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This report contains the text as adopted by Plenary and has been issued without formal editing.

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GENERAL SUMMARY OF THE WORK OF THE SESSION

1. OPENING OF THE SESSION *(agenda item 1)*

1.1 The extraordinary session (2006) of the Commission for Basic Systems was held in Seoul, from 9 to 16 November 2006 at the invitation of the Government of the Republic of Korea. The session, which took place at Sheraton Grande Walkerhill Hotel, was opened at 10 a.m. on 9 November 2006 by the president of the Commission, Mr A.I. Gusev.

1.2 Mr Man-Ki Lee, administrator of the Korea Meteorological Administration (KMA) and Permanent representative of the Republic of Korea with WMO extended a warm welcome to all the participants and wished them a pleasant stay in the beautiful city of Seoul. He expressed his deep appreciation for this significant meeting to be held in Seoul. He mentioned that abnormal weather conditions are becoming increasingly threatening and that it is time for all meteorologist of the world to do their best to cope with this situation. He expressed his belief that strengthening meteorological technology could contribute to guaranteeing people's safety and happiness, as well as the sustainable development of all the fields of human activities. KMA is actively working at a number of development processes and is willing to share its experiences in improving technologies in meteorology.

1.3 Mr Woo-Sik Kim, Deputy Prime Minister and Minister of Science and Technology welcomed all the participants. He also emphasized the increasing fatal losses and damages caused by severe disasters, which affect many parts of the world, including the Republic of Korea. His Government recognized the importance of meteorological affairs and wished to move from disaster recovery to disaster prevention. He stressed that the Commission for Basic Systems was the most important technical commission of WMO. Mr Kim mentioned the meaningful activities of the Group on Earth Observation (GEO), which prepared promotive actions of collecting wisdom on disaster prevention plans from all over the world. The Government of the Republic of Korea had itself been participating in many GEO activities and established a Korean GEO Secretariat.

1.4 The Secretary-General of WMO, Mr M.J. Jarraud, welcomed the participants of the session on behalf of the Organization, and expressed appreciation to the Government of the Republic of Korea for hosting the session, as well as the Technical Conference on WMO Information System held prior to the session. He also extended his thanks to the Korea Meteorological Administration for the excellent arrangements made to ensure the success of the session.

1.5 The Secretary-General, in his opening statement, provided a summary of the developments which led to the establishment of the World Weather Watch and which had been made possible by the propitious advent of satellites and computers. The WWW evolved into a coordinated integrated system, based on all the facilities operated by WMO's Members and on the understanding that all parts of the global weather system are interactive, so that no country can be fully sufficient.

1.6 The Secretary-General pointed to a number of topics of importance for the session. Among others, he mentioned the continuing efforts, which will be needed for the deployment of a composite Global Observing System, the challenges linked to the data exchange requirements, the use of internet and the use of off-the-shelf equipment, which facilitates capacity building efforts and supports the use of the Global Telecommunication System (GTS) and information system in developing countries. Another recurrent issue would be the securing of radiofrequency allocation for meteorology. He stressed that numerical weather predictions were crucial to deliver weather forecasts and warnings, which were time-critical. The use of Ensemble Prediction Systems (EPS) provided additional capabilities, but guidance and training in that field would be much needed to enable forecasters to integrate these outputs into their forecasting processes. He mentioned that the provision of environmental services in support of decision-making and the development of strong partnerships with the media were two important issues that needed to be considered by the Public Weather Service programme.

1.7 The Secretary-General recalled that he is giving great importance to cross-cutting issues, within WMO, as well as with its partner organizations. He mentioned that the WWW provides essential support to the WMO Disaster Prevention and Mitigation Programme by providing the basic observation networks, telecommunications systems, forecasting capabilities and delivery procedures. In particular, he recalled that, following the tragic Indian Ocean tsunami and the immediate action undertaken by WMO and its partners, the GTS had been identified as the backbone for the exchange of tsunami-related information and warnings.

1.8 The Secretary-General mentioned that a number of new operational meteorological satellites had been included in the WMO Space Programme and that the Global Space-based Inter-Calibration System (GSICS) would prove extremely valuable in improving data quality for many application areas, including climate monitoring. Data delivery would also be improved through the use of the Integrated Global Data Dissemination Service (IGDDS), responsible for data circulation. He recalled that WMO had been very active in the development of the Global Earth Observation System of Systems (GEOSS) and that the WMO Executive Council had agreed that several WMO key systems, such as the WIS, could be core GEOSS components. He emphasized that this would have strong implications for CBS and consequently efficient collaboration between CBS and GEO was of capital importance.

1.9 The Secretary-General concluded by emphasizing that CBS's challenge is to guarantee the development of the basic systems infrastructure in support of all programmes, so that WMO can contribute to meeting the objectives of national development plans as well as those of international strategies. He also stressed the need for closer interaction with the Regional Associations, and to further encourage the active participation of experts from the developing countries in the work of the Commission.

1.10 The president of CBS, Mr A. Gusev, welcomed the participants and mentioned that NMHSs are playing an ever-increasing role in modern society, to ensure the protection of life and the reduction of damages caused by meteorological phenomena, but also to develop strategies for the economical development and the protection of the environment. The tasks of meteorological services are consequently evolving and they are increasingly related to ensuring hydro-meteorological safety. He emphasized that the role of CBS was unique in the structure of WMO technical commissions since it dealt with the basic infrastructures, which provided the Members with the necessary data and products they needed. He also shared his pride for the excellent basic systems that are shared by the Members and recalled that no country could be autonomous in this respect. The basic infrastructure that is coordinated by CBS is global, thanks to the infrastructure of all NMHSs and is also of great importance for research, climate monitoring and disaster prevention and mitigation to mention a few and supports many other WMO programmes, like THORPEX, IPY and the Disaster Prevention and Mitigation Programme. He wished full success to the Commission and was convinced that it would also benefit from the outcome of the TECO-WIS meeting.

1.11 There were 142 participants at the session, which included representations of 55 Members of WMO and 7 international organizations. A complete list of participants is given in the Appendix to the present report.

2. ORGANIZATION OF THE SESSION *(agenda item 2)*

2.1 CONSIDERATION OF THE REPORT ON CREDENTIALS *(agenda item 2.1)*

The Commission received and approved the report of the representative of the Secretary-General.

2.2 ADOPTION OF THE AGENDA *(agenda item 2.2)*

The provisional agenda was adopted by the session. It was decided that an ad-hoc committee would be established for the examination of agenda item 11.

2.3 ESTABLISHMENT OF COMMITTEES *(agenda item 2.3)*

2.3.1 The Commission agreed to conduct its business in plenary meetings. The General Plenary would be chaired by the president, Mr A. Gusev, for the consideration of items 1, 2, 4, 9.1, 10 and 12 to 15 and by the vice-president Mr G.-R. Hoffmann, for items 3, 9.2 to 9.5 and 11. Plenary A will be chaired by Mr T. Hart (Australia) and will consider items 5, 6.1, 6.3, 6.5 and 8. Plenary B will be chaired by Mr W. Nyakwada (Kenya) and will consider items 6.2, 6.4, 6.6 and 7.

2.3.2 The Commission decided to establish a Credentials Committee, which would be chaired by Mr S. Foreman and would also include Ms S. Barrell and Mr G. Fleming, as members. A Coordination Committee was established to monitor the work of the session.

2.3.3 Mr Kwang-Joon Park (Republic of Korea) was appointed Rapporteur on Previous Recommendations of the Commission (agenda item 12).

2.4 OTHER ORGANIZATIONAL QUESTIONS *(agenda item 2.4)*

The session agreed upon the working hours for the duration of the session. The session was informed on the document approval procedure. It was agreed that summarized minutes of the plenary meetings would not need to be prepared.

3. REPORT BY THE PRESIDENT OF THE COMMISSION *(agenda item 3)*

3.1 The Commission noted with appreciation the report of its president, Mr A. Gusev (Russian Federation), which provided information on the activities of the Commission since its thirteenth session in February 2005.

3.2 The Commission recalled with satisfaction that both the OPAG Expert Teams and the Implementation Coordination Teams, which together included more than 160 experts, had accomplished a great deal of work during the shortened intersessional period. There had been more than 50 meetings, workshops and seminars during the period on matters falling under the Commission's purview or otherwise related to the WWW. Further details of the activities and accomplishments and tasks were provided in the reports of the chairpersons of the working groups and discussed under the relevant agenda items.

3.3 The Commission noted that during the intersessional period the president was actively involved in many activities dealing with matters of general importance to WMO, representing CBS and the WWW Programme in numerous meetings and providing input to the discussions in various forums. The Commission particularly noted the activities related to THORPEX, IPY, QMF, NDPM and GEO.

3.4 The Commission expressed its appreciation for the important role of the CBS-MG at its fifth session (April 2005) and sixth session (April 2006) in coordinating the work of the four OPAGs, in making necessary adjustments in the intersessional period and in advising the president on relevant issues especially as regards the participation of the Commission in the work of other constituent bodies and for representing the Commission at sessions of the Executive Council. In that regard, the Commission noted that EC-LVIII had reaffirmed that the WWW is and will continue to be the backbone Programme of the WMO that also actively contributes to cross-cutting activities, and had agreed with the need for reciprocal input from cross-cutting activities towards the strengthening of the WWW structure. EC-LVIII emphasized that these activities should eliminate unnecessary duplication to ensure best use of available resources. It further felt that an envisioned integration of observing systems would support this goal. EC-LVIII also agreed that there is a need to strengthen the visibility of the WWW, by increasing public awareness of this unique Programme of WMO, which contributes to the security of life and property and sustainable development. It confirmed that the WWW basic systems could provide an important input to the GEOSS process and this collaboration, in turn, should contribute to further the development and enhancement of the WWW. EC-LVIII also stressed the need to explore additional resources for strengthening the basic components of the WWW, especially in developing countries.

3.5 The president expressed his sincere appreciation to all CBS members who had participated in the activities of the Commission for their enthusiastic cooperation. In particular, he thanked the chairpersons of the Open Programme Area Groups and the Expert Teams as well as the rapporteurs for their outstanding work. On behalf of CBS, the president also thanked the Secretary-General of WMO and the staff of the Secretariat, in particular the WWW and Applications Departments, for their support and cooperation.

4. REVIEW OF DECISIONS OF THE EXECUTIVE COUNCIL RELATED TO THE COMMISSION *(agenda item 4)*

4.1 The outcome of the discussions held at the fifty-seventh and fifty-eigth sessions of the Executive Council were reviewed with particular emphasis placed on those decisions that would have an impact of the future work programme of the Commission.

4.2 The Commission discussed the relevant cross-cutting programme areas and included its conclusions in the general summary under their respective agenda items, including: WMO Information System (agenda item 7), WMO Space Programme (agenda item 8), Group on Earth Observations (agenda item 9.1), Disaster Prevention and Mitigation (agenda item 9.2), Quality Management Framework (agenda item 9.3), THORPEX (agenda item 9.4) and International Polar Year (agenda item 9.5).

4.3 The Commission noted concerns expressed at EC-LVIII (paragraph 3.1.1.7) that there may be outdated information contained in WMO Technical Note 170 entitled “Meteorological and Hydrological Aspects of Siting and Operation of Nuclear Power Plants” (1985), used as a guide for NMHSs for solving problems related to safety aspects of nuclear power plants, including siting, operations and emergency response. The Council therefore requested the Secretary-General to develop a strategy for addressing this issue, including to seek the cooperation of the International Atomic Energy Agency (IAEA). The Commission agreed that participation of CBS experts should be considered in the strategy, in particular regarding guidelines or standards for observations, and data-processing and forecasting aspects. The meeting noted that the Russian Federation could provide relevant expertise as a part of a WMO strategy.

5. STATUS OF WORLD WEATHER WATCH IMPLEMENTATION AND OPERATION *(agenda item 5)*

5.1 The percentage of SYNOP reports available at MTN centres in comparison with the number of reports required from RBSN stations was about 77 per cent during the period 2003-2006, with a slight oscillation of one per cent over the period. There were still deficiencies in the availability of SYNOP reports from areas in Region I (52 per cent in July 2006), in Region III (60 per cent) and in Region V (72 per cent). The session noted that the monitoring information submitted in the session documents provided a good overview of the availability of observational data through the WWW, but required careful interpretation when a specific station or area was considered. Further detailed monitoring information was available from the WMO server (http://www.wmo.int/web/www/ois/monitor/monitor-home.htm).

5.2 The percentage of TEMP reports available at MTN centres increased from 63 per cent in 2003 to 70 per cent in 2006. The availability of TEMP reports was relatively satisfactory for the northern and eastern parts of Region II, the northern part of Region IV and some countries in Region V. The availability of TEMP reports from Region VI had increased in recent years, except from the south-eastern part of the Region. The availability of TEMP reports was unsatisfactory from many parts of Regions I and III. The session noted that, in some stations, the upper-air observations were usually made once a day, and twice a day during periods with severe weather conditions; this is not reflected in the monitoring process.

5.3 During the 2005 AGM period, 76 per cent of the required SYNOP reports were received within one hour after the observation time, and an additional 2 per cent were received between one hour and six hours after the observation time; 68 per cent of the required TEMP reports were received within two hours after the observation time and an additional 2 per cent were received between two hours and twelve hours after the observation time.

5.4 The session noted the difficulties met by certain developing countries in the operation of upper-air stations, notably due to the high costs of the equipment and the consumables. The meeting stressed the need to assist the countries in the purchase of equipment and consumables, including for the rehabilitation of equipment.

5.5 The representative of ASECNA noted that countries in the Central and Western part of Region I have been striving to maintain and develop their networks of observing stations; as an example, two new upper-air stations have been established in Benin within the framework of the AMMA project. However, some countries, notably in the Central part of Region I, experienced difficulties and needed assistance. ASECNA was collaborating with WMO to assist these countries.

5.6 The daily average number of SHIP reports received by MTN centres for main synoptic hours oscillated between 2400 and 3000 during the period 2003-2006. The session noted that the number of SHIP reports had not significantly increased for several years. Action should be taken, in co-ordination with JCOMM, in order to increase the number of observations from marine stations, particularly from areas such as the Arabian Sea.

5.7 During the period 2003-2006, the number of TEMP SHIP reports oscillated between 13 and 32. The number of BUOY reports increased from 11000 to 33000 during the period 2003-2006; this increase is in particular due to an increase in the frequency of the collection of data from the buoys by extending the use of Argos multi-satellite system providing more passes over each buoy. The number of AIREP reports oscillated between 3400 and 5400. The number of AMDAR reports increased from 15000 to 42000 during the period 2003-2006. The number of aircraft reports from BUFR aircraft reports increased from 112000 to 152000 during the period 2004-2006. Except for AIREP and BUOY reports, a large part of the reports from mobile stations were issued from the Northern Hemisphere.

5.8 The improvement in the presentation of the monitoring information provided by the Secretariat makes it possible to identify more easily shortcomings in the operation of the WWW. The session requested the OPAG-IOS and the OPAG-ISS to further develop the WWW monitoring procedures that monitor against the evolving requirement for observations as identified by the OPAG-IOS; these procedures should distinguish between shortcomings of observing and telecommunication practices.

6. WORLD WEATHER WATCH PROGRAMME, SUPPORT FUNCTIONS AND PUBLIC WEATHER SERVICES, INCLUDING THE REPORTS BY THE CHAIRS OF THE OPEN PROGRAMME AREA GROUPS (*agenda item 6)*

6.1 INTEGRATED OBSERVING SYSTEMS (IOS) (*agenda item 6.1)*

6.1.1 The Commission expressed its appreciation to the Chair of the OPAG-IOS, Mr James Purdom, and his Co-Chair Ms Sue Barrell, for their comprehensive report on the performance and further development of the surface-based and space-based subsystem of the GOS. Appreciation was also expressed to the Expert Teams, Rapporteurs and Coordinators for their contribution to the work of the OPAG-IOS as presented in the "Progress/Activity Report on the Integrated Observing System" document prepared as background for the conclusions and recommendations contained in this general summary. It noted that the GOS, through coordinated efforts of Members, continued to provide sustainable observational data and information on the state of the Earth and its atmosphere to meet evolving requirements of various users. It underlined that along with the broadening satellite data and services, especially through R&D satellites, further improvements were achieved in the availability of data produced by other components of the GOS, notably marine and AMDAR data.

6.1.2 The Commission noted with satisfaction that in accordance with standing TORs and work plans, the major activities of the OPAG-IOS were concentrated on the evolution of the GOS, coordination and advice on satellite system matters, satellite utilization and products, requirements and representation of data from AWSs, scientific evaluation of OSEs and OSSEs, cooperation with GCOS, integration of AMDAR in WWW operations, revision and updating of GOS regulatory material. The Commission expressed its gratitude to all experts who contributed to the effective work of expert teams established under OPAG-IOS.

6.1.3 Based on the activities and results achieved under various areas under the OPAG-IOS responsibilities, the Commission decided as follows:

Implementation and operation of the surface-based and space-based subsystems of the GOS

(i) Urged Members to secure sustainable operation of the GOS and encouraged activities on the optimization of observing elements and development and deployment of the advanced composite system. Following the recommendation of EC-LVIII, the Commission also urged Members and regional associations to follow guidelines and recommendations contained in the *Implementation Plan for Evolution of Space and Surface-Based Sub Systems of the GOS* (WMO/TD-No. 1267);

(ii) Requested the OPAG-IOS in collaboration with CAS and regional associations to provide input to the development and implementation of adaptable observing programmes and systems to improve the early-warning capability of NMHSs;

Evolution of the GOS

(i) Requested OPAG-IOS to maintain and update the Implementation Plan for Evolution of Space and Surface-Based Sub Systems of the GOS (EGOS-IP), taking into account the developments with respect to GEOSS, in close cooperation with the regional associations, their WG on Planning and Implementation of the WWW, and technical commissions concerned with particular attention to the developing countries;

(ii) Requested Members to supply a point of contact responsible for reporting progress and plans in their country related to EGOS-IP;

(iii) Requested OPAG-IOS in collaboration with OPAG-ISS to review the existing process for gathering, producing and presenting performance summary statistics for the surface-based sub-system of the GOS and examine possibilities for more meaningful ways of providing this information to Members;

(iv) Requested OPAG-OS in view of the current operational requirements for timely delivery of RBSN data, especially for NWP, to include more stringent delivery targets in the monitoring of data availability on the GOS. This includes considering a 30 minute cut-off for surface data and less than two hour cut-off for upper-air data.

(v) Requested the Secretariat to gather information from Members on progress and plans in their country related to EGOS-IP, with a focus on those activities not covered through established mechanisms, e.g. WMO Space Programme, AMDAR Panel, JCOMM;

(vi) Requested the Secretariat to advise OPAG-IOS on appropriate mechanisms for issue of reports on progress and plans of Members related to EGOS-IP;

(vii) Requested OPAG-IOS to analyse information on progress and plans supplied by Members related to EGOS-IP, and to summarize progress;

(viii) Requested ET-EGOS to consider the potential of long-range ground-based remote sensing lightning detection system as a cost-effective component of the evolving GOS. Such systems should be considered complementary to existing lightning detection systems for improving coverage in data sparse regions (including oceanic and polar areas);

(ix) Requested CBS, in collaboration with CAS, CIMO and other relevant commissions and programmes within WMO to consider the development of a strategy to sustain key components of AMMA, IPY and THORPEX observational networks beyond the end of their respective experiments;

Satellite systems

(i) Requested the WMO Satellite Programme, through the CGMS and WMO Consultative Meetings on High-level Policy on Satellite Matters, and through cooperation and coordination with satellite agencies, to:

(a) Ensure greater optimization of LEO and GEO mission planning to meet the GOS baseline;
(b) Increase data and product availability in an open and timely manner and ensure data quality meets agreed standards, in terms of characterization and calibration, the latter through the GSICS worldwide inter-calibration initiative;

(ii) Approved implementation of the 9 cross-cutting recommendations formulated by GCOS in the Satellite Supplement to the GCOS Implementation Plan;

(iii) Requested OPAG-IOS to commence an update of the GOS baseline of the space-based GOS up to 2025 as a new horizon, and expand its scope beyond WWW in order to include sustained observations of additional variables required for climate monitoring, and ultimately to address the needs of other WMO Programmes;

Satellite utilization and products

(i) Requested OPAG-IOS to advise CBS of the additional factors that could influence the evolution of the baseline of the space-based component of the GOS in the 2015 to 2025 period through the inclusion of sustained R&D missions. Impacts on the GOS Plan and evolution to be investigated through collaboration between ET-EGOS, ET-SAT and ET-SUP;

(ii) Endorsed the establishment of two new Virtual Laboratories for Education and Training in Satellite Meteorology Centres of Excellence in Brazil and Argentina;

(iii) Encourage the growth of the Virtual Laboratory to ensure that all WMO Members have access to the training and materials that are available through VL Centers of Excellence and their sponsoring satellite operator(s);

(iv) Encourage Members, especially from developing countries, to participate more actively in the training and outreach programmes provided by their respective VL Centres of Excellence;

Requirements and representation of data from AWSs

(i) Reviewed requirements for the reference system to be used by the WMO as the reference for both horizontal and vertical position of an observing station and adopted Recommendation 1 (CBS-Ext.(06));

(ii) Following the recommendation of EC-LVII that requested technical commissions to review technical regulations relevant to observation generation with a view to rectifying deficiencies, inconsistencies and errors, requested all CBS OPAGs and their respective ETs to review BUFR descriptors for traceability of the definitions to the *International Meteorological Vocabulary* (WMO-No. 182). Specification of detected problems should be submitted directly to the ET on Data Representation and Codes;

(iii) Requested OPAG-IOS, in collaboration with other relevant technical commissions to develop further the set of standard and optional variables for a standard AWS; address the issue related to the robustness of AWSs to be operated in severe weather conditions, especially by developing countries;

(iv) Taking into account the latest development of the WMO Core Profile of Metadata Standards, agreed to develop catalogues with regard to AWS, minimizing the actual data transmission such as: (a) Variables measured; (b) Instruments used; (c) Data processing procedures used; and (d) Data QC procedures used;

(v) Urge Members to follow guidelines on the QC procedures for data from AWS which now included in the revised *Guide on the GOS* (WMO-No. 488).

Scientific evaluation of Observing System Experiments (OSEs) and Observing System Simulation Experiments (OSSEs)

(i) Requested OPAG-IOS to interact more closely on observational issues with CAS and the EC Working Group on Antarctic Meteorology in accordance with planned THORPEX, AMMA and IPY activities; taking into account the need for legacy of these experiments and campaigns for the future of the GOS, establish a sustainable coordination mechanism with regional associations;

(ii) Encouraged Members to work through their national and regional spectrum protection mechanisms to guarantee the central role within the GOS of microwave sounders;

(iii) Encouraged NWP centres to keep stimulating the studies of observation targeting strategies in coordination with the THORPEX ad hoc groups;

(iv) Requested OPAG-IOS and the Secretariat to organize the fourth Workshop on the Impact of New Observing Systems on the NWP;

AMDAR matters

(i) Requested the OPAG-IOS in coordination with the Secretariat to take further steps on the integration of AMDAR Panel into WWW structure;

Marine Systems

(i) Invited Members to participate in the ASAP Panel of the JCOMM Ship Observations Team (SOT) for providing in situ aerological profiles from ocean data sparse areas as complementary data to AMDAR;

(ii) Invited Members to pursue efforts for adding pressure sensors to drifting buoys in a way that is consistent with the JCOMM Observations Programme Area (OPA) strategic work plan (target 1250 barometers);

(iii) Stressed that unique ship's identification was essential for real-time and delayed mode quality monitoring activities, and therefore that ship's call sign masking schemes proposed by Member Countries in compliance with Resolution 7 (EC-LVIII), should provide unique ship identification;

GCOS matters

(i) Encouraged Members concerned to communicate historical data and metadata from their GCOS network stations to newly established CBS Lead Centres for GCOS;

(ii) Requested OPAG-IOS in coordination with CIMO to continue activities to ensure interoperability among all appropriate observing systems so that observations from any observing systems may contribute to all WMO Programmes;

Regional aspects of the GOS

(i) Invited Regional Rapporteurs/Coordinators on Regional Aspects of the GOS to develop an implementation plan for the evolution of the GOS in their Regions based on the document prepared for Region I by March 2007. This document is intended to be passed to the president of each Regional Association, through the WG on PIW, for consideration and endorsement by Members of the Region;

Impact of new instrumentation on the GOS

(i) Noting the report on the progress achieved in the upgrades and replacement of certain radiosonde systems especially in developing countries and the introduction of new technologies, requested the Secretariat to continue monitoring the situation, reissue the questionnaire on "***Impact of new instrumentation on the GOS***", keep Members informed on its accessibility and disseminate the results of the survey;

(ii) Invited Members to provide their responses to the Questionnaire on the Impact of New Instrumentation (including those who had responded to confirm their information/add any missing details) in order to facilitate preparation of a comprehensive report for CBS XIV;

(iii) Invited pro-active involvement of the Rapporteurs/Co-coordinators on the Regional Aspects of the GOS and the Virtual Laboratory for Education and Training in Satellite Meteorology Centres of Excellence (through the Virtual Laboratory Management Group) in organizing the survey on the impact of new instrumentation on the GOS;

Future composite GOS and its impact on developing countries

(i) Recommended that the evolution of the GOS must take into account upgrading, restoring, substitution and capacity building (especially in the use of new technologies), taking into consideration both the use of the data and the production of the data;

(ii) To help countries produce data for international exchange, recommended that due consideration must be given to the public infrastructure, expertise and funding;

(iii) Agreed, following the guidance given in the Implementation Plan for Evolution of Space and Surface-Based Sub Systems of the GOS (IP-EGOS), to recommend for developing countries a wider use of observing systems (satellite, AMDAR, and AWSs) that were less dependent on infrastructure, expertise, and funding. It also recommended that a minimum set of reliable RAOBs would be required both as a backbone to the upper-air network and to validate the satellite observations with enough height and accuracy;

(iv) Urged Members concerned to follow migration toward the BUFR/CEREX code as required;

(v) Recommended that the highest priority should be given to:
   (a) Maintaining the RBSN and RBCN, noting that GUAN stations are part of the RBSN;
   (b) Rehabilitating observing sites in critical locations;

IOS input to the GEOSS Work Plan

(i) Following the recommendation of EC-LVIII, requested OPAG-IOS to study and provide recommendations related to a more coordinated approach to WMO observing systems as part of an overall WMO contribution to GEOSS;

GOS-related regulatory material

(i) Reviewed the revised version of the *Guide on the GOS* (WMO-No. 488) and adopted Recommendation 2 (CBS-Ext.(06)); Following the decision of the EC-LVIII, requested the Secretary-General to accomplish the editorial work and publish the Guide in 2007;

(ii) Noting that revisions to the text of the *Manual on the GOS* (WMO-No. 544) relating to Regional Associations I, II, III and IV is yet pending, invited regional associations concerned to ensure updating appropriate parts of the Manual.

6.2 INFORMATION SYSTEMS AND SERVICES (ISS) *(agenda item 6.2)*

6.2.1 The Commission thanked Mr Peiliang Shi, Chairperson of the OPAG, for his report. It noted with satisfaction the progress and achievements made, covering a wide range of tasks. It noted that the proposals and recommendations developed by the Expert Teams had been reviewed and consolidated by the Implementation Coordination Team on ISS. The Commission expressed its thanks to the many experts who had served on the various expert and implementation coordination teams.

Status of implementation and operation of the GTS

6.2.2 All the 25 MTN circuits were in operation. Seventeen MTN circuits were implemented through data-communication network services in the framework of the Improved MTN, five circuits were operating at 64 kbit/s, one at 28.8 kbit/s and one at 9.6 kbit/s. All MTN circuits (but one) were operating with TCP/IP or had a firm plan for the migration to TCP/IP. However, the Commission noted with concern that one circuit (New Delhi-Cairo) remained using very low speed characteristics and was not capable of meeting the MTN requirements. The Commission noted that the implementation of computer-based systems for GTS functions in WWW centres were making progress, in particular through the introduction of cost-effective PC-based systems in several developing countries. The Commission was pleased with the significant progress made in the implementation of RMTNs, but it also noted that serious shortcomings still existed in some Regions at the regional and national levels. In this regard, the Commission noted that cooperation between NMHSs within regions, through the organization of workshops, training activities and pilot projects, could facilitate overcoming these deficiencies.

6.2.3 In Region I, despite serious economic difficulties, continuous efforts had enabled some improvement of GTS circuits via leased lines, satellite-based telecommunications or public data networks, including the Internet. Satellite-based data-distribution systems (EUMETCast, RETIM-Africa and SADIS, as part of the ICAO Aeronautical Fixed Service (AFS)) and data-collection systems (METEOSAT/DCS) continue to play a crucial role. There were still serious shortcomings, in particular at the national level, and the Strategy for enhancing WWW basic systems was developed to foster sustainable development, in particular of meteorological data-communications.

6.2.4 Most of Region II GTS circuits were operating at medium- or high-speed, but there were still a number of low-speed connections. The RMTN in Region II, particularly in its eastern and southern parts, was being improved by the continued implementation of improved data communication services, including Frame Relay services, complemented by satellite-based distribution systems (PCVSAT operated by China, MeteoInform by the Russian Federation, EUMETCast and SADIS, as part of the ICAO AFS) and the use of the Internet. About 60% of the current GTS circuits had been migrated to TCP/IP. The plan for an improved RMTN was nearly implemented.

6.2.5 In South America, there is a firm plan for starting in 2006 the actual implementation of the RA III Regional Meteorological Data Communication Network (RMDCN) based on the provider's Framework Contract for the new RMDCN that was concluded by WMO. These upgrades would enable NMHSs to considerably enhance their reception and use of highly valuable data and products. All 13 NMCs were also equipped with receiving systems of the International Satellite Communication System (ISCS) operated by the United States.

6.2.6 In Region IV, the International Satellite Communication System (ISCS) operated by the USA that was providing for the RMTN as well as data distribution over Regions III and V, was upgraded to TCP/IP procedures with an increased capacity; the ISCS upgrade also led to the replacement of all NMCs' workstations.

6.2.7 Significant progress was made in the Region V RMTN with the implementation of Frame Relay services and the expansion and upgrades of satellite-based communications (ISCS). The Emergency Managers Weather Information Network (EMWIN) via the GOES-East, GOES-West and PeaceSAT satellites is a crucial source of data, warnings and forecasts for the Pacific, in particular for small island countries. There was also an increasing use of the Internet, in particular for the collection of observational reports and for linking small nations in the Pacific. Expanding the current RANET project and a Pacific HF digital e-mail network were under development primarily undertaken by Australia and New Zealand.

6.2.8 The RA VI RMDCN, based on a shared managed network service coordinated by the ECMWF, was interconnecting 36 RTHs and NMCs, as well as ECMWF and EUMETSAT. These data-communication network services had continued to be an excellent cost-effective implementation of the GTS, with a very high reliability and full security, a guaranteed quality of service and an easy scalability of capacity. The RMDCN services were extended to include interregional and MTN GTS circuits. Migration of the underlying network structure of the RMDCN from Frame Relay to the Multi-Protocol Label Switching (MPLS) was planned for early 2007. The other RA VI Members were operating leased point-to-point GTS circuits and Internet connections and were expected to join the RMDCN when cost-effective. Satellite-based distribution systems based on DVB-S (DWDSAT, RETIM, MeteoInform and EUMETCast/MDD) were also playing an important role.

6.2.9 The Commission expressed its appreciation for the extensive implementation and significant technological upgrades of satellite-based multipoint telecommunications systems that were operating as integrated components of the GTS for the distribution of large volumes of information, in complement to the dedicated connections. Each WMO Region was completely covered by at least one satellite-based data-distribution system, and several systems were implemented at national or sub-regional level. Satellite-based systems using digital video broadcasting (DVB) techniques were implemented or firmly planned in several Regions. Satellite-based systems using digital audio broadcasting (DAB) techniques for "data casting" were also used by the WorldSpace Radio and Internet (RANET) experiment over Africa and part of the Pacific, and by the NMS of India (IMD) for replacing and upgrading the radiobroadcast from RTH New Delhi (see also paragraphs 6.2.13 to 6.2.15 and agenda item 8 on IGDDS).

GTS-WIS Communication Structure

6.2.10 The Commission agreed that the WIS should provide various types of services to meet the different requirements; the following fundamental types of services could be identified:

(1) Routine collection and dissemination service for time-critical and operation-critical data and products:

This service is based on real-time "push" mechanism including multicast and broadcast; it would be implemented essentially through dedicated telecommunication means providing a guaranteed quality of service, e.g. leased circuits, dedicated data communication network services and satellite-based data-distribution systems;

(2) Data Discovery, Access and Retrieval service:

This service is based on request/reply "pull" mechanism with relevant data management functions; it would be implemented essentially through the Internet (HTTP, FTP,…);

(3) Timely delivery service for data and products:

This service is based on delayed mode "push" mechanism; it would be implemented through a combination of dedicated telecommunication means (used for (1)) and of public data-communication networks, especially the Internet.

It is envisaged that dynamic adjustment and management of services (1) and (3) could be provided through flexible user interfaces.

6.2.11 EC-LVIII "emphasized that with the sustained progress benefiting from Information & Communication Technology (ICT) development made in its implementation, operation and upgrade, the GTS, including satellite-based data-distribution systems and the Improved MTN, would effectively contribute to the WIS implementation as the core communication component for exchange and delivery of time-critical and operation-critical data and products". In this regard, the Commission emphasized that the first phase of the WIS implementation was the GTS for time-critical and operation-critical data; the GTS is under continuous upgrades and improvements. The operational data exchange service provided by the GTS, which was currently mainly focused on WWW requirements, would be extended to meet operational requirements of other programmes as part of the WIS.

6.2.12 The Commission emphasized that the second WIS implementation phase would provide for an extension of the information services through more flexible data discovery, access and retrieval services (type (2)) to all authorized users, as well as more flexible timely delivery services (type (3)).

6.2.13 The Commission noted the WMO Integrated Global Data Dissemination Service (IGDDS) as one component of the WIS, which, as a system, is the exchange scheme of space-based observation data and products for WMO Programmes. The IGDDS project provides for activities directed towards the definition and operational implementation of the IGDDS system.

6.2.14 IGDDS addresses different functions, as follows:

(a) Data acquisition (raw data from satellites, high-level products, inter-regional data exchange);

(b) Data dissemination (via telecom satellite broadcast, via Direct Broadcast, or, via point-to-point networks):

(c) Data access, on request, allowing data discovery and delivery to authorized users;

(d) Data and user management including user requirements review, interoperable catalogue, ensuring service quality and user support.

6.2.15 The baseline for IGDDS is a collection of regional components linked in a global network for inter-regional data exchange. Each regional component will include a Data Collection or Production Centre (DCPC) as defined in WIS and will ensure routine dissemination by various means including an satellite-based data-distribution system (Advanced Dissemination Methods, ADM) covering its region. Activities under the IGDDS project include namely the expansion of the Rolling Requirements Review process to express regional data needs, the expansion of the RARS concept towards a global coverage, the implementation of a global ADM coverage and the appropriate global coordination among CGMS satellite operators and WMO to ensure interoperability along WIS agreed standards. The Commission noted that the IGDDS, as a component of WIS would essentially provide for service types (1) and (2) as identified above. It was expected that satellite-based data-distribution systems implemented in the framework of IGDDS would continue to support the dissemination of other data in addition to space-based observation data and products.

6.2.16 The Commission requested the OPAG-ISS, in particular the ET-CTS to further develop the WIS-GTS data-communication structure and consider how to improve global exchange of high priority data and products in support of a virtual all hazards network within the WIS-GTS.

Data-communication systems and techniques

TCP/IP and related protocols on the GTS

6.2.17 The Commission endorsed the revised foreword, introduction, Chapters 1 and 2 of Attachment II-15 (Use of TCP/IP on the GTS), and requested the ET-DCS to pursue the task of revising and updating the whole Attachment as a reference for implementation and application of the TCP/IP suite. The Commission recalled that the set of IP addresses that were originally allocated to GTS links were no longer officially available, as a consequence of a strict application of Internet standards (RFCs) by Internet Services Providers. The Commission noted that the ET-DCS had developed recommended arrangements for IP addresses, including a short guide to help NMHSs that so desire to establish a TCP architecture with a minimum set of IP addresses.

6.2.18 With respect to IPv6 development, the Commission noted that the global uptake of IPv6, even in Asia, was slower than expected. It concluded that it was still premature to expend much effort in IPv6 testing, but requested the OPAG-ISS to keep abreast of developments with a view to taking action as appropriate, and to pursue investigating the possibility and benefits of an early registration of IPv6 addresses for WMO purposes.

6.2.19 The Commission recalled the general file naming convention that had been approved. File names for new message types shall follow the following format:

pflag_productidentifier_oflag_originator_yyyyMMddhhmmss[_freeformat].type[.compression]

The Commission noted with satisfaction and endorsed for inclusion in the *Manual on the GTS*, Attachment II-15, the procedure developed by the OPAG on ISS for allocating the corresponding new mandatory field “productidentifier”, based on a hierarchy of sections with a cascade of identified “authorities” that would ensure its uniqueness and facilitate its management. It noted that the Country code in the <location indicator> would comply with ISO 3166-1 (alpha 2 code elements); it also requested the OPAG on ISS to further consolidate and maintain the <data designator> list, consistent with data categories and sub-categories defined in the Common Table C-13 of the *Manual on Codes*. The Commission urged all centres to implement this procedure and to complete the transition by 2008.

Data access procedures

6.2.20 The Commission noted that netCDF, HDF5 and OpenDAP were data access procedures that had wide acceptance in the general field of environmental sciences. NetCDF (network common data form) is an interface for array-oriented data access providing a machine-independent format that support the creation, access, and sharing of scientific data; HDF5 is the storage layer used by netCDF while OpenDAP (Open-source project for a network data access protocol) makes local data accessible to remote locations regardless of local storage format. The Commission noted that these data format and access procedures were optimized for processing the data, but were not optimized for large scale data exchange or archive in view of the large volume of self-documented data (metadata) that are embedded in these formats. The Commission agreed, however, that these formats should be supported by the WIS, at least by relevant DCPCs, for the requirements of the scientific community.

Guidance for using the Internet between GTS centres

6.2.21 EC-LVIII noted that the Internet was playing an increasing role for the exchange, access to and delivery of a wide range of data and products in complement to the GTS. It also emphasized its particular importance for some smaller NMHSs, especially developing countries and LDCs, as the only affordable telecommunication means, including for transmitting data into the GTS. The Council urged more Members operating RTHs to implement the Internet-based services for complementary data-collection, in compliance with the recommended practices developed by CBS. It also re-affirmed the importance that CBS pursue the development/update of guidance material for the use of the Internet with minimized operational and security risks, and for the use of adequate ICT for NMHSs of developing countries.

6.2.22 The Commission recalled the guidance for the establishment of cost-effective and secure Internet-based connections between RTHs and NMCs, including the current *Guide on Virtual Private Networks (VPN) via the Internet between GTS centres* and the Technical Note *IPSec Feasibility Study – Guidance on IPSec-based VPNs over the Internet*. The Commission also noted with appreciation the WIS VPN pilot project in Regions II and V, which was primarily concerned with the connectivity of WIS NCs to their GISC. The Commission requested the OPAG on ISS to continue to keep abreast of VPN developments and to update and refine accordingly the guidance documentation.

6.2.23 The Commission noted with satisfaction that the *Guide on Internet Practices* had been updated to take account of technological developments.

Guidance on Information Technologies facilities at WWW centres

6.2.24 The Commission noted with appreciation that the ET-CTS had completed the *Guide on use of FTP and FTP servers at WWW centres*, based on a document that was developed by JMA. The guide shares useful experience and provides valuable guidance for implementing efficient FTP servers and avoiding major difficulties.

6.2.25 The Commission emphasized the increasing security threats to networked systems that NMHSs had to face and the potential impacts to specific sites as well as other interconnected sites, in particular for WWW systems. It noted with satisfaction that the ET-CTS had completed the Guide on Information Technology Security (ITS) at WWW centres. The document covers purpose, industry approved security processes, security procedures and best practices. The guide is readable by managers and also provides a precise source of information for technical personnel.

6.2.26 The Commission noted that the above guides were posted on the WMO Web server, which facilitated their access by all NMHSs' personnel, as well as their update. In view of the importance of this guidance for smaller NMHSs, especially developing countries, the Commission invited the Secretary-General to consider possible resources for translating the guides into the other working languages. The Commission also emphasized the importance of education and training on Information and Communication Technologies, and the value of test bed to validate relevant technologies for operational applications.

GTS operation and information exchange

Format of meteorological bulletins

6.2.27 The Commission agreed on amendments required to the *Manual on the GTS*, as follows:

(a) To remove all references to segmentation and the BBB indicator Pxx from the *Manual on the GTS* after 7 November 2007;

(b) To reflect that RRx is used for additional or subsequent issuances of messages with the same abbreviated heading line including the YYGGgg regardless whether these reports are on time, late or delayed;

(c) To clarify the procedures for defining BUFR and CREX bulletins containing “additional” data;

(d) For the representation of NIL bulletins and reports in BUFR;

(e) To satisfy requirements of aeronautical meteorology, in particular for exclusive allocation of WMO heading identifiers for GAMET bulletins and for special aircraft reports for volcanic ash;

(f) For the allocation of abbreviated heading for BUFR/CREX bulletins.

GTS procedures for the collection and distribution of sea level data and deep-ocean tsunami detection data, seismic data and distribution of Tsunami warnings and related information

6.2.28 Tsunami warning systems require sea level and deep-ocean tsunami detection data for the detection and measurement of the tsunami waves, and the prompt distribution of warnings and related information. There were in particular a number of sea level gauges run in the Pacific Ocean and in the Indian Ocean that contribute to the Tsunami Warning System. The Commission agreed that the GTS should support the collection and distribution of these data. In this respect, it agreed on the allocation of specific abbreviated headings $T_1T_2A_1A_2ii$ to be included in the *Manual on the GTS*. Noting that CREX code form provisions exist for reporting oceanographic and meteorological elements related to sea level reports, the Commission recommended the use of table-driven code forms to represent these data.

6.2.29 Tsunami warning systems also require seismic data for the early detection of potential Tsunami. The GTS includes procedures for the exchange of seismic data in parametric form, which were currently used by some countries. In view of the limited volume of parametric seismic data, the GTS is able to provide for the international exchange of parametric seismic data, according to the requirements to be defined by the countries concerned. In contrast, seismic waveform data (i.e. data from seismic sensors) represent a large volume of data that is collected from the field by countries, especially those exposed to local threats from nearby tsunamigenic areas. The current GTS implementation is not generally able to handle this volume of traffic with the timeliness requirement. Upgrades of the GTS-WIS may be agreed upon and implemented on a multi-lateral basis to accommodate this additional traffic. This should be done in support of a multi-hazard approach, and in coordination with GTS-WIS regional planning.

6.2.30 The Commission agreed on T_1T_2 allocation for the exchange of seismic data to facilitate the implementation of the GTS support on a multi-lateral basis. It also agreed that priority 2 should be allocated for the exchange of seismic parametric data on the GTS, and that priority 3 be allocated to seismic waveform data, noting that a higher priority level may be implemented on a multi-lateral basis to meet specific requirements

6.2.31 WMO, in coordination with UN/ISDR, UNESCO/IOC, and NMHSs have actively promoted and taken action for ensuring the most effective use of the GTS for the immediate support of the Interim Tsunami Advisory Information service as well as for the longer-term support of the Tsunami Warning System in the Indian Ocean. This support, which is already implemented for the Pacific, was being planned to be extended to other relevant areas, including the Caribbean, Mediterranean and North Atlantic, within a multi-hazard Early Warning approach. The Commission emphasized that appropriate training to relevant NMS personnel would be required to ensure an effective operational support to multi-hazard Early Warning from the GTS-WIS and, more generally, from the WWW components.

6.2.32 "Tsunami Watch Information" (TWI) bulletins that are targeted primarily at the countries of the Indian Ocean Region, are issued when required by The Pacific Tsunami Warning Centre (PTWC, NOAA/NWS, Hawaii, USA) and the Japan Meteorological Agency (JMA, Tokyo, Japan), via WMC/RTH Washington and RTH Tokyo respectively. Regional Telecommunication Hubs (RTHs), and in particular RTHs on the MTN, have updated their routing directories to ensure the efficient routing and distribution of these TWI messages, and in particular towards RTHs serving associated NMCs in the Indian Ocean, and to RTHs operating satellite-based data distribution systems covering any part of the Indian Ocean. TWI bulletins are also inserted in the transmission programme of satellite-based data distribution systems, including RETIM-Africa, EUMETCast (West IO), CMA PCVSAT (N-E IO), ISCS and EMWIN (East IO).

6.2.33 The Commission noted that the exchange of the Tsunami Watch and Warning bulletins are exchanged on the GTS with the highest priority (Priority 1). The requirement for an end-to-end transmission within 2 minutes was recognized as being achievable and recommended for the GTS. This had already been proven on the MTN and some other GTS circuits. The relevant NMCs, e.g. NMCs of the relevant Indian Ocean countries, should take the necessary action to receive and process/relay Tsunami Watch or Warning bulletins as quickly as possible for national purposes as required.

6.2.34 The Commission agreed on the procedures developed and tested by the ET-OI to acknowledge reception of a message received through the GTS, and noted the urgent requirements in the framework of the development of the IO-TWS. Although requirements for these procedures were originally raised to support effective exchanges of Tsunami Watch Information (TWI), the Commission agreed that the procedures shall be common to all bulletins requiring acknowledgment and be therefore included in the *Manual on the GTS*.

Amendments to the *Manual on the GTS*, Volume I, Global Aspects

6.2.35 Subsequent to the conclusions reflected above, the Commission adopted Recommendation 3 (CBS-Ext.(06)) concerning amendments to the *Manual on the GTS*, Volume I, Global Aspects, Parts I and II.

6.2.36 The Commission emphasized that a deep and extensive revision and re-organization of the *Manual on the GTS* was required to better match the current technologies and practices and to assist Members in their design and implementation of relevant information systems. The revision should also be fully coordinated with the development of appropriate regulatory documentation for the WIS (e.g. a Manual on WIS). It requested the OPAG-ISS, with the assistance of the Secretariat, to consider the most effective mechanisms for carrying out this task, noting that it would require significant human resources and adequate expertise.

Quantity monitoring of the operation of the WWW

6.2.37 The use of a PC-based common monitoring application would greatly facilitate a consistent and effective implementation of the Integrated WWW Monitoring (IWM) at WWW centres, and in particular the implementation of the operational trial. The Commission was very pleased to note that Germany (DWD) had developed a monitoring application on personal computer (METDATA Monitor). Germany offered to provide the METDATA Monitor software to all

WMO Members, and 58 countries requested and downloaded the software. The Commission expressed its strong appreciation to DWD for this major contribution to the monitoring activities of the WWW.

6.2.38 An operational trial of the IWM was carried out at RTH Dakar, using the METDATA monitor software. The results obtained were very positive. RTH Dakar recommended that the METDATA Monitor software be used in all RTHs and NMCs, as a means to greatly facilitate a consistent and effective implementation of the Integrated WWW Monitoring at WWW centres. The Commission thanked RTH Dakar for its contribution to the trial of the IWM. The Commission noted that RTH Teheran was also planning to participate in the operational trial of the IWM.

6.2.39 The Commission agreed to move from the test phase to a pre-operational phase of the IWM as from October 2007. The Commission stressed the key role of the RTHs in the IWM since they are responsible for collecting monitoring reports from their associated RTHs and to send the consolidated IWM monitoring reports to their associated MTN centres and to the Secretariat. The Commission agreed that the WMO Members operating an RTH should be invited to participate in the pre-operational phase of the IWM as from October 2007. The Commission requested the OPAG-ISS to prepare a guide on the implementation of the IWM, which could be used during the pre-operational phase, to make an assessment of the results and experience gained during the pre-operational phase and to refine the guide accordingly.

6.2.40 In view of the migration to TDCF, the Commission stressed the importance of monitoring data presented in BUFR code. It noted with appreciation the following contributions for the extension of the Special MTN monitoring (SMM):

(a) Offenbach and Tokyo were producing pre-analysis files for aircraft BUFR data (T1T2A1= IUA) and wind profiler BUFR data ($T_1T_2A_1$= IUP) respectively;

(b) Melbourne agreed to prepare pre-analysis files for surface ($T_1T_2A_1$= ISM, ISI, ISN) and upper-air observations ($T_1T_2A_1$= IUK, IUS, IUW, IUJ).

The Commission invited RTHs to further contribute to the monitoring of other types of data presented in the BUFR code.

6.2.41 The Commission requested the OPAG-ISS to revise the procedures of the Integrated WWW Monitoring (IWM) with a view to starting the monitoring of the availability of BUFR/CREX reports at WWW centres during the IWM pre-operational phase. The Commission noted that the METDATA Monitor software can be used to monitor BUFR reports, and that it is planned to extend it to monitor CREX reports.

Improved MTN project (IMTN)

6.2.42 The Commission noted with much satisfaction that the Improved MTN project (IMTN) implementation was nearly completed and had facilitated a progressive but rapid implementation of effective and reliable data-communication network services for the core GTS services.

6.2.43 The IMTN implementation plan was consisting of:

(a) The implementation of a “cloud I” providing the interconnectivity between the RTH/WMCs Washington and Melbourne and the RTHs Tokyo, Exeter, Brasilia and Buenos Aires, including RTH/WMC Moscow in a further step;

(b) The implementation of a “cloud II” as an extension of the RA VI-RMDCN, providing the interconnectivity between the RTHs Exeter, Toulouse, Offenbach, RTH/WMC Moscow and other adjacent RTHs, i.e. RTHs Nairobi, Dakar, Algiers, Cairo, Jeddah, New Delhi and Beijing. The inclusion of the Tokyo-Beijing and Tokyo-New Delhi circuits also provide an effective interconnectivity between both “clouds”.

6.2.44 With respect to "cloud I", the portion Washington, Melbourne, Tokyo and Exeter was implemented. Asymmetric Committed Information Rate (CIR) was cost-effective for matching the unbalanced traffic. It was noted that the current provider's contract would terminate at the end of 2007. The inclusion of RTHs Brasilia and Buenos Aires that were currently connected to RTH/WMC Washington via 64 kbit/s digital leased circuits would be considered at the opportunity of the end of the current contracts. The connection of RTH/WMC Moscow was planned as a further step. The Commission invited the Secretariat to organize early 2007 an implementation-coordination meeting for the IMTN "cloud I" centres to facilitate the transition towards new contractual arrangements.

6.2.45 The implementation of "cloud II" was made through the extension of the RA VI-RMDCN managed data-communication services. The ECMWF, in the framework of the WMO/ECMWF agreement, was managing the RMDCN and monitoring, on behalf of all participating centres, the quality of service and the contractor's adherence to the Service Level Agreements. The Commission noted with appreciation that the master RMDCN contract was renegotiated and revised, which lead to significant improvement in cost-effectiveness for the benefit of the IMTN "cloud II". The Commission also noted the plan for migrating "cloud II" to advanced data-communication network services (MPLS).

6.2.46 The Commission noted that RTH Dakar had decided not to join the RMDCN, since the option of upgrading the Dakar-Toulouse MTN circuit via an extension of their VSAT SATCOM network, which was implemented, was more cost-effective at that time. RTH Nairobi had also implemented the upgrade the Nairobi-Offenbach MTN circuit via an extension of their national VSAT network. The Commission was informed that RTH Algiers and Cairo were planning to join "cloud II" managed data-communication services. The Commission invited the Secretariat to organize an implementation-coordination meeting for the IMTN "cloud II" African centres.

6.2.47 The Commission noted with satisfaction the progress made in the implementation of the IMTN project and expressed its great appreciation for the collaborative and fruitful efforts made by the NMHSs concerned that contributed to the upgrade of the overall GTS as well as to an effective building block for WIS.

Telecommunication techniques and services

6.2.48 The OPAG on ISS had reviewed the development of telecommunication techniques and services for an improved GTS. The Commission particularly noted that Digital Audio Broadcasting (DAB) and Digital Video Broadcasting (DVB) techniques via satellite that were implemented by several NMHSs for national and international data-distribution systems, confirmed their suitability and cost-effectiveness for an improved GTS.

6.2.49 The Commission noted the characteristics of new emerging advanced data-communication network services, especially MPLS (Multi-Protocol Label Switching) that was quickly superseding Frame Relay networks in some areas of the World. The Commission noted that MPLS would give the potential capability of any-to-any connectivity, and was providing new opportunities and challenges with respect to traffic management between GTS centres. The Commission asked the OPAG on ISS to consider the full implications, and agreed that the exchange and routing mechanisms for messages and files on the GTS should be reviewed in the light of these new capabilities, with a view to WIS and with a view to improving exchange of high priority data and products in support of a virtual all hazards network within the WIS-GTS.

Radio frequencies for meteorological activities

6.2.50 The Commission emphasized that the threat on the full range of radio frequency bands allocated to meteorological systems and environmental satellites would continue with the increasing development and expansion of new commercial radiocommunication systems, especially Ultra Wide Band (UWB) devices, i.e. radiocommunication systems operating with very large bandwidth.

6.2.51 The Commission noted with much appreciation the activities of the Steering Group on Radio-Frequency Coordination in the preparation of the forthcoming World Radiocommunication Conference 2007 (WRC-07, November 2007), and its active involvement at the regional level in safeguarding radio frequency bands allocated to meteorological systems and environmental satellites. It noted with satisfaction that a Workshop on Radio Frequencies for meteorology, including sharing aspects between Met Aids and Met Sat in common bands, was organized (Geneva, February 2006). The SG-RFC was finalizing the update of the joint ITU-WMO publication "*Handbook on use of radio spectrum for meteorology*" in coordination with the ITU, and that the updated information would be posted on the WMO and ITU websites. The revised handbook would be an important reference documentation in preparation and for WRC-07. The Commission also noted with satisfaction that the SG-RFC activities were an important contribution to the respective GEO task.

6.2.52 The Commission noted that the agenda of WRC-07 included several items of serious importance for WMO. The most important issues were related to the threat on the 2700-2900 MHz band (meteorological radar) and the protection of spaceborne passive sensing bands. The Commission noted and endorsed the WRC-07 WMO's position document that was developed by the SG-RFC, submitted to relevant ITU-R groups and would be distributed to WMO Members and relevant international organizations, with a view to facilitating an effective preparation of national WRC-07 positions favourable for the WMO related issues. The Commission recalled that the Executive Council urged all NMHSs and meteorological and environmental satellite operators to do their utmost to safeguard frequency band allocations as they were was crucial for WMO. It noted with appreciation that WMO, meteorological and R&D satellite agencies and several NMSs were actively participating in ITU-R activities. EC, with reference to Resolution 3 (Cg-XIV), urged Members to participate actively in national, regional and global (i.e. ITU-R) activities regarding radio-frequencies to ensure that meteorological and related environmental interests are protected.

6.2.53 The Commission confirmed the importance of keeping NMHSs aware of the criticality of issues related to the various radio frequency bands used by meteorological systems. It urged Members to ensure that their respective national Radiocommunication Authorities were fully aware of the impact of relevant issues for meteorological operations and to seek their support on relevant WRC-07 issues. The Commission asked the Steering Group on Radio-Frequency Coordination to actively pursue its activities, with focus on the preparatory activities for WRC-07, including the ITU-R Conference Preparatory Meeting (CPM) planned for February 2007.

Metadata standards

WMO Core Metadata Profile

6.2.54 Noting the crucial importance of metadata for the WIS, Fourteenth Congress requested all WMO Programmes to join their efforts in the further development of detailed WMO metadata standards. The Commission noted that the presidents of the WMO Technical Commissions were invited to designate experts to represent their Commissions in the CBS Inter-Programme Expert Team on Metadata Implementation (IPET-MI).

6.2.55 The Commission noted with appreciation the development by the IPET-MI of a draft version 1.0 of the WMO Core Metadata Profile of the ISO Metadata Standard.(1) It agreed to designate it as the final version 1.0, that should be made available on the WMO server in the three formats: text description, XML representation based on ISO 19139 standard and UML representation.

Operational information catalogues

6.2.56 Version 1.0 of the WMO Core Metadata Profile uses simple catalogues for its information: in addition to those required by the relevant ISO standard, a thesaurus for keywords, a

1 The standard may be found at http://wis.wmo.int

list of the *CCCC* country codes and a gazetteer to allow the translation of station names, station identifiers and station numbers into their geographical positions. The Commission invited the OPAG-ISS, in consultation with the OPAG-IOS, to further develop with a high priority methods of representing comprehensive information related to observing stations using the metadata, such as the catalogue of variables measured by a standard observing station or the catalogue of instruments used for variables measured by standard observing station, in particular:

(a) Using unambiguous and standard terminology for key words/key phrases based on *International Meteorological Vocabulary* (WMO-No. 182), *Technical Regulations* (WMO-No. 49);

(b) Keeping the station history for different reasons, an example being the homogeneity of data times series for the monitoring of climate changes;

(c) Tracking changes of station data (i.e. metadata of the station) that can be done any day; not having this capability could negatively influence results.

6.2.57 The Commission requested the OPAG-ISS to consider appropriate editor(s) for the creation and maintenance of the catalogues.

Implementation of the WMO metadata standard

6.2.58 The Commission invited the OPAG-ISS to take the lead on identifying tools to allow users to create metadata documents. Priority should be given to tools to allow automated "harvesting" of routine data because this is needed for the GISC prototype generation. An editor for manually creating metadata must also be created. It will also be necessary to develop training for WMO Programmes so that metadata are created in an appropriate way; a "best practice" guide is also needed.

Use of related ISO metadata standards, especially the ISO 191xx series, for the development of the WIS

6.2.59 Activities to communicate relevant ISO 191xx standards to other teams of the OPAG-ISS were included in the work plan of the IPET-MI. Actions were included in the work plan of the IPET-MI to prepare for the use of features in version 2.0.

Interaction with the ISO TC 211

6.2.60 The Commission noted the need for extensions of the ISO 19115 for time issues. The ISO TC211 should be asked by a WMO Member country to add a work item to include these**.**

Other WWW Data Management matters

6.2.61 The Commission recalled the revised contents for the *Guide on WWW Data Management*. The Guide should be designed for electronic publication and that only those aspects of the Guide that described best practices were maintained, in the general framework of the Operational Information Service. Guidance on other aspects of data management should be included indirectly through references to other sources of information available on the Web. The Commission agreed that the responsibility for editing each of the part of the Guide should lie with the CBS OPAGs and expert teams with key knowledge on each topic, under the coordination of the OPAG on ISS assisted by the Secretariat, and it asked the OPAGs to contribute to updating the Guide accordingly. It also agreed that the current Guide, which had fully served its purpose but was now outdated, should be retired from the WMO Web server.

Data Representation and Codes

6.2.62 The Commission noted with appreciation the work of the Expert Team on Data Representation and Codes (ET/DR&C) and thanked Mr Milan Dragosavac (ECMWF), who chaired the team.

Modifications to the *Manual on Codes*

6.2.63 The Commission recalled the scheme agreed upon during its Extraordinary Session (2002) which defined a three-steps mechanism for modifications to BUFR, CREX and GRIB 2 tables: (see paragraph 6.2.66, *Abridged Final Report with Resolutions and Recommendations of the 2002 Extraordinary Session of the Commission for Basic Systems* (WMO-No. 955)). The Commission noted the working results and recommendations of the ET/DR&C and the ICT/ISS concerning additions to data representation tables, including the additions approved during the intersessional period for pre-operational use, as summarized in the following paragraphs.

FM 92 GRIB Edition 2

6.2.64 In the light of various requirements, the Commission agreed to a set of additions of parameters in GRIB 2 Tables, for THORPEX TIGGE fields, for fire detection and clear sky radiance satellite data, for UV Index field and for additional precipitation fields. The Commission agreed to additions of new templates for lossless IEEE floats packing and simple packing and to a new system for defining Master Table Version Number for pre-operational Tables. It also recommended new parameters and a new regulation to ensure orthogonal structure of the parameters definition (see Annex 1 to Recommendation 4 (CBS-Ext.(06))). The Commission agreed to the request of ICAO to extend the use of GRIB 1 for the user of aviation products up to November 2010, because necessary equipment and software for GRIB 2 will not be available in all countries by November 2008. The Commission noted with appreciation that EUMETSAT had decided that all image type products would be encoded in GRIB Edition 2, and that the number of products in GRIB 2 format generated by main Centres was increasing.

FM 94 BUFR, FM 95 CREX and Common Code Tables

6.2.65 The Commission agreed to additions to BUFR/CREX Tables for answering various needs. Additional Common Sequences for BUFR templates of SYNOP (including needs for regional practices), SHIP and buoy observations, CLIMAT, CLIMAT SHIP, CLIMAT TEMP and CLIMAT TEMP SHIP data were recommended. Numerous additions were recommended for satellite data, especially for the new European polar orbiting satellite data with the instruments MHS, IASI and ASCAT. At the request of Japan, additions were recommended for reporting in BUFR, tropical cyclone observations performed by satellite and Radar (SAREP and RADOB data), and TRACKOB ship data. Descriptors to report extended degree of turbulence in SIGWX messages and for transmission of SIGMET in BUFR were recommended. Clarifications to some BUFR regulations were approved. Additions were recommended for height of temperature sensor in SST measurement by ship, for representation of nominal values and for temperature and salinity profiles recorded by profiling floats. (See Annex 2 to Recommendation 4 (CBS-Ext.(06)).)

Operational implementation of the amendments to Binary Codes and Common Features

6.2.66 The Commission adopted Recommendation 4 (CBS-Ext.(06)) – Amendments to the *Manual on Codes*, Volume I.2, for FM XIII GRIB 2, FM XIII BUFR and FM XIII CREX, and recommended operational implementation of the amendments on 7 November 2007.

Modifications to FM 15 METAR, FM 16 SPECI and FM 51 TAF

6.2.67 In response to the requirements expressed by ICAO related to the amendment 74 to Annex 3/Technical Regulations [C.3.1], the Commission recommended modifications to METAR/SPECI and TAF codes, for implementation on 5 November 2008 (see Annex to Recommendation 5 (CBS-Ext.(06))). The Commission adopted Recommendation 5 (CBS-Ext.(06)) – Amendments to the *Manual on Codes*, Vol. I.1. Regarding the implementation dates of amendments to aviation codes, the Commission was pleased that ICAO accepted to bringing into phase the implementation dates of amendments to Annex 3/Technical Regulations [C.3.1] with implementation dates of CBS recommended code changes.

Regulations for reporting traditional observations data in Table Driven Code Forms (TDCF): BUFR or CREX

6.2.68 Regarding the implications of the Migration to TDCF for the *Manual on Codes*, CBS-XIII had re-asserted the need to adapt and update current reporting practices from the Traditional Alphanumeric Codes (TAC) for TDCF, and agreed to include regional/national practices in the BUFR templates; this would help particularly the development of automated encoding systems. A proposed set of regulations for reporting traditional observations data in BUFR or CREX was developed by Ms Eva Červená, in consultation with members of the ET/DR&C and endorsed by the OPAG on ISS. The Commission commended Ms Červená for this task and recommended these regulations (see Annex to Recommendation 6 (CBS-Ext.(06))) to be part of the *Manual on Codes*, Volume I.2, as a new chapter d. of Part C, Common Features to Binary and Alphanumeric Codes, but being placed only on the WMO website. The Commission adopted Recommendation 6 (CBS-Ext.(06)) – Amendments to the *Manual on Codes*, Volume I.2, Part C, Common Features to Binary and Alphanumeric Codes and recommended operational implementation of the amendments on 7 November 2007.

Migration to Table-Driven Code Forms (MTDCF)

6.2.69 The Commission noted also with appreciation the work of the Coordination Team on Migration to Table Driven Code Forms (CT-MTDCF) and thanked Mr Fred Branski (USA), who chaired the team.

6.2.70 The Commission recalled that Fourteenth Congress had endorsed the migration plan developed by CBS; however CBS noted that Member countries were having difficulties implementing the migration process, even with developing national migration plans in many cases. These could be derived from the international plan, with analysis of impacts, costs, solutions, sources of funding (as necessary), national training, technical planning and scheduling. The Commission noted that a very important milestone had been reached by the start of the operational exchange of migrated data, which began on 2 November 2005. The Commission also took note that more BUFR bulletins were exchanged than recorded in the WMO monitoring file; however their number was still small.

6.2.71 The Commission considered the difficulties slowing implementation of migration by the WMO Members. The Commission noted that some Members, who have the technology, were not yet beginning migration. Developing countries needed the benefit of experience from more advanced countries. The Commission agreed that there was a problem of visibility of migration activities. The Regional Associations, the Regional Rapporteurs on ISS, Data Management (and/or Codes) and the RTH Focal points should be systematically involved and informed. The Commission requested the CT-MTDCF to prepare a letter, which the Secretariat should send to the WMO Members, with two annexes: a short, one or two page outline of the main actions or tasks which should be considered and possibly undertaken, and a Migration Guidance document. The Migration Guidance document would be targeted at executive management to increase their awareness of the migration and related issues and activities, including a list of all the benefits expected from the migration to TDCF. This would stimulate the relay of requirements to and accomplishment of actions by the experts involved more directly with the different aspects of the implementation of the migration to TDCF. The procedure to start the dissemination of new BUFR/CREX bulletins should be clearly explained in the guidance as well as a procedure for completion of migration at MTN level.

6.2.72 The Commission stressed the need for Members to inform the WMO of the insertion onto the GTS of new BUFR or CREX bulletins by following the procedures currently used when informing the WMO of the insertion onto the GTS of any new bulletins. This makes it possible to distribute relevant METNO messages on the GTS informing all Members of the insertion onto the GTS of new BUFR/CREX bulletins and to update Volume C1 of WMO Publication No. 9 (catalogue of meteorological bulletins) which consequently also allows updating of the WMO monitoring file.

6.2.73 The Commission stressed that numerous tasks remained to be done, especially to help developing countries. The Commission stressed that it would be highly desirable to have a website offering test data for decoding, and centrally coordinated preoperational testing of encoded messages in BUFR or CREX for helping members perform operational implementation. To demonstrate to users the advantages of BUFR, an example of a simple application, with a demonstrated implementation should be made available. The Commission requested the CT-MTDCF to take action in this respect. The need for “turn-key” encoder/decoder software running under WINDOWS operating system to be made available at no cost was stressed by several Members. Financial assistance to developing Countries for the migration should be considered through cooperation mechanisms (trust funds, VCP, etc.).

6.2.74 The Commission also stressed a coordination scheme should be systematically introduced at the regional level and the migration plans should be coordinated between countries. All new workstations for data acquisition implemented in NMHSs should have the capability to decode and display BUFR.

6.2.75 The Commission was pleased to note in all WMO Regions from 2003 to 2005, the total number of countries, where at least one participant had been trained on TDCF, was 100 out of 183 countries. Because of the critical need to correctly implement BUFR and CREX processing by software and equipment producers, the Commission strongly recommends having a training seminar targeting this group. CBS was pleased to note that representatives from the HMEI assisted as observers to the last meeting of the Coordination Group for the Migration and are now engaged with the efforts of this group. The Commission took note of the need for additional training in several Regions, and asked the Secretariat to implement all possible forms of training on TDCF including CAL and web services. The Commission called on support from developed countries for this matter.

6.2.76 The Commission was pleased that some countries in Africa were trying to implement SYNOP observations in CREX as an interim solution. In West Africa, CREX is also being used for reporting squall lines. The Commission recommended that training be completed for countries not yet covered and repeated for RA I. The representative of ASECNA stated the plan of the Agency to move forwards the migration to TDCF in its Member Countries. It reported its plan to organize training events on TDCF and wished WMO to be associated with it.

6.2.77 The Commission recommended that pilot projects be implemented with a view to helping developing countries. These pilot projects, called Migration Implementation Programmes (MIPs), should be supported only if they have implementation as the defined result of their completion.

6.2.78 The Commission was pleased that, as stated in its terms of reference, the Coordination Team on migration coordinated its activities with other relevant international bodies. There had been contacts with ICAO, CAeM, IOC, JCOMM and the satellite operators in order to coordinate, agree and resolve migration issues related to specific code types. The Commission took note that ICAO wished to target completion of migration to BUFR only in 2016. The new proposed schedule for the Migration is listed in Annex I to the present report.

6.2.79 EC-LVIII had requested CBS to address the data representation requirements of the user community, in view of the demand for the use of modern industry standards, such as XML; it noted in this regard the emerging requirements from the aeronautical community, which should be addressed in collaboration with CAeM and ICAO. The Commission also noted the reports from several countries on the use of XML and NetCDF; the Commission decided to study the real implications of using these data forms for meteorological data, especially in operational meteorological real time exchanges, and assessing the development efforts and resources that would be required. The Commission requested its Management Group to establish an Expert Team within the OPAG-ISS for assessing advantages and disadvantages, including implications (need for defining standardization, data processing development and integration, costs and benefits: flexibility, compression, feasibility of implementation, etc.), of different data representation systems (e.g. BUFR, CREX, XML, NetCDF, HDF) for use in real time operational international exchanges between NMHSs and in transmission of information to users outside the NMHSs. The Expert Team should develop recommendations on the most appropriate system depending on the type of exchange applications and report on the possible impacts of its findings on the migration to TDCF. All WMO Technical Commissions should be invited to participate in this Ad-Hoc Expert Team.

6.2.80 The Commission requested its Management Group to urgently establish an inter-Commission dialogue between the relevant expert teams of CBS and CAeM, in coordination with ICAO, with the remit to discuss concerns raised by aviation specialists regarding the migration of OPMET codes to TDCF.

Future activities

6.2.81 The Commission reviewed the key tasks of the OPAG on ISS for the forthcoming CBS intersessional period (2007-2008) (see agenda item 11).

6.3 DATA-PROCESSING AND FORECASTING SYSTEM (DPFS) INCLUDING EMERGENCY RESPONSE ACTIVITIES (ERA) *(agenda item* 6.3)

6.3.1 The Commission noted the significant progress made by the OPAG on DPFS under its Chairperson Mr Bernard Strauss (France), including the work of the ICT on DPFS, Expert Team on EPS, Expert Teams on Long-range Forecasting (Infrastructure, Verification), Coordination Group on Nuclear Emergency Response Activities, Expert Team on Atmospheric Transport Modelling for Non-nuclear Emergency Response Activities, the Rapporteur on the Application of NWP to Severe Weather Forecasting, and the Severe Weather Forecasting Demonstration Project Steering Group.

Forecasting Standards and Recommended Practices

6.3.2 The Commission noted that Fourteenth Congress was of the view that the establishment of a WMO standard and/or recommended practices for weather forecasting techniques would assist in producing more reliable forecasts using optimally the current levels of meteorological science and technology. Two documents have been developed and made accessible to Members via the WMO website:

- “Guidelines on Using Information from EPS In Combination with Single Higher Resolution NWP Forecasts” (February, 2006);

- “A Summary of Recommended Practices for Weather Forecasting” (November 2004).

6.3.3 The Commission noted that a review and updating of the WMO *Guide on the GDPFS* (WMO-No. 305) would require some experts and/or a suitable consultant. The updated *Guide* would be best made available as a Web-accessible document on the WMO website.

6.3.4 The Commission was informed of the intention within the World Weather Research Programme (WWRP) to work on the matter of “Forecast Systems”, which is linked and would potentially benefit from developments under Forecasting Standards and agreed that the DPFS programme should participate in a joint meeting or workshop planned for 2007.

Ensemble Prediction Systems Products and Applications

6.3.5 The Commission was informed that fourteen GDPFS centres are running Ensemble Prediction Systems (EPS), some are running multiple systems, and their products are of considerable and growing interest to all WMO Members, as EPS products are a realization of quantifying uncertainty in the numerical simulations and predictions of the atmosphere.

6.3.6 The Commission re-emphasized the continuing need for training and capacity building measures on the use of EPS products at many NMHSs in order to realize the benefits, especially for developing countries. One desirable approach, for example, is to establish an international training desk at EPS producing centre, in similar fashion to the Africa Desk or the Tropical Desk established at NCEP (USA).

6.3.7 The continuing development of EPS, in model resolution, methods of accounting for uncertainties, forecast ranges, and applications, is important for weather forecasting on all time scales, i.e., short-range to long-range predictions. The concept of including uncertainty in all forecasts needs to be promoted to decision makers and managers who in turn could set new requirements for probabilistic forecasts as part of the provision of weather information, forecasts and warnings.

6.3.8 WMO Members are encouraged to access EPS products of GDPFS centres which are also encouraged to provide the access information for their respective EPS websites.

6.3.9 In response to guidance that was sought at CBS-XIII (2005), a document was produced entitled: "Guidelines on using information from EPS in combination with single higher resolution NWP forecasts". This guide includes the following highlights:

- A forecaster can assess how much weight to place on a single high-resolution forecast (or on the ensemble control) from the spread in the ensemble. Small spread in the ensemble provides confidence in the single forecast, while larger spread indicates that it is essential to include information on forecast uncertainty;

- As spread increases, it is less appropriate to rely on a single forecast as the most likely scenario (be it the high resolution or the control forecast of the ensemble). All solutions in the ensemble must then be considered when weighing the likelihood of different forecast scenarios. However, until the lead time where an ensemble indicates large forecast uncertainty, a high resolution control forecast can be utilized in the formation of the most likely scenario;

- The aim of post-processing should be to produce a probability distribution function taking account of information from both single high-resolution model run and EPS members. In general it is expected that in short-range forecasts high weight will be attached to the high-resolution forecasts and lower weights to the perturbed members whereas for the longer range forecasts it is expected that similar weights will be applied to all members.

6.3.10 The Commission noted that regional collaboration on EPS could lead to the development of a specializing EPS centre(s) that would provide EPS products for NMHSs in a geographical sub-region. Examples include:

- The COSMO-LEPS which provides regional downscaling of ECMWF global ensemble;

- The EUMETNET SRNWP-PEPS project (a poor-person's ensemble combining data from different countries' regional scale models); or

- The South American centres that developed collaboration over the Plata region (MASTER Super Model Ensemble System).

6.3.11 Since some EPS producing centres are developing and implementing diagnostic methods and products for severe weather applications for national requirements, the Commission encouraged these centres to either extend some of these applications to other NMHSs or to provide access to their EPS products or datasets and assist these NMHSs to develop for themselves suitable tools for severe weather forecasting relevant in their own regions of interest. Illustrative examples could be documented and made accessible to NMHSs. In this connection it was noted that the operational multi-centre North American Ensemble Forecasting System (NAEFS) will produce and distribute on its website weather forecast information, including products for use in severe weather warning activities.

6.3.12 In connection with the provision of location-specific NWP products to developing countries as an incentive to enhance support for the GOS, the Commission noted the request of EC-LVII (paragraph 3.1.1.5 (c) (vii)) to CBS to consider ways to take the matter under the WWW Programme. The Commission noted and agreed with CBS-MG-VI (2006) which has assigned an additional task to develop product guidelines and standards for these graphical products ("EPS-grams") for international exchange.

6.3.13 The Commission encouraged EPS producing centres to provide additional products related to severe weather forecasting such as the Extreme Forecast Index (EFI) developed at ECMWF. Such new products may require additional post-processing ("downscaling") and may not always have been fully assessed for all areas of the globe; however producing centres could make them available with suitable caveats and invite feedback from users.

6.3.14 The Commission noted that the Japan Meteorological Agency operates the Lead Centre for EPS Verification using two Internet sites: a FTP-site (ftp://ftpepsv.kishou.go.jp/) for gathering the statistical data of EPS verification, and a website (http://epsv.kishou.go.jp/ EPSproducer/) for publishing the results. EPS producing centres are encouraged to register with the Lead Centre and commence providing their verification data to the Lead Centre as soon as possible if they have not already done so. Currently, the Web and FTP-sites are password protected and accessible only by the registered centres. The Commission agreed that access to this website should be made available to all WMO Members.

6.3.15 The Commission recommended to add to the current paragraphs in the *Manual on the GDPFS* (Volume I, Part II, Appendix II-6, paragraph 4.1) the additional EPS graphical product type known as "EPSgrams", and that specific product standards or guidelines should be developed for their international exchange. The recommended amendment to the *Manual on the GDPFS* is given in Part 1 of Annex 1 to Recommendation 7 (CBS-Ext.(06)).

6.3.16 The Commission recommended a revised text to replace the existing text in the *Manual on the GDPFS* (Volume I, Part II, Attachment II.7, Table F) related to EPS Verification. The recommended amendment is given in Part 2 of Annex 1 to Recommendation 7 (CBS-Ext.(06)).

Severe Weather Forecasting

6.3.17 The Commission noted the progress of the Severe Weather Forecasting Demonstration Project (SWFDP), including the establishment of a Project Steering Group, which developed the "Overall Project Plan" and a document entitled "SWFDP Guidebook on Planning Regional Subprojects".

6.3.18 The Commission noted that the first SWFDP regional subproject has been implemented in the southeastern region of Africa in 2006 and focuses on heavy precipitation and strong winds not specifically associated with Tropical Cyclones. The following centres are participating in the first regional subproject:

- NMCs of: Botswana, Madagascar, Mozambique, United Republic of Tanzania, Zimbabwe;
- RSMC Pretoria, RSMC La Réunion, ACMAD;
- Global products centres: ECMWF, Met Office UK, NCEP (USA).

6.3.19 A Preparatory Training session was conducted at RSMC Pretoria (South Africa), 31 October to 3 November 2006. On 6 November 2006 RSMC Pretoria commenced issuing the new daily severe weather guidance product, while dedicated web/ftp sites have been implemented by the Global products centres; they are all accessible via a protected Web portal implemented at RSMC Pretoria.

6.3.20 It was also noted that this project is contributing significantly and in a very concrete way to capacity building in the NMHSs through better understanding and use of NWP and EPS products, and is providing the opportunity to improve the interaction with Disaster Management and Civil Protection Authorities, thereby supporting the goal of increasing the visibility of NMHSs. For example, the South African Weather Service noted that through the SWFDP, it has received high-level support and visibility in government.

6.3.21 The Commission recommended that the SWFDP should include the involvement of civil protection authorities to improve the delivery of severe weather warning services. Regarding this aspect, collaboration with the PWS and DPM programmes is encouraged.

6.3.22 The Commission was informed of numerous activities through which NCEP’s (USA) Africa Desk is supporting the SWFDP, directly, including:

- Contributing expert lectures to the Preparatory Training session’s programme,
- Providing global products, including EPS, in real-time,
- Receiving and training forecasters from southeastern Africa at the Africa Desk at NCEP.

6.3.23 The Commission was informed that ECMWF is providing special severe weather guidance products for the SWFDP, including EPSgrams, probability charts, and the Extreme Forecast Index (EFI), with the caveat that there is little experience with their accuracy and reliability in South-eastern Africa; feedback from the participating regional and national centres is requested.

6.3.24 The Commission was informed that the Met Office UK is providing numerous guidance products and in particular has implemented an “Africa-LAM” windowed over southern Africa.

6.3.25 The Commission noted enthusiastic appreciation for the strong participation of all the Global products centres (ECMWF, Met Office UK, NCEP-Africa Desk) as well as RSMC Pretoria in their efforts to tailor and implement NWP and EPS guidance products for the geographical region of the project, as well as the training provided on the products. As well, it noted that participating national centres were committed to fully engage in the project.

6.3.26 The SWFDP offers an important opportunity to demonstrate, learn and refine the “Cascading” process for severe weather forecasting. It is therefore important that severe weather cases be archived so that case studies could be developed to determine ways of improving any and all aspects of the forecasting process relevant to the specific region and the nature of the severe weather events. The Commission agreed that the identification and development of case studies, with participation by the relevant centres, is a high priority within the project.

6.3.27 Noting the increasing importance of accurate and timely severe weather warnings for most countries, the Commission recommended that if the SWFDP is successful, its concept should be expanded to other Regions of WMO especially in developing countries. In addition, NMHSs should apply all efforts to improve their severe weather forecasting process, the methods, and warning management structures, in order to respond effectively to the needs of the disaster reduction agencies.

6.3.28 The Commission was informed that under the GEO Workplan there is a thrust to coordinate various NWP capacity building initiatives (training events) across NMHSs in all regions of the world, with the goal of leveraging improved capacity building in certain regions.

6.3.29 Another regional subproject will focus on forecasting of severe weather associated with Tropical Cyclones, and will be considered following the implementation of the first subproject.

Long-range Forecasting

6.3.30 In the *Manual on the GDPFS* the designation of RSMCs with activity specialization includes "long-range weather forecasts" (products). The Commission agreed that an explanatory note be added in the Manual to clarify this reference in relation to GPC of LRF (Vol. I, Part II, paragraph 1.4.1.2 (b)). The recommended amendment is given in Part 1 of Annex 2 to Recommendation 7 (CBS-Ext.(06)).

6.3.31 The Commission recommended that the criteria for designating a Global Producing Centre of Long-range Forecasts (GPC of LRF) and the list of designated GPCs be added to the Manual as a new section (Vol. I, Part II, APPENDIX II-8). The recommended amendment is given in Part 2 of Annex 2 to Recommendation 7 (CBS-Ext.(06)).

6.3.32 The Commission agreed that the "Minimum List of Products to be made available by GPCs", as included in the Appendix II-6 of the *Manual on the GDPFS* be revised to include some necessary clarifications without any change to the minimum list of products. These products should be made available to as many NMCs and Regional Climate Centres (RCC) as possible, for the purpose of enabling them to perform their tasks. The recommended amendment to the *Manual on the GDPFS* is given in Part 3 of Annex 2 to Recommendation 7 (CBS-Ext.(06)).

6.3.33 The Commission noted data or products in addition to those required in the minimum list of products could also be provided by GPCs on request by RCCs or NMCs; the RCCs and NMCs would adhere to conditions, if any, attached by the GPCs to these data and products. This additional list is given in Annex II to the present report.

6.3.34 The Commission noted the requests of the Permanent Representatives of Australia, Canada, China, France, Japan, the Republic of Korea, the USA and the United Kingdom, and the Director of ECMWF for the designation of their respective Centres: Melbourne, Montreal, Beijing, Toulouse, Tokyo, Seoul, Washington, Exeter, and ECMWF each as a Global Producing Centre for Long-range Forecasts (GPC for LRF). The Commission was informed of the formal commitment of these Centres to fulfil the functions of GPC for LRF. The Commission expressed appreciation for the presentations made on the capabilities of these Centres, and agreed after considering their achievements, that the Centres have fulfilled the relevant provisions of the designation procedures. The Commission therefore, recommended the designation of each of these centres as GPC for LRF and adopted Recommendation 8 (CBS-Ext.(06)).

6.3.35 The Commission took note with appreciation of the intentions by the Russian Federation and South Africa to seek recognition of GPC for LRF, respectively for Moscow and Pretoria Centres. The Commission encouraged these Centres to pursue official recognition in view of their achievements, at the next session in 2008, after official requests submitted by their respective Permanent Representatives to the Secretariat. The Commission also encouraged other centres producing long-range forecasts to work at achieving the criteria for GPC status.

6.3.36 The Commission agreed to recognize, after considering their achievements, the following Centres to be included in the Manual on the GDPFS as GPCs of LRF: Melbourne, Montreal, Beijing, Toulouse, Tokyo, Seoul, Washington, Exeter, and ECMWF.

6.3.37 The Commission agreed the use of multi-model ensembles (MME) for long-range forecasting (LRF) is worthwhile since:

- MMEs provide the opportunity for improved reliability over that available from single model ensembles alone;
- MMEs provide the opportunity to estimate uncertainties in LRF, and to particularly identify limitations of LRF;
- MMEs provide a means to a "confidence builder" in the area of LRF; and
- Larger improvements in skill can be achieved from the use of MMEs.

6.3.38 The Commission agreed that some GPCs of LRF could serve as collectors of global LRF data to build MMEs. Such centres could perform the following functions:

- Collect global hindcasts and forecasts from participating GPCs and make them available to other GPCs, Regional Climate Centres (RCC) and NMHSs, as registered users (with password protected access);
- Promote the exchange of research and experience on MME, and provide documentation on MME;
- Work at the establishment of standards for MME products;
- Provide a repository of different MME techniques for the generation of MME in support of GPCs and RCCs; and
- Provide display of GPCs forecasts in a common format based on agreed standards, to RCCs, NMCs and GPCs, with password protected access.

6.3.39 The Commission took note with appreciation of the presentation by KMA (Republic of Korea) and NOAA (United States of America) highlighting their collaboration as collectors of global LRF data towards meeting future operational requirements for Long-Range Forecast Multi-Model Ensemble (LRF MME) predictions, with a view to become “Lead Centre” in this field. The Commission encouraged Global Producing Centres (GPCs) for Long-Range Forecasts to exchange their seasonal hindcast and forecast data, and to provide them to centres pursuing LRF MME predictions, in particular to GPC Seoul and GPC Washington to facilitate development work as soon as possible.

6.3.40 The Commission requested the OPAG on DPFS to give consideration to the need for recognition of “Lead Centre for LRF MME predictions” and if so to further refine and clarify the functions of such Lead Centre(s), taking into account the concern raised by the United Kingdom regarding data policy and for the control of the forecast message to governments, key users and the media. Potential Lead Centre(s) could then receive official recognition at the next CBS session in 2008.

6.3.41 The Commission at its thirteenth session (CBS-XIII, 2005) and the Commission for Climatology at its fourteenth session (CCl-XIV, 2005) recognized that several regions had undertaken pilot projects for implementation of RCCs, and that requests to WMO for formal designation of RCCs would be likely before the end of 2008. The Commission noted that the *Manual on the GDPFS* would therefore require amendments to the Global Aspects section to describe the functions that could be undertaken by a WMO RCC, with the appropriate regulatory text and criteria for performance and evaluation of, at least, the basic, minimum set of RCC functions. The Commission further noted that many essential RCC functions would require consistent and reliable products and support from the GPCs. In response to the request from the CCl, the Commission decided to work with the CCl to develop appropriate revisions to the Manual to support formal designation of RCCs, prior to CBS-XIV (2008).

6.3.42 The Commission was informed that the Indian Meteorological Department has been successfully making LRF of the South West Monsoon seasonal rainfall over the country for the past many decades, issued each April and updated each June. The forecasts were prepared using indigenously developed statistical models. In addition, IMD has implemented a dynamical prediction system in 2003 using a T63 model of ECPC (USA), which has shown some skill. The model was used for experimental forecasts over the Indian region in 2005 and 2006. India would seek a designation of RCC for its National Climate Centre so that the benefits of this activity may be extended to the whole of RA II, whenever such proposals are invited.

6.3.43 The Commission noted the revised Statement of Guidance list of Observation Data Needs for Producing Global LRF (2006) has been conveyed for consideration by the CBS/OPAG on IOS, CCl, and GCOS.

6.3.44 The Commission noted the Standardized Verification System for Long-range Forecasts, as included in the Appendix II-8 of the *Manual on the GDPFS,* was reviewed. It recommended that the revisions, which provide necessary clarifications and corrections, be incorporated as an amendment to the *Manual on the GDPFS*, found in Part 4 of Annex 2 to Recommendation 7 (CBS-Ext.(06)).

Emergency Response Activities

Nuclear Emergency Response Activities (Nuclear ERA)

6.3.45 The Commission noted in emergency response mode faxing remains the official product transmission method and it further noted maintaining up-to-date operational fax numbers and contacts points remains a challenge. It agreed that appropriate actions will be taken by RSMCs and the Secretariat to confirm through testing and to update (via correspondence to Permanent Representatives with WMO) operational contact information.

6.3.46 The Commission noted all eight RSMCs use web-based technologies to exchange information and products. Some RSMCs have implemented identical (mirrored/congruent) but independent password protected Web pages and tested them in monthly exercises. In addition, these Web pages have been implemented in a way that minimizes the risk of failure due to Internet disruptions, while accounting for varying capabilities of NMHSs to access. The Commission agreed the use of mirrored Web pages should be extended to include all RSMCs in this activity specialization.

6.3.47 The Commission was informed about WMO's participation in the ConvEx-3 (2005) international exercise that was carried out on 11-12 May 2005 organized by the International Atomic Energy Agency. WMO's performance during the exercise in relation to the standing Regional and Global Arrangements was assessed as relevant, excellent and functioning.

6.3.48 The Commission noted the WMO Technical Document No. 778 entitled: "Documentation on RSMC support for Environmental Emergency Response (targeted for meteorologists at NMHSs)" is the technical reference to the ERA programme and agreed that it required updating.

6.3.49 The Commission noted while the atmospheric transport modelling technology in the prediction of atmospheric dispersion is a critical element to support response to many environmental emergencies, the evolution and expansion of the same numerical simulation technology to include "backtracking" has also proven to be a very useful operational tool for the determination of the possible source of an airborne hazard that has been detected at a monitoring location or through some other method such as remote sensing. The Commission recognized the evolution of atmospheric transport modelling and recommended that the current RSMC designation with Activity Specialization in Environmental Emergency Response be maintained and renamed as "RSMCs with Activity Specialization for Atmospheric Transport Modelling". This activity specialization would then include support to environmental emergency response, backtracking support to the CTBT Verification, and backtracking in support of other environmental incidents provided to NMHSs and relevant international organizations. The WMO centres that are not designated RSMCs but that would wish to be designated for backtracking would be invited to submit a nomination with supporting documentation to demonstrate their capabilities.

6.3.50 The Commission agreed it would be useful for the RSMCs to organize and conduct an experiment on backtracking modelling for an event. The experiment will also be helpful as a starting point to further explore the concept of operations for the requesting and the provision of atmospheric transport modelling backtracking products and services.

6.3.51 The Commission recommended to revise numerous sections of the *Manual on the GDPFS* relevant to Emergency Response Activities, especially to include references to atmospheric transport modeling backtracking. The recommended amendments are found in Annex 3 to Recommendation 7 (CBS-Ext.(06)).

6.3.52 The Commission noted the successful collaboration with the Preparatory Commission of the Comprehensive Nuclear-Test-Ban Treaty Organization (CTBTO) has now reached a stage for the installation of a CTBTO-WMO response system triggered upon Treaty relevant radionuclide detection in the CTBTO Radionuclide International Monitoring System. In such a system, WMO Centres would, at the request of the CTBTO Provisional Technical Secretariat, apply atmospheric dispersion models in "backtracking" mode to calculate ''standardized Source Receptor Sensitivity (SRS)'' information related to Radionuclide Measurements of the International Monitoring Network and report back their results within 24 hours of the request. The Commission agreed with the establishing of new arrangements regarding atmospheric transport modelling backtracking including the provision of RSMC services to NMHSs, and the CTBTO-WMO backtracking response system. It recommended that the arrangements be formally included into the *Manual on the GDPFS* as new Appendix I-6 and Appendix II-9. These recommended amendments are included in Annex 4 to Recommendation 7 (CBS-Ext.(06)).

6.3.53 The Commission agreed that RSMCs should continue to work towards exchanging among themselves numeric files that would enable the exploration of additional tools and methods to quality assure or enhance the RSMC specialized products, including the potential application of ensemble techniques for environmental emergency response.

Non-Nuclear Emergency Response Activities (Non-nuclear ERA)

6.3.54 The Commission was informed that chemical incidents are predominantly of the localized and short-lived nature where very rapid emergency response is essential, therefore it suggested that the most suitable strategy would be to concentrate efforts on developing the necessary capabilities at the NMHSs. Of a higher priority for WMO, would be the transboundary transport of airborne hazards such as in the case of smoke from large fires. A regionalized approach would be appropriate where designated RSMCs would provide emergency support to NMHSs and at the same time build capacity at the national level. Similarly, for large trans-boundary dust or sand storms coordination of RSMC-type operational arrangements might be appropriate.

6.3.55 The Commission agreed to update relevant sections of the WMO Technical Document No. 778 on the ERA programme, for example, related to meteorological aspects of chemical incidents, which were originally adopted and included in the general summary of CBS-Ext.(98) including the following:

- Definition of requirements concerning chemical incidents (CBS-Ext.(98) Annex V);
- Role of national meteorological services (in Environmental Emergency Response) (CBS-Ext.(98) Annex VI);
- Guidance for development of the interface between national meteorological service and other emergency response agencies in case of chemical incidents (CBS-Ext.(98) Annex VII).

6.3.56 The Commission recognized the importance of cooperation with International Organizations. Collaboration with the IAEA on the nuclear component of the ERA programme and with ICAO on the airborne volcanic ash advisory service exemplify strong linkages with relevant international organizations are essential for the successful provision of meteorological support services in environmental emergencies.

6.3.57 The Commission encouraged cooperation with the United Nations Environment Programme/ UN Office for the Coordination of Humanitarian Affairs (UNEP/UN-OCHA) Joint Unit, for example possibly in the following aspects:

- During the emergency phase, updated weather forecasts and, where necessary, atmospheric dispersion modelling, could be provided directly to emergency responders. Within the OCHA framework a password-controlled website, accessible to all emergency managers exists (Virtual On-Site Operations and Coordination Centre), and could be utilized to deliver meteorological support products;

- Interface procedures, including 24/7 emergency contact details could be developed between WMO and the Joint Unit;

- Technical expertise and/or training for atmospheric transport and models related to airborne hazards could be provided by WMO for UN Disaster Assessment and Coordination teams.

6.3.58 The Commission encouraged pursuing cooperation in some of the relevant activities of World Health Organization (WHO) that fall under its International Programme on Chemical Safety (IPCS), in particular operational components that could be linked to the developing operational framework for non-nuclear ERA.

Future work programme

6.3.59 The Commission recalled in the *Manual of the GDPFS*, “nowcasting” is defined as weather forecasting from the present to up to 2 hours into the future, while the terminology loosely refers typically to a very short period beyond the present within which techniques are used to improve forecasts (e.g. over persistence). While nowcasting does not exclusively benefit the severe weather forecasting area, its greatest importance and relevance is to forecasting hazardous conditions in the very short-range.

6.3.60 The Commission noted nowcasting relies on observational data and systems, high resolution NWP and such techniques as image processing, data fusion, data analysis, extrapolation, improve high-impact weather forecasting, e.g., convective hazards (heavy rain, hail, lightning, wind gusts, etc.), winter weather events (snowstorm, blizzards, etc.) or other hazardous conditions (fog, extreme fire danger, dust storms, etc.). The complementary mix of the use of observations and high-resolution NWP to support nowcasting depends on the phenomenon, the lead-time, and actual events as they develop. Nowcasting can be implemented on a wide variety of systems and means, ranging from local treatment on a PC to the establishment of dedicated centres.

Evolution of the working structure and Terms of Reference of the OPAG on DPFS

6.3.61 The Commission noted its Management Group at its 6th Meeting (April 2006) considered that while the current working structure is well suited to the short-term goals, some changes would be necessary, in view of the overall terms of reference of the DPFS and of the emerging requirements, to facilitate the work of the various teams and groups under DPFS and the coordination with other groups within or outside CBS.

6.3.62 The Commission agreed that the following changes to the OPAG would increase the effectiveness of the programme:

- To establish an expert team on very short-range forecasting, to address issues related to the use of emerging operational models with resolutions in the order of a few kilometres;

- To appoint a rapporteur on Infrastructure for Numerical Weather Prediction, to deal with the development of the exchange of NWP products on the GTS, including the provision of nesting data sets for Limited Area Models (LAM) run at NMHSs;

- To merge the existing Teams on LRF infrastructure and LRF verification into one Expert Team on Extended- and Long-range Forecasting;

- To place increased emphasis by the Expert Team on EPS on the use of ensembles (or any other tools) for the production of probabilistic forecasts, and in broader terms for the generation of products in support of decision-making;

- To establish a Coordination Group on forecast verification, to review and update current procedures for computing WMO standard scores, and to respond to new requirements such as the verification of very high-resolution NWP models in particular to develop suitable procedures for verifying severe weather forecasts and warnings, and the verification of nowcasting products. As well, an expert from this group would participate in the appropriate expert group in the Commission for Atmospheric Sciences (CAS) that is concerned with NWP verification. This Group would draw on the output of the relevant Expert Teams dealing with verification e.g., of EPS products or of long-range forecast products, and would address the verification aspects not covered by any Expert Team.

6.3.63 The Commission emphasized strong liaison with the PWS programme would be very desirable in several areas, in particular in the area of EPS and of very short-range forecasting because of the wide range of end users who could benefit from their development.

6.3.64 The Commission agreed to the revised working structure of the OPAG on DPFS as follows:

- Implementation Coordination Team on Data-Processing and Forecasting System;
- Coordination Group on Forecast Verification;
- Expert Team on Ensemble Prediction Systems;
- Rapporteur on Infrastructure for Numerical Weather Prediction;
- Expert Team on Very Short-range Forecasting;
- Expert Team on Extended- and Long-range Forecasting;
- Coordination Group on Nuclear Emergency Response Activities;
- Expert Team on Modelling Atmospheric Transport for Non-nuclear Emergency Response Activities;
- Rapporteur on the Application of NWP to Severe Weather Forecasting.

6.3.65 The Commission agreed with the new working structure of DPFS but noted the possible financial implication of the increased number of teams. Therefore, it asked the WMO Secretariat to pursue effective ways of supporting the activities of the teams and the rapporteurs.

Introducing probabilistic information into RSMC products

6.3.66 The Commission noted that operational centres that use Ensemble Prediction System (EPS) output derive significant benefit for forecasting during periods of severe and high impact weather. NMHSs make use of deterministic output of RSMCs with responsibility for specific geographical areas. These RSMCs currently provide advice and products to NMHSs in their region that are deterministic in nature. This practice does not therefore allow RSMCs with expertise in interpretation of EPS products (from whatever source) to pass on this expertise to the NMHSs in the RSMC's geographic area of responsibility. The Commission agreed that NMHSs could benefit significantly, particularly in forecasting severe weather events, from receiving products from RSMCs that incorporate interpretation and advice derived from the use of EPS data. Such an approach would allow transfer of skills and expertise to NMHSs with limited experience in the use of EPS.

6.3.67 The Commission requested the OPAG on DPFS to revise the Terms of Reference of the Expert Team on EPS, as appropriate, to include the introduction of probabilistic information into products from RSMCs with geographical specialization.

6.4 PUBLIC WEATHER SERVICES (PWS) *(agenda item 6.4)*

6.4.1 The Commission noted with appreciation the report of the chairperson of the OPAG on PWS, Mr Gerald Fleming (Ireland), and recalled that the work of the OPAG was coordinated through three expert teams and an Implementation Coordination Team (ICT). In commending the dedication of the respective team members for delivering on their mandate according to the decisions of Congress and CBS, the Commission expressed satisfaction with the continued evolution and the new areas of responsibility taken on by the PWS Programme (PWSP).

6.4.2 The Commission emphasized that the primary purpose of all NMHSs was to contribute to the environmental, economic and social benefit and welfare of their national communities through the provision of meteorological and related products and services. In this context, the Commission agreed that public weather services were at the cutting edge of the contribution made by NMHSs to national goals in relation to multi-hazard warnings contributing to the safety of life and livelihood to national sustainable development, to the quality of life, and to the preservation of the quality of the environment. In the pursuance of these goals, the Commission noted that some Members had widened the scope of their PWS programmes to encompass other areas of service delivery related to climate and water in recognition of the fact that PWS contributed to the understanding and education of the public and provided a mechanism for effective dissemination and communication of these subjects.

6.4.3 The Commission stressed that public weather services as a critical element of NMHSs, performed this role through the delivery and communication of high quality, useful, relevant and timely, weather and related information on a regular daily basis so as to enable users to make informed and timely decisions. The Commission emphasized that a well-run and credible public weather service would help NMHSs secure the long-term trust of the public, which would be critical to the effectiveness of warnings of much less frequent severe weather events. It is no longer sufficient for NMHSs to provide the public with more accurate and timely forecasts and warnings of severe weather. It is necessary to assist NMHSs, both with improving their forecasting of hazards and, in consultation with the relevant agencies (including emergency services), their forecasting of impacts, thus delivering a coordinated and consistent message to the public. The Commission supported the request by the Executive Council for the preparation of guidelines to assist NMHSs, in working with the appropriate and competent authorities in forecasting the impacts of hazardous weather, through applying techniques such as combining an assessment of vulnerability with weather information to produce risk or impact forecasts, and creating public awareness of the risks of severe and high impact weather by using a proper communications strategy.

PWS Strategy and related issues

6.4.4 At its meeting in Dublin (October 2005), the ICT of the OPAG/ PWS, in order to ensure the alignment of its work with the Strategic Plan of WMO, carried out an extensive review of the PWSP and its functions. The ICT defined the Programme’s strategies in view of the emerging trends and needs in service provision and delivery to help guide the work of the Programme during the coming years. The Commission agreed with the ICT that public weather services functioned through building and maintaining the position and visibility of NMHSs as suppliers of high quality services through the following strategic approach:

(a) Applying excellence in science and technology;

(b) Understanding, respecting, and responding to user needs;

(c) Building relationships with stakeholders; and

(d) Establishing credibility in delivery of weather and related products and services.

6.4.5 The Commission reviewed the direction outlined by the ICT to be followed by the PWSP in order to implement its strategic approach as indicated below:

(a) Improving early warning services and products and their presentation as an integral part of PWS;

(b) Engaging in capacity building and outreach activities;

(c) Widening the range and improving the reach of NMHSs products and services leading to their improved visibility and credibility;

(d) Promoting the application of the science of meteorology and related technology to improve products and services; engaging in demonstration projects;

(e) Collaborative activities as appropriate;

(f) Establishing and promoting best practices;

(g) Researching, providing and promoting information on social and economic aspects of weather services;

(h) Promulgating the results of the work of PWS expert teams and groups;

(i) Engaging in surveys and assessments;

(j) Promoting and strengthening the brand of WMO;

(k) Promoting quality management including verification with respect to PWS products and services.

6.4.6 The Commission recalled that the CBS Management Group had approved the PWSP Strategic approach which had then been endorsed by the Executive Council with the request to the Secretary-General to provide support for its implementation. The Commission thus adopted the PWSP Strategy as amended and requested that the requirements of the accompanying work plan be appropriately reflected in the Secretariat Operating Plan. It further requested that the OPAG on PWS work closely with the WIS community and in particular pay special attention to the impact of WIS on PWSP Strategy.

6.4.7 The Commission noted that, in response to requests by Members for guidance from the PWSP in defining their national PWS mandate, the ICT had proposed two categories of services for the consideration of the Commission. The Commission agreed to the definitions as follows:

***Core Elements of a National PWS Programme*:**

(1) Provide basic weather observations and forecasts to aid citizens in their day-to-day activities; warnings of severe weather, and information to other government authorities as appropriate in pursuance of their mission to protect their citizens lives, livelihoods, and property;

(2) Engage in education, awareness and preparedness activities aimed at helping citizens to make the best use of forecasts and warnings information, understand the potential impacts of severe weather, and be aware of the appropriate mitigating actions.

***Recommended Elements of a National PWS Programme*:**

(1) Exchange and coordinate warnings with neighbouring NMHSs;

(2) Provide presentation training to all NMHS staff who are required to interact with the media in the course of their work;

(3) Conduct quality assurance activities, and use the outcome of these initiatives to improve products and services;

(4) Facilitate a two-way communication between the research and user communities to enable the optimum application of research results to improvements in products and services, and encourage the design of R&D programmes that take account of user needs;

(5) Develop and strengthen collaborative relationships with the media to ensure the optimum reach of PWS products and services.

Services and Products Improvement for PWS

6.4.8 The PWS Expert Team on Products and Services Improvement (ET/SPI) has an extensive mandate of identifying, reporting and providing recommendations on emerging needs for new and improved products and services with emphasis on key PWS user groups. The Expert Team at its meeting (New York, May 2005) had identified several key areas that needed to be assessed in order to improve PWS products and services. These included the application of enhanced data and observations and new technologies, enhancement of: dissemination capabilities, an effective public education programme, and the relationship between NMHSs, other government agencies, the private sector and the media.

6.4.9 Data and products from Ensemble Prediction Systems (EPS) have the potential to change the way forecast information is provided to the user community, but there are challenges in the use and interpretation of this information. Thus, education of the user community as well as working with the media is vital to derive maximum benefit from and improve the communication of probabilistic information to users (see paragraph 6.4.16). The Commission emphasized that developing countries and LDCs required significant assistance to benefit from EPS products. It stressed the need for the major NWP centres with EPS capability to work with the smaller NMHSs to develop a range of products and tools to help them use EPS effectively.

6.4.10 Verification is an important tool to improve PWS products and services. The Commission was informed of two regional projects on verification namely, a basic verification of temperature forecasts in RA VI from the WWIS Website and a Pilot Project on NWP City-specific Forecasts in RA II. With regard to the latter, 14 Members from RA II participate in the pilot project for which meteograms are provided by KMA, JMA and the Hong Kong Observatory (see 6.4.31). The Commission agreed that such information could be very useful to developing countries and requested the ET/SPI to monitor and report on their implementation and continued development.

6.4.11 The Commission took note that some emerging requirements such as meteorological services to assist in the management and control of airborne and waterborne diseases, were not sufficiently covered in the *Guidelines on Biometeorology and Air Quality Forecasts* (2004). It requested that a brief supplement to the guidelines should be developed to address this need. The Commission also requested that, following the publication of the *Guidelines on Quality Management Procedures and Practices for PWS*, the ET/SPI should start assessing the impact of this publication on NMHSs' management practices. In discussing quality management practices in NMHSs, the Commission welcomed the examples gathered by the ET/SPI on the first hand experience of implementing quality management practices and its consequential benefits, as well as information on an IT management standard.

6.4.12 Database forecasting techniques, mobile communication devices utilizing GIS and GDPS technology, and next generation forecast workstations that are able to readily retrieve observations, nowcast and prognostic information from databases offer new opportunities for integrating PWS forecast and service delivery. The Commission requested that particular emphasis be put on training in these new technologies so that developing countries and LDCs might extract maximum benefit from them. The Commission further requested the ET/SPI to keep abreast of and report on those and other emerging technologies which can assist NMHSs in PWS product preparation and delivery through multiple communication pathways.

Communication Aspects of PWS

6.4.13 In recognizing the importance of positive relationships with the media and the need for NMHSs information to be adapted appropriately to the needs of the media, the Commission endorsed the approach taken by the Expert Team on Communication Aspects of PWS (ET/COM) to develop sets of “best practice”. These would demonstrate good communication methods, use of clear and non-technical language, effective but unobtrusive attribution of the NMHS, as well as new technologies, such as mobile telecommunications and pod-casting, and effective presentation and communication of PWS products and services. The Commission requested that these examples be made available to all NMHSs.

6.4.14 The Commission took note of the positive results of the work of the Expert Team in further promoting attribution of NMHSs in the media. It especially noted with pleasure the establishment of a satellite weather channel in China with the involvement of CMA and encouraged other NMHSs where possible to consider engagement with similar initiatives. The production by ET/COM of the *Guidelines on Weather Broadcasting and the Use of Radio for the Delivery of Weather Information* was considered by the Commission as a positive step to provide NMHSs with very useful material on communication skills. The Commission requested the wide distribution of these guidelines.

6.4.15 The Commission paid special attention to the needs of developing countries, most of which are situated in the tropics where seasonal time scale and climate can be more important than the day-to-day weather, thus making it even more important for NMHSs to work closely with relevant user sectors such as agriculture and health. The Commission stressed that establishing effective communication channels with these user sectors was essential for ensuring the relevance of NMHSs in developing countries. It requested that the set of best practice should include examples from developing countries and demonstrate the effectiveness of non-complex tools such as RANET as a means of communication. It placed special emphasis on the importance of training in communication and presentation and requested that the work of the ET/COM should continue to provide guidance on the best and most effective ways of conducting such trainings, including the use of ‘virtual laboratory’ or ‘interactive classrooms’.

6.4.16 In recognizing that whereas forecast information could be expressed and conveyed in probabilistic fashion, decision making by users was frequently deterministic in nature. The importance of communicating uncertainty and confidence in PWS products and services is growing and this challenging area can sometimes be overlooked. In this regard, the Commission agreed that user understanding of uncertainty information, including terminology of probabilities, is an area that can benefit from some clear guidelines. The Commission requested that the development by ET/COM of a set of guidelines on effective means of communicating probabilistic forecast uncertainty and confidence, which would include user understanding and interpretation of, and response to, probability information as well as the visual representation of such information be accelerated and the guidelines be widely distributed.

PWS in Support of Disaster Prevention and Mitigation

6.4.17 In reviewing the work of the expert team on PWS in support of DPM, the Commission emphasized that NMHSs were the appropriate authority to provide a single official voice in support of warning management for disaster prevention and mitigation. It reviewed the survey of WMO Members conducted in January 2006 jointly with the ET/SPI to assess the gaps and needs of NMHSs regarding severe weather warning services. It noted the results of the survey and concluded that the success of a warning was in changing people’s behaviour and that education was the key. Workshops on reaching out to decision makers and the public, to build capacity in understanding the meaning of warnings and enhancing their ability to translate these into effective actions, are essential. The Commission agreed that to improve on the warnings of short-term severe weather phenomena, nowcasting represented an important decision-support tool and requested the OPAG on PWS to make every effort to pursue capacity building in nowcasting.

6.4.18 To define and clarify the role of NMHSs in the early warning process and develop reference material, the ET/DPM had prepared specific recommendations for NMHSs as well as guidelines on integration of warnings into risk management. The Commission supported the recommendation by the Expert Team that developed countries should be encouraged to do more to provide advice and assistance for NMHSs in developing countries including LDCs. The Commission requested that the recommendations and guidance material be made widely available to NMHSs.

6.4.19 The Commission strongly supported the planned activities led by the ET/DPM as regards nowcasting. The result of the survey of Members (see paragraph 6.4.17) provided input to a workshop on nowcasting organized in close collaboration with the WWRP Nowcasting Working Group (Sydney, October 2006). A workshop is planned for a later date to address the urgent need to reduce vulnerability to natural hazards through public education and outreach. In this regard, the Commission welcomed the involvement by PWS in the Severe Weather Forecast Demonstration Project organized by the OPAG on DPFS.

The effective use of seasonal and long-range weather forecasts

6.4.20 The delegation of the United Kingdom informed the Commission of the steps taken between the Met Office and the UK Government to ensure that a consistent message was given to the UK public in the issuing of a colder than average winter season forecast for 2005/6. The Commission welcomed the expanding provision of seasonal and long-range forecasts and noting that these are issued by a number of Members, agreed that these forecasts can be of significant benefit to users even in the absence of a strong signal indicating unusual weather.

6.4.21 The Commission noted the preparatory work undertaken by the Met Office and the UK Government on this occasion. It stressed that it was particularly important, when issuing seasonal forecasts of potentially high impact, to effectively communicate these forecasts, in a timely fashion, to relevant Government authorities and to the public. It agreed that education of the public, the media and of specialist users was essential to ensure that these forecasts, and their attendant limitations, were effectively understood and properly acted upon. In particular, it recommended that the uncertainties attached to these forecasts be properly expressed and explained.

6.4.22 Considering the geographically widespread nature of seasonal forecasts, the Commission invited Members to enhance the regional coordination on this matter, using the Global Prediction Centres and the Regional Climate Centres structure which is being set up in liaison with CCl. Furthermore, noting the international nature of the mass media, the Commission suggested that, when a Centre engaged in seasonal forecasting, intended to release the potentially high impact forecast to the media, suitable coordination with relevant NMHSs in the affected area might be arranged in advance.

International Exchange of Public Weather Forecasts and Warnings

6.4.23 The Commission reviewed the progress in the development of the World Weather Information Service (WWIS) and Severe Weather Information Centre (SWIC) Websites. The Commission recalled that these websites had to be established to encourage and enable the improved use of official information in the media. By the end of May 2006, the WWIS carried forecasts for 1082 cities from 111 Members. The SWIC Website provides a centralized source for official tropical cyclone warnings and information on rainstorms and heavy snowfall from all Regions and is consulted by the media. It commended those Members (China; Macao, China; Hong Kong, China; Oman; Spain) hosting the two Websites and in particular Hong Kong, China for continuing to manage the development of the sites.

6.4.24 The SWIC Website has been further developed with the addition of a recap function to loop tropical cyclone positions in the previous 7 days and a new Webpage on thunderstorms. The Commission was informed of the production of the video on regional and global tropical cyclone tracks animation produced by stitching together 3-hourly web pages of SWIC from the archive of

2005 events, and of plans to display gales and extreme temperatures on the WWIS Website. It requested that the user guide to both websites being prepared by ET/SPI and ET/DPM be made available to the general public and major media organizations.

6.4.25 The Commission urged Members to continue to contribute information to the WWIS and to actively participate in both WWIS and SWIC websites. In being informed that beta versions of the WWIS Website in French was under preparation and would be launched soon, the Commission agreed that through the different language versions (Arabic, Chinese, English, Portuguese and Spanish) of WWIS, the information was accessible to a global audience. It encouraged close coordination among Members concerned through regular consultations and welcomed the organization of a coordination meeting at the request of the Executive Council in January 2007 for host NMHSs to ensure the development of the system in a coherent manner. It requested the ICT/PWS to keep under review the need for further coordination meetings.

6.4.26 The Commission welcomed the active cooperation between the PWSP and the European Multiservice Meteorological Awareness (EMMA) project of EUMETNET (soon to be renamed MeteoAlarm). Through its participation at the EMMA Advisory Board, the PWSP had discussed issues related to the development of the EMMA concept for other WMO regions, harmonization of cross-border warning thresholds, cooperation between EMMA and SWIC projects, and cooperation on defining the user needs for EMMA. As part of this cooperation, the Commission recommended that a link be established between SWIC and EMMA Web pages after the latter becomes operational.

6.4.27 The PWSP had been informed of the EU project GMES (Global Monitoring for Environment and Security) and the opportunities and challenges to the meteorological community posed by the project. Projects within GMES of particular interest to the PWS Programme include RESPOND, which aims at providing geographical information to the humanitarian community, and the EURORISK PREVIEW, which seeks to develop operational information services for the emergency management community. The Commission requested the PWSP to keep abreast of these and other developments through the participation of a representative from RA VI in the work of GMES.

Social and Economic Applications of PWS

6.4.28 The Commission stressed that public weather services embraced a wide range of environmental services to users in many sectors of society which supported decision making for social and economic applications. It agreed that more cooperation and interaction was needed between providers and users of weather, climate and water information to make such information more relevant and useful in decision making. In this regard, the Commission commended the Secretary-General for his response to the requests by Members through the WMO constituent bodies for a focus on the social and economic aspects of the work of NMHSs, by setting up a "Task Force on Social and Economic Applications of Meteorological and Hydrological Services". The Commission fully supported the work of the Task Force to specifically assist Members in the evaluation and demonstration of the social, environmental and economic benefits of their public weather services to various user sectors in society, through preparation of methodologies and guidance material. It supported the request by the Executive Council that the Task Force should continue its work in a phased approach towards identifying potential mechanisms which addressed the critical Provider-User issues.

6.4.29 The PWSP will actively contribute to the focus of WMO on the social and economic aspects of the work of NMHSs. The Commission endorsed the full participation of the PWSP and the Task Force in the organization, by WMO, of the International Conference on Social and Economic Benefits of Weather, Climate and Water Services (Madrid, March 2007). The Commission noted the organization by WMO of a number of regional conferences in RAs I, III, V and VI on social and economic benefits of meteorological and hydrological services leading up to the Madrid Conference, the last of which will be held in Zagreb in February 2007 with the participation of countries in South East Europe and supported by the World Bank and the Finnish

Meteorological Institute. In addition, the Commission strongly recommended the active engagement of the PWSP and the Task Force with the resulting on-going outcomes of the Conference by activities such as generation of guidance materials and organization of workshops for all regions.

Public Education and Outreach

6.4.30 NMHSs need to ensure that the information contained in their forecasts and warnings, including the risks implied and the intrinsic uncertainty of the information, are understood by the decision makers and the end users who are thus enabled to take timely action. In doing so, NMHSs would promote realistic expectations of the users and the public in the accuracy of these products. In this connection, the Commission strongly supported the formation through the PWSP, in collaboration with ETR, of an Expert Group on Public Education and Outreach to prepare strategies and guidelines on these important topics. This Group would develop and promote web-based resources, and prepare generic educational material suitable for use by NMHSs in addressing the public, educational, and policy and decision-making authorities. The final result of this activity should contribute to an increase in the public’s level of confidence in forecasts and warnings, as well as an increase in their understanding of the potential impacts of high impact or hazardous weather on their well-being and livelihood. The Commission acknowledged the request by the Executive Council for support to this initiative and for making the results of the work of the Expert Group widely available to Members.

Capacity Building and Training

6.4.31 Recognizing that capacity building constituted a basic responsibility of the PWSP, the Commission anticipated increased demands from Members for this activity. It requested the PWSP to continue its efforts in capacity building despite funding constraints, especially as regards developing countries and LDCs. It further encouraged the developed countries to provide assistance in these activities to LDCs and developing countries. The Commission especially welcomed the workshop held in Hong Kong, China on the interpretation and use of meteograms and similar products organized under the pilot project on NWP in RA II with the participation of 10 Members under the WMO VCP. The Commission welcomed the preparation of *Guidelines on PWS Strategy in Capacity Building* and the organization of PWS regional training workshops and seminars and encouraged that communications professionals and end-users be included in these training events in addition to NMHSs staff. It expressed appreciation to those Members who had hosted and provided facilities for these events.

PWS Programme and WMO cross-cutting activities

6.4.32 The PWSP has actively contributed to WMO cross-cutting programmes and activities and is itself an example of a cross-cutting programme as shown through its collaboration with other WMO Programmes, in particular, WWW, WCP, TCP, ETR, AREP and CPA in addition to the WMO cross-cutting programmes. The Commission requested that PWSP continue this approach and build stronger relationships with other Technical Commissions as appropriate, and in particular the applications and service delivery areas of the Commission for Climatology with a view to cost saving and efficiency in programme delivery.

6.4.33 The Commission welcomed the close collaboration and participation by the PWSP in the work of the THORPEX Social and Economic Research and Application (SERA) Working Group. The Chair of the Working Group is a member of the Task Force on the Socio-Economic Applications of Meteorological and Hydrological Services and the interests of the PWSP are represented through the participation of the Chair of the OPAG on PWS in the SERA Working Group. The link with THORPEX had been strengthened through the participation of the Executive Director and Manager of the THORPEX International Project Office in the meeting of the PWS ICT. The Commission stressed that a key user group of THORPEX constituted operational forecasters, and that some effort was needed to inform and educate them on the potential benefits of multi-model ensembles, and on the optimum use of probabilistic forecast products. The Commission requested that the PWS Programme continue its active collaboration with THORPEX in the above areas.

6.4.34 The PWSP has established linkages for collaboration with GEO through submission of a project entitled “The design of multi-media training modules to communicate the levels of risk from hydrometeorological hazards to the public for informed decision making” to the GEO work plan. The Commission requested to be kept informed of progress in this area.

6.4.35 A number of activities of the PWS Programme have specifically supported the WMO cross cutting approach to disaster prevention and mitigation. In addition to the survey of Members (see paragraph 6.4.17), project proposals had been developed and submitted to DPM Programme for mobilizing resources.

Collaborative activities with other CBS OPAGs

6.4.36 The Commission supported the approach taken by the Chair of OPAG on PWS to identify collaborative opportunities with other CBS OPAGs. One such cooperative arrangement already established is through the participation of the Chair of ET/SPI in the CBS Severe Weather Forecasting Demonstration Project Steering Group (OPAG on DPFS). The Commission requested that such arrangements should be strengthened.

International Symposium on PWS

6.4.37 The Commission agreed that the achievements of the PWSP, following more than a decade of existence as a WMO scientific and technical programme, had been recognized by Members as an essential contribution to the improvement of national public weather programmes. The Commission expressed the view that the PWSP had arrived at a point where a thorough review of its past achievements and the preparation of a road map for the implementation of its strategic approach for the next decade was desirable. This road map would need to respond to the evolution of meteorology and related technologies, changes in the priorities, modes of operation and areas of focus of NMHSs. The Commission took note that the Executive Council had strongly supported the organization of an international symposium on PWS after the Fifteenth Congress and had requested the Secretary-General to make relevant arrangements for its organization. The Commission added its own full support to this decision of the Council.

Trends, developments and evolving needs

6.4.38 The Commission stressed that effective discharge of their national mandate would require NMHSs to keep abreast of achievements in the science of meteorology and related technologies in order to plan in preparation for emerging trends, and to anticipate evolving needs of users. To respond to Members’ needs, the Commission requested the PWSP to pay particular attention to the issues highlighted below.

6.4.39 New forecasting products destined to the public, such as nowcasting products, EPS-based probabilistic forecasts, extended range and trend/change forecasts are increasingly valuable. These products must be coupled with effective presentation and delivery methods for optimum effect. The use of the Internet and wireless delivery channels is gaining acceptance as a delivery mechanism for nowcasting products to the public on a real-time basis, allowing the evaluation of hazards and identification of the most appropriate action in an evolving weather situation. The important element is that information should be accessible to the public wherever they are, in the form that they can understand and use.

6.4.40 The increasing availability of EPS products opened up new possibilities in probabilistic forecasting, especially for risk assessment of potential hazardous weather. In terms of PWS products, these can be translated quantitatively into probability indices or qualitatively into possible alternative scenarios. Recognizing that developing countries, in particular, need assistance in the use and exploitation of EPS products, the Commission requested that explanatory guidelines be prepared, that workshops be organized and projects be developed on this subject. A host of weather warnings and indices such as UV, heat waves and cold snaps have emerged in response to the multi-faceted needs and demands of various community groups. To be useful to the public, such indices need to be calibrated according to differences in geography and climate. As PWS products become more specific and comprehensive, NMHSs should consider developing illustrative materials such as icons, charts, diagrams or pictures in order to make these products more clearly accessible to end users. As IT continues to evolve, NMHSs need to keep up with rapid changes and new opportunities. The Commission stressed that the key point of the new trends is to emphasize the move away from data and information provision to service delivery in the framework of application of information and knowledge.

Members' priority areas

6.4.41 The Commission agreed that the areas of focus of the PWS Programme, in line with the WMO Strategic Plan, should be those which provide greatest assistance to Members in meeting their requirements to face developments and changing needs as outlined above, emphasizing the following priority areas:

(a) *Service delivery* – Addressing service excellence, brand image, service improvement, user needs, total quality management, continuous improvement;

(b) *Effective and timely warning message and communication* – Reaching and influencing the public to take action to safeguard life and property by using understandable language and terminology in NMHS products. Successful NMHS communication leads to increased credibility, and the greater chance of positive response from the public;

(c) *Dissemination and presentation* – Every opportunity should be taken to train the NMHS staff in media skills and presentation techniques since effective and timely dissemination and presentation of forecasts, warnings and information is essential for a credible performance especially during severe weather. New technological opportunities should be utilized to improve service delivery and supplement more traditional delivery systems;

(d) *Strong media relationships* – Key partnerships with media are an extremely important element in a successful PWS programme. Collaboration and partnership with media will assist the NMHS to get its official message out in a timely manner without unwanted editing, especially during severe weather;

(e) *Public education and awareness* – A weather-literate public is much more likely to respond positively to the NMHS warnings and take appropriate action. The NMHS must ensure its ''single official voice'' is the authority behind public warnings and information and should take all practical steps to enshrine that role in their national policy. There is a need to increase public awareness and understanding of risk and vulnerability in disaster risk reduction;

(f) *Coordination and collaboration* – Close coordination and collaboration with all sectors and institutions requiring weather services who can also facilitate service delivery (e.g. the media), is essential. This will ensure NMHSs' involvement with the hazards community in creating and testing effective disaster preparedness plans, warning systems, mitigation strategies and public education programmes;

(g) *Enhancing the economic and social well-being* – Various weather-sensitive sectors of society such as energy, health, transport and tourism depend on public weather services for their planning and operations purposes. To help the process of planning and developing projects the availability of climatological data is especially important. When planning their national PWS programmes, NMHSs will by involving representatives from these sectors, and incorporating their suggestions for product design and service delivery as far as practicable, make a direct contribution to their national socio-economic sustainable development.

Future directions

6.4.42 Taking into consideration the trends and developments as well as Members' evolving needs, the Commission requested that future focus be directed towards assisting Members to improve their national public weather services programmes through:

(a) Providing guidance on the application of new technology and scientific research in: (a) data acquisition and use especially for nowcasting; (b) probabilistic forecasts and information; (c) multi-hazard warnings; (d) new product design and communication; and (e) service delivery;

(b) Capacity building through training in all aspects of PWS leading to enhanced credibility of NMHS, and the publication of guidance materials on topics identified through the work of the PWS experts;

(c) Continuing to provide guidance on valuation of social and economic aspects of meteorological services especially PWS;

(d) Continuing to provide guidance on user-based service assessment, and product verification;

(e) Providing guidance on international and regional weather information exchange, including information on seasonal forecasts as appropriate.

6.4.43 Taking into consideration the discussions held under the present agenda item, the Commission agreed to the future work plan of the PWS Programme as given under agenda item 11.

6.5 OPERATIONAL INFORMATION SERVICE (OIS) *(agenda ite*m 6.5)

6.5.1 The Commission confirmed the requirement for the Operational Information Service (OIS) to provide for information related to WWW operations, which should be made available and should be promptly kept updated through the WMO server.

6.5.2 The Commission underlined that the overall efficiency of the Operational Information Service (OIS) was dependent on the prompt notifications of changes and updated information from NMHSs. Noting that there were shortcomings as regards the completeness and updating of the operational information, the Commission agreed to invite:

(a) WMO Members to review the content of WMO Publication No. 9, Volume A - Observing Stations, to check that all their stations are included in Volume A with the appropriate information, and to send to the WMO Secretariat updated information as required;

(b) MTN centres to maintain their own part of the WMO Publication No. 9, Volume C1 – Catalogue of Meteorological Bulletins, using data base procedures agreed by CBS-Ext.(98);

(c) RTHs to make their routing catalogues accessible in the format recommended in the *Manual on the GTS*, preferably directly from their website, and to update them monthly if possible, but not less than every three months;

(d) RTHs to review the results of the comparisons between Volume C1, routing catalogues and SMM monitoring results prepared by the Secretariat, and to update their part of Volume C1 and their routing catalogues as necessary;

(e) RTHs to review the contents of Volume C2 in coordination with their associated NMCs and to send amendments to the WMO Secretariat as required;

(f) WWW centres having responsibilities in quality monitoring to provide the Secretariat with the relevant URL addresses of their websites.

6.5.3 The Commission agreed on the following development of the OIS with a view to facilitating the updating, access and use to/of the operational information:

(a) To develop procedures and tools to facilitate and improve the updating of Volume A;

(b) To extend the interactive on-line access to Volume C1 to other parts of the OIS;

(c) To extend the presentation of the information in XML.

6.5.4 Noting the potential of the eXtended Mark-up Language (XML) for the representation of data and metadata such as operational catalogues, the Commission stressed the need to develop and share expertise in XML within/between the WMO Members and the Secretariat.

6.5.5 The Commission was pleased to note the offers of Japan and Switzerland to assist the Secretariat in the improvement of Volume A. The Commission agreed to invite other Members to consider supporting the Secretariat in the development of the OIS with a view to speeding up its development.

6.6 SYSTEM SUPPORT ACTIVITIES, INCLUDING TECHNICAL COOPERATION *(agenda item 6.6)*

6.6.1 The Commission reviewed the technical cooperation and system support activities carried out through the WMO Technical Cooperation Programme and related to the WWW Basic Systems and Public Weather Services during the period 2005-2006. The Commission agreed on guidelines for the allocation of priorities for technical cooperation support as given below, but noted that successful implementation would depend largely on the alignment of priorities as specified by CBS, the requesting WMO Member and the Donor concerned. The Commission noted the importance of streamlining the priorities, limiting the number of proposals with the “highest” and “high” priorities; this would help the donors and recipient countries in making better use of limited available funds and also in helping focusing efforts in resources mobilization.

Integrated Observing Systems (IOS)

6.6.2 The Commission agreed on the following guidelines for the allocation of priorities for the IOS:

(a) Highest priority should be given to the projects aiming at improving and restoring the existed and building the new upper-air observational capabilities of the RBSN/RBCN with emphasis to the activation of silent upper-air stations and the improvement of coverage over data-sparse areas;

(b) High priority should be given to the projects related to the improvement of data quality, regularity and coverage of surface observations of the RBSN/RBCN with emphasis to the activation of silent stations and the improvement of coverage over data-sparse areas;

(c) High priority should be given to projects related to the introduction and/or use of new cost-effective observing equipment and systems including surface-based AWSs, AMDAR, ASAP and drifting buoys;

(d) Medium priority should be given to the projects related to the improvement/upgrading of stations not included in RBSN/RBCN list of stations.

Information Systems and Services (ISS)

6.6.3 The Commission agreed on the following guidelines for the allocation of priorities for cooperation activities for the ISS:

(a) Highest priority to the implementation of the connection of each NMC to the GTS for the exchange of observational data and processed information (at a minimum speed of 16 Kbits/s using TCP/IP procedures), including reception of satellite-based data-distribution systems;

(b) Highest priority for the exchange of data between RTHs at a minimum speed of 64 Kbits/s using TCP/IP procedures;

(c) Highest priority for the completion of the implementation of the project for an improved MTN;

(d) Highest priority for the collection of data from RBSN stations at NMCs or centres with similar functions;

(e) Highest priority for activities on capacity building facilities and use of Internet and implementation of related facilities in developing countries for improving exchange of meteorological and related information;

(f) High priority for a backup connection of each WWW centre to the GTS;

(g) High priority for the implementation of virtual private network (VPN) connections via the Internet as a backup for the exchange of data, in particular for RTHs;

(h) High priority for the migration to Table Driven Code Forms (TDCF).

6.6.4 The WMO goals for Members equipped with meteorological satellite receiving equipment were 100 per cent for polar-orbiting satellite data receivers and for geostationary satellite receivers. The Integrated Global Data Dissemination service (IGDDS) concept offers new technical possibilities for efficiently meeting these goals through the use of Advanced Dissemination Methods (ADM) in several WMO Regions. The Commission agreed on the following guidelines for the allocation of priorities for satellite data receiving systems:

(a) Highest priority for a multipurpose telecommunication satellite receiving system providing space-based observation data and products (ADM) if the WMO Member is within the area covered by such as a dissemination system;

(b) Second highest priority for meteorological satellite direct broadcast receivers for those Members who are not within the area covered by a telecommunication satellite dissemination system providing satellite data and products (ADM), and who are without any direct broadcast receiver;

(c) High priority for direct broadcast geostationary or polar-orbiting receiver for those Members who are not covered by any ADM system and who have either no geostationary or no polar-orbiting satellite receiver respectively;

(d) Medium priority for high resolution satellite direct broadcast receiver for those Members who have only low resolution direct broadcast receivers and cannot be covered by any ADM system;

(e) Low priority for satellite direct broadcast receivers for those Members who are in an area covered by an ADM system.

Data-processing and Forecasting System (DPFS)

6.6.5 The Commission agreed on the following guidelines for the allocation of priorities for cooperation activities for the DPFS:

(a) Highest priority for establishing access at NMHSs to NWP products from advanced centres, for viewing and use as guidance for forecasting applications, in particular severe weather forecasting;

(b) Highest priority for automation of operational data-processing functions, including the processing of observations and post-processing of NWP products, for improvement of all weather forecasting applications, in particular nowcasting;

(c) High priority for training on use of NWP products, in particular use of relevant EPS products, and applications to probabilistic forecasting;

(d) High priority for training on operational data-processing, including on the implementation of post-processing of NWP products and running of a Limited Area Model.

Public Weather Services (PWS)

6.6.6 The Commission agreed on the following guidelines for the allocation of priorities for the PWS:

(a) Highest priority for TV/media presentation systems comprising high performance computing and communications hardware, peripherals and software, video equipment for television production, as well as the related training of staff;

(b) Highest priority for computer-based meteorological workstations that enabled, through forecaster interaction, the creation of new or enhanced products for users, based on satellite imagery and processed products (inputs);

(c) Highest priority for enhanced Internet access for NMHSs as a communications tool to improve their data access, as well as expand the dissemination methods of their public weather services, and promote the use of official consistent information;

(d) Highest priority for training related to national PWS plans; that included training in media skills (writing and presentation), product design, and public education and awareness;

(e) Highest priority for fixed and mobile communications systems for the dissemination of public weather services, preferably modern telephone and communication services (e.g., mobile telephones, pagers/short message system and fax-on-demand);

(f) Medium priority for VHF radios to provide radio broadcast and warning alert systems.

CBS software registry

6.6.7 The CBS software registry provides information to Members on the software packages offered by individual Members through the WMO Web server. Stressing that the World Weather Watch is dependent on computer-based solutions for its operation, the Commission invited the WWW centres to consider offering meteorological application software for free exchange among Members and to provide the Secretariat with the information required to update the CBS software registry available from the WMO server.

6.6.8 The Commission noted the difficulties met by developing countries in the purchase of software packages, including licences, and their maintenance. The Commission agreed that this issue should be taken into account in the offers of donor countries, in particular as regards the possibility of developing common “standard” software packages, such as packages for automatic weather stations or visualization systems.

7. WMO INFORMATION SYSTEM, INCLUDING THE REPORT ON THE TECHNICAL CONFERENCE ON WIS *(agenda item 7)*

7.1 The Commission noted with appreciation that several ISS expert teams were pursuing a proactive role in the further development of the WIS and were also providing an important contribution to the Intercommission Coordination Group on the WMO Information System (ICG-WIS). The Commission recalled that, after being reviewed by the Presidents of Technical Commissions Meeting (PTC), the outcome of the ICG-WIS sessions is submitted to the Executive Council by the president of CBS. While confirming the leading role of CBS, the Council re-affirmed that WIS was serving all WMO Programmes, and emphasized that significant further work was required from all the individual WMO Programmes, as well as through a common effort, to ensure the successful development and implementation of WIS.

7.2 The Commission noted with satisfaction the considerable efforts made by a few NMSs in the development of WIS pilot projects and prototypes, with a special focus on the following key projects:

- WMO Core Profile version of metadata and reference implementation;
- RA VI VGISC project (Exeter, Offenbach, Toulouse) as a GISC prototype;
- DCPCs prototypes including the ECMWF and EUMETSAT DCPC projects associated with the VGISC project, also including the SIMDAT project;
- A DCPC prototype (World data centre, Obninsk) for JCOMM related data;
- An NCAR DCPC prototype.

7.3 The Commission noted that EC had emphasized that, as the WIS was developing as a major component of all WMO Programmes, there was an emerging requirement for appropriate regulatory documentation (e.g. a Manual on WIS), including a precise definition of the WIS position and functions in the general WMO infrastructure, as well as an implementation plan and guidance material for implementation. The Commission noted that the development of regulatory documentation should be carried out in phases based on the validation of preliminary organizational, functional and operational design. It requested its OPAG-ISS to contribute to this task, in coordination with the ICG-WIS, but also emphasized that the completion of the task would require significant additional resources. It requested its OPAG-ISS Chair, in coordination with the ICG-WIS and the CBS Management Group, to consider the most effective mechanisms and develop a realistic schedule for carrying out the task, and to revise the ET-WISC work programme accordingly.

7.4 As regards the WIS implementation plan, the Commission emphasized that the WIS implementation should be carried out in two phases that would be developed in parallel:

- WIS implementation Phase A was the continued consolidation and further improvements of the GTS for time-critical and operation-critical data, including its extension to meet operational requirements of WMO Programmes in addition to the World Weather Watch (including improved management of services);
- WIS implementation Phase B would provide for an extension of the information services through flexible data discovery, access and retrieval services to all users, as well as flexible timely delivery services.

7.5 The Commission confirmed that the WMO Integrated Global Data Dissemination Service (IGDDS) in the framework of the WMO Space Programme was a component of the WIS focusing on the exchange of space-based observation data and products for all WMO Programmes, which was providing an important contribution essentially for Phase A and Phase B as regards timely delivery services.

7.6 The Commission concurred with the need for a coordinated, effective plan for building capacity in developing countries to enable them to participate in WIS, and the importance of involving developing countries' experts in the development work of WIS to take account of the realistic capabilities, opportunities and constraints for the participation of the NMHSs of the developing countries in the WIS. The Commission emphasized the importance of promoting the awareness of WIS services to the NMHSs as well as potential user communities, including through pilot demonstration project with the involvement of NMHSs from developing countries.

7.7 The Commission recognized the good progress that has been made in demonstrating the technological solutions for WIS, but expressed concern that much work remains to be done before an operational version of WIS can be realized in the WMO community. The Commission concurred in the concern expressed by EC-LVIII on the general lack of adequate financial and human resources for the proper development of WIS and importantly, its introduction into operations, despite the considerable efforts made by a few Members. The Commission was pleased to learn that the establishment of a full time WIS project manager, which would be of considerable assistance in the coordination of the implementation of the WIS in close cooperation with the ICG-WIS, was making good progress, with the foreseen contribution from a Member through expert secondment. The Commission noted that the WIS project manager will require a strong, possibly full time, team if the project is to be successful. It also expressed satisfaction for the establishment of a WIS Trust Fund which would facilitate potential financial donations from Members and Organizations for the WIS development and implementation; it welcomed that a steering committee, composed of the ICG-WIS Chair, the OPAG-ISS Chair and one expert from each of the Members involved in the current key projects (i.e. Australia, Russian Federation, USA, France or Germany or UK, China, Japan) would advise on the best use of the funds for fostering the technical development and implementation of the key components of WIS.

7.8 The Commission noted that, in view of their fundamental importance for the function of WIS, the ICG-WIS had recommended a formal mechanism to designate the Global Information System Centres (GISC) and the Data Collection or Production Centres (DCPC). Since the basic design features of the WWW infrastructure also apply to the WIS, the recommended procedure for the designation of GISCs and DCPCs was similar to the one which had been successfully used for RSMCs under the WWW Programme. The Commission fully endorsed ICG-WIS conclusions and agreed upon the recommended procedures in principle, which are described in Annex III to the present report. These procedures would eventually be included in regulatory documentation related to the WIS. The Commission noted that the designation of DCPCs based on the functions of centres, should also take due consideration of the geographical distribution and relevant zone of responsibility.

7.9 The Commission urged WMO Technical Commissions and other bodies representing the participating programmes to state their requirements for WIS services. In this regard, the Commission emphasized that early identification of, and consultation with potential major users of WIS within the user community external to WMO, in particular within the International Disaster Risk Management community, was an important step towards ensuring that WIS takes into account their requirements as appropriate in order to fully meet its objectives for the benefit of all Members. To this end, the Commission requested that the WIS crosscutting programme takes the lead together with WMO Crosscutting programmes, in particular the DPM programme, identify and consult with potential users of WIS through appropriate coordination mechanisms. The coordination mechanism should be developed and implemented with urgency, by mid-2007, to bring on board the interdisciplinary user community and relevant international organizations such as ISDR, FAO, UNOCHA, to develop their requirements and their future participation in and contribution to WIS.

7.10 The Commission re-emphasized that the essential WIS data exchange and data management services would have to play an important role to the GEOSS as an essential WMO contribution with respect to weather, water and climate data and products.

Technical Conference on WIS

7.11 The Commission expressed its satisfaction for convening the Technical Conference on the WMO Information System (TECO-WIS) in Seoul (6-8 November 2006), immediately preceding the extraordinary session of the Commission. The TECO-WIS programme included an actual demonstration of the V-GISC and DCPC prototypes, which were expected to lead to a pre-operational implementation in the near future. TECO-WIS reviewed Metadata developments, Information and communication technology building blocks and Pilot & Prototype projects. The TECO-WIS programme also included presentations from various stakeholders, including CAS, CAgM and WMO NDPM Programmes, and from the Information & Communication Technology (ICT) Industry. TECO-WIS greatly contributed to a clarification of the benefits for all WMO Programmes and Members that are expected from the new services that would be made available through WIS. TECO-WIS noted with appreciation the significant progress made in the development of WIS, through the active participation and efforts of an increasing number of NMHSs and the participation and contribution of several WMO Programmes and Technical Commissions, including THORPEX, IPY and JCOMM.

7.12 TECO-WIS noted with satisfaction that the components of the WIS centres functions and data communications services were all based on available technology and industry standards that would facilitate a cost-effective implementation. The evaluation of enabling technologies for the different functional elements has been made through pilots and prototypes projects. TECO-WIS noted with much appreciation the progress made in the development of the V-GISC project, including the SIMDAT project, through the demonstration system that currently supported the discovery and retrieval of datasets and associated metadata crosscutting different WMO programmes from several NMSs and International Centres, including DWD, Météo-France, UK Met Office, ECMWF, EUMETSAT, NCAR and NODC. It was also pleased of the efforts made in converting the current implicit metadata information currently included in WWW Manuals and Operational Information into standard Metadata, and in the development of tools for harvesting metadata from other programmes (e.g. JCOMM and CAS) enabling effective data discovery and access by the users.

7.13 The Commission reviewed the conclusions of the Technical Conference and endorsed the following conclusions and recommended actions:

(a) Metadata is a new concept to be implemented by NMHSs. Recommended practices, procedures and guidelines for the metadata generation and exchange, especially on the GTS, are urgently needed by the NMHSs. The NMHSs need for common operational metadata editing tools for facilitating the implementation was particularly stressed as well as the related capacity building activities, especially training;

(b) The current CBS development of the WMO core metadata profiles and operational catalogues, including other aspects related to the of data definition, presentation, access and transfer should be actively pursued. The critical importance of the compliance to industry standards, i.e. the ISO 191xx series, as well as the contribution of WMO to the development of these standards, was emphasized to ensure the interoperability of WMO Programmes' data and products of WIS within the WMO community and with information systems of other relevant communities. Therefore, TECO-WIS stressed the need to develop WMO expertise on the ISO 191xx series, and requested the Secretary-General to reinforce the participation and involvement of the Secretariat, through appropriate resources, in the related key activities of ISO; it also recommended the participation of WMO in the UN Geographic Information Working Group;

(c) Review and update the plans on development and implementation of WIS in the light of emerging relevant activities and development, foremost GEOSS and the GEO-NetCast; to this end active collaboration with GEO is essential;

(d) To make it possible to plan and proceed with an actual implementation of WIS components, there is an urgent need for the development of appropriate regulatory documentation (e.g. a Manual on WIS) including organization and recommended practices and procedures and guidance material for implementation. The urgent need for the specifications for the GISC interfaces, including a unified user interface for WIS components was particularly emphasized, as well as the need for a WIS guide for NCs clarifying their contribution, involvement and benefits for their participation in WIS development and services. It requested the Secretary-General to identify appropriate resources to support CBS teams and the ICG-WIS in expediting these developments that are critical for the WIS implementation;

(e) The involvement of all NMHSs in the WIS development is a crucial factor for ensuring a successful implementation of all WMO Programmes and a shared ownership of the system. An important goal for the WIS has been facilitating a cost-effective access to and reception of WMO Programmes' data and products for NMHSs of developing countries and LDCs. In this respect, the need for outreach activities for promoting the awareness of WIS development and services to the WMO communities as well as other communities was emphasized. Enhanced efforts are required to expeditiously implement an outreach programme for developing countries to enable them to cooperate in the development and effective use of WIS. This programme should include appropriate action plans which should be coordinated through the appropriate mechanisms of the Regional Associations. The crosscutting activities initiated by the Secretary-General on the Enhancement of WIS Development and Implementation were noted with appreciation;

(f) Information about WIS, including values and benefits, practical participation in and interaction with implemented pilot projects, should be published through appropriate means, giving attention to the needs of the various WIS user communities and target groups, such as technical experts and decision makers;

(g) Some technical challenges still required further development, including the timely data and metadata synchronization between different GISCs, the service interfaces to other systems and applications to achieve the desired interoperability, and consolidated scheme and practices for security, authentication and authorization procedures for WIS services. It was also emphasized that the consolidation of the techniques, procedures and applications that have been tested in prototypes, into an operational implementation would require considerable further efforts;

(h) In addition to the European VGISC which was developed by France, Germany and the United Kingdom with the active partnership of ECMWF and EUMETSAT, it was noted with appreciation that WMC/RTH Melbourne, Moscow and Washington and CMA, JMA and KMA were initiating development plans for the implementation of WIS centres functions and services. It was recognized that a realistic target date for the start of operation of at least one GISC and several DCPCs was mid-2008.

8. WMO SPACE PROGRAMME *(agenda item 8)*

8.1 The Commission reviewed the main activities of the WMO Space Programme regarding the space-based observation requirements from WMO programmes, improvement of the space-based GOS, enhanced access to its data and products and promotion of Members capability to use this data.

8.2 The Commission recalled that the status of the space-based component of the Global Observing System (GOS) was reported in Integrated Observing Systems (agenda item 6.1). It was pleased to note the expansion of the space-based component of the GOS, with the launch of the following geostationary satellites since the last CBS meeting: MTSAT-1R, MTSAT-2, Meteosat-9, GOES-13 and the imminent launch of FY-2D to be located at 86.5 E. Concerning polar-orbiting satellites it noted the launch of NOAA-18, the launch of Metop-A with an advanced payload, as well as China's plans to launch FY-3A in September 2007 and plans of the Russian Federation to launch a METEOR 3-M No. 1 satellite in December 2007. Several new R&D satellites would also contribute to the GOS: ALOS, Cloudsat and Calipso, Resurs-DK. Radio-occultation sounding data from the COSMIC constellation were also available. Furthermore the Commission noted that the China National Space Administration (CNSA) had confirmed its intention to contribute to the space-based component of WMO's GOS by providing remote sensing data from the oceanographic satellite HY-1B to be launched soon, the Chinese-Brazilian CBERS series, and the HJ environment and disaster monitoring satellite constellation HJ-1 (-A, -B, -C) to be launched in 2007/2008 with visible to near infrared hyperspectral instrumentation of great potential value for intercalibration of other satellite system instruments.

8.3 The Commission also noted NOAA activities to move GOES-10 to 60 degrees West in order to enhance coverage of the Americas. By significantly improving satellite detection of such natural hazards as severe storms, floods, drought, landslides, and wildfires, the move would help to protect lives and property in North, Central and South America as well as the Caribbean. GOES-10, once operational in its new position, would provide for imagery data as frequently as every 15 minutes. The Commission noted that with the move of GOES-10 and its increase in temporal resolution over South America the space-based component of the GOS would now meet the full set of WMO global requirements. It also welcomed EUMETSAT's decision to relocate Meteosat-7 to continue the Indian Ocean Data Coverage mission until 2008, as well as the DCP service provided in support of the Indian Ocean Tsunami Warning System. The Commission noted the need for continuous and robust coverage over the Indian Ocean and was pleased that plans from Russian Federation and China would respond to this need in the longer term.

8.4 The Commission welcomed the implementation of a Global Space-based Inter-Calibration System (GSICS) intended to ensure comparability of observations from different missions, which was considered essential to take full benefit of satellite observations for NWP and climate change detection. It was noted that China, EUMETSAT, Japan, the Russian Federation and the USA were participating in GSICS and the Republic of Korea was preparing to join.

8.5 The Commission noted the progress in implementing the satellite-related recommendations of the Implementation Plan for Evolution of the Global Observing System. It welcomed the action taken to initiate an update of the vision of the GOS for the 2025 timeframe. It further noted the review of GCOS requirements that highlighted that some Essential Climate Variables (ECV) were only observed through R&D missions with no plan for long-term availability, and was pleased to note that the update of the GOS baseline would seek to include sustained observations of such variables.

8.6 The Commission confirmed the importance of the IGDDS project within the WIS to ensure timely access to satellite data and products. It noted with appreciation the expansion of the operational EUMETCAST system by EUMETSAT to Region I, South-West Region II, Regions III and IV, as well as the successful demonstration of FengyungCast by China with plans to open this service to all countries in the Asia-Pacific area. It also noted the potential contribution of the Russian DVB/S system "Meteoinform" based on "MITRA" technology to IGDDS. The Commission welcomed the start of an Asia-Pacific Regional ATOVS Retransmission Service (RARS) that was already providing ATOVS data in level 1c AAPP format over the GTS from 10 HRPT stations including Syowa in Antarctica. The Commission encouraged efforts towards completion of a global RARS network, that was seen very beneficial for NWP.

8.7 The Commission confirmed the importance of the Virtual Laboratory and of Centers of Excellence (COE) and encouraged their growth. Each COE was encouraged to permanently establish a focus group in its Region for supporting exchange of information and continued education.

8.8 The Commission was pleased to note the overwhelming success of the High Profile Training Event (HPTE) that provided on-line training to over 1000 users from more than 120 WMO members, demonstrating the efficiency of distance learning. It encouraged the WMO Space Programme to pursue this approach with events at the regional scale, e.g. on satellite applications for climate studies.

8.9 In view of the progress in achieving the goals stated in the WMO Space Programme Implementation Plan 2004-2007 the Commission agreed that much had been accomplished to the direct benefit of WMO Members. It encouraged that continuing and enhanced efforts be made by all stakeholders to fully implement the goals.

9. OTHER CROSS-CUTTING ACTIVITIES

9.1 GROUP ON EARTH OBSERVATIONS *(agenda item 9.1)*

9.1.1 The Commission noted the resolution adopted by the WMO Executive Council (Resolution 15 (EC-LVIII)) affirming its commitment to GEO and agreeing that all essential data as defined by WMO Resolution 40 (Cg-XII) should be made available through the GEOSS interoperable arrangements to serve the needs of the global community. The Commission also noted the considerable involvement of WMO in the GEO/GEOSS process. It expressed its gratitude to the two GEO Rapporteurs and to those involved in the CBS Expert Meeting on GEOSS Related Matters that discussed GEOSS and provided detailed comments to the GEO Secretariat on Version 1 of the 2006 Work Plan of GEO.

9.1.2 The Commission was strongly of the opinion that WWW component systems should be a core to the system of systems within GEOSS. The Commission also strongly believed that WMO Members' considerable experience and expertise would greatly assist GEO in its efforts to establish GEOSS. The Commission noted there were nine Societal Benefit Areas (SBAs) within GEO and that WMO was expected to provide a dominant role and responsibility for the SBAs for weather, water, climate and hydro-meteorological disasters. In doing so, NMHS mandates would not be encroached upon by GEO. The Commission recalled that GEOSS was focused on observations and turning data into information but did not include provision of decision making products, such as warnings and alerts.

9.1.3 With regard to GEO-NETCast, the Commission noted at present it was comprised of EUMETCast and Fengyuncast and that it disseminated primarily meteorological satellite data and products for use by WMO Members. The Commission also noted that when GEO-NETCast expanded to meet the needs of SBAs outside WMO Members' needs that the GEO Information System of System would need to provide data management functions comparable to those presently contained within the WWW. Thus, the Commission was strongly of the opinion that the 2007-2009 GEO Work Plan should take advantage of the WMO's offer for WIS to be a core component of the GEO Information System of Systems. Furthermore, the Commission reaffirmed its previous offer for GEO participation in the WIS programme and particularly in WIS implementation during 2007 and beyond.

9.1.4 The Commission also agreed that linguistic support would be an issue for GEO to address as a matter of urgency. The Commission recalled that it issued all its reference documents in four languages. If GEO documents or the GEO portals would be in English only, this would be a significant and unnecessary impediment for GEOSS.

9.1.5 The Commission agreed that implementation of GEOSS concept would be extremely important to WMO Members. It would provide an outlet for WMO data and products in support of most of all Societal Benefit Areas (SBAs). It would give greater recognition of the NMHSs' value to societal needs and keep WMO involved in a major initiative. By placing WWW component systems as a core for the system of systems, new and emerging capabilities such as expected from WIS would be of benefit to all. Thus, the Commission urged the Secretary-General and all GEO Members that were also WMO Members to stress in GEO fora the need to take full advantage of WMO systems as components of GEOSS.

9.1.6 The Commission requested the two Rapporteurs on GEO to continue their work with the WMO Secretariat and with Members to provide advice on WMO involvement in GEO.

9.2 DISASTER PREVENTION AND MITIGATION *(agenda item 9.2)*

Role of the Commission in relation to the DPM Programme

9.2.1 The Commission recalled the critical role of the WWW Basic Systems in contributing to the objectives of the WMO DPM Programme. The Commission further recognized that these operational systems comprising the surface-based and space-based components of the GOS, the WIS/GTS, the GDPFS and service delivery of PWS, provide the essential underpinning that support NMHSs in their efforts to meet their ultimate mandate of services for the safety of life and security of property.

9.2.2 The Commission noted that the contributions of the NMHSs span the entire scope of disaster risk management including risk identification, risk reduction and risk transfer activities at the national level, including,

- Participation in the national disaster risk management planning;
- Provision of hazard databases and analysis;
- Provision of operational hazard early detection and warnings;
- Provision of meteorological services in support of pre- and post-disaster emergency response and relief operations;
- Enhancing NMHSs products and services and their utilization in decision-making processes through cooperation with other agencies;
- Education and training programmes and modules of NMHSs and their key stakeholders such as ministerial, disaster risk managers and authorities, emergency response operators, media;
- Public outreach programmes and materials.

The Commission emphasized the value of NMHSs working in partnership with other national agencies to ensure the role of NMHSs in national disaster management is recognized, both to enhance national planning, preparedness, emergency response and recovery, and to strengthen the role of the NMHSs in those processes.

9.2.3 The Commission also noted that much of the work of its OPAGs are relevant to, and make a valuable contribution to, DPM Programme objectives. However, for the most part the motivation for its activities is much broader. Activities that might come under this broader ‘backbone’ role include:

(a) Evolution of the Global Observing System to provide a sustained observational basis for detecting and monitoring extreme weather events, and a basis for responding to new observational requirements (OPAG-IOS);

(b) Coordinated development and implementation of data processing and forecasting systems that support the weather forecasting operations of NMHSs, and which also underpin the establishment of specialized numerical prediction systems within the GDPFS required for mitigating various hazards in which meteorology is a factor (OPAG-DPFS);

(c) Strengthening the GTS to ensure that data, products, forecasts and warnings can be distributed effectively to NMHSs to assist them in providing DPM services to their communities (OPAG-ISS);

(d) Enhancing the delivery by NMHSs of well designed and communicated Public Weather Services and addressing social and economic issues related to meteorological and hydrological services (OPAG-PWS).

9.2.4 The Commission noted particularly that the OPAGs are also engaged in a number of focused activities that are specifically undertaken with the aim of assisting NMHSs in their disaster prevention and mitigation activities. These include, for example:

(a) Severe Weather Forecasting Demonstration Project, which aims to improve severe weather forecasting services in countries where sophisticated NWP model outputs are not currently used (OPAG-DPFS);

(b) Emergency Response Activities programme, which includes developing and maintaining operational arrangements for the use of atmospheric dispersion modelling tools and expertise for nuclear and non-nuclear emergencies, for example volcanic eruptions, dust storms, wild-land fires, chemical and biological incidents and other hazards (OPAG-DPFS);

(c) Assisting developing country NMHSs in risk reduction activities, such as through a workshop on advances in nowcasting and applications in early warnings of meteorological and hydrological hazards (OPAG-PWS);

(d) Implementing satellite-based real-time data collection from tsunami buoys (OPAG-ISS);

(e) Enhancing the role of NMHSs within national DRR strategies through broad implementation and uptake of WIS/GTS (OPAG-ISS) (see also agenda item 7, paragraph 7.9).

Progress on Disaster Prevention and Mitigation Activities within the Commission

9.2.5 The Commission noted the interaction between its DPM Coordinator and the DPM Programme office aimed at cross-mapping the activities of the Commission and the goals of the DPM Programme, and encouraged them to continue to identify areas where the Commission and the DPM Programme could be mutually supportive, including through relevant enhanced operation of the WWW, the WMO Space Programme and the PWS. The Commission noted that various country level and Technical Commission surveys being undertaken by the DPM Programme office will provide information on these interactions.

9.2.6 The Commission welcomed the opportunity to build into its work plans an enhanced response to DPM Programme requirements and, at the same time, requested the DPM Programme to reflect relevant Commission requirements in planned DPM Programme activities. To this end, the Commission requested the DPM Programme office to report to each OPAG and relevant Expert Teams on specific requirements that they could assist in addressing. The Commission noted that OPAGs will continue to regularly assess the extent to which their activities assist DPM and other cross-cutting programmes, and that they will report accordingly on their achievements.

9.2.7 The Commission acknowledged the benefit of a multi-hazard approach to DPM and noted that the WWW and PWS Programmes reflect a multi-hazard approach through the operation of their basic observing, communications, data processing and forecasting and service delivery systems. The Commission emphasized the need to continue to strengthen these basic systems and services and ensure their sustained and robust operation, while supplementing them with targeted, more hazard-specific components to address specified requirements.

9.2.8 The Commission recognized that achieving many of the DPM Programme objectives will require a cross-Commission approach, and requested its DPM Coordinator to explore opportunities to work with counterparts in other Commissions, such as CIMO and JCOMM, on relevant issues including the development of standardized data and reporting formats across all relevant hazard types and all regimes.

9.2.9 The Commission noted that the DPM Programme intended to hold a meeting of Technical Commission DPM Coordinators late in 2006 to further explore the cross-programme opportunities. The outcomes of this coordination meeting will be presented at the 2nd meeting of the EC Advisory Group on DPM in late January 2007, to which the Presidents of Technical Commissions will be invited to discuss (inter-) Commission activities in support of WMO DPM Programme. Among issues to be discussed are those related to development of guidelines for hazard data products, methodologies, statistical analysis of hazard characteristics and mapping, which are relevant to the work of several Expert Teams within the OPAGs. The Commission requested its DPM Coordinator to interact closely with the DPM Programme office in identifying key areas relevant to the Commission and requested its expert teams to consider to these requirements.

9.3 QUALITY MANAGEMENT FRAMEWORK *(agenda item 9.3)*

9.3.1 The Commission noted the decisions of the Executive Council (EC) on the development the WMO Quality Management Framework (QMF), the introduction of Quality Management Systems (QMS) by NMHSs, the establishment of cooperation with International Organization for Standardization (ISO), the revision of quality management (QM) documentation by Technical Commissions and the harmonization of terminology related to QM.

9.3.2 Following the Executive Council’s decisions, the Commission decided to request each OPAG to review the parts of their publications addressing quality terms (in particular quality management, quality control and quality assurance) to ensure that the terminology used in them is in agreement with the definitions of the quality related terms given in the ISO 9000:2005 standard and develop QA/QC procedures, if necessary, and requested its Rapporteur on QMF to review the revised texts to ensure consistency among the OPAGs and with the publications of other Commissions. The Commission noted the proposal of the Rapporteur to review, in priority, the following manuals, which are annexes to the WMO Technical Regulations: the *Manual on the Global Observing System*, and the *Manual on the Global Telecommunication System*. As regards the *Manual on Codes*, the Commission noted that it contained procedures describing the representation of data as well as procedures on the observing and interpretation of observations. The Commission asked the OPAG-ISS and OPAG-IOS to ensure that the procedures on the observing and interpretation of observations are described in a separate document. The Commission asked the Secretariat to work with the OPAGs and the management group to address resources necessary to address this review.

9.3.3 The Commission noted that in a quality management system, the status of revision of the documents needed to be properly managed to ensure that the latest versions of the documents were used. In order to assist Members in their duties and also to ensure the widest possible availability and implementation of valid CBS technical guidance documents, the Commission requested the Secretariat to ensure that for those CBS technical documents, Guides and Manuals that are available on the WMO Website, only the latest version be available (including the latest supplement, if any) and that the date and number of the latest edition and supplement issued be clearly indicated.

9.3.4 The Commission noted the recommendation of the Executive Council that capacity building activities addressing the implementation of QMS in developing countries be best addressed through the VCP Programme, by including “Implementation of Quality Management System” as one high-priority area and by promoting partnerships and cooperations rather than through a demonstration project.

9.3.5 The Commission noted that, in view of the recent developments concerning international civil aviation, it could be expected that a QMS based on the ISO 9000 series of standards would become mandatory during the next few years for the parts of the NMHSs providing meteorological services for international air navigation.

9.3.6 The Commission agreed on the TOR for its Rapporteur on QMF (see agenda item 11).

9.4 THORPEX *(agenda item 9.4)*

9.4.1 The Commission reviewed the progress made in the implementation of THORPEX.

9.4.2 The Commission noted with appreciation the THORPEX activity report highlighting the development of THORPEX since its inception in 2002. The Commission also thanked the many scientists who had contributed, and continued to contribute, their expertise to the ongoing success of the programme, and drew particular attention to Canada, China, Japan, France, Norway, the United States and the United Kingdom for their continuing financial support, and to China for its seconded expert at the IPO. The Commission appreciated plans of the Republic of Korea to make contribution to the THORPEX trust fund during 2006.

9.4.3 The Commission noted the pressing budgetary issues and urged more Members to commit support to the trust fund.

9.4.4 The Commission also noted the comments of the fifty-seventh session of the Executive Council, which had drawn attention to the explicit roles of the majority of WMO Programmes in THORPEX, namely cross-cutting activities and developing cooperation, and noted that the recommendations of the fifty-sixth session of the Executive Council had been followed, for example the CBS provided full support of all OPAGs coordinated through its vice-president and the Management Group and designated experts to THORPEX, and vice versa.

9.4.5 The Commission was particularly pleased with the progress made towards the development of the THORPEX Interactive Grand Global Ensemble (TIGGE), which was a prototype for a multi-model ensemble forecast system that would guide the development of a possible Global Interactive Forecasting System (GIFS). In its first phase, TIGGE would provide near-real-time access to ensemble forecast products to all WMO Members for research purposes. It was noted that the data discovery requests would be handled in the context of the WMO Information System (WIS). The Commission reiterated that overall, under the auspices of THORPEX, it is envisaged that regional and global projects and experiments will be carried out to:

(a) Improve forecast skill by advancing the knowledge of global-to-regional influences on the initiation, evolution and predictability of weather systems;

(b) Target satellite and in situ observations to design the strategy for interactive forecasting and observation, thus contributing to the evolution of the WMO Global Observing System (GOS), a core component of the Global Earth Observation System of Systems (GEOSS);

(c) To create and evaluate systems for the assimilation of targeted observations from satellites and in situ measurements;

(d) Accelerate improvements in the accuracy of numerical weather prediction, probabilistic forecasting and the description of uncertainty in initial conditions;

(e) Test and demonstrate the effectiveness of a global multinational multi-model multi-analysis ensemble forecasting system;

(f) Demonstrate societal and economic benefits of improved forecasts, by improving decision-support tools, which utilize advanced forecasting products to benefit directly social and economic sectors.

9.4.6 The Commission noted that the above research activities had the potential to have significant impacts on the functioning of the WWW. It requested the Management Group to consider the likely impacts of THORPEX research on operations in future work plans, and to maintain dialogue with THORPEX to ensure the research activities undertaken through the programme would have maximum benefit for the operation of the WWW. The Commission also noted that the Terms of Reference of the THORPEX Technical Advisory Board (TAB) included specifically the provision of guidance in the transition of research results to operations.

9.4.7 The Commission noted the regional organization of THORPEX in RA II, RA IV and RA VI, including WWRP/THORPEX Rapporteurs nominated by the respective regional associations, and the efforts to initiate health- and agriculture-related demonstration projects within RA I. The Commission was pleased to note the rapid development of the THORPEX partnership in the Southern hemisphere led by Australia and South Africa, with the active participation of New Zealand, Chile, Brazil and Cook Islands, which should involve countries from RA I, RA III and RA V. The Commission noted the importance of the emphasis THORPEX placed on social and economic benefits for WMO Members and the ongoing activities designed to show the utility of improved forecasts to users.

9.4.8 The Commission was pleased with the:

(a) Cooperation that has developed between THORPEX and AMMA that has recently leaded to a successful driftsonde programme to monitor easterly waves;

(b) The THORPEX participation in the GEO Work Plans;

(c) The development of THORPEX IPY activities.

9.4.9 The Commission noted with satisfaction that the appointments of Mr W. Zwieflhofer (ECMWF) as the CBS nominated co-chair of the THORPEX Technical Advisory Board (TAB), Mr Shi Peiliang (OPAG-ISS Chair) as Chairman of the THORPEX WG on Data Policy and Management (DPM) and Mr J. Purdom (OPAG-IOS Chair) as a Co-chair of the THORPEX Observing Systems Working Group had assured the provision of appropriate CBS expertise and is contributing to the successful planning and implementation of THORPEX. The Commission also noted the close working relationships that have developed between the OPAG on PWS and the Social and Economic Research and Applications (SERA) WG of THORPEX.

9.5 INTERNATIONAL POLAR YEAR (IPY) *(agenda item 9.5)*

9.5.1 The Commission noted with satisfaction substantial progress made by the WMO/ICSU Joint Committee (JC) for IPY on the preparation of the International Polar Year 2007-2008. It was pleased to note that the JC at its second session (Geneva, November, 2005) had welcomed the involvement of technical commissions in the development and implementation of IPY, in particular addressing observational data and products, data management and information services.

9.5.2 The Commission recognized that most of the IPY projects endorsed by JC were closely related to WMO Programmes and that a large number of NMHS had played an active role in preparation of more than half of IPY project proposals and 52 countries planned to participate in their implementation. It noted that, considering the role of NMHS and technical commissions in IPY, EC-LVIII (June 2006) had concluded that they would play an important role during the IPY implementation when the existing elements of global observing systems which are within their areas of responsibility would be in use, as well as beyond IPY, when the major role of NMHS and technical commissions should be to ensure the legacy of observing systems improved or established during the IPY. The Commission stressed that Members should be kept informed of improvements to the observing systems related to the IPY. It recommended that in addition to the IPY web page (http://www.ipy.org), the CBS Newsletter should be widely used for this purpose. The Commission was advised that inter alia, the IPY should be extended if possible, to address also unique features such as snow caps of mountains Kilimanjaro and Kenya.

9.5.3 The Commission strongly endorsed the IPY data exchange policy which is in compliance with resolutions previously adopted by the WMO Congress. The Commission strongly encouraged all IPY projects to exchange observational data on the GTS *in real time* to support WMO Members' activities.

9.5.4 The Commission felt that in course of further IPY preparation it is highly desirable to ensure the submission of requirements for satellite data and products from IPY project coordinators, where it is necessary, as well as requirements related to exchange of IPY data and information via WIS that have to be developed as a high priority matter and provided to CBS for planning purposes. In this connection the Commission stressed the necessity of close communication between the JC Sub-Committee on Observations and the Sub-Committee on Data Policy and Management on one side and CBS OPAGs on IOS and ISS on another side, on the matters of common interest.

10. LONG-TERM PLANNING RELEVANT TO THE COMMISSION *(agenda item 10)*

Monitoring and evaluation of the implementation of the Sixth WMO Long-term Plan (6LTP)

10.1 The Commission requested its Management Group to ensure the provision of the relevant contribution expected from CBS in the evaluation process, particularly with respect to the realization of the nine WMO strategies.

Preparation of the WMO Strategic Plan 2008-2011

10.2 The Commission noted the decisions of the Executive Council related to the preparation of the WMO Strategic Plan 2008-2011 and the preparation of the WMO Operating Plan. The Commission requested its Management Group to ensure the provision of the relevant contribution expected from CBS for the preparation of these plans.

10.3 The Commission requested the Secretariat, in preparing its contributions to the WMO Plans, to ensure that the plans for CBS, and the WWW and the PWS programmes, have objectives that are specific, measurable, achievable, relevant and time bound.

10.4 The Commission noted that the WMO Plans will have wide scope and, if they are to be achieved, constant adjustment will be needed. It therefore asked its Management Group to ensure that they addressed not only the technical outputs, but also the relative funding that is needed to achieve them. It asked the Secretariat to provide the Management Group with the financial information needed to achieve this.

11. FUTURE WORK PROGRAMME *(agenda item 11)*

11.1 The Commission reviewed the progress made since its thirteenth session and consolidated its two-year work programme taking into account the relevant decisions of the Executive Council and the detailed discussion held during the session, in particular under agenda item 6.

11.2 The Commission reviewed and adapted, as necessary, the terms of reference and tasks of the teams and rapporteurs of each OPAG that were established by CBS-XIII. The specific tasks that were identified in complement or adjustment of the current terms of reference of teams and rapporteurs, or revised terms of reference, as appropriate, are listed in Annex IV to the present report. The Commission requested each OPAG chairperson to ensure that the specific tasks be adequately addressed. It further requested its Management Group to keep under review the work programme and make arrangements, as necessary, on the proposals of OPAG chairpersons.

11.3 Noting the decisions of EC-LVIII related to the question of the volunteerism in the work of Technical Commissions and Regional Associations, the Commission asked its Management Group to develop recommendations on how the situation on the difficulties in obtaining appropriate national experts to participate as rapporteurs or members of teams of each OPAG could be improved, including proposals for recognizing the valuable contribution of these national experts. The Commission also requested it Management Group to analyse the situation with respect to the performance of the rapporteurs and teams as a way of identifying areas of concern on which recommendations may be proposed.

11.4 The work plans for the OPAG Expert Teams should provide clarity over responsibilities, proposed timescales and deliverables and an indication of the resources and expertise that will be required to achieve them. Noting the increasing difficulty in securing expertise and support for activities within all the OPAGs, the Commission recommended the establishment of a Trust Fund for the CBS OPAG Expert Teams.

Participation of women in the work of the Commission

11.5 The Commission noted the recommendations of the Second WMO Conference on Women in Meteorology and Hydrology (Geneva, March 2003) and Resolution 33 (Cg-XIV) of Fourteenth World Meteorological Congress which calls for equal opportunities for the participation of women in meteorology and hydrology and noted the past efforts of the Commission to strengthen the participation of women in the work of the Commission. Recognizing that these efforts need to be revised and strengthened with new initiatives on a continuous basis, the Commission adopted Resolution 1 (CBS-Ext.(06)) and designated Ms Vicki Nadolski (USA) as the CBS focal point for gender issues. The terms of reference of the gender focal point are included in Annex IV to the present report.

12. REVIEW OF PREVIOUS RESOLUTIONS AND RECOMMENDATIONS OF THE COMMISSION AND RELEVANT EXECUTIVE COUNCIL RESOLUTIONS
(agenda item 12)

In accordance with established practice, the Commission examined those resolutions and recommendations adopted prior to the present session which were still in force and adopted Resolution 2 (CBS-Ext.(06)) and Recommendation 9 (CBS-Ext.(06)).

13. OTHER BUSINESS *(agenda item 13)*

13.1 The Commission noted the significant changes in the collection, distribution of and access to data and products made possible as new programmes and initiatives, such as WIS and GEOSS, are planned and implemented, taking benefit from new Information and Communication Technologies opportunities. It requested the CBS Management Group to consider the issue and asked its president to take appropriate action to ensure continued awareness of potential data policy implications, including discussing the topic at the next meeting of presidents of Technical Commissions and reporting, as appropriate, to the Executive Council Advisory Group on the International Exchange of data and products.

13.2 Some Members emphasized that the Public Weather Services programme was a cross-cutting activity which worked cooperatively with several WMO Programmes and Technical Commissions. They noted that there are issues, such as impact of seasonal weather forecasting, which cannot be easily and completely addressed by the Public Weather Services programme in its current structure, in view of the implications to and involvement of other Technical Commissions (e.g. CAS, CCl). The Commission requested the CBS Management Group to consider this issue and asked its president to take appropriate action for addressing it, including raising the matter at the next meeting of presidents of Technical Commissions and reporting, as appropriate, to the Executive Council Working Group on the evolution of NMHSs and WMO.

14. DATE AND PLACE OF THE FOURTEENTH SESSION *(agenda item 14)*

In the absence of any formal invitation from Members represented at the session, the Commission decided that the date and place of the fourteenth session should be decided at a later date and requested its president to make the necessary arrangements in consultation with the Secretary-General.

15. CLOSURE OF THE SESSION *(agenda item 15)*

15.1 In his closing remarks the president of the Commission, Mr A. Gusev, reviewed the major outcomes of the session. He recalled the tremendous changes, which had occurred in NMHSs, in the last decades and believed that NMHSs were now at the eve of a new technological revolution, which would again require an extensive engagement from the Commission to find solutions on the challenges that all would be facing. He emphasized the tremendous responsibility that CBS had in supporting a number of interdisciplinary activities, and in providing the basic systems, which were critical for other programmes to carry out their work. He mentioned the evolving role of NMHSs in the modern world, which provided essential contributions to protect life and property, to provide data relevant to sustainable development, the impact of climate changes and hydrological safety. In that sense, NMHSs had now become an economical factor. He called on Members to attract young specialists and asked that they become more numerous in the work of the expert teams. Finally, he felt that the Commission needed to take on a strategic task to widen the awareness of the people to the World Weather Watch, its mission and its achievements. He concluded by thanking the OPAGs for their work, the management group, the rapporteurs and all those who actively contributed to the activities of the Commission for their work, the WMO Secretariat for its constant support, the interpreters and the local staff for the excellent arrangements.

15.2 Mr Kwang-Joon Park, Director General of the Forecasting Bureau expressed the pleasure of the Korea Meteorological Administration in hosting this extraordinary session of CBS. He appreciated the success of the discussions of this meeting and the achievements agreed on all items. He ensured that the Korea Meteorological Administration would do all its possible to continue supporting CBS.

15.3 Mr J. Hayes, representative of the Secretary-General, addressed the session on behalf of M. Jarraud. He expressed his warmest thanks to the Government of the Republic of Korea and to the Korea Meteorological Administration for the their hospitality and the outstanding arrangements made to support the work of the session and thanked all participants for the insights they provided. He summarized the major challenges that the Commission would have to face in the future and stressed the need to strengthen collaboration with other programmes and commissions to ensure effective work. He welcomed the success of the session and appreciated that the Commission continued to carry out its work in a spirit of collaboration by taking into consideration the needs and capabilities of all Members. He concluded by thanking all the supporting staff, from the WMO Secretariat as well as from the local Secretariat, which had enabled the smooth conduct of this session.

15.4 The Extraordinary session of the Commission for Basic System was closed at 10:40 hrs on 16 November 2006.

RESOLUTIONS ADOPTED BY THE SESSION

Resolution 1 (CBS-Ext.(06))

PARTICIPATION OF WOMEN IN THE WORK OF THE COMMISSION

THE COMMISSION FOR BASIC SYSTEMS,

Noting:

(1) The United Nations Conference on Women (Beijing, 1995) and its recognition of the importance of women and their contribution to science,

(2) The appeals made in *Agenda 21: Programme for Action for Sustainable Development* (Rio de Janeiro, June 1992), Chapter 24: Global action for women towards sustainable and equitable development,

(3) The Report of the Second WMO Conference on Women in Meteorology and Hydrology, Geneva, March 2003,

(4) Resolution 33 of the Fourteenth World Meteorological Congress (Cg-XIV), which calls for equal opportunities for the participation of women in meteorology and hydrology,

Considering:

(1) The need for trained, qualified professionals regardless of gender, in the work of the Commission,

(2) The need to encourage national education programmes in science and technology that actively target girls and woman predisposing and training them to enter the fields of meteorology and related sciences,

(3) The need to increase opportunities and inducements for the recruitment of women within NMHSs, and provide equal opportunities for career advancement to the highest levels,

Welcoming and supporting the active participation of women delegates in this Commission,

Urges increased participation and involvement of women in the work of this Commission;

Recommends that Members:

(1) Continue to encourage, promote and facilitate equal opportunities for women in science and technology in order to prepare them for careers in scientific professions such as meteorology and related sciences;

(2) Facilitate the participation of women in the activities of the Commission;

(3) Provide active encouragement and support for equal opportunity for the participation of women in all fields of meteorology and related sciences at decision-making levels, particularly, in CBS and its working programmes;

Further recommends that Members encourage the promotion of science studies in schools, as a means of ensuring the participation of women and men on an equal basis in this field of work;

Requests the president of the Commission to report to the fourteenth session of the Commission on progress made on the main aspects of the implementation of this resolution during the intersessional period;

Decides to appoint and support a gender focal point with appropriate expertise, who will report to the president of the Commission.

Note: This resolution replaces Resolution 1 (CBS- Ext.(98)), which is no longer in force.

Resolution 2 (CBS-Ext.(06))

REVIEW OF PREVIOUS RESOLUTIONS AND RECOMMENDATIONS OF THE COMMISSION FOR BASIC SYSTEMS

THE COMMISSION FOR BASIC SYSTEMS,

Noting the actions taken on the resolutions and recommendations adopted by the Commission prior to its Extraordinary Session (2006),

Decides:

(1) To keep in force Resolution 2 of CBS-Ext.(98), Resolution 1 of CBS-XII (2000), and Resolutions 1 and 2 of CBS-XIII (2005);

(2) To keep in force Recommendation 1 of CBS-XIII (2005);

(3) Not to keep in force other recommendations adopted before its Extraordinary Session (2006).

RECOMMENDATIONS ADOPTED BY THE SESSION

Recommendation 1 (CBS-Ext.(06))

ADOPTION OF A WORLD GEODETIC SYSTEM AND A GLOBAL GEOID MODEL AS REFERENCES FOR POSITIONING THE OBSERVING STATION

THE COMMISSION FOR BASIC SYSTEMS,

Noting:

(1) The position of a weather station is given by longitude, latitude and altitude,

(2) No standard reference system has been endorsed by the WMO to be used as the reference for both horizontal and vertical position of a station,

(3) Both longitude and latitude require one universal standard positioning system as reference,

(4) The *International Meteorological Vocabulary* (WMO-No. 182) defines the Mean Sea Level (MSL) as the average sea surface level for all stages of the tide over a 19-year period, usually determined from hourly heights observed above a fixed reference level, while the fixed reference level for MSL is yet to be identified,

Considering that:

(1) The standard reference system the World Geodetic System 1984 (WGS 84) is applicable for the worldwide use by all applications used in meteorology,

(2) Most regional and national systems refer to WGS 84,

(3) The WGS 84 is endorsed by other international bodies, such as ICAO,

(4) The Earth Geodetic Model – EGM-96 is applicable for all applications in meteorology,

Recommends that:

(1) The World Geodetic System 1984 (WGS 84) be used as the primary reference for horizontal positioning;

(2) The Earth Geodetic Model – EGM-96 be used as the fixed reference level for MSL determination;

(3) The WMO *Technical Regulations* (WMO-No. 49) and the appropriate WMO Manuals and Guides are updated accordingly.

Recommendation 2 (CBS-Ext.(06))

REVIEW OF THE *GUIDE ON THE GLOBAL OBSERVING SYSTEM* (WMO-No. 488)

THE COMMISSION FOR BASIC SYSTEMS,

Recalling the need for a review of the *Guide on the Global Observing System* (WMO-No. 488), as agreed by CBS-XII (*Abridged Final Report with Resolutions and Recommendations of the Twelfth Session of the Commission for Basic Systems* (WMO-No. 923), general summary, paragraphs 6.1.48 – 6.1.52),

Noting:

(1) The work carried out by the CBS Task Team on Regulatory Material, the OPAG-IOS Expert Team on Evolution of the GOS, and the OPAG-IOS Implementation Coordination Team on Integrated Observing System, in this respect,

(2) That the comprehensive review process on the revised draft *Guide on the Global Observing System* was completed in accordance with the decision of CBS-XII (*Abridged Final Report with Resolutions and Recommendations of the Twelfth Session of the Commission for Basic Systems* (WMO-No. 923), general summary paragraph 6.1.52),

Recommends that the revised *Guide on the Global Observing System* be published;

Requests the Secretary-General to make arrangements for publishing the revised *Guide* as soon as possible.

Recommendation 3 (CBS-Ext.(06))

AMENDMENTS TO THE *MANUAL ON THE GLOBAL TELECOMMUNICATION SYSTEM* (WMO-No. 386), VOLUME I, PARTS I AND II

THE COMMISSION FOR BASIC SYSTEMS,

Noting:

(1) Resolution 2 (Cg-XIV) – World Weather Watch Programme for 2004-2007,

(2) The *Manual on the Global Telecommunication System* (WMO-No. 386), Volume I, Global Aspects, Parts I and II,

Recommends that the *Manual on the Global Telecommunication System*, Volume I, Global Aspects, Parts I and II, be amended as given in the Annex to this recommendation, with effect from 7 November 2007;

Requests the Secretary-General to make the amendments, as given in the Annex to this recommendation, to the *Manual on the Global Telecommunication System*, Volume I, Global Aspects, Parts I and II;

Authorizes the Secretary-General to make any consequent purely editorial amendments of the *Manual on the Global Telecommunication System*, Volume I, Global Aspects, Parts I and II.

Annex to Recommendation 3 (CBS-Ext.(06))

AMENDMENTS TO THE *MANUAL ON THE GLOBAL TELECOMMUNICATION SYSTEM* (WMO-No. 386), VOLUME I, PARTS I AND II

PART I, ORGANIZATION OF THE GLOBAL TELECOMMUNICATION SYSTEM

ATTACHMENT I–5, PLAN FOR MONITORING THE OPERATION OF THE WORLD WEATHER WATCH

Read the beginning of paragraph 5.2 as follows:

5.2 The responsibilities for carrying out the real-time and non-real-time monitoring activities are given in Tables A and B. An essential part of the monitoring plan is that information should be exchanged between adjacent centres on the GTS in order that telecommunication problems in particular may be readily identified. A special aspect of the exchange of information is that procedures should be developed to ensure that no doubts exist that a bulletin contains all the observations available for inclusion in it. In the case of standard bulletins containing routine observations, the contents of the bulletins should always conform to the list included in the appropriate WMO publication, as amended. When the observations from some stations included in the publication are not available for any reason, ~~NIL should appear in place of the coded report~~ the reports should be properly encoded as NIL reports. As a further check on completeness, NMCs should send messages to the associated RTH, preferably in advance, when it is known that observations from listed stations are not (or will not be) available. It is important that all WWW centres (NMCs, RSMCs, RTHs and WMCs) make a contribution to the overall monitoring effort. Obviously, centres having a multiple role will make more than one contribution. In the contributions, the following points should be taken into account:

For the monitoring at bulletin level, additional or subsequent (RRx) and corrected (CCx) bulletins should be included;

PART II, OPERATIONAL PROCEDURES FOR THE GLOBAL TELECOMMUNICATION SYSTEM

Read paragraph 2.3.2.2 as follows for the parts related to ii and BBB:

ii It shall be a number with two digits. When an originator or compiler of bulletins issues two or more bulletins with the same $T_1T_2A_1A_2$ and CCCC the ii shall be used to differentiate the bulletins and will be unique to each bulletin.

Alphanumeric bulletins containing reports prepared at the main synoptic hours for the stations included in the Regional Basic Synoptic Networks or stations included in the Regional Basic Climatological Networks shall be compiled into bulletins with ii in the series 01 to 19. This does not apply to bulletins compiled in ~~BUFR or~~ CREX code.

Alphanumeric bulletins containing “additional” data as defined in Resolution 40 (Cg-XII) shall be compiled into bulletins with ii above 19. This does not apply to bulletins compiled in ~~BUFR or~~ CREX code.

For ~~some~~ bulletins ~~such as those~~ compiled in GRIB, BUFR or CREX code or containing pictorial information, the use of ii is defined in the tables contained in Attachment II-5. Originators or compilers of bulletins shall use the ii values from these tables when they are defined for the purpose for which a bulletin is being intended.

For all bulletins ii shall only be used to designate “additional” data as defined in Resolution 40 (Cg-XII) if the same heading is never used for essential data and it complies with all the requirements above. If this is not the case, a unique CCCC be used as described below.

BBB An abbreviated heading defined by T1T2A1A2 ii CCCC YYGGgg shall be used only once. Consequently, if this abbreviated heading has to be used again for an addition, a correction or an amendment, it shall be mandatory to add an appropriate BBB indicator, identified by a three-letter indicator which shall be added after the date-time group.

The BBB indicator shall have the following forms

RRx for additional or subsequent issuance of bulletins;

CCx for corrections to previously relayed bulletins;

AAx for amendments to previously relayed bulletins;

where x is an alphabetic character of A through as described in Attachment II-12;

Bulletins containing observational or climatic data (surface or upper-air) from land stations will be compiled from a defined list of stations. ~~This does not apply to bulletins compiled in BUFR or CREX code.~~ The abbreviated headings and the contents of bulletins shall be published in WMO Publication No. 9 Volume C1 – *Catalogue of Meteorological Bulletins*

Read the title of paragraph 2.3.3 as follows:

2.3.3 ~~Text~~Contents of meteorological bulletins

Add new paragraph (d) in paragraph 2.3.3.1:

(d) When all the reports normally contained in a routine message are not available at the normal time of transmission, the text NIL shall be sent.

Read paragraph 2.3.3.2.7 as follows:

2.3.3.2.7 NIL - In the case of routine messages containing meteorological reports, NIL shall be inserted following the appropriate station index number (which should however retain its proper place in the coded message) when the report from that station is included in the published contents of the bulletin (in the Catalogue of Meteorological Bulletins and elsewhere) but is not available at the time of transmission. The same procedures also apply to other coded information (such as CLIMAT, CLIMAT TEMP).

~~When the whole bulletin for a routine message is not available at the normal time of transmission, the text NIL shall be sent.~~
~~Note: For messages containing aerodrome forecasts in the TAF code, NIL should not be used.~~

Insert paragraph 2.3.3.3.1 and 2.3.3.3.2 as follows:

2.3.3.3.1 The text of meteorological bulletins in binary representation shall consist of one single message and start by the sequence….followed by the code indicator coded in International Alphabet No. 5.

2.3.3.3.2 NIL - In the case of BUFR routine bulletins containing meteorological reports, all fields in the relevant subsets within Section 4 (Data Section) of the BUFR message, other than the station identifier and delayed replication factors, shall be set to the appropriate missing value, when the report from that station is included in the published contents of the bulletin (in the Catalogue of Meteorological Bulletins and elsewhere) but is not available at the time of transmission.

Add new paragraph 2.5.7

2.5.7 Acknowledgment messages

Acknowledgment procedures from a centre receiving a bulletin to its originating centre or to other centre (e.g. a relaying centre) should comply with standard GTS addressed messages (reference: paragraph 2.4 of Part II of Volume I of the *Manual on the GTS*), as very urgent administrative messages transmitted as a service message. The format for the content of an addressed message for acknowledgment of receipt of bulletin should be as follows:

BMBB01 $C_aC_aC_aC_a$ YYGGgg (BBB)
CCCC
QSL TTAAii YYGGgg $C_oC_oC_oC_o$ (BBB) (DDHHMM)
(optional text)

Notes:

$C_aC_aC_aC_a$ = location indicator of the destination centre, usually the originating centre of the message being acknowledged

CCCC = international location indicator of the centre sending the acknowledgement

TTAAii $C_oC_oC_oC_o$ YYGGgg (BBB) is the abbreviated heading of the message being acknowledged, prefixed by the word QSL

DDHHMM is the day-time group (day, hour, minute in UTC) of actual reception of the acknowledged message at the centre CCCC and is inserted when required

The third line of the text of the message is added as necessary

Example:

BMBB01 PHEB 051132
AMMC
QSL WEIO21 PHEB 051130 051132

ATTACHMENT II–4

Read the title of Attachment II-4 as follows:

FORMAT OF METEOROLOGICAL MESSAGES

Read paragraph 5 as follows:

5. EXAMPLES OF PRESENTATION OF NIL TEXTS:

(a) SYNOP bulletin
SMRS10 RUMS 220600
NIL
(b) TEMP bulletin
USSN01 ESWI 011200
NIL
(c) CREX bulletin
KOMS10 FAPR 220600
NIL
(d) BUFR bulletin
IUKN01 EGGR 221200
NIL

ATTACHMENT II–5

Table A

In the column priority,

Replace priority “3” by priority “2” for T_1=I

Read Note (1) as follows:

“Priority level: 1 is allocated to service messages
2 is allocated to data and request messages
3 is allocated to seismic waveform data (T_1T_2 = SY)
4 is allocated to administrative messages”

Delete the column "Max length (octets)".

Table B1

Add for T_1 =S, T_2 = Z for sea level data and deep-ocean tsunami data (any alphanumeric format);
Add for T_1 = S, T_2 = Y for seismic waveform data (any format)

For T_1 = F, read as follows:

Designator	Data type	Code form (name)
C	Aerodrome (VT $<$ 12 hours)	FM 51 (TAF)
	— — — — — — — —	
T	Aerodrome (VT $\geqslant$ 12 hours)	FM 51 (TAF)

Read Table B3 as follows:

Table B3
Data type designator T_2 when T_1=I or J

T_2	Data type
N	Satellite data
O	Oceanographic/limnographic (water property)
P	Pictorial
S	Surface/sea level
T	Text (plain language information)
U	Upper air data
X	Other data types

Tables C1 and C2

Add: "Note: For T_1T_2=SZ, A_1A_2 areas designator from Table C1 should be used"

Read Table C6 as follows:

Table C6
Data type designator A_1
(when T_1 = I or J)

Instructions for the proper application of the data type designators

1. The designators specified in this table should be used to the greatest extent possible to indicate the type of data contained within the body of the BUFR bulletin.
2. Where more than one data type is contained in the bulletin, the designators for only one of the data types should be used.
3. When the table does not contain a suitable designator for the data types, an alphabetic designator which is not assigned in the table should be introduced and the WMO Secretariat notified.

T_1T_2	A_1	Data type	TAC Correspondence	Data category/ sub-category (Common table C-13)
IO	B	Buoy observations	BUOY	001/025
	I	Sea ice		
	P	Sub-surface profiling floats	TESAC	031/004
	R	Sea surface observations	TRACKOB	031/001
	S	Sea surface and below Soundings	BATHY, TESAC	031/005

T_1T_2	A_1	Data type	TAC Correspondence	Data category/ sub-category (Common table C-13)
	T	Sea surface temperature		
	W	Sea surface waves	WAVEOB	031/002
	X	Other sea environmental		
IP	I	Satellite imagery data		
	C	Radar composite imagery Data		
	R	Radar imagery data		
	X	Not defined		
IS	A	Routinely scheduled observations for distribution from automatic (fixed or mobile) land stations (e.g. 0000, 0100, … or 0220, 0240, 0300, …, or 0715, 0745, ... UTC) ii = 01-29	n/a	000/006
	A	N-minute observations from automatic (fixed or mobile) land stations ii = 30-59	n/a	000/007
	B	Radar reports (parts A and B)	RADOB	006/003
	C	Climatic observations from land stations ii = 01-45	CLIMAT	000/020
	C	Climatic observations from marine stations ii = 46-59	CLIMAT SHIP	001/020
	D	Radiological observation	RADREP	010/001
	E	Ozone measurement at surface	n/a	008/000
	F	Source of atmospherics	SFAZI, SFLOC, SFAZU	000/030
	I	Intermediate synoptic observations from fixed land stations ii = 01-45	SYNOP (SIxx)	000/001
	I	Intermediate synoptic observations from mobile land stations ii = 46-59	SYNOP MOBIL	000/004
	M	Main synoptic observations from fixed land stations ii = 01-45	SYNOP (SMxx)	000/002
	M	Main synoptic observations from mobile land stations ii = 46-59	SYNOP MOBIL	000/005
	N	Synoptic observations from fixed land stations at non-standard time (i.e. 01, 02, 04, 05, ... UTC) ii = 01 – 45	SYNOP (SNxx)	000/000
	N	Synoptic observations from mobile land stations at non-standard time (i.e. 01, 02, 04, 05, ... UTC) ii = 46-59	SYNOP MOBIL	000/003
	R	Hydrologic reports	HYDRA	000/040
	S	Synoptic observations from marine stations ii = 01-19	SHIP	001/000

T_1T_2	A_1	Data type	TAC Correspondence	Data category/ sub-category (Common table C-13)
	S	One-hour observations from automatic marine stations ii = 20-39	n/a	001/006
	S	N-minute observations from automatic marine stations ii = 40-59	n/a	001/007
	T	Tide gauge observations ii = 01-19	n/a	001/030
	T	Observed water level time series ii = 20-39	n/a	001/031
	V	Special aeronautical observations (SPECI)	SPECI	000/011
	W	Aviation routine weather observations (METAR)	METAR	000/010
	X	Other surface data	IAC, IAC FLEET	
IT	A	Administrative message		
	B	Service message		
	R	Request for data (inclusive of type)		
	X	Other text messages of information		
IU	A	Single level aircraft reports (automatic)	AMDAR	004/000
		Single level aircraft reports (manual)	AIREP/PIREP	004/001
	B	Single level balloon reports	n/a	
	C	(used for single level satellite-derived reports – see Note 3)	SAREP/SATOB	005/000
	D	Dropsonde/Dropwindsondes	TEMP DROP	002/007
	E	Ozone vertical sounding	n/a	008/001
	I	Dispersal and transport analysis	n/a	009/000
	J	Upper wind from fixed land stations (entire sounding) ii = 01-19	PILOT (parts A, B, C, D)	002/001
	J	Upper wind from mobile land stations (entire sounding) ii = 20-39	PILOT MOBIL (parts A, B, C, D)	002/003
	J	Upper wind from marine stations (entire sounding) ii = 40-59	PILOT SHIP (parts A, B, C, D)	002/002
	K	Radio soundings from fixed land stations (up to 100 hPa) ii = 01-19	TEMP (parts A, B)	002/004
	K	Radio soundings from mobile land stations (up to 100 hPa) ii = 20-39	TEMP MOBIL (parts A, B)	002/006
	K	Radio soundings from marine stations (up to 100 hPa) ii = 40-59	TEMP SHIP (parts A, B)	002/005
	M	Model derived sondes		
	N	Rocketsondes		
	O	Profiles of aircraft observations in ascending /descending	AMDAR	002/020

T_1T_2	A_1	Data type	TAC Correspondence	Data category/ sub-category (Common table C-13)
	P	Profilers	PILOT	002/010
	Q	RASS temperature profilers	TEMP	002/011
	R	(used for radiance data – see Note 3)		
	S	Radiosondes/pibal reports from fixed land stations (entire sounding) ii = 01-19	TEMP (parts A, B, C, D)	002/004
	S	Radio soundings from mobile land stations (entire sounding) ii = 20-39	TEMP MOBIL (parts A, B, C, D)	002/006
	S	Radio soundings from marine stations (entire sounding) ii = 40-59	TEMP SHIP (parts A, B, C, D)	002/005
	T	(used for satellite-derived sondes – see Note 3)	SATEM SARAD SATOB	
	U	Monthly statistics of data from upper-air stations ii = 01-45	CLIMAT TEMP	002/025
	U	Monthly statistics of data from marine stations ii = 46-59	CLIMAT TEMP SHIP	002/026
	W	Upper wind from fixed land stations (up to 100 hPa) ii = 01-19	PILOT (parts A, B)	002/001
	W	Upper wind from mobile land stations (up to 100 hPa) ii = 20-39	PILOT MOBIL (parts A, B)	002/003
	W	Upper wind from marine stations (up to 100 hPa) ii = 40-59	PILOT SHIP (parts A, B)	002/002
	X	Other upper air reports		
JO	I	Sea ice		
	S	Sea surface and below soundings		
	T	Sea surface temperature		
	W	Sea surface waves		
	X	Other sea environmental data		
JS	A	Surface area forecast (e.g.airways)		
	D	Radiological forecast	RADOF	
	M	Surface forecasts (e.g. MOS)		
	O	Maritime forecast	MAFOR	
	P	Forecast amendments (airways)		
	R	Hydrologic forecast	HYFOR	
	S	Forecast amendments (TAF)		
	T	Aerodrome forecast (TAF)		
	X	Other surface forecasts		
JT	E	Tsunami		

T_1T_2	A_1	Data type	TAC Correspondence	Data category/ sub-category (Common table C-13)
	H	Hurricane, typhoon, tropical Storm warning		
	S	Severe weather, SIGMET		
	T	Tornado warning		
	X	Other warnings		
JU	A	Forecast at single levels		
	B	Binary coded SIGWX, Embedded Cumulonimbus		
	C	Binary coded SIGWX, Clear air turbulence		
	F	Binary coded SIGWX, Fronts		
	N	Binary coded SIGWX, Other SIGWX parameters		
	O	Binary coded SIGWX, Turbulence		
	S	Forecast soundings		
	T	Binary coded SIGWX, Icing/Tropopause		
	V	Binary coded SIGWX, Tropical storms, sandstorms, volcanoes		
	W	Binary coded SIGWX, High-level winds		
	X	Other upper air forecasts		

Notes:

Content of ISMx, ISIx, ISNx messages corresponds to the content of traditional SYNOP messages SMxx, SIxx, SNxx.

Category/Subcategory = 000/000 identifies SYNOP data from 01, 02, 04, 05, 07, 08, 10, 11, 13, ..UTC). Thus SNxx in traditional SYNOP corresponds to ISNx in BUFR.

Designators A_1 for T_1T_2 already used for satellite data (e.g. IUC, IUR, IUT) are not allocated and reserved for future allocations, pending the allocation of A_1 for T_1T_2 = IN (satellite data).

Read Table C7 as follows:

Table C7
Data type designator T_2 and A_1
(when T_1 = K)

T_1T_2	A_1	Data type	TAC Correspondence	Data category/ sub-category (Common table C-13)
KO	B	Buoy observations	BUOY	001/025
	I	Sea ice		
	P	Sub-surface profiling floats	TESAC	031/004
	R	Sea surface observations	TRACKOB	031/001
	S	Sea surface and below Soundings	BATHY, TESAC	031/005
	T	Sea surface temperature		
	W	Sea surface waves	WAVEOB	031/002

T_1T_2	A_1	Data type	TAC Correspondence	Data category/ sub-category (Common table C-13)
	X	Other sea environmental		
KS	A	Routinely scheduled observations for distribution from automatic (fixed or mobile) land stations (e.g. 0000, 0100, … or 0220, 0240, 0300, …, or 0715, 0745, ... UTC) ii = 01-29	n/a	000/006
	A	N-minute observations from automatic (fixed or mobile) land stations ii = 30-59	n/a	000/007
	B	Radar reports (parts A and B)	RADOB	006/003
	C	Climatic observations from land stations ii = 01-45	CLIMAT	000/020
	C	Climatic observations from marine stations ii = 46-59	CLIMAT SHIP	001/020
	D	Radiological observation	RADREP	010/001
	E	Ozone measurement at surface	n/a	008/000
	F	Source of atmospherics	SFAZI, SFLOC, SFAZU	000/030
	I	Intermediate synoptic observations from fixed land stations ii = 01-45	SYNOP (SIxx)	000/001
	I	Intermediate synoptic observations from mobile land stations ii = 46-59	SYNOP MOBIL	000/004
	M	Main synoptic observations from fixed land stations ii = 01-45	SYNOP (SMxx)	000/002
	M	Main synoptic observations from mobile land stations ii = 46-59	SYNOP MOBIL	000/005
	N	Synoptic observations from fixed land stations at non-standard time (i.e. 01, 02, 04, 05, 07, 08, 10, 11, 13, ..,UTC) ii = 01 – 45	SYNOP (SNxx)	000/000
	N	Synoptic observations from mobile land stations at non-standard time (i.e. 01, 02, 04, 05, 07, 08, 10, 11, 13, ..UTC) ii = 46-59	SYNOP MOBIL	000/003
	R	Hydrologic reports	HYDRA	000/040
	S	Synoptic observations from marine stations ii = 01-19	SHIP	001/000

T_1T_2	A_1	Data type	TAC Correspondence	Data category/ sub-category (Common table C-13)
	S	One-hour observations from automatic marine stations ii = 20-39	n/a	001/006
	S	N-minute observations from automatic marine stations ii = 40-59	n/a	001/007
	V	Special aeronautical observations (SPECI)	SPECI	000/011
	W	Aviation routine weather observations (METAR)	METAR	000/010
	X	Other surface data	IAC, IAC FLEET	
KU	A	Single level aircraft reports (automatic)	AMDAR	004/000
		Single level aircraft reports (manual)	AIREP/PIREP	004/001
	B	Single level balloon reports	n/a	
	C	Single level satellite-derived reports	SAREP	005/000
	D	Dropsonde/dropwindsondes	TEMP DROP	002/007
	I	Dispersal and transport analysis	n/a	009/000
	J	Upper wind from fixed land stations (parts A, B, C and D) ii = 01-19	PILOT	002/001
	J	Upper wind from mobile land stations (parts A, B, C and D) ii = 20-39	PILOT MOBIL	002/003
	J	Upper wind from marine stations (parts A, B, C and D) ii = 40-59	PILOT SHIP	002/002
	K	Radio soundings from fixed land stations (parts A and B) ii = 01-19	TEMP	002/004
	K	Radio soundings from mobile land stations (parts A and B) ii = 20-39	TEMP MOBIL	002/006
	K	Radio soundings from marine stations (parts A and B) ii = 40-59	TEMP SHIP	002/005
	L	Ozone vertical profile	n/a	008/001
	M	Model derived sondes		
	N	Rocketsondes		
	O	Profiles of aircraft observations in ascending /descending	AMDAR	002/020
	P	Profilers	PILOT	002/010
	Q	RASS temperature profilers	TEMP	002/011
	S	Radiosondes/pibal reports from fixed land stations (parts A, B, C and D) ii = 01-19	TEMP	002/004

T_1T_2	A_1	Data type	TAC Correspondence	Data category/ sub-category (Common table C-13)
	S	Radio soundings from mobile land stations (parts A, B, C and D) ii = 20-39	TEMP MOBIL	002/006
	S	Radio soundings from marine stations (parts A, B, c and d) ii = 40-59	TEMP SHIP	002/005
	T	Satellite derived sondes		
	U	Monthly statistics of data from upper-air stations ii = 01-45	CLIMAT TEMP	002/025
	U	Monthly statistics of data from marine stations ii = 46-59	CLIMAT TEMP SHIP	002/026
	W	Upper wind from fixed land stations (parts A and B) ii = 01-19	PILOT	002/001
	W	Upper wind from mobile land stations (parts A and B) ii = 20-39	PILOT MOBIL	002/003
	W	Upper wind from marine stations (parts A and B) ii = 40-59	PILOT SHIP	002/002
	X	Other upper air reports		
KF	A	Surface area forecast (e.g. airways)		
	D	Radiological forecast	RADOF	
	M	Surface forecasts (e.g. MOS)		
	O	Maritime forecast	MAFOR	
	P	Forecast amendments (airways)		
	R	Hydrologic forecast	HYFOR	
	S	Forecast amendments (TAF)		
	T	Aerodrome forecast (TAF)		
	X	Other surface forecasts		
KP	I	Sea ice		
	S	Sea surface and below soundings		
	T	Sea surface temperature		
	W	Sea surface waves		
	X	Other sea environmental		
KT	E	Tsunami		
	H	Hurricane, typhoon, tropical storm warning		
	S	Severe weather, SIGMET		
	T	Tornado warning		
	X	Other warnings		
KV	A	Forecast at single levels		

T_1T_2	A_1	Data type	TAC Correspondence	Data category/ sub-category (Common table C-13)
	B	Coded SIGWX, Embedded Cumulonimbus		
	C	CREX coded SIGWX, Clear air turbulence		
	F	CREX coded SIGWX, Fronts		
	N	CREX coded SIGWX, Other SIGWX parameters		
	O	CREX coded SIGWX, Turbulence		
	S	Forecast soundings		
	T	CREX coded SIGWX, Icing/Tropopause		
	V	CREX coded SIGWX, Tropical storms, sandstorms, volcanoes		
	W	CREX coded SIGWX, High-level winds		
	X	Other upper air forecasts		

Note: T_1T_2=SZ is allocated to sea level data and deep-ocean tsunami data in any alphanumeric form, including CREX.

<u>Add new Table D3</u>

TABLE D3

Designator ii

(when T_1T_2 = FA, UA)

T_1T_2	Designator ii	Data type	Code form (name)
FA	01 to 49	Aviation area /advisories	FM 53 (ARFOR)/[text]
	50 to 59	GAMET	[TEXT]
	60 to 99	Not assigned	
UA	01 to 59	Routine aircraft reports	ICAO AIREP
	60 to 69	Special aircraft reports, except for volcanic ash	
	70 to 79	Special aircraft reports related to volcanic ash	
	80 to 99	Routine aircraft reports (see note)	

Note: Noting that there is no known use of the series 80-99, these series are allocated to routine aircraft reports up to 1 September 2008. After 1 September 2008, the series should be reserved for future use.

ATTACHMENT II–12

Read Attachment II-12 as follows:

INSTRUCTIONS FOR THE USE OF THE INDICATOR BBB

1. The BBB indicator ~~should only~~ shall be included in the abbreviated heading lines of ~~delayed~~ additional, subsequent, corrected or amended bulletins by those centres which are responsible for preparing or compiling the bulletins concerned.

2. The BBB indicator ~~should only~~ shall be added when the abbreviated heading line defined by $T_1T_2A_1A_2ii$ CCCC YYGGgg has already been used for the transmission of ~~the~~ a corresponding initial bulletin. Once the initial bulletin has been transmitted, the centre responsible for preparing or compiling the bulletin uses the BBB indicator to transmit additional, subsequent, ~~or~~ corrected ~~reports~~ or amended ~~information~~ messages for the same ~~abbreviated~~ $T_1T_2A_1A_2ii$ CCCC YYGGgg, but appended with the appropriate form of BBB indicator, following these guidelines:

(a) To transmit ~~weather~~ information or reports ~~which are~~ normally contained in ~~the~~ an initial bulletin ~~but which were received~~ after the initial bulletin has been transmitted or for a subsequent or additional issuance of a bulletin whose T1T2A1A2II CCCC YYGGgg would not be unique without a BBB field and CCx or AAx does not apply. The ~~form of the~~ BBB indicator to be used is ~~then~~ RRx, where x =:
A, for the first bulletin ~~containing delayed reports~~ after the issuance of the initial bulletin;
B, if ~~a second bulletin~~ another bulletin ~~containing delayed reports is subsequently necessary~~ needs to be issued;
and so on up to and including x = X;

(b) To transmit a bulletin containing corrected ~~to~~ information or reports that have already been ~~included~~ issued in a previous bulletin ~~which has previously been transmitted~~. The ~~form of the~~ BBB indicator to be used is ~~then~~ CCx, where x =:
A, for the first bulletin containing ~~only~~ corrected reports or information;
B, if a second bulletin containing corrected reports or information is ~~subsequently necessary~~ issued;
and so on up to including x = X;

To transmit a bulletin containing amendments to the ~~processed~~ information included in a previously issued bulletin ~~which has previously been sent~~. The ~~form of the~~ BBB indicator to be used is AAx, where x = :
A, for the first bulletin containing amendments to ~~processed~~ information;
B, for a second bulletin containing ~~amended processed~~ amendments to information;
and so on up to and including x = X;

(d) If more than 24 BBB indicators ~~or~~ have to be used for the sequences detailed in (a), (b) and (c) above ~~have to be used~~, then x = X should continue to be used ~~subsequently~~;

(e) For ~~each of~~ (a), (b) and (c) above, the characters x = Y and x = Z are to be used for ~~the~~ special purposes ~~as~~ indicated below:
(i) x = Y should be used for the encoding of BBB when a system failure causes loss of the record of the sequence of character values assigned to x;
(ii) x = Z should be used for the encoding of BBB when bulletins are prepared or compiled more than 24 hours after the time of observation.

~~3. The indicator BBB should also be included in the abbreviated headings of bulletins used for the transmission of large sets of information which need to be segmented into several bulletins. The form of the indicator BBB to be used is then Pxx, where xx =AA for the first bulletin containing the first segment of the set of information;~~
~~AB for the second bulletin containing the second segment;~~

~~and so on including AX, AY, AZ, BA etc., as required.~~

~~xx = Zx for the last bulletin containing the last segment~~

~~(e.g.: AA = part 1, AB = part 2, ZC = third and last part)~~

~~The values of the first x can be A through Y and the values of the second x can be A through Z.~~

~~4. For every bulletin that a centre is responsible for preparing or compiling and for each corresponding abbreviated heading defined by T1T2A1A2ii CCCC YYGGgg each centre should establish and update the sequence of the forms of BBB indicator used in accordance with the specifications above.~~

3. An RTH on the GTS should ensure the relay of the bulletins received in accordance with its routeing directories even if the bulletins containing BBB indicators have not been received in the correct sequence.

ATTACHMENT II–15

In* FOREWORD, *Read the three last paragraphs as follows:

Considerable efforts have been applied in defining the framework for applying TCP/IP to the GTS and for the orderly transition from the OSI/X.25 based origin of the GTS. Furthermore, it is understood that TCP/IP will be the basis for all new telecommunication functions implemented in support of the Wmo Information Systems (WIS).

Procedures are defined to ensure that the primary function of the GTS in carrying real time operational traffic with minimum delay is preserved. The issue of securing the GTS from interference via the Internet is also addressed in general terms. Reliance must however be placed on all Members with a TCP/IP based connection to the GTS, who are also connected to the Internet, to implement and maintain thorough security practices.

This Attachment was originally written as the culmination of work undertaken by CBS during 1997 and 1998. The TCP/IP procedures have since been implemented by most national Centres. The opportunity has been taken to capture the practical experiences gained in the use of TCP/IP and update material accordingly. In addition, a World Wide Web resource has been set-up which gives further details of the technical implementation of many of the concepts and procedures introduced within this Attachment. This is available on the following WMO web pages:
http://www.wmo.int/web/www/manuals.html
http://www.wmo.int/web/www/documents.html

Read* Chapter 1 *as follows:

1. Introduction

Historical perspective

The GTS at present is predominantly used to support the message switching application using message exchange in WMO format. This exchange is done using:
the TCP/IP protocol suite,
limited OSI transport service based on point to point X.25,
and is supplemented by broadcasts.

This implementation is adequate for the legacy application of message switching but it is recognized that it requires continuous improvements to fully support the various WMO programs and the new requirements of the WIS. For example, the GTS should support:
Distributed Data Bases (DDB);
Data exchange between non adjacent centres;
Exchange of information that cannot readily be handled by message switching systems (MSSs).

Purpose of this Attachment

This Attachment is intended to assist Centres to implement Transmission Control Protocol/Internet Protocol (TCP/IP) based services on the GTS. Throughout this document, it is understood that the implementation of TCP/IP protocols include all essential protocols that are normally part of the TCP/IP protocol suite, as described in the Internet Engineering Task Force (IETF) reference documents RFC112 and RFC1123. These documents are available from the IETF website at
http://www.ietf.org/rfc/

The aim of this Attachment is to describe those aspects of the application of TCP/IP that apply specifically to the GTS to meet new requirements and also the long established routine data exchange undertaken by Message Switching Systems (MSSs). The Attachment takes account of the technical evolution of the GTS from an X.25 based network, and maintains the philosophy that Centres continue to be autonomous as far as possible. It is recognised that the timing for implementation of new systems is determined by individual Members in the light of their available resources and relative priorities, but it is also understood that new WIS functionality is expected to be achieved mostly via TCP/IP protocols.

This Attachment does not cover fundamentals of TCP/IP but focuses on those aspects that are essential for successful application on the GTS. Such aspects include appropriate use of the GTS compared with the Internet, co-existence of the GTS and the Internet, IP and X.25 and Autonomous System addressing, router management, TCP/IP application services (such as FTP) and fault management. The Attachment also gives an overview of recommended security practices with TCP/IP, but does not address security issues and practices in detail, this being a highly complex subject in itself. Some references on TCP/IP and on computer security are given in Appendix 4. A more comprehensive discussion on security can be found in the “WMO Guide on Information Technology Security”, which is available on the WMO website at
http://www.wmo.int/web/www/manuals.html

Relationship of the Internet and GTS

The Internet has grown rapidly in capacity, penetration and diversity of applications. As well, day to day performance of the Internet, which used to be recognized as a weakness, is now reaching acceptable levels of reliability in many countries. It should be noted however that the very nature of the Internet will always mean that no one can build a system using the Internet for which specific service levels can be guaranteed, since the Internet is the result of the amalgamation of numerous telecommunication systems, for which no operator has complete responsibility.

It is therefore recognized that the Internet can be used as:
- an underlying technology for some components of the GTS in special conditions,
- as a backup to the GTS, and
- as a complement to the GTS.

Table 1 Usage of GTS and Internet

Communication Component	**Underlying Technologies**	**Function**
GTS	Dedicated links, high availability network clouds, VPN via Internet for backup or when no other technology is available	Delivery of time critical communication for weather, water and climate operations
Internet	As provided by supplier	Communication for less critical requirements and possibly for large volumes of data

Coexistence with the Internet also brings some special security problems that must be addressed to ensure the GTS can fulfil its function. In particular, the networks must be engineered in such a way that the GTS is protected from general Internet traffic and is secured against inappropriate use and unauthorised access. For example, the use of IP and dynamic routing protocols such as BGP4 (Border Gateway Protocol) on the GTS will have to be managed in such a way as to allow communication between non-adjacent Centres only with the knowledge and concurrence of all intermediate Centres. Otherwise there is a danger that large amounts of GTS capacity could be consumed by non-routine traffic, to the detriment of real time operational data exchange.

Evolution of the GTS

The use of the ISO/ITU standard X.25 was adopted by WMO in the early 1980's to facilitate the exchange of data and products encoded in WMO binary code forms (GRIB, BUFR etc) and to act as a base for higher level OSI applications. Although OSI was regarded at the time as the strategic direction for the evolution of data communications, this has changed. Today, there is no doubt TCP/IP protocols are the most accepted and widespread protocols for exchange of data.

TCP/IP is still appropriate because:

- it is the dominant protocol suite in everyday use being now packaged with virtually all implementations of Unix and many PC operating systems;
- it offers a wide range of standard applications (file transfer, electronic mail, remote logon, World Wide Web, etc.) that will greatly reduce the need for the WMO community to develop special procedures and protocols as it has had to do in the past.
- it provides useful features such as automatic alternate routing (in a meshed network) which could improve the reliability of the GTS.

This Attachment however takes account of the fact that centres have based plans and developed systems in line with the OSI standards, particularly X.25, as endorsed by WMO and specified in the Manual on the GTS*. the transition to TCP/IP based services must continue in an orderly fashion from the X.25 based links in such a way that operation of the gts is not disrupted or put at risk.*

The Attachment provides for this by defining procedures for:

- an interim hybrid based on:
  - carrying TCP/IP based services over an X.25 network service; or
  - carrying X.25 data over IP based network service via directly connected routers;
- subsequent transition to pure IP utilising directly connected routers, together with TCP/IP based application services, such as TCP sockets or File Transfer Protocol (FTP).

The transition to the second step (pure IP) is desirable because:

- Operating TCP/IP over X.25 may not provide expected throughput because of router processing overheads involved in packet encapsulation of IP frames within X.25 packets. This appears to become worse as line speeds increases. Limited tests which have been done between Centres in Region VI indicate efficiency less than 70% at 64Kbps.
- The management and maintenance activities required for the X.25 network and associated packet switches can be avoided.
- Carrying X.25 over IP requires use of proprietary features of specific router brands.

In order to move to pure IP, it is necessary to modify MSSs at each Centre to make use of TCP/IP services such as FTP and Sockets. This is covered in some detail in Chapter 4.

Other related issues

Many Centres now have experience of TCP/IP on the GTS. Experience has shown that the main technical issues, which need to be addressed to establish widespread use of TCP/IP on the GTS, are:

agreed methods for the message switching application to use TCP/IP either directly or via higher level applications e.g. FTP;

an agreed file naming convention and standard for metadata associated with files;

a community wide Naming and Addressing agreement.

It is the aim of this Attachment to make some progress with these issues, some of which lie in the domain of Data Management as much as Telecommunications. It must also be recognised that overall, the existing GTS is not a homogenous network in the true sense of the word, but a collection of regional networks and discrete point-to-point links. Also managed networks using Frame Relay and MPLS (Multi Protocol Label Switching) technology are now part of the GTS. These developments introduce new issues regarding multi lateral co-operation in operating the GTS. While these issues are raised, they are beyond the scope of this Attachment.

In* Chapter 2 "Principles governing the use of TCP/IP on the GTS" r*ead the following sections as follows:

Management of traffic on GTS and Internet

The TCP/IP protocol suite is an enabler to:

simplify interconnectivity between computer systems by allowing several telecommunication technologies to be integrated into a coherent network which may include automatic redundant backup routes,

lower costs by providing standard telecommunication solutions,

build modern applications not just limited to strict, fixed store and forward traffic rules.

However, some care must be taken to address the counter effects of these benefits and in particular, more flexibility in interconnection and in applications comes at the price of less control on where traffic can go. For example, a general purpose link to a GTS cloud network might get flooded with less critical traffic requested by a site that doesn't normally request data through a given link. It may also mean that traffic has trouble reaching its destination because there are several ill-defined routes (through both the GTS and the Internet) to get there.

This care can be achieved through traffic control and segregation, which would address three basic issues:

traffic management (ensuring timely delivery of critical data, controlling limited bandwidth availability in some areas)

security (protecting centres from unwanted threatening events)

routing coherence (ensuring that the overall resulting network can deliver traffic without difficulty to any given location)

To achieve traffic control and segregation, there are several important aspects to consider:

IP addressing: using universally recognizable and coherent network addresses so that all systems only have one unique reference number, which is valid not only within the GTS but across the Internet and any other network which may eventually be interconnected to the GTS

IP network routing rules: using a common set of routing protocols and rules to ensure that any traffic can be consistently sent to its destination without delay or confusion

Zoning of each Centre's network elements: creating different network zones with different security levels, to isolate a Centre's critical elements from publicly available areas and ensuring that data can still flow between zones of differing security levels

Overall topology of interconnection

A general view of the possible interconnectivity between Centers using the GTS and the Internet is given in Appendix 1, as well a typical data flows.

Actual device configuration details to implement these functions in the Cisco family of routers are given in Appendix 2.

Traffic management

Traffic management is an area which is unfortunately not limited to networks, but also involves data management and application configurations. Several groups are therefore involved in this matter.

In general, it can be said that some applications such as file transfer, World Wide Web have potential to place heavy loads on the limited bandwidth circuits that comprise the GTS. Limits need to be applied to ensure that the GTS carries only important traffic such as the real time data and products currently exchanged on the GTS plus data to be carried to fulfil new requirements such as Distributed Data Bases (DDBs), and routinely exchanged large data files such as satellite imagery.

Less important traffic such as ad hoc file exchange, e-mail, general World Wide Web and suchlike should be carried on the Internet. To protect the GTS, the full capabilities of TCP/IP connectivity and information exchange must be restricted. In practical terms, TCP/IP traffic carried on the GTS could be restricted on the basis of

- protocol type (e.g. FTP, HTTP, SMTP etc);
- originating and destination IP address;
- a combination of the above.

If the measures adopted are to be successful, it is necessary that they be:

- not confined to a single router brand since it cannot be assumed that all centres will have the same brand of router; and
- be reasonably straightforward to configure, so that there is minimum risk that configuration errors or omissions will endanger the GTS.

Security issues and segregation of Internet and GTS traffic

Any Centre which has a TCP/IP based GTS connection <u>and</u> a connection to the Internet, is a potential weak point where the GTS could be exposed to deliberate or inadvertent interference through unwanted traffic or unauthorised connection to GTS hosts.

Centres are strongly encouraged to implement protective barriers such as firewall systems on the connection of their Centre with the Internet. It is important that every practical step is taken to prevent accidental or deliberate use of GTS links or unauthorised access to GTS Centres, by Internet users.

When setting up IP on the GTS, it is vital to ensure that the GTS does NOT become part of the Internet or an unintended transmission path for Internet traffic. Each Centre must consider the GTS and the Internet as two separate networks and ensure that inappropriate flow of traffic from one to the other cannot occur. This will ensure that the GTS is used only for transferring bona fide meteorological data between authorised hosts.
(Figures 2.1 and 2.2 are deleted)

Some basic principles for implementing basic security measures for the GTS are shown in figure A1.2 in Appendix 1. It illustrates in a general way, how a Centre ……
(rest of section unchanged)
…./...

Routing and traffic management
…./….

Registered and private addresses

It is recommended that Centres strive to use officially registered IP addresses issued by the Internet Assigned Numbers Authority (IANA) or the relevant Regional Internet Registry. Official IP addresses are required for all systems which communicate through the Internet. Their use is also strongly recommended for systems which communicate on any inter-organization network, including of course the GTS.

Since it is recognized that official IP addresses sometimes difficult to obtain in certain areas of the world, some compromise options have been developed to mitigate this problem.

Appendix 7 describes IP addresses in further detail and the recommended options for the use of IP addresses over the GTS.

If Centres use private IP addresses on their internal networks, then Network Address Translation (NAT) must be adopted ….

(rest of section unchanged)

…./…

Implementation of GTS links via Internet

CBS has expressed the view that the use of Internet for GTS links can be considered in circumstances where they are cost effective, offer an acceptable level of service and where adequate security measures are implemented. In general, the same principles for routing and security described above, apply where Internet links are used instead of dedicated links. Further details applying to the use of Internet based links, especially related to small GTS Centres, are given in Appendix 4.

Summary of tasks to ensure proper use of IP on the GTS

Use only official IP addresses for external communication on the GTS.
Establish an IP connection with one or more Centres. This connection will be pure IP using PPP as a level 2 protocol on the link, (or a proprietary protocol such as Cisco HDLC by bilateral agreement) or IP over X.25 (RFC 1356). In this case use X.121 addresses as defined in Chapter 3.
Configure dynamic routing with BGP (unless you are a Centre with only one GTS connection and have agreed with your neighbouring Centre to use static routing)
Check the barrier between Internet and the GTS (prevent routing from the Internet to the GTS.)
Filter incoming and outgoing traffic in accordance with the requirements described above.

In* Chapter 3 "Implementation Guidelines" r*ead the following sections as follows:

Introduction

IP based services on the GTS may be implemented with direct IP connections or by using a mixture of X.25 and IP because of the technical evolution of the GTS described in chapter 1. IP services may be carried over an X.25 network by encapsulating IP packets within X.25 packets. An appropriately configured router at each GTS Centre carries out this function. Alternatively, where routers of the same brand are used in adjacent Centres, X.25 data may be carried on an IP link using X.25 switching capability of the routers.

….
(rest of section unchanged)

…./…

Addressing for IP over X.25

In order to carry IP traffic over X.25, two globally co-ordinated address schemes are necessary:
an X.25 scheme as described above; and
an IP address scheme to apply to the interface between the router and packet switch to enable the router to encapsulate the IP packets into X.25 packets.

The general arrangement is shown in figure 3.1.

For IP over X.25 to function correctly, it is necessary for the underlying X.25 network to be allocated a single IP network address and for each Centre to have an address within this network for the connection point between its router and its packet switch. Each IP node on the network can be assigned a sequential host address within a single Class C IP address as illustrated in Figure 3.1. The Class C address can provide for 254 Centres to be connected using a subnet mask of 255.255.255.0.
….
(rest of section unchanged)

Addressing for Direct IP

The preferred connection for the future is to use direct IP links. Centres already using IP over X.25 should consider updating the links to use direct IP. This transition should be considered in the near future. Figure 3.2 below illustrates how a pair of Centres have agreed to implement a direct IP connection using the first available pair of 'host' numbers using the 193.105.178.0 network as an example.
….(rest of section unchanged)

Management and allocation of addresses and AS numbers

X.25 addresses

The framework described above allows Centres full autonomy in allocating X.25 numbers. The WMO Secretariat will maintain a current list of X.25 addresses which Centres have allocated for use on the GTS. Centres are requested to notify the Chief of the Information Systems and Services Division of the WWW Department, WMO Secretariat by E-mail or fax of X.25 addresses allocated.

IP addresses

IP addresses should be acquired or agreed on as per the instructions in Appendix 7.

AS numbers

AS numbers for use on the GTS will be co-ordinated and issued by the WMO Secretariat as required. Centres should direct their requests for AS numbers to WMO as described above.

In* Chapter 4 r*ead the following section as follows:

General file naming conventions

The following file naming convention should be implemented with a transition period not exceeding 2008. The implementation date is subject to review by CBS.
The procedure is based on transmission of file pairs, one file being the information file and the other being the associated metadata file. The concept of file pairs allows the communications function to be implemented independently of data management requirements for structure of metadata, yet provides for the carriage of whatever metadata is required. It is not compulsory to always have a .met file, such as when the information file itself is self-specifying or when a single

.met file can describe several information files (for example as in the case of same data type for different times). There is always however a clear relation between the Information File Name and the Metadata File Name, which should only differ from their Extension field and possible wildcards.
File names for new message types (no existing AHL) shall follow the following format. It should be noted that file names for existing message types (existing AHL) can also follow the following format.
The File Name format is a predetermined combination of fields, delimited by the _ (underscore) character except for the last 2 fields, which are delimited by the . (period) character.
Each field can be of variable length, except for the Date/time stamp field which is predetermined.
The order of the fields is mandatory.
The File Name fields are as follows:

pflag_productidentifier_oflag_originator_yyyyMMddhhmmss[_freeformat].type[.compression]

where the mandatory fields are:

pflag is a character or combination of characters indicating how to decode the **productidentifier** field. At this time, the **pflag** field has only the following acceptable value:

Table 4.1 Accepted **pflag** values

pflag	Meaning
T	The **productidentifier** field will be decoded as a standard $T_1T_2A_1A_2$ii data designator (The WMO standard data designators are given in Attachment II-5)
A	The **productidentifier** field will be decoded as a standard Abbreviated Heading, including BBB as appropriate, space characters being discarded, e.g. $T_1T_2A_1A_2$iiCCCCYYGGgg[BBB]
W	WMO Product Identifier
Z	Originating centre's local product identifier

productidentifier is a variable length field containing information that describes the nature of the data in the file. The **productidentifier** field should be decoded according to the **pflag.**

The WMO Product Identifier to be used with **pflag** = W shall be decoded as follows:

<location indicator>,<data designator>,<free description>,<International date-time group>,<BBB modification header>

The WMO Product Identifier is composed of two parts:
the “static part” for description of the product and the "optional part" to define the time stamp and status of the product (correction, amendment).

The WMO Product Identifier is not case sensitive. These two parts are defined as follows:

Static part: <location indicator>,<data designator>,<free description>
<location indicator> defines the producer: Country, organization and the production centre; The country shall be represented by the official ISO 3166 standard 2 letter code. Example: <gb-metoffice-exeter>. Each field shall be separated by “-” symbol.
<data designator> specifies the type of data with reference to the categories and sub-categories defined in the Common Table C-13 of the *Manual on Codes*, e.g. <SYNOP>, <TAF>, <MODEL>, <RADAR>, <SATELLITE>, etc. When the type of data is a composite type, use the sign ”+” for concatenation.
<free description> is determined by the production centre to characterize the product.

Optional part: [,<International date-time group>,<BBB modification header>]

<International date-time group> is a YYYYMMDDHHMMSS time stamp of the product, full format without substitution characters (only decimal digits). This field is optional because it can be recovered from the file name field: yyyyMMddhhmmss

<BBB modification header> is a complementary group with a similar purpose as the current BBB group of AHL

Note: in order to facilitate the identification of each field of the product identifier, the static part, as well as the optional part if used, shall comprise two symbols “,” separating the fields. Each field shall not contain any symbol “,”. If a field is empty, no character shall be inserted between the relevant field delimiters “_” or “,”.

oflag is a character or combination of characters indicating how to decode the **originator** field. At this time, the **oflag** field has only the following acceptable value:

Table 4.2 Accepted **oflag** values

oflag	Meaning
C	The **originator** field will be decoded as a standard CCCC country code

originator is a variable length field containing information that states where the file originated from. The **originator** field should be decoded according to the **oflag**

yyyyMMddhhmmss is a fixed length date and time stamp field. The interpretation of this field should be in accordance with the standard rules set for specific data description and types. Therefore it may have various significance such as date of creation or the file, or date of collection of data. If a particular date and time stamp field is not specified, it should be replaced by a `-` (minus) character. For example: ------311500-- represents a stamp that specifies only the day (31st), hours (15) and minutes (00). If there are no rules for a specific data type, this field should represent the date and time of creation of the file by the originator.

Type is a variable length field that describes the general format type of the file. Although this information could be considered somewhat redundant to the **productidentifier** field, it is kept as such for industry accepted standard compatibility. It should be noted that the delimiter before the **type** field is a . (period). This is to help parse the file name for fields, since the **freeformat** field could make use of further _ (underscore) to delimit subfields.

Table 4.3 Accepted **type** values

type	Meaning
met	The file is a metadata file pair which describes the content and format of the corresponding information file with the same name
tif	TIFF file
gif	GIF file
png	PNG file
ps	Postscript file
mpg	MPEG file
jpg	JPEG file
txt	text file
htm	HTML file
bin	a file containing data encoded in a WMO binary code form such as GRIB or BUFR
doc	a Microsoft Word file
wpd	a Corel WordPerfect file

And the non mandatory fields are:
freeformat is a variable length field containing further descriptors as required by a given originator. This field can be further divided in sub-fields. Originating countries should strive to make their **freeformat** descriptions available to others.
compression is a field that specifies if the file uses industry standard compression techniques

Table 4.4 Accepted **compression** values

compression	Meaning
Z	The file has been compressed using the Unix COMPRESS technique
zip	The file has been compressed using the PKWare zip technique
gz	The file has been compressed using the Unix gzip technique
bz2	The file has been compressed using the Unix bzip2 technique

Maximum file name length: Although no maximum length is specified for the entire file name, the mandatory fields shall not exceed 128 characters (including all delimiters) to allow processing by all international systems.
Character set: The filenames shall be composed of any combination of the standard character set (ITU-T Rec. X.4) with the exceptions noted in Table 4.5. Case insensitivity shall be used as it is widely accepted and implemented in the industry (for example email addresses and URLs). However, it is recommended to use the "canonical form" of file names when files are being processed in a system. In this manner it would be expected that:
File names be saved in their original form as received (with any combination of upper-lower case characters or any character set)
Files would be saved with lower case characters only for internal processing, comparison, name searches, etc.
Files would be retransmitted with the original saved name to preserve character set and the upper lower case differences.
This keeps the benefits of readability of upper lower case throughout the systems, but provides case independence for processing and reference.

Table 4.5 Symbols for filenames

Symbol	Allowed	Meaning
_	yes	The underscore symbol is used has a delimiter symbol. To be used only as a delimiter of fields. The underscore is also accepted in the **freeformat** field, but not in other fields.
-	yes	The minus symbol shall be used only as a field delimiter inside the “location indicator” and “free description” fields of the WMO Product Identifier in the **productidentifier** field. For example, in the case of location indicator: gb-metoffice-exeter. This symbol shall not appear in the "data designator" field.
+	yes	The plus symbol shall be used to concatenate several words in a field of the WMO Product Identifier in the **productidentifier** field. For example, in the “data designator” field: TEMP+MOBIL or CLIMAT+TEMP+SHIP
.	yes	The period symbol is used has a delimiter symbol. To be used only before the **type** and **compression** fields.
/	no	Forward stroke often has special meaning for the full path specification of a filename in some operating systems
\	no	Backward stroke often has special meaning for the full path specification of a filename in some operating systems
>	no	Greater than symbol shall not be used since it often represents special file manipulation in some operating systems
<	no	Less than symbol shall not be used since it often represents special file manipulation in some operating systems
|	no	Vertical bar (pipe) symbol shall not be used since it often represents special file manipulation in some operating systems
?	no	Question mark symbol shall not be used

Symbol	Allowed	Meaning
‘	no	Single quote shall not be used.
“	no	Double quotes shall not be used
*	no	The star symbol is often used for wildcard specification in procedures that process filenames.
Space	no	The space symbol shall not be used
,	yes	The comma symbol shall be used as a field delimiter in the WMO Product Identifier of the **productidentifier** field. For example, in the static part: <location indicator>,<data designator>,<free description>. The comma symbol can be also used in the **freeformat** field
A-Z a-z 0-9	yes	

The structure of the ‘.met’ file, related to the WMO Metadata standard, is not defined in this guide.

Examples

A possible imagery file (Sig Weather Chart) that would have originated from the USA:
T_PGBE07_C_KWBC_20020610180000_D241_SIG_WEATHER_250-600_VT_06Z.tif

A possible model output file from France:
A_HPWZ89LFPW131200RRA_C_LFPW_20020913160300.bin

A possible synoptic surface observations file from France:
W_fr-meteofrance-Toulouse,SYNOP,MAIN+HOURS,,RRA_C_LFPW_20060913030000.txt

A possible model output file from France:
W_fr-meteofrance-toulouse,GRIB,ARPEGE-75N10N-60W65E_C_LFPW_200610000000.bin

A possible image from Australia:
Z_IDN60000_C_AMMC_20020617000000.gif
Note that this shows that the date and time stamp is to be interpreted to be 00 hours, 00 minutes and 00 seconds.

A possible compressed TOVS satellite data file from the United Kingdom:
Z_LWDA_C_EGRR_20020617000000_LWDA16_0000.bin.Z

A possible image (radar) from Canada:
T_SDCN50_C_CWAO_200204201530--_WKR_ECHOTOP,2-0,100M,AGL,78,N.gif

A possible single-record GRIB file from Canada:
Z__C_CWAO_2002032812----_CMC_reg_TMP_ISBL_500_ps60km_2002032812_P036.bin

A possible multiple record batch file from China:
Z_SM_C_BABJ_20020520101502.txt

In* Appendices, *insert a new Appendix 1, renumber Appendices 1 to 5 into 2 to 6 (including references) and insert a new Appendix 7 as follows:

1. High Level TCP/IP Topology and TCP/IP Data Flows

The following diagrams show a high level view of the topology of a simple Centre and the main data flows regarding GTS and Internet telecommunication. More detailed X.25 over IP configurations can be found in the following appendices.

Figure A1.1 – General interconnectivity between Centres

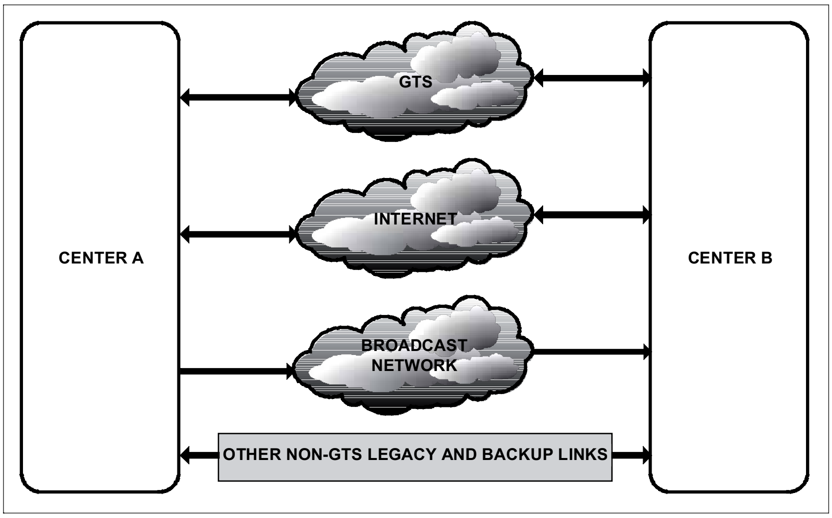


Figure A1.2 – Topology of TCP/IP network in a simple Centre

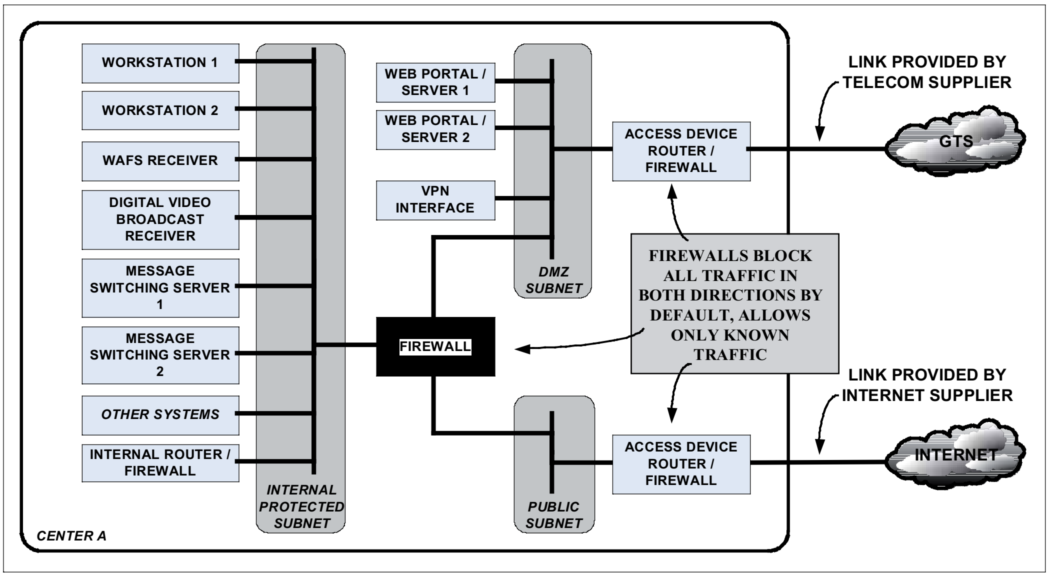


Figure A1.3 – Data flow of traffic over the GTS – IP only

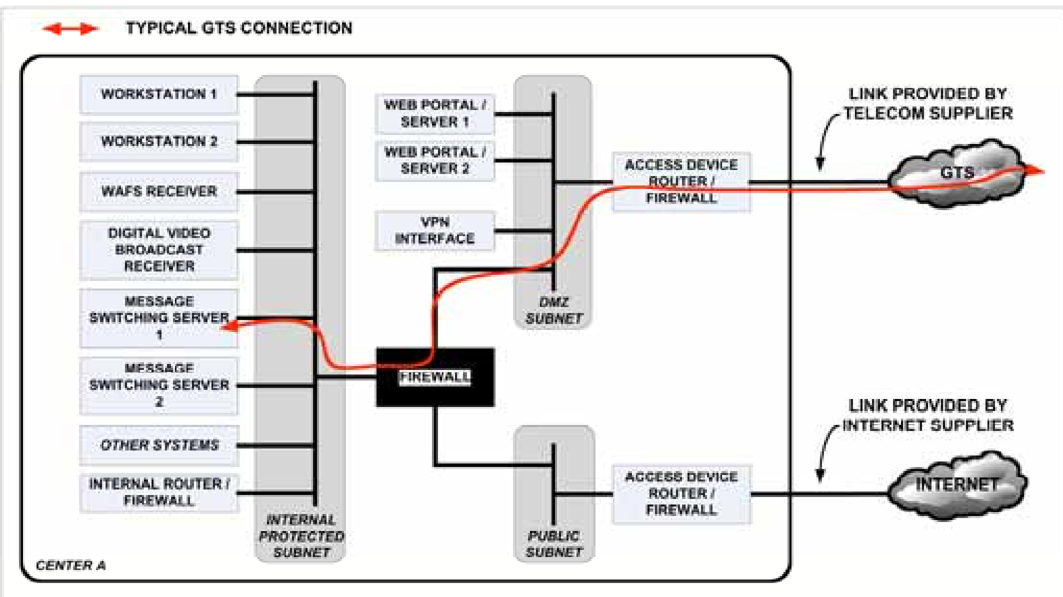


Figure A1.4 – Data flow of traffic over the GTS – X.25 over IP

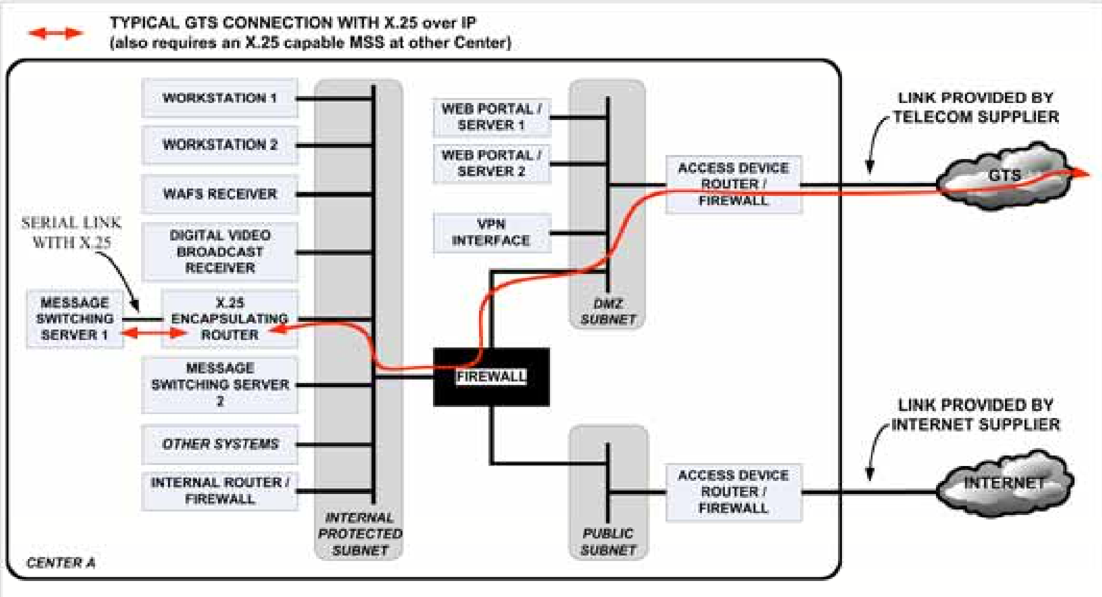
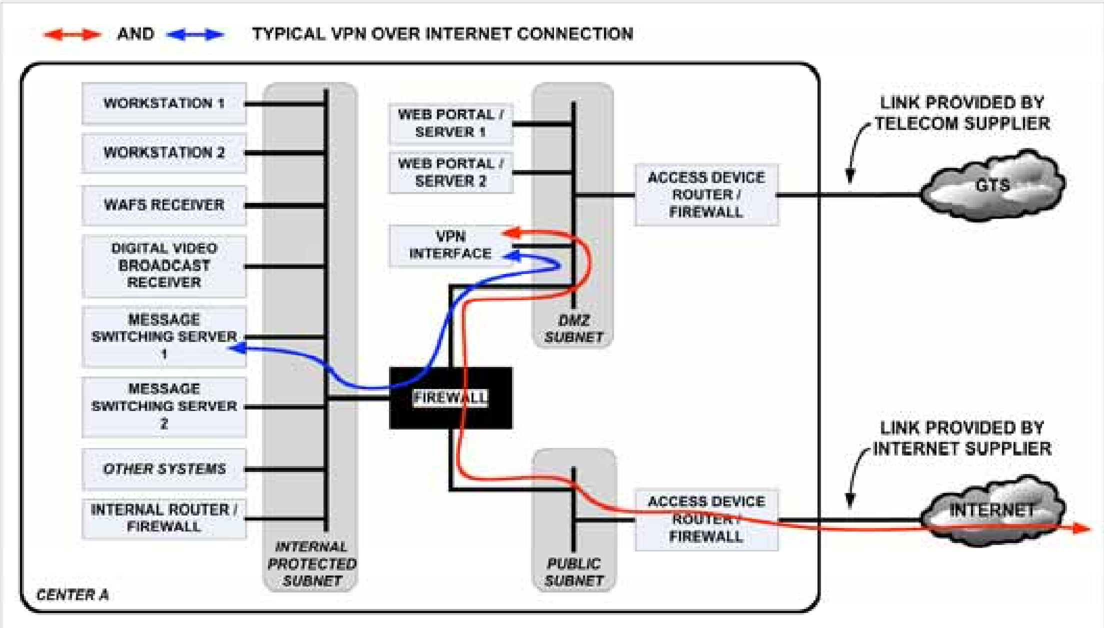


Figure A1.5 – Data flow of traffic using VPN over the Internet



7. IP addresses for use on the GTS

Introduction

The current “Recommended practices and procedures for the implementation, use and application of the Transmission Control Protocol/Internet Protocol (TCP/IP) on the GTS” as given in the *Manual on the GTS*, Volume II, Attachment II.15 (also known as “Guide on Use of TCP/IP on the GTS”) describes guidelines and a procedure for assigning IP addresses to GTS links which is no longer adequate. In particular, it states that a number of official class C IP addresses were available through the WMO Secretariat to be assigned for GTS links. These sets of IP addresses are no longer officially available, as a consequence of a strict application of Internet standards (RFCs) by Internet Authorities and Services Providers, and unfortunately cannot be used on the GTS, as they may now be assigned to other organizations on the Internet. The WMO Secretariat has therefore been instructed to discontinue the assignment of such IP addresses.

The Expert Team on Communication Techniques and Structure (ET-CTS) has been tasked to provide alternate solutions to solve this issue.

This document is a provisional description of the available options and related guidance to mitigate this problem and assist Members in their implementation. The included guidelines only concern the IP addressing. They do not change the existing recommendations on how IP relates to X.25 or other IP functionality.
The ET-CTS will proceed with developing the proposed amendments to Attachment II.15 to reflect the new recommended practices for allocating IP addresses.

Who can provide official IP addresses?

In order to build a network that interconnects many organizations from various countries in the world, it is essential to maintain a standard in the addressing scheme, and to maintain uniqueness in the allocation of addresses to the various organizations. The Internet community has identified this basic principle and created some official bodies to coordinate the distribution of official IP addresses. Today, this responsibility belongs to the Internet Assigned Numbers Authority (IANA), and its regional delegates, the relevant Regional Internet Registries:

AfriNIC (African Network Information Centre) **–** Africa region

APNIC (Asia Pacific Network Information Centre) **–** Asia Pacific region

ARIN (American Registry for Internet Numbers) **–** Americas and Southern Africa

LACNIC (Regional Latin-American and Caribbean IP Address Registry) **–** Latin America and some Caribbean islands

RIPE NCC (Réseaux IP Européens Network Coordination Centre) **–** Europe and surrounding areas

These organizations further delegate the allocation of addresses to their regional Internet and telecommunications suppliers through national Internet registries.

In this scheme, it is not the WMO's business to allocate IP addresses. Since the GTS is not built as a unique network under the complete authority of a single organization, the allocation of addresses must therefore go through the respective national Internet registry or the appropriate Regional Internet Registry.

However, several countries now face the issue of the restriction of allocation of IP version 4 (IPv4) addresses and may have difficulty obtaining official addresses. This problem is not an easy one to solve in the short term and provisional measures may have to be taken to allow the further development of the GTS. The following guidelines explain how to interconnect networks with and without the use of official IP addresses.

Connecting networks with official IP addresses

Using official IP addresses assigned directly to an organization (e.g. the NMS)

This remains the preferred option if it is feasible. It is basically the main procedure described in the existing "Guide on Use of TCP/IP on the GTS". It follows all the Internet rules and allows an organization to build a coherent network with interconnections to the Internet, GTS and possibly other partner organizations. It is also the easiest configuration to maintain.

In interconnecting two countries to form a GTS link, the two National Meteorological Services should decide which one actually provides the address to the interconnecting link. The decision remains one of practicality for the countries. There are no general rules that would favour one set of addresses over another one.

Using official IP addresses provided by a telecommunications supplier

This option is very similar to the previous one. The addresses supplied would be official and all the rules would of course be followed.

It may require that a common telecommunications supplier be used between the two interconnecting organizations.

This option however has the draw back that a change in telecommunication suppliers may require a change in IP addressing as original incumbent reclaims “his” addresses. Each organization should plan for this possibility ahead of time and evaluate its impact on future operations. If these addresses are only used for link purposes and not for an organization’s internal purposes, then this draw back may be of minimal impact.

Using IP version 6 (IPv6) addresses

The new IP version 6 (IPv6) protocol standard was designed in great part to address the shortage of IPv4 addresses. Although the IPv6 protocol is available and supported in many telecommunication equipments available today, its implementation requires much planning. In particular, IPv4 and IPv6 are not compatible without the use of gateways and there are several operational tools still missing to make IPv6 usable for the GTS at this time. Converting to IPv6 would be a major task that can not be imposed on our members until the industry is ready to take this step as a whole.

This option is therefore not available today. It is only mentioned here for completeness and will be further studied over the next years.

Connecting networks without official IP addresses

Using the “ip unnumbered” feature

Several network equipment suppliers (Cisco, 3Com, Juniper) have now introduced a feature in their configurations which allows the implementation of links without the need for allocation of IP addresses. This feature is usually called the “ip unnumbered“ feature. For example, Cisco provides a document on “Understanding and Configuring the ip unnumbered Command“ (see reference section for details).

This feature is not a standard IP protocol feature, so it requires compatible equipment at both ends of the link to work (most frequent situation anyhow).

Routing between the two networks can be accomplished by binding the unnumbered interface to another existing interface in the router (either a real LAN or virtual loopback interface). The use of this feature may introduce limitations in routing flexibility.

Using RFC1918 – Addresses for private internets

The Internet Engineering Task Force (IETF) document “RFC1918 – Addresses for private internets“ describes a set of addresses reserved for use by organizations *for sole intra-enterprise communications, without any intention to ever directly connect to other enterprises or the Internet itself*.

Therefore the use of these addresses does not require official registration. The main purpose of this scheme is to allow a big organization to make use of a larger address space for its internal operations. As soon as the organization needs to exchange with others, a gateway must be traversed to enter an area of officially assigned addresses to maintain overall network coherence. This gateway must translate the internal RFC1918 addresses into official external IP addresses, which must be obtained via the official bodies. The function (usually performed by a router or firewall) that does this translation is called “Network Address Translation” (NAT). This address translation will also have the effect of concentrating several RFC1918 internal addresses into a very small number of official addresses, thus preserving official address space.

Although this scheme might seem attractive at first for our issue, the GTS is not the network of a single enterprise. At this time, any number of the WMO Member NMHSs and related organizations may already make use of the RFC1918 in their own networks, which may result in conflicting address allocations if the networks interconnect. A recommendation from WMO for the use of RFC1918 is almost an impossible task, as the NMHSs may already be under guidelines of their own government, which might conflict with a directive of WMO. However, interconnecting countries may find adequate address space within RFC1918 in a bilateral agreement.

This option is therefore feasible as long as the following points are carefully considered, planned, maintained and monitored:

- Great care should be taken in selecting a proper RFC1918 set of addresses for links between organizations. It is important that the selected addresses are not already in use by any of the involved organizations.
- Great care should be taken to ensure that routing configurations do not allow the leaking of RFC1918 addresses into other organization’s network or worse, into the Internet.
- Although this solution will work quite satisfactorily between a few countries, it cannot be expanded to many directly interconnected countries, as the choice of RFC1918 addresses will get more and more complicated.
- The IANA has reserved the following blocks in RFC1918.
  - 10.0.0.0 - 10.255.255.255 (10/8 prefix)
  - 172.16.0.0 - 172.31.255.255 (172.16/12 prefix)
  - 192.168.0.0 - 192.168.255.255 (192.168/16 prefix)

  Since many organizations already use the 10.0.0.0/8 block internally and since the 192.168.0.0/16 block is often used as default addresses by several equipment manufacturers, it is recommended that GTS links be used out of the 172.16.0.0/12 block only if possible.
- Furthermore, it is also recommended that the 172.16.0.0/12 be subnetted in a way to maximize the usage of the address space. To that effect, GTS links can be subnetted to /30 bits. This allows 4 hosts per link (leaving the hosts addresses 1 and 2 available to designate the 2 ends of a given link).
- NMHS that consider using the RFC1918 addresses should consult with all potential NMHS with whom they might establish a link in order to coordinate and plan the use of these subnets ahead of time. In the case of address conflicts, other address schemes within RFC1918 might be used by bilateral agreement. The ET-CTS would like to be informed of such issues if they arise to further develop this recommendation.

The use of RFC1918 addresses should not introduce security problems as long as the above points are well managed.

Recommendation

All the options described above can be used in the GTS. The order of preference is as follows:

1- Using official IP addresses assigned directly to an organization, e.g. the NMHS (preferred)
2- Using official IP addresses provided by a telecommunications supplier
3- Using the “ip unnumbered” feature
4- Using RFC1918 – Addresses for private internets

The use of IPv6 on the GTS is not recommended at this time.

It should be understood that all options that do not require official IP addresses are workarounds to mitigate the shortage of addresses and must be used with care.

Configuration Examples

Option 1 – Using existing organization (NMHS) official IP addresses or Option 2 – Using Telecommunication Supplier official IP addresses

This is the standard way to configure an interface between two networks.

```
Router A:

!
interface Ethernet0
 ip address 131.238.17.11 255.255.255.0
!
interface Serial0
 description 64Kbps leased line to router B
 ip address 131.238.18.01 255.255.255.252
 encapsulation ppp
 bandwidth 64
!
ip route 142.47.43.0 255.255.255.0 131.238.18.2
!

Router B:

!
interface Ethernet0
 ip address 142.47.43.201 255.255.255.0
!
interface Serial0
 description 64Kbps leased line to router A
 ip address 131.238.18.02 255.255.255.252
 encapsulation ppp
 bandwidth 64
!
ip route 131.238.17.0 255.255.255.0 131.238.18.1
```

Insert the following new section in Appendix 4 (former Appendix 3)

Virtual Private Network – secure GTS connections over the Internet

A **virtual private network** (**VPN**) is a private network implementation among organizations to communicate over a publicly accessible network. VPN message traffic can be carried over the Internet on top of the standard TCP/IP protocols. **Secure VPNs** use cryptographic tunneling protocols to provide the sender authentication, message integrity and confidentiality to achieve privacy. This is considered suitable for use for the transmission and exchange of meteorological data among centres.

The most common Secure VPN protocol is **IPSec**. IPSec is designed to provide interoperable high quality, cryptographically-based security for IP. The set of security services offered includes access control, connectionless integrity, data origin authentication, protection against replays, as well as confidentiality.

IPSec is an end-to-end security protocol: all the functionality and intelligence of the VPN connection reside at the end points, either in a gateway or in the end-host. Through IPSec, it is possible to establish a tunnel between two gateways. An IPSec gateway would typically consist of an access router, a firewall or a VPN gateway on which the IPSec protocol is implemented. The IPSec gateway locates between the user's private network and the carrier's shared network.

IPSec tunnels are established dynamically and released automatically when they are not in use. To establish an IPSec tunnel, two gateways must authenticate themselves and define which security algorithms and keys they will use for the tunnel. The entire original IP packet is encrypted and wrapped inside IPSec authentication and encryption headers. Figure 5 shows an implementation of a VPN connection using IPSec between two GTS centres.

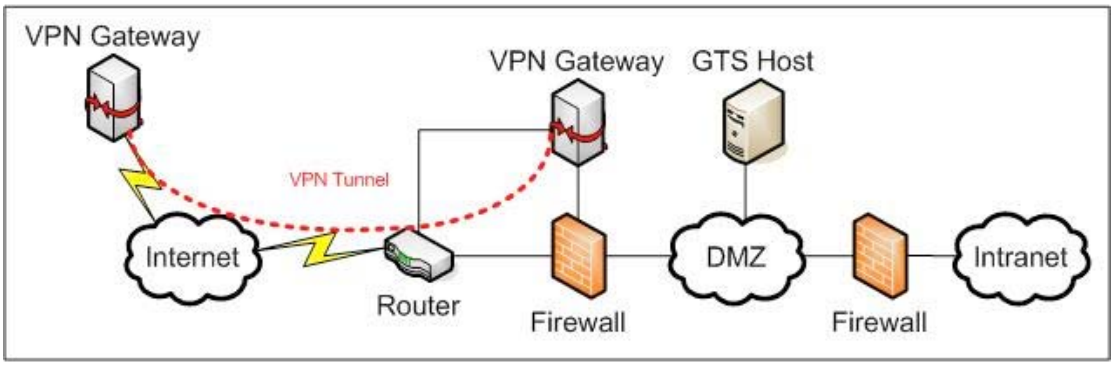


Figure 5 - The use of VPN over the Internet to connect two GTS centres.

The VPN gateway is connected to a firewall and a router. The VPN gateway can establish a VPN tunnel with other VPN gateways through the interface of the router. The flow of traffic into the internal network will be through the firewall and will be controlled by an access list defined by the user.

IPSec makes use of the Authentication Header (AH) and the Encapsulation Security Payload (ESP) to achieve data integrity and confidentiality.

The most common encryption algorithm used in ESP is Triple Data Encryption Standard (3DES) and Advanced Encryption Standard (AES). They have encryption key sizes from 128 bits to 256 bits, providing sufficient protection for data traffic along the trunk.

Further details on VPN implementation can be found in the Guide on Virtual Private Network (VPN) via the Internet between GTS centres. This Guide is available on the WMO web page at

http://www.wmo.int/web/www/manuals.html

Recommendation 4 (CBS-Ext.(06))

AMENDMENTS TO THE *MANUAL ON CODES*, VOLUME I.2, FOR FM XIII GRIB 2, FM XIII BUFR AND FM XIII CREX

THE COMMISSION FOR BASIC SYSTEMS,

Noting:

(1) The report of the Meeting of the ET on Data Representation and Codes (Muscat, Oman, 5-8 December 2005),

(2) The report of the Joint Meeting of the ET on Data Representation and Codes and CT on Migration to Table Driven Code Forms (ICAO, Montreal, 8-12 May 2006),

(3) The report of the ICT on ISS (Geneva, 18-22 September 2006),

Considering the various requirements:

(1) In GRIB Edition 2 for:

(a) THORPEX TIGGE fields, fire detection and clear sky radiance satellite data, UV Index field and additional precipitation fields in GRIB Edition 2;

(b) New templates for lossless IEEE floats packing and simple packing and for a new system for defining Master Table Version Number for pre-operational Tables;

(c) New parameters and a new regulation to ensure orthogonal structure of the parameters definition in GRIB Edition 2.

(2) In BUFR and CREX for:

(a) Additional Common Sequences for templates of SYNOP (including needs for regional practices), SHIP and buoy observations, CLIMAT, CLIMAT SHIP, CLIMAT TEMP and CLIMAT TEMP SHIP data;

(b) New satellite data, especially the new European polar orbiting satellite data with the instruments MHS, IASI and ASCAT;

(c) Reporting in BUFR, tropical cyclone observations performed by satellite and Radar (SAREP and RADOB data), and TRACKOB ship data;

(d) Descriptors to report extended degree of turbulence in SIGWX messages and transmission of SIGMET in BUFR;

(e) Clarifications to some BUFR regulations;

(f) Additions for height of temperature sensor in SST measurement by ship, for representation of nominal values, and for temperature and salinity profiles recorded by profiling floats,

Recommends that the following amendments be adopted for operational use as from 7 November 2007:

(1) Additions to FM 92-XIII GRIB defined in Annex 1 to this recommendation;

(2) Additions to FM 94-XIII BUFR and FM 95-XIII CREX defined in Annex 2 to this recommendation;

Requests the Secretary-General to arrange for the inclusion of these amendments in the *Manual on Codes*.

Annex 1 to Recommendation 4 (CBS-Ext.(06))

ADDITIONS TO FM 92-XIII GRIB

For Fire Detection from Space:

Code Table 4.2, Product Discipline 3 – Space products, Parameter category 0: image format products

Add:	9, Parameter = Fire detection indicator, Units = Code table (4.223)
Change:	9 – 191, Parameter = Reserved
to:	10 – 191, Parameter = Reserved

And add a new Code Table, 4.223 as follows:

Code Table 4.223 - Fire detection indicator

Code figure	Meaning
0	No fire detected
1	Possible fire detected
2	Probable fire detected
3	Missing

For Clear Sky Reflectance:

Code Table 4.2, Product Discipline 3 – Space products, Parameter category 1: quantitative products

Add:	Number 6, Parameter = Number of pixels used, Units = numeric
Add:	Number 7, Parameter = Solar zenith angle, Units = degrees
Add:	Number 8, Parameter = Relative azimuth angle, Units = degrees
Add:	Number 9, Parameter = Reflectance in 0.6 micron channel, Units = %
Add:	Number 10, Parameter = Reflectance in 0.8 micron channel, Units = %
Add:	Number 11, Parameter = Reflectance in 1.6 micron channel, Units = %
Add:	Number 12, Parameter = Reflectance in 3.9 micron channel, Units = %
Change:	Number 6 – 191, Parameter = Reserved
to:	Number 13 – 191, Parameter = Reserved

Add in Table 1.3 on Production Status of Data:

Number	Meaning
======	======
4	THORPEX Interactive Grand Global Ensemble (TIGGE)
5	THORPEX Interactive Grand Global Ensemble (TIGGE) test

Add in Code Table 4.2, Discipline 0 – category 1 - moisture

51	Total column water	kg m^{-2}	Vertically integrated total water (vapour + cloud water/ice)

Amendments needed:

In octets 6-7 of Section 1:

Change Common Code Table reference to C-11:

6-7 Identification of originating/generating centre (see Common Code Table C-11)

In Common Code Table C5 – Satellite identifier

An additional column for GRIB edition 2 should be added with 65535 for the missing value and other currently unused entries reserved for future use.

Additions to GRIB Edition 2 Code table 5.0

4	Grid point data – IEEE floating point data
5-39	Reserved
52-60	Reserved
61	Grid point data - simple packing with logarithm pre-processing
62-49151	Reserved
49152-65534	Reserved for local use
65535	Missing

For Packing:

Note to be added at start of template definitions used in sections 5 and 7.

Note: For most templates, details of the packing process are described in regulation 92.9.4

For UV index add new parameters as follows:

In Code table 4.2, Product discipline 0 - Meteorological products, parameter category 4: short-wave radiation, add:

Number	Parameter	Units
50	UV index *(under clear sky)	Numeric
51	UV index *	Numeric

Add:

Note:

The Global Solar UVI is formulated using the International Commission on Illumination (CIE) reference action spectrum for UV-induced erythema on the human skin (ISO 17166:1999/CIE S 007/E-1998). It is a measure of the UV radiation that is relevant to and defined for a horizontal surface. The UVI is a unitless quantity defined by the formula:

$$I_{\mathrm{UV}} = \mathrm{k}_{\mathrm{er}} \cdot \int_{250\ \mathrm{nm}}^{400\ \mathrm{nm}} E_{\lambda} \cdot s_{\mathrm{er}}(\lambda)\,\mathrm{d}\lambda$$

where $\mathbf{E}_{\lambda}$ is the solar spectral irradiance expressed in W·/ (m^2·nanometer) at wavelength λ and **dλ** is the wavelength interval used in the summation. $\mathbf{S}_{er}$ λ is the erythema reference action spectrum, and $\mathbf{k}_{er}$ is a constant equal to 40 m^2 / W.

Add a note to Code table 3.11:

Note:

For entry 1, it should be noted that depending on values of extreme (first/last) coordinates, and regardless of bit-map, effective number of points per row may be less than the number of points on the current circle.

Duplicate Note (3) within Grid Definition Template (GDT) 3.0 for all other GDTs

Note (3) within Grid Definition Template (GDT) 3.0 should be duplicated for all other GDTs which might be associated to quasi-regular grids. It is then recommended to:

- duplicate Note (3) of GDT 3.0 into GDT 3.40 (by adding there a Note (4))
- insert a “pointer” to Note (3) of GDT 3.0 into GDTs 3.[1 to 3]
- do the same to new Note (4) of GDT 3.40 into GDTs 3.[41 to 43]

For template GDT 3.0:

Also add to Octet list:

73-nn List of number of points along each meridian or parallel (These octets are only present for quasi-regular grids as described in notes 2 and 3)

Similar changes are needed for Grid definition templates 3.1, 3.2, 3.3, 3.10, 3.40, 3.41, 3.42, 3.43.

Add entries in Table 4.2, discipline 0, category 1: moisture

47	Large scale water precipitation (non-convective)	kg m^{-2}
48	Convective water precipitation	kg m^{-2}
49	Total water precipitation	kg m^{-2}
50	Total snow precipitation	kg m^{-2}

Add:

Note: Entries 9 and 10 include all phases of precipitation.

Add new templates:

Data representation template 5.4 Grid point data – IEEE floating point data

----

Octet No.	Content
12	Precision (See Code table 5.7)

Data template 7.4 Grid point data - IEEE floating point data

Octet No.	Content
6-nn	Binary data values (See Code table 5.1)

Data representation template 5.61: Grid point data - simple packing with logarithm pre-processing

Preliminary Note: This template is experimental, was not validated at the time of publication and should be used only for bi-lateral previously agreed tests.

Octet Number(s)	Contents
12-15	Reference value (R) (IEEE 32-bit floating-point value)
16-17	Binary scale factor (E)
18-19	Decimal scale factor (D)
20	Number of bits used for each packed value
21-24	Pre-processing parameter (B) (IEEE 32- bit floating-point value)

Notes:

(1) This template is appropriately designed for data sets with all non-negative values and a wide variability range (more then 5 orders of magnitude). It must not be used for data sets with negative values or smaller variability range.
(2) A logarithm pre-processing algorithm is used to fit the variability range into one or two order of magnitudes before using the simple packing algorithm. It requires a parameter (B) to assure that all values passed to the logarithm function are positive. Thus scaled values are Z=log(Y+B), where Y are the original values, log is the natural logarithm function and B is chosen so that Y+B>0.
(3) Best practice follows for choosing the B pre-processing parameter.
   a. If the data set minimum value is positive, B can be safely put to zero.
   b. If the data set minimum is zero, all values must be scaled to become greater than zero and B can be equal to the minimum positive value in the data set.
(4) **Data shall be packed using Data template 7.**

Modifications to Code table 3.11

Code table 3.11 - Interpretation of list of numbers at end of section 3

Code figure	Meaning
0	There is no appended list
1	Numbers define number of points corresponding to full coordinate circles (i.e. parallels), coordinate values on each circle are multiple of the circle mesh, and extreme coordinate values given in grid definition (i.e. extreme longitudes) may not be reached in all rows
2	Numbers define number of points corresponding to coordinate lines delimited by extreme coordinate values given in grid definition (i.e. extreme longitudes) which are present in each row
3	Numbers define the actual latitudes for each row in the grid. The list of numbers are integer values of the valid latitudes in microdegrees (scaled by 10^6) or in unit equal to the ratio of the basic angle and the subdivisions number for each row, in the same order as specified in the "scanning mode flag" (bit no. 2). (see Note)
4-254	Reserved
255	Missing

Note:
The value for the constant direction increment Di (or Dx) in the accompanying Grid Definition Template should be set to all ones (missing).

Changes implied by additional entry in Code Table 3.11:

- contents definition of octets 11 and 12 of Section 3 specification: delete “defining number of points”
- Notes (2) to (4) of Section 3 to modify as follows:

1. *(unchanged)*

2. An optional list of numbers may be used to document a quasi-regular grid In such a case, octet 11 is non zero, and gives the number of octets used per item in the list. For all other cases, such as regular grids, octets 11 and 12 are zero and no list is appended to the Grid Definition Template.

3. If a list of numbers is present, it is appended at the end of Grid Definition Template (or directly after Grid Definition Template Number if template is missing), the length of the list is given by the grid definition. When the Grid Definition Template is present, the length is given according to bit 3 of scanning mode flag octet (length is Nj or Ny for flag value 0). List ordering is implied by data scanning.

4. Depending on code value given in octet 12, the list of numbers either:
   - corresponds to the coordinate lines as given in the grid definition, or
   - corresponds to a full circle, or
   - does not apply

- Notes (2) and (3) of GDT 3.0 to read as follows:

  (2) For data on a quasi-regular grid where all the rows or columns do not necessarily have the same number of grid points, either Ni (Octets 31-34) or Nj (Octets 35-38) and the corresponding Di (Octets 64-67) or Dj (Octets 68-71) shall be coded with all bits set to 1 (missing). **The actual number of points along each parallel or meridian shall be coded in the octets immediately following the Grid Definition Template (Octets [xx+1] – nn), as described in the description of the Grid Definition Section.**
  (3) A quasi-regular grid is only defined for appropriate grid scanning modes. Either rows or columns, but not both simultaneously, may have variable numbers of points or variable spacing. **The first point in each row (column) shall be positioned at the meridian (parallel) indicated by Octets 47-54. The grid points shall be evenly spaced in latitude (longitude).**

MODIFICATIONS TO CODE TABLE 1.0:

Code Table 1.0: GRIB Master Tables Version Number

0	Experimental
1	Version implemented on 7 November 2001
2	Version implemented on 4 November 2003
3	Version implemented on 2 November 2005
4	Version implemented on 7 November 2007
5	Pre-operational to be implemented by next amendment
6 -254	Future version
255	Missing value

TO MAINTAIN ORTHOGONAL STRUCTURE OF GRIB EDITION 2*:*

Add new regulation:

92.6.2 To maintain orthogonal structure of GRIB Edition 2, parameter names in the Code table 4.2 should not contain surface type and statistical process as part of the name.

1) Add new parameters

Discipline	Category	Parameter Number	Proposed name of the parameter class	Unit
0	4	9	Net short wave radiation flux	W m^{-2}
0	5	5	Net long wave radiation flux	W m-^{2}

2) Deprecate:

Name of the parameter	**Discipline**	**Category**	**Parameter Number**
Short wave radiation flux*	0	4	2
Long wave radiation flux*	0	5	2

Note: * Parameter deprecated - See Regulation 92.6.2 and use another parameter instead.

3) Add parameters:

Name	**Unit**	**Discipline**	**Category**	**Proposed Parameter number**
Soil moisture	kg m^{-3}	2	0	22
Cloud cover	%	0	6	22

4) Parameters, which contain statistical process:

Deprecate parameters:

Parameter to be deprecated	**Discipline**	**Category**	**Parameter Number**
Maximum temperature*	0	0	4
Minimum temperature*	0	0	5
Minimum dew point depression*	0	0	14
Maximum relative humidity*	0	1	27
Maximum absolute humidity*	0	1	28
Maximum wind speed*	0	2	21
Time-integrated air concentration of caesium pollutant*	0	18	6
Time-integrated air concentration of iodine pollutant*	0	18	7
Time-integrated air concentration of radioactive pollutant*	0	18	8

Note: * Parameter deprecated - See Regulation 92.6.2 and use another parameter instead.

5) Deprecate parameters, which contain the surface type

Parameter to be deprecated	Discipline	Category	Parameter Number
Net short wave radiation flux (surface)*	0	4	0
Net short wave radiation flux (top of atmosphere)*	0	4	1
Net long wave radiation flux (surface)*	0	5	0
Net long wave radiation flux (top of atmosphere)*	0	5	1
Upper layer soil temperature*	2	3	1
Lower layer soil temperature*	2	3	4
Upper layer soil moisture*	2	3	2
Lower layer soil moisture*	2	3	3
Low Cloud cover*	0	6	3
Medium Cloud cover*	0	6	4
High Cloud Cover*	0	6	5

Note: *Parameter deprecated - See Regulation 92.6.2 and use another parameter instead.

6) Deprecate:

Parameter name	Discipline	Category	Parameter number
Precipitation rate*	0	1	7
Snowfall rate water equivalent*	0	1	12

Note: *Parameter deprecated - See Regulation 92.6.2 and use another parameter instead.

7) Add new parameters:

Parameter name	Discipline	Category	Parameter number
Total(1) precipitation rate	0	1	52
Total(1) snowfall rate water equivalent	0	1	53

Note: (1) Total precipitation/snowfall rate stands for the sum of convective and large-scale precipitation/snowfall rate

8) Add new parameters:

Parameter name	Unit	Discipline	Category	Proposed parameter number
Large scale precipitation rate	kg m^{-2} s^{-1}	0	1	54
Convective snowfall rate water equivalent	kg m^{-2} s^{-1}	0	1	55
Large scale snowfall rate water equivalent	kg m^{-2} s^{-1}	0	1	56
Total snowfall rate	m s^{-1}	0	1	57
Convective snowfall rate	m s^{-1}	0	1	58
Large scale snowfall rate	m s^{-1}	0	1	59

9) Deprecate:

Parameter to be deprecated	**Discipline**	**Category**	**Paramete rNumber**
Total precipitation*	0	1	8
Large scale precipitation*	0	1	9
Convective precipitation*	0	1	10
Convective snow*	0	1	14
Large scale snow*	0	1	15
Total snowfall*	0	1	29

Note: *Parameter deprecated - See Regulation 92.6.2 and use another parameter instead.

10) Deprecate:

Name of parameter	**Discipline**	**Category**	**Parameter Number**
Soil moisture content*	2	0	3
Maximum snow albedo*	0	19	17
Ground heat flux*	2	0	10
Water equivalent of accumulated snow depth*	0	1	13

Note: *Parameter deprecated - See Regulation 92.6.2 and use another parameter instead.

11) Add new parameters:

Proposed parameter name	**Discipline**	**Category**	**Parameter Number**	**Unit**
Column-integrated soil water	2	0	23	kg m^{-2}
Snow albedo	0	19	19	%
Heat Flux	2	0	24	W m^{-2}
Snow depth water equivalent	0	1	60	kg m^{-2}

12) Add new parameter:

Standard deviation of sub-grid scale orography	0	3	20	m

13) Add new parameter

Cloud ice mixing ratio	0	6	23	kg kg^{-1}

14) Add new parameter

Total column integrated ozone	0	14	2	Dobson	

15) Add new parameters

Name	**Unit**	**Discipline**	**Category**	**Proposed Parameter number**
Skin temperature	K	0	0	17
Sunshine	Numeric	0	6	24
Snow density	kg m^{-3}	0	1	61
Ice temperature	K	10	2	8
Snow evaporation	kg m^{-2}	0	1	62
Large scale precipitation fraction	s	0	1	63
Downward UV radiation	W m^{-2}	0	4	12
Photosynthetically active radiation	W m^{-2}	0	4	10
Total column integrated water vapour	kg m^{-2}	0	1	64
Anisotropy of sub-gridscale orography	Numeric	0	3	24
Angle of sub-gridscale orography	Rad	0	3	21
Slope of sub-gridscale orography	Numeric	0	3	22
Gravity wave dissipation	W m^{-2}	0	3	23
Net short-wave radiation flux clear sky	W m^{-2}	0	4	11
Net long-wave radiation flux, clear sky	W m^{-2}	0	5	6

Annex 2 to Recommendation 4 (CBS-Ext.(06))

ADDITIONS TO FM 94-XIII BUFR

FOR REPORTING DEGREE OF TURBULENCE IN WAFS SIGWX MESSAGES

Add:

F X Y	Element name	BUFR				CREX		
0 11 030	Extended degree of turbulence	Code table	0	0	6	Code table	0	2

0 11 030
Extended degree of turbulence

Code figure		
0	Nil	in cloud
1	Light	
2	Moderate	
3	Severe	
4	Nil	in clear air
5	Light	
6	Moderate	
7	Severe	
8	Nil	cloud/clear air not specified
9	Light	
10	Moderate (MOD)	
11	Severe (SEV)	
12	Extreme, in clear air	
13	Extreme, in cloud	
14	Extreme, cloud/clear air not specified (EXTREME)	
15	Light, isolated moderate (ISOL MOD)	
16	Light, occasional moderate (OCNL MOD)	
17	Light, frequently moderate (FRQ MOD)	
18	Moderate, isolated severe (MOD ISOL SEV)	
19	Moderate, occasional severe (MOD OCNL SEV)	
20	Moderate, frequently severe (MOD FRQ SEV)	
21	Severe, isolated extreme (SEV ISOL EXTREME)	
22	Severe, occasional extreme (SEV OCNL EXTREME)	
23	Severe, frequently extreme (SEV FRQ EXTREME)	
24-62	Reserved	
63	Missing value	

SEQUENCE DESCRIPTORS FOR SYNOPTIC REPORTS FROM LAND AND SEA STATIONS (SUITABLE FOR SYNOP, SYNOP MOBIL AND SHIP OBSERVATION DATA)

New sequence descriptors 3 02 046, 3 02 047 and 3 02 048

3 02 046 is proposed to express the data of the SYNOP group $54g_0s_nd_T$, where

g_0 is “Period of time, in hours, between the time of observation and the temperature change”,
s_n is “Sign of the temperature change” – Code table 3845,
d_T is “ Amount of temperature change, the sign of the change given by s_n “– Code table 0822.

		(Temperature change)
3 02 046	0 04 024	Time period or displacement
	0 04 024	Time period or displacement
	0 12 049	Temperature change over period specified

3 02 047 is proposed to express data of SYNOP group $56D_LD_MD_H$, where

D_L is "True direction from which C_L clouds are moving" – Code table 0700,
D_M is "True direction from which C_M clouds are moving" – Code table 0700,
D_H is "True direction from which C_H clouds are moving" – Code table 0700.

		(Direction of cloud drift)
3 02 047	1 02 003	Replicate 2 descriptors 3 times
	0 08 002	Vertical significance
	0 20 054	True direction from which clouds are moving

3 02 048 is proposed to express data of SYNOP group $57CD_ae_C$, where

C is "Genus of cloud" – Code table 0500,
D_a is "True direction in which the phenomenon indicated is observed" – Code table 0700,
e_C is "Elevation angle of the top of the cloud indicated by C" – Code table 1004.

		(Direction and elevation of cloud)
3 02 048	0 05 021	Bearing or azimuth
	0 07 021	Elevation angle
	0 20 012	Cloud type
	0 05 021	Bearing or azimuth (= missing to cancel the previous value)
	0 07 021	Elevation angle (= missing to cancel the previous value)

For data representation of groups $54g_0s_nd_T$ and $56D_LD_MD_H$ of SYNOP Section 3, following BUFR/CREX Table B entries are proposed (0 12 049 for representation of s_nd_T, 0 20 054 for D_L, D_M and D_H):

F X Y	Element name	BUFR				CREX		
0 12 049	Temperature change over specified period	K	0	-30	6	^oC	0	2
0 20 054	True direction from which a phenomenon or clouds are moving	Degree true	0	0	9	Degree true	0	3

Note: By naming descriptor **0 20 054** "**True direction from which a phenomenon or clouds are moving**" it will allow its usage for data representation of groups $919M_WD_a$ (type of water spout, tornado, whirlwind, dustdevils and direction from which they approach the station) and $918s_qD_p$ (type of squall and direction from which it approaches the station).

NEW DESCRIPTORS FOR REGIONAL PRACTICES

F X Y	Element name	BUFR				CREX		
0 12 121	Ground minimum temperature	K	2	0	16	°C	2	4
0 12 122	Ground minimum temperature of the preceding night	K	2	0	16	°C	2	4
0 13 056	Character and intensity of precipitation	Code table	0	0	4	Code table	0	2
0 13 057	Time of beginning or end of precipitation	Code table	0	0	4	Code table	0	2
0 20 040	Evolution of drift of snow	Code table	0	0	4	Code table	0	2
0 20 055	State of sky in tropics	Code table	0	0	4	Code table	0	2
0 20 066	Maximum diameter of hailstones	m	3	0	8	m	3	3
0 20 067	Diameter of deposit	m	3	0	9	m	3	3
0 20 101	Locust (acridian) name	Code table	0	0	4	Code table	0	2
0 20 102	Locust (maturity) color	Code table	0	0	4	Code table	0	2
0 20 103	Stage of development of locusts	Code table	0	0	4	Code table	0	2
0 20 104	Organization state of swarm or band of locusts	Code table	0	0	4	Code table	0	2
0 20 105	Size of swarm or band of locusts and duration of passage of swarm	Code table	0	0	4	Code table	0	2
0 20 106	Locust population density	Code table	0	0	4	Code table	0	2
0 20 107	Direction of movements of locust swarm	Code table	0	0	4	Code table	0	2
0 20 108	Extent of vegetation	Code table	0	0	4	Code table	0	2

Proposed new Code tables:

		Manual on Codes, WMO-No. 306, Vol. II
0 13 056 -	Character and intensity of precipitation	Code table 167
0 13 057 -	Time of beginning or end of precipitation	Code table 168
0 20 055 -	State of sky in tropics	Code table 430
0 20 101 -	Locust (acridian) name	Code table 162
0 20 102 -	Locust (maturity) color	Code table 159
0 20 103 -	Stage of development of locusts	Code table 160

		Manual on Codes, WMO-No. 306, Vol. II
0 20 104 -	Organization state of swarm or band of locusts	Code table 161
0 20 105 -	Size of swarm or band of locusts and duration of passage of swarm	Code table 173
0 20 106 -	Locust population density	Code table 139
0 20 107 -	Direction of movements of locust swarm	Code table 140
0 20 108 -	Extent of vegetation	Code table 182

The existing extent of the above listed Code tables from the *Manual on Codes*, WMO-No. 306, Volume II, is to be supplemented by code figures 10-14 Reserved and by code figure15 Missing value.

Code Table 0 20 040 is proposed to express code figures for S'_8 (Code table 3776, *Manual on Codes*, WMO-No. 306, Volume I.1).

0 20 040
Evolution of drift of snow

Code figure	
0	Drift snow ended before the hour of observation
1	Intensity diminishing
2	No change
3	Intensity increasing
4	Continues, apart from interruption lasting less than 30 minutes
5	General drift snow has become drift snow near the ground
6	Drift snow near the ground has become general drift snow
7	Drift snow has started again after an interruption of more than 30 minutes
8 -14	Reserved
15	Missing value

Additions to the existing Flag tables:

0 20 023

Bit No.	**Other weather phenomena**
12	Water-spout

0 20 027

Bit No.	**Phenomenon occurrence**
6	Below station level

ADD COMMON SEQUENCES OF BUFR TEMPLATE FOR SYNOPTIC REPORTS FROM FIXED LAND STATIONS SUITABLE FOR SYNOP OBSERVATION DATA

		Sequence for representation of synoptic reports from a fixed land station suitable for SYNOP data
3 07 080	3 01 090	Fixed surface station identification, time, horizontal and vertical coordinates
	3 02 031	Pressure data
	3 02 035	Basic synoptic “instantaneous” data
	3 02 036	Clouds with bases below station level
	3 02 047	Direction of cloud drift
	0 08 002	Vertical significance
	3 02 048	Direction and elevation of cloud
	3 02 037	State of ground, snow depth, ground minimum temperature
	3 02 043	Basic synoptic “period” data
	3 02 044	Evaporation data
	1 01 002	Replicate next descriptor 2 times
	3 02 045	Radiation data (from 1 hour and/or 24 hour period)
	3 02 046	Temperature change

New sequences for BUFR template for synoptic reports from fixed land stations:

		Pressure data	
3 02 031	3 02 001	Pressure	
	0 10 062	24-hour pressure change	**$p_{24}p_{24}p_{24}$**
	0 07 004	Pressure (standard level)	**a_3**
	0 10 009	Geopotential height of the standard level	**hhh**
		Basic synoptic “instantaneous” data	
3 02 035	**3 02 032**	Temperature and humidity data	
	3 02 033	Visibility data	
	3 02 034	Precipitation past 24 hours	
	0 07 032	Height of sensor above local ground (set to missing to cancel the previous value)	
	3 02 004	General cloud information	
	1 01 000	Delayed replication of 1 descriptor	
	0 31 001	Delayed descriptor replication factor	
	3 02 005	Cloud data	
		Temperature and humidity data	
3 02 032	0 07 032	Height of sensor above local ground (for temperature and humidity measurement)	
	0 12 101	Temperature/dry-bulb temperature(sc.2)	**s_nTTT**
	0 12 103	Dew-point temperature (scale 2)	**$s_nT_dT_dT_d$**
	0 13 003	Relative humidity	
		Visibility data	
3 02 033	0 07 032	Height of sensor above local ground (for visibility measurement)	
	0 20 001	Horizontal visibility	**VV**

		Precipitation past 24 hours	
3 02 034	0 07 032	Height of sensor above local ground (for precipitation measurement)	
	0 13 023	Total precipitation past 24 hours	**$R_{24}R_{24}R_{24}R_{24}$**

		Clouds with bases below station level
3 02 036	1 05 000	Delayed replication of 5 descriptors
	0 31 001	Delayed descriptor replication factor
	0 08 002	Vertical significance
	0 20 011	Cloud amount **N'**
	0 20 012	Cloud type **C'**
	0 20 014	Height of top of cloud **H'H'**
	0 20 017	Cloud top description $\mathbf{C_t}$
		State of ground, snow depth, ground minimum temperature
3 02 037	0 20 062	State of ground (with or without snow) **E** or **E'**
	0 13 013	Total snow depth **sss**
	0 12 113	Ground minimum temperature (scale2), past 12 hours $\mathbf{s_nT_gT_g}$
		Basic synoptic "period" data
3 02 043	**3 02 038**	Present and past weather
	1 01 002	Replicate 1 descriptors 2 times
	3 02 039	Sunshine data (from 1 hour and 24 hour period)
	3 02 040	Precipitation measurement
	3 02 041	Extreme temperature data
	3 02 042	Wind data
	0 07 032	Height of sensor above local ground (set to missing to cancel the previous value)

		Present and past weather
3 02 038	0 20 003	Present weather **ww**
	0 04 024	Time period in hours
	0 20 004	Past weather (1) $\mathbf{W_1}$
	0 20 005	Past weather (2) $\mathbf{W_2}$

		Sunshine data (from 1 hour and 24 hour period)
3 02 039	0 04 024	Time period in hours
	0 14 031	Total sunshine **SS** and **SSS**

		Precipitation measurement
3 02 040	0 07 032	Height of sensor above local ground (for precipitation measurement)
	1 02 002	Replicate next 2 descriptors 2 times
	0 04 024	Time period in hours $\mathbf{t_R}$
	0 13 011	Total precipitation / total water equivalent of snow **RRR**

		Extreme temperature data
3 02 041	0 07 032	Height of sensor above local ground (for temperature measurement)
	0 04 024	Time period or displacement
	0 04 024	Time period or displacement (see Notes 1 and 2)
	0 12 111	Maximum temperature (scale 2) at height and over period specified $\mathbf{s_nT_xT_xT_x}$
	0 04 024	Time period or displacement
	0 04 024	Time period or displacement (see Note 2)

	0 12 112	Minimum temperature (scale 2) at height and over period specified **$s_nT_nT_nT_n$**
		Wind data
3 02 042	0 07 032	Height of sensor above local ground (for wind measurement)
	0 02 002	Type of instrumentation for wind measurement **i_w**
	0 08 021	Time significance (= 2 (time averaged))
	0 04 025	Time period (= - 10 minutes, or number of minutes after a significant change of wind)
	0 11 001	Wind direction **dd**
	0 11 002	Wind speed **ff**
	0 08 021	Time significance (= missing value)
	1 03 002	Replicate next 3 descriptors 2 times
	0 04 025	Time period in minutes
	0 11 043	Maximum wind gust direction
	0 11 041	Maximum wind gust speed 910**f_mf_m**, 911**f_xf_x**

		Evaporation data
3 02 044	0 04 024	Time period in hours
	0 02 004	Type of instrument for evaporation or crop type for evapotranspiration **i_E**
	0 13 033	Evaporation/evapotranspiration **EEE**

		Radiation data (from 1 hour and 24 hour period)
3 02 045	0 04 024	Time period in hours
	0 14 002	Long-wave radiation, integrated over period specified 553SS 4**FFFF** or 553SS 5**FFFF,** 55SSS 4**$F_{24}F_{24}F_{24}F_{24}$** or 55SSS 5**$F_{24}F_{24}F_{24}F_{24}$**
	0 14 004	Short-wave radiation, integrated over period specified 553SS 6**FFFF,** 55SSS 6**$F_{24}F_{24}F_{24}F_{24}$**
	0 14 016	Net radiation, integrated over period specified 553SS 0**FFFF** or 553SS 1**FFFF,** 55SSS 0**$F_{24}F_{24}F_{24}F_{24}$** or 55SSS 1**$F_{24}F_{24}F_{24}F_{24}$**
	0 14 028	Global solar radiation (high accuracy), integrated over period specified 553SS 2**FFFF,** 55SSS 2**$F_{24}F_{24}F_{24}F_{24}$**
	0 14 029	Diffuse solar radiation (high accuracy), integrated over period specified 553SS 3**FFFF,** 55SSS 3**$F_{24}F_{24}F_{24}F_{24}$**
	0 14 030	Direct solar radiation (high accuracy), integrated over period specified 55408 4**FFFF,** 55508 5**$F_{24}F_{24}F_{24}F_{24}$**
		Temperature change group **$54g_0s_nd_T$**
3 02 046	0 04 024	Time period or displacement
	0 04 024	Time period or displacement (see Note 3)
	0 12 049	Temperature change over period specified **s_nd_T**

Notes:

1) Within RA-IV, the maximum temperature at 1200 UTC is reported for the previous calendar day (i.e. the ending time of the period is not equal to the nominal time of the report). To construct the required time range, descriptor 004024 has to be included two times. If the period ends at the nominal time of the report, value of the second 004024 shall be set to 0.

2) Within RA-III, the maximum day-time temperature and the minimum night-time temperature is reported (i.e. the ending time of the period may not be equal to the nominal time of the report). To construct the required time range, descriptor 004024 has to be included two times. If the period ends at the nominal time of the report, value of the second 004024 shall be set to 0.

3) To construct the required time range, descriptor 004024 has to be included two times.

NEW SEQUENCES TO FOLLOW REGIONAL REGULATIONS FOR REPORTING SYNOP DATA IN BUFR/CREX:

3 07 081: BUFR template for synoptic reports from fixed land stations suitable for SYNOP data in compliance with reporting practices in RA I

3 01 090	Fixed surface station identification, time, horizontal and vertical coordinates
3 02 031	Pressure data
3 02 035	Basic synoptic “instantaneous” data
3 02 036	Clouds with bases below station level
3 02 047	Direction of cloud drift
0 08 002	Vertical significance (= missing to cancel the previous value)
3 02 048	Direction and elevation of cloud
3 02 037	State of ground, snow depth, ground minimum temperature (past 12 hours)
0 12 122	Ground minimum temperature of the preceding night **$s_nT_gT_g$**
0 13 056	Character and intensity of precipitation **R_c**
0 13 057	Time of beginning or end of precipitation **R_t**
0 20 101	Locust (acridian) name **L_n**
0 20 102	Locust (maturity) color **L_c**
0 20 103	Stage of development of locusts **L_d**
0 20 104	Organization state of swarm or band of locusts **L_g**
0 20 105	Size of swarm or band of locusts and duration of passage of swarm **s_L**
0 20 106	Locust population density **d_L**
0 20 107	Direction of movements of locust swarm **D_L**
0 20 108	Extent of vegetation **v_e**
3 02 043	Basic synoptic “period” data
3 02 044	Evaporation data
1 01 002	Replicate next descriptor 2 times
3 02 045	Radiation data (from 1 hour and/or 24 hour period)
3 02 046	Temperature change

3 07 082: BUFR template for synoptic reports from fixed land stations suitable for SYNOP data in compliance with reporting practices in RA II

3 01 090	Fixed surface station identification, time, horizontal and vertical coordinates
3 02 031	Pressure data
3 02 035	Basic synoptic “instantaneous” data
3 02 036	Clouds with bases below station level
3 02 047	Direction of cloud drift
0 08 002	Vertical significance (= missing to cancel the previous value)
3 02 048	Direction and elevation of cloud

3 02 037	State of ground, snow depth, ground minimum temperature (past 12 hours)
0 12 121	Ground minimum temperature (at the time of observation) **$s_nT'_gT'_g$**
0 12 122	Ground minimum temperature of the preceding night **$s_nT_gT_g$**
3 02 043	Basic synoptic “period” data
3 02 044	Evaporation data
1 01 002	Replicate next descriptor 2 times
3 02 045	Radiation data (from 1 hour and/or 24 hour period)
3 02 046	Temperature change

3 07 083: BUFR template for synoptic reports from fixed land stations suitable for SYNOP data in compliance with reporting practices in RA III

3 01 090	Fixed surface station identification, time, horizontal and vertical coordinates
3 02 031	Pressure data
3 02 035	Basic synoptic “instantaneous” data
3 02 036	Clouds with bases below station level
3 02 047	Direction of cloud drift
0 08 002	Vertical significance (= missing to cancel the previous value)
3 02 048	Direction and elevation of cloud
3 02 037	State of ground, snow depth, ground minimum temperature (past 12 hours)
0 12 122	Ground minimum temperature of the preceding night **$s_nT_gT_g$**
3 02 043	Basic synoptic “period” data
3 02 044	Evaporation data
1 01 002	Replicate next descriptor 2 times
3 02 045	Radiation data (from 1 hour and/or 24 hour period)
3 02 046	Temperature change

3 07 084: BUFR template for synoptic reports from fixed land stations suitable for SYNOP data in compliance with reporting practices in RA IV

3 01 090	Fixed surface station identification, time, horizontal and vertical coordinates
3 02 031	Pressure data
3 02 035	Basic synoptic “instantaneous” data
3 02 036	Clouds with bases below station level
3 02 047	Direction of cloud drift
0 08 002	Vertical significance (= missing to cancel the previous value)
3 02 048	Direction and elevation of cloud
3 02 037	State of ground, snow depth, ground minimum temperature (past 12 hours)
0 20 055	State of sky in tropics **C_S**
1 01 000	Delayed replication of 1 descriptor
0 31 001	Delayed descriptor replication factor
2 05 001	Character field of 1 character
3 02 043	Basic synoptic “period” data
3 02 044	Evaporation data
1 01 002	Replicate next descriptor 2 times
3 02 045	Radiation data (from 1 hour and/or 24 hour period)
3 02 046	Temperature change

3 07 086: BUFR template for synoptic reports from fixed land stations suitable for SYNOP data in compliance with reporting practices in RA VI

3 07 086	3 01 090	Fixed surface station identification, time, horizontal and vertical coordinates	Unit, scale
	3 02 031	Pressure data	
	3 02 035	Basic synoptic “instantaneous” data	
	3 02 036	Clouds with bases below station level	
	0 08 002	Vertical significance (= missing to cancel the previous value)	
	3 02 037	State of ground, snow depth, ground minimum temperature	
	3 02 066	**Dangerous weather phenomena**	
	3 02 043	Basic synoptic “period” data	
	3 02 044	Evaporation data	
	1 01 002	Replicate next descriptor 2 times	
	3 02 045	Radiation data (from 1 hour and/or 24 hour period)	
3 02 066		**Dangerous weather phenomena**	
		Groups 919M_WD_a and 96119 in SYNOP	
	0 20 023	Other weather phenomena **M_W** (1= Dust/sand whirl, 9= Funnel clouds not touching surface, 10 = Funnel clouds touching surface, 12 = Water-spout)	Flag table, 0
	0 20 024	Intensity of phenomena (1= Light, 2 = Moderate, 3 = Heavy, 4 = Violent)	Code table, 0
	0 20 027	Phenomenon occurrence (1=At time of observation, 3=In time period for past weather)	Flag table, 0
	0 20 054	True direction from which a phenomenon or clouds are moving **D_a**	Degree true, 0
		Group 918s_qD_p in SYNOP	
	0 20 023	Other weather phenomena (2 = Squalls) **s_q**	Flag table, 0
	0 20 027	Phenomenon occurrence (1=At time of observation, 3=In time period for past weather)	Flag table, 0
	0 20 054	True direction from which a phenomenon or clouds are moving **D_p**	Degree true, 0
		Group 929$S_8S'_8$ in SYNOP	
	0 20 025	Obscuration (13 = Snow)	Flag table, 0
	0 20 026	Character of obscuration (5= Low drifting, 6= Blowing) **S_8**	Code table, 0
	0 20 027	Phenomenon occurrence (1=At time of observation, 3=In time period for past weather)	Flag table, 0
	0 20 040	Evolution of drift of snow **S'_8**	Code table, 0
		Group 932RR	
	0 20 066	Maximum diameter of hailstones **RR**	m, 3
	0 20 027	Phenomenon occurrence (1=At time of observation, 3=In time period for past weather)	Flag table, 0
		Groups 934RR- 937RR in SYNOP	
	0 20 021	Type of precipitation (15=Glaze, 16=Rime, 20=Wet snow)	Flag table, 0
	0 20 067	Diameter of deposit **RR**	m, 3
	0 20 027	Phenomenon occurrence (1=At time of observation, 3=In time period for past weather)	Flag table, 0

Note:
Groups 56$D_LD_MD_H$, 57CD_ae_C and 54$g_0s_nd_T$ are not used in RA VI and therefore the corresponding sequence descriptors 3 02 047, 3 02 048 and 3 02 046 are not included in the RA VI regional template for SYNOP data.

		Sequence for representation of synoptic reports from a mobile land station suitable for SYNOP MOBIL data
3 07 090	3 01 092	Mobile surface station identification, time, horizontal and vertical coordinates
	3 02 031	Pressure data
	3 02 035	Basic synoptic “instantaneous” data
	3 02 036	Clouds with bases below station level
	3 02 047	Direction of cloud drift
	0 08 002	Vertical significance
	3 02 048	Direction and elevation of cloud
	3 02 037	State of ground, snow depth, ground minimum temperature
	3 02 043	Basic synoptic “period” data
	3 02 044	Evaporation data
	1 01 002	Replicate next descriptor 2 times
	3 02 045	Radiation data (from 1 hour and/or 24 hour period)
	3 02 046	Temperature change

			Mobile surface station identification, time, horizontal and vertical coordinates	
3 01 092	0 01 011		Mobile land station identifier	**D….D**
	0 01 003		WMO Region number	$\mathbf{A_1}$
	0 02 001		Type of station	$(\mathbf{i_x})$
	3 01 011	0 04 001	Year	
		0 04 002	Month	
		0 04 003	Day	**YY**
	3 01 012	0 04 004	Hour	**GG**
		0 04 005	Minute	**gg**
	3 01 021	0 05 001	Latitude (high accuracy)	$\mathbf{L_aL_aL_a}$
		0 06 001	Longitude (high accuracy)	$\mathbf{L_oL_oL_oL_o}$
	0 07 030		Height of station ground above mean sea level	
	0 07 031		Height of barometer above mean sea level	
	0 33 024		Station elevation quality mark	$\mathbf{i_m}$

FOR SEA SURFACE TEMPERATURE MEASUREMENT

New entries (shaded) are proposed for addition in code/flag table 002038

0 02 038

Method of water temperature and/or salinity measurement

Code figure	
0	Ship intake
1	Bucket
2	Hull contact sensor
3	Reversing Thermometer
4	STD/CTD sensor
5	Mechanical BT
6	Expendable BT
7	Digital BT
8	Thermistor chain
9	Infrared scanner
10	Micro-wave scanner
11	Infrared radiometer
12	In line thermosalinograph
13	Towed body
14	Other
15	Missing value

Proposed new descriptor for Depth below sea water surface (High resolution)

TABLE REFERENCE			TABLE ELEMENT NAME	BUFR				CREX		
F	X	Y		UNIT	SCALE	REF. VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Charac.)
0	07	063	Depth below sea/water surface	m	2	0	20	m	2	7

NEW TABLE ENTRIES FOR MARINE DATA

0 08 080 - Qualifier for GTSPP quality class

New Code figure

5-9	*Reserved*
10	**Water pressure at a level**
11	**Water temperature at a level**
12	**Salinity at a level**
13-19	*Reserved*
20	**Position**
21-62	*Reserved*

New table entries to describe profiling float identifier and vertical coordinate below sea/water surface in pressure are necessary as follows.

Table reference	Table element name	Unit	Scale	Ref.	Data width
001087	**WMO Marine observing platform extended identifier**	Numeric	0	0	23
007065	**Water pressure**	Pa	-3	0	17

SEQUENCE FOR REPRESENTATION OF SYNOPTIC REPORTS FROM A SEA STATION SUITABLE FOR SHIP DATA

		Sequence for representation of synoptic reports from a sea station suitable for SHIP data
3 08 009	3 01 093	Ship identification, movement, date/time, horizontal and vertical coordinates
	3 02 001	Pressure data
	3 02 054	SHIP “instantaneous” data
	0 08 002	Vertical significance
	3 02 055	Icing and ice
	3 02 057	SHIP marine data
	3 02 060	SHIP “period” data

		Ship identification, movement, date/time, horizontal and vertical coordinates
3 01 093	3 01 036	Ship
	0 07 030	Height of station platform above mean sea level
	0 07 031	Height of barometer above mean sea level
		SHIP “instantaneous” data
3 02 054	**3 02 052**	Temperature and humidity data
	3 02 053	Visibility data
	0 07 033	Height of sensor above water surface (set to missing to cancel the previous value)
	3 02 034	Precipitation past 24 hours
	0 07 032	Height of sensor above marine deck platform (set to missing to cancel the previous value)
	3 02 004	General cloud information
	1 01 000	Delayed replication of 1 descriptor
	0 31 001	Delayed descriptor replication factor
	3 02 005	Cloud data
		Temperature and humidity data
3 02 052	0 07 032	Height of sensor above marine deck platform (for temperature and humidity measurement)
	0 07 033	Height of sensor above water surface (for temperature and humidity measurement)
	0 12 101	Temperature/dry-bulb temperature(sc.2) **s_nTTT**
	0 02 039	Method of wet-bulb temperature measurement
	0 12 102	Wet-bulb temperature (scale 2) **$s_wT_bT_bT_b$**
	0 12 103	Dew-point temperature (scale 2) **$s_nT_dT_dT_d$**
	0 13 003	Relative humidity

		Visibility data
3 02 053	0 07 032	Height of sensor above marine deck platform (for visibility measurement)
	0 07 033	Height of sensor above water surface (for visibility measurement)
	0 20 001	Horizontal visibility **VV**
		Icing and ice
3 02 055	0 20 031	Ice deposit (thickness) **E_sE_s**
	0 20 032	Rate of ice accretion **R_s**
	0 20 033	Cause of ice accretion **I_s**
	0 20 034	Sea ice concentration **c_i**

	0 20 035	Amount and type of ice **b_i**
	0 20 036	Ice situation **z_i**
	0 20 037	Ice development **S_i**
	0 20 038	Bearing of ice edge **D_i**
		SHIP marine data
3 02 057	**3 02 056**	Sea surface temperature, method of measurement, and depth below sea surface
	3 02 021	Waves
	3 02 024	Direction of wind waves
		Sea surface temperature, method of measurement, and depth below sea surface
3 02 056	0 02 038	Method of sea/water temperature measurement
	0 07 063	Depth below sea/water surface (for sea surface temperature measurement)
	0 22 043	Sea/water temperature **$s_sT_wT_wT_w$**
	0 07 063	Depth below sea/water surface (set to missing to cancel the previous value)
3 02 060		**SHIP "period" data**
	3 02 038	Present and past weather
	3 02 058	Extreme temperature data
	3 02 059	Wind data
		Extreme temperature data
3 02 058	0 07 032	Height of sensor above marine deck platform (for temperature measurement)
	0 07 033	Height of sensor above water surface (for temperature measurement)
	0 04 024	Time period or displacement
	0 04 024	Time period or displacement (see Notes 1 and 2)
	0 12 111	Maximum temperature (scale 2) at height and over period specified **$s_nT_xT_xT_x$**
	0 04 024	Time period or displacement
	0 04 024	Time period or displacement (see Note 2)
	0 12 112	Minimum temperature (scale 2) at height and over period specified **$s_nT_nT_nT_n$**

		Wind data
3 02 059	0 07 032	Height of sensor above marine deck platform (for wind measurement)
	0 07 033	Height of sensor above water surface (for wind measurement)
	0 02 002	Type of instrumentation for wind measurement **i_w**
	0 08 021	Time significance (= 2; time averaged)
	0 04 025	Time period (= - 10 minutes, or number of minutes after a significant change of wind)
	0 11 001	Wind direction **dd**
	0 11 002	Wind speed **ff**
	0 08 021	Time significance (= missing value)
	1 03 002	Replicate next 3 descriptors 2 times
	0 04 025	Time period in minutes
	0 11 043	Maximum wind gust direction
	0 11 041	Maximum wind gust speed 910**f_mf_m**, 911**f_xf_x**

SEQUENCES FOR REPRESENTATION OF MONTHLY VALUES SUITABLE FOR CLIMAT DATA

		Sequence for representation of monthly values suitable for CLIMAT data
3 07 073	3 07 071	Monthly values from a land station
	3 07 072	Monthly normals for a land station

		Monthly values from a land station (data of CLIMAT Sections 0, 1, 3 and 4)
3 07 071	**3 01 090**	Surface station identification, date/time[(1)], horizontal and vertical co-ordinates
		Monthly mean values of pressure, temperature, extreme temperatures and vapour pressure
	0 04 074	Short time displacement (= UTC – LST)[(1)]
	0 04 023	Time period (= number of days in the month)
	0 08 023	First order statistics (= 4; mean value)
	0 10 004	Pressure $\overline{\mathbf{P_oP_oP_oP_o}}$
	0 10 051	Pressure reduced to msl $\overline{\mathbf{PPPP}}$
	0 07 004	Pressure (standard level) (for lowland stations = missing value)
	0 10 009	Geopotential height of the standard level $\overline{\mathbf{PPPP}}$ (for lowland stations = missing value)
	0 07 032	Height of sensor above local ground
	0 12 101	Temperature/dry-bulb temperature $\mathbf{s_n\overline{TTT}}$
	0 02 051	Indicator to specify observing method for extreme temperatures $\mathbf{i_y}$
	0 04 051	Principal time of daily reading of maximum temperature $\mathbf{G_xG_x}$
	0 12 118	Maximum temperature at height specified, past 24 hours $\mathbf{s_nT_xT_xT_x}$
	0 04 052	Principal time of daily reading of minimum temperature $\mathbf{G_nG_n}$
	0 12 119	Minimum temperature at height specified, past 24 hours $\mathbf{s_nT_nT_nT_n}$
	0 13 004	Vapour pressure $\overline{\mathbf{eee}}$
	0 08 023	First order statistics (= 63; missing value)
	0 12 151	Standard deviation of daily mean temperature $\mathbf{s_ts_ts_t}$
	0 07 032	***Height of sensor above local ground*** (set to missing to cancel the previous value)
	1 02 005	Replicate 2 descriptors 5 times

	0 08 050	Qualifier for number of missing values in calculation of statistic (= 1; pressure) (= 2; temperature) (= 4; vapour pressure) (= 7; maximum temperature) (= 8; minimum temperature)

	0 08 020	Total number of missing entities (days) $\mathbf{m_p m_p}$ (for pressure) $\mathbf{m_T m_T}$ (for temperature) $\mathbf{m_e m_e}$ (for vapour pressure) $\mathbf{m_{Tx}}$ (for maximum temperature) $\mathbf{m_{Tn}}$ (for minimum temperature)
		Monthly sunshine duration
	0 14 032	Total sunshine $\mathbf{S_1S_1S_1}$
	0 14 033	Total sunshine $\mathbf{p_s p_s p_s}$
	0 08 050	Qualifier for number of missing values in calculation of statistic (= 6; sunshine duration)
	0 08 020	Total number of missing entities (days) $\mathbf{m_S m_S}$
		Number of days with parameters beyond certain thresholds or with hail or thunderstorm
	1 02 018	Replicate 2 descriptors 18 times
	0 08 052	Conditions for which number of days of occurrence follows (= 0; wind ≥ 10 m/s) (= 1; wind ≥ 20 m/s) (= 2; wind ≥ 30 m/s) (= 3; max. T <273.15 K) (= 4; max. T ≥ 298.15 K) (= 5; max. T ≥ 303.15 K) (= 6; max. T ≥ 308.15 K) (= 7; max. T ≥ 313.15 K) (= 8; min. T < 273.15 K) (= 16; sss > 0.00 m) (= 17; sss > 0.01 m) (= 18; sss > 0.10 m) (= 19; sss > 0.50 m) (= 20; horizontal visibility < 50 m) (= 21; horizontal visibility < 100 m) (= 22; horizontal visibility < 1000 m) (= 23; hail) (= 24; thunderstorm)
	0 08 022	Total number (of days) $\mathbf{f_{10}f_{10}}$ (wind ≥10 m/s) $\mathbf{f_{20}f_{20}}$ (wind ≥ 20 m/s) $\mathbf{f_{30}f_{30}}$ (wind ≥ 30 m/s) $\mathbf{T_{x0}T_{x0}}$ (T_x < 273.15 K) $\mathbf{T_{25}T_{25}}$ (T_x ≥ 298.15 K) $\mathbf{T_{30}T_{30}}$ (T_x ≥ 303.15 K) $\mathbf{T_{35}T_{35}}$ (T_x ≥ 308.15 K) $\mathbf{T_{40}T_{40}}$ (T_x ≥ 313.15 K) $\mathbf{T_{n0}T_{n0}}$ (T_n < 273.15 K) $\mathbf{s_0s_0}$ (sss > 0.00 m) $\mathbf{s_1s_1}$ (sss > 0.01 m) $\mathbf{s_{10}s_{10}}$ (sss > 0.10 m) $\mathbf{s_{50}s_{50}}$ (sss > 0.50 m) $\mathbf{V_1V_1}$ (h. viz. < 50 m) $\mathbf{V_2V_2}$ (h. viz. < 100 m) $\mathbf{V_3V_3}$ (h. viz. < 1000 m) $\mathbf{D_{gr}D_{gr}}$ (hail) $\mathbf{D_{ts}D_{ts}}$ (thunderstorm)
		Occurrence of extreme values of temperature and wind speed
	0 07 032	Height of sensor above local ground

	0 08 053	Day of occurrence qualifier (= 0; on 1 day only) (= 1; on 2 or more days)
	0 04 003	Day **y_xy_x**
	0 12 152	Highest daily mean temperature **$s_nT_{xd}T_{xd}T_{xd}$**
	0 08 053	Day of occurrence qualifier (= 0; on 1 day only) (= 1; on 2 or more days)
	0 04 003	Day **y_ny_n**
	0 12 153	Lowest daily mean temperature **$s_nT_{nd}T_{nd}T_{nd}$**
	0 08 053	Day of occurrence qualifier (= 0; on 1 day only) (= 1; on 2 or more days)
	0 04 003	Day **$y_{ax}y_{ax}$**
	0 08 023	First order statistics (= 2; maximum value)
	0 12 101	Temperature/dry-bulb temperature **$s_nT_{ax}T_{ax}T_{ax}$**
	0 08 053	Day of occurrence qualifier (= 0; on 1 day only) (= 1; on 2 or more days)
	0 04 003	Day **$y_{an}y_{an}$**
	0 08 023	First order statistics (= 3; minimum value)
	0 12 101	Temperature/dry-bulb temperature **$s_nT_{an}T_{an}T_{an}$**
	0 08 023	First order statistics (= 63; missing value)
	0 07 032	Height of sensor above local ground
	0 02 002	Type of instrumentation for wind measurement
	0 08 053	Day of occurrence qualifier (= 0; on 1 day only) (= 1; on 2 or more days)
	0 04 003	Day **$y_{fx}y_{fx}$**
	0 11 046	Maximum instantaneous wind speed **$f_xf_xf_x$**
	0 08 053	Day of occurrence qualifier (set to missing to cancel the previous value)
		Monthly values of precipitation
	0 04 003	Day (= 1) (2)
	0 04 004	Hour (= 6) (2)
	0 04 023	Time period (= number of days in the month) (2)
	0 07 032	Height of sensor above local ground
	0 13 060	Total accumulated precipitation **$R_1R_1R_1R_1$**
	0 13 051	Frequency group; precipitation **R_d**
	0 04 053	Number of days with precipitation equal to or more than 1 mm **n_rn_r**
	0 08 050	Qualifier for number of missing values in calculation of statistic (= 5; precipitation)
	0 08 020	Total number of missing entities (days) **m_Rm_R** (for precipitation)
		Number of days with precipitation beyond certain thresholds
	1 02 006	Replicate 2 descriptors 6 times
	0 08 052	Conditions for which number of days of occurrence follows (= 10; precipitation ≥ 1.0 kg m^{-2}) (= 11; precipitation ≥ 5.0 kg m^{-2}) (= 12; precipitation ≥ 10.0 kg m^{-2}) (= 13; precipitation ≥ 50.0 kg m^{-2}) (= 14; precipitation ≥ 100.0 kg m^{-2}) (= 15; precipitation ≥ 150.0 kg m^{-2})

	0 08 022	Total number (of days) $\mathbf{R_1R_1}$ (precipitation ≥ 1.0 kg m^{-2}) $\mathbf{R_5R_5}$ (precipitation ≥ 5.0 kg m^{-2}) $\mathbf{R_{10}R_{10}}$ (precipitation ≥ 10.0 kg m^{-2}) $\mathbf{R_{50}R_{50}}$ (precipitation ≥ 50.0 kg m^{-2}) $\mathbf{R_{100}R_{100}}$ (precipitation ≥ 100.0 kg m^{-2}) $\mathbf{R_{150}R_{150}}$ (precipitation ≥ 150.0 kg m^{-2})
		Occurrence of extreme precipitation
	0 08 053	Day of occurrence qualifier (= 0; on 1 day only) (= 1; on 2 or more days)
	0 04 003	Day $\mathbf{y_ry_r}$
	0 13 052	Highest daily amount of precipitation $\mathbf{R_xR_xR_x}$
	0 07 032	Height of sensor above local ground (set to missing to cancel the previous value)

Notes:

1) The time identification refers to the beginning of the one-month period.
2) In case of precipitation measurements, the one-month period begins at 06 UTC on the first day of the month and ends at 06 UTC on the first day of the following month.
3) If the height of the sensor was changed during the period specified, the value shall be that which existed for the greater part of the period.

		Monthly normals for a land station **(data of CLIMAT Section 2)**
3 07 072	0 04 001	Year (of beginning of the reference period)
	0 04 001	Year (of ending of the reference period)
	0 04 002	Month
	0 04 003	Day (= 1) (1)
	0 04 004	Hour (= 0) (1)
	0 04 074	Short time displacement (= UTC – LST)(1)
	0 04 022	Time period (= 1)
		Normals of monthly mean pressure, temperatures, vapour pressure and of standard deviation
	0 08 023	First order statistics (= 4; mean value)
	0 10 004	Pressure $\overline{\mathbf{P_oP_oP_oP_o}}$
	0 10 051	Pressure reduced to msl $\overline{\mathbf{PPPP}}$
	0 07 004	Pressure (standard level)
	0 10 009	Geopotential height of the standard level $\overline{\mathbf{PPPP}}$
	0 07 032	Height of sensor above local ground
	0 12 101	Temperature/dry-bulb temperature $\mathbf{s_n\overline{TTT}}$
	0 02 051	Indicator to specify observing method for extreme temperatures $\mathbf{i_y}$
	0 04 051	Principal time of daily reading of maximum temperature $\mathbf{G_xG_x}$
	0 12 118	Maximum temperature at height specified, past 24 h. $\mathbf{s_n\overline{T_xT_xT_x}}$
	0 04 052	Principal time of daily reading of minimum temperature $\mathbf{G_nG_n}$
	0 12 119	Minimum temperature at height specified, past 24 h. $\mathbf{s_n\overline{T_nT_nT_n}}$
	0 13 004	Vapour pressure $\overline{\mathbf{eee}}$

	0 12 151	Standard deviation of daily mean temperature $\overline{s_t s_t s_t}$
	0 07 032	Height of sensor above local ground (set to missing to cancel the previous value)
		Normal of sunshine duration
	0 14 032	Total sunshine **$S_1S_1S_1$**
	0 08 023	First order statistics (= 63; missing value)
		Normals of precipitation
	0 04 001	Year (of beginning of the reference period)
	0 04 001	Year (of ending of the reference period)
	0 04 002	Month
	0 04 003	Day (= 1) (2)
	0 04 004	Hour (= 6) (2)
	0 04 022	Time period (= 1)
	0 07 032	Height of sensor above local ground
	0 08 023	First order statistics (= 4; mean value)
	0 13 060	Total accumulated precipitation **$R_1R_1R_1R_1$**
	0 04 053	Number of days with precipitation equal to or more than 1 mm **n_rn_r**
	0 08 023	First order statistics (= 63; missing value)
		Number of missing years
	1 02 008	Replicate 2 descriptors 8 times
	0 08 050	Qualifier for number of missing values in calculation of statistic (= 1; pressure) (= 2; temperature) (= 3; extreme temperatures)(4) (= 4; vapour pressure) (= 5; precipitation) (= 6; sunshine duration) (= 7; maximum temperature) (4) (= 8; minimum temperature) (4)
	0 08 020	Total number of missing entities (years) **y_py_p** (for pressure) **y_Ty_T** (for temperature) **$y_{Tx}y_{Tx}$** (for extreme temperatures)(4) **y_ey_e** (for vapour pressure) **y_Ry_R** (for precipitation) **y_Sy_S** (for sunshine duration) for maximum temperature (4) for minimum temperature (4)

Notes:

1) The time identification refers to the beginning of the one-month period.
2) In case of precipitation measurements, the one-month period begins at 06 UTC on the first day of the month and ends at 06 UTC on the first day of the following month.
3) If the height of the sensor was changed during the period specified, the value shall be that which existed for the greater part of the period.
4) The number of missing years within the reference period from the calculation of normal for mean extreme air temperature should be given, if available, for both the calculation of normal maximum temperature and for the calculation of normal minimum temperature in addition to the number of missing years for the extreme air temperatures reported under 0 08 020 preceded by 0 08 050 in which Figure 3 is used.

SEQUENCES FOR REPRESENTATION OF MONTHLY VALUES SUITABLE FOR CLIMAT SHIP DATA

		Sequence for representation of monthly values suitable for CLIMAT SHIP data
3 08 013	3 08 011	Monthly values from an ocean weather station
	3 08 012	Monthly normals for an ocean weather station

		Monthly values from an ocean weather station (data of CLIMAT SHIP Section 1)
3 08 011	0 01 011	Ship's call sign
	0 02 001	Type of station
	3 01 011	Year[(1)], month[(1)], day (= 1) [(1)]
	3 01 012	Hour (= 0) [(1)] , Minute (= 0) [(1)]
	3 01 023	Latitude, Longitude (coarse accuracy)
	0 07 030	Height of station platform above mean sea level
	0 07 031	Height of barometer above mean sea level
		Monthly mean values of pressure, temperature, vapour pressure and sea/water temperature
	0 04 074	Short time displacement (= UTC – LST)[(1)]
	0 04 023	Time period (= number of days in the month)
	0 08 023	First order statistics (= 4; mean value)
	0 10 051	Pressure reduced to mean sea level
	0 07 032	Height of sensor above marine deck platform (for temperature measurement)
	0 07 033	Height of sensor above water surface (for temperature measurement)
	0 12 101	Temperature/dry-bulb temperature
	0 13 004	Vapour pressure
	0 07 032	Height of sensor above marine deck platform (set to missing to cancel the previous value)
	0 07 033	Height of sensor above water surface (set to missing to cancel the previous value)
	3 02 056	Sea surface temperature, method of measurement, and depth below sea surface
	0 08 023	First order statistics (= 63; missing value)
		Monthly precipitation data
	0 04 003	Day (= 1) [(2)]
	0 04 004	Hour (= 6) [(2)]
	0 04 023	Time period (= number of days in the month) [(2)]
	0 07 032	Height of sensor above marine deck platform
	0 13 060	Total accumulated precipitation
	0 13 051	Frequency group; precipitation
	0 04 053	Number of days with precipitation equal to or more than 1 mm
	0 07 032	Height of sensor above marine deck platform (set to missing to cancel the previous value)

Notes:

1) The time identification refers to the beginning of the one-month period.
2) In case of precipitation measurements, the one-month period begins at 06 UTC on the first day of the month and ends at 06 UTC on the first day of the following month.
3) If the height of the sensor was changed during the period specified, the value shall be that which existed for the greater part of the period.

		Monthly normals for an ocean weather station (data of CLIMAT SHIP Section 2)
3 08 012	0 04 001	Year (of beginning of the reference period)
	0 04 001	Year (of ending of the reference period)
	0 04 002	Month
	0 04 003	Day (= 1) (1)
	0 04 004	Hour (= 0) (1)
	0 04 074	Short time displacement (= UTC – LST)(1)
	0 04 022	Time period (= 1)
		Normals of monthly mean pressure, temperature, vapour pressure and sea/water temperature
	0 08 023	First order statistics (= 4; mean value)
	0 10 051	Pressure reduced to mean sea level
	0 07 032	Height of sensor above marine deck platform (for temperature measurement)
	0 07 033	Height of sensor above water surface (for temperature measurement)
	0 12 101	Temperature/dry-bulb temperature
	0 13 004	Vapour pressure
	0 07 032	Height of sensor above marine deck platform (set to missing to cancel the previous value
	0 07 033	Height of sensor above water surface (set to missing to cancel the previous value)
	3 02 056	Sea surface temperature, method of measurement, and depth below sea surface
	0 08 023	First order statistics (= 63; missing value)
	0 04 001	Year (of beginning of the reference period)
	0 04 001	Year (of ending of the reference period)
	0 04 002	Month
	0 04 003	Day (= 1) (2)
	0 04 004	Hour (= 6) (2)
	0 04 022	Time period (= 1)
		Normals of precipitation
	0 07 032	Height of sensor above marine deck platform (for precipitation measurement)
	0 08 023	First order statistics (= 4; mean value)
	0 13 060	Total accumulated precipitation
	0 04 053	Number of days with precipitation equal to or more than 1 mm
	0 08 023	First order statistics (= 63; missing value)

Notes:

1) The time identification refers to the beginning of the one-month period.

2) In case of precipitation measurements, the one-month period begins at 06 UTC on the first day of the month and ends at 06 UTC on the first day of the following month.

3) If the height of the sensor was changed during the period specified, the value shall be that which existed for the greater part of the period.

ADD TABLE D DESCRIPTOR FOR CLIMAT TEMP AND CLIMAT TEMP SHIP DATA

		Sequence for representation CLIMAT TEMP and CLIMAT TEMP SHIP data
3 09 054	3 01 001	Identification of launch site
	0 01 011	Ship's call sign
	3 01 011	Date [(1)]
	3 01 012	Time[(1)]
	3 01 021	Horizontal and vertical coordinates
	0 07 030	Height of station ground above mean sea level
	0 07 031	Height of barometer above mean sea level
	0 07 007	Height release of sonde above mean sea level
		Monthly mean data
	0 04 023	Time period (= number of days in the month)
	0 04 059	Times of observations used to compute the reported mean values
	1 15 000	Delayed replication of 15 descriptors
	0 31 001	Delayed descriptor replication factor
	0 08 001	Vertical sounding significance
	0 08 023	First order statistics (= 4; mean value)
	0 07 004	Pressure
	0 10 009	Geopotential height
	0 12 101	Temperature/dry-bulb temperature
	0 12 103	Dew-point temperature
	0 08 023	First order statistics (= 32; vector mean)
	0 11 001	Wind direction
	0 11 002	Wind speed
	0 08 023	First order statistics (= 63; missing value)
	0 11 019	Steadiness of wind
	0 08 050	Qualifier for number of missing values in calculation of statistic (= 2; temperature)
	0 08 020	Total number of missing entities (days)
	0 08 050	Qualifier for number of missing values in calculation of statistic (= 9; wind)
	0 08 020	Total number of missing entities (days)

Note:

(1) The time identification refers to the beginning of the one-month period.

ADDITIONAL ENTRY:

Add the following new entry to existing BUFR/CREX code table 0-02-169/B-02-169 (i.e. “type of anemometer”):

3 Sonic

PROPOSED ADDITIONS TO THE EXISTING FLAG TABLE 0 08 042:

Bit No.	**0 08 042** **Extended vertical sounding significance**
14	Top of wind sounding
15	Level determined by regional decision
17	Pressure level originally indicated by height as the vertical coordinate

IN CODE TABLE 0-02-163

Change: 13, Parameter = Reserved
to: 13, Parameter = IR / two WV channel ratioing method

For RADOB, TRACKOB and SAREP

I. Add descriptors

I-1 For RADOB

Class 02 - Instrumentation

0	02	160	Wave length of the radar	Code table	0	0	4	Code table	0	2

Class 19 - Synoptic features

0	19	100	Time interval to calculate the movement of the tropical cyclone	Code table	0	0	4	Code table	0	2
0	19	101	Accuracy of the position of the centre of the tropical cyclone	Code table	0	0	4	Code table	0	2
0	19	102	Shape and definition of the eye of the tropical cyclone	Code table	0	0	3	Code table	0	1
0	19	103	Diameter of major axis of the eye of the tropical cyclone	Code table	0	0	4	Code table	0	2
0	19	104	Change in character of the eye during the 30 minutes	Code table	0	0	4	Code table	0	2
0	19	105	Distance between the end of spiral band and the centre	Code table	0	0	4	Code table	0	2

I-2 For TRACKOB

Class 02 - Instrumentation

0	02	042	Indicator for sea surface current speed	Code table	0	0	2	Code table	0	1

Class 04 - Location (time)

0	04	080	Averaging period for following value	Code table	0	0	4	Code table	0	2

Class 22 - Oceanographic elements

0	22	005	Direction of sea surface current	Degree true	0	0	9	Degree true	0	3
0	22	032	Speed of sea surface current	$m\ s^{-1}$	2	0	13	$m\ s^{-1}$	2	4
0	22	049	Sea surface temperature	K	2	0	15	K	2	5
0	22	059	Sea surface salinity	Part per thousand	2	0	14	Part per thousand	2	5

I-3 For SAREP

Class 19 - Synoptic features

0	19	106	Identification number of tropical cyclone	Numeric	0	0	7	Numeric	0	3
0	19	107	Time interval of the tropical cyclone analysis	Code table	0	0	4	Code table	0	2
0	19	108	Accuracy of geographical position of the tropical cyclone	Code table	0	0	3	Code table	0	1
0	19	109	Mean diameter of the overcast cloud of the tropical cyclone	Code table	0	0	4	Code table	0	2
0	19	110	Apparent 24-hour change in intensity of the tropical cyclone	Code table	0	0	4	Code table	0	2
0	19	111	Current Intensity (CI) number of the tropical cyclone	Numeric	1	0	7	Numeric	1	3
0	19	112	Data tropical (DT) number of the tropical cyclone	Numeric	1	0	7	Numeric	1	3
0	19	113	Cloud pattern type of the DT-number	Code table	0	0	4	Code table	0	2
0	19	114	Model Expected tropical (MET) number of the tropical cyclone	Numeric	1	0	7	Numeric	1	3

0	19	115	Trend of past 24-hour change (+: Developed, -: Weakened)	Numeric	1	-30	6	Numeric	1	2
0	19	116	Pattern tropical (PT) number of the tropical cyclone	Numeric	1	0	7	Numeric	1	3
0	19	117	Cloud picture type of the PT-number	Code table	0	0	3	Code table	0	1
0	19	118	Final tropical (T) number of the tropical cyclone	Numeric	1	0	7	Numeric	1	3
0	19	119	Type of the final T-number	Code table	0	0	3	Code table	0	1
0	19	150	Typhoon International Common Number (Typhoon Committee)	CCITTIA5	0	0	32	Character	0	4

Class 25 - Processing information

0	25	150	Method of tropical cyclone intensity analysis using satellite data	Code table	0	0	4	Code table	0	2

Category 01 - Location and identification sequence

3	01	005	0 01 035 0 01 034	Originating centre Identification of originating/generating sub-centre

II. Code Tables

II-1 For RADOB

0 02 160
Wave length of the radar

Code figure	
0	Reserved
1	10 to less than 20 mm
2	Reserved
3	20 to less than 40 mm
4	Reserved
5	40 to less than 60 mm
6	Reserved
7	60 to less than 90 mm
8	90 to less than 110 mm
9	110 mm and greater
10-14	Not used
15	Missing value

0 19 100
Time interval to calculate the movement of the tropical cyclone

Code figure	
0-2	Not used
3	During the preceding 15 minutes
4	During the preceding 30 minutes
5	During the preceding 1 hour
6	During the preceding 2 hours
7	During the preceding 3 hours
8	During the preceding 6 hours
9	During a period of more than 6 hours
10	Undetermined
11-14	Not used
15	Missing value

0 19 101

Accuracy of the position of the centre of the tropical cyclone

Code figure	
0	Reserved
1	Eye visible on radar scope, accuracy good (within 10 km)
2	Eye visible on radar scope, accuracy fair (within 30 km)
3	Eye visible on radar scope, accuracy poor (within 50 km)
4	Position of the centre within the area covered by the radar scope, determination by means of the spiral-band overlay, accuracy good (within 10 km)
5	Position of the centre within the area covered by the radar scope, determination by means of the spiral-band overlay, accuracy fair (within 30 km)
6	Position of the centre within the area covered by the radar scope, determination by means of the spiral-band overlay, accuracy poor (within 50 km)
7	Position of the centre outside the area covered by the radar scope, extrapolation by means of the spiral-band overlay
8-9	Reserved
10	Accuracy undetermined
11-14	Not used
15	Missing value

0 19 102

Shape and definition of the eye of the tropical cyclone

Code figure		
0	Circular	
1	Elliptical — the minor axis is at least 3/4 the length of the major axis	*well defined*
2	Elliptical — the minor axis is less than 3/4 the length of the major axis	*well defined*
3	Apparent double eye	*well defined*
4	Other shape	*well defined*
5	Ill defined	
6	Undetermined	
7	Missing	

0 19 103

Diameter of major axis of the eye of the tropical cyclone

Code figure	
0	Less than 5 km
1	5 to less than 10 km
2	10 to less than 15 km
3	15 to less than 20 km
4	20 to less than 25 km
5	25 to less than 30 km
6	30 to less than 35 km
7	35 to less than 40 km
8	40 to less than 50 km
9	50 km and greater
10	Undetermined
11-14	Not used
15	Missing value

0 19 104

Change in character of the eye during the 30 minutes

Code figure	
0	Eye has first become visible during the past 30 minutes
1	No significant change in the characteristics or size of the eye
2	Eye has become smaller with no other significant change in characteristics
3	Eye has become larger with no other significant change in characteristics
4	Eye has become less distinct with no significant change in size
5	Eye has become less distinct and decreased in size
6	Eye has become less distinct and increased in size
7	Eye has become more distinct with no significant change in size
8	Eye has become more distinct and decreased in size
9	Eye has become more distinct and increased in size
10	Change in character and size of eye cannot be determined
11-14	Not used
15	Missing value

0 19 105

Distance between the end of spiral band and the centre

Code figure	
0	0 to less than 100 km
1	100 to less than 200 km
2	200 to less than 300 km
3	300 to less than 400 km
4	400 to less than 500 km
5	500 to less than 600 km
6	600 to less than 800 km
7	800 km or more
8-9	Reserved
10	Doubtful or undetermined
11-14	Not used
15	Missing value

II-2 For TRACKOB

0 02 042

Indicator for sea surface current speed

Code figure	
0	Value originally reported in m/s
1	Value originally reported in knots
2	No sea current data available
3	Missing

0 04 080

Averaging period for following value

Code figure	
0	Spot values
1	Less than 15 minutes
2	From 15 to 45 minutes
3	More than 45 minutes
4-8	Reserved
9	Data not available
10-14	Not used
15	Missing

II-3 For SAREP

0 19 107
Time interval of the tropical cyclone analysis

Code figure	
0	Less than 1 hour
1	1 to less than 2 hours
2	2 to less than 3 hours
3	3 to less than 6 hours
4	6 to less than 9 hours
5	9 to less than 12 hours
6	12 to less than 15 hours
7	15 to less than 18 hours
8	18 to less than 21 hours
9	21 to less than 30 hours
10-14	Not used
15	Missing value

0 19 108
Accuracy of geographical position of the tropical cyclone

Code figure	
0	Cyclone centre within 10 km of the transmitted position
1	Cyclone centre within 20 km of the transmitted position
2	Cyclone centre within 50 km of the transmitted position
3	Cyclone centre within 100 km of the transmitted position
4	Cyclone centre within 200 km of the transmitted position
5	Cyclone centre within 300 km of the transmitted position
6	Cyclone centre undetermined
7	Missing value

0 19 109
Mean diameter of the overcast cloud of the tropical cyclone

Code figure	
0	Less than 1° of latitude
1	1° to less than 2° of latitude
2	2° to less than 3° of latitude
3	3° to less than 4° of latitude
4	4° to less than 5° of latitude
5	5° to less than 6° of latitude
6	6° to less than 7° of latitude
7	7° to less than 8° of latitude
8	8° to less than 9° of latitude
9	9° of latitude or more
10	Undetermined
11-14	Not used
15	Missing value

0 19 110
Apparent 24-hour change in intensity of the tropical cyclone

Code figure	
0	Much weakening
1	Weakening
2	No change
3	Intensification
4	Strong Intensification
5-8	Reserved
9	Not observed previously
10	Undetermined
11-14	Not used
15	Missing value

0 19 113
Cloud pattern type of the DT-number

Code figure	Type
1	Curved Band
2	Shear
3	Eye
4	Banding Eye
5	Central Dense Overcast (CDO)
6	Embedded Center
7	Center Cold Cover (CCC)
8-14	Reserved
15	Missing value

0 19 117
Cloud picture type of the PT-number

Code figure	Type
1	A (Curved Band)
2	B (CDO)
3	C (Shear)
4-6	Reserved
7	Missing value

0 19 119
Type of the final T-number

Code figure	Type
1	DT-number
2	PT-number
3	MET-number
4-6	Reserved
7	Missing value

0 25 150
Method of tropical cyclone intensity analysis using satellite data

Code figure	Method
1	The Dvorak’s VIS (visual imagery) intensity analysis
2	The Dvorak’s EIR (Enhanced Infrared imagery) intensity analysis
3-14	Reserved
15	Missing value

Table D descriptors which correspond with whole sequences of RADOB, TRACKOB and SAREP:

1. RADOB Template (part A: Information on tropical cyclone)

3 16 050	3 01 001	WMO block and station number
	3 01 011	Date
	3 01 012	Time
	0 02 160	Wave length of the radar
	0 08 005	Meteorological attribute significance (=1)
	0 05 002	Latitude (coarse accuracy)
	0 06 002	Longitude (coarse accuracy)
	0 08 005	Cancel Meteorological attribute significance
	0 19 100	Time interval to calculate the movement of the tropical cyclone
	0 19 005	Direction of motion of feature
	0 19 006	Speed of motion of feature
	0 19 101	Accuracy of the position of the centre of the tropical cyclone
	0 19 102	Shape and definition of the eye of the tropical cyclone
	0 19 103	Diameter of major axis of the eye of the tropical cyclone
	0 19 104	Change in character of the eye during the 30 minutes
	0 19 105	Distance between the end of spiral band and the centre

2. TRACKOB Template

<u>BUFR template</u>

3 08 010	0 01 011	Ship or mobile land station identifier
	1 13 000	Delayed replication of 13 descriptors
	0 31 001	Delayed descriptor replication factor
	3 01 011	Date
	3 01 012	Time
	3 01 021	Latitude/Longitude (high accuracy)
	0 04 080	Averaging period for following value
	0 22 049	Sea surface temperature
	0 04 080	Averaging period for following value
	0 22 059	Sea surface salinity
	0 04 080	Averaging period for following value
	0 22 005	Direction of sea surface current
	0 02 042	Indicator for sea surface current speed
	0 22 032	Speed of sea surface current
	0 02 042	Indicator for sea surface current speed (cancel)
	0 04 080	Averaging period for following value (cancel)

<u>CREX template</u>

D 08 010	B 01 011	Ship or mobile land station identifier
	R 13 000	Delayed replication of 13 descriptors
	D 01 011	Date
	D 01 012	Time
	D 01 021	Latitude/Longitude (high accuracy)
	B 04 080	Averaging period for following value
	B 22 049	Sea surface temperature
	B 04 080	Averaging period for following value
	B 22 059	Sea surface salinity
	B 04 080	Averaging period for following value
	B 22 005	Direction of sea surface current
	B 02 042	Indicator for sea surface current speed
	B 22 032	Speed of sea surface current
	B 02 042	Indicator for sea surface current speed (cancel)
	B 04 080	Averaging period for following value (cancel)

3. SAREP Template (part A: Information on tropical cyclone)

<u>BUFR template</u>

3 16 052	3 01 005	Originating centre/sub-centre
	3 01 011	Date
	3 01 012	Time
	0 01 007	Satellite identifier
	0 25 150	Satellite intensity analysis method of tropical cyclone
	1 22 000	Delayed replication of 22 descriptors
	0 31 001	Delayed descriptor replication factor
	0 01 027	WMO long storm name
	0 19 150	Typhoon International Common Number (Typhoon Committee)
	0 19 106	Identification number of tropical cyclone
	0 08 005	Meteorological attribute significance (=1)
	0 05 002	Latitude (coarse accuracy)
	0 06 002	Longitude (coarse accuracy)
	0 08 005	Cancel Meteorological attribute significance
	0 19 107	Time interval of the tropical cyclone analysis
	0 19 005	Direction of motion of feature
	0 19 006	Speed of motion of feature
	0 19 108	Accuracy of geographical position of the tropical cyclone
	0 19 109	Mean diameter of the overcast cloud of the tropical cyclone
	0 19 110	Apparent 24-hour change in intensity of the tropical cyclone
	0 19 111	Current Intensity (CI) number of the tropical cyclone
	0 19 112	Data tropical (DT) number of the tropical cyclone
	0 19 113	Cloud pattern type of the DT-number

0 19 114 Model Expected tropical (MET) number of the tropical cyclone
0 19 115 Trend of the past 24-hour change (+: Developed, -: Weakened)
0 19 116 Pattern tropical (PT) number of the tropical cyclone
0 19 117 Cloud picture type of the PT-number
0 19 118 Final tropical (T) number of the tropical cyclone
0 19 119 Type of the final T-number

<u>CREX template</u>

D 16 052	D 01 005	Originating centre/sub-centre
	D 01 011	Date
	D 01 012	Time
	B 01 007	Satellite identifier
	B 25 150	Satellite intensity analysis method of tropical cyclone
	R 22 000	Delayed replication of 22 descriptors
	B 01 027	WMO long storm name
	B 19 150	Typhoon International Common Number (Typhoon Committee)
	B 19 106	Identification number of tropical cyclone
	B 08 005	Meteorological attribute significance (=1)
	B 05 002	Latitude (coarse accuracy)
	B 06 002	Longitude (coarse accuracy)
	B 08 005	Cancel Meteorological attribute significance
	B 19 107	Time interval of the tropical cyclone analysis
	B 19 005	Direction of motion of feature
	B 19 006	Speed of motion of feature
	B 19 108	Accuracy of geographical position of the tropical cyclone
	B 19 109	Mean diameter of the overcast cloud of the tropical cyclone
	B 19 110	Apparent 24-hour change in intensity of the tropical cyclone
	B 19 111	Current Intensity (CI) number of the tropical cyclone
	B 19 112	Data tropical (DT) number of the tropical cyclone
	B 19 113	Cloud pattern type of the DT-number
	B 19 114	Model Expected tropical (MET) number of the tropical cyclone
	B 19 115	Trend of the past 24-hour change (+: developed, -: weakened)
	B 19 116	Pattern tropical (PT) number of the tropical cyclone
	B 19 117	Cloud picture type of the PT-number
	B 19 118	Final tropical (T) number of the tropical cyclone
	B 19 119	Type of the final T-number

For SIGMET*:*

Proposed Table B entries

Table Reference	Element name	BUFR				CREX		
F X Y		Unit	Scale	Ref. value	Data width	Unit	Scale	Data width
0 01 037	SIGMET sequence identifier	CCITT IA5	0	0	24	Character	0	3
0 01 065	ICAO region identifier	CCITT IA5	0	0	256	Character	0	32
0 08 019	Qualifier for following centre identifier	Code table	0	0	4	Code table	0	2
0 08 079	Product status	Code table	0	0	4	Code table	0	2
0 10 064	SIGMET cruising level	Code table	0	0	3	Code table	0	1
0 20 028	Expected change in intensity	Code table	0	0	3	Code table	0	1

Add the following new categories to Table A within BUFR and CREX:

13 Forecasts
14 Warnings

Add the following new code table values for BUFR/CREX Table B descriptors:

0 08 011
21 Thunderstorm
22 Tropical Cyclone
23 Mountain Wave
24 Duststorm
25 Sandstorm

0 20 008
15 Obscured (OBSC)
16 Embedded (EMBD)

0 20 024
5 Severe

Code tables for proposed new Table B descriptors:

Code figure	**0 08 019** **Qualifier for following centre identifier**
0	Reserved
1	ATS (Air Traffic Service) unit serving FIR (Flight Information Region)
2	FIR (Flight Information Region)
3	UIR (Upper Information Region)
4	CTA (Control Area)
5	VAAC (Volcanic Ash Advisory Centre)
6	MWO (Meteorological Watch Office) issuing SIGMET
7-14	Reserved
15	Missing value

Code figure	**0 08 079** **Product status**
0	Normal issue
1	correction to a previously issued product (**COR**)
2	Amendment to a previously issued product (**AMD**)
3	Correction to a previously issued amended product (**COR AMD**)
4	Cancellation of a previously issued product (**CNL**)
5	No product available (**NIL**)
6-14	Reserved
15	Missing

Code figure	**0 10 064** **SIGMET cruising level**
0	Subsonic
1	Transonic
2	Supersonic
3-6	Reserved
7	Missing value

Code figure	**0 20 028** **Expected change in intensity**
0	No change (NC)
1	Forecast to weaken (WKN)
2	Forecast to intensify (INTSF)
3	Unknown (*)
4-6	Reserved
7	Missing value

Note: (*) This entry is not allowed in SIGMET messages.

New Table D descriptors:

		(Time period)
3 01 014	1 02 002	Replication of 2 descriptors 2 times
	3 01 011	Year, Month, Day
	3 01 012	Hour, Minute
		(Description of a feature in 3-D or 2-D)
3 01 027	0 08 007	Dimensional significance, 0=Point, 1=Line, 2=Area, 3=Volume
	1 01 000	Delayed replication of 1 descriptor
	0 31 001	Replication factor [1]
	3 01 028	Description of horizontal section
	0 08 007	Dimensional significance, Missing=Cancel
		(Horizontal section of a feature described as a polygon, circle, line or point)
3 01 028	0 08 040	Flight level significance
	0 33 042	Type of limit represented by following (flight level) value
	0 07 010	Flight level
	1 01 000	Delayed replication of 1 descriptor
	0 31 002	Extended replication factor [2]
	3 01 023	Location
	0 19 007	Radius of feature [3]
	0 08 040	Flight level significance, Missing=Cancel

[1] This replication factor shall have a value of “1” when a 2-D feature is being described, whereas 3-D features may be described via any one of the following methods:

(a) Via two or more horizontal sections in successive ascending flight levels. In this case, each section shall be described by an identical number of latitude/longitude points listed in identical order (i.e. where each point x of section n is to be joined via a straight line to point x of section n+1), in order to ensure that the overall shape of the 3-D feature is unambiguously described. In this case, all values reported for 0 33 042 shall be “missing”.

(b) Via a single horizontal section with an appropriate value reported for 0 33 042, as follows. In all such cases, the corresponding horizontal section description applies throughout the entire region.
   a. A value of “0” to indicate a region above (but not including) the reported flight level and with unspecified upper bound.
   b. A value of “1” to indicate a region above (and including) the reported flight level and with unspecified upper bound.
   c. A value of “2” to indicate a region below (but not including) the reported flight level and extending to the surface.
   d. A value of “3” to indicate a region below (and including) the reported flight level and extending to the surface.

(c) Via two replications of the same horizontal section at the same reported flight level, in order to indicate a region extending both below and above (and including!) the reported flight level. In this case, the values reported for the two replications of 0 33 042 shall be as follows:
   a. Values of “3” and “1”, respectively, to indicate a region beginning from below a reported flight level, but continuing through that level upward to some unspecified point above (e.g. TOP ABV FL100).
   b. Values of “1” and “3”, respectively, to indicate a region beginning from above a reported flight level, but continuing through that level downward to some unspecified point below (e.g. CIGS BLW FL010).

[2] This replication factor shall have a value of “1” when a circle or point is being described, and it shall have a value of “2” when a line is being described. A polygon, on the other hand, shall be described via a sequence of three or more contiguous points in accordance with the note to code table 0 08 007.

[3] The value reported for 0 19 007 shall be “missing” unless the horizontal section being described is a circle.

		(SIGMET header)
3 16 030	3 01 014	Time period (for which SIGMET is valid)
	0 01 037	SIGMET sequence identifier
	0 10 064	SIGMET cruising level
	0 08 019	Qualifier for location identifier, 1=ATS unit serving FIR
	0 01 062	Short ICAO location identifier
	0 08 019	Qualifier for location identifier, 2=FIR, 3=UIR, 4=CTA
	0 01 065	ICAO region identifier
	0 08 019	Qualifier for location identifier, 6=MWO
	0 01 062	Short ICAO location identifier
	0 08 019	Qualifier for location identifier, Missing=Cancel

		(SIGMET, Observed or forecast location and motion)
3 16 031	0 08 021	Time Significance, 16=Analysis, 4=Forecast
	3 01 011	Year, Month, Day
	3 01 012	Hour, Minute
	3 01 027	Description of feature
	0 19 005	Direction of motion
	0 19 006	Speed of motion
	0 20 028	Expected change in intensity
	0 08 021	Time significance, Missing=Cancel
		(SIGMET, Forecast position)
3 16 032	0 08 021	Time Significance, 4=Forecast
	3 01 011	Year, Month, Day
	3 01 012	Hour, Minute
	3 01 027	Description of feature
	0 08 021	Time significance, Missing=Cancel
		(SIGMET, Outlook)
3 16 033	0 08 021	Time Significance, 4=Forecast
	3 01 011	Year, Month, Day
	3 01 012	Hour, Minute
	1 01 000	Delayed replication of 1 descriptor
	0 31 001	Replication factor
	3 01 027	Description of feature
	0 08 021	Time significance, Missing=Cancel

		(Volcanic Ash SIGMET)
3 16 034	0 08 079	Product status, 0=Normal Issue, 1=Correction
	3 16 030	SIGMET Header
	0 08 011	Meteorological feature, 17=Volcano
	0 01 022	Name of feature
	0 08 007	Dimensional significance, 0=Point
	3 01 023	Location
	0 08 007	Dimensional significance, Missing=Cancel
	0 20 090	Special Clouds, 5=Clouds from volcanic eruptions
	3 16 031	SIGMET Observed or forecast location and motion
	1 01 000	Delayed replication of 1 descriptor
	0 31 000	Short replication factor
	3 16 032	SIGMET Forecast position

	1 01 000	Delayed replication of 1 descriptor
	0 31 001	Replication factor
	3 16 033	SIGMET Outlook
	0 08 011	Meteorological feature, Missing=Cancel
	0 08 079	Product status, Missing=Cancel
		(Thunderstorm SIGMET)
3 16 035	0 08 079	Product status, 0=Normal Issue, 1=Correction
	3 16 030	SIGMET Header
	0 08 011	Meteorological feature, 21=Thunderstorm
	0 20 023	Other weather phenomenon, bit 2=Squalls or all 18 bits = Missing
	0 20 021	Type of precipitation, bit 14=Hail or all 30 bits=Missing
	0 20 008	Cloud distribution 15=OBSC, 16=EMBD, 12=FRQ, 31=Missing
	3 16 031	SIGMET Observed or forecast location and motion
	0 08 011	Meteorological feature, Missing=Cancel
	0 08 079	Product status, Missing=Cancel

		(Tropical Cyclone SIGMET)
3 16 036	0 08 079	Product status, 0=Normal Issue, 1=Correction
	3 16 030	SIGMET Header
	0 08 011	Meteorological feature, 22=Tropical Cyclone
	0 01 027	WMO storm name
	3 16 031	SIGMET Observed or forecast location and motion
	1 01 000	Delayed replication of 1 descriptor
	0 31 000	Short replication factor
	3 16 032	SIGMET Forecast position
	1 01 000	Delayed replication of 1 descriptor
	0 31 001	Replication factor
	3 16 033	SIGMET Outlook
	0 08 011	Meteorological feature, Missing=Cancel
	0 08 079	Product status, Missing=Cancel

		(Turbulence SIGMET)
3 16 037	0 08 079	Product status, 0=Normal Issue, 1=Correction
	3 16 030	SIGMET Header
	0 08 011	Meteorological feature, 13=Turbulence
	0 11 031	Degree of turbulence, 10=Moderate, 11=Severe
	3 16 031	SIGMET Observed or forecast location and motion
	0 08 011	Meteorological feature, Missing=Cancel
	0 08 079	Product status, Missing=Cancel
		(Icing SIGMET)
3 16 038	0 08 079	Product status, 0=Normal Issue, 1=Correction
	3 16 030	SIGMET Header
	0 08 011	Meteorological feature, 15=Airframe Icing
	0 20 041	Airframe icing, 7=Severe
	0 20 021	Type of precipitation, bit 3=Liquid freezing or all 30 bits = Missing
	3 16 031	SIGMET Observed or forecast location and motion
	0 08 011	Meteorological feature, Missing=Cancel
	0 08 079	Product status, Missing=Cancel

		(Mountain Wave, Duststorm or Sandstorm SIGMET)
3 16 039	0 08 079	Product status, 0=Normal Issue, 1=Correction
	3 16 030	SIGMET Header
	0 08 011	Meteorological feature, 23=MountainWave, 24=Duststorm, 25=Sandstorm
	0 20 024	Intensity of phenomena, 3=Heavy, 5=Severe
	3 16 031	SIGMET Observed or forecast location and motion
	0 08 011	Meteorological feature, Missing=Cancel
	0 08 079	Product status, Missing=Cancel

		(Cancellation of SIGMET)
3 16 040	3 16 030	SIGMET header
	0 08 079	Product status, 4=Cancellation
	3 01 014	Time period (of the SIGMET to be cancelled)
	0 01 037	SIGMET sequence identifier (of the SIGMET to be cancelled)
	0 10 064	SIGMET cruising level (of the SIGMET to be cancelled)
	0 08 079	Product status, Missing=Cancel

FOR POLLUTANT

Add the following new entry to BUFR/CREX Class 15:

TABLE REFERENCE			TABLE ELEMENT NAME	BUFR				CREX		
F	X	Y		UNIT	SCALE	REFERENCE VALUE	DATA WIDTH (Bits)	UNIT	SCALE	DATA WIDTH (Characters)
0	15	027	Concentration of pollutant	Kg m^{-3}	9	0	10	Kg m^{-3}	9	4

Add the following new entries to existing BUFR/CREX code table 0-15-025/B-15-025 (i.e. "type of pollutant"):

11 Fine particulate matter (diameter < 2.5 microns)

12 Fine particulate matter (diameter < 10 microns)

Correct the following typographical errors in the English version of the current WMO Manual 306, Part B for BUFR/CREX Class 15:

- *For both 0-15-025 and 0-15-026, the "ELEMENT NAME" contains the word "pollutant" misspelled as "polluant".*

The units of 0-15-026 should be "mol mol^{-1}" (i.e. one included space) rather than "$molmol^{-1}$", which seems to imply the reciprocal of some heretofore-unknown unit of measure!

REPRESENTATION OF NOMINAL VALUES

To represent any nominal value in BURF a new descriptor in class 8 of the BURF table b is to be used to indicate the cause of nominal value.

Ref number	Name	Unit	Scale	Reference	Data width
008083	Nominal value indicator	Flag table	0	0	15

008083 Nominal value indicator

Bit No.	Meaning
1	Adjusted with respect to representative height of sensor above local ground (or Deck of marine platform)
2	Adjusted with respect to representative height of sensor above water surface
3	Adjusted with respect to standard surface roughness
4	Adjusted with respect to wind speed
5	Adjusted with respect to temperature
6	Adjusted with respect to pressure
7	Adjusted with respect to humidity
8	Adjusted with respect to evaporation
9	Adjusted with respect to wetting losses
10-14	Reserved
All 15	Missing value

ADD THE FOLLOWING NEW ENTRIES TO BUFR/CREX CLASS 0:

0 00 004	**BUFR/CREX Master Table (see Note (2))**	**CCITT IA5 Character**	**0 0**	**0**	**16 2**
0 00 006	**BUFR Master Table Version Number (see Note (3))**	**CCITT IA5 Character**	**0 0**	**0**	**16 2**
0 00 007	**CREX Master Table Version Number (see Note (4))**	**CCITT IA5 Character**	**0 0**	**0**	**16 2**
0 00 008	**BUFR Local Table Version Number (see Note (5))**	**CCITT IA5 Character**	**0 0**	**0**	**16 2**

Add the following new notes to BUFR/CREX Class 0:

(2) Master Tables are described in Note (2) to Section 1 of the BUFR regulations.
(3) BUFR Master Table Version Numbers are described in Notes (2) and (4) to Section 1 of the BUFR regulations for edition 3, and in Notes (2) and (5) to Section 1 of the BUFR regulations for edition 4.
(4) CREX Master Table Version Numbers are described in Note (1) to Section 1 of the CREX regulations.
(5) Local Table version number (see Note (2) to Section 1 of the BUFR regulations

Revise Note (2) under Section 1 of the BUFR regulations (for both editions 3 and 4) to read:

A BUFR master table may be defined for a scientific discipline other than meteorology. This shall be indicated by a non-zero numeric value in octet 4. Such a table will be developed, in coordination with the ET/DR+C, when a recognized organization exists with the necessary expertise to maintain such a master table, and when at least one of the following situations also exists:
— Requirements cannot be met using Master Table 0.
— There is expected to be a minimal amount of overlap with respect to the entries in Master Table 0.

The current list of master tables, along with their associated values in octet 4, is as follows:

0	Meteorology maintained by World Meteorological Organization (WMO)
10	Oceanography maintained by International Oceanographic Commission (IOC)

Whenever a new master table is developed, the following criteria shall apply:

— Table C may not be changed, nor may Classes 00 and 31 of Table B. These would remain identical for any of the master tables.

— For Classes 01 through 09 (coordinate classes) and Class 33 of Table B, and for Categories 00 and 01 of Table D, these Classes and Categories must have the same name and be used for the same types of descriptors as in Master Table 0; however, individual descriptors within these Classes and Categories would be left to the discretion of the organization defining the particular master table in question.

— For Table A and all remaining Classes of Table B and Categories of Table D, these would be left to the discretion of the organization defining the particular master table in question.

For all master tables (including Master Table 0):

— Each revision of the master table shall be given a new version number.

— Local tables shall define those parts of the master table which are reserved for local use, thus version numbers of local tables may be changed at will by the originating centre.

Revise octet 11 under Section 1 of the BUFR regulations for edition 3 to read:

11 Version number of master table used – see Notes (2) and (4)

Revise octet 14 under Section 1 of the BUFR regulations for edition 4 to read:

14 Version number of master table used – see Notes (2) and (5)

Add the following as new Note (4) under Section 1 of the BUFR regulations for edition 3 (and as new Note (5) for edition 4):

For Master Table 0, the master table version numbers are as follows:

0	Experimental
1	Version implemented on 1 November 1988
2	Version implemented on 1 November 1993
3	Version implemented on 2 November 1994
4	Version implemented on 8 November 1995
5	Version implemented on 6 November 1996
6	Version implemented on 5 November 1997
7	Version implemented on 4 November 1998
8	Version implemented on 3 May 2000
9	Version implemented on 8 November 2000
10	Version implemented on 7 November 2001
11	Version implemented on 5 November 2003
12	Version implemented on 2 November 2005
13	Pre-operational to be implemented by next amendment

Change vv definition in CREX Section 1 Edition 1 and Edition 2 to:
vv: CREX Master Table version number (see Note 1)

Change bb definition in CREX Section 1 Edition 2 to:
bb: BUFR Master Table version number (see Note (5) under Section 1 of the BUFR regulations for Edition 4)

Add the following as new Note (1) under Section 1 of the CREX regulations:

For Master Table 0, the master table version numbers are as follows:

0	Experimental
1	Version implemented on 3 May 2000
2	Version implemented on 7 November 2001
3	Version implemented on 4 November 2003
4	Version implemented on 2 November 2005
5	Pre-operational to be implemented by next amendment

FOR ENCODING MORE SATELLITE DATA:

Add class in BUFR Table B — Classification of elements:

0	40	Satellite data

Add a new Category of sequences in BUFR Table D:

3	40	Additional satellite report sequences

For data of ENVISAT Satellite:

Add:

021093	Ku band peakiness	numeric	3	0	16
021094	S band peakines	numeric	3	0	16

Flag table 033047 " Measurement confidence data " should be amended with the addition of:

Bit number	Meaning
8	S band anomaly error detected

NEW CODE TABLE ENTRIES FOR POLAR SATELLITE DATA

1 MHS

The MHS instrument replaces the AMSU-B instrument in the ATOVS package operated by EUMETSAT and NOAA. The level 1b data from the MHS can be represented in BUFR using exactly the same sequence of descriptors, which was used for AMSU-B.

The following changes are required to standardize the representation of MHS data:

Code Table 0-02-048

Add:	11, Parameter = MHS
Change:	11 to 14, Parameter = Reserved
to:	12 to 14, Parameter = Reserved

Code Table 0-02-150

Change:	43, Parameter = AMSU-B 1
to:	43, Parameter = AMSU-B 1 / MHS 1
Change:	44, Parameter = AMSU-B 2
to:	44, Parameter = AMSU-B 2 / MHS 2

Change:	45, Parameter = AMSU-B 3
to:	45, Parameter = AMSU-B 3 / MHS 3
Change:	46, Parameter = AMSU-B 4
to:	46, Parameter = AMSU-B 4 / MHS 4
Change:	47, Parameter = AMSU-B 5
to:	47, Parameter = AMSU-B 5 / MHS 5

Code Table 0-02-151

Add:	9, Parameter = MHS
Change:	8 to 2046, Parameter = Reserved
to:	10 to 2046, Parameter = Reserved

Sequence Descriptor 3-10-010

Change:	Title = "ATOVS AMSU-B report"
to:	Title = "ATOVS AMSU-B / MHS report"

2 IASI

The IASI instrument is a hyperspectral sounder, which will fly on the Metop spacecraft operated by EUMETSAT. The level 1c data from IASI will be exchanged in BUFR. The details of the representation of the data have been discussed by many parties (ECMWF, UK Met Office, NOAA, MeteoFrance, DWD) in great detail and presented at several international meetings (including the 14th International TOVS Study Conference in Beijing). Synthetic IASI data are being generated in near real time by NOAA using the descriptors proposed here. These data have been successfully encoded and decoded by independent software.

The new element and sequence descriptors given here are from the range of local values and are shown in parentheses. It is proposed to assign descriptors from Classes and Categories 40, 41 and 42 of BURF Tables B and D.

The following changes are required to standardize the representation of IASI data:

New Sequence Descriptor (3-40-001): " IASI Level 1c data"

0-01-007	Satellite identifier
0-01-031	Identification of originating/generating centre
0-02-019	Satellite instruments
0-02-020	Satellite classification
0-04-001	Year
0-04-002	Month
0-04-003	Day
0-04-004	Hour
0-04-005	Minute
2-02-131	Add 3 to scale
2-01-138	Add 10 to width
0-04-006	Second
2-01-000	Reset width
2-02-000	Reset scale
0-05-001	Latitude (high accuracy)
0-06-001	Longitude (high accuracy)
0-07-024	Satellite zenith angle
0-05-021	Bearing or azimuth
0-07-025	Solar zenith angle
0-05-022	Solar azimuth
0-05-043	Field of view number
0-05-040	Orbit number

2-01-133	Add 5 to width
0-05-041	Scan line number
2-01-000	Reset width
2-01-132	Add 4 to width
0-25-070	Major frame count
2-01-000	Reset width
2-02-126	Subtract 2 from scale
0-07-001	Height of station
2-02-000	Reset scale
(0-33-060)	GQisFlagQual
(0-33-061)	QGisQualIndex
(0-33-062)	QGisQualIndexLoc
(0-33-063)	QGisQualIndexRad
(0-33-064)	QGisQualIndexSpect
(0-33-065)	GQisSysTecSondQual
1-01-010	Repeat next 1 descriptor 10 times
(3-40-002)	IASI Level 1c band description
1-01-087	Repeat next 1 descriptor 87 times
(3-40-003)	IASI Level 1c 100 channel sequence
0-02-019	Satellite instruments
0-25-051	AVHRR channel combination
1-01-007	Repeat next 1 descriptor 7 times
(3-40-004)	IASI Level 1c AVHRR single scene sequence

New Sequence Descriptor: (3-40-002) "IASI Level 1c band description"

(0-25-140)	Start channel
(0-25-141)	End channel
(0-25-142)	Channel scale factor

New Sequence Descriptor: (3-40-003) " IASI Level 1c 100 channel sequence"

1-04-100	Repeat next 4 descriptor 100 times
2-01-136	Add 8 to width
0-05-042	Channel number
2-01-000	Reset width
(0-14-046)	Scaled IASI radiance

New Sequence Descriptor: (3-40-004) " IASI Level 1c AVHRR single scene sequence"

(0-05-060)	Y angular position from centre of gravity
(0-05-061)	Z angular position from centre of gravity
0-25-085	Fraction of clear pixels in HIRS FOV
1-05-006	Repeat next 5 descriptor 6 times
0-05-042	Channel number
(0-25-142)	Channel scale factor
(0-14-047)	Scaled mean AVHRR radiance
(0-25-142)	Channel scale factor
(0-14-048)	Scaled std dev AVHRR radiance

New Element Descriptors:

Descriptor	Name	Units	Scale	Reference	Width
(0-05-060)	Y angular position from centre of gravity	Degree	6	-8000000	24
(0-05-061)	Z angular position from centre of gravity	Degree	6	-8000000	24
(0-14-046)	Scaled IASI radiance	$Wm^{-2}sr^{-1}m^{-1}$	0	-5000	16
(0-14-047)	Scaled mean AVHRR radiance	$Wm^{-2}sr^{-1}m^{-1}$	0	0	31
(0-14-048)	Scaled std dev AVHRR radiance	$Wm^{-2}sr^{-1}m^{-1}$	0	0	31
(0-25-140)	Start channel	Numeric	0	0	14
(0-25-141)	End channel	Numeric	0	0	14
(0-25-142)	Channel scale factor	Numeric	0	0	6
(0-33-060)	GqisFlagQual - individual IASI-System quality flag	Code Table	0	0	2
(0-33-061)	GqisQualIndex - indicator for instrument noise performance (contributions from spectral and radiometric)	%	0	0	7
(0-33-062)	GqisQualIndexLoc - indicator for geometric quality index	%	0	0	7
(0-33-063)	GqisQualIndexRad - indicator for instrument noise performance (contributions from radiometric calibration)	%	0	0	7
(0-33-064)	GqisQualIndexSpect - indicator for instrument noise performance (contributions from spectral calibration)	%	0	0	7
(0-33-065)	GqisSysTecSondQual - output of system TEC (Technical Expertise Centre) quality function	Numeric	0	0	24

New Code Table (0-33-060) "GQisFlagQual - individual IASI-System quality flag"

0,	Parameter = Good
1,	Parameter = Bad
2,	Parameter = Reserved
3,	Parameter = Missing

3 ASCAT

EUMETSAT will produce level 1b ASCAT products at its headquarters in Darmstadt, Germany. These data will be encoded in BUFR and disseminated via EUMETCast (DVB satellite multicast service) and on the GTS. EUMETSAT's Ocean and Sea Ice Satellite Application Facility (OSI-SAF), hosted by KNMI, will produce level 2 products from the level 1b data. It is also foreseen to add soils moisture to the level 2 ASCAT product in the future.

The new element and sequence descriptors given here have been developed by close co-operation between EUMETSAT, the OSI-SAF and the ASCAT Science Advisory Group (SAG). The proposed sequence will accommodate both the level 1b and the level 2 data simultaneously. When the level 1b data leave EUMETSAT, the parts of the sequence relating to level 2 processing will be set to "missing". This approach will allow users to ingest the same sequence, whether they are receiving level 1b data or level 2 data.

The new element and sequence descriptors are from the range of local values and are shown in parentheses. It is proposed to assign descriptors from Classes and Categories 40, 41 and 42 of BUFR Tables B and D within Master Tables 0, as per Section 3.5 of the Final Report of the 2004 meeting of the ET/DR&C.

The following changes are required to standardize the representation of ASCAT data:

New Sequence Descriptor: (3-12-061) "ASCAT Level 1b and level 2 data sequence"

(3-12-058)	ASCAT level 1b data
(3-12-060)	Scatterometer soil moisture data
(3-12-059)	Scatterometer wind data

New Sequence Descriptor: (3-12-058) "ASCAT level 1b data sequence"

(3-01-125)	ASCAT header information
3-01-011	Date information
3-01-013	Time information
3-01-021	Position information
(3-12-055)	ASCAT level 1b cell information
(0-21-150)	Beam co-location
1-01-003	Repeat next 1 descriptor 3 times
(3-21-030)	ASCAT sigma-0 information

New Sequence Descriptor: (3-12-060) "Scatterometer soil moisture data sequence"

0-25-060	Software identification
(0-25-062)	Database identification
(0-40-001)	Surface soil moisture (ms)
(0-40-002)	Estimated error in surface soil moisture
0-21-062	Extrapolated backscatter at 40deg incidence angle (sigma0_40)
(0-21-151)	Estimated error in sigma0 at 40deg incidence angle
(0-21-152)	Slope at 40deg incidence angle
(0-21-153)	Estimated error in slope at 40deg incidence angle
(0-21-154)	Soil moisture sensitivity
0-21-062	Dry backscatter
(0-21-088)	Wet backscatter
(0-40-003)	Mean surface soil moisture
(0-40-004)	Rain fall detection
(0-40-005)	Soil moisture correction flag
(0-40-006)	Soil moisture processing flag
(0-40-007)	Soil moisture quality
0-20-065	Snow cover
(0-40-008)	Frozen land surface fraction
(0-40-009)	Inundation and wetland fraction
(0-40-010)	Topographic complexity

New Sequence Descriptor: (3-12-059) "Scatterometer wind data sequence"

(3-12-056)	Scatterometer wind cell information
1-01-000	Delayed replication of next 1 descriptor
0-31-001	Delayed replication factor
(3-12-057)	Ambiguous wind data

New Sequence Descriptor: (3-01-125) "ASCAT header information sequence"

0-01-033	Identification of originating/generating centre
0-01-034	Identification of originating/generating sub-centre
0-25-060	Software identification
0-01-007	Satellite identifier
0-02-019	Satellite instruments
0-01-012	Direction of motion of moving observing platform

New Sequence Descriptor: (3-12-055) " ASCAT level 1b cell information"

0-05-033	Pixel size on horizontal-1
0-05-040	Orbit number
0-06-034	Cross track cell number
(0-10-095)	Height of atmosphere used
(0-21-157)	Loss per unit length of atmosphere used

New Sequence Descriptor: (3-21-030) "ASCAT sigma-0 information"

(0-08-085)	Beam identifier
2-02-129	Increase scaling by 10^1
2-01-131	Increase data width by 3 bits
0-02-111	Radar incidence angle
2-01-000	Cancel change data width
2-02-000	Cancel change scaling
0-02-134	Antenna beam azimuth
0-21-062	Backscatter
0-21-063	Radiometric resolution (noise value)
(0-21-158)	ASCAT kp estimate quality
(0-21-159)	ASCAT sigma-0 usability
(0-21-160)	ASCAT synthetic data quality
(0-21-161)	ASCAT synthetic data quantity
(0-21-162)	ASCAT satellite orbit and attitude quality
(0-21-163)	ASCAT solar array reflection contamination
(0-21-164)	ASCAT telemetry presence and quality
(0-21-165)	ASCAT extrapolated reference function
(0-21-166)	ASCAT land fraction

New Sequence Descriptor: (3-12-056) "Scatterometer wind cell information sequence"

0-25-060	Software identification
0-01-032	Generating application
0-11-082	Model wind speed at 10 m
0-11-081	Model wind direction at 10 m
(0-20-095)	Ice probability
(0-20-096)	Ice age (a-parameter)
(0-21-155)	Wind vector cell quality
2-01-133	Increase data width by 5 bits
0-21-101	Number of vector ambiguities
0-21-102	Index of selected wind vector
2-01-000	Cancel change data width

New Sequence Descriptor: (3-12-057) "Ambiguous wind data"

2-01-130	Increase data width by 2 bits
2-02-129	Increase scaling by 10^1
0-11-012	Wind speed at 10 m
2-02-000	Cancel change scaling
2-01-000	Cancel change data width
2-01-131	Increase data width by 3 bits
2-02-129	Increase scaling by 10^1
0-11-011	Wind direction at 10 m
2-02-000	Cancel change scaling
2-01-000	Cancel change data width
(0-21-156)	Backscatter distance
0-21-104	Likelihood computed for solution

New Element Descriptors:

Descriptor	Name	Units	Scale	Reference	Width
(0-10-095)	Height of atmosphere used	m	0	0	16
(0-08-085)	Beam identifier	Code table	0	0	3
(0-20-095)	Ice probability	Numeric	3	0	10
(0-20-096)	Ice age ("A" parameter)	dB	2	-4096	13
(0-21-088)	Wet backscatter	dB	2	-5000	13
(0-21-150)	Beam collocation	Code table	0	0	2
(0-21-151)	Estimated error in sigma0 at 40deg incidence angle	dB	2	0	9
(0-21-152)	Slope at 40deg incidence angle	dB/Deg	2	-80	7
(0-21-153)	Estimated error in slope at 40deg incidence angle	dB/Deg	2	-40	6
(0-21-154)	Soil moisture sensitivity	dB	2	0	12
(0-21-155)	Wind vector cell quality	Flag table	0	0	24
(0-21-156)	Backscatter distance	Numeric	1	-4096	13
(0-21-157)	Loss per unit length of atmosphere used	dB m-1	10	0	22
(0-21-158)	ASCAT kp estimate quality	Code table	0	0	2
(0-21-159)	ASCAT sigma-0 usability	Code table	0	0	2
(0-21-160)	ASCAT use of synthetic data	Numeric	3	0	10
(0-21-161)	ASCAT synthetic data quality	Numeric	3	0	10
(0-21-162)	ASCAT satellite orbit and attitude quality	Numeric	3	0	10
(0-21-163)	ASCAT solar array reflection contamination	Numeric	3	0	10
(0-21-164)	ASCAT telemetry presence and quality	Numeric	3	0	10
(0-21-165)	ASCAT extrapolated reference function presence	Numeric	3	0	10
(0-21-166)	ASCAT land fraction	Numeric	3	0	10
(0-25-062)	Database identification	Numeric	0	0	14
(0-40-001)	Surface soil moisture (ms)	%	1	0	10
(0-40-002)	Estimated error in surface soil moisture	%	1	0	10

Descriptor	Name	Units	Scale	Reference	Width
(0-40-003)	Mean surface soil moisture	Numeric	3	0	10
(0-40-004)	Rain fall detection	Numeric	3	0	10
(0-40-005)	Soil moisture correction flag	Flag table	0	0	8
(0-40-006)	Soil moisture processing flag	Flag table	0	0	16
(0-40-007)	Soil moisture quality	%	1	0	10
(0-40-008)	Frozen land surface fraction	%	1	0	10
(0-40-009)	Inundation and wetland fraction	%	1	0	10
(0-40-010)	Topographic complexity	%	1	0	10

New Code Table (0-08-085) "Beam identified"

0,	Parameter = Fore beam
1,	Parameter = Mid beam
2,	Parameter = Aft beam
3 to 6,	Parameter = Reserved
7,	Parameter = Missing

New Code Table (0-21-150) "Beam co-location"

0,	Parameter = Data from single ground station (no co-location)
1,	Parameter = Data from multiple ground station (co-located data)
2,	Parameter = Reserved
3,	Parameter = Missing

New Flag Table (0-21-155) "Wind vector cell quality"

Bit 1:	Not enough good sigma-0 available for wind retrieval
Bit 2:	Poor azimuth diversity among sigma-0 for wind retrieval
Bit 3:	Any beam noise content above threshold
Bit 4:	Product monitoring not used
Bit 5:	Product monitoring flag
Bit 6:	KNMI quality control fails
Bit 7:	Variational quality control fails
Bit 8:	Some portion of wind vector cell is over land
Bit 9:	Some portion of wind vector cell is over ice
Bit 10:	Wind retrieval not performed for wind vector cell
Bit 11:	Reported wind speed is greater than 30 m/s
Bit 12:	Reported wind speed is less than or equal to 3 m/s
Bit 13:	Rain flag for the wind vector cell is not usable
Bit 14:	Rain flag algorithm detects rain
Bit 15:	No meteorological background used
Bit 16:	Data are redundant
Bit 17-23:	Reserved
All 24:	Missing

New Code Table (0-21-158) "ASCAT KP quality estimate"

0,	Parameter = Acceptable
1,	Parameter = Not acceptable
2,	Parameter = Reserved
3,	Parameter = Missing

New Code Table (0-21-159) "ASCAT sigma-0 usability"

0,	Parameter = Good
1,	Parameter = Usable
2,	Parameter = Bad
3,	Parameter = Missing

New Flag Table (0-40-005) "Soil moisture correction flags"

Bit 1:	Soil moisture between -20% and 0%
Bit 2:	Soil moisture between 100% and 120%
Bit 3:	Correction of wet backscatter reference
Bit 4:	Correction of dry backscatter reference
Bit 5:	Correction of volume scattering in sand
Bits 6-7:	Reserved
All 8:	Missing

New Flag Table (0-40-006) "Soil moisture processing flags"

Bit 1:	Not soil
Bit 2:	Sensitivity to soil moisture below limit
Bit 3:	Azimuthal noise above limit
Bit 4:	Backscatter Fore-Aft beam out of range
Bit 5:	Slope Mid-Fore beam out of range
Bit 6:	Slope Mid-Aft beam out of range
Bit 7:	Soil moisture below -20%
Bit 8:	Soil moisture above 120%
Bits 9-16:	Reserved

Code Table 0-02-048

Add:	12, Parameter = ASCAT
Change:	12 to 14, Parameter = Reserved
to:	13 to 14, Parameter = Reserved

ADDITION IN CODE TABLE 0 02 152 SATELLITE INSTRUMENT DATA USED IN PROCESSING

12 Multi-channel scanning radiometer

ADD THE FOLLOWING TABLE B ENTRY FOR NUMERICAL MODEL IDENTIFIER:

0 01 030 Numerical model identifier, CCITTIA5, Scale=0, Reference=0,Data bit width=128

Note: The value of this feature could be a string of characters which contains the name of the model and other useful elements such as the model mesh.

“EDITORIAL” CORRECTIONS

1. Compression of CCITT IA5 elements

Current version of regulation 94.6.3, in particular sub-notes (iv) and (v) to Note (2), results into increasing of the data volume if character data are compressed.

It is recommended to change the current text of 94.6.3 **Note (2), sub-note (iv)**
“...or for character data, specifying number of octets representing the character string.”
to read
“...or for character data, specifying number of octets **needed for representing the character string in the data subsets.**”
Moreover, it is proposed change the current text of 94.6.3 **Note (2), sub-note (v)**
“Actual values, V, will then be obtained ...”
to read
“Actual values, V, **other than character values,** will then be obtained ...”.

2. Indirect reference to descriptors – Reg. 94.5.6.2

Current Regulation 94.5.6.2 reads:
"A sequence descriptor shall be equivalent to the corresponding list of descriptors in Table D."
This statement is fully valid when data are being expanded. Data producers and authors of data templates, however, have to pay attention to the fact that if a sequence descriptor is located under a replication descriptor 1 X Y, the X has to be modified when the sequence descriptor is replaced by the corresponding list of descriptors from Table D.

It is proposed to add a **Note under Regulation 94.5.6.2**:

> If a sequence descriptor is included within the scope of a replication descriptor 1 X Y, the number of descriptors to be repeated shall be modified if the sequence descriptor is replaced by the corresponding list of descriptors from Table D.

3. Definition of operator 2 02 Y

The current definition of 2 02 Y reads:
"Add Y-128 to scale in Table B for elements which are not code or flag tables."
CCITT IA5 elements, however, should always have their scale = 0. Therefore, 2 02 Y should not apply to CCITT IA5 data.

It is proposed to modify the definition of 2 02 Y to read:
"**Add (Y-128) to the scale given for each data element in Table B, other than CCITT IA5 (character) data, code or flag tables.**"

4. Note (7) under the BUFR Table C

The Note (7) referring to 2 04 YYY reads:
"The data description operator 2 04 YYY shall be followed immediately by the descriptor 0 31 021 to indicate the meaning of the associated field".
According to this Note, 2 04 000 should be also followed by the descriptor 0 31 021. According to Note (9), however, inclusion of the descriptor 0 31 021, defined or redefined within the scope of a 2 04 YYY, is pointless outside the scope of this 2 04 YYY.

It is proposed to modify Note (7) to read:
"The data description operator 2 04 YYY**, other then 2 04 000,** shall be followed immediately by the descriptor 0 31 021 to indicate the meaning of the associated field".

5. Code figure 6 in the code table 0 31 021

The code figure 6 in 0 31 021 is defined as "Quality control flag according to GTSPP". The entries of the detailed description of the associated field (0 = unqualified to 9 = missing) are values, not bit numbers.

It is proposed to rename code figure 6 to read:
"**4-bit indicator of quality control class** according to GTSPP".

6. Note (5) under BUFR Table C

The Note (5)(a) specifies that each new definition adds to the currently defined associated field. It does not specify, however, the order of the included associated information. The order might either correspond with the order of the associated field significance or it might be reversed to it, i.e. the first included associated information would be related to the most recently defined associated field. The later approach would be in compliance with the procedure of cancellation in Note (5)(b), according to which cancellation 2 04 000 applies to the most recently defined addition to the associated field. The former alternative is reflected in the proposal below.

It is proposed to supplement Note (5)(a) with the following text:
"The order of the included associated information shall correspond with the order in which the associated fields have been defined."

7. Addition of a Note under Class 20

Cloud cover (total) 0 20 010 is defined in BUFR/CREX Table B with UNIT = %. The corresponding Code table 2700 for N (Total cloud cover) in [1] allows to make a difference between N = 9 "Sky obscured by fog and/or other meteorological phenomena" and N = / (Cloud cover is indiscernible for reasons other than fog or other meteorological phenomena, or observation is not made). In the Regulations for reporting TAC data in TDCF, Cloud cover (total) 0 20 010 is recommended to be set to a missing value in both cases, which has been found not satisfactory.

It is proposed to add a Note under Class 20:
A cloud cover (total) value 113 shall indicate "Sky obscured by fog and/or other meteorological phenomena".

8. Modification of the text of entry 62 in 0 08 002

In Regulation B/C 1.4.4.2 (e) for reporting SYNOP data in TDCF (and elsewhere), Vertical significance 0 08 002 is recommended to be set to "63 (Missing value)" if sky clear is observed. This might be confusing as the actual meaning is "not applicable".

It is proposed to modify the text of the code figure 62 in 0 08 002 to read:

62 Value not applicable.

9. Addition of another Note under Class 20

Bearing of ice edge 0 20 038 is defined in BUFR/CREX Table B with UNIT = Degree true. The Regulations for reporting SHIP data in TDCF require usage 0 20 038 set to 0, corresponding to the code figure 0 = "Ship in shore or flaw lead" in the Code table 0739 for D_i (True bearing of principal ice edge).

It is proposed to add a Note under Class 20:

A bearing of ice edge value 0 shall indicate "Ship in shore or flaw lead".

10. Changes entries in Code Table 0 08 052:

3 Maximum temperature less than 273.15 K
4 Maximum temperature equal to or more than 298.15 K
5 Maximum temperature equal to or more than 303.15 K
6 Maximum temperature equal to or more than 308.15 K
7 Maximum temperature equal to or more than 313.15 K
8 Minimum temperature less than 273.15 K
9 Maximum temperature equal to or more than 273.15 K

PROPOSAL FOR REGIONAL PRACTICES

New descriptors and a Note under the Class 13

F X Y	Element name	BUFR				CREX		
0 11 054	Mean wind direction for 1500 m – 3000 m	Degree true	0	0	9	Degree true	0	3
0 11 055	Mean wind speed for 1500 m – 3000 m	m s^{-1}	1	0	12	m s^{-1}	1	4
0 13 047	Modified Showalter stability index	K	0	-60	6	ºC	0	2

It is proposed to add a Note under Class 13:

The “Modified Showalter stability index” is defined as the temperature difference between the ambient 500 hPa temperature and the temperature a parcel of air, initially at a selected base level, would have if brought from its condensation level to the 500 hPa surface by a moist adiabatic process. Positive values denote stable conditions, while negative values denote unstable conditions. The base level is 850 hPa, 800hPa or 750 hPa if the station elevation is less than 1000, 1000 to 1400 or 1401 to 2000 gpm above mean sea level, respectively.

ADD CREX SEQUENCES FOR CODING OF SQUALL LINES IN WEST AFRICA IN CREX

	Definition of squall line (by 3 points)
D16060	D01011 Date of observation
	D01012 Hour of observation
	Position of Squall Line Centre:
	B05002 Latitude
	B06002 Longitude
	B19005 Direction of moving feature
	B19006 Speed of moving feature
	Amplitude of feature, from most external point to centre point:
	North side:
	B05002 Latitude:
	B06002 Longitude:
	South side:
	B05002 Latitude
	B06002 Longitude
	Evolution of feature:
	B04074 Period of validity
	B20028 Expected change in intensity
	B11041 Maximum burst expected
	B13055 Intensity of rain expected

	Definition of squall line (by more than 3 points)
D16061	D01011 Date of observation
	D01012 Hour of observation
	Position of Squall Line Centre:
	B05002 Latitude
	B06002 Longitude
	B19005 Direction of moving feature
	B19006 Speed of moving feature
	Amplitude of feature, from most external point to centre point:
	North side:
	R02000 Define delayed replication of next 2 descriptors:
	B05002 Latitude
	B06002 Longitude
	South side:
	R02000 Define delayed replication of next 2 descriptors:
	B05002 Latitude
	B06002 Longitude
	Evolution of feature:
	B04074 Period of validity
	B20028 Expected change in intensity
	B11041 maximum burst expected
	B13055 intensity of rain expected

FOR EXCHANGE IN BUFR OF TEMPERATURE AND SALINITY PROFILE DATA OBSERVED BY PROFILING FLOATS:

Three ADMT members of the Argo Data Management Team (ADMT): the Japan Meteorological Agency (JMA), Canadian Marine Environmental Data Service (MEDS) and the US Naval Oceanographic Office, successfully completed the validation test of the following sequence for exchange in BUFR of temperature and salinity profile data observed by profiling floats.

Common sequence, Category 15 — Oceanographic report sequences

(Temperature and salinity profile observed by profile floats)

3 15 003 001087 - WMO Marine observing platform extended identifier
001085 - Observing platform manufacturers model
001086 - Observing platform manufacturers serial number
002036 - Buoy type
002148 - Data collection and/or location system
002149 - Type of data buoy
022055 - Float cycle number
022056 - Direction of profile
022067 - Instrument type for water temperature profile measurement
301011 - Date
301012 - Time
301021 - Latitude and longitude (high accuracy)
008080 - Qualifier for quality class
033050 - GTSPP quality class
109000 - Delayed replication of 9 descriptors
031002 - Extended delayed descriptor replication factor
007065 - Water pressure
008080 - Qualifier for quality class
033050 - GTSPP quality class
022045 - Subsurface sea temperature
008080 - Qualifier for quality class
033050 - GTSPP quality class
022064 - Salinity
008080 - Qualifier for quality class
033050 - GTSPP quality class

ADDITIONS TO COMMON CODE TABLES (OPERATIONAL)

Common Code Table C 1 and Common Code Table C 11

63 IRI (International Research Institute for Climate and Society)

Common Code Table C 2

Modify:
58 AVK-BAR (Russian Federation)
68 AVK-MRZ-UAP (Russian Federation)
69 AVK-BAR-UAP (Russian Federation)
88 MARL-A-MRZ (Russian Federation)
89 MARL-A-BAR (Russian Federation)

To use alternative words for their definition:
58 AVK - MRZ* (Russian Federation)
68 AVK - RZM-2 (Russian Federation)
69 MARL-A or Vektor-M - RZM-2 (Russian Federation)
88 MARL-A or Vektor-M - MRZ (Russian Federation)
89 MARL-A or Vektor-M - MRZ* (Russian Federation)

Note: MRZ* is the new brand-name for BAR radiosonde.

Common Code Table C 3: Instrument type for water temperature profile measurement with fall rate equation coefficients

081 Sippican AXBT(300 m probes) coefficients: 1.52, 0.0

859 Profiling Float, NEMO, no conductivity
860 Profiling Float, NEMO, SBE conductivity sensor
861 Profiling Float, NEMO, FSI conductivity sensor

Change meaning of 900 for: LMP-5 XBT (previously named T-12)

Entries for animal instruments as listed below:
995 Mammal animals
996 Other animals

Common Code Table C 4: Water temperature profile recorder types

08 Sippican MK-10

64 Iridium communications, sampling on up transit
65 Iridium communications, sampling on down transit

Common Code Table C-5: Satellite identifier

172	MTSAT-2
257	GOES 13
258	GOES 14
259	GOES 15
283	CORIOLIS
785	AURA

In Common Table C-12:

Add the following 2 new sub-centres to existing Common Code Table C-12 for originating center number 254 (EUMETSAT):

140	Lannion, France
150	Svalbard, Norway

Add the following 2 new sub-centres to existing Common Code Table C-12 for originating center number 7 (U.S/NCEP):

15	North American Regional Reanalysis Project
16	Space Environment Center

Rename the following entry in Common Code Table C-12, in order to reflect the changed name of the underlying sub-center:

6 Ocean Prediction Center

Common Code Table C-13: Data sub-categories of categories defined by entries in BUFR Table A

Add in: 007 Synoptic features
001 Squall Line

Recommendation 5 (CBS-Ext.(06))

AMENDMENTS TO THE *MANUAL ON CODES*, VOLUME I.1.

THE COMMISSION FOR BASIC SYSTEMS,

Noting:

(1) The report of the Meeting of the ET on Data Representation and Codes (Muscat, Oman, 5-8 December 2005),

(2) The report of the Joint Meeting of the ET on Data Representation and Codes and CT on Migration to Table Driven Code Forms (ICAO, Montreal, 8-12 May 2006),

(3) The report of the ICT on ISS (Geneva, 18-22 September 2006),

Considering the requirement:

(1) For amendments to aeronautical codes resulting from corresponding changes in ICAO Amendment 74 of Annex 3 – *Meteorological Service for International Air Navigation*/WMO Technical Regulations [C.3.1],

Recommends that the following amendments be adopted for use as from 5 November 2008:

(1) Amendments to FM 15-XIII METAR, FM 16-XIII SPECI and FM 51-XIII TAF, defined in the Annex to this recommendation;

Requests the Secretary-General to arrange for the inclusion of these amendments in Volume I.1 of the *Manual on Codes*.

Annex to Recommendation 5 (CBS-Ext.(06))

AMENDMENTS TO FM 15–XIII METAR, FM 16-XIII SPECI AND FM 51-XIII TAF

FM 15–XIII Ext. METAR **Aerodrome routine meteorological report (with or without trend forecast)**

FM 16-XIII Ext. SPECI **Aerodrome special meteorological report (with or without trend forecast)**

CODE FORM:

$$\left.\begin{matrix}\textbf{METAR}\\ \textbf{or}\\ \textbf{SPECI}\end{matrix}\right\}\quad \textbf{COR}\quad \mathrm{CCCC}\quad \mathrm{YYGGgg}\textbf{Z}\quad \textbf{NIL}\quad \textbf{AUTO}\quad \mathrm{dddff}\textbf{G}\mathrm{f_mf_m}\left\{\begin{matrix}\textbf{KMH}\\ \text{or}\\ \textbf{KT}\ \text{or}\\ \textbf{MPS}\end{matrix}\right\}\quad \mathrm{d_nd_nd_n}\textbf{V}\mathrm{d_xd_xd_x}$$

$$\left\{\begin{matrix}\mathrm{VVVV}\\ \text{or}\\ \mathrm{VVVV}\textbf{NDV}\\ \text{or}\\ \textbf{CAVOK}\end{matrix}\right.\quad \mathrm{V_NV_NV_NV_ND_v}\quad \left\{\begin{matrix}\textbf{R}\mathrm{D_RD_R/V_RV_RV_RV_Ri}\\ \text{or}\\ \textbf{R}\mathrm{D_RD_R/V_RV_RV_RV_R}\textbf{V}\mathrm{V_RV_RV_RV_Ri}\end{matrix}\right\}\quad \mathrm{w'w'}\quad \left\{\begin{matrix}\mathrm{N_sN_sN_sh_sh_sh_s}\\ \text{or}\\ \textbf{VV}\mathrm{h_sh_sh_s}\\ \text{or}\\ \textbf{NSC}\\ \text{or}\\ \textbf{NCD}\end{matrix}\right\}$$

$T'T/T'_dT_d$ **Q**$P_HP_HP_HP_H$ **RE**w'w' { **WS R**D_RD_R or **WS ALL RWY** } (**W**T_ST_S**/S**S') (**R**$D_RD_RE_RC_Re_Re_RB_RB_R$)

{ (TTTTT or NOSIG) } TTGGgg dddff**G**f_mf_m { **KMH** or **KT** or **MPS** } { VVVV or **CAV OK** } { w'w' or **NSW** } { $N_SN_SN_Sh_Sh_Sh_S$ or **VV**$h_Sh_Sh_S$ or **NSC** }

(RMK ……………)

Changes to FM 15 and FM 16 Regulations:

Delete second sentence of Note of 15.6:

15.6 **Groups** VVVV VVVV**NDV** $V_NV_NV_NV_ND_v$

N O T E: The coding of visibility is based on the use of the metre and kilometre, in accordance with the units specified in ICAO Annex 5. ~~However, some Members in Region IV use statute miles and fractions thereof in accordance with national coding procedures as indicated in Volume II of this Manual.~~

In 15.6.2, insert after "50% of the prevailing visibility": and less than 5 000 metres

15.6.2 Directional variation in visibility $V_NV_NV_NV_ND_v$

When the horizontal visibility is not the same in different directions and when the minimum visibility is different from the prevailing visibility, and less than 1 500 metres, or less than 50% of the prevailing visibility and less than 5 000 metres, the group $V_NV_NV_NV_ND_v$ shall also be used to report the minimum visibility and its general direction in relation to the aerodrome indicated by reference to one of the eight points of the compass. If the minimum visibility is observed in more than one direction, the D_v shall represent the most operationally significant direction.

Delete last sentence in Note of 15.7.

~~…~~

15.7 **Groups** $RD_RD_R/V_RV_RV_RV_Ri$ or $RD_RD_R/V_RV_RV_RV_R\mathbf{V}V_RV_RV_RV_Ri$

N O T E: The coding of runway visual range is based on the use of the metre in accordance with the unit specified in ICAO Annex 5. ~~However, some Members in Region IV use feet in accordance with national coding procedures as indicated in Volume II of this Manual.~~

Delete third sentence of 15.7.3 to read:

15.7.3 **Runway designator** $D_RD_R/$

The designator of each runway for which runway visual range is reported shall be indicated by D_RD_R. Parallel runways should be distinguished by appending to D_RD_R letters L, C or R indicating the left, central or right parallel runway, respectively. ~~A suitable combination of these letters is used for up to, and including, five parallel runways (i.e. LL, L, C, R, RR).~~ The letter(s) shall be appended to D_RD_R as necessary in accordance with the standard practice for runway designation, as laid down by ICAO in Annex 14 – Aerodromes, Volume I – Aerodrome design and operations, paragraphs 5.2.2.4 and 5.2.2.5.

Add a sentence to ~~18~~15.8.6

~~…~~

15.8.6 If more than one significant weather phenomenon is observed, separate w'w' groups shall be included in the report in accordance with Code table 4678. However, if more than one form of precipitation is observed, the appropriate letter abbreviations shall be combined in a single group with the dominant type of precipitation being reported first. In such a single group, the intensity shall refer to the total precipitation and be reported with one or no indicator as appropriate.

When an automatic observing system is used and when the type of the precipitation cannot be identified by this system, the abbreviation UP shall be used for precipitation. The abbreviation UP may be combined, as necessary, with the following characteristics of present weather: FZ, SH and TS.

~~…~~

Change Note (1) of 15.8.10 as:

15.8.10 The qualifier VC shall be used to indicate the following significant weather phenomena observed in the vicinity of the aerodrome: TS, DS, SS, FG, FC, SH, PO, BLDU, BLSA, BLSN and VA. Regulations referring to the combination of VC and FG are given in Regulation 15.8.17.

NOTES:

(1) Such weather phenomena should be reported with the qualifier VC only when observed ~~within eight kilometres of the aerodrome perimeter but not at the aerodrome~~ between approximately 8 km and 16 km from the aerodrome reference point.

(2) See Regulation 15.8.7.

*Delete **SKC** in 15.9:*

15.9 **Group** $\left\{ \begin{array}{l} N_S N_S N_s h_s h_s h_s \\ \text{or} \\ \mathbf{VV} h_s h_s h_s \\ \cancel{\text{or SKC}} \\ \text{or } \mathbf{NSC} \\ \text{or } \mathbf{NCD} \end{array} \right.$

Change 15.9.1.1 as:

15.9.1 *Cloud amount and cloud height* $N_S N_S N_s h_s h_s h_s$

15.9.1.1 Cloud amount, cloud type and height of cloud base shall be reported to describe the clouds of operational significance, i.e. clouds with the height of base below 1500 meters (5000 ft) or below the highest minimum sector altitude, whichever is greater, or Cumulonimbus or towering Cumulus at any height. The cloud amount $N_S N_S N_s$ shall be reported as few (1 to 2 oktas), scattered (3 to 4 oktas), broken (5 to 7 oktas) or overcast (8 oktas), using the three-letter abbreviations FEW, SCT, BKN and OVC followed, without a space, by the height of the base of the cloud layer (mass) hshshs. ~~If there are no clouds and no restriction on vertical visibility and the abbreviation CAVOK is not appropriate, the abbreviation SKC shall be used. If SKC is reported but visibility is restricted by FG, SS, DS, BR, FU, HZ, DU, IC and SA, vertical visibility shall not be reported.~~ If there are no clouds below 1 500 m (5 000 ft) or below the highest minimum sector altitude, whichever is greater, no Cumulonimbus and no towering cumulus and no restriction on vertical visibility and the abbreviation CAVOK ~~and SKC are~~is not appropriate, then the abbreviation NSC shall be used. When an automatic observing system is used and no clouds are detected by that system, the abbreviation NCD shall be used.

~~…~~

Modify 15.9.1.5 as:

“The height of cloud base shall be reported in steps of 30 m (100 ft) up to 3 000 m (10 000 ft). Any observed value which does not fit the reporting scale in use shall be rounded down to the nearest lower step in the scale.”

Change 15.9.1.6 as:

15.9.1.6 ~~At mountain stations, when the cloud base is below station level, the cloud group shall read~~

~~NSNsNs///.~~When cumulonimbus clouds or towering cumulus clouds are detected by the automatic observing system and the cloud amount and the height of cloud base cannot be observed, the cloud amount and the height of cloud base should be replaced by “//////”

Add after “Cumulonimbus” in (b) of 15.10:

~~…~~

15.10 **Code word CAVOK**

The code word **CAVOK** shall be included in place of the groups under Regulations 15.6, 15.8 and 15.9, when the following conditions occur simultaneously at the time of observation:

(a) Visibility: 10 km or more;
(b) No cloud below 1 500 metres (5 000 ft) or below the highest minimum sector altitude, whichever is greater, and no Cumulonimbus and no towering cumulus;
(c) No significant weather phenomena (see Code table 4678).

N O T E: Highest minimum sector altitude is defined in ICAO PANS-OPS, Part 1 - Definitions, as the lowest altitude which may be used under emergency conditions which will provide a minimum clearance of 300 metres (1 000 ft) above all objects located in an area contained within a sector of a circle of 46 km (25 nautical miles) radius centred on a radio aid to navigation.

~~…~~

Keep only the first sentence of Note (2) of 15.12.2:

15.12.2 If the value of QNH is less than 1000 hPa, it shall be preceded by 0; for example, QNH 995.6 shall be reported as Q0995.

NOTES:

(1) When the first digit following the letter indicator Q is either 0 or 1, the QNH value is reported in the unit hectopascal (hPa).
(2) The unit prescribed by ICAO Annex 5 for pressure is the hectopascal. ~~However, if, by national decision and in accordance with requirements established by the authorities concerned, inches of mercury are used as the unit for QNH, the group shall be preceded by the letter A (instead of Q), followed by the value in inches, tenths and hundredths of inch, but without the decimal point. For example, QNH 29.1 in. shall by given as A2991, QNH 30.27 in. shall be given as A3027. When the QNH value is reported in the unit of inches of mercury, the first digit following the letter indicator A is either 2 or 3.~~

Change 15.13 as:

15.13 **Supplementary information – groups**

WS R~~WY~~D_RD_R

REw'w' or $(\mathbf{W}T_ST_S/\mathbf{S}S')$ $(\mathbf{R}D_RD_RE_RC_Re_Re_RB_RB_R)$

WS ALL RWY

Add a sentence to 15.13.2.1:

15.13.2.1 Up to three groups of information on recent weather shall be given by the indicator letters RE followed, without a space, by the appropriate abbreviations, in accordance with Regulation 15.8 (but no intensity of the recent weather phenomena shall be indicated) if the following weather phenomena were observed during the period since the last routine report, or last hour, whichever is shorter, but not at the time of observation:

- Freezing precipitation;
- Moderate or heavy drizzle, rain or snow;
- Moderate or heavy: ice pellets, hail, small hail and/or snow pellets;
- Blowing snow;
- Sandstorm or duststorm;
- Thunderstorm;
- Funnel cloud(s) (tornado or water-spout);
- Volcanic ash.

When an automatic observing system is used and when the type of the precipitation cannot be identified by this system, the abbreviation REUP shall be used for recent precipitation. It may be combined with the characteristics of the present weather in accordance with Regulation 15.8.6.

~~…~~

Change 15.13.3 as:

WS R~~WY~~D_RD_R

15.13.3 **Wind shear in the lower layers** or

WS ALL RWY

Replace in the paragraph **WS RWY**D_RD_R *by* **WS R**~~WY~~D_RD_R.

Change 15.3.6 and 15.13.6.1 and add a Note:

~~…~~

15.13.6 State of the runway (~~RRRR~~**R**$D_RD_RE_RC_Re_Re_RB_RB_R$)

15.13.6.1 Subject to regional air navigation agreement, information on the state of the runway provided by the appropriate airport authority shall be included. ~~The runway designator RRRR shall be reported in accordance with the relevant ICAO regional Air Navigation Plan.~~The runway deposits E_R, the extent of runway contamination C_R, the depth of deposit e_Re_R and the friction coefficient/braking action BRBR shall be indicated in accordance with code tables 0919, 0519, 1079 and 0366, respectively. The state of the runway group shall be replaced by the abbreviation SNOCLO when the aerodrome is closed due to extreme deposit of snow. If contaminations on a single runway or on all runways at an aerodrome have ceased to exist, this should be reported by replacing the last six digits of the group by "CLRD//".

Note.- Concerning runway designator D_RD_R, Regulation 15.7.3 applies. Additional code figures 88 and 99 are reported in accordance with the European Air Navigation Plan, FASID, Part III-AOP, Attachment A.

Change 15.14.12 as:

~~…~~

15.14.12 Inclusion of significant forecast weather w'w', using the appropriate abbreviations in accordance with Regulation 15.8, shall be restricted to indicate:

(1) the onset, cessation or change in intensity of the following weather phenomena:
- Freezing precipitation;
- Moderate or heavy precipitation (including showers);
- Duststorm;
- Sandstorm;
- Thunderstorm (with precipitation)

(2) the onset or cessation of the following weather phenomena:
- Freezing fog;
- Ice crystals;
- Low drifting dust, sand or snow;
- Blowing dust, sand or snow;
- Thunderstorm without precipitation;
- Squall;
- Funnel cloud (tornado or waterspout).

Modify 15.14.14 as

15.14.14 ~~To indicate a change to clear sky, the abbreviation SKC (sky clear) shall replace the groups N_1NSNshshsh, or VVhshshs.~~When no cloud below 1 500 metres (5 000 ft) or the highest minimum sector altitude, whichever is greater, and no Cumulonimbus and no towering cumulus are forecast, and **CAVOK** ~~or SKB are~~is not appropriate, the abbreviation NSC shall be used.

FM 51-XIII Ext. TAF Aerodrome forecast

CODE FORM:

$$\left\{\begin{array}{l}\textbf{TAF AMD}\text{ or}\\ \textbf{TAF COR}\text{ or}\\ \textbf{TAF}\end{array}\right\}\ \text{CCCC}\ \ \text{YYGGgg}\mathbf{Z}\ \left\{\begin{array}{l}\textbf{NIL}\\ \text{or}\\ Y_1Y_1G_1G_1\mathbf{/}Y_2Y_2G_2G_2\end{array}\right.\ \left\{\begin{array}{l}\text{dddff}\mathbf{G}f_mf_m\\ \text{or}\\ \textbf{CNL}\end{array}\right.\ \left\{\begin{array}{l}\textbf{KMH}\\ \text{or }\textbf{KT}\\ \text{or }\textbf{MPS}\end{array}\right\}$$

$$\left\{\begin{array}{l}\text{VVVV w'w'}\ \left\{\begin{array}{l}N_SN_SN_Sh_Sh_Sh_S\\ \text{or VV}\mathbf{h_Sh_Sh_S}\\ \text{or }\textbf{NSC}\end{array}\right\}\\ \text{or}\\ \textbf{CAVOK}\end{array}\right\}$$

$$(\mathbf{TX}T_FT_F/Y_FY_FG_FG_F\mathbf{Z}\ \ \mathbf{TN}T_FT_F/Y_FY_FG_FG_F\mathbf{Z})$$

$$\left\{\begin{array}{l}\left\{\begin{array}{l}\textbf{PROB}\ C_2C_2\text{ or}\\ \textbf{PROB}\ C_2C_2\text{ TTTTT}\\ \text{or TTTTT}\end{array}\right\}\text{YYGG}/Y_eY_eG_eG_e\\ \text{or}\\ \text{TTYYGGgg}\end{array}\right\}\ \text{dddff}\mathbf{G}f_mf_m\ \left\{\begin{array}{l}\textbf{KMH}\\ \text{or }\textbf{KT}\\ \text{or }\textbf{MPS}\end{array}\right\}\ \left\{\begin{array}{l}\text{VVVV}\ \left\{\begin{array}{l}\text{w'w'}\\ \text{or}\\ \textbf{NSW}\end{array}\right\}\left\{\begin{array}{l}N_SN_SN_Sh_Sh_Sh_S\\ \text{or }\mathbf{VV}h_Sh_Sh_S\\ \text{or }\textbf{NSC}\end{array}\right\}\\ \text{or}\\ \textbf{CAVOK}\end{array}\right.$$

CHANGES to REGULATIONS:

51.1.4 The forecast shall cover the period $Y_1Y_1G_1G_1$ to $Y_2Y_2G_2G_2$. The forecast period may be divided into two or more self-contained parts by the use of the time indicator group TTYYGGgg in the form of FMYYGGgg. A complete description of the forecast prevailing conditions shall be given at the beginning of the forecast or the self-contained parts designated by FMYYGGgg. If any element is expected to change significantly during the forecast period or a self-contained part thereof, one or more sets of change groups TTTTT YYGG/$Y_eY_eG_eG_e$ shall be added after the complete description of the conditions prevailing before the change. Each change group shall be followed by the modified elements subject to Regulation 51.1.5.

NOTES:

(1) The governing criteria for inclusion of change groups are specified in publication WMO-No. 49 – Technical Regulations [C.3.1].

(2) See Regulation **51.8.1.**

51.1.5 The group w'w' and/or the group $N_SN_SN_Sh_Sh_Sh_S$, or **VV**$h_Sh_Sh_S$ shall be omitted if the corresponding element(s) is (are) expected to be absent or not significant. After change groups TTTTT YYGG/$Y_eY_eG_eG_e$, elements shall be omitted if they are not expected to differ significantly from the preceding values they possessed in the coded forecast (see Regulations 51.5.2, 51.6.1.7 and 51.6.3). However, in case of significant change of the clouds, all cloud groups, including any significant layer(s) or masses not expected to change, shall be given

…

Delete second sentence of note in 51.4:

51.4 **Group VVVV**

NOTE: The coding of visibility is based on the use of the metre and kilometre, in accordance with the units specified in ICAO Annex *5.* . ~~However, in Region VI, statute miles and fractions thereof are used in accordance with national coding procedures as indicated in Volume II of this Manual.~~

…

Change 51.5.1 to read:

51.5.1 Inclusion of significant forecast weather w'w', using the appropriate abbreviations in accordance with Regulation 15.8, shall be restricted to indicate:

(1) the occurrence, cessation or change in intensity of the following weather phenomena:
- Freezing precipitation;
- Moderate or heavy precipitation (including showers);
- Duststorm;
- Sandstorm;
- Thunderstorm (with precipitation);

(2) the occurrence or cessation of the following weather phenomena:
- Ice crystals;
- Freezing fog;
- Low drifting dust, sand or snow;
- Blowing dust, sand or snow;
- Thunderstorm without precipitation;
- Squall;
- Funnel cloud (tornado or waterspout).

…

Change 51.6 as:

$N_SN_SN_Sh_Sh_Sh_S$

or

51.6 **Group VV**$h_Sh_Sh_S$

~~or~~

~~SKC(~~**or NSC**~~)~~

Delete 51.6.1.7:

~~51.6.1.7 When clear sky is forecast, the cloud group shall be replaced by the abbreviation SKC.~~

Modify 51.8 to 51.10.1 as follows:

51.8 **Groups** TTTTT YYGG/ $Y_eY_eG_eG_e$ or TTYYGGgg

51.8.1 These groups shall be used when, during the period $Y_1Y_1G_1G_1$ to $Y_2Y_2G_2G_2$, a change in some or all of the elements forecast is expected to occur at some intermediate time YYGGgg or during the period YYGG to $Y_eY_eG_eG_e$. Such groups shall not be introduced until all the data groups necessary to describe the elements forecast in the period $Y_1Y_1G_1G_1$ to Y_2Y_2 G_2G_2 or YYGGgg have been given.

NOTES:
(1) If the end of the forecast period is midnight, Y_eY_e should be the date before midnight and G_eG_e should be indicated as 24.
(2) See Note (1) to Regulation 51.1.4.

51.8.2 The time indicator group TTYYGGgg in the form of FMYYGGgg (from YYGGgg) shall be used to indicate the beginning of a self-contained part of the forecast indicated by YYGGgg. When the group FMYYGGgg is used, all forecast conditions given before the group FMYYGGgg are superseded by the conditions indicated after the group.

51.8.3 The change groups TTTTT YYGG/ $Y_eY_eG_eG_e$ in the form of BECMG YYGG/ $Y_eY_eG_eG_e$ shall indicate a change to forecast meteorological conditions expected to occur at either a regular or irregular rate at an unspecified time within the period YYGG to $Y_eY_eG_eG_e$. The duration of the period YYGG to $Y_eY_eG_eG_e$ shall normally not exceed two hours and in any case shall not exceed four hours. The change groups shall be followed by a description of all the elements for which a change is forecast. When an element is not described in data groups which follow the change groups, the description of this element for the period between $Y_1Y_1G_1G_1$ and Y_2Y_2 G_2G_2 shall be considered to remain valid subject to Regulation 51.1.5.

N O T E : The conditions described after the groups BECMG YYGG/ $Y_eY_eG_eG_e$ are those expected to prevail from $Y_eY_eG_eG_e$ until $Y_2Y_2G_2G_2$, unless a further change is expected, in which case a further set of change groups BECMG YYGG/ $Y_eY_eG_eG_e$ or FMYYGGgg must be used.

51.8.4 The change groups TTTTT YYGG/ $Y_eY_eG_eG_e$ in the form of TEMPO YYGG/ $Y_eY_eG_eG_e$ shall indicate frequent or infrequent temporary fluctuations to forecast meteorological conditions which are expected to last less than one hour in each instance and, in the aggregate cover, less than half of the period indicated by YYGG/ $Y_eY_eG_eG_e$.

NOTES:
(1) If the modified forecast condition is expected to last one hour or more, Regulation 51.8.2 or 51.8.3 applies, i.e. the change groups BECMG YYGG/ $Y_eY_eG_eG_e$ or FMYYGGgg must be used at the beginning and end of the period during which conditions are expected to depart from those forecast prior to YYGG or YYGGgg.
(2) To keep forecasts clear and unambiguous, the use of change indicators should be carefully considered and kept to a minimum. In particular, the overlapping of change periods should be avoided. At any time during the period of validity of the TAF, only one possible variation to the prevailing forecast conditions should normally be indicated. The subdivision of the forecast period by FMYYGGgg should be used to avoid too complex forecasts in cases where many significant changes to weather conditions are expected to occur throughout the forecast period.

51.9 **Groups PROB**C_2C_2 YYGG/ $Y_eY_eG_eG_e$

51.9.1 In order to indicate the probability of occurrence of alternative value(s) of forecast element(s), during a defined period of time, the **PROB**C_2C_2 YYGG/ $Y_eY_eG_eG_e$ shall be placed directly before the alternative value(s). For C_2C_2, only the values 30 and 40 shall be used to indicate the probabilities 30 and 40%, respectively.

N O T E: A probability of less than 30% of actual values deviating from those forecast is not considered to justify the use of the group PROB. When the possibility of an alternative value is 50% or more, this should be indicated by the use of BECMG, TEMPO or FM as appropriate.

51.9.2 A probability statement may also be related to the occurrence of temporary fluctuations. In this case, the group **PROB**C_2C_2 shall be placed immediately before the change group TEMPO and the group YYGG/ $Y_eY_eG_eG_e$ shall be placed after TEMPO (for example PROB30 TEMPO 2922/3001).

51.9.3 The group **PROB**C_2C_2 shall not be used in combination with the change indicator group BECMG or the time indicator group FMYYGGgg.

51.10 **Groups (TX**T_FT_F/$Y_FY_FG_FG_F$**Z TN**T_FT_F/$Y_FY_FG_FG_F$**Z)**

51.10.1 To indicate forecast maximum and minimum temperatures expected to occur at the time indicated by $Y_FY_FG_FG_F$**Z**, the letter indicator **TX** for the maximum forecast temperature and **TN** for the minimum forecast temperature shall precede T_FT_F without a space.

Changes to Specification of symbolic letters:

1. Entry for YY

Delete FM 51 from subparagraph (b)

Add subparagraphs:

(d) On which the forecast was issued (FM 51)

(e) Indicating the date (day) on which part of the forecast commences or a forecast change commences (FM 51)

2. Entry for Y_FY_F

Add paragraph

Valid day of the month (UTC) of the temperature forecast (FM 51)

3. Entry for Y_EY_E

Add paragraph:

Day of month (UTC) of end of forecast change

4. Entry for Y_2Y_2

Add FM51 to the list of code forms.

5. Change D_RD_R to:

“Runway designator reported in accordance with ICAO Annex 14.”
(FM 15, FM 16)

6. Delete $R_R R_R$.

Change in Notes to Code Table 4678

(10) The descriptor SH shall be used only in combination with one or more of the letter abbreviations RA, SN, ~~PL,~~ GS, GR and UP to …..

(11) The descriptor TS, if not used on its own, shall be used only in combination with one or more of the letter abbreviations RA, SN, GS, GR and UP to indicate thunderstorm …….

(12) The descriptor FZ shall be used only in combination with the letter abbreviations FG, DZ, RA and UP for example FZRA.

Recommendation 6 (CBS-Ext.(06))

AMENDMENTS TO THE *MANUAL ON CODES*, VOLUME I.2, PART C, COMMON FEATURES TO BINARY AND ALPHANUMERIC CODES

THE COMMISSION FOR BASIC SYSTEMS,

Noting:

(1) The *Abridged Final Report with Resolutions and Recommendations of the Thirteenth Session of the Commission for Basic Systems* (WMO-No. 985) general summary, paragraph 5.2.73,

(2) The report of the Meeting of the CT on Migration to Table Driven Code Forms (Geneva, 1-4 November 2005),

(3) The report of the Meeting of the ET on Data Representation and Codes (Muscat, Oman, 5-8 December 2005),

(4) The report of the Joint Meeting of the ET on Data Representation and Codes and CT on Migration to Table Driven Code Forms (ICAO, Montreal, 8-12 May 2006),

(5) The report of the ICT on ISS (Geneva, 18-22 September 2006),

Considering the requirements to adapt and update current reporting practices from the Traditional Alphanumeric Codes for TDCF, and to include regional/national practices in the BUFR templates,

Recommends that the following amendments be adopted for operational use as from 7 November 2007:

(1) Addition in the *Manual on Codes*, Volume, I.2, Part C, Common Features to Binary and Alphanumeric Codes, of chapter: “d. Regulations for reporting traditional observations data in Table Driven Code Forms: BUFR or CREX” defined in the Annex to this recommendation;

Requests the Secretary-General to arrange for the inclusion of these amendments in the *Manual on Codes*, but to be kept only in the WMO Web server.

Annex to Recommendation 6 (CBX-Ext.(06))

PART C – COMMON FEATURES TO BINARY AND ALPHANUMERIC CODES
d. Regulations for reporting traditional observations data in Table Driven Code Forms (TDCF): BUFR or CREX

B/C1 – Regulations for reporting SYNOP data in TDCF

ANNEX: Regional regulations for reporting SYNOP data in BUFR/CREX for RA I – RA II – RA III – RA IV – RA VI

B/C5 – Regulations for reporting SYNOP MOBIL data in TDCF

B/C10 – Regulations for reporting SHIP data in TDCF

B/C20 – Regulations for reporting PILOT, PILOT SHIP and PILOT MOBIL data in TDCF

B/C25 – Regulations for reporting TEMP, TEMP SHIP and TEMP MOBIL data in TDCF

ANNEX I: RA IV BUFR template for TEMP, TEMP SHIP and TEMP MOBIL data

ANNEX II: List of parameters for representation of additional information on sounding instrumentation

B/C26 – Regulations for reporting TEMP DROP data in TDCF

B/C30 – Regulations for reporting CLIMAT data in TDCF

B/C32 – Regulations for reporting CLIMAT SHIP data in TDCF

B/C35 – Regulations for reporting CLIMAT TEMP and CLIMAT TEMP SHIP data in TDCF

Regulations for reporting traditional observations data in TDCF

B/C1 – Regulations for reporting SYNOP data in TDCF
B/C5 – Regulations for reporting SYNOP MOBIL data in TDCF
B/C10 – Regulations for reporting SHIP data in TDCF
B/C20 – Regulations for reporting PILOT, PILOT SHIP and PILOT MOBIL data in TDCF
B/C25 – Regulations for reporting TEMP, TEMP SHIP and TEMP MOBIL data in TDCF
B/C26 – Regulations for reporting TEMP DROP data in TDCF
B/C30 – Regulations for reporting CLIMAT data in TDCF
B/C32 – Regulations for reporting CLIMAT SHIP data in TDCF
B/C35 – Regulations for reporting CLIMAT TEMP and CLIMAT TEMP SHIP data in TDCF

General

(i) The regulations for reporting data of traditional observations in BUFR or CREX are intended to provide a link between the *Manual on Codes*, Volume I.1 and Volume II, containing traditional alphanumeric codes (TAC) regulations with detailed description of reporting practices and the Volume I.2, where the code forms FM 94 BUFR and FM 95 CREX are defined.

(ii) A BUFR/CREX template has been developed for each traditional observation that is considered suitable for migration to table driven code forms (TDCF). Templates presented prior the regulations are BUFR templates; if used for CREX, relevant modifications have to be introduced.

(iii) The regulations for reporting data of each traditional observation in TDCF are numbered in the increasing order in compliance with a standard BUFR/CREX template recommended for the data type. For reference, the number of the corresponding TAC regulation is included at the end of the regulation, written in square brackets.

(iv) BUFR/CREX templates defined for traditional observation data contain not only the elements reported in the corresponding TAC, but also other important information. The regulations for reporting traditional observations data in BUFR/CREX address also these additional entries (e.g. horizontal and vertical coordinates of the observation site, position of sensors, significance qualifiers).

(v) With each element introduced within the regulations, the unit and the required precision are specified. If different units are used in BUFR and CREX, the unit in which the element value is reported in CREX is also mentioned. Scaling is expected to be executed by the encoding BUFR or CREX software; in case of manual encoding of a CREX message, however, the scaling shall be included in the reporting procedure.

(vi) If the unit of the element is defined as a flag table, the element values shall be reported in octal representation in CREX.

(vii) Reporting practices primarily refer to the procedures relevant for producing of the data in BUFR or CREX at the observing site. When data are collected in TAC and converted into BUFR or CREX in the centre, the differences in the reporting procedures, if any, are mentioned.

(viii) If regional or national reporting practices require inclusion of additional parameters, the regulations provide guidance for addition of the relevant descriptors.

(ix) A NIL report shall be represented by setting all values to “missing value” except for the identification of the station or observing site and delayed replication factors.

Note: Texts in italic within the regulations indicate that special attention should be given to this aspect of the regulation.

References:

[1] *Manual on Codes*, WMO-No. 306, Volume I.1 and I.2

[2] *Manual on Codes*, WMO-No. 306, Volume II

[3] Final Report, ET DR&C, Kuala Lumpur, 21 – 26 June 2004

[4] Final Report, ET DR&C, Muscat, 5 – 8 December 2005

[5] Guide to Climatological Practices, WMO-No. 100

[6] Technical Regulations, WMO-No. 49

[7] Handbook on CLIMAT and CLIMAT TEMP reporting, WMO/TD No.1188

B/C1 – Regulations for reporting SYNOP data in TDCF

TM 307080 - BUFR template for synoptic reports from fixed land stations suitable for SYNOP data

3 07 080		**Sequence for representation of synoptic reports from a fixed land station suitable for SYNOP data**
	3 01 090	Fixed surface station identification, time, horizontal and vertical coordinates
	3 02 031	Pressure data
	3 02 035	Basic synoptic “instantaneous” data
	3 02 036	Clouds with bases below station level
	3 02 047	Direction of cloud drift
	0 08 002	Vertical significance
	3 02 048	Direction and elevation of cloud
	3 02 037	State of ground, snow depth, ground minimum temperature
	3 02 043	Basic synoptic “period” data
	3 02 044	Evaporation data
	1 01 002	Replicate next descriptor 2 times
	3 02 045	Radiation data (from 1 hour and/or 24 hour period)
	3 02 046	Temperature change

This BUFR template for synoptic reports from fixed land stations further expands as follows:

3 01 090			**Fixed surface station identification, time, horizontal and vertical coordinates**		Unit, scale
	3 01 004	0 01 001	WMO block number	**II**	Numeric, 0
		0 01 002	WMO station number	**iii**	Numeric, 0
		0 01 015	Station or site name		CCITT IA5, 0
		0 02 001	Type of station	**(i_x)**	Code table, 0
	3 01 011	0 04 001	Year		Year, 0
		0 04 002	Month		Month, 0
		0 04 003	Day	**YY**	Day, 0
	3 01 012	0 04 004	Hour	**GG**	Hour, 0
		0 04 005	Minute	**gg**	Minute, 0
	3 01 021	0 05 001	Latitude (high accuracy)		Degree, 5
		0 06 001	Longitude (high accuracy)		Degree, 5
	0 07 030		Height of station ground above mean sea level		m, 1
	0 07 031		Height of barometer above mean sea level		m, 1
3 02 031			**Pressure data**		
	3 02 001	0 10 004	Pressure	**$P_0P_0P_0P_0$**	Pa, –1
		0 10 051	Pressure reduced to mean sea level	**PPPP**	Pa, –1
		0 10 061	3-hour pressure change	**ppp**	Pa, –1
		0 10 063	Characteristic of pressure tendency	**a**	Code table, 0
	0 10 062		24-hour pressure change	**$p_{24}p_{24}p_{24}$**	Pa, –1
	0 07 004		Pressure (standard level)	**a_3**	Pa, –1
	0 10 009		Geopotential height of the standard level	**hhh**	gpm, 0
3 02 035			**Basic synoptic “instantaneous” data**		
			Temperature and humidity data		
	3 02 032	0 07 032	Height of sensor above local ground (for temperature and humidity measurement)		m, 2
		0 12 101	Temperature/dry-bulb temperature(sc.2)	**s_nTTT**	K, 2
		0 12 103	Dew-point temperature (scale 2)	**$s_nT_dT_dT_d$**	K, 2
		0 13 003	Relative humidity		%, 0
			Visibility data		

	3 02 033	0 07 032	Height of sensor above local ground (for visibility measurement)	m, 2
		0 20 001	Horizontal visibility **VV**	m, –1
			Precipitation past 24 hours	
	3 02 034	0 07 032	Height of sensor above local ground (for precipitation measurement)	m, 2
		0 13 023	Total precipitation past 24 hours **$R_{24}R_{24}R_{24}R_{24}$**	kg m^{-2}, 1
	0 07 032		Height of sensor above local ground (set to missing to cancel the previous value)	m, 2
			Cloud data	
	3 02 004	0 20 010	Cloud cover (total) **N**	%, 0
		0 08 002	Vertical significance	Code table, 0
		0 20 011	Cloud amount (of low or middle clouds) **N_h**	Code table, 0
		0 20 013	Height of base of cloud **h**	m, –1
		0 20 012	Cloud type (low clouds C_L) **C_L**	Code table, 0
		0 20 012	Cloud type (middle clouds C_M) **C_M**	Code table, 0
		0 20 012	Cloud type (high clouds C_H) **C_H**	Code table, 0
			Individual cloud layers or masses	
	1 01 000		Delayed replication of 1 descriptor	
	0 31 001		Delayed descriptor replication factor	Numeric, 0
	3 02 005	0 08 002	Vertical significance	Code table, 0
		0 20 011	Cloud amount (N_s) **N_s**	Code table, 0
		0 20 012	Cloud type (C) **C**	Code table, 0
		0 20 013	Height of base of cloud (h_sh_s) **h_sh_s**	m, -1
			Clouds with bases below station level	
3 02 036	1 05 000		Delayed replication of 5 descriptors	
	0 31 001		Delayed descriptor replication factor	Numeric, 0
	0 08 002		Vertical significance	Code table, 0
	0 20 011		Cloud amount **N'**	Code table, 0
	0 20 012		Cloud type **C'**	Code table, 0
	0 20 014		Height of top of cloud **H'H'**	m, -1
	0 20 017		Cloud top description **C_t**	Code table, 0
			Direction of cloud drift gr. **$56D_LD_MD_H$**	
3 02 047	1 02 003		Replicate 2 descriptors 3 times	
	0 08 002		Vertical significance = 7 (low cloud) = 8 (middle cloud) = 9 (high cloud)	Code table, 0
	0 20 054		True direction from which clouds are moving **D_L, D_M, D_H**	Degree true, 0
0 08 002			Vertical significance (set to missing to cancel the previous value)	Code table, 0
			Direction and elevation of cloud gr. **$57CD_ae_C$**	
3 02 048	0 05 021		Bearing or azimuth **D_a**	Degree true, 2
	0 07 021		Elevation angle **e_C**	Degree, 2
	0 20 012		Cloud type **C**	Code table, 0
	0 05 021		Bearing or azimuth (set to missing to cancel the previous value)	Degree true, 2
	0 07 021		Elevation angle (set to missing to cancel the previous value)	Degree, 2
			State of ground, snow depth, ground minimum temperature	
3 02 037	0 20 062		State of ground (with or without snow) **E** or **E'**	Code table, 0
	0 13 013		Total snow depth **sss**	m, 2
	0 12 113		Ground minimum temperature (scale2), past 12 hours **$s_nT_gT_g$**	K, 2
3 02 043			**Basic synoptic "period" data**	

			Present and past weather	
	3 02 038	0 20 003	Present weather **ww**	Code table, 0
		0 04 024	Time period in hours	Hour, 0
		0 20 004	Past weather (1) $\mathbf{W_1}$	Code table, 0
		0 20 005	Past weather (2) $\mathbf{W_2}$	Code table, 0
			Sunshine data (from 1 hour and 24 hour period)	
	1 01 002		Replicate 1 descriptors 2 times	
	3 02 039	0 04 024	Time period in hours	Hour, 0
		0 14 031	Total sunshine **SS** and **SSS**	Minute, 0
			Precipitation measurement	
	3 02 040	0 07 032	Height of sensor above local ground (for precipitation measurement)	m, 2
		1 02 002	Replicate next 2 descriptors 2 times	
		0 04 024	Time period in hours $\mathbf{t_R}$	Hour, 0
		0 13 011	Total precipitation / total water equivalent of snow **RRR**	kg m^{-2}, 1
			Extreme temperature data	
	3 02 041	0 07 032	Height of sensor above local ground (for temperature measurement)	m, 2
		0 04 024	Time period or displacement	Hour, 0
		0 04 024	Time period or displacement (see Notes 1 and 2)	Hour, 0
		0 12 111	Maximum temperature (scale 2) at height and over period specified $\mathbf{s_nT_xT_xT_x}$	K, 2
		0 04 024	Time period or displacement	Hour, 0
		0 04 024	Time period or displacement (see Note 2)	Hour, 0
		0 12 112	Minimum temperature (scale 2) at height and over period specified $\mathbf{s_nT_nT_nT_n}$	K, 2
			Wind data	
	3 02 042	0 07 032	Height of sensor above local ground (for wind measurement)	m, 2
		0 02 002	Type of instrumentation for wind measurement $\mathbf{i_w}$	Flag table, 0
		0 08 021	Time significance (= 2 (time averaged))	Code table, 0
		0 04 025	Time period (= - 10 minutes, or number of minutes after a significant change of wind)	Minute, 0
		0 11 001	Wind direction **dd**	Degree true, 0
		0 11 002	Wind speed **ff**	m s^{-1}, 1
		0 08 021	Time significance (= missing value)	Code table, 0
		1 03 002	Replicate next 3 descriptors 2 times	
		0 04 025	Time period in minutes	Minute, 0
		0 11 043	Maximum wind gust direction	Degree true, 0
		0 11 041	Maximum wind gust speed 910$\mathbf{f_mf_m}$, 911$\mathbf{f_xf_x}$	m s^{-1}, 1
	0 07 032		Height of sensor above local ground (set to missing to cancel the previous value)	m, 2
			Evaporation data	
3 02 044	0 04 024		Time period in hours	Hour, 0
	0 02 004		Type of instrument for evaporation or crop type for evapotranspiration $\mathbf{i_E}$	Code table, 0
	0 13 033		Evaporation /evapotranspiration **EEE**	kg m^{-2}, 1
			Radiation data (from 1 hour and 24 hour period)	
1 01 002			Replicate next descriptor 2 times	
3 02 045	0 04 024		Time period in hours	Hour, 0
	0 14 002		Long-wave radiation, integrated over period specified 553SS 4**FFFF** or 553SS 5**FFFF,** 55SSS 4$\mathbf{F_{24}F_{24}F_{24}F_{24}}$ or 55SSS 5$\mathbf{F_{24}F_{24}F_{24}F_{24}}$	J m^{-2}, -3

	0 14 004		Short-wave radiation, integrated over period specified 553SS 6**FFFF,** 55SSS 6$\mathbf{F_{24}F_{24}F_{24}F_{24}}$	J m^{-2}, -3
	0 14 016		Net radiation, integrated over period specified 553SS 0**FFFF** or 553SS 1**FFFF,** 55SSS 0$\mathbf{F_{24}F_{24}F_{24}F_{24}}$ or 55SSS 1$\mathbf{F_{24}F_{24}F_{24}F_{24}}$	J m^{-2}, -4
	0 14 028		Global solar radiation (high accuracy), integrated over period specified 553SS 2**FFFF,** 55SSS 2$\mathbf{F_{24}F_{24}F_{24}F_{24}}$	J m^{-2}, -2
	0 14 029		Diffuse solar radiation (high accuracy), integrated over period specified 553SS 3**FFFF,** 55SSS 3$\mathbf{F_{24}F_{24}F_{24}F_{24}}$	J m^{-2}, -2
	0 14 030		Direct solar radiation (high accuracy), integrated over period specified 55408 4**FFFF,** 55508 5$\mathbf{F_{24}F_{24}F_{24}F_{24}}$	J m^{-2}, -2
			Temperature change group $\mathbf{54g_0s_nd_T}$	
3 02 046	0 04 024		Time period or displacement	Hour, 0
	0 04 024		Time period or displacement (see Note 3)	Hour, 0
	0 12 049		Temperature change over period specified $\mathbf{s_nd_T}$	K, 0

Notes:

1) Within RA-IV, the maximum temperature at 1200 UTC is reported for the previous calendar day (i.e. the ending time of the period is not equal to the nominal time of the report). To construct the required time range, descriptor 004024 has to be included two times. If the period ends at the nominal time of the report, value of the second 004024 shall be set to 0.

2) Within RA-III, the maximum day-time temperature and the minimum night-time temperature is reported (i.e. the ending time of the period may not be equal to the nominal time of the report). To construct the required time range, descriptor 004024 has to be included two times. If the period ends at the nominal time of the report, value of the second 004024 shall be set to 0.

3) To construct the required time range, descriptor 004024 has to be included two times.

Regulations:

B/C 1.1 Section 1 of BUFR or CREX
B/C 1.2 Fixed station identification, time, horizontal and vertical coordinates
B/C 1.3 Pressure data
B/C 1.4 Basic synoptic “instantaneous” data
B/C 1.4.1 Temperature and humidity data
B/C 1.4.2 Visibility data
B/C 1.4.3 Precipitation past 24 hours
B/C 1.4.4 Cloud data
B/C 1.4.5 Individual cloud layers or masses
B/C 1.5 Clouds with bases below station level
B/C 1.6 Direction of cloud drift
B/C 1.7 Direction and elevation of cloud
B/C 1.8 State of ground, snow depth, ground minimum temperature
B/C 1.9 “Instantaneous” data required by regional or national reporting practices
B/C 1.10 Basic synoptic “period” data
B/C 1.10.1 Present and past weather
B/C 1.10.2 Sunshine data
B/C 1.10.3 Precipitation measurement
B/C 1.10.4 Extreme temperature data
B/C 1.10.5 Wind data
B/C 1.11 Evaporation data
B/C 1.12 Radiation data
B/C 1.13 Temperature change
B/C 1.14 “Period” data required by regional or national reporting practices

B/C 1.1 Section 1 of BUFR or CREX

B/C 1.1.1 Entries required in Section 1 of BUFR

The following entries shall be included in BUFR Section 1:

- BUFR master table,
- identification of originating/generating centre,
- identification of originating/generating sub-centre,
- update sequence number,
- identification of inclusion of optional section,
- data category (= 000 for SYNOP data),
- international data sub-category [(1), (2)],
- local data subcategory,
- version number of master table,
- version number of local tables,
- year (year of the century up to BUFR edition 3),
- month (standard time),
- day (standard time = YY in the abbreviated telecommunication header for SYNOP data),
- hour (standard time = GG in the abbreviated telecommunication header for SYNOP data),
- minute (standard time = 00 for SYNOP data).

Notes:

(1) Inclusion of this entry is required starting with BUFR edition 4.

(2) If required, the international data sub-category shall be included for SYNOP data as
= 002 at main synoptic times 00, 06, 12, 18 UTC,
= 001 at intermediate synoptic times 03, 09, 15, 21 UTC,
= 000 at observation times 01, 02, 04, 05, 07, 08, 10, 11, 13, 14, 16, 17, 19, 20, 22 and 23 UTC.

B/C 1.1.2 Entries required in Section 1 of CREX

The following entries shall be included in CREX Section 1:

- CREX master table,
- CREX edition number,
- CREX table version number,
- version number of BUFR master table [(1)],
- version number of local tables [(1)],
- data category (= 000 for SYNOP data),
- international data sub-category [(1), (2)],
- identification of originating/generating centre [(1)],
- identification of originating/generating sub-centre [(1)],
- update sequence number [(1)],
- number of subsets [(1)],
- year (standard time) [(1)],
- month (standard time) [(1)],
- day (standard time = YY in the abbreviated telecommunication header for SYNOP data) [(1)],
- hour (standard time = GG in the abbreviated telecommunication header for SYNOP data) [(1)],
- minute (standard time = 00 for SYNOP data) [(1)].

Notes:

(1) Inclusion of these entries is required starting with CREX edition 2.

(2) If inclusion of international data sub-category is required, Note (2) under B/C 1.1.1 applies.

B/C 1.2 Fixed station identification, time, horizontal and vertical coordinates <3 01 090>

B/C 1.2.1 Fixed station identification

WMO block number station (0 01 001) and WMO station number (0 01 002) shall be always reported as a non-missing value.

Station or site name (0 01 015) shall be reported as published in WMO-No. 9, Volume A, Observing Stations, provided that the station name does not exceed 20 characters. A shortened version of the name shall be reported otherwise.

Type of station (0 02 001) shall be reported to indicate the type of the station operation (manned, automatic or hybrid).

Note:

(1) If a station operates as a manned station for a part of the day and as an automatic station for the rest of the day, code figure 2 (Hybrid) may be used in all reports. It is preferable, however, to use code figure 1 (Manned) in reports produced under the supervision of an observer, and a code figure 0 (Automatic) in reports produced while the station operates in the automatic mode.

B/C 1.2.2 Time of observation

Year (0 04 001), month (0 04 002), day (0 04 003), hour (0 04 004) and minute (0 04 005) of the actual time of observation shall be reported.

Note:

(1) The actual time of observation shall be the time at which the barometer is read. [12.1.6]

B/C 1.2.2.1

If the actual time of observation differs by 10 minutes or less from the standard time reported in Section 1, the standard time may be reported instead of the actual time of observation. [12.2.8]

B/C 1.2.3 Horizontal and vertical coordinates

Latitude (0 05 001) and longitude (0 06 001) of the station shall be reported in degrees with precision in 10^{-5} of a degree.

Height of station ground above mean sea level (0 07 030) and height of barometer above mean sea level (0 07 031) shall be reported in meters with precision in tenths of a meter.

B/C 1.3 Pressure data <3 02 031>

B/C 1.3.1 Pressure at the station level

Pressure at the station level (0 10 004), i.e. at the level defined by 0 07 031 (height of barometer above mean sea level), shall be reported in pascals (with precision in tens of a pascal).

B/C 1.3.1.1

The station pressure shall be included in reports for global exchange from land stations, together with either the mean sea level pressure or, in accordance with Regulation B/C 1.3.5.1, with the geopotential height of a standard pressure level. [12.2.4]

Note:

(1) Inclusion of the station pressure at other times is left to the decision of individual Members.

B/C 1.3.2 Pressure reduced to mean sea level

Pressure reduced to mean sea level (0 10 051) shall be reported in pascals (with precision in tens of a pascal).

B/C 1.3.2.1

Whenever air pressure at mean sea level can be computed with reasonable accuracy, this pressure shall be reported. [12.2.3.4.1]

Notes:

(1) For a station situated in a region of normal synoptic network density, the pressure at mean sea level is considered not to be computed with reasonable accuracy when it introduces a deformation into the analysis of the horizontal pressure field, which is purely local and recurring.

(2) For a station lying in a data-sparse area of the synoptic network, reasonable accuracy will be obtained when using a reduction method, which has proved to be satisfactory in a region of normal network density and under similar geographic conditions.

B/C 1.3.3 Three-hour pressure change and characteristic of pressure tendency

Amount of pressure change at station level, during the three hours preceding the time of observation (0 10 061), either positive, zero *or negative*, shall be reported in pascals (with precision in tens of a pascal).

B/C 1.3.3.1

Unless specified otherwise by regional decision, pressure tendency shall be included whenever the three-hourly pressure tendency is available. [12.2.3.5.1]

B/C 1.3.3.2

The characteristic of pressure tendency (Code table 0 10 063) over the past three hours shall, whenever possible, be determined on the basis of pressure samples at equi-spaced intervals not exceeding one hour. [12.2.3.5.2]

Note:

(1) Algorithms for selecting the appropriate code figure are included in publication WMO–No.8, Guide to Meteorological Instruments and Methods of Observation.

B/C 1.3.3.3

Where it is not possible to apply the algorithms specified in Regulation B/C 1.3.3.2 in reports from automatic weather stations, the characteristic of pressure tendency shall be reported as 2 when the tendency is positive, as 7 when the tendency is negative, and as 4 when the atmospheric pressure is the same as three hours before. [12.2.3.5.3]

B/C 1.3.4 24-hour pressure change

If specified by regional decision, amount of surface pressure change at station level, during 24 hours preceding the time of observation (0 10 062), either positive, zero or negative, shall be reported in pascals (with precision in tens of a pascal). [12.4.7.1.2(k), (l)]

B/C 1.3.5 Geopotential height of the standard level

Geopotential height of the standard level (0 10 009) shall be reported in geopotential meters. The standard isobaric level is specified by the preceding entry Pressure (0 07 004).

B/C 1.3.5.1

By regional decision, a high-level station, which cannot give pressure at mean sea level to a satisfactory degree of accuracy, shall report both the station-level pressure and the geopotential height of an agreed standard isobaric surface. [12.2.3.4.2]

B/C 1.4 Basic synoptic “instantaneous” data <3 02 035>

B/C 1.4.1 Temperature and humidity data <3 02 032>

B/C 1.4.1.1 Height of sensor above local ground

Height of sensor above local ground (0 07 032) for temperature and humidity measurement shall be reported in meters (with precision in hundredths of a meter).

This datum represents the actual height of temperature and humidity sensors above ground at the point where the sensors are located.

B/C 1.4.1.2 Dry-bulb air temperature

Dry-bulb air temperature (0 12 101) shall be reported in degrees Kelvin (with precision in hundredths of a degree Kelvin); if produced in CREX, in degrees Celsius (with precision in hundredths of a degree Celsius)

Notes:

(1) Temperature data shall be reported with precision in hundredths of a degree even if they are measured with the accuracy in tenths of a degree. This requirement is based on the fact that conversion from the Kelvin to the Celsius scale has often resulted into distortion of the data values.

(2) Temperature t (in degrees Celsius) shall be converted into temperature T (in degrees Kelvin) using equation: $T = t + 273.15$.

B/C 1.4.1.2.1

When the data are not available as a result of a temporary instrument failure, this quality shall be included as a missing value. [12.2.3.2]

B/C 1.4.1.3 Dew-point temperature

Dew-point temperature (0 12 103) shall be reported in degrees Kelvin (with precision in hundredths of a degree Kelvin); if produced in CREX, in degrees Celsius (with precision in hundredths of a degree Celsius).

Note:

(1) Notes (1) and (2) under Regulation B/C 1.4.1.2 shall apply.

B/C 1.4.1.3.1

When the data are not available as a result of a temporary instrument failure, this quality shall be included as a missing value. [12.2.3.3.2]

B/C 1.4.1.4 Relative humidity

Relative humidity (0 13 003) shall be reported in units of a percent.

B/C 1.4.1.4.1

Both dew point temperature and relative humidity shall be reported when available.

B/C 1.4.2 Visibility data <3 02 033>

B/C 1.4.2.1 Height of sensor above local ground

Height of sensor above local ground (0 07 032) for visibility measurement shall be reported in meters (with precision in hundredths of a meter).
This datum represents the actual height of visibility sensors above ground at the point where the sensors are located. If visibility is estimated by a human observer, average height of observer's eyes above station ground shall be reported.

B/C 1.4.2.2 Horizontal visibility

Horizontal visibility (0 20 001) at surface shall be reported in meters (with precision in tens of a meter).

B/C 1.4.2.2.1

When the horizontal visibility is not the same in different directions, the shortest distance shall be given for visibility. [12.2.1.3.1]

B/C 1.4.3 Precipitation past 24 hours <3 02 034>

B/C 1.4.3.1 Height of sensor above local ground

Height of sensor above local ground (0 07 032) for precipitation measurement shall be reported in meters (with precision in hundredths of a meter).

This datum represents the actual height of the rain gauge rim above ground at the point where the rain gauge is located.

B/C 1.4.3.2 Total amount of precipitation during the 24-hour period

Total amount of precipitation during the 24-hour period ending at the time of observation (0 13 023) shall be reported in kilograms per square meter (with precision in tenths of a kilogram per square meter). [12.4.9]

B/C 1.4.3.2.1

The precipitation over the past 24 hours shall be included (not missing) at least once a day at one appropriate time of the main standard times (0000, 0600, 1200, 1800 UTC). [12.4.1]

B/C 1.4.3.2.2

Precipitation, when it can be and has to be reported, shall be reported as 0.0 kgm^{-2} if no precipitation were observed during the referenced period. [12.2.5.4]

B/C 1.4.3.2.3

Trace shall be reported as “- 0.1 kgm^{-2} “.

B/C 1.4.4 Cloud data <3 02 004>

B/C 1.4.4.1 Total cloud cover

Total cloud cover (0 20 010) shall embrace the total fraction of the celestial dome covered by clouds irrespective of their genus. It shall be reported in *units of a percent*.

Note:

(1) Total cloud cover shall be reported as 113 when sky is obscured by fog and/or other meteorological phenomena.

B/C 1.4.4.1.1

Total cloud cover shall be reported as actually seen by the observer during the observation. [12.2.2.2.1]

B/C 1.4.4.1.2

Altocumulus perlucidus or Stratocumulus perlucidus (“mackerel sky”) shall be reported *as 99% or less* (unless overlying clouds appear to cover the whole sky) since breaks are always present in this cloud form even if it extends over the whole celestial dome. [12.2.2.2.2]

B/C 1.4.4.1.3

Total cloud cover shall be reported as zero when blue sky or stars are seen through existing fog or other analogous phenomena without any trace of cloud being seen. [12.2.2.2.3]

B/C 1.4.4.1.4

When clouds are observed through fog or analogous phenomena, their amount shall be evaluated and reported as if these phenomena were non-existent. [12.2.2.2.4]

B/C 1.4.4.1.5

Total cloud cover shall not include the amount resulting from rapidly dissipating condensation trails. [12.2.2.2.5]

B/C 1.4.4.1.6

Persistent condensation trails and cloud masses which have obviously developed from condensation trails shall be reported as cloud. [12.2.2.2.6]

B/C 1.4.4.2 Vertical significance – Code table 0 08 002

To specify vertical significance (0 08 002) within the sequence 3 02 004, a code figure shall be selected in the following way:

(a) If low clouds are observed, then code figure 7 (Low cloud) shall be used.
(b) If there are no low clouds but middle clouds are observed, then code figure 8 (Middle clouds) shall be used.
(c) If there are no low and there are no middle clouds but high clouds are observed, then code figure 0 shall be used.

(d) If sky is obscured by fog and/or other phenomena, then code figure 5 (Ceiling) shall be used.
(e) If there are no clouds (clear sky), then code figure 62 (Value not applicable) shall be used.
(f) If the cloud cover is not discernible for reasons other than (d) above or observation is not made, then code figure 63 (Missing value) shall be used.

B/C 1.4.4.3 Cloud amount (of low or middle clouds) – Code table 0 20 011

Amount of all the low clouds (clouds of the genera Stratocumulus, Stratus, Cumulus, and Cumulonimbus) present or, if no low clouds are present, the amount of all the middle clouds (clouds of the genera Altocumulus, Altostratus, and Nimbostratus) present.

B/C 1.4.4.3.1

Cloud amount shall be reported as follows:

(a) If there are low clouds, then the total amount of all low clouds, as actually seen by the observer during the observation shall be reported for the cloud amount.
(b) If there are no low clouds but there are middle clouds, then the total amount of the middle clouds shall be reported for the cloud amount.
(c) If there are no low clouds and there are no middle clouds but there are high clouds (clouds of the genera Cirrus, Cirrocumulus, and Cirrostratus), then the cloud amount shall be reported as zero. [12.2.7.2.1]

B/C 1.4.4.3.2

Amount of Altocumulus perlucidus or Stratocumulus perlucidus (“mackerel sky”) shall be reported using code figure 7 or less since breaks are always present in this cloud form even if it extends over the whole celestial dome. [12.2.7.2.2]

B/C 1.4.4.3.3

When the clouds reported for cloud amount are observed through fog or an analogous phenomenon, the cloud amount shall be reported as if these phenomena were not present. [12.2.7.2.3]

B/C 1.4.4.3.4

If the clouds reported for cloud amount include contrails, then the cloud amount shall include the amount of persistent contrails. Rapidly dissipating contrails shall not be included in the value for the cloud amount. [12.2.7.2.4]

B/C 1.4.4.4 Height of base of lowest cloud

Height above surface of the base (0 20 013) of the lowest cloud seen shall be reported in meters (with precision in tens of a meter).

Note:

(1) The term “height above surface” shall be considered as being the height above the official aerodrome elevation or above station elevation at a non-aerodrome station.

B/C 1.4.4.4.1

When the station is in fog, a sandstorm or in blowing snow but the sky is discernable, the base of the lowest cloud shall refer to the base of the lowest cloud observed, if any. When, under the above conditions, the sky is not discernible, the base of the lowest cloud shall be reported as missing. [12.2.1.2]

B/C 1.4.4.4.2

When no cloud are reported (Total cloud cover = 0) the base of the lowest cloud *shall be reported as a missing value.*

B/C 1.4.4.4.3

When, by national decision, clouds with bases below the station are reported from the station and clouds with bases below and tops above the station are observed, the base of the lowest cloud *shall be reported having a negative value if the base of cloud is discernible, or as a missing value.*

B/C 1.4.4.5 Cloud type of low, middle and high clouds - Code table 0 20 012

Clouds of the genera Stratocumulus, Stratus, Cumulus, and Cumulonimbus (low clouds) shall be reported for the first entry 0 20 012, clouds of the genera Altocumulus, Altostratus, and Nimbostratus (middle clouds) shall be reported for the second entry 0 20 012 and clouds of the genera Cirrus, Cirrocumulus, and Cirrostratus (high clouds) shall be reported for the third entry 0 20 012.

B/C 1.4.4.5.1

The reporting of type of low, middle and high clouds shall be as specified in publication WMO-NO. 407 – International Cloud Atlas, Volume I. [12.2.7.3]

B/C 1.4.5 Individual cloud layers or masses

B/C 1.4.5.1 Number of individual cloud layers or masses

The number of individual cloud layers or masses shall be indicated by Delayed descriptor replication factor 0 31 001 in BUFR and by a four-digit number in the Data Section corresponding to the position of the replication descriptor in the Data Description Section of CREX.

Note:
(1) The number of cloud layers or masses shall never be set to missing value.
(2) The number of cloud layers or masses shall be set to a positive value in a NIL report.

B/C 1.4.5.1.1

The number of individual cloud layers or masses shall in the absence of Cumulonimbus clouds not exceed three. Cumulonimbus clouds, when observed, shall always be reported, so that the total number of individual cloud layers or masses can be four. The selection of layers (or masses) to be reported shall be made in accordance with the following criteria:

(a) The lowest individual layer (or mass) of any amount (cloud amount at least one octa or less, but not zero);
(b) The next higher individual layer (or mass) the amount of which is greater than two octas;
(c) The next higher individual layer (or mass) the amount of which is greater than four octas;
(d) Cumulonimbus clouds, whenever observed and not reported under (a), (b) and (c) above. [12.4.10.1]

B/C 1.4.5.1.2

When the sky is clear, the number of individual cloud layers or masses shall be set to zero.

B/C 1.4.5.1.3

The order of reporting the individual cloud layers or masses shall always be from lower to higher levels. [12.4.10.2]

B/C 1.4.5.2 Individual cloud layer or mass <3 02 005>

Each cloud layer or mass shall be represented by the following four parameters: Vertical significance (0 08 002), amount of individual cloud layer or mass (0 20 011), type of cloud layer or mass (0 20 012) and height of base of individual cloud layer or mass (0 20 013).

B/C 1.4.5.2.1 Vertical significance – Code table 0 08 002

To specify vertical significance (0 08 002) within the sequence 3 02 005, a code figure shall be selected in the following way:

(a) Code figure 1 shall be used in the first non-Cumulonimbus layer.
(b) Code figure 2 shall be used in the second non-Cumulonimbus layer.
(c) Code figure 3 shall be used in the third non-Cumulonimbus layer.
(d) Code figure 4 shall be used in any Cumulonimbus layer.
(e) If sky is obscured by fog and/or other phenomena, then code figure 5 (Ceiling) shall be used.
(f) If the cloud cover is not discernible for reasons other than (e) above or observation is not made, then code figure 63 (Missing value) shall be used.

B/C 1.4.5.2.2 Cloud amount, type and height of base

B/C 1.4.5.2.2.1

When the sky is clear, in accordance with Regulation B/C 1.4.5.1.2 cloud amount, genus, and height shall not be included. [12.4.10.4]

B/C 1.4.5.2.2.2

In determining cloud amounts (Code table 0 20 011) to be reported for individual layers or masses, the observer shall estimate, by taking into consideration the evolution of the sky, the cloud amounts of each individual layer or mass at the different levels, as if no other clouds existed. [12.4.10.3]

B/C 1.4.5.2.2.3

Type of a cloud layer or mass (Code table 0 20 012) shall be reported using code figures 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 59 and 63.

B/C 1.4.5.2.2.4

If, notwithstanding the existence of fog, sandstorm, duststorm, blowing snow or other obscuring phenomena, the sky is discernible, the partially obscuring phenomena shall be disregarded. If, under the above conditions, the sky is not discernible, the cloud type shall be reported using *code figure 59* and the cloud height shall be replaced by vertical visibility. [12.4.10.5]

Note:

(1) The vertical visibility is defined as the vertical visual range into an obscuring medium.

B/C 1.4.5.2.2.5

If two or more types of cloud occur with their bases at the same level and this level is one to be reported in accordance with Regulation B/C 1.4.5.1.1, the selection for cloud type and amount shall be made with the following criteria:

(a) If these types do not include Cumulonimbus then cloud genus shall refer to the cloud type that represents the greatest amount, or if there are two or more types of cloud all having the same amount, the highest applicable code figure for cloud genus shall be reported. Cloud amount shall refer to the total amount of cloud whose bases are all at the same level;

(b) If these types do include Cumulonimbus then one layer shall be reported to describe only this type with cloud genus indicated as Cumulonimbus and the cloud amount as the amount of the Cumulonimbus. If the total amount of the remaining type(s) of cloud (excluding Cumulonimbus) whose bases are all at the same level is greater than that required by Regulation B/C 1.4.5.1.1, then another layer shall be reported with type being selected in accordance with (a) and amount referring to the total amount of the remaining cloud (excluding Cumulonimbus). [12.4.10.6]

B/C 1.4.5.2.2.6

Regulations B/C1.4.4.1.3 to B/C1.4.4.1.6, inclusive, shall apply. [12.4.10.7]

B/C 1.4.5.2.2.7

Height above surface of the cloud base (0 20 013) shall be reported in meters (with precision in tens of a meter).

Note:

(1) The term “height above surface” shall be considered as being the height above the official aerodrome elevation or above station elevation at a non-aerodrome station.

B/C 1.5 Clouds with bases below station level <3 02 036>

B/C 1.5.1 Number of cloud layers with bases below station level

The number of cloud layers with bases below station level shall be indicated by Delayed descriptor replication factor 0 31 001 in BUFR and by a four-digit number in the Data Section corresponding to the position of the replication descriptor in the Data Description Section of CREX.

Notes:

(1) The number of cloud layers with bases below station level shall never be set to a missing value.

(2) The number of cloud layers with bases below station level shall be set to a positive value in a NIL report.

B/C 1.5.1.1

Inclusion of these data shall be determined by national decision. The number of cloud layers with bases below station level shall be always set to zero in reports from a station at which observations of clouds with bases below station level are not executed.

B/C 1.5.1.2

When no cloud layers with bases below station are observed, the number of cloud layers with bases below station level shall be set to zero.

B/C 1.5.1.3

If the station is in continuous or almost continuous cloud, the number of cloud layers with bases below station level shall be set to one, with all parameters reported as missing except for vertical significance 0 08 002 that shall be set to 10 (cloud layer with a base below and tops above station level). [12.5.4]

B/C 1.5.1.4

If clouds with bases below station level are not discernible due to fog and/or other phenomena or observation is not made, then the number of cloud layers with bases below station level shall be set to one, with all parameters reported as missing except for vertical significance 0 08 002 that shall be set to 11.

B/C 1.5.1.5

When two or more cloud layers with their bases below station level occur at different levels, two or more cloud layers shall be reported. [12.5.5]

B/C 1.5.1.6

Clouds with bases below and tops above station level shall be reported as the first layer within the sequence 3 02 036, provided that the station is out of cloud sufficiently frequently to enable the various features to be recognized. Other low clouds present with tops below station level shall be reported as the following layers (one or more) within the sequence 3 02 036. [12.5.3]

Notes:

(1) Clouds with bases below and tops above station level shall be reported also in sequences 3 02 004 and 3 02 005. [12.5.3]

(2) Clouds with tops below station level shall be reported only in sequence 3 02 036, and any co-existent clouds with bases above station level shall be reported only in sequences 3 02 004 and 3 02 005. [12.5.2]

B/C 1.5.2 Individual cloud layer with base below station level

Each cloud layer with base below station level shall be represented by the following five parameters: Vertical significance (0 08 002), amount of clouds with base below station level (0 20 011), type of clouds with base below station level (0 20 012), altitude of the upper surface of clouds (0 20 014) and cloud top description (0 20 017).

B/C 1.5.2.1 Vertical significance - Code table 0 08 002

Code figure 10 shall be used for cloud layers with bases below and tops above station level; code figure 11 shall be used for cloud layers with bases and tops below station level.

B/C 1.5.2.2 Amount of clouds with base below station level - Code table 0 20 011

B/C 1.5.2.2.1

Regulations B/C1.4.4.1.1 to B/C1.4.4.1.6, inclusive, shall apply. [12.5.8]

B/C 1.5.2.2.2

Spaces occupied by mountains emerging from the cloud layers shall be counted as occupied by clouds. [12.5.9]

B/C 1.5.2.3 Type of clouds with base below station level - Code table 0 20 012

Type of clouds with bases below station level shall be reported using code figures 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 and 63.

B/C 1.5.2.4 Height of top of clouds above mean sea level

Height of top of clouds (0 20 014) shall be used to report the height above mean sea level of the upper surface of clouds, and shall be expressed in meters (with precision in tens of a meter).

B/C 1.5.2.4.1

Height of top of clouds with bases below and tops above station level shall be reported, provided that the upper surface of clouds can be observed. [12.5.3 (b)]

B/C 1.5.2.5 Cloud top description - Code table 0 20 017

B/C 1.5.2.5.1

Description of top of clouds with bases below and tops above station level shall be reported, provided that the station is out of cloud sufficiently frequently to enable the features to be recognized.

B/C 1.5.2.5.2

Rapidly dissipating condensation trails shall not be reported. However, the top of persistent condensation trails and cloud masses which have obviously developed from condensation trails (and whose bases are below station level) shall be reported in Sequence 3 02 036. [12.5.6], [12.5.7]

B/C 1.6 Direction of cloud drift <3 02 047>

This information is required from land stations mainly in the tropics. [12.4.7.5]

B/C 1.6.1 Vertical significance – Code table 0 08 002

To specify vertical significance (0 08 002) within the sequence 3 02 047, code figures shall be selected in the following way:

(a) Code figure 7 (Low cloud) shall be used in the first replication.
(b) Code figure 8 (Middle clouds) shall be used in the second replication.
(c) Code figure 9 (High cloud) shall be used in the third replication.

B/C 1.6.2 True direction from which clouds are moving

True direction from which low, middle, or high clouds are moving (0 20 054) shall be reported in degrees true as follows:

(a) True direction from which the low clouds are moving shall be included in the first replication.
(b) True direction from which the middle clouds are moving shall be included in the second replication.
(c) True direction from which the high clouds are moving shall be included in the third replication.

B/C 1.7 Direction and elevation of cloud <3 02 048>

This information is required from land stations mainly in the tropics. [12.4.7.5]

B/C 1.7.1 Direction of cloud

True direction (0 05 021), from which orographic clouds or clouds with vertical development are seen, shall be *reported in degrees true*. The cloud genus shall be specified by the third entry of the sequence 3 02 048, i.e. by Cloud type – Code table 0 20 012.

Note:

(1) It is considered sufficient to report direction of cloud in degrees true, although 0 05 021 (Bearing or azimuth) is defined with higher accuracy (hundredths of a degree true).

B/C 1.7.2 Elevation of cloud

Elevation angle (0 07 021) of the top of the cloud shall be reported in degrees. The cloud genus shall be specified by the following entry, i.e. by Cloud type – Code table 0 20 012.

Note:
(1) It is considered sufficient to report elevation of the top of cloud in degrees, although 0 07 021 (Elevation angle) is defined with higher accuracy (hundredths of a degree).

B/C 1.8 State of ground, snow depth, ground minimum temperature <3 02 037>

B/C 1.8.1 State of ground (with or without snow) - Code table 0 20 062.

State of ground without snow or with snow shall be reported using Code table 0 20 062. The synoptic hour at which this datum is reported shall be determined by regional decision.

B/C 1.8.2 Total snow depth

Total snow depth (0 13 013) shall be reported in meters (with precision in hundredths of a meter). The synoptic hour at which this datum is reported shall be determined by regional decision.

B/C 1.8.2.1

When total snow depth has to be reported, it is reported as 0.00 m if no snow, ice and other forms of solid precipitation on the ground are observed at the time of observation. A snow depth value of "– 0.01 m" shall indicate a little (less than 0.005 m) snow. A snow depth value of "– 0.02 m" shall indicate "snow cover not continuous".

B/C 1.8.2.2

The measurement shall include snow, ice and all other forms of solid precipitation on the ground at the time of observation. [12.4.6.1]

B/C 1.8.2.3

When the depth is not uniform, the average depth over a representative area shall be reported. [12.4.6.2]

B/C 1.8.3 Ground minimum temperature, past 12 hours

Ground minimum temperature from the previous 12 hours (0 12 113) shall be reported in degrees Kelvin (with precision in hundredths of a degree Kelvin); if produced in CREX, in degrees Celsius (with precision in hundredths of a degree Celsius).

Notes:
(1) Ground minimum temperature shall be reported with precision in hundredths of a degree even if they are measured with the accuracy in tenths of a degree. This requirement is based on the fact that conversion from the Kelvin to the Celsius scale has often resulted into distortion of the data values.
(2) Ground minimum temperature t (in degrees Celsius) shall be converted into ground minimum temperature T (in degrees Kelvin) using equation: $T = t + 273.15$.
(3) The period of time covered by ground minimum temperature and the synoptic hour at which this temperature is reported shall be determined by regional decision. If ground minimum temperature is to be reported from the period of previous night, then "ground minimum temperature, past 12 hours" (0 12 113) shall be reported as a missing value. In this case, ground minimum temperature of the previous night (0 12 122) shall be reported as shown in Common sequences 3 07 081, 3 07 082 and 3 07 083 suitable for SYNOP data in compliance with reporting practices in RA I, RA II and RA III, respectively.

B/C 1.9 "Instantaneous" data required by regional or national reporting practices

If regional or national reporting practices require inclusion of additional "instantaneous" parameters, the sequence descriptor 3 07 080 shall not be used. In this case BUFR/CREX template for SYNOP data shall be used in its first level expanded form and the descriptors, corresponding to the required "instantaneous" parameters, shall be inserted to precede 3 02 043 (Basic synoptic "period" data).

Note:
(1) "Instantaneous" parameter is a parameter that is not coupled to a time period descriptor, e.g. 0 04 024, 0 04 025.

B/C 1.9.1 “Instantaneous” data required by reporting practices in RA I

Regulations for reporting additional “instantaneous” parameters, required by regional reporting practices in RA I, are shown in the Annex.

B/C 1.9.2 “Instantaneous” data required by reporting practices in RA II

Regulations for reporting additional “instantaneous” parameters, required by regional reporting practices in RA II, are shown in the Annex.

B/C 1.9.3 “Instantaneous” data required by reporting practices in RA III

Regulations for reporting additional “instantaneous” parameters, required by regional reporting practices in RA III, are shown in the Annex.

B/C 1.9.4 “Instantaneous” data required by reporting practices in RA IV

Regulations for reporting additional “instantaneous” parameters, required by regional reporting practices in RA IV, are shown in the Annex.

B/C 1.9.5 “Instantaneous” data required by reporting practices in RA V

No regional requirements are indicated for reporting SYNOP data in RA V.

B/C 1.9.6 “Instantaneous” data required by reporting practices in RA VI

Regulations for reporting additional “instantaneous” parameters, required by regional reporting practices in RA VI, are shown in the Annex.

B/C 1.10 Basic synoptic “period” data <3 02 043>

B/C 1.10.1 Present and past weather <3 02 038>

B/C 1.10.1.1

Present weather (Code table 0 20 003) and past weather (1) (Code table 0 20 004) and past weather (2) (Code table 0 20 005) shall be reported as non-missing values if present and past conditions are known. In case of a report from a manually operated station after a period of closure or at start up, when past weather conditions for the period applicable to the report are unknown, past weather (1) and past weather (2) reported as missing shall indicate that previous conditions are unknown. This regulation shall also apply to automatic reporting stations with the facility to report present and past weather. [12.2.6.1]

B/C 1.10.1.2

Code figures 0, 1, 2, 3, 100, 101, 102 and 103 for present weather and code figures 0, 1, 2 and 10 for past weather (1) and past weather (2) shall be considered to represent phenomena without significance. [12.2.6.2]

B/C 1.10.1.3

Present and past weather shall be *reported if observation was made (data available), regardless significance of the phenomena.*

Note:

(1) If data are produced and collected in traditional codes and present weather and past weather is omitted in a SYNOP report (no significant phenomena observed), code figure 508 shall be used for present weather and code figure 10 for past weather (1) and past weather (2) when converted into BUFR or CREX.

B/C 1.10.1.4

If no observation was made (data not available), code figure 509 shall be used for present weather and both past weather (1) and past weather (2) shall be reported as missing.

B/C 1.10.1.5 Present weather from a manned weather station

B/C 1.10.1.5.1

If more than one form of weather is observed, the highest applicable code figure from the range <00 to 99> shall be selected for present weather. Code figure 17 shall have precedence over code figures 20 – 49. Other weather may be reported using additional entries 0 20 003 or 0 20 021 to 0 20 026 applying Regulation B/C 1.9. [12.2.6.4.1]

B/C 1.10.1.5.2

In coding 01, 02, or 03, there is no limitation on the magnitude of the change of the cloud amount. Code figures 00, 01, and 02 can each be used when the sky is clear at the time of observation. In this case, the following interpretation of the specifications shall apply:

- 00 is used when the preceding conditions are not known,
- 01 is used when the clouds have dissolved during the past hour,
- 02 is used when the sky has been continuously clear during the past hour. [12.2.6.4.2]

B/C 1.10.1.5.3

When the phenomenon is not predominantly water droplets, the appropriate code figure shall be selected without regard to visibility. [12.2.6.4.3]

B/C 1.10.1.5.4

The code figure 05 shall be used when the obstruction to vision consists predominantly of lithometeors. [12.2.6.4.4]

B/C 1.10.1.5.5

National instructions shall be used to indicate the specifications for code figures 07 and 09. [12.2.6.4.5]

B/C 1.10.1.5.6

The visibility restrictions on code figure 10 shall be 1000 meters or more. The specification refers only to water droplets and ice crystals. [12.2.6.4.6]

B/C 1.10.1.5.7

For code figures 11 or 12 to be reported, the apparent visibility shall be less than 1000 meters. [12.2.6.4.7]

B/C 1.10.1.5.8

For code figure 18, the following criteria for reporting squalls shall be used:

(a) When wind speed is measured: A sudden increase of wind speed of at least eight meters per second, the speed rising to 11 meters per second or more and lasting for at least one minute;

(b) When the Beaufort scale is used for estimating wind speed: A sudden increase of wind speed by at least three stages of the Beaufort scale, the speed rising to force 6 or more and lasting for at least one minute. [12.2.6.4.8]

B/C 1.10.1.5.9

Code figures 20 – 29 shall never be used when precipitation is observed at the time of observation. [12.2.6.4.9]

B/C 1.10.1.5.10

For code figure 28, visibility shall have been less than 1000 meters.

Note:

(1) The specification refers only to visibility restrictions which occurred as a result of water droplets or ice crystals. [12.2.6.4.10]

B/C 1.10.1.5.11

For synoptic coding purposes, a thunderstorm shall be regarded as being at the station from the time thunder is first heard, whether or not lightning is seen or precipitation is occurring at the station. A thunderstorm shall be reported if thunder is heard within the normal observational period preceding the time of the report. A thunderstorm shall be regarded as having ceased at the time thunder is first heard and the cessation is confirmed if thunder is not heard for 10 – 15 minutes after this time. [12.2.6.4.11]

B/C 1.10.1.5.12

The necessary uniformity in reporting code figures 36, 37, 38, and 39, which may be desirable within certain regions, shall be obtained by means of national instructions. [12.2.6.4.12]

B/C 1.10.1.5.13

A visibility restriction “less than 1000 meters” shall be applied to code figures 42 – 49. In the case of code figures 40 or 41, the apparent visibility in the fog or ice fog patch or bank shall be less than 1000 meters. Code figures 40 – 47 shall be used when the obstructions to vision consist predominantly of water droplets or ice crystals, and 48 or 49 when the obstructions consist predominantly of water droplets. [12.2.6.4.13]

B/C 1.10.1.5.14

When referring to precipitation, the phrase “at the station” in the code table shall mean “at the point where the observation is normally taken”. [12.2.6.4.14]

B/C 1.10.1.5.15

The precipitation shall be encoded as intermittent if it has been discontinuous during the preceding hour, without presenting the character of a shower. [12.2.6.4.15]

B/C 1.10.1.5.16

The intensity of precipitation shall be determined by the intensity at the time of the observation. [12.2.6.4.16]

B/C 1.10.1.5.17

Code figures 80 – 89 shall be used only when the precipitation is of the shower type and takes place at the time of the observation.

Note:

(1) Showers are produced by convective clouds. They are characterized by their abrupt beginning and end and by the generally rapid and sometimes great variations in the intensity of the precipitation. Drops and solid particles falling in a shower are generally larger than those falling in non-showery precipitation. Between showers openings may be observed unless stratiform clouds fill the intervals between the cumuliform clouds. [12.2.6.4.17]

B/C 1.10.1.5.18

In reporting code figure 98, the observer shall be allowed considerable latitude in determining whether precipitation is or is not occurring, if it is not actually visible. [12.2.6.4.18]

B/C 1.10.1.6 Present weather from an automatic weather station

B/C 1.10.1.6.1

The highest applicable code figure shall be selected. [12.2.6.5.1]

B/C 1.10.1.6.2

In coding code figures 101, 102, and 103, there is no limitation on the magnitude of the change of the cloud amount. Code figures 100, 101, and 102 can each be used when the sky is clear at the time of observation. In this case, the following interpretation of the specifications shall apply:

- Code figure 100 is used when the preceding conditions are not known;
- Code figure 101 is used when the clouds have dissolved during the past hour;
- Code figure 102 is used when the sky has been continuously clear during the past hour. [12.2.6.5.2]

B/C 1.10.1.6.3

When the phenomenon is not predominantly water droplets, the appropriate code figure shall be selected without regard to the visibility. [12.2.6.5.3]

B/C 1.10.1.6.4

The code figures 104 and 105 shall be used when the obstruction to vision consists predominantly of lithometeors. [12.2.6.5.4]

B/C 1.10.1.6.5

The visibility restriction on code figure 110 shall be 1000 meters or more. The specification refers only to water droplets and ice crystals. [12.2.6.5.5]

B/C 1.10.1.6.6

For code figure 118, the following criteria for reporting squalls shall be used:

A sudden increase of wind speed of at least eight meters per second, the speed rising to 11 meters per second or more and lasting for at least one minute. [12.2.6.5.6]

B/C 1.10.1.6.7

Code figures 120 – 126 shall never be used when precipitation is observed at the time of observation. [12.2.6.5.7]

B/C 1.10.1.6.8

For code figure 120, visibility shall have been less than 1000 meters.

Note: The specification refers only to visibility restrictions which occurred as a result of water droplets or ice crystals. [12.2.6.5.8]

B/C 1.10.1.6.9

For synoptic coding purposes, a thunderstorm shall be regarded as being at the station from the time thunder is first detected, whether or not lightning is detected or precipitation is occurring at the station. A thunderstorm shall be reported in present weather if thunder is detected within the normal observational period preceding the time of the report. A thunderstorm shall be regarded as having ceased at the time thunder is last detected and the cessation is confirmed if thunder is not detected for 10 – 15 minutes after this time. [12.2.6.5.9]

B/C 1.10.1.6.10

A visibility restriction “less than 1000 meters” shall be applied to code figures 130 – 135. [12.2.6.5.10]

B/C 1.10.1.6.11

The precipitation shall be encoded as intermittent if it has been discontinuous during the preceding hour, without presenting the character of a shower. [12.2.6.5.11]

B/C 1.10.1.6.12

The intensity of precipitation shall be determined by the intensity at the time of observation. [12.2.6.5.12]

B/C 1.10.1.6.13

Code figures 180 – 189 shall be used only when the precipitation is intermittent or of the shower type and takes place at the time of observation.

Note:

(1) Showers are produced by convective clouds. They are characterized by their abrupt beginning and end and by the generally rapid and sometimes great variations in the intensity of the precipitation. Drops and solid particles falling in a shower are generally larger than those falling in non-showery precipitation. Between showers openings may be observed unless stratiform clouds fill the intervals between the cumuliform clouds. [12.2.6.5.13]

B/C 1.10.1.7 Past weather reported from a manned weather station

B/C 1.10.1.7.1 Time period

The time period (0 04 024) covered by past weather (1) and past weather (2) shall be expressed as *a negative value* in hours:

(a) Six hours, for observations at 0000, 0600, 1200, and 1800 UTC;
(b) Three hours for observations at 0300, 0900, 1500, and 2100 UTC;
(c) Two hours for intermediate observations if taken every two hours.
(d) *One hour* for intermediate observations if taken every hour. [12.2.6.6.1]

B/C 1.10.1.7.2

The code figures for past weather (1) and past weather (2) shall be selected in such a way that past and present weather together give as complete a description as possible of the weather in the time interval concerned. For example, if the type of weather undergoes a complete change during the time interval concerned, the code figures selected for past weather (1) and past weather (2) shall describe the weather prevailing before the type of weather indicated by present weather began. [12.2.6.6.2]

B/C 1.10.1.7.3

When the past weather (1) and past weather (2) are used in hourly reports, Regulation B/C 1.10.1.7.1 (d) shall apply. [12.2.6.6.3]

B/C 1.10.1.7.4

If, using Regulation B/C 1.10.1.7.2, more than one code figure may be given to past weather (1), the highest figure shall be reported for past weather (1) and the second highest code figure shall be reported for past weather (2). [12.2.6.6.4]

B/C 1.10.1.7.5

If the weather during the period has not changed so that only one code figure may be selected for past weather, then that code figure shall be reported for both past weather (1) and past weather (2). [12.2.6.6.5]

B/C 1.10.1.8 Past weather reported from an automatic weather station

B/C 1.10.1.8.1 Time period

The time period (0 04 024) covered by past weather (1) and past weather (2) shall be expressed as *a negative value* in hours:

(a) Six hours for observations at 0000, 0600, 1200, and 1800 UTC;
(b) Three hours for observations at 0300, 0900, 1500, and 2100 UTC;
(c) Two hours for intermediate observations if taken every two hours.
(d) *One hour* for intermediate observations if taken every hour. [12.2.6.7.1]

B/C 1.10.1.8.2

The code figures for past weather (1) and past weather (2) shall be selected so that the maximum capability of the automatic station to discern past weather is utilized, and so that past and present weather together give as complete a description as possible of the weather in the time interval concerned. [12.2.6.7.2]

B/C 1.10.1.8.3

In cases where the automatic station is capable only of discerning very basic weather conditions, the lower code figures representing basic and generic phenomena may be used. If the automatic station has higher discrimination capabilities, the higher code figures representing more detailed explanation of the phenomena shall be used. For each basic type of phenomenon, the highest code figure within the discrimination capability of the automatic station shall be reported. [12.2.6.7.3]

B/C 1.10.1.8.4

If the type of weather during the time interval concerned undergoes complete and discernible changes, the code figures selected for past weather (1) and past weather (2) shall describe the weather prevailing before the type of weather indicated by present weather began. The highest figure shall be reported for past weather (1) and the second highest code figure shall be reported for past weather (2). [12.2.6.7.4]

B/C 1.10.1.8.5

If a discernible change in weather has not occurred during the period, so that only one code figure may be selected for the past weather, then that code figure shall be reported for both past weather (1) and past weather (2). For example, rain during the entire period shall be reported as code figure 14 for both past weather (1) and past weather (2) in the case of an automatic station incapable of differentiating types of precipitation, or code figure 16 for both past weather (1) and past weather (2) in the case of a station with the higher discrimination capability. [12.2.6.7.5]

B/C 1.10.2 Sunshine data <1 01 002><3 02 039>

B/C 1.10.2.1 Period of reference for sunshine duration

Time period in hours (0 04 024) shall be included as follows:

(a) one hour in the first replication (reported as -1);
(b) 24 hours in the second replication (reported as -24).

B/C 1.10.2.2 Duration of sunshine

Duration of sunshine from the time period specified by the preceding parameter 0 07 024, shall be reported in minutes.

B/C 1.10.2.2.1

The duration of sunshine over the previous hour shall be reported by national decision. When reported, it shall be included in the first replication.

B/C 1.10.2.2.2

The duration of sunshine over the previous 24 hours shall, by regional decision, be reported at all stations capable of doing so and included at either 0000 UTC, 0600 UTC, 1200 UTC or 1800 UTC. When reported, it shall be included in the second replication. [12.4.7.4.2]

B/C 1.10.3 Precipitation measurement <3 02 040>

B/C 1.10.3.1 Height of sensor above local ground

Height of sensor above local ground (0 07 032) for precipitation measurement shall be reported in meters (with precision in hundredths of a meter).
This datum represents the actual height of the rain gauge rim above ground at the point where the rain gauge is located.

B/C 1.10.3.2 Period of reference for amount precipitation

Time period (0 04 024) for amount of precipitation shall be reported as *a negative value* in hours. It shall be determined

(a) by regional decision (e.g. -6, -12, -24) in the first replication,
(b) by national decision (e.g. -1, -3) in the second replication.

B/C 1.10.3.3 Total amount of precipitation

Total amount of precipitation, which has fallen during the period of reference for amount of precipitation, shall be reported in kilograms per square meter (with precision in tenths of a kilogram per square meter).

B/C 1.10.3.3.1

Precipitation, when it can be and has to be reported, shall be reported as 0.0 kgm^{-2} if no precipitation were observed during the referenced period. [12.2.5.4]

B/C 1.10.3.3.2

Trace shall be reported as “- 0.1 kgm^{-2} “.

B/C 1.10.4 Extreme temperature data <3 02 041>

B/C 1.10.4.1 Height of sensor above local ground

Height of sensor above local ground (0 07 032) for temperature measurement shall be reported in meters (with precision in hundredths of a meter).
This datum represents the actual height of temperature sensor(s) above ground at the point where the sensors are located.

B/C 1.10.4.2 Periods of reference for extreme temperatures

Time period for maximum temperature and time period for minimum temperature (0 04 024) shall be determined by regional decision and reported as *negative values* in hours. [12.4.4]

Notes:

(1) If the period for maximum temperature or the period for minimum temperature ends at the nominal time of report, the second value of 0 04 024 shall be reported as 0.
(2) If the period for maximum temperature or the period for minimum temperature does not end at the nominal time of report, the first value of 0 04 024 shall indicate the beginning of the period of reference and the second value of 0 04 024 shall indicate the end of the period of reference. E.g. to report the maximum temperature for the previous calendar day from a station in RA IV, value of the first 0 04 024 shall be set to – 30 and value of the second 0 04 024 shall be set to – 6, provided that the nominal time of the report 12 UTC corresponds to 6 a.m. local time.

B/C 1.10.4.3 Maximum and minimum temperature

Maximum and minimum temperature shall be reported in degrees Kelvin (with precision in hundredths of a degree Kelvin); if produced in CREX, in degrees Celsius (with precision in hundredths of a degree Celsius). Extreme temperature data shall be reported with precision in hundredths of a degree even if they are measured with the accuracy in tenths of a degree.

Note:

(1) Notes (1) and (2) under Regulation B/C 1.4.1.2 shall apply.

B/C 1.10.5 Wind data <3 02 042>

B/C 1.10.5.1 Height of sensor above local ground

Height of sensor above local ground (0 07 032) for wind measurement shall be reported in meters (with precision in hundredths of a meter).
This datum represents the actual height of the sensors above ground at the point where the sensors are located.

B/C 1.10.5.2 Type of instrumentation for wind measurement - Flag table 0 02 002

This datum shall be used to specify whether the wind speed was measured by certified instruments (bit No. 1 set to 1) or estimated on the basis of the Beaufort wind scale (bit No. 1 set to 0), and to indicate the original units for wind speed measurement. Bit No. 2 set to 1 indicates that wind speed was originally measured in knots and bit No. 3 set to 1 indicates that wind speed was originally measured in kilometers per hour. Setting both bits No.2 and No.3 to 0 indicates that wind speed was originally measured in meters per second.

In CREX, type of instrumentation for wind measurement (0 02 002) shall be reported in octal representation. For example, if wind speed was measured by instruments in knots (bit No.1 and bit No.2 set to 1), then this datum shall be reported as 14.

B/C 1.10.5.3 Wind direction and speed

The mean direction and speed of the wind over the 10-minute period immediately preceding the observation shall be reported. The time period (0 04 025) shall be included as -10. However, when the 10-minute period includes a discontinuity in the wind characteristics, only data obtained after the discontinuity shall be used for reporting the mean values, and hence the period (0 04 025) in these circumstances shall be correspondingly reduced. [12.2.2.3.1]
The time period is preceded by a time significance qualifier (0 08 021) that shall be set to 2 (Time averaged).
The wind direction (0 11 001) shall be reported in degrees true and the wind speed (0 11 002) shall be reported in meters per second (with precision in tenths of a meter per second).

B/C 1.10.5.3.1

In the absence of wind instruments, the wind speed shall be estimated on the basis of the Beaufort wind scale. The Beaufort number obtained by estimation is converted into meters per second by use of the relevant wind speed equivalent column on the Beaufort scale, and this speed is reported for wind speed. [12.2.2.3.2]

B/C 1.10.5.4 Maximum wind gust direction and speed

Time period for maximum wind gust direction and speed (0 04 025) shall be determined by regional or national decision and reported as a negative value in minutes.

Direction of the maximum wind gust (0 11 043) shall be reported in degrees true and speed of the maximum wind gust (0 11 041) shall be reported in meters per second (with precision in tenths of meters per second).

B/C 1.11 Evaporation data <3 02 044>

B/C 1.11.1 Period of reference for evaporation data

Evaporation or evapotranspiration during the previous 24 hours shall be reported. Time period in hours (0 04 024) shall be included as -24.

B/C 1.11.2 Indicator of type of instrument for evaporation measurement or the type of crops – Code table 0 02 004

B/C 1.11.3 Evaporation or evapotranspiration

Amount of either evaporation or evapotranspiration (0 13 033) shall be reported in kilograms per square meter (with precision in tenths of a kilogram per square meter) at 0000 UTC, 0600 UTC or 1200 UTC. [12.4.7.2.2]

B/C 1.12 Radiation data <1 01 002><3 02 045>

B/C 1.12.1 Period of reference for radiation data

Radiation integrated over the previous hour and over the previous 24 hours may be reported. Time period in hours (0 04 024) shall be included as follows:
(a) one hour in the first replication (reported as -1);
(b) 24 hours in the second replication (reported as -24).

B/C 1.12.2 Amount of radiation

If included, amount of radiation integrated over the time period specified by the preceding parameter 0 07 024 shall be reported in joules per square meter (with precision in thousands of a joule per square meter for radiation type (1) and (2); with precision in ten-thousands of a joule per square meter for radiation type (3); with precision in hundreds of a joule per square meter for radiation types (4) to (6)).

B/C 1.12.2.1

The radiation data may take one or more of the following forms:
(a) Long-wave radiation (0 14 002); the positive sign shall be used to specify downward long-wave radiation and the negative sign to specify upward long-wave radiation;
(b) Short-wave radiation (0 14 004);
(c) Net radiation (0 14 016); the corresponding sign shall be used to specify positive and negative net radiation);
(d) Global solar radiation (0 14 028);
(e) Diffuse solar radiation (0 14 029);
(f) Direct solar radiation (0 14 030).
[12.4.7.4.3], [12.4.7.4.4]

B/C 1.13 Temperature change <3 02 046>

This information is required by regional or national decision from islands or other widely separated stations.

B/C 1.13.1 Period of reference for temperature change

The temperature change shall be reported for the period of time between the time of the observation and the time of the occurrence of temperature change. To construct the required period, time period 0 04 024 shall be included twice; the first one corresponding to period covered by past weather (1) and past weather (2), the second one specified by the time of the occurrence of temperature change. Both values of 0 04 024 shall be negative and expressed in hours.

Note:
(1) The period is the number of whole hours, disregarding the minutes. For example, if the time of occurrence is 45 minutes after the time of the observation, the time period is considered to be zero hours. If the time of occurrence is 1 hour or more, but less than 2 hours after the observation, the time period go shall be considered to be 1 hour, etc.

B/C 1.13.2 Temperature change over period specified

Temperature change (0 12 049) shall be reported in degrees Kelvin in BUFR, in degrees Celsius in CREX.

B/C 1.13.2.1

For a change of temperature to be reported, the change shall be equal to or more than 5° C and occur in less than 30 minutes during the period covered by past weather (1) and past weather (2). [12.4.7.3]

B/C 1.14 "Period" data required by regional or national reporting practices

If regional reporting practices in a Region require inclusion of additional "period" parameters, the corresponding "regional" common sequence (see the Annex) shall be supplemented by relevant descriptors. If national reporting practices require inclusion of additional "period" parameters, either the common sequence 3 07 080 or any of the common sequences 3 07 081 to 3 07 086, whichever is the most convenient, shall be supplemented by relevant descriptors

Note:

(1) "Period" parameter is a parameter that is coupled to a time period descriptor, e.g. 0 04 024, 0 04 025.

(2) No additional "period" parameters are currently required by regional regulations for SYNOP data in the *Manual on Codes*, WMO-No. 306, Volume II.

ANNEX to B/C1 – Regulations for reporting SYNOP data in TDCF

Regional regulations for reporting SYNOP data in BUFR/CREX

TM 307081 - BUFR template for synoptic reports from fixed land stations suitable for SYNOP data in compliance with reporting practices in RA I

3 07 081:

3 01 090	Fixed surface station identification, time, horizontal and vertical coordinates		Unit, scale
3 02 031	Pressure data		
3 02 035	Basic synoptic "instantaneous" data		
3 02 036	Clouds with bases below station level		
3 02 047	Direction of cloud drift		
0 08 002	Vertical significance (= missing to cancel the previous value)		Code table, 0
3 02 048	Direction and elevation of cloud		
3 02 037	State of ground, snow depth, ground minimum temperature (past 12 hours)		
0 12 122	Ground minimum temperature of the preceding night	$\mathbf{s_nT_gT_g}$	K, 2
0 13 056	Character and intensity of precipitation	$\mathbf{R_c}$	Code table, 0
0 13 057	Time of beginning or end of precipitation	$\mathbf{R_t}$	Code table, 0
0 20 101	Locust (acridian) name	$\mathbf{L_n}$	Code table, 0
0 20 102	Locust (maturity) color	$\mathbf{L_c}$	Code table, 0
0 20 103	Stage of development of locusts	$\mathbf{L_d}$	Code table, 0
0 20 104	Organization state of swarm or band of locusts	$\mathbf{L_g}$	Code table, 0
0 20 105	Size of swarm or band of locusts and duration of passage of swarm	$\mathbf{s_L}$	Code table, 0
0 20 106	Locust population density	$\mathbf{d_L}$	Code table, 0
0 20 107	Direction of movements of locust swarm	$\mathbf{D_L}$	Code table, 0
0 20 108	Extent of vegetation	$\mathbf{v_e}$	Code table, 0
3 02 043	Basic synoptic "period" data		
3 02 044	Evaporation data		
1 01 002	Replicate next descriptor 2 times		
3 02 045	Radiation data (from 1 hour and/or 24 hour period)		
3 02 046	Temperature change		

Regulations:

General

(i) BUFR template TM 307081 shall not be mandatory for Member States in Region I. Either the template TM 307080 or any of the templates TM 307081 to TM 307086, whichever is the most convenient, may be used.

(ii) Regulations **B/C 1.1** to **B/C 1.9**, inclusive, shall apply.

(iii) Regulations **B/C 1.10** to **B/C 1.14**, inclusive, shall apply.

B/C 1.9.1 “Instantaneous” data required by reporting practices in RA I

B/C 1.9.1.1 Ground minimum temperature of the preceding night

Ground minimum temperature of the preceding night (0 12 122) shall be reported in degrees Kelvin (with precision in hundredths of a degree Kelvin); if produced in CREX, in degrees Celsius (with precision in hundredths of a degree Celsius).

Notes (1), (2) and (3) under Regulation B/C 1.8.3 shall apply.

This datum shall be reported by all Members at 0600 UTC. [1/12.6.1]

B/C 1.9.1.2 Character, intensity and time of beginning or end of precipitation

Character and intensity of precipitation (Code table 0 13 056) and Time of beginning or end of precipitation (Code table 0 13 057) shall be reported by all Members at 0600 UTC to meet requirements of agrometerological monitoring in the Region. [1/12.6.1] Inclusion of these data into reports at 0000 and 1200 UTC shall be left to national decision. [1/12.6.3]

B/C 1.9.1.3 Locust control-related observations

Following data shall be reported by all Members capable of doing so:

(a) Locust (acridian) name (Code table 0 20 101),
(b) Locust (maturity) color (Code table 0 20 102),
(c) Stage of development of locusts (Code table 0 20 103),
(d) Organization state of swarm or band of locusts (Code table 0 20 104),
(e) Size of swarm or band of locusts and duration of passage of swarm (Code table 0 20 105),
(f) Locust population density (Code table 0 20 106),
(g) Direction of movements of locust swarm (Code table 0 20 107),
(h) Extent of vegetation (Code table 0 20 108). [1/12.14.1]

TM 307082 - BUFR template for synoptic reports from fixed land stations suitable for SYNOP data in compliance with reporting practices in RA II

3 07 082:

3 01 090	Fixed surface station identification, time, horizontal and vertical coordinates	Unit, scale
3 02 031	Pressure data	
3 02 035	Basic synoptic “instantaneous” data	
3 02 036	Clouds with bases below station level	
3 02 047	Direction of cloud drift	
0 08 002	Vertical significance (= missing to cancel the previous value)	Code table, 0
3 02 048	Direction and elevation of cloud	
3 02 037	State of ground, snow depth, ground minimum temperature (past 12 hours)	
0 12 121	Ground minimum temperature (at the time of observation) **$s_nT'_gT'_g$**	K, 2

0 12 122	Ground minimum temperature of the preceding night **$s_nT_gT_g$**	K, 2
3 02 043	Basic synoptic "period" data	
3 02 044	Evaporation data	
1 01 002	Replicate next descriptor 2 times	
3 02 045	Radiation data (from 1 hour and/or 24 hour period)	
3 02 046	Temperature change	

Regulations:

General

(i) BUFR template TM 307082 shall not be mandatory for Member States in Region II. Either the template TM 307080 or any of the templates TM 307081 to TM 307086, whichever is the most convenient, may be used.

(ii) Regulations **B/C 1.1** to **B/C 1.9**, inclusive, shall apply.

(iii) Regulations **B/C 1.10** to **B/C 1.14**, inclusive, shall apply.

B/C 1.9.2 "Instantaneous" data required by reporting practices in RA II

B/C 1.9.2.1 Ground minimum temperature at the time of observation

Ground minimum temperature measured at the time of observation (0 12 121) shall be reported in degrees Kelvin (with precision in hundredths of a degree Kelvin); if produced in CREX, in degrees Celsius (with precision in hundredths of a degree Celsius).

Notes (1) and (2) under Regulation B/C 1.8.3 shall apply.

Inclusion of this datum into reports at least at 0000 and 1200 UTC shall be left to national decision. [2/12.6.1]

B/C 1.9.2.2 Ground minimum temperature of the preceding night

Ground minimum temperature of the preceding night (0 12 122) shall be reported in degrees Kelvin (with precision in hundredths of a degree Kelvin); if produced in CREX, in degrees Celsius (with precision in hundredths of a degree Celsius).

Notes (1), (2) and (3) under Regulation B/C 1.8.3 shall apply.

TM 307083 - BUFR template for synoptic reports from fixed land stations suitable for SYNOP data in compliance with reporting practices in RA III

3 07 083:

3 01 090	Fixed surface station identification, time, horizontal and vertical coordinates	Unit, scale
3 02 031	Pressure data	
3 02 035	Basic synoptic "instantaneous" data	
3 02 036	Clouds with bases below station level	
3 02 047	Direction of cloud drift	
0 08 002	Vertical significance (= missing to cancel the previous value)	Code table, 0
3 02 048	Direction and elevation of cloud	
3 02 037	State of ground, snow depth, ground minimum temperature (past 12 hours)	
0 12 122	Ground minimum temperature of the preceding night **$s_nT_gT_g$**	K, 2
3 02 043	Basic synoptic "period" data	
3 02 044	Evaporation data	
1 01 002	Replicate next descriptor 2 times	
3 02 045	Radiation data (from 1 hour and/or 24 hour period)	
3 02 046	Temperature change	

Regulations:

General

(i) BUFR template TM 307083 shall not be mandatory for Member States in Region III. Either the template TM 307080 or any of the templates TM 307081 to TM 307086, whichever is the most convenient, may be used.

(ii) Regulations **B/C 1.1** to **B/C 1.9**, inclusive, shall apply.

(iii) Regulations **B/C 1.10** to **B/C 1.14**, inclusive, shall apply.

B/C 1.9.3 "Instantaneous" data required by reporting practices in RA III

B/C 1.9.3.1 Ground minimum temperature of the preceding night

Ground minimum temperature of the preceding night (0 12 122) shall be reported in degrees Kelvin (with precision in hundredths of a degree Kelvin); if produced in CREX, in degrees Celsius (with precision in hundredths of a degree Celsius).

Notes (1), (2) and (3) under Regulation B/C 1.8.3 shall apply.

This datum shall be included into reports at 1200 UTC, if possible. [3/12.7.2]

TM 307084 - BUFR template for synoptic reports from fixed land stations suitable for SYNOP data in compliance with reporting practices in RA IV

3 07 084:

3 01 090	Fixed surface station identification, time, horizontal and vertical coordinates		Unit, scale
3 02 031	Pressure data		
3 02 035	Basic synoptic "instantaneous" data		
3 02 036	Clouds with bases below station level		
3 02 047	Direction of cloud drift		
0 08 002	Vertical significance (= missing to cancel the previous value)		Code table, 0
3 02 048	Direction and elevation of cloud		
3 02 037	State of ground, snow depth, ground minimum temperature (past 12 hours)		
0 20 055	State of sky in tropics	**C_S**	Code table, 0
1 01 000	Delayed replication of 1 descriptor		
0 31 001	Delayed descriptor replication factor		Numeric, 0
2 05 001	Character field of 1 character		CCITT IA5, 0
3 02 043	Basic synoptic "period" data		
3 02 044	Evaporation data		
1 01 002	Replicate next descriptor 2 times		
3 02 045	Radiation data (from 1 hour and/or 24 hour period)		
3 02 046	Temperature change		

Regulations:

General

(i) BUFR template TM 307084 shall not be mandatory for Member States in Region IV. Either the template TM 307080 or any of the templates TM 307081 to TM 307086, whichever is the most convenient, may be used.

(ii) Regulations **B/C 1.1** to **B/C 1.9**, inclusive, shall apply.

(iii) Regulations **B/C 1.10** to **B/C 1.14**, inclusive, shall apply.

B/C 1.9.4 "Instantaneous" data required by reporting practices in RA IV

B/C 1.9.4.1 State of sky in tropics

State of sky in tropics (Code table 0 02 055) shall be reported only by stations in the southern part of Region IV, below 1000 m elevation and within 500 kilometers of the shore, and only during the part of the year in which tropical weather is observed. Direction of cloud drift shall be reported using sequence 3 02 047. [4/12.4.2]

B/C 1.9.4.2 Additional information in plain language

Information in plain language shall be reported as a character field, using delayed replication of the operator descriptor 2 05 001. The value of the delayed replication factor 0 31 001 shall correspond with the number of characters required for the reported information (space characters included). For example, if the word TORNADO is included in the report (tornado has been observed at, or within sight of, the station [4/12.14.1]), delayed replication factor 0 31 001 shall be set to 7.

M 307086 - BUFR template for synoptic reports from fixed land stations suitable for SYNOP data in compliance with reporting practices in RA VI

3 07 086:

3 01 090		Fixed surface station identification, time, horizontal and vertical coordinates	Unit, scale
3 02 031		Pressure data	
3 02 035		Basic synoptic "instantaneous" data	
3 02 036		Clouds with bases below station level	
0 08 002		Vertical significance (= missing to cancel the previous value)	
3 02 037		State of ground, snow depth, ground minimum temperature	
3 02 066		**Dangerous weather phenomena**	
		Groups 919$M_W D_a$ and 96119 in SYNOP	
	0 20 023	Other weather phenomena **M_W** (1= Dust/sand whirl, 9= Funnel clouds not touching surface, 10 = Funnel clouds touching surface, 12 = Water-spout)	Flag table, 0
	0 20 024	Intensity of phenomena (1= Light, 2 = Moderate, 3 = Heavy, 4 = Violent)	Code table, 0
	0 20 027	Phenomenon occurrence (1=At time of observation, 3=In time period for past weather)	Flag table, 0
	0 20 054	True direction from which a phenomenon or clouds are moving **D_a**	Degree true, 0
		Group 918$s_q D_p$ in SYNOP	
	0 20 023	Other weather phenomena (2 = Squalls) **s_q**	Flag table, 0
	0 20 027	Phenomenon occurrence (1=At time of observation, 3=In time period for past weather)	Flag table, 0
	0 20 054	True direction from which a phenomenon or clouds are moving **D_p**	Degree true, 0
		Group 929$S_8 S'_8$ in SYNOP	
	0 20 025	Obscuration (13 = Snow)	Flag table, 0
	0 20 026	Character of obscuration (5= Low drifting, 6= Blowing) **S_8**	Code table, 0

	0 20 027	Phenomenon occurrence (1=At time of observation, 3=In time period for past weather)	Flag table, 0
	0 20 040	Evolution of drift of snow **S'_8**	Code table, 0
		Group 932RR	
	0 20 066	Maximum diameter of hailstones **RR**	m, 3
	0 20 027	Phenomenon occurrence (1=At time of observation, 3=In time period for past weather)	Flag table, 0
		Groups 934RR- 937RR in SYNOP	
	0 20 021	Type of precipitation (15=Glaze, 16=Rime, 20=Wet snow)	Flag table, 0
	0 20 067	Diameter of deposit **RR**	m, 3
	0 20 027	Phenomenon occurrence (1=At time of observation, 3=In time period for past weather)	Flag table, 0
3 02 043		Basic synoptic “period” data	
3 02 044		Evaporation data	
1 01 002		Replicate next descriptor 2 times	
3 02 045		Radiation data (from 1 hour and/or 24 hour period)	

Note:
Groups $56D_LD_MD_H$, $57CD_ae_C$ and $54g_0s_nd_T$ are not used in RA VI and therefore the corresponding sequence descriptors 3 02 047, 3 02 048 and 3 02 046 are not included in the RA VI regional template for SYNOP data.

Regulations:

General

(i) BUFR template TM 307086 shall not be mandatory for Member States in Region VI. Either the template TM 307080 or any of the templates TM 307081 to TM 307086, whichever is the most convenient, may be used.
(ii) Regulations **B/C 1.1** to **B/C 1.9**, inclusive, shall apply.
(iii) Regulations **B/C 1.10** to **B/C 1.14**, inclusive, shall apply.

B/C 1.9.6 “Instantaneous” data required by reporting practices in RA VI

B/C 1.9.6.1 Dangerous weather phenomena

Sequence 3 02 066 should be used for regional exchange of data on dangerous phenomena. Reporting of other phenomena shall be left to national decision. [6/12.12.2]

B/C 1.9.6.1.1 Tornado, water spout, whirlwinds and dust devils

Tornadoes, water spouts, whirlwinds and dust devils between observation times shall be reported using two parameters: Other weather phenomena (Flag table 0 20 023) and Intensity of phenomena (Code table 0 20 024). Occurrence of the phenomenon (Flag table 0 20 027) shall be specified by setting bit No. 3 to 1 (In time period for past weather).

B/C 1.9.6.1.2 Squall

Squalls between observation times shall be reported using Flag table 0 20 023 (bit No.2 set to 1). Occurrence of the phenomenon (Flag table 0 20 027) shall be specified by setting bit No. 3 to 1 (In time period for past weather). True direction from which the squall approaches the station (0 20 054) shall be reported in degrees true.

B/C 1.9.6.1.3 Drifting and blowing snow

Drifting and blowing snow shall be reported using two parameters: Obscuration (Flag table 0 20 025) and Character of obscuration (Code table 0 26 026). Occurrence of the phenomenon (Flag table 0 20 027) shall be specified by setting to 1 either bit No. 1 (At time of observation) or bit No. 3 (In time period for past weather) or both. Evolution of drift of snow shall be reported using Code table 0 20 040.

B/C 1.9.6.1.4 Maximum diameter of hailstones

Maximum diameter of hailstones (0 20 066) shall be reported in meters (with precision in thousandths of a meter). Occurrence of the phenomenon (Flag table 0 20 027) shall be specified by setting to 1 either bit No. 1 (At time of observation) or bit No. 3 (In time period for past weather) or both.

B/C 1.9.6.1.5 Frozen deposit

Diameter of frozen deposit (0 20 067) shall be reported in meters (with precision in thousandths of a meter). The preceding entry Type of precipitation (Flag table 0 20 021) shall specify type of the frozen deposit, i.e. bit No. 15 set to 1 shall indicate deposit of glaze, bit No. 16 set to 1 shall indicate deposit of rime and bit No. 20 set to 1 shall indicate deposit of wet snow; compound deposit shall be indicated by at least two of the above mentioned bits set to 1. Occurrence of the phenomenon (Flag table 0 20 027) shall be specified by setting to 1 either bit No. 1 (At time of observation) or bit No. 3 (In time period for past weather) or both.

B/C5 – Regulations for reporting SYNOP MOBIL data in TDCF

TM 307090 - BUFR template for synoptic reports from mobile land stations suitable for SYNOP MOBIL data

3 07 090		**Sequence for representation of synoptic reports from a mobile land station suitable for SYNOP MOBIL data**
	3 01 092	Mobile surface station identification, time, horizontal and vertical coordinates
	3 02 031	Pressure data
	3 02 035	Basic synoptic “instantaneous” data
	3 02 036	Clouds with bases below station level
	3 02 047	Direction of cloud drift
	0 08 002	Vertical significance
	3 02 048	Direction and elevation of cloud
	3 02 037	State of ground, snow depth, ground minimum temperature
	3 02 043	Basic synoptic “period” data
	3 02 044	Evaporation data
	1 01 002	Replicate next descriptor 2 times
	3 02 045	Radiation data (from 1 hour and/or 24 hour period)
	3 02 046	Temperature change

This BUFR template for synoptic reports from mobile land stations further expands as follows:

3 01 092			**Mobile surface station identification, time, horizontal and vertical coordinates**		Unit, scale
	0 01 011		Mobile land station identifier	**D….D**	CCITT IA5, 0
	0 01 003		WMO Region number	$\mathbf{A_1}$	Code table, 0
	0 02 001		Type of station	$(\mathbf{i_x})$	Code table, 0
	3 01 011	0 04 001	Year		Year, 0
		0 04 002	Month		Month, 0
		0 04 003	Day	**YY**	Day, 0
	3 01 012	0 04 004	Hour	**GG**	Hour, 0
		0 04 005	Minute	**gg**	Minute, 0
	3 01 021	0 05 001	Latitude (high accuracy)	$\mathbf{L_aL_aL_a}$	Degree, 5
		0 06 001	Longitude (high accuracy)	$\mathbf{L_oL_oL_oL_o}$	Degree, 5

	0 07 030		Height of station ground above mean sea level	m, 1
	0 07 031		Height of barometer above mean sea level	m, 1
	0 33 024		Station elevation quality mark **i_m**	Code table, 0
3 02 031			**Pressure data**	
	3 02 001	0 10 004	Pressure **$P_0P_0P_0P_0$**	Pa, –1
		0 10 051	Pressure reduced to mean sea level **PPPP**	Pa, –1
		0 10 061	3-hour pressure change **ppp**	Pa, –1
		0 10 063	Characteristic of pressure tendency **a**	Code table, 0
	0 10 062		24-hour pressure change **$p_{24}p_{24}p_{24}$**	Pa, –1
	0 07 004		Pressure (standard level) **a_3**	Pa, –1
	0 10 009		Geopotential height of the standard level **hhh**	gpm, 0
3 02 035			**Basic synoptic “instantaneous” data**	
			Temperature and humidity data	
	3 02 032	0 07 032	Height of sensor above local ground (for temperature and humidity measurement)	m, 2
		0 12 101	Temperature/dry-bulb temperature(sc.2) **s_nTTT**	K, 2
		0 12 103	Dew-point temperature (scale 2) **$s_nT_dT_dT_d$**	K, 2
		0 13 003	Relative humidity	%, 0
			Visibility data	
	3 02 033	0 07 032	Height of sensor above local ground (for visibility measurement)	m, 2
		0 20 001	Horizontal visibility **VV**	m, –1
			Precipitation past 24 hours	
	3 02 034	0 07 032	Height of sensor above local ground (for precipitation measurement)	m, 2
		0 13 023	Total precipitation past 24 hours **$R_{24}R_{24}R_{24}R_{24}$**	kg m^{-2}, 1
	0 07 032		Height of sensor above local ground (set to missing to cancel the previous value)	m, 2
			Cloud data	
	3 02 004	0 20 010	Cloud cover (total) **N**	%, 0
		0 08 002	Vertical significance	Code table, 0
		0 20 011	Cloud amount (of low or middle clouds) **N_h**	Code table, 0
		0 20 013	Height of base of cloud **h**	m, –1
		0 20 012	Cloud type (low clouds C_L) **C_L**	Code table, 0
		0 20 012	Cloud type (middle clouds C_M) **C_M**	Code table, 0
		0 20 012	Cloud type (high clouds C_H) **C_H**	Code table, 0
			Individual cloud layers or masses	
	1 01 000		Delayed replication of 1 descriptor	
	0 31 001		Delayed descriptor replication factor	Numeric, 0
	3 02 005	0 08 002	Vertical significance	Code table, 0
		0 20 011	Cloud amount (N_s) **N_s**	Code table, 0
		0 20 012	Cloud type (C) **C**	Code table, 0
		0 20 013	Height of base of cloud (h_sh_s) **h_sh_s**	m, -1
			Clouds with bases below station level	
3 02 036	1 05 000		Delayed replication of 5 descriptors	
	0 31 001		Delayed descriptor replication factor	Numeric, 0
	0 08 002		Vertical significance	Code table, 0
	0 20 011		Cloud amount **N’**	Code table, 0
	0 20 012		Cloud type **C’**	Code table, 0
	0 20 014		Height of top of cloud **H’H’**	m, -1
	0 20 017		Cloud top description **C_t**	Code table, 0
			Direction of cloud drift gr. **$56D_LD_MD_H$**	
3 02 047	1 02 003		Replicate 2 descriptors 3 times	

	0 08 002		Vertical significance = 7 (low cloud) = 8 (middle cloud) = 9 (high cloud)	Code table, 0
	0 20 054		True direction from which clouds are moving **D_L, D_M, D_H**	Degree true, 0
0 08 002			Vertical significance (set to missing to cancel the previous value)	Code table, 0
			Direction and elevation of cloud gr. **$57CD_ae_C$**	
3 02 048	0 05 021		Bearing or azimuth **D_a**	Degree true, 2
	0 07 021		Elevation angle **e_C**	Degree, 2
	0 20 012		Cloud type **C**	Code table, 0
	0 05 021		Bearing or azimuth (set to missing to cancel the previous value)	Degree true, 2
	0 07 021		Elevation angle (set to missing to cancel the previous value)	Degree, 2
			State of ground, snow depth, ground minimum temperature	
3 02 037	0 20 062		State of ground (with or without snow) **E** or **E'**	Code table, 0
	0 13 013		Total snow depth **sss**	m, 2
	0 12 113		Ground minimum temperature (scale2), past 12 hours **$s_nT_gT_g$**	K, 2
3 02 043			**Basic synoptic "period" data**	
			Present and past weather	
	3 02 038	0 20 003	Present weather **ww**	Code table, 0
		0 04 024	Time period in hours	Hour, 0
		0 20 004	Past weather (1) **W_1**	Code table, 0
		0 20 005	Past weather (2) **W_2**	Code table, 0
			Sunshine data (from 1 hour and 24 hour period)	
	1 01 002		Replicate 1 descriptors 2 times	
	3 02 039	0 04 024	Time period in hours	Hour, 0
		0 14 031	Total sunshine **SS** and **SSS**	Minute, 0
			Precipitation measurement	
	3 02 040	0 07 032	Height of sensor above local ground (for precipitation measurement)	m, 2
		1 02 002	Replicate next 2 descriptors 2 times	
		0 04 024	Time period in hours **t_R**	Hour, 0
		0 13 011	Total precipitation / total water equivalent of snow **RRR**	kg m^{-2}, 1
			Extreme temperature data	
	3 02 041	0 07 032	Height of sensor above local ground (for temperature measurement)	m, 2
		0 04 024	Time period or displacement	Hour, 0
		0 04 024	Time period or displacement (see Notes 1 and 2)	Hour, 0
		0 12 111	Maximum temperature (scale 2) at height and over period specified **$s_nT_xT_xT_x$**	K, 2
		0 04 024	Time period or displacement	Hour, 0
		0 04 024	Time period or displacement (see Note 2)	Hour, 0
		0 12 112	Minimum temperature (scale 2) at height and over period specified **$s_nT_nT_nT_n$**	K, 2
			Wind data	
	3 02 042	0 07 032	Height of sensor above local ground (for wind measurement)	m, 2
		0 02 002	Type of instrumentation for wind measurement **i_w**	Flag table, 0
		0 08 021	Time significance (= 2 (time averaged))	Code table, 0
		0 04 025	Time period (= - 10 minutes, or number of	Minute, 0

			minutes after a significant change of wind)	
		0 11 001	Wind direction **dd**	Degree true, 0
		0 11 002	Wind speed **ff**	m s^{-1}, 1
		0 08 021	Time significance (= missing value)	Code table, 0
		1 03 002	Replicate next 3 descriptors 2 times	
		0 04 025	Time period in minutes	Minute, 0
		0 11 043	Maximum wind gust direction	Degree true, 0
		0 11 041	Maximum wind gust speed 910$\mathbf{f_m f_m}$, 911$\mathbf{f_x f_x}$	m s^{-1}, 1
	0 07 032		Height of sensor above local ground (set to missing to cancel the previous value)	m, 2
			Evaporation data	
3 02 044	0 04 024		Time period in hours	Hour, 0
	0 02 004		Type of instrument for evaporation or crop type for evapotranspiration $\mathbf{i_E}$	Code table, 0
	0 13 033		Evaporation /evapotranspiration **EEE**	kg m^{-2}, 1
			Radiation data (from 1 hour and 24 hour period)	
1 01 002			Replicate next descriptor 2 times	
3 02 045	0 04 024		Time period in hours	Hour, 0
	0 14 002		Long-wave radiation, integrated over period specified 553SS 4**FFFF** or 553SS 5**FFFF,** 55SSS 4$\mathbf{F_{24}F_{24}F_{24}F_{24}}$ or 55SSS 5$\mathbf{F_{24}F_{24}F_{24}F_{24}}$	J m^{-2}, -3
	0 14 004		Short-wave radiation, integrated over period specified 553SS 6**FFFF,** 55SSS 6$\mathbf{F_{24}F_{24}F_{24}F_{24}}$	J m^{-2}, -3
	0 14 016		Net radiation, integrated over period specified 553SS 0**FFFF** or 553SS 1**FFFF,** 55SSS 0$\mathbf{F_{24}F_{24}F_{24}F_{24}}$ or 55SSS 1$\mathbf{F_{24}F_{24}F_{24}F_{24}}$	J m^{-2}, -4
	0 14 028		Global solar radiation (high accuracy), integrated over period specified 553SS 2**FFFF,** 55SSS 2$\mathbf{F_{24}F_{24}F_{24}F_{24}}$	J m^{-2}, -2
	0 14 029		Diffuse solar radiation (high accuracy), integrated over period specified 553SS 3**FFFF,** 55SSS 3$\mathbf{F_{24}F_{24}F_{24}F_{24}}$	J m^{-2}, -2
	0 14 030		Direct solar radiation (high accuracy), integrated over period specified 55408 4**FFFF,** 55508 5$\mathbf{F_{24}F_{24}F_{24}F_{24}}$	J m^{-2}, -2
3 02 046			**Temperature change** group **54**$\mathbf{g_0 s_n d_T}$	
	0 04 024		Time period or displacement	Hour, 0
	0 04 024		Time period or displacement (see Note 3)	Hour, 0
	0 12 049		Temperature change over period specified $\mathbf{s_n d_T}$	K, 0

Notes:

1) Within RA-IV, the maximum temperature at 1200 UTC is reported for the previous calendar day (i.e. the ending time of the period is not equal to the nominal time of the report). To construct the required time range, descriptor 004024 has to be included two times. If the period ends at the nominal time of the report, value of the second 004024 shall be set to 0.

2) Within RA-III, the maximum day-time temperature and the minimum night-time temperature is reported (i.e. the ending time of the period may not be equal to the nominal time of the report). To construct the required time range, descriptor 004024 has to be included two times. If the period ends at the nominal time of the report, value of the second 004024 shall be set to 0.

3) To construct the required time range, descriptor 004024 has to be included two times.

Regulations:

B/C 5.1	Section 1 of BUFR or CREX
B/C 5.2	Mobile station identification, time, horizontal and vertical coordinates
B/C 5.3	Pressure data
B/C 5.4	Basic synoptic “instantaneous” data
B/C 5.4.1	Temperature and humidity data
B/C 5.4.2	Visibility data
B/C 5.4.3	Precipitation past 24 hours
B/C 5.4.4	Cloud data
B/C 5.4.5	Individual cloud layers or masses
B/C 5.5	Clouds with bases below station level
B/C 5.6	Direction of cloud drift
B/C 5.7	Direction and elevation of cloud
B/C 5.8	State of ground, snow depth, ground minimum temperature
B/C 5.9	“Instantaneous” data required by regional or national reporting practices
B/C 5.10	Basic synoptic “period” data
B/C 5.10.1	Present and past weather
B/C 5.10.2	Sunshine data
B/C 5.10.3	Precipitation measurement
B/C 5.10.4	Extreme temperature data
B/C 5.10.5	Wind data
B/C 5.11	Evaporation data
B/C 5.12	Radiation data
B/C 5.13	Temperature change
B/C 5.14	“Period” data required by regional or national reporting practices

B/C 5.1 Section 1 of BUFR or CREX

B/C 5.1.1 Entries required in Section 1 of BUFR

The following entries shall be included in BUFR Section 1:

- BUFR master table,
- identification of originating/generating centre,
- identification of originating/generating sub-centre,
- update sequence number,
- identification of inclusion of optional section,
- data category (= 000 for SYNOP MOBIL data),
- international data sub-category (1), (2),
- local data subcategory,
- version number of master table,
- version number of local tables,
- year (year of the century up to BUFR edition 3),
- month (standard time),
- day (standard time = YY in the abbreviated telecommunication header for SYNOP MOBIL data),
- hour (standard time = GG in the abbreviated telecommunication header for SYNOP MOBIL data),
- minute (standard time = 00 for SYNOP MOBIL data).

Notes:
(1) Inclusion of this entry is required starting with BUFR edition 4.
(2) If required, the international data sub-category shall be included for SYNOP MOBIL data as
= 005 at main synoptic times 00, 06, 12, 18 UTC,
= 004 at intermediate synoptic times 03, 09, 15, 21 UTC,
= 003 at observation times 01, 02, 04, 05, 07, 08, 10, 11, 13, 14, 16, 17, 19, 20, 22 and 23 UTC.

B/C 5.1.2 Entries required in Section 1 of CREX

The following entries shall be included in CREX Section 1:

- CREX master table,
- CREX edition number,
- CREX table version number,
- version number of BUFR master table (1),
- version number of local tables (1),
- data category (= 000 for SYNOP MOBIL data),
- international data sub-category (1), (2),
- identification of originating/generating centre (1),
- identification of originating/generating sub-centre (1),
- update sequence number (1),
- number of subsets (1),
- year (standard time) (1),
- month (standard time) (1),
- day (standard time = YY in the abbreviated telecommunication header for SYNOP MOBIL data) (1),
- hour (standard time = GG in the abbreviated telecommunication header for SYNOP MOBIL data) (1),
- minute (standard time = 00 for SYNOP MOBIL data) (1).

Notes:
(1) Inclusion of these entries is required starting with CREX edition 2.
(2) If inclusion of international data sub-category is required, Note (2) under B/C 5.1.1 applies.

B/C 5.2 Mobile station identification, time, horizontal and vertical coordinates <3 01 092>

B/C 5.2.1 Mobile station identification

Mobile land station identifier (0 01 011) shall be always reported as a non-missing value. In the absence of a suitable call sign, the word MOBIL shall be used for mobile land station identifier. [12.1.7(c)]

WMO regional number (0 01 003) shall be reported to indicate the geographical area in which the mobile station has been deployed.

Type of station (Code table 0 02 001) shall be reported to indicate the type of the station operation (manned, automatic or hybrid).
Note:
(1) If a station operates as a manned station for a part of the day and as an automatic station for the rest of the day, code figure 2 (Hybrid) may be used in all reports. It is preferable, however, to use code figure 1 (Manned) in reports produced under the supervision of an observer, and a code figure 0 (Automatic) in reports produced while the station operates in the automatic mode.

B/C 5.2.2 Time of observation

Year (0 04 001), month (0 04 002), day (0 04 003), hour (0 04 004) and minute (0 04 005) of the actual time of observation shall be reported.
Note:
(1) The actual time of observation shall be the time at which the barometer is read. [12.1.6]

B/C 5.2.2.1

If the actual time of observation differs by 10 minutes or less from the standard time reported in Section 1, the standard time may be reported instead of the actual time of observation. [12.2.8]

B/C 5.2.3 Horizontal and vertical coordinates

Latitude (0 05 001) and longitude (0 06 001) of the station shall be reported in degrees with precision in 10^{-5} of a degree.

Height of station ground above mean sea level (0 07 030) and height of barometer above mean sea level (0 07 031) shall be reported in meters with precision in tenths of a meter.

B/C 5.2.4 Station elevation quality mark – Code table 0 33 024

Station elevation quality mark shall be reported to indicate the accuracy of the vertical coordinates of the mobile station.

B/C 5.3 Pressure data <3 02 031>

B/C 5.3.1 Pressure at the station level

Pressure at the station level (0 10 004), i.e. at the level defined by 0 07 031 (height of barometer above mean sea level), shall be reported in pascals (with precision in tens of a pascal).

B/C 5.3.1.1

The station pressure shall be included in reports for global exchange from land stations, together with either the mean sea level pressure or, in accordance with Regulation B/C 5.3.5.1, with the geopotential height of a standard pressure level. [12.2.4]

Note:

(1) Inclusion of the station pressure at other times is left to the decision of individual Members.

B/C 5.3.2 Pressure reduced to mean sea level

Pressure reduced to mean sea level (0 10 051) shall be reported in pascals (with precision in tens of a pascal).

B/C 5.3.2.1

Whenever air pressure at mean sea level can be computed with reasonable accuracy, this pressure shall be reported. [12.2.3.4.1]

Notes:

(1) For a station situated in a region of normal synoptic network density, the pressure at mean sea level is considered not to be computed with reasonable accuracy when it introduces a deformation into the analysis of the horizontal pressure field, which is purely local and recurring.

(2) For a station lying in a data-sparse area of the synoptic network, reasonable accuracy will be obtained when using a reduction method,which has proved to be satisfactory in a region of normal network density and under similar geographic conditions.

B/C 5.3.3 Three-hour pressure change and characteristic of pressure tendency

Amount of pressure change at station level, during the three hours preceding the time of observation (0 10 061), either positive, zero *or negative*, shall be reported in pascals (with precision in tens of a pascal).

B/C 5.3.3.1

Unless specified otherwise by regional decision, pressure tendency shall be included whenever the three-hourly pressure tendency is available. [12.2.3.5.1]

B/C 5.3.3.2

The characteristic of pressure tendency (Code table 0 10 063) over the past three hours shall, whenever possible, be determined on the basis of pressure samples at equi-spaced intervals not exceeding one hour. [12.2.3.5.2]

Note:

(1) Algorithms for selecting the appropriate code figure are included in publication WMO–No.8, Guide to Meteorological Instruments and Methods of Observation.

B/C 5.3.3.3

Where it is not possible to apply the algorithms specified in Regulation B/C 5.3.3.2 in reports from automatic weather stations, the characteristic of pressure tendency shall be reported as 2 when the tendency is positive, as 7 when the tendency is negative, and as 4 when the atmospheric pressure is the same as three hours before. [12.2.3.5.3]

B/C 5.3.4 24-hour pressure change

If specified by regional decision, amount of surface pressure change at station level, during 24 hours preceding the time of observation (0 10 062), either positive, zero or negative, shall be reported in pascals (with precision in tens of a pascal). [12.4.7.1.2(k), (l)]

B/C 5.3.5 Geopotential height of the standard level

Geopotential height of the standard level (0 10 009) shall be reported in geopotential meters. The standard isobaric level is specified by the preceding entry Pressure (0 07 004).

B/C 5.3.5.1

By regional decision, a high-level station which cannot give pressure at mean sea level to a satisfactory degree of accuracy shall report both the station-level pressure and the geopotential height of an agreed standard isobaric surface. [12.2.3.4.2]

B/C 5.4 Basic synoptic "instantaneous" data <3 02 035>

B/C 5.4.1 Temperature and humidity data <3 02 032>

B/C 5.4.1.1 Height of sensor above local ground

Height of sensor above local ground (0 07 032) for temperature and humidity measurement shall be reported in meters (with precision in hundredths of a meter).
This datum represents the actual height of temperature and humidity sensors above ground at the point where the sensors are located.

B/C 5.4.1.2 Dry-bulb air temperature

Dry-bulb air temperature (0 12 101) shall be reported in degrees Kelvin (with precision in hundredths of a degree Kelvin); if produced in CREX, in degrees Celsius (with precision in hundredths of a degree Celsius)

Notes:

(1) Temperature data shall be reported with precision in hundredths of a degree even if they are measured with the accuracy in tenths of a degree. This requirement is based on the fact that conversion from the Kelvin to the Celsius scale has often resulted into distortion of the data values.

(2) Temperature t (in degrees Celsius) shall be converted into temperature T (in degrees Kelvin) using equation: $T = t + 273.15$.

B/C 5.4.1.2.1

When the data are not available as a result of a temporary instrument failure, this quality shall be included as a missing value. [12.2.3.2]

B/C 5.4.1.3 Dew-point temperature

Dew-point temperature (0 12 103) shall be reported in degrees Kelvin (with precision in hundredths of a degree Kelvin); if produced in CREX, in degrees Celsius (with precision in hundredths of a degree Celsius).

Note:

(1) Notes (1) and (2) under Regulation B/C 5.4.1.2 shall apply.

B/C 5.4.1.3.1

When the data are not available as a result of a temporary instrument failure, this quality shall be included as a missing value. [12.2.3.3.2]

B/C 5.4.1.4 Relative humidity

Relative humidity (0 13 003) shall be reported in units of a percent.

B/C 5.4.1.4.1

Both dew point temperature and relative humidity shall be reported when available.

B/C 5.4.2 Visibility data <3 02 033>

B/C 5.4.2.1 Height of sensor above local ground

Height of sensor above local ground (0 07 032) for visibility measurement shall be reported in meters (with precision in hundredths of a meter).
This datum represents the actual height of visibility sensors above ground at the point where the sensors are located. If visibility is estimated by a human observer, average height of observer's eyes above station ground shall be reported.

B/C 5.4.2.2 Horizontal visibility

Horizontal visibility (0 20 001) at surface shall be reported in meters (with precision in tens of a meter).

B/C 5.4.2.2.1

When the horizontal visibility is not the same in different directions, the shortest distance shall be given for visibility. [12.2.1.3.1]

B/C 5.4.3 Precipitation past 24 hours <3 02 034>

B/C 5.4.3.1 Height of sensor above local ground

Height of sensor above local ground (0 07 032) for precipitation measurement shall be reported in meters (with precision in hundredths of a meter).
This datum represents the actual height of the rain gauge rim above ground at the point where the rain gauge is located.

B/C 5.4.3.2 Total amount of precipitation during the 24-hour period

Total amount of precipitation during the 24-hour period ending at the time of observation (0 13 023) shall be reported in kilograms per square meter (with precision in tenths of a kilogram per square meter). [12.4.9]

B/C 5.4.3.2.1

The precipitation over the past 24 hours shall be included (not missing) at least once a day at one appropriate time of the main standard times (0000, 0600, 1200, 1800 UTC). [12.4.1]

B/C 5.4.3.2.2

Precipitation, when it can be and has to be reported, shall be reported as 0.0 kgm^{-2} if no precipitation were observed during the referenced period. [12.2.5.4]

B/C 5.4.3.2.3

Trace shall be reported as "- 0.1 kgm^{-2} ".

B/C 5.4.4 Cloud data <3 02 004>

B/C 5.4.4.1 Total cloud cover

Total cloud cover (0 20 010) shall embrace the total fraction of the celestial dome covered by clouds irrespective of their genus. It shall be reported in *units of a percent*.

Note:

(1) Total cloud cover shall be reported as 113 when sky is obscured by fog and/or other meteorological phenomena.

B/C 5.4.4.1.1

Total cloud cover shall be reported as actually seen by the observer during the observation. [12.2.2.2.1]

B/C 5.4.4.1.2

Altocumulus perlucidus or Stratocumulus perlucidus ("mackerel sky") shall be reported *as 99% or less* (unless overlying clouds appear to cover the whole sky) since breaks are always present in this cloud form even if it extends over the whole celestial dome. [12.2.2.2.2]

B/C 5.4.4.1.3

Total cloud cover shall be reported as zero when blue sky or stars are seen through existing fog or other analogous phenomena without any trace of cloud being seen. [12.2.2.2.3]

B/C 5.4.4.1.4

When clouds are observed through fog or analogous phenomena, their amount shall be evaluated and reported as if these phenomena were non-existent. [12.2.2.2.4]

B/C 5.4.4.1.5

Total cloud cover shall not include the amount resulting from rapidly dissipating condensation trails. [12.2.2.2.5]

B/C 5.4.4.1.6

Persistent condensation trails and cloud masses which have obviously developed from condensation trails shall be reported as cloud. [12.2.2.2.6]

B/C 5.4.4.2 Vertical significance – Code table 0 08 002

To specify vertical significance (0 08 002) within the sequence 3 02 004, a code figure shall be selected in the following way:

(a) If low clouds are observed, then code figure 7 (Low cloud) shall be used.

(b) If there are no low clouds but middle clouds are observed, then code figure 8 (Middle clouds) shall be used.

(c) If there are no low and there are no middle clouds but high clouds are observed, then code figure 0 shall be used.

(d) If sky is obscured by fog and/or other phenomena, then code figure 5 (Ceiling) shall be used.

(e) If there are no clouds (clear sky), then code figure 62 (Value not applicable) shall be used.

(f) If the cloud cover is not discernible for reasons other than (d) above or observation is not made, then code figure 63 (Missing value) shall be used.

B/C 5.4.4.3 Cloud amount (of low or middle clouds) – Code table 0 20 011

Amount of all the low clouds (clouds of the genera Stratocumulus, Stratus, Cumulus, and Cumulonimbus) present or, if no low clouds are present, the amount of all the middle clouds (clouds of the genera Altocumulus, Altostratus, and Nimbostratus) present.

B/C 5.4.4.3.1

Cloud amount shall be reported as follows:

(a) If there are low clouds, then the total amount of all low clouds, as actually seen by the observer during the observation shall be reported for the cloud amount.

(b) If there are no low clouds but there are middle clouds, then the total amount of the middle clouds shall be reported for the cloud amount.

(c) If there are no low clouds and there are no middle clouds but there are high clouds (clouds of the genera Cirrus, Cirrocumulus, and Cirrostratus), then the cloud amount shall be reported as zero. [12.2.7.2.1]

B/C 5.4.4.3.2

Amount of Altocumulus perlucidus or Stratocumulus perlucidus (“mackerel sky”) shall be reported using code figure 7 or less since breaks are always present in this cloud form even if it extends over the whole celestial dome. [12.2.7.2.2]

B/C 5.4.4.3.3

When the clouds reported for cloud amount are observed through fog or an analogous phenomenon, the cloud amount shall be reported as if these phenomena were not present. [12.2.7.2.3]

B/C 5.4.4.3.4

If the clouds reported for cloud amount include contrails, then the cloud amount shall include the amount of persistent contrails. Rapidly dissipating contrails shall not be included in the value for the cloud amount. [12.2.7.2.4]

B/C 5.4.4.4 Height of base of lowest cloud

Height above surface of the base (0 20 013) of the lowest cloud seen shall be reported in meters (with precision in tens of a meter).

Note:

(1) The term "height above surface" shall be considered as being the height above the official aerodrome elevation or above station elevation at a non-aerodrome station.

B/C 5.4.4.4.1

When the station is in fog, a sandstorm or in blowing snow but the sky is discernable, the base of the lowest cloud shall refer to the base of the lowest cloud observed, if any. When, under the above conditions, the sky is not discernible, the base of the lowest cloud shall be reported as missing. [12.2.1.2]

B/C 5.4.4.4.2

When no cloud are reported (Total cloud cover = 0) the base of the lowest cloud *shall be reported as a missing value.*

B/C 5.4.4.4.3

When, by national decision, clouds with bases below the station are reported from the station and clouds with bases below and tops above the station are observed, the base of the lowest cloud *shall be reported having a negative value if the base of cloud is discernible, or as a missing value.*

B/C 5.4.4.5 Cloud type of low, middle and high clouds - Code table 0 20 012

Clouds of the genera Stratocumulus, Stratus, Cumulus, and Cumulonimbus (low clouds) shall be reported for the first entry 0 20 012, clouds of the genera Altocumulus, Altostratus, and Nimbostratus (middle clouds) shall be reported for the second entry 0 20 012 and clouds of the genera Cirrus, Cirrocumulus, and Cirrostratus (high clouds) shall be reported for the third entry 0 20 012.

B/C 5.4.4.5.1

The reporting of type of low, middle and high clouds shall be as specified in publication WMO-NO. 407 – International Cloud Atlas, Volume I. [12.2.7.3]

B/C 5.4.5 Individual cloud layers or masses

B/C 5.4.5.1 Number of individual cloud layers or masses

The number of individual cloud layers or masses shall be indicated by Delayed descriptor replication factor 0 31 001 in BUFR and by a four-digit number in the Data Section corresponding to the position of the replication descriptor in the Data Description Section of CREX.

Notes:

(1) The number of cloud layers or masses shall never be set to a missing value.

(2) The number of cloud layers or masses shall be set to a positive value in a NIL report.

B/C 5.4.5.1.1

The number of individual cloud layers or masses shall in the absence of Cumulonimbus clouds not exceed three. Cumulonimbus clouds, when observed, shall always be reported, so that the total number of individual cloud layers or masses can be four. The selection of layers (or masses) to be reported shall be made in accordance with the following criteria:

(a) The lowest individual layer (or mass) of any amount (cloud amount at least one octa or less, but not zero);

(b) The next higher individual layer (or mass) the amount of which is greater than two octas;

(c) The next higher individual layer (or mass) the amount of which is greater than four octas;

(d) Cumulonimbus clouds, whenever observed and not reported under (a), (b) and (c) above. [12.4.10.1]

B/C 5.4.5.1.2

When the sky is clear, the number of individual cloud layers or masses shall be set to zero.

B/C 5.4.5.1.3

The order of reporting the individual cloud layers or masses shall always be from lower to higher levels. [12.4.10.2]

B/C 5.4.5.2 Individual cloud layer or mass <3 02 005>

Each cloud layer or mass shall be represented by the following four parameters: Vertical significance (0 08 002), amount of individual cloud layer or mass (0 20 011), type of cloud layer or mass (0 20 012) and height of base of individual cloud layer or mass (0 20 013).

B/C 5.4.5.2.1 Vertical significance – Code table 0 08 002

To specify vertical significance (0 08 002) within the sequence 3 02 005, a code figure shall be selected in the following way:

(a) Code figure 1 shall be used in the first non-Cumulonimbus layer.
(b) Code figure 2 shall be used in the second non-Cumulonimbus layer.
(c) Code figure 3 shall be used in the third non-Cumulonimbus layer.
(d) Code figure 4 shall be used in any Cumulonimbus layer.
(e) If sky is obscured by fog and/or other phenomena, then code figure 5 (Ceiling) shall be used.
(f) If the cloud cover is not discernible for reasons other than (e) above or observation is not made, then code figure 63 (Missing value) shall be used.

B/C 5.4.5.2.2 Cloud amount, type and height of base

B/C 5.4.5.2.2.1

When the sky is clear, in accordance with Regulation B/C 5.4.5.1.2 cloud amount, genus, and height shall not be included. [12.4.10.4]

B/C 5.4.5.2.2.2

In determining cloud amounts (Code table 0 20 011) to be reported for individual layers or masses, the observer shall estimate, by taking into consideration the evolution of the sky, the cloud amounts of each individual layer or mass at the different levels, as if no other clouds existed. [12.4.10.3]

B/C 5.4.5.2.2.3

Type of a cloud layer or mass (Code table 0 20 012) shall be reported using code figures 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 59 and 63.

B/C 5.4.5.2.2.4

If, notwithstanding the existence of fog, sandstorm, duststorm, blowing snow or other obscuring phenomena, the sky is discernible, the partially obscuring phenomena shall be disregarded. If, under the above conditions, the sky is not discernible, the cloud type shall be reported using *code figure 59* and the cloud height shall be replaced by vertical visibility. [12.4.10.5]

Note:

(1) The vertical visibility is defined as the vertical visual range into an obscuring medium.

B/C 5.4.5.2.2.5

If two or more types of cloud occur with their bases at the same level and this level is one to be reported in accordance with Regulation B/C 5.4.5.1.1, the selection for cloud type and amount shall be made with the following criteria:

(a) If these types do not include Cumulonimbus then cloud genus shall refer to the cloud type that represents the greatest amount, or if there are two or more types of cloud all having the same amount, the highest applicable code figure for cloud genus shall be reported. Cloud amount shall refer to the total amount of cloud whose bases are all at the same level;
(b) If these types do include Cumulonimbus then one layer shall be reported to describe only this type with cloud genus indicated as Cumulonimbus and the cloud amount as the amount of the Cumulonimbus. If the total amount of the remaining

type(s) of cloud (excluding Cumulonimbus) whose bases are all at the same level is greater than that required by Regulation B/C 5.4.5.1.1, then another layer shall be reported with type being selected in accordance with (a) and amount referring to the total amount of the remaining cloud (excluding Cumulonimbus). [12.4.10.6]

B/C 5.4.5.2.2.6

Regulations B/C5.4.4.1.3 to B/C5.4.4.1.6, inclusive, shall apply. [12.4.10.7]

B/C 5.4.5.2.2.7

Height above surface of the cloud base (0 20 013) shall be reported in meters (with precision in tens of a meter).

Note:

(1) The term "height above surface" shall be considered as being the height above the official aerodrome elevation or above station elevation at a non-aerodrome station.

B/C 5.5 Clouds with bases below station level <3 02 036>

B/C 5.5.1 Number of cloud layers with bases below station level

The number of cloud layers with bases below station level shall be indicated by Delayed descriptor replication factor 0 31 001 in BUFR and by a four-digit number in the Data Section corresponding to the position of the replication descriptor in the Data Description Section of CREX.

Notes:

(1) The number of cloud layers with bases below station level shall never be set to a missing value.

(2) The number of cloud layers with bases below station level shall be set to a positive value in a NIL report.

B/C 5.5.1.1

Inclusion of these data shall be determined by national decision. The number of cloud layers with bases below station level shall be always set to zero in reports from a station at which observations of clouds with bases below station level are not executed.

B/C 5.5.1.2

When no cloud layers with bases below station are observed, the number of cloud layers with bases below station level shall be set to zero.

B/C 5.5.1.3

If the station is in continuous or almost continuous cloud, the number of cloud layers with bases below station level shall be set to one, with all parameters reported as missing except for vertical significance 0 08 002 that shall be set to 10 (cloud layer with a base below and tops above station level). [12.5.4]

B/C 5.5.1.4

If clouds with bases below station level are not discernible due to fog and/or other phenomena or observation is not made, then the number of cloud layers with bases below station level shall be set to one, with all parameters reported as missing except for vertical significance 0 08 002 that shall be set to 11.

B/C 5.5.1.5

When two or more cloud layers with their bases below station level occur at different levels, two or more cloud layers shall be reported. [12.5.5]

B/C 5.5.1.6

Clouds with bases below and tops above station level shall be reported as the first layer within the sequence 3 02 036, provided that the station is out of cloud sufficiently frequently to enable the various features to be recognized. Other low clouds present with tops below station level shall be reported as the following layers (one or more) within the sequence 3 02 036. [12.5.3]

Notes:

(1) Clouds with bases below and tops above station level shall be reported also in sequences 3 02 004 and 3 02 005. [12.5.3]

(2) Clouds with tops below station level shall be reported only in sequence 3 02 036, and any co-existent clouds with bases above station level shall be reported only in sequences 3 02 004 and 3 02 005. [12.5.2]

B/C 5.5.2 Individual cloud layer with base below station level

Each cloud layer with base below station level shall be represented by the following five parameters: Vertical significance (0 08 002), amount of clouds with base below station level (0 20 011), type of clouds with base below station level (0 20 012), altitude of the upper surface of clouds (0 20 014) and cloud top description (0 20 017).

B/C 5.5.2.1 Vertical significance - Code table 0 08 002

Code figure 10 shall be used for cloud layers with bases below and tops above station level; code figure 11 shall be used for cloud layers with bases and tops below station level.

B/C 5.5.2.2 Amount of clouds with base below station level - Code table 0 20 011

B/C 5.5.2.2.1

Regulations B/C 5.4.4.1.1 to B/C 5.4.4.1.6, inclusive, shall apply. [12.5.8]

B/C 5.5.2.2.2

Spaces occupied by mountains emerging from the cloud layers shall be counted as occupied by clouds. [12.5.9]

B/C 5.5.2.3 Type of clouds with base below station level - Code table 0 20 012

Type of clouds with bases below station level shall be reported using code figures 0, 1, 2, 3, 4, 5, 6, 7, 8, 9 and 63.

B/C 5.5.2.4 Height of top of clouds above mean sea level

Height of top of clouds above mean sea level (0 20 014) shall be reported in meters (with precision in tens of a meter).

B/C 5.5.2.4.1

Height of top of clouds with bases below and tops above station level shall be reported, provided that the upper surface of clouds can be observed. [12.5.3 (b)]

B/C 5.5.2.5 Cloud top description - Code table 0 20 017

B/C 5.5.2.5.1

Description of top of clouds with bases below and tops above station level shall be reported, provided that the station is out of cloud sufficiently frequently to enable the features to be recognized.

B/C 5.5.2.5.2

Rapidly dissipating condensation trails shall not be reported. However, the top of persistent condensation trails and cloud masses which have obviously developed from condensation trails (and whose bases are below station level) shall be reported in Sequence 3 02 036. [12.5.6], [12.5.7]

B/C 5.6 Direction of cloud drift <3 02 047>

This information is required from land stations mainly in the tropics. [12.4.7.5]

B/C 5.6.1 Vertical significance – Code table 0 08 002

To specify vertical significance (0 08 002) within the sequence 3 02 047, code figures shall be selected in the following way:

(a) Code figure 7 (Low cloud) shall be used in the first replication.

(b) Code figure 8 (Middle clouds) shall be used in the second replication.

(c) Code figure 9 (High cloud) shall be used in the third replication.

B/C 5.6.2 True direction from which clouds are moving

True direction from which low, middle, or high clouds are moving (0 20 054) shall be reported in degrees true as follows:

(a) True direction from which the low clouds are moving shall be included in the first replication.
(b) True direction from which the middle clouds are moving shall be included in the second replication.
(c) True direction from which the high clouds are moving shall be included in the third replication.

B/C 5.7 Direction and elevation of cloud <3 02 048>

This information is required from land stations mainly in the tropics. [12.4.7.5]

B/C 5.7.1 Direction of cloud

True direction (0 05 021), from which orographic clouds or clouds with vertical development are seen, shall be *reported in degrees true*. The cloud genus shall be specified by the third entry of the sequence 3 02 048, i.e. by Cloud type – Code table 0 20 012.

Note:

(1) It is considered sufficient to report direction of cloud in degrees true, although 0 05 021 (Bearing or azimuth) is defined with higher accuracy (hundredths of a degree true).

B/C 5.7.2 Elevation of cloud

Elevation angle (0 07 021) of the top of the cloud shall be reported in degrees. The cloud genus shall be specified by the following entry, i.e. by Cloud type – Code table 0 20 012.

Note:

(1) It is considered sufficient to report elevation of the top of cloud in degrees, although 0 07 021 (Elevation angle) is defined with higher accuracy (hundredths of a degree).

B/C 5.8 State of ground, snow depth, ground minimum temperature <3 02 037>

B/C 5.8.1 State of ground (with or without snow) - Code table 0 20 062.

State of ground without snow or with snow shall be reported using Code table 0 20 062. The synoptic hour at which this datum is reported shall be determined by regional decision.

B/C 5.8.2 Total snow depth

Total snow depth (0 13 013) shall be reported in meters (with precision in hundredths of a meter). The synoptic hour at which this datum is reported shall be determined by regional decision.

B/C 5.8.2.1

When total snow depth has to be reported, it is reported as 0.00 m if no snow, ice and other forms of solid precipitation on the ground are observed at the time of observation. A snow depth value of "– 0.01 m" shall indicate a little (less than 0.005 m) snow. A snow depth value of "– 0.02 m" shall indicate "snow cover not continuous".

B/C 5.8.2.2

The measurement shall include snow, ice and all other forms of solid precipitation on the ground at the time of observation. [12.4.6.1]

B/C 5.8.2.3

When the depth is not uniform, the average depth over a representative area shall be reported. [12.4.6.2]

B/C 5.8.3 Ground minimum temperature, past 12 hours

Ground minimum temperature from the previous 12 hours (0 12 113) shall be reported in degrees Kelvin (with precision in hundredths of a degree Kelvin); if produced in CREX, in degrees Celsius (with precision in hundredths of a degree Celsius).

Notes:
(1) Ground minimum temperature data shall be reported with precision in hundredths of a degree even if they are measured with the accuracy in tenths of a degree. Notes (1) and (2) under Regulation B/C 5.4.1.2 shall apply.
(2) The period of time covered by ground minimum temperature and the synoptic hour at which this temperature is reported shall be determined by regional decision. If ground minimum temperature is to be reported from the period of previous night, then “ground minimum temperature, past 12 hours” (0 12 113) shall be reported as a missing value. In this case, ground minimum temperature of the previous night (0 12 122) shall be reported in compliance with Regulation B/C 5.9.

B/C 5.9 “Instantaneous” data required by regional or national reporting practices

If regional or national reporting practices require inclusion of additional “instantaneous” parameters, the sequence descriptor 3 07 090 shall not be used. In this case BUFR/CREX template for SYNOP MOBIL data shall be used in its first level expanded form and the descriptors, corresponding to the required “instantaneous” parameters, shall be inserted to precede 3 02 043 (Basic synoptic “period” data).
Notes:
(1) “Instantaneous” parameter is a parameter that is not coupled to a time period descriptor, e.g. 0 04 024, 0 04 025.
(2) No regional requirements are currently indicated for reporting SYNOP MOBIL data in the *Manual on Codes*, WMO-No. 306, Volume II.

B/C 5.10 Basic synoptic “period” data <3 02 043>

B/C 5.10.1 Present and past weather <3 02 038>

B/C 5.10.1.1

Present weather (Code table 0 20 003) and past weather (1) (Code table 0 20 004) and past weather (2) (Code table 0 20 005) shall be reported as non-missing values if present and past conditions are known. In case of a report from a manually operated station after a period of closure or at start up, when past weather conditions for the period applicable to the report are unknown, past weather (1) and past weather (2) reported as missing shall indicate that previous conditions are unknown. This regulation shall also apply to automatic reporting stations with the facility to report present and past weather. [12.2.6.1]

B/C 5.10.1.2

Code figures 0, 1, 2, 3, 100, 101, 102 and 103 for present weather and code figures 0, 1, 2 and 10 for past weather (1) and past weather (2) shall be considered to represent phenomena without significance. [12.2.6.2]

B/C 5.10.1.3

Present and past weather shall be *reported if observation was made (data available), regardless significance of the phenomena.*
Note:
(1) If data are produced and collected in traditional codes and present weather and past weather is omitted in a SYNOP report (no significant phenomena observed), code figure 508 shall be used for present weather and code figure 10 for past weather (1) and past weather (2) when converted into BUFR or CREX.

B/C 5.10.1.4

If no observation was made (data not available), code figure 509 shall be used for present weather and both past weather (1) and past weather (2) shall be reported as missing.

B/C 5.10.1.5 Present weather from a manned weather station

B/C 5.10.1.5.1

If more than one form of weather is observed, the highest applicable code figure from the range <00 to 99> shall be selected for present weather. Code figure 17 shall have precedence over code figures 20 – 49. Other weather may be reported using additional entries 0 20 003 or 0 20 021 to 0 20 026 applying Regulation B/C 5.9. [12.2.6.4.1]

B/C 5.10.1.5.2

In coding 01, 02, or 03, there is no limitation on the magnitude of the change of the cloud amount. Code figures 00, 01, and 02 can each be used when the sky is clear at the time of observation. In this case, the following interpretation of the specifications shall apply:

- 00 is used when the preceding conditions are not known,
- 01 is used when the clouds have dissolved during the past hour,
- 02 is used when the sky has been continuously clear during the past hour. [12.2.6.4.2]

B/C 5.10.1.5.3

When the phenomenon is not predominantly water droplets, the appropriate code figure shall be selected without regard to visibility. [12.2.6.4.3]

B/C 5.10.1.5.4

The code figure 05 shall be used when the obstruction to vision consists predominantly of lithometeors. [12.2.6.4.4]

B/C 5.10.1.5.5

National instructions shall be used to indicate the specifications for code figures 07 and 09. [12.2.6.4.5]

B/C 5.10.1.5.6

The visibility restrictions on code figure 10 shall be 1000 meters or more. The specification refers only to water droplets and ice crystals. [12.2.6.4.6]

B/C 5.10.1.5.7

For code figures 11 or 12 to be reported, the apparent visibility shall be less than 1000 meters. [12.2.6.4.7]

B/C 5.10.1.5.8

For code figure 18, the following criteria for reporting squalls shall be used:

(a) When wind speed is measured: A sudden increase of wind speed of at least eight meters per second, the speed rising to 11 meters per second or more and lasting for at least one minute;

(b) When the Beaufort scale is used for estimating wind speed: A sudden increase of wind speed by at least three stages of the Beaufort scale, the speed rising to force 6 or more and lasting for at least one minute. [12.2.6.4.8]

B/C 5.10.1.5.9

Code figures 20 – 29 shall never be used when precipitation is observed at the time of observation. [12.2.6.4.9]

B/C 5.10.1.5.10

For code figure 28, visibility shall have been less than 1000 meters.

Note:

(1) The specification refers only to visibility restrictions which occurred as a result of water droplets or ice crystals. [12.2.6.4.10]

B/C 5.10.1.5.11

For synoptic coding purposes, a thunderstorm shall be regarded as being at the station from the time thunder is first heard, whether or not lightning is seen or precipitation is occurring at the station. A thunderstorm shall be reported if thunder is heard within the normal observational period preceding the time of the report. A thunderstorm shall be regarded as having ceased at the time thunder is first heard and the cessation is confirmed if thunder is not heard for 10 – 15 minutes after this time. [12.2.6.4.11]

B/C 5.10.1.5.12

The necessary uniformity in reporting code figures 36, 37, 38, and 39, which may be desirable within certain regions, shall be obtained by means of national instructions. [12.2.6.4.12]

B/C 5.10.1.5.13

A visibility restriction “less than 1000 meters” shall be applied to code figures 42 – 49. In the case of code figures 40 or 41, the apparent visibility in the fog or ice fog patch or bank shall be less than 1000 meters. Code figures 40 – 47 shall be used when the obstructions to vision consist predominantly of water droplets or ice crystals, and 48 or 49 when the obstructions consist predominantly of water droplets. [12.2.6.4.13]

B/C 5.10.1.5.14

When referring to precipitation, the phrase "at the station" in the code table shall mean "at the point where the observation is normally taken". [12.2.6.4.14]

B/C 5.10.1.5.15

The precipitation shall be encoded as intermittent if it has been discontinuous during the preceding hour, without presenting the character of a shower. [12.2.6.4.15]

B/C 5.10.1.5.16

The intensity of precipitation shall be determined by the intensity at the time of the observation. [12.2.6.4.16]

B/C 5.10.1.5.17

Code figures 80 – 89 shall be used only when the precipitation is of the shower type and takes place at the time of the observation.

Note:

(1) Showers are produced by convective clouds. They are characterized by their abrupt beginning and end and by the generally rapid and sometimes great variations in the intensity of the precipitation. Drops and solid particles falling in a shower are generally larger than those falling in non-showery precipitation. Between showers openings may be observed unless stratiform clouds fill the intervals between the cumuliform clouds. [12.2.6.4.17]

B/C 5.10.1.5.18

In reporting code figure 98, the observer shall be allowed considerable latitude in determining whether precipitation is or is not occurring, if it is not actually visible. [12.2.6.4.18]

B/C 5.10.1.6 Present weather from an automatic weather station

B/C 5.10.1.6.1

The highest applicable code figure shall be selected. [12.2.6.5.1]

B/C 5.10.1.6.2

In coding code figures 101, 102, and 103, there is no limitation on the magnitude of the change of the cloud amount. Code figures 100, 101, and 102 can each be used when the sky is clear at the time of observation. In this case, the following interpretation of the specifications shall apply:

- Code figure 100 is used when the preceding conditions are not known;
- Code figure 101 is used when the clouds have dissolved during the past hour;
- Code figure 102 is used when the sky has been continuously clear during the past hour. [12.2.6.5.2]

B/C 5.10.1.6.3

When the phenomenon is not predominantly water droplets, the appropriate code figure shall be selected without regard to the visibility. [12.2.6.5.3]

B/C 5.10.1.6.4

The code figures 104 and 105 shall be used when the obstruction to vision consists predominantly of lithometeors. [12.2.6.5.4]

B/C 5.10.1.6.5

The visibility restriction on code figure 110 shall be 1000 meters or more. The specification refers only to water droplets and ice crystals. [12.2.6.5.5]

B/C 5.10.1.6.6

For code figure 118, the following criteria for reporting squalls shall be used:

A sudden increase of wind speed of at least eight meters per second, the speed rising to 11 meters per second or more and lasting for at least one minute. [12.2.6.5.6]

B/C 5.10.1.6.7

Code figures 120 – 126 shall never be used when precipitation is observed at the time of observation. [12.2.6.5.7]

B/C 5.10.1.6.8

For code figure 120, visibility shall have been less than 1000 meters.

Note:

(1) The specification refers only to visibility restrictions, which occurred as a result of water droplets or ice crystals. [12.2.6.5.8]

B/C 5.10.1.6.9

For synoptic coding purposes, a thunderstorm shall be regarded as being at the station from the time thunder is first detected, whether or not lightning is detected or precipitation is occurring at the station. A thunderstorm shall be reported in present weather if thunder is detected within the normal observational period preceding the time of the report. A thunderstorm shall be regarded as having ceased at the time thunder is last detected and the cessation is confirmed if thunder is not detected for 10 – 15 minutes after this time. [12.2.6.5.9]

B/C 5.10.1.6.10

A visibility restriction "less than 1000 meters" shall be applied to code figures 130 – 135. [12.2.6.5.10]

B/C 5.10.1.6.11

The precipitation shall be encoded as intermittent if it has been discontinuous during the preceding hour, without presenting the character of a shower. [12.2.6.5.11]

B/C 5.10.1.6.12

The intensity of precipitation shall be determined by the intensity at the time of observation. [12.2.6.5.12]

B/C 5.10.1.6.13

Code figures 180 – 189 shall be used only when the precipitation is intermittent or of the shower type and takes place at the time of observation.

Note:

(1) Showers are produced by convective clouds. They are characterized by their abrupt beginning and end and by the generally rapid and sometimes great variations in the intensity of the precipitation. Drops and solid particles falling in a shower are generally larger than those falling in non-showery precipitation. Between showers openings may be observed unless stratiform clouds fill the intervals between the cumuliform clouds. [12.2.6.5.13]

B/C 5.10.1.7 Past weather reported from a manned weather station

B/C 5.10.1.7.1 Time period

The time period (0 04 024) covered by past weather (1) and past weather (2) shall be expressed as *a negative value* in hours:

(a) Six hours, for observations at 0000, 0600, 1200, and 1800 UTC;
(b) Three hours for observations at 0300, 0900, 1500, and 2100 UTC;
(c) Two hours for intermediate observations if taken every two hours.
(d) *One hour* for intermediate observations if taken every hour. [12.2.6.6.1]

B/C 5.10.1.7.2

The code figures for past weather (1) and past weather (2) shall be selected in such a way that past and present weather together give as complete a description as possible of the weather in the time interval concerned. For example, if the type of weather undergoes a complete change during the time interval concerned, the code figures selected for past weather (1) and past weather (2) shall describe the weather prevailing before the type of weather indicated by present weather began. [12.2.6.6.2]

B/C 5.10.1.7.3

When the past weather (1) and past weather (2) are used in hourly reports, Regulation B/C 5.10.1.7.1 (d) shall apply. [12.2.6.6.3]

B/C 5.10.1.7.4

If, using Regulation B/C 5.10.1.7.2, more than one code figure may be given to past weather (1), the highest figure shall be reported for past weather (1) and the second highest code figure shall be reported for past weather (2). [12.2.6.6.4]

B/C 5.10.1.7.5

If the weather during the period has not changed so that only one code figure may be selected for past weather, then that code figure shall be reported for both past weather (1) and past weather (2). [12.2.6.6.5]

B/C 5.10.1.8 Past weather reported from an automatic weather station

B/C 5.10.1.8.1 Time period

The time period (0 04 024) covered by past weather (1) and past weather (2) shall be expressed as *a negative value* in hours:
(a) Six hours for observations at 0000, 0600, 1200, and 1800 UTC;
(b) Three hours for observations at 0300, 0900, 1500, and 2100 UTC;
(c) Two hours for intermediate observations if taken every two hours.
(d) *One hour* for intermediate observations if taken every hour. [12.2.6.7.1]

B/C 5.10.1.8.2

The code figures for past weather (1) and past weather (2) shall be selected so that the maximum capability of the automatic station to discern past weather is utilized, and so that past and present weather together give as complete a description as possible of the weather in the time interval concerned. [12.2.6.7.2]

B/C 5.10.1.8.3

In cases where the automatic station is capable only of discerning very basic weather conditions, the lower code figures representing basic and generic phenomena may be used. If the automatic station has higher discrimination capabilities, the higher code figures representing more detailed explanation of the phenomena shall be used. For each basic type of phenomenon, the highest code figure within the discrimination capability of the automatic station shall be reported. [12.2.6.7.3]

B/C 5.10.1.8.4

If the type of weather during the time interval concerned undergoes complete and discernible changes, the code figures selected for past weather (1) and past weather (2) shall describe the weather prevailing before the type of weather indicated by present weather began. The highest figure shall be reported for past weather (1) and the second highest code figure shall be reported for past weather (2). [12.2.6.7.4]

B/C 5.10.1.8.5

If a discernible change in weather has not occurred during the period, so that only one code figure may be selected for the past weather, then that code figure shall be reported for both past weather (1) and past weather (2). For example, rain during the entire period shall be reported as code figure 14 for both past weather (1) and past weather (2) in the case of an automatic station incapable of differentiating types of precipitation, or code figure 16 for both past weather (1) and past weather (2) in the case of a station with the higher discrimination capability. [12.2.6.7.5]

B/C 5.10.2 Sunshine data <1 01 002><3 02 039>

B/C 5.10.2.1 Period of reference for sunshine duration

Time period in hours (0 04 024) shall be included as follows:
(a) one hour in the first replication (reported as -1);
(b) 24 hours in the second replication (reported as -24).

B/C 5.10.2.2 Duration of sunshine

Duration of sunshine from the time period specified by the preceding parameter 0 07 024, shall be reported in minutes.

B/C 5.10.2.2.1

The duration of sunshine over the previous hour shall be reported by national decision. When reported, it shall be included in the first replication.

B/C 5.10.2.2.2

The duration of sunshine over the previous 24 hours shall, by regional decision, be reported at all stations capable of doing so and included at either 0000 UTC, 0600 UTC, 1200 UTC or 1800 UTC. When reported, it shall be included in the second replication. [12.4.7.4.2]

B/C 5.10.3 Precipitation measurement <3 02 040>

B/C 5.10.3.1 Height of sensor above local ground

Height of sensor above local ground (0 07 032) for precipitation measurement shall be reported in meters (with precision in hundredths of a meter).
This datum represents the actual height of the rain gauge rim above ground at the point where the rain gauge is located.

B/C 5.10.3.2 Period of reference for amount precipitation

Time period (0 04 024) for amount of precipitation shall be reported as *a negative value* in hours. It shall be determined

(a) by regional decision (e.g. -6, -12, -24) in the first replication,
(b) by national decision (e.g. -1, -3) in the second replication.

B/C 5.10.3.3 Total amount of precipitation

Total amount of precipitation, which has fallen during the period of reference for amount of precipitation, shall be reported in kilograms per square meter (with precision in tenths of a kilogram per square meter).

B/C 5.10.3.3.1

Precipitation, when it can be and has to be reported, shall be reported as 0.0 kgm^{-2} if no precipitation were observed during the referenced period. [12.2.5.4]

B/C 5.10.3.3.2

Trace shall be reported as "- 0.1 kgm^{-2} ".

B/C 5.10.4 Extreme temperature data <3 02 041>

B/C 5.10.4.1 Height of sensor above local ground

Height of sensor above local ground (0 07 032) for temperature measurement shall be reported in meters (with precision in hundredths of a meter).
This datum represents the actual height of temperature sensor(s) above ground at the point where the sensors are located.

B/C 5.10.4.2 Periods of reference for extreme temperatures

Time period for maximum temperature and time period for minimum temperature (0 04 024) shall be determined by regional decision and reported as *negative values* in hours. [12.4.4]

Notes:

(1) If the period for maximum temperature or the period for minimum temperature ends at the nominal time of report, the second value of 0 04 024 shall be reported as 0.
(2) If the period for maximum temperature or the period for minimum temperature does not end at the nominal time of report, the first value of 0 04 024 shall indicate the beginning of the period of reference and the second value of 0 04 024 shall indicate the end of the period of reference. E.g. to report the maximum temperature for the previous calendar day from a station in RA IV, value of the first 0 04 024 shall be set to – 30 and value of the second 0 04 024 shall be set to – 6, provided that the nominal time of the report 12 UTC corresponds to 6 a.m. local time.

B/C 5.10.4.3 Maximum and minimum temperature

Maximum and minimum temperature shall be reported in degrees Kelvin (with precision in hundredths of a degree Kelvin); if produced in CREX, in degrees Celsius (with precision in hundredths of a degree Celsius).

Note:

(1) Notes (1) and (2) under Regulation B/C 5.4.1.2 shall apply.

B/C 5.10.5 Wind data <3 02 042>

B/C 5.10.5.1 Height of sensor above local ground

Height of sensor above local ground (0 07 032) for wind measurement shall be reported in meters (with precision in hundredths of a meter).
This datum represents the actual height of the sensors above ground at the point where the sensors are located.

B/C 5.10.5.2 Type of instrumentation for wind measurement - Flag table 0 02 002

This datum shall be used to specify whether the wind speed was measured by certified instruments (bit No. 1 set to 1) or estimated on the basis of the Beaufort wind scale (bit No. 1 set to 0), and to indicate the original units for wind speed measurement. Bit No. 2 set to 1 indicates that wind speed was originally measured in knots and bit No. 3 set to 1 indicates that wind speed was originally measured in kilometers per hour. Setting both bits No.2 and No.3 to 0 indicates that wind speed was originally measured in meters per second.

B/C 5.10.5.3 Wind direction and speed

The mean direction and speed of the wind over the 10-minute period immediately preceding the observation shall be reported. The time period (0 04 025) shall be included as -10. However, when the 10-minute period includes a discontinuity in the wind characteristics, only data obtained after the discontinuity shall be used for reporting the mean values, and hence the period (0 04 025) in these circumstances shall be correspondingly reduced. [12.2.2.3.1]
The time period is preceded by a time significance qualifier (0 08 021) that shall be set to 2 (Time averaged).
The wind direction (0 11 001) shall be reported in degrees true and the wind speed (0 11 002) shall be reported in meters per second (with precision in tenths of a meter per second).

B/C 5.10.5.3.1

In the absence of wind instruments, the wind speed shall be estimated on the basis of the Beaufort wind scale. The Beaufort number obtained by estimation is converted into meters per second by use of the relevant wind speed equivalent column on the Beaufort scale, and this speed is reported for wind speed. [12.2.2.3.2]

B/C 5.10.5.4 Maximum wind gust direction and speed

Time period for maximum wind gust direction and speed (0 04 025) shall be determined by regional or national decision and reported as a negative value in minutes.

Direction of the maximum wind gust (0 11 043) shall be reported in degrees true and speed of the maximum wind gust (0 11 041) shall be reported in meters per second (with precision in tenths of meters per second).

B/C 5.11 Evaporation data <3 02 044>

B/C 5.11.1 Period of reference for evaporation data

Evaporation or evapotranspiration during the previous 24 hours shall be reported. Time period in hours (0 04 024) shall be included as -24.

B/C 5.11.2 Indicator of type of instrument for evaporation measurement or the type of crops – Code table 0 02 004

B/C 5.11.3 Evaporation or evapotranspiration

Amount of either evaporation or evapotranspiration (0 13 033) shall be reported in kilograms per square meter (with precision in tenths of a kilogram per square meter) at 0000 UTC, 0600 UTC or 1200 UTC. [12.4.7.2.2]

B/C 5.12 Radiation data <1 01 002><3 02 045>

B/C 5.12.1 Period of reference for radiation data

Radiation integrated over the previous hour and over the previous 24 hours may be reported. Time period in hours (0 04 024) shall be included as follows:

(a) one hour in the first replication (reported as -1);
(b) 24 hours in the second replication (reported as -24).

B/C 5.12.2 Amount of radiation

If included, amount of radiation integrated over the time period specified by the preceding parameter 0 07 024 shall be reported in joules per square meter (with precision in thousands of a joule per square meter for radiation type (1) and (2); with precision in ten-thousands of a joule per square meter for radiation type (3); with precision in hundreds of a joule per square meter for radiation types (4) to (6)).

B/C 5.12.2.1

The radiation data may take one or more of the following forms:

(a) Long-wave radiation (0 14 002); the positive sign shall be used to specify downward long-wave radiation and the negative sign to specify upward long-wave radiation;
(b) Short-wave radiation (0 14 004);
(c) Net radiation (0 14 016); the corresponding sign shall be used to specify positive and negative net radiation);
(d) Global solar radiation (0 14 028);
(e) Diffuse solar radiation (0 14 029);
(f) Direct solar radiation (0 14 030).

[12.4.7.4.3], [12.4.7.4.4]

B/C 5.13 Temperature change <3 02 046>

This information is required by regional or national decision from islands or other widely separated stations.

B/C 5.13.1 Period of reference for temperature change

The temperature change shall be reported for the period of time between the time of the observation and the time of the occurrence of temperature change. To construct the required period, time period 0 04 024 shall be included twice; the first one corresponding to period covered by past weather (1) and past weather (2), the second one specified by the time of the occurrence of temperature change. Both values of 0 04 024 shall be negative and expressed in hours.

Note:

(1) The period is the number of whole hours, disregarding the minutes. For example, if the time of occurrence is 45 minutes after the time of the observation, the time period is considered to be zero hours. If the time of occurrence is 1 hour or more, but less than 2 hours after the observation, the time period go shall be considered to be 1 hour, etc.

B/C 5.13.2 Temperature change over period specified

Temperature change (0 12 049) shall be reported in degrees Kelvin in BUFR, in degrees Celsius in CREX.

B/C 5.13.2.1

For a change of temperature to be reported, the change shall be equal to or more than 5°C and occur in less than 30 minutes during the period covered by past weather (1) and past weather (2). [12.4.7.3]

B/C 5.14 "Period" data required by regional or national reporting practices

If regional or national reporting practices require inclusion of additional "period" parameters, the common sequence 3 07 090 shall be supplemented by relevant descriptors.

Notes:

(1) "Period" parameter is a parameter that is coupled to a time period descriptor, e.g. 0 04 024, 0 04 025.

(2) No regional requirements are currently indicated for reporting SYNOP MOBIL data in the *Manual on Codes*, WMO-No. 306, Volume II.

B/C10 – Regulations for reporting SHIP data in TDCF

TM 308009 - BUFR template for synoptic reports from sea stations suitable for SHIP data

3 08 009		**Sequence for representation of synoptic reports from a sea station suitable for SHIP data**
	3 01 093	Ship identification, movement, date/time, horizontal and vertical coordinates
	3 02 001	Pressure data
	3 02 054	SHIP "instantaneous" data
	0 08 002	Vertical significance
	3 02 055	Icing and ice
	3 02 057	SHIP marine data
	3 02 060	SHIP "period" data

This BUFR template for synoptic reports from sea stations further expands as follows:

3 01 093			**Ship identification, movement, date/time, horizontal and vertical coordinates**	Unit, scale
	3 01 036	0 01 011	Ship or mobile land station identifier **D….D**	CCITT IA5, 0
		0 01 012	Direction of motion of moving observing platform(3) $\mathbf{D_s}$	Degree true, 0
		0 01 013	Speed of motion of moving observing platform(4) $\mathbf{v_s}$	m s^{-1}, 0
		0 02 001	Type of station $\mathbf{(i_x)}$	Code table, 0
		0 04 001	Year	Year, 0
		0 04 002	Month	Month, 0
		0 04 003	Day **YY**	Day, 0
		0 04 004	Hour **GG**	Hour, 0
		0 04 005	Minute **gg**	Minute, 0
		0 05 002	Latitude (coarse accuracy) $\mathbf{L_aL_aL_a}$	Degree, 2
		0 06 002	Longitude (coarse accuracy) $\mathbf{L_oL_oL_oL_o}$	Degree, 2
	0 07 030		Height of station platform above mean sea level	m, 1
	0 07 031		Height of barometer above mean sea level	m, 1
			Pressure data	
3 02 001	0 10 004		Pressure $\mathbf{P_0P_0P_0P_0}$	Pa, –1
	0 10 051		Pressure reduced to mean sea level **PPPP**	Pa, –1
	0 10 061		3-hour pressure change **ppp**	Pa, –1
	0 10 063		Characteristic of pressure tendency **a**	Code table, 0
3 02 054			**SHIP "instantaneous" data**	
			Temperature and humidity data	

	3 02 052	0 07 032	Height of sensor above marine deck platform (for temperature and humidity measurement)	m, 2
		0 07 033	Height of sensor above water surface (for temperature and humidity measurement)	m, 1
		0 12 101	Temperature/dry-bulb temperature(sc.2) **s_nTTT**	K, 2
		0 02 039	Method of wet-bulb temperature measurement	Code table, 0
		0 12 102	Wet-bulb temperature (scale 2) **$s_wT_bT_bT_b$**	K, 2
		0 12 103	Dew-point temperature (scale 2) **$s_nT_dT_dT_d$**	K, 2
		0 13 003	Relative humidity	%, 0

			Visibility data	
	3 02 053	0 07 032	Height of sensor above marine deck platform (for visibility measurement)	m, 2
		0 07 033	Height of sensor above water surface (for visibility measurement)	m, 1
		0 20 001	Horizontal visibility **VV**	m, –1
	0 07 033		Height of sensor above water surface (set to missing to cancel the previous value)	m, 1
			Precipitation past 24 hours	
	3 02 034	0 07 032	Height of sensor above marine deck platform (for precipitation measurement)	m, 2
		0 13 023	Total precipitation past 24 hours **$R_{24}R_{24}R_{24}R_{24}$**	kg m^{-2}, 1
	0 07 032		Height of sensor above marine deck platform (set to missing to cancel the previous value)	m, 2
			Cloud data	
	3 02 004	0 20 010	Cloud cover (total) **N**	%, 0
		0 08 002	Vertical significance	Code table, 0
		0 20 011	Cloud amount (of low or middle clouds) **N_h**	Code table, 0
		0 20 013	Height of base of cloud **h**	m, –1
		0 20 012	Cloud type (low clouds) **C_L**	Code table, 0
		0 20 012	Cloud type (middle clouds) **C_M**	Code table, 0
		0 20 012	Cloud type (high clouds) **C_H**	Code table, 0
	1 01 000		Delayed replication of 1 descriptor	
	0 31 001		Delayed descriptor replication factor	Numeric, 0
	3 02 005	0 08 002	Vertical significance	Code table, 0
		0 20 011	Cloud amount **N_s**	Code table, 0
		0 20 012	Cloud type **C**	Code table, 0
		0 20 013	Height of base of cloud **h_sh_s**	m, -1
0 08 002			Vertical significance (set to missing to cancel the previous value)	Code table, 0
			Icing and ice	
3 02 055	0 20 031		Ice deposit (thickness) **E_sE_s**	m, 2
	0 20 032		Rate of ice accretion **R_s**	Code table, 0
	0 20 033		Cause of ice accretion **I_s**	Flag table, 0
	0 20 034		Sea ice concentration **c_i**	Code table, 0
	0 20 035		Amount and type of ice **b_i**	Code table, 0
	0 20 036		Ice situation **z_i**	Code table, 0
	0 20 037		Ice development **S_i**	Code table, 0
	0 20 038		Bearing of ice edge **D_i**	Degree true, 0
3 02 057			**SHIP marine data**	
	3 02 056		Sea surface temperature, method of measurement, and depth below sea surface	
		0 02 038	Method of sea/water temperature measurement	Code table, 0
		0 07 063	Depth below sea/water surface (for sea surface temperature measurement)	m, 2
		0 22 043	Sea/water temperature **$s_sT_wT_wT_w$**	K, 2

		0 07 063	Depth below sea/water surface (set to missing to cancel the previous value)	m, 2
			Waves	
	3 02 021	0 22 001	Direction of waves	Degree true
		0 22 011	Period of waves **$P_{wa}P_{wa}$**	s, 0
		0 22 021	Height of waves **$H_{wa}H_{wa}$**	m, 1
	3 02 024	0 22 002	Direction of wind waves	Degree true, 0
		0 22 012	Period of wind waves **P_wP_w**	s, 0
		0 22 022	Height of wind waves **H_wH_w**	m, 1
		1 01 002	Replicate 1 descriptor 2 times	
		3 02 023	Swell waves (2 systems of swell) **$d_{w1}d_{w1}$, $P_{w1}P_{w1}$, $H_{w1}H_{w1}$ $d_{w2}d_{w2}$, $P_{w2}P_{w2}$, $H_{w2}H_{w2}$**	
3 02 060			**SHIP“period” data**	
			Present and past weather	
	3 02 038	0 20 003	Present weather **ww**	Code table, 0
		0 04 024	Time period in hours	Hour, 0
		0 20 004	Past weather (1) **W_1**	Code table, 0
		0 20 005	Past weather (2) **W_2**	Code table, 0
			Precipitation measurement	
	3 02 040	0 07 032	Height of sensor above marine deck platform (for precipitation measurement)	m, 2
		1 02 002	Replicate next 2 descriptors 2 times	
		0 04 024	Time period in hours **t_R**	Hour, 0
		0 13 011	Total precipitation / total water equivalent of snow **RRR**	kg m^{-2}, 1
			Extreme temperature data	
	3 02 058	0 07 032	Height of sensor above marine deck platform (for temperature measurement)	m, 2
		0 07 033	Height of sensor above water surface (for temperature measurement)	m, 1
		0 04 024	Time period or displacement	Hour, 0
		0 04 024	Time period or displacement (see Notes 1 and 2)	Hour, 0
		0 12 111	Maximum temperature (scale 2) at height and over period specified **$s_nT_xT_xT_x$**	K, 2
		0 04 024	Time period or displacement	Hour, 0
		0 04 024	Time period or displacement (see Note 2)	Hour, 0
		0 12 112	Minimum temperature (scale 2) at height and over period specified **$s_nT_nT_nT_n$**	K, 2
			Wind data	
	3 02 059	0 07 032	Height of sensor above marine deck platform (for wind measurement)	m, 2
		0 07 033	Height of sensor above water surface (for wind measurement)	m, 1
		0 02 002	Type of instrumentation for wind measurement **i_w**	Flag table, 0
		0 08 021	Time significance (= 2 (time averaged))	Code table, 0
		0 04 025	Time period (= - 10 minutes, or number of minutes after a significant change of wind)	Minute, 0
		0 11 001	Wind direction **dd**	Degree true, 0
		0 11 002	Wind speed **ff**	m s^{-1}, 1
		0 08 021	Time significance (= missing value)	Code table, 0
		1 03 002	Replicate next 3 descriptors 2 times	
		0 04 025	Time period in minutes	Minute, 0
		0 11 043	Maximum wind gust direction	Degree true, 0
		0 11 041	Maximum wind gust speed 910**f_mf_m**, 911**f_xf_x**	m s^{-1}, 1

Notes:

1) Within RA-IV, the maximum temperature at 1200 UTC is reported for the previous calendar day (i.e. the ending time of the period is not equal to the nominal time of the report). To construct the required time range, descriptor 004024 has to be included two times. If the period ends at the nominal time of the report, value of the second 004024 shall be set to 0.

2) Within RA-III, the maximum day-time temperature and the minimum night-time temperature is reported (i.e. the ending time of the period may not be equal to the nominal time of the report). To construct the required time range, descriptor 004024 has to be included two times. If the period ends at the nominal time of the report, value of the second 004024 shall be set to 0.

3) 0 01 012: Means course made good (average course over the ground) during the three hours preceding the time of observation.

4) 0 01 013: Means speed made good (average speed over the ground) during the three hours preceding the time of observation.

5) If "plain language" text is reported within Section 2, this information can be conveyed in BUFR via the use of an appropriate 205YYY field as an extra descriptor following the above basic template.

Regulations:

B/C 10.1 Section 1 of BUFR or CREX
B/C 10.2 Ship identification, movement, date/time, horizontal and vertical coordinates
B/C 10.3 Pressure data
B/C 10.4 SHIP "instantaneous" data
B/C 10.4.1 Temperature and humidity data
B/C 10.4.2 Visibility data
B/C 10.4.3 Precipitation past 24 hours
B/C 10.4.4 Cloud data
B/C 10.4.5 Individual cloud layers or masses
B/C 10.5 Icing and ice
B/C 10.6 SHIP marine data
B/C 10.7 Instantaneous" data required by regional or national reporting practices
B/C 10.8 SHIP "period" data
B/C 10.8.1 Present and past weather
B/C 10.8.2 Precipitation measurement
B/C 10.8.3 Extreme temperature data
B/C 10.8.4 Wind data
B/C 10.9 "Period" data required by regional or national reporting practices

B/C 10.1 Section 1 of BUFR or CREX

B/C 10.1.1 Entries required in Section 1 of BUFR

The following entries shall be included in BUFR Section 1:

- BUFR master table,
- identification of originating/generating centre,
- identification of originating/generating sub-centre,
- update sequence number,
- identification of inclusion of optional section,
- data category (= 001 for SHIP data),
- international data sub-category [(1), (2)],
- local data subcategory,
- version number of master table,
- version number of local tables,
- year (year of the century up to BUFR edition 3),
- month (standard time),
- day (standard time = YY in the abbreviated telecommunication header for SHIP data),

- hour (standard time = GG in the abbreviated telecommunication header for SHIP data),
- minute (standard time = 00 for SHIP data).

Notes:
(1) Inclusion of this entry is required starting with BUFR edition 4.
(2) If required, the international data sub-category shall be included for SHIP data as 000 at all observation times 00, 01, 02, ..., 23 UTC.

B/C 10.1.2 Entries required in Section 1 of CREX

The following entries shall be included in CREX Section 1:

- CREX master table,
- CREX edition number,
- CREX table version number,
- version number of BUFR master table (1),
- version number of local tables (1),
- data category (= 001 for SHIP data),
- international data sub-category (1), (2),
- identification of originating/generating centre (1),
- identification of originating/generating sub-centre (1),
- update sequence number (1),
- number of subsets (1),
- year (standard time) (1),
- month (standard time) (1),
- day (standard time = YY in the abbreviated telecommunication header for SHIP data) (1),
- hour (standard time = GG in the abbreviated telecommunication header for SHIP data) (1),
- minute (standard time = 00 for SHIP data) (1).

Notes:
(1) Inclusion of these entries is required starting with CREX edition 2.
(2) If inclusion of international data sub-category is required, Note (2) under B/C 10.1.1 applies.

B/C 10.2 Ship identification, movement, date/time, horizontal and vertical coordinates <3 01 093>

B/C 10.2.1 Ship identification, movement, type of station

Ship identifier (0 01 011) shall be always reported as a non-missing value. In the absence of a suitable call sign, the word SHIP shall be used for ship identifier in reports of sea stations other then buoys, drilling rigs and oil- and gas-production platforms. [12.1.7(b)]

B/C 10.2.2 Ship movement

Direction of motion of moving observing platform (0 01 012) shall be reported in degrees true to indicate course made good (average course over the ground) during the three hours preceding the time of observation.

Speed of motion of moving observing platform (0 01 013) shall be reported in meters per second to indicate speed made good (average speed over the ground) during the three hours preceding the time of observation.

B/C 10.2.2.1

Direction and speed of motion of moving observing platform shall always be included in reports from stations, which have observed maritime conditions, and in reports from ships being requested to include this information as a routine procedure. [12.3.1.1]

B/C 10.2.2.2

Direction and speed of motion of moving observing platform may be included as missing values in reports from a supplementary or auxiliary ship, except when reporting from an area for which the ship report collecting centre, in order to meet a requirement of a search and rescue centre, has requested inclusion of direction and speed of ship motion as a routine procedure. [12.3.1.2(b)]

B/C 10.2.3 Type of station

Type of station (0 02 001) shall be reported to indicate the type of the station operation (manned, automatic or hybrid).

Note:

(1) If a station operates as a manned station for a part of the day and as an automatic station for the rest of the day, code figure 2 (Hybrid) may be used in all reports. It is preferable, however, to use code figure 1 (Manned) in reports produced under the supervision of an observer, and a code figure 0 (Automatic) in reports produced while the station operates in the automatic mode.

B/C 10.2.4 Time of observation

Year (0 04 001), month (0 04 002), day (0 04 003), hour (0 04 004) and minute (0 04 005) of the actual time of observation shall be reported.

Note:

(1) The actual time of observation shall be the time at which the barometer is read. [12.1.8]

B/C 10.2.4.1

If the actual time of observation differs by 10 minutes or less from the standard time reported in Section 1, the standard time may be reported instead of the actual time of observation. [12.2.6]

B/C 10.2.5 Horizontal and vertical coordinates

Latitude (0 05 002) and longitude (0 06 002) of the station shall be reported in degrees with precision in hundredths of a degree.

Height of station ground above mean sea level (0 07 030) and height of barometer above mean sea level (0 07 031) shall be reported in meters with precision in tenths of a meter.

B/C 10.3 Pressure data <3 02 001>

B/C 10.3.1 Pressure at the station level

Pressure at the station level (0 10 004), i.e. at the level defined by 0 07 031 (height of barometer above mean sea level), shall be reported in pascals (with precision in tens of a pascal).

Note:

(1) Inclusion of the station pressure in reports from sea stations is left to the decision of individual Members.

B/C 10.3.2 Pressure reduced to mean sea level

Pressure reduced to mean sea level (0 10 051) shall be reported in pascals (with precision in tens of a pascal).

B/C 10.3.2.1

In reports from ships, air pressure at mean sea level shall be reported. [12.1.3.6], [12.1.3.7]

B/C 10.3.3 Three-hour pressure change and characteristic of pressure tendency

Amount of pressure change at station level, during the three hours preceding the time of observation (0 10 061), either positive, zero *or negative*, shall be reported in pascals (with precision in tens of a pascal).

B/C 10.3.3.1

Unless specified otherwise by regional decision, pressure tendency shall be included whenever the three-hourly pressure tendency is available. [12.2.3.5.1]

B/C 10.3.3.2

The characteristic of pressure tendency (Code table 0 10 063) over the past three hours shall, whenever possible, be determined on the basis of pressure samples at equi-spaced intervals not exceeding one hour. [12.2.3.5.2]

Note:

(1) Algorithms for selecting the appropriate code figure are included in publication WMO–No.8, Guide to Meteorological Instruments and Methods of Observation.

B/C 10.3.3.3

Where it is not possible to apply the algorithms specified in Regulation B/C 10.3.3.2 in reports from automatic weather stations, the characteristic of pressure tendency shall be reported as 2 when the tendency is positive, as 7 when the tendency is negative, and as 4 when the atmospheric pressure is the same as three hours before. [12.2.3.5.3]

B/C 10.4 SHIP "instantaneous" data <3 02 054>

B/C 10.4.1 Temperature and humidity data <3 02 052>

B/C 10.4.1.1 Height of sensor above marine deck platform and height of sensor above water surface

Height of sensor above marine deck platform (0 07 032) for temperature and humidity measurement shall be reported in meters (with precision in hundredths of a meter).
This datum represents the actual height of temperature and humidity sensors above marine deck platform at the point where the sensors are located.

Height of sensor above water surface (0 07 033) for temperature and humidity measurement shall be reported in meters (with precision in hundredths of a meter).
This datum represents the actual height of temperature and humidity sensors above marine water surface of sea or lake.

B/C 10.4.1.2 Dry-bulb air temperature

Dry-bulb air temperature (0 12 101) shall be reported in degrees Kelvin (with precision in hundredths of a degree Kelvin); if produced in CREX, in degrees Celsius (with precision in hundredths of a degree Celsius). Temperature data shall be reported with precision in hundredths of a degree even if they are measured with the accuracy in tenths of a degree.

Notes:

(1) This requirement is based on the fact that conversion from the Kelvin to the Celsius scale has often resulted into distortion of the data values.

(2) Temperature t (in degrees Celsius) shall be converted into temperature T (in degrees Kelvin) using equation: $T = t + 273.15$.

B/C 10.4.1.2.1

When the data are not available as a result of a temporary instrument failure, this quality shall be included as a missing value. [12.2.3.2]

B/C 10.4.1.3 Wet-bulb temperature and method of its measurement

Wet-bulb temperature (0 12 102) shall be reported in degrees Kelvin (with precision in hundredths of a degree Kelvin); if produced in CREX, in degrees Celsius (with precision in hundredths of a degree Celsius). Method of wet-bulb temperature measurement shall be reported by the preceding entry (Code table 0 02 039). Wet-bulb temperature data shall be reported with precision in hundredths of a degree even if they are available with the accuracy in tenths of a degree.

Note:

(1) Notes (1) and (2) under Regulation B/C 10.4.1.2 shall apply.

B/C 10.4.1.3.1

When wet-bulb temperature is used to derive dew-point value in a ship report, 0 12 102 shall be included to report the wet-bulb temperature measurement. [12.3.6]

B/C 10.4.1.4 Dew-point temperature

When available, dew-point temperature (0 12 103) shall be reported in degrees Kelvin (with precision in hundredths of a degree Kelvin); if produced in CREX, in degrees Celsius (with precision in hundredths of a degree Celsius).

Note:

(1) Notes (1) and (2) under Regulation B/C 10.4.1.2 shall apply.

B/C 10.4.1.5 Relative humidity

Relative humidity (0 13 003) shall be reported in units of a percent.

B/C 10.4.1.5.1

Both dew point temperature and relative humidity shall be reported when available.

B/C 10.4.2 Visibility data <3 02 053>

B/C 10.4.2.1 Height of sensor above marine deck platform and height of sensor above water surface

Height of sensor above marine deck platform (0 07 032) for visibility measurement shall be reported in meters (with precision in hundredths of a meter).
This datum represents the actual height of visibility sensors above marine deck platform at the point where the sensors are located. If visibility is estimated by a human observer, the average height of observer's eyes above marine deck platform shall be reported.

Height of sensor above water surface (0 07 033) for visibility measurement shall be reported in meters (with precision in hundredths of a meter).
This datum represents the actual height of visibility sensors above the level of water surface of sea or lake. If visibility is estimated by a human observer, the average height of observer's eyes above the level of water surface of sea or lake at the time of observation shall be reported.

B/C 10.4.2.2 Horizontal visibility

Horizontal visibility (0 20 001) at surface shall be reported in meters (with precision in tens of a meter).

B/C 10.4.2.2.1

When the horizontal visibility is not the same in different directions, the shortest distance shall be given for visibility. [12.2.1.3.1]

B/C 10.4.3 Precipitation past 24 hours <3 02 034>

B/C 10.4.3.1 Height of sensor above marine deck platform

Height of sensor above marine deck platform (0 07 032) for precipitation measurement shall be reported in meters (with precision in hundredths of a meter).
This datum represents the actual height of the rain gauge rim above marine deck platform at the point where the rain gauge is located.

Note:
(1) Height of sensor above water surface (0 07 033) is not required for precipitation measurement. Therefore, there is an entry 0 07 033, directly preceding the sequence 3 02 034, that is set to a missing value to cancel the previous value.

B/C 10.4.3.2 Total amount of precipitation during the 24-hour period

Total amount of precipitation during the 24-hour period ending at the time of observation (0 13 023) shall be reported in kilograms per square meter (with precision in tenths of a kilogram per square meter). [12.4.9]

B/C 10.4.3.2.1

The precipitation over the past 24 hours shall be included (not missing) at least once a day at one appropriate time of the main standard times (0000, 0600, 1200, 1800 UTC). [12.4.1]

B/C 10.4.3.2.2

Precipitation, when it can be and has to be reported, shall be reported as 0.0 kgm^{-2} if no precipitation were observed during the referenced period. [12.2.5.4]

B/C 10.4.3.2.3

Trace shall be reported as "- 0.1 kgm^{-2} ".

B/C 10.4.4 Cloud data <3 02 004>

B/C 10.4.4.1 Total cloud cover

Total cloud cover (0 20 010) shall embrace the total fraction of the celestial dome covered by clouds irrespective of their genus. It shall be reported in *units of a percent*.

Note:

(1) Total cloud cover shall be reported as 113 when sky is obscured by fog and/or other meteorological phenomena.

B/C 10.4.4.1.1

Total cloud cover shall be reported as actually seen by the observer during the observation. [12.2.2.2.1]

B/C 10.4.4.1.2

Altocumulus perlucidus or Stratocumulus perlucidus ("mackerel sky") shall be reported *as 99% or less* (unless overlying clouds appear to cover the whole sky) since breaks are always present in this cloud form even if it extends over the whole celestial dome. [12.2.2.2.2]

B/C 10.4.4.1.3

Total cloud cover shall be reported as zero when blue sky or stars are seen through existing fog or other analogous phenomena without any trace of cloud being seen. [12.2.2.2.3]

B/C 10.4.4.1.4

When clouds are observed through fog or analogous phenomena, their amount shall be evaluated and reported as if these phenomena were non-existent. [12.2.2.2.4]

B/C 10.4.4.1.5

Total cloud cover shall not include the amount resulting from rapidly dissipating condensation trails. [12.2.2.2.5]

B/C 10.4.4.1.6

Persistent condensation trails and cloud masses, which have obviously developed from condensation trails, shall be reported as cloud. [12.2.2.2.6]

B/C 10.4.4.2 Vertical significance – Code table 0 08 002

To specify vertical significance (0 08 002) within the sequence 3 02 004, a code figure shall be selected in the following way:

(a) If low clouds are observed, then code figure 7 (Low cloud) shall be used.
(b) If there are no low clouds but middle clouds are observed, then code figure 8 (Middle clouds) shall be used.
(c) If there are no low and there are no middle clouds but high clouds are observed, then code figure 0 shall be used.
(d) If sky is obscured by fog and/or other phenomena, then code figure 5 (Ceiling) shall be used.
(e) If there are no clouds (clear sky), then code figure 62 (Value not applicable) shall be used.
(f) If the cloud cover is not discernible for reasons other than (d) above or observation is not made, then code figure 63 (Missing value) shall be used.

B/C 10.4.4.3 Cloud amount (of low or middle clouds) – Code table 0 20 011

Amount of all the low clouds (clouds of the genera Stratocumulus, Stratus, Cumulus, and Cumulonimbus) present or, if no low clouds are present, the amount of all the middle clouds (clouds of the genera Altocumulus, Altostratus, and Nimbostratus) present.

B/C 10.4.4.3.1

Cloud amount shall be reported as follows:

(a) If there are low clouds, then the total amount of all low clouds, as actually seen by the observer during the observation shall be reported for the cloud amount.
(b) If there are no low clouds but there are middle clouds, then the total amount of the middle clouds shall be reported for the cloud amount.

(c) If there are no low clouds and there are no middle clouds but there are high clouds (clouds of the genera Cirrus, Cirrocumulus, and Cirrostratus), then the cloud amount shall be reported as zero. [12.2.7.2.1]

B/C 10.4.4.3.2

Amount of Altocumulus perlucidus or Stratocumulus perlucidus ("mackerel sky") shall be reported using code figure 7 or less since breaks are always present in this cloud form even if it extends over the whole celestial dome. [12.2.7.2.2]

B/C 10.4.4.3.3

When the clouds reported for cloud amount are observed through fog or an analogous phenomenon, the cloud amount shall be reported as if these phenomena were not present. [12.2.7.2.3]

B/C 10.4.4.3.4

If the clouds reported for cloud amount include contrails, then the cloud amount shall include the amount of persistent contrails. Rapidly dissipating contrails shall not be included in the value for the cloud amount. [12.2.7.2.4]

B/C 10.4.4.4 Height of base of lowest cloud

Height above surface of the base (0 20 013) of the lowest cloud seen shall be reported in meters (with precision in tens of a meter).

Note:

(1) The term "height above surface" shall be considered as being the height above water surface of sea or lake.

B/C 10.4.4.4.1

When clouds are observed through fog or analogous phenomena but the sky is discernable, the base of the lowest cloud shall refer to the base of the lowest cloud observed, if any. When, under the above conditions, the sky is not discernible, the base of the lowest cloud shall be reported as missing. [12.2.1.2]

B/C 10.4.4.4.2

When no cloud are reported (Total cloud cover = 0) the base of the lowest cloud *shall be reported as a missing value.*

B/C 10.4.4.5 Cloud type of low, middle and high clouds - Code table 0 20 012

Clouds of the genera Stratocumulus, Stratus, Cumulus, and Cumulonimbus (low clouds) shall be reported for the first entry 0 20 012, clouds of the genera Altocumulus, Altostratus, and Nimbostratus (middle clouds) shall be reported for the second entry 0 20 012 and clouds of the genera Cirrus, Cirrocumulus, and Cirrostratus (high clouds) shall be reported for the third entry 0 20 012.

B/C 10.4.4.5.1

The reporting of type of low, middle and high clouds shall be as specified in publication WMO-NO. 407 – International Cloud Atlas, Volume I. [12.2.7.3]

B/C 10.4.5 Individual cloud layers or masses

B/C 10.4.5.1 Number of individual cloud layers or masses

The number of individual cloud layers or masses shall be indicated by Delayed descriptor replication factor 0 31 001 in BUFR and by a four-digit number in the Data Section corresponding to the position of the replication descriptor in the Data Description Section of CREX.

Note:

(1) The number of cloud layers or masses shall never be set to missing value.
(2) The number of cloud layers or masses shall be set to a positive value in a NIL report.

B/C 10.4.5.1.1

The number of individual cloud layers or masses shall in the absence of Cumulonimbus clouds not exceed three. Cumulonimbus clouds, when observed, shall always be reported, so that the total number of individual cloud layers or masses can be four. The selection of layers (or masses) to be reported shall be made in accordance with the following criteria:

(a) The lowest individual layer (or mass) of any amount (cloud amount at least one octa or less, but not zero);

(a) The next higher individual layer (or mass) the amount of which is greater than two octas;

(b) The next higher individual layer (or mass) the amount of which is greater than four octas;

(c) Cumulonimbus clouds, whenever observed and not reported under (a), (b) and (c) above. [12.4.10.1]

B/C 10.4.5.1.2

When the sky is clear, the number of individual cloud layers or masses shall be set to zero.

B/C 10.4.5.1.3

The order of reporting the individual cloud layers or masses shall always be from lower to higher levels. [12.4.10.2]

B/C 10.4.5.2 Individual cloud layer or mass <3 02 005>

Each cloud layer or mass shall be represented by the following four parameters: Vertical significance (0 08 002), amount of individual cloud layer or mass (0 20 011), type of cloud layer or mass (0 20 012) and height of base of individual cloud layer or mass (0 20 013).

B/C 10.4.5.2.1 Vertical significance – Code table 0 08 002

To specify vertical significance (0 08 002) within the sequence 3 02 005, a code figure shall be selected in the following way:

(a) Code figure 1 shall be used in the first non-Cumulonimbus layer.
(b) Code figure 2 shall be used in the second non-Cumulonimbus layer.
(c) Code figure 3 shall be used in the third non-Cumulonimbus layer.
(d) Code figure 4 shall be used in any Cumulonimbus layer.
(e) If sky is obscured by fog and/or other phenomena, then code figure 5 (Ceiling) shall be used.
(f) If the cloud cover is not discernible for reasons other than (e) above or observation is not made, then code figure 63 (Missing value) shall be used.

B/C 10.4.5.2.2 Cloud amount, type and height of base

B/C 10.4.5.2.2.1

When the sky is clear, in accordance with Regulation B/C 10.4.5.1.2 cloud amount, genus, and height shall not be included. [12.4.10.4]

B/C 10.4.5.2.2.2

In determining cloud amounts (Code table 0 20 011) to be reported for individual layers or masses, the observer shall estimate, by taking into consideration the evolution of the sky, the cloud amounts of each individual layer or mass at the different levels, as if no other clouds existed. [12.4.10.3]

B/C 10.4.5.2.2.3

Type of a cloud layer or mass (Code table 0 20 012) shall be reported using code figures 0, 1, 2, 3, 4, 5, 6, 7, 8, 9, 59 and 63.

B/C 10.4.5.2.2.4

If, notwithstanding the existence of fog or other obscuring phenomena, the sky is discernible, the partially obscuring phenomena shall be disregarded. If, under the above conditions, the sky is not discernible, the cloud type shall be reported using *code figure 59* and the cloud height shall be replaced by vertical visibility. [12.4.10.5]

Note:

(1) The vertical visibility is defined as the vertical visual range into an obscuring medium.

B/C 10.4.5.2.2.5

If two or more types of cloud occur with their bases at the same level and this level is one to be reported in accordance with Regulation B/C 10.4.5.1.1, the selection for cloud type and amount shall be made with the following criteria:

(a) If these types do not include Cumulonimbus then cloud genus shall refer to the cloud type that represents the greatest amount, or if there are two or more types of cloud all having the same amount, the highest applicable code figure for cloud genus shall be reported. Cloud amount shall refer to the total amount of cloud whose bases are all at the same level;

(b) If these types do include Cumulonimbus then one layer shall be reported to describe only this type with cloud genus indicated as Cumulonimbus and the cloud amount as the amount of the Cumulonimbus. If the total amount of the remaining type(s) of cloud (excluding Cumulonimbus) whose bases are all at the same level is greater than that required by Regulation B/C 10.4.5.1.1, then another layer shall be reported with type being selected in accordance with (a) and amount referring to the total amount of the remaining cloud (excluding Cumulonimbus). [12.4.10.6]

B/C 10.4.5.2.2.6

Regulations B/C 10.4.4.1.3 to B/C 10.4.4.1.6, inclusive, shall apply. [12.4.10.7]

B/C 10.4.5.2.2.7

Height above surface of the cloud base (0 20 013) shall be reported in meters (with precision in tens of a meter).

Note:

(1) The term “height above surface” shall be considered as being the height above water surface of sea or lake.

B/C 10.5 Icing and ice <3 02 055>

B/C 10.5.1 Icing

Thickness of ice deposit (0 20 031) shall be reported in meters (with precision in hundredths of a meter).

Rate of ice accretion (0 20 032) shall be reported using corresponding Code table.

Cause of ice accretion (0 20 033) shall be reported using corresponding Flag table.

B/C 10.5.1.1

When the ice accretion on ships is reported in plain language, this information shall be conveyed in BUFR/CREX via the use of an appropriate 205YYY field as an extra descriptor following the basic template.

B/C 10.5.1.2

When the ice accretion on ships is reported in plain language, it shall be preceded by the word ICING. [12.3.5]

B/C 10.5.2 Ice

Sea ice concentration (0 20 034) shall be reported using corresponding Code table.

Amount and type of ice (0 20 035) shall be reported using corresponding Code table.

Ice situation (0 20 036) shall be reported using corresponding Code table.

Ice development (0 20 037) shall be reported using corresponding Code table.

Bearing of ice edge (0 20 038) shall be reported in degrees true.

B/C 10.5.2.1

The reporting of sea ice and ice of land origin using the sequence <0 20 034, 0 20 035, 0 20 036, 0 20 037, 0 20 038> shall not supersede the reporting of sea ice and icebergs in accordance with the International Convention for the Safety of Life at Sea. [12.3.7.1]

B/C 10.5.2.2

The sequence <0 20 034, 0 20 035, 0 20 036, 0 20 037, 0 20 038> shall be reported whenever sea ice and/or ice of land origin are observed from the ship’s position at the time of observation, unless the ship is required to report ice conditions by means of a special sea-ice code. [12.3.7.2]

B/C 10.5.2.3

When an ice edge is crossed or sighted between observational hours, it shall be reported as a plain-language addition in the form “ice edge lat. long.” (with position in degrees and minutes). This information shall be conveyed in BUFR/CREX via the use of an appropriate 205YYY field as an extra descriptor following the basic template. [12.3.7.3]

B/C 10.5.2.4

If the ship is in the open sea reporting an ice edge, the sea ice concentration (0 20 034) and ice development (0 20 037) shall be reported only if the ship is close to the ice (i.e. within 0.5 nautical mile). [12.3.7.4]

B/C 10.5.2.5

If the ship is in an open lead more than 1.0 nautical mile wide, sea ice concentration (0 20 034) shall be set to 1 and bearing of ice edge (0 20 038) to 0. If the ship is in fast ice with ice boundary beyond limit of visibility, sea ice concentration (0 20 034) shall be set to 1 and bearing of ice edge (0 20 038) to missing. [12.3.7.5]

B/C 10.5.2.6

If no sea ice is visible and the sequence <0 20 034, 0 20 035, 0 20 036, 0 20 037, 0 20 038> is used to report ice of land origin only, 0 20 035 shall be used to report the amount of ice of land origin, and 0 20 034 and 0 20 036 shall be set to 0, and 0 20 037 and 0 20 038 shall be set to missing; e.g. <0,2,0, missing, missing> would mean 6-10 icebergs in sight, but no sea ice. [12.3.7.6]

B/C 10.5.2.7

In coding concentration or arrangement of sea ice (0 20 034) that condition shall be reported which is of the most navigational significance. [12.3.7.7]

B/C 10.5.2.8

The bearing of the principal ice edge reported shall be to the closest part of that edge. [12.3.7.8]

B/C 10.5.2.9

The requirements for sea-ice reporting are covered in the following way by the associated parameters:

Sea ice concentration - Code table 0 20 034

(a) The purpose of the code figure 0 in code table 0 20 034 is to establish in relation to code figure 0 in code table 0 20 036 and code table 0 20 035 whether the floating ice that is visible is only ice of land origin;

(b) The possible variation in sea-ice concentration and arrangement within an area of observation are almost infinite. However, the field of reasonably accurate observation from a ship's bridge is limited. For this reason, and also because minor variations are of temporary significance, the choice of concentrations and arrangements has been restricted for reporting purposes to those representing significantly different conditions from a navigational point of view. The code figures 2-9 have been divided into two sections depending on:

  (i) Whether sea-ice concentration within the area of observation is more or less uniform (code figures 2-5); or

  (ii) Whether there are marked contrasts in concentration or arrangement (code figures 6-9).

Amount and type of ice - Code table 0 20 035

(a) This code provides a scale of increasing navigational hazard;

(b) Growlers and bergy bits, being much smaller and lower in the water than icebergs, are more difficult to see either by eye or radar. This is especially so if there is heavy sea running. For this reason, code figures 4 and 5 represent more hazardous conditions than code figures 1 to 3.

Ice situation - Code table 0 20 036

(a) The purpose of this parameter is to establish:

  (i) Whether the ship is in pack ice or is viewing floating ice (i.e. sea ice and/or ice of land origin) from the open sea; and

  (ii) A qualitative estimate, dependent on the sea-ice navigation capabilities of the reporting ship, of the penetrability of the sea ice and of the recent trend in conditions;

(b) The reporting of the conditions represented by code figures 1-9 in Code table 0 20 036 can be used to help in the interpretation of reports from the two code tables (ice concentration 0 20 034 and ice development 0 20 037).

Ice development - Code table 0 20 037

(a) This code table represents a series of increasing navigational difficulties for any given concentration; i.e. if the concentration is, for example, 8/10ths, then new ice would hardly have any effect on navigation while predominantly old ice would provide difficult conditions requiring reductions in speed and frequent course alternations;
(b) The correlation between the stage of development of sea ice and its thickness is explained in publication WMO-No.8 – Guide to Meteorological Instruments and Methods of Observation.

Bearing of ice edge – 0 20 038

There is no provision in this code for the reporting of distance from the ice edge. It will be assumed by those receiving the report that the bearing has been given to the closest part of the ice edge. From the reported code figures for ice concentration 0 20 034 and ice development 0 20 037, it will be clear whether the ship is in ice or within 0.5 nautical mile of the ice edge. If the ship is in open water and more than 0.5 nautical mile from the ice edge, the ice edge will be assumed to be aligned at right angles to the bearing which is reported.

B/C 10.6 SHIP marine data <3 02 057>

B/C 10.6.1 Sea surface temperature, method of its measurement and depth below sea/water surface <3 02 056>

Method of sea/water temperature measurement shall be reported by Code table 0 02 038; depth bellow sea/water surface (0 07 063) shall be reported in meters (with precision in hundredths of a meter). Sea/water temperature (0 22 043) shall be reported in degrees Kelvin (with precision in hundredths of a degree Kelvin); if produced in CREX, in degrees Celsius (with precision in hundredths of a degree Celsius). Sea/water temperature data shall be reported with precision in hundredths of a degree even if they are available with the accuracy in tenths of a degree.

Note:
(1) Notes (1) and (2) under Regulation B/C 10.4.1.2 shall apply.

B/C 10.6.1.1

Sea/water temperature shall always be included in reports from ocean weather stations, when data are available. [12.3.2]

B/C 10.6.2 Instrumental wave data <3 02 021>

Direction of waves (0 22 001) shall be used to reported true direction (direction from which the waves are coming) in degrees true.

Period of waves (0 22 011) shall be reported in seconds.

Height of waves (0 22 021) shall be reported in meters with precision in tenths of a meter.

Note:
(1) Height of waves shall be reported with precision in tenths of a meter even if the data are available with lower accuracy and reported in TAC in units of 0.5 meter. [12.3.3.2]

B/C 10.6.2.1

These data shall always be included in reports from ocean weather stations, when data are available. [12.3.3.1]

B /C 10.6.2.2

The sequence 3 02 021 shall be used to report instrumental wave data. [12.3.3.2]

B/C 10.6.2.3

When the sea is calm (no waves and no swell) direction of waves, period of waves and height of waves shall be reported as 0. [12.3.3.4(a)] [12.3.3.5(a)]

B/C 10.6.2.4

If instrumental wave data are not available for direction, period or height of waves, as the case may be, 0 22 001, 0 22 011 or 0 22 021shall be set to missing. [12.3.3.4(c)]

B/C 10.6.3 Wind waves and swell waves <3 02 024>

Direction of wind waves (0 22 002) shall be used to reported true direction (direction from which the waves are coming) in degrees true.

Period of wind waves (0 22 012) shall be reported in seconds.

Height of wind waves (0 22 022) shall be reported in meters with precision in tenths of a meter.

Direction of swell waves (0 22 003) shall be used to reported true direction (direction from which the waves are coming) in degrees true.

Period of swell waves (0 22 013) shall be reported in seconds.

Height of swell waves (0 22 023) shall be reported in meters with precision in tenths of a meter.

B/C 10.6.3.1

Wind wave data and swell wave data shall always be included in reports from ocean weather stations, when data are available. [12.3.3.1] [12.3.4.4]

B /C 10.6.3.2

The sequence <0 22 002, 0 22 012, 0 22 022> shall be used to report wind waves, when instrumental wave data are not available. [12.3.3.3]

B/C 10.6.3.3

When the sea is calm (no waves and no swell) direction, period and height of wind waves shall be reported as 0. [12.3.3.4(a)]

B/C 10.6.3.4

If wind wave data are not available (owing to confused sea or for any other reason) for direction, period or height of wind waves, as the case may be, 0 22 002, 0 22 012 or 0 22 022 shall be set to missing. [12.3.3.4(b), (d)]

B/C 10.6.3.5

Swell wave data shall be reported only when swell waves can be distinguished from wind waves. [12.3.4.1]

B/C 10.6.3.6

When the sea is calm (no waves and no swell) direction, period and height of swell waves shall be reported as 0.

B/C 10.6.3.7

If swell waves cannot be distinguished from wind waves, direction 0 22 003, period 0 22 013 and height 0 22 023 of swell waves shall be set to missing.

B/C 10.6.3.8

If only one system of swell is observed, direction, period and height of swell waves shall be reported in the first replication of <3 02 023> = <0 22 003, 0 22 013, 0 22 023>. All elements in the second replication of <3 02 023> shall be set to missing. [12.3.4.2]

B/C 10.6.3.9

If a second system of swell is observed, its direction, period and height shall be reported in the second replication of <3 02 023> = <0 22 003, 0 22 013, 0 22 023>. The corresponding data for the first system of swell shall be reported as prescribed by Regulation B/C 10.6.3.8. [12.3.4.3]

B/C 10.7 “Instantaneous” data required by regional or national reporting practices

If regional or national reporting practices require inclusion of additional “instantaneous” parameters, the sequence descriptor 3 08 009 shall not be used. In this case BUFR/CREX template for SHIP data shall be used in its first level expanded form and the descriptors, corresponding to the required “instantaneous” parameters, shall be inserted to precede 3 02 060 (SHIP “period” data).

Notes:

(1) “Instantaneous” parameter is a parameter that is not coupled to a time period descriptor, e.g. 0 04 024, 0 04 025.

(2) No regional requirements are currently indicated for reporting SHIP data from sea stations in the *Manual on Codes*, WMO-No. 306, Volume II.

B/C 10.8 SHIP “period” data <3 02 060>

B/C 10.8.1 Present and past weather <3 02 038>

B/C 10.8.1.1

Present weather (Code table 0 20 003) and past weather (1) (Code table 0 20 004) and past weather (2) (Code table 0 20 005) shall be reported as non-missing values if present and past conditions are known. In case of a report from a manually operated station after a period of closure or at start up, when past weather conditions for the period applicable to the report are unknown, past weather (1) and past weather (2) reported as missing shall indicate that previous conditions are unknown. This regulation shall also apply to automatic reporting stations with the facility to report present and past weather. [12.2.6.1]

B/C 10.8.1.2

Code figures 0, 1, 2, 3, 100, 101, 102 and 103 for present weather and code figures 0, 1, 2 and 10 for past weather (1) and past weather (2) shall be considered to represent phenomena without significance. [12.2.6.2]

B/C 10.8.1.3

Present and past weather shall be *reported if observation was made (data available), regardless significance of the phenomena.*

Note:

(1) If data are produced and collected in traditional codes and present weather and past weather is omitted in a SHIP report (no significant phenomena observed), code figure 508 shall be used for present weather and code figure 10 for past weather (1) and past weather (2) when converted into BUFR or CREX.

B/C 10.8.1.4

If no observation was made (data not available), code figure 509 shall be used for present weather and both past weather (1) and past weather (2) shall be reported as missing.

B/C 10.8.1.5 Present weather from a manned weather station

B/C 10.8.1.5.1

If more than one form of weather is observed, the highest applicable code figure from the range <00 to 99> shall be selected for present weather. Code figure 17 shall have precedence over code figures 20 – 49. Other weather may be reported using additional entries 0 20 003 or 0 20 021 to 0 20 026 applying Regulation B/C 10.7. [12.2.6.4.1]

B/C 10.8.1.5.2

In coding 01, 02, or 03, there is no limitation on the magnitude of the change of the cloud amount. Code figures 00, 01, and 02 can each be used when the sky is clear at the time of observation. In this case, the following interpretation of the specifications shall apply:

- 00 is used when the preceding conditions are not known,
- 01 is used when the clouds have dissolved during the past hour,
- 02 is used when the sky has been continuously clear during the past hour. [12.2.6.4.2]

B/C 10.8.1.5.3

When the phenomenon is not predominantly water droplets, the appropriate code figure shall be selected without regard to visibility. [12.2.6.4.3]

B/C 10.8.1.5.4

The code figure 05 shall be used when the obstruction to vision consists predominantly of lithometeors. [12.2.6.4.4]

B/C 10.8.1.5.5

National instructions shall be used to indicate the specifications for code figures 07 and 09. [12.2.6.4.5]

B/C 10.8.1.5.6

The visibility restrictions on code figure 10 shall be 1000 meters or more. The specification refers only to water droplets and ice crystals. [12.2.6.4.6]

B/C 10.8.1.5.7

For code figures 11 or 12 to be reported, the apparent visibility shall be less than 1000 meters. [12.2.6.4.7]

B/C 10.8.1.5.8

For code figure 18, the following criteria for reporting squalls shall be used:

(a) When wind speed is measured: A sudden increase of wind speed of at least eight meters per second, the speed rising to 11 meters per second or more and lasting for at least one minute;

(b) When the Beaufort scale is used for estimating wind speed: A sudden increase of wind speed by at least three stages of the Beaufort scale, the speed rising to force 6 or more and lasting for at least one minute. [12.2.6.4.8]

B/C 10.8.1.5.9

Code figures 20 – 29 shall never be used when precipitation is observed at the time of observation. [12.2.6.4.9]

B/C 10.8.1.5.10

For code figure 28, visibility shall have been less than 1000 meters.

Note:

(1) The specification refers only to visibility restrictions which occurred as a result of water droplets or ice crystals. [12.2.6.4.10]

B/C 10.8.1.5.11

For synoptic coding purposes, a thunderstorm shall be regarded as being at the station from the time thunder is first heard, whether or not lightning is seen or precipitation is occurring at the station. A thunderstorm shall be reported if thunder is heard within the normal observational period preceding the time of the report. A thunderstorm shall be regarded as having ceased at the time thunder is first heard and the cessation is confirmed if thunder is not heard for 10 – 15 minutes after this time. [12.2.6.4.11]

B/C 10.8.1.5.12

The necessary uniformity in reporting code figures 36, 37, 38, and 39, which may be desirable within certain regions, shall be obtained by means of national instructions. [12.2.6.4.12]

B/C 10.8.1.5.13

A visibility restriction “less than 1000 meters” shall be applied to code figures 42 – 49. In the case of code figures 40 or 41, the apparent visibility in the fog or ice fog patch or bank shall be less than 1000 meters. Code figures 40 – 47 shall be used when the obstructions to vision consist predominantly of water droplets or ice crystals, and 48 or 49 when the obstructions consist predominantly of water droplets. [12.2.6.4.13]

B/C 10.8.1.5.14

When referring to precipitation, the phrase “at the station” in the code table shall mean “at the point where the observation is normally taken”. [12.2.6.4.14]

B/C 10.8.1.5.15

The precipitation shall be encoded as intermittent if it has been discontinuous during the preceding hour, without presenting the character of a shower. [12.2.6.4.15]

B/C 10.8.1.5.16

The intensity of precipitation shall be determined by the intensity at the time of the observation. [12.2.6.4.16]

B/C 10.8.1.5.17

Code figures 80 – 89 shall be used only when the precipitation is of the shower type and takes place at the time of the observation.

Note:

(1) Showers are produced by convective clouds. They are characterized by their abrupt beginning and end and by the generally rapid and sometimes great variations in the intensity of the precipitation. Drops and solid particles falling in a shower are generally larger than those falling in non-showery precipitation. Between showers openings may be

observed unless stratiform clouds fill the intervals between the cumuliform clouds. [12.2.6.4.17]

B/C 10.8.1.5.18

In reporting code figure 98, the observer shall be allowed considerable latitude in determining whether precipitation is or is not occurring, if it is not actually visible. [12.2.6.4.18]

B/C 10.8.1.6 Present weather from an automatic weather station

B/C 10.8.1.6.1

The highest applicable code figure shall be selected. [12.2.6.5.1]

B/C 10.8.1.6.2

In coding code figures 101, 102, and 103, there is no limitation on the magnitude of the change of the cloud amount. Code figures 100, 101, and 102 can each be used when the sky is clear at the time of observation. In this case, the following interpretation of the specifications shall apply:

- Code figure 100 is used when the preceding conditions are not known;
- Code figure 101 is used when the clouds have dissolved during the past hour;
- Code figure 102 is used when the sky has been continuously clear during the past hour. [12.2.6.5.2]

B/C 10.8.1.6.3

When the phenomenon is not predominantly water droplets, the appropriate code figure shall be selected without regard to the visibility. [12.2.6.5.3]

B/C 10.8.1.6.4

The code figures 104 and 105 shall be used when the obstruction to vision consists predominantly of lithometeors. [12.2.6.5.4]

B/C 10.8.1.6.5

The visibility restriction on code figure 110 shall be 1000 meters or more. The specification refers only to water droplets and ice crystals. [12.2.6.5.5]

B/C 10.8.1.6.6

For code figure 118, the following criteria for reporting squalls shall be used:

A sudden increase of wind speed of at least eight meters per second, the speed rising to 11 meters per second or more and lasting for at least one minute. [12.2.6.5.6]

B/C 10.8.1.6.7

Code figures 120 – 126 shall never be used when precipitation is observed at the time of observation. [12.2.6.5.7]

B/C 10.8.1.6.8

For code figure 120, visibility shall have been less than 1000 meters.

Note: The specification refers only to visibility restrictions, which occurred as a result of water droplets or ice crystals. [12.2.6.5.8]

B/C 10.8.1.6.9

For synoptic coding purposes, a thunderstorm shall be regarded as being at the station from the time thunder is first detected, whether or not lightning is detected or precipitation is occurring at the station. A thunderstorm shall be reported in present weather if thunder is detected within the normal observational period preceding the time of the report. A thunderstorm shall be regarded as having ceased at the time thunder is last detected and the cessation is confirmed if thunder is not detected for 10 – 15 minutes after this time. [12.2.6.5.9]

B/C 10.8.1.6.10

A visibility restriction “less than 1000 meters” shall be applied to code figures 130 – 135. [12.2.6.5.10]

B/C 10.8.1.6.11

The precipitation shall be encoded as intermittent if it has been discontinuous during the preceding hour, without presenting the character of a shower. [12.2.6.5.11]

B/C 10.8.1.6.12

The intensity of precipitation shall be determined by the intensity at the time of observation. [12.2.6.5.12]

B/C 10.8.1.6.13

Code figures 180 – 189 shall be used only when the precipitation is intermittent or of the shower type and takes place at the time of observation.

Note:

(1) Showers are produced by convective clouds. They are characterized by their abrupt beginning and end and by the generally rapid and sometimes great variations in the intensity of the precipitation. Drops and solid particles falling in a shower are generally larger than those falling in non-showery precipitation. Between showers openings may be observed unless stratiform clouds fill the intervals between the cumuliform clouds. [12.2.6.5.13]

B/C 10.8.1.7 Past weather reported from a manned weather station

B/C 10.8.1.7.1 Time period

The time period (0 04 024) covered by past weather (1) and past weather (2) shall be expressed as *a negative value* in hours:

(a) Six hours, for observations at 0000, 0600, 1200, and 1800 UTC;
(b) Three hours for observations at 0300, 0900, 1500, and 2100 UTC;
(c) Two hours for intermediate observations if taken every two hours.
(d) *One hour* for intermediate observations if taken every hour. [12.2.6.6.1]

B/C 10.8.1.7.2

The code figures for past weather (1) and past weather (2) shall be selected in such a way that past and present weather together give as complete a description as possible of the weather in the time interval concerned. For example, if the type of weather undergoes a complete change during the time interval concerned, the code figures selected for past weather (1) and past weather (2) shall describe the weather prevailing before the type of weather indicated by present weather began. [12.2.6.6.2]

B/C 10.8.1.7.3

When the past weather (1) and past weather (2) are used in hourly reports, Regulation B/C 10.8.1.7.1 (d) shall apply. [12.2.6.6.3]

B/C 10.8.1.7.4

If, using Regulation B/C 10.8.1.7.2, more than one code figure may be given to past weather (1), the highest figure shall be reported for past weather (1) and the second highest code figure shall be reported for past weather (2). [12.2.6.6.4]

B/C 10.8.1.7.5

If the weather during the period has not changed so that only one code figure may be selected for past weather, then that code figure shall be reported for both past weather (1) and past weather (2). [12.2.6.6.5]

B/C 10.8.1.8 Past weather reported from an automatic weather station

B/C 10.8.1.8.1 Time period

The time period (0 04 024) covered by past weather (1) and past weather (2) shall be expressed as *a negative value* in hours:

(a) Six hours for observations at 0000, 0600, 1200, and 1800 UTC;
(b) Three hours for observations at 0300, 0900, 1500, and 2100 UTC;
(c) Two hours for intermediate observations if taken every two hours.
(d) *One hour* for intermediate observations if taken every hour. [12.2.6.7.1]

B/C 10.8.1.8.2

The code figures for past weather (1) and past weather (2) shall be selected so that the maximum capability of the automatic station to discern past weather is utilized, and so that past and present weather together give as complete a description as possible of the weather in the time interval concerned. [12.2.6.7.2]

B/C 10.8.1.8.3

In cases where the automatic station is capable only of discerning very basic weather conditions, the lower code figures representing basic and generic phenomena may be used. If the automatic station has higher discrimination capabilities, the higher code figures representing more detailed explanation of the phenomena shall be used. For each basic type of phenomenon, the highest code figure within the discrimination capability of the automatic station shall be reported. [12.2.6.7.3]

B/C 10.8.1.8.4

If the type of weather during the time interval concerned undergoes complete and discernible changes, the code figures selected for past weather (1) and past weather (2) shall describe the weather prevailing before the type of weather indicated by present weather began. The highest figure shall be reported for past weather (1) and the second highest code figure shall be reported for past weather (2). [12.2.6.7.4]

B/C 10.8.1.8.5

If a discernible change in weather has not occurred during the period, so that only one code figure may be selected for the past weather, then that code figure shall be reported for both past weather (1) and past weather (2). For example, rain during the entire period shall be reported as code figure 14 for both past weather (1) and past weather (2) in the case of an automatic station incapable of differentiating types of precipitation, or code figure 16 for both past weather (1) and past weather (2) in the case of a station with the higher discrimination capability. [12.2.6.7.5]

B/C 10.8.2 Precipitation measurement <3 02 040>

B/C 10.8.2.1 Height of sensor above marine deck platform

Height of sensor above marine deck platform (0 07 032) for precipitation measurement shall be reported in meters (with precision in hundredths of a meter).
This datum represents the actual height of the rain gauge rim above marine deck platform at the point where the rain gauge is located.

B/C 10.8.2.2 Period of reference for amount precipitation

Time period (0 04 024) for amount of precipitation shall be reported as *a negative value* in hours. It shall be determined

(a) by regional decision (e.g. -6, -12, -24) in the first replication,
(b) by national decision (e.g. -1, -3) in the second replication.

B/C 10.8.2.3 Total amount of precipitation

Total amount of precipitation, which has fallen during the period of reference for amount of precipitation, shall be reported in kilograms per square meter (with precision in tenths of a kilogram per square meter).

B/C 10.8.2.3.1

Precipitation, when it can be and has to be reported, shall be reported as 0.0 kgm^{-2} if no precipitation were observed during the referenced period. [12.2.5.4]

B/C 10.8.2.3.2

Trace shall be reported as "- 0.1 kgm^{-2} ".

B/C 10.8.3 Extreme temperature data <3 02 058>

B/C 10.8.3.1 Height of sensor above marine deck platform and height of sensor above water surface

Height of sensor above marine deck platform (0 07 032) for temperature measurement shall be reported in meters (with precision in hundredths of a meter).
This datum represents the actual height of temperature sensors above marine deck platform at the point where the sensors are located.

Height of sensor above water surface (0 07 033) for temperature measurement shall be reported in meters (with precision in hundredths of a meter).
This datum represents the actual height of temperature sensors above marine water surface of sea or lake.

B/C 10.8.3.2 Periods of reference for extreme temperatures

Time period for maximum temperature and time period for minimum temperature (0 04 024) shall be determined by regional decision and reported as *negative values* in hours. [12.4.4]

Notes:

(1) If the period for maximum temperature or the period for minimum temperature ends at the nominal time of report, the second value of 0 04 024 shall be reported as 0.

(2) If the period for maximum temperature or the period for minimum temperature does not end at the nominal time of report, the first value of 0 04 024 shall indicate the beginning of the period of reference and the second value of 0 04 024 shall indicate the end of the period of reference. E.g. to report the maximum temperature for the previous calendar day from a station in RA IV, value of the first 0 04 024 shall be set to – 30 and value of the second 0 04 024 shall be set to – 6, provided that the nominal time of the report 12 UTC corresponds to 6 a.m. local time.

B/C 10.8.3.3 Maximum and minimum temperature

Maximum and minimum temperature shall be reported in degrees Kelvin (with precision in hundredths of a degree Kelvin); if produced in CREX, in degrees Celsius (with precision in hundredths of a degree Celsius).

Note:

(1) Notes (1) and (2) under Regulation B/C 10.4.1.2 shall apply.

B/C 10.8.4 Wind data <3 02 059>

B/C 10.8.4.1 Height of sensor above marine deck platform and height of sensor above water surface

Height of sensor above marine deck platform (0 07 032) for wind measurement shall be reported in meters (with precision in hundredths of a meter).
This datum represents the actual height of wind sensors above marine deck platform at the point where the sensors are located.

Height of sensor above water surface (0 07 033) for wind measurement shall be reported in meters (with precision in hundredths of a meter).
This datum represents the actual height of wind sensors above marine water surface of sea or lake.

B/C 10.8.4.2 Type of instrumentation for wind measurement - Flag table 0 02 002

This datum shall be used to specify whether the wind speed was measured by certified instruments (bit No. 1 set to 1) or estimated on the basis of the Beaufort wind scale (bit No. 1 set to 0), and to indicate the original units for wind speed measurement. Bit No. 2 set to 1 indicates that wind speed was originally measured in knots and bit No. 3 set to 1 indicates that wind speed was originally measured in kilometers per hour. Setting both bits No.2 and No.3 to 0 indicates that wind speed was originally measured in meters per second.

B/C 10.8.4.3 Wind direction and speed

The mean direction and speed of the wind over the 10-minute period immediately preceding the observation shall be reported. The time period (0 04 025) shall be included as -10. However, when the 10-minute period includes a discontinuity in the wind characteristics, only data obtained after the discontinuity shall be used for reporting the mean values, and hence the period (0 04 025) in these circumstances shall be correspondingly reduced. [12.2.2.3.1]

The time period is preceded by a time significance qualifier (0 08 021) that shall be set to 2 (Time averaged).
The wind direction (0 11 001) shall be reported in degrees true and the wind speed (0 11 002) shall be reported in meters per second (with precision in tenths of a meter per second).

B/C 10.8.4.3.1

In the absence of wind instruments, the wind speed shall be estimated on the basis of the Beaufort wind scale. The Beaufort number obtained by estimation is converted into meters per second by use of the relevant wind speed equivalent column on the Beaufort scale, and this speed is reported for wind speed. [12.2.2.3.2]

B/C 10.8.4.4 Maximum wind gust direction and speed

Time period for maximum wind gust direction and speed (0 04 025) shall be determined by regional or national decision and reported as a negative value in minutes.
Direction of the maximum wind gust (0 11 043) shall be reported in degrees true and speed of the maximum wind gust (0 11 041) shall be reported in meters per second (with precision in tenths of meters per second).

B/C 10.9 "Period" data required by regional or national reporting practices

If regional reporting practices in a Region require inclusion of additional "period" parameters, the corresponding "regional" common sequence (see the Annex) shall be supplemented by relevant descriptors. If national reporting practices require inclusion of additional "period" parameters, the common sequence 3 08 009 shall be supplemented by relevant descriptors.

Note:

(1) "Period" parameter is a parameter that is coupled to a time period descriptor, e.g. 0 04 024, 0 04 025.

(2) No additional "period" parameters are currently required by regional regulations for SHIP data in the *Manual on Codes*, WMO-No. 306, Volume II.

B/C20 – Regulations for reporting PILOT, PILOT SHIP and PILOT MOBIL data in TDCF

General

A BUFR (or CREX) message should be sent when level the 100 hPa is reached. In any case, a BUFR (or CREX) message shall be produced when the sounding is completed containing data from the entire sounding.

BUFR templates for wind vertical profiles suitable for PILOT, PILOT SHIP and PILOT MOBIL observation data:

TM 309050 - BUFR template for wind vertical profiles with pressure as the vertical coordinate

3 09 050		**Sequence for representation PILOT, PILOT SHIP and PILOT MOBIL observation type data with pressure as the vertical coordinate**
	3 01 110	Identification of launch site and instrumentation for wind measurement
	3 01 113	Date/time of launch
	3 01 114	Horizontal and vertical coordinates of launch site
	1 01 000	Delayed replication of 1 descriptor
	0 31 002	Extended delayed descriptor replication factor
	3 03 050	Wind data at a pressure level
	1 01 000	Delayed replication of 1 descriptor
	0 31 001	Delayed descriptor replication factor
	3 03 051	Wind shear data at a pressure level

TM 309051 - BUFR template for wind vertical profiles with height as the vertical coordinate

3 09 051		**Sequence for representation PILOT, PILOT SHIP and PILOT MOBIL observation type data with height as the vertical coordinate**
	3 01 110	Identification of launch site and instrumentation for wind measurement
	3 01 113	Date/time of launch
	3 01 114	Horizontal and vertical coordinates of launch site
	1 01 000	Delayed replication of 1 descriptor
	0 31 002	Extended delayed descriptor replication factor
	3 03 052	Wind data at a height level
	1 01 000	Delayed replication of 1 descriptor
	0 31 001	Delayed descriptor replication factor
	3 03 053	Wind shear data at a height level

BUFR template TM 309050 for wind vertical profiles *(with pressure as the vertical coordinate)* is further expanded as follows:

3 01 110		**Identification of launch site and instrumentation**	
	3 01 001	WMO block number	Numeric
		WMO station number	Numeric
	0 01 011	Ship or mobile land station identifier	CCITT IA5
	0 02 011	Radiosonde type	Code table
	0 02 014	Tracking technique/status of system used	Code table
	0 02 003	Type of measuring equipment used	Code table
3 01 113		**Date/time of launch**	
	0 08 021	Time significance (= 18 (launch time))	Code table
	3 01 011	Year	Year
		Month	Month
		Day	Day
	3 01 013	Hour	Hour
		Minute	Minute
		Second	Second
3 01 114		**Horizontal and vertical coordinates of launch site**	
	3 01 021	Latitude (high accuracy)	Degree, scale 5
		Longitude (high accuracy)	Degree, scale 5
	0 07 030	Height of station ground above mean sea level	m, scale 1
	0 07 031	Height of barometer above mean sea level	m, scale 1
	0 07 007	Height of release of sonde above mean sea level	m
	0 33 024	Station elevation quality mark (for mobile stations)	Code table
		Wind data at pressure levels	
1 01 000		Delayed replication of 1 descriptor	
0 31 002		Extended delayed descriptor replication factor	Numeric
3 03 050		**Wind data at a pressure level**	
	0 04 086	Long time period or displacement (since launch time)	Second
	0 08 042	Extended vertical sounding significance	Flag table
	0 07 004	Pressure	Pa, scale –1
	0 05 015	Latitude displacement since launch site (high accuracy)	Degree, scale 5
	0 06 015	Longitude displacement since launch site (high accuracy)	Degree, scale 5
	0 11 001	Wind direction	Degree true
	0 11 002	Wind speed	m s^{-1}, scale 1
		Wind shear data	
1 01 000		Delayed replication of 1 descriptor	

0 31 001		Delayed descriptor replication factor	Numeric
3 03 051		**Wind shear data at a pressure level**	
	0 04 086	Long time period or displacement (since launch time)	Second
	0 08 042	Extended vertical sounding significance	Flag table
	0 07 004	Pressure	Pa, scale –1
	0 05 015	Latitude displacement since launch site (high accuracy)	Degree, scale 5
	0 06 015	Longitude displacement since launch site (high accuracy)	Degree, scale 5
	0 11 061	Absolute wind shear in 1 km layer below	m s^{-1}, scale 1
	0 11 062	Absolute wind shear in 1 km layer above	m s^{-1}, scale 1

Notes:

(1) Time of launch 3 01 013 shall be reported with the highest possible accuracy available. If the launch time is not available with second accuracy, the entry for seconds shall be put to zero.

(2) Long time displacement 0 04 086 represents the time offset from the launch time 3 01 013 (in seconds).

(3) Latitude displacement 0 05 015 represents the latitude offset from the latitude of the launch site. Longitude displacement 0 06 015 represents the longitude offset from the longitude of the launch site.

(4) If maximum wind data and/or wind shear data are reported with height as the vertical coordinate in Parts A or C of Pilot report, while the whole vertical wind profile is reported with pressure as the vertical coordinate, the data may be converted into BUFR using sequence 3 09 050 because the maximum wind data are as significant levels also included in Parts B or D (being identified by pressure as the vertical coordinate), provided that Part B and D are available when the entire wind profile is produced in BUFR or CREX.

BUFR template 3 09 051 for wind vertical profiles *(with height as the vertical coordinate)* is further expanded as follows:

3 01 110		**Identification of launch site and instrumentation for wind measurements**	
	3 01 001	WMO block number	Numeric
		WMO station number	Numeric
	0 01 011	Ship or mobile land station identifier	CCITT IA5
	0 02 011	Radiosonde type	Code table
	0 02 014	Tracking technique/status of system used	Code table
	0 02 003	Type of measuring equipment used	Code table
3 01 113		**Date/time of launch**	
	0 08 021	Time significance (= 18 (launch time))	Code table
	3 01 011	Year	Year
		Month	Month
		Day	Day
	3 01 013	Hour	Hour
		Minute	Minute
		Second	Second
3 01 114		**Horizontal and vertical coordinates of launch site**	
	3 01 021	Latitude (high accuracy)	Degree, scale 5
		Longitude (high accuracy)	Degree, scale 5
	0 07 030	Height of station ground above mean sea level	m, scale 1
	0 07 031	Height of barometer above mean sea level	m, scale 1
	0 07 007	Height of release of sonde above mean sea level	m
	0 33 024	Station elevation quality mark (for mobile stations)	Code table
		Wind data at heights	
1 01 000		Delayed replication of 1 descriptor	
0 31 002		Extended delayed descriptor replication factor	Numeric
3 03 052		**Wind data at a height level**	

	0 04 086	Long time period or displacement (since launch time)	Second
	0 08 042	Extended vertical sounding significance	Flag table
	0 07 009	Geopotential height	gpm
	0 05 015	Latitude displacement since launch site (high accuracy)	Degree, scale 5
	0 06 015	Longitude displacement since launch site (high accuracy)	Degree, scale 5
	0 11 001	Wind direction	Degree true
	0 11 002	Wind speed	m s^{-1}, scale 1
		Wind shear data at heights	
1 01 000		Delayed replication of 1 descriptor	
0 31 001		Delayed descriptor replication factor	Numeric
3 03 053		**Wind shear data at a height level**	
	0 04 086	Long time period or displacement (since launch time)	Second
	0 08 042	Extended vertical sounding significance	Flag table
	0 07 009	Geopotential height	gpm
	0 05 015	Latitude displacement since launch site (high accuracy)	Degree, scale 5
	0 06 015	Longitude displacement since launch site (high accuracy)	Degree, scale 5
	0 11 061	Absolute wind shear in 1 km layer below	m s^{-1}, scale 1
	0 11 062	Absolute wind shear in 1 km layer above	m s^{-1}, scale 1

Notes: (1) Time of launch 3 01 013 shall be reported with the highest possible accuracy available. If the launch time is not available with second accuracy, the entry for seconds shall be put to zero.

(2) Long time displacement 0 04 086 represents the time offset from the launch time 3 01 013 (in seconds)

(3) Latitude displacement 0 05 015 represents the latitude offset from the latitude of the launch site. Longitude displacement 0 06 015 represents the longitude offset from the longitude of the launch site.

Regulations:

B/C 20.1 Section 1 of BUFR or CREX
B/C 20.2 Identification of launch site and instrumentation
B/C 20.3 Date/time of launch
B/C 20.4 Horizontal and vertical coordinates of launch site
B/C 20.5 Wind data at pressure levels
B/C 20.6 Wind data at height levels
B/C 20.7 Criteria for reporting standard and significant levels
B/C 20.8 Wind shear data at pressure levels
B/C 20.9 Wind shear data at pressure levels
B/C 20.10 Data required by regional or national reporting practices

B/C 20.1 Section 1 of BUFR or CREX

B/C 20.1.1 Entries required in Section 1 of BUFR

The following entries shall be included in BUFR Section 1:
- BUFR master table,
- identification of originating/generating centre,
- identification of originating/generating sub-centre,
- update sequence number,
- identification of inclusion of optional section,
- data category (= 002 for all PILOT type data),
- international data sub-category [(1), (2)],
- local data subcategory,
- version number of master table,
- version number of local tables,
- year (year of the century up to BUFR edition 3),

- month (standard time),
- day (standard time = YY in the abbreviated telecommunication header for all PILOT type data),
- hour (standard time = GG in the abbreviated telecommunication header for all PILOT type data),
- minute (standard time = 00 for all PILOT type data).

- Notes:
  (1) Inclusion of this entry is required starting with BUFR edition 4.
  (2) If required, the international data sub-category shall be included at all observation times as follows:
  = 001 for PILOT data,
  = 002 for PILOT SHIP data,
  = 003 for PILOT MOBIL data.

B/C 20.1.2 Entries required in Section 1 of CREX

The following entries shall be included in CREX Section 1:

- CREX master table,
- CREX edition number,
- CREX table version number,
- version number of BUFR master table (1),
- version number of local tables (1),
- data category (= 002 for all PILOT type data),
- international data sub-category (1), (2),
- identification of originating/generating centre (1),
- identification of originating/generating sub-centre (1),
- update sequence number (1),
- number of subsets (1),
- year (standard time) (1),
- month (standard time) (1),
- day (standard time = YY in the abbreviated telecommunication header for all PILOT type data) (1),
- hour (standard time = GG in the abbreviated telecommunication header for all PILOT type data) (1),
- minute (standard time = 00 for all PILOT type data) (1).

Notes:
(1) Inclusion of these entries is required starting with CREX edition 2.
(2) If inclusion of international data sub-category is required, Note (2) under B/C 20.1.1 applies.

B/C 20.2 Identification of launch site and instrumentation <3 01 110>

B/C 20.2.1 Identification of launch site

WMO block number station (0 01 001) and WMO station number (0 01 002) shall be always reported as a non-missing value in reports from a fixed land station.

Ship or mobile land station identifier (0 01 011) shall be always reported not exceeding 9 characters in reports from ships or mobile stations. [32.2.1]

B/C 20.2.1 Instrumentation for wind measurement

Radiosonde type (Code table 0 02 011), tracking techniques/status of system used (Code table 0 02 014) and type of measuring equipment used (Code table 0 02 003) shall be reported.

B/C 20.3 Date/time of launch <3 01 113>

Time significance (0 08 021) shall be always set to 18 to indicate that the following entries specify the date and time of launching the radiosonde.

Date of launch <3 01 011> and time of launch <3 01 013> shall be reported, i.e. year (0 04 001), month (0 04 002), day (0 04 003)> and hour (0 04 004), minute (0 04 005) and second (0 04 006) of the actual time of launch shall be reported.

Note:

(1) Time of launch <3 01 013> shall be reported with the highest possible accuracy available. If the launch time is not available with second accuracy, the entry 0 04 006 for seconds shall be set to zero.

B/C 20.4 Horizontal and vertical coordinates of launch site <3 01 114>

Latitude (0 05 001) and longitude (0 06 001) of the launch site shall be reported in degrees with precision in 10^{-5} of a degree.

Height of station ground above mean sea level (0 07 030) and height of barometer above mean sea level (0 07 031) shall be reported in meters with precision in tenths of a meter.

Height of release of sonde above mean sea level (0 07 007) shall be reported in meters.

Station elevation quality mark (Code table 0 33 024) shall be reported to indicate the accuracy of the vertical coordinates of the mobile land station. Fixed land stations and sea stations shall report this datum as a missing value. [32.2.1]

B/C 20.5 Wind data at pressure levels

Wind data at pressure levels shall be always reported using *template TM 309050* and shall be included in descending order with respect to pressure. Data at each pressure level shall be included only once. For example, if a significant level with respect to wind and a standard level coincide, data for that level shall be included only once, the multiple attributes being indicated by Extended vertical sounding significance (Flag table 0 08 042) as specified in Regulation B/C 20.5.2.2.

Note:

(1) If data are produced and collected in traditional PILOT codes, the order of pressure levels may correspond to the order of levels in Parts A, B, C and D, when converted into BUFR or CREX. In this case, data at a level may be included more than once.

B/C 20.5.1 Number of reported pressure levels

The number of reported pressure levels shall be indicated by Extended delayed descriptor replication factor 0 31 002 in BUFR and by a four-digit number in the Data Section corresponding to the position of the replication descriptor in the Data Description Section of CREX.

Notes:

(1) The number of pressure levels shall never be set to a missing value.

(2) The number of pressure levels shall be set to a positive value in a NIL report.

B/C 20.5.1.1

All required data from the entire ascent shall be reported in a BUFR (or CREX) message that shall be produced when the sounding is completed. In interest of timely data delivery, however, a BUFR (or CREX) message should be sent when level 100 hPa is reached.

B/C 20.5.2 Wind data at a pressure level <3 03 050>

B/C 20.5.2.1 Long time displacement (since launch time)

Long time displacement (0 04 086) represents the time offset from the launch time specified in Regulation 20.3, and shall be reported in seconds if available.

B/C 20.5.2.2 Extended vertical sounding significance – Flag table 0 08 042

This datum shall be used to specify vertical sounding significance in the following way:

(a) Bit No. 1 set to 1 indicates surface (see Regulation B/C 20.7.1).

(b) Bit No. 2 set to 1 indicates a standard level (see Regulation B/C 20.7.2).

(c) Bit No. 4 set to 1 indicates a maximum wind level (see Regulation B/C 20.7.3).
(d) Bit No. 7 set to 1 indicates a level significant with respect to wind (see Regulation B/C 20.7.4).
(e) Bit No. 12 set to 1 indicates beginning of missing wind data bit No. 13 set to 1 indicates end of missing wind data (see Regulation B/C 20.7.5).
(f) Bit No. 14 set to 1 indicates the top of wind sounding.
(g) Bit No. 15 set to 1 indicates a level determined by regional decision.
(h) Bit No. 17 set to 1 indicates a pressure level originally identified by height as the vertical coordinate.
(i) All bits set to 0 indicate a level determined by national decision.
(j) All bits set to 1 indicate a missing value.

B/C 20.5.2.3 Pressure

Pressure (0 07 004) shall be reported in pascals (with precision in tens of a pascal).

Notes:
(1) Pressure as the vertical coordinate shall be used when template TM 309050 is applied.
(2) Pressure as the only vertical coordinate shall be used in a report. [32.3.1.4]

B/C 20.5.2.4 Latitude and longitude displacements

Latitude displacement (0 05 015) represents the latitude offset from the latitude of the launch site specified in Regulation 20.4, and shall be reported in degrees with precision in 10^{-5} of a degree if available. Longitude displacement 0 06 015 represents the longitude offset from the longitude of the launch site specified in Regulation 20.4, and shall be reported in degrees with precision in 10^{-5} of a degree if available.

B/C 20.5.2.5 Wind direction and speed

The wind direction (0 11 001) shall be reported in degrees true and the wind speed (0 11 002) shall be reported in meters per second (with precision in tenths of a meter per second).

B/C 20.6 Wind data at height levels

Wind data at height levels shall be always reported using *template TM 309051* and shall be included in ascending order with respect to altitude. Data at each height level shall be included only once. For example, if a significant level with respect to wind and a standard level coincide, data for that level shall be included only once, the multiple attributes being indicated by Extended vertical sounding significance (Flag table 0 08 042) as specified in Regulation B/C 20.5.2.2.

Note:
(1) If data are produced and collected in traditional PILOT codes, the order of height levels may correspond to the order of levels in Parts A, B, C and D, when converted into BUFR or CREX. In this case, data at a level may be included more than once.

B/C 20.6.1 Number of reported height levels

The number of reported height levels shall be indicated by Extended delayed descriptor replication factor 0 31 002 in BUFR and by a four-digit number in the Data Section corresponding to the position of the replication descriptor in the Data Description Section of CREX.

Notes:
(1) The number of height levels shall never be set to a missing value.
(2) The number of height levels shall be set to a positive value in a NIL report.

B/C 20.6.1.1

Regulation B/C 20.5.1.1 shall apply.

B/C 20.6.2 Wind data at a height level <3 03 052>

B/C 20.6.2.1 Long time displacement (since launch time)

Long time displacement (0 04 086) represents the time offset from the launch time specified in Regulation 20.3, and shall be reported in seconds if available.

B/C 20.6.2.2 Extended vertical sounding significance – Flag table 0 08 042

Regulation B/C 20.5.2.2 shall apply.

B/C 20.6.2.3 Geopotential height

Geopotential height of the level (0 07 009) shall be reported in geopotential meters.

Notes:

(1) Geopotential height as the vertical coordinate shall be used when template TM 309051 is applied.

(2) Geopotential height as the only vertical coordinate shall be used in a report. [32.3.1.4]

B/C 20.6.2.4 Latitude and longitude displacements

Regulation B/C 20.5.2.4 shall apply.

B/C 20.6.2.5 Wind direction and speed

Regulation B/C 20.5.2.5 shall apply.

B/C 20.7 Criteria for reporting standard and significant levels

B/C 20.7.1 Surface

The surface level shall be always reported.

Note:

(1) The value of Extended vertical sounding significance 0 08 042 at the surface level shall indicate that this level is also a level significant with respect to wind, i.e. bit No.1 and also bit No. 7 shall be set to 1.

B/C 20.7.2 Standard levels

B/C 20.7.2.1

The standard levels of 850, 700, 500, 400, 300, 250, 200, 150, 100, 70, 50, 30, 20 and 10 hPa shall be reported in descending order with respect to pressure (in ascending order with respect to altitude). [32.2.2.1]

B/C 20.7.2.2

When pressure measurements are not available, wind data shall be reported using geopotential approximations to the standard isobaric surfaces. [32.2.2.2]

B/C 20.7.2.3

When wind data at a standard level are not available, the corresponding entries for that level shall be reported as missing values. [32.2.2.3]

B/C 20.7.2.4

When the standard levels are located by means of pressure equipment and if the pressure element failed during the ascent, the remaining standard levels to be reported shall be indicated by 0 08 042 - bit No. 2 set to 1 (standard level) and by bit No. 17 set to 1 (a pressure level originally identified by height as the vertical coordinate) [32.2.2.4]

B/C 20.7.3 Maximum wind level(s)

B/C 20.7.3.1

When a maximum wind level (one or more) is reported, the corresponding number of levels shall be included in the report indicated by 0 08 042 - bit No. 4 set to 1. [32.2.3.3]

Notes:

(1) Criteria for determining maximum wind levels are given in Regulations B/C 20.7.3.3 and B/C 20.7.3.4 below.

(2) As a maximum wind level is also a level significant with respect to wind, bit No. 7 as well as bit No. 4 shall be set to 1 in the Extended vertical sounding significance 0 08 042.

B/C 20.7.3.2

When no maximum wind level is observed, no level shall be indicated by bit No. 4 of 0 08 042 set to 1. [32.2.3.4.5]

B/C 20.7.3.3

A maximum wind level:

(a) Shall be determined by consideration of the list of significant levels for wind speed, as obtained by means of the relevant recommended or equivalent national method (see Note under Regulation B/C 20.7.4.2) and *not* by consideration of the original wind-speed curve;

(b) Shall be located above the 500-hPa isobaric surface and shall correspond to a speed of more than 30 meters per second.

Note:

(1) A maximum wind level is defined as a level at which the wind speed is greater than that observed immediately above and below that level. [32.2.3.1]

B/C 20.7.3.4

Whenever more than one maximum wind level exists, these levels shall be reported as follows:

(a) The level of greatest maximum wind speed shall be always included;

(b) The other levels shall be included in the report only if their speed exceeds those of the two adjacent minima by at least 10 meters per second;

(c) Furthermore, the highest level attained by the sounding shall be indicated as a maximum wind level, provided:

(i) It satisfies the criteria set forth in Regulation B/C 20.7.3.3 above;

(ii) It constitutes the level of the greatest speed of the whole sounding. [32.2.3.2]

B/C 20.7.3.5

When the greatest wind speed observed throughout the sounding occurred at the top of the sounding, this level shall be indicated by 0 08 042 - bit No. 4 set to 1 (maximum wind level), bit No. 7 set to 1 (level significant with respect to wind) and bit No. 14 set to 1 (top of wind sounding). [32.2.3.4.3], [32.2.3.4.4]

B/C 20.7.3.6

In compliance with Regulation B/C 20.5.2.3 or B/C 20.6.2.3, maximum wind level data shall be reported with the same vertical coordinate as the other data in the profile, using template TM 309050 or template TM 309051 for the entire sounding.

Note:

(1) If data are produced and collected in traditional PILOT codes, maximum wind data may be reported with height as the vertical coordinate in Parts A or C of Pilot report, while the whole vertical wind profile is reported with pressure as the vertical coordinate. Even in this case, the maximum wind data may be converted into BUFR using sequence 3 09 050 because the maximum wind data were selected from the list of significant levels with respect to wind. And these significant levels are included in Parts B or D of Pilot report, identified by pressure as the vertical coordinate. [32.3.1.4]

B/C 20.7.4 Levels significant with respect to wind

B/C 20.7.4.1

Significant wind levels shall be chosen so that the data from them *alone* shall make it possible to reconstruct the wind profile with sufficient accuracy for practical use. [32.3.1.1]

B/C 20.7.4.2

Criteria for determining significant levels with respect to changes in wind speed and direction:

(a) The direction of speed curves (in function of the log of pressure or altitude) can be reproduced with their prominent characteristics;

(b) These curves can be reproduced with the accuracy of at least 10 for direction and five meters per second for speed;

Note:
To satisfy these criteria, the following method of successive approximations is recommended, but other methods of attaining equivalent results may suit some national practices better and may be used:

(i) The surface level and highest level for which wind data are available constitute the first and the last significant levels.
The deviation from the linearly interpolated values between these two levels is then considered. If no direction deviates by more than 10 and no speed by more than five meters per second, no other significant level need be reported. Whenever one parameter deviates by more than the limit specified in paragraph (b) above the level of greatest deviation becomes a supplementary significant level for both parameters.

(ii) The additional significant levels so introduced divide the sounding into two layers. In each separate layer, the deviation from the linearly interpolated values between the base and the top are then considered. The process used in paragraph (i) above is repeated and yields other significant levels. These additional levels in turn modify the layer distribution, and the method is applied again until any level is approximated to the above-mentioned specified values. [32.3.1.1]

B/C 20.7.5 Beginning and end of missing wind data

B/C 20.7.5.1

If wind profile data are reported with pressure as the vertical coordinate, a layer for which wind data are missing shall be indicated by reporting the boundary levels of the layer, provided that the layer is at least 50 hPa thick. The boundary levels are the levels closest to the bottom and the top of the layer for which the observed data are available. The boundary levels are not required to meet “significant wind level” criteria. [32.3.1.5.2]

B/C 20.7.5.2

If wind profile data are reported with height as the vertical coordinate, a layer for which wind data are missing shall be indicated by reporting the boundary levels of the layer, provided that the layer is at least 1 500 geopotential meters thick. The boundary levels are the levels closest to the bottom and the top of the layer for which the observed data are available. The boundary levels are not required to meet “significant wind level” criteria. [32.3.1.5.1]

B/C 20.8 Wind shear data at pressure levels

B/C 20.8.1 Number and order of levels for which wind shear is reported

B/C 20.8.1.1

The number of levels with wind shear data shall be indicated by Delayed descriptor replication factor 0 31 001 in BUFR and by a four-digit number in the Data Section corresponding to the position of the replication descriptor in the Data Description Section of CREX.

Notes:
(1) The number of levels with wind shear data shall never be set to a missing value.
(2) The number of levels with wind shear data shall be set to a positive value in a NIL report.
(3) The number of levels with wind shear data shall be set to zero if data for vertical wind shear are not computed and required. [32.2.3.5]

B/C 20.8.1.2

Whenever wind shear data are reported for more than one level, these maximum wind levels shall be included in the same order as in the sequence <3 03 050>, i.e. in descending order with respect to pressure.

B/C 20.8.2 Wind shear data at a pressure level <3 03 051>

B/C 20.8.2.1 Long time displacement (since launch time)

Long time displacement (0 04 086) represents the time offset from the launch time specified in Regulation 20.3, and shall be reported in seconds if available.

B/C 20.8.2.2 Extended vertical sounding significance – Flag table 0 08 042

A level, for which wind shear data are reported, shall be indicated by vertical sounding significance 0 08 042 - bit No. 4 set to 1 (maximum wind level) and by bit No. 7 set to 1 (level significant with respect to wind). Moreover, if the top of the wind sounding corresponds to the highest wind speed observed throughout the ascent, this level shall be indicated also by bit No. 14 set to 1 (top of wind sounding).

B/C 20.8.2.3 Pressure

Pressure (0 07 004) shall be reported in pascals with precision in tens of a pascal.

B/C 20.8.2.4 Latitude and longitude displacements

Latitude displacement (0 05 015) represents the latitude offset from the latitude of the launch site specified in Regulation 20.4, and shall be reported in degrees with precision in 10^{-5} of a degree if available. Longitude displacement 0 06 015 represents the longitude offset from the longitude of the launch site specified in Regulation 20.4, and shall be reported in degrees with precision in 10^{-5} of a degree if available.

B/C 20.8.2.5 Wind shear data

Absolute wind shear in 1 km layer below (0 11 061) and absolute wind shear in 1 km layer above (0 11 062) shall be reported in meters per second (with precision in tenths of a meter per second), if data for vertical wind shear are computed and required. [32.2.3.5]

B/C 20.9 Wind shear data at heights

B/C 20.9.1 Number and order of levels for which wind shear is reported

B/C 20.9.1.1

Regulation B/C 20.8.1.1 shall apply.

B/C 20.9.1.2

Whenever wind shear data are reported for more than one level, these maximum wind levels shall be included in the same order as in the sequence <3 03 052>, i.e. in ascending order with respect to altitude.

B/C 20.9.2 Wind shear data at a height level <3 03 053>

B/C 20.9.2.1 Long time displacement (since launch time)

Long time displacement (0 04 086) represents the time offset from the launch time specified in Regulation 20.3, and shall be reported in seconds if available.

B/C 20.9.2.2 Extended vertical sounding significance – Flag table 0 08 042

Regulation B/C 20.8.2.2 shall apply.

B/C 20.9.2.3 Geopotential height

Geopotential height of the level (0 07 009) shall be reported in geopotential meters.

B/C 20.9.2.4 Latitude and longitude displacements

Regulation B/C 20.8.2.4 shall apply.

B/C 20.9.2.5 Wind shear data

Regulation B/C 20.8.2.5 shall apply.

B/C 20.10 Data required by regional or national reporting practices

If regional or national reporting practices require inclusion of wind data at additional levels, these data shall be reported using sequence <3 03 050> for wind data at a pressure level or sequence <3 03 052> for wind data at a height level. Regulation B/C 20.5 or Regulation B/C 20.6 shall apply.

Notes:

(1) A level determined by regional decision shall be indicated by Extended vertical sounding significance 0 08 042 - bit No. 15 set to 1.

(2) A level determined by national decision shall be indicated by Extended vertical sounding significance 0 08 042 – all bits set to 0.

B/C 20.10.1 Additional data required by reporting practices in RA I

Wind data at additional levels 600, 900, 2 100, 3 900, 4 500, 5 100, 21 000, and all successive levels at 3 000 m intervals, shall be reported in compliance with Regulation B/C 20.10 and Note (1) under this regulation. [1/32.2] [1/32.4.1]

B/C 20.10.2 Additional data required by reporting practices in RA II

B/C 20.10.2.1

Wind data at additional levels 300, 600, 900, 2 100, 3 600, 4 500, 6 000 m shall be reported in compliance with Regulation B/C 20.10 and Note (1) under this regulation. [2/32.3]

B/C 20.10.2.2

The inclusion of wind shear data shall be left to national decision. Members are recommended to include these data as often as possible. [2/32.2]

B/C 20.10.3 Additional data required by reporting practices in RA III

Wind data at additional levels 300, 600, 900, 2 100, 2 400, 4 200, 6 000, 8 100, 33 000 m, and all successive levels at 3 000 m intervals, shall be reported in compliance with Regulation B/C 20.10 and Note (1) under this regulation. [3/32.2] [3/32.4.1]

B/C 20.10.4 Additional data required by reporting practices in RA IV

Wind data at additional levels 300, 600, 900, 1 200, 1 800, 2 100, 2 400, 2 700, 3 600, 4200, 4 800, 6 000, 7 500, 9 000, 15 000 m, and all successive levels at 3 000 m intervals, shall be reported in compliance with Regulation B/C 20.10 and Note (1) under this regulation. [4/32.2] [4/32.4.1]

B/C 20.10.5 Additional data required by reporting practices in RA V

Wind data at additional levels 900, 2 100, 4 200 m shall be reported in compliance with Regulation B/C 20.10 and Note (1) under this regulation. [5/32.3]

B/C 20.10.6 Additional data required by reporting practices in RA VI

B/C 20.10.6.1

Wind data at additional levels 900, 800, 600 hPa (with pressure as the vertical coordinate) and at levels 1 000, 2 000, 4 000 m or 900, 2 100, 4 200 m (with height as the vertical coordinate), shall be reported in compliance with Regulation B/C 20.10 and Note (1) under this regulation. [6/32.3.1]

B/C 20.10.6.2

The inclusion of wind shear data shall be left to national decision. Members are recommended to include these data as often as possible. [6/32.2] [6/32.5]

B/C25 – Regulations for reporting TEMP, TEMP SHIP and TEMP MOBIL data in TDCF General

A BUFR (or CREX) message should be sent when level the 100 hPa is reached. In any case, a BUFR (or CREX) message shall be produced when the sounding is completed containing data from the entire sounding.

TM 309052 - BUFR template for P, T, U and wind vertical profiles suitable for TEMP, TEMP SHIP and TEMP MOBIL observation data

3 09 052		**Sequence for representation TEMP, TEMP SHIP and TEMP MOBIL observation type data**
	3 01 111	Identification of launch site and instrumentation
	3 01 113	Date/time of launch
	3 01 114	Horizontal and vertical coordinates of launch site
	3 02 049	Cloud information reported with vertical soundings
	0 22 043	Sea/water temperature (for ship stations)
	1 01 000	Delayed replication of 1 descriptor
	0 31 002	Extended delayed descriptor replication factor
	3 03 054	Temperature, dew-point and wind data at a pressure level
	1 01 000	Delayed replication of 1 descriptor
	0 31 001	Delayed descriptor replication factor
	3 03 051	Wind shear data at a pressure level

This BUFR template for P, T, U and wind profiles further expands as follows:

3 01 111		**Identification of launch site and instrumentation**	
	3 01 001	WMO block number	Numeric
		WMO station number	Numeric
	0 01 011	Ship or mobile land station identifier	CCITT IA5
	0 02 011	Radiosonde type	Code table
	0 02 013	Solar and infrared radiation correction	Code table
	0 02 014	Tracking technique/status of system used	Code table
	0 02 003	Type of measuring equipment used	Code table
3 01 113		**Date/time of launch**	
	0 08 021	Time significance (= 18 (launch time))	Code table
	3 01 011	Year	Year
		Month	Month
		Day	Day
	3 01 013	Hour	Hour
		Minute	Minute
		Second	Second
3 01 114		**Horizontal and vertical coordinates of launch site**	
	3 01 021	Latitude (high accuracy)	Degree, scale 5
		Longitude (high accuracy)	Degree, scale 5
	0 07 030	Height of station ground above mean sea level	m, scale 1
	0 07 031	Height of barometer above mean sea level	m, scale 1
	0 07 007	Height of release of sonde above mean sea level	m
	0 33 024	Station elevation quality mark (for mobile stations)	Code table

3 02 049		**Cloud information reported with vertical soundings**	
	0 08 002	Vertical significance	Code table
	0 20 011	Cloud amount (of low or middle clouds N_h)	Code table
	0 20 013	Height of base of cloud (h)	m, scale –1
	0 20 012	Cloud type (low clouds C_L)	Code table
	0 20 012	Cloud type (middle clouds C_M)	Code table
	0 20 012	Cloud type (high clouds C_H)	Code table
	0 08 002	Vertical significance (= missing value)	Code table
0 22 043		Sea/water temperature (for ship stations)	K, scale 2
		Temperature, dew-point and wind data at pressure levels	

1 01 000		Delayed replication of 1 descriptor	
0 31 002		Extended delayed descriptor replication factor	Numeric
3 03 054		**Temperature, dew-point and wind data at a pressure level with radiosonde position**	
	0 04 086	Long time period or displacement (since launch time)	Second
	0 08 042	Extended vertical sounding significance	Flag table
	0 07 004	Pressure	Pa, scale –1
	0 10 009	Geopotential height	gpm
	0 05 015	Latitude displacement since launch site (high accuracy)	Degree, scale 5
	0 06 015	Longitude displacement since launch site (high accuracy)	Degree, scale 5
	0 12 101	Temperature/dry-bulb temperature (scale 2)	K, scale 2
	0 12 103	Dew-point temperature (scale 2)	K, scale 2
	0 11 001	Wind direction	Degree true
	0 11 002	Wind speed	m s^{-1}, scale 1
		Wind shear data	
1 01 000		Delayed replication of 1 descriptor	
0 31 001		Delayed descriptor replication factor	Numeric
3 03 051		**Wind shear data at a pressure level**	
	0 04 086	Long time period or displacement (since launch time)	Second
	0 08 042	Extended vertical sounding significance	Flag table
	0 07 004	Pressure	Pa, scale –1
	0 05 015	Latitude displacement since launch site (high accuracy)	Degree, scale 5
	0 06 015	Longitude displacement since launch site (high accuracy)	Degree, scale 5
	0 11 061	Absolute wind shear in 1 km layer below	m s^{-1}, scale 1
	0 11 062	Absolute wind shear in 1 km layer above	m s^{-1}, scale 1

Notes: (1) Time of launch 3 01 013 shall be reported with the highest possible accuracy available. If the launch time is not available with second accuracy, the entry for seconds shall be put to zero.

(2) Long time displacement 0 04 086 represents the time offset from the launch time 3 01 013 (in seconds)

(3) Latitude displacement 0 05 015 represents the latitude offset from the latitude of the launch site. Longitude displacement 0 06 015 represents the longitude offset from the longitude of the launch site.

(4) If additional information on sounding instrumentation is required, the sequence <3 09 052> may be supplemented by one or more additional parameters to allow data representation of this information, e.g. Radiosonde serial number (0 01 081).

Regulations:

B/C 25.1 Section 1 of BUFR or CREX
B/C 25.2 Identification of launch site and instrumentation
B/C 25.3 Date/time of launch
B/C 25.4 Horizontal and vertical coordinates of launch site
B/C 25.5 Cloud information reported with vertical soundings
B/C 25.6 Sea/water temperature (for ship stations)
B/C 25.7 Temperature, dew-point and wind data at pressure levels
B/C 25.8 Criteria for reporting standard and significant levels
B/C 25.9 Wind shear data
B/C 25.10 Data required by regional or national reporting practices
B/C 25.11 Other additional data

B/C 25.1 Section 1 of BUFR or CREX

B/C 25.1.1 Entries required in Section 1 of BUFR

The following entries shall be included in BUFR Section 1:

- BUFR master table,
- identification of originating/generating centre,
- identification of originating/generating sub-centre,
- update sequence number,
- identification of inclusion of optional section,
- data category (= 002 for all TEMP type data),
- international data sub-category (1), (2),
- local data subcategory,
- version number of master table,
- version number of local tables,
- year (year of the century up to BUFR edition 3),
- month (standard time),
- day (standard time = YY in the abbreviated telecommunication header for TEMP, TEMP SHIP and TEMP MOBIL type data),
- hour (standard time = GG in the abbreviated telecommunication header for TEMP, TEMP SHIP and TEMP MOBIL type data),
- minute (standard time = 00 for TEMP, TEMP SHIP and TEMP MOBIL type data).

Notes:

(1) Inclusion of this entry is required starting with BUFR edition 4.

(2) If required, the international data sub-category shall be included at all observation times as follows:

= 004 for TEMP data,
= 005 for TEMP SHIP data,
= 006 for TEMP MOBIL data.

B/C 25.1.2 Entries required in Section 1 of CREX

The following entries shall be included in CREX Section 1:

- CREX master table,
- CREX edition number,
- CREX table version number,
- version number of BUFR master table (1),
- version number of local tables (1),
- data category (= 002 for all TEMP type data),
- international data sub-category (1), (2),
- identification of originating/generating centre (1),
- identification of originating/generating sub-centre (1),
- update sequence number (1),
- number of subsets (1),
- year (standard time) (1),
- month (standard time) (1),
- day (standard time = YY in the abbreviated telecommunication header for TEMP, TEMP SHIP and TEMP MOBIL type data) (1),
- hour (standard time = GG in the abbreviated telecommunication header for TEMP, TEMP SHIP and TEMP MOBIL type data) (1),
- minute (standard time = 00 for TEMP, TEMP SHIP and TEMP MOBIL type data) (1).

Notes:

(1) Inclusion of these entries is required starting with CREX edition 2.

(2) If inclusion of international data sub-category is required, Note (2) under B/C 25.1.1 applies.

B/C 25.2 Identification of launch site and instrumentation <3 01 111>

B/C 25.2.1 Identification of launch site

WMO block number station (0 01 001) and WMO station number (0 01 002) shall be always reported as a non-missing value in reports from a fixed land station.

Ship or mobile land station identifier (0 01 011) shall be always reported not exceeding 9 characters in reports from ships or mobile land stations. [35.2.1]

B/C 25.2.1 Instrumentation for P, T, U and wind measurement

Radiosonde type (Code table 0 02 011), solar and infrared radiation correction (Code table 0 02 013), tracking techniques/status of system used (Code table 0 02 014) and type of measuring equipment used (Code table 0 02 003) shall be reported. [35.2.5]

B/C 25.3 Date/time of launch <3 01 113>

Time significance (0 08 021) shall be always set to 18 to indicate that the following entries specify the date and time of launching the radiosonde.

Date of launch <3 01 011> and time of launch <3 01 013> shall be reported, i.e. year (0 04 001), month (0 04 002), day (0 04 003)> and hour (0 04 004), minute (0 04 005) and second (0 04 006) of the actual time of launch shall be reported. [35.2.5]

Note:

(1) Time of launch <3 01 013> shall be reported with the highest possible accuracy available. If the launch time is not available with second accuracy, the entry 0 04 006 for seconds shall be set to zero.

B/C 25.4 Horizontal and vertical coordinates of launch site <3 01 114>

Latitude (0 05 001) and longitude (0 06 001) of the launch site shall be reported in degrees with precision in 10^{-5} of a degree.

Height of station ground above mean sea level (0 07 030) and height of barometer above mean sea level (0 07 031) shall be reported in meters with precision in tenths of a meter.

Height of release of sonde above mean sea level (0 07 007) shall be reported in meters.

Station elevation quality mark (Code table 0 33 024) shall be reported to indicate the accuracy of the vertical coordinates of the mobile land station. Fixed land stations and sea stations shall report this datum as a missing value. [35.2.1]

B/C 25.5 Cloud information reported with vertical sounding <3 02 049>

B/C 25.5.1 Vertical significance – Code table 0 08 002

To specify vertical significance (0 08 002) within the sequence 3 02 049, a code figure shall be selected in the following way:

(a) If low clouds are observed, then code figure 7 (Low cloud) shall be used.
(b) If there are no low clouds but middle clouds are observed, then code figure 8 (Middle clouds) shall be used.
(c) If there are no low and there are no middle clouds but high clouds are observed, then code figure 0 shall be used.
(d) If sky is obscured by fog and/or other phenomena, then code figure 5 (Ceiling) shall be used.
(e) If there are no clouds (clear sky), then code figure 62 (Value not aplicable) shall be used.
(f) If the cloud cover is not discernible for reasons other than (d) above or observation is not made, then code figure 63 (Missing value) shall be used.

B/C 25.5.2 Cloud amount (of low or middle clouds) – Code table 0 20 011

Amount of all the low clouds (clouds of the genera Stratocumulus, Stratus, Cumulus, and Cumulonimbus) present or, if no low clouds are present, the amount of all the middle clouds (clouds of the genera Altocumulus, Altostratus, and Nimbostratus) present.

B/C 25.5.2.1

Cloud amount shall be reported as follows:

(a) If there are low clouds, then the total amount of all low clouds, as actually seen by the observer during the observation shall be reported for the cloud amount.
(b) If there are no low clouds but there are middle clouds, then the total amount of the middle clouds shall be reported for the cloud amount.
(c) If there are no low clouds and there are no middle clouds but there are high clouds (clouds of the genera Cirrus, Cirrocumulus, and Cirrostratus), then the cloud amount shall be reported as zero. [35.3.4.1] [12.2.7.2.1]

B/C 25.5.2.2

Amount of Altocumulus perlucidus or Stratocumulus perlucidus (“mackerel sky”) shall be reported using code figure 7 or less since breaks are always present in this cloud form even if it extends over the whole celestial dome. [35.3.4.1] [12.2.7.2.2]

B/C 25.5.2.3

When the clouds reported for cloud amount are observed through fog or an analogous phenomenon, the cloud amount shall be reported as if these phenomena were not present. [35.3.4.1] [12.2.7.2.3]

B/C 25.5.2.4

If the clouds reported for cloud amount include contrails, then the cloud amount shall include the amount of persistent contrails. Rapidly dissipating contrails shall not be included in the value for the cloud amount. [35.3.4.1] [12.2.7.2.4]

B/C 25.5.3 Height of base of lowest cloud

Height above surface of the base (0 20 013) of the lowest cloud seen shall be reported in meters (with precision in tens of a meter).

Note:

(1) The term ” height above surface » shall be considered as being the height above the official aerodrome elevation or above station elevation at a non-aerodrome station.

B/C 25.5.3.1

When the station is in fog, a sandstorm or in blowing snow but the sky is discernable, the base of the lowest cloud shall refer to the base of the lowest cloud observed, if any. When, under the above conditions, the sky is not discernible, the base of the lowest cloud shall be reported as missing. [35.3.4.1] [12.2.1.2]

B/C 25.5.3.2

When no cloud are reported (Total cloud cover = 0) the base of the lowest cloud *shall be reported as a missing value.*

B/C 25.5.3.3

When, by national decision, clouds with bases below the station are reported from the station and clouds with bases below and tops above the station are observed, the base of the lowest cloud *shall be reported having a negative value if the base of cloud is discernible, or as a missing value.*

B/C 25.5.4. Cloud type of low, middle and high clouds - Code table 0 20 012

Clouds of the genera Stratocumulus, Stratus, Cumulus, and Cumulonimbus (low clouds) shall be reported for the first entry 0 20 012, clouds of the genera Altocumulus, Altostratus, and Nimbostratus (middle clouds) shall be reported for the second entry 0 20 012 and clouds of the genera Cirrus, Cirrocumulus, and Cirrostratus (high clouds) shall be reported for the third entry 0 20 012.

B/C 25.5.4.1

The reporting of type of low, middle and high clouds shall be as specified in publication WMO-NO. 407 – International Cloud Atlas, Volume I. [35.3.4.1], [12.2.7.3]

B/C 25.6 Sea/water temperature

Sea/water temperature (0 22 043) shall be reported in degrees Kelvin (with precision in hundredths of a degree Kelvin); if produced in CREX, in degrees Celsius (with precision in hundredths of a degree Celsius). Sea/water temperature data shall be reported with precision in hundredths of a degree even if they are available with the accuracy in tenths of a degree.

Note:

(1) Notes (1) and (2) under Regulation B/C 25.7.2.6 shall apply.

B/C 25.6.1

Sea/water temperature shall always be included in reports from sea stations, when data are available. [35.2.5]

B/C 25.7 Temperature, dew-point and wind data at pressure levels

Temperature, dew-point and wind data at pressure levels obtained during the radiosonde ascent shall be included in descending order with respect to pressure. Data at each pressure level shall be included only once. For example, if a significant level with respect to air temperature and relative humidity and a standard isobaric surface coincide, data for that level shall be included only once, the multiple attributes being indicated by Extended vertical sounding significance (Flag table 0 08 042) as specified in Regulation B/C 25.7.2.2.

Note:

(1) If data are produced and collected in traditional TEMP codes, the order of pressure levels may correspond to the order of levels in Parts A, B, C and D, when converted into BUFR or CREX. In this case, data at a level may be included more than once.

B/C 25.7.1 Number of reported pressure levels

The number of reported pressure levels shall be indicated by Extended delayed descriptor replication factor 0 31 002 in BUFR and by a four-digit number in the Data Section corresponding to the position of the replication descriptor in the Data Description Section of CREX.

Notes:

(1) The number of pressure levels shall never be set to a missing value.

(2) The number of pressure levels shall be set to a positive value in a NIL report.

B/C 25.7.1.1

All required data from the entire radiosonde ascent shall be reported in a BUFR (or CREX) message that shall be produced when the sounding is completed. In interest of timely data delivery, however, a BUFR (or CREX) message should be sent when level 100 hPa is reached.

B/C 25.7.2 Temperature, dew-point and wind data at a pressure level <3 03 054>

B/C 25.7.2.1 Long time displacement (since launch time)

Long time displacement (0 04 086) represents the time offset from the launch time specified in Regulation 25.3, and shall be reported in seconds if available.

B/C 25.7.2.2 Extended vertical sounding significance – Flag table 0 08 042

This datum shall be used to specify vertical sounding significance in the following way:

(a) Bit No. 1 set to 1 indicates surface (see Regulation B/C 25.8.1).
(b) Bit No. 2 set to 1 indicates a standard level (see Regulation B/C 25.8.2).
(c) Bit No. 3 set to 1 indicates a tropopause level (see Regulation B/C 25.8.3).
(d) Bit No. 4 set to 1 indicates a maximum wind level (see Regulation B/C 25.8.4).
(e) Bit No. 5 set to 1 indicates a level significant with respect to temperature (see Regulation B/C 25.8.5).
(f) Bit No. 6 set to 1 indicates a level significant with respect to relative humidity (see Regulation B/C 25.8.6).

(g) Bit No. 7 set to 1 indicates a level significant with respect to wind (see Regulation B/C 25.8.7).
(h) Bit No. 8 set to 1 indicates beginning of missing temperature data and bit No. 9 set to 1 indicates end of missing temperature data (see Regulation B/C 25.8.8).
(i) Bit No. 10 set to 1 indicates beginning of missing humidity data and bit No. 11 set to 1 indicates end of missing humidity data (see Regulation B/C 25.8.9).
(j) Bit No. 12 set to 1 indicates beginning of missing wind data bit No. 13 set to 1 indicates end of missing wind data (see Regulation B/C 25.8.10).
(k) Bit No. 14 set to 1 indicates the top of wind sounding.
(l) Bit No. 15 set to 1 indicates a level determined by regional decision.
(m) All bits set to 0 indicate a level determined by national decision.
(n) All bits set to 1 indicate a missing value.

B/C 25.7.2.3 Pressure

Pressure (0 07 004) shall be reported in pascals (with precision in tens of a pascal).

B/C 25.7.2.4 Geopotential height

Geopotential height of the level (0 10 009) shall be reported in geopotential meters.

B/C 25.7.2.5 Radiosonde drift - latitude and longitude displacements

Latitude displacement (0 05 015) represents the latitude offset from the latitude of the launch site specified in Regulation 25.4, and shall be reported in degrees with precision in 10^{-5} of a degree if available. Longitude displacement 0 06 015 represents the longitude offset from the longitude of the launch site specified in Regulation 25.4, and shall be reported in degrees with precision in 10^{-5} of a degree if available.

B/C 25.7.2.6 Temperature

Temperature (0 12 101) shall be reported in degrees Kelvin (with precision in hundredths of a degree Kelvin); if produced in CREX, in degrees Celsius (with precision in hundredths of a degree Celsius). Temperature data shall be reported with precision in hundredths of a degree even if they are measured with the accuracy in tenths of a degree.

Notes:
(1) This requirement is based on the fact that conversion from the Kelvin to the Celsius scale has often resulted into distortion of the data values.
(2) Temperature t (in degrees Celsius) shall be converted into temperature T (in degrees Kelvin) using equation: $T = t + 273.15$.

B/C 25.7.2.7 Dew-point temperature

Dew-point temperature (0 12 103) shall be reported in degrees Kelvin (with precision in hundredths of a degree Kelvin); if produced in CREX, in degrees Celsius (with precision in hundredths of a degree Celsius).

Note:
(1) Notes (1) and (2) under Regulation B/C 25.7.2.6 shall apply.

B/C 25.7.2.7.1

Dew-point temperature data shall be derived using the function (or a near equivalent) for a relationship between saturation vapour pressure over water and air temperature (specified in publication WMO-No. 49 – *Technical Regulations*). Dew-point temperature data shall not be reported when the air temperature is outside the range stated by WMO for the application of the function; a lesser range may be used as a national practice. [35.3.1.1]

B/C 25.7.2.8 Wind direction and speed

The wind direction (0 11 001) shall be reported in degrees true and the wind speed (0 11 002) shall be reported in meters per second (with precision in tenths of a meter per second).

B/C 25.7.2.8.1

When during an ascent the pressure data can no longer be obtained, but wind data can be obtained, the wind data so obtained shall not be reported in the BUFR (or CREX) message in which data are described by the common sequence 3 09 052. These wind data so obtained may be reported using BUFR template TM 309051 suitable PILOT, PILOT SHIP or PILOT MOBIL data. [35.1.5]

B/C 25.7.2.8.2

Only wind data obtained from the radiosonde ascent by either visual or electronic means shall be included in the BUFR (or CREX) message in which data are described by the common sequence 3 09 052. Wind data obtained by means other than a radiosonde-type ascent shall not be included in a message under common sequence 3 09 052. [35.1.6]

B/C 25.8 Criteria for reporting standard and significant levels

B/C 25.8.1 Surface

The surface level shall be always reported.

Note:

(1) The value of Extended vertical sounding significance 0 08 042 at the surface level shall indicate that this level is also a level significant with respect to temperature, relative humidity and wind, i.e. not only bit No.1 but also bits No. 5, 6 and 7 shall be set to 1.

B/C 25.8.2 Standard levels

B/C 25.8.2.1

The standard levels of 1 000, 925, 850, 700, 500, 400, 300, 250, 200, 150, 100, 70, 50, 30, 20 and 10 hPa shall be reported in ascending order with respect to altitude. [35.2.2.1]

B/C 25.8.2.2

When the geopotential of a standard level is lower than the altitude of the reporting station, the time displacement, latitude displacement and longitude displacement for that level shall be set to zero and the air temperature, dew-point temperature and wind data for that level shall be reported as missing values. [35.2.2.2]

B/C 25.8.2.3

When air temperature, dew-point temperature or wind data at a standard level are not available, the corresponding entries for that level shall be reported as missing values.

B/C 25.8.2.4

Whenever it is desired to extrapolate a sounding for the computation of the geopotential at a standard level, the following rules shall apply:

(a) Extrapolation is permissible if, and only if, the pressure difference between the minimum pressure of the sounding and the isobaric surface for which the extrapolated value is being computed does not exceed one quarter of the pressure at which the extrapolated value is desired, provided the extrapolation does not extend through a pressure interval exceeding 25 hPa;

(b) For the purpose of geopotential calculation, and for this purpose only, the sounding will be extrapolated, using two points only of the sounding curve on a T-log p diagram, namely that at the minimum pressure reached by the sounding and that at the pressure given by the sum of this minimum pressure and the pressure difference, mentioned in (a) above. [35.2.2.4]

B/C 25.8.3 Tropopause level(s)

B/C 25.8.3.1

When a tropopause (one or more) is observed, the corresponding number of levels shall be included (indicated by 0 08 042 - bit No. 3 set to 1).

Note:

(1) For a definition of tropopause, see publication WMO-No. 100 – *Guide to Climatological Practices.* [35.2.3.1]

B/C 25.8.3.2

When no tropopause data are observed, no level shall be indicated by bit No. 3 of 0 08 042 set to 1. [35.2.3.2]

B/C 25.8.4 Maximum wind level(s)

B/C 25.8.4.1

When a maximum wind level (one or more) is reported, the corresponding number of levels shall be included in the report indicated by 0 08 042 - bit No. 4 set to 1.

Notes:

(1) Criteria for determining maximum wind levels are given in Regulations B/C 25.8.4.3 and B/C 25.8.4.4 below. [35.2.4.1]

(2) As a maximum wind level is also a level significant with respect to wind, bit No. 7 as well as bit No. 4 shall be set to 1 in the Extended vertical sounding significance 0 08 042.

B/C 25.8.4.2

When no maximum wind level is observed, no level shall be indicated by bit No. 4 of 0 08 042 set to 1. [35.2.4.2]

B/C 25.8.4.3

A maximum wind level:

(a) Shall be determined by consideration of the list of significant levels for wind speed, as obtained by means of the relevant recommended or equivalent national method (see Note under Regulation B/C 25.8.7.2) and *not* by consideration of the original wind-speed curve;

(b) Shall be located above the 500-hPa isobaric surface and shall correspond to a speed of more than 30 meters per second.

Note:

(1) A maximum wind level is defined as a level at which the wind speed is greater than that observed immediately above and below that level. [35.2.4.1], [32.2.3.1]

B/C 25.8.4.4

Whenever more than one maximum wind level exists, these levels shall be reported as follows:

(a) The level of greatest maximum wind speed shall be always included;

(b) The other levels shall be included in the report only if their speed exceeds those of the two adjacent minima by at least 10 meters per second;

(c) Furthermore, the highest level attained by the sounding shall be indicated as a maximum wind level, provided:

(i) It satisfies the criteria set forth in Regulation B/C 25.8.4.3 above;

(ii) It constitutes the level of the greatest speed of the whole sounding. [35.2.4.1], [32.2.3.2]

B/C 25.8.4.5

If the top of the wind sounding corresponds to the highest wind speed observed throughout the ascent, this level shall be indicated by 0 08 042 - bit No. 4 set to 1 (maximum wind level), bit No. 7 set to 1 (level significant with respect to wind) and bit No. 14 set to 1 (top of wind sounding).

Note:

(1) For the purpose of the above regulation, the “top of the wind sounding” is to be understood as the highest level for which wind data are available. [35.2.4.3]

B/C 25.8.5 Levels significant with respect to temperature

B/C 25.8.5.1

The reported significant levels *alone* shall make it possible to reconstruct the air temperature profile within the limits of the criteria specified.

If the criteria for determination of significant levels with respect to air temperature are satisfied at a particular point of altitude, data for all variables (if available) shall be reported for that level. [35.3.1.1]

B/C 25.8.5.2

The following shall be included as “mandatory” significant temperature levels:

(a) Surface level and the highest level of the sounding;

(b) A level between 110 and 100 hPa;
(c) Bases and tops of inversions and isothermal layers which are at least 20 hPa thick, provided that the base of the layer occurs below the 300-hPa level or the first tropopause, whichever is the higher;
(d) Bases and tops of inversion layers which are characterized by a change in temperature of at least 2.5ºC, provided that the base of the layer occurs below the 300-hPa level or the first tropopause, whichever is the higher.

Note:
(1) The inversion layers of (c) and (d) may be comprised of several thinner inversion layers separated by thin layers of temperature lapse. To allow for this situation, the tops of the inversion layers of (c) and (d) shall each be at a level such that no further inversion layers, whether thick or thin, shall occur for at least 20 hPa above the level. [35.3.1.2]

B/C 25.8.5.3

The following shall be included as “additional” significant levels. They shall be selected in the order given, thereby giving priority to representing the temperature profile. As far as possible, these additional levels shall be the actual levels at which prominent changes in the lapse rate of air temperature occur:
(a) Levels which are necessary to ensure that the temperature obtained by linear interpolation (on a T-log P or essentially similar diagram) between adjacent significant levels shall not depart from the observed temperature by more than 1ºC below the first significant level reported above the 300-hPa level or the first tropopause, whichever level is the lower, or by more than 2ºC thereafter;
(b) Levels which are necessary to limit the interpolation error on diagrams other than T-log P. These levels shall be such that the pressure at one significant level divided by the pressure of the preceding significant layer shall exceed 0.6 for levels up to the first tropopause and shall be determined by use of the method for selecting additional levels but with application of tighter criteria. [35.3.1.3]

B/C 25.8.5.4

When a significant level with respect to air temperature and a standard level coincide, data for that level shall be reported only once.

B/C 25.8.6 Levels significant with respect to relative humidity

B/C 25.8.6.1

The reported significant levels *alone* shall make it possible to reconstruct the relative humidity profiles within the limits of the criteria specified.
If the criteria for determination of significant levels with respect to relative humidity are satisfied at a particular point of altitude, data for all variables (if available) shall be reported for that level. [35.3.1.1]

B/C 25.8.6.2

The following shall be included as “mandatory” significant humidity levels:
(a) Surface level and the highest level of the sounding;
(b) A level between 110 and 100 hPa;
(c) Bases and tops of inversions and isothermal layers which are at least 20 hPa thick, provided that the base of the layer occurs below the 300-hPa level or the first tropopause, whichever is the higher;
(d) Bases and tops of inversion layers which are characterized by a change in relative humidity of at least 20 per cent, provided that the base of the layer occurs below the 300-hPa level or the first tropopause, whichever is the higher.

Note:
Note (1) under Regulation B/C 25.8.5.2 shall apply. [35.3.1.2]

B/C 25.8.6.3

The following shall be included as “additional” significant levels. They shall be selected in the order given, thereby giving priority to representing the temperature profile. As far as possible, these additional levels shall be the actual levels at which prominent changes in the lapse rate of air temperature occur:
(a) Levels which are necessary to ensure that the relative humidity obtained by linear interpolation between adjacent significant levels shall not depart by more than 15 per

cent from the observed values. (The criterion of 15 per cent refers to an amount of relative humidity and NOT to the percentage of the observed value, e.g. if an observed value is 50 per cent, the interpolated value shall lie between 35 per cent and 65 per cent.);

(b) Levels which are necessary to limit the interpolation error on diagrams other than T-log P. These levels shall be such that the pressure at one significant level divided by the pressure of the preceding significant layer shall exceed 0.6 for levels up to the first tropopause and shall be determined by use of the method for selecting additional levels but with application of tighter criteria. [35.3.1.3]

B/C 25.8.6.4

When a significant layer with respect to relative humidity and a standard level coincide, data for that level shall be reported only once.

B/C 25.8.7 Levels significant with respect to wind

B/C 25.8.7.1

Significant wind levels shall be chosen so that the data from them *alone* shall make it possible to reconstruct the wind profile with sufficient accuracy for practical use. [35.3.2.1]

If the criteria for determination of significant levels with respect to wind speed and direction are satisfied at a particular point of altitude, data for all variables (if available) shall be reported for that level.

B/C 25.8.7.2

Criteria for determining significant levels with respect to changes in wind speed and direction:

(a) The direction of speed curves (in function of the log of pressure or altitude) can be reproduced with their prominent characteristics;

(b) These curves can be reproduced with the accuracy of at least 10 for direction and five meters per second for speed;

Note:

To satisfy these criteria, the following method of successive approximations is recommended, but other methods of attaining equivalent results may suit some national practices better and may be used:

(i) The surface level and highest level for which wind data are available constitute the first and the last significant levels.
The deviation from the linearly interpolated values between these two levels is then considered. If no direction deviates by more than 10 and no speed by more than five meters per second, no other significant level need be reported. Whenever one parameter deviates by more than the limit specified in paragraph (b) above the level of greatest deviation becomes a supplementary significant level for both parameters.

(ii) The additional significant levels so introduced divide the sounding into two layers. In each separate layer, the deviation from the linearly interpolated values between the base and the top are then considered. The process used in paragraph (i) above is repeated and yields other significant levels. These additional levels in turn modify the layer distribution, and the method is applied again until any level is approximated to the above-mentioned specified values. [35.3.2.1], [32.3.1.1]

B/C 25.8.8 Beginning and end of missing temperature data

B/C 25.8.8.1

A layer for which temperature data are missing shall be indicated by reporting the boundary levels of the layer, provided that the layer is at least 20 hPa thick. The boundary levels are the levels closest to the bottom and the top of the layer for which temperature data are available. The boundary levels are not required to meet “significant temperature level” criteria. [35.3.1.6]

B/C 25.8.9 Beginning and end of missing humidity data

B/C 25.8.9.1

A layer for which dew-point temperature data are missing shall be indicated by reporting the boundary levels of the layer, provided that the layer is at least 20 hPa thick. The boundary levels are the levels closest to the bottom and the top of the layer for which dew-point temperature data are available. The boundary levels are not required to meet “significant humidity level” criteria. [35.3.1.6]

B/C 25.8.10 Beginning and end of missing wind data

B/C 25.8.10.1

A layer for which wind data are missing shall be indicated by reporting the boundary levels of the layer, provided that the layer is at least 50 hPa thick. The boundary levels are the levels closest to the bottom and the top of the layer for which the observed data are available. The boundary levels are not required to meet “significant wind level” criteria. [35.3.2.2]

B/C 25.9 Wind shear data

B/C 25.9.1 Number and order of levels for which wind shear is reported

B/C 25.9.1.1

The number of levels with wind shear data shall be indicated by Delayed descriptor replication factor 0 31 001 in BUFR and by a four-digit number in the Data Section corresponding to the position of the replication descriptor in the Data Description Section of CREX.

Notes:

(1) The number of levels with wind shear data shall never be set to a missing value.
(2) The number of levels with wind shear data shall be set to a positive value in a NIL report.
(3) The number of levels with wind shear data shall be set to zero if data for vertical wind shear are not computed and required. [35.2.4.4]

B/C 25.9.1.2

Whenever wind shear data are reported for more than one level, these maximum wind levels shall be included in the same order as in the sequence <3 03 054>, i.e. in descending order with respect to pressure.

B/C 25.9.2 Wind shear data at a pressure level <3 03 051>

B/C 25.9.2.1 Long time displacement (since launch time)

Long time displacement (0 04 086) represents the time offset from the launch time specified in Regulation 25.3, and shall be reported in seconds if available.

B/C 25.9.2.2 Extended vertical sounding significance – Flag table 0 08 042

A level, for which wind shear data are reported, shall be indicated by vertical sounding significance 0 08 042 - bit No. 4 set to 1 (maximum wind level) and by bit No. 7 set to 1 (level significant with respect to wind). Moreover, if the top of the wind sounding corresponds to the highest wind speed observed throughout the ascent, this level shall be indicated also by bit No. 14 set to 1 (top of wind sounding).

B/C 25.9.2.3 Pressure

Pressure (0 07 004) shall be reported in pascals with precision in tens of a pascal.

B/C 25.9.2.4 Latitude and longitude displacements

Latitude displacement (0 05 015) represents the latitude offset from the latitude of the launch site specified in Regulation 25.4, and shall be reported in degrees with precision in 10^{-5} of a degree if available. Longitude displacement 0 06 015 represents the longitude offset from the longitude of the launch site specified in Regulation 25.4, and shall be reported in degrees with precision in 10^{-5} of a degree if available.

B/C 25.9.2.5 Wind shear data

Absolute wind shear in 1 km layer below (0 11 061) and absolute wind shear in 1 km layer above (0 11 062) shall be reported in meters per second (with precision in tenths of a meter per second), if data for vertical wind shear are computed and required. [35.2.4.4]

B/C 25.10 Data required by regional or national reporting practices

If regional or national reporting practices require inclusion of temperature, humidity and/or wind data at additional levels, these data shall be reported using sequence <3 03 054> for Temperature, dew-point, wind at a pressure level. Regulation B/C 25.7 shall apply.

Notes:

(1) A level determined by regional decision shall be indicated by Extended vertical sounding significance 0 08 042 - bit No. 15 set to 1.

(2) A level determined by national decision shall be indicated by Extended vertical sounding significance 0 08 042 – all bits set to 0.

B/C 25.10.1 Additional data required by reporting practices in RA I

Temperature, dew-point, wind data at additional levels shall be reported in compliance with Regulation B/C 25.10.

B/C 25.10.2 Additional data required by reporting practices in RA II

B/C 25.10.2.1

No additional data are required by regional reporting practices in RA II.

B/C 25.10.2.2

The inclusion of wind shear data shall be left to national decision. Members are recommended to include these data as often as possible. [2/35.2]

B/C 25.10.3 Additional data required by reporting practices in RA III

No regional requirements are indicated for reporting TEMP, TEMP SHIP and TEMP MOBIL data in RA III.

B/C 25.10.4 Additional data required by reporting practices in RA IV

B/C 25.10.4.1

When available, temperature, dew-point, wind data for levels 7, 5, 3, 2 and 1 hPa shall be reported in compliance with Regulation B/C 25.10. [4/35.2.1]

B/C 25.10.4.2

When required, additional information shall be reported using RA IV BUFR template for data representation of TEMP, TEMP SHIP and TEMP MOBIL data as shown in the Annex. [4/35.1] [4/35.2.2]

B/C 25.10.5 Additional data required by reporting practices in RA V

No regional requirements are indicated for reporting TEMP, TEMP SHIP and TEMP MOBIL data in RA V.

B/C 25.10.6 Additional data required by reporting practices in RA VI

B/C 25.10.6.1

The inclusion of wind shear data shall be left to national decision. Members are recommended to include these data as often as possible. [6/35.1]

B/C 25.10.6.2

Wind direction and speed shall be reported:

(i) For 900 or 1000 meters above the surface;

(ii) For 800 hPa level;

(iii) For 600 hPa level.

[6/35.2.2]

B/C 25.11 Other additional data

If additional information on sounding instrumentation is required, the sequence <3 09 052> for representation of TEMP, TEMP SHIP and TEMP MOBIL data may be supplemented by one or more additional parameters to allow data representation of this information. The list of such parameters is shown in Annex II, others may be added in compliance with the future requirements.

ANNEX I TO B/C25 – Regulations for reporting TEMP, TEMP SHIP and TEMP MOBIL data in TDCF

RA IV BUFR template for TEMP, TEMP SHIP and TEMP MOBIL data

The RA IV Regional coding procedures for TEMP and TEMP SHIP data require data representation of additional information that is specified in the *Manual on Codes*, WMO-No. 306, Volume II, by supplementary groups 101$A_{df}A_{df}$ (code table 421 for $A_{df}A_{df}$ – Form of additional data reported). The sequence <3 09 052> for representation of TEMP, TEMP SHIP and TEMP MOBIL data is supplemented by additional parameters to allow data representation of this information, if it is required.

3 09 052	**Sequence for representation of TEMP, TEMP SHIP and TEMP MOBIL observation type data**	
	Reason for no report or incomplete report	
0 35 035	Reason for termination	Code table
	Corrected data	
1 04 000	Delayed replication of 4 descriptors	
0 31 001	Delayed descriptor replication factor	Numeric
2 04 001	Add associated field of 1 bit in length	
0 31 021	Associated field significance = 21 (indicator of correction)	Code table
	Associated field set to 1 (corrected value)	
3 03 054	Temperature, dew-point, wind at a pressure level with radiosonde position	
2 04 000	Cancel Add associated field	
0 08 042	Extended vertical sounding significance = missing (to cancel the previous value)	Flag table
	Stability index and mean wind data	
0 13 047	Modified Showalter stability index	K
0 11 044	Mean wind direction for surface – 1500 m	Degree true
0 11 045	Mean wind speed for surface – 1500 m	$m\ s^{-1}$, scale 1
0 11 054	Mean wind direction for 1500 m – 3000 m	Degree true
0 11 055	Mean wind speed for 1500 m – 3000 m	$m\ s^{-1}$, scale 1
	Doubtful data	
1 12 000	Delayed replication of 12 descriptors	
0 31 001	Delayed descriptor replication factor	Numeric
1 11 002	Replicate next 11 descriptors 2 times	
0 04 086	Long time period or displacement (since launch time)	Second
0 08 040	Flight level significance In the 1st replication = 4 (Begin doubtful temperature, height data); In the 2nd replication = 9 (End doubtful temperature, height data).	Code table
0 07 004	Pressure	Pa, scale –1
0 05 015	Latitude displacement since launch site (high accuracy)	Degree, scale 5
0 06 015	Longitude displacement since launch site (high accuracy)	Degree, scale 5

1 01 000	Delayed replication of 1 descriptor	
0 31 000	Short delayed descriptor replication factor	Numeric
0 10 009	Geopotential height	gpm
1 01 000	Delayed replication of 1 descriptor	
0 31 000	Short delayed descriptor replication factor	Numeric
0 12 101	Temperature/dry-bulb temperature (scale 2)	K, scale 2
	Extrapolated geopotential data	
1 08 000	Delayed replication of 8 descriptors	
0 31 001	Delayed descriptor replication factor	Numeric
0 04 086	Long time period or displacement (since launch time)	Second
0 08 040	Flight level significance = 31 (Incremented height level (generated))	Code table
0 07 004	Pressure	Pa, scale –1
0 05 015	Latitude displacement since launch site (high accuracy)	Degree, scale 5
0 06 015	Longitude displacement since launch site (high accuracy)	Degree, scale 5
0 10 009	Geopotential height	gpm
0 11 001	Wind direction	Degree true
0 11 002	Wind speed	m s^{-1}, scale 1

Note:
The “Modified Showalter stability index” 0 13 047 is defined as the temperature difference between the ambient 500 hPa temperature and the temperature a parcel of air, initially at a selected base level, would have if brought from its condensation level to the 500 hPa surface by a moist adiabatic process. Positive values denote stable conditions, while negative values denote unstable conditions. The base level is 850 hPa, 800hPa or 750 hPa, if the station elevation is less than 1000, 1000 to 1400 or 1401 to 2000 gpm above mean sea level, respectively.

ANNEX II TO B/C25 – Regulations for reporting TEMP, TEMP SHIP and TEMP MOBIL data in TDCF

List of parameters for representation of additional information on sounding instrumentation

TABLE REFERENCE	ELEMENT NAME	UNIT, SCALE
0 01 081	Radiosonde serial number	CCITT IA5, 0
0 01 082	Radiosonde ascension number	Numeric, 0
0 02 067	Radiosonde operating frequency	Hz, -5
0 02 081	Type of balloon	Code table, 0
0 02 082	Weight of balloon	kg, 3
0 02 084	Type of gas used in balloon	Code table, 0
0 02 095	Type of pressure sensor	Code table, 0
0 02 096	Type of temperature sensor	Code table, 0
0 02 097	Type of humidity sensor	Code table, 0
0 25 061	Software identification and version number	CCITT IA5, 0
2 05 Y	Signify character (to allow insertion of Y characters as a data field of Y x 8 bits in length)	

B/C26 – Regulations for reporting TEMP DROP data in TDCF

TM 309053 - BUFR template for P, T, U and wind vertical profiles suitable for TEMP DROP observation data

3 09 053		**Sequence for representation TEMP DROP observation type data**
	3 01 112	Identification of launch point and instrumentation of dropsonde
	3 01 113	Date/time of launch
	3 01 114	Horizontal and vertical coordinates of launch site
	1 01 000	Delayed replication of 1 descriptor
	0 31 002	Extended delayed descriptor replication factor
	3 03 054	Temperature, dew-point and wind data at a pressure level
	1 01 000	Delayed replication of 1 descriptor
	0 31 001	Delayed descriptor replication factor
	3 03 051	Wind shear data at a pressure level

This BUFR template for P, T, U and wind profiles further expands as follows:

3 01 112		**Identification of launch point and instrumentation of dropsonde**	
	0 01 006	Aircraft identifier	CCITT IA5
	0 02 011	Radiosonde type	Code table
	0 02 013	Solar and infrared radiation correction	Code table
	0 02 014	Tracking technique/status of system used	Code table
	0 02 003	Type of measuring equipment used	Code table
3 01 113		**Date/time of launch**	
	0 08 021	Time significance (= 18 (launch time))	Code table
	3 01 011	Year	Year
		Month	Month
		Day	Day
	3 01 013	Hour	Hour
		Minute	Minute
		Second	Second
3 01 114		**Horizontal and vertical coordinates of launch site**	
	3 01 021	Latitude (high accuracy)	Degree, scale 5
		Longitude (high accuracy)	Degree, scale 5
	0 07 030	Height of station ground above mean sea level	m, scale 1
	0 07 031	Height of barometer above mean sea level	m, scale 1
	0 07 007	Height of release of sonde above mean sea level	m
	0 33 024	Station elevation quality mark	Code table
		Temperature, dew-point and wind data at pressure levels	
1 01 000		Delayed replication of 1 descriptor	
0 31 002		Extended delayed descriptor replication factor	Numeric
3 03 054		**Temperature, dew-point and wind data at a pressure level with radiosonde position**	
	0 04 086	Long time period or displacement (since launch time)	Second
	0 08 042	Extended vertical sounding significance	Flag table
	0 07 004	Pressure	Pa, scale –1
	0 10 009	Geopotential height	gpm
	0 05 015	Latitude displacement since launch site (high accuracy)	Degree, scale 5

	0 06 015	Longitude displacement since launch site (high accuracy)	Degree, scale 5
	0 12 101	Temperature/dry-bulb temperature (scale 2)	K, scale 2
	0 12 103	Dew-point temperature (scale 2)	K, scale 2
	0 11 001	Wind direction	Degree true
	0 11 002	Wind speed	m s^{-1}, scale 1
		Wind shear data	
1 01 000		Delayed replication of 1 descriptor	
0 31 001		Delayed descriptor replication factor	Numeric
3 03 051		**Wind shear data at a pressure level**	
	0 04 086	Long time period or displacement (since launch time)	Second
	0 08 042	Extended vertical sounding significance	Flag table
	0 07 004	Pressure	Pa, scale –1
	0 05 015	Latitude displacement since launch site (high accuracy)	Degree, scale 5
	0 06 015	Longitude displacement since launch site (high accuracy)	Degree, scale 5
	0 11 061	Absolute wind shear in 1 km layer below	m s^{-1}, scale 1
	0 11 062	Absolute wind shear in 1 km layer above	m s^{-1}, scale 1

Notes: (1) Time of launch 3 01 013 shall be reported with the highest possible accuracy available. If the launch time is not available with second accuracy, the entry for seconds shall be put to zero.

(2) Long time displacement 0 04 086 represents the time offset from the launch time 3 01 013 (in seconds)

(3) Latitude displacement 0 05 015 represents the latitude offset from the latitude of the launch site. Longitude displacement 0 06 015 represents the longitude offset from the longitude of the launch site.

Regulations:

B/C 26.1 Section 1 of BUFR or CREX
B/C 26.2 Identification of launch point and instrumentation of dropsonde
B/C 26.3 Date/time of launch
B/C 26.4 Horizontal and vertical coordinates of launch site
B/C 26.5 Temperature, dew-point and wind data at pressure levels
B/C 26.6 Criteria for reporting standard and significant levels
B/C 26.7 Wind shear data
B/C 26.8 Data required by regional or national reporting practices

B/C 26.1 Section 1 of BUFR or CREX

B/C 26.1.1 Entries required in Section 1 of BUFR

The following entries shall be included in BUFR Section 1:
- BUFR master table,
- identification of originating/generating centre,
- identification of originating/generating sub-centre,
- update sequence number,
- identification of inclusion of optional section,
- data category (= 002 for all TEMP type data),
- international data sub-category [(1), (2)],
- local data subcategory,
- version number of master table,
- version number of local tables,

- year (year of the century up to BUFR edition 3),
- month (standard time),
- day (standard time = YY in the abbreviated telecommunication header for TEMP DROP type data),
- hour (standard time = GG in the abbreviated telecommunication header for TEMP DROP type data),
- minute (standard time = 00 for TEMP DROP type data).

Notes:
(1) Inclusion of this entry is required starting with BUFR edition 4.
(2) If required, the international data sub-category shall be included at all observation times as follows:
= 007 for TEMP DROP data.

B/C 26.1.2 Entries required in Section 1 of CREX

The following entries shall be included in CREX Section 1:

- CREX master table,
- CREX edition number,
- CREX table version number,
- version number of BUFR master table [1],
- version number of local tables [1],
- data category (= 002 for all TEMP type data),
- international data sub-category [1], [2],
- identification of originating/generating centre [1],
- identification of originating/generating sub-centre [1],
- update sequence number [1],
- number of subsets [1],
- year (standard time) [1],
- month (standard time) [1],
- day (standard time = YY in the abbreviated telecommunication header for TEMP DROP type data) [1],
- hour (standard time = GG in the abbreviated telecommunication header for TEMP DROP type data) [1],
- minute (standard time = 00 for TEMP DROP type data) [1].

Notes:
(1) Inclusion of these entries is required starting with CREX edition 2.
(2) If inclusion of international data sub-category is required, Note (2) under B/C 26.1.1 applies.

B/C 26.2 Identification of launch point and instrumentation of dropsonde <3 01 112>

B/C 26.2.1 Identification of launch point of dropsonde

Aircraft identifier (0 01 006) shall be always reported.

B/C 26.2.1 Instrumentation for P, T, U and wind measurement

Radiosonde type (Code table 0 02 011), solar and infrared radiation correction (Code table 0 02 013), tracking techniques/status of system used (Code table 0 02 014) and type of measuring equipment used (Code table 0 02 003) shall be reported. [35.2.5]

B/C 26.3 Date/time of launch <3 01 113>

Time significance (0 08 021) shall be always set to 18 to indicate that the following entries specify the date and time of launching the dropsonde.

Date of launch <3 01 011> and time of launch <3 01 013> shall be reported, i.e. year (0 04 001), month (0 04 002), day (0 04 003)> and hour (0 04 004), minute (0 04 005) and second (0 04 006) of the actual time of launch shall be reported. [35.2.5]

Note:

(1) Time of launch <3 01 013> shall be reported with the highest possible accuracy available. If the launch time is not available with second accuracy, the entry 0 04 006 for seconds shall be set to zero.

B/C 26.4 Horizontal and vertical coordinates of launch site <3 01 114>

Latitude (0 05 001) and longitude (0 06 001) of the launch site shall be reported in degrees with precision in 10^{-5} of a degree.

Height of station ground above mean sea level (0 07 030) shall be reported as a missing value.

Height of barometer above mean sea level (0 07 031) shall be reported in meters with precision in tenths of a meter.

Height of release of dropsonde above mean sea level (0 07 007) shall be reported in meters.

Station elevation quality mark (Code table 0 33 024) shall be reported as a missing value. [35.2.1]

B/C 26.5 Temperature, dew-point and wind data at pressure levels

Temperature, dew-point and wind data at pressure levels obtained during the dropsonde descent shall be included in descending order with respect to pressure. Data at each pressure level shall be included only once. For example, if a significant level with respect to air temperature and relative humidity and a standard isobaric surface coincide, data for that level shall be included only once, the multiple attributes being indicated by Extended vertical sounding significance (Flag table 0 08 042) as specified in Regulation B/C 26.5.2.2.

Note:

(1) If data are produced and collected in traditional TEMP DROP code, the order of pressure levels may correspond to the order of levels in Parts A, B, C and D, when converted into BUFR or CREX. In this case, data at a level may be included more than once.

B/C 26.5.1 Number of reported pressure levels

The number of reported pressure levels shall be indicated by Extended delayed descriptor replication factor 0 31 002 in BUFR and by a four-digit number in the Data Section corresponding to the position of the replication descriptor in the Data Description Section of CREX.

Notes:

(1) The number of pressure levels shall never be set to a missing value.
(2) The number of pressure levels shall be set to a positive value in a NIL report.

B/C 26.5.2 Temperature, dew-point and wind data at a pressure level <3 03 054>

B/C 26.5.2.1 Long time displacement (since launch time)

Long time displacement (0 04 086) represents the time offset from the launch time specified in Regulation 26.3, and shall be reported in seconds if available.

B/C 26.5.2.2 Extended vertical sounding significance – Flag table 0 08 042

This datum shall be used to specify vertical sounding significance in the following way:

(a) Bit No. 1 set to 1 indicates a surface (see Regulation B/C 26.6.1)
(b) Bit No. 2 set to 1 indicates a standard level (see Regulation B/C 26.6.2).
(c) Bit No. 3 set to 1 indicates a tropopause level (see Regulation B/C 26.6.3).
(d) Bit No. 4 set to 1 indicates a maximum wind level (see Regulation B/C 26.6.4).
(e) Bit No. 5 set to 1 indicates a level significant with respect to temperature (see Regulation B/C 26.6.5).

(f) Bit No. 6 set to 1 indicates a level significant with respect to relative humidity (see Regulation B/C 26.6.6).
(g) Bit No. 7 set to 1 indicates a level significant with respect to wind (see Regulation B/C 26.6.7).
(h) Bit No. 8 set to 1 indicates beginning of missing temperature data and bit No. 9 set to 1 indicates end of missing temperature data (see Regulation B/C 26.6.8).
(i) Bit No. 10 set to 1 indicates beginning of missing humidity data and bit No. 11 set to 1 indicates end of missing humidity data (see Regulation B/C 26.6.9).
(j) Bit No. 12 set to 1 indicates beginning of missing wind data bit No. 13 set to 1 indicates end of missing wind data (see Regulation B/C 26.6.10).
(k) Bit No. 14 set to 1 indicates the top of wind sounding (the lowest level for which wind data are available).
(l) Bit No. 15 set to 1 indicates a level determined by regional decision.
(m) All bits set to 0 indicate a level determined by national decision.
(n) All bits set to 1 indicate a missing value.

B/C 26.5.2.3 Pressure

Pressure (0 07 004) shall be reported in pascals (with precision in tens of a pascal).

B/C 26.5.2.4 Geopotential height

Geopotential height of the level (0 10 009) shall be reported in geopotential meters.

B/C 26.5.2.5 Radiosonde drift - latitude and longitude displacements

Latitude displacement (0 05 015) represents the latitude offset from the latitude of the launch site specified in Regulation 26.4, and shall be reported in degrees with precision in 10^{-5} of a degree if available. Longitude displacement 0 06 015 represents the longitude offset from the longitude of the launch site specified in Regulation 26.4, and shall be reported in degrees with precision in 10^{-5} of a degree if available.

B/C 26.5.2.6 Temperature

Temperature (0 12 101) shall be reported in degrees Kelvin (with precision in hundredths of a degree Kelvin); if produced in CREX, in degrees Celsius (with precision in hundredths of a degree Celsius). Temperature data shall be reported with precision in hundredths of a degree even if they are measured with the accuracy in tenths of a degree.

Notes:
(1) This requirement is based on the fact that conversion from the Kelvin to the Celsius scale has often resulted into distortion of the data values.
(2) Temperature t (in degrees Celsius) shall be converted into temperature T (in degrees Kelvin) using equation: $T = t + 273.15$.

B/C 26.5.2.7 Dew-point temperature

Dew-point temperature (0 12 103) shall be reported in degrees Kelvin (with precision in hundredths of a degree Kelvin); if produced in CREX, in degrees Celsius (with precision in hundredths of a degree Celsius).

Note:
(1) Notes (1) and (2) under Regulation B/C 26.5.2.6 shall apply.

B/C 26.5.2.7.1

Dew-point temperature data shall be derived using the function (or a near equivalent) for a relationship between saturation vapour pressure over water and air temperature (specified in publication WMO-No. 49 – *Technical Regulations*). Dew-point temperature data shall not be reported when the air temperature is outside the range stated by WMO for the application of the function; a lesser range may be used as a national practice. [35.3.1.1]

B/C 26.5.2.8 Wind direction and speed

The wind direction (0 11 001) shall be reported in degrees true and the wind speed (0 11 002) shall be reported in meters per second (with precision in tenths of a meter per second).

B/C 26.5.2.8.1

Only wind data obtained from the radiosonde descent by electronic means shall be included in the BUFR (or CREX) message in which data are described by the common sequence 3 09 053. Wind data obtained by means other than a radiosonde-type descent shall not be included in a message under common sequence 3 09 053. [35.1.7]

B/C 26.6 Criteria for reporting standard and significant levels

B/C 26.6.1 Surface level

If extrapolated surface data are included in the report, the level shall be indicated by bit No. 1 of 0 08 042 set to 1.

B/C 26.6.2 Standard levels

B/C 26.6.2.1

The standard levels of 1 000, 925, 850, 700, 500, 400, 300, 250, 200, 150, 100, 70, 50, 30, 20 and 10 hPa shall be reported in descending order with respect to pressure. [35.2.2.1]

B/C 26.6.2.2

When air temperature, dew-point temperature or wind data at a standard level are not available, the corresponding entries for that level shall be reported as missing values.

B/C 26.6.2.3

Whenever it is desired to extrapolate a sounding for the computation of the geopotential at a standard level, the following rules shall apply:

(a) Extrapolation is permissible if, and only if, the pressure difference between the minimum pressure of the sounding and the isobaric surface for which the extrapolated value is being computed does not exceed one quarter of the pressure at which the extrapolated value is desired, provided the extrapolation does not extend through a pressure interval exceeding 25 hPa;

(b) For the purpose of geopotential calculation, and for this purpose only, the sounding will be extrapolated, using two points only of the sounding curve on a T-log p diagram, namely that at the minimum pressure reached by the sounding and that at the pressure given by the sum of this minimum pressure and the pressure difference, mentioned in (a) above. [35.2.2.4]

B/C 26.6.3 Tropopause level(s)

B/C 26.6.3.1

When a tropopause (one or more) is observed, the corresponding number of levels shall be included (indicated by 0 08 042 - bit No. 3 set to 1).

Note:

(1) For a definition of tropopause, see publication WMO-No. 100 – *Guide to Climatological Practices*. [35.2.3.1]

B/C 26.6.3.2

When no tropopause data are observed, no level shall be indicated by bit No. 3 of 0 08 042 set to 1. [35.2.3.2]

B/C 26.6.4 Maximum wind level(s)

B/C 26.6.4.1

When a maximum wind level (one or more) is reported, the corresponding number of levels shall be included in the report indicated by 0 08 042 - bit No. 4 set to 1.

Notes:

(1) Criteria for determining maximum wind levels are given in Regulations B/C 26.6.4.3 and B/C 26.6.4.4 below. [35.2.4.1]

(2) As a maximum wind level is also a level significant with respect to wind, bit No. 7 as well as bit No. 4 shall be set to 1 in the Extended vertical sounding significance 0 08 042.

B/C 26.6.4.2

When no maximum wind level is observed, no level shall be indicated by bit No. 4 of 0 08 042 set to 1. [35.2.4.2]

B/C 26.6.4.3

A maximum wind level:

(a) Shall be determined by consideration of the list of significant levels for wind speed, as obtained by means of the relevant recommended or equivalent national method (see Note under Regulation B/C 26.6.7.2) and *not* by consideration of the original wind-speed curve;

(b) Shall be located above the 500-hPa isobaric surface and shall correspond to a speed of more than 30 meters per second.

Note:

(1) A maximum wind level is defined as a level at which the wind speed is greater than that observed immediately above and below that level. [35.2.4.1] [32.2.3.1]

B/C 26.6.4.4

Whenever more than one maximum wind level exists, these levels shall be reported as follows:

(a) The level of greatest maximum wind speed shall be always included;

(b) The other levels shall be included in the report only if their speed exceeds those of the two adjacent minima by at least 10 meters per second. [35.2.4.1] [32.2.3.2]

B/C 26.6.4.5

If the top of the wind sounding corresponds to the highest wind speed observed throughout the descent, this level shall be indicated by 0 08 042 - bit No. 4 set to 1 (maximum wind level), bit No. 7 set to 1 (level significant with respect to wind) and bit No. 14 set to 1 (top of wind sounding).

Notes:

(1) For the purpose of the above regulation, the “top of the wind sounding” is to be understood as the lowest level (termination level of the sounding) for which wind data are available. [35.2.4.3]

(2) Although not very probable, the situation described in the above regulation cannot be excluded.

B/C 26.6.5 Levels significant with respect to temperature

B/C 26.6.5.1

The reported significant levels *alone* shall make it possible to reconstruct the air temperature profile within the limits of the criteria specified.

If the criteria for determination of significant levels with respect to air temperature are satisfied at a particular point of altitude, data for all variables (if available) shall be reported for that level. [35.3.1.1]

B/C 26.6.5.2

The following shall be included as “mandatory” significant temperature levels:

(a) Aircraft reference level and termination level of the sounding (the lowest level of the sounding);

(b) A level between 110 and 100 hPa;

(c) Bases and tops of inversions and isothermal layers which are at least 20 hPa thick, provided that the base of the layer occurs below the 300-hPa level or the first tropopause, whichever is the higher;

(d) Bases and tops of inversion layers which are characterized by a change in temperature of at least 2.5ºC, provided that the base of the layer occurs below the 300-hPa level or the first tropopause, whichever is the higher.

Note:

(1) The inversion layers of (c) and (d) may be comprised of several thinner inversion layers separated by thin layers of temperature lapse. To allow for this situation, the tops of the inversion layers of (c) and (d) shall each be at a level such that no further inversion layers, whether thick or thin, shall occur for at least 20 hPa above the level. [35.3.1.2]

B/C 26.6.5.3

The following shall be included as "additional" significant levels. They shall be selected in the order given, thereby giving priority to representing the temperature profile. As far as possible, these additional levels shall be the actual levels at which prominent changes in the lapse rate of air temperature occur:

(a) Levels which are necessary to ensure that the temperature obtained by linear interpolation (on a T-log P or essentially similar diagram) between adjacent significant levels shall not depart from the observed temperature by more than 1ºC below the first significant level reported above the 300-hPa level or the first tropopause, whichever level is the lower, or by more than 2ºC thereafter;

(b) Levels which are necessary to limit the interpolation error on diagrams other than T-log P. These levels shall be such that the pressure at one significant level divided by the pressure of the preceding significant layer shall exceed 0.6 for levels up to the first tropopause and shall be determined by use of the method for selecting additional levels but with application of tighter criteria. [35.3.1.3]

B/C 26.6.5.4

When a significant level with respect to air temperature and a standard level coincide, data for that level shall be reported only once.

B/C 26.6.6 Levels significant with respect to relative humidity

B/C 26.6.6.1

The reported significant levels *alone* shall make it possible to reconstruct the relative humidity profiles within the limits of the criteria specified.

If the criteria for determination of significant levels with respect to relative humidity are satisfied at a particular point of altitude, data for all variables (if available) shall be reported for that level. [35.3.1.1]

B/C 26.6.6.2

The following shall be included as "mandatory" significant humidity levels:

(a) Aircraft reference level and termination level of the sounding (the lowest level of the sounding);

(b) A level between 110 and 100 hPa;

(c) Bases and tops of inversions and isothermal layers which are at least 20 hPa thick, provided that the base of the layer occurs below the 300-hPa level or the first tropopause, whichever is the higher;

(d) Bases and tops of inversion layers which are characterized by a change in relative humidity of at least 20 per cent, provided that the base of the layer occurs below the 300-hPa level or the first tropopause, whichever is the higher.

Note:

Note (1) under Regulation B/C 26.6.5.2 shall apply. [35.3.1.2]

B/C 26.6.6.3

The following shall be included as "additional" significant levels. They shall be selected in the order given, thereby giving priority to representing the temperature profile. As far as possible, these additional levels shall be the actual levels at which prominent changes in the lapse rate of air temperature occur:

(a) Levels which are necessary to ensure that the relative humidity obtained by linear interpolation between adjacent significant levels shall not depart by more than 15 per cent from the observed values. (The criterion of 15 per cent refers to an amount of relative humidity and NOT to the percentage of the observed value, e.g. if an observed value is 50 per cent, the interpolated value shall lie between 35 per cent and 65 per cent.);

(b) Levels which are necessary to limit the interpolation error on diagrams other than T-log P. These levels shall be such that the pressure at one significant level divided by the pressure of the preceding significant layer shall exceed 0.6 for levels up to the first tropopause and shall be determined by use of the method for selecting additional levels but with application of tighter criteria. [35.3.1.3]

B/C 26.6.6.4

When a significant layer with respect to relative humidity and a standard level coincide, data for that level shall be reported only once.

B/C 26.6.7 Levels significant with respect to wind

B/C 26.6.7.1

Significant wind levels shall be chosen so that the data from them *alone* shall make it possible to reconstruct the wind profile with sufficient accuracy for practical use. [35.3.2.1]

If the criteria for determination of significant levels with respect to wind speed and direction are satisfied at a particular point of altitude, data for all variables (if available) shall be reported for that level.

B/C 26.6.7.2

Criteria for determining significant levels with respect to changes in wind speed and direction:

(a) The direction of speed curves (in function of the log of pressure or altitude) can be reproduced with their prominent characteristics;

(b) These curves can be reproduced with the accuracy of at least 10 for direction and five meters per second for speed.

Note:

To satisfy these criteria, the following method of successive approximations is recommended, but other methods of attaining equivalent results may suit some national practices better and may be used:

(ii) The lowest level for which wind data are available and the aircraft reference level constitute the first and the last significant levels.
The deviation from the linearly interpolated values between these two levels is then considered. If no direction deviates by more than 10 and no speed by more than five meters per second, no other significant level need be reported. Whenever one parameter deviates by more than the limit specified in paragraph (b) above the level of greatest deviation becomes a supplementary significant level for both parameters.

(ii) The additional significant levels so introduced divide the sounding into two layers. In each separate layer, the deviation from the linearly interpolated values between the base and the top are then considered. The process used in paragraph (i) above is repeated and yields other significant levels. These additional levels in turn modify the layer distribution, and the method is applied again until any level is approximated to the above-mentioned specified values. [35.3.2.1] [32.3.1.1]

B/C 26.6.8 Beginning and end of missing temperature data

B/C 26.6.8.1

A layer for which temperature data are missing shall be indicated by reporting the boundary levels of the layer, provided that the layer is at least 20 hPa thick. The boundary levels are the levels closest to the bottom (beginning of the missing data) and the top (end of the missing data) of the layer for which temperature data are available. The boundary levels are not required to meet “significant temperature level” criteria. [35.3.1.6]

B/C 26.6.9 Beginning and end of missing humidity data

B/C 26.6.9.1

A layer for which dew-point temperature data are missing shall be indicated by reporting the boundary levels of the layer, provided that the layer is at least 20 hPa thick. The boundary levels are the levels closest to the bottom (beginning of the missing data) and the top (end of the missing data) of the layer for which dew-point temperature data are available. The boundary levels are not required to meet “significant humidity level” criteria. [35.3.1.6]

B/C 26.6.10 Beginning and end of missing wind data

B/C 26.6.10.1

A layer for which wind data are missing shall be indicated by reporting the boundary levels of the layer, provided that the layer is at least 50 hPa thick. The boundary levels are the levels closest to the bottom (beginning of the missing data) and the top (end of the missing data) of the layer for which the observed data are available. The boundary levels are not required to meet “significant wind level” criteria. [35.3.2.2]

B/C 26.7 Wind shear data

B/C 26.7.1 Number and order of levels for which wind shear is reported

B/C 26.7.1.1

The number of levels with wind shear data shall be indicated by Delayed descriptor replication factor 0 31 001 in BUFR and by a four-digit number in the Data Section corresponding to the position of the replication descriptor in the Data Description Section of CREX.

Notes:

(1) The number of levels with wind shear data shall never be set to a missing value.

(2) The number of levels with wind shear data shall be set to a positive value in a NIL report.

(3) The number of levels with wind shear data shall be set to zero if data for vertical wind shear are not computed and required. [35.2.4.4]

B/C 26.7.1.2

Whenever wind shear data are reported for more than one level, these maximum wind levels shall be included in the same order as in the sequence <3 03 054>, i.e. in descending order with respect to pressure.

B/C 26.7.2 Wind shear data at a pressure level <3 03 051>

B/C 26.7.2.1 Long time displacement (since launch time)

Long time displacement (0 04 086) represents the time offset from the launch time specified in Regulation 26.3, and shall be reported in seconds if available.

B/C 26.7.2.2 Extended vertical sounding significance – Flag table 0 08 042

A level, for which wind shear data are reported, shall be indicated by vertical sounding significance 0 08 042 - bit No. 4 set to 1 (maximum wind level) and by bit No. 7 set to 1 (level significant with respect to wind).

B/C 26.7.2.3 Pressure

Pressure (0 07 004) shall be reported in pascals with precision in tens of a pascal.

B/C 26.7.2.4 Latitude and longitude displacements

Latitude displacement (0 05 015) represents the latitude offset from the latitude of the launch site specified in Regulation 26.4, and shall be reported in degrees with precision in 10^{-5} of a degree if available. Longitude displacement 0 06 015 represents the longitude offset from the longitude of the launch site specified in Regulation 26.4, and shall be reported in degrees with precision in 10^{-5} of a degree if available.

B/C 26.7.2.5 Wind shear data

Absolute wind shear in 1 km layer below (0 11 061) and absolute wind shear in 1 km layer above (0 11 062) shall be reported in meters per second (with precision in tenths of a meter per second), if data for vertical wind shear are computed and required. [35.2.4.4]

B/C 26.8 Data required by regional or national reporting practices

If regional or national reporting practices require inclusion of temperature, humidity and/or wind data at additional levels, these data shall be reported using sequence <3 03 054> for Temperature, dew-point, wind at a pressure level. Regulation B/C 26.5 shall apply.

Notes:

(1) A level determined by regional decision shall be indicated by Extended vertical sounding significance 0 08 042 - bit No. 15 set to 1.

(2) A level determined by national decision shall be indicated by Extended vertical sounding significance 0 08 042 – all bits set to 0.

B/C 26.8.1 Additional data required by reporting practices

No regional requirements are indicated for reporting TEMP DROP data in the *Manual on Codes*, WMO-No. 306, Volume II.

B/C30 – Regulations for reporting CLIMAT data in TDCF

TM 307073 - BUFR template for reports of monthly values from a land station suitable for CLIMAT data

3 07 073		**Sequence for representation of monthly values suitable for CLIMAT data**
	3 07 071	Monthly values from a land station
	3 07 072	Monthly normals for a land station

Monthly values from a land station (data of CLIMAT Sections 0, 1, 3 and 4) Sequence BUFR descriptor **<3 07 071>** expands as shown in the leftmost column below.				
3 01 090			**Fixed surface station identification, time, horizontal and vertical coordinates**	Unit, scale
	3 01 004		Surface station identification	
		0 01 001	WMO block number	Numeric,0
		0 01 002	WMO station number	Numeric,0
		0 01 015	Station or site name	CCITT IA5, 0
		0 02 001	Type of station	Code table, 0
	3 01 011	0 04 001	Year[1]	Year, 0
		0 04 002	Month[1]	Month, 0
		0 04 003	Day (= 1) [1]	Day, 0
	3 01 012	0 04 004	Hour (= 0) [1]	Hour, 0
		0 04 005	Minute (= 0) [1]	Minute, 0
	3 01 021	0 05 001	Latitude (high accuracy)	Degree, 5
		0 06 001	Longitude (high accuracy)	Degree, 5
	0 07 030		Height of station ground above msl	m, 1
	0 07 031		Height of barometer above msl	m, 1
			Monthly mean values of pressure, temperature, extreme temperatures and vapour pressure	
0 04 074			Short time displacement (= UTC - LST) [1]	Hour, 0
0 04 023			Time period (= number of days in the month)	Day, 0
0 08 023			First order statistics (= 4; mean value)	Code table, 0
0 10 004			Pressure $\overline{\mathbf{P_oP_oP_oP_o}}$	Pa, –1
0 10 051			Pressure reduced to msl $\overline{\mathbf{PPPP}}$	Pa, –1
0 07 004			Pressure (standard level) (for lowland stations = missing value)	Pa, –1
0 10 009			Geopotential height of the standard level $\overline{\mathbf{PPPP}}$ (for lowland stations = missing value)	gpm, 0

0 07 032			Height of sensor above local ground (3)	m, 2
0 12 101			Temperature/dry-bulb temperature $s_n\overline{TTT}$	K, 2
0 02 051			Indicator to specify observing method for extreme temperatures (3) i_y	Code table, 0
0 04 051			Principal time of daily reading of maximum temperature G_xG_x	Hour, 0
0 12 118			Maximum temperature at height specified, past 24 hours $s_nT_xT_xT_x$	K, 2
0 04 052			Principal time of daily reading of minimum temperature G_nG_n	Hour, 0
0 12 119			Minimum temperature at height specified, past 24 hours $s_nT_nT_nT_n$	K, 2
0 13 004			Vapour pressure $\overline{eee}$	Pa, -1
0 08 023			First order statistics (set to missing to cancel the previous value)	Code table, 0
0 12 151			Standard deviation of daily mean temperature $s_ts_ts_t$	K, 2
0 07 032			Height of sensor above local ground (set to missing to cancel the previous value)	m, 2
			Number of days in the month for which values are missing	
1 02 005			Replicate 2 descriptors 5 times	
0 08 050			Qualifier for number of missing values in calculation of statistic (= 1; pressure) (= 2; temperature) (= 4; vapour pressure) (= 7; maximum temperature) (= 8; minimum temperature)	Code table, 0
0 08 020			Total number of missing entities (days) m_pm_p (for pressure) m_Tm_T (for temperature) m_em_e (for vapour pressure) m_{Tx} (for maximum temperature) m_{Tn} (for minimum temperature)	Numeric, 0
			Monthly duration of sunshine	
0 14 032			Total sunshine $S_1S_1S_1$	Hour, 0
0 14 033			Total sunshine $p_sp_sp_s$	%, 0
0 08 050			Qualifier for number of missing values in calculation of statistic (= 6; sunshine duration)	Code table, 0
0 08 020			Total number of missing entities (days) m_Sm_S	Numeric, 0
			Number of days with parameters beyond certain thresholds; number of days with thunderstorm and hail	
1 02 018			Replicate 2 descriptors 18 times	
0 08 052			Conditions for which number of days of occurrence follows (= 0; wind ≥ 10 m s^{-1}) (= 1; wind ≥ 20 m s^{-1}) (= 2; wind ≥ 30 m s^{-1}) (= 3; max. T <273.15 K) (= 4; max. T ≥ 298.15 K) (= 5; max. T ≥ 303.15 K) (= 6; max. T ≥ 308.15 K)	Code table, 0

			(= 7; max. T ≥ 313.15 K) (= 8; min. T < 273.15 K) (= 16; sss > 0.00 m) (= 17; sss > 0.01 m) (= 18; sss > 0.10 m) (= 19; sss > 0.50 m) (= 20; horizontal visibility < 50 m) (= 21; horizontal visibility < 100 m) (= 22; horizontal visibility < 1000 m) (= 23; hail) (= 24; thunderstorm)	
0 08 022			Total number (of days) $\mathbf{f_{10}f_{10}}$ (wind ≥10 m s^{-1}) $\mathbf{f_{20}f_{20}}$ (wind ≥ 20 m s^{-1}) $\mathbf{f_{30}f_{30}}$ (wind ≥ 30 m s^{-1}) $\mathbf{T_{x0}T_{x0}}$ (T_x < 273.15 K) $\mathbf{T_{25}T_{25}}$ (T_x ≥ 298.15 K) $\mathbf{T_{30}T_{30}}$ (T_x ≥ 303.15 K) $\mathbf{T_{35}T_{35}}$ (T_x ≥ 308.15 K) $\mathbf{T_{40}T_{40}}$ (T_x ≥ 313.15 K) $\mathbf{T_{n0}T_{n0}}$ (T_n < 273.15 K) $\mathbf{s_0s_0}$ (sss > 0.00 m) $\mathbf{s_1s_1}$ (sss > 0.01 m) $\mathbf{s_{10}s_{10}}$ (sss > 0.10 m) $\mathbf{s_{50}s_{50}}$ (sss > 0.50 m) $\mathbf{V_1V_1}$ (h. viz. < 50 m) $\mathbf{V_2V_2}$ (h. viz. < 100 m) $\mathbf{V_3V_3}$ (h. viz. < 1000 m) $\mathbf{D_{gr}D_{gr}}$ (hail) $\mathbf{D_{ts}D_{ts}}$ (thunderstorm)	Numeric, 0
			Occurrence of extreme values of temperature and wind speed	
0 07 032			Height of sensor above local ground	m, 2
0 08 053			Day of occurrence qualifier (= 0; on 1 day only) (= 1; on 2 or more days)	Code table, 0
0 04 003			Day $\mathbf{y_xy_x}$	Day, 0
0 12 152			Highest daily mean temperature $\mathbf{s_nT_{xd}T_{xd}T_{xd}}$	K, scale 2
0 08 053			Day of occurrence qualifier (= 0; on 1 day only) (= 1; on 2 or more days)	Code table, 0
0 04 003			Day $\mathbf{y_ny_n}$	Day, 0
0 12 153			Lowest daily mean temperature $\mathbf{s_nT_{nd}T_{nd}T_{nd}}$	K, 2
0 08 053			Day of occurrence qualifier (= 0; on 1 day only) (= 1; on 2 or more days)	Code table, 0
0 04 003			Day $\mathbf{y_{ax}y_{ax}}$	Day, 0
0 08 023			First order statistics (= 2; maximum value)	Code table, 0
0 12 101			Temperature/dry-bulb temperature $\mathbf{s_nT_{ax}T_{ax}T_{ax}}$	K, scale 2
0 08 053			Day of occurrence qualifier (= 0; on 1 day only) (= 1; on 2 or more days)	Code table, 0
0 04 003			Day $\mathbf{y_{an}y_{an}}$	Day, 0
0 08 023			First order statistics (= 3; minimum value)	Code table, 0
0 12 101			Temperature/dry-bulb temperature $\mathbf{s_nT_{an}T_{an}T_{an}}$	K, 2
0 08 023			First order statistics (set to missing to cancel the previous value)	Code table, 0

0 07 032			Height of sensor above local ground	m, 2
0 02 002			Type of instrumentation for wind measurement	Flag table, 0
0 08 053			Day of occurrence qualifier (= 0; on 1 day only) (= 1; on 2 or more days)	Code table, 0
0 04 003			Day $\mathbf{y_{fx}y_{fx}}$	Day, 0
0 11 046			Maximum instantaneous wind speed $\mathbf{f_xf_xf_x}$	m s^{-1}, 1
0 08 053			Day of occurrence qualifier (set to missing to cancel the previous value)	Code table, 0
			Monthly precipitation data	
0 04 003			Day (= 1) (2)	Day, 0
0 04 004			Hour (= 6) (2)	Hour, 0
0 04 023			Time period (= number of days in the month) (2)	Day, 0
0 07 032			Height of sensor above local ground(3)	m, 2
0 13 060			Total accumulated precipitation $\mathbf{R_1R_1R_1R_1}$	kg m^{-2}, 1
0 13 051			Frequency group; precipitation $\mathbf{R_d}$	Code table, 0
0 04 053			Number of days with precipitation equal to or more than 1 mm $\mathbf{n_rn_r}$	Numeric, 0
0 08 050			Qualifier for number of missing values in calculation of statistic (= 5; precipitation)	Code table, 0
0 08 020			Total number of missing entities (days) $\mathbf{m_Rm_R}$ (for precipitation)	Numeric, 0
			Number of days with precipitation beyond Certain thresholds	
1 02 006			Replicate 2 descriptors 6 times	
0 08 052			Conditions for which number of days of occurrence follows (= 10; precipitation ≥ 1.0 kg m^{-2}) (= 11; precipitation ≥ 5.0 kg m^{-2}) (= 12; precipitation ≥ 10.0 kg m^{-2}) (= 13; precipitation ≥ 50.0 kg m^{-2}) (= 14; precipitation ≥ 100.0 kg m^{-2}) (= 15; precipitation ≥ 150.0 kg m^{-2})	Code table, 0
0 08 022			Total number (of days) $\mathbf{R_1R_1}$ (precipitation ≥ 1.0 kg m^{-2}) $\mathbf{R_5R_5}$ (precipitation ≥ 5.0 kg m^{-2}) $\mathbf{R_{10}R_{10}}$ (precipitation ≥ 10.0 kg m^{-2}) $\mathbf{R_{50}R_{50}}$ (precipitation ≥ 50.0 kg m^{-2}) $\mathbf{R_{100}R_{100}}$ (precipitation ≥ 100.0 kg m^{-2}) $\mathbf{R_{150}R_{150}}$ (precipitation ≥ 150.0 kg m^{-2})	Numeric, 0
			Occurrence of extreme precipitation	
0 08 053			Day of occurrence qualifier (= 0; on 1 day only) (= 1; on 2 or more days)	Code table, 0
0 04 003			Day $\mathbf{y_ry_r}$	Day, 0
0 13 052			Highest daily amount of precipitation $\mathbf{R_xR_xR_x}$	kg m^{-2}, 1
0 07 032			Height of sensor above local ground (set to missing to cancel the previous value)	m, 2

Monthly normals for a land station (data of CLIMAT Section 2)

Sequence BUFR descriptor **<3 07 072>** expands as shown in the leftmost column below.

			Normals of pressure, temperatures, vapour pressure, standard deviation of daily mean temperature, and sunshine duration	Unit, scale
0 04 001			Year (of beginning of the reference period)	Year, 0
0 04 001			Year (of ending of the reference period)	Year, 0
0 04 002			Month	Month, 0
0 04 003			Day (= 1) (1)	Day, 0

0 04 004			Hour (= 0) (1)	Hour, 0
0 04 074			Short time displacement (= UTC - LST) (1)	Hour, 0
0 04 022			Time period (= 1)	Month, 0
0 08 023			First order statistics (= 4; mean value)	Code table, 0
0 10 004			Pressure $\overline{P_oP_oP_oP_o}$	Pa, –1
0 10 051			Pressure reduced to msl $\overline{PPPP}$	Pa, –1
0 07 004			Pressure (standard level)	Pa, –1
0 10 009			Geopotential height of the standard level $\overline{PPPP}$	Gpm
0 07 032			Height of sensor above local ground(3)	m, 2
0 12 101			Temperature/dry-bulb temperature $s_n\overline{TTT}$	K, 2
0 02 051			Indicator to specify observing method for extreme temperatures(3) i_y	Code table, 0
0 04 051			Principal time of daily reading of maximum temperature G_xG_x	Hour, 0
0 12 118			Maximum temperature at height specified, past 24 h. $s_n\overline{T_xT_xT_x}$	K, 2
0 04 052			Principal time of daily reading of minimum temperature G_nG_n	Hour, 0
0 12 119			Minimum temperature at height specified, past 24 h. $s_n\overline{T_nT_nT_n}$	K, 2
0 13 004			Vapour pressure $\overline{eee}$	Pa, -1
0 12 151			Standard deviation of daily mean temperature $\overline{s_ts_ts_t}$	K, 2
0 07 032			Height of sensor above local ground (set to missing to cancel the previous value)	m, 2
0 14 032			Total sunshine $S_1S_1S_1$	Hour, 0
0 08 023			First order statistics (set to missing to cancel the previous value)	Code table, 0

			Normals of precipitation	
0 04 001			Year (of beginning of the reference period)	Year, 0
0 04 001			Year (of ending of the reference period)	Year, 0
0 04 002			Month	Month, 0
0 04 003			Day (= 1) (2)	Day, 0
0 04 004			Hour (= 6) (2)	Hour, 0
0 04 022			Time period (= 1)	Month, 0
0 07 032			Height of sensor above local ground(3)	m, 2
0 08 023			First order statistics (= 4; mean value)	Code table, 0
0 13 060			Total accumulated precipitation $R_1R_1R_1R_1$	kg m^{-2}, 1
0 04 053			Number of days with precipitation equal to or more than 1 mm n_rn_r	Numeric, 0
0 08 023			First order statistics (set to missing to cancel the previous value)	Code table, 0
			Number of missing years	
1 02 008			Replicate 2 descriptors 8 times	

0 08 050			Qualifier for number of missing values in calculation of statistic (= 1; pressure) (= 2; temperature) (= 3; extreme temperatures)(4) (= 4; vapour pressure) (= 5; precipitation) (= 6; sunshine duration) (= 7; maximum temperature) (4) (= 8; minimum temperature) (4)	Code table, 0
0 08 020			Total number of missing entities (years) $\mathbf{y_p y_p}$ (for pressure) $\mathbf{y_T y_T}$ (for temperature) $\mathbf{y_{Tx} y_{Tx}}$ (for extreme temperatures)(4) $\mathbf{y_e y_e}$ (for vapour pressure) $\mathbf{y_R y_R}$ (for precipitation) $\mathbf{y_S y_S}$ (for sunshine duration) for maximum temperature (4) for minimum_temperature (4)	Numeric, 0

Notes:

(1) The time identification refers to the beginning of the one-month period. Except for precipitation measurements, the one-month period is recommended to correspond to the local standard time (LST) month. [7]

(2) In case of precipitation measurements, the one-month period begins at 06 UTC on the first day of the month and ends at 06 UTC on the first day of the following month. [5]

(3) If the height of the sensor or observing method for extreme temperatures was changed during the period specified, the value shall be that which existed for the greater part of the period.

(4) The number of missing years within the reference period from the calculation of normal for mean extreme air temperature should be given, if available, for both the calculation of normal maximum temperature and for the calculation of normal minimum temperature in addition to the number of missing years for the extreme air temperatures reported under 0 08 020 preceded by 0 08 050 in which Figure 3 is used.

Regulations:

B/C 30.1 Section 1 of BUFR or CREX

B/C 30.2 Monthly values from a land station
B/C 30.2.1 Station identification, date/time, horizontal and vertical coordinates
B/C 30.2.2 Monthly mean values of pressure, temperature, extreme temperatures vapour pressure; standard deviation of daily mean temperature
B/C 30.2.3 Monthly duration **of sunshine**
B/C 30.2.4 Number of days with parameters beyond certain thresholds; number of days with thunderstorm and hail
B/C 30.2.5 Occurrence of extreme values of temperature and wind speed
B/C 30.2.6 Monthly precipitation data
B/C 30.2.7 Number of days with precipitation beyond certain thresholds
B/C 30.2.8 Occurrence of extreme precipitation

B/C 30.3 Monthly normals for a land station
B/C 30.3.1 Normals of pressure, temperatures, vapour pressure, standard deviation of daily mean temperature, and sunshine duration
B/C 30.3.2 Normals of precipitation
B/C 30.3.3 Number of missing years

B/C 30.4 Data required by regional or national reporting practices

B/C 30.1 Section 1 of BUFR or CREX

B/C 30.1.1 Entries required in Section 1 of BUFR

The following entries shall be included in BUFR Section 1:
- BUFR master table,
- identification of originating/generating centre,
- identification of originating/generating sub-centre,
- update sequence number,
- identification of inclusion of optional section,
- data category (= 000 for CLIMAT data),
- international data sub-category (1), (2),
- local data subcategory,
- version number of master table,
- version number of local tables,
- year (year of the century up to BUFR edition 3) (3),
- month (for which the monthly values are reported) (3),
- day (= 1) (3),
- hour (= 0) (3),
- minute (= 0) (3).

Notes:
(1) Inclusion of this entry is required starting with BUFR edition 4.
(2) If required, the international data sub-category shall be included for CLIMAT data as 020.
(3) The time identification refers to the beginning of the month for which the monthly mean values are reported.

B/C 30.1.2 Entries required in Section 1 of CREX

The following entries shall be included in CREX Section 1:
- CREX master table,
- CREX edition number,
- CREX table version number,
- version number of BUFR master table (1),
- version number of local tables (1),
- data category (= 000 for CLIMAT data),
- international data sub-category (1), (2),
- identification of originating/generating centre (1),
- identification of originating/generating sub-centre (1),
- update sequence number (1),
- number of subsets (1),
- year (1), (3),
- month (for which the monthly values are reported) (1), (3),
- day (= 1) (1), (3),
- hour (= 0) (1), (3),
- minute (= 0) (1), (3).

Notes:
(1) Inclusion of these entries is required starting with CREX edition 2.
(2) If inclusion of international data sub-category is required, Note (2) under B/C 30.1.1 applies.
(3) Note (3) under B/C 30.1.1 applies.

B/C 30.2 Monthly values from a land station <3 07 071>

B/C 30.2.1 Station identification, date/time, horizontal and vertical coordinates <3 01 090>

B/C 30.2.1.1 Station identification

WMO block number station (0 01 001) and WMO station number (0 01 002) shall be always reported as a non-missing value.

Station or site name (0 01 015) shall be reported as published in WMO-No. 9, Volume A, Observing Stations, provided that the station name does not exceed 20 characters. A shortened version of the name shall be reported otherwise.

Type of station (0 02 001) shall be reported to indicate the type of the station operation (manned, automatic or hybrid).

B/C 30.2.1.2 Date/time (of beginning of the month)

Date <3 01 011> and time <3 01 012> shall be reported, i.e. year (0 04 001), month (0 04 002), day (0 04 003) and hour (0 04 004), minute (0 04 005) of beginning of the month for which the monthly values are reported. Day (0 04 003) shall be set to 1 and both hour (0 04 004) and minute (0 04 005) shall be set to 0.

B/C 30.2.1.3 Horizontal and vertical coordinates

Latitude (0 05 001) and longitude (0 06 001) of the station shall be reported in degrees with precision in 10^{-5} of a degree.

Height of station ground above mean sea level (0 07 030) and height of barometer above mean sea level (0 07 031) shall be reported in meters with precision in tenths of a meter.

B/C 30.2.2 Monthly mean values of pressure, temperature, extreme temperatures and vapour pressure; standard deviation of daily mean temperature

The monthly mean values of pressure, pressure reduced to mean sea level or geopotential height, temperature, extreme temperatures and vapour pressure shall be reported. Any missing element shall be reported as a missing value.

B/C 30.2.2.1 Reference period for the data of the month

Monthly data (with the exception of precipitation data) are recommended to be reported for one-month period, corresponding to the local standard time (LST) month. In that case, short time displacement (0 04 074) shall specify the difference between UTC and LST (set to *non-positive values in the eastern hemisphere, non-negative values in the western hemisphere*).

Time period (0 04 023) represents the number of days in the month for which the data are reported, and shall be expressed as a *positive value* in days.

Note:
(1) A BUFR (or CREX) message shall contain reports for one specific month only. [71.1.4]

B/C 30.2.2.2 First order statistics – Code table 0 08 023

This datum shall be set to 4 (mean value) to indicate that the following entries represent mean values of the elements (pressure, pressure reduced to mean sea level or geopotential height, temperature, extreme temperatures and vapour pressure) averaged over the one-month period.

B/C 30.2.2.3 Monthly mean value of pressure

Monthly mean value of pressure shall be reported using 0 10 004 (Pressure) in pascals (with precision in tens of a pascal).

B/C 30.2.2.4 Monthly mean value of pressure reduced to mean sea level

Monthly mean value of pressure reduced to mean sea level shall be reported using 0 10 051 (Pressure reduced to mean sea level) in pascals (with precision in tens of a pascal), if the air pressure at mean sea level can be computed with reasonable accuracy.

B/C 30.2.2.5 Monthly mean value of geopotential height

Monthly mean value of geopotential height of a standard level shall be reported using 0 10 009 (Geopotential height) in geopotential meters from high-level stations which cannot give pressure at mean sea level to a satisfactory degree of accuracy. The standard isobaric level is specified by the preceding entry Pressure (0 07 004).

B/C 30.2.2.6 Height of sensor above local ground

Height of sensor above local ground (0 07 032) for temperature and humidity measurement shall be reported in meters (with precision in hundredths of a meter).
This datum represents the actual height of temperature and humidity sensors above ground at the point where the sensors are located.

Note:
(1) If the height of the sensor was changed during the period specified, the value shall be that which existed for the greater part of the period.

B/C 30.2.2.7 Monthly mean value of temperature

Monthly mean value of temperature shall be reported using 0 12 101 (Temperature/dry bulb temperature) in degrees Kelvin (with precision in hundredths of a degree Kelvin); if produced in CREX, in degrees Celsius (with precision in hundredths of a degree Celsius). Temperature data shall be reported with precision in hundredths of a degree even if they are available with the accuracy in tenths of a degree.

Notes:
(1) This requirement is based on the fact that conversion from the Kelvin to the Celsius scale has often resulted into distortion of the data values.
(2) Temperature t (in degrees Celsius) shall be converted into temperature T (in degrees Kelvin) using equation: $T = t + 273.15$.

B/C 30.2.2.8 Indicator to specify observing method for extreme temperatures – Code table 0 02 051

This datum shall be set to 1 (maximum/minimum thermometers) or to 2 (automated instruments) or to 3 (thermograph) to indicate observing method for extreme temperatures.

Note:
(1) If the observing method for extreme temperatures was changed during the period specified, the code figure shall be that which existed for the greater part of the period.

B/C 30.2.2.9 Monthly mean value of maximum temperature

Monthly mean value of maximum temperature shall be reported in degrees Kelvin (with precision in hundredths of a degree Kelvin); if produced in CREX, in degrees Celsius (with precision in hundredths of a degree Celsius).

Notes:
(1) Notes (1) and (2) under Regulation B/C 30.2.2.7 shall apply.
(2) The monthly mean value of maximum temperature shall be reported using 0 12 118 (Maximum temperature at height specified, past 24 hours). The height is specified by the preceding entry 0 07 032. Principal time of daily reading of maximum temperature (0 04 051) indicates the end of the 24 hour period to which the daily maximum temperature refers.

B/C 30.2.2.10 Monthly mean value of minimum temperature

Monthly mean value of minimum temperature shall be reported in degrees Kelvin (with precision in hundredths of a degree Kelvin); if produced in CREX, in degrees Celsius (with precision in hundredths of a degree Celsius).

Notes:
(1) Notes (1) and (2) under Regulation B/C 30.2.2.7 shall apply.

(2) The monthly mean value of minimum temperature shall be reported using 0 12 119 (Minimum temperature at height specified, past 24 hours). The height is specified by the preceding entry 0 07 032. Principal time of daily reading of minimum temperature (0 04 052) indicates the end of the 24 hour period to which the daily minimum temperature refers.

B/C 30.2.2.11 Monthly mean value of vapour pressure

Monthly mean value of vapour pressure shall be reported using 0 13 004 (Vapour pressure) in pascals (with precision in tens of a pascal).

B/C 30.2.2.12 First order statistics – Code table 0 08 023

This datum shall be set to missing to indicate that the following entries do not represent the monthly mean values.

B/C 30.2.2.13 Standard deviation of daily mean temperature

Standard deviation of daily mean temperature (0 12 151) shall be reported in degrees Kelvin (with precision in hundredths of a degree Kelvin); if produced in CREX, in degrees Celsius (with precision in hundredths of a degree Celsius). [71.3.1]

B/C 30.2.2.14 Number of days in the month for which values are missing

Number of days in the month for which values are missing shall be reported using Total number of missing entities (0 08 020) being preceded by Qualifier for number of missing values in calculation of statistic (0 08 050) in each of the required five replications (1 02 005).

Qualifier for number of missing values in calculation of statistic (0 08 050) is - set to 1 (pressure) in the first replication,
- set to 2 (temperature) in the second replication,
- set to 4 (vapour pressure) in the third replication,
- set to 7 (maximum temperature) in the fourth replication,
- set to 8 (minimum temperature) in the fifth replication.

The number of days in the month for which values of the parameter are missing, shall be reported using 0 08 020 in the corresponding replication.

B/C 30.2.3 Monthly duration of sunshine

B/C 30.2.3.1 Total sunshine duration

The monthly values of total duration of sunshine shall be reported in hours using Total sunshine (0 14 032) and the percentage of the normal that that value represents shall be reported using Total sunshine (0 14 033). Any missing element shall be reported as a missing value.

Note:

(1) If the percentage of the normal is 1% or less but greater than 0, Total sunshine 0 14 033 shall be set to 1.

(2) If the normal is zero hours, *Total sunshine 0 14 033 shall be set to 510*.

(3) If the normal is not defined, Total sunshine 0 14 033 shall be set to missing. [71.3.3]

B/C 30.2.3.2 Number of days in the month for which sunshine data are missing

Number of days in the month for which sunshine data are missing shall be reported using Total number of missing entities (0 08 020) being preceded by Qualifier for number of missing values in calculation of statistic (0 08 050) set to 6 (sunshine duration).

B/C 30.2.4 Number of days with parameters beyond certain thresholds and number of days with thunderstorm and hail

Number of days in the month with parameters beyond certain thresholds and with thunderstorm and hail shall be reported using Total number (0 08 022) being preceded by Conditions for which number of days of occurrence follows (0 08 052) in each of the required eighteen replications (1 02 018).

Conditions for which number of days of occurrence follows (0 08 052) is
- set to 0 (mean wind speed over 10-minute period ≥ 10 m s^{-1}),
- set to 1 (mean wind speed over 10-minute period ≥ 20 m s^{-1}),
- set to 2 (mean wind speed over 10-minute period ≥ 30 m s^{-1}),
- set to 3 (maximum temperature < 273.15 K),
- set to 4 (maximum temperature ≥ 298.15 K),
- set to 5 (maximum temperature ≥ 303.15 K),
- set to 6 (maximum temperature ≥ 308.15 K),
- set to 7 (maximum temperature ≥ 313.15 K),
- set to 8 (minimum temperature < 273.15 K),
- set to 16 (snow depth > 0.00 m),
- set to 17 (snow depth > 0.01 m),
- set to 18 (snow depth > 0.10 m),
- set to 19 (snow depth > 0.50 m),
- set to 20 (horizontal visibility < 50 m),
- set to 21 (horizontal visibility < 100 m),
- set to 22 (horizontal visibility < 1000 m),
- set to 23 (occurrence of hail),
- set to 24 (occurrence of thunderstorm) in the last replication.

The number of days in the month with parameters beyond the specified thresholds and with thunderstorm and hail shall be reported using 0 08 022 in the corresponding replication.

Note:

(1) Number of days in the month with horizontal visibility beyond the specified thresholds is the number of days with visibility less than 50, 100 and 1000 m, respectively, *irrespective of the duration of the period* during which horizontal visibility below the specified thresholds was observed or recorded.

B/C 30.2.5 Occurrence of extreme values of temperatures and wind speed

B/C 30.2.5.1 Height of sensor above local ground (for temperature)

Height of sensor above local ground (0 07 032) for temperature measurement shall be reported in meters (with precision in hundredths of a meter).
This datum represents the actual height of temperature sensor above ground at the point where the sensor is located.

B/C 30.2.5.2 Occurrence of the highest daily mean temperature

The day on which the highest daily mean temperature occurred shall be reported using Day (0 04 003). If the highest daily mean temperature occurred on only one day, the preceding entry 0 08 053 (Day of occurrence qualifier) shall be set to 0. If the highest daily mean temperature occurred on more than one day, the first day shall be reported for 0 04 003 and the preceding entry 0 08 053 shall be set to 1. [71.6.1]

Highest daily mean temperature (0 12 152) shall be reported in degrees Kelvin (with precision in hundredths of a degree Kelvin); if produced in CREX, in degrees Celsius (with precision in hundredths of a degree Celsius).
Note:
(1) Notes (1) and (2) under Regulation B/C 30.2.2.7 shall apply.

B/C 30.2.5.3 Occurrence of the lowest daily mean temperature

The day on which the lowest daily mean temperature occurred shall be reported using Day (0 04 003). If the lowest daily mean temperature occurred on only one day, the preceding entry 0 08 053 (Day of occurrence qualifier) shall be set to 0. If the lowest daily mean temperature occurred on more than one day, the first day shall be reported for 0 04 003 and the preceding entry 0 08 053 shall be set to 1. [71.6.1]

Lowest daily mean temperature (0 12 152) shall be reported in degrees Kelvin (with precision in hundredths of a degree Kelvin); if produced in CREX, in degrees Celsius (with precision in hundredths of a degree Celsius).

Note:

(1) Notes (1) and (2) under Regulation B/C 30.2.2.7 shall apply.

B/C 30.2.5.4 Occurrence of the highest air temperature of the month

The day on which the highest air temperature occurred shall be reported using Day (0 04 003). If the highest air temperature occurred on only one day, the preceding entry 0 08 053 (Day of occurrence qualifier) shall be set to 0. If the highest air temperature occurred on more than one day, the first day shall be reported for 0 04 003 and the preceding entry 0 08 053 shall be set to 1. [71.6.1]

The highest air temperature of the month shall be reported using 0 12 101 (Temperature/dry bulb temperature), preceded by First order statistics (0 08 023) set to 2 (maximum value). The temperature shall be reported in degrees Kelvin (with precision in hundredths of a degree Kelvin); if produced in CREX, in degrees Celsius (with precision in hundredths of a degree Celsius).

Note:

(1) Notes (1) and (2) under Regulation B/C 30.2.2.7 shall apply.

B/C 30.2.5.5 Occurrence of the lowest air temperature of the month

The day on which the lowest air temperature occurred shall be reported using Day (0 04 003). If the lowest air temperature occurred on only one day, the preceding entry 0 08 053 (Day of occurrence qualifier) shall be set to 0. If the lowest air temperature occurred on more than one day, the first day shall be reported for 0 04 003 and the preceding entry 0 08 053 shall be set to 1. [71.6.1]

The lowest air temperature of the month shall be reported using 0 12 101 (Temperature/dry bulb temperature), preceded by First order statistics (0 08 023) set to 3 (minimum value). The temperature shall be reported in degrees Kelvin (with precision in hundredths of a degree Kelvin); if produced in CREX, in degrees Celsius (with precision in hundredths of a degree Celsius).

Note:

(1) Notes (1) and (2) under Regulation B/C 30.2.2.7 shall apply.

B/C 30.2.5.6 Height of sensor above local ground (for wind measurement)

Height of sensor above local ground (0 07 032) for wind measurement shall be reported in meters (with precision in hundredths of a meter).

This datum represents the actual height of wind sensors above ground at the point where the sensors are located.

B/C 30.2.5.7 Type of instrumentation for wind measurement - Flag table 0 02 002

This datum shall be used to specify whether the wind speed was measured by certified instruments (bit No. 1 set to 1) or estimated on the basis of the Beaufort wind scale (bit No. 1 set to 0), and to indicate the original units for wind speed measurement. Bit No. 2 set to 1 indicates that wind speed was originally measured in knots and bit No. 3 set to 1 indicates that wind speed was originally measured in kilometers per hour. Setting both bits No.2 and No.3 to 0 indicates that wind speed was originally measured in meters per second.

In CREX, type of instrumentation for wind measurement (0 02 002) shall be reported in octal representation. For example, if wind speed was measured by instruments in knots (bit No.1 and bit No.2 set to 1), then this datum shall be reported as 14.

B/C 30.2.5.8 Occurrence of the highest instantaneous wind speed of the month

The day on which the highest instantaneous wind speed occurred shall be reported using Day (0 04 003). If the highest instantaneous wind speed occurred on only one day, the preceding entry 0 08 053 (Day of occurrence qualifier) shall be set to 0. If the highest instantaneous wind speed occurred on more than one day, the first day shall be reported for 0 04 003 and the preceding entry 0 08 053 shall be set to 1. [71.6.1]

The highest instantaneous wind speed of the month shall be reported using 0 11 046 (Maximum instantaneous wind speed) in meters per second (with precision in tenths of a meter per second).

B/C 30.2.6 Monthly precipitation data

B/C 30.2.6.1 Date/time (of beginning of the one-month period for precipitation data)

Day (0 04 003) and hour (0 04 004) of the beginning of the one-month period for monthly precipitation data are reported. Day (0 04 003) shall be set to 1 and hour (0 04 004) *shall be set to 6*.

Notes:

(1) In case of precipitation measurements, a month begins at 0600 hours UTC on the first day of the month and ends at 0600 hours UTC on the first day of the following month *[Guide to Climatoligical Practices, WMO-No. 100]*.

(2) Year (0 04 001), month (0 04 002) and minute (0 04 005) of the beginning of the one-month period specified in the Regulations B/C 30.2.1.2 apply.

B/C 30.2.6.2 Period of reference for precipitation data of the month

Time period (0 04 023) represents the number of days in the month for which the monthly mean data are reported, and shall be expressed as a *positive value* in days.

Note:

(1) A BUFR (or CREX) message shall contain reports for one specific month only. [71.1.4]

B/C 30.2.6.3 Height of sensor above local ground

Height of sensor above local ground (0 07 032) for precipitation measurement shall be reported in meters (with precision in hundredths of a meter).

This datum represents the actual height of the rain gauge rim above ground at the point where the rain gauge is located.

Note:

(1) If the height of the sensor was changed during the period specified, the value shall be that which existed for the greater part of the period.

B/C 30.2.6.4 Total amount of precipitation of the month

Total accumulated precipitation (0 13 060) which has fallen during the month shall be reported in kilograms per square meter (with precision in tenths of a kilogram per square meter).

Note:

(1) Trace shall be reported as "- 0.1 kg m-2 ".

B/C 30.2.6.5 Indication of frequency group

Frequency group in which the total amount of precipitation of the month falls shall be reported using Code table 0 13 051 (Frequency group; precipitation).

Note:

(1) If for a particular month the total amount of precipitation is zero, the code figure for 0 13 051 shall be given by the highest number of quintile which has 0.0 as lower limit (e.g. in months **with no rainfall in the 30-year period, 0 13 051 shall be set to 5). [71.3.2]**

B/C 30.2.6.6 Number of days with precipitation equal to or greater than 1 mm

Number of days in the month with precipitation equal to or greater than 1 kilogram per square meter shall be reported using 0 04 053 (Number of days in the month with precipitation equal to or greater than 1 mm).

B/C 30.2.6.7 Number of days in the month for which precipitation data is missing

Number of days in the month for which precipitation is missing shall be reported using Total number of missing entities (0 08 020) being preceded by Qualifier for number of missing values in calculation of statistic (0 08 050) set to 5 (precipitation).

B/C 30.2.7 Number of days with precipitation beyond certain thresholds

Number of days in the month with precipitation beyond certain thresholds shall be reported using Total number (0 08 022) being preceded by Conditions for which number of days of occurrence follows (0 08 052) in each of the required six replications (1 02 006).

Conditions for which number of days of occurrence follows (0 08 052) is
- set to 10 (precipitation ≥ 1.0 kg m^{-2}) in the first replication,
- set to 11 (precipitation ≥ 5.0 kg m^{-2}),
- set to 12 (precipitation ≥ 10.0 kg m^{-2}),
- set to 13 (precipitation ≥ 50.0 kg m^{-2}),
- set to 14 (precipitation ≥ 100.0 kg m^{-2}),
- set to 15 (precipitation ≥ 150.0 kg m^{-2}) in the last replication.

The number of days in the month with precipitation beyond the specified thresholds shall be reported using 0 08 022 in the corresponding replication.

B/C 30.2.8 Occurrence of extreme precipitation

The day on which the highest daily amount of precipitation occurred shall be reported using Day (0 04 003). If the highest daily amount of precipitation occurred on only one day, the preceding entry 0 08 053 (Day of occurrence qualifier) shall be set to 0. If the highest daily amount of precipitation occurred on more than one day, the first day shall be reported for 0 04 003 and the preceding entry 0 08 053 shall be set to 1. [71.6.1]

Highest daily amount of precipitation (0 13 052) shall be reported in kilograms per square meter (with precision in tenths of a kilogram per square meter).
Note:
(1) Trace shall be reported as "- 0.1 kg m^{-2} ".

B/C 30.3 Monthly normals for a land station <3 07 072>

Meteorological Services shall submit to the Secretariat complete normal data of the elements for stations to be included in the CLIMAT bulletins. The same shall apply when Services consider it necessary to make amendments to previously published normal values. [71.4.1]

B/C 30.3.1 Normals of pressure, temperatures, vapour pressure, standard deviation of daily mean temperature, and sunshine duration

Normal values of pressure, pressure reduced to mean sea level or geopotential height, temperature, extreme temperatures, vapour pressure, standard deviation of daily mean temperature, and sunshine duration shall be reported. Any missing element shall be reported as a missing value.

B/C 30.3.1.1 Reference period for normal data

Reference period for calculation of the normal values of the elements shall be reported using two consecutive entries 0 04 001 (Year). The first 0 04 001 shall express the year of beginning of the reference period and the second 0 04 001 shall express the year of ending of the reference period.
Note:
(1) The normal data reported shall be deduced from observations made over a specific period defined by *Technical Regulations*. [71.4.2]

B/C 30.3.1.2 Specification of the one-month period for which normals are reported

The one-month period for which the normal values are reported shall be specified by month (0 04 002), day (0 04 003) being set to 1, hour (0 04 004) being set to 0, short time displacement (0 04 074) and time period (0 04 022) being set to 1, i.e. 1 month.

Short time displacement (0 04 074) shall be set to *non-positive values in the eastern hemisphere, negative values in the western hemisphere*.

B/C 30.3.1.3 First order statistics – Code table 0 08 023

This datum shall be set to 4 (mean value) to indicate that the following entries represent mean values of the elements (pressure, pressure reduced to mean sea level or geopotential height, temperature, extreme temperatures, vapour pressure, standard deviation of daily mean temperature and sunshine duration) averaged over the reference period specified in Regulation B/C 30.3.1.1.

B/C 30.3.1.4 Normal value of pressure

Normal value of pressure shall be reported using 0 10 004 (Pressure) in pascals (with precision in tens of a pascal).

B/C 30.3.1.5 Normal value of pressure reduced to mean sea level

Normal value of pressure reduced to mean sea level shall be reported using 0 10 051 (Pressure reduced to mean sea level) in pascals (with precision in tens of a pascal), if the air pressure at mean sea level can be computed with reasonable accuracy.

B/C 30.3.1.6 Normal value of geopotential height

Normal value of geopotential height of a standard level shall be reported using 0 10 009 (Geopotential height) in geopotential meters from high-level stations which cannot give pressure at mean sea level to a satisfactory degree of accuracy. The standard isobaric level is specified by the preceding entry Pressure (0 07 004).

B/C 30.3.1.7 Height of sensor above local ground

Regulation B/C 30.2.2.6 shall apply.

B/C 30.3.1.8 Normal value of temperature

Normal value of temperature shall be reported using 0 12 101 (Temperature/dry bulb temperature) in degrees Kelvin (with precision in hundredths of a degree Kelvin); if produced in CREX, in degrees Celsius (with precision in hundredths of a degree Celsius).

Note:
(1) Notes (1) and (2) under Regulation B/C 30.2.2.7 shall apply.

B/C 30.3.1.9 Indicator to specify observing method for extreme temperatures – Code table 0 02 051

Regulation B/C 30.2.2.8 shall apply.

B/C 30.3.1.10 Normal value of maximum temperature

Normal value of maximum temperature shall be reported in degrees Kelvin (with precision in hundredths of a degree Kelvin); if produced in CREX, in degrees Celsius (with precision in hundredths of a degree Celsius).

Notes:
(1) Notes (1) and (2) under Regulation B/C 30.2.2.7 shall apply.
(2) Note (2) under Regulation B/C 30.2.2.9 shall apply.

B/C 30.3.1.11 Normal value of minimum temperature

Normal value of minimum temperature shall be reported in degrees Kelvin (with precision in hundredths of a degree Kelvin); if produced in CREX, in degrees Celsius (with precision in hundredths of a degree Celsius).

Notes:
(1) Notes (1) and (2) under Regulation B/C 30.2.2.7 shall apply.
(2) Note (2) under Regulation B/C 30.2.2.10 shall apply.

B/C 30.3.1.12 Normal value of vapour pressure

Normal value of vapour pressure shall be reported using 0 13 004 (Vapour pressure) in pascals (with precision in tens of a pascal).

B/C 30.3.1.13 Normal value of standard deviation of daily mean temperature

Normal value of standard deviation of daily mean temperature shall be reported using 0 12 151 in degrees Kelvin (with precision in hundredths of a degree Kelvin); if produced in CREX, in degrees Celsius (with precision in hundredths of a degree Celsius).

B/C 30.3.1.14 Normal of monthly sunshine duration

Normal of monthly sunshine duration shall be reported in hours using 0 14 032 (Total sunshine).

B/C 30.3.2 Normals of precipitation

Normal values of monthly amount of precipitation and of number of days in the month with precipitation equal to or greater than 1 mm, shall be reported. Any missing element shall be reported as a missing value.

B/C 30.3.2.1 Reference period for normal values of precipitation

Reference period for calculation of the normal values of precipitation shall be reported using two consecutive entries 0 04 001 (Year). The first 0 04 001 shall express the year of beginning of the reference period and the second 0 04 001 shall express the year of ending of the reference period.

Note:

(1) Note (1) under Regulation B/C 30.3.1.1 shall apply.

B/C 30.3.2.2 Specification of the one-month period for which normals are reported

The one-month period for which the normals of precipitation are reported shall be specified by month (0 04 002), day (0 04 003) being set to 1, hour (0 04 004) *being set to 6* and time period (0 04 022) being set to 1, i.e. 1 month.

Note:

(1) Note (1) under Regulation B/C 30.2.6.1 shall apply.

B/C 30.3.2.3 Height of sensor above local ground

Regulation B/C 30.2.6.3 shall apply.

B/C 30.3.2.4 First order statistics – Code table 0 08 023

This datum shall be set to 4 (mean value) to indicate that the following entries represent mean values of precipitation data, averaged over the reference period specified in Regulation B/C 30.3.2.1.

B/C 30.3.2.5 Normal value of monthly amount of precipitation

Normal value of monthly amount of precipitation shall be reported in kilograms per square meter (with precision in tenths of a kilogram per square meter) using 0 13 060 (Total accumulated precipitation).

Note:

(1) Trace shall be reported as "- 0.1 kg m^{-2} ".

B/C 30.3.2.6 Normal value of number of days with precipitation ≥ 1 mm

Normal value of number of days in the month with precipitation equal to or greater than 1 kilogram per square meter shall be reported using 0 04 053 (Number of days in the month with precipitation equal to or greater than 1 mm).

B/C 30.3.3 Number of missing years

Number of missing years within the reference period shall be reported using Total number of missing entities (0 08 020) being preceded by Qualifier for number of missing values in calculation of statistic (0 08 050) in each of the required eight replications (1 02 008).

Qualifier for number of missing values in calculation of statistic (0 08 050) is
- set to 1 (pressure) in the first replication,
- set to 2 (temperature),
- set to 3 (extreme temperatures),
- set to 4 (vapour pressure),
- set to 5 (precipitation),
- set to 6 (sunshine duration),
- set to 7 (maximum temperature),
- set to 8 (minimum temperature) in the last replication.

The number of missing years within the reference period for calculation of the normal values of the element shall be reported using 0 08 020 in the corresponding replication.

Note:

(1) The number of missing years within the reference period from the calculation of normal for mean extreme air temperature should be given, if available, for both the calculation of normal maximum temperature and for the calculation of normal minimum temperature in addition to the number of missing years for the extreme air temperatures reported under 0 08 020 preceded by 0 08 050 in which Figure 3 is used.

B/C 30.4 Data required by regional or national reporting practices

No additional data are currently required by regional or national reporting practices for CLIMAT data in the *Manual on Codes*, WMO-No. 306, Volume II.

B/C32 – Regulations for reporting CLIMAT SHIP data in TDCF

TM 308013 - BUFR template for reports of monthly values from an ocean weather station suitable for CLIMAT SHIP data

3 08 013		**Sequence for representation of monthly values suitable for CLIMAT SHIP data**
	3 08 011	Monthly values from an ocean weather station
	3 08 012	Monthly normals for an ocean weather station

Monthly values from an ocean weather station (data of CLIMAT SHIP Section 1)
Sequence BUFR descriptor **<3 08 011>** expands as shown in the leftmost column below.

		Station identification, date/time, horizontal and vertical coordinates	Unit, scale
0 01 011		Ship's call sign	CCITT IA5, 0
0 02 001		Type of station	Code table, 0
3 01 011	0 04 001	Year[(1)]	Year, 0
	0 04 002	Month[(1)]	Month, 0
	0 04 003	Day (= 1) [(1)]	Day, 0
3 01 012	0 04 004	Hour (= 0) [(1)]	Hour, 0
	0 04 005	Minute (= 0) [(1)]	Minute, 0
3 01 023	0 05 002	Latitude (coarse accuracy) **$L_aL_aL_a$**	Degree, 2
	0 06 002	Longitude (coarse accuracy) **$L_oL_oL_oL_o$**	Degree, 2
0 07 030		Height of station platform above mean sea level	m, 1
0 07 031		Height of barometer above mean sea level	m, 1
		Monthly mean values of pressure, temperature, vapour pressure and sea/water temperature	
0 04 074		Short time displacement (= UTC - LST) [(1)]	Hour, 0
0 04 023		Time period (= number of days in the month)	Day, 0
0 08 023		First order statistics (= 4; mean value)	Code table, 0
0 10 051		Pressure reduced to msl **$\overline{PPPP}$**	Pa, –1
0 07 032		Height of sensor above marine deck platform (for temperature measurement) [(3)]	m, 2

0 07 033		Height of sensor above water surface (for temperature measurement) (3)	m, 1
0 12 101		Temperature/dry-bulb temperature **$s_n\overline{TTT}$**	K, 2
0 13 004		Vapour pressure **$\overline{eee}$**	Pa, -1
0 07 032		Height of sensor above marine deck platform (set to missing to cancel the previous value)	m, 2
0 07 033		Height of sensor above water surface (set to missing to cancel the previous value)	m, 1
3 02 056		Sea surface temperature, method of measurement, and depth below sea surface	
	0 02 038	Method of sea/water temperature measurement (3)	Code table, 0
	0 07 063	Depth below sea/water surface (for sea surface temperature measurement) (3)	m, 2
	0 22 043	Sea/water temperature **$\overline{s_nT_wT_wT_w}$**	K, 2
	0 07 063	Depth below sea/water surface (set to missing to cancel the previous value)	m, 2
0 08 023		First order statistics (set to missing to cancel the previous value)	Code table, 0
		Monthly precipitation data	
0 04 003		Day (= 1) (2)	Day, 0
0 04 004		Hour (= 6) (2)	Hour, 0
0 04 023		Time period (= number of days in the month) (2)	Day, 0
0 07 032		Height of sensor above marine deck platform (3)	m, 2
0 13 060		Total accumulated precipitation **$R_1R_1R_1R_1$**	kg m^{-2}, 1
0 13 051		Frequency group; precipitation **R_d**	Code table, 0
0 04 053		Number of days with precipitation equal to or more than 1 mm **n_rn_r**	Numeric, 0
0 07 032		Height of sensor above marine deck platform (set to missing to cancel the previous value)	m, 2

Monthly normals for an ocean weather station (data of CLIMAT SHIP Section 2)
Sequence BUFR descriptor **<3 08 012>** expands as shown in the leftmost column below.

		Normals of pressure, temperature, vapour pressure and sea/water temperature	Unit, scale
0 04 001		Year (of beginning of the reference period)	Year, 0
0 04 001		Year (of ending of the reference period)	Year, 0
0 04 002		Month	Month, 0
0 04 003		Day (= 1) (1)	Day, 0
0 04 004		Hour (= 0) (1)	Hour, 0
0 04 074		Short time displacement (= UTC - LST) (1)	Hour, 0
0 04 022		Time period (= 1)	Month, 0
0 08 023		First order statistics (= 4; mean value)	Code table, 0
0 10 051		Pressure reduced to msl **$\overline{PPPP}$**	Pa, –1
0 07 032		Height of sensor above marine deck platform (for temperature measurement) (3)	m, 2
0 07 033		Height of sensor above water surface (for temperature measurement) (3)	m, 1
0 12 101		Temperature/dry-bulb temperature **$s_n\overline{TTT}$**	K, 2
0 13 004		Vapour pressure **$\overline{eee}$**	Pa, -1

0 07 032		Height of sensor above marine deck platform (set to missing to cancel the previous value	m, 2
0 07 033		Height of sensor above water surface (set to missing to cancel the previous value)	m, 1
3 02 056		Sea surface temperature, method of measurement, and depth below sea surface	
	0 02 038	Method of sea/water temperature measurement[(3)]	Code table, 0
	0 07 063	Depth below sea/water surface (for sea surface temperature measurement) [(3)]	m, 2
	0 22 043	Sea/water temperature **$\overline{s_nT_wT_wT_w}$**	K, 2
	0 07 063	Depth below sea/water surface (set to missing to cancel the previous value)	m, 2
0 08 023		First order statistics (set to missing to cancel the previous value)	Code table, 0
		Normals of precipitation	
0 04 001		Year (of beginning of the reference period)	Year, 0
0 04 001		Year (of ending of the reference period)	Year, 0
0 04 002		Month	Month, 0
0 04 003		Day (= 1) [(2)]	Day, 0
0 04 004		Hour (= 6) [(2)]	Hour, 0
0 04 022		Time period (= 1)	Month, 0
0 07 032		Height of sensor above marine deck platform (for precipitation measurement) [(3)]	m, 2
0 08 023		First order statistics (= 4; mean value)	Code table, 0
0 13 060		Total accumulated precipitation **$R_1R_1R_1R_1$**	kg m^{-2}, 1
0 04 053		Number of days with precipitation equal to or more than 1 mm **n_rn_r**	Numeric, 0
0 08 023		First order statistics (set to missing to cancel the previous value)	Code table, 0

Notes:

(1) The time identification refers to the beginning of the one-month period. Except for precipitation measurements, the one-month period is recommended to correspond to the local standard time (LST) month [7].

(2) In case of precipitation measurements, the one-month period begins at 06 UTC on the first day of the month and ends at 06 UTC on the first day of the following month [5].

(3) If the heights/depth of sensors or method of sea/water temperature measurement were changed during the period specified, the value shall be that which existed for the greater part of the period.

Regulations:

B/C 32.1 Section 1 of BUFR or CREX

B/C 32.2 Monthly values from an ocean weather station
B/C 32.2.1 Station identification, date/time, horizontal and vertical coordinates
B/C 32.2.2 Monthly mean values of pressure, temperature, vapour pressure and sea/water temperature
B/C 32.2.3 Monthly precipitation data

B/C 32.3 Monthly normals for an ocean weather station
B/C 32.3.1 Normals of pressure, temperature, vapour pressure and sea/water temperature
B/C 32.3.2 Normals of precipitation

B/C 32.4 Data required by regional or national reporting practices

B/C 32.1 Section 1 of BUFR or CREX

B/C 32.1.1 Entries required in Section 1 of BUFR

The following entries shall be included in BUFR Section 1:

- BUFR master table,
- identification of originating/generating centre,
- identification of originating/generating sub-centre,
- update sequence number,
- identification of inclusion of optional section,
- data category (= 001 for CLIMAT SHIP data),
- international data sub-category (1), (2),
- local data subcategory,
- version number of master table,
- version number of local tables,
- year (year of the century up to BUFR edition 3) (3),
- month (for which the monthly values are reported) (3),
- day (= 1) (3),
- hour (= 0) (3),
- minute (= 0) (3).

Notes:

(1) Inclusion of this entry is required starting with BUFR edition 4.

(2) If required, the international data sub-category shall be included for CLIMAT SHIP data as 020.

(3) The time identification refers to the beginning of the month for which the monthly mean values are reported.

B/C 32.1.2 Entries required in Section 1 of CREX

The following entries shall be included in CREX Section 1:

- CREX master table,
- CREX edition number,
- CREX table version number,
- version number of BUFR master table (1),
- version number of local tables (1),
- data category (= 001 for CLIMAT SHIP data),
- international data sub-category (1), (2),
- identification of originating/generating centre (1),
- identification of originating/generating sub-centre (1),
- update sequence number (1),
- number of subsets (1),
- year (1), (3),
- month (for which the monthly values are reported) (1), (3),
- day (= 1) (1), (3),
- hour (= 0) (1), (3),
- minute (= 0) (1), (3).

Notes:

(1) Inclusion of these entries is required starting with CREX edition 2.

(2) If inclusion of international data sub-category is required, Note (2) under B/C 32.1.1 applies.

(3) Note (3) under B/C 32.1.1 applies.

B/C 32.2 Monthly values from an ocean weather station <3 08 011>

B/C 32.2.1 Station identification, date/time, horizontal and vertical coordinates

B/C 32.2.1.1 Station identification

Ship identifier (0 01 011) shall be always reported as a non-missing value.

Type of station (0 02 001) shall be reported to indicate the type of the station operation (manned, automatic or hybrid).

B/C 32.2.1.2 Date/time (of beginning of the month)

Date <3 01 011> and time <3 01 012> shall be reported, i.e. year (0 04 001), month (0 04 002), day (0 04 003) and hour (0 04 004), minute (0 04 005) of beginning of the month for which the monthly values are reported. Day (0 04 003) shall be set to 1 and both hour (0 04 004) and minute (0 04 005) shall be set to 0.

B/C 32.2.1.3 Horizontal and vertical coordinates

Latitude (0 05 002) and longitude (0 06 002) of the station shall be reported in degrees with precision in hundredths of a degree.

Height of station platform above mean sea level (0 07 030) and height of barometer above mean sea level (0 07 031) shall be reported in meters with precision in tenths of a meter.

B/C 32.2.2 Monthly mean values of pressure, temperature, vapour pressure and sea/water temperature

The monthly mean values of pressure reduced to mean sea level, temperature, vapour pressure and sea/water temperature shall be reported. Any missing element shall be reported as a missing value.

B/C 32.2.2.1 Reference period for the data of the month

Monthly data (with the exception of precipitation data) are recommended to be reported for one-month period, corresponding to the local standard time (LST) month. In that case, short time displacement (0 04 074) shall specify the difference between UTC and LST (set to *non-positive values in the eastern hemisphere, non-negative values in the western hemisphere*).

Time period (0 04 023) represents the number of days in the month for which the data are reported, and shall be expressed as a *positive value* in days.

Note:

(1) A BUFR (or CREX) message shall contain reports for one specific month only. [72.1.3]

B/C 32.2.2.2 First order statistics – Code table 0 08 023

This datum shall be set to 4 (mean value) to indicate that the following entries represent mean values of the elements (pressure reduced to mean sea level, temperature, vapour pressure and sea/water temperature) averaged over the one-month period.

B/C 32.2.2.3 Monthly mean value of pressure reduced to mean sea level

Monthly mean value of pressure reduced to mean sea level shall be reported using 0 10 051 (Pressure reduced to mean sea level) in pascals (with precision in tens of a pascal).

B/C 32.2.2.4 Height of sensor above marine deck platform and height of sensor above water surface

Height of sensor above marine deck platform (0 07 032) for temperature and humidity measurement shall be reported in meters (with precision in hundredths of a meter). This datum represents the actual height of temperature and humidity sensors above marine deck platform at the point where the sensors are located.

Height of sensor above water surface (0 07 033) for temperature and humidity measurement shall be reported in meters (with precision in hundredths of a meter). This datum represents the actual height of temperature and humidity sensors above water surface of sea or lake.

Note:

(1) If the heights of the sensors were changed during the period specified, the value shall be that which existed for the greater part of the period.

B/C 32.2.2.5 Monthly mean value of temperature

Monthly mean value of temperature shall be reported using 0 12 101 (Temperature/dry bulb temperature) in degrees Kelvin (with precision in hundredths of a degree Kelvin); if produced in CREX, in degrees Celsius (with precision in hundredths of a degree

Celsius). Temperature data shall be reported with precision in hundredths of a degree even if they are available with the accuracy in tenths of a degree.

Notes:

(1) This requirement is based on the fact that conversion from the Kelvin to the Celsius scale has often resulted into distortion of the data values.

(2) Temperature t (in degrees Celsius) shall be converted into temperature T (in degrees Kelvin) using equation: $T = t + 273.15$.

B/C 32.2.2.6 Monthly mean value of vapour pressure

Monthly mean value of vapour pressure shall be reported using 0 13 004 (Vapour pressure) in pascals (with precision in tens of a pascal).

B/C 32.2.2.7 Monthly mean value of sea surface temperature, method of its measurement and depth below sea/water surface

Method of sea/water temperature measurement shall be reported by Code table 0 02 038; depth below sea/water surface (0 07 063) shall be reported in meters (with precision in hundredths of a meter).

Monthly mean value of sea surface temperature shall be reported using 0 22 043 (Sea/water temperature) in degrees Kelvin (with precision in hundredths of a degree Kelvin); if produced in CREX, in degrees Celsius (with precision in hundredths of a degree Celsius). Sea/water temperature data shall be reported with precision in hundredths of a degree even if they are available with the accuracy in tenths of a degree.

Notes:

(1) If the method of sea/water temperature measurement or the depth of the sensor below sea/water surface was changed during the period specified, the value shall be that which existed for the greater part of the period.

(2) Notes (1) and (2) under Regulation B/C 32.2.2.5 shall apply.

B/C 32.2.2.8 First order statistics – Code table 0 08 023

This datum shall be set to missing to indicate that the following entries do not represent the monthly mean values.

B/C 32.2.3 Monthly precipitation data

B/C 32.2.3.1 Date/time (of beginning of the one-month period for precipitation data)

Day (0 04 003) and hour (0 04 004) of the beginning of the one-month period for monthly precipitation data are reported. Day (0 04 003) shall be set to 1 and hour (0 04 004) *shall be set to 6*.

Notes:

(1) In case of precipitation measurements, a month begins at 0600 hours UTC on the first day of the month and ends at 0600 hours UTC on the first day of the following month *[Guide to Climatoligical Practices, WMO-No. 100]*.

(2) Year (0 04 001), month (0 04 002) and minute (0 04 005) of the beginning of the month specified in the Regulations B/C 32.2.1.2 apply.

B/C 32.2.3.2 Period of reference for precipitation data of the month

Time period (0 04 023) represents the number of days in the month for which the monthly mean data are reported, and shall be expressed as a *positive value* in days.

Note:

(1) A BUFR (or CREX) message shall contain reports for one specific month only. [72.1.3]

B/C 32.2.3.3 Height of sensor above marine deck platform

Height of sensor above marine deck platform (0 07 032) for precipitation measurement shall be reported in meters (with precision in hundredths of a meter).

This datum represents the actual height of the rain gauge rim above marine deck platform at the point where the rain gauge is located.

Note:

(1) If the height of the sensor was changed during the period specified, the value shall be that which existed for the greater part of the period.

B/C 32.2.3.4 Total amount of precipitation of the month

Total accumulated precipitation (0 13 060) which has fallen during the month shall be reported in kilograms per square meter (with precision in tenths of a kilogram per square meter).

Note:

(1) Trace shall be reported as "- 0.1 kg m^{-2} ".

B/C 32.2.3.5 Indication of frequency group

Frequency group in which the total amount of precipitation of the month falls shall be reported using Code table 0 13 051 (Frequency group; precipitation).

Note:

(1) If for a particular month the total amount of precipitation is zero, the code figure for 0 13 051 shall be given by the highest number of quintile which has 0.0 as lower limit (e.g. in months with no rainfall in the 30-year period, 0 13 051 shall be set to 5). [72.1.4.2]

B/C 32.2.3.6 Number of days with precipitation equal to or greater than 1 mm

Number of days in the month with precipitation equal to or greater than 1 kilogram per square meter shall be reported using 0 04 053 (Number of days in the month with precipitation equal to or greater than 1 mm).

Note:

(1) When the monthly total precipitation is not available, both 0 13 060 and 0 04 053 shall be set to missing. [72.1.4.1]

B/C 32.3 Monthly normals for an ocean weather station <3 08 012>

Meteorological Services shall submit to the Secretariat complete normal data of the elements for stations to be included in the CLIMAT bulletins. The same shall apply when Services consider it necessary to make amendments to previously published normal values. [72.2.1]

B/C 32.3.1 Normals of pressure, temperature, vapour pressure and sea/water temperature

Normal values of pressure reduced to mean sea level, temperature, vapour pressure and sea/water temperature shall be reported. Any missing element shall be reported as a missing value.

B/C 32.3.1.1 Reference period for normal data

Reference period for calculation of the normal values of the elements shall be reported using two consecutive entries 0 04 001 (Year). The first 0 04 001 shall express the year of beginning of the reference period and the second 0 04 001 shall express the year of ending of the reference period.

Note:

(1) The normal data of pressure, temperature and sea/water temperature reported shall be deduced from observations made over a 30-year normal period. [72.2.2]

B/C 32.3.1.2 Specification of the one-month period for which normals are reported

The one-month period for which the normal values are reported shall be specified by month (0 04 002), day (0 04 003) being set to 1, hour (0 04 004) being set to 0, short time displacement (0 04 074) and time period (0 04 022) being set to 1, i.e. 1 month.

Short time displacement (0 04 074) shall be set to *non-positive values in the eastern hemisphere, non-negative values in the western hemisphere*.

B/C 32.3.1.3 First order statistics – Code table 0 08 023

This datum shall be set to 4 (mean value) to indicate that the following entries represent mean values of the elements (pressure reduced to mean sea level, temperature, vapour pressure and sea/water temperature) averaged over the reference period specified in Regulation B/C 32.3.1.1.

B/C 32.3.1.4 Normal value of pressure reduced to mean sea level

Normal value of pressure reduced to mean sea level shall be reported using 0 10 051 (Pressure reduced to mean sea level) in pascals (with precision in tens of a pascal).

B/C 32.3.1.5 Height of sensor above marine deck platform and height of sensor above water surface

Regulation B/C 32.2.2.4 shall apply.

B/C 32.3.1.6 Normal value of temperature

Normal value of temperature shall be reported using 0 12 101 (Temperature/dry bulb temperature) in degrees Kelvin (with precision in hundredths of a degree Kelvin); if produced in CREX, in degrees Celsius (with precision in hundredths of a degree Celsius).

Note:

(1) Notes (1) and (2) under Regulation B/C 32.2.2.5 shall apply.

B/C 32.3.1.7 Normal value of vapour pressure

Normal value of vapour pressure shall be reported using 0 13 004 (Vapour pressure) in pascals (with precision in tens of a pascal).

B/C 32.3.1.8 Normal value of sea surface temperature, method of measurement and depth below sea/water surface

Method of sea/water temperature measurement shall be reported by Code table 0 02 038; depth below sea/water surface (0 07 063) shall be reported in meters (with precision in hundredths of a meter).

Normal value of sea surface temperature shall be reported using 0 22 043 (Sea/water temperature) in degrees Kelvin (with precision in hundredths of a degree Kelvin); if produced in CREX, in degrees Celsius (with precision in hundredths of a degree Celsius).

Notes:

(1) Note (1) under Regulation B/C 32.2.2.7 shall apply.

(2) Notes (1) and (2) under Regulation B/C 32.2.2.5 shall apply.

B/C 32.3.2 Normals of precipitation

Normal values of monthly amount of precipitation and of number of days in the month with precipitation equal to or greater than 1 mm, shall be reported. Any missing element shall be reported as a missing value.

B/C 32.3.2.1 Reference period for normal values of precipitation

Reference period for calculation of the normal values of precipitation shall be reported using two consecutive entries 0 04 001 (Year). The first 0 04 001 shall express the year of beginning of the reference period and the second 0 04 001 shall express the year of ending of the reference period.

B/C 32.3.2.2 Specification of the one-month period for which normals are reported

The one-month period for which the normals of precipitation are reported shall be specified by month (0 04 002), day (0 04 003) being set to 1, hour (0 04 004) *being set to 6* and time period (0 04 022) being set to 1, i.e. 1 month.

Note:

(1) Note (1) under Regulation B/C 32.2.3.1 shall apply.

B/C 32.3.2.3 Height of sensor above local marine deck platform

Regulation B/C 32.2.3.3 shall apply.

B/C 32.3.2.4 First order statistics – Code table 0 08 023

This datum shall be set to 4 (mean value) to indicate that the following entries represent mean values of precipitation data, averaged over the reference period specified in Regulation B/C 32.3.2.1.

B/C 32.3.2.5 Normal value of monthly amount of precipitation

Normal value of monthly amount of precipitation shall be reported in kilograms per square meter (with precision in tenths of a kilogram per square meter) using 0 13 060 (Total accumulated precipitation).

Note:

(1) Trace shall be reported as "- 0.1 kg m^{-2} ".

B/C 32.3.2.6 Normal value of number of days with precipitation ≥ 1 mm

Normal value of number of days in the month with precipitation equal to or greater than 1 kilogram per square meter shall be reported using 0 04 053 (Number of days in the month with precipitation equal to or greater than 1 mm).

B/C 32.4 Data required by regional or national reporting practices

No additional data are currently required by regional or national reporting practices for CLIMAT SHIP data in the *Manual on Codes*, WMO-No. 306, Volume II.

B/C35 – Regulations for reporting CLIMAT TEMP and CLIMAT TEMP SHIP and data in TDCF

General

A BUFR (or CREX) message shall contain reports for one specific month only. [75.8]

TM 309054 - BUFR template for reports of monthly aerological means suitable for CLIMAT TEMP and CLIMAT TEMP SHIP data

3 09 054		**Sequence for representation CLIMAT TEMP and CLIMAT TEMP SHIP data**

Sequence BUFR descriptor <3 09 054> expands as it is shown in the leftmost column below:

		Identification of launch site	Unit, scale
3 01 001	0 01 001	WMO block number	Numeric, 0
	0 01 002	WMO station number	Numeric, 0
0 01 011		Ship's call sign	CCITT IA5, 0
		Date/time(1)	
3 01 011	0 04 001	Year(1)	Year, 0
	0 04 002	Month(1)	Month, 0
	0 04 003	Day (= 1) (1)	Day, 0
3 01 012	0 04 004	Hour (= 0) (1)	Hour, 0
	0 04 005	Minute (= 0) (1)	Minute, 0
		Horizontal and vertical coordinates	
3 01 021	0 05 001	Latitude (high accuracy)	Degree, 5
	0 06 001	Longitude (high accuracy)	Degree, 5
0 07 030		Height of station ground above mean sea level	m, 1
0 07 031		Height of barometer above mean sea level	m, 1
0 07 007		Height release of sonde above mean sea level	m, 0
		Monthly mean data	
0 04 023		Time period (= number of days in the month)	Day, 0
0 04 059		Times of observations used to compute the reported mean values	Flag table, 0
1 15 000		Delayed replication of 15 descriptors	
0 31 001		Delayed descriptor replication factor	Numeric, 0
0 08 001		Vertical sounding significance	Flag table, 0
0 08 023		First order statistics (= 4; mean value)	Code table, 0
0 07 004		Pressure	Pa, –1
0 10 009		Geopotential height	gpm, 0
0 12 101		Temperature/dry-bulb temperature	K, 2
0 12 103		Dew-point temperature	K, 2
0 08 023		First order statistics (= 32; vector mean)	Code table, 0
0 11 001		Wind direction	Degree true, 0
0 11 002		Wind speed	m s^{-1}, 1

0 08 023		First order statistics (= 63; missing value)	Code table, 0
0 11 019		Steadiness of wind	%, 0
0 08 050		Qualifier for number of missing values in calculation of statistic (= 2; temperature)	Code table, 0
0 08 020		Total number of missing entities (days)	Numeric, 0
0 08 050		Qualifier for number of missing values in calculation of statistic (= 9; wind)	Code table, 0
0 08 020		Total number of missing entities (days)	Numeric, 0

Note:

(1) The time identification refers to the beginning of the one-month period.

Regulations:

B/C 35.1 Section 1 of BUFR or CREX
B/C 35.2 Identification of launch site
B/C 35.3 Date/time (of the beginning of the one-month period)
B/C 35.4 Horizontal and vertical coordinates of launch site
B/C 35.5 Monthly mean data
B/C 35.5.1 Period of reference for monthly mean data
B/C 35.5.2 Times of observation used to compute the reported mean values
B/C 35.5.3 Number of reported pressure levels
B/C 35.5.4 Monthly mean data reported for a pressure level
B/C 35.6 Data required by regional or national reporting practices

B/C 35.1 Section 1 of BUFR or CREX

B/C 35.1.1 Entries required in Section 1 of BUFR

The following entries shall be included in BUFR Section 1:

- BUFR master table,
- identification of originating/generating centre,
- identification of originating/generating sub-centre,
- update sequence number,
- identification of inclusion of optional section,
- data category (= 002 for CLIMAT TEMP and CLIMAT TEMP SHIP data),
- international data sub-category (1), (2),
- local data subcategory,
- version number of master table,
- version number of local tables,
- year (year of the century up to BUFR edition 3) (3),
- month (for which the monthly mean values are reported) (3),
- day (= 1) (3),
- hour (= 0) (3),
- minute (= 0) (3).

Notes:

(1) Inclusion of this entry is required starting with BUFR edition 4.

(2) If required, the international data sub-category shall be included as follows:
= 025 for CLIMAT TEMP data,
= 026 for CLIMAT TEMP SHIP data.

(3) The time identification refers to the beginning of the one-month period for which the monthly mean values are reported.

B/C 35.1.2 Entries required in Section 1 of CREX

The following entries shall be included in CREX Section 1:

- CREX master table,
- CREX edition number,
- CREX table version number,
- version number of BUFR master table [(1)],
- version number of local tables [(1)],
- data category (= 002 for CLIMAT TEMP and CLIMAT TEMP SHIP data),
- international data sub-category [(1), (2)],
- identification of originating/generating centre [(1)],
- identification of originating/generating sub-centre [(1)],
- update sequence number [(1)],
- number of subsets [(1)],
- year [(1), (3)],
- month (for which the monthly mean values are reported) [(1), (3)],
- day (= 1) [(1), (3)],
- hour (= 0) [(1), (3)],
- minute (= 0) [(1), (3)].

Notes:
(1) Inclusion of these entries is required starting with CREX edition 2.
(2) If inclusion of international data sub-category is required, Note (2) under B/C 35.1.1 applies.
(3) Note (3) under B/C 35.1.1 applies.

B/C 35.2 Identification of launch site

WMO block number station (0 01 001) and WMO station number (0 01 002) shall be always included as a non-missing value in reports from land stations.
Ship identifier (0 01 011), if available, shall be included in reports from a sea station not exceeding 9 characters.

B/C 35.3 Date/time (of the beginning of the one-month period)

Date <3 01 011> and time <3 01 012> shall be reported, i.e. year (0 04 001), month (0 04 002), day (0 04 003) and hour (0 04 004), minute (0 04 005) of the beginning of the one-month period for which the monthly mean values are reported. Day (0 04 003) shall be set to 1 and both hour (0 04 004) and minute (0 04 005) shall be set to 0.

B/C 35.4 Horizontal and vertical coordinates of launch site

Latitude (0 05 001) and longitude (0 06 001) of the launch site shall be reported in degrees with precision in 10^{-5} of a degree.
Height of station ground above mean sea level (0 07 030) and height of barometer above mean sea level (0 07 031) shall be reported in meters with precision in tenths of a meter.
Height release of sonde above mean sea level (0 07 007) shall be reported in meters.

B/C 35.5 Monthly mean data

The monthly mean values of temperature, dew-point and wind data shall include information for station level (surface) and for standard levels 850, 700, 500, 300, 200, 150, 100, 50, and 30 hPa. Each of the levels shall be reported even if the monthly mean data are not available. Any missing element shall be reported as a missing value. [75.4]

B/C 35.5.1 Period of reference for monthly mean data

Time period (0 04 023) represents the number of days in the month for which the monthly mean data are reported, and shall be expressed as a *positive value* in days.
Note:
(1) A BUFR (or CREX) message shall contain reports for one specific month only. [75.8]

B/C 35.5.2 Times of observation used to compute the reported mean values –
Flag table 0 08 059

This datum shall be used to specify the observation times used to compute the reported mean values:

(a) Bit No. 1 set to 1 indicates usage of data from 0000 UTC.
(b) Bit No. 2 set to 1 indicates usage of data from 0600 UTC.
(c) Bit No. 3 set to 1 indicates usage of data from 1200 UTC.
(d) Bit No. 4 set to 1 indicates usage of data from 1800 UTC.
(e) Bit No. 5 set to 1 indicates usage of data from other hours.

B/C 35.5.3 Number of reported pressure levels

The number of reported pressure levels shall be indicated by Delayed descriptor replication factor 0 31 001 in BUFR and by a four-digit number in the Data Section corresponding to the position of the replication descriptor in the Data Description Section of CREX.

Notes:

(1) The number of pressure levels shall never be set to a missing value.
(2) The number of pressure levels shall be set to a positive value in a NIL report.
(3) In compliance with Regulation B/C 35.5, the number of pressure levels shall be set to 10. If reporting of monthly mean data for additional levels is requested, the number of pressure levels shall be modified accordingly.

B/C 35.5.4 Monthly mean data reported for a pressure level

B/C 35.5.4.1 Vertical sounding significance – Flag table 0 08 001

This datum shall be used to specify vertical sounding significance in the following way:

(a) Bit No. 1 set to 1 indicates surface (station level).
(b) Bit No. 2 set to 1 indicates a standard level.
(c) All bits set to 1 indicate a missing value.

B/C 35.5.4.2 First order statistics – Code table 0 08 023

This datum shall be set to 4 (mean value) to indicate that the following entries represent mean values of the elements (pressure, geopotential height, temperature and dew-point temperature).

B/C 35.5.4.3 Monthly mean value of pressure

Monthly mean value of pressure (0 07 004) shall be reported in pascals (with precision in tens of a pascal).

Notes:

(1) The mean value of station-level pressure shall be reported in the first replication. It shall be the monthly mean value of station-level pressure data measured at the time of release of the radiosonde. [75.5]
(2) The values 85000, 70000, 50000, 30000, 20000, 15000, 10000, 5000, and 3000 Pa shall be reported in the other replications in compliance with Regulation B/C 35.5.

B/C 35.5.4.4 Monthly mean value of geopotential height

Monthly mean value of geopotential height of the level (0 10 009) shall be reported in geopotential meters.

B/C 35.5.4.5 Monthly mean value of temperature

Monthly mean value of temperature (0 12 101) shall be reported in degrees Kelvin (with precision in hundredths of a degree Kelvin); if produced in CREX, in degrees Celsius (with precision in hundredths of a degree Celsius). Temperature data shall be reported with precision in hundredths of a degree even if they are measured with the accuracy in tenths of a degree.

Notes:

(1) This requirement is based on the fact that conversion from the Kelvin to the Celsius scale has often resulted into distortion of the data values.
(2) Temperature t (in degrees Celsius) shall be converted into temperature T (in degrees Kelvin) using equation: $T = t + 273.15$.
(3) The mean value of station-level temperature shall be the monthly mean value of station-level temperature data measured at the time of release of the radiosonde. [75.5]

B/C 35.5.4.6 Monthly mean value of dew-point temperature

Monthly mean value of dew-point temperature (0 12 103) shall be reported in degrees Kelvin (with precision in hundredths of a degree Kelvin); if produced in CREX, in degrees Celsius (with precision in hundredths of a degree Celsius).

Note:

(1) Notes (1) and (2) under Regulation B/C 35.5.4.5 shall apply.

(2) The mean value of station-level dew-point temperature shall be the monthly mean value of station-level dew-point temperature data measured at the time of release of the radiosonde. [75.5]

B/C 35.5.4.7 First order statistics – Code table 0 08 023

This datum shall be set to 32 (vector mean) to indicate that the two following entries wind direction (0 11 001) and wind speed (0 11 002) represent the monthly mean vector wind.

B/C 35.5.4.8 Monthly mean vector wind

The wind direction (0 11 001) of the monthly mean vector wind shall be reported in degrees true and the wind speed (0 11 002) of the monthly mean vector wind shall be reported in meters per second (with precision in tenths of a meter per second).

Notes:

(1) The mean vector wind data shall be reported for all standard levels specified in Regulation B/C 35.5. [75.7.1]

(2) The mean vector wind data shall be reported as missing values for the station level.

B/C 35.5.4.9 Steadiness of wind

Steadiness of wind (0 11 019) at specified standard levels represents the ratio of speed of the monthly mean vector wind to the speed of the monthly mean scalar wind. It shall be reported in units of a percent.

Notes:

Steadiness of wind shall be reported for all standard levels specified in Regulation B/C 35.5.

(1) Steadiness of wind shall be reported as a missing value for the station level.

B/C 35.5.4.10 Number of days in the month for which temperature observations are missing

Number of days in the month for which temperature observations are missing for the specified standard level shall be reported using Total number of missing entities (0 08 020) being preceded by Qualifier for number of missing values in calculation of statistic (0 08 050) set to 2 (temperature).

B/C 35.5.4.11 Number of days in the month for which wind observations are missing

Number of days in the month for which wind observations are missing for the specified standard level shall be reported using Total number of missing entities (0 08 020) being preceded by Qualifier for number of missing values in calculation of statistic (0 08 050) set to 9 (wind).

B/C 35.6 Data required by regional or national reporting practices

No regional requirements are indicated for reporting CLIMAT TEMP and CLIMAT TEMP SHIP data in the *Manual on Codes*, WMO-No. 306, Volume II.

If national reporting practices require inclusion of monthly mean data at additional levels, these data shall be reported using sequence <3 09 054>. Note (3) under Regulation B/C 35.5.3 shall apply.

Note:

(1) A level determined by national decision shall be indicated by Vertical sounding significance 0 08 001 – all bits set to 0.

Recommendation 7 (CBS-Ext.(06))

AMENDMENTS TO THE *MANUAL ON THE GLOBAL DATA-PROCESSING AND FORECASTING SYSTEM* (WMO-No. 485)

THE COMMISSION FOR BASIC SYSTEMS,

Noting:

(1) The *Abridged Final Report with Resolutions of the Fourteenth World Meteorological Congress* (WMO-No. 960),

(2) The *Abridged Final Report with Resolution of the Fifty-seventh Session of the Executive Council* (WMO-No. 988),

(3) The *Abridged Final Report with Resolution of the Fifty-eighth Session of the Executive Council* (WMO-No. 1007),

(4) The Report of Meeting of the RA III/IV Training Workshop on Use of EPS Products (January 2005),

(5) The Report of Meeting of the RA II/V Training Workshop on Use of EPS Products (April 2005),

(6) The Report of Meeting of the RA I Workshop for countries ready to implement operational NWP (September 2005),

(7) The Report of Meeting of the CBS/ET on Modeling of Atmospheric Transport for non-Nuclear Emergency Response Activities (September 2005),

(8) The Report of Meeting of the Workshop for Global Long-range Forecast Producing Centres (October 2005),

(9) The Report of Meeting of the RA I Workshop on Operational Use of GDPFS Products for French-speaking countries (November 2005),

(10) The Report of Meeting of the WMO Workshop on Multi-Hazard, Early Warning Centres' Concept of Operations for the Indian Ocean Tsunami Warning System (November 2005),

(11) The Report of Meeting of the Steering Group for the Severe Weather Forecasting Demonstration Project (December 2005),

(12) The Report of Meeting of the Expert Team on Ensemble Prediction Systems (February 2006),

(13) The Report of Meeting of the Joint Expert Teams On Long-Range Forecasting (Infrastructure and Verification) (April 2006),

(14) The Report of Meeting of the CBS Coordination Group for Nuclear Emergency Response Activities (May 2006),

(15) The Report of Meeting of the CBS Implementation Coordination Team on Data-Processing and Forecasting Systems (June 2006),

(16) The Report of Meeting of the Severe Weather Forecasting Demonstration Project – Subproject RA I (August 2006),

(17) The Report of the RA II/RA VI Regional Training Seminar on GDPFS Products and Improvement of PWS for Early Warnings and Emergency Response (September 2006),

(18) The *Manual on the Global Data-Processing and Forecasting System (GDPFS)* (WMO-No. 485),

Considering:

(1) The need to further clarify existing text in the *Manual on the GDPFS* on Ensemble Prediction Systems,

(2) The need to further clarify existing text in the *Manual on the GDPFS* on Long-range Forecasts,

(3) The need to include in the *Manual on the GDPFS* the criteria to be used to designate Global Producing Centres for Long-range Forecasts, as well as those Centres that have been designated as such a Centre,

(4) The need to further clarify existing text in the *Manual on the GDPFS* on Emergency Response Activities,

(5) The need to include in the *Manual on the GDPFS* the renaming of the RSMCs designated for activity specialization in "Environmental Emergency Response" to become RSMCs with activity specialization in "Atmospheric Transport Modelling",

(6) The need to include in the *Manual on the GDPFS* the standards and procedures for requesting and provision of atmospheric transport modeling backtracking, support to CTBT Verification, and support of other environmental incidents to NMHSs and relevant international organizations as part of the activity specialization for RSMCs for Atmospheric Transport Modellling (formerly named Environmental Emergency Response),

Recommends the amendments to the relevant sections of the *Manual on the GDPFS* (WMO No. 485) Vol. I, Parts I and II, given in the annexes to this recommendation be adopted for inclusion in the *Manual on the GDPFS* to take effect from 1 July 2007;

Requests the Secretary-General to make appropriate changes, as given in the annexes to this recommendation in the *Manual on the GDPFS* (WMO-No. 485);

Authorizes the president of CBS, in consultation with the Secretary-General to make any consequential purely editorial amendments with respect to the *Manual on the GDPFS* (WMO-No. 485).

Annex 1 to Recommendation 7 (CBX-Ext.(06))

PART 1

A. <u>Ensemble Prediction Systems</u>

A.1 Recommended amendment (new) to Vol. I, Part II, APPENDIX II-6

4.1 Ensemble prediction system products
4.1.1 Products for short range and medium range

New paragraph as follows:

(c) Other graphical products

Location-specific time series of Temperature, Precipitation, Wind speed, depicting the most likely solution and an estimation of uncertainty ("EPSgrams"). The definition, method of calculation, and the locations should be documented.

PART 2

A.2 Recommended amendment (revised) to Vol. I, Part II, Attachment II.7 (Table F)

Revised entire section III – Standard Verification Measures of EPS, as follows:

III – STANDARD VERIFICATION MEASURES OF EPS

EXCHANGE OF SCORES
Monthly exchanges:

Ensemble mean
For verification of ensemble mean, the specifications in this table of the attachment for variables, levels, areas and verifications should be used.

Spread
Standard deviation of the ensemble averaged over the same regions and variables as used for the ensemble mean.

Probabilities
Probabilistic scores are exchanged in the form of reliability tables. Details of the format of the reliability tables are provided on the website of the Lead Centre for verification of EPS.

List of parameters
PMSL anomaly ± 1, ± 1.5, ± 2 standard deviation with respect to a centre-specified climatology. Verified for areas defined for verification against analysis.

Z500 with thresholds as for PMSL. Verified for areas defined for verification against analysis.

850 hPa wind speed with thresholds of 10, 15, 25 m s^{-1}. Verified for areas defined for verification against analysis.

850 hPa u and v wind components with thresholds of 10^{th}, 25^{th}, 75^{th} and 90^{th} percentile points with respect to a centre-specified climatology. Verified for areas defined for verification against analysis.

250 hPa u and v wind components with thresholds of 10^{th}, 25^{th}, 75^{th} and 90^{th} percentile points with respect to a centre-specified climatology. Verified for areas defined for verification against analysis.

T850 anomalies with thresholds ± 1, ± 1.5, ± 2 standard deviation with respect to a centre-specified climatology. Verified for areas defined for verification against analysis.

Precipitation with thresholds 1, 5, 10, and 25 mm/24 hours every 24 hours verified over areas defined for deterministic forecast verification against observations.
Observations for EPS verification should be based on the GCOS list of surface network (GSN).

NOTE: Where thresholds are defined with respect to climatology, the daily climate should be estimated.

Scores
Brier Skill Score (with respect to climatology) (see definition below*)
Relative Operating Characteristic (ROC)
Relative economic value (C/L) diagrams
Reliability diagrams with frequency distribution

NOTE: Annual and seasonal averages of the Brier Skill Score at 24, 72, 120, 168 and 240 hours for Z500 and T850 should be included in the yearly Technical Progress Report on the Global Data-processing and Forecasting System.

Annex 2 to Recommendation 7 (CBX-Ext.(06))

PART 1

B. <u>Long-Range Forecasts</u>

B.1 Recommended amendment (new) to Vo. I, Part II, paragraph 1.4.1.2 (b)
Add following note :

1) Centres producing global long-range forecasts, and recognized as such by CBS, are called Global Producing Centres for Long-range forecasts (GPCs). The criteria to be recognized as a GPCs and the list of official recognized GPCs can found in APPENDIX II-8.

PART 2

B.2 Recommended amendment (new) to Vol. I, Part II, APPENDIX II-8

In order to be officially recognized as a GPC (Global Producing Centre of Long-range forecasts), a centre must as a minimum adhere to the following criteria:

- Fixed production cycles and time of issuance;
- Provide a limited set of products as determined by the APPENDIX II-6 of this Manual;
- Provide verifications as per the WMO SVSLRF;
- Provide up-to-date information on methodology used by the GPC;
- Make products accessible through the GPC Website and/or disseminated through the GTS and/or Internet.

Centres that are designated as Global Producing Centres for Long-range Forecasts are as follows: Melbourne, Montreal, Beijing, Toulouse, Tokyo, Seoul, Washington, Exeter, and ECMWF.

PART 3

B.3 Recommend amendment (revised) to Vol. I, Part II, APPENDIX II-6

"Minimum list of LRF products to be made available by global scale producing centres"

1. Forecast Products

Note: it is recognized that some centres may provide more information than the list including for example daily data or hind cast data.

Basic properties

<u>Temporal resolution</u>.

Averages, accumulations or frequencies over 1-month or longer periods (seasons)

<u>Spatial resolution.</u>
2.5° x 2.5° (note: selected to match resolution of current verification data)

Spatial coverage. **Global**
(separate areas of interest to users, down to sub-regions of a continent or ocean basin, may be provided on special request from Members)

Lead time. ~~**0-4 months for seasonal forecasts.**~~ **Any leadtimes between 0, and 4 months (**definition of lead time: for example, a three-monthly forecast issued on 31 December has a lead time of 0 months for a January-to-March forecast, and a lead time of 1 month for February-to-April forecast, etc.)

Issue frequency. **Monthly or at least quarterly**

Output types. Either rendered images (eg forecast maps and diagrams) or digital data.. GRIB-2 format should be used for products posted on FTP-sites or disseminated through the GTS.

Indications of skill including hind cast **should be provided**, in accordance with recommendations from CBS on the Standardised Verification System (Attachments II-8). The minimum required is level 1 and level 2 verification. The verification of Nino3.4 index will only apply to those centres producing such indices. However GPCs are encouraged to provide level 3 verification. Verification results over the hindcast period are mandatory.

Content of basic forecast output: (some products are intended as directly meeting NMS requirements with regard to information needed for end-user applications [direct or further processed]; others are to assist the contributing global centres in product comparison and in the development of multimodel ensembles. These products are regarded as feasible from current systems).

A. **Calibrated outputs from ensemble prediction system showing the mean and spread of the distribution for:**
   - **2 metre temperature over land**
   - **sea surface temperature**
   - **precipitation**
   - **Z500, MSLP, T850**

Notes:

1. These fields are to be expressed as departures from normal model climate.

B. **Calibrated probability information for forecast categories.**

- **2 metre temperature over land**
- **SST (Atmospheric coupled models only)**
- **Precipitation**

Notes:

o B is the minimum requirement. A should be provided, at least, by request.
o **Tercile categories should be provided**, consistent with present capabilities. Information for larger numbers of categories (e.g. deciles) is foreseen, however, as capabilities increase and to match better the anticipated end-user requirements. These targets are implied also for forecasts from statistical/empirical models.
o **Information on how category boundaries are defined should be made available.**
o "Calibrated" implies correction based on systematic errors in model climatology, using at least 15 years of retrospective forecasts.

PART 4

B.4 Recommended amendment (revised) to Vol. I, Part II, Attachment II-8

“Standardized Verification System (SVS) for Long-range Forecasts (LRF)”

In Executive Summary:
Add:

1.5 Exchange of verification information

The SVSLRF verification results are made available through a website maintained by the Lead Centre. The functions of the Lead Centre for SVSLRF include creating and maintaining coordinated Websites for the LRF verification information so that potential users would benefit from a consistent presentation of the results. The address of the website is http://www.bom.gov.au/wmo/lrfvs/.

In : 3. Parameters

The key list of parameters in the Core SVS is provided below. Any verification for these key parameters should be assessed using the Core SVS techniques wherever possible. Many long-range forecasts are produced which do not include parameters in the key list (for example, there are numerous empirical systems that predict seasonal rainfall over part of/or over an entire, country). The Core SVS diagnostics should be used to assess these forecasts also, but full details of the predictions will need to be provided.
***Add**:*
Forecast can be made using different levels of post-processing typically no-post-processing (raw or uncalibrated), simple correction of systematic errors (calibrated, i.e. calibration of mean and of variance) and more complex correction using hindcast skill (recalibrated, e.g. Model Output Statistics or perfect prog approaches). Most centres are currently issuing forecasts resulting from a simple calibration and so for sake of comparison on the Lead Centre website scores for forecasts that were raw or calibrated (as specified in respective skill score section) are to be submitted. At the moment the team prefer to exclude forecast that were recalibrated, but GPCs are encouraged to apply the SVSLRF methodology and to display the results on their recalibrated forecasts on their website.

3.1 Level 1: Diagrams and scores to be produced for regions
Diagrams (e.g. ROC and reliability curves) are to be supplied in digital format as specified on the Lead Centre website.

IN MAIN TEXT:

In 3. SVS for Long-Range Forecasts, Add at the beginning:

Forecast can be made using different levels of post-processing typically no-post-processing (raw or uncalibrated), simple correction of systematic errors (calibrated, i.e. calibration of mean and of variance) and more complex correction using hindcast skill (recalibrated, e.g. Model Output Statistics or perfect prog approaches). Most centres are currently issuing forecasts resulting from a simple calibration and so for sake of comparison on the Lead Centre website scores for forecasts that were raw or calibrated (as specified in respective skill score section) are to be submitted. At the moment the team prefer to exclude forecast that were recalibrated, but GPCs are encouraged to apply the SVSLRF methodology and to display the results on their recalibrated forecasts on their website.

Amend 3.1.4 as:

The following gives a summary of parameters, validation regions and diagnostics that form the core SVS. The required periods, lead-times and stratification against the state of ENSO are given in section 3.2.

The number of realisations of LRF is far smaller than in the case of short term numerical weather prediction forecasts. Consequently it is essential as part of the core SVS, to calculate and report error bars and level of significance (see section 3.3.5).

In order to ease implementation, participating LRF producers may stage the introduction of the core SVS by prioritizing implementation of verification at levels 1 and 2.

Other parameters and indices to be verified as well as other verification scores can be added to the core SVS in future versions.

In 3.3.1 amend the following table as:

⇒ MSSS, provided as a single bulk number, is mandatory for level 1 verification in the core SVS. MSSS together with its three term decomposition are also mandatory for level 2 verification in the core SVS. For the exchange of scores via the Lead Centre website the MSSS and its decomposition term should be calculated using the raw forecasts and preferably not the calibrated ones.

In 3.3.5 Level of significance

MSSS

Amend table as:

⇒ Level of significance will be mandatory in the core SVS once guidelines for calculation have been established for the complete suite of scores. A phased in introduction of level of significance in the SVS may be used (see section 3.1.4).

In 3.4 Hind casts amend first paragraph as:

In contrast to short- and medium-range dynamical Numerical Weather Prediction (NWP) forecasts, LRF are produced relatively few times a year (for example, one forecast for each season or one forecast for the following 90-day period, issued every month). Therefore the verification sampling for LRF may be limited, possibly to the point where the validity and significance of the verification results may be questionable. Providing verification for a few seasons or even over a few years only may be misleading and may not give a fair assessment of the skill of any LRF system. LRF systems should be verified over as long a period as possible in hind cast mode. Although there are limitations on the availability of verification data sets and in spite of the fact that validating numerical forecast systems in hind cast mode requires large computer resources, the hind cast period should be as long as possible. The recommended period for the exchange of scores is advertised on the Lead Centre website (http://www.bom.gov.au/wmo/lrfvs/).

Add in last array:

⇒ Verification results over the hindcast period are mandatory for the exchange of LRF verification scores. Producing centres have to send new hindcast verification results as soon as their forecast system is changed.

In 4. VERIFICATION DATA SETS amend as:

The same data should be used to generate both climatology and verification data sets, although the forecast issuing Centres/Institutes own analyses or reanalyses and subsequent operational analyses may be used when other data are not available.

Many LRF are produced that are applicable to limited or local areas. It may not be possible to use the data in either the recommended climatology or verification data sets for validation or verification purposes in these cases. Appropriate data sets should then be used with full details provided.

Verification should be done using the recommended data sets as listed on the Lead Centre website (http://www.bom.gov.au/wmo/lrfvs/).

Amend as:

6.1.1 **Create, develop and maintain website (the "SVSLRF website") to provide access to the LRF verification information. The address of the website is** http://www.bom.gov.au/wmo/lrfvs/. The website will:

(i) Provide access to standardized software for calculating scoring information (ROC curves, areas, contingency table scores, hit rates, …).

(ii) Provide consistent graphical displays of the verification results from participating centres through processing of digital versions of the results;

(iii) Contain relevant documentation and links to the websites of global-scale producing centres;

(iv) Provide some means for the collection of feedback from NMHSs and RCCs on the usefulness of the verification information;

(v) Contain information and, preferably, provide access to available verification data sets;

6.1.2 The centre will also:

(i) Produce monthly verification data sets in common format on 2.5° x 2.5° grid where appropriate;

(ii) Liaise with other groups involved in verification (e.g. WGSIP, CCl, etc.) on the effectiveness of the current standardised verification system (SVS) and identify areas for future development and improvement;

(iii) Provide periodic reports to CBS and other relevant Commissions assessing the effectiveness of the SVS**.**

(iv) Facilitate the availability of information to assess the skill of long-range forecasts but not to provide a direct inter-comparison between the GPCs' models.

6.1.3 Detailed tasks of the "lead centre":

Annex 3 to Recommendation 7 (CBX-Ext.(06))

C. Emergency Response Activities

C.1 Recommended amendment (revised) to Vol. I, Part II, APPENDIX II-7:

o "Users Interpretation Guide for Atmospheric Transport Model Products provided by RSMCs".

(Introductory section, second paragraph)
"The International Atomic Energy Agency (IAEA) requests support from WMO RSMCs for atmospheric transport modelling products by using the form agreed between WMO and IAEA. The IAEA then sends the completed form immediately, by fax and by e-mail (preferred), to the RSMCs as per the regional and global arrangements and ensures receipt of the form by phone. The Lead-RSMCs shall confirm receipt of the IAEA request by fax or e-mail (preferred) to IAEA. This will

initiate a joint response from the RSMCs in their region of responsibility. The IAEA sends an information copy of its Request Form by fax or by e-mail (preferred) to RTH Offenbach." When the Lead-RSMC's products become available, the Lead-RSMCs shall send an announcement to the IAEA that their respective products are available and the products' location (RSMC's dedicated website), by fax or by e-mail (preferred).“

o "ENVIRONMENTAL EMERGENCY RESPONSE REQUEST FOR WMO RSMC SUPPORT BY IAEA"

Environmental Emergency Response

Request for WMO RSMC Support by IAEA

The IAEA sends the completed form by fax to all RSMCs and RTH Offenbach.
At the same time the IAEA calls the 'Lead' RSMCs (selected on the form) to ensure receipt of this form.

Date/Time of Request: yyyy-MM-dd/HH:mm(UTC)

STATUS: ☐ **EMERGENCY** ☐ **EXERCISE**

REQUESTED RSMCs: (indicate the lead RSMCs by a checkmark below)

☐ EXETER ☐ TOULOUSE ☐ MELBOURNE ☐ MONTREAL ☐ WASHINGTON

☐ BEIJING ☐ TOKYO ☐ OBNINSK ☒ RTH Offenbach

SENDERS NAME :**INTERNATIONAL ATOMIC ENERGY AGENCY**

COMMUNICATION DETAILS:	Tel .: +43 1 2600 22023	use to confirm receipt of request
	Fax: +43 1 26007 29309	use to confirm receipt of request
	Email: eru3@iaea.org	use to confirm receipt of request

NAME OF RELEASE SITE AND COUNTRY (facility and place)

GEOGRAPHICAL LOCATION OF RELEASE: (MUST BE COMPLETED)	.	decimal degrees	☐ N	☐ S
	.	decimal degrees	☐ E	☐ W

DECLARED EMERGENCY CLASS:

☐ NONE ☐ other, specify:

ACTION REQUIRED:

☐ NONE

☐ GO ON STANDBY (request for products or for assistance on weather conditions is to be expected)

☐ GENERATE STANDARD PRODUCTS AND SEND TO IAEA ONLY

☐ GENERATE STANDARD PRODUCTS FOR THE IAEA AND REGIONAL DISTRIBUTION

☐ OTHER ACTION:

(essential accident information for model simulation - if not available, model will execute with standard default values)

RELEASE CHARACTERISTICS:

START OF RELEASE: Date/Time: - - / : (UTC)

DURATION: (hours) or END OF RELEASE: Date/Time: - - / : (UTC)

RADIONUCLIDE SPECIES:

TOTAL RELEASE QUANTITY: (Becquerel)

OR POLLUTANT RELEASE RATE: (Becquerel/hour)

EFFECTIVE HEIGHT OF RELEASE: ☐ surface or

☐ stack height: (m), or

☐ aloft:top: (m), base: (m)

(helpful information for improved simulation)

SITE ELEVATION: (m)

LOCAL METEOROLOGICAL CONDITIONS NEAR ACCIDENT:

(wind speed and direction/weather/cloudiness/precipitation, etc.)

OTHER INFORMATION:

(nature of accident, cause, fire explosion, controlled release, foreseeable development, normal activity, projected conditions, etc)

(to be completed by RSMC)

DATE/TIME OF RECEIPT OF REQUEST: .... (UTC)

FOR LEAD RSMC(s) ONLY
DATE/TIME OF RETURN CONFIRMATION OF RECEIPT:.. (UTC)

Note: All times in UTC

C.2 Recommended amendment (revised) to Vol. I, Part I, paragraph 4.1.2

4.1.2.2 Centres with activity specialization

The functions of RSMCs with activity specialization shall include, inter alia:

(a) Providing long-, extended- and/or medium-range forecasting products;

(b) Providing advisories for tropical cyclones, severe storms and other dangerous weather phenomena;

(c) Providing tailored specialized products to service users in a particular area;

(d) Providing trajectories and atmospheric transport modelling products, including backtracking, in case of environmental emergencies or other incidents;

(e) Providing information on prolonged adverse weather conditions, including drought monitoring;

(f) Undertaking activities related to the WCP and other WMO international programmes. This includes providing climate diagnostic, climate analysis and prediction products to assist in climate monitoring.

4.1.2.3 RSMCs shall also carry out verification and intercomparison of products and arrange regional workshops and seminars on centres' products and their use in national weather forecasting. RSMCs with geographical and activity specialization shall be co-located where possible.

4.1.2.4 RSMCs designated by WMO for the provision of atmospheric transport model products shall implement the Regional and Global Arrangements and related procedures as found in APPENDIX I-3,and/or backtracking in APPENDIX I-6, respectively.

4.1.2.5 The designated WMCs and RSMCs are given in APPENDIX I-1 and the procedures for broadening the functions of existing RSMCs and for designating new RSMCs are given in APPENDIX I-2. ~~APPENDIX~~

NOTE: Guidelines to review the status of RSMCs with geographical specialization are given in Attachment I.1.

C.3 Recommended amendment (revised) to Vol. I, Part I, APPENDIX I-1

APPENDIX I-1

LOCATION OF WMCs AND RSMCs WITH GEOGRAPHICAL SPECIALIZATION AND RSMCs WITH ACTIVITY SPECIALIZATION

1. The WMCs are located at:
Melbourne (southern hemisphere only)
Moscow
Washington

2. The RSMCs with geographical specialization are located at:

Algiers	Khabarovsk	Pretoria
Beijing	Melbourne	Rome
Exeter	Miami	Tashkent
Brasilia	Montreal	Tokyo
Buenos Aires	Moscow	Tunis/Casablanca
Cairo	Nairobi	Washington
Dakar	New Delhi	Wellington
Darwin	Novosibirsk	
Jeddah	Offenbach	

Broadened RSMC functions:

Offenbach — Provision of ultraviolet-index forecasts for Region VI (Europe)

3. The RSMCs with activity specialization are the following:

RSMC Nadi – Tropical Cyclone Centre

RSMC New Delhi – Tropical Cyclone Centre

RSMC Miami – Hurricane Centre

RSMC Tokyo – Typhoon Centre

RSMC La Réunion – Tropical Cyclone Centre

RSMC Honolulu – Hurricane Centre

RSMC European Centre for Medium Range Weather Forecasts (RSMC ECMWF)

Provision of atmospheric transport modelling (for environmental emergency response and/or backtracking)

RSMC Beijing	RSMC Obninsk
RSMC Exeter	RSMC Tokyo
RSMC Melbourne	RSMC Toulouse
RSMC Montreal	RSMC Washington

C.4 Recommended amendment to Vol. I, Part II, paragraphs. 1.4.1.2 (revised), 5.3.10 (revised), 5.3.11 (new)

1.4.1.2 Regional Specialized Meteorological Centres (RSMCs) with activity specialization

Regional Specialized Meteorological Centre (RSMC) with activity specialization shall be designated, subject to the formal commitment by a Member or group of cooperating Members, to fulfil the required functions of the centre and meet the requirements for the provision of WWW products and services initiated and endorsed by the relevant WMO constituent body or bodies concerned. The centre should be capable of preparing independently or with the support of WMCs, and where appropriate, other GDPFS centres and disseminating to Members concerned:

(a) Global medium-range forecasts and related analyses;

(b) Extended- and long-range weather forecasts and related mean analysed values and anomalies;

(c) Tropical cyclone warnings and advisories, storm position, intensity and track forecasts for their areas;

(d) Three-dimensional atmospheric transport modelling products including trajectories, integrated pollutant concentration, and total deposition for environmental emergency response; atmospheric backtracking modelling products;

(e) Drought monitoring products such as drought indices.

5.3.10 Standards in the provision of international services by Regional Specialized Meteorological Centres (RSMC) for atmospheric transport modelling, in radiological environmental emergency response

5.3.10.1 The designated RSMCs with activity specialization in this field shall implement agreed standard procedures and products.

NOTE: Standards in the provision of international services by RSMCs for atmospheric transport modelling, for radiological environmental emergency response are given in APPENDIX II-7.

5.3.11 Standards in the provision of international services by Regional Specialized Meteorological Centres (RSMC) for atmospheric transport modelling in backtracking

5.3.11.1 The designated RSMCs with activity specialization in this field shall implement agreed standard procedures and products.

NOTE: Standards in the provision of international services by RSMCs for CTBT Verification support are given in APPENDIX II-9.

Annex 4 to Recommendation 7 (CBX-Ext.(06))

C.5 Recommended amendment (new) to Vol. I, Part I, APPENDIX I-6

APPENDIX I-6

REGIONAL AND GLOBAL ARRANGEMENTS FOR ATMOSPHERIC BACKTRACKING

NOTIFICATION

In the framework of the cooperation agreement between CTBTO and WMO that entered into force on July 11th, 2003, the (Provisional) Technical Secretariat ((P)TS) notifies the RSMCs designated for the provision of atmospheric backtracking products and the WMO Secretariat in case that anomalous Radionuclide measurements occur in the International Monitoring System. The notification will be in the form of an electronic mail message that will specify the coordinates of the requested stations as well as start and stop of the measurements. The measurement scenario will not be revealed.

Global arrangements for all RSMCs to distribute the products to CTBTO

1. All notified RSMCs shall acknowledge the receipt of the request and deliver the requested atmospheric backtracking products in electronic form and in the predefined format to a server specified by CTBTO/PTS as part of the notification;

2. The products shall be delivered as fast as technically possible within defined timelines;

3. Every participating RSMC that is temporarily unable to honour the request should notify CTBTO/PTS and the WMO Secretariat as soon as possible, but in any case within 24 hours. The contact officer from side of the PTS is specified on the electronic mail message;

4. Requests for support from the PTS are considered confidential and must not be disclosed.

REGIONAL ARRANGEMENTS FOR ONE OR MORE RSMCS TO DISTRIBUTE PRODUCTS TO AN NMHS

If support is required for response to an incident requiring backtracking using atmospheric transport models, then the Permanent Representative with WMO, or the person authorised of the requesting country may direct its request for support to the operational contact point of the designated RSMC(s) for its Regional Association.

1. The RSMC shall consider each request with regard to its capabilities and the suitability of its products to address the requirements and will then respond accordingly.

2. The RSMC shall inform the WMO Secretariat of the request and the agreed actions, and may inform all other designated RSMC's of the request.

3. The RSMC products will be provided to the NMS Operational Contact Point designated by the Permanent Representative.

C.6 Recommended amendment (new) to Vol. I, Part II, APPENDIX II-9

"Products Provided by RSMCs with Activity Specialization in Atmospheric Transport Modelling (Backtracking for CTBT Verification Support)"

APPENDIX II-9

PRODUCTS PROVIDED BY RSMCS WITH ACTIVITY SPECIALISATION IN ATMOSPHERIC TRANSPORT MODELLING (BACKTRACKING FOR CTBT VERIFICATION SUPPORT)

The CTBTO (Provisional) Technical Secretariat requests support from WMO Regional Specialized Meteorological Centres (RSMC) for atmospheric transport modelling (backtracking) products by using an electronic mail message with subject line "====== PTS REQUEST FOR SUPPORT ======" to all RSMCs. This will initiate a response from all the RSMCs.

The designated RSMCs shall

a) Mail back the response form to the responsible officer at the PTS within 3 hours

b) Conduct standardized backtracking computations according to the specifications listed below for all measurements included in the notification message

c) Upload the results on a secured ftp server, as defined in the notification message, within 24 hours of reception and according to the format as defined below

The specifications for the backtracking are as follows:

- Simulate a release of 1.3 10^{15} Bq of a tracer integrated backward in time (no deposition, no decay) at a constant rate at the point of the station location from surface to 30 m from measurement stop to measurement start.

- Calculate the respective (backward) tracer concentrations [in Bq/m^3] at a global 1x1 degree grid, output frequency 3 hours, time average of output 3 hours, from surface to 30 m.
- Simulate backwards in time to the requested ending date/time (usually 6-14 days from sample collection stop)

The PTS shall

a) Restrict requests to cases of anomalous radionuclide measurements or system tests
b) Contact the RSMCs in case no confirmation of a request was received within 3 hours
c) Conduct regular announced and/or unannounced system tests
d) Share the results of tests with the other RSMCs at a website

The (P)TS will not request any graphical or products other than specified above. Customized end-user products will be produced by the (P)TS for submission to the National Authorities, along with RSMC model output. Measurements and end-user products will not be shared by the (P)TS with the RSMCs or the WMO secretariat for reasons of confidentiality.

NOTIFICATION MAIL MESSAGE SENT OUT BY THE PTS TO WMO RSMCs

```
====== PTS REQUEST FOR SUPPORT =====
Date issued: YYYYMMDD hhmm
Responsible officer: NAME

Point of contact:
NAME
Tel. …………………
Fax. ………………….
name@****.***

Secure Website (location/user/password)
---------------
Download of information:
****://**************
username
Password
---------------
Data upload:
****://**************
Username
Password
---------------

For authentication purposes, this mail message is also available
on the website:
****://**************************************.txt
==============================================================
Source-receptor matrix results are requested for
005
stations
 # LON LAT ID Measurement Start/stop time (YYYYMMDD hh)
001 -70.90 -53.10 CLP18 20050328 15 20050329 15
002 -70.90 -53.10 CLP18 20050329 15 20050330 15
003 -71.25 -41.10 ARP03 20050329 12 20050330 12
004 -58.47 -34.54 ARP01 20050329 18 20050330 18
005 -70.90 -53.10 CLP18 20050330 15 20050331 15
==============================================================
Please calculate backward to
YYYYMMDD hh
==============================================================
```

Please upload data within
24
hours

==RESPONSE FORM==
=== WMO Centre response form ===
=== Please send back this form ===
=== to the sender of the request as ===
=== soon as possible ===
===

(x) We will send our contributions within the time limit (default)
( ) We will send our contributions kkk hours later then the time limit
( ) We got your request but are not able to perform computations
===

====== PTS REQUEST FOR SUPPORT =====

FORMAT OF THE MODEL RESULTS AS DELIVERED BY THE RSMCs

Line 1: Header Line (Station longitude, latitude, start of measurement interval (YYYYMMDD hh), end of measurement interval (YYYYMMDD hh), release strength (Bq), number of hours backward, output every "k" hours, time average of output, Station Name)

Line 2-k: data lines (latitude, longitude, time step number, value)

17.57 59.23 20030106 09 20030107 09 0.13E+16 144 3 3 1.00 1.00 "SEP63"
58.00 15.00 1 0.1209120E-01
59.00 15.00 1 0.6446140E-01
60.00 15.00 1 0.3212887E-02
58.00 16.00 1 0.2649441E+01
59.00 16.00 1 0.9029172E+01
60.00 16.00 1 0.7616042E-01
58.00 17.00 1 0.1073919E+02
59.00 17.00 1 0.3082339E+02
60.00 17.00 1 0.1408468E-01
58.00 18.00 1 0.2643455E+00
59.00 18.00 1 0.7357535E+00
58.00 14.00 2 0.7759376E-02
59.00 14.00 2 0.6508716E-01
60.00 14.00 2 0.2403110E-01
61.00 14.00 2 0.6662516E-03
62.00 14.00 2 0.2838572E-04
58.00 15.00 2 0.1015775E+01
59.00 15.00 2 0.5030275E+01
60.00 15.00 2 0.8239139E+00
61.00 15.00 2 0.6797127E-02
62.00 15.00 2 0.6521360E-04
58.00 16.00 2 0.8181147E+01
59.00 16.00 2 0.2503959E+02
60.00 16.00 2 0.5937406E+00
61.00 16.00 2 0.1784474E-02
58.00 17.00 2 0.1403705E+02
59.00 17.00 2 0.3715418E+02
60.00 17.00 2 0.1306086E-01
58.00 18.00 2 0.2718492E+00
59.00 18.00 2 0.7555131E+00
……

Recommendation 8 (CBS-Ext.(06))

DESIGNATION OF GLOBAL PRODUCING CENTRES FOR LONG-RANGE FORECASTS

THE COMMISSION FOR BASIC SYSTEMS,

Noting:

(1) The *Abridged Final Report with Resolutions of the Fourteenth World Meteorological Congress (WMO-No. 960),*

(2) The *Abridged Final Report with Resolutions of the Fifty-seventh Session of the Executive Council* (WMO-No. 988),

(3) The *Abridged Final Report with Resolutions of the Fifty-eighth Session of the Executive Council* (WMO-No. 1007),

(4) The Report of Meeting of the Workshop for Global Long-range Forecast Producing Centres (October 2005),

(5) The Report of Meeting of the Joint Expert Teams On Long-Range Forecasting (Infrastructure and Verification) (April 2006),

(6) The Report of Meeting of the CBS Implementation Coordination Team on Data-Processing and Forecasting Systems (June 2006),

(7) The *Manual on the Global Data-Processing and Forecasting System (GDPFS)* (WMO-No. 485),

Considering:

(1) The need for designating Global Producing Centres for Long-range Forecasts (GPCs for LRF),

(2) That the following Meteorological Centres: Melbourne, Montreal, Beijing, Toulouse, Tokyo, Seoul, Washington, Exeter, and ECMWF provide the required products and the operational service for Long-range Forecasting,

Recommends that the following Meteorological Centres: Melbourne, Montreal, Beijing, Toulouse, Tokyo, Seoul, Washington, Exeter and ECMWF be designated as Global Producing Centres (GPCs) for Long-Range Forecasts with effect from 1 July 2007;

Requests:

(1) The Members operating the designated GPCs to make available their Long-range forecast products, as required, to NMCs and RCCs of WMO Members concerned and to coordinate such activities with the relevant programmes of WMO;

(2) The Secretary-General to arrange for the inclusion of the newly designated GPCs in the *Manual on the GDPFS* as soon as the Executive Council has approved this recommendation.

Recommendation 9 (CBS-Ext.(06))

REVIEW OF RESOLUTIONS OF THE EXECUTIVE COUNCIL BASED ON PREVIOUS RECOMMENDATIONS OF THE COMMISSION FOR BASIC SYSTEMS OR RELATED TO THE WORLD WEATHER WATCH

THE COMMISSION FOR BASIC SYSTEMS,

Noting with satisfaction action taken by the Executive Council on the previous recommendations of the Commission for Basic Systems or related to the World Weather Watch in general,

Considering that some of the previous Executive Council resolutions are still valid,

Recommends that the following Executive Council resolutions be kept in force:

Resolutions 14 and 15 (EC-LV), Resolutions 2 and 9 (EC-LVI), Resolution 2 (EC-LVII), Recommendation 1 (CBS-XIII), Resolutions 3, 13 and 15 (EC-LVIII);

Recommends that the following Executive Council resolutions be not kept in force:

Resolution 12 (EC-LV), Resolution 2 (EC-LVII), Recommendations 2-7 (CBS-XIII), Recommendation 1 (CBS-05), Resolution 2 (EC-LVIII).

ANNEXES

ANNEX I

Annex to paragraph 6.2.78 of the general summary

CODE MIGRATION SCHEDULE

Category →	**Cat. 1: common**	**Cat. 2: satellite observations**	**Cat. 3: aviation(1)**	**Cat. 4: maritime**	**Cat. 5(2): miscellaneous**	**Cat. 6(2): almost obsolete**
Lists of → Traditional code forms ***Schedule ↓***	SYNOP SYNOP MOBIL PILOT PILOT MOBIL TEMP TEMP MOBIL TEMP DROP CLIMAT CLIMAT TEMP	SAREP SATEM SARAD SATOB	METAR SPECI TAF AMDAR ROFOR	BUOY TRACKOB BATHY TESAC WAVEOB SHIP CLIMAT SHIP PILOT SHIP TEMP SHIP CLIMAT TEMP SHIP	RADOB IAC IAC FLEET GRID*(to GRIB)* RADOF	CODAR ICEAN GRAF NACLI etc. SFAZI SFLOC SFAZU RADREP ROCOB ROCOB SHIP ARFOR WINTEM MAFOR HYDRA HYFOR
Start experimental exchange(3)	**Nov. 2002** for some data (AWS SYNOP, TEMP USA)	Current at some Centres	**2006** **2002** at some Centres for AMDAR	**2005** **2003** for Argos data (BUOY, sub-surface floats, XBT/XCTD)	**2004**	Not applicable
Start operational exchange(3)	**Nov. 2005**	Current at some Centres	**2008** **2003** for AMDAR	**2007** **2003** for Argos data (BUOY, sub-surface floats, XBT/XCTD)	**2006**	Not applicable
Migration complete	**Nov. 2010**	**Nov. 2006**	**2016** **2007** for AMDAR	**2012** **2008** for Argos data (BUOY, sub-surface floats, XBT/XCTD)	**2008**	Not applicable

Notes:

(1) Aviation Codes require ICAO coordination and approval, except for AMDAR.

(2) For category 5 consider that codes need to be reviewed in order to decide whether or not they should be migrated to BUFR/CREX. Codes in category 6 are not to be migrated.

(3) All dates above are meant as "not later than". However, Members and Organizations are encouraged to start experimental exchange, and, if all relevant conditions (see below) are satisfied, to start operational exchange as soon as possible.

- Start of experimental exchange: data will be made available in BUFR (CREX) but not operationally, i.e. in addition to the current alphanumeric codes, which are still operational.
- Start of operational exchange: data will be made available in BUFR (CREX) whereby some (but not all) Members rely on them operationally. Still the current alphanumeric codes will be distributed (parallel distribution).
- Migration complete: at this date the BUFR (CREX) exchange becomes the standard WMO practice. Parallel distribution is terminated. For archiving purposes and at places where BUFR (CREX) exchange still causes problems the alphanumeric codes may be used on a local basis only.

Relevant conditions to be satisfied before experimental exchange may start:

- Corresponding BUFR/CREX-tables and templates are available;
- Training of concerned testing parties has been completed;
- Required software of testing parties (encoding, decoding, viewing) is implemented;

Relevant conditions to be satisfied before operational exchange may start:

- Corresponding BUFR/CREX-tables and templates are fully validated;
- Training of all concerned parties has been completed;
- All required software (encoding, decoding, viewing) is operational.

ANNEX II
Annex to paragraph 6.3.33 of the general summary

OTHER LRF DATA AND PRODUCTS FROM GPCs

1. Experimental products desired by users of GPC outputs:

- Averages, accumulations or frequencies over 1-month period to 3-month period.
- Probabilities of exceeding some threshold values (e.g., seasonal rainfall totals above a range of thresholds).
- Risk of extreme climate anomalies that may help in warning of e.g. occurrence of heat and cold waves over a particular region.
- Predicted generalized indices of drought, monsoon etc.
- Dry and wet spells: frequency and duration (with one month lead time).
- Probable date of onset of main rainy seasons (over a region, like South Asia, East Asia, southern Africa, GHA, etc.).
- The need to have first month (0-lead) averages was expressed.

2. The GPV (grid point value) products are preferred in GRIB 2 format rather than NetCDF, especially for downscaling. The requirements are as follows:

- Forecast data for downscaling algorithms; this is likely to require more than monthly mean data, e.g.:
  - Statistics on daily variability
  - Anomalies for some or all ensemble members
  - Hind cast data
- Data for RCM boundary and initial conditions (including SST data).
- Data for calculating regional specialized indices (drought).
- Analysed fields of surface and upper air parameters for use in empirical models as predictors.
- Observed and predicted global weekly values of SST.
- Daily satellite precipitation analysis for use in monitoring through the season.

3. Regional climate centres/NMCs may not have expertise in all aspects of Long-range forecasts. They will need assistance in training from GPCs in the following main areas:

- Interpretation and use of GPC LRF products.
- Downscaling techniques (both statistical and dynamical).
- Verification techniques (for local verification of RCC generated products and application outputs).
- Development of local user applications from RCC downscaled products.
- Use and implementation of regional climate models.

ANNEX III
Annex to paragraph 7.8 of the general summary

RECOMMENDED DESIGNATION PROCEDURES FOR GISCs AND DCPCs

1. Designation Procedure for Global Information System Centres (GISCs)

1.1 The procedure for the designation of GISCs consists of four steps, namely:

i) Statement of WIS requirements and acceptance by the programme bodies

The WMO Technical Commissions and other bodies representing the participating programmes state their requirements for WIS services and will review them periodically. The list of all relevant requirements will be compiled and regularly reviewed by the Inter-Commission Coordination Group on WIS (ICG/WIS) which reports through the president of CBS to EC.

ii) Service offers by potential GISCs

The list of WIS requirements and functions as compiled by the ICG-WIS will be published to serve as a basis for offers to perform the required duties. Existing centres from the WMO basic systems may wish to apply for designation as GISC forming the core infrastructure of WIS. The service offer should include:

- A statement of compliance with the required WIS functions,
- A proposal for the area of responsibility for WIS data services, and a
- Formal commitment by the PR of the Member to provide such services on a routine basis.

The service offer should be addressed to WMO and will be submitted to the ICG-WIS, which will inform the president of the Regional Association(s) concerned; the ICG-WIS will analyse the proposed services versus WIS requirements as well as the compliance to the required WIS/GISC functions and specifications, and will formulate a recommendation.

iii) Demonstration of GISC capabilities

The candidate GISCs will be invited to demonstrate to CBS their capabilities to provide WIS services to the accredited users with the necessary reliability and quality. This refers to the real-time functions of data and product collection and dissemination as well as to non real-time services for requests. It should also include storage functions for the complete set of WIS data and products and relevant up-to-date metadata catalogues. The coordination functions with other GISCs and the planning of mutual back-up services should also be demonstrated. Furthermore, the adherence to WIS standards and relevant data exchange policies and access rights must be granted. A formal commitment and time schedule to implement the GISC and to provide GISC services in accordance with the offer will be given by the PR of the Member operating the candidate GISC. Upon acceptance of the demonstration of capabilities of the candidate GISC, CBS will formulate the recommendation for the GISC designation.

iv) Designation of GISCs

The Executive Council will consider for approval the ICG-WIS recommendation and CBS recommendation for the GISC designation; after the EC approval, the GISC will be included in the relevant WMO programme documentation.

2. Designation of Data Collection or Production Centres (DCPCs)

2.1 There are a considerable number of centres that meet the functional specifications of a DCPC already, either partly or fully. These centres are natural candidates for integration under WIS. Many of these centres have been established under the WWW Programme and have been submitted for a formal acceptance process within CBS (e.g. the World Meteorological Centres (WMC), the Regional Telecommunication Hubs of the GTS (RTH) and the Regional/Specialized Meteorological Centres).

Apart from the operational WWW centres, there are many other centres that have been established under other WMO Programmes for the purpose of collecting programme related data or of providing products and making them available to NMHSs and other users in the form of real-time dissemination or non real-time data services. Most of the above centres and additional centres established under national responsibility have important contributions in the form of data and products to be included in WIS. Some are offering well-developed data management and data dissemination services which are of great interest to WIS.

In view of the fact that many programmes will be participating in WIS, there will be a large number of DCPC candidates. The ICG-WIS has to determine which centres should be integrated in WIS in which function. The total number of DCPCs, unlike the number of GISCs, has no, *a priori,* limitation, provided the GISCs are able to handle the synchronization and other communications with their attached DCPCs.

2.2 In view of the above, the procedure for the designation of DCPCs consists of three steps, namely:

i) Service offers by potential DCPCs
Since potential DCPCs functions would be undertaken by centres that have been established under the respective WMO Programmes, the relevant Technical Commissions are expected to consider the service offers by potential DCPCs (likely according to procedures similar to 1.1 ii above), and to endorse their programmes' candidate DCPCs.

The programmes' candidate DCPCs should then be submitted to the ICG-WIS; the ICG-WIS will analyse the compliance to the required WIS/DCPC functions and specifications, and will formulate a recommendation.

ii) Demonstration of DCPC capabilities
As for candidate GISCs, the candidate DCPC will be invited to demonstrate to CBS their capabilities to provide WIS services in compliance with the DCPCs functions and responsibilities. This refers to the possible real-time functions of data and product dissemination as well as to non real-time services for requests. It should also include the provision of relevant up-to-date metadata catalogues. The coordination and synchronization functions with the associated GISC should also be demonstrated. Furthermore, the adherence to WIS standards and relevant data exchange policies and access rights must be granted. Upon acceptance of the demonstration of capabilities of the candidate DCPC, CBS will formulate the recommendation for the DCPC designation.

iii) Designation of DCPC
The Executive Council will consider for approval the ICG-WIS recommendation and CBS recommendation for the DCPC designation; after the EC approval, the DCPC will be included in the relevant WMO programme documentation.

ANNEX IV
Annex to paragraphs 11.2 and 11.5 of the general summary

TERMS OF REFERENCE OF OPAG TEAMS AND RAPPORTEURS

OPAG ON INTEGRATED OBSERVING SYSTEMS

Work plans for OPAG-IOS Expert Teams

The terms of Reference for the Expert Teams and rapporteurs/coordinators established under OPAG-IOS remain unchanged; the work plans for ET EGOS, ET-AWS, ET-SAT and ET-SUP are as follows:

ET-EGOS WORK PLAN FOR 2007-2008

(a) Update CEOS/WMO databases of user requirements and observing system capabilities and include user reviewed R&D expected performances (upon receiving information from data users and data producers);

(b) Expand user requirements database to include “break-through” values;

(c) Continue Rolling Review of Requirements for ten application areas and expand to new areas as required;

(d) Work with application area Points-of-Contact to update Statements of Guidance;

(e) Review with Rapporteurs and NWP experts the progress concerning OSE guidance for evolution of GOS;

(f) Organize and hold next NWP Impact Studies Workshop in early 2008;

(g) Initiate actions, monitor and assure progress on Implementation Plan for the Evolution of the GOS (EGOS-IP) and coordinate this activity with the Rapporteurs/Coordinators on the Regional Aspects of the GOS. Prepare a summary of progress on EGOS-IP;

(h) Follow up CBS approved recommendations for the evolution to the GOS with particular attention to the developing countries; develop a summary of these activities;

(i) Maintain and improve ET-EGOS web page;

(j) Interaction between ET-EGOS and IPY: take actions to ensure near real-time distribution of IPY observations where possible; review results of observation gap analysis performed by IPY SC on Observations;

(k) Support Chair of ICT/IOS on preparation of a Brochure on the Evolution of the GOS;

(l) Support activities EC Task Team on Integrated WMO Observing Systems;

(m) Review proposal for GCOS Reference Upper-Air Network;

(n) Improve interaction between GOS performance statistics and EGOS-IP;

(o) With other IOS ETs prepare updated vision for the GOS.

ET-SAT WORK PLAN FOR 2007-2008

(a) Review both operational and R&D environmental satellites present capabilities and plans, and provide input to relevant OPAG-IOS, OPAG-ISS Expert Teams and ICT meetings to assist in the integration of WMO-coordinated observing systems;

(b) Review CM recommendations for the relevant period and provide input to OPAG-IOS and ICT work programmes;

(c) Review SOGs and plans for GOS evolution and provide input to ET-EGOS towards improvement of system capabilities, particularly with respect to developing countries;

(d) Review the implications of expanding the space-based component of the GOS baseline to include, namely, sustained observations of additional variables as required for climate monitoring, in concert with ET-SUP and ET-EGOS, and report to CBS as appropriate;

(e) Provide input to other WMO sponsored expert groups and meetings, e.g. JCOMM, GCOS, WCRP and GAW, with regard to satellite system capabilities and their requirements;

(f) Review progress on the Implementation Plan for Evolution of the Space- and Surface-based Subsystems of the GOS, initiate actions as appropriate and coordinate this activity with ET-EGOS.

ET-SUP WORK PLAN FOR 2007-2008

(a) In following the Rolling Review for the Strategy to Improve Satellite System Utilization, analyse the 2007 biennial questionnaire and other relevant information to prepare a new TD summarizing the current status of the Implementation Plan to Improve Satellite System Utilization;

(b) Interact with the IGDDS Implementation Group to check that the data requirements including inter-regional exchange, equipment, standards, content and timeliness are such that WMO Members can take full advantage of the ADMs and the inter-regional data dissemination systems;

(c) In conjunction with ET-SAT, review present and future R&D satellite data and products including their availability and applications towards better utilization by WMO Members;

(d) Represent WMO Member needs to the CGMS/WMO Virtual Laboratory for Satellite Data Utilization (VL) in relevant areas;

(e) In conjunction with WSP Secretariat further clarify the Information Needs of WMO Members regarding access to and utilization of satellite data and products and the associated capacity building, and the best way to meet these requirements;

(f) Further develop the concept of Regional/Specialized Centres on Satellite Products;

(g) Further expand the space-based component of the GOS baseline to include sustained observations of additional variables as required for climate monitoring working jointly with ET-SAT and ET-EGOS;

(h) Further develop “R&D to operations transition” concept and identify in more detail the role WMO could assume;

(i) Prepare documents to assist Members, summarizing the results from the above activities.

ET-AWS WORK PLAN FOR 2007-2008

(a) Update AWS functional specifications in collaboration with CIMO and other Technical Commissions concerned;

(b) Develop the requirements and implementation plan for a robust, low power, continuous communications platform for all AWS, particularly those in remote locations;

(c) Develop the requirements and subsequent implementation plan for AWS hosted sensors to contribute directly to the calibration and ground truth of space-based observations;

(d) Develop the requirements for new sensors or the integration of sensors to meet the deficiencies of AWS following the migration from manual observations;

(e) Address, in collaboration with CIMO, the need for integration of point measurements with area measurements;

(f) Develop guidelines and procedures to assist in the transition from manual to automatic surface observing stations;

(g) Collaborate with other Technical Commissions in preparing guidelines for the implementation of new data types from either new sensors or following the successful integration of sensors;

(h) Develop the recommended four catalogues of AWS metadata;

(i) Develop Guidelines for the siting classification of AWS;

(j) Collaborate with other Technical Commissions in finalization of a list of standard and optional variables to be reported by AWS;

(k) Review BUFR descriptors related to AWS measurements for inconsistencies and traceability to the *International Meteorological Vocabulary* (WMO-No. 182);

(l) With other IOS ETs update the vision for the GOS.

OPAG ON INFORMATION SYSTEM AND SERVICES

The additional tasks for the OPAG on Information System and Services are as follows:

Implementation-Coordination Team on Information Systems and Services (ICT-ISS)

To consider the most effective mechanisms for carrying a deep and extensive revision and re-organization of the *Manual on the GTS* to better match the current technologies and practices and to assist Members in their design and implementation of relevant information systems;

To assist the Management Group in establishing an expert team for assessing advantages and disadvantages of different data representation systems (e.g. BUFR, CREX, XML, NetCDF, HDF) for use in real time operational exchange between NMHSs and in transmission of information to users outside the NMHSs;

In coordination with the ICG-WIS and the CBS Management Group, to consider the most effective mechanisms and develop a realistic schedule for carrying out the development of appropriate regulatory documentation on WIS (e.g. a Manual on WIS) including organization and recommended practices and procedures, guidance material for implementation, and a WIS guide for NCs clarifying their contribution, involvement and benefits for their participation in WIS development and services.

Coordination Team on Migration to Table Driven Code Forms (CT-MTDCF)

To prepare a letter, which the Secretariat should send to the WMO Members, with two annexes: an outline of the main actions or tasks which should be considered and possibly undertaken, and a Migration Guidance document;

To coordinate the development of a website providing validation service to facilitate operational implementation and pre-operational testing of migration data flows.

Inter-Programme Expert Team on Metadata Implementation (IPET-MI)

To take the lead on identifying tools to allow users to create metadata documents, giving priority to tools to allow automated “harvesting” of routine data, to create an editor for manually creating metadata and to prepare a “best practice” guide;

To communicate relevant ISO 191xx standards to other teams of the OPAG-ISS and to prepare for the use of “features” in version 2.0 of the WMO Core Metadata Standard.

Rapporteur on the WMO Guide on Data Management

To pursue the coordination the edition of the Guide on WWW Data Management with the assistance of the Secretariat.

ET on WIS-GTS Communication Techniques and Structure (ET-CTS)

To further develop the WIS-GTS data-communication structure and consider how to improve global exchange of high priority data and products in support of a virtual all hazards network within the WIS-GTS;

To keep abreast of IPv6 developments;

To pursue the development/update of guidance material for the use of the Internet with minimized operational and security risks, and for the use of adequate ICT for NMHSs of developing countries;

To continue to keep abreast of VPN developments and to update and refine accordingly the guidance documentation;

To consider the full implications of the introduction of MPLS, and to review the exchange and routeing mechanisms for messages and files on the GTS in the light of the new capabilities of any-to-any connectivity, with a view to WIS and with a view to improving exchange of high priority data and products in support of a virtual all hazards network within the WIS-GTS.

Expert Team on WIS GISCs and DCPCs (ET-WISC)

To develop specifications for the GISC/DCPC/NC interfaces, including a unified user interface for WIS components.

Steering Group on Radio-Frequency Coordination (SG-RFC)

To actively pursue its activities, with focus on the preparatory activities for WRC-07, including the ITU-R Conference Preparatory Meeting (CPM) planned for February 2007.

Expert Team on GTS-WIS Operations and Implementation (ET-OI) and Rapporteur on WWW Monitoring

To further consolidate and maintain the <data designator> list, consistent with data categories and sub-categories defined in the Common Table C-13 of the *Manual on Codes*;

To prepare a guide on the implementation of the IWM, which could be used during the pre-operational phase to make an assessment of the results and experience gained during the pre-operational phase and to refine the guide accordingly;

To revise the procedures of the Integrated WWW Monitoring (IWM) with a view to starting the monitoring of the availability of BUFR/CREX reports at WWW centres during the IWM pre-operational phase.

OPAG ON DATA-PROCESSING AND FORECASTING SYSTEM

Future Working Structure of the OPAG on DPFS and Terms of Reference of its Expert Teams, Coordination Groups, Rapporteur in the period (2007-2008)

1. Implementation Coordination Team on Data-Processing and Forecasting System

(a) Identify new emerging requirements (input required from RAs and other bodies);

(b) Determine how GDPFS Centres can best contribute to fulfill emerging requirements;

(c) Participate in THORPEX planning groups as appropriate to advise on conditions and requirements for practical implementations in operational systems;

(d) Identify needs for training through workshops and other means of delivery;

(e) Coordinate the implementation of decisions by CBS related to GDPFS;

(f) Review of Expert Teams and Rapporteurs and make recommendations to CBS concerning future work.

2. Coordination Group on Forecast Verification

(a) In consultation with the relevant Expert Teams, review procedures for verification of the performance of forecasting systems to ensure that they are adequate and meet CBS needs;

(b) Ensure that verification systems are appropriate to emerging forecast types such as probabilistic forecasts, very high resolution NWP products, and nowcasting products;

(c) Develop suitable verification procedures for severe weather forecasts and warnings;

(d) Review Lead Centre activities and provide guidance as appropriate;

(e) Liaise with WWRP/WGNE as required;

(f) Provide guidance on how to implement verification systems.

3. Expert Team on Ensemble Prediction Systems

(a) Provide advice on EPS in relation to probabilistic forecasts in the context of short- and medium-range EPS products, focusing on applications concerned with all aspects of the EPS systems which forecast the weather on a daily basis;

(b) Review progress on EPS and its application to severe weather forecasting including progress on multi-centre ensembles and on regional model based EPS, and prepare ways to make best operational usage of these developments;

(c) Review the list of fields and products that should be distributed taking into account their potential skill and the requirement of all relevant WMO Programmes;

(d) Propose standards for EPS products (e.g. EPS-grams, presentation of cyclone tracks and strike probabilities, calculation of probability, calibration methodologies, etc.) to ensure compatibility of EPS products supplied to WMO Members by different centres;

(e) Develop education and training material for forecasters including rationale of concepts and strategies of EPS, and on the nature, interpretation and application of EPS products, with a view to contributing to the *Guide on the GDPFS*;

(f) In consultation with the Coordination Group on verification, review verification system for EPS products and provide Forecast guidance on the interpretation of verification;

(g) Support the further development of the Lead Centre on Verification of EPS by reporting on verification measures and determining the best way of presenting skill of ensemble forecasting systems. Provide relevant software to NMHSs through the Lead Centre Website;

(h) Propose an update to the *Manual on the GDPFS* (WMO-No. 485) concerning:

1. The list of output products available for international exchange and dissemination,
2. Post-processing and applications of the EPS and how to integrate them into the forecast system,
3. The verification system for EPS;

(i) Develop and test procedures for the exchange of EPS data, including the needs of large centres to exchange their ensembles;

(j) Participate in THORPEX Working Groups:

1. To ensure that the proposed GIFS (Global Interactive Forecast System) is suitable for operational implementation and application,
2. To review progress on the use of EPS for targeting of observations.

4. Rapporteur on Infrastructure for Numerical Weather Prediction (NWP)

(a) In consultation with the relevant Expert Teams and in coordination with the Regional Rapporteurs on GDPFS, review the minimum list of NWP products to be exchanged on the GTS (WIS);

(b) Provide requirements for the access to or dissemination of the products to help OPAG/ISS in determining appropriate technical means of meeting these requirements;

(c) Review the need for establishing standards and guidelines for the provision of initial and boundary conditions to NMCs for limited area models for operational NWP.

5. Expert Team on Very Short-Range Forecasting

(a) Provide guidance on the use of NWP models and of nowcasting systems for the 0 to 12 hours' description of weather parameters, including probabilistic description, in light of the experience and progress in research;

(b) In consultation with the Coordination Group on Forecast verification:

1. Identify suitable techniques for the verification of very high resolution NWP;
2. Provide guidelines for the development of operational verification of 0 to 12 hours forecast products;

(c) Propose an update to the *Manual on the GDPFS* (WMO-No. 485) as required.

6. Expert Team on Extended- and Long-range Forecasting

(a) On the basis of stated requirements for LRF products and their improvements, review input from the Global Producing Centres (GPCs), Regional Climate Centres (RCCs) and NMHSs and develop proposals concerning the establishment and implementation of appropriate operational infrastructure for the production, access dissemination and exchange of LRF including multi-model ensembles;

(b) Develop procedures for the exchange of LRF forecasts between GPCs, including defining products (multi-model ensemble, model output, forecast skill, etc.) and defining terms and conditions for exchange;

(c) Develop new interpretation guidance to facilitate the use of extended- and long-range anomaly forecasts, with a view to contributing to the *Guide on the GDPFS*;

(d) Report on production, access, dissemination and exchange and provide recommendations for future consideration and adoption by CAS, CCl, CBS and other appropriate bodies;

(e) Coordinate the provision of extended- and long-range forecast verification scores and related information from GPCs for use by NMHSs and RCCs;

(f) Encourage and monitor feedback from NMHSs and RCCs to GPCs on the usefulness of verification information provided under the scheme;

(g) Contribute to the further development of the role of the Lead Centre on Verification and of the Website including the development and provision of relevant software and data sets;

(h) In consultation with the Coordination Group on Forecast Verification, recommend updates to operational practices to be followed in computation of verification statistics and the information useful to attach to extended and long-range forecast products in the light of the experience and progress in research on verification activities;

(i) In consultation with CAS (CLIVAR/Working Group on Seasonal to Interannual Prediction) and CCl, propose recommendations for improvements of the SVSLRF including for developing areas such as multi-model ensembles.

7. Coordination Group on Nuclear Emergency Response Activities

(a) Test and improve the collective ability of all RSMCs, the IAEA, the RTH Offenbach and NMHSs in the ERA to fulfil the operational requirements specified in global and regional arrangements, according to adopted standards and procedures;

(b) Implement and explore further improved distribution/access methods for specialized products to NMHSs, and the IAEA in collaboration with the IAEA and other relevant organizations;

(c) Collate the individual capabilities of RSMCs to produce enhanced products in support of nuclear emergencies;

(d) Examine the operational availability of radiological monitoring data;

(e) Develop concepts of operational arrangements for atmospheric transport Modelling backtracking products;

(f) Pursue the implementation of operational arrangements with CTBTO.

8. Expert Team on Modelling of Atmospheric Transport for Non-nuclear ERA

(a) Identify the needs of the NMHSs for atmospheric transport modelling;

(b) Examine the atmospheric transport modelling capabilities of RSMCs and other centres for support to non-nuclear emergencies, for example in volcanic eruptions, dust storms, wild-land fires, chemical and biological incidents and other hazards;

(c) Identify the potential role of international organizations relevant to non-nuclear ERA (e.g. WHO, UNEP, UN-OCHA, others);

(d) Review the status and develop an action plan.

9. Rapporteur on the Application of NWP to Severe Weather Forecasting

(a) Review the application of NWP to severe and high impact weather forecasting at all ranges;

(b) Report on new developments and advances in severe and high impact weather forecasting;

(c) Provide advice on the proposed demonstration project(s).

OPAG ON PUBLIC WEATHER SERVICES

The outstanding tasks for the OPAG on Public Weather Services (from those approved at CBS XIII for the period 2005–2008) are given below. In addition, the ICT may add further tasks as it sees appropriate when it meets in 2007.

Expert Team on Services and Products Improvement

(a) Workshop on the applicability of probabilistic forecast products and services facilitated by ensemble prediction systems (EPS) (to include forecasters and representatives from the emergency management community).

(b) Preparation of a supplement to the Guidelines on Biometeorology and Air Quality forecasting.

(c) Expand work on verification techniques piloted in RAVI and the preparation of a technical document on the subject.

Expert Team on Public Weather Services in support of DPM

(a) Compilation of case studies and success stories on how the role of PWS in disaster prevention and preparedness, in particular through effective warning systems, contributes to reduced vulnerability.

(b) Pursue development of linkages between SWIC and EMMA (MeteoAlarm) as this European project moves into its operational phase.

Expert Team on the Communication aspects of PWS

(a) Develop criteria for the identification of appropriate trainers and trainees for consideration for PWS media presentation training initiatives.

(b) Compile and publish examples of "Best Practice" in the media presentation of all weather and climate-related information.

(c) Finalize the publication and distribution of the user guide pamphlet on the WWIS and SWIC websites.

(d) Continue to evaluate the effectiveness of WWIS and SWIC.

(e) Prepare and publish Guidelines on the communication of uncertainty and confidence in the presentation of probabilistic weather forecasts.

Implementation Coordination Team

(a) Initiate the design of projects, in coordination with the appropriate Expert Teams, to move many of the PWS Programme activities into an implementation phase, building on the set of PWS Guidelines already published and the analysis of surveys already conducted.

(b) Continue to develop guidance on the needs and requirements of PWS as input to the design and implementation of THORPEX.

(c) Follow up on areas which need further collaboration with other CBS OPAGs based on the information gathered through a questionnaire distributed to the Chairs.

RAPPORTEUR ON QUALITY MANAGEMENT FRAMEWORK

1. To review, as appropriate, CBS documents addressing quality guidance revised by the responsible OPAGs so as to ensure that the terminology used in them is in agreement with the definitions of the quality related terms given in the ISO 9000:2005 standard.

2. To represent the Commission and actively participate in the work of the ICTT-QMF.

3. To update yearly, in coordination with the OPAGs, the list of valid CBS guidance documents to be used by Members.

4. To report to the Commission and advise the Commission on activities that should be undertaken to support the WMO QMF as integral part of the Commission activities.

CBS GENDER FOCAL POINT

(a) To gather and analyse details as required, of the role of women and men in the work of the Commission;

(b) To liaise with the WMO Gender Focal Point and to jointly collect and disseminate information including studies and policies on the role of women in areas relevant to the Commission;

(c) To collaborate with gender focal points in other technical commissions;

(d) To explore, document and make recommendations for addressing the need for capacity building in each region, pertinent to the commission;

(e) To submit reports in accordance with the requirements of the CBS Management Group.

APPENDIX

LIST OF PARTICIPANTS

1. Officers of the session

President	A.I. Gusev (Russian Federation)
Vice-President	G.-R. Hoffmann (Germany)

2. Representatives of WMO Members

Algeria	
S. Fekhar	Delegate
Australia	
S. Barrell	Principal Delegate
P. Gigliotti	Delegate
T. Hart	Delegate
Azerbaijan	
S. Shiraliyev	Principal Delegate
S. Khalilov	Delegate
Bahrain	
Y.A. Khalaf	Delegate
Belarus	
A. Sushchenia	Delegate
Belgium	
D. Gellens	Delegate
Brazil	
J. M. de Rezende	Principal Delegate
W. Almeida	Delegate
British Caribbean Territories	
F. Sambula	Principal Delegate
Bulgaria	
M. Grueva-Altanova	Principal Delegate
Canada	
A. Simard (Ms)	Principal Delegate
M. Jean	Alternate
T. Nichols	Delegate
S. Nadon	Delegate
J-F. Gagnon	Delegate
China	
Zhang Wenjian	Principal Delegate
Yang Jun	Delegate
Zhao Licheng	Delegate
Shi Peiliang	Delegate
Hu Xin	Delegate

Croatia	
I. Čačić	Principal Delegate
K. Pandžić	Delegate
Czech Republic	
E. Červená (Ms)	Principal Delegate
Denmark	
N. Olsen	Delegate
Egypt	
M.H. Hassan	Delegate
Estonia	
J. Saar	Principal Delegate
Finland	
P. Plathan	Principal Delegate
France	
B. Strauss	Principal Delegate
M. Dell'Acqua	Delegate
Germany	
G-R. Hoffmann	Principal Delegate
G. Steinhorst	Delegate
Hong Kong, China	
Wai Man MA	Principal Delegate
Hungary	
M. Buránszkiné Sallai (Ms)	Delegate
Iceland	
G. Hafsteinsson	Principal Delegate
India	
A.K. Bhatnagar	Delegate
Indonesia	
A. Sumartono	Principal Delegate
A. Badrul Jamal	Delegate
Iran, Islamic Republic of	
A.M. Noorian	Principal Delegate
M. Jabbari (Ms)	Delegate
Ireland	
P. Halton	Principal Delegate
G. Fleming	Delegate
Italy	
D. Villa	Principal Delegate
A. Raspanti	Delegate
Japan	
H. Ichijo	Principal Delegate
K. Koizumi	Delegate
A. Shimazaki	Delegate

Kenya	
J.R. MukabanaPrincipal	Delegate
W. Nyakwada	Delegate
Libyan Arab Jamahiriya	
A.R. Wlad ELHAJ	Principal Delegate
H.S. Ganedi	Delegate
Lithuania	
V. Auguliené (Ms)	Delegate
Malaysia	
Tan Huvi Vein	Delegate
Morocco	
A. Mokssit	Delegate
Namibia	
E. Akwaake	Principal Alternate
F. Uirab	Delegate
Netherlands	
T. van Stijn	Principal Delegate
New Zealand	
T. Quayle	Principal Delegate
Norway	
R. Skålin	Principal Delegate
K. Bjørheim	Alternate
Oman	
A.H. Al-Harthi	Principal Delegate
S.A. Al-Harthi	Delegate
Poland	
M. Ostojski	Principal Delegate
J. Zielinski	Alternate
B. Ozga-Zielinski	Delegate
Republic of Korea	
B.J. Koo	Principal Delegate
K.J. Park	Alternate
H.S. Lee	Delegate
W.T. Yun	Delegate
D.I. Lee	Delegate
H.D. Yoo	Delegate
D.E. Chang	Delegate
B.H. Heo	Delegate
M.L. Ou	Delegate
J.C. Nam	Delegate
S.O. Han	Observer
H.S. Jung	Observer

Russian Federation

V. Dyadyuchenko	Principal Delegate
A. Gusev	Delegate
R. Vilfand	Delegate
A. Minaev	Delegate
A. Gavrilov	Delegate
S. Lubov	Delegate
L. Bezruk	Delegate

Senegal

S. Diallo	Principal Delegate

Serbia

J. Andrejevic (Ms)	Principal Delegate
P. Sunderic	Delegate
D. Jovanovic	Delegate

Slovakia

I. Zahumenský	Delegate

South Africa

J. Mphepya	Principal Delegate
M. Ndabambi	Delegate

Sweden

T. Kvick	Delegate

Switzerland

P. Rauh	Principal Delegate
E. Grüter (Ms)	Delegate

Turkey

C. Oktar	Principal Delegate

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Y.N. Al Kalbani	Principal Delegate
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A. Dhanaani	Delegate
H. Banihmad	Delegate
A. Al Hamairy	Delegate

United Kingdom of Great Britain and Northern Ireland

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T. Butcher	Delegate

United Republic of Tanzania

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J.E. Jones	Principal Delegate
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J.F.W. Purdom	Delegate
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