WORLD METEOROLOGICAL ORGANIZATION

COMMISSION FOR BASIC SYSTEMS

ELEVENTH SESSION

CAIRO, 28 OCTOBER–7 NOVEMBER 1996

ABRIDGED FINAL REPORT WITH RESOLUTIONS AND RECOMMENDATIONS

WMO-No. 854

Secretariat of the World Meteorological Organization - Geneva - Switzerland
1997

ISBN 92-63-10854-4

NOTE

The designations employed and the presentation of material in this publication do not imply the expression of any opinion whatsoever on the part of the Secretariat of the World Meteorological Organization concerning the legal status of any country, territory, city or area, or of its authorities, or concerning the delimitation of its frontiers or boundaries.

CONTENTS

Page

RESOLUTIONS ADOPTED BY THE SESSION

RECOMMENDATIONS ADOPTED BY THE SESSION

Page

ANNEXES

APPENDICES

GENERAL SUMMARY OF THE WORK OF THE SESSION

1. OPENING OF THE SESSION (agenda item 1)

1.1 The eleventh session of the Commission for Basic Systems (CBS) was held in Cairo from 28 October to 7 November 1996 at the invitation of the Government of Egypt. The session, which took place in the Conference Centre of the Heliopolis Movenpick Hotel, was opened at 10 a.m. on 28 October 1996 by the president of the Commission, Dr A. A. Vasiliev.

1.2 The Secretary-General of the World Meteorological Organization (WMO), Professor G. O. P. Obasi, welcomed the participants to the session on behalf of the Organization. He expressed his pleasure that the session was being held in Egypt, and in Cairo in particular, as well as his gratitude to the Government of Egypt for its kind invitation, for having provided such splendid facilities, and for making all the necessary arrangements for the session. As to the session itself, the Secretary-General recalled that the primary function of CBS remained the planning and development of the basic systems in support of the World Weather Watch (WWW), on which all WMO Programmes depended. The Commission was also expected to contribute fully to the World Climate Programme (WCP), the Global Climate Observing System (GCOS), the Global Terrestrial Observing System (GTOS), the Global Ocean Observing System (GOOS), and the follow-up to the United Nations Conference on Environment and Development (UNCED) and Agenda 21. He emphasized the need for the basic systems to continue to develop and adapt to make the best use of new knowledge and technology, and to take into account the changing socio-economic conditions and requirements. The Secretary-General noted that the session was expected to review and make recommendations on the further modernization of the observing, the telecommunication, and the data-processing systems and the data management function, and that that would include a study on the potential use of Internet for the exchange of meteorological information and the impact which that might have on the operations of national Meteorological and Hydrological Services (NMHSs). He hoped that the session would also give urgent attention to the serious impact that the imminent closure of the OMEGA radio-navigation system was likely to have on the worldwide network of upper-air sounding stations.

1.3 Professor Obasi was pleased to acknowledge that the Commission had carried out its responsibilities in regard to Resolution 40 (Cg-XII) — WMO policy and practice for the exchange of meteorological and related data and products including guidelines on relationships in commerical meteorological activities, concerning the exchange of data and products and urged all concerned to continue to strive to keep up the spirit and letter of that resolution. He also noted the support being given to other programmes such as arrangements for meteorological assistance to humanitarian missions and the development of a coordinated programme of emergency response activities. He noted with satisfaction that the Commission had prepared a provisional *Guide to Public Weather Services Practices* (WMO-No. 834), which would go a long way in assisting NMSs to develop and improve their activities, and that much had still to be done in such areas as training and disaster preparedness. He expressed the hope that recent progress in improving the participation of developing countries in the work of technical commissions and in CBS, in particular, would continue and welcomed, in that connection, the participation in the session for the first time of representatives of the regional associations (RAs). He hoped that all concerned would continue to strive towards universal participation in CBS so that the WWW as a whole would continue to develop and function as a worldwide coherent system for the benefit of all Member countries. He wished the session every success.

1.4 On behalf of His Excellency, Soliman Metwali, Minister of Transport, the Vice-Minister and Head of the Civil Aviation Sector, Mr Alaa Rahmy, welcomed the participants to Egypt and expressed his country's pleasure and honour at hosting such a major WMO meeting. He stressed the importance of the basic systems to the operation of national Meteorological Services (NMSs) and to meteorology as one of the most important sciences; as it did not respect national boundaries, international cooperation was essential for its study and application. Weather and climate, he noted, had a direct impact on the socio-economic activities of every country and Governments were giving more and more attention to those and other related environmental matters. WMO, and CBS in particular, played a vital role in coordinating meteorological activities worldwide especially in arranging for the exchange of data and processed information. Mr Rahmy also emphasized the continuing need to modernize Meteorological Services by introducing new technology and, in that, CBS also had great responsibilities in providing guidance and standardization. He and his staff would do everything possible to ensure the smooth running of the meeting and to make the participants' stay in Cairo a memorable one.

1.5 Mr H. M. Zohdy, Permanent Representative of Egypt with WMO, extended, on behalf of the Egyptian Meteorological Authority, a warm welcome to all participants. He spoke of the vital importance of meteorology and particularly of CBS in the modern world, especially in view of the immense human and economic losses caused by natural disasters. He commended the work of WMO in which the Meteorological Authority of Egypt was striving to play its full role; through a programme of

modernization there had been notable improvements in the dissemination of warnings and services rendered to the general public, to aviation, and to the economic sectors. He wished the session every success in its deliberations.

1.6 The president of the Commission, Dr A. A. Vasiliev, thanked the Government of Egypt and the Egyptian Meteorological Authority for their generosity in hosting that meeting of CBS. He spoke of the many new and broader responsibilities of the Commission in supporting all WMO Programmes, including public weather services and satellite activities. He referred to the many challenges facing the Commission, such as the potential impact of the commercialization of meteorological services, the increasing pressures to reduce costs, and the need to make the best use of new technologies in the interests of all countries. He acknowledged the great devotion, hard work, and skill of many individuals throughout the world who had contributed to the progress made by the Commission in meeting its heavy responsibilities. The combined wisdom, experience, and enthusiasm of its members were at the core of its success.

1.7 The president added that one of those persons who had contributed more than most over a period of more than 20 years from the early 1970's was Dr T. Mohr (Germany). As chairman of the Working Groups on Observations and on Satellites and as vice-president of the Commission from 1988 to 1992, he had given much to the development of the WWW, particularly the Global Observing System (GOS), and had shown outstanding qualities of leadership, tact and dedication. Upon a recommendation of the CBS Advisory Working Group (AWG), the president proposed that Dr Mohr be awarded an appropriately worded certificate in recognition of his long and outstanding service to the Commission. The proposal was enthusiastically endorsed by the session with the understanding that the award would be presented to Dr Mohr at a suitable occasion in the near future.

1.8 There were 150 participants at the session which included representatives of 67 Members of WMO and 7 international organizations. A complete list of participants is given in Appendix A to this report.

2. ORGANIZATION OF THE SESSION (agenda item 2)

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

In accordance with WMO General Regulation 22, a Credentials Committee was established comprising the principal delegates of Canada, Jordan, New Zealand, Oman, Seychelles, and Venezuela. The session approved the report of the Committee.

2.2 ADOPTION OF THE AGENDA (agenda item 2.2)

The provisional agenda was adopted by the session. The final agenda is reproduced in Appendix B to this report.

2.3 ESTABLISHMENT OF COMMITTEES (agenda item 2.3)

2.3.1 One working committee was established to examine in detail the various agenda items. Following proposals made by the president, the following chairmen were appointed for the consideration of individual items:

G. B. Love (Australia), items 4 and 6.1;
F. S. Zbar (United States), item 6.2;
E. A. Mukolwe (Kenya), item 6.3;
H. Allard (Canada), item 6.4;
Yan Hong (China), item 6.5;
R. A. Sonzini (Argentina), items 6.6, 8 and 13;
A. A. Hassan (Egypt), item 7;
H. A. Abu Talib (Egypt), item 9.

Items 4 (general discussion only), 5, 10 11 and 12 would be considered in a Committee of the Whole, chaired by the vice-president, Mr S. Mildner (Germany), and the remainder of the items would be considered in plenary, chaired by the president. Mr A. Kignaman-Soro (Côte d'Ivoire) was appointed Rapporteur on Previous Recommendations and Resolutions of the Commission.

2.3.2 In accordance with WMO General Regulations 24 and 28, a Nomination Committee and a Coordination Committee were established. The Nomination Committee comprised the principal delegates of Brazil, Botswana, Czech Republic, India, Malaysia, Russian Federation and United States. The Coordination Committee comprised the president and vice-president of the Commission, the representative of the Secretary-General, and the chairmen of the working committees.

2.4 OTHER ORGANIZATIONAL QUESTIONS (agenda item 2.4)

It was agreed that, with the exception of agenda item 2.1, summarized minutes of plenary meetings would not need to be prepared. The working hours for the duration of the session were agreed upon. A full list of documents presented at the session is contained in Appendix C to this report. In that connection, the session noted with appreciation that, following the exhortations of Congress and the Executive Council, the number and size of the pre-session documents had been considerably reduced in comparison with previous sessions of the Commission.

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

3.1 The Commission noted with appreciation the report of the president, which provided information on the activities of the Commission since its extraordinary session in August 1994. It noted with satisfaction that although it had been possible for only the Working Group on Satellites to have a full session during the intersessional period, a great deal of work had been accomplished by subgroups, expert meetings, and task teams set up to deal with specific issues. There had been some 35 meetings during the period on matters falling under the Commission' purview or otherwise related to WWW. Further details of the activities and accomplishments were provided in the reports of the chairmen of the working groups and discussed under the relevant agenda items.

3.2 The Commission expressed its appreciation for the extensive guidance provided by the two sessions of the AWG, which had kept under review the follow-up to the decisions of the extraordinary session of CBS. It also expressed its appreciation for the various actions taken

by the president, especially as regarded the participation of the Commission in the work of other constituent bodies, and for representing the Commission at Twelfth Congress and at the two subsequent sessions of the Executive Council. The Commission noted the various requests for action made by Congress and the Executive Council, particularly regarding the structure and working arrangements within CBS, the use of Internet, and the new WMO practice for the international exchange of data and products, and considered those under the appropriate agenda items. The decision of Congress providing for the participation of the chairmen of the six Regional Association working groups dealing with WWW in the work of the session was also greatly appreciated as it constituted a potentially significant contribution to the cooperation between the Commission and the RAs.

3.3 In recognizing the substantial progress that had been made, the Commission recognized that a number of major issues and challenges were still before it, as had been indicated by the Executive Council, and should be kept in mind when dealing with the details of its work programme. As regarded the future work of the Commission, the forty-seventh session of the Executive Council endorsed, with a few amendments, the views expressed by the president on the main issues and challenges which faced CBS. Those included:

(*a*) The optimization of various mixes of observing elements, including environmental components, in the composite observing system — particularly in the light of increased pressures in many countries to reduce the cost of observing and of the need to ensure compatibility of data from different sources;
(*b*) The identification of satellite data and product requirements;
(*c*) The further development and generation of extended- and long-range forecasts;
(*d*) The further development of forecasts of environmental quality and improvement in products in support of environmental emergency response, aiming in both cases at improving the operational capacity in developing countries;
(*e*) The development of an overall WMO Data Management Plan;
(*f*) Increased coordination and assistance to NMSs in order to protect radio-frequency allocations to meet meteorological requirements;
(*g*) The best use of new telecommunication techniques and protocols for an improved Global Telecommunication System (GTS);
(*h*) The transfer of knowledge and technology related to Public Weather Services (PWS).

3.4 The Commission would also have to keep in mind certain more general policy issues and challenges with which it was faced, namely:

(*a*) The need for technical advice, support and coordination in the implementation of the new WMO policy and practice for the international exchange of meteorological and related data and products;
(*b*) Ensuring the wider support of the basic systems to other programmes both within and outside WMO;
(*c*) Applying the important links between meteorology and sustainable development;
(*d*) The needs of developing countries, and those with economies in transition, for support in implementing the basic systems and in building the capacities of regional and national Meteorological Centres (NMCs);
(*e*) Exploiting new technologies with maximum benefit and minimizing any adverse impact for Members and programmes;
(*f*) Contributing to climate monitoring, making the best use of existing networks and avoiding unnecessary duplication;
(*g*) Improving the participation of developing countries in the planning and decision-making process regarding basic systems.

3.5 The president expressed his sincere appreciation to all Commission members who had participated in its activities for their enthusiastic cooperation. In particular, he thanked the vice-president, Mr S. Mildner, the chairmen of working groups and study groups, and the rapporteurs for their outstanding work, which had made his task so much easier. On behalf of the Commission, the president also thanked the Secretary-General and the staff of the Secretariat, in particular the World Weather Watch Department, for their support and cooperation.

4. INTERNATIONAL EXCHANGE OF METEOROLOGICAL AND RELATED PRODUCTS (agenda item 4)

4.1 The Commission recalled the policy and practice for the exchange of meteorological and related data and products adopted by Congress in Resolution 40 (Cg-XII) — WMO policy and practice for the exchange of meteorological and related data and products including guidelines on relationships in commercial activities, and in particular that all such data and products required to fulfill Members' obligations under WMO Programmes were encompassed by the combination of "essential" and "additional" data and products exchanged by Members. While "essential" data and products were available on a free and unrestricted basis, "additional" data and products were provided with the understanding that Members might be justified in placing conditions on their re-export for commercial purposes, as was consistent with Resolution 40 (Cg-XII).

STATUS OF IMPLEMENTATION OF RESOLUTION 40 (Cg-XII)

4.2 The Commission noted that by now about one-fifth of all WMO Members had provided information on their plans or actions related to the implementation of Resolution 40 (Cg-XII). The responses received so far could be grouped into four categories:

(*a*) Confirmation of the intent to implement Resolution 40 (Cg-XII);
(*b*) Information that it was not intended to place conditions on any data and products in case of their re-export;
(*c*) Identification of "additional" data or products with generic conditions attached;
(*d*) Identification of "additional" data or products without generic conditions attached.

4.3 The Commission noted that some Members had, so far, chosen to identify their "additional" data and products through abbreviated headers, some having introduced new headers (currently not contained in *Weather Reporting*, Volume C (WMO-No. 9)) and some having regrouped or changed the stations of existing bulletins. Some Members had explicitly indicated "for regional or bilateral exchange", or had used the designator ii respectively, or both.

4.4 The Commission expressed its appreciation to those Members who had expanded their range of data and products to be exchanged over the GTS, which would benefit the whole WMO user community. It noted the view of the Executive Council that a real increase in the data and products, which was a key objective in the development of Resolution 40 (Cg-XII), should be promoted and monitored. In that context, it was recognized that most, if not all, of the new products required coordination of the arrangements between the Regional Telecommunication Hubs (RTHs) and NMCs involved to facilitate their regular exchange on the GTS.

4.5 The Commission felt that it was now important to monitor the situation and to gain more experience from the implementation of Resolution 40 (Cg-XII) in order to be able to assess the operational aspects of the new data exchange practice.

4.6 The Commission was informed of the activities of the World Intellectual Property Organization (WIPO) aimed at convening a Diplomatic Conference on Certain Copyright and Neighbouring Rights Questions and the Related Basic Proposal for the Substantive Provision of the Treaty on Intellectual Property in Respect of Databases in Geneva in December 1996. The preparation for the conference was being coordinated by WIPO through regional consultation meetings with a view to seeking the adoption of an international treaty. Such a treaty might have an impact on database, data processing and data exchange activities of many NMSs, the WMO World Data Centres (WDCs), and the meteorological research community. Given the urgency of that matter, the Commission was pleased to note that the Secretary-General had initiated discussions with the Director-General of WIPO in order to express the concerns of WMO and to arrange for WMO representation at the forthcoming WIPO Conference. In addition, the Secretary-General had dispatched letters to the Ministers of Foreign Affairs of WMO Members and to the Permanent Representatives in order to make WMO Members aware of WIPO's plan and the possible consequences the adoption of that treaty might have for WMO. The Commission urged Permanent Representatives to consult with their relevant national authorities as regarded the specific meteorological aspects and concerns with a view to gaining their support in obtaining suitable recognition and/or exemptions for WMO's data exchange policy and practice. The Commission requested the Secretariat, as a follow-up measure to the Conference, to provide Members with information on their relevant national authorities with respect to WIPO.

Mechanisms and formats for reporting, collecting and handling the information related to "additional" data and products

4.7 Concerning the mechanisms and formats for use by Members and the Secretariat in reporting, collecting and handling the information related to "additional" data and products in the future, the Commission recalled that the forty-eighth session of the Executive Council concluded that thorough planning would be required in order to find the best practice and to keep cost and efforts involved at a minimum for both the Members and the Secretariat. The Council had invited the president of the Commission to study the various aspects involved and to develop proposals as soon as practicable.

4.8 The Commission commended the work done by the Secretariat in compiling and distributing to Members the information received so far, which was managed through circular letters, and which would soon be supplemented by disseminating the information in the monthly *WWW Operational Newsletter*. The Commission recognized that many Members had chosen different approaches and formats in identifying their "additional" data and products (including the formulation of generic conditions attached thereto), and that the list of "additional" data and products was likely to change. It was also felt that the use of abbreviated bulletin headers might not be the only way to categorize and identify the "additional" data and products.

4.9 The Commission, therefore, requested its Working Group on Data Management to develop proposals for the most efficient way of dealing with that information, taking into account the optimal managability of the information in the long term as well as the need to minimize the cost and efforts for the Members and the Secretariat. It was seen as particularly important that the methodology to be applied should allow computer processing and exchange of the information over electronic networks.

Study on the use of Internet

4.10 The forty-eighth session of the Executive Council had requested the Commission to address also the question of data and products exchanged through the Internet, including all its possible ramifications, in the context of Resolution 40 (Cg-XII), and furthermore, to consider setting up an ad hoc group to study the impact of Internet on NMSs (see also agenda item 6.4). The Commission, on the one hand, welcomed the various benefits derived from the effective use of the Internet, such as the potential to assist in increasing the visibility of an NMS in its country and the quality of end-user oriented services it could provide through direct and cost-effective information exchange with end users, and the potential to raise the level of scientific knowledge and public awareness of meteorological matters.

4.11 On the other hand, the Commission recognized the concerns over the potential issues that should be solved with regard to Internet, and more specifically, the attribution of sources of data and products, the capacity of the system, its operational drawbacks, and the

associated costs of the system. The Commission recognized that Internet was an open network of communication links on a global scale. In view of that, the content of meteorological data and products on servers connected to that environment should be consistent with Resolution 40 (Cg-XII). Also, the Commission noted that special consideration must be taken on the content of the data made available openly on servers, in view of a possible negative impact on some NMSs. The information on those servers should include, among other things, recognition of the suppliers of the data and products as the national or international official scientific voice, and the status of the information.

4.12 The Commission noted with appreciation that the AWG had started to discuss those matters and had, as a first step, carried out a study on the extent to which the Internet actually had the potential to be used to exchange meteorological information (see agenda item 6.4). As the next step, it had agreed to establish an ad hoc task group as proposed by the Executive Council. The Commission agreed that the best approach was to determine from the beginning the range of issues the task group should investigate, being fully aware that studying all possible ramifications of Internet in the context of Resolution 40 (Cg-XII) would likely exceed the resources and capabilities of the Commission. It requested the task group to address the technical and operational aspects involved and their possible ramifications on the implementation of Resolution 40 (Cg-XII) but to set aside, for further consideration by the Executive Council, other relevant questions. The Commission agreed on the terms of reference and composition of the task group, as given in Annex I to this report.

4.13 Finally, the Commission noted with satisfaction that the forty-eighth session of the Executive Council had agreed that the president of CBS should be invited as observer to the forthcoming session of the Executive Council Advisory Group on the Exchange of Meteorological and Related Data and Products. It invited the president to present a progress report to that group both on the development of mechanisms and formats for reporting, collecting and handling the information related to "additional" data and products and on the then available results on the Internet question, and to provide an update on the technical aspects of the status of implementation of Resolution 40 (Cg-XII).

AMENDMENTS TO THE *TECHNICAL REGULATIONS* (WMO-No. 49)

4.14 The Commission noted with appreciation the action taken to establish an Intercommission Task Team on Data and Product Requirements, and expressed its thanks to the presidents of the technical commissions for their cooperation. It also thanked the vice-president of the Commission, Mr Mildner, for leading the Task Team which had developed a consolidated list of data and products required for international exchange to meet the needs of WMO, and WMO-sponsored, Programmes. The list had been submitted to Twelfth Congress to assist in its deliberations on the new WMO practice for the international exchange of data and products. Congress had noted the list, expressed its appreciation for the prompt action taken by CBS and agreed with the view that the list should be included in WMO regulatory material. Congress had further requested CBS, in consultation with the other technical commissions, to review and update relevant parts of the list, as necessary, at regular intervals.

4.15 Following Twelfth Congress the list had been submitted to the president of each of the technical commissions for formal endorsement on behalf of their respective commissions. All had done so except the president of the Commission for Hydrology (CHy) who considered the list to be incomplete from the point of view of hydrological programmes. The Commission, therefore, agreed that the title of the list should be slightly modified and a note should be inserted to indicate that it did not cover the needs of hydrology. The Commisssion considered whether the list itself should be amended to exclude those items, if any, which were required exclusively for hydrological programmes but decided to recommend its adoption as it stood. It further agreed that the most appropriate place in WMO regulatory material to include the list was in the introductory part, immediately following the definitions in *Technical Regulations* (WMO-No. 49), Volume I. Recommendation 1 (CBS-XI) was adopted.

4.16 Finally, it was noted that Volume I of the *Technical Regulations* dealt with general meteorological standards and recommended practices, while Volume III dealt with hydrology. It would, therefore, have to be considered in which volume it would be more appropriate to include the requirements of hydrological programmes, when finalized.

4.17 As regarded the regular review and the updating of the list, the session noted that the Intercommission Task Team was of the view that a revision every four years should suffice. It, therefore, agreed that it should be brought to the attention of each session of the technical commissions concerned which should prepare any required amendments. A compilation of their proposals would then be considered by each session of the Commission, together with any additions it might wish to make, formulated in a recommendation to the Executive Council. The Commission requested the AWG and the Working Group on Data Processing to keep the list under review from the point of view of CBS.

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

5.1 The Commission received a summary report on the status of implementation and operation of the WWW. It was noted that the last full report — the seventeenth — had been published in time for Twelfth Congress in May 1995 and that the next one was being finalized for publication early in 1997.

5.2 It was noted with some concern that the implementation of the Regional Basic Synoptic Networks (RBSNs) of surface and upper-air stations remained at around 88 and 80 per cent, respectively although the requirements for surface observations had been reduced,

especially in two regions. There had also been very little improvement in the actual receipt of observation reports for the four main standard times, which had stood at 70 per cent for surface observations and 64 per cent for upper-air observations during the 15-day monitoring period in October 1995. The Commission, however, noted with serious concern the severe degradation in upper-air observations which was occurring in Region II after the global monitoring of October 1995. The Commission urged RA II and all Members concerned to take urgent action to alleviate the problem. The Commission expressed its deep concern about the serious constraints affecting upper-air observations, both on shorter term with the cessation of OMEGA and on a longer term with the threat on meteorological aids radio-frequency bands. Further consideration of those issues are reflected under agenda items 6.1 and 6.2.

5.3 More encouraging, however, was the continuing increase in the number of drifting buoys to around 1 500, of which 600 were providing a daily average of 3 000 reports through the GTS, and the large number of aircraft (mainly from the United States, Europe and Australia) which were now equipped with one of the various systems for automated meteorological observing and reporting; some 17 000 reports were being generated daily from observations made not only at cruising altitudes but also, in many cases, during the ascent and descent stages. Concern was expressed about the uneven availability of ship and aircraft reports in various regions, and the Commission urged all WWW centres to ensure that those important data were adequately inserted and routed on the GTS.

5.4 As regarded the GTS, the Commission noted that good progress had been made in enhancing further the system through the upgrading of low speed circuits to telephone type circuits of medium speed and especially in the implementation of satellite/cable-based circuits. The introduction of X.25 procedures was also continuing to make rapid progress with a total of 42 circuits — all on the main telecommunication network (MTN) and 19 on regional networks — now having the capability of exchanging data in binary form, e.g. GRIB and BUFR. Furthermore, several MTN and some regional and interregional circuits were upgraded to 64 kbit s^{-1} digital circuits.

5.5 Noting that details of equipment, forecasting systems, and verification methods in use at Global Data-processing System (GDPS) centres were given in the 1995 technical progress report on the GDPS, the Commission was informed that further advances had been made in the introduction of supercomputer facilities at GDPS centres, with the three World Meteorological Centres (WMCs) and nine Regional Specialized Meteorological Centres (RSMCs) being so equipped along with two emerging centres, the Brazilian Agency for Space Research (INPE) in Sao Paulo and the Association of South-East Asian Nations (ASEAN) Specialized Meteorological Centre in Singapore. It was also noted that at least nine major GDPS centres had the capability of providing trajectory and pollutant concentration estimates on a global and/or regional basis.

5.6 The Commission learned that the programme for monitoring the quality of land surface observations was now almost fully operational with GDPS lead Centres, Buenos Aires, Tokyo, Montreal, Melbourne, Offenbach and Nairobi, designated for their respective Regions. All but Nairobi were operational, the monitoring of observations from Region I being carried out by WMC Melbourne. The Commission requested that the results of the monitoring of the quality of observations, which were presented under agenda item 6.4, should in the future be included routinely in the WWW status report. Under the Data Management programme, the number of computer-resident databases in use in WWW centres had continued to increase and the implementation of WMO Distributed Databases (DDBs) had been progressing well.

5.7 Detailed discussion on each of the components of the WWW is reflected under agenda item 6.

6. WORLD WEATHER WATCH COMPONENTS AND SUPPORT FUNCTIONS, INCLUDING REPORTS BY THE CHAIRMEN OF WORKING GROUPS (agenda item 6)

6.1 GLOBAL OBSERVING SYSTEM (GOS) (agenda item 6.1)

REPORT OF THE CHAIRMAN OF THE WORKING GROUP ON OBSERVATIONS

6.1.1 The Commission noted with appreciation the report of the chairman of the Working Group on Observations, Mr F. S. Zbar (United States) on the work accomplished by the working group itself and Task Teams on the *Manual* and the *Guide on the Global Observing System (GOS)* (WMO-No. 544 and 488, respectively) and on Data Requirements for Environmental Emergency Response Activities (DREERA).

DATA REQUIREMENTS FOR ENVIRONMENTAL EMERGENCY RESPONSE ACTIVITIES (DREERA)

6.1.2 The Commission recalled that the Task Team on DREERA had been established by its extraordinary session (1994) at the request of XI-RA VI to specify the requirements for meteorological and non-meteorological observational data needed by designated RSMCs to provide Members with transport model products for environmental emergency response. It was pleased to learn that the Task Team, at its meeting held in Geneva in March 1995, had developed guidance material for Members of RA VI on their responsibilities in support of environmental emergency response activities, which contained many specific recommendations on data, observational facilities, communication procedures, and collaboration with other national agencies which were required in environmental emergency situations. The Commission noted that the guidance material was sent to the president of RA VI for distribution among the Members.

MANUAL ON THE GLOBAL OBSERVING SYSTEM (WMO-No. 544)

6.1.3 The Commission endorsed the proposed amendments to Part II of the *Manual on the GOS* which had been developed by the Task Team on the *Manual* and *Guide on the GOS*. Those included requirements for

environmental emergency response activities which had been prepared on the basis of recommendations made the Task Team on DREERA. Recommendation 2 (CBS-XI) was adopted.

6.1.4 The Commission noted with satisfaction that the Task Team on the *Manual* and the *Guide on the GOS* had reviewed and updated the format and content of Volume II of the *Manual on the GOS*, which was published as a supplement at the end of 1995.

DEVELOPMENT AND OPERATION OF SPECIALIZED OBSERVING SYSTEMS

6.1.5 The Commission noted that the Working Group on Observations had continued to review the development of specialized observing systems, such as the automated shipboard aerological programme (ASAP), the aircraft meteorological data relay system (AMDAR), and wind profilers and their introduction into the GOS.

AUTOMATED SHIPBOARD AEROLOGICAL PROGRAMME

6.1.6 The Commission noted that 11 ships equipped with ASAP systems continued making upper-air observations in the North Atlantic. There were two ships currently operating on the Pacific, with a third planned for 1997. The Commission noted that many of the ships were equipped with OMEGA-based radiosondes and that they would be affected by the termination of OMEGA in September 1997. Plans for the conversion of ASAP ships from OMEGA varied from country to country. The Commission considered that high priority should be given to continuing the operation of ASAP ships through conversion to alternative systems.

AUTOMATED AIRCRAFT OBSERVING AND REPORTING SYSTEMS

6.1.7 The Commission noted the continuing increase in the availability of meteorological reports from aircraft. About 17 000 reports were being generated and transmitted daily on the GTS, which included observations at cruising levels and in some cases, measurements made during ascent and descent which the Commission felt were particularly valuable. Different systems, especially as regarded data collection and transmission, were currently in use by an increasing number of airlines in Australia, North America, western Europe, and a small number elsewhere. Those observations were seen as a major source of high quality upper-air data, including moisture measurements. The Commission anticipated with interest the results of the comprehensive study of the many issues involved, including requirements, costs, data collection and dissemination and quality control undertaken by the operational consortium of AMDAR participants, in consultation with the Commission for Aeronautical Meteorology (CAeM), CBS, airlines, and aviation organizations. It requested the Working Group on Observations to assist, as required, and to keep itself informed on the progress made and the outcome of the study, and to make appropriate proposals for the integration of AMDAR observations into the GOS. The Commission noted that airlines were increasingly using air-ground data link communications which would further increase the availability of automated aircraft observations worldwide. Members were encouraged to work closely with their national airlines so that the need for aircraft observations was understood. In that connection, the Commission noted the offer made by France to distribute to Members, on request, data formatting software developed by France for installation aboard aircraft.

WIND PROFILERS

6.1.8 The Commission was informed on the progress made in the United States in attaining an operational frequency assignment at 449 MHZ. More serious difficulties existed for wind profiler frequency allocation in Europe (see agenda item 6.2). Improvements had been implemented in the United States experimental profilers to extend the reliability of transmitters. The Commission noted with appreciation that, on its request, the United States Wind Profiler Assessment Report had been sent in November 1995 to Commission members identifying the utility of wind profilers in forecasting various hydrometeorological phenomena. Noting that no further refined estimates for operational purchase costs had been made since its extraordinary session (1994), the Commission requested the Working Group on Observations to prepare and provide Members with a report on the costs and benefits of wind profilers in order to assist them in determining the best mix of observing systems in their geographical area. The Working Group on Observations could make use of information from cost/benefit studies on the European wind-profiler network.

GLOBAL POSITIONING SYSTEM (GPS) METEOROLOGY

6.1.9 The Commission noted that new techniques for the observation of temperature and moisture through ground-based and space-based GPS techniques were under development. They held the promise of ground-based vertically-integrated measurement of moisture, and of global observations of temperature or humidity at high vertical resolution through occultation techniques. The Commission requested the Working Group on Observations, in concert with the Working Group on Satellites, to monitor progress in that area.

OBSERVING SYSTEM DESIGN EFFORTS

6.1.10 The Commission was informed on the status and development of the Composite Observing System for the North Atlantic (COSNA). COSNA was composed of several operational systems established and maintained by Members of RA VI and which were coordinated and monitored continuously. It was noted that that activity was based on voluntary contributions and included close cooperation with the CBS monitoring centres and relevant consortia for the operation of system components, such as ASAP, aircraft-to-satellite data relay (ASDAR) and data buoys.

6.1.11 The Commission noted, in that context, that a group of RA VI Members had agreed on a mechanism for joint planning of composite observing systems which included COSNA. That would eventually lead to a joint project on the redesign, implementation, operation and funding of the composite observing system.

6.1.12 Great emphasis was put on the activity of the Scientific Evaluation Group which supported the Coordinating Group of COSNA (CGC) with respect to the design of COSNA and, more specifically on intiating and evaluating studies carried out by participating GDPS centres on the impact of observations on numerical weather prediction (NWP). It was noted that CGC was to organize a workshop on impact studies in April 1997 in Geneva with the participation of leading GDPS centres.

6.1.13 The Commission was informed about a new activity initiated by the United States and including Canada and Mexico, to provide a basis for the redesign of various components of the RBSN. It was called North American Atmospheric Observing System (NAOS) and was supported by governmental and university organizations to address the expanding and complex observing system problems. Its initial focus was to make recommendations on the configuration of the upper-air observing programme in those three countries and adjacent ocean areas to meet future needs for meteorological observations and services. The main thrusts were: (*a*) a scientific evaluation programme focussed on, but not limited to, the value of various combinations of observing systems in NWP; and (*b*) an assessment of the operational, financial and organizational implications of configurations based upon the results of the scientific evaluations. A Council had been constituted, a programme plan developed, and detailed test, evaluation, and system design plans were under development. A series of impact tests utilizing observational and simulated datasets and a carefully crafted set of key hypotheses were in the process of being carried out focusing upon the "best mix" of radiosondes, aircraft, radar, and wind profiler observing systems.

6.1.14 In the light of increased pressures in many countries to reduce the cost of observing, the Commission agreed that studies, such as those being carried out by the COSNA and NAOS programmes, were needed to effect improvements in network design, in the introduction of new observing technologies or in the improved use of existing technologies, and to evaluate the relative importance of the various types of basic data. The Commission encouraged Members and the CGC, as well as the NAOS groups to continue their cooperation in scientific studies of that type and to keep the Commission informed.

OMEGA RADIO-NAVIGATION SYSTEM

6.1.15 The Commission noted that in the past three years, WMO constituent bodies, Members, and the Secretariat had undertaken considerable efforts to secure the continued operation of the OMEGA radio-navigation system for upper-air wind finding, on which about 25 per cent (247 stations) of the worldwide network depended, until such time as a feasible alternative was found. Those efforts had resulted in the continuation of the OMEGA system for at least three years. However, the Commission noted with great concern that despite WMO's strong appeal to the International OMEGA Technical Commission (IOTC) Meeting in Melbourne in April 1996, the IOTC, Members had agreed to advise promptly relevant government agencies and principle user organizations in their respective countries that the system would be terminated by 30 September 1997.

6.1.16 In considering the need for immediate action to limit the loss of upper-air data after September 1997, the Commission noted with appreciation that the Secretary-General had provided the 79 Members concerned with guidance material regarding alternative systems developed by the Working Group on Upper-air Measurements of the Commission for Instruments and Methods of Observation (CIMO). It also noted the preliminary results of a survey conducted by the Secretariat providing information on the location of OMEGA-based wind-finding systems, the relevant monitoring results on performance, and on the plans of 34 of the Members concerned for the replacement by alternative systems. Those showed that there was a reasonable expectation of up to 40 per cent of the OMEGA-based stations being converted to alternative systems by September 1997.

6.1.17 It was further noted that an additional 10 countries operating a total of 25 upper-air stations would be prepared to operate replacement systems if funds could be found for their conversion and several were already seeking assistance in that regard. The Commission expressed its serious concern that with less than one year remaining until the termination of the OMEGA system, 47 countries covering 131 stations had not provided information on their future plans, which left a large degree of uncertainty in the assessment of the overall impact of the termination on the GOS and on NWP operations in particular.

6.1.18 The Commission considered that the situation was extremely serious as it seemed likely that a significant number of upper-air stations would cease to operate after 30 September 1997, at least for a period of several months before additional NMSs were in a position to select alternative systems, obtain budgetary approval, and effect the necessary upgrading. The Commission strongly urged all Members concerned to make every effort to ensure that any reduction in observations was kept to a minimum for the shortest possible time.

6.1.19 The responses to the survey had also indicated that a number of Members were conducting trials with the use of alternative systems, particularly the global positioning system (GPS), and the Commission urged that the results of those trials should be exchanged between the Members concerned. From additional information provided at the session, it was felt that GPS would be the most suitable long-term alternative yielding high quality measurements, but the higher operating costs were likely to pose problems for some countries.

6.1.20 To add to those concerns, the Commission noted the critical erosion of the upper-air network encountered in the Russian Federation because of problems in the national production of instruments and consumables and the grave economic difficulties in maintaining station staffing, particularly in remote locations. It was feared that that situation could lead to a great loss of upper-air observations over the Russian Federation for an extended period of time.

6.1.21 In the medium term, the constraints expected in the availability of radio frequencies would further compound the threats to the global upper-air network because many Members might be forced to offset the higher cost of deploying radiosondes with a narrower radio-frequency bandwidth and the associated ground stations equipment by a reduction in the density of their station network and/or reduced observing programmes.

6.1.22 The Commission agreed that studies needed to be carried out as a matter of urgency to assess the impact of the loss of individual or groups of upper-air stations and/or the changes in the observation programmes of upper-air stations in some countries, on the WWW forecasting operations. The Commission was informed by the United States of the results of initial studies that had been carried out. The results of such studies were seen as being fundamental for Members to develop plans for restructuring their upper-air networks to meet their requirements for observational data with reduced costs and higher effectiveness.

6.1.23 The studies were also needed urgently to develop guidance as regarded the identification of the most critical areas and stations in order to achieve the maximum benefit from the limited available resources for bilateral or Voluntary Cooperation Programme (VCP) aid projects. With respect to the latter, the Commission noted with appreciation that some donor countries had already initiated projects to assist in replacing OMEGA-dependent upper-air systems. The Commission requested the Secretary-General to organize a forum to compare and consolidate the various study results through an expert meeting. The Commission recognized that the COSNA workshop on the GOS impact studies planned for April 1997 should provide a valuable opportunity to consolidate the results of such studies.

6.1.24 The Commisson felt, however, that it would not be possible to complete such studies in time for the informal meeting of major VCP donors in February 1997. The chairman of the Working Group on Data Processing was, therefore, requested to form a Task Team to work mainly by correspondence to provide expert views, based on all available relevant information, in order for the VCP donors to take into account prior to their February meeting.

Interrelation between the Global Observing System and the Global Climate Observing System

6.1.25 The Commission noted with appreciation the valuable contribution provided by the Working Group on Observations to the review of GCOS observational data requirements, the design and selection of stations for the GCOS upper-air network (GUAN) and the GCOS surface network (GSN) (see also paragraph 8.3). Noting that the operational and performance requirements for GUAN stations were not additional to the present requirements for GOS upper-air stations, the Commission agreed that a set of "best practices" to be implemented for GUAN stations to enhance the value of the observations for climate purposes should include:

(*a*) Making provision for long-term continuity of the station;
(*b*) Providing detailed metadata about the station;
(*c*) Utilizing sounding systems with a capacity of reaching 5 hPa;
(*d*) Exercising rigorous quality control at the stations;
(*e*) Releasing back-up sondes in cases of failure.

6.1.26 The Commission requested the Working Group on Observations to refine further those "best practices" recommendations after some experience was obtained with the GUAN implementation to achieve optimum data quality. The European Centre for Medium Range Weather Forecasts (ECMWF), in its capacity as CBS lead centre for the monitoring of upper-air data quality, had been requested to provide regular six-month reports on the availability and quality of upper-air data from GUAN stations to the GCOS Joint Planning Office.

6.1.27 As regarded GSN stations, the Commission, noting that the existing system of regional lead centres for monitoring land surface data quality could be used for monitoring GSN stations, agreed that that matter should be examined by a CBS/Commission for Climatology (CCl) group of experts after the network had been established. The Commission requested that the Working Group on Observations should continue to review the proposed GSN through regional mechanisms and through individual members.

Future work programme

6.1.28 The Commission agreed on the following work programme of the Working Group on Observations:

(*a*) To continue to review and advise on the design and implementation of the GOS with emphasis on maximum cost effectiveness, in particular with respect to:
  (i) Specialized observing systems, such as AMDAR, ASAP, drifting buoys, wind profilers, automated weather stations, new moisture measurement techniques, and sensors and lightning detection networks; and
  (ii) The potential reduction of the upper-air network arising from the discontinuation of the OMEGA navigation system and the possible reduction in available radio-frequencies;
(*b*) To keep under review the results of the monitoring of the status of the GOS subsystems with respect to availability and quality of data and to advise on the maintenance of the existing networks;
(*c*) To elaborate further user requirements in collaboration with the Working Groups on Satellites and on Data Processing;
(*d*) To keep abreast of those observing system design efforts involving future composite observing systems in the North Atlantic, the North American, and the European geographical areas and to examine the results of those studies for feasibility of implementation;
(*e*) To develop long-term integrated observing strategies in collaboration with the Working Groups on Satellites and on Data Processing to meet user requirements;

(*f*) To continue to update, as necessary, the *Manual* and the *Guide on the GOS* particularly in respect of specialized observing systems;

(*g*) To coordinate with CIMO those activities relating to surface and upper-air observations and on matters of inconsistencies between the GOS and CIMO *Guides* and of the inclusion of regulatory material in the *Manual on the GOS*;

(*h*) To provide assistance in the review of implementation of the GCOS upper-air and surface networks.

6.2 Global Telecommunication System (GTS) (agenda item 6.2)

Report of the chairman of the Working Group on Telecommunications

6.2.1 The Commission noted with appreciation the report of the chairman of the Working Group on Telecommunications, Mr Maurice Fischer (France), including the work accomplished by the sessions of the study groups on radio-frequency coordination and on operational matters of the Working Group on Telecommunications (WG/TEL). The Commission felt that the current arrangements for holding expert meetings, implementation coordination meetings, and study group sessions during the inter-sessional period of the WG/TEL enabled the working group to keep pace with the development of the GTS.

Status of implementation and operation of the GTS

Point-to-point circuits and centres

6.2.2 All 23 MTN circuits were in operation and all MTN centres were automated. Twenty circuits were operating at data signalling rates higher than 4.8 kbit s^{-1}, and six were operating at 64 kbit s^{-1} including the whole segment Melbourne-Tokyo-Washington-Bracknell-Toulouse-Offenbach. The X.25 procedures were implemented on all circuits of the MTN. Besides the MTN, an increasing number of GTS circuits were leased circuits, and steady progress had been made in upgrading low-speed circuits into telephone-type circuits of medium speed and in the implementation of satellite/cable-based circuits in replacement of HF circuits. The implementation of X.25 procedures continued to make rapid progress, and the TCP/IP protocol had been introduced on some GTS circuits, in a test mode.

Multipoint telecommunication services via satellite and radio broadcasts

6.2.3 The new regional meteorological telecommunication network (RMTN) in Region IV, based on a 38.4 kbit s^{-1} two-way multipoint telecommunication service via satellite supported by the International Satellite Communication System (ISCS) and operated by the United States, was implemented in 1995/1996 and was operational. The Meteorological Data Distribution (MDD) service via METEOSAT included three 2 400 bit s^{-1} channels. France and Germany were operating satellite-based distribution systems called RETIM and FAX-E, respectively, via the EUTELSAT satellite which were integrated in the RMTN of Region VI. China was implementing a very small aperture terminal (VSAT) telecommunication system via the Asiasat satellite, which was being considered to be a component of the RMTN of Region II. Japan planned to operate a multipoint data distribution service via the multifunctional transport satellite (MTSAT), which would be launched in 1999 to replace GMS-5. The new service would disseminate observational data and NWP products in addition to satellite images. Within the framework of the International Civil Aviation Organization (ICAO), the United States had implemented the world area forecast system (WAFS) satellite-based broadcast via the ISCS for the Americas and for the Pacific, and the United Kingdom had implemented the WAFS satellite-based broadcast called SADIS, to serve Europe (except Iceland), Africa, the Middle East and most of Asia. The Commission noted with satisfaction that several RAs and Members were taking advantage of satellite-based multipoint telecommunication systems, and it encouraged all Members to pursue further the integration of those systems into the GTS for improving the distribution of data and products.

6.2.4 Several RTHs were transmitting bulletins and warnings for maritime activities on the International Maritime Satellite Organization (INMARSAT) SafetyNET service, for the broadcast to ships. Ships were progressively equipped with INMARSAT-C terminals, although that evolution was relatively slow in some areas, and INMARSAT broadcasts would eventually supersede the radiofacsimile and radio teleprinter broadcasts for ships. The collection of ship reports through INMARSAT coast Earth stations (CES) was a routine and efficient service, but those reports were not always inserted into the GTS for distribution to Members.

6.2.5 Several Members from Regions II, III, IV, V and VI, had implemented or had firm plans for the implementation of satellite-based multipoint telecommunication systems for their national MTNs which, in some cases, had a subregional coverage.

6.2.6 Radio broadcasts, which had high recurrent operational costs and a limited efficiency, were being progressively replaced by more cost-effective means of transmission, in particular satellite-based multipoint distribution systems. Nevertheless, radiobroadcasts remained a useful telecommunication means in some areas.

Monitoring activities

6.2.7 As regarded the 1995 annual global monitoring of the operation of the WWW, a total of 88 centres participated, and 42 centres, including 10 RTHs on the MTN, provided results on floppy disks in compliance with the agreed procedures. The large number of participating centres was noted with appreciation, and all centres were urged to contribute actively by monitoring at least the part of the global dataset for which they were responsible to collect and forward onto the GTS, and to provide the monitoring results preferably on diskette or via Internet.

Pilot MTN monitoring exercises

6.2.8 The Commission noted with appreciation that the monitoring activities carried out during 1–15 July

and October 1995, and 1–15 May 1996 in the framework of the pilot MTN monitoring (PMM) were instrumental in identifying specific deficiencies in the operation of the GTS, such as the incorrect use of abbreviated headings of bulletins, the incorrect compilation of reports within bulletins, and the incorrect routing of bulletins. RTHs Algiers, Cairo, Nairobi, New Delhi, Offenbach, Sofia, Tokyo and Toulouse participated in the PMM. The responsibilities shared between them are given in Annex II to this report. The Commission expressed its appreciation for all the work done by those centres and by the Secretariat in the implementation of the PMM, which demonstrated that the concept of exchanging "raw bulletins" files through electronic media (mainly via file transfer protocol (FTP) server) and analysing them was effective.

6.2.9 In view of the very positive impact of the PMM and the relatively limited workload required from participating centres, the Commission decided to integrate the PMM into the operational non-real-time monitoring activities related to the GTS, as a special MTN monitoring (SMM). The periods for carrying out the SMM exercises would be 1–15 April, 1–15 July and 1–15 October; the Commission requested the Secretariat to pursue the coordination of those monitoring exercises. The initial list of participating MTN centres and the procedures of the SMM would be those of the PMM. With a view to identifying easily the shortcomings in the exchange of data on the MTN, the SMM centres monitoring a specific type of data should preferably be located in different WMO Regions. In order to limit the workload for processing SMM monitoring results, the number of centres participating in the SMM should be limited to four for each type of data. The Commission invited MTN centres to consider their participation in the SMM accordingly and noted with appreciation that RTH Tokyo was willing to undertake the SMM monitoring and analysis of SYNOP and TEMP messages, in addition to its involvement in monitoring AIREP and AMDAR messages. The Commission requested its WG/TEL to pursue further development of that concept within the overall review of the procedures for the monitoring coordinated by the AWG.

6.2.10 The Commission considered the additional workload required from the Secretariat for the analysis of the SMM results and, with a view to maintaining working resources required for supporting quantitative monitoring at a similar level, it agreed that the detailed analysis of the annual global monitoring results at the regional level should be limited to the tables showing the availability of SYNOP and Part A of TEMP reports at the NMCs, the RTHs, and the MTN centres.

MONITORING OF THE EXCHANGE OF BATHY/TESAC REPORTS AND BULLETINS ON THE GTS

6.2.11 The Commission was informed that the monitoring of BATHY/TESAC transmitted over the GTS for the IOC Global Temperature and Salinity Pilot Project (GTSPP) actually mixed the monitoring of bulletins compiling BATHY/TESAC reports before quality control, not intended for global exchange (e.g. SOVD31 KWBC), with bulletins for global exchange (e.g. SOVD01 KWBC). That situation could easily lead to drawing wrong conclusions on possible loss of data on the GTS; the Commission stressed that, before carrying out such specific monitoring exercises, a careful coordination of the monitoring procedures was required to ensure that the analysis of the monitoring results would provide a consistent and true picture of the operation of the GTS. In that respect, the Commission stressed that the requirements put on the GTS for the exchange of oceanographical data should be provided to the Commission as appropriate, in particular as regarded the data sources and the recipients, and the exchange of oceanographical data before quality control. A clear definition of those requirements was essential to ensure that the GTS could meet them.

OPERATIONAL MATTERS

FUNCTIONS OF GTS CENTRES AND PLAN FOR ROUTING DATA ON THE MTN

6.2.12 The Commission endorsed the proposed refinements to the responsibilities of RTHs and the routing of data on the MTN, with a view to clarifying telecommunication functions of GTS centres. It requested the Secretariat, in coordination with the WG/TEL, to prepare the list of the location indicators CCCC of NMCs and RSMCs from which each RTH acquired data for insertion into the GTS, and in particular WMC/RTH centres on the MTN responsible for data insertion into the MTN.

ADDRESSED MESSAGES

6.2.13 The Commission noted with appreciation that the necessary guidance material for implementation of addressed messages, including examples of request and reply messages (*Manual on the Global Telecommunication System* (WMO-No. 386), Attachment II-6), was developed and made available to WWW centres. The Commission stressed the importance of that procedure and urged all MTN centres to implement it and participate in a specific monitoring exercise on the routing of addressed messages on the MTN in April 1997. The Commission requested the Secretariat to coordinate the implementation of that specific monitoring exercise with the MTN centres, and endorsed necessary refinements to the procedures for requests for GTS messages.

FORMAT OF METEOROLOGICAL MESSAGES

6.2.14 The Commission endorsed the proposed optional use of a five-digit sequence number (instead of three digits), if agreed, on a bilateral basis between adjacent centres, in view of the requirements on a limited number of circuits.

TABLES OF THE *MANUAL ON THE GTS*, ATTACHMENT II-5

6.2.15 The Commission endorsed the recommended amendments in Table A, C6 and D2 and the addition of the new Table C7 to meet the requirements of GDPS centres and the use, still at an experimental stage, of the CREX code. The Commission also recalled that its president had approved the amendments to Table B1 for the

allocation of T_1T_2 = WA for AIRMET messages, T_1T_2 = FA for GAMET messages (in addition to ARFOR messages), T_1T_2 = FK for tropical cyclone advisory messages and T_1T_2 = FV for volcanic ash advisory messages, with effect from 1 January 1996, to meet ICAO requirements.

EXCHANGE OF MESSAGES INCLUDING TEST MESSAGES FOR THE VALIDATION OF NEW CODES

6.2.16 The Commission agreed that test messages for the validation of new codes could be transmitted on the GTS as addressed messages with $T_1T_2A_1A_2$ii = BMDA01 for messages in alphanumeric form and $T_1T_2A_1A_2$ii = BIDA01 for messages in binary form. GTS centres would ensure the delivery of the messages, and the necessary arrangements for handling the addressed data messages in WWW centres should be made in the framework of the respective tests. With a view to avoiding errors in the forwarding of the test messages, no abbreviated headings should appear at the beginning of the text contained in the messages.

CATALOGUE OF METEOROLOGICAL BULLETINS

6.2.17 The Commission reaffirmed the requirement for a comprehensive catalogue of meteorological bulletins for observational data and processed information, which would be accessible by GTS centres as a database in quasi-real-time, and it noted with appreciation the development made by the Secretariat in that respect (see agenda item 6.6). Based on the fact that the functions and responsibilities of RTHs made them the centres best informed on the bulletins issued from their associated NMCs, the Commission agreed that the maintenance of the catalogue by RTHs would be the best means to ensure that the information included in the catalogue was correct and regularly updated. It invited each WMCs/RTHs on the MTN to take the responsibility of maintaining the catalogue as regarded bulletins issued from the zone for which they were responsible for the collection, exchange and distribution of data — as given in paragraph 1, Attachment I-3, *Manual on the Global Telecommunication System* (WMO-No. 386) — and also including data from Antarctica, as appropriate. Moreover, through regional arrangements, WMCs/RTHs on the MTN might share their responsibility with the RTHs (not on the MTN) included in their zone of responsibility.

6.2.18 The list of WWW centres generating bulletins, which were controlled by each responsible RTH for maintaining the catalogue, should be maintained by the Secretariat. Any amendments to the catalogue of meteorological bulletins should be addressed by the WMO Member countries to the responsible RTH. Each responsible RTH should check that the part of the catalogue maintained by itself was in conformity with the standard and recommended practices and procedures called for in the *Manual on the GTS* and should liaise with the WMO Member countries, as required. The catalogue should continue to include at least all bulletins exchanged on the GTS at the global, regional and interregional levels (ii = 01–39). The Commission encouraged the WG/TEL to proceed in developing a detailed format for the catalogue as well as a method for updating its content in accordance with the above scheme, but stressed that the format should be independent from any database application software.

ROUTING CATALOGUES

6.2.19 The Commission noted with appreciation that several RTHs had already made available their routing catalogues on diskette and/or by FTP (e.g. Internet) to RTHs and associated NMCs, and that several other RTHs had plans to do so in the near future. It re-emphasized the importance of the exchange of routing catalogues for ensuring consistency of data exchange between centres, and also for informing NMCs of the bulletins actually or potentially available at their associated RTH. The Commission requested the Secretariat to publish twice a year in the monthly *WWW Operational Newsletter* the list of RTHs which were making available their routing catalogues, with a view to informing the NMCs and RTHs concerned of the availability of that valuable information. Adjacent RTHs should exchange their routing catalogues at least once a year, and more often on a request basis. Routing catalogues should also have been developed regularly to remove bulletins which were no longer expected for exchange. The Commission encouraged RTHs to use FTP servers (i.e. via Internet) to make routing catalogues available for consultation. The Commission also took note of the simplified format for routing catalogues developed by the WG/TEL, which should facilitate quick access to that salient information.

DESIGNATION OF FOCAL POINTS OF RTHS

6.2.20 The Commission was of the opinion that the designation of focal points of RTHs would greatly facilitate coordination of the GTS operation. Those coordination activities included monitoring procedures, the maintenance of the catalogue of meteorological bulletins, the exchange of routing catalogues, the arrangements for tests, etc. The Commission, therefore, invited those Members operating an RTH to designate a focal point who could be contacted by other GTS centres and the Secretariat, and to inform the Secretariat and other Members by April 1997.

AMENDMENTS TO THE *MANUAL ON THE GTS*, VOLUME I, PART II

6.2.21 Subsequent to the conclusions reflected above, the Commission adopted Recommendation 3 (CBS-XI) concerning amendments to the *Manual on the GTS*, Volume I, Parts I and II.

COMMUNICATION TECHNIQUES AND PROTOCOLS

6.2.22 Considerable progress had been made in the implementation of X.25 logical multiplexing (virtual circuits) on MTN and other GTS circuits, enabling centres to draw full benefit from the total circuit capacity. The installation of packet switches at several RTHs made it possible to operate direct logical channels between non-adjacent centres (notably Melbourne-Tokyo-Washington), as an initial step towards an improved MTN. A technical evaluation of X.25, TCP/IP and their combined use over GTS circuits was conducted by a number of centres. The WG/TEL had developed a provisional addressing scheme

for the use of IP on the GTS and was preparing a guide for using TCP/IP on the GTS. The Commission expressed its appreciation for those developments and urged the WG/TEL to complete them in 1997 in order to support a consistent and efficient implementation of improved data-communication services on the GTS.

6.2.23 The use of V.29 modems on analogue circuits was now becoming obsolete as the use of digital circuits, where available, was more cost effective in many cases. In cases where analogue circuits must be used, the use of recently standardized modems (ITU-T V.32, V. 33, V.34, etc.), which dramatically increased the speed on existing telephone-type circuits, without additional recurrent costs, and which were very cost-effective, was recommended under bilateral agreements. It also underlined the importance of adequate technical measures for ensuring the protection of the GTS against improper use, access or disruption when implementing improved data communication services.

STUDY ON THE POSSIBLE USE OF SATELLITE DISTRIBUTION SYSTEM (SADIS) FOR WWW DATA EXCHANGE

6.2.24 Twelfth Congress had requested the Commission to study the technical aspects of the offer made by ICAO to use SADIS for WWW data exchange and to report to the Executive Council, who would examine, in addition to the technical aspects, the legal, policy, financial and strategy implications of the offer (general summary paragraph 3.4.3.6 of the *Abridged Final Report with Resolutions of the Twelfth World Meteorological Congress* (WMO-No. 827)). CBS reviewed the report of an ad hoc expert meeting on the possible use of SADIS for the transmission of WWW data and products. It noted that SADIS, which referred to the distribution of WAFS and operational meteorology (OPMET) information, as specified by and funded through ICAO, was supported by a satellite-based multipoint telecommunications system. That satellite-based system was also supporting other data-distribution applications meeting national requirements of the United Kingdom Meteorological Office.

6.2.25 The Commission noted that both applications, SADIS and that of the United Kingdom Meteorological Office, currently had a significant amount of spare capacity in their respective part of the supporting satellite-based system. It stressed that the possible telecommunication capacity for WWW purposes must be available on a sustainable basis in order to protect the investments of NMSs in VSATs and data-processing systems. It noted, in that regard, that ICAO was already considering additional requirements which, when implemented, would reduce the spare capacity within the SADIS share of the satellite-based system. The Commission was informed that the United Kingdom was willing to use its capacity to broadcast data and products for WWW purposes as part of its contribution to the WWW Programme, with a guarantee of minimum capacity to be provided for WWW traffic even at peak periods, and during the lifetime of the system of a minimum of 10 years. The Commission expressed its appreciation for that offer, and considered it an important opportunity for improving the availability of data and products at many NMCs, in particular where the GTS circuits were not adequate or reliable.

6.2.26 The Commission noted that the SADIS service included a two-way component, and that ICAO was in the process of redefining the user requirement and the consequential technical design and costs. It agreed that it would be premature to consider a possible use of the two-way component for WWW purposes until ICAO had agreed the definite scheme. The general opinion was, however, that the two-way component could not replace the operational and organizational arrangements for collecting and exchanging data which were implemented and planned in the framework of regional plans for the GTS in the Regions concerned.

6.2.27 The Commission was of the opinion that the capacity of the satellite-based system offered by the United Kingdom Meteorological Office should be used as an interregional complementary component of the GTS for facilitating the distribution of meteorological data and products. The Commission emphasized that the following matters required careful consideration:

(*a*) An appropriate management mechanism should be established between the United Kingdom Meteorological Office and relevant regional representatives to ensure that the WWW data and products distributed by the system met NMHSs requirements;

(*b*) The routing via GTS circuits of RSMCs products to RTH Bracknell for satellite-based distribution would require ad hoc arrangements on interregional and MTN circuits of the GTS taking due account of their actual transmission load;

(*c*) The single vendor source and proprietary nature of VSAT equipment, although inherent to multipoint satellite-based system, might cause difficulties for its procurement, funding and maintenance in some countries. However, the presence of a number of different workstation suppliers (who could include the proprietary VSAT equipment within their offerings) meant that procurement could be conducted on a competitive basis.

6.2.28 The Commission, furthermore, noted that the access to the SADIS aviation data by aeronautical users required the approval of the ICAO Contracting States, on advice from the designated national Meteorological Authority for ICAO, whereas access to the WWW data and products could only be obtained with the approval of the NMS. The design of the system enabled those two data streams to be controlled separately. NMSs could receive the two flows of data (World Area Forecast System (WAFS) and WWW) for their meteorological applications. It was noted that the system was a closed one — only approved users had access to the data and products. NMHSs would, therefore, have control of the distribution of the WWW data and products within their country.

6.2.29 The Commission requested the Secretary-General to submit to the forty-ninth session of the Executive Council the ad hoc expert meeting report on the possible use for WWW data exchange of SADIS and

the associated satellite-based telecommunications system, as included in Annex III to this report, after consolidation with its views expressed in the above paragraphs.

ORGANIZATION AND STRUCTURE OF THE GTS

TELECOMMUNICATION SUPPORT TO OTHER PROGRAMMES

6.2.30 Due consideration was also given to the GTS support for, and coordination with, other WMO and international programmes (particularly GCOS, GOOS, and the World Hydrological Cycle Observing System (WHYCOS)). The Commission agreed that their data exchange requirements should be duly taken into account when reviewing and further developing telecommunication procedures and GTS plans.

NEW TELECOMMUNICATION TECHNIQUES AND SERVICES

6.2.31 The Commission expressed its appreciation for the report on new telecommunication techniques and services submitted by the chairman of the WG/TEL. It requested him, with the assistance of the Secretariat, to consolidate the document as a technical report to be distributed to WMO Members and members of regional working groups on planning and implementation of the WWW. The technical report was expected to facilitate the assessment of the impact of new techniques and services on a cost-effective structure of the GTS. The Commission also requested the WG/TEL to keep the content of the report under review in pace with new developments.

6.2.32 The Commission underlined that the current and future evolution of the GTS, particularly through the increasing role of new telecommunication techniques and services, required a review of the functions and responsibilities and the number of RTHs on the MTN and of other RTHs. The Commission requested its WG/TEL to keep that question under review and to develop a methodology for the determination of requirements and verification of the capabilities of centres, and for designating centres carrying out international responsibilities on the GTS.

6.2.33 The Commission also noted with interest that RA VI was considering commercially-managed network services (also called value-added network in Europe) for the design and implementation of the new Regional Meteorological Data Communication Network in Region VI, and that Argentina had firm plans for using similar services between RTH Buenos Aires and its associated NMCs.

STRUCTURE OF THE GTS

6.2.34 The Commission re-affirmed the requirements for developing further the MTN, as elaborated by its extraordinary session (1994), as well as for enhancing the MTN concept. It noted with some concern the relative low pace for the implementation of improved data-communication services, and urged MTN centres to make all efforts possible with a view to enabling the GTS to meet increasing data exchange requirements.

6.2.35 The Commission agreed that the present arrangements for sharing recurrent costs of GTS circuits were no longer applicable for the new telecommunication services, including satellite-based systems and commercially-managed network services. The new satellite-based RMTN for Region IV, as well as the Regional Meteorological Data Communication Network (RMDCN) for Region VI being planned, had resulted in the development of innovative legal and contractual arrangements between the group of Members concerned. The Commission requested its WG/TEL to consider as a matter of urgency the administrative, financial and operational aspects of the introduction of new telecommunication services for implementing the GTS, and to develop guidelines for facilitating regional planning.

RADIO-FREQUENCIES FOR METEOROLOGICAL ACTIVITIES

6.2.36 The Commission noted with appreciation the favourable outcome of the World Radiocommunication Conference 1995 as regarded safeguarding radio-frequency allocation for meteorology, which resulted from the support given to WMO's statements by several countries' delegations at that conference. The coordination between Meteorological Services and their national telecommunication administrations, and the preparatory work by the WG/TEL Study Group on Radio-frequency Coordination (SG-RFC) and the WMO Secretariat proved most helpful in that connection.

6.2.37 The Commission expressed its concern about the continuing threat to meteorological radio-frequencies, as the agenda of the 1997 World Radiocommunication Conference (WRC) would again include several items of concern for meteorology, in particular:

(*a*) Additional frequency allocations to the Mobile-Satellite service, including the possible use of 1675–1710 MHz, 401–406 MHz and 137–138 MHz bands;

(*b*) Upgrade allocation to the meteorological satellite system in the band 401–403 MHz to the primary status, to ensure protection of meteorological satellites data-collection platforms;

(*c*) Frequency requirements for space-borne passive remote sensing, in particular in the 50–71 GHz (oxygen absorption band);

(*d*) Frequency requirements for wind profiler radars.

6.2.38 The Commission urged all Members to give their full support to Resolution 3 (Cg-XII) — Radio-frequencies for meteorological activities, particularly as regarded both the coordination between Meteorological Services and their national telecommunication administrations to ensure adequate recognition and consideration of the issue at future World Radiocommunication Conferences, and the active involvement of Meteorological Services in relevant activities of the International Telecommunication Union (ITU) Radiocommunication Sector (ITU-R). The Commission particularly stressed the importance of an adequate participation of meteorological experts in the ITU-R/Working Party 7C, entrusted with the development of technical recommendations on radio-communication services for meteorology and Earth exploration. It requested the WG/TEL/SG-RFC, with the assistance of the WMO Secretariat, to provide the appropriate documentation and guidance on WRC-97 issues.

6.2.39 The Commission noted with appreciation the arrangements made for holding the second session of the WG/TEL/SG-RFC consecutively with a related ITU Radiocommunication meeting (ITU-R/WP 7C). The Commission invited the Secretary-General to consider similar arrangements in the future, in particular for preparing WRC-97, as that would enable the efficient coordination of radio-frequency matters. Two important milestones for the preparation by ITU-R of WRC-97 would be the Conference Preparatory Meeting (CPM) scheduled for May 1997, and a session of WP 7C in June 1997.

6.2.40 The Commission noted that the relevant WMO and ITU-R meetings (including important contributions provided by several WMO Members and the European Organization for the Exploitation of Meteorological Satellites (EUMETSAT)) had resulted in significant progress on several issues, in particular:

(*a*) Sharing arrangements for the band 1 675–1 690 MHz between the mobile-satellite service (MSS) and the meteorological-satellite service (METSAT), safeguarding adequate protection of main meteorological Earth stations as well as the 1 690–1 710 MHz band for METSAT;

(*b*) Studies on sharing of the band 401–406 MHz between MSS and METSAT;

(*c*) Protection of spaceborne passive sensing, including allocations near 60 GHz (oxygen band);

(*d*) Technical characteristics, performance and interference criteria for radiosonde systems.

6.2.41 Studies had shown that, in general, co-frequency sharing between radiosondes and MSS was not feasible and that sharing would generally require band segmentation. In that respect, the Commission noted that the ITU-R developed a recommendation urging "manufacturers of meteorological aids equipment (i.e. radiosondes) to develop equipment with improved radiocommunication characteristics at minimum incremental cost in order to reduce the bandwidth requirements" in the band 1 675–1 700 MHz, and urging "meteorological aids system operators and/or other appropriate organizations, in particular WMO, to take appropriate steps to implement their systems with improved radiocommunication characteristics". The Commission invited all Members concerned to take that ITU-R recommendation in due consideration and, in view of its impact on radiosonde systems operated in several countries, it requested the Secretary-General to organize an expert meeting on the issue as a matter of urgency. The Commission expressed its deep concern that any significant increase in the cost of radiosondes which would result from those improvements would have an adverse impact on upper-air observations, in particular for less developed and developing countries. The Commission also noted that the ITU-R invited Administrations (i.e. ITU Members) to "assess their future requirements for meteorological aids systems, including civilian and defence users, in the range 400.15 to 406 MHz and submit them to WP 7C and the WMO", and it urged NMSs to participate in that study.

6.2.42 The Commission was informed of a project for an ITU-R handbook on radiocommunication services for meteorological activities, to be developed jointly by ITU-R (Study Group 7) and WMO. The Commission felt that the handbook would greatly facilitate the comprehensive awareness of radiocommunications for meteorology, both inside and outside the meteorological community and concurred with the project. It invited NMSs concerned and manufacturers of relevant meteorological equipment to consider providing support to that development.

6.2.43 The Commission recalled that the WMO Secretariat had issued several circular letters urging WMO Members to register with their national telecommunication administration all meteorological radio-communication stations and frequencies used. The Commission re-emphasized the extreme importance of properly registering meteorological radio-communication stations and frequencies and urged NMSs to do so.

Future work programme

6.2.44 The Commission agreed on the future work programme for its present Working Group on Telecommunications as follows, including specific matters reflected under the present agenda item:

(*a*) Develop technical guidance for the development and implementation of improved data communication services on the GTS and in particular on the MTN to meet the requirements for the MTN (as agreed by CBS Ext 94) including guidance on the introduction of TCP/IP (1997);

(*b*) Study and provide technical and operational information on the further introduction of new telecommunication techniques and services for the implementation of the GTS, including satellite-based telecommunication systems (one-way and two-way, such as the new RMTN in RA IV), and commercially-managed network services (such as those under consideration in RA VI);

(*c*) Study and provide advice on the impact of technical and operational attributes of new telecommunication techniques and services on the administrative and financial aspects of their implementation in the GTS;

(*d*) Further develop operational procedures with a view to an improved efficiency and flexibility of the GTS, and keep under review the routing of GTS traffic;

(*e*) Further develop monitoring procedures relevant to the GTS;

(*f*) Keep under review matters related to radio frequency for all meteorological activities (operational and research), coordinate with relevant ITU activities with the assistance of the Secretariat, and develop guidance and documentation to Members, in particular in preparation for the ITU-WRC 97 (1997);

(*g*) Coordinate and develop guidance on the management of operational information related to GTS operation (catalogue of bulletins, routing directories, etc);

(*h*) Advise on WMO training materials, seminars and workshops on telecommunication techniques and operations.

6.3 GLOBAL DATA-PROCESSING SYSTEM (GDPS) (agenda item 6.3)

REPORT OF THE CHAIRMAN OF THE WORKING GROUP ON DATA PROCESSING

6.3.1 The Commission received with appreciation the report of the chairman of the Working Group on Data Processing, Mr H. Allard (Canada), which included also the results of the Expert Meeting on Operational Matters of GDPS Centres (December 1995) and the CBS Expert Meeting on Environmental Emergency Response Activities (December 1995).

IMPACT OF LIMITED AREA MODEL (LAM) AND VARIABLE RESOLUTION MODEL (VRM) ON THE GLOBAL FORECASTING SYSTEM

6.3.2 Current high resolution global models had considerable skill, and it was considered that even higher resolution global models might be available before the end of the century. Improved telecommunication dissemination systems now made it easier to receive more information which was ready for post processing and/or interpretation. In that context, the Commission noted that some experts suggested that, for some centres, a better use of resources might be obtained from concentrating on post processing and generating value-added end products and graphical display rather than allocating considerable resources required for running and maintaining a modelling system.

6.3.3 However, the Commission also noted expert views that certain models could now be run operationally on small inexpensive workstations to provide numerical forecasts for a limited area. While such technology was still considered developmental by many experts, that numerical guidance would be of a suitable quality for meeting many requirements of some national centre services. Nevertheless, it was agreed that developing regional centres that were starting NWP activities might have to resort to modest facilities such as high end workstations for that purpose. It was also recognized that even if running NWP models on small inexpensive workstations might not be suitable for operations, it might be useful for training purposes.

6.3.4 The Commission considered the value added by LAM and VRM to the global forecasting system and agreed that the main advantage of operation of LAM or VRM were the timely availability of model outputs with enhanced representation of local geographical phenomena and better resolution in both time and space. The Commission was informed of the following advantages and disadvantages of the two approaches:

(*a*) Centres needed to have considerable resources for running the LAM or VRM systems over a reasonably sized grid and at a resolution higher than global models;

(*b*) The major advantage of VRM over LAM was its ability to generate high resolution small-scale forecasts in a limited area of choice without the use of lateral boundary conditions. The need for defining a global initial state was its disadvantage;

(*c*) The major advantage for LAM was its ability to be initialized early with a subset of global observations. Its need for boundary conditions from a global modelling system was its disadvantage.

6.3.5 The Commission emphasized that cooperation between centres having a common interest in running a high resolution regional modelling system could be highly beneficial, in particular in areas such as research and development, realization of numerical weather prediction applications, use of a common computing centre, or the establishment of a specialized computing centre. The high resolution limited area atmospheric model (HIRLAM) was seen as an excellent example of a cooperative approach.

6.3.6 Systems such as the LAMs and VRMs were rather complex and their operation might require a critical mass of scientific staff. If research and development work was to be done, even more staff would be required. Continually upgrading the systems was important in order to maintain and improve the model skill over that of the global model systems.

6.3.7 In the framework of advanced post-processing, the interpretation of model output could be used through locally-applied diagnostic tools to derive weather parameters. Each of those tools had specific characteristics, for example:

(*a*) The perfect prognosis (PP) method could be used when archived analysis fields were available but did not take into account the bias of the forecast fields;

(*b*) Model output statistics (MOS) required an archived model output, and the re-computation of the coefficients every time the model was significantly modified;

(*c*) The auto-adaptive Kalman filtering methodology had no constraints and had become more and more popular;

(*d*) One-dimensional models implemented on workstations or small computers could also be used.

Centres with limited resources available could noticeably benefit from the application of advanced post-processing and the realization of value-added products, because they could be effectively performed on today's workstations. NMCs were encouraged to acquire and implement such facilities.

6.3.8 The importance of training was emphasized for acquiring and maintaining competence in numerical weather prediction. A promising way to achieve that goal was to develop experimental models, allowing staff to become accustomed to the numerical techniques, and participate in, and contribute to, cooperative model development projects. Another effective training method was the attachment of staff to more developed GDPS centres. Developing centres were encouraged to establish working arrangements with developed centres to facilitate such cooperative activities and attachments.

6.3.9 The Commission concluded that in order to improve their outputs, Members should give proper consideration to the above noted alternatives and select the most appropriate approach to their specific purpose.

LONG-RANGE PREDICTIONS

6.3.10 The Commission noted that several NMSs were issuing long-range products in the form of climate anomaly predictions from one month to two years in the future. It agreed that in order to achieve valid intercomparisons of such products, standard verification procedures should be developed and agreed upon. To that end, the Commission considered an initial set of standard verification procedures as given in Annex IV to this report. The Commission invited NMSs issuing long-range products to review and test the procedures, and requested its Working Group on Data Processing to analyse the results and to refine the procedures as necessary.

REVIEW OF THE *MANUAL ON THE GLOBAL DATA-PROCESSING SYSTEM* (WMO-No. 485)

6.3.11 The Commission reviewed Part I of the *Manual on the Global Data-processing System*. It agreed to recommend to the Executive Council those amendments reflecting changes in the organization and functions of the GDPS which related mainly to extended- and long-range weather forecasts, as well as to environmental quality monitoring and prediction. The Commission felt that it was necessary to give regulatory effect to standards and practices that had so far been contained in Attachments to the *Manual*, notably Attachments I.1, I.2, I.5 and I.6. Therefore, it agreed to recommend that those parts should be converted to the status of appendices (in accordance with paragraph 11 of the introduction to the *Technical Regulations* (WMO-No. 49)). Consequently, they should become Appendices I.1 to I.4 to the *Manual*. In Appendix I.1, the global role of RSMC ECMWF should be emphasized by changing of its activity specialization to "Global medium-range weather forecasting". Appendix I.4 gave improved and expanded definitions related to forecast ranges up to two years and climate forecasts beyond two years. The old Attachments I.3 and I.4 should maintain their status and should be renumbered as Attachments I.1 to I.2.

6.3.12 In reviewing Part II of the *Manual on the GDPS*, the Commission agreed to recommend to the Executive Council the amendments corresponding to, and supplementing, those recommended for Part I. In noting the request made by Twelfth Congress to include a consolidated list of requirements for the exchange of data and products in support of all WMO Programmes into the Technical Regulations, the Commission reviewed and proposed amendments to the lists/tables of observational data and product requirements of the GDPS centres of the WWW. It also considered and updated the role of RSMCs in the dissemination of products in accordance with their output capabilities and stated requirements. It also agreed to recommend to give the regulatory effect to the material contained so far in Attachments II.1 to II.6 and II.16 (including the new amendments). Consequently, the Commission recommended to convert those attachments to the status of appendices to the *Manual* and to renumber them to become Appendices II.1 to II.7. Attachments II.8 to II.15 should maintain their status and be renumbered as Attachments II.1 to II.8; Attachment II.7 would be incorporated into the new Appendix II.6. In adopting the improved and expanded definitions related to forecast ranges, the Commission considered that, in order to facilitate the achievement of standard procedures and consistency in all WMO Programmes, further cooperation with CCl and the Commission for Atmospheric Sciences (CAS) should be pursued to avoid confusion related to the definition of forecast ranges.

6.3.13 The Commission adopted Recommendation 4 (CBS-XI) on amendments to Parts I and II of the *Manual on the GDPS* and the new Appendix I.5, with the understanding that the annex to that appendix would be circulated to all Members, inviting them to confirm their choice of the RSMC to which they wished to be associated.

USE OF ELECTRONIC MEANS TO EXCHANGE VERIFICATION AND MONITORING DATA

6.3.14 The Commission felt that electronic mail was quite appropriate for the exchange of information between experts of different NMSs. Most centres operating a global model had been exchanging monthly WMO standard scores by e-mail. A computer format had now been derived from the tables which had been in use since 1988. The format is given in Annex V to this report (in English only). The Commission recommended that all centres use that format for the exchange of standard scores.

6.3.15 The Commission further agreed that the use of electronic means for the exchange of quality monitoring statistics should be promoted to enable centres to access that information more readily. That should be particularly helpful for the consolidation of monitoring results performed regularly by the various lead centres for data monitoring, and also for reviewing the monitoring of COSNA.

6.3.16 The dataset of monitoring statistics, together with a suitable format for the exchange by electronic media, is defined in Annex VI to this report (in English only). The Commission agreed that that format and the data exchange via e-mail should be implemented on a trial basis and requested its Working Group on Data Processing to review the experience gained after a period of about two years. In the meantime, the production of the printed monitoring reports should continue.

THE PROVISION OF GUIDANCE ON THE OCCURRENCE OF SEVERE WEATHER

6.3.17 Issues of concern were the exchange of severe weather warnings and advisories within the international meteorological community, the distribution of such information to the media, and the coordination of activities with relief agencies, in particular the United Nations Department of Humanitarian Affairs (DHA).

6.3.18 The Commission recommended that regional associations should review and possibly encourage the harmonization of severe weather thresholds between adjacent NMSs and the criteria by which warnings would be exchanged between NMSs. The responsibility of individual NMSs to decide on what constituted severe weather and its occurrence in their area of responsibility would continue to exist without change. Likewise, it was

clear that the authority to originate a warning of a severe weather event in a particular area would always remain with the relevant NMS. No NMS should issue warnings of events occurring beyond its area of responsibility without the consent of the relevant NMS. Sea areas were covered in that provision in that there was a clear definition of responsibilities for all sea areas as specified in the *Manual on Marine Meteorological Services* (WMO-No. 471). As a severe weather event might affect the areas of more than one NMS, there was the potential for conflicting warnings being issued by neighbouring NMSs. The Commission also recommended that RAs should review prevailing procedures and seek to minimize the issuing of conflicting warnings within their Regions.

METEOROLOGICAL AND HYDROLOGICAL SUPPORT TO UNITED NATIONS HUMANITARIAN MISSIONS

6.3.19 The Commission, noting the decision of Twelfth Congress to coordinate the provision of meteorological and hydrological information for United Nations humanitarian efforts related to natural disasters and other crises, agreed that, because the information required in an emergency could likely include general forecasts, severe weather advisories and warnings, where available seasonal outlooks and possibly other specialized meteorological and hydrological services, such support should be provided by NMHSs. Furthermore, it was to be assumed that in some emergencies the NMHSs concerned were not fully functioning or could not be contacted. In such cases, a backup arrangement would be required. The Commission concluded that backup support from RSMCs would be the most appropriate one and that that should be based on the existing structure of centres with geographical specialization. The Commission considered the arrangements for the provision of meteorological assistance to United Nations humanitarian missions as given in Annex 2 to Recommendation 4 (CBS-XI) as the most appropriate ones and recommended their adoption.

ENVIRONMENTAL EMERGENCY RESPONSE (EER)

6.3.20 The Commission noted with satisfaction the conclusions and recommendations of the Expert Meeting on Environmental Emergency Response Activities (Vienna, December 1995). It endorsed the following recommendations:

(*a*) The Secretariat should maintain and publish at annual intervals, the official lists of Delegated Authorities and Operational Contacts for the NMSs and make them available to Members and the International Atomic Energy Agency (IAEA). Updates on changes notified by Members should be made available to all concerned as soon as they are received. The RSMCs concerned would inform the WMO Secretariat of inoperative contact numbers;

(*b*) The "Documentation on RSMC support for EER (for meteorologists)" should be formalized as a WMO technical publication in the four WMO languages, possibly by seeking assistance from Members in obtaining translations.

6.3.21 The Commission noted with satisfaction that an exercise on the generation and dissemination of EER products was carried out in June 1995 at the global level with the participation of the IAEA in order to test the viability of the WMO/IAEA arrangements. In the light of the very positive results of that exercise, the Commission recommended amendments to the EER procedures as specified in the *Manual on the GDPS* and as given in Recommendation 4 (CBS-XI), and recommended further to provide them, when approved by the Executive Council, to the IAEA for inclusion in its *Emergency Notification and Assistance Technical Operations Manual (ENATOM)*. The Commission considered all proposals addressing principles and the technical aspects of EER exercises and general rules of display of atmospheric transport model (ATM) results and endorsed the summary matrix for WMO-IAEA exercises given in Annex VII to this report. The matrix was an attempt to prioritize the critical processes identified as a function of the scale of the exercise. It endorsed changes to general rules of display of results as given in Annex 1 to Recommendation 4 (CBS-XI).

6.3.22 As regarded training of NMS staff in the use of EER products, the Commission felt that that should have a high priority in the present biennium because products and procedures were relatively new and experience was not yet widespread. It recognized that the requirements and options for training were different in each Region. For instance, the potential number of target trainees could be very large in certain Regions. The Commission thought it best to develop hard copy training packages that could be generally used and hoped that an expert could be retained to develop that material appropriately.

6.3.23 The Commission also recommended that the training of trainers' activities under the WMO Education and Training Programme, which normally provided training in selected subjects, should include EER subjects in those training events.

6.3.24 The Commission noted further that training could be achieved by attachments of NMS experts during EER exercises at RSMCs. It was also noted that some RSMCs had developed examples of model interpretation training material which could be made available on diskettes upon request.

6.3.25 The Commission was pleased to note that two training seminars on EER activities were planned for 1996/1997, one for participants from RAs I, II and VI (Toulouse, September 1996) and one for participants from RAs III, IV and V (Montreal, 1997).

EMERGENCY RESPONSE TO CHEMICAL ACCIDENTS

6.3.26 With regard to the request made by the United Nations DHA for assistance in developing and implementing an emergency response system for chemical accidents, the Commission agreed that that should be considered as part of the Emergency Response Activity programme. As a first step, and for accidents of a local nature, the NMCs with capability for running pollution models would be the appropriate centres to be approached by DHA. For

accidents with a transboundary potential, the Commission recommended that a few CBS/CAS experts jointly meet with DHA representatives to define better the DHA requirements and explore how they could best be responded to by the meteorological community.

NATIONAL ARRANGEMENTS FOR THE PROVISION OF EER SERVICES

6.3.27 The Commission recognized the need to strengthen coordination at the national level between the NMS operational contact and the IAEA State national official contact point to assure appropriate interpretation and use of RSMC products as guidance in case of a radiological accident. It encouraged Members to establish and/or strengthen liaison between NMSs and relevant national agencies including the corresponding IAEA contact points.

DESIGNATION OF REGIONAL SPECIALIZED METEOROLOGICAL CENTRES (RSMCs)

6.3.28 As regarded Resolution 6 (XI-RA I) — Assignment of the responsibilities of RSMCs with geographical specialization in central and southern Africa, that urgent steps be taken leading to the designation of the GDPS centre in Pretoria as RSMC with geographical specialization in central and southern Africa, the Commission was informed of the formal commitment of South Africa that its centre would fulfil such functions. The Commission also appreciated the presentations made on the capabilities of the centre. It noted the communications and computing facilities as well as the related operational product generation functions and agreed that the relevant provisions of the designation procedures had been fulfilled by the centre. The Commission, therefore, recommended the designation of the GDPS centre in Pretoria as an RSMC and adopted Recommendation 5 (CBS-XI).

6.3.29 The Commission noted the statements of RA II that there was a requirement for specialized transport/dispersion/deposition model products to be made available to Members in the Region and the IAEA in case of a nuclear accident or other environmental emergencies. As regarded the recommendation of RA II that steps be taken leading to the designation of GDPS centres in Beijing, Tokyo, and the Regional Operational Centre (ROC), Obninsk, as RSMCs with such activity specialization, the Commission was informed of the formal commitments of China, Japan and the Russian Federation that their centres would fulfil those functions. The Commission also expressed its appreciation for the presentations made on the capabilities of the three centres. It noted the capabilities of the centres to generate and make available operationally, upon request, the required products in the event of an accident, and agreed that the relevant provisions of the designation procedures had been fulfilled by the centres. The Commission, therefore, recommended the designation of the GDPS centres in Beijing, Tokyo and the ROC, Obninsk, as RSMCs with activity specialization on the provision of transport model products for EER, and adopted Recommendation 6 (CBS-XI).

PROGRESS REPORT OF RSMC NADI, FIJI

6.3.30 The Commission noted with appreciation the report of the Fiji Meteorological Service operating the Nadi Tropical Cyclone Warning Centre on its current development. It noted the present capabilities of RSMC Nadi to perform its requested tasks.

6.3.31 The Commission also took note of the major Project for the Upgrading of Meteorological Observation and Forecasting System of the Fiji Meteorological Service, currently in development and to be completed in 1997. In particular, the Commission recognized the substantial contributions that centre would make to the WWW in the South-West Pacific and appreciated the contribution to its establishment, particularly by the Government of Japan and also by the Governments of Australia, New Zealand and the United States. It was suggested that the Member operating RSMC Nadi should keep the Commission informed at its next session on the progress of the project.

FUTURE WORK PROGRAMME

6.3.32 The Commission agreed on the following work programme of the Working Group on Data Processing:

(*a*) Plan and coordinate studies of the impacts on GDPS outputs resulting from changes to the GOS. Synthesize results of the impact studies and provide scientific advice to Members;

(*b*) Continue to coordinate development and implementation of a verification system for long-range weather forecasts to improve their accuracy and monitor their reliability;

(*c*) Develop the capabilities of the GDPS to fulfil Members' existing and newly emerging requirements by coordinating the development of training material and organizing workshop/training seminars on the application and use of GDPS outputs including atmospheric model transport products;

(*d*) Further the benefits that could be derived from the application of GDPS to other WMO and related international programmes, such as monitoring the situation and potentially-coordinating the development of services in support of the activities of the new Comprehensive Test Ban Treaty (CTBT) Organization, in which WMO should play a role as far as atmospheric detection techniques were concerned since they relied heavily on GDPS model outputs;

(*e*) Better define, in collaboration with DHA, the requirements concerning chemical spill and determine how best to respond to those requirements.

6.4 WORLD WEATHER WATCH DATA MANAGEMENT (DM) (agenda item 6.4)

6.4.1 The Commission noted with appreciation and interest the report of the chairman of the Working Group on Data Management, Dr G. Love (Australia). The Commission also emphasized the importance of data management functions and the role played by the WGDM in integrating the GOS, the GTS and the GDPS components into a more efficient system providing improved services to NMHS in the framework of the WWW programme as well as other WMO Programmes.

DATA REPRESENTATION AND CODES ACTIVITIES

6.4.2 The Commission noted with appreciation the work of the Subgroup on Data Representation and Codes of the Working Group on Data Management and thanked its chairman, Dr C. Dey (United States), for his excellent work.

6.4.3 The Commission noted Recommendation 14 (CBS-95) — Amendments to alphanumeric codes FM 15-IX Ext. METAR, FM 16-IX Ext. SPECI, FM 51-IX Ext. TAF, FM 53-IX Ext. ARFOR, FM 54-IX Ext. ROFOR for use as from 1 January 1996 and to the tables of binary codes FM 92-X Ext. GRIB and FM 94-X Ext. BUFR for use as from 8 November 1995, as well as Recommendation 15 (CBS-96) — Amendments in the tables of binary codes FM 92-X Ext. GRIB and FM 94-X Ext. BUFR for use as from 6 November 1996.

6.4.4 The Commission considered the requirement for facilitating the exchange in binary form of a set of synoptic features including many from significant weather charts (like jet stream, turbulence area (in clear air or cloud), storm (tropical or sand/dust), cloud area, front, tropopause height, airframe icing, volcano, special cloud). The advantage of that, in comparison with traditional graphical methods of exchanging information, was a significant reduction in the amount of data to be transmitted. In addition, the availability of the information in digital form greatly facilitated the production of charts on a variety of map projections and formats. The necessary additions to the FM 94-X Ext. BUFR Table B and the corresponding explanatory regulations were adopted for use as from 5 November 1997. The proposed regulation change would not affect existing encoder/decoder software.

6.4.5 The Commission considered the existing discrepancies that existed between the alphanumeric codes tables (for SATEM, SATOB and SARAD) and the binary code tables in BUFR for the identification of satellites, and for the distinction between the satellite operator and the data originating/generating centre. Noting the proposals made by the Working Group on Satellites and by the Coordination Group for Meteorological Satellites (CGMS), the Commission recommended the adoption of a single common code table C-5 for both the alphanumeric and BUFR codes to define the satellite name. The satellite operators would have entries reserved in the table and would be asked to coordinate with the WMO Secretariat when new satellites that required an entry in the table were commissioned. The common code table C-1 defining the originating/processing centres and subcentres would be common to BUFR and SATEM, SATOB and SARAD. In that connection, it recommended an additional group in Section 1 of SATEM, SATOB and SARAD codes: $F_3F_3F_3F_4F_4F_4$. The centres $F_3F_3F_3$ (and subcentres $F_4F_4F_4$ defined independently by each centre and notified to the WMO Secretariat) would also be defined in Table C-1. The symbolic letters $I_6I_6I_6$ identified the satellites in SATEM, SATOB and SARAD and were defined in Table C-5. The Commission recommended the adoption of the water temperature profile instruments tables as common code tables C-3 and C-4.

6.4.6 The Commission adopted a new regulation to avoid possible confusion in the radiation groups and groups 5 of section 3 in the FM 12-X Ext. SYNOP, 13-X SHIP and 14-X Ext. SYNOP MOBIL, added entries in a code table for reporting showers or intermittent precipitation by automatic stations, and corrected some inconsistences in the regulations. The Commission considered the request made by the United States to transmit additional optional national groups in the FM 18-X BUOY code and agreed to add a new optional national section. The Commission considered the requirement expressed by the Operating Consortium of ASDAR Participants (OCAP) Executive Board concerning a problem in reporting an "unsteady" flight phase in the FM 42-IX Ext. AMDAR, which caused the loss of many reports. The Commission adopted a new regulation in FM 42-IX Ext. AMDAR to alleviate that problem. The Commission recommended that some small adjustments be made in the definition of some parameters of FM 71-X CLIMAT.

6.4.7 The Commission agreed on modifications or additions to the *Manual on Codes* (WMO-No. 306) in paragraphs 6.4.5 and 6.4.6 above and adopted Recommendation 7 (CBS-XI).

6.4.8 The Commission was concerned about the current irregular practices in using FM 71-X CLIMAT as evidenced in the surveys carried out by several GDPS centres. The Commission recommended that CCl consider the adoption of the following procedure in order to provide more time to prepare a good quality CLIMAT: "CLIMAT and CLIMAT TEMP reports should normally be transmitted by the fifth day of each month, but not later than the eighth day of each month." The Commission also requested CCl to consider developing within the climate computing (CLICOM) system functions to generate automatically the CLIMAT reports and to include them in the CCl Training Programme encoding and use of FM 71 CLIMAT.

6.4.9 The Commission was informed that considerable progress had already been made in cooperation with the Intergovernmental Oceanographic Commission (IOC)/International Oceanographic Data Exchange (IODE) to develop a more comprehensive representation of oceanographic data through the development of a new BUFR master table for oceanography.

6.4.10 The Commission noted the work being done with regard to the development of the CREX representation form and encouraged the Working Group to continue its experimental testing.

6.4.11 The Commission was concerned about the increased complexity of binary representation forms and other table driven codes which would soon include more than one million figures. Reliable maintaining, checking and editing of that material was only possible through a team of experts from different centres and the use of data-processing techniques. The Commission also stressed that an operational explanation of those tables required their representation in computer-readable formats and storage modes. The Commission concluded that that could only be managed by providing on-line

access to those datasets, preferably through FTP, and that datasets on diskettes should be made available.

6.4.12 Users and providers of WAFS had expressed a strong requirement for a freeze of GRIB edition 1; the Commission, therefore, agreed to protect GRIB edition 1 from any further changes. The Commission noted that the World Area Forecast Centres (WAFCs) would continue to produce WAFS products in GRIB edition 1 until they were no longer required by ICAO. However, it was also recognized that Members had many requirements which were not met by the current edition of GRIB and recommended that a new GRIB edition 2 be developed and implemented as a matter of urgency. The Commission requested the WGDM to proceed with the development and experimental use of GRIB edition 2.

ISSUES REFERRING TO DATA REPRESENTATION AND CODES

6.4.13 The Commission noted that the use of BUFR for the international exchange of data traditionally handled in the character codes had been insignificant and the reluctance of Members to commence large-scale conversions between the character codes and BUFR appeared to be slowing its adoption. The Commission requested the WGDM to develop a strategy for migration from the character codes to table-based data representation forms for the international exchange of large collectives of data currently encoded as SYNOP and TEMP messages.

6.4.14 The Commission noted that the amendments to the meteorological data representation forms had a significant financial impact on smaller NMSs, which had to rely on external and commercial expertise. While recognizing that with changing user requirements, instrumentation, observing systems, science, and technology, the data representation forms would inevitably have to evolve, the Commission requested the WGDM to pay due attention to that problem, to the largest extent feasible.

MONITORING OF THE QUALITY OF OBSERVATIONS

6.4.15 The Commission noted with appreciation the activities carried out by GDPS lead centres on data quality monitoring. It noted with satisfaction that most Member countries where upper-air and surface stations were identified as suspect stations had taken remedial action to improve the quality of observations. It was pleased to learn that due to that remedial action, about 50 per cent of upper-air stations and 66 per cent of land-surface stations had been excluded from the consolidated list of suspect stations. The Commission urged Members to continue to work on that issue in order to improve the quality of observational data to the extent possible.

6.4.16 As regarded the quality of marine-surface data, the Commission noted with satisfaction the success achieved by Members concerned, with the assistance of RSMC Bracknell and the Data Buoy Cooperation Panel (DBCP), in monitoring the quality of ship and buoy reports.

6.4.17 As regarded satellite data quality, the Commission noted the recommendations of the Working Group on Satellites and invited the GDPS lead centre (WMC Washington) to include in its monitoring programme production of bias and root-mean-square (r.m.s.) statistics, the monitoring of radiances from sounding instruments, the monitoring of sea-surface temperatures (SSTs) data, and the monitoring of the quality of the calibration and navigation of radiances from sounding and imaging instruments.

6.4.18 The Commission recommended that all designated GDPS lead centres should provide the Secretariat every six months with consolidated reports on the results of data quality monitoring with the exception of aircraft data. That would allow the Secretariat to communicate regularly with the Members concerned and to request them to evaluate the results, to identify the causes of erroneous data, and to take remedial action.

6.4.19 The Commission noted with satisfaction that according to the recommendations made by the Working Groups on Observations and on Data Processing, a network of focal points on data quality monitoring, which had the responsibility for managing observing networks within Member countries, had been established. It consisted of approximately 100 focal points nominated by NMCs. The list of focal points had been distributed to lead centres for resolving data quality problems on a real-time basis. The Secretariat should be informed of any changes to the list so that it could be kept up to date.

DISTRIBUTED DATABASES

6.4.20 The Commission expressed its satisfaction with the further development of the DDBs concept, through the trial which had begun in late 1995, and welcomed the participation of United States National Weather Service, the United Kingdom Meteorological Office, *Météo-France*, the Australian Bureau of Meteorology, the Japan Meteorological Agency, and the WMO Secretariat in operating servers for the trial. It agreed that the trial should:

(*a*) Assist in the development of file-naming conventions;
(*b*) Encourage Members to understand the Internet;
(*c*) Encourage Members to identify the relevance of the Internet technologies to meeting their requirements for data exchange;
(*d*) Assist the Working Group on Data Management in further defining the requirement for the DDBs and the specifications of the system to be implemented.

6.4.21 The Commission agreed that all centres running servers as part of the trial should produce a report once every six months to be distributed through the WMO Secretariat. The report should include the following:

(*a*) A summary of the data available on the server;
(*b*) How the data was made accessible;
(*c*) What standards were followed regarding data representation, file names, etc.;
(*d*) Potential operational applications of the data provided;
(*e*) Statistics on who was using the system (in broad classes of users);

(*f*) Statistics on how often various types of data were requested;
(*g*) Feedback received from users;
(*h*) The costs of setting up and operating the server in terms of hardware, software, and personnel.

6.4.22 The Commission noted with interest that the United Kingdom Meteorological Office, *Météo-France*, the Australian Bureau of Meteorology, the United States National Weather Service, the Japan Meteorological Agency, and the WMO Secretariat all operated FTP servers to meet ad hoc requests for data files. It also noted that many Members and the WMO Secretariat operated World Wide Web servers. Those servers supplied meteorological information, products, meta and ancillary data to the public and to other Meteorological Services. Annex VIII to this report lists the Uniform Resource Locator (URL) and the location of some NMS's servers. The Commission was informed that several Members (e.g. Hong Kong, Republic of Korea) had recently implemented a World Wide Web server. The usage of the *Météo-France* World Wide Web server had risen from around 1 700 connections (meeting around 550 000 requests) in June 1995 to around 4 600 connections (meeting around 1 500 000 requests) in April 1996. The World Wide Web server of the United Kingdom Meteorological Office received about 10 000 queries per day with 90 per cent of users from within the United Kingdom. The World Wide Web server of the Australian Bureau of Meteorology averaged around 8 000 accesses per day, most from within Australia. The United States World Wide Web server at the RTH averaged about 80 000 requests per day. The WMO Secretariat server averaged around 1 000 requests per day.

6.4.23 The Commission noted that the high level of support for Internet technology and the widespread use of the Internet indicated that Meteorological Services using the Internet to provide a public service would be well regarded by that part of their user community which had access. While the Internet supported queries across national boundaries, the experience indicated that the user base would be predominantly national in origin. Furthermore, the requirement for easy file exchange between applications seemed more evident than ever and the DDBs concept was still relevant to the WWW. The DDBs concept did, however, need to be reviewed in the light of the emerging use of World Wide Web servers. Before such review, and possible revision of the concept, the Commission requested the WGDM to gather substantially more data on the use of both FTP and World Wide Web servers.

6.4.24 The Commission re-affirmed that a major objective of the DDB concept was to provide access and file transfer services to NMSs via the GTS, and emphasized the urgent requirement put on the GTS for providing the necessary data-communication services (see also paragraph 6.2.22 and 6.2.34). The Commission also requested the WGDM to pursue, as a matter of urgency, the development of file-naming conventions and metadata definition, which were an essential step towards an enhanced WWW system.

Monitoring

6.4.25 The Commission agreed that a general review of the current monitoring procedures should be conducted with a view to developing broad principles on how they might be modified or redesigned. It noted with satisfaction that the terms of reference for the review had been proposed by the WGDM and would be provided to the chairmen of all the working groups.

WMO plan for data management

6.4.26 Twelfth Congress had requested the Commission to coordinate the preparation of an integrated data management plan for all WMO Programmes. The Commission noted that that was a major task, beyond the resources of the WGDM and impossible to complete without considerable cooperation from all technical commissions. The Commission agreed on the approach to be taken in preparing the Plan as described in Annex IX to this report.

Guide to Data Management

6.4.27 The Commission expressed satisfaction that the WGDM had developed a draft outline for a *Guide to Data Management* and had provided it to the presidents of the other technical commissions. The Commission agreed both on the outline as given in Annex X to this report and on the fact that individual chapters should be written by experts and submitted to an editorial panel. It also agreed that an intercommission task team should be formed for that purpose and recommended that the team should perform the bulk of its work through correspondence.

The year 2000 problem

6.4.28 The Commission noted that, with the change from the year 1999 to the year 2000, various problems were likely to occur with computer software and hardware. The Commission underlined that the problem was not trivial and might affect computer-based systems operating in all components of the WWW system. It invited NMSs to pay serious attention to the matter so that necessary changes to computer systems might be made in good time. It also requested its WGDM and other working groups to consider the matter and to provide appropriate guidance to NMSs.

Study on the impact of Internet

6.4.29 As a first step in the study of Internet, as requested by the forty-eighth session of the Executive Council (see paragraph 4.10 to 4.12), the Commission reviewed with interest a consultant's report on the extent to which the World Wide Web components of the Internet actually had the potential to be used to exchange meteorological information. The report included the results of a survey of the meteorological data and products posted by World Wide Web servers, and identified the technical and implementation attributes of the Internet.

6.4.30 The survey indicated that about 170 sites held meteorological data or products and another 200 sites contained pointers only. Of the 170 sites identified, approximatively 30 per cent provided access to

observations, 70 per cent to products, and 40 per cent to meteorological imagery, mainly from satellites. Of the 50 000 weather-related documents posted on the Internet, approximately 37 per cent were posted by universities, 32 per cent by NMHSs, 22 per cent by commercial services, 5 per cent by military or other government agencies, and 4 per cent by others (including international organizations). About 85 per cent of the meteorological documents identified by standard Internet search services were located in North America, 7 per cent in Europe, 3 per cent in Australia, and 5 per cent in the rest of the world.

6.4.31 The Commission noted that, as the Internet relied on the telecommunication infrastructure, some areas of the developed world had very high-capacity (greater than 45 Mbits s^{-1}), while most of the developing world had no or only very limited connections. Internet traffic varied by time of day with even high-capacity lines or sites becoming congested at peak hours. However, the needs of many users could be accommodated by voice grade communication lines using slow/medium speed modems. That method of operation was encouraged in locations where onlylow-speed communication lines existed. There was a vast amount of information available over the Internet but there was no guarantee regarding the quality of the information posted. Security was an area of serious concern, since a server on the Internet could be open to attack by computer hackers. However, technical solutions existed which could reduce substantially those problems. The report also identified a special application, the Unidata Internet Data Distribution (IDD) system, providing for the real-time distribution of meteorological data files over the Internet for a consortium of universities in North America. The system had proved to be efficient in the North American Internet environment.

6.4.32 The Commission felt that in order for the study to progress, more information was needed concerning the actual use of the Internet by Members and other identified users. It requested the Secretariat to carry out a technical survey; to that end, a questionnaire was developed by an ad hoc group. The Commission requested the Secretariat to inform promptly all Members of the analysis of the responses to the questionnaire, which would be undertaken by the ad hoc task group (see paragraph 4.12).

6.4.33 As the Internet supported the use of both the FTP for the exchange of large files and the World Wide Web browsers (for http presentations), it could provide for significant data exchange and availability, which could enhance the meteorological services and should be considered as a new component of those services. The Commission recognized that it must develop CBS guidance on server construction and DDB file-naming standards for all Member countries of WMO. It was also noted by the Commission that there was a continuing need for a dedicated Intranet (private Internet, i.e., enhanced GTS using the Internet technology) as an additional capability of the GTS for reliable and secure data exchange in support of critical hydro-meteorological data needs for the production of numerical forecast models and the protection of life and property.

FUTURE WORK PROGRAMME

6.4.34 As regarded the future tasks to be carried out by the Working Group, the Commission agreed as follows:

(*a*) To continue the DDBs trial, including development of file-naming conventions and metadata standards;
(*b*) To review monitoring activities in cooperation with the other working groups; to develop broad principles for the re-design of monitoring activities;
(*c*) To develop a WMO Plan for Data Management (draft plan for task had been developed);
(*d*) To initiate the *Guide on Data Management*;
(*e*) To continue the development of CREX;
(*f*) To initiate development work on GRIB edition 2;
(*g*) To review the strategy for the migration of data held in character code form to binary representation forms;
(*h*) To provide guidance on the impact of the year 2000 problem on computer systems;
(*i*) Ongoing tasks:
  (i) Continue the maintenance of code and data representation forms;
  (ii) Review *Guides* and Plans, as appropriate;
  (iii) Develop training activities to meet data management requirements;
  (iv) Support the activities of other WMO programmes, particularly those of GCOS.

6.5 WMO SATELLITE ACTIVITIES (agenda item 6.5)

REPORT OF THE SECOND SESSION OF THE CBS WORKING GROUP ON SATELLITES (WG/SAT)

6.5.1 The Commission noted the report of the second session of the WG/SAT, held in Geneva, from 15 to 19 April 1996. Discussions at the second session included: satellite data; product and service requirements; improvement of the satellite system utilization; small ground-stations; education and training; satellite soundings; monitoring; and archiving.

6.5.2 The Commission endorsed a general procedure within which the users' requirements for observations and the capabilities of existing, planned, and proposed satellite observing systems to provide those capabilities would be reviewed, and through which guidance on appropriate observing systems to meet users requirements would be developed in cooperation with the Working Group on Observations. In doing so, it requested the Working Group to continue with the procedure and to document, as appropriate, each step in the review process in order to maintain a heritage as well as the ability to provide feedback to the technical commissions.

6.5.3 The Commission noted the links that existed between the WG/SAT and related activities, such as GCOS, and the Committee on Earth Observation Satellites (CEOS). The Commission encouraged the continuation and strengthening of those links.

6.5.4 The Commission was informed of the development of a WMO Requirement for Digital Satellite Image

Data and Extracted Product Exchange over the GTS. It noted that the twenty-fourth session of CGMS, held in April 1996, had indicated, as a preliminary reaction, that with the presently available technology such a requirement could best be satisfied through the data distribution system onboard the meteorological satellites. The Commission requested the various working groups involved to continue the development of the requirement with the expectation that it could endorse the requirement at its next session.

6.5.5 The Commission noted the critical role which satellite data provided to data sparse areas, particularly in the southern hemisphere and the south-west Pacific. In particular, the continuing geostationary meteorological satellites programmes of Japan (GMS), the United States (GOES) the EUMETSAT (METEOSAT), and the Russian Federation (GOMS) were providing vital data. In that respect, the anticipated and planned launch of FY2 by China would contribute to that important data source. The Commission expressed its appreciation to all the satellite operators for their contribution to WWW.

6.5.6 The Commission welcomed the statements made by satellite operators concerning their plans for future launch. Those plans included:

(*a*) China to launch FY2 in the first half of 1997;
(*b*) The United States to launch GOES-K in April 1997 and NOAA-K in August 1997;
(*c*) Russia to launch a second geostationary satellite at 76°E in 1998;
(*d*) EUMETSAT to launch Meteosat 7 in 1997;
(*e*) Japan to launch a multifunctional transport satellite (MTSAT) in 1999.

It also noted that more detailed information, regularly updated, was now available on the WMO home page of the World Wide Web.

6.5.7 The Commission welcomed the efforts of some satellite operators to establish services to provide users with full information required to receive and use data broadcast by their satellites. The Commission encouraged all satellite operators to establish such services and suggested that CGMS might coordinate those activities.

6.5.8 The Commission agreed on a set of recommendations to improve satellite system utilization as followed:

(*a*) Recognizing the lack of coverage over the Indian Ocean, it was recommended to satellite operators — through CGMS — to assure the continuity of coverage and the distribution of direct real-time observational data over the Indian Ocean from geostationary satellites;
(*b*) While appreciating that satellite operators had ongoing plans to improve the present global satellite observing system, the Commission expressed the urgent need for EUMETSAT and the European Space Agency (ESA) to approve programmes leading to the full implementation of the EUMETSAT polar system;
(*c*) CGMS Members were invited to continue the direct read-out of satellite images receivable by means of low-cost systems;
(*d*) It was requested that the Working Group on Telecommunications assess the feasibility, limitations, costs and the impact on the users of alternative schemes of distribution of satellite data and derived products, and in particular:
  (i) The use of VSAT technology;
  (ii) The use of the switched network such as Internet;
  (iii) The use of other frequency bands, such as the X-band and the Ku-band;
(*e*) It was recommended that manufacturers of data collection platforms (DCPs) include a global navigation satellite system (GNSS) receiver, or similar systems, to assure clock stability onboard the stations;
(*f*) It invited CGMS and requested the Working Group on Telecommunications to consider the improvement of DCP dissemination schemes (also including a possible increase of the transmission rate) to better comply with the WMO rules regarding data circulation on the GTS, the connection of the Meteorological Data Distribution mission with the DCS mission, and the improvement of system capacity through different dissemination schemes;
(*g*) The provision of low-cost receiving facilities should be initiated for those WMO Members which presently did not have one, but indicated in the questionnaire on improved satellite system utilization that they had such a need. WMO should seek potential donors for such systems.

It, furthermore, requested WG/SAT to complete its development of a strategy to improve satellite system utilization.

6.5.9 The Commission strongly supported the activities to keep WMO Members informed of the conversion of the analogue automatic picture transmission (APT) and weather facsimile (WEFAX) services to digital low resolution picture transmission (LRPT) and low rate information transmission (LRIT), respectively, through the preparation of a report describing the conversion and required actions by WMO Members. The EUMETSAT observer informed the Commission of the significant research and development being undertaken on the conversion, particularly as it pertained to workstations.

6.5.10 The Commission noted the concerns of three Members regarding EUMETSAT costs associated with acquiring high resolution images on a frequency of greater than eight pictures per day. In that respect, the Commission noted the comments of the representative of EUMETSAT who reminded the Commission of the significant investments made in satellite systems and the need to ensure long-term provision of satellite data and suggested that the Director of EUMETSAT be made aware of those concerns by individual Members. That would include bringing those concerns to the attention of the EUMETSAT Council. Those comments were endorsed by one Member, being also a Member State of EUMETSAT, as reflecting the policy agreed by all EUMETSAT Member States. The Commission noted that access to high resolution EUMETSAT satellite products was free to all countries with a GNP per capita of less than US$ 2 000

and that all other products were available free of charge to NMHSs. Some Members noted that they had contacted the EUMETSAT Director and were still awaiting a response. The Commission urged the Secretary-General to continue discussions with EUMETSAT regarding satisfying Members' requirements and addressing their concerns.

6.5.11 The Commission was briefed on the status of the new Strategy for Education and Training in Satellite Matters. It agreed to focus on four key areas:

(*a*) Support actively the strengthening of the specialized satellite applications centres at Nairobi and Niamey in association with the co-sponsors;

(*b*) Support actively the National Oceanic and Atmospheric Administration (NOAA) demonstration project at the Costa Rica and Barbados Regional Meteorological Training Centres (RMTCs);

(*c*) Examine means of establishing a specialized satellite applications training centre at one RMTC within RA II or RA V;

(*d*) Improve the operation and use of the system for identifying experts in satellite education and training, relevant books and training materials, and relevant training courses.

6.5.12 The Commission noted with appreciation the support given by the German Government to training in Africa through its contribution to computer-aided learning (CAL) in satellite meteorology. That programme, which was supported by EUMETSAT, as the executing agency, was based at RMTC Nairobi and the African School of Meteorology and Civil Aviation (EAMAC) in Niamey. The programme was aimed at providing training to trainers and at transfering technology through the training of experts capable of producing CAL modules relevant to Africa.

6.5.13 The Commission was informed of the latest status of registration of the use of frequency bands by both satellites and ground receiving stations. Concerning the latter, very few Members had registered their interests with ITU. The Commission strongly recommended that Members re-double their efforts to ensure that each Member was registered through its national telecommunications administration with the ITU. Registration by all concerned Members would greatly increase the potential to protect the required frequency bands, and without such registration, the use of those bands was in jeopardy.

6.5.14 The Commission agreed on the following recommendations concerning satellite soundings:

REGARDING THE USE OF TELEVISION INFRARED OBSERVATION SATELLITE (TIROS) OPERATIONAL VERTICAL SOUNDER (TOVS) DATA IN CLIMATE STUDIES

(*a*) The archive of level 1B TOVS data was not readily accessible to the research community as a climate dataset. Steps to improve such access were encouraged;

(*b*) The importance of calibration and validation activities was stressed. Long-term international calibration sites were required. Also, satellite-to-aircraft and satellite-to-satellite intercalibration experiments could play an important role.

REGARDING THE USE OF TOVS DATA IN NUMERICAL WEATHER PREDICTION (NWP)

(*a*) NWP centres currently used both radiances and retrieved products, and it was probable that that situation would continue for many years. However, there were increasing moves towards assimilation of radiance data directly into 3D and 4D variational schemes. Data distribution plans should take account of the distribution of radiances and retrieved products;

(*b*) Information on the error characteristics, including biases, of satellite sounding data (whether as radiances or retrieved products) was essential for their successful assimilation. Enhanced collaboration between NWP centres and product generation centres, especially after the launch of a new satellite, was required to improve the understanding and specification of those errors;

(*c*) Concerning the notification of changes made by NOAA/National Environmental Satellite Data Information Service (NESDIS) to the TOVS processing system, users had noted with appreciation the steps which had recently been taken to improve the dissemination of that information to NWP centres and other users. It was recommended that all changes with significant meteorological impact should continue to be notified, and that the dissemination procedures should be monitored. The valuable role that NWP centres could play in post-launch validation activities (for both radiances and retrieved products) was noted.

REGARDING PREPARATIONS FOR ADVANCED TOVS (ATOVS) DATA

(*a*) Software being developed under the EUMETSAT ATOVS project should be made available to research and operational users during the development phase in order to facilitate rapid testing and evaluation of the system as soon after launch as possible;

(*b*) The spatial resolution of global ATOVS cleared radiances and retrieved products planned at NOAA/NESDIS for international distribution (i.e. 500 km) and the stated WMO requirement (100 km) were not in agreement. That matter was being brought to the attention of NOAA and CGMS. The Commission reconfirmed the earlier stated requirement for 100 km and asked the Working Group on Telecommunications to take that into consideration when reviewing plans for the future of the GTS.

REGARDING ADVANCED INFRARED SOUNDERS

(*a*) Satellite agencies were again encouraged to give their highest priority to the development of advanced infrared sounders, along with complementary imaging and microwave sounding instruments;

(*b*) WMO goals for operational temperature and water vapour soundings (summarized as r.m.s. errors of 1 K for temperature and 10 per cent for water vapour, with 1 km vertical resolution) should not be compromised in operational sounding systems

designed for the future joint United States/EUMETSAT polar system. Also, noting the spatial sample density required to reduce cloud contamination problems, it recommended that the spatial sampling of high resolution infrared sounding systems should not be poorer than that of high resolution infrared sounder (HIRS).

REGARDING INTERNATIONAL ISSUES AND FUTURE SYSTEMS

(*a*) Noting that many absorption features in the 1 to 200 GHz frequency range were not protected for exclusive use by passive sensors on environmental satellites, all satellite operators and Members were recommended to include those frequencies in the lists of registered frequency bands through the mechanism described in paragraph 6.5.13;

(*b*) In the context of the planned joint United States/EUMETSAT polar system, the provision of advanced sounders into orbit was a high priority task. Users had expressed the desirability of having common instruments on those satellites, and they had welcomed plans to achieve that for most instruments. Noting that that might not be possible for advanced infrared soundes, EUMETSAT and the United States were encouraged to plan user interfaces for those instruments that were as similar as possible;

(*c*) Recognizing the key role that the direct broadcast of sounder and imager data had had on the exploitation of environmental remote sensing systems, it strongly recommended that all satellite agencies continue either to provide or to implement, as appropriate, a direct broadcast capability for those data;

(*d*) Satellite operators were encouraged to develop an integrated plan for the distribution of global data and products to minimize the problems of redundancy and inconsistency. Coordination through CGMS was suggested;

(*e*) The implementation of a mail list server at WMO to allow the timely exchange of technical data and information between International TOVS Working Group (ITWG) members and the plan to establish a World Wide Web home page for ITWG were welcomed and supported.

REGARDING EDUCATION AND TRAINING

With the continuing growth in the user community for satellite sounding data, there was a need for coordinated international training programmes. The offer of ITWG to help with appropriate workshops and/or training sessions was noted. Such assistance could include "training the trainers" at the Specialized Satellite Training Centres.

6.5.15 As regarded the group activities to be carried out by the Working Group, the Commission agreed as follows:

(*a*) Satellite data, product and service requirements:
  (i) Complete the first iteration of the "Rolling Requirements Review" procedure, and distribute the results (end 1998);
  (ii) Finalize the requirements for the exchange of satellite imagery and extracted products (end 1997);
  (iii) Review the updated GCOS space plan (as available);

(*b*) Improve satellite system utilization:
  (i) Continue monitoring the utilization (ongoing);
  (ii) Complete the development of the strategy for improving utilization (1998);

(*c*) Ground stations:
  (i) Distribute documentation describing LRIT/LRPT and their implementation (mid-1997);
  (ii) Develop a document describing a low-cost advanced processing system (end 1997);

(*d*) Monitoring: seek improved procedures for monitoring satellite data quality;

(*e*) Education and training: continue the implementation of the existing strategy (up to 2004);

(*f*) Satellite soundings and satellite winds: interact with expert groups; formulate and pursue detailed technical recommendations (ongoing).

6.6 OPERATIONAL INFORMATION SERVICE (OIS) (agenda item 6.6)

6.6.1 The Commission recalled that the purpose of the WWW Operational Information Service (OIS) was to collect from, and distribute to, WMO Members and WWW centres detailed and up-to-date information on facilities, services, and products made available in the day-to-day operation of the WWW.

6.6.2 The Commission noted with appreciation that in response to various requests made both by its tenth and extraordinary (1994) sessions, and by Twelfth Congress — which had called for higher data reliability, improved timeliness of distribution, and provision of updated and additional information on WWW facilities and services — the OIS was undergoing a major restructuring which, when completed, would result in comprehensive and efficient services.

6.6.3 The Commission was informed that work had been completed to restructure the computer-based support for the *International List of Selected Supplementary and Auxiliary Ships* (WMO-No. 47). Further work was in progress on *Weather Reporting* (WMO-No. 9) Volumes A and C1 (see also paragraphs 6.2.17 and 6.2.18) and the RBSN list. The already available diskette service for those volumes would be expanded to as many subscribers as possible with the eventual aim of reducing their production as printed editions, thus making substantial savings in production and mailing costs and reducing delays. In that connection, the Commission agreed that the printed editions of Volumes A and C1 should be published once a year for Members who required printed copies, and that diskettes should be distributed twice a year with the possibility of increasing the frequency of diskette distribution in the future to meet Members' requirements. The Commission strongly encouraged Members to use the diskette service to the largest extent possible.

6.6.4 The Commission noted with appreciation that, as part of the WMO DDBs trial, on-line access via Internet to files containing the information in WMO-No. 9, Volumes A and C1, and No. 47 as well as in the *Manual on Codes* had been provided for almost two years. As part of the future WMO policy on electronic publishing that would significantly facilitate access to information, improve the efficiency of the operation of the WWW centres, and result in savings in printing and mailing costs. The Commission welcomed the fact that the monthly *WWW Operational Newsletter* was also available on the Internet and strongly encouraged those subscribers who had the required facilities, to use it and as a result, to benefit from the rapid access to that publication.

7. PUBLIC WEATHER SERVICES (PWS) PROGRAMME (agenda item 7)

7.1 The Commission was pleased to note that the development of the Public Weather Services (PWS) Programme had progressed successfully in accordance with the work plan of the programme, as approved in the Third and Fourth WMO Long-term Plans.

7.2 The Commission noted with appreciation that optimum use had been made of the modest resources available to the PWS Programme. That, in a great measure, had been due to the assistance provided by those Members with well-developed PWS to less developed ones through expert meetings and training workshops. In addition, the initiative had been taken to coordinate PWS training activities with those of other WMO Programmes. Such arrangements had been successfully made with the Tropical Cyclone Programme (TCP) and GDPS.

7.3 The Commission noted with satisfaction that two expert meetings on PWS (Geneva, 1994 and 1995) had helped to refine the goals of the programme and implement one of the primary objectives, namely the preparation of a preliminary guide on public weather services practices. That publication, which was based on available information, would be developed into a full *Guide* through soliciting contributions and inputs from Members. The Commission urged Members to provide examples of national PWS practices for inclusion in the *Guide*. In that respect, the Commission encouraged Members to provide information on positive feedback from Services.

7.4 The Commission noted with appreciation that the Training Workshops on PWS (Singapore, 1995 for Regions II/V and Republic of Korea, 1996 for Region II) were most important for furthering the PWS capabilities of the NMSs. A presentation on PWS had also been given in Nairobi in 1994 at a workshop for meteorologists from the eastern and southern parts of Africa. A Training Workshop on Communication Techniques and Improved Media Relations (Costa Rica, May 1996 for Regions III/IV) addressed the coordination that existed between NMSs, disaster coordinators, and the media. In addition, the Commission noted the Expert Meeting on PWS and Hurricane Disaster Preparedness (Trinidad and Tobago, 1995) for participants from Region IV, which had discussed the use of seasonal forecasting techniques in relation to disaster mitigation and the preparation of warnings for hurricanes. The Commission expressed its appreciation to Costa Rica, Kenya, the Republic of Korea, Singapore, and Trinidad and Tobago for hosting those events.

7.5 The Commission was pleased to note that as a response to the concerns regarding the proliferation of weather forecasts from different sources in the media, and in particular, international television broadcasts by satellite, discussions had been held with producers and disseminators of those forecasts with a view to agreeing on a "best practice". Initial discussions had been fruitful and demonstrated the willingness on the part of international broadcasters to continue working with WMO on that subject. That issue was also addressed by the Expert Meeting on Operational Matters of GDPS Centres (Geneva, December 1995). The Commission noted the summary results of that meeting and agreed that WMO, through the PWS Programme, should continue to be involved in future discussions on issues associated with media communication. In particular, the Commission expressed several specific comments as given in Annex XI to this report.

7.6 The Commission noted the actions coordinated in response to the request made by Congress as regarded the provision of meteorological and hydrological information in support of the United Nations humanitarian and relief missions. In that connection, the Commission referred to paragraph 6.3.19 and Annex 2 to Recommendation 4 (CBS-XI).

7.7 Congress had requested CBS to consider establishing an open working group on PWS with a rapporteur from each RA as core members of the group. The Commission decided to establish that working group and recorded its discussions under agenda item 12.

7.8 As regarded areas of future work, the Commission requested its Working Group on Public Weather Services to address the PWS issues identified by Congress and, in particular:

(*a*) To develop the preliminary *Guide on Public Weather Services Practices* (WMO-No. 834) into a full *Guide* and to keep it under review with the aim of incorporating updates as necessary;

(*b*) To develop plans and recommendations for PWS training events, such as regional workshops and seminars with contents suitably tailored to deal with subjects of special concern and interest for each Region;

(*c*) To develop practices for the production and dissemination of severe weather warnings through addressing the sensitive issue of the exchange of such warnings among neighbouring countries, in coordination with the Working Group on Data Processing;

(*d*) To prepare material aimed at raising the level of public response to warnings of severe weather as part of the disaster preparedness and prevention;

(*e*) To develop proposals to improve relationships between NMSs, the media, and the private sector and to provide better coordination between NMSs, disaster coordinators and the media as part of the efforts to provide high quality services to the public;

(*f*) To develop guidance material on how to improve the presentation of weather information through various media including the issuance of forecasts and warnings in multiple languages;

(*g*) To develop procedures on the issuance of guidance for extratropical storms based on the approach used in the TCP;

(*h*) To develop guidance material on practices of quality monitoring on the accuracy and utility of forecast information to the public, and exchange of information on the practices and results;

(*i*) To develop practices to deal with public weather service broadcasts which covered several countries simultaneously;

(*j*) To promote and develop outreach programmes with the intent to enhance the understanding of meteorology and weather forecasting by the public, particularly for use in all levels of educational institutions.

8. INTERPROGRAMME COORDINATION AND BASIC SYSTEMS SUPPORT TO OTHER PROGRAMMES (agenda item 8)

POST-UNCED ACTIVITIES

8.1 The Commission noted with appreciation the action that had been taken as regarded the publication of various materials on the role of WMO, the technical commissions, and the NMSs in the follow-up to UNCED and the implementation of Agenda 21. The brochure entitled *A Response to the Weather and Climate Challenge: The World Weather Watch* (WMO-No. 821), published in 1995, was felt to be particularly useful in connection with fund raising efforts.

8.2 The Commission — recalling that the Rapporteur on the Follow-up to UNCED, in his report to the extraordinary (1994) session of the Commission, had identified the areas in which action could be taken by the Commission as a contribution to the Organization's overall response to Agenda 21, Capacity Building and the United Nations Framework Convention on Climate Change, felt that its immediate tasks in that area had been accomplished and that there was no need to re-appoint a rapporteur. The further follow-up action rested with the working groups which were requested to keep that subject under continuous review and to be alert to the possibilities of assisting in the primarily national and local action to be taken in that regard.

GLOBAL CLIMATE OBSERVING SYSTEM (GCOS)

8.3 The Commission expressed its appreciation for the action taken to further the Commission's contribution to the development of GCOS, especially as regarded the identification of upper-air and surface observing stations which would form GUAN and GSN. It was noted with satisfaction that GUAN had been finalized following consultation with Members and was adopted by the GCOS Joint Scientific and Technical Committee (JSTC); the Commission recommended that the list of stations in each Region should be formally adopted by the respective RA and that their operation should be kept under permanent review by the regional Working Groups on the WWW.

8.4 Noting that a first list of some 1 000 surface stations proposed for inclusion in the GSN had been drawn up by a joint CCl/CBS group of experts and reviewed by the CBS Working Group on Observations, the Commission fully endorsed the approach taken of establishing certain criteria for the selection of stations and of developing a computer algorithm. It recommended that, as had been done for GUAN, the list of proposed stations should be considered by individual Members concerned as to the practicability of implementation and the possibility of their undertaking long-term commitments to maintain and operate the stations, before submission to the GCOS/JSTC and eventually to the RAs for formal adoption.

OTHER PROGRAMMES

8.5 Regarding cooperation with, and support to, other programmes, the Commission noted that apart from routine activities in support of programmes, such as those concerning meteorological applications, a number of special activities had been undertaken in support of environmental emergency response (see items 6.1 and 6.3) and in support of humanitarian relief activities (see paragraphs 6.3.19 and 7.6).

9. EDUCATION AND TRAINING RELATED TO THE COMMISSION'S ACTIVITIES (agenda item 9)

9.1 The Commission reviewed the activities of the Education and Training Programme of relevance to CBS and stressed the importance of education and training to Members, particularly from developing countries.

9.2 The Commission noted the views and recommendations of the Executive Council Panel of Experts on Education and Training, with the subsequent comments of the Executive Council, on the activities of the technical commissions, and agreed that there should be coordination and collaboration between the Commission and the Panel. The Commission felt that arrangements were already in place to ensure that education and training as related to the Commission's activities on the various components of the basic systems were given full consideration, particularly by the working groups and that there was no need to establish a working group or rapporteur on education and training. The Commission agreed to follow the guidelines set out by the Executive Council Panel of Experts as far as possible.

9.3 The Commission urged its members to use the results of the *Education and Training Requirements in Meteorology and Operational Hydrology: WMO Survey 1994* (WMO/TD-No. 668), to execute the actions indicated under the Programme in Part II, Volume 6, of the *Fourth WMO Long-term Plan* (WMO/TD-No. 705).

9.4 The Commission noted with satisfaction the successful quadrennial WMO Symposium on Education and Training (Toulouse, France, July 1995). It also noted the considerable value of the symposium in identifying the type and level of professional meteorologists and hydrologists needed to meet the future demands of society and to utilize the advances in science and technology beyond the year 2000.

9.5 The Commission noted with appreciation the activities of the Standing Conference of Heads of Training Institutions of National Meteorological Services (SCHOTI) and its working groups dealing with the application of up-to-date scientific and technical issues to the education and training process and, in particular, the Second International Conference on Computer-aided Learning and Distance Learning in Meteorology (CALMet95) (Toulouse, France, July 1995).

9.6 The Commission noted the information provided on the activities of RMTCs and the recent expansion of the RMTC network. The Commission agreed that more emphasis should be placed by RMTCs on regional training requirements for specialized courses in various subject areas.

9.7 The Commission recorded with satisfaction the fact that EUMETSAT had decided to sponsor two RMTCs in Africa (the Institute for Meteorological Training and Research (IMTR) in Nairobi, Kenya, and EAMAC in Niamey, Niger) in accordance with WMO's strategy for satellite education and training. The goal of the project was to improve the use of satellite data for applications in meteorology and operational hydrology over the next decade. It also noted with appreciation that the German Government, through its agent the German Agency for Technical Cooperation (GTZ), had embarked on an aid project for the development of CAL modules to enhance the use of satellite data and products in the African Meteorological Services. It noted with appreciation that the United States was also supporting satellite education and training in the RMTCs in Barbados and Costa Rica and expressed the hope that that might be extended to other parts of the world.

9.8 The Commission noted that, since its last session, WMO had either organized or was a joint organizer of a number of training events, particularly for the training of instructors and for training in telecommunications and data processing. The Commission noted the relevant training events approved by the forty-seventh session of the Executive Council for implementation during the current financial period, subject to the availability of funds. The Commission expressed the hope that Members would continue to provide financial and other support for the organization of appropriate training events.

9.9 The Commission was informed that the Training Library was functioning as an exchange forum for audiovisual and computer software materials and that it had substantially increased its holdings. It noted the increase in the number of training aids made available to Members and urged them to continue to make use of facilities and holdings of the Training Library in training programmes and to provide relevant material and training aids to contribute to the enlargement of the Library's holdings.

9.10 The Commission was informed that the English version of a modern textbook on synoptic meteorology had been offered by Germany to WMO in the summer of 1995. While the finalization of the text for general use needed some additional work, publication could be made available immediately to interested Members of the northern hemisphere and of RA VI especially.

10. SCIENTIFIC LECTURES (agenda item 10)

10.1 At the invitation of the president of the Commission, two scientific lectures were presented at the session:

(*a*) What is the scope for extended prediction of climate and weather?, by Professor Lennart Bengtsson of the Max-Planck Institute for Meteorology, Hamburg, Germany;

(*b*) Multi-purpose data communication systems, by William E. Brockman of the United States National Weather Service.

10.2 Both lectures, which were followed by lively discussions, were extremely well received by the session.

11. LONG-TERM PLANS (agenda item 11)

FOURTH WMO LONG-TERM PLAN (4LTP)

11.1 The Commission noted the adoption by Twelfth Congress of the Fourth WMO Long-term Plan as well as the guidelines and directives developed by the Executive Council for its monitoring and evaluation. Since the 4LTP had been under implementation for less than a year, the Commission made no attempt to review its implementation but requested the chairmen of the working groups to keep that constantly under review. The AWG, at its twenty-first session, planned for the third quarter of 1997, was requested to advise on the first report on the evaluation of the impacts of activities performed under the Plan, to be submitted by the president of the Commission to the Executive Council Working Group on Long-term Planning early in 1998.

FIFTH WMO LONG-TERM PLAN (5LTP)

11.2 The Commission was pleased to note that the AWG, at its nineteenth session in November 1995, had discussed in some detail the preparation of the Fifth WMO Long-term Plan and that the various comments and suggestions made had been taken into account by the Executive Council Working Group on Long-term Planning and by the Executive Council itself in developing its views on the format, structure and content of the new Plan. As regarded the optimal programme structure which had yet to be decided by the Council, the Commission noted that the preliminary version adopted by the forty-eighth session of the Executive Council for the purposes of the 5LTP did not contain any major changes from the current

structure; the WWW Programme remained as it was while the Public Weather Services Programme had been extended to include mitigation of natural disasters.

11.3 The chairmen of the working groups of the Commission were requested to develop in the coming year the 5LTP for their respective subprogrammes for review initially by the AWG and then by the Commission at its extraordinary session in 1998. The Plan should be prepared in a manner enabling the evaluation of their implementation as requested by the forty-eighth session of the Executive Council.

11.4 The Commission considered that the 5LTP provided a good opportunity for CBS to set down its future strategy. It considered that targets should be set which really reflected the envisaged programme of work for the Commission and the NMHSs in the field of basic systems. Targets should be clear, forward looking, and practical so that the 5LTP became a living document within CBS, less geared to the procedures of the Commission and much more towards the outcomes to which it aspired.

12. THE COMMISSION'S WORK PROGRAMME; ESTABLISHMENT OF WORKING GROUPS AND RAPPORTEURS (agenda item 12)

STRUCTURE OF CBS

12.1 Based on various proposals, the Commission embarked on an intensive discussion on how best to improve the efficiency and effectiveness of the structure of the Commission and its working mechanisms. After having considered various options, the Commission agreed that the following options for a future working structure should be studied in more detail:

(*a*) Merging of working groups with partly overlapping activity areas: That would result in an expansion of the work programme of the new working groups and the expertise required for carrying it out. It was, therefore, considered necessary to organize the work of the working groups in modular work packages. Special emphasis should be given to the provision of services and to the verification of products delivered to end users and to the development of associated feedback mechanisms;

(*b*) Appointment of rapporteurs for special tasks: Those rapporteurs would focus within a given time-frame on special fields of innovation in science and technology relevant to the Commission.

12.2 Among the key goals should be the optimization of the use of available financial resources and expertise, and regional representation.

12.3 It was concluded that a comprehensive study of the above options would take a considerable period of time and could not be carried out during the session. The Commission envisaged that a period of two years leading up to the extraordinary session in 1998 should be used to carry out the study and gain some experience with new working mechanisms.

12.4 To that end, it was agreed to establish a Task Team to Examine and Advise on Options for Restructuring the Commission for Basic Systems, composed of Messrs H. Allard (Canada), N. Gordon (New Zealand) and Yan Hong (China), with the terms of reference and time-frame for completing that study as given in Annex XII to this report.

WORK PROGRAMME

12.5 The Commission agreed that its work programme for the next two years — based on the relevant sections of the Fourth WMO Long-term Plan and on the decisions of Congress concerning the WWW Programme — should be as reflected in the detailed discussions under the various agenda items of its eleventh session, as well as in relevant decisions of the Executive Council, including those concerning the role and operation of NMHSs. To carry out that programme, the Commission decided to establish an AWG as well as Working Groups on Observations, on Telecommunications, on Data Processing, on Satellites, on Data Management, and on Public Weather Services. Resolutions 1 (CBS-XI) to 7 (CBS-XI) were adopted. It was understood that the "open" working groups would consist, in principle, of a core membership, including the chairmen and experts representing the WMO RAs and, where applicable, experts designated by other CBS working groups.

12.6 The Commission requested the AWG to appoint a rapporteur to report on the role and operation of NMHSs, as related to the work of CBS. The rapporteur should take into account the paper submitted to, and the report on discussions at, the forty-eighth session of the Executive Council, as well as the discussions held during the present session of the Commission, which suggested that NMHSs needed to take positive and cooperative action in an increasingly technological and competitive world.

13. REVIEW OF PREVIOUS RESOLUTIONS AND RECOMMENDATIONS OF THE COMMISSION AND RELEVANT EXECUTIVE COUNCIL RESOLUTIONS (agenda item 13)

13.1 In accordance with established practice, the Commission examined those resolutions and recommendations adopted prior to its eleventh session which were still in force.

13.2 The Commission noted that the action on all of its previous recommendations had either been completed or their content included in the relevant WMO *Manuals* and decided that they should not be kept in force. Moreover, the Commission decided to replace certain resolutions still in force by new resolutions. Resolution 8 (CBS-XI) was adopted.

13.3 The Commission then examined the Executive Council's resolutions within the field of CBS and agreed that Resolutions 16 (EC-XLIII) — Environmental emergency response, and 4 (EC-XLVII) — Report of the extraordinary session (1994) of the Commission for Basic Systems, needed no longer be kept in force. It decided to recommend that Resolutions 1 — Support to the continuity of WWW facilities, and 2 (EC-XXXVI) — Extrabudgetary support to WWW implementation, and Resolution 5 (EC-XLII) — Composite observing system for the North Atlantic (COSNA), be kept in force. Recommendation 8 (CBS-XI) was adopted.

14. **ELECTION OF OFFICERS** (agenda item 14)

Mr S. Mildner (Germany) was elected president of the Commission and Mr G. Love (Australia) was elected vice-president.

15. **DATE AND PLACE OF THE NEXT SESSION** (agenda item 15)

The delegate of Germany informed the session that an earlier provisional offer to hold the next session of the Commission in Germany was still being considered by his Government. The session agreed that, subject to the receipt of any formal offer, the date and place of its next extraordinary session, tentatively planned for the fourth quarter of 1998, should be determined by its president after consultation with the Secretary-General and in accordance with the provisions of General Regulation 186.

16. **CLOSURE OF THE SESSION** (agenda item 16)

16.1 In his closing address, the president of the Commission, Dr A. A. Vasiliev reviewed the work of the session which he deemed to have been very successful. There had been major accomplishments in the period leading up to the session, which had facilitated the decisions taken, and important proposals had been made for a thorough review of the Commission's responsiblities and the way in which they were carried out. The Commission had also made several substantive recommendations on procedures affecting the operation of the WWW. He thanked the participants for their valuable contributions and for the spirit of friendly cooperation in which the discussions had been conducted. He thanked all those who had contributed to the smooth running of the session, especially the chairmen of the committees and ad hoc groups, the local staff, and the staff of the Secretariat who had worked long and hard.

16.2 As the eleventh session was his fourth and last as president of the Commission, Dr Vasiliev reviewed the may achievements of the Commission over the period and stressed how much the basic systems had changed in that time. It had been a very rewarding experience to serve the Commission and he expressed his gratitude for the support, advice, and assistance which he had received during his terms of office from a great number of people, particularly from the vice-president, Mr Mildner, the chairmen of the working groups, and other members of the AWGs, as well as the Secretary-General and the staff of the WWW Department. He considered that the Commission was in very capable hands under the leadership of Messrs Mildner and Love and he wished them every success.

16.3 On behalf of all members of the Commission, Mr E. A. Mukolwe paid tribute to the long and outstanding contribution of Dr Vasiliev, who had served two terms each as vice-president and president of the Commission, over a period of accelerating change, both technically and politically, in the work of the Commission. Dr Vasiliev had proved to be an excellent leader and had carried out his duties with diplomacy and an unfailing sense of humour. It was fortunate that his experience would not be lost to the Commission as he was to continue to serve in an advisory capacity.

16.4 On behalf of the Secretary-General, Mr R. C. Landis, thanked the Government of Egypt for providing excellent facilities for the session and for the generous hospitality offered to the participants. It had been a pleasure to work with the local staff who had made a major contribution to the session. He also thanked the president and the delegates for their understanding cooperation in the conduct of the session.

16.5 The eleventh session of the Commission for Basic Systems closed at 2.30 p.m. on 7 November 1996.

RESOLUTIONS ADOPTED BY THE SESSION

RESOLUTION 1 (CBS-XI)

ADVISORY WORKING GROUP OF THE COMMISSION FOR BASIC SYSTEMS

THE COMMISSION FOR BASIC SYSTEMS,

NOTING:

(1) Paragraph 7.13.5 of the general summary of the *Abridged Report with Resolutions of the Fifth World Meteorological Congress* (WMO-No. 213.RC.28),

(2) Resolution 2 (CBS-X) — Advisory Working Group of the Commission for Basic Systems,

CONSIDERING that a working group is of value in advising the president of the Commission and in assisting him in his duties of coordination and planning,

DECIDES:

(1) To establish the Advisory Working Group of CBS with the following terms of reference:

(*a*) To advise the president on all matters related to the work of the Commission;

(*b*) To assist the president in planning and coordinating the work of the Commission and its working groups;

(*c*) To review the internal structure and working methods of the Commission;

(*d*) To advise the president on policy matters related to the exchange of data and products;

(*e*) To monitor the implementation of the WWW Programme in relation to the WMO Long-term Plan and advise the president on appropriate actions;

(*f*) To advise the president on matters related to cooperation with other technical commissions and support to other WMO and related programmes;

(*g*) To keep under review the work of the Commission;

(*h*) To assist the president in the coordination, guidance and development of the WWW support functions;

(*i*) To formulate specific plans for education and training activities in the field of responsibility of the Commission;

(2) That the composition of the Advisory Working Group shall be as follows:
President of CBS (chairman)
Vice-president of CBS
Past president of CBS
Chairmen of the CBS Working Groups on Data Processing, on Observations, on Telecommunications, on Data Management, on Satellites, and on Public Weather Services:
Mr E. A. Mukolwe (Kenya)
Mr R. Sonzini (Argentina)
Mr Yan Hong (China).

NOTE: This resolution replaces Resolution 2 (CBS-X), which is no longer in force.

RESOLUTION 2 (CBS-XI)

WORKING GROUP ON DATA PROCESSING

THE COMMISSION FOR BASIC SYSTEMS,

CONSIDERING that there is a need for the continuation of the work of the Working Group established by Resolution 3 (CBS-X) — Working Group on Data Processing,

DECIDES:

(1) To establish the Working Group on Data Processing with the following terms of reference:

(*a*) To keep abreast of scientific and technical developments relating to the methods of meteorological analysis and forecasting for general purposes, to consider the implementation of new techniques, and to keep under review organizational and planning aspects of the GDPS;

(*b*) To provide coordination and guidance on the use of modern data-processing techniques for meteorological analysis and forecasting including the processing and interpretation of incoming products by NMCs;

(*c*) To coordinate observational data requirements for the production of GDPS products and to provide advice on the formulation of requirements to be met by the GOS;
(*d*) To review requirements stated by Members and relevant constituent bodies for WMC and RSMC products;
(*e*) To coordinate the production of analysed and forecast data by WMCs and RSMCs taking into account the requirements of Members for new kinds of products;
(*f*) To consider the transmission priorities of processed products to meet the requirements of NMCs and other users;
(*g*) To keep under review and further develop real-time and non-real-time monitoring relating to the GDPS, in coordination with the Working Group on Data Management, in order to assist Members in improving their data processing;
(*h*) To keep under review the established procedures for standardized verification of numerical products and for monitoring the quality of observations, and to develop additional proposals, where necessary, in consultation with the Working Group on Data Management;
(*i*) To monitor progress on implementation of the relevant parts of the current WMO Long-term Plan on matters related to the GDPS and to contribute to the development of the next WMO Long-Term Plan;
(*j*) To keep under review and up-to-date the *Manual on the GDPS*;
(*k*) To keep under review and up-to-date the relevant training syllabi as required and to suggest training materials and the holding of seminars and symposia;
(*l*) To act upon matters referred to the Working Group by the president of CBS;
(*m*) To coordinate its activities with the work of the Working Group on Data Management and of other working groups of CBS, with a view to the integration of the WWW system conceived as an entity;

(2) That the Working Group on Data Processing shall have the following composition:
(*a*) The expert designated by each regional association, as rapporteur/coordinator with respect to regional aspects of the GDPS;
(*b*) An expert nominated by each of the Members responsible for the operation of a WMC;
(*c*) An expert from one RSMC in each of the WMO Regions, to be nominated by the president of the corresponding regional association;
(*d*) An expert nominated by the chairmen of the Working Groups on Data Management and on Public Weather Services;
(*e*) Experts nominated by other Members or groups of Members, wishing to participate actively in the work of the Working Group;
(*f*) Experts who may be nominated by presidents of other technical commissions and by international organizations according to the work programme;

(3) To select, in accordance with General Regulation 32, Mr H. Allard (Canada), as chairman of the Working Group;

AUTHORIZES the president of CBS to adjust the membership and chairman of the Working Group, as required;
REQUESTS the chairman to submit a report to the Commission not later than six months before its sessions.

NOTE: This resolution replaces Resolution 3 (CBS-X), which is no longer in force.

RESOLUTION 3 (CBS-XI)

WORKING GROUP ON OBSERVATIONS

THE COMMISSION FOR BASIC SYSTEMS,
CONSIDERING that there is a need for the continuation of the work of the Working Group established by Resolution 4 (CBS-X) — Working Group on Observations,
DECIDES:

(1) To establish the Working Group on Observations with the following terms of reference:
(*a*) To review and advise on the overall comprehensive observational data requirements of the WWW, other WMO Programmes, and other international programmes supported by WMO;
(*b*) To review and advise on the design and implementation of the GOS taking account of:
(i) The established requirements for data;
(ii) The cost, capabilities, and performance of observing systems including information received from observational demonstrations and impact studies;
(*c*) To keep under review and develop further real-time and non-real-time monitoring relating to the GOS, in coordination with the Working Group on Data Management, in order to assist Members in improving their observing system;

(*d*) To keep the *Manual* and *Guide on the GOS* under review and to make recommendations for amendments;
(*e*) To evaluate data requirements of climate monitoring with respect to the overall GOS and to recommend measures to meet those requirements, where possible;
(*f*) To keep abreast of developments in remote sensing;
(*g*) To coordinate requirements and other matters related to the space-based systems with the Working Group on Satellites;
(*h*) To coordinate with other CBS working groups on radio-frequency utilization matters;
(*i*) To keep under review matters related to the development and introduction of new observing systems into the GOS;
(*j*) To monitor progress in the implementation of the current WMO Long-term Plan on matters related to GOS and to contribute to the development of the next WMO Long-term Plan;
(*k*) To keep up-to-date relevant training syllabi and to suggest training materials and the holding of seminars and symposia;
(*l*) To coordinate its activities with the work of the Working Group on Data Management and of other working groups of CBS, with a view to the integration of the WWW system conceived as an entity;
(*m*) To act upon matters referred to the Working Group by the president of CBS;

(2) That the Working Group on Observations shall have the following composition:
   (*a*) The expert designated by each regional association, as rapporteur/coordinator with respect to regional aspects of the GOS;
   (*b*) An expert nominated by the chairmen of the CBS Working Groups on Satellites and on Data Management;
   (*c*) Experts nominated by other Members, or groups of Members, wishing to participate actively in the work of the Working Group;
   (*d*) Experts designated by the presidents of the Commission for Marine Meteorology and of the Commission for Instruments and Methods of Observation and of any other technical commission or international organization interested in the work of the Working Group;
(3) To select, in accordance with General Regulation 32, Mr F. Zbar (United States), as chairman of the Working Group;

AUTHORIZES the president of CBS to adjust the membership and chairman of the Working Group, as required;
REQUESTS the chairman to submit a report to the Commission not later than six months before its sessions.

NOTE: This resolution replaces Resolution 4 (CBS-X), which is no longer in force.

RESOLUTION 4 (CBS-XI)

WORKING GROUP ON TELECOMMUNICATIONS

THE COMMISSION FOR BASIC SYSTEMS,
CONSIDERING that there is a need for the continuation of the work of the Working Group established by Resolution 5 (CBS-X) — Working Group on Telecommunications,
DECIDES:
(1) To establish the Working Group on Telecommunications, with the following terms of reference:
   (*a*) To keep abreast of technical developments and requirements relating to telecommunications, to consider the implementation of new techniques, and to keep under review and make proposals regarding the organizational and planning aspects of the GTS, as it relates to the WWW, other WMO Programmes, and other international organizations;
   (*b*) To keep under review and make proposals regarding the organization, technical, and operational aspects of the entire GTS of the WWW, including the Main Telecommunication Network, regional and subregional telecommunication networks, as well as meteorological data collection and distribution systems via meteorological and communications satellites;
   (*c*) To keep under review and further develop real-time and non-real-time monitoring procedures relating to the GTS operation, in coordination with the Working Group on Data Management, in order to assist Members in improving the operation of their telecommunication systems;
   (*d*) To follow closely the progress on the implementation and continued operation of meteorological telecommunication systems and to formulate recommendations with a view to remedying shortcomings and effecting improvements;
   (*e*) To keep under review the regulatory and guidance material relating to telecommunications;
   (*f*) To keep under review the developments in telecommunication techniques, procedures

and equipment, including international standards on data communications, and to formulate for meteorological information exchange proposals (in binary, alphanumeric, and pictorial form) on the international standardization of operating practices, procedures and equipment;

(*g*) To keep under review allocations of radio-frequency bands and assignments of radio-frequencies to meteorological activities for operational requirements on telecommunications, instruments, sensors, etc. and research purposes, in coordination with the CBS Working Groups on Observations and on Satellites;

(*h*) To monitor progress on the implementation of the current WMO Long-term Plan on matters related to the GTS and to contribute to the development of the next WMO Long-Term Plan;

(*i*) To coordinate its activities with the work of the Working Group on Data Management and of other working groups of CBS, with a view to the integration of the WWW system conceived as an entity;

(*j*) To keep abreast of the activities of the ITU, and in particular, of its Radiocommunication Sector (ITU-R) and the International Frequency Registration Board (IFRB), on frequency matters pertaining to meteorological activities, and to assist the WMO Secretariat in its participation in the ITU-R work, the International Organization for Standardization (ISO), ICAO, the International Maritime Organization (IMO) and other international organizations concerned on matters pertaining to telecommunications;

(*k*) To keep up-to-date relevant training syllabi, as requested, and to suggest training materials and the holding of seminars and symposia;

(*l*) To act upon matters referred to the Working Group by the president of CBS;

(2) That the Working Group on Telecommunications shall have the following composition:

(*a*) The expert designated by each regional association, as the rapporteur/coordinator for regional aspects of the GTS;

(*b*) An expert from one RTH in each of the WMO Regions, to be nominated by the president of the corresponding regional association;

(*c*) An expert designated by the chairman of the CBS Working Group on Data Management;

(*d*) Experts nominated by other Members, or groups of Members, wishing to participate actively in the work of the Working Group;

(*e*) Experts who may be nominated by presidents of other technical commissions and international organizations according to the work programme;

(3) To select, in accordance with General Regulation 32, Mr M. Fischer (France), as chairman of the Working Group;

AUTHORIZES the president of CBS to adjust the membership and chairman of the Working Group, as required;

REQUESTS the chairman to submit a report to the Commission not later than six months before its sessions.

NOTE: This resolution replaces Resolution 5 (CBS-X), which is no longer in force.

RESOLUTION 5 (CBS-XI)

WORKING GROUP ON DATA MANAGEMENT

THE COMMISSION FOR BASIC SYSTEMS,

CONSIDERING:

(1) That full integration of WWW system components, monitoring activities and common, standardized procedures for the handling of data are essential prerequisites for an efficient and flexible operation which will be able to cope with the rapid evolution of requirements and techniques and to ensure that data are available to Members in a timely and convenient fashion,

(2) That there is a need for the continuation of the work of the Working Group established by Resolution 6 (CBS-X) — Working Group on Data Management,

DECIDES:

(1) To establish a Working Group on Data Management, with the following terms of reference:

(*a*) To keep under review the provision of services of meteorological data management supporting the WWW (GOS, GDPS, GTS) and other WMO Programmes as required in both real-time and non-real time, e.g.:

(i) Coordination and orderly monitoring of the generation and flexible exchange of observational data and products;

(ii) Quality control, storage, and retrieval of observational data and products;

(iii) Representation forms (meteorological codes and formats) and procedures for syntax conversion (binary, character and graphics) of observational data and products;

(*b*) To develop or adjust appropriate (interfacing) meteorological data-management specifications to:

(i) Provide observational data and products in an efficient manner and convenient to the various application entities;
(ii) Meet new, revised or specialized requirements for WWW facilities and services;
(iii) Ensure that mutually-compatible and internally-consistent subsets of data emerge from data which are being obtained in different manners on different time- and space-scales;
(iv) Facilitate the transfer of management and monitoring information (i.e. status of operation) among users of meteorological information and data;

(*c*) To consolidate and coordinate statements received from other bodies, Members, regional associations, other technical commissions, and appropriate international organizations on the need for new forms of presentation of meteorological and related data;
(*d*) To keep abreast of the activities of ISO on matters relating to international standards on systems architecture;
(*e*) To monitor progress on the implementation of relevant parts of the current WMO Long-term Plan on matters related to data management and to contribute to the development of the next WMO Long-term Plan;
(*f*) To keep up-to-date relevant training syllabi, as requested, and to suggest training materials and the holding of seminars and symposia;
(*g*) To keep the regulatory and guidance material relating to data management under review;
(*h*) To act upon matters referred to the Working Group by the president of CBS;
(*i*) To liaise with the other working groups of CBS with a view to integrating the GDPS, GOS and GTS components into an integrated WWW system;

(2) That the Working Group on Data Management shall have the following composition:
(*a*) The expert designated by each regional association, as rapporteur/coordinator, with respect to regional aspects of data management;
(*b*) Experts designated by the chairmen of the CBS Working Groups on Observations, on Data Processing, on Satellites, and on Telecommunications in the light of the issues considered in the work programme;
(*c*) Experts to be nominated by Members, or groups of Members, wishing to participate actively in the work of the Working Group;
(*d*) Experts who may be nominated by presidents of other technical commissions and international organizations according to the work programme;

(3) To select, in accordance with General Regulation 32, Mr K. Kashiwagi (Japan), as chairman of the Working Group;

AUTHORIZES the president of CBS to adjust the membership and chairman of the Working Group, as required;
REQUESTS the chairman to submit a report to the Commission not later than six months before its sessions.

NOTE: This resolution replaces Resolution 6 (CBS-X), which is no longer in force.

RESOLUTION 6 (CBS-XI)

WORKING GROUP ON SATELLITES

THE COMMISSION FOR BASIC SYSTEMS,
CONSIDERING that there is a need for the continuation of the work of the Working Group established by Resolution 7 (CBS-X) — Working Group on Satellites,
DECIDES:

(1) To establish the CBS Working Group on Satellites with the following terms of reference:
(*a*) To assess the observation, collection, and analysis systems relating to the use of satellites in activities of interest to all WMO Members and to suggest ways and means for improving system capabilities, particularly to Members in developing countries;
(*b*) To collect, collate and keep under review, in collaboration with the Working Group on Observations, the requirements for observations to meet the needs of all WMO Programmes and to provide guidance on the provision of data products and services from environmental observation satellites;
(*c*) To assess the status of implementation of the space-based subsystem of the GOS and the adequacy of plans for implementation;
(*d*) To coordinate issues and requirements relating to the GOS with the Working Group on Observations;
(*e*) To make recommendations concerning standardization of satellite services and related ground-receiving systems;
(*f*) To coordinate with the other working groups of CBS on relevant matters, such as the exchange, management, and archiving of satellite data and radio-frequency utilization;
(*g*) To represent WMO's interests and to convey WMO Members' requirements through appropriate involvement in international satellite groups including CGMS and CEOS;

(*h*) To keep under review the availability, performance, continuity, and use of environmental observation satellites in WMO Programmes;
(*i*) To keep under review satellite-related education and training requirements and to evaluate the adequacy of existing and planned activities;
(*j*) To identify opportunities and/or problem areas concerning satellite technology and plans of environmental observation satellite operators;
(*k*) To assist in the continuing maintenance of a record of plans for satellite developments and operations in order to assure appropriate consideration of satellite technology in WMO Long-term Plans;
(*l*) To act upon matters referred to the Working Group by the president of CBS;

(2) That the Working Group on Satellites shall have the following composition:
(*a*) An expert designated by each of the following Members:
Australia;
Brazil;
China;
France;
India;
Italy;
Japan;
Kenya;
Russian Federation;
United Kingdom;
United States;
(*b*) An expert nominated by each of the following:
The chairman of the CBS Working Group on Observations;
The director of EUMETSAT;
The presidents of other technical commissions, as appropriate;
The chairman of the Joint Scientific Committee (JSC) of the World Climate Research Programme (WCRP);
The chairman of the JSTC of GCOS;

(3) That CGMS and CEOS be invited to be represented at meetings of the CBS Working Group on Satellites, as observers;
(4) To select, in accordance with General Regulation 32, Mr J. Eyre (United Kingdom), as chairman of the Working Group;

AUTHORIZES the president of CBS to adjust the membership and chairman of the Working Group, as required;

REQUESTS:
(1) The chairman to submit a report to the Commission not later than six months before its sessions;
(2) The Working Group to report annually to the Executive Council, through the president of CBS, under the World Weather Watch Programme.

NOTE: This resolution replaces Resolution 7 (CBS-X), which is no longer in force.

RESOLUTION 7 (CBS-XI)

WORKING GROUP ON PUBLIC WEATHER SERVICES

THE COMMISSION FOR BASIC SYSTEMS,

NOTING paragraph 3.4.1.11 of the *Abridged Final Report with Resolutions of the Twelfth World Meteorological Congress* (WMO-No. 827),

CONSIDERING that establishing a working group is the most suitable mechanism to ensure further development of the Public Weather Services Programme and to provide guidance and focus on its implementation, keeping in mind the need to respect the authority of NMSs,

DECIDES:
(1) To establish the Working Group on Public Weather Services with the following terms of reference:
(*a*) To keep under review and develop documentation and advice on the overall implementation of the Public Weather Services Programme, for example:
(i) On the formulation of public weather forecasts and warnings;
(ii) On the content and quality of public weather forecasts and warnings;
(iii) On the liaison that exists between NMSs and the media and others involved in the dissemination of public weather forecasts and warnings;
(*b*) To keep abreast of, and evaluate, technical and scientific developments relating to the formulation, presentation and dissemination techniques and make recommendations on a regional and national scale. This should include the role of international broadcasts of meteorological forecasts and warnings and the use of telecommunication systems such as Internet;
(*c*) To keep under review and develop proposals on education and training requirements related to the Public Weather Services Programme and how they might be met;
(*d*) To keep under review the *Guide to Public Weather Services Practices* (WMO-No. 834);
(*e*) To keep abreast of, and develop, proposals on the most suitable mechanisms for providing

assistance on matters related to the International Decade for Natural Disaster Reduction (IDNDR), especially disaster awareness, preparedness, prevention and response;

(*f*) To keep under review the requirements for the provision of meteorological and hydrological information, in particular in support of United Nations humanitarian and relief efforts;

(*g*) To monitor progress on the implementation of the current WMO Long-term Plan on matters related to the Public Weather Services Programme and to contribute to the development of the next WMO Long-term Plan;

(*h*) To act on matters referred to the Working Group by the president of CBS;

(*i*) To develop guidelines for the verification of the quality and content and usefulness of public weather forecasts and warnings;

(*j*) To develop requirements for the public weather services and to liaise with other CBS Working Groups, as appropriate, for the implementation of the programme.

(2) That the Working Group on Public Weather Services shall have the following composition:

(*a*) An expert designated by each regional association, as rapporteur to form the core membership of the Working Group and to take on the responsibilities in accordance with the projects identified by Congress;

(*b*) Experts nominated by other Members or groups of Members, wishing to participate actively in the work of the Working Group;

(*c*) Experts who may be nominated by presidents of other technical commissions and by international organizations according to the work programme;

(3) To select, in accordance with General Regulation 32, Mr D. Wernly (United States), as chairman of the Working Group;

AUTHORIZES the president of CBS to adjust the membership and chairman of the Working Group, as required;

REQUESTS the chairman to submit a report to the Commission not later than six months before its sessions.

RESOLUTION 8 (CBS-XI)

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

THE COMMISSION FOR BASIC SYSTEMS,

NOTING the action taken on the resolutions and recommendations adopted by the Commission prior to its eleventh session,

DECIDES:

(1) To replace Resolutions 2, 3, 4, 5, 6 and 7 (CBS-X) and 3 (CBS-Ext.(94)) with new resolutions;

(2) Not to keep in force the other resolutions or any of the recommendations adopted before its eleventh session.

RECOMMENDATIONS ADOPTED BY THE SESSION

RECOMMENDATION 1 (CBS-XI)

REQUIREMENTS FOR THE INTERNATIONAL EXCHANGE OF DATA AND PRODUCTS — AMENDMENTS TO THE *TECHNICAL REGULATIONS*

THE COMMISSION FOR BASIC SYSTEMS,

NOTING:

(1) The *Abridged Final Report with Resolutions of the Forty-sixth session of the Executive Council* (WMO-No. 810), general summary, paragraph 17.4 (*a*),

(2) The *Abridged Final Report with Resolutions and Recommendations of the Extraordinary Session of the Commission for Basic Systems* (WMO-No. 815), general summary, paragraphs 7.4 and 7.5,

(3) The *Abridged Final Report with Resolutions of the Twelfth World Meteorological Congress* (WMO-No. 827), general summary, paragraph 11.4.16,

(4) Resolution 40 (Cg-XII) — WMO policy and practice for the exchange of meteorological and related data and products including guidelines on relationships in commercial meteorological activities,

RECOMMENDS that the list of meteorological and related data and products contained in the annex to this recommendation be incorporated in the preliminary section of Volume I of the WMO *Technical Regulations*.

ANNEX TO RECOMMENDATION 1 (CBS-XI)

REQUIREMENTS FOR THE INTERNATIONAL EXCHANGE OF OBSERVATIONAL DATA AND PRODUCTS TO MEET THE NEEDS OF WMO PROGRAMMES

A. DATA

NOTE: There is a general requirement for metadata to be made available through appropriate channels (e.g. *Weather Reporting* (WMO-No. 9)). The following tables represent the total data requirements for international exchange to support all WMO Programmes and WMO-sponsored programmes*.

Table 1 — Three-dimensional data

	Horizontal resolution (km)	*Vertical resolution (km)*	*Temporal resolution (hours)*	*Source of requirement*
Wind (horizontal)	100	.1 up to 2 km .5 up to 16 2 up to 30	3	Most programmes
Temperature	100	.1 up to 2 km .5 up to 16 2 up to 30	3	Most programmes
Geopotential	100		3	Most programmes
Relative humidity (RH)	100	.1 up to 2 km .5 up to tropopause	3	Most programmes
Turbulence	100	.3	1	AeM
Ozone	Variable	Variable	Variable	GCOS, GAW, WWW
Greenhouse gases	Variable	Variable	Variable	GCOS, GAW
Reactive gases	Variable	Variable	Variable	GCOS, GAW
Aerosols — chemical and physical properties	Variable	Variable	Variable	GCOS, GAW
Salinity	250	Variable	6h	IGOSS, GCOS, GOOS
Subsea surface temperature	250	Variable	6h	IGOSS, GCOS, GOOS
Subsea surface current	250	Variable	6h	IGOSS, GCOS, GOOS
Soil moisture 0–10 cm	100	–	1 day	Most programmes
Soil moisture 10–100 cm	100	–	1 week	Most programmes

* The requirements for hydrological programmes are subject to further review.

Table 2 — Surface data

	Horizontal resolution (km)	*Temporal resolution*	*Source of requirement*
Pressure	100	1h	Most programmes
Wind	100	1h	Most programmes
Temperature (air)	100	1h	Most programmes
Relative humidity	100	1h	Most programmes
Visibility	100	1h	Most programmes
Present weather	100	1h	Most programmes
Accumulated precipitation	100	1h	Most programmes
Precipitation rate	100	1h	Most programmes
Sea-surface temperature	100	1 day	Most programmes
Land-surface temperature	100	3h	Most programmes
Sea-ice cover	100	1 day	Most programmes
Snow and ice cover	100	1 day	Most programmes
Snow equivalent-water depth	100	1 day	Most programmes
River runoff	250	1 day	GCOS, OHP
Lake water levels	Variable	1 week	GCOS, OHP
Water quality	250	1 week	OHP
Sediment	250	1 week	OHP
Percentage of vegetation	100	1 week	Most programmes
Phenological data	Variable	10 days	GCOS, AgM
Soil temperature, 20 cm	100	6h	GCOS, AgM
Deep soil temperature, 100 cm	100	1 day	GCOS, AgM
Surface roughness	50	1 month	GCOS, AgM
Albedo, visible	100	1 day	Most programmes
Albedo, near infrared	100	1 day	Most programmes
Long-wave emissivity	100	1 day	Most programmes
Multipurpose imagery	1 or 4	6h	Most programmes
Surface net radiation	50	6h	GCOS, AgM
UV incoming	50	1h	PWS, AREP, WCP
Wave spectra	100	1h	WWW, MM
Salinity	100	6h	GCOS
Sea level	50	12h	GCOS
Ocean current	100	6h	IGOSS, GCOS, GOOS
Greenhouse gas concentrations	Variable	Variable	GCOS, WCP, AREP
Ozone	Variable	Variable	GCOS, GAW
Precipitation chemistry	Variable	Variable	GAW, GCOS
Aerosols — chemical and physical properties	Variable	Variable	GAW, GCOS
Reactive gases	Variable	Variable	PWS,CCl,GAW
Radionuclides	Variable	Variable	EER, GAW
Volcanic activity	Variable	Variable	PWS, AeM

NOTE: For some programmes, e.g. environmental monitoring/agriculture/hydrology/environmental emergency response and public weather services, much higher resolution data are needed operationally.

Table 3 — Other two-dimensional data

	Horizontal resolution (km)	*Temporal resolution*	*Source of requirement*
Cloud fractional cover	100	3h	Most programmes
Cloud top height	100	3h	Most programmes
Cloud base height	100	3h	Most programmes
Total liquid water content	100	3h	Most programmes
Cloud phase/particle size	50	6h	GCOS
TOA net short-wave radiation	100	3h	Most programmes
TOA net long-wave radiation	100	3h	Most programmes
Multipurpose IR/VIS imagery	1–4	30 min.	Most programmes
Radiance	1–4	6h	Most programmes
Column ozone	Variable	Variable	GCOS, GAW
Optical depth/turbidity	Variable	Variable	GCOS, GAW
Column greenhouse and reactive gases	Variable	Variable	GCOS, GAW

The following notes provide some explanation of the tables and some provisos on their use:

Variables:

Following past convention, the observational requirements for data assimilation are stated in terms of geophysical variables. This is thought to be useful since, from a user's perspective, these are the variables on which information is required. However it is important to note that these variables are not always observed directly (satellite systems observe none of them directly, with the exception of top-of-the-atmosphere radiation). Also it is no longer true that the users need their data exclusively in the form of geophysical parameters; recent developments in data assimilation have demonstrated the potential and the benefits of using data at the engineering level (e.g. radiances, brightness temperatures).

Horizontal resolution:

(*a*) In general (and with some over-simplification), data are useful for assimilation and validation on spatial scales which the models are attempting to represent. One hundred kilometres is given as the requirement for the variables listed in the tables. However, it is possible to benefit from higher resolution data, considering the current developments towards global models with a grid length of less than 50 km;

(*b*) Regional models attempted to represent spatial scales above the mesoscale. Observational data are required at a resolution of 10 km;

(*c*) The horizontal resolutions provided for hydrological data are averages only and will vary with physiographic characteristics.

Vertical resolution:

(*a*) The same rationale is applied here: global NWP models are expected to have a resolution of less than 1 km throughout the troposphere and lower stratosphere, with considerably higher resolution in the planetary boundary layer. In the mid and upper stratosphere, a resolution of 2 km is likely to be sufficient. The requirements for observations should be comparable;

(*b*) For regional models, observations are required at a resolution of 100 m (50 m in the planetary boundary layer).

Temporal resolution:

(*a*) Just as with spatial resolution, data will be useful for assimilation and validation on temporal scales which the models are attempting to represent. In the past, this has not been the case; so-called "four-dimensional" assimilation systems would more appropriately be described as "intermittent three-dimensional" systems, and they have not been able to make proper use of observations more frequently than the period of the data assimilation cycle (typically six hours). However, continued progress towards truly four-dimensional data assimilation is making it possible to extract useful information from observations at higher temporal frequency. With such systems, higher temporal resolution of two-dimensional data can compensate to some extent for the loss of three- dimensionality. A requirement of three hours for upper-air data and one hour for surface data has been specified. However, as in the case of spatial resolution, upper-air data of higher specification (up to one hour) should also be made available (e.g. cloud motion wind data from geostationary satellites, wind profiles from wind profilers);

(*b*) For regional models, both upper-air and surface data are required at a resolution of one hour.

Timeliness:

For real-time activities, the value of data degrades with time, and it does so particularly rapidly for variables which change quickly. Operational assimilation systems are usually run with a cutoff time of about three hours for global models, and 1.5 hours for regional models.

B. PRODUCTS

NOTE: Within the constraints of technology and programme requirements, model output should be supplied at the highest possible resolution.

Analysis

Surface (including synoptic features)	Parameters: Pressure (P)/ geopotential height (H), temperature (T), wind (W) and humidity (R), as appropriate and applicable
925 hPa	
850 hPa	
700 hPa	
500 hPa	
400 hPa	
300 hPa	
250 hPa	
200 hPa	
150 hPa	
100 hPa	
70 hPa	
50 hPa	
30 hPa	
20 hPa	
10 hPa	
Tropopause and maximum wind or tropopause and vertical wind shear	
Relative topography, in particular the thickness 500/1 000 hPa	
Jet streams	
Digitized cloud mosaics	
Mapped radiometric data	
Stability	
Precipitable water	
Snow depth	
Changes to 500 hPa, 24 hours	

Changes to relative topography, thickness 500/1 000 hPa, 24 hours
Freezing level
Pressure changes, three hours
Pressure changes, 12 and/or 24 hours
Precipitation areas, six hours
Precipitation areas, 24 hours
Sferics
Radar echoes
Nephanalyses
Sea-surface temperature
Land surface temperature
Snow and ice cover
Storm alerts
Sea ice
State of sea
Storm surge
Thermoclines
Superstructure icing
Top of Ekman layer
Transpiration and evaporation estimates
Grid related estimates of hydrological variables
Water balance assessments involving estimates of soil moisture deficits or soil moisture contents
Estimates of potential photosynthesis (possible dry matter production)
Surface air trajectories
850 hPa air trajectories
700 hPa air trajectories
500 hPa air trajectories
Health risk index for travellers
Stratospheric ozone bulletins
Diagnostic analyses of:
- Spatial distributions
- Temporal variations
- Atmospheric reactions and mechanisms based on atmospheric composition and radiation measurements

Assessments of satellite ground-truthing radiation experiments
Climate-related analyses (e.g. climate system monitoring and climate normals)

Five-day, 15-day and 30-day mean analysed values and anomalies

Surface, 850 hPa, 500 hPa — Parameters: P/H, T, W and R, as appropriate and applicable
Sea-surface temperature anomaly

Plotted data

Plotted surface data (three-hourly)
Plotted upper-air data (850, 700, ..., 100 hPa)
Tabulated winds
Aerological diagrams

Forecasts

Surface (including synoptic features), 925 hPa, 850 hPa, 700 hPa, 500 hPa, 400 hPa, 300 hPa, 250 hPa, 200 hPa, 150 hPa, 100 hPa — Parameters: P/H, T, W and R, as appropriate and applicable
70, 50, 30, 20 10 hPa
Jet-stream location and tropopause/layer of maximum wind
Significant weather
Relative topography, thickness 500/1 000 hPa

NOTE: The above list includes products which are required as part of the ICAO World Area Forecast System in accordance with the requirements determined by ICAO.

Freezing level
Vorticity
Vertical motion
Areal distribution of cloudiness
Precipitation location, occurrence, amount and type
Sequences at specific locations (time diagrams) at the surface and aloft of T, P, W and R
Vorticity advection, temperature/thickness advection, vertical motion, stability indices, moisture distribution and other derived parameters
Tropical storm positions and intensities
River stage, discharge and ice phenomena
Tropical depression and easterly wave positions and movement
Four-to-ten-day outlook in middle latitudes and subtropical areas or four- to five-day outlook in the tropics for T, W, R and precipitation
Forecasts of probability of precipitation and temperature extremes for middle latitudes and subtropical areas or forecasts of cloudiness, temperature range and precipitation probability for tropical areas
State of the sea
Storm surge
Sea-surface temperature
Thermoclines
Sea ice
Superstructure icing
Three-dimensional trajectories with particle locations at synoptic hours for EER
Time integrated pollutant concentration within the 500 m layer above ground in three time periods up to 72 hours for EER
Total deposition up to 72 hours
Extended range forecasts five, 10, 15 or 30 day mean values — Levels and parameters as appropriate and applicable
Long-term forecasts (seasonal to interannual).

RECOMMENDATION 2 (CBS-XI)

AMENDMENTS TO THE *MANUAL ON THE GLOBAL OBSERVING SYSTEM* — VOLUME I, PART II

THE COMMISSION FOR BASIC SYSTEMS,

NOTING:

(1) Resolution 6 (XI-RA VI) — Data requirements for emergency response activities,

(2) Resolution 1 (CBS-Ext.(94)) — Task Team on Data Requirements for Environmental Emergency Response Activities,

(3) Report of the Meeting of the Task Team on Data Requirements for Environmental Emergency Response Activities, Geneva, 13–15 March 1995,

CONSIDERING the need to provide the designated RSMCs with meteorological and non-meteorological observational data to improve the quality of transport model products for environmental emergency response,

RECOMMENDS that the *Manual on the GOS*, Volume I, Part II be amended as indicated in the annex to this recommendation to take effect as from 1 July 1997.

ANNEX TO RECOMMENDATION 2 (CBS-XI)

AMENDMENTS TO THE *MANUAL ON THE GLOBAL OBSERVING SYSTEM*

Part II

Replace paragraph 1.4 with the following:

1.4 **Requirements for environmental emergency response activities**

In order for the designated Regional Specialized Meteorological Centre (RSMC) to be in a position to provide Members with transport model products for environmental emergency response, meteorological and non-meteorological (radiological) data requirements need to be met. They are specified in Attachment II.4. These data, particularly from the site of accident, are also needed by Members for taking appropriate preventive and remedial action in case of an accidental release of radioactive material into the environment. Data should be made available promptly in accordance with the Convention on Early Notification of a Nuclear Accident (Article 5(*e*)).

Replace Attachment II.4 by the following:

ATTACHMENT II.4
OBSERVATIONAL REQUIREMENTS FOR ENVIRONMENTAL EMERGENCY RESPONSE ACTIVITIES

A. **Meteorological data requirements**

1. Data needed to run transport models are the same as specified for the production of weather forecasts by NWP models and are given in Attachment II.2 of the *Manual on the GDPS* and Attachment II.1 of the *Guide on the GOS*.

2. Additional[1] data are desirable from the accident site[2] and potentially affected area[3] and should be provided to the designated RSMC to improve the quality of information about the transport of pollutants. These should include:

(*a*) Wind, temperature and humidity upper-air data;

(*b*) Precipitation data (type and amount);

(*c*) Surface air temperature data;

(*d*) Atmospheric pressure data;

(*e*) Wind direction and speed (surface and stack height) data;

(*f*) Humidity data.

3. The data needed from the accident site may be provided by the following systems in combination as necessary and possible:

(*a*) At least one radiosonde station should be located at a suitably safe distance to enable continued operation in an emergency situation and to be representative of conditions at or near the accident site;

(*b*) In an emergency situation, at two or three stations closest to the site of the accident (within 500 km) the observing frequency should be increased to every three hours for the duration of the emergency. Stocks of consumables should be stored for use in emergency situations;

(*c*) At least one surface station should be located at the accident site or, if not possible, at a nearby site. It should be convertible to an hourly automated mode for both operations and telecommunications in case of emergency;

---

[1] The words "additional data" are used with their usual meaning and not as in Resolution 40 (Cg-XII).

[2] Due to the highly variable types of nuclear accidents, a precise definition of "accident site" is not possible. The accident site should be understood as the location where the accident occurred and the immediate surrounding zone within a range of a few kilometers.

[3] The potentially affected area is dependent on the state and evolution of the atmosphere over an extended area around the accident site, as well as on the nuclear event itself and cannot be precisely defined in advance. It should be understood as the area where, using all the information available including the air transport pollution products if already issued, the nuclear pollutants are likely to be transported in the air or on the ground at a significant level over the natural (background) radioactivity. Advice in this area may be obtained from the RSMC concerned.

(*d*) Additional information should be provided at or near the accident site by instrumented towers or masts (up to 100 m) and conventional or Doppler radars, Sodars and boundary layer sondes with automatic transmission of data.

4. The data needed from the potentially-affected area should be provided as follows:

(*a*) All upper-air stations within the potentially-affected area should make observations every six hours for the duration of the emergency;

(*b*) Where possible, one or more additional observing systems, including wind profilers, mobile radiosounding equipment, and ascent/descent data from aircraft should be provided;

(*c*) All surface stations within the potentially-affected area including those which are not normally exchanged data internationally on a routine basis should provide observational data to designated RSMCs. Platforms and buoys should also provide observational data to ensure adequate coverage over sea areas;

(*d*) A series of best estimates of precipitation should be made by combining information from direct measurements (automated or manual) at surface stations, composite radar information extending over the whole WMO Region, and satellite-derived data.

B. **Non-meteorological data requirements**

1. In case of emergency, non-meteorological data to be provided to designated RSMCs from the accident site should include:

(*a*) Start of release (date, time);

(*b*) Duration;

(*c*) Radionuclide species;

(*d*) Total release quantity or pollutant release rate;

(*e*) Effective height of release.

Points (*a*) and (*b*) are necessary information for running transport models, while (*c*), (*d*) and (*e*) are desirable additional information.

2. In order to calibrate and validate the atmospheric transport model forecasts processed, radiological data from potentially affected area are needed. The most suitable radiological data required are:

(*a*) Time-integrated air pollutant concentration;

(*b*) Total deposition.

3. The required data from the accident site and potentially-affected area may be obtained by the following means:

(*a*) Fixed radiological monitoring stations;

(*b*) Mobile surface units;

(*c*) Radiological sounding/or;

(*d*) Instrumental aircraft.

The frequency of observations should be increased from one hour to 10 minutes during the accident (routine frequency of observations varies from one to six hours).

C. **Exchange of meteorological and non-meteorological data**

1. Non-meteorological data and, to some extent, additional meteorological data are likely to be provided by non-meteorological national authorities. The NMSs should encourage the provision of these data by non-meteorological agencies/operators to NMCs for onward transmision to their associated RSMCs.

2. For the exchange of relevant meteorological and non-meteorological (radiological) data, a complete list of abbreviated heading bulletins, including all the regional meteorological and radiological observations should be sent by Members to the WMO Secretariat for their insertion into the *Catalogue of Meteorological Bulletins* (WMO-No. 9), Volume C1.

3. Radiological data available in the early phase of a nuclear accident (containment radiation reading, on-site radiation levels, etc.) which assist in characterizing the nuclear accident, should be provided by national authorities to the IAEA as soon as practicable via the most reliable communication means. The IAEA will verify and assess the information and then provide these data to the appropriate RSMC, which should distribute them to NMCs via the GTS. In case of environmental emergencies, all relevant observational (meteorological and non-meteorological) data should be transmitted to both RSMCs and NMSs through the GTS as quickly as possible.

4. End-to-end testing of procedures for data acquisition, quality control, communication use, and product dissemination should be carried out periodically to assure system performance.

RECOMMENDATION 3 (CBS-XI)

AMENDMENTS TO THE *MANUAL ON THE GLOBAL TELECOMMUNICATION SYSTEM*, VOLUME I, PARTS I AND II

THE COMMISSION FOR BASIC SYSTEMS,

NOTING:

(1) Resolution 2 (Cg-XII) — World Weather Watch Programme,

(2) The *Manual on the Global Telecommunication System*, Volume I, Parts I and II,

RECOMMENDS that the *Manual on the Global Telecommunication System*, Volume I, Part I and Part II, be

amended as given in the annex to this recommendation, with effect from 1 November 1997;

REQUESTS the Secretary-General to insert the amendments as given in the annex to this recommendation, in the *Manual on the Global Telecommunication System*, Volume I, Parts I and Part II;

AUTHORIZES the Secretary-General to make any consequent purely editorial amendments of the *Manual on the Global Telecommunication System*, Volume I.

ANNEX TO RECOMMENDATION 3 (CBS-XI)

AMENDMENTS TO THE *MANUAL ON THE GLOBAL TELECOMMUNICATION SYSTEM*, VOLUME I

PART I

Amend paragraphs 2.1 and 2.3 to read:

2.1 The World Meteorological Centres (as regards telecommunications) and the Regional Telecommunication Hubs shall be responsible for:

(*a*) Collecting the bulletins from the associated NMCs and transmitting them in the appropriate form on the Main Telecommunication Network, either directly or through the appropriate WMC/RTH;

(*b*) Transmitting on the Main Telecommunication Network, either directly or through the appropriate RTH, as internationally agreed and in the appropriate form, the bulletins containing the processed meteorological information produced by the WMC or RSMC associated with them;

(*c*) Relaying selectively on the circuits of the Main Telecommunication Network, as agreed, the bulletins which they receive from these circuits and/or from the RTHs not situated on the Main Telecommunications Network;

(*d*) Ensuring the selective distribution of bulletins to the associated NMCs and the RTHs not situated on the Main Telecommunication Network which they serve;

(*e*) Checking and making corrections to the parts related to telecommunications of the messages that RTHs insert on to the Main Telecommunication Network in order to maintain standard telecommunication procedures;

(*f*) Establishing data dissemination systems (terrestrial and/or via satellite) as required in accordance with regional plans;

(*g*) Carrying out the relevant monitoring of the operation of the GTS of the WWW.

NOTE: The plan for monitoring the operation of the WWW is given in Attachment I-5.

(2.2 No change)

2.3 With regard to telecommunications, the National Meteorological Centres shall be responsible for:

(*a*) Collecting observational data from their own territory or that of one or more Members according to bilateral agreements, as well as observational data from aircraft and ships received by centres located within the area of responsibility. This collection shall take place as soon as possible and shall be completed within 15 minutes of the observing station's filing time;

NOTES: (1) The observing station's filing time is defined as the time at which the coded meteorological report is first presented to the telecommunication system. For an aircraft or ship weather report, it is the time when it is received by the appropriate communication station (land station/coast station).

(2) *Under normal conditions, the report should be* presented to the telecommunication system not later than five minutes after the completion of its coding.

(*b*) Compiling such data into bulletins and transmitting them to the associated Regional Telecommunication Hubs, in compliance with standard telecommunications procedures;

NOTE: NMCs may be associated with more than one RTH.

(*c*) Receiving and distributing for their benefit and that of Members that request them, in accordance with bilateral agreements, observational data and processed meteorological information, to meet the requirements of the Members concerned;

(*d*) (cancelled)

former (*e*) becoming:

(*d*) Carrying out the relevant monitoring of the operation of the GTS of the WWW.

NOTES: (1) Checking of meteorological content of national observational data is to be accomplished by the responsible NMC, or the other originating centre as appropriate (ref. paragraph 2.4), before such data are compiled into bulletins for further transmission on the GTS.

(2) The plan for monitoring the operation of the WWW is given in Attachment I-5.

Amend in Attachment I-3, the title of paragraph 1, the table, and Figure 1 to read:

1. **RESPONSIBILITIES FOR THE COLLECTION, EXCHANGE AND DISTRIBUTION OF OBSERVATIONAL DATA OF WMCs AND RTHs LOCATED ON THE MAIN TELECOMMUNICATION NETWORK**

The responsibilities are given in the following table:

WMC/RTH	*Collection of observational data from the zones of responsibility of the following RTHs:*
Melbourne	Melbourne (51), Wellington (52)
Tokyo	Tokyo (25), Bangkok (26)
Washington	Washington (41)
Bracknell	Bracknell (61)
Toulouse	Toulouse (63), Rome (66)
Offenbach	Offenbach (64), Norrköping (62), Vienna (68)
Prague	Prague (67)
Moscow	Moscow (65), Khabarovsk (24), Novosibirsk (23), Tashkent (22)
Cairo	Cairo (11)
New Delhi	New Delhi (27), Tehran (21)
Brasilia	Brasilia (31), Maracay (33)
Buenos Aires	Buenos Aires (32)
Nairobi	Nairobi (12), Lusaka (13), Pretoria (14)
Beijing	Beijing (28)
Dakar	Dakar (15), Brazzaville (17), Niamey (18)
Jeddah	Jeddah (29)
Sofia	Sofia (69)
Algiers	Algiers (16)

*

* *

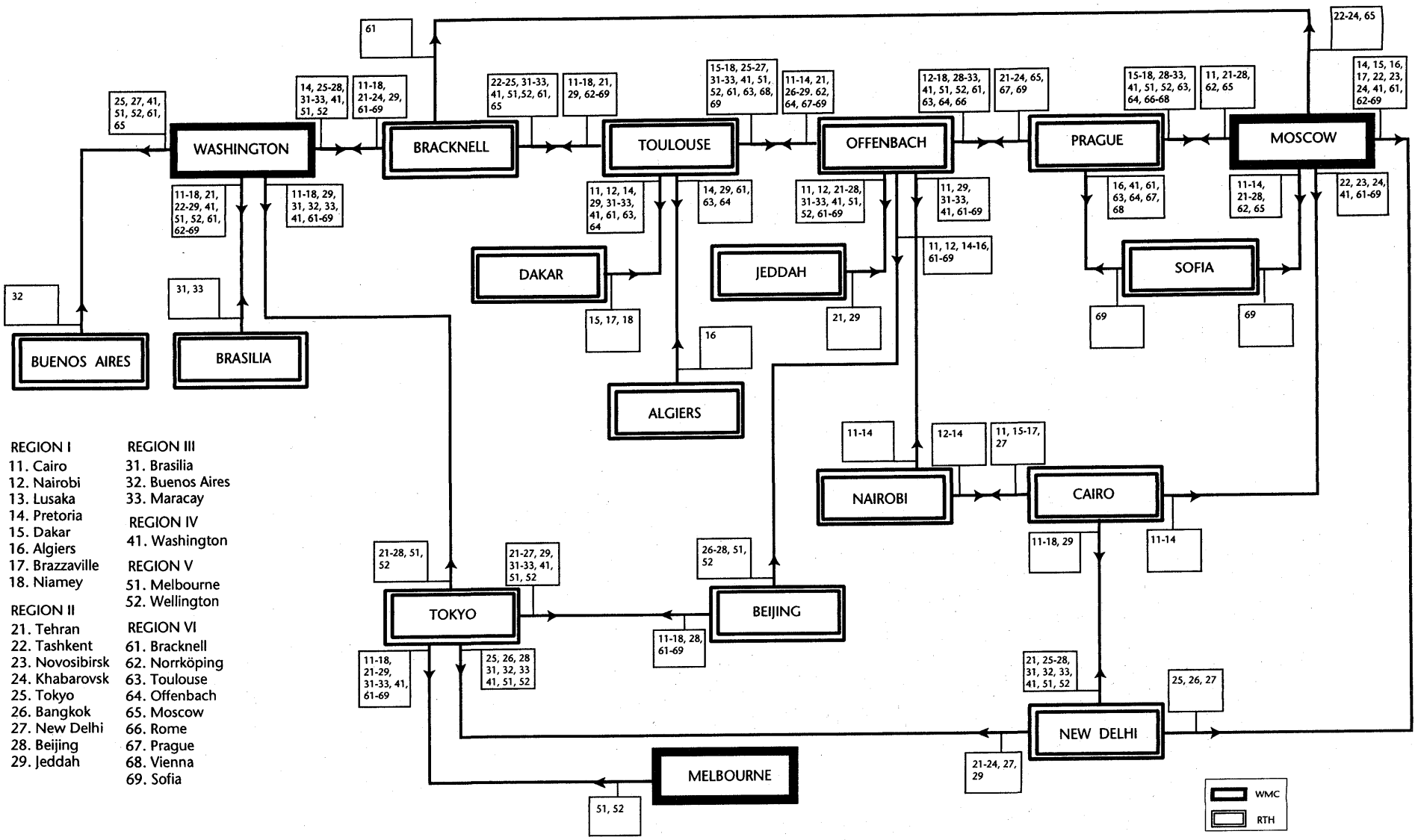

Figure 1 — Plan for routeing observational data on the Main Telecommunication Network.

NOTE: The responsiblities of centers and routeing arrangements for the exchange of processed information on the MTN are the same as for observational data.

PART II

Amend section 2.5 to read:

2.5 Requests for GTS messages

2.5.1 An existing GTS message shall be the smallest unit requested. All requests for GTS messages, and in particular requests for repetition, shall be made as soon as possible; otherwise the requested message(s) may no longer be available (see also 2.10.2.2).

2.5.2 Request messages

2.5.2.1 Requests for GTS messages shall be made by addressed message-requests for GTS messages (see 2.4.1.2, 2.4.2 for abbreviated headings and 2.4.3 for the first line of the text of the message).

2.5.2.2 The requested messages shall be identified by their abbreviated headings, and all designators shall be used to specify a particular message. One request message shall not contain more than eight requests, when addressed to a centre beyond an adjacent centre.

2.5.2.3 Each line of the text of the message shall begin with the indicator AHD (except the first line, see 2.4.3). Each line will end with the report separation signal. Each line should contain a single abbreviated heading of a requested message.

2.5.3 Request for repetition

2.5.3.1 Requests for repetition of GTS messages shall be made by addressed messages as requests for GTS messages, transmitted to the adjacent centre upstream.

2.5.3.2 In addition to the procedures for request messages as defined in 2.5.2.2 and 2.5.2.3, the messages requested for repetition may be identified in the request by their transmission sequence numbers on the circuit concerned. In this case, the second line of the text of the message shall begin with the indicator SQN, followed by the transmission sequence number or a series of sequence numbers separated by "/", or consecutive sequence numbers (nnn - nnn).

2.5.3.3 One request-for-repetition message shall only contain a single type of identification for requested messages, i.e. abbreviated headings (see 2.5.2.3) or transmission sequence numbers (see 2.5.3.2). The maximum number of messages requested in one single request message and identified by abbreviated headings may be agreed upon on a bilateral basis between adjacent centres.

2.5.4 Replies to requests for GTS messages

2.5.4.1 A reply shall use the format for addressed data messages (see 2.4.1.4). By bilateral agreement between adjacent centres, in particular for replies to requests for repetition, replies may be made in the format of a routine message.

2.5.4.2 An addressed data message in reply to a request for GTS messages shall contain a single GTS message.

2.5.4.3 Requests shall be answered in all cases. If a requested message is not available, an addressed data message (see 2.4.1.4) shall be sent to the originator of the request with the indicator NIL followed by the identifier of the message concerned. If a request for GTS messages is incorrect, an addressed data message should be sent to the originator of the request with the indicator ERR followed by the incorrect identifier, when possible.

2.5.4.4 Replies to messages requesting repetitions shall be transmitted within 30 minutes of the filing time of the requests.

NOTE: If all the requests cannot be met at one time, the remainder of the replies may be transmitted later.

Add a new paragraph 2.10.3:

2.10.3 Review of the content of switching directories

In addition to the regular updating of the switching directories, all automated GTS centres should clean regularly (e.g. once every six months) their switching directories thereby removing all abbreviated headings of bulletins which are no longer expected for exchange on the GTS.

Amend the text of paragraph 2.11.2 to read:

Duplicated messages received within at least three hours of the original message should be detected and eliminated.

Amend Attachment II-6 as follows:

Amend the Note and add Note 2 under subparagraph (*a*) "Requests for alphanumeric messages" of section TYPE 3 "Request/Reply message", CLASS 2 "Request for a bulletin" as follows:

NOTE 1: Limit restriction — no more than eight headings in a request beyond an adjacent centre.

NOTE 2: When the date-time group YYGGgg or the time group GGgg is not known, the following requests may be used:

AHD $T_1T_2A_1A_2$ii CCCC YY//// (BB/) (when BB=RR, CC or AA)

AHD $T_1T_2A_1A_2$ii CCCC YY//// (P//)

AHD $T_1T_2A_1A_2$ii CCCC //////

where YY//// means last occurrence in time for day YY where ////// means last occurrence in day-time and the time is not older than 24 hours.

Amend Attachment II-5 as follows:

(*a*) In Table A, add:
T_1 = K, data type: CREX,T_2:B3, A_1:C7, A_2:C3, ii:**, priority: 2, max length in characters or octets: 3 800;

(*b*) In Table C6 where T_2 = U, add: M, Model derived sondes;

(*c*) In Table D2, add the following level definitions for ii:

93 : 975 hPa	77 : 775 hPa
91 : 875 hPa	72 : 725 hPa
87 : 1 000–500 hPa thickness	67 : 675 hPa
82 : 825 hPa	62 : 625 hPa

(*d*) **Add** a new Table C7:

Table C7

Data type designator A_1 (when T_1 = K)

	Designator	*Data type*
(OBSERVATIONAL DATA) T_2 = S SURFACE	A	Land-based hourly reports
	C	Climatic reports
	I	Land intermediate synoptic reports
	M	Land-based main synoptic reports
	N	Asynoptic intermediate reports
	P	Land-based hourly specials
	S	Floating platforms (ship, buoy, etc.)
	R	Hydrologic reports
	X	Other surface data
	Z	Bulletins with mixed data type reports
(OBSERVATIONAL DATA) T_2 = U UPPER AIR	A	Single level aircraft reports
	B	Single level balloon reports
	C	Single level satellite-derived reports
	D	Dropsondes/dropwindsondes
	L	Ozone data
	N	Rocketsondes
	P	Profilers
	R	Radiance data
	S	Radiosondes/pibals reports
	T	Satellite-derived sondes
	X	Other upper air reports
	Z	Mixed upper air data type reports
(OBSERVATIONAL DATA/FORECAST PRODUCTS) T_2 = O OCEANOGRAPHIC/ LIMNOGRAPHIC	I	Sea ice
	S	Sea surface and below sounding
	T	Sea surface temperature
	W	Sea surface waves
	X	Other sea environmental
	Z	Mixed collection of oceanographic types
(FORECAST PRODUCTS) T_2 = F SURFACE/ SEA LEVEL	A	Surface area forecast (e.g. airways)
	M	Surface forecasts (e.g. MOS)
	P	Forecast amendments (airways)
	R	Hydrologic forecasts
	S	Forecast amendments (TAF)
	T	Aerodrome forecasts (TAF)
	X	Other surface forecasts
	Z	Mixed collection of forecasts
(FORECAST PRODUCTS) T_2 = V UPPER AIR	A	Forecast at single levels
	S	Forecast sounding
	X	Other upper air forecasts
	Z	Mixed collection of forecasts

NOTE: The allocation of abbreviated headings for CREX messages (see (*a*) and (*d*) above) is pending the formal approval of the code CREX.

RECOMMENDATION 4 (CBS-XI)

PROPOSED NEW APPENDIX I.5 AND AMENDMENTS TO PARTS I AND II OF THE *MANUAL ON THE GLOBAL DATA-PROCESSING SYSTEM*

THE COMMISSION FOR BASIC SYSTEMS,

NOTING:

(1) The conclusions of the CBS Expert Meetings on Operational Matters of GDPS Centres and on Environmental Emergency Response Activities (December 1995),

(2) The *Manual on the GDPS*, Parts I and II,

CONSIDERING that there is a need:

(1) For an enhancement of functions and services of GDPS centres in response to new requirements and improved capabilities related to extended-range and long-range weather forecasts as well as environmental monitoring and prediction,

(2) For updating the role of RSMCs in providing products in accordance with their capabilities and stated requirements,

(3) For updating the regional and global arrangements for the provision of Environmental Emergency Response services,

(4) For establishing procedures for the provision of services to United Nations humanitarian missions,

(5) For giving the resulting amendments to the *Manual on the GDPS* regulatory status,

RECOMMENDS:

(1) That the amendments to Parts I and II of the *Manual on the GDPS* given in Annex 1 to this

recommendation, be adopted for inclusion in the *Manual on the GDPS*, and take effect on 1 July 1997;

(2) That the procedures for the provision of services to United Nations humanitarian missions given in Annex 2 to this recommendation, be adopted for inclusion as Appendix I.5 to the *Manual on the GDPS*, and take effect from 1 July 1997;

REQUESTS the Secretary-General to include the appropriate changes, based on the annexes to this recommendation, in the *Manual on the GDPS*;

AUTHORIZES the president of CBS, in consultation with the Secretary-General, to make any consequent purely editorial amendments as regards the *Manual on the GDPS*.

ANNEX 1 TO RECOMMENDATION 4 (CBS-XI)

PART I

ORGANIZATION AND FUNCTIONS OF THE DATA-PROCESSING SYSTEM

(The proposed additions to the existing text appear in bold italic; proposed deletions from the existing text are scored through)

1. PURPOSE OF THE GLOBAL DATA-PROCESSING SYSTEM (GDPS)

The main purpose of the GDPS shall be to prepare and make available to Members in the most cost-effective way meteorological analyses and forecast products. The design, functions, organizational structure and operations of the GDPS shall be in accordance with Members' needs and their ability to contribute to, and benefit from, the system.

2. FUNCTIONS OF THE GDPS

2.1 The real-time functions of the GDPS shall include:

(*a*) Pre-processing of data, e.g. retrieval, quality control, decoding, sorting of data stored in a database for use in preparing output products;

(*b*) Preparation of analyses of the three-dimensional structure of the atmosphere with up-to-global coverage;

(*c*) Preparation of forecast products (fields of basic and derived atmospheric parameters) with up-to-global coverage for one to 10 days ahead;

(*d*) ~~Preparation of specialized products such as limited area very fine mesh short range forecasts, long range forecasts (beyond 10 days), tropical cyclone track forecasts, tailored products for marine, aviation and other purposes;~~
Preparation of specialized products such as limited area very-fine mesh short-, medium-, extended-, and long-range forecasts, tailored products for marine, aviation, environmental quality monitoring, and other purposes;

(*e*) Monitoring of observational data quality;

(*f*) Post-processing of NWP data using workstation and PC-based systems with a view to producing tailored value added products and generation of weather and climate forecasts directly from model output.

2.2 The non-real-time functions of the GDPS shall include:

(*a*) ~~Preparation of special products for non-real time weather or climate related diagnostic (i.e. 10-day or 30-day means, summaries, frequencies and anomalies) on a global or regional scale, as agreed upon within the WWW system;~~
Preparation of special products for climate-related diagnosis (i.e. 10-day or 30-day means, summaries, frequencies and anomalies) on a global or regional scale;

(*b*) Intercomparison of analysis and forecast products, monitoring of observational data quality, verification of the accuracy of prepared forecast fields, diagnostic studies and NWP model development;

(*c*) ~~Long-term storage in a recommended format and medium of GOS data and GDPS products, as well as verification results for operational and research use;~~
Long-term storage of GOS data and GDPS products, as well as verification results for operational and research use;

(*d*) Maintenance of a continuously-updated catalogue of data and products stored in the system;

(e) Exchange between GDPS centres of ad hoc information via distributed databases;

~~(e)~~ ***(f)*** Conduct of workshops and seminars on the preparation and use of GDPS output products.

3. ORGANIZATION OF THE GDPS

The GDPS shall be organized as a three-level system of World Meteorological Centres (WMCs), Regional Specialized Meteorological Centres (RSMCs) and National Meteorological Centres (NMCs), which carry out GDPS functions at the global, regional, and national levels, respectively. The GDPS shall also support other WMO Programmes and relevant programmes of other international organizations in accordance with policy decisions of the Organization.

4. FUNCTIONS OF GDPS CENTRES

4.1 The general functions of GDPS centres shall be as follows:

4.1.1 World Meteorological Centres (WMCs)

These shall consist of ~~new~~ centres applying sophisticated high-resolution global NWP models ~~which also describe the relevant physical processes of the tropical atmosphere~~ and preparing for distribution to Members and other GDPS centres the following products:

(*a*) Global (hemispheric) analysis products;

(*b*) ~~Short and medium range forecast products with a global coverage, but presented separately, if required, for:~~

Short-, medium-, extended- and long-range forecasts and products with a global coverage, but presented separately, if required, for:

(i) The tropical belt;

(ii) The middle and high latitudes or any other geographical area according to Members' requirements;

(*c*) Climate-related diagnostic products, particularly for tropical regions.

WMCs shall also carry out verification and intercomparison of products, support the inclusion of research results into operational models and their supporting systems, and provide training courses on the use of WMC products.

4.1.2 Regional Specialized Meteorological Centres (RSMCs)

4.1.2.1 Centres with geographical specialization

These shall be either existing national or regional centres which have accepted responsibilities by multilateral or regional agreement, or centres implemented by a joint cooperative effort by several countries in a Region. The functions of RSMCs with geographical specialization shall include:

(*a*) Providing the interface between WMCs and NMCs by formatting and distributing global products to meet the needs in a particular Region;

(*b*) ~~Undertaking limited-area fine-scale analyses and fine-mesh forecast products~~ Providing regional analysis and forecast products for 12–48 hours, for designated areas;

(c) Providing meteorological assistance to United Nations humanitarian missions, in the event the relevant associated NMC is facing an emergency or is in catastrophic distress and out of service, as specified in Appendix I.5;

(d) Coordinating with other RSMCs as appropriate.

4.1.2.2 Centres with activity specialization

The functions of RSMCs with activity specialization shall include, *inter alia*:

(*a*) Providing long-~~range~~, ***extended-, and***/or medium-range forecasting products;

(*b*) Providing advisories for tropical cyclones, severe storms and other dangerous weather phenomena;

(*c*) Providing tailored ~~aviation* or marine~~ ***specialized*** products to service users in a particular area;

(*d*) Providing trajectories or dispersion of pollutants in case of ~~nuclear or chemical accident~~ ***environmental emergencies;***

(*e*) Providing information on prolonged adverse weather conditions, including drought monitoring;

(*f*) ~~Undertaking activities related to the WCP and other WMO or international programmes.~~ ***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 should be co-located where possible.

4.1.2.4 RSMCs designated by WMO for the provision of atmospheric transport model products for environmental emergency response shall implement the regional and global arrangements and related procedures in Appendix I.3.

~~NOTES:~~

4.1.2.5 The designated WMCs and RSMCs are given in Appendix I.1 and ~~(1)~~ the procedures for broadening the functions of existing RSMCs and for designating new RSMCs are given in ~~Attachment~~ ***Appendix*** I.2. ~~(4)~~ Regional and global arrangements for the provision of transport model products for environmental emergency response are given in ~~Attachment I.5~~. ***Appendix I.3.***

NOTE:

~~(2)~~ Guidelines to review the status of RSMCs with geographical specialization are given in Attachment ~~I.3~~. ***I.1.***

4.1.3 National Meteorological Centres (NMCs)

~~The functions of NMCs shall include preparation of:~~ ***The NMCs carry out functions to meet their national and international requirements. Typically, the functions of NMCs include the preparation of:***

(*a*) Nowcasts and very short-range forecasts;

~~(b) Short-, medium- and long-range forecasts by applying objective or manual interpretation methods to products received from World and Regional Specialized Meteorological Centres or by integrating limited-area models using boundary conditions based on these products;~~

~~(c) Special application user products, including warnings for severe weather;~~

(b) Short-, medium-, extended- and long-range forecasts by applying objective or subjective interpretation methods to products received from World and Regional Specialized Meteorological Centres or by integrating regional models using boundary conditions based on these products;

(c) Special application-user products, including warnings of severe weather, climate and environmental quality monitoring and prediction products;

(d) Specific products and their delivery in support of United Nations humanitarian missions as specified in Appendix I.5;

~~(d)~~***(e)*** Non-real-time climate-related analyses and diagnosis.

NMCs should be linked via suitable terminals to computer systems at other GDPS centres in order to

carry out inter-processing activities between centres, according to bilateral or multilateral agreements among Members. ***The definition of forecast ranges is given in Appendix I.4.***

~~(3)~~ ***4.1.3.1*** The basic organization of the GDPS is also given in Chapter A.2.1 of the *Technical Regulations*.

NOTES:

(1) The national data-processing activities may also be concerned with large-scale analyses and forecasts.

(2) Detailed specifications of the real-time and non-real-time functions of WWW centres are given in Parts II and III, respectively.

(3) **Procedures for the elaboration of observational data requirements are given in Attachment** ~~I.4~~. I.2.

(4) In some instances, WMCs, RSMCs and NMCs are co-located and the functions of one centre are included in those of the other.

~~* NOTE: The role of the ICAO WAFS and its responsibilities to provide tailored products for international aviation are recognized.~~

4.2 The above functions of the various centres shall not affect the status of any international commitments of Members for support to shipping and aviation, nor determine the manner in which Members execute these responsibilities.

APPENDIX I.3

~~ATTACHMENT I.5~~

REGIONAL AND GLOBAL ARRANGEMENTS FOR THE PROVISION OF TRANSPORT MODEL PRODUCTS FOR ENVIRONMENTAL EMERGENCY RESPONSE

Regional arrangements — no change

Global arrangements

Until such time as new RSMCs have been designated, it is proposed that Regional Association VI-designated RSMCs be responsible to provide services for radiological emergencies to Regional Associations I and II; **Regional Association IV-designated RSMCs be responsible to provide services to Regional Association III; while the Regional Association V-designated RSMC, in collaboration with Regional Association IV-designated RSMCs, will be responsible to provide services to Regional Association V.**

In cases of radiological emergencies where coordination is required between RSMCs of different regions, the RSMCs of the region where the emergency has occurred will provide this coordination.

In the event of an actual or apprehended nuclear incident, the IAEA shall provide the timely authoritative notification to RSMCs and WMO that its emergency response system has returned to normal mode and no longer requires the assistance of RSMCs. RSMCs will also notify NMSs of termination of their special activities, as appropriate.

APPENDIX I.4

DEFINITION OF FORECASTING RANGES

1.	Nowcasting	A description of current weather parameters and 0–2 hours description of forecasted weather parameters.
2.	Very-short range weather forecasting	Up to 12 hours description of weather parameters.
3.	Short-range weather forecasting	Beyond 12 hours and up to 72 hours description of weather parameters.
4.	Medium-range weather forecasting	Beyond 72 hours and up to 240 hours description of weather parameters.
5.	Extended-range weather forecasting	Beyond 10 days and up to 30 days description of weather parameters, usually averaged and expressed as a departure from climate values for that period.
6.	Long-range weather forecasting	From 30 days up to two years.
	6.1 Monthly outlook	Description of averaged weather parameters expressed as a departure (deviation, variation, anomaly) from climate values for that month (not necessarily the coming month).
	6.2 Three month or 90-day outlook	Description of averaged weather parameters expressed as a departure from climate values for that 90-day period (not necessarily the coming 90-day period).
	6.3 Seasonal outlook	Description of averaged weather parameters expressed as a departure from climate values for that season.

NOTE: Season has been loosely defined as Dec/Jan/Feb = Winter; Mar/Apr/May = Spring; etc...in the northern hemisphere. Outlooks spanning several months such as multi-seasonal outlooks or tropical rainy season outlooks may be provided.

7.	Climate forecasting	Beyond two years.

NOTE: Climate forecasts are different from long-range weather forecasts in that they attempt to forecast changes of climate parameters such as its variability or average values.

7.1	Climate variability prediction	Description of the climate parameters associated with the variation of amplitude of the (inter-annual, decadal, multi-decadal, etc.) climate anomalies.
7.2	Climate prediction	Description of the change in climate expressed as new climate normals.

PART II

DATA-PROCESSING ASPECTS

1. Functions of WMCs, RSMCs and NMCs

1.1 GDPS products and services

Each Member or group of Members(s) responsible for a GDPS Centre should ensure that its centre performs the relevant category of the following functions:

1.1.1 Real-time products and services for middle latitudes and subtropical areas

For middle latitudes and subtropical areas, the GDPS should provide the following products and services in real time:

(*a*) Surface and upper-air analyses;

(*b*) Prognoses one to three days in advance, including:

(i) Surface and upper-air prognoses of pressure (geopotential), temperature, humidity and wind in map or other form;

(ii) Diagnostic interpretation of numerical weather prediction (NWP) products to give:

a. Areal distribution of cloudiness;

b. Precipitation location, occurrence, amount and type;

c. Sequences at specific locations (time diagrams), at the surface and aloft, of temperature, pressure, wind, humidity, etc., subject to agreement between Members where appropriate;

d. Vorticity advection, temperature/thickness advection, vertical motion, stability indices, moisture distribution, and other derived parameters as agreed by Members;

e. Jet-stream location and tropopause/layer of maximum wind;

f. Numerical products providing sea-state or storm-surge forecasts;

(*c*) Prognoses four to 10 days in advance, including:

(i) Surface and upper-air prognoses of pressure (geopotential), temperature, humidity and wind;

(ii) Outlooks of temperature, precipitation, humidity and wind in map or other form;

(d) Extended- and long-range forecasts of averaged weather parameters as appropriate, including sea-surface temperature, temperature extremes and precipitation;

~~(d)~~***(e)*** Interpretation of numerical products using relations derived by statistical or statistical/dynamical methods to produce maps or spot forecasts of probability of precipitation or precipitation type, maximum and minimum temperature, probability of thunderstorm occurrence, etc.;

~~(e)~~(*f*) Sea-state and storm-surge forecasts using models driven by winds from global NWP models;

(g) Environmental quality monitoring and prediction products;

~~(f)~~(*h*) Independent real-time quality control of the Level II and Level III data defined in Note (3) to paragraph 1.5.2.

1.1.2 Real-time products and services for tropical areas

For tropical areas, the GDPS should provide the following products and services in real time:

(*a*) Surface and upper-air analyses;

(*b*) Prognoses one to three days in advance, including:

(i) Surface and upper-air prognoses, particularly of wind and humidity in map or other form;

(ii) Diagnostic interpretation of NWP products to give:

a. Areal distribution of cloudiness;

b. Precipitation location/occurrence/amounts;

c. Time sequence of weather parameters at specific locations, subject to agreement between Members, where appropriate;

d. ***Vorticity, divergence, velocity potential, vertical motion, stability indices, moisture distribution and other derived parameters as agreed by Members;***

e. Jet stream and layer of maximum wind locations;

f. Numerical products providing sea-state or storm-surge forecasts;

(iii) The use of special NWP nested models or diagnostic interpretation of fine-mesh global models to give:

a. Tropical storm positions and tracks;
b. Tropical depression and easterly wave positions and movement;

(c) Prognoses four to five days in advance, including:
(i) Surface and upper-air prognoses, particularly of wind and humidity;
(ii) Outlooks of precipitation, wind, cloudiness and wet and dry periods;
(iii) Life cycle of tropical storms;

(d) Extended- and long-range forecasts of averaged weather parameters, as appropriate, including sea surface temperature, temperature range and precipitation;

~~(d)~~(e) Interpretation of NWP prognoses using statistical or statistical/dynamical methods to produce maps or specific location forecasts of cloudiness, temperature range, precipitation probability, etc.;

(f) Environmental quality monitoring and prediction products;

~~(e)~~(g) Sea-state and storm-surge forecasts using models driven by winds from global NWP models;

~~(f)~~(h) Independent real-time quality control of the Level II and Level III data defined in Note (3) to paragraph 1.5.2.

1.1.3 Non-real-time products and services

The GDPS should also provide the following products and services in non-real time:

(a) ~~Long-range outlooks when operationally useful;~~ ***Long-range weather and climate monitoring products when operationally useful;***

(b) Climate-related diagnoses (10- or 30-day mean charts, summaries, anomalies, etc.) particularly for the tropical/subtropical belt;

(c) Intercomparison of products, verification and diagnostic studies, as well as NWP model development;

(d) Access to data, products and intercomparison results using internationally-accepted formats and media;

(e) Provision of continuously updated catalogues of data and products;

(f) Regional and global analyses (circulated by Members or research institutions) of the atmosphere and oceans, including means and anomalies of surface and upper-air pressure, temperature, wind and humidity, ocean currents, sea-surface temperature, and ocean surface layer temperature; derived indices, including blocking and teleconnection indices;

(g) Satellite remote sensing products distributed by Members; including outgoing long-wave radiation, sea-surface elevation, normalized vegetation indices;

(h) Monthly and annual means or totals for each year of a decade (e.g. 1971–1980, etc.) and the corresponding decadal (10-year) averages of pressure (station level and mean sea level), temperature and precipitation, principally from CLIMAT ***reporting stations;***

(i) Climatological standard normals (for the periods 1931–1960, 1961–1990, etc.) of selected elements, principally from CLIMAT ***reporting stations;***

~~(f)~~***(j)*** Guidelines on the operational use of GDPS centre products; and

~~(g)~~***(k)*** Carrying out periodic monitoring of the operation of the WWW.

1.2 Functions of Members responsible for GDPS centres

1.2.1 Interpretation at NMCs

National Meteorological Centres (NMCs) should be able to use, interpret and interact fully with GDPS products in order to reap the benefits of the WWW system. Appropriate guidance on the methods for the interpretation of the GDPS output to end-user products shall be made available to Members, as well as methods for the verification and intercomparison of forecasts.

1.2.2 Accessibility of products

GDPS products should be accessible through a system of World Meteorological Centres (WMCs) and Regional Specialized Meteorological Centres (RSMCs)* with functions and responsibilities ***as defined in the Manual and*** according to agreements among Members ***when appropriate.***

---

* The present structure of the GDPS is ~~described in paragraph 32 et seq. of the Third WMO Long-term Plan, Part II, Volume I – The World Weather Watch Programme 1992–2001.~~ ***given in Appendix I.1.***

1.2.3 Data Management

The WWW Data Management function shall be used to coordinate the real-time storage, quality control, monitoring and handling of GDPS data and products.

1.3 WMC responsibilities

1.3.1 Output products

Each WMC applying sophisticated high-resolution global NWP models ~~which also describe the relevant physical processes of the tropical atmosphere~~ should prepare for distribution to Members and other GDPS centres the following products, based on the list in paragraphs 1.1 to 1.1.3 above:

(a) Global (hemispheric) analysis products;

(b) ~~Short- and medium-range forecast products with global coverage, but~~ ***Short-, medium-, extended- and long-range weather forecasts*** with global coverage presented separately, if required, for:
(i) The tropical belt;
(ii) The middle and high latitudes or any other geographical area according to Members' requirements;

(c) Climate-related diagnostic products, particularly for tropical regions;

(d) Environmental quality monitoring, analyses, forecasts and prediction products.

1.3.1.1 Global model products required to meet the needs of all WMO Programmes should be made available to national and regional centres at the highest possible resolution given technological and other constraints.

1.3.2 Use of products

WMCs should also carry out verification and intercomparison of products and make results available to all Members concerned, support the inclusion of research results into operational models and their supporting systems and provide training courses on the use of WMC products.

1.3.3 The functions of a WMC should also include the following non-real-time activities:

(*a*) Carrying out the development of research in support of large- and planetary-scale analyses and forecasting;

(*b*) Exchanging technical information with other centres;

(*c*) Providing opportunities for training personnel in data processing;

(*d*) Managing non-real-time data involving:

(i) Collection and quality control of data not available from the GOS in real-time, via mail or other means;

(ii) Storage and retrieval of all basic observational data and processed information needed for large- and planetary-scale research and applications;

(iii) Making non-real-time data available to Members or research institutes upon request;

(*e*) Continuously updating and providing, on request, catalogues of available products.

1.4 RSMC responsibilities

1.4.1 Output products

1.4.1.1 Regional Specialized Meteorological Centres (RSMCs) with geographical specialization

Regional Specialized Meteorological Centres (RSMCs) ***with geographical specialization*** shall be designated in each Region, capable of preparing with the support of WMCs, and where applicable RSMCs outside the Region, analyses and short-, ~~and medium-range forecast products with the highest possible quality and with the meteorological content, geographical coverage and frequency required by Members and agreed for the system.~~ ***medium-, extended- and long-range weather forecasts with the highest possible quality and with meteorological content, geographical coverage and frequency required by Members and agreed for the system.*** Output products from RSMCs should comprise:

(*a*) Analyses and prognoses at the surface and/or in the free atmosphere for ~~short and medium ranges~~ ***short-, medium-, extended- and long-ranges***, for the tropical, subtropical and extratropical areas, according to the obligations of each RSMC and as agreed by the Regional Association;

(*b*) Interpreted forecasts of specific weather parameters in map form or at specific locations (e.g. precipitation amounts, temperature, wind, humidity, etc.), subject to agreement between Members, where appropriate;

(*c*) ***Guidance on*** storm-position and track forecasts for the areas affected by tropical storms;

(*d*) ~~Climate analyses and, if possible, long range outlooks of wet and dry periods~~ ***Climate analyses, long-range forecasts, onset, intensity and cessation of the rainy season(s);***

(e) Environmental quality monitoring and predictions, such as UV-B;

~~(e)~~***(f)*** Results of forecast verifications and intercomparison studies.

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 shall be capable of preparing independently or with the support of WMCs, and where appropriate, other GDPS 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 environmental emergency response transport model trajectories, integrated pollutant concentration, and total deposition;

(e) Drought monitoring products such as drought indices.

1.4.1.3 Regional model output products required to meet the needs of all WMO Programmes should be made available to national centres at the highest possible resolution given the technological and other constraints.

1.4.2 The overall list of output products required for international exchange from GDPS centres is given in Appendix II.6.

(paragraphs 1.4.3 through 2.1.2.1 remain unchanged)

~~2.1.2.2 For the NMCs not capable of implementing the minimum standards, Members concerned should establish agreements with an appropriate RSMC or NMC to perform the necessary quality control on an interim basis.~~

~~Note: Minimum standards of quality control for real-time data are given in Attachment II.1.~~

2.1.2.~~3~~**2** Quality control of observational data needed for real-time uses shall not introduce any significant delay in the onward transmission of the data over the GTS.

2.1.2.~~4~~**3** To detect errors which may escape the national quality control system and errors introduced subsequently, RSMCs, WMCs and other GDPS centres should also carry out appropriate quality monitoring of the observational data they receive.

2.1.3 Minimum standards

2.1.3.1 Members should implement minimum standards of real-time quality control at all NMCs, RSMCs and WMCs. Note: ~~Minimum~~ These standards of quality control for real-time data are given in ~~Attachment~~ ***Appendix*** II.1.

2.1.3.2 For the NMCs not capable of implementing these standards, Members concerned should establish agreements with an appropriate RSMC or NMC to perform the necessary quality control on an interim basis.

2.2 Requirements for observational data

2.2.1 In determining observational ***data*** requirements for their data-processing functions, Members shall keep in mind the ~~need to avoid unnecessary loading of the GTS~~ ***needs of all WMO Programmes and WMO-supported programmes.***

(Paragraphs 2.2.2 through 5.2.2 remain unchanged)

5.2.3 In order to avoid overloading the GTS, Members should limit requests by their NMCs for products, taking into account the following considerations:

(*a*) Members should require output products from RSMCs with geographic specialization normally from one RSMC located in the same WMO Region (exceptions shall be restricted to cases where the area, for which a Member needs to receive RSMC output products, is not covered by the products from one RSMC in the same Region);

(*b*) If there is an urgent need for a Member to receive the same product from more than one geographically-specialized RSMC or WMC for special operational purposes, these requirements should be limited to a selection of two levels of analyses and prognoses;

(*c*) Members should request processed information from the centres most readily accessible on the GTS.

NOTE: The lists of ~~WMC and RSMC~~ ***global and regional model*** products, to which the highest priority should be given ***by WMCs and RSMCs*** for preparation, are given in Attachments ~~II.8~~ ***II.1*** and ~~II.9~~ ***II.2.***

5.2.4 Globally-specialized RSMCs should tailor their products to regions to meet regional requirements and, if possible, to limit their size to avoid overloading the GTS.

5.3 Transmission priorities for GDPS products

NOTE: The priorities listed in this section are intended as guidance to GDPS centres on providing observational data and output products to the GTS in the proper sequence. As regards the relay of information by automated telecommunication centres, the provisions of the *Manual on the Global Telecommunication System* apply.

5.3.1 Transmission priorities for ~~WMC~~ ***global model*** products ***from WMCs and RSMCs***

5.3.1.1 Priorities for the transmission of ~~WMC~~ output products should be used when several such WMC ***and RSMC*** products are available at the same time.

NOTE: Transmission priorities for ~~WMC~~ ***global model*** output products are given in Attachment ~~II.10~~ ***II.3.***

5.3.2 Transmission priorities for ~~RSMC~~ ***regional model*** products ***from RSMCs***

5.3.2.1 Priorities for transmission of ~~RSMC~~ ***regional model*** products should be based on the requirements for the interregional exchange of RSMC products on the MTN and its branches.

NOTE: ~~A list of available RSMC~~ ***Transmission priorities for regional model*** products, ***from RSMCs*** which have the highest priority for transmission on the MTN and its branches (without indication of order of preference), is given in Attachment ~~II.11~~ ***II.4.***

~~5.3.2.2 If restrictions are encountered in scheduling transmission due to limitations in the capacity of the MTN, the transmission of output products of RSMCs needed in support of the Area Forecast System shall have a higher priority than WMC products.~~

5.3.3 Transmission priorities after transmission outages on the MTN and its branches:

(*a*) Normal transmission schedules of observational data should be resumed no later than the first main standard time of observation following the cessation of the outage;

(*b*) Procedures for the transmission of accumulated meteorological data should not interfere with the resumption of normal transmission schedules. If these data are redundant, they should not be transmitted.

NOTES:

(1) Although new automatic re-routeing procedures provide a capability for routeing traffic when a segment of the MTN is disrupted, there is still a need for a system of priorities which can be used for the transmission of meteorological data when the re-routeing procedures cannot be used.

(2) Priorities for transmission of observational data on the MTN and its branches are given in Attachment ~~II.12~~ ***II.5*** (Part 1).

5.3.4 Transmission priorities for ~~WMC~~ ***global model*** products ***from WMCs and RSMCs*** after outages

5.3.4.1 ~~WMC~~ ***Global model*** products accumulated due to circuit disruption should be transmitted with the least possible delay.

NOTE: A list of transmission priorities for ~~WMC~~ ***global model*** products, ***from WMCs and RSMCs*** after outages on the MTN and its branches, is given in Attachment ~~II.12~~ ***II.5*** (Part 2).

5.3.5 Transmission priorities for ~~RSMC~~ ***regional model*** products ***from RSMCs*** after outages

5.3.5.1 ~~RSMC~~ ***Regional model*** products ***from RSMCs*** accumulated due to circuit disruptions on the MTN and its branches should be transmitted with the least possible delay.

5.3.5.2 The ~~RSMC~~ ***regional model*** products should have a higher priority than ~~WMC~~ ***global model*** products for transmission after outages on the MTN and its branches.

NOTE: A list of transmission priorities for ~~RSMC~~ ***regional model*** products ***from RSMCs*** after outages on the MTN and its branches, is given in Attachment II.12 II.5 (Part 3).

5.3.6 Priority of observational data over processed data

5.3.6.1 On the MTN and its branches, the transmission of observational data shall have priority over the transmission of processed data (in both analogue and digital form).

APPENDIX II.2

OBSERVATIONAL DATA REQUIREMENTS FOR GDPS CENTRES FOR GLOBAL AND REGIONAL EXCHANGE

The following paragraphs 1, 2, and 3 state the observations required to operate all GDPS centres at the national, regional, and global levels. Paragraph 4 addresses the data requirements for NWP operations only.

1. The types of observation networks and platforms providing data required at data processing centres are as follows:

(*a*) All stations included in the Regional Basic Synoptic Networks;
(*b*) The network of supplementary synoptic stations, including automatic stations;
(*c*) Automatic marine stations (drifting buoy and moored buoys);
(*d*) Mobile sea stations;
(*e*) All other stations making radiowind, radiosonde/radiowind and pilot balloon observations;
(*f*) Meteorological rocket stations;
(*g*) Aircraft meteorological observations;
(*h*) Wind profilers;
(*i*) Doppler and weather watch radar systems and networks;
(*j*) Space-based systems producing:
  (i) Imagery (including both analogue and digital imagery);
  (ii) Radiance data;
  (iii) Vertical temperature and humidity profiles;
  (iv) Cloud and water vapor motion winds;
  (v) **Cloud height, temperature, type and amount;**
  (vi) Digital information about clouds (liquid water or ice (total));
  (vii) Surface wind, precipitation rate and precipitable water;
  (viii) Land temperature;
  (ix) Sea-surface temperature;
  (x) Ocean surface wind vector;
  (xi) Albedo;
  (xii) Ocean wave spectra;
  (xiii) Sea ice cover;
  (xiv) Snow cover, depth and water equivalent;
  (xv) Earth radiation fluxes;
  (xvi) Aerosols and trace gases;
  (xvii) Volcanic ash;
  ~~(x)~~**(xviii)** Other meteorological and environmental products;
(*k*) Radiological data reporting station in case of nuclear accidents (required for GDPS Centres running transport models for environmental emergency response);
(l) **Selected climatological/agrometeorological/hydrological stations;**
(*m*) Lightning detection and location systems network;
(n) **Global Atmosphere Watch (GAW) Network.**

The observational data which will be needed to obtain optimum results from NWP systems by the year 2000 and meet the needs of all WMO Programmes and WMO-supported Programmes are elaborated in section 4 and its related three tables of this appendix.

2. The report code types which carry the data provided by the platforms listed in paragraph 1 of this appendix are given below:

(*a*) BUFR and GRIB;
(*b*) TEMP – Parts A, B, C, and D;
(*c*) PILOT – Parts A,B,C, and D;
(*d*) TEMP SHIP – Parts A,B,C, and D;
(*e*) PILOT SHIP – Parts A, B, C, and D;
(*f*) TEMP MOBIL – Parts A,B,C, and D;
(*g*) PILOT MOBIL – Parts A,B,C, and D;
(*h*) COLBA;
(*i*) TEMP DROP;
(*j*) ROCOB;
(*k*) SYNOP;
(*l*) SHIP;
(*m*) Reports from automatic stations on land and at sea;
(*n*) CODAR/AIREP/AMDAR;
(*o*) Selected satellite data, such as cloud images, SATEM, SAREP, SARAD, SATOB;
(*p*) BUOY;
(*q*) CLIMAT, CLIMAT SHIP;
(*r*) CLIMAT TEMP, CLIMAT TEMP SHIP;
(*s*) BATHY, TESAC, TRACKOB;
(*t*) WAVEOB;
(*u*) RADOB;
(*v*) RADREP;

NOTES:
(1) Items (*a*) to (*v*) do not indicate priorities.
(2) BUFR and CREX can encode any of the other above data forms and many more. If BUFR or CREX are used to represent any of these data forms, in lieu of the specific alphanumeric code form, the same data requirements apply.

(Items 3 and 4 — no changes)

Replace current Table 1 with:

Table 1 — Three-dimensional fields

	Horizontal resolution (km)	*Vertical resolution (km)*	*Temporal resolution (hours)*	*Accuracy (RMS error)*	*Notes*
Wind (horizontal)	100	.1 up to 2 km .5 up to 16 2 up to 30	3	2 m s^{-1} in the troposphere 3 m s^{-1} in the stratosphere	(1) (2)
Temperature	100	.1 up to 2 km .5 up to 16 2 up to 30	3	.5K in the troposphere 1K in the stratosphere	(3)
Relative humidity (RH)	100	.1 up to 2 km .5 up to tropopause	3	5% (RH)	
Turbulence	100	.3	1	–	
Ozone	Variable	Variable	Variable	5%	
Greenhouse gases	Variable	Variable	Variable	2–10% (1pptv–1ppmv)	
Reactive gases	Variable	Variable	Variable	2–10% (1pptv–1ppbv)	
Aerosols-chemical and physical properties	Variable	Variable	Variable	–	
Salinity	250	Variable	6h	1%	
Sub-sea surface temperature	250	Variable	6h	0.5K	
Sub-sea surface current	250	Variable	6h	2 cm s^{-1}	
Soil moisture 0–10 cm	100	–	1 day	0.02 $m^3 m^{-3}$	
Soil moisture 10–100 cm	100	–	1 week	0.02 $m^3 m^{-3}$	

NOTES:
(1) Accuracy specified as RMS vector error.
(2) Hourly wind data from geostationary satellites and from wind profilers are also required. Tropospheric horizontal and vertical resolution and accuracy can be met by a space-based Doppler wind lidar in a Sun-synchronous orbit.
(3) Geopotential height can be retrieved from specified T and RH with sufficient accuracy.

Table 2 — Surface fields

Replace current Table 2 with:

	Horizontal resolution (km)	*Temporal resolution*	*Accuracy (RMS error)*	*Notes*
Pressure	100	1h	0.5 hPa	
Wind	100	1h	2 m s^{-1}	(1)
Temperature	100	1h	1 K	
Relative humidity	100	1h	5%	
Visibility	100			
Accumulated precipitation	100	1h	0.1 mm	(2)
Precipitation rate	100	1h	0.1 mm h^{-1}	
Sea and lake surface temperature	100	1 day	0.5 K	
Soil temperature	100	3h	0.5 K	
Sea-ice and lake ice cover	100	1 day	10%	
Snow cover	100	1 day	10%	
Snow equivalent-water depth	100	1 day	5 mm	
River runoff	250	1 week		
Lake water level	Variable	1 week		
Water quality	250	1week		
Sediments	250	1week		
Percentage of vegetation	100	1 week	10% (relative)	
Phenomological data	Variable	10 days		
Soil temperature, 20 cm	100	6h	0.5 K	
Deep soil temperature, 100 cm	100	1 day	0.5 K	
Surface roughness	50	1 month		
Albedo, visible	100	1 day	1%	
Albedo, near infrared	100	1 day	1%	
Long-wave emissivity	100	1 day	1%	
Multipurpose imagery	1 or 4	6h	–	
Surface net radiation	50	6h	1%	
UV incoming	50	1h	1–5%	
Waves spectra	100	1h	0.01 m	
Salinity	100	6h	1%	
Sea level	50	12h	0.01m	
Ocean current	100	6h	2 cm s^{-1}	
Greenhouse gas concentrations	Variable	Variable	2–10% (1pptv–1ppmv)	(3)
Ozone	Variable	Variable	1–5%	
Precipitation chemistry	Variable	Variable	–	
Aerosols-chemical and physical properties	Variable	Variable	–	
Reactive gases	Variable	Variable	2–10% (1pptv–1ppmv)	
Radionuclides	Variable	Variable		
Volcanic activity	Variable	Variable		(3)

NOTES:
(1) Wind at 10 metres over land;
Over sea, height in the range 1 to 40 metres (to be transmitted with the observation).
(2) Required principally for model validation, not time critical.
(3) For some programmes e.g. environmental monitoring, environmental emergency response and public weather services, much higher resolution data is needed operationally.

Replace current Table 3 with:

Table 3 — Other two-dimensional fields

	Horizontal resolution (km)	*Temporal resolution*	*Accuracy (RMS error)*	*Notes*
Cloud fractional cover	100	3h	10%	
Cloud top height	100	3h	0.5 km	(1)
Cloud base height	100	3h	0.5 km	(1)
Total liquid water content	100	3h	20%	
Cloud phase/particle size	50	6h	–	
TOA net short-wave radiation	100	3h	5 W m^{-2}	(2)
TOA net long-wave radiation	100	3h	5 W m^{-2}	(2)
Multipurpose IR/VIS imagery Radiance	5	30 min.	–	(3)
Column ozone	Variable	Variable	1%	
Optical depth/turbidity	Variable	Variable	–	
Column greenhouse and reactive gases	Variable	Variable	–	

NOTES:
(1) Accuracy is higher in planetary boundary layer.
(2) Required principally for model validation; not time critical.
(3) Required to assist real-time observation monitoring and analysis/forecast validation.

APPENDIX II.6

OVERALL LIST OF OUTPUT PRODUCTS REQUIRED FOR INTERNATIONAL EXCHANGE FROM GDPS CENTRES

Within the constraints of technology and programme requirements, model output should be supplied at the highest possible resolution.

1. **ANALYSES**

Surface including synoptic features
925 hPa
850 hPa
700 hPa
500 hPa
400 hPa
300 hPa
250 hPa
200 hPa
150 hPa
100 hPa
70 hPa
50 hPa
30 hPa
20 hPa
10 hPa

} Parameters: Pressure (P)/geopotential height (H), temperature (T), wind (W) and humidity (R), as appropriate and applicable

Tropopause and maximum wind or tropopause and vertical wind shear
Relative topography, in particular the thickness 500/1 000 hPa
Jet streams
Digitized cloud mosaics
Mapped radiometric data
Stability
Precipitable water
Snow depth
Changes to 500 hPa, 24 hours
Changes to relative topography, thickness 500/1 000 hPa, 24 hours
Freezing level
Pressure changes, three hours
Pressure changes, 12 and/or 24 hours
Precipitation areas, six hours
Precipitation areas, 24 hours
Sferics
Radar echoes
Nephanalyses
Sea-surface temperature
Land-surface temperature
Snow and ice cover
Storm alerts
Sea ice
State of sea
Storm surge
Thermoclines
Superstructure icing
Top of Ekman layer
Surface air trajectories
850 hPa air trajectories
700 hPa air trajectories
500 hPa air trajectories
Health risk index for travellers
Stratospheric ozone bulletins
Assessments of satellite ground-truthing radiation experiments
Climate-related analyses (e.g. climate system monitoring and climate normals)

2. **FIVE-DAY, 15-DAY AND 30-DAY MEAN ANALYSED VALUES AND ANOMALIES**

Surface
850 hPa
500 hPa

} Parameters: P/H, T, W and R, as appropriate and applicable

Sea-surface temperature anomaly

3. **PLOTTED DATA**

Plotted surface data (three-hourly)
Plotted upper-air data (850, 700, ..., 100 hPa)
Tabulated winds
Aerological diagrams

4. **FORECASTS**

Surface (including synoptic features)
925 hPa
850 hPa
700 hPa
500 hPa
400 hPa
300 hPa
250 hPa
200 hPa
150 hPa
100 hPa
70, 50, 30, 20 10 hPa
} Parameters: P/H, T, W and R, as appropriate and applicable

Jet-stream location and tropopause/layer of maximum wind
Significant weather
Relative topography, thickness 500/1 000 hPa

NOTE: The above list includes products which are required as part of the ICAO World Area Forecast System in accordance with requirements determined by ICAO.

Freezing level
Vorticity
Vertical motion
Areal distribution of cloudiness
Precipitation location, occurrence, amount and type
Sequences at specific locations (time diagrams) at the surface and aloft of T, P, W and R
Vorticity advection, temperature/thickness advection, vertical motion, stability indices, moisture distribution and other derived parameters
Tropical storm positions and intensities
River stage, discharge and ice phenomena
Tropical depression and easterly wave positions and movement
Four-to-10-day outlook in middle latitudes and subtropical areas or four- to five-day outlook in the tropics for T, W, R and precipitation
Forecasts of probability of precipitation and temperature extremes for middle latitudes and subtropical areas or forecasts of cloudiness, temperature range and precipitation probability for tropical areas
State of sea
Storm surge
Sea-surface temperature
Thermoclines
Sea ice
Superstructure icing
Three dimensional trajectories with particle locations at synoptic hours for EER
Time integrated pollutant concentration within the 500 m layer above ground in three time periods up to 72 hours for EER
Total deposition up to 72 hours
Extended range forecasts (Levels and parameters as appropriate five, 10, 15 or 30 day) and applicable mean values
Long-range forecasts (monthly, three- month or 90-day, seasonal to multi-seasonal outlook)

APPENDIX II.7
~~ATTACHMENT II.16~~

STANDARDS IN THE PROVISION OF INTERNATIONAL SERVICES BY RSMCS FOR RADIOLOGICAL ENVIRONMENTAL EMERGENCY RESPONSE

The Delegated Authority requests for WMO Regional Specialized Meteorological Centres (RSMC) support for atmospheric transport modelling products by using the form entitled "Environmental Emergency Response Alert — Request WMO RSMC Support by Delegated Authority". The Delegated Authority then sends the completed form immediately to the RSMCs as per the regional and global arrangements.

The designated RSMCs shall implement agreed standard procedures and products by:

(*a*) The adoption of the following common default source parameters for the initial run of the transport/dispersion models;

(*b*) The provision of the following standard set of basic products within two to three hours of reception of a request and according to the general rules for displaying results;

(c) The adoption of the following forecast periods for the numerical calculations;

(d) The adoption of a joint response approach;

(e) The adoption of the general rules for displaying results.

1. Default source parameters for the initial run[1]

(*a*) Uniform vertical distribution up to 500 m above the ground;

(*b*) Uniform emission rate during six hours;

1 This concept is based on the understanding that the first (initial) run of the transport/dispersion models needs to be carried out with default parameters because little or no information (except location and accident time) will be available to the RSMC at this early stage. RSMCs are, however, requested to conduct subsequent model runs with more realistic parameters as they become available. This may, for example, refer to a more precise assumption of the vertical distribution or the need to conduct a model run for the release of noble gases.

(*c*) Starting time 0000 UTC or 1200 UTC if not known;
(*d*) Total pollutant release 1 unit (arbitrary);
(*e*) Type of radionuclide CS 137.

2. ***Standard set of products for initial response***
Five maps consisting of:
(*a*) Three-dimensional trajectories starting at 500, 1 500 and 3 000 m above the ground, with particle locations at synoptic hours ***up to the end of the dispersion model forecast;***
(*b*) Time-integrated pollutant concentrations within the layer 500 m above the ground, in Unit·s m^{-3} for each of the three forecast periods; (rest of text deleted)
(*c*) Total deposition (wet + dry) in Unit m^{-2} from the release time to the end of the ***dispersion model forecast.***
Previously transmittted products from the dispersion model need not be re-transmitted.

3. ***Forecast periods for numerical calculations***
The initial set of products will cover the period from T, the start time of the release, through a forecast of 72 hours from t, the start time of the current output from the operational NWP model.
The first 24-hour period for integrated exposures in the dispersion model will start at the nearest synoptic time (0000 or 1200 UTC) prior to or equal to T. Subsequent 24-hour integrations of the dispersion model will be made up to, but not exceeding, the synoptic time nearest to t+72.
If T is earlier than t, the first response will use hindcasts to cover the period up to t. Results from the hindcasts need not be transmitted.

4. ***Joint response and joint statements***
A joint response means that the two collaborating RSMCs shall immediately inform each other of any request received, initially both should produce and send the standard set of products (charts) independently and then move rapidly towards providing fully coordinated response and services for the duration of the response. Following the initial response, the RSMCs shall develop and provide, and update as required, a "joint statement" to describe a synopsis of the current and forecast meteorological conditions over the area of concern, and the results from the transport models, their differences and similarities and how they apply to the event.

5. ***General rules for displaying results***
In order to make the interpretation of the maps easier, the producing centres should ***adopt the following guidelines***:
General guidelines for all maps:
(a) Provide labelled latitude and longitude lines at 10° intervals and sufficient geographic map background (shore lines, country borders, etc.) to be able to locate precisely the trajectories and contours;
(b) Indicate the source location with a highly visible symbol (●, ▲, ✖, ✳, *, ■, etc.);
(c) Indicate the source location (latitude — N or S specified, longitude — E or W specified, plotting symbol used), date/time of release (UTC), and where possible, the meteorological model initialization date/time (UTC);
Specific guidelines for trajectories map:
(a) Distinguish each trajectory (500, 1 500, 3 000 m) with a symbol (▲, ■, ●, etc.) at synoptic hours (UTC);
(b) Use solid lines (darker than map background lines) for each trajectory;
(c) Provide a time-height (m or hPa) diagramme, preferably directly below the trajectory map, to indicate vertical movement of trajectory parcels.
Specific guidelines for concentration and deposition maps:
(a) Adopt a maximum of four concentration/deposition contours corresponding to powers of 10;
(b) A legend should indicate that contours are identified as powers of 10 (i.e., –12 = 10^{-12}). If grey- shading is used between contours, the individual contours must be clearly distinguishable after facsimile transmission and a legend provided on the chart;
(c) Use solid dark lines (darker than map background lines) for each contour;
(d) Indicate with a legend if this is an exercise, an unconfined event or an IAEA confirmed event and indicate the following input characteristics: (i) source assumption (height, duration, isotope, amount released); (ii) the units of concentration (Units m^{-3}) or depositon (Unit m^{-2}). In addition, charts should specify: (i) "Time integrated surface to 500 m layer concentrations"; (ii) "Contour values may change from chart to chart"; and if the default source is used; (iii) "RESULTS BASED ON DEFAULT INITIAL VALUES".
(e) Indicate, if possible, the location of the maximum concentration/deposition with a symbol on the map and include a legend indicating the symbol used and maximum numerical value;
(f) Indicate the time integration starting and ending date/time (UTC).
The RSMCs will normally provide the products in the ITU-T T4 format suitable for both group 3 facsimile machines and transmission on parts of the GTS.

ATTACHMENT ~~II.8~~ II.1

LIST OF *GLOBAL MODEL* OUTPUT PRODUCTS WHOSE PREPARATION SHOULD BE GIVEN HIGHEST PRIORITY *BY WMCS AND RSMCS*

1. **ANALYSES**

Surface	0000, 1200 UTC	Parameters: Pressure (P)/geopotential height (H), temperature (T), wind (W) and humidity (R), as appropriate and applicable
850 hPa	0000, 1200 UTC	
700 hPa	0000, 1200 UTC	
500 hPa	0000, 1200 UTC	
300 hPa	0000, 1200 UTC	
200hPa	0000, 1200 UTC	
100 hPa	0000, 1200 UTC	
50 hPa*	0000, 1200 UTC	
or		
70 hPa*	0000, 1200 UTC	

Nephanalyses or digitized cloud mosaics
Storm alerts ~~(based on satellite pictures)~~ } As applicable

Area coverage: northern hemisphere, southern hemisphere and selected products for the tropical areas

* In accordance with any requirements expressed by regional associations.

Five-day, 15-day and 30-day mean analysed values and anomalies
Surface
850 hPa
500 hPa
Sea-surface temperature anomaly } ***Parameters P/H, T, W and R as appropriate and applicable***

2. **FORECASTS**

Surface	H+24 (0000, 1200 UTC), H+48 (0000, 1200 UTC), H+72, beyond H+72, beyond 240
850 hPa	H+24 (0000, 1200 UTC), H+48 (0000, 1200 UTC), H+72, beyond H+72
700 hPa	H+24 (0000, 1200 UTC), H+48 (0000, 1200 UTC), H+72, beyond H+72
500 hPa	H+24 (0000, 1200 UTC), H+48 (0000, 1200 UTC), H+72, beyond H+72, beyond 240
300 hPa	H+24 (0000, 1200 UTC), H+48 (0000, 1200 UTC)
250/200 hPa	H+24 (0000, 1200 UTC), H+48 (0000, 1200 UTC), H+72, beyond H+72, beyond 240
100 hPa	H+24 (0000, 1200 UTC), H+48 (0000, 1200 UTC), H+72

Precipitation ~~or~~ ***and*** vertical motion (twice per day)
Tropical storm position and intensity
Sea-surface temperature anomaly
Transport model products for EER (as required)
Extended-range forecasts
Five, 10, 15 or 30-day mean surface ~~(twice per month)~~
Five, 10, 15 or 30-day mean 850 hPa ~~(twice per month)~~ } ***Parameters as appropriate and applicable***
Five, 10, 15 or 30-day mean 500 hPa ~~(twice per month)~~
Long-range forecasts (monthly, three-month or 90-day, seasonal to multi-seasonal outlook)
Area coverage: northern hemisphere and southern hemisphere, middle latitude and subtropical areas, and products for the tropical areas
Parameters: P/H, T, W and R, as appropriate and applicable

ATTACHMENT ~~II.9~~ *II.2*

LIST OF ~~RSMC~~ *REGIONAL MODEL* OUTPUT PRODUCTS WHOSE PREPARATION SHOULD BE GIVEN HIGHEST PRIORITY *BY RSMCS*

1. **ANALYSES**

Surface	0000, 0600, 1200, 1800 UTC	Parameters: Pressure (P)/geopotential height (H), temperature (T), wind (W) and humidity (R), as appropriate and applicable
925 hPa	0000, 1200 UTC	
850 hPa	0000, 1200 UTC	
700 hPa	0000, 1200 UTC	
500 hPa	0000, 1200 UTC	
400 hPa	0000, 1200 UTC	
300 hPa or 250 hPa	0000, 1200 UTC	
200 hPa	0000, 1200 UTC	
150 hPa	0000, 1200 UTC	
100 hPa	0000, 1200 UTC	
50 hPa or 70 hPa	0000, 1200 UTC*	

Tropopause and maximum wind or tropopause and vertical wind shear 0000, 1200 UTC
Sea-surface temperature as appropriate, but not more than once daily
Nephanalyses
Sea-ice distribution as appropriate, but not more than once daily

2. **FORECASTS**

~~NOTE: The list given below includes products which may also be required by Area Forecast Center in accordance with ICAO regulations.~~

Surface	0000, 0600, 1200, 1800 UTC,	H+24 (once daily),	H+48 or	H+36 (once daily)
850 hPa	H+18 (0000, 1200 UTC)*,	H+24 (0000, 1200 UTC),	H+48 or	H+36 (0000, 1200 UTC)
700 hPa	H+18 (0000, 1200 UTC)*,	H+24 (0000, 1200 UTC)		
500 hPa	H+18 (0000, 1200 UTC)*,	H+24 (0000, 1200 UTC),	H+48 or	H+36 (0000, 1200 UTC)
400 hPa	H+18 (0000, 1200 UTC)*,	H+24 (0000, 1200 UTC),		H+36 (0000, 1200 UTC)
300 hPa or 250 hPa or 200 hPa	H+18 (0000, 1200 UTC)*,	H+24 (0000, 1200 UTC),	H+48 or	H+36 (0000, 1200 UTC)
150 hPa	H+18 (0000, 1200 UTC)*,	H+24 (0000, 1200 UTC),	H+48 or	H+36 (0000, 1200 UTC)
100 hPa**	H+24 (0000, 1200 UTC)**,	H+24 (0000, 1200 UTC),	H+48 or	H+36 (0000, 1200 UTC)

Parameters: P/H, T, W and R as appropriate and applicable
Precipitation ~~(quantitative) (twice per day)~~ ***location, occurence, amount and type***
Tropopause and maximum wind or tropopause and vertical wind shear: H+18 (0000, 1200 UTC)
H+24 (0000,1200 UTC)
Significant weather: four times per day*
State of sea: a least once daily
Vertical motion or vorticity: H+24 (0000, 1200 UTC), H+48 or H+36 (0000, 1200 UTC)
Tropical storm position and intensity
Tropical depression and coastal wave position and movement
Transport model products for EER (as required)
Four- to-10-day outlook for surface T, W, R and precipitation.
Forecasts of probability of precipitation and temperature extremes for middle latitude and subtropical areas or forecasts of cloudiness, temperature range and precipitation probability for tropical areas.

* In accordance with any requirements expressed by regional associations.

** To meet aviation demands in accordance with the requirements expressed by regional associations.

ATTACHMENT ~~II.10~~ II.3

TRANSMISSION PRIORITIES FOR ~~WMC~~ *GLOBAL MODEL* PRODUCTS *FROM WMCS AND RSMCS*

1. **FORECASTS BASED ON 0000 AND 1200 UTC DATA**

24 h	500 hPa
24 h	Surface
48 h	500 hPa
48 h	Surface
72 h	500 hPa
72 h	Surface
300 hPa or 250 hPa or 200 hPa	24 h, 48 h and 72 h

Medium-range products (beyond H+72):
Surface
850 hPa
500 hPa
250/200 hPa

Larger-range products (beyond H+240)
Surface, 850 hPa, 500 hPa, 250/200 hPa — Parameters, as appropriate

2. **ANALYSES**

Surface	0000 and 1200 UTC
500 hPa	0000 and 1200 UTC
300 hPa or 250 hPa or 200 hPa	0000 and 1200 UTC
100 hPa	0000 and 1200 UTC*
50 hPa	0000 UTC*

Nephanalyses, as available

3. **FORECASTS**

24 h, 100 hPa, based on 0000 and 1200 UTC data*
Parameters: P/H, T, W and R as appropriate and applicable
Precipitation and vertical motion
Tropical storm position and intensity
Sea-surface temperature anomaly
Transport model products for EER (as required)
Extended-range forecasts five-, 10-, 15- or 30-day mean values (level surface, 500 hPa and parameters as applicable)
Long-range forecasts (monthly, three-month or 90-day, seasonal to multi-seasonal outlook)

* In accordance with any requirements expressed by regional associations.

ATTACHMENT ~~II.11~~ II.4

TRANSMISSION PRIORITIES FOR ~~RSMC~~ *REGIONAL MODEL* PRODUCTS *FROM RSMCS*

Surface	Analyses: 0000 and 1200 UTC Forecasts: 24 h, based on 0000 and 1200 UTC data
850 hPa, 700 hPa, 500 hPa	Analyses: 0000 and 1200 UTC Forecasts: 24 h, based on 0000 and 1200 UTC data
Either 300, 250 or 200 hPa*	Analyses: 00 and 1200 UTC Forecasts: 24 h, based on 0000 and 1200 UTC data
100 hPa** and 50 hPa**	Analyses: 0000 and 1200 UTC Forecasts: 24 h, based on 0000 and 1200 UTC data
Products beyond H+36 up to and including H+72	Surface 850 hPa 700 hPa 500 hPa 250/200 hPa 100 hPa
Medium-range products (beyond H+72)	Surface 850 hPa 500 hPa 250/200 hPa
Significant weather	Forecasts: 0000/0600/1200/1800 UTC Requirements established regionally
Nephanalyses	One per day as available
State of sea	Forecasts: 24 h, based on 0000 and 1200 UTC data

* The use of 300 hPa, 250 hPa or 200 hPa to be decided by regional associations.
** In accordance with any requirements expressed by regional associations.

Tropopause/maximum wind or Tropopause/vertical wind-shear analysis	0000 and 1200 UTC
Precipitation ***location, occurrence, amount and type*** ~~forecasts (quantitative)~~	As available
Parameters: PH, T, W and R as appropriate and applicable	
Tropical storm position and intensity	
Tropical depression and easterly wave position and movement	
Transport model products for EER (as required)	
Four- to-five-day or four- to-10-day outlook for surface T, W, R and precipitation	
Forecasts of probability of precipitation and temperature extremes for middle latitude and subtropical areas or forecasts of cloudiness, temperature range and precipitation probability for tropical areas	

ATTACHMENT ~~II.12~~ II.5

TRANSMISSION PRIORITIES AFTER OUTAGES

1. OBSERVATIONAL DATA	
Storm alerts TEMP, TEMP SHIP (Part A) Soundings derived from satellite data	Not more than 12 hours after the time of observation
SYNOP and SHIP	Not more than six hours for the 0600 and 1800 UTC observations or 12 hours for the 0000 and 1200 UTC observations
2. ~~WMC~~ ***GLOBAL MODEL*** PRODUCTS ***FROM WMCs and RSMCs***	
48 h surface, 850, 700 and 500 hPa forecasts, 0000 or 1200 UTC 72 h surface, 850, 700 and 500 hPa forecasts, 0000 or 1200 UTC	Until new products are available
3. ~~RSMC~~ ***REGIONAL MODEL*** PRODUCTS ***FROM RSMCs***	
24 h surface forecasts, 0000 or 1200 UTC 24 h 850, 700 and 500 hPa forecasts, 0000 or 1200 UTC 24 h forecasts of the 300 or 250 or 200 hPa level 24 h 100 hPa forecasts, 0000 or 1200 UTC* 24 h 50 hPa forecasts, 0000 or 1200 UTC* Parameters: P/H, T, W and R as appropriate and applicable	Until new products are available

* In accordance with any requirements expressed by regional associations.

ANNEX 2 TO RECOMMENDATION 4 (CBS-XI)

APPENDIX I.5 TO THE *MANUAL ON THE GLOBAL DATA-PROCESSING SYSTEM*

ARRANGEMENTS FOR THE PROVISION OF METEOROLOGICAL ASSISTANCE TO UNITED NATIONS HUMANITARIAN MISSIONS

The United Nations Department of Humanitarian Affairs (UN/DHA) shall normally request a service from a National Meteorological Centre (NMC) of the national Meteorological Service of the country concerned. If the NMC is not operational, this fact shall be confirmed to the associated RSMC with geographical specialization when requesting a service. UN/DHA shall also specify details of the area or location for which the service is required and the location of recipient of information if different from the UN/DHA Headquarters operations centre. The RSMCs zones of responsibility are as specified in the annex to this appendix.

The NMC shall:

Upon receipt of a request from UN/DHA, provide to it or its designated recipient location, basic meteorological and climate information and forecasts. This information will consist of 72-hour public weather forecasts, severe weather advisories and warnings, longer-range outlooks, and may include climate information for specified areas or locations in support of humanitarian missions.

The WMO Secretariat shall:

(*a*) Upon request, from UN/DHA, provide guidance in the interpretation of specialized meteorological

information and products made available by NMCs or RSMCs with specific activity specialization;

(*b*) Establish and maintain up-to-date NMCs operational contact points for assistance to United Nations humanitarian missions and make these available to UN/DHA and RSMCs.

The RSMC with geographical specialization for the relevant zone of responsibility shall:

(*a*) Upon receipt of a first request from UN/DHA, inform the WMO Secretariat and request the NMC of the national Meteorological Service, if it is still operational, to respond to the request directly or through the RSMC and provide the services stated in (*b*) below;

(*b*) Upon receipt of a request from UN/DHA with confirmation that the relevant NMC of the national Meteorological Service of a Member facing an emergency or in catastrophic distress and out of Service, provide to UN/DHA or its designated recipient location, basic meteorological and climate information and forecasts. This information will consist of 72-hour public weather forecasts, severe weather advisories, and longer-range outlook and may include climate information for specified areas or locations in support of humanitarian missions;

(*c*) Determine in consultation with UN/DHA, the relevant set of climate information, basic forecasts, their format and methods of delivery, depending on the nature of the situation;

(*d*) Make arrangements to provide backup services.

ANNEX TO APPENDIX I.5

ZONES OF RESPONSIBILITY OF RSMCs FOR PROVIDING BACKUP SERVICES TO UNITED NATIONS HUMANITARIAN MISSIONS

RSMC	ZONES OF RESPONSIBILITY
Region I	
Algiers	Algeria, Libyan Arab Jamahiriya, Morocco, Tunisia
Cairo	Egypt, Libyan Arab Jamahiriya, Sudan
Dakar	Benin, Burkina Faso, Cape Verde, Cameroon, Chad, Central African Republic, Congo, Côte d'Ivoire, Equatorial Guinea, Gabon, Gambia, Ghana, Guinea, Guinea-Bissau, Liberia, Mali, Mauritania, Morocco, Niger, Nigeria, Sao Tome and Principe, Senegal, Sierra Leone, Togo, Ascension Islands, Spain (Canary Islands), St Helena, Portugal (Madeira), Western Sahara, Zaire
Nairobi	Burundi, Djibouti, Ethiopia, Kenya, Rwanda, Somalia, Uganda, United Republic of Tanzania
Pretoria	Angola, Comoros, Botswana, Kerguelen and New Amsterdam, Lesotho, Madagascar, Malawi, Mauritius, Mozambique, Namibia, France (Department of La Réunion), Seychelles, South Africa, Swaziland, Zimbabwe, Zambia
Region II	
Beijing	China, Democratic People's Republic of Korea*, Hong Kong, Macao, Viet Nam*,
Jeddah	Bahrain, Kuwait, Oman, Qatar, Republic of Yemen, Saudi Arabia
Khabarovsk	Democratic People's Republic of Korea*, Russian Federation (in RA II)
New Delhi	Bangladesh, Bhutan, India, Maldives, Myanmar*, Nepal, Pakistan, Sri Lanka
Novosibirsk	Mongolia, Russian Federation
Tashkent	Afghanistan (Islamic State of), Iran (Islamic Republic of), Iraq, Kazakstan, Kyrgyz Republic, Tajikistan, Turkmenistan, Uzbekistan
Tokyo	Cambodia, Japan, Lao People's Democratic Republic, Myanmar*, Thailand, Viet Nam*, Republic of Korea
Region III	
Brasilia	Brazil, Colombia, Ecuador, France (Department of French Guyana), Guyana, Suriname, Venezuela
Buenos Aires	Argentina, Bolivia, Chile, Paraguay, Peru, Uruguay
Region IV	
Washington	Bahamas, Barbados, Belize, British Caribbean Territories, Canada, Colombia, Costa Rica, Cuba, Dominica, Dominican Republic, El Salvador, France (Martinique, Guadeloupe, Saint-Pierre-and-Miquelon), Guatemala, Haiti, Honduras, Jamaica, Mexico, Netherlands Antilles, Nicaragua, Panama, Saint-Lucia, Trinidad and Tobago, United States, Venezuela

* Choice of RSMC subject to confirmation by the Member.

Region V	
Melbourne	Australia
Darwin	Brunei Darussalam, Indonesia, Malaysia, Papua New Guinea, Philippines, Singapore, Solomon Islands
Wellington	Cook Islands, Fiji, French Polynesia, Kiribati, New Caledonia, New Zealand, Niue, Pitcaim, Tokelau, Tonga, Tuvalu, Vanuatu, Wallis and Futuna, Western Samoa
Region VI	
Bracknell	Gibraltar, Denmark (Greenland), Iceland, Ireland, Netherlands, United Kingdom
Moscow	Albania, Armenia, Azerbaijan, Belarus, Bulgaria, Cyprus, Former Yugoslav Republic of Macedonia, Georgia, Jordan, Poland, Romania, Syrian Arab Republic, Bosnia and Herzegovina, Republic of Moldova, Russian Federation (in RA VI), Ukraine, Yugoslavia
Offenbach	Austria, Belgium, Czech Republic, Croatia, Denmark, Estonia, Germany, Hungary, Israel, Finland, France, Latvia, Lithuania, Luxembourg, Norway, Portugal, Slovakia, Slovenia, Spain, Sweden, Switzerland
Rome	Greece, Italy, Lebanon, Malta, Turkey

RECOMMENDATION 5 (CBS-XI)

DESIGNATION OF A REGIONAL SPECIALIZED METEOROLOGICAL CENTRE (RSMC) WITH GEOGRAPHICAL SPECIALIZATION IN CENTRAL AND SOUTHERN AFRICA

THE COMMISSION FOR BASIC SYSTEMS,

NOTING:

(1) Resolution 6 (XI-RA I) — Assignment of responsibilities of RSMCs with geographical specialization in central and southern Africa,

(2) *Manual on the Global Data-processing System*, Part I, paragraph 4.1.2.1 — RSMCs,

(3) Attachment I.2 to the *Manual on the Global Data-processing System* — Procedures for broadening the functions of existing RSMCs and for designation of new RSMCs,

(4) Attachment I.3 to the *Manual on the Global Data-processing System* — Guidelines to review the status of RSMCs with geographical specialization,

CONSIDERING that the GDPS Centre in Pretoria has implemented communications, computing facilities as well as related operational product generation functions in response to requirements stated by the associated NMCs and meets the criteria stated in **NOTING** (2), (3) and (4),

RECOMMENDS that the GDPS Centre in Pretoria be designated as an RSMC with geographical specialization in central and southern Africa, with effect from 1 July 1997;

REQUESTS:

(1) The Member operating the designated RSMC to continue to make available its specialized products, as required, to Members concerned on a Regional basis, as specified in relevant parts of the *Manual on the Global Data-processing System*;

(2) The Secretary-General to arrange for the inclusion of the newly designated RSMC and the outline of its functions in the *Manual on the Global Data-processing System* as soon as the Executive Council has approved this recommendation.

RECOMMENDATION 6 (CBS-XI)

DESIGNATION OF REGIONAL SPECIALIZED METEOROLOGICAL CENTRES (RSMCs) ON THE PROVISION OF TRANSPORT MODEL PRODUCTS FOR ENVIRONMENTAL EMERGENCY RESPONSE

THE COMMISSION FOR BASIC SYSTEMS,

NOTING:

(1) The views expressed by the forty-second session of the Executive Council that a minimum of two RSMCs for the provision of transport model products be established in each Region,

(2) The requirements stated by Regional Association II for the provision, upon request, of specialized transport/dispersion/deposition model products to Members in the Region,

(3) The request of the IAEA to receive transport model products in case of a nuclear accident or emergency,

(4) Attachment I.2 to the *Manual on the Global Data-processing System* — Procedures for broadening the functions of existing RSMCs and for designation of new RSMCs,

CONSIDERING that the GDPS centres in Beijing and Tokyo and the Regional Operational Centre (ROC), Obninsk, can generate and make available transport/dispersion/deposition model products operationally upon request, and have fulfilled the relevant provisions of the designation procedures for new RSMCs and/or broadening the function(s) of an existing RSMC with geographic specialization to include activity specialization,

RECOMMENDS that the GDPS centres in Beijing and Tokyo and the Regional Operational Centre (ROC), Obninsk, be designated as RSMCs with activity specialization on the provision of transport model products for environmental emergency response to Members of Regional Association II with effect from 1 July 1997;

REQUESTS:

(1) The Members operating the designated RSMCs to continue to make available their specialized products, as required, to Members concerned, as specified in Appendices I.3 and II.7 to the *Manual on the Global Data-processing System*;

(2) The Members operating the designated RSMCs to take active part in the 1997 and future international WMO EER exercices;

(3) The Secretary-General to arrange for the inclusion of the newly designated RSMCs and the outline of their specialized functions in the *Manual on the Global Data-processing System* as soon as the Executive Council has approved this recommendation.

RECOMMENDATION 7 (CBS-XI)

AMENDMENTS TO THE *MANUAL ON CODES*, VOLUME I.1, ALPHANUMERIC CODES AND VOLUME I.2, BINARY CODES AND COMMON CODE TABLES

THE COMMISSION FOR BASIC SYSTEMS,

NOTING:

(1) Resolution 6 (CBS-X) — Working Group on Data Management,

(2) The report of the Second Session of the Subgroup on Data Representation (23–26 April 1996),

(3) The report of the Expert Meeting on Data Management (29 April–2 May 1996),

(4) The *Abridged Final Report of the Tenth Session of the Commission for Basic Systems* (WMO-No. 784), general summary, paragraph 6.4.38,

CONSIDERING the requirements:

(1) To represent significant synoptic features in BUFR code,

(2) To improve identification of satellites and satellite data producers,

(3) To make necessary small adjustments to alphanumeric codes,

RECOMMENDS that the amendments:

(1) To FM 94-X Ext. BUFR given in Annex 1 to this recommendation;

(2) To the alphanumeric codes: FM 12-X Ext. SYNOP, 13-X SHIP, 14-X Ext. SYNOP MOBIL, FM 18-X BUOY, FM 42-IX Ext. AMDAR, FM 71-X CLIMAT, FM 86-VIII Ext. SATEM, FM 87-VIII Ext. SARAD and FM 88-X SATOB given in Annex 2 to this recommendation;

(3) To Common Code Tables given in Annex 3 to this recommendation;

be adopted for use as from 5 November 1997;

REQUESTS the Secretary-General to arrange for the inclusion of these amendments in Volume I.1 and Volume I.2 of the *Manual on Codes*.

ANNEX 1 TO RECOMMENDATION 7 (CBS-XI)

CHANGES TO MANUAL ON CODES, VOLUME I.2, PART B, BINARY CODES

ADDITIONS TO FM 94-X Ext. BUFR FOR REPRESENTATION OF SIGNIFICANT SYNOPTIC FEATURES:

Add in Table B the following entries:

Table reference	Element name	Unit	Scale	Reference value	Data width (bits)
0 08 007	Dimensional significance	Code table	0	0	4

Code table: 0 08 007 (4 bits)

Code figure	Dimensional significance
0	Point
1	Line
2	Area

3	Volume
4–14	Reserved
15	Missing

Table reference = 0 20 090, element name = 'Special clouds',
unit = code table, scale = 0, reference value = 0, data width (bits) = 4

Code table: 0 20 090 (4 bits)

Code figure	Special clouds (taken from WMO code table 0521)
0	Reserved
1	Nacreous clouds
2	Noctilucent clouds
3	Clouds from waterfalls
4	Clouds from fires
5	Clouds from volcanic eruptions
6–14	Reserved
15	Missing

Rename entry and code table 0 08 011 'Meteorological feature'.
Add to code table 0 08 011

10	Jet stream
11	Cloud clear
12	Cloud
13	Turbulence
14	Storm
15	Airframe icing
16	Phenomenon
17	Volcano
18–19	Reserved
20	Special clouds
21–62	Reserved

Add to Class 01 — Identification:
0 01 022 Element name: "Name of feature". Units: CCITTIA5, Scale: 0, Reference value: 0, data width (bits): 224.
Add a note to Class 01 table: The character string representing the "Name of feature" should be of the form: "Type of phenomenon" — "Location or geographical name" (e.g.: "volcano — Popocatepl", "oil fire — Kuwait")

Add to code table 0 19 001 — Type of synoptic feature:

Code figure	
5–9	Reserved
10	Dust/sandstorm
11–62	Reserved

Amend in code table 0 08 021 — Time significance:

16	Analysis
17	Start of phenomenon

Rename entry and code table 0 08 005 'Meteorological attribute significance'.

Add in the proposed new BUFR code table 0 08 007 which enables points, lines, areas or volumes to be described, the following note:

NOTE: A consecutive sequence of two or more of location coordinates, such as latitude and longitude pairs, defines a line or polygon. Points shall be joined in the order given in the message. Any area described will fall left of the drawn boundary in the direction established by the order of the points given in the message. This definition is for simple non-intersecting polygons without holes.

Change in regulation 94.5.3.4 the last sentence to read:
This enables the definition of layers and simple time periods.
Insert a new regulation after 94.5.3.4 and renumber the following regulations, as appropriate:
The definition of line, areas, volumes and more complex time attributes shall be accomplished using descriptors from class 04 to 07 in association with suitable descriptors from class 08.

Add the following set of 10 common sequences in Table D Category 16 — Synoptic feature sequences:
3 16 002 to 3 16 011 as defined below.

A1 Header

Description	Descriptor	Unit	Comment
Data time (analysis)	0 08 021(1)	Code tb	Data time = 16
Year	0 04 001	Year	yyyy
Month	0 04 002	Month	mm
Day	0 04 003	Day	dd
Hour	0 04 004	Hour	hh
Minute	0 04 005	Minute	mm
Orig/generating centre	0 01 033	Code tb	UK Met O = EGRR = 74
Validity time (forecast)	0 08 021	Code tb	Validity time = 4
Year	0 04 001	Year	yyyy
Month	0 04 002	Month	mm
Day	0 04 003	Day	dd
Hour	0 04 004	Hour	hh
Minute	0 04 005	Minute	mm
Flight level (altitude)	0 07 002	m	Base of chart layer
Flight level (altitude)	0 07 002	m	Top of chart layer

NOTE: (1) Proposed new value in table 0 08 021.

A2 Jet stream

Description	Descriptor	Unit	Comment
Delayed replication	1 10 000	None	Delayed repl (10 desc)
Replication	0 31 001	Numeric	No. of jets to follow
Meteorological feature	0 08 011(1)	Code tb	Jet stream value = 10
Dimensional significance	0 08 007(2)	Code tb	Value for line = 1
Delayed replication	1 04 000	None	Delayed repl (4 desc)
Replication	0 31 001	Numeric	No. of points to follow
Latitude (coarse)	0 05 002	Deg	
Longitude (coarse)	0 06 002	Deg	
Flight level (altitude)	0 10 002	m	
Wind speed	0 11 002	m s^{-1}	
Dimensional significance	0 08 007	Code tb	Cancel
Meteorological feature	0 08 011	Code tb	Cancel

NOTES: (1) Proposed new value for jet stream in table 008011.
(2) Proposed new table for dimensional significance.

A3 Turbulence

Description	Descriptor	Unit	Comment
Delayed replication	1 11 000	None	Delayed repl (11 desc)
Replication	0 31 001	Numeric	No. of turb areas
Meteorological feature	0 08 011(1)	Code tb	Value for turbulence = 13
Dimensional significance	0 08 007(2)	Code tb	Value for area = 2
Flight level (altitude)	0 07 002	m	Base of layer
Flight level (altitude)	0 07 002	m	Top of layer
Delayed replication	1 02 000	None	Delayed repl (2 descs)
Replication	0 31 001	Numeric	No. of points to follow
Latitude (coarse)	0 05 002	Deg	
Longitude (coarse)	0 06 002	Deg	
Degree of turbulence	0 11 031(3)	Code tb	Severity of turbulence
Dimensional significance	0 08 007	Code tb	Cancel
Meteorological feature	0 08 011	Code tb	Cancel (end of object)

NOTES: (1) Proposed new value for turbulence in code table.
(2) Proposed new table for dimensional significance.
(3) In clear air or cloud. For MOD OCNL SEV code as 12 (Extreme).

A4 Storm

Description	Descriptor	Unit	Comment
Delayed replication	1 08 000	None	Delayed repl (8 desc)
Replication	0 31 001	Numeric	No. of storms to follow
Met attribute significance	0 08 005	Code tb	Storm centre = 1
Dimensional significance	0 08 007(1)	Code tb	Value for point = 0
Latitude (coarse)	0 05 002	Deg	
Longitude (coarse)	0 06 002	Deg	
WMO storm name	0 01 026(2)	CCITTIA5	Storm name
Synoptic features	0 19 001(3)	Code tb	Value for type of storm
Dimensional significance	0 08 007	Code tb	Cancel
Met attribute significance	0 08 005	Code tb	Cancel (end of object)

NOTES: (1) 0 08 007 added in version 3 to provide consistency in description across features.
(2) Use 'UNKNOWN' for a sandstorm.
(3) Proposed new value in table 0 19 001 for sandstorm = 10.

A5 Cloud

Description	Descriptor	Unit	Comment
Delayed replication	1 12 000	None	Delayed repl (12 desc)
Replication	0 31 001	Numeric	No. of areas to follow
Meteorological feature	0 08 011(1)	Code tb	Value for cloud = 12
Dimensional significance	0 08 007(2)	Code tb	Value for area = 2
Flight level (altitude)	0 07 002	m	Base of layer
Flight level (altitude)	0 07 002	m	Top of layer
Delayed replication	1 02 000	None	Delayed repl (2 descs)
Replication	0 31 001	Numeric	No. of points to follow
Latitude (coarse)	0 05 002	Deg	
Longitude (coarse)	0 06 002	Deg	
Cloud amount	0 20 011(3)	Code tb	Code table value
Cloud type	0 20 012	Code tb	Code table value
Dimensional significance	0 08 007	Code tb	Cancel
Meteorological feature	0 08 011	Code tb	Cancel (end of object)

NOTES: (1) Proposed new value for cloud in code table.
(2) Proposed new table for dimensional significance.
(3) Code table values: FRQ = code figure 8 (8 oktas).
: OCNL EMBD = code figure 6 (6 oktas).
: ISOL = code figure 2 (2 oktas) when the cloud = Cb.

A6 Front

Description	Descriptor	Unit	Comment
Delayed replication	1 10 000	None	Delayed repl (10 desc)
Replication	0 31 001	Numeric	No. of fronts to follow
Meteorological feature	0 08 011	Code tb	Code for type of front
Dimensional significance	0 08 007(1)	Code tb	Code value for line = 1
Delayed replication	1 04 000	None	Delayed repl (4 descs)
Replication	0 31 001	Numeric	No. of points to follow
Latitude (coarse)	0 05 002	Deg	
Longitude (coarse)	0 06 002	Deg	
Direction of feature	0 19 005	Deg true	See note
Dpeed of feature	0 19 006	m s^{-1}	See note
Dimensional significance	0 08 007	Code tb	Cancel
Meteorological feature	0 08 011	Code tb	Cancel (end of object)

NOTE: (1) Proposed new table for dimensional significance.

Front direction (towards which the front is moving) must always be given as it is needed for plotting purposes. A front direction with a front speed of zero would indicate a slow front. A value in the code table exists to represent a quasi-stationary front.

A7 Tropopause

Description	Descriptor	Unit	Comment
Delayed replication	1 11 000	None	Delayed repl (11 desc)
Replication	0 31 001	Numeric	No. of trop groups to come
Vertical significance	0 08 001	Flag tb	Bit 3 set for trop.
Dimensional significance	0 08 007(1)	Code tb	Value for point = 0
Statistic	0 08 023(2)	Code tb	Type of tropopause value
Delayed replication	1 03 000	None	Delayed repl (3 descs)
Replication	0 31 001	Numeric	No. of points to follow
Latitude (coarse)	0 05 002	Deg	
Longitude (coarse)	0 06 002	Deg	
Height/altitude	0 10 002	m	
Statistic	0 08 023	Code tb	Cancel
Dimensional significance	0 08 007	Code tb	Cancel
Vertical significance	0 08 001	Code tb	Cancel (end of object)

NOTES: (1) Dimensional significance is added in version 3.
(2) The statistic is to determine whether the following tropopause levels are minimum, maximum or spot values (missing code value).

A8 Airframe icing area

Description	Descriptor	Unit	Comment
Delayed replication	1 11 000	None	Delayed repl (11 desc)
Replication	0 31 001	Numeric	No. of icing areas.
Meteorological feature	0 08 011(1)	Code tb	Airframe icing = 15
Dimensional significance	0 08 007(2)	Code tb	Value for area = 2
Flight level (altitude)	0 07 002	m	Base of layer
Flight level (altitude)	0 07 002	m	Top of layer
Delayed replication	1 02 000	None	Delayed repl (2 descs)
Replication	0 31 001	Numeric	No. of points to follow
Latitude (coarse)	0 05 002	Deg	
Longitude (coarse)	0 06 002	Deg	
Airframe icing	0 20 041	Code tb	Type of airframe icing
Dimensional significance	0 08 007	Code tb	Cancel
Meteorological feature	0 08 011	Code tb	Cancel (end of object)

NOTES: (1) Proposed new value for airframe icing in code table.
(2) Proposed new table for dimensional significance.

A9 Name of feature

Description	Descriptor	Unit	Comment
Delayed replication	1 07 000	None	Delayed repl (7 desc)
Replication	0 31 001	Numeric	No. of volcanoes to follow
Meteorological feature	0 08 011(1)	Code tb	Volcano = 17
Dimensional significance	0 08 007(2)	Code tb	Value for point = 0
Name of feature	0 01 022(3)	CCITTIA5	Volcano name
Latitude (coarse)	0 05 002	Deg	
Longitude (coarse)	0 06 002	Deg	
Dimensional significance	0 08 007	Code tb	Cancel
Meteorological feature	0 08 011	Code tb	Cancel (end of object)

NOTES: (1) Proposed new value in table 0 08 011 for special clouds = 20.
(2) Proposed new table for dimensional significance.
(3) Proposed new element in class 01, 0 01 022 (volcano name).

A10 Volcano erupting

Description	Descriptor	Unit	Comment
Delayed replication	1 16 000	None	Delayed repl (16 desc)
Replication	0 31 001	Numeric	No. of eruptions to follow
Meteorological feature	0 08 011(1)	Code tb	Special clouds = 20
Name of feature	0 01 022	CCITTIA5	Volcano name
Dimensional significance	0 08 007(2)	Code tb	Value for point = 0
Delayed replication	1 02 000	None	Delayed repl (2 desc)
Replication	0 31 001	Numeric	No. of points to follow
Latitude (coarse)	0 05 002	Deg	
Longitude (coarse)	0 06 002	Deg	
Time significance	0 08 021(3)	Code tb	Eruption start time = 17
Year	0 04 001	Year	yyyy
Month	0 04 002	Month	mm
Day	0 04 003	Day	dd
Hour	0 04 004	Hour	hh
Minute	0 04 005	Minute	mm
Special clouds	0 20 090(4)	Code tb	Clouds from volcanic eruptions = 5.
Time significance	0 08 021	Code tb	Cancel
Dimensional significance	0 08 007	Code tb	Cancel
Meteorological feature	0 08 011	Code tb	Cancel (end of object)

NOTES: (1) Proposed new value in table 0 08 011 for special clouds = 20.
(2) Proposed new table for dimensional significance
(3) Proposed new value in table for "start of phenomenon" e.g. eruption.
(4) Proposed new code table for special phenomena clouds.

ANNEX 2 TO RECOMMENDATION 7 (CBS-XI)

CHANGES TO THE *MANUAL ON CODES*, VOLUME I.1, PART A, ALPHANUMERIC CODES

Add in FM 12-X Ext. SYNOP, 13-X SHIP and 14-X Ext. SYNOP MOBIL, a new regulation:

12.4.7.1.3 When more than one group $5j_1j_2j_3j_4$ is used, these groups shall be included in the order as listed in regulation 12.4.7.1.2 with the supplementary groups $j_5j_6j_7j_8j_9$ at the appropriate place.

Add in code table 4680 for w_aw_a — Present weather reported from an automatic weather station:

77	Snow grains
78	Ice crystals
79	Reserved
88	Reserved
89	Hail

Correct the inconsistencies in the following regulations (additions or corrections are in italics):

In 12.2.6.5.4:
"The code figure *04* and 05 shall..."

In 12.2.6.5.7:
"Code figures 20–*26* shall..."

In 12.2.6.5.8:
"For w_aw_a = *20*, visibility..."

In 12.2.6.5.10:
Suppress entirely the second sentence.

In 12.2.6.5.13:
"Code figures 80–89 shall be used only when the precipitation is *intermittent* or of the shower type..."

Add the following to the FM 18-X BUOY code form:

SECTION 5 (555 Groups to be developed nationally)

and **add** at end of NOTE (5):

5 555 Data for national use

Delete in the FM 42-IX Ext. AMDAR code, paragraph 42.2.1.2 the words after "unsteady".
Add a new regulation:

42.2.1.7 An observation during an unsteady phase of flight shall be indicated by encoding the phase of flight indicator as UNS.

Replace in the FM 71-X CLIMAT code, in regulation 71.3.3 the existing Note by the following three Notes:

(1) If the percentage of the normal is 1 per cent or less but greater than zero, $p_sp_sp_s$ shall be coded as 001.
(2) If the normal is zero hours, $p_sp_sp_s$ shall be coded as 999.
(3) If the normal is not defined, $p_sp_sp_s$ shall be coded as 3 solidi (///).

Change in Section 1, group $8m_Pm_Pm_Tm_Tm_Tm_{Tx}m_{Tx}$ by $8m_Pm_Pm_Tm_Tm_{Tx}m_{Tn}$ ($m_{Tx}m_{Tx}$ becoming $m_{Tx}m_{Tn}$).
Delete the definition of $m_{Tx}m_{Tx}$.
Add the following definitions:

m_{Tx} Number of days missing from the record for daily maximum temperature.
(1) If data are missing for nine days or more m_{Tx} shall be reported as 9.

m_{Tn} Number of days missing from the record for daily minimum temperature.
(1) If data are missing for nine days or more m_{Tn} shall be reported as 9.

Replace in each code form $I_1I_2I_2$ by $I_6I_6I_6$ (defining satellite name) and **add** one group containing $F_3F_3F_3$ (originating/generating centre) and $F_4F_4F_4$ (originating/generating subcentre) if necessary, if not coded /// in SECTION 1.
Amend in FM 86-VIII Ext. SATEM the following code form:

Part A
SECTION 1 $M_iM_iM_jM_j$ YYGG/ $I_6I_6I_6I_3I_4$ $F_3F_3F_3F_4F_4F_4$

Amend in FM 87-VIII Ext. SARAD the following code form:

SECTION 1 $M_iM_iM_jM_j$ YYGG/ $I_6I_6I_6I_3I_4$ $F_3F_3F_3F_4F_4F_4$

Amend in FM 88-X SATOB the following code form:

SECTION 1 $M_iM_iM_jM_j$ YYMMJ GGggwi $I_6I_6I_6I_3I_4$ $F_3F_3F_3F_4F_4F_4$

ANNEX 3 TO RECOMMENDATION 7 (CBS-XI)

CHANGES TO *MANUAL ON CODES*, VOLUME I.2, PART C, COMMON FEATURES

Add a COMMON CODE TABLE C-5: Satellite identifier
Common code table: ($I_6I_6I_6$ for alphanumeric codes
(Code table 0 01 007 in BUFR

Code figure for $I_6I_6I_6$	Code figure for BUFR (Code table 0 01 007)	
(EVEN DECILES INDICATE POLAR-ORBITING SATELLITES AND ODD DECILES INDICATE GEOSTATIONARY SATELLITES)		
000	000	Reserved
		001–099: Allocated to European Union
001	001	ERS 1
002	002	ERS 2
020	020	SPOT 1
021	021	SPOT 2
022	022	SPOT 3
023	023	SPOT 4
050	050	METEOSAT 3
051	051	METEOSAT 4
052	052	METEOSAT 5
053	053	METEOSAT 6
054	054	METEOSAT 7
		100–199: Allocated to Japan
150	150	GMS 3
151	151	GMS 4
152	152	GMS 5

COMMON CODE TABLE C-5: Satellite identifier (*continued*)

		200–299: Allocated to USA
200	200	NOAA 8
201	201	NOAA 9
202	202	NOAA 10
203	203	NOAA 11
204	204	NOAA 12
205	205	NOAA 14
206	206	NOAA 15
220	220	LANDSAT 4
221	221	LANDSAT 5
222	222	LANDSAT 7
240	240	DMSP 7
241	241	DMSP 8
242	242	DMSP 9
243	243	DMSP 10
244	244	DMSP 11
250	250	GOES 6
251	251	GOES 7
252	252	GOES 8
253	253	GOES 9
254	254	GOES 10
255	255	GOES 11
256	256	GOES 12
		300–399: Allocated to Russian Federation
310	310	GOMS 1
311	311	GOMS 2
		400–499: Allocated to India
430	430	INSAT 1B
431	431	INSAT 1C
432	432	INSAT 1D
450	450	INSAT 2A
451	451	INSAT 2B
452	452	INSAT 2E
470	470	INSAT 3A
		500–599: Allocated to China
		600–699: Allocated to European Union
		700–799: Allocated to USA
700	700	TIROS M (ITOS 1)
701	701	NOAA 1
702	702	NOAA 2
703	703	NOAA 3
704	704	NOAA 4
705	705	NOAA 5
706	706	NOAA 6
707	707	NOAA 7
708	708	TIROS-N
710	710	GOES (SMS 1)
711	711	GOES (SMS 2)
731	731	GOES 1
732	732	GOES 2
733	733	GOES 3
734	734	GOES 4
735	735	GOES 5

COMMON CODE TABLE C-5: Satellite identifier (*continued*)

800–998		800–998	Reserved
999	Missing	999–1022	Reserved
		1023	Missing value

Amend the COMMON CODE TABLE C-1: Identification of originating/generating centre

Common code table: (F_1F_2 for alphanumeric codes; $F_3F_3F_3$ for alphanumeric codes; (Code Table 0 in GRIB/Code Table 0 01 033 in BUFR

Code figure for: F_1F_2	Code figure for: $F_3F_3F_3$	Octet 5 in GRIB Sect. 1	Octet 6 in BUFR Sect. 1
00	000	0	WMO Secretariat
			01–09: WMCs
01	001	1	Melbourne
02	002	2	Melbourne
03	003	3	)
04	004	4	Moscow
05	005	5	Moscow
06	006	6	)
07	007	7	US National Weather Service, National Centres for Environmental Prediction (NCEP)
08	008	8	US National Weather Service Telecommunications Gateway (NWSTG)
09	009	9	Reserved for USA
			10–25: Centres in Region I
10	010	10	Cairo (RSMC/RAFC)
11	011	11	)
12	012	12	Dakar (RSMC/RAFC)
13	013	13	)
14	014	14	Nairobi (RSMC/RAFC)
15	015	15	)
16	016	16	Reserved
17	017	17	Reserved
18	018	18	Tunis-Casablanca (RSMC)
19	019	19	)
20	020	20	Las Palmas (RAFC)
21	021	21	Algiers (RSMC)
22	022	22	Reserved
23	023	23	Reserved
24	024	24	Pretoria (RSMC)
25	025	25	La Réunion (RSMC)
			26–40: Centres in Region II
26	026	26	Khabarovsk (RSMC)
27	027	27	)
28	028	28	New Delhi (RSMC/RAFC)
29	029	29	)
30	030	30	Novosibirsk (RSMC)
31	031	31	)
32	032	32	Tashkent (RSMC)
33	033	33	Jeddah (RSMC)
34	034	34	Tokyo (RSMC), Japan Meteorological Agency
35	035	35	)

COMMON CODE TABLE C-1: Identification of originating/generating centre (*continued*)

36	036	36	Bangkok
37	037	37	Ulan Bator
38	038	38	Beijing (RSMC)
39	039	39	)
40	040	40	Seoul
			41–50: Centres in Region III
41	041	41	Buenos Aires (RSMC/RAFC)
42	042	42	)
43	043	43	Brasilia (RSMC/RAFC)
44	044	44	)
45	045	45	Santiago
46	046	46	Brazilian Space Agency — INPE
47–50	047–050	47–50	Reserved for other centres in Region III
			51–63: Centres in Region IV
51	051	51	Miami (RSMC)
52	052	52	Miami RSMC, National Hurricane Center
53	053	53	Montreal (RSMC)
54	054	54	)
55	055	55	San Francisco
56	056	56	Reserved
57	057	57	U.S. Air Force — Air Force Global Weather Central
58	058	58	Fleet Numerical Meteorology and Oceanography Center, Monterey, CA
59	059	59	The NOAA Forecast Systems Laboratory, Boulder, CO, USA
60	060	60	United States National Centre for Atmospheric Research (NCAR)
61–63	061–063	61–63	Reserved for other centres in Region IV
			64–73: Centres in Region V
64	064	64	Honolulu
65	065	65	Darwin (RSMC)
66	066	66	)
67	067	67	Melbourne (RSMC)
68	068	68	Reserved
69	069	69	Wellington (RSMC/RAFC)
70	070	70	)
71	071	71	Nadi (RSMC)
72–73	072–073	72–73	Reserved for other centres in Region V
			74–99: Centres in Region VI
74	074	74	UK Meteorological Office — Bracknell (RSMC)
75	075	75	)
76	076	76	Moscow (RSMC/RAFC)
77	077	77	Reserved
78	078	78	Offenbach (RSMC)
79	079	79	)
80	080	80	Rome (RSMC)
81	081	81	)
82	082	82	Norrköping
83	083	83	)
84	084	84	Reserved
85	085	85	Toulouse (RSMC)
86	086	86	Helsinki
87	087	87	Belgrade
88	088	88	Oslo

COMMON CODE TABLE C-1: Identification of originating/generating centre (*continued*)

89	089	89	Prague
90	090	90	Episkopi
91	091	91	Ankara
92	092	92	Frankfurt/Main (RAFC)
93	093	93	London (WAFC)
94	094	94	Copenhagen
95	095	95	Rota
96	096	96	Athens
97	097	97	European Space Agency (ESA)
98	098	98	ECMWF, RSMC
99	099	99	De Bilt
n.a.	100 to 109	100 to 109	Reserved for centres in Region I which are not in the list above
n.a.	110	110	Hong Kong
n.a.	111 to 139	111 to 139	Reserved for centres in Region II which are not in the list above
n.a.	140 to 159	140 to 159	Reserved for centres in Region III which are not in the list above
n.a.	160	160	US NOAA/NESDIS
n.a.	161 to 199	161 to 199	Reserved for centres in Region IV which are not in the list above
n.a.	200 to 209	200 to 209	Reserved for centres in Region V which are not in the list above
n.a.	210	210	Frascati (ESA/ESRIN)
n.a.	211	211	Lanion
n.a.	212 to 253	212 to 253	Reserved for centres in Region VI which are not in the list above or below
n.a.	254	254	EUMETSAT Operation Centre
n.a.	255	255	Missing value
n.a.	250 to 999	n.a.	Not used

NOTES:
(1) The closed bracket sign) indicates that the corresponding code figure is reserved for the previously named centre.
(2) n.a. means not available.
(3) With GRIB or BUFR, if there is a need to define subcentres, the following procedure should be applied:
Use in GRIB of Octet 26 of section 1 or use in BUFR of Octet 5 of section 1 with the following meaning:
Code figure for Octet 26 of GRIB section 1 or for Octet 5 of BUFR section 1:
0 Subcentre as defined by Octet 5, section 1 of GRIB or Octet 6, section 1 of BUFR.
1 to 254 Subcentre identifier allocated by centre as defined by Octet 5, section 1 of GRIB or Octet 6, section 1 of BUFR.

BUFR descriptor changes:

Add to descriptor 0 01 004:
(see Note 9)
and to descriptor 0 01 031:
(see Note 10).

Add Note 9 to Table of Class 01:
(9) Descriptor 0 01 020 should be used instead of 0 01 004 for encoding this element.

Add two new descriptors:

	Element name	Unit	Scale	Reference value	Data width
0 01 033	Identification of originating/generating centre	Code table	0	0	8
0 01 034	Identification of originating/generating subcentre	Code table	0	0	8

Add Note 10 to Table of Class 01:
(10) Descriptor 0 01 033 shall be used instead of descriptor 0 01 31 for encoding originating/generating centre. Code table 0 01 034 is to be established by the originating/generating centre identified by descriptor 0 01 033 and provided to the Secretariat for publication.

Modify also accordingly the description of octets 5 and 26 in Section 1 of GRIB and the description of octets 5 and 6 in Section 1 of BUFR.

Add a common code table C-3: Instrument type for water temperature profile measurement with fall rate equation coefficients

Common code table: [Code table 1770 $I_XI_XI_X$ (Instrument type for XBT, with fall rate equation coefficients) — for alphanumeric codes

[Code table 0 22 067 (Instrument type for water temperature profile measurement) in BUFR

Code figure for $I_XI_XI_X$	Code figure for BUFR (Code table 0 22 067)	Meaning		
		Instrument make	Equation coefficients *a*	*b*
001	001	Sippican T-4	6.472	–2.16
002	002	Sippican T-4	6.691	–2.25
011	011	Sippican T-5	6.828	–1.82
021	021	Sippican Fast Deep	6.346	–1.82
031	031	Sippican T-6	6.472	–2.16
032	032	Sippican T-6	6.691	–2.25
041	041	Sippican T-7	6.472	–2.16
042	042	Sippican T-7	6.691	–2.25
051	051	Sippican Deep Blue	6.472	–2.16
052	052	Sippican Deep Blue	6.691	–2.25
061	061	Sippican T-10	6.301	–2.16
071	071	Sippican T-11	1.779	–0.255
201	201	TSK T-4	6.472	–2.16
202	202	TSK T-4	6.691	–2.25
211	211	TSK T-6	6.472	–2.16
212	212	TSK T-6	6.691	–2.25
221	221	TSK T-7	6.472	–2.16
222	222	TSK T-7	6.691	–2.25
231	231	TSK T-5	6.828	–1.82
241	241	TSK T-10	6.301	–2.16
401	401	Sparton XBT-1	6.301	–2.16
411	411	Sparton XBT-3	5.861	–0.0904
421	421	Sparton XBT-4	6.472	–2.16
431	431	Sparton XBT-5	6.828	–1.82
441	441	Sparton XBT-5DB	6.828	–1.82
451	451	Sparton XBT-6	6.472	–2.16
461	461	Sparton XBT-7	6.472	–2.16
471	471	Sparton XBT-7DB	6.472	–2.16
481	481	Sparton XBT-10	6.301	–2.16
491	491	Sparton XBT-20	6.472	–2.16
501	501	Sparton XBT-20DB	6.472	–2.16
700	700	Sippican XCTD standard		
710	710	Sippican XCTD deep		
720	720	Sippican AXCTD		
730	730	Sippican SXCTD		
800	800	Mechanical BT		
810	810	Hydrocast		
820	820	Thermistor Chain		
830	830	CTD		
831–999 Reserved	831–999	Reserved		
	1000–1022	Reserved		
	1023	Missing value		

NOTES: (1) The depth is calculated from coefficients *a* and *b* and the time *t* as follows:

$$z = at + 10^{-3}bt^2$$

(2) All unassigned numbers are reserved for future use.

(3) The values of *a* and *b* are supplied for information only.

Add a common code table C-4: Water temperature profile recorder types

Common Code Table: [Code table 4770 X_RX_R (Recorder type) — for alphanumeric codes
[Code table 0 22 068 (Water temperature profile recorder types) in BUFR

Code figure for X_RX_R	Code figure for BUFR (Code table 0 22 068)	Meaning
01	1	Sippican Strip Chart Recorder
02	2	Sippican MK2A/SSQ-61
03	3	Sippican MK-9
04	4	Sippican AN/BHQ-7/MK8
05	5	Sippican MK-12
10	10	Sparton SOC BT/SV Processor Model 100
20	20	ARGOS XBT-ST
21	21	CLS-ARGOS / Protecno XBT-ST Model-1
22	22	CLS-ARGOS / Protecno XBT-ST Model-2
30	30	BATHY Systems SA-810
31	31	Scripps Metrobyte Controller
32	32	Murayama Denki Z-60-16 III
33	33	Murayama Denki Z-60-16 II
34	34	Protecno ETSM2
35	35	Nautilus Marine Service NMS-XBT
40	40	TSK MK-2A
41	41	TSK MK-2S
42	42	TSK MK-30
43	43	TSK MK-30N
99	99	Unknown
	127	Missing value

NOTE: All unassigned numbers are reserved for future use.

RECOMMENDATION 8 (CBS-XI)

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 the action taken by the Executive Council on the previous recommendations of the Commission for Basic Systems or related to the WWW in general,

CONSIDERING that some of the previous Executive Council resolutions are still valid,

RECOMMENDS:

(1) That the following Executive Council resolutions be kept in force:
Resolutions 1 and 2 (EC-XXXVI) and 5 (EC-XLII);

(2) That the following Executive Council resolutions are no longer needed and should not be kept in force:
Resolutions 16 (EC-XLIII) and 4 (EC-XLVII).

ANNEXES

ANNEX I

Annex to paragraph 4.12 of the general summary

TERMS OF REFERENCE

Task Group on the Internet

Composition and reporting

1. The Task Group shall be comprised of technical experts nominated by the following Members:
   Australia (chairman)
   Argentina
   France
   Kenya
   New Zealand
   United Kingdom
   United States
   and shall report to the president of CBS.

Objective

2. The Task Group will report on the technical and operational aspects of the Internet, and their ramifications on the implementation of Resolution 40 (Cg-XII) — WMO policy and practice for the exchange of meteorological and related data and products including guidelines on relationships in commercial meteorological activities.

Scope and issues

3. The Task Group will consider the:
(*a*) New opportunities for the beneficial use of the Internet to enhance meteorological services;
(*b*) Relevant technical and operational attributes of the Internet;
(*c*) Impacts of the Internet on the public weather services of NMHSs;
(*d*) The possibility of unauthorized access to 'additional' data and products via the Internet;
(*e*) The reliability and system security issues raised by the use of the Internet;
(*f*) The dynamic evolutionary nature of the capability of the Internet;
(*g*) The use of the Internet in support of research, commercial, education and public interest activites.

Process and consultation

4. The Task Group will distribute, with the Secretariat support, a questionnaire to all CBS members, and use the results of that questionnaire with all other available, relevant information to address the issues listed above.
5. The Task Group will consult widely including distribution of the results of the analysis of the replies to questionnaires to all CBS members who participated in the survey.

Timeline

6. The Secretariat is requested to circulate the questionnaires prior to 20 December 1996 and the Task Group will submit a preliminary report by the end of March 1997.

ANNEX II

Annex to paragraph 6.2.8 of the general summary

RESPONSIBILITIES SHARED BETWEEN MAIN TELECOMMUNICATION NETWORK (MTN) CENTRES FOR PILOT MTN MONITORING (PMM)

Set of data	*Specialized MTN monitoring centres (SMMCs) monitoring set of messages*	*Specialized MTN monitoring centres (SMMCs) in charge of the analysis of the set of messages*
1. SYNOP reports (TT=SY)	- Algiers - Offenbach - Tokyo	- Tokyo
2. Parts A of TEMP (TT=TT) and PILOT reports (TT=PP)	- Nairobi - Sofia - Toulouse	- Sofia
3. CLIMAT (TT= CL) and CLIMAT TEMP (TT=CT) reports	- Cairo - New Delhi - Sofia - Toulouse	- Cairo
4. SHIP (TT=SH), TEMP SHIP (TT=TS), PILOT SHIP (TT=PS), BUOY (TT=BU) and BATHY/ TESAC/TRACKOB (TT= BT) reports	- Cairo - Offenbach - Toulouse	- Offenbach
5. AIREP (TT=AI) and AMDAR (TT=AM) reports	-Tokyo -Toulouse	- Toulouse

ANNEX III

Annex to paragraph 6.2.29 of the general summary

REPORT OF THE AD HOC EXPERT MEETING ON THE POSSIBLE USE OF THE SADIS SATELLITE-BASED TELECOMMUNICATION SYSTEM FOR THE TRANSMISSION OF WORLD WEATHER WATCH INFORMATION

Introduction

1. ICAO has an obligation to ensure that all ICAO Contracting States have access to all the WAFS data they may require through at least one component of the ICAO Aeronautical Fixed Service (AFS). It was decided that WAFS data would be made available through three INTELSAT communication satellites to achieve world-wide coverage. Two of these services originate from WAFC Washington, and the third (serving the European, African, Middle East and western Asian regions of ICAO) from WAFC London. This latter service is known as SADIS and is operated by the United Kingdom Meteorological Office (UKMO) under contract to the United Kingdom's Civil Aviation Authority. The United States' system is known as ISCS. WAFC London is a service operated by UKMO at its headquarters in Bracknell.

2. As a result of a competitive procurement exercise in 1994, Matra Marconi Space (MMS) was selected as the prime supplier of the system needed to implement SADIS. SADIS began service in test mode in 1995 and was recently declared operational by the first meeting of the SADIS Operations Group (Paris, June 1996), SADISOPSG/1. In its present form, SADIS fully meets the ICAO user requirement for broadcast of WAFS information and the number of receivers of the broadcast continues to grow; there are expected to be about 50 reception sites by the end of 1996. ICAO's user requirement for a small amount of data to be collected via SADIS was part of the original design and has been successfully demonstrated but is not implemented beyond the test configuration. Modification of the user requirement for data collection (and thus of the technical design) was discussed by SADISOPSG/1, but no decision to proceed with the change, with the consequential need for additional funding, has yet been made.

3. Twelfth Congress, in paragraph 3.4.36 of the *Abridged Final Report with Resolutions of the Twelfth World Meteorological Congress* (WMO-No. 827), noted:

> The offer by ICAO to WMO to use SADIS, subject to equitable cost allocation, for the collection and exchange of any meteorological observational data and products ... as ... a possible mechanism for an efficient and effective use of resources, particularly in those areas of the world where telecommunications had been traditionally difficult.

Congress requested the Executive Council to study the various issues (technical, legal, policy, financial and strategy) relevant to this offer, with a report from CBS on the technical aspects. To facilitate the study, the WMO Secretariat organized an ad hoc Expert Meeting in Geneva, 15–17 July 1996. This paper is the result of that meeting.

4. It is important to note that the term SADIS refers to the distribution of data as specified by, and funded through, ICAO. The physical transmission system is shared with UKMO, which directly funds a fraction of the central infrastructure (the hub) and a fraction of the bandwidth on the INTELSAT satellite (the space segment). To avoid confusion between the term SADIS and the (un-named) physical transmission system, the latter is referred to in the remainder of this paper as the "satellite-based system".

5. The capacity to meet the requirements specified by WMO for transmission of WWW data and products could be provided from either ICAO's or UKMO's share of the "satellite-based system". The Expert Meeting was informed that the United Kingdom is also willing to offer capacity to WMO for this purpose, as part of its contribution to the WWW Programme.

6. The conclusion of the Expert Meeting was that the "satellite-based system" could indeed complement the existing GTS and could be envisaged as an integrated component of the GTS, in Region II in particular. But this conclusion is subject to the caveat that the requirements of those NMSs who would benefit are not fully known. The Expert Meeting hoped that a fuller discussion of user requirements for data and products, grouped by Region, would be possible at CBS to clarify the requirements for transmission capacity.

7. The remainder of this paper contains the detailed conclusions of the Expert Meeting, and an appendix which describes the "satellite-based system" and discusses the technical issues which arise in relation to its possible use to meet WMO requirements.

Conclusions

8. The existing "satellite-based system" supports two applications, SADIS and a national requirement of the United Kingdom. The SADIS application has two components, broadcast (point to multi-point) and two-way (multi-point to point). The United Kingdom application has only a broadcast component. The Expert Meeting concluded that, technically, it is straightforward to add a third broadcast application, i.e. the point to multi-point dissemination of WWW data and products. Data and products contained within bulletins could be routed by the message switch at RTH Bracknell to the uplink site and could be delivered (via port 2 on the very small aperture terminal (VSAT)) to each user's computer, in the same way as the broadcast component of SADIS is delivered (via port 1 on the VSAT) (for the technical characteristics of the VSAT ports, channelling, protocol, data formats etc., please refer to the appendix).

9. Both ICAO and UKMO currently have a significant amount of spare capacity in their respective part of the "satellite-based system". ICAO has indicated to WMO a willingness to discuss a sharing arrangement. UKMO is also able to offer to share spare capacity, for broadcast only. ICAO is already considering additional requirements which, when implemented, will reduce the spare capacity within the SADIS share of the "satellite-based system". WMO, therefore, has the possibility to negotiate with either body as regards the provision of broadcast capacity for WWW purposes, but must ensure that capacity is offered on a sustainable basis in order to protect the investments of NMSs in VSATs and data-processing systems.

10. The original two-way component of SADIS has not been implemented beyond the demonstration of compliance with ICAO's User Requirement. ICAO is in the process of redefining the User Requirement and of considering advice on the consequential changes to the technical design and costs. ICAO has yet to commit to an updated User Requirement, to the technical and non-technical aspects of implementation and deployment of the modified scheme. The Expert Meeting recommends that WMO should not consider the original two-way scheme for WWW purposes. If WMO has an interest in sharing the SADIS two-way component, this should be explored after ICAO has agreed the modified scheme.

11. The costs of adding a broadcast of WWW data and products fall in a number of places. The following remarks make the important assumption that no Member of WMO would be committed to bear additional cost before the relevant WWW requirements were agreed:

(*a*) Production costs. Much of the material is expected to be produced in any event. Some products (e.g. charts in T4 code derived from a numerical forecast model) might require additional computer resources. Without a detailed list of user requirements, it is not possible to comment further. It is assumed that production will be undertaken by the NMSs concerned as part of their contribution to WWW;

(*b*) Delivery of additional data and products to RTH Bracknell for dissemination. Similarly, it is assumed that the transport of data and products over the GTS, as required, will be provided by the NMSs concerned as part of their contribution to WWW;

(*c*) Costs at RTH Bracknell. Data management and switching at Bracknell would involve some additional cost but UKMO offers to absorb this cost as an RTH function;

(*d*) Hub and space segment. If WMO requests to share the UKMO's part of the hub and space segment, UKMO would make no charge, subject to

agreement, including the fraction of capacity required for WWW purposes and a satisfactory management mechanism. The possible sharing of ICAO's part of the hub and space segment, as offered, would be subject to negotiation between WMO and ICAO;

(*e*) VSAT and attached system(s). The cost of terminal equipment, installation, system integration, possible modification of existing systems etc., and of on-going supporting services would be the responsibility of users. There may be the opportunity to share some of these costs locally, given that the one VSAT can support the provision of data on more than one port;

(*f*) Other national charges. The cost of national import duties, taxes, telecommunication fees for operation of VSAT equipment, etc., where applicable, would be the responsibility of users.

12. The Expert Meeting considered general requirements in WMO Regions I, II and VI, in the light of the technical characteristics of the "satellite-based system". It was agreed that requirements should be discussed region by region. No conflict between regional requirements is seen at present.

Region VI (Europe)

13. SADIS meets the requirements specified by ICAO States in this Region. Because of the capabilities (existing and planned) of the GTS in RA VI, there is no known user requirement for additional WWW data and products to be disseminated or collected using the "satellite-based system".

Region I (Africa)

14. A major difficulty in a number of countries of RA I is the national collection of observations from remote sites into the NMC. The two-way component of SADIS is not recommended for this purpose, because it would not be cost-effective. The data collection system (DCS) mission of METEOSAT is currently a more effective means for collecting small quantities of data from such sites, using the technology of data collection platforms. DCS is integrated into the Regional Meteorological Telecommunication Network (RMTN) of RA I.

15. The exchange of data between NMCs and RTHs is also problematic in some cases, but again there are likely to be more cost-effective solutions than the use of the SADIS two-way component. The economy of scale so evident in broadcast applications does not appear when satellite communication is used for point-to-point links, especially when communication is routed via the hub. In any event, the use of a two-way satellite system of the SADIS type implies a major change to the responsibilities of RTHs, simply because all the data flows into the hub, which in this case is located in the United Kingdom. Data management would, therefore, be necessarily shared with a centre outside the Region. This is possible in principle, but unlikely to be acceptable in practice.

16. The dissemination of larger quantities of data and products for the whole of RA I is addressed by the MDD mission of METEOSAT, which is integrated into the RMTN. MDD supports the broadcast of alphanumeric bulletins and charts encoded using T4, but not GRIB. There is at present a requirement for GRIB products at only a few centres in RA I and their needs are currently met by using existing links from RTHs outside RA I. If there was a requirement at more centres in Africa for significant quantities of GRIB data, then the use of the broadcast capability of the "satellite-based system" would be an effective method of delivery and should be considered. On a longer timescale, the replacement of MDD by an expanded capability for data distribution within METEOSAT second generation (MSG) offers the opportunity to meet new requirements in RA I for dissemination of data and products.

Region II (Asia)

17. There is a stated requirement in RA II for the urgent replacement of radio teleprinter and radio facsimile transmissions, as the operators of these facilities are finding increasing difficulty in sustaining service and in some cases have withdrawn service. These services have supported the dissemination of data (as alphanumeric bulletins) and charts. These data types correspond to the data types disseminated by MDD, but the footprint of MDD has only a partial coverage of RA II and limited spare capacity. However, the footprint of SADIS has excellent coverage of RA II and significant spare capacity as already noted. The Expert Meeting suggested that an MDD-like service for RA II would be an effective way to use broadcast capacity on offer. This assumes that the data and products to be uplinked can be made available at RTH Bracknell. The GTS within RA II should be used to collect and forward observational bulletins, and to transport products from the larger centres within RA II to RTH Bracknell via other RTHs on the Main Telecommunication Network of the GTS. Of course a fuller assessment of such an arrangement would require a detailed list of the contents of such a broadcast. It should also be noted that some suppliers intend to market lower-cost workstations designed to connect to the VSAT to handle and display alphanumeric data and chart products. GRIB products could also be included within the service if required, but would need suitable computer facilities for further processing.

18. The provision of such an MDD-like facility would require cooperation between Members in RA II and UKMO as operator (whether ICAO or UKMO capacity is used). The Expert Meeting envisaged a coordination mechanism between RA II's Working Group on WWW and UKMO, by analogy with the arrangements for management of MDD which involve EUMETSAT, the three RTHs operating uplinks, and representatives of users.

19. The use of the two-way component of SADIS to support national data collection or links between NMCs and RTHs in RA II is subject to the same conclusions as

for RA I. The Expert Meeting also noted that some WMO Members in RA II are increasingly able to make significant investments in new facilities to support their operations. This investment leads to continuing improvements in the GTS in parts of RA II and so supports the delivery of additional data and products.

20. The Expert Meeting agreed that the technical design of the "satellite-based system" incorporates strong configuration and data management characteristics which enable an effective management regime to be implemented for the benefit of the current applications and potentially to meet WMO's needs. This would enable WMO's policy for data exchange to be respected in such a system. For example, the provision of broadcast WWW data would be realized through a separate port on the VSAT and controlled separately from other applications. Also, the facility to enable/disable reception by command from the hub would protect the interests of the NMS concerned: the VSAT would not be enabled to be operated for WWW purposes without the permission of the NMS. (Note that SADIS and WWW data streams could be controlled separately, even when delivered via a shared VSAT.) The involvement of the NMS in this respect would mirror the procedure adopted by ICAO in respect of the SADIS application. (In many countries, the NMS is also the authority for aviation meteorology, but in others, the responsibilities are held by different bodies.)

21. The realization of benefit by an NMS depends not just on the availability of additional data and products but also upon the infrastructure (computers, support services, trained staff, etc.) which enables productive use to be made of the additional information. The Expert Meeting stressed the importance of NMSs taking a broad view to encompass these nationally provided elements as well as the opportunity to exploit the "satellite-based system".

22. The Expert Meeting also wished to underline several points which are contained within the detailed technical description in the appendix, as follows:

(*a*) There is no choice as to the supplier of the VSAT because the design of this element is proprietary. Within the proprietary design are the mechanisms which protect the integrity of the system; therefore the proprietary nature is a benefit in this respect. By contrast, users have a wide choice of computer equipment to attach to the VSAT. This is important because user's requirements vary widely and to limit choice in this respect would be a major disadvantage;

(*b*) It is possible to use the same VSAT for more than one (authorized) service. Thus, by local agreement, the VSAT could be used to feed data to separate computers (e.g. to support the ICAO application at one site and the WWW application at another); the VSAT could also support both applications on the same system, again assuming both have been authorized;

(*c*) The available spare capacity of the system varies over 24 hours and therefore cannot simply be considered in terms of average daily utilization. For the broadcast component of SADIS, about half the current traffic is concentrated into two peak hours per day. Future requirements (e.g. possible issue of aviation GRIB every six hours) may introduce peaks at other times. For the UKMO's application, the data flow is spread evenly through 24 hours. Operational arrangements to share capacity with a WWW application should include a guarantee of minimum capacity to be provided for WWW traffic at peak periods, as well as agreement as to the total traffic over 24 hours.

APPENDIX TO ANNEX III

SUMMARY OF TECHNICAL CHARACTERISTICS OF THE "SATELLITE-BASED SYSTEM" AND EVALUATION OF COMPATIBILITY WITH THE GTS

Design of the "satellite-based system"

Overall design of the broadcast system

1. The SADIS broadcast contains three basic types of data, adhering to WMO data structures and WMO message format:

(*a*) Global numerical forecast fields as binary coded data (GRIB);

(*b*) SIGWX and wind/temperature charts as coded digital facsimile (CDF) (T4 encoding);

(*c*) OPMET data (TAFs, METARs, SIGMETs etc.) as alphanumeric bulletins.

These are sourced as follows (see Figure 1):

(*a*) GRIB from WAFC London (with WAFC Washington as backup);

(*b*) CDF mainly from WAFC London, plus some charts from other centres (via GTS);

(*c*) OPMET from London Heathrow node of ICAO's AFS and from GTS.

2. These bulletins are concentrated into the broadcast datastream by the message switch at Bracknell and uplinked to INTELSAT 604 at 60°E from a ground station in the United Kingdom which is linked to Bracknell by an X.25 network. The footprint of this satellite covers Europe, Africa, most of Asia, and part of Australia (see Figure 2). The frequency band is C band (6 GHz uplink, 4 GHz downlink) because of requirement for a 'global beam', with a bandwidth of 1.4 MHz. ICAO's requirements (both broadcast and two-way operation) need a bandwidth of 0.9 MHz; UKMO funds an additional 0.5 MHz. The transmission speed of the "satellite-based system" is 64 kbps, at a very low error rate (so as to minimize the probability of bit errors corrupting the datastream, particularly important in the case of the

GRIB data). ICAO's user requirement is for 38.4 kbps, which exceeds the speed actually needed to disseminate today's WAFS and OPMET data volumes within the required time limits but allows for growth in the requirement. 64 kbps is the speed which is achieved by meeting ICAO and UKMO requirements in a single transmission system. The high speed means that transmission delays are minimized.

3. Data (GRIB, CDF, OPMET) are transmitted as soon as available from the message switch at Bracknell, i.e. there is no time-dependent scheduling. However, forecasts are generated to a regular pattern and so, on most days, forecast products become available for transmission at about the same time. The current volume of SADIS data is approximately 31 MBytes/day. It is planned (beginning in October 1996) to transmit the GRIB data twice with a two-hour delay, to permit users a second chance to receive (e.g. if they had a local problem with their equipment or a product was corrupted by a transmission error).

4. The broadcast signal is received by a VSAT, comprising an antenna (2.4 metre diameter), mount, low-noise block and receiver/demultiplexor equipment, as supplied by MMS. The VSAT supports four data ports (two at X.25/64 kbps, one at X.25/19.2 kbps, one asynchronous/9.6 kbps), as shown in Figure 3; the first one is currently used for SADIS, and the fourth for a UKMO requirement. Ports 2 and 3 are unused at present. The SADIS datastream is presented at port 1 as standard WMO messages using the X.25 level 3 protocol (one physical channel, three logical channels); the protocol is exactly as specified in the *Manual on the GTS*. A maximum of five logical broadcast channels are available through port 1; three are used for GRIB, CDF and alphanumeric bulletins, the fourth is used for test transmissions and the fifth is spare. The unused ports also have five channels available. Port 1 also has a channel which can be used to supply data uniquely to any single VSAT; this facility is not used at present.

5. The received datastream can be processed in one of two main ways:

(*a*) By a message switch conforming to GTS specifications (and supporting binary data ingestion at 64 kbps). The message switch could then distribute the data according to its capabilities and links; e.g. to workstation(s), other local or remote computers etc;

(*b*) Into a workstation (via a suitable X.25 communications card), typically for local use (e.g. display, printing etc.); this is the more usual arrangement.

NOTES: (1) The X.25 is "spoofed"; i.e. the one-way broadcast (using proprietary VSAT protocol including forward error correction) is presented as a pseudo two-way connection at the port, the interface to the user's computer. The spoofed protocol has important consequences. Firstly, there is no flow control: if the receiving computer signals that it is unable to receive data and wishes to wait, this has no effect; thus the first computer downstream from each port must be able to accept data at the fastest rate that the data can flow via the port, e.g. 64 kbps for port 1 or 2. Secondly, any residual errors can be detected but not corrected since there is no method to ask for a retransmission of a corrupt packet from the hub; decisions about what to do with a detected error are for the user's computer.

(2) Many message switches may not be able to take data on a 64 kbps link in the absence of flow control. A solution to this problem is to take the datastream into a workstation (which acts as a buffer) and then forward to the message switch over a normal connection, using standard X.25 or other suitable protocol, via a direct link or network (see Figure 4(*a*)).

(3) The VSAT can support service on more than one port simultaneously. Several computers can be connected, in various configurations (see Figure 4(*b*)). The use of a packet switch permits different logical channels to be combined or split out on different physical connections (see Figure 4(*c*)).

(4) The provision of terminal equipment, e.g. VSAT plus workstation, to receive the datastream is the responsibility of the user, not UKMO or MMS. The specifications of the received datastream, which conforms strictly to WMO/ICAO standards, and of the VSAT ports have been made available to suppliers of such systems and several have developed products to compete in the market created by SADIS and ISCS. The proprietary design of the VSAT itself means that only MMS can supply that element, either directly or as part of a larger package, but end-users are free to attach whatever computer equipment best suits local needs.

6. The operation of SADIS (and UKMO's application) is managed at Bracknell. Receiving VSATs can be enabled/disabled by command from the management system, at the level of individual ports. Technical supervision and a help-desk are available 24 hours a day. Liaison is maintained with the United Kingdom Civil Aviation Authority who provide much of the OPMET data from their switch at Heathrow, and with the operator of the ground station providing the uplink to the satellite.

The two-way capability

7. ICAO's original user requirement included the collection of small quantities of OPMET data from locations where the existing terrestrial AFS was inadequate. The more complex two-way VSAT has one of its ports configured to accept data at 19.2 kbps over X.25 from a system which supplies a bulletin of data in the standard WMO format. The hub polls each two-way VSAT in turn, giving an opportunity to transmit (at 19.2 kbps) for a fixed period. Depending on the number of two-way VSATs to be installed, the average data rate per VSAT would be quite low, but sufficient for short alphanumeric

messages. In the event, only three two-way VSATs have been deployed (one in South Africa, two in the United Kingdom), to meet the requirement to demonstrate two-way operation during the pre-operational test phase of SADIS and to support development work. ICAO's user requirement may change to include the collection of charts (CDF using T4) which are large data objects and to collect data such as SIGMETs more quickly.

8. A study has been performed and a modified technical design for two-way operation recommended to the SADISOPSG of ICAO. This design would provide four channels each at 19.2 kbps dedicated to data collection, necessitating a more complex management scheme. Using a fifth channel, a two-way VSAT could signal its readiness to transmit a variable quantity of data and be assigned a data channel for the required length of time. This arrangement can be accommodated within the existing leased bandwidth, so there would be no increase in the recurring cost of the space segment. There would of course be development costs plus capital/support costs for the two-way VSAT equipment. No decision has yet been taken by ICAO to proceed with this modification to SADIS.

9. The two-way VSAT, like the receive-only VSAT, is designed to attach to a message switch or workstation.

10. National regulations for the operation of VSAT equipment must be observed. This is not usually a problem for receive-only equipment, but two-way VSAT operation is a different matter and is usually strictly regulated. In some countries, there may be telecommunication fees to be paid in respect of VSAT operation.

Compatibility with the GTS

Codes, message formats etc.

11. The code forms and message structure used by SADIS are identical to those on the GTS. Note that a chart product in CDF is contained within a single message and averages about 65 kilobits in length; not all message switches on the GTS can handle such long messages. The broadcast is of course a one-way data flow and so there is no possibility for the receiving computer to signal that it is not ready to receive data or that an unrecoverable data error has been detected. The lack of flow control (a feature of all broadcasts) combined with the relatively high speed means that receiving computers have to be carefully configured to ensure that data is not lost during the transfer from the VSAT. The probability of errors within the datastream is minimized within the design of the overall system and in practice no difficulties have been encountered when using correctly installed equipment.

12. Once a message has been received successfully into a receiving system, there is no difference compared with a message received over a standard X.25 point-to-point link. GTS messages could be inserted into the broadcast datastream via the message switch at Bracknell and picked up by remote message switches (or workstations). A WWW application on the "satellite-based system" can therefore be integrated into the GTS.

13. To facilitate data management, it is recommended that a WWW datastream should be separated from the other broadcast applications and, within the WWW datastream, different logical channels should be used for different data types (i.e. GRIB/BUFR separate from CDF and from alphanumeric bulletins).

14. If the two-way component of SADIS were used for WWW data collection, the WWW bulletins should be separated on a different logical channel.

One-way (broadcast) operation

15. It follows from above that a WWW broadcast datastream should be presented via one of the two unused ports (port 2 or 3) on the VSAT, since there are not sufficient spare logical channels on port 1 (see Figure 3). This has the further consequence that a receiving computer would have a separate physical connection to the VSAT to ingest WWW data. Depending on the local user requirement, the VSAT plus receiving computer might be configured to receive either or both datastreams; in the latter case, two physical connections to the VSAT would be necessary (see Figure 4(*b*)). Irrespective of the number of ports and logical channels in use, the maximum aggregate data rate remains 64 kbps, as determined by the capacity of the path from Bracknell via the uplink, satellite and VSAT.

16. There is a choice as to whether a WWW broadcast datastream is presented via port 2 or port 3. Both are synchronous running spoofed X.25 (as explained above) but one has a maximum speed of 64 kbps and the other of 19.2 kbps. The lower speed eases the problem of accepting data without flow control but obviously puts a limit on the maximum rate of flow. The higher speed is much more demanding in terms of data rate, noting that the whole 64 kbps is available to one channel if all the others are quiet. The use of channel 2 for WWW data would mean that SADIS and WWW services look very similar and would need identical hardware in the attached computers. Without further knowledge of the WWW user requirement which might influence the choice, this symmetrical arrangement is probably to be preferred since it avoids technical differences between workstations designed for SADIS and WWW applications.

Two-way operation

17. The two-way capability of SADIS, as initially designed, would be technically capable of collecting small quantities of WWW data in addition to OPMET data but, for the reason discussed above, this two-way capability is unlikely to be implemented as originally designed. The proposed modified two-way scheme would have at least four times the capacity plus a more flexible management scheme and would be able to handle large binary objects (such as a chart in T4 code) as well as alphanumeric data. The two-way nature of the scheme permits data errors to be corrected. In principle, therefore, WWW messages could be transmitted to Bracknell and inserted into the GTS. There is as yet no

commitment from ICAO to implement the modified scheme, and no evaluation of the capacity which would be available after aviation requirements were satisfied.

Available capacity on the broadcast

18. The data flow over 24 hours (at a 15-minute resolution) can easily be measured using the message switch at Bracknell. This was done on 27 June 1996, with the following results:

SADIS GRIB	9.1 MBytes	
SADIS CDF	18.4 MBytes	total of 31.2 MBytes per day
SADIS OPMET	3.7 MBytes	total of 34.9 MBytes per day
UKMO traffic		

19. If the transmission system was working at peak capacity at all times, then the theoretical maximum (ignoring the capabilities of the input or output systems) would be about 640 MBytes/day. Shared in proportion to the split of broadcast capacity between SADIS and UKMO, this splits into 380 MBytes/day for SADIS, and 260 MBytes/day for UKMO. The current actual usage over 24 hours represents 8 per cent and 13 per cent, respectively. Retransmission of the SADIS GRIB would raise the former to 11 per cent. No system can operate close to the theoretical maximum but the above figures demonstrate that significant spare capacity is available over the full 24 hours.

20. Half of the current SADIS traffic is concentrated into two peaks, 0330–0430 and 1530–1630 UTC, corresponding to the output of GRIB and CDF from the global numerical forecasting runs at Bracknell. It is important, therefore, to consider the traffic in the peak hour, not just over the whole day. In a peak hour, about 8.5 MBytes are transmitted, which is equivalent to a sustained rate of 19 Kbps, i.e. half the capacity (38.4 Kbps) funded by ICAO. In contrast, the traffic from the United Kingdom's application is spread much more evenly through the 24 hours. In the same peak hour, about 1.5 MBytes are transmitted which is equivalent to a sustained rate of 3.5 Kbps.

21. The peak period for SADIS traffic is, not surprisingly, when the message switch is heavily loaded. The ability of the switch to drive any single output channel under conditions of heavy load is limited. However, the proposed method of adding WWW traffic is to use separate logical channels, which has the advantage that the load can be spread within the switch. It is difficult to predict how the system would behave under various additional loads, depending on the time of day. The more load that can be handled outside the busiest periods, the better. It would be possible to calculate the effects of additional traffic once a definition of the proposed additional bulletins is available.

Costs

(See also paragraph 11.)

Central data management and switching

22. On the assumption that most of the additional data that might be added is already available at RTH Bracknell, or can be obtained over existing channels without enhancement, the marginal cost of feeding the additional data into the "satellite-based system" would be, at first sight, small and would be absorbed by RTH Bracknell. Similarly, the minor marginal cost of data management and system management would be absorbed as part of the existing RTH responsibilities. There is a proviso: adding additional data flows at peak times may be a problem because the peaks generated by numerical forecast production systems are very large. Thus, to guarantee service at peak times may require additional investment in computer capacity. Conversely, adding additional flows in the quieter periods is normally no problem because the switch is then operating well below its maximum load.

Transmission to uplink and space segment

23. If spare capacity within the SADIS space segment were to be used for WWW data, the issue of cost sharing has to be resolved between WMO and ICAO, and that is outside the scope of this paper. The UKMO also has spare capacity within its share of the central infrastructure and space segment. Subject to negotiation on data volume etc., and an agreed mechanism for interacting with WMO Members, UKMO is prepared to offer to WMO part of UKMO's share at no cost, i.e. the offer would be made as an element of the United Kingdom's contribution to WWW.

Terminal equipment

24. Funding a VSAT (from MMS as sole supplier) and associated computer equipment (from various suppliers) is the responsibility of the user. For users with suitable computer equipment, a receive-only VSAT can be obtained from MMS for about £6K, plus £5K for spares, £2K for shipping and installation and optional £3K for four-year support contract (to extend one year warranty). Most users will need both VSAT and workstation, and UKMO recommends they negotiate a package deal (including the VSAT) with the workstation supplier. The cost of workstations varies widely, depending on the functions included. One supplier (at least) is developing a low-cost system which takes alphanumeric and CDF data only.

Access control

25. The proprietary VSAT equipment is configured by MMS before delivery and, when installed, enabled to receive data by command from the management system at Bracknell. The formal permission for enabling a receiving system comes from the National Aviation Meteorological Authority in the ICAO State concerned. It is recommended that a similar approach should be taken in the case of reception of WWW data. Permission to activate a receiving system should be granted by the NMS concerned, thus enabling the NMS to retain control of what would be, in effect, an extension of the GTS in that WMO Member State. That receiving system, when installed, would not be activated by Bracknell to receive WWW data until the formal permission was granted. Just as it is not possible for an unauthorized receiver to gain access to the SADIS

aviation data (or UKMO's data), it would not be possible for such a user to eavesdrop on WWW data. This strong control mechanism is an important feature of the satellite-based system and is a significant benefit in the context of WMO's policy for data distribution.

26. In some countries, the same organization fulfils both functions of NMS and National Aviation Meteorological Authority. This simplifies the coordination of use of the "satellite-based system" for the purposes of both SADIS and WWW. In countries where the functions are separate, there would need to be liaison between the two authorities, e.g. to agree on local sharing arrangements where one receiver may support both datastreams.

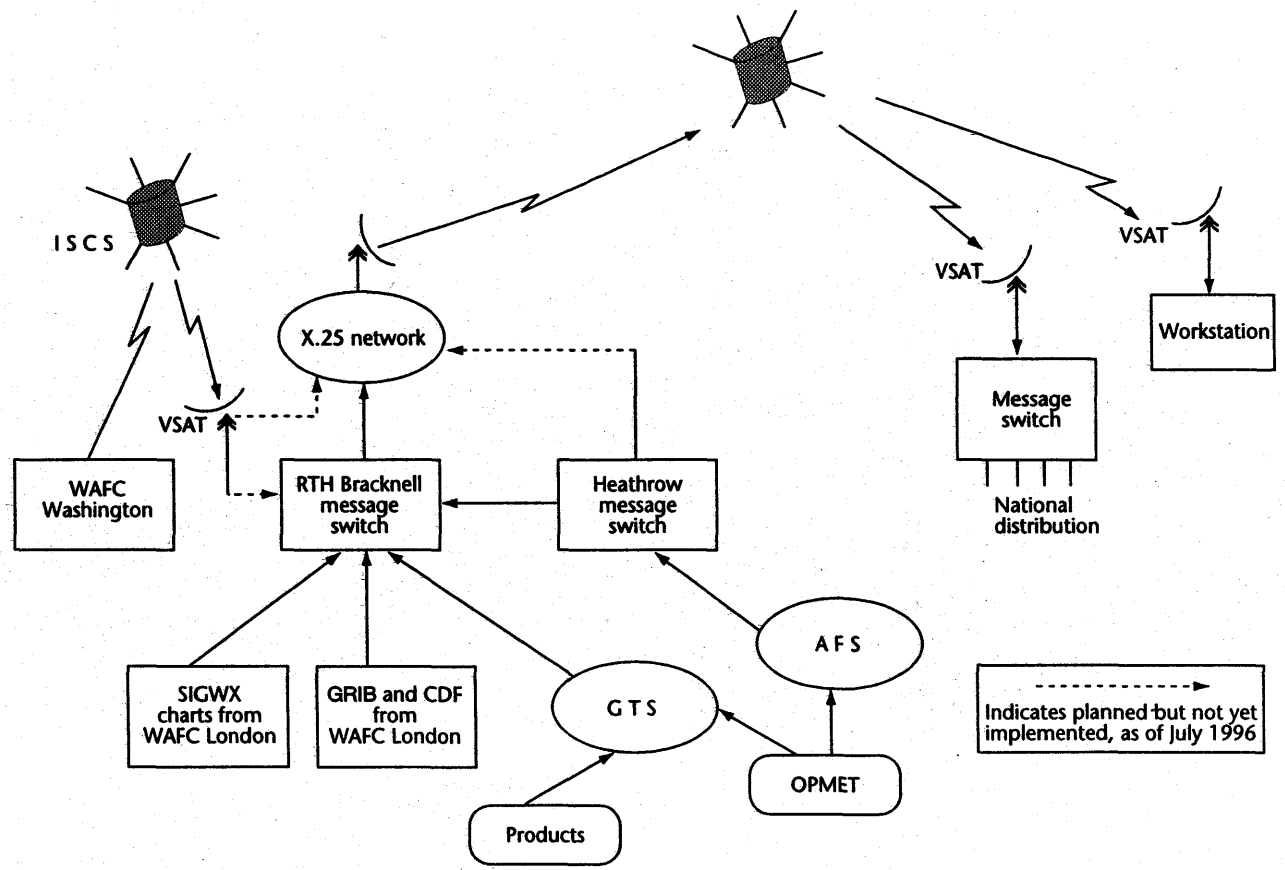

Figure 1 — SADIS broadcast data flow.

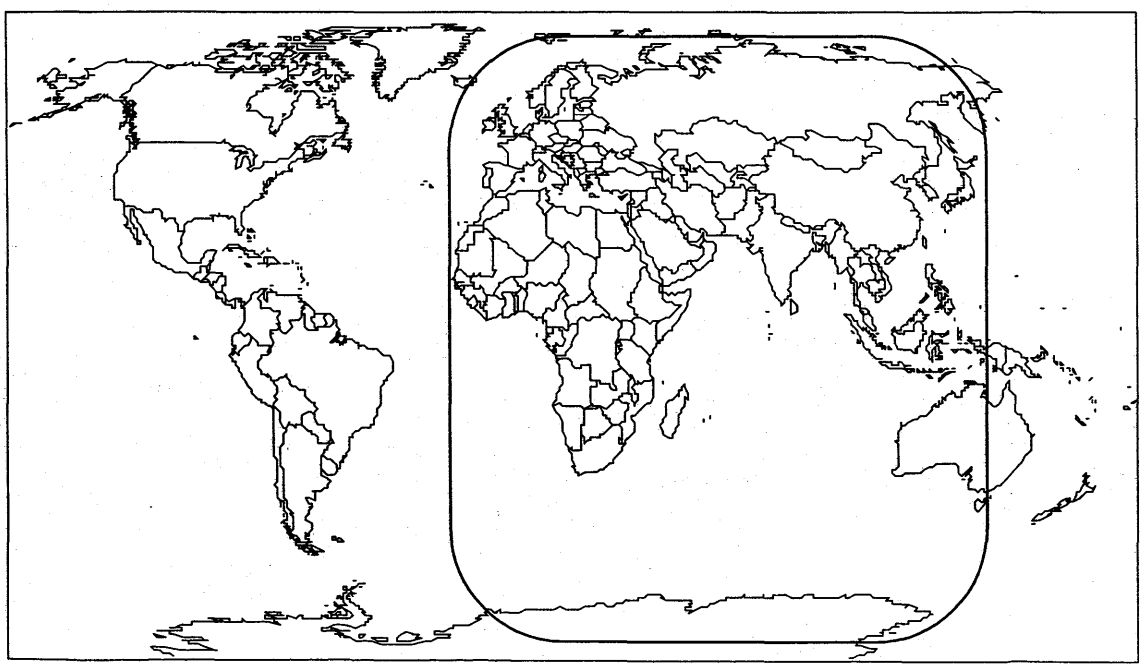

Figure 2 — Footprint of SADIS satellite-based telecommunication services.

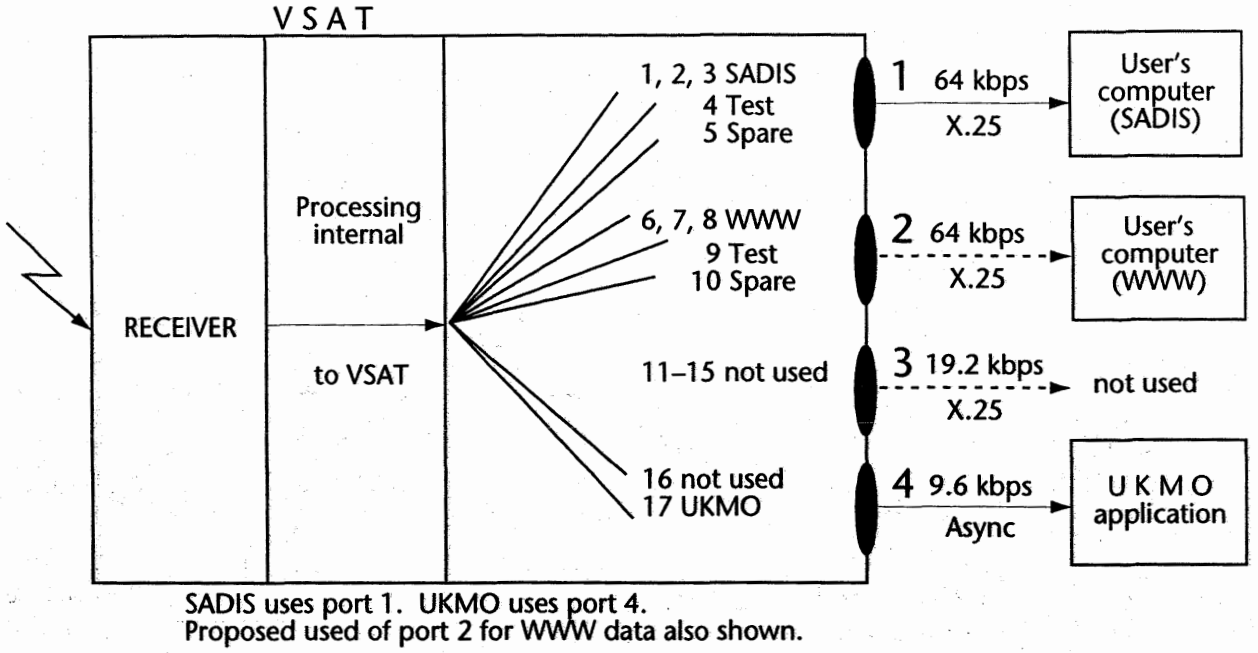

Figure 3 — Allocation of broadcast channels and ports on receive-only VSAT.

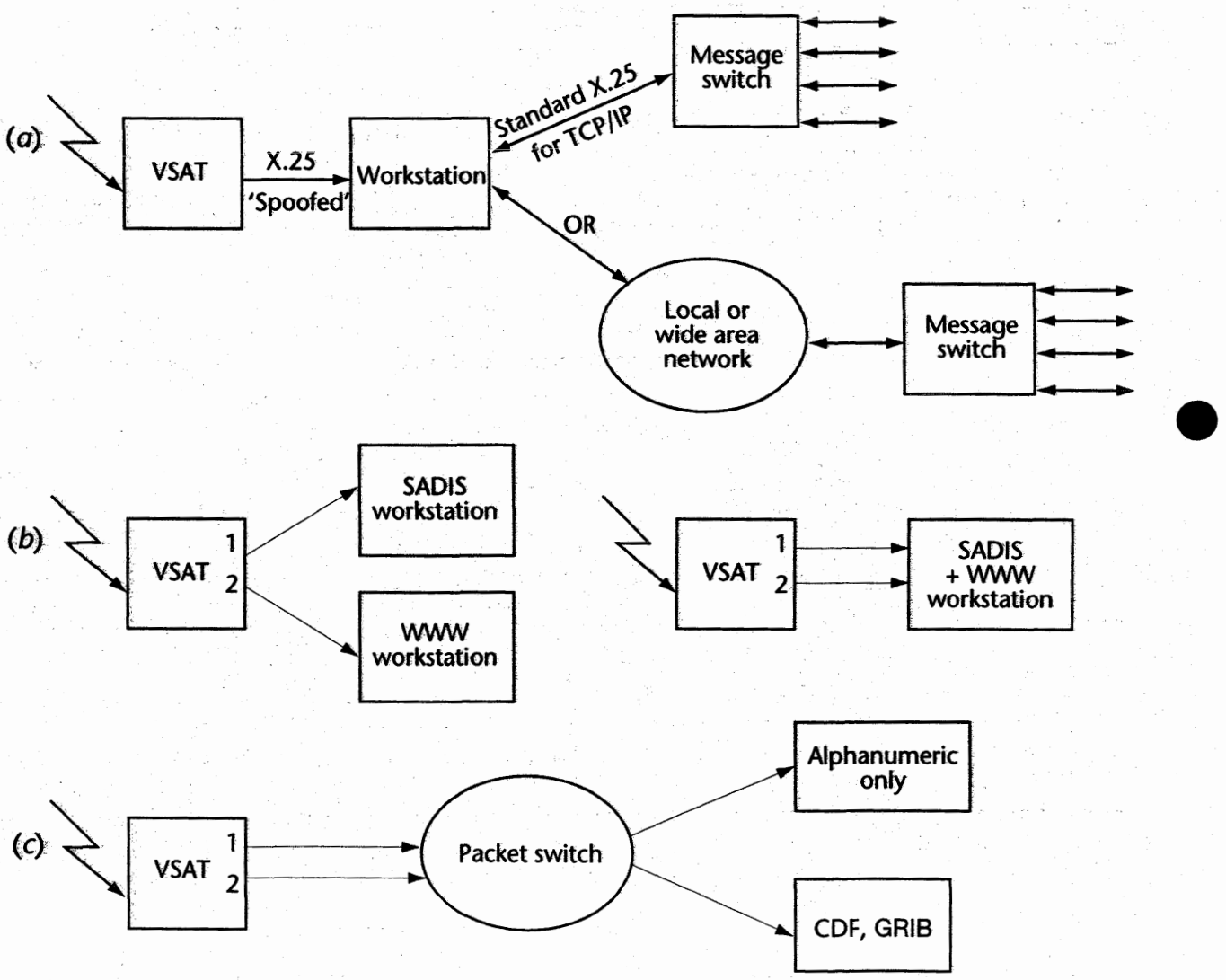

Figure 4 — VSAT connection to user's equipment.

ANNEX IV

Annex to paragraph 6.3.10 of the general summary

STANDARD PROCEDURES FOR THE VERIFICATION OF LONG-RANGE OUTLOOKS

(Parameters to be verified: Climate anomalies of temperature and precipitation)

Climatology to be used: 1961–1990, to be updated every 10 years

I. Categorical forecasts

CATEGORIES: Above normal, normal, below normal temperature limits: equal probability categories
Precipitation limits: equal probability categories*

SCORES TO BE USED:

A. Linear error in probability space for categorical forecasts (LEPSCAT)
B. Bias
C. Post agreement
D. Percent correct

II. Probability forecasts of binary predictands

CATEGORIES: Above normal, below normal

SCORES TO BE USED:

A. Brier
B. Brier skill score with respect to climatology

* Arid and semi-arid areas will need special consideration.

C. Reliability
D. Sharpness (measure to be decided)

III. Probability of multiple-category predictands

CATEGORIES: Above normal, normal, below normal temperature limits: equal probability categories
Precipitation limits: equal probability categories*

SCORES TO BE USED:

A. Ranked probability score
B. Ranked probability skill score with respect to climatology

IV. Continuous forecasts in space

SCORE TO BE USED:

Murphy-Epstein Decomposition (phase error, amplitude error, bias error)

V. Continuous forecasts in time

SCORES TO BE USED:

A. Mean-square-error
B. Correlation
C. Bias

ANNEX V

Annex to paragraph 6.3.14 of the general summary

FORMAT FOR THE EXCHANGE OF WMO STANDARD SCORES BY ELECTRONIC MEDIA

(Examples of a number of tables are given)

```
Columns
0000000001111111111222222222233333333334444444444555555555566666666667777777778
1234567890123456789012345678901234567890123456789012345678901234567890123456789
```

n1 blank lines see note 4

```
                    VERIFICATION TO WMO STANDARDS
                CENTRE NAME                 MMMMMMMMM   YYYY
                        Model name or characteristics
# COMMENT LINE
# COMMENT LINE
```

File header 8 lines see note 1

n2 blank lines see notes 4 & 5

```
TABLE 1.1   NORTHERN HEMISPHERE VERIFICATION AGAINST ANALYSIS (90N–20N)
            MEAN-SEA-LEVEL PRESSURE         MMMMMMMMM   YYYY
```

Table header 11 lines see note 2

FORECAST PERIOD	MEAN ERROR (hPa)		RMSE (hPa)		CORRELATION		SKILL SCORE	
(HOURS)	00 GMT	12 GMT	00 GMT	12 GMT	00 GMT	12 GMT	00 GMT	12 GMT
24	0.1	0.0	1.6	1.8	0.94	0.092		34.2
48	–0.24	–0.27	3.25	3.24	0.912	0.911		40.12
72	–.3	.5	4.3	4.2	0.77	0.76		47.6
96	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx
120	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx

n data lines see note 3

n3 blank lines see note 4

TABLE 1.2 NORTHERN HEMISPHERE VERIFICATION AGAINST ANALYSIS (90N–20N)
500 HPA GEOPOTENTIAL HEIGHT MMMMMMMMM YYYY

FORECAST PERIOD	MEAN ERROR (M)		RMSE (M)		CORRELATION		SKILL SCORE	
(HOURS)	00 GMT	12 GMT	00 GMT	12 GMT	00 GMT	12 GMT	00 GMT	12 GMT
24	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx
48	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx
72	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx
96	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx
120	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx

TABLE 1.4 NORTHERN HEMISPHERE VERIFICATION AGAINST ANALYSIS (90N–20N)
500 HPA TEMPERATURE MMMMMMMMM YYYY

FORECAST PERIOD	MEAN ERROR (K)		RMSE (K)		CORRELATION	
(HOURS)	00 GMT	12 GMT	00 GMT	12 GMT	00 GMT	12 GMT
24	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx
48	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx
72	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx
96	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx
120	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx

TABLE 1.6 NORTHERN HEMISPHERE VERIFICATION AGAINST ANALYSIS (90N–20N)
500 HPA WIND MMMMMMMMM YYYY

FORECAST PERIOD	MEAN SPEED ERROR (M/S)		RMSE (M/S)	
(HOURS)	00 GMT	12 GMT	00 GMT	12 GMT
24	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx
48	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx
72	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx
96	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx
120	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx

TABLE 4.1 NORTH AMERICA VERIFICATION AGAINST RADIOSONDES
850 HPA GEOPOTENTIAL HEIGHT MMMMMMMMM YYYY

FORECAST PERIOD	MEAN ERROR (M)		RMSE (M)		CORRELATION	
(HOURS)	00 GMT	12 GMT	00 GMT	12 GMT	00 GMT	12 GMT
24	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx
48	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx
72	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx
96	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx
120	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx

TABLE 4.7 NORTH AMERICA VERIFICATION AGAINST RADIOSONDES
850 HPA WIND MMMMMMMMM YYYY

FORECAST PERIOD	MEAN SPEED ERROR (M/S)		RMSE (M/S)	
(HOURS)	00 GMT	12 GMT	00 GMT	12 GMT
24	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx
48	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx
72	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx
96	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx
120	xxxxxxx	xxxxxxx	xxxxxxx	xxxxxxx

0000000001111111111222222222233333333334444444444555555555566666666667777777778
1234567890123456789012345678901234567890123456789012345678901234567890123456789

NOTES:

(1) (File header)
Underlining is optional.
Line 1: Fixed title (A80)
Line 4, columns 17 to 48: Centre name
Line 4, columns 49 to 64: Month and year in full (16X, A32, A16)
Line 7: Model name or characteristics (A80)

(2) (Table header)
Underlining is optional.
Line 1, columns 11 to 16: Table number
Line 1, columns 17 to 80: Table name (10X, F6.0, A64)
Line 3, columns 17 to 48: Parameter name
Line 3, columns 49 to 64: Month and year in full (16X, A32, A16)
Line 7: Score names (10X, 4(1X, A16))
Line 8: Units (optional) (10X, 4(1X, A16))
Line 9: Times (10X, 4(2X, A7, 1X, A7))

(3) (Data lines)
n depends on forecast length.
Examples of specifying data are given.
xxxxxxx represents any numerical value.
Missing data should be left blank.
Reading data: (1X, I5, 4X, 4(2X, F7, 0.1X, F7.0))
Searching for missing data: (10X, 4(2X, A7, 1X, A7))

(4) n1, n2, n3 may be variable.

(5) A line beginning # is treated as a comment.
A comment line should not occur within the file header, table header or between data lines.
Comment lines can be used to give information on abnormal events, any forecasts missed, and/or any significant changes introduced into the NWP system during the month.

(6) All characters should be in ASCII representation.

ANNEX VI

Annex to paragraph 6.3.16 of the general summary

FORMAT FOR THE EXCHANGE OF DATA MONITORING STATISTICS BY ELECTRONIC MEDIA

LAND SURFACE OBSERVATIONS

- Average number of reports in 24 hours and number of stations reporting at least five times in WMO Regions I to VI and Antarctica
- Suspect stations, mslp (MSLP) or geopotential height (Z):
  Nobs>=20, and one or more of the following:
  abs(bias)>= 3 hPa or 25 m
  sd>= 5 hPa or 30 m
  %gross>= 20 (limit 15 hPa for mslp
  or 100 m for geopotential height)

Ident Elev Elem lat lon Nobs %gross %rej bias sd

MARINE SURFACE OBSERVATIONS

Ships, fixed buoys and platforms

- Average number of reports in 24 hours and number of platforms reporting at least five times in the Atlantic Ocean north and south
  Pacific Ocean NW, NE, SW, SE
  Indian Ocean north and south
- Suspect stations, mslp (MSLP):
  Nobs>=20, and one or more of the following:
  abs(bias)>= 3 hPa
  sd>= 5 hPa
  %gross>= 20 (limit 15 hPa)
- Suspect stations, wind direction (DD), light winds (<3 m s^{-1}) excluded:
  Nobs>=20, and one or more of the following:
  abs(bias)>= 20 degrees
  sd>= 60 degrees
  %gross>= 20 (limit 25 m s^{-1} on vector wind)
- Suspect stations, wind speed (FF):
  Nobs>=20, and one or more of the following:
  abs(bias)>= 4 m s^{-1}
  %gross>= 20 (limit 25 m s^{-1} on vector wind)
- Suspect stations, air temperature (TT):
  Nobs>=20, and one or more of the following:
  abs(bias) >= 3 K
  sd>= 5 K
  %gross> = 20 (limit 10 K)

Ident Elev Elem lat lon Nobs %gross %rej bias sd
(lat lon: position of the platform at the middle of the reporting period)

Drifters

As ships, fixed buoys and platforms (above)

RADIOSONDE OBSERVATIONS

- Average number of reports per day at 0000, 0600, 1200 and 1800 UTC and overall number of stations reporting at least five times in the month in WMO Regions I to VI and Antarctica in Atlantic Ocean north and south Pacific Ocean NW, NE, SW, SE Indian Ocean north and south separately for geopotential height (Z) and wind (V)

- Suspect stations, geopotential height (Z) from 1 000–30 hPa:
  at least three levels with Nobs>=10 and
  80 m weighted r.m.s
  for 0000, 0600, 1200 and 1800 UTC separately

Ident Elev Elem Time lat lon Nobs %gross %rej W_lev nlev bias sd r.m.s (r.m.s is the unweighted RMS of the worst level W_lev)

- Suspect stations, vector wind (V) from 1 000–100 hPa:
  at least one level with Nobs >= 10 and
  r.m.s >= 12 m s^{-1}

for 0000, 0600, 1200 and 1800 UTC separately

Ident Elev Elem Time lat lon Nobs %gross %rej W_lev nlev r.m.s speed_bias (r.m.s is the RMS (vector difference) of the worst level W_lev)

- Suspect stations, wind direction (DD) from 500–150 hPa, light winds (<5 m s^{-1}) excluded:
  Nobs>= 5 at each level, and
  abs(bias)>= 10 degrees
  spread< 10 degrees
  sd< 30 degrees

Spread: maximum spread of the mean departure at each level around the average sd averaged over all monitored levels for 0000, 0600, 1200 and 1800 UTC separately

Ident Elev Elem Time lat lon Nobs bias spread sd

AIRCRAFT OBSERVATIONS

Conventional AIREPs

- Total number of reports in 5 x 5 degree boxes
- Suspect carriers, vector wind (V):
  Nobs >= 20 and one or more of the following
  r.m.s>= 10 m s^{-1}
  %gross>= 25 (limit 40 m s^{-1} (vector))
  %calm>= 3

Ident Elem Nobs %gross %rej %calm r.m.s speed_bias

Automated observations

- Total number of reports in 5 x 5 degree boxes (all levels)
- Separately for three layers
  above 400 hPa, 700 to 400 hPa and below 700 hPa:
  Suspect aircrafts, vector wind (V) (refer to tail numbers):
  Nobs>= 20 and one or more of the following
  r.m.s>= 7 m s^{-1}
  %gross>= 25 (limit 40 m s^{-1} (vector))
  %calm>= 3

Ident Elem Nobs %gross %rej %calm r.m.s speed_bias

Suspect aircrafts, temperature (TT) (refer to tail numbers):
Nobs>= 20 and one or more of the following
r.m.s>= (to be decided)
%gross>= 25 (limit to be decided)

Ident Elem Nobs %gross %rej bias sd

SECTION FOR COSNA

Radiosonde observations (special list of stations):
Z 100 hPa, as above, all stations
Vector wind 100 hPa, as above, all stations
Z 500 hPa, as above, all stations
Vector wind 500 hPa, as above, all stations

Aircraft observations (40N–70N, 60W–0)
statistics per carrier, vector wind, as above

Surface marine observations, drifters (10-80N, 85W-0)
surface pressure, as above, all platforms
wind speed, as above, all platforms
wind direction, as above, all platforms

bias: mean of departures from background, excluding gross errors
Elem: element monitored
Elev: station or platform elevation
Ident: WMO identifier
lat: latitude
lon: longitude
nlev: number of suspect levels (radiosonde observations)
Nobs: number of observations presented to the objective analysis
r.m.s: root mean square deviation of departures from background, excluding gross errors
sd: standard deviation of departures from background, excluding gross errors
W_lev : worst level (radiosonde observations)
%calm: percentage of reported calm winds (< 5 m s^{-1})
%gross: percentage of gross errors
%rej: percentage of obsservations rejected by the objective analysis

Formatting:

- Maximum 80 characters per line
- Blank lines ignored
- Comment lines start with #
- Average numbers of reports in 24 hours should be given with one decimal — all percentages should be given with one decimal
- All sections should start with Monitoring Centre Month Year
- Availability:
  Monitoring Centre Month Year
  Availability Observation type
  RA1 <number per day> <number of stations> RA2 etc...
  n_atlantic <number per day> <number of stations> s_atlantic etc...
  n_hemis <number per day> s_hemis etc...

or (for radiosonde observations)
RA1 <numbers per day at 0000/0600/1200/1800 UTC> <number of stations> RA2 etc...

ANNEX VII

Annex to paragraph 6.3.21 of the general summary

PRINCIPLES OF ENVIRONMENTAL EMERGENCY RESPONSE EXERCISES

	National	*Regional*	*Global*	*Special*[1]
Coordinator	Appropriate National Authority	WMO Regional Association	WMO/CBS	As appropriate
Purpose	To establish and strengthen the linkages between National Meteorological Services and IAEA contacts at the national level	To strengthen the linkages between RSMCs, NMSs and IAEA at the national and international levels	To strengthen the linkages between WMO, IAEA and other international agencies	To maintain preparedness with respect to pre-identified critical tasks
Frequency	At least twice a year	Once a year	18 months	As required to maintain preparedness with respect to the critical tasks
Communications	Notification, and products dissemination	Notification, coordination and products dissemination; should be done frequently for night and day scenarios	Notification, coordination and products dissemination; should be done night and day on a rotation basis	
Operations	As required based on national structures and procedures	Comparison and coordination of modelling results	Coordination of modelling results	
Product standards	User feedback on standards; coupling of standard products within national systems and databases	User feedback on standards	User feedback on standards	
Product Interpretation	Get feedback whether products are understandable	Get feedback if products are understandable; products intercomparison	Get feedback if products are understandable; products intercomparison	
Assessment[2]	Internal among national authorities	Done jointly by the RSMCs involved	Done by the WMO expert(s) using the inputs from all the participants	

1 The details for special exercises are left open since the emphasis will change from one case to the other. Examples of such exercises are the monthly tests that RSMCs Montreal, Washington and Melbourne are doing for nuclear accidents.

2 In order for exercises to be useful, a report highlighting the problems encountered and the possible improvements to operational systems should be done after the event takes place. For WMO regional and global exercises, these reports should be circulated so that others can benefit from the findings.

ANNEX VIII

Annex to paragraph 6.4.22 of the general summary
(English only)

SOME WORLD WIDE WEB SERVERS OF NATIONAL METEOROLOGICAL SERVICES

Uniform Resource Locator	*Organization*	*Location*
http://www.bom.gov.au	Bureau of Meteorology	Melbourne, Australia
http://www.cmc.ec.gc.ca	Environment Canada	Montreal, Canada
gopher://madhz.dhz.hr/11/eng	Meteorological and Hydrological Service	Zagreb, Croatia
http://www.ecmwf.int	ECMWF	Reading, United Kingdom
http://www.fmi.fi	The Finnish Meteorological Institute	Finland
http://www.meteo.fr	MétéoFrance	Toulouse, France
http://www.knmi.nl/home.html	Royal Netherlands Meteorological Institute (KNMI)	Netherlands
http://www.met.co.nz	Meteorological Service of NZ, Ltd	Wellington, New Zealand
http://cirrus.sawb.gov.za	Weather Bureau	Pretoria, South Africa
http://ftp.sma.ch	Swiss Meteorological Administration	Zurich, Switzerland (FTP only)
http://www.meto.gov.uk	The Meteorological Office	Bracknell, United Kingdom
http://www.nws.noaa.gov	National Weather Service	Silver Spring, MD, United States
http://www.smhi.se	Swedish Meteorological and Hydrological Institute	Norrköping, Sweden
http://www.wmo.ch	WMO Secretariat	Geneva
http://ddb.kishou.go.jp	Japan Meteorological Agency	Tokyo, Japan
http://www.dwd.de	German Weather Service	Offenbach, Germany
http://www.info.gov.hk/ro/	Royal Observatory	Hong Kong
http://www.univie.ac.at/ZAMG http://www.austrocontrol.co.at	Institute for Meteorology and Geophysics Austro Control	Vienna, Austria

ANNEX IX

Annex to paragraph 6.4.26 of the general summary

OUTLINE OF ACTIVITIES AND TIMETABLE FOR THE PREPARATION OF THE INTEGRATED WMO DATA MANAGEMENT PLAN

STEP 1	Draft December 1996	Develop a preliminary analysis of WWW data management according to the methodology proposed for the component by component analysis (Experts from the Working Group on Data Management and other working groups).
	Final March 1997	
STEP 2	April 1997	Letters to presidents of technical commissions. Describe task, present draft analysis of WWW data management. Obtain contacts in technical commissions (chairman of the Working Group on Data Management).

STEP 3	October 1997	Perform a component by component analysis (emphasis on graphical display of results). Identify data sources, flows, processing, storage and uses, monitoring activities. Document systems, formats, processes and procedures. Specify how requirements are identified and addressed. Determine how cost-effectiveness of system changes can be assessed (Inter-Commission panel of experts (ICPE))
STEP 4	Late 1997	Consider interrelation of the components, identify common requirements, develop WMO-wide Plan which includes common approaches to meet common requirements, propose common policies and procedures where appropriate (ICPE).
STEP 5	Early 1998	Circulate draft plan and prepare final plan (ICPE).
STEP 6	Third quarter 1998	Prepare document for submission to Thirteenth Congress (ICPE).

ANNEX X

Annex to paragraph 6.4.27 of the general summary

PROPOSED STRUCTURE FOR THE WMO *GUIDE TO DATA MANAGEMENT*

1. **Introduction:** This section would cover the purpose and scope of the *Guide* and its intended audience (implementors and project managers).

The purpose includes helping implementors and project managers to make informed decisions in their everyday work by providing a suitable context.

The scope includes the principles of data management derived from a wide range of experiences, and overviews of topics with more detail in annexes or other existing documents. It explains that some details may not yet exist elsewhere. The chapter will also include pointers to the WMO Data Management plan and other relevant *Guides*.

The document should NOT include:

Material that should be covered by other *Manuals*:

(*a*) Technical Regulations;

(*b*) Specific procedures (such as observational practice);

(*c*) Details of individual authors.

The chapter would also include pointers to other language versions and the on-line version(s) and describe how these versions of the *Manual* are updated. The following is suggested: The document would be available both on paper and on-line, working drafts would be machinable, possibly authored in a local language, and translated by Members into the working language of the editorial team. Once the editorial team has agreed on a version of the document, it would be made available to the Working Group on Data Management and the Commissions (on-line). The document would then be translated into the WMO official languages for approval by the Executive Council. After approval, it would be made generally available on-line and on paper.

2. **Standards and change management**, covering de facto and *de jure* standards, market acceptance and global trends.

3. **Metadata:** Including data modelling and the physical versus logical views of data and processes; Metadata (of various types) and the summary process used to create directories, catalogues and indexes.

4. **Data representation:** Including issues raised by coordinates, and compression.

5. **Data exchange:** Including collection, distribution and exchange, both real-time, non- real-time, and off-line or on-line.

6. **Data storage, archiving and retrieval:** Including data preparation and technology migration.

7. **Data processing:** This chapter should include the principle: one person's product is another's data. It should also discuss data conversions, and differing types of processing and their needs (such as some processes being irreversible). An important type of processing that should be included is visual display.

8. **Monitoring and quality control**

9. **Software:** This should describe CBS software registry and Internet as sources of software.

Annexes:

Glossary and acronyms;
Overview of WMO Programmes, including those shared with other organizations;
Overview of technology (including databases, computer graphics, communications and Internet);
Case studies.

ANNEX XI

Annex to paragraph 7.5 of the general summary

COMMENTS ON ISSUES ASSOCIATED WITH MEDIA COMMUNICATION

(*a*) Concern exists with international media bodies which have the capability of global dissemination of weather forecasts, where these forecasts typically originate from a forecast office remote from the area of occurrence of severe weather. As a possible action, the Commission suggested that each regional association consider possible mechanisms under certain predefined agreed upon conditions where RSMCs could provide assistance to NMCs in communicating their severe weather and storm related warnings to the media and humanitairan relief organizations. Such mechanisms would need to ensure that existing guidelines or the authority of individual NMSs are not compromised;

(*b*) The Internet World Wide Web should be studied more closely as a means of communication with the media and those United Nations and other international organizations responsible for humanitarian relief efforts;

(*c*) While effective media dissemination of severe weather warnings is to be welcomed, it is not possible for NMSs to control the content of media output. However, there are practical steps which can and should be taken to encourage best practices or a code of ethics among the international broadcast media. The following actions, are proposed for further discussions with major international media bodies which broadcast warnings:

(i) Warnings and advisories should not be modified except for their format and appropriate attributions should be given to the relevant NMSs;

(ii) When issued directly to the general public, warnings and advisories should be issued verbatim (either translated or in graphical presentation) as far as possible and always as soon as possible after receipt;

(iii) Warnings and advisories should not be broadcast after their expiration time;

(iv) The public should be urged to monitor their NMS information services for further information on local or regional weather conditions;

(v) Broadcast entities should be encouraged to regularly display or voice over attribution messages to the issuing NMS, thus supporting the role of NMSs and WMO in making weather information possible.

ANNEX XII

Annex to paragraph 12.4 of the general summary

TERMS OF REFERENCE FOR THE TASK TEAM TO EXAMINE AND ADVISE ON OPTIONS FOR RESTRUCTURING THE COMMISSION FOR BASIC SYSTEMS

Reporting

1. The Task Team shall report to the president of the Commission. The report of the Task Team is to be delivered to the extraordinary session of the Commission, scheduled for 1998, for consideration for adoption from that date.

Objectives and outcomes

2. The Task Team will make fully justified recommendations on the most effective working structure for the Commission having regard to:

(*a*) The terms of reference of the Commission;

(*b*) The work programme of the Commission;

(*c*) The requirement to ensure effective regional representation in all activities of the Commission;

(*d*) The need to optimize the use of available financial resources and expertise.

3. The Task Team will consider the:

(*a*) Role and composition of a group to advise the president of the Commission (CBS Advisory Working Group);

(*b*) Associated costs of the work structure options as well as the most efficient use of the available expertise;

(*c*) Other organizational arrangements required to ensure that the work programme of the Commission is properly addressed and that overlapping responsibilities between groups are kept to an absolute minimum;

(*d*) Priorities for tasks and any needs for resource re-allocation.

Process and consultation

4. The Task Team will take into account relevant documentation arising from the eleventh session of the Commission, relevant experience that will be gained over the next two years, and consult as widely as possible in the time available.

5. The Task Team is encouraged to use e-mail as extensively as possible in the consultation process.

Timeframe

6. The Task Team will submit an interim (draft) report to the president of the Commission by October 1997 and their final report three months prior to the 1998 extraordinary session of the Commission.

APPENDIX A

LIST OF PERSONS ATTENDING THE SESSION

A. Officers of the session

A. A. Vasiliev	President
S. Mildner	Vice-president

B. Representatives of WMO Members

Member	*Name*	*Capacity*
Algeria	A. Zehar	Principal delegate
Argentina	R. A. Sonzini	Principal delegate
	F. P. Requena	Delegate
Australia	G. B. Love	Principal delegate
Austria	H. Gmoser	Principal delegate
	K. Panosch	Delegate
Belgium	E. De Dycker	Principal delegate
	N. De Keyser (Ms)	Delegate
Botswana	D. F. Molotsi	Principal delegate
	J. K. Leepile	Delegate
Brazil	R. C. Senna	Principal delegate
	H. Hofer	Delegate
	W. Sandoval	Delegate
Brunei Darussalam	H. S. Haji Sirabaha	Principal delegate
	A. H. Haji Lamat	Delegate
Bulgaria	M. Popova (Ms)	Principal delegate
Burkina Faso	A. J. Garane	Principal delegate
Canada	H. Allard	Principal delegate
	A. Kellie	Delegate
China	Yan Hong	Principal delegate
	Zhang Guocai	Delegate
	Shi Peiliang	Delegate
Côte d'Ivoire	A. Kignaman-Soro	Principal delegate
Croatia	K. Pandzic	Principal delegate
Czech Rep.	E. Cervena (Ms)	Principal delegate
Denmark	N. J. Pedersen (28.10–2.11.96)	Principal delegate
	K. Jensen (3–7.11.96)	Principal delegate
Egypt	A. M. A. R. Ibrahim	Principal delegate
	A. M. Rebba	Alternate
	S. A. Ibrahim	Delegate
	M. A. Mahran	Delegate
	A. A. Hassan	Delegate
	A. A. M. Said	Delegate
	M S. A. Hammad	Delegate
	A. A. Amer	Delegate
	H. A. Talib	Delegate
	M. Abbas	Delegate
	S. Ragab	Delegate
Finland	J. Riissanen	Principal delegate
	K. Karlsson	Delegate
France	D. Lambergeon	Principal delegate
	J. P. Bourdette	Alternate
	F. Dutartre	Delegate
	D. Marbouty	Delegate
Germany	S. Mildner	Principal delegate
	G. Steinhorst	Delegate
	M. Engels	Delegate
Ghana	G. A. Wilson	Principal delegate
Greece	G. Sakellaridis	Principal delegate
Hong Kong	B. Y. Lee	Principal delegate
Hungary	K. Vissy	Principal delegate
	A. Takacs (Ms)	Alternate
Iceland	G. Hafsteinsson	Principal delegate
India	R. R. Kelkar	Principal delegate
Israel	A. Goldman	Principal delegate
Italy	G. De Florio	Principal delegate
Japan	K. Kashiwagi	Principal delegate
	H. Ono	Delegate
Jordan	A. D. Karien	Principal delegate
	A. Saleh	Delegate
Kenya	E. A. Mukolwe	Principal delegate
	I. K. Essendi	Alternate
Lebanon	A. P. Bejjani	Principal delegate
	I. Barakat-Diab	Alternate

Member	*Name*	*Capacity*
Lesotho	F. M. Tjabane (Ms)	Principal delegate
Libyan Arab Jamahiriya	A. Ramadan	Principal delegate
	M. J. Elghadi	Delegate
	Musa Ali Issa	Delegate
Macao	A. Viseu	Principal delegate
Malaysia	Wong Kiat Kong	Principal delegate
Malta	J. M. Mifsud	Principal delegate
Netherlands	S. Kruizinga	Principal delegate
	D. Van der Duyn Schouten	Delegate
New Zealand	N. D. Gordon	Principal delegate
Niger	I. Also	Principal delegate
	M. Saloum	Alternate
Nigeria	T. Obidike	Principal delegate
Norway	K. Bjørheim	Principal delegate
Oman	A. H. Al-Harthy	Principal delegate
	J. S. Al-Maskari	Delegate
Portugal	M. Almeida	Principal delegate
Qatar	R. G. Al-Kubaisi	Principal delegate
Republic of Korea	Lee Chun Woo	Principal delegate
Republic of Yemen	A. K. Hassen	Principal delegate
	M. N. Abdulla	Delegate
Romania	M. Ioana	Principal delegate
Russian Federation	V. N. Dyadyuchenko	Principal delegate
	A. A. Vasiliev	Alternate
	V. A. Antsypovich	Delegate
	L. Bezruk	Delegate
Senegal	S. Diallo	Principal delegate
Seychelles	F. Bijoux	Principal delegate
Slovakia	M. Ondras	Principal delegate
South Africa	K. E. Estié	Principal delegate
Spain	C. Torres	Principal delegate
Swaziland	S. P. Gumede	Principal delegate
Sweden	L. Moen	Principal delegate
	S. Nilsson	Delegate
Switzerland	P. Rauh	Principal delegate
	H. Müller	Delegate
Syrian Arab Republic	S. Jabbour	Principal delegate
	M. Souleiman	Alternate
	A. F. Najjar	Delegate
Thailand	S. Tansriratanawong	Principal delegate
	S. Agsorn	Delegate
Tunisia	A. Ben Jemaa	Principal delegate
	B. Hadj Larbi Hosni	Delegate
Turkey	S. Demirkiram	Principal delegate
	N. Yaman	Delegate
Ukraine	N. F. Tokar (Ms)	Principal delegate
	V. Sepik	Delegate
United Arab Emirates	A. N. A. Akkeen	Principal delegate
	A. M. Al Dhanhani	Delegate
	K. A. Ahmed	Delegate
	H. S. Al Reyami	Delegate
United Kingdom of Great Britain and Northern Ireland	C. R. Flood	Principal delegate
	S. J. Caughey	Delegate
	W. A. McIlveen	Delegate
	M. J. Atkins (Ms)	Delegate
	J. R. Eyre	Delegate
	S. J. Foreman	Delegate
United States of America	S. F. Zevin (Ms)	Principal delegate
	W. Telesetsky	Alternate
	W. J. Hussey	Delegate
	M. C. Yerg, Jr.	Delegate
	J. L. R. Fenix	Delegate
	C. H. Dey	Delegate
	F. S. Zbar	Delegate
Venezuela	F. C. Gonzalez Rodriguez	Principal delegate
	E. C. Colon (Ms)	Alternate
	J. Rangel	Delegate
Viet Nam	Tran Van Sap	Principal delegate

C. Representatives of Regional Associations

E. A. Mukolwe	RA I
K. Prasad	RA II
S. Pollonais	RA IV
R. Brook	RA V
M. Kurz	RA VI

D. Lecturers

L. Bengtsson
W. E. Brockman

E. Representatives of International Organizations

Organization	*Name*
United Nations Educational, Scientific and Cultural Organization (UNESCO)	T. Ezzat

Organization	*Name*
International Civil Aviation Organization (ICAO)	O. M. Turpeinen A. G. Koh
African Centre of Meteorological Applications for Development (ACMAD)	S. Jamoneau
Agency for Air Safety in Africa and Madagascar (ASECNA)	B. Aby M. Sissako
European Centre for Medium-Range Weather Forecasts (ECMWF)	M. Capaldo
European Organization for the Exploitation of Meteorological Satellites (EUMETSAT)	R. Wolf G. Bridge
League of Arab States (LAS)	N. A. Salem M. H. Doos

APPENDIX B

AGENDA

	Agenda item	*Documents*	*Resolutions and recommendations adopted*
1.	**OPENING OF THE SESSION**	PINK 1	
2.	**ORGANIZATION OF THE SESSION**	PINK 1	
2.1	Consideration of the report on credentials	PINK 5	
2.2	Adoption of the agenda	1; 2	
2.3	Establishment of committees		
2.4	Other organizational questions		
3.	**REPORT BY THE PRESIDENT OF THE COMMISSION**	22; PINK 3	
4.	**INTERNATIONAL EXCHANGE OF METEOROLOGICAL AND RELATED DATA AND PRODUCTS**	19; 27; PINK 2 PINK 16	Rec. 1
5.	**STATUS OF THE WORLD WEATHER WATCH IMPLEMENTATION AND OPERATION**	3; PINK 18	
6.	**WORLD WEATHER WATCH COMPONENTS AND SUPPORT FUNCTIONS, INCLUDING REPORTS BY THE CHAIRMEN OF WORKING GROUPS**		
6.1	Global Observing System (GOS)	18; PINK 14	Rec. 2
6.2	Global Telecommunication System (GTS)	23; 24; 28; 30; PINK 15	Rec. 3
6.3	Global Data-processing System (GDPS)	5; 6; 6, ADD. 1; 6, ADD. 2; 7; 8; 9; 21; 29 PINK 13; PINK 20	Recs. 4–6
6.4	World Weather Watch data management (DM)	10; 10, ADD. 1; 11 12; 20; 26; PINK 17	Rec. 7
6.5	WMO satellite activities	13; PINK 22	
6.6	Operational information service (OIS)	14; PINK 4	
7.	**PUBLIC WEATHER SERVICES (PWS) PROGRAMME**	15; PINK 12	
8.	**INTERPROGRAMME COORDINATION AND BASIC SYSTEMS SUPPORT TO OTHER PROGRAMMES**	17; PINK 8	
9.	**EDUCATION AND TRAINING RELATED TO THE COMMISSION'S ACTIVITIES**	16; PINK 9	
10.	**SCIENTIFIC LECTURES**	PINK 6	
11.	**LONG-TERM PLANS**	25; PINK 19	
12.	**THE COMMISSION'S WORK PROGRAMME; ESTABLISHMENT OF WORKING GROUPS AND RAPPORTEURS**	PINK 21	Res. 1–7
13.	**REVIEW OF PREVIOUS RESOLUTIONS AND RECOMMENDATIONS OF THE COMMISSION AND RELEVANT EXECUTIVE COUNCIL RESOLUTIONS**	4; PINK 10	Res. 8 Rec. 8
14.	**ELECTION OF OFFICERS**	PINK 7; PINK 11	
15.	**DATE AND PLACE OF THE NEXT SESSION**	PINK 23	
16.	**CLOSURE OF THE SESSION**	PINK 23	

APPENDIX C

LIST OF DOCUMENTS

Doc. No.	*Title*	*Agenda item*	*Submitted by*
	I. "DOC" series		
1	Provisional agenda	2.2	
2	Explanatory memorandum relating to the provisional agenda	2.2	
3	Status of the World Weather Watch implementation and operation	5	Secretary-General
4	Review of previous resolutions and recommendations of the Commission and relevant Executive Council resolutions	13	Secretary-General
5	Global Data-processing System (GDPS) Demonstration of the capabilities of RSMC Designation of Beijing as an RSMC with activity specialization on the provision of transport model products for environmental emergency repsonse	6.3	China
6	Global Data-processing System (GDPS) Report of the chairman of the Working Group on Data Processing ADD. 1 ADD. 2	6.3	Chairman, Working Group on Data Processing
7	Global Data-processing System (GDPS) Demonstration of the capabilities of Pretoria, South Africa, as a Regional Specialized Meteorological Centre (RSMC) with geographical specialization	6.3	Permanent Representative of South Africa with WMO
8	Global Data-processing System (GDPS) Demonstration of the capabilities of RSMC Demonstration of Tokyo as an RSMC with activity specialization on the provision of transport model products for environmental emergency response	6.3	Japan
9	Global Data-processing System (GDPS) Designated of Regional Specialized Meteorological Centres (RSMCs)	6.3	Secretary-General
10	World Weather Watch data management (DM) Data representation and codes ADD. 1	6.4	Secretary-General
11	World Weather Watch data management (DM) FM 92 GRIB edition 2	6.4	Chairman, Working Group on Data Management

Doc. No.	*Title*	*Agenda item*	*Submitted by*
12	World Weather Watch data management (DM) Report of the chairman of the Working Group on Data Management	6.4	Chairman, Working Group on Data Management
13	WMO satellite activities Report of the second session of the Working Group on Satellites	6.5	Chairman, Working Group on Satellites
14	Operational information service (OIS)	6.6	Secretary-General
15	Public Weather Services (PWS) Programme and products	7	Secretary-General
16	Education and training related to the Commission's activities	9	Secretary-General
17	Interprogramme coordination and basic systems support to other programmes	8	Secretary-General
18	Global Observing System (GOS)	6.1	Chairman, Working Group on Observations
19	International exchange of meteorological and related data and products	4	Secretary-General
20	World Weather Watch data management (DM) Monitoring of data quality	6.4	Secretary-General
21	Global Data-processing System (GDPS) Progress report of RSMC Nadi, Fiji	6.3	Fiji
22	Report of the president of the Commission	3	President of the Commission
23	Global Telecommunication System (GTS) Study of the possible use of SADIS for WWW data exchange	6.2	Secretary-General
24	Global Telecommunication System (GTS) New telecommunication services and networks	6.2	Chairman, Working Group on Telecommunications
25	Long-term plans	11	Secretary-General
26	World Weather Watch data management (DM) Meteorological data posted on the Internet	6.4	Secretary-General
27	International exchange of meteorological and related data and products	4	Secretary-General
28	Global Telecommunication System (GTS)	6.2	Chairman, Working Group on Telecommunications
29	Global Data-processing System (GDPS)	6.3	Russian Federation
30	Global Telecommunication System (GTS) Protection of meteorological radio spectrum	6.2	United States

Doc. No.	*Title*	*Agenda item*	*Submitted by*
	II. "PINK" series		
1	Opening of the session; organization of the session	1, 2	President of CBS
2	International exchange of meteorological and related data and products	4	Vice-president of CBS
3	Report of the president of the Commission	3	President of CBS
4	Operational information service (OIS)	6.6	Chairman, Working Committee
5	Consideration of the report on credentials	2.1	Chairman, Credentials Committee
6	Scientific lectures	10	Vice-president of CBS
7	Election of officers Report of the Nomination Committee	14	Chairman, Nomination Committee
8	Interprogramme coordination and basic systems support to other programmes	8	Chairman,Working Committee
9	Education and training related to the Commission's activities	9	Chairman, Working Committee
10	Review of previous resolutions and recommendations of the Commission and relevant Executive Council resolutions	13	Côte d'Ivoire
11	Election of officers	14	President of CBS
12	Public Weather Services (PWS) Programme and products	7	Chairman, Working Committee
13	Global Data-processing System (GDPS)	6.3	Chairman, Working Committee
14	Global Observing System (GOS)	6.1	Chairman, Working Committee
15	Global Telecommunication System (GTS)	6.2	Chairman, Working Committee
16	International exchange of meteorological and related data and products	4	Chairman, Working Committee
17	World Weather Watch data management (DM)	6.4	Chairman, Working Committee
18	Status of the World Weather Watch implementation and operation	5	Chairman, Committee of the Whole
19	Long-term plans	11	Vice-president of CBS
20	Global Data-processing System (GDPS)	6.3	Chairman, Working Committee

Doc. No.	*Title*	*Agenda item*	*Submitted by*
21	The Commission's work programme; establishment of working groups and rapporteurs	12	Vice-president of CBS
22	WMO satellite activities	6.5	Chairman, Working Committee
23	Date and place of the next session	15, 16	President of CBS
	Closure of the session		