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**COMMISSION
FOR MARINE METEOROLOGY**

ABRIDGED FINAL REPORT

OF THE

ELEVENTH SESSION

Lisbon, 19–30 April 1993



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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 Marine Meteorology was opened by the president of the Commission, Mr R. Shearman (United Kingdom), at 14.30 on 19 April 1993 in the Hotel Estoril Sol, Cascais, near Lisbon, Portugal.

1.2 On behalf of the World Meteorological Organization, Professor G.O.P. Obasi, Secretary-General, welcomed delegates to the eleventh session of the Commission for Marine Meteorology. He expressed his appreciation to the Government and people of Portugal, as well as to the Portuguese National Meteorological and Geophysical Institute, for having offered to host the session, and for the excellent facilities and support services which had been made available for the session and which would undoubtedly help to ensure its success. At the same time, he noted the pleasure of WMO at being able to hold a session of its Commission for Marine Meteorology in Portugal, in view of that country's long and distinguished maritime history.

1.3 In noting that the importance of marine meteorology globally had continued to increase significantly over the past decade, Professor Obasi stressed that a primary concern of WMO and of national Meteorological Services continued to be the provision of high quality and timely meteorological services in support of the safety of life and property at sea. This concern was manifested in a very concrete way in the new WMO Marine Broadcast System for the Global Maritime Distress and Safety System (GMDSS) of the International Maritime Organization (IMO), which had been implemented as from 1 February 1992 in accordance with the requirements of the GMDSS and which now ensured the availability of at least a minimum of basic safety-related meteorological information, broadcast via satellite, for all the world's oceans. The efforts of CMM and Members concerned in developing and implementing this new system were highly appreciated by WMO as well as by the marine user community.

1.4 In addition to its work in support of maritime safety, Professor Obasi noted that CMM had a major continuing role to play in assisting in the further development, co-ordination and implementation of a variety of specialized marine meteorological and oceanographic services, and also in maintaining and improving various types of marine observing systems for the provision of high quality meteorological and oceanographic data in support of services as well as for use in global climate studies. As an example of an important new specialized service, Professor Obasi cited the proposed new Marine Pollution Incident Support System being developed by CMM, which would be designed to ensure the reliable and timely provision of meteorological and oceanographic

services required by major marine pollution emergency response operations on the high seas. With regard to marine observing systems, the Secretary-General made reference, in particular, to the continuing importance of the ships of the voluntary observing ships scheme, the data from which continued to be invaluable for basic meteorological forecasting and the provision of services, and were increasingly important to air-sea interaction and global climate studies.

1.5 Professor Obasi then referred to the United Nations Conference on Environment and Development (Brazil, June 1992) and, in particular, to the ocean-related follow-up actions specified in Chapter 17 of Agenda 21. He stressed the challenge and the opportunity provided by Agenda 21 and the conventions adopted in Rio de Janeiro, in particular for substantially improving global environmental monitoring and assessment systems in support of sound environmental management and of sustainable development. The Global Ocean Observing System (GOOS), initiated by the Intergovernmental Oceanographic Commission (IOC) of UNESCO, represented an important follow-up response to a number of ocean-related aspects of Agenda 21, to which WMO was now also fully committed. The Commission for Marine Meteorology, as the principal technical advisory body of WMO on marine-related matters, must co-ordinate WMO input to GOOS development, as well as assist in mobilizing the necessary national support. In doing so, the Commission would also greatly assist national Meteorological Services in developing and expanding their own marine observing, data management and services activities. The Secretary-General also shared with the Commission his thoughts regarding certain issues affecting WMO and which were within CMM's area of responsibility. These issues included the participation of developing countries in WMO activities, commercialization, and co-ordination among various WMO bodies, including technical commissions. He asked the session to deliberate on these issues in particular as a part of its consideration of the Fourth WMO Long-term Plan.

1.6 In concluding, the Secretary-General assured the session of the full support of the WMO Secretariat in its work and wished it every success in its deliberations. He paid a special tribute to the officers and members of the Commission for their major achievements during the past inter-sessional period and finally wished delegates a very enjoyable stay in Lisbon.

1.7 On behalf of the National Meteorological and Geophysical Institute of Portugal, the Permanent Representative of Portugal with WMO, Dr J. Cristina welcomed delegates to Portugal and to the town of Cascais, and indicated his pleasure in being able to host

the eleventh session of CMM. Dr Cristina also welcomed particularly the presence of the Secretary-General of WMO, Professor Obasi, at the opening of the session. Dr Cristina then noted the importance of marine meteorological and oceanographic observations to the World Climate Programme, and in particular to the Global Climate Observing System (GCOS) and to the GOOS, and underlined the important role which national Meteorological Services had to play in maintaining systematic ocean monitoring programmes to provide these observations. The Commission, in turn, should assist and guide Members in this work. Finally, Dr Cristina noted the efforts that his Institute was making to assist several developing countries in Africa to expand their meteorological capabilities within the framework of WMO's overall programme structure.

1.8 On behalf of the Government of Portugal, the Minister of the Environment and Natural Resources, Professor C. Borrego, welcomed delegates to Portugal. He noted that this session of the Commission for Marine Meteorology was being held at a time when Portugal was commemorating the fifth centenary of Portuguese discoveries of the world, achieved through the efforts and skill of its mariners, such as Vasco da Gama and Bartolomeu Dias. The voyages of these mariners were governed very much by meteorological conditions, but could nevertheless be planned, at least partially, on the basis of existing meteorological knowledge. Despite great advances in technology and understanding of meteorological processes in the ensuing centuries, the provision of meteorological services, and therefore the work of CMM, remained of vital importance to the safety of the maritime community.

1.9 Professor Borrego then stressed the importance of the UN Conference on Environment and Development (UNCED), which had underlined the concept of a fully interdependent world environment, and of the important role which the oceans played in this environment. In this context, the work of WMO, and its CMM, in co-operation with other organizations such as IOC and the United Nations Environment Programme (UNEP), in systematic monitoring of the environment and in providing sound scientific advice on aspects of global and climate change, was of vital importance to Governments in their work for sound environmental management and sustainable development. Professor Borrego noted that it was now essential to implement the results of UNCED, and indicated that Portugal was already taking actions towards such implementation, including initiation of marine observing programmes, especially in the coastal zone, contributions to the WWW of WMO, and assistance to Portuguese speaking African countries.

1.10 Professor Borrego finally emphasized once more the important role of CMM in support of maritime safety and in systematic ocean monitoring. He concluded by wishing delegates a successful session and an enjoyable stay in Portugal.

1.11 Following a recommendation of the 1991 Meeting of the Presidents of Technical Commissions

concerning the formal recognition of outstanding services by individuals to the activities of specific technical commissions, certificates of outstanding service to CMM were awarded to:

- (a) Captain Gordon V. Mackie (United Kingdom), in recognition of his outstanding leadership in the provision of meteorological services to the mariner, including in particular the preparation and implementation of the new global WMO marine broadcast system, his invaluable liaison work on behalf of WMO with IMO and INMARSAT and his substantial contributions during three sessions of the Commission;
- (b) Dr Glen Hamilton (United States), in recognition of his outstanding service in the development, standardization and implementation of automated marine data acquisition systems and his substantial and valuable contributions to the Commission and to Members in the preparation of a large number of high-quality technical reports on marine data acquisition and processing systems.

The certificates were presented by the Secretary-General and by the president of the Commission.

1.12 There were 89 participants in the session. These included representatives of 43 Members of WMO and of seven 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)

At the first plenary meeting, the representative of the Secretary-General presented a brief report on delegations whose credentials had been found valid. This was accepted as the first report on credentials. Reports on credentials were submitted to subsequent plenary meetings and were accepted by the Commission. It was decided not to set up a Credentials Committee.

2.2 ADOPTION OF THE AGENDA (agenda item 2.2)

The provisional agenda was adopted without amendments at the first plenary meeting on the understanding that, at any time during the session, additions or alterations could be made. The agenda finally adopted is reproduced as Appendix B to this report.

2.3 ESTABLISHMENT OF COMMITTEES (agenda item 2.3)

WORKING COMMITTEES

2.3.1 Two working committees were established to deal with specific agenda items:

- (a) Committee A to deal with agenda items 5, 7, 8 and the relevant parts of 4, 9, 10 and 16. Mr R. Landis (USA) was elected chairman and Dr J.T. Lim (Malaysia), vice-chairman;
- (b) Committee B to deal with agenda item 6 and the relevant parts of 4, 9, 10 and 16. Mr J. Guddal (Norway) was elected chairman and Mr S. Ragoonaden (Mauritius), vice-chairman.

The session decided to deal with agenda items 11, 12, 13 and 14 as a Committee of the Whole chaired by the president of the Commission.

CO-ORDINATION COMMITTEE

2.3.2 In accordance with Regulation 28 of the WMO General Regulations, a Co-ordination Committee was established consisting of the president, the vice-president, the chairmen of the working committees and the Secretary-General's representative.

NOMINATIONS COMMITTEE

2.3.3 To facilitate the election of the officers of the Commission, and the appointment of the chairmen of working groups and sub-groups, a Nominations Committee was established consisting of the principal delegates of Australia, Canada, Chile, China, Portugal and the United Republic of Tanzania.

2.4 OTHER ORGANIZATIONAL MATTERS (agenda item 2.4)

Under this item, the Commission decided on its working hours for the duration of the session. It was agreed that, in accordance with the WMO General Regulations, no minutes of the session would be prepared, but that statements by delegations might be reproduced and distributed as and when requested, in accordance with Regulation 112. A full list of documents presented at the session is contained in Appendix C to this report

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

3.1 In his report, Mr R. Shearman, president of CMM, gave a brief account of the activities of the Commission since its tenth session. Over the previous four years the Commission membership had grown. It comprised 166 members from 94 Members of WMO at the time of CMM-XI and 192 members from 101 Members as of September 1992. The tenth session had established five working groups and a variety of substantive activities had been undertaken, both within WMO and elsewhere, in co-ordination with related organizations and programmes, in the areas of marine meteorological services, marine telecommunications, marine observing systems, marine climatology, sea ice, the WMO wave programme and specific technical problems. With regard to the coming inter-session period, Mr Shearman indicated that the Commission would have to look once again very carefully at its work priorities and internal organization in order to ensure that maximum benefits were achieved for Members within the increasingly limited budgetary resources. In this context, the president noted that the future work programme and Commission structure would have to ensure that the new WMO marine broadcast system under the GMDSS, and the new marine pollution incident support system were both fully implemented and operated effectively; that Members would be provided with appropriate guidance and assistance in the provision of specialized marine meteorological and oceanographic services including

wave and sea-ice services; that the marine climatological and oceanographic database would be maintained and strengthened in support of the WWW, marine services and the WCP; that marine observing systems would be expanded and upgraded using the most recent technological developments including satellites, and that the recommendations of the VOS Special Observing Project-North America (VSOP-NA) were implemented as widely as possible; that enhanced specialized education and training and implementation support be provided for developing countries; and that co-operation and co-ordination with related organizations, including in particular IOC, in these activities would be further expanded.

3.2 Mr Shearman then noted that the close co-operation which already existed between CMM, other technical commissions and international organizations such as IOC (UNESCO), IMO, the International Hydrographic Organization (IHO) and the International Maritime Satellite Organization (INMARSAT) had contributed greatly to the implementation of ocean-related programmes. The president thanked all members of CMM, particularly the vice-president, the chairmen, and members of working groups and rapporteurs, for their major contributions to the work of the Commission over the previous four years. Finally, he expressed his appreciation to the Secretary-General and his staff in the WWW Department for their valuable assistance during the past inter-session period.

3.3 The Commission expressed its satisfaction and appreciation for the report of the president of CMM and the activities of the Commission since its tenth session and paid a special tribute to the president for his leadership during the past four years. During the general discussion of the presidential report and the reports by the chairmen of working groups which followed, many comments and suggestions were made by delegates. Some of the subjects which were given particular attention by the Commission are described in the following paragraphs.

3.4 The Commission recognized that major changes had taken place globally during the past inter-session period, including in particular substantially increased public concern for the quality of the environment and for the effects of global and climate change. These concerns could only be properly addressed on the basis of data obtained through long-term systematic monitoring of the environment, including the oceans and marine atmosphere. In this context, CMM had an increasingly important role to play in enhancing aspects of this monitoring and in ensuring that the data obtained were of the highest possible quality and were made generally available and retrievable. At the same time, the Commission must also look at new ways of making use of modern technology to provide data and information available to users in the most efficient and cost-effective way, both in real-time to operational users on ships at sea and also in non-real-time in support of global climate studies.

3.5 In this context, the Commission also agreed that the meteorological and oceanographic data obtained by the fleet of oceanographic vessels operated by the Japan

Meteorological Agency in the Western Pacific were essential for both operational and research purposes. While noting that such vessels were expensive to maintain and operate, the Commission nevertheless strongly encouraged Members to continue such operations and, if possible, even expand these operations in view of the ever increasing value of the oceanographic and marine meteorological data they provided.

3.6 The Commission agreed that the potential contributions by developing countries to marine monitoring and the provision of marine services were not being fully realized, and that major efforts were required to encourage and expand such contributions for the benefit of the countries themselves, as well as of the global marine community. In this context, it applauded the study and co-ordination mission undertaken by the president and vice-president of CMM during the past inter-sessional period to countries in South-East Asia. The Commission strongly encouraged the implementation of similar missions to other regions or sub-regions in the future, as budgetary resources allowed, in view of the stimulus which such missions provided to the countries concerned, as well as the information gathered and recommendations resulting from the missions.

3.7 The Commission noted with satisfaction the high level of co-operation that existed between WMO and other international marine-related organizations, most particularly IMO and IOC. It expressed its sincere appreciation to the representatives of these two Organizations for their very supportive statements concerning co-operation with WMO, in general, and CMM, in particular. The Commission strongly underlined the increasing importance of such co-operation, in view of the need to best serve the requirements of the marine user community for data and services in the most cost-effective way, in a situation of stable or decreasing budgetary resources.

3.8 The Commission expressed the belief that there was a need to re-establish the CMM Advisory Working Group which would continue to assist the president of the Commission in the co-ordination and direction of the work of its working groups and rapporteurs, in the monitoring of the implementation of the Third WMO Long-term Plan and the preparation of the Fourth WMO Long-term Plan, and in furthering co-operation with other WMO bodies and with international organizations such as IOC. Specific action taken in this regard is recorded under agenda item 15.

3.9 The Commission considered the future work programme in the light of the general policy guidance and priority activities outlined by Eleventh Congress and the specific objectives and tasks for the WMO Marine Meteorology and Associated Oceanographic Activities Programme, as detailed in the Third WMO Long-term Plan. It adopted the work programme proposed for CMM for 1993-1997 (see Annex I).

4. REPORTS BY THE CHAIRMEN OF WORKING GROUPS AND BY RAPPORTEURS (agenda item 4)

The Commission noted the reports of the chairmen of the working groups and expressed its

appreciation for their excellent work and for the time and effort spent in carrying out their tasks. These reports are discussed in detail under the relevant agenda items.

5. MARINE METEOROLOGICAL SERVICES (agenda item 5)

5.1 BASIC MARINE METEOROLOGICAL SERVICES (agenda item 5.1)

5.1.1 The Commission considered the report submitted by Mr R. Landis (USA), chairman of the Working Group on Basic Marine Meteorological Services, as well as the reports by Captain G. Mackie (United Kingdom), chairman of the Sub-group of Experts on Marine Observations and Telecommunications and by Dr D. O'Neill (Canada), chairman of the Sub-group of Experts on Warning and Forecast Preparation. It expressed its appreciation to the chairmen and to their respective working groups for the excellent work accomplished during the inter-sessional period. Discussion on various items addressed by these groups is recorded in subsequent paragraphs and also under the relevant agenda items.

MARINE METEOROLOGICAL SERVICES MONITORING PROGRAMME

5.1.2 The Commission recalled that it had initiated development of a marine meteorological services monitoring programme at its eighth session (Hamburg, September 1981), as a means of obtaining feedback from the users on the quality, timeliness and value of these services, with a view to effecting continuing improvements in support of user requirements. The outline of a monitoring programme was adopted by CMM-IX (Geneva, October 1984) and subsequently distributed to Members for action. CMM-X (Paris, February 1989) requested the Sub-group of Experts on Warning and Forecast Preparation to evaluate the results of monitoring of marine meteorological services and advise on development of services.

5.1.3 In this context, the Commission noted with interest the comprehensive report of the sub-group on this subject. This report had been compiled by Mr G. Kassimidis (Greece), on behalf of the sub-group, on the basis of summary responses from 21 Members, which had in turn been prepared from 1 625 individual questionnaires completed by ships' masters. The Commission expressed its appreciation to the Members concerned, to the ships' masters and to Mr Kassimidis and the chairman of the sub-group, Dr D. O'Neill (Canada), for their efforts in preparing this excellent and very valuable report.

5.1.4 The Commission noted and agreed with the main conclusions of the report, namely:

- (a) High quality, reliable and readily accessible marine meteorological services continued to be of great importance to mariners;
- (b) Charts and other pictorial information, transmitted to ships at sea by facsimile, were highly regarded by mariners and should be continued;
- (c) The response of users to existing services was generally favourable, although there was evident room for

improvement in certain geographical areas as well as in aspects of service delivery;

- (d) The priority which CMM gave to marine meteorological services, as well as to the communications and related systems for their preparation and delivery was fully justified by user responses to these services;
- (e) The monitoring of marine meteorological services was a very useful diagnostic tool for improving the quality and value of these services, which was also appreciated by the users, and should be continued on a systematic basis.

5.1.5 As a direct follow-up to these conclusions and to the recommendations made by the sub-group, the Commission agreed on the need to implement and maintain a systematic long-term global marine meteorological services monitoring programme, based on the questionnaire and response summary format developed by the Sub-group of Experts on Warning and Forecast Preparation. It further agreed that the monitoring should be undertaken by Members on a four-year basis, co-ordinated by the Secretariat which should also compile and summarize the monitoring results and distribute these to Members for follow-up action. Recommendation 1 (CMM-XI) on this subject was therefore adopted. In doing so, the Commission urged the Secretariat to ensure that the monitoring results were distributed as quickly as possible, and encouraged Members to make these results available to marine forecasters, to Port Meteorological Officers (PMOs), and also to users, as appropriate.

5.1.6 The Commission invited Members to carefully review the results of the survey already undertaken by the sub-group, including the detailed criticisms and suggestions made by users, and to take appropriate measures to correct those identified deficiencies in marine meteorological services within their respective areas of concern. An annex to the sub-group report containing a geographic breakdown of user responses is available, upon request, from the WMO Secretariat. Finally, in view of the value placed by mariners on chart and other pictorial information presently transmitted by facsimile, the Commission requested the Working Group on Marine Meteorological Services to investigate means for ensuring that such information continued to be made available to users after the final change-over to broadcasts via satellite. In this regard, it noted with interest the development work undertaken by France on a system for transmission of such information through INMARSAT-C, and requested that details of this system should be made available to the working group, when appropriate.

REGIONAL RAPPORTEURS' REPORTS

5.1.7 The Commission considered the reports submitted by the regional rapporteurs and expressed its appreciation for their contribution to the work of the Commission. It agreed that many of the topics raised in the reports would be considered under the relevant agenda items. However, it noted that some of them were common and appeared in all or most of the reports. These included, in particular, the provisions made for the

implementation of the telecommunication arrangements through the International SafetyNET service under the GMDSS, the requirements for the enhancement of the PMO network, the need for specialized training in the field of marine meteorology, and the requirement for effective support measures in cases of marine pollution emergency response operations.

ENHANCEMENT OF MARINE OBSERVING SYSTEMS AND MARINE OBSERVATIONS IN THE SOUTHERN HEMISPHERE

5.1.8 The Commission noted with interest and appreciation the comprehensive report presented by Mr A. Moran (Uruguay), prepared at the request of the Advisory Working Group, which summarized problems with marine observing systems and the provision of marine services in the southern hemisphere, and made a number of substantive recommendations to address these problems. This report had been compiled on the basis of a survey of Members in the southern hemisphere, to which a large number of responses had been received.

5.1.9 The Commission agreed that the recommendations made by Mr Moran were both valuable and practical. However, since the report had become available only just prior to the session, and therefore had not yet been studied in detail by many delegates, the Commission considered that it could not take action as yet on the recommendations. It therefore referred the report to the Working Group on Marine Meteorological Services for further consideration, and requested the working group to prepare a specific plan of action for implementing the recommendations, as appropriate. In doing so, the Commission noted with appreciation, and accepted, the offer of INMARSAT to assist the working group in its study. It also agreed that certain of the recommendations should be referred to IGOSS and the Drifting Buoy Co-operation Panel for further action, and requested the Secretariat to undertake this referral.

STORM SURGES

5.1.10 The Commission noted that a comprehensive report on storm surge analysis and forecasting was now being prepared and would be published shortly by WMO. This report would comprise separate reports on tropical and extratropical storm surges, prepared respectively by members of the Sub-group of Experts on Warning and Forecast Preparation, Dr H. Nakamura (Japan) and Mr W. Seifert (Germany), together with a consolidated analysis of all types of surges prepared by Dr V. Ryabinin, the former RA II Rapporteur on Marine Meteorological Services. The Commission expressed its considerable appreciation to these authors for their efforts, and considered that this comprehensive report would provide very valuable guidance for many maritime Members. With regard to future activities on storm surges, including co-operation with IOC, the Commission agreed to consider this under item 5.4, in relation to the revised WMO wave programme.

MARINE POLLUTION EMERGENCY RESPONSE SUPPORT SYSTEM (MPERSS)

5.1.11 The Commission recalled that, at its tenth session (Paris, February 1989), it had recommended the

development of a new WMO system to provide internationally co-ordinated meteorological support to marine pollution emergency response operations, and had requested its Working Group on Basic Marine Meteorological Services to undertake such development. In this context, the Commission noted with appreciation that a first draft of a new WMO Marine Pollution Emergency Response Support System (MPERSS) had been prepared in early 1992 by two experts, Captain G. Mackie (United Kingdom) and Dr S. Ovsienko (Russia), on behalf of the working group, and subsequently reviewed extensively by the full working group, which had largely supported the proposed system. The draft MPERSS was then revised by the Secretariat on the basis of comments provided by working group members, for presentation to the session.

5.1.12 In discussing the draft MPERSS, the Commission noted that it took into account, and used the same ocean areas as the new WMO GMDSS Marine Broadcast System (see agenda item 5.3), but was conceptually and functionally different. Specifically, the MPERSS did not require routine broadcasts of meteorological information to users on the high seas, but simply that designated Members should be prepared to provide, at a short notice, specific meteorological/oceanographic information, to pre-designated authorities, relevant to limited ocean areas within their overall areas of responsibility and for a limited period of time. Two levels of information flow would be required under the MPERSS: non-operational information exchange, to establish communication links and appropriate action plans involving both designated Members and relevant marine pollution emergency response operations authorities; and operational information exchange, involving requests for assistance from these authorities and the provision of the agreed meteorological support.

5.1.13 The Commission appreciated that the number of future marine pollution incidents requiring activation of the new system (those which occurred in international waters, but sufficiently close to shore so as to threaten coastlines and therefore justify emergency response operations) was likely to be small. Nevertheless, it agreed that the potential impacts of such incidents were very serious, and response operations certainly required the best possible meteorological support to be made rapidly and effectively available to the relevant authorities. The Commission therefore agreed that the draft new MPERSS should be implemented on a trial basis and adopted Recommendation 2 (CMM-XI) to this effect. In doing so, the Commission expressed its appreciation to those Members which might accept provisional responsibilities under the new system. It agreed that much further work remained to be done in the development of the proposed new system, including the preparation of appropriate guidance material for Members in the provision of MPERSS services, and entrusted the supervision of this work to its Working Group on Marine Meteorological Services, working in close co-ordination with other relevant international organizations including, in particular, IOC, UNEP and IMO.

5.1.14 The representative of the Intergovernmental Oceanographic Commission indicated that his organization had an interest in the establishment of the proposed system and was willing to contribute to it, within the fields falling under its competence. IOC would even consider co-sponsoring this activity, if so desired. In particular, IOC could certainly provide some information regarding paragraph 2.4 of the proposed system on monitoring programmes as well as the identification of sensitive (vulnerable) areas, if requested to do so. It was noted that:

- (a) In the context of the GIPME Programme, IOC had encouraged the acquisition of data on the physical oceanographic factors that affected the transport and distribution of pollutants in various regions where IOC was a sponsor or co-sponsor or an associate of regional pollution monitoring programmes within the MARPOLMON system;
- (b) In many regions, IOC had sponsored/co-sponsored the construction of hydrodynamic models that would afford adequate predictive tools for the movement and deposition of pollutants in the cases of accidental toxic chemical (including oil) spills in the marine environment.

If required, IOC could provide the area co-ordinators in this scheme with the necessary contacts in various regions/countries which could make such data and models available to them. As for the future, the IOC representative noted that the GOOS modules on the health of the oceans and, possibly also the coastal zone, once developed, could contribute to the WMO system. He reiterated that IOC certainly wished to maintain close liaison with the proposed system and would be willing to consider co-sponsorship.

5.1.15 The Commission expressed its appreciation to the representative of IOC for his offer and agreed that the support of IOC in the development, implementation and maintenance of the MPERSS would be very valuable. It therefore accepted the offer of co-operation and requested the Secretary-General to ensure that the proper procedures were implemented in order for this co-operation to be fully effective.

5.2 SPECIALIZED MARINE METEOROLOGICAL SERVICES (agenda item 5.2)

5.2.1 The Commission noted with interest and appreciation the report of the chairman of the Working Group on Specialized Marine Meteorological Services, Mr D. Linforth (Australia). Discussion on various items addressed by this group, and also on some other items, was recorded in subsequent paragraphs. Discussions on the work of the Sub-group on Marine Climatology are recorded under agenda item 7.

5.2.2 The Commission noted with concern that it had not been possible to fully address a number of different types of specialized services during the past inter-session period because of difficulties in identifying suitable expert rapporteurs on these topics. Such services included those for fisheries, ship routing and coastal marine services. The Commission nevertheless agreed that these remained topics of considerable importance to

many Members, and decided that every effort should be made to prepare appropriate guidance material during the coming inter-sessional period. It therefore referred these topics to the Working Group on Marine Meteorological Services for further consideration.

COST BENEFIT STUDIES OF MARINE METEOROLOGICAL SERVICES

5.2.3 The Commission recalled that it had charged the Sub-group of Experts on Warning and Forecast Preparation with, *inter alia*, preparing an analysis of the costs and benefits of marine meteorological services to the marine user community, in particular with reference to developing countries. In this regard, the Commission noted with interest and appreciation the report of the sub-group, which took the form of a preliminary survey of cost benefit studies of marine weather and oceanographic services. This report provided some qualitative examples of benefits from such services, which demonstrated that the benefits generally far outweighed the costs of the services.

5.2.4 The Commission considered that more quantitative studies of this type would have considerable potential value in assisting Governments to make decisions with regard to developing and expanding their marine meteorological and oceanographic services. At the same time, the Commission noted that the Joint IOC/WMO Committee for IGOSS had, in 1991, appointed two rapporteurs, from Canada and the Russian Federation, on this subject, and had been requested to work closely with the relevant CMM experts in the development of quantitative analyses of the costs and benefits of oceanographic services. The Commission therefore instructed the Working Group on Marine Meteorological Services to collaborate with the IGOSS rapporteurs and with the Commission for Climatology in the continuation of this work and, at the same time, requested the Secretariat to investigate the possibilities for appointing an expert consultant to undertake specific studies in support of the rapporteurs, including in particular the preparation of a detailed questionnaire for use by CMM members and IGOSS National Representatives on cost-benefit studies. The Commission requested Members undertaking such studies to inform the Secretariat of the results. The Commission also suggested that the assistance of representative organizations for marine users, such as the E & P Forum, the Food and Agriculture Organization of the United Nations (FAO), and the International Chamber of Shipping (ICS) should be sought for this project.

PREDICTED CLIMATE TRENDS AND THEIR EFFECTS ON MARINE INDUSTRY

5.2.5 The Commission noted with interest a paper presented by the chairman of the Working Group on Technical Problems and the president of CMM, which outlined the concerns expressed by certain marine users, such as offshore oil producers and those involved in coastal construction and engineering, on the possible implications of global climate change for the marine climatological records on which marine engineering designs were based. The Commission agreed:

- (a) That these concerns might be very legitimate;
- (b) That it had access to, and in many cases special relations with, many of the concerned user groups and therefore was an appropriate body to liaise with users on the matter.

At the same time, however, doubts were expressed that CMM might not have access to the appropriate scientific expertise and information to address properly these concerns of marine users.

5.2.6 In the light of these considerations, the Commission therefore agreed that this issue should be further addressed during the coming inter-sessional period and referred it to the Working Group on Marine Meteorological Services to prepare appropriate guidance.

5.3 MARINE TELECOMMUNICATION ARRANGEMENTS FOR PRODUCT DISSEMINATION (agenda item 5.3)

5.3.1 The Commission recalled that, at its tenth session, it had recognized the need for the development of a new global system for the preparation and dissemination of meteorological forecasts and warnings for shipping on the high seas, to be in conformity with the telecommunications' provisions of the Global Maritime Distress and Safety System (GMDSS) of IMO. The GMDSS had been adopted in 1988 as amendments to the 1974 International Convention for the Safety of Life at Sea (SOLAS), for entry into force on 1 February 1992, with a seven-year transition period to full implementation on 1 February 1999. The tenth session of CMM had charged its Working Group on Basic Marine Meteorological Services with the preparation of a new WMO GMDSS marine broadcast system, noting that this new system should be approved for implementation on or before 1 February 1992.

5.3.2 Following preparatory work by its Sub-group of Experts on Marine Observations and Telecommunications, the Working Group on Basic Marine Meteorological Services had adopted a draft new system in September 1990. After extensive consultation and review by Members during the following 18 months, and with the agreement of Eleventh Congress, the draft new system was approved in January 1992 by the President of WMO for provisional implementation from 1 February 1992, as required by the GMDSS implementation plan. Subsequently, a WMO Workshop on the GMDSS, which included participation from Members with designated responsibilities under the new system as well as from other international organizations directly concerned (IMO, IHO, INMARSAT, ICS), was convened in Geneva in May 1992 to review progress in implementation and any specific difficulties encountered. This workshop slightly revised the new system and recommended it to CMM for inclusion in the *Manual on Marine Meteorological Services* (WMO-No. 558), to operate in parallel with the existing WMO marine broadcast system.

5.3.3 In reviewing the implementation status of the new system, the WMO Workshop on the GMDSS had recognized that there were delays in implementation in certain ocean areas, due largely to reasons beyond the control of the Members concerned, but which might

result in dangers to some ships in these areas through their inability to access relevant meteorological warning information. The workshop had therefore prepared a supplementary interim urgent meteorological warning information service for the GMDSS, to operate in these ocean areas only until the full new GMDSS system could be implemented. This interim urgent warning service had subsequently been approved by EC-XLIV and implemented immediately.

5.3.4 The Commission noted these developments with satisfaction and expressed its considerable appreciation to Captain G.V. Mackie, chairman of the Sub-group of Experts on Marine Observations and Telecommunications, to the Working Group on Basic Marine Meteorological Services, to the Members having accepted responsibilities under the new system and to those Members which had or were still operating the interim urgent warning service, for their major efforts in developing and implementing the new WMO GMDSS marine broadcast system in support of the safety of life and property at sea. The Commission also offered its thanks to IMO, IHO and INMARSAT for their co-operation and assistance in this work, which had contributed substantially to its successful completion.

5.3.5 The Commission once more reviewed and revised slightly the new system and agreed that it should be incorporated into the *Manual on Marine Meteorological Services*, to operate in parallel with the existing system until 1 February 1999, after which time the existing system, based on conventional terrestrial broadcast facilities, would no longer be mandatory. Recommendation 3 (CMM-XI) was adopted to this effect. The Commission noted that the operation of the new system should be kept under close review during this transition period, with the system being revised as necessary in the light of experience. The Commission requested its Working Group on Marine Meteorological Services to undertake this review and revision and to prepare a final revised version of the new system for its consideration at its twelfth session (tentatively scheduled for 1997).

5.3.6 In reviewing the new GMDSS broadcast system, the Commission recalled that such broadcasts operated through the International SafetyNET Service of INMARSAT, and were intended to provide meteorological coverage for sea areas outside those covered by NAVTEX broadcasts. In this context, it noted that overlapping of broadcast coverage might occur in certain ocean regions as NAVTEX coverage was gradually extended, particularly in areas such as the Mediterranean. In this case, the Commission reiterated that the NAVTEX broadcasts must take precedence as required under the SOLAS amendments for the GMDSS. It therefore urged Members concerned to co-ordinate closely in cases where such overlapping was likely to occur, and also in cases where overlapping occurred between adjacent NAVTEX broadcasts, so as to ensure that the regulations were respected and that non-conflicting advice was provided to mariners.

5.3.7 The Commission noted that the formal requirement on Governments to provide broadcasts of meteorological forecasts and warnings for shipping was

included in Chapter V of SOLAS, and that the actual signatories to SOLAS were normally national government agencies or authorities whose responsibilities included, *inter alia*, the safety of shipping. At the same time, the Commission recognized that the provision of meteorological broadcasts through the International SafetyNET Service under the new WMO GMDSS Marine Broadcast System incurred substantial costs for Members concerned. In view of the formal commitment to SOLAS on the part of other national agencies or authorities, the Commission therefore recommended to Members having responsibilities under the new WMO GMDSS Marine Broadcast System, where appropriate, to negotiate with their relevant national authorities with a view to agreeing on a possible sharing of their broadcast costs under the new system.

5.3.8 Finally, the Commission agreed that the effective operation of the new system, from the point of view of the user, required that broadcast of meteorological forecasts and warnings should be made according to an agreed and well-publicized broadcast schedule. It therefore requested the Secretariat to ensure that the GMDSS broadcast schedule, as well as the transmission schedule for the interim urgent warning service, which are given in Annex II to this report, be included in *Information for Shipping*, Volume D (WMO-No. 9), and other operational publications designed for use by mariners. It urged Members concerned to ensure that these schedules were kept up-to-date, but that changes to publicized broadcast times be made as infrequently as possible and notified well in advance.

5.4 WMO WAVE PROGRAMME (agenda item 5.4)

5.4.1 The Commission noted with interest the report of the chairman of the *Ad Hoc* Group on Wave Modelling, Dr A. Laing (New Zealand) and expressed its appreciation to Dr Laing and to all the members of his group for the excellent work already accomplished or ongoing with regard to the implementation of the WMO Wave Programme. The Commission noted in particular:

- (a) The publication of the *WMO Guide to Wave Analysis and Forecasting* (WMO-No. 702), also in French, Russian and Spanish;
- (b) The preparation of a second (revised) edition of the *Guide*, which was almost completed;
- (c) The publication of supplements No. 2 (1989) and No. 3 (1991) to *Marine Meteorology and Related Oceanographic Activities Report No. 12* (WMO Wave Programme);
- (d) The preparation of draft table entries for the Global Telecommunication System transmission of spectral wave data using BUFR (see also agenda item 6.7);
- (e) The preparation of a detailed proposal by the *ad hoc* group for expanding and re-focussing slightly the WMO Wave Programme.

5.4.2 The Commission stressed the continuing and increasing requirements for many Members to provide high quality sea wave data and wave analysis and forecast services to an expanding community. This community included, in addition to traditional users

such as shipping and offshore industry, applications also to coastal engineering, recreation, aquaculture, fisheries, pollution control, etc. In this context, the Commission reiterated its belief in the value of the WMO Wave Programme in assisting Members to develop and expand their wave-related services and noted with appreciation that many of the initial objectives set out for the programme when it was first adopted in 1984 had already been achieved.

5.4.3 At the same time, the Commission recognized an increasing need for Members also to provide a variety of other specialized, interdisciplinary services, based on a widening range of oceanographic and atmospheric variables in support of natural disaster prevention, hazard mitigation, environmental protection and national economic interests. It noted that this view had been fully supported by Members in their responses to the survey undertaken by the *Ad Hoc* Group on Wave Modelling, relating to a revision of the Wave Programme. The Commission therefore agreed on the need to expand somewhat the scope of the Wave Programme so as to encompass other variables and services that were normally derived from numerical models of boundary-layer wind fields, particularly in the coastal zone. At the same time, it also recognized the need to refocus the purely wave related aspects of the programme to give priority to those aspects of the original programme which were of greatest concern to Members, but which had not yet been fully addressed.

5.4.4 The Commission therefore adopted Recommendation 4 (CMM-XI) on this topic. It also agreed on the need to re-establish a sub-group charged generally with overseeing the implementation of the revised Wave Programme. Further action in this regard is taken under agenda item 15.

6. SYSTEMS AND TECHNIQUES FOR MARINE OBSERVATION AND DATA COLLECTION (agenda item 6)

6.1 OBSERVATIONAL DATA REQUIREMENTS (agenda item 6.1)

6.1.1 The Commission reviewed the WWW requirements for observational data, in particular data from the world's oceans, as specified in Part II, Volume I of the Third WMO Long-term Plan. It noted that the existing marine observing system, which included:

- (a) Approximately 7500 VOS, heavily concentrated in the North Atlantic and North Pacific;
- (b) Approximately 650 drifting buoys, of which only some 150 reported surface air pressure and 100 were located in the southern hemisphere oceans south of 20°S;
- (c) Twelve ASAP ships, 11 in the Atlantic and one in the North Pacific;
- (d) Around 300 moored buoys and fixed platforms, mostly in coastal waters in the northern hemisphere;

was far from satisfying these requirements, in particular in the southern hemisphere oceans. It agreed that major efforts were required to try to remedy these deficiencies, and some specific actions in this regard are recorded below under subsequent sub-items of agenda item 6.

6.1.2 The Commission also reviewed a consolidated list of WMO satellite data requirements, which had been prepared by the EC Panel of Experts on Satellites. This list had been prepared, *inter alia*, on the basis of inputs from the different technical commissions, and IOC where relevant, including the Advisory Working Group on behalf of CMM, and was eventually to be passed to the satellite operating agencies, for assistance in planning future satellite missions and for future implementation. The Commission noted a few small amendments and improvements which it felt could be made to this list, from the point of view of marine data requirements, and requested the Secretariat to convey these to the new Executive Council Panel/CBS Working Group on Satellites for its consideration.

6.1.3 The Commission recalled that it had reviewed in detail the Operational WWW Systems Evaluation-North Atlantic (OWSE-NA) at its tenth session, and in this context noted that the Composite Observing System for the North Atlantic (COSNA) had been developed as a natural follow-up to the OWSE-NA. The COSNA was managed by the Co-ordinating Group for COSNA (CGC), whose terms of reference included: to assess the performance of the COSNA; to conduct network design studies; and to recommend system changes. The CGC was now in the process of developing an action plan for the further development of the COSNA over the remainder of the decade.

6.1.4 The Commission agreed that the development of the COSNA, and the work of the CGC, has important implications for the development of marine observing systems generally, in particular through activities such as network design studies, the evaluation of new technologies, and the assessment of the cost-effectiveness of specific observing system components. It therefore requested the Working Group on Marine Observing Systems and the Advisory Working Group to maintain a close liaison with the CGC, with a view to eventually applying the results of these different activities to the improvement of marine observing systems in other ocean basins. In this context, the Commission also supported strongly the recommendation of the CGC for a study to be made of the possible implementation of an OWSE for the Indian Ocean.

6.1.5 The Commission recalled that it had reviewed WCRP (TOGA/WOCE) requirements for marine data at its tenth session, and noted that a number of specific activities had been taking place over the past four years in support of the WCRP through the different ocean-related bodies of WMO (or WMO/IOC). Such activities included the VSOP-NA (CMM), the new Argos GTS processing chain (DBCP), and the Global Temperature Salinity Pilot Project (IGOSS/IODE). The Commission requested the Advisory Working Group and the Working Group on Marine Observing Systems to continue their liaison with the WCRP on its marine data requirements, and to propose and implement projects to support these requirements, as appropriate.

6.1.6 With regard to GCOS and GOOS, the Commission noted that these had not yet developed sufficiently to be able to specify marine observational data

requirements in detail. However, such requirements were likely to emerge over the next two or three years, and the Commission therefore requested the Advisory Working Group and the Working Group on Marine Observing Systems to liaise closely with the relevant bodies dealing with GCOS/GOOS, with a view to determining how CMM might assist to satisfy these requirements as they developed.

6.1.7 The Commission then debated on the desirability and feasibility of developing a detailed global set of specific requirements for marine observational data to support the provision of marine meteorological services. It noted that such requirements must necessarily be related to those of the WWW generally, and at the same time might vary substantially depending on the type of service, user group or geographical region concerned.

6.1.8 As requested by the 1992 Meeting of the Presidents of Technical Commissions (Geneva, November 1992), the Commission reviewed the Statement of Operational Accuracy Requirements of Level II Data According to FM 12, 13, 15, 16 Codes, which was prepared at the request of CIMO by a group of experts representing all WMO technical commissions. The Commission agreed that this statement served well to promote the standardization of techniques and methods of observation at a time when observing techniques were rapidly evolving. The statement is given in Annex III to this report.

6.1.9 The Commission agreed that the statement should be kept under review by CMM, specifically in those aspects concerning marine observations, and therefore requested its Working Group on Marine Observing Systems to undertake this task.

6.1.10 In adopting the Statement of Operational Accuracy Requirements, the Commission requested further that the working group:

- (a) Provide guidance in accuracy requirements for the appropriate variables contained in reports of surface observations from sea stations, including automatic stations;
- (b) Use the statement as a model for stating new or revised accuracy requirements for meteorological variables for particular applications.

6.2 THE WMO VOLUNTARY OBSERVING SHIPS (VOS) SCHEME (agenda item 6.2)

6.2.1 The Commission noted that the ships of the WMO Voluntary Observing Ships (VOS) scheme had traditionally been the primary source of surface meteorological and oceanographic data from the world's oceans in support of the Global Observing System (GOS) of the World Weather Watch (WWW) and of marine meteorological services. It agreed that the importance of VOS data was, if anything, increasing at the present time and the VOS would continue to be a key component of the Global Observing System of the WWW, of the Global Climate Observing System (GCOS) and of the Global Ocean Observing System (GOOS). VOS data, in particular, were regarded as essential to the ocean monitoring required as part of the global climate programmes. At the

same time, however, more stringent requirements were being placed on the VOS in terms of data quality, timeliness and availability from all ocean areas.

6.2.2 The Commission acknowledged that there was, at present, little likelihood of substantially increasing the total numbers of VOS, for a variety of reasons, although the geographical coverage might still be improved through selective recruiting of ships sailing in certain ocean areas. The Commission therefore once again urged Members to make every effort to recruit additional VOS, in particular in known data-sparse ocean areas. At the same time, it agreed that the quality and availability of ships' reports were at least of equal importance to quantity, in terms of their value to both operations and research. In this context, the Commission addressed under this agenda item a number of topics related to the quality of meteorological and oceanographic reports from the VOS. Questions concerning the operational availability of these reports are considered under agenda item 6.6.

6.2.3 The Commission recalled that CBS-IX (Geneva, January/February 1988) had established procedures for monitoring the quality of real-time data on the GTS. RSMC Bracknell (United Kingdom) had been nominated lead centre for monitoring marine surface data, specifically for surface atmospheric pressure. This monitoring allowed for the identification of platforms (including ships and buoys) with consistently poor quality observations.

6.2.4 The Commission noted with appreciation that a comprehensive report, giving full results of the monitoring and details of ships identified as having consistently poor quality pressure observations, was prepared on a monthly basis by the United Kingdom Meteorological Office and distributed both by them and by the Secretariat (on a six-month basis) to those countries having recruited ships identified in the report. Secretariat distribution was to national Port Meteorological Officer focal points. The objective of the exercise was to enable appropriate remedial action to be taken to correct the source of the identified error. The Commission noted with satisfaction that, to date, these procedures had resulted in identifiable improvements in the quality of VOS surface pressure reports, and it therefore urged Members concerned to make every effort to follow-up the results of this real-time monitoring programme, in the interests of meteorological operations, of marine services, and of global climate studies.

6.2.5 The Commission noted with interest that the automation of shipboard observations and data transmissions was a subject which had been dealt with by the Sub-group of Experts on Marine Observations and Telecommunications during the inter-sessional period. The Commission reaffirmed its opinion that increased automation would assist substantially in improving the quality and timeliness of ships' weather reports. In this context, it:

- (a) Noted with appreciation the offers from France, the United Kingdom and the United States to make both technical assistance and software related to automated shipboard observing and calculating systems available to other Members, as appropriate;

- (b) Urged Members interested in installing such automated systems to consider the use of the Voluntary Co-operation Programme and related programmes to obtain the relevant hardware;
- (c) Agreed on the value of having available an up-to-date technical review report on the configuration, availability and cost of automated shipboard systems, and decided to appoint a rapporteur on this topic. Further action in this regard is taken under agenda item 15.

6.2.6 The Commission recalled that, at its tenth session, it had reviewed the establishment, objectives and timetable of the VOS Special Observing Project North Atlantic (VSOP-NA). It therefore noted with satisfaction that the project had been completed in 1991 and that the final results of the project, including a ship catalogue, detailed data analyses, conclusions and recommendations, had subsequently been published, jointly by WMO and IOC, as reports No. 25 and 26 in the WMO series Marine Meteorology and Related Oceanographic Activities. The Commission expressed its considerable appreciation to the Members concerned (Canada, France, Germany, Netherlands, United Kingdom, and United States), to the project Management Committee, the Port Meteorological Officers, and the owners and crews of the participating ships for their contributions to this important and successful project.

6.2.7 The Commission noted that the recommendations stemming from the project, relating to the operation of the VOS, the management of ships' meteorological and oceanographic data, and the application of these data to climate research, had been addressed to Members, to WMO, and to the climate research community, respectively. Actions on the recommendations addressed to WMO had been proposed by the Sub-group on Marine Climatology at its sixth session (Geneva, April 1991). These actions are mostly dealt with under other agenda items. In addition, the Commission agreed on the need for a rapporteur to prepare a reference booklet on standardized shipboard observing and reporting practices. The appointment of this rapporteur is effected under agenda item 15.

6.2.8 With regard to the recommendations addressed to Members, the Commission agreed that their implementation was critical to improving the quality of VOS data and to their successful application to global climate studies. It therefore adopted Recommendation 5 (CMM-XI) on this subject.

6.2.9 The Commission reiterated its view that Port Meteorological Officers (PMOs) had an absolutely essential role to play in the recruitment and maintenance of the VOS and in acting as a means of liaison between national Meteorological Services and mariners on all aspects of services to this community, and it noted that the results of the VSOP-NA fully supported this view. In this context, the Commission noted with interest and appreciation the following actions, which had been taken or were underway:

- (a) A small PMO guidance booklet, based on that produced by the United Kingdom for its own PMOs, had been distributed to Members, in four languages, in early 1991;

- (b) A international seminar/workshop for PMOs was to take place at IMO in London from 20 to 25 September 1993, co-sponsored by WMO, IMO, ICS and INMARSAT. This seminar/workshop would consider, *inter alia*, topics related to enhancing PMO services world-wide such as special brochures on PMOs and VOS, an international PMO newsletter and regional training seminars for PMOs.

6.2.10 In addition to these actions, the Commission felt that consideration, by both the seminar/workshop and by the Working Group on Marine Observing Systems, should be given to the following matters:

- (a) A compilation of existing national practices regarding awards to VOS officers;
- (b) The use of PMOs in support of the IGOSS ship of opportunity programme;
- (c) The submission of a formal proposal by WMO to the IMO Maritime Safety Committee for joint encouragements to Governments and shipowners to participate in the VOS scheme, in response to the SOLAS recommendation and in support of improved marine services;
- (d) The possibility of removing some less important variables from ship reports, to simplify reporting procedures for ships' officers;
- (e) The preparation of a statistical analysis of the VOS as a proportion of total registered shipping.

6.3 DRIFTING AND MOORED DATA BUOYS (agenda item 6.3)

6.3.1 The Commission reiterated its belief in the value of drifting and moored data buoys for the collection of essential meteorological and oceanographic data from remote ocean areas. In this context, it noted with interest that the numbers of such platforms deployed and reporting data over the GTS had increased substantially in the past few years. Specifically, in December 1992, there were: 1 012 drifting buoys active and reporting through Argos, of which 658 (65 per cent), operated by 12 countries, had their data distributed on the GTS; 19 countries operating 195 moored buoys and 83 fixed platforms, although not all such Ocean Data Acquisition Systems (ODAS) were reporting on the GTS; 57 of the planned 65 platforms in the Tropical Ocean Global Atmosphere (TOGA) tropical Pacific array deployed, with the data from almost all being sent for GTS distribution. For drifting buoys, the December 1992 number reporting on the GTS represented almost a five-fold increase over that for 1989, with percentage reporting increasing from 26 per cent to 65 per cent. Despite these impressive increases, however, the Commission recognized that much remained to be done to fill the gaps in continuing data-sparse ocean areas in the southern hemisphere, in particular, as well as in increasing the amount of air pressure data available from buoys and in ensuring the timely return of buoy data to countries near to their origin.

6.3.2 The Commission noted with appreciation the impressive achievements of the Drifting Buoy Co-operation Panel (DBCP) over the past four years, including in particular:

- (a) Increasing the numbers and percentage of drifting buoys reporting on the GTS, including those deployed in support of oceanographic research programmes such as WOCE;
- (b) Improving the quality of buoy data on the GTS and designing and implementing new real-time quality control procedures for such data, which were formally adopted by CBS-X in 1992 as part of the operation of the WWW;
- (c) Contributing to the design and implementation of a new GTS processing chain within the Argos processing system, to manage more efficiently buoy reports destined for GTS distribution;
- (d) Collaborating with the WOCE/TOGA Surface Velocity Programme (SVP) in developing and testing a new low-cost Lagrangian drifter with pressure sensor;
- (e) Developing and modifying the new GTS code DRIFTER/BUOY (the BUOY amendments had to come into force on 2 November 1994);
- (f) Assistance in the establishment of new regional action groups to co-ordinate and manage buoy deployments in the Arctic and Antarctic;
- (g) Continuing support for the European Group on Ocean Stations;
- (h) Assistance to a possible new programme in the South-West Indian Ocean;
- (i) Initiation of preparations for a possible programme in the South Atlantic.

6.3.3 The Commission expressed its thanks to the panel, and in particular to its technical co-ordinator, Mr E. Charpentier (France) for its very valuable work in support of all WMO Programmes. It noted and approved the proposal by the panel to change its terms of reference and name so as to also cover the co-ordination of moored as well as drifting buoys, and agreed that the work of the panel would become even more important in the future in view of the developing requirements for buoy data in support of GOOS and GCOS. In this context, the Commission recalled that the panel and its technical co-ordinator were supported entirely by voluntary contributions from panel Member countries. It expressed its considerable appreciation to those Members already providing such contributions, and urged as many other Members as possible to provide support to the panel so as to ensure the continuation of its work in the future. The Commission also noted with appreciation that the Responsible National Oceanographic Data Centre (drifting buoys) of IOC was operated by the Marine Environmental Data Service of Canada, and that this centre quality controlled and archived all GTS buoy reports as well as buoy data from other sources.

6.3.4 The Commission expressed its considerable thanks to Dr G. Hamilton (United States) for his excellent work in preparing the *Guide to Moored Buoys and other Ocean Data Acquisition Systems* (WMO-No. 750). It also thanked the IGOSS National Representatives of Chile and France for their agreement to prepare Spanish and French versions of this *Guide*, respectively. The Commission noted with appreciation various other publications relating to drifting and moored buoys, including:

- (a) The IGOSS regular information service bulletin on non-drifting ODAS;
- (b) The quarterly report on drifting buoys prepared by CLS/Service Argos and the DBCP;
- (c) The annual reports of the DBCP;
- (d) Occasional technical publications of the DBCP.

6.3.5 The Commission noted with appreciation that the proposals which it had incorporated in Recommendation 4 (CMM-X) had been either completed or were being implemented. The Commission nevertheless considered that a number of additional actions might be investigated by the DBCP and by Members to improve the quantity, quality, timeliness and geographical distribution of buoy data available on the GTS, including in particular:

- (a) Introduction by Members of a regular information exchange on the current status of all types of ODAS;
- (b) Active participation by national Meteorological Services in the operational deployment of the low-cost Lagrangian pressure drifters, in collaboration with the SVP and the DBCP;
- (c) Implementation of a South Atlantic Drifting Buoy Programme;
- (d) Increasing drifting buoy deployments in the Arctic under the International Arctic Buoy Programme.

6.3.6 Finally on this item, the Commission noted with interest and appreciation:

- (a) The extensive use also of the geostationary meteorological satellites for the collection of data from some moored buoys and coastal stations;
- (b) Recent developments in the proposed South-West Indian Ocean Buoy Programme, including the appointment of a technical co-ordinator and the offer of assistance from France;
- (c) The decision by the Japan Meteorological Agency to initiate an operational drifting buoy programme and also to participate in the operation of the new buoy data quality control guidelines.

6.3.7 In view of the need to expand the deployment of oceanographic drifters equipped with atmospheric pressure sensors, and also to ensure the continued operational deployment of drifting buoys after the termination of research programmes such as TOGA and the World Ocean Circulation Experiment (WOCE), the Commission agreed to update Recommendation 4 (CMM-X). Recommendation 6 (CMM-XI) was therefore adopted.

6.4 OCEANOGRAPHIC SATELLITES AND OTHER REMOTE SENSING (agenda item 6.4)

6.4.1 The Commission noted with interest and appreciation the report of the chairman of the CMM/IGOSS *Ad Hoc Group on Ocean Satellites and Remote Sensing*, Mr J. Sherman (United States). In particular, it was pleased to learn that the first substantial report by the group, detailing polar-orbiting satellites currently available or planned over the next 10 to 15 years, which would support marine meteorology and physical oceanography, would be published shortly. The Commission endorsed the proposal by Mr Sherman that the group should continue with its ocean remote-sensing

documentation through a four-cycle series of reports, covering polar orbiting satellites, geostationary satellites, and ground-based remote sensing and data access, noting that each report would contain sections dealing with the applications of remotely-sensed ocean data, in particular by way of specific examples.

6.4.2 The Commission noted and fully endorsed the plans for a WMO/IOC Technical Conference on Space-based Ocean Observation, to be held in Bergen, Norway, in September 1993. It expressed its appreciation to the chairman of the organizing committee, Mr R. Shearman (president of CMM), to the scientific programme organizer, Mr J. Sherman, to the local organizer, Mr J. Guddal, to the different co-sponsors of the conference and to all others involved in its planning for their efforts. The Commission stressed the importance of the conference as a means to foster communications between the users and potential users of space-based ocean observations and the operators/managers of satellite remote-sensing systems, and it urged as many of its members as possible to participate in the conference.

6.4.3 The Commission expressed its appreciation to Mr Sherman and to other members of the *ad hoc* group for their efforts in preparing and presenting the scientific lectures during the present Commission session. Further action in this regard is recorded under agenda item 14.

6.4.4 The Commission reiterated its belief in the enormous potential value to Members of data from the new oceanographic satellites, in support of both services and research. It also stressed the value of the work of the *ad hoc* group in facilitating access to and applications of these data by Members, as well as the importance of continuing seminars, conferences and workshops on ocean remote sensing, such as the Bergen Conference and the WMO Workshop on the Operational Remote Sensing of Sea Ice, held in Ottawa in 1991 (see also agenda item 8). The Commission welcomed the offer by the Joint Committee for IGOSS and the IOC Committee for IODE to co-sponsor the group and agreed to re-establish it into a sub-group. Action in this regard is taken under agenda item 15. Finally, the Commission agreed that Recommendation 5 (CMM-X) on this topic required some revision and updating. It therefore adopted Recommendation 7 (CMM-XI) to this effect.

6.5 OTHER MARINE OBSERVING METHODS AND INSTRUMENTATION (agenda item 6.5)

6.5.1 Under this agenda item, the Commission reviewed in particular the status of the Automated Shipboard Aerological Programme (ASAP). It recalled that it had first reviewed the status of ASAP at its tenth session and, at that time, had urged that attention should be given to expanding ASAP implementation also to the Pacific and Indian Oceans.

6.5.2 In this context, the Commission noted that, in late 1992, twelve ASAP systems were active on the Atlantic (operated by Denmark, Finland, France, Germany and the United Kingdom) and one on the North Pacific (Canada). Recent ASAP monitoring had indicated reductions in data losses, and a routine moni-

toring programme had now been implemented, through a monitoring centre in Vancouver (Canada) and by EUMETSAT for those reports transmitted via METEOSAT. Further developments with shipboard upper-air soundings included the evaluation of the use of a wind-profiler by the United States; the inclusion of Global Positioning System (GPS) capabilities for ship position reports with ASAP; the use of other satellite systems such as INMARSAT; and the use of more cost-effective distributed ASAP systems on board ships, such as being evaluated by the United States, which might substantially reduce capital costs.

6.5.3 The Commission reiterated its belief in the importance of ASAP as a means of obtaining essential upper-air data from remote ocean regions. It expressed its appreciation to those countries presently operating ASAP systems for their efforts, and urged them to continue and, if possible, to expand their ASAP operations in the future. At the same time, the Commission expressed concern that a number of countries had recently been forced to terminate their ASAP programmes. It regarded this overall reduction in the number of active ASAP vessels as particularly unfortunate at a time when the importance of observational data from the world's oceans was being highlighted in the context of programmes such as WWW, GOOS and GCOS.

6.5.4 The Commission recognized the difficulties inherent in expanding the deployment of ASAP systems, in particular in the Indian, Pacific and South Atlantic Oceans, at a time of static or reducing observing system budgets in most national Meteorological Services. It noted, however, that an ASAP system could be made available for operations by Mauritius on various routes in the Indian Ocean. The problem was the need to find support for the operating costs. It urged, therefore, that special attention be given to the support of this system.

6.5.5 The Commission noted that a possible way for obtaining the additional funding necessary to expand the ASAP network might lie with requirements identified by the Global Climate Observing System (GCOS) for ASAP data in support of global climate studies, coupled with technological developments. It therefore urged Members to keep themselves closely informed of progress in GCOS development and, where possible, to use the requirements for additional marine meteorological and oceanographic data in support of global climate studies as a means of expanding essential marine observing system components such as ASAP.

6.5.6 The Commission noted with appreciation the possibility that the Russian Federation could make ships available for ASAP deployments. It recommended that the Russian Federation should contact the ASAP Co-ordinating Committee to discuss details of the implementation of such an offer. Finally, the Commission noted that ASAP, as an operational technique for observing the marine atmosphere from Voluntary Observing Ships, generally managed in some way by PMOs, might be regarded as another operational marine observing system component, which could fall logically within the overall scope of the WMO marine

programme, and within the terms of reference of CMM. At the same time, certain aspects of ASAP operations, such as codes and formats, quality control and data flow monitoring, fell within the responsibilities of the Commission for Basic Systems (CBS). The Commission therefore requested the president of CMM to consult with the president of CBS as well as with the Advisory Working Groups of both Commissions, with a view to developing a common proposal concerning the future management of the ASAP programme, for consideration by the Executive Council.

6.6 MARINE TELECOMMUNICATION ARRANGEMENTS FOR DATA COLLECTION AND TRANSMISSION (agenda item 6.6)

INMARSAT

6.6.1 The Commission recalled that the INMARSAT satellite-based maritime telecommunications system had become operational on 1 February 1982, and that CMM had continued to follow its development and growth closely since that time, in view of its potential importance to all national Meteorological Services. The Commission noted that in July 1992 almost 3 000 voluntary observing ships were equipped with INMARSAT Ship Earth Stations (SES) and that this number was likely to increase to close to 100 per cent of the voluntary observing ships by the year 2000, in view of the formal requirement for the carriage by most ships of INMARSAT equipment as part of the Global Maritime Distress and Safety System of IMO (see also agenda item 5.3). In addition, in late 1992 a total of eleven INMARSAT Coast Earth Stations (CES), covering all ocean regions, had agreements with their national Meteorological Services to accept ships' meteorological reports free of charge to ships. Of these, six also accepted BATHY/TESAC reports, under the same conditions.

6.6.2 The Commission noted with appreciation that the WMO Secretariat, together with experts from CMM and CBS, has continued to co-ordinate closely with INMARSAT officers on the enhanced use of the system for meteorological and oceanographic data collection purposes. In this context, the Commission noted with interest the new INMARSAT-C facility, which had been developed for two-way store and forward telex or data messaging communications from ships. This system would bring about a number of advantages and improvements in procedures for generating and transmitting ships' meteorological and oceanographic reports, at considerably lower costs to many national Meteorological Services, than was the case today.

6.6.3 The Commission was further informed on the intensive co-ordination that existed between INMARSAT and WMO in this particular matter. It agreed that the requirements of national Meteorological Services for data reporting through INMARSAT-C were as follows:

- (a) The procedures should cover the transmission of both meteorological and oceanographic reports;
- (b) Software for encoding and transmission of the reports from a Ship Earth Station (SES) should be as simple as possible to install, operate and modify;

- (c) No special decoding software should be required at those NMCs receiving the reports from CESs, with the reports being encoded in standard WMO code forms suitable for transmission on the GTS. This implied the use of these code forms throughout the transmission process;
- (d) Procedures should be applied uniformly, both on ships and at NMCs, to facilitate development, maintenance and distribution of software;
- (e) As large cost reductions as possible should be achieved;
- (f) As rapid as possible installation on ships equipped with INMARSAT-C terminals was required.

6.6.4 The Commission recognized that it might not be possible to meet all these requirements to their fullest extent because of technical constraints determined by the characteristics of two different modes of transmission procedures available on the INMARSAT-C service and by the technical capabilities of some NMCs for collecting the reports. It was, therefore, agreed that the following actions should be undertaken:

- (a) As soon as possible, implementation of suitable procedures for the transmission of reports in WMO standard formats through INMARSAT-C, bearing in mind the substantial cost reduction this would entail;
- (b) In the short term, identification of central source(s) for the development and distribution to meteorological services of software for encoding and transmitting both meteorological and oceanographic reports in WMO standard formats;
- (c) In the medium term, development and implementation of software for the transmission of BUFR encoded messages (this being not yet an immediate priority, because BUFR was not yet widely implemented in the NMCs).

6.6.5 Furthermore, the Commission noted that additional cost savings might be achievable through the use of a different reporting mode together with a more sophisticated data handling technique in the NMCs concerned and, therefore, agreed that WMO should, in the long term, investigate these options in co-operation with INMARSAT, as appropriate.

6.6.6 With regard to 6.6.4 (a) and (b) above, the Commission noted with appreciation the agreement by the Netherlands to supply and maintain software for the compilation, encoding and transmission of SHIP reports through INMARSAT-C, and that actions were already underway to make this software available for installation on VOS equipped with INMARSAT-C. The Commission requested other Members to investigate the possibilities for developing, supplying and maintaining similar software for BATHY/TESAC and, eventually, BUFR reports through INMARSAT-C. The Commission also urged Members operating VOS to make every effort to install this software on their ships as they became equipped with INMARSAT-C, for the general benefit of the whole of WMO.

6.6.7 In noting once more the need for as wide as possible a geographical distribution in the collection on

land of ship reports transmitted through INMARSAT, in view in particular of the value of these reports to countries nearest to their origins, as well as the cost burdens incurred by individual Members operating CES for their collection, the Commission agreed with the views of Eleventh Congress on the matter, and urged:

- (a) All Members with CESs in their countries to establish agreements with their CES to accept both meteorological and oceanographic reports, using code 41, free of charge to the ships;
- (b) Members operating relevant GTS switching centres to ensure that SHIP and oceanographic report bulletins were forwarded as quickly as possible, in particular to countries in the geographical vicinity of the origins of the reports;
- (c) Members requiring ship reports through the GTS to ensure that their telecommunication centres had requested receipt of all relevant GTS bulletins containing such reports;
- (d) Members requiring such reports also to investigate other means for receiving them from collecting centres, such as through Meteorological Data Distribution (MDD) systems.

6.6.8 Finally on this topic, the Commission noted with concern that INMARSAT-C facilities were not available at all CES and that code 41 was not yet implemented in all INMARSAT-C CES or SES. It therefore requested the Secretariat to liaise with both INMARSAT and IMO on this matter, and also urged Members concerned to approach their CES operators directly, with a view to ensuring the widest possible availability of both INMARSAT-C and code 41 for the collection of meteorological and oceanographic reports from ships.

6.6.9 Recommendation 8 (CMM-XI) on this general subject was adopted.

COASTAL RADIO STATIONS AND THE OBS CLASSIFICATION

6.6.10 The Commission recalled that, at its tenth session, it had reviewed the status of coastal radio stations (CRS) which were available for the collection of ships' meteorological and oceanographic reports. It noted that the numbers of such stations had remained virtually unchanged over the past four years and that, increasingly, ships' reports were being transmitted to shore through INMARSAT. The Commission nevertheless agreed that CRS would remain an important element of the total marine data collection system for the remainder of the decade, and it therefore urged Members to make every effort to ensure the maintenance of the numbers and efficiency of their CRS over this period.

6.6.11 The Commission recalled that at CMM-X it had also reviewed the changes to the provisions relating to meteorological messages with the OBS indicator recently effected by the Comité consultatif international téléphonique et télégraphique (CCITT) of ITU, and had expressed concern at the likely deleterious effects of such changes for meteorological services. It affirmed that the future widespread use of INMARSAT would not necessarily improve the situation, since the principal change in the provisions for OBS messages was the removal of the

specific recommendation for a 50 per cent reduction in charges for the landline segment of the transmission process for meteorological messages. At the same time, the Commission noted that CCITT would be unlikely to reconsider its position on this matter, despite strong representations from the WMO and IMO Secretariats, without hard evidence of the predicted negative effect of the changes and also without internal pressure from its own Member States. The Commission therefore urged Members to:

- (a) Inform the Secretariat of specific changes to national PTT charges for OBS messages resulting from the modified CCITT recommendations;
- (b) Impress upon their national PTTs the likely negative effects of increased charges for transmission of OBS messages.

ARGOS SYSTEM

6.6.12 The Commission noted with interest that the use of the Argos system for the collection and location of environmental data from remote ocean platforms had continued to expand. In particular, it noted that, in addition to data collection and location from drifting and moored buoys, Argos also provided facilities for the collection of data from ships and tide-gauge stations and, where appropriate, their encoding into relevant WMO code forms such as SHIP, BATHY, BUFR, for global distribution on the GTS.

6.6.13 The Commission further noted with appreciation that CLS/Service Argos and the DBCP had jointly funded and developed a new Argos GTS processing chain, for the management of data within the Argos system destined for GTS distribution. This new chain, which would be fully operational in 1993, would greatly improve the efficiency and flexibility of such data management by Argos, with consequent benefits to platform operators and data users alike. Finally, the Commission noted that the global tariff applicable to non-commercial users of the Argos system had effectively been reduced in real terms over a number of years, and continued to represent a considerable saving for such users over the full commercial tariff. The Commission therefore encouraged Members to make use of the Argos system and of the favourable global tariff, where appropriate, for the collection of meteorological and oceanographic data from remote platforms of all types, and for their subsequent insertion onto the GTS.

HF DATA TRANSMISSION

6.6.14 The Commission noted that the World Administrative Radio Conference for the Mobile Services, 1987 (WARC-MOB (87)) had modified the HF bands assigned for the transmission of meteorological and oceanographic data from remote ocean platforms, with effect from 1 July 1991, and had requested WMO and IOC to develop a frequency utilization plan for the new assignments. Subsequently, such a frequency utilization plan was prepared by the Secretariats on the basis of information submitted by Members of WMO and Member States of IOC, and circulated to Members in finalized form in June 1991.

6.6.15 The Commission expressed its appreciation to all concerned for the development of this new frequency utilization plan. It noted that requirements for the use of HF radio for meteorological/oceanographic data transmission were decreasing and that, unless continuing requirements could be clearly confirmed, a future WARC-MOB might remove all HF band assignments for this purpose, in view of pressure from other users of the HF radio spectrum for increased allocations for other purposes. The Commission therefore urged Members to review and assess carefully their present and future requirements for data transmission via HF radio, and to inform the Secretariat of these requirements, as soon as possible, in order that they might be included in the frequency utilization plan and also assist in retaining the existing HF band assignments at future WARC-MOB.

INTERNATIONAL DATA COLLECTION SYSTEM (IDCS)

6.6.16 The Commission recalled that an informal group for the Co-ordination of Geostationary Meteorological Satellites (CGMS) had co-ordinated the services offered by these satellites. A most successful example of this co-ordination was the operation of the International Data Collection System (IDCS). This service was supported by Europe (METEOSAT), Japan (GMS) and the United States (GOES). This data collection and relay service, which was designed for use with platforms moving through the fields of view of two or more satellites, was provided free of charge by the satellite operators for meteorological ocean observations destined for the GTS. Further information on this system could be obtained from the CGMS Secretariat, EUMETSAT, Am Elfengrund 45, 6100 Da-Eberstadt, Germany, Tel. (49) 61 51 53920, Telex: 4197335, Fax, (49)61 51 53 92 25. The Commission urged Members to consider making use of this valuable component to the overall marine data collection system.

6.7 REQUIREMENTS FOR REPORTING CODES (agenda item 6.7)

6.7.1 The Commission noted with appreciation that a number of minor amendments had been made during the inter-sessional period, with regard to the following codes: FM 65-IX-WAVEOB, FM 13-IX Ext.(90)-SHIP, FM 36-IX-TEMP SHIP, FM 76-VI-CLIMAT TEMP SHIP, FM 63-BATHY and FM 64-TESAC. These amendments were all designed to improve the coding of marine meteorological and/or oceanographic data.

6.7.2 The Commission noted the implementation of the new DRIFTER code (to replace DRIBU) in 1992 following an initiative of the Drifting Buoy Co-operation Panel (DBCP) and the subsequent requirements expressed by the DBCP for modifying the DRIFTER code to incorporate new data types currently becoming available from drifting buoys, to include quality-control flags, to address the concern of oceanographic researchers regarding confidentiality in the relay of data through the GTS, and to change the name to BUOY to avoid possible confusion with a Lagrangian drifter. The Commission noted with appreciation the favourable actions taken by CBS-X which led to the adoption of the amended FM 18-X BUOY code.

6.7.3 The Commission noted with appreciation the actions taken by CBS on proposals from the CMM Sub-group on Marine Climatology for modifications to the SHIP code in order to improve marine data availability and quality for climatological purposes, specifically:

- (a) The addition of a group for reporting wet-bulb temperature;
- (b) The systematic reporting of all present weather, past weather, cloud and wave groups for all meteorological and sea state conditions (e.g. when there are no clouds or waves);
- (c) An indicator for the type of measurement of sea surface temperature.

CBS had not, however, agreed to change the present method of indicating the position of the ship. These modifications would be implemented from 2 November 1994. The Commission expressed some concern that the reporting of visual observation groups sometimes provided difficulties for ships officers, resulting in potential loss of data, and that this new requirement, while not substantial, might nevertheless increase these difficulties. It therefore referred the matter to the Working Group on Marine Observing Systems for further consideration.

6.7.4 The Commission noted with interest the work undertaken by IGOSS to develop a flexible character code for new types of oceanographic data, the IGOSS Flexible Code (IFC). Although having some difficulties with accepting IFC as presented, the CBS Sub-group on Codes of the Working Group on Data Management nevertheless recognized the real requirement of the oceanographic community for a format of this type. It therefore subsequently:

- (a) Developed a limited version of the IFC specifically for sea-level data transmission (an immediate requirement), the SEALEV code;
- (b) Began work on the concept of a generalized universal, table-based, character code FLEX, for the GTS transmission in character form of all new types of meteorological and oceanographic data. FLEX would be compatible with both BUFR and the oceanographic data exchange format GF3.

6.7.5 The Commission noted with appreciation that CBS reviewed and approved the use on an experimental basis of the SEALEV code on the basis of the strong IGOSS requirement, and had taken into consideration the immediate need for the use of real-time sea level data by the oceanographic and meteorological communities, especially as a requirement for climate change monitoring. CBS also agreed, with certain conditions, that further development work on the FLEX code should take place during the coming inter-sessional period.

6.7.6 The Commission noted with appreciation the work now underway within the CBS Working Group on Data Management to develop appropriate BUFR table entries for data now carried on the GTS in WAVEOB, BATHY, TESAC, TRACKOB and SEALEV. Bearing in mind the general CBS policy with regard both to new character codes and to modifications to existing character codes, the Commission considered any possible requirements for new or modified codes for reporting marine data. It

noted in particular a requirement for the addition of a new section to the BUOY code to cover the possible GTS exchange of certain types of buoy data at the national or regional level. It therefore referred the matter to the Working Group on Marine Observing Systems, and to the DBCP, for further consideration.

6.8 THE GLOBAL OCEAN OBSERVING SYSTEM (GOOS) AND GLOBAL CLIMATE OBSERVING SYSTEM (GCOS) (agenda item 6.8)

6.8.1 The Commission noted with interest that, following the recommendations made at the Second World Climate Conference (Geneva, October 1990), actions had been taken, jointly by WMO, IOC, UNEP and ICSU, to plan and implement a Global Climate Observing System (GCOS). The objective of GCOS was to enhance existing observing systems, such as WWW, GAW and IGOSS and, where necessary, establish new ones, and to provide a comprehensive set of data from the atmosphere, oceans, land surface and cryosphere in support of global climate monitoring, diagnosis, research and prediction. It was intended that the climate module of the Global Ocean Observing System (GOOS) would provide the oceanographic component of GCOS. A Joint Scientific and Technical Committee (JSTC) had been established for GCOS, as well as a joint planning office in the WMO Secretariat in Geneva. The JSTC had, in turn, established a number of task groups dealing with different components of the climate system, to define data requirements for these components, to identify gaps in existing observing systems, and to advise on ways of filling these gaps. These task groups included one on atmospheric processes, while for the oceans the Ocean Observing System Development Programme (OOSDP), established by the Joint Scientific Committee (JSC) for the World Climate Research Programme (WCRP) and the Committee on Climate Changes and the Ocean (CCCO), had already been charged with providing the appropriate advice, both to GCOS and to GOOS.

6.8.2 The Commission agreed that it had an important role to play in satisfying some of the requirements expressed by GCOS and GOOS, in particular for ocean surface data from the VOS, drifting and moored buoys, oceanographic satellites, and other ground-based ocean remote-sensing techniques. It recognized that many of these requirements were still to be clearly established, but noted that the Task Group on Atmospheric Processes had already identified the serious lack of surface atmospheric pressure, temperature, wind and humidity data from the South Atlantic, Indian and Southern Oceans as a problem to be rectified as soon as possible.

6.8.3 The Commission recalled that it had itself, on many occasions, underlined this deficiency, but that solutions remained difficult to find in view of the lack of VOS sailing in these waters as well as the cost of deploying drifting buoys and of collecting their data. It nevertheless agreed that the requirements of GCOS might provide an additional incentive to Members to deploy observing platforms in these ocean areas and therefore requested the Working Group on Marine

Observing Systems in conjunction with the Drifting Buoy Co-operation Panel to undertake an urgent study of the problem and to develop specific recommendations for its possible solution.

6.8.4 The Commission was informed that, following an initiative by the Intergovernmental Oceanographic Commission Assembly in 1989, which was supported by the WMO Executive Council and by Eleventh Congress in 1991, work had begun to develop the concept and detailed structure of a Global Ocean Observing System, and to effect its implementation. GOOS was being designed as a comprehensive ocean monitoring and data management system, involving physical, chemical and biological variables of the oceans, and based on the co-ordinated development of existing ocean observation system components such as those of the WWW, IGOSS and GLOSS, together with the introduction of new observing technologies as they became available. GOOS would have a number of components or modules, reflecting essentially different types of applications for GOOS data, specifically covering climate, the health of the oceans, living marine resources, the coastal zone and ocean services. As noted above, the GOOS climate module would provide the oceanographic component of GCOS. WMO's interest in GOOS centres was primarily on the climate and ocean services modules, with some involvement also in the coastal zone and health of the oceans modules. In addition to WMO, UNEP also had a major interest in the development and implementation of GOOS, while other Organizations, such as FAO and IMO, had an interest as potential users of GOOS data.

6.8.5 The Commission noted that an IOC Intergovernmental Committee for GOOS (I-GOOS), had been established, *inter alia*, to co-ordinate national support for GOOS implementation, in addition to a possible Joint Scientific and Technical Committee for GOOS (JGOOS) to provide the necessary scientific advice and oversight for GOOS development, while a GOOS support office had been set up in the IOC Secretariat. A Memorandum of Understanding on GOOS Development was to be signed in 1993 by IOC, WMO and ICSU, and, under the terms of this, WMO would co-sponsor the JGOOS and contribute to the work of the GOOS support office.

6.8.6 The Commission agreed that GOOS was an important development which might lead to substantial benefits to national Meteorological Services from enhanced ocean data in support of the WWW and of global climate studies. At the same time GOOS, in building on existing ocean observing system components such as the VOS and drifting buoys, would need to make good use of the expertise already available concerning the operation of these components, and in addition would require substantial new resources from participating countries for full implementation, to ensure maintenance of all existing ocean observing system components as well as the addition of the new components and platforms which would be necessary to satisfy user requirements. In this context, the Commission stressed:

- (a) That GOOS must build as much as possible on existing systems;

- (b) That all components of these existing observing, communications, data exchange and processing systems should be maintained and strengthened;
- (c) That the operational exchange of GOOS data should be effected as much as possible through the GTS, which should be improved and expanded as necessary.

6.8.7 While noting that specific requirements for ocean data were yet to be established by GOOS, the Commission nevertheless urged Members to already begin considering the role which they might be able to play in the GOOS implementation and maintenance, once these requirements became known. The Commission recognized that extensive education and training and technical co-operation activities under GOOS would be essential if all maritime countries were to participate effectively in both the implementation and benefits of GOOS. In this context, it suggested that the existing Education and Training and Technical Co-operation Programmes of WMO (including the VCP) might be used by Members wishing to enhance their participation in ocean monitoring, data management and services generally, in support of both GOOS and GCOS.

6.8.8 The Commission noted with interest and appreciation the invitation by the Seventeenth IOC Assembly (Paris, February/March 1993) to WMO to co-sponsor the IOC Intergovernmental Committee for GOOS (I-GOOS). In this context, it recalled the decisions already taken by Congress and the Executive Council regarding WMO support for GOOS development, including in particular WMO co-sponsorship of the process for scientific and technical planning for GOOS. The Commission recognized that national Meteorological and Hydrological Services would be both users of GOOS data and also substantial contributors to GOOS observing, data exchange and data management systems, and it considered that WMO co-sponsorship of I-GOOS would greatly facilitate the participation of national Meteorological and Hydrological Services in the intergovernmental decision-making process concerning GOOS development and implementation. At the same time, the Commission understood that co-sponsorship of I-GOOS carried resource implications for WMO, in particular in terms of the WMO Secretariat support to I-GOOS. In view of the existing budgetary and staffing constraints on the Secretariat, it requested Members to consider possibilities for secondment of staff to the WMO Secretariat in Geneva, to co-ordinate WMO support for GOOS, including in particular for the I-GOOS. Recommendation 9 (CMM-XI) was adopted.

6.8.9 The Commission noted that both GCOS and GOOS were mentioned specifically in Agenda 21, adopted by the United Nations Conference on Environment and Development (UNCED) (see also discussion under agenda item 12.3), as being new developments whose implementation should be supported by Governments as a means for establishing the global database needed to remove uncertainties relating to global climate and climate change. The Commission acknowledged that this recognition by UNCED, and hence by Governments

themselves, of the need for enhanced, systematic, long-term ocean monitoring, had provided an important opportunity for Members to obtain the additional support required to maintain and enhance their own ocean observation activities. It therefore strongly urged Members to make use of this opportunity and adopted Recommendation 10 (CMM-XI) on the subject.

6.8.10 The Commission noted that the implementation of GOOS, within the framework of Agenda 21, would necessitate increasingly closer co-operation between WMO and IOC, as well as with other Organizations, such as UNEP. This co-operation would extend, even more importantly, to the national level, and the Commission urged Members and the Secretariats of both WMO and IOC to make every effort to ensure that GOOS national focal points would be in a position to co-ordinate fully and effectively the complementary efforts of their national meteorological and oceanographic communities in support of GOOS implementation. At the same time, the Commission recognized that the successful operation of GOOS would depend heavily on the wide availability of oceanographic satellite data, and it therefore urged the responsible GOOS bodies to make every effort to involve satellite operating agencies, and their national governments, in appropriate aspects of GOOS planning and implementation.

6.8.11 With regard to formal interaction and co-ordination of CMM with the JSTC of GCOS and the JGOOS, the Commission agreed that this was an important matter which needed further elaboration. It therefore requested the president of CMM to liaise as appropriate with the chairmen of both bodies with a view to preparing a suitable *modus operandi* for consideration by the Advisory Working Group of CMM and the two committees. The Commission requested JGOOS to consider appointing the president of CMM, *ex-officio*, as a formal member of the committee, in view of the major input which CMM would make to GOOS development and implementation, in order to facilitate the required liaison and co-ordination.

7. MARINE CLIMATOLOGY (agenda item 7)

7.1 CONTRIBUTION OF CMM TO THE WORLD CLIMATE PROGRAMME (agenda item 7.1)

7.1.1 The Commission recognized that marine meteorological and related oceanographic data, in particular those processed through the Marine Climatological Summaries Scheme (MCSS), were of major importance to all components of the WCP. In this context, it noted that the major revision to the MCSS had been designed at least partly to satisfy the requirements of the WCP for these data, while the VSOP-NA (see agenda item 6.2) had been initiated in support of global climate studies under the WCRP. In addition, a number of other activities of the Commission were of direct relevance to the WCP (see, for example discussions under agenda items 6.1, 6.8, 7.3), while a number of Members reported to the session on their marine activities in support of the WCP and its various component programmes and projects.

7.1.2 The Commission noted with interest that the Commission for Climatology had recently agreed to the

preparation of a third edition of the *Guide to Climatological Practices* (WMO-No. 100), as well as to the layout for the revised *Guide*. The Commission agreed that there were many aspects of this *Guide* which were directly relevant to the collection and processing of marine climatological data, as well as to material contained in the new *Guide to Applications of Marine Climatology*. It therefore requested the chairman of the CMM Sub-group on Marine Climatology to liaise directly with the group within CCI concerned with the preparation of the revised *Guide*, in order to ensure appropriate CMM input to this revision.

7.1.3 The Commission noted with interest a report submitted by the United Kingdom Meteorological Office on the operation, to date, of the TOGA Marine Climatology Data Centre. It recalled that this centre, maintained by the United Kingdom Meteorological Office, had begun operations on 1 January 1988 to collect and process ships' observations from the tropical oceans from 1985 to 1994 in support of TOGA. These data, which were eventually forwarded as an annually updated archive to the WDCs A and B for permanent archival, comprised a mixture of logbook and GTS reports, with density varying considerably over the tropical oceans. To date, more than five million observations had been processed by this centre.

7.1.4 The Commission expressed its appreciation to the United Kingdom Meteorological Office for its efforts in operating this centre in support of TOGA, as well as to all the other Members contributing data to the centre. It urged all maritime Members to continue to contribute relevant ships' observations to the centre until sometime after the end of the TOGA observing period (end 1994), to ensure that all potential data were made available to TOGA.

7.1.5 Finally under this agenda item, the Commission requested its Sub-group on Marine Climatology to consider other ways in which CMM might contribute to the WCP, and to prepare specific proposals in this regard, as appropriate.

7.2 MARINE CLIMATOLOGICAL SUMMARIES SCHEME (MCSS) (agenda item 7.2)

7.2.1 The Commission recalled that, at its tenth session, it had considered a proposal for a modification to the Marine Climatological Summaries Scheme (MCSS), which had been developed in response to new requirements for marine climatological data for marine services and global climate studies, as well as to advances in technology for the exchange and processing of such data. The Commission had been unable to agree to the proposal at that time, for a variety of reasons, and had referred the matter again to its Sub-group on Marine Climatology for further study, as a high priority issue.

7.2.2 Subsequently, the sub-group had prepared a revised proposal for consideration by the Commission. In addressing this proposal, the Commission first agreed:

- (a) That the timeliness of data availability through the MCSS must be improved, in the submission of data from the contributing Members, in the quality

control and archiving of these data by the responsible Members, and in the distribution of the data sets to other Members, as appropriate;

- (b) That at least the minimum quality control procedures adopted by CMM-X should be applied to all the data, so that users could be confident that the data had a certain, known, quality;
- (c) That, if possible, additional administrative and technical burdens placed on both contributing Members and responsible Members should be minimized;
- (d) That maximum advantage should be taken of modern technology;
- (e) That global marine climatological data sets should be as widely available as possible, as rapidly as possible, to satisfy user requirements.

7.2.3 Bearing in mind these requirements, as well as the arguments put forward at CMM-X, the Commission agreed that the revised MCSS should have the following features:

- (a) That all contributing Members should send all their ships' observations, after minimum quality control procedures had been applied, to two responsible Members, designated as global collecting centres;
- (b) That the global collecting centres should:
 - (i) Ensure that minimum quality control procedures had been applied to all data;
 - (ii) Maximize the data availability by bilateral exchange between themselves;
 - (iii) Deliver complete (global) data set updates to all other responsible Members on a quarterly basis;
 - (iv) Undertake any necessary correspondence with both contributing Members and responsible Members;
 - (v) Ensure that the correct country code was included with the data from the contributing Members;
- (c) That contributing Members should make data submissions on a quarterly basis;
- (d) That existing Members' responsibilities and functions should remain unchanged, including the application of second level quality control.

7.2.4 The Commission noted that these modifications to the MCSS needed to be implemented in the form of amendments to Part I, Section 5 of the *Manual on Marine Meteorological Services* (WMO-No. 558). Recommendation 11 (CMM-XI) was therefore adopted to effect these amendments. In adopting these amendments, the Commission agreed that there no longer existed a requirement to make reference to the International Maritime Meteorological Punch Card (IMPCC) in either the *Manual* or the *Guide*, since no data were now exchanged in this medium. This reference was therefore omitted from the amended Section 5, while the existing Appendices I.12 and I.13 in the *Manual* were merged as given in the annex to the recommendation. The Commission recognized that appropriate amendments were also now required to the *Guide to Marine Meteorological Services* (WMO-No. 471) to reflect these modifications to the MCSS, and requested the Secretariat

to prepare such amendments for approval by the president of the Commission on its behalf. Finally, the Commission accepted with considerable appreciation the offers by Germany and the United Kingdom to act as the two global collecting centres.

7.2.5 With regard to data exchange media, the Commission noted that several media now existed in addition to magnetic tape, which might be used for MCSS exchange, such as diskettes and IBM standard tape cartridges. However, it was felt to be premature to make specific reference to these at this time in the MCSS, in view of the complexities of specifying generally acceptable exchange formats and that any data exchange on these media should be arranged bilaterally.

7.2.6 Finally on this topic, the Commission noted that the major proportion of the data now archived under the MCSS was made up of SHIP reports taken from the GTS, rather than data extracted from logbooks. The Commission requested the Sub-group on Marine Climatology to examine this development further during the inter-sessional period, with a view to:

- (a) Assessing the feasibility of compiling separate data sets of GTS-derived data;
- (b) Making recommendations to Members concerning the preferred source of SHIP data for MCSS exchange and archival.

7.3 OTHER MATTERS RELATED TO MARINE CLIMATOLOGY (agenda item 7.3)

7.3.1 The Commission recalled that it had recommended, through Recommendation 4 (CMM-IX), the preparation of a comprehensive *Guide to Applications of Marine Climatology* (WMO-No. 781), and that this recommendation had been subsequently supported by Congress and the Executive Council. Preparation of the *Guide* was undertaken by an editorial board nominated by the CMM Sub-group on Marine Climatology and working under the general guidance and direction of Mr A. Saulesleja (Canada).

7.3.2 Following extensive drafting, review and revision over a number of years, the finalized *Guide* was submitted to WMO for publication in mid-1992. The Commission noted with satisfaction that the publication of the English version would take place shortly after the session and urged that the other language versions should also be published as soon as possible. It expressed its considerable appreciation to Mr Saulesleja for the major effort which he had put into preparing this *Guide*, as well as to the other members of the editorial board for their contributions and support, and agreed that this *Guide* represented a substantial contribution by CMM to WMO, which would be of benefit to maritime Members for many years to come. The Commission requested the sub-group to keep the contents of the *Guide* under review, with a view to preparing amendments and updates, as necessary, in the future.

7.3.3 The Commission recalled that the existing WMO Beaufort equivalent scale for wind speed (as given in the *Manual on Marine Meteorological Services*) was agreed upon following extensive discussion at a number of past Commis-

sion sessions. It had been in place for many years now and was consequently well integrated into shipboard observing practices as well as the marine climatological data archives. At the same time, the Commission recognized that a number of scientific studies in recent years had thrown into doubt the validity and accuracy of this scale for climate research purposes. These studies had also indicated significant differences amongst the various scientific Beaufort equivalent scales now in existence, as well as the importance of taking into account ships' environmental factors (day/night, head/stern wind, etc.) when using ship wind estimates in climate research.

7.3.4 The Commission noted that this topic had been discussed in detail at the sixth session of the Sub-group on Marine Climatology (Geneva, April 1992) and agreed with the basic conclusions of the sub-group, as follows:

- (a) There was an urgent need to standardize observing and reporting practices on board ships for Beaufort estimates of surface winds, in view of the clear differences which occurred between VOS of different countries and between different observers, as well as inconsistencies in the way such estimates were reported in both SHIP reports and logbooks. This standardization should include, in particular, the preparation and wide distribution of a standard, agreed set of sea state photographs related to the Beaufort scale. This set of photographs should be included in the new booklet on standardized observing and reporting practices (see agenda item 6.2);
- (b) The existing Beaufort equivalent scale in use by WMO, as given in the *Manual on Marine Meteorological Services* had been shown to give biased estimates of surface wind speeds, with the errors varying as a function of Beaufort number. Nevertheless, this scale should be retained for operational observation purposes, where the accuracy was adequate in order to avoid complications for observers, as well as to maintain consistency in the data archives. Provided both observing practices and archives were consistent, it should then be possible for climate researchers and others using the archived data to apply scientific techniques to determine surface wind speeds for their own purposes;
- (c) Where ships were equipped with anemometers, information on height and exposure of the anemometer was essential. In addition, information on the ship's speed and heading at the time of wind observation should be reported at all times, whether the observation was measured or estimated. Ships' observers should always correctly report the method used to obtain the wind speed;
- (d) A variety of scientific Beaufort equivalent scales now existed, all of which appeared superior to the WMO operational scale in their estimates of wind speed from Beaufort numbers for scientific purposes (see also the VOS Special Observing Project North Atlantic (VSOP-NA) report). There was insufficient evidence to allow a clear differentiation among these, and indeed each might be the most appropriate under different circumstances (e.g. with reports

from different national fleets). Furthermore, for some purposes it might be necessary to apply statistical distributions of wind speeds to each Beaufort class, to obtain the most accurate results. There was, in any case, a clear need to provide good summary documentation on this aspect of the Beaufort equivalent scale;

- (e) It would also help those concerned with marine observing practices and marine data archival if climate researchers could develop and publish clear recommendations on the structure and application of Beaufort equivalent scales.

7.3.5 On the basis of these conclusions, the Commission agreed on the following actions:

- (a) That the existing WMO Beaufort equivalent scale should be retained for operational observation and archival purposes; that climate researchers should take great care in using archived ships' wind estimates for climate study purposes; and that efforts should be made to ensure the correct use of agreed standardized observing and reporting practices for surface wind speeds from ships; Recommendation 12 (CMM-XI) was adopted;
- (b) That rapporteurs should be appointed to prepare:
 - (i) A booklet on standardized observing practices, as described above in paragraph 7.3.4 (see also agenda item 6.2);
 - (ii) An updated summary report on Beaufort equivalent scales, including an analysis of biases and errors, of the various scientific scales and of their application for climate studies (see also the Reports on Marine Science Affairs No. 3).

The appointment of these rapporteurs is effected under agenda item 15;

- (c) That certain modifications should be made to the SHIP code, to the international maritime meteorological tape (IMMT) format, and to the BUFR code tables, to allow reporting and archival of additional information relevant to a ship's wind estimates (see also paragraph 7.3.6 below);
- (d) That the *International List of Selected, Supplementary and Auxiliary Ships* (WMO-No. 47) should be modified to include new information on anemometer exposure, ship size and type, etc. Proposed modifications to this publication are detailed under agenda item 10;
- (e) That the Sub-group on Marine Climatology should examine, during the next inter-sessional period, the possibilities for preparing an extended Beaufort equivalent scale (beyond Beaufort force 12) for expressing extreme winds in marine forecasts.

7.3.6 The Commission recalled that, at its tenth session, it had proposed to the Sub-group on Marine Climatology to investigate the possibilities for introducing certain coding changes into both the SHIP code and the IMMT format, to enable the inclusion of additional information of relevance to marine climatology, in the data reports from the VOS. These proposals were considered by the sub-group at its sixth session, along with a

number of other possible modifications which had been recognized during the discussions on other agenda items for the session as being important for the reporting of information relevant to global climate studies (see paragraph 7.3.5. above). On the basis of these considerations, the sub-group had prepared a consolidated set of proposed modifications to the SHIP code (and also eventually to BUFR), which were submitted to CBS through its Sub-group on Codes. The actions taken by CBS on these modifications are noted under agenda item 6.7.

7.3.7 The Commission agreed that any changes to VOS reporting practices, whether via real-time SHIP reports or through logbooks — to allow reporting of additional information — necessitated corresponding changes to the IMMT format to allow this information to be exchanged through the Marine Climatological Summaries Scheme (MCSS) and stored in marine climatological data archives. In this context, the Commission also noted that marine climatological data for archival were increasingly coming directly from the real-time SHIP reports or through electronic logbooks rather than the traditional manual logbooks. The Commission therefore agreed to adopt provisionally a revised IMMT format, to incorporate the new data to be recorded, which should be implemented in line with the SHIP code modifications adopted by CBS-X. Recommendation 13 (CMM-XI) was adopted to effect this.

7.3.8 The Commission recalled that, at its tenth session, it had requested its Sub-group on Marine Climatology to study the possibility of preparing a global archive of tropical cyclone track and intensity data, in a standard format. The sub-group had subsequently considered this matter and had recommended various modifications to a draft standard format prepared by the Commission for Atmospheric Sciences (CAS) Working Group on Tropical Meteorology. The Sub-group had also noted that relevant tropical cyclone data were already archived by the different regional tropical cyclone bodies in a variety of formats, and had therefore requested the respective regional tropical cyclone bodies to advise further on the feasibility of implementing such a standard format.

7.3.9 The Technical Co-ordination Meeting on Operational Tropical Cyclone Forecasting and Dissemination of Results by RSMCs (Tokyo, December 1992) agreed on a revised standard format, on the basis of the original proposal by CAS as well as on suggestions from various other responsible bodies, including CCI and the CMM Sub-group on Marine Climatology. The meeting had furthermore recommended that the format should be adopted by WMO as a standard for tropical cyclone track and intensity information archival, and requested CMM to consider formally transmitting this recommendation to the Executive Council for approval. The Commission agreed with this proposal, and Recommendation 14 (CMM-XI) was adopted.

8. SEA ICE (agenda item 8)

8.1 The Commission noted with appreciation the report of Dr I. Frolov (Russian Federation), chairman of the Working Group on Sea Ice, and expressed its thanks

to Dr Frolov and to all members of the group for the work accomplished during the inter-sessional period. In particular it noted with satisfaction the successful implementation of the Global Digital Sea Ice Data Bank (GDSIDB), located in the WDCs A and B for sea-ice data in Boulder, Colorado (United States) and in St. Petersburg (Russian Federation), respectively. The GDSIDB already had extensive holdings of sea-ice data for certain polar regions going back to 1972, and submissions in the SIGRID format were continuing from a number of countries. The operations of the GDSIDB were guided by a special steering group comprised of experts from the two data centres and the Commission requested the Secretariat and the Sub-group on Sea Ice to continue to provide support for the work of this steering group during the coming intersessional period.

8.2 The Commission noted with interest that the complexity and detail of the existing SIGRID format had created difficulties for Members in digitizing and encoding sea-ice data for submission to the GDSIDB and that, in response to this, the GDSIDB Steering Group had prepared a reduced form of SIGRID, to facilitate such encoding, in particular of data to support the WCP. The Commission agreed that this reduced SIGRID format, once reviewed by relevant sea ice experts, and revised as necessary, should be directly promulgated by the GDSIDB centres as the preferred format for data submission. It further agreed that there was no need to formally include the reduced format in the *Manual on Marine Meteorological Services*, since it had already adopted the full SIGRID at its previous session. The Commission reiterated the high priority which it accorded to the GDSIDB, which was providing a major source of sea-ice data essential for the WCP and for global climate studies. The Commission also noted the importance of verifying the quality of the GDSIDB data through comparative analyses of the data submitted by contributing countries. It encouraged the GDSIDB Steering Group to consider the feasibility of also including snow on ice data in the data bank. Finally the Commission urged the GDSIDB Steering Group to make every effort to ensure that the existence, operation and holdings of the data bank were properly publicized, in particular within the climate studies community.

8.3 The Commission noted with interest and appreciation progress in the preparation of the two handbooks which it had proposed at CMM-X. It endorsed the high potential value of the *Handbook on the Analysis and Forecasting of Sea Ice* and requested that every effort be made to ensure the quality and accuracy of the material in the handbook, in the interest of users. It noted that reviews of the first draft of the *Handbook on Sea-ice Navigation in the Southern Ocean* (prepared by an expert from the Russian Federation), by user organizations such as IMO, IHO and ICS, had proposed substantial modifications to and shortening of this draft, so as to make it more accessible to users, in particular ships' officers. The Commission therefore requested the author of the draft handbook to carefully consider these reviews in preparing a revised draft, in

order that the publication, jointly sponsored by WMO and IMO, might be of maximum value to users.

8.4 The Commission noted with interest and appreciation that a second WMO Workshop on the Operational Remote Sensing of Sea Ice had taken place in September 1991 in Ottawa, Canada, hosted by Canada. The Commission expressed its considerable thanks to Canada and to the workshop organizers for this highly successful event, which had addressed recent developments in future potential for quantitative assessments of sea-ice variables using remote sensing techniques. The Commission reiterated the importance of such techniques for quantitative and qualitative sea-ice measurements for both operational and research purposes. It therefore requested the new Sub-group on Sea Ice to consider the development of standardized procedures for the exchange and archival of remotely-sensed sea-ice data during the coming inter-sessional period.

8.5 In addition to the subjects dealt with above, the Commission considered that there were a number of other topics in the field of sea ice which would require attention during the coming inter-sessional period, in particular:

- (a) Further development and revision of the sea-ice nomenclature and terminology, especially in the light of the new remote sensing techniques;
- (b) Consideration of standardized observing practices for sea ice;
- (c) Consideration of the establishment of standardized procedures for the operational exchange of sea-ice products in near-real-time.

In the light of these considerations, the Commission agreed on the need to establish a Sub-group on Sea Ice of the Working Group on Marine Meteorological Services. It noted an increased interest by Members in participating in the group and therefore agreed further that the sub-group should be open, rather than closed, as in the past. Further action in this regard is taken under agenda item 15.

8.6 Finally under this item, the Commission noted with appreciation the important work being undertaken by regional groups, in particular the Baltic Sea Ice Meeting. It agreed that liaison should be continued between the Sub-group on Sea Ice and these regional groups, and requested the chairman of the sub-group and the Secretariat to arrange for such liaison, as appropriate.

9. REVIEW OF TECHNICAL REGULATIONS OF INTEREST TO CMM (agenda item 9)

9.1 The Commission recalled that at its present session it had already adopted amendments and/or additions to the *Manual on Marine Meteorological Services* (also Annex VI to the Technical Regulations), as follows:

- (a) Agenda item 5.1 — Recommendation 3 (CMM-XI) to incorporate the new WMO GMDSS Marine Broadcast system into Part I;
- (b) Agenda item 7.2 — Recommendation 11 (CMM-XI) to revise the Marine Climatological Summaries Scheme, Part I, Section 5.

9.2 The Commission noted that, consequent on these and other recent amendments made to the *Manual*, the text of parts of Chapter B.1 (Climatology) and Chapter C.1 (Meteorological Services for Marine Activities) of the *Technical Regulations* (WMO-No. 49) required to be updated. The Commission therefore adopted Recommendation 15 (CMM-XI) to effect this updating.

9.3 The Commission noted other modifications or corrections to the *Manual on Marine Meteorological Services*, which were required now or might be required in the future:

- (a) Corrections to the Spanish version of the *Manual*, as noted at CMM-X;
- (b) Possible revised standardized format for the presentation of high seas forecasts and warnings.

The Commission requested the Secretariat to deal with (a) above, and the Working Group on Marine Meteorological Services to undertake a study of the formats in use at the present time, with a view to preparing such a revised standard format for consideration at CMM-XII.

10. GUIDES AND OTHER TECHNICAL PUBLICATIONS (agenda item 10)

10.1 The Commission noted with appreciation that the amendments to the *Guide to Marine Meteorological Services*, which it had adopted at CMM-X, had been incorporated into the *Guide*, while the *Guide to Wave Analysis and Forecasting* (WMO-No. 702) had been published during the inter-sessional period also in French, Russian and Spanish. The Commission noted with appreciation that the new *Guide to Applications of Marine Climatology* (WMO-No. 781) would shortly be published, so far in English only. It expressed its appreciation to Mr A. Saulesleja (Canada) and to the other authors for their work in preparing this new *Guide*, which would be of value to all maritime Members concerned with the use of marine climatological data.

10.2 The Commission noted the recommendation stemming from the VOS Special Observing Project North Atlantic (VSOP-NA), which was endorsed by the Subgroup on Marine Climatology at its sixth session, for the inclusion of additional information concerning type and location of instrumentation on board ships of the VOS in the *International List of Selected, Supplementary and Auxiliary Ships* (WMO-No. 47). The Commission agreed that such information was essential for an accurate interpretation of ships' meteorological and oceanographic observations for both operational and research purposes. The Commission agreed further that this publication was a very valuable resource tool in the monitoring of the quality of surface marine observations, as well as in global climate studies, which required to be updated as frequently as possible and also made available in computer-compatible form. Recommendation 16 (CMM-XI) on this topic was therefore adopted. The Commission requested the Secretariat to specify a preferred format for the submission of updates by Members when requesting such submission.

10.3 The Commission noted with appreciation that Mr H. Erdmann (Germany) had prepared a draft revision of Chapter 17 — Marine observations, of the *Guide to Meteorological Instruments and Methods of Observation* (WMO-No. 8), which was now being reviewed prior to inclusion in the updated *Guide*. The Commission noted further that CBS-X had recommended the inclusion of the new operating procedures for the quality control of drifting buoy data on the GTS into the *Guide on the Global Observing System* (WMO-No. 488) (see also agenda item 6.3), and that the Commission for Climatology was undertaking a major revision of the *Guide to Climatological Practices* (WMO-No. 100) (see also agenda item 7.1).

10.4 The Commission noted with appreciation the following technical publications which had been issued under the Marine Programme during the inter-sessional period:

- (a) Marine Meteorology and Related Oceanographic Activities Report series: Reports No. 12 (supplements 2 and 3), 21–27 (No. 25–27, jointly with IOC);
- (b) Reports on Marine Science Affairs No. 16;
- (c) *Handbook on Marine Meteorological Services* (plus revisions);
- (d) Eighteen IGOSS related publications (all jointly with IOC);
- (e) Six DBCP publications (jointly with IOC).

The Commission expressed its appreciation to the authors of all the publications and, in particular, to Mr D. Linforth and Mr P. Parker (Australia) for the *Handbook on Marine Meteorological Services*, which it considered a most valuable publication. The Commission noted with satisfaction that a special edition of the *WMO Bulletin* (Volume 40, No. 2, April 1991) had been devoted to marine related activities, including in particular six feature articles and an interview with Dr H. Stommel. The Commission agreed that all these technical publications had provided very valuable support to Members in implementing their marine-related activities and urged that publication of such reports and documents should be continued during the coming inter-sessional period. The Commission also requested Members to consider translating technical reports into languages other than the original (most often English), so as to increase their value to all Members and in this regard it expressed appreciation to Chile and France for the work already undertaken to prepare such translations.

10.5 The Commission then considered requirements for new publications taking into account priorities for guidance material as well as continuing difficulties in locating rapporteurs willing to prepare technical documents on relevant subjects. It proposed that the following topics were of importance to the Commission and should therefore be considered for study and publication:

- (a) Coastal marine services;
- (b) The weather routing of ships;
- (c) Services for ports, harbours and confined waterways;
- (d) Services in support of combating marine pollution;
- (e) Capabilities and techniques for the transmission of graphical information to ships at sea;
- (f) Techniques for determining precipitation at sea.

The Commission requested its Working Groups on Marine Meteorological Services and on Marine Observing Systems to address these problems and in particular to assist in locating suitable rapporteurs to prepare the proposed reports.

10.6 Finally, the Commission noted that many recent developments, including substantive amendments to the *Manual on Marine Meteorological Services*, would most likely require some extensive revisions to be made to the *Guide to Marine Meteorological Services*. It therefore agreed that a rapporteur should be appointed, within the Working Group on Basic Marine Meteorological Services, to analyse the *Guide* and to prepare proposals for where such revisions were required as well as how these revisions might be effected. These proposals should be considered and, where possible, implemented by the working group during the coming inter-sessional period. Further actions in this regard are taken under agenda item 15.

11. EDUCATION AND TRAINING, TECHNOLOGY TRANSFER AND IMPLEMENTATION SUPPORT ACTIVITIES IN THE FIELD OF CMM (agenda item 11)

11.1 SPECIALIZED EDUCATION AND TRAINING ACTIVITIES (agenda item 11.1)

11.1.1 The Commission noted with interest the report of the chairman of the Sub-group of Regional Rapporteurs, Mr S. Ragoonaden (Mauritius), and expressed its appreciation to Mr Ragoonaden, and to his sub-group, for their work on behalf of CMM. The Commission then reviewed the WMO Education and Training Programme activities of particular relevance to CMM that had taken place during the inter-sessional period. The Commission agreed that, in general, the activities undertaken in this field had been particularly successful, especially with regard to the workshops and training seminars, considered of great value in stimulating and assisting in the further development of marine meteorological services and associated oceanographic activities in developing countries. The Commission noted with pleasure that Eleventh Congress had agreed that related seminars should continue in the future, giving them a new orientation towards specific specialized areas.

11.1.2 The Commission also considered the activities under the Third WMO Long-term Plan relating to the Education and Training Programme (ETRP) and agreed that appropriate support should be given to the Secretariat in its surveys of Members' training requirements. The Commission requested that its Working Group on Education, Training and Implementation Support take into account appropriate aspects of the TLTP/ETRP in the development of its proposals and plans.

11.1.3 The Commission noted the request of EC-XLIV for the establishment of a mechanism to enable a two-way flow of information between, on the one hand, the Commission and the Working Group on Education, Training and Implementation Support and, on the other hand, the WMO Secretariat. It therefore requested the chairman of its working group to be the focal point of

such exchange of information and to keep the Secretariat and the Executive Council Panel on Education and Training informed through the president of the Commission. This arrangement was also taken into consideration in the determination of the terms of reference of the working group (see item 15).

11.1.4 The Commission noted that despite efforts made by Members and the availability of some limited courses and programmes at RMTCs, in particular at RMTC Manila, Philippines, there continued to exist an unfulfilled demand for specialized training in marine meteorology, in particular at the postgraduate (including M.Sc.) level. The Commission felt that one of the possible ways to make known existing curricula in marine meteorology and physical oceanography was through the appropriate insertions in the *Compendium of Training Facilities for Meteorology and Operational Hydrology* (WMO-No. 240). The Commission noted with pleasure that there was a sixth edition of this publication available and that the information contained in it could be provided on diskettes and in database format. The Commission requested that Members should endeavour to keep this information updated for the benefit of all those in need of information for planning their training activities in the marine meteorology field.

11.1.5 The Commission recalled its Recommendation 13 (CMM-X) and was pleased to note the progress achieved towards the implementation of a specialized diploma course in marine meteorology and physical oceanography at the Regional Meteorological Training Centre (RMTTC) Nairobi, Kenya. The Commission agreed that, in view of the acceptance by both international and national authorities for the establishment of the course, urgent efforts were now required to find the appropriate funding so that the course could be initiated as soon as possible. The Commission noted that the project proposed for the course had been submitted for support by UNDP, as well as to other potential funding donor agencies. The Commission expressed its appreciation for the contributions made by the IOC towards the implementation of the course, and hoped that this co-operation could be continued. The Commission agreed that this programme should be used as a pilot project and that similar courses should be established as soon as feasible in other RMTTCs.

11.1.6 The Commission felt that the series of regional seminars and workshops had very well achieved its purpose, and that the new orientation given by Eleventh Congress, namely to plan and implement courses in more specific subjects, represented well the national and regional requirements. Taking into consideration that there were two planned activities for 1993, the International Seminar/Workshop for Port Meteorological Officers (London, September 1993) and the Technical Conference on Space-based Ocean Observations (Bergen, Norway, September 1993), the Commission considered that other subjects which might be covered by seminars during the next inter-sessional period might include marine meteorological services for fisheries, regional wave modelling, waves and storm surges, marine

pollution, marine forecasts for coastal and offshore activities and the role of the ocean in climate and climate change.

11.1.7 The Commission noted with pleasure that the publication of training material for all levels had continued during the inter-sessional period and noted especially the publication of new editions of existing compendia as well as their publication in languages other than English. It requested the Secretariat to maintain the effort to make available training publications in all the languages of the Organization. The Commission was especially pleased with the new version of the *Compendium of Lecture Notes in Marine Meteorology for Class III and IV Personnel* (WMO-No. 434). The Commission also recalled its recommendation for reviewing and updating the *Compendium of Meteorology for Use by Class I and II Meteorological Personnel* (WMO-No. 364), Volume II, Part 3 — Marine meteorology, which dated from 1979. The Commission felt that in view of the technical advances, both in observing and modelling techniques during the last years, as well as other developments in telecommunications, it was now urgent to update that publication. The Commission requested Members to propose suitable experts who could undertake this difficult task. The Commission also noted that the *Guidelines for the Education and Training of Personnel in Meteorology and Operational Hydrology*, (WMO-No. 258), containing syllabi with the aim of assisting Members in the preparation and implementation of training programmes, dated to 1984. In view of the considerable changes and advances that had taken place since its publication, the Commission requested the Working Group on Education, Training and Implementation Support to arrange for the updating of Chapter 10 of this publication.

11.1.8 The Commission also noted the publication of a small booklet containing Instructions for the Guidance of Port Meteorological Officers by Captain G.V. Mackie, which was available in all working languages of WMO, and of another useful publication for training purposes, Cours et manuel No. 5 — Connaissances de base sur la prévision des vagues by J. Manach.

11.1.9 The Commission noted with pleasure that the WMO training library had continued to strengthen and expand its audiovisual materials and update its equipment for use with video cassettes and Computer Assisted Learning (CAL), and invited Members to continue providing relevant material and training aids.

11.1.10 The Commission expressed its thanks to all Members which had hosted seminars and training events during the inter-sessional period and especially to Argentina, China, France, India, Italy, Kenya, Malaysia, United Kingdom and United States. The Commission also expressed appreciation to the United States for establishing two forecast "desks" at WMC Washington. The desks would be staffed by invited forecasters from RA III and RA IV. Forecasters would participate generally for up to six months, and prepared forecast guidance for Members of the Regions. The Commission invited other Members to consider establishing similar programmes.

11.1.11 The Commission was highly appreciative of the fellowships that had been awarded by WMO for studies specifically related to marine meteorology and physical oceanography and noted that an increase in the number of requests for postgraduate studies in those areas was expected. The Commission expressed its hope that fellowships might continue to be awarded to applicants in these fields, and requested those Members who did have ongoing postgraduate programmes in marine meteorology and physical oceanography to co-operate with WMO in its efforts to fulfil the maximum number of requests. The Commission considered that in view of the increasing difficulties in obtaining funding for training activities from traditional sources, including the UNDP and the WMO regular budget, some new sources for funding should be investigated. In this context, it invited both Members and the WMO Secretariat to seek new solutions in this regard. The Commission noted with appreciation that several Members already offered training facilities and fellowships through the Voluntary Co-operation Programme, and invited other Members also to consider providing such assistance.

11.2 TECHNOLOGY TRANSFER AND IMPLEMENTATION SUPPORT ACTIVITIES (agenda item 11.2)

11.2.1 The Commission noted the opinion of Eleventh Congress that continuing high priority should be given to assisting Members in the further implementation of marine meteorological services within the context of the Third WMO Long-term Plan. Such implementation support was normally provided through the WMO Technical Co-operation Programme, at the specific request of the Members concerned, although some limited activities (normally expert advisory missions) were also implemented through the implementation support project of the marine meteorology programme.

11.2.2 The Commission was informed of various implementation support activities which had taken place during the inter-sessional period since CMM-X. These included a number of expert missions and UNDP projects executed in RA I, RA II and RA V through the Technical Co-operation Programme, together with expert missions in RA II/RA V and support for the RA I rapporteurs on marine meteorological services through the marine meteorology programme.

11.2.3 In expressing its approval for these activities, the Commission urged other maritime Members, where appropriate, to submit similar requests for support to facilitate the further development of their marine observing systems and marine services, within the context of the overall marine meteorology programme component of the Third WMO Long-term Plan. The Commission considered that many Members might benefit in particular from a regionally-based co-operative approach to the development of marine meteorological services. In this regard it strongly encouraged the rapid implementation of the proposed South-East Asian sub-regional project, which had been developed following the expert mission to the region undertaken by the president and vice-president of the Commission, together with the separate expert missions to single countries by the

vice-president and by Mr P. Parker (Australia). It also requested that studies should be undertaken during the next inter-sessional period on the possibility of developing similar projects in other geographical regions, in particular East and West Africa.

11.2.4 The Commission noted the potential high value to maritime Members of a study on the costs and benefits of marine meteorological services to the marine user community, and in this regard it recalled the joint study now being undertaken by the CMM Working Group on Marine Meteorological Services, in conjunction with IGOSS, on the costs and benefits of both marine meteorological and oceanographic services (see also agenda items 5.2 and 12.2). It urged that this study should be completed as soon as possible, and the results made widely available to national Meteorological and Oceanographic Services.

11.2.5 The Commission recalled that the WMO Voluntary Co-operation Programme (VCP) had been established essentially to facilitate the global implementation of the WWW and that the programme could also be used in this context to enhance both marine observing systems and marine services. The Commission therefore urged maritime Members to consider strongly the possibilities for formulating appropriate VCP requests, in line with established procedures, as a means in particular for enhancing their marine observing systems in support of the World Weather Watch (WWW) and also of marine meteorological services, the Global Climate Observing System (GCOS) and the Global Ocean Observing System (GOOS).

12. RELATIONSHIP WITH OTHER WMO PROGRAMMES AND THOSE OF OTHER ORGANIZATIONS AND BODIES (agenda item 12)

12.1 OTHER WMO PROGRAMMES (agenda item 12.1)

12.1.1 The Commission noted with interest the results of studies undertaken within the WMO Global Atmosphere Watch Programme and the IMO/FAO/UNESCO/WMO/WHO/IAEA/UN/UNEP Joint Group of Experts on the Scientific Aspects of Marine Pollution (GESAMP) on assessing the atmospheric transport and deposition of pollutants into the marine environment, which showed that the atmospheric input of some pollutants was equal to or dominated their input through the rivers. It was also noted that marine climatological data, especially those on precipitation, over many sea areas, were not sufficient for more precise assessments of atmospheric transport and deposition of pollutants, and of the air/sea exchange of substances. The Commission noted with interest and appreciation the monitoring activities being undertaken by Japan of chemical components of both the atmosphere and ocean in the western Pacific region, and urged other countries to implement similar monitoring programmes in other ocean areas. The Commission agreed on the need for a rapporteur to prepare an analysis of techniques for assessing precipitation over the oceans, and referred this matter to the Sub-group on Ocean Satellites and Remote Sensing for further consideration.

12.1.2 The Commission recalled that Eleventh Congress had noted with concern that commercial

activities had the potential to undermine the exchange of meteorological data and products among national Meteorological Services. As a follow-up to this decision of Congress, the Executive Council established the EC Working Group on Commercialization of Meteorological and Hydrological Services, which met in October 1992 and made a number of recommendations which would be considered by EC-XLV in June 1993. The Secretary-General, in his opening address to CMM-XI, requested the Commission to provide technical advice concerning marine data and products. Such advice would be very valuable for consideration at EC-XLV as they addressed the report of the working group.

12.1.3 The Commission considered this to be an important and complex issue that had some unique characteristics regarding the acquisition and exchange of data from the ocean and coastal areas. It agreed that there were many marine meteorological services which depended on unrestricted data exchange. These included:

- (a) Responsibilities under the SOLAS Convention, providing services to ships of all nations;
- (b) The provision of services in support of marine environmental quality; and
- (c) Marine observations and climatological activities related to the World Climate Programme.

The Commission noted that observing systems such as satellites, data buoys and voluntary observing ships were the primary data sources for accomplishing the Commission's programmes, and since these observations were made largely over extraterritorial areas of the globe, special consideration for their exchange would be necessary. At the same time, the Commission recognized that many Members used marine meteorological and oceanographic data in the provision of specialized services to support particular marine user groups and activities.

12.1.4 The Commission asked the president of CMM to bring this matter to the attention of EC-XLV for consideration in the ongoing work of the Executive Council working group. The Commission also asked the Advisory Working Group to provide advice to the president on this issue, in the light of further guidance to be provided by the Executive Council.

12.2 INTEGRATED GLOBAL OCEAN SERVICES SYSTEM (IGOSS) (agenda item 12.2)

12.2.1 The Commission noted with interest the continuing improvements in IGOSS implementation, including in particular:

- (a) Overall maintenance of the numbers of BATHY reports distributed on the GTS, including observations made by some national navies, despite severe financial difficulties (and hence restrictions in observing programmes) being experienced by a number of countries;
- (b) Continuation of the successful sea-level programme in the Pacific, initial implementation of a similar pilot project in the North and Tropical Atlantic and re-activation of a satellite altimetry pilot project;
- (c) Conversion of the successful sub-surface thermal structure pilot project into a permanent programme;

- (d) Initiation and regular publication of an IGOSS products bulletin, as a concrete demonstration of the advent of operational oceanography and as a vehicle for providing a regular analysis of the synoptic state of the world's oceans.

12.2.2 In addition to these ongoing aspects of IGOSS, the Commission noted with appreciation two other major achievements of IGOSS during the past four years, namely:

- (a) The establishment, jointly with the International Oceanographic Data and Information Exchange (IODE) of IOC, of the Global Temperature Salinity Pilot Project (GTSP), to provide as complete as possible a set of global sub-surface temperature and salinity data, of known high quality, in support of many users, but including global climate studies in particular;
- (b) The work of the Task Team on Quality Control Procedures for Automated Systems, in analysing and revising the existing XBT fall-rate equation.

The Commission agreed that all these activities of IGOSS, which were complementary to its own work in marine observing systems and marine services, were indicative of the present healthy state of IGOSS and of the important role which it must play, along with CMM itself, in supporting GCOS and GOOS. At the same time, the Commission noted the continuing problems in obtaining sub-surface temperature data from large parts of the southern hemisphere oceans, as well as the general lack of salinity data from all ocean areas. It agreed that filling these data gaps would be very important to the success of studies of global climate and climate change, and it therefore urged its members to make every effort to assist their national oceanographic communities, through the National Representatives for IGOSS, in their efforts to remedy this situation. The Commission further recommended that efforts should be made to persuade national navies to release their oceanographic data to IGOSS, for both operational and archival purposes, and noted with appreciation that navies in some countries were already taking such actions. Finally, the Commission noted the importance of establishing clear and specific requirements for oceanographic data, particularly salinity data, in terms of spatial coverage, quality, depth, etc., in order that the most effective use could be made of the limited available resources for the collection of such data.

12.2.3 The Commission welcomed the support of IGOSS in the work of the joint *Ad Hoc* Group on Ocean Satellites and Remote Sensing as well as the offer of the sixth session of the joint IOC/WMO Committee for IGOSS (Geneva, November 1991) to continue to co-sponsor the group. In this context, it also noted and welcomed the offer by the IOC Committee for International Oceanographic Data and Information Exchange (IODE) to become a third co-sponsor of the group. Further action on this matter is taken under agenda item 15. A number of other important results of IGOSS-VI which were relevant to the work of CMM were also dealt with under the relevant agenda items (e.g. oceanographic data exchange codes under agenda item 6.7).

12.2.4 In addition to the new oceanographic satellites, the Commission agreed that there were a number of

other areas of overlapping interest between CMM and IGOSS, including satisfying user requirements for combined meteorological and oceanographic services, support to global climate studies and to GCOS and GOOS, and making the most cost-effective use of marine observing platforms and facilities. The Commission agreed that it was essential to continue to co-ordinate at the working group level through reciprocal membership. Further action on this matter is taken under agenda item 15. At the same time, the Commission considered that broader possibilities for enhanced co-operation should be studied further and therefore requested the president of CMM to address this question, together with the chairman of IGOSS.

12.3 INTER-SECRETARIAT COMMITTEE ON SCIENTIFIC PROGRAMMES RELATED TO OCEANOGRAPHY (ICSPRO) AND OTHER ORGANIZATIONS AND BODIES (agenda item 12.3)

UNITED NATIONS CONFERENCE ON ENVIRONMENT AND DEVELOPMENT (UNCED) AND AGENDA 21

12.3.1 A presentation was made on the results of UNCED including Agenda 21 and the Framework Convention on Climate Change as well as on Resolution 14 and Resolution 15 (EC-XLIV). The presentation discussed the specific relationship between these activities and those of WMO and the Commission.

12.3.2 The Commission agreed that UNCED, and its results, represented a major milestone for the protection of the global environment and for the sustainable development of all peoples. It recognized the long-term implications of both Agenda 21 and the Framework Convention on Climate Change to its work, especially as they applied to strengthening of systematic ocean observations and to the full and open exchange of data. The Commission also recognized the importance of the role of the national Meteorological and Hydrological Services in implementing the results of UNCED at the local level.

12.3.3 The Commission established Rapporteurs on the Follow-up to UNCED with the urgent task of reviewing Agenda 21 and the Framework Convention on Climate Change, in co-operation with the EC Working Group on the Follow-up to UNCED, including Capacity Building, in order to identify specific actions which could be taken by CMM and national Meteorological and Hydrological Services in the areas of systematic ocean observations and the exchange of data. Resolution 1 (CMM-XI) was adopted.

INTER-SECRETARIAT COMMITTEE ON SCIENTIFIC PROGRAMMES RELATED TO OCEANOGRAPHY (ICSPRO)

12.3.4 The Commission noted with approval that WMO had continued to participate in, and strongly supported the inter-secretariat co-ordination in marine scientific research and monitoring provided through ICSPRO. It supported the proposal that both the membership and terms of reference of ICSPRO should be broadened so that ICSPRO might act in the future as a UN system-wide mechanism for co-operation and co-ordination in all aspects of marine affairs, as well as for reporting on the follow-up to marine aspects of

Agenda 21 and the UNCED Conventions. Finally, the Commission noted with appreciation that UNEP had recently agreed to become a full member organization of ICSPRO.

INTERGOVERNMENTAL OCEANOGRAPHIC COMMISSION (IOC)

12.3.5 In recalling the numerous references to co-operation with IOC already recorded during its present session, the Commission underlined the importance to WMO of maintaining and expanding this co-operation in the future. In this context, the Commission noted with approval the wide range of co-ordination issues and co-operative activities between WMO and IOC now being addressed at the inter-secretariat level as well as by the governing bodies of both Organizations.

12.3.6 The Commission agreed that these activities augured well for the future co-operation between WMO and IOC at the international level. At the same time, however, it recognized that such co-operation could only be truly effective if reflected also at the national level. The Commission therefore urged its members to become actively involved within their own countries in fostering closer co-operation between national Meteorological Services and oceanographic institutions and agencies on matters of common interest.

OTHER ORGANIZATIONS

12.3.7 The Commission recalled with satisfaction the close and fruitful co-operation which existed among WMO, IMO, IHO and INMARSAT in the development and implementation of the new WMO GMDSS marine broadcast system (see agenda item 5.3), as well as in many other aspects of the collection of data from and the provision of services for the marine environment. In addition, it noted with appreciation that WMO had continued to co-operate with a variety of other organizations and bodies during the inter-sessional period on marine-related matters, including the UN, UNEP, FAO, ITU, CPPS, ICS, IFSMA, Oil Industry E&P Forum, ICSU/SCOR, IUCN, IOMAC and CLS/Service Argos. It agreed on the value to WMO and Members of this co-operation, and urged that it should be continued and expanded in the future.

13. WMO LONG-TERM PLAN (agenda item 13)

13.1 The Commission noted that Eleventh Congress had approved the Third WMO Long-term Plan (TLTP) as the single planning document of WMO and that the programme and budget of the Organization for the eleventh financial period (1992–1995) had been developed to effect the implementation programme given in the TLTP. The Marine Meteorology and Associated Oceanographic Activities Programme 1992–2000, included in Part II, Volume 4 of the TLTP, therefore constituted the overall objectives and broad work programme of the Commission and its working groups and rapporteurs for the coming inter-sessional period. On this basis, the Commission developed its comprehensive work programme for the period 1993–1997. The terms of reference of working groups and rapporteurs adopted by the Commission were also directed towards achieving the objectives of the TLTP. These are recorded under agenda item 15.

13.2 The Commission also noted that Eleventh WMO Congress had requested that the status of implementation of the TLTP should be monitored and that EC-XLIV had provided some guidance on the role of the technical commissions in this monitoring. The Commission therefore instructed its working groups and rapporteurs to monitor those sections of the marine meteorology programme for which they had specific responsibility. It also instructed the Advisory Working Group to monitor implementation and impacts of the overall programme and to prepare summary results of this monitoring for consideration by the Executive Council and by Cg-XII, as appropriate.

13.3 Eleventh Congress also decided that the Fourth WMO Long-term Plan (4LTP) should be prepared for the period 1996–2005, with the technical commissions, as before, taking the lead in preparing the respective volumes of Part II of the plan. General guidance for the preparation of the 4LTP had been developed by the EC Working Group on Long-term Planning and endorsed by EC-XLIV. Taking into account this guidance, and based on its own perspective of developments and requirements in the marine field over the next decade, as well as the existing TLTP, the Commission agreed that the following general priority areas should merit consideration in the preparation of the marine meteorology programme section of the 4LTP:

- (a) The development of global marine meteorological and oceanographic observing systems, making use of both traditional and new techniques;
- (b) Improvements in both basic and specialized marine meteorological services, including further development of the new GMDSS marine broadcast system and the trial MPERSS;
- (c) The expansion of the global digital sea ice data bank, and continuing improvements to the MCSS;
- (d) Enhanced specialized education and training activities; expanded technology transfer; and an expanded and improved PMO network;
- (e) Increased emphasis on the role of the oceans in global climate studies and in global environmental protection.

13.4 With regard to procedures for the preparation, review and finalization of the 4LTP, the Commission requested the president of CMM to arrange for the initial drafting of the text for the marine meteorology programme, in collaboration with the Secretariat and in line with the guidance on structure, content and timing to be provided by the EC-XLV. This initial text should be reviewed as widely as possible within the Commission, including the Advisory Working Group and other working groups, as appropriate, before the preparation of a revised version of the plan for the consideration of the Executive Council, Members and ultimately Cg-XII.

13.5 With regard to the status of the marine programme within the context of the overall WMO programme structure in the 4LTP, the Commission noted with interest the proposal contained in the final report of the first session of the Executive Council Working Group on Long-term Planning (Geneva, June 1992), that consideration might be

given to elevating the Marine Meteorology and Associated Oceanographic Activities Programme to the status of a major Programme of WMO. The Commission agreed that the scope and range of activities under the marine programme had grown considerably in the past few years, and that this growth would certainly continue in the future. Such growth was reflected in the expanding range of issues dealt with by CMM; the Commission's increased work programme; other new activities now falling under the marine programme; increased co-operative activities with other organizations, in particular IOC; and, most importantly, the increasing involvement of national Meteorological Services in the operation of marine observing systems, the processing of marine data and the provision of marine services.

13.6 At the same time, the Commission recognized that the marine programme was closely related to almost all other WMO programmes, and that its status could not be addressed in isolation but must be evaluated in the light of the overall WMO programme structure. The Commission therefore requested the president of CMM to bring these views to the attention of the Executive Council during its discussions on the preparation of the 4LTP, as well as to the Executive Council Working Group on Long-term Planning, as appropriate. The Commission also requested the Advisory Working Group to keep the question of the status of the WMO Marine Meteorology and Associated Oceanographic Activities Programme under review, and to advise the president, as necessary, on further actions which might be taken in this regard.

14. SCIENTIFIC LECTURES (agenda item 14)

14.1 Following the decision of the CMM Advisory Working Group, scientific lectures at the session were arranged within the main technical part of the agenda on the theme of Ocean Remote Sensing. The lectures were intended to serve as a means of informing the members of the Commission on the present status and future plans in this field, as well as of the role of such observations in programmes such as the Global Ocean Observing System (GOOS) and in support of meteorological and oceanographic services.

14.2 The Commission agreed that all the lectures presented were highly informative in a subject which was, as yet, not well known to many potential users of ocean remote-sensing data. The Commission expressed its appreciation to the lecturers for the time and effort they had spent in preparing the lectures. The Commission requested that the full texts of all the lectures should be compiled by the Secretariat and published as a single volume in the Marine Meteorology and Related Oceanographic Activities Reports series.

15. ESTABLISHMENT OF WORKING GROUPS AND NOMINATION OF RAPORTEURS (agenda item 15)

15.1 The Commission recalled that the working groups and rapporteurs which it had established at CMM-X had undertaken very valuable work during the past inter-sessional period, and it agreed that it had a continuing requirement for an appropriate system of

working groups and rapporteurs in the future. At the same time, it noted that major developments and changes were now occurring, both nationally and internationally, in ocean monitoring, ocean research and the provision of ocean-related services. Some of these changes were forced externally by events such as the United Nations Conference on Environment and Development (UNCED), some were essentially internal such as GCOS and GOOS, and some were forced by changing user requirements such as the need for integrated meteorological/oceanographic services. At the same time, WMO had been required to maintain a zero-growth budget, so that the Organization was being asked to expand its work load with effectively decreasing funds.

15.2 In view of these considerations, and in the light of the reports of the president and working group chairmen to CMM-XI, as well as discussions held during the session, the Commission agreed on the requirement for a modified system of working groups and rapporteurs for the coming inter-sessional period. The main features of this modified system were:

- (a) The Advisory Working Group would continue to be the key element in the management of the marine programme and would remain largely unchanged. The Advisory Working Group might also invite other experts to participate in its sessions, as appropriate, on those matters to be discussed;
- (b) The major working groups were reduced to three, corresponding to the three major components of the marine programme as given in the LTP: services, observations and education, training and implementation support (ETIS);
- (c) The Working Group on Marine Meteorological Services would cover both basic and specialized marine meteorological services and would include as sub-groups all the existing service-related activities of CMM (climatology, sea ice, GMDSS, waves) together with rapporteurs on specific topics or for liaison with other relevant bodies;
- (d) The Working Group on Observing Systems would give overall coherence to the various marine observing system components (including satellites), in the light of expressed requirements for data. It would propose approaches to remedying deficiencies and provide for liaison with other relevant bodies and activities;
- (e) The new Working Group on Education, Training and Implementation Support had a number of important roles to play:
 - (i) To provide a mechanism for enhanced regional input to the work of the Commission;
 - (ii) To provide coherent advice to CMM, to Members and to the Secretariat on Members' requirements for marine meteorological services;
 - (iii) To better structure the advice from Members on education and training requirements, including areas such as remote sensing, pollution and modelling;

- (iv) To also provide advice to Members on relevant aspects of information technology development.

15.3 The Commission recalled that it had established requirements, under various agenda items at the present session, for the appointment of rapporteurs to prepare technical reports or detailed proposals on specific topics. It agreed that these rapporteurs should also be selected within the appropriate major working groups.

15.4 The Commission adopted Resolutions 2 (CMM-XI), 3 (CMM-XI), 4 (CMM-XI) and 5 (CMM-XI) to establish these working groups. Details of the terms of reference and membership of each group are included in the respective resolutions.

16. REVIEW OF PREVIOUS RESOLUTIONS AND RECOMMENDATIONS OF THE COMMISSION AND OF RELEVANT RESOLUTIONS OF THE EXECUTIVE COUNCIL (agenda item 16)

16.1 In accordance with current practice, the Commission examined those resolutions and recommendations adopted prior to its eleventh session and which were still in force. It noted that the action on most of its previous recommendations had already been taken and completed, or their substance incorporated in the *Manual on Marine Meteorological Services*, and the *Guide to Marine Meteorological Services*, as appropriate. Resolution 6 (CMM-XI) was adopted. A list of past recommendations maintained in force appears in Annex IV to this report.

16.2 The Commission also examined the Executive Council resolutions within the field of the activities of CMM. Recommendation 17 (CMM-XI) was adopted.

17. ELECTION OF OFFICERS (agenda item 17)

The Commission elected Mr R.J. Shearman (United Kingdom) as president of CMM and Dr Lim Joo Tick (Malaysia) as vice-president.

18. DATE AND PLACE OF THE TWELFTH SESSION (agenda item 18)

18.1 In the absence of any formal invitation from delegations during the session, the Commission decided that the date and place of its twelfth session should be determined by its president, after consultation with the Secretary-General, and in accordance with the provisions of Regulation 186 of the General Regulations.

18.2 The Commission noted with concern the relatively low representation from developing countries at the present session and urged that every effort should be made to increase such representation at the twelfth session in view of the important contribution which such countries could make to the session and to the work of CMM, as well as the benefits which they would derive from participating in the Commissions' sessions. The Commission therefore requested the president of CMM to consult with the presidents of other technical commissions and with the Secretariat on this matter, with a view

to identifying specific proposals for increasing such representation. A reduction in the length of Commission sessions was suggested as one such possible proposal.

19. CLOSURE OF THE SESSION (agenda item 19)

19.1 In his closing address, the president of the Commission, Mr R. J. Shearman, reviewed the major achievements of the Commission during the past inter-session period, including in particular the implementation of the new GMDSS marine broadcast system, the development of the marine pollution emergency response support system, the Marine Services Monitoring Programme, and the revision to the Marine Climatological Summaries Scheme. With regard to the future, Mr Shearman stressed the importance during the coming few years of the work to be done by the Commission in areas such as increasing the range and quality of marine meteorological and oceanographic services on the basis of expressed user requirements, further developing certain components of composite operational ocean observing systems, such as the VOS and ocean satellites, assisting Members to further develop their marine-related activities through special training and assistance projects, and ensuring that full co-ordination was maintained with the new initiatives such as GOOS and GCOS.

19.2 Mr Shearman then expressed his gratitude to the Government of Portugal and the National Meteorological Service for hosting the session, and to the vice-president, chairmen of working groups, sub-groups and *ad hoc* groups, and rapporteurs for their hard work and co-operation, all of which had contributed to the considerable achievements of the Commission. He also thanked the staff of the WMO Secretariat for their assistance and support throughout the inter-session period.

19.3 Speaking on behalf of delegates to the session, Mr Y. Salahu (Nigeria) expressed his thanks to the president for his excellent leadership during the past four years, and for his very effective conduct of the session. He also reiterated the appreciation of the president to the Government of Portugal and to the Secretariat (including the interpreters, translators, and secretaries) for their support. These remarks were echoed by many delegates.

19.4 On behalf of the Secretary-General of WMO, Professor G.O.P. Obasi, Dr P. Dexter expressed his appreciation to the Government of Portugal and the national Meteorological Service for having hosted the session and for providing such excellent facilities, hospitality and support. Dr Dexter then thanked particularly the interpreters, translators, secretaries and support staff for their efforts throughout the session. Finally, Dr Dexter thanked the president and delegates for their kind words to the Secretariat and wished the Commission another successful inter-session period, during which it would continue to receive the full support of the Secretariat.

19.5 The eleventh session of the Commission for Marine Meteorology closed at 10.45 a.m. on 30 April 1993.

RESOLUTIONS ADOPTED BY THE SESSION

RESOLUTION 1 (CMM-XI)

RAPPORTEURS ON THE FOLLOW-UP TO UNCED

THE COMMISSION FOR MARINE METEOROLOGY,

NOTING:

- (1) The results of the UN Conference on Environment and Development including the Rio Declaration, Agenda 21, the Statement of Forest Principle, the Convention on Biodiversity, and the Framework Convention on Climate Change,
- (2) Resolutions 14 and 15 (EC-XLIV),

useful **CONSIDERING:**

- (1) That there are long-term implications of the results of the UN Conference on Environment and Development for WMO and for national Meteorological and Hydrological Services,
- (2) That there is international recognition of the importance of systematic ocean observations and full and open exchange of data for sustainable development and for detection and prediction of climate change,

- (3) The need for CMM to consider the role and support of the WMO marine observing systems and services in the follow-up to UNCED and their relationship with other related activities, both within and outside WMO,

DECIDES:

- (1) To establish Rapporteurs on the Follow-up to UNCED who will work closely with the EC Working Group on Follow-up to UNCED including Capacity Building to review, as a matter of urgency, Agenda 21 and the Framework Convention on Climate Change in order to identify specific actions which could be taken by CMM and national Meteorological and Hydrological Services in the areas of systematic ocean observations and exchange of data;
- (2) To nominate the vice-chairmen of the CMM Working Groups on Marine Meteorological Services, on Marine Observing Systems and on Education, Training and Implementation Support, as rapporteurs.

RESOLUTION 2 (CMM-XI)

ADVISORY WORKING GROUP OF THE COMMISSION FOR MARINE METEOROLOGY

THE COMMISSION FOR MARINE METEOROLOGY,

NOTING:

- (1) Resolution 1 (CMM-X) — Advisory Working Group of CMM,
- (2) Resolution 18 (Cg-XI) — Marine meteorology and associated oceanographic activities for the period 1992–1995,
- (3) Resolution 28 (Cg-XI) — The Third WMO Long-term Plan,

CONSIDERING:

- (1) The need of the Commission to promote marine meteorological and related oceanographic programmes and activities,
- (2) The contributions of the Commission to the WWW, WCP, GCOS and GOOS,
- (3) The need to co-ordinate the work of CMM with that of IOC and other appropriate international organizations and their subsidiary bodies,
- (4) The need for continued overall co-ordination of the

work programme of the Commission and for advice on matters referred to it by the Executive Council or Congress,

DECIDES:

- (1) To establish an Advisory Working Group with the following terms of reference:
 - (a) To advise the president in the short- and long-term planning of the future work of the Commission, including preparation of the relevant section of the Fourth WMO Long-term Plan;
 - (b) To assist the president in the co-ordination of activities of working groups and rapporteurs of CMM;
 - (c) To keep under review the internal structure and working methods of the Commission, including its relationship to other bodies, both internal and external to WMO;
 - (d) To advise on the methods of carrying out projects and activities referred to CMM for

- action by WWW, WCP, IGOSS, GCOS, GOOS and other programmes;
- (e) To advise the president on matters requiring co-ordination with IOC and other international organizations;
- (f) To monitor the implementation of the Marine Meteorology and Associated Oceanographic Activities Programme within the Third WMO Long-term Plan, with particular reference to the development and implementation of marine meteorological services;
- (2) That the Advisory Working Group will be composed of:
- (a) The president of CMM;
- (b) The vice-president of CMM;
- (c) The chairman of the CMM Working Group on Marine Meteorological Services;
- (d) The chairman of the CMM Working Group on Marine Observing Systems;
- (e) The chairman of the CMM Working Group on Education, Training and Implementation Support;
- (f) Dr I. Frolov (Russian Federation);
- (g) Mr K. Nagasaka (Japan);
- (h) Mr R. Sonzini (Argentina);
- (3) That additional experts may be invited by the president, in consultation with the Secretary-General, to participate in sessions of the working group, as appropriate;
- (4) That Captain G.V. Mackie (United Kingdom) be co-opted to assist the working group on matters related to the GMDSS, VOS, PMOs and liaison with IMO and INMARSAT.

RESOLUTION 3 (CMM-XI)

WORKING GROUP ON MARINE METEOROLOGICAL SERVICES

THE COMMISSION FOR MARINE METEOROLOGY,

NOTING:

- (1) Resolution 2 (CMM-X) — Working Group on Basic Marine Meteorological Services,
- (2) Resolution 3 (CMM-X) — Working Group on Specialized Marine Meteorological Services, including Marine Climatological Services,
- (3) Resolution 4 (CMM-X) — Working Group on Sea Ice,
- (4) Resolution 5 (CMM-X) — Working Group on Technical Problems,
- (5) The *Third WMO Long-term Plan*, Part II, Volume 4, Section 4.4 — Marine Meteorology and Associated Oceanographic Activities Programme,
- (6) The report of the president of CMM to CMM-XI,
- (7) The reports of the chairmen of the working groups on Basic Marine Meteorological Services, on Specialized Marine Meteorological Services, on Sea Ice and on Technical Problems to CMM-XI,

CONSIDERING:

- (1) The continuing and expanding user demand for marine meteorological services and information, including both basic services in support of the safety of life at sea as well as more specialized services for particular user groups,
- (2) The need to monitor continuously marine meteorological services to ensure that these services fully meet user requirements,
- (3) The need to keep under review the requirements of Members for guidance in the implementation of their obligations as specified in the *Manual on Marine Meteorological Services* (WMO-No. 558),

- (4) The need to closely monitor the implementation of the new WMO GMDSS marine broadcast system, to further develop the WMO marine pollution emergency response support system, and to provide guidance and assistance to Members in this work, as appropriate,
- (5) The need to co-ordinate closely with other WMO Programmes (WWW, WCP), as well as with other organizations such as IOC, IMO, IHO and ICS in the provision of marine meteorological services and information,

DECIDES:

- (1) To establish a Working Group on Marine Meteorological Services with the following terms of reference:
 - (a) To monitor user response to existing services and requirements for new services, both basic and specialized;
 - (b) To monitor and assist in the implementation of the new GMDSS system, including NAVTEX services, as required;
 - (c) To assist in and evaluate the trials of the draft MPERSS and to prepare a revised version for consideration by CMM-XII;
 - (d) To provide advice to Members on the development and implementation of marine meteorological services, in particular in areas such as fisheries, coastal zone management, wave forecasting, sea ice, etc;
 - (e) To co-ordinate with CBS, IGOSS and the WCP, as well as with user organizations such as IMO,

- IHO and ICS, on the requirements for marine meteorological services;
- (f) To review and co-ordinate requirements for and provision of marine climatological data and services, including sea ice;
 - (g) To review and update, as necessary, existing marine-related meteorological manuals and guides;
 - (h) To undertake specific studies and prepare guidance material and technical reports on aspects of marine services, as necessary;
 - (i) To co-ordinate and assist in the implementation of the revised WMO Wave Programme;
- (2) That the working group will include:
 - (a) A sub-group on marine climatology;
 - (b) A sub-group on sea ice;
 - (c) A sub-group on wave modelling and forecasting;
 - (d) An *ad hoc* group on GMDSS implementation;
 - (e) Rapporteurs for CBS; WCP; IGOSS; the revision to the *Guide to Marine Meteorological Services*; marine pollution transport modelling; other specific topics as dictated by the work programme;
 - (3) That the working group will be essentially open, with additional membership as follows:
 - (a) The Sub-group on Marine Climatology, to include representatives of the eight responsible Members for the Marine Climatological Summaries Scheme;
 - (b) The Sub-group on Wave Modelling and Forecasting, to be composed of an appropriate number of experts selected by the president of CMM, in consultation with the chairman of the sub-group, together with an expert designated by the Secretary IOC;
 - (c) The *Ad Hoc* Group on GMDSS Implementation, to include representatives of the fifteen issuing services for the GMDSS and a rapporteur on NAVTEX services in the Baltic Sea region;
 - (d) Rapporteurs to be nominated by CMM, by the president of CMM, or by other WMO bodies;
 - (4) To select, in accordance with Regulation 32 of the General Regulations:
 - (a) Mr R. Landis (United States) as chairman of the working group;
 - (b) An expert from Canada as vice-chairman of the working group;
 - (c) Dr L. Kaufeld (Germany) as chairman of the Sub-group on Marine Climatology;
 - (d) Dr I. Frolov (Russian Federation) as chairman of the Sub-Group on Sea Ice;
 - (e) Dr V. Ryabinin (Russian Federation) as chairman of the Sub-group on Wave Modelling and Forecasting;
 - (f) Captain G. Mackie (United Kingdom) as chairman of the *Ad Hoc* Group on GMDSS Implementation;
 - (5) To select, in accordance with Regulation 32 of the General Regulations the following rapporteurs:
 - (a) Mr D. Linforth (Australia) on the revision to the *Guide to Marine Meteorological Services*;
 - (b) Dr S. Ovsienko (Russian Federation) and an expert from France on marine pollution transport modelling;
 - (c) Mr M. Ziemianski (Poland) on NAVTEX services in the Baltic Sea region;
- INVITES** the president of CBS, the president of CCI and the chairman of IGOSS to nominate rapporteurs to serve on the working group;
- REQUESTS** the Secretary-General to invite IOC, IMO, FAO, IHO, ICS, IFMA and INMARSAT to participate in the work of the group;
- REQUESTS** further the president of CMM, in consultation with the chairman of the working group and the chairmen of the respective sub-groups and *ad hoc* group, as appropriate, to elaborate specific and detailed terms of reference for these sub-groups and *ad hoc* group, as soon as possible after the session and within the overall terms of reference and other guidance provided by the Commission for the working group.

RESOLUTION 4 (CMM-XI)

WORKING GROUP ON MARINE OBSERVING SYSTEMS

THE COMMISSION FOR MARINE METEOROLOGY,
NOTING:

- (1) Resolution 2 (CMM-X) — Working Group on Basic Marine Meteorological Services,
- (2) Resolution 5 (CMM-X) — Working Group on Technical Problems,
- (3) The *Third WMO Long-term Plan*, Part II, Volume 4, Section 4.4 — Marine Meteorology and Associated Oceanographic Activities Programme,
- (4) The report of the president of CMM to CMM-XI,
- (5) The reports of the chairmen of the working groups on Basic Marine Meteorological Services and Technical Problems to CMM-XI,
- (6) Resolution 9 (Cg-XI) — Global Climate Observing System,
- (7) Resolution 21 (Cg-XI) — WMO's involvement in the development of a Global Ocean Observing System,

- (8) The proposals by the Joint IOC/WMO Committee for IGOSS and by the IOC Committee for IODE to co-sponsor the sub-group on ocean satellites and remote sensing,

CONSIDERING:

- (1) The need to maintain, co-ordinate and improve a variety of marine observing systems, including the VOS, moored and drifting buoys and various ocean remote-sensing systems, in response to requirements for marine data to support the WWW, WCP, marine meteorological services, IGOSS, GCOS and GOOS,
- (2) The need to monitor new developments in marine observation technology and advise on its incorporation, as appropriate, into operational observing systems;
- (3) The need to review continuously marine telecommunications systems and procedures, as well as marine reporting codes, to ensure that they fully meet requirements for the collection and exchange of marine data,
- (4) The need to continue to provide guidance to Members on technical aspects of marine observing systems,
- (5) The need to liaise and co-ordinate with appropriate bodies of CBS, CIMO, IGOSS, DBCP, GCOS and GOOS on marine instrumentation and observations as well as on requirements for marine data,

DECIDES:

- (1) To establish a Working Group on Marine Observing Systems with the following terms of reference:
 - (a) To monitor requirements for marine meteorological and oceanographic data for marine services as well as in support of other programmes and activities;
 - (b) To monitor status of existing operational marine meteorological observing systems and to develop specific proposals to overcome deficiencies;
 - (c) To monitor development of new observing techniques, including ground and satellite-based remote sensing, and to provide advice and guidance on incorporation of these into operational marine observing systems, on the applications of these data for the provision of marine services, and on the processing, formatting and archival of the data;
 - (d) To review requirements for marine reporting codes and make proposals for additions or modifications, as necessary;
 - (e) To review and advise on developments in marine telecommunications, in particular INMARSAT and other satellite-based systems;
 - (f) To undertake specific studies and prepare technical reports on aspects of marine observing systems, as necessary;
 - (g) To co-ordinate with CBS, CIMO, IGOSS, DBCP, GCOS and GOOS bodies, as appropriate, on marine instrumentation and observations, as well as on requirements for marine data;

- (2) That the working group will include:
 - (a) A sub-group on ocean satellites and remote sensing to be jointly sponsored by the Joint IOC/WMO Committee for IGOSS;
 - (b) Rapporteurs for CBS; CIMO; IGOSS; DBCP; GCOS and GOOS; standardized shipboard observing practices; Beaufort equivalent scales; automated shipboard observing systems, and other specific topics, as dictated by the work programme;
- (3) That the working group will be essentially open, with additional membership as follows:
 - (a) The Sub-group on Ocean Satellites and Remote Sensing, to be composed of seven experts selected by the president of CMM, the chairman of the Joint Committee for IGOSS, and the chairman of the IOC Committee for IODE, in consultation with the chairman of the sub-group;
 - (b) Rapporteurs to be nominated by the Commission for Marine Meteorology or by other WMO bodies;
- (4) To select, in accordance with Regulation 32 of the General Regulations:
 - (a) Mr J. Guddal (Norway) as chairman of the working group;
 - (b) An expert from France as vice-chairman of the working group;
 - (c) Mr J. Sherman (United States) as chairman of the Sub-group on Ocean Satellites and Remote Sensing;
- (5) To select, in accordance with Regulation 32 of the General Regulations the following rapporteurs:
 - (a) Mr. G. Venendaal (Netherlands) to prepare a technical report on standardized shipboard observing practices;
 - (b) Dr H.-J. Isemer (Germany) to prepare a technical report on Beaufort equivalent scales;
 - (c) An expert from France and an expert from the United States to prepare a technical report on automated shipboard observing systems;

INVITES the presidents of CBS and CIMO, the chairmen of the Joint Committee for IGOSS, DBCP, Joint Scientific and Technical Committee for GCOS and Intergovernmental Committee for GOOS to nominate rapporteurs to serve on the working group;

ACCEPTS the offer of IOC for the Sub-group on Ocean Satellites and Remote Sensing to be also co-sponsored by the IOC Committee for IODE;

REQUESTS the Secretary-General to invite IOC, IMO, ICS and INMARSAT to participate in the work of the group;

REQUESTS FURTHER the president of CMM, in consultation with the chairman of the working group, the chairman of the Sub-group on Ocean Satellites and Remote Sensing, and the chairmen of the Committees for IGOSS and IODE, to elaborate specific and detailed terms of reference for the sub-group as soon as possible after the session, and within the overall terms of reference and other guidance provided by CMM, IGOSS and IODE.

RESOLUTION 5 (CMM-XI)**WORKING GROUP ON EDUCATION, TRAINING AND IMPLEMENTATION SUPPORT**

THE COMMISSION FOR MARINE METEOROLOGY,

NOTING:

- (1) Resolution 2 (CMM-X) — Working Group on Basic Marine Meteorological Services,
- (2) The *Third WMO Long-term Plan*, Part II, Volume 4, Section 4.4 — Marine Meteorology and Associated Oceanographic Activities Programme,
- (3) The report of the president of CMM to CMM-XI,
- (4) The report of the chairman of the Working Group on Basic Marine Meteorological Services to CMM-XI,
- (5) The reports of the regional rapporteurs on marine meteorological services to CMM-XI,

CONSIDERING:

- (1) The need to closely monitor Members' requirements and problems in the implementation of marine services and observing systems,
- (2) The value of co-ordinating implementation support to Members in marine services and observing systems on a regional or sub-regional basis,
- (3) The need for improved education and training in the field of marine meteorology and physical oceanography, including areas such as remote sensing, pollution and modelling,
- (4) The important potential role of the regional rapporteurs or working groups in advising the Commission on regional requirements for implementation support and education and training,
- (5) The need to provide Members with guidance on the development of relevant aspects of information technology,

DECIDES:

- (1) To establish a Working Group on Education, Training and Implementation Support with the following terms of reference:
 - (a) To monitor specific national and regional requirements and problems in the implementation of marine services and marine observing systems;

- (b) To advise the Commission on support required, nationally and regionally, to improve marine observing systems and services;
- (c) To develop appropriate technical guidance material for Members on aspects of information technology relevant to the processing, exchange and presentation of marine data and products;
- (d) To provide advice and guidance on requirements for specialized education and training in the field of marine meteorology and physical oceanography, including remote sensing, pollution control and numerical modelling;
- (e) To liaise, as necessary, with the Executive Council Panel on Education and Training and with the WMO Secretariat on relevant aspects of the WMO Education and Training Programme;

- (2) That the working group will be composed of a chairman and vice-chairman selected by CMM, together with members in their capacity as regional rapporteurs/chairmen of regional working groups on marine meteorological services selected by the six regional associations and one member nominated by the Secretary of IOC;
- (3) To select, in accordance with Regulation 32 of the General Regulations, Mr S. Ragoonaden (Mauritius) as chairman of the working group and an expert from the People's Republic of China as vice-chairman of the working group;

INVITES the regional associations, when appointing regional rapporteurs on marine meteorological services, to provide appropriate terms of reference to facilitate their participation in this working group;

INVITES FURTHER the Secretary of IOC to nominate a representative to serve on the working group.

RESOLUTION 6 (CMM-XI)**REVISION OF THE RESOLUTIONS AND RECOMMENDATIONS OF THE COMMISSION FOR MARINE METEOROLOGY**

THE COMMISSION FOR MARINE METEOROLOGY,

CONSIDERING that all resolutions adopted prior to its eleventh session are now obsolete,

CONSIDERING FURTHER that all recommendations adopted prior to its eleventh session and still in force have been reconsidered,

NOTING the action on the recommendations adopted prior to its eleventh session,

DECIDES:

- (1) Not to keep in force Resolutions 1 to 6 (CMM-X);
- (2) Not to keep in force Recommendations 1 and 2 (CMM-VIII), 2, 4 and 7 (CMM-IX), 1 to 8, 11, 12 and 14 (CMM-X);
- (3) To keep in force Recommendation 3 (CMM-IX) and Recommendations 9, 10 and 13 (CMM-X);
- (4) To publish in the final report of the eleventh session the texts of the recommendations which are kept in force.

RECOMMENDATIONS ADOPTED BY THE SESSION

RECOMMENDATION 1 (CMM-XI)

MARINE METEOROLOGICAL SERVICES MONITORING PROGRAMME

THE COMMISSION FOR MARINE METEOROLOGY,

NOTING:

- (1) Recommendation 1 (CMM-VIII) — Marine meteorological services monitoring programme,
- (2) Abridged final report, CMM-IX, general summary, paragraph 5.7 and Annex II,
- (3) Report and recommendations to CMM-XI by the Sub-group of Experts on Warning and Forecast Preparation on Marine Meteorological Services Monitoring,

CONSIDERING:

- (1) The continuing importance to mariners of the provision of high quality, timely marine meteorological services,
- (2) The need for routine and continuous monitoring of marine meteorological services to maintain the highest possible standards,
- (3) The importance of keeping up-to-date information on the requirements of marine users for meteorological and oceanographic information and services,

RECOGNIZING the activities for the monitoring of marine meteorological services already effected by many Members,

RECOMMENDS:

- (1) That a systematic, long-term marine meteorological services monitoring programme be implemented;
- (2) That the programme be based on the questionnaire and response summary format given in the annex to this recommendation;

NOTE: This recommendation replaces Recommendation 1 (CMM-VIII) which is no longer in force.

- (3) That the monitoring should be undertaken by Members and co-ordinated by the WMO Secretariat and should take place on a routine basis every four years;
- (4) That a comprehensive analysis of the results of the monitoring should be prepared by the WMO Secretariat following each four-yearly monitoring, and transmitted immediately to Members for follow-up action, as appropriate;
- (5) That a brief summary of the results of this monitoring should be prepared for each session of CMM, as well as for sessions of the Advisory Working Group and the Working Group on Marine Meteorological Services;

INVITES Members to carefully review the results of this monitoring, including detailed criticisms and suggestions provided by users, and to take appropriate measures to correct identified deficiencies in marine meteorological services within their respective areas of concern, including through the distribution of results to marine forecasters and PMOs;

REQUESTS:

- (1) The Advisory Working Group and the Working Group on Marine Meteorological Services to closely follow the implementation and results of this monitoring programme and to propose modifications, as appropriate;
- (2) The Secretary-General to arrange for Secretariat support for the monitoring programme as detailed under **RECOMMENDS** above.

ANNEX TO RECOMMENDATION 1 (CMM-XI)

MARINE METEOROLOGICAL SERVICES MONITORING PROGRAMME QUESTIONNAIRE

A. To masters, deck and radio officers of VOS

In order to monitor the effectiveness of the weather and sea bulletins produced and transmitted by Meteorological Services, the World Meteorological Organization would appreciate your co-operation in completing the following questionnaire. The objective of this programme is the improvement of meteorological support to shipping.

Ship's name (call sign)
 Country of registry
 Name of master
 Operational area(s)
 Voyage from to
 Position of ship when questionnaire completed
 Date and time

Please complete the following questionnaire by ticking the appropriate heading and inserting comments, as appropriate.

	Good	Fair	Poor	Met. service issued by	CRS
1. Storm and gale warnings					
(a) Clarity of information	_____	_____	_____	_____	_____
(b) Accuracy of information	_____	_____	_____	_____	_____
(c) Timeliness	_____	_____	_____	_____	_____
2. Weather bulletins					
(a) Clarity of information	_____	_____	_____	_____	_____
(b) Accuracy of information	_____	_____	_____	_____	_____
(c) Timeliness	_____	_____	_____	_____	_____
(d) Terminology used	_____	_____	_____	_____	_____
3. Radiofacsimile broadcasts					
(a) Maintaining schedules	_____	_____	_____	_____	_____
(b) Accuracy of information	_____	_____	_____	_____	_____
(c) Readability	_____	_____	_____	_____	_____
(d) Symbology	_____	_____	_____	_____	_____
(e) Quality of reception	_____	_____	_____	_____	_____
4. Coastal Radio Stations (CRS)/Coast Earth Stations (CES)					
(a) Establishing contact with receiving station (CRS/CES)	_____	_____	_____	_____	_____
(b) Delays with OBS messages	_____	_____	_____ Yes	(Time.....)	_____ No
(c) Refusal of CRS/CES to accept OBS messages	_____	_____	_____ Yes	(CRS/CES.....)	_____ Yes
(d) Use of five or ten-figure groups	_____	_____	_____ 5	_____ 10	_____

5. Other related problems (if any)

Date and time
 Position of the ship
 Radio frequency and station call sign

6. Suggested improvements

.....

Use additional sheets if necessary

For each case complete one questionnaire

After completion, please return to Meteorological Service at the following address:

.....

Master's signature

B. A summary of the replies to the questionnaire addressed to Voluntary Observing Ships (VOS) received by (Meteorological Service)

	Number of ships which replied			Percentage of total replies		
	Good	Fair	Poor	Good	Fair	Poor
1. Storm and gale warnings						
(a) Clarity of information	_____	_____	_____	_____	_____	_____
(b) Accuracy of information	_____	_____	_____	_____	_____	_____
(c) Timeliness	_____	_____	_____	_____	_____	_____
2. Weather bulletins						
(a) Clarity of information	_____	_____	_____	_____	_____	_____
(b) Accuracy of information	_____	_____	_____	_____	_____	_____
(c) Timeliness	_____	_____	_____	_____	_____	_____
(d) Terminology used	_____	_____	_____	_____	_____	_____
3. Radio-facsimile broadcasts						
(a) Maintaining schedules	_____	_____	_____	_____	_____	_____
(b) Accuracy of information	_____	_____	_____	_____	_____	_____
(c) Readability	_____	_____	_____	_____	_____	_____
(d) Symbology	_____	_____	_____	_____	_____	_____
4. Coastal Radio Stations (CRS) / Coast Earth Stations (CES)						
(a) Establishing contact with receiving station	_____	_____	_____	_____	_____	_____
(b) Delays with OBS message	_____	_____	_____	_____	_____	_____
(c) Refusal of CRS/CES to accept OBS	_____	_____	_____	_____	_____	_____
(d) Use of five or ten-figure groups	_____	_____	_____	_____	_____	_____
5. Other related problems						
.....						
.....						
.....						
.....						
.....						
.....						
6. Suggested improvements						

RECOMMENDATION 2 (CMM-XI)

MARINE POLLUTION EMERGENCY RESPONSE SUPPORT SYSTEM (MPERSS) FOR THE HIGH SEAS

THE COMMISSION FOR MARINE METEOROLOGY,

NOTING:

- (1) Recommendation 2 (CMM-X) — Meteorological support for marine pollution emergency operations,
- (2) The final report of the meeting of the IMO Working Group on the International Convention on Oil Pollution Preparedness, response and Co-operation (London, October 1992),

- (3) Recommendation 3 (CMM-XI) — New WMO GMDSS Marine Broadcast System,

CONSIDERING:

- (1) That operations at sea in response to marine pollution emergencies are fundamentally dependent on the support of meteorological services,
- (2) That marine pollution emergency events outside waters under national jurisdiction are essentially international in character,

- (3) That no co-ordinated system currently exists for the provision of meteorological support for operations in response to such events,
- (4) That considerable benefits would accrue to all coastal states through the establishment of such a co-ordinated system for meteorological support,

RECOMMENDS:

- (1) That a new WMO Marine Pollution Emergency Response Support System (MPERSS) for the high seas, as detailed in the annex to this recommendation, should be implemented on a trial basis;
- (2) That the trial system should ideally be implemented on or as soon as possible after 1 January 1994;

EXPRESSES ITS APPRECIATION to those Members which may accept provisional responsibilities under the new system,

BEARING IN MIND:

- (1) The need for substantial further work to be undertaken, nationally and internationally, in developing the concept and structure of the MPERSS,
- (2) The continuing need to provide guidance and support to Members in the development and implementation of the services required in support of marine pollution emergency response operations,
- (3) The work being undertaken on marine pollution monitoring, assessment and modelling by IOC, UNEP and IMO,

REQUESTS:

- (1) The Working Group on Marine Meteorological Services to:

- (a) Further develop the concept and structure of the proposed MPERSS in co-operation with Members concerned as well as with appropriate international organizations;
- (b) Continue its work on the development of guidance material, in co-operation with IOC, UNEP and IMO, as appropriate, and generally to provide technical support to Members in the implementation and operation of the trial MPERSS;
- (c) Prepare a revised draft MPERSS, for the consideration of CMM-XII for inclusion in the *Manual on Marine Meteorological Services*;

- (2) The Secretary-General to provide, as resources permit, appropriate Secretariat support in the further development, implementation and operation of the MPERSS and, in particular, to agree with Members concerned on their role and responsibilities in a future operational MPERSS;

INVITES IOC, UNEP and IMO to collaborate with WMO in the further development and operation, as necessary, of the MPERSS;

FURTHER INVITES the International Maritime Organization:

- (1) To provide WMO with additional information on national and regional marine pollution combatting centres, for inclusion in the draft MPERSS plan, for the benefit of Members accepting responsibilities under the MPERSS;
- (2) To inform national and regional marine pollution combatting authorities, as well as IMO national contact points, of the existence and details of the MPERSS.

ANNEX TO RECOMMENDATION 2 (CMM-XI)

MARINE METEOROLOGICAL SUPPORT FOR MARINE POLLUTION EMERGENCY RESPONSE OPERATIONS ON THE HIGH SEAS

1. PRINCIPLES

The principles for marine meteorological support for marine pollution emergency response operations are as follows:

Principle 1

For the purpose of the efficient and effective provision of meteorological information for marine pollution emergency response operations on the high seas and in view of the international character of these operations, there is a requirement to provide an internationally co-ordinated system of meteorological support for such operations. For this purpose the oceans and seas are divided into areas for which national Meteorological Services assume responsibility. These areas, termed Marine Pollution Incident (MPI) areas, are the same areas as the METAREAs of the Global Maritime Distress and Safety System (GMDSS).

Principle 2

The areas of responsibility together provide complete coverage of oceans and seas by meteorological

information contained in the products prepared and issued by the participating national Meteorological Services.

Principle 3

The preparation and issue of meteorological information for areas of responsibility is co-ordinated in accordance with the procedures mentioned in section 2.

Principle 4

The efficiency and effectiveness of the provision of meteorological information in support of marine pollution emergency response operations is monitored by obtaining opinions and reports from the users.

2. PROCEDURES

2.1 Definitions

2.1.1 An *Area Meteorological Co-ordinator (AMC)* is a national Meteorological Service which has accepted responsibility for ensuring that regional meteorological information is issued to support marine pollution emergency response operations in the designated area for which

the Service has accepted responsibility. [These national Meteorological Services may eventually become designated Regional Specialized Meteorological Centres (RSMC) for Marine Pollution Emergency Support.] The support supplied by an AMC (or a Supporting Service) may include some or all of the following:

- (a) Basic meteorological forecasts and warnings for the area(s) concerned;
- (b) The observation, analysis and forecasting of the values of specific meteorological and oceanographic variables required as input to models describing the movement, dispersion, dissipation and dissolution of marine pollution;
- (c) In some cases, the operation of these models;
- (d) In some cases, access to national and international telecommunications facilities;
- (e) Other operational support.

The issued information may have been prepared solely by the AMC, or by another Supporting Service(s), or a combination of both, on the basis of an agreement between the Services concerned. It is also the responsibility of the AMC to ascertain the location and contact (telex, telefax, etc.) details of any marine pollution emergency response operations authority (or authorities) responsible within the designated Marine Pollution Incident (MPI) area. This information should be made available by the AMC to Supporting Service(s) for the area.

2.1.2 A *Supporting Service* is a national Meteorological Service which has accepted responsibility to provide on request, either directly or to the AMC, meteorological (basic or enhanced) support for parts of, or an entire, designated MPI area. Depending on the location of the incident, Supporting Services may be requested by the emergency authority to provide the meteorological support directly to that authority. In such cases, the AMC should be so advised by the Supporting Service. A Supporting Service should advise the AMC of the facilities it has available to fulfil its role.

2.2 Areas of responsibility

2.2.1 **Areas of responsibility (Marine Pollution Incident (MPI) areas) and the responsible Services for AMCs and Supporting Service(s) shall be as given in Appendix I.**

NOTES: (1) The areas of responsibility given in Appendix I are reviewed by the Commission for Marine Meteorology to ensure complete area coverage and adequacy of services.

(2) An MPI area has, in some cases, been sub-divided to meet the requirements of national Meteorological Services.

(3) The areas of responsibility defined in Appendix I represent a minimum requirement for AMC and Supporting Services. Both AMCs and Supporting Services may extend the area of coverage for the issue of meteorological support information beyond these areas of responsibility, if they so wish, to meet national requirements. In this case, the area of coverage should be specified in the text of each communication to the marine pollution emergency response operations authority.

2.2.2 **Any amendments to the area of responsibility or proposal for the introduction of a change in national Meteorological Services' responsibilities for an area, shall have the approval of the Executive Council based on a recommendation by the Commission for Marine Meteorology.**

2.2.2.1 **Before drawing up any recommendation on the proposed amendment for submission to the Executive Council, the Commission for Marine Meteorology shall receive the comments of the national Meteorological Services directly concerned with the proposed amendment as well as the comments of the president(s) of the regional association(s) concerned.**

NOTE: All correspondence relating to the areas of responsibility is addressed to the Secretary-General.

2.2.3 Whenever a national Meteorological Service responsible for the issue of meteorological support data to a MPI area is no longer able to provide this service, the national Meteorological Service should inform the Secretary-General at least six months in advance of the intended termination date.

2.3 Meteorological support to marine pollution emergency response operations on the high seas

2.3.1 Support to these emergency operations may, as stated in paragraph 2.1.1, include a variety of elements, such as:

- (a) *Basic meteorological forecasts and warnings for the area(s) concerned.* Special attention should be given to the early provision of actual and forecast surface conditions in the area of the pollution incident. This may be the initial requirement following a pollution incident;
- (b) *The observation, analysis and forecasting of the values of specific meteorological and oceanographic variables required as input to models describing the movement, dispersion, dissipation and dissolution of marine pollution.* AMC and Supporting Service should, if possible, ascertain from the relevant marine pollution emergency response operations authority the specific meteorological and oceanographic variables required for a particular model, also the location of the model operator and access details. If information regarding specific required variables for a model is not available, general guidelines for the type of data which will be required are given in Appendix II;
- (c) *The operation of the models by the national Meteorological Service.* If an AMC or Supporting Service has this facility and it can be used in the MPI area, the existence of this facility should be made known to the relevant marine pollution emergency response operations authority at an early stage, and ideally prior to an actual pollution incident in the MPI area. [AMCs should give consideration to conducting periodic trials of their pollution models and

co-operating with the pollution emergency authorities in their MPI area to assess the efficiency and effectiveness of the output data from their models.]

- (d) *Access to national and international telecommunications facilities.* Effective and efficient communications is an essential element in an emergency situation and AMCs and Supporting Services must ensure that they have access to reliable communication links between all parties involved in a marine pollution incident within their MPI area. The AMC should ascertain from the marine pollution emergency response operations authority the method by which the transfer of the required meteorological support shall be effected. **This information shall be relayed to the Supporting Service(s) for the MPI area concerned.** The use of the International SafetyNET service (of INMARSAT) should be considered if the meteorological support is required at the location of the pollution incident, e.g. by the on-scene dispersal craft. Similarly, use of the Global Telecommunication System (GTS) by a marine pollution emergency response operations authority via a regional telecommunication hub (RTH) of the Global Telecommunication System (GTS) may also be a consideration in cases of a major pollution incident;
- (e) *Other operational support.* AMCs shall, at an early stage of a marine pollution incident affecting their area of responsibility, ascertain from the relevant marine pollution emergency response operations authority details of the incident and the nature of the support required. It shall be the responsibility of the AMC to advise the marine pollution emergency response operations authority of the support facilities which the AMC and/or the Supporting Service(s) can provide. [This shall be undertaken whether or not a pollution incident occurs in an MPI area, and this information shall be updated to the marine pollution emergency response operations authorities at regular intervals, and immediately should there be a change in the support facilities available from the AMC or Supporting Service. It is the responsibility of the Supporting Service(s) to advise the AMC of any change to its support facilities.] It should be noted that operations at sea in response to marine pollution emergencies are fundamentally dependent on

the support of Meteorological Services. It is thus essential that AMCs and Supporting Services offer as full a range of operational support as possible and practicable to marine pollution emergency response operations.

2.3.2 A permanent record of all communications should be maintained, showing the times of origin, transmission and reception of the information provided.

2.4 IMO regional marine pollution combatting centres. Marine pollution research and monitoring programmes of IOC/UNEP

2.4.1 IMO and UNEP have established regional marine pollution combatting centres in a few locations throughout the world. These centres have been incorporated in the co-ordinated meteorological support plan at Appendix I. Full details of these centres are given in Appendix III. The majority of these centres are non-operational and have an advisory capacity only. The nature of the centre, whether advisory or operational, is indicated in Appendix III. It should be noted that it is the responsibility of the participating national Meteorological Service(s) to ascertain the location of any marine pollution emergency response operations authority relevant to the MPI area and/or to each marine pollution incident.

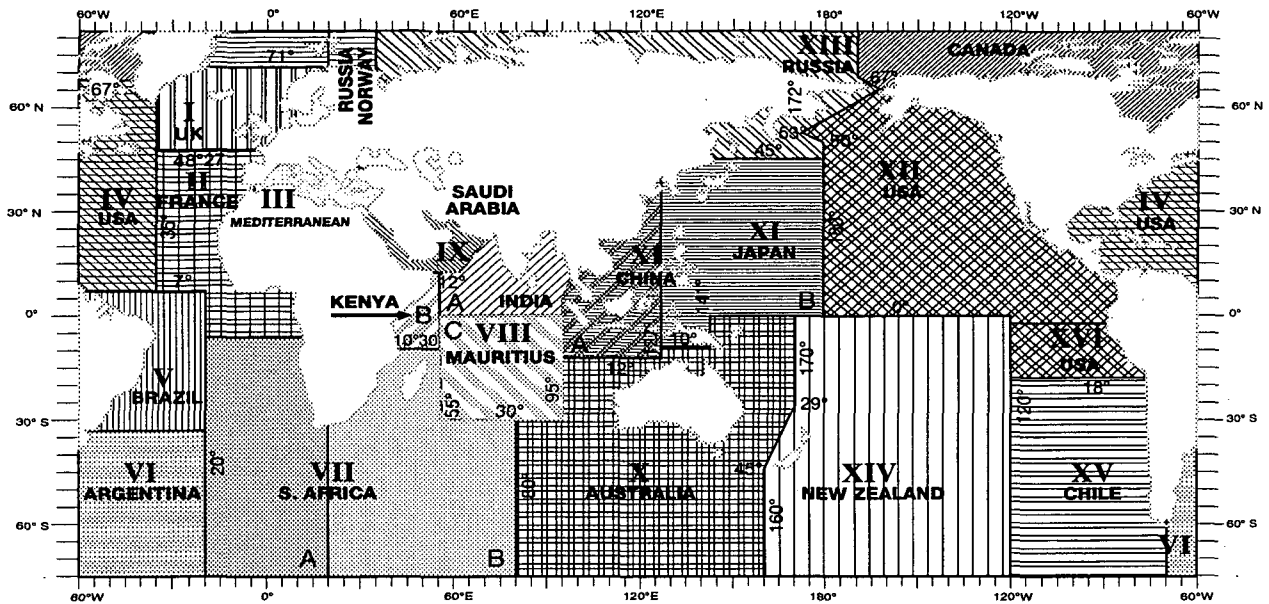
2.4.2 The objectives and activities of the Regional Marine Pollution Emergency Response Centre for the Mediterranean Sea and its role in the case of emergency are given in Appendix IV.

2.4.3 The International Convention on Oil Pollution Preparedness, Response and Co-operation, 1990 (OPRC Convention), in Article 12 — Institutional Arrangements identified the International Maritime Organization Secretariat as having specific responsibilities with regard to the provision of information and technical services under the Convention. Contact information for the IMO Secretariat is also given in Appendix III and information on activities in Appendix V. It is the responsibility of the WMO Secretariat to keep the IMO Secretariat informed of all international dispositions and arrangements made under the WMO meteorological support system. At the same time, AMCs may wish to contact the IMO Secretariat directly to obtain information on specific arrangements which may exist for combatting oil and other pollution incidents in their MPI area(s) of responsibility.

2.4.4 IOC and UNEP co-sponsor the programme on Global Investigation of Pollution in the Marine Environment (GIPME).

APPENDIX I

AREAS OF RESPONSIBILITY AND NATIONAL METEOROLOGICAL SERVICES DESIGNATED AS AREA METEOROLOGICAL CO-ORDINATORS FOR ISSUING OF METEOROLOGICAL DATA FOR SUPPORT TO MARINE POLLUTION EMERGENCY RESPONSE OPERATIONS ON THE HIGH SEAS



CO-ORDINATED METEOROLOGICAL SUPPORT TO MARINE POLLUTION INCIDENT (MPI) AREA

RECIPIENT OF METEOROLOGICAL DATA

MPI area	Area Meteorological Co-ordinator	Supporting Service	IMO regional marine pollution combatting centres Suggested additional centres	Remarks
I	United Kingdom	Norway Iceland Ireland France	Relevant Coast Guard Authority/Pollution Control Centre	Norway responsible for Arctic waters north of 71°N
II	France	Portugal Spain	Relevant Coast Guard Authority/Pollution Control Centre	
III	Italy	Greece Malta France	REMPEC (Malta Centre). Relevant Coast Guard Authority.	
IV	USA	Canada	Relevant Coast Guard Authority. IMO Regional Consultant, Santurce, Puerto Rico (Wider Caribbean)	Canada responsible for Arctic waters north of 67°N
V	Brazil		Relevant Coast Guard/Pollution Control Centre	
VI	Argentina		Relevant Coast Guard/Pollution Control Centre	
VII (A)	South Africa*		Relevant Coast Guard/Pollution Control Centre	West of 20°E
VII (B)	South Africa*	Réunion	Relevant Coast Guard/Pollution Control Centre	East of 20°E
VIII (A)	India		Relevant Coast Guard/Pollution Control Centre	VIII (A): Area VIII-(B)+(C). Indian Ocean north of the equator, west of 95°E, east of 55°E excluding Area IX
VIII (B)	Kenya	United Republic of Tanzania	Relevant Coast Guard/Pollution Control Centre	VIII (B): 12°N - 10°30'S 55°E to East African Coast
VIII (C)	Mauritius	Réunion	Relevant Coast Guard/Pollution Control Centre	VIII (C): 0° - 30°S 55°E - 95°E
IX	Saudi Arabia	Bahrain	Relevant Coast Guard/Pollution Control Centre	
X	Australia		Relevant Coast Guard/Pollution Control Centre	
XI (A)	China	Hong Kong Malaysia Indonesia Singapore	Relevant Coast Guard/Pollution Control Centre	XI (A) 125°E - Mainland China to west boundary of area XI (95°E) (excluding Philippine waters)
XI (B)	Japan	Philippines Indonesia Guam (USA)	Relevant Coast Guard/Pollution Control Centre	East of 125°E - 180° including Philippine waters
XII & XVI	USA	Canada	Relevant Coast Guard/Pollution Control Centre	Canada responsible for Arctic waters north of 67°N
XIII	Russian Federation		Relevant Coast Guard/Pollution Control Centre	
XIV	New Zealand		Relevant Coast Guard/Pollution Control Centre	
XV	Chile		Relevant Coast Guard/Pollution Control Centre	

* The Government of the Republic of South Africa has been suspended by Resolution 38 (Cg-VII) from exercising its rights and enjoying its privileges as a Member of WMO.

APPENDIX II

INPUT DATA REQUIREMENTS FOR MARINE POLLUTION TRANSPORT AND DISPERSION MODELS

<i>Simple local models</i>	<i>Simple regional models</i>	<i>Hydrological local models</i>	<i>Hydrological regional models</i>	<i>Expert local systems</i>	<i>Expert regional systems</i>
Surface wind (local)	Surface wind field	Surface wind (local)	Surface wind field	Surface wind	Surface wind field
Water temperature	Water temperature	Water temperature	Water temperature	Water temperature	Water temperature field
Air temperature	Air temperature	Air temperature	Air temperature	Air temperature	Air temperature
Waves	Waves	Waves	Waves	Waves	Waves
(Rain)	Currents	Rain	Rain	Rain	Rain
Currents		Currents	Stratification	Pollutant properties	Pollutant properties
		Tides	Constant information	Surface and sub-surface currents	Surface and sub-surface currents
			Ice	Tides	Tides
			Tides	Stratification	Stratification
				Technical information	Technical information
					Regional information
					Ice
	<i>Local systems</i>		<i>Regional systems</i>		
	Surface wind		Surface wind field		
	Water temperature		Air temperature field		
	Air temperature		Water temperature field		
	Rain or not		Rain or not		
	Waves		Stratification		
			Ice information		
				Grid point data	

APPENDIX III

IMO REGIONAL MARINE POLLUTION COMBATting CENTRES AND MARINE POLLUTION RESEARCH AND MONITORING PROGRAMMES OF IOC/UNEP (AS OF MARCH 1992)

1. Regional Marine Pollution Emergency Response Centre for the Mediterranean Sea (REMPEC) of IMO/UNEP (also known as the Malta Centre)
Manoel Island
Malta
tel +356 337296 or 337297 or 337298; fax +356 339951; telex 2464 UNROCC MW; 1396 UNROCC MW
Status: Information and advisory centre.
2. Office of IMO Regional Consultant on Marine Pollution (Wider Caribbean)
P.O. Box 3037
Ceiba, Puerto Rico 00735
USA
tel +1809 8654343 (24 hrs); fax +1809 8651785
Status: Advisory services.
3. Marine Emergency Mutual Aid Centre (MEMAC)
P.O. Box 10112, Bahrain
tel (973) 274554; fax (973) 274551; telex 9890 MEMAC BN
4. Oil Pollution Co-ordination Centre
Pollution Preparedness and Response Section
International Maritime Organization
4 Albert Embankment
London SE1 7SR, United Kingdom
tel +44 71 7357611; fax +44 71 5873210; telex 23588
Status: Information and advisory centre.

APPENDIX IV

REGIONAL MARINE POLLUTION EMERGENCY RESPONSE CENTRE FOR THE
MEDITERRANEAN SEA (REMPEC)**Objectives**

The objectives of the Centre are the following:

- (a) To strengthen the capacities of the coastal States in the Mediterranean and to facilitate co-operation among them in case of a major marine pollution accident;
- (b) To assist coastal States of the Mediterranean region, which so request, in the development of their own capabilities for response to accidents;
- (c) To facilitate information exchange, technological co-operation and training;
- (d) To provide a framework for the exchange of information on operational, technical, scientific, legal and financial matters.

Activities

In conformity with these objectives and with the decisions of the meetings of the Contracting Parties to the Barcelona Convention, the Centre is developing its activities in the following areas:

- (a) Informing the coastal states — regional information system (oil and hazardous substances)

The Centre is developing and keeping up-to-date a regional information system made up of four parts:

- (i) Basic documents;
 - (ii) Lists and inventories;
 - (iii) Data banks, simulation models and decision support system;
 - (iv) Operational guides and technical documents.
- (b) Assistance in the preparation of contingency plans

The Centre provides assistance to those countries which so request for:

- (i) The preparation or adaptation of national contingency plans;
- (ii) The preparation and the development of operational bilateral or multilateral agreements between neighbouring Coastal States.

- (c) Training

The Centre annually organizes the following regional training courses:

- (i) A general training course;
- (ii) A specialized and practical training course.

The Centre provides, to countries which so request, assistance in organizing national training courses.

- (d) Co-operation and mutual assistance in cases of emergency

The Centre:

- (i) Develops and keeps up-to-date a regional communications network;
- (ii) Organizes periodically communication exercises;
- (iii) Provides, at the request of the Mediterranean Coastal States in case of an accident, technical advice and facilitates and co-ordinates mutual assistance between them.

Role of the Centre in case of emergency

In the case of a marine pollution accident, REMPEC, at the request of States, in accordance with its objectives and functions and taking into account the means at its disposal shall:

- (a) By using the regional information system developed and updated by the Centre, provide advice and technical expertise as well as other relevant information the States would need;
- (b) Put into action once it will be operational the Mediterranean Task Force which will assist response to accidental marine pollution;
- (c) Help to obtain international assistance and its co-ordination, whether the means (equipment, products, combatting equipment) come from Government or the private sector;
- (d) Endeavour to help States affected by an accident in disseminating information.

The assistance that the Centre can thus give at the request of the States shall be decided on a case by case basis, between the competent national authorities and REMPEC. REMPEC shall endeavour to reply in the quickest and best possible way to all the requests of assistance supported by the Regional Information System.

APPENDIX V

OIL POLLUTION CO-ORDINATION CENTRE (OPCC)

Objectives

The objectives of the Co-ordination Centre are the following:

- (a) To co-ordinate oil spill response activities, if requested;
- (b) To monitor oil spill incidents;

- (c) To facilitate information exchange on operational and institutional capacities to combat oil spills;

- (d) To provide a framework for the collection and dissemination of information on operational and technical matters;

- (e) To assist Governments in the development of their own capabilities for response to accidents;
- (f) To facilitate the provision of technical assistance and advice upon request.

Activities

In conformity with the objectives mentioned above, the Co-ordination Centre is developing its activities in the following areas:

- (a) Information services
The Centre is developing and keeping up-to-date information on:
 - (i) National focal points for Oil Pollution Preparedness and Response (OPRC);
 - (ii) The nature and extent of the type of assistance which is available with every State;
 - (iii) National Policy for Oil Pollution Preparedness and Response including National Contingency Plan for oil pollution incidents;
 - (iv) Marine Pollution Preparedness and Response Database Systems.

In addition, the Centre will manage an already developed International Oil Pollution Research and Development Abstract Database. This database, developed by the United States Coast Guard, has information on research category, project description, R and D sponsor, researcher, funding, etc.

- (b) Education and Training
 - (i) To promote training in the field of oil pollution preparedness and response under the OPRC training strategy using IMO model courses;
 - (ii) To promote the holding of international symposia.

- (c) Technical services
 - (i) To facilitate co-operation in research and development;
 - (ii) To provide advice to State(s) establishing national or regional response capabilities; and
 - (iii) To analyse the information provided by Parties in case of an oil pollution incident and relevant information provided by other sources and provide advice or information to States.
- (d) Technical assistance
 - (i) To facilitate the provision of technical assistance to States establishing national or regional response capabilities; and
 - (ii) To facilitate the provision of technical assistance and advice, upon the request of States faced with major oil pollution incidents.

Role of the Centre in case of an emergency

In the case of a marine pollution accident, OPCC, at the request of State(s), in accordance with its objectives and functions and taking into account the means at its disposal shall:

- (a) Monitor and assess the situation by collecting information from various sources, e.g., Government, industry, etc and keeping in touch with affected State(s);
- (b) Provide technical advice, if requested, by affected State(s);
- (c) Facilitate and co-ordinate, as appropriate, the provision of international assistance; and
- (d) Assist in the dissemination of spill information to affected State(s).

RECOMMENDATION 3 (CMM-XI)

NEW WMO GMDSS MARINE BROADCAST SYSTEM

THE COMMISSION FOR MARINE METEOROLOGY,

NOTING:

- (1) The International Convention for the Safety of Life at Sea (SOLAS), 1974, in particular Chapter V (Safety of Navigation), Regulation 4 (Meteorological Services),
- (2) The 1988 Amendments to SOLAS for the Global Maritime Distress and Safety System (GMDSS) which, *inter alia*, require meteorological broadcasts through SafetyNET to have commenced on 1 February 1992,
- (3) Recommendation 3 (CMM-X) — Areas of responsibility for the issue of weather and sea bulletins,
- (4) Abridged report with resolutions, Cg-XI, general summary, paragraph 3.4.4.3,
- (5) The final report of the fifth session of the CMM Working Group on Basic Marine Meteorological Services (Geneva, September 1990),

- (6) The final report of the WMO Workshop on the GMDSS (Geneva, May 1992),
- (7) Resolution 8 (EC-XLIV) — Implementation of the new WMO GMDSS marine broadcast system,

NOTING FURTHER:

- (1) IMO Assembly Resolution A.705 (17) — Promulgation of Maritime Safety Information (MSI),
- (2) International Hydrographic Conference New Technical Resolution 6.2 on the early implementation of GMDSS services,
- (3) That the sixtieth session of the IMO Maritime Safety Committee (London, April 1992) had urged Governments to establish maritime safety information broadcasts via SafetyNET without delay,

RECOGNIZING:

- (1) The importance of meteorological warnings and forecasts to the safety of life and property at sea,

- (2) The obligations for countries which are signatories to SOLAS to provide meteorological services for shipping as specified in the SOLAS Convention, including the 1988 amendments,
- (3) That major changes in operational procedures are required by many Members, as well as new relationships between ministries, to implement meteorological broadcast requirements under the GMDSS,
- (4) That new levels of collaboration are required by Members involved in the preparation and issuing of marine meteorological services under the GMDSS,
- (5) That the full implementation of the GMDSS requires a close collaborative effort by several international bodies, including IHO, IMO, INMARSAT, WMO, and the operating agencies of Coast Earth Stations (CES),

EXPRESSES ITS APPRECIATION to those Members which have accepted specific responsibilities under the new WMO GMDSS marine broadcast system;

RECOMMENDS:

- (1) That the new WMO GMDSS marine broadcast system, as detailed in the annex to this recommendation, should be adopted as an annex to the WMO *Technical Regulations* (WMO-No. 49), to operate in parallel with the existing WMO marine broadcast system as given in the *Manual on Marine Meteorological Services* (WMO-No. 558), Volume I, Part I, Sections 1 to 3, during the period 1 February 1992 to 1 February 1999,
- (2) That this new system should, as an interim measure, be included in the *Manual on Marine Meteorological Services* as Part I, Sections 1 to 3 bis,

BEARING IN MIND that difficulties in implementing the new system in some areas are due to reasons beyond the control of Members concerned,

URGES Members with marine forecast and warning preparation and broadcast responsibilities under the new system:

- (1) To make every effort to implement their responsibilities at the earliest possible date, if they have not already done so;
- (2) To endeavour to impress upon INMARSAT CES operators the importance of early implementation by them of the International SafetyNET service;
- (3) To keep the WMO Secretariat closely informed of progress with implementation;
- (4) To co-ordinate closely with other Members concerned in cases where overlapping with NAVTEX broadcasts may occur, to ensure that the SOLAS requirements are respected and that conflicting advice is not provided to users;

REQUESTS the Working Group on Marine Meteorological Services to keep the implementation of the new system under close review during the inter-sessional period and, in co-operation with the Members concerned, prepare, as necessary, a revised version for consideration during adoption by CMM-XII, prior to the final implementation date for the GMDSS on 1 February 1999;

REQUESTS the Secretary-General:

- (1) To provide appropriate technical advisory assistance to Members concerned in the implementation of the new WMO GMDSS marine broadcast system;
- (2) To bring this resolution to the attention of IMO, IHO, ICS, INMARSAT and other organizations and bodies directly concerned.

ANNEX TO RECOMMENDATION 3 (CMM-XI)

ADDITIONS TO PART I OF THE MANUAL ON MARINE METEOROLOGICAL SERVICES (WMO-NO. 558)

The system given in these amendments will:

- (a) Operate in parallel with the existing system as given now in Volume I, Part I, Sections 1 to 3 of the *Manual on Marine Meteorological Services* between 1 February 1992 and 1 February 1999;
- (b) In final revised form, completely replace the existing system (and existing *Manual* text) as from 1 February 1999.

P A R T I B I S

SERVICES FOR THE HIGH SEAS

1. GENERAL

Marine meteorological services for the high seas shall include:

- (a) Provision of warnings and weather and sea bulletins;
- (b) Marine meteorological support for maritime search and rescue;
- (c) Provision of information by radio-facsimile;
- (d) Marine Climatological Summaries Scheme;

- (e) Provision of special marine climatological information;
- (f) Provision of marine meteorological information and expert advice.

2. PROVISION OF WARNINGS AND WEATHER AND SEA BULLETINS (GMDSS APPLICATION)

(Global Maritime Distress and Safety System (GMDSS) application which is compatible with and required by the radiocommunication provisions of the 1988 SOLAS amendments via the NAVTEX, International SafetyNET and HF Maritime Safety Information (MSI) Services. See Appendix I-1 for Glossary of Terms.)

2.1 Principles

The principles for the preparation and issue of warnings and weather and sea bulletins are as follows:

Principle 1

For the purpose of the preparation and issue of meteorological warnings and the regular preparation

and issue of weather and sea bulletins, the oceans and seas are divided into areas for which national Meteorological Services assume responsibility.

Principle 2

The areas of responsibility together provide complete coverage of oceans and seas by meteorological information contained in warnings and weather and sea bulletins for the high seas.

Principle 3

The issue of meteorological warnings and routine weather and sea bulletins for areas not covered by NAVTEX shall be by the International SafetyNET Service for the reception of maritime safety information (MSI) in compliance with SOLAS, CH IV, "RADIO-COMMUNICATIONS".

NOTE: In addition, national Meteorological Services may have to prepare and/or issue warnings and routine forecasts for transmission by an HF-direct-printing telegraphy maritime safety information service for areas where such a service is provided for ships engaged exclusively on voyages in such areas.

Principle 4

The preparation and issue of warnings and weather and sea bulletins for areas of responsibility is co-ordinated in accordance with the procedures mentioned in section 2.2.

Principle 5

The efficiency and effectiveness of the provision of warnings and of weather and sea bulletins is monitored by obtaining opinions and reports from marine users.

Principle 6

Maritime safety information broadcasts are monitored by the originating issuing service to ensure the accuracy and integrity of the broadcast.

2.2 Procedures

2.2.1 Definitions

2.2.1.1 A *preparation service* is a national Meteorological Service which has accepted responsibility for the preparation of forecasts and warnings for parts of, or an entire, designated area (METAREA) in the WMO system for the dissemination of meteorological forecasts and warnings to shipping under the GMDSS and for their transfer to the relevant issuing service for broadcast.

2.2.1.2 An *issuing service* is a national Meteorological Service which has accepted responsibility for ensuring that meteorological forecasts and warnings for shipping are disseminated through the INMARSAT SafetyNET service to the designated area for which the Service has accepted responsibility under the broadcast requirements of the GMDSS. The forecasts and warnings for broadcast may have been prepared solely by the issuing service, or by another preparation service, or a combination of both, on the basis of negotiations between the services concerned, or otherwise as appropriate. The

issuing service is responsible for composing a complete broadcast bulletin on the basis of information input from the relevant preparation services, and for inserting the appropriate EGC header, as specified in Appendices I-4 and I-5 of the *Manual on Marine Meteorological Services* and Annex 4(b) of the *International SafetyNET Manual*. Procedures for any modifications by issuing services to information provided by preparation services, and for the choice of appropriate C₁, C₂ and C₃ codes for the broadcast of this information, should be developed by bilateral agreement between the services concerned. The issuing service is also responsible for monitoring the broadcasts of information to its designated area of responsibility.

- NOTES: (1) For some METAREAS there may be only one preparation service, which will be the same national Meteorological Service as the issuing service (e.g. United Kingdom for area I, Argentina for area VI and Australia for area X).
- (2) An appropriate format for the attribution of the origins of the forecast and warning information contained in a broadcast bulletin may be developed on the basis of negotiations amongst the services concerned.
- (3) In situations where appropriate information, data or advice from other designated preparation services for a given METAREA is not available, it is the responsibility of the issuing service for that area to ensure that complete broadcast coverage for the area is maintained.

2.2.2 Areas of responsibility

2.2.2.1 Areas of responsibility and the responsible services for the preparation and issue of warnings, weather and sea bulletins through the International SafetyNET service for the high seas shall be as given in Appendix I-2.

- NOTES: (1) The areas of responsibility given in Appendix I-2 are reviewed by the Commission for Marine Meteorology to ensure complete area coverage and adequacy of services.
- (2) A broadcast area may be sub-divided in the text of the EGC message into sub-areas to meet the requirements of national Meteorological Services concerned.
- (3) The areas of responsibility defined in Appendix I-2 represent a minimum requirement for issuing and preparation services. Both issuing and preparation services may extend the area of coverage for the preparation and issue of warnings, weather and sea bulletins beyond these areas of responsibility, if they so wish, to meet national requirements. In this case, the area of coverage should be specified in the text of each broadcast.

2.2.2.2 Any amendments to the area of responsibility, or proposal for the introduction of a change in national Meteorological Services' responsibility for an area, shall have the approval of the Executive Council based on a recommendation by the Commission for Marine Meteorology.

2.2.2.2.1 Before drawing up any recommendation on the proposed amendment for submission to the Executive Council, the Commission for Marine Meteorology shall receive the comments of the national Meteorological Services directly concerned with the proposed amendment as well as the comments of the president(s) of the regional association(s) concerned.

NOTE: All correspondence relating to areas of responsibility is addressed to the Secretary-General.

2.2.2.3 Whenever a national Meteorological Service responsible for the preparation and/or issue of warnings and weather and sea bulletins for a given area is no longer able to provide this service, the national Meteorological Service should inform the Secretary-General at least six months in advance of the intended termination date.

2.2.3 **Preparation and issue of weather and sea bulletins for the high seas**

2.2.3.1 Weather and sea bulletins for the high seas shall include, in the order given hereafter:

- Part I : Warnings;
- Part II : Synopsis of major features of the surface weather chart and, to the extent possible, significant characteristics of corresponding sea-surface conditions;
- Part III : Forecasts.

2.2.3.2 Weather and sea bulletins for the high seas may, in addition, include the following parts:

- Part IV : Analyses and/or prognoses in IAC FLEET code form;
- Part V : Selection of reports from sea stations;
- Part VI : Selection of reports from land stations.

NOTES: (1) The reports included in Part VI should be for a fixed selection of stations in a fixed order.
(2) Parts IV, V and VI may be issued at a separate, scheduled time

2.2.3.3 Major changes in form and content of warnings, synopses and forecasts should be announced at least six months prior to the effective date of the change.

2.2.3.4 Information on broadcast schedules for routine forecasts and contents of bulletins shall be notified to the WMO Secretariat for inclusion in *Information for Shipping*, Volume D (WMO-No. 9).

2.2.3.5 For area(s) for which an issuing service has assumed responsibility, the Service shall select the appropriate Coastal Earth Station (CES) to service that area.

NOTES: (1) As there are several CESs which can serve an Ocean Region and hence an area of broadcast responsibility, issuing services may negotiate directly with the various CES operators to obtain the most favourable tariff (and service) considerations.
(2) In order to ensure reception of unscheduled broadcasts by shipping in an area which is

served by more than one satellite and recognizing that national Meteorological Services will not know to which of these satellites the ship's equipment is tuned, the following procedures shall be adopted by issuing services. For unscheduled broadcasts, these shall be issued for broadcast under the SafetyNET service through all INMARSAT ocean region satellites covering the issuing service's area of responsibility. [NOTE: The broadcast requirement for unscheduled broadcasts has been determined by IMO.] For scheduled forecasts, these shall be issued for broadcast over at least a single nominated satellite, in accordance with a pre-arranged schedule, co-ordinated by WMO.

2.2.3.6 The issuing service shall select the method by which the transfer of information to the CES shall be effected.

NOTE: The transfer of information may be accomplished in several ways. See Appendix I-3 for details.

2.2.3.7 Weather and sea bulletins shall be prepared and issued at least twice daily.

2.2.3.7.1 The issue of the weather and sea bulletins shall be at a scheduled time and be in the following sequence: Part I to be followed immediately by Part II and then Part III. A schedule of transmission start times for these bulletins has been compiled for all METAREAs and the CESs which serve the areas and takes into consideration, *inter alia*, the existing WMO synoptic times for observations, data analysis and forecast production. Additionally, as these broadcast schedules for the International SafetyNET Service have to be co-ordinated, under the aegis of WMO, with other Organizations such as IHO, issuing services should not independently change or request WMO to arrange frequent alterations to these co-ordinated and published schedules (see also paragraph 2.2.3.4).

2.2.3.7.2 Issuing services must ensure that the correct EGC message addressing formats are adhered to for all warning and forecast messages intended for broadcast by a CES (see Appendix I-4 message addressing and Appendix I-5 operational guidance).

2.2.3.8 Warnings, synopses and forecasts shall be given in plain language.

2.2.3.8.1 Warnings, synopses and forecasts intended for the International SafetyNET Service shall be broadcast in English.

NOTE: Additionally, if a national Meteorological Services wishes to issue warnings and forecasts to meet national obligations under SOLAS, broadcasts may be made in other languages. These broadcasts will be part of a National SafetyNET Service.

2.2.3.8.2 In order to ensure the integrity of the warnings and forecasts being received by mariners, it is essential that issuing services monitor the broadcasts which they originate. Monitoring is especially important in a highly automated system which is dependent on

careful adherence to procedure and format. This may be accomplished by the installation of an EGC receive-capability at the issuing service's facility.

NOTE: Each issuing service may use the EGC receiver to check the following:

- (a) That the message has been broadcast;
- (b) That the message is received correctly;
- (c) That cancellation messages are properly executed;
- (d) Any unexplained delay in the message being broadcast.

2.2.3.8.3 The language of the synopsis should be as free as possible from technical phraseology.

2.2.3.8.4 The terminology in weather and sea bulletins should be in accordance with the multilingual list of terms used in weather and sea bulletins, which is given in Annex 1.2.A of the *Guide to Marine Meteorological Services* (WMO-No. 471) and in Appendix I-2 in the existing *Manual on Marine Meteorological Services*.

2.2.3.9 **Wind direction shall be given in points of the compass and not in degrees.**

2.2.3.9.1 Wind force should be given in Beaufort notation or wind speed in metres per second or in knots. **If metres per second or knots are used, the words "metres per second" or "knots" shall be included in the text of the message.**

NOTE: The criteria of the Beaufort notation of wind force are given in a Beaufort scale table.

2.2.4 **Warnings**

2.2.4.1 **Warnings shall be given for gales (Beaufort force 8 or 9) and storms (Beaufort force 10 or over), and for tropical cyclones (hurricanes in the North Atlantic and eastern North Pacific, typhoons in the Western Pacific, cyclones in the Indian Ocean and cyclones of similar nature in other regions).**

- NOTES:
- (1) Warnings to circular areas require a specific address code, C₂ code = 24. See Appendix I-4.
 - (2) Warnings may be addressed for reception by shipping in a circular area within the main METAREA (C₂ code = 24), or addressed for reception by shipping within the entire METAREA (C₂ code = 31) — this is at the discretion of the issuing services in consultation with the preparation service responsible for the warning. If a circular area address (C₂ code = 24) is chosen, only ships within that area as defined by the C₃ circular address will receive the warning.
 - (3) Definition of a tropical cyclone is contained in the *International Meteorological Vocabulary* (WMO-No. 182) and classification of tropical cyclones is left to the Regions concerned.

2.2.4.2 The issue of warnings for near gales (Beaufort force 7) is optional.

2.2.4.3 Warnings for gales, storms and tropical cyclones should have the following content and order of items:

- (a) Type of warning;
- (b) Date and time of reference in UTC;
- (c) Type of disturbance (e.g. low, hurricane, etc.) with a statement of central pressure in hectopascals;
- (d) Location of disturbance in terms of latitude and longitude or with reference to well-known landmarks;
- (e) Direction and speed of movement of disturbances;
- (f) Extent of affected area;
- (g) Wind speed or force and direction in the affected areas;
- (h) Sea and swell conditions in the affected area;
- (i) Other appropriate information such as future positions of disturbances.

2.2.4.3.1 **Items (a), (b), (d), (f) and (g) listed under 2.2.4.3 shall always be included in the warnings.**

2.2.4.4 In addition to indicating the positions of pressure disturbances in terms of latitude and longitude, or with reference to well-known landmarks, the boundaries of the existing and forecast storm-wind area or areas of high waves (including swell) should be indicated.

NOTE: The usual practice in warnings is to indicate boundaries with reference to the centre of the pressure disturbance, or to divide the disturbance (low, tropical cyclone) into sectors for which prevailing and forecast conditions are described.

2.2.4.4.1 When warnings are included for more than one pressure disturbance or system, the systems should be described in a descending order of threat.

2.2.4.4.2 Warnings shall be as brief as possible and, at the same time, clear and complete.

2.2.4.5 **The time of the last location of each tropical cyclone or extratropical storm shall be indicated in the warning.**

2.2.4.6 **A warning shall be issued immediately the need becomes apparent, and broadcast immediately on receipt, followed by a repeat after six minutes (repetition code 11), when issued as an unscheduled broadcast.**

2.2.4.6.1 **When no warnings for gales, storms or tropical cyclones are to be issued, that fact shall be positively stated in Part I of each weather and sea bulletin.**

2.2.4.6.2 **Warnings shall be updated whenever necessary and then issued immediately.**

2.2.4.6.3 **Warnings shall remain in force until amended or cancelled.**

2.2.4.6.4 Warnings issued as Part I of a scheduled bulletin do not need to be repeated after six minutes.

2.2.5 **Synopses**

2.2.5.1 **The synopses given in Part II of weather and sea bulletins shall have the following content and order of items:**

- (a) Date and time of reference in UTC;
- (b) Synopsis of major features of the surface weather chart;
- (c) Direction and speed of movement of significant pressure systems and tropical disturbances.

2.2.5.1.1 Significant characteristics of corresponding wave conditions (sea and swell) should be included in the synopsis whenever this information is available, as well as characteristics of other sea-surface conditions (drifting ice, currents, etc.) if feasible and significant.

2.2.5.2 Significant low-pressure systems and tropical disturbances which affect or are expected to affect the area within or near the valid period of the forecast should be described. The central pressure and/or intensity, location, movement and changes of intensity should be given for each system. Significant fronts, high-pressure centres, troughs and ridges should be included whenever this helps to clarify the weather situation.

2.2.5.3 Direction and speed of movement of significant pressure systems and tropical disturbances should be indicated in compass points and metres per second or knots, respectively.

2.2.5.3.1 Units used for speed of movement of systems shall be indicated.

2.2.6 Forecasts

2.2.6.1 The forecasts given in Part III of weather and sea bulletins shall have the following content and order of items:

- (a) The valid period of forecast;
- (b) Name or designation of forecast area(s) within the main MSI area;
- (c) A description of:
 - (i) Wind speed or force and direction;
 - (ii) Visibility when forecast is less than six nautical miles (ten kilometres);
 - (iii) Ice accretion, where applicable;
 - (iv) Waves (sea and swell).

2.2.6.1.1 The forecasts should include expected significant changes during the forecast period, significant meteors such as freezing precipitation, snowfall or rainfall, and an outlook for a period beyond that normally covered by the forecast.

2.2.6.2 The valid period shall be indicated either in terms of number of hours from the time of issue of forecast or in terms of dates and times in UTC of the beginning and end of the period.

2.2.6.3 Visibility should be indicated in nautical miles or kilometres or given in descriptive terms.

2.2.6.3.1 Units used for visibility shall be indicated.

2.2.7 Selection of reports from sea stations

2.2.7.1 When included in weather and sea bulletins for the high seas, reports from ships and other sea stations should be selected to give a reasonable geographical distribution, taking into account the important synoptic features.

2.2.7.2 The information should include the position of ships and other sea stations, time of observation, wind, visibility, atmospheric pressure and, if possible, cloudiness, present and past weather, air and sea-surface temperatures and waves.

2.2.8 Selection of reports from land stations

2.2.8.1 Reports included should be for selected land stations in a fixed order.

2.2.8.2 The reports should include the same elements as those listed in paragraph 2.2.7.2, as applicable.

2.2.9 Issue of sea-ice information

Sea-ice terminology shall be in accordance with the *WMO Sea-Ice Nomenclature* (WMO-No. 259).

3. MARINE METEOROLOGICAL SUPPORT FOR MARITIME SEARCH AND RESCUE

3.1 Principles

The principle for marine meteorological support for maritime search and rescue (SAR) is as follows:

Principle

For the purpose of maritime search and rescue (SAR), a meteorological forecast centre may serve more than one Rescue Co-ordination Centre (RCC). Likewise, an RCC may make requests for information from more than one meteorological forecast centre depending on the nature of the maritime SAR operation.

3.2 Procedures

3.2.1 Marine meteorological services for maritime search and rescue (SAR) shall be provided in accordance with the national overall co-ordination procedures for SAR and taking into account the international recommendations and the requirements in force.

NOTES: (1) Requirements for SAR services including meteorology are contained in the ICAO Regional Air Navigation Plans.

(2) Additional requirements for maritime SAR services are contained in the *IMO Search and Rescue Manual*.

3.2.1.1 Requests from Rescue Co-ordination Centres (RCCs) shall be dealt with as expeditiously as possible and shall be given highest priority when an SAR operation is in progress.

3.2.1.2 On receiving formal notification from an RCC that a ship or aircraft or survival craft thereof is in distress, every effort shall be made to meet the requirements of the RCC.

3.2.2 Information on the following parameters and phenomena, as may be requested by or be of value to an RCC, should be provided:

- (a) Atmospheric pressure;
- (b) Surface winds;
- (c) Sea and swell;
- (d) Surface visibility;
- (e) Ice accretion;
- (f) Sea ice;
- (g) Icebergs;
- (h) Precipitation and cloud cover, including height of cloud base;
- (i) Air temperature;
- (j) Humidity;
- (k) Sea-surface temperature;
- (l) Surface currents;
- (m) Tidal current deviation;
- (n) Bar conditions;

- (o) Surf and breakers;
- (p) Storm surge;
- (q) Water discolouration.

- NOTES:
- (1) Special weather forecasts covering periods of up to 24 hours and possibly beyond may be required for maritime SAR operations on a continental shelf and slightly beyond. Ships of all sizes, helicopters and fixed-wing aircraft may be involved in these operations.
 - (2) Medium-range forecasts may be required in the event of SAR operations taking place over large ocean areas where ocean-going ships and fixed-wing aircraft may be involved for considerable periods of time and possibly searching for relatively small objects on the sea surface.
 - (3) Some of the information to be provided may be the responsibility of more than one authority and should be co-ordinated nationally.

3.2.3 Notification of SAR operations and all subsequent communications between the RCC and weather forecast centre should be by telephone, telex or other medium designed for rapid transmission or reception.

3.2.3.1 When communicating with RCCs or when providing weather forecasts the terminology should be similar to that used in weather bulletins and warnings to shipping.

3.2.3.2 A permanent record of all communications should be maintained, showing the times of origin, transmission and reception of the information provided.

3.2.3.3 Weather forecast centres should not attempt to communicate directly, or through coastal radio stations, with ships or aircraft involved in the SAR operation unless specifically requested by the RCC.

3.2.4 Meteorological Services should encourage ships operating under their national flag, when taking part in any medium- or long-term SAR operation or in the vicinity of an SAR operation but not necessarily participating, to make weather observations at main and intermediate standard times for surface synoptic observations and to transmit them, in the international SHIP code form or plain language, immediately to the appropriate coastal radio station for onward transmission, or through a coast earth station (CES) directly to a Meteorological Service.

APPENDIX I-1

GLOSSARY

In 1973 the International Maritime Organization (IMO) Assembly adopted a recommendation on the development of the maritime distress systems which laid down the IMO policy for improved distress and safety communications at sea based on the most up-to-date techniques. This policy foresaw, as an essential element, the advent of satellite and automatic terrestrial communications. To achieve the former, IMO in 1976 adopted an international convention establishing the INMARSAT organization. The terrestrial element was achieved by the development of the necessary techniques for digital selective calling and direct-printing telegraphy. This was accomplished with the assistance of the International Telecommunication Union's (ITU) International Radio Consultative Committee (CCIR) and the World Administrative Radio Conference (WARC).

In 1983 and 1987 the necessary frequencies were allocated to test and prove the equipment and this facilitated the establishment of the GMDSS. The 1988 GMDSS Conference adopted amendments to the 1974 International Convention for the Safety of Life at Sea (SOLAS) to introduce GMDSS. SafetyNET provides shipping with navigational and meteorological warnings, meteorological forecasts, shore-to-ship alerts and other urgent information in accordance with the requirements of SOLAS 1974. It is suitable for use in all sizes and types of surface craft. SafetyNET is a service of INMARSAT's enhanced group call (EGC) system and was specifically designed for promulgation

of maritime safety information (MSI) as part of GMDSS. SafetyNET meets international requirements for broadcasting area, regional or local navigational warnings, meteorological warnings and forecasts and shore-to-ship distress alerts. It is designed with the capacity to provide services within the coverage areas of geostationary maritime communications satellites, that is in sea area A3 of the GMDSS. In addition to providing service to ships operating in sea area A3, it also provides the means of disseminating MSI to coastal waters not covered by NAVTEX. SafetyNET messages can be originated by a registered provider (e.g. a WMO Member) anywhere in the world and broadcast to the appropriate ocean area via an INMARSAT-C* coast earth station (CES). Messages are broadcast according to priority, i.e. distress, urgent, safety and routine.

Atlantic Ocean Region (west) (AOR(W)), Atlantic Ocean Region (east) (AOR(E)), Indian Ocean Region (IOR), Pacific Ocean Region (POR); Ocean areas within the footprints (0° elevation) of the INMARSAT satellites located at 55.5°W, 18.5°W, 63°E and 180°E, respectively.

Coast Earth Station (CES): A land station in the INMARSAT satellite communications system which provides inter-connexion between the satellite and shore systems such as telex and telephone.

* INMARSAT-A and INMARSAT-C, previously termed INMARSAT Standard-A and Standard-C.

Enhanced Group Call (EGC): The system for broadcasting messages via the mobile satellite communications system operated by INMARSAT. EGC is a part of the INMARSAT-C system and currently supports two services: SafetyNET™ and FleetNET™. (FleetNET: A commercial service for the broadcast and automatic receipt of fleet management and general public information by means of direct-printing through INMARSAT's Enhanced Group Call system.)

International NAVTEX Service: The system for the broadcast and automatic reception of maritime safety information by means of narrow-band direct-printing on 518 kHz, using the English language. (NAVTEX receiving capability is part of the mandatory equipment which is required to be carried in certain vessels under the provisions of the revised Chapter IV of the International Convention for the Safety of Life at Sea (SOLAS), 1974).

International SafetyNET Services: The co-ordinated broadcast and automated reception of Maritime Safety Information via the INMARSAT Enhanced Group Call system using the English language to meet the requirements of the SOLAS Convention.

Maritime Safety Information (MSI): Navigational and meteorological warnings, meteorological forecasts and other urgent safety-related messages broadcast to ships.

National SafetyNET Services: The broadcast and automated reception of Maritime Safety Information via the INMARSAT Enhanced Group Call system using languages as decided by the administration concerned.

Network Co-ordination Station (NCS): A land station in the INMARSAT mobile satellite communications system which controls channel assignments and other communications functions through a satellite for an entire ocean region.

Registered Provider: An authorized MSI provider which has an agreement with one or more CES for providing SafetyNET broadcast information.

Rescue Co-ordination Centre (RCC): A unit responsible for promoting efficient organization of search and rescue services for co-ordinating the conduct of search and rescue operations within a search and rescue region.

SafetyNET: A service for the broadcast and automatic reception of maritime safety information by means of direct-printing through INMARSAT's Enhanced Group Call system.

Schedule broadcasts: The regular single transmission of weather and sea bulletins for the high seas, including gale and storm warnings as necessary. Each bulletin broadcasts at least twice daily, in accordance with a pre-arranged and published schedule co-ordinated by WMO and in the prescribed high seas bulletin format, as described in the *Manual on Marine Meteorological Services*. The EGC priority code (C_1) for messages intended for scheduled broadcast is $C_1 = 1$ – Safety, and repetition code (C_4) is $C_4 = 01$ – Broadcast once only.

Sea Area A1: An area within the radiotelephone coverage of at least one VHF coast station in which continuous Digital Selective Calling (DSC) alerting is available, as may be defined by a (SOLAS) Contracting Government.

Sea Area A2: An area, excluding sea area A1, within the radiotelephone coverage of at least one MF coast station in which continuous DSC alerting is available, as may be defined by a Contracting Government.

Sea Area A3: An area, excluding sea areas A1 and A2, within the coverage of an INMARSAT geostationary satellite in which continuous alerting is available.

Sea Area A4: An area outside sea areas A1, A2 and A3.

Ship Earth Station (SES): A mobile earth station in the maritime mobile-satellite service located aboard a ship, or elsewhere.

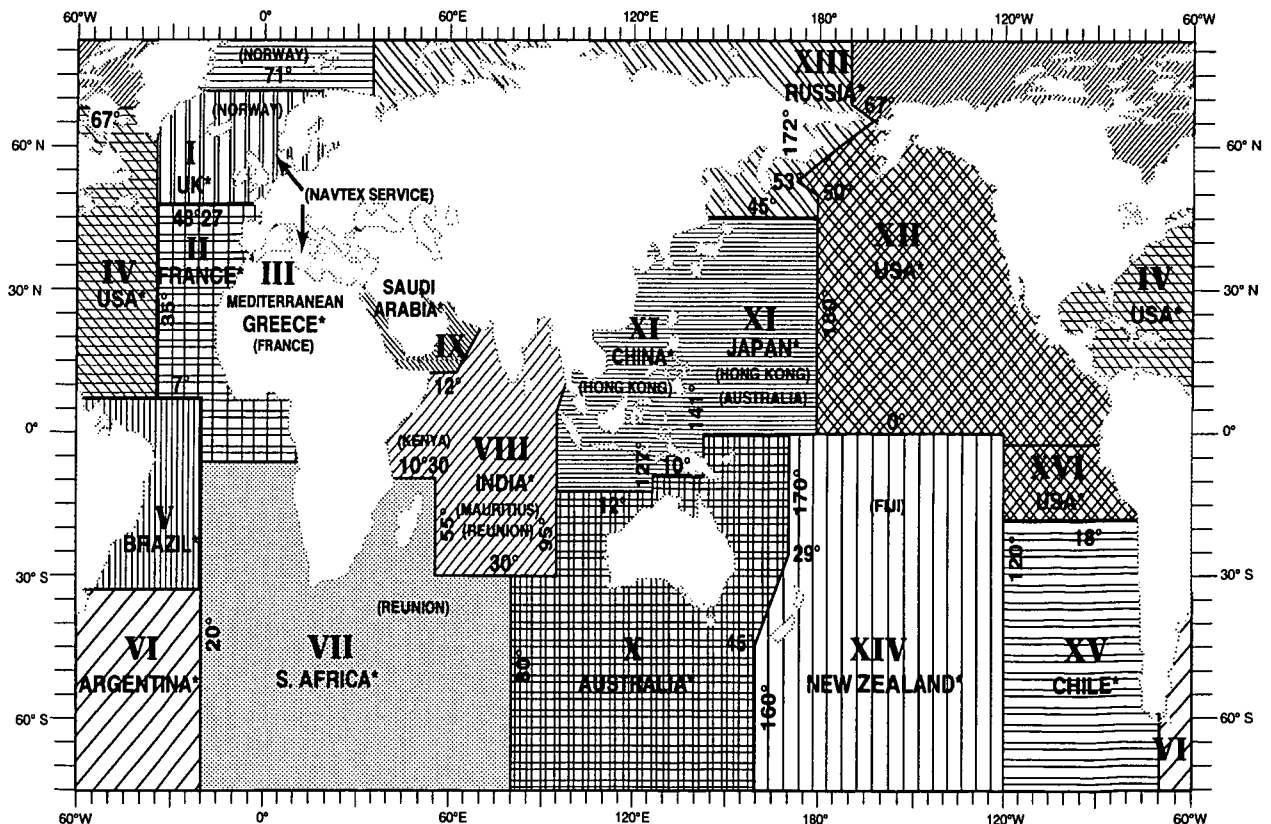
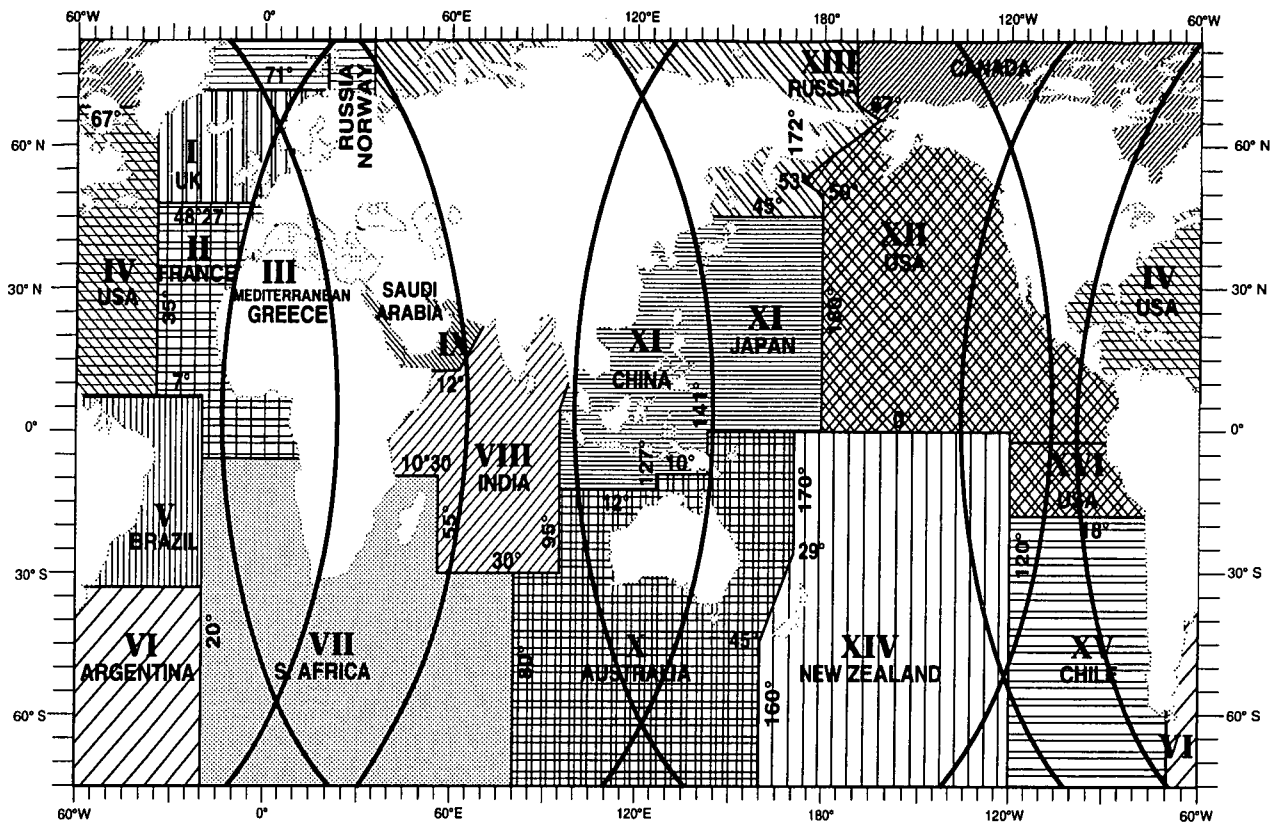
INMARSAT-A: A satellite communications system for transmission of voice, telex, facsimile or data using directional antennas in the INMARSAT satellite system.

INMARSAT-C: A satellite communications system for telex or data messaging using small terminals and omni-directional antennas in the INMARSAT satellite system.

Unscheduled broadcasts: The contingent broadcast, with a six-minute repetition, of urgent meteorological information which is intended for immediate delivery to shipping. When such urgent meteorological information comprises or includes urgent tropical cyclone warnings, the EGC priority code (C_1) is $C_1 = 2$ – URGENT and repetition code (C_4) is $C_4 = 11$ – Repeat six minutes after the initial transmission. All other warnings (e.g. gale and storm) will have $C_1 = 1$ – SAFETY and $C_4 = 11$ – Repeat after six minutes.

APPENDIX I-2

AREAS OF RESPONSIBILITY AND DESIGNATED NATIONAL METEOROLOGICAL SERVICES FOR THE ISSUE OF WARNINGS AND WEATHER AND SEA BULLETINS FOR THE GMDSS



*Denotes a preparation and issuing member

() Denotes a preparation member

AREAS OF RESPONSIBILITY FOR HIGH SEAS (GMDSS)

TABLE 1

METAREA	Issuing Service	Area CES for the issue of scheduled broadcasts (see paragraph 2.2.3.5)
I	United Kingdom	Goonhilly
II	France	Pleumeur Bodou
III	Greece	Thermopylae
IV	USA	Southbury (AOR (W))
V	Brazil	Tangua
VI	Argentina	Southbury (AOR (W))
VII-Atlantic Ocean Region	South Africa*	Goonhilly (AOR (E))
VII-Indian Ocean Region	South Africa*	Perth (IOR)
VIII	India	Arvi
IX	Saudi Arabia	Jeddah (IOR)
X-Indian Ocean Region	Australia	Perth (IOR)
X-Pacific Ocean Region	Australia	Perth (POR)
XI-Indian Ocean Region	China	Beijing
XI-Pacific Ocean Region	Japan	Perth
XII-Pacific Ocean Region	USA	Santa Paula (POR)
XII-Atlantic Ocean Region	USA	Southbury (AOR (W))
XIII	Russian Federation	Nakhodka (POR)
XIV	New Zealand	Perth (POR)
XV	Chile	Southbury (AOR (W))
XVI	USA	Southbury (AOR (W))

* The Government of the Republic of South Africa has been suspended by Resolution 38 (Cg-VII) from exercising its rights and enjoying its privileges as a Member of WMO.

Co-ordinates for GMDSS METAREAS (IHO NAVAREAS)

Area I The North Atlantic Ocean east of 35°W, from 48°27'N to 71°N including the North Sea and Baltic Sea sub-area.

Area II Atlantic waters east of 35°W, from 7°N to 48°27'N, thence east of 20°W from 48°27'N to 6°S.

Area III The Mediterranean and Black Seas, east of the Straits of Gibraltar.

Area IV The western part of the North Atlantic Ocean eastwards of the North American coast to 35°W, from 7°N to 67°N, including the Gulf of Mexico and Caribbean Sea.

Area V Atlantic waters west of 20°W from 35°50'S to 7°N, narrowing in the coastal strips at the extremities to the Uruguay/Brazil frontier in 33°45'S and the French Guyane/Brazil frontier in 4°30'N.

Area VI The South Atlantic and Southern Oceans south of 35°50'S, from 20°W to the longitude of Cape Horn, 67°16'W.

Area VII The South Atlantic and Southern Oceans south of 6°S from 20°W to the coast of Africa, thence south to the Cape of Good Hope; the South Indian and Southern Oceans south of 10°30'S from the Cape to 55°E, thence south of 30°S to 80°E.

Area VIII The area of the Indian Ocean enclosed by lines from the Indo-Pakistan frontier in 23°45'N 68°E to 12°N 63°E, thence to Cape Gardafui; the east African coast south to 10°30'S, thence to 55°E, to 30°S to 95°E, to

6°N, thence NE'wards to the Myanmar/Thailand frontier in 10°N 98°30'E.

Area IX The Red Sea, Gulf of Aden, Arabian Sea and Persian Gulf, north of Area VIII.

Area X The South Indian and Southern Oceans east of 80°E and south of 30°S to 95°E, to 12°S, to 127°E; thence the Timor Sea, South Pacific and Southern Oceans south of 10°S to 141°E to the equator, to 170°E, to 29°S, thence SW'wards to 45°S in 160°E, then the 160°E meridian.

Area XI The Indian Ocean, China Sea and North Pacific Ocean northward of Area X and on the equator to longitude 180°, eastward of Area VIII and the Asian continent to the North Korea/Russian Federation frontier in 42°30'N 130°E, thence to 135°E, NE'wards to 45°N 138°E, to 45°N 180°.

Area XII The eastern part of the Pacific Ocean, west of the North and South American coast and east of 120°W, from 3°25'S to the equator, thence to 180°, to 50°N thence NW'wards to 53°N 172°E, NE'wards following the marine frontier between USA and Russian Federation waters to 67°N.

Area XIII Sea areas enclosed north of area XI and west of Area XII; also all Arctic waters from 170°W westwards to 20°E.

Area XIV The South Pacific and Southern Oceans south of the equator, bounded by Area X to the west, Area XII to the north and Area XV to the east.

Area XV The South Pacific and Southern Oceans south of 18°30'S following the coast of Chile to the longitude of Cape Horn in 67°16'W, and 120°W.

Area XVI The South Pacific Ocean between 18°30'S and 3°25'S bounded by the coast of Peru and 120°W.

TABLE 2

METAREA	Issuing service*	Preparation service	Area CES of issuing service (a) For scheduled broadcasts (b) For unscheduled broadcasts	Remarks
I	United Kingdom	United Kingdom, Norway	(a) Goonhilly (For AOR (W)) (b) Goonhilly (For AOR (W), AOR (E))	Forecasts and warnings for areas not covered by NAVTEX
II	France	France	(a) Pleumeur Bodou (For AOR (E)) (b) Goonhilly (For AOR (W)) Pleumeur Bodou (For AOR (E))	Forecasts and warnings for areas not covered by NAVTEX
III	Greece	Greece, France	(a) Thermopylae (For IOR) (b) Thermopylae (For IOR) Goonhilly (For AOR (W), AOR (E))	Forecasts and warnings for areas not covered by NAVTEX
IV	USA	USA	(a) Southbury (For AOR (W)) (b) Southbury (For AOR (W)) Goonhilly (for AOR (E))	
V	Brazil	Brazil	(a) Tangua (For AOR (E)) (b) Southbury (For AOR (W)) Tangua (For AOR (E))	No NAVTEX services planned in this area
VI	Argentina	Argentina	(a) Southbury (For AOR (W)) (b) Southbury (For AOR (W)) Tangua (for AOR (E))	Forecasts and warnings outside NAVTEX coverage
VII-AOR	South Africa **	South Africa	(a) Goonhilly (For AOR (E)) (b) Southbury (For AOR (W)) Goonhilly (for AOR (E))	
VII-IOR	South Africa **	South Africa Réunion	(a) Perth (IOR) (b) Goonhilly (For AOR (E)) Perth (For IOR)	
VIII	India	Kenya, Mauritius, Réunion, India	(a) Arvi (For IOR) (b) Pleumeur Bodou (For AOR (E))	Forecasts and warnings for areas not covered by NAVTEX
IX	Saudi Arabia	Saudi Arabia	(a) Jeddah (b) Pleumeur Bodou (For AOR (E))	
X-IOR	Australia	Australia	(a) Perth (For IOR) (b) Perth (For IOR and POR)	No NAVTEX service
X-POR	Australia	Australia	(a) Perth (For POR) (b) Perth (For POR and IOR)	No NAVTEX service
XI-IOR	China	China, Hong Kong	(a-b) Beijing (For IOR)	Forecasts and warnings for areas not covered by NAVTEX
XI-POR	Japan	Japan, Hong Kong,	(a-b) Perth (For POR)	
XII	USA	Australia, USA	(a) Santa Paula (For POR) Southbury (For AOR (W)) (b) Southbury (For AOR (W)) Goonhilly (For AOR (E)) Santa Paula (For POR)	Forecasts and warnings for areas not covered by NAVTEX
XIII	Russian Federation	Russian Federation	(a-b) Nakhodka (For POR)	Fully covered by NAVTEX from 1996
XIV	New Zealand	Fiji, New Zealand	(a) Perth (For POR) (b) Southbury (For AOR (W)) Perth (For POR)	No NAVTEX service
XV	Chile	Chile	(a) Southbury (For AOR (W)) (b) Southbury (For AOR (W)) Tangua (For AOR (E))	Single CES can service satellite footprint overlaps
XVI	USA	USA	(a) Southbury (For AOR (W)) (b) Southbury (For AOR (W)) Goonhilly (For AOR (E)) Santa Paula (For POR)	No NAVTEX service

* It is the responsibility of the issuing member to ensure that data are available to provide input for its entire areas of broadcast responsibility and to develop appropriate procedures to rectify any data deficiency.

** The Government of the Republic of South Africa has been suspended by Resolution 38 (Cg-VII) from exercising its rights and enjoying its privileges as a Member of WMO.

APPENDIX I-3

TRANSFER OF INFORMATION FROM AN ISSUING SERVICE TO A COAST EARTH STATION (CES)
PROVIDING INMARSAT-C SERVICES*

The transfer of warnings and forecasts by the issuing service to a CES may be accomplished by:

- (1) Telex link from the issuing service directly to the CES;
- (2) X.25 packet switching networks**
- (3) A dedicated landline;
- (4) The GTS to another national Meteorological Service whose country hosts the relevant CES, thence by

* Access to the SafetyNET service for the broadcast of meteorological data will be granted only to message originators authorized by the WMO and registered with one or more INMARSAT-C CES operators.

** Such networks, which operate at transmission speeds higher than telex, may attract lower charges for the land-line portion of the transmissions.

either (1) or (2) above by the co-operating national Meteorological Services to the CES;

- (5) An INMARSAT-C SES direct to the CES. [The approval of the national licensing authority has to be obtained for this method.] Such an approach to message transfer could prove particularly attractive to those issuing services located in countries without a CES, as potential delays and problems in the international terrestrial telecommunications networks could be avoided. It could also serve as an emergency back-up to normal terrestrial communications systems for urgent messages;
- (6) Other means, as appropriate to national requirements and facilities.

APPENDIX I-4

MESSAGE ADDRESSING

INTRODUCTION

Messages for transmission via the SafetyNET service are received and processed automatically. Because the system is automatic, it depends on accurate preparation of the traffic.

Messages are not reviewed for corruption or accuracy at the CES. Therefore, the originator must take special care to adhere to the specified format as detailed in this appendix. It is for this reason that issuing services should monitor the broadcasts that they originate.

Participating CES transmit SafetyNET messages over an interstation signalling link to the Ocean Region Network Co-ordination Station (NCS) for transmission over the broadcast channel.

Messages will be queued at the CES according to priority and scheduled for retransmission according to instructions contained in the special address headers (C_1 and C_4). Messages with the highest priority will be transmitted first. Shore-to-ship distress alerts will be broadcast first followed by urgency, safety and then routine traffic. The originator of each message will specify in the message parameters the desired number of repetitions and the interval between transmissions.

1. WARNING AND FORECAST ADDRESSING FOR EGC MESSAGES

1.1 Introduction

This appendix describes the methods by which EGC messages are transmitted to CES by issuing services for subsequent transmission over the INMARSAT satellite system. The format in which they are transmitted is also described.

1.2 Routing of messages to the CES by an issuing service

(see Appendix I.3 for methods)

1.3 Addressing of EGC packets

After having gained access to the CES, the issuing service must give EGC packet address information so that the ships in the right areas receive the EGC messages. The EGC packet address information is sent by the issuing service by means of a special message header at the beginning of messages that are required to be transmitted. These message headers will consist of five special codes called C codes. The five codes may be prefixed by additional characters to indicate that the message is an EGC transmission. [A C_0 code, to identify the ocean region, may be necessary when addressing EGC messages to CES which operate in more than one ocean region.]

The following generalized message header format using C codes shall be adopted by all issuing services. C codes transmitted to the CES are: $C_1:C_2:C_3:C_4:C_5$, where:

- | | |
|--------------------------------|-------------------|
| C_1 is the priority code | - 1 digit |
| C_2 is the service code | - 2 digits |
| C_3 is the address | - up to 12 digits |
| C_4 is the repetition rate | - 2 digits |
| C_5 is the presentation code | - 2 digits |

A digit in this context means an alphanumeric character received from the terrestrial network. The meaning of the C codes is explained later in this appendix, but for illustration purposes an example follows:

An incoming (to the CES) EGC "warning" telex would appear as:

1:31:01:11:00 (the C code message header)
SECURITE
0245 UTC

STORM WARNING. AT 190600 UTC, LOW 970
57N 20W MOVING NE 15KT. WINDS STORM 10
WITHIN 150 MILES RADIUS OF CENTRE
NNNN

This example is for "SAFETY" priority ($C_1=1$) EGC call containing a meteorological warning ($C_2=31$) to Metarea 01, which will be repeated six minutes ($C_4=11$) after the initial transmission. The text of the storm warning is transmitted in International Alphabet 5 ($C_5=00$).

1.3.1 Priority codes (C_1)

Format as received at the CES – 1 digit. The C_1 code is used to indicate to the CES the level of priority needed for the message's transmission. The priority number is given in ascending order as follows:

0	ROUTINE	} Meteorological messages will be either SAFETY ($C_1=1$) or URGENT ($C_1=2$)
1	SAFETY	
2	URGENT	
3	DISTRESS	

NOTE: Priority URGENT ($C_1=2$) to be used for urgent tropical cyclone warnings only. All other meteorological warnings to be classified as SAFETY ($C_1=1$).

1.3.2 Service codes (C_2)

Format as received at the CES – two digits. A C_2 code is adopted that will explicitly indicate to the EGC receiver the length of the address it will need to decode during message processing. The service codes allocated for WMO use are described below together with the number of digits in the C_3 code.

- (a) 13–Coastal warnings and forecasts
 C_3 code – 4 digits
 24–Meteorological and navigational warnings and search and rescue information to circular areas
 C_3 code – 10 digits;
- (b) 31–Meteorological and NAVAREA warnings and meteorological forecasts to pre-defined METAREAs
 C_3 code – 2 digits

1.3.3 Addresses (C_3)

The method that issuing services will use to transmit the EGC packet addresses is given below for each service type described in paragraph 1.3.2 of this appendix.

- 1.3.3.1 *Service code 13 – Coastal warnings and forecasts*
 Coastal warnings and forecasts – $C_3 = X_1X_2$ to identify the METAREA and B_1B_2 to emulate NAVTEX. Note that B_1 codes will be allocated by IMO in accordance with the procedure for allocating

NAVTEX transmitter identities laid down in the *IMO NAVTEX Manual* (IMO Publication 951 88.08). B_2 will always be B for warnings and E for forecasts. The METAREA X_1X_2 code and the NAVTEX B_1 and B_2 are sent to the CES as a 4-character group, in the order $X_1X_2B_1B_2$.

1.3.3.2 *Service code 24 – Meteorological and navigational warnings and search and rescue information to circular areas*

The circular address consists of 10 characters as follows:

$D_1D_2L_aD_3D_4D_5L_0M_1M_2M_3$, where
 D_1D_2 is latitude of centre in degrees with leading zero if required;
 L_a is hemisphere N or S;
 $D_3D_4D_5$ is longitude of centre in degrees with leading zero if required;
 L_0 is longitude E or W;
 $M_1M_2M_3$ is radius of circle in nautical miles (up to 999);

A circle with a radius of 10 nautical miles is coded as 56N034W010

1.3.3.3 *Service code 31 – Meteorological and NAVAREA warnings and meteorological forecasts to pre-defined METAREAs*

Meteorological and NAVAREA warnings and meteorological forecasts are addressed to the areas described in Appendix I-2 using the 2 digits N_1N_2 where N_1N_2 is the numerical designation of the area.

1.3.4 Repetition codes (C_4)

Format as received at CES – two digits. The C_4 repetition codes are for messages that are required to be repeated at specified intervals until cancelled by the issuing Member and incorporate the needs of MSI providers for the SafetyNET service.

1.3.4.1 *Repetition codes*

A repetition code allows a message to be broadcast once only on receipt ($C_4=01$) or broadcast on receipt and repeated six minutes later ($C_4=11$). Many other types of repetition are possible, but are not relevant to meteorological broadcasts.

1.3.4.2 *Cancel facility*

A cancellation facility for messages transmitted to a CES with repetition codes is necessary. An example of a cancel instruction is as follows:

Cancel messages: message reference number at time; where message reference number is the number given to the message provider by the CES on receipt of the initial message and time is of the form:

DDHHMMZ space MMM space YY e.g.
211430Z FEB 88

If the cancel instruction accompanies a broadcast message it will appear between the NNNN and +++ characters as follows:

C₁:C₂:C₃:C₄:C₅

SECURITE

"text"

NNNN

CANCEL (message reference number) at
(date/time group)

++++

- NOTES: (1) Only the "text" is for transmission.
(2) When included with a message for broadcasting, the CES message cancellation instructions will appear between the NNNN and the ++++ characters. There will only be one instruction to each line, but the facility to provide for more than one line of instructions is desirable.
(3) If the cancellation instruction terminates after the message reference

number, i.e. the (time/date) is not included, then the instruction should be executed immediately.

- (4) It should also be possible for a cancel instruction to be sent to the CES Store and Forward Unit.

1.3.5 Presentation codes (C₅)

The current allocation of presentation codes is as follows PQ173:

- 00 IA number 5 (IR.V version) odd parity
- 01 Katakana odd parity
- 02 Devnagiri odd parity
- 03 Arabic odd parity
- 04 Cyrillic odd parity
- 05 Greek odd parity
- 06 ITA 2
- 07 Data

APPENDIX I-5

INTERNATIONAL SAFETYNET MANUAL ANNEX 4 — OPERATIONAL GUIDANCE

This annex contains operational guidance for the benefit of Registered Information Providers who are responsible for preparing messages for broadcast via the International SafetyNET Service. Use of the codes given in this annex is mandatory for all messages in the system.

Examples of the various types of messages and message formats are detailed in the sub-sections of this annex:

- (a) Navigational warning services;
- (b) Meteorological services;
- (c) Search and rescue services;
- (d) Chart correction services (to be developed).

The broadcast parameters are controlled by the use of 5 "C" codes which are combined into a generalized message header format as follows:

C₁:C₂:C₃:C₄:C₅

(Spaces, colons or other delimiters between these fields will be required, depending on the CES addressed).

Each "C" code controls a different broadcast parameter and is assigned a numerical value according to the available options which are fully tabulated in Annex 6.

Because distortion of the header format of a message may prevent its being released, MSI providers must install an INMARSAT SafetyNET receiver and monitor broadcasts of messages which they originate.

ANNEX 4b — Meteorological services

1. The following sets out the arrangements to be used for the broadcast of meteorological forecasts and warnings via SafetyNET for the GMDSS. They

are mandatory for broadcasts in the International SafetyNET Service.

2. These guidelines are to be read in conjunction with the WMO *Manual on Marine Meteorological Services*, as revised for the GMDSS.
3. In order to ensure uniformity of the broadcast of meteorological bulletins and warnings globally, the following standard "C" codes should be used for meteorological forecasts and warnings issued via SafetyNET for the GMDSS.

C₁ — Message priority

Always C₁ = 2 URGENT for tropical cyclone warnings only

Always C₁ = 1 SAFETY for forecasts and for warnings other than urgent tropical cyclone warnings

C₂ — Service code

Meteorological warnings (C₁ = 1 or 2) to circular area — C₂ = 24

Meteorological warnings or forecasts (C₁ = 1 or 2) to coastal area — C₂ = 13

Meteorological warnings or forecasts to METAREA — C₂ = 31.

C₃ — Address code

Meteorological warnings (C₁ = 1 or 2) to circular area (Service code C₂ = 24) C₃ = 10 characters. Address code for circular areas is fully described in Annex 6, paragraph 1.3.3.5, but repeated here for ease of reference. Circular address will consist of 10 numbers as follows:

D₁D₂L_aD₃D₄D₅L_oR₁R₂R₃, where

D₁D₂L_a (3 characters) is latitude of centre in degrees and L_a whether north (N) or south (S). A leading zero should be used for latitudes less than 10;

$D_3D_4D_5L_0$ (4 characters) is longitude of centre in degrees and L_0 whether east (E) or west (W) of the prime meridian. A leading zero should be used for longitudes less than 100;

$R_1R_2R_3$ (3 characters) is radius of circle in nautical miles, up to 999.

Example: A circle centred at latitude 56°N longitude 34°W with radius of 10°NM is coded as: 56N034W010

Meteorological warnings (Service code 31) C_3 = the two digits denoting the area of broadcast responsibility (the METAREA) with a leading zero where necessary e.g. 01, 06, 13.

C_4 – Repetition code

Meteorological warning (category (a) repetition code)

$C_4 = 11$ On receipt followed by repeat six minutes later. Note a six-minute repeat is used to ensure that the warning is received by the maximum number of ships

Meteorological forecast (category (a) repetition code)

$C_4 = 01$ Transmit once on receipt.

C_5 – Presentation code

Always $C_5 = 00$, international alphabet number 5.

Examples:

Meteorological warning (to main broadcast area (METAREA))

1:31:01:11:00

SECURITE

(text) storm warning. At 190600 UTC low 970 57N 20W moving NE 15kts. Wind storm force 10 within 150 miles radius of centre
NNNN.

Tropical cyclone warning (to circular area i.e. only intended to be received by ships within the area of the address)

2:24:20N065W500:11:00

PAN PAN (text) At 161200 UTC Hurricane Betty located 15 nm north of San Juan, Puerto Rico, moving NW 15 knots with hurricane force winds 75 miles from centre NW and NE quadrants and within 30 miles SW and SE quadrants.

NNNN

Meteorological forecast

1:31:08:01:00

SECURITE

(text) forecast text as Manual on Marine Meteorological Services

NNNN

RECOMMENDATION 4 (CMM-XI)

WMO WAVE PROGRAMME 1993–1997

THE COMMISSION FOR MARINE METEOROLOGY,

NOTING:

- (1) Recommendation 2 (CMM-IX) — WMO wave programme,
- (2) Resolution 5 (CMM-X) — Working Group on Technical Problems,
- (3) Report to CMM-XI by the chairman of the *Ad Hoc* Group on Wave Modelling,

NOTING FURTHER:

- (1) *Guide to Wave Analysis and Forecasting* (WMO-No. 702),
- (2) Marine Meteorology and Related Oceanographic Activities Report No. 12, WMO Wave Programme, plus supplements 1–3,
- (3) The terms of reference and activities of the Responsible National Oceanographic Data Centre (Waves) of IOC,

CONSIDERING:

- (1) The continuing and increasing requirement for many Members to provide high quality sea wave data and wave analysis and forecast services in support of a large variety of applications,

- (2) The increasing need for Members also to provide a variety of other specialized, interdisciplinary services, based on a widening range of oceanographic and atmospheric variables, in support of natural disaster prevention, hazard mitigation, environmental protection and national economic interest,

RECOGNIZING:

- (1) The success to date of the Wave Programme in assisting Members to improve and expand their wave-related services,
- (2) The need nevertheless to further expand the scope of the programme so as to encompass other variables and services that are normally derived from numerical models of boundary-layer wind fields, particularly in the coastal zone,

RECOMMENDS:

- (1) That the WMO Wave Programme during the period 1993–1997 should comprise the elements and activities detailed in the annex to this recommendation;

- (2) That the scope of and activities under the programme should be further reviewed at the next session of the Commission;
- (3) That Members be urged to contribute whenever possible to the implementation of the programme;

REQUESTS the Secretary-General, in consultation with the president of CMM and in co-operation with relevant user groups, where appropriate, to assist in the implementation of the programme within the available budgetary resources;

INVITES the IOC to participate fully in the implementation of the programme.

ANNEX TO RECOMMENDATION 4 (CMM-XI)

WAVE PROGRAMME ELEMENTS AND ACTIVITIES FOR 1993-1997

A. DATA

1. Real time exchange and reporting of marine surface data

Measurement and modelling of waves provides data which are of great interest to a large community of marine forecasters, climatologists, offshore and coastal operators, etc. Large and increasing volumes of data from satellite sensors and wave models (especially directional wave spectra) make it necessary to provide increasingly efficient and effective means of communicating and storing this information. Important issues are coding and standards.

The development of GOOS and the efforts to extend and enhance IGOSS will increase the pressure to report and exchange marine surface data other than waves, especially from satellite sensors (sea-level, etc.). Such data are particularly important in combined atmosphere-ocean studies.

Recommended actions

- (a) Determine the efficiency of bit-oriented codes and the provision of a bit-oriented format for WAVEOB;
- (b) Promote the practices set out in the *Users' Guide for the Exchange of Measured Wave Data* (IOC);
- (c) Investigate the applicability of the new FLEX code concept to non-wave elements.

2. Visual wave observations

Much of the wave information used in climatological studies and in operational forecasting is acquired as visual observations from shipping (especially from vessels in the VOS system). The use of such data requires caution as they exhibit considerable variability in quality. These data can be enhanced by seeking more uniform observing practices through training and providing guidance material. Guidance material is under review in the *Guide to Meteorological Instruments and Methods of Observation* (WMO-No. 8) and the *Guide to Wave Analysis and Forecasting* (WMO-No. 702).

Recommended actions

- (a) Produce a training video for use by PMOs and ships' officer training schools;
- (b) Include material on wave observation in a workshop for PMOs.

3. Exploitation of existing data

Continuing attempts should be made to identify all public and private sources of wave and surface wind measurements. Efforts should be

made where possible to gain access to as much such data as possible and incorporate these into data exchange networks. Further, WMO should assist Members in making best use of such data.

Very often wave data are not used in wave forecasting. Waves are diagnosed from wind information. The application of observed data in operational forecasting has been the subject of a survey by WMO and work is continuing to collate the responses.

Recommended actions

- (a) Promote the cataloguing of all known sources of data through the Responsible National Oceanographic Data Centre for Waves (RNODC-Waves) of IOC;
- (b) Ensure that Members receive summaries of catalogued data as a stimulus to their participation;
- (c) Publish the results of an investigation based on the survey into the application of observed data in real-time wave forecasting;
- (d) Investigate possibilities for designating a centre for the archival of wave data available on the GTS in WAVEOB or BUFR, possibly through IGOSS as an IGOSS Specialized Oceanographic Centre.

B. BASIC WAVE SERVICES

4. Real-time wave analysis and forecasting

One of the most critical limiting factors to wave hindcasting and forecasting is access to appropriate surface wind-fields. It is important to assess specific requirements for boundary-layer wind fields to be used in wave modelling (or in specific wave models) and wave forecasting and to make the information available to Members. This is particularly pertinent as surface winds derived from satellite data become incorporated into wind and wave estimation.

The cataloguing of operational and experimental wave models has become an established activity and regular updates are a useful means of disseminating to Members the nature and status of models currently in use. Further, the standardization of presentation formats for chart and grid-point data from wave models would be promoted by the exposure of acceptable and technically correct formats.

Recommended actions

- (a) To monitor specific requirements for boundary-layer wind fields to be used in wave-modelling;

- (b) Prepare regular updates (two-yearly) of the catalogue of operational and experimental wave models and disseminate these alongside other Wave Programme information in WMO publications.

5. **Guide to Wave Analysis and Forecasting**

The *Guide to Wave Analysis and Forecasting* (WMO-No. 702) was first published in 1988 and serves as a handbook on analysis and forecasting techniques. It is presently being revised and its updating will be an ongoing effort.

Recommended action

Complete and publish the second edition of the *WMO Guide to Wave Analysis and Forecasting*.

6. **Guidance material and assistance**

Establishment and improvement of the provision of services can only be achieved by adequate training of staff. Every opportunity should be taken to incorporate wave analysis and forecasting material in training workshops and seminars on marine meteorology, and Member States which run professional meteorology courses should be encouraged to include specific course material on wave analysis and forecasting.

Further, WMO should provide assistance in the creation of new national and international wave programmes providing guidance and assistance to Members in establishing wave related services and in implementing wave models.

Recommended actions

- (a) Encourage Members to include specific material on wave analysis and forecasting in training courses;
- (b) Organize training courses and workshops to include wave analysis and forecasting and promote the inclusion of such material in an advanced physical oceanography and marine meteorology course for RMTC Nairobi;
- (c) Provide assistance as required to Members or groups of Members in establishing wave related services.

C. **SPECIAL RELATED SERVICES**

7. **Application of wave and surface wind data to inter-disciplinary problems**

The application of wave information to inter-disciplinary problems is an important motivation for its acquisition and processing. Wave and surface wind data are components in integrated environmental modelling efforts which are providing a holistic approach to a range of problems involving bio-physical, land-sea and air-sea interactions.

The Wave Programme should ensure that the requirements of wave information and its application in areas of national and international concern (such as marine pollution, coastal erosion, etc.)

and other special services (ship routing, fisheries, aquaculture, etc.) are understood and facilitated.

Recommended action

Establish requirements for and of wave and wind information, its application, and its relationship to other elements in a range of environmental problems, including marine pollution and coastal erosion.

8. **Storm surges**

Storm surges are an important factor in marine and coastal forecasting for many regions. They are often associated with severe weather events. Basic technical guidance for forecasting surge events, both in tropical and mid-latitudes, should be provided. Further, publication of information on what services are presently available and what models are employed by organizations actively providing storm surge forecasts should be initiated.

Recommended actions

- (a) Survey present surge forecasting services and disseminate information to Members;
- (b) Prepare and publish guidance information on storm surge forecasting.

9. **Extreme wave events**

Wave nowcasting and forecasting concentrates on routine parameters and extrapolation from those parameters (for example to expected maximum height). Many users are only perturbed by unlikely or rogue waves in the present storm event. Effort is needed to establish techniques to assess the risk of extreme waves occurring.

Recommended action

Review the subject and prepare a technical note on the occurrence and forecasting of extreme waves.

10. **Hindcast studies**

With the increasing use of numerical wave models to generate wave climatologies by hindcasting, a wealth of synthetic wave data is accumulating. These data extend knowledge of the wave conditions from areas in the vicinity of wave measuring devices to regions where no such instruments have ever been deployed. An inventory of known hindcast and measured climatologies is being prepared for inclusion into the revised *Guide to Wave Analysis and Forecasting*.

Recommended action

Monitor studies on surface wind and wave climatologies from all sources and continually update the inventory of hindcast climatologies.

D. **DEVELOPMENTS**

11. **Remotely-sensed data**

Preparing Members for introduction of new kinds of data is part of a continuing campaign to share the benefits of new technology. To this end Members should be made aware of the expected impact of new data streams and how to use such

data. Of particular importance at present is the progress on assimilation of remotely-sensed wave and marine surface wind data. This item should be pursued in conjunction with the Sub-Group on Ocean Satellites.

Recommended actions

- (a) Monitor progress in the use of satellite-derived data in wave and marine surface wind models and make information on techniques available to Members;
- (b) Consider procedures and techniques for the operational application of satellite-derived wave data by national Meteorological Services.

12. Wave modelling

The rapid development in wave modelling in recent years has made it necessary to monitor the state-of-the-art and make such information available to Members. Much of the effort is now focusing on specialized and localized applications. Apart from the increased resolution often required in such applications there are a number of factors needing more detailed attention, such as the effects of complicated local topography, shallow water, strong tides and currents. Through the Wave Programme, expert advice on such specialized requirements can be provided. The collation of such technical information, and continuing reviews of practices adopted by various modelers is recommended.

Recommended actions

- (a) Monitor the state-of-the-art in wave modelling;
- (b) Prepare information on the application of wave models in areas affected by strong local influences, such as complicated topography, currents, shallow water, etc.

13. Combined ocean-atmosphere modelling

Waves are only one manifestation of the atmosphere-ocean interaction. The role of waves and

surface winds in the exchange of momentum, heat and gases between atmosphere and oceans is an important research problem. The requirements for wind and wave data in such research problems need to be addressed.

14. New techniques and experiments for measurement of waves and surface wind

By making information available to Members, they are better positioned to take opportunities for exploiting new technology and participating in national and international initiatives. National reports of known work are elicited through the national focal points in conjunction with the survey of wave models. These keep Members informed on progress in developing techniques.

Co-operation with international and national research projects depends on local involvement of personnel who are associated with national Meteorological Services. Such involvement is to be encouraged through national focal points. Publicity should be given to future plans and to network experiments to facilitate co-operation of parties with a potential interest. This includes large-scale international efforts which have some element of interest to the WMO Wave Programme.

Recommended actions

- (a) Continue to update and publish information on new techniques for measurement of waves and surface wind;
- (b) Elicit within the national reviews reports on known work regarding experiments on instrumental and model intercomparisons and verifications, including relevant bibliographies;
- (c) Collate and publish material on major wave/marine wind experimental campaigns.

RECOMMENDATION 5 (CMM-XI)

**APPLICATIONS OF THE RESULTS OF THE VOS SPECIAL OBSERVING PROJECT
NORTH ATLANTIC (VSOP-NA)**

THE COMMISSION FOR MARINE METEOROLOGY,

NOTING:

- (1) The *Third WMO Long Term Plan*, Part II, Volume I — World Weather Watch Programme (WMO-No. 761) and Volume 4 — Applications of Meteorology Programme (WMO-No. 764),
- (2) IOC Assembly Resolution XV-4 — Global Integrated Ocean Observing System Development,
- (3) IOC Assembly Resolution XVI-8 — Global Ocean Observing System (GOOS),
- (4) Résolution 9 (Cg-XI) — Global Climate Observing System,
- (5) Resolution 21 (Cg-XI) — WMO's involvement in the development of a Global Ocean Observing System,
- (6) Recommendation 6 (CMM-X) — The WMO Voluntary Observing Ships (VOS) scheme,
- (7) Marine Meteorology and Related Oceanographic Activities Reports No. 25 (Ship Catalogue) and No. 26 (Results of the VSOP-NA),

- (8) Recommendation 8 (CBS-IX) — Amendments to the *Manual on the Global Data-Processing System — Monitoring the quality of observations*.

CONSIDERING:

- (1) That reports from the VOS will remain a primary source of surface meteorological and oceanographic data from all ocean areas for operational, research and climatological purposes for the foreseeable future,
- (2) That improvements in the quality, quantity and timeliness of such reports need to be made if the full requirements of WMO Programmes for these data are to be met,

BEARING IN MIND that action on a number of recommendations of the VSOP-NA addressed to WMO has been taken under appropriate agenda items at the present session,

EXPRESSES ITS APPRECIATION:

- (1) To all Members which operate VOS, which have appointed Port Meteorological Officers (PMOs), or which support coastal radio stations and INMARSAT Coast Earth Stations for the collection of ships' weather reports;

- (2) Specifically to those Members, their PMOs and the ships' crews who participated in the VSOP-NA;
- (3) To the United Kingdom Meteorological Office for acting as the lead centre for the real-time monitoring of the quality of surface marine data;

RECOMMENDS TO MEMBERS:

- (1) To implement relevant recommendations of the VSOP-NA, as detailed in the annex to this recommendation, as a matter of priority;
- (2) To follow-up the results of the real-time monitoring of the quality of VOS reports, which are prepared by the United Kingdom Meteorological Office as lead centre designated by CBS for this purpose and distributed regularly to Members concerned;
- (3) Whenever possible, to increase automation in the collection and transmission of VOS reports;

REQUESTS the Secretary-General, the president and vice-president of the Commission and the chairmen of the relevant working groups to assist Members in the implementation of this recommendation.

ANNEX TO RECOMMENDATION 5 (CMM-XI)

**RECOMMENDATIONS OF THE VOS SPECIAL OBSERVING PROJECT NORTH ATLANTIC (VSOP-NA)
RELEVANT TO IMPLEMENTATION BY MEMBERS**

Observing practices and equipment

The results of VSOP-NA demonstrate clearly the value of national observing fleets conforming to recognized standards of instrument exposure and observing practice. Additionally, for some variables, one method of measurement has been shown to be superior to others (e.g. SST by hull-contact sensor). For other variables, different methods have both advantages and disadvantages. Good exposure is often more important than choice of instrument type. It is therefore strongly recommended that Members take note of these findings and ensure that equipment, exposures and observing practices are chosen and maintained appropriately, with a view to achieving greater accuracy and consistency across the international VOS.

Real-time data monitoring

The existing real-time monitoring systems for VOS reports should be extended to cover all variables required for surface flux calculations. Specifically VOS databases maintained at each monitoring centre should include more detail for each ship, to facilitate identification of the appropriate corrections. Results of the real-time monitoring should be made available more frequently to Members and PMOs, ideally on a monthly basis.

Reduction in reporting errors

The results of VSOP-NA show that many errors were made in converting measured relative wind into true wind, and in deriving dewpoint from dry- and wet-bulb temperatures. Members are recommended to

provide their VOS with dedicated calculators or computer programs for deriving these quantities, in order to achieve a significant decrease in the number of such errors.

Port Meteorological Officer System

The results of the VSOP-NA study demonstrate that an efficient Port Meteorological Officer system can have significant impact on the overall quality of data submitted by individual national fleets. It is recommended that appropriate funding and resources be made available to improve the organization, training and operation of the Port Meteorological Officer systems of Member countries. Members with existing, well-established and effective PMO systems should be encouraged to offer training and assistance facilities to other Members to enable them to upgrade their respective PMO services.

Applications of VOS data

Noting that model-derived ocean surface flux values will be increasingly used for forcing ocean models, and recognizing that the VSOP-NA project has shown that biases exist in model-derived data such that significant errors would exist in the predicted flux values, it is recommended that increased use be made of the VOS ship observations to verify model flux determinations.

It is recommended that, where VOS observations are used to construct sea surface temperature data sets, the observations should be classified according to measurement type and that greatest weight should be

given to hull contact sensors, bucket measurements, and condenser or engine intake instruments, in that order. In particular it should be noted that there is evidence that intake measurements are of poorer quality and likely to be biased warm compared to the other methods.

Recognizing that ships' observations transmitted over the GTS at present contain a significant number of errors due to the incorrect calculation of true wind velocity and dewpoint, and that these errors can be

reduced by the use of logbook data, the use of delayed-mode logbook-derived data for climate research is recommended.

Noting that the greatest accuracy requirements for VOS data are for the calculation of flux fields for climate research, and recognizing that the VSOP-NA project has demonstrated that the quality of ships' data depends on the efficiency of the PMO system, it is recommended that the climate research community supports measures designed to improve the PMO system.

RECOMMENDATION 6 (CMM-XI)

DRIFTING BUOYS IN SUPPORT OF METEOROLOGICAL AND OCEANOGRAPHIC OPERATIONS AND RESEARCH

THE COMMISSION FOR MARINE METEOROLOGY,

NOTING:

- (1) Resolution 10 (EC-XXXVII) — Drifting Buoy Co-operation Panel,
- (2) The *Third WMO Long-term Plan*, Part II, Volume 1 — The WWW Programme (WMO-No. 761),
- (3) The *Third WMO Long-term Plan*, Part II, Volume 4 — The Applications of Meteorology Programme (WMO-No. 764),
- (4) The TOGA International Implementation Plan,
- (5) The WOCE Implementation Plan, WMO/TD No. 242 and No. 243,
- (6) Annual Reports of the DBCP for 1991 and 1992,

FURTHER NOTING:

- (1) That not all drifting buoys carry sensors for atmospheric pressure and/or sea-surface temperature,
- (2) That the majority of drifting buoy deployments now taking place or planned over the next few years are funded through research programmes and that these deployments are therefore likely to cease with the termination of the research programmes,

CONSIDERING:

- (1) That drifting buoys represent a very cost-effective means for acquiring surface meteorological and oceanographic data from remote ocean areas,

NOTE: This recommendation replaces Recommendation 4 (CMM-X) which is no longer in force.

- (2) The stated requirements for operational drifting buoy data in support of the WWW, marine meteorological services and climate analysis and forecasting,

RECOMMENDS:

- (1) That agencies, institutions, and organizations involved in the acquisition and deployment of drifting buoys be urged to equip these buoys with at least atmospheric pressure and air temperature sensors so as to enhance their potential value to a wide variety of WMO Programmes;
- (2) That the WOCE community also be urged to continue to make the data from their drifting buoys available for real-time distribution over the GTS and for later permanent archival;
- (3) That Members and the Data Buoy Co-operation Panel continue their efforts to ensure funding of drifting buoy deployments on a long-term, operational basis following the termination of the TOGA and WOCE projects, and in known data-sparse areas, such as the Indian and South Atlantic Oceans;

REQUESTS the Secretary-General and the Data Buoy Co-operation Panel to bring this recommendation to the attention of Members and others concerned and to assist whenever possible in the implementation of the recommendation.

RECOMMENDATION 7 (CMM-XI)

THE APPLICATION OF REMOTELY-SENSED MARINE DATA TO MARINE METEOROLOGICAL AND OCEANOGRAPHIC SERVICES

THE COMMISSION FOR MARINE METEOROLOGY,

NOTING:

- (1) Recommendation 5 (CMM-X) — The application of remotely-sensed marine data to marine meteorological and oceanographic services,
- (2) Field Workshop on Intercalibration of Conventional and Remotely-Sensed Sea Surface Temperature Data,

Marine Meteorology and Related Oceanographic Activities Report No.16,

- (3) The *Third WMO Long-term Plan*, Part II, Volume 1 — World Weather Watch Programme (WMO-No. 761) and Volume 4 — Applications of Meteorology Programme (WMO-No. 764),
- (4) The IGOSS plan and implementation programme 1989-1995,

- (5) The final report of the sixth session of the Joint IOC/WMO Committee for IGOSS, Geneva, November 1991,
- (6) The report to CMM-XI by the chairman of the *Ad Hoc* Group on Ocean Satellites and Remote Sensing,
- (7) The scientific lectures at CMM-XI,

FURTHER NOTING that a number of ocean remote-sensing systems, both satellite and ground based, are likely to be operationally available within the next few years, or are in some cases already operationally available,

CONSIDERING:

- (1) That marine meteorological and surface oceanographic data from remote-sensing systems are of great potential benefit to Members for both operational and research purposes,
- (2) That procedures need to be developed to facilitate the timely availability of such data on time and space scales and in formats relevant to the Members' requirements,
- (3) That intercomparison of marine data obtained by conventional and remote-sensing systems should be expanded with the development of procedures to enable a coherent use of combined data for operational and research purposes,

NOTE: This recommendation replaces Recommendation 5 (CMM-X) which is no longer in force.

RECOMMENDS:

- (1) That studies and workshops on remotely-sensed measurements of ocean variables using satellite, air and ground-based systems be continued and that these include in particular:
 - (a) The intercalibration of remotely-sensed data with conventional ocean data;
 - (b) The development of procedures to facilitate the availability of remotely-sensed data for operational and research purposes;
 - (c) Consideration of means to effect the appropriate transfer of technology to enable all Members to benefit fully from the new systems;
- (2) That such studies be undertaken with the active collaboration of CIMO, CBS, the Joint IOC/WMO Committee for IGOSS, IOC and the satellite operating agencies, as appropriate;
- (3) That Members and satellite operators be requested to consider the implementation of procedures for the operational dissemination of remotely-sensed data to national Meteorological Services and national oceanographic services;

REQUESTS the Secretary-General, in consultation with the president of the Commission, to arrange for or facilitate the conduct of such studies and workshops as resources permit, and to take the necessary measures to facilitate the incorporation of any operational procedures developed, into the overall WWW data exchange.

RECOMMENDATION 8 (CMM-XI)

THE COLLECTION OF METEOROLOGICAL AND OCEANOGRAPHIC INFORMATION USING INMARSAT

THE COMMISSION FOR MARINE METEOROLOGY,

NOTING:

- (1) Abridged final report, CMM-X, sub-item 6.1,
- (2) Resolution 19 (Cg-XI) — The collection and dissemination of marine meteorological and oceanographic information using INMARSAT,

CONSIDERING:

- (1) The continuing rapid expansion in the use of the International Maritime Satellite Organization (INMARSAT) marine telecommunication system, particularly among the WMO Voluntary Observing Ships (VOS),
- (2) That INMARSAT-C facilities are likely to be available on virtually all the VOS by the year 2000,
- (3) The improvements being noted in the receipt of meteorological and oceanographic reports from ships at sea through the enhanced use of the INMARSAT system,
- (4) The substantial reductions in communications costs to Members which occur for meteorological and oceanographic reports sent using the INMARSAT-C facility,

RECOGNIZING WITH APPRECIATION that a number of Members operating INMARSAT Coast Earth Stations (CES) have already arranged to accept ships' meteorological and oceanographic reports through their CES, free of charge to the ships, which are of general value to all Members of WMO,

BEING CONCERNED, however, that these reports are, at the present time, concentrated on a sub-set of the CES already in operation, and that problems continue to be related to the timely redistribution to the countries closest to their geographical origin of reports collected through INMARSAT, **NOTING WITH APPRECIATION** the agreement by the Netherlands to supply and maintain software for the compilation, encoding in SHIP code, storage and transmission through the INMARSAT-C facility of ships' meteorological reports,

RECOMMENDS:

- (1) To those Members operating CES that have not yet done so to accept the ships' meteorological and oceanographic reports transmitted through their CES, free of charge to ships, using the special code 41 short code dialing procedure;

- (2) To those Members in regions where the introduction of INMARSAT has produced recognized changes in patterns of data collection, to develop interregional, regional, subregional or bilateral agreements for cost-sharing, as appropriate;
- (3) To all Members concerned to make every effort to ensure the timely redistribution of reports collected through INMARSAT to countries in the areas of the geographical origins of those reports, through the GTS and by other means such as MDD, as appropriate;
- (4) To Members requiring ships' reports on the GTS to ensure that their telecommunications centres actually request receipt of all relevant GTS bulletins containing such reports;

REQUESTS THE SECRETARY-GENERAL:

- (1) In consultation with the Secretary IOC, to investigate possibilities for one or more Members to supply

and maintain software for the compilation, encoding in BATHY, TESAC or TRACKOB codes, storage and transmission through the INMARSAT-C facility of ships' oceanographic reports;

- (2) In consultation with the Secretary of IOC, the presidents of CMM and CBS, the chairman of IGOSS and the chairmen of the relevant working groups of CMM, CBS and IGOSS, to continue discussions with INMARSAT and others on the expanded use of the INMARSAT system for the collection of ships' meteorological and oceanographic reports, including in particular the possible use of the INMARSAT-C signalling channel for transmitting such reports in binary format and, if appropriate, to establish a small WMO/INMARSAT liaison group for this purpose;
- (3) To keep Members closely informed of any significant relevant new developments in this regard.

RECOMMENDATION 9 (CMM-XI)

WMO CO-SPONSORSHIP OF THE IOC INTERGOVERNMENTAL COMMITTEE FOR THE GLOBAL OCEAN OBSERVING SYSTEM (I-GOOS)

THE COMMISSION FOR MARINE METEOROLOGY,

NOTING:

- (1) IOC Resolutions XV-4, XVI-8, XVI-10, EC-XXIII.5 and EC-XXV.3 on GOOS, which call for the IOC to develop GOOS and establish the necessary co-ordination mechanisms,
- (2) WMO Resolutions 11 (EC-XLI), 9 (Cg-XI) and 21 (Cg-XI) which express WMO support for GOOS development and relevant co-operation with IOC;
- (3) Abridged report with resolutions, EC-XLIV, general summary, paragraph 6.4.8 and subsequent actions by IOC, WMO and ICSU to establish a Memorandum of Understanding on Scientific and Technical Planning for GOOS,

NOTING FURTHER IOC Resolution XVII-5 which, *inter alia*, invites WMO to co-sponsor the IOC Intergovernmental Committee for GOOS,

CONSIDERING:

- (1) That national Meteorological and Hydrological Services will be at the same time both users of GOOS

data and also substantial contributors to the operation of GOOS observing, data exchange and data management systems,

- (2) That WMO co-sponsorship of the I-GOOS will greatly facilitate input by national Meteorological and Hydrological Services into GOOS planning (including development of user requirements), as well as decisions regarding GOOS implementation,

RECOGNIZING that WMO co-sponsorship of I-GOOS carries resource implications, in particular in terms of WMO Secretariat support for I-GOOS,

RECOMMENDS:

- (1) That WMO accepts the invitation of the IOC Assembly to co-sponsor I-GOOS;
- (2) That Members be urged to participate actively in the work of the I-GOOS, including through participation in meetings of the I-GOOS;
- (3) That Members be invited to consider seconding staff to the WMO Secretariat in Geneva, specifically to facilitate the provision of appropriate WMO Secretariat support to I-GOOS.

RECOMMENDATION 10 (CMM-XI)

AGENDA 21 AND IMPLEMENTATION OF GOOS AND GCOS

THE COMMISSION FOR MARINE METEOROLOGY,

NOTING:

- (1) Resolution 9 (Cg-XI) — Global Climate Observing System,
- (2) Resolution 21 (Cg-XI) — WMO's involvement in the development of a Global Ocean Observing System,

- (3) UNCED Agenda 21, in particular Chapter 9 (Atmosphere) and Chapter 17 (Oceans, especially Section E — addressing critical uncertainties),

CONSIDERING:

- (1) That existing marine meteorological and oceanographic observing system components, including the VOS,

ocean data buoys, satellites and meteorological/oceanographic vessels already contribute data which are being used in analyses of global climate and climate change, and that these components will be essential to the future GOOS and GCOS,

- (2) That the implementation of GOOS and GCOS will require the allocation of substantial resources by Governments to maintain and expand systematic long-term ocean monitoring,
- (3) That the full implementation of GOOS and GCOS will also provide valuable new ocean data in support of the WWW, of marine meteorological services and of global climate studies,
- (4) That the adoption by Governments of Agenda 21 implies a commitment on their part to implement the activities specifically mentioned therein, including GOOS and GCOS,

INSTRUCTS the Working Group on Marine Observing Systems, in co-ordination with the Data Buoy Co-operation Panel and with the appropriate subsidiary body of IGOSS, to prepare specific proposals to enhance marine observing systems to fulfil the requirements of GOOS and GCOS, once these requirements are established;

RECOMMENDS:

- (1) To Members to make specific and clear reference to the activities agreed in Agenda 21, Chapter 17

(Oceans), when preparing submissions to their Governments for the additional resources required to implement GOOS and GCOS;

- (2) To Members to maintain and expand recruitment of VOS and deployment of ocean data buoys;
- (3) To Members operating marine meteorological/oceanographic vessels to maintain and, if possible, expand the use of such vessels, to provide comprehensive and reliable *in situ* data for global climate studies and the provision of marine services;
- (4) To the operators of ocean observation satellites to make their data generally available for use by both meteorological and oceanographic services, and also by the ocean and climate research community;

REQUESTS THE SECRETARY-GENERAL,

- (1) To assist Members, as appropriate, in preparing resource submissions to Governments for implementation of relevant parts of GOOS and GCOS;
- (2) To further assist Members in the preparation of project proposals relating to enhanced, long-term ocean monitoring, for submission to funding bodies such as the Global Environment Fund and the UNDP;
- (3) To provide additional assistance, as required, and within the available budgetary resources, for the implementation of this recommendation.

RECOMMENDATION 11 (CMM-XI)

MODIFICATION TO THE MARINE CLIMATOLOGICAL SUMMARIES SCHEME

THE COMMISSION FOR MARINE METEOROLOGY,

NOTING:

- (1) The *Manual on Marine Meteorological Services* (WMO-No.558), Part I, Section 5 — Marine Climatological Summaries Scheme (MCSS),
- (2) The abridged final report of CMM-X, general summary paragraphs 8.2.1 to 8.2.4,
- (3) The final report of the sixth session of the CMM Sub-group on Marine Climatology, Geneva, April 1992,

CONSIDERING:

- (1) The continuing and increasing importance of the global marine climatological data collection and archival system operated under the MCSS, in particular in support of global climate monitoring, research and prediction,
- (2) The need to improve the timeliness and efficiency of this data collection and archival in keeping with the requirements of global climate studies,
- (3) The increasing requirements of a variety of users for global marine climatological data sets,
- (4) The need to ensure uniform application of known and agreed minimum quality control standards for these global data sets,
- (5) The need to provide an appropriate back-up in the data collection and exchange procedures, to ensure

continuous global availability of marine climatological data,

RECOMMENDS that the existing MCSS be modified to include the following features:

- (1) Two of the eight existing responsible Members under the MCSS to be designated as global collecting centres (GCC) for marine climatological data;
- (2) Contributing Members to send all marine surface observations from their ship stations to each of the GCCs on a quarterly basis;
- (3) GCCs to ensure that the minimum quality-control procedures agreed under the existing MCSS have been applied to the full global data set, and by bilateral exchange between themselves, to ensure that the global data set is as complete as possible;
- (4) The GCCs to ensure despatch of one copy of all the quality controlled data collected from contributing Members to the remaining responsible Members, also on a quarterly basis;
- (5) The existing responsibilities of the responsible Members under the MCSS to remain unchanged;

RECOMMENDS FURTHER:

- (1) That these modifications to the MCSS be incorporated into the *Manual on Marine Meteorological Services* in the

- form of amendments to Part I, Section 5 — Marine Climatological Summaries Scheme as given in the annex to this recommendation;
- (2) That the new data exchange procedures should come into effect for data despatch by contributing Members as from 1 January 1994;
- (3) That existing procedures and functions under the MCSS should continue unchanged until 1 January 1994;
- (4) That Members contributing data under the MCSS make every effort to improve the quality of these data, as well as the timeliness of their submission, in view of their importance to global climate studies;

ACCEPTS with appreciation the kind offers of Germany and the United Kingdom to act as the two GCCs.

ANNEX TO RECOMMENDATION 11 (CMM-XI)

5. MARINE CLIMATOLOGICAL SUMMARIES SCHEME

NOTE: The international arrangements regarding the Marine Climatological Summaries Scheme are based on Resolution 35 (Cg-IV), Recommendation 36 (68-CMM), Recommendation 6 (CMM-VI), Recommendation 15 (CMM-VII), Recommendation 35 (79-CMM), Recommendation 6 (CMM-VIII), Recommendation 8 (CMM-VIII), Recommendation 12 (CMM-X) and Recommendation 11 (CMM-XI).

5.1 Principles

The principles of the Marine Climatological Summaries Scheme are as follows:

Principle 1

The oceans and seas are divided into eight areas of responsibility for the purpose of preparing the marine climatological summaries and with a view to continued international co-operation regarding the collection, archiving and exchange of marine data.

Principle 2

Members having assumed responsibility for the respective areas as shown in Appendix I.5 — hereinafter called responsible Members — prepare climatological summaries for their area of responsibility. The preferred method of producing summaries is the chart form. However, Members may prepare, without cost to the World Meteorological Organization, climatological summaries in tabular form for selected representative areas. The tabular form of the summaries is to be used for fixed ship stations. The procedures are specified in paragraph 5.3.

Principle 3

Two responsible Members operate global collecting centres as shown in Appendix I.6. Members operating fixed ship stations or selected, supplementary and auxiliary ship stations make available all surface observations from these stations to both global collecting centres in accordance with the procedures specified in the agreed plan. The cost of this work is borne by the Member operating the ship stations.

Principle 4

Global collecting centres ensure that minimum quality control has been applied to the data, and exchange the data collected with each other, to ensure that both have a complete data set. Global collecting centres ensure that one copy of the global (update) data is sent quarterly to those responsible Members which wish to maintain as global data set — otherwise a data set for their area of

responsibility is sent to the remaining responsible Members. The cost of this work is borne by the Members operating the Global collecting centres.

Principle 5

Responsible Members make available, on request, copies of marine climatological data on magnetic tape in the agreed international exchange format (IMMT). The Member making the request may be asked to bear the cost of copying the data. Other formats may be agreed between the requesting Member and the responsible Member provided that the requesting Member undertakes to bear the additional expenditure involved.

5.2 Areas of responsibility

Each responsible Member shall prepare climatological summaries of observations made after 1960 in accordance with the agreed plan (Appendix I.8), in chart form for its area of responsibility, in tabular form for a number of selected representative areas in its area of responsibility, or in tabular form for a number of fixed ship stations within its area and for fixed ship stations operated solely by the responsible Member in the area of another responsible Member.

5.2.1 *Boundaries of areas of responsibility*

5.2.1.1 The areas of responsibility shall be as given in Appendix I.5.

5.2.1.2 Examination of the boundaries of areas of responsibility with a view to making recommendations for adjustment shall be the responsibility of the Commission for Marine Meteorology (CMM). Such adjustments may become necessary if other Members wish to become responsible Members. Alternatively, existing responsible Members may find that it is necessary to adjust boundaries.

5.2.1.3 Adjustments of boundaries of areas of responsibility should be kept to a minimum.

5.2.2 *Polar and extra-polar regions*

For the purpose of marine climatological summaries, polar regions are defined as extending poleward from latitudes 60°N and 50°S, respectively.

5.2.3 *Selected representative areas*

NOTE: This section applies only if the tabular form of summaries is produced.

5.2.3.1 Each responsible Member shall propose a number of selected representative areas from within its assigned area of responsibility. These areas should be chosen to achieve a good density of data or because of other requirements, such as climatic gradients and related factors.

5.2.3.2 Responsible Members shall submit the list of areas selected to the president of CMM who will ensure that the final choice of the selected representative areas, proposed by the responsible Members, provides a reasonable distribution throughout all areas of responsibility.

5.2.3.3 The indices system, which is given in Appendix I.7 shall be used to code the extent and location of the selected representative areas.

5.2.3.4 The selected representative areas shall remain fixed in their size, shape and position for as many years as possible.

NOTE: The recommended maximum size of a selected area in polar regions is 50 one-degree squares.

5.2.3.5 A map (or maps) showing the distribution of the selected representative areas in each area of responsibility shall be included in the summaries for that area.

5.2.4 **Fixed ship station area/ocean island stations/moored buoys and fixed platforms**

5.2.4.1 The "on station" area should be defined for each fixed station. This area should consist of the smallest number of adjacent one-degree squares, centered on the nominal fixed position, which contain at least 95 per cent of the observations from the fixed station.

5.2.4.2 It should be left to the discretion of the responsible Members to publish data from ocean island stations located in data-sparse areas as supplements to the marine climatological summaries. The island data summaries should not be combined with summaries of ocean data and a warning to this effect must be included in the supplements. Data from ocean island stations should be published in the same form as for fixed ship stations.

5.3 **Procedures for preparing marine climatological summaries**

5.3.1 **General plan**

The plan for the production of marine climatological summaries is shown in Appendix I.8.

5.3.2 **Layout of marine climatological summaries**

5.3.2.1 CHART FORM

The layout of the marine climatological summary in chart form is given in Appendix I.9.

5.3.2.2 TABULAR FORM

The parameters to be included in the tabular form of marine climatological summaries are given in Appendices I.10, I.11 and I.12.

5.3.3 **Period of marine climatological summaries**

5.3.3.1 ANNUAL SUMMARIES

The routine publication of annual summaries ceased in 1981 (Recommendation 6 (CMM-VIII)).

However, annual climatological summaries may be published by the responsible Members on an optional basis, preferably in chart form. The processing of data shall be continued so that the original observations will be readily available upon request.

5.3.3.2 DECADAL SUMMARIES

Decadal climatological summaries shall be prepared for the periods 1961-70, 1971-80, 1981-90.

5.4 **Minimum number of observations for the preparation of the marine climatological summaries**

5.4.1 **General**

All available data shall be used in the preparation of annual and decadal summaries.

5.4.2 **Annual summaries**

5.4.2.1 The annual mean for any unit area or selected representative area should not be calculated if there are less than 10 observations from the area in any individual month.

5.4.2.2 Statistics for chart areas and frequency tables should not be prepared if there are less than 10 observations from a unit area of a chart or selected representative area or tabulation in any individual month.

5.4.2.3 For tabular summaries, the data should be listed if there are less than 40 observations from a selected representative area in any individual month and those observations have been made on less than 10 different days of the month.

5.4.2.4 For tabular summaries, the data should be summarized if there are less than 40 observations from a selected representative area in any individual month and those observations have been made on 10 or more different days of the month.

5.4.2.5 The data should be summarized in charts or tabulations if there are less than 40 observations from a selected representative area in any individual month.

5.4.3 **Decadal summaries**

5.4.3.1 Summaries are prepared for decadal periods and not for individual years if there are less than 40 observations from a selected representative area in any individual month.

5.4.3.2 In preparing a climatological summary for a decade or longer period, the summary for each month should be prepared by combining all available observations from that particular months for all years during the period of the summary.

5.4.3.3 It must be clearly state in the text of the summary when data are summarized, which are known to be irregularly distributed over the ten-year period.

5.5 **Parameters to be included in and form of the marine climatological summaries**

5.5.1 **Fixed ship stations**

Annual and decadal summaries for fixed ship stations shall be produced in tabular form and shall contain the parameters listed in Appendix I.10.

5.5.2 **Polar and extra-polar regions**

5.5.2.1 ANNUAL SUMMARIES

Data for annual summaries shall be prepared either in a format suitable for publication of charts or alternatively in a format suitable for publication of tables. The type of output required in any individual year is specified in Appendix I.8.

5.5.2.2 DECADAL SUMMARIES

Decadal summaries shall be published either in chart form (preferred) or in tabular form as also indicated in Appendix I.8.

5.5.2.3 CHART FORM

Parameters to be included in the summaries which are produced in chart form are listed in Appendix I.9.

5.5.2.4 TABULAR FORM

Parameters to be included in the summaries are listed in Appendices I.10, I.11 and I.12.

5.5.3 **Inventory of marine climatological summaries**

During the first quarter of each year, responsible Members shall send a list of marine climatological summaries which have been produced during the previous year to the Secretary-General.

5.6 **Marine climatological data**

5.6.1 **Collection and exchange of data**

5.6.1.1 Members operating fixed ship stations or selected, supplementary and auxiliary ship stations should transfer all surface observations from these stations onto magnetic tape. It is recommended that the data be arranged in the agreed format of the International Maritime Meteorological Tape (IMMT) as described in Appendix I.13. The data should be dispatched to both global collecting centres at three-monthly intervals.

5.6.1.2 The Member originating the data should notify the global collecting centres of the dispatch of the quarterly collection of data. The notification should contain details of the order in which the records are sorted.

5.6.1.3 Members may use the alternative format for maritime meteorological tapes which is given in

Appendix I.14. Any alternative format must only be used by mutual agreement between the two Members which are exchanging data.

5.6.1.4 Members should ensure that magnetic tapes are 9-track and written at a density of 1600 or 6250 bpi. The tapes should be unlabelled and written in EBCDIC or ASCII with blocking factor 10.

5.6.1.5 The responsible Member should indicate clearly, in the summary, the extent to which auxiliary ship data have been used.

5.6.2 **Inventory of marine climatological data**

Global collection centres shall keep an inventory of all marine climatological data received from Members.

5.6.3 **Quality control of data**

5.6.3.1 All Members should make every effort to apply the minimum quality control procedures in Appendix I.15 before dispatching the data to the global collecting centres. These centres should ensure that this minimum quality control has been applied before making the data available to responsible Members.

5.6.3.2 Quality control of marine data by Members and responsible Members should be continued and improved. Details of national quality-control schemes should be made available to responsible Members.

5.6.4 **Period before 1961**

5.6.4.1 The Historical Sea Surface Temperature Data (HSSTD) project provides for the collection and summarizing of marine climatological data for the period 1861 to 1960. The participants in the HSSTD project have agreed to exchange any additional digitized historical data as they become available.

5.6.4.2 Members having historical data, which are not yet included in the HSSTD project, should send those data to the appropriate participating Member. The data should be converted into the international exchange format (IMMT), or a mutually agreed format, before dispatch to the participating Member. The cost of conversion should be borne by the Member supplying the data.

APPENDIX I.6

GLOBAL COLLECTING CENTRES FOR MARINE CLIMATOLOGICAL SUMMARIES SCHEME

Germany

Deutscher Wetterdienst
Seewetteramt
Bernhard-Nocht-Strasse 76
D-20359 Hamburg
tel: +40 3190-0; fax: +40 31908803

United Kingdom

Meteorological Office
London Road
Bracknell, Berkshire RG12 2SZ
tel: +344 420242; fax: +344 854412/861197

APPENDIX I.13
LAYOUT FOR THE INTERNATIONAL MARITIME METEOROLOGICAL TAPE (IMMT)

<i>Element Number</i>	<i>Character Number</i>	<i>Code</i>	<i>Element</i>	<i>Coding procedure</i>
1	1	i _T	Format/temperature indicator	3=IMMT format with temperatures in tenths of °C 4=IMMT format with temperatures in halves of °C 5=IMMT format with temperatures in whole °C
2	2-3	AA	Year UTC	Last two digits
3	4-5	MM	Month UTC	01 - 12 January to December
4	6-7	YY	Day UTC	01 - 31
5	8-9	GG	Time of observation	Nearest whole hour UTC, WMO specifications
6	10	i _w	Indicator for wind speed	WMO code table 1855
7	11	Q	Octant of the globe	WMO code table 3300; quadrant converted into octant
8	12-14	L _a L _a L _a	Latitude	Tenths of degrees, WMO specifications
9	15-17	L _o L _o L _o	Longitude	Tenths of degrees; four digit longitude converted to three digits by removal of first digit; e.g. longitude 160.0° coded 1600 as four digits becomes 600 as three digits; longitude 40.0° coded 0400 as four digits becomes 400 as three digits.
10	18		Cloud height (h) and visibility (VV) measuring indicator	0 - h and VV estimated 1 - h measured, VV estimated 2 - h and VV measured 3 - h estimated, VV measured
11	19	h	Height of clouds	WMO code table 1600
12	20-21	VV	Visibility	WMO code table 4377
13	22	N	Cloud amount	Oktas, WMO code table 2700; show 9 where applicable
14	23-24	dd	True wind direction	Tens of degrees, WMO code table 0877; show 00 or 99 where applicable
15	25-26	ff	Wind speed	Tens and units of knots or metres per second, hundreds omitted; values in excess of 99 knots are to be indicated in units of metres per second and i _w encoded accordingly; the method of estimation or measurement and the units used (knots or metres per second) are indicated in element 6
16	27	s _n	Sign of temperature	WMO code table 3845
17	28-30	TTT	Air temperature	Tenths of degrees Celsius
18	31		Sign of wet bulb or dew-point temperature	0 - positive dew-point temperature 1 - negative dew-point temperature 5 - positive wet bulb temperature 6 - negative wet bulb temperature 7 - used if ice-bulb temperature reported
19	32-34		Wet-bulb dew-point temperature	Tenths of degrees Celsius
20	35-38	PPPP	Air pressure	Tenths of hectopascals
21	39-40	WW	Present weather	WMO code table 4677
22	41	W ₁	Past weather	WMO code table 4561
23	42	W ₂	Past weather	WMO code table 4561

Element Number	Character Number	Code	Element	Coding procedure														
24	43	N_h	Amount of lowest clouds	As reported for C_L or, if no C_L cloud is present, for C_M , in oktas; WMO code table 2700														
25	44	C_L	Genus of C_L clouds	WMO code table 0513														
26	45	C_M	Genus of C_M clouds	WMO code table 0515														
27	46	C_H	Genus of C_H clouds	WMO code table 0509														
28	47	s_n	Sign of sea-surface temperature	WMO code table 3845														
29	48-50	$T_w T_w T_w$	Sea surface temperature	Tenth of degrees Celsius														
30	51		Indicator for sea-surface temperature measurement	0 - Bucket thermometer 1 - Condenser inlet 2 - Trailing thermistor 3 - Hull contact sensor 4 - "Through hull" sensor 5 - Radiation thermometer 6 - Bait tanks thermometer 7 - Others														
31	52		Indicator for wave measurement	<table border="0"> <tr> <td></td> <td>0 - Wind sea and swell estimated</td> </tr> <tr> <td rowspan="3">Shipborne wave recorder</td> <td>1 - Wind sea and swell measured</td> </tr> <tr> <td>2 - Mixed wave measured, swell estimated</td> </tr> <tr> <td>3 - Other combinations measured and estimated</td> </tr> <tr> <td rowspan="3">Buoy</td> <td>4 - Wind sea and swell measured</td> </tr> <tr> <td>5 - Mixed wave measured, swell estimated</td> </tr> <tr> <td>6 - Other combinations measured and estimated</td> </tr> <tr> <td rowspan="3">Other measurement system</td> <td>7 - Wind sea and swell measured</td> </tr> <tr> <td>8 - Mixed wave measured, swell estimated</td> </tr> <tr> <td>9 - Other combinations measured and estimated</td> </tr> </table>		0 - Wind sea and swell estimated	Shipborne wave recorder	1 - Wind sea and swell measured	2 - Mixed wave measured, swell estimated	3 - Other combinations measured and estimated	Buoy	4 - Wind sea and swell measured	5 - Mixed wave measured, swell estimated	6 - Other combinations measured and estimated	Other measurement system	7 - Wind sea and swell measured	8 - Mixed wave measured, swell estimated	9 - Other combinations measured and estimated
	0 - Wind sea and swell estimated																	
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	6 - Other combinations measured and estimated																	
Other measurement system	7 - Wind sea and swell measured																	
	8 - Mixed wave measured, swell estimated																	
	9 - Other combinations measured and estimated																	
32	53-54	$P_w P_w$	Period of wind waves or of measured waves	Whole seconds; show 99 where applicable in accordance with Note (3) under specification of $P_w P_w$ in the <i>Manual on Codes</i>														
33	55-56	$H_w H_w$	Height of wind waves or of measured waves	Half-metre values. Examples: Calm or less than $1/4$ m to be encoded 00; $3 1/2$ m to be encoded 07; 7m to be encoded 14; $11 1/2$ m to be encoded 23														
34	57-58	$d_{w1} d_{w1}$	Direction of predominant swell waves	Tens of degrees, WMO code table 0877; encoded 00 or 99 where applicable. Blanks = No observation of waves attempted														
35	59-60	$P_{w1} P_{w1}$	Period of predominant swell waves	Whole seconds; encoded 99 where applicable (see under element 32)														
36	61-62	$H_{w1} H_{w1}$	Height of predominant swell waves	Half-metre values (see under element 33)														
37	63	I_s	Ice accretion on ships	WMO code table 1751														
38	64-65	$E_s E_s$	Thickness of ice accretion	In centimetres														
39	66	R_s	Rate of ice accretion	WMO code table 3551														
40	67		Source of observation	<table border="0"> <tr> <td>0 - Unknown</td> <td rowspan="3">National</td> </tr> <tr> <td>1 - Logbook</td> </tr> <tr> <td>2 - Telecommunication channels</td> </tr> <tr> <td>3 - Publications</td> <td rowspan="4">International data exchange</td> </tr> <tr> <td>4 - Logbook</td> </tr> <tr> <td>5 - Telecommunication channels</td> </tr> <tr> <td>6 - Publications</td> </tr> </table>	0 - Unknown	National	1 - Logbook	2 - Telecommunication channels	3 - Publications	International data exchange	4 - Logbook	5 - Telecommunication channels	6 - Publications					
0 - Unknown	National																	
1 - Logbook																		
2 - Telecommunication channels																		
3 - Publications	International data exchange																	
4 - Logbook																		
5 - Telecommunication channels																		
6 - Publications																		

Element Number	Character Number	Code	Element	Coding procedure
41	68		Observation platform	0 - unknown 1 - Selected ship 2 - Supplementary ship 3 - Auxiliary ship 4 - Automated station/data buoy 5 - Fixed sea station 6 - Coastal station 7 - Aircraft 8 - Satellite 9 - Others
42	69-75		Ship identifier	Ship's call sign or other identifier encoded as follows: 7 characters call sign Columns 69-75 6 characters call sign Columns 70-75 5 characters call sign Columns 71-75 4 characters call sign Columns 72-75
43	76-77		Country which has recruited the ship	According to numbers assigned by WMO
44	78		Quality control indicator	0 - No quality control (QC) 1 - Manual QC only 2 - Automated QC only (no time-sequence checks) 3 - Automated QC only (including time sequence checks) 4 - Manual and automated QC (superficial; no automated time-sequence checks) 5 - Manual and automated QC (superficial; including time-sequence checks) 6 - Manual and automated QC (intensive, including automated time-sequence checks) 7 - Not used 8 - Not used 9 - National system of QC (information to be furnished to WMO)
45	79	i_x	Weather data indicator	WMO code table 1860
46	80		National use	
47	81	i_R	Indicator for inclusion or omission of precipitation data	WMO code table 1819
48	82-84	RRR	Amount of precipitation which has fallen during the period preceding the time of observation, as indicated by t_R	WMO code table 3590
49	85	t_R	Duration of period of reference for amount of precipitation, ending at the time of the report	WMO code table 4019
50	86		Sign of computed wet-bulb or dew-point temperature	0 - positive dew-point 1 - negative dew-point 5 - positive wet-point 6 - negative wet-point
51	87-89	$T_d T_d T_d$	Computed dew-point or wet-bulb temperature	In tenths of degree Celsius, sign given by element 50
52	90	a	Characteristic of pressure tendency during the three hours preceding the time of observation	WMO code table 0200
53	91-93	ppp	Amount of pressure tendency at station level during the three hours preceding the time of observation	In tenths of hectopascal
54	94	D_s	True direction of resultant displacement of the ship during three hours preceding the time of observation	WMO code table 0700

Element Number	Character Number	Code	Element	Coding procedure
55	95	v ₃	Ship's average speed made good during the three hours preceding the time of observation	WMO code table 4451
56	96-97	d _{w2} d _{w2}	Direction of secondary swell waves	Tens of degrees, WMO code table 0877; encoded 00 or 99 where applicable. Blanks = No observation of waves attempted
57	98-99	P _{w2} P _{w2}	Period of secondary swell waves	Whole seconds; encoded 99 where applicable (see under element 32)
58	100-101	H _{w2} H _{w2}	Height of secondary swell waves	Half-metre values (see under element 33)
59	102	c ₁	Concentration or arrangement of sea ice	WMO code table 0639
60	103	S ₁	Stage of development	WMO code table 3739
61	104	b ₁	Ice of land origin	WMO code table 0439
62	105	D ₁	True bearing of principal ice edge	WMO code table 0739
63	106	z ₁	Present ice situation and trend of conditions over preceding three hours	WMO code table 5239
64	107	Q ₁	Quality control indicator for (h)	0 - No quality control (QC) has been performed in this element 1 - QC has been performed; element appears to be correct 2 - QC has been performed; element appears to be inconsistent with other elements 3 - QC has been performed; element appears to be doubtful 4 - QC has been performed; element appears to be erroneous 5 - The value has been changed as a result of QC 6 - 8 Reserve 9 - The value of the element missing
65	108	Q ₂	QC indicator for (VV)	- idem -
66	109	Q ₃	QC indicator for (clouds: elements 13, 24-27)	- idem -
67	110	Q ₄	QC indicator for (dd)	- idem -
68	111	Q ₅	QC indicator for (ff)	- idem -
69	112	Q ₆	QC indicator for (TTT)	- idem -
70	113	Q ₇	QC indicator for (wet bulb/dew point)	- idem -
71	114	Q ₈	QC indicator for (PPPP)	- idem -
72	115	Q ₉	QC indicator for (weather: elements 21-23)	- idem -
73	116	Q ₁₀	QC indicator for (T _w T _w T _w)	- idem -
74	117	Q ₁₁	QC indicator for (P _w P _w)	- idem -
75	118	Q ₁₂	QC indicator for (H _w H _w)	- idem -
76	119	Q ₁₃	QC indicator for (swell: elements 34-36; 56-58)	- idem -
77	120	Q ₁₄	QC indicator for (i _R RRRt _R)	- idem -
78	121	Q ₁₅	QC indicator for (a)	- idem -
79	122	Q ₁₆	QC indicator for (ppp)	- idem -
80	123	Q ₁₇	QC indicator for (D _s)	- idem -
81	124	Q ₁₈	QC indicator for (V _s)	- idem -

RECOMMENDATION 12 (CMM-XI)**USE OF BEAUFORT EQUIVALENT SCALE OF WIND FORCE**

THE COMMISSION FOR MARINE METEOROLOGY,

NOTING:

- (1) The *Manual on Marine Meteorological Services* (WMO-No.558), Volume I, Part I, Appendix I.3 — Beaufort scale of wind force,
- (2) The final report of the sixth session of the CMM Sub-group on Marine Climatology,

NOTING FURTHER various papers published in the scientific literature in recent years which analyse the consequences of the use of various Beaufort equivalent scales for determining sea surface wind speeds for scientific studies of marine climate and climate change,

RECALLING the extensive discussions on this subject which had taken place at previous sessions of the Commission,

BEARING IN MIND the likely difficulties for global climate studies resulting from variations in observing practices for surface wind speeds from ships as well as from the use of different Beaufort equivalent scales for deriving such wind speeds,

CONSIDERING, however,

- (1) The need to maintain continuity and consistency in data archives of marine surface winds and to avoid complications for marine observers,
- (2) That the existing Beaufort equivalent scale is sufficiently accurate for operational observation purposes,
- (3) That no international agreement yet exists on an appropriate Beaufort equivalent scale for scientific study applications,

AGREES that the existing Beaufort equivalent scale, as given in the *Manual on Marine Meteorological Services*, should be retained for operational observation and data archival purposes;

RECOMMENDS:

- (1) To Members to standardize shipboard observing practices for marine surface winds, according to guidelines given in the *Manual on Marine Meteorological Services* and the *Guide to Marine Meteorological Services*;
- (2) To those involved in climate research to take into account the difficulties and differences noted with the official WMO Beaufort equivalent scale and also with other "scientific Beaufort equivalent scales", as well as various environmental ship factors, when using archived ship wind data in studies of marine climate and climate change;

REQUESTS:

- (1) The Secretary-General to bring this recommendation to the attention of all concerned;
- (2) The Sub-group on Marine Climatology to continue to review the development and application of Beaufort equivalent scales for climate study purposes, to report any significant developments to the Commission and to Members, as appropriate, and also to examine the possibility of developing an extended Beaufort equivalent scale for marine forecast presentation purposes.

RECOMMENDATION 13 (CMM-XI)**MODIFICATION TO THE INTERNATIONAL MARITIME METEOROLOGICAL TAPE (IMMT) FORMAT FOR THE EXCHANGE OF MARINE CLIMATOLOGICAL DATA**

THE COMMISSION FOR MARINE METEOROLOGY,

NOTING:

- (1) The abridged final report of the tenth session of CMM-X, general summary, paragraph 8.4.8,
- (2) The *Manual on Marine Meteorological Services*, Volume I, Part 1, Appendix I.12 — Layout for the International Maritime Meteorological Tape (IMMT),
- (3) The final report of the sixth session of the CMM Sub-group on Marine Climatology,
- (4) Recommendation 9 (CBS-X) — Proposed amendments to FM 13-IX Ext. SHIP,
- (5) Results of the VOS Special Observing Project North Atlantic (VSOP-NA) — Marine Meteorology and Related Oceanographic Activities Report No. 26,

CONSIDERING:

- (1) The continuing and increasing importance of the Marine Climatological Summaries Scheme (MCSS)

to both research and operational users of marine climatological data,

- (2) That all available information relating to meteorological and oceanographic observations from the voluntary observing ships should be exchanged and archived through the MCSS,

RECOMMENDS:

- (1) That the modified IMMT format for the exchange of marine climatological data, as given in the annex to this recommendation, should be adopted for inclusion as an Appendix to Volume I, Part 1 of the *Manual on Marine Meteorological Services*,
- (2) That the implementation date for the modified IMMT format should be the same as that for the SHIP code modification adopted by CBS-X, that is 2 November 1994.

ANNEX TO RECOMMENDATION 13 (CMM-XI)

LAYOUT FOR THE INTERNATIONAL MARITIME METEOROLOGICAL TAPE (IMMT)
[VERSION IMMT-1]

Element Number	Character Number	Code	Element	Coding procedure
1	1	i_T	Format/temperature indicator	3=IMMT format with temperatures in tenths of °C 4=IMMT format with temperatures in halves of °C 5=IMMT format with temperatures in whole °C
2	2-5	AAAA	Year UTC	Four digits
3	6-7	MM	Month UTC	01 - 12 January to December
4	8-9	YY	Day UTC	01 - 31
5	10-11	GG	Time of observation	Nearest whole hour UTC; WMO specifications
6	12	Q	Octant of the globe	WMO code table 3300; quadrant converted into octant
7	13-15	$L_a L_a L_a$	Latitude	Tenths of degrees, WMO specifications
8	16-19	$L_o L_o L_o L_o$	Longitude	Tenths of degrees
9	20		Cloud height (h) and visibility (VV) measuring indicator	0 - h and VV estimated 1 - h measured, VV estimated 2 - h and VV measured 3 - h estimated, VV measured
10	21	h	Height of clouds	WMO code table 1600
11	22-23	VV	Visibility	WMO code table 4377
12	24	N	Cloud amount	Oktas, WMO code table 2700; show 9 where applicable
13	25-26	dd	True wind direction	Tens of degrees, WMO code table 0877; show 00 or 99 where applicable
14	27	i_w	Indicator for wind speed	WMO code table 1855
15	28-29	ff	Wind speed	Tens and units of knots or metres per second, hundreds omitted; values in excess of 99 knots are to be indicated in units of metres per second and i_w encoded accordingly; the method of estimation or measurement and the units used (knots or metres per second) are indicated in element 14
16	30	s_n	Sign of temperature	WMO code table 3845
17	31-33	TTT	Air temperature	Tenths of degrees Celsius
18	34	s_t	Sign of dew-point temperature	0 - positive or zero measured dew-point temperature 1 - negative measured dew-point temperature 2 - iced measured dew-point temperature 5 - positive or zero computed dew-point temperature 6 - negative computed dew-point temperature 7 - iced computed dew-point temperature
19	35-37	$T_d T_d T_d$	Dew-point temperature	Tenths of degrees Celsius
20	38-41	PPPP	Air pressure	Tenths of hectopascals
21	42-43	ww	Present weather	WMO code table 4677
22	44	W_1	Past weather	WMO code table 4561
23	45	W_2	Past weather	WMO code table 4561
24	46	N_h	Amount of lowest clouds	As reported for C_L or, if no C_L cloud is present, for C_M , in oktas; WMO code table 2700

Element Number	Character Number	Code	Element	Coding procedure										
25	47	C _L	Genus of C _L clouds	WMO code table 0513										
26	48	C _M	Genus of C _M clouds	WMO code table 0515										
27	49	C _H	Genus of C _H clouds	WMO code table 0509										
28	50	s _n	Sign of sea-surface temperature	WMO code table 3845										
29	51-53	T _w T _w T _w	Sea surface temperature	Tenth of degrees Celsius										
30	54		Indicator for sea-surface temperature measurement	0 - Bucket thermometer 1 - Condenser inlet 2 - Trailing thermistor 3 - Hull contact sensor 4 - "Through hull" sensor 5 - Radiation thermometer 6 - Bait tanks thermometer 7 - Others										
31	55		Indicator for wave measurement	<table> <tr> <td>Shipborne wave recorder</td> <td rowspan="3"> 0 - Wind sea and swell estimated 1 - Wind sea and swell measured 2 - Mixed wave measured, swell estimated 3 - Other combinations measured and estimated 4 - Wind sea and swell measured 5 - Mixed wave measured, swell estimated 6 - Other combinations measured and estimated 7 - Wind sea and swell measured 8 - Mixed wave measured, swell estimated 9 - Other combinations measured and estimated </td> </tr> <tr> <td>Buoy</td> </tr> <tr> <td>Other measurement system</td> </tr> </table>	Shipborne wave recorder	0 - Wind sea and swell estimated 1 - Wind sea and swell measured 2 - Mixed wave measured, swell estimated 3 - Other combinations measured and estimated 4 - Wind sea and swell measured 5 - Mixed wave measured, swell estimated 6 - Other combinations measured and estimated 7 - Wind sea and swell measured 8 - Mixed wave measured, swell estimated 9 - Other combinations measured and estimated	Buoy	Other measurement system						
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Buoy														
Other measurement system														
32	56-57	P _w P _w	Period of wind waves or of measured waves	Whole seconds; show 99 where applicable in accordance with Note (3) under specification of P _w P _w in the <i>Manual on Codes</i>										
33	58-59	H _w H _w	Height of wind waves or of measured waves	Half-metre values. Examples: Calm or less than 1/4m to be encoded 00; 3 1/2m to be encoded 07; 7m to be encoded 14; 11 1/2m to be encoded 23										
34	60-61	d _{w1} d _{w1}	Direction of predominant swell waves	Tens of degrees, WMO code table 0877; encoded 00 or 99 where applicable. Blanks = No observation of waves attempted										
35	62-63	P _{w1} P _{w1}	Period of predominant swell waves	Whole seconds; encoded 99 where applicable (see under element 32)										
36	64-65	H _{w1} H _{w1}	Height of predominant swell waves	Half-metre values (see under element 33)										
37	66	I _s	Ice accretion on ships	WMO code table 1751										
38	67-68	E _s E _s	Thickness of ice accretion	In centimetres										
39	69	R _s	Rate of ice accretion	WMO code table 3551										
40	70		Source of observation	<table> <tr> <td>0 - Unknown</td> <td rowspan="3">} National</td> </tr> <tr> <td>1 - Logbook</td> </tr> <tr> <td>2 - Telecommunication channels</td> </tr> <tr> <td>3 - Publications</td> <td rowspan="3">} International data exchange</td> </tr> <tr> <td>4 - Logbook</td> </tr> <tr> <td>5 - Telecommunication channels</td> </tr> <tr> <td>6 - Publications</td> <td></td> </tr> </table>	0 - Unknown	} National	1 - Logbook	2 - Telecommunication channels	3 - Publications	} International data exchange	4 - Logbook	5 - Telecommunication channels	6 - Publications	
0 - Unknown	} National													
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Element Number	Character Number	Code	Element	Coding procedure
41	71		Observation platform	0 - unknown 1 - Selected ship 2 - Supplementary ship 3 - Auxiliary ship 4 - Automated station/data buoy 5 - Fixed sea station 6 - Coastal station 7 - Aircraft 8 - Satellite 9 - Others
42	72-78		Ship identifier	Ship's call sign or other identifier encoded as follows: 7 characters call sign Columns 72-78 6 characters call sign Columns 72-77 5 characters call sign Columns 72-76 4 characters call sign Columns 72-75 3 characters call sign Columns 72-74
43	79-80		Country which has recruited the ship	According to numbers assigned by WMO
44	81		National use	
45	82		Quality control indicator	0 - No quality control (QC) 1 - Manual QC only 2 - Automated QC only (no time-sequence checks) 3 - Automated QC only (inc. time sequence checks) 4 - Manual and automated QC (superficial; no automated time-sequence checks) 5 - Manual and automated QC (superficial; including time-sequence checks) 6 - Manual and automated QC (intensive, including automated time-sequence checks) 7 & 8 - Not used 9 - National system of QC (information to be furnished to WMO)
46	83	i_x	Weather data indicator	1 - Manual 4 - Automatic If present and past weather data included Code tables 4677 and 4561 used 7 - Automatic If present and past weather data included Code tables 4680 and 4531 used
47	84	i_R	Indicator for inclusion or omission of precipitation data	WMO code table 1819
48	85-87	RRR	Amount of precipitation which has fallen during the period preceding the time of observation, as indicated by t_R	WMO code table 3590
49	88	t_R	Duration of period of reference for amount of precipitation, ending at the time of the report	WMO code table 4019
50	89	s_w	Sign of wet-bulb temperature	0 - positive or zero measured wet-bulb temperature 1 - negative measured wet-bulb temperature 2 - iced measured wet-bulb temperature 5 - positive or zero computed wet-bulb temperature 6 - negative computed wet-bulb temperature 7 - iced computed wet-bulb temperature
51	90-92	$T_b T_b T_b$	Wet-bulb temperature	In tenths of degree Celsius, sign given by element 50
52	93	a	Characteristic of pressure tendency during the three hours preceding the time of observation	WMO code table 0200

Element Number	Character Number	Code	Element	Coding procedure
53	94-96	ppp	Amount of pressure tendency at station level during the three hours preceding the time of observation	In tenths of hectopascal
54	97	D _s	True direction of resultant displacement of the ship during three hours preceding the time of observation	WMO code table 0700
55	98	v _s	Ship's average speed made good during the three hours preceding the time of observation	WMO code table 4451
56	99-100	d _{w2} d _{w2}	Direction of secondary swell waves	Tens of degrees, WMO code table 0877; encoded 00 or 99 where applicable. Blanks = No observation of waves attempted
57	101-102	P _{w2} P _{w2}	Period of secondary swell waves	Whole seconds; encoded 99 where applicable (see under element 32)
58	103-104	H _{w2} H _{w2}	Height of secondary swell waves	Half-metre values (see under element 33)
59	105	c _i	Concentration or arrangement of sea ice	WMO code table 0639
60	106	S _i	Stage of development	WMO code table 3739
61	107	b _i	Ice of land origin	WMO code table 0439
62	108	D _i	True bearing of principal ice edge	WMO code table 0739
63	109	z _i	Present ice situation and trend of conditions over preceding three hours	WMO code table 5239
64	110		FM 13 code version	0 = previous to FM 24-V 1 = FM 24-V 2 = FM 24-VI Ext. 3 = FM 13-VII 4 = FM 13-VIII 5 = FM 13-VIII Ext. 6 = FM 13-IX 7 = FM 13-IX Ext. 8 = FM 13-X, etc.
65	111		IMMT version	0 = previous IMMT 1 = IMMT-1 (this version) 2 = IMMT-2 (next version) 3 = IMMT-3, etc.
66	112	Q ₁	Quality control indicator for (h)	0 - no quality control (QC) has been performed in this element 1 - QC has been performed; element appears to be correct 2 - QC has been performed; element appears to be inconsistent with other elements 3 - QC has been performed; element appears to be doubtful 4 - QC has been performed; element appears to be erroneous 5 - The value has been changed as a result of QC 6 - 8 Reserve 9 - The value of the element missing
67	113	Q ₂	QC indicator for (VV)	- idem -
68	114	Q ₃	QC indicator for (clouds: elements 12, 24-27)	- idem -
69	115	Q ₄	QC indicator for (dd)	- idem -
70	116	Q ₅	QC indicator for (ff)	- idem -

<i>Element Number</i>	<i>Character Number</i>	<i>Code</i>	<i>Element</i>	<i>Coding procedure</i>
71	117	Q ₆	QC indicator for (TTT)	- idem -
72	118	Q ₇	QC indicator for (T _d T _d T _d)	- idem -
73	119	Q ₈	QC indicator for (PPPP)	- idem -
74	120	Q ₉	QC indicator for (weather: elements 21-23)	- idem -
75	121	Q ₁₀	QC indicator for (T _w T _w T _w)	- idem -
76	122	Q ₁₁	QC indicator for (P _w P _w)	- idem -
77	123	Q ₁₂	QC indicator for (H _w H _w)	- idem -
78	124	Q ₁₃	QC indicator for (swell: elements 34-36, 56-58)	- idem -
79	125	Q ₁₄	QC indicator for (i _R RRRt _R)	- idem -
80	126	Q ₁₅	QC indicator for (a)	- idem -
81	127	Q ₁₆	QC indicator for (ppp)	- idem -
82	128	Q ₁₇	QC indicator for (D ₁)	- idem -
83	129	Q ₁₈	QC indicator for (v ₁)	- idem -
84	130	Q ₁₉	QC indicator for (T _b T _b T _b)	- idem -
85	131	Q ₂₀	QC indicator for ships' position	- idem -

RECOMMENDATION 14 (CMM-XI)

GLOBAL TROPICAL CYCLONE DATA SET — REPORT FORMAT

THE COMMISSION FOR MARINE METEOROLOGY,

NOTING:

- (1) Final report of the First WMO International Workshop on Tropical Cyclones (Bangkok, 1985),
- (2) Abridged final report of CMM-X, general summary, paragraph 8.4.8,
- (3) Final report of the third session of the CAS Working Group on Tropical Meteorology (Geneva, March 1988),
- (4) Final report of the sixth session of CMM Sub-group on Marine Climatology, Geneva, April 1992,

NOTING FURTHER the final report of the Technical Co-ordination Meeting on Operational Tropical Cyclone Forecasting and Dissemination of Results by RSMCs (Tokyo, December 1992), which agreed on a revised standard format for the archival of tropical cyclone track and intensity information,

CONSIDERING:

- (1) That tropical cyclone track and intensity data for each tropical cyclone region are already archived within the region according to procedures and formats agreed by the Members concerned, but that

archival formats vary from region to region,

- (2) The value to research and climatological applications of having available through WDCs A and B a single global archive of tropical cyclone track and intensity data in the same format,

RECOMMENDS:

- (1) That the standard format for the archival of tropical cyclone track and intensity information, as given in the annex to this recommendation be adopted for general use by Members concerned;
- (2) That the RSMCs with activity specialization in tropical cyclones be requested to provide tropical cyclone track and intensity data to the National Climatic Data Center (NCDC), United States (WDC A), in this agreed format or in another format if this is not feasible;
- (3) That the NCDC be invited to transform all tropical cyclone data received in other formats into the standard format before archival;

REQUESTS the Secretary-General to assist Members concerned in the implementation of this recommendation, within the available budgetary resources.

ANNEX TO RECOMMENDATION 14 (CMM-XI)
GLOBAL TROPICAL CYCLONE DATA SET — REPORT FORMAT

<i>Position</i>	<i>Contents</i>	<i>Position</i>	<i>Contents</i>
1-10	Cyclone identification code (if any) and name (if any) separated by one space if applicable. If the 'code and name' exceeds 10 characters, then use an abbreviation of the name (first letters only) instead of the full name in positions 1-10 and the complete name should then be entered in the expansion fields beginning in position 53. Not more than one name should be entered for the cyclone during the period shown in positions 11-20. That is the name most used for regional or international purposes by the centre indicated in positions 51-52.	39-41	Maximum average wind speed (whole values) (999 if unknown or unavailable)
		42	Units of wind speed. 1 = knots; 2 = meters per second
		43-44	Time interval for averaging surface wind speed (minutes) for measured or derived wind speeds or 99 if unknown (e.g. estimated).
		45-46	Cyclone type: 01 = tropics; disturbance (no closed isobars) 02 = <34 knot winds, <17 m/s winds and at least one closed isobar 03 = 34-63 knots, 17-32 m/s 04 = ≥64 knots, ≥33 m/s 05 = extratropical 06 = dissipating 07 = subtropical cyclone (nonfrontal, low pressure system that comprises initially baroclinic circulation developing over sub-tropical water) 08 = overland 99 = unknown
11-14	Year	47-50	Central pressure (nearest hectopascal) (9999 if unknown or unavailable)
15-16	Month (01-12)	51-52	Source code (2-digit code to represent the country or organization that provided the data to NCDC USA, WMO Secretariat, TCP applied to assign numbers to additional participating centers, organizations) 01 RSMC Miami — Hurricane Center 02 RSMC Tokyo — Typhoon Center 03 RSMC — Tropical cyclones New Delhi 04 RSMC, La Réunion 05 Australian Bureau of Meteorology 06 Meteorological Service of New Zealand Ltd. 07 TCWC Nadi, Fiji 08 Joint Typhoon Warning Center, Guam 09 Madagascar Meteorological Service 10 Mauritius Meteorological Service 11 Meteorological Service, New Caledonia
17-18	Day (01-31)		Headings 1-10 Cyclone identification code and name; 11-20 Date time group; 21-34 Best track positions; 35-46 Intensity; 47-50 Pressure; 51-52 Source code; 53-80 Expansion.
19-20	Hour — universal time (at least every six hourly position -- 00Z, 06Z, 12Z and 18Z)		NOTE: The 80-character format allows for data to be digitized on cards, diskettes, or magnetic tape.
21	Latitude indicator: 1 = North latitude; 2 = South latitude		
22-24	Latitude (degrees and tenths)		
25-26	Check sum (sum of all digits in the latitude)		
27	Longitude indicator: 1 = West longitude; 2 = East longitude		
28-31	Longitude (degrees and tenths)		
32-33	Check sum (sum of all digits in the longitude)		
34	Position confidence 1 = good (<30 nm; <55 km) 2 = fair (30-60 nm; 55-110 km) 3 = poor (>60 nm; >110 km) 9 = unknown		
NOTE:	Confidence in the center position: Degree of confidence in the center position of a tropical cyclone expressed as the radius of the smallest circle within which the center may be located by the analysis. "Position good" implies a radius of less than 30 nautical miles, 55 kilometers; "Position fair", a radius of 30 to 60 nautical miles, 55 to 110 km; and "Position poor", radius of greater than 60 nautical miles, 110 km.		
35-36	Dvorak T-number (99 if unknown or unavailable)		
37-38	Dvorak CI-number (99 if unknown or unavailable)		

RECOMMENDATION 15 (CMM-XI)

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

THE COMMISSION FOR MARINE METEOROLOGY,
NOTING the WMO *Technical Regulations* (WMO-No. 49), in particular Volume I, Chapters B.1, C.1 and Annex VI which are of most relevance to CMM,
RECALLING that proposed amendments to the *Manual on Marine Meteorological Services* (Annex VI to the *Technical Regulations*) had been adopted through Recommendations 3 and 11 (CMM-XI),

CONSIDERING that parts of Chapters B.1 and C.1 of the *Technical Regulations* require to be amended to conform with the amended text in the *Manual on Marine Meteorological Services*,

RECOMMENDS that the amendments to Chapters B.1 and C.1 of the *Technical Regulations*, as detailed in the annex to this recommendation, be adopted.

ANNEX TO RECOMMENDATION 15 (CMM-XI)

**CHAPTER B.1
CLIMATOLOGY**

....

[B.1.] 2.1.2

The international maritime meteorological ~~punch-card~~ tape format shown as Appendix F I.13 of Annex VI (*Manual on Marine Meteorological Services*) should be used for recording surface synoptic observations made at sea stations.

....

[B.1.] 3.1.5

When supplying synoptic surface observational data from mobile ship stations to meteorological services for international use, the international maritime meteorological ~~punch-card~~ tape format reproduced as ~~Part I of Appendix F~~ Appendix I.13 of Annex VI (*Manual on Marine Meteorological Services*) should be used; when supplying such data ~~originally reported in deviating codes, or in codes from former years or for providing additional data, the supplementary punching originating before 1960, the coding procedures given in Part II (of Appendix F)~~ Appendix I.13 of Annex VI (*Manual on Marine Meteorological Services*) should also be used, or some mutually acceptable format.

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**CHAPTER C.1
METEOROLOGICAL SERVICES FOR MARINE
ACTIVITIES**

....

[C.1.] 2

Marine meteorological services for the high seas

N O T E: In this context, the term "high seas" applies to open oceans or sea areas of responsibility of Members for issuing weather and sea bulletins ~~of Group A~~, governed by the procedures given in Part I of Annex VI (*Manual on Marine Meteorological Services*).

....

[C.1.]2.5.1

Members operating fixed ship stations, selected, supplementary and auxiliary ship stations should ensure that all surface observations from these stations are ~~punched~~ or put on magnetic tape in accordance with the layout of the international maritime meteorological ~~punch~~ card tape format and despatched at ~~half-yearly~~ quarterly intervals to the Members (Global Collecting Centres) having accepted the responsibility for the ~~preparation and issue of marine climatological summaries~~ processing these data.

....

....

[C.1.]3

Marine meteorological services for coastal and off-shore areas

N O T E: In this context, the term "coastal and off-shore areas" applies to areas for which Members issue weather and sea bulletins ~~of Group B~~, governed by the procedures given in Part II of Annex VI (*Manual on Marine Meteorological Services*).

....

....

[C.1.]4

Marine meteorological services for main ports and harbour areas

N O T E: In this context, the term "main ports and harbour areas" applies to areas for which Members issue port weather and sea bulletins, governed by the procedures given in Part III of Annex VI (*Manual on Marine Meteorological Services*).

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[C.1.]4.3

Port Meteorological Officer (PMO) services

[C.1.]4.3.1

Port Meteorological Officer services shall include at least those specified in ~~2.2.3-9~~ 2.2.3 of Part III of the *Manual on the Global Observing System* (Annex V to the WMO *Technical Regulations*).

RECOMMENDATION 16 (CMM-XI)

MODIFICATIONS TO THE *INTERNATIONAL LIST OF SELECTED, SUPPLEMENTARY AND AUXILIARY SHIPS* (WMO-NO. 47)

THE COMMISSION FOR MARINE METEOROLOGY,
NOTING:

- (1) The results of the VOS Special Observing Project North Atlantic (VSOP-NA), Marine Meteorology and Related Oceanographic Activities Report No. 26, in particular the conclusions and recommendations of this project,
- (2) The final report of the sixth session of the CMM Sub-group on Marine Climatology (Geneva, April 1992),

CONSIDERING:

- (1) That the WMO *International List of Selected, Supplementary and Auxiliary Ships* (WMO-No. 47) is a valuable tool in monitoring the quality of surface marine observations, as well as in processing these observations for climate study purposes,
- (2) That information on the location and type of meteorological instrumentation on board ships of the VOS is essential for an accurate interpretation of the observations from these ships, for both operational and research purposes,

RECOMMENDS that the format and content of the WMO *International List of Selected, Supplementary and Auxiliary Ships* (WMO-No. 47) be modified as indicated in the annex to this recommendation;

RECOMMENDS FURTHER:

- (1) That each Member should be requested to submit updates to their national ships' list on a quarterly basis, preferably on diskette, to allow maximum efficiency in keeping the master list updated;
- (2) That the updated master list should be made available to interested Members, organizations and institutions, on diskette, also on a quarterly basis, in addition to the annual hard copy publication;
- (3) That the modifications proposed in the annex to this recommendation be incorporated as soon as possible, but in any case by the first issue of the WMO *International List of Selected, Supplementary and Auxiliary Ships* (WMO-No. 47) for 1994;

URGES Members to provide the Secretariat with the necessary additional information to be included in the new layout of the ships' list as quickly as possible.

ANNEX TO RECOMMENDATION 16 (CMM-XI)

INTERNATIONAL LIST OF SELECTED, SUPPLEMENTARY AND AUXILIARY SHIPS (WMO-NO. 47)

1. Proposed modifications to the format:

(a) Most variables published at present are useful and should be retained, with the following exceptions:

- (i) "Number of radio operators" (column 13), to be omitted;
- (ii) "Height of observing platform..." (column 14), to be modified to read: "Height of barometer, measured from maximum load line";
- (iii) "Height of anemometer..." (column 15), to be modified to read: "Height of anemometer, measured from maximum load line";

(b) The following additional information should be included:

- (i) Vessel type: e.g.
 - Closed container
 - Ro/Ro container
 - Liquid tanker
 - Gas tanker
 - General cargo
 - Research vessel
 - Trawler
 - Other fishing vessel
 - Passenger vessels
 - Ferries
 - Bulk carriers
 - Yachts and pleasure craft
 - Support vessels
 - Others

- (ii) Vessel dimensions: Length (m)
Breadth (m)
Freeboard (m)

(iii) Depth of sea temperature measurement (m) — below maximum load line;

(c) The following additional information should be listed:

Vessel type }
Vessel dimensions } after existing column 2

Depth of sea temperature measurement, after existing column 15;

(d) Additionally, the list of recruiting countries (Part B, page (iii) of 1991 edition) should be reviewed to ensure that it is up-to-date and also consistent with country codes in use for IMMT purposes;

(e) Modify the content of column 12A to merge MF and HF radiotelegraphy and include INMARSAT-C communication facilities in column 12B.

2. Proposed mechanism for compilation and production: The information to be maintained as a PC data set; Members should submit modifications on a quarterly basis, preferably on diskette, to allow maximum efficiency in keeping the master list updated. The Secretariat should make the updated list available to Members on diskette.

RECOMMENDATION 17 (CMM-XI)**REVISION OF RESOLUTIONS OF THE EXECUTIVE COUNCIL BASED ON PREVIOUS RECOMMENDATIONS OF THE COMMISSION FOR MARINE METEOROLOGY**

THE COMMISSION FOR MARINE METEOROLOGY,

NOTING with satisfaction the action taken by the Executive Council on the previous recommendations of the Commission for Marine Meteorology and on other matters related to the work of the Commission,

CONSIDERING that many of these recommendations have been redundant in the meantime,

RECOMMENDS:

- (1) That Resolutions 10 (EC-XXXVII), 8 and 11 (EC-XLI) no longer be considered necessary;
 - (2) That Resolutions 15 (EC-XXI), 12 (EC-XXV), and 8 (EC-XLIV) be kept in force.
-

ANNEXES

ANNEX I

Annex to paragraph 3.9 of the general summary

WORK PROGRAMME OF THE COMMISSION FOR MARINE METEOROLOGY FOR THE PERIOD 1993-1997

<i>Major project</i>	<i>Task</i>	<i>Execution</i>	<i>Target date</i>
<i>Marine meteorological services</i>	(a) Implement and maintain a systematic long-term global marine meteorological services monitoring programme with a clear feedback mechanisms;	WG on MMS and Secretariat	Continuous
	(b) Promote continuing improvement in basic and specialized MMS, monitor marine user requirements and make recommendations for relevant MMS including updating of the <i>Guide to and Manual on MMS</i> ;	WG on MMS and Secretariat	Continuous
	(c) Co-ordination of MMS with related service organizations such as IMO, IHO, IOC and with user organizations (E&P Forum, ICS, FAO, etc.);	WG on MMS and Secretariat	Continuous
	(d) Keep under review, in co-ordination with IMO, IHO and INMARSAT, the implementation of the GMDSS and prepare a final version for CMM-XII;	WG on MMS and Secretariat	1997
	(e) Provisionally implement and continue developing, in conjunction with IMO, IOC and UNEP, the MPISS for meteorological support for marine pollution emergency operations for presentation to CMM-XII;	WG on MMS and Secretariat	1994, continuous
	(f) Prepare and keep under review guidance material on the application of remote-sensing techniques to the provision of MMS, including the preparation of appropriate amendments to the <i>Manual on and Guide to MMS</i> ;	WG on MMS, WG on MOS	Continuous
	(g) Promote improvements in the provision of specialized MMS, including the preparation of guidance material on: <ul style="list-style-type: none"> (i) Services for ports and harbour areas; (ii) Services for fisheries; (iii) Ocean wave-related services; (iv) Weather routeing of ships; (v) Coastal marine services; (vi) Exploitation of resources of the deep ocean, offshore, inshore and coastal regions; (vii) More detailed sea-ice information for sea-ice services; (viii) Impacts of climatic change; (ix) Techniques for cost-benefit studies; 	WG on MMS, WG on ETIS, rapporteurs and Secretariat	1997
	(h) Development of procedures and guidance in the provision of sea-ice data for operational services;	WG on MMS	Continuous
	(i) Develop new methods beyond HF radiifax for distributing graphic presentations to ships;	WG on MMS	1997

<i>Major project</i>	<i>Task</i>	<i>Execution</i>	<i>Target date</i>
<i>Marine meteorological services (contd.)</i>	(j) Review high-seas bulletin formats and determine more effective consistency between services;	WG on MMS	1997
	(k) Develop criteria for Regional Specialized Marine Meteorological Centres.	AWG	1995
<i>Marine climatology</i>	(a) Co-ordination of marine climatological requirements (including for sea-ice data) with WCP and provision of technical advice on exchange and archival of such data;	WG on MMS	Continuous
	(b) Continued review and revision, as appropriate, of MCSS;	WG on MMS	Continuous
	(c) Study of operationally and scientifically useful marine data from remote-sensing and numerical modelling with a view to archival and exchange;	WG on MMS, WG on MOS	Continuous
	(d) Evaluation and development of marine climatological data exchange for special projects;	WG on MMS	Continuous
	(e) Review and revision of relevant sections of the <i>Guide to and Manual on MMS</i> ;	WG on MMS, WG on MOS with Secretariat	Continuous
	(f) Publication of the <i>Guide to Applications of Marine Climatology</i> in languages other than English;	WG on MMS with Secretariat	1994
	(g) Continuing review of quality control procedures for marine climatological data, including standardization between the new global collecting centre;	WG on MMS	Continuous
	(h) Promote co-operation in improving the methodology for the acquisition, exchange, processing, quality control, storage and dissemination of sea-ice data (including remotely-sensed data);	WG on MMS	Continuous
	(i) Review the data quality procedures for digital sea-ice data;	WG on MMS	1997
	(j) Promote the cataloguing of sources of wave data and associated metadata at RNODC on Waves;	WG on MMS	Continuous
	(k) Continuing review of the information available in the <i>International List of Selected, Supplementary and Auxiliary Ships</i> (WMO-No. 47);	WG on MOS	Continuous
(l) Study the preparation of separate archive of marine climate data from GTS reports.	WG on MMS	1997	
<i>Marine observations and data collection</i>	(a) Monitor requirements for meteorological and oceanographic data for marine services and other programmes and activities such as GCOS, GOOS, WCRP, TOGA, etc.;	WG on MMS, WG on MOS and AWG	Continuous
	(b) Develop plans to enhance marine observing systems to fulfil requirements of GOOS and GCOS;	WG on MOS, with IGOSS and DBCP	1995
	(c) Continue monitoring and promoting the improvement of the VOS scheme, including implementation of the recommendations of the VSOP-NA, specifically to: (i) Improve data quality; (ii) Automate observations, taking care to preserve climatological continuity; (iii) Increase recruitment in data-sparse areas;	WG on MOS	Continuous

<i>Major project</i>	<i>Task</i>	<i>Execution</i>	<i>Target date</i>	
<i>Marine observations and data collection (contd.)</i>	(d) Improvement of real-time data collection procedures through: (i) Enhanced use of INMARSAT, in particular INMARSAT-C; (ii) Support for the maintenance of the coastal radio station network; (iii) Increased automation; (iv) Increased use of other satellite-based systems such as Argos and the geostationary satellites; (v) Close liaison with the Co-ordinating Group for COSNA; (vi) A study for an OWSE for the Indian Ocean;	WG on MOS with Secretariat	Continuous	
	(e) Develop proposals to improve the availability of data collected by satellite (VOS and drifting buoys) for countries near their origin;	WG on MOS	1997	
	(f) Preparation for the collection, processing and application of satellite ocean data (including priorities and procedures);	WG on MOS	Continuous	
	(g) Provision of guidance on the application of satellite ocean data;	WG on MOS	Continuous	
	(h) Co-ordination with IOC in the development of the GOOS;	AWG, WG on MOS, I-GOOS	Continuous	
	(i) Monitor specific requirements for boundary layer wind fields for use in wave modelling;	WG on MOS, WG on MMS	Continuous	
	(j) Continue monitoring CCITT recommendations on charges for OBS messages as well as national requirements for the use of HF frequencies;	WG on MOS	Continuous	
	(k) Improvement of the PMO network through the provision of guidance on the organization, training and operation of PMOs;	WG on MOS and WG on ETIS	Continuous	
	(l) Review and propose amendments, as necessary, to marine reporting codes;	WG on MOS with I-GOOS	Continuous	
	(m) Promote the expansion of new marine observing system components.	WG on MOS	Continuous	
	<i>Information exchange</i>	(a) Review and update the <i>Guide to MMS</i> ;	WG on MMS and rapporteur	1997
		(b) Preparation and publication of guidance material on: (i) Use of satellite data for MMS; (ii) Analysis and forecasting of sea ice; (iii) Application to offshore areas and high seas of subjective and numerical forecasting techniques and objective techniques such as model output statistics; (iv) Use of coastal Doppler radar and profiling radiometers in analysing and forecasting nearshore wind fields; (v) Marine pollution transport modelling; (vi) Beaufort equivalent scales; (vii) Standard shipboard observing practices; (viii) Estimation of coastal wind in tropical regions;	WG on MMS, WG on MOS	Continuous
		(c) Review and updating, as appropriate, of: (i) Relevant chapters of the <i>CIMO Guide to Meteorological Instruments and Methods of Observation</i> (WMO-No. 8);	WG on MOS, WG on MMS	1997

Major project	Task	Execution	Target date
<i>Information exchange</i> (contd.)	(ii) <i>Guide to Wave Analysis and Forecasting</i> (WMO-No. 702); (iii) <i>Sea-ice Information Services in the World</i> (WMO-No. 574); (iv) Sea-ice Nomenclature and SIGRID data format;		
	(d) Review and updating of INFOCLIMA catalogue relevant to CMM;	WG on MMS	Continuous
	(e) Review and updating, as appropriate, the <i>Manual on MMS</i> and other WMO regulatory and guidance material, including the <i>Technical Regulations</i> ;	All WGs with Secretariat	Continuous
	(f) Provide appropriate initial input and keep under review the proposed International Exchange of Data and Products;	All WGs with Secretariat	Continuous
	(g) Continue the preparation and publication of relevant material in the Marine Meteorology and Related Oceanographic Activities Report series, including the scientific lectures on Ocean Remote-Sensing (CMM-XI);	All WGs with Secretariat	Continuous
	(h) Following guidance from the Executive Council, prepare information for EC on special marine data exchange requirements.	AWG	Continuous
<i>Techniques development</i>	(a) Keep under review development in the automation of shipboard observations, including hardware and software;	WG on MOS, CIMO	Continuous
	(b) Keep under review development in coupled ocean/atmosphere numerical models;	WG on MMS	Continuous
	(c) Promote and publicize development in numerical wave forecast techniques, including the use of satellite-derived wave data and marine surface wind models;	WG on MMS	Continuous
	(d) Advise and assist in the implementation of new wave forecast models;	WG on MMS	Continuous
	(e) Monitoring of requirements for specialized marine forecasts and preparation of guidance material;	WG on MMS	Continuous
	(f) Monitoring and publicizing improved techniques for <i>in situ</i> measurement: (i) For ocean waves; (ii) For winds and precipitation from VOS; (iii) From moored and drifting buoys;	WG on MOS with DBCP	Continuous
	(g) Review and preparation of guidance material, as appropriate, on remote-sensing techniques of ocean variables: (i) Satellite-based (active and passive); (ii) Ground-based; (iii) Aircraft-based.	WG on MOS	1993
<i>Implementation support</i>	(a) Identification of experts to advise on requirements for support by Members and on regional projects;	All WGs with Secretariat	Continuous
	(b) Monitor specific national and regional requirements for the implementation of MMS and MOS with the objective of developing regional co-operative arrangements and services;	WG on ETIS, Secretariat and RAs	1997

<i>Major project</i>	<i>Task</i>	<i>Execution</i>	<i>Target date</i>
<i>Implementation support (contd.)</i>	(c) Produce a study on techniques available on the quantitative analysis of the costs and benefits of marine meteorology and oceanographic services;	WG on MMS with IGOSS	1995
	(d) Monitoring of follow-up action on Agenda 21 by Members of WMO;	Rapporteur, AWG with Secretariat;	Continuous
	(e) Application of new information technology techniques to marine programmes;	AWG, WG on ETIS	Continuous
	(f) Provision of guidance and assistance on implementation and operation of automated coastal and near-shore marine stations.	WG on MOS with Secretariat	Continuous
<i>Specialized education and training</i>	(a) Review the curriculum for specialized long-term training courses at RMTCs and advise on the establishment of additional courses;	WG on ETIS	Continuous
	(b) Provision of specialized input and identification of expert lecturers for training seminars;	All WGs	Continuous
	(c) Identification and preparation of appropriate specialized training material for use by Members and RMTCs;	WG on ETIS with Secretariat	Continuous
	(d) Provide guidance material for education;	All WGs with WG on ETIS	1997
	(e) Completion of a bibliography on available publications in marine meteorology and physical oceanography;	WG on ETIS	1997
	(f) Produce a training video on observing at sea for use by PMOs and ships' officer training schools;	Members with Secretariat	1997
	(g) Support education and training and technical co-operation activities for implementation of GOOS;	AWG, WG on ETIS with I-GOOS	Continuous
	(h) Update the <i>Compendium of Meteorology for Use by Class I and II Meteorological Personnel</i> , (WMO-No. 364) Volume II — Part 3, Marine Meteorology;	WG on ETIS with Secretariat	1997
	(i) Provide training on the use of computer workstations to use gridded type data.	WG on ETIS	1997

ANNEX II

Annex to paragraph 5.3.8 of the general summary

TRANSMISSION SCHEDULE FOR FULL GMDSS SERVICE
(April 1993)

<i>METAREA</i>	<i>Issuing service</i>	<i>CES for scheduled broadcasts</i>	<i>Broadcasts schedule (UTC)</i>			
I	UK	Goonhilly for AOR (E)	0930	2130		
II	France	Pleumeur Bodou for AOR (E)	0900	2100		
III	Greece	Thermopylae (IOR)	0930	2130 (after October 1993)		
IV	USA	Southbury for AOR (W)	0430	1030	1630	2230
V	Brazil	Tangua for AOR (W)	0130	0730	1330	1930
VI	Argentina	Southbury for AOR (W)	0230	1730		
VII AOR	South Africa*	Goonhilly (AOR (E))	0920	1920		
VII IOR	South Africa*	Perth (IOR)	0920	1920		
VIII	India	Arvi (IOR)	(to be determined)			
IX	Saudi Arabia	Jeddah (IOR)	0500	1700		
X IOR	Australia	Perth (IOR)	1030		2330	
X POR	Australia	Perth (POR)	1100		2300	
XI IOR	China (FOR IOR)	Beijing (IOR)	0330	1530		
XI POR	Japan (FOR POR)	Perth (POR)	0230	0830	1430	2030
XII	USA	Santa Paula (POR) Southbury (AOR (W))	0545	1145	1745	2345
XIII	Russian Federation	Nakhodka (POR)	0930	2130		
XIV	New Zealand	Perth (POR)	0900	2100		
XV	Chile	Southbury (AOR (W))	1800			
XVI	USA	Southbury (AOR (W))	0515	1115	1715	2315

**TRANSMISSION SCHEDULE FOR INTERIM URGENT METEOROLOGICAL
WARNING INFORMATION SERVICE**
(April 1993)

<i>METAREA</i>	<i>Preparation service</i>	<i>Issuing service</i>	<i>CES for scheduled broadcasts</i>	<i>Broadcasts schedule (UTC)</i>			
III	Greece (Eastern Mediterranean) France (Western Mediterranean)	United Kingdom	Goonhilly (AOR (E))	1030			
V	Brazil	USA	Southbury (AOR (W))	2000			
VI	Argentina	USA	Southbury (AOR (W))	on receipt			
VIII	India (north of equator)	Australia	Perth (IOR)	0845			
VIII	Réunion ** (south of equator)	South Africa*	Perth (IOR)	on receipt			
IX	Saudi Arabia	Australia	Perth (IOR)	0845			
XIII	Japan (south of 60°N)	Japan***	Perth (POR)	0230	0830	1430	2030
XIV	New Zealand	Australia	Perth (POR)	2000			
XV	Chile	USA	Southbury (AOR (W))	2000			

* The Government of the Republic of South Africa has been suspended by Resolution 38 (Cg-VII) from exercising its rights and enjoying its privileges as a Member of WMO.

** Scheduled meteorological bulletins are prepared by Mauritius at 0830 and 1630. They include in PART I urgent meteorological warnings prepared by Réunion.

*** Included as part of full GMDSS services broadcasts for MSI Area XI.

ANNEX III

Annex to paragraph 6.1.8 of the general summary

STATEMENT OF OPERATIONAL ACCURACY REQUIREMENTS OF LEVEL II DATA
ACCORDING TO FM 12, 13, 15, 16 CODES

Variable	Range (1)	Reported resolution (2)	Mode of measurement/ observation (3)	Required accuracy (4)	Remarks
I. Temperature					
1. Air temperature	-60 – +60°C	0.1°C	I	±0.1°C	
2. Extremes	-60 – +60°C	0.1°C	I	±0.5°C	
3. Sea surface temperature	-2 – +40°C	0.1°C	I	±0.1°C	
II. Humidity					
1. Dewpoint	<-60 – +35°C	0.1°C	I	±0.5°C	• if measured directly • tending to ±0.1°C when relative humidity nearing saturation
2. Relative humidity	5 – 100%	1%	I	±3%	• if measured directly • tending to ±1% when relative humidity nearing saturation
III. Atmospheric pressure					
1. Pressure	920–1080 hPa	0.1 hPa	I	±0.1 hPa	• range at sea level
2. Tendancy	not specified	0.1 hPa	I	±0.2 hPa	• difference between instantaneous values
IV. Clouds					
1. Cloud amount	0 – 8/8	1/8	I	±1/8	
2. Height of cloud base	<30m – 30km	30m	I	±10m for 100m ±10% for >100m	
V. Wind					
1. Speed	0 – 75m/s	0.5 m/s	A	±0.5m/s for 5m/s ±10% for >5m/s	• average over 2 and/or 10 min.
2. Direction	0 – 360°	10°	A	±5°	• average over 2 and/or 10 min.
3. Gusts	5 – 75m/s	0.5 m/s	A	±10%	• highest 3 sec. average
VI. Precipitation					
1. Amount	0 – >400mm	0.1mm	T	±0.1mm for 5mm ±2% for >5mm	
2. Depth of snow	0 – 10m	1cm	A	±1cm for 20cm ±5% for >20cm	• average depth over an area representative for the observing site
3. Thickness of ice accretion on ships	not specified	1cm	I	±1cm for 10cm ±10% for >10cm	
VII. Radiation					
1. Sunshine duration	0 – 24h	0.1h	T	±0.1h	
2. Net radiation	not specified	1MJm ⁻² d ⁻¹	T	±0.4MJm ⁻² d ⁻¹ for 8MJm ⁻² d ⁻¹ ±5% for >8MJm ⁻² d ⁻¹	
VIII. Visibility					
1. M.O.R.	<50m – 70km	50m	I	±50m for 500m ±10% for >500m	
2. R.V.R.	50 – 1 500m	25m	A	±25m for 150m ±50m for 150–500m ±100m for 500–1 000m ±200m for >1 000m	• average over 1 min. and 10 min.
IX. Waves					
1. Wave height	0 – 30m	0.1m	A	±0.5m for 5m ±10% for >5m	• average over 20 min. for instrumental measurements
2. Wave period	0 – 100s	1s	A	±0.5s	• average over 20 min. for instrumental measurements
3. Wave direction	0 – 360°	10°	A	±10°	• average over 20 min. for instrumental measurements
X. Evaporation					
1. Amount of pan evaporation	0 – 10mm	0.1mm	T	±0.1mm for 5mm ±2% for >5mm	

(1) Common range for most variables, limits depend on local climatological conditions.

(2) The most stringent resolution as determined by the *Manual on Codes* (WMO-No. 306).

(3) I: Instantaneous – In order to exclude the natural small-scale variability and the noise, an averaged value over a period of one minute is considered as a minimum and most suitable; averages over periods of up to 10 minutes are acceptable.

A: Averaging – Averaged values over a fixed-time period as specified by coding requirements.

T: Totals – Totals over a fixed-time period(s) as specified by coding requirement.

(4) Recommended accuracy requirement for general operational use. Individual applications may have less stringent requirements. The stated value of required accuracy represents the uncertainty of the reported value with respect to the true value and indicates the interval in which the true value lies with a stated probability. The recommended probability level is 95% which corresponds to the 2 σ level for a normal (Gaussian) distribution of the variable. The assumption that all known corrections are taken into account implies that the errors in reported values will have a mean value (or bias) close to zero. Any residual bias should be small compared with the stated accuracy requirement. The true value is that value which, under operational conditions, perfectly characterizes the variable to be measured/observed over the representative time, area and/or volume interval required, taking into account siting and exposure.

ANNEX IV

Annex to paragraph 16.1 of the general summary

RECOMMENDATIONS OF THE COMMISSION FOR MARINE METEOROLOGY ADOPTED PRIOR TO ITS ELEVENTH SESSION AND MAINTAINED IN FORCE

Recommendation 3 (CMM-IX) — Expansion of marine climatological services

THE COMMISSION FOR MARINE METEOROLOGY,

NOTING:

- (1) The final report of CMM-VIII, general summary, paragraph 7.1 — Contribution of CMM to the World Climate Programme,
- (2) Resolution 5 (CMM-VIII) — Terms of reference of the Working Group on Marine Climatology,
- (3) The types of action required to achieve World Climate Data Programme objectives as established by Resolution 17 (Cg-IX),
- (4) The existence of potentially useful oceanic data products originating from remote-sensing and numerical analysis activities,
- (5) Technological advances in mass storage and information and microcomputer technology,

CONSIDERING:

- (1) The responsibility of CMM for developing guidelines relating to data management and archives,
- (2) The lack of such guidelines for marine data from remote-sensing and numerical analysis activities,
- (3) The existence of software in certain Member countries which is useful for providing data services and derived data products for climate research and applications,

- (4) The potential usefulness of microcomputer technology and other advances for the development of efficient and inexpensive marine climate data services,

RECOMMENDS:

- (1) That a list of marine climate parameters available from remote-sensing and numerical analysis activities be developed with a view to the future archival and exchange of related data for both operational and research purposes;
- (2) That guidelines be prepared for the archival and exchange of such data;
- (3) That the use of microcomputers and associated software for production and exchange of marine data products be encouraged and advances in emerging information storage technologies be kept under review;

INVITES Members to participate in these activities;**REQUESTS** the Secretary-General, in consultation with the presidents of CMM, CBS and CCI, as necessary, to provide support for the promotion of these activities.

Recommendation 9 (CMM-X) — Handbook on sea-ice navigation in the Southern Ocean

THE COMMISSION FOR MARINE METEOROLOGY,

NOTING:

- (1) The abridged final report of CMM-X, general summary, paragraph 10.3,
- (2) The final report of the fifth session of the CMM Working Group on Sea Ice,
- (3) Recommendation X of the XIVth Antarctic Treaty Consultative Meeting,
- (4) Resolution 14 (Cg-X) — Marine meteorology and associated oceanographic activities for the period 1988–1991,
- (5) The abridged report with resolutions of EC-XL, general summary, paragraphs 9.2.1 and 9.2.3,
- (6) Resolution 19 (Cg-X) — Antarctic meteorology,

CONSIDERING:

- (1) That the Antarctic Treaty Consultative Parties have invited WMO, SCAR and IOC to advise on ways of improving or developing operational marine meteorological and sea-ice information services for the Treaty area of the Southern Ocean,
- (2) That the publication of relevant manuals and guidance material relating to sea ice for the Region is a

necessary step in the development of marine meteorological and sea-ice information services,

- (3) That maximum acceptance of such guidance material amongst the maritime community may be gained through the participation of the International Maritime Organization (IMO) in its preparation,

RECOMMENDS:

- (1) That the preparation of a handbook on sea-ice navigation in the Southern Ocean be undertaken, based on the outline given in the annex to this recommendation;
- (2) That the handbook should not duplicate information already contained in *Sea-ice Information Services in the World* (WMO-No. 574);
- (3) That this handbook be published in all four languages of WMO since these are also the official languages of the Antarctic Treaty parties;

REQUESTS the Secretary-General to arrange for the preparation and publication of the handbook in 1991, as resources permit, in consultation with the president of CMM and the Secretary-General of IMO, as appropriate.

ANNEX TO RECOMMENDATION 9 (CMM-X)

DRAFT OUTLINE OF A HANDBOOK ON SEA-ICE NAVIGATION IN THE SOUTHER OCEAN

Preface: Goals and objectives of the publication; the scope of its application	3. Assessment and consideration of marine meteorological and sea-ice conditions in planning and in ship routing operations
1. Description of navigation conditions in the Southern Ocean	3.1 Marine meteorological conditions
1.1 Physiographic	3.2 Sea-ice conditions
1.2 Hydrological and meteorological	3.2.1 Quantitative indicators of sea-ice affects on ship routing
1.3 Sea ice	3.2.2 Types of marine operations and sea-ice classification as navigation medium
1.4 Ship routing	3.2.3 Classification of sea-ice conditions of ship routing
2. Regular features of spatial and temporal distribution of hydrological, meteorological and sea-ice conditions of ship routing	3.3 Location of optimal ship routes and recommended navigation time
2.1 Pressure systems, their trajectories and development, their effects on weather conditions	3.4 Recommendations for cargo operations at the Antarctic coast
2.2 Areas of storm waves and other adverse marine meteorological effects on weather conditions	4. Established international practices of marine meteorological services to ship routing
2.3 Characterization of Antarctic sea ice and its spatial and temporal variations	4.1 Sources of marine meteorological and sea-ice data
2.3.1 Pack ice	4.2 Volumes and types of information provided to users
2.3.2 Ice massifs and zones of their divergence	4.3 Principles of the usage of real-time and predicted information by users
2.3.3 Fast ice	5. List of recommended reference material for marine meteorological services to ship routing in the Southern Ocean: atlases, handbooks, reference books and similar publications.
2.3.4 Polynyas	
2.3.5 Icebergs	

Recommendation 10 (CMM-X) — Handbook on the analysis and forecasting of sea-ice

THE COMMISSION FOR MARINE METEOROLOGY,

NOTING:

- (1) Resolution 6 (CMM-IX) — Working Group on Sea Ice, by which the Commission decided to re-establish the Working Group on Sea Ice with terms of reference which included, *inter alia*, the review and promotion of international co-operation in improving methods of predicting sea-ice growth, drift and decay (including the preparation of guidance material on forecasting sea-ice conditions),
- (2) The report of the fifth session of the CMM Working Group on Sea Ice,

CONSIDERING:

- (1) That a handbook on the analysis and forecasting of sea ice is a means for technology transfer in the field of sea

ice to countries which do not have enough experience in the subject, in particular developing countries,

- (2) The responsibility of CMM for developing guidelines relating to sea-ice forecasting methods,
- (3) The lack of such guidelines for sea-ice forecasting techniques used at present by the leading Members of WMO for providing sea-ice services for various users,

RECOMMENDS:

- (1) That the preparation of a handbook on the analysis and forecasting of sea ice be undertaken, based on the outline given in the annex to this recommendation;
- (2) That the handbook be published by WMO;

REQUESTS the Secretary-General, in consultation with the president of CMM, to arrange for the preparation and publication of the handbook, as resources permit.

ANNEX TO RECOMMENDATION 10 (CMM-X)

DRAFT OUTLINE OF A HANDBOOK ON THE ANALYSIS AND FORECASTING OF SEA ICE

Contents	Coastal radar Other
Preface	
1. Major definitions and descriptions of sea ice	2.6.4 Upward-looking sonar
1.1 Terminology and main definitions	2.6.5 Other, including sea-ice albedo
1.2 Sea-ice formation	3. Methodological principles of collecting, processing and analysing ice data
1.2.1 Freezing of sea water	3.1 Visual observations
1.2.2 Ice crystals: formation and growth	3.1.1 Surface observations
1.2.3 Sea-ice growth	3.1.2 Airborne observations
1.3 Texture and physical characteristics of sea ice	3.1.3 Shipboard observations
1.3.1 Sea-ice structure	3.1.4 Specialized observations
1.3.2 Sea-ice texture	3.2 Instrumental observations
1.3.3 Sea-ice density and porosity	3.2.1 Contact measurements
1.3.4 Sea-ice thermal and physical characteristics	3.2.2 Remote sensing
1.4 Chemical composition and salinity of sea ice	3.2.3 Automatic data buoys
1.4.1 Sea-ice phase composition	3.3 Ice data collection
1.4.2 Brine migration	3.3.1 International sea ice formats
1.4.3 Salt crystallization	3.3.2 Data transmission procedures
1.4.4 Sea-ice salinity	3.3.3 Sea-ice composite maps
1.5 Sea-ice melting and disintegration	3.3.4 Centres of data collection
1.5.1 Radiational properties of sea ice	3.3.5 Sea-ice data banks: national and international
1.5.2 Thermal melting of sea ice	3.4 Review of sea-ice data analysis techniques
1.5.3 Enthalpy of sea ice (sensible heat)	3.4.1 Review of sea-ice data analysis techniques
1.5.4 Equilibrium thickness of sea ice	3.4.2 Statistical methods of sea-ice data analysis
1.5.5 Elastic and plastic properties of sea ice	3.4.3 Joint analysis of the processes in the ocean/atmosphere and sea ice
1.5.6 Sea-ice strength	3.4.4 Climatic regime atlases and reference books
1.5.7 Disintegration of sea ice	4. Introduction to mathematical modelling of sea ice
2. Main definitions and descriptions of sea-ice physical and geographic features	4.1 Major concepts
2.1 Terminology and main concepts	4.2 Interaction processes in the ocean/sea-ice/atmosphere system
2.2 Sea-ice formation	4.3 Simulation of sea-ice formation processes
2.2.1 Sea-surface cooling	4.4 Simulation of sea-ice dynamics
2.2.2 Ice freezing	4.5 Simulation of thermal breaking of sea ice
2.2.3 Sea-ice growth and spreading	4.6 Simulation of the annual sea-ice cycle
2.2.4 Snow on ice	5. Principles of sea-ice forecasting techniques
2.2.5 Heat flux to the sea-ice bottom	5.1 Basic principles of forecasting
2.3 Pack-ice motion processes	5.2 Empiric methods
2.3.1 Forms of floating ice	5.2.1 Generalized characteristics
2.3.2 Sea-ice drift	5.2.2 Time of ice formation
2.3.3 Deformation and hummocking	5.2.3 Sea-ice thickness
2.4 Melting and disintegration of sea ice	5.2.4 Time of sea-ice melting away
2.4.1 Melting from the surface, bottom and sides	5.3 Statistical methods
2.4.2 Formation of thaw holes	5.3.1 Evaluation of sea-ice occurrence probability
2.4.3 Stages of melting and disintegration of sea ice	5.3.2 Probability evaluation of sea-ice pressure
2.5 Spatial and temporal variability of sea ice	5.3.3 Forecasts with the due consideration of external forcing
2.5.1 Large-scale variability	5.4 Dynamic and thermodynamic methods
2.5.2 Mesoscale variability	5.4.1 Ice formation and growth
2.5.3 Effects of sea-ice inhomogeneities on thermal and dynamic sea/air interaction processes	5.4.2 Pressure and sea-ice redistribution
2.6 Sea-ice remote sensing	5.4.3 Melting and ice-free conditions
2.6.1 Visual and IR emissions of sea ice	5.5 Sea-ice forecasts: their validity, skill/score and adequacy
2.6.2 Sea-ice (microwave) brightness temperatures	
2.6.3 Radar: SAR	
SLAR	
Forward-looking radar	

6.	Provision of sea-ice information: structure	ANNEXES
6.1	Goals and objectives of sea-ice information	I-1 List of handbooks for sea-ice physics and chemistry
6.2	Provision of sea-ice information for long-term planning	I-2 Tables of the changes of major physical and chemical characteristics of sea ice
6.3	Provision of sea-ice information for annual planning	II-1 Sea-ice publications: bibliography
6.4	Operational sea-ice data	II-2 Tables and graphs of major statistical characteristics of the spatial and temporal variability of sea ice
6.5	Typical objectives of sea-ice data provision	III Table of comparison of different ice observing techniques
6.5.1	Sea-ice information for ship routing	IV List of models used in national sea-ice services and their capabilities
6.5.2	Sea-ice information for construction activity at the coast and offshore	V List of sea-ice forecasting methods used in national sea-ice services and their capabilities
6.5.3	Sea-ice data for geological prospecting, exploration, development	VI Bibliography on sea-ice information provision to user.
6.5.4	Sea-ice data for fishing	
6.5.5	Sea-ice data for operations on pack ice	
6.5.6	Sea-ice data for operations on fast ice	
6.5.7	Other uses of sea-ice data	

Recommendation 13 (CMM-X) — Specialized long-term education and training in marine meteorological and physical oceanography

THE COMMISSION FOR MARINE METEOROLOGY,

NOTING:

- (1) The high priority given by Tenth Congress to marine meteorological services and to improved specialized education and training in marine meteorological and physical oceanography,
- (2) The report of the Rapporteur on Education and Training to CMM-X,
- (3) Recommendation 11 (JWC-IGOSS-V) — Specialized long-term education and training related to IGOSS,

BEING AWARE that, with the notable exception of RMTc Manila, there is presently a lack of long-term specialized training courses in marine meteorology and physical oceanography at Regional Meteorological Training Centres,

CONSIDERING:

- (1) That properly trained personnel are essential to the further development, implementation and operation of marine meteorological services, and that training should extend also to the users of marine meteorological services, where this does not already occur,
- (2) That the expanded involvement of developing countries in programmes such as the Integrated Global Ocean Services System and the World Climate Research Programme is also dependent on the availability of specialized personnel in the field of marine meteorological and physical oceanography,

RECOGNIZING that long-term specialized training courses in marine meteorology and physical oceanography are

essential for the provision of suitably trained personnel for these purposes,

RECOMMENDS:

- (1) That high priority within WMO should be given to the development of long-term specialized training courses in RMTcs in the field of marine meteorology and physical oceanography;
- (2) That in particular every effort should be made to establish a six-month course on marine meteorology and physical oceanography at RMTc Nairobi as a matter of some urgency;
- (3) That, whenever possible, these courses should be developed and operated in close collaboration with IOC and the oceanographic community;
- (4) That following the successful establishment of a course in Nairobi, consideration should be given to the establishment of similar courses in RMTcs Oran and Buenos Aires;

REQUESTS the Secretary-General:

- (1) To approach funding sources, including UNDP, with a view to establishing appropriate long-term funding support for such courses;
- (2) In consultation with the president of CMM, the Secretary of IOC and the Directors of the RMTcs concerned, to develop as soon as possible curricula for these courses, for the consideration of the Executive Council Panel of Experts on Education and Training.

<i>Member</i>	<i>Name</i>	<i>Capacity</i>
Portugal (contd.)	A.M. Dias Pinheiro	Delegate/IHO
	C. Martínez A. Dias	Delegate
Rep. of Korea	Seang Hak Joong	Principal delegate
Russian Federation	P.A. Nikitin	Principal delegate
	I.E. Frolov	Delegate
Saudi Arabia	M. Al-Zaheri	Principal delegate
Socialist Rep. of Viet Nam	Nguyễn doãn Toàn	Principal delegate
Spain	J.L. Sánchez	Principal delegate
	A. Jansa	Delegate
Sweden	S. Andersson	Principal delegate
Syrian Arab Republic	A. Suleiman	Principal delegate
Tunisia	M. Rajhi	Principal delegate
United Kingdom	G. Mackie	Principal delegate
	R.J. Shearman	Alternate
	J. Hopkins	Delegate
United Rep. of Tanzania	D.N. Wambura	Principal delegate
United States of America	R.C. Landis	Principal delegate
	D.M. Feit	Alternate
	J.D. Elms	Delegate
	F. Kniskern	Delegate
	M.P. Koehn	Delegate
	J.W. Sherman III	Delegate

C. Lecturers

J. Guddal (Norway)
M. Heron (Australia)
E. Oriol (European Space Agency)
J.W. Sherman (United States)
S. Victorov (Russian Federation)
G. Withee (United States)
S. Yamamoto (Japan)

D. Representatives of international organizations

<i>Organization</i>	<i>Name</i>
United Nations Environment Programme (UNEP)	M.A. Gerges
United Nations Educational, Scientific and Cultural Organization/ Intergovernmental Oceanographic Commission (UNESCO/IOC)	Y. Tréglos
International Maritime Organization (IMO)	E. Rymarz
Collecte localisation satellites/ service Argos	C. Ortega
International Federation of Ships' Masters Association (IFSMA)	M.J.F. Marques Damas
International Hydrographic Organization (IHO)	A.M. Dias Pinheiro
International Maritime Satellite System Organization (INMARSAT)	A. Fuller

APPENDIX B

AGENDA

<i>Agenda item</i>	<i>Documents</i>	<i>Resolutions and Recommendations adopted</i>
1. OPENING OF THE SESSION	PINK 1	
2. ORGANIZATION OF THE SESSION	PINK 1	
2.1 Consideration of the report on credentials		
2.2 Adoption of the agenda	1; 2	
2.3 Establishment of committees		
2.4 Other organizational matters		
3. REPORT BY THE PRESIDENT OF THE COMMISSION	14; PINK 1	
4. REPORTS BY THE CHAIRMEN OF WORKING GROUPS AND BY RAPPORTEURS	17; 21; 26; 30; PINK 1	
5. MARINE METEOROLOGICAL SERVICES	21	
5.1 Basic marine meteorological services	11; 28; 34; PINK 3; PINK 10	Rec. 1, 2
5.2 Specialized marine meteorological services	23; 30; 40; PINK 3	
5.3 Marine telecommunication arrangements for product dissemination	4; 4, ADD. 1; PINK 8	Rec. 3
5.4 WMO Wave Programme	37; PINK 3	Rec. 4
6. SYSTEMS AND TECHNIQUES FOR MARINE OBSERVATION AND DATA COLLECTION		
6.1 Observational data requirements	29; 29, ADD. 1; PINK 2	
6.2 The WMO Voluntary Observing Ships (VOS) scheme	6; PINK 9	Rec. 5
6.3 Drifting and moored data buoys	36; PINK 9	Rec. 6
6.4 Oceanographic satellites and other remote sensing	35; PINK 12	Rec. 7
6.5 Other marine observing methods and instrumentation	10; PINK 15	
6.6 Marine telecommunication arrangements for data collection and transmission	7; 9; PINK 15	Rec. 8
6.7 Requirements for reporting codes	32; PINK 15	
6.8 The Global Ocean Observing System (GOOS) and Global Climate Observing System (GCOS)	16; 20; 20, ADD. 1; PINK 15	Rec. 9, 10
7. MARINE CLIMATOLOGY	30; PINK 4	
7.1 Contribution of CMM to the World Climate Programme	27	
7.2 Marine Climatological Summaries Scheme (MCSS)	3	Rec. 11
7.3 Other matters related to marine climatology	5; 5, ADD. 1; 5, ADD. 2	Rec. 12, 13, 14
8. SEA ICE	26; PINK 6	
9. REVIEW OF TECHNICAL REGULATIONS OF INTEREST TO CMM	24; PINK 6	Rec. 15

10. GUIDES AND OTHER TECHNICAL PUBLICATIONS	18; PINK 6	Rec. 16
11. EDUCATION AND TRAINING, TECHNOLOGY TRANSFER AND IMPLEMENTATION SUPPORT ACTIVITIES IN THE FIELD OF CMM		
11.1 Specialized education and training activities	13; 13, CORR. 1; 41; PINK 5	
11.2 Technology transfer and implementation support activities	19; PINK 5	
12. RELATIONSHIP WITH OTHER WMO PROGRAMMES AND THOSE OF OTHER ORGANIZATIONS AND BODIES		
12.1 Other WMO Programmes	8; 31; PINK 16	
12.2 Integrated Global Ocean Services System (IGOSS)	33; PINK 11	
12.3 Inter-secretariat Committee on Scientific Programmes relating to Oceanography (ICSPRO) and other organizations and bodies	15; 38; PINK 11	Res. 1
13. WMO LONG-TERM PLAN	22; PINK 16	
14. SCIENTIFIC LECTURES	39; 39, ADD. 1; PINK 12	
15. ESTABLISHMENT OF WORKING GROUPS AND NOMINATION OF RAPORTEURS	25; PINK 17	Res. 2, 3, 4, 5
16. REVIEW OF PREVIOUS RESOLUTIONS AND RECOMMENDATIONS OF THE COMMISSION AND OF RELEVANT RESOLUTIONS OF THE EXECUTIVE COUNCIL	12; PINK 7	Res. 6, Rec. 17
17. ELECTION OF OFFICERS	PINK 13; PINK 14	
18. DATE AND PLACE OF THE TWELFTH SESSION	PINK 14	
19. CLOSURE OF THE SESSION	PINK 14	

APPENDIX C

LIST OF DOCUMENTS

<i>Doc. No.</i>	<i>Title</i>	<i>Agenda item</i>	<i>Submitted by</i>
I. "DOC" series			
1	Provisional agenda	2.2	-
2	Explanatory memorandum relating to the provisional agenda	2.2	-
3	Marine Climatological Summaries Scheme	7.2	Secretary-General
4	Marine telecommunication arrangements for product dissemination The new GMDSS broadcast system ADD. 1	5.3	Secretary-General
5	Other matters related to marine climatology ADD. 1 ADD. 2	7.3	Secretary-General
6	The WMO Voluntary Observing Ships (VOS) scheme	6.2	Secretary-General
7	Marine telecommunications arrangements for data collection and transmission Meteorological and oceanographic reports through INMARSAT	6.6	Secretary-General
8	Other WMO Programmes Global Atmosphere Watch (GAW) and Joint Group of Experts on the Scientific Aspects of Marine Pollution (GESAMP)	12.1	Secretary-General
9	Marine telecommunication arrangements for data collection and transmission	6.6	Secretary-General
10	Other marine observing methods and instrumentation Automated Shipboard Aerological Programme (ASAP)	6.5	Secretary-General
11	Basic marine meteorological services Reports by the regional Rapporteurs on Marine Meteorological Services	5.1	Rapporteurs
12	Review of previous resolutions and recommendations of the Commission and of relevant resolutions of the Executive Council	16	Secretary-General
13	Specialized education and training activities CORR. 1	11.1	Secretary-General

<i>Doc. No.</i>	<i>Title</i>	<i>Agenda item</i>	<i>Submitted by</i>
14	Report by the president of the Commission	3	President of CMM
15	Inter-secretariat Committee on Scientific Programmes relating to Oceanography (ICSPRO) and other organizations and bodies Results of the United Nations Conference on Environment and Development	12.3	Secretary-General
16	The Global Ocean Observing System (GOOS) and Global Climate Observing System (GCOS) Global Climate Observing System	6.8	Secretary-General
17	Reports by the chairmen of working groups Report by the chairman of the Working Group on Technical Problems	4	Chairman of the working group
18	Guides and other technical publications	10	Secretary-General
19	Technology transfer and implementation support activities	11.2	Secretary-General
20	The Global Ocean Observing System (GOOS) and Global Climate Observing System (GCOS) Global Climate Observing System ADD. 1	6.8	Secretary-General
21	Reports by the chairmen of working groups Report by the chairman of the Working Group on Basic MMS	4, 5	Chairman of the working group
22	WMO Long-term Plan	13	Secretary-General
23	Specialized marine meteorological services A preliminary survey of cost-benefit studies of marine weather and oceanographic services	5.2	Chairman of the sub-group of experts
24	Review of technical regulations of interest to CMM	9	Secretary-General
25	Establishment of working groups and nomination of rapporteurs	15	President of CMM
26	Reports by the chairmen of working groups and rapporteurs Report by the chairman of the Working Group on Sea Ice	4, 8	Chairman of the working group
27	Contribution of CMM to the World Climate Programme	7.1	Secretary-General
28	Basic marine meteorological services Monitoring of marine meteorological services	5.1	Chairman of the sub-group of experts
29	Observational data requirements ADD. 1	6.1	Secretary-General

<i>Doc. No.</i>	<i>Title</i>	<i>Agenda item</i>	<i>Submitted by</i>
30	Reports by the chairmen of working groups and by rapporteurs Report by the chairman of the Working Group on Specialized Marine Meteorological Services, including Marine Climatology	4, 5.2, 7	Chairman of the working group
31	Other WMO Programmes Results from the 26 to 30 October 1992 Meeting of the Executive Council Working Group on the Commercialization of Meteorological and Hydrological Services	12.1	Secretary-General
32	Requirements for reporting codes	6.7	Secretary-General
33	Integrated Global Ocean Services System	12.2	Secretary-General
34	Basic marine meteorological services Marine Pollution Incident Support System	5.1	Secretary-General
35	Oceanographic satellites and other remote sensing Report by the chairman of the <i>Ad Hoc</i> Group on Ocean Satellites and Remote Sensing	6.4	Chairman of the <i>ad hoc</i> group
36	Drifting and moored data buoys	6.3	Secretary-General
37	WMO Wave Programme	5.4	Chairman of the <i>ad hoc</i> group
38	Inter-secretariat Committee on Scientific Programmes related to Oceanography (ICSPRO) and other organizations and bodies	12.3	Secretary-General
39	Scientific lectures ADD. 1	14	Secretary-General
40	Specialized marine meteorological services Predicted climate trends and their effect on marine industry	5.2	Chairman of the working group and president of CMM
41	Specialized education and training activities	11.1	Chairman of the sub-group
II. "PINK" series			
1	Opening of the session Organization of the session Report by the president of the Commission Reports by the chairmen of working groups and by rapporteurs	1, 2, 3, 4	President of CMM
2	Observational data requirements	6.1	Chairman, Committee B
3	Basic marine meteorological services Specialized marine meteorological services WMO Wave Programme	5.1, 5.2, 5.4	Chairman, Committee A

<i>Doc. No.</i>	<i>Title</i>	<i>Agenda item</i>	<i>Submitted by</i>
4	Marine climatology	7	Chairman, Committee A
5	Specialized education and training activities Technology transfer and implementation support activities	11.1, 11.2	President of CMM
6	Sea ice Review of technical regulations of interest to CMM Guides and other technical publications	8, 9, 10	Chairman, Committee B
7	Review of previous resolutions and recommendations of the Commission and of relevant resolutions of the Executive Council	16	Rapporteur
8	Marine telecommunication arrangements for product dissemination	5.3	Chairman, Committee A
9	The WMO Voluntary Observing Ships (VOS) scheme Drifting and moored data buoys	6.2, 6.3	Chairman, Committee B
10	Basic marine meteorological services Marine pollution incident support system	5.1	Chairman, Committee A
11	Integrated Global Ocean Services System (IGOSS) Inter-secretariat Committee on Scientific Programmes relating to Oceanography (ICSPRO) and other organizations and bodies	12.2, 12.3	President of CMM
12	Oceanographic satellites and other remote sensing Scientific lectures	6.4, 14	President of CMM
13	Election of officers Report of the Nomination Committee	17	Chairman, Nomination Committee
14	Election of officers Date and place of the twelfth session Closure of the session	17, 18, 19	President of CMM
15	Other marine observing methods and instrumentation Marine telecommunication arrangements for data collection and transmission Requirements for reporting codes The Global Ocean Observing System (GOOS) and Global Climate Observing System (GCOS)	6.5, 6.6, 6.7, 6.8	Chairman, Committee B
16	Other WMO Programmes WMO Long-term Plan	12.1, 13	President of CMM
17	Establishment of working groups and nomination of rapporteurs	15	President of CMM

LIST OF ABBREVIATIONS AND ACRONYMS

AMC	Area Meteorological Co-ordinator
ASAP	Automated Shipboard Aerological Programme
ASDAR	Aircraft-to-Satellite Data Relay
BATHY	Bathymetric Report
BUFR	Binary Universal Form for Records
BUOY	Report of a Buoy Observation
CAL	Computer Assisted Learning
CAS	Commission for Atmospheric Sciences
CBS	Commission for Basic Systems
CCCCO	Committee on Climate Changes and the Ocean
CCITT	Comité consultatif international télégraphique et téléphonique (of ITU)
CCI	Commission for Climatology
CES	Coast Earth Station
CGC	Co-ordination Group for COSNA
CGMS	Co-ordination of Geostationary Meteorological Satellites
CIMO	Commission for Instruments and Methods of Observation (of WMO)
CLICOM	Climate Data Management System
CLS	Collection, Location, Satellites
CMM	Commission for Marine Meteorology
COSNA	Composite Observing System for the North Atlantic
CPPS	Comisión Permanente del Pacífico Sur
CRS	Coastal Radio Station
DBCP	Data Buoy Co-operation Panel
DCP	Data Collection Platform
DRIFTER	Report of a Drifting Buoy Observation
E and P Forum	International Exploration and Production Forum (oil industry)
EGC	Enhanced Group Call System (of INMARSAT)
ESCAP	United Nations Economic and Social Commission for Asia and the Pacific
ETIS	Education, Training and Implementation Support
ETRP	Education and Training Programme
FAO	Food and Agriculture Organization of the United Nations
GAW	Global Atmosphere Watch
GCC	Global Collecting Centre
GCOS	Global Climate Observing System
GDPS	Global Data-processing System
GDSIDB	Global Digital Sea Ice Data Bank
GESAMP	Joint Group of Experts on the Scientific Aspects of Marine Pollution
GIPME	Global Investigation of Pollution in the Marine Environment (of IOC)
GLOSS	Global Sea-level Observing System (of IOC)
GMDSS	Global Maritime Distress and Safety System (of IMO)
GOOS	Global Ocean Observing System
GOS	Global Observing System
GTS	Global Telecommunication System
GTSPP	Global Temperature Salinity Pilot Project
ICS	International Chamber of Shipping
ICSPRO	Inter-secretariat Committee on Scientific Programmes Relating to Oceanography
ICSU	International Council of Scientific Unions
IDCS	International Data Collection System
IDPSS	IGOSS Data Processing and Services System
IFC	IGOSS Flexible Code
IFSMA	International Federation of Shipmasters' Associations
I-GOOS	IOC Intergovernmental Committee for GOOS
IGOSS	Integrated Global Ocean Services System
IHO	International Hydrographic Organization
IMMPC	International Maritime Meteorological Punch Card
IMMT	International Maritime Meteorological Tape
IMO	International Maritime Organization
IMPCC	International Maritime Meteorological Punch Card
INMARSAT	International Maritime Satellite Organization

IOC	Intergovernmental Oceanographic Commission
IODE	International Oceanographic Data and Information Exchange (IOC)
IOMAC	Indian Ocean Marine Affairs Conference
IOS	IGOSS Observing System
ISLP	IGOSS Sea Level Project
ITU	International Telecommunication Union
IUCN	International Union for the Conservation of Nature and Natural Resources
JGOOS	Joint Scientific and Technical Committee for GOOS
JSC	Joint Scientific Committee (for WCRP)
JSTC	Joint Scientific and Technical Committee
LTP	Long-term Plan
LUT	Local User Terminal
MARPOLMON	Marine Pollution Monitoring System (IOC)
MCSS	Marine Climatological Summaries Scheme
MDD	Meteorological Data Distribution System
MMS	Marine Meteorological Services
MPERSS	Marine Pollution Emergency Response Support System
MPI	Marine Pollution Incident
NMC	National Meteorological Centre
ODAS	Ocean Data Acquisition System
OOSDP	Ocean Observing System Development Programme
OPRC	Oil Pollution Preparedness Response and Co-operation
OWSE-NA	Operational WWW Systems Evaluation–North Atlantic
PMO	Port Meteorological Officer
REMPEC	Regional Marine Pollution Emergency Response Centre for the Mediterranean
RMC	Regional Meteorological Centre
RMTC	Regional Meteorological Training Centre
RNODC	Responsible National Oceanographic Data Centre (of IODE)
RSMC	Regional Specialized Meteorological Centre
RTH	Regional Telecommunication Hub
SCAR	Scientific Committee on Antarctic Research (of ICSU)
SCOR	Scientific Committee on Ocean Research (of ICSU)
SEALEV	Sea-level Reporting Code
SES	Ship Earth Station
SHIP	Report of Surface Observation from a Sea Station
SIGRID	Format for the Archival of Sea-ice Data in Digital Form
SOC	Specialized Oceanographic Centre (of IGOSS)
SOLAS	International Convention for the Safety of Life at Sea
SVP	Surface Velocity Programme
TEMA	Training, Education and Mutual Assistance in the Marine Sciences (IOC)
TESAC	Temperature, Salinity, Current Message
TOGA	Tropical Ocean Global Atmosphere (of WCRP)
TRACKOB	Marine Surface Observations Along a Ship's Track Report
UNCED	United Nations Conference on Environment and Development (Brazil, 1992)
UNEP	United Nations Environment Programme
UNESCO	United Nations Education, Scientific and Cultural Organization
UTC	Universal Co-ordinated Time
VCP	Voluntary Co-operation Programme
VOS	Voluntary Observing Ships
VSOP-NA	VOS Special Observing Project–North Atlantic
WARC	World Administrative Radio Conference
WCDMP	World Climate Data and Monitoring Programme
WCIRP	World Climate Impact Assessment and Response Strategies Programme
WCP	World Climate Programme
WCRP	World Climate Research Programme
WDC	World Data Center
WMC	World Meteorological Centre
WMO	World Meteorological Organization
WOCE	World Ocean Circulation Experiment (of WCRP)
WWW	World Weather Watch
XBT	Expendable Bathythermograph

WORLD METEOROLOGICAL ORGANIZATION

Supplement to WMO-No. 792
Abridged final report of the
eleventh session of the Commission for Marine Meteorology

Decisions taken by the Executive Council
at its forty-fifth session (1993)
on the abridged final report
of the eleventh session of the Commission for Marine Meteorology

This document should be considered as a guide to the status of the decisions adopted at the eleventh session of the Commission for Marine Meteorology.

A. DECISIONS RECORDED IN THE GENERAL SUMMARY OF THE WORK OF EC-XLV

6.4 MARINE METEOROLOGY AND ASSOCIATED OCEANOGRAPHIC ACTIVITIES PROGRAMME; THE REPORT OF THE PRESIDENT OF CMM AND REPORT OF THE ELEVENTH SESSION OF THE COMMISSION (agenda item 6.4)

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THE REPORT OF THE PRESIDENT OF CMM; REPORT OF THE ELEVENTH SESSION OF CMM

6.4.3 The Council noted with interest the report of the president of CMM, Mr R. J. Shearman, and expressed its considerable appreciation to Mr Shearman, to the chairmen of CMM working groups and sub-groups and rapporteurs, and to all members of the Commission, for their valuable efforts on behalf of WMO. The Council expressed its satisfaction with the work of CMM, as manifested in the final report of the eleventh session of the Commission and in the detailed workplan which had been developed for the next inter-sessional period.

6.4.4 The Council emphasized the importance of the Marine Meteorology and Associated Oceanographic Activities Programme, and of the work of CMM, both in the meteorological applications area in the provision of services in response to the expressed requirements of the marine user community, and also in the substantial support provided to other WMO Programmes through the development, implementation and improvement in a range of marine observing and communications systems. Such support includes that for the WWW, and also increasingly for global climate studies within the WCP and GCOS. The Council further emphasized the importance of the specialized education and training and implementation support activities of CMM to the full implementation of the marine programme. In this context, it noted with appreciation the establishment by the Commission of a full working group dealing with education, training and implementation support; the efforts underway, jointly with IOC, to establish a pilot postgraduate diploma course in marine meteorology and physical oceanography at RMTN Nairobi; and the projects, both underway and planned, for the co-ordinated development of marine observing systems, communications and services in a number of sub-regional areas. The Council strongly urged Members to co-operate in, and contribute to, these activities as a matter of priority.

6.4.5 The Council noted with satisfaction the increasing co-operation and co-ordination between CMM and the IOC in the work of the Commission, and expressed its appreciation to IOC for its support in this work. The Council specifically recognized newly developing areas of co-operation such as the joint implementation of specialized education and training courses in marine meteorology and physical oceanography, the implementation of the WMO wave programme and the use of Port Meteorological Officers to support IGOSS ships-of-opportunity. It therefore urged Members to co-operate with and assist the IOC and national oceanographic communities in their support for these activities, such as in submitting information on wave observation programmes to the Responsible National Oceanographic Data Centre for Waves (RNODC-waves) of IOC and in collaborating directly with oceanographers in the maintenance of IGOSS ships-of-opportunity lines.

6.4.6 The Council acknowledged the substantive work undertaken by CMM in developing the new WMO GMDSS Marine Broadcast System and the draft Marine Pollution Emergency Response Support System, as recorded in the final report of CMM-XI and in the recommendations adopted by the session. The Council further acknowledged the major contributions of the Commission to the co-ordination and maintenance of marine observing and data collection systems, including the voluntary observing ships, drifting and moored data buoys, meteorological/oceanographic vessels and oceanographic satellites, in support of both operations and research, including global climate studies. It congratulated the Commission for these achievements and urged it to continue its efforts to maintain and improve these systems and generally to provide the essential support in the marine area required by all other WMO Programmes. The Council recorded its decisions on the recommendations of the eleventh session of CMM in Resolution 10 (EC-XLV) — Report of the eleventh session of the Commission for Marine Meteorology. Relevant budgetary provisions for the implementation of the marine programme during the 1994/1995 biennium are included under agenda item 11. . .

B. RESOLUTION

Resolution 10 (EC-XLV) — REPORT OF THE ELEVENTH SESSION OF THE COMMISSION FOR MARINE METEOROLOGY

THE EXECUTIVE COUNCIL,

HAVING CONSIDERED the abridged final report of the eleventh session of the Commission for Marine Meteorology,

NOTES:

- (1) The report;
- (2) Resolutions 1 to 6 (CMM-XI);

DECIDES to take the following action on the recommendations:

Recommendation 1 (CMM-XI) — MARINE METEOROLOGICAL SERVICES MONITORING PROGRAMME

- (a) Approves this recommendation;
- (b) Urges Members to participate in the operation of this programme as specified in the recommendation;
- (c) Requests the Secretary-General to manage the implementation and operation of the programme, within the available budgetary resources.

Recommendation 2 (CMM-XI) — MARINE POLLUTION EMERGENCY RESPONSE SUPPORT SYSTEM (MPERSS)

- (a) Approves this recommendation;
- (b) Agrees that the implementation date for the trial system should be 1 January 1994;
- (c) Invites Members proposed to undertake certain responsibilities under the MPERSS to accept such responsibilities on a provisional basis;
- (d) Requests the Secretary-General:
 - (i) To assist Members in the implementation and further development of the trial system within the available budgetary resources;
 - (ii) To agree with Members concerned on their role and responsibilities in a possible future operational MPERSS;
 - (iii) To bring this recommendation to the attention of IMO, IOC and UNEP and to invite them to collaborate in the development and implementation of the MPERSS, as appropriate.

Recommendation 3 (CMM-XI) — NEW WMO GMDSS MARINE BROADCAST SYSTEM

- (a) Approves this recommendation;
- (b) Expresses its appreciation to CMM, and to Members concerned, for their efforts in developing and implementing the new system;
- (c) Requests the Secretary-General:
 - (i) To arrange for the inclusion of the new system in the *Manual on Marine Meteorological Services*;
 - (ii) To assist Members in the operation and further development of the new system, as appropriate;
 - (iii) To arrange for the inclusion of the broadcast schedules in WMO-No. 9, Volume D, as well as for their regular updating and promulgation to marine user organizations.

Recommendation 4 (CMM-XI) — WMO WAVE PROGRAMME 1993-1997

- (a) Approves this recommendation;
- (b) Urges Members to contribute, whenever possible, to the implementation of the wave programme;
- (c) Requests the Secretary-General:
 - (i) To assist in the implementation of the programme within the available budgetary resources;
 - (ii) To bring the recommendation to the attention of IOC and invite it to participate in the implementation of the programme.

Recommendation 5 (CMM-XI) — APPLICATIONS OF THE RESULTS OF THE VOS SPECIAL OBSERVING PROJECT NORTH ATLANTIC (VSOP-NA)

- (a) Approves the recommendation;
- (b) Urges Members operating VOS to implement relevant recommendations of the VSOP-NA as a matter of priority and, whenever possible, increase automation in the collection and transmission of ships' meteorological and oceanographic reports;
- (c) Requests the Secretary-General to assist Members, as necessary, in the implementation of this recommendation and to undertake other appropriate actions to follow-up the conclusions and recommendations of the VSOP-NA.

Recommendation 6 (CMM-XI) — DRIFTING BUOYS IN SUPPORT OF METEOROLOGICAL AND OCEANOGRAPHIC OPERATIONS AND RESEARCH

- (a) Approves this recommendation;
- (b) Urges Members and the Data Buoy Co-operation Panel to give serious consideration to the specific actions noted in the recommendation and, in particular, to endeavour to ensure the continued funding of existing and new buoy deployments on an operational basis;
- (c) Requests the Secretary-General to bring the recommendation to the attention of all concerned and to assist, as appropriate, in its implementation.

Recommendation 7 (CMM-XI) — THE APPLICATION OF REMOTELY-SENSED MARINE DATA TO MARINE METEOROLOGICAL AND OCEANOGRAPHIC SERVICES

- (a) Approves this recommendation;
- (b) Urges Members and satellite operating agencies to consider the implementation of procedures for the operational dissemination of remotely-sensed data to national Meteorological Services;
- (c) Requests the presidents of CIMO and CBS and the chairman of the Joint IOC/WMO Committee for IGOSS to collaborate in the implementation of the recommendation;
- (d) Invites the Secretary IOC to also collaborate in the implementation of the recommendation;
- (e) Requests the Secretary-General, in consultation with the president of CMM and others concerned, to facilitate the conduct of studies and workshops within the available budgetary resources.

Recommendation 8 (CMM-XI) — THE COLLECTION OF METEOROLOGICAL AND OCEANOGRAPHIC INFORMATION USING INMARSAT

- (a) Approves this recommendation;
- (b) Urges Members concerned to make every effort to implement the specific recommendations contained therein;

- (c) Requests the Secretary-General:
 - (i) To assist Members in the implementation of the recommendation;
 - (ii) To arrange for the establishment, as necessary, of a small WMO/INMARSAT liaison group, within the available budgetary resources;
 - (iii) In consultation with the Secretary IOC, to continue negotiations with Members concerning the development and implementation of software packages for the transmission of oceanographic data from ships at sea through INMARSAT.

Recommendation 9 (CMM-XI) — WMO CO-SPONSORSHIP OF THE IOC INTERGOVERNMENTAL COMMITTEE FOR THE GLOBAL OCEAN OBSERVING SYSTEM (I-GOOS)

- (a) Approves this recommendation;
- (b) Expresses its appreciation to the IOC for the offer to co-sponsor the I-GOOS;
- (c) Urges Members to participate actively in the work of the I-GOOS, and in all aspects of GOOS planning and implementation;
- (d) Invites Members to consider seconding staff to the WMO Secretariat in Geneva to facilitate the provision of WMO support to GOOS development;
- (e) Requests the Secretary-General:
 - (i) To establish the necessary arrangements, with the Secretary IOC, concerning WMO Secretariat support for GOOS, within the available budgetary resources;
 - (ii) To explore all possibilities for obtaining the extra-budgetary resources necessary for properly planning and implementing GOOS and to fulfil WMO's commitment as a co-sponsor of GOOS.

Recommendation 10 (CMM-XI) — AGENDA 21 AND IMPLEMENTATION OF GOOS AND GCOS

- (a) Approves this recommendation;
- (b) Urges the CMM Rapporteurs on the Follow-up to UNCED to provide advice and assistance to Members, as appropriate, in the implementation of the recommendation;
- (c) Urges Members to make use of the activities agreed in Agenda 21, Chapter 17 in their efforts to maintain and expand their marine observing systems in support of GOOS and GCOS, including recruitment of VOS, deployment of ocean data buoys, operation of marine meteorological/oceanographic vessels, and operation of ocean observation satellites;
- (d) Requests the Secretary-General:
 - (i) To bring the recommendation to the attention of all concerned;
 - (ii) To assist Members, as appropriate, in the implementation of the recommendation.

Recommendation 11 (CMM-XI) — MODIFICATION TO THE MARINE CLIMATOLOGICAL SUMMARIES SCHEME

- (a) Approves this recommendation;
- (b) Requests the Secretary-General:
 - (i) To bring the recommendation to the attention of Members concerned;
 - (ii) To arrange for the amendments given in the annex to this recommendation to be included in the *Manual on Marine Meteorological Services*.

Recommendation 12 (CMM-XI) — USE OF BEAUFORT EQUIVALENT SCALE OF WIND FORCE

- (a) Approves this recommendation;
- (b) Requests the Secretary-General to bring the recommendation to the attention of all concerned.

Recommendation 13 (CMM-XI) — MODIFICATION TO THE INTERNATIONAL MARITIME METEOROLOGICAL TAPE (IMMT) FORMAT FOR THE EXCHANGE OF MARINE CLIMATOLOGICAL DATA

- (a) Approves this recommendation;
- (b) Requests the Secretary-General:
 - (i) To arrange for the modified IMMT format to be included in the *Manual on Marine Meteorological Services*, following its formal implementation;
 - (ii) To inform Members in good time of details of the modified format and of its implementation date.

Recommendation 14 (CMM-XI) — GLOBAL TROPICAL CYCLONE DATA SET - REPORT FORMAT

- (a) Approves this recommendation;
- (b) Requests RSMCs concerned to provide tropical cyclone track and intensity data to the National Climatic Data Center, NOAA, USA, if possible in this agreed format;
- (c) Invites NCDC to transform all tropical cyclone data received in other formats into the agreed format before archival;
- (d) Requests the Secretary-General to assist Members in the implementation of this recommendation, within the available budgetary resources;
- (e) Notes that some additional improvements to the format, such as the inclusion of radius of tropical cyclone core and radius of maximum wind gust, may be required and requests the Secretary-General to bring this to the attention of the Third WMO/ICSU International Workshop on Tropical Cyclones (Mexico, November 1993) for its consideration.

Recommendation 15 (CMM-XI) — AMENDMENTS TO THE *TECHNICAL REGULATIONS*

- (a) Approves this recommendation;
- (b) Requests the Secretary-General to incorporate these amendments in his consolidated report on Technical Regulations to Twelfth Congress.

Recommendation 16 (CMM-XI) — AMENDMENTS TO THE *INTERNATIONAL LIST OF SELECTED, SUPPLEMENTARY AND AUXILIARY SHIPS (WMO-No. 47)*

- (a) Approves this recommendation;
- (b) Urges Members concerned:
 - (i) To provide the Secretariat with the necessary additional information to be included in the amended layout of the ships' list;
 - (ii) To submit updates to their national ships' lists on a quarterly basis, preferably on diskette;
- (c) Requests the Secretary-General:
 - (i) To bring this recommendation to the attention of all concerned;
 - (ii) To arrange for the agreed modifications to be made to the format and contents of publication WMO-No. 47 before 1 January 1994;
 - (iii) To arrange for the provision of the updated master ships' list to interested Members, organizations and institutions, on diskette, on a quarterly basis, in addition to the annual hard copy publication and magnetic tape dispatch.

Recommendation 17 (CMM-XI) — REVISION OF RESOLUTIONS OF THE EXECUTIVE COUNCIL BASED ON PREVIOUS RECOMMENDATIONS OF THE COMMISSION FOR MARINE METEOROLOGY

(Action on this recommendation was taken by the Council when reviewing its previous resolutions.)

NOTE: Budgetary implications of this draft resolution for the 1994/1995 biennium are taken into account in the Secretary-General's Programme and Budget proposals, which are considered under agenda item 11.