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

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ANNEXES

GENERAL SUMMARY OF THE WORK OF THE SESSION

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

1.1 The third session of the Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM) was opened by Dr Peter Dexter, co-president of the Commission, at 10 a.m. on Wednesday, 4 November 2009, in the Hotel Atlas Asni, in Marrakech, Morocco.

1.2 On behalf of the Government of the Kingdom of Morocco, Mr Abdelkebir Zahoud, Secretary of State in charge for the Water and Environment, welcomed the delegates to Marrakech, Morocco. He noted that JCOMM successfully brought together the marine meteorological and oceanographic communities to find the most effective ways of using and sharing collective resources, through enhanced partnerships among Members/Member States for a common purpose.

1.3 Mr Zahoud recalled that due to its geographical position, Morocco's coast stretches from the Mediterranean Sea to the Atlantic Ocean. Morocco development – economically, socially and culturally was highly dependent on the land and sea and their resources. He noted that as an impact of the climate change, Moroccan had been experiencing a number of natural disaster events, including droughts, inundations, erosion and desertification. Mr Zahoud emphasized that Morocco ever since, had been taking a keen interest in understanding the atmosphere and oceans, and to use it to improve services to citizens. He indicated that Morocco, and in particular the National Meteorological Administration, had been strengthening its infrastructure and staff capabilities, as well as national and international partnerships, to provide a better user-oriented service. Mr Zahoud noted that the third session of JCOMM would address a number of issues of relevance to all maritime Members/Member States, and would provide recommendations that reinforce the importance for international collaboration in developing and improving marine meteorological and oceanographic observation, data management and service systems. In closing, Mr Zahoud expressed the pleasure of Morocco in hosting this session and associated Scientific Lectures, and wished participants a productive meeting and an enjoyable stay in Marrakech.

1.4 On behalf of the World Meteorological Organization (WMO), Mr Michel Jarraud, Secretary-General, welcomed the delegates and expressed his appreciation to the Government of Morocco for hosting this session in the beautiful and historic city of Marrakech, an oasis at the foot of the High Atlas. He expressed his appreciation to the JCOMM Co-presidents, Drs Peter Dexter and Jean-Louis Fellous, for their leadership of the Commission during the intersessional period, as well as to all JCOMM Groups, Teams, Panels and Focal Points, for their outstanding work since the second JCOMM session, held in Halifax (Canada) during September 2005. Mr Jarraud indicated WMO's gratitude to Mr Abdalah Mokssit, Director of the National Meteorological Administration and Permanent Representative of Morocco with WMO, and to his staff, for the excellent arrangements made to ensure the success of the session.

1.5 Mr Jarraud recalled the origins of the partnership between WMO and IOC of UNESCO, traced back to the mid-fifties when UNESCO and WMO collaborated in the field of oceanography at the request of the United Nations, which took on a new dimension with the establishment of IOC in 1960. JCOMM was born from this long-standing partnership in order to coordinate worldwide marine meteorological and oceanographic services and their supporting observational, data management and capacity-building programmes. JCOMM had been operating as a WMO Technical Commission, as defined in the WMO General Regulations, and as a major IOC subsidiary body, as defined in the IOC Statutes, encompassing the activities of the former WMO Commission for Marine Meteorology (CMM) and the Joint IOC/WMO Committee for the Integrated Global Ocean Services System (IGOSS).

1.6 The Secretary-General of WMO noted that beyond an innovative approach in operational oceanography and marine meteorology, JCOMM had been a key step forward in interdisciplinary and inter-agency cooperation, so it can also be seen as a model of cooperation between oceanographers and meteorologists. However, he pointed out that a key issue facing both

disciplines had long been the lack of high-quality and timely data from vast oceanic areas, in particular to support weather prediction, climate studies and research, as well as to sustain marine safety services. In the same context, he emphasized that with our ever-increasing understanding of ocean and atmospheric processes and their coupled effects, as well as our unprecedented computational capabilities and data availability, we were indeed on the verge of an exciting new era. He then highlighted some of WMO's key accomplishments by briefly referring to two application areas where WMO makes a central societal contribution. The first one of these was related to climate services and the second to high impact weather forecasting, service delivery and disaster risk reduction.

1.7 Mr Jarraud recalled that the WMO had begun a new phase in the establishment of a Global Framework for Climate Services, a process that began in 1979 with the first World Climate Conference and the creation of the World Climate Research Programme (WCRP). A second consequence of the first Climate Conference was the 1988 establishment of the Intergovernmental Panel on Climate Change (IPCC) by WMO and UNEP, which was awarded the 2007 Nobel Peace Prize. He noted that in 1990, WMO convened the second World Climate Conference with partners, including the IOC of UNESCO, which led to the establishment of the Global Climate Observing System (GCOS) and the United Nations Framework Convention on Climate Change (UNFCCC). He informed the Commission that the third World Climate Conference approved a Declaration containing the decision to establish a Global Framework for Climate Services. Mr Jarraud emphasized that now the stage had been set to develop a new generation of prediction services and information, which will be delivered to decision-makers in all sectors through an internationally coordinated mechanism, having WMO and UNESCO, in particular through its IOC, to play a key role.

1.8 The Secretary-General of WMO recalled that the IPCC Fourth Assessment Report stated that some weather events and extremes would become even more frequent, more widespread and/or more intense during the 21st century. He indicated that this had also brought into focus the potential additional impacts of sea-level rise on coastal regions and lowlands, especially Small Island Developing States (SIDS), for which appropriate marine services would be vital. He indicated that WMO, the National Meteorological and Hydrological Services of its maritime Members and WMO's partners, including UNESCO/IOC, had long been active in the provision of marine meteorological forecasts and warnings, but the need for cooperation in the field of storm surge and wave prevention and mitigation was stronger than ever.

1.9 Mr Jarraud emphasized that the challenge for WMO and UNESCO/IOC would be to contribute to meeting the objectives of their respective Members' national development plans and those of the major international strategies, as well as striving for sustainable development and promoting scientific advances in marine meteorology and oceanography. Consequently, he indicated that active participation of Members/Member States in the Commission's work throughout the intersessional period was essential, keeping in mind that JCOMM should strive for an appropriate involvement of developing countries and countries with economies-in-transition in JCOMM's scientific and technical work.

1.10 In concluding, Mr Jarraud recalled that this would be Dr Patricio Bernal's last JCOMM session as UNESCO/IOC Executive Secretary, a key responsibility which he assumed in April 1998. He further recalled that the entire JCOMM lifetime had taken place during his mandate and so, on behalf of WMO as well as on his own behalf, Mr Jarraud wished to thank him wholeheartedly for his generous dedication to this vision and his unflinching collaboration. Lastly, he expressed once again WMO's gratitude to Morocco, for hosting this session and for the excellent facilities provided, and wished all the delegates an enjoyable stay in Marrakech and a most successful and productive session.

1.11 On behalf of the Intergovernmental Oceanographic Commission (IOC) of UNESCO, the Assistant Director-General of UNESCO and the Executive Secretary of UNESCO/IOC, Dr Patricio Bernal, welcomed the delegates to the third session of JCOMM. He expressed his sincere appreciation to the Government of Morocco, for hosting the session and for the excellent facilities and support services.

1.12 Dr Bernal recalled that JCOMM had been extremely successful as an implementation mechanism, by coordinating and developing standards and procedures for fully integrated marine observing, data management, and services system. He indicated that, as a joint body of two organizations, WMO and UNESCO/IOC, JCOMM benefited from the strengths and expertise of the existing met and ocean institutions, minimizing duplication of efforts acting as bridge between the meteorological and oceanographic communities. Dr Bernal stressed that despite progress, there were areas of concern, including the implementation of the ocean observing system that was particularly needed for the data sparse areas, such as the Polar Regions and Southern Ocean. He pointed out that many of the Essential Climate Variables (ECVs) defined in the GCOS Implementation Plan, over the ocean, had not been sufficiently covered so far. He encouraged all national institutions represented in JCOMM to continue supporting the sustained ocean-observing networks, and the relevant initiatives to monitor/analyse ECVs through advanced technologies, within in situ and satellite observations.

1.13 The UNESCO/IOC Executive Secretary highlighted that the key to the success of JCOMM had been the cooperation with existing relevant programmes, in particular, with the UNESCO/IOC International Oceanographic Data and Information Exchange (IODE). He emphasized that cooperation between IODE and the Data Management Programme Area of JCOMM had been very good and continuous JCOMM–IODE cooperation was needed with a view to acquiring a wider range of observing data for marine services, and to benefit from the technology and infrastructure of the IODE Ocean Data Portal (ODP) for developing marine services. Dr Bernal indicated that JCOMM priorities for the following years should also include the development of standards and best practices for operational ocean and marine meteorological data, products and services.

1.14 Dr Bernal informed the Commission that a number of initiatives had been made to improve regional monitoring and forecasting capabilities with respect to storm surges, following the recommendations by the first JCOMM Scientific and Technical Symposium on Storm Surges, held in Seoul, Republic of Korea, in October 2007. In this context, he welcomed the draft JCOMM workplan for the coming intersessional period, which put emphasis on the development of real time operational forecast capability for wind waves and storm surge. He stressed that we would also rely on the work of the Expert Team on Operational Ocean Forecasting Systems (ETOOFS) for identifying technical requirements, developing operational guides and best practices regarding ocean forecast products and services.

1.15 Dr Bernal recalled that in 2010 the IOC of UNESCO would celebrate its 50th anniversary and this would be a major milestone in its history. He further recalled that in the last fifty years, the UNESCO/IOC had achieved many accomplishments to global ocean systems in cooperation with many international organizations, agencies and institutes, including WMO, who had been a major partner for decades. He underlined that the establishment of JCOMM had been seen by many as an example of a successful cooperation and collaboration between two UN organizations.

1.16 The UNESCO/IOC Executive Secretary informed the Commission that a Ministerial Round Table on oceans during the 35th UNESCO General Conference was held in Paris, in October 2009. Conclusions of the Ministerial Round Table clearly showed the challenges that we were facing, which included climate change, ocean governance, monitoring, ecological services, and coastal communities. He further informed that Ministers highlighted the vital role of oceans in understanding climate change, as well as the role of UNESCO/IOC in supporting global governance of the oceans.

1.17 Dr Bernal indicated that JCOMM had been understood by UNESCO/IOC Member States as an essential mechanism to perform the mission of the UNESCO/IOC. He stressed that JCOMM had also been valued as a mechanism to integrate different communities of professionals working with operational systems, sharing common objectives for the provision of scientific and technical advice in order to improve the understanding of the oceans. He highlighted sharing views between communities had brought innovative ideas regarding the integrated operational systems for oceanography and marine meteorology.

1.18 Dr Bernal concluded by saying that this third session of JCOMM would be graded as an important milestone to review past achievements and future challenges, and to agree on the strategic and implementation plans that would eventually guide our two organizations to achieve the UNESCO/IOC High Level Objectives as well as the WMO Expected Results. He noted that this session would be an opportunity for Members/Member States to reaffirm their support to the completion and sustainability of the Global Ocean Observing System and related service systems. Finally, he wished all delegates a very productive and enjoyable session.

1.19 Mr Abdalah Mokssit, the Director of the National Meteorological Administration and Permanent Representative of Morocco with WMO, joined in welcoming the delegates to Morocco and to Marrakech. He noted that the development and implementation of meteorological and climatological information provides an essential support for the socio-economic development of any nation, and the Government of Morocco had been conscientious of the requirements for such developments. He was pleased to inform the Commission that the pillars of the strategic plan and developing programme for the National Meteorological Administration were:

(1) Strengthening of the observational network;

(2) Improving the telecommunication and data management systems;

(3) Applying Limited Area Models for improved forecasting and early warning systems;

(4) Improving the calibration and maintenance of instruments. In this context, Mr Mokssit noted that Morocco had became a Regional Instrument Centre within the framework of the WIGOS, and he was pleased to inform the Commission that it would be ready to take the required activities to act as a Regional Marine Instrument Centre;

(5) Undertaking technological development and adequate research for better addressing the users' requirements;

(6) Reinforcement of national and international partnerships;

(7) Strengthening of capacity and modernization of human resources management.

1.20 In concluding, Mr Mokssit reiterated the commitment of the National Meteorological Administration and the Government of Morocco to WMO and UNESCO/IOC activities, in particular those whose coordination falls under the responsibility of JCOMM. Finally, he wished all the participants a productive meeting and an enjoyable stay in Marrakech.

1.21 Following the long tradition within WMO Technical Commissions to formally recognize selected individuals who have undertaken outstanding work over many years, certificates for outstanding service to WMO and UNESCO/IOC, through JCOMM, were awarded by the Secretary-General of WMO and the Executive Secretary of UNESCO/IOC to:

(a) Mr John Falkingham (Canada), in recognition of his outstanding contributions over more than 30 years to the collection, processing, management and delivery to users of sea ice data and metadata, and especially to the development and fostering of international cooperation, procedures, formats and standards in sea ice data exchange, management and delivery;

(b) Mr Michael Johnson (United States of America), in recognition of his outstanding contributions to the development and implementation of operational ocean observing systems over the past 10 years, and in particular for coordinating, guiding and materially supporting the work of the JCOMM Observations Programme Area and its component teams in developing and carrying out strategies for this implementation, as well as for encouraging and supporting the incorporation of experimental and research systems into the operational programme;

(c) Mr Robert Keeley (Canada), in recognition of his outstanding contributions over more than 25 years to the collection, processing, management and delivery to users of ocean data and metadata, and especially to the development and fostering of international

cooperation, procedures, formats and standards in oceanographic data exchange and management.

1.22 On behalf of the *Institut Français de Recherche pour l'Exploitation de la Mer* (IFREMER), Dr Jean-Louis Fellous donated an Argo float to the National Meteorological Administration of Morocco. He noted that France had been very active in collaborating with Morocco in further developing operational oceanography and the understanding of the marine environment, and had played an important role in the implementation of the international Argo programme. The donation was seen as an encouragement to Morocco and other Members/Member States to join in contributing to the global ocean observing system.

1.23 There were 105 participants in the session. These included representatives of 40 Members of WMO and/or Member States of UNESCO/IOC, 4 international organizations and a number of invited experts. A complete list of participants is given in the appendix to the present report.

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

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

The representative of the Secretary-General of WMO presented a brief report on delegations whose credentials had been found valid. In accordance with General Regulations 20 to 23, the Commission approved this report and decided not to set up a Credentials Committee.

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

The proposed agenda, as contained in JCOMM-III/Doc. 2.2(1), was adopted on the understanding that, at any time during the session, additions or alterations could be made.

2.3 ESTABLISHMENT OF COMMITTEES *(agenda item 2.3)*

2.3.1 The Commission agreed that the work of the session would be carried out in plenary. General Plenary would be chaired by the co-presidents of the Commission and would consider agenda items 1, 2, 3, 4, 9, 13, 14, 15, 16 and 17. The co-presidents of the Commission delegated to (a) Prof. Johanny Johannessen (Norway) the chairmanship of Plenary A, which would consider the agenda items 6, 7, 10 and 12, related to Observations and Data Management Programme Areas; and (b) Dr Alexander Frolov (Russian Federation) the chairmanship of Plenary B that would address agenda items 5, 8, 11 and 12, on or relevant to Services Programme Area.

2.3.2 In accordance with Regulations 22 to 31, the Commission decided to establish three Committees.

Coordination Committee

2.3.3 In accordance with Regulation 28 of the WMO General Regulations, a Coordination Committee was established consisting of the co-presidents of the Commission, the representatives of the Secretary-General of WMO and Executive Secretary of UNESCO/IOC, and a representative of the host country.

Nomination Committee

2.3.4 To facilitate the election of the officers of the Commission, a Nomination Committee was established consisting of Dr Trevor Guymer (chair, United Kingdom of Great Britain and Northern Ireland) and principal delegates from the following members of the Commission: Chile, China, Malaysia, Morocco and the United States.

Selection and Structure Committee

2.3.5 The Commission decided to establish a Selection and Structure Committee for reviewing the proposed structure of the Commission, selecting members of the working groups (or similar bodies) established by the session and for nominating individual experts to undertake specific tasks. This Committee comprised of Dr Savi Narayanan (chair, Canada) and principal delegates from the following members of the Commission as core members: Mauritius, India, Brazil, New Zealand and Italy. However, the Commission decided that the Selection and Structure Committee would have an open membership.

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 Regulation 112 of 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.

3. REPORT BY THE CO-PRESIDENTS OF THE COMMISSION *(agenda item 3)*

3.1 The Commission noted with appreciation the report by Dr P. Dexter (Australia) and Dr J.-L. Fellous (France), co-presidents of the Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM), which provided an overview of the major activities, challenges and issues that the Commission had faced since its second session in September 2005, and would continue to face in the years to come; and the views of the Commission under the relevant WMO and UNESCO/IOC top-level objectives and expected results.

3.2 Recalling that JCOMM had come a long way since the development of the concept of a joint WMO/IOC technical commission in the mid-1990s, and its formal establishment in 1999, the Commission recognized the substantial work carried out in relation to in situ met-ocean observing, data management and forecasting systems, and services. In particular, the Commission noted the significant progress made in support of the development and implementation of operational met-ocean observing and forecasting systems, the interoperability between ocean data management systems and the WIS, and the delivery of real-time met-ocean services focused on marine user requirements. Details on those activities and major accomplishments were provided in the reports of the chairpersons of the Programme Areas and discussed under the relevant agenda items.

3.3 The Commission noted with appreciation the remarkable achievement of JCOMM during the past intersessional period, and congratulated the co-presidents and the JCOMM Management Committee for their continuing efforts to lead, review and guide the work of the three programme areas and crosscutting teams in order to implement the workplan. The Commission also noted with pleasure the efforts made to align JCOMM priorities and workplan with WMO Expected Results and UNESCO/IOC High Level Objectives, of which the details were further discussed under agenda item 14, and noted the need to streamline its structure, working methods and priorities in order to undertake work which is achievable within the available resources.

3.4 The Commission supported the priorities and theme areas introduced by the WMO EC-LXI and UNESCO/IOC-XXV (June 2009, see agenda item 4). In addition, the Commission called attention to the potential role of JCOMM in the work of the Global Reporting and Assessment of the state of the Marine Environment (GRAME), as well as in the Coastal GOOS implementation with particular focus to the needs of developing/least developed coastal countries.

3.5 In response to the information and issues raised in the report by the co-presidents, the Commission provided a number of comments and other inputs, the substance of which was recorded under subsequent agenda items.

3.6 The co-presidents expressed their sincere appreciation to all JCOMM members who had participated in the activities of the Commission for their enthusiastic cooperation. In particular, they thanked the chairpersons of the Programme Area Coordination Groups and the Expert Teams as well as the rapporteurs for their dedicated and outstanding work. On behalf of JCOMM, the co-presidents also thanked the Secretary-General of WMO, the Executive Secretary of UNESCO/IOC and the staff of the Secretariats, in particular the WMO WDS and OBS Departments, and the UNESCO/IOC GOOS Project Office, for their support and cooperation.

4. REVIEW OF DECISIONS OF THE GOVERNING BODIES OF WMO AND UNESCO/IOC RELATED TO THE COMMISSION *(agenda item 4)*

4.1 The Commission reviewed the decisions of sessions of the Governing Bodies of WMO and UNESCO/IOC relevant to the work of JCOMM and discussed their impact on the future work programme of JCOMM. Major conclusions were included in the general summary under the respective agenda items.

4.2 The Commission noted that WMO EC-LXI and UNESCO/IOC-XXV (June 2009) endorsed the theme areas proposed in the JCOMM work programme (aligned with WMO and UNESCO/IOC Strategic Planning) for the period 2010–2013, and agreed to consider the following priorities for the future under the agenda item 14.2:

- Further work to standardize, facilitate and apply operational met-ocean forecasting systems and services;
- Scientific and technical support for marine hazard forecasting systems, particularly for vulnerable coastal areas;
- Development of best practices and standards for operational ocean and marine meteorological data, products and services;
- Long-term maintenance and enhanced implementation of the ocean observing system, including close coordination with pilot projects and programmes, such as Argo and OceanSITES, and support for the IPY legacy projects SOOS and SAON;
- Joint work with IODE of UNESCO/IOC on data management standards, the UNESCO/IOC-IODE Ocean Data Portal, the JCOMM Pilot Project for WIGOS and further development of interoperability between ocean data management systems and the WIS;
- Technology transfer and implementation support, with especial attention to LDCs and SIDSs.

4.3 The Commission recalled that WMO Cg-XV (May 2007) reaffirmed that many of the marine-related activities, including those described above, could only be implemented through the full and active cooperation between WMO and UNESCO/IOC. Recognizing the advantage of multi-sponsored arrangements, such as JCOMM, the Commission supported enhanced inter-agency cooperation with clear lines of responsibility with respect to their mandates and specialities, and encouraged Members/Member States to follow this approach at national and regional levels.

4.4 The Commission discussed its contribution to the WMO and UNESCO/IOC Strategic Planning, its related JCOMM work programme, operating plan and organization, as well as new working methods with a view to improving efficiency and cost-effectiveness. The Commission noted that at the 2009 Meeting of Presidents of Technical Commissions, it was generally accepted that the Terms of Reference (ToRs) of the technical commissions need review with a view to linking each of the technical commissions' ToRs with the WMO's Results-based Management approach and overall Organization objectives and strategic thrusts. Recognizing that for JCOMM there was a need to fit in with both WMO and UNESCO/IOC planning processes, the Commission agreed to review its ToR and strategic approach. Major conclusions and decisions were included in the general summary and recommendations under agenda item 14.

5. ASSESS SCIENTIFIC AND OPERATIONAL REQUIREMENTS *(agenda item 5)*

5.0.1 The Commission recalled that it was its responsibility to review and propose responses to the requirements of operational and scientific users of in situ marine meteorological and oceanographic data. These users were represented in its own Services Programme Area; as well as by the other WMO Technical Commissions and programmes, other joint WMO/IOC programmes such as GOOS and GCOS, and other user communities.

5.0.2 The Commission requested that the observational and data requirements be regularly reviewed by the scientific and operational communities where feasible through Observing System Experiments, Observing System Simulation Experiments and various test-beds for the verification of impacts in a range of application areas. It recognized that this would be a valuable opportunity to strengthen collaboration among the JCOMM Programme Areas and with the GODAE Ocean View and relevant WMO Technical Commissions, as well as coordination between IODE and JCOMM. The Commission also recognized the need to refine cost-benefit analyses for ocean observations in order to build national support for implementation.

5.1 MET-OCEAN APPLICATIONS *(agenda item 5.1)*

5.1.1 The Commission noted that the WMO Rolling Review of Requirements (RRR) process gathered user requirements for observations by application area. The application areas included, inter alia, meteorology (global and regional NWP, nowcasting and synoptic meteorology) (see agenda item 5.3), operational oceanography, and its own marine services components. The Commission noted that the WMO-CEOS database fed by the RRR provided the requirements for both in situ and satellite derived observational data in support of all WMO Programmes, including joint WMO/IOC Programmes such as GOOS and GCOS.

5.1.2 Noting with appreciation that the WMO-CEOS database now contained a new sub-set relevant to marine meteorology and operational oceanography, allowing an accurate assessment of how the existing in situ ocean observing system was addressing JCOMM's own service requirements for such data, the Commission requested the Services and Forecasting Systems Programme Area (SFSPA) to ensure that the set of observational data requirements to support met-ocean applications continues to be reviewed. Further noting that the JCOMMOPS and the SFSPA had participated in the WMO/CBS Rolling Requirements Review process and that a new *Statement of Guidance (SoG) for Met-ocean Applications* had been produced (available at: http://www.wmo.int/pages/prog/sat/RRR-and-SOG.html), the Commission requested this work be pursued, through one or more experts designated by the co-presidents, and that the existing SoG be kept updated. In particular, the operational requirements for data in polar regions including the new Arctic METAREAs require further definition. The Commission reviewed extracts from this database relating to operational meteorology and met-ocean applications, and agreed that the Observations and Data Management Programme Areas should continue to address these requirements as part of their ongoing work programmes, in coordination with CBS as appropriate. The Commission urged the WMO Commission for Basic Systems to give full consideration to the requirements of JCOMM for real-time data transmission, storage and access when implementing WIS plan, and to invite JCOMM experts to involve in the implementation of WIS plan.

5.1.3 The Commission further addressed the RRR process under Item 5.3

5.2 GLOBAL OCEAN OBSERVING SYSTEM AND GLOBAL CLIMATE OBSERVING SYSTEM *(agenda item 5.2)*

5.2.1 The Commission recognized that as the primary scientific body for providing advice on requirements of ocean data for climate and related physical ocean systems, the GCOS-GOOS-WCRP Ocean Observations Panel for Climate was the scientific partner of JCOMM in the development of an ocean observing system. The Commission therefore welcomed the opportunity to regularly review the work of the Panel, which had responsibility to review the requirements for the open-ocean/climate module of the Global Ocean Observing System (GOOS), the ocean component of the Global Climate Observing System (GCOS).

The Global Ocean Observing System (GOOS)

5.2.2 The Commission noted with interest that GOOS comprised an open-ocean/climate module with scientific requirements and implementation guidelines recommended by OOPC and major implementation coordination by JCOMM; and a coastal module with scientific requirements and implementation guidelines recommended by the Panel for Integrated Coastal Observations (PICO) and major implementation coordination through GOOS Regional Alliances. The Commission recognized that JCOMM was responsible for the implementation and maintenance of a number of key observing elements of GOOS, including the GLOSS network of tide gauge stations, the tropical moored arrays and surface drifting buoy arrays coordinated by the Data Buoy Cooperation Panel (DBCP), and the surface meteorological and subsurface ocean observations taken from commercial ships coordinated by the Ship Observations Team (SOT), and that reaching and maintaining full implementation of the observing network design goals should be a key element of its work programme in the coming intersessional period. It appealed to Members/Member States to commit additional resources to reach and maintain full implementation, noting that forward progress had slowed in the past intersessional period. The Commission took note of the GOOS secretariat and advisory panels intent to develop recommendations for an open-ocean observing system that would extend beyond its current designed capability to monitor, understand, and forecast climate variability and change, to include the ability to monitor and assess human impacts on and vulnerabilities to the ocean. This would include observations of relevant biogeochemical and ecosystems variables, and contribute to a potential UN regular process for assessments of the marine environment.

5.2.3 The Commission emphasized the importance of coastal observations in providing information relevant to society, and recognized the need to build capacity in developing countries to take these observations according to internationally agreed standards, and to promote capability and procedures for the exchange of data and information. It emphasized the importance of free exchange of data in the coastal zone (including biogeochemical and socio-economic), and welcomed all Members/Member State contributions in this regard. The Commission re-stated its willingness to collaborate with relevant bodies and groups in the implementation of non-physical observations and data products on a global basis. It took note of the Intergovernmental Committee for GOOS's (I-GOOS) desire to develop quantitative benchmarks for coastal implementation with stepwise implementation, and in particular noted its willingness to work with GOOS Regional Alliances where appropriate.

The OceanObs'09 Conference

5.2.4 The Commission recognized that the *OceanObs'09 conference* (Venice, Italy, September 2009, http://www.oceanobs09.net/) had played a major role in consolidating a vision for the provision of routine and sustained global information on the marine environment sufficient to meet society's needs for describing, understanding and forecasting marine variability (including physical, biogeochemical, ecosystems and living marine resources), weather, seasonal to decadal climate variability, climate change, sustainable management of living marine resources, and assessment of longer term trends. The Commission noted that a JCOMM representative was involved in a post-conference Working Group on the integration of the ocean observing system, and requested its Management Committee to coordinate with the appropriate Programme Areas to address the implementation of any actions referred to JCOMM by the conference and the Working Group.

The Global Climate Observing System (GCOS)

5.2.5 The Commission recognized that JCOMM was responsible for the implementation of the ocean domain of GCOS. It noted with satisfaction the progress in the previous intersessional period.

5.2.6 The Commission urged Members/Member States to continue efforts to ensure sustainability of the different components of the initial ocean observing network that have reached their design goal (surface drifters and Argo). The Commission noted that several important

components are only partially implemented. It noted that support from operational agencies and users will be needed to justify their longer-term funding. Recalling the Conference Statement from OceanObs'09, which calls on nations and governments to fully implement by 2015 the initial global ocean observing system, the Commission urged Members/Member States to increase their efforts to complete and sustain all components of the initial system in accordance with the GCOS Implementation Plan.

5.2.7 The Commission recognized that ASAP soundings over remote ocean areas complement AMDAR data (vertical AMDAR soundings are only available at or near airports). It recognized that satellite data telecommunication Pilot Projects (e.g., DBCP and SOT Iridium pilot project) were showing promising results and were leading to the potential decrease in the overall costs of drifter and ship Automatic Weather Station (AWS) observations, while at the same time improving the timeliness of data delivery.

5.2.8 The Commission was informed that the GCOS-WCRP Atmospheric Observation Panel for Climate, at its thirteenth session (Geneva, April 2007), had recognized that monthly CLIMAT TEMP/CLIMAT TEMP SHIP reports had very limited value for ongoing climate research purposes, taking into account improvements in collection and exchange of the daily TEMP/TEMP SHIP messages and improved real-time quality control at operational weather prediction centres. However, it was noted that an agreement was foreseen with ECMWF and the US National Climatic Data Center to pursue their respective TEMP/TEMP SHIP monitoring activities for the GCOS Upper-air Network.

5.2.9 The Commission recalled that many ocean observing systems, such as Argo, had developed from research-based systems. It thus supported the continuing work of the WCRP Climate Variability and Predictability (CLIVAR) project on the development of pilot observing systems in all oceans of the world. It encouraged increased coordination of sustained ship-based hydrographic sections making hydrographic, carbon and biogeochemical observations through the GO-SHIP programme.

5.2.10 The Commission recognized that VOS measurements of SST and other variables are an essential component of GOOS and GCOS. It requested Members/Member States to collaborate with the shipping industry to maintain and increase the flow of VOS marine meteorological and oceanographic reports. It requested Members/Member States to make efforts to ensure that records are as complete as possible, can be associated with up-to-date metadata and where appropriate to collect and record the additional elements required for VOSclim. In particular, real-time information on ship call signs is used by NWP centres to monitor the quality of the data, and readily accessible information on call signs is needed by climate scientists to link the observations to ships metadata so that the data can be properly quality controlled or bias adjusted. At the same time the Commission agreed that the prevention of information on ships' call signs being made available outside the JCOMM community was very important in safeguarding the security of ships and in retaining the cooperation of ship operators and crews in the VOS scheme.

5.2.11 The Commission supported the request from the WMO Executive Council to develop cost-effective in situ wave-observing technology and to promote the deployment of wave buoys in data-sparse areas.

5.2.12 The Commission noted that the OOPC had contributed to a Progress Report on the Implementation of GCOS 2004–2008, prepared by the Global Climate Observing System (GCOS) in response to a request from the UNFCCC as well as an update of the 2004 GCOS Implementation Plan (GCOS-92), drawing in part on the OceanObs'09 conference, which was currently under open review and would be finalized in 2010. The Commission recalled that this Implementation Plan is the plan for the open-ocean/climate component of GOOS and was recognized by JCOMM as the roadmap for the Observations Programme Area workplan in the previous inter-sessional period. The Commission urged Members/Member States to take the necessary actions to ensure that progress is made with respect to the status of the climate observations documented in the Progress Report and in the updated Implementation Plan.

5.2.13 The Commission called on Members/Member States to establish the GCOS National Committees and to identify GCOS National Coordinators in order to facilitate coordinated national action on observing systems for climate, including in particular the ocean components.

5.2.14 The Commission stressed the need to continue its support for the implementation of the Climate for Development in Africa (ClimDev Africa) Programme, which, among other issues on climate, addresses both observational and climate services needs in Africa.

5.2.15 The Commission welcomed the ongoing implementation of the Global Space-based Inter-calibration System that contributes to the integration of satellite systems and consistency of satellite data records as required for climate monitoring, and encouraged the further implementation of the Sustained Coordinated Processing of Environmental Satellite Data for Climate Monitoring.

5.2.16 The Commission expressed grave concern at the continuing difficulty in maintaining adequate climate observing networks in many parts of the world, especially in developing countries, as well as the potential unavailability over the next decade of several vital satellite records of Essential Climate Variables, including key oceanographic missions such as the precision altimeters.

5.2.17 The Commission recognized the vital role of GOOS in providing the ocean component of the strengthened Global Climate Observing System that will be required as part of the proposed new Global Framework for Climate Services (GFCS) and urged its co-sponsors (WMO, UNEP, IOC, ICSU) and Members/Member States to provide the strongest possible support for GOOS implementation and long-term continuity in the UN system-wide follow-up to the World Climate Conference-3.

5.3 GLOBAL AND REGIONAL NUMERICAL WEATHER PREDICTION AND SYNOPTIC METEOROLOGY *(agenda item 5.3)*

5.3.1 In addition to those issues addressed under agenda item 5.1, the Commission agreed on the importance of the RRR process for all applications, including not only met-ocean applications but also global and regional NWP, seasonal and inter-annual forecasting and synoptic meteorology. The Commission emphasized the importance of an integrated approach between in situ and satellite observations when considering requirements. It emphasized the importance of broad participation of experts in the RRR process, including those familiar with the in situ ocean observing networks. The Commission therefore agreed that all Programme Areas of JCOMM should work with CBS in reviewing the requirements for ocean observations for the above-mentioned applications and their Statement of Guidance (SoGs).

5.3.2 Noting that the *Implementation Plan for the Evolution of the GOS* (EGOS-IP), which was developed in response to the *Vision for the GOS* and the gaps identified by the SoGs, contains sections relevant to ocean observing systems, the Commission agreed that the Observations and Data Management Programme Areas should address the requirements described in those sections as part of their ongoing work programmes, in coordination with CBS. It appealed to Members/Member States to commit additional resources to address the gaps noted in the EGOS-IP.

5.4 OTHER *(agenda item 5.4)*

5.4.1 The Commission also emphasized the importance of polar observations for global understanding and prediction of climate change, and noted that there would be increasing requirements for information in polar regions under the SOLAS convention. It noted that a number of initiatives to secure an International Polar Year (IPY) 2007/2008 observing system legacy were endorsed by the WMO EC-LXI and IOC-XXV Sessions, including the Sustained Arctic Observing Networks (SAON), the Integrated Arctic Ocean Observing system (iAOOS), the Southern Ocean Observing System (SOOS), the Global Cryosphere Watch (GCW) and Polar Satellite Constellation (PSC), which will be developed to reinforce regional observing systems in both polar regions as

valuable contributions to existing global observing systems. The Commission encouraged involvement of its Programme Areas in these initiatives in cooperation with the WMO EC Panel on Polar Observations, Research and Services established by WMO EC-LX. Further IPY legacy issues were addressed under agenda item 13.

5.4.2 The Commission requested the Management Committee to keep the issue of ocean data requirements in general under constant review.

6. IN SITU AND SATELLITE OBSERVING SYSTEMS *(agenda item 6)*

6.0.1 The Commission noted with appreciation the detailed report by Dr Eric Lindstrom (United States) on behalf of the Coordinator of the Observations Programme Area (OPA), Ms Candyce Clark (United States), and the significant progress made during the last intersessional period on the implementation of the global ocean observing system, for the enhanced coordination between the different system components, and on enhancing collaboration with other organizations. The Commission noted that the metrics for the observational elements which was presented by OPA has been particularly useful to promote JCOMM nationally and internationally. The Commission expressed its appreciation to Ms Clark and to the many experts who had served on the OPA Coordination Group (OCG) and teams, including their chairpersons, Mr David Meldrum (United Kingdom), Mr Graeme Ball (Australia), and Dr Mark Merrifield (United States), and rapporteurs, Dr Eric Lindstrom (United States) and Ms Miriam Andrioli (Argentina).

6.1 JCOMM OBSERVATIONS PROGRAMME AREA IMPLEMENTATION GOALS *(agenda item 6.1)*

Implementation goals

6.1.1 The Commission reviewed the OPA implementation goals, and welcomed the increasing emphasis on system-wide performance metrics based on Essential Climate Variables (ECVs) as a way to further integrate and rationalize the networks. The Commission requested the OCG to continue its work towards ECV-based metrics, and directed the OCG to keep the document under review and update it according to the latest developments with regard to (i) the Progress Report on the Implementation of the Global Observing System for Climate in Support of the UNFCCC 2004–2008; (ii) the outcome and recommendations from the OceanObs'09 conference; (iii) the outcome of the Third World Climate Conference (WCC-3); (iv) non-climate requirements arising from the CBS Rolling Review of Requirements, including Statements of Guidance and gap analysis, and (v) the forthcoming update to GCOS-92, the implementation strategy for the global climate observing system. The Commission emphasized the importance of a dialogue between those who implement the networks and potential users asking for new capabilities based on their requirements, in order to balance technological capability, network optimization, and funding interest.

6.1.2 While the Commission noted with appreciation that 61 percent of the overall ocean observing system was now completed (August 2009), where the drifting buoy and Argo float arrays had achieved their initial implementation targets and the preliminary target for VOS Climate (VOSClim) recruitment had been achieved, it recognized with concern that progress had slowed recently. The Commission agreed that efforts remained to be made to achieve sustainability for those components that reached their design goal, including broadening support for some observing components beyond the traditional research-based funding to include operational support. It therefore requested the Observations Coordination Group (OCG) to develop its work programme for the next intersessional period according to the need to enhance the partnerships between research institutes and operational services. The Commission stressed that integration was key and that every effort should be made to satisfy multiple requirements so that all stakeholders might benefit from Member/Member State contributions. The Commission appealed to Members/Member States to commit additional resources to eventually ensure full implementation and sustainability of the observing components of GOOS and support the integration of in situ and space-based ocean observations

6.1.3 The Commission agreed that it was important to clearly articulate priorities. The Observations Coordination Group was expected to produce a list of expected outcomes, the corresponding actions that would be undertaken by the OPA during the next intersessional period and the related performance indicators. This would enable the funders of the OPA to better assess how well the workplan had been implemented.

6.1.4 The Commission recognized the continued logistical challenge of maintaining the array of global drifters at its target level, especially in data sparse regions, and agreed that a more coordinated approach was needed to address the management of deployment opportunities and the deployment of instruments at sea, including drifters and profiling floats, as well as the servicing of moored buoys. It requested the Observations Coordination Group to propose a strategy for the OPA to enhance deployment opportunities, and Members/Member States to make information on deployment opportunities routinely available to JCOMMOPS.

6.1.5 The Commission noted that the JCOMMOPS was playing an increasingly vital role in the activities of most of the OPA panels and that JCOMMOPS provided a strong link between the OPA implementation goals and the DMPA implementation goals. The Commission also noted that the current funding model and level of contributions from Members/Member States, was not sufficient to ensure a sustained JCOMMOPS. Activities such as increased coordination for opportunistic deployments and management of detailed platform metadata are important for achieving system wide efficiencies and for ensuring the usefulness and long-term preservation of the data gathered by the in situ observing system. The Commission urged Members/Member States to commit resources to JCOMMOPS so that JCOMMOPS can realize its potential of serving a truly integrated observing system. Furthermore, recognizing the value of JCOMMOPS metadata holdings to parties outside the panels and associated programmes supporting its work, the Commission urged OCG to find a funding mechanism by which JCOMMOPS can partner with other agencies (e.g. space agencies) for the benefit of JCOMM.

6.1.6 The Commission requested the OCG to complete the oceanographer's and marine meteorologist's cookbook for submitting data in real time and in delayed mode as a matter of priority in order to improve the wider dissemination of the collected oceanographic and marine meteorological data by Members/Member States to the international community.

6.1.7 The Commission agreed that a number of activities should be further developed to increase the performance of the overall ocean observing system, including: (1) the establishment of an expanded JCOMMOPS (see agenda item 6.4); (2) the increased coordination with communities that use marine mammals as platforms for ocean observing sensors (see agenda item 6.3); (3) the overall JCOMM strategy on Quality Management, including strengthened JCOMM performance metrics (see agenda item 11); and (4) the implementation of the recommendations from the JCOMM Pilot Project for WIGOS (see agenda item 10.2). The Commission applauded the Community White Papers prepared on each of the observing networks for the OceanObs'09 conference, and instructed the OCG to work to incorporate these consensus plans into its future work.

6.1.8 The Commission reaffirmed that its priority remains building and sustaining the current observing systems to agreed standards with near-real-time data reporting, and broadening the base of national participation.

6.1.9 The Commission noted that the OceanObs'09 conference (Venice, Italy, September 2009) had permitted to update a number of user requirements for ocean observations. It requested the OPA to translate the outcome and recommendations of OceanObs'09 into an updated version of the JCOMM OPA implementation goals.

6.1.10 The Commission requested the OPA to better consider coastal requirements in its workplan, taking into consideration the needs of developing/least developed coastal countries.

In situ observing systems

6.1.11 JCOMM Observations Panels

The Data Buoy Cooperation Panel (DBCP)

6.1.11.1 The Commission noted with appreciation that the quality and quantity of drifter data continued to improve, and that half of the drifter fleet is now equipped with barometers. The Commission therefore strongly endorsed the OPA implementation goals, which call for installing barometers on all newly deployed drifters. It urged Members/Member States to make use of the DBCP barometer upgrade scheme implemented through the Global Drifter Programme (GDP) and supported by the United States.

6.1.11.2 Noting that the Panel had been working at enhancing data timeliness through both the extension of the Argos regional antenna network, and the increasing use of Iridium satellite data telecommunication to collect the data in real-time, the Commission urged the DBCP to continue its efforts to improve data timeliness. It also urged Members/Member States to collaborate with the DBCP by making Local User Terminal data available through Service Argos. Noting that data delivery from some stored Argos datasets continued to be subject to serious delay, the Commission invited the US to assist in the resolving of the blind orbit issue due to a non-optimal geographic distribution of global ground stations for the NOAA polar orbiters that carry the Argos payload.

6.1.11.3 The Commission strongly supported the DBCP approach and initiatives towards more efficiency, as well as the evaluation of new sensors and communication technologies, and the development of Pilot and Capacity-Building activities. It urged Members/Member States to commit resources to the DBCP Trust Fund of WMO and UNESCO/IOC to ensure the essential DBCP Technical Coordinator's position, and allow full support of the DBCP work programme.

The Ship Observations Team (SOT)

6.1.11.4 Noting that the preliminary target for VOS Climate (VOSClim) recruitment was achieved by June 2007, the Commission endorsed the proposals from the Ship Observations Team (SOT), as documented in the final report of SOT-V (available at http://www.jcomm.info/sot5), to end the VOSClim as a project, and integrate it in the wider VOS. The Commission agreed to consider amendments to the *Guide to Marine Meteorological Services* (WMO-No. 471) under agenda item 12. At the same time, the Commission noted that much effort still needed to be made to ensure that the required additional metadata and quality control elements are routinely produced, collected, and recorded in the archives. It therefore urged Members/Member States to pay particular attention to this issue. The Commission recognized that the VOS data were now of as great a value to global climate studies as they were to NWP and operational meteorology and oceanography. It therefore urged the global climate community, through the OOPC, to work with JCOMM and its SOT to secure the support necessary to maintain and if possible expand the existing VOS fleet. It further recognized that many of the traditional manually observed variables from the VOS were no longer available, because of the increased automation of shipboard observing systems, but nevertheless remained of value to global climate studies and weather forecasts. It therefore requested VOS operators, and the SOT, to take this issue into account in their management of the VOS fleet.

6.1.11.5 The Commission recalled the issue of ship owners and masters concerns with regard to availability of VOS information on public web sites. Noting that the WMO Executive Council adopted Resolution 27 (EC-LIX) authorizing Members to implement ship-masking schemes, the Commission requested the SOT as a matter of priority to coordinate the development of a universally accepted solution as soon as possible for subsequent consideration by the WMO Executive Council.

6.1.11.6 The Commission endorsed the recommendations from the SOT, as documented in the final report of SOT-V, to improve coherence and quality of the data, resulting from the conduct

of an e-logbook intercomparison, and urged Members/Member States to implement the recommendations.

6.1.11.7 Noting the progress made regarding the development of guidelines on standards for instruments, which include a list of related WMO, UNESCO/IOC, and national publications for each of the SOT programme components, the Commission requested the SOT to continue its efforts to further develop these guidelines and high quality best practices for the Voluntary Observing Fleet (VOF) and publish them as a JCOMM Technical Report. The Commission requested that SOT extend these efforts of documenting VOS best practices to include the ocean variables managed under the SOT Ship Of Opportunity Implementation Panel (SOOPIP).

6.1.11.8 The Commission noted with concern (i) that some Members had terminated their PMO networks, or are considering terminating their VOF, and (ii) the increased difficulty to recruit ships. The Commission recalled that WMO Executive Council, at its sixty-first session (EC-LXI, Geneva, June 2009) recognized the ongoing key role of the Port Meteorological Officers in recruiting and maintaining the VOS, and recording their essential metadata, and therefore urged Members to continue and expand, where possible, this key resource for supporting the ocean observing system. The Commission requested the WMO Secretariat to promote resource mobilization for organizing a fourth international workshop for Port Meteorological Officers in 2010.

6.1.11.9 The Commission noted the proposals from the SOT-V to change the WMO-No. 47 in terms of metadata requirements or improvements to the documentation and agreed to address this issue under agenda item 12.

6.1.11.10 The Commission noted the work undertaken by E-SURFMAR (EUMETNET) regarding the preparation of a draft format for the transmission of ship observations through AIS, and requested the SOT to continue its efforts for using this mandatory positioning system to collect ship observations for the benefit of JCOMM. It further requested the SOT to consider the technical implications related to the compatibility between AIS equipments and observation stations.

6.1.11.11 The Commission noted with appreciation that Morocco had initiated a Voluntary Observing Fleet with its first vessel – equipped with the BATOS AWS system – recruited in 2008. It was planned to equip recruited VOS with AWS systems, as well as to cooperate with the Royal Navy of Morocco.

6.1.11.12 The Commission noted with concern the termination as of 1 January 2010 of Ocean weather ship M(ike) – Norwegian Sea at 66°N, 2°E – as JCOMM was also supporting long term monitoring of the oceans for climate applications, and marine climatology. The weather ship represented a variety of time series, some of which started in 1948 covering ocean profiles from the deep ocean (> 2000m) to the surface using CTD measurements, water samples (oxygen from 1953), standard meteorological observations, air-sea interaction measurements and radiosondes for atmospheric profiles. It was of crucial importance to continue these unique time series, some of them representing the longest observation series in the world from the deep ocean. Some of the operational observations of the ship were being shifted towards other platforms and locations, but there was currently no replacement for the scientific and climatological observations that had been made. The location was proven to be strategic both for studying the Atlantic inflow (important for the Arctic) and the Norwegian Sea Deep Water (which are traced all the way to the Antarctic), of which the properties were being important indicators of global climate change. JCOMM hereby put forward the importance of maintaining in situ long term measurements (as exemplified by station M) through relevant infrastructure to monitor: air-sea interaction, surface carbon fluxes, physical and biological variability of the upper ocean, and the physical variability of the deep-ocean.

The Global Sea Level Observing System (GLOSS)

6.1.11.13 The Commission recognized the importance of GLOSS and the provision of tide gauge data for understanding the recent history of global sea level rise and for studies of interannual to multi-decadal variability. It emphasized that tide gauges had an important role in regional and global tsunami warning systems and for operational storm surge monitoring. The Commission also

acknowledged the importance of the GLOSS tide gauge network for the ongoing calibration and validation of satellite altimeter time series, and as such, GLOSS is an essential observing component for assessing global sea level change. It welcomed the increased operational contribution GLOSS had made in the development of the tsunami warning systems.

6.1.11.14 The Commission noted the gaps in the GLOSS observation network and the increased demand for sea level observations in support of both science and operational purposes. The Commission recalled that there are five data streams within GLOSS and requested to Members/Member States to contribute data to all five in accordance with the GLOSS Implementation Plan and the UNESCO/IOC Oceanographic Data Exchange Policy, as follows:

(a) Delayed mode Mean Sea Level quality controlled data (monthly average) to the Permanent Service for Mean Sea Level;

(b) Delayed mode higher frequency quality data to UHSLC or BODC (GLOSS Archiving Centres);

(c) Near Real time ("Fast") higher frequency data to UHSLC (GLOSS Fast Centre) for altimetry and modelling calibration/validation;

(d) Real time data to VLIZ for station status monitoring and quick inspection of the raw data stream from individual stations;

(e) GPS data to the Tide Gauge Benchmark Monitoring Project (TIGA) data centre.

6.1.11.15 The Commission noted that high costs and/or national security policy issues might have contributed to reluctance for some Members/Member States to provide high frequency sea level and GPS data for some stations, even though they are a declared part of the GLOSS Programme for which the UNESCO/IOC Oceanographic Data Policy applies. It therefore encouraged Members/Member States to remove these limitations for stations that are part of GLOSS and/or the four regional tsunami-warning systems.

6.1.11.16 The Commission welcomed the establishment of the UNESCO/IOC Sea Level Monitoring Facility (http://www.vliz.be/gauges/) and the status reporting for real time stations that the facility offers. It encouraged GLOSS to further consolidate and integrate the status reporting from the other data streams under GLOSS.

6.1.11.17 The Commission urged Members/Member States to increase their national support to upgrade and maintain sea level stations in the GLOSS network, including the sea level stations in the four regional tsunami warning systems.

6.1.11.18 The Commission thanked Bulgaria, Norway, Finland, Government of Flanders (Kingdom of Belgium), UK POL/BODC/PSML, USA/NOAA UHSLC, GFZ, JMA, NTC, University of Puerto Rico, SHOM and VLIZ, for their financial and in kind contributions to GLOSS.

6.1.11.19 The Commission noted that a number of tide gauges have been installed in the East African region coastline (Kenya, United Republic of Tanzania, Mozambique, South Africa) with purpose of tsunami detection, storm surges and coastal flooding forecasting/warning systems, as well as for mean sea level applications. It encouraged Members/Member States to make sure that these gauges are included into the GLOSS network and further maintained and upgraded according to standards promoted by the Commission.

6.1.12 Associated programmes

The Argo profiling float programme

6.1.12.1 The Commission noted with appreciation the progress that Argo has made in achieving its target of establishing an array of 3000 operating floats in the world oceans by November 2007.

However, it recognized that Argo presently falls short of its design requirements as some of the floats were in marginal seas or at high latitudes (which were outside the Argo array design), some regions were overpopulated and some floats were not providing quality profile data; in particular there was a shortfall of around 600 floats in the southern hemisphere. It recognized that efforts were necessary to ensure adequate geographical coverage and ensure sustainability of the array (requiring around 800 new floats each year). The Commission requested the OCG, the DBCP, and the SOT to assist, as appropriate, the Argo Programme in the coming years to deploy floats to achieve and maintain the array's design requirements, including in particular the southern hemisphere.

6.1.12.2 The Commission welcomed the integrative nature of the Argo Information Centre (AIC) and the Argo Technical Coordinator as part of JCOMMOPS, and urged Members/Member States to contribute to the AIC Trust Fund in order to strengthen this function.

6.1.12.3 The Commission noted with appreciation the development of the Euro-Argo initiative – coordinated by France – an European research infrastructure project, which main objective was to define and agree on a long term funding and European organization (i.e. governance and legal issues) for European Argo activities. France, through its Coriolis partnership, also contributed to the international Argo programme (float procurement, global data centre, French data assembly centre, Atlantic regional centre).

The OCEAN Sustained Interdisciplinary Timeseries Environment observation System (OceanSITES)

6.1.12.4 Noting with appreciation the excellent collaboration established between OceanSITES and the DBCP through JCOMMOPS, which now provides for a part time Project Office function to OceanSITES, the Commission urged Members/Member States to contribute to the DBCP Trust Fund in order to strengthen this function.

6.1.12.5 The Commission invited OceanSITES to work with its Principal Investigators, with a view to maximize the number of sites making the geo-physical variables available in real-time to the international community on a free and unrestricted basis.

The International Ocean Carbon Coordination Project (IOCCP)

6.1.12.6 The Commission acknowledged the efforts made by the International Ocean Carbon Coordination Project (IOCCP) to develop an internationally agreed implementation strategy for a surface pCO_2 network using Ships of Opportunity (SOOP), drifter and time series observations from the Surface Reference Mooring Network and other platforms together with associated products.

6.1.12.7 The Commission welcomed the progress made by the IOCCP-CLIVAR Global Ocean Ship-based Hydrographic Investigations Panel (GO-SHIP), which brought together interests from physical hydrography, carbon, biogeochemistry, Argo, OceanSITES, and other users and collectors of hydrographic data to develop guidelines and advice for the development of a globally coordinated network of sustained ship-based hydrographic sections that would become an integral component of the ocean observing system. These guidelines, including a strategy for the next global survey, were presented at the OceanObs'09 conference and the community consensus was to move forward with the development of a sustained coordination effort for repeat hydrography. The Commission supported this initiative and noted that IOCCP and CLIVAR have developed an oversight committee to move this forward with the goal of presenting a plan for a sustained coordination effort to the next session of the UNESCO/IOC Executive Council for endorsement. The Commission also welcomed the GO-SHIP revision of the 1994 WOCE Hydrographic Programme Manual, which would be published electronically in January 2010.

6.1.12.8 The Commission invited IOCCP to develop stronger links with JCOMM and the SOT in particular for its projects to exploit potential synergies and enhance coordination. The Commission noted with appreciation efforts by Japan to work in this direction.

International Polar Year (IPY)

6.1.13 The Commission noted with satisfaction the significant progress in the extension of the marine observations and implementation of new techniques in the Polar Regions during the IPY including deployment of the increased number of drifting meteorological buoys within the IABP and IPAB, oceanographic ice-tethered profiling buoys (ITP), ice mass-balance buoys (IMP), ship-borne and drifting platforms (Russian Federation North Pole (NP) stations, Tara yacht), with most of observation sources available in real-time on GTS and/or Internet (e.g. ITP and IMB, NP). The Commission highly appreciated the national activities of the related Members/Member-States, and recalled that a number of observational systems were proposed to secure the International Polar Year (IPY) 2007/2008 observing system legacy and were endorsed by the EC-LXI and IOC-XXV (SAON, SOOS, GCW, PSC and others) and encouraged active involvement of its bodies in implementation of the stated initiatives. Further IPY legacy issues were addressed under agenda item 13.

6.1.14 The Commission requested the OPA to continue to be involved in the developments of observing systems in Polar Regions.

Remote sensing

6.1.15 The Commission recognized that much progress had been achieved in the last ten years in addressing the ocean community requirements for satellite data. However, efforts remain to be made to ensure the sustainability of some of the satellite missions and the Commission appealed to its members to address the issue nationally with a view to increasing national support to space programmes contributing to ocean observations.

6.1.16 Recalling that the OPA Implementation Goals included space-based observations to address climate needs, and stressed the following key variables: sea surface temperature, sea surface height, surface vector winds, ocean colour, and sea ice, the Commission strongly recommended continued close coordination with the in situ systems for a comprehensive ocean observation system. The Commission agreed that non-climate requirements such as for NWP and Marine Services, and gaps identified in the Statement of Guidance for Ocean Applications, needed to be considered, and therefore requested the OCG to add wave observations as a key variable to be derived from satellite observations.

6.1.17 The Commission requested all Programme Areas to liaise with the WMO Space Programme and address the UNESCO/IOC Strategy for the use of Remote Sensing in Oceanography.

Integration of in situ and satellite systems

6.1.18 The Commission agreed that the following issues should be addressed in the integration of in situ and satellite observations:

(a) Satellite data are the only means for providing high-resolution data in key ocean areas where in situ observations are sparse or absent. In situ and satellite observations are complementary for data assimilation in the numerical models for ocean mesoscale forecast and weather prediction. Some variables cannot presently be easily derived from satellite products (e.g. sea level pressure) while other variables observed by satellites require sparse in situ ocean observations for ground (or surface) truth or bias correction. It is essential that the measurements returned through both in situ and space-based systems are properly documented, coherent, and traceable;

(b) In situ observations are required for the calibration and validation of satellite products;

(c) Mixed products are now assimilating observations from both in situ and various satellite sources (e.g. the Global High Resolution SST – GHRSST – Pilot Project);

(d) Satellite products provide quality information regarding in situ observing systems that are useful to platform operators for taking corrective action (e.g. removing platform data from GTS distribution, or correcting their biases, in case systematic errors are detected).

6.1.19 The Commission requested its Coordination Groups, Panels, and Expert Teams to address these issues and liaise as appropriate with the international groups dealing with satellite issues, including the WMO Commission for Basic Systems (CBS) Expert Team on Satellite Utilization and Products (ET-SUP).

6.1.20 Following the recommendation from the JCOMM cross-cutting Team on Satellite Data Requirements, the Commission agreed that there was a need to produce a document that provides an integrated (space and in situ) observing strategy for a number of geophysical variables. The Commission requested the OCG to lead the production of this document in consultation with DMCG and SCG.

6.1.21 The Commission requested JCOMMOPS to coordinate the collection of information on satellite data requirements and planning, and to make it available via its website.

6.1.22 The Commission recognized that there was a need to make satellite ocean observations and marine information products more readily available, especially for developing countries, and African countries. Useful SST, wind, and wave data had been available through the GTS or dedicated sites but were not necessarily easily accessible by users in those countries. The Commission agreed that such data products should be better communicated, and tools made available to facilitate access and their use.

6.1.23 The Commission noted with appreciation the valuable contribution by China to ocean observations during the last intersessional period through the launch of HY-1B in April 2007 (ocean color), HY-2A in May 2008 (meteorology) with ocean color and SST capability. Plans were to launch FY-3 in 2011 for ocean dynamics and meteorology, and FY-3E in 2016 with scatterometer for surface vector wind. The Commission also noted the efforts by China to strengthen its cooperation through JCOMM with the goal to facilitate access to marine observations and improve satellite performance.

Technical Coordination and Monitoring

6.1.24 The Commission was pleased to note the activities of JCOMMOPS during the intersessional period (see agenda item 6.4), and the progress that the two Technical Coordinators and JCOMMOPS have made towards integrating the observing networks (see http://www.jcommops.org for more information). The Commission also appreciated the development of the Observing System Monitoring Centre (OSMC) (see http://osmc.info/) as a real-time monitoring tool for the observing system, and encouraged JCOMMOPS and OSMC to continue to work together on system monitoring to avoid duplication of efforts.

6.2 INSTRUMENTATION ISSUES *(agenda item 6.2)*

Best practices for instruments

6.2.1 The Commission noted the progress made by the Observation Programme Area (OPA) in reviewing best practices for instruments and their related documentation, including the development of a *Catalogue of Best Practices and Standards under JCOMM and IODE of UNESCO/IOC* (see agenda item 11.2), on which integration issues (such as identifying compatibilities, avoiding duplication of information, and proposing higher levels of standards as joint WMO-ISO standards) were addressed. The Commission requested the OPA to update the content of relevant documents where necessary, taking into account, in particular, the increasing need to enhance the quality of the data through appropriate standards in order to address the climate requirements.

6.2.2 Noting the recommendations from the SOT based on the 2008 intercomparison of Electronic Logbooks, the Commission urged Members/Member States in charge of E-logbook developments to implement the changes proposed by the SOT as documented in the Annex XIX of the final report of SOT-V, which is available at http://www.jcomm.info/sot5. The Commission requested the SOT to continue its efforts on developing high quality best practices for the Voluntary Observing Fleet with the goal of publishing them as a JCOMM Technical Report.

Regional Marine Instrument Centres (RMIC)

6.2.3 The Commission reviewed the proposal from the JCOMM Pilot Project for WIGOS to establish Regional Marine Instrument Centres (RMIC). This concept was based on experience and knowledge gained from the WMO Commission for Instruments and Methods of Observation (CIMO). The RMIC would aim to facilitate adherence of observational data, metadata, and processed observational products to higher level standards for instruments and methods of observation, by providing: (1) facilities for the calibration and maintenance of marine instruments and the monitoring of instrument performance; and (2) assistance for instrument intercomparisons, as well as appropriate training facilities that would complement what the manufacturers were already providing. The Commission agreed that the establishment of RMICs would be essential to promote standardization and intercomparability of instrumentation and data, and therefore adopted Recommendation 1 (JCOMM-III) – Establishment of WMO/IOC Regional Marine Instrument Centres, which defines Terms of Reference of an RMIC, including capabilities and corresponding functions, and a mechanism for formal WMO and UNESCO/IOC designation of an RMIC. The Commission stressed that a regular review of the RMIC's capabilities should be organized by JCOMM. It agreed that the established procedure for designing an RMIC should be included into the *Guide to Meteorological Instruments and Methods of Observations* (WMO-No. 8).

6.2.4 The Commission was pleased to note that the US had offered to act as a RMIC on a trial basis in order to prove the RMIC concept, and invited other Members/Member States to consider offering national facilities for acting as RMIC. The Commission also appreciated the offer made by China to act as RMIC for the Asia-Pacific region. The Commission also noted that Morocco was running a WIGOS Demonstration Project in which it was offering a Regional Instrument Centre (RIC) for meteorological instruments, and was also pleased to note Morocco's interest to extend its RIC functions to eventually become a RMIC and address marine instrumentation as well once the results from the United States trial become available.

Platform/instrument metadata

6.2.5 The Commission agreed that routinely collecting instrument/platform metadata was an essential useful practice, which enhanced observational data traceability to standards, helped interpret the data correctly and increased the data coherence (e.g. information about sensor height is essential for appropriate data assimilation). It also stressed that such data and information would improve effectiveness of climate applications, and facilitate quality-monitoring activities and instrument intercomparisons (see agenda item 7.2). The Commission recommended that appropriate quality control procedures should be applied and the most relevant metadata distributed in real-time together with the observational data, including in particular for offshore platforms. The Commission reaffirmed that such efforts should be continued in close collaboration with WIS, CIMO and manufacturers.

Cooperation with manufacturers

6.2.6 The Commission noted a recommendation from the JCOMM Pilot Project for WIGOS to establish closer links with manufacturers. The Commission considered the Association of Hydro-Meteorological Equipment Industry (HMEI) could be a mechanism to represent manufacturers within the WMO and UNESCO/IOC through JCOMM, and therefore suggested that the HMEI could be given similar status within the UNESCO/IOC as those non-governmental organizations that were already granted consultative status by WMO. In the meantime, the Commission noted that for the time being the HMEI included a very small number of marine instrument manufacturers in its members, and requested the Secretary-General of WMO and the Executive Secretary of

UNESCO/IOC to facilitate arrangements to ensure that the main marine meteorological instrument manufacturers eventually become HMEI members and to develop an additional mechanism to involve oceanographic instrument manufacturers. This would allow: (1) future interaction, cooperation and collaboration of HMEI and other appropriate entities with both the WMO and the UNESCO/IOC, including JCOMM Expert Teams and Panels; and (2) the participation of HMEI in specific JCOMM activities such as pilot projects, technology developments, instrument evaluations, and intercomparisons (see agenda item 10.2). The Commission noted that certain groups and panels including the DBCP had been maintaining close collaboration with manufacturers over the years. It therefore requested the panels and groups under OPA to look for ways for enhanced linkage with manufacturers.

Technical Publications

6.2.7 Noting the proposal from the JCOMM Pilot Project for WIGOS to undertake a review of WMO and UNESCO/IOC Technical Publications in terms of best practices for instruments and methods of observation, the Commission requested the Observations Coordination Group and the Observing Panels to assist in this regard according to the plan proposed by the Pilot Project. In particular, it requested the DBCP to provide enhanced advice, support, and possibly funding to update the content of the relevant documents where necessary.

6.3 SCIENTIFIC AND TECHNICAL DEVELOPMENTS FOR OCEAN OBSERVATIONS *(agenda item 6.3)*

6.3.1 The Commission recalled the longstanding requirements expressed in OceanObs'99 and in GCOS-92 for enhancing in situ wave observations from moored and drifting buoys, in support of wave modelling/forecasting as well as calibration/validation of satellite wave sensors. In this context, the Commission welcomed the pilot initiatives across the Programme Areas, including:

– The DBCP Pilot Project on Wave Measurement from Drifters (PP-WMD) for the investigation of techniques for making wave spectral measurements from drifting buoys;

– The DBCP-ETWS Pilot Project on Wave Measurement Evaluation and Test (PP-WET) for the intercomparison and evaluation of wave spectral measurements from moored buoys.

6.3.2 Noting the importance and potential benefit of the results from these pilot initiatives to monitor Essential Climate Variables (ECVs) as well as to contribute to marine-hazard warning systems, the Commission invited Members/Member States to actively participate in the pilot initiatives and related national/regional activities such as developing technology through deployment, testing of prototypes, and evaluating wave measuring instruments.

6.3.3 The Commission recognized that the DBCP was particularly experienced and proactive with regard to satellite data telecommunication systems, and noted its pilot activities to test and evaluate new data collection options (e.g. Iridium, Argos3). The Commission requested the OCG to compile and synthesize similar activities by all programmes and panels of JCOMM Observations Programme Area as well as associated programmes in order to ensure streamlined efforts during the intersessional period. The Commission also requested the SOT, GLOSS, and associated ocean observations programmes such as Argo, IOCCP, and OceanSITES to collaborate with the DBCP in this regard, with coordination provided through the OCG. The Commission also emphasized that the data telecommunication in Southern Ocean should be closely investigated and wherever possible through the use of improved technologies.

6.3.4 The Commission also noted with approval that the DBCP was engaged in a close dialogue with the Group for High Resolution Sea Surface Temperature (GHRSST). This would be expected to lead to a collaborative effort in improving the quality of in situ SST data from drifters and better calibration and validation of satellite SST products.

6.3.5 The Commission noted with appreciation the success of project-based planning in the implementation of new ocean observing technologies, which had met the immediate needs of Members/Member States as well as the workplan of the Commission. It therefore requested the OCG to continue implementation and planning of pilot projects during the next intersessional

period, with a view to maximizing the use of available resources as well as enhancing participation of interested Members/Member States. The Commission also encouraged Members/Member States to support and participate in the scientific and technical developments through pilot projects, by providing extrabudgetary contributions and/or expert support.

External developments

6.3.6 The Commission noted with interest that there had also been significant technical developments within Argo, leading to improved float reliability/longevity (over 80 per cent of floats now being deployed could last for 180 profiles or more) and on additional measurements (e.g. dissolved oxygen). In addition, there had been developments on gliders, instrumented marine mammals, automated deep ocean sounders, and satellite-based measurements. It recognized that, in some cases, data from such instrumentation were already being distributed on the GTS, and monitored by JCOMMOPS to some extent, to the benefit of all users. The Commission requested the Observation Coordination Group and the Management Committee to keep new observing technology developments under continuous review, and to liaise with relevant coordination groups with a view to incorporating the results of this review into their workplans and to keeping JCOMM and GOOS communities informed.

6.4 OBSERVING PROGRAMME SUPPORT CENTRE *(agenda item 6.4)*

6.4.1 The Commission was pleased to note that with reference to its request to the Observations Coordination Group (OCG) to review JCOMMOPS activities, substantial discussion had taken place within relevant JCOMM Groups and Observing Panels. The Commission further noted that, whilst recognizing that JCOMMOPS had been very useful in providing effective support towards the implementation of in situ ocean observing systems under its responsibility, the JCOMMOPS review process had concluded that there was an urgent need for an expanded Observing Programme Support Centre (OPSC), which should include system performance monitoring, system design evaluation, and authority to suggest deployments to improve system efficiency and effectiveness. The Commission recognized the recent development of the GLOSS real-time sea-level monitoring facility at the Flanders Marine Institute (VLIZ) and the Observing System Monitoring Centre (OSMC) maintained by NOAA. The Commission agreed that an OPSC could also provide synergies for such functions that were distributed and make available a more integrated framework for the deployment and further development of ocean observing networks.

6.4.2 In reviewing the overall JCOMMOPS evaluation and OPSC development process, the Commission noted with appreciation the high quality of the proposals submitted by the fifteen agencies that had expressed their intention to host a future OPSC. The Commission was pleased to note that, based on the recommendations from the Evaluation Committee, the Executive Secretary of the UNESCO/IOC and the Secretary-General of WMO had reached an agreement and selected the proposal from France (CLS and IFREMER), and invited Members/Member States, and in particular those who had submitted Letters of Intent, to be involved in the future development of the OPSC by providing assistance to the ocean observing programme implementation on a regional basis through proper cooperation and liaison with the Centre.

6.4.3 With guidance provided by the Evaluation Committee, the Commission discussed the future functions of the OPSC and agreed that the name JCOMMOPS should be kept in order to ensure continuity and to build on the existing worldwide recognition of JCOMMOPS. In order to reflect its view on the matter, the Commission adopted Recommendation 2 (JCOMM-III) – New terms of reference for an expanded Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology In Situ Observations Programme Support Centre. In doing so, it invited Members/Member States to commit resources to support the implementation and operations of the expanded JCOMMOPS, through voluntary contributions.

6.5 FUTURE PRIORITY ACTIVITIES FOR THE OBSERVATIONS PROGRAMME AREA *(agenda item 6.5)*

The Commission endorsed the future priority activities for the next intersessional period for the Observations Programme Area (OPA) as described below, with no particular order:

(i) Completion and sustainability of the initial observing system (target 100 per cent completion), and updating of the OPA implementations goals to take into account input from OceanObs'09 conference (Venice, Italy, September 2009);

(ii) Integration in the WMO Integrated Global Observing System (WIGOS), including the review and update of appropriate WMO and UNESCO/IOC Technical Publications (4 WMO Publications, and 2 UNESCO/IOC Publications), and the establishment of Regional Marine Instrument Centres (RMIC) in the regions (target 6 regions);

(iii) Enhancement of in situ global wave observing capability and quality in support of satellite products and ocean models through evaluation of wave measurements, and development of new cost-effective technology (target improved quality, and new technology available);

(iv) Increased use of high data rate satellite data telecommunication (target relevant platforms using high data rate);

(v) Implementation of the Partnership for New GEOSS Applications Concept (PANGEA) – i.e. developing partnership with developing countries regarding the use of ocean observations and products, and their participation in the maintenance of the observing networks (target 1 workshop per year);

(vi) Exploration of mechanisms, including funding, by which JCOMMOPS can partner with other agencies (e.g. space agencies) and programmes for the benefit of JCOMM (target new funding and expanded JCOMMOPS);

(vii) Coordinate with DMCG the completion of the JCOMM Cookbook for the submission of ocean data in real time and delayed mode (target: cookbook completed and published as a JCOMM Technical Report).

7. INFORMATION SYSTEMS AND SERVICES (DATA MANAGEMENT) *(agenda item 7)*

7.0.1 The Commission noted with interest the detailed report by the Coordinator of the Data Management Programme Area (DMPA), Mr Robert Keeley (Canada) and the significant progress and achievements made, covering a wide range of activities, including addressing all instructions to DMPA from JCOMM-II. The Commission expressed its appreciation to Mr Keeley and to the many experts who had served on the DMPA Coordination Group (DMCG) and teams, including their chairpersons, Mr N. Mikhailov (Russian Federation) and Mr S. Woodruff (United States).

7.1 DATA MANAGEMENT *(agenda item 7.1)*

7.1.1 In reference to its request to prepare a JCOMM Data Management Strategy (Recommendation 6 (JCOMM-II)) and the GCOS-IP, the Commission was pleased to note that this document had been prepared and published in 2008 as JCOMM/TR-No. 40, and endorsed its implementation details, which can be downloaded from http://www.jcomm.info/dmp-id. Recognizing that the DMPA had addressed many of the activities included in the Data Management Plan during the intersessional period, the Commission requested the DMCG to routinely review and update this master document, in order to ensure continued relevance of DMPA activities. It further requested the DMCG to consider the results from the OceanObs'09 conference (Venice, Italy, September 2009), and to propose changes to the Data Management Plan, based on these results, where appropriate, for consideration by JCOMM-IV. In the same context, the Commission noted with appreciation the progress made towards meeting GCOS-IP requirements (see http://www.jcomm.info/DMPA-GCOS) and encouraged continuing action.

7.1.2 The Commission noted with appreciation the increasingly close cooperation that had been developed between JCOMM and the IODE of UNESCO/IOC, through cooperation under the JCOMM Pilot Project for WIGOS (see also agenda item 10.2), the establishment of a joint JCOMM-IODE Expert Team on Data Management Practices (ETDMP) and its activities, including data management standards, preparation of documentation, and contributions of JCOMM to the UNESCO/IOC Strategic Plan for Oceanographic Data and Information Management (see

http://www.iode.org/strategy), and urged the DMPA to continue and further strengthen this collaboration, which was based upon complementarity of strengths and expertise.

7.1.3 The Commission noted that other DMPA activities addressed a number of issues that had been raised by the OIT meeting in September 2002. In particular, the ISO 19115 profile called the Marine Community Profile would be proposed as a standard. The Commission requested that an appropriate documentation that describes this template should be developed. Some JCOMM experts also participate in the International Caucus of DMAC (United States) as well as the European Union's SeaDataNet Project where they can both influence and respond to developments. Quality control issues were raised at the First Session of the IODE-JCOMM Forum on Oceanographic Data Management and Exchange Standards held in January 2008 at the UNESCO/IOC Project Office for IODE in Oostende, Belgium, and participants at that meeting agreed to submit documents on best practices for consideration. It was further recalled that IODE-XX had established the Ocean Data Standards Pilot Project through Recommendation IODE-XX.2.

7.1.4 Noting that the DMPA had been addressing the development and evolution of the use of Table Driven Codes (TDCs) within JCOMM, and their implementation, in collaboration with the WMO Commission for Basic Systems (CBS), the Commission recommended that work be undertaken to more carefully validate BUFR and other TDCs, so as to ensure that originally reported data are completely and accurately preserved.

7.1.5 The Commission recalled Recommendation 1 (JCOMM-I) on closer collaboration between the Commission and the UNESCO/IOC, and Resolution 7 (JCOMM-II), which reviews previous resolutions and recommendations, and noted the progress reported at JCOMM-II in the management of the Ocean Data Acquisition Systems (ODAS) metadata as reported by China. The Commission noted with appreciation that since then, China and the US have begun cooperation on a second project to manage instrumentation metadata for water temperature observations (Meta-T), which had developed a prototype database, server and data assembly facilities. Whilst noting that the technology to assemble, preserve and disseminate the information was in place for both of these metadata projects, the Commission stressed that it was important for Members/Member States to provide the metadata content on a routine basis. In order to assist China and the United States to fully implement these metadata systems, the Commission adopted Recommendation 3 (JCOMM-III) – Provision of Ocean Data Acquisition System and water temperature metadata. The Commission noted with appreciation the statement of China renewing its commitment to continue the hosting and management of ODAS as well as to continue the development and operating of the Meta-T database.

7.1.6 The Commission, whilst expressing its strong appreciation for the achievements of the DMPA during the intersessional period, called on the DMPA Expert Teams to ensure that duplication of work carried out by similar bodies in other national, regional and international organizations is avoided but that collaboration with such bodies is sought.

7.1.7 The Commission noted with appreciation the efforts made by the DMPA in terms of capacity-building (to be discussed under agenda item 9) aiming at equitable participation of developing countries in JCOMM data management activities as well as to ensure continuous professional development for all WMO Members and UNESCO/IOC Member States.

7.1.8 The Commission expressed its high appreciation and gratitude to Mr Robert Keeley for his eight-year contribution and commitment to JCOMM in general, and to the work of the JCOMM Data Management Programme Area in particular. The Commission also welcomed the efforts of the DMPA Coordinator to strengthen cooperation between the DMPA and other Programme Areas through participation in meetings of their Coordination Groups, as well as through joint activities.

7.1.9 The IODE Co-Chair, Mr Greg Reed, speaking on behalf of the IODE Committee, congratulated Mr Keeley for his excellent leadership of the Data Management Programme Area during the intersessional period and for his continued support for cooperation between JCOMM and IODE. Mr Reed noted that the JCOMM DMPA and IODE collaborate on a number of activities such as Ocean Data Standards Pilot Project and the JCOMM Pilot Project for WIGOS as well as in

the joint Expert Team on Data Management Practices. He stressed that the joint IODE-JCOMM Ocean Data Standards Pilot Project was of crucial importance to develop standardization of processes for ocean and marine meteorological data management. The ETDMP would play an important role in leading this process but it does require contribution from other Programme Areas and the broader JCOMM community. Mr Reed stated the strong interest of IODE in continued and strengthened cooperation between the DMPA and IODE over the next intersessional period.

7.2 MARINE CLIMATOLOGY *(agenda item 7.2)*

7.2.1 The Commission was pleased to note that during the intersessional period the Expert Team on Marine Climatology (ETMC) had reviewed a wide range of topics focused around the requirements for, and provision of, marine climatological data management and services. Among topics reviewed were: the International Maritime Meteorological Tape (IMMT) and Archive (IMMA) formats; Minimum Quality Control Standard (MQCS); enhanced operations of the Global Collecting Centres (GCCs) and modernization of the Marine Climatological Summaries Scheme (MCSS); electronic logbooks; the status of historical data and metadata rescue; platform and instrumental metadata for Voluntary Observing Ships (WMO-No. 47) and for buoys and other automated Ocean Data Acquisition Systems (ODAS); climate change detection monitoring and indices; and manuals, guides, and other technical publications. Modifications to the IMMT format and MQCS are addressed under agenda item 12. At the same time, the Commission recognized that GPS now records position and time to high levels of accuracy, but that such accuracy was not being reported in coded reports nor included in the climate records. It therefore requested the ETMC to review this situation, in consultation with the SOT and the Task Team on Table Driven Codes, with a view to perhaps enhancing the precision of such metadata records in the future. The Commission recommended that the ETMC also addresses climatologies for the deep ocean, and for sea-ice regions.

7.2.2 The Commission welcomed the results of the Third JCOMM Workshop on Advances in Marine Climatology (CLIMAR-III, Gdynia, Poland, May 2008), which were published as WMO/TD-No. 1445 and can be downloaded at http://icoads.noaa.gov/climar3. The Commission noted with appreciation that a special issue of the International Journal of Climatology would contain selected papers from CLIMAR-III, and would be included in the *dynamic* part of the *Guide to the Applications of Marine Climatology* (WMO-No. 781). The Commission agreed that this workshop had provided a valuable contribution to the development of the activities assigned to ETMC and recommended that similar workshops be held in the future. It therefore suggested that the Fourth JCOMM Workshop on Advances in Marine Climatology (CLIMAR-IV) be held around 2012. In addition, the Commission requested that a third Workshop on Advances in the Use of Historical Marine Climate Data (MARCDAT-III) be organized.

7.2.3 The Commission noted with appreciation that a modernization of the Marine Climatological Summaries Scheme (MCSS), originally established in 1963, had been initiated, and it endorsed the proposed activities as described at http://www.jcomm.info/MCSS-mod. In order to guide modernization efforts over the upcoming intersessional period, including exploring possibilities for interoperability, such as via the IMMA format, with the International Comprehensive Ocean-Atmosphere Data Set (ICOADS), the Commission requested the DMPA, through the ETMC, to undertake the following actions:

(a) With the Ship Observations Team (SOT), to continue to develop and agree on detailed proposals for the future international marine data flow, including Higher Quality Control Standard (HQCS), as well as questions of format and QC interoperability;

(b) To continue to consider:

  (i) Making products more readily discoverable through product and services level metadata, and accessible through the use of modern web services technologies;

  (ii) Integration of oceanographic and ice climatologies together with marine meteorological information;

(c) Develop appropriate documents describing the modernization progress and amendments regarding the IMMT-III format and version V of Minimum Quality Control Standards to be proposed for the *Manual on Marine Meteorological Services* and the *Guide to Marine Meteorological Services* and to be implemented for all data collected as from 1 January 2011;

(d) To undertake the modernization, to continue to implement the revised data management scheme and the end-user product development, and continue to review the value and effectiveness of these modernization steps.

7.2.4 The Commission expressed its appreciation to the NOAA Climate Database Modernization Program (CDMP) for supporting the imaging and digitization of WMO-No. 47 back to 1955, together with imaging of 1973–93 volumes. However, the Commission noted with concern continuing delays in the availability of recent metadata, and requested the WMO to allocate sufficient resources to the development and maintenance of this publication. Noting that the ODAS Metadata Service (ODASMS), operated by the National Marine Data and Information Service (NMDIS, China), had recently been developing its meta-database and website, the Commission agreed that the ODASMS take over metadata formerly managed in the *On-line Information Service Bulletin on Non-drifting ODAS* operated by Integrated Science Data Management (formerly MEDS) of Canada. The Commission stressed again the need for Members/Member States to routinely submit all metadata necessary to ensure that the system is up-to-date and complete.

7.2.5 Noting that the ETMC and the Ship Observations Team (SOT) had different views about where information about manual observing systems on “rigs and platforms” should be recorded (in ODAS or in WMO-No. 47), the Commission strongly recommended that a coordinated strategy for the preservation and archival of metadata associated with ocean rigs and platforms be devised. The Commission noted that there was confusion as some mobile drilling rigs were ship-shaped and lent themselves more to the Pub 47 format type, while this format may not really be entirely suitable for fixed platforms. There was also the question of how this metadata should be collected e.g. should JCOMMOPS have a role to play in this or should it be collected via the E-SURFMAR metadata database (which is now acting as the global repository for Pub 47 VOS metadata). The Commission recognized that it will need to decide how such data should be handled, as offshore installations provide high volumes of quality data, but are not considered within JCOMM as being an independent network (partly because most of them use third party equipment). As this was related to metadata issues, the Commission requested that ETMC resolve the discussion with the above-mentioned groups.

7.2.6 The Commission was pleased to note the progress made toward the definition and initiation of an extreme wave events archive, and expressed its appreciation to the US National Oceanographic Data Centre (NODC) for agreeing to host this database. The Commission urged Members/Member States to participate in this activity by identifying potential events and providing the data to this archive. It recommended that the potential for calculation of wave monthly summaries for ICOADS be evaluated.

7.2.7 The Commission expressed its appreciation to the Deutscher Wetterdienst (DWD), which, acting in accordance with a recommendation from the GCOS AOPC/OOPC Working Group on Surface Pressure and endorsed by the ETMC, made available high-priority selections from the DWD historical marine archive so as to help enrich ICOADS and thereby advance historical reanalyses and other urgent climate research applications, and welcomed continued collaboration with DWD to supply additional archive data as possible.

7.3 DATA MANAGEMENT PRACTICES *(agenda item 7.3)*

7.3.1 Considering the rapid development of the WMO Information System (WIS) and the initiation of the WMO Integrated Global Observing System (WIGOS) (see agenda item 10.1), the Commission acknowledged the key role of the joint JCOMM-IODE ETDMP in prototyping connections of oceanographic and marine meteorological data sets to, and the interoperability of, E2EDM and the WIS, and recommended to pursue the very close collaboration of the JCOMM

Pilot Project for WIGOS (see agenda item 10.2) with the UNESCO/IOC-IODE Ocean Data Portal (ODP), the WMO Commission for Basic Systems (CBS) and the WMO Commission for Instruments and Methods of Observation (CIMO). It urged both the DMPA and the OPA to provide full support to the development of the Pilot Project, and requested the DMPA to ensure continuing cooperation between the UNESCO/IOC-IODE ODP and WIGOS in order to address the issue of uniformity of a user interface for access to data and information.

7.3.2 The Commission noted that following the Recommendation IODE-XIX.4 and Recommendation IODE-XX.3 – The IODE Ocean Data Portal Project, documentation on the implementation of the JCOMM Pilot Project for WIGOS and the UNESCO/IOC-IODE Ocean Data Portal (Version 1) had been developed, based on the E2EDM technology (http://www.oceandataportal.org). It therefore agreed that the work carried out by the ETDMP was a good illustration of the rationale for the joint ownership of the ETDMP by IODE of UNESCO/IOC and JCOMM and recommended to further strengthen this collaboration. The Commission noted also Ocean Data Portal V.1 uses the technologies of the Unified System of Information for World Ocean (ESIMO, Russian Federation) and it is planned to expand the ODP capabilities by advanced components of Australian IMOS. The Commission expressed its great satisfaction with the progress made by the ETDMP with respect to the E2EDM technology and IODE ODP v.1 development, and congratulated the Ocean Data Portal project participants in general, and the RIHMI–WDC team (Obninsk, Russian Federation) in particular, for the accomplishment made during the first phase of the project.

7.3.3 Recalling that JCOMM-II had requested that both the DMPA and the IODE of UNESCO/IOC reconsider the Ocean Information Technology (OIT) Project action items, the Commission was pleased to note that a number of the activities of DMPA during the intersessional period were addressing these items, including the development of the IODE-JCOMM Ocean Data Standards Pilot Project (ODS), mentioned under agenda item 7.1, that is to be managed by the ETDMP to encourage and recommend the wide adoption of best practices and standards for broad community use. In order to reflect its views on the matter, the Commission adopted Recommendation 4 (JCOMM-III) – Development of data management standards. In this regard, the Commission stressed the importance of ensuring that the relevant communities were consulted on the usability and acceptability of candidate standards prior to their adoption to ensure that they are able to be effectively used by these target communities.

7.3.4 The Commission agreed on the need to expand the Terms of Reference of the ETDMP in order to cover a wider range of activities, and endorsed the proposal for sharing the activities of the ETDMP with the UNESCO/IOC-IODE Committee, including its membership. The Commission noted with appreciation that the twentieth session of the IODE of UNESCO/IOC (Beijing, China, May 2009) had formally nominated four members of ETDMP. The Commission nominated its own members under agenda item 14.4.

7.4 FUTURE PRIORITY ACTIVITIES FOR THE DATA MANAGEMENT PROGRAMME AREA *(agenda item 7.4)*

The Commission endorsed the future priority activities for the next intersessional period for the Data Management Programme Area (DMPA) as described below, with no particular order:

(i) Develop standards/best practices in the marine community through the IODE-JCOMM Standards Process;

(ii) Continue to work under the JCOMM Pilot Project for WIGOS to make the ODP and WIS interoperable as well as other ocean data systems interoperable with ODP and/or WIS;

(iii) Upgrade present BUFR encoding for marine variables to include instrument/platform metadata;

(iv) Complete Meta-T and ODAS implementation and capture of instrument/platform metadata;

(v) Modernize the Marine Climatological Summaries Scheme;

(vi) Review and update the Data Management Plan;

(vii) Update the *Catalogue of Standards and Best Practices* and contribute to the implementation of QMS in compliance with the WMO-QMF;

(viii) Review and update the DMPA website;

(ix) Organize of MARCDAT-III and CLIMAR-IV meetings.

8. MARINE METEOROLOGICAL AND OCEANOGRAPHIC FORECASTING SYSTEMS AND SERVICES *(agenda item 8)*

8.0.1 The Commission noted with interest the detailed report by the Coordinator of the Services Programme Area (SPA), Dr Craig Donlon (ESA), and the significant progress made during the last intersessional period in assisting Members/Member States on the implementation of met-ocean forecasting systems and services. The Commission expressed its appreciation to Dr Donlon and to the many experts who had served on the SPA Coordination Group (SCG) and teams, including their chairpersons, Dr Gary Brassington (Australia), Mr Henri Savina (France), Mr Pierre Daniel (France), Mr Val Swail (Canada) and Dr Vasily Smolyanitsky (Russian Federation), and rapporteurs, Mr Johannes Guddal (Norway) and Dr Pierre Yves Le Traon (France).

8.1 FORECASTING SYSTEMS AND SERVICES *(agenda item 8.1)*

Operational Ocean Forecasting

8.1.1 The Commission was pleased to note that, following the conclusion of the Global Ocean Data Assimilation Experiment (GODAE), and in recognition of the need to continue the legacy of GODAE, the Management Committee, at its sixth session (Paris, December 2007), established an Expert Team on Operational Ocean Forecasting Systems (ETOOFS), within the Services Programme Area, as a means to coordinate the efficient transition of mature ocean forecasting systems, developed and refined under the GODAE (see http://www.godae.org), to an operational environment, through facilitating and standardizing their operational implementation. In this context, the Commission endorsed the collaborating arrangements established between ETOOFS and the GODAE OceanView (GOV) Steering Team, which was responsible for activities on research and development, to ensure that the on-going research on ocean modelling and forecasting, and associated data assimilation and model intercomparison, are matured and transitioned into operations.

8.1.2 The Commission recognized that operational oceanography, in a similar context to operational meteorology, was now becoming a reality, with ocean observational data being collected, transmitted and assimilated in near real time into ocean prediction models, to provide operational ocean products to a wide range of applications, including enhanced weather and climate predictions, marine safety, efficiency and environmental protection services. The Commission encouraged Members/Member States to continue research and development of ocean models, and their full coupling with atmospheric models in support of enhancing the accuracy in weather and climate predictions as well as of a number of direct user applications, through participation in GOV. It requested ETOOFS to assist in and guide the transition of ocean forecasting systems from research to operations, and the transfer of existing ocean forecasting technologies from advanced centres to agencies of developing countries. In this context, the Commission agreed on the need to document best practices, conventions and standards in all aspects of the provision of ocean forecasting services including nomenclature and symbology. It therefore adopted Recommendation 5 (JCOMM-III) – Guide to Operational Ocean Forecasting Systems.

8.1.3 The Commission noted that met-ocean forecasting, as a central component of the end-to-end system for Service Delivery including warning services, depended heavily on outputs of numerical ocean prediction (NOP) systems. It further stressed that the accuracy and usefulness of NOP depended critically on the quality and reliability of all ocean observational data and atmospheric forcing from NWP. In particular, ocean observations are needed for both data-assimilation and for verification of forecast products. For the Polar Regions, in addition to the data and products available at lower latitudes, sea ice information systems with ice charts as an output are also important. In this context, the Commission requested ETOOFS to: (1) keep under review the ocean observational requirements for operational ocean forecasting systems; and (2) address issues relating to the transition of a GODAE data information services into operations and provide coordination and guidance to improve interoperability and standardization. It requested ETOOFS to work closely with DMPA on matters related to input/output observations and products to ensure that interoperable standards and best practices are developed, implemented and maintained. It requested ETOOFS to work closely with JCOMMOPS, the OPA and across the SFSPA, particularly in matters related to the effective use of observations within ocean forecasting systems, optimization of the observing network by strengthening feedback mechanisms on matters of data quality, timeliness and coverage that impact on data assimilation systems and the ability to provide services and products that are fit for purpose. It requested the OPA and DMPA to continue to address these requirements as part of their ongoing work programmes (see agenda item 5).

8.1.4 The Commission noted that the European Commission had been very active in providing support for the development of Marine Core Services in Europe, through its MyOcean Project. It also noted that ocean forecasting systems had been implemented in a number of GOOS Regional Alliances (GRAs). In this sense, the Commission strongly encouraged ETOOFS to strengthen relationships with those programmes and bodies to bring their expertise to the global arena.

Wind Wave and Storm Surge Forecasting

8.1.5 The Commission reaffirmed the importance of the wave forecast verification scheme, which was initiated in 1997. It endorsed the plan of ETWS to expand the verification scheme to include additional data types, spatial and spectral intercomparison of wave model outputs, formats and policy issues, including validation against remotely sensed data. In this context, the Commission was pleased to note that ETWS had established collaborating arrangements with the European Space Agency (ESA) in support of this scheme through the ESA Data User Element (DUE) *GlobWave* project that will develop, implement and operate, in a demonstration mode, components of the wave forecast verification scheme. The Commission expressed its appreciation to the current twelve contributing centres and encouraged Members/Member States to participate in the wave forecast verification scheme and to disseminate their wave data in order to further develop the scheme. It urged Members/Member States to make maximum use of the scheme applications for marine forecasting purposes.

8.1.6 Noting that geographical coverage of the wave data is still very limited and most measurements are taken in the Northern Hemisphere, the Commission was pleased to note that JCOMM, through joint efforts of DBCP and the ETWS, had initiated two pilot projects to coordinate the development of cost-effective global in situ wave observing technology in support of a wide range of applications, including the monitoring of extreme wave events for disaster risk reduction, wave modelling, and the calibration and validation of satellite wave measurements (see agenda item 6.3 and http://www.jcomm.info/wavebuoys). The Commission invited Members/Member States to assist in the development of technology through deployment, testing of prototypes, and evaluation of wave measuring instruments. The Commission further requested the DBCP and ETWS to address the establishment of a network of moored wave measuring buoys to cover, in particular, data sparse ocean areas where storms are generated and propagated. It urged Members/Member States, especially those that have island territories under their jurisdiction, to consider installing such equipment and exchanging the data obtained through the GTS.

8.1.7 The Commission recognized the importance of global scientific fora for exchange of information on databases, methodologies and techniques, and sharing expertise. It recognized the

value of such exercises to develop technical advice for Members/Member States in fulfilling their services' duties in support of the requirements of users in the whole range of maritime activities and in disaster risk reduction. In this context, the Commission requested the Expert Team on Wind Wave and Storm Surge (ETWS) to continue to co-sponsor and co-organize *International Workshops on Wave Hindcasting and Forecasting and Coastal Hazard Symposia* (http://www.waveworkshop.org), and follow-up event to the *JCOMM Scientific and Technical Symposia on Storm Surge* (http://www.surgesymposium.org). The Commission also encouraged Members/Member States to continue supporting these events by actively participating in and by hosting these important events in the future, and requested WMO and UNESCO/IOC Secretariats to keep Members/Member States informed of these developments, to take the necessary actions to promote the involvement of marine forecasters, modellers and researches in those events, and to continue to support such workshops and symposia. In this context, the Commission noted that 2nd International Symposium on Effects of Climate Change on the World's Ocean would be held in 2012, in the Republic of Korea.

8.1.8 The Commission noted that the JCOMM Storm Surge Symposium had initiated renewed awareness of the need to improve storm surge forecasting systems that make full use of modern techniques and observations. In this context, the Commission was pleased to note that ETWS had established collaborating arrangements with the European Space Agency (ESA) in support of improved storm surge forecasting through the ESA *Storm Surge Project* that will develop a comprehensive database of storm surge events, satellite data, NWP outputs and storm surge model outputs that can be used to explore and develop new tools, techniques and understanding of storm surge forecasting.

8.1.9 The Commission was pleased to note that ETWS had documented the status of worldwide implementation of wave and storm surge forecasting systems (http://www.jcomm.info/SPA_WWSS). It requested the ETWS to promote the implementation of operational specialized numerical prediction systems on wave and storm surge, and the use of probabilistic prediction products. The Commission expressed its appreciation to the advanced centres, including, for example ECMWF, Bureau of Meteorology (Australia), the Meteorological Service of Canada, met.no (Norway), NOAA/NCEP (United States), etc., for maintaining and upgrading their systems, and for making freely available on their Websites a broad range of global and regional wave products and datasets. It encouraged Members/Member States to make maximum use of these products and requested the WMO and UNESCO/IOC Secretariats to ensure that capacity-building activities aimed at promoting and facilitating the use of such forecasts should be continued, in order to improve Members/Member States' marine services. Noting that NOAA/NCEP also provided access to spectral data and to the wave model source code WaveWatch-III, the Commission requested the WMO and UNESCO/IOC Secretariats to facilitate and support the development of regional and subregional projects, particularly for Members/Member States in need of capacity development, in the implementation and use of such a model for marine forecasting. It urged the advanced centres concerned to consider providing technical expertise in support of these projects and encouraged Members/Member States to make maximum use of these tools, as well as for downscaling purposes. The Commission noted with appreciation that a number of Members/Member States, including China and Republic of Korea, had been expanding their wave and storm surge forecasting systems and services, and were deeply committed to further enhance their marine forecasting and services capabilities and support the Services and Forecasting Systems Programme Area activities in this domain. The Commission noted with appreciation that Japan was active in capacity-building activities during the intersessional period, in particular providing its numerical storm surge and wind wave prediction models to other Members/Member States for operational use.

8.1.10 The Commission very much appreciated that ECMWF had provided additional products to WMO Members, including wave products on 0.5-degree latitude/longitude grids. It encouraged WMO Members to use these products, and to provide feedback on their use to ECMWF. The Commission requested the Secretary-General of WMO to help facilitate WMO Members obtain access to ECMWF marine products.

8.1.11 The Commission recognized the value of the *Guide to Wave Analysis and Forecasting* (WMO-No. 702) and other relevant technical guidance publications in ensuring the provision of high quality, accurate, consistent and timely operational forecast products. In the same context, the Commission noted with appreciation that the English version of the first edition of the *JCOMM Guide to Storm Surge Forecasting* had been prepared during the intersessional period, and would be published and available shortly (see agenda item 12). At the same time, recognizing the developments and advances relating to wave and storm surge forecasting, the Commission recommended these publications should be maintained as up-to-date as possible, and therefore requested ETWS to keep the contents of these publications under review, as well as cross-referenced with other Manuals and Guides, including the *Manual of Quality Control Procedures for Validation of Oceanographic Data* (UNESCO/IOC M&G No. 26), and advise on the need for future updating as appropriate. The Commission also requested ETWS to continue to develop technical guidance materials on wave and storm surge forecasting for inclusion in the dynamic parts of the Guides.

8.2 DISASTER RISK REDUCTION *(agenda item 8.2)*

Marine Multi-hazard Warning Systems

8.2.1 In addition to those issues addressed under agenda item 8.1 on wave and storm surge forecasting that contribute to developing or improving marine multi-hazard warning systems, the Commission recognized with appreciation the positive impacts of the training workshop series on storm surge and wave forecasting, which is jointly organized by JCOMM and WMO Tropical Cyclone Programme (TCP). It therefore requested ETWS to continue co-sponsoring and co-organizing such training workshops in the future and expand to other regions, for the benefit of all Members/Member States exposed to these risks. The Commission requested its co-presidents and Management Committee to assess and categorize Members/Member States needs to facilitate their inclusion in its capacity-building work programmes, and to report to the next session of JCOMM. It also recommended that priority be given to the organization of training workshops for trainers in order to ensure continuity and to enhance the capabilities at national level.

8.2.2 The Commission recalled the request of the WMO Executive Council, at its sixtieth session (June 2008), to the Secretary-General of WMO, in consultation with UNESCO/IOC to facilitate the development of storm surge watch schemes (SSWS) (see http://www.jcomm.info/SSWS). The Commission was pleased to note that, through collaborative efforts of JCOMM/ETWS and WMO/TCP, immediate actions were taken by the five TCP regional bodies to assist their members by establishing regionally coordinated frameworks for enhancing their capabilities to access and understand existing wave and storm surge products worldwide, and to make use of them for operational forecast and warning services.

8.2.3 Additionally, the Commission recalled that the WMO and UNESCO/IOC Executive Councils, in their sixtieth and forty-first sessions (June 2008), respectively, requested JCOMM, WMO/CAS, WMO/CHy, and relevant UNESCO/IOC subsidiary bodies to implement the scientific/technical recommendations from the *First JCOMM Scientific and Technical Symposium on Storm Surges* (Seoul, October 2007), including coastal inundation and linkages to storm surge forecast and warning operations in all relevant regions. The Commission was pleased to note that planning was initiated on several components of a *Demonstration Project* leading towards a comprehensive and integrated storm surge watch scheme. In this context,

(i) The Commission was pleased to note that a JCOMM/CHy project for building improved operational forecasts and warnings capability for coastal inundation had been initiated and its first meeting was convened in Geneva (June/July 2009) (see http://www.jcomm.info/CIFDP). The major outcome of this project would be the development of an effective software package involving both ocean and hydrological models to enable an assessment and forecast of total coastal inundation from combined extreme events. The Commission reinforced the importance of an integrated effort for developing and improving forecasting capabilities and service delivery in coastal risk reduction by strengthening the existing cooperation between JCOMM, CHy, CAS and UNESCO.

(ii) The Commission noted that timely and verified results of scientific activities would mobilize resources for follow-up activities; following the recommendations by the *First JCOMM Scientific and Technical Symposium on Storm Surges*, the UNESCO/IOC has established a pilot project to improve storm surge predictability by community models, in view of enhanced support for coastal hazard and management issues. The Commission was pleased to note the successful launch of this project in the North Indian Ocean through the first expert advisory workshop in New Delhi, India (July 2009) (see http://www.jcomm.info/SSindia), in which the mid-term plan for model improvement was consolidated, and thanked the Republic of Korea and India for their support to this project. The Commission requested the UNESCO/IOC to continue coordinating this project and extend similar exercises to other surge-prone regions, as long as the resources are available.

(iii) The Commission noted with appreciation the activities of the European Space Agency in which satellite contributions to storm surge monitoring and forecasting would be carried forward, though the development of an *ESA Data User Element Storm Surge Project,* which held its User Consultation Meeting in Venice, September 2009 (see http://www.jcomm.info/SSucm). The Commission requested the Secretary-General of WMO and the Executive Secretary of UNESCO/IOC to further promote participation of ESA and other space agencies in JCOMM activities on marine-related hazards, including storm surge.

8.2.4 In order to reflect its views on the matter, the Commission adopted Recommendation 6 (JCOMM-III) – Integrated Storm Surge Watch Scheme.

8.2.5 Recalling the outcomes of the WMO Country-level DRR survey (http://www.wmo.int/pages/prog/drr/natRegCap_en.html), related to the top ten hazards of concern, including storm surge, and the expressed need by 90 per cent of the Members/Member States for guidance on standard methodologies for monitoring, archiving, and analysing hazards, the Commission noted with appreciation the ETWS initiative in collaboration with the Expert Team on Marine Climatology (ETMC) to develop and maintain an Extreme Wave Database (see agenda item 7.2). Following the recommendation from the *First JCOMM Scientific and Technical Symposium on Storm Surges*, the Commission requested ETWS to continue to develop regional and global storm surge climatologies as a measure of risk assessment for marine hazards and assist Members/Member States in developing their own databases and hazard analysis.

8.2.6 Recalling the discussion during the 25th UNESCO/IOC Assembly (June 2009) on the Working Group on Tsunamis and other Ocean Hazards Warning and Mitigation Systems (TOWS), the Commission re-affirmed that sea level observations are critical for enhancing storm surge forecasting and thus contribute to the storm surge watch schemes and tsunami prediction. The Commission therefore requested that efforts be made, by all concerned, to ensure that in situ and remotely sensed sea level observations are routinely collected and disseminated via the GTS. It requested GLOSS to continue supporting activities for extending the network of sea level measuring gauges, as well as increasing the number of those reporting in real-time, and other sea level observing techniques (see agenda item 6.1). The Commission urged Members/Member States undertaking sea level observation programmes to make their sea level data freely available in real-time, in support of coastal marine hazard warning services, including in particular for storm surges and tsunamis.

8.2.7 The Commission was pleased to note that JCOMM, through the ETWS, had been supporting the development and implementation of the *WMO/CBS Severe Weather Forecasting and Disaster Risk Reduction Demonstration Project* (SWFDDP) for the South Pacific Islands (WMO Regional Association V), which includes a component on damaging waves, both in terms of guidance information from the RSMC Wellington (New Zealand), and also through a dedicated website, on which sea state forecast products sourced from the ECMWF, the UK Met Office, and most likely NOAA/NCEP, JMA and French Polynesia (Météo-France) would be available. The Commission urged ETWS to continue and further strengthen its collaboration with the CBS Data Processing and Forecasting System (GDPFS) on issues of common interest, including the SWFDDP, and in assessing the status of the forecasting systems worldwide (see agenda item 13.1). It requested Members/Member States concerned to consider providing support for and participating in these regional initiatives.

Marine Accident Emergency Support

8.2.8 The Commission recognized the importance of direct interaction with the International Maritime Organization (IMO) Marine Environment Protection and Maritime Safety Committees (MEPC and MSC) in defining met-ocean input data requirements for marine pollution monitoring and response, and the meteorological services in support of maritime search and rescue. It agreed to address amendments to the *Guide to Marine Meteorological Services* (WMO-No. 471) related to these requirements under agenda item 12.

8.2.9 The Commission recognized that the core information provided by the Area Meteorological and Oceanographic Coordinators (AMOCs) in support of marine pollution monitoring and response, and maritime search and rescue, was basic meteorological and oceanographic information generated by NWP and ocean forecasting systems, including oil spill model outputs (weathering and fate). It therefore requested ETOOFS to consider ocean forecasting systems in support of this application area as part of its ongoing work programme. The Commission also requested the Expert Team on Maritime Safety Services (ETMSS) to monitor implementation and operations of the Marine Pollution Emergency Response Support System (MPERSS) in accordance with the International Convention for the Prevention of Pollution from Ships (MARPOL), as amended, and other international conventions, and assist Members/Member States in implementing their services in support of marine accident emergencies, including marine pollution and search and rescue operations.

8.2.10 The Commission noted challenges that the developing countries and LDCs were facing when implementing services in support of marine accident emergencies, including marine pollution, and search and rescue operations, and underlined the need for relevant capacity-building activities and strengthened connections with supporting services and marine pollution authorities.

8.2.11 The Commission commended Members for their contributions to and participation in the MAES-MPERSS Website (http://www.maes-mperss.org), which was managed and hosted by Météo-France. The Commission urged Members serving as AMOCs to make available detailed information on their MPERSS operations, and specifications of available models, in an appropriate manner, such as on their own Websites where possible.

8.2.12 Noting the WMO Emergency Response Activities (ERA) Programme was established to assist Members, and relevant national and international organizations, to respond effectively to environmental emergencies involving large-scale dispersion of air-borne hazardous substance, and that such environmental emergencies could happen over the ocean as a result of an oil spill and burning, the Commission requested SFSPA to consider establishing collaborating arrangements with the CBS Coordination Group on Nuclear Emergency Response Activities to address issues of common interest.

8.3 SERVICE DELIVERY *(agenda item 8.3)*

Maritime Safety Services

8.3.1 The Commission recognized the importance of direct interaction with and feedback from the marine users and welcomed the results of the JCOMM survey on monitoring the effectiveness of the marine meteorological and oceanographic information produced and transmitted by NMHSs. The results demonstrated the increased demand for user-focused marine meteorological and oceanographic products and services, and showed that there remained considerable room for improvement with regards to both the quality and content of services, and their coverage and timeliness in some oceanic regions (see http://www.jcomm.info/SPA_MSS). The Commission urged Members/Member States concerned to take the appropriate actions to improve marine meteorological and oceanographic services within their areas of responsibility, especially on the identified weaknesses, in order to meet marine user requirements. It noted that amendments to Annex VI of the WMO Technical Regulations (*Manual on Marine Meteorological Services* – WMO-No. 558) related to the provision of improved met-ocean services, were addressed under agenda item 12. Additionally, the Commission reiterated that strengthened

collaboration with both IMO and the IHO was critical to further improve marine meteorological and oceanographic services for international navigation.

8.3.2 Recalling the continuing importance to mariners at sea in receiving graphical products, the gradual demise of HF radiofax as a means of disseminating those products, and the WMO Executive Council's request, at its sixtieth session (Geneva, June 2008), that JCOMM continue researching methods for transmitting high quality graphical products to marine users, the Commission noted the successful development, in accordance with IHO standards, of product specification for sea ice information in Electronic Navigation Chart Systems (ENC). It encouraged Members/Members States to make maximum use of these essential tools and requested the Expert Team on Maritime Safety Services (ETMSS), in collaboration with the Expert Team on Sea Ice (ETSI), and in consultation with IMO and IHO, to develop similar standards for other met-ocean variables, based on experience and knowledge gained from the ETSI and guidance from IMO through its E-Navigation strategy and review of the GMDSS. In this context, the Commission emphasized the importance of a representative of the IHO's Hydrographic Standards and Services Committee participating in the ETMSS. The Commission requested WMO to keep Members/Member States closely informed on the progress of development of such standards. In addition, the Commission encouraged Members/Member States to investigate low-cost options for on-demand approaches that are compatible with ENC. Finally the Commission recommended that Members/Member States investigate a pragmatic approach (e.g., post Doctoral research) to developing a means for the dissemination of graphical products to marine users.

8.3.3 The Commission noted that through the IMO Resolution A.705(17) on promulgation of maritime safety information, adopted by IMO/MSC-85 (2008), which set out the organization, standards and methods that should be used for the promulgation and reception of maritime safety information, including navigational and meteorological warnings, meteorological forecasts and other urgent safety-related messages broadcast to ships, as documented in the International Convention for the Safety of Life at Sea (SOLAS), the IMO was seeking the implementation of Quality Management Systems by its Member States, with France as one of the pilots. In the same context, the Commission recalled that the WMO Executive Council, at its sixty-first session (Geneva, June 2009), requested the WMO Secretary-General to establish and develop, in collaboration with the IMO, the terms of reference for an IMO/WMO World-Wide Met-ocean Information and Warning Service (WWMIWS), to complement the existing IMO/International Hydrographic Organization (IHO) World-Wide Navigational Warning Services (WWNWS, IMO Resolution A.706(17)). In order to clearly define the requirements for the provision of marine meteorological services for international navigation (one of the eight quality management principles), as a supplement to the IMO Resolution A.705(17), the Commission adopted Recommendation 7 (JCOMM-III) – Establishment of an IMO/WMO World-Wide Met-Ocean Information and Warning Service. The Commission recognized the need for specialized training on marine meteorological services, focused on Quality Management Systems for the provision of met-ocean services for international maritime navigation (see agenda item 11). It therefore requested the WMO Secretariat, in collaboration with the ETMSS, to organize such a training activity during the intersessional period.

8.3.4 The Commission recalled the coordinated initiative by IMO, IHO and WMO to expand the Global Maritime Distress and Safety System (GMDSS) into the Arctic waters and the commitment by Environment Canada, Norwegian Meteorological Institute and Roshydromet (Russian Federation) to serve as Issuing Services for the new Arctic METAREAs, and the offer by Denmark and the United States to consider acting as Preparation Services. The Commission noted that new METAREA Issuing Services had developed their operating plans, including timelines, for the implementation of marine meteorological and oceanographic operational services. Noting that the GMDSS for the Arctic region should be fully implemented by 2010/11, the Commission requested the ETMSS to assist the Issuing Services concerned in implementing their operating plans for the provision of marine meteorological and oceanographic services for the Arctic region. It also requested the new Issuing Services to regularly report on the progress of the implementation of Maritime Safety Information Services to the WMO Secretariat. The Commission agreed on the need to also improve marine meteorological services in Antarctic waters and requested the ETMSS to cooperate closely with the WMO Executive Council Working Group on Polar

Observations, Research and Services (EC-PORS), the Antarctic Treaty Consultative Meeting (ATCM), and WMO Members concerned, in the development of met-ocean services in Arctic and Antarctic waters, including specialized services in support of national interests such as ship routeing, as well as in the training of specialized personnel for that purpose.

8.3.5 The Commission commended WMO Members for their contributions to and participation in the GMDSS-Weather Website (see http://weather.gmdss.org), which was managed and hosted by Météo-France. Noting the current expansion of this Website to include products prepared for International NAVTEX dissemination (see, for example, http://weather.gmdss.org/II.html), the Commission urged Members to disseminate these products through the GTS and to provide to the WMO Secretariat and Météo-France the appropriate metadata, including the bulletin headers, in compliance with the WIS. It noted that Kenya had been enhancing its capability to provide met-ocean services to mariners and had been recognized as Preparation Service for METAREA VIII(S). It also noted that Kenya was planning to implement a NAVTEX service in that area.

8.3.6 The Commission noted that a major marine weather-related threat in coastal areas is due to complex sea states. Forecasts of ocean wave parameters to describe these situations are required, as well as associated terminology to be used in weather and sea bulletins to be disseminated through SafetyNET and NAVTEX services to SOLAS and non-SOLAS vessels. It therefore requested the ETMSS, in collaboration with the ETWS, to develop proposals for inclusion of information on complex sea states in weather and sea bulletins, in close consultation with Members/Member States that are providers of such information, and subsequently for amendment of Annex VI of the WMO Technical Regulations (*Manual on Marine Meteorological Services* – WMO-No. 558).

Sea Ice Services

8.3.7 The Commission recognized that increased activity in Arctic and Antarctic regions by the marine community (including commercial, military and scientific) required maritime safety services in these regions, which consist of ice-infested waters. It therefore requested the Expert Team on Sea Ice to collaborate with ETMSS, under the overall direction of the EC-PORS, in implementing such services in Arctic and Antarctic METAREAs, and in proposing sea ice specifications for Maritime Safety Information to be disseminated via SafetyNET and international NAVTEX services, and included in the Annex VI of the WMO Technical Regulations (*Manual on Marine Meteorological Services* – WMO-No. 558).

8.3.8 The Commission expressed its appreciation to Members/Member States and the European Space Agency through the EarthWatch GMES Service Element *PolarView* project for their contributions to and participation in the Ice Logistics Portal Website (http://ipy-ice-portal.com/), which was developed in support of the International Polar Year (IPY) 2007/2008. The Commission urged Members/Member States to provide to the WMO Secretariat the appropriate metadata in order to ensure that this Portal is compliant with the WIS, and contributes to the Global Cryosphere Watch (GCW).

8.3.9 The Commission recognized the importance of the *Ice Analysts Workshops* in the coordination of sea ice services, including assessing differences between current practices of ice analysis and charting at National Ice Services and estimating accuracies of ice charts to meet both operational and climate needs. In this context, the Commission requested the ETSI to continue to co-sponsor and co-organize workshops in the future in order to enhance the capability of Members/Member States concerned to provide harmonized sea ice services and to understand sea ice historical variations. Recognizing the value of sea ice technical guidance material in ensuring the provision of high quality, accurate, consistent and timely sea ice services, the Commission also requested the ETSI to keep under review the relevant publications on formats and standards for sea ice information.

8.3.10 Noting that sea ice in situ and space-based data are crucial to both operational and climate applications, the Commission requested ETSI to keep under review requirements for sea ice observations and services.

8.3.11 The Commission noted the growing demand from the user community for integrated sea ice information products and to this end endorsed further development of the coupled sea ice – ocean – atmosphere numerical model approach being adopted by a number of Members/Member States. It requested the ETSI to closely cooperate with ETOOFS to further develop these numerical models, and sea ice forecasting and data assimilation techniques.

8.3.12 The Commission noted that the Global Digital Sea Ice Data Bank held 7 or 10-day period mapped ice data for the Arctic starting from March 1950 and for the Antarctic from January 1973, up to near the present for both regions. From the 1970s, GDSIDB ice charts could serve as ground-truth for SSM/I products (based on a comprehensive usage of all available sources of ice information and expert knowledge) or could form a unique source of ice conditions and climate for the pre-1978 period. In order to expand sea ice climatologies in collaboration with the ETMC and enhance the GDSIDB, the Commission encouraged Members/Member States to submit sea ice data to the GDSIDB and requested ETSI to review and provide guidance to them on the operation of the database.

8.3.13 The Commission noted the successful development, in accordance with IMO, IHO and the International Electrotechnical Commission (IEC) standards and specifications for Marine Information Objects (MIOs), of product specification for sea ice information in Electronic Navigation Chart Systems (ENC) and the preparation of an *Ice Objects Catalogue*, which was integrated into the IHO Registry of MIOs in May 2008 (see http://195.217.61.120/iho_registry/). Taking into account that this Catalogue would provide an essential tool to enable Members/Members States to develop products specifically for ENC and would allow the implementation of software to decode and display ice information by the manufacturers of these systems, using the S-57 (in the future in S-100) chart data exchange standard, the Commission encouraged Members/Members States to make maximum use of these essential tools.

Global Framework for Climate Services

8.3.14 The Commission noted that the World Climate Conference-3 (Geneva, August/September 2009) aimed at initiating a "*Global Framework for Climate Services*" (GFCS) to boost climate adaptation, which is intended to bridge the gap between climate information providers and users (see http://www.wmo.int/wcc3). The GFCS seeks to integrate climate observations, research, assessments and predictions in order to generate information and services required for factoring climate variability and change into socio-economic decision-making. Recognizing the considerable importance of the GFCS to WMO and UNESCO/IOC, and to their Members/Member States, as well as the potential role for JCOMM in climate services, the Commission requested the Management Committee to maintain oversight on WCC-3's follow up activities, with a view to determining JCOMM's contribution to the GFCS and to include it in its work programme, when required.

8.4 FUTURE PRIORITY ACTIVITIES FOR THE SERVICES AND FORECASTING SYSTEMS PROGRAMME AREA *(agenda item 8.4)*

The Commission endorsed the priority activities for the next intersessional period for the individual Expert Teams as described below, with no particular order:

(i) Expert Team on Operational Ocean Forecasting Systems (ETOOFS)

- Develop a Guide to Operational Ocean Forecasting (see Recommendation 5 (JCOMM-III));
- Define operational ocean observation requirements;
- Develop operational performance metrics to monitor operational ocean forecasts;
- Implement a survey on user requirements for ocean services;

- Improve capacity in terms of technology transfer and access to existing products and services;
- Address issues relating to the transition of a GODAE data service into operations;
- Facilitate implementation of Quality Management Systems (QMSs) for NOP among Members for the provision of Marine Accident Emergency Support.

(ii) Expert Team on Wind Waves and Storm Surges (ETWS)

- Implement the recommendations from the 1st JCOMM SS Symposium;
- Support UNESCO pilot project on coastal hazard forecasting;
- Support JCOMM/CHy Coastal Inundation Forecast Demonstration Project;
- Facilitate the development of Storm Surge Watch Schemes (SSWS) for regions subject to tropical cyclones (see Recommendation 6(JCOMM-III));
- Support WMO Severe Weather Forecasting Demonstration Project (SWFDP) with respect to wave and storm surge issues;
- Participate in two DBCP Pilot Projects on wave measurement from buoys;
- Expansion of the Wave Forecast Verification Exchange Project in coordination with the ESA GlobWave project;
- Develop and update guidance documents;
- Enhance Capacity-Building activities.

(iii) Expert Team on Maritime Safety Services (ETMSS)

- Improve interaction between the GMDSS Issuing Services and the AMOCs of MPERSS;
- Keep under review the implementation of the GMDSS and MPERSS in the Arctic and continue to support the Issuing Services and AMOCs, to reach the expected target in 2011 for the GMDSS;
- In association with ETWS and ETSI, develop guidelines and recommendations to update WMO-Nos. 471 and 558, especially for the provision of sea state and sea ice in MSI;
- Continue to develop the catalogue on Met-Ocean Object Classes and Attributes to define standards for ENC and e-Navigation, in collaboration with ETSI and guidance from IMO and IHO;
- Facilitate implementation of Quality Management Systems (QMSs) among Members for the provision of MMS (see Recommendation 7 (JCOMM-III) and agenda item 11).

(iv) Expert Team on Sea Ice

- Update sea ice standards;
- Continue to develop and manage technical documentation for ENC and sea ice services and information;
- Develop sea ice climatology based on ice charts and maintenance of the Global Digital Sea Ice Data Bank (GDSIDB);
- Contribute to the development and implementation numerical forecasting systems;
- Enhance the efficiency and safety of navigation in ice infested waters by harmonizing sea ice products.

9. EDUCATION AND TRAINING, TECHNOLOGY TRANSFER AND IMPLEMENTATION SUPPORT *(agenda item 9)*

9.1 SPECIALIZED EDUCATION AND TRAINING *(agenda item 9.1)*

9.1.1 The Commission noted that during the intersessional period, activities related to specialized education and training in marine meteorology, physical oceanography and data management had taken place as part of the work programmes of its Programme Areas (PAs), and agreed to continue with this approach and to assign one of its Management Committee members

to oversee these activities and to liaise closely with the relevant educational and training activities such as the WMO Education and Training Programme, IOC's Capacity-Building Section and the IODE Ocean Teacher and ODIN projects.

9.1.2 The Commission agreed that, in general, the activities undertaken in this area had been particularly successful, especially with regard to the workshops and training seminars, which were considered of great value in stimulating and assisting in the further development of marine meteorological and oceanographic observing systems and enhancing the capability of Members/Members States, especially Least Developed Countries (LDCs) and Small Island Developing States (SIDS), in accessing existing products and providing marine forecasting and warning services.

9.1.3 The Commission recognized that it was essential that all maritime Members/Member States should be in a position to both contribute to and benefit from the work of JCOMM. This applied equally to the operation of ocean observing systems, the receipt and management of marine data and the generation and delivery of products and services. It therefore adopted a statement of principles for JCOMM Capacity-Building to better represent the requirements and describe the implementation mechanism and activities to be undertaken by JCOMM, including training, transfer of technology, and development of projects, which is included as Annex I to the present report. The Commission requested that these principles should be transmitted to the Executive Councils of WMO and UNESCO/IOC, to seek their assistance in implementation, and that they should be kept under review by the Management Committee.

9.1.4 The Commission agreed that the series of international and regional seminars and workshops had very well achieved its purpose, and that the new orientation, namely, to plan and implement courses in more specific subjects, corresponded well with national and regional requirements. In this context, the Commission commended all Members/Member States which had hosted seminars, workshops and training events during the intersessional period. It particularly thanked the UNESCO/IOC and its Project Office for IODE for hosting and supporting a number of training events in its excellent facilities in Ostend, Belgium, and expressed the hope that the productive partnership between JCOMM and IODE of UNESCO/IOC would be expanded in the future. The Commission recognized that some workshops and related training events were already planned for the coming intersessional period in the work programme for each PA, on topics such as wave and surge forecasting, maritime safety services with focus on Quality Management Systems (QMS), Port Meteorological Officers (PMO), implementation of buoy and ship programmes, GLOSS and establishment of national UNESCO/IOC-IODE Ocean Data Portal nodes in different regions. In addition to these, and in liaison with the relevant WMO and UNESCO/IOC branches and offices, it proposed that consideration should be given to workshops on marine services including links to public weather services and disaster risk reduction aspects, with a focus on regions of specific concern, such as coastal inundation in vulnerable low-lying areas. It emphasized the need for future training to focus in particular on "training the trainers", to maximize the benefit of the training. The Commission agreed that efforts should be directed towards the development of additional training tools for effective communication to users of the products and services coordinated through the SPA, and that additional efforts should be made to engage the space agencies more extensively in JCOMM capacity-building, to ensure an effective pooling of resources. The Commission also noted the need to encourage the development of courses in operational oceanography within universities, to work closely with the new EC-PORS on training related to polar regions, and it encouraged Members/Member States to further share their training facilities and courses in marine meteorology and oceanography with others. The Commission recalled that the Ice Analysts Workshops, organized by the ETSI with the International Ice Chart Working Group (IICWG) and local hosts, had been of particular value to national ice services, and it agreed that they should continue during the coming intersessional period.

9.1.5 The Commission was highly appreciative of the fellowships that had been awarded by WMO for studies related specifically to marine meteorology and physical oceanography. It expressed the hope that fellowships would continue to be awarded to applicants in those fields, and therefore requested Members/Member States to inform the WMO Education and Training Programme on the institutions running recommended courses for prospective WMO Fellowship

holders. The Commission was also highly appreciative of the training activities undertaken directly in support of JCOMM, and within the context of various WMO and UNESCO/IOC capacity-building programmes, by a number of countries, including Belgium, China, Kenya, Republic of Korea, Russian Federation, Spain and the United States.

9.1.6 The Commission noted with appreciation that both the UNESCO/IOC and the WMO facilitate access to a wide range of training materials, through OceanTeacher (http://www.oceanteacher.org) that was developed by the IODE of UNESCO/IOC, the UNESCO Bilko (http://www.bilko.org) for remote-sensing image analysis, and Met e-learning (http://www.met-elearning.org), which was managed by the WMO Education and Training Programme. It recommended that these efforts should be closely coordinated, to avoid duplication. Additionally, it recalled that one of the main developers of high quality Distance Learning material in different languages, is the Cooperative Programme for Operational Meteorology, Education and Training (COMET, http://www.meted.ucar.edu/), that COMET Modules cover many fields of interest to the marine meteorological and oceanographic communities, covering atmospheric and oceanic processes as well as remote sensing of marine and oceanographic elements, and that work was now underway to translate some COMET modules into Spanish. It requested the Management Committee to explore developing an expanded partnership with COMET. The Commission also noted other virtual training centres and e-learning tools, such as Eumetcal – EUMeTrain (http://www.eumetcal.org/). The Commission agreed that such e-learning tools could be used as a selection mechanism for candidate trainees, as well as to assist trainees in preparing for courses, and requested the Secretariats to take the necessary actions in this regard.

9.1.7 The Commission also recognized the importance and value of the training courses in satellite oceanography provided by several of the space agencies. In this regard, it would be timely and worthwhile to seek further coordination and sharing of efforts and responsibilities between JCOMM and the space agencies to support the strengthening of capacity for training and education.

9.1.8 The Commission urged the Activity Leader on Capacity-Building to work with the PA coordinators and the Secretariats to revise the JCOMM CB strategy that builds on existing capacity-building work in both WMO and UNESCO/IOC, to implement a range of JCOMM-focused capacity-building activities.

9.2 TECHNOLOGY TRANSFER AND IMPLEMENTATION SUPPORT *(agenda item 9.2)*

9.2.1 The Commission recalled that the WMO Voluntary Cooperation Programme (VCP) had been established essentially to facilitate the global implementation of the WWW and that the programme could also now be used to enhance marine observing, forecasting and warning systems and services. The Commission therefore urged maritime Members/Member States to consider the possibilities of formulating appropriate VCP requests, in line with established procedures, as a means of enhancing their marine observing systems in support of the WWW, marine meteorological and oceanographic forecasting and warning systems and services, GCOS and GOOS. The Commission expressed its appreciation to those Members/Member States that had already committed to support capacity-building activities through their WMO/VCP contributions, various IOC programmes, and/or in kind, including Australia, Brazil, China, Finland, France, Japan, Portugal, Russian Federation, Spain and the United States. It expressed particular appreciation to the Russian Federation for the operation of three “Floating Universities” in the Baltic and Caspian Seas and the North Atlantic, where the training was conducted during ship-based marine research; for the operation of international research laboratories, jointly with Germany and Norway, providing specialized high education; and for the international conference in honour of the fiftieth anniversary of UNESCO/IOC (“Fifty Years of education and awareness raising for shaping the future of the oceans and coasts”), planned for April 2010 in St Petersburg, Russian Federation. It encouraged Members/Member States to participate actively in that conference. It also expressed particular appreciation to Spain for the MarineMet project in West Africa, with its particular focus on enhancing marine meteorology and ocean services, and to the United States for its training work related to instrumentation and observations through the NOAA/NDBC, as well as the preparation of a documentation process to help the development of a data exchange and communications

strategy in an end to end early warning system, being undertaken with the in put and support of Regional Associations of III and IV and the WMO DRR and WIS.

9.2.2 The Commission recognized the importance of getting input from the WMO Regional Associations and GOOS Regional Alliances (GRAs) to many aspects of its work, including marine services, implementation support, and education and training. It therefore requested the co-presidents of JCOMM and the Management Committee to develop a mechanism to further interact with the WMO Regional Associations and GOOS Regional Alliances (GRAs).

9.2.3 Noting the success of the WMO/CBS Severe Weather Forecasting Demonstration Project (SWFDP) and the Ocean Data and Information Network (ODIN) strategy developed by the IODE of UNESCO/IOC, the Commission recommended that these concepts should be used by the different PAs in developing their regional projects.

10. WMO INTEGRATED SYSTEMS *(agenda item 10)*

10.1 WMO INFORMATION SYSTEM *(agenda item 10.1)*

10.1.1 The Commission recalled that the WMO Information System (WIS) implementation is to build upon existing WMO information systems in a smooth and evolutionary process and that the WIS Implementation Plan has two parts being developed in parallel:

(a) Part A: the continued consolidation and further improvements of the GTS for time-critical and operation-critical data, including its extension to meet operational requirements of WMO Programmes in addition to the World Weather Watch (including improved management of services);

(b) Part B: an extension of the information services through flexible data discovery, access and retrieval services to authorized users, as well as flexible timely delivery services; it would be implemented essentially through the Internet.

10.1.2 The Commission appreciated the important and successful role of the Data Management Programme Area (DMPA) in ensuring WIS incorporates JCOMM's needs. It noted that through the DMPA, JCOMM has been an active contributor to the development of WIS and a leader in implementing some of the new functionality of WIS with projects such as the End-to-End Data Management (E2EDM) that participated in the SIMDAT project and the UNESCO/IOC-IODE Ocean Data Portal (ODP) that is demonstrating the WIS interoperability as an essential component of WIGOS. It thanked the Data Management Coordination Group (DMCG) for its participation with the Inter-commission Coordination Group on WIS (ICG-WIS) and encouraged the continued representation of JCOMM experts in inter-commission and cross cutting information management fora. This has included working with the IODE and WMO on data management and information exchange strategies including the adoption and review of the WMO core profile of ISO 19115 metadata standard, and the migration to Table Driven Code Forms (TDCF). It highlighted that working collaboratively on standards should not only reduce the cost of transmitting data, but in the long run will also reduce the cost of implementation, including mapping between data representation systems, and maintenance of standards relating to data representation and codes. The Commission in particular requested its DMCG to contribute to the development of a WIS data representation system policy in collaboration with the other technical commissions, including CBS as the lead Commission.

10.1.3 The Commission endorsed that the adoption of ISO 23950 for search as an effective enablement for interoperability between systems allowing information discovery across Members/Member States' systems as well as connecting many other communities. It agreed that implementation of the search standard, combined with the use of ISO 19115, would allow Members/Member States to quickly see the benefits of standardization in making data collections more visible to a wider community and increase their profile. It also agreed that experience gained through using information discovery would help in further refining of metadata and that this refinement would increase the value of the data with time.

10.1.4 The Commission noted that WIS had moved from development to implementation and thanked the Members/Member States such as Croatia, Italy, Germany, the Russian Federation, the United Kingdom, and the United States for their initiative in having their ocean and/or marine centres as centres holding marine datasets, in particular identified early as WIS candidate for GISCs/DCPCs (full list of candidates provided at: http://www.wmo.int/pages/prog/www/WIS/centres/index.html). In addition, the Russian Federation is providing support - as a contribution to JCOMM – to the IODE Ocean Data Portal (ODP), which will be interoperable with the WIS. It encouraged other Members/Member States to consider adopting the WIS standards of interoperability as a matter of priority in order to gain some of the benefits of these principles. It noted that these benefits would increase significantly as the Discovery, Access and Retrieval catalogues hosted at the GISCs become available online in the next year or two. Similarly it called on Members/Member States to participate in the IODE ODP network, as appropriate.

10.1.5 The Commission recognized the importance of supporting Members/Member States in implementing the standards adopted by WIS and the role of the DMCG in meeting JCOMM's obligations in the WIS centre designation process as approved by the Fifteenth WMO Congress in 2007. It therefore requested the DMCG to provide the necessary support to Members/Member States in the WIS centre designation process as a part of the DMPA planned activities. It also noted the role of WIS in assisting Members/Member States to benefit from other major WMO initiatives such as WIGOS and external initiatives such as GEOSS.

10.1.6 Recognizing the increasing need for standardization outside the traditional organizations, and the benefits that can be expected from it, the Commission welcomed the proposed Memorandum of Understanding (MoU) between WMO and the Open Geospatial Consortium (OGC), a global, non-profit making, consensus based, standards making body that is responsible for many of the interoperability standards between IT systems. The MoU is expected to recognize the themes of meteorology, oceanography, climatology and hydrology.

10.1.7 The Commission noted that although many oceanographic data are available on the GTS, some users do not have easy access to the GTS. It welcomed that the WIS will address making information available to users beyond the GTS. It is anticipated that with the implementation of WIS, any user with access to the Internet will be able to discover information and learn how to gain access to it. The Commission encouraged oceanographic marine data producers to make and publish the metadata for their information through the WIS to take advantage of this opportunity.

10.1.8 Regarding the risk of describing through the WIS the same data provided through different sources more than once, the Commission noted that owners and producers of the data are responsible to generate the metadata, or designate who should be responsible to generate the metadata, which could then be used to avoid data duplication issues.

10.2 JCOMM PILOT PROJECT FOR THE WMO INTEGRATED GLOBAL OBSERVING SYSTEM *(agenda item 10.2)*

10.2.1 The Commission noted with appreciation that JCOMM was very proactive in responding to and following the guidance given by WMO Cg-XV to initiate a Pilot Project for the integration of in situ and space-based marine meteorological and other appropriate oceanic observations into the WMO Global Observing System (GOS). The Commission noted that the Pilot Project was a contribution to the WIGOS implementation and proposed that the initiative should be called JCOMM Pilot Project for WIGOS.

10.2.2 Recalling that marine meteorological and oceanic observations were delivered within the context of the Global Ocean Observing System (GOOS), the Commission requested that the project and implementation plans for the JCOMM Pilot Project for WIGOS clearly indicate that it complements rather than duplicates the implementation plan of GOOS. It appealed to Members/Member States to commit additional resources to maximize standardization of the observing components of GOOS through the JCOMM Pilot Project for WIGOS and its legacy.

10.2.3 In the same context, the Commission agreed that, in order to avoid duplication and to make the best use of the available resources, marine meteorological and oceanographic data and information should be accessible through the WMO Information System (WIS) and the UNESCO/IOC-IODE Ocean Data Portal (ODP). It therefore strongly recommended that ODP become fully interoperable with the WIS. While noting that a number of agencies hosting key ocean datasets have already expressed interest in developing interoperability with the ODP and/or WIS, the Commission recognized that much work remains to be done to develop interoperability between the WMO and UNESCO/IOC communities at both the data discovery (metadata) and data level (compatible formats) and strongly encouraged further strengthening of JCOMM's coordination and collaboration with the IODE of UNESCO/IOC and the WMO Commission for Basic Systems on these matters (see agenda items 7 and 10.1).

10.2.4 The Commission recalled that the ownership of observing systems components and related standards, and data-sharing policies of all partner organizations, in particular the UNESCO/IOC, are respected and ensured as part of the WIGOS framework. The Commission further noted that WIS and the IODE Ocean Data Portal would be interoperable with, and can be considered as contributions to, the Global Earth Observation System of Systems (GEOSS).

10.2.5 The Commission noted challenges that the developing countries and LDCs were facing when implementing WIGOS and underlined the need for relevant capacity-building activities. In this regard, the Commission welcomed the continued development of Ocean Data and Information Networks (ODINs) in general, and the starting ODP-related capacity development in particular. The Commission further welcomed the development of training modules in *OceanTeacher* on ODP, and invited WMO to develop similar modules on WIS to be part of, or shared with *OceanTeacher*. The Commission urged UNESCO/IOC and WMO to jointly ensure that the relevant capacity-building activities be carried out and enhanced to enable all Members/Member States to share or access data through WIS and/or the IODE Ocean Data Portal.

10.2.6 Recognizing the increasing need for standardization and the benefits that can be expected from it, the Commission noted with appreciation that JCOMM and IODE of UNESCO/IOC prepared and published a *Catalogue of Best Practices and Standards under JCOMM and IODE of UNESCO/IOC* (see agenda item 11.2 and http://bestpractice.iode.org). The Commission stressed that this would facilitate updating the content of the documents listed in the Catalogue where necessary, and provide input to other relevant WMO and UNESCO/IOC publications, including the *Guide to Meteorological Instruments and Methods of Observation* (WMO-No. 8) within the framework of the project. The Commission therefore strongly encouraged further strengthening of JCOMM's coordination and collaboration with the IODE of UNESCO/IOC, the WMO Commission for Instruments and Methods of Observation (CIMO) and the Association of Hydro-Meteorological Equipment Industry (HMEI) on these matters.

10.2.7 The Commission agreed that the IODE-JCOMM Ocean Data Standards Pilot Project (ODS) provides a framework for the JCOMM Pilot Project for WIGOS to further develop appropriate and widely accepted quality management standards to address issues such as best practices for instruments, real-time and delayed-mode quality control procedures (automatic and/or manual), data collection and exchange formats, and products using observational data (see agenda item 11.2). It therefore requested Members/Member States to actively contribute to the Pilot Project. Standardization of instrument practices, establishment of regional marine instrument centres, collection of instrument/platform metadata, cooperation with the manufacturers, and updating of the WMO and UNESCO/IOC technical regulations in the framework of WIGOS were discussed in detail under agenda item 6.2.

10.2.8 The Commission agreed that marine meteorological and oceanographic requirements should be highlighted in sessions of the WIGOS and WIS working committees, with the intent of making use of WIGOS and WIS mechanisms and infrastructure. In this respect, it decided that during the intersessional period a member of the Management Committee should be made responsible for maintaining interaction with WIGOS and WIS activities in the met-ocean context.

10.2.9 The Commission expressed its concern regarding the resources required and the available time frame for testing the WIGOS concept. In this regard, the Commission requested the Secretary-General of WMO and the Executive Secretary of UNESCO/IOC to provide adequate budgetary resources (i) to achieve the objectives of the project, and (ii) to support capacity-building for developing countries. The Commission urged Members/Member States to support the JCOMM Pilot Project for WIGOS by providing extra-budgetary contributions to the WIGOS Trust Fund as well as to the UNESCO/IOC for the further development and enhancement of the IODE Ocean Data Portal and related capacity-building, and by seconding experts to work in the Planning Office and to the UNESCO/IOC Project Office for IODE, to speed up the project development and implementation.

11. QUALITY MANAGEMENT *(agenda item 11)*

11.0.1 The Commission recalled with appreciation that JCOMM had for many years been engaged: (1) in the global coordination, standardization and regulation of the provision of marine meteorological services; and (2) in evaluating and setting recommended practices and standards for instruments, observations and data management. The Commission recognized that quality management issues related to instruments, observations and data management were discussed under the relevant agenda items. However, it agreed that the consideration of quality management aspects related to the delivery of met-ocean data, products and services would require a holistic approach and recommended that the JCOMM Management Committee develop a framework to address these issues in the overall context of developing standards and recommended practices on met-ocean data acquisition and delivery of services and products.

11.1 QUALITY MANAGEMENT SYSTEMS FOR SERVICES AND THE WMO QUALITY MANAGEMENT FRAMEWORK *(agenda item 11.1)*

11.1.1 The Commission recognized that the adoption of quality management principles, approaches and practices facilitates the efficient and effective management and operation of a Service and the implementation of Quality Management Systems (QMS) is likely to assist Members/Member States in adopting good management practices and enhance confidence in the quality of their data, products and services. Whilst it encouraged Members/Member States to implement, where possible, a QMS following, as far as possible, the ISO Quality Management Standards, the Commission recognized the need for training in the development and operation of QMS. The Commission also recognized that Members/Member States had to face a number of national and regional policies and that the implementation of a QMS was customer-driven and country-specific. In this context, it noted that a number of Members/Member States have undergone ISO certification processes and urged them to share their documentation for the establishment of best technical practices for advancing QMF and QMS development, with a view to facilitating and expanding QMS implementation.

11.1.2 The Commission agreed that the adopted Recommendation 7 (JCOMM-III) on the establishment of an IMO/WMO World-Wide Met-Ocean Information and Warning Service (WWMIWS), defines user/customer requirements for the provision of met-ocean services for international navigation (one of the eight quality management principles) and would be the first step towards the establishment of standards/regulations for met-ocean services in accordance with ISO Quality Management Standards. In order to reflect its views on the matter, the Commission adopted Recommendation 8 (JCOMM-III) – Implementation of Quality Management Systems for Met-ocean data, products and services by Members/Member States.

11.1.3 The Commission decided that Quality Management (QM) principles and templates should be incorporated into the regulatory documents on met-ocean services as soon as possible, including in publication WMO-No. 558 (*Manual on Marine Meteorological Services*), and stressed that this would be a valuable opportunity to update the content of these documents where necessary.

11.1.4 The Commission expressed the desire that its members be periodically updated on the advances made in the relationship with ISO and the development of common best technical practices. The Commission also urged its members to become engaged with ISO national counterpart agencies for the development of standards of importance to Members/Member States.

11.1.5 The Commission noted with appreciation that the Australian Bureau of Meteorology had already commenced a quality management initiative and in doing so had achieved certification of compliance with the AS/NZS ISO 9001:2008 Quality Management Standard for the delivery of aviation weather services. In September 2009 the Bureau had begun broadening the scope of its quality management system, and among others, it was to include the delivery of marine weather services. This will be a stand-alone initiative that will also include within its scope not only marine services but oceanographic services and the national tidal facility. It was believed this would provide an opportunity for a pilot study for the introduction of quality management into the oceanographic and marine meteorological service environment. It was noted that Australia would be seeking a third party certification of compliance with the AS/NZS ISO 9001:2008 Quality Management Standard for the three components in scope. The Commission agreed that this was a significant development, and requested that the Management Committee and the Services Coordination Group be kept closely informed on progress, with a view to using the results as a pilot, to assist other countries to implement their own quality management systems for met-ocean services.

11.1.6 The Commission agreed to assign one of its Management Committee members to deal with publications and QMF activities. It therefore adopted the TOR for an Activity Leader on QMF as follows:

Terms of Reference of the Activity Leader on Quality Management Framework

– To review, as appropriate, JCOMM documents addressing quality issues so as to ensure that the terminology used in these documents is in accordance with the definitions of the quality related terms given in the relevant ISO standards;

– To represent the Commission and actively participate in the work of the ICTT-QMF;

– To update yearly, in coordination with the PAs, a list of valid JCOMM guidance documents to be used by Members/Member States;

– To report to and advise the Commission on activities that should be undertaken to support the WMO-QMF as an integral part of the Commission's activities.

11.2 BEST PRACTICES AND STANDARDS *(agenda item 11.2)*

11.2.1 The Commission noted with appreciation that a Catalogue of Best Practices and Standards under JCOMM and IODE of UNESCO/IOC had been prepared and published on the web at http://bestpractice.iode.org/. It stressed that this would identify deficiencies, duplication, discrepancies, and potential for cross-referencing. In this context, the Commission recommended that the JCOMM Management Committee establish a policy for the systematic review of these publications before they were recommended for adoption as tools for the QMS.

11.2.2 The Commission recognized that although there were mechanisms to help coordinate ocean data exchange, these had not resulted in the degree of agreement on a wide range of matters that is needed in order to allow the easy exchange and interoperability of the collected data. The Commission therefore expressed its appreciation to the efforts of JCOMM and IODE of UNESCO/IOC in setting up a process for adopting standards related to ocean data management and exchange, which is described at http://www.oceandatastandards.org. The Commission requested the JCOMM-IODE Expert Team on Data Management Practices to identify the standards that are widely applicable within the marine meteorological and oceanographic community, for including in the WMO and UNESCO/IOC Technical Regulations, and/or submission to appropriate international standards bodies, such as ISO, taking into account the procedures to be followed by all technical commissions in proposing common ISO/WMO Technical Standards

(see agenda items 6.2, 7.3 and 10.2). It also called on Members/Member states to participate in the IODE-JCOMM Standards Process, as appropriate.

12. REVIEW OF TECHNICAL REGULATIONS OF INTEREST TO THE COMMISSION, INCLUDING GUIDES AND OTHER TECHNICAL PUBLICATIONS *(agenda item 12)*

WMO Technical Regulations

12.1 The Commission recalled that, under agenda item 7.2, it had agreed to amend (1) the International Maritime Meteorological Tape (IMMT) format, to clarify the coding procedure for element 40 (source of observation) and 41 (observation platform), and to include a space for the IMO number at the end of each record; and (2) the Minimum Quality Control Standard (MQCS), to increase the limit of the maximum height (in metres) of deck cargo above summer maximum load line (element 90) to 40 metres in order to allow for the new generation of larger cargo vessels being built. The Commission therefore adopted Recommendation 9 (JCOMM-III) – Modifications to the International Maritime Meteorological Tape Format and Minimum Quality Control Standard.

12.2 The Commission further recalled that, under agenda item 8.3, it had agreed to adopt a number of amendments to the WMO GMDSS Marine Broadcast System, which is included in Volume I, Part I of the *Manual on Marine Meteorological* Services, WMO-No. 558 and Annex VI to the WMO Technical Regulations. It therefore adopted Recommendation 10 (JCOMM-III) – Amendments to the WMO Global Maritime Distress and Safety System Marine Broadcast System. No further modifications to relevant parts of the WMO Technical Regulations were considered necessary.

12.3 The Commission recognized the value of the WMO Technical Regulations, in particular the *Manual on Marine Meteorological Services* (WMO-No. 558), in ensuring the provision of high quality and timely services to marine users, as well as in assisting and guiding National Meteorological Services in this regard. At the same time, recognizing the developments and advances relating to emerging marine meteorological services, including the expansion of the GMDSS into the Arctic waters and other requirements for maritime safety services expressed by the International Maritime Organization (IMO), which also impacts the *Guide to Marine Meteorological Services* (WMO-No. 471), the Commission recommended that these two publication should be maintained as up-to-date as possible, and therefore agreed on a fast-track procedure for the approval of amendments to these two publications, by adopting Recommendation 11 (JCOMM-III) – Amendments to the WMO Technical Regulations, including the *Manual on Marine Meteorological Services* (WMO-No. 558) and the *Guide to Marine Meteorological Services* (WMO-No. 471). Taking into account that these publications had been significantly revised in the last decade, the Commission recommended that new editions be published and made available as soon as possible on the Internet.

12.4 The Commission recognized that the services required by users increasingly involved oceanographic variables and products, and that oceanographic institutes and agencies were becoming more involved in the preparation and dissemination of oceanographic services. In this context, it recommended that UNESCO/IOC consider preparing an equivalent set of UNESCO/IOC Technical Regulations relating to the provision of oceanographic services. It requested the Services and Forecasting Systems Programme Area Coordination Group to review this question, with a view to proposing such technical regulations for further consideration by the JCOMM Management Committee, JCOMM-IV and subsequently the UNESCO/IOC Governing Bodies.

WMO and UNESCO/IOC guides and other technical publications

12.5 The Commission recalled that, under agenda item 6.1, it had agreed to amend the relevant parts of the *Guide to* Marine *Meteorological Services* (WMO-No. 471) related to the WMO Voluntary Observing Ship Scheme and the marine climatological summaries. It therefore adopted Recommendation 12 (JCOMM-III) – Amendments to the Marine Climatological Summaries and the WMO Voluntary Observing Ship Scheme. The Commission also recalled that, under agenda

item 8.2, it had agreed to amend the relevant parts of the *Guide to Marine Meteorological Services* (WMO-No. 471) related to the Marine Accident Emergency Support, including the description of met-ocean input data requirements for marine pollution monitoring and response, and the meteorological services in support of maritime search and rescue. It therefore adopted Recommendation 13 (JCOMM-III) – Amendments to the Marine Accident Emergency Support.

12.6 The Commission noted with appreciation that a new edition of the *Sea Ice Services in the World* (WMO-No. 574) had been published and the English version of the first edition of the *JCOMM Guide to Storm Surge Forecasting* had been prepared during the intersessional period, and would be published and available shortly. Noting the increasing demand for improved storm surge forecasting, the Commission encouraged Members/Member States to make maximum use of this new publication. In addition, the Commission recalled that, under agenda item 8.1, it had agreed on the requirement for the preparation of a *Guide to Operational Ocean Forecasting*, as well as a draft table of contents for this Guide (see Recommendation 5 (JCOMM-III)).

12.7 Recalling the proposal from the WIGOS Pilot Project for JCOMM to undertake a review of WMO and UNESCO/IOC Technical Publications in terms of best practices for instruments and methods of observation, the Commission requested the Observations Coordination Group and the Observing Panels to make proposals to update the relevant parts of the following publications, for consideration by JCOMM-IV:

(a) *Guide to Meteorological Instruments and Methods of Observation* (WMO-No. 8);

(b) *Guide to the Global Observing System* (WMO-No. 488);

(c) *Manual on the Global Observing System* (WMO-No. 544);

(d) *Guide to Oceanographic and Marine Meteorological Instruments and Observing Practices* (UNESCO/IOC M&G No. 4);

(e) *Manual of Quality Control Procedures for Validation of Oceanographic Data* (UNESCO/IOC M&G No. 26).

12.8 The Commission endorsed the proposals from the Ship Observations Team (SOT) relating to modifications to WMO-No. 47, including metadata requirements, as documented in the final report of SOT-V (available at http://www.jcomm.info/sot5), and urged that these be considered by the WMO Executive Council, at its sixty-second session (Geneva, June 2010). Considering that the management of WMO-No. 47, its updating and timeliness, had been a matter of concern, the Commission requested the SOT to discuss with CBS how ship metadata could be managed in the future, and agreed in principle that: (1) the regulatory part of WMO-No. 47 be included in the future Manual on WIS or WIGOS; and (2) the metadata management be operated by an operational centre as part of the WIS.

12.9 The Commission recalled that publication WMO-No. 9 (Weather Reporting), Volume D (Information for Shipping) was an essential component of the documentation of worldwide services to shipping, providing a major cross-reference of Meteorological Broadcast Schedules for Shipping and other Marine Activities, Coastal Radio Stations Accepting Ships' Weather Reports and Oceanographic Reports, Specialized Meteorological Services, etc. Whilst, recognizing that for WMO Members this publication is the chief source of metadata concerning the services provided by other countries in other parts of the world, the Commission expressed its concerns regarding the speed and regularity of updates. It therefore requested WMO Members to coordinate with the appropriate authorities in their countries, in order to provide regular updates relating to Volume D to the WMO Secretariat.

12.10 The Commission requested the relevant JCOMM Groups and Expert Teams to keep the contents of all WMO and UNESCO/IOC marine-related publications under review, and advise on the need for future updating as necessary.

13. RELATIONSHIP WITH OTHER PROGRAMMES AND BODIES *(agenda item 13)*

13.1 PROGRAMMES AND BODIES OF WMO AND UNESCO/IOC *(agenda item 13.1)*

Programmes and Bodies of WMO

WMO Space Programme (SAT)

13.1.1 The Commission noted that the WMO Congress, at its fifteenth session (Cg-XV, Geneva, May 2007) considered the progress and results from the sessions of the Consultative Meetings on High-level Policy on Satellite Matters and stressed that the WMO user community and space agencies should be represented at the highest level at the sessions. The Consultative Meetings should continue to provide advice and guidance on policy-related matters and should maintain a high-level overview of the WMO Space Programme. It noted that Cg-XV agreed that the Commission for Basic Systems (CBS) should continue the lead role, in full consultation with the other technical commissions, for the WMO Space Programme, and in this regard supported the nomination of Dr J.-L. Fellous and Dr Craig Donlon to act as technical experts to the Expert Team on Satellite Utilization and Products (ET-SUP) to represent the needs and requirements of the JCOMM community.

13.1.2 The Commission noted with appreciation that WMO, through its Space Programme, had acted as a catalyst to greatly improve the utilization of satellite data and products. The Virtual Laboratory for Education and Training in Satellite Meteorology (VL) had already made a considerable impact through its “Centres of Excellence”. It encouraged Members/Member States to make maximum use of the tools, including for their capacity-building activities on marine forecasting.

Disaster Risk Reduction (DRR) Programme

13.1.3 The Commission welcomed the results of the WMO Country-level DRR survey (http://www.wmo.int/pages/prog/drr/natRegCap_en.html), which shows that storm surge is included in the top ten hazards of concern for WMO Members. Whilst noting that some NMHSs archive hazard data, the Commission recognized the need for developing technical guidance material on standard methodologies for monitoring, archiving, analysis and mapping of these hazards. The Commission therefore requested the JCOMM Expert Teams concerned, primary and foremost the Expert Team on Marine Climatology (ETMC) and the Expert Team on Wind Waves and Storm Surges (ETWS), to develop such guidelines as a matter of priority.

13.1.4 The Commission noted that the DRR Programme had been seeking for a working partnership with all relevant WMO technical programmes for the implementation of the DRR projects. It recognized the key role of and responsibility for JCOMM to assist in implementing the marine component of DRR projects. The Commission therefore requested the Management Committee to maintain oversight on DRR-related activities and agreed that the SFSPA coordinator should act as the JCOMM rapporteur on DRR matters.

Global Data-Processing and Forecasting System (GDPFS) and its Severe Weather Forecasting Demonstration Project (SWFDP)

13.1.5 The Commission recognized that the SWFDP framework represented a systematic approach for building capacity and for transferring knowledge and skills to NMHSs, especially those of developing countries. The Commission was pleased to note that, in the SWFDP in southern Africa, RSMC Pretoria (South Africa) intended to extend its regional guidance role to include marine forecasting. It also recognized that the recently initiated Severe Weather Forecasting and Disaster Risk Reduction Demonstration Project (SWFDDP) for the South Pacific Islands (WMO Regional Association V) includes a component on damaging waves, both in terms of guidance information from the RSMC Wellington (New Zealand), and also through a dedicated website, on which sea state forecast products sourced from the ECMWF, the UK Met Office, and most likely NOAA/NCEP, JMA and French Polynesia (Météo-France) would be available. It

expressed its appreciation to Members/Member States concerned for their contributions to these projects. The Commission requested ETWS, in close collaboration with relevant groups and teams of WMO Technical Commissions, to assist in the implementation of the marine component of these regional projects and to use the SWFDP concept to further develop and implement marine forecasting products and services in regions subject to marine hazards (e.g., West Africa, Caribbean, Bay of Bengal, etc.). It requested Members/Member States concerned to consider providing support for and participating in these regional initiatives.

13.1.6 Noting that operational sea-state models and forecasting systems are widely available among the existing network of Regional Specialized Meteorological Centres (RSMCs) of the Global Data-Processing and Forecasting System (GDPFS), the Commission requested the co-presidents of JCOMM and the Management Committee, in collaboration with the CBS/GDPFS, to give additional consideration to the possible recognition of a role that a specialized regional centre might have in the Cascading Forecasting Process for Marine Forecasting Services aspects, and to specify the criteria for the designation of a RSMC with Activity Specialization in Marine Meteorology to be included in the GDPFS. It encouraged Members to send their proposals to the WMO Secretariat for consideration.

Other WMO Programmes and Technical Commissions

13.1.7 The Commission noted that it had reviewed its relationship with other WMO Programmes and Technical Commissions, including the Tropical Cyclone Programme (TCP), the Commission for Basic Systems (CBS), the Commission for Instruments and Methods of Observations (CIMO), and the Commission for Climatology (CCl), under the relevant agenda items. In particular, it noted with appreciation that JCOMM had recently established collaborative arrangements with the Commission for Hydrology (CHy) and the Commission for Atmospheric Sciences (CAS) for building improved operational forecasts and warnings capability for coastal inundation and coastal ecosystem modelling, and on ocean prediction issues related to weather and climate predictions, respectively. Recognizing the similarities between aviation and maritime navigation user requirements, and the services provided, the Commission stressed a need to work closely with the Commission for Aeronautical Meteorology on Quality Management Systems aspects. The Commission particularly emphasized the need for enhanced collaboration with the CHy to meet the emerging need for hydrological and oceanographic data exchange in coastal oceanography. The Commission supported the interactions of JCOMM with all technical commissions, including the Commission for Agrometeorology (CAgM) on fishery issues, and requested its co-presidents and the Management Committee to facilitate and strengthen these relationships.

13.1.8 Commission noted the initiative of WMO for establishing the Regional Climate Centres (RCCs) that assist WMO Members in a given region to deliver better climate services and products including regional long-range forecasts, and to strengthen their capacity to meet national climate information needs. In this regard, the Commission requested the JCOMM Management Committee to study the possibility to implement the ocean and marine meteorological climate services via these RCCs.

Programmes and Bodies of UNESCO/IOC

Integrated Coastal Area Management (ICAM)

13.1.9 The Commission noted with interest that a central strategy of the ICAM programme had been to work on developing science based methodologies (such as for marine spatial guidelines, coastal indicators), which were technically applicable and adaptable in different geographical and socio-economic contexts. As a result, in the last five years, the ICAM programme had been promoting the development of regional projects, which were using and testing the tools and guidelines developed at the global scale. It was mainly through this regional approach that the collaboration with IODE of UNESCO/IOC had been strengthened (see http://ioc3.unesco.org/icam/). It recalled that JCOMM had been interacting with the ICAM programme through the Expert Team on Wind Waves and Storm Surges, which contributed to the preparation of the

UNESCO/IOC publication *Hazard Awareness and Risk Mitigation in Integrated Coastal Area Management (ICAM)* (UNESCO/IOC Guides & Manuals No. 50; ICAM Dossier No. 5) (see http://www.ioc-unesco.org/ioc-25). The Commission considered this interaction and collaboration to be very valuable, and agreed that it continue. It requested the Management Committee to investigate, with the ICAM programme, other possible areas of collaboration, taking into account the relevant JCOMM team activities and pilot projects. The Commission thanked several Members/Member States including Morocco and the Republic of Korea, which offered continuing support and commitment for coastal hazard related activities and JCOMM-ICAM collaboration.

Tsunami Warning Systems

13.1.10 The Commission noted with interest and appreciation that significant progress had been made since JCOMM-II in the development of tsunami warning systems (TWS) worldwide. The four regional tsunami warning systems coordinated by their respective Intergovernmental Coordination Groups (ICGs) and UNESCO/IOC were now beginning to focus on optimizing and improving their performance. There were at present improved levels of consistency between participating Member States, particularly in the detection and verification components. For production, formulation and dissemination of advisories, alerts, alarms and nationally mandated warnings common procedures were being developed, and performance measures introduced. The Interim Advisory Service in the Indian Ocean, which was provided by NOAA Pacific Tsunami Warning Centre (PTWC) in Hawaii and Japan Meteorological Agency (JMA) in Tokyo, would be replaced in next 12–18 months by a Regional Tsunami Watch Provider (RTWP) service supported at least initially by India, Australia and Indonesia. Other countries had also expressed an interest in becoming a RTWP in the future. Where ocean bathymetry and coastal topography data with the required accuracy exist for inundation modelling, risk and hazard maps were being generated and increasingly being introduced and standardized to guide planning and community preparedness at the national level. Guidelines for Risk Assessments from tsunamis were adopted by the Intergovernmental Coordination Group for the Indian Ocean Tsunami Warning System (ICG/IOTWS) and are in the process of being adoption by ICGs of other regions. Internationally agreed standards on tsunami signage were being implemented by many Member States (ISO 20712-1 (Safety Flags and Water Safety Signs) & ISO 20712-3 (Design Guidance)). Following the United Nations General Assembly Resolution A/Res/62/91, paragraph 13, UNESCO/IOC Member States had nominated Tsunami National Contacts (TNC) and Tsunami Warning Focal Points (TWFP) to improve the formal communication between the governing bodies, Member States and the operational entities. The critical TWFP information to ensure National Tsunami Warning Centres (NTWCs) receive tsunami advisories from regional centres was being tested through regional exercises. Collaboration and coordination on coastal and deep ocean sea level monitoring was occurring between GLOSS, the DBCP and the relevant ICG Working Groups. The Commission expressed the desire that its members be periodically updated on the advances made in the relationship with TWS and the development of common best technical practices.

13.1.11 The Commission recognized that it had been able to contribute positively to the development of TWS in a number of areas, including in sea level observations (through GLOSS and the DBCP, in collaboration with the International Tsunameter Partnership), in the distribution of observational and related data and information on the GTS, and in aspects of the dissemination of tsunami warnings to marine users, in collaboration with IMO. The Commission noted that UNESCO/IOC had charged its Working Group on Tsunamis and Other Hazards Related to Sea-Level Warning and Mitigation Systems (TOWS-WG) to review the governance and organization of the Intergovernmental Coordination Groups (ICG's) of all TWS, to ensure common operational procedures, explore synergy effects, and mainstream in particular the upstream activities, i.e. detection and verification, into existing ocean observing systems (see next section below). The Commission requested the Management Committee to collaborate with TOWS-WG wherever possible, to ensure that JCOMM could continue to contribute in every way possible to this work, and to the enhancement of TWS as a component of a coordinated and comprehensive marine hazards warning system. The Commission also requested the ETMSS to continue working with IHO and the ICG's to develop best practices for the preparation and dissemination of tsunami-related Maritime Safety Information for mariners in ports and in coastal areas.

UNESCO/IOC Tsunamis and Other Ocean Hazards Warning and Mitigation Systems Working Group (TOWS-WG)

13.1.12 The Commission noted with interest that the TOWS-WG had been established by the UNESCO/IOC Assembly at its twenty-fourth session (Paris, June 2007), following on from the work of the Global Tsunami and other Ocean-related Hazards Early Warning and Mitigation System (GOHWMS) WG. The TOWS-WG mandate was focused around sea level and coastal inundation, and charged the group to develop a systematic approach to all aspects of warning systems related to coastal inundation, with a primary focus being on harmonizing the work and procedures of the four existing ICGs for the TWS. To this end, key results from the second meeting of the TOWS-WG included, inter alia:

(a) Proposal to establish three inter-ICG Task Teams devoted respectively to sea level, preparedness, and tsunami watch operations, with a view to facilitate coordination of activities, development of common requirements and standards, and sharing of best practices;

(b) Inclusion of requirements on the collection and exchange of real-time sea level data for tsunami warning purposes in the work programmes of GLOSS and DBCP, as well as the possible review of GLOSS terms of reference to reflect the operational requirements of the tsunami warning centres;

(c) Investigation with CTBTO and other seismic networks of the possibilities for improved exchange and standardization of real-time seismic data and coordination of training programmes for global seismic monitoring for tsunami warning purposes;

(d) Development of a document with definitions and terminology on hazards, disasters, vulnerability and risks, drawing on existing documents developed by bodies like UN/ISDR for use by the UNESCO/IOC Secretariat, its Subsidiary Bodies, and its programmes;

(e) Assessment of the UNESCO/IOC Oceanographic Data Exchange Policy (UNESCO/IOC Resolution XXII-6) as it applies to tsunami warning systems and the monitoring of its implementation to ensure the open, free, and unrestricted sharing of tsunami-relevant observational data needed for timely and effective ocean-related hazard detection, analysis, and warning for coastal communities.

The Commission requested its co-presidents and the Secretariats to keep its members periodically updated on the activities and advances made by the TOWS-WG in the development of a systematic approach to all aspects of warning systems related to coastal inundation.

13.1.13 The Commission further noted that JCOMM was formally represented on the TOWS-WG through the co-presidents, and had contributed to the first two meetings and their follow-up. In light of the important role being played by TOWS-WG in coordinating and harmonizing procedures for marine warning systems related to sea level hazards, and its own significant activities in storm surge warning systems as well as sea level observations, the Commission agreed that it should continue to participate actively in the working group, through the co-presidents and the chairpersons of relevant subsidiary bodies as required, and contribute to all significant aspects of its work.

Other UNESCO/IOC Programmes and Bodies

13.1.14 The Commission recalled that it had addressed its collaboration with the IODE of UNESCO/IOC under the relevant agenda items. It urged the DMPA to continue and further strengthen this collaboration.

Co-Sponsored Programmes and Bodies of WMO and UNESCO/IOC

Global Climate Observing System (GCOS)

13.1.15 Noting that a letter signed by the Executive Heads of the four Sponsors of GCOS and GOOS had urged the establishment of national GCOS coordinators and committees, the Commission recommended that appropriate steps be taken to promote the establishment of these coordinators and committees, in particular by encouraging national ocean services, where they exist, to participate in the national GCOS committees and to collaborate with their counterparts in other agencies, e.g., National Meteorological and Hydrological Services, to advance climate observing needs.

13.1.16 Noting that some 14 percent of actions to be undertaken to improve ocean observing systems were considered to have made slow progress in the recent *Progress Report on the Implementation of the Global Observing System for Climate in Support of the UNFCCC 2004–2008*, the Commission requested the OPA to take the appropriate steps to facilitate the implementation of these actions. It also urged that attention continue to be given to those actions where moderate to good progress has been made.

13.1.17 The Commission encouraged the GOOS Secretariat and ocean community to work closely with the GCOS Steering Committee and Secretariat to ensure the effective implementation of the open ocean module of GOOS.

13.1.18 The Commission recommended that the GCOS and GOOS Secretariats continue to seek opportunities for joint activities where mutual and overlapping interests can be advanced (for example, the WCC-3 and OceanObs'09 produced outcomes that are highly relevant to both GCOS and GOOS). Recognizing that COP-15 provides an important venue to publicize these outcomes, the Commission recommended that GCOS and GOOS organize a joint Side Event at COP-15. The Commission agreed that capacity-building activities in developing countries may provide another opportunity for joint action. It recognized the long-term climate record as a key foundation for adaptation and reinforced the high importance of adequate support to existing GCOS networks for effective use of both research-based and operational observations in climate monitoring.

13.1.19 The Commission agreed that Action 16 of the *2004 Implementation Plan* (GCOS-92) should be reinforced, specifically that the initial ocean observing system be completed and sustained, that national agents for implementation be designated and supported, and that effective partnerships be established between ocean research and operational communities to assist implementation. It requested the OPA to continue its work in this regard.

13.1.20 The Commission noted with appreciation the continuing commitment by space agencies to respond to the climate monitoring requirements for sustained, comprehensive satellite-based datasets and products formulated by GCOS. The Commission noted the progress in the implementation of the Global Space-based Inter-Calibration System that contributes to the integration of satellite systems and consistency of satellite data records, as required for climate monitoring, and the establishment of the Sustained Coordinated Processing of Environmental Satellite Data for Climate Monitoring (SCOPE-CM, previously referred to as R/SSC-CM). The Commission urged Members/Member States with space agencies to support ongoing efforts. It welcomed the ESA Climate Change Initiative addressing several GCOS Essential Climate Variables.

13.1.21 Given the need for continuous operation of a global ocean observing system in support, inter alia, of coupled ocean–atmosphere climate modelling and operational ocean prediction, as well as the limited lifetime of individual platforms, data buoys, floats, ship-based and bottom-mounted systems, the Commission urged Members/Member States to establish a system of national ocean centres or services dedicated to implementation and maintenance of ocean observing systems and to improve cooperative support and coordination through JCOMM.

13.1.22 The Commission expressed its appreciation to UNEP and ICSU, co-sponsors with WMO and IOC/UNESCO of IPCC, WCRP and GCOS, for their support, which enabled valuable information, scientific products and other contributions to the extensive negotiations under

UNFCCC. It affirmed that JCOMM would continue to contribute fully in line with the United Nations climate strategy elements, support the UNFCCC negotiation process within an agreed framework, and contribute to the implementation on the Nairobi Work Programme on Impacts, Vulnerability and Adaptation to Climate Change and other activities mandated by WMO Congresses and UNESCO/IOC Assemblies.

Global Ocean Observing System (GOOS)

13.1.23 The Commission recalled that JCOMM had primary responsibility for implementing the open ocean/climate module of GOOS, and that the requirements and implementation process had been dealt with in depth under agenda items 5 and 6, respectively. It noted with interest that the GOOS Secretariat had prepared a draft report on progress in implementing this module, in supporting OOPC activities, as an integral part of a GCOS report on progress in implementing the global observing system for climate in support of the UNFCCC (GOOS Document No. 173, GCOS Document No. 129). The GCOS and GOOS Secretariats had participated in a side event and exhibit at the UNFCCC Subsidiary Body Meetings in Bonn, in June 2009, focused on progress in implementing the global observing systems for climate in support of the UNFCCC. The UNFCCC Conclusions acknowledged the need for systematic climate observations and noted the need for enhanced commitment of Parties to the GCOS Mechanisms.

13.1.24 The Commission noted that, at the ninth session of the Intergovernmental Committee for the Global Ocean Observing System (I-GOOS IX, June 2009), its members agreed with the assessment of the JCOMM co-president of JCOMM's role as an implementation mechanism for global GOOS and as the in situ marine component of the WMO Global Observing System, bridging between meteorology and oceanography toward the operational oceanography. I-GOOS noted with appreciation JCOMM's efforts to address priorities defined by the UNESCO/IOC High Level Objectives and WMO Expected Results, through activities and new initiatives under each Programme Area (Observations, Data Management, and Services). I-GOOS also noted that local and regional scale issues should be strengthened by more direct involvement of the GOOS Regional Alliances in JCOMM activities. In this context, the Commission agreed with I-GOOS' recommendation to each GRA to designate a JCOMM rapporteur to ensure each region would implement UNESCO/IOC policy principles and JCOMM data standards and guidelines in observing essential ocean variables and data dissemination.

13.1.25 The Commission was reported to on the discussion during the 12th Session of the GOOS Scientific Steering Committee (GSSC XII, February 2009), which addressed issues concerning the future role of the GODAE OceanView (GOV) within GOOS. A GSSC working group evaluated the implications of GODAE OceanView involvement with GSSC and concluded that close cooperation with the JCOMM Expert Team on Operational Oceanographic Forecasting Systems (ETOOFS) was necessary. Considering the complementary nature of the JCOMM/ ETOOFS and GOV, the Commission agreed to consider a liaison with GOV in the new JCOMM structure, while keeping GOV's separate autonomy to enable it to conduct its R&D as determined by its members. In the context of operational ocean forecasting, the Commission noted with appreciation that Australia, under the umbrella of Indian Ocean GOOS and Southeast Asian GOOS, was developing a cooperative demonstration project for the NE Indian Ocean on the value of its global ocean model forecasts to regional and coastal ocean forecasting in this area. A planning workshop was scheduled for March 2010 in Perth, Australia.

World Climate Research Programme (WCRP)

13.1.26 The Commission congratulated WCRP on its numerous significant achievements in research on climate change and predictability and especially acknowledged the major contributions made by the WCRP affiliated scientists to the Fourth Assessment Report (AR4) of IPCC.

13.1.27 The Commission acknowledged that WCRP as a whole and many of its projects conduct important scientific research of high relevance for the Commission, especially the WCRP Climate Variability and Predictability (CLIVAR) Project that provides the focus within WCRP for understanding the role of the ocean in climate, helps to promote, plan and coordinate

implementation of observing systems, reanalysis of existing ocean data, and develops ocean modules of global climate models.

13.1.28 The Commission acknowledged with appreciation the establishment of a joint WCRP – UNESCO/IOC Task Group on Sea-Level Variability and Change, which would lead fundamental research on sea-level variations including their geographical distribution and would work on producing tangible practical outcomes in terms of sea-level change predictions and projections.

13.1.29 The Commission noted with appreciation that the Joint CCl/CLIVAR/JCOMM Expert Team on Climate Change Detection and Indices (ETCCDI) published the "Guidelines on Analysis of extremes in a changing climate in support of informed decisions for adaptation" and supported the plans of ETCCDI to sharpen the focus on the needs of the developing world with respect to climate information to support adaptation activities.

13.1.30 The Commission concluded that the activities of the global research programmes, exemplified by the achievements of WCRP, are central for developing capacity for observing the Earth and its oceans and predicting their future state on a variety of scales. Effective partnership of JCOMM with WCRP and GCOS is therefore an essential requirement for further development of operational oceanography and marine meteorology. It acknowledged with deep appreciation the continuing commitment of WCRP to the work on creating a science–based observing system of the Earth and its ongoing efforts to optimize plans and future structure to remain at the forefront of climate research and provide a key contribution to the development of the future Global Framework for Climate Services. The Commission emphasized a need for stronger cooperation with WCRP in all areas of climate science of interest to JCOMM. It recommended to its Management Committee to organize a consultation with WCRP on the themes and modalities of such cooperation, with a focus on the activities that contribute to the implementation of main outcomes of World Climate Conference-3 and OceanObs'09.

International Polar Year (IPY)

13.1.31 The Commission noted with satisfaction the remarkable progress made during the IPY period and highly appreciated the work of the WMO/ICSU Joint Committee (JC) for IPY, its Sub-Committees, IPY International Programme Office, and over 50,000 participants of the IPY projects from more than 60 countries. It was pleased to note that during the IPY period the researchers had observed exciting new phenomena, made fundamental scientific discoveries, developed new methods and tools, advanced interdisciplinary and international links in polar science and, most importantly, gained new understanding of the role of the Polar Regions in the total Earth system. Preliminary scientific and observational advances of IPY were summarized in the JC Statement "The State of Polar Research" publicly presented to WMO and ICSU Executive Heads on 25 February 2009 at the WMO Headquarters. The Commission recognized that the success of IPY had inspired many nations to continue IPY projects beyond the IPY "official" period and that an official closure of IPY was planned at the IPY Science Conference (Oslo, June 2010).

13.1.32 The Commission stressed the important role that JCOMM can play in sustaining observing systems set up in connection with the IPY. To secure the IPY marine observing systems legacy as a contribution to WIGOS development, which would lead to reinforcement and integration of existing global observing systems, including GOOS and creation of a new Global Cryosphere Watch (GCW), the Commission agreed to:

(a) Promote the Sustaining Arctic Observing Networks (SAON) concept (marine meteorological and oceanographic components) among JCOMM members concerned to mobilize contributions to SAON building blocks development;

(b) Build a partnership between the JCOMM on one side, and SAON and Southern Ocean Observing System stakeholders on another side, in establishing oceanographic observations in Polar Regions as a part of the GOOS;

(c) Build a synergy between the development of SAON, SOOS, GCW on one side and GOOS regarding its sea-ice component on another side.

It requested the Management Committee to take the lead in implementing these actions.

13.1.33 Noting that the idea of an International Polar Decade had been met positively at several international forums, including the Arctic Council Ministerial Meeting, and that the WMO Executive Council, at its sixty-first session (Geneva, June 2009), requested its Panel on Polar Observations, Research and Services (EC-PORS) to consider modalities and plans for the Decade, focusing on decadal needs and issues of long-term character, the Commission recommended that OPA provide a contribution to these activities, as required. The Commission called upon Members/ Member States to be actively involved in the preparation of the International Polar Decade.

13.1.34 Recognizing that one of the challenges of the IPY process at present is data exchange and preservation, the Commission urged its members to ensure free and unrestricted exchange of IPY oceanographic data. It requested the DMPA to assist the EC-PORS to facilitate acquisition, exchange, and archiving of observational data from Polar Regions, in compliance with WIGOS and WIS requirements related to instruments and data exchange, to support the provision of services required for safety of marine operations in the Polar Regions.

13.2 ORGANIZATIONS AND BODIES *(agenda item 13.2)*

UN system agencies

13.2.1 Noting that UN-Oceans had been operating as a flexible mechanism to review joint and overlapping activities and to support related deliberations of the United Nations Open-ended Informal Consultative Process on Oceans and the Law of the Sea (UNICPOLOS), the Commission agreed that those developments would be useful in coordinating ocean and coastal activities within the UN System and a potentially valuable mechanism for addressing marine issues of relevance to JCOMM, including sustained ocean monitoring and prediction, to a wide and influential audience involved in ocean affairs. Noting the critical importance of the marine safety in the work of JCOMM, the Commission re-emphasized the importance of collaboration with IMO (see also agenda item 8).

13.2.2 At the same time, the Commission recognized that a number of UN Conventions and other coordinated activities were of continuing or increasing importance to JCOMM activities. These include, in particular, the International Convention for the Safety Of Life At Sea (SOLAS), UN Framework Convention on Climate Change (UNFCCC), the Convention on Biological Diversity (CBD), and the regular process for Global Reporting and Assessment of the state of the Marine Environment (GRAME). It therefore requested the Management Committee and the Secretariat to continue to review progress and activities associated with these Conventions, and take actions as appropriate.

13.2.3 The Commission was informed that the development of the UN Atlas of the Oceans was initiated in November 1999 by the UN agencies responsible for matters relevant to the sustainable development of the oceans and the advancement of ocean science as an initiative of the United Nations Chief Executives Board for Coordination (CEB). It was constructed and supported by FAO, IAEA, IMO, UNEP, WMO, UNESCO/IOC, with funding and other support from many national and international institutions. The Commission noted that the internet portal was presently operated (http://www.oceansatlas.org/) to provide policy-makers with information relevant to the sustainable development of the oceans, to provide the ocean industry and stakeholders with pertinent information on ocean matters and to highlight the work of the various UN agencies dealing with ocean issues.

Non-UN system organizations and programmes

13.2.4 The Commission recognized that, in addition to the joint activities with other UN-System agencies, both WMO and UNESCO/IOC also collaborated extensively on marine issues with international organizations and programmes outside the system, both governmental and non-governmental, such as ICSU, IOI, IHO, ICES, PICES, POGO, EMSA; etc. The Commission agreed on the high value to WMO and UNESCO/IOC of this collaboration, and urged that it should be continued and further developed in the future.

13.2.5 The Commission noted the need for close liaison between the Programme Areas and aid agencies to leverage opportunities for enhancing observing systems in the developing world, particularly in coastal areas, and for linking these enhancements to improved services for disaster risk reduction and climate change adaptation. The Commission also requested the co-presidents and PA coordinators to improve communication with organizations and institutions, such as the European Environmental Agency (EEA), on ways to improve observing and services capabilities.

Group on Earth Observations (GEO)

13.2.6 The Commission agreed that both the WMO and the UNESCO/IOC participation in GEO was of importance to JCOMM in particular as it related to the coordination and implementation of an operational in situ and space-based ocean observing systems. Noting that some of the key issues facing GEO leading up to the next Ministerial Summit in 2010 are: data sharing principles; interoperability arrangements; and, governance and sustained financing as GEO transits from a developmental to operational phase for a System of Systems, the Commission emphasized that JCOMM, as an implementation mechanism for oceanographic and marine meteorological components of Earth Observation, should play a key role in implementing marine observations within the GEOSS framework and further developing interoperability between met and ocean communities. Recognizing the important interaction already underway, on which the WMO and the UNESCO/IOC continues to provide a coordinated response to GEO by the UN Agencies' co-sponsored global observing systems (GOOS, GCOS and GTOS), the Commission agreed that continuous efforts should be made to maintain and enhance the communication with GEO, through the WMO and UNESCO/IOC, and requested the Management Committee to maintain oversight on WMO and UNESCO/IOC marine-related activities in GEO. It encouraged Members/Member States to play an active part in the GEO process at the national level, through national delegations to GEO, to ensure that the oceanographic and marine meteorology component is both comprehensive at global, regional and national levels.

CEOS

13.2.7 The Commission agreed that satellite systems for ocean observation are essential for marine meteorology and ocean monitoring and forecasting. It therefore welcomed JCOMM's initiatives to aim at securing the continuity of such systems and encouraged Members/Member States to make maximum use of these met-ocean space-based data, including for operational forecasting purposes. The Commission agreed that continuous efforts should be made to maintain and enhance the communication with the Committee on Earth Observation Satellites (CEOS), through the WMO Space Programme and the UNESCO/IOC GOOS Project offices, which are represented in the Coordination Group for Meteorological Satellites (CGMS) and in CEOS. The Commission, in view of JCOMM's stronger role in expressing the benefits and international user requirements for continuous satellite missions, requested the Management Committee to maintain oversight on WMO and UNESCO/IOC activities related to satellite systems for ocean observation and agreed to assign one of its Management Committee members to look after these activities.

Industry and commerce

13.2.8 Recalling that WMO and the UNESCO/IOC had worked for many years with some organizations representing industrial and commercial marine-related activities and companies, the Commission agreed on the importance of actively seeking to enhance its involvement with the private sector. Noting that both organizations had been exploring mechanisms for further developing cooperation with the private sector, including the private sector service providers, the Commission requested the Management Committee to develop an approach for contributing to the WMO and UNESCO/IOC activities towards enhanced collaboration with private sector. In particular, noting that the WMO Executive Council, at its sixty-first session (EC-LXI, June 2009), recommended a mechanism for technical commissions concerned and regional associations for developing guidelines of best practice models of partnership in furthering cooperation with the private sector, the Commission requested the Management Committee to assist the CBS OPAG on PWS in assembling information relating to the experiences of those Members/Member States that meet regularly with private sector met-ocean providers, and from these develop draft,

generalized guidance concerning options relating to such matters as their terms of reference, frequency of occurrence, use of independent facilitators and the like, for use by all Members/ Member States. Finally on this issue, the Commission supported the decision of the Management Committee to join with the GOOS Scientific Steering Committee in coordinating with industry and the private sector in developing advocacy for sustained global ocean observations.

14. JCOMM PROGRAMME AND PLANNING *(agenda item 14)*

14.1 WMO AND UNESCO/IOC STRATEGIC PLANNING AND THE JCOMM STRATEGY; MONITORING AND EVALUATION OF JCOMM ACTIVITIES *(agenda item 14.1)*

Strategic Planning

14.1.1 The Commission recalled that the current Terms of Reference (ToRs) for the Commission were approved, in conjunction with the establishment of JCOMM in 1999 by the Thirteenth WMO Congress and the Twentieth Session of the UNESCO/IOC Assembly. As recorded under agenda item 4, the Commission noted that the 2009 Meeting of Presidents of Technical Commissions, acting on advice from Members and the WMO Executive Council, agreed that the Terms of Reference (ToRs) of the technical commissions needed review, with a view to linking these with the WMO Results-based Management approach and overall Organization objectives and strategic thrusts. Recognizing strong needs expressed by the governing bodies of WMO and UNESCO/IOC for JCOMM to align its implementation and deliverables to the process regarding the WMO Expected Results and UNESCO/IOC Actions for the Medium-term Strategy, the Commission reviewed and proposed a modified version of its Terms of Reference. This version is structured into functions which are common to all WMO Technical Commissions and also relevant to UNESCO/IOC major subsidiary bodies, and those functions which are specific to JCOMM. The Commission adopted Recommendation 14 (JCOMM-III) – Terms of reference for the Joint WMO/ICO Technical Commission for Oceanography and Marine Meteorology.

14.1.2 The Commission recalled that, at its second session (JCOMM-II, Halifax, September 2005), it had reviewed and adopted a JCOMM Strategy Document, which version 1 was subsequently published at http://www.jcomm.info. It recognized that this strategy was to be a dynamic document, and should be closely linked to, and in conformity with, the overall organizational objectives, strategies, and expected results of both WMO and UNESCO/IOC. Noting that, since JCOMM-II, WMO had adopted a Strategic Plan for the period 2008–2011 and UNESCO/IOC had likewise adopted a Medium-term Strategy 2008–2014, the Commission agreed that there was a need to revise and update this document to address in particular the WMO Expected Results and the UNESCO/IOC Actions, as included in their respective strategic plans. The Commission reviewed, revised and adopted the Executive Summary for the JCOMM Strategy Document 2010–2013 as given in Annex II to the present report. In doing so, it recognized that the JCOMM strategy would continue to be a dynamic document, and requested the co-presidents and the Management Committee to finalize this document based on decisions taken during the session and to keep it under review and revise it as necessary during the coming intersessional period, in the light of revisions to the overall strategies of WMO and UNESCO/IOC. It requested the Secretariats to publish the revised JCOMM Strategy Document in electronic form and make it available on the JCOMM Website.

Resource requirements

14.1.3 The Commission noted that there were resource issues for JCOMM associated with adequately addressing on-going and emerging requirements. It therefore requested the co-presidents of the Commission, with the assistance of the Management Committee, to work with the Secretariats and potential donors and stakeholders in order to seek for external funding for the implementation of such activities of common interest.

JCOMM review

14.1.4 The Commission recalled that the JCOMM Strategy, endorsed by JCOMM-II (Halifax, September 2005), included, inter alia, a requirement for a periodic review of the Commission. The Commission further recalled that JCOMM-II specifically requested that this review should be conducted during the intersessional period. It noted that both WMO and UNESCO/IOC Executive Councils (June 2008) endorsed the proposed JCOMM review, considering it timely at this stage in the Joint Commission's lifetime, and stressed that: (i) the review process should reside with, and be carried out by, the Governing Bodies of the two co-sponsoring organizations of JCOMM, and not by JCOMM itself; (ii) the review should reflect the views of WMO Members and UNESCO/IOC Member States; and (iii) that carrying out such a review would require extrabudgetary support. The Commission noted that a broader study to examine the cooperation and interactions between UNESCO/IOC and WMO in the implementation of the Global Ocean Observing System (GOOS), including JCOMM, was carried out by Dr James Baker (see http://www.jcomm.info/GOOS), and made available to Members/Member States for comments and input in June 2009.

14.1.5 The Commission stressed the need for a full review of JCOMM across all the Programme Areas, taking into account the findings of the Dr Baker study, and other existing review documents. It strongly recommended to the Governing Bodies of WMO and UNESCO/IOC to take the appropriate actions to arrange for this review, and therefore adopted Recommendation 15 (JCOMM-III) – Terms of reference for an end-to-end external review of the Joint WMO/ICO Technical Commission for Oceanography and Marine Meteorology.

14.2 FUTURE WORK PROGRAMME AND OPERATING PLAN *(agenda item 14.2)*

14.2.1 The Commission recognized that it had considered all elements of its work programme for the period 2010–2013, based on priorities identified by the WMO EC-LXI and UNESCO/IOC-XXV (June 2009) (see agenda item 4), when discussing the various agenda items above. It requested the Secretariats to compile the work programme in an appropriately structured form after the session and to include it as Annex III to the present report. The work was structured under the three programme areas (see agenda item 14.4), integrated across the subsidiary bodies of the Commission, and prioritized to the extent possible.

14.2.2 The Commission was pleased to note that the Management Committee prepared a draft JCOMM Operating Plan, including planned programme implementation, for the periods 2010–2013, taking into account the WMO and UNESCO/IOC strategic planning processes and their respective Expected Results and Actions. The Commission requested the Management Committee to revise the JCOMM Operating Plan in order to take into account the adopted JCOMM work programme for the period 2010–2013.

14.3 REVIEW OF PREVIOUS RESOLUTIONS AND RECOMMENDATIONS OF THE COMMISSION AND OF RELEVANT RESOLUTIONS OF THE GOVERNING BODIES OF WMO AND UNESCO/IOC *(agenda item 14.3)*

14.3.1 In accordance with WMO General Regulation 190, the Commission examined those resolutions and recommendations adopted by JCOMM (including the WMO Commission for Marine Meteorology (CMM) and the IOC-WMO Committee for the Integrated Global Ocean Services System (IGOSS)) prior to JCOMM-III which were still in force. It noted that action on most of the previous recommendations had already been taken and completed, or their substance incorporated into different WMO and UNESCO/IOC Manuals and Guides, as appropriate. The Commission therefore adopted Resolution 5 (JCOMM-III) – Review of previous resolutions and recommendations of the Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology.

14.3.2 The Commission also examined resolutions of the Governing Body of WMO and UNESCO/IOC within the field of the activities of JCOMM and adopted Recommendation 16 (JCOMM-III) – Review of relevant resolutions of the governing bodies of WMO and UNESCO/IOC.

14.4 ESTABLISHMENT OF GROUPS AND EXPERT TEAMS AND NOMINATION OF RAPPORTEURS *(agenda item 14.4)*

14.4.1 The Commission discussed the most efficient way in organizing its working structure, without increasing the cost, in view of: (i) the priorities and requirements set by the governing bodies of WMO and UNESCO/IOC; (ii) the need for much closer and enhanced coordination between its Programme Areas; (iii) the increasing need to fulfil the Commission's growing responsibilities and to respond to emerging tasks; (iv) the need for resources in terms of number of experts engaged in the work of the Commission; and (v) budget allocated within the WMO and the UNESCO/IOC to support the work of the Commission. Recognizing that there remained several possible approaches to the overall structure of JCOMM to address its objectives and work priorities, the Commission nevertheless decided to continue with the three Programme Areas: Observations, Data Management, and Services and Forecasting Systems. At the same time, it agreed that a project-oriented approach should be adopted wherever possible to address specific, defined, time limited activities, in particular within the Data Management and Services and Forecasting Systems Programme Areas. In doing so, the Commission did not address teams that had been established for a relatively short period to deal with specific crosscutting activities and projects, and which would be of the responsibility of the Management Committee. Additionally, the Commission specifically entrusted the Management Committee, amongst its other duties, to keeping the JCOMM structure under permanent review and adapting it when the rationale and the need for implementing any specific change(s) in the structure is necessary.

14.4.2 The Commission stressed that the success of the new structure would depend to a great extent on the strengthened role of the JCOMM Management Committee in assessing, guiding and coordinating the work of the PAs, in making necessary adjustments in the intersessional period and in advising the co-presidents on relevant issues. The Commission therefore decided to re-establish the JCOMM Management Committee by adopting Resolution 1 (JCOMM-III) – Management Committee of the Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology.

14.4.3 The Commission decided to implement a new working structure and re-establish the three Programme Areas and their appropriate component groups and expert teams by adopting Resolution 2 (JCOMM-III) – Observations Programme Area, Resolution 3 (JCOMM-III) – Data Management Programme Area and Resolution 4 (JCOMM-III) – Services and Forecasting Systems Programme Area. The Commission recognized the fundamental importance to the accomplishment of the JCOMM work programme of the work of the individual experts within the proposed structure. It therefore requested Members/Member States to ensure to the extent possible that their appointed experts were allowed sufficient time within their normal national work programme to complete allocated tasks in support of the Commission, and to provide resources to carry out the related activities.

14.4.4 The Commission recognized the need to improve coordination amongst, and integration of, the different Programme Areas in response to crosscutting requirements, and requested that this be a priority issue for the Management Committee during the coming intersessional period. It recommended that the Coordination Groups explore better and more frequent mechanisms for communication and coordination within the PA, including alternative methods of communication such as tele- and videoconferences. It also recommended that a specific responsibility for cross-cutting activities within the Programme Areas be assigned to a member of the Management Committee, who would then be responsible for identifying and communicating relevant actions across PAs as well as to the Management Committee.

14.5 DATE AND PLACE OF THE FOURTH SESSION *(agenda item 14.5)*

The Commission was pleased to receive the tentative offer by the Republic of Korea to host its fourth session in the year 2012. It requested the co-presidents to consult with the Secretary-General of WMO, the Executive Secretary of UNESCO/OC and the Government of the Republic of Korea, with a view to confirming the offer and determining the exact date and place, in accordance with WMO General Regulation 187.

15. SCIENTIFIC LECTURES: *SOCIO-ECONOMIC BENEFITS OF MET-OCEAN INFORMATION AND SERVICES* *(agenda item 15)*

15.1 Following the decision by the JCOMM Management Committee, at its seventh session (Melbourne, December 2008), scientific lectures at the session were arranged within the main technical part of the agenda on the theme of socio-economic benefits of met-ocean information and services. Since a large number of the population lives on the coast and depends on coastal resources and the marine environment, they are permanently at risk and are vulnerable to extreme met-ocean events. The lectures therefore were intended to serve as a means of informing Members/Member States on global and regional impacts of the provision of met-ocean information and services on the marine environment, including coastal zones, and socio-economic activities. They were directly relevant to, and in support of, the role of JCOMM as the intergovernmental technical body for coordinating and regulating marine meteorology and operational oceanography.

15.2 The Commission agreed that all the lectures presented were highly informative, and expressed its appreciation to Professor John Zillman, Dr Malika Bel Hassen-Abid, Dr Geoffrey Holland and Mr Hassan Bouksim for the time and effort they had spent in preparing them. The Commission decided that the full text of the lectures should be compiled by the Secretariats and published as a single report in the JCOMM Technical Report series. The Commission greatly appreciated the presentation of such technical lectures at each Commission session and requested the Management Committee to prepare a similar set of lectures for its fourth session.

16. ELECTION OF OFFICERS *(agenda item 16)*

16.1 The Commission elected Dr P. Dexter (Australia) as its co-president for meteorology, and Dr A. Frolov (Russian Federation) as its co-president for oceanography. The Commission recognized that the co-presidents would assume their respective responsibilities for coordination and interaction with WMO and UNESCO/IOC. In addition, the Commission recommended to the co-presidents to implement an arrangement whereby they shared, to the extent possible, responsibilities for overseeing different components of the technical work of JCOMM.

16.2 Following the elections, the Commission took the opportunity to place on record its considerable and sincere appreciation to the re-elected co-president, Dr P. Dexter (Australia), and the retiring co-president, Dr J.-L. Fellous (France), for their outstanding work in guiding the work of the Commission during the past intersessional period.

17. CLOSURE OF THE SESSION *(agenda item 17)*

Following the exchange of courtesies, the third session of the Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology closed at 11.55 a.m. on Wednesday, 11 November 2009.

RESOLUTIONS ADOPTED BY THE SESSION

Resolution 1 (JCOMM-III)

MANAGEMENT COMMITTEE OF THE JOINT WMO/IOC TECHNICAL COMMISSION FOR OCEANOGRAPHY AND MARINE METEOROLOGY

THE JOINT WMO/IOC TECHNICAL COMMISSION FOR
OCEANOGRAPHY AND MARINE METEOROLOGY,

Noting:

(1) Resolution 1 (JCOMM-II) – Management Committee of the Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology,

(2) WMO Resolution 6 (EC-LVIII) – Report of the second session of the Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology,

(3) UNESCO/IOC Resolution EC-XXXIX.2 – Second Session of the Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM-II),

(4) WMO Resolution 19 (Cg-XV) – Marine Meteorology and Oceanography Programme,

(5) The report of the co-presidents of the Commission at its third session,

Considering:

(1) The requirement of the Commission to promote, coordinate and integrate marine meteorological and oceanographic programmes and activities,

(2) The contributions of the Commission to the World Weather Watch (WWW), World Climate Programme (WCP), World Climate Research Programme (WCRP), Global Ocean Observing System (GOOS), Global Climate Observing System (GCOS), International Oceanographic Data and Information Exchange (IODE), Disaster Risk Reduction (DRR) and other major programmes of WMO and UNESCO/IOC,

(3) The need to coordinate the work of the Commission with other appropriate international organizations and their subsidiary bodies, as well as with relevant non-governmental organizations and the private sector,

(4) The need for the work of JCOMM to be aligned with and contribute directly to the WMO Strategic Plan and the UNESCO/IOC Medium-Term Strategy, and their expected results,

(5) The need for continued overall coordination of the work programme of the Commission and for advice on matters referred to it by the governing bodies of WMO and UNESCO/IOC,

Decides:

(1) To re-establish a Management Committee with the following terms of reference:

   (a) Review and prioritize the short- and long-term planning of the work programme of JCOMM and advise on its implementation;

   (b) Take all necessary actions to ensure that the JCOMM strategy, work programme and operating plan are aligned with and contribute directly to the WMO Strategic Plan and

the UNESCO/IOC Medium-Term Strategy and their expected results, as well as with the respective Operating Plans;

(c) Assess the resources required for the implementation of the work programme, as well as approaches to identifying and mobilizing these resources;

(d) Coordinate and integrate the work of JCOMM, as implemented through the various subsidiary groups, expert teams and rapporteurs;

(e) Coordinate and provide oversight for the capacity-building and quality management activities undertaken within the three programme areas, as appropriate;

(f) Ensure that the JCOMM requirements for satellite and other remotely sensed ocean data are properly documented and communicated to the appropriate mechanisms of WMO and UNESCO/IOC, and to the satellite system operators, as required;

(g) Coordinate and integrate the work of JCOMM, as appropriate, with that of the other WMO technical commissions, UNESCO/IOC major subsidiary bodies and other programmes of WMO and UNESCO/IOC, and in particular initiate, coordinate and provide oversight for joint projects and activities with these bodies and programmes;

(h) Review the internal structure and working methods of the Commission, including its relationship to other bodies, both internal and external to WMO and UNESCO/IOC, and in the light of lessons learned and available resources develop proposals for modifications as required;

(i) Assess the implementation of activities and projects referred to JCOMM for action by WWW, WCP, WCRP, GOOS, GCOS, IODE, DRR and other programmes;

(2) That the co-presidents shall have the responsibility to jointly undertake the duties required of presidents of technical commissions of WMO and technical committees of UNESCO/IOC as defined in their respective regulations. These would include or be extended to include the following:

(a) In joint consultation, to guide and coordinate the activities of the Commission and its groups intersessionally;

(b) In joint consultation, and with the assistance of the Secretariats, to direct and approve intersessional actions including the creation and dissolution of ad hoc expert groups, task teams and rapporteurs, pending approval by the Commission in session;

(c) To carry out specific duties as prescribed by decisions of the governing bodies of WMO and UNESCO/IOC, as well as by the Regulations of each organization;

(d) To report to the governing bodies of WMO and UNESCO/IOC at their regular sessions on the activities of the Commission, as required;

(e) To ensure that the activities, recommendations and resolutions of the Commission are consistent with the provisions of the WMO Convention, the UNESCO/IOC Statutes, the decisions of WMO and UNESCO/IOC governing bodies, and the regulations of both organizations;

(f) To liaise with presidents of regional associations and chairs of GOOS regional alliances to ensure that regional requirements are taken into consideration when developing the work programme for JCOMM;

(3) That the Management Committee will be composed of:

(a) The two co-presidents of the Commission;

(b) The Programme Area coordinators;

(c) The Activity Leader on Quality Management Framework (to be nominated by the co-presidents in consultation with the Management Committee);

(d) Hassan Bouksim (Morocco) as the Activity Leader on Capacity-Building;

(e) The Activity Leader on Satellite Data Requirements (to be nominated by the co-presidents in consultation with the Management Committee);

(f) Senior representatives of GOOS, GCOS and IODE of UNESCO/IOC will also be invited to participate in Management Committee sessions, to ensure full coordination of programmes and activities;

Representatives of WMO technical commissions, especially the Commission for Basic Systems, regional associations, GOOS regional alliances and other bodies may be invited, as appropriate;

(4) That additional experts may be invited by the co-presidents, in consultation with the Secretary-General of WMO and the Executive Secretary of UNESCO/IOC, to participate in sessions of the Committee, as appropriate.

Resolution 2 (JCOMM-III)

OBSERVATIONS PROGRAMME AREA

THE JOINT WMO/IOC TECHNICAL COMMISSION FOR
OCEANOGRAPHY AND MARINE METEOROLOGY,

Noting:

(1) Resolution 3 (JCOMM-II) – Observations Programme Area,

(2) WMO Resolution 4 (EC-LII) and UNESCO/IOC Resolution EC-XXXIII.8 – Data Buoy Cooperation Panel,

(3) UNESCO/IOC Resolution EC-XXXIII.9 – Global Sea Level Observing System,

(4) The *Abridged Final Report with Resolutions of the Fourteenth World Meteorological Congress* (WMO-No. 960), general summary, paragraph 3.4.4.13 (Argo),

(5) UNESCO/IOC Assembly Resolution XX-6 – The Argo Project,

(6) Conference Statement, OceanObs'09, Venice, Italy, September 2009,

(7) The report of the chairperson of the Observations Coordination Group to the Commission at its third session,

Considering:

(1) The need to maintain, improve, coordinate and integrate a comprehensive, in situ, ocean observing system, in response to stated requirements for marine data to support the World Weather Watch, World Climate Programme , World Climate Research Programme, Global Ocean Observing System, Global Climate Observing System and marine services,

(2) The need to monitor new developments in marine observing technology and advise on their incorporation into operational observing networks, as appropriate,

(3) The need to coordinate the development and implementation of standardized, high-quality marine observing practices and instrumentation,

(4) The need to review continuously and provide advice on new marine telecommunications systems and procedures,

(5) The need to provide guidance to Members/Member States on technical aspects of marine observing systems,

(6) The need to identify and coordinate the provision of resources and logistic facilities for the deployment and servicing of marine observing platforms and instrumentation,

(7) The need to continuously monitor the performance and quality of marine observing systems and to assist in the implementation of remedial actions as necessary,

(8) The need to coordinate with appropriate bodies of the Commission for Basic Systems, Commission for Instruments and Methods of Observation, Global Ocean Observing System and Global Climate Observing System on marine instrumentation, observations networks and requirements for marine data,

Decides:

(1) To re-establish a JCOMM Observations Programme Area, with the following components:

   (a) An Observations Coordination Group;

   (b) A Data Buoy Observations Team, known as the Data Buoy Cooperation Panel;

   (c) A Sea Level Observations Team, known as the GLOSS Group of Experts;

   (d) A Ship Observations Team, aimed at continuing to develop coordination and synergies among the existing ship-based panels, that is, the Ship-of-Opportunity Programme Implementation Panel and the Voluntary Observing Ship Panel;

(2) To maintain a close liaison and coordination with the Argo Steering Team, the OceanSITES project, and the International Ocean Carbon Coordination Project;

(3) That the terms of reference for the Observations Coordination Group and the Ship, Data Buoy and Sea Level Observations Teams shall be as given in the annex to this resolution;

(4) That the general membership of the Observations Coordination Group and Ship, Data Buoy and Sea Level Observations Teams shall also be as given in the annex to this resolution;

(5) To select, in accordance with WMO General Regulation 32 and Rule 25 of the UNESCO/IOC Rules of Procedure:

   (a) Candyce Clark (United States) as chairperson of the Observations Coordination Group and Observations Programme Area Coordinator;

   (b) David Meldrum (United Kingdom) as vice-chairperson of the Observations Coordination Group, with specific responsibilities for polar region observing systems

and liaison with the WMO Executive Council Panel of Experts on Polar Observations, Research and Services;

(c) Graeme Ball (Australia) as chairperson of the Ship Observations Team;

(d) Gustavo Goni (United States) as chairperson of the Ship of Opportunity Programme Implementation Panel;

(e) Julie Fletcher (New Zealand) as chairperson of the Voluntary Observing Ship Panel;

(f) David Halpern (United States) as Activity Leader on Satellite Data Requirements;

(g) Vitaly Sychev (Russian Federation) as Activity Leader on Capacity-Building;

Requests the Secretary-General of WMO and the Executive Secretary of UNESCO/IOC to invite relevant organizations and bodies to participate in the work of this programme area as appropriate.

Annex to Resolution 2 (JCOMM-III)

TERMS OF REFERENCE AND GENERAL MEMBERSHIP OF THE COORDINATION GROUP AND TEAMS OF THE OBSERVATIONS PROGRAMME AREA

1. Observations Coordination Group

Terms of reference

The Observations Coordination Group shall:

(a) Keep under review and advise on the effectiveness, coordination and operation of the Observations work programme, including performance measured against scientific requirements, delivery of raw data, marine telecommunications, measurement standards, logistics and resources;

(b) Provide advice to JCOMM and to Observations teams on possible solutions for newly-identified requirements, consulting, as appropriate, with relevant scientific groups, the Commission for Basic Systems and the Commission for Instruments and Methods of Observation;

(c) Coordinate with appropriate bodies to ensure the JCOMM contribution towards the development of the WMO Integrated Global Observing System;

(d) Review in situ data requirements and recommend changes, as appropriate, taking into account the continuing development of satellite observations and their capabilities;

(e) Coordinate the development of standardized, high-quality observing practices and instrumentation and prepare recommendations for JCOMM;

(f) With concurrence of the co-presidents of JCOMM, establish and create expert teams, task teams, pilot projects and appoint rapporteurs, as appropriate, to undertake the work of the Observations Programme Area;

(g) Examine trade-offs and use of new and improved observation techniques/developments against: (i) relevant requirements for variables within the Global Climate Observing System, Global Ocean Observing System, the WMO Commission for Basic Systems rolling review of requirements and the Global Observing System; and (ii) available resources;

(h) Liaise with, and input to, Commission for Basic Systems activities regarding the consolidated requirements database and operational satellites;

(i) Liaise with, and input to, Commission for Instruments and Methods of Observation activities regarding instruments and methods of observation;

(j) Identify capacity-building requirements related to the programme area;

(k) Identify satellite remote sensing requirements in the meteorological and ocean domains related to the programme area.

General membership

The membership is selected to ensure an appropriate range of expertise and to maintain an appropriate geographical representation.

Programme Area/Observations coordinator (Observations Coordination Group chairperson)
Observations Coordination Group vice-chairperson
Chairperson Ship Observations Team (SOT)
Chairperson Data Buoy Cooperation Panel
Chairperson Global Sea Level Observing System (GLOSS) Group of Experts
Representative of Argo Steering Team
Representative of International Ocean Carbon Coordination Project
Representative of OceanSITES
Data Management Programme Area coordinator
Services and Forecasting Systems Programme Area coordinator
Activity Leader on Capacity-Building
Activity Leader on Satellite Data Requirements

The JCOMM In Situ Observing Platform Support Centre will participate in the work and the meetings of the Coordination Group.

2. Ship Observations Team

Terms of reference

The Ship Observations Team shall:

(a) Respond to requirements for ship-based observational data expressed by relevant existing international programmes and/or systems in support of marine services, and coordinate actions to implement and maintain the networks to satisfy these requirements;

(b) Provide continuing assessment of the extent to which those requirements are being met;

(c) Develop methodology for constantly controlling and improving the quality of data;

(d) Review marine telecommunication facilities and procedures for observational data collection, as well as technology and techniques for data processing and transmission, and propose actions as necessary for improvements and enhanced application;

(e) Coordinate Port Meteorological Officer (PMO)/ship greeting operations globally, propose actions to enhance PMO standards and operations, and contribute as required to PMO and observers training;

(f) Review, maintain and update as necessary technical guidance material relating to ship observations and Port Meteorological Officers;

(g) Liaise and coordinate as necessary with other JCOMM programme areas and expert teams, as well as with other interested parties;

(h) Participate in the planning activities of the appropriate observing system experiments and major international research programmes as the specialist group on observations based onboard ships, including Voluntary Observing Ships, Ships-of-Opportunity, ships from the Automated Shipboard Aerological Programme, and research ships;

(i) Seek new opportunities for deploying various kinds of measuring devices as recommended by the relevant panels and widely publicize those opportunities;

(j) Develop as necessary new pilot projects and/or operational activities and establish new specialized panels as required;

(k) Carry out other activities as agreed by participating Members/Member States to implement and operate the SOT programme and to promote and expand it internationally.

Terms of reference of Component Panels

Ship-of-Opportunity Programme Implementation Panel

The Ship-of-Opportunity Programme Implementation Panel (SOOPIP) coordinates the installation and deployment of instrumentation from Ships of Opportunity that travel in fixed transects, and in particular coordinates the implementation of regional and basin-wide instrumentation that measure physical, chemical and biological parameters, such as XBTs, TSGs and CPR. Its terms of reference are to:

(a) Review, recommend on and, as necessary, coordinate the implementation of specialized shipboard instrumentation and observing practices dedicated, but not limited, to temperature and salinity measurements;

(b) Coordinate the exchange of technical information on relevant oceanographic equipment and expendables, development, functionality, reliability and accuracy, and survey new developments in instrumentation technology and recommended practices;

(c) Ensure the distribution of available programme resources to ships to meet the recommended sampling network in the most efficient way;

(d) Ensure the transmission of data in real time from participating ships; ensure that delayed mode data are distributed in a timely manner (within 24 hours of the observations) to data-processing centres;

(e) Maintain, through the SOT chairperson, appropriate inventories, monitoring reports and analyses, performance indicators and information exchange facilities;

(f) Provide guidance to the coordinator in supporting the Ship-of-Opportunity Programme (SOOP);

(g) Prepare annually a report on the status of SOOP operations, data availability and data quality;

(h) Where relevant, serve as a platform for other observational programmes;

(i) Maintain close communications with the scientific community;

(j) Support the formation of a SOOP Science Team dedicated to meet and discuss on a periodic basis results and ongoing research performed with XBT observations.

Automated Shipboard Aerological Programme Panel

The Automated Shipboard Aerological Programme (ASAP) Panel is terminated and all of its outstanding and proposed future activities passed to the SOT Task Team on ASAP established by the Ship Observations Team at its fourth session. Decisions regarding the management of the ASAP trust fund are transferred to the SOT.

Voluntary Observing Ship Panel

The Voluntary Observing Ship (VOS) Panel shall:

(a) Review, recommend and coordinate the implementation of new and improved specialized shipboard meteorological instrumentation, siting and observing practices, as well as of associated software;

(b) Support the development and maintenance of new pilot projects;

(c) Oversee the transition of ships from the Voluntary Observing Ship Climate Project (VOSClim) status to the VOSClim class within the VOS, and encourage other suitable ships to be upgraded to the VOSClim class;

(d) Develop and implement activities to enhance ship recruitment, including promotional brochures and training videos;

(e) Prepare annually a report on the status of VOS operations, data availability and data quality.

General membership

Chairperson of the Ship Observations Team, selected by the Commission
Chairpersons of the SOOPIP and Voluntary Observing Ship Panel, selected by the Commission
Open membership, comprising operators of VOS and SOOP, representatives of monitoring centres, data management centres and bodies, representatives of the International Mobile Satellite Organization and other communications satellite systems, representatives of manufacturers, representatives of science advisory bodies and users as appropriate.

The JCOMM In Situ Observing Platform Support Centre will participate in the work and the meetings of the Ship Observations Team.

3. Data Buoy Observations Team

Data Buoy Cooperation Panel

Terms of reference

Existing terms of reference for the Data Buoy Cooperation Panel (DBCP), the Tropical Moored Buoy Implementation Panel (TIP) and action groups.

General membership

Open membership, comprising existing DBCP members, action groups, TIP.

JCOMMOPS will participate in the work and the meetings of the Team.

4. Sea Level Observations Team

GLOSS Group of Experts

Terms of reference

Existing terms of reference as determined by the UNESCO/IOC Executive Council.

General membership

Existing GLOSS Group of Experts and GLOSS Scientific Sub-group.

Resolution 3 (JCOMM-III)

DATA MANAGEMENT PROGRAMME AREA

THE JOINT WMO/IOC TECHNICAL COMMISSION FOR
OCEANOGRAPHY AND MARINE METEOROLOGY,

Noting:

(1) Resolution 4 (JCOMM-II) – Data Management Programme Area,

(2) The report of the chairperson of the Data Management Programme Area to the Commission at its third session,

(3) The report of the twentieth session of the UNESCO/IOC Committee on International Oceanographic Data and Exchange (IODE),

Considering:

(1) The need to implement, maintain and make available to users a fully integrated ocean/atmosphere data system,

(2) The requirement for the timely delivery of integrated data and associated metadata,

(3) The need to develop and maintain monitoring, evaluation and follow-up procedures,

(4) The need for common practices including quality control, metadata, analysis, data flow and data exchange standards, formats and procedures,

(5) The need to identify and, as appropriate, rescue, digitize and archive historical data,

(6) The need to collaborate and coordinate closely with other programmes and bodies, both within and outside WMO and UNESCO/IOC, namely the Commission for Basic Systems, Commission for Climatology and IODE of UNESCO/IOC,

(7) The capabilities and experience of existing data management centres, systems and programmes, both within and outside WMO and UNESCO/IOC,

(8) The need to develop and/or strengthen national data management capacity, especially in developing countries,

(9) The successful ongoing collaboration between JCOMM and IODE of UNESCO/IOC,

Agrees that, to the extent possible, the work of the Data Management Programme Area should be implemented through specific, clearly defined, time-limited projects,

Decides:

(1) To re-establish a JCOMM Data Management Programme Area with the following components:

(a) A Data Management Coordination Group;

(b) An Expert Team on Data Management Practices, co-sponsored by the UNESCO/IOC Committee on IODE;

(c) An Expert Team on Marine Climatology;

(2) That the terms of reference of the Data Management Coordination Group and the expert teams shall be as given in the annex to this resolution;

(3) That the general membership of the Data Management Coordination Group and the expert teams shall also be as given in the annex to this resolution;

(4) To select, in accordance with WMO General Regulation 32 and Rule 25 of the UNESCO/IOC Rules of Procedure, the following experts to serve as members of the Data Management Coordination Group:

(a) Athanasia Iona (Greece) as chairperson of the Data Management Coordination Group and Data Management Programme Area Coordinator;

(b) After consultation with the chairperson of the UNESCO/IOC Committee on IODE, Nikolay Mikhaylov (Russian Federation) as chairperson of the Expert Team on Data Management Practices;

(c) Scott Woodruff (United States) as chairperson of the Expert Team on Marine Climatology;

(d) William Burnett (United States) as Activity Leader on coding and instrument standards;

(e) Joseph Mukuria Kimani (Kenya);

(5) To select, in accordance with WMO General Regulation 32 and Rule 25 of the UNESCO/IOC Rules of Procedure, the following experts to serve as members of the Expert Team on Marine Climatology:

Derrick Snowden (United States)
Gudrun Rosenhagen (Germany)
Elizabeth Kent (United Kingdom)
Mizuho Hoshimoto (Japan)
Svetlana Somova (Russian Federation)
Wing-Tak Wong (Hong Kong, China)

(6) To select, in accordance with WMO General Regulation 32 and Rule 25 of the UNESCO/IOC Rules of Procedure and in consultation with the UNESCO/IOC Committee on IODE, the following experts to serve as members of the Expert Team on Data Management Practices:

UNESCO/IOC-IODE selections:
Mr Mathieu Ouellet (Canada)
Prof. Yutaka Michida (Japan)
Dr Sergey Belov (Russian Federation)
Mr Don Collins (United States)

JCOMM selections:
Anyuan Xiong (China)
Jixiang Chen (China)
Nicola Scott (United Kingdom)
Paul Ng'ala Oloo (Kenya)

Requests the Secretary-General of WMO and the Executive Secretary of UNESCO/IOC to invite the Commission for Basic Systems, Commission for Climatology, IODE of UNESCO/IOC, directors of relevant centres of the World Data System and other relevant organizations and bodies to participate in the work of this programme area as appropriate.

Annex to Resolution 3 (JCOMM-III)

TERMS OF REFERENCE AND GENERAL MEMBERSHIP OF THE COORDINATION GROUP AND TEAMS OF THE DATA MANAGEMENT PROGRAMME AREA

1. Data Management Coordination Group

Terms of reference

The Data Management Coordination Group, in close collaboration with International Oceanographic Data and Information Exchange (IODE) and Commission for Basic Systems subsidiary bodies and related experts, shall:

(a) Maintain a data management plan for JCOMM that identifies, assesses and specifies priorities and actions for the Data Management Programme Area;

(b) In concurrence with the co-presidents of JCOMM and the co-chairs of IODE, establish and create expert teams, task teams, pilot projects and appoint rapporteurs, as appropriate, to undertake the work of the Data Management Programme Area;

(c) Ensure collaboration, appropriate coordination and liaison with IODE as well as with the Commission for Basic Systems and other relevant bodies and activities external to WMO and UNESCO/IOC;

(d) Keep under review, assess and coordinate the adoption of appropriate new information technology;

(e) Establish and maintain cooperation with science programmes and assist with their data management activities, as appropriate;

(f) Provide advice and feedback to users of the Data Management Programme Area functions, through the appropriate JCOMM programme area, through IODE directly;

(g) Identify capacity-building requirements related to the programme area and, as appropriate, coordinate activities to address these requirements;

(h) Identify satellite remote sensing requirements related to the programme area.

General membership

The membership is selected to ensure a range of expertise and to maintain an appropriate geographical representation, and includes:

(a) Data Management Programme Area coordinator (Chairperson of the Data Management Coordination Group);

(b) Chairperson of the Expert Team on Data Management Practices;

(c) Chairperson of the Expert Team on Marine Climatology;

(d) IODE co-chairpersons;

(e) Up to four additional experts with experience in areas such as codes, data standards, communication systems and information technology, and capacity-building;

Additional experts may be invited as appropriate, with the concurrence of the co-presidents of the Commission and in general with no resource implications to JCOMM.

2. Expert Team on Data Management Practices

The JCOMM-IODE Expert Team on Data Management Practices, in close collaboration with JCOMM programme areas, Commission for Basic Systems subsidiary bodies, IODE officers and related experts, shall:

(a) Manage the process of adopting and documenting standards and best practices to be used in IODE-JCOMM data management through the Ocean Data Standards Pilot Project;

(b) Review and assess the effectiveness of end-to-end data management practices, including those of WIS/WIGOS and UNESCO/IOC-IODE Ocean Data Portal;

(c) In concurrence with the co-presidents of JCOMM, the chairperson of the JCOMM Data Management Coordination Group and UNESCO/IOC-IODE officers, establish task teams and pilot projects, as necessary, to undertake the work of the Expert Team on Data Management Practices;
(d) Direct and coordinate the activities of the task teams and pilot projects referred to under (c);

(e) Provide advice to the IODE of UNESCO/IOC and the Data Management Coordination Group and other groups of JCOMM, as required;

(f) Liaise and collaborate with other groups as needed, to ensure access to required expertise, appropriate coordination and to avoid duplication.

Membership

The membership is selected to ensure a range of expertise and to maintain an appropriate geographical representation, and includes:

(a) Up to five experts selected by JCOMM, including the chairperson, selected from Members/Member States with an appropriate geographical representation;

(b) Up to four experts with relevant expertise based on the current workplans of the task teams and pilot projects established by the Expert Team on Data Management Practices, selected by IODE of UNESCO/IOC;

(c) Representatives of JCOMM Programme Areas, the IODE Committee, and other expert bodies may be invited as appropriate with the concurrence of the co-presidents of JCOMM and with no resource implications to the Commission;

(d) One co-chairperson of the UNESCO/IOC Committee on IODE.

3. Expert Team on Marine Climatology

The Expert Team on Marine Climatology, in close collaboration with UNESCO/IOC-IODE, the Global Ocean Observing System, Global Climate Observing System, Commission for Climatology and Commission for Basic Systems subsidiary bodies and related experts, shall:

(a) Determine procedures and principles for the development and management of global and regional oceanographic and marine meteorological climatological datasets;

(b) Review and assess the climatological data elements of the Commission, including the operation of the Marine Climatological Summaries Scheme and the Global Collecting Centres, and the development of required oceanographic and marine meteorological products;

(c) Review the Global Ocean Observing System and Global Climate Observing System requirements for climatological datasets, taking account of the need for quality and integration;

(d) Develop procedures and standards for data assembly and the creation of climatological datasets, including the establishment of dedicated facilities and centres;

(e) Collaborate and liaise with other groups as needed to ensure access to expertise and ensure appropriate coordination;

(f) Keep under review and update, as necessary, relevant technical publications in the area of oceanographic and marine meteorological climatologies.

Membership

The membership is selected to ensure a range of expertise and to maintain an appropriate geographical representation, and includes:

(a) Up to eight experts, including the chairperson, selected from Members/Member States, representative of the range of responsibilities of the Expert Team. It is expected that, in general, the Expert Team on Marine Climatology will be self-funding;

(b) Additional representatives from the responsible members for the Marine Climatological Summaries Scheme and the Global Collecting Centres, from the Services and Forecasting Systems Programme Area's Expert Teams on Wind Waves and Storm Surges (and on Sea Ice, and from relevant projects and subsidiary bodies of IODE of UNESCO/IOC; as required, in consultation with the co-presidents of JCOMM;

(c) Additional representatives of JCOMM programme areas and of other expert bodies may be invited, as appropriate, with the concurrence of the co-presidents and with no resource implications to the Commission.

Resolution 4 (JCOMM-III)

SERVICES AND FORECASTING SYSTEMS PROGRAMME AREA

THE JOINT WMO/IOC TECHNICAL COMMISSION FOR OCEANOGRAPHY AND MARINE METEOROLOGY,

Noting:

(1) Resolution 2 (JCOMM-II) – Services Programme Area,

(2) The report of the co-presidents of the Commission at its third session,

(3) The report of the chairperson of the Services Programme Area to the Commission at its third session,

Considering:

(1) The continuing and expanding requirements of marine users for marine meteorological and oceanographic services and information,

(2) The need to ensure that the services provided to users meet these requirements, including in terms of timeliness and quality,

(3) The need to keep under review and to respond to the requirements of Members/Member States for guidance in the implementation of their duties and obligations with regard to marine services, in particular those specified in the *Manual on Marine Meteorological Services* (WMO-No. 558),

(4) The need to monitor closely the operations of the WMO marine broadcast system for the Global Maritime Distress and Safety System, as well as the Marine Pollution Emergency Response Support System, to develop modifications to the systems as necessary and to assist Members/Member States as required,

(5) The need to guide and coordinate developments in the preparation and dissemination of ocean products and services,

(6) The need to coordinate closely with other programmes of WMO and UNESCO/IOC (World Weather Watch, World Climate Programme, Global Ocean Observing System, Global Climate Observing System, Disaster Risk Reduction, etc.), as well as with other organizations such as the International Maritime Organization, International Hydrographic Organization, International Mobile Satellite Organization and International Chamber of Shipping in the provision of marine services and information,

Agrees that, to the extent possible, the work of the Services and Forecasting Systems Programme Area should be implemented through specific, clearly defined, time-limited projects;

Decides:

(1) To implement a JCOMM Services and Forecasting Systems Programme Area with the following components:

   (a) A Services and Forecasting Systems Coordination Group;

   (b) An Expert Team on Maritime Safety Services;

   (c) An Expert Team on Wind Waves and Storm Surges;

   (d) An Expert Team on Sea Ice;

   (e) An Expert Team on Operational Ocean Forecasting Systems;

(2) That the terms of reference of the Services and Forecasting Systems Coordination Group and the expert teams shall be as given in the annex to this resolution;

(3) That the general membership of the Services and Forecasting Systems Coordination Group and the expert teams shall also be as given in the annex to this resolution;

(4) To select, in accordance with WMO General Regulation 32 and Rule 25 of the UNESCO/IOC Rules of Procedure:

   (a) Ming Ji (United States) as chairperson of the Services and Forecasting Systems Coordination Group, and Services and Forecasting Systems Programme Area Coordinator;

   (b) Ali Juma Mafimbo (Kenya) as vice-chairperson of the Services and Forecasting Systems Coordination Group;

(c) Henri Savina (France) as chairperson of the Expert Team on Maritime Safety Services;

(d) Val Swail (Canada) as chairperson of the Expert Team on Wind Waves and Storm Surges;

(e) Vasily Smolyanitky (Russian Federation) as chairperson of the Expert Team on Sea Ice;

(f) Gary Brassington (Australia) as chairperson of the Expert Team on Operational Ocean Forecasting Systems;

(g) Moon-Sik Suk (Republic of Korea) as Activity Leader on Capacity-Building;

(5) To select, in accordance with WMO General Regulation 32 and Rule 25 of the UNESCO/IOC Rules of Procedure, the following experts to serve as core members of the Expert Team on Maritime Safety Services:

Alasdair Hainsworth (Australia)
Mohamed Aitlaamel (Morocco)
Nicholas Ashton (United Kingdom)
Oyvind Breivik (Norway)
Timothy Rulon (United States)
Valery Martyshchenko (Russian Federation)
Zenghai Zhang (China)

(6) To select, in accordance with WMO General Regulation 32 and UNESCO/IOC Rule 25, the following experts to serve as core members of the Expert Team on Wind Waves and Storm Surges:

Hendrik Tolman (United States)
Kevin Horsburgh (United Kingdom)
Mikhail Entel (Australia)
Maria Paula Etala (Argentina)
Richard Gorman (New Zealand)
Sung-Hyup You (Republic of Korea)
Thomas Bruns (Germany)

(7) To select, in accordance with WMO General Regulation 32 and UNESCO/IOC Rule 25, the following experts to serve as core members of the Expert Team on Sea Ice:

Ari Seina (Finland)
Baohui Li (China)
Beatriz Enriqueta Lorenzo (Argentina)
Jonathan Shanklin (United Kingdom)
Jurgen Holfort (Germany)
Marie-France Gauthier (Canada)
Nick Hughes (Norway)

(8) To select, in accordance with WMO General Regulation 32 and UNESCO/IOC Rule 25, the following experts to serve as core members of the Expert Team on Operational Ocean Forecasting Systems:

Adrian Hines (United Kingdom)
Eric Dombrowsky (France)
Frank Lee Bub (United States)
Jang-Won Seo (Republic of Korea)
Pierre Daniel (France)
Shiro Ishizaki (Japan)

Requests the Secretary-General of WMO and the Executive Secretary of UNESCO/IOC to invite International Maritime Organization, International Hydrographic Organization, International Chamber of Shipping, International Federation of Shipmasters' Associations, International Mobile Satellite Organization, Food and Agriculture Organization of the United Nations and other relevant organizations and bodies to participate in the work within this programme area as appropriate.

Annex to Resolution 4 (JCOMM-III)

TERMS OF REFERENCE AND GENERAL MEMBERSHIP OF THE COORDINATION GROUP AND TEAMS OF THE SERVICES AND FORECASTING SYSTEMS PROGRAMME AREA

1. Services and Forecasting Systems Coordination Group

Terms of reference

The Services and Forecasting Systems Coordination Group, in close collaboration with the Commission for Basic Systems, Global Ocean Observing System, Global Climate Observing System, Disaster Risk Reduction and other subsidiary bodies and related experts, shall:

(a) Keep under review and ensure the effectiveness, coordination and operation of the Services work programme, including performance with respect to timeliness, standards, quality and relevance to established user requirements;

(b) Through the assembly of requirements identified by specialist service groups, and other Programme Areas of JCOMM, provide advice on Services and Forecasting Systems Programme Area activities that need to be changed, implemented or discontinued;

(c) Develop and enhance interfaces to representative user groups to monitor the strength and weaknesses of existing Services and Forecasting Systems Programme Area activities;

(d) With the concurrence of the co-presidents of JCOMM, establish and create Expert Teams, Task Teams, Demonstration Projects and appoint Rapporteurs, as appropriate, to undertake the work of the Services and Forecasting Systems Programme Area;

(e) Ensure effective coordination and cooperation with groups and bodies in the area of service provision, including other Programme Areas of the Commission;

(f) Assess and recommend capacity-building tools/systems in accordance with identified requirements;

(g) Identify and maintain in situ and satellite measurement requirements for Services and Forecasting Systems Programme Area and monitor its implementation.

General membership

The membership is selected to ensure a range of expertise and to maintain an appropriate geographical representation, and includes:

Programme Area/Services and Forecasting Systems Coordinator (chairperson)
Vice-chairperson of the Services and Forecasting Systems Coordination Group
Chairpersons Expert Teams (4)
Regional Rapporteurs on Marine Meteorological and Oceanographic Services
Activity Leader on Capacity-Building
Chairpersons of Task Teams upon the Teams' lifetime

Additional experts may be invited as appropriate, representative of the range of Services and Forecasting Systems Programme Area activities, on a self-funded basis, and in general with no resource implications to JCOMM.

Representatives of JCOMM programme areas and of other expert bodies may be invited as appropriate, with the concurrence of the co-presidents of the Commission, and in general with no resource implications to JCOMM.

2. Expert Team on Maritime Safety Services

Terms of reference

The Expert Team on Maritime Safety Services (ETMSS), in close collaboration with international organizations and other entities representing users' interests, such as the International Maritime Organization (IMO), International Hydrographic Organization (IHO), International Chamber of Shipping (ICS), International Mobile Satellite Organization (IMSO), and other concerned organizations and bodies on maritime safety, search and rescue and marine pollution issues, including the Global Maritime Distress and Safety System (GMDSS), shall:

(a) In support of the Maritime Safety, Efficiency, and Search and Rescue (SAR) operations:

  (i) Monitor and review the operations of marine broadcast systems, including for the GMDSS and others for vessels not covered by the International Convention for the Safety of Life at Sea;

  (ii) Monitor and review technical and service quality standards for meteorological and oceanographic maritime safety information, particularly for the GMDSS, and provide assistance and support to Members/Member States as required;

  (iii) Propose actions as appropriate to meet requirements for international coordination of meteorological and related communication services;

  (iv) Develop technical advice and guidance material on Marine Meteorological Services, including keep under review the *Manual on Marine Meteorological Services* (WMO-No. 558), the *Guide on Marine Meteorological Services* (WMO-No. 471) and *Weather Reporting* (WMO-No. 9, Volume D – *Information for Shipping*), and provide assistance and support to Members/Member States as required;

(b) In support of the Marine Pollution Emergency Response Support System (MPERSS):

  (i) Monitor implementation and operations of MPERSS; review and suggest, as necessary, improvements to the contents of the overall system plan; (in consistency with the International Convention for the Prevention of Pollution from Ships, and other international conventions);

  (ii) Facilitate coordination and cooperation amongst the Area Meteorological and Oceanographic Coordinators (AMOCs) of MPERSS, in particular, with a view to ensuring full and ongoing operations in all areas, as well as the exchange of relevant advice, information, data and products between AMOCs, as appropriate and required;

(c) Monitor requirements by ensuring feedback from the user communities is obtained through appropriate and organized channels and applied to improve the relevance, effectiveness and quality of services;

(d) Liaise with and gather input from the Expert Team on Sea Ice, the Expert Team on Wind Waves and Storm Surges and the Expert Team on Operational Ocean Forecasting Systems on all aspects of sea ice, sea state, storm surge and ocean circulation relevant to

the operation and improvement of maritime safety services and maritime accident emergency support;

(e) Ensure effective coordination and cooperation with concerned organizations, bodies and Members/Member States on maritime safety issues and marine accident emergency support needs;

(f) Assist Members/Member States in the implementation of services and in the development of standardized methods for the quality assurance related to the provision of Maritime Safety Information, especially for the GMDSS, through capacity-building activities;

(g) Develop, in accordance with existing standards (for example, from the International Hydrographic Organization), graphical/numerical product specification for marine parameters, foremost wind, sea state, currents and sea ice, in Electronic Navigation Chart Systems;

(h) Provide advice to the Services and Forecasting Systems Coordination Group and other JCOMM groups, as required, on issues related to maritime safety services and marine accident emergency support;

(i) Continue to liaise closely with relevant groups and teams of organizations, such as IMO, IHO, ICS, IMSO and the European Maritime Safety Agency, to coordinate and improve maritime safety services, SAR and marine accident emergency support.

As a general principle, these terms of reference will be implemented through specific, defined, time-limited projects.

General membership

The membership will consist of a core membership of up to eight members, including the chairperson, selected to ensure an appropriate range of expertise in the provision of services for maritime safety and efficiency, SAR operations and marine pollution response.

Additional experts may be invited as appropriate, representative of a range of activities related to the implementation of services for maritime safety and efficiency, SAR operations and marine pollution response, as well as representatives of international organizations and other entities representing users' interests, such as the IMO, IHO, ICS, IMSO, and other user groups, on a self-funded basis, and in general with no resource implications to JCOMM.

3. Expert Team on Wind Waves and Storm Surges

Terms of reference

The Expert Team on Wind Waves and Storm Surges (ETWS) shall:

(a) Provide advice to Members/Member States on the development of real time operational forecast capability for wind waves and storm surge, as part of marine multi-hazard warning systems, to enhance their capacities to issue more accurate, consistent and timely operational forecast products;

(b) Develop technical advice and guidance material on wind wave and storm surge modelling, forecasting and service provision as part of marine multi-hazard warning systems, including coastal inundation modelling, forecasting and risk assessment, and provide assistance and support to Members/Member States as required;

(c) Provide advice to Members/Member States on the development of capability to provide marine multi-hazard warning services, with special attention to least developed countries and small island developing States, through capacity-building activities;

(d) Provide advice to Members/Member States on the development of wind wave and storm surge climatology and indices as a measure of risk assessment for marine coastal hazards;

(e) Ensure effective coordination and cooperation with other WMO and appropriate Global Ocean Observing System bodies, particularly on requirements for, and implementation of, wind wave and storm surge data, products and services.

As a general principle, these terms of reference will be implemented through specific, defined, time-limited projects.

General membership

The membership will consist of a core membership of up to eight members, four each representing the subject areas of waves and storm surges, including the chairperson, selected to ensure an appropriate range of expertise in both areas.

Additional experts may be invited as appropriate, representative of a range of activities related to wind waves, storm surges and coastal marine hazards, including coastal inundation, on a self-funded basis, and in general with no resource implications to JCOMM.

4. Expert Team on Sea Ice

Terms of reference

The Expert Team on Sea Ice (ETSI) shall:

(a) Coordinate and advise Members/Member States on products and services required by user communities in sea ice areas, to support navigation, coastal and off-shore activities, monitoring of the sea ice cover;

(b) Provide advice to ETMSS on all aspects of impacts of sea ice relevant to maritime safety, marine pollution response and search and rescue services;

(c) Maintain linkages with the Expert Team on Operational Ocean Forecasting Systems on the relevant sea ice modelling and forecasting techniques;

(d) Maintain linkages with projects and programmes related to the role of sea ice in the global climate system, including through the World Climate Research Programme and the Global Cryosphere Watch;

(e) Develop technical advice and guidance material, software exchange, specialized training and other appropriate capacity-building activities with regard to sea ice observations, analysis and services, and provide assistance to Members/Member States as required;

(f) Keep under review and provide guidance as appropriate on the operations of the Global Digital Sea Ice Data Bank, in collaboration with the Expert Team on Marine Climatology;

(g) Maintain and develop formats, nomenclatures and procedures for sea ice data and information exchange as well as relevant terminology, coding and mapping standards;

(h) Maintain linkages with relevant international organizations and programmes, in particular the Baltic Sea Ice Meeting, CLIC, European Ice Service, International Ice Charting Working Group, North American Ice Service, ASPeCt, Global Climate Observing System and the International Hydrographic Organization.

As a general principle, these terms of reference will be implemented through specific, defined, time-limited projects.

General membership

Up to eight Members, including the chairperson, representative of a range of activities related to sea ice and the ice-covered regions within JCOMM, and to maintain an appropriate geographical representation. It is expected that, in general, the ETSI will be self-funding. ETSI representatives will also act as full members of ETMSS and the Expert Team on Marine Climatology.

Representatives of regional and international sea ice bodies in particular the Baltic Sea Ice Meeting, European Ice Service, International Ice Charting Working Group and North American Ice Service will also be invited to participate at their own expense.

Additional experts may be invited as appropriate, representative of the range of activities related to sea ice, on a self-funded basis, and in general with no resource implications to JCOMM.

5. Expert Team on Operational Ocean Forecasting Systems

Terms of reference

The Expert Team on Operational Ocean Forecasting Systems (ETOOFS) shall:

(a) Manage and maintain the guide, scope and requirement documents, adhering to relevant Quality Management Systems, for Members/Member States providing ocean forecasting services;

(b) Guide and initiate actions at an international level that will contribute to the improvement of operational ocean prediction system efficiency, fidelity and service quality;

(c) Provide advice on Operational Ocean Forecasting Systems related matters and prepare submissions on the requirements (for example, research, observations and data management) of Operational Ocean Forecasting Systems operated by Members/Member States to other international groups;

(d) Manage and promote the adoption of an international standard to support interoperability and the common formatting of ocean forecast products and services;

(e) Promote and facilitate the support for and development and adoption of services to the wider community, particularly recognized special interest activity areas (for example, marine accident emergency support, maritime safety services, sea ice, and wind waves and storm surges).

As a general principle, these terms of reference will be implemented through specific, defined, time-limited projects.

General membership

Membership is selected to ensure an appropriate range of expertise and to maintain an appropriate geographical representation. Up to eight members, including the chairperson, representative of a range of activities related to ocean forecasting systems.

Additional experts may be invited as appropriate, representative of the range of activities related to ocean forecasting systems, on a self-funded basis, and in general with no resource implications to JCOMM.

Resolution 5 (JCOMM-III)

REVIEW OF PREVIOUS RESOLUTIONS AND RECOMMENDATIONS OF THE JOINT WMO/IOC TECHNICAL COMMISSION FOR OCEANOGRAPHY AND MARINE METEOROLOGY

THE JOINT WMO/IOC TECHNICAL COMMISSION FOR OCEANOGRAPHY AND MARINE METEOROLOGY,

Noting the actions taken on the resolutions and recommendations adopted by the Commission prior to its third session,

Decides:

(1) To keep in force the following recommendations:

JWC-IGOSS-V	2
CMM-XI	1 and 12
CMM-XII	4 and 6
JCOMM-I	1, 2, 3, 4, 5 and 12
JCOMM-II	3, 5, 12, 13 and 14

(2) Not to keep in force other resolutions and recommendations adopted before its third session (2009).

Annex to Resolution 5 (JCOMM-III)

RECOMMENDATIONS OF THE JOINT WMO/IOC TECHNICAL COMMISSION FOR OCEANOGRAPHY AND MARINE METEOROLOGY ADOPTED PRIOR TO ITS THIRD SESSION AND MANTAINED IN FORCE

Recommendation 2 (JWC-IGOSS-V)

REAL-TIME DISTRIBUTION AND ARCHIVING OF OCEANOGRAPHIC DATA

THE JOINT IOC/WMO WORKING COMMITTEE FOR IGOSS,

NOTING: (i) the requirements of IGOSS for real-time oceanographic data in support of both operational and research users, (ii) the value of long-term series of oceanographic data for climatological studies, (iii) Recommendation 2 (DBCP-III) – Real-time Distribution and Archiving of Oceanographic Data from Drifting Buoys,

CONSIDERING: (i) that many oceanographers make both surface and sub-surface measurements of oceanographic variables of great potential value to IGOSS, (ii) that many of these measurements are not presently being made available in real-time over the GTS,

RECOMMENDS: (i) that oceanographers and others involved in the collection of both surface and sub-surface oceanographic data make every effort to ensure the distribution of these data in real time over the GTS, (ii) that oceanographic data be also made available to the RNODCs for permanent global archival,

REQUESTS the Secretariats, the IGOSS Operational Coordinator, the Chairperson of the Joint Working Committee and Member States, in liaison with the Drifting Buoy Cooperation Panel, to bring this recommendation to the attention of those concerned.

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;

(3) That the monitoring should be undertaken by Members and coordinated by the WMO Secretariat and should take place on a routine basis every four years;

(4) That a comprehensive analysis of the results oft he 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.

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

Annex to Recommendation 1 (CMM-XI)

MARINE METEORLOGICAL 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 cooperation 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. Radio-facsimile 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 of 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 messages	_____	_____	_____	_____	_____	_____
(c) Refusal of CRS/CES to accept OBS messages	_____	_____	_____	_____	_____	_____
(d) Use of five- or ten-figure groups	_____	_____	_____	_____	_____	_____

5. Other related problems

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6. Suggested improvements

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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 4 (CMM-XII)

WAVE FORECAST VERIFICATION SCHEME

THE COMMISSION FOR MARINE METEOROLOGY,

NOTING:

(1) Recommendation 4 (CMM-XI) — WMO wave programme 1993–1997,

(2) The report to CMM-XII by the chairperson of the Subgroup on Wave Modelling and Forecasting,

RECOGNIZING that formal verification systems for operational numerical weather prediction models have led directly to general and specific improvements in these models,

NOTING with interest the informal wind wave forecast verification scheme already adopted by a number of centres operating operational global or basin-scale models,

CONSIDERING:

(1) The potential improvements which might be expected in operational wind wave models through a more generalized and formal approach to wave model forecast verification,

(2) That for a verification scheme to be most effective, all National Meteorological Services operating global or basin-scale models should, if possible, participate,

RECOMMENDS:

(1) That the wind wave model forecast verification scheme outlined in the annex to this recommendation should be further developed and formally implemented;

(2) That all Members operating global or basin-scale wave forecast models should be urged to participate;

REQUESTS the Subgroup on Wave Modelling and Forecasting:

(1) To develop further details of the scheme, for eventual consideration and adoption, on a trial basis, by interested Members;

(2) To review the implementation and operation of the trial scheme and to report on progress to CMM-XIII;

REQUESTS the Secretary-General to provide assistance to Members in the implementation of the scheme, as appropriate, and within the available budgetary resources.

Annex to Recommendation 4 (CMM-XII)

WIND WAVE FORECAST VERIFICATION SCHEME

1. A scheme for exchanging verification statistics for operational wave models

Reliable wave observations are available only from around 40 to 50 moored buoys, and there are only a few parameters for which observations are available. A subset of the available moored buoys has been used, choosing those buoys in deep water, away from coasts, and ensuring that all possible regions are adequately represented.

Model values are extracted at six-hourly intervals both at t+00 (analysis) and for forecast periods of t+24,48, 72, 96 and 120 hours (if available). Each month the data files are transmitted to the anonymous ftp server at the UKMO, where a file is produced containing the observations and model values from all centres. These files are placed on the UKMO anonymous ftp server for retrieval by participants.

Tables of statistics based on this data are calculated at ECMWF, and the summary files are transmitted o the UKMO ftp server for retrieval by participants. Thus, the workload involved in running the exchange is shared. All the files of data, statistics and any post-script files for the current month are freely available via anonymous ftp from the UKMO server.

The exchange has grown to now compare data from five participating centres, at 36 moored buoys, and for six separate forecast periods. Early results showed the impact at t+00 of assimilating ERS-1altimeter data: those models that assimilated ERS-1data had a wave height bias of some –0.2 m, and showed a rapid

increase in model wave height during the first 24 hours of the forecast, compared to those centres not assimilating. Further, the immediate benefit of the switch early in 1996 to using ERS-2 data was readily seen. The t+00 bias of –0.2 m was removed, and the spin up of wave height was reduced.

The data exchange, by comparing both instantaneous observations and six-hourly averaged observations, revealed some ongoing problems with wave reports from the UKMO buoys west of Ireland. This was communicated to those responsible for maintaining the instruments, and a program to replace the communication units, already in hand, was seen to cure the problems.

Examination of time-series of model and observed wave heights, particularly in November 1995, showed a systematic failure of the WAM model at ECMWF to reach the highest wave heights observed during extreme storms in the west Atlantic. The WAM model run at FNMOC was closer to the observations. This illustrates that WAM model results may depend on details of the implementation (model grid and spectral resolution), and the wind data used.

2. Wider benefits from adopting an international verification of wave models

Many National Meteorological Services engaged in wave forecasting may benefit from this activity, in the same way in which many countries benefit from the exchange of internationally accepted weather forecast verification scores. Until now, model validation has been carried out with special case studies, rather than using routinely available forecast model results.

Widespread access to information on wave model performance may also stimulate those Meteorological or Hydrographic centres that at present do not place their buoy observations on the GTS to consider doing so, and so allow a verification of wave models in the areas of local interest to these centres.

Several centres already make use of the third generation WAM model, and the UKMO is planning to implement a version of WAM in the near future. Yet already the exchange has revealed differences between different operational implementations of WAM —using winds from different models, with differing grid and spectral resolutions, assimilating altimeter data, or not. Even with most operational wave models based on WAM, a formally-adopted verification exchange will lead to improvements in wave model forecast systems.

A better understanding of the quality of surface winds from NWP models may lead to improvements in the modelling of the marine boundary layer. This may, through improved modelling of surface fluxes of heat, moisture and momentum, lead to improved NWP forecasts of surface winds.

Improvements in global wave modelling will also lead to improvements in regional wave modelling, through a better specification of boundary forcing and incoming swell, and improvements in model formulation. Many smaller, regional Meteorological Centres, although not running a global wave model, may still wish to run a regional wave model to provide local forecasts of sea state. Making available information on global wave model verification will assist with this.

Recommendation 6 (CMM-XII)

DATA BUOYS IN SUPPORT OF METEOROLOGICAL AND OCEANOGRAPHIC OPERATIONS AND RESEARCH

THE COMMISSION FOR MARINE METEOROLOGY,

NOTING:

(1) Resolution 9 (EC-XLV) — Data Buoy Cooperation Panel,

(2) Recommendation 6 (CMM-XI) — Drifting buoys in support of meteorological and oceanographic operations and research,

(3) The Fourth WMO Long-term Plan, Part II, Volume 1(WMO/TD-No. 700) — The WWW Programme —and Volume 4 (WMO/TD-No. 703) — The Applications of Meteorology Programme,

(4) The final report of the Ocean Observing System Development Panel — An Ocean Observing System for Climate,

(5) Annual reports of the DBCP for 1995 and 1996,

(6) DBCP Technical Document No. 4 (1995) — *WOCE Surface Velocity Programme Barometer Drifter Construction Manual*,

NOTING with appreciation the efforts of the DBCP, in conjunction with GCOS and global research programmes, to expand cooperative buoy deployments worldwide through the creation of new regional action groups such as those in the South Atlantic and Indian Oceans,

RECOGNIZING nevertheless:

(1) That not all drifting buoys carry sensors for atmospheric pressure and/or sea-surface temperature,

(2) That a large number of drifting buoy deployments now taking place or planned over the next few years are funded through research programmes and that these deployments may cease with the termination of the specific research programmes,

CONSIDERING:

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

(2) The stated requirements for operational buoy data in support of the WWW, marine meteorological services and global climate studies,

CONSIDERING further that the success of the DBCP was critically dependent on the activities of, and the coordination provided by, its technical coordinator, and that increasing difficulties for Members in maintaining voluntary financial contributions were threatening the continuance of the position,

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, SST and, if possible, air temperature sensors so as to enhance their potential value to a wide variety of WMO programmes, in particular making use of the low-cost SVP-B drifter whenever practicable;

(2) That the international research 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 Cooperation Panel continue their efforts to ensure funding of drifting buoy deployments on a long-term, operational basis following the termination of the specific research programmes;

(4) That as many additional Members as possible contribute to the DBCP Trust Fund, to reduce the burden on existing contributors and ensure the maintenance of the essential technical coordinator position, which benefited all Members of WMO;

(5) That the DBCP and the Executive Council consider the possibilities for new and innovative ways of funding and maintaining the technical coordinator position;

REQUESTS the Secretary-General and the Data Buoy Cooperation 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 1 (JCOMM-I)

OCEAN DATA ACQUISITION SYSTEM (ODAS) METADATA FORMAT

THE JOINT WMO/IOC TECHNICAL COMMISSION FOR
OCEANOGRAPHY AND MARINE METEOROLOGY,

NOTING:

(1) The *Abridged Final Report with Resolutions and Recommendations of the Twelfth Session of the Commission for Marine Meteorology* (WMO-No.860), general summary paragraph 7.3.9,

(2) The final report of the JCOMM Subgroup on Marine Climatology, eighth session (Asheville, April 2000), paragraphs 6.1.1–6.1.3 and annex VIII,

(3) The summary report of the DBCP-XVI (Victoria, October 2000), paragraphs 95–99,

CONSIDERING:

(1) That a comprehensive ODAS metadatabase would allow a full and accurate interpretation of the observational data from ODAS which are available in climatological archives,

(2) That observational data and associated metadata from ODAS are of importance to global climate studies as well as for a range of marine climate applications,

RECOMMENDS that the format given in the annex to this recommendation be used as the global format for the assembly, exchange and archival of metadata from all types of ODAS, including, in particular, drifting and moored buoys and fixed platforms;

INVITES:

(1) One or more Members/Member States to agree to host an ODAS metadatabase;

(2) Members/Member States operating ODAS to arrange for the assembly of the metadata from these platforms in the agreed format and for their eventual submission to the ODAS metadata archival centre(s);

REQUESTS the Secretary-General of WMO and the Executive Secretary IOC, with the assistance of the co-presidents of JCOMM and the chairperson of the DBCP, to consult with Members/Member States, with a view to establishing the metadata archival centre(s), and to otherwise assist Members/Member States, as necessary, in the submission of metadata to these centre(s).

Annex to Recommendation 1 (JCOMM-I)

OCEAN DATA ACQUISITION SYSTEM (ODAS) INGEST FORMAT

The two basic metadata record types (header and data) are listed. Within the data record type, there are different subsidiary record types defined for the different sensor types that are presently defined (the data record list could be expanded in the future). The descriptions of the fields that make up each record type are listed in the table.

1. **Header record** (HR is the identifier for the meta-data header record)

HR; ts; WMOn; stn; Ain; ind; oed; cnty; ragy; Idum; DA; Lat; Lon; WC; lngth; brth; diam; hult;huln; mtyp; cmsy; Stt; foo; dfmt; wdpth; plt; DI; WebA; footnote # 1; footnote # 2; footnote # 3;footnote # 4; footnote # 5

2. **Data records** (DR is the identifier for the sensor information record, thus designated data record) the first six elements will link the data record to the header record. A data record will only exist when there is an actual sensor on the platform and it can be repeated for every sensor of a given type.

“Sno” in the eighth element represents the sequence number of sensors located on the platform, e.g. if two anemometer sensors were on the platform there would be two data records for anemometers indicated in elements 7 and 8 asAN1and AN 2.

The “ind” field is a critical part in linking records in the case where a platform was moved or totally re-equipped or redesigned. This will allow the correct data records to be linked to the proper header record especially in cases where the same identifier was reissued at a later date.

AN metadata record: **Anemometer** sensor (AN in 7th element).
DR; ts; WMOn; stn; AIn; ind; AN; Sno; anmI; aMS; anmL; anDB; anDC; hwl; ouAN; sfWD; sfWS; apWD; apWS; amWS; cmpT; apWG; amWG; amScd; amID; amSD; footnote # 1

AT metadata record: **Air temperature** sensor (AT in 7th element).
DR; ts; WMOn; stn; AIn; ind; AT; Sno; ats; atsMS; atsL; atsDB; atsC; atswl; ouAT; sfAT; apAT; atScd; atID; atSD; footnote # 1; footnote # 2

WT metadata record: **Water temperature** sensor (WT in 7th element).
DR; ts; WMOn; stn; AIn; ind; WT; Sno; wts; wtsMS; wtsL; wtsDB; wtsC; dws; ouWT; sfWT; apWT; wtScd; wtID; wtSD; footnote # 1

SA metadata record: **Salinity** sensor (SA in 7th element).
DR; ts; WMOn; stn; AIn; ind; SA; Sno; Sstp, Ssm; SsL; SsDB; SsC; dss; ouSs; sfSs; apSs; mSs; SsScd; SsID; SsSD; footnote # 1

BP metadata record: **Barometric pressure** (BP in 7th element).
DR; ts; WMOn; stn; AIn; ind; BP; Sno; bps; bpsMS; bpsL; bpsDB; bpsC; bpswl; ouBP; sfBP; apBP; bpScd; bpsID; bpsSD

RH metadata record: **Relative humidity** (wetbulb/dew point) sensor (RH in 7th element).
DR; ts; WMOn; stn; AIn; ind; RH; Sno; hs; hsMS; hsL; hsDB; hsC; hswl; ouHS; sfHS; apHS; hsScd; hsID; hsSD

PG metadata record: **Precipitation gauge** (PG in 7th element).
DR; ts; WMOn; stn; AIn; ind; PG; Sno; pg; pgMS; pgL; pgDB; pgC; pgwl; pupg; sfPG; apPG; pgScd; pgID; pgSD

RD metadata record: **Radiation** sensor (RD in7th element).
DR; ts; WMOn; stn; AIn; ind; RD; Sno; srs; rMS; rsL; rsDB; rsC; srwl; ours; sfSR; apSR; srScd; rsID; rsSD

CR metadata record: **Ocean current** sensor (CR in 7th element).
DR; ts; WMOn; stn; AIn; ind; CR; Sno; OC; Tsmoc; dmOC; ouOC; sfOC; apOC; ocScd; ocID; ocSD

WS metadata record: **Wave spectra** (WS in 7th element).
DR; ts; WMOn; stn; AIn; ind; WS; Sno; wasp; Digf; Nblks; Npts; spAT; sfWAS, apWAS

HV metadata record: **Horizontal visibility** (HV in 7th element).
DR; ts; WMOn; stn; AIn; ind; HV; Sno; hvm; hvit;hvl; hvDB; hvC; hvwl; hvou; hvsf; hvap; hvScd; hvID; hvSD

Table. ODAS metadatabase contents

Record type and sequence number		*Field abbreviation*	*Input codes*	*Description of fields*
HEADER RECORD (HR)				
HR	1	ts		Type of station
			MB	Moored buoy
			DB	Drifting buoy
			ID	Ice drifter
			FP	Fixed platform (oil rig, etc.)
			IS	Island station
			AL	Automatic light station
			CM	Coastal marine automated station
			PF	Profiling floats (e.g. ARGO – a global array of profiling floats)
			OT	Other (specify in footnote # 1 Header record)
	2	WMOn		WMO number – 5-digit identifier
	3	stn		Unique call sign if available; otherwise, station name (C-MAN, platforms, etc.)
	4	AIn		Additional identifier number; define in footnote # 2 (e.g. ARGOS = up to 7 digits, GOES no., others)
	5	nd		Period of validity/beginning of historical record (initiation date – year, month, day, e.g. 19950321) date of mooring, launching, or platform instrumentation (date the platform began collecting weather observations under its current ID and location). If the platform is moved or assigned a new ID then a new period of validity should be initiated
	6	oed		Operational end date of platform operations (year, month, day, e.g. 20000127). This item is associated with the entry above which shows the beginning date and this item the ending date when a platform closed operations. If for example a moored buoy was placed in the Great Lakes each spring and with drawn each winter the beginning date would not change unless the identifier, ownership, or location changed at some point. When one of these change, a new beginning date should be entered “ind” above and an operational end date entered in this field
	7	cnty	see list	Country of ownership—International Organization for Standardization (ISO) country code (Alpha-2; two character alpha code)
	8	ragy		Responsible agency/organization within a country responsible for the platform’s operations, launch, and metadata [e.g. in the United States it could be the National Ocean Service (NOS) NOAA, National Data Buoy Center (NDBC) NOAA, Woods Hole Institute, etc.] List the full name of the organization or agency responsible. There should be a link between the responsible agency/organization and the Web address listed in item 114
	9	ldmu		Last date metadata updated (year, month, day, e.g. 20000527 representing 27 May 2000)
	10	DA		Degree of automation
			1	Fully automated
			2	Always supplemented with manual input
			3	Occasionally supplemented with manual input
			4	Fully manual (no automation)
			5	Unknown
	11	Lat		Latitude – degrees, up to three decimal places if available (e.g. 50.985N/S)
	12	Lon		Longitude – degrees, up to three decimal places if available (e.g. 124.976E/W)
	13	WC		Watch circle – nearest whole metre (e.g. 346.5 = 347 m). The maximum distance a moored buoy can be located from its central position related to the length and type of mooring. Outside the watch circle and the moored buoy is likely adrift
	14	Lngth		Length – the length of the platform (if rectangular or boat shape hull). See code “diam” below if the platform is a discus. Metres to tenths (e.g. 26.9 m)

Record type and sequence number		*Field abbreviation*	*Input codes*	*Description of fields*
	15	Brth		Breath – the breath (width) of the platform (if rectangular or boat shaped hull). Metres to tenths (e.g. 12.6 m)
	16	Diam		Diameter – platform dimension for discus type hulls. Diameter in metres to tenths (e.g. 6.0 m)
	17	Hult		Hull type
			DS	Discus (cylinders)
			BS	Boat shaped hull
			RS	Rectangular shape
			SP	Spars
			OD	ODAS 30 series
			NM	NOMAD
			TR	Torus
			CN	Conic
			OR	Omnidirectional wave-rider
			DR	Directional wave-rider
			OT	Other (specify in footnote # 3 Header record)
	18	Huln		Hull or platform number—enter as assigned (a combination of numeric and alpha characters if required)
	19	Mtyp		Mooring type – mooring type if a moored buoy or drouge type if drifting buoy
			AC	All chain (shallow depths generally up to 90 m)
			ST	Semitaut (intermediated depths generally 60 to 600 m – generally nylon cable)
			FC	Float inverse catenary (deep ocean generally 600 to 6 000 m – generally nylon with glass floats)
			PC	Poly-nylon inverse catenary (deep ocean generally 1 200 to 6 000 m)
				Drouge type
			HS	Holeysock drogue
			TS	Tristar
			WS	Window shade
			PA	Parachute
			NL	Non-Lagrangian sea anchor
				Use for either mooring or drouge as needed
			OT	Other (specify in footnote # 4 Header record)
	20	Cmsy		Satellite data-collection system – system used to transmit the observations
			GO	GOES DCP
			AR	ARGOS PTT
			GA	GOES primary ARGOS backup
			RF	RF
			OT	Other (specify in footnote # 5 Header record)
	21	Stt		Satellite transmission time – times lot assigned for observation transmission. Hours and minutes UTC (e.g. 1230) or for example, on the hour, on the half-hour, two orbits per day, etc.
	22	Foo		Frequency of observations – hours and minutes (e.g. every hour = 1.0, every 6 hours = 6.0, or every half hour 0.5, etc., I = irregular)
	23	dfmt		Data format – data format (*Manual on Codes* (WMO-No.306)) the observations was transmitted or digitized (i.e. observational form). BUOY – FM 18-X TESAC – FM 64-IX WAVEOB – FM 65-IX BUFR – FM 94-XI Other WMO codes added as needed NOTE: Use actual WMO code designator as the abbreviation (e.g. FM 18-X)
	24	wdpth		Water depth (nearest whole metre)
	25	plt		Payload type (e.g. DACT, VEEP, GSBP, ZENO, ODAS33, etc.) Details should be provided regarding each type of payload (payload description)
	26	DI		Digital image – a photograph or schematic of the platform and equipment
			AV	Available in digital file
			NA	Not available
	27	WebA		Web address (URL) where additional information can be obtained
ANEMOMETER (AN)				
DR	1	anmI		Anemometer instrument type
			P	Propeller type
			TC	Three cup
			FC	Four cup
			S	Sonic
			WT	WOTAN (wind observation through ambient noise)
			OT	Other (define in footnote)
	2	aMS		Anemometer – model (manufacturer/series no.)

Record type and sequence number		*Field abbreviation*	*Input codes*	*Description of fields*
	3	anmL	 FM AM CM RY LY OT	Anemometer – location Foremast Aftmast Centremast (mainmast) Right yardarm Left yardarm Other (define in footnote)
	4	anDB		Anemometer – distance from the bow or front of platform (metres to tenths)
	5	anDC		Anemometer – distance from centre line or from centre of discus (metres to tenths)
	6	hwl		Anemometer – height above water line (metres to tenths). Value can be negative for WOTAN
	7	ouAN		Anemometer – operational range and units of measurement (e.g. 0 to 60 ms^{-1}; 000 to 360°)
	8	sfWD		Sampling frequency (Hz) – wind direction (e.g. 1.28 Hz)
	9	sfWS		Sampling frequency (Hz) – wind speed (e.g. 1.28 Hz)
	10	apWD		Averaging period (minutes to tenths) – wind direction (e.g. 8.0 minutes)
	11	apWS		Averaging period (minutes to tenths) – wind speed (e.g. 8.0 minutes)
	12	amWS	 S V	Averaging method – wind speed Scalar Vector
	13	cmpT		Compass type/model no. – anemometer
	14	apWG		Averaging period (seconds) – wind gust (e.g. 5 seconds)
	15	amWG	 S V	Averaging method – wind gust Scalar Vector
	16	amScd		Calibration date – anemometer sensor no. Date sensor was last calibrated (year, month, day, e.g. 20000723)
	17	amID		Anemometer sensor installation date (year, month, day, e.g.19950228). If the direction sensor and speed sensor are separate instruments then use footnote # 1 in the anemometer data record to enter the dates for speed sensor and this position for direction sensor
	18	amSD		Anemometer out of service dates (beginning and ending dates; year, month, day, e.g. 19960123–19960212). If known these dates should be entered any time either the direction, speed, or both is unavailable due to equipment outage (non-reporting or invalid reports)
AIR TEMPERATURE (AT)				
DR	1	ats	 ER M MS A AS OT	Air temperature sensor – instrument type Electrical resistance thermometer Mercury-in-glass thermometer Screen shelter – mercury thermometer Alcohol-in-glass thermometer Screen shelter – alcohol thermometer Other (specify in footnote # 1 in the air temperature data record)
	2	atsMS		Air temperature sensor – model (manufacturer/series no.)
	3	atsL	 FM AM CM RY LY OT	Air temperature sensor – location Foremast Aftmast Centremast (mainmast) Right yardarm Left yardarm Other (specify in footnote # 2 in the air temperature data record)
	4	atsDB		Air temperature sensor– distance (metre to tenths) from bow or front of platform NOTE: Leave this field blank if platform is a discus
	5	atsC		Air temperature sensor – distance (metres to tenths) from centre line or centre of discus
	6	atswl		Air temperature sensor – height (metres to tenths) above water line
	7	ouAT		Air temperature sensor – operational range and units of measurement (e.g. – 40°C to + 5 0°C)
	8	sfAT		Sampling frequency (Hz) – air temperature sensor (e.g. 1.28 Hz)
	9	apAT		Averaging period (minutes to tenths) – air temperature sensor (e.g. 8.0 minutes)
	10	atScd		Calibration date – air temperature sensor no. Date sensor was last calibrated (year, month, day, e.g. 20000723)

Record type and sequence number		*Field abbreviation*	*Input codes*	*Description of fields*
	11	atID		Air temperature sensor installation date (year, month, day, e.g. 19950228)
	12	atSD		Air temperature sensor out of service dates (beginning and ending dates; year, month, day, e.g. 19960123–19960212). If known these dates should be entered any time the air temperature is unavailable due to equipment outage (non-reporting or invalid reports)
WATER TEMPERATURE (WT)				
DR	1	wts	HC HT RT ER TT BU CTD STD RM XC NS AL XBT OT	Water temperature sensor – instrument type Hull contact sensor “Through hull” sensor Radiation thermometer Electrical resistance thermometer Trailing thermistor Bucket thermometer CTD (conductivity-temperature-depth) STD (salinity-temperature-depth) Refractometer XCTD (expendable CTD probe) Nansen cast ALACE (autonomous Lagrangian circulation explorer) Expendable bathythermograph Other (specify in footnote # 1 in the water temperature data record)
	2	wtsMS		Water (sea) temperature sensor – model (manufacturer/series no.)
	3	wtsL		Water temperature sensor – location (e.g. port bow, bottom of discus, etc.)
	4	wtsDB		Water temperature sensor – distance (metres to tenths) from the bow or front of platform NOTE: Left blank for discus hulls and subsurface temperatures
	5	wtsC		Water temperature sensor – distance (metres to tenths) from centre line or centre of discus
	6	dws		Depth of water temperature sensor; tenths of metres (e.g. 10.3 m) below the water line
	7	ouWT		Operational range and units of measurement – water temperature sensor (e.g. range – 4°C to + 40°C)
	8	sfWT		Sample frequency (Hz) – water temperature sensor (e.g. 1.28 Hz)
	9	apWT		Averaging period (minutes to tenths) – water temperature sensor (e.g. 8.0 minutes)
	10	wtScd		Calibration date – water temperature sensor no. Date sensor was last calibrated (year, month, day, e.g. 20000723)
	11	wtID		Water temperature sensor installation date (year, month, day, e.g. 19950228)
	12	wtSD		Water temperature sensor out of service dates (beginning and ending dates; year, month, day, e.g. 19960123–19960212). If known these dates should be entered any time the water temperature is unavailable due to equipment outage (non-reporting or invalid reports)
SALINITY (SA)				
DR	1	Sstp	CTD STD RM XC NS AL OT	Salinity – sensor type CTD (conductivity-temperature-depth) STD (salinity-temperature-depth) Refractometer XCTD (expendable CTD probe) Nansen cast ALACE (autonomous Lagrangian circulation explorer) Other (specify in footnote # 1 in the salinity data record)
	2	Ssm		Salinity sensor (model/manufacturer/series no.)
	3	SsL		Salinity sensor no. – location NOTE: To be used only for those sensors attached to a platform)
	4	SsDB		Salinity sensor no. – distance from bow or front of platform NOTE: To be used only when sensor is attached to a platform (same as location above)
	5	SsC		Salinity sensor no. – distance from centre line or centre of discus
	6	dss		Depth of salinity sensor no. –metres to tenths (e.g. 10.7 m) of salinity sensor below the water line (surface of the water)
	7	ouSs		Salinity sensor – operational range and units of measurement (e.g. 25 to 45 parts per thousand. Salinity is calculated based on the measurement of chlorinity)
	8	sfSs		Sample frequency – available only for automated digital sensors
	9	apSs		Averaging period – available only for automated digital sensors
	10	mSs		Method used to compute the salinity (e.g. chlorinity, electrical conductivity, refractive index, etc.)

Record type and sequence number		*Field abbreviation*	*Input codes*	*Description of fields*
	11	SsScd		Calibration date – salinity sensor no. Date the sensor was last calibrated (year, month, day, e.g. 20000207)
	12	SsID		Salinity sensor installation date (year, month, day, e.g. 19950228)
	13	SsSD		Salinity sensor out of service dates (beginning and ending dates; year, month, day, e.g. 19960123–19960212). If known these dates should be entered any time the salinity is unavailable due to equipment outage (non-reporting or in valid reports)
BAROMETRIC PRESSURE (BP)				
DR	1	bps		Barometric pressure sensor – instrument type
	2	bpsMS		Barometric pressures sensor – model (manufacturer/series no.)
	3	bpsL		Barometric pressure sensor – location (e.g. centremast)
	4	bpsDB		Barometric pressure sensor – distance (metres to tenths) from the bow or front of platform NOTE: Leave this field blank if platform is a discus
	5	bpsC		Barometric pressure sensor – distance (metres to tenths) from centre line or centre of discus
	6	bpswl		Barometric pressure sensor – height (metres to tenths) above water line
	7	ouBP		Barometric pressure sensor – operational range and units of measurement (e.g. 900–1100hPa)
	8	sfBP		Sampling frequency (Hz) – barometric pressure sensor (e.g. 1.28 Hz)
	9	apBP		Averaging period (minutes to tenths) – barometric pressure sensor (e.g. 8.0 minutes)
	10	bpScd		Calibration date – barometric pressure sensor no. Latest date of calibration (year, month, day, e.g. 20000207)
	11	bpsID		Barometric pressure sensor installation date (year, month, day, e.g. 19950228)
	12	bpsSD		Barometric pressure sensor out of service dates (beginning and ending dates; year, month, day, e.g. 19960123–19960212). If known these dates should be entered any time the barometric pressure is unavailable due to equipment outage (non-reporting or invalid reports)
RELATIVE HUMIDITY (RH)				
DR	1	hs		Relative humidity (wet bulb/dew point) sensor – instrument type
	2	hsMS		Relative humidity (wet bulb/dew point) sensor – model (manufacturer/series no.)
	3	hsL		Relative humidity (wet bulb/dew point) sensor – location (left yardarm mast)
	4	hsDB		Relative humidity sensor – distance (metres to tenths) from the bow or front of platform NOTE: Leave this field blank if platform is a discus
	5	hsC		Relative humidity sensor – distance (metres to tenths) from centre line or centre of discus
	6	hswl		Relative humidity sensor – (metres to tenths) above water line
	7	ouhs		Relative humidity (wet bulb/dew point) sensor – operational range and units of measurement (e.g. range 0–100 per cent)
	8	sfhs		Sampling frequency (Hz) – relative humidity (wet bulb/dew point) sensor (e.g. 1 Hz)
	9	aphs		Averaging period (minutes) –relative humidity (wet bulb/dew point) sensor (e.g. 1 min.)
	10	hsScd		Calibration date – relative humidity (wet bulb/dew point) sensor no. Latest date the sensor was calibrated (year, month, day, e.g. 20000207)
	11	hsID		Relative humidity (wet bulb/dew point) sensor installation date (year, month, day, e.g. 19950228)
	12	hsSD		Relative humidity (wet bulb/dew point) sensor out of service dates (beginning and ending dates; year, month, day, e.g. 19960123–19960212). If known, these dates should be entered any time the relative humidity (wet bulb/dew point) is unavailable due to equipment outage non-reporting or invalid reports)
PRECIPITATION (PG)				
DR	1	pg		Precipitation gauge – instrument type (e.g. weighing bucket, tipping bucket, etc.)
	2	pgMS		Precipitation gauge – model (manufacturer/series no.)
	3	pgL		Precipitation gauge – location
	4	pgDB		Precipitation gauge – distance (metres to tenths) from the bow or front of platform
	5	pgC		Precipitation gauge – distance (metres to tenths) from centre line or off centre of a discus
	6	pgwl		Precipitation gauge – height (metres to tenths) above water line
	7	oupg		Precipitation gauge – operational range and units of measurement (e.g. 0 to 25 cm per hour)

Record type and sequence number		*Field abbreviation*	*Input codes*	*Description of fields*
	8	sfPG		Sampling frequency – precipitation gauge (e.g. continuous)
	9	apPG		Averaging period – precipitation gauge (e.g. 6 hours; then reset)
	10	pgScd		Calibration date – precipitation gauge no. Latest date sensor/gauge was calibrated (year, month, day, e.g. 20000207)
	11	pgID		Precipitation gauge installation date (year, month, day, e.g. 19950228)
	12	pgSD		Precipitation gauge out of service dates (beginning and ending dates; year, month, day, e.g. 19960123–19960212). If known, these dates should be entered any time he precipitation measurement is unavailable due to equipment outage (non-reporting or invalid reports)
RADIATION (RD)				
DR	1	srs		Solar radiation sensor – instrument type
	2	rMS		Radiation sensor – model (manufacturer/series no.)
	3	rsL		Radiation sensor – location (e.g. foremast)
	4	rsDB		Solar radiation sensor – distance (metres to tenths) from the bow or front of platform NOTE: Leave this field blank if platform is a discus
	5	rsC		Radiation sensor – distance (metres to tenths) from centre line or centre of discus
	6	srwl		Solar radiation sensor – height (metres to tenths) above water line
	7	ours		Radiation sensor – operational range and units of measurement (e.g. 0.07 – 1.65 cal cm^{-2} min^{-1})
	8	sfSR		Sampling frequency (Hz) – solar radiation sensor (e.g. 1 Hz)
	9	apSR		Averaging period (minutes to tenths) – solar radiation sensor (e.g. 8.0 minutes)
	10	srScd		Calibration date – solar radiation sensor no. Latest date the sensor was calibrated (year, month, day, e.g. 20000207)
	11	rsID		Radiation sensor installation date (year, month, day, e.g. 19950228)
	12	rsSD		Radiation sensor out of service dates (beginning and ending dates: year, month, day, e.g. 19960123–19960212). If known, these dates should be entered any time the radiation measurement is unavailable due to equipment outage (non-reporting or invalid reports)
OCEAN CURRENTS (CR)				
DR	1	OC	C M E	Ocean current speed reported Calculated Measured Estimated
	2	TSmoc		Type sensor measuring ocean currents (type/model/manufacturer)
	3	dmOC		Depth of measurement (in metres, e.g. 10 m) of the ocean current
	4	ouOC		Ocean currents – operational range and units of measurement (range, e.g. –10 ms^{-1} to +10 ms^{-1})
	5	sfOC		Sampling frequency (Hz) – ocean currents (e.g. 0.667 Hz)
	6	apOC		Averaging period (minutes to tenths) – ocean currents (e.g. 20.0 minutes)
	7	ocScd		Calibration date – ocean current sensor (year, month, day, e.g. 20000208)
	8	ocID		Ocean current sensor installation date (year, month, day, e.g. 19950228)
	9	ocSD		Ocean current sensor out of service dates (beginning and ending dates; year, month, day, e.g. 19960123–19960212). If known, these dates should be entered any time the ocean current measurement is unavailable due to equipment outage (non-reporting or invalid reports)
WAVE SPECTRA (WS)				
DR	1	wasp		Wave spectra – type of surface elevation sensor (from which wave spectra is derived)
	2	Digf		Digital filter used – wave spectra
	3	Nblks		Number of blocks used for averaging – wave spectra
	4	Npts		Number of points in each block – wave spectra
	5	spAT		Spectral analysis technique (e.g. FFT, MEM, etc.)
	6	sfWAS		Sampling frequency – wave spectra (e.g. 2.56 Hz)
	7	apWAS		Averaging period – length of record for averaging period – wave spectra (e.g. 20 minutes)

Record type and sequence number		*Field abbreviation*	*Input codes*	*Description of fields*
HORIZONTAL VISIBILITY (HV)				
DR	1	hvm	MAN ATM	Horizontal visibility Manual Automated
	2	hvit		Instrument type (automated sensor) – model/manufacturer/series no.
	3	hvl		Location – horizontal visibility sensor no.
	4	hvDB		Horizontal visibility sensor – distance (metres to tenths) from the bow or front of platform NOTE: Leave this field blank if platform is a discus
	5	hvC		Horizontal visibility sensor – distance metres to tenths) from centre line or centre of discus
	6	hvwl		Horizontal visibility sensor – height (metres to tenths) above water line
	7	hvou		Horizontal visibility sensor – operational range and units of measurement (e.g. 0000 to 9999 m or < 0.1 km – 10 km)
	8	hvsf		Sampling frequency – horizontal visibility sensor no.
	9	hvap		Averaging period – horizontal visibility sensor no.
	10	hvScd		Calibration date – horizontal visibility sensor no. Latest date sensor was calibrated (year, month, day. e.g. 20000208)
	11	hvID		Horizontal visibility sensor installation date (year, month, day, e.g.19950228)
	12	hvSD		Horizontal visibility sensor out of service dates (beginning and ending dates; year, month, day, e.g. 19960123–19960212). If known, these dates should be entered any time the visibility measurement is unavailable due to equipment outage (non-reporting or invalid reports)

Recommendation 2 (JCOMM-I)

RESOURCES FOR SHIP-BASED OBSERVATIONS

THE JOINT WMO/IOC TECHNICAL COMMISSION FOR OCEANOGRAPHY ON MARINE METEOROLOGY,

NOTING:

(1) The SOOPIP chairperson's report to JCOMM and final report of SOOPIP-III (La Jolla, March 2000),

(2) The ASAP Panel chairperson's report to JCOMM and final report of ASAP Panel-XII (Reading, September 2000),

(3) Final report of the Subgroup on the VOS, first session (Athens, March 1998),

(4) Expressed WWW, GOOS/GCOS and CLIVAR requirements for upper ocean thermal data and the conclusions from the Global Upper Ocean Thermal Review,

CONSIDERING:

(1) That ship-based observation programmes have been faced with decreased resources, coupled with increases in the costs of instruments and expendables (e.g. XBTs and radiosondes),

(2) That this situation could potentially adversely affect the data, products and services provided through JCOMM, GOOS and CLIVAR, in support of operational meteorology and oceanography, marine scientific research and global climate studies,

(3) That in situ ocean observing systems are complementary to space-based systems and supply the ground truth data on which the space-based systems depend,

(4) That there are many data-sparse ocean areas where ship-based observing systems can offer a unique contribution,

(5) That the PMO network provides the essential link to ship management and crew for the operations of the VOS, SOOP and ASAP and is critical to the maintenance of the quantity and quality of the observations,

(6) The importance attached to integrated, high-quality data streams from ship observations,

(7) That the SOOP Coordinator's position is essential for the implementation and operation of the SOOP programme,

(8) That the VOS scheme and ASAP would also greatly benefit from similar international coordination support,

RECOMMENDS strongly that Members/Member States recognize the continued importance of long-term commitment to ship-based observational programmes and, in particular:

(1) Emphasize a ship observations network that recognizes the benefits of a unified approach for meteorological, oceanographic and climate applications, and the heightened importance attached to integration of the former separate networks and higher quality and more timely data streams;

(2) Address the increasing need for ship deployment of autonomous observational platforms and expendables, and automated shipboard meteorological observation and data transmission systems;

(3) Increase the resources committed to supplying expendables for ship observations in support of international implementation plans;

(4) Make concerted efforts to maintain the level of recruitment of ships to the ship observations programme at the present level or above;

(5) Ensure maintenance and expansion of the PMO network;

(6) Increase the resources committed to support the activities of JCOMMOPS;

REQUESTS the Secretary General of WMO and the Executive Secretary IOC, with the assistance of the co-presidents of JCOMM and the chairpersons of the VOS, ASAP and SOOP Panels, to consult with Members/Member States, with a view to increasing the resources committed to ship-based observation programmes.

Recommendation 3 (JCOMM-I)

INTERNATIONAL SEAKEEPERS SOCIETY

THE JOINT WMO/IOC TECHNICAL COMMISSION FOR
OCEANOGRAPHY AND MARINE METEOROLOGY,

NOTING:

(1) The reports of the chairpersons of the Working Group on Marine Observing Systems and the OOP Implementation Panel to JCOMM-I,

(2) The presentation to JCOMM-I on the work of the International SeaKeepers Society,

(3) The report of the first JCOMM Transition Planning Meeting (St Petersburg, July 1999), JCOMM Meeting Report No. 1,

RECOGNIZING:

(1) That extensive scientific evaluation and quality assessment of the SeaKeepers module had taken place over a number of years,

(2) That observational data from the SeaKeepers module installed on a number of vessels were already being distributed in real time on the GTS,

CONSIDERING:

(1) That SeaKeepers vessels were distributed world-wide and often sailed in data-sparse ocean areas away from commercial shipping lanes,

(2) That meteorological and oceanographic observations from SeaKeepers vessels, if made freely and openly available to users in both real time and delayed mode, through the GTS and other communication channels, would be of substantial value to the WWW, GOOS, GCOS and other major programmes of WMO and IOC,

RECOMMENDS:

(1) That vessels equipped with the SeaKeepers module (members of the International SeaKeepers Society) whose meteorological and physical oceanographic data are made freely available to all users, in both real time and delayed mode, in support of the major programmes of WMO and IOC, should be formally recognized as a component of the integrated ship observations programme;

(2) That the International SeaKeepers Society should participate actively in the work of the Ship Observations Team;

(3) That the Ship Observations Team includes observational data from SeaKeepers vessels in its overall monitoring and evaluation of the quality, integrity, timeliness and value of meteorological and oceanographic observations from ship-based platforms, to ensure that SeaKeepers data conform with the requirements of JCOMM programmes;

REQUESTS:

(1) GOOS, through its Coastal Ocean Observations Panel, to review and assess the quality and value of non-physical oceanographic data collected through the SeaKeepers module and, as appropriate, recommend on their inclusion as part of an integrated operational ocean monitoring system;

(2) The Secretary-General of WMO and the Executive Secretary IOC to bring the work of the International SeaKeepers Society to the attention of Members/Member States, and otherwise to assist in the implementation of this recommendation.

Recommendation 4 (JCOMM-I)

VANDALISM OF OCEAN DATA BUOYS

THE JOINT WMO/IOC TECHNICAL COMMISSION FOR
OCEANOGRAPHY AND MARINE METEOROLOGY,

NOTING:

(1) The final report of DBCP-XVI (Victoria, October2000), paragraph 9.2.4,

(2) The “hydrogram”* dated 5 August 2000 and issued by the International hydrographic Organization to bring the problem of vandalism of buoys, both deliberate or inadvertent, to the attention of the maritime community,

(3) The text of the hydrogram, available via the DBCP Web site at http://dbcp.nos.noaa.gov/dbcp/vandalism.html.

CONSIDERING:

(1) That the acts of vandalism that seriously damaged buoys were very detrimental to the ocean observing networks of which these buoys were an important part,

(2) That the collection or inadvertent damage to buoys by fishing vessels or mariners was similarly a substantial problem in some areas,

(3) The need to alert mariners and fishermen to the importance of data buoy programmes to maritime safety, maritime operations, climate research and prediction and other marine applications,

RECOMMENDS to Members/Member States:

(1) To contact their respective Hydrographic Services to reinforce the message in the hydrogram and to ensure that it is reissued as often as possible;

(2) To develop, if possible, tamper-proof designs for buoy systems;

(3) To design a warning system in the event that any data buoys were intentionally damaged;

(4) To take legal steps nationally to limit acts of vandalism within their territorial seas and Exclusive Economic Zones;

REQUESTS the Secretary-General of WMO and the Executive Secretary IOC to provide assistance, as required, to Members/Member States in the implementation of this recommendation.

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* Hydrogram: A message to bring to the attention of the mariner important and significant maritime safety information not normally contained in the weekly Notice to mariners.

Recommendation 5 (JCOMM-I)

THE GLOBAL SEA-LEVEL OBSERVING SYSTEM (GLOSS)

THE JOINT WMO/IOC TECHNICAL COMMISSION FOR OCEANOGRAPHY AND MARINE METEOROLOGY,

NOTING:

(1) The considerable achievements of GLOSS in establishing a global system to monitor sea-level variability and changes,

(2) That over two thirds of the GLOSS Core Network stations, as defined in accordance with the 1997Implementation Plan for GLOSS, are operational and that this number has remained essentially unchanged over the past few years,

CONSIDERING:

(1) The importance of long-term sea-level measurements to many WMO Programmes concerned with climate change, hydrology, storm surges and tropical cyclones,

(2) The importance of sea-level measurements for operational oceanography, marine meteorology coastal engineering and defence applications and in the wider implementation of GOOS,

(3) The potential for station sharing and use of tide gauge data transmission platforms for delivery of other data types,

RECOMMENDS to Members/Member States and national agencies to:

(1) Continue and strengthen the support for GLOSS:

  (a) at the national level through maintenance of GLOSS-designated tide gauges; and

  (b) at the inter-national level through support to the IOC Trust Fund or through bilateral and/or multilateral assistance for GLOSS activities by, for example, collaborative support for maintaining/upgrading GLOSS gauges in accordance with the GLOSS Implementation Plan;

(2) Provide in situ sea-level data from GLOSS stations to the international data centres without delay in accordance with the provisions of the Implementation Plan;

(3) Consider local and regional observation platform sharing for data acquisition of other important parameters at GLOSS sites, especially by providing the necessary upgrades for real-time data acquisition;

RECOMMENDS further that the products of GLOSS-related Sea-level Centres (such as the Permanent Service for Mean Sea Level in the United Kingdom and the Hawaii Sea-level Center in the United States)should be made more widely known to the WMO/IOC communities through existing WMO information services, in order to promote enhanced knowledge and understanding in this important field;

REQUESTS the Secretary-General of WMO and the Executive Secretary IOC to provide assistance to Members/Member States, as appropriate, and within the available budgetary resources, in the implementation of this recommendation.

Recommendation 12 (JCOMM-I)

WORKING ARRANGEMENTS BETWEEN WMO AND THE INTERNATIONAL MOBILE SATELLITE ORGANIZATION (IMSO)

THE JOINT WMO/IOC TECHNICAL COMMISSION FOR OCEANOGRAPHY AND MARINE METEOROLOGY,

NOTING:

(1) Resolution 19 (Cg-XI) – The collection and dissemination of marine meteorological and oceanographic information using INMARSAT,

(2) Recommendation 8 (CMM-XI) – The collection of meteorological and oceanographic information using INMARSAT,

(3) The Convention of the International Mobile Satellite Organization, as amended,

CONSIDERING:

(1) That the INMARSAT system is now the primary mechanism for the collection of meteorological and oceanographic reports from ships at sea, as well as for providing a major facility for the dissemination of meteorological and oceanographic information to maritime users under the GMDSS,

(2) That IMSO is the intergovernmental organization charged with providing the necessary oversight for the provision of satellite services for the GMDSS,

RECOGNIZING that WMO will need to continue to interact closely in the future with IMSO on many issues relating to the use of the INMARSAT system for the dissemination of meteorological and oceanographic information essential to the safety of life and property at sea,

RECOMMENDS that WMO establish formal working arrangements with IMSO to facilitate this interaction;

REQUESTS the Secretary-General of WMO, in consultation with the Secretary-General of IMSO, to prepare appropriate draft working arrangements, for the consideration of the WMO Executive Council and the IMSO Assembly.

Recommendation 3 (JCOMM-II)

CONSUMABLES FOR SHIP-BASED OBSERVATIONS

THE JOINT WMO/IOC TECHNICAL COMMISSION FOR OCEANOGRAPHY AND MARINE METEOROLOGY,

NOTING:

(1) Recommendation 2 (JCOMM-I) – Resources for Ship-Based Observations,

(2) The final report of the third session of the Ship Observations Team, JCOMM Meeting Report No. 35,

(3) The report of the Observations Programme Area Coordinator to JCOMM-II,

RECOGNIZING:

(1) That many components of the operational, in situ ocean observing system coordinated by JCOMM are currently well short of requirements, including in particular the XBT network coordinated by the Ship Observations Team,

(2) That currently only a small number of Members/Member States contribute to the maintenance of the observing system,

(3) That the cost of the purchase and supply of consumables (such as XBTs) represents a major obstacle to the enhanced involvement of maritime countries in the system,

CONSIDERING:

(1) That the implementation of the observing system could be enhanced through the establishment of a simple mechanism to encourage more countries to contribute to the system and complete the global XBT and other networks,

(2) That considerable cost savings could be achieved through the bulk purchase and supply of consumables for ship-based observations, including in particular XBTs,

(3) That the provision of consumables from a common pool would greatly assist maritime countries wishing to contribute to the implementation and maintenance of the observing system, in support of national, regional and global interests and programmes,

RECOMMENDS:

(1) That a scheme for the bulk purchase and supply of consumables for ship-based observations be developed, and a special Trust Fund be established for that purpose;

(2) That Members/Member States which are in a position to do so, contribute to this Trust Fund, in support of the full implementation and maintenance of the ocean observing system coordinated by JCOMM, and the enhanced involvement of maritime countries in this work;

(3) That, at the same time, Members/Member States continue to procure and supply consumables for ship-based observations through their existing national procedures;

REQUESTS:

(1) The Observations Programme Area Coordinator, in consultation with the chairperson of the Ship Observations Team, the co-presidents of JCOMM, the JCOMM Secretariat and relevant Members/Member States, to develop a plan for the bulk purchase and supply of consumables for ship-based observations, for consideration and approval by the Management Committee;

(2) The Secretary-General of WMO and the Executive Secretary IOC to support the implementation of this plan through the establishment of a special Trust Fund for this purpose.

Recommendation 5 (JCOMM-II)

IOC PROJECTOFFICE FOR IODE

THE JOINT WMO/IOC TECHNICAL COMMISSION FOR
OCEANOGRAPHY AND MARINE METEOROLOGY,

NOTING:

(1) Paragraphs 4.3.6 and 4.4.4 of the final report of the fourth session of the Management Committee, JCOMM Meeting Report No. 34,

(2) Paragraphs 3.2 and 4.1 of the final report of the eighteenth session of the IOC Committee for IODE,

(3) The official inauguration of the IOC Project Office for IODE that took place on 25 April 2005 in Ostend, Belgium,

(4) The successful organization of a first joint JCOMM/IODE/GOOS training event held at the Project Office in September 2005 (Digital Modelling Training Course 2005),

CONSIDERING the excellent facilities provided by the IOC Project Office for IODE to potentially support a range of data management-related activities of IOC, WMO and other organizations as appropriate,

RECOMMENDS:

(1) That the IOC Project Office for IODE should be used for joint data management-related activities of IOC/IODE, JCOMM, WMO, and other relevant organizations, on projects of mutual interest;

(2) The further organization of joint JCOMM/IODE/GOOS training events through the Project Office;

REQUESTS Members/Member States to promote the Project Office and to second relevant experts on a short-or long-term basis to support its activities.

Recommendation 12 (JCOMM-II)

JCOMM SUPPORT FOR MARINE MULTI-HAZARD WARNING SYSTEMS, INCLUDING TSUNAMIS

THE JOINT WMO/IOC TECHNICAL COMMISSION FOR OCEANOGRAPHY ON MARINE METEOROLOGY,

EXPRESSING its deepest sympathies to the people affected by the tsunami that hit Indian Ocean coastal countries on 26 December 2004, as well as by various other natural disasters during the intersessional period,

NOTING with appreciation the actions taken by IOC and WMO and Members/Member States in response to the tsunami, including, in particular, the establishment of an Intergovernmental Coordination Group for the Indian Ocean Tsunami Warning and Mitigation System (ICG/IOTWS), and the WMO's actions to upgrade its GTS, where necessary, to facilitate the timely and reliable exchange of tsunami-related information and warnings as a critical contribution to not only the Indian Ocean Tsunami Warning and Mitigation System, but also for other regions at risk,

RECOGNIZING that:

(1) The rapid implementation of reliable and comprehensive tsunami preparedness, warning and mitigation systems for all ocean basins vulnerable to such events is an immediate and urgent priority,

(2) Other marine hazards, including storm surges and extreme waves, specifically associated with tropical cyclones are significant and frequently occurring threats, with the potential to cause major damage and loss of life,

(3) To be sustainable and effective in the long-term, tsunami warning systems should be developed and operated within the context of a broader marine multi-hazard early warning strategy,

(4) Several warning systems have been developed and operated under the umbrella of WMO (e.g. tropical cyclones) and IOC (ITSU),

CONSIDERING:

(1) The expertise, facilities and infrastructure already existing within or coordinated by the different JCOMM Programme Areas, including in particular Services and Observations,

(2) The potential for these JCOMM resources to be further developed and enhanced to support the implementation and long-term maintenance of marine multi-hazard warning systems, including for tsunamis,

REQUESTS the JCOMM co-presidents, in consultation with the Programme Area Coordinators, with relevant WMO technical commissions and subsidiary bodies of IOC, GOOS regional alliances and associations and IODE regional networks, as appropriate, to develop and implement a plan of action to contribute to the implementation and maintenance of marine multi-hazard warning systems for all ocean basins, including in particular the actions specified in paragraph 11.5.17 of the general summary of this report;

RECOMMENDS:

(1) That Members/Member States, the Secretary-General of WMO and the Executive Secretary IOC be urged to provide the necessary support to JCOMM, in terms of facilities, funding and expertise, to enable the implementation of its plan of action for contributing to marine multi-hazard warning systems;

(2) That the work being undertaken by JCOMM towards marine multi-hazard warning systems be incorporated into broader programmes of action being implemented by IOC and WMO;

(3) That early warning systems for ocean-related hazards be incorporated within a multi-hazard approach using collaborative inter-commission and inter-agency mechanisms;

(4) That the WMO Global Telecommunication System (GTS) be recognized as the backbone global telecommunication mechanism for the exchange of multi-hazard, observations, information and warnings, including tsunami warnings and alert information;

(5) That the Commission should contribute, as a first priority, to the development of the global tsunami warning system within a multi-hazard framework in collaboration with all stakeholders including the relevant WMO Technical Commissions and programmes, IOC subsidiary bodies, other United Nations agencies and other intergovernmental organizations.

Recommendation 13 (JCOMM-II)

THE GLOBAL EARTH OBSERVATION SYSTEM OF SYSTEMS

THE JOINT WMO/IOC TECHNICAL COMMISSION FOR OCEANOGRAPHY AND MARINE METEOROLOGY,

RECALLING the WSSD Plan of Implementation, particularly paragraph 132,

NOTING:

(1) Resolution 9 (EC-LVI) – Global Earth Observation System of Systems,

(2) Resolution IOC EC-XXXVII.2 – The Earth Observation Summit,

(3) The Declaration from the First Earth Observation Summit,

(4) The Communiqué from the Second Earth Observation Summit

(5) The Resolution of the Third Earth Observation Summit,

(6) The Global Earth Observation System of Systems (GEOSS) 10-Year Implementation Plan endorsed by the Third Earth Observation Summit,

(7) The Implementation Plan for the Global Observing System for Climate in Support of the UNFCCC (GCOS No. 92),

CONSIDERING:

(1) The relevance to GEOSS of WMO and IOC programmes, experience and expertise, and the roles and responsibilities of other intergovernmental organizations,

(2) The exceptional opportunity provided by the development of the GEOSS 10-year Implementation Plan to define and secure, at a high political level, firm resources for sustained operational observation of the Earth, and at the national and international levels for the observing systems for oceans, coastal areas, and natural and human-induced hazards,

(3) The significant contributions made by IOC and WMO to the overall process for GEOSS establishment and for developing its 10-year Implementation Plan,

(4) That JCOMM is recognized in the GEOSS 10-YearImplementation Plan and its Work Plan as a mechanism to implement an in situ ocean observing system, in relation to the support for implementation of actions called for in GCOS Implementation Plan,

(5) That the GCOS-92 identified JCOMM as the implementing agent, or a contributing implementing agent for actions relating to ocean observations,

RECOMMENDS that:

(1) Members/Member States be urged to endorse the objectives of GEOSS, to become members of GEO, and to support its 10-year Implementation Plan to the maximum extent possible;

(2) Members/Member States become involved in the planning and implementation of GEOSS at the national and international levels;

(3) Members/Member States ensure that each national coordination mechanism for GEO/GEOSS is fully informed of, and consistent with, existing and planned activities of JCOMM;

INVITES the Group on Earth Observations (GEO) to:

(1) Recognize JCOMM as a key implementation mechanism for oceanographic and marine meteorological components of Earth Observation, providing global, intergovernmental coordination of implementation activities and regulatory and guidance material for operational oceanography and marine meteorology;

(2) Ensure that the implementation of GEOSS will be based on full and open exchange of observational data with minimum delay and cost, and will be in accordance with relevant international instruments, national policies and legislation, in particular, the WMO and IOC Data Exchange Policies;

(3) Ensure GEOSS comprises a rational balance of in-situ measurements, surface-based and satellite(oceans and atmosphere) remote sensing measurements of the Earth;

(4) Pursue the evolution of common data protocols and exchange standards, based on best practices, in order to maximise the ease of information exchange;

(5) Pursue the synergy with existing and planned inter-national and national observing systems, in particular those under the leadership of the WMO and IOC, which include JCOMM;

REQUESTS the Secretary-General of WMO and the Executive Secretary IOC:

(1) With the assistance of the co-presidents of JCOMM, to keep GEO fully informed of JCOMM activities in operational oceanography and marine meteorology, and of its capacity to provide effective leadership in the coordination of the global ocean observation network;

(2) To ensure GEO fully utilizes the potential contribution from JCOMM to deliver the GEOSS 10-Year Implementation Plan.

Recommendation 14 (JCOMM-II)

REVISION OF RESOLUTIONS OF THE WMO AND IOC GOVERNING BODIES BASED ON PREVIOUS RECOMMENDATIONS OF THE JOINT WMO/IOC TECHNICAL COMMISSION FOR OCEANOGRAPHY AND MARINE METEOROLOGY (INCLUDING THE WMO COMMISSION FOR MARINE METEOROLOGY AND THE JOINTIOC/WMO COMMITTEE FOR THE INTEGRATED GLOBAL OCEAN SERVICES SYSTEM)

THE JOINT WMO/IOC TECHNICAL COMMISSION FOR
OCEANOGRAPHY AND MARINE METEOROLOGY,

NOTING with satisfaction the action taken by the WMO and IOC governing bodies on the previous recommendations of the Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology (including the WMO Commission for Marine Meteorology and the Joint IOC/WMO Committee for IGOSS), as well as on other matters related to the work of that body,

CONSIDERING that many of these recommendations have become redundant in the meantime,

RECOMMENDS:

(1) That WMO Resolution 7 (EC-LIV) and IOC Resolution EC-XXXV.4 be no longer considered necessary;

(2) That WMO Resolutions 15 (EC-XXI), 12 (EC-XXV) and 3 (EC-XLVIII) be kept in force.

RECOMMENDATIONS ADOPTED BY THE SESSION

Recommendation 1 (JCOMM-III)

ESTABLISHMENT OF WMO/IOC REGIONAL MARINE INSTRUMENT CENTRES

THE JOINT WMO/IOC TECHNICAL COMMISSION FOR
OCEANOGRAPHY AND MARINE METEOROLOGY,

Noting:

(1) The JCOMM terms of reference, especially in relation to: (i) the development of observing networks; (ii) the provision of capacity-building to Member States; and (iii) assistance in the documentation and management of the data in international systems,

(2) WMO Resolution 30 (Cg-XV) – Towards enhanced integration between WMO observing systems,

(3) The final reports of the first and second sessions of the WMO Executive Council Working Group on the WMO Integrated Global Observing System and the WMO Information System,

(4) The final report of the ad hoc planning meeting for the JCOMM Pilot Project for the WMO Integrated Global Observing System (JCOMM/MR-No. 57),

(5) The final report of the meeting of the joint Steering Group for the IODE Ocean Data Portal and the JCOMM Pilot Project for WIGOS (JCOMM/MR-No. 59),

(6) The final report of the twenty-fourth session of the Data Buoy Cooperation Panel (JCOMM/MR-No. 61),

(7) The final report of the first session of the Sub-Group on WIGOS of the WMO Executive Council Working Group on the WMO Integrated Global Observing System and the WMO Information System,

(8) The final report of the seventh session of the JCOMM Management Committee (JCOMM/MR-No. 62),

(9) The final report of the fifth session of the JCOMM Ship Observations Team (JCOMM/MR-No. 63),

Noting further:

(1) The WIGOS Concept of Operations as adopted by the WMO Executive Council at its sixty-first session,

(2) The WIGOS Development and Implementation Plan as adopted by the WMO Executive Council at its sixty-first session,

(3) The Project Plan of the JCOMM Pilot Project for the WMO Integrated Global Observing System,

(4) The overarching Implementation Plan for the UNESCO/IOC-IODE Ocean Data Portal (ODP) and the JCOMM Pilot Project for the WMO Integrated Global Observing System,

(5) The proposal from the United States to run a Regional Marine Instrument Centre (RMIC) on a trial basis at the United States National Oceanic and Atmospheric Administration National Data Buoy Center,

Having considered:

(1) Members/Member States need for high quality marine meteorology and oceanographic measurements from the world oceans to address the requirements of WMO and UNESCO/IOC programmes and co-sponsored programmes,

(2) The need for facilities for the regular calibration and maintenance of marine instruments and the monitoring of instrument performance, on a regional basis in order to address adherence of ocean observations and associated metadata to high level standards for instruments and methods of observation,

(3) The need for documenting methods of measurements, for understanding biases introduced by each type of instrumentation, and for developing methods to correct such biases, in order to achieve delivery and use of coherent datasets,

(4) That RMICs would facilitate fulfilling these requirements,

(5) The role that RMICs could play with regard to instrument comparisons and evaluations, as well as for the training of marine meteorology and oceanography instrument experts,

Recognizing:

(1) The experience gained by the WMO Commission for Instruments and Methods of Observation regarding establishment and operations of Regional Instrument Centres (RIC) and World Radiation Centres and Regional Radiation Centres,

(2) The necessity of close coordination with the Commission for Instruments and Methods of Observation on establishing the network of RMICs to take into account the experience of establishing and operating the RICs and to avoid potential duplication of activities between RMICs and RICs,

(3) Expertise of Members/Member States with regard to marine meteorology and oceanography instrument best practices, as well as the dedicated facilities they operate,

(4) The excellent facilities and long experience of the National Data Buoy Centre regarding ocean instrument calibration, evaluation, and deployment,

Recommends:

(1) To establish a network of Regional Marine Instrument Centres and a mechanism for formal WMO and UNESCO/IOC designation of RMICs where:

   (a) Governance for defining the functions and adoption of an RMIC is proposed by JCOMM and endorsed by the WMO and UNESCO/IOC Executive Councils;

   (b) Candidate RMIC will be required to produce a statement of compliance, list capabilities of the proposed centre, state the suite of instrument expertise offered, state the formal commitment to voluntarily host the centre, and demonstrate capability to JCOMM;

   (c) Following possible agreement by JCOMM, the WMO and UNESCO/IOC Executive Councils will be invited to accept and approve new RMICs;

   (d) Terms of reference of an RMIC will become part of the *Guide to Meteorological Instruments and Methods of Observations* (WMO-No. 8);

(2) That the terms of reference of an RMIC, including capabilities, and corresponding functions, should be as given in the annex to this recommendation;

(3) That the National Data Buoy Center of the United States undertake the functions of an RMIC on a trial basis and reports on the results to JCOMM with a view to eventually become an RMIC under the mechanism defined above;

Invites:

(1) Members/Member States to consider taking advantage of the RMIC resources offered by the National Data Buoy Center on a trial basis as appropriate;

(2) Members/Member States to consider proposing new RMICs as they see fit;

Requests the Secretary-General of WMO and the Executive Secretary of UNESCO/IOC to facilitate implementation of this recommendation and provide appropriate technical advisory assistance to Members/Member States concerned as required, in the operations of Regional Marine Instrument Centres.

Annex to Recommendation 1 (JCOMM-III)

TERMS OF REFERENCE FOR A WMO/IOC REGIONAL MARINE INSTRUMENT CENTRE

A WMO/IOC Regional Marine Instrument Centre (RMIC) should have the following capabilities to carry out their corresponding functions:

Capabilities:

(a) An RMIC must have, or have access to, the necessary facilities and laboratory equipment to perform the functions necessary for the calibration of meteorological and related oceanographic instruments deployed to address the common requirements of WMO and UNESCO/IOC marine-related programmes and co-sponsored programmes;[1]

(b) An RMIC must maintain a set of meteorological and oceanographic standard instruments or references and establish the traceability of its own measurement standards and measuring instruments to the International System of Units (SI);

(c) An RMIC must have qualified managerial and technical staff with the necessary experience to fulfil its functions;

(d) An RMIC must develop its individual technical procedures for the calibration of meteorological and related oceanographic instruments using its own calibration equipment;

(e) An RMIC must develop its individual quality assurance procedures;

(f) An RMIC must participate in, or organize, inter-laboratory comparisons of standard calibration instruments and methods;

(g) An RMIC must utilize the resources and capabilities of its region of interest according to the region's best interests, when appropriate;

[1] Basically in situ geophysical instruments deployed in the surface marine environment or subsurface.

(h) An RMIC must apply international standards applicable for calibration laboratories, such as ISO/IEC 17025, to the extent possible;

(i) A recognized authority[2] must assess an RMIC, at least every five years, to verify its capabilities and performance.

Corresponding functions:

(a) An RMIC must assist Members/Member States of its region in calibrating their national meteorological standards and related oceanographic monitoring instruments according to the RMIC capabilities;

(b) An RMIC must participate in, or organize, JCOMM and/or regional instrument inter-comparisons, following relevant JCOMM recommendations;

(c) An RMIC must make a positive contribution to Members/Member States regarding the quality of measurements;

(d) An RMIC must advise Members/Member States on enquiries regarding instrument performance, maintenance and the availability of relevant guidance materials;

(e) An RMIC must actively participate, or assist, in the organization of regional workshops on meteorological and related oceanographic instruments and measurements;

(f) The RMIC must cooperate with other RMICs in the standardization of meteorological and related oceanographic measurements and sensors;

(g) An RMIC must regularly inform Members/Member States and report, on an annual basis, to the JCOMM Management Committee on the services offered to Members/Member States and the activities carried out. JCOMM in turn should keep the Executive Councils of WMO and UNESCO/IOC informed on the status and activities of the RMICs, and propose changes, as required.

Recommendation 2 (JCOMM-III)

NEW TERMS OF REFERENCE FOR AN EXPANDED JOINT WMO/IOC TECHNICAL COMMISSION FOR OCEANOGRAPHY AND MARINE METEOROLOGY IN SITU OBSERVATIONS PROGRAMME SUPPORT CENTRE

THE JOINT WMO/IOC TECHNICAL COMMISSION FOR
OCEANOGRAPHY AND MARINE METEOROLOGY,

Noting:

(1) The JCOMM terms of reference and especially those related to the development of observing networks,

(2) Recommendation 4 (JCOMM-II) – New terms of reference for JCOMMOPS,

(3) The final reports of the fifth (JCOMM/MR-No. 45), sixth (JCOMM/MR-No. 55) and seventh (JCOMM/MR-No. 62) sessions of the JCOMM Management Committee,

[2] JCOMM will be the body that formally proposes new RMICs and proposes any authority to do evaluations.

(4) The final reports of the twenty-second (JCOMM/MR-No. 42), twenty-third (JCOMM/MR-No. 54) and twenty-fourth (JCOMM/MR-No. 61) sessions of the Data Buoy Cooperation Panel,

(5) The final report of the fourth session of the JCOMM Ship Observations Team (SOT) (JCOMM/MR-No. 52),

(6) The final report of the second session of the JCOMM Observations Programme Area Coordination Group (JCOMM/MR-No. 53),

Noting further the decision by the Executive Secretary of UNESCO/IOC and the Secretary-General of WMO, regarding the agency selected to host the Observations Programme Support Centre,

Considering:

(1) The requirement for JCOMM to be active in a process in which oceanographic and marine meteorological observing system elements make the transition to a fully integrated system,

(2) The need to integrate at the international level a number of activities regarding operation and implementation of in situ marine observing systems,

(3) The success of the JCOMM In Situ Observing Platform Support Centre (JCOMMOPS) development and work, based on resources provided by Members/Member States through the Data Buoy Cooperation Panel, SOT and Argo,

(4) The potential value of extending JCOMMOPS activities to include services to support coordination for the Ocean Sustained Interdisciplinary Timeseries Environment observation System (OceanSITES), the International Ocean Carbon Coordination Project (IOCCP), and the Global Sea-level Observing System (GLOSS),

(5) The recommendation by the Management Committee to consider enhancing links to the satellite information services,

Recommends:

(1) That the JCOMMOPS expand its activities to enable: (i) the provision of support to the DBCP, Argo, the SOT, the IOCCP, GLOSS, and the OceanSITES coordination; and (ii) disseminates information on Satellite Data Requirements, and satellite information services on its Website;

(2) That the terms of reference of the expanded JCOMMOPS should be as given in the annex to this recommendation;

(3) That JCOMMOPS should be based in Toulouse, France, under the supervision of the WMO and UNESCO/IOC Secretariats;

(4) That the JCOMMOPS workplan would be provided by the Observations Coordination Group and relevant panels, and associated programmes;

(5) That the expansion of JCOMMOPS activities take place only as new funding is provided for this expansion or it can be demonstrated that there is no impact on present levels of support, in order to protect the interests of the Members/Member States who presently provide funding for specific activities at JCOMMOPS;

Invites France to consider increasing its support to JCOMMOPS through national mechanisms;

Encourages Members/Member States, where possible, to commit the resources required to support JCOMMOPS.

Note: This recommendation replaces Recommendation 4 (JCOMM-II), which is no longer in force.

Annex to Recommendation 2 (JCOMM-III)

TERMS OF REFERENCE FOR AN EXPANDED JOINT WMO/IOC TECHNICAL COMMISSION FOR OCEANOGRAPHY AND MARINE METEOROLOGY IN SITU OBSERVATIONS PROGRAMME SUPPORT CENTRE

Under the overall guidance of the JCOMM Observations Coordination Group and following the direction of the Data Buoy Cooperation Panel, the Ship Observations Team, the Argo Steering Team, the OceanSITES Science Team, the Global Sea Level Observing System Group of Experts, the International Ocean Carbon Coordination Project and the Commission for Basic Systems Expert Team on Satellite Utilization and Products, and under the supervision of the WMO and UNESCO/IOC Secretariats, and executing the workplan provided by the Observations Coordination Group and relevant panels, and associated programmes, the JCOMM In Situ Observing Platform Support Centre (JCOMMOPS) shall promote an integrated framework for deployment and further development of ocean observing networks.

Specifically, JCOMMOPS shall:

(a) Act as a focal point for implementation and coordination of observing programmes by clarifying and assisting in resolving technical issues between platform operators, data centres, manufacturers and satellite data telecommunication providers;

(b) Assist in demonstrating the scientific value of global ocean observing programmes in support of WMO and UNESCO/IOC Programmes and co-sponsored Programmes by compiling materials and assisting ocean observation science teams as appropriate;

(c) Maintain information on relevant observational requirements in support of the Global Ocean Observing System, the Global Climate Observing System and the World Weather Watch as provided by the appropriate international scientific panels, JCOMM experts participating in the Commission for Basic Systems Expert Team on Satellite Utilization and Products, and other JCOMM expert teams and groups;

(d) Routinely collect and distribute information on: (i) the performance of the observing system networks relative to requirements, in cooperation with the Observing System Monitoring Centre; (ii) instrumentation and telecommunication systems; and (iii) functional status and data quality of individual observing platforms;

(e) Act as a focal point for instrument and data management standardization by collecting and distributing information on current and best practices from across all elements of the observing system and by representing the observing system interest in international standardization processes;

(f) Facilitate free and unrestricted data and metadata exchange in real time, by providing appropriate technical assistance to platform operators, and serving as a collection and distribution point for select platform/instrument metadata and as a source of information on other metadata and data distribution services;

(g) Facilitate the flow of data and metadata to the archiving centres;

(h) Provide a gateway for information on observing platform deployment plans and servicing opportunities, and on operator contact information, to maximize deployment opportunities and sharing of resources;

(i) Encourage cooperation between communities, observing programmes and Members/ Member States to develop synergies between and to promote the observing systems.

Recommendation 3 (JCOMM-III)

PROVISION OF OCEAN DATA ACQUISITION SYSTEM AND WATER TEMPERATURE METADATA

THE JOINT WMO/IOC TECHNICAL COMMISSION FOR OCEANOGRAPHY AND MARINE METEOROLOGY,

Noting:

(1) Recommendation 1 (JCOMM-I) – Ocean Data Acquisition System (ODAS) metadata format, defining an ODAS metadata format, and kept in force at JCOMM-II,

(2) The *Abridged Final Report with Resolutions and Recommendations of the Second Session of the Joint WMO/IOC Commission for Oceanography and Marine Meteorology* (WMO-No. 995), general summary, paragraphs 4.1.3 (d), 6.1.9, 7.1.3 and 7.5.6,

(3) The final report of the second meeting of the JCOMM Expert Team on Marine Climatology (JCOMM/MR-No. 50),

(4) The final report of the third session of the JCOMM Data Management Programme Area Coordination Group (JCOMM/MR-No. 56),

Considering:

(1) The importance of metadata in a number of domains including climate applications and research (for example, bias correction), and operational applications, permitting amongst other things to interpret the data correctly, ensure traceability to standards, enhance coherence of data records, and facilitate quality monitoring activities,

(2) That China has fully developed an ODAS Metadata Service (ODASMS) for assembling, preserving and disseminating metadata on ODAS platforms,

(3) The initiation in the last intersessional period of a pilot project to manage metadata about instrumentation used for water temperature observations (Meta-T),

(4) That the United States and China have collaborated to produce an initial system to assemble, preserve and disseminate metadata about water temperature instrumentation as part of the Meta-T Pilot Project,

(5) That both of these metadata systems require the active involvement of all Members/Member States which operate such platforms and equipment to provide updated metadata in a routine fashion,

Recommends:

(1) Members/Member States to record and provide to the ODASMS on a routine basis appropriate metadata about ODAS platforms that they operate;

(2) Members/Member States to provide to China and the United States on a routine basis appropriate metadata about water temperature instrumentation that they use;

(3) China and the United States to expand their Meta-T facilities to include the management of metadata related to other ocean variables than water temperature;

(4) The JCOMMOPS to routinely contact platform operators so that the metadata are being submitted to the ODASMS, including for operational platforms and for historical ones;

Requests the Secretary-General of WMO and the Executive Secretary of UNESCO/IOC, to assist Members/Member States, as necessary, in the submission of metadata to China and the United States.

Recommendation 4 (JCOMM-III)

DEVELOPMENT OF DATA MANAGEMENT STANDARDS

THE JOINT WMO/IOC TECHNICAL COMMISSION FOR OCEANOGRAPHY AND MARINE METEOROLOGY,

Noting:

(1) The *Abridged Final Report with Resolutions and Recommendations of the Second Session of the Joint WMO/IOC Commission for Oceanography and Marine Meteorology* (WMO-No. 995), general summary, paragraphs 4.1.3 (d), 6.1.26 (c), 6.5, 7.1.14, 7.6.1, 14.2.2 and Recommendation 5 (JCOMM-II) – IOC Project Office for IODE, regarding the use of the UNESCO/IOC International Oceanographic Data and Information Exchange (IODE) Project Office,

(2) Proposals made by JCOMM at its second session regarding reconsideration by the Data Management Programme Area and UNESCO/IOC-IODE of the Ocean Information Technology initiative of 2002,

(3) The report of the Steering Team of the Oceans Information Technology Pilot Project, in 2002,

(4) The report of the IODE/JCOMM Forum on Oceanographic Data Management and Exchange Standards (UNESCO/IOC Workshop Report No. 206),

(5) The summary report of the twentieth session of the UNESCO/IOC Committee on International Oceanographic Data and Information Exchange (IODE-XX),

Considering:

(1) That standardization of data management procedures is an important first step in achieving interoperability,

(2) That success of the WIGOS and UNESCO/IOC-IODE Ocean Data Portal, among other initiatives, is dependent on standardization of practices,

(3) That a process is needed to moderate and guide the development and recommendation of standards and best practices,

(4) That the First Session of the IODE-JCOMM Forum on Oceanographic Data Management and Exchange Standards developed a proposed process for managing the development of recommended standards and best practices,

(5) That new terms of reference of Expert Team on Data Management Practices will enact the process proposed by the Standards Forum,

Recommends:

(1) Members/Member States to submit their proposals to the IODE-JCOMM Ocean Data Standards Pilot Project for wide community adoption;

(2) Members/Member States to implement the recommended standards in agencies in their own countries at the earliest possible date.

Requests the Secretary-General of WMO and the Executive Secretary of UNESCO/IOC to assist Members/Member States in the implementation of this recommendation.

Recommendation 5 (JCOMM-III)

GUIDE TO OPERATIONAL OCEAN FORECASTING SYSTEMS

THE JOINT WMO/IOC TECHNICAL COMMISSION FOR OCEANOGRAPHY AND MARINE METEOROLOGY,

Noting:

(1) The *Abridged Final Report with Resolutions and Recommendations of the Second Session of the Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology* (WMO-No. 995), general summary, paragraphs 5.2.5 to 5.2.7 and Recommendation 2 (JCOMM-II) – The development of operational oceanographic products and services under JCOMM,

(2) The final report of the sixth session of the JCOMM Management Committee (JCOMM/MR-No. 55),

(3) The final report of the third session of the JCOMM Services Programme Area Coordination Group (JCOMM/MR-No. 44),

Recalling with appreciation that the Global Ocean Data Assimilation Experiment (GODAE) had been instrumental in stimulating, coordinating and enhancing the development of operational ocean forecasting models, as well as of the ocean observing system and ocean data assimilation techniques essential to the effective and skilful operation these models,

Considering:

(1) That ocean forecasting systems are now implemented operationally in a number of advanced centres, delivering analyses and forecasts of ocean conditions on timescales from hours to intra-seasonal, and that a number of other centres are likely to implement similar operational systems in coming years,

(2) That operational ocean forecasting systems are delivering products of substantial value in a wide range of societal benefit areas, including maritime safety, marine environmental

management, maritime industry and commerce, weather and climate prediction and national defence,

(3) That the Expert Team on Operational Ocean Forecasting Systems has been established, as one component of the follow-on to GODAE, to document and guide the further development of operational ocean forecasting systems, and standardize the delivery of products to users,

(4) That there is a requirement to compile, publish and maintain documentation on the ocean forecasting systems that are currently in operation, to facilitate efficient access by all Members/Member States and user communities to ocean analyses and forecasts delivered by advanced centres,

(5) That this documentation should include both real-time and non-real-time functions of the systems,

Recommends:

(1) That a JCOMM Guide to Operational Ocean Forecasting Systems be prepared;

(2) The contents of this guide should include elements as outlined in the annex to this recommendation;

Requests the Expert Team on Operational Ocean Forecasting Systems to coordinate and provide technical advice and guidance in the preparation of the guide;

Requests the Secretary-General of WMO and the Executive Secretary of UNESCO/IOC:

(1) To arrange for the preparation of the guide, in consultation with the co-presidents of JCOMM, the presidents of the Commission for Basic Systems and the Commission for Atmospheric Sciences, the chairpersons of the GODAE OceanView Science Team, and other bodies and organizations as appropriate;

(2) To publish the guide in the WMO and UNESCO/IOC Manuals and Guides series.

Annex to Recommendation 5 (JCOMM-II)

GUIDE TO OPERATIONAL OCEAN FORECASTING SYSTEMS

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Recommendation 6 (JCOMM-III)

INTEGRATED STORM SURGE WATCH SCHEME

THE JOINT WMO/IOC TECHNICAL COMMISSION FOR OCEANOGRAPHY AND MARINE METEOROLOGY,

Noting:

(1) The *Abridged Final Report with Resolutions and Recommendations of the Second Session of the Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology* (WMO-No. 995), general summary, paragraphs 3.4 (a) and (c), 5.1.33, 8.1.3, 11.5.11 and 11.5.15,

(2) The final report of the second session of the JCOMM Expert Team on Wind Waves and Storm Surges (ETWS) (JCOMM/MR-No. 49),

(3) The final report and recommendations of the JCOMM Scientific and Technical Symposium on Storm Surges (JCOMM/TR-No. 44),

(4) The request by the WMO Executive Council, at its sixtieth session (Geneva, June 2008), endorsed by the forty-first session of the UNESCO/IOC Executive Council (Paris, June 2008), to implement the recommendations from the Symposium,

(5) The request by the WMO Executive Council at its sixtieth session (Geneva, June 2008) to the Secretary-General of WMO, in consultation with UNESCO/IOC, to:

   (a) Facilitate the development of storm surge watch schemes for regions subject to tropical cyclones, and to regional associations concerned to incorporate such schemes in the tropical cyclone advisory arrangements and in the Tropical Cyclone Programme Regional Operating Plans and/or Manual,

   (b) Promote the participation of space agencies in the storm surge watch schemes,

   (c) Give high priority to these activities,

Considering:

(1) That storm surges, both tropical and extra-tropical, represent a major marine hazard, and result in the loss of life and property in many parts of the world on a regular basis,

(2) That accurate and timely forecasts and warnings would contribute substantially to mitigating the threat to life and property from storm surges,

(3) That the preparation and issuing of such forecasts and warnings is the responsibility of National Meteorological Services and/or oceanographic agencies in many countries,

(4) That many such Services and agencies would benefit substantially from storm surge model enhancement, hydrological forecast information and increased data resources, including both in situ and space-based observations in the preparation of forecasts and warnings of storm surges and associated inundation,

(5) That related activities addressing various components of an Integrated Storm Surge Watch Scheme have recently been initiated, including:

(a) A *JCOMM/Commission for Hydrology Coastal Inundation Forecasting Demonstration Project* for building improved operational forecasts and warnings capability and service delivery in coastal risk reduction, including for coastal inundation,

(b) A UNESCO project on *Enhancing Regional Capabilities for Coastal Hazards Forecasting and Data Portal Systems* for scientific development on enhanced storm surge modelling capabilities,

(c) A *European Space Agency (ESA) Storm Surge Project* to improve storm surge forecasting systems and applications through the innovative use of ocean, land and atmospheric satellite observations,

Agrees that JCOMM should give high priority to the development of demonstration project(s) for building integrated global and regional storm surge watch schemes within a multi-hazard framework, in collaboration with relevant stakeholders, including with the appropriate WMO technical commissions and programmes, UNESCO/IOC subsidiary bodies, other United Nations agencies and international organizations, and that both WMO and UNESCO/IOC be involved in the storm surge watch schemes and related activities through an open and mutually-agreed workplan in this area,

Requests the Expert Team on Wind Waves and Storm Surges to provide technical advice, guidance and coordination in the development of such demonstration project(s), in close collaboration with WMO regional associations,

Recommends that Members/Member States support the development and implementation of the Demonstration Project(s) by providing extrabudgetary contributions to the JCOMM Trust Fund and seconding experts to work in the WMO and UNESCO/IOC Secretariats to speed up project development and implementation,

Requests the Secretary-General of WMO and the Executive Secretary of UNESCO/IOC to provide adequate budgetary resources to achieve the objectives of the demonstration project(s).

Recommendation 7 (JCOMM-III)

ESTABLISHMENT OF AN IMO/WMO WORLDWIDE MET-OCEAN INFORMATION AND WARNING SERVICE

THE JOINT WMO/IOC TECHNICAL COMMISSION FOR OCEANOGRAPHY AND MARINE METEOROLOGY,

Noting:

(1) The International Convention for the Safety of Life at Sea (SOLAS), 1974, in particular Chapter V (Safety of navigation), Regulation 5 (Meteorological services and warnings) of the 2003 amendments,

(2) The 1988 amendments to SOLAS for the Global Maritime Distress and Safety System,

(3) Recommendation 3 (CMM-XI) – New WMO GMDSS marine broadcast system,

(4) Recommendation 2 (CMM-XII) – Amendments to the WMO GMDSS marine broadcast system,

(5) Annex VI to the WMO Technical Regulations – *Manual on Marine Meteorological Services* (WMO-No. 558),

Recalling the request by the WMO Executive Council at its sixty-first session (Geneva, June 2009), to the Secretary-General of WMO to establish and develop, in collaboration with the International Maritime Organization (IMO), terms of reference for an IMO/WMO World-Wide Met-ocean Information and Warning Service to complement the existing IMO/International Hydrographic Organization (IHO) World-Wide Navigational Warning Service (IMO Resolution A.706(17)), for consideration at its sixty-second session,

Recognizing:

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

(2) The obligations of countries which are signatories to SOLAS to provide meteorological services for shipping as specified in the Convention, including its 1988 amendments,

(3) That the existing WMO Global Maritime Distress and Safety System (GMDSS) Marine Broadcast System, as amended, is an integral part of the IMO/WMO Worldwide Met-ocean Information and Warning Service,

(4) That the WMO GMDSS Marine Broadcast System needs to be constantly reviewed and updated so as to best meet the requirements of users and the internationally agreed commitments under SOLAS,

(5) That the WMO GMDSS Marine Broadcast System also needs to be fully in harmony with the IMO/IHO Worldwide Navigational Warning Service for the GMDSS, and to respond to requirements for maritime safety services expressed by the International Maritime Organization,

(6) The need for a coordination mechanism within each METAREA,

Recommends:

(1) That the guidance document for an IMO/WMO Worldwide Met-ocean Information and Warning Service, including the terms of reference for a METAREA Coordinator, as detailed in the annex to this recommendation, be adopted;

(2) That the *Manual on Marine Meteorological Services*, Volume I, Part I, be amended accordingly,

Expresses its appreciation:

(1) To those WMO Members that have accepted responsibilities under the WMO GMDSS Marine Broadcast System;

(2) In particular to Météo-France for managing and hosting the GMDSS-Weather Website;

Urges WMO Members with forecast and warning preparation and broadcast responsibilities under the WMO GMDSS Marine Broadcast System:

(1) To continue to implement their responsibilities in full, in accordance with the specifications in the *Manual on Marine Meteorological Services*;

(2) To keep the WMO Secretariat closely informed of developments and changes in their operation of the system, including any changes in broadcast schedules;

(3) To liaise closely with users regarding their requirements for and response to meteorological forecast and warning services under the Global Maritime Distress and Safety System;

(4) To serve as METAREA Coordinator within its area of responsibility;

Requests the Expert Team on Maritime Safety Services to keep the implementation of and user response to the IMO/WMO Worldwide Met-ocean Information and Warning Service under review, and to develop proposals for amendments as necessary;

Requests the Secretary-General of WMO:

(1) To provide appropriate technical advisory assistance to WMO Members concerned in the implementation of the IMO/WMO Worldwide Met-ocean Information and Warning Service;

(2) To bring this recommendation to the attention of International Maritime Organization and International Hydrographic Organization, and other organizations and bodies concerned, and to continue to liaise closely with them in the operation and further development of the service.

Annex to Recommendation 7 (JCOMM-III)

IMO/WMO WORLDWIDE MET-OCEAN INFORMATION AND WARNING SERVICE

GUIDANCE DOCUMENT

1. INTRODUCTION

1.1 The International Convention for the Safety of Life at Sea (SOLAS), 1974, Chapter V (Safety of navigation), Regulation 5 (Meteorological services and warnings), as amended, states:

"2 In particular, Contracting Governments undertake to carry out, in co-operation, the following meteorological arrangements:

.10 To endeavour to obtain a uniform procedure in regard to the international meteorological services already specified, and, as far as practicable, to conform to the technical regulations and recommendations made by the World Meteorological Organization, to which the Contracting Governments may refer, for study and advice, any meteorological question which may arise in carrying out the present Convention."

1.2 IMO Resolution A.705(17) on promulgation of maritime safety information, adopted by IMO/MSC-85 (2008), set out the organization, standards and methods which should be used for the promulgation and reception of maritime safety information, including navigational and meteorological warnings, meteorological forecasts and other urgent safety-related messages broadcast to ships, as documented in the International Convention for the Safety of Life at Sea. The WMO Executive Council, at its sixty-first session in June 2009, requested WMO to establish and develop, in collaboration with the International Maritime Organization (IMO), terms of reference for an IMO/WMO World-Wide Met-ocean Information and Warning Service (WWMIWS), to complement the existing IMO/International Hydrographic Organization (IHO) World-Wide Navigational Warning Services (WWNWS, IMO Resolution A.706(17)). In this context, this document is intended to provide specific guidance for the promulgation of internationally coordinated meteorological information, forecast and warnings services, which does not apply to purely national services.

1.3 The regulatory framework for the provision of marine meteorological services within the new WMO GMDSS Marine Broadcast System was developed from Recommendation 3 (CMM-XI) in 1993, endorsed by the WMO Executive Council at its forty-fourth session. This new system reflects the evolution since the advent of the Global Maritime Distress and Safety System (GMDSS), as adopted by the Conference of Contracting Governments to the International Convention for the Safety of Life at Sea, 1974, on the Global Maritime Distress and Safety System in November 1988, effective on 1 February 1992. The WMO GMDSS Marine Broadcast System is an integral part of the WWMIWS.

1.4 Future amendments to this guidance document will be considered formally and approved by both WMO and IMO. Proposed amendments shall be evaluated by the Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM) Expert Team on Maritime Safety Services, which includes an ex officio representative of the IMO Secretariat, prior to any extensive WMO and IMO consideration.

2. DEFINITIONS

2.1 For the purposes of meteorological information, the following definitions apply:

2.1.1 *Coastal and offshore area* applies to areas for which WMO Members issue weather and sea bulletins, governed by the procedures in the *Manual on Marine Meteorological Services* (WMO-No. 558).

2.1.2 *HF NBDP* means high-frequency narrow-band direct printing, using radio telegraphy as defined in Recommendation ITU-R M.688.

2.1.3 *International NAVTEX service* means the coordinated broadcast and automatic reception on 518 kHz of maritime safety information by means of narrow-band direct-printing telegraphy using the English language.

2.1.4 *International SafetyNET service* means the coordinated broadcasting and automated reception of maritime safety information via the Inmarsat Enhanced Group Call (EGC) system, using the English language, in accordance with the provisions of the International Convention for the Safety of Life at Sea, 1974, as amended.

2.1.5 *Maritime Safety Information (MSI)* means navigational and meteorological warnings, meteorological forecasts and other urgent safety-related messages broadcast to ships.

2.1.6 *METAREA* means a geographical sea area established for the purpose of coordinating the broadcast of marine meteorological information. The term METAREA followed by a roman numeral may be used to identify a particular sea area. The delimitation of such areas is not related to and should not prejudice the delimitation of any boundaries between States.

2.1.7 *METAREA Coordinator* means the authority charged with coordinating Maritime Safety Information broadcasts by one or more National Meteorological Services acting as Preparation or Issuing Services within the METAREA.

2.1.8 *National NAVTEX service* means the broadcast and automatic reception of maritime safety information by means of narrow-band direct-printing telegraphy using frequencies other than 518 kHz and languages as decided by the Administration concerned.

2.1.9 *National SafetyNET service* means the broadcasting and automated reception of maritime safety information via the Inmarsat EGC system, using languages as decided by the Administration concerned.

2.1.10 *NAVAREA* means a geographical sea area established for the purpose of coordinating the broadcast of navigational warnings. The term NAVAREA followed by a roman numeral may be used to identify a particular sea area. The delimitation of such areas is not related to and should not prejudice the delimitation of any boundaries between States.

2.1.11 *NAVTEX coordinator* means the authority charged with operating and managing one or more NAVTEX stations broadcasting maritime safety information as part of the International NAVTEX service.

2.1.12 *Sub-area* means a subdivision of a METAREA in which a number of countries have established a coordinated system for the promulgation of meteorological information. The delimitation of such areas is not related to and shall not prejudice the delimitation of any boundaries between States.

2.1.13 In the operating procedures *coordination* means that the allocation of the time for data broadcast is centralized, the format and criteria of data transmissions are compliant as described in the *Joint IMO/IHO/WMO Manual on Maritime Safety Information* and that all services are managed as set out in IMO Resolution A.705(17), as amended.

3. METEOROLOGICAL INFORMATION BROADCASTS

3.1 Guidance for handling and formatting meteorological information is given in the *Joint IMO/IHO/WMO Manual on Maritime Safety Information*, as approved by IMO under MSC1./Circ.1310, the *NAVTEX Manual*, the *International SafetyNET Manual* and the *Manual on Marine Meteorological Services* (WMO-No. 558), and is summarized as follows:

3.2 Methods

3.2.1 Two principal methods are used for broadcasting meteorological information as part of MSI in accordance with the provisions of the International Convention for the Safety of Life at Sea, 1974, as amended, in the areas covered by these methods, as follows:

3.2.1.1 NAVTEX: broadcasts to coastal and offshore waters; and

3.2.1.2 SafetyNET: broadcasts which cover all the waters of the globe except for sea area A4, as defined by IMO Resolution A.801(19), Annex 3, paragraph 4, as amended.

3.2.2 Information shall be provided for unique and precisely defined sea areas, each being served only by the most appropriate of the above systems. Although there will be some duplication to allow a ship to change from one system to another, the majority of messages will only be broadcast on one system.

3.2.3 NAVTEX broadcasts shall be made in accordance with the standards and procedures set out in the *NAVTEX Manual*.

3.2.4 SafetyNET broadcasts shall be made in accordance with the standards and procedures set out in the *International SafetyNET Manual*.

3.2.5 HF NBDP may be used to promulgate maritime safety information in areas outside Inmarsat coverage (SOLAS regulation IV/7.1.5).

3.2.6 In addition, Administrations may also provide maritime safety information by other means.

3.3 Scheduling

3.3.1 Automated methods (NAVTEX/SafetyNET)

3.3.1.1 Meteorological warnings shall be broadcast as soon as possible or as dictated by the nature and timing of the event. Normally, the initial broadcast should be made as follows:

3.3.1.1.1 For NAVTEX, at the next scheduled broadcast, unless circumstances indicate the use of procedures for VITAL or IMPORTANT warnings; and

3.3.1.1.2 For SafetyNET, within 30 minutes of receipt of original information, or at the next scheduled broadcast.

3.3.1.2 Meteorological warnings shall be repeated in scheduled broadcasts in accordance with the guidelines promulgated in the *NAVTEX Manual* and *International SafetyNET Manual* as appropriate.

3.3.1.3 At least two scheduled daily broadcast times are necessary to provide adequate promulgation of meteorological information.

3.3.2 Schedule changes

3.3.2.1 Broadcast times for NAVTEX are defined by the B1 character of the station, allocated by the IMO NAVTEX Coordinating Panel.

3.3.2.2 Times of scheduled broadcasts under the international SafetyNET service are coordinated through the IMO SafetyNET Coordinating Panel.

3.3.2.3 Information on broadcast schedules and the content of bulletins are contained in *Weather Reporting* (WMO-No. 9), Volume D – *Information for Shipping*)

3.4 Language

3.4.1 All meteorological information shall be broadcast only in English in the International NAVTEX and SafetyNET services.

3.4.2 In addition to the required broadcasts in English, meteorological information may be broadcast in a national language using national NAVTEX and SafetyNET services and/or other means.

4. METEOROLOGICAL INFORMATION

4.1 General

4.1.1 Marine meteorological services are provided to satisfy the requirements for information on marine environmental conditions and phenomena, established by national practices and international conventions in relation to marine operations.

4.1.2 Marine meteorological services are designed for the safety of marine operations and to promote, where possible, the efficiency and economy of marine activities.

4.1.3 There are three types of marine meteorological information: forecasts and warnings for the High Seas, forecasts and warnings for Coastal and Offshore Areas and services for Ports and Harbour areas. The Marine Meteorological Information guidance and coordination are involved with only two of them:

4.1.3.1 Services for the High Seas, which will comprise:

(a) Warnings of gales and storms;

(b) Weather and sea bulletins, which shall include, in the order given hereafter:

Part I – Storm 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.

4.1.3.2 Services for Coastal and Offshore Areas, which will comprise Warnings, Synopses and Forecasts.

4.1.4 Operational guidance for handling and formatting meteorological information is given in detail in the Annex VI of the WMO Technical Regulations – *Manual on Marine Meteorological Services* (WMO-No. 558). It is summarized in 4.2 and 4.3 below.

4.2 Services for the High Seas shall consist of:

4.2.1 Warnings

4.2.1.1 Warnings shall be given for gales, storms, hurricane wind force 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). Warnings shall include:

(a) Type of warning;

(b) Date and time of reference in UTC;

(c) Location of disturbance in terms of latitude and longitude or with reference to well-known landmarks;

(d) Extent of affected area;

(e) Wind speed or force and direction in the affected areas.

4.2.1.2 Warnings for other severe conditions such as poor visibility, severe sea states (swell), ice accretion, ice conditions, etc. shall also be issued, as necessary. Phenomena such as breaking seas, cross seas and abnormal/rogue waves could also be included, if feasible.

4.2.1.3 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.

4.2.2 Synopses

4.2.2.1 Synopses will be broadcast as part of routine meteorological information, within Part II of weather and sea bulletins, and 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;

(d) Ice conditions, where applicable (concise description of sea ice: position of ice edge, total concentration, stages of ice development, etc.).

4.2.3 Forecasts

4.2.3.1 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) Sea state;

  (iii) Visibility when forecast is less than five nautical miles;

  (iv) Ice accretion, where applicable;

  (v) Ice conditions, where applicable.

4.2.3.2 The forecasts should include expected significant changes during the forecast period, significant meteors such as freezing precipitation, snowfall or rainfall, and an outlook for these factors and variables for the following 24 to 72 hours, as feasible. In addition, phenomena such as breaking seas, cross seas and abnormal or rogue waves could also be included, if feasible.

4.3 Services for the Coastal and Offshore Areas shall consist of:

4.3.1 Warnings

4.3.1.1 When included, warnings shall be placed at the beginning of the bulletin.

4.3.1.2 Warnings shall be given for:

(a) 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);

(b) Gales (Beaufort force 8 or 9) and storms (Beaufort force 10 or over);

(c) Ice accretion;

(d) Ice conditions.

4.3.2 Synopses and Forecasts

4.3.2.1 Synopses and Forecasts should have the following content:

(a) A synopsis of major features of the surface weather chart;

(b) The valid period of forecast;

(c) Name or designation of forecast area(s);

(d) A description of:

(i) Wind speed or force and direction;

(ii) Visibility when forecast is less than five nautical miles;

(iii) Ice accretion, where applicable;

(iv) Ice conditions, where applicable (concise description of sea ice: position of ice edge, total concentration, stages of ice development, etc.)

(v) Sea and swell.

5. ISSUING AND PREPARATION SERVICES

5.1 Issuing Service

5.1.1 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 and NAVTEX services to the designated area for which the Service has accepted responsibility under the broadcast requirements of the GMDSS. The forecasts and warnings for broadcasts 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 broadcasting this in accordance with the guidelines contained within the *International SafetyNET Manual* and the *NAVTEX Manual*. The Issuing Service is also responsible for monitoring the broadcasts of SafetyNET 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 (for example, 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 among the services concerned.

3. In situations where appropriate information, data or advice from other designated Preparation Services for a given area of responsibility 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.

5.2 Preparation Service

5.2.1 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.

6. METAREA COORDINATOR

6.1 METAREA Coordinator resources

6.1.1 The METAREA coordinator should have:

6.1.1.1 The expertise and information sources of a well-established Issuing Service;

6.1.1.2 Effective communications, for example, telephone, e-mail, facsimile, Internet, and telex, with National Meteorological Services in the METAREA, with other METAREA coordinators, and with other data providers.

6.2 METAREA Coordinator responsibilities

6.2.1 The METAREA coordinator should ensure that within its METAREA, National Meteorological Services that act as Preparation Services have the capability to:

6.2.1.1 Be informed of all meteorological events that could significantly affect the safety of navigation within their area of responsibility;

6.2.1.2 Assess all meteorological information immediately upon receipt in the light of expert knowledge for relevance to navigation within their area of responsibility;

6.2.1.3 Forward meteorological warnings and relevant associated information which may require wider promulgation directly to adjacent METAREA coordinators and/or others as appropriate, using the quickest possible means;

6.2.1.4 Ensure that information concerning all meteorological warning subject areas listed in 4 above that may not require a METAREA warning within their own area of responsibility is forwarded immediately to the appropriate National Meteorological Services and METAREA coordinators affected by the meteorological event;

6.2.1.5 Maintain records of source data relating to meteorological information and warnings messages within their area of responsibility.

6.2.2 The METAREA coordinator should ensure that within its METAREA, National Meteorological Services that act as Issuing Services have the capability to:

6.2.2.1 Select meteorological information and warnings for broadcast in accordance with the guidance given in 4 and 5 above;

6.2.2.2 Monitor the SafetyNET transmission of their bulletins, broadcast by the Issuing Service.

6.2.3 The METAREA coordinator should also:

6.2.3.1 Act as the central point of contact on matters relating to meteorological information and warnings within the METAREA;

6.2.3.2 Promote and oversee the use of established international standards and practices in the promulgation of meteorological information and warnings throughout the METAREA;

6.2.3.3 Coordinate preliminary discussions between neighbouring Members, seeking to establish and operate NAVTEX services, prior to formal application;

6.2.3.4 Contribute to the development of international standards and practices through attendance and participation in the JCOMM Expert Team on Maritime Safety Services meetings, and also attend and participate in relevant IMO, IHO and WMO meetings as appropriate and required.

Recommendation 8 (JCOMM-III)

IMPLEMENTATION OF QUALITY MANAGEMENT SYSTEMS FOR MET-OCEAN DATA, PRODUCTS AND SERVICES BY MEMBERS/MEMBER STATES

THE JOINT WMO/IOC TECHNICAL COMMISSION FOR OCEANOGRAPHY AND MARINE METEOROLOGY,

Noting:

(1) WMO Resolution 27 (Cg-XIV) – Quality management,

(2) WMO Resolution 8 (EC-LVI) – Intercommission Task Team on Quality Management Framework,

(3) WMO Resolution 31 (Cg-XV) – Implementation of quality management systems by National Meteorological and Hydrological Services,

(4) WMO Resolution 32 (Cg-XV) – WMO Quality Management Framework,

(5) WMO Resolution 8 (EC-LXI) – Procedures to be followed in proposing common ISO/WMO Technical Standards,

Noting further:

(1) The recommendations of the second session of the Inter-Commission Task Team on Quality Management Framework, held in Geneva from 15 to 17 January 2007,

(2) The working arrangements between the International Organization for Standardization (ISO) and WMO formally adopted on 16 September 2008,

(3) The International Oceanographic Data and Information Exchange (IODE)-JCOMM Standards Process related to ocean data management and exchange,

Recognizing:

(1) That the users/customers of met-ocean data, products and services are also increasingly requesting that quality management systems be put in place to assist in providing a level of confidence in the quality of those data, products and services,

(2) That the adoption of quality management principles, approaches and practices facilitates the efficient and effective management and operation of a Service and the implementation of quality management systems is likely to assist Members/Member States in adopting good management practices and enhance confidence in the quality of their data, products and services,

(3) That the International Maritime Organization and WMO had recommended introducing quality management systems for the provision of met-ocean services for international maritime navigation,

(4) That an enhanced peer review process for JCOMM publications would be required before they are acknowledged as the recommended marine meteorological and oceanographic practices for adoption as tools for the Quality Management System,

Noting with appreciation that the Australian Bureau of Meteorology had already begun the process to implement a Quality Management System for its own met-ocean services,

Noting further that the Commission will be requested to review the draft of Volume IV of the WMO Technical Regulations on the administrative aspects of quality management systems, which would be coordinated by the Inter-Commission Task Team on Quality Management Framework,

Considering:

(1) That wide ranging benefits to Members/Members Sates and user communities will result from the implementation of common standards for marine meteorological and oceanographic data, products and services,

(2) That implementing quality management systems will satisfy user/customer requirements, provide good management practices and ultimately will enhance confidence in the quality of data, products and services,

(3) That the adoption and implementation of a quality management system can be the result of a Members/Member States initiative and/or be customer-driven and country-specific,

(4) That the enhancement of the quality of products and services also depends substantially on the quality of data and products internationally exchanged through the WMO and UNESCO/IOC coordinated systems,

(5) That the implementation of an effective quality management system requires full commitment, endorsement and resourcing by the top management of Members/Member States,

Recommends to Members/Member States:

(1) To propose and implement quality management systems for met-ocean data, products and services, based on the IODE-JCOMM Standards Process, the WMO Quality Management Framework and the principles of ISO or any relevant quality management standards, as appropriate to their circumstances;

(2) To participate in ISO activities through their appropriate national channels and to assist WMO and UNESCO/IOC in the development of common standards with ISO, within the framework of the WMO-ISO Working Arrangements;

(3) To share relevant experience and cooperate with one another, as appropriate, in developing quality management systems, including assisting Members/Member States with specific quality management system implementation needs;

(4) To collaborate with the Inter-Commission Task Team on Quality Management Framework in furthering this approach of peer reviews as an example of effective implementation of the WMO-wide Quality Management Framework;

(5) To submit their common practices in collecting, managing and exchanging oceanographic and marine meteorological data though the IODE-JCOMM Standards Process.

Recommendation 9 (JCOMM-III)

MODIFICATIONS TO THE INTERNATIONAL MARITIME METEOROLOGICAL TAPE FORMAT AND MINIMUM QUALITY CONTROL STANDARD

THE JOINT WMO/IOC TECHNICAL COMMISSION FOR OCEANOGRAPHY AND MARINE METEOROLOGY,

Noting:

(1) The *Manual on Marine Meteorological Services* (WMO-No. 558), Volume I, Appendix I.13 – Layout for the International Maritime Meteorological Tape, and Appendix I.15 – Minimum Quality Control Standards,

(2) The final report of the second session of the JCOMM Expert Team on Marine Climatology (JCOMM/MR-No. 50),

Considering:

(1) That the International Maritime Meteorological Tape (IMMT) format is the primary format for the exchange of marine climatological data, for both the Marine Climatological Summaries Scheme (MCSS) and the VOSClim,

(2) The importance of the Minimum Quality Control Standard (MQCS) to the quality of the data in the MCSS archives,

(3) The importance to the Global Collecting Centres of keeping both the IMMT and the MQCS up to date,

Recognizing the need for including information on the source of observations (electronic or paper logbook) in IMMT; as well as the need for taking account in MQCS of increased deck cargo height of modern cargo vessels,

Recommends:

(1) That the amendments to the *Manual on Marine Meteorological Services* (WMO-No. 558) and the *Guide to Marine Meteorological Services* (WMO-No. 471), as detailed in Annexes 1 and 2 to this recommendation be approved, and included in the appropriate appendices in the Manual and Guide;

(2) That the new version (IMMT-IV) of the IMMT format be implemented generally for all data collected as from 1 January 2011;

(3) That the new version of the Minimum Quality Control Standard (MQCS-VI) be also implemented generally for all data collected as from 1 January 2011;

Requests the Expert Team on Marine Climatology to continue to review the implementation and value of the revised format and quality control standard, to provide technical assistance to the Members/Member States concerned as required and to propose further amendments to the format and standard as necessary;

Requests the Secretary-General of WMO to provide appropriate technical advisory assistance to Members/Member States concerned, as required, in the implementation of the revised format and standard.

Annex 1 to Recommendation 9 (JCOMM-III)

AMENDMENTS TO THE *MANUAL ON MARINE METEOROLOGICAL SERVICES* (WMO-No. 558) AND *GUIDE TO MARINE METEOROLOGICAL SERVICES* (WMO-No. 471)

LAYOUT FOR THE INTERNATIONAL MARITIME METEOROLOGICAL TAPE (IMMT) FORMAT
IMMT-IV (Version 4)

Notes:
(a) Highlighting marks noteworthy changes (including additional clarification Notes in [brackets]) with respect to IMMT-III.
(b) The representation for missing data in any field is all blank(s).
(c) Many of the "Codes" in the IMMT format match "symbolic letters" as defined in the *Manual on Codes* (WMO–No.306) for the traditional alphanumeric (FM 13-XII Ext.) SHIP code. However, the elements added for the VOSClim (as introduced for IMMT-II), for example, did not appear in WMO–No.306, thus an effort was made to select unique new Codes to avoid conflicts in meaning between symbolic letter groups in WMO–No.306 versus Codes defined only in IMMT.

Element number	*Character number*	*Code*	*Element*	*Coding procedure*
1	1	i_T	Format/temperature indicator	3 – temperatures in tenths of °C 4 – temperatures in halves of °C 5 – temperatures in whole °C [Note: codes 1–2 were previously used to refer to the obsolete IMMPC format; current codes all refer to the IMMT format]
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	Qc	Quadrant of the globe	WMO code table 3333
7	13–15	$L_aL_aL_a$	Latitude	Tenths of degrees, WMO specifications
8	16–19	$L_oL_oL_oL_o$	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 meters per second, hundreds omitted; values in excess of 99 knots are to be indicated in units of meters per second and i_w encoded accordingly; the method of estimation or measurement and the units used (knots or meters per second) are indicated in element 14

Element number	*Character number*	*Code*	*Element*	*Coding procedure*	
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	$T_dT_dT_d$	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 or 4680	
22	44	W_1	Past weather	WMO code table 4561 or 4531	
23	45	W_2	Past weather	WMO code table 4561 or 4531	
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	
25	47	C_L	Genus of CL clouds	WMO code table 0513	
26	48	C_M	Genus of CM clouds	WMO code table 0515	
27	49	C_H	Genus of CH clouds	WMO code table 0509	
28	50	s_n	Sign of sea-surface temperature	WMO code table 3845	
29	51–53	$T_WT_WT_W$	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	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
				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

Element number	*Character number*	*Code*	*Element*	*Coding procedure*
32	56–57	P_WP_W	Period of wind waves or of measured waves	Whole seconds; show 99 where applicable in accordance with Note (3) under specification of P_WP_W in the *Manual on Codes* (WMO No. 306).
33	58–59	H_WH_W	Height of wind waves or of measured waves	Half-meter values. Examples: Calm or less than ¼m to be encoded 00; 3½m to be encoded 07; 7m to be encoded 14; 11½m 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-meter values (see under element 33)
37	66	I_s	Ice accretion on ships	WMO code table 1751
38	67–68	E_sE_s	Thickness of ice accretion	In centimetres
39	69	R_s	Rate of ice accretion	WMO code table 3551
40	70		Source of observation	0 – Unknown 1 – Logbook (paper) 2 – National Telecommunication channels 3 – National Publications 4 – Logbook (electronic) 5 – Global Telecommunication channels (GTS) 6 – International Publications [Note: Formerly (usage now discontinued): codes 1–3 also referred to “National data exchange,” and codes 4–6 also referred to “International data exchange”; distinction added between paper and electronic logbook]
41	71		Observation platform	0 – Unknown 1 – Selected ship 2 – Supplementary ship 3 – Auxiliary ship 4 – Registered VOSClim ship 5 – Fixed sea station (e.g., rig or platform) 6 – Coastal station [Note: 7 – Reserved] [Note: 8 – Reserved] 9 – Others/data buoy [Note: Formerly (usage now discontinued): code 4 referred to “Automated station/data buoy;” and codes 7–8 referred to “Aircraft” and “Satellite,” respectively]
42	72–78		Ship’s call sign	Ship’s call sign stored left-justified (with right-blank fill) as follows: 7-character call sign: columns 72–78 6-character call sign: columns 72–77 5-character call sign: columns 72–76 4-character call sign: columns 72–75 3-character call sign: columns 72–74
43	79–80		Country which has recruited the ship	According to the 2-character alphabetical codes assigned by the International Organization for Standardization (ISO)

Element number	*Character number*	*Code*	*Element*	*Coding procedure*	
44	81		National use		
45	82		Quality control indicator	0 – No quality control (QC) 1 – Manual QC only 2 – Automated QC only /MQC (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) [Note: 7 and 8 – Reserved] 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	$T_bT_bT_b$	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	
53	94–96	ppp	Amount of pressure tendency at station level during the three hours preceding the time of observation	In tenths of hectopascal	

Element number	*Character number*	*Code*	*Element*	*Coding procedure*
54	97	D_s	True direction of resultant displacement of the ship during the 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-meter 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 the preceding three hours	WMO code table 5239
64	110		FM 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 9 – FM 13-XI A – FM 13-XII Ext. [Note: etc. for future configurations]
65	111		IMMT version	0 – IMMT version just prior to version number being included 1 – IMMT-I (in effect from Nov. 1994) 2 – IMMT-II (in effect from Jan. 2003) 3 – IMMT-III (in effect from Jan. 2006) 4 – IMMT-IV (this version) [Note: etc. for future configurations]
66	112	Q_1	Quality control indicator for (h)	0 – no quality control (QC) has been performed on this element 1 – QC has been performed; element appears to be correct

Element number	*Character number*	*Code*	*Element*	*Coding procedure*
				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 – The flag as received by the GCCs was set to “1” (correct), but the element was judged by their MQCS as either inconsistent, dubious, erroneous or missing 7 – The flag as received by the GCCs was set to “5” (amended) but the element was judged by their MQCS as inconsistent, dubious, erroneous or missing [Note: 8 – Reserved] 9 – The value of the element is 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 -
71	117	Q_6	QC indicator for (TTT)	- idem -
72	118	Q_7	QC indicator for ($T_dT_dT_d$)	- 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 ($T_WT_WT_W$)	- idem -
76	122	Q_{11}	QC indicator for (P_WP_W)	- idem -
77	123	Q_{12}	QC indicator for (H_WH_W)	- idem -
78	124	Q_{13}	QC indicator for (swell: elements 34–36, 56–58)	- idem -
79	125	Q_{14}	QC indicator for (i_RRRRt_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_s)	- idem -
83	129	Q_{18}	QC indicator for (v_s)	- idem -

Element number	*Character number*	*Code*	*Element*	*Coding procedure*
84	130	Q_{19}	QC indicator for ($T_bT_bT_b$)	- idem -
85	131	Q_{20}	QC indicator for ships' position	- idem -
86	132	Q_{21}	Version identification for Minimum quality control standards (MQCS)	1 – MQCS- I (Original version, Feb. 1989): CMM-X 2 – MQCS-II (Version 2, March 1997) CMM-XII 3 – MQCS-III (Version 3, April 2000) SGMC-VIII 4 – MQCS-IV (Version 4, June 2001): JCOMM-I 5 – MQCS-V (Version 5, July 2004): ETMC-I 6 – MQCS-VI (this version, to be agreed) [Note: etc. for future configurations]
Additional Requirements for VOSClim:				
87	133–135	HDG	Ship's heading; the direction to which the bow is pointing, referenced to true North	(000–360); e.g. 360 = North 000 = No Movement 090 = East
88	136–138	COG	Ship's ground course; the direction the vessel actually moves over the fixed earth and referenced to True North	(000–360); e.g. 360 = North 000 = No Movement 090 = East
89	139–140	SOG	Ship's ground speed; the speed the vessel actually moves over the fixed earth	(00–99); Round to nearest whole knot
90	141–142	SLL	Maximum height in meters of deck cargo above Summer maximum load line	(00–99); report to nearest whole meter
91	143	s_L	Sign of departure of reference level	0 = positive or zero, 1 = negative
92	144–145	hh	Departure of reference level (Summer maximum load line) from actual sea level	(00–99) is the difference to the nearest whole meter between the Summer maximum load line and the sea level. Consider the difference positive when the Summer maximum load line is above the level of the sea and negative if below the water line.
93	146–148	RWD	Relative wind direction in degrees off the bow	Relative wind direction; e.g. 000 = no apparent relative wind speed (calm conditions on deck). Reported direction for relative wind = 001–360 degrees in a clockwise direction off the bow of the ship. When directly on the bow, RWD = 360.
94	149–151	RWS	Relative wind speed indicated by i_w (knots or m s^{-1})	Reported in either whole knots or whole meters per second (e.g. 010 knots or 005 m s^{-1}). Units established by i_w (element 14) [Note: RWS is a 3-character field to store values of RWS larger than ff (if i_w indicates knots), e.g. ff=98 knots, RWS=101 knots; see also element 15.]
95	152	Q_{22}	QC indicator for (HDG)	[Note: coding as for element 66]
96	153	Q_{23}	QC indicator for (COG)	- idem -

Element number	*Character number*	*Code*	*Element*	*Coding procedure*
97	154	Q_{24}	QC indicator for (SOG)	- idem -
98	155	Q_{25}	QC indicator for (SLL)	- idem -
	156		blank	[Note: Formerly (usage now discontinued): QC indicator for (s_L); now Q_{27} serves as the indicator for both s_L and hh]
99	157	Q_{27}	QC indicator for (s_L and hh)	- idem -
100	158	Q_{28}	QC indicator for (RWD)	- idem -
101	159	Q_{29}	QC indicator for (RWS)	- idem -
Fields new for IMMT-IV:				
102	160–163	RH	Relative humidity	Tenths of Percentage
103	164	RHi	Relative humidity indicator	0 – Relative humidity in tenths of Percentage, measured and originally reported 1 – Relative humidity in whole Percentage, measured and originally reported [Note: 2 – Reserved] 3 – Relative humidity in tenths of Percentage, computed 4 – Relative humidity in whole Percentage, computed
104	165	AWSi	AWS indicator	1 – Automated Weather Station (AWS) 2 – Automated Weather Station plus Manual Observation
105	166–172	IMOno	IMO number	Seven digits (or left justified with right-blank fill)

Annex 2 to Recommendation 9 (JCOMM-III)

AMENDMENTS TO THE *MANUAL ON MARINE METEOROLOGICAL SERVICES* (WMO-No. 558) AND THE *GUIDE TO MARINE METEOROLOGICAL SERVICES* (WMO-No. 471)

MINIMUM QUALITY CONTROL STANDARD (MQCS)
MQCS-VI (Version 6)

Notes:
(a) Highlighting marks changes with respect to MQCS-V.
(b) See the specifications for setting quality control Indicators Q_1 to Q_{29} at the end of this annex.
(c) Δ = space (ASCII 32).

Element	*Error*	*Action*
1	$i_T \neq 3 – 5, \Delta$	Correct manually otherwise 3
2	AAAA ≠ valid year	Correct manually otherwise reject
3	MM ≠ 01 - 12	Correct manually otherwise reject
4	YY ≠ valid day of month	Correct manually otherwise reject
5	GG ≠ 00 - 23	Correct manually otherwise reject
6	Qc ≠ 1, 3, 5, 7	Correct manually and $Q_{20} = 5$, otherwise $Q_{20} = 4$
	$Q_c = \Delta$	$Q_{20} = 2$
7	$L_aL_aL_a \neq$ 000-900	Correct manually and $Q_{20} = 5$, otherwise $Q_{20} = 4$
	$L_aL_aL_a = \Delta\Delta\Delta$	$Q_{20} = 2$
8	$L_oL_oL_oL_o \neq$ 0000-1800	Correct manually and $Q_{20} = 5$, otherwise $Q_{20} = 4$
	$L_oL_oL_oL_o = \Delta\Delta\Delta\Delta$	$Q_{20} = 2$
	$L_aL_aL_a = L_oL_oL_oL_o = \Delta\Delta\Delta(\Delta)$	Correct manually otherwise reject
Time sequence checks		
	Change in latitude > 0.7°/hr	Correct manually otherwise $Q_{20} = 3$
	Change in longitude > 0.7 °/hr when lat. 00–39.9	Correct manually otherwise $Q_{20} = 3$
	Change in longitude > 1.0 °/hr when lat. 40–49.9	Correct manually otherwise $Q_{20} = 3$
	Change in longitude > 1.4 °/hr when lat. 50–59.9	Correct manually otherwise $Q_{20} = 3$
	Change in longitude > 2.0 °/hr when lat. 60–69.9	Correct manually otherwise $Q_{20} = 3$
	Change in longitude > 2.7 °/hr when lat. 70–79.9	Correct manually otherwise $Q_{20} = 3$
9	Indicator ≠ 0–3, Δ	Correct manually, otherwise Δ
10	h ≠ 0–9	Correct manually and $Q_1 = 5$, otherwise $Q_1 = 4$
	h = Δ	$Q_1 = 9$
11	VV ≠ 90–99	Correct manually and $Q_2 = 5$, otherwise $Q_2 = 4$
	VV = ΔΔ	$Q_2 = 9$
12	N ≠ 0–9, Δ	Correct manually and $Q_3 = 5$, otherwise $Q_3 = 4$
	$N < N_h$	Correct manually and $Q_3 = 5$, otherwise $Q_3 = 2$
13	dd ≠ 00–36, 99	Correct manually and $Q_4 = 5$, otherwise $Q_4 = 4$
	dd = ΔΔ	$Q_4 = 9$
	dd versus ff	
	dd = 00, ff ≠ 00	Correct manually and Q_4 or $Q_5 = 5$ otherwise $Q_4 = Q_5 = 2$
	dd ≠ 00, ff = 00	Correct manually and Q_4 or $Q_5 = 5$ otherwise $Q_4 = Q_5 = 2$
14	$i_w \neq 0, 1, 3, 4$	Correct manually, otherwise $Q_5 = Q_{29} = 4$
15	ff > 80 knots	Correct manually and $Q_5 = 5$, otherwise $Q_5 = 3$
	ff = ΔΔ	$Q_5 = 9$
16	$s_n \neq 0, 1$	Correct manually, otherwise $Q_6 = 4$
17	TTT = ΔΔΔ	$Q_6 = 9$
	If –25 > TTT >40 then	
	when Lat. < 45.0	
	TTT < –25	$Q_6 = 4$
	TTT > 40	$Q_6 = 3$
	when Lat. ≥ 45.0	
	TTT < –25	$Q_6 = 3$
	TTT > 40	$Q_6 = 4$
TTT versus humidity parameters		
	TTT < WB (wet bulb)	Correct manually and $Q_6 = 5$, otherwise $Q_6=Q_{19}= 2$
	TTT < DP (dew point)	Correct manually and $Q_6 = Q_7 = 5$, otherwise $Q_6 = Q_7 = 2$
18	$s_t \neq 0, 1, 2, 5, 6, 7$	Correct manually, otherwise $Q_7 = 4$
19	DP > WB	Correct manually and $Q_7 = 5$, otherwise $Q_7=Q_{19} = 2$
	DP > TTT	Correct manually and $Q_7 = 5$, otherwise $Q_7 = Q_6 = 2$
	WB = DP = ΔΔΔ	$Q_7 = Q_{19} = 9$
20	930 > PPPP > 1050 hPa	Correct manually and $Q_8 = 5$, otherwise $Q_8 = 3$
	870 > PPPP > 1070 hPa	Correct manually and $Q_8 = 5$, otherwise $Q_8 = 4$
	PPPP = ΔΔΔΔ	$Q_8 = 9$
21	ww = 22–24, 26, 36–39, 48, 49, 56, 57, 66–79, 83–88	Correct manually and $Q_9 = 5$, otherwise $Q_9= 4$

Element	*Error*	*Action*
	93–94 and latitude <20° if i_x = 7:	Correct manually and Q_9 = 5, otherwise Q_9 = 3
	w_aw_a = 24–25, 35, 47–48, 54–56, 64–68, 70–78, 85–87 and latitude <20°	Correct manually and Q_9 = 5, otherwise Q_9= 4
22, 23	W_1 or W_2 = 7 and latitude <20°	Correct manually and Q_9 = 5, otherwise Q_9= 4
	$W_1 < W_2$	Correct manually and Q_9 = 5, otherwise Q_9 = 2
	$W_1 = W_2$ = ww = ΔΔΔΔ	Q_9 = 9
24–27	N = 0, and $N_hC_LC_MC_H \neq 0000$	Correct manually and Q_3 = 5, otherwise Q_3 = 2
	N = Δ, and $N_hC_LC_MC_H \neq$ ΔΔΔΔ	Correct manually and Q_3 = 5, otherwise Q_3 = 2
	N = 9, and not (N_h =9 and $C_LC_MC_H \neq$ ΔΔΔ	Correct manually and Q_3 = 5, otherwise Q_3 = 2
	N=Δ, and $N_hC_LC_MC_H$=ΔΔΔΔ	Q_3 = 9
28	$s_n \neq$ 0, 1	Correct manually otherwise Q_{10} = 4
29	$T_WT_WT_W$ = ΔΔΔ	Q_{10} = 9
	if –2.0 > $T_wT_wT_w$ > 37.0 then when Lat. < 45.0	
	$T_WT_WT_W$ < –2.0	Control manually and Q_{10} = 5, otherwise Q_{10} = 4
	$T_wT_wT_w$ > 37.0	Control manually and Q_{10} = 5, otherwise Q_{10} = 3
	when Lat. ≥ 45.0	
	$T_WT_WT_W$ < –2.0	Control manually and Q_{10} = 5, otherwise Q_{10} = 3
	$T_WT_WT_W$ > 37.0	Control manually and Q_{10} = 5, otherwise Q_{10} = 4
30	Indicator ≠ 0–7, Δ	Correct manually, otherwise Δ
31	Indicator ≠ 0–9, Δ	Correct manually, otherwise Δ
32	20 < P_wP_w < 30	Q_{11} = 3
	P_WP_W ≥ 30 and ≠ 99	Q_{11} = 4
	P_WP_W = ΔΔ	Q_{11} = 9
33	35< HwHw < 50	Q_{12} = 3
	H_WH_W ≥ 50	Q_{12} = 4
	H_WH_W = ΔΔ	Q_{12} = 9
34	d_{w1} $d_{w1} \neq$ 00–36, 99	Correct manually and Q_{13} = 5, otherwise Q_{13} = 4
	$swell_1$ = $swell_2$ = Δ	Q_{13} = 9
35	25 < $P_{w1}P_{w1}$ < 30	Q_{13} = 3
	$P_{w1}P_{w1}$ ≥ 30 and ≠ 99	Q_{13} = 4
36	35 < $H_{w1}H_{w1}$ < 50	Q_{13} = 3
	$H_{w1}H_{w1}$ ≥ 50	Q_{13} = 4
37	$I_s \neq$ 1–5, Δ	Correct manually, otherwise Δ
38	$E_sE_s \neq$ 00–99, ΔΔ	Correct manually, otherwise ΔΔ
39	$R_s \neq$ 0–4, Δ	Correct manually, otherwise Δ
40	Source ≠ 0–6	Correct manually, otherwise Δ
41	Platform ≠ 0–9	Correct manually, otherwise Δ
42	No call sign	Insert manually, mandatory entry
43	No country code	Insert manually
44	No Quality Control	
45	Q ≠ 0–6, 9	Correct manually, otherwise Δ
46	$i_x \neq$ 1–7	Correct manually, otherwise Δ
47	i_R = 0–2 and RRR = 000, ΔΔΔ	Correct manually, otherwise Q_{14} = 4
	i_R = 3 and RRR ≠ ΔΔΔ	Correct manually, otherwise Q_{14} = 2
	i_R = 4 and RRR ≠ ΔΔΔ	Correct manually, otherwise Q_{14} = 2
	$i_R \neq$ 0– 4	Correct manually, otherwise Q_{14} = 4
48	RRR ≠ 001–999 and iR = 1, 2	Correct manually and Q_{14} = 5, otherwise Q_{14} = 2
49	$t_R \neq$ 0–9, Δ	Correct manually and Q_{14} = 5, otherwise Q_{14} = 4
50	$s_w \neq$ 0, 1, 2, 5, 6, 7	Correct manually, otherwise Q_{19} = 4
51	WB < DP	Correct manually and Q_{19} = 5, otherwise Q_{19}=Q_7=2
	WB = ΔΔΔ	Q_{19} = 9
	WB > TTT	Correct manually and Q_{19}= 5, otherwise Q_{19}=Q_6=2
52	a ≠ 0–8	Correct manually and Q_{15} = 5, otherwise Q_{15} = 4
	a = 4 and ppp ≠ 000	Correct manually and Q_{15} or Q_{16} = 5, otherwise Q_{15}=Q_{16}=2
	a =1,2,3,6,7,8 and ppp=000	Correct manually and Q_{15} or Q_{16} = 5, otherwise Q_{15}=Q_{16} = 2
	a = Δ	Q_{15} = 9
53	250 ≥ ppp > 150	Correct manually and Q_{16} = 5, otherwise Q_{16} = 3
	ppp > 250	Correct manually and Q_{16} = 5 otherwise Q_{16} = 4
	ppp = ΔΔΔ	Q_{16} = 9
54	$D_s \neq$ 0–9	Correct manually and Q_{17} = 5, otherwise Q_{17} = 4
	D_s = Δ	Q_{17} = 9

Element	*Error*	*Action*
55	$V_s \neq$ 0–9	Correct manually and Q_{18} = 5, otherwise Q_{18} = 4
	V_s = Δ	Q_{18} = 9
56	$d_{w2}d_{w2} \neq$ 00–36, 99, ΔΔ	Correct manually and Q_{13} = 5, otherwise Q_{13} = 4
57	25 < $P_{w2}P_{w2}$ < 30	Q_{13} = 3
	$P_{w2}P_{w2} \geq$ 30 and ≠99	Q_{13} = 4
58	35 < $H_{w2}H_{w2}$ < 50	Q_{13} = 3
	$H_{w2}H_{w2} \geq$ 50	Q_{13} = 4
59	$c_i \neq$ 0–9, Δ	Correct manually, otherwise Δ
60	$S_i \neq$ 0–9, Δ	Correct manually, otherwise Δ
61	$b_i \neq$ 0–9, Δ	Correct manually, otherwise Δ
62	$D_i \neq$ 0–9, Δ	Correct manually, otherwise Δ
63	$z_i \neq$ 0–9, Δ	Correct manually, otherwise Δ
64	version ≠ 0–9, A, Δ	Correct manually, otherwise Δ
65	version ≠ 0–4, Δ	Correct manually, otherwise Δ
86	Minimum Quality Control Standard (MQCS) version identification	1= MQCS-I (Original version, Feb. 1989) CMM-X 2= MQCS-II (Version 2, March 1997) CMM-XII 3= MQCS-III (Version 3, April 2000) SGMC-VIII 4= MQCS-IV (Version 4, June 2001) JCOMM-I 5= MQCS-V (Version 5, July 2004) ETMC-I 6 = MQCS-VI (this version, to be agreed)
87	HDG ≠ 000–360	Correct manually and Q_{22} = 5, otherwise Q_{22} = 4
	HDG = ΔΔΔ	Q_{22} = 9
88	COG ≠ 000–360	Correct manually and Q_{23} = 5, otherwise Q_{23} = 4
	COG = ΔΔΔ	Q_{23} = 9
89	SOG ≠ 00–99	Correct manually and Q_{24} = 5, otherwise Q_{24} = 4
	SOG = ΔΔ	Q_{24} = 9
	SOG > 33	Correct manually and Q_{24} = 5, otherwise Q_{24} = 3
90	SLL ≠ 00–99	Correct manually and Q_{25} = 5, otherwise Q_{25} = 4
	SLL = ΔΔ	Q_{25} = 9
	SLL > 40	Correct manually and Q_{25} = 5, otherwise Q_{25} = 3
91	$s_L \neq$ 0,1	Correct manually and Q_{27} = 5, otherwise Q_{27} = 4
92	hh ≠ 00–99	Correct manually and Q_{27} = 5, otherwise Q_{27} = 4
	hh = ΔΔ	Q_{27} = 9
	hh >= 13	Correct manually and Q_{27} = 5, otherwise Q_{27} = 3
	hh < –01	Correct manually and Q_{27} = 5, otherwise Q_{27} = 4
93	RWD ≠ 000 – 360, 999	Correct manually and Q_{28} = 5, otherwise Q_{28} = 4
	RWD = ΔΔΔ	Q_{28} = 9
94	RWS ≠ 000–999	Correct manually and Q_{29} = 5, otherwise Q_{29} = 4
	RWS = ΔΔΔ	Q_{28} = 9
	RWS > 110 kts	Correct manually and Q_{29} = 5, otherwise Q_{29} = 3
RWD versus RWS		
	RWD = 000, RWS ≠ 000	Correct manually and Q_{28} or Q_{29} = 5, otherwise Q_{28} = Q_{29} = 2
	RWD ≠ 000, RWS = 000	Correct manually and Q_{28} or Q_{29} = 5, otherwise Q_{28} = Q_{29} = 2

Specifications for setting quality control Indicators Q_1 to Q_{29}

0	No quality control (QC) has been performed on 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	The original flag is set “1” (correct) and the value will be classified by MQCS as inconsistent, dubious, erroneous or missing
7	The original flag is set “5” (amended) and the value will be classified by MQCS as inconsistent, dubious, erroneous or missing
8	Reserve
9	The value of the element is missing

Recommendation 10 (JCOMM-III)

AMENDMENTS TO THE WMO GLOBAL MARITIME DISTRESS AND SAFETY SYSTEM MARINE BROADCAST SYSTEM

THE JOINT WMO/IOC TECHNICAL COMMISSION FOR OCEANOGRAPHY AND MARINE METEOROLOGY,

Noting:

(1) The International Convention for the Safety of Life at Sea (SOLAS), 1974, in particular Chapter V (Safety of navigation), Regulation 5 (Meteorological services and warnings) of the 2003 amendments,

(2) The 1988 amendments to SOLAS for the Global Maritime Distress and Safety System (GMDSS),

(3) Recommendation 3 (CMM-XI) – New WMO GMDSS marine broadcast system,

(4) Recommendation 2 (CMM-XII) – Amendments to the WMO GMDSS marine broadcast system,

(5) The final reports of the first (JCOMM/MR-No. 15) and second (JCOMM/MR-No. 46) sessions of the JCOMM Expert Team on Maritime Safety Services (ETMSS),

(6) Annex VI to the WMO Technical Regulations – *Manual on Marine Meteorological Services* (WMO-No. 558),

Recognizing:

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

(2) The obligations of countries that are signatories to SOLAS to provide meteorological services for shipping as specified in the Convention, including its 1988 amendments,

(3) That the WMO GMDSS Marine Broadcast System needs to be constantly reviewed and updated so as to best meet the requirements of users and the internationally agreed commitments under SOLAS,

(4) That the WMO GMDSS Marine Broadcast System also needs to be fully in harmony with navigational warning services for the GMDSS coordinated by the International Hydrographic Organization, and to respond to requirements for maritime safety services expressed by the International Maritime Organization,

Recommends:

(1) That the amendments to the WMO GMDSS Marine Broadcast System as detailed in the annex to this recommendation be adopted;

(2) That the *Manual on Marine Meteorological Services*, Volume I, Part I, be amended accordingly;

Urges WMO Members with forecast and warning preparation and broadcast responsibilities under the WMO GMDSS Marine Broadcast System:

(1) To continue to implement their responsibilities in full, in accordance with the specifications in the *Manual on Marine Meteorological Services*;

(2) To keep the WMO Secretariat closely informed of developments and changes in their operation of the system, including any changes in broadcast schedules;

(3) To liaise closely with users regarding their requirements for and response to meteorological forecast and warning services under the GMDSS;

Requests the Expert Team on Maritime Safety Services to keep the implementation of and user response to the WMO GMDSS Marine Broadcast System under review, and to develop proposals for amendments as necessary;

Requests the Secretary-General of WMO:

(1) To provide appropriate technical advisory assistance to WMO Members concerned in the implementation of the WMO GMDSS Marine Broadcast System;

(2) To bring this recommendation to the attention of the International Maritime Organization, International Hydrographic Organization, International Chamber of Shipping, Inmarsat and other organizations and bodies concerned, and to continue to liaise closely with them in the operation of the system.

Annex to Recommendation 10 (JCOMM-III)

AMENDMENTS TO THE *MANUAL ON MARINE METEOROLOGICAL SERVICES* (WMO-No. 558)

AMENDMENTS TO THE WMO GLOBAL MARITIME DISTRESS AND SAFETY SYSTEM BROADCAST SYSTEM

Part I-bis: Section 1 shall be amended to read:

1. GENERAL

1.1 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) Marine climatological summaries scheme;
(d) Provision of special marine climatological information;
(e) Provision of marine meteorological information and expert advice.

1.2 Marine meteorological services for the high seas should include provision of information by radio-facsimile or other means for the receipt on board ship of graphical data

Part I-bis: Section 2.2.4.7 shall be amended to read:

2.2.4.7 Warnings for other severe conditions such as poor visibility, severe sea states (swell), ice accretion, ice conditions, etc., shall also be issued, as necessary. Phenomena such as breaking seas, cross seas and abnormal/rogue waves could also be included, if feasible.

Part I-bis: Section 2.2.6.1 item (c) shall be amended to read:

(c) A description of:
- (i) Wind speed or force and direction;
- (ii) Sea State (significant wave height/total sea)
- (iii) Visibility when forecast is less than five nautical miles;
- (iv) Ice accretion, where applicable
- (v) Ice conditions, where applicable.

Part I-bis: insert sub-item (d) in Section 2.2.5.1. The new sub-item shall read as follows:

(d) Ice conditions where applicable.

Part I-bis: insert a new paragraph 2.2.5.4 after paragraph 2.2.5.3. The new paragraph shall read as follows:

2.2.5.4 Concise description of ice conditions should be included in the synopsis (position of ice edge, total concentration, stages of ice development, etc.).

Part I-bis: insert sub-item (iv) under item (c) in Section 2.2.6.1. The new sub-item shall read as follows:

(c) A description of:
……..

(iv) Ice conditions, where applicable.

Part I-bis: Section 2.2.6.1.1 shall be amended to read:

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 24 hours. In addition, phenomena such as breaking seas, cross seas and abnormal/rogue waves could also be included, if feasible.

Part I-bis: insert a new paragraph 2.2.9 after paragraph 2.2.8.2, and rename existing paragraph 2.2.9 as 2.2.10. The new paragraph shall read as follows:

2.2.9 For visibility, the following descriptive terms should be used:

Very poor	Less than 0.5 nautical miles (nm)
Poor	0.5 nm to 2 nm
Moderate	2 nm to 5 nm
(Good)*	(greater than 5 nm)

* not mandatory

Part I-bis: Appendix I–2 BIS – create a new table merging Table 1 and Table 2. The Column Area LES of Issuing Service to include only the satellite used, e.g. AOR(E), IOR, etc.

Part I-bis: Appendix I-2 BIS – add Australia as an Issuing Service in Metarea VIII(S) in table 1, and the following note: "Tropical Cyclone warnings prepared and issued by Perth (area east of 90E) are also included in the regular bulletins issued by Mauritius". Following table 1, change the existing note to read: "Tropical Cyclone warnings prepared and issued by La Reunion (area west of 90E) are also included in the regular bulletins issued by Mauritius".

Recommendation 11 (JCOMM-III)

AMENDMENTS TO THE WMO TECHNICAL REGULATIONS, INCLUDING THE *MANUAL ON MARINE METEOROLOGICAL SERVICES* (WMO-No. 558) AND THE *GUIDE TO MARINE METEOROLOGICAL SERVICES* (WMO-No. 471)

THE JOINT WMO/IOC TECHNICAL COMMISSION FOR OCEANOGRAPHY AND MARINE METEOROLOGY,

Noting:

(1) WMO Resolution 1 (Cg-XV) – Technical Regulations of the World Meteorological Organization,

(2) The *Manual on Marine Meteorological Services* (WMO-No. 558),

(3) The *Guide to Marine Meteorological Services* (WMO-No. 471),

Considering the requirements for:

(1) Fast-track procedures for the adoption of amendments to the *Manual on Marine Meteorological Services* (WMO-No. 558) and the *Guide to Marine Meteorological Services* (WMO-No. 471),

(2) Procedures for the adoption of amendments to the *Manual on Marine Meteorological Services* and the *Guide to Marine Meteorological Services* between sessions of the Commission,

(3) Procedures for the adoption of amendments to the *Manual on Marine Meteorological Services* and the *Guide to Marine Meteorological Services* during sessions of the Commission,

Recommends that the procedures for amending the *Manual on Marine Meteorological Services* and the *Guide to Marine Meteorological Services* defined in the annex to this recommendation be applied as from 1 January 2010;

Requests the Secretary-General of WMO to arrange for the inclusion of these procedures in the introduction chapters of Volume I of the *Manual on Marine Meteorological Services* and in the *Guide to Marine Meteorological Services*;

Authorizes the Secretary-General of WMO to make any consequent purely editorial amendments to the introduction chapters of the *Manual on Marine Meteorological Services* and the *Guide to Marine Meteorological Services*.

Annex to Recommendation 11 (JCOMM-III)

PROCEDURES FOR AMENDING THE *MANUAL ON MARINE METEOROLOGICAL SERVICES* (WMO-No. 558) AND THE *GUIDE TO MARINE METEOROLOGICAL SERVICES* (WMO-No. 471)

1. General validation and implementation procedures

1.1 Amendments to the *Manual on Marine Meteorological Services* (WMO-No. 558) and the *Guide to Marine Meteorological Services* (WMO-No. 471) must be proposed in writing to the WMO Secretariat. The proposal shall specify the needs, purposes and requirements and include information on a contact point for technical matters.

1.2 The Expert Team on Maritime Safety Services (ETMSS), Expert Team on Marine Climatology (ETMC) or Ship Observations Team (depending of the nature of the change),[3] supported by the WMO Secretariat, shall validate the stated requirements (unless it is consequential to an amendment to the WMO Technical Regulations) and develop a draft recommendation to respond to the requirements, as appropriate.

1.3 A draft recommendation of the ETMSS, ETMC or SOT must be validated. A draft recommendation of the ETMSS, ETMC or SOT must be endorsed by the respective Programme Area (PA) Coordination Group. The ETMSS, ETMC or SOT should define a date of implementation in order to give sufficient time to the WMO Members to implement the amendments after the date of notification; the ETMSS should document the reasons to propose a time span less than three months.

1.4 Depending on the type of amendments, the ETMSS, ETMC or SOT may select one of the following procedures for the approval of the amendments:

- Fast track procedure (see section 2 below);
- Procedure for the adoption of amendments between JCOMM sessions (see section 3 below);
- Procedure for the adoption of amendments during JCOMM sessions (see section 4 below).

1.5 Once amendments to the *Manual on Marine Meteorological Services* (WMO-No. 558) and the *Guide to Marine Meteorological Services* (WMO-No. 471) are adopted, an updated version of the relevant part of the Manual and/or the Guide shall be issued in the four languages: English, French, Russian and Spanish. The WMO Secretariat will inform all WMO Members of the availability of a new updated version of that part at the date of notification mentioned in section 1.3.

2. Fast track procedure

2.1 Fast track mechanism can be used for additions or changes to the WMO GMDSS Marine Broadcast System or to address requirements for maritime safety services expressed by the International Maritime Organization (IMO).

2.2 A draft recommendation of the ETMSS, ETMC or SOT must be validated in accordance with the procedures given in section 6 below. Draft recommendations developed by the ETMSS, ETMC or SOT must be endorsed by the Chair of the respective PA. The filling of reserved and unused entries in the existing IMMT format and MQCS are considered as minor adjustments, and will be done by the Secretary-General of WMO in consultation with the co-presidents of JCOMM. For other types of amendments, the English version of the draft recommendation, including a date of implementation, should be distributed to the GMDSS focal points for comments, with a deadline of two months for the reply. It should then be submitted to the co-presidents of JCOMM for its adoption on behalf of the WMO Executive Council.

2.3 The implementation of amendments approved through the fast track procedure shall normally be limited to one per year. If the Chairs of ETMSS, ETMC or SOT, and the coordinator of the respective PA agree that an exceptional situation exists, a second fast track implementation can be initiated.

3. Procedures for the adoption of amendments between JCOMM sessions

3.1 For the direct adoption of amendments between JCOMM sessions, as a first step, the ETMSS, ETMC or SOT submits its recommendation, including a date of implementation of the

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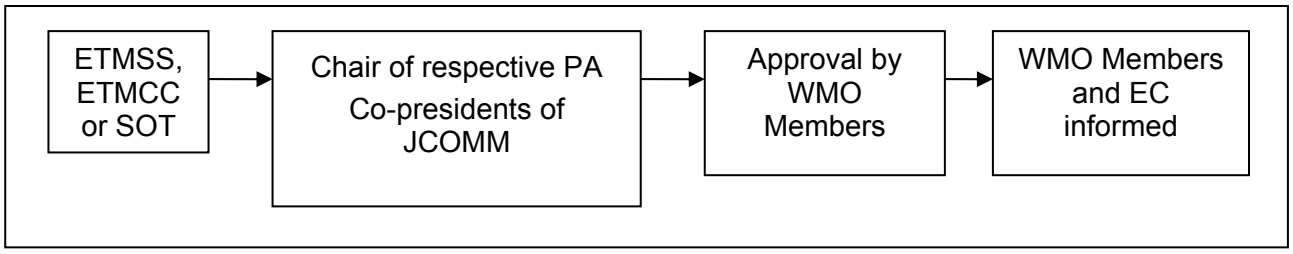
[3]: The ETMSS, the ETMC and the SOT are the current bodies dealing with marine meteorological services within JCOMM: maritime safety services, marine climatological formats, and VOS, respectively. If they were replaced by other bodies performing the same function, the same rules would apply, by replacing the names of the entities appropriately.

amendments, to the Chair of the respective PA and co-presidents of JCOMM. In a second step, upon approval of the co-presidents of JCOMM, the WMO Secretariat sends the recommendation in the four languages (English, French, Russian and Spanish), including a date of implementation of the amendments, to all WMO Members for comments within two months; WMO Members are invited to designate a focal point responsible to discuss any comments/disagreements with the ETMSS, ETMC or SOT. If the discussion between the ETMSS, ETMC or SOT and the focal point cannot result in an agreement on a specific amendment by a WMO Member, this amendment will be reconsidered by the ETMSS, ETMC or SOT. Those WMO Members having not replied within the two months following the dispatch of the amendments are implicitly considered as having agreed with the amendments. In a third step, once amendments are agreed by WMO Members, and after consultation with the Chair of the respective PA and co-presidents of JCOMM, the WMO Secretariat notifies at the same time the WMO Members and the members of the WMO Executive Council (EC) of the approved amendments and of the date of their implementation.

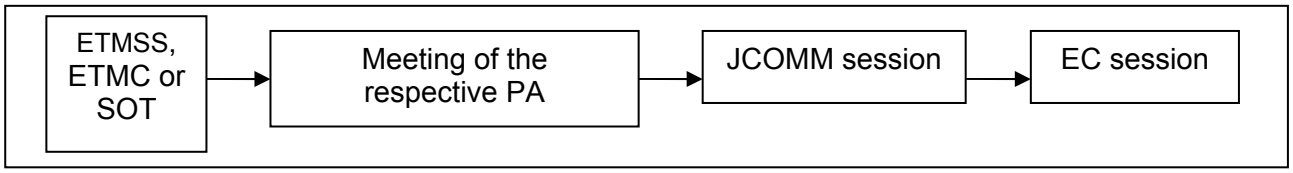
Figure . Adoption of amendments between JCOMM sessions



4. Procedures for the adoption of amendments during JCOMM sessions

4.1 For the adoption of amendments during JCOMM sessions, the ETMSS, ETMC or SOT submits its recommendation, including a date of implementation of the amendments, to the respective PA. The recommendation is then submitted to a JCOMM session and then to an EC session.

Figure 2. Adoption of the amendments through a JCOMM session



5. Procedures for the correction of existing entries in the IMMT format and MQCS

5.1 If an erroneous specification of an entry is found in an operational IMMT format and MQCS Element descriptor, a new descriptor should preferably be added or changed to the appropriate table through the fast track procedure or the procedure for adoption of amendments between JCOMM sessions. An appropriate explanation shall be added to the notes of the table to clarify the practice along with the date of the change. This situation is considered a minor adjustment according to subsection 2.2 above.

6. Validation procedures

6.1 The need for, and the purpose of, the proposal for changes should be documented.

6.2 This documentation must include the results of validation testing of the proposal.

Recommendation 12 (JCOMM-III)

AMENDMENTS TO THE MARINE CLIMATOLOGICAL SUMMARIES AND THE WMO VOLUNTARY OBSERVING SHIP SCHEME

THE JOINT WMO/IOC TECHNICAL COMMISSION FOR OCEANOGRAPHY AND MARINE METEOROLOGY,

Noting:

(1) The *Guide to Marine Meteorological Services* (WMO-No. 471),

(2) The final report of the fifth session of the Ship Observations Team (JCOMM/MR-No. 63),

Considering:

(1) The need to update the WMO Voluntary Observing Ship Scheme in the *Guide to Marine Meteorological Services* in accordance with MSC.1/Circ.1293 of the International Maritime Organization approved in December 2008,

(2) That reports from the VOS will remain an important source of surface meteorological and oceanographic data from all ocean areas to meet the full requirements of WMO programmes, including in particular climate applications,

(3) The successful development of the VOSClim and proposal from the Ship Observations Team at its fifth session to integrate the VOSClim fleet in the wider VOS scheme,

Recommends:

(1) That the amendments to the *Guide to Marine Meteorological Services* as detailed in the annex to this recommendation be approved and included in the appropriate parts in the Guide;

(2) That Members enhance the recruitment of high quality VOS specifically providing additional required VOSClim elements;

Requests the Secretary-General of WMO to provide appropriate technical advisory assistance to Members/Member States concerned, as required, in the implementation of the Voluntary Observing Ship Scheme.

Annex to Recommendation 12 (JCOMM-III)

AMENDMENTS TO THE *GUIDE TO MARINE METEOROLOGICAL SERVICES* (WMO-No. 471)

AMENDMENTS TO THE MARINE CLIMATOLOGICAL SUMMARIES AND THE WMO VOLUNTARY OBSERVING SHIP SCHEME

Chapter 3: Section 3.2.1, first paragraph shall be amended to read as follows:

The establishment of the international exchange and processing arrangements described above for the 'Marine Climatological Summaries Scheme', as it is called, required the cooperation of all maritime countries participating in the WMO Voluntary Observing Ship Scheme, i.e. those which have recruited Selected, VOSClim, Supplementary or Auxiliary ships (see Chapter 6 of this Guide*).* More information about the

Marine Climatological Summaries Scheme can be found on the GCC Website (http://www.metoffice.gov.uk/science/creating/working_together/gcc.html or http://www.dwd.de/gcc), whilst more information about the VOS Scheme can be found on the VOS Website (http://www.bom.gov.au/jcomm/vos/).

Chapter 6: Section 6.1, first and second paragraphs shall be amended to read as follows:

The international scheme under which ships plying the various oceans and seas of the world are recruited for taking and transmitting meteorological observations is known as the WMO Voluntary Observing Ship Scheme. The forerunner of the scheme dates back to 1853, the year in which delegates of 10 maritime countries came together at a conference in Brussels, on the initiative of Lieutenant Matthew F. Maury, then director of the U.S. Navy Hydrographic Office, to discuss the establishment of a uniform system for the collection of meteorological and oceanographic data from the oceans and their use for the benefit of shipping. In the twentieth century, the system was recognized in the *International Convention for the Safety of Life at Sea (SOLAS)* as amended, which specifies in Regulation 5 of Chapter V – Safety of navigation – that 'the Contracting Governments undertake to encourage the collection of meteorological data by ships at sea and to arrange for their examination, dissemination and exchange in the manner most suitable for the purpose of aiding navigation'.

Voluntary observing ships make a highly important contribution to the Global Observing System of the World Weather Watch. They also contribute substantially to the IOC-WMO-ICSU-UNEP Global Climate Observing System (GCOS), and the IOC-WMO-ICSU-UNEP Global Ocean Observing System (GOOS). Relevant standard and recommended practices and procedures are contained in Volume I, Part III, Section 2.3.3 of the *Manual on the Global Observing System* (WMO-No. 544). Although new technological means, such as satellites and automated buoys, are used to gather data from the oceans, voluntary observing ships continue to be the main source of oceanic meteorological information.

Chapter 6: Section 6.2.1, second and third paragraphs shall be amended to read as follows:

Since this Guide emphasizes the mutual collaboration between marine users and meteorologists, only the activities of Meteorological Services with regard to mobile ship stations are described in the following paragraphs. There are eight types of mobile ship stations engaged in the WMO Voluntary Observing Ship Scheme, namely:

(a) Selected ships;
(b) Selected AWS ships;
(c) VOSClim (VOS Climate) ships;
(d) VOSClim (VOS Climate) AWS ships;
(*e*) Supplementary ships;
(f) Supplementary AWS ships;
(g) Auxiliary ships; and.
(h) Auxiliary AWS ships.

The types of observation normally made by each of these types of ship stations is shown in Table 6.1, in addition appropriate metadata to each class must be maintained in WMO-No. 47.

Chapter 6: Section 6.2.2, first paragraph shall be amended to read as follows:

A mobile ship station equipped with sufficient certified meteorological instruments for making observations, transmits regular weather reports and enters the observations in a meteorological logbook. A Selected ship should have at least a barometer, a thermometer to measure SST, a psychrometer (for air temperature and humidity), a barograph and possibly an anemometer.

Chapter 6: Sections 6.2.3 to 6.2.4 shall be deleted. Insert new Sections 6.2.2 to 6.2.9 after Section 6.2.1, and rename existing paragraph 6.2.5 as 6.2.10. The new Sections shall read as follows:

6.2.3 Selected AWS ships

A mobile ship station equipped with an Automatic Weather Station (AWS) system comprising certified meteorological instruments to measure at least air pressure, pressure change, temperature and humidity. Optional sensors would include wind speed and direction and sea temperature measurement. The AWS may or may not have the facility for manual input of the visual elements, and transmit reports at least three hourly or more frequently. The AWS should have the facility to log the data.

6.2.4 VOSClim (VOS Climate) ships

A mobile ship station equipped with sufficient certified meteorological instruments for making observations, transmits regular and timely weather reports, enters the observations in an International Maritime Meteorological Tape (IMMT) compliant electronic logbook and has a proven record of providing high-quality observations. A VOSClim ship should have at least a barometer, a thermometer to measure SST, a psychrometer (for air temperature and humidity), a barograph and possibly an anemometer. The full range of metadata must be maintained in WMO-No. 47, ideally including the full suite of digital images, sketches and drawings, and the delayed-mode IMMT data must be submitted to the Global Collecting Centres (GCCs) according to the procedures described in Chapter 3 of this Guide. It is highly desirable for a VOSClim ship to be inspected at less than six monthly intervals.

6.2.5 VOSClim (VOS Climate) AWS ships

A mobile ship station equipped with an AWS system comprising certified meteorological instruments to measure at least air pressure, pressure change, temperature and humidity. Optional sensors would include wind speed and direction and sea temperature measurement. The AWS should have a facility for manual input of the visual elements, and transmit reports at least three hourly or more frequently. The AWS must have the facility to log the data including the additional IMMT delayed-mode VOSClim groups. The full range of metadata must be maintained in WMO-No., ideally including the full suite of digital images, sketches and drawings, and the delayed-mode IMMT data must be submitted to the GCCs according to the procedures described in Chapter 3 of this Guide. It is highly desirable for a VOSClim ship to be inspected at less than six monthly intervals.

6.2.6 Supplementary ships

A mobile ship station equipped with a limited number of certified meteorological instruments for making observations. It transmits regular weather reports and enters the observations in a meteorological logbook.

6.2.7 Supplementary AWS ship

A mobile ship station equipped with an AWS system comprising a limited number of certified meteorological instruments and reporting regularly.

6.2.8 Auxiliary ships

A mobile ship station normally without certified meteorological instruments, which transmits in a reduced code form or in plain language, either on a routine basis or on request, in certain data-sparse areas and under certain conditions.

6.2.9 Auxiliary AWS ship

A mobile ship station equipped with an AWS system comprising non-certified meteorological instruments and reporting regularly.

Chapter 6: the new Section 6.2.10 shall be amended to read as follows:

6.2.10 International list of selected, VOSClim, supplementary and auxiliary ships

Selected, Selected AWS, VOSClim, VOSClim AWS, Supplementary, Supplementary AWS, Auxiliary and Auxiliary AWS ships constitute an important source of marine data. In analysing these data, Meteorological Services should be aware of the type of instrumentation onboard a given ship, or the particular method of observation when several methods are generally in use. To this end WMO compiled the *International List of Selected, VOSClim, Supplementary and Auxiliary Ships* (WMO-No. 47), which is kept up to date through information supplied by Members, and for each ship. The information contained covers such particulars as:

(a) Name of ship;
(b) Call sign;
(c) Vessel type;
(d) Vessel dimensions;
(e) Area or routes the ship normally plies;
(f) Type of barometer;
(g) Type of thermometer;
(h) Exposure of thermometer;

(i) Type of hygrometer or psychrometer;
(j) Exposure of hygrometer or psychrometer;
(k) Method of obtaining sea surface temperature;
(l) Type of barograph;
(m) Various other meteorological instruments used aboard the ship;
(n) Types of radio equipment, including INMARSAT;
(o) Height of barometer, in metres, measured from maximum load line;
(p) Height of anemometer, in metres, measured from maximum load line;
(q) Depth of sea temperature measurement;
(r) Ships' routes;
(i) Satellite transmission system;
(t) Make and model of AWS system;
(u) Name and version of electronic logbook software.

The *International List of Selected, VOSClim, Supplementary and Auxiliary Ships* needs to be regularly updated (see the *Manual on the Global Observing System*, Volume I, Part III, paragraph 2.3.3.3) because of frequent changes in the international merchant fleet and changes in the recruitment of observing ships. Members are asked to provide to the WMO Secretariat at least every quarter, but preferably every month, updates of their list of Selected, VOSClim, Supplementary and Auxiliary ships, as an e-mail attachment in approved format. This is the most efficient means of keeping the master list updated, as no retyping is required. The Secretariat makes available the master list through its web page (http://www.wmo.int/pages/prog/www/ois/pub47/pub47-home.htm).

Chapter 6: in the new Section 6.2.10, Table 6.1 shall be deleted.

Chapter 6: Section 6.3.1, first and second paragraphs shall be amended to read as follows:

According to the *Manual on the Global Observing System*, Volume I, Part III, paragraph 2.3.3.2, each Member shall recruit as mobile ship stations as many ships as possible that traverse data-sparse areas and regularly follow routes through areas of particular interest. If possible, some of these ships should be non-AWS, or VOSClim AWS ships equipped with a facility for manual input of visual elements (paragraph 6.2.5) so that at least some ships in these data-sparse areas take the full range of Selected or VOSClim Observations, including visual observations of cloud, present weather and phenomena. In fulfilling this obligation, each Member contributes to the common objective of obtaining sufficient coverage of meteorological observations over the sea. While a uniform coverage of the oceans is desirable, this is difficult to achieve in view of the large differences in the density of shipping traffic. This traffic is comparatively dense in the northern hemisphere, but this is not the case in the tropics or in the southern hemisphere. Consequently, greater attention should be given to the recruitment of voluntary observing ships in these areas. Monthly maps showing the density of observations received from ships are available from JCOMMOPS (http://wo.jcommops.org/cgi-bin/WebObjects/JCOMMOPS.woa/wa/map?type=GTSM_VOS).

Meteorological Services in many countries are required to provide more detailed information of the weather and sea conditions in coastal areas. Some services recruit ships of local shipping companies to make and transmit observations during their voyage from harbour to harbour along the coast. Their observations have been widely recognized as being of great value.

Chapter 6: Section 6.3.2, third paragraph shall be deleted. First, second and fourth paragraphs shall be amended to read as follows:

Several criteria can be used in deciding whether a particular ship should be recruited as a Selected, VOSClim, Supplementary or Auxiliary ship, to satisfy national and international needs. Questions which should be examined are whether all the necessary instruments can be installed with adequate exposure, whether the ship's officers will have the time available for recording and transmitting the observations and whether the necessary regular contact can be established for training the observers and for the receipt of electronic or hardcopy logbook data. Shipowners and masters are generally very cooperative in these matters; however, it is advisable that these questions be thoroughly discussed at the recruiting stage. In all cases observations should never be undertaken if they will impair the safe navigation of the recruited ship.

Contrary to the early days of the VOS Scheme ships are now registered in a variety of different countries. Ships registered in ports outside those of the recruiting country are therefore commonly recruited, although it is advisable to contact the Meteorological Service of the flag State beforehand and to check that the ships have not already been recruited by reference to WMO-No. 47. Care should be taken to ensure that duplicate recruitment is avoided.

Members should establish a suitable organizational structure for the maintenance of their marine networks and for the recruitment of voluntary observing ships. It will often be necessary to contact shipping companies, managers and shipping agencies to enlist their cooperation to arrange visits to ships and for the provision of instruments. Port Meteorological Officers play a large role in the recruitment of ships.

Chapter 6: Section 6.4.1, first and second paragraphs shall be amended to read as follows:

The International Convention for the Safety of Life at Sea (SOLAS), 1974, in its Regulation 31, Chapter V, concerning the safety of navigation, specifies that ship masters are obliged to issue a danger message when a ship meets with objects or conditions which are of direct danger to navigation. As far as meteorological phenomena are concerned, danger messages should contain information on dangerous ice, tropical storms, encounters sub-freezing air temperatures associated with gale force winds causing severe ice accretion on superstructures, or winds of force 10 or above on the Beaufort scale for which no storm warning has been received.

Details concerning the contents of danger messages and their transmission are described in Regulation 32 of Chapter V of the International Convention for the Safety of Life at Sea. The information given in these messages directly serves the safety of navigation. Those containing meteorological information are of vital importance to Meteorological Services for the preparation of weather and sea bulletins.

Chapter 6: Section 6.4.2.1, first paragraph shall be amended to read as follows:

The elements observed by the various types of voluntary observing ship are shown in Table 6.1.

Chapter 6: Section 6.4.2.1, Table 6.2 shall be replaced by: (rename existing Table 6.2 as 6.1)

Table 6.1

Typical (or minimum) measurements made for AWS

	Selected	*Selected AWS*	*VOSClim*	*VOSClim AWS*	*Supplementary*	*Supplementary AWS*	*Auxiliary*	*Auxiliary AWS*
Present and past weather	x		x		x		x	
Wind direction and speed	x		x		x		x	
Cloud amount	x		x		x		x	
Cloud type and height of base	x		x		x			
Visibility	x		x		x		x	
Temperature	x	x	x	x	x		x	
Humidity (dew point)	x	x	x	x				
Atmospheric pressure	x	x	x	x	x	x	x	x
Pressure tendency	x	x	x	x				
Ship's course and speed	x	x	x	x				
Sea temperature	x		x					
Period and height of wind waves	x		x					
Direction, period and height of swell	x		x					
Sea-ice and/or icing (if appropriate)	x		x		x		x	
Special phenomena (if appropriate)	x		x					
Max height of deck cargo above the SLL	–	–	x	x	–	–	–	–
Height difference from the SLL to the water line	–	–	x	x	–	–	–	–
Course of ship over ground	–	–	x	x	–	–	–	–
Ship's ground speed	–	–	x	x	–	–	–	–
Ship's heading	–	–	x	x	–	–	–	–

x = mandatory

Chapter 6: Section 6.4.2.1, second paragraph shall be deleted.

Chapter 6: Section 6.4.2.2, first paragraph, item (e) shall be amended to read as follows:

(e) In accordance with SOLAS Chapter V, Regulation 32, when a master has reported a tropical cyclone or other dangerous storm, it is desirable but not obligatory, that further observations be made and transmitted hourly, if practicable, but in any case at intervals of not more than 3 hours, so long as the ship remains under the influence of the storm Meteorological Services may also request more frequent observations for storm warnings, particularly for tropical cyclones and special observations may also be requested for search and rescue operations or other safety reasons;

Chapter 6: Section 6.4.2.2, first paragraph, items (g) and (i) shall be deleted, and rename item (h) as item (g).

Chapter 6: Section 6.4.3, first, third and fourth paragraphs shall be amended to read as follows:

In the past very few mobile ship stations were equipped for making upper-air synoptic observations. An automated means of making upper air soundings from a merchant ship has now been developed under the Automated Shipboard Aerological Programme (ASAP). The balloon is filled with helium and released by a ship's officer. After launch, the observations are automatically received, encoded, and transmitted to the NMS. However, the number of ships making upper-air observations is still small and mostly concentrated in the North Atlantic.

The standard times of upper-air synoptic observations are 0000, 0600, 1200 and 1800 UTC, although most ASAP ships report only two times per day. The actual launch time of regular upper-air synoptic observations is about 60 minutes before these standard times to provide sufficient reserves for re-launches as well as delayed satellite transmissions. The actual time of a balloon observation may deviate from this time range if wind observations at considerably greater heights can be achieved.

In the basic programme of upper-air soundings from mobile ships the general objective is to obtain reports from positions which are not more than 1000 km apart and the observations are typically required at 0000 and 1200 UTC. These observations are to be coordinated within the framework of an international programme to ensure that data are obtained from those parts of the oceans where upper-air data are most needed. Members establishing a programme of upper-air observation on board voluntary observing ships are required to complete the ASAP section of the national SOT Annual Report:

Chapter 6: Section 6.4.4, first and second paragraphs shall be amended to read as follows:

Selected ships may also be equipped to make bathythermograph (XBT) and numerous other observations during ocean crossings. The use of an expendable bathythermograph does not oblige the ship to reduce speed or make course alterations. All arrangements for this type of observation are made within the framework of the JCOMM Ship Observations Team (SOT) and its Ship of Opportunity Programme (SOOP).

Procedures for the collection and exchange of BATHY and TESAC (temperature, salinity and current) observations are specified in the *Guide to Operational Procedures for the Collection and Exchange of JCOMM Oceanographic Data* (IOC/WMO Manuals and Guides No. 3) and the WMO *Manual on the Global Telecommunication System* (WMO-No. 386), Volume 1, Part 1, Attachment I-1. The preferred times for BATHY and TESAC observations are 0000, 0600, 1200 and 1800 UTC. However observations taken at any time are useful and should be transmitted.

Chapter 6: Section 6.4.5, first, second and third paragraphs shall be amended to read as follows:

In relation to international programmes of scientific or economic significance, observations of a special nature are needed from ships at sea and WMO is requested to assist through its Voluntary Observing Ship Scheme. One such example is the request for observations on locust swarms in the seas around Africa, Arabia, Pakistan and India. This programme, which is of great importance to the agricultural economy in the countries concerned, is described in Annex 6.A of this Chapter.

Another example is the report of freak waves. A freak wave is defined as a wave of very considerable height preceded by a deep trough. It is the unusual steepness of the wave which makes it dangerous to shipping. Favourable conditions for the development of freak waves seem to be strong current flows in the opposite direction to a heavy sea and especially when this occurs near the edge of the continental shelf. The reports

may contribute to a mapping of these particularly dangerous areas and to a better understanding of the phenomenon. Guidelines covering the content and form of the report and the forwarding arrangements are described in Annex 6.B of this Chapter (see also Chapter 3, paragraph 3.3.1).

Chapter 6: Section 6.4.6, first, paragraph shall be amended to read as follows:

Ships' observations are coded in the international meteorological codes published in the *Manual on Codes* (WMO-No. 306), Volume I The various code forms are given code names which are sometimes included in the heading of the ship's report. In all cases, however, a 4-letter identification group is used (see code 2582 in the *Manual on Codes*). The identification groups normally used by ships are shown in Table 6.2.

Chapter 6: Section 6.4.6, Table 6.3 shall be amended to read as follows (rename existing Table 6.3 as 6.2):

Table 6.2
Identification groups of codes reported by SHIPS

Code name	*Identification group(s)*	*Content of the code*
SHIP	BBXX	Surface report from a sea station
PILOT SHIP	QQAA, QQBB, QQCC, QQDD	Upper-wind report from a sea station; Parts A, B, C, D respectively
TEMP SHIP	UUAA, UUBB, UUCC, UUDD	Upper-level pressure, temperature, humidity and wind report from a sea station; Parts A, B, C, D respectively
BATHY	JJVV	Bathythermal observation
TESAC	KKYY	Observation of temperature, salinity and current from a sea station
TRACKOB	NNXX	Report of a marine surface observation along a ship's track
BUFR	BUFR	Binary Universal Form for the Representation of meteorological data (specific sequences and/or templates should be used for specific ship reports)
CREX	CREX	Character form for the Representation and EXchange of data (specific sequences and/or templates should be used for specific ship reports)

Chapter 6: Section 6.4.7 shall be amended to read as follows (delete third and fourth paragraphs):

6.4.7 *Electronic Meteorological logbooks*

The manual coding of shipboard observations has been greatly aided by the use of electronic logbook software and by the increased availability of satellite communications on merchant ships. Observations are taken manually in the traditional way and then entered into a dedicated software programme loaded onto a personal computer. This may be in the form of a laptop provided by a National Meteorological Service (NMS), or by installing the software on a ship's computer (with the permission of the shipowner). The computer programme then:

(a) Provides screen prompts to assist with data entry;
(b) Calculates the true wind, MSL pressure and dew point;
(c) Checks the validity of some data, for example, month in range 1–12, observations near climatological extremes;
(d) Allows the real-time observation in SHIP code to be downloaded to a floppy disk or USB device so that it can then be transferred to the ships Inmarsat system for transmission to the Meteorological Service; because most ocean-going ships are required to carry INMARSAT-C equipment, the floppy disk can usually be placed in the INMARSAT terminal and the observation can be transmitted without re-keying. However some ships' Inmarsat equipment may not have this facility, in which case the data will need to be transcribed.
(e) Automatically formats and stores the observation in IMMT format (referred to in Chapter 3, paragraph 3.2.7), which can be subsequently downloaded to floppy disk or USB. These data are usually collected by a Port Meteorological Officer at the time of inspection, or e-mailed directly from the ship to the NMS when e-mail is available.

Chapter 6: Section 6.5.2, first and second paragraphs shall be amended to read as follows:

Aneroid barometers, precision aneroid barometers and digital barometers are commonly used on VOS to measure atmospheric pressure. These instruments are subject to drift and require regular checking by a PMO using a Transfer Standard Barometer, preferably at intervals not exceeding three months. A permanent record of all such checks should be maintained by the PMO, with a copy attached to the barometer showing the date of the check, and the ambient temperature and pressure.

Some aneroid (dial type) barometers are set to indicate Mean Sea Level pressure when they are installed on the ship. Other aneroid barometers, precision aneroid barometers and digital barometers require correction to Mean Sea Level. The barometer height can vary significantly with the loading of the ship, so the barometer correction table for height needs to provide a range of height reduction constants. The draught of very large tankers can vary by as much as 10 metres between a sea-going ballast condition and a fully-loaded condition. If the barometer elevation is great, air temperature may also have to be taken into consideration when preparing reduction tables. At all times the limit of accuracy of the applied reduction should be kept within 0.2 hPa.

Chapter 6: Section 6.5.2, insert a new paragraph after the second paragraph, which shall read as follows:

The correction of the barometer to Mean Sea Level may be made manually by use of correction tables, or in the case of ships using electronic logbook software, computed by the software.

Chapter 6: Section 6.5.3, second paragraph shall be amended to read as follows:

Due to the flow distortion caused by superstructure, masts and spars, the site of the anemometer sensor has to be carefully selected, preferably as far forward and as high as possible, ideally on the foremast if this is possible.

Chapter 6: Section 6.5.4, first and second paragraphs shall be amended to read as follows:

Temperature and humidity observations should be made by means of a psychrometer with good ventilation and exposed in the fresh airstream on the windward side of the bridge. Many countries use a louvred screen and secure on each side of the vessel, so that the observation can be made on the windward side. The muslin and wick fitted to a wet-bulb thermometer in a louvred screen should be changed at least once a week, and more often in stormy weather, and the water bottle filled.

Automated or distant-reading thermometers and hygrometers should be sited in a well-ventilated and exposed screen with good radiation protection and placed as far as possible from any artificial source of heat. It is advisable to compare the readings with standard psychrometer observations at the windward side of the bridge at regular intervals, particularly when new types of equipment are introduced.

Chapter 6: Section 6.5.5, second paragraph shall be amended to read as follows:

The ‘bucket’ instrument method is the simplest and probably the most effective method of sampling this mixed layer, but unfortunately the method can only really be used on board vessels with low freeboards and moving slowly. Other methods are:

(a) Intake and tank thermometers, preferably with distant reading display and used only when the ship is moving;
(b) Hull-attached thermometers located forward of all discharges;
(c) Trailing thermometers; and,
(d) Infra-red radiometers.

Chapter 6: Section 6.6.1, first paragraph shall be amended to read as follows:

Ship reports can be readily transmitted to an Inmarsat Land Earth Station (LES) which has been authorized to accept these reports. Such reports should always be sent via Special Access Code 41 to ensure that they are automatically routed to the Meteorological Service and that no cost is incurred to the ship. The NMS of the country operating the LES pays the cost. There are a number of such LESs in each satellite footprint and they are listed, together with the area from which they will accept reports in WMO-No. 9, Volume D, Part B, Coastal Radio Stations Accepting Ships’ Weather Reports. To place a limit on the costs incurred by an NMS, a LES may be authorized to accept reports only from ships within a designated area of ocean. These limits

should be drawn to the attention of the relevant ship's officers when recruiting a ship under the Voluntary Observing Ships Scheme.

Chapter 6: Section 6.6.1, insert a new paragraph after the first paragraph, which shall read as follows:

An increasing number of ships are now willing to use their Inmarsat systems to send their weather reports by e-mail direct to the Meteorological Services. In such cases, however, the cost of the transmission will be incurred by the shipowner, so it must be ensured that the shipowner is willing to accept such costs. In addition, the Meteorological Service will need to establish a secure system for the receipt and routing of the reports through its message switching systems.

Chapter 6: replace Sections 6.6.2 and 6.6.3 by the new text, which shall read as follows:

6.6.2 ***Service Argos***

Service Argos is a system for receipt of data from automatic weather stations by orbiting satellites, and has been used for many years to collect data from drifting buoys and profiling floats. The data are sent from the satellite to ground stations for processing and distribution on the GTS.

6.6.3 ***Other satellite data telecommunication providers***

There are now private satellite data telecommunication service providers that offer the possibility to collect ship observations via specific satellite systems, for example, Iridium. The data can be transmitted in free format to shore, and the Member recruiting the ship should be responsible for converting the raw data to geophysical units, and applying the necessary quality control procedures before the dissemination of the data over the GTS.

Chapter 6: Section 6.7, first paragraph shall be amended to read as follows:

Ship weather reports received at an NMC from INMARSAT Land Earth Stations (LES) and coastal radio stations should be assembled into meteorological bulletins and transmitted over the GTS with minimum delay. Some Centres transmit a bulletin of available ship weather reports every 15 minutes. Because ship weather reports are a vital input to a variety of forecast models runs, it is important the data from different parts of the world are received with minimum delay.

Chapter 6: Section 6.8.1, first to fourth paragraphs shall be amended to read as follows:

The recording of observations in permanent form is obligatory for selected, VOSClim and supplementary ships and recommended for auxiliary ships. Although most ships now use electronic logbooks for compiling their observations, a small number of ships still record their observations in a hardcopy meteorological logbook. The layout of logbooks is a national responsibility. Generally, the order of parameters recorded in the logbook follows the order of elements in the WMO SHIP code format. Thus the logbook can be used both for recording the synoptic weather report which is to be transmitted and to include additional information required for climatological purposes. For the latter use, the entries are subsequently transferred on to IMMT format (see Chapter 3, paragraph 3.2.7 and Annex 3.C).

Logbooks should contain clear instructions for entering observations. Code books or code cards should also be provided, along with logbooks, for ready reference and to help correct wrong entries as necessary. It is useful to mark in the logbook those columns which are earmarked for entries to be transmitted as part of the weather report. In some national logbooks, these columns are lightly shaded or coloured and in others they are inserted in a special frame. Space is often also provided in logbooks to enter the various readings used to compute a meteorological element such as air pressure reduced to sea-level, or actual wind derived from a measured apparent wind and the ship's movement. This will enable a check of the computations carried out on board ship for subsequent quality control of the data during processing for climatological purposes.

Ships should be requested to return a completed logbook to the Meteorological Service or PMO which has recruited the ship. The period covered by a logbook should ideally not be more than three months, so that the delay in entering the observations in the climatological system is not too great.

Logbooks should be returned with information regarding the ship, the instruments used and other details of a general nature, and space should accordingly be provided for these entries. The name of the master, the observers and the radio officer (if carried) should also be included, particularly if an Award system exists in the country where the ship has been recruited

Chapter 6: Section 6.8.2 shall be amended to read as follows:

6.8.2 *Supply and return*

The observations made by VOS using electronic logbook software, are archived by the programme and need to be downloaded by PMOs at regular intervals. Some VOS still use hardcopy logbooks, so PMOs need to issue these ships with the required stationery and collect the completed logbooks. The completed paper logbooks and the electronic data are generally considered to be the property of the NMS which has recruited the ship.

The NMS should archive the paper and electronic logbook data and submit it to the Global Collecting Centres (GCCs) under the Marine Climatological Summaries Scheme (MCSS).

Chapter 6: Section 6.8.3, first paragraph shall be amended to read as follows:

However clear the instructions relating to entering observations in a logbook, there is always the possibility of errors occurring in entries to a logbook. Completed logbooks must therefore be scrutinized upon receipt and obvious errors corrected. It is of great importance that recurrent types of errors be brought to the attention of the observers concerned so that any misinterpretation of the instructions or erroneous practices in reading instruments or making entries can be corrected. When the logbooks are received by the Port Meteorological Officer, a first check should be made as soon as possible to permit a personal conversation with the appropriate ship's officers. Such conversations or written responses commenting on logbooks which have been received constitute an important element of the continuous training of shipborne observers. Without this feedback ship officers would soon become uncertain as to the quality of their work or the implementation of certain observing or coding procedures and, with the inevitable waning of interest, the quality of their observations may deteriorate.

Chapter 6: Section 6.8.3, delete second paragraph.

Chapter 6: Section 6.9, first, second and fourth paragraphs shall be amended to read as follows (keep third paragraph and delete the fifth paragraph):

In recruiting voluntary observing ships and assisting them in their meteorological work, direct contact with ships' officers is often needed to provide them with instructive material and other documents, to inspect meteorological instruments on board ships, to collect completed hardcopy logbooks and to download log files from electronic logbooks, and to provide feedback on the quality of their observations. For this purpose, Port Meteorological Officers (PMOs) ideally with seagoing experience should be appointed at the main ports routinely visited by observing ships.

PMOs are representatives of the Meteorological Service of the country as far as the local contact with maritime authorities is concerned. The role of PMOs is a very important one and the efficiency of the voluntary system of ships' observations often depends on the initiative displayed by these officers. They are in a good position to discuss with ships' officers any problems they have encountered and offer suggestions, bring to their attention any changes in procedures that may have taken place and give them the latest information which they may wish for. Opportunity should also be taken to explain various meteorological and/or oceanographic programmes whenever observations are specially needed from ships. Meteorological instruments on board ships should be checked and other advice or assistance in meteorological matters should be given by PMOs upon request by the master of any ship.

The scope of the work of PMOs depends largely on the importance of the marine traffic in the particular area served. Before deciding to establish a PMO in a given port, a study must be made of the various services which should be provided. As marine activities develop, a review should be made from time to time to see whether new services should be provided. Guidelines for organizing PMO activities are given in Annex 6.C of this Chapter, and are also available on the VOS Website (http://www.bom.gov.au/jcomm/vos/). A list of PMOs with their addresses and telephone numbers is available on the JCOMM Website (http://www.jcomm.info/pmos).

Chapter 6: Section 6.10 shall be amended to read as follows:

6.10 Incentive programme for voluntary observing ships

In recognition of the valuable work done by ships' officers in taking and transmitting meteorological observations and as an incentive to maintaining a high standard of observation many maritime countries

have established a national award or certificate system. These systems vary greatly from country to country; in some countries the ships receive the awards, while in other countries awards are made to the individual masters or officers. Sometimes recognition for the meteorological work done on board ships is given in the form of books, charts and other documents presented to the ship.

Members are encouraged to continue the practice of issuing national awards or certificates to Selected, VOSClim, Supplementary and Auxiliary ships recruited by them, or to the ships' personnel, as a sign of their participation in the WMO Voluntary Observing Ship Scheme.

In addition to national award schemes, the JCOMM Ship Observations Team has produced a "Certificate of Appreciation" that can be issued by Meteorological Services to participating observing ships.

Chapter 6: Section 6.11 shall be amended to read as follows:

6.11 Marine meteorological publications produced by National Services for seafarers and marine observers

A number of National Meteorological Services in maritime countries publish magazines directed to the masters and officers of ships participating in the WMO Voluntary Observing Ship Scheme. Although content and format differ widely, all these periodicals have two goals in common: first to stress the importance of ships' participation in the marine observing programme and second to offer timely marine meteorological information of interest. A list of these periodicals is given in Annex 6.D of this Chapter.

Among the material included in these periodicals are:

(a) Incidents where ships' observations proved particularly useful;
(b) Commendations on active participation in the WMO Voluntary Observing Ship Scheme;
(c) Hints on observing practices;
(d) Changes in broadcast schedules of weather and sea bulletins or radiofacsimile broadcasts;
(e) Articles on important weather features of particular ocean areas.

Members are encouraged to produce such periodicals and supply them to voluntary marine observers.

Chapter 6: delete Annex 6.A. Rename existing Annex 6.B as 6.A, on which the fourth paragraph shall be amended to read as follows (delete fifth paragraph):

Details of such reports should be entered in the ship's meteorological logbook or recorded in the ships electronic logbook, even when it has not been possible to send a radio report.

Chapter 6: rename existing Annex 6.C as 6.B, on which item (3) shall be deleted and item (2) shall be amended to read as follows:

(2) *Information to be attached to freak wave reports by National Meteorological Centres:*

Ship's name: .....
Gross registered tonnage: .....
Ship's radio call-sign: .....

Chapter 6: delete Annexes 6.D, 6.E and 6.F. Rename existing Annex 6.G as 6.C, which shall be amended to read as follows:

GUIDELINES FOR ORGANIZING PORT METEOROLOGICAL OFFICER (PMO) ACTIVITIES

(Reference paragraph 6.9)

1. Introduction

The functions of a Port Meteorological Officer (PMO) cover seven broad areas:

(a) Recruitment of ships to take part in the Voluntary Observing Ship Scheme;
(b) Regular liaison with recruited ships to ensure the highest standard of observations;
(c) Collection of completed ships' meteorological logbooks and data from electronic logbooks;

(d) Act as an interface between the meteorological service and the marine community;
(e) In large ports act as a focus for the provision of meteorological services in the port;
(f) Assist with arranging deployment of drifting buoys and profiling floats;
(g) Inspection of ships fitted with upper-air radiosonde equipment, an AWS system, or XBT equipment.

1.1 Personnel requirements

Each maritime Member of WMO should endeavour to appoint PMOs with maritime experience at its main ports. Their maritime experience enables them to communicate effectively with the ship's master and other officers. They should also have experience in, and knowledge of, meteorology, theoretical as well as practical. Knowledge of the English language would be an advantage, as most ships' officers whose mother tongue is not English are able to express themselves in this language. The necessary training of PMOs is described in the Manual on Marine Meteorological Services, Part IV, Section 3.

[……]

2.1.1 MERCHANT SHIPPING

Recruiting of observing ships should be in the hands of the PMOs, but subject to overall guidance from the relevant section of the NMS. A worldwide distribution of observing ships is the objective to attain and every effort should be made to recruit ships which operate in data-sparse areas, e.g. the oceans of the southern hemisphere.

PMOs often prioritize the recruitment of ships which are registered in their own country, but ships of other registry are commonly considered for recruitment if they are regular callers and if the PMO considers that they would make a useful addition to the voluntary observing fleet.

Points to be considered when recruiting ships are:

(*a*) Willingness of masters and officers to carry out the voluntary weather observing and to submit reports throughout the voyage;
(*b*) Suitability of the ship to carry and care for the instruments.

Permission to recruit a ship should, whenever possible, be obtained from the ship owners or managers, usually through the marine superintendent of the company and from the master. It is recommended that only a verbal undertaking by a ship's master to carry out the work of an observing ship should be obtained. This service is voluntary, and it is therefore not desirable to create the impression that a formal binding contract will be imposed.

When a ship agrees to participate (or volunteer) in the scheme, the PMO equips the ship with the necessary instruments and stationery. This needs to be done quickly as many ships do not spend much time in port. A list of the instruments issued to the ship should be recorded along with the metadata required for WMO Pub 47 by the PMO.

If calibrated NMS instruments are available, the ship should be recruited as a Selected or a VOSClim ship. If available, e-logbook software should be installed and training given on how to prepare observations.

Suggested lists of instruments and stationery for the various types of observing ships are as follows:

Selected and VOSClim ships:

– One suitably certificated precision or digital barometer;
– One barograph (unless the digital barometer includes a tendency display);
– One whirling pyschrometer OR two screens and two sheathed thermometers (1 air, 1 wet bulb) for each screen, plus two spares OR a suitable digital electronic device to measure temperature and humidity;
– Two sea thermometers and suitable sea buckets (if that bucket method is to be used for measuring sea-surface temperature);
– Electronic logbook software (or hardcopy meteorological logbooks);
– Barograph charts;
– Plotting charts;
– Code and decode information (usually in the form of a code card);
– State of sea card or booklet;
– Cloud types for observers booklet;

– Reduction to mean sea level card (for ships where the pressure height correction is not automatically applied by the electronic logbook software);
– Dewpoint tables (for ships that aren't equipped with electronic logbook software).

Supplementary ships:

– One suitably certificated precision or digital barometer;
– One whirling pyschrometer OR two screens and two sheathed thermometers (1 air, 1 wet bulb) for each screen, plus two spares OR a suitable digital electronic device to measure temperature and humidity;
– Electronic logbook software (or hardcopy meteorological logbooks);
– Code and decode information (usually in the form of a code card);
– State of sea card or booklet;
– Cloud types for observers booklet;
– Reduction to mean sea level card (for ships where the pressure height correction is not automatically applied by the electronic logbook software.

Auxiliary ships:

–Aneroid barometer correction card;
– Code and decode information (usually in the form of a code card);
– Electronic logbook software (or hardcopy meteorological logbooks);
– State of sea card or booklet;
– Cloud types for observers booklet.

[……]

Subject to financial constraints, ships under construction may be supplied with distant reading equipment. PMOs should inform their headquarters of any ships being built in their area which would be suitable, and their respective owners and marine superintendents could then be approached by headquarters with a view to installing the necessary cabling and equipment during the construction. When the necessary agreements and financial approvals with the shipowners or managers have been obtained, the PMO should be informed. He should then arrange to visit the ship with a technician if necessary to discuss the siting and installation of the instruments.

It is of the greatest importance that the PMO's initial guidance and instruction to newly-recruited ships' officers should be as thorough and complete as possible. This will immediately ensure a uniformity in observing technique.

2.1.2 FISHING VESSELS AND SMALL CRAFT

[……]

2.2 Visits to ships

[……]

The barometer is probably the most important instrument for weather observing. The reading should be checked by comparison with a PMO's Transfer Standard Barometer, such as a Vaisala digital barometer.

The barometer should be withdrawn from a ship if the difference from the Transfer Standard barometer exceeds 0.3 hPa.

It is recommended that a record card is kept for each barometer issued to a ship. On the card is recorded the difference between the barometer and the Transfer Standard barometer. The difference, however small, should always be entered on a form, so that an accurate record can be kept of the behaviour of each barometer. Plus or minus signs should be used to indicate high or low differences: the plus sign when the ship's barometer is reading higher than the Transfer Standard and the minus sign when the barometer is lower than the standard.

[……]

A standard inspection form should be used for each visit. Space should be available on this form for recording, for example:

(a) Any replacement of instruments;
(b) Any instruments which are the property of the ship's owners or officers;

(c) Any instruments supplied by other authorities, for example, XBTs, plankton recorders, which affect the appropriate entry to the *International List of Selected, VOSClim, Supplementary and Auxiliary Ships* WMO-No. 47);
(d) Any metadata required by WMO-No. 47 (unless these data re collected using the ship's electronic logbook).

The inspection report should be forwarded to the relevant section of the NMS as soon as possible after the inspection.

On visiting an observing ship, the PMO should ascertain that the necessary hardcopy logbooks (if applicable) and stationery are on board and are up to date. The ship's officers should be encouraged to understand the international meteorological codes and be familiar with the procedures to be carried out in transmitting weather messages to the meteorological centres ashore.

Courtesy visits should, if possible, be made to voluntary observing ships of other nations when they are in local ports and advice and assistance given as necessary.

2.2.1 WITHDRAWAL OF INSTRUMENTS

[……]

2.3 Collection of ships' hardcopy meteorological logbooks

When completed ships normally return their hardcopy meteorological logbooks to the: NMS, but some may prefer to hand it to a PMO. The latter should see the meteorological logbook of all visiting ships and, if it is full or nearly full, they should forward it to the relevant section of their NMS as soon as possible after collection.

[……]

2.4 General liaison with ships

[……]

A PMO is the channel use to communicate advice, instruction and correction to marine observers and also the gratitude of the meteorological departments responsible for coordinating the work. Thus a complimentary call by these officers upon the master and officers of a ship should be regarded as more valuable than a letter or e-mail, but a complimentary card should be left if it was not possible to see the master.

PMOs should make themselves familiar with the current international meteorological codes for ships in order to be able to explain it to the masters and officers of the voluntary observing fleet. Advice and encouragement to voluntary observing officers should be given at every opportunity during visits and, for example, through the medium of any national marine meteorological publications aimed at the voluntary observing ships.

Every encouragement should be given to marine observers and others interested in marine meteorology, to contribute papers or remarks on pertinent subjects, for publication in meteorological journals. Special attention should be directed to the pages, where provided, in the meteorological logbooks for 'additional remarks'. Masters and officers should be encouraged to write descriptions of their experiences not only as regards weather, but of all subjects of scientific interest. It is important that PMOs should maintain contact with their national navigation schools and colleges and give them any advice and assistance they may require.

[……]

Attention should be drawn to the Special Access Code 41 procedures for ships fitted with INMARSAT. Addressed telexes to Meteorological Services without the code 41+ procedures are chargeable to the ship.

PMOs should explain the use of radio weather bulletins, gale, storm and tropical cyclone warnings issued specially for shipping, and which radio weather bulletins, including facsimile broadcasts are the most suitable for masters and officers. They should be familiar with Meteorological Maritime Safety Information (MSI) broadcasts such as SafetyNet and Navtex forecasts and warnings. Information on other meteorological services available to mariners should also be given to navigation schools.

PMOs should try to keep in touch with the management and marine superintendent of shipping companies with offices in their area and make regular visits to them.

2.5 Provision of port meteorological services

[……]

Weather information useful to shipping, fishing or small craft should, if possible, be available at the Port Meteorological Office and details made available of marine forecast products that are available over the Internet. In large ports with a network of automatic weather stations the latest observations may be displayed electronically at the PMO's office (see Chapter 5 for more information on services in ports).

As the first point of contact by ships' officers on meteorological matters, the PMO may be asked for more specific technical information, e.g. on cargo ventilation. If the PMO is unable to answer the query himself, he should transmit it to the appropriate section of the Meteorological Service and ensure that a prompt reply is made.

Chapter 6: rename existing Annex 6.G as 6.D, which shall be amended to read as follows:

MARINE METEOROLOGICAL PUBLICATIONS PRODUCED BY NATIONAL SERVICES AND INTERNATIONAL ORGANIZATIONS OF INTEREST TO SEAFARERS AND MARINE OBSERVERS

(Reference: paragraph 6.11)

Title of publication	*Editions per year*	*Country of origin*	*Language*
Boletín Climático Marino	3	Cuba	Sp.
Météo le magazine	4	France	F
Guide de l'Observateur Météorologiste en Mer	1	France	F
Der Wetterlotse	6	Germany	German
Ship and Maritime Meteorology (*Fune to Kaijou Kishou*)	3	Japan	Japanese
Meteorological Information Bulletin Maritime	4	Netherlands	Dutch and English
Monthly Weather Summary	12	Qatar	E
IMO News	4	United Kingdom	E
Mariners Weather Log	4	United States	E
Storm Data	12	United States	E
WMO Bulletin	2	Switzerland	E, F, R, Sp.

Recommendation 13 (JCOMM-III)

AMENDMENTS TO THE MARINE ACCIDENT EMERGENCY SUPPORT

THE JOINT WMO/IOC TECHNICAL COMMISSION FOR OCEANOGRAPHY AND MARINE METEOROLOGY,

Noting:

(1) The *Guide to Marine Meteorological Services* (WMO-No. 471),

(2) The final Report of the first session of the JCOMM Expert Team on Marine Accident Emergency Support (ETMAES) (JCOMM/MR-No. 47),

Considering:

(1) That operations at sea in response to marine accident emergencies are fundamentally dependent on the support of meteorological and/or oceanographic data, information and services,

(2) That a description of met-ocean input data requirements for marine accident emergency response should be included in the *Guide to Marine Meteorological Services*,

Recommends that the amendments to the *Guide to Marine Meteorological Services* as detailed in the annex to this recommendation be approved and included in the appropriate parts in the Guide;

Requests the Secretary-General of WMO and the Executive Secretary of UNESCO/IOC to bring this recommendation to the attention of the United Nations Environment Programme, International Maritime Organization and other organizations and bodies concerned, and to invite them to collaborate with JCOMM in the further development and operation of the Marine Pollution Emergency Response Support System;

Requests the Secretary-General of WMO and the Executive Secretary of UNESCO/IOC to provide appropriate technical advisory assistance to Members/Member States concerned, as required, in the implementation of the Marine Pollution Emergency Response Support System.

Annex to Recommendation 13 (JCOMM-III)

AMENDMENTS TO THE *GUIDE TO MARINE METEOROLOGICAL SERVICES* (WMO-No. 471)

AMENDMENTS TO THE MARINE ACCIDENT EMERGENCY SUPPORT

Chapter 2: Section 2.3 shall be amended to read:

2.3 Meteorological services in support of maritime search and rescue

2.3.1 *Maritime search and rescue*

Under the GMDSS, Rescue Coordination Centres (RCCs) are responsible for coordinating search and rescue of ships in distress in each SAR region (links to IMO COMSAR to review issues). The success of a search and rescue operation depends to a large extent on the meteorological and oceanographic information available to the RCC. Survivors may be aboard an open small boat which will drift with the wind, waves, tides and currents and search areas may be extensive if the position of the survival craft is not known with any degree of accuracy. Also, it may be extremely difficult to see a small craft in conditions of poor visibility.

The use made of meteorological and oceanographic information by a RCC is shown in the relevant extracts from the IMO Search and Rescue Manual, reproduced in Annex 2.F of this Chapter.

2.3.2 *Marine meteorological supporting services*

The procedures which should be followed when providing marine meteorological and oceanographic services to maritime search and rescue operations are described in Volume I, Part I, Paragraph 3.2 of the *Manual on Marine Meteorological Services.*

In an emergency situation, meteorological and oceanographic information will be required quickly, and procedures should be in place for an NMS to provide the required information to an RCC as quickly as possible when a request is received. This requires the RCC to be kept informed of the addresses of relevant forecasting centres and the available means of communication. It is also recommended that there is agreement between the respective NMSs and the RCCs on the standard format of the information that is

required, as this would save time when a request is initiated. The parameters required are described in detail in Annex 2.G. Alongside the general meteorological forecasts, specific met-ocean data requirements can be summarized as follows:

– Atmospheric pressure;
– Surface winds;
– Sea and swell;
– Visibility;
– Icing;
– Sea ice;
– Cloud cover;
– Surface air temperature;
– Sea-surface temperature;
– Surface/tidal currents.

It is a useful practice to supply the RCC with routine weather and sea bulletins, so that, in an emergency, the RCC has at least a general forecast of the weather and oceanographic conditions in the area while waiting for the response to a request for more specific advice. On many occasions, when the weather is benign, the routine bulletins will be sufficient for RCC purposes.

Chapter 2: Insert new Annex G as follows (and rename Annexes 2.G and 2.H as 2.H and 2.I respectively):

MET-OCEAN INPUT DATA REQUIREMENTS
FOR MARINE ACCICENT EMERGENCY MONITORING AND RESPONSE

Basic principles

– Nowcast, forecast (short- and medium-term), and short-term archive weather, oceanographic and sea-ice information should be made available for the incident site.
– Regional models should be used to ensure coverage of the MPERSS areas.
– Optimal use should be made of the combination of in situ and remotely-sensed observations together with numerical models (preferably with data assimilation where available).
– Priority focus should be on the high-risk areas of coastline, shipping routes, ports, navigation hazards or regions that are known as major problem areas for shipping or oil production/exploration platforms.
– Fast communication of met-ocean data and numerical model outputs is essential for the MPEROAs across the MPERSS regions.
– Effective electronic data communications methods should be established for the MPEROAs.
– The data must be in a form that meets user requirements in quality, accuracy and presentation needs.
– Spill models should be ground-truthed using observations to ensure the accuracy and performance and to assist in the refinement of algorithms.
– Procedures should be in place for an NMS to provide the required information as quickly as possible when a request is received.
– Routine weather, oceanographic and sea-ice bulletins should be provided in addition to the response to a request for more specific advice.

Activities requiring environmental information

The particular activities that require environmental information input for specific applications are:

A. Vessel and crew safety and support:

To ensure safety of life and reduce the potential of further pollution following an incident, Met-ocean information will be required for:

- A1: Crew safety and evacuation;
- A2: Drifting of a vessel;
- A3: Salvage operations;
- A4: Cargo removal and lightering.

B. Pollution at sea (including oil, chemicals and cargo containers)

This can be addressed through spill and drift trajectory modelling using either fixed or dynamic met-ocean data. The trajectory models to be used vary in complexity, cost and depending upon the geographic area of need, with different input data requirements (for example, open sea (primarily influenced by ocean currents and winds) or near shore (influence of tidal conditions and winds). Knowledge of the chemical, physical and biological properties of the pollutant from the beginning of the incident is essential for prediction of the outcome. The extent of weathering of the pollutant at sea affects the choice of response procedures to be used to combat the spill. The primary function in response to these incidents is to determine:

- B1: 3-dimensional movement direction and speed;
- B2: 3-dimensional spreading and dispersion of the pollutant;
- B3: Weathering of the pollutant;
- B4: Stranding of the pollutant.

C. Support for Marine Pollution Emergency Response Operation Authorities (MPEROAs)

MPEROAs will require both the archived and real-time met-ocean information to support the planning and carrying out of field operations in response to incidents. The activities to be supported include:

- C1: Planning (scenario development);
- C2: Logistics/equipment (limitations of use under certain sea-states);
- C3: Recording of response actions and decision support information.

D. SAR Operations

Response to SAR cases may involve some or all of the following activities requiring support:

- D1: Planning based on pre-incident voyage;
- D2: Prediction of drift trajectories;
- D3: Search effort allocation;
- D4: Search operations;
- D5: Account for previous search effort;
- D6: Decision to stop the case.

E. Preparedness for, and response to, algae blooms

Preparedness for response to the occurrence of algae blooms depends on the provision of indicators of the risk of blooms. The response to algae blooms also depends on knowledge of ocean transport and the evolution of the bloom itself. Operations carried out in response to (a) bloom(s) may include relocating aquaculture and restricting access to bathing waters. The activities that require met-ocean data inputs are as follows:

- E1: Identification of conditions conducive to blooms;
- E2: Direction of further monitoring;
- E3: Determine spreading and landfall of the bloom;
- E4: Operations in response to the bloom.

Met-ocean parameter requirements

Table 1 contains details of the Met-ocean data requirements for each of the tasks that are required to be undertaken in response to incidents. It should be noted that requirements for sea-ice and iceberg information are only applicable for operations in ice -infested waters.

Requirements for data latency and updating frequency, together with temporal and spatial sampling requirements, will depend upon the nature and location of a particular incident.

Table 2 provides details of sources typically used to meet particular data requirements. This table is not intended to provide an exhaustive list. Field data sources refer to observed data other than that measured by satellite. Optimal use should be made of the combination of data from the different sources.

Table 1. Met-ocean data requirements

Response activity		*Environmental information requirement*
A. Vessel safety and support	A1: Crew safety and evacuation	Sea-state Surface winds Visibility
	A2: Drifting of the vessel	Surface winds Surface and near-surface currents Sea-state Sea-ice Bathymetry/shoreline
	A3: Salvage operations	Surface winds Sea-state Sea-ice Lightning Surface and near-surface currents Visibility Bathymetry/shoreline
	A4: Cargo removal and lightering	Surface winds Sea-state Sea-ice Lightning Visibility Bathymetry/shoreline
B. Pollution at sea	B1: Movement direction and speed	Surface winds 3-D ocean currents Sea-state Sea-ice Ocean density
	B2: Spreading of the pollutant	Surface winds 3D ocean currents Sea-state Sea-ice Ocean density Bathymetry/shoreline
	B3: Weathering of the pollutant	Sea-state Precipitation Air temperature Sea temperature Ocean density
	B4: Stranding of the pollutant	3D ocean currents Bathymetry/shoreline
C. Support for MPEROAs	C1: Planning (scenario development)	Surface winds Sea-state Surface/tidal currents Sea-ice Bathymetry/shoreline
	C2: Logistics/equipment (limitations of use under certain sea states)	Sea-state Sea-ice Surface winds
	C3: Recording of response actions and decision support information for cost recovery.	Data as used in the response as appropriate

Response activity		*Environmental information requirement*
D. SAR Operations	D1: Planning based on pre-incident voyage	Sea-state Ice accretion Sea-ice
	D2: Prediction of drift trajectories	Surface winds Surface currents Sea-state Bathymetry/shoreline Sea-ice
	D3: Search effort allocation	Surface and upper air winds Sea-state Sea-ice Visibility Cloud cover
	D4: Search operations	Surface winds Sea-state Visibility Sea-surface temperature Surface-air temperature Sea-ice
	D5: Account for previous search effort	Surface winds Sea-state Visibility Cloud cover Sea-ice
	D6: Decision to stop the case	Surface winds Sea-state Sea-surface temperature Surface-air temperature Sea-ice
E. Preparedness for, and response to, algae blooms	E1: Identification of conditions conducive to blooms	*To be included*
	E2: Direction of further monitoring	*To be included*
	E3: Determine spreading and landfall of the bloom	*To be included*
	E4: Operations in response to the bloom	*To be included*

Table 2: Sources of Met-ocean data

Parameter	*Field data sources*	*Satellite data sources*	*Numerical model and analysis data sources*
Sea-state	Wave buoys Ship observations Oil platforms Coastal HF radar	Satellite altimetry (wave height data) Synthetic Aperture Radar data	Wave model analysis and forecast systems
Surface-wind	Moored buoys Drifting buoys Ship observations Oil platforms	Scatterometer data Satellite altimetry	NWP analysis and forecast systems
Surface and sub-surface currents	Drifting buoys Moored buoys Current profilers Coastal HF radar	Satellite altimetry (surface only)	Ocean analysis and forecasting systems Surface current analysis systems
Lightning	Lightning detection systems	Satellite-based detection	
Visibility	Ship observations Coastal stations		NWP analysis and forecast systems
Sea ice	Ship observations Coastal stations Ice mass balance buoys	AMSR / SSM/I / AVHRR satellite data Satellite altimetry Synthetic Aperture Radar data Scatterometer data	Ice chart Coupled ocean–sea-ice - atmosphere analysis and forecast systems
Precipitation	Ship observations Coastal stations Oil platforms Weather radar		NWP analysis and forecast systems
Air temperature	Ship observations Coastal stations Oil platforms Moored buoys (surface only) Drifting buoys (surface only)		NWP analysis and forecast systems
Ocean temperature and density	Argo floats Ship observations Moored buoys Drifting buoys		Ocean analysis and forecast systems
Ice accretion	Ship observations		NWP analysis and forecast systems
Cloud cover	Ship observations Coastal stations Oil platforms	Passive radiometry satellite data Geostationary satellite data	NWP analysis and forecast systems
Sea-surface temperature	Argo floats Ship observations Moored buoys Drifting buoys	Infrared satellite data Microwave satellite data	SST analysis systems Ocean analysis and forecast systems
Surface-air temperature	Ship observations Moored buoys Drifting buoys		NWP analysis and forecast systems
Bathymetry/ shoreline	Aerial photographs	Satellite imagery	Bathymetric chart data Gridded bathymetric datasets

Recommendation 14 (JCOMM-III)

TERMS OF REFERENCE FOR THE JOINT WMO/IOC TECHNICAL COMMISSION FOR OCCEANOGRAPY AND MARINE METEOROLOGY

THE JOINT WMO/IOC TECHNICAL COMMISSION FOR
OCEANOGRAPHY AND MARINE METEOROLOGY,

Noting:

(1) The *Abridged Final Report with Resolutions of the Thirteenth WMO Congress* (WMO-No. 902),

(2) The summary report of the twentieth session of the UNESCO/IOC Assembly (IOC-XX*)*,

(3) The final report of the 2009 Meeting of the Presidents of WMO Technical Commissions (Geneva, February 2009),

(4) The *WMO Strategic Plan* (WMO-No 1028),

(5) The IOC Draft Medium-term Strategy (2008–2013*)* (UNESCO/IOC Resolution EC-XXXIX.1),

Recognizing that the existing terms of reference for the Joint WMO/IOC Commission for Oceanography and Marine Meteorology had served well the overall organizational objectives and Strategic Plans of both WMO and UNESCO/IOC over the first ten years of its existence,

Considering at the same time,:

(1) That the terms of reference of all WMO technical commissions should be linked to and in conformity with the WMO Results-based Management approach and overall Organization objectives and strategic thrusts, and have a common structure,

(2) That there was also a need for JCOMM to conform with the UNESCO/IOC planning processes and Organization objectives and strategy,

Recommends that the terms of reference for JCOMM should be as given in Annex 1 to this recommendation, which were aligned with the WMO Expected Results and the UNESCO/IOC Actions as given in Annex 2 to this recommendation;

Requests the Secretary-General of WMO and the Executive Secretary of UNESCO/IOC to bring this recommendation to the attention of the WMO and UNESCO/IOC Executive Councils in 2010 for their consideration.

Annex 1 to Recommendation 14 (JCOMM-III)

TERMS OF REFERENCE FOR THE JOINT WMO/IOC TECHNICAL COMMISSION FOR OCEANOGRAPHY AND MARINE METEOROLOGY

The Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM), as a contribution to achieving the top-level objectives and expected results of WMO and UNESCO/IOC, shall:

WMO Expected Results 1, 2, 6 and 7, and UNESCO/IOC Actions 1(a), 1(b), 3(a), 3(c), 4(a) and 4(c):

Coordinate, develop and recommend standards and procedures for the work of Members/Member States in the overall collection, exchange, access, understanding, application and delivery of marine meteorological and oceanographic data, information, forecasts and warnings upon which marine meteorological and oceanographic services and marine-related decision-making processes are based.

WMO Expected Results 3, 4, 6 and 7, and UNESCO/IOC Actions 2(a), 2(b), 2(c), 3(a), 3(c) and 4(a):

Coordinate, develop and recommend standards and procedures for the work of Members/Member States in the overall collection, management, exchanges and archival of high-quality marine meteorological and oceanographic data, information and products, on which climate studies, predictions and services, as well as climate change impacts and adaptation strategies, are based.

WMO Expected Results 5, 6 and 7, and UNESCO/IOC Actions 3(a), 3(b), 3(c), 4(a) and 4(b):

Promote and facilitate the international sharing of implementing experience, transfer of technology and research uptake, and support relevant education and training to meet the capacity development needs of national agencies and of other organizations that play a role in the provision of marine meteorological and oceanographic services.

In this regard, the Commission should give special attention to education and training, and technology transfer initiatives on marine meteorological and oceanographic data, products and services that respond to the needs of, and build capacity in, the developing countries with particular emphasis on the least developed countries and small island developing States. Additionally, the Commission should support cooperation among WMO, UNESCO/IOC and other Untied Nations agencies that are members of UN-Oceans, the International Hydrographic Organization (IHO), the International Council for Science (ICSU) and other governmental and non-governmental organizations, the private sector as well as user organizations, on matters related to marine meteorology and oceanography.

Within its terms of responsibility as defined above, and consistent with the Technical Regulations of WMO and the Statutes of UNESCO/IOC, a joint technical commission of WMO and UNESCO/IOC shall:

1. Study and review advances in science and technology, keep Members/Member States informed and advise the WMO Congress, the UNESCO/IOC Assembly, the Executive Councils of WMO and UNESCO/IOC, and other constituent and major subsidiary bodies on these advances and their implications;

2. Prepare and propose, for consideration by the Executive Councils of WMO and UNESCO/IOC, the WMO Congress and the UNESCO/IOC Assembly, international standards for methods, procedures, techniques and operational practices in its area of technical capability, including, in particular, the relevant parts of the WMO Technical Regulations, marine-related guides and manuals of WMO and UNESCO/IOC;

3. Under the general guidance of the WMO Congress, the UNESCO/IOC Assembly and the Executive Councils of WMO and UNESCO/IOC, carry out functions with other bodies as necessary relating to the planning, implementation and evaluation of the scientific and technical programme activities of both Organizations;

4. Provide a forum to discuss, examine and resolve relevant scientific and technical issues;

5. Based on the requirements of Members/Member States, promote training by assisting in the organization of seminars and workshops and in the preparation of related material and the development of other suitable mechanisms for the transfer of knowledge, technology and methodology, including the results of research, between Members/Member States;

6. Promote international cooperation and maintain, through appropriate channels, close cooperation on scientific and technical matters with other relevant international organizations; and

7. Make such recommendations to WMO and UNESCO/IOC governing bodies as it may consider necessary.

Annex 2 to Recommendation 14 (JCOMM-III)

WMO EXPECTED RESULTS AND UNESCO/IOC ACTIONS

WMO Expected Results

1. Enhanced capabilities of Members to deliver and improve access to high-quality weather, climate and water and related environmental predictions, information and services in response to users' needs and to enable their use in decision-making by all relevant societal sectors.

2. Enhanced capabilities of Members to reduce risks and potential impacts of hazards caused by weather, climate and water and related environmental elements.

3. Enhanced capabilities of NMHSs to produce better weather, climate, and water and related environmental information, predictions and warnings to support in particular climate change impacts and adaptation strategies.

4. Enhanced capabilities of Members to access, develop, implement and use integrated and interoperable surface-based and space-based systems for weather, climate and hydrological observations, as well as related environmental observations, based on world standards set by WMO.

5. Enhanced capabilities of Members to contribute to and draw benefits from the global research capacity for weather, climate, water and environment science and technology development.

6. Enhanced capabilities of NMHSs, in particular in developing and least developed countries, to fulfil their mandates.

7. New and strengthened partnerships and cooperation activities to improve NMHSs' performance in delivering services and to increase the value of the contributions of WMO within the United Nations system, relevant international conventions and national strategies.

8. An effective and efficient Organization.

UNESCO/IOC Actions

1a. Promote integrated and sustained monitoring and warning systems for coastal and oceanic natural hazards, in close coordination with other relevant intergovernmental organizations

where appropriate, using enhanced coastal and ocean networks, including education and training activities.

1b. Educate communities at risk with respect to natural hazards impact prevention, preparedness and mitigation measures.

2a. Increase the understanding of the ocean's role in climate variability and climate change.

2b. Contribute to the better prediction of climate through ocean observations and process studies, at regional and global scales.

2c. Increase the understanding of the impacts of climate change and variability on marine ecosystems and their living resources.

3a. Actively contribute to the "Regular Process for Global Reporting and Assessment of the State of the Marine Environment, including socio-economic aspects".

3b. Further develop the research and monitoring required for the prevention of marine environment degradation, and the maintenance of biodiversity and the sustainable use of marine habitats.

3c. Identify and develop the capacity-building necessary for maintenance of healthy oceans ecosystems focusing on the regional needs.

4a. Enhance regional cooperation and involvement of the Member States through capacity-building and transfer of technology and measures to strengthen the capabilities of the IOC Regional Subsidiary Bodies and IOC decentralized offices.

4b. Facilitate science related to ocean and coastal resource management.

4c. Enhance development and implementation of decision-support tools that improve integrated ocean and coastal management.

Recommendation 15 (JCOMM-III)

TERMS OF REFERENCE FOR AN END-TO-END EXTERNAL REVIEW OF THE JOINT WMO/IOC TECHNICAL COMMISSION FOR OCEANOGRAPHY AND MARINE METEOROLOGY

THE JOINT WMO/IOC TECHNICAL COMMISSION FOR OCEANOGRAPHY AND MARINE METEOROLOGY,

Noting:

(1) The *Abridged Final Report with Resolutions and Recommendations of the Second Session of the Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology* (WMO-No. 995), general summary, paragraph 14.1.7;

(2) A Strategy for JCOMM (version 1), paragraph 6.4;

(3) The *Abridged Final Report with Resolutions of the Sixty-first Session of the Executive Council* (WMO-No. 1042), general summary, paragraph 4.2.51;

(4) The summary report of the forty-first session of the UNESCO/IOC Executive Council (IOC/EC-XLI/3), paragraph 221,

(5) The final report of the seventh session of the JCOMM Management Committee (JCOMM/MR-No. 62), paragraphs 3.4 and 3.5;

Considering:

(1) That the review process should be carried out on behalf of the governing bodies of the two co-sponsoring organizations of JCOMM, and not by JCOMM itself;

(2) That the review should reflect the views of WMO Members and UNESCO/IOC Member States;

(3) That carrying out such a review would require extrabudgetary support;

Considering further that guidance was required to better understand the reasons for and respond to:

(1) The current stagnation in implementing the ocean observing systems;

(2) The slow development of automated data collection and processing systems and the application of free and open data exchange policies;

(3) The need for coordinated marine climate services and their contribution to the Global Framework for Climate Services;

Recognizing that the study by Dr James Baker on the Planning and Implementation for the Global Ocean Observing System contains a number of valuable comments and recommendations of direct relevance to JCOMM, and therefore provides a good input for the preparation of an end-to-end review of the Commission, as do other existing review documents,

Recommends:

(1) That an end-to-end review of JCOMM be carried out as a matter of priority, and concluded by the end of 2010, to provide input to the sixteenth session of the WMO Congress and the twenty-sixth session of the UNESCO/IOC Assembly, in 2011;

(2) That the terms of reference for the end-to-end review of JCOMM be as given in the annex to this recommendation;

(3) That the review of the Commission be conducted by a group of independent qualified experts representing Members/Member States;

(4) That Members/Member States be requested to provide in-kind or budgetary contributions to coordinate the review process in an efficient and expedient matter, and prepare the final report;

(5) That a review team be established and Members/Member States invited to nominate experts to this team;

Requests the Secretary General of WMO and the Executive Secretary of UNESCO/IOC to bring this recommendation to the attention of Members/Member States for their consideration.

Annex to Recommendation 15 (JCOMM-III)

TERMS OF REFERENCE FOR AN END-TO-END EXTERNAL REVIEW OF THE JOINT WMO/IOC TECHNICAL COMMISSION FOR OCEANOGRAPHY AND MARINE METEOROLOGY

The review process shall:

(a) Consider the period starting at the first session of the Commission and finish at the close of the third session of the Commission;

(b) Include, as a component of an end-to-end review process, existing review documents that consider JCOMM activities, structure and governance;

(c) Consult with JCOMM stakeholders and users;

(d) Analyse how JCOMM has fulfilled the requirements for the Commission set out by WMO and UNESCO/IOC;

(e) Analyse to what extent JCOMM, as a technical commission, is cost-effective in its operations and delivers benefits to Members/Member States;

(f) Assess the alignment of JCOMM activities with, and how these address, the forward looking strategic objectives and expected results set out by WMO and UNESCO/IOC strategic planning documents;

(g) Consider any other aspects of JCOMM that would improve the efficiency of JCOMM, as well as its relevance to and impact on Members/Member States.

(h) Based on items (a) to (g), provide a report to the governing bodies of WMO and UNESCO/IOC describing the approach taken for the review, the review findings and the information sources used. The report shall include recommendations on how JCOMM can deliver improved benefits to its Members/Member States.

Recommendation 16 (JCOMM-III)

REVIEW OF RELEVANT RESOLUTIONS OF THE GOVERNING BODIES OF WMO AND UNESCO/IOC

THE JOINT WMO/IOC TECHNICAL COMMISSION FOR OCEANOGRAPHY AND MARINE METEOROLOGY,

Noting with satisfaction the action taken by the WMO and UNESCO/IOC governing bodies on the previous recommendations of the Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM) or concerning the Commission,

Considering that, a number of previous resolutions of the governing bodies of WMO and UNESCO/IOC are still valid,

Recommends:

(1) That WMO Resolution 6 (EC-LVIII) and UNESCO/IOC Resolution EC-XXXIX.2 be no longer considered necessary;

(2) That WMO Resolutions 15 (EC-XXI), 12 (EC-XXV), 3 (EC-XLVIII) and 27 (EC-LIX) be kept in force.

ANNEXES

ANNEX I
Annex to paragraph 9.1.3 of the general summary

JOINT WMO/IOC TECHNICAL COMMISSION FOR OCEANOGRAPHY AND MARINE METEOROLOGY CAPACITY-BUILDING PRINCIPLES

1. INTRODUCTION

1.1 The purpose of this document is to lay down the guiding principles on which JCOMM capacity-building activities in marine meteorology and oceanography should be based. The document has been prepared taking into account previous documents and initiatives on capacity development undertaken by JCOMM. A member of the JCOMM Management Committee will be charged with coordinating capacity-building activities.

2. CAPACITY-BUILDING PRINCIPLES

WMO and UNESCO/IOC Capacity-Building Programmes

2.1 The JCOMM is jointly sponsored by the WMO and the UNESCO/IOC and therefore its capacity-building activities must operate within, and draw upon, the overall principles of its governing bodies. The WMO and UNESCO/IOC should also assist with the development of partnerships with potential donor agencies and with links with other UN and other relevant regional and global organizations. The activities also must be compatible and work with similar efforts in other WMO and UNESCO/IOC Programmes. In addition, the JCOMM should seek partnerships to pursue mutual objectives in the development of capability. Finally, capacity-building requirements of the WMO Regional Associations and GOOS Regional Alliances (GRAs) must be considered.

2.2 It is generally agreed that a separate capacity-building programme for JCOMM was not required, taking into consideration the existing capacity-building strategies of WMO and UNESCO/IOC.

Rationale for JCOMM Capacity Principles

2.3 JCOMM should support capacity development elements that are not fully included in other ocean or atmosphere programmes, and draw attention specifically to other capacity-building programmes of the WMO or UNESCO/IOC. Examples include specialized observations and resulting products, e.g., those of some satellite missions, the Argo profiling float programme, or the Data Buoy Cooperation Programme, and other applications.

2.4 The three JCOMM Programme Areas each should include capacity-building activities for a more integrated, focused and proactive approach.

The JCOMM Capacity-Building Principles

Note that there is no priority implied by the order of these principles:

(i) The primary objective of JCOMM capacity-building is to enhance the implementation of the overall JCOMM Programme through enhancing capacity in all Members/Member States to contribute to and benefit from the programme;

(ii) The Activity Leader on Capacity-Building should work with the PA coordinators and the Secretariats to revise the JCOMM capacity-building strategy that builds on existing

capacity-building work in both WMO and UNESCO/IOC, to implement a range of JCOMM-focused capacity-building activities;

(iii) Specific JCOMM-focused capacity-building activities should be implemented by the respective Programme Areas and included in their respective workplans;

(iv) JCOMM capacity-building activities should aim to fill-in gaps and avoid overlapping at national, regional and international levels. It is highly desirable that national partners from both JCOMM themes (i.e., oceanography and marine meteorology) be involved so the complementary and "symbiotic" benefits of JCOMM are clearly demonstrated;

(v) JOMMM capacity-building will include continuous professional development;

(vi) JCOMM capacity-building will aim, where possible, for a "train the trainer" approach to help ensure continuity by countering staff turnover/brain drain problems and to promote the wide spread of knowledge and practices;

(vii) At the regional level, JCOMM capacity-building will develop programmes and projects that follow WMO and UNESCO/IOC strategies (e.g. the ODIN strategy, developed by IODE of UNESCO/IOC; the SWFDP, developed by WMO/CBS; the PANGEA concept, developed by the JCOMM OPA);

(viii) At the regional level, JCOMM capacity-building will develop, preferably, medium to long-term programmes and projects that will result in national structural and embedded capacity that can be sustained by national funding sources;

(ix) Creating awareness in the minds of the public and policy makers is essential for raising national and international support;

(x) JCOMM capacity-building activities will include assessment of feedback regarding the satisfaction and requirements of users of JCOMM observations, products and services;

(xi) One member of the JCOMM Management Committee will be responsible for liaison with the three Programme Areas regarding capacity-building activities;

(xii) JCOMM capacity-building activities should endeavour to utilize existing methods, courses, tools and other capacity-building aids, particularly those of the WMO and UNESCO/IOC.

3. TYPES OF EDUCATION AND TRAINING ACTIVITIES AND IMPLEMENTATION

Methods and Tools

3.1 Capacity-building activities will be implemented using a wide variety of methods, tools and resources that are currently available within WMO (including its 23 Regional Training Centres (RTCs)) and the IODE of UNESCO/IOC, or which will need to be developed by JCOMM and its parent bodies.

Training Courses

3.2 A traditional mechanism for transfer of capacity is the training course. This will also be the case for JCOMM's capacity-building activities. Each JCOMM capacity-building activity (programme or project) should include a training component. The project document should contain a clear statement on what expertise needs to be built. Based upon this information training activities will be planned.

Training Tools

3.3 The JCOMM Management Committee, at its fifth session (Geneva, October 2006) identified *OceanTeacher* (http://www.oceanteacher.org), a training tool that was developed by the IODE of UNESCO/IOC, as one of the suitable tools for the management of JCOMM-related knowledge and training materials. Other tools also were identified and should be explored. WMO/ETR *Met e-learning* modules (http://www.met-elearning.org) have been used for the management of educational and training materials on meteorology, including for marine meteorology. Other virtual training centres and e-learning tools, such as the Cooperative Programme for Operational Meteorology, Education and Training (COMET, http://www.meted.ucar.edu/) and the Eumetcal – EUMeTrain (http://www.eumetcal.org/), make available Modules covering many fields of interest to the marine meteorological and oceanographic communities, including atmospheric and oceanic processes as well as remote-sensing of marine and oceanographic elements.

3.4 It is important to maintain the highest possible standards for the quality of materials entered into *OceanTeacher* and *Met e-learning*, and interoperability between these tools should be ensured. It will also be desirable to establish and agree upon standard curricula for all topics. This can be achieved through close coordination between the resource persons and between the resource persons and the Chief Editors. It may be necessary to identify multiple Chief Editors, e.g. one per Programme Area.

3.5 E-learning modules use dynamic content management technology. As such, materials can be entered by resource persons from their usual place of work. In principle, the number of resource persons who can enter materials is unlimited.

3.6 Bilko is a complete data analysis system developed primarily for learning and teaching remote sensing image analysis skills, providing a powerful application capable of handling ocean model data. Current lessons teach the application of remote sensing to oceanography and coastal management, but Bilko routines may be applied to the analysis of any image in an appropriate format, and include a wide range of standard image processing functions. Supported by UNESCO, Bilko is available to users absolutely free including a wide variety of satellite and ocean model outputs with associated self-study lessons that are ideally suited for 'off the shelf' training courses in oceanography (see http://www.bilko.org/).

3.7 In many cases material in the Digital Library and Training Curriculum materials make extensive use of hyperlinks to other content both within and outside *OceanTeacher* and *WMO Digital Library*. An important quality control task for the Secretariats is therefore, to regularly check whether links are still valid. It is noted that the use of these e-learning modules is free and open to all. Access to the Digital Library is open and does not require registration. Access to the training Curriculum also is free, but registration is required for full functionality.

Workshops

3.8 Workshops are useful tools to promote the sharing of expertise and experience at the national, regional and global levels.

Travel and Study Grants

3.9 Travel and Study Grants allow national experts to benefit from the expertise acquired in other institutions. They also are effective in promoting long-term informal professional relations between experts. As an example, the WMO Fellowship Programme enables fellowship holders to derive from their training the knowledge and professional competence, which will increase their ability to make essential contribution to enhancing the capabilities of the National Meteorological and Hydrological Services (NMHS) and enable them to participate more actively in the economic and social development of their countries. The fellowships granted by WMO are for studies or training in meteorology, including marine meteorology and hydrology, at universities or training institutes with appropriate facilities. Fellowships are awarded only at the request of the candidate's

government and the candidates must be endorsed by the Permanent Representative of the candidate's country with WMO (more information is available at http://www.wmo.int/pages/prog/etr/fellowship_en.html).

Communication and Outreach Tools

3.10 As a way of documenting and monitoring JCOMM capacity-building activities, the use of the UNESCO/IOC-IODE Alumni database to record all JCOMM capacity-building events and alumni is recommended. This will assist in tracking JCOMM training course participants and in assessing the long-term impact of the training provided.

ANNEX II
Annex to paragraph 14.1.2 of the general summary

A STRATEGY FOR THE JOINT WMO/IOC TECHNICAL COMMISSION FOR OCEANOGRAPHY AND MARINE METEOROLOGY 2010–2013

Executive Summary

The Joint Technical Commission for Oceanography and Marine Meteorology (JCOMM) was established by its parent Organizations, the World Meteorological Organization and the Intergovernmental Oceanographic Commission (of UNESCO) in 1999 to coordinate worldwide marine meteorological and oceanographic services and their supporting observational, data management and capacity-building programmes.

As expressed in the strategic planning documents of WMO and UNESCO/IOC, urgent social and economic drivers need targeted improvements in weather, climate, water, oceanic and related environmental information and services. At the same time, while the future state of the oceans remains uncertain, there is a need to ensure that society and policymakers are better informed of the impact of oceans on humankind and vice versa. JCOMM has developed a vision, objectives and work programme which respond directly to these considerations.

JCOMM coordinates, and develops and recommends standards and procedures for a fully integrated marine observing, data management and services system that uses state-of-the-art technologies and capabilities; is responsive to the evolving needs of all users of marine data and products; and includes an outreach programme to enhance the national capacity of all maritime countries. The long-term objectives for JCOMM are: (i) to enhance the provision of marine meteorological and oceanographic services; (ii) to coordinate the enhancement and long-term maintenance of an integrated global marine meteorological and oceanographic observing and data management system, within the context of GOOS and WIGOS/WIS and as a contribution to the GEOSS; and (iii) to manage the evolution of an effective and efficient programme, embracing all maritime Members/Member States.

Fundamental to the Strategic Planning Documents of WMO and UNESCO/IOC are agreed sets of Expected Results and Actions, respectively. The work of JCOMM over the period 2010 to 2013 will contribute to WMO Expected Results and UNESCO/IOC Actions in several overlapping but complementary ways. Specifically:

WMO Expected Results 1, 2, 6 and 7, and UNESCO/IOC Actions 1(a), 1(b), 3(a), 3(c), 4(a) and 4(c):

Coordinate, develops- and recommends standards and procedures for the work of Members/Member States in the overall collection, exchange, access, understanding,

application and delivery of marine meteorological and oceanographic data, information, forecasts and warnings upon which marine meteorological and oceanographic services and marine-related decision-making processes are based.

WMO Expected Results 3, 4, 6 and 7, and UNESCO/IOC Actions 2(a), 2(b), 2(c), 3(a), 3(c) and 4(a):

Coordinate, develops- and recommends standards and procedures for the work of Members/Member States in the overall collection, management, exchanges and archival of high quality marine meteorological and oceanographic data, information and products, on which climate studies, predictions and services, as well as climate change impacts and adaptation strategies, are based.

WMO Expected Results 5, 6, and 7, and UNESCO/IOC Actions 3(a), 3(b), 3(c), 4(a) and 4(b):

Promote and facilitate the international sharing of implementing experience, transfer of technology and research uptake, and support relevant education and training to meet the capacity development needs of national agencies and of other organizations that play a role in the provision of marine meteorological and oceanographic services.

In this regard, the Commission will give special attention to education and training, and technology transfer initiatives on marine meteorological and oceanographic data, products and services that respond to the needs of, and build capacity in, the developing countries with particular emphasis on the Least Developed Countries (LDC) and Small Island Developing States (SIDS). Additionally, the Commission will support cooperation among WMO, UNESCO/IOC and other UN Agencies that are members of UN-Oceans, the International Hydrographic Organization (IHO), the International Council for Science (ICSU) and other governmental and non-governmental organizations, the private sector as well as user organizations, on matters related to marine meteorology and oceanography.

JCOMM's work will be accomplished through a Management Committee and three programme areas (Observations, Data Management, and Services and Forecasting Systems), and their subsidiary expert and task teams. The JCOMM strategy includes an increased emphasis on communications, both internal within JCOMM and external with marine users, partners and stakeholders.

Receiving feedback from marine users is fundamental to the successful implementation of the JCOMM work programme. Some mechanisms to evaluate programme performance and satisfaction of marine users and stakeholders already exist, and strengthened mechanisms will be essential to help provide regular feedback and guide the evolution of JCOMM.

JCOMM has an ambitious and complex work programme. It holds the prospect of considerable potential benefits to all Members/Member States in the long-term operation of a coordinated, integrated, global oceanographic and marine meteorological observing, data management, and forecasting and services system. The implementation of the Commission's work programme will be a long-term, complex process, necessitating a phased, iterative and cost-effective approach over the period.

ANNEX III
Annex to paragraph 14.2.1 of the general summary

WORKPLAN FOR THE JOINT WMO/IOC TECHNICAL COMMISSION FOR OCEANOGRAPHY AND MARINE METEOROLOGY FOR THE PERIOD 2010-2013

Reference	*Task*	*By whom*	*Target*
Organizational			
Paragraph 5.2.4	Coordinate the implementation of any actions referred to JCOMM by the OceanObs'09 and the post-conference Working Group on the integration of the ocean observing system	Management Committee, relevant Programme Areas	Ongoing
Paragraphs 6.1.17 and 6.1.19	Liaise with the WMO Space Programme and address the UNESCO/IOC Strategy for the use of Remote Sensing in oceanography, and other international groups dealing with satellite issues	Observations, Data Management, and Services and Forecasting Systems Programme Area	Ongoing
Paragraph 6.2.3 and Recommendation 1 (JCOMM-III)	Establish a network of Regional Marine Instrument Centres (RMIC) and a mechanism for the formal WMO and UNESCO/IOC designation of a RMIC	Observations Programme Area and Management Committee	Continuing
Paragraph 6.3.6	Review new observing technology developments and liaise with relevant coordination groups with a view to incorporating them in the work programme	Observations Programme Area and Management Committee	Continuing
Paragraph 6.4.3	Expand the activities of the JCOMMOPS	Observations Programme Area and Management Committee	Intersessional period
Paragraph 8.2.1	Assess and categorize Members/Member States needs to facilitate their inclusion in its capacity building work programmes	Co-presidents and Management Committee	Before JCOMM-IV
Paragraphs 9.1.3 and 9.1.8	Keep the JCOMM Capacity Building principles under review and revise the JCOMM Capacity Building strategy	Activity leader on Capacity Building, Management Committee	ASAP
Paragraph 9.1.6	Develop an expanded partnership with COMET	Management Committee	ASAP
Paragraph 9.2.2	Develop a mechanism to further interact with the WMO Regional Associations and GOOS Regional Alliances (GRAs)	Management Committee	ASAP
Paragraphs 11.0.1 and 11.2.1	Develop a framework to address quality management aspects in the overall context of developing standards and recommended practices on met-ocean data acquisition and delivery of services and products, and establish a policy for the systematic review of relevant publications	Management Committee	Intersessional period
Paragraph 13.1.4	Maintain oversight on DRR-related activities	Management Committee, Services and Forecasting Systems Programme Ares	Intersessional period
Paragraph 13.1.6	Consider the possible recognition of a role of a specialized regional centre might have in the cascading forecasting process for the marine forecasting services aspects, and specify the criteria for the designation of a RSMC with activity specialization in marine meteorology, to be included in the GDPFS	Co-presidents and Management Committee, in collaboration with CBS/GDPFS	Intersessional period

Reference	*Task*	*By whom*	*Target*
Paragraphs 13.1.7 and 13.1.9	Facilitate and strengthen relationships with WMO Technical Commissions and UNESCO/IOC programmes, taking into account relevant JCOMM team activities and pilot projects	Co-presidents and Management Committee	Intersessional period
Paragraph 13.1.8	Study the possibility to implement the ocean and marine meteorological services via the WMO Regional Climate Centres	Management Committee	Intersessional period
Paragraphs 13.1.11 and 13.1.12	Collaborate with TOWS-WG wherever possible to the enhancement of TWS as a component of a coordinated and comprehensive marine hazards warning system and keep Members/Member States informed on the progress	Management Committee	Intersessional period
Paragraph 13.1.30	Consult with WCRP on the themes and modalities for a stronger cooperation with a focus on activities that contribute to the implementation of main outcomes of WCC-3 and OceanObs'09	Management Committee	Intersessional period
Paragraph 13.1.32	Take the lead in implementing the actions to secure the IPY marine observing systems legacy as a contribution to WIGOS development	Management Committee	Intersessional period
Paragraph 13.2.2	Review progress and activities associated with the UN Conventions and take actions as appropriate	Management Committee and Secretariats	Continuing
Paragraph 13.2.5	Establish and improve collaboration with organizations and institutions, including aid agencies, to leverage opportunities for enhancing observing systems and services capabilities in the developing world, particularly in coastal areas	Management Committee	Continuing
Paragraphs 13.2.6 and 13.2.7	Maintain oversight on WMO and UNESCO/IOC marine-related activities in GEO and activities related to satellite systems for ocean observations	Management Committee	Continuing
Paragraph 13.2.8	Develop an approach for contributing to WMO and UNESCO/IOC activities towards enhanced collaboration with private sector	Management Committee, in collaboration with CBS OPAG on PWS and GSSC	Intersessional period
Paragraph 14.1.2	Finalize the JCOMM Strategy document 2010-2013	Co-presidents and Management Committee	ASAP
Paragraph 14.1.3	Seek for external funding for the implementation of the JCOMM work programme	Co-presidents, Management Committee and Secretariats, in collaboration with potential donors and stakeholders	Continuing
Paragraph 8.3.14	Maintain oversight on WCC-3's follow-up activities, with a view to determining JCOMM's contribution to the GFCS and to include it in its work programme, when required	Management Committee	Ongoing
Observations			
Paragraph 5.1.2	Address the met-ocean observational data requirements as part of the work programmes, in coordination with CBS as appropriate	Observations and Data Management Programme Areas	Ongoing
Paragraph 6.1.1	Continue to work towards ECV-based metrics and keep the OPA implementation goals document under review and up-to-date	Observations Coordination Group	Ongoing
Paragraph 6.1.1	Develop the OPA work programme according to the need to enhance the partnerships between research institutes and operational services	Observations Coordination Group	ASAP
Paragraph 6.1.4	Propose a strategy for the OPA to enhance deployment opportunities	Observations Coordination Group	ASAP

Reference	*Task*	*By whom*	*Target*
Paragraph 6.1.5	Find a funding mechanism by which JCOMMOPS can partner with other agencies (e.g. space agencies) for the benefit of JCOMM	Observations Coordination Group	ASAP
Paragraph 6.1.6	Complete the oceanographer's and marine meteorologist's cookbook for submitting data in real time and in deployed mode	Observations Coordination Group	ASAP
Paragraph 6.1.9	Translate the outcome and recommendations of OceanObs'09 into an updated version of the JCOMM OPA implementation goals	Observations Programme Area	ASAP
Paragraph 6.1.10	Consider coastal requirements in the OPA work programme, taking into account the need of developing/least developed coastal countries	Observations Programme Area	ASAP
Paragraph 6.1.11.4	Secure the support necessary to maintain and if possible expand the existing VOS fleet	Observations Coordination Group, Ship Observations Team and OOPC	Ongoing
Paragraph 6.1.11.5	Coordinate the development of a universally accepted solution for the ship call-sign masking for consideration by the WMO Executive Council	Ship Observations Team	ASAP
Paragraph 6.1.11.7	Further develop the guidelines on standards for instruments and high quality best practices for the Voluntary Observing Fleet and publish them as a JCOMM Technical Report	Ship Observations Team	ASAP
Paragraph 6.1.11.7	Document VOS best practices to include the ocean variables managed under the SOT Ship Of Opportunity Implementation Panel (SOOPIP)	Ship Observations Team	ASAP
Paragraph 6.1.11.10	Evaluate the technical implications related to the compatibility between AIS equipments and observation stations	Ship Observations Team	Ongoing
Paragraph 6.1.12.1	Assist the Argo programme in deploying floats to achieve and maintain the array's design requirements	Observations Coordination Group, Data Buoy Cooperation Panel and Ship Observations Te	Ongoing
Paragraph 6.1.13 and 6.1.14	Continue to be involved in the developments of observing systems in Polar Regions	Observations Programme Area	Ongoing
Paragraph 6.1.16	Add wave observations as a key variable to be derived from satellite observations	Observations Coordination Group	ASAP
Paragraph 6.1.20	Produce a document that provides an integrated (space and *in situ*) observing strategy for a number of geophysical variables	Observations Coordination Group, in consultation with Data Management, and Services and Forecasting Systems Programme Areas	ASAP
Paragraph 6.1.21	Coordinate the collection of information on satellite data requirements and planning, and make it available via the JCOMMOPS website	JCOMMOPS	ASAP
Paragraphs 6.2.1, 6.2.7 and 12.7	Update the content of relevant publications taking into account the increasing need to enhance the quality of data through appropriate standards in order to address the climate requirements	Observations Programme Area	Intersessional period
Paragraph 6.2.2	Develop high quality best practices for the Voluntary Observing Fleet with the goal of publishing them as a JCOMM Technical Report	Ship Observations Team	Intersessional period

Reference	*Task*	*By whom*	*Target*
Paragraph 6.2.2	Identify ways for enhance JCOMM linkage with manufacturers	Observations Programme Area and its Panels and Groups	Continuing
Paragraph 6.3.3	Compile and synthesize activities related to satellite data telecommunication systems and data collection options under all programmes and panels of OPA	Observations Coordination Group	Intersessional period
Paragraph 6.5.1	Implement the priority activities for the OPA defined by the Commission	Observations Programme Area	Intersessional period
Paragraph 8.2.6	Continue supporting activities for extending the network of sea level measuring gauges, as well as increasing the number of those reporting in real-time, and other sea-level observing techniques	GLOSS Group of Experts	Continuing
Paragraph 13.1.16	Take the appropriate steps, including establishing partnerships between ocean research and operational communities, to facilitate the implementation of the actions to improve ocean observing systems arose from the Progress Report on the implementation of GCOS in support of the UNFCCC 2004-2008	Observations Programme Area	Intersessional period
Data Management			
Paragraph 7.1.1	Routinely review and update the Data Management Plan	Data Management Coordination Group	Intersessional period
Paragraphs 7.1.2 and 7.3.1	Continue and further strengthen the collaboration with the IODE of UNESCO/IOC based upon complementarity of strengths and expertise	Data Management Programme Area	Continuing
Paragraph 7.1.3	Develop an appropriate documentation that describes the template for the Marine Community Profile	Data Management Programme Area	ASAP
Paragraph 7.2.1	Review if the accuracy of the GPS position and time is being reported in coded and climate reports	Expert Team on Marine Climatology, Ship Observations Team and Task Team on Table Driven Codes	Intersessional period
Paragraph 7.2.2	Organize CLIMAR-IV and MARCDAT-III	Expert Team on Marine Climatology	Intersessional period
Paragraph 7.2.3	Modernize the Marine Climatological Summaries Scheme	Expert Team on Marine Climatology	Intersessional period
Paragraph 7.2.5	Decide how the manual observations on “rigs and platforms” should be preserved and archived	Expert Team on Marine Climatology, Ship Observations Team	Intersessional period
Paragraph 7.4.1	Implement the priority activities for the DMPA defined by the Commission	Data Management Programme Area	Intersessional period
Paragraph 10.1.2	Contribute to the development of a WIS data representation system policy	Data Management Coordination Group	Continuing
Paragraph 10.1.5	Assist Members/Member States in the WIS centre designation process	Data Management Coordination Group	Ongoing
Paragraph 11.2.2 and Recommendation 4 (JCOMM-III)	Identify the standards that are widely applicable by the marine meteorological and oceanographic communities for inclusion in the WMO and UNESCO/IOC publications and/or submission to appropriate standards bodies such as ISO	JCOMM-IODE Expert Team on Data Management Practices	Intersessional period
Paragraph 13.1.34	Assist the WMO EC-PORS in facilitating acquisition, exchange and archiving of observational data from Polar Regions	Data Management Programme Area	Intersessional period

Reference	*Task*	*By whom*	*Target*
Services and Forecasting Systems			
Paragraphs 5.0.1 and 5.1.2	Regularly review of the observational data requirements for met-ocean applications, where feasible through Observing System Experiments, Observing System Simulation Experiments and various test-beds for the verification of impacts in a range of application areas	Services and Forecasting Systems Programme Area	Ongoing
Paragraph 5.21.2	Participate in the WMO/CBS Rolling Review of Requirements and update the Statement of Guidance for Met-ocean Applications	Services and Forecasting Systems Programme Area and JCOMMOPS	Ongoing
Paragraphs 8.1.2, 8.1.3 and Recommendation 5 (JCOMM-III)	Assist in and guide the transition of ocean forecasting systems from research to operations, and develop a JCOMM Guide to Operational Ocean Forecasting Systems	Expert Team on Operational Ocean Forecasting Systems	Continuing
Paragraph 8.1.3	Keep under review the ocean observational requirements for operational ocean forecasting systems and ensure that interoperable standards and best practices are developed	Expert Team on Operational Ocean Forecasting Systems; Services and Forecasting Systems, Observations and Data Management Programme Areas	Continuing
Paragraph 8.1.5	Expand the wave forecast verification scheme	Expert Team on Wind Waves and Storm Surges	Continuing
Paragraph 8.1.6	Address the establishment of a network of moored wave measuring buoys to cover sparse ocean areas where storms are generated and propagated	Expert Team on Wind Waves and Storm Surges, Data Buoy Cooperation Panel	Ongoing
Paragraphs 8.1.7 and 8.2.1	Continue to co-sponsor and co-organize: (a) International Workshops on Wave Analysis and Forecasting and Coastal Hazard Symposia; (b) Scientific and Technical Symposium on Storm Surge; and (c) training workshops on storm surge and wave forecasting	Expert Team on Wind Waves and Storm Surges	Intersessional period
Paragraph 8.1.9	Promote the implementation of operational specialized numerical prediction systems on wave and storm surge, and the use of probabilistic prediction products	Expert Team on Wind Waves and Storm Surges	Ongoing
Paragraph 8.1.11	Review the existing guides and manuals, and continue to develop technical guidance material on wave and storm surge forecasting	Expert Team on Wind Waves and Storm Surges	Continuing
Paragraphs 8.2.3 and 8.2.4, and Recommendation 6 (JCOMM-III)	Provide technical advice, guidance and coordination in the development of Demonstration Projects for building integrated global and regional storm surge watch schemes within a multi-hazard framework	Expert Team on Wind Waves and Storm Surges	Intersessional period
Paragraph 8.2.5	Continue to develop regional and global wave and storm surge climatologies as a measure of risk assessment for marine hazards and assist Members/Member States in developing their own databases and hazard analysis	Expert Team on Wind Waves and Storm Surges	Intersessional period
Paragraphs 8.2.7 and 13.1.5	Assist in the implementation of the marine component of the SWFDP and use the concept to further develop and implement marine forecasting products and services in regions subject to marine hazards	Expert Team on Wind Waves and Storm Surges	Intersessional period
Paragraph 8.2.9	Consider ocean forecasting systems in support of marine pollution monitoring and response, and maritime search and rescue, in ETOOFS workplan	Expert Team on Operational Ocean Forecasting Systems	Intersessional period

Reference	*Task*	*By whom*	*Target*
Paragraph 8.2.9	Monitor implementation and operations of the Marine Pollution Emergency Response Support System (MPERSS) and assist Members/Member States in implementing their services in support of marine accident emergencies	Expert Team on Maritime Safety Services	Continuing
Paragraph 8.2.12	Establish collaborating arrangements with the CBS Coordination Group on Nuclear Emergency Response Activities to address common issues related to environmental emergencies	Services and Forecasting Systems Programme Area	ASAP
Paragraphs 8.3.2 and 8.3.13	Develop product specification for met-ocean variables, in accordance with IHO standards	Expert Team on Maritime Safety Services, Expert Team on Sea Ice, in consultation with IMO and IHO	Intersessional period
Paragraphs 8.3.3 and 11.1.2, and Recommendations 7 (JCOMM-III) and 8 (JCOMM-III)	Organize a training workshop on maritime safety services, focused on Quality Management Systems for the provision of met-ocean services for international maritime navigation	Expert Team on Maritime Safety Services, and WMO Secretariat	Intersessional period
Paragraph 8.3.4	Assist the METAREA Issuing Services concerned in implementing their operating plans for the provision of marine meteorological and oceanographic services for the Arctic Region	Expert Team on Maritime Safety Services	Before 2011
Paragraph 8.3.6	Develop proposals for inclusion of information on complex sea states in weather and sea bulletins	Expert Team on Maritime Safety Services, Expert Team on Wind Waves and Storm Surges	Intersessional period
Paragraph 8.3.7	Propose sea ice specifications for Maritime Safety Information to be disseminated via SafetyNET and international NAVTEX services	Expert Team on Sea Ice, Expert Team on Maritime Safety Services	Intersessional period
Paragraphs 8.3.9 and 9.1.4	Continue to co-sponsor and co-organize Ice Analysts Workshops	Expert Team on Sea Ice	Intersessional period
Paragraph 8.3.10	Keep under review requirements for sea ice observations and services	Expert Team on Sea Ice	Intersessional period
Paragraph 8.3.11	Contribute to the development of coupled sea ice-ocean-atmosphere numerical models and sea ice forecasting and data assimilation techniques	Expert Team on Sea Ice, Expert Team on Operational Ocean Forecasting Systems	Intersessional period
Paragraph 8.3.12	Review the GDSIDB and provide guidance to Members/Member States submitting data to this database	Expert Team on Sea Ice	Continuing
Paragraph 8.4.1	Implement the priority activities for the SFSPA defined by the Commission	Services and Forecasting Systems Programme Area	Intersessional period
Paragraph 13.1.3	Develop technical guidance material on standard methodologies for monitoring, archiving, analysis and mapping of marine-related hazards	Expert Team on Marine Climatology, Expert Team on Wind Waves and Storm Surges	Intersessional period

APPENDIX

LIST OF PARTICIPANTS

1. Officers of the session

Co-Presidents	Peter Dexter (Australia) Jean-Louis Fellous (France)

2. Representatives of WMO Members

Algeria	
Thamane Tribeche	Principal Delegate
Australia	
Peter Dexter	Principal Delegate
Gregory Reed	Delegate
Andreas Schiller	Delegate
Belgium	
Jean-Louis Fellous	Delegate (7 November)
Brazil	
Alaor Moacyr Dall'Antonia	Principal Delegate
Marcelo Fricks Cavalcante	Delegate
Bulgaria	
Georgi Kortchev	Principal Delegate
Canada	
Savithri Narayanan (Ms)	Principal Delegate (4–7 November) Alternate (8–11 November)
Al Wallace	Alternate (4–7 November) Principal Delegate (8–11 November)
Bruce Angle	Delegate
Robert Keeley	Delegate
Val Swail	Delegate
Chile	
Gonzalo Espinosa Doggenweiler	Principal Delegate
Gustavo Bendel Vidal	Alternate
China	
Xu Xiaofeng	Principal Delegate
Chen Zhi	Delegate
Han Guijun (Ms)	Delegate
Huang Zhuo	Delegate
Lin Shaohua (Ms)	Delegate
Lin Mingsen	Delegate
Liu Qinzheng	Delegate
Mao Dongyan (Ms)	Delegate
Song Lianchun	Delegate
Wang Yuan (Ms)	Delegate
Yu Jixin	Delegate
Croatia	
Krešo Pandžić	Principal Delegate
Egypt	
Hassan Mohamed Hassan	Principal Delegate
Adel Ahmed M. Mosbah	Alternate

Finland
Marja Aarnio-Frisk (Ms) — Principal Delegate

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Henri Savina — Principal Delegate
Pierre Daniel — Alternate
Jean-Louis Fellous — Delegate

Germany
Gudrun Rosenhagen (Mrs) — Principal Delegate
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Panayotis Stournaras — Delegate
Athina Makri (Ms) — Delegate
Athanasia Iona (Ms) — Delegate

Hong Kong, China
Wing-tak Wong — Principal Delegate

Ireland
Karen McCourt (Ms) — Delegate (7 November)

Italy
Massimo Ferri — Principal Delegate

Japan
Yoshiteru Kitamura — Principal Delegate
Satoshi Ogawa — Alternate

Kenya
Ali Juma Mafimbo — Principal Delegate

Malaysia
Muhammad Helmi bin Abdullah — Principal Delegate

Mauritius
Mohamudally Beebeejaun — Principal Delegate

Monaco
Michel Boisson — Delegate

Morocco
Abdalah Mokssit — Principal Delegate
Hassan Bouksim — Alternate
Omar Chafki — Delegate
Brahim El Messaoudi — Delegate
Samir Issara — Delegate
Abadia Nassif — Delegate

Netherlands
Jan Rozema — Principal Delegate
Pierre Daniel — Delegate (7 November)

New Zealand
Ramon Oosterkamp — Principal Delegate

Nigeria
Juliana E. Ukeje (Mrs) — Principal Delegate
Louis E. Edafienene — Alternate
Regina Folorunsho (Ms) — Delegate

Norway
Johnny Johannessen — Principal Delegate
Einar Svendsen — Alternate
Oywind Breivik — Delegate

Republic of Korea

SHIN Soon Ho	Principal Delegate
SEO Jang-won	Alternate
CHO Yangki	Delegate
LIM Kwan Chang	Delegate
SUK Moon-sik	Delegate
YOU Sung Hyup	Delegate

Russian Federation

A.V. Frolov	Principal Delegate
V.A. Martyshchenko	Alternate
N.N. Mikhailov	Delegate
V.M. Smolyanitsky	Delegate

Senegal

Sory Diallo	Principal Delegate

Slovenia

Samir ISSARA	Delegate (7 November)

South Africa

Johan Stander	Principal Delegate

Spain

Milagros Garcia-Pertierra (Ms)	Principal Delegate
Gregorio Parrilla Barrera	Delegate

Sweden

Bertil Hakansson	Principal Delegate

Thailand

Songkran Agsorn	Principal Delegate

The Former Yugoslav Republic of Macedonia

Bernd Brugge	Delegate (7 November)

Tunisia

Moncef RAJHI	Principal Delegate

United Kingdom of Great Britain and Northern Ireland

Keith Groves	Principal Delegate (4–7 November)
Jon Turton	Alternate
Trevor Guymer	Delegate (4-10 November)
Karen McCourt (Ms)	Delegate
David Meldrum	Delegate

United States of America

James M. Turner	Principal Delegate
Margarita E.C. Gregg (Ms)	Alternate
Patricia I. Bergmann (Ms)	Delegate
Frederick Branski	Delegate
William H. Burnett	Delegate
Ming Ji	Delegate
Jennifer Lewis (Ms)	Delegate
Eric Lindstrom	Delegate
Allison D. Reed (Ms)	Delegate
Angela H. Walker (Ms)	Delegate
Scott D. Woodruff	Delegate

Zimbabwe

Jephius Mugumbate	Principal Delegate
Vimbai Mamombe (Ms)	Delegate

3. President of technical commission

Frederick Branski	President, CBS

4. Invited experts

Malika Bel Hassen-Abid (Ms)	Co-Chair, IODE
Gregory Reed	Co-Chair, IODE
Craig J. Donlon	JCOMM Services Coordination Group
Al Wallace	Chair, Data Buoy Cooperation Panel (DBCP)
John W. Zillman	Chair, GCOS Steering Committee

5. Scientific lecturers

Malika Bel Hassen-Abid (Ms)
Hassan Bouksim
Geoffrey Hollland
John W. Zillman

6. Representatives of international organizations

European Global Ocean Observing System (EuroGOOS)
Hans Dahlin

European Organization for the Exploitation of Meteorological Satellites (EUMETSAT)
Sean Burns
François Montagner

International Union for Conservation of Nature (IUCN)
François Simard

Partnership for Observation of the Global Oceans (POGO)
Trevor Platt

7. Other participant

Ali Al-Yarobi (Oman)

8. IOC Secretariat

Patricio Bernal
Keith Alverson
Peter Pissierssens
Torkild Aarup
Boram Lee (Ms)
Albert Fischer
Mathieu Belbeoch
Hester Viola (Ms)

9. WMO Secretariat

Michel Jarraud
Geoffrey B. Love
Wenjian Zhang
Edgard Cabrera
Alice Soares Dos Santos (Ms)
Etienne Charpentier
Marc Peeters

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