

**EXPERT MEETING ON POSSIBLE JCOMM  
CONTRIBUTIONS TO THE DEVELOPMENT AND  
MAINTENANCE OF MARINE MULTI-HAZARD  
WARNING SYSTEMS**

Geneva, Switzerland, 1-3 February 2006

***FINAL REPORT***

JCOMM Meeting Report No. 37



**EXPERT MEETING ON POSSIBLE JCOMM  
CONTRIBUTIONS TO THE DEVELOPMENT AND  
MAINTENANCE OF MARINE MULTI-HAZARD  
WARNING SYSTEMS**

Geneva, Switzerland, 1-3 February 2006

***FINAL REPORT***

JCOMM Meeting Report No. 37

## NOTE

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

## CONTENTS

General Summary of the Work of the Meeting.....	1
Annex I - List of Participants .....	11
Annex II - Agenda .....	13
Annex III - Action Plan .....	14
Annex IV - Acronyms and Other Abbreviations .....	17

## **GENERAL SUMMARY OF THE WORK OF THE MEETING**

### **1. OPENING OF THE SESSION**

#### **1.1 Opening**

1.1.1 The Expert Meeting on Possible JCOMM Contributions to the Development and Maintenance of Marine Multi-Hazard Warning Systems (J-MMWS) was opened by the co-president of JCOMM, Dr Peter Dexter, at 09.25 on Wednesday, 1 February 2006, in the WMO headquarters, Geneva, Switzerland.

1.1.2 On behalf of the Secretary-General of WMO, Mr Michel Jarraud, and the Executive Secretary of IOC, Dr P. Bernal, the Chief of the Ocean Affairs Division of WMO, Mr Edgard Cabrera, welcomed participants to the meeting. He assured participants of the full support of the Secretariat during the meeting, highlighted the importance of an integrated approach to support coastal risk management and the critical need for closer collaboration with WMO Programmes and Commissions. He concluded by informing all participants of the commitment of WMO and IOC to JCOMM activities and announced that an Expert Meeting on the Development of the JCOMM Guide to Storm Surge Forecasting would be held in the WMO headquarters from 8-10 February 2006.

1.1.3 The chairman presented a framework for the meeting by outlining the background, objectives and issues to be discussed. He focused his presentation on the existing WMO and IOC Programmes and the potential JCOMM contributions and initiatives to improve Marine Multi-Hazard Warning Systems. He stressed the importance of reviewing the JCOMM-II recommendations to develop specific activities and proposals for action based on the existing infrastructures and programmes. He also noted the extensive work carried out jointly by IOC, WMO and ISDR towards the establishment of Tsunami Warning and Mitigation Systems (TWS) worldwide, with first priority to the Indian Ocean, in response to the devastating tsunami that took place on 26 December 2004. He further noted that the WMO EC-LVII requested JCOMM, in cooperation with CBS, to prepare a framework document for its fifty-eighth session on the contribution of WMO to the global tsunami warning system within a multi-hazard framework.

1.1.4 The list of participants in the meeting is given in Annex I.

#### **1.2 Adoption of the agenda**

1.2.1 The J-MMWS adopted its agenda on the basis of the provisional agenda. This agenda is given in Annex II.

#### **1.3 Working arrangements**

1.3.1 The meeting agreed on the hours of work and other practical arrangements for the session. The documentation for the meeting was introduced by the Secretariat.

### **2. REVIEW OF DISCUSSIONS AND RECOMMENDATIONS OF JCOMM-II AND OF RELEVANT JCOMM PROGRAMME COMPONENTS AND ACTIVITIES**

#### **2.1 JCOMM-II Results**

2.1.1 The Secretariat presented an outline of the results of JCOMM-II relevant to the forecasting and warning of marine hazards.

2.1.2 The meeting reviewed the following possible JCOMM contributions to tsunami and marine-related natural disaster reduction:

- (a) Analysis of potential for existing marine platforms and deployment facilities to contribute to a tsunami and other marine hazard early warning network;

- (b) Contribute to the development of guidance material for Members/Member States relating to the components and operations of a marine hazard warning service;
- (c) Coordination with IMO and IHO to ensure the dissemination of tsunami warnings and related information through GMDSS communication facilities for Maritime Safety;
- (d) Enhancement of the GLOSS network through the upgrading of some of the existing GLOSS stations to tsunami monitoring standards;
- (e) Coordinate an effective link for exchange and dissemination of early warnings, contribute to the development of a fast warning system, especially in the maritime safety, utilizing both existing and new transmission facilities in order to reach the public and the relevant mitigation mechanisms;
- (f) Coordination through the DBCP of deployment logistics for data buoys, and of multi-use buoys for all hazard warnings and other mission requirements.

2.1.3 The expert meeting also reviewed Recommendation 12 (JCOMM-II) on this topic, which provided the formal justification and guidance for the work being undertaken.

## **2.2 Existing JCOMM Programmes and Activities**

2.2.1 The meeting noted with interest the reports by the JCOMM expert teams chairpersons and Programme Area Coordinators related to marine multi-hazard warning systems. The discussions that followed each presentation highlighted a number of issues and possible activities that could form the basis of a JCOMM action plan for the coordinated development and maintenance of marine multi-hazard warning systems. The action plan was discussed under agenda item 5, and is attached in Annex III.

### **Expert Team on Maritime Safety Services (ETMSS)**

2.2.2 Mr Henri Savina, chairperson of the Expert Team on Maritime Safety Services (ETMSS), presented a report on behalf of his Team. He opened his briefing by outlining the terms of reference of the ETMSS, noting that the work of the task team was addressed in particular to fulfilling statutory requirements under the SOLAS Convention. He also outlined the Natural Disaster Prevention and Mitigation (NDP) status and potential within the Expert Team, including tsunami and other aspects with particular importance to early warning systems. The briefing outlined the need to keep under review and to respond to the requirements of Members/Member States for guidance with regard to maritime safety services, pointing out the need to cooperate with (a) IHO and IMO in specific issues such as the harmonization and clarification of terminology and the provision of maritime safety information, including warnings related to tsunamis; and (b) TCP also for harmonization of units and parameters provided in TC warnings. He concluded pointing out the need to reinforce cooperation between organizations and WMO Commissions that provide maritime safety related information, and establish links between their websites to improve the availability of such information, avoiding as far as possible redundancies and gaps.

2.2.3 The next session of the ETMSS has been proposed for November 2006.

### **Expert Team on Marine Accident Emergency Support (ETMAES)**

2.2.4 Mr Henri Savina presented a report on behalf of the chairperson of the Expert Team on Marine Accident Emergency Support (ETMAES), Mr Pierre Daniel. He started his briefing by outlining the terms of reference of the ETMAES and the need (a) to improve coordination with IMO regarding its marine environment protection programme, and (b) to update guidance material focusing on specific products for search and rescue operations, cargo removal and lightering, pollution removal at sea and high risk areas, such as shipping routes, ports, etc

2.2.5 In terms of multi-hazard support, it is essential to build on the existing operational infrastructure. Experience with MAES would bring synergies to other operational activities dealing with emergency response support because it requires similar operational infrastructure and know-how. Another important benefit is that it increases the efficiency of the response because of frequent use of the system for different hazards.

2.2.6 The meeting was informed that it is proposed to hold the first session of the ETMAES, back to back with ETMSS II in November 2006.

### **Expert Team on Sea Ice**

2.2.7 Dr Vasily Smolyanitsky, chairperson of the Expert Team on Sea Ice (ETSI), presented a report on behalf of the Team. He opened his briefing by outlining the special features of sea ice information systems, which are now operated by 21 national ice services in both polar regions and regional alliances in the Baltic Sea and North America. Further, he provided description of basic sea ice hazards and noted that many of the standards and systems for marine hazard warning systems have gaps or are inadequate for high-latitude areas in terms of the quality and quantity of information produced for NDP, particularly in the context of international standards for ice information dissemination, as well as for ice warning bulletins. To this effect participants agreed that minimization of these inadequacies should be one of the ETSI and JCOMM Service Programme Area (SPA) tasks before the International Polar Year (IPY) 2007-2008. He concluded by stressing that ice information products are commonly issued by ice services through all applicable communication systems, including GMDSS, to ensure the safety of marine activities. However, there remains critical gaps in INMARSAT coverage in Polar Regions.

2.2.8 The meeting was informed that the next session of the ETSI will take place in November-December 2006.

### **Expert Team on Wind Waves and Storm Surges**

2.2.9 Mr Graham Warren presented a report on behalf of the chairperson of the Expert Team on Wind Waves and Storm Surges (ETWS), Mr Val Swail. He started his briefing by outlining the ETWS activities and developments, particularly with emphasis to storm surges. The briefing outlined the future ETWS developments, noting the importance of forecasting total water level and extreme storm seas. He concluded by informing that the next international Workshop on Wave Hindcasting and Forecasting would take place in Victoria, Canada in September 2006, and will have as its focus the so-called extreme storm seas (ESS).

### **JCOMM Observations Programme Area**

2.2.10 Mr Mike Johnson, Coordinator of the JCOMM Observations PA (OPA), presented a report related to expertise, facilities, and infrastructure already existing in the OPA to support Marine Multi-Hazard Warning Systems. He outlined the status of the GLOSS network of real-time reporting tide gauge stations, and stated that minor upgrades were needed to make all stations capable of contributing to a global warning system. He reviewed the status of the observing system against the GCOS implementation plan, which is the agreed standard for the integrated observing system coordinated by JCOMM. The briefing noted the important progress that had taken place in the Indian Ocean since the tsunami that took place on 26 December 2004, mainly by the establishment of tsunami water level stations within the GLOSS core network. The ICGs and GLOSS have also begun coordinating plans for implementation of global tsunami warning stations in all ocean basins. He emphasized the need for long-term support and maintenance of these stations. He concluded by pointing out the potential value in the coordinated use of deployment facilities for ocean data buoys, as well as the potential for developing and deploying multi-purpose deep ocean moorings.



## **JCOMM Data Management Programme Area**

2.2.11 Mr Bob Keeley, Coordinator of the JCOMM Data Management PA (DMPA), presented a report on the work of the DMPA relevant to the objectives of the meeting. He discussed the possible contribution of ETMC, to develop climatologies or special archives to support improvements in models and in risk analysis. Related to ETDMP, he outlined the “end-to-end data management” (E2EDM) technology and the capability of the system to support marine multi-hazard warning systems. Finally, he noted that the DMPA could support the real time distribution of sea level data on the GTS by developing appropriate CREX formats and descriptors and by working to standardize automated QC procedures for real-time sea level observations.

## **2.3 National Marine Hazard Warning Services Case Studies**

### **National Reports**

2.3.1 The meeting noted with interest the reports from national services (Australia, France, Mauritius and Norway) on their experience and plans related to Marine Multi-Hazard Warning Systems.

2.3.2 Mr Graham Warren presented a report on Australian Marine Hazard Warning Services. He outlined the main marine hazards experienced in the Australian region which are mainly storm surges due tropical cyclones, marine pollution and tsunamis. He note that Australia has a very large coastline but is subject to few major coastal marine hazards. He also reported on work to develop the Australian Tsunami Warning System, as well as Australian contributions to the international efforts under IOC for the IOTWS and the PTWS.

2.3.3 Dr Philippe Dandin presented a report on natural hazard warning systems in France. He informed that Météo-France provides the French civil security department with meteorological and oceanographic information that helps them in reducing the effects of anthropogenic and natural disasters. A wide range of disasters are covered, from forest fires to cyclonic storm surges. He noted that France has a "vigilance" procedure, where various graphical presentations are used to represent the hazard, or the risk. This takes into account the local vulnerability, combining it with the weather hazard forecasts, and delivering it in a very simple, easy to understand manner. This procedure was defined with the Civil Security department. The media are heavily involved in the dissemination and important efforts are made for education and awareness. The vigilance procedure is currently being extended to other hazards due to cyclones and for the overseas territories.

2.3.4 Mr Mohamudally Beebeejaun presented a report on Marine Multi-Hazard Systems used in Mauritius. He noted the vulnerability of Mauritius to marine natural hazards arising from high waves, storm surges, tropical cyclones, climate change, and tsunamis. He informed that the Mauritius Meteorological Services (MMS) is considered the key agency regarding the issuance of warnings to mariners and coastal managers in the context of marine multi-hazards. He also noted the existing capacities in Mauritius and outlined future requirements for marine multi-hazard system facilities.

2.3.5 Mr Johannes Guddal described briefly the Norwegian Marine Multi-Hazard System and a “cross section” of impressions derived from related JCOMM capacity building activities. Multi-Hazard Warnings Services in Norway have emphasized fast and efficient interactions with key decision makers. The experience gained from the related capacity building regional workshops showed that countries exposed to tropical cyclones clearly prioritize warnings related to storm surge incidents, followed by extreme wave events. Tsunami simulation tools have been requested. He noted that Black Sea countries have emphasized coastal-related hazards such as oil spills as their major concern.

### **3. REVIEW OF OTHER ACTIVITIES IN WMO AND IOC RELEVANT TO MARINE MULTI-HAZARD WARNING SYSTEMS**

#### **3.1 WMO DPM Programme**

3.1.1 The WMO Natural Disaster Prevention and Mitigation (DPM) Programme purposes and objectives were presented by the Secretariat. The primary goal of the DPM programme is to ensure that, through organization-wide coordination and strong strategic partnerships, the utilization of WMO's global infrastructure and integration of its core scientific capabilities and expertise, particularly related to risk assessment and early warning systems for weather-, water-, and climate-related hazards, in all relevant phases of disaster risk management decision-making at the international, regional and national levels, is optimized.

3.1.2 The meeting noted that, within a "multi-hazard" framework, detailed regional and national surveys of capabilities, gaps and needs, in WMO's core areas of activities, are being carried out as a high priority activity of the DPM Programme. These surveys relate to technical capabilities for observing, monitoring, forecasting and warning, capacity building and training, educational and public outreach programmes of the National Meteorological and Hydrological Services (NMHSs), and the linkages of the NMHSs with risk management and emergency structures. These efforts will be coordinated with WMO's activities related to Least Developed Countries (LDCs) and Small Island Developing States (SIDS), to ensure that relevant projects are developed to address the specific needs of LDCs and SIDS.

3.1.3 The Secretariat informed that over the period since the 2004 tsunami in the Indian Ocean, WMO has reinforced its partnerships with IOC, ISDR, and other concerned organizations, to ensure that WMO's expertise and capabilities can be utilized and built upon to accelerate efforts in strengthening pre-disaster strategies, including the development of the tsunami early warning system.

3.1.4 The meeting noted that WMO is planning to hold a Symposium on "Multi-Hazard Early Warning Systems for Integrated Disaster Risk Management", 23-24 May 2006, at the WMO headquarters in Geneva. This symposium is designed to identify, prioritize and frame the main challenges for addressing gaps and needs identified through the Global Early Warning Survey and the Third International Early Warning Conference. The symposium will be a multi-disciplinary expert meeting to discuss major challenges and to recommend a framework, with concrete actions at international, regional and national levels, for the implementation of "Multi-Hazard Early Warning Systems", with particular focus on the developing and least developed countries.

3.1.5 The meeting discussed at some length the planned country-level surveys, including their objectives, content and applications. Some concern was expressed that the surveys, being oriented primarily to the activities of NMHS, might not fully reflect or capture the full range and impact of marine-related natural hazards, including longer-term hazards associated with climate change and sea-level rise. It therefore requested the Secretariat to ensure that these concerns are addressed, if possible prior to finalization and distribution of the surveys.

3.1.6 The meeting noted with interest the plans to prepare a global catalogue of hydro-meteorological hazards, based partially on the results of the survey as well as other sources. It agreed that JCOMM had potentially a significant input to make to such a catalogue, with regard specifically to marine hazards, and therefore requested the Secretariat to consider the possible participation of JCOMM experts in this work.

#### **3.2 WMO Tropical Cyclone Programme**

3.2.1 The WMO Tropical Cyclone Programme's purpose and objectives were presented by the Secretariat. TCP's goals are to encourage and assist its Members to:

- Provide reliable forecasts of tropical cyclone tracks and intensity, and related forecasts

of strong winds, quantitative forecasts or timely assessments of heavy rainfall, quantitative forecasts and simulation of storm surges, along with timely warnings covering all tropical cyclone-prone areas;

- Provide forecasts of floods associated with tropical cyclones;
- Promote awareness to warnings and carry out activities at the interface between the warning systems and the users of warnings, including public information, education and awareness;
- Provide the required basic meteorological and hydrological data and advice to support hazard assessment and risk evaluation of tropical cyclone disasters; and
- Establish national disaster preparedness and prevention measures.

3.2.2 The meeting recalled the ongoing series of joint JCOMM-TCP training workshops on wave and storm surge forecasting. The workshops were designed to enhance local capacity and enable countries exposed to tropical cyclones to run their own marine hazard warning services. Three such workshops have been held in the South-east Asian region, and a fourth workshop is planned for late 2006.

### **3.3 RSMCs and Multi-Hazard Warnings**

3.3.1 Mr Peter Chen presented the WMO global data-processing and forecasting system (GDPFS) of the World Weather Watch (WWW). He opened his briefing by outlining the strategic direction of GDPFS, in the context of a multi-hazard, multi-purpose early warnings approach for sustainable operations and programmes. He also informed the expert meeting of the existence of the WMO ERA Programme (Environmental Emergency Response) and its strategy to support the broader area of EER in the context of Disaster Prevention and Mitigation. He presented the main goals and objectives of the WMO Workshop on Multi-Hazard Early Warning Centres' Concept of Operations for the Indian Ocean Tsunami Warning System, held in Singapore, November 2005. He concluded by outlining some of the workshop recommendations regarding the centres for the early warning system, as follows:

- Regional Centres, like National Centres should be operational on a 24/7 basis;
- Regional Centres should be able to access all seismic waveform data via the Internet or other communication means and generate parametric data in real-time for distribution on the GTS;
- Each Regional Centre should have arrangements in place to be backed up by another Regional Centre, and those arrangements should be regularly tested;
- Regional Centres should have the capability to run operational tsunami propagation models, which generate products relevant to that Region;
- Structured training in tsunami warning procedures and science should be established and be applied in all Regional and National Centres. Event simulators, which can be played back in real-time, are very desirable;
- There needs to be a designation and accreditation process for the regional advisory centres through IOC ICG/IOTWS. If IOC decides to use either the WMO RSMC framework concept or to apply a multi-hazard approach, then it is recommended that consultation be conducted with WMO. It is recommended that each centre would have a defined area of responsibility with a designated backup centre for each area. A geographic balance between designated centres would be desirable;

- On a national basis, the distribution of warnings would be handled most efficiently through an agency that operates on a “24/7” basis, and is active on routine operations on a continuous basis;
- For reliability, multiple data sources and communication links should be employed by Regional Advisory and National Warning Centres for receipt and transmission of tsunami-related data and information;
- The advisory dissemination system should be tested regularly;
- IOTWS ICG WG 1 should be requested to resolve the issue of differing seismic waveform data formats to ensure that the data can be used by all those who require it;
- National Centres should make their national seismic waveform data available to all in real-time in a standard format, using the Internet or other networks with sufficient bandwidth. Metadata should also be made available;
- Existing tsunami historical databases should be merged and national centres should be encouraged to extend them;
- Sea-level data frequency should be at least 1-min sampling and 15-min reporting, with overlapping reporting periods to capture missed transmissions. Compiled bulletins from multiple sites may be preferred by recipients, but transmission should not be delayed;
- Countries installing the Deep ocean Assessment and Reporting of Tsunami (DART) system should ensure that standard data formats and reporting frequencies are used. Procedures need to be developed to ensure that DARTs can be triggered when required, possibly by a designated Regional Centre;
- Quality control strategies should be developed at both the national and Regional levels to ensure that raw seismic and sea level data are accessible, accurate and reliable;
- Regional Centres should have the capability to process seismic and sea level data and provide to national TWCs processed products. Output from advisory centres should be provided in a variety of formats (text, graphic) and include all parameters required for national warning centres to produce their own warnings (listed in the detailed recommendations);
- The ICG/IOTWS should establish an agreed set of thresholds for determining tsunamigenic potential so that there is consistency in advisories from different centres. The regional centre determines the magnitude and location of an event. These values are then issued by RTACs as guidance to NTWCs. National centres could use the same criteria in instances where the time is too short to wait for advice from a regional advisory centre.

### **3.4 Tsunami Warning Systems under IOC**

3.4.1 The Secretariat outlined tsunami warning system activities under the IOC. The IOC has been actively involved in promoting an end-to-end tsunami warning system in the Pacific since the inception of the International Coordination Group for the Tsunami Warning System in the Pacific (ITSU, now ICG/PTWS). Following the 26 December 2004, undersea earthquake, the subsequent greatest tsunami in living memory and the tragic death of hundreds of thousands of people,

UNESCO actively participated in the international effort to assess the tsunami impact and to identify priority needs in the recovery and reconstruction process. Activities are focused in particular on environmental, cultural as well as educational damage assessment and rehabilitation. Through the IOC, UNESCO took the lead in coordinating activities for immediate action to establish a Tsunami Warning System (TWS) in the Indian Ocean. The immediate response included an interim tsunami advisory information system under the aegis of IOC's International Tsunami Information Center (ITIC) in cooperation with the Pacific Tsunami Warning Center (PTWC) in Hawaii and the Japan Meteorological Agency (JMA), as from 1 April 2005, as well as the installation and upgrade of existing sea level stations reporting in near real-time around the Indian Ocean.

3.4.2 The IOC General Assembly XXIII in Paris, 21-30 June, gave great priority to this initiative and adopted resolutions to create three additional regional Intergovernmental Coordination Groups (ICGs) as subsidiary bodies of IOC, which together with the existing International Coordination Group for Tsunami Warning in the Pacific and other relevant UN bodies, should form a global working group on Tsunamis and other ocean-related hazards early-warning systems. The three new ICGs: the Indian Ocean (ICG/IOTWS), the Northeast Atlantic and Mediterranean (ICG/NEAMTWS), the Caribbean and Adjacent Seas (ICG/CARTWS) have all met and are in the process of implementing plans for regional warnings systems.

3.4.3 In addition to the technical installation of instrumentation and national Warning Centres, the December 2004 tragedy also highlighted the need for ongoing education, information and capacity-building on tsunami issues. Schools need to ensure that children are aware of protective measures to be instituted should a tsunami alert be issued. Government authorities need to have appropriate structures in place to handle potential tsunami situations. The general public needs to recognize the signs of an impending tsunami and know how to take shelter. Thus IOC's International Tsunami Warning Centre in Hawaii, in cooperation with regional NGO's and lately ISDR, has been continuously providing educational material and conducting training courses for technical personnel and the public.

3.4.4 Mr Joël Martellet presented extracts from the preliminary report of the ICG/IOTWS-I Intersessional WG-2 (provided by GLOSS at the ICG/IOTWS-II meeting, Hyderabad, 14-16 December 2005). He informed the meeting that tide gauge and sea level data in text format have been used and distributed on the GTS. He also emphasized that the lack of a standard traditional alphanumeric code form for tide gauge and sea level observations in the WMO Manual on Codes has resulted in multiple formats being used in different systems. Also the lack of station information and the inconsistency of representing the station identification in the message have made it very difficult for data processing centres to capture and decode the sea level data in real time. He also noted that the Sea Level Working Group discussed with code experts regarding the use of CREX (Character form for the Representation and EXchange of data) as the data representation for sea level data. He pointed out that this has the added advantage in that it can be easily converted into BUFR, which has become the standard WMO practice.

### **3.5 Activities under GEO/GEOSS**

3.5.1 Mr Brian O'Donnell presented a report on the activities under GEO/GEOSS. He started his briefing by outlining GEO activities, structure and procedures. The meeting was informed that the first Global Earth Observation Summit in July 2003 established an ad hoc Group on Earth Observations (GEO) to promote the development of a comprehensive, coordinated and sustainable Earth Observation System(s) with participation of governments and the international community to improve the ability to understand and address global environmental and economic challenges. Since then, remarkable efforts have been made to develop a Global Earth Observation System of Systems (GEOSS), based on existing observing systems. He concluded by noting the GEO 2006 Work Plan.

3.5.2 Mr Guy Duchossois presented the activities of the GEO Working Group on Tsunami Activities. He informed the expert meeting that the ad hoc Working Group on Tsunami Activities was established at the first Meeting of GEO (Geneva, May 2005) to follow up the Communiqué at EOS III.

It seeks ways to support the coordinating activities of the IOC/UNESCO and other national, regional, and international initiatives to foster the effective warning and mitigation systems for natural hazards, as an integral part of a multi-hazard approach supported by GEOSS. He noted that the Working Group on Tsunami Activities may extend its scope from tsunamis to all hazards.

3.5.3 Mr Guy Duchossois also reported on the proposed GEO Tasks for 2006 as follows:

- Encourage in-situ and space agencies to (i) systematically record data over regions subject to tsunami risk and (ii) archive data in a user-friendly form easily accessible to all countries;
- Promote free and unrestricted exchange of all data relevant to tsunami early warning systems;
- Facilitate the production in coastal zones of high-resolution near-shore bathymetric maps, land use/ land cover maps, and digital elevation models.
- Harmonize efforts towards the preparation of a “global tsunami hazard map” to support coastal zone monitoring and infrastructure planning and investment;
- Promote the cooperation of national and international agencies towards a multi-hazard approach to coastal risk management;
- Explore possibilities for the development of an international charter on telecommunication systems and disasters;
- Initiate and maintain a dialogue between GEO, the Board of the International Charter on Space and Major Disasters and relevant UN agencies to identify mechanisms for strengthening the scope and mandate of the Charter.

3.5.4 Mr Guy Duchossois concluded his presentation by informing the expert meeting that the next meeting of the GEO Working Group on Tsunami Activities will take place on 27-28 February 2006 in Paris.

### **3.6 Other**

3.6.1 Mr Dieter Schiessl informed the expert meeting about the convening of the Joint Consultative Meeting of the IOC Officers and WMO Bureau Members. The meeting was very supportive of JCOMM and its work. The results will be presented to the WMO and IOC Executive Councils in June 2006. Further actions related to the work of JCOMM will be taken into account during the next JCOMM Management Committee meeting, to be held late 2006.

## **4. FORMULATION OF SPECIFIC PROPOSALS AND ACTIONS FOR JCOMM CONTRIBUTIONS TO THE DEVELOPMENT AND MAINTENANCE OF MARINE MULTI-HAZARD WARNING SYSTEMS**

4.1 Based on information and discussions under the preceding agenda items, the meeting developed and agreed on a range of possible contributions of JCOMM, through its Programme Areas and component Expert Teams, to multi-hazard warning systems, within the areas of expertise of the Commission. These comprised, in particular, contributions which could and would be immediately implemented on a relatively short time scale, those which were feasible for implementation under the Commission but which would require additional resources, and those which JCOMM would support, but for which it had no direct control.

4.2 In developing these proposals, the meeting recognized that they would be addressed to a number of specific audiences and targets, including:

- (i) The planned symposium on multi-hazard early warning systems (Geneva, May 2006);
- (ii) The Executive Councils of WMO and IOC;
- (iii) The GEO working group on tsunami activities;
- (iv) The IOC ICGs for the different TWSs;
- (v) The WMO DPM Programme;
- (vi) National Agencies involved in the provision of marine hazard warnings;
- (vii) IPY legacy.

## **5. PREPARATION OF A JCOMM ACTION PLAN**

5.1 On the basis of the proposals developed and discussed under agenda item 4, the meeting adopted an action plan for JCOMM contributions to multi-hazard warning systems, which is given in Annex III. The meeting requested the Secretariat to make this action plan available to the target audiences as noted above, including specifically the report requested by the WMO Executive Council. The meeting also requested the Secretariat to report the outcomes and decisions of this reporting to the JCOMM co-presidents, so that appropriate follow-up actions within JCOMM could be initiated.

5.2 The actions were divided into two different categories. The first set of actions comprises those that are immediately feasible and would be undertaken by JCOMM within the next two years. These actions address tsunamis, cyclones and storm surges, and also maritime safety issues. The second set of actions includes those that JCOMM could offer as a contribution to marine multi-hazard warning systems, with additional resources.

5.3 In addition, the group highlighted several issues that are the primary responsibilities of other bodies, but that are important for the work of JCOMM, especially related to marine multi-hazard warning systems. These items include: (i) extension of communication means for the dissemination of MSI especially in areas of poor coverage, by geostationary and polar-orbiting satellites or ground-based radio systems, (ii) additional research to enhance forecasts and product delivery for marine hazards on all time scales, (iii) operation and sustained access to EOS polar orbiting satellites, and (iv) operation of coupled atmosphere-ice-ocean models.

## **6. REVIEW OF J-MMWS session report and action items**

6.1 The meeting reviewed, revised and adopted the final report of the session, including action items and recommendations.

## **7. CLOSURE OF THE SESSION**

7.1 The Expert Meeting on Possible JCOMM Contributions to the Development and Maintenance of Marine Multi-Hazard Warning Systems closed at 11.50 hours on Friday, 3 February 2006.

LIST OF PARTICIPANTS

AUSTRALIA

Dr Peter E. Dexter  
Co-president, JCOMM  
Ocean Policy Unit  
Bureau of Meteorology  
GPO Box 1289  
MELBOURNE, Vic. 3001  
Australia  
Telephone: +61-3 9669 4870  
Telefax: +61-3 9669 4695  
E-mail: p.dexter@bom.gov.au

Mr Graham R. Warren  
Supervisor  
Oceanographic Systems Development  
Bureau of Meteorology  
G.P.O. Box 1289  
MELBOURNE, Vic. 3001  
Australia  
Telephone: +61-3 9669 4041  
Telefax: +61-3 9662 1223  
E-mail: g.warren@bom.gov.au

CANADA

Mr Robert Keeley  
MEDS, Department of Fisheries and Oceans  
W082, 12th floor, 200 Kent Street  
OTTAWA, ON K1A 0E6  
Canada  
Telephone: +1-613 990 0246  
Telefax: +1-613 993 4658  
E-mail: keeley@meds-sdmm.dfo-mpo.gc.ca

FRANCE

Dr Philippe Dandin  
Météo-France  
Direction de la Prévision  
Division Marine et Océanographie  
42, avenue Coriolis  
31057 TOULOUSE Cedex 1  
France  
Telephone: +33-5 61 07 82 90  
Telefax: +33-5 61 07 82 09  
E-mail: philippe.dandin@meteo.fr

Mr Henri Savina  
Chairperson, JCOMM Expert Team on  
Maritime  
Safety Services  
Météo-France

Direction de la Prévision  
Division Marine et Océanographie  
42, avenue Gaspard Coriolis  
31057 TOULOUSE Cedex 1  
France  
Telephone: +33-5 61 07 82 91  
Telefax: +33-5 61 07 82 09  
E-mail: henri.savina@meteo.fr

MAURITIUS

Mr Mohamudally Beebeejaun  
Divisional Meteorologist  
Mauritius Meteorological Services  
Saint Paul Road  
VACOAS  
Mauritius  
Telephone: +230 686 1031  
Telefax: +230 686 1033  
E-mail: meteo@intnet.mu  
m.bbjohn@odinafrica.net

NORWAY

Mr Johannes Guddal  
Norwegian Meteorological Institute  
Region West  
Allegt. 70  
5007 BERGEN  
Norway  
Telephone: +47-55 23 66 26  
Telefax: +47-55 23 67 03  
E-mail: j.guddal@met.no

RUSSIAN FEDERATION

Dr Vasily Smolyanitsky  
Chairperson, JCOMM Expert Team on Sea  
Ice  
Arctic and Antarctic Research Institute (AARI)  
38, Bering Street  
199397 ST PETERSBURG  
Russian Federation  
Telephone: +7-812 352 2152  
Telefax: +7-812 352 2688  
E-mail: vms@aari.nw.ru

USA

Mr Michael Johnson  
Coordinator, JCOMM Observations PA  
Chairperson, JCOMM Observations  
Coord.



Group  
NOAA Office of Climate Observation  
1100 Wayne Avenue, No. 1202  
SILVER SPRING, MD 20910  
USA  
Telephone: +1-301 427 2330  
Telefax: +1-301 427 0033  
E-mail: mike.johnson@noaa.gov

Telephone: +41-22 730 84 84  
Telefax: +41-22 730 81 81  
E-mail: gduchossois@wmo.int

#### IOC SECRETARIAT

Ms Candyce Clark  
Intergovernmental Oceanographic  
Commission  
UNESCO  
1, rue Miollis  
75732 PARIS Cedex 15  
France  
Telephone: +33-1 45 68 39 89  
Telefax: +33-1 45 68 58 12  
E-mail: c.clark@unesco.org

#### WMO SECRETARIAT

Mr Edgard Cabrera  
Chief  
Ocean Affairs Division  
Applications Programme Department  
World Meteorological Organization  
7 bis, Avenue de la Paix  
Case postale No 2300  
CH-1211 GENEVE 2  
Switzerland  
Telephone: +41-22 730 82 37  
Telefax: +41-22 730 81 28  
E-mail: ecabrera@wmo.int

Ms Alice Soares  
Ocean Affairs Division  
Applications Programme Department  
World Meteorological Organization  
7 bis, Avenue de la Paix  
Case postale No 2300  
CH-1211 GENEVE 2  
Switzerland  
Telephone: +41-22 730 84 49  
Telefax: +41-22 730 81 28  
E-mail: asoares@wmo.int

#### GEO SECRETARIAT

Mr Guy Duchossois  
World Meteorological Organization  
7 bis, Avenue de la Paix  
Case postale No 2300  
CH-1211 GENEVE 2  
Switzerland

## **AGENDA**

### **1. OPENING**

### **2. REVIEW OF DISCUSSIONS AND RECOMMENDATIONS OF JCOMM-II AND OF RELEVANT JCOMM PROGRAMME COMPONENTS AND ACTIVITIES**

- 2.1 JCOMM-II results
- 2.2 Existing JCOMM programmes and activities
- 2.3 National marine hazard warning services case studies

### **3. REVIEW OF OTHER ACTIVITIES IN WMO AND IOC RELEVANT TO MARINE MULTI-HAZARD WARNING SYSTEMS**

- 3.1 WMO DPM programme
- 3.2 WMO tropical cyclone programme
- 3.3 RSMCs and multi-hazard warnings
- 3.4 Tsunami warning systems under IOC
- 3.5 Activities under GEO/GEOSS
- 3.6 Other

### **4. FORMULATION OF SPECIFIC PROPOSALS AND ACTIONS FOR JCOMM CONTRIBUTIONS TO THE DEVELOPMENT AND MAINTENANCE OF MARINE MULTI-HAZARD WARNING SYSTEMS**

### **5. PREPARATION OF A JCOMM ACTION PLAN**

### **6. CLOSURE**

**ACTION PLAN**

Action	Responsibility	Timeline	Result of action
<b>WILL DO NOW</b>			
<b>Tsunamis, cyclones and storm surges</b>			
Work with all ICGs for TWSs to develop CREX code for SL data transmission in real-time on the GTS	DMPA in coordination with OPA (GLOSS)	May 2006 (for approval by CBS)	Code form published and in operation
Develop and publish QC standards for real-time GTS transmission of SL data	DMPA in coordination with OPA (GLOSS)	May 2006	Published QC form in operation
Cooperate with IHO and IMO to coordinate the provision of maritime safety information (MSI) related to tsunami warnings	SPA (ETMSS)	Late 2006	Update JCOMM, IHO and IMO guidance and regulation materials to incorporate tsunamis related to tsunamis
Contribution to OceanTeacher (include module on applications of data to marine hazards)	DMPA in coordination with IODE, SPA, OPA	2006	Local capacity building
Maintenance of guides on wave and storm surges	SPA (ETWS)	Ongoing	Input to JCOMM DPM and other relevant programmes guidance materials related to marine hazards
<b>Maritime safety and others</b>			
Review and develop linkages with ongoing IPY projects	Co-presidents	2006-07	Improvement of observations, data delivery and ensurance of marine safety during and after IPY
Update guidance material related to maritime accidents	SPA (ETMAES)	Late 2006	Improve provision of services in response to marine accidents
Update guidance and regulation materials related to MSI	SPA (ETMSS, ETWS)	Ongoing	Improve description of sea state in MSI
Update guidance and regulation materials related to MSI in polar regions (including improved coordination, dissemination, information content, guidance material)	SPA (ETMSS, ETSI)	Ongoing	Enhance provision of MSI in polar regions
In cooperation with IMO and IHO, define boundaries for new Metareas covering the Arctic Ocean; define responsibilities for dissemination of Metocean MSI for all polar regions	SPA (ETMSS, ETSI)	Late 2006	Enhancement of marine safety operations in polar regions; contribute to update of IMO regulations
Develop standards for ice hazard warning in text bulletins	SPA (ETMSS, ETSI)	Late 2006	Update of JCOMM guidance and regulation materials
Development of web-portal for polar operational information, including warnings (possibly on the basis of Polarview proposal)	SPA (ETSI, ETMSS)	Prior to IPY and follow-up	Single-point access for MSI for IPY participants and ongoing applications (post-IPY)

<b>Action</b>	<b>Responsibility</b>	<b>Timeline</b>	<b>Result of action</b>
Develop presentation and dissemination models for sea ice and icebergs; update and extend existing guidance material for sea ice	SPA (ETSI)	Ongoing	Update to WMO Publications
Definition of objects (including graphical presentation) for met-ocean parameters within ECDIS (and future open formats) in liaison with IHO and ISO	SPA (ETSI, ETMSS), co-presidents	May 2006 for sea ice; ongoing for other parameters	Update to IHO catalogue; provision of JCOMM documentation
<b>OFFER TO DO (subject to requirements and resources)</b>			
Archive of data of extreme wave events	DMPA (ETMC) in collaboration with IODE and SPA	Long-term (2007+)	Improve way models handle extreme wave events; input to risk assessments
Archive of data of storm surge events	DMPA (ETMC) in cooperation with SPA, OPA	Long-term (2007+)	Partly for risk analysis (frequency of occurrence); model validation
E2EDM - implementation of prototype in a multi-hazard environment (perhaps as work with WIS)	DMPA	2007	Demonstration project
DBCP offer to support DART Consortium (issues include real-time GTS data reporting, deployment, potential multi-purpose buoys, code format, QC)	OPA (JCOMM co-president to provide Consortium contact details)	May 2006	Integration into global ocean observing system; increased efficiency of deployment facilities; evolution towards multi-use platforms
Observational network analysis (what assets are available) of data to contribute to marine hazard warnings	OPA	2006-07	Interactive data base sortable by application
Upgrade and expansion of GLOSS stations for real-time multi-hazard warnings	OPA (GLOSS)	2006-07	Enhancement of multi-hazard warning systems
Work with IPY participants to identify requirements for sustained marine polar observing systems	OPA	2007-09	Enhancement of multi-use observing system; improved global coverage
Long-term maintenance of required marine polar observing systems	OPA	2009	Enhancement of multi-use observing system; improved global coverage
Continued SL training including maintenance of gauges and use of data (archiving, access and multi-hazard applications)	OPA (GLOSS)	Ongoing	Local ability to use SL data; long-term health of GLOSS network
Training for applications of ocean data to multi-hazard warning systems	OPA, SPA	Ongoing	Enhance local capacity to use ocean data
Improve coordination with IMO/MEPC	SPA (ETMAES)	Ongoing	Metocean support to IMO Regional Response Centres such as REMPEC
Integrate MAES capabilities into RSMCs framework	Secretariat	Ongoing	Creation of MAES RSMCs
Develop project to provide information	SPA	2007-09	Improved MSI

<b>Action</b>	<b>Responsibility</b>	<b>Timeline</b>	<b>Result of action</b>
(including improved reception) to non-SOLAS vessels and coastal users			dissemination systems for non-SOLAS vessels (especially off West Africa and Bay of Bengal)
Provide climatology on sea ice hazards (iceberg propagation, sea ice/old ice boundaries) and other marine hazards	SPA (ETSI and others), DMPA (ETMC)	2007	Improve model validations; input to risk assessments
Ensure capacity building elements on storm surges are incorporated into existing projects (e.g., SEACAMP, WIOMAP, MILAC); liaise with TCP regarding CB (especially with RSMCs)	SPA (ETWS)	2007	Enhance local capacity through MILAC, WIOMAP, SEACAMP
Continuation of workshops in collaboration with WMO/TCP (work with TCP RSMCs to extend and expand to all tropical cyclone areas)	SPA	2006 then ongoing	Enhance local capacity in storm surge, sea state and wind wave analysis and forecast

## ACRONYMS AND OTHER ABBREVIATIONS

CARTWS	Caribbean and Adjacent Seas Tsunami Warning System
CB	Capacity Building
CBS	Commission for Basic Systems
CREX	Character form for the Representation and EXchange of data
DART	Deep ocean Assessment and Reporting of Tsunami
DBCP	Data Buoy Cooperation Panel
DMPA	Data Management Programme Area
DPM	Disaster Prevention and Mitigation Programme
EC	Executive Council
ECDIS	Electronic Chart Display and Information System
EER	Environmental Emergency Response
EOS	Earth Observation Summit
ERA	Emergency Response Activities
ESS	Extreme Storm Seas
ETDMP	Expert Team on Data Management Practices
ETMAES	Expert Team on Marine Accident Emergency Support
ETMC	Expert Team on Marine Climatology
ETMSS	Expert Team on Maritime Safety Services
ETSI	Expert Team on Sea Ice
ETWS	Expert Team on Wind Waves and Storm Surges
E2EDM	End-to-end Data Management
GDPFS	Global Data-Processing and Forecasting System
GEO	Group on Earth Observations
GEOSS	Global Earth Observations System of Systems
GLOSS	Global Sea Level Observation System
GMDSS	Global Maritime Distress and Safety System
GCOS	Global Climate Observing System
GTS	Global Telecommunication System (WWW)
ICG	Intergovernmental Coordination Group
IHO	International Hydrographic Organization
IMO	International Maritime Organization
IOC	Intergovernmental Oceanographic Commission (of UNESCO)
IODE	International Oceanographic Data and Information Exchange
IOTWS	Indian Ocean Tsunami Warning and Mitigation System
IPY	International Polar Year
ISDR	International Strategy for Disaster Reduction
ISO	International Organization for Standardization
ITIC	International Tsunami Information Center
ITSU	International Tsunami Warning System in the Pacific
JCOMM	Joint WMO/IOC Technical Commission for Oceanography and Marine Meteorology
JMA	Japan Meteorological Agency
J-MMWS	Expert Meeting on possible JCOMM contributions to the development and maintenance of Marine Multi-hazard Warning Systems
LDC	Least Developed Countries
MAES	Marine Accident Emergency Support
MEPC	Marine Environment Protection Committee
MILAC	Marine Impacts on Lowland Agriculture and Coastal Resources
MMS	Mauritius Meteorological Service
MSI	Maritime Safety Information
NDP	Natural Disaster Prevention and Mitigation
NGO	Non-Governmental Organization
NMHS	National Meteorological and Hydrological Service

NTWC	National Tsunami Warning Centre
OPA	Observations Programme Area
PTWS	Pacific Tsunami Warning and Mitigation System
QC	Quality Control
REMPEC	Regional Marine Pollution Emergency Response Centre for the Mediterranean Sea
RSMC	Regional Specialized Meteorological Centre
RTAC	Regional Tsunami Advisory Centre
SEACAMP	South-East Asian Centre for Atmospheric and Marine Prediction
SIDS	Small Island Developing States
SL	Sea Level
SPA	Services Programme Area
SOLAS	International Convention for the Safety of Life at Sea
TC	Tropical Cyclone
TCP	Tropical Cyclone Programme
TWC	Tsunami Warning Centres
TWS	Tsunami Warning and Mitigation System
UN	United Nations
UNESCO	United Nations Educational, Scientific and Cultural Organization
WIOMAP	Western Indian Ocean Marine Applications Project
WIS	WMO Information System
WG	Working Group
WMO	World Meteorological Organization
WWW	World Weather Watch