

**JCOMM EXPERT TEAM ON
WIND WAVES AND STORM SURGES (ETWS)
THIRD SESSION**

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FINAL REPORT

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NOTE

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www.jcomm.info/ETWS3

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GENERAL SUMMARY OF THE WORK OF THE SESSION

1. OPENING OF THE SESSION

1.1 Opening

1.1.1 The Third Session of the JCOMM Expert Team on Wind Waves and Storm Surges (ETWS) was opened by Val Swail, Chairman of the Expert Team, at 0930 hours on Tuesday, 18 May 2010, at the Hyatt Regency Hotel, Toronto, Canada.

1.1.2 Kerri Swail, on behalf of David Grimes, Assistant Deputy Minister for the Meteorological Service and the Permanent Representative of Canada with WMO, wished the members of the Team a warm welcome to Canada. Grimes noted the importance of the work of JCOMM to Canada as it is bordered by three oceans. He also noted Canada's recent adoption of Metareas 17-18 in the Arctic which demonstrates Canada's commitments in this area. He welcomed the Team to Canada and wished them a successful meeting.

1.1.3 Edgard Cabrera, on behalf of the Secretary-General, Michel Jarraud, expressed his gratitude to the Government of Canada, for hosting the Expert Team on Wind Waves and Storm Surges in Toronto, and recognized the long-standing contribution and commitment to the Marine Meteorology and Oceanographic activities, provided by Canada. He recalled that from their origins the National Meteorological Services (NMSs) were vitally concerned with the provision of quality meteorological forecasts and warnings in support of the safety at sea. The work of the Expert Team is of high importance and relevance for the overall activities to be undertaken by the WMO-IOC Joint Commission on Meteorology and Oceanography (JCOMM) on the coordination, facilitation and standardization of marine and ocean product preparation and service delivery (including services for maritime safety and DRR). A major focus is the further development of forecast systems and services and enhanced service delivery. He wished the Team a productive session on the extensive agenda planned.

1.1.4 Boram Lee, on behalf of the Executive Secretary of IOC, Wendy Watson-Wright, welcomed all participants. She congratulated the Team on its remarkable achievement during the last intersessional period, particularly its contribution to the marine/coastal hazard mitigation and adaptation to climate change, that are highlighted as IOC High Level Objectives. She noted some priority issues within the IOC Medium Term Strategy (2008-2013) where the Team's contribution is required, including marine disaster management, coastal area management, and climate services. She expressed appreciation of the Team's inter-programme pilot initiatives that have proved to be the efficient way to achieve the goals of JCOMM, and encouraged the Team to consider maintaining and extending its cooperation with other JCOMM teams and related IOC and WMO programmes. Lee concluded by ensuring IOC's continued support for the Team, and expressing gratitude to the Environment Canada for its continuous support for JCOMM activities.

1.1.5 The list of participants is given in Annex 1.

1.2 Adoption of the Agenda (Annex 2)

1.2.1 The Team adopted the agenda for the Session on the basis of the Provisional Agenda prepared by the Secretariats.

1.3 Working Arrangements

1.3.1 The Team agreed on its hours of work and other practical session arrangements. The

documentation was introduced by the Secretariats.

2. REPORTS

2.1 Report of the Coordinator of the Services and Forecast Systems Programme Area (SFSPA) (Annex 3)

2.1.1 The Coordinator of the Services and Forecast Systems Programme Area, Ming Ji, provided a report on activities within the SFSPA, noting the relationship of the work of the Team to the high-level requirements of the two parent organizations – WMO and IOC. He also noted the priorities for the SFSPA including: Marine Weather Safety, reducing risks of natural disasters on coastal communities and establishing operational ocean forecasting services. Climate services were mentioned as a major driver for priorities.

2.1.2 He introduced the workplan for four Expert Teams under the SFSPA: ETWS (Wind Waves and Storm Surge); ETOOFS (Operational Ocean Forecast Systems); ETSI (Sea Ice); and, ETMSS (Marine Safety Services).

2.1.3 Furthermore, he outlined the ten key priority projects for this Team (ETWS) which were discussed later in the session.

2.2 Report of the Chairperson of ETWS (Annex 4)

2.2.1 The Chair reminded the Team of their key deliverables which he addressed in detail later. He reported that the Third Session of the Commission (JCOMM-III, Marrakech, Morocco, 4-11 November 2009), re-established the Expert Team. Eight Team members were approved by JCOMM-III, four of them representing the wave and the storm surge expertise. Subsequent to JCOMM-III, and according to the provisions set forth by the meeting, seven additional experts were added to the team on a self-supporting basis, to address deficiencies in the breadth of technical expertise of the team. The Team was also informed on the activities of the JCOMM Observations Programme Area (OPA), the Services and Forecasting Systems Programme Area (SFSPA), and the Data Management Programme Area (DMPA), of interest to ETWS. Of particular interest were the outcomes of the Fifth Session of the Services Coordination Group (SCG-V, Melbourne, Australia, 7-8 May 2010), and the Third Session of JCOMM (JCOMM-III, Marrakech, Morocco, 4-11 November 2009), as well as actions taken since these sessions.

2.2.2 The Chair elaborated on a number of accomplishments achieved during the intersessional period including:

2.2.2.1 One of the most important activities of the ETWS continues to be the Operational Wave Forecast Verification Project. A routine inter-comparison of wave model forecast verification data was first established in 1995 to provide a mechanism for benchmarking and assuring the quality of wave forecast model products that contribute to applications, such as safety of life at sea, ship routing, and, in general, the Global Maritime Distress and Safety System GMDSS. The project has expanded to include thirteen centres, ten running global wave forecast systems, with different wave models, different wind forcing, and different model configurations, and the goal is to continue to add new participants, including regional participants, and to expand the scope of the intercomparison as feasible. Some participants are providing observations that are not commonly available on the GTS. This information is also being used to identify wave modeling shortcomings and ultimately it should lead to improvements of future wave models. It is recognized that centres engaged in wave forecasting benefit from this activity in the same way as weather centres benefit from the exchange of forecast verification scores. The project also plans to expand the verification to include 1-D and 2-D spectral quantities, satellite quantities, and to investigate

the development of spatial intercomparison techniques for wave forecasts in cooperation with the European Space Agency's GlobWave Project. Technical Report 30 was produced describing the project, and two papers were presented to the 10th International Workshop on Wave Hindcasting and Forecasting, November, 2008 (www.waveworkshop.org).

2.2.2.2 A recent workshop co-sponsored by JCOMM/ETWS and the International Association of Oil and Gas Producers (OGP) (New York, 2-3 October 2008) on *in situ* wave measurement technology (see <http://www.jcomm.info/WaveBuoys>) noted that: (1) geographical coverage of *in situ* data is still very limited especially as far as any measure of wave directionality is concerned, and most measurements are taken near coasts in the Northern Hemisphere; (2) present *in situ* reports are not standardized resulting in impaired utility; (3) significant differences exist in measured waves from different platforms, sensors, processing and moorings. Three main topics were discussed: (1) how to add wave observing capabilities to drifting buoys; (2) how to assess and improve the quality of observations from the present networks of moored buoys; 3) the addition of wave observation capabilities to future moored buoy networks. JCOMM Technical Report No.47 was produced containing the presentations and recommendations. One of the recommendations of the workshop was to establish two Pilot Projects under the JCOMM Data Buoy Cooperation Panel, one to coordinate an evaluation of various wave measurement systems in order to contribute to a description of best practices for wave measurement, and the second to investigate the feasibility of making spectral wave measurements from inexpensive drifting buoys. Details on the two projects can be found on their respective web sites, www.jcomm.info/WET and www.jcomm.info/WMD. The WET project is well underway, with initial comparison results expected to be available on the web by fall 2010.

2.2.2.3 JCOMM-II had urged the ETWS to prepare a *JCOMM Guide to Storm Surge Forecasting* during the intersessional period. In order to develop the contents and the implementation plan for the preparation of the *JCOMM Guide to Storm Surge Forecasting*, the WMO hosted an Expert Meeting in Geneva, Switzerland, 8-10 February 2006, which developed the Table of Contents of the *Guide*, and adopted an implementation plan for its preparation. That Meeting agreed to contribute towards the development of the sections and sub-sections, and assigned responsibilities related to the preparation and creation of each of them. The *Guide* is presently undergoing a second level of peer review and technical editing, and is expected to be published, in English, in hard copy and online by the end of 2010.

2.2.2.4 The First JCOMM Scientific/Technical Symposium on Storm Surges was held in Seoul, Republic of Korea, 2-6 October 2007, organized by the ETWS and co-hosted by the Korea Meteorological Administration and the Korea Ocean Research and Development Institute. This workshop attracted more than one hundred participants from twenty six countries, and dealt with topics including operational forecasting, data requirements, climatology and risk assessment, and socio-economic effects. The presentations and papers are available online at www.surgesymposium.org. Twenty-eight papers were selected and published in two special journals issues, one on operational forecasting aspects in *Marine Geodesy*, and one on modelling and risk assessment in *Natural Hazards*. The conclusions and recommendations from the workshop have been endorsed by both the WMO and IOC Executive Councils, and JCOMM-III urged the ETWS to implement the recommendations as part of its work plan for the next intersessional period. The Symposium has already had an influence, spawning the Coastal Hazards Symposia, the UNESCO coastal hazard forecasting project, the ESA storm surge project and the WMO Coastal Inundation Forecast Demonstration Project.

2.2.2.5 In response to the recommendations from the Storm Surge Symposium, 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. This project was successfully launched for 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. The Republic of Korea and India have provided their support to this project. A status report on the project will be provided to ETWS-III under agenda item 3.6.

2.2.2.6 In response to the recommendations from the Storm Surge Symposium, in an effort to improve storm surge forecasting systems that make full use of modern techniques and observations, ETWS and IOC had established collaborating arrangements with the European Space Agency (ESA) in support of improved storm surge forecasting through the ESA *Storm Surge Project* that aims to 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. A User Consultation Meeting was held in Venice, Italy, 16-17 September 2009 to establish the framework for the project, which is expected to get underway later this year (<http://www.jcomm.info/SSucm>). A status report on the project will be provided to ETWS-III under agenda item 3.7.

2.2.2.7 Questionnaires were distributed to National Meteorological and Hydrological Services (NMHSs) during the previous intersessional period to identify operational and pre-operational wave and surge models, forecast activities, hindcasts and measured data bases, for inclusion into the dynamic part of the respective wave and surge Guides. The questionnaires have been analyzed and will be made available on the JCOMM website as part of the dynamic parts of the wave and surge Guides.

2.2.2.8 An important and ongoing activity of the ETWS is to keep under review both the *Guide to Wave Analysis and Forecasting* and the *Guide to Storm Surge Forecasting*, and to propose additional new material, as appropriate, for the dynamic parts of the *Guides*. The review of the Wave Guide identified that much of the material was outdated, and should be revised. A proposal to undertake the revision will be discussed under agenda item 4.1.1.

2.2.2.9 ETWS developed a set of detailed requirements for surface wave observations for wave forecast modelling and related activities as a contribution to the WMO Statement of Guidance and the Rolling Review of Requirements. Varying requirements were identified to address five application areas: (i) assimilation into offshore wave forecast models; (ii) validation of wave forecast models; (iii) calibration / validation of satellite wave sensors; (iv) ocean wave climate and variability; and (v) the role of waves in coupling. The requirements will be reviewed and updated as necessary under agenda item 5.2.

2.2.2.10 ETWS continued to have strong links to the JCOMM Expert Team on Marine Climatology (ETMC) of the Data Management Programme Area, ensuring that waves and surges are well represented within the marine climatology envelope. The ETWS was on the Organizing Committee for the CLIMAR-III Workshop held in Gdynia, Poland May 2008, and is involved in the planning for the MARDCAT-III meeting tentatively scheduled for Frascati, Italy in February 2011. ETWS has also been represented, along with ETMC, on the CLIVAR/CCI/JCOMM Expert Team on Climate Change Detection and Indices (ETCCDI) to promote the development of marine climate indices including waves and surges. A set of proposed indices was endorsed by CLIMAR-III and presented to the 3rd session of ETCCDI in De Bilt, Netherlands, May 2008. The 2nd session of ETWS endorsed a joint proposal with ETMC for the development of an extremes wave data base, for wave events exceeding 14m significant wave height. Progress on this activity will be discussed under agenda item 3.2. Further development of storm surge climatologies with ETMC will be discussed under agenda item 3.3.

2.2.2.11 ETWS organized the JCOMM/OGP/WCRP Workshop on Climate Change and the Offshore Industry in Geneva, 27-29 May 2008 to address the issue of design and operating criteria in the offshore under a changed climate. The workshop presentations and meeting report were produced as a JCOMM Technical Report on CD-ROM. A follow-on activity is being organized to investigate wave climate

projections as a potential contribution to the IPCC 5AR; a workshop is being planned for May 2011 on this issue.

2.2.2.12 Three sessions of the International Workshop on Wave Hindcasting and Forecasting were held during the intersessional period co-sponsored by JCOMM/ETWS, Environment Canada and the US Army Corps of Engineers (9th in Victoria, Canada, 24-29 September, 2006; 10th in Oahu, Hawaii, 11-16 November 2007; and 11th in Halifax, Canada, 18-23 October 2010). The latter two meetings also introduced an associated Coastal Hazards Symposium, recognizing the combined risks for coastal areas. The presentations and full papers were produced as JCOMM Technical Reports on CD-ROM, and are also available from the Workshop web site at www.waveworkshop.org.

2.2.2.13 The ETWS participated extensively in the OceanObs'09 Conference in Venice, Italy, 21-25 September 2009, contributing two Community White Papers, one on requirements for wave measurements, the other on observational and other requirements related to storm surges. Both peer-reviewed papers will be published in 2010 in the Conference book.

2.2.2.14 ETWS participated in the WCRP *Understanding Sea Level Rise and Variability Workshop* in Paris, France, 6-9 June 2006. The workshop highlighted the requirements for additional wave measurements, especially in coastal areas, as well as more research on combined models of wave-surge-tide-water levels, and better understanding of past and future wave and surge climates. The position paper has been published in a book chapter from the meeting.

2.2.2.15 Many activities of the ETWS can be classified as Capacity Building. Several of these have been described elsewhere in this section. Specific Capacity Building activities targeted to developing countries included the development and implementation of the *WMO/CBS Severe Weather Forecasting and Disaster Risk Reduction Demonstration Project* (SWFDP) for southern Africa (WMO Regional Association I) and 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 NOAA/NCEP. Products from JMA and French Polynesia (Météo-France) were expected to be available. In addition, the 4th and 5th JCOMM/TCP Workshops on Storm Surge and Wave Forecasting were held in the Philippines (2006), and Australia (2008, for the Pacific Islands).

2.3 Report of the Secretariat

2.3.1 The Secretariat reported on the JCOMM activities, with focus on the results of the third session of JCOMM (Marrakech, Morocco, 4-11 November 2009). There were some one hundred five participants in the session, from thirty nine Members/Member States and four international organizations. Highlights of the session:

(a) The Commission had played a leading role in coordinating the implementation of an ocean observing system for climate (the open ocean component of [GOOS](#))

(b) The coordination, facilitation and standardization of marine and ocean product preparation and service delivery (including services for maritime safety and DRR) were the major part of the work of the Commission. Major focus areas within the Services Programme Area agreed by the Session were: further development of forecast systems and services; disaster risk reduction; and enhanced service delivery;

(c) During the intersessional period, capacity building activities had taken place as part of the work programmes of its Programme Areas (PAs). The Commission agreed to continue with this approach, 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 (<http://www.oceanteacher.org>) and ODIN projects.

(d) JCOMM was now a major contributor to both WIGOS and WIS, through the JCOMM Pilot Project for WIGOS, which sought to enhance the availability of ocean data to the WIS, and their interoperability with other environmental data. With the adoption of an IMO/WMO Worldwide Metocean Information and Warning Service, JCOMM was engaged in coordinating the development and the implementation of QMS for maritime safety services;

(e) The Government of the Republic of Korea, had made a formal offer to host JCOMM-IV in Yeosu in 2012, in conjunction with the 2012 World Expo (with the theme of "The Living Ocean and Coast").

2.3.2 The WMO Secretariat representative noted that the JCOMM, as other WMO Technical Commissions, was requested to review its goals, objectives and the roles in the organization particularly its intergovernmental functions. To this end, the Terms of References of the Commission was being aligned to the WMO Expected Results and IOC High Level Objectives.

2.3.3 The IOC Secretariat representative noted that JCOMM and other IOC subsidiary bodies have conducted the technical work required to keep Members/Member States operating in a coordinated and coherent way, and that JCOMM's achievements have been highly regarded in the external scientific and technical community. In the meantime, JCOMM has been strongly recommended to continue making efforts to engage wider number of Members/Member States in its activities, and in this context, to make efforts for Capacity Building.

2.3.4 The Secretariats then briefly reported on a result from the Joint IOC-WMO Officers meeting which took place in Paris, January 2010, which concerned the JCOMM. The Officers of two organizations noted that, at present, IOC and WMO have various different arrangements for each cooperative programme/body, and many of these agreements are not reviewed regularly. Therefore the current formal arrangements do not correctly reflect the situation. The Officers requested the WMO and IOC Secretariats to review the current status of the organizational framework for the IOC-WMO cooperation, and to work on a new general agreement between two organizations that allows flexibility to adapt to the evolving requirements of both organizations.

3. ACTIVITIES

3.1 Operational wave forecast verification project

3.1.1 A presentation was made by Jean Bidlot on the status of the operational wave forecast verification project. In particular, Bidlot reported on the collaboration of the ETWS with the European Space Agency (ESA) GlobWave project, and the development of spatial validation techniques. The GlobWave Project has been underway for one year and it is planned to have results available by November 2010. The Team was informed on the methodology for the project. Summary reports of their work are posted on the JCOMM web site. An expansion to include wave spectra is being investigated, including the 'First -5' technique and wave partitioning methods such as those developed by Mr Jeff Hanson. Another expansion is planned to include altimeter data. The Team discussed the verification scheme and how it might be extended to additional global and regional participants, and how to develop the additional verification measures. The Team considered that it should propose that more directional buoys be deployed to enhance spectral data.

3.1.2 The team agreed to pursue better use of standard methods of model validation techniques,

including, but not limited to Q-Q plots, Taylor diagrams and event-based validation. The team agreed to expand spectral data and its analysis by expanding the spectral data exchanged by the participants and by pursuing detailed spectral analysis methods such as the IMED package developed by Jeff Hanson of the US Army Corps of Engineers (USACE).

Action: The Team requested the Secretary-General of WMO to recommend to ECMWF that the web products from this project be made more widely available (Jean Bidlot will consult within ECMWF on possible actions).

3.1.3 The Team agreed to encourage DBCP members to deploy more directional buoys and that their forecast centres participate more actively in the wave verification scheme.

Action : J. Bidlot and H.Tolman will coordinate between the NOPP project and ETWS to work on standard validation techniques.

3.2 Extreme wave database

3.2.1 The Chair of the Expert Team reported on activities associated with the development of this database, in particular the outcomes of the discussion at the ETMC-III meeting on 8-12 February 2010. The Team was asked to review the progress on this project and to consider how they can contribute to the population of the data base with information on extreme wave occurrences. The US National Ocean Data Centre (NODC) will host this database. NODC will develop a template, which ETWS will review and provide feedback. The proposal is for WMO to request nations through their Permanent Representatives to contribute extreme wave data from their national data bases to NODC; a similar request should be made through the IOC Action Addressees. One proposal would be to attempt to restrict the data base to extreme events and limit the data from non-extreme events.

3.2.2 The Team was also asked to provide guidance to ETMC on how the scope of the database can be expanded to include additional sources of wave information, in particular from satellite. The Team noted that much of these data are already available on line from all altimeter data including some cross calibrated data.

Action: The Team will review the template for extreme wave data base and provide feedback to the US National Ocean Data Center (NODC). The Secretariats will request WMO and IOC to encourage all Nations to submit their respective databases to NODC, when the template is available. The Chair will also request the Oil and Gas Producers Metocean Committee to also submit their data. With regard to satellite altimeter data, Hendrik Tolman will approach GlobWave to suggest development of a demonstration project to extract extreme wave data from correspondening datasets, as soon as possible.

3.3 Storm Surge Climatologies

3.3.1 The Chair of the Expert Team introduced this item, noting that the development of global storm surge climatologies was a recommendation of the 1st JCOMM Scientific and Technical Symposium on Storm Surges, Seoul Korea, October 2007. JCOMM-III requested that ETWS and ETMC work jointly to produce a plan for the development of storm surge climatologies. ETMC-III agreed to participate in this activity and to work on a proposal for such a climatology pending the results of ETWS-III, with a target of a proposal by the time of the MARCDAT-III workshop in early 2011.

3.3.2 The Chair noted that the Team needed to consider how best to proceed to develop a Storm Surge Climatology. It was noted that some nations already retain these kinds of data. A questionnaire

had been distributed and perhaps more information is available on who may already have a data base. A first step could be to consolidate these existing data bases into a centralized climatology. Second, one could proceed to encourage other nations to begin to collect these data and forward them to this proposed Centre. The Team noted that extreme data was often missing as a result of extreme storms destroying the sensors. Another suggestion was to have a network of regional data bases which fits surge data better than a global centre. Another idea was to include the characteristics of the storm that created the surge. These types of data would be very helpful to understand the climatology. It was suggested that many studies involve coastal inundation rather than surge. The value of such climatology is to help calibrate the models and other tools to better predict future extreme events. A series of case studies may be one component of the climatology added to a point-based data base.

Action: The Team will re-evaluate the proposal from the Storm Surge Symposium to more precisely define requirement by December 2010.

3.3.3 The Team noted that it will be important to know who are the key stakeholders for these types of data and what they really want or need. The Storm Surge Congress (13-17 September 2010) could provide an opportunity to canvas the opinion at that Conference.

Action: Kevin Horsburgh, convener of the storm surge climate session at the SSC2010, will canvas the opinion (September 2010).

3.4 WMO Coastal Inundation and Forecasting Demonstration Project

3.4.1 The Team recalled during its second meeting held in Geneva in March 2007 (ETWS-2) the critical role to play by the improvement of ocean hazards operational capacities in support of disaster risk management decision-making and in particular by the enhancement of monitoring, detecting and forecasting of storm surges for coastal management. The Team underscored the importance in this context of the challenging integration of the hydrological component into a consolidated prediction and warning system.

3.4.2 The Team noted that following the WMO 60th Executive Council decision, the JCOMM/CHy CIFDP had been initiated in a kick-off meeting held in Geneva in 2009, from 29 June to 1 July. The kick-off meeting agreed that coastal inundation forecasting and warning systems depend on the cross-cutting cooperation of different scientific disciplines and user communities, and that an integrated approach would be the project's strategy for building improved operational forecast and warning capabilities for coastal inundation. The kick-off meeting agreed on the major goals and expected outcomes of the CIFDP as follows:

(a) Technology development and transfer, including training, which would enhance the capabilities of NMHSs to produce and provide coastal inundation forecasting and warning services, through the provision of tools for coastal inundation services and risk assessment;

(b) Communication platform and training, which would improve interactions of NMHSs with stakeholders and partners (Government, Disaster Management and Civil Protection Agencies, media, etc) for better understanding of user requirements, effective communication of the message, and user feedback.

3.4.3 The Team noted that Don Resio and Val Swail continue to lead this project as co-chairs. The full report of the kick-off meeting can be found at www.jcomm.info/CIFDP. The Team agreed to act as advisory group to this project as requested by JCOMM and CHy.

3.5 WMO Storm Surge Watch Scheme (Annex 5)

3.5.1 During the ETWS 2nd meeting held in Geneva in March 2007, the Team recalled its critical role to play in support of Disaster Risk Management for the enhancement of capacities by monitoring, detecting and forecasting of ocean-related hazards, to further improve coastal management.

3.5.2 The Team also noted that following the request by the WMO Executive Council, in its sixtieth session (June 2008), to the Secretary-General, in consultation with UNESCO/IOC, to facilitate the development of storm surge watch schemes (SSWS) for regions subject to tropical cyclones, and to regional associations concerned to incorporate such schemes in the tropical cyclone advisory arrangements and in the TCP Regional Operating Plans and/or Manual, WMO has initiated, through the joint efforts of TCP and JCOMM, the development of such schemes in regions subjected to tropical cyclones.

3.5.3 The third session of JCOMM (Marrakech, November 2009) requested in its 6th Recommendation the collaboration between WMO Members, Regional Associations, and Expert Teams on the Integrated Storm Surge Watch Scheme. The Commission also, recommended a regional approach towards storm surge risk reduction through the implementation of demonstration projects, such as the “*JCOMM/Commission for Hydrology Coastal Inundation Forecasting Demonstration Project (CIFDP)* for building improved operational forecasts and warnings capability and service delivery in coastal risk reduction”.

3.5.4 The ETWS will provide advice and guidance as requested by WMO Regional Associations in support of their efforts to develop Storm Surge Watch Schemes in their Regions.

3.6 UNESCO-IOC “Enhancing Regional Capabilities for Coastal Hazards Forecasting and Data Portal Systems” (Annex 6)

3.6.1 Boram Lee, IOC of UNESCO, reported on the progress of the UNESCO-IOC pilot project on “enhancing regional capabilities for coastal hazard forecasting and data portal systems”. This project was initiated following the recommendations of the JCOMM Scientific and Technical Symposium on Storm Surges that was held in Seoul, 2-5 October 2007 (JCOMM2007SSS, <http://www.surgesymposium.org>), on enhancing regional capabilities for storm surge prediction. The 1st phase of the project was launched in the North Indian Ocean that is the most surge-prone region in the world, with financial contribution from the government of Korea, and technical support from institutional partnership with the government of India.

3.6.2 The first workshop on enhancing storm surge forecasting capabilities in North Indian Ocean (<http://www.jcomm.info/SSIndia>) was held at Indian Institute of Technology, Delhi (IIT Delhi), India, in July 2009, with objectives of: 1) review the performance of the currently operating storm surge model in the region (IIT-D model), and: 2) set workplans to upgrade the model predictability. Key members of the ETWS (storm surge experts) have led the process, in partnership with the modeling experts of IIT Delhi. As a result of this workshop, a scientific advisory committee (led by Kevin Horsburgh) and a regional working group (led by Shishir Dube) were established in order to carry out the agreed workplan for three years. Lee reported that the second workshop was planned for February 2011, in order to: 1) review progress of the IIT-D model upgrade against the three-year workplan, and revise workplans if necessary; 2) to demonstrate the enhanced model’s performance in hindcast/operational mode, and; 3) to share the improved technology with scientific and operational agencies in the North Indian Ocean (NIO) region.

3.6.3 The Team agreed that this project, which is aligned with the ETWS activity and further with JCOMM and IOC workplans, would produce solid outcomes as achievements of the Team. The Team

was also pleased to note that the three-year work plan for model upgrade has been closely followed by participating institutions including the IIT Delhi and INCOIS - the tide-surge interaction component was enhanced within the IIT-D model, and INCOIS has been working on improving WaveWatch three model operation in cooperation with NOAA (training workshop in January 2010, Hyderabad). The Team agreed to continue supporting the project through the participating Members, particularly the proposed follow-on workshop scheduled for February 2011.

3.7 ESA R&D project on storm surge application (Annex 7)

3.7.1 The Team was informed of the planned project of the European Space Agency (ESA) on storm surge application. Following the recommendations of the 2007 JCOMM Symposium on Storm Surges, particularly those related to the enhanced use of the satellite information, this project was initiated in order to demonstrate enhanced use of Earth Observation information to improve storm surge applications. The ESA and IOC jointly convened the User Consultation Meeting on ESA Storm Surge project in Venice, Italy, 17-18 September 2009 (<http://www.jcomm.info/SSucm>), to review and discuss the current use of satellite data, and to identify the user requirements for improved future storm surge applications.

3.7.2 Boram Lee reported that a two-year project was being launched with one million funds by ESA, to be launched by the end of 2010. Following the recommendations of the User Consultation Meeting, the project would focus on providing easy access to useful EO datasets for storm surge applications, and on demonstrating improved techniques built on currently available observations, modeling and assessment tools.

3.7.3 The Team welcomed the ESA's initiative to support research and development for storm surge applications, and agreed that the expected deliverables of this project would be an important contribution to the activities for storm surge warning and coastal disaster mitigation. Recalling the Team's involvement in the ESA GlobWave project, as well as the common objectives and application technologies between two projects, the Team also recommended that these two ESA projects should take into account each other in planning and implementing through the project period. The Team agreed that, once the project is launched, the Team would provide advice as required.

4. GUIDES AND RELEVANT PUBLICATIONS

4.1 Guides

4.1.1 Guide to Wave Analysis and Forecasting

4.1.1.1 The Chair and Thomas Bruns provided a status report on the review of the contents of the Guide to Wave Analysis and Forecasting (WMO 702) undertaken during the past intersessional period. The Team was invited to consider a recommendation to update the Guide, and suggest an approach to carry out this work. The Chair noted that this guide was targeted to users, largely forecasters in NMHSs rather than wave experts. The Team reviewed the table of contents with a view to editing the existing Guide. The Team was reminded that this Guide is considered a base document not aimed to cover all the leading edge models but to cover the generally accepted fundamentals.

4.1.1.2 The Team noted that there are several books available on this subject with relatively simple explanations of this topic and perhaps the Guide could point to some of these books. It was proposed that new chapters be added to the Guide to cover ensemble forecasting techniques and wave forecast verification. The Team recommended removing the section on wave climate but maintain some information on model climates particularly for ensemble forecasts. The Team agreed that the Guide needed to be updated.

Action: The Chair will organize a Task Team to produce the annotated Table of Contents by the end of September 2010.

4.1.2 Guide to Storm Surge Forecasting

4.1.2.1 The Chair provided an update on the status of the JCOMM Guide to Storm Surge Forecasting, which was completed in the previous intersessional period, and will soon be published as part of the WMO Guide series. A peer review is underway and some recommendations will come forward. A final edit based on the comments needs to be done in next few weeks.

Action: Kevin Horsburgh and Hans de Vries will respond to the reviewer comments on the basis of the latest version. They will also indicate non-technical edits to the WMO publication department.

4.1.3 Dynamic parts of the Guides (Annex 8)

4.1.3.1 The Chair introduced this item, on the creation and updating of dynamic content for both the Guide to Storm Surge Forecasting and the Guide to Wave Analysis and Forecasting. The Team was invited to comment on the scope of the dynamic Guide as proposed by the Chair, and on approaches which can be used to develop appropriate content, including, for example, the contents of the two special journal issues produced as a result of the JCOMM Storm Surge Symposium. The proposed Scope outlined mainly links to publications, surveys and catalogues.

4.1.3.2 The Team was encouraged to consider OceanTeacher in developing the dynamic parts of the Guides, for example, linking the dynamic guide as OT components.

Action: The Chair will propose a structure for the Dynamic Part of the Guides including how to link the Guide under the main JCOMM ETWS Web page for review by the Team. The timeline is Sept. 2010.

4.2 Technical Reports

4.2.1 The Chair reported on the recent completion of two Technical Reports on extreme value analysis of wind waves, and storm surges. Suggestions for new technical reports during the intersessional period was discussed, in particular a requirement was identified for a technical report describing wind field forcing and its use in high resolution wave and storm surge models.

Action: Don Resio and Val Swail will approach Vince Cardone to lead the preparation of the overall Report. Team members will provide contributions to the report, as appropriate, based on the table of contents.

4.3 JCOMM Services Web Page

4.3.1 The Secretariat provided an update on the status of the JCOMM info Services Web Page. The Team was invited to consider what additional content may be included on the web site, or linked to it, and how to manage the maintenance of the ETWS content. The Site will include the ETWS Work plan and any pilot projects and a publications list. The Team was requested to ensure that during the intersessional period members periodically review and update the information as it pertains to projects they were leading. It was proposed to add a number of sub-pages or links to the specific project or activity areas. It was proposed that the site has one page with the key priority areas or events (highlights)

listed so we could attempt to have the 'two click rule' for access to the key information areas. Normally the Team Chairs will have edit access and in some cases each team member will have password accessible edit authority but now the Secretariat has sole authority.

Action: Team members will review and comment on the new JCOMM SPA website to update the contents. The Chair will work with the Secretariat regarding development of the Highlight section within the ETWS page.

5. OBSERVATIONS REQUIREMENTS

5.1 DBCP Pilot Projects

5.1.1 PP-WET (Wave measurement Evaluation and Test) (Annex 9)

5.1.1.1 The Chair made a presentation on this DBCP Pilot Project, established as an outcome from the JCOMM/OGP workshop on wave measurement evaluation held in New York, October 2008. The Team was informed of the recommendations from this workshop. In particular the Team was informed of the recent progress in this Pilot Project, including the 2nd meeting of the Steering Committee in February 2010, and present intercomparison activities and plans. The project details can be found at www.jcomm.info/WET. The Chair provided a status report on the Work Plan progress for the Project. The Team expressed its strong support for the work of the Pilot Project, and agreed to continue its support for the Project.

5.1.2 PP-WMD (Wave Measurements from Drifters) (Annex 10)

5.1.2.1 The Chair made a presentation on this DBCP Pilot Project, established as an outcome from the JCOMM/OGP workshop on wave measurement evaluation held in New York, October 2008. In particular the Team was informed of the recent progress in this Pilot Project, the goal of which is to assess the feasibility of making low cost wave observations from drifting buoys. The project details can be found at www.jcomm.info/WMD. The Team was informed that NOAA may have some resources available for the development of this type of sensor. The Team expressed its strong support for the work of the Pilot Project, and agreed to continue its support for the Project.

Action: Nadao Kohno will provide a summary of Japanese wave drifter activities to the PP Chair (by DBCP-26, September 2010).

5.2 WMO Rolling Review of Requirements (Wave measurements)

5.2.1 The WMO Secretariat provided an update on the status of this Rolling Review of Requirements and the updated version of the Statement of Guidance for Ocean Applications. The Team was invited to suggest how the Statement of Guidance for Ocean Applications should be updated, and to make specific recommendations for inclusion in the JCOMM Observing System Implementation Goals.

5.2.2 The Chair reviewed the Table of Requirements used in the rolling review for the wave elements for measurements. A number of concerns came from the Team that the current table needs revision. Due to lack of adequate documentation and precision of what was requested of the Team, the Team was unable to edit the Table during the meeting.

5.2.3 The Team proposed that new observational requirements for coastal zone management applications needed to be added.

Action: Don Resio and Mikhail Entel will develop the proposed requirements for coastal zone management. The Team will provide an update to the Rolling Review of Requirements once the Secretariat has provided specific guidance on what is to be reviewed.

5.3 Wave Measurement issues (BUFR, CIMO Guide)

5.3.1 Under this item, the Team discussed BUFR encoding requirements and template development status for wave data, including the work by the DMPA Task Team on Table Driven Code Forms.

5.3.2 The Team was invited to comment on the requirement for and approach to the proposed revisions to WMO and IOC guidance documents related to waves, including WMO No.8. The Team noted that there are about six pages in this document that has to be reviewed.

5.3.3 The Team commented that under tables 209 to 211 the labelling for spectral data needs more precision (example wave length or wave period). The Team worked through the tables and provided comments to Jean Bidlot.

Action: Jean Bidlot will prepare a formal response on behalf of the Team and provide this to the BUFR focal point. Bidlot will also provide review comments on WMO Document No.8; Kevin Horsburgh will review the section on ocean sensors by 4 June 2010.

5.4 OceanObs'09

5.4.1 The Chair provided an overview of the major outcomes of the OceanObs'09 Conference held in September 2009, and the potential implications for ETWS, particularly for storm surge. The input from ETWS will become part of the final 'book' providing the outcomes of the Conference. Waves got a very high profile during the Conference as well.

6. WORKSHOPS AND CAPACITY BUILDING

6.1 Technology transfer

6.1.1 Storm Surge Symposium (follow-up) (Annex 10)

6.1.1.1 The Chair reviewed activities undertaken as a follow-up to this Symposium with particular reference to the collaboration with ESA referred to in Agenda item 3.7, the UNESCO project discussed in Agenda item 3.6, the forthcoming Storm Surge Congress 2010 in September. Plans for organizing a second JCOMM Storm Surge Symposium were also discussed.

6.1.1.2 The Chair listed a number of important meetings to be held over the next two years in which the Team may wish to ensure that Team members are actively involved. The Team suggested a closer liaison with the WISE (Waves in Shallow Environments) group to coordinate the workshops to minimize the overlap between the two groups. It was suggested that meetings could be lead in alternate years by WISE and ETWS.

Action: Don Resio will contact the WISE (Waves in Shallow Environments) leadership to investigate the idea of coordinated meetings. Resio, Swail, and Tolman will organize the next Wave Workshop, to be held tentatively in Hawaii in the fall of 2011.

6.1.2 JCOMM Training workshops

6.1.2.1 The WMO Secretariat noted the goals of the TCP/JCOMM Series of Workshops on storm surges and wave forecasting. The sixth workshop is planned for the Dominican Republic in December 2010 and targets training for local regional staff to enhancing capacities of NMHSs to broader disaster preparedness and mitigation activities. The Secretariat invited the Team to provide feedback on how they could contribute to this training event. The Team will provide an outline of the workshop run by ETWS in 2008 in Australia for small island states and see if these modules could be ported over to meet the needs of this Workshop.

6.1.2.2 The Chair reported on the Workshop on the Use of Satellite Wind and Wave products for Marine Forecasting held in Ostend, Belgium and on the proposal for a second workshop in Brazil in 2011.

6.1.2.3 The Team noted that specialized education and training in marine meteorology, physical oceanography and data management has continuously taken place in close cooperation with IODE, particularly the UNESCO/IOC Project Office for IODE in Ostend, Belgium. The Team fully agreed that the JCOMM-IODE collaboration has been an important mechanism for successful capacity building activities, and that the Team should strengthen the liaison with the UNESCO/IOC Project Office for IODE to better coordinate meetings and workshops.

6.1.2.4 Recalling a recommendation at JCOMM-3 to consider training on marine services including links to public weather services and disaster risk reduction aspects, with a focus on regions of specific concern (e.g. coastal inundation in vulnerable low-lying areas), the Team considered that future proposals for such training should be duly reviewed and considered, particularly for Africa. The Team also recommended to make efforts for close communication not only between WMO and IOC but also relevant programmes within the organizations and national institutions, in planning national and or international training events.

6.1.3 Development of e-learning modules (OceanTeacher, Bilko, COMET)

6.1.3.1 The Chair introduced this item related to the status and suggestions for the development of training modules for wind waves and storm surges in the OceanTeacher and Bilko systems, and with the COMET program of UCAR. Modules have been provided to COMET from ETWS and are available on line at www.comet.ucar.edu. The two modules are: www.meted.ucar.edu/oceans/wavewatch3 and www.meted.ucar.edu/oceans/ocean_swell. The WMO Secretariat noted that it has an agreement with COMET to develop to produce training modules including one on waves.

6.1.3.2 The IOC Secretariat representative noted that the UNESCO/IOC facilitates access to a wide range of training materials, through OceanTeacher (<http://www.Oceanteacher.org>) that was developed by the IODE of UNESCO/IOC, and the UNESCO Bilko (<http://www.bilko.org>) for remote-sensing image analysis. The Team considered that such e-learning tools could be used to assist trainees in preparing for courses, to plan and coordinate successive training events with relevant subjects, and further to link with the dynamic part of JCOMM Guides and Manuals. The Team was encouraged to consider OceanTeacher in developing the dynamic parts of the Guides that was discussed under agenda item 4.1.3, for example, linking the dynamic guide as OT components.

6.2 Other workshops and conferences

6.2.1 The Team provided information on known upcoming workshops and conferences which may be of interest to members. The Team was informed of a proposal to the WMO Secretary-General to host a workshop on wave information for ship designers and classification societies. The Team encouraged WMO to support a workshop.

7. COOPERATION WITH OTHER JCOMM BODIES

7.1 Expert Team on Maritime Safety Services (ETMSS)

7.1.1 The Team recalled that JCOMM-III noted that a major marine weather-related threat is due to dangerous and complex seas and the risk of rogue waves. 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 IV of the WMO Technical Regulations (*Manual on Marine Meteorological Services* – WMO No.558).

7.1.2 The Chair provided an update on the work of this ET following the meeting of the Services Coordination Group (SCG-V) and the ETMSS workshop in May 2010. In particular, ETWS was invited to consider how it can contribute to ETMSS activities in support of the GMDSS, including development of forecast guidance on rogue waves, crossing and complex sea states, and review and update as appropriate the above noted Manuals.

7.1.3 The Team agreed to prepare a draft white paper on the key elements which could be considered as “dangerous” for sea state including discussion on nomenclature and standardized forecasts, in time for the ETMSS meeting in October 2010. The paper could go to the Maritime Safety Committee of IMO in December 2010.

Action: The Team will prepare a draft white paper (by ETMSS meeting, October 2010). The Team will also provide review comments on relevant sections of the Manuals No.558 and 471.

7.2 Expert Team on Marine Climatology (ETMC)

7.2.1 The Chair provided an update on the work of the ETMC, in particular the recent ETMC-III meeting in February 2010. This discussion focused on areas of joint interest, including the items on the extreme wave data base and storm surge climatologies discussed previously in agenda items 3.2 and 3.3 respectively. Other areas of ETWS/ETMC cooperation include the possibility of including wave summaries in ICOADS, development of marine climate indices in support of the CLIVAR/CCI/JCOMM Expert Team on Climate Change Detection and Indices (ETCCDI), and the co-organization of the MARDCAT and CLIMAR workshops with respect to wind waves and storm surge issues.

7.2.2 The Team agreed to continue its collaboration with ETMC on matters of joint interest. In particular the Team encouraged the ETMC to produce a paper on wave climate summaries for consideration at the MARCDAT-III workshop tentatively scheduled for February 2011 in Frascati, Italy, hosted by the European Space Agency. The Team also agreed to contribute to the organization of the MARCDAT and CLIMAR workshops.

Action: The Chair will contribute to the organization of the MARCDAT-3 workshop in early 2011.

7.3 Expert Team on Operational Ocean Forecast Systems (ETOOFS)

7.3.1 The Chair and Secretariat provided an update on the work of this ET and potential interactions with the work of the ETWS. The Team was made aware of the work of ETOOFS noting that the wave-current interactions are a potential area for collaboration as well as coastal zone forecasting.

8. COOPERATION WITH OTHER WMO/IOC AND INTERNATIONAL PROGRAMMES

8.1 WMO Tropical Cyclone Programme (TCP)

8.1.1 The WMO Secretariat made a presentation providing an update from the WMO TCP on its recent and planned activities. He noted that the capacity building aspects are one of the high priorities of the TCP and thus several training programs are carried out by the TCP. All the Regional bodies of the TCP have taken action to implement the Storm Surge Watch Scheme.

8.2 WMO Disaster Risk Reduction Programme (DRR)

8.2.1 The WMO Secretariat informed the Team that the Disaster Risk Reduction Programme (DRR), in cooperation with partners such as UN-ISDR, UNDP and World Bank, who are actively working with national governments in developing their DRM capacities, is working to analyze and understand DRM institutional capacities and opportunities for partnerships with the NMHS. Furthermore, through DRR cooperation projects, partnerships across NMHS and their various stakeholders could be developed/strengthened. DRR programme with assistance from the Resource Mobilization Office is identifying bi-lateral donors who are interested in supporting DRR activities in different regions.

8.2.2 The first step towards effective DRM is quantification of risks, noting the important role of statistical hazard analysis tools. Various commissions including Commission of Hydrology (CHy), the Commission for Agricultural Meteorology (CAgM), and the Joint WMO/IOC TC for Oceanography and Marine Meteorology (JCOMM) are developing guidelines for standardization of data, metadata as well as hazard analysis tools for floods, droughts and storm surges, respectively.

8.3 UNESCO-IOC Integrated Coastal Area Management (ICAM) (Annex 12)

8.3.1 The IOC Secretariat provided an update on activities of IOC Integrated Coastal Area management (IOC/ICAM). This programme was established in 1997, with the objectives to assist IOC Member States in their efforts to build marine scientific and technological capabilities in the field of ICAM, and to ensure that scientific requirements are integrated into national and regional ICAM programmes and plans.

8.3.2 The Team noted four main lines of IOC/ICAM activities and related projects under way, including; 1) development and application of performance indicators; 2) development of Marine Spatial Planning methodologies and their application; 3) development and application of guidelines for the mitigation of coastal hazards, and; 4) Adaptation to climate change in the coastal zones.

8.3.3 The Team noted with pleasure that the relevant parts of the Team's work is well acknowledged and linked within the IOC/ICAM activities (e.g. dynamic parts of the Storm Surge guide and ICAM coastal hazard guide), and agreed that such a cooperation should be extended during the intersessional period, particularly in storm surges and coastal hazards, and regional applications.

9. ORGANIZATIONAL MATTERS

9.1 Review of ETWS Terms of Reference (Annex 13)

9.1.1 The Team reviewed its Terms of Reference and proposed the following revision: (a) Provide advice to Members and Member States on the development of wind wave and storm surge climatology as a contribution to risk assessment for marine coastal hazards.

Action: The Secretariats will submit the proposed modification of the ToR for consideration at JCOMM IV.

10. REVIEW OF THE INTERSESSIONAL WORK PLAN (ANNEX 14)

10.1 The draft work plan for the intersessional period was reviewed and accepted by the Team. The revised work plan is attached to this Summary report.

11. AOB

11.1 There was no other business.

12. REVIEW OF ETWS-III SESSION REPORT AND ACTION ITEMS (ANNEX 15)

12.1 The Team reviewed and approved action items and recommendations. The draft final report of the session was circulated to the Team Members for review and was approved with some changes.

13. Closure of the session

13.1 In closing the meeting, the ETWS chairperson, Val Swail, thanked all participants for their valuable input to what had been a very productive meeting, and looked forward to working with all the members of the Team on the many ongoing action items. He noted that the Team had an ambitious work plan and that the meeting had made positive steps towards its implementation.

13.2 On behalf of the Secretariats, Edgard Cabrera expressed his sincere appreciation and thanks to all participants, especially to the ETWS chairperson, Val Swail, for hosting the session, and to Environment Canada for their support.

13.3 The Third Session of the JCOMM Expert Team on Wind Waves and Storm Surges closed at 11.10 hours on Saturday, 22 March 2010.

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Agenda

2. Opening of the session

- 1.1 Opening
- 1.2 Adoption of the Agenda
- 1.3 Working arrangements

2. Reports

- 2.1 Report of the SPA Coordinator
- 2.2 Report of the Chairperson of the Team
- 2.3 Report of the Secretariat

3. Activities

- 3.1 Operational wave forecast verification project
- 3.2 Extreme wave database
- 3.3 Storm Surge Climatologies
- 3.4 WMO Coastal Inundation and Forecasting Demonstration Project
- 3.5 WMO Storm Surge Watch Scheme
- 3.6 UNESCO-IOC "Enhancing regional capabilities for Coastal Hazards Forecasting and Data Portal Systems
- 3.7 ESA R&D project on storm surge application

4. Guides and relevant publications

- 4.1 Guides
 - 4.1.1 Guide to Wave Analysis and Forecasting
 - 4.1.2 Guide to Storm Surge Forecasting
 - 4.1.3 Dynamic parts of the Guides

4.2 Technical Reports

4.3 JCOMM Services Web Page

5. Observations Requirements

- 5.1 DBCP Pilot Projects
 - 5.1.1 PP-WET
 - 5.1.2 PP-WMD
- 5.2 WMO Rolling Review of Requirements (Wave measurements)
- 5.3 Wave Measurement issues (BUFR, CIMO Guide)

- 5.3.1 Wave measurement issues – BUFR
- 5.3.1 Wave Measurement Issues – 2
(1)
- 5.3.2 WMO Publication No.8 – Guide to Meteorological Instruments and Methods of
Observation

5.4 OceanObs 09

6. Workshops and Capacity Building

6.1 Technology transfer

- 6.1.1 Storm Surge Symposium (Follow-up)
- 6.1.2 JCOMM Training Workshops
- 6.1.3 Development of e-learning modules (OceanTeacher, Bilko)

6.2 Other workshops and conferences

7. Cooperation with other JCOMM Bodies

- 7.1 Expert Team on Maritime Safety Services (ETMSS)
- 7.2 Expert Team on Marine Climatology (ETMC)
- 7.3 Expert Team on Operational Ocean Forecast Systems (ETOFS)

8. Cooperation with other WMO/IOC and International Programmes

- 8.4 WMO Tropical Cyclone Programme (TCP)
- 8.5 WMO Disaster Risk Reduction Programme (DRR)
- 8.6 UNESCO-IOC Integrated Coastal Area Management (ICAM)

9. Organizational Matters

9.1 Review of ETWS Terms of Reference

10. Review of the Intersessional work plan

11. AOB

12. Review of ETWS-III session report and action items

13. Closure of the session