



Joint WMO-IOC Technical Commission
for Oceanography and Marine Meteorology

JCOMM Storm Surge Symposium - Follow up

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Chair, ETWS

ETWS-III

Toronto, Canada 18-22 May 2010



WMO



IOC/UNESCO

JCOMM2007SSS

JCOMM Scientific and Technical Symposium on Storm Surges

2 - 6 October 2007, Seoul, Korea Rep

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The Joint WMO–IOC Technical Commission for Oceanography and Marine Meteorology (JCOMM), from its predecessors, has a long-standing programme activity relating to the provision of expert technical advice on the modeling, analysis and forecasting of storm surges, to assist national agencies in fulfilling their service obligations. In this context, JCOMM organized the first international Scientific and Technical Symposium on Storm Surges, hosted by the Korean Government.

DEATHS IN TROPICAL CYCLONES

| YEAR | COUNTRIES | DEATHS |
|------|------------------------|-------------------|
| 1970 | Bangladesh | 300,000 – 500,000 |
| 1737 | India | 300,000 |
| 1839 | India | 300,000 |
| 1886 | China | 300,000 |
| 1881 | Vietnam | 300,000 |
| 1923 | Japan | 250,000 |
| 1876 | Bangladesh | 200,000 |
| 1897 | Bangladesh | 175,000 |
| 2008 | Myanmar | 146,000 |
| 1991 | Bangladesh | 140,000 |
| 1882 | India | 100,000 |
| 1864 | India | 60,000 |
| 1922 | China | 60,000 |
| 1833 | India | 50,000 |
| 1822 | Bangladesh | 40,000 |
| 1780 | Antilles (West Indies) | 22,000 |
| 1965 | Bangladesh | 19,279 |
| 1999 | India | 15,000 |
| 1961 | Bangladesh | 11,466 |
| 1985 | Bangladesh | 11,069 |
| 1977 | India | 10,000 |
| 1966 | Cuba | 7,196 |
| 1900 | USA | 6,000 |
| 1960 | Japan | 5,000 |

2004 Indian Ocean
tsunami - 230,000

1908 Messina Italy
tsunami - 100,000

1883 Indonesia
tsunami - 36,000

Agreed Recommendations and Actions

| Recommendation or Action | By whom |
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| <i>Future research and development</i> | |
| Improved physics and physical processes in the models; e.g. wave/current and wind/current interactions | SS research community |
| Need development of fully coupled basin / coastal / tide / wave / atmosphere <u>models</u> and programme for continuous improvement | SS research community |
| Improvements required in total water level <u>predictions</u> as a result of tide, wave and surge interactions | SS research community |
| Coupled hydrologic, hydraulic and surge models for inundation | SS research community |
| Research required on mesoscale wind forced events and remotely forced inundation events | SS research community |
| Pursue studies of model sensitivity to spatial and temporal resolution for specific locations | SS research community |
| Enhance and expand use of ensemble modeling techniques | SS research community |
| Develop methodologies to project changes in storm surge climate over the next century, with associated measures of uncertainty | SS research community |
| Further development of empirical techniques, e.g. AI, neural networks, statistical | SS research community |
| Further field work and laboratory and numerical modeling required to determine effectiveness of wetland and island barrier restoration in surge and wave attenuation | SS research community |
| More research, including case studies, to understand the cause of deviations from normal predictions and forecast failures, such as the sharp structural and intensity changes/variability in TC wind fields | Meteorological and SS research communities |
| Develop fully coupled models to improve NWP for tropical cyclones, extra-tropical storms and for winds in coastal areas | Meteorological research community |
| Improvements in wind field analyses and forecasting (including TC track and intensity forecasts) remain essential | Meteorological research community |
| Improved boundary layer specification over water and land | Meteorological research community |
| Forum required for enhanced and rapid exchange of information and ideas on surge modeling among existing and future national efforts | JCOMM/ETWS and Secretariat |

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| Research to Operations | |
| Downscaling of existing high resolution, integrated models for a range of practical applications | SS research community |
| Investigate improved means to incorporate uncertainty into forecast guidance | SS research community and national agencies |
| Support for a limited subset of models, as “community models”, for use by smaller countries and as capacity building tools | JCOMM/ETWS, Secretariat |
| Recognizing that models have been mostly used in hindcast mode or to develop simulations and scenarios, build on experience to develop better real time forecasting | JCOMM/ETWS and national agencies |
| Provide inventory and description of inundation models | JCOMM/ETWS, Secretariat |
| Assess appropriate ensemble techniques for forecasting | JCOMM/ETWS |
| Document storm surge forecasting practices in a standard way to make them internationally interoperable | JCOMM/ETWS |
| More effective cooperation of meteorologists, oceanographers, coastal and ocean engineers and hydrologists required; e.g. for inundation mapping | National agencies |
| Develop better visualization tools | National agencies |
| Adopt appropriate resolution models, based on sensitivity assessments and subject to data availability and requirements | National agencies |
| Observations and Data | |
| National access to, or development of, high resolution, near shore, bathymetric data sets highly desirable | National agencies |
| Space agencies should contribute to high resolution bathymetric and coastal zone topographic data for better storm surge and coastal inundation forecasts | Space agencies |
| Documentation of satellite earth observation data requirements for storm surge modeling and forecasting; e.g. scatterometer, ASAR, altimeter, nearshore | JCOMM/ETWS, Secretariat |
| Assessment and evaluation of the accuracy and value of satellite data for storm surge and wave modeling and forecasting | JCOMM/ETWS and SS research community |
| Assess value and practicability of other remote sensing; e.g. airborne LIDAR, HF radar | SS research community |

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| Monitor coastal flooding by remote sensing | National agencies |
| Enhanced GLOSS network to support storm surge risk assessments, research and forecasting, with recommended 1 minute sampling | JCOMM/GLOSS GE |
| Enhance in situ networks for all relevant variables, including higher time resolution | National agencies |
| Look to utilise other observation platforms to enhance in situ data; e.g. tsunameters | National agencies, JCOMM and Secretariat |
| Countries should prioritise data acquisition on the basis of risk analysis, including vulnerability and hazard impact probability | National agencies |
| Global access to existing storm surge data sets, perhaps through a storm surge metadata catalogue; Development of interoperable storm surge databases and climatologies | JCOMM/ETWS, Secretariat |
| <i>Capacity Building and Outreach</i> | |
| Develop generic storm tide: (i) Public education packages; (ii) Public warning packages; (iii) Evacuation guidelines | WMO/DRR and PWS, with JCOMM and IOC/ICAM |
| Training: (i) Training of trainers essential; (ii) Storm surge forecasting and modeling; (iii) Storm surge outreach; (iv) Training needs to be continuous, to upgrade skills and to ensure lessons are not forgotten for relatively infrequent phenomena | (i) and (ii) JCOMM (iii) WMO/DRR and PWS with IOC/ICAM |
| Inundation mapping support | WMO and IOC |
| Reactivate regional storm surge development projects; e.g. North Indian Ocean and West Africa | WMO and IOC |
| Support for participation in post-impact assessment and data collection | WMO and IOC |
| Outreach activities required, strengthening links with other relevant programmes and communities (* mitigation is social issue covering wide range up to national defence.) | WMO and IOC |
| Investigate forecast requirements for vertical vs horizontal evacuation | National agencies with JCOMM |
| Assist in identification of risk levels to ensure that the information provided is appropriate to level of risk | WMO and IOC |

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| <p>Recognize the importance of development of risk assessments</p> <ul style="list-style-type: none"> • Need a more strategic approach to risk assessments – act for both short and long term • Identify and apply multiple approaches to risk assessment • Include non-stationary climate effects, land use and demographic changes • Ensemble methods can quantify risks with long lead times • Identification of and focus on high risk regions • Define vulnerability before defining solutions | WMO and IOC, national agencies |
| <i>The Guide</i> | |
| Dynamic part to be proactive in distributing new developments in modeling and forecasting | ETWS/JCOMM |
| How to develop future input to dynamic part of the Guide? See next section | ETWS/JCOMM |
| Guide to include description of mesoscale wind forcing and remote forcing events, to stimulate future research | ETWS/JCOMM |
| Recognize differences between tropical and extra-tropical surges, for example in terms of scale | ETWS/JCOMM |
| Ensure effective linkage with ICAM hazard guidelines and manual on flood forecasting | ETWS/JCOMM with IOC/ICAM |
| <i>The Future</i> | |
| General agreement on value and need for future symposia | JCOMM |
| Full symposium on a 4-year cycle; Recommend second storm surge symposium in approximately 4 years | JCOMM |
| Potential synergies with related work on waves and currents | JCOMM |
| Recommend possible association with coastal hazards symposium as part of biennial waves workshops | JCOMM |

And beyond SSS.....

- Advisory workshop on Enhancing forecasting capabilities for North Indian Ocean Storm Surges, 14-17 July 2009 New Delhi, India; **February 2011**
- ESA User Consultation Meeting on Storm Surges, 17-18 September 2009, Venice, **Project start up September 2010**
- Coastal Inundation Forecast Demonstration Project, June 29-July 1 2009, Geneva
- OceanObs'09 – Storm Surge Community White Paper, 20-25 September 2009, Venice
- 11th Wave Workshop & 2nd Coastal Hazards Symposium, 18-23 October 2009, Halifax
- **Storm Surge Congress SSC2010 13-17 September 2010, Hamburg**
- **12th Wave Workshop & 3rd Coastal Hazards Symposium, Fall 2011**
- **Plan the 2nd SS Symposium**



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