Date and Time	**4 October 2007, 09:00-12:20**
Session Title	**Regional Studies #1 & Regional Studies #2**
Reported and Summarized by	**Keith Thompson (Chair), Marzenna Sztobryn (Rapporteur)**

[Summary of the Presentations]

(i) Presentation 1: **DYNAMICAL ASPECTS OF SE SOUTH AMERICA STORM SURGES**
(by **Paula Etala**)

Storm surges and tides along the coast of South America between 34 and 54S were examined with particular focus on estuaries, including the Rio de la Plata (an area of high economical importance and high population density) and the Bahia Blanca Estuary (where navigation is an issue). Depth averaged models of various resolution (down to 600m for the Bahia Estuary) were used to model the tide, surge and their interaction. Overall the prediction of tides was excellent. Attention was drawn to the effect of nonlocal forcing, and nonlinear bottom friction which caused coupling of tide and surge sea levels and currents in the Bahia Estuary. This in turn led lto strong asymmetries in flood and ebb, and also challenges in developing a good surge forecast system for the estuaries (where the timing of the meteorology is critical). An important conclusion was the need to build a “culture of prevention” i.e. making potential users aware of the products than can be generated by the surge forecast systems at the present time.

(ii) Presentation 2: **OPERATIONALSTORM SURGES FORECASTING IN A ESTUARY**
(by **Pierre Daniel**)

The talk focused on the reasons for the poor forecasts of a high sea level event observed in the Gironde Estuary, on the Atlantic Coast of France, in December, 2007. Atmospheric forecasts from three models were used to assess the effect of atmospheric forecast errors. The importance of correct temporal interpolation of the wind fields was stressed and it was shown that significantly better predictions of the sea level at the mouth of the estuary resulted from the use of 1 hour versus 3 or 6 hour winds. Significant improvements were also obtained by using hindcast compared to analysis winds. To extrapolate sea level predictions from the mouth into the estuary, three models were used (one finite difference, two finite element). All three models gave good predictions in the estuary, given good predictions at the mouth. The Telemac finite element model was used to extrapolate into the river. Based on the performance of the models it was concluded that the operational storm surge forecasting system will reduce the threat of flooding in this region. Needs identified by the author included (1) better visualization tools (ii) more training of meteorologists and hydrologists (iii) more effective cooperation of meteorologists and hydrologists (iv) daily forecasts of sea level, and warnings if necessary. Next steps include interaction with waves, and modeling of the flooded areas.

(iii) Presentation 3: **NUMERICAL SIMULATIOND OF STORM SURGES IN THE BAY OF BENGAL**
(by **Sujit Debsarma**)

A depth-averaged, nonlinear storm surge model was developed for the Bay of Bengal (18-23N, 83.5-94.5E) with a horizontal resolution of 4km. The model was made available to the researchers by the WMO. The model was used to simulate storm surges in the vicinity of Orissa, West Bengal and Bangladesh coast. Three or six hourly track data of several storms were used in a series of sensitivity studies. Good model performance was claimed in terms of computational performance and agreement with sea level observations. It was noted the model is now available for operational use. Future work will include the effect of river discharge from the Megha Estuary and inundation modeling. An important recommendation was that JCOMM assist with access to high resolution bathymetry and needed for inundation modelling. (Low bandwidth limited the ability of the author's to access data through the internet.)

(iv) Presentation 4: **THE STORM SURGE MODEL AT THE BRAZILIAN MARINE METEOROLOGICAL SERVICE**
(by **Jean Felix de Oliveira)**

The maritime meteorological service of Brazil is using a two atmospheric models (HRM and ETA, horizontal resolution of 19 km), two wave models (WAM and WAVEWATCH, 19 km resolution, 72h lead time), and two ocean models (POM and MIPOM) to generate weather and ocean forecast products for the coastal regions of Brazil. The focus of the talk was on the use of MIPOM to predict sea level variability. The horizontal resolution of the model was 0.2 degrees, the model time step was 20s, and 12 sigma levels were used. The wind forcing was defined with a horizontal resolution of 1 degree. The agreement between the observed and predicted sea level left room for improvement and plans are underway to improve the wind forcing and bathymetry. Plans are to look at more case studies and include the tides. Collaboration is underway with two universities and a private sector company to improve the model. One suggestion made after the talk was the possibility of using a simpler version of POM, specifically a depth averaged version, which may be less computationally expensive, easier to configure and understand.

(v) Presentation 5: **NUMERICAL STUDY OF THE STORM SURGES/TIDE AROUND KOREA THE KMA OPERATIONAL OCEAN MODEL**
(by **Sung Hyup You)**

The 2D version of POM, with a horizontal resolution of 1/12 degree, has been used since June 2006 by KMA to operationally predict storm surges around Korea. The forcing data include surface wind and air pressure data from the Regional Data Assimilation and Prediction System. Overall the performance of the model is good (bias errors of typically 20 cm based on sea level observations from 33 stations). Six coastal models, with a horizontal resolution of 1/120 degree, are being nested within the regional model and used to downscale results from the larger model. One interesting application of the work was a sensitivity study to identify changes in bathymetry and coastline associated with the development of dykes within the Saemangeum project area.

(vi) Presentation 6: **STORM SURGE PREDICTION USING ARTIFICIAL NEURAL NETWORK AND CLUSTER ANALYSIS**

(BY **DA-UN LEE)**

A combination of neural network (NN) and cluster analysis (CL) was used to predict water levels around the coast of Korea. The inputs to the neural network analysis include tidal residuals, wind and air pressure. The cluster analysis is used to group stations with similar sea level responses. The results of the CL-NN analysis were compared with forecasts made by conventional harmonic analysis, neural network models for each station, and with observations. The accuracy of CL-NN is higher than predictions made with the standard harmonic analysis approach. It was suggested that the CL-NN model can be very usefully applied to regional storm surge forecasts.

(vii) Presentation 7: **METEOROLOGICALLY INDUCED STORM SURGE IN THE GULF OF GUINEA: CONSEQUENCES ON COSTAL RESOURCES AND INFRASTRUCTURE**
(BY **REGINA FOLORUNSHO)**

There are low-lying areas of great economic and social importance along the coast of the Gulf of Guinea, from Cote d'Ivoire to Cameroon. A high storm surge of 4m can cause coast erosion, flooding, destabilize socio-economic activities, damage roads, and oil producing infrastructure. The MIPOM model, with a 10 km resolution, was used to model a pronounced flooding event in the region in August 1995. (The model was made available by JCOMM through a recent workshop/training session in Ostende.) The lack of data made model evaluation difficult. The need for a regional database for the formulation and implementation of flood and erosion control was noted, along with the need for more GOOS observation stations. It was suggested during the question period that the effect of wave setup could be important and worth further study.

(viii) Presentation 8: **Operational Wind Wave Prediction System at KMA**
(by **Sangwook Park)**

KMA has a range of numerical weather prediction models available to drive wave models. Wave prediction started at KMA in 1987. Major developments include the implementation of WAM in 1999, and the installation of a 1024-CPU CrayX1E System (18 terraflops) in 2005. A global model with nested regional and coastal wave models (the latter with 1/12 degree resolution) are being developed. Data from coastal buoys, remote sensing from TOPEX/POSEIDON, Jason retrieval wave height and QuickSCAT are being used for verification. The WAVEWATCH III code will replace the WAM model. It has already showed good parallel scaling on the Cray. The need for more calibration of model parameters was stressed.

[Recommendations / Input to the Discussion Session]

- A bulleted list of recommendations arising from the presentations themselves (where applicable) or the questions following should be developed here for input to subsequent discussion sessions
- Given the demonstration of the value of hourly wind data to drive surge models, advise on how we can take advantage of the wind products generated by satellites (now and planned).
- Need better visualization tools.

- Continue to support the capacity building in surge modeling. (Several examples were given of the successful development of storm surge modeling capacity e.g. surges in the Bay of Bengal, coast of Brazil and Gulf of Guinea. How can JCOMM assist in the continued development of this modeling capacity as the models undergo rigorous testing against observations, , and also refinement to meet the specific needs of the users?)
- Strengthen cooperation of meteorologists and hydrologists (Pierre Daniel).
- Provide a mechanism to share expertise on developing methodologies for coupling wave and surge models. (Web page?)
- Advice on when to use finite element and nested finite difference models when predicting surges in regions with complex bathymetry.
- Improve access to high resolution bathymetry, particularly for surge modellers with limited internet bandwidth.
- Provide inventory and description of inundation models.