A backrgound note on Indian Ocean Forecasting System

Indian National Centre for Ocean Information Services (INCOIS), under Ministry of Earth Sciences (MoES), Govt. of India is the nodal agency to provide operational oceanographic services to the coastal states of India. It is actively involved in the numerical modeling of ocean circulation, waves, tsunami and storm-surge as well as regional coupled ocean-atmosphere models for the prediction of track and intensity of tropical cyclones.

INCIOIS has the mandate to provide ocean analysis, reanalysis and forecasts, INCOIS has been spearheading the research in numerical ocean modeling and ocean data assimilation in India for the past several years. This has led to the successful implementation of the High-resolution operational Ocean Forecast and reanalysis System (HOOFS), in which a suite of Regional Ocean Modeling System (ROMS)- to model the regional and coastal ocean processes-are setup and integrated with the data assimilation scheme, known as the Localized Ensemble Kalman Filter (LETKF). HOOFS takes boundary conditions from a global model, a relatively low resolution Modular Ocean Model (version 4.0), with a data assimilation system based on 3D-VAR (Global Ocean Data Assimilation System GODAS).

Another ocean analysis and forecast system being run at INCOIS is based on HYCOM model and data assimilation using Tentral Statistical Interpolation Scheme. HYCOM configuration for the global ocean at a lower resolution provides boundary conditions for the Indian Ocean configuration of HYCOM. These Ocean General Circulation models simulate key physical oceanographic variables such as temperature, salinity and currents at various spatial, temporal and depth scales that are being used for operational forecasting applications as well as the ocean analysis. Efforts are underway to simulate biogeochemical parameters using ROMS and ECOLAB/MIKE models with the ultimate aim of forecasting potential fishing zones and water quality parameters in the near future.

Forecasts and early warning of wave parameters are being provided by the global configuration of WAVEWATCH III (WWIII) and the regional configuration of SWAN models. For the early warning of swell surges, (Simulating Waves Nearshore) SWAN model is nested within the Advanced Circulation Model (ADCIRC) model8 and takes boundary conditions from WWIII. Storm surge forecasts are generated using ADCIRC model configuration.

Operational tsunami advisories in the Indian Ocean are provided based on a large database of pre-run scenarios – Open Ocean Propagation Scenario Data Base (OOPSDB) generated using the Tohoku University's Numerical Analysis Model for Investigation of Near-field Tsunamis (TUNAMI N2) model, 2006, for other than Indian Ocean tsunamigenic earthquakes Tohoku University's Numerical Analysis Model for Investigation of Far-field Tsunamis (TUNAMIFF) 2011 is used for the real-time tsunami propagation scenarios (IOC. Manuals and guides 35). While INCOIS has recently acquired the capability to run ADCIRC model in real-time to issue tsunami warnings for the global oceans, outside Indian Ocean. General NOAA Operational Modeling Environment (GNOM) is used for oil spill trajectory prediction. Efforts are underway to develop an extended prediction of wave-induced coastal erosion using a combination of WWIII and Xbeach model.