

About 25% of India's population resides in the "coastal zone". The activities of these people vary from traditional fishing to high-tech oil and gas exploration in the 2 million sq. km. of Indian EEZ. These communities, irrespective of their level of technology, would like to know 'how it is going to be out there when they are at sea'. Providing such information to this heterogeneous community demands the existence of an ocean state prediction system that would routinely provide forecasts on 'how it is going to be out there when they are at sea'. Such a forecast system requires a mathematical model (or models) that mimic the actual conditions at sea on a day-to-day basis. As a pre-condition, such a model should first mimic the observed currents, waves, winds, etc.

Realising the needs of this heterogeneous community that venture in to the sea, the Ministry of Earth Sciences (earlier Department of Ocean development), Government of India established Indian National Centre for Ocean Information Services (INCOIS) in 1999 in Hyderabad to provide ocean information services at various levels. One of the services provided by INCOIS includes the Ocean State Forecast (OSF). This service informs the community about the state of waves (wave height and direction) in advance when they plan to venture out at sea.

The ocean state forecast involves the forecasting of ocean state during the next

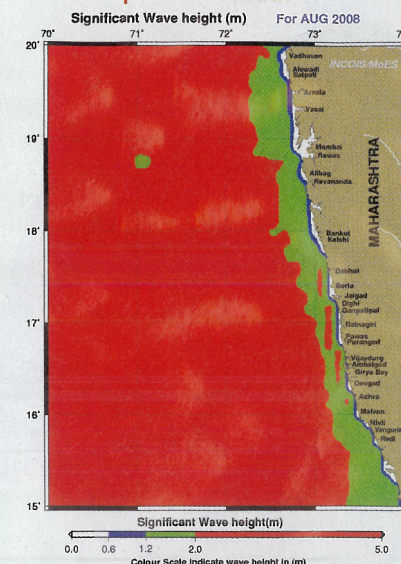
6, 24, 48, 72, 120 hours or more. INCOIS generates these forecasts on daily basis for next 6 days using the forecasted winds obtained from weather prediction centres and disseminates this information on real time basis to users via electronic display boards, Village Information Centres, All India Radio, FM radio, TV channels in local languages and INCOIS web site.

The duration, accuracy and spatial resolution of the forecasts depend on the user needs. While the fishermen are usually interested in the information at least two days in advance, the navy requires it ten days in advance. The requirements of offshore industries are operational specific. INCOIS meets such demands by customising the forecast products. Currently, INCOIS issues Global forecasts for next 5 days at 6 hour intervals, Regional forecast for 7 days at 3 hour intervals, Coastal forecasts for 7 days at 3 hour intervals, and Location Specific forecast, at any location along Indian coast, for 3 days at 3 hour intervals.

The acceptability of forecasts depends on reliability of forecasts or how close they mimic the actual observations. To test the accuracy and reliability of the forecast products, they are continuously compared with the observations. At INCOIS, the satellite and in-situ measurements of wave heights and directions are used for the validation of forecasts. The errors in the forecast are determined for south west monsoon season and extreme

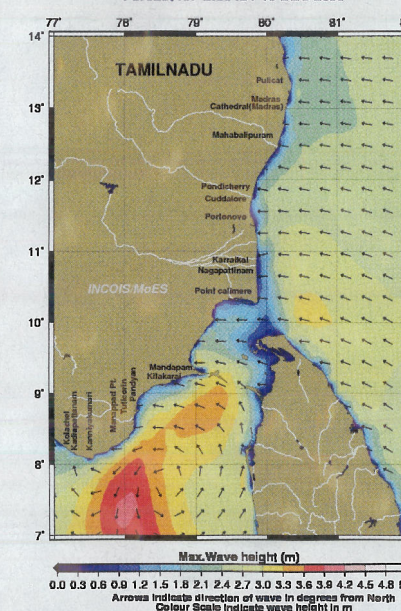
conditions (e. g. cyclone) when sea is very rough and the maritime activities are at risk. The forecast error in significant wave height varies from 12-28 % during the south west monsoon period upto six days

Value added product for port administration

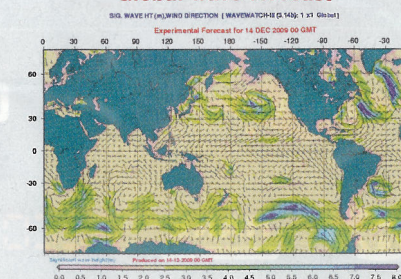


Coastal wave forecast

Max.Wave height (m) and Direction (°)
Forecast for 2.30 IST 16 DEC 2009



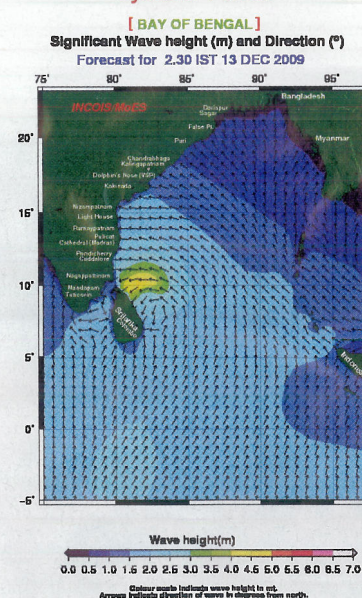
Global wave forecast



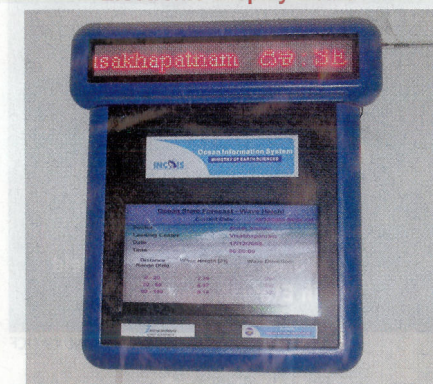
of forecast at different locations. The error is estimated during most of the cyclone conditions in the northern Indian Ocean during 2007 and 2008. Percentage error varies from 15-35 % for six days of forecast. In general, the error increases with forecast time.

Scientists at INCOIS are working towards improving the forecast such as accuracy, spatial and temporal resolution etc. Assimilating observed real-time data in the numerical forecast models will significantly improve the accuracy of the forecast. INCOIS is increasing the the number of coastal and offshore automated observation systems with real-time data transmission capability. Argo profiling floats, ship mountable real-time automated weather stations, moored and coastal wave rider buoy net work etc are few examples for these kind of observation systems. Data from automated observational systems are presently used for real-time monitoring of

Regional forecast during Cyclone Period



Electronic Display Board



the sea state and validation of forecast.

Ocean state forecast has become an inevitable component in the maritime activity along the Indian coast. In addition to traditional and mechanised fishermen, the users of forecasts also include maritime boards, navy, coast guard, shipping companies and oil, natural gas and energy industries, academia etc. The user base has doubled over the last four years. State Maritime Boards of Gujarat and Maharashtra use the OSF products for regulating the ship, barge and other vessel movement. This information is useful for regulating vessel navigation at 80 minor ports along the Gujarat and Maharashtra coast. The information on significant wave height contours provided by INCOIS help the Chief Nautical officers to regulate the movement of the ships. According to the wave and swell height information from INCOIS, the maritime authorities regulate the movement of vessels depending upon their size and displacement.

INCOIS is working with Gujarat, Maharashtra, and Andaman & Nicobar Maritime Boards to use this information for demarcating the Inland Vessel limits (IVL) so as to improve the safety of vessels and onboard personnel. IVL can be defined as the navigational demarcation line which divides the high seas from tidal rivers/ estuaries /ports. The demarcation is done on the basis of Significant Wave Heights (SWH) and the categorization of regions are (1) region where SWH less than 0.6 m, (2) region where SWH is between 0.6 to 1.2 m, (3) region where SWH is between 1.2 and 2m.

INCOIS is closely working with Indian Navy and Indian Coast Guard for providing customized ocean state forecast product. Forecast is disseminated daily to all offices of naval commands and coast guard. Feed-

back indicates that the information is used for panning the Naval operations as well as search and rescue operations.

INCOIS became a household name in fishermen community all along the Indian coast by providing an integrated solution for safe fishing-integrating two missions of Potential Fishing Zone (PFZ) and OSF. The PFZ advisories are generated using data from satellites based on locations of oceanic fronts, meandering patterns, eddies, rings, upwelling areas as seen on sea surface temperature and chlorophyll images. The integrated PFZ advisories prepared in local languages and local measurement units are disseminated thrice a week during non-fishing ban and cloud-free days through electronic display boards, information kiosks at fishing harbours, Door-darshan, print media, e-mails, the INCOIS website, fax and telephone. This service is unique as it is the only short-term forecast available to the fishing community in the country. INCOIS is disseminating the ocean state forecast through 40 Electronic Display Boards installed at different fish landing centres along with PFZ advisories.

The forecast for other ocean parameters such as ocean currents, mixed layer depth, Sea surface temperature, sea surface height, sonic depth, vertical profiles of temperature and salinity will be made operationally available to public and industries from January, 2010 onwards.

INCOIS, in pursuit of excellence, has a young, vibrant and compact team of scientists and engineers with formal education in Ocean Sciences, Mathematics, Physics, Computer Science, Engineering and Management. It has been greatly successful in translating scientific knowledge into useful products and services through synergy and knowledge networking.

Inauguration of broadcast of ocean forecast through FM Radio in Puducherry

