# Avoiding Disaster Surprises

Three years ago a mighty submarine earthquake lifted the floor of the Indian ocean, triggering a vast rush of water what surged towards the coasts of India, Indonesia, the Maldives, Sri Lanka and Thailand. Nearly a quarter of a million people lost their lives and the damage was unprecedented. Prevention is better than cure and developing early-warning systems aims at preventing human suffering in the case of tsunami. The Indian government has understood this. After the Christmas 2004 tragedy, a tsunami early-warning system was put in place with surprisingly speed.

**NEWS**

The devastating oceanic waves constituting a tsunami originate from submarine earthquake mainly generated by the forces released by subduction of oceanic tectonic plates. In South Asia two subduction zones periodically release huge forces: one along the Andaman-Nicobar-Sumatra Island Arc, east of India, and the other in the Makran zone, north of the Arabian Sea, west of India. Rupture along the zone east of India caused the gigantic submarine earthquake leading to the tragedy of 26th December 2004. The trail of destruction resulting from a huge wall of water slamming up over her coasts demonstrated to the Government of India the imperative of setting up a National Early Warning System (NEWS) designed to guard against tsunamis induced by the two subduction zones described above.

**Inauguration**

The project was completed in just two years and involved about 150 scientists and engineers from fourteen organisations. NEWS cost Rs.125 Crore (US$30 million) to put in place, executing authorities being the Ministry of Earth Sciences as nodal ministry, in collaboration with the Department of Science and Technology, the Department for Space and the Council for Scientific and Industrial Research. NEWS was formally inaugurated on 15th October 2007. The three main observation components of the system enable estimation of hazard risk posed by a submarine earthquake; one component is for detecting the cause of a tsunami, earthquake; two are for detecting consequence, sea-level rise.

**Control Room**

Real-time seismic data from (inter)national seismic networks enables detection of earthquakes greater than magnitude six on the Richter Scale, as they occur in the Indian Ocean and within twenty minutes of the birth of such forces. Pressure sensors forming the core of the system are positioned on the bottom of the ocean and act as sentinels to detect sea rise; four are installed in the southern Bay of Bengal, and two in the northern Arabian Sea. Time-series analyses allow computation of changes in water pressure; increase indicates a passing tsunami. The measurements are passed on to a buoy, which then sends the information in real-time via satellite to the Indian National Centre of Ocean Information Services (INCOIS) in Hyderabad, where a state-of-the-art National Tsunami Early Warning Centre (NTEWC) has been set up. At this hub, real-time data from all sensors is collected and analysed, and alerts issued to the control room at the Ministry of Home Affairs for further dissemination to state and local administration, media and the public. Communication with the Ministry of Home Affairs is via a satellite-based, virtual, private net; authorised officials are also contacted by phone, fax, SMS and email.

**Effectiveness**

The second observation component involved in detecting sea-level rise consists of a series of thirty tide-gauges that monitor the progress of tsunami waves. All data generated by the three sensor systems in the network is continuously transmitted via satellite to the Hyderabad centre and here monitored. The travel time and magnitude of a tsunami can be estimated from a large database of model scenarios, using location and magnitude of earthquake derived from the sensor data. Historical earthquake data provides a basis for ascertaining areas under threat of inundation and, by combining this information with high-resolution digital elevation models and cadastral maps at scale 1:5,000, it becomes possible to identify communities and infrastructure at risk. A high level of redundancy is built into the communication system to prevent it failing in the case of technological breakdown. The large submarine earthquake of magnitude 8.4 that occurred on 12th September 2007 in the Indian Ocean proved the effectiveness of the system.

**Human Factor**

The weakest component in any early warning system is not technology but the human factor. Particularly crucial are preparedness of government agencies and the capability of people in vulnerable regions to respond swiftly to alert. Periodic workshops guarantee the user community becomes familiar with the use of tsunami and storm-surge advice and inundation maps. Further, the Indian government tries to increase public awareness by distributing easily understandable publicity material. Early-warning systems cannot prevent disasters but may reduce harm, damage and human suffering. Let us hope that these efforts succeed and this leap year, 2008, does not bring with it the tragedy of the last.