

the contours reflect well spread out character is the zone that is most affected by the tsunami, which includes Nagapattanam and Cuddalore. Fig.1 also indicates that the shelf break is much nearer the shoreline in this anomalous zone compared to its adjoining areas. As shipboard tracks are not available from this zone it is not possible to check the efficacy of the ETOPO2 data. If this feature is indeed anomalous, its true nature can best be tested by examining the shipboard echosounding data collected under the EEZ program by the National Institute of Oceanography, Regional Center, Visakhapatnam and the Geological Survey of India under its seabed-mapping program.

In general, the continental slope from Sri Lanka to Chennai can be categorized as a steep slope. Studies related to tsunami amplification on such a steep continental slope need special attention. Further, the angle of incidence of the tsunami on the slope can also be a contributing factor (Koshimura et al. 1999). It is generally stated that the wave motion affects a water column of at least half the wavelength of the tsunami wave and if that is so, then a tsunami arriving

with a great speed at a steep continental slope may suddenly encounter a steep barrier. In such cases the transformation from a large wavelength low amplitude wave to a short wavelength high amplitude one (in other words, the transformation from kinetic energy to potential energy) may be abrupt thereby generating waves of greater height on the shore. We speculate that the tsunami having traveled with great speed across the Bay of Bengal and approached the continental slope, possibly moved along the slope and surged towards the shoreline through the bathymetric window in Nagapattanam and Cuddalore offshore regions. However, there is need to explain why the tsunami did not climb, with equal speed, the gentle continental slopes north of Chennai.

This is only a qualitative inference and detailed study of wave propagation along the continental slope should be addressed by physical oceanographers.

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References

- KOSHIMURA, S., IMAMURA, F. and Shuto, N. (1999) Propagation of obliquely incident Tsunamis on a slope part I: Amplification of tsunamis on a continental slope. *Coastal Engg. Jour.*, v.41(2), pp.151-164.
- NARAYANA, A.C., TATAWARTI, R. and MUDRIKA, S. (2005) Tsunami of 26 December, 2004: Observations on Kerala coast. *Jour. Geol. Soc. India*, v.65(2), pp.239-246.
- RADHAKRISHNA, B.P. (2005) *O, horrible! most horrible!* — Devastating Tsunami Strikes Coastline of India. *Jour. Geol. Soc. India*, v.65(2), pp.129-134.
- SUBRAHMANYAM, C. and OTHERS. (1999) Tectonics of the Bay of Bengal, northeastern Indian ocean: New insights from satellite-derived gravity and shipborne geophysical data. *Earth Planet. Sci. Lett.*, v.171, pp.237-251.

SEMINAR ON TSUNAMI AND COASTAL PROTECTION

A seminar on Tsunami and Coastal Protection was held in Thiruvananthapuram on 11.02.2005 under the auspices of Kerala State Council for Science, Technology & Environment (KSCSTE) in association with Centre for Earth Science Studies, Thiruvananthapuram. The seminar was organized to have a re-look at the coastal engineering strategies followed for the Kerala coast in the context of the December 2004 tsunami. In addition to the keynote address by the renowned Tsunami expert Dr. Tad Murty, lead papers were presented by scientists/engineers from Central Water and Power Research Station, National Institute of Ocean Technology, Ocean Engineering Department, IIT Madras and Centre for Earth Science Studies.

Dr. Tad Murty delivered his key note address in the

inaugural session chaired by Dr. A.E. Muthunayagam, Executive Vice President, KSCSTE. Dr. Murty described the Tsunami warning system in the Pacific and suggested a scheme for Indian Ocean Tsunami warning system. He underlined the need for modelling of Tsunami impact on the coastal areas and gave details of the various parameters and aspects to be considered for this purpose. Dr. Murty explained that the warning system in the Indian Ocean had to be different from the Pacific warning system because of the peculiarities of the Indian Ocean. For example, in the Pacific Ocean, 23 hours warning time may be available for countries depending upon their locations, while in Indian Ocean, because of its smaller size, maximum time available will be less than 10 hours. He advocated a combination

of different systems for protection of the coast in place of the seawall which is constructed all along the Kerala coast.

In the ensuing technical session which was chaired by Prof. S. Narasimhan of IIT, Mumbai and co-chaired by Dr. K R S Krishnan, Director, KSCSTE, presentations were made by Dr. V Sundar and Prof. J S Mani of IIT, Chennai, Dr. Kudale of CWPRS, Pune, Dr. Nagendra Kumar of NIOT, Chennai, Dr. M. Prithviraj of Department of Science and Technology, Government of India and Dr. M. Baba of CESS, Trivandrum. Scientists and engineers from IIT, Mumbai, NIO, CWC, Irrigation Department, Harbour Engineering, IMD, Revenue, Planning Board, Army, Air force, Police, Kerala and Cochin Universities, CWRDM, NATPAC and several other institutions participated in the seminar. A total of 101 delegates attended the seminar.

On the basis of the presentations and discussion, the seminar came out with the following recommendations for adoption in Kerala:

- i) The management and protection of the coast needs to be viewed in the background of the different types of hazards like monsoonal waves, cyclones, floods, sea level rise, earthquakes, etc. and not confined to the recent Tsunami event alone.
- ii) The protection of the coastal areas need not always be by structural means such as seawalls, groins, offshore breakwaters. Soft methods like beach nourishment, bio-shield, buffer zones, sand dune, artificial reefs, etc. may be adopted wherever appropriate.
- iii) The seminar recommended that in future the coastal protection using sea wall along the Kerala coast shall be only in essential situations where protection of vital installations are involved.
- iv) The CRZ regulations may be implemented strictly for

the safety of the people. The meeting appreciated the 'No Development Zone' concept of category III (CRZ III) of the CRZ notification which will protect the coastal areas from natural hazards. It was also felt that similar 'No Development Zone' provision may have to be thought of for urban and highly populated areas and at least the existing building line be frozen for this purpose.

- v) Coastal vulnerability zone for the frequent hazards such as annual floods, coastal erosion, etc. may be identified for restricting developmental activities and another zone for long term hazards like tsunamis, storm surges, cyclones may be identified for restricting other major investments like power plants, highways, airports etc.
- vi) Integrated Coastal Zone Management Plans may be prepared for the coastal areas taking into account both the sea and land part and also vulnerability to hazards, livelihood security of the people and other social, economic and infrastructural requirements of the population.
- vii) Kerala should have additional monitoring infrastructure like seismic stations, tide gauges, wave and current monitoring systems along its coast for hazard preparedness and early warning.
- viii) The seminar was unanimous in recommending co-ordination of various agencies and activities for hazard mitigation and suggested that it should be integrated with the newly established Department of Disaster Management.

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WORKSHOP ON TSUNAMI AND NATURAL DISASTER MITIGATION

A one day workshop on the above topic was conducted at Yavanika Seminar Hall, Bangalore on 19.3.2004 by the Disaster Management Centre (erstwhile Drought Monitoring Cell of the Karnataka Government) in the wake of the threat that looms large over India and many parts of the world due to natural calamities. As the human mind prides that it has understood many mysteries of the nature, the nature unfolds new challenges for man to comprehend and conquer. In his attempts to unravel the secrets of the natural events and to

grapple with them, man is always innovative and inventive in following the maxim—*necessity is the mother of invention*. The need to organize disaster management/mitigation centers was felt by all the concerned especially after the devastation caused in the wake of the Boxing day Earthquake off Sumatra.

It was a well thought of and well organized workshop by the Government of Karnataka who have taken the task seriously although the threat perception due to any of the