ABSTRACT

Historical records show that tsunami is frequent in the Arabian Sea, although they may not be as frequent as they are in Bay of Bengal. Recently great tsunamigenic earthquake of December 26, 2004 Andaman-Sumatra caused about 30,000 causalities. However, prior to this event there were no ideas about tsunami phases such as tsunamigenic sources, tsunami travel time, run-up height and inundation in the Indian Ocean. Therefore, this event had given a good prospect to study carry out on various aspects of tsunami that will be useful in assessing the tsunami hazard. These studies are past tsunamis in the Indian Ocean to identify tsunamigenic earthquake zones and their gap areas, numerical modeling of tsunamis, possible inundation map of coastal areas of Gujarat.

It is well known that past is the key for future. Hence, catalog is the basic requirement to assess the possible future source zones of tsunami generating earthquakes (possible seismic gap areas) in the Indian Ocean. A much needed and reliable catalog of tsunami in the Indian Ocean has been prepared from historical period, 326 BC to present 2009 AD. A map of tsunamis that affected the Indian region and vicinity is presented. For this study data sets considered from National Geophysical Data Center (NGDC); National Oceanic and Atmospheric Administration (NOAA), National Environmental Satellite Data and Information Service (NESDIS), Indian National Center for Ocean Information Services (INCOIS) and from earlier publications. This map needs to be improved by putting more reliable and historic tsunami data.

Once identification of tsunamigenic earthquake zones, we have taken a case studies such as Makran source zone to simulate the tsunami. It is further recognized by us that the western and eastern parts of the Makran subduction zone (MSZ) are tsunami
potential zones that can affect western coast of India. Therefore, simulations have been performed for tsunami generating earthquakes from these zones to estimate tsunami phases. NAMI-DANCE numerical model has been used to simulate 1945 Makran tsunamigenic source. To the best of our knowledge the NAMI-DANCE techniques has not done till date in the study area. Fault parameters have been taken from Byrne et al. (1992) published in Journal of Geophysical Research. The bathymetry data are taken from General Bathymetric Chart of the Oceans (GEBCO) and land topography data were collected using Shuttle Radar Topography Mission (SRTM). The present simulation is carried out for duration of 360 min. It is observed that the maximum calculated tsunami run-ups were about 0.7-1.1 m along the coast of Oman, 0.5 m near Muscat, 0.1 m near Sur, 0.7-1.35 m along the western coast of India, 0.5-2.3 m along the southern coast of Iran and 1.2-5.8 m along the southern coast of Pakistan. After the tsunamigenic earthquake, the tsunami wave reached the Gulf of Kachchh in about 240 min, Okha in about 185 min, Dwarka in about 150 min, Porbandar in about 155 min, Mumbai in about 300 min and Goa in about 210 min. The calculated 2-hr tsunami travel time to the Indian coast is in good agreement with the available reports and published data. If the tsunami strikes during high tide, we should expect more serious hazards which would impact local coastal communities.

The results obtained in this study are converted to be compatible with the geographic information system based applications for display and spatial analysis of modeling results. The paper also presents classification of tsunami risk zones based on elevation vulnerability. We expect that the results presented here will be supportive to the tsunami emergency response system and useful in planning the protection measures due to tsunami.
Results of these above studies will be valuable in planning the protection measures against inundation due to tsunami and in the implementation of a tsunami early warning system. The work presented in present thesis useful for geoscientists, oceanographers and researchers for tsunami hazard study.