

## Future earthquakes and other natural hazards: Impact on people living in the Ganga basin

Common people never expected that a big earthquake of magnitude 9 can occur in Sumatra followed by another earthquake of magnitude 7.5 in the Andaman and Nicobar islands that can generate an intense tsunami killing about 200,000 people and making millions of people homeless who were living along the coastal areas of nine countries. There is no tsunami-early-warning system at or around the nine affected countries. Who should be blamed! The IUGG, UNESCO, UN, ISDSR, UNEP and other international organizations are concerned with various kinds of natural disasters but it is surprising that these agencies have never expressed their concern for monitoring a tsunami in the Bay of Bengal and the Indian Ocean. The tsunami associated with the two recent earthquakes (Sumatra and Andaman Nicobar, 26 December 2004) clearly shows ignorance on the part of various international agencies. Although these agencies have prepared Global Seismic Hazard Maps (GSHM), no agency has ever anticipated that a tsunami can cause such a disaster.

The recent paper by Ortiz and Bilham<sup>1</sup> provides an account of the damages caused by a tsunami and its impact on the coastal areas of India, Myanmar, Malaysia and Indonesia associated with the Nicobar earthquake of 31 December 1881. After reading this paper, I wonder as to why the various international committees related to disasters never thought of a tsunami. There is a need to debate all aspects while preparing vulnerability maps and also update these maps within every 10 years for our national committee on disasters. The recent deadly tsunami disaster could have been avoided if the International agency (Global Seismic Hazard Assessment Program of the International Lithosphere Program) responsible for preparing global seismic hazard map could have considered all the parameters while preparing this map.

All the International agencies after the Sumatra earthquake, have brought out statements (see <http://www.iugg-georisk.org>, <http://www.iugg.org/jan05a.html> and [http://www.iugs.org.iugs.news.iugs\\_hazards\\_statement.htm](http://www.iugs.org.iugs.news.iugs_hazards_statement.htm)). Further, the Geo-Risk Commission has noted that before such a warning system is in operation in the region, the Pacific Tsunami Warning Center in Hawaii, USA should extend its warnings to cover all vulnerable areas in the Indian Ocean. The IUGG which covers seven sections of earth, ocean and atmospheric sciences has come up with the following recommendations (<http://www.iugg.org/jan05a.html>):

That systems and procedures be prescribed for early warning, public awareness, regional evacuation routes and shelters based on charts of natural hazards, vulnerability and risk assessment.

That regional disaster management centers be established where they do not now exist to catalogue information on the population and infrastructure at risk, and to monitor land, ocean and atmosphere in relation to all kinds of natural hazards.

That regional tsunami warning systems be set up in order to generate and disseminate timely and accurate information needed by decision makers and the public.

That multidisciplinary and multinational research programs and research networks on geophysical hazards and risks be developed to integrate diverse data streams, to improve understanding of the natural phenomena associated with the disasters, and to develop predictive modelling capability.

With respect to earthquake hazards in India, Bilham *et al.*<sup>2</sup> show that not a major earthquake of magnitude 8 has occurred after 1950 in Assam region. They have identified a seismic gap region in the part of western Nepal for a major earthquake of magnitude 8 in the Himalaya. The historical earthquakes in the Himalayan re-

gion have caused very little damage to cities lying in the Ganga basin but now due to growing urbanization similar earthquakes can take lives of millions of people (see <http://cires.colorado.edu/~bilham/indexHimEq.html>). About 500 million people live all along the Himalayan region in the Indo-Gangetic basin. It is high time the Indian Government reviews the future earthquake hazard when the periodicity of a major earthquake is not well known and when a major earthquake in this region has occurred about 50 years ago. A strong need for deployment of broadband seismographs in the Ganga basin from Delhi to Kolkata has been felt by the scientists who had attended Hazards 2004 Conference in Hyderabad (India). The Indian Government must review its disaster program especially when urban population in the Ganga basin is increasing and immediately deploy network of broadband seismographs to monitor the seismicity of the Himalayan region.

Further, special attention is immediately needed for the 500 million people living in the Indo-Gangetic basin who are vulnerable to the Natural Hazards. These people are vulnerable to various catastrophes, apart from earthquakes, such as floods, snow avalanches, landslides, forest fires, cloudbursts, droughts, dust storms, air pollution and epidemics.

1. Ortiz, M. and Bilham, R., *J. Geophys. Res.*, 2003, **108**, B5, doi: 10.1029/2002JB001941.
2. Bilham, R., Gaur, V. K. and Molnar, P., *Science*, 2001, **293**, 1442–1444.

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