

## 6. The December 26, 2004 Tsunami Disaster in Indian Ocean

### 6-1. Overview of the Earthquake and Tsunami

On Sunday morning, December 26, 2004, a devastating earthquake of the magnitude of 9.0 on the Richter scale (reported by USGS: United States Geological Survey) occurred at 07:58 (Local Time/Western Indonesia Standard Time, UTC+0700), off the western coast of Northern Sumatra, Indonesia. The hypocenter was located at 3.307 N, 95.947 E and some 10 km under the seabed. This part is known as the subduction zone which the Indo-Australian Plate is thrusting under the Eurasia Plate. This earthquake is considered as a typical “reverse fault” one at the plate boundary.

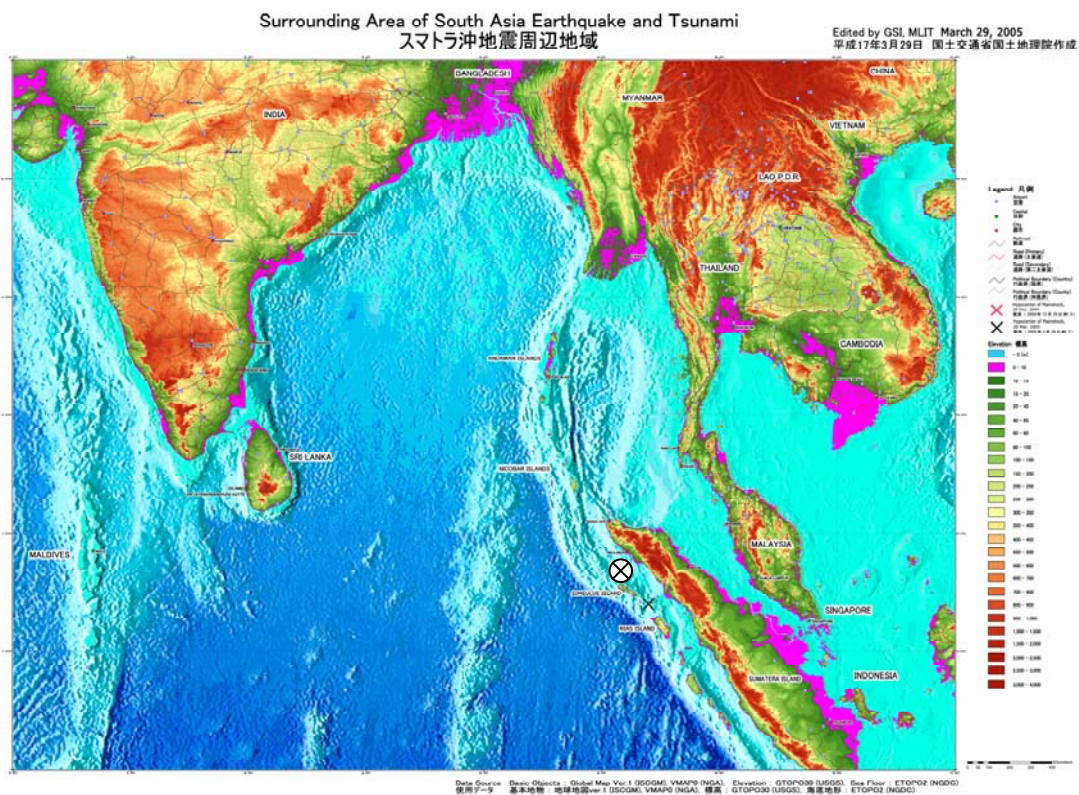


Fig. 6-1-1 Bathymetry and land topography in South Asia  
The point “⊗” is an epicenter of the earthquake on 26 December, 2004 (M9.0).  
The point “×” is an epicenter of the earthquake on 28 March 2005 (M8.7).  
(Developed by the Geographical Survey Institute of Japan)

The aftershocks of the earthquake on December 26, 2004 were distributed toward the north of the main quake, along the Andaman and Nicobar Islands (Fig. 6-1-2), according to the USGS observations and reports. The length of the earthquake fault ran over 1,000 km from north to south and triggered deadly powerful tsunamis which propagated mainly toward the east and west directions (Fig. 6-1-3).

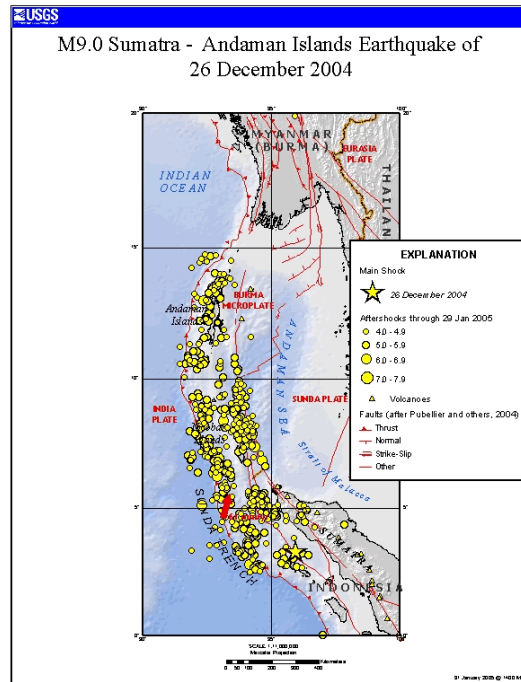


Fig. 6-1-2 The main shock and distribution of aftershocks (until January 29 2005, first 35 days) determined by the USGS.

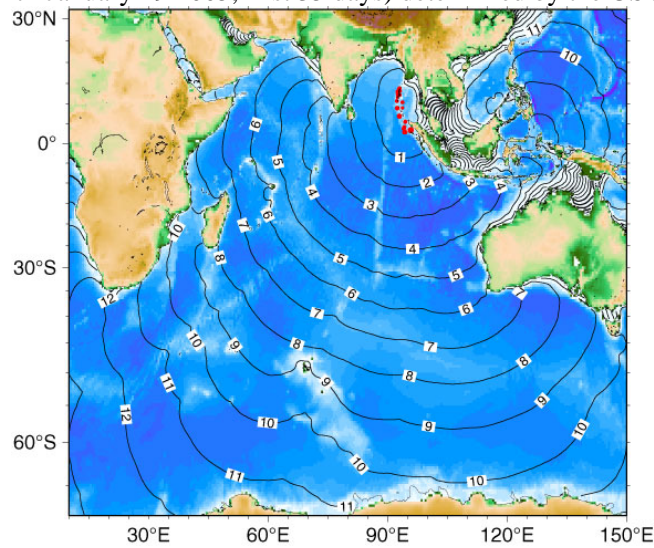


Fig. 6-1-3 Estimated tsunami arrival times (every one hours) based on computer simulation (Developed by Dr. K. Satake, Active Fault Research Center, National Institute of Advanced Industrial Science and Technology, Japan)

There were no reports regarding the direct damage by the ground motion, except the one from Ache, Indonesia. (The Andaman and Nicobar Islands might also have been damaged by the ground motion before the tsunami. However, there were no detailed reports on this matter.) The ground motion was attenuated quickly with distance from the seismic source area. So, many people were attacked by the tsunami without any strong ground motion in advance. The length of the affected coastlines is considered to exceed 15,000 km (Fig. 6-1-4). An international research group found the traces of a tsunami 40 m high or over along the west coast of Sumatra. This is the most severely affected site because it is located very close to the hypocenter of the earthquake. A tsunami higher than 10 meters was also observed at the western coast of Thailand. The tsunami reached the maximum height of 2 to 6 meters in Sri Lanka, India, Malaysia and Myanmar. Bangladesh, Maldives, Somalia, Kenya, Tanzania, Seychelles, and Madagascar also reported tsunami heights of 1 to 3 meters. (Each tsunami height is based on the



interim report.) Every affected area was hit by the tsunami several times.

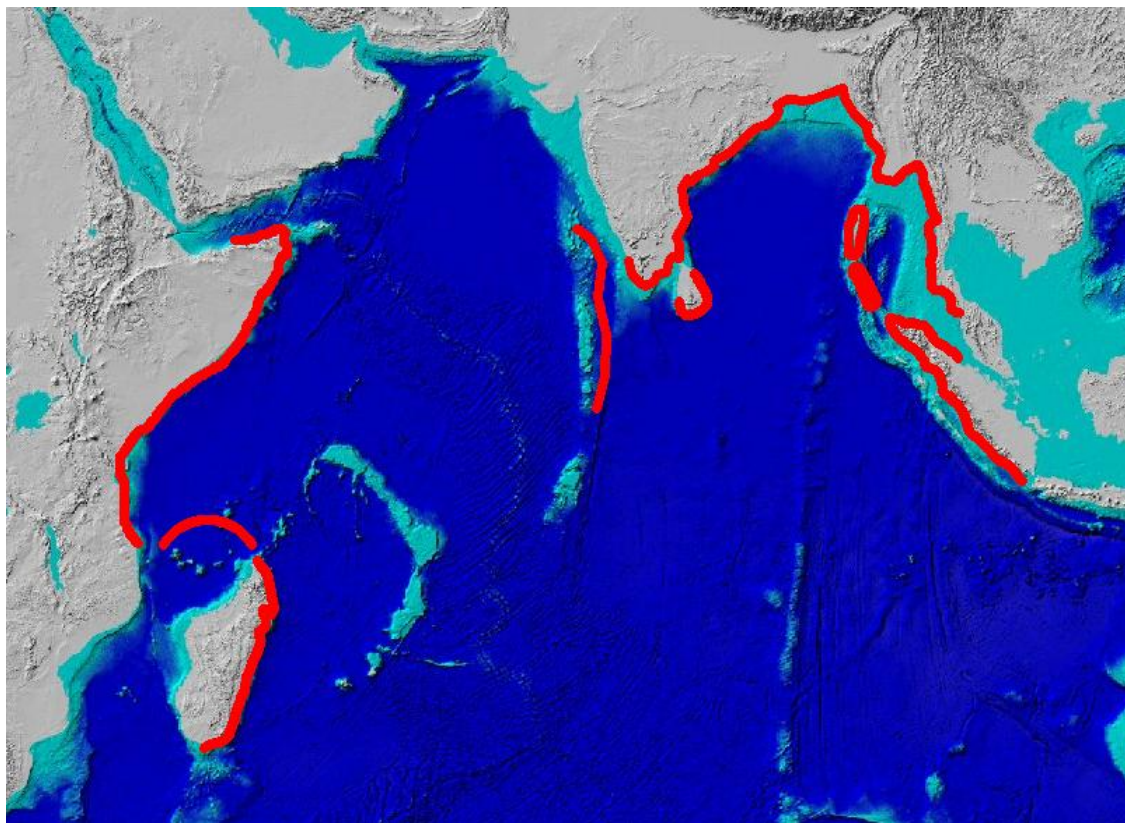


Fig. 6-1-4 Major coastal areas attacked by tsunami  
(Edited by the ADRC based on the GIS data developed by ESRI)

The damage assessment process faced difficulties. For example, this wide-area disaster affected over 10 countries around the Indian Ocean. The traffic network and communication systems in these areas were destroyed. Some of the affected areas are politically unstable.

At first, the number of the dead and missing was estimated to exceed 280,000. Then, in April 2005, the Government of Indonesia reported that the number of missing people were 37,063, not 93,458. Now, the total number of the dead and missing is over 220,000.

The affected regions are principally the developing countries. It is difficult to assess the impact by the disaster based only on the total amount of economic damages. To evaluate the actual impact on each society, the ADRC calculated the economic damages (interim)/GDP ratio in each severely affected country (Table 6-1-1). The calculation result showed that the total amount of economic damage in Maldives was smaller than that in Indonesia, Sri Lanka or India, nearly equal to that in Thailand. However, the damage in Maldives was the worst in terms of the damage/GDP ratio

Table 6-1-1 International comparison on the economic damages (interim) / GDP ratio

Country	Economic Damage (US\$)	GDP(2002) (US\$)	Economic Damage / GDP
Maldives	410,000,000	626,249,019	65.47%
Sri Lanka	1,000,000,000	16,567,132,195	6.04%
Indonesia	4,505,000,000	172,911,305,030	2.61%
Thailand	405,200,000	126,905,108,610	0.32%
India	1,500,000,000	510,177,250,750	0.29%

(Source: CRED EM-DAT, World Bank World Development Indicators)