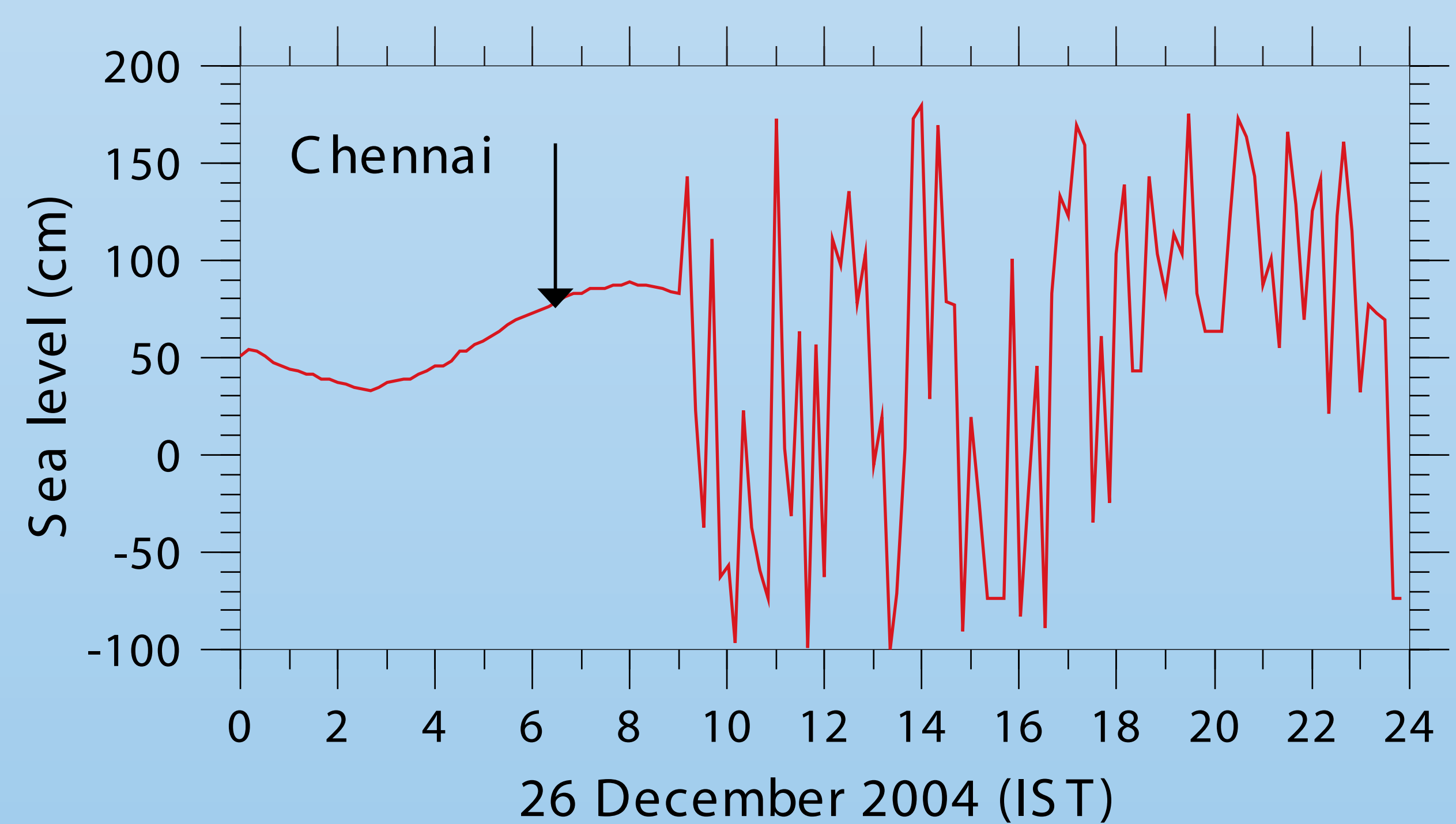


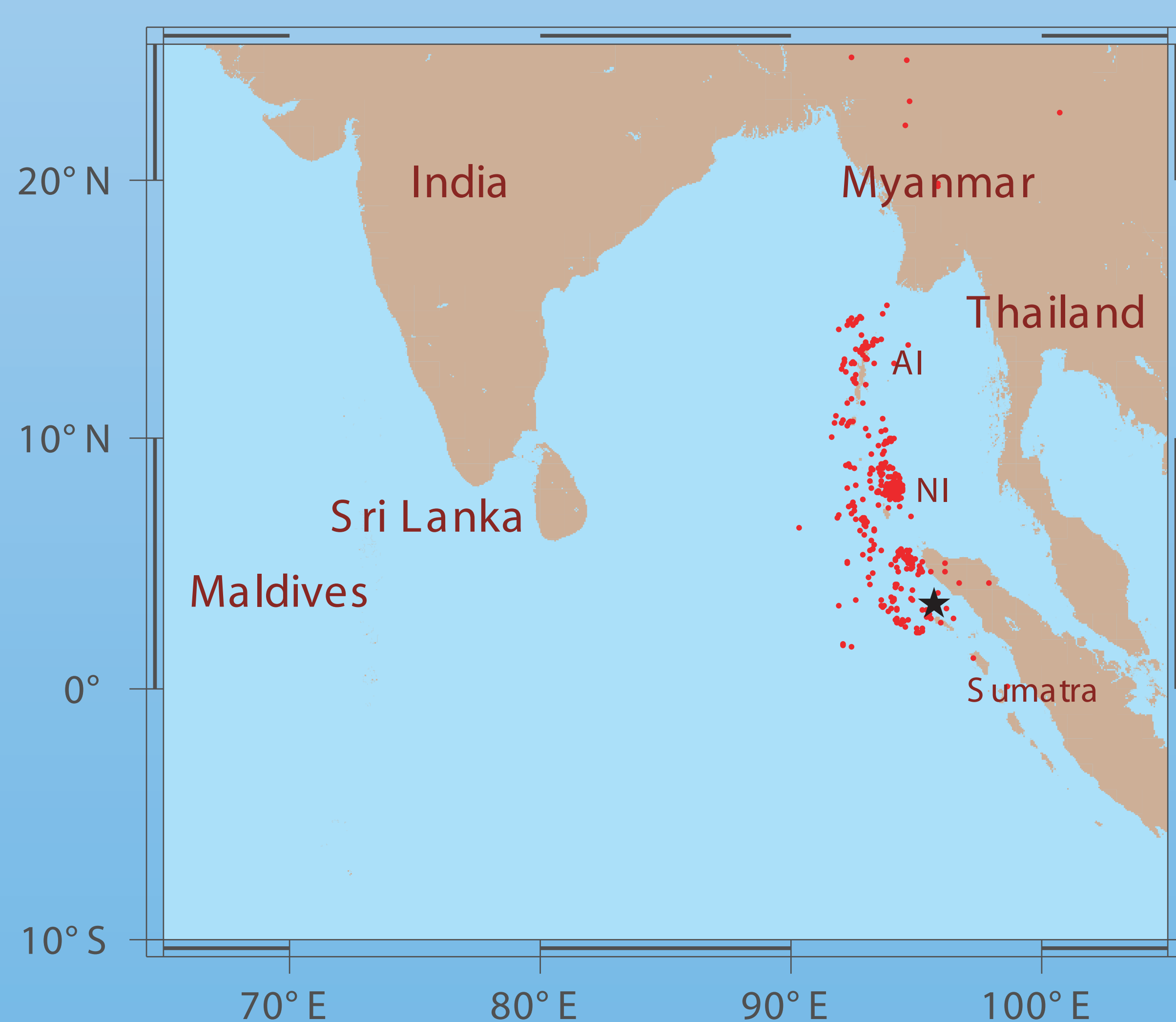
Tsunamis

- □ Tsunami is a Japanese word meaning "harbour wave(s)".
- □ Tsunamis are shallow-water waves, and therefore, like tides, they move in the open ocean at very high speeds.
- □ However, they have shorter wavelengths (ranging from 10-1000 km) and periods (100-3000 seconds).
- □ The surface perturbation due to a tsunami is small (usually less than half a metre) in the open sea and the particle (not wave) speed is a few cm/s, making them too insignificant for a passing ship to notice.
- □ When they approach a coast, however, tsunamis amplify owing to two changes. First, the decrease in depth implies that energy that was distributed over a larger depth in the open ocean now has to be squeezed into a smaller depth. Second, the decrease in depth leads to a decrease in the wave speed, and therefore in its wavelength. As a result, the energy has to be accommodated in a smaller horizontal distance too. This leads to an increase in wave height and particle velocity, which can exceed 7 m/s (~ 25 km/hr). The water level due to tsunamis rises and falls, and this goes on for about 2-3 days until the energy contained in the tsunami wave packet is exhausted and the ocean regains equilibrium.

- □ Tsunamis are caused by a large-scale perturbation of the ocean floor that displaces a huge volume of water. Three mechanisms can cause this:
 - *earthquakes* with epicentres located below the ocean floor
 - *mudslides* on the ocean floor, particularly on the continental slope
 - *volcanic eruptions* either on the ocean floor or on the nearby continent, can lead to a shaking of the ocean floor, or huge quantities of ash accompanying an explosion can flow rapidly on the ocean floor.
- □ Most tsunamis have been recorded in the Pacific, and submarine earthquakes are the major cause.
- □ Tsunamis are rare in the Indian Ocean: only 0.8% of tsunamis are recorded in the Bay of Bengal.



Tide-gauge sea level at Chennai. The arrow marks the time of the earthquake.



The black star marks the epicentre of the 26 December 2004 earthquake; the red dots mark the aftershock locations till 10 February 2005. The aftershocks are spread over the region affected by the quake. AI: Andaman Islands, NI: Nicobar Islands.

- On 26 December 2004, an earthquake of magnitude 9.3 (Richter scale) occurred at 0629 IST at 3.4°N, 95.7°E off the coast of Sumatra, Indonesia. This triggered the devastating tsunami that killed over 300,000 people in Indonesia, Sri Lanka, India, Thailand, Myanmar, and Somalia, making it the biggest killer tsunami on record.
- Signatures of the tsunami were recorded by tide gauges in India and in several other countries. The tsunami reached Chennai on the Indian east coast at 0900 IST, ~ 2.5 hours after the earthquake and tsunami perturbed the sea level from the normal rhythmic tidal variation.