

Tsunami Hazard and Risk Assessment along the Western Coast of Thailand

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Abstract

The primary motivation for the present study was, in the wake of the devastating 26 December 2004 Sunda-Andaman earthquake and tsunami, to assist the authorities in Thailand with development of plans for how to deal with the future tsunami risk in both short and long term perspectives. The study is centered on defining and analyzing a number of future scenarios (megathrust, M 8.5, 8.0 and 7.5) with associated return periods, each one accompanied by specific tsunami modeling.

Along the most affected part of the west coast of Thailand, the 2004 tsunami wave caused an inundation (flooding) level ranging along the coast from ~5 to 10-12 m above mean sea level. These levels and their spatial distributions have been confirmed by detailed numerical simulations. The source model used was developed based on available seismological inversions and subsequently adjusted based on a fine-tuning against the inundation observations.

Another conclusion from the study is that another megathrust earthquake affecting the coastline of Thailand is not likely to occur again for several hundred years. This is in part based on the assumption that the Southern Andaman Microplate Boundary near the Simeulue Islands constitutes a geologic barrier that will prohibit significant rupture across it, and in part on the decreasing subduction rates north of the Banda Aceh region.

It is also concluded that the largest credible earthquake to be prepared for along the part of the Sunda-Andaman arc that could affect Thailand, is in the short to medium term (say within the next 50-100 years) an earthquake of magnitude 8.5, which is expected to occur with more spatio-temporal irregularity than the megathrust events. Modeling has shown such earthquakes to cause tsunamis with an inundation level up to 1.5-2.0 m along the west coast of Thailand. For an M 8.5 earthquake and tsunami scenario, the potential consequences to human life and property will therefore be such that no immediate risk reduction measures are strictly required. However, in a longer time perspective (say more than 50-100 years) the potentials for earthquakes of similar magnitude and consequences as the 2004 event will become gradually larger and eventually posing an unacceptable societal risk. With the disaster fresh in mind the study has therefore recommended to take some mitigation measures immediately, including land-use planning, escape routes, building codes, etc.

These conclusions apply only to Thailand, since the effects of an M 8.5 earthquake in the same region could be worse for north-western Sumatra, the Andaman and Nicobar Islands, may be even for Sri Lanka and parts of the Indian coastline. Moreover, further south along the Sunda arc the potentials for large ruptures are now much higher than for the region that ruptured on 26 December 2004.