

# **Tsunami Source of the 2004 Sumatra-Andaman Earthquake Inferred from Tide Gauge and Satellite Data**

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The tsunami source of the 2004 Sumatra-Andaman earthquake was estimated from a joint inversion of tsunami waveforms recorded on tide gauges and sea surface heights captured by satellite altimetry measurements. The earthquake, the largest in the last 40 years, caused devastating tsunami damage to the countries around the Indian Ocean, but the tsunami source, particularly its northern end, was not well resolved. While the aftershocks and crustal deformation were extended from off northwestern Sumatra Island through Nicobar Islands to Andaman Islands, seismic wave analyses indicated shorter source length, several hundred km. We used tsunami waveforms recorded at 12 tide gauge stations around the source and the sea surface heights measured by three satellites: Jason-1, TOPEX and Envisat. We numerically computed the tsunami propagation on actually bathymetry; over 66, 000 depth points were digitized from nautical charts and combined with the ETOPO2 data. Inversion of satellite data indicated the tsunami source extended to Andaman Islands with the total length of 1, 400 km, but such a model would produce much larger tsunami waveforms than observed at Indian tide gauge stations. Inversion of tide gauge records and the joint inversion indicated that the tsunami source was about 900 km long. The largest slip, about 13 to 25 m, was located off Sumatra Island and the second largest slip, up to 7 m, near Nicobar Islands. The slip distribution is similar for different rupture velocities or rise time, while slow velocity of 1 km/s and rise time of 3 min yield the largest variance reduction. Finally, we compare the maximum coastal heights calculated from the tsunami source models with the results of tsunami-height surveys conducted around the Indian Ocean in order to examine the estimated tsunami source models.