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2010 年インドネシア，メンタワイ地震の津波波形インバージョン
Tsunami Waveform Inversion of the 2010 Mentawai, Indonesia Earthquake

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We performed a tsunami waveform inversion of the Mentawai, Indonesia earthquake (Mw 7.7, USGS) on October 25, 2010. The tsunami generated by this earthquake was about 4 to 7 m height and killed at least 445 on Mentawai Islands. Seismological analyses (e.g., USGS or NIED) indicate that this earthquake was tsunami earthquake with a long (~ 100 s) duration. The tsunami was recorded at tide gauge and DART stations located in and around the Indian Ocean. We downloaded the tide gauge and DART data from WCATWC's, IOC's and NOAA's web sites and inverted the tsunami waveform data recorded at 9 tide gauges in Indonesia, Cocos, Sri Lanka, Maldives and a DART station located at southeast from the source region.

In order to estimate the slip distribution on the fault, 8 subfaults (4 along strike by 2 downdip) are assumed with the each subfault size of 50 km x 50 km. The focal mechanism is strike of 326 deg, dip of 12 deg and slip of 101 deg for each subfault from the USGS's Wphase moment tensor solution. The top depths of the shallower and deeper subfaults are 3 km and 13.4 km, respectively. Static seafloor deformation (Okada, 1985, BSSA) is calculated for each subfault model as an initial condition for the tsunami numerical computation. We adopted a constant rise time (or slip duration) of 30 s for each subfault. In order to calculate Green's functions from each subfault to the stations, the linear shallow-water equations were numerically solved by using a finite-difference method (Satake, 1995, PAGEOPH). For the far filed stations, we used a basic bathymetry grid of 2 arc-minute with finer grids of 24 arc-second around tide gauges, resampled from GEBCO_08 30 arc-second grid data. For the near field stations (Padang, Enggano, Tanahbalah and Telukdalam in Indonesia), an uniform grid of 12 arc-second was used, which was also resample form GEBCO_08.

The inversion indicates that large slips more than 2 m are located at the shallower subfaults near the trench, a feature similar to other tsunami earthquakes (e.g., Satake and Tanioka, 1999, PAGEOPH; Fujii and Satake, 2006, GRL). The total seismic moment is 4.3 x 10^{20} Nm (Mw 7.7) and the fault length is about 150 km. The synthetic tsunami waveforms generally agree with the observed ones. However, we found that the observed tsunami at Padang is not well reproduced, which is more sensitive to the solution of the slip distribution than the other stations. More detailed tsunami modeling may be required to estimate a reliable tsunami source model, by updating the bathymetry data with nautical charts and adopting a finer grid to express the complicated shorelines.

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