



Potential tsunamigenesis from the threatened Mentawai Islands earthquake on the Sunda Trench

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Following the recent earthquakes in the Sumatra region, there is a significantly increased risk of a large ($M > 8$) earthquake to the west of Sumatra. The coseismic Coulomb stress increase due to the combination of the December 2004 and the March 2005 events is high under the island of Siberut and it has also been shown that the Sunda trench megathrust has been locked in this area since 1797 and has thus accumulated over 10m of strain. The megathrust under the Mentawai Islands south of Siberut has probably not slipped since 1833 which again suggests the possibility of on the order of 10m of slip. An event rupturing the megathrust beneath Siberut might be expected to propagate southward into this area resulting in a great earthquake of magnitude M 8-9. Here we show results for a range of possible tsunamis that might be produced by such an event. We produce a suite of stochastic slip simulations of slip for a large number of possible earthquakes of magnitudes between M 8.0 and 9.0 and construct a 3D finite element model of subduction under the Mentawai islands that incorporates realistic seafloor topography, trench geometry, and cross trench rheological variations. We then calculate the movements in the seabed which would result from each of these events and input these into a tsunami model as the initial condition: the hydrodynamic equations governing the tsunami wave propagation are then solved numerically using a finite-difference method. In this way the wave energy and maximum water level which can be expected everywhere in the circum-Indian ocean region from a range of possible earthquakes are computed and mapped.