

# **Tsunami risk in the Indian Ocean from threatened megathrust earthquake west of Sumatra**

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Several independent indicators imply a high probability of a great ( $M > 8$ ) earthquake rupture of the subduction megathrust under the Mentawai Islands of West Sumatra. The human consequences of such an event depend crucially on its tsunamigenic potential, which in turn depends on unpredictable details of slip distribution on the megathrust and how resulting seafloor movements and the propagating tsunami waves interact with bathymetry. Here we address the forward problem by modelling about 100 possible complex, scale invariant earthquake ruptures whose details have been constrained by reference to recent paleogeodetic data, to the location of historical earthquakes and to the interaction stresses from the 2004 and 2005 Sumatran earthquakes. We use a finite element model customised for the Sumatran forearc complex, to calculate the seafloor displacements which would result from each of these earthquake and use these displacements as boundary conditions for a tsunami wave simulation. We record tsunami wave height distributions through out the Indian Ocean which would result from them. Our results indicate a generally smaller regional tsunami hazard than was realized in Aceh during the December 2004 event, though more than 20% of simulations result in tsunami wave heights of more than 5m for the southern Sumatran cities of Padang and Bengkulu. These results will be of great importance in developing tsunami preparedness strategies around the Indian Ocean and in particular along the coasts of western Sumatra.