

Persistent Behaviour of the Sunda Megathrust in Sumatra: Opportunities to Forecast Destructive Earthquakes

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The 2000-km-long section of the Sunda megathrust from Myanmar to southern Sumatra has produced an extraordinary sequence of three great earthquakes in just the past 5 years. Modern geodetic measurements and records of relative sea-level change extracted from corals reveal enough about the variable behaviors of this long section of the megathrust to suggest that meaningful forecasts of future behavior are possible. For example, the southern portion of the M 9.2 rupture of 2004 appears to fail only about every 600 years or so. Ostensibly this implies that communities around the northern Bay of Bengal need not concern themselves about a repeat of the devastating 2004 tsunami anytime soon. However, at least near Aceh, Sumatra, the previous episode, about AD 1400, involved two large ruptures, only a few decades apart. Farther south, the section of the megathrust that ruptured in 2005 appears to have a much shorter recurrence interval, but the penultimate sequence there also involved more than one closely spaced large earthquakes. Still farther south, the 700-km-long Mentawai section has generated broadly similar sequences of great earthquakes about every two centuries for at least the past 700 years. That history strongly implies that the M 8.4 Mentawai earthquake of September 2007 represents the first in a series of large partial failures of the Mentawai section that will probably be completed within the next several decades. The nature of the remaining locked patch is well-enough constrained to estimate the nature of the tsunami generated by future failures of the Mentawai section. This particular forecast has generated a great deal of attention in at-risk coastal communities. But will these political, economic and social responses be an adequate response to this rather specific prediction?