

Learning from Earthquakes 2007 Sumatra, Indonesia, Earthquakes

The following report was prepared by Rich Briggs at the Caltech Tectonics Observatory.

Two large ruptures on the Sunda megathrust (M 8.4 and M 7.9) and dozens of large aftershocks (up to M 7.0) occurred on September 12 and 13 off the west coast of Sumatra, Indonesia. They are the most recent in a remarkable sequence of M 7.3 and greater earthquakes along the Sunda subduction zone since 2000. These recent events reflect progressive failure of the plate boundary, as the Indian and Australian plates subduct beneath Southeast Asia.

According to the NEIC, the M 8.4 rupture occurred 12 September UTC at 6:10 p.m. local time. NEIC data and the Global CMT solution show a hypocentral depth of ~23 km with an epicenter ~125 km offshore of Bengkulu. Slip along the megathrust is consistent with the shallow-dipping (12°) plane of the focal mechanism.

The M 7.9 event occurred on an adjacent section of the megathrust just over 12 hours later (6:49 a.m. local time, 12 September UTC), with a ~45 km deep hypocenter just off the coast of western Sumatra. A series of large aftershocks, including one M 7.0 beneath Sipora Island, are occurring near the edges and within the slip areas of the larger ruptures.

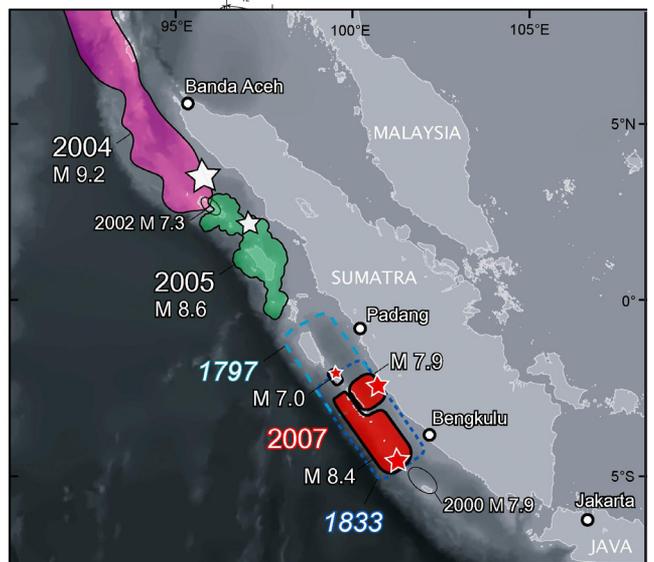
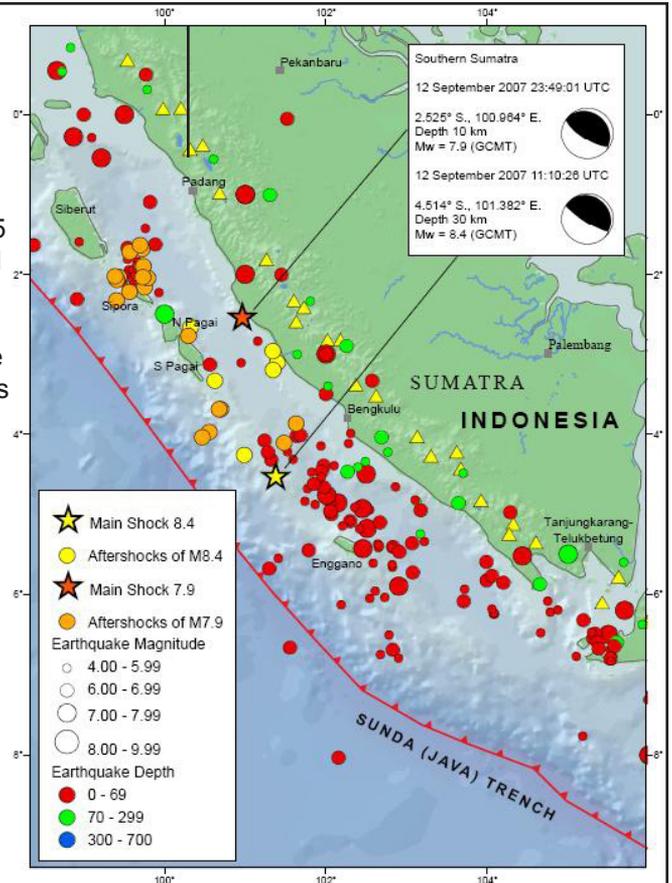
Cumulative damage from shaking that accompanied the ruptures is widespread along the western Sumatran coast and Mentawai Islands, and ranges from moderate to locally severe. A few dozen deaths have been reported so far. Bengkulu, Mukomuko, Padang, and the Mentawai Islands have reported thousands of heavily damaged structures, including many schools, hos-

pitals, and other public buildings. The United Nations Office for the Coordination of Humanitarian Affairs (OCHA) reports that 45,000 houses and 995 schools were damaged as of 17 September 2007; these data only partially reflect damage on the Mentawai Islands

Each rupture generated a tsunami. Fortunately, the waves were not destructive basin wide, and the large cities of Bengkulu and Padang appear to have been spared heavy damage. Information about locally destructive waves, several meters high, along the coast between Bengkulu and Padang, and on the Mentawai Islands, is just beginning to be reported.

Much of the plate boundary off Sumatra has now ruptured, but a large unbroken patch remains. The recent M 8.4 and M 7.9 ruptures occurred along a section of the megathrust that last ruptured in 1833, leaving a large portion of the 1797 rupture area to the north unbroken.

The fortuitous presence of outer arc islands has allowed for dense instrumentation of the rupture areas during the preceding decade by the Tectonics Observatory at Caltech, and ongoing geologic, geodetic, and seismologic studies are addressing the amount and location of slip during the recent events.



Figures: Historical ruptures and seismicity (available from NEIC at ftp://hazards.cr.usgs.gov/maps/sigeqs/20070912/mainmap_pg.pdf).

A more complete report on these earthquakes will be published in a future Newsletter.

