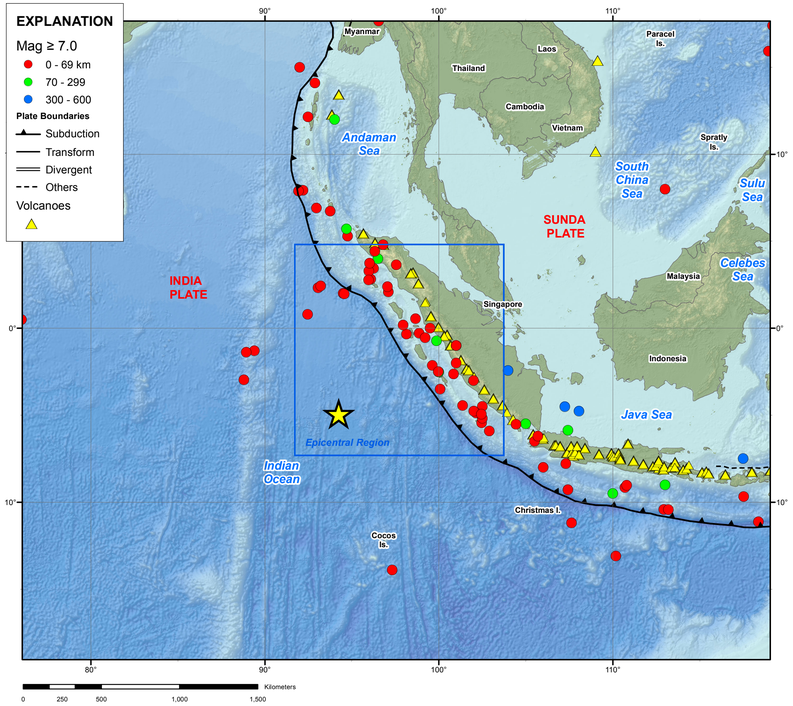
U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

EARTHQUAKE SUMMARY MAP

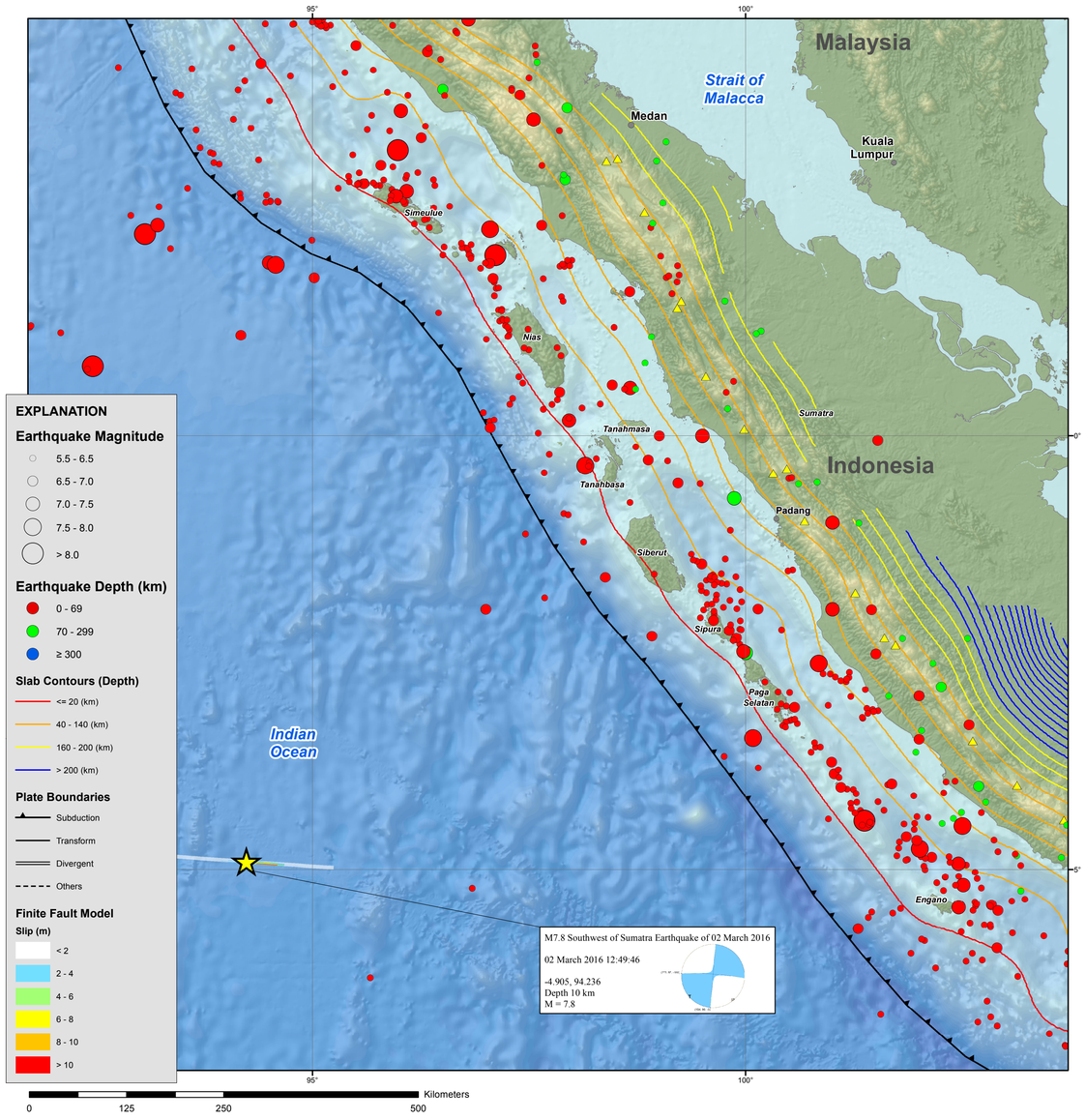
Prepared in cooperation with the Global Seismographic Network

M7.8 Southwest of Sumatra Earthquake of 02 March 2016

Tectonic Setting



Epicentral Region



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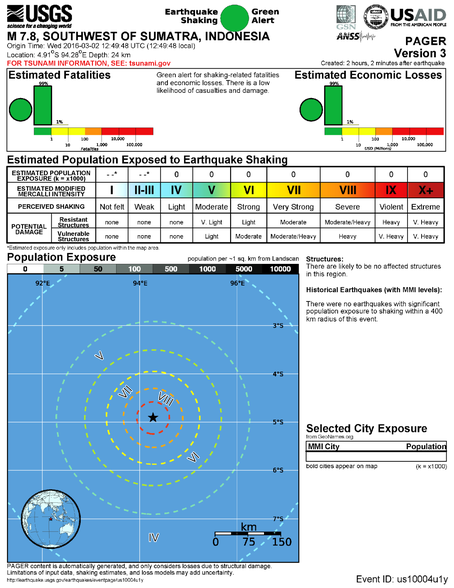
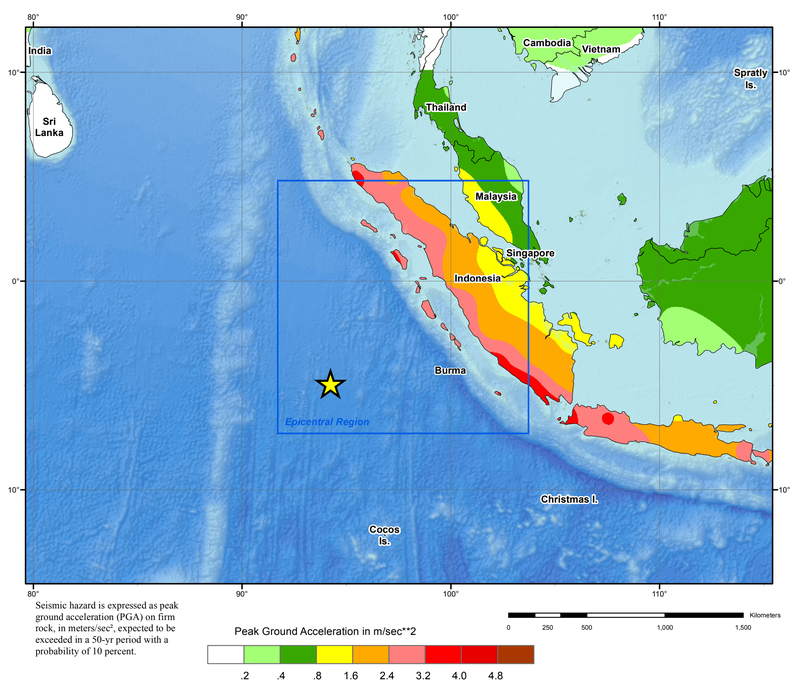
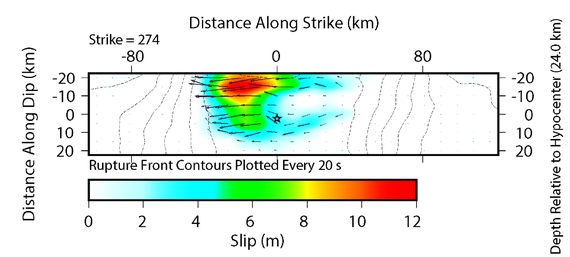


Seismic Hazard



Seismic hazard is expressed as peak ground acceleration (PGA) on firm rock, in meters/sec^2, expected to be exceeded in a 50-yr period with a probability of 10 percent.

Finite Fault Model



Distribution of the amplitude and direction of slip for subfault elements of the fault rupture model are determined from the inversion of teleseismic body waveforms and long period surface waves. Arrows indicate the amplitude and direction of slip (of the hanging wall with respect to the foot wall); the slip is also colored by magnitude.The view of the rupture plane is from above. The strike of the fault rupture plane is 274° and the dip is 84°N. The dimensions of the subfault elements are 9 km in the strike direction and 5 km in the dip direction.The rupture surface is approximately 35 km along strike and 20 km downdip. The seismic moment release based upon this plane is 6.0e+27 dyne.cm.

TECTONIC SUMMARY

The March 2, 2016 M 7.8 earthquake, 800 km off the west coast of southern Sumatra, Indonesia, occurred as a result of strike-slip faulting within the oceanic lithosphere of the Indo-Australia plate. This event is located 600 km to the southwest of the major subduction zone that defines the plate boundary between the India/Australia and Sunda plates offshore Sumatra. At this location, the India/Australia plates move north-northeast relative to the Sunda plate at a velocity of about 55 mm/yr. The deformation zone defining the defuse boundary between the India and Australia plates is nearby the March 2 earthquake.

Large strike-slip earthquakes are not unprecedented in the diffuse boundary region separating the India and Australia plates, southwest of the Sumatra subduction zone. In 2012, two events of M 8.6 and M 8.2 on the same day (04/12/2012) ruptured a series of oceanic strike-slip structures 650-850 km to the north of the March 3, 2016 event. On June 18, 2000, a M 7.9 earthquake ruptured an oceanic strike-slip structure about 1000 km southeast of the March 3, 2016 earthquake. The focal mechanisms of the all of these earthquakes are consistent in implying that each event could have occurred as the result of left-lateral slip on an approximately north striking fault or right-lateral slip on an approximately west striking fault. The two different orientations of strike-slip faulting are both possible under the same tectonic stress field; perpendicular strike-slip faults that are both compatible with the same stress field are called "conjugate faults". In 2012, in-depth studies of those major events showed that faults of both orientations were involved in their rupture processes, breaking a network of conjugate faults over an area of ~ 200x200 km in size in the Wharton Basin. Because of the remote locations of these oceanic earthquakes, such events rarely cause shaking-related fatalities (the 2012 M 8.6 event caused two). Similarly, strike-slip earthquakes do not typically generate tsunamis.

DATA SOURCES

EARTHQUAKES AND SEISMIC HAZARD
USGS, National Earthquake Information Center
NOAA, National Geophysical Data Center
IASPEI, Centennial Catalog (1900 - 1999) and extensions (Engdahl and Villaseñor, 2002)
EHB catalog (Engdahl et al., 1998)
HDF (unpublished earthquake catalog, Engdahl, 2003)
Global Seismic Hazard Assessment Program
Volcanoes of the World (Siebert and Simkin, 2002)

PLATE TECTONICS AND FAULT MODEL
PB2002 (Bird, 2003)
Ji, C., D.J. Wald, and D.V. Helmberger, Source description of the 1999 Hector Mine, California earthquake; Part I: Wavelet domain inversion theory and resolution analysis, Bull. Seism. Soc. Am., Vol 92, No. 4. pp. 1192-1207, 2002.
DeMets, C., Gordon, R.G., Argus, D.F., 2010. Geologically current plate motions, Geophys. J. Int. 181, 1-80.

BASE MAP
NIMA and ESRI, Digital Chart of the World
USGS, EROS Data Center
NOAA GEBCO and GLOBE Elevation Models

REFERENCES

Bird, P., 2003, An updated digital model of plate boundaries: Geochem. Geophys. Geosyst., v. 4, no. 3, pp. 1027-80.

Engdahl, E.R., and Villasenor, A., 2002, Global Seismicity: 1900-1999, chap. 41 of Lee, W.H.K., and others, eds., International Earthquake and Engineering Seismology, Part A: New York, N.Y., Elsevier Academic Press, 932 p.

Engdahl, E.R., Van der Hilst, R.D., and Buland, R.P., 1998, Global teleseismic earthquake relocation with improved travel times and procedures for depth determination;Bull. Seism. Soc. Amer., v. 88, p. 722-743.

DISCLAIMER

Base map data, such as place names and political boundaries, are the best available but may not be current or may contain inaccuracies and therefore should not be regarded as having official signifiance.

Map updated by U.S. Geological Survey National Earthquake Information Center
02 March 2016
http://earthquake.usgs.gov/
Map not approved for release by Director USGS