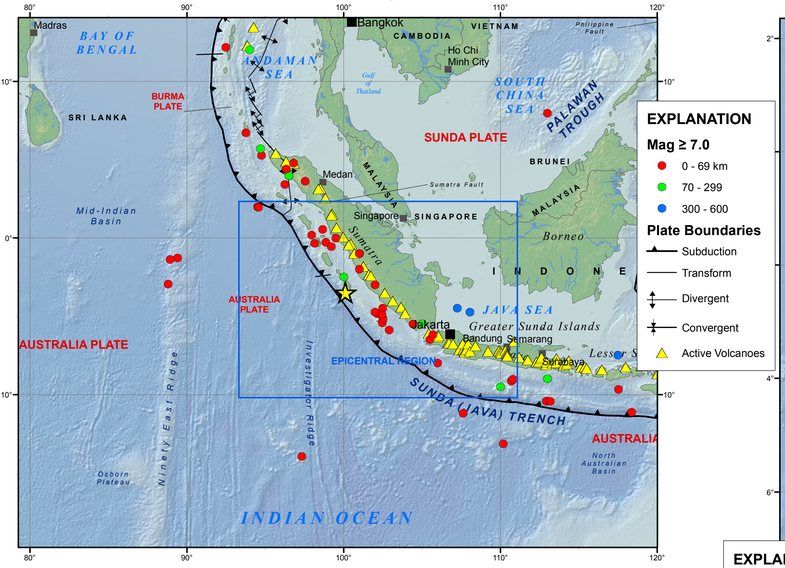
U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

Prepared in cooperation with the Global Seismographic Network
GSN

M7.7 Kepulauan Mentawai, Indonesia, Earthquake of 25 October 2010

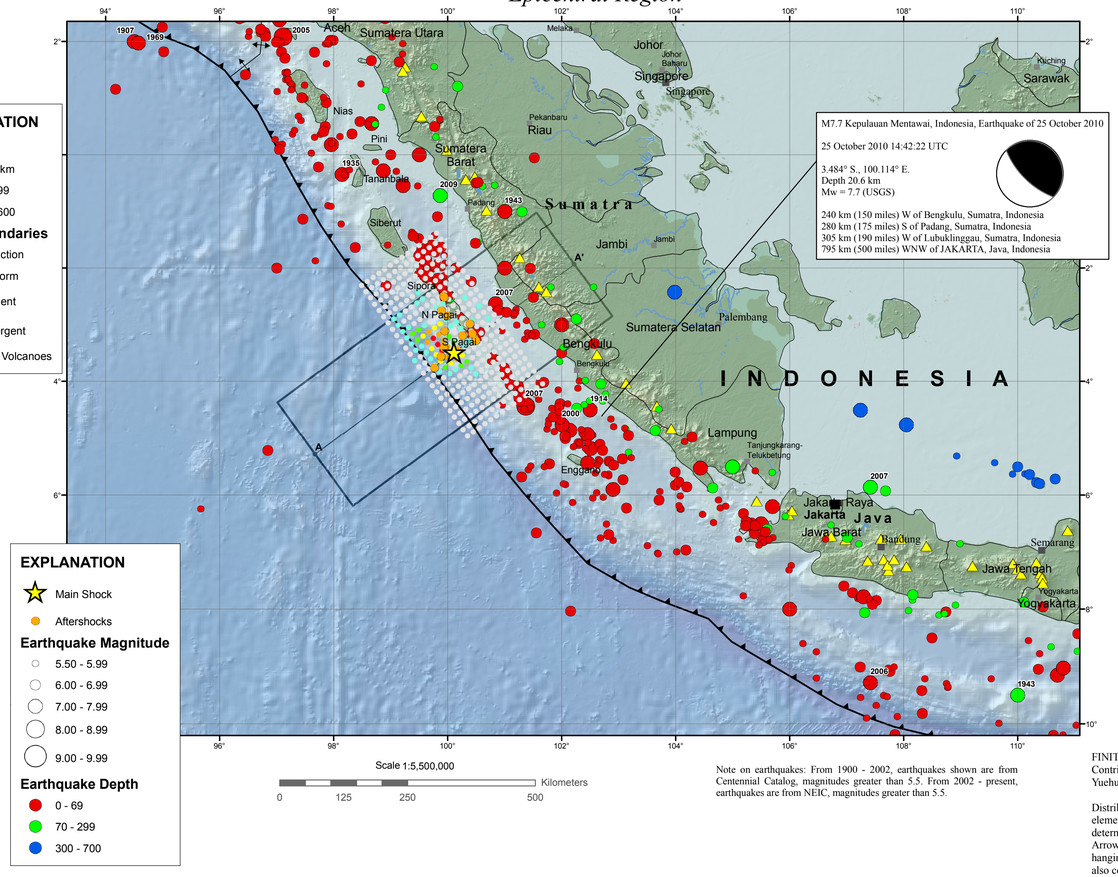
Tectonic Setting



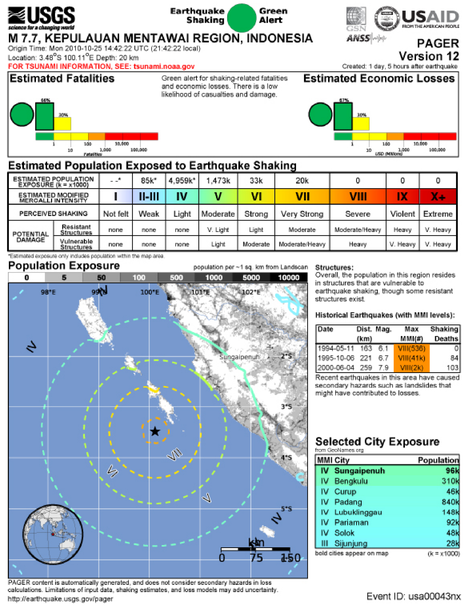
RELATIVE PLATE MOTIONS

Eastern Indonesia is a region of complex plate interactions. From a global perspective, eastern Indonesia consists of microplates whose relative motions absorb the convergence of the Pacific, Australia, and Eurasia plates.(Pacific Plate boundary is east of this map).

Epicentral Region



Note on earthquakes: From 1900 - 2002, earthquakes shown are from Centennial Catalog, magnitudes greater than 5.5. From 2002 - present, earthquakes are from NEIC, magnitudes greater than 5.5.



USGS science for a changing world — Earthquake Shaking Green Alert — USAID FROM THE AMERICAN PEOPLE — ANSS

M 7.7, KEPULAUAN MENTAWAI REGION, INDONESIA

Origin Time: Mon 2010-10-25 14:42:22 UTC (21:42:22 local)
Location: 3.48°S 100.11°E Depth: 20 km
FOR TSUNAMI INFORMATION, SEE: tsunami.noaa.gov

PAGER Version 12
Created: 1 day, 5 hours after earthquake

Estimated Fatalities

65% 20%
1 10 100 1,000 10,000 100,000
FATALITIES

Green alert for shaking-related fatalities and economic losses. There is a low likelihood of casualties and damage.

Estimated Economic Losses

51% 30%
1 10 100 1,000 10,000 100,000
USD (MILLIONS)

Estimated Population Exposed to Earthquake Shaking

ESTIMATED POPULATION EXPOSURE (k = x1000)	- -*	85k*	4,959k*	1,473k	33k	20k	0	0	0
ESTIMATED MODIFIED MERCALLI INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+
PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very Strong	Severe	Violent	Extreme
POTENTIAL DAMAGE: Resistant Structures	none	none	none	V. Light	Light	Moderate	Moderate/Heavy	Heavy	V. Heavy
POTENTIAL DAMAGE: Vulnerable Structures	none	none	none	Light	Moderate	Moderate/Heavy	Heavy	V. Heavy	V. Heavy

*Estimated exposure only includes population within the map area.

Population Exposure

population per ~1 sq. km from Landscan
0 5 50 100 500 1000 5000 10000

98°E 99°E 100°E 101°E 102°E
2°N 1°N 0° 1°S 2°S 3°S 4°S
Singaipenuh
IV V VI VII VIII
0 75 150 km

Structures:
Overall, the population in this region resides in structures that are vulnerable to earthquake shaking, though some resistant structures exist.

Historical Earthquakes (with MMI levels):

Date	Dist. (km)	Mag.	Max MMI(#)	Shaking Deaths
1994-05-11	163	6.1	VII(7,50)	0
1995-10-06	221	6.7	VIII(41k)	84
2000-06-04	259	7.9	VIII(2k)	103

Recent earthquakes in this area have caused secondary hazards such as landslides that might have contributed to losses.

Selected City Exposure
from Geonames.org

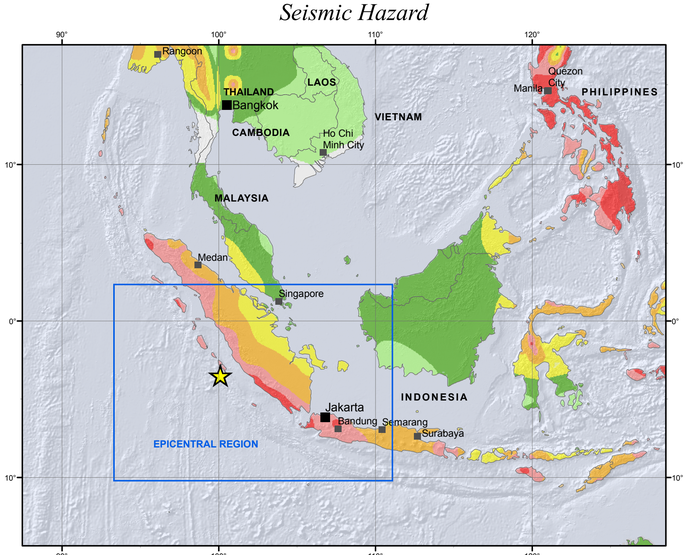
MMI	City	Population
IV	Sungaipenuh	96k
IV	Bengkulu	310k
IV	Curup	46k
IV	Padang	840k
IV	Lubuklinggau	148k
IV	Pariaman	92k
IV	Solok	45k
III	Sijunjung	28k

bold cities appear on map (k = x1000)

PAGER content is automatically generated, and does not consider secondary hazards in loss calculations. Limitations of input data, shaking estimates, and loss models may add uncertainty.
http://earthquake.usgs.gov/pager

Event ID: usa00043nx

Seismic Hazard



Seismic hazard is expressed as peak ground acceleration (PGA) on firm rock, in meters/sec², expected to be exceeded in a 50-yr period with a probability of 10 percent.

Peak Ground Acceleration in m/sec**2

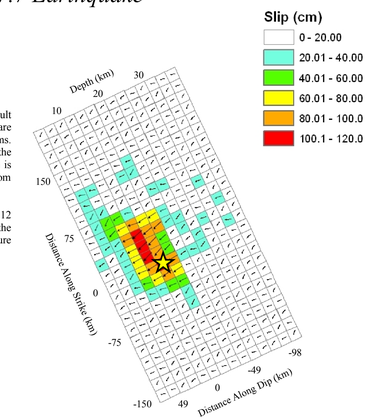
.2 .4 .8 1.6 2.4 3.2 4.0 4.8

Finite Fault Model for M7.7 Earthquake

FINITE FAULT MODEL
Contributed by
Yuehua Zeng and Gavin Hayes (NEIC), and Chen Ji (UCSB)

Distribution of the amplitude and direction of slip for subfault elements (small rectangles) of the fault rupture model are determined from the inversion of teleseismic body waveforms. Arrows indicate the amplitude and direction of slip (of the hanging wall with respect to the foot wall); the slip amount is also color-coded as shown. The view of the rupture plane is from above.

The strike of the fault rupture plane is N35W and the dip is 12 NE. The dimensions of the subfault elements are 15 km in the strike direction and 14 km in the dip direction. The rupture surface is 375 km along strike, and 196 km downdip.



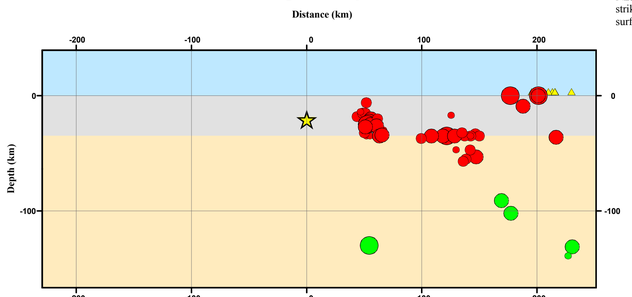
TECTONIC SUMMARY

The Pulau Pagai Selatan, Sumatra earthquake of October 25, 2010 occurred as a result of thrust faulting on or near the subduction interface plate boundary between the Australia and Sunda plates. At the location of this earthquake, the Australia Plate move north-northeast with respect to the Sunda plate at a velocity of approximately 57-69 mm/yr. On the basis of the currently available fault mechanism information and earthquake depth it is likely that this earthquake occurred along the plate interface. The subduction zone adjacent to the region of this event last slipped during the Mw 8.5 and 7.9 earthquakes of September 2007, and today's event appears to have occurred near the rupture zones of those earthquakes. Today's earthquake is the latest in a sequence of large ruptures along the Sunda megathrust, including a M 9.1 earthquake that ruptured to within 800 km north of this earthquake in 2004; a M 8.6 700 km to the north between Nias and Simeulue in 2005; and a M 7.5 300 km to the north near Padang in 2009. Today's earthquake occurred near the southern edge of a Mw 8.7-8.9 rupture in 1797 and within the rupture area of a Mw 8.9-9.1 earthquake in 1833.

Significant Earthquakes Mag >= 7.5

Year	Mon	Day	Time	Lat	Long	Dep	Mag
1907	01	04	0519	2.000	94.500	50	7.5
1914	06	25	1907	-4.500	102.500	0	7.6
1935	12	28	0235	-0.345	98.147	35	7.8
1943	06	09	0306	-1.000	101.000	50	7.5
1943	07	23	1453	-9.500	110.000	90	7.6
1969	11	21	0205	1.973	94.574	11	7.6
2000	06	04	1628	-4.762	102.007	34.6	7.9
2005	03	28	1609	2.085	97.108	30	8.6
2006	07	17	0819	-9.284	107.419	20	7.7
2007	08	08	1705	-5.859	107.419	280	7.5
2007	09	12	1110	-4.438	101.367	34	8.5
2007	09	12	2349	-2.625	100.841	35	7.9
2009	09	30	1016	-0.720	99.867	81	7.5
2010	10	25	1442	-3.484	100.114	20.6	7.7

Depth Profile



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 significance.

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 Villaseñor, 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 Academeic 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.

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)
HDF (unpublished earthquake catalog) (Engdahl, 2003)
Global Seismic Hazard Assessment Program

PLATE TECTONICS AND FAULT MODEL
PB2002 (Bird, 2003)
Finite Fault Model, Chen Ji, UC Santa Barbara (2007)

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

Map prepared by U.S. Geological Survey
National Earthquake Information Center
26 October 2010
Map not approved for release by Director USGS