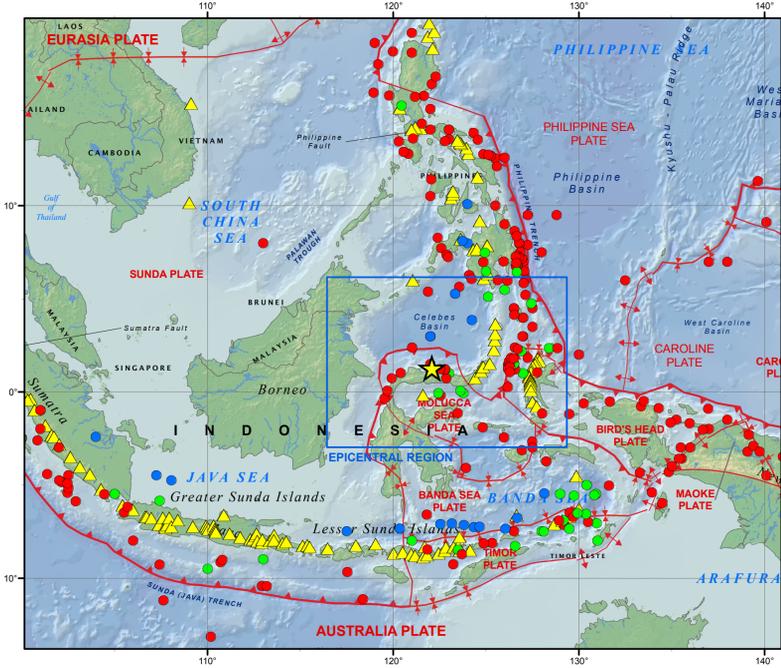


M7.4 Sulawesi, Indonesia, Earthquake of 16 November 2008



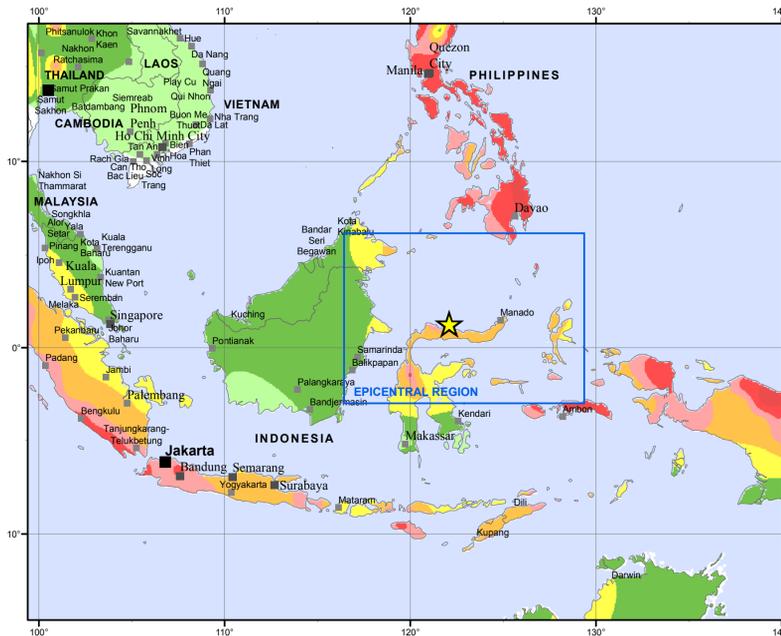
Tectonic Setting



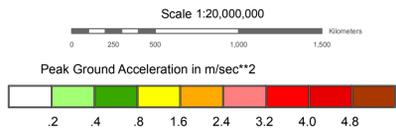
RELATIVE PLATE MOTIONS

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).

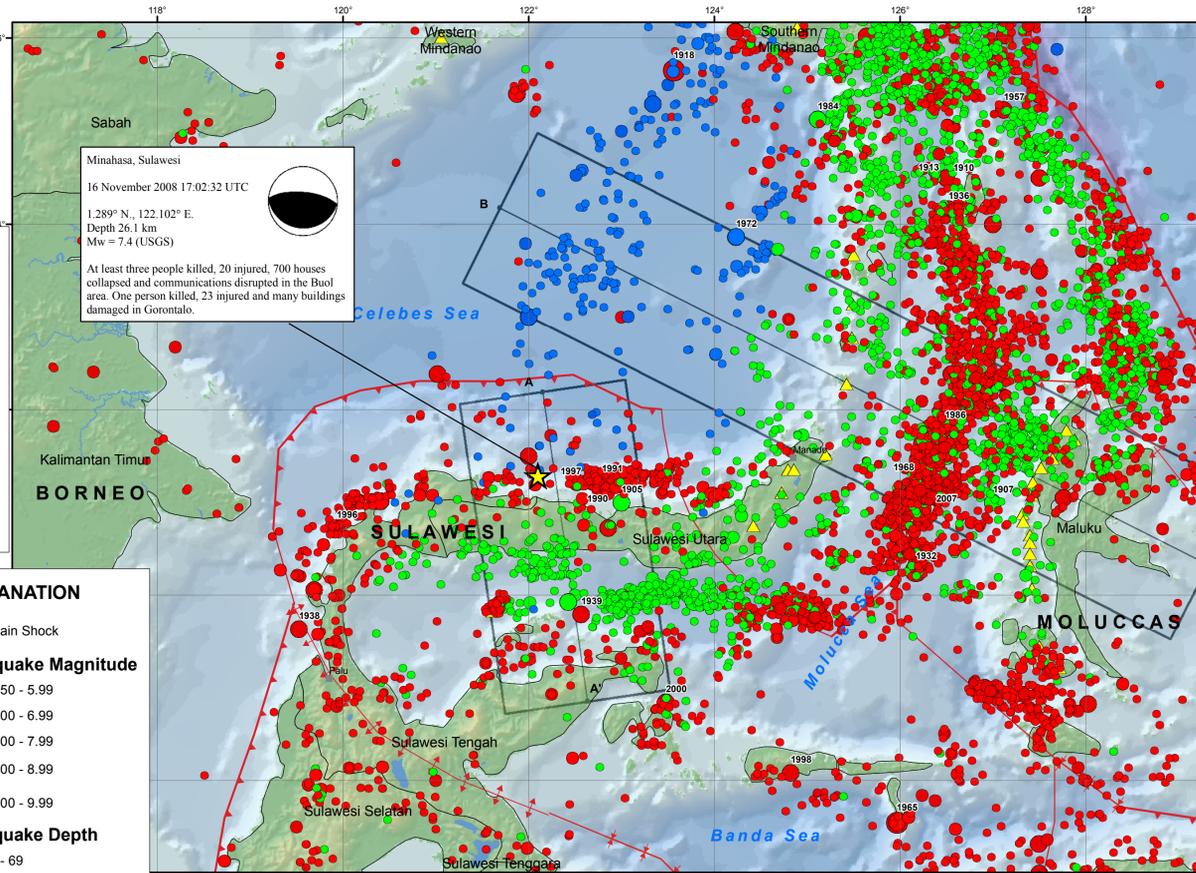
Seismic Hazard



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.



Epicentral Region



Minahasa, Sulawesi
16 November 2008 17:02:32 UTC
1.289° N, 122.102° E
Depth 26.1 km
Mw = 7.4 (USGS)

EXPLANATION
Mag ≥ 7.0
● 0 - 69 km
● 70 - 299
● 300 - 600
Plate Boundaries
— Subduction
— Transform
— Divergent
— Convergent
▲ Volcanoes

EXPLANATION
★ Main Shock
Earthquake Magnitude
○ 5.50 - 5.99
○ 6.00 - 6.99
○ 7.00 - 7.99
○ 8.00 - 8.99
○ 9.00 - 9.99
Earthquake Depth
● 0 - 69
● 70 - 299
● 300 - 700

TECTONIC SUMMARY

The magnitude 7.4 Sulawesi, Indonesia earthquake of November 16, 2008 occurred as a result of thrust faulting on a plate-boundary that is marked by the North Sulawesi trench, separating the Celebes Sea basin and the Minahasa peninsula. Eastern Indonesia is characterized by complex tectonics in which motions of numerous small plates are accommodating large-scale convergence between the Australia, Pacific, and Eurasia plates. At the location of today's earthquake, the Celebes Sea basin (commonly considered part of the Sunda plate) moves south with respect to the Minahasa peninsula (part of the Molucca sea plate) at a velocity of about 30 mm/year. The lithosphere of the Celebes Sea basin is thrust beneath that of the Minahasa peninsula and is seismically active to a depth of about 250 km. Earthquakes in the epicentral region having depths greater than 300 km (sections A - A' and B - B') are occurring in lithosphere that has been subducted from the east rather than in the southward subducting lithosphere of the Celebes Sea basin.

The earthquake occurred approximately 25 km off the northern coast of the Minahasa peninsula of the Island of Sulawesi in an area that has seen large earthquakes in the past. For example, a damaging magnitude 7.6 earthquake occurred on April 18, 1990 approximately 85 km east of today's earthquake. The magnitude 7.6 earthquake in 1990 was followed a year later by a magnitude 7.5 earthquake in approximately the same place. More recently a magnitude 7.0 occurred within 45 km of today's earthquake on November 25, 1997. The 1997 earthquake caused damage to at least 90 building in the Gorontalo area of northern Sulawesi.

Significant Earthquakes Mag >= 7.5

Year	Mon	Day	Time	Lat	Long	Dep	Mag
1905	01	22	0243	1.000	123.000	90	7.8
1907	06	25	1754	1.000	127.000	200	7.5
1910	12	16	1445	4.500	126.500	0	7.6
1913	03	14	0845	4.500	126.500	0	7.9
1918	08	15	1218	5.653	123.563	35	8.2
1932	05	14	1311	0.258	126.169	35	8.1
1936	04	01	0209	4.165	126.521	35	7.7
1938	05	19	1708	-0.366	119.525	49.4	7.5
1939	12	21	2100	-0.208	122.565	35	7.8
1957	09	24	0821	5.230	127.117	35	7.7
1965	01	24	0011	-2.455	125.965	28.4	8.2
1968	08	10	0207	1.422	126.260	19.6	7.6
1972	06	11	1641	3.866	124.236	330	7.8
1984	11	20	0815	5.129	125.114	167	7.5
1986	08	14	1939	1.805	126.485	30.9	7.5
1990	04	18	1339	1.186	122.799	26	7.6
1991	06	20	0518	1.226	122.789	32.5	7.5
1996	01	01	0805	0.725	119.932	24	7.9
1998	11	29	1410	-1.916	124.823	16	7.7
2000	05	04	0421	-1.153	123.478	26	7.6
2007	01	21	1127	1.065	126.282	22	7.5

DISCLAIMER

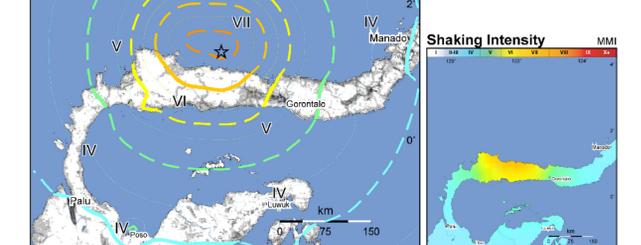
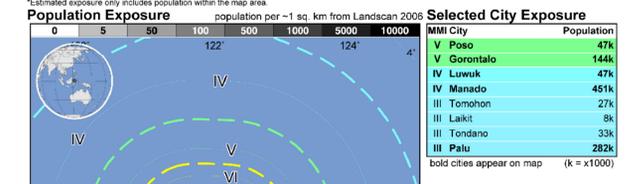
Base map data, such as place names and political boundaries, are the best available but may not be current or may contain inaccuracies and therefore should not be regarded as having official significance.

USGS
M 7.3, MINAHASA, SULAWESI, INDONESIA
Origin Time: Sun 2008-11-16 17:02:32 UTC
Location: 1.29° N 122.10° E Depth: 30 km

USAID
PAGER
Version 5
Created: 1 days, 1 hrs after earthquake

Estimated Population Exposed to Earthquake Shaking

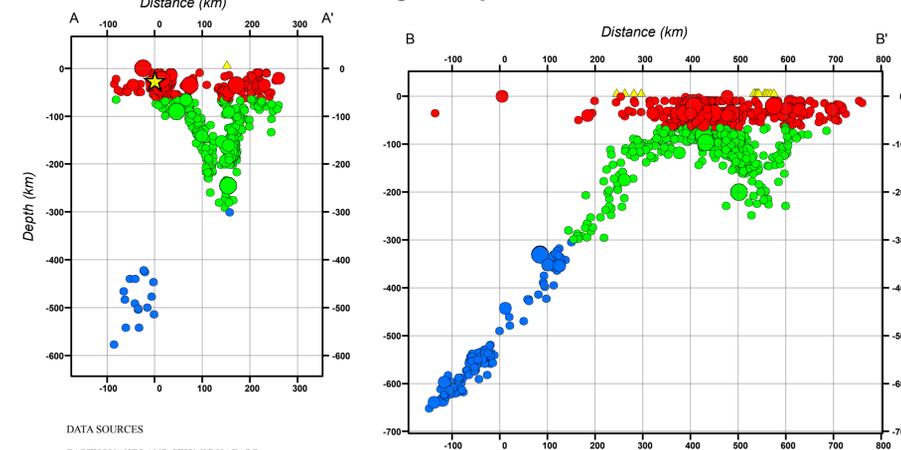
ESTIMATED POPULATION EXPOSURE (k = 1000)	0	1,272k	2,242k	835k	611k	120k	0	0	0
ESTIMATED MODIFIED MERCALLI INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+
PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	Resistant Structures: none	none	none	V. Light	Light	Moderate	Moderate/Heavy	Heavy	V. Heavy
	Vulnerable Structures: none	none	none	Light	Moderate	Moderate/Heavy	Heavy	V. Heavy	V. Heavy



Overall, the population in this region resides in structures that are vulnerable to earthquake shaking, though some resistant structures exist. A magnitude 7.5 earthquake and tsunami 311 km Northeast of this one struck Indonesia on May 04, 2000 (UTC), with estimated population exposures of 11,000 at intensity VIII and 154,000 at intensity VII, resulting in an estimated 46 fatalities. Recent earthquakes in this area have caused tsunamis that may have contributed to losses.

This information was automatically generated and has not been reviewed by a seismologist.
<http://earthquake.usgs.gov/pager> Event ID: us2008zbn

Depth Profiles



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 Villasehor, 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

REFERENCES

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

Engdahl, E.R. and Villasehor, 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.

Map prepared by U.S. Geological Survey
National Earthquake Information Center
20 November 2008
Map not approved for release by Director USGS