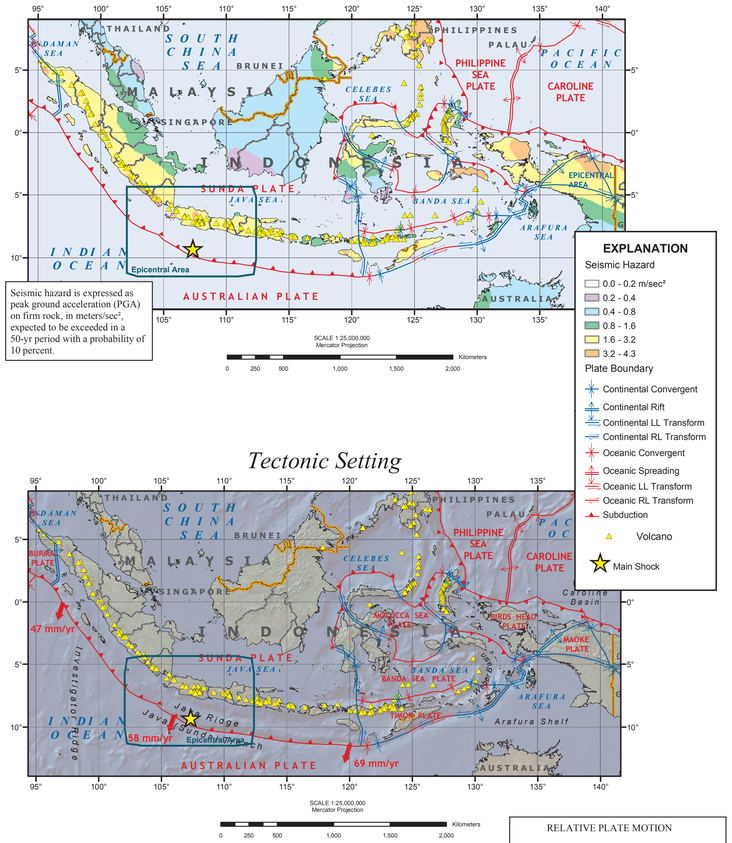
M7.7 Java, Indonesia Earthquake of 17 July 2006

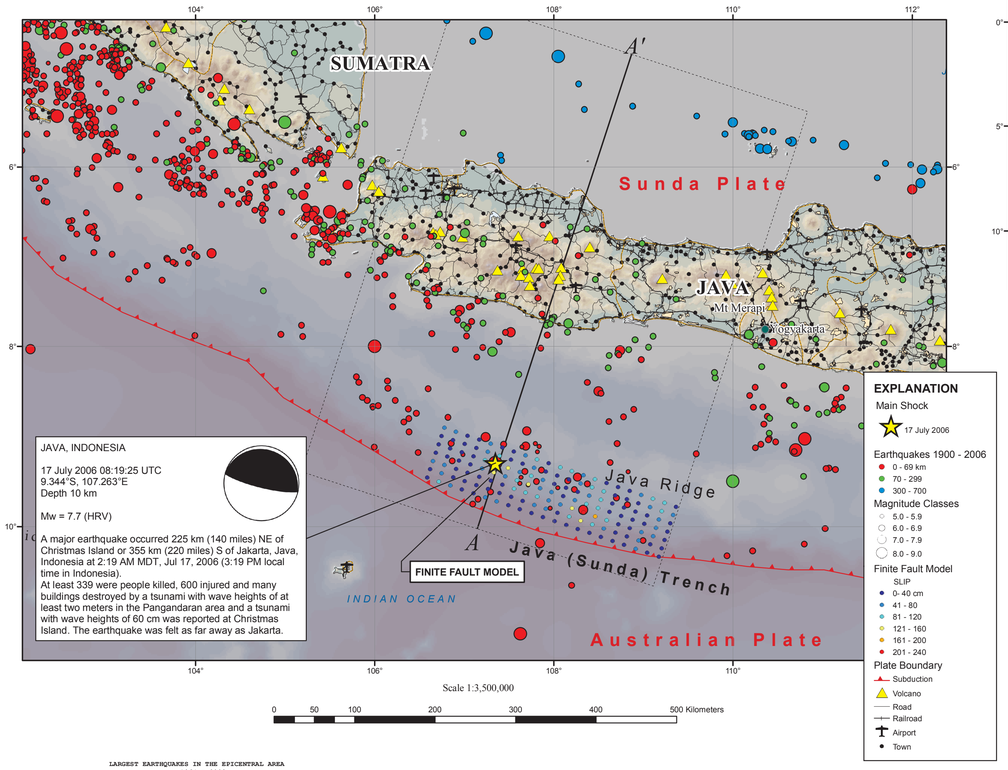
Generalized Seismic Hazard



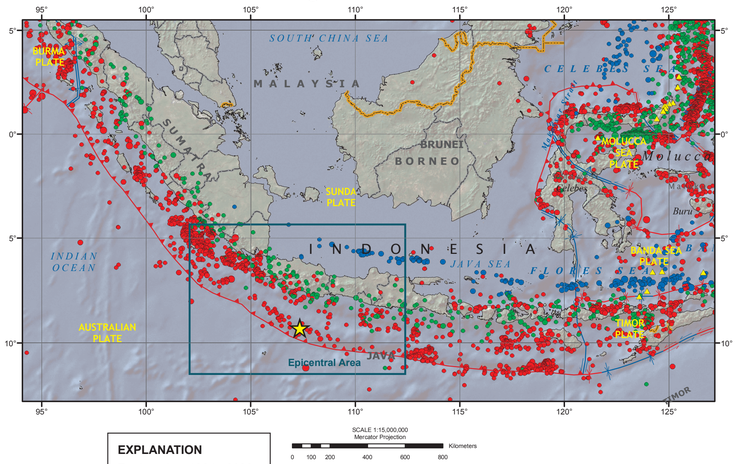
Seismic hazard is expressed as peak ground acceleration (PGA) on firm rock, in meters/sec², expected to be exceeded in a 50-yr period with a probability of 10 percent.

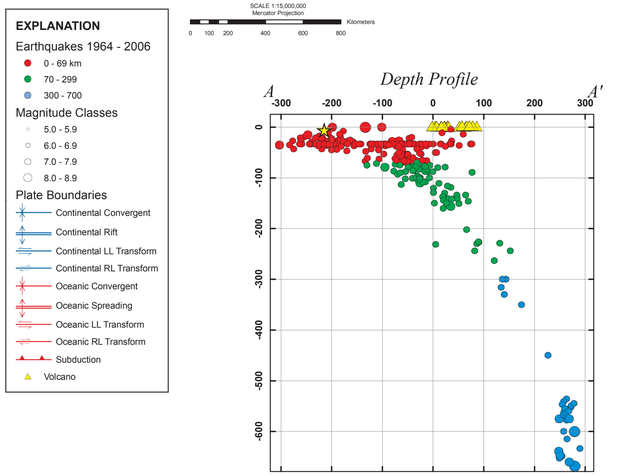
Tectonic Setting

Epicentral Area



Regional Seismicity





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HDF (unpublished earthquake catalog) (Engdahl, 2003)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
PB2003 (Bird, 2003)

VOLCANOES
Smithsonian Institution, Global Volcano Program

BASE MAP
NIMA and ESRI, Digital Chart of the World
USGS, EROS Data Center

RELATIVE PLATE MOTION

The relative motion of the Australian and Sunda tectonic plates is depicted on the Tectonic Setting map by solid vector arrows at selected locations along the boundary. Here, the Australian plate is defined as the reference plate. The vectors therefore represents the direction of motion of the Sunda plate relative to the Australian plate. The rates of relative motion are also shown. The vectors indicate that the Sunda plate is moving roughly south-southwest relative to the Australian plate at a rate that varies from about 47 mm/yr to 69 mm/yr.

In general, components of relative motion perpendicular and parallel to plate margins approximate convergent/divergent and transverse styles. All three component styles are shown on the Tectonic Setting map. Inward directed components indicate convergence at and near plate boundaries that may be expressed as crustal folding, uplift, thrust faulting, or plate subduction. Similarly, outward directed components indicate plate divergence as would be expected along zones of crustal spreading. A transcurrent component style, resulting in transform faulting, may occur when relative motion is parallel to the plate margin.

Features such as the Java (Sunda) Trench, deep earthquake foci (Regional Seismicity map), and line of volcanoes along the Australian-Sunda plate boundary are typical of subduction zones and convergent plate settings world wide.

LARGEST EARTHQUAKES IN THE EPICENTRAL AREA
1964 - 2002

YR	MO	DY	LAT	LON	DEPTH	MAG
1964	4	23	-5.420	133.939	6.1	6.4
1968	7	29	-0.291	133.499	32.7	6.1
1970	11	8	-3.418	135.624	2.3	6.2
1971	9	16	-5.971	130.697	133.0	6.4
1972	12	4	-1.513	136.639	1.4	6.1
1975	1	14	-4.942	130.021	16.4	6.0
1976	11	18	-4.193	135.116	3.6	6.5
1977	3	15	-4.976	131.036	75.7	6.2
1978	4	3	-4.884	133.956	6.4	6.3
1978	8	3	-0.157	131.785	40.5	6.4
1979	9	12	-1.686	135.969	18.5	7.6
1979	9	13	-1.166	136.430	17.9	6.1
1979	10	17	-1.171	136.535	18.4	6.1
1979	11	16	-1.951	134.170	37.8	6.1
1985	4	8	-4.050	136.259	18.3	6.0
1985	4	21	-5.151	130.430	91.0	6.0
1985	9	15	-4.065	136.093	4.4	6.4
1985	9	15	-4.120	136.287	11.1	6.3
1985	11	17	-1.634	134.434	26.5	6.0
1985	11	17	-1.671	134.937	11.8	7.3
1985	12	6	-1.623	134.918	19.9	6.0
1986	10	17	-5.283	131.453	58.1	6.4
1987	6	17	-5.599	130.835	67.0	7.1
1987	10	3	-5.467	131.023	74.0	6.4
1989	1	10	-3.170	130.500	32.0	6.7
1989	9	4	-4.253	136.713	9.0	6.4
1989	12	12	-4.671	130.821	74.2	6.1
1990	12	5	-5.269	131.446	75.0	6.1
1991	12	29	-4.407	132.665	42.5	6.4
1992	4	7	-4.161	130.961	51.0	6.0
1993	6	12	-4.357	135.175	10.0	6.1
1994	1	19	-3.205	136.000	23.0	6.8
1994	4	13	-3.159	136.005	29.0	6.5
1994	5	25	-4.182	135.520	15.0	6.5
1994	11	20	-2.011	135.962	16.0	6.3
1995	1	27	-4.445	134.442	22.0	6.8
1995	3	19	-4.143	135.118	26.5	6.9
1995	3	19	-4.236	135.051	19.0	6.1
1996	2	17	-0.558	135.804	19.0	6.5
1996	2	17	-0.811	136.096	32.0	6.5
1996	2	17	-0.871	136.128	32.0	6.5
1996	2	17	-0.918	136.971	36.0	8.2
1996	2	18	-0.665	136.550	20.2	6.3
1996	2	18	-1.360	136.487	11.0	6.4
1998	4	27	-2.965	136.275	24.0	6.1
1998	11	18	-3.332	130.757	31.2	6.0
1999	10	10	-2.056	134.245	10.0	6.1
2001	1	29	-0.710	133.250	14.0	6.2
2001	4	4	-5.265	132.290	17.0	6.4
2001	7	22	-5.216	132.322	38.4	6.0
2001	9	11	-0.618	133.115	31.1	6.5
2002	9	20	-1.675	134.281	24.0	6.4
2002	9	20	-1.747	134.054	9.0	6.0
2002	10	10	-1.432	133.966	15.8	6.0
2002	10	10	-1.493	134.056	48.8	6.0
2002	10	10	-1.526	133.996	36.7	6.7
2002	10	10	-1.711	134.311	16.0	7.7

From: Engdahl (2003, unpublished catalog)

DISCUSSION

The earthquake of 17 July 2006 occurred as a result of thrust-faulting on the boundary between the Australia plate and the Sunda plate. On this part of their mutual boundary, the Australia plate moves north-northeast with respect to the Sunda plate at about 59 mm/y. The Australia plate thrusts beneath the Sunda plate at the Java trench, south of Java, and is subducted to progressively greater depths beneath Java and north of Java. The earthquake occurred on the shallow part of the plate boundary, about 50 km north of the Java trench.

The region of the plate boundary between the Australia plate and Sunda plate is seismically highly active. From preliminary results, it appears that today's earthquake is similar to the earthquake of June 2, 1994, magnitude 7.8, which produced a tsunami that had a maximum run-up height of 13 m and killed over 200 people. That earthquake occurred south of Java about 600 km east-southeast of today's earthquake, also as a result of thrust faulting on the shallow plate boundary. On August 20, 1977, a magnitude 8.3 normal-fault earthquake occurred within the Australia plate about 1200 km east-southeast of today's earthquake, producing a tsunami that had a maximum run-up height of 15 m and killed almost 200 people. This year's (May 26) devastating Yogyakarta earthquake, magnitude 6.3, occurred at shallow depth within the overriding Sunda plate.

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.

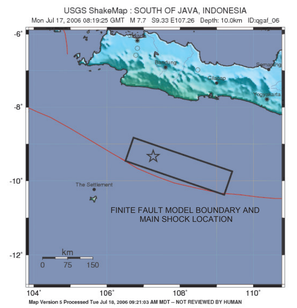
FINITE FAULT MODEL

Contributed by
C. Ji, California Institute of Technology

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 is from above, perpendicular to the fault plane.

The fact that the orientation of the finite fault plane may differ from the corresponding best double couple nodal plane depicted in the focal mechanism diagram on the main map reflects differing methods of analysis and data sets.

The strike of the fault rupture plane is N40°W and the dip is 11°. The dimensions of the subfault elements are 15 km in the strike direction and 12 km in the dip direction.



PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	none	none	none	Very light	Light	Moderate	Moderate/Heavy	Heavy	Very Heavy
PEAK ACC.(%g)	<.17	.17-1.4	1.4-3.9	3.9-9.2	9.2-18	18-34	34-65	65-124	>124
PEAK VEL.(cm/s)	<0.1	0.1-1.1	1.1-3.4	3.4-8.1	8.1-16	16-31	31-60	60-116	>116
INSTRUMENTAL INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+

Map prepared by U.S. Geological Survey
National Earthquake Information Center
30 May 2006
Map not approved for release by Director USGS