USGS

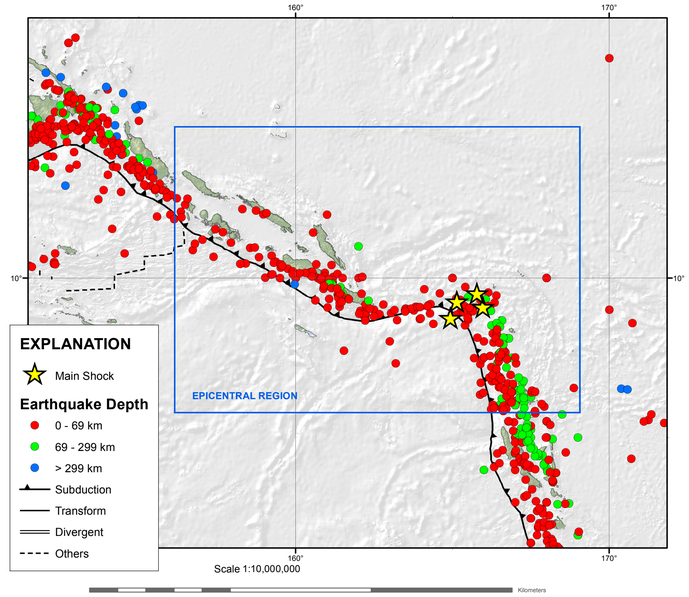
U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

EARTHQUAKE SUMMARY MAP XXX

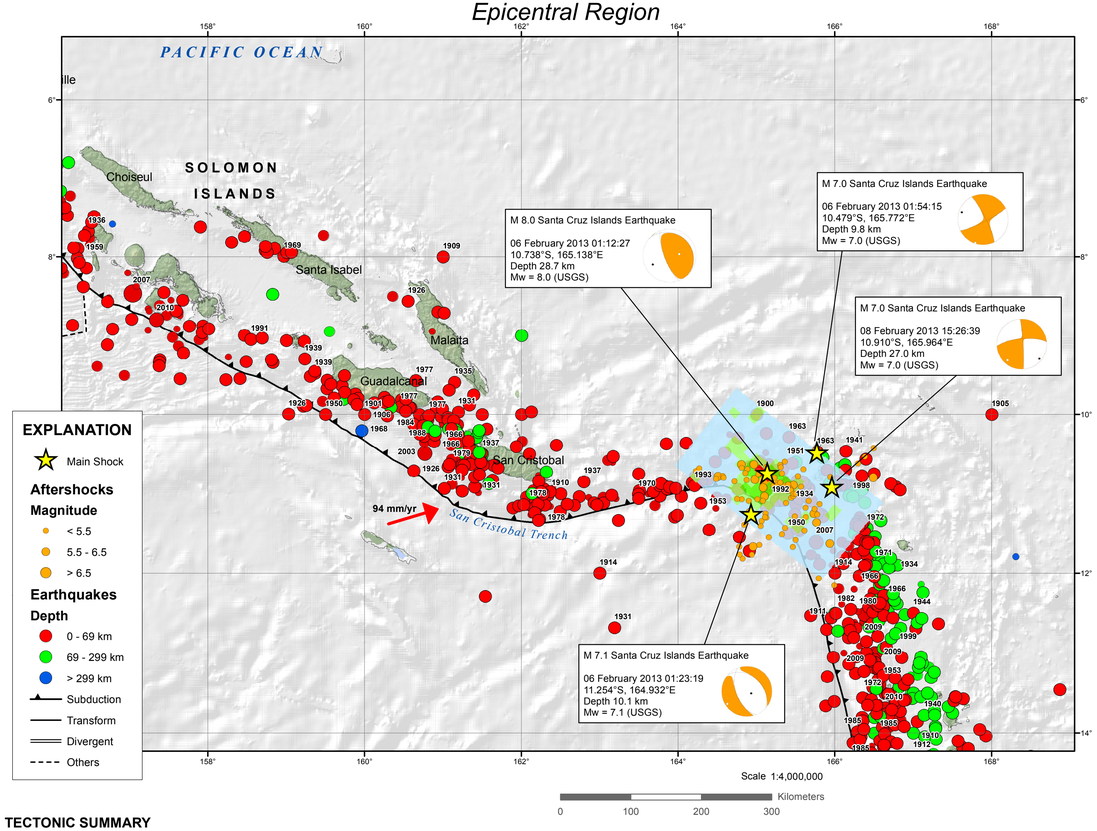
Prepared in cooperation with the Global Seismographic Network

M8.0 Santa Cruz Islands Earthquake of 06 February 2013

Tectonic Setting



Epicentral Region



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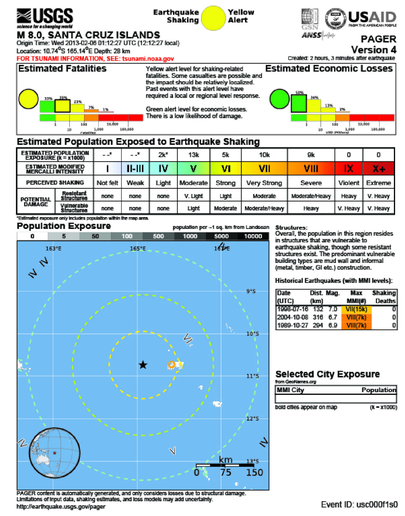
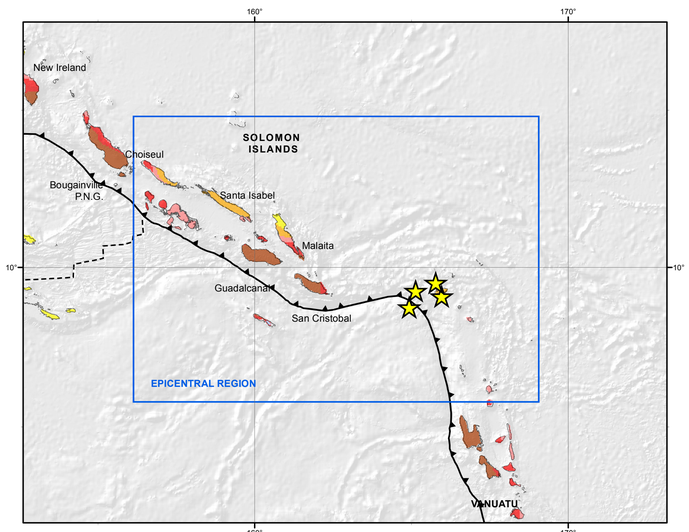


Seismic Hazard



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

Significant Earthquakes Mag >= 7.5

Year	Mon	Day	Time	Lat	Long	Dep	Mag
1900	07	29	0659	-10.000	165.000	0	7.6
1931	10	03	1913	-10.932	161.016	35	7.8
1931	10	10	0020	-9.968	161.194	50.2	7.7
1934	07	18	1940	-11.907	166.731	35	7.8
1935	12	15	0707	-9.590	161.145	35	7.5
1939	04	30	0255	-9.295	159.234	35	7.9
1953	11	04	0349	-13.189	166.516	35	7.5
1963	09	15	0046	-10.472	165.770	35	7.5
1963	09	17	1920	-10.286	165.413	27.6	7.5
1970	08	11	1022	-14.095	166.570	39.1	7.5
1980	07	08	2319	-12.487	166.482	56	7.5
1980	07	17	1942	-12.504	166.011	31.6	7.8
1984	02	07	2133	-9.957	160.522	17	7.6
1988	08	10	0438	-10.258	160.896	36.1	7.6
1997	04	21	1202	-12.560	166.738	29.8	7.7
2007	04	01	2039	-8.466	157.043	24	8.1
2009	10	07	2203	-13.006	166.510	45	7.7
2009	10	07	2218	-12.517	166.382	35	7.8
2013	02	06	0112	-10.738	165.138	28.7	8.0

TECTONIC SUMMARY

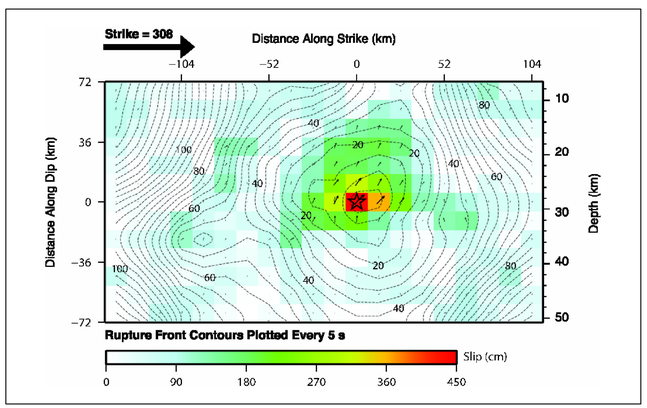
The February 6th, 2013 M 8.0 earthquake in the Santa Cruz Islands occurred as a result of shallow thrust faulting on or near the plate boundary interface between the Australia and Pacific plates. In the region of this earthquake, the Australia plate converges with and subducts beneath the Pacific plate, moving towards the east-northeast at a rate of approximately 94 mm/yr.

The February 6th earthquake is located approximately 700-750 km ESE of the Mw 8.1 Solomon Islands earthquake of April 1, 2007, and the Mw 7.1 Solomon Island earthquake of January 3, 2010. It is over 900 km to NNW of the February 2, 2012 Mw 7.1 Vanuatu earthquake, and approximately 200-300 km north of a series of earthquakes in October, 2009 along the Vanuatu Trench that included two earthquakes larger than magnitude 7 (Mw 7.8, Mw 7.4).

This earthquake is located adjacent to a complex section of the Australia-Pacific plate boundary, where the Solomon Trench to the west is linked to the New Hebrides (Vanuatu) Trench to the south by a short segment of dominantly strike-slip plate motion. The February 6th earthquake is located at the northern end of the New Hebrides (Vanuatu) segment. To the north and west of this event, the plate boundary changes in character, is oriented more west-to-east, and connects the segment ruptured by this event with the continuation of the subduction zone along the Solomon Islands.

Over the month leading up to the February 6th earthquake, there have been dozens of earthquakes in the epicentral region – over 40 M4.5 or larger in the preceding 7 days alone, 7 of which were larger than M6. Faulting mechanisms for these earthquakes suggest a mixture of strike-slip, normal and thrust faulting events. Within an hour of the February 6th M8.0 mainshock, there were also two large aftershocks with magnitudes greater than M6.

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 N38W and the dip is 18 NE. The dimensions of the subfault elements are 13 km in the strike direction and 11 km in the dip direction. The rupture surface is approximately 115 km along strike and 75 km downdip. The seismic moment release based upon this plane is 1.45e+28 dyne.cm.

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)
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 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.

Map prepared by U.S. Geological Survey
National Earthquake Information Center
06 February 2013
Map not approved for release by Director USGS