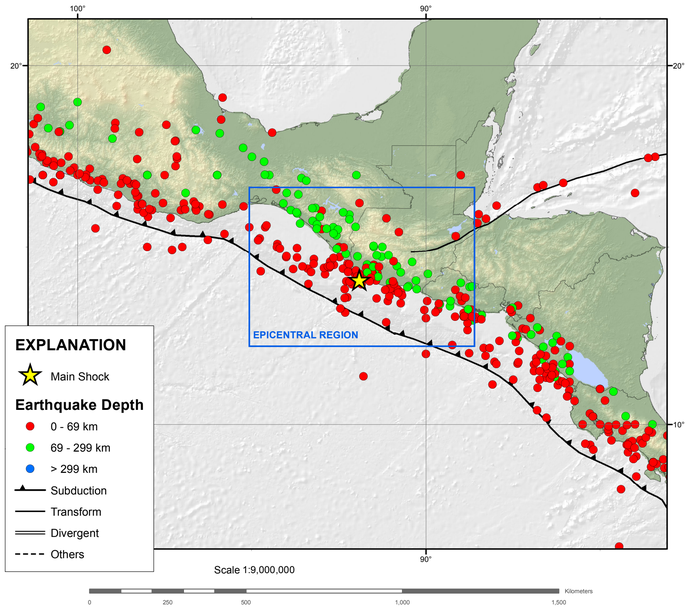
U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

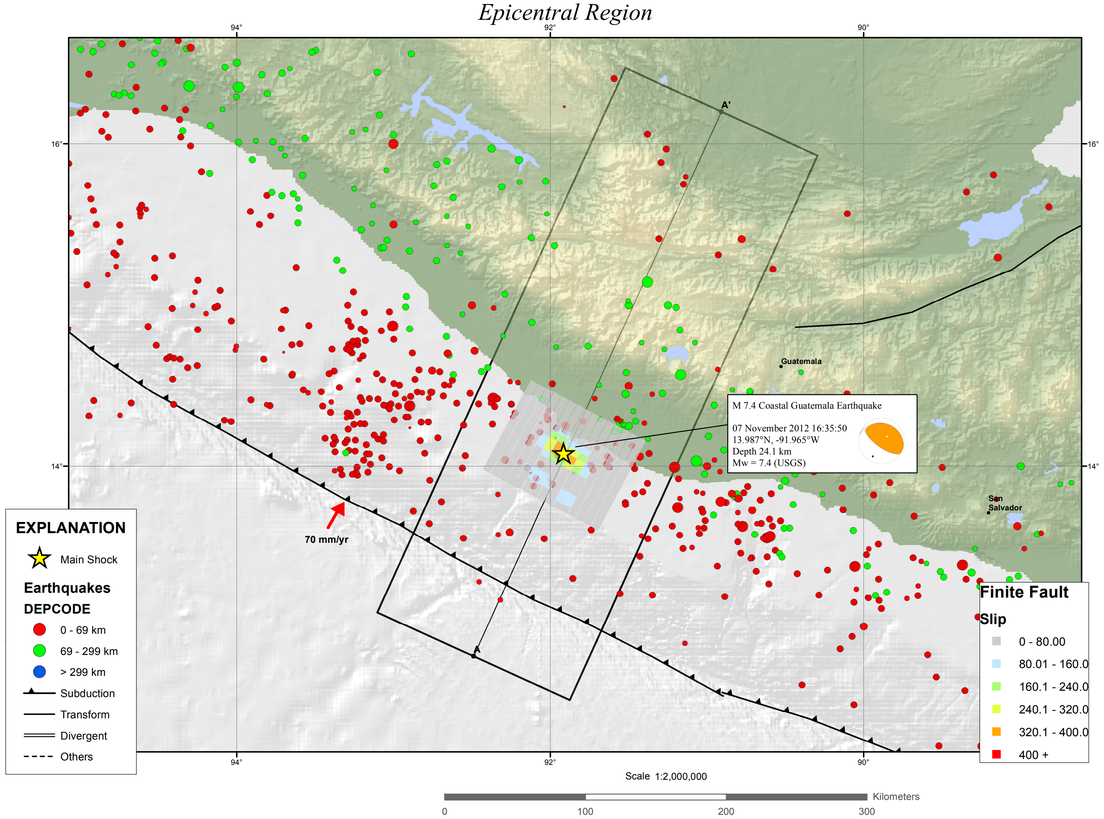
Prepared in cooperation with the Global Seismographic Network

M7.4 Coastal Guatemala Earthquake of 07 November 2012

Tectonic Setting



Epicentral Region



PAGER

M 7.4, OFFSHORE GUATEMALA
Origin Time: Wed 2012-11-07 16:35:50 UTC (10:35:50 local)
Location: 14.08°N 91.92°W Depth: 41 km

Earthquake Shaking — Yellow Alert

PAGER Version 1
Created: 22 minutes, 43 seconds after earthquake

Estimated Fatalities

Yellow alert for shaking-related fatalities and economic losses. Some casualties and damage are possible and the impact should be relatively localized. Past yellow alerts have required a local or regional level response.

Estimated economic losses are less than 1% of GDP of Guatemala.

Estimated Economic Losses

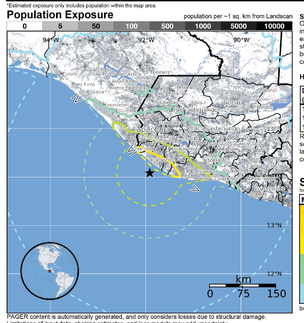
Estimated Population Exposed to Earthquake Shaking

ESTIMATED POPULATION EXPOSURE (k = x1000)	- -*	147k*	12,606k	7,347k	1,929k	236k	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



Structures:
Overall, the population in this region resides in structures that are vulnerable to earthquake shaking, though some resistant structures exist. The predominant vulnerable building types are mud wall and concrete/cinder block masonry construction.

Historical Earthquakes (with MMI levels):

Date (UTC)	Dist. (km)	Mag.	Max MMI(#)	Shaking Deaths
1999-05-08	12	6.0	VII(230k)	5
1991-09-18	121	6.2	IX(9k)	25
1976-02-04	327	7.5	IX(60k)	23k

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

Selected City Exposure
from GeoNames.org

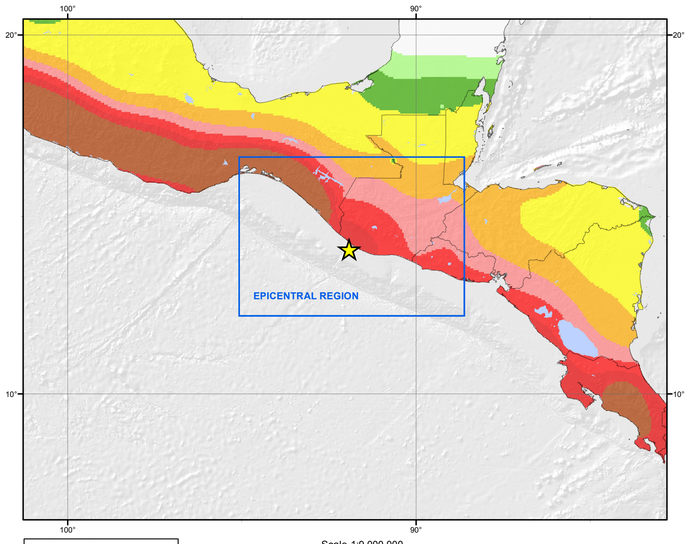
MMI	City	Population
VII	Champerico	8k
VII	Suchiate	14k
VII	La Libertad	4k
VII	Ciudad Tecun Uman	11k
VI	Ocos	9k
V	Guatemala City	995k
V	Villa Nueva	407k
V	Mixco	473k
IV	San Salvador	526k
IV	Tuxtla Gutierrez	481k

bold cities appear on map (k = x1000)

PAGER content is automatically generated, and only considers losses due to structural damage. Limitations of input data, shaking estimates, and loss models may add uncertainty.
http://earthquake.usgs.gov/pager

Event ID: usb000dlwm

Seismic Hazard

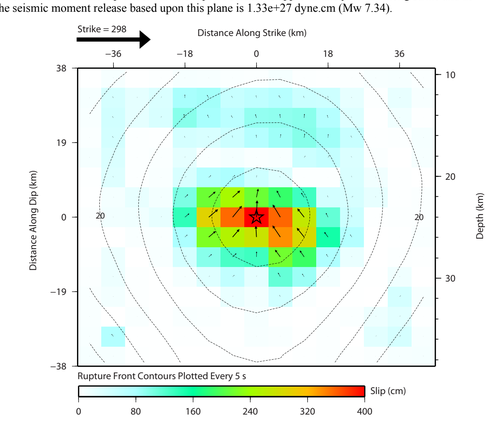


Seismic hazard is expressed as peak ground acceleration (PGA) on firm rock, in meters/sec^2, expected to be exceeded in a 50-yr period with a probability of 10 percent.

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 N28W and the dip is 23 NE. The dimensions of the subfault elements are 6 km in the strike direction and 5 km in the dip direction. The rupture surface is approximately 40 km along strike and 25 km downdip. The seismic moment release based upon this plane is 1.33e+27 dyne.cm (Mw 7.34).



TECTONIC SUMMARY

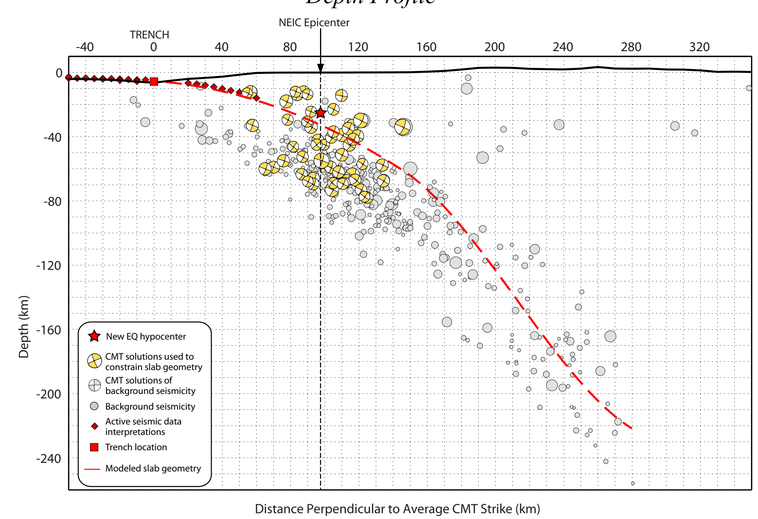
The November 7, 2012 M 7.4 earthquake south of Champerico, Guatemala occurred as a result of thrust faulting on or near the subduction zone interface between the subducting Cocos plate and the overlying Caribbean and North America plates, near their triple junction. At the latitude of this earthquake, the Cocos plate moves north-northeast with respect to the Caribbean and North America plates at a velocity of approximately 70-80 mm/yr, and subducts beneath Central America at the Middle America Trench.

Over the past 40 years, the region within 250 km of the November 7 earthquake has experienced 50 earthquakes with M 6 or greater; two of these were larger than M 7. The first was a M 7.1 in December of 1983, in approximately the same location as the November 7 event, and resulted in no documented fatalities. The second had a magnitude of M 7.2, and struck a region just over 100 km to the northwest offshore Mexico in September 1993. There was one known fatality associated with the 1993 event. A M6.8 earthquake in October of 1979, 120 km to the east-southeast of the November 7 earthquake, resulted in 7 fatalities in Guatemala.

Significant Earthquakes Mag >= 7

Year	Mon	Day	Time	Lat	Long	Dep	Mag
1900	11	09	1610	13.000	-90.000	0	7.0
1902	04	19	0223	14.000	-91.000	0	7.5
1902	09	23	2018	16.000	-93.000	0	7.8
1912	12	09	0832	15.500	-93.000	0	7.1
1915	09	07	0120	14.000	-89.000	80	7.4
1916	02	27	2020	12.000	-90.000	0	7.3
1921	02	04	0822	15.411	-90.780	35	7.4
1926	02	08	1517	12.011	-88.758	35	7.1
1935	12	14	2205	14.718	-92.484	35	7.2
1942	08	06	2337	13.780	-90.913	35	7.7
1944	06	28	0758	15.000	-92.500	0	7.1
1950	10	23	1613	14.500	-91.500	0	7.5
1970	04	29	1401	14.461	-92.760	50.9	7.3
1976	02	04	0901	15.297	-89.145	12.1	7.5
1982	06	19	0621	13.337	-89.312	73.1	7.3
1983	12	02	0309	14.055	-91.914	31	7.0
1993	09	10	1912	14.702	-92.656	34	7.2
2012	11	07	1635	14.083	-91.916	41.6	7.4

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.

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.
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
07 November 2012
Map not approved for release by Director USGS