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

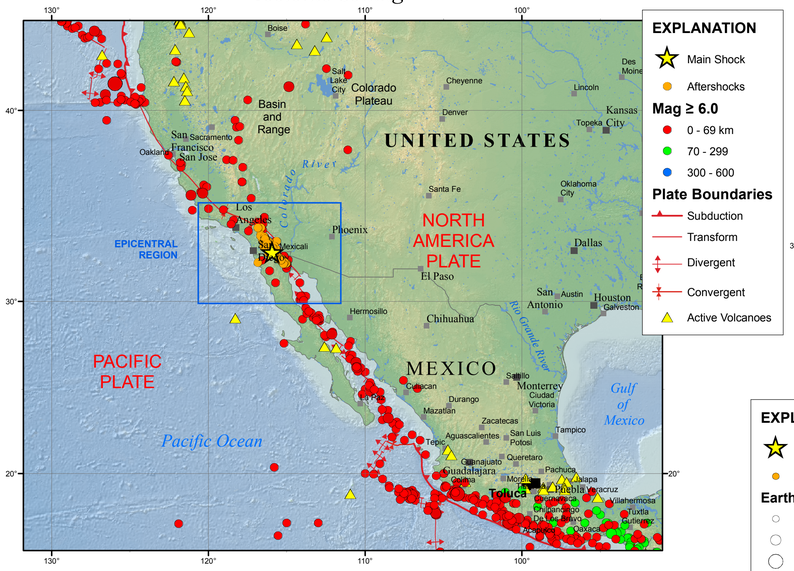
EARTHQUAKE SUMMARY MAP

Prepared in cooperation with the Global Seismographic Network

GSN

M5.7 Southern California, Earthquake of 15 June 2010

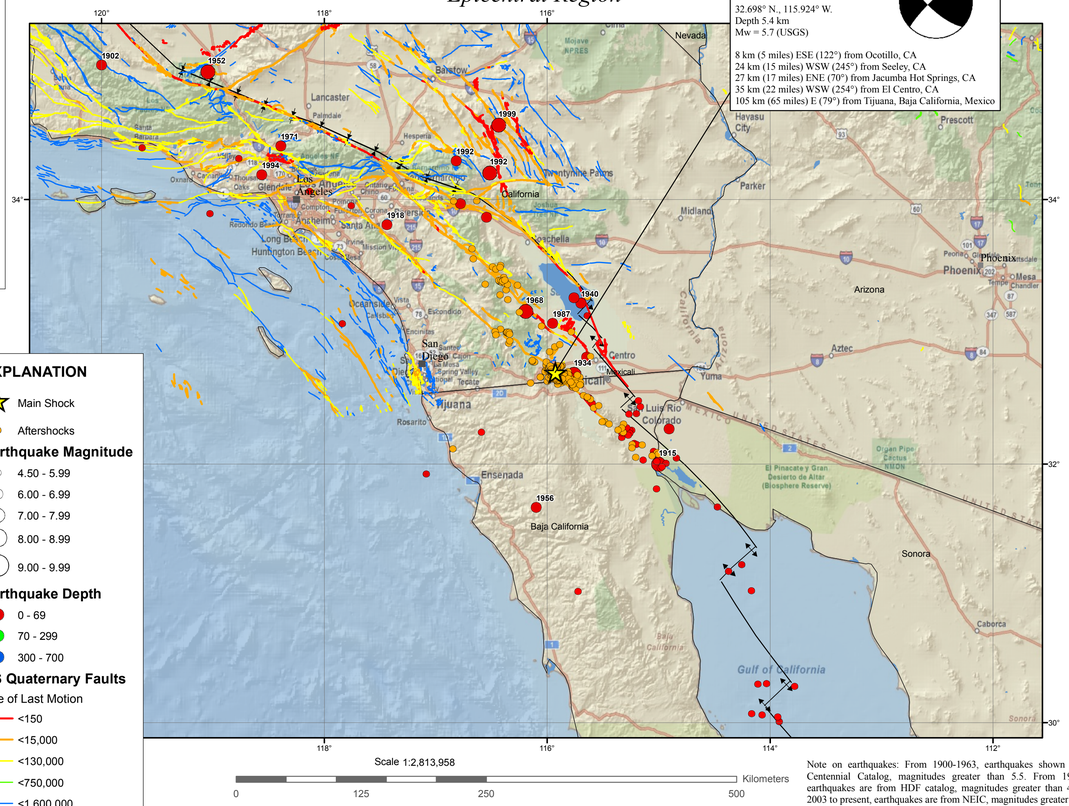
Tectonic Setting



RELATIVE PLATE MOTIONS

In the region of this earthquake, the Pacific Plate moves northwest with respect to the North America Plate at about 45 mm/yr.

Epicentral Region



Southern California 5.7

15 June 2010 22:40:41 UTC

32.698° N., 115.924° W.
Depth 5.4 km
Mw = 5.7 (USGS)

8 km (5 miles) ESE (122°) from Ocotillo, CA
24 km (15 miles) WSW (245°) from Seeley, CA
27 km (17 miles) ENE (70°) from Jacumba Hot Springs, CA
35 km (22 miles) WSW (254°) from El Centro, CA
105 km (65 miles) E (79°) from Tijuana, Baja California, Mexico

Note on earthquakes: From 1900-1963, earthquakes shown are from Centennial Catalog, magnitudes greater than 5.5. From 1964-2002, earthquakes are from HDF catalog, magnitudes greater than 4.5. From 2003 to present, earthquakes are from NEIC, magnitudes greater than 4.5.

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M 5.7, 4.8 mi ESE of Ocotillo, CA
Origin Time: Tue 2010-06-15 04:26:58 UTC
Location: 32.70°N 115.92°W Depth: 6 km

USAID FROM THE AMERICAN PEOPLE

PAGER
Version 3
Created: 12 hours, 10 minutes after earthquake

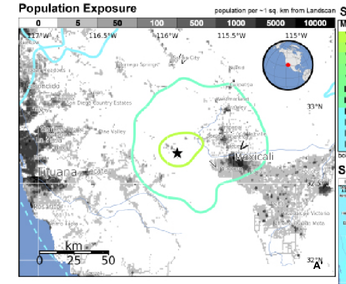
Estimated Population Exposed to Earthquake Shaking

ESTIMATED POPULATION EXPOSURE (k = x1000)		- -*	230k*	3,705k	729k	9k	0	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

*estimated exposure only includes population within the map area

Population Exposure

population per ~1 sq. km from Landscan

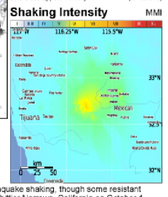


Selected City Exposure

MMI	City	Population
V	Holtville	5k
V	Seeley	2k
V	El Centro	38k
V	Heber	3k
V	Imperial	10k
IV	Brawley	22k
IV	Mexicali	597k
III	Tijuana	1,376k
III	Chula Vista	213k
III	Ensenada	257k
III	San Diego	1,223k

bold cities appear on map (k = x1000)

Shaking Intensity



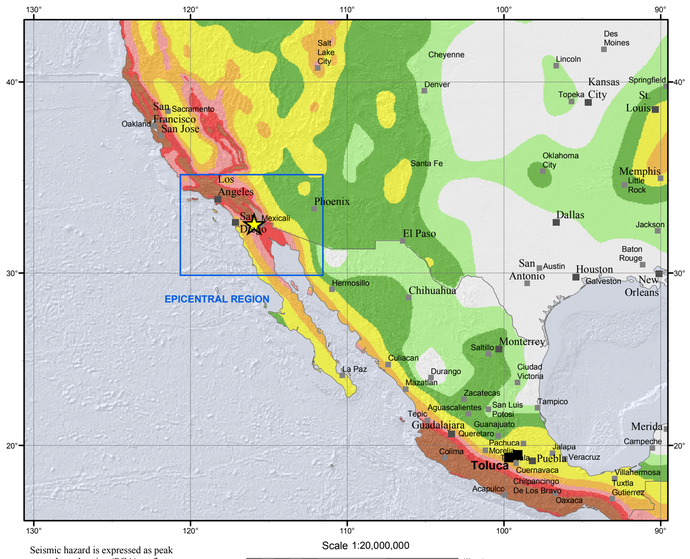
Overall, the population in this region resides in structures that are vulnerable to earthquake shaking, though some resistant structures exist. A magnitude 5.9 earthquake 255 km northwest of this one struck Whittier Narrows, California on October 1, 1987 (UTC), with estimated population exposures of 20,000 at intensity VIII and 1,292,000 at intensity VII, resulting in a reported 8 fatalities. On January 17, 1994 (UTC), a magnitude 6.7 earthquake 294 km Northwest of this one struck Northridge, California, with estimated population exposures of 211,000 at intensity IX or greater and 1,968,000 at intensity VIII, resulting in a reported 60 fatalities. Recent earthquakes in this area have caused landslides and liquefaction 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: ci14745580

Seismic Hazard

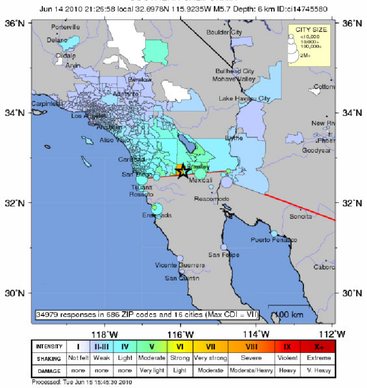


Seismic hazard is expressed as peak ground acceleration (PGA) on firm rock, in meters/sec^2, expected to be exceeded in a 50-yr period with a probability of 10 percent.

Peak Ground Acceleration in m/sec**2

.2 .4 .8 1.6 2.4 3.2 4.0 4.8

USGS Community Internet Intensity Map
SOUTHERN CALIFORNIA
Jun 14 2010 21:26:58 local 32.6978N 115.9235W M5.7 Depth: 6 km ID:ci14745580



INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+
SHAKING	Not felt	Weak	Light	Moderate	Strong	Very strong	Severe	Violent	Extreme
DAMAGE	none	none	none	Very light	Light	Moderate	Moderate/Heavy	Heavy	V. Heavy

Processed: Tue Jun 15 15:18:39 2010

TECTONIC SUMMARY

A M5.7 aftershock to the M7.2 April, 4th 2010 Easter Sunday mainshock, called El Mayor-Cucapah earthquake, occurred at 9:27 pm (Western Standard Time) on June 14th, about 5 miles southeast of the Imperial County community of Ocotillo, at the US Mexico border. This aftershock was the largest so far of the M7.2 El Mayor-Cucapah sequence. This aftershock was located within the large cluster of aftershocks at the northwest end of the ongoing aftershock sequence. The M5.7 event was followed by its own vigorous aftershock sequence, with four M4+ and 35 M3 to M4 events, during the first 12 hours.

The June 14th event probably occurred on a northwest striking fault that follows the trend of the Elsinore fault in this region. The Elsinore fault is more than 110 miles long, and extends into the Orange County and Los Angeles area as the Whittier fault. The Elsinore fault is capable of a major earthquake that would significantly affect the large metropolitan areas of southern California. The Elsinore fault has not hosted a major earthquake in more than 100 years.

The occurrence of this aftershock and its own aftershock sequence, and the M4.9 earthquake that occurred along the San Jacinto fault on June 12th 2010 demonstrate that the earthquake activity in the region remains at an elevated level. The San Jacinto fault is known as the most active earthquake fault in southern California. Caltech and USGS seismologist continue to monitor the on going earthquake activity using the Caltech/USGS Southern California Seismic Network and a GPS network of more than 100 stations.

Significant Earthquakes Mag >= 6

Year	Mon	Day	Time	Lat	Long	Dep	Mag
1902	03	22	2212	35.000	-120.000	0	6.8
1915	11	21	0013	32.000	-115.000	0	7.1
1918	04	21	2232	33.812	-117.440	15	6.8
1934	12	31	1845	32.685	-115.761	15	7.1
1940	05	19	0436	33.222	-115.697	15	6.9
1952	07	21	1152	34.949	-119.046	10	7.3
1956	02	09	1432	31.669	-116.099	10	6.8
1968	04	09	0229	33.159	-116.192	15	6.0
1968	04	09	0229	33.160	-116.192	15	7.0
1971	02	09	1400	34.401	-118.392	5.9	6.2
1971	02	09	1400	34.401	-118.392	6.4	6.7
1979	10	15	2317	32.814	-115.646	12	6.9
1979	10	15	2317	32.815	-115.646	12	6.4
1980	06	09	0328	32.268	-114.906	3.1	6.5
1980	06	09	0328	32.269	-114.906	2.2	6.4
1981	04	26	1209	33.125	-115.643	10.1	6.0
1981	09	04	1550	33.894	-119.028	15	6.0
1986	07	08	0920	33.969	-116.779	11.7	6.1
1986	07	08	0920	33.970	-116.779	11.7	6.1
1987	10	01	1442	34.061	-118.133	14.4	6.0
1987	11	24	0154	33.256	-115.755	15	6.3
1987	11	24	0154	33.264	-115.759	15	6.1
1987	11	24	1315	33.070	-115.952	1.9	6.5
1987	11	24	1315	33.070	-115.952	1.9	6.6
1992	04	23	0450	33.868	-116.546	12	6.1
1992	06	28	1157	34.194	-116.511	15	7.6
1992	06	28	1157	34.198	-116.515	15	7.3
1992	06	28	1505	34.287	-116.817	12.2	6.6
1992	06	28	1505	34.289	-116.817	12.4	6.5
1994	01	17	1230	34.185	-118.563	19	6.7
1999	10	16	0946	34.555	-116.436	15	7.2

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)
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
ESRI Online

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
15 June 2010
Map not approved for release by Director USGS