USGS science for a changing world

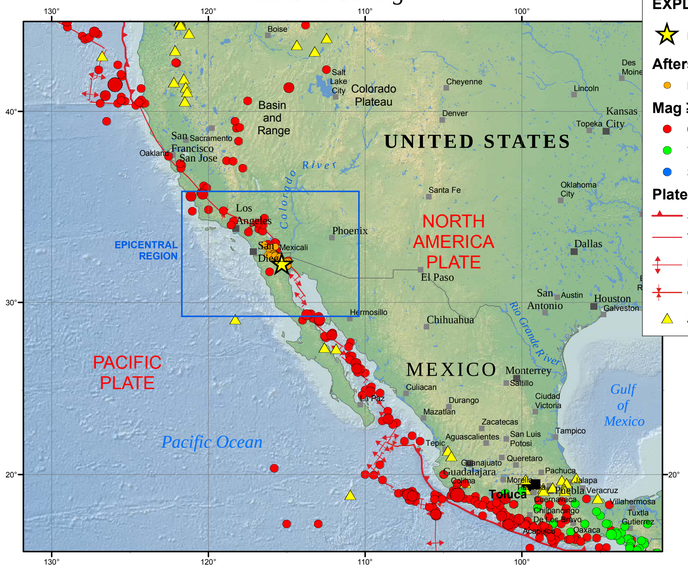
U.S. DEPARTMENT OF THE INTERIOR
U.S. GEOLOGICAL SURVEY

EARTHQUAKE SUMMARY MAP

M7.2 Baja, Mexico, Earthquake of 4 April 2010

Prepared in cooperation with the Global Seismographic Network

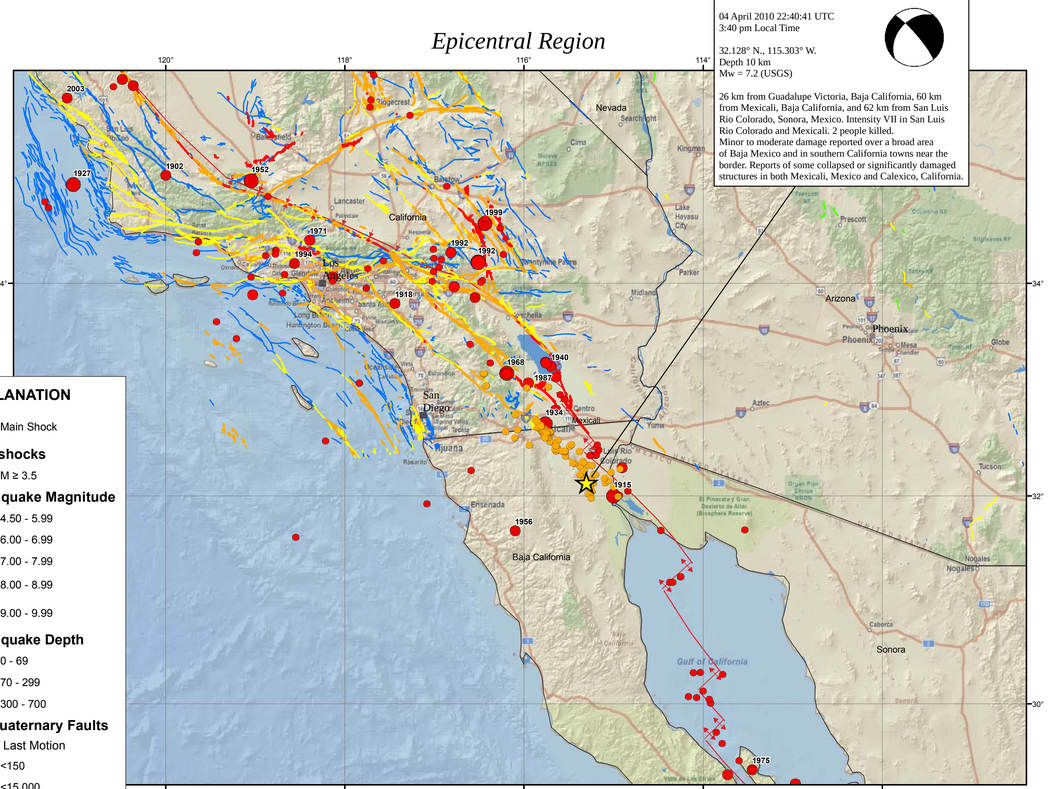
Tectonic Setting



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



Baja, Mexico

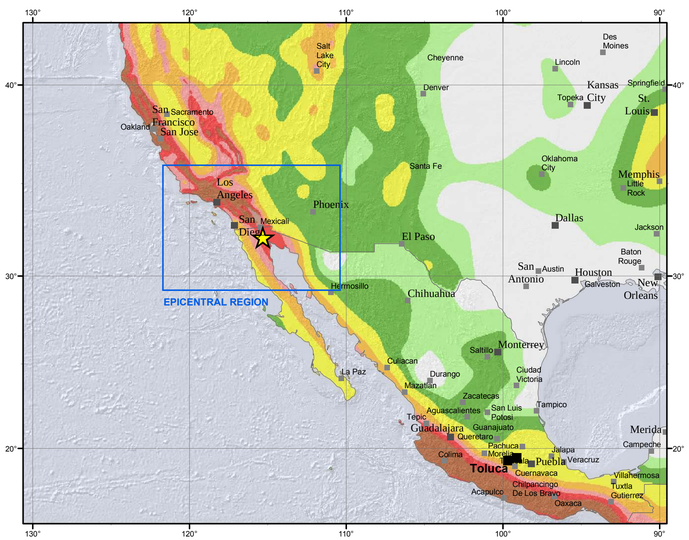
04 April 2010 22:40:41 UTC
3:40 pm Local Time

32.128° N., 115.303° W.
Depth 10 km
Mw = 7.2 (USGS)

26 km from Guadalupe Victoria, Baja California, 60 km from Mexicali, Baja California, and 62 km from San Luis Rio Colorado, Sonora, Mexico. Intensity VII in San Luis Rio Colorado and Mexicali. 2 people killed.
Minor to moderate damage reported over a broad area of Baja Mexico and in southern California towns near the border. Reports of some collapsed or significantly damaged structures in both Mexicali, Mexico and Calexico, California.

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.

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.

Peak Ground Acceleration in m/sec**2

.2	.4	.8	1.6	2.4	3.2	4.0	4.8

TECTONIC SUMMARY

The magnitude 7.2 northern Baja California earthquake of Sunday April 4th 2010, occurred approximately 40 miles south of the Mexico-USA border at shallow depth along the principal plate boundary between the North American and Pacific plates. This is an area with a high level of historical seismicity, and also it has recently been seismically active, though this is the largest event to strike in this area since 1892. Today's earthquake appears to have been larger than the M 6.9 earthquake in 1940 or any of the early 20th century events (e.g., 1915 and 1934) in this region of northern Baja California.

At the latitude of the earthquake, the Pacific plate moves northwest with respect to the North America plate at about 45 mm/y. The principal plate boundary in northern Baja California consists of a series of northwest-trending strike-slip (transform) faults that are separated by pull-apart basins. The faults are distinct from, but parallel to, strands of the San Andreas fault system. The April 4 main-shock occurred along a strike-slip segment of the plate boundary that coincides with the southeastern part of the Laguna Salada fault. Although the location and focal-mechanism of the earthquake are consistent with the shock having occurred on this fault, we do not yet have surface rupture or other confirmation. Aftershocks appear to extend in both directions along this fault system from the epicenter of today's event. The aftershock zone extends from the northern tip of the Gulf of California to the Mexico-USA border.

Earthquakes having magnitudes as high as 7 have been historically recorded from the section of the Pacific/North American plate boundary on which the 4 April 2010 earthquake occurred. The 1892 earthquake occurred along the Laguna Salada fault system, but significantly farther northwest than today's event epicenter. The 1940 Imperial Valley earthquake approached magnitude 7, though it occurred farther to the north and on the Imperial fault. Both the 1892 and 1940 earthquakes were associated with extensive surface faulting. An event of M 7.0 or 7.1 occurred in this region in 1915, and then a M 7.0 to 7.2 in 1934 broke the Cerro Prieto fault with up to several meters of surface slip.

In the vicinity of the 4 April 2010 earthquake, there are several active faults and it has not yet been determined specifically which fault the earthquake occurred on. Within the transition from the ridge-transform boundary in the Gulf of California to the continental transform boundary in the Salton Trough, faulting is complex. Most of the major active faults are northwest-southeast oriented right-lateral strike-slip faults that are common in mechanism to the San Andreas fault and parallel Elsinore and San Jacinto faults, that run north of the Mexico-USA border.

Significant Earthquakes Mag ≥ 6.5

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
1927	11	04	1351	34.915	-121.031	15	7.1
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	33.160	-116.192	15	7.0
1971	02	09	1400	34.401	-118.392	6.4	6.7
1975	07	08	0937	29.360	-113.452	1.9	6.5
1987	11	24	1315	33.070	-115.952	1.9	6.5
1992	06	28	1157	34.198	-116.515	15	7.3
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
2003	12	22	1915	35.706	-121.102	7	6.6

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 science for a changing world

M 7.2, 39.0 mi SSE of Calexico, CA
Origin Time: Sun 2010-04-04 22:40:40 UTC
Location: 32.13°N 115.30°W Depth: 10 km

USAID FROM THE AMERICAN PEOPLE

PAGER
Version 6
Created: 5 hours, 10 minutes after earthquake

Estimated Population Exposed to Earthquake Shaking

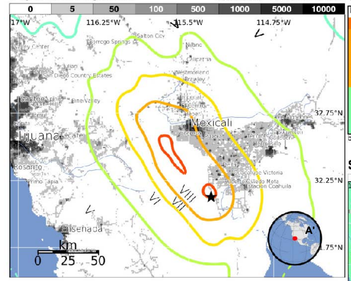
ESTIMATED POPULATION EXPOSURE (k = x1000)		- - *	- - *	112k*	2,883k*	301k	373k	52bk	0	0
ESTIMATED MODIFIED MERCALLI INTENSITY		I	II-III	IV	V	VI	VII	VIII	IX	X+
PERCEIVED SHAKING		Not felt	Weak	Light	Moderate	Strong	Very Strong	Severe	Violent	Extreme
POTENTIAL DAMAGE	Resistant Structures	none	none	none	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

0	5	50	100	500	1000	5000	10000

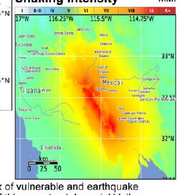


Selected City Exposure

MMI	City	Population
VIII	Progreso	5k
VII	Alberto Oviedo Mota	8k
VII	Mexicali	697k
VII	Calexico	36k
VII	Heber	3k
VII	Seeley	2k
V	Tijuana	1,376k
IV	Escondido	137k
IV	Chula Vista	213k
IV	Ensenada	257k

Bold cities appear on map (< = x1000)

Shaking Intensity



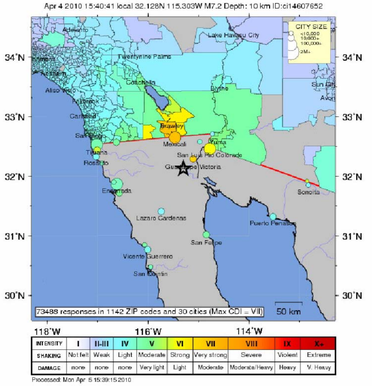
Overall, the population in this region resides in structures that are a mix of vulnerable and earthquake resistant construction. A magnitude 6.5 earthquake 88 km Northwest of this one struck Imperial Valley, California on October 15, 1979 (UTC), with estimated population exposures of 3,000 at intensity IX and 291,000 at intensity VIII, resulting in 0 fatalities, 91 injuries, and an estimated 30 Million US Dollars in damage. 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: ci14607652

USGS Community Internet Intensity Map
BAJA CALIFORNIA, MEXICO
Apr 4 2010 15:40:41 local 32.128N 115.303W M7.2 Depth: 10 km ID:ci14607652



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 Mon Apr 5 15:39:15 2010

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
4 April 2010
Map not approved for release by Director USGS