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

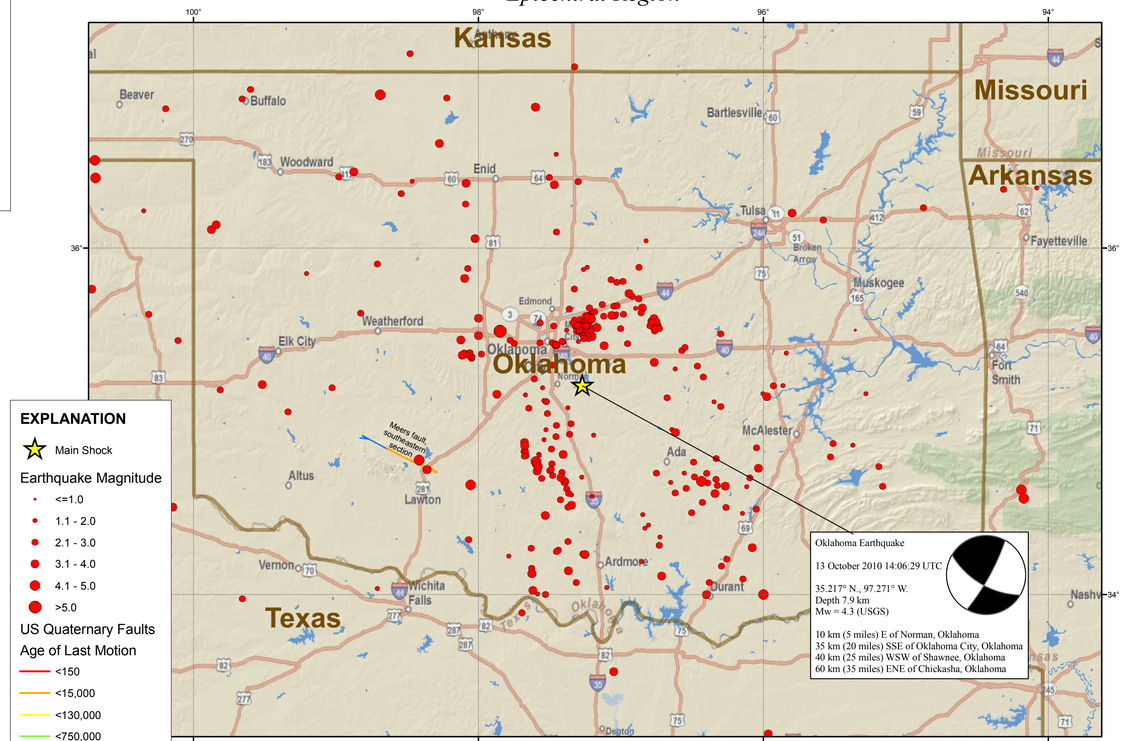
EARTHQUAKE SUMMARY MAP

Prepared in cooperation with the Global Seismographic Network
GSN

M 4.3 Oklahoma Earthquake of 13 October 2010

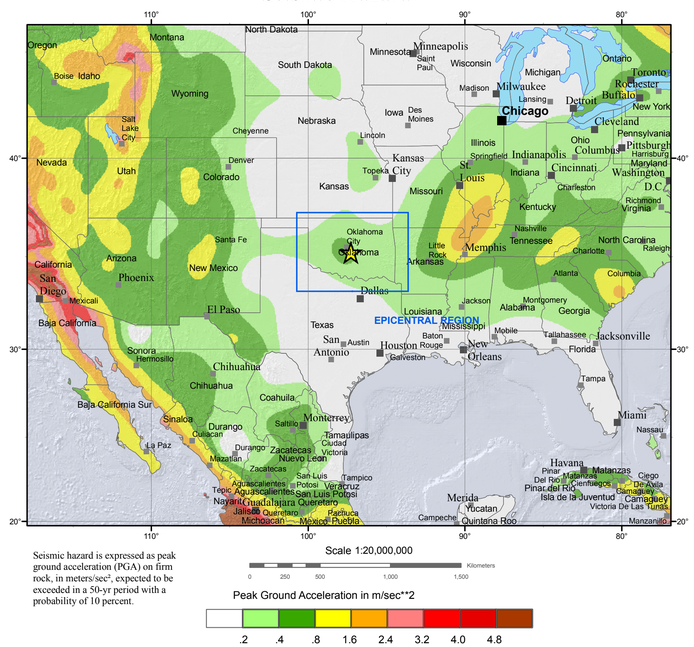
Tectonic Setting

Epicentral Region



Note on earthquakes: Earthquakes shown are from NEIC, magnitudes greater than 0, 1987 to present; magnitude equal to or greater than 3.5, 1990 to 2006; 1769 to 1989, magnitude equal to or greater than 3.5.

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.

TECTONIC SUMMARY

Today's earthquake is not unprecedented in central Oklahoma. The area has had earthquakes at least since it was settled. Most of them were small. Since 1974 more than 200 earthquakes have been detected within about 80 kilometers (50 miles) of today's shock. Since 1974 earthquakes roughly the size of the one this morning occurred in 1995 and on last February 27. Earthquakes large enough to cause damage are rare. Since 1882, all of Oklahoma has had 11 damaging earthquakes. The largest of these caused moderate damage in and near El Reno in 1952.

Most of North America east of the Rocky Mountains has infrequent earthquakes that can strike anywhere at irregular intervals. Here and there earthquakes are more numerous, but central Oklahoma is far from the most active area in the central U.S. That honor goes to the New Madrid seismic zone in southeastern Missouri and neighboring states. The causes of earthquakes are not understood well enough for us to predict earthquakes reliably. Because most earthquakes are small, it is possible but unlikely that any subsequent shock would be much larger than this morning's earthquake. East of the Rockies, an earthquake the size of the one this morning can be felt as far away as roughly 100 km (60 miles).

Earthquakes occur on faults. Most earthquakes occur miles deep. At well-studied plate boundaries like the San Andreas fault system in California, often seismologists can determine the specific fault on which an earthquake occurred. East of the Rockies, far from plate boundaries, that is rarely the case. Most of the known faults are deep, and probably there are other faults that have not been discovered. It is hard to link an individual earthquake to an individual fault. In most areas, the best guide to earthquake hazards is the earthquakes themselves.

Earthquakes east of the Rocky Mountains, although less frequent than in the West, are typically felt over a much broader region. East of the Rockies, an earthquake can be felt over an area as much as ten times larger than a similar magnitude earthquake on the west coast. A magnitude 4.0 eastern U.S. earthquake typically can be felt at many places as far as 100 km (60 mi) from where it occurred, and it infrequently causes damage near its source. A magnitude 5.5 eastern U.S. earthquake usually can be felt as far as 500 km (300 mi) from where it occurred, and sometimes causes damage as far away as 40 km (25 mi).

PAGER Version 1

M 4.5, OKLAHOMA
Origin Time: Wed 2010-10-13 14:06:29 UTC (09:06:29 local)
Location: 35.21°N 97.31°W Depth: 5 km

Earthquake Shaking — Green Alert

Created: 16 minutes, 59 seconds after earthquake

Estimated Fatalities

Green alert for shaking-related fatalities and economic losses. There is a low likelihood of casualties and damage.

Estimated Economic Losses

Estimated Population Exposed to Earthquake Shaking

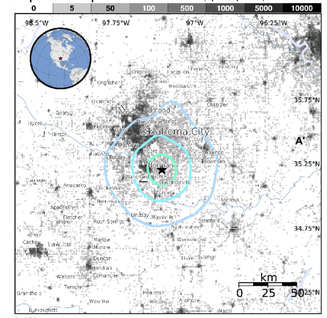
ESTIMATED POPULATION EXPOSURE (k = x1000)	206k*	1,844k	218k	99k	0	0	0	0	0
ESTIMATED MODIFIED MERCALLI INTENSITY	I	II-III	IV	V	VI	VII	VIII	IX	X+
PERCEIVED SHAKING	Not felt	Weak	Light	Moderate	Strong	Very Strong	Severe	Violent	Extreme
POTENTIAL DAMAGE: Resistant Structures	none	none	none	V. Light	Light	Moderate	Moderate/Heavy	Heavy	V. Heavy
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

0 | 5 | 50 | 100 | 500 | 1000 | 5000 | 10000



Structures:
Overall, the population in this region resides in structures that are highly resistant to earthquake shaking, though some vulnerable structures exist.

Historical Earthquakes (with MMI levels):

There were no earthquakes with significant population exposure to shaking within a 400 km radius of this event.

Selected City Exposure

from GeoNames.org

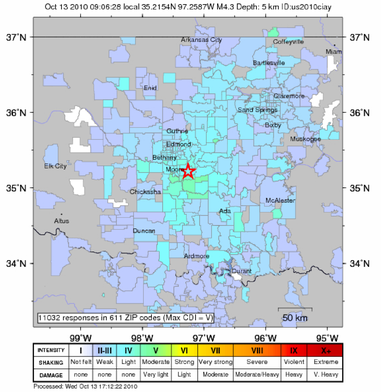
MMI	City	Population
V	Hall Park	1k
IV	Noble	5k
IV	Norman	96k
IV	Slaughterville	4k
IV	Goldsby	1k
IV	Moore	47k
II	Oklahoma City	533k
II	Edmond	74k
I	Lawton	92k
I	Tulsa	393k
I	Broken Arrow	86k

bold cities appear on map (k = x1000)

PAGER content is automatically generated, and does not consider secondary hazards in loss calculations. Limitations of input data, shaking estimates, and loss models may add uncertainty.
http://earthquake.usgs.gov/pager

Event ID: us2010ciay

USGS Community Internet Intensity Map
OKLAHOMA
Oct 13 2010 09:06:28 local 35.2154N 97.2587W M4.3 Depth: 5 km ID:us2010ciay



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: Wed Oct 13 17:12:22 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
13 October 2010 v1
Map not approved for release by Director USGS