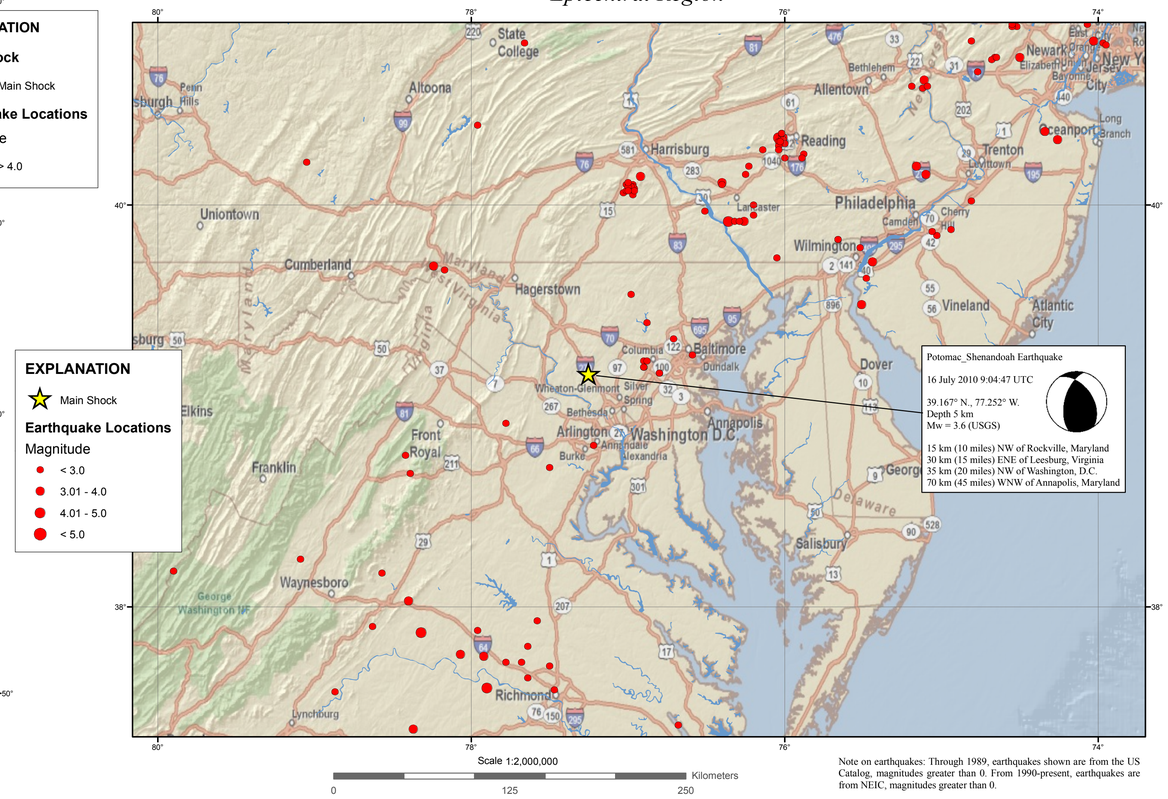
Prepared in cooperation with the Global Seismographic Network

GSN

M 3.6 Potomac-Shenandoah Region Earthquake of 16 July 2010

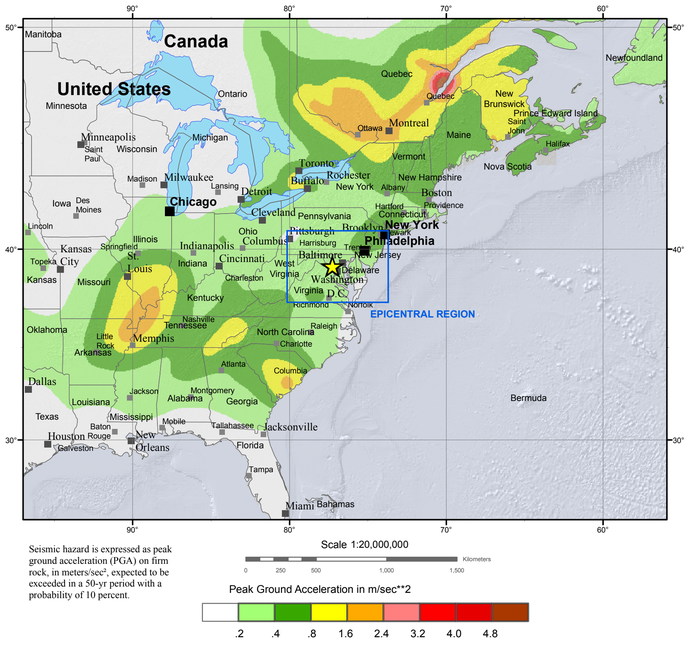
Tectonic Setting

Epicentral Region



Note on earthquakes: Through 1989, earthquakes shown are from the US Catalog, magnitudes greater than 0. From 1990-present, earthquakes are from NEIC, magnitudes greater than 0.

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.

USGS
science for a changing world

USAID
FROM THE AMERICAN PEOPLE

M 3.6, POTOMAC-SHENANDOAH REGION

PAGER
Version 1

Origin Time: Fri 2010-07-16 09:04:47 UTC
Location: 39.17°N 77.25°W Depth: 5 km

Created: 18 minutes, 21 seconds after earthquake

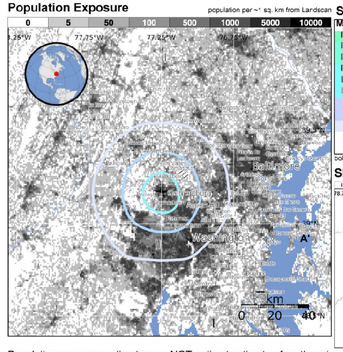
Estimated Population Exposed to Earthquake Shaking

ESTIMATED POPULATION EXPOSURE (k = x1000)		5,441k	3,286k	307k	12k	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
	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

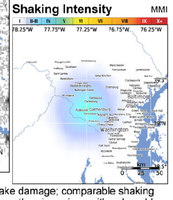


Selected City Exposure

MMI	City	Population
IV	Gaithersburg	60k
IV	Germantown	85k
IV	Montgomery Village	42k
IV	Darnestown	7k
III	Clarksburg	2k
III	Redland	18k
I	Washington	552k
I	Arlington	186k
I	Alexandria	127k
I	Annapolis	36k
I	Baltimore	611k

bold cities appear on map (k = x1000)

Shaking Intensity



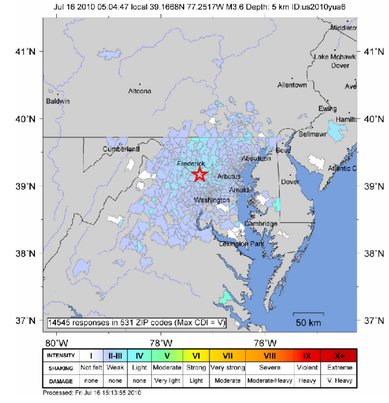
Population exposure estimates are NOT a direct estimate of earthquake damage; comparable shaking will result in significantly lower losses in regions with well built structures than in regions with vulnerable structures. Overall, the population in this region resides in structures that are a mix of vulnerable and earthquake resistant construction.

This information was automatically generated and has not been reviewed by a seismologist.

http://earthquake.usgs.gov/pager

Event ID: us2010yua6

USGS Community Internet Intensity Map
POTOMAC-SHENANDOAH REGION
Jul 16 2010 09:04:47 local 39.1668N 77.2517W M3.6 Depth: 5 km ID:us2010yua6



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: Fri Jul 16 15:13:55 2010

TECTONIC SUMMARY

Earthquakes in the Stable Continental Region

Most of North America east of the Rocky Mountains has infrequent earthquakes. Here and there earthquakes are more numerous, for example in the New Madrid seismic zone centered on southeastern Missouri, in the Charlevoix-Kamouraska seismic zone of eastern Quebec, in New England, in the New York - Philadelphia - Wilmington urban corridor, and elsewhere. However, most of the enormous region from the Rockies to the Atlantic can go years without an earthquake large enough to be felt, and several U.S. states have never reported a damaging earthquake. The earthquakes that do occur strike anywhere at irregular intervals.

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).

Faults

Earthquakes everywhere occur on faults within bedrock, usually miles deep. Most of the region's bedrock was formed as several generations of mountains rose and were eroded down again over the last billion or so years.

At well-studied plate boundaries like the San Andreas fault system in California, often scientists can determine the name of the specific fault that is responsible for an earthquake. In contrast, east of the Rocky Mountains this is rarely the case. All parts of this vast region are far from the nearest plate boundaries, which, for the U.S., are to the east in the center of the Atlantic Ocean, to the south in the Caribbean Sea, and to the west in California and offshore from Washington and Oregon. The region is laced with known faults but numerous smaller or deeply buried faults remain undetected. Even most of the known faults are poorly located at earthquake depths. Accordingly, few earthquakes east of the Rockies can be linked to named faults. It is difficult to determine if a known fault is still active and could slip and cause an earthquake. In most areas east of the Rockies, the best guide to earthquake hazards is the earthquakes themselves.

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
16 July 2010 v2
Map not approved for release by Director USGS