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

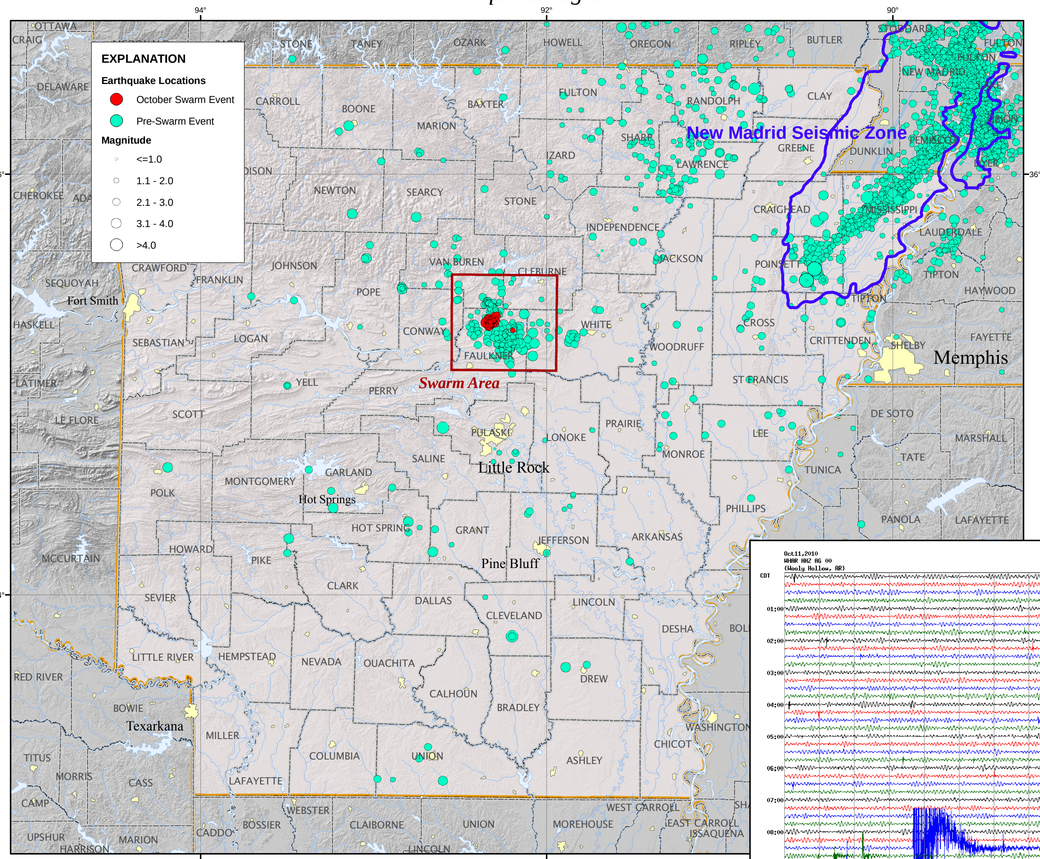
EARTHQUAKE SUMMARY MAP

Arkansas Earthquake Swarm of October, 2010

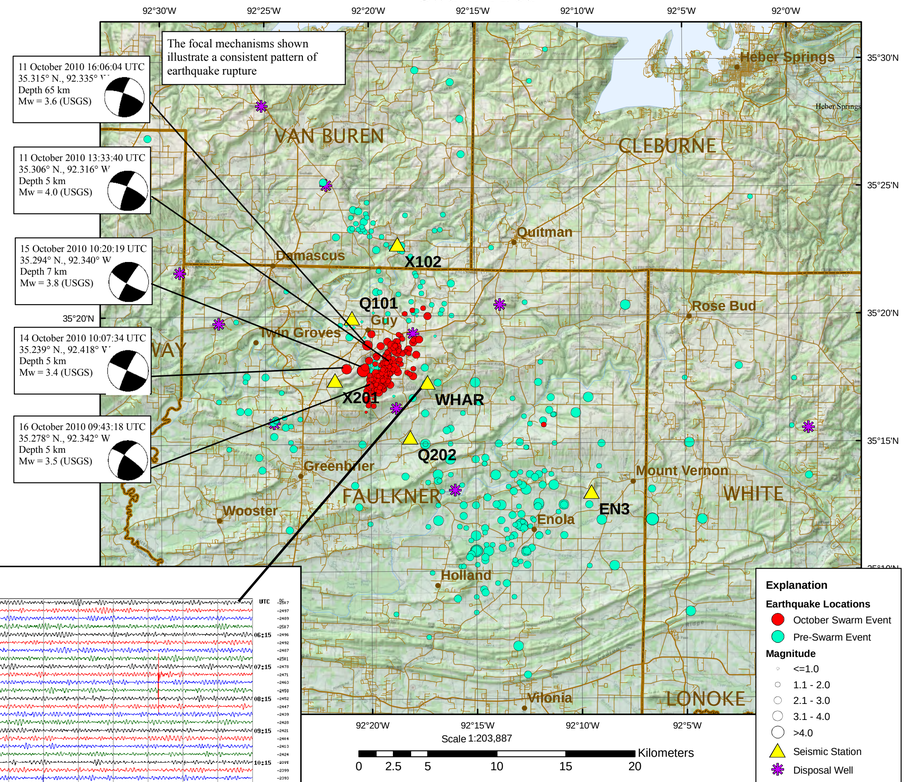
Prepared in cooperation with the Arkansas Geoloical Survey and the Center for Earthquake Research and Information

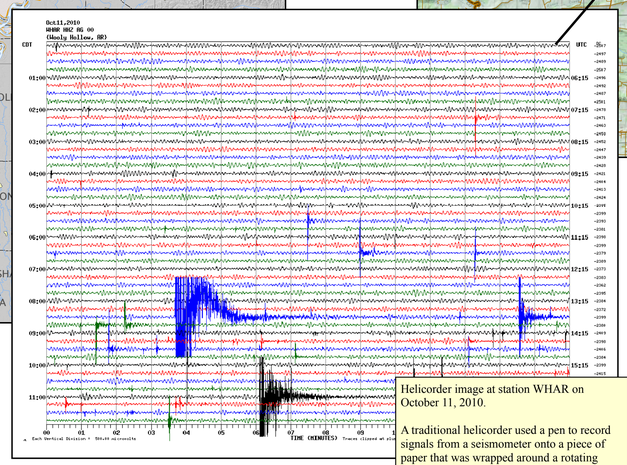
Center for Earthquake Research and Information

Earthquake Region



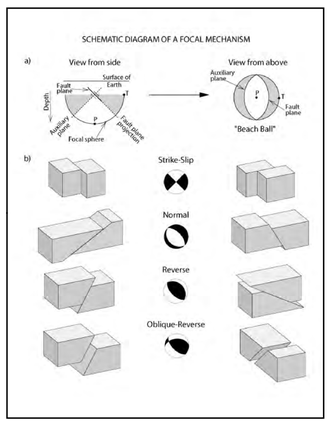
Swarm Area





Helicorder image at station WHAR on October 11, 2010.

A traditional helicorder used a pen to record signals from a seismometer onto a piece of paper that was wrapped around a rotating drum. The paper records made a nice continuous display of seismic activity at a site. Today we still emulate the traditional paper record with a helicorder image that is produced digitally. In this image from October 11, each wiggle line represents 15 minutes of vertical ground motion beginning at midnight (top of image) until noon (11:45 A.M. at the bottom) at the WHAR station in Wooly Hollow. The lines alternate in color so each one can be easily distinguished from the next. The earth's surface is normally moving up and down a small amount (called a microseism). Microseisms cause the small wiggles in the lines. Small earthquakes show up as small spikes such as at about 02:01 CDT. As the earthquake size increases, the duration of shaking increases. The Mw4.0 earthquake is the long duration (blue) signal that begins about 08:33 CDT.



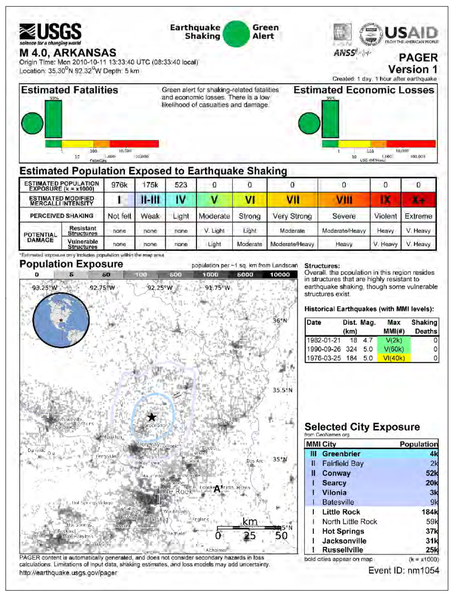
TECTONIC SUMMARY

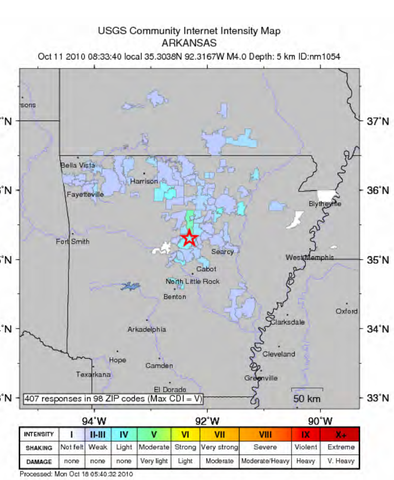
The Mw4.0 and Mw3.8 earthquakes on October 11 and 15, 2010 were felt widely across Arkansas. Since the beginning of October, central Arkansas has experienced hundreds of small earthquakes but only a few have been large enough to be felt outside the local area. Central Arkansas has a history of earthquake activity with a swarm of thousands of earthquakes smaller than magnitude 4.5 to 4.7 in the early 1980s and another swarm in 2001. During the last six months, central Arkansas has experienced more earthquakes than the New Madrid seismic zone (NMSZ), traditionally accepted as the most seismically active area east of the Rocky Mountains. The Center for Earthquake Research and Information (CERI) at the University of Memphis and the Arkansas Geological Survey (AGS) have deployed a local seismic array in the Greenbrier-Enola, Arkansas, area to augment regional seismic stations to carefully monitor this situation. USGS scientists have been working with their AGS and CERI colleagues. The CERI and AGS array and personnel are the best source of the most current information about the new earthquake swarm. The AGS and CERI are investigating whether the recent earthquakes are naturally occurring or related to human activities. The earthquake locations plotted on the maps above are from AGS and CERI data catalogs.

Earthquake swarms are common east of the Rocky Mountains; although none of the others have involved so many small earthquakes as the central Arkansas swarms. Scientists don't know why swarms start, why they stop, or how long to expect them to last. None of the other swarms have given us any reason to expect an earthquake large enough to cause significant damage in central Arkansas in the near future. Most of North America east of the Rocky Mountains has infrequent earthquakes that can strike anywhere at irregular intervals. The causes of earthquakes are not understood well enough for us to predict earthquakes reliably.

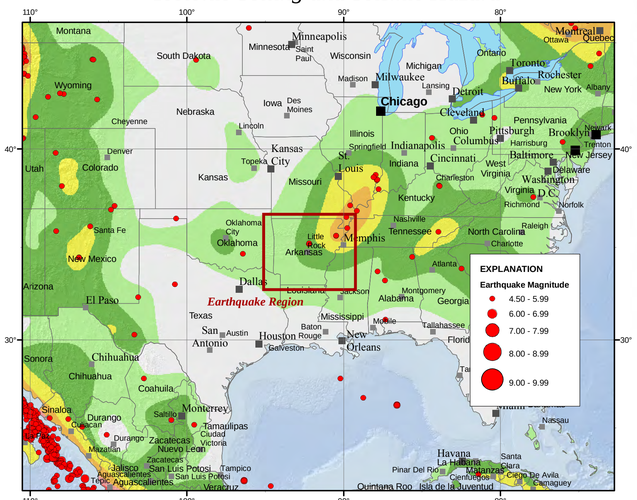
Earthquakes occur on faults. Most earthquakes occur miles deep. At well-studied plate boundaries like the San Andreas Fault System in California, often seismologists can determine the specific fault on which an earthquake occurred. East of the Rockies, far from plate boundaries, that is rarely the case. 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 if the earthquake had occurred 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) and more from where it occurred, and it can cause slight 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 it causes damage as far away as 40 km (25 mi).





Tectonic Setting and 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.

The earthquake locations shown are National Earthquake Information Center (NEIC) magnitude 4.5 and greater events from 1973 to the present.

DATA SOURCES

EARTHQUAKES AND SEISMIC HAZARD
AGS, Arkansas Geological Survey
CERI, Center for Earthquake Research and Information
USGS/NEIC, National Earthquake Information Center

BASE MAP
NIMA and ESRI, Digital Chart of the World
USGS, EROS Data Center
TOPO!, National Geographic
ESRI Online

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.

Map prepared by U.S. Geological Survey
National Earthquake Information Center
20 October 2010
Map not approved for release by Director USGS