

# Not Just a California Thing

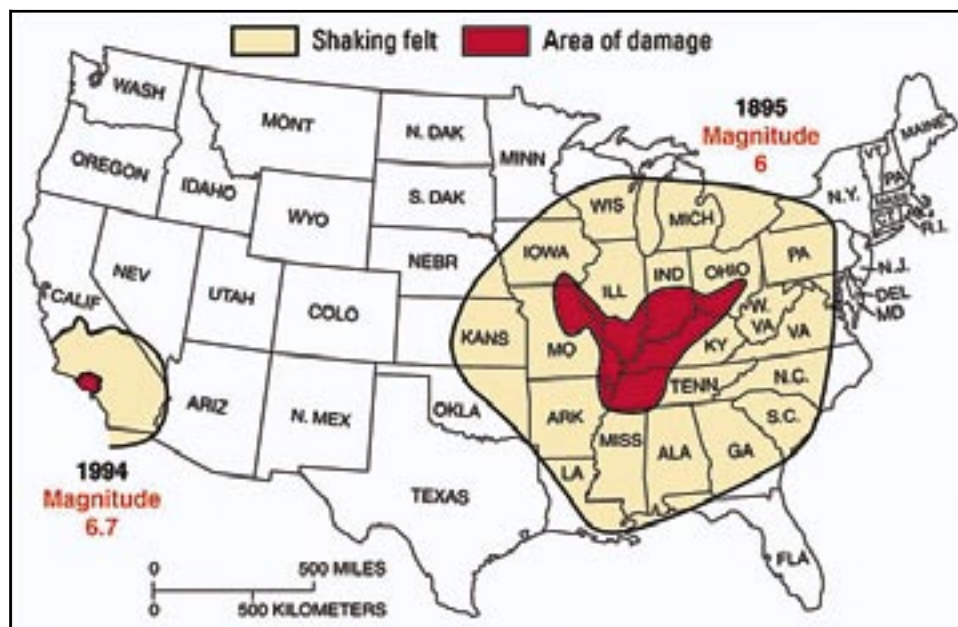
## Why Earthquakes in the Eastern and Central United States could be a Bigger Problem than You Think

By Diane Noserale

Scientists estimate that Memphis has a 25 to 40 percent probability of a magnitude-6.0 or greater earthquake during the next 50 years. During the winter of 1811 to 1812, the central Mississippi River Valley was violently shaken by a series of earthquakes with magnitudes of 7.5 to 8.0. The area of strong shaking from these shocks was two to three times larger than that of the 1964 Alaska earthquake and 10 times larger than that of the 1906 San Francisco earthquake. And there's a 7 to 10 percent chance that an earthquake of this size will hit in the next 50 years.

The eastern United States is not generally regarded as "earthquake country." Yet, earthquakes do strike here. A look back shows that the eastern and central United States have a significant earthquake history, and there are factors that could make these areas of the country even more vulnerable than the West.

In November 1755, an earthquake with an estimated magnitude of 6.0, centered 25 miles off the coast of Cape Ann, Mass., heavily damaged Boston. In August 1886, a magnitude-7.3 earthquake hit Charleston, S.C., destroying most of the city. During the winter earthquakes of 1811 to 1812, observers reported that the ground rose and fell. Large waves were generated on the Mississippi River; high banks collapsed; and whole islands disappeared. Raised or sunken lands, fissures and large landslides



Earthquakes of similar size (1895 New Madrid Seismic Zone earthquake and 1994 Northridge earthquake) show how earthquakes in the central and eastern United States affect much larger areas than earthquakes in the West. Illustration by Eugene Schweig

covered an area of at least 30,000 square miles. Chimneys were toppled, and log cabins were thrown down as far away as Cincinnati, Ohio, and St. Louis, Mo. These earthquakes were felt throughout the eastern United States, rattling even the White House. President Madison and his wife were said to have thought a burglary was in progress.

Almost every state east of the Mississippi River has had at least one earthquake strong enough to cause damage, and a major earthquake seems to occur somewhere along the Eastern Seaboard about once every 100 years.

Earthquakes in the central and eastern United States are less frequent than in the

western United States, but they affect much larger areas. For example, let's compare two earthquakes of similar strength: a magnitude-6.8 earthquake in the New Madrid Seismic Zone in 1895 and the magnitude-6.7 Northridge, Calif., earthquake in 1994. After the New Madrid earthquake, shaking was reported from Louisiana to Michigan and from Kansas to North Carolina. Shaking reports from the Northridge earthquake, however, were mostly limited to Southern California.

This strong contrast is caused by differences in geology east and west of the Rocky Mountains. Rocks in the eastern and central United States transmit earthquake waves

more efficiently and for greater distances than those in the West.

This expansive shaking is a concern because of how shaking affects buildings and other structures. It has been said that earthquakes don't kill people, buildings do. A greater population density and an older stock of buildings and roads that have not been retrofitted for earthquake safety are a big concern. Building codes with strict provisions for earthquake-resistant construction of new buildings are less common in eastern and Middle America than in California and much of the West.

Another complication for earthquake science in the eastern United States is that faults here rarely break the ground surface. Although this is a good thing, it means that in many areas faults capable of hosting earthquakes have not been mapped or even identified. How frequently and how strongly earthquakes hit the area is, therefore, often unknown.

When it comes to earthquakes, one of the most important differences between the East and the West is the lack of awareness about earthquake hazards. Many people are unaware of the potential for a major earthquake to hit outside of California, and fewer still know what to do when one does hit. Whether in the East, the West or somewhere in between, all Americans should learn the earthquake risk for their area and incorporate earthquake preparedness into their overall disaster plan.

Written with assistance from Tania Larson

## Forecast of Aftershock Hazard Maps Show Daily Shaking Probability

By Tania Larson

In the course of a day, the probability for moderate-to-strong earthquake shaking in California is between 1-in-10,000 and 1-in-100,000. That isn't very high when you consider that the average American has a one-in-2,500 chance of being in a car accident in the same period of time. However, there are times when the likelihood of experiencing earthquake shaking goes up considerably. The USGS 24-hour forecast of aftershock hazard maps show Californians when and where the risk is elevated.

Custom earthquake probability maps are available nationwide. Simply enter your ZIP code, the magnitude, and number of years you would like the probability to reflect; and the tool will return a map of your area. But the results are



Forecast of aftershock hazard maps show Californians the likelihood of strong aftershocks, which could destroy already damaged buildings. Photo: J.K. Nakata

based on a mean probability for random time periods.

The USGS and the Swiss Federal Institute of Technology, with additional funding from the Southern California Earthquake Center, have developed a

way to quantify the current probability of shaking based on recent seismic activity — all the earthquakes recorded by the California Integrated Seismic Network, part of the USGS ANSS. [See page 22].

The aftershock forecast map, released in May 2005, shows the chance for strong shaking at any location in California within the next 24 hours.

"The only times probabilities become large enough to cause concern is after a significant earthquake that may have already caused damage," said Matt Gerstenberger, former USGS Mendenhall Fellow, when the maps were released. "Aftershocks are likely in this situation, and the new maps show where those aftershocks are most likely to be felt and how the hazard changes with time."

As a fault ruptures, it tends to stutter, like heavy furniture pushed along a hard

floor. Sometimes, the first earthquake is a main event, followed by a series of aftershocks. At other times, it is a foreshock with a larger earthquake to follow. Either way, after the rumbles of one earthquake subside, there is a strong probability of more shaking to come. Within an hour of a damaging earthquake, there will likely be several aftershocks. The second day will often have half as many aftershocks as the first day.

Updated hourly, the forecast maps illustrate this change in the likelihood of experiencing shaking during earthquake sequences. Perhaps even more importantly, they take magnitude and distance into account and show where potentially damaging levels of shaking are likely to occur. Past sequences show that an increase in probability could be seen before about half of California's larger earthquakes.