

Questions about aftershocks answered

Sherry Seethaler, San Diego Union-Tribune, 7-4-10

Question: Months after the 7.2-magnitude Easter earthquake, earthquakes, such as the 5.7 event on June 14, are still being reported as aftershocks. After such a long time, why are these earthquakes considered aftershocks?

-- Rick Bialick

Answer: Although aftershock frequency drops off rapidly, at a rate proportional to the inverse of time, seismic activity can remain elevated for years. The U.S. Geological Survey defines an earthquake as an aftershock as long as the rate at which earthquakes occur in the region remains greater than the rate at which they occurred before the main shock, the largest earthquake in the cluster.

To satisfy the traditional U.S.G.S. definition of an aftershock, the earthquake must happen within a distance of approximately the length of the main shock's fault. Aftershocks are concentrated at the edges of the fault where the main shock's displacement occurred, as well as on adjacent fault segments. The pattern of aftershocks can be used to confirm the extent of the main shock.

Yet, computer modeling of earthquake clusters and increasingly sensitive seismic networks have revealed that earthquakes can trigger seismic activity at distances out to at least 10 times the distance of the main shock fault length. For example, a study by Scripps Institution of Oceanography researchers found that aftershocks of the 2005 5.2 Anza earthquake were detected along 31 miles (50 kilometers) of the San Jacinto fault, although the fault length of the main shock was only 2.8 miles (4.5km).

Larger aftershocks and more aftershocks follow larger earthquakes. Although the exact physics of how one earthquake triggers another is not known, aftershocks are thought to be the slipping of patches within the fault that did not slip during the main shock and the adjustments of adjacent faults due to the strain created by the main shock.

The 7.2 Easter earthquake (dubbed the El Mayor-Cucapah earthquake), centered 32 miles (52 km) southeast of Calexico, was a slip along the principal boundary between the North American and Pacific plates. The 5.7 aftershock on June 14 occurred on the Elsinore fault, northwest of the main shock. Seismic activity along the Elsinore fault has been well above background since the El Mayor-Cucapah earthquake.

How long we can expect greater than usual shaking, rattling and rolling? According to a study published in the journal *Nature* (Nov. 5, 2009), aftershock activity lasts about a decade near fast-moving boundaries, like those of the North American and Pacific plates, although aftershocks decline dramatically after the first couple of years. In contrast, slow-moving faults in continental interiors can take hundreds of years to redistribute stresses and return to background seismicity.