Using new technique, scientists find 11 times more aftershocks for 2004 quake

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(PhysOrg.com) -- Using a technique normally used for detecting weak tremor, scientists at the Georgia Institute of Technology discovered that the 2004 magnitude 6 earthquake along the Parkfield section of the San Andreas fault exhibited almost 11 times more aftershocks than previously thought. The research appears online in *Nature Geoscience* and will appear in print in a forthcoming edition.

"We found almost 11 times more events in the first three days after the main event. That's surprising because this is a well-instrumented place and almost 90 percent of the activity was not being determined or reported," said Zhigang Peng, assistant professor at Georgia Tech's School of Earth and Atmospheric Sciences.

In examining how these aftershocks occurred, Peng and graduate research assistant Peng Zhao discovered that the earliest aftershocks occurred in the region near the main event. Then with time, the aftershocks started migrating. Seeing how the aftershocks move from the center of the quake outward lends credence to the idea that it's the result of the fault creeping, said Peng.

"Basically, the big event happens due to sudden fault movement, but the fault doesn't stop after the main event. It continues to move because the stress has been perturbed and the fault is trying to adjust itself. We believe this so-called fault creep is causing most of the aftershocks," he said.

Peng and Zhao used a method known as the matched filter technique, rather than the standard technique to examine the aftershocks. The traditional way of determining a location of an earthquake is that a human analyst has to go through each seismic recording, determine the order of events and their location. This takes time and if there are many events, or if some of them occur at the same time, it's hard for the analyst to figure out which came first.

"Because of these difficulties, only the largest aftershocks are located, with many small ones missing. So, we used the matched filter technique because it allows us to use a computer to automatically scan the seismic records to detect events when their patterns are similar. There is no need to manually pick out the aftershocks after the mainshock," said Peng.

The team chose the 2004 Parkfield quake to test the matched filter technique because the quake is on the San Andreas fault. The San Andreas is one of the most heavily instrumented places in the world, owing to the famous Parkfield, California, earthquake prediction experiment in the 1980s.

Peng is currently using the matched filter technique to work with several other research groups to detect early aftershocks of recent large earthquakes in Japan and China.

Source: Georgia Institute of Technology