Links in Hayward, Calaveras faults a big danger, scientists warn

David Perlman, San Francisco Chronicle, 4-3-15

New evidence shows clearly that traces of the long-feared Hayward Fault and the recently active Calaveras Fault are closely linked underground — indicating that both could rupture together in an earthquake more destructive than past forecasts have indicated, Berkeley quake scientists report.

Satellite surveys of the region using advanced versions of high-precision radar known as InSAR have revealed signs that the ground is creeping on the surface between the two faults, while arrays of seismometers have registered barely detectable microquakes underground in the same region, according to scientists at the UC Berkeley Seismological Laboratory.

The evidence raises the likelihood of larger quakes in the region than anticipated if both fault segments rupture together, they said.

Past forecasts have indicated that earthquakes with magnitudes of 6.7 to 6.9 are possible on either fault, but a rupture of the two linked faults could produce a quake with magnitudes of up to 7.3, the Berkeley scientists said. That would release at least 2½ times more energy than previous estimates have indicated.

The new evidence was published Thursday in the journal Geophysical Review Letters by Estelle Chaussard, a postdoctoral fellow at the Berkeley lab, who has used similar satellite information to monitor volcanoes in motion and California groundwater.

David Schwartz, a geophysicist at the U.S. Geological Survey in Menlo Park, noted that a similar underground link between faults was discovered in Alaska in 2002 after the major Denali earthquake. Fresh evidence showed that the Denali Fault and the distant Susitna Glacier Fault were connected, Schwartz said.

He read Chaussard's report and had heard her discuss it at a recent Menlo Park meeting. "This is a very nice job of defining the structured connection between the Hayward and the Calaveras," Schwartz said. "She has raised a significant issue that calls for a lot more geological work to define that connectivity — particularly more clearly along the Calaveras."

A seismic fault's length determines the size of the earthquake its rupture can produce, Chaussard noted, and while the Hayward Fault runs about 43.5 miles from San Pablo Bay to its southern end roughly at Fremont, the longer Calaveras extends for more than 76 miles from north of Danville to south of Hollister in the Salinas Valley.

A rupture along that kind of connected fault from Richmond on the Hayward to Gilroy on the Calaveras, for example, she said, could produce a magnitude 7.3 earthquake, larger than the 1989 Loma Prieta quake, which measured a magnitude of 6.9. "But it would be even greater if the rupture extended south to Hollister, where the Calaveras Fault meets the San Andreas," she said.

The San Andreas Fault is 800 miles long, but so far there's no evidence of any connection between the two fault traces.

Chaussard's work uses 19 years of seismic data from two European Space Agency satellites carrying highly sensitive instruments known as InSAR, or Interferometric synthetic aperture radar, and has also used the satellite data to monitor volcanoes.

At the Geological Survey, Wayne Thatcher, a research geophysicist who is a member of the survey's InSAR Research Group and is familiar with Chaussard's earthquake work, praised the report.

"She's made a very good connection with her evidence of surface creep between the two faults," Thatcher said, "because that evidence is so difficult if not impossible to observe on the ground, when you're searching for it."

Chaussard's colleagues include Roland Bürgmann, professor of earth and planetary sciences at Berkeley and an expert on the deformation of seismic faults.