Strain-Rate Changes Triggered by Local and Regional Earthquakes?: Strainmeter Observations in the Anza Section of the San Jacinto Fault

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The Anza segment of the San Jacinto Fault in southern California has not had a large earthquake in the last 200 years, longer than for any other part of this fault. From 1934 through 2000, there was only one earthquake of magnitude ≥5 in this region, in 1980; since 2001 there have been three (in 2001, 2005, and 2010). On March 11 (day 70) 2013, a magnitude 4.7 event occurred in this area. Immediately following this earthquake, changes in long-term strain rates were observed both on the PBO borehole strainmeters (BSM's) that were installed in the region in 2006-2007, and also on the longbase laser strainmeters (LSM's) that have operated at Piñon Flat Observatory (PFO) since well before the PBO.

At PFO the BSM (B084) is located inside the area enclosed by the LSM's. Both instruments show a significant increase in the fault-parallel shear strain ($e_{EE} - e_{NN}$) following the earthquake: note that the LSM result comes from combining results from two completely independent systems. The BSM and LSM shears show several episodes of more rapid slip lasting for 1-2 hr. Agreement in other components is not as good; in particular, the NW-SE LSM shows little change, which is not the case for the fault-normal shear on the BSM.

Postseismic strain changes were observed on other PBO BSM's in the Anza area, though in some cases with significantly different time behavior. The LSM's at PFO have shown a similar response following the El-Mayor Cucapah earthquake in 2010, and earlier Anza-area shocks in 2005 (mag 5.2) and 2001 (5.0) – though not following a magnitude 5.4 in 2010; the latter, and the El-Mayor Cucapah earthquake, also caused strain changes at many of the BSM's.

The shear observed at PFO can be explained by aseismic slip at depth in the Anza seismic gap. We are investigating how well this source, or another, could explain the BSM observations over a wider area.