July 6, 2019 03:19:52UTC 6.9 Ridgecrest, CA

Douglas Dreger, Berkeley Seismological Laboratory
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Strong motion data from the Southern California Earthquake Data Center (scedc.org) was inverted for the finite-source rupture model. The strong motion data was instrument corrected, integrated from acceleration to displacement, and resampled to 10 samples per second. A causal highpass Butterworth filter with a corner of 0.01 Hz was applied to remove long-period drift in the data. Green's functions were computed for the SOCAL velocity model using Bob Herrmann's (2014) frequency wavenumber code.

The method employed for the source inversion is based on (Hartzell and Heaton, 1983; e.g. Kaverina and Dreger, 2002; Dreger et al., 2014). For this inversion a 50 km long by 20 km wide fault with the hypocenter located in the center at 17 km depth (based on the Caltech hypocenter location). The slip angle was allowed to vary and 6 overlapping time windows each with a 1 second rise time were considered allowing for a total of 5.5 second rise time. The rupture velocity was assumed to be 2.8 km/s (80% of the average Vs of the depth of the rupture).

Three-component waveform data from the 8 closest stations (distances ranging from 58 to 178 km) of the SCSN was used (Figure 1). There is generally a good level of fit to the displacement waveform data (Figure 2). The slip model in Figure 3 shows the predominant rupture was toward the northwest, initiating deep and rupturing strongly upward. The overall rupture is bilateral though the primary rupture direction was to the NW. The scalar seismic moment was found to be 3.14e+26 dyne cm corresponding to a moment magnitude (Mw) of 6.9. Average and peak slip was found to be 1.9 and 8.4 meters, respectively. The peak slip is somewhat dependent on the smoothing of the model. From the slip model the stress change may be computed (Ripperger and Mai, 2004), and the earthquake is found to have a high average stress drop of approximately 12 MPa. This model does predict some surface slip of the order of 2-3m, however this part of the model is not very well constrained and the use of InSAR and GPS data is expected to better constrain the shallow slip. Future work will jointly invert the seismic waveform, GPS and InSAR datasets.

References

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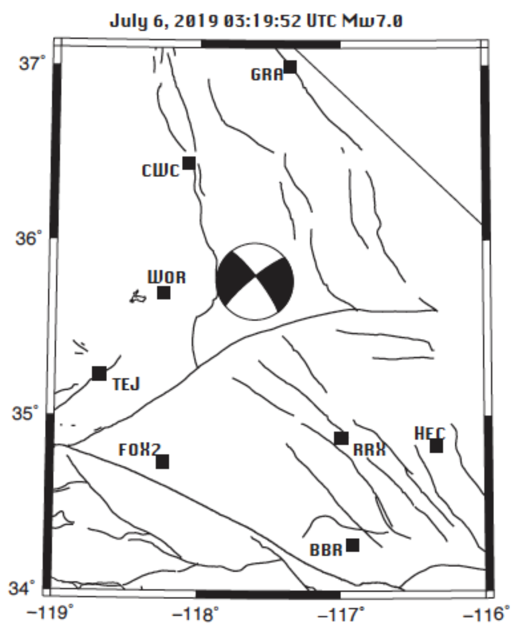

Figure 1. Map showing the location of the event with the Caltech moment tensor solution, and the 8 SCSN strong motion stations used in the finite-source inversion.

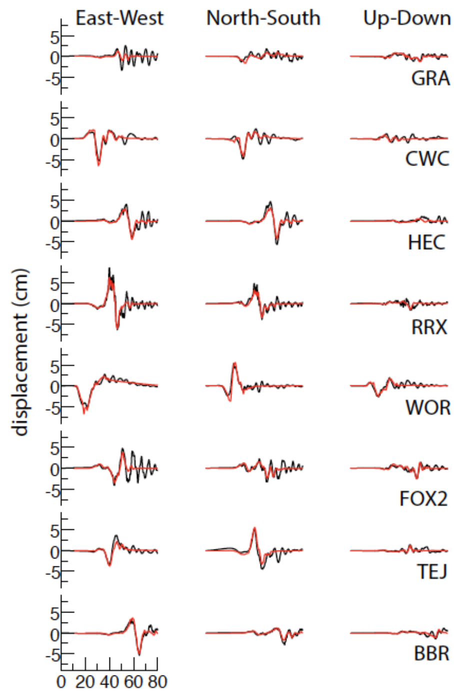

Figure 2. Observed (black) and synthetic (red) displacement waveforms. The acceleration data was instrument corrected, and doubly integrated to displacement. A causal highpass Butterworth filter with a 0.01 Hz corner was applied to both the data and synthetics.

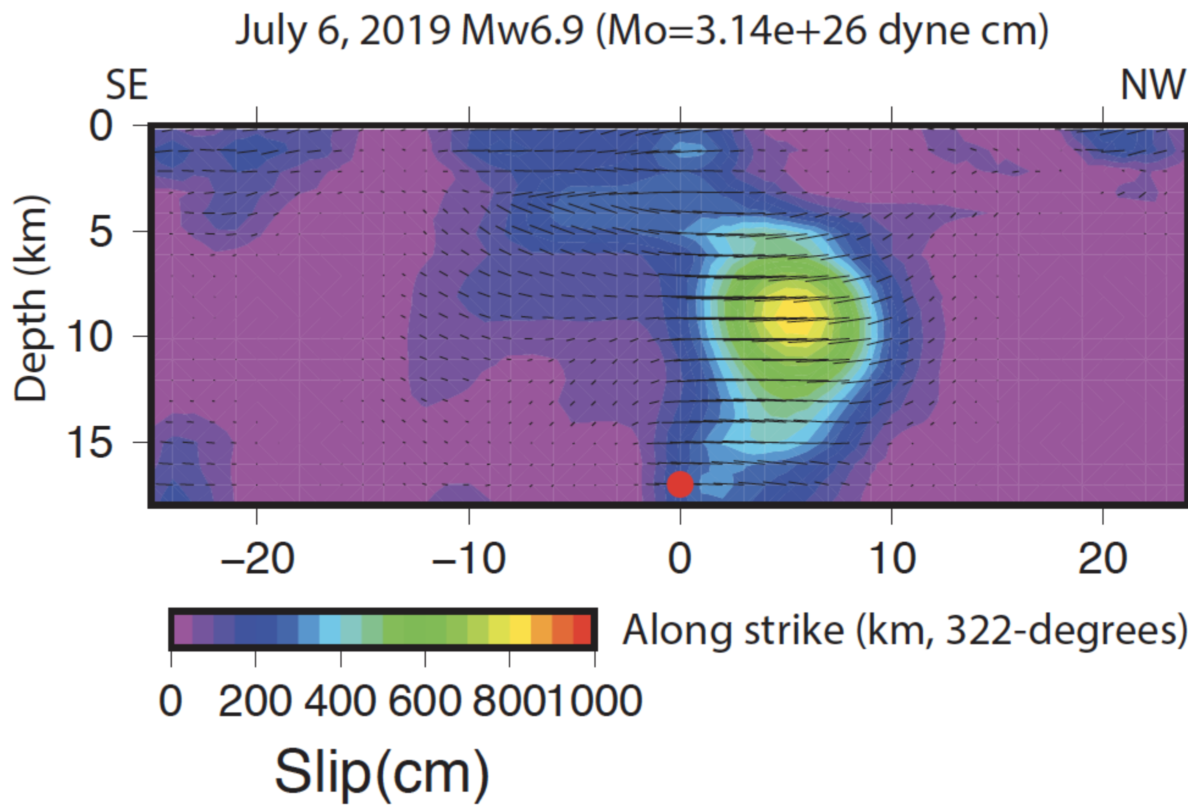

Figure 3. Slip model for the July 6, 2019 Mw 6.9 Ridgecrest earthquake. The hypocenter is shown as the small red circle. The black lines show the slip direction. The rupture started deep (17 km, Caltech hypocenter) and rupture predominantly updip and to the NW. The average slip is 1.9 m, and the peak slip (dependent on the smoothing) is 8.4 m. The scalar seismic moment is 3.14+26 dyne cm, and the average stress drop in the model is 12 MPa.