Preliminary UC Berkeley Finite-Source Model for the August 24, 2014 Mw6.0 West Napa Earthquake

A preliminary finite-source slip model was obtained for the August 24, 2014 Mw6.0 West Napa earthquake by inverting seismic waveform data from 8 three-component stations of the Berkeley Digital Seismic Network (Figure 1). The acceleration channels were processed by removing the mean, removing the instrument response, integrating to displacement, applying a bandpass filter between 0.02 to 1.0 Hz, and resampling the time series to 0.1 seconds/sample.

Green's functions were computed for the GIL7 velocity model (Pasyanos et al., 1996) using an FK-integration program written by Saikia. The Green's functions where filtered with same two-pass Butterworth filter applied to the data.

The finite-source code reg_inv (Dreger and Kaverina, 2000; Kaverina et al., 200) was used to invert for a kinematic finite-source model assuming the BSL focal mechanism (strike=155, dip=82, rake=-172). A rupture velocity of 2.8 km/s, 82% of the shear wave velocity of the main body of slip was assumed. The slip model shown in Figure 2 indicates the earthquake ruptured unilaterally to the N-NW and updip toward Napa, CA. The average slip in the model is 44 cm and the peak is 100 cm. The region of shallowest slip is consistent with preliminary field reports of surface offsets of as much as 25 cm (Oskin, SCEC clearing house website). The main body of slip extending updip from the hypocenter to 2 km depth, and extending approximately 12 km NW of the hypocenter is well resolved. Shallower slip produced by the model is much less certain, and would not radiate strongly, however it is consistent with the observations of largest surface slip.

This model will be updated using static GPS and InSAR deformation data as well as the surface slip constraints as they become available.

Questions regarding the model can be directed to Douglas Dreger (ddreger@berkeley.edu).

References:

Dreger, D., and A. Kaverina (2000). Seismic remote sensing for the earthquake source process and near-source strong shaking: A case study of the October 16, 1999 Hector Mine earthquake, Geophys. Res. Lett., 27, 1941-1944.

Kaverina, A., D. Dreger, and E. Price (2002) The combined inversion of seismic and geodetic data for the source process of the 16 October 1999 M (sub w) 7.1 Hector Mine, California, Earthquake, Bull. Seism. Soc. Am., vol.92, no.4, pp.1266-1280.

Pasyanos, M. E., D. S. Dreger, and B. Romanowicz (1996), Towards Real-Time Determination of Regional Moment Tensors, Bull. Seism. Soc. Am., 86, 1255-1269.

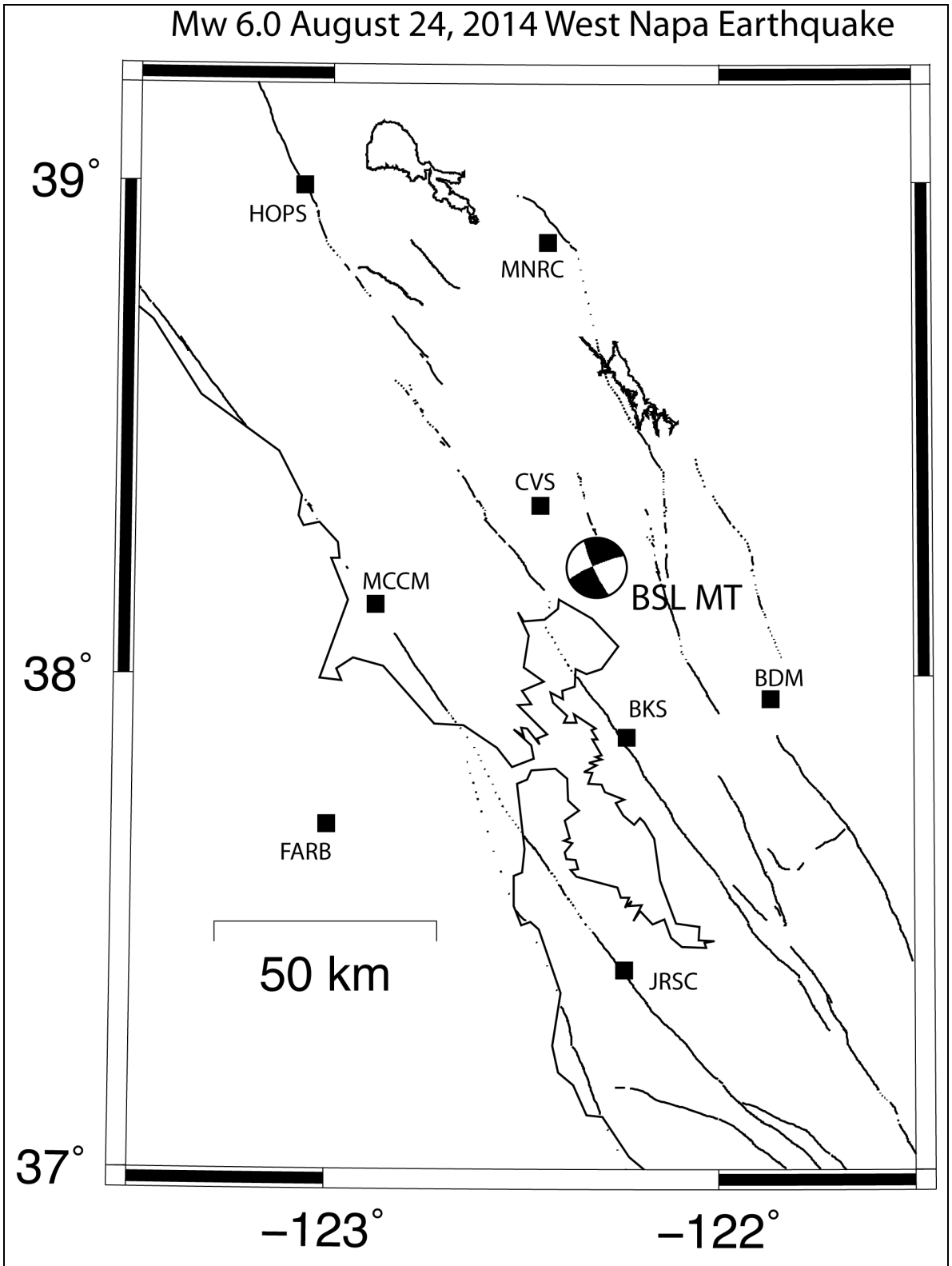

Figure 1. Map showing the Berkeley Seismological Laboratory focal mechanism plotted at the earthquake epicenter, and BDSN stations used to compute a finite kinematic source model of the earthquake.

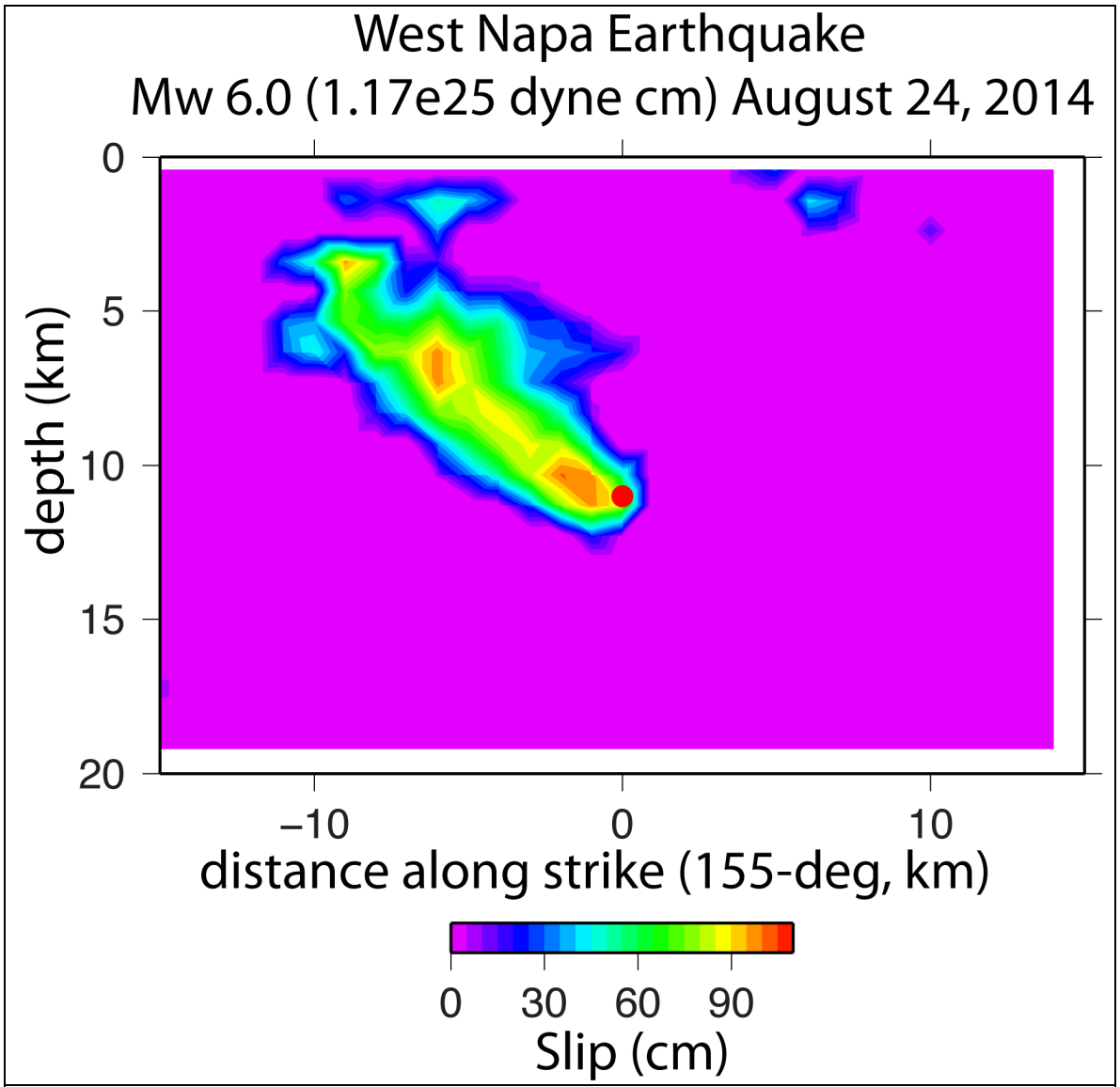

Figure 2. Slip model obtained by fitting three-component displacement waveform data at 8 BDSN strong motion sites. The hypocenter is indicated by a red circle at 11.3 km depth. The rupture extends approximately 12 km NW of the hypocenter and updip. The trajectory of the rupture was directly toward Napa, CA. Slip shallower than 2 km is consistent with the relative position of observed peak surface slip, though it is not well constrained by the seismic waveform data.

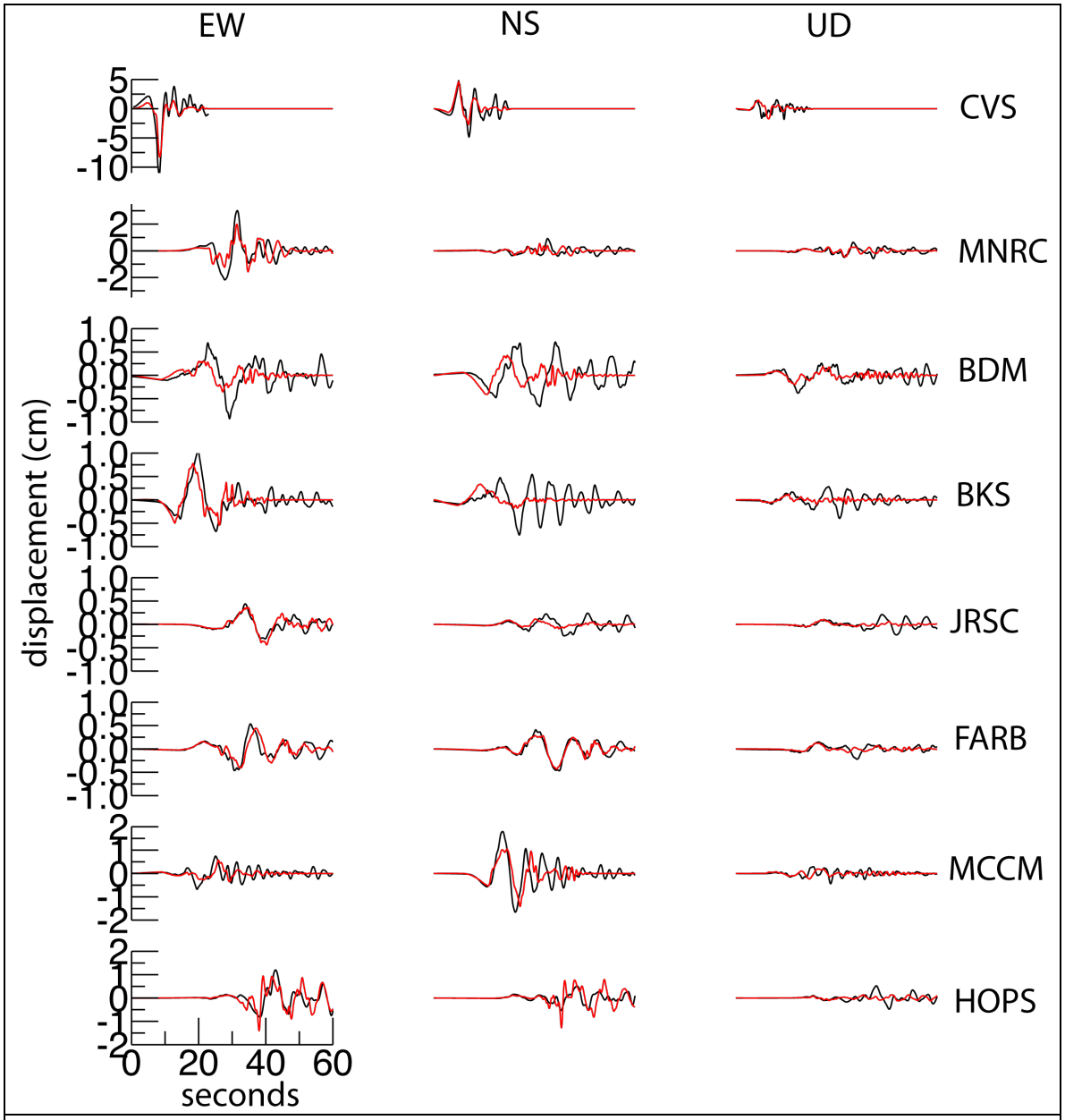

Figure 3. Observed (black) and predicted (red) displacement time histories are compared. The data and synthetic seismograms were bandpass filtered from 0.02 to 1.0 Hz using a two-pass Butterworth filter.