Path Calibration and Source Estimation in the LA Basin, CA

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Abstract

The 2008 Chino Hills events produced extraordinary datasets to perform high-resolution source studies. Our preliminary studies show that the 3D Community Velocity Model (CVM) misrepresent the velocity structures above the blind-thrust faults beneath the eastern LA basin. Thus simulating broadband wave fields to higher frequency provides an excellent opportunity to refine shallow velocity structure in this region. Twelve stations are path-calibrated for the respective 1D velocity models and a preliminary finite fault inversion is performed to promote the high-resolution source studies.

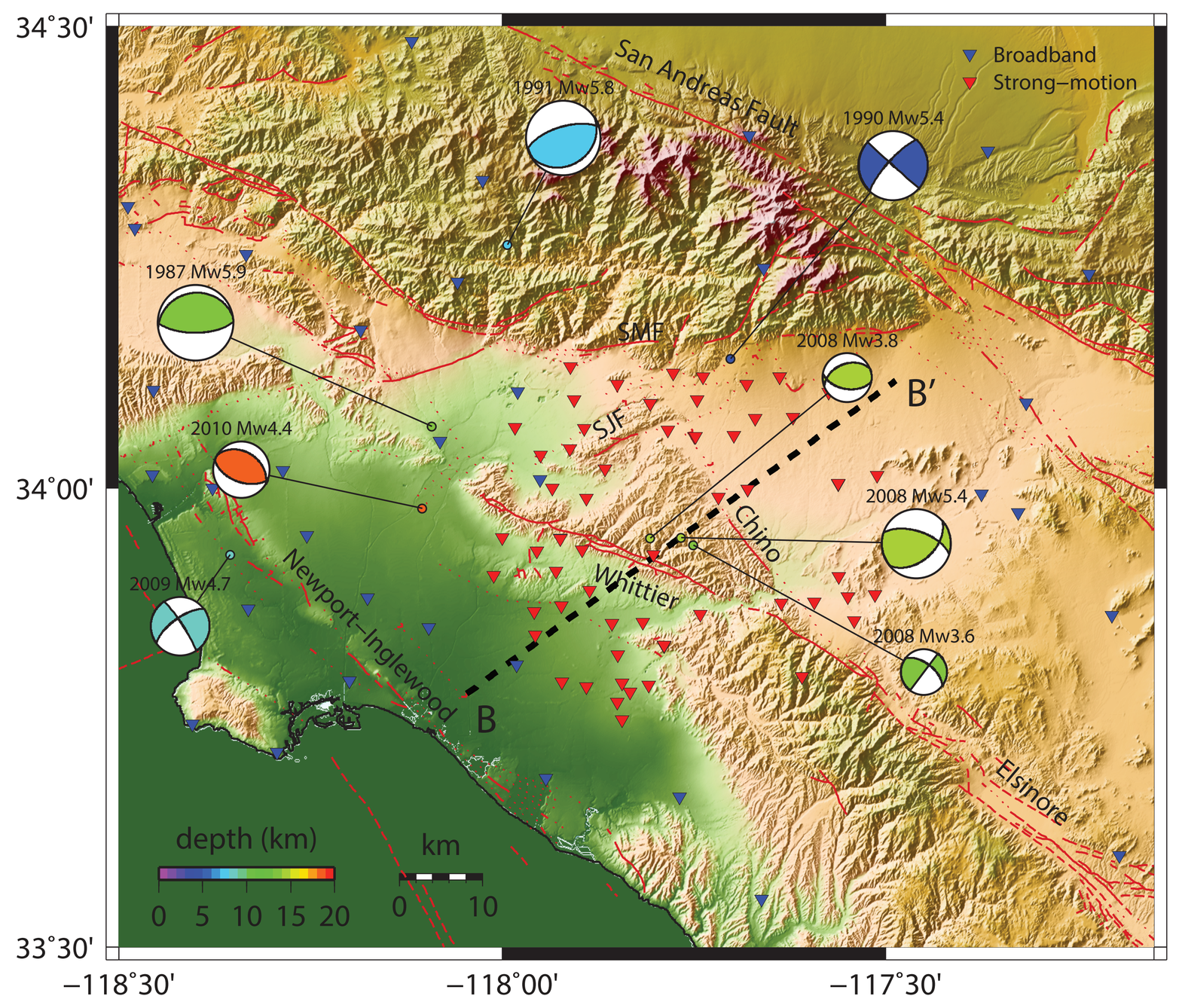


Figure 1. Seismicity (1981-2010) in the Los Angeles metropolitan area. Relocated earthquake catalog are from Yang et al. (2011).

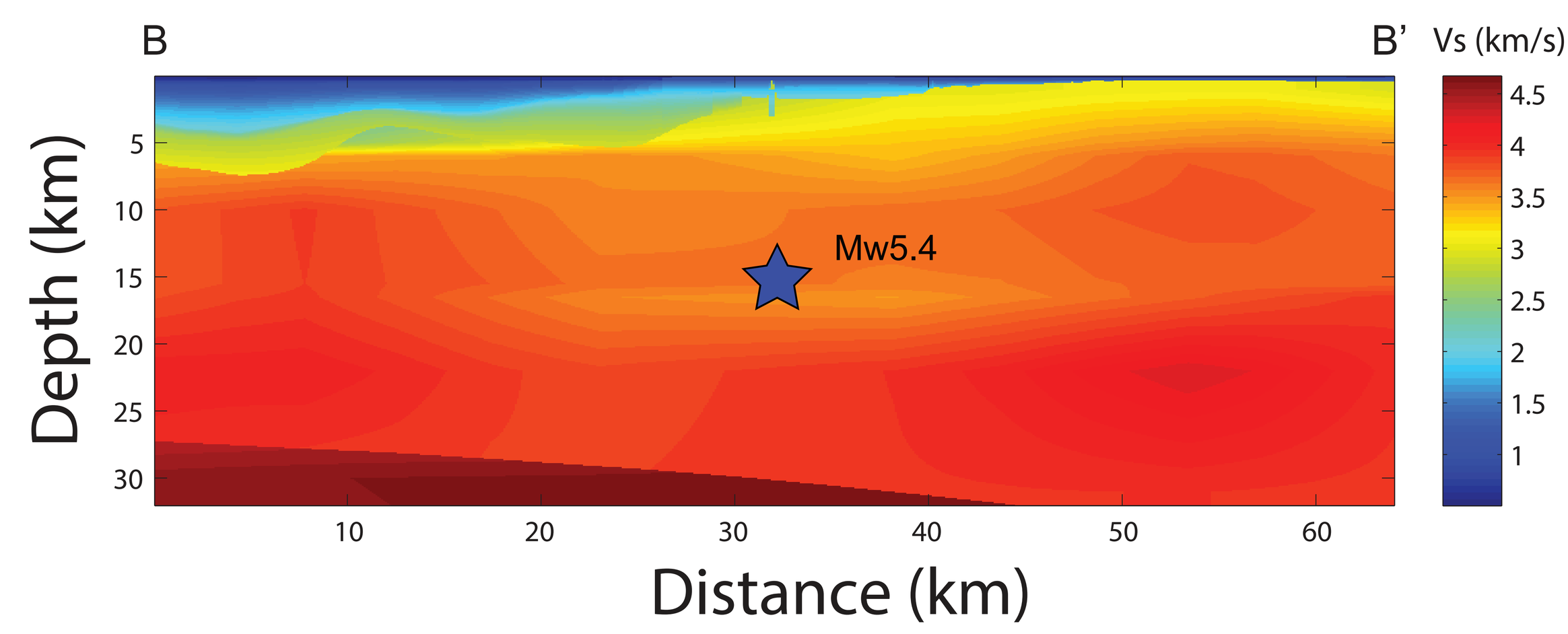


Figure 2. 2D shear velocity profile along B-B' extracted from the CVM-S model. The blue star shows the hypocenter of the 2008 Chino Hills earthquake.

Path Calibration

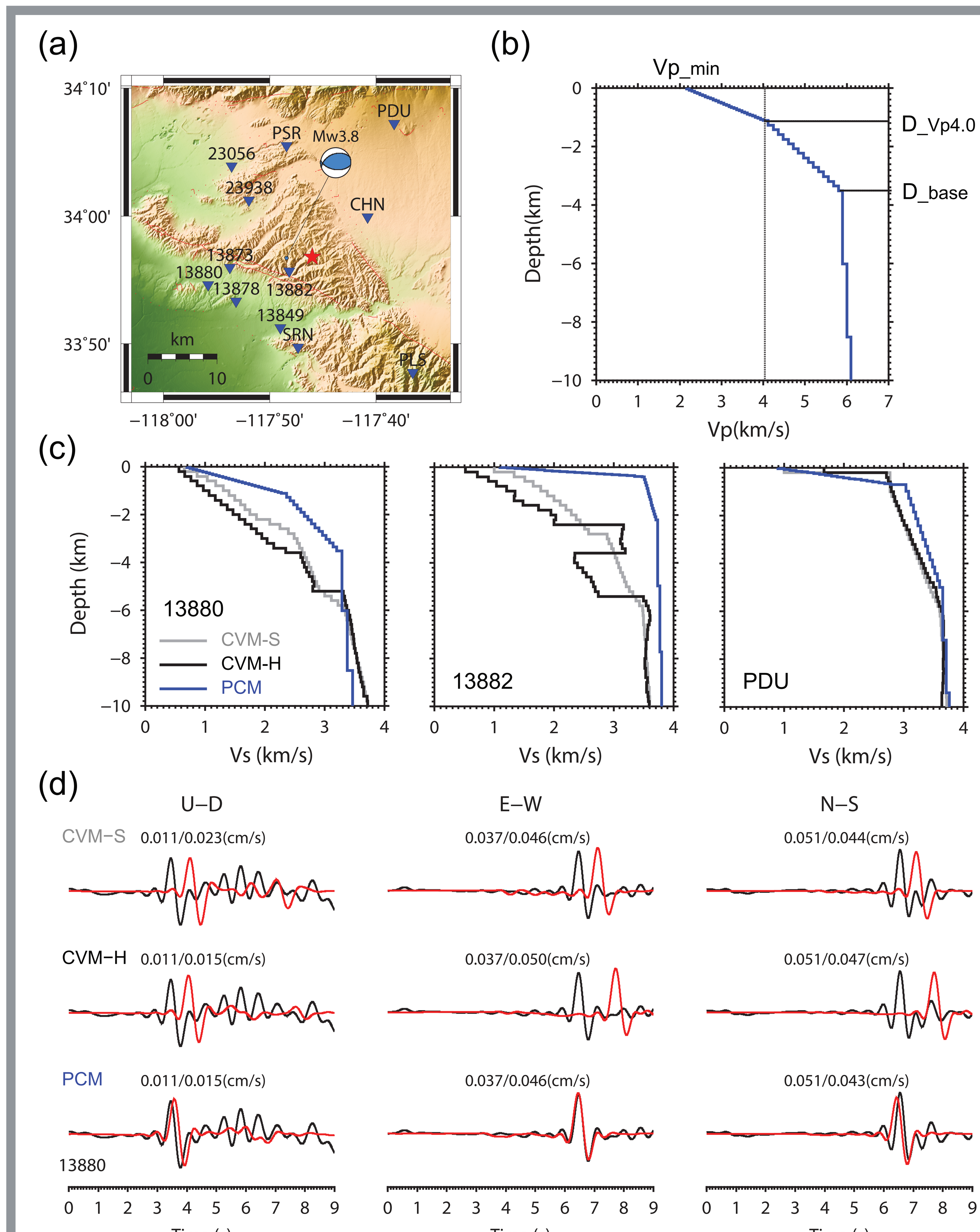


Figure 4. (a) Map of path-calibrated stations for the Mw 3.8 event. (b) Schematic velocity profiles indicating how to conduct path calibration in this study. Vp_min, D_Vp4.0 and D_base are the three variable parameters during a grid search. (c) Selected Vs depth profiles for the path calibration model (PCM) and the two 1D profiles extracted from the CVM-S and CVM-H velocity models at the respective stations. (d) Three-component waveform comparisons between the data (black) and the synthetics (red) for the 13880 station. All the waveforms are filtered to 0.02-2.0 Hz, and the peak amplitudes of data (first) and synthetics (second) are shown.

Finite Fault Inversion

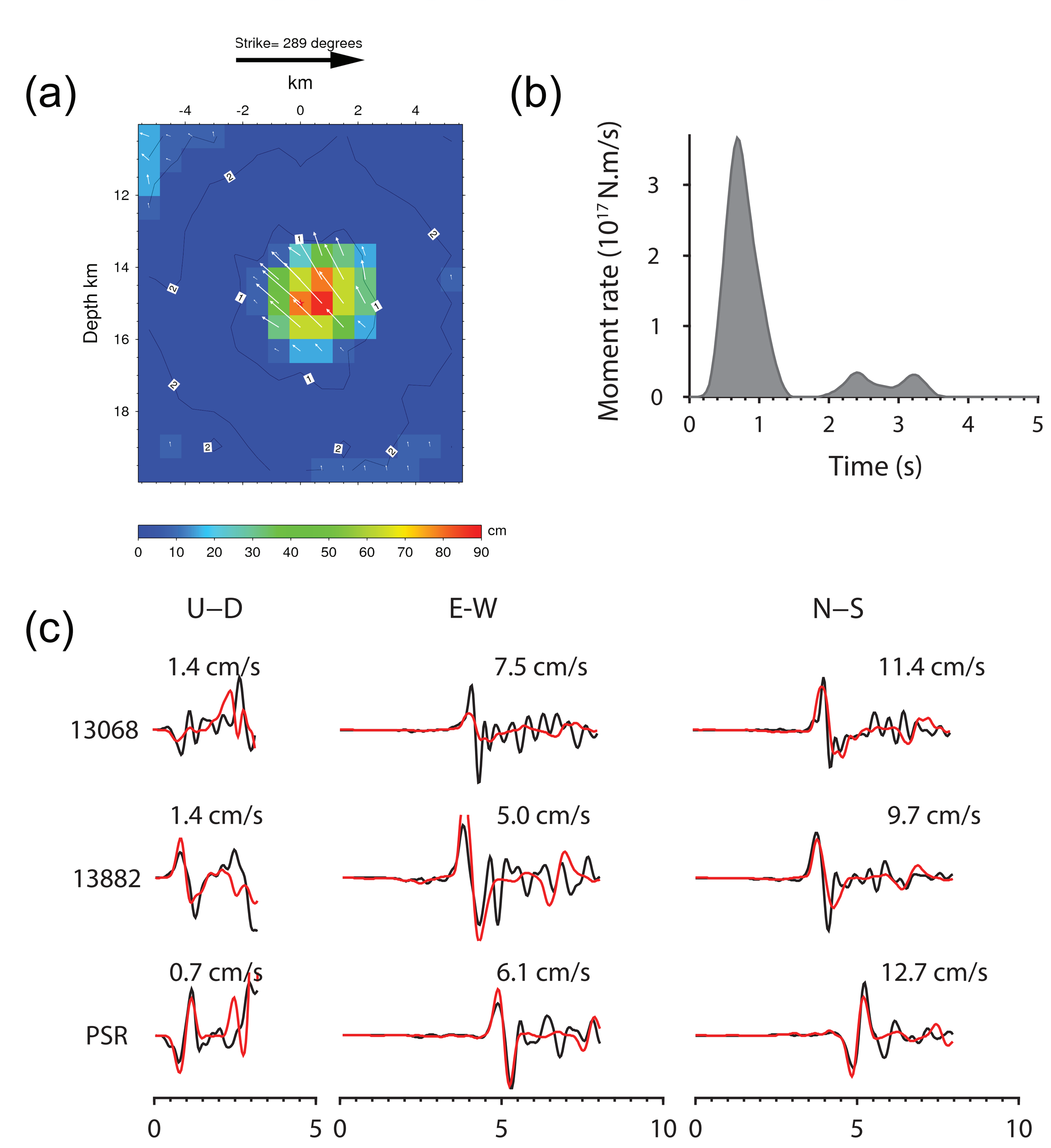


Figure 5. (a) Slip distribution of the Mw 5.4 event on the NE dipping nodal plane. The red star shows the hypocenter. (b) Three-component waveform comparisons between the data (black) and synthetics (red) using preferred slip model for the Mw 5.4 event. All the waveforms are filtered to 0.1-3.0 Hz and the peak amplitudes of data are shown. (c) Moment rate as a function of time.

Mechanism Inversion

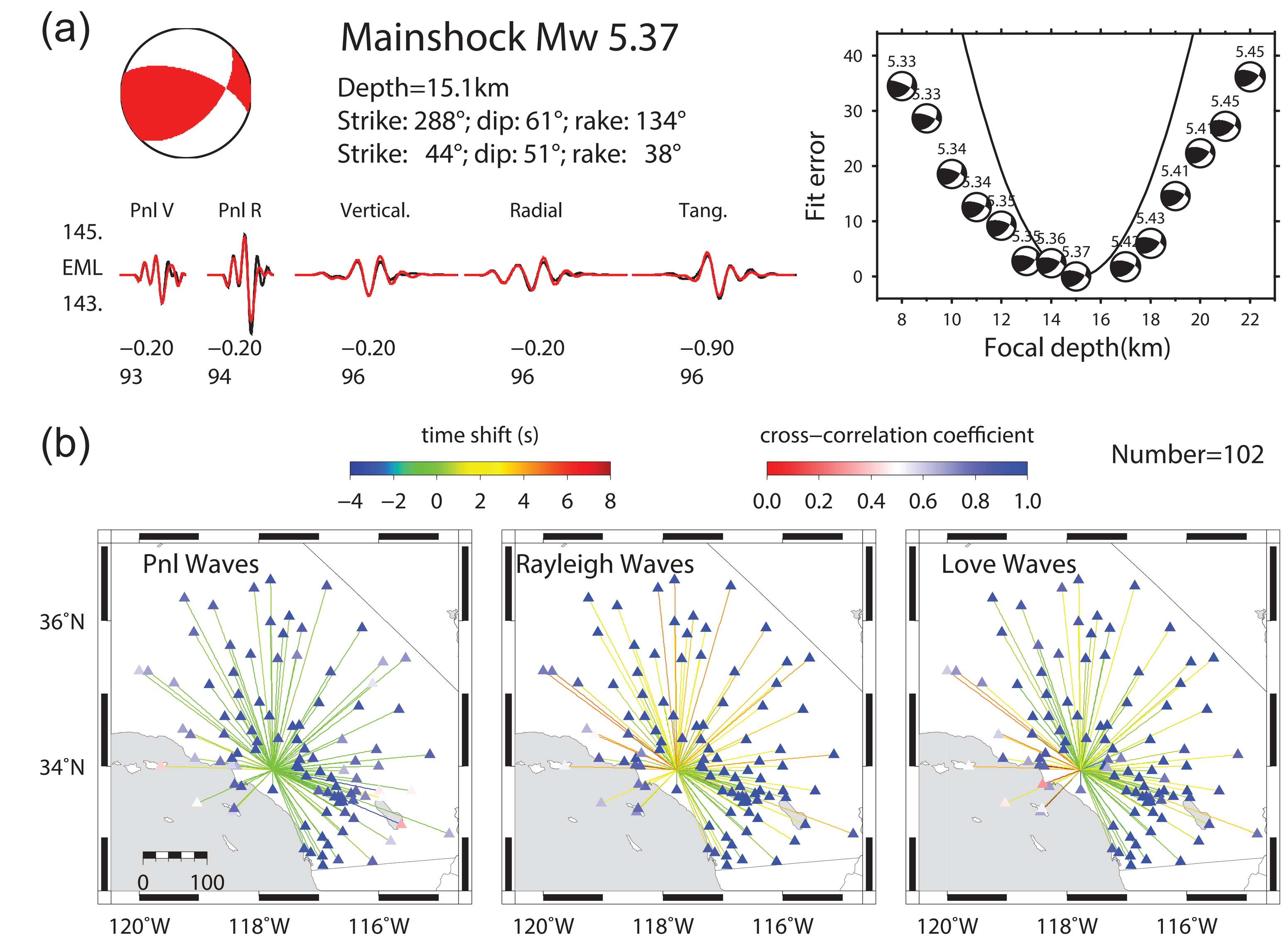
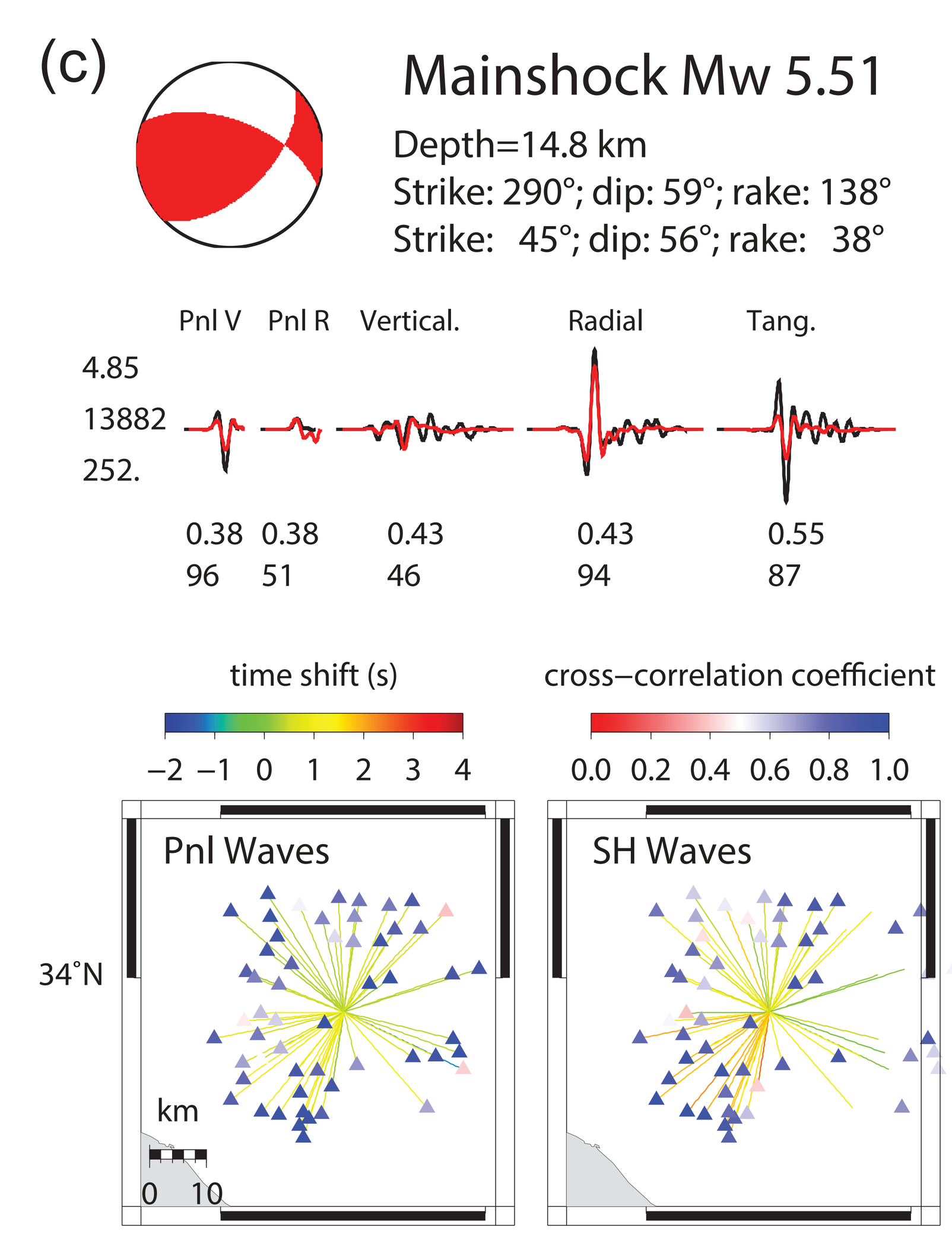
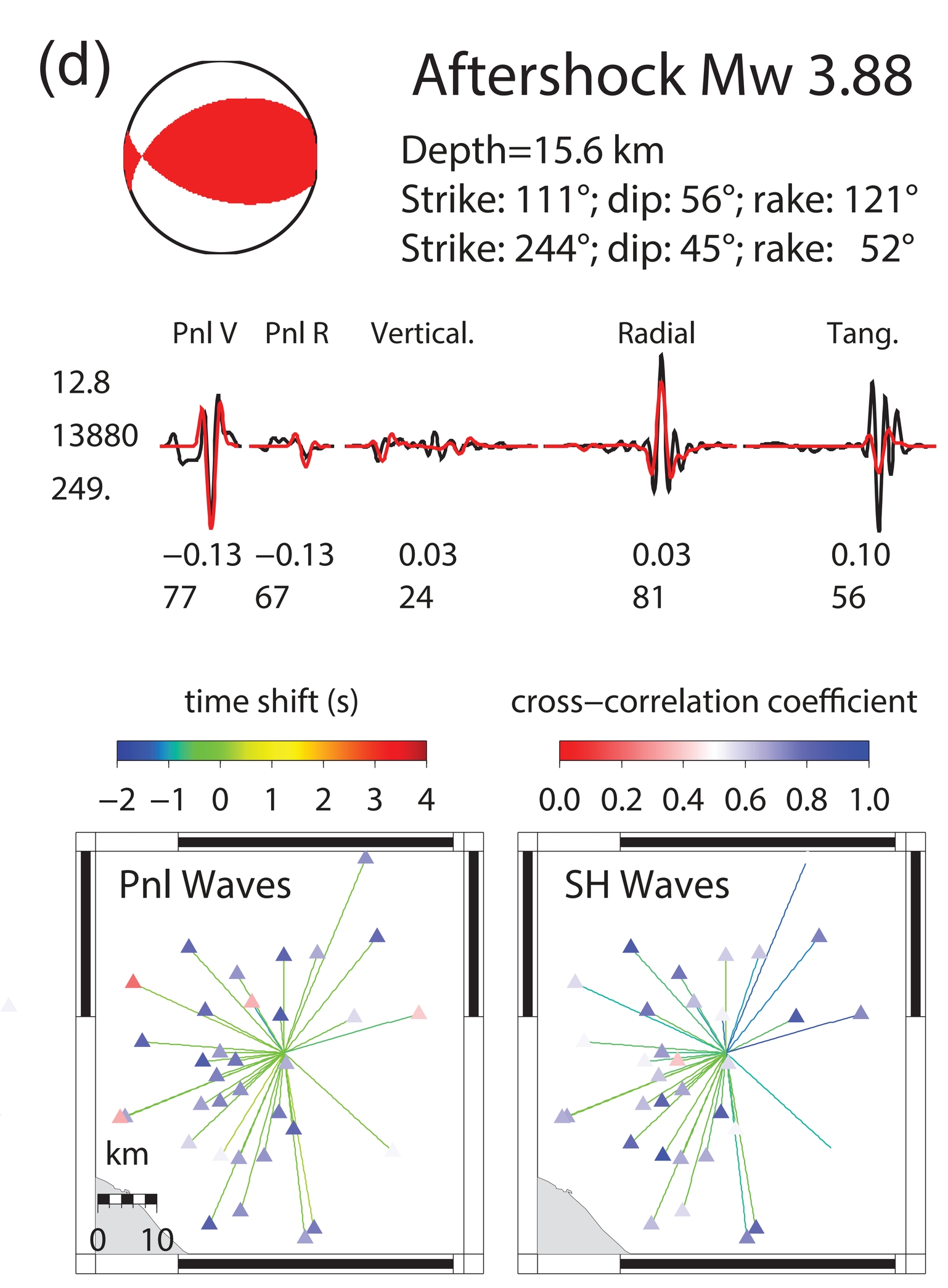


Figure 3. (a) The CAP inversion of the Mw 5.4 main shock at low frequency (0.02-0.20 Hz for Pnl, 0.01-0.10 Hz for Surface waves). The upper left plot shows the inverted focal mechanism. The lower left plot shows the comparison of data (black) and synthetics (red) for EML station. Right plot shows the fit-error as a function of focal depth; the number above each focal mechanism is the corresponding Mw. (b) Time shifts of Pnl (left), Rayleigh (middle) and Love (right) waves obtained from the CAP inversion.



(c) The CAP inversion of the Mw 5.4 main shock at high frequency (0.01-1.0 Hz) and the corresponding spider diagrams.



(d) The CAP inversion of the Mw 3.8 aftershock at high frequency (0.20-2.0 Hz) and the corresponding spider diagrams.