# FAULT ZONE STRUCTURES INFERRED FROM HIGH FREQUENCY WAVEFORMS OF AFTERSHOCKS OF THE 1992 LANDERS EARTHQUAKE

Hongyi Li, M.S.

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# Abstract

High-frequency body-wave waveforms recorded by a temporary seismic array across the surface trace of the 1992 Landers, California, earthquake rupture were used to determine fault-zone structures down to the seismogenic depth. The seismic array consisted of 31 three-component short-period stations, 21 of which were deployed along a 1-km-long line perpendicular to the strike of the fault.

I first developed a technique to apply the generalized ray theory to an arbitrarily-oriented tabular fault-zone model. Synthetic seismograms computed from the method agree well with those using the finite-difference method. They show that both arrival times and waveforms of $P$- and $S$-waves vary systematically across a fault due to transmissions and reflections in the low-velocity fault zone. The waveform characteristics and arrival-time patterns in waveform record sections can be used to locate the boundaries of the fault zone and its $P$- and $S$-wave velocities. Moreover, the depth extent of the fault zone can be determined by waveforms from deep aftershocks that are close or in the fault-zone events.

I located 132 unlocated aftershocks from their $P$ arrival times and $S - P$ times at the array using an array location method. Their locations essentially follow the surface trace of the Landers rupture. Waveform recording sections of aftershocks show that the Landers fault zone at the location of the seismic array has a width of about 300 m with its western boundary coinciding with the surface trace of the rupture. The $P$-wave velocity decreases by 40% relative to the host rock and the $S$-velocity is reduced by 50%. The low-velocity fault zone extends down to a depth of at least 10 km.