

Preliminary Seismic Study on the Longmenshan Central Fault Zone from Temporary Seismic Arrays

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The NNE-trending Longmenshan fault zone where the 2008 M8.0 Wenchuan earthquake occurred is located on the eastern margin of the Tibetan Plateau and acts as the boundary between the Sichuan Basin to the east and the Songpan-Ganze block to the west. The Longmenshan fault zone consists of the Back-range, the Central and the Front-range Faults. In this study, continuous seismic data recorded by 14 permanent seismic stations from the Sichuan Seismic network (SSN) between October 2004 and January 2009, 176 temporary short-period seismic stations deployed by China University of Geosciences (Beijing) between 22 October and 20 November 2017 and a dense linear seismic array of 16 stations are used to study the Longmenshan fault zone structure by applying the receiver function technique and fault zone waveform method, respectively. The short-period dense stations with 100 Hz sampling frequency span an area of about 12 km × 10 km, and the station spacing gradually increases from about 10–20 m to 100–500 m with increase of the distance to the surface rupture. The vertical component data were also used for ambient-noise tomography in this study to obtain the near-surface shear-velocity structure beneath the Longmenshan fault zone.

P-wave receiver functions calculated from 21 teleseismic events with $M_w > 5.5$ show that the Moho depth around the Longmenshan fault zone is about 45–48 km, and the Longmenshan fault does not extend to the deep crust. By examining waveform data of aftershocks close to the fault, due to the low-velocity zone associated with the fault zone, we observed clear fault zone trapped waves characterized by large amplitudes and long wavetrains with dispersive feature recorded at near-fault stations at a width of approximately 200–300 m around Hongkou town. From ambient noise tomography, our results show that an obvious low-velocity zone from the surface down to ~3 km is observed beneath the fault zone.