Study of the crust and uppermost mantle shear velocity structure beneath the eastern part of the Ordos Block

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The eastern part of the Ordos Block, also called Fen-Wei graben, is located at the boundary of eastern and western China, which is a geotectonic decoupling region and an earthquake-prone area. The high resolution crust and upper mantle shear velocity structure in the study area is the key to study the geological formation and evolution of the Fen-Wei graben. In addition, the study is also beneficial for a better understanding of the earthquake pregnant system and focal mechanisms in the region.

We collected three-component continuous seismic data recorded from 106 stations involved in the China Digital Seismograph Network and a temporary seismic array deployed by China University of Geosciences (Wuhan), respectively. Both ambient noise tomography and teleseismic tomography (Barmin et al., 2001; Lin & Ritzwoller, 2011) were applied to measure the local Rayleigh wave phase (8 s -70 s) and group velocities (8 s - 40 s). Moreover, we measured the Rayleigh wave horizontal-to-vertical ratios (H/V; 10 s-90 s) by ambient noise cross-correlations and teleseismic from each station, respectively. Because the sensitivity kernels of phase velocity, group velocity and H/V are significantly different (Lin et al., 2014), we performed the joint inversion of all the types of data to obtain the crust and upper mantle shear velocity structure beneath the study area, based on a Bayesian Monte-Carlo approach (Shen et al., 2013).

Our high resolution shear velocity structure shows that: 1) The thickness of sediments beneath the western Ordos Block is generally greater than that beneath the Fen-Wei graben, which is related to a different formation time; 2) The sediment thickness of the Ordos Block generally decreases from west to east, accounting for a reduced subsidence rate from the load center to the marginal uplift; 3) In the Fen-Wei graben, the thickness of sediments beneath the Datong basin and the Taiyuan basin is greater than the sediment thickness in the Linfen basin; 4) The crustal thickness generally decreases from west to east in the study area; 5) A distinct lower velocity layer is observed in the crust beneath the Datong volcano where the lithosphere thickness is thinnest in the study area (Tang et al., 2013), which implies that the thermal material such as magma upwelling remained in the crust.

References

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