3D Crustal P-Wave Velocity Structure for the Ordos block and Its Adjacent Area based on travel time tomography

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The Ordos block is located on the west side of the North China Carton, adjacent to the northeastern part of the Tibetan Plateau. Affected by two tectonic movements, Ordos block internal structure remains relatively stable structure, but surrounded by active tectonic belts. With the development of the second and third part of the “China Seismological Science Array”, the distribution of seismic observation stations in Ordos region has been greatly improved. This study will use the new seismic observation data of “Array III”, and combined with the phase observation data of "Array II" to form a more complete seismic phase travel time data set. The regional seismic body-wave travel time tomography will figure out a more reliable three-dimensional velocity structure of P waves in Ordos.

Our study area spans from 32°N to 42°N and 108°E to 114°E, which includes the Ordos block and its adjacent structures. The seismic data we used for inversion were recorded by 1244 stations including: 198 permanent stations and 1043 temporary stations (ChinArray II and III), from November 2013 to August 2017. After manual labeled the seismic phase, we select events with more than ten phase records of individual seismic events. The epicentral distance is less than 200km. Finally, we obtained about 22,500 phase records of 1882 local seismic events.

The preliminary results are consistent with previous studies and surface structures of a wide range of velocity distributions. However, in the middle-upper crust under the Liupan Mountain west, the low-speed anomaly extending downward is shown, which may be caused by the shallow crustal damage caused with the continuous eastward compression of asthenosphere in the northeastern margin of the Qinghai-Tibet Plateau during the Cenozoic. It is worth noting that there is an EW-trending low-velocity zone under the Dingbian-Suide fault beneath the Ordos Basin, with a depth form lower crust to 50 km in upper mantle. This low-velocity anomaly divides the high-speed disturbance in the Ordos block into two parts—indicate the depth of the fault can reach the upper mantle. In the Taihang Mountains in the west of the study area, low-velocity anomalies extending to the upper layer of the mantle are shown. We initially believe that this anomaly is related to the volcanic thermal motion that once existed on the area.