Uppermost mantle structure of Lhasa-Shigatse region from interstation Pn travel-time difference tomography

Yulan Li[1], Rizheng He[1], Baoshan Wang[1], Jiangyong Yan[1], Yao Li[1]

[1]Institute of Geophysics, China Earthquake Administration, China

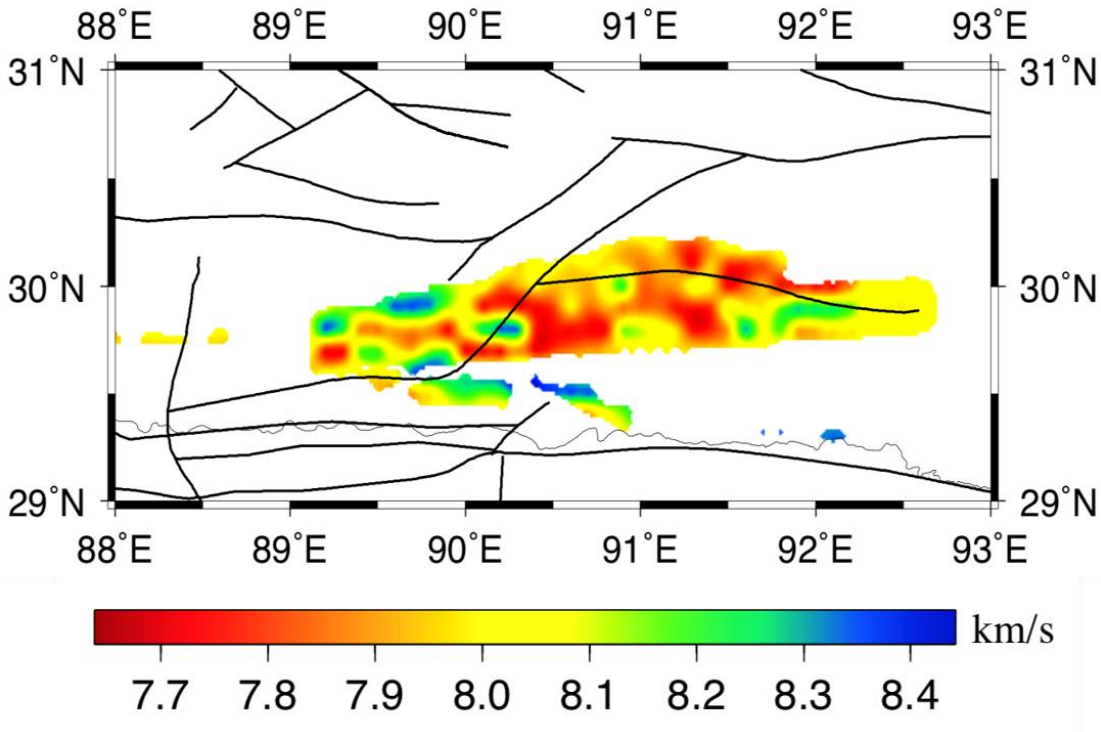
The top of the upper mantle is a key area for energy transfer and material exchange in the crust and lithospheric mantle. The Lhasa block locates between the Yarlung Zangbo suture zone and the Bangong Nujiang suture zone. The Indian continent continues to collide and subduct northward beneath this area. The Qinghai-Tibet Plateau rapidly uplifts for a long time in the past. There are a large number of NE-trending rift systems formed by east-west extension. In the Lhasa-Shigatse region, we deployed a broadband-measured line measuring nearly 300 km with an average spacing of 10 km across the Yangbajian Rift Belt.

Using the Pn wave traveltime data recorded by the temporal and permanent stations in Lhasa-Shigatse and surrounding areas, we obtained the Pn wave velocity structure of the upper mantle in the Lhasa-Shigatse region by the interstation Pn traveltime difference tomography. For Pn arrivals, when an earthquake lies approximately on the extension of the great circle path connecting two stations, the travel-time of the Pn wave along the over lapped raypaths are almost identical. For a specific earthquake, the interstation Pn traveltime difference between stations *i* and *j* can be represented as:

$$\Delta t_{ij} = t_i - t_j = \Delta t_i^{sta} - \Delta t_j^{sta} + \left(\sum_{k=1}^{N_i} d_{ik} s_{ik} - \sum_{k=1}^{N_j} d_{jk} s_{jk} \right)$$

Where t_i and t_j are the Pn travel-times at the each station respectively; Δt_i^{sta} and Δt_j^{sta} are the travel-times taken for the ray to pass from Moho to the station; and d_{ik} and d_{jk} are the *k*th ray path lengths; s_{ik} and s_{jk} are the corresponding Pn slowness at the *k*th ray path segment.

We used uniform grids in the inversion and chose the grid length of 0.1 degrees in both longitude and latitude direction. The average crustal velocity and average Moho depth we got are 6.2-6.5 km/s and 65-75 km, respectively. The velocity structure of the upper mantle top changes little.



The figure shows that the Yadong-Gulu fault zone is a high-angle west-dipping fault. The east side of the fault zone shows low Pn velocity and the west side shows high Pn velocity. The velocity difference between the two sides of the fault zone is significant.

This work was jointly supported by the National Key R/D Project (2016YFE0109300, 2016YFC0600301, 2016YFE0109300), the National Natural Science Foundation of China (41574086, 41761134094), and China Geological Survey project (DD20160022-05).