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3D Crustal structure of Longmenshan and its surroundings revealed by receiver function data

Ya Sun (1,2) and jianxin Liu (1,2)

(1) Central South University, China (sunya_seis@csu.edu.cn), (2) Key Laboratory of Non-ferrous Resources and Geological Hazard Detection, Central South University, Changsha, China

Due to the convergence of India-Eurasia plates and the obstruction from the Sichuan Basin, Longmenshan (LMS) has suffered the steepest uplifting in the eastern Tibetan Plateau. However, the mechanisms of surface uplift are still controversial. In this paper, we estimate the crustal structure and deformation under LMS and its surroundings by analyzing a large amount of receiver functions data recorded by regional seismic networks of the China Earthquake Administration. A comprehensive splitting measurement technique is used to calculate the seismic anisotropy from azimuthal variations of receiver functions in this paper. Our results show that most of the seismic stations located near LMS exhibit significant seismic anisotropy with the splitting time of 0.22-0.94s and a fast polarization direction of NW-SE. Both the splitting time and fast polarization are comparable to those estimated from SKS/SKKS data, indicating that half of the SKS/SKKS splitting time may be caused by the lower crustal deformation. It also indicates that the deformation patterns of the crust and upper mantle may be vertically coherent, but incoherent between the upper crust and lower crust based on comparison of GPS data. In addition, both the Moho depth and Vp/Vs ratio are estimated using the H-κ stacking method. The results show a distinct difference between the west of LMS and the Sichuan Basin. Stations on the west of LMS have high Vp/Vs values (1.74-1.86) and very thick crust (>55 km), while a relatively low Vp/Vs ($\sim$1.70) and shallow Moho depth (<45 km) for the stations on the east of LMS. All of these observations sustain a scenario in which, the lower crustal materials flow and accumulate in the southeastern Songpan-Ganzi and LMS region. Combined with the observation of low effective elastic thickness and a thin lithosphere, we suggest that this lower crustal material may partly extrude along a subvertical trajectory into the weak mantle lithosphere as a result of the continuous convergence of India-Eurasia plate and resistance of the rigid Sichuan Basin.