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Seismic evidence for the subducting Pacific slab and upper mantle upwelling beneath Northeast China

Qingju Wu and Fengxue Zhang
Institute of Geophysics, China Earthquake Administration

Northeast China is a unique place to study the ongoing subduction process and the structure of the subducting oceanic slab under the continental mantle, and the intraplate continental magmatism and volcanism during the Cenozoic. Seismic tomography provides a direct way to reveal the deep image of the subducting oceanic slab and the origin of the intraplate magmatism and volcanism. With the permanent regional seismic network as the backbone, 120 high quality broadband seismometers were deployed along 2 profiles from the Suifenhe to the Manzhouli and the Hulin to the Ergun, each with 60 stations respectively, from 2009 to 2011. Based on the teleseismic waveform data observed by the permanent and temporarily seismographs, we present 3D P-wave and S-wave velocity models of the upper mantle beneath the Northeast China. Our results show that both P and S wave velocity tomography models are similar to each other in general, in spite of minor differences in fine structure. Except the heterogeneous velocity of upper mantle, the Songliao basin is featured by outstanding high velocity, in contrast to the distinguished low velocity in the Daxinganling to the west and the Changbaishan to the east. However, low velocity anomaly is locally observed in the upper mantle of the Songliao basin, which may be the hint related to the Cretaceous magmatism or the possible delamination of Archean lithospheric mantle. High velocity zone is observed within the transition zone beneath the Songliao Bain, which may represent the stagnant of subducted Pacific slab, but our tomography models don't have any sign reflecting the existence of subducting Pacific slab speculated by the deep seismic event distribution, within the region well constrained by our two temporarily passive seismic profiles, and we infer that the subducting slab may be too thin to be resolved by our seismic data. However we observed a high velocity zone consistent with the depth distribution of deep seismic events nearby the Changbai volcano. Our models shows that the low velocity anomaly beneath the Changbaishan volcano can be traced from the surface to more than 400 km depth, suggesting a local upwelling of the hydrous mantle from the transition zone, such a feature can also be observed beneath the Aershan where the Cenozoic magmatism was also active. Our tomographic result yet indicates that the low velocity of upper mantle beneath the Wudalianchi volcano is not as striking as those beneath the Changbaishan and the Aershan area.