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Seismic imaging of crust and upper mantle beneath northeast China

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Northeast China is located in the composite part of Paleo Asia ocean and Pacific ocean Domain, it has undergone multi-stage tectonism. The geological structure is complicated and volcanic activity is strong. In this region, two major geologic and geophysical boundaries are distinct, the NNE-trending North South Gravity Lineament (NSGL) and Tanlu fault. With respect to North China Craton (NCC), Northeast China is more closely adjacent to the subduction zone of Pacific slab, along the eastern boundary of Northeast China the subducting Pacific plate approaches depths of 600 km, many deep earthquakes occurred here. This region becomes an ideal place to investigate deep structure related to deep subduction, deep earthquakes as well as intraplate volcanism. In this study, we determined high-resolution three dimensional P- and S-wave velocity models of the crust and upper mantle to 800 km depth by jointly inverting arrival times from local events and relative residuals from teleseismic events. Our results show that main velocity anomalies exhibited block feature and are generally oriented in NE to NNE direction, which is consistent with regional tectonic direction. The NSGL is characterized by a high-velocity (high-V) anomaly belt with a width of approximately 100 km, and the high-V anomaly extents to the bottom of upper mantle or mantle transition zone. The songliao basin, which is located between NSGL and Tanlu fault tectonic boundaries, obvious low-velocity anomaly extends to about depth of 200 km. Under the Great Xing'an Range on the west side of NSGL, the low velocity extend to the lithosphere. Our results also revealed that most of deep earthquakes all occurred in deep subduction zone with high-velocity anomaly. Further, we also observed that extensive low velocity exists above deep-earthquakes zones, this result suggests that deep subduction of the Pacific slab maybe affect overlying lithosphere, resulting in the state of molten, semi-molten or high water.