Whole-mantle P-wave tomography beneath East Asia

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The geological structure and tectonics of East Asia are characterized by the India-Asia collision in the southwest and subduction of the Pacific plate and the Philippine Sea plate from the east. The Pacific slab exists as a stagnant slab in the mantle transition zone, which is closely related to intraplate volcanism in NE Asia. Volcanoes in mainland China, such as those in Changbai, Datong, Ashikule and Hainan are intraplate volcanoes, which are quite different from the volcanoes in subduction zones and mid-ocean ridges. The origin of magmatic fluids associated with the formation of the intraplate volcanoes and causal mechanism of large earthquakes in the continental region have been investigated by many previous tomographic studies (e.g., Zhao et al., 2011; Ma et al., 2019). However, the detailed crustal and mantle structures under the intraplate volcanoes and the slab structures are still not very clear. In this study, we investigate these issues by conducting whole-mantle P-wave tomography beneath the East Asian region.

We use a large number of P-wave arrival time data of earthquakes selected from the ISC-EHB catalog and Annual Bulletin of Chinese Earthquakes. The events are relocated using depth phase data. To select a best set of earthquakes, we divided the crust and mantle into small cubic blocks and only selected an event in each block that had the maximum number of arrival-time data and the smallest error in the hypocentral location. The events are selected so that they have a uniform distribution in the study region.

We use the multiscale global tomography method (Zhao et al., 2013, 2017), which can prevent the over-dense grid nodes arranged at higher latitudes. A denser 3-D grid is arranged in East Asia, whereas a coarser 3-D grid is arranged in the surrounding whole globe.

Our new tomographic model shows the following features.

(1) Low-velocity anomalies are generally revealed in the whole mantle under the Hainan region, which may reflect the whole-mantle Hainan plume.

(2) Very heterogeneous structures are revealed under the Tibetan region, which may reflect the complex subduction of the Indian plate beneath the Eurasian plate.

(3) Slab tear is revealed under the marginal seas, which is consistent with the recent result obtained by Ma et al. (2019).

References

Ma, J., Y. Tian, D. Zhao, C. Liu, T. Liu (2019). Mantle dynamics of Western Pacific and East Asia: New insights from P-wave anisotropic tomography. *Geochem. Geophys. Geosyst.* 20, 3628-3658.
Zhao, D., S. Yu, E. Ohtani (2011). East Asia: Seismotectonics, magmatism and mantle dynamics. *J. Asian Earth Sci.* 40, 689-709.
Zhao, D., Y. Yamamoto, T. Yanada (2013). Global mantle heterogeneity and its influence on teleseismic regional tomography. *Gondwana Res.* 23, 595-616.
Zhao, D., M. Fujisawa, G. Toyokuni (2017). Tomography of the subducting Pacific slab and the 2015 Bonin deepest earthquake (Mw 7.9). *Scientific Reports* 7, 44487, doi:10.1038/srep44487.

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