Japan Geoscience Union Meeting 2013
(May 19-24 2013 at Makuhari, Chiba, Japan)

SIT39-P01 Room:Convention Hall Time:May 24 16:15-17:30

Whole-mantle 3-D velocity structure obtained with ISC, USArray and China seismic network data

Takuma Sasaki[1*], Dapeng Zhao[1], Genti Toyokuni[1], Yoshihiro Yamamoto[2]

[1]Department of Geophysics, Tohoku University, Sendai, Japan, [2]Ofunato High School, Iwate, Japan

In the last 30 years, global seismic tomography has been used to determine the whole-mantle 3-D velocity structure, which has provided important information on the deep structures of subducting slabs and mantle plumes as well as deep Earth dynamics. Tomographic images under the hotspot volcanoes exhibit low-velocity anomalies, which may reflect hot mantle plumes, while the subducting slabs are generally imaged as high-velocity anomalies (e.g., Zhao, 2004, 2009; Zhao et al., 2013).

In this work, we have tried to determine a more detailed 3-D whole-mantle velocity model using global tomography. To obtain a high-resolution whole-mantle tomography, we adopted a much denser flexible-grid with a grid interval of 50-200 km in depth and ~200 km in the lateral direction. We used a great number of data recorded by the ISC, USArray and China seismic networks. Many previous global-tomography studies have used the ISC data, but the distribution of ISC seismic stations is very non-uniform in the world. By adding the USArray and China seismic data, we could obtain a better result. We used five kinds of P-wave data (P, pP, PP, PcP and Pdiff phases), and adopted a flexible-grid model parameterization, thus the mantle structure under the polar regions can be better determined (Zhao, 2009; Yamamoto and Zhao, 2010; Zhao et al., 2013). By using many kinds of seismic phases, the spatial resolution of the tomographic images has been much improved for the upper mantle under the oceanic regions. The 1-D iasp91 Earth model was adopted to be the starting model for the tomographic inversion. We have used about two million P-wave arrival times from about 13,000 earthquakes which have reliable hypocentral locations.

Our new whole-mantle P-wave tomography shows the subducting slabs clearly as high-velocity anomalies. The old stable continents (e.g., Eurasia, North America, Australia) also exhibit high velocities down to 200-300 km depths in the upper mantle. Low-velocity anomalies are visible in the upper mantle under the circum-Pacific regions, which reflect the hot anomalies under the active arc volcanoes. Under the hotspot volcanoes, low-velocity anomalies exist at some depth ranges in the upper and/or lower mantle. The overall pattern of our present tomography model is the same as that of the previous models, whereas the mantle structures under China and North America are better imaged due to the use of new data.

References

Zhao, D. (2004) Global tomographic images of mantle plumes and subducting slabs: insight into deep Earth dynamics. *Phys. Earth Planet. Inter.* 146, 3-34.

Zhao, D. (2009) Multiscale seismic tomography and mantle dynamics. *Gondwana Res.* 15, 297-323.

Zhao, D., Y. Yamamoto, T. Yanada (2013) Global mantle heterogeneity and its influence on teleseismic regional tomography. *Gondwana Res.* 23, 595-616.

Keywords: tomography, slab, mantle plume