Deep structure of Java subduction zone: Comparing with Japan

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The Java Island is located in the southern part of Southeast Asia, where the India-Australian plate is subducting beneath the Sunda plate. The strong plate convergence has resulted in clustered arc volcanoes and intense seismicity in Java. To better understand the arc magmatism and seismotectonics in the region, we use a tomographic method (*Zhao* 2015) to determine a high-resolution 3-D P-wave velocity (Vp) model of the crust and upper mantle down to 600 km depth beneath Java. The geometry of the subducting Australian slab is taken into account in the starting model to obtain a better tomographic result by inverting a large number of travel-time data of local and teleseismic events. Our results show lower intra-slab Vp anomalies at depths of ~100–200 km than other parts of the slab, which may reflect dehydration embrittlement and a slab hole. Weak low-Vp anomalies are revealed below the subducting Australian slab, which is probably due to the slab hole where subslab hot materials flow into the mantle wedge. This feature may be related to the occurrence of potassium-rich back-arc volcanoes and the lack of giant megathrust earthquakes (Mw 8.5) in Java. Our tomographic results also support the hot finger model for explaining the arc magmatism in Java, similar to that in Japan (*Zhao et al.* 1992, 2012). We also apply tilting-axis anisotropic tomography (*Wang & Zhao* 2021) to obtain a high-resolution 3-D Vp anisotropic model beneath the Java-Banda region. Our results show significant differences between Java and Banda in the pattern of anisotropy in both the subducting slab and its surrounding mantle, which reflect two distinctly different deformation modes in the two domains. Our results support the single-slab subduction model for the Banda region. In addition, trench-normal and upright fast-velocity-planes appear in the deep upper mantle, which may indicate material migrations in the big mantle wedge. Fast-velocity-planes in the shallow mantle exhibit a toroidal distribution, reflecting past counter-clockwise rotation and asthenospheric material extrusion.

References

Wang, Z.W., D. Zhao (2021). 3D anisotropic structure of the Japan subduction zone. *Science Advances* 7, eabc9620.

Zhao, D. (2015). *Multiscale Seismic Tomography*. Springer, 304 pp.

Zhao, D. et al. (1992). Tomographic imaging of P and S wave velocity structure beneath northeastern Japan. *J. Geophys. Res.* 97, 19909-19928.

Zhao, D. et al. (2012). Imaging the subducting slabs and mantle upwelling under the Japan Islands. *Geophys. J. Int.* 190, 816-828.

