# Three-dimensional Body Wave Velocity Structures beneath Japan

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We determined 3-D Vp and Vs structures beneath all the Japan Islands by applying the seismic tomography method of Zhao et al. (1992) and Zhao et al. (1994) with a spatial resolution of 10 km in the shallow land areas and of 20 km in other areas (Nakamura et al., 2008). The target area was from 20N to 48N, from 120E to 154E and shallower than 800km. For the inversion, we explicitly defined the Conrad, the Moho and the upper boundary of the Pacific plate. We used 557,492 P arrival times and 301,999 S arrival times of 20,269 regional earthquakes and 337 teleseismic ones, observed at 2,931 stations. Those included arrival times observed by temporary pop-up type ocean bottom seismometer, and of blasts. We used 368 OBS stations and removed travel time delays due to unconsolidated sediments, which are several kilometers thick and have velocities several tens of percent lower than the initial velocity, the JMA 2001 model. Those station corrections were principally estimated from travel time differences between direct P and P-S basement conversions (Iwasaki et al., 1991).

As a result, we obtained more precise seismic images than previous studies. In the crust and the uppermost mantle, southwestern Honshu exhibited weaker heterogeneity than the other areas in Japan, corresponding to the distribution of active volcanoes. Low Vp and Vs zones exist beneath most active volcanoes at depths of 10 to 40 km. Also, zones of low Vp/Vs ratio exist in the upper crust, and zones of high Vp/Vs ratios exist in the lower crust and the uppermost mantle. Those features suggest that the partial melting zones spread out from the uppermost mantle up to the mid-crust and that $H_2O$ exists in the upper crust beneath the volcanoes (Nakajima et al., 2001). Stripe-like heterogeneities exist in the subducting Pacific slab. Relatively low-velocity zones correspond to low-seismicity areas in the Pacific slab, suggesting that the slab is possibly torn or thin around the areas. The subducting oceanic crust atop the Pacific slab was found to have low-velocity zones. An aseismic Philippine Sea slab was recognized, and a complicated configuration was observed; but obscurity made it difficult to define the configuration and the deep limits of the slab based on only the seismic velocity structures. Prominent low-velocity anomalies exist above and beneath the high-velocity Philippine Sea and Pacific slabs. Those just above the slabs may be related to the dehydration of the subducted slab; the others are perhaps associated with small-scale mantle convections. The fact that nonvolcanic deep tremors associated with the subducting Philippine Sea slab beneath Shikoku, Kii, and Tokai do not occur in zones of high Vp, high Vs, and low Vp/Vs ratio may reflect the existence of fluids generated by the dehydration processes of the slab. Prominent and wide low Vp and Vs zones exist beneath central Honshu at the depth range of 30 to 60 km, where the volcanic front related to the subducting Pacific plate is located and seismicity around the Philippine Sea plate is very low. This condition may exist because magma genesis processes related to the subducting Pacific plate activate the same processes around the Philippine Sea plate.

Additionally, you can freely use the above velocity model from http://wwweic.eri.u-tokyo.ac.jp/ssjapan/ for non-commercial purposes only.

I would like to thank the members who operate the above routine and temporary observation network to provide useful data.

References: Iwasaki et al., 1991, GJI, 105, 693-711; Nakajima et al., 2001, JGR, 106, 21843-21857;Nakamura et al., 2008, PEPI, 168, 49-70; Zhao et al., 1992, JGR, 97, 19909-19928; Zhao et al., 1994, JGR, 99, 22313-22329.