A detailed seismic velocity structure in and above the Pacific slab crust subducting beneath Hokkaido, Tohoku and Kanto

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High quality arrival-time data recorded at a nationwide seismograph network in the Japan Islands have enabled us to image detailed heterogeneous structures in the mantle and deepened our understanding of arc magmatism (e.g. Zhao et al., 1992; Nakajima et al., 2001). We have also enhanced our understanding of the generation mechanism of interplate earthquakes by improving the asperity model. On the other hand, we have not comprehended so well heterogeneous structure within the subducting slab and its relationship to the occurrence of intraslab earthquakes. Although dehydration-embrittlement hypothesis is proposed as a possible model of the generation of intraslab earthquakes, the hypothesis needs to be confirmed by observations. I addition, transportation path of released water by dehydration reaction in the oceanic crust is not understood well. Therefore, a detailed imaging of the heterogeneous structure around the subducting slab is very important to understand not only the generation mechanism of intraslab earthquakes but also water-transportation process in subduction zone.

In order to understand generation mechanism of intraslab earthquakes and water-transportation process in subduction zones, we investigated detailed seismic velocity structure in and around focal areas of intermediate-depth earthquakes within the Pacific slab and Philippine Sea slab from Hokkaido to Kanto by double-difference tomography (Zhang and Thurber, 2003, 2006). As a result, we found the following features: (1) remarkably low-Vs zone exists at the uppermost part of the Pacific slab with a thickness of 5-10km, (2) the low-Vs zone reaches 70-130km depth, and then exudes to the mantle wedge just above the slab around these depth, (3) the low-Vs zone extends downward along the upper boundary of the slab. These results may reflect the following water-transportation process around the slab. Hydrated minerals in the oceanic crust activates dehydration reaction at 70-90km depths associated with eclogite-forming phase transportation. The water released by this reaction migrates upward to the mantle wedge right above and hydrates mantle peridotite. This hydrated peridotite is dragged downward by the subducting Pacific slab and is transported to deeper depths along the plate boundary. These observations are quite important to understand the water-transportation process in subduction zones.