

Seismic Evidence for Deep Water Transportation in the Mantle

Hitoshi Kawakatsu[1]; Shingo Watada[2]

[1] ERI, Univ of Tokyo; [2] Earthquake Research Insititute, U. of Tokyo

Water in the mantle is expected to play essential roles in various significant problems of geodynamics, and delineating its location and abundance in the mantle may be considered as one of the most important issues in the current earth science. How water is transported into the mantle, however, has never been clear, except that it is generally believed the subducting hydrated oceanic crust is the major carrier, preventing earth scientists from accurately estimating the overall water circulation budget of the earth system.

We present seismic evidence indicating the transportation of water into the deeper portion of the mantle wedge of the subduction zone beneath northeastern Japan. The reflectivity profiles of seismic waves obtained from migrated receiver functions of teleseismic earthquakes recorded by the dense Japanese seismic network, Hi-net, show strong signature of the dehydration of the subducting oceanic crust in the depth interval of 50-90km. Below this depth range, a low-velocity layer on the top of the subducting plate, which we infer as a channel of serpentinite that brings water into the deep mantle, is observed. The overall feature of our image is remarkably similar to the result of the numerical simulation of the water transportation beneath the Japan arc, and thus provides a strong line of evidence for deep water transportation within the mantle wedge of the subduction zone. Our result indicates that a significant amount of water (several weight percent H_2O) must be transported at least to a depth ~130-150km through this channel, and may significantly affect the overall water circulation budget in the earth system.