Slab layering

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A large number of waveform data observed at high-density seismic stations enable us to resolve the detailed seismological structure in and around descending slabs. We show new findings of the velocity discontinuity structure at the lower boundary and in the interior of the Pacific plate (PAC) beneath the northeastern (NE) Japan by receiver function (RF) migration analysis combined with a recent 3-D tomographic velocity model.

We applied RF analysis to P wave coda potions of 233 teleseismic events collected by Hi-net and J-array short-period stations expanding throughout the NE Japan (Fig. 1). RFs are conventionally calculated through frequency domain division of radial components by vertical ones with a water level of 0.001 and a 1.0 Hz low-pass Gaussian filter. To make transects, we followed previous RF studies with the CCP (common conversion point) stacking. Here, for the reference velocity model we referred to a recent 3-D tomographic velocity model, and for a width from the line of the cross-section we selected 25 km.

A cross-section shows the stacked RFs for a E-W section at 40N. Positive RF amplitudes generated at the continental Moho are clearly traced at depths from 30 to 40 km, with a depression due to the loading of the mountain chain. For the structure of the subducting PAC, we observe three traces of remarkable RF amplitudes. First, a negative P-to-S conversion from the top surface of the PAC can be seen down to a depth of 120 km. Second, a positive P-to-S conversion from the oceanic Moho is well recognized down to a depth of 130 km. Finally, the most notable feature is that the lower boundary of the PAC is successively traced by a negative polarity, which is imaged parallel to the oceanic Moho. The depth that the lower boundary is imaged significantly exceeds 200 km. In addition to these findings, we observe negative signals just below the upper boundary of the PAC, indicating the existence of the multiple layers within the slab.