Receiver function imaging of the subducting Pacific plate beneath NE Japan using offshore and on land seismic arrays

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The seismogenic zone of NE Japan subduction zone locates at offshore, where in situ observation is only possible with ocean bottom sensors. The seismogenesis of subduction zones has a close relationship with the hydrous state of the subduction zone system, and water has been observed as a low velocity zone of the subducting plate. Continuous imaging of the subsurface structure from the trench, crossing the whole forearc, is important to understand the relationship between seismicity and seismic structure, as well as to delineate the water transportation in subduction. On land, arrays from different institutes cover Japanese islands densely enough to get good quality receiver function images. On the seafloor, several temporary arrays of pop-up type ocean bottom seismometers were deployed over the years (e.g., Shinohara et al., 2012, EPS). Furthermore, the ocean bottom cable network off the coast of NE Japan (S-net; Kanazawa et al., 2016, SubOptic) has allowed a real-time and permanent observation on the seafloor from late 2016. In this work, we conduct the receiver function analysis of those amphibious array data to produce continuous receiver function images from ocean to land. To use the ocean bottom seismic data for imaging, special care has to be taken for the effect of the low velocity sediment on top of the seafloor; an extremely slow S-wave velocity (< 0.5 km/s) of the thin sediment causes a large delay in arrival times (e.g., ~2 seconds) to the converted waves that may result in misplacement of an image if the effect is not corrected. The common conversion point stacked images show a continuously dipping oceanic Moho along profiles crossing ocean and land. Besides, the forearc part of the subducting plate shows a signature of a low velocity layer above the oceanic Moho as land stations do. The result of this work presents the first receiver function image in NE Japan using both ocean and land stations that shows coherent structural signatures of the subducting oceanic plate.

