Features of western Pacific slabs as derived by spectral analysis of body waves from intraslab earthquakes

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We show that the characteristics of western Pacific slabs can be revealed by systematic analysis of body-wave spectrograms obtained at the fore-arc stations.
By analyzing features of P and S waves radiated by intraslab earthquakes, we can elucidate the nature of slabs where the seismic waves have passed. One of the features is difference in arrival time between low-frequency ($f < 0.25$ Hz) and high-frequency ($f > 2$ Hz) signals. This can be observed clearly in the fore-arc side of the volcanic front in northern Japan. Furumura and Kennett (JGR 2005) showed that the P and S waves from intraslab earthquakes beneath the Sea of Japan have low-frequency onsets with high-frequency long-duration signals, suggesting that they are the result of small-scale quasi-laminar heterogeneity within the subducting Pacific slab. The late arrivals of high-frequency P and S signals can be enhanced for earthquakes deeper than 400 km due to the low-velocity metastable olivine wedge (MOW) in the slab (Furumura et al., JGR 2016).
Ohata and Kuge (JpGU 2017) examined seismograms of deep earthquakes (depth>300 km) worldwide to look for similar observations to Furumura’ s ones. The result suggested that such observations may appear in other western Pacific regions. However, the analysis was preliminary, and the examined earthquakes were limited only in the down-dip directions from fore-arc stations.
In this study, we analyzed intraslab earthquakes in western Pacific regions by obtaining spectrograms from velocity waveforms. We examined earthquakes located deeper than 150 km, distributed widely in the subduction zones. The earthquakes were much increased from Ohata and Kuge (2017). We collected the waveform data of the P and S waves from the IRIS and F-net broadband seismometers in the fore-arc sides of the subduction zones. Based on observations of the spectrograms, we first classified the earthquakes into several types, considering how strong its low-frequency onset is, how long the difference in arrival time between low-frequency and high-frequency signals is, and in what range of frequency the low-frequency signal is. Then, we made 3D maps of the classified earthquakes. As the result, we found that the types of the earthquakes strongly depend on the locations in the subduction zones. We especially note that the presence of earthquakes with strong low-frequency P onsets, followed by high-frequency signals, was found in a specific part of the Tonga region, in addition to the Sea of Japan where Furumura et al. (2016) indicated the presence of such earthquakes.

