Tomographic imaging of seismic velocity structure in the NE Japan forearc region: implications for the corner flow pattern

Yojiro Yamamoto[1]; Ryota Hino[1]; Yoshihiro Ito[1]; Hiromi Fujimoto[1]

[1] RCPEV, Graduate School of Sci., Tohoku Univ.

In northeastern Japan, the seismic structure has known to be significantly different between the land area and the offshore area. For example, the depth to the island arc Moho changes sharply beneath the coastline of the Honshu island. The island arc Moho is located about 35 km depth at under volcanoes [Nakajima et al. 2002], but it located about 22 km in the off-Miyagi area [Miura et al. 2005]. The Pn velocity also has heterogeneity in the forearc region. Active source refraction/reflection studies showed that Pn velocity below the island arc is less than 7.7 km/s [e.g., Iwasaki et al. 1994], while Pn velocity below the sea is about 8 km/s. These features suggest that there exists some kind of structural discontinuity between the onshore and the offshore region in the NE Japan forearc.

The corner flow exists in the mantle wedge. In the NE Japan, mantle upwelling, which is called the 'return flow' of the corner flow, is clearly imaged by seismic tomography [Nakajima et al. 2001]. Recently, the dragged flow is also imaged [Tsuji 2007]. But the connecting point of the return flow and dragged flow has not clarified yet.

We performed a seismic tomography and estimated 3D velocity structure of the forearc region in the middle and southern part of NE Japan. Using both onshore and offshore seismic station data, we can image the deep structure beneath the coastline. From our results, we found that there are clear boundary between high velocity anomaly and low velocity anomaly in the mantle wedge just beneath the coastline. The location of the downdip limit of the zone of interplate seismic coupling defined by thrust type earthquake distribution [Igarashi et al. 2001] almost coincides with that of the velocity boundary. The numerical simulation study made by Wada et al. (2007) found that the tip of the corner flow could not enter into the mantle wedge above the decoupled part of the plate boundary. The high velocity part of the forearc mantle corresponds to the stagnant part of the mantle wedge and the location of the front of the low velocity mantle is formed by downward flow of the corner flow circulation.