Estimation of the structure of the Philippine Sea slab under south Kyushu using receiver function analysis

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In the subduction zone, it is considered that magmatism is caused by fluid transported to the upper mantle from the subducting slab [Tatsumi, 1986, GRL]. In order to clarify the relation between the magmatism and the subsurface structure of Sakurajima and Kirishima volocanoes, we investigate seismic velocity discontinuities beneath these regions by receiver function analyses of the teleseismic waveform.

A Receiver function (RF) is calculated by deconvolving the vertical component of a waveform of a teleseismic P-wave from its horizontal component, and phases converted at seismic velocity discontinuities in its coda can be detected with RFs [Langston, 1979, JGR]. In order to estimate the geometry of steeply dipping discontinuities, such as the upper boundary of the subducting Philippine Sea plate, with RFs, refraction of the seismic rays at the dipping discontinuities should be taken into account. For this purpose, we apply the method for stacking RFs using the multi-stage fast marching method developed by Abe et al. [2011, GJI].

Abe et al. [2013, JGR] revealed the regional variation of S wave velocity discontinuity across the Philippine Sea plate, which is divided by the Kyushu - Palau Ridge, from RF analyses of the waveform data obtained at the permanent stations. In this research, we use waveform data obtained at dense observation networks along Miyazaki-Akune and Miyazaki-Sakurajima lines from teleseismic earthquakes with magnitude greater than 5.5 occurred from November 2009 to March 2017. We use 3-D seismic velocity model [Matsubara et al. 2007, Tectonophysics] for stacking RFS, although Abe et al. [2013] used one dimensional IASP91 model.

Beneath the south Kyushu where the Western Philippine Basin formed at about 50 Ma subducts [Hilde and Lee, 1984, Tectonophysics], it is suggested that the fluid dehydrated from the Philippine Sea slab is transported to the back-arc and may cause arc volcanism activity by Abe et al. [2013]. In addition, low velocity zone of mantle wedge is detected, and this zone is considered to correspond to a serpentinized mantle by a fluid derived from oceanic crust [Bostock et al. 2002, Nature], based on the S wave velocity of serpentinite estimated by Hacker et al. [2003, JGR] and Christensen [2004, Int Geol Rev].

We obtain more precise receiver function images using dense network data and discuss the seisimic structure of Sakurajima and Kirishima volcanoes.

Keywords: Receiver function analyses, Southern Kyushu, Philippine Sea slab

