

Detection of Philippine Sea plate in southwest Japan by waveform stacking and receiver function methods using a seismic array

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1. Introduction

The Philippine Sea plate is descending into the mantle beneath the Honshu with a velocity of several cm/year. It is very important to know the plate boundary of the subducting Philippine Sea slab. A large earthquake, which was named the 2000 Western Tottori earthquake, occurred at the central part of southwestern Japan in 2000. Several seismic observations were conducted to understand the source area of the earthquake. We set up 40 seismic-stations in the area and operated the seismic stations from 2002 to 2004 (Japanese University Group of the Joint Seismic Observations at the Southwestern Japan, 2002). The 40 seismic stations were located as an array with a T-shaped formation. The lengths in the EW-direction and NS-direction of the T-shape array are about 125 km and 135 km, respectively. We used the seismic stations as an array to detect the P-S converted wave at the upper boundary of the Philippine Sea plate, and estimate the configuration of the subducting slab.

2. Data and Analysis.

We use the seismic array located in southwestern Japan consisting of 40 seismic stations. Most of the seismometers have a natural frequency of 1 Hz. Earthquakes deeper than 300 km are picked up within the period from 1 April, 2002 to 31 March, 2004. The source area is in the latitude of 33 N ~ 36 N, in the longitude of 131 E ~ 137 E. Deep earthquakes with magnitudes larger than 4.1 are used. Far field earthquakes are also used for receiver function method.

The following processes are used for the analysis. 1) Radial component of the waveform is picked up. 2) The amplitude of the waveform is normalized. 3) Band-pass filter is applied to the waveforms. 4) Waveform envelope is constructed for each waveform, and is squared to emphasize later phases. 5) The waveform envelopes are stacked at each seismic station for the earthquakes occurring in a cluster.

3. Analysis and Results

A weak signal could be detected by the waveform stacking process, resulting in observation of the PS converted phase at the upper boundary of the subducting Philippine Sea slab. The configuration of the subducting Philippine Sea plate was estimated using the PS converted phase. The configuration of the subducting Philippine Sea plate was obtained at a depth range of 50 km - 75 km. The result of the receiver function method also suggests that a boundary which dips toward north was detected.