Spatial variation of attenuation factor in subduction zone of Philippine Sea slab around Kyushu Island Japan

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Kyushu Island, in south-western part of Japan is characterized by subduction from Philippine Sea Slab and Eurasian Plate (Amurian); volcanic front seen in islands arcs runs through the central part of Kyushu Island. In Kyushu, shallow and intermediate-depth earthquakes occur robustly through a depth of about 200 km.

We estimated attenuation structure beneath Southern Part of Japan, at subduction zone of Philippine Sea Slab by applying *modified coda normalization* method (Eq.1) proposed by *Parithusta, et.al.* (2008*).

The method estimates relative source spectra by taking spectral ratio in coda waves between two events at first. From a lot of the spectral data, those can be estimated with higher stability through singular value decomposition. After that, the relative source effect between event pair can be eliminated by the solution from ratios between direct wave spectra for many event pairs. We confirmed the estimation of source factor by assessment with empirical method, the result show that estimates of source factor almost satisfy empirical relation between magnitude and energy relation. The attenuation factor can be obtained from a relation below;

$$d_n = \ln\left(\frac{Ed_{ij}(t_{ij}, \omega)}{Ed_{i'j}(t_{i'j}, \omega)}\right) = -\omega Q(\omega)^{-1}(t_{ij} - t_{i'j}) + const\ldots. \tag{1}$$

Where: Ed denotes Direct S-wave power spectrum and Q is attenuation factor at target area; t is lapse time from origin time. Subscript i, j denote identification number for event and station, respectively. Q^{-1} factor can be estimated from decay with $\Delta t_{ii'j}(= t_{ij} - t_{i'j})$. By using this method, we obtained frequency dependent Q^{-1} value with smaller estimation error than previous study carried by *Matsumoto et.al* (2007).

We used waveform data from earthquakes occurred in Philippine Sea Slab, recorded by Hi-net and Kyushu University seismic networks. Window length adopted here is 2.5 seconds for taking spectrum. The results shows the Q^{-1} values around Bungo-Suido area, northern part of Kyushu. Q^{-1} values are plotted in seven depth ranges as a function of frequency. The Q^{-1} values are obtained in a range from 10^{-4} to 10^{-1}. This range is similar to that estimated in other studies. These results suggest that attenuation at depths 30-60 km is high but decreases markedly within 75 km depth, high attenuation is also observed at depth greater than 90 km. We found that Q^{-1} value in this study has frequency dependency, which decrease gradually with frequency.

Keywords: Attenuation, Coda, Philippine Sea Slab, Subduction, Kyushu Island.

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