# Frequency & Depth - Dependent Attenuation of S Waves in the PHS Plate, Kyushu, Japan, based on Modified Coda Normalization method

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We present a high resolution 3D model of S-wave attenuation for the Philippine Sea Plate, Kyushu, Japan. Spectrum data from 686 tectonic earthquakes located at PHS plate around Bungo Suido Channel and Hyuganada region, recorded at 60 stations of the Institute of Seismology and Volcanology, Kyushu University (SEVO), the Japan Meteorological Agency (JMA) and the National Research Institute for Earth Science and Disaster Prevention (NIED), were used for this estimation.

We obtained the estimate of $Q^{-1}$ for each an event pair using a single-station method based on the modified coda normalization of the S-wave spectrum with time window of 2.5 s by the coda-spectrum. At first, we modified the order of taken ratio between direct wave spectrums for coda spectrum of an event pair; then we can separately solve an estimation of relative source factor for coda ratio of an event pair from $Q^{-1}$ estimation. Followed by obtained the spectral ratio data to estimate the $Q^{-1}$ values from the decay of data distribution in the study area.

Using this method, we measured frequency and depth - dependent attenuation. By fitting power-law frequency dependence to the estimated values over the whole possible event and stations pairs, we obtained $0.024\ f^{-0.70}$, $0.230\ f^{-1.41}$ and $0.136\ f^{-0.97}$ for 30, 50 and 70 km respectively , where f is frequency in Hz. After removing the main site effects and scattering coefficient effect, the lapse-time dependence is interpreted as due to attenuation variations with depth. Our results are show that attenuation is depth dependent in the PHS plate zone and that the values decrease with the increase of the frequency band.

Results show that attenuation structure resembles the velocity structure, well reproducing the interface of Philippine Sea Plate. Higher $Q^{-1}$ contrast is found for the Bungo Suido Channel area, we interpreted that the Bungo Suido Channel is located on the lateral transition region from strong to weak coupling. The high $Q^{-1}$ zones exist as a characteristic mode of stress release at a transition zone of interplate coupling strength, where the slow slip event existed. The low $Q^{-1}$ values found at Hyuganada area is interpreted as a homogeneous plate interface which causes strong plate coupling associated with the asperity in the case of large earthquake. These suggest that the $Q^{-1}$ values could reflect coupling property of plate boundary.