

Envelope broadening of S-wave seismograms from earthquakes near the hypocenter of the 2011 Tohoku-Oki earthquake

Kazuya Hasegawa^{1*}, Ryota Hino¹, Yoshihiro Ito¹, Kensuke Suzuki¹, Norihito Umino¹

¹Graduate school of Science, Tohoku Univ.

It is reported that the seismograms of the earthquakes in the forearc of the northeastern Japan show clear difference in their S-wave envelope shapes according to difference in their focal depths [Gamage et al, 2007; Koga 2010]. The seismograms of interplate earthquakes tend to have broader S-wave envelopes than those of intraplate earthquakes. We investigated the envelope broadening by measuring peak delay times of the S waves of earthquakes occurred beneath the landward slope of the Japan Trench. By including the aftershocks of the 2011 Tohoku-Oki earthquakes, we could analyze a number of intraplate earthquakes, both in the downgoing slab and in the overriding plate, as well as interplate earthquakes.

As a result, we noticed that interplate earthquakes are not always associated with significantly large peak delay times showing remarkable envelope broadening. In the trenchward half, up to ~ 130 km from the trench axis, of the landward slope area, the earthquakes near the plate interface tend to have evidently broadened S-wave envelope whereas those in the landward area are characterized by moderate peak delay times. We also confirmed that intraslab earthquakes have small peak delay times indicating less S-wave envelope broadening. Peak delay times of the earthquakes with considerable waveform broadening tend to increase rapidly in the small hypocentral distance range. This observation suggests strong short wavelength heterogeneity along the plate boundary in the trenchward zone. In contrast, increase rate of peak delay times of intraslab earthquakes are smaller than the averaged values. This reflects less heterogeneity in the Pacific slab in terms of short wavelength perturbation of material properties.

Keywords: S-coda wave, interplate earthquake, intraplate earthquake