

Source, path, and site effects of intraslab and interplate earthquakes off Miyagi Prefecture in Northeastern Japan

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Kasatani and Takehi (2014) made spectral inversion analysis of the intraslab and interplate earthquakes off Miyagi Prefecture in Northeastern Japan using K-NET strong ground motion data of NIED. Their result showed that the high-frequency levels of intraslab and interplate earthquakes with nearly the same depth are nearly the same, and that the high-frequency level depends simply on source depth and is higher for deeper source, independent of tectonic environments such as intraslab and interplate earthquakes. In previous studies, the view that high-frequency level of intraslab earthquake is higher than that of interplate earthquake has been widely accepted. On the other hand, some studies (e.g. Kato et al. (1999)) presented another view that high-frequency level depends simply on source depth, independent of tectonic environments, and high-frequency level is higher for deeper source. Result of Kasatani and Takehi (2014) supported the latter.

Takehi (2016) selected three events with different depths, whose epicenters are aligned linearly, from the events that Kasatani and Takehi (2014) studied, and made an analysis of attenuation relation of peak ground acceleration using NIED K-NET and KiK-net strong ground motion data. He showed that the slope of the decay of attenuation relation of the deepest event is obviously steeper than those of the other two shallow events. This kind of depth-dependent trend of attenuation relation is frequently seen in previous studies.

In the spectral inversion of Kasatani and Takehi (2014), common attenuation relation is assumed for all the events, independent of source depths. In this case, attenuation relation that is actually depth-dependent is attributed to source and site effects. Actually, the attenuation relations of the acceleration amplitudes with the site effects (obtained in the spectral inversion) removed shows similar gentle slope of decay for all of the three events. This means that in the spectral inversion of Kasatani and Takehi (2014), the strength of attenuation is underestimated for deeper events, and therefore, the high-frequency level of source effect is also underestimated for deeper events.

When this underestimation of high-frequency level of deeper source is considered, high-frequency levels of deeper events will be higher than those obtained in Kasatani and Takehi (2014). That is, validity of the conclusion itself that high-frequency level is higher for deeper source by Kasatani and Takehi (2014) is supported, and the depth dependency of high-frequency level is more enhanced.

In the presentation, detailed report on source, path, and site effects of the intraslab and interplate earthquakes off Miyagi Prefecture is given, based on the evaluation of site effects from the inversion of "network of adjacent two station pairs" by Ikeura and Kato (2011) that does not assume attenuation functions.

Keywords: high-frequency level, intraslab earthquake, interplate earthquake, focal depth, attenuation relation, site effect