Comparison of Qs and site response obtained from S- and Coda waves: Based on KiK-net and Hi-net records in southern Tohoku region

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The pioneering work for the origin of coda waves was done by Aki and Chouet(1975), and they found that the coda decay curves are independent of the event-station pairs considered. This characteristic of coda wave is applied to evaluate site response from coda waves (Phillips and Aki, 1986), and Qs value (Aki, 1980). It is interesting issue to know that the Qs and site response obtained from coda waves correspond to those from S-waves. Kato et al. (1995) found that the coda site response agrees with the S-wave site response within a factor of about 1.5 on the basis of observed records from TERRAscope instrument in Southern California. On the other hand, Margheriti et al.(1994) and Sato et al. (1998) indicate that coda based site response overestimates S-wave amplification in the frequency range lower around 1 Hz. Since the target regions used in these studies are restricted, the study under various geological conditions is desired.

We performed S-wave spectral inversion (Iwata and Irikura, 1986) and separate source S(f), path Qs(f), and site response G(f) from strong motion records observed at KiK-net stations located in Fukushima, Miyagi, and Iwate prefectures. In order to increase strong motion data, K-NET records are also added to our data set. We then compared the Qs(f) and G(f) with those obtained from coda waves in the same region (Takahashi et al., 2005). The target events for S-wave inversion are plate boundary earthquakes with JMA magnitude greater than 5.0 in southern tohoku region. We constrained the site response at FKS015 obtained by Uetake and Ikeura (2002) to resolve an indeterminate degree of freedom in this method. Seismic moment Mo from this study agrees with Mo from F-NET within a factor of 2.0. The obtained Qs(f) is modeled Qs(f)=200fˆ0.7, showing almost the same Qs from Takahashi et al. (2005). This Qs(f) shows relatively larger value than Qs(f) from off-Fukushima region by Kato et al. (1998) and Uetake and Ikeura (2002). G(f) from this study in various geological conditions agrees with G(f) from coda waves by Takahashi et al. (2005) within a factor of 2.0 in the frequency range higher than 2.0 Hz. Meanwhile, in the frequency range lower than 1.0 Hz, G(f) from coda waves shows systematically larger site response than G(f) from S-waves at stations located on Neogene and Quaternary age. This tendency disappears at stations located on Cretaceous granite and Cretaceous-Paleogene age. The presence of surface waves locally generated in deep-soil sites of Neogene and Quaternary age may contaminate coda waves in lower frequency range. This research project has been conducted under the research contract with the Japan Nuclear Energy Safety Organization (JNES).