Estimation of site amplifications for strong motion stations in Hokuriku district, Japan, based on spectral inversion technique

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To develop the underground velocity structure model for strong motion prediction in Hokuriku district (i.e., Fukui, Ishikawa, and Toyama prefectures), Japan, we evaluate site amplification factors for strong motion stations in this area. Strong motion stations targeted in this study are K-NET, KiK-net, and F-net operated by the National Research Institute for Earth Science and Disaster Prevention (NIED), Japan, and local government Shindo-kei networks in Fukui, Ishikawa, and Toyama prefectures. Owing to dense strong motion stations including local government Shindo-kei networks, we can obtain high density local site amplification factors, especially for the urbanized area, in Hokuriku district.

Site amplifications are estimated by separating source, propagation path, and site characteristics from observed Fourier amplitude spectra based on the spectral inversion technique. We use the vectorial summation of the two horizontal components of Fourier amplitude spectra, which are calculated from the windows of 10.24 s for S-wave records. A moving average of ±5 % window for each frequency point is applied to smooth the amplitude spectra. We choose the F-net SRN station as a reference rock site assuming no site amplification to resolve the trade-off between the source spectra and site effect.

For example of K-NET ISK011, the site amplification from spectral inversion shows the peak between 0.5 and 2.0 Hz with amplification factor from 10 to 20. On the other hand, the 1-D theoretical amplification factor based on the velocity structure model by Japan Seismic Hazard Information Station does not show the peak between 0.5 and 2.0 Hz. However, the 1-D theoretical amplification factor calculated from the improved velocity structure model by using microtremor observations (Asano et al., J. Jpn. Assoc. Earthq. Eng., 15(7), 194-204, 2015) is from 10 to 20 between 0.5 and 2.0 Hz as well as the amplification from spectral inversion. Thus, the obtained high density site amplifications could be useful for performance-checking of existing velocity structure model for each local site, especially for the urbanized area. We identified where we need to improve the velocity structure model by comparing the site amplification obtained from spectral inversion with 1-D theoretical amplification factor from existing velocity structure model in Hokuriku district.

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