Subsurface structure model based at diffuse-field theory in Oiwake region: Simultaneous inversion analysis on adjacent two sites

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During the 2018 Hokkaido Eastern Iburi Earthquake, 6.7 seismic intensity was observed in KiK-net Oiwake. On the other hand, observed seismic intensity at K-NET Oiwake, which is 100m away from the KiK-net, was 6.4. The amplitude of response spectra at KiK-net were higher near the predominant period than those at K-NET. The reason for the difference between their seismic intensity seems to be thought of due to the difference of their subsurface structure. In this study, we deduce subsurface structure models at the two sites by H/V inversion based on diffuse-field theory and estimate amplification factor at the sites.

To select the earthquakes for inversion analysis, we set the conditions such as occurrence before the main shock, less PGA than 100 cm/s^2, and higher ratio of epicentral distance to depth of hypocenter than 2. We used the average H/V of the selected earthquakes for observed H/V. In the calculation of H/V, we use the square-root of sum of squares of NS and EW component for horizontal component. The period at the peak observed H/V at K-NET Oiwake is shorter than that at KiK-net. The difference between their observed H/V is small in longer period range than 2 seconds.

Because of the adjacent of the sites and similarity of observed H/V in the long period, we set the deep part of structure at the 2 sites to be in common and search for shallow part of that individually. In order to make the deep part of structure in common, we adopted simultaneous inversion analysis at the two sites. We used the hybrid heuristic method and set the range of search based on the model of PS logging and J-SHIS. We searched for the thickness for the deep structure and S wave velocity for the shallow structure.

As a result of inversion analysis, we could deduce subsurface structure models which accorded with the observed H/V. The depth up to engineering bedrock of deduced K-NET model is 7m, and that at KiK-net is 20m. AVS30 at K-NET is 278m/s, whereas that at KiK-net is 243m/s. On the whole, S wave velocity at KiK-net in shallow part is lower than that at K-NET. We calculated the amplification factor of the shallow part, which was searched individually. The first natural period of amplification factor at KiK-net is 0.31s and that at K-NET is 0.20s. The predominant period of response spectra at KiK-net’ s (0.53s) is also longer than K-NET (0.48s). Because both of the natural and the predominant period at K-NET are shorter than those at KiK-net, the difference between subsurface structures might cause that of the amplitude of the main shock. However, the predominant period of the main shock is longer than the natural period at both sites, which seems to be influenced by nonlinear effect of the subsurface soil.

We will study about a cause of the difference of seismic intensity considering nonlinear effect of the subsurface soil.

Keywords: The 2018 Hokkaido Eastern Iburi Earthquake, Diffuse-field theory, H/V inversion, Subsurface structure

