Site amplification at strong-motion stations in the Kumamoto prefecture and identification of underground velocity structures at Mashiki

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We made a field survey near ten strong-motion stations to confirm the damage of buildings after the mainshock of the 2016 Kumamoto Earthquake. The JMA seismic intensity was as large as 6-upper at six stations. We measured microtremors at two K-NET stations, three KiK-net stations and five Seismic Intensity Information Network (SIIN) stations. We found that the microtremor H/V of spectral ratios at most of the stations have a predominant period around 1.0 sec. We examined the reliability of PS logging data at three KiK-net stations, i.e., KMMH03, KMMH14 and KMMH16 by comparing the theoretical H/V spectral ratio based on diffuse field approach (Sanchez-Sesma, et al. 2011, GJI) with the observed one. The shape and amplitude of the theoretical H/V spectral ratios around the fundamental predominant period are almost the same as those of the observed counterpart at these three KiK-net stations. It suggests that the PS logging data under these stations are reliable. However, the PS logging data at the KMMH16 station (Mashiki) are not adequate to explain the peak at about 2.5 sec of the observed microtremor H/V spectral ratio.

We attempt to identify the underground velocity structures in the deep layer at KMMH16 station from the microtremor H/V spectral ratio of surface waves based on the diffuse field approach (DFA). The initial underground velocity model in the deep layer is referred to the J-SHIS. We obtain the best underground velocity structures after confirming the good coincidence between the theoretical and observed H/V spectral ratios. The identified underground velocity structures are used to evaluate the transfer functions at KMMH16. We make a comparison of the transfer functions at these three KiK-net stations. We find that the site amplification as large as about 8 at 0.2 sec and 1.0 sec is almost the same at the KMMH03 and KMMH14 stations. The site amplification at the KMMH16 station is as large as 10 from 0.2 sec to 1.0 sec, and as large as 5 from 2.0 sec to 3.0 sec which is affected by the deep layers.

Keywords: site amplification, microtremor H/V spectral ratio, underground velocity structures

