Analysis of Site Effects at the Sagami Bay Strong Motion Stations for Real Time Application

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The large scale installation of cable linked network of ocean bottom seismographs (OBS) and pressure gauges (S-net) is undergoing in the Japan Trench area for more accurate and rapid early warning of earthquake and tsunami. It is expected that the data recordings will begin in this year. Previous studies of ground motions recorded at the OBS in the Nankai Trough area in Japan showed that the amplitudes of the ground motions at the OBS are significantly larger than those recorded at the land stations at equal distances. The studies elucidated that the main reason for the large amplitude motions at the OBS is the large amplification effects of low velocity layers beneath the stations. The studies have, therefore, recommended correction for the magnitude estimated by using the current procedures for OBS data. It is important to devise a methodology for accurate magnitude estimation applicable to the S-net seismic data as the S-net stations are expected to record the far offshore events first in the Japan Trench area. In this paper, we obtain site amplifications by spectral inversion method at the K-NET OBS in the Sagami Bay area. There are six such stations, namely KNG201 through KNG206, in the Sagami Bay area. In the inversion, we also included land stations in the Kanto area. Theoretical amplification factors based on PS-logging data at the KNGH21 KiK-net site are used as constraints to minimize the tradeoff between the various parameters. We used recordings from moderate events (Mw 4 ~ 6) and epicentral distances between 30 to 300 km. The PGAs are mostly < 100 gal for the recordings. The obtained results show that the sites at the Sagami Bay area experience amplifications by five to ten folds compared to the reference KiK-net site in wide frequency ranges. These results are similar to those reported for the Tonankai sea floor areas in Japan. Previous researches have shown that the amplifications of high frequency ground motions may differ substantially due to nonlinear site response during strong shaking. It is, therefore, important to consider the effects of nonlinear site amplification as well. This paper focusses mainly on the linear site amplification. We will examine the nonlinear site amplification effects on the OBS recordings in our future study. In this study, the estimated magnitudes based on the inverted source spectra agree well with the F-net Mw. We also found that the estimated Qs values are in the range of previous studies.

Keywords: Ocean bottom seismographs, S-net, Site effects, Spectral inversion, Sagami bay

