

Long-period Ground Motion Characteristics of the Osaka Sedimentary Basin during the 2011 Great Tohoku Earthquake

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Seismic risk by long-period ground motion is one of important issues in mega-cities in the large sedimentary basin because the resonances of long-period structures such as oil tanks, long bridges, and high-rise buildings would cause the seismic disaster. For example, strong long-period ground motion cause a fire in Tomakomai, 200km away from the epicenter, in the 2003 Tokachi-oki earthquake. In this study, we analyze long-period ground motions of the 2011 great Tohoku-Oki earthquake (Mw9.0). Its long-period ground motions are well-recorded at about 100 strong motion stations by many organizations in and around the Osaka sedimentary basin. This data set could help detail feature of the ground motion propagation characteristics in the Osaka sedimentary basin.

Firstly, we compared horizontal components of reference site's record and each site's record in the long period range, 30 to 50s, and calculated its cross-correlation. We estimated difference in orientations and delay time to give a maximum cross-correlation. Second, we calculated the Fourier amplitude spectrum for S-wave portion of each horizontal record. Horizontal spectral ratio between vector-summed two components of amplitude spectra at the sedimentary site and the average of those at six rock sites are estimated. Predominant period of each spectral ratio in the long period range (10-1s) is obtained. Theoretical 1-D resonance period of S-wave for each sedimentary site is estimated from the Osaka sedimentary basin model by Iwata et al.(2008) and Iwaki and Iwata (2011), and is compared to the observed predominant period.

Observed predominant period distribution in the sedimentary basin is obtained. The observed predominant period of the spectral ratio is comparable or shorter than the theoretical resonance period at each site. Two- or three-dimensional basin effect could affect the observed predominant periods. Spectral ratio in the coda part, HV spectral ratio, and azimuthal spectral characteristics will be analyzed.

We used ground motion data of seismic intensity observation network in Osaka prefecture, K-NET, KiK-net and F-net of NIED, CEORKA network, and BRI network.

Keywords: Long-period Ground Motion, Osaka Sedimentary Basin, 2011 Great Tohoku Earthquake