

Spatial Variation of Earthquake Ground Motion and Subsurface Structure - Aftershock observation in KK-NPS -

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Asperity pulses of the 1995 Hyogo-ken Nanbu earthquake were enhanced by irregular subsurface structure of Kobe area and it was one of the reasons of the heavy damage belt of Kobe. The phenomena was characterized the amplification of seismic wave at basin edge and it was named 'edge effects' by Kawasa(1996). The heavy damage belt will not be represented whenever a large event will occur near Kobe area. The location and size of high amplification area will be move after source process of asperity, asperity size and geometrical relation between asperity and irregular subsurface structure.

Three asperity pulses are identified in the recorded waveforms at the Kashiwazaki-Kariwa Nuclear Power Station (KK-NPS) during the 2007 Niigata-ken Chuetsu-oki earthquake. The amplification of three asperity pulses showed different characteristics. The first pulse was amplified similar in the south side and north side of the site but the third pulse in the south site was amplified twice in the north side. The reason of the difference was assumed the effects of the fold structure of geology in the site. Since the KK-NPS site is located over the source fault of the 2007 Niigata-ken Chuetsu-oki event, the geometrical relation of the site and three asperities are different each other.

After the 1995 Hyogo-ken Nanbu earthquake, the sub-surface structure in Kobe area studied in detail and the generation mechanism of strong ground motion cooperated with the study of source mechanism of the event. After the 2007 Niigata-ken Chuetsu-oki earthquake, additional sub-surface survey was carried out too. Two-dimensional sub-surface structure models for two specific section lines were made and the reasons of strong motion generation were studied using these models. The three-dimensional model will be needed to study on the effects of the geometrical relation between asperity and the site.

After the 2007 Niigata-ken Chuetsu-oki earthquake, the 19 aftershock observation points were deployed in the KK-NPS site. The averaging distance of neighboring observation point is about 300 m. The large events did not occurred in aftershock area of the 2007 Niigata-ken Chuetsu-oki earthquake but many events including remote large events were observed by continuously recording system.

The results of data examination are as follows: (1) The time delay of S-wave onset and variation of spectral amplitude coincide with the variation of geological structure. (2) Radial - Vertical spectral ratios show the peak at the frequency calculated from the subsurface structure model estimated by array analysis of microtremors. (3) The receiver function waveform at each station varies spatially in company with the change of geological structure and the waveforms change after azimuth of epicenter.

These characteristics will be useful to create three-dimensional model of the site.

Keywords: Subsurface structure, Spatial variation of ground motion, the 2007 Niigata-ken Chuetsu-oki earthquake, Aftershock observation, Radial-Vertical spectral ratio, Receiver function