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2009年駿河湾の震源の強震動シミュレーションと震源モデルの構築および浜岡原子力発電所における強震動の特徴

Source Model for Strong Motion Simulation and the Characteristics of Strong Motions in the Hamaoka Nuclear Power Plant

倉橋 奨[1*], 入倉 孝次郎[1], 宮腰 研[2]

Susumu Kurahashi[1*], Kojiro Irikura[1], Ken Miyakoshi[2]

[1]愛知工業大学, [2]（財）地域地盤環境研究所

[1]Aichi Institute of Technology, [2]Geo-Research Institute

On August 11, 2008, a Mj 6.5 (JMA magnitude) earthquake occurred at the Suruga-Bay in Shizuoka Prefecture in Japan. The epicenter was located near the source area of the anticipated Tokai earthquake. However, the depth of the hypocenter is deeper than the anticipated Tokai earthquake, suggesting that the source is not located on the plate boundary but in the intra-slab different from the anticipated Tokai earthquake.
We try to construct the source model for simulating this earthquake using the aftershock records by the empirical Green's function method. The rupture area of this earthquake consists of two segments, a southern segment and a north-western segment (NIED, 2009). The southern segment has south dip and the north-western segment has north-east dip, respectively. In this study, we assumed the two fault segments for this earthquake. The observed records close to the source of this earthquake have several features. The ground motions observed west of the source have a distinctive pulse with 0.3 to 0.5 seconds. On the other hands, the ground motions observed east of the source have smaller amplitudes without distinctive pulses. Therefore, it is assumed that the rupture of this earthquake propagated mainly westwards from the hypocenter.
We choose small events whose records are used as the EGF in the following conditions: (1) almost the same source mechanism and (2) almost the same hypocentral distance as the mainshock. We selected an aftershock as the EGF for each segment of the source fault. For the southern and the north-western segments, the observed records from an aftershock occurring at 12:42 on August 1 3, 2009 (EGF1) and those from another aftershock doing at 18:11 August 13, 2009 (EGF2) are used, respectively. The corner frequencies of the spectra of the aftershock records are determined fitting to the omega-squared model. The source areas of the aftershocks are estimated from the corner frequencies based on Brune's (1970;1971) formula.
The best source model of the mainshock was estimated by comparing the observed waveforms with the synthetics using the EGF method. The source model consists of two asperities, one on the southern segment (Asperity 1) and the other on the north-western segment (Asperity 2). Asperity 1 on the southern segment has an area of about 6 km long by 4.5 km wide, where the rupture propagated radially from the hypocenter on the southern segment. Asperity 2 on the north-western segment has an area of about 6 km long by about 7 km wide. The stress drops on those two asperities are about 15MPa.
The Hamaoka Nuclear Power Plant is located about 37 km west of the epicenter of this earthquake. Ground motions at strong motion stations on surface, underground, and inside facilities in the plant were observed. They found that the amplitudes of the ground motions from

this earthquake were spatially different. For example, at the second basements of the reactor buildings the PGAs are 109 to 163 gals in Unit No.1 to No. 4, while the PGA is 426 gals in Unit No.5. The ground motions from two aftershocks occurring near the southern segment of the mainshock have the same characteristics as the mainshock. That is, the PGA at the second basements in Unit No.5 is more than twice of the PGAs in Unit 1to Unit No. 4. On the other hand, the ground motions from an aftershock occurring near the north-western segment of the mainshock have almost the same amplitudes as those in Unit No.5 as well as in No.1 to No.4. We simulated the ground motions in Unit No. 3 and No. 4 as well as in No. 5 using two aftershocks mentioned above. The simulated ground motions in Unit No. 3 and No. 4 as well as in No. 5 agree well with the observed motions from the mainshock. This means that the spatial variation of ground motions from Unit No.1 to Unit No.5 is not the source effect but the propagation-path effect from the source and the sites.

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