Strong ground motion simulation of the Northern Osaka earthquake of June 18, 2018

*Yosuke Nagasaka[1], Atsushi Nozu[1]

1. Port and Airport Research Institute

Strong ground motion simulation with point source model is simpler than the model with rectangular asperities. On the other hand, if the point source model ignores spacio-temporal extension of the fault, this can cause discrepancy between observation and synthetics. We have examined the applicability of the pseudo point-source model (Nozu, 2012) for intraslab earthquakes and so on and the results showed good agreement with observation records. However, validation of the method for crustal earthquakes is not enough. In this study, we conducted strong ground motion simulation for the June 18, 2018 Northern Osaka earthquake (M_J6.0) as an example of crustal earthquake.

First we assumed two fault planes based on moment tensor solution and aftershock distribution. These two fault planes have the mechanism of reverse fault and right-lateral slip fault, respectively. Then we estimated slip distribution by general inversion technique using empirical Green’ s functions. The result was that the reverse fault first ruptured and the right-lateral fault ruptured after a while, larger slip was seen on the reverse fault.

We then conducted strong ground motion simulation with the pseudo point-source model. In the method, we regard one asperity as one point source that follows omega-square model. We get the synthetic waveforms by combining the omega-square model with path spectrum, empirical site amplification factor, and site phase characteristics for each target station. We assumed only one point source in the first case. We put the point source on the hypocenter, and determined seismic moment (1.7×10^{17} Nm) and corner frequency (0.65 Hz) so that the synthetic Fourier spectra explain observed spectra the best. For phase characteristics, we chose the earthquake of June 19, 2018 occurred at 4:53 (M_J3.9). This small earthquake has the mechanism of reverse-fault, which explained the observed phase characteristics better than the phase of right-lateral earthquake. The result with one point source showed good agreement with observations in terms of amplification and phase characteristics. However, the result underestimated at OSK002, the closest station from the epicenter.

In order to improve this problem, we then conducted the simulation with two point sources, which can better consider the effect of the rupture propagation than the case of one point source. The location of the second point source is about 0.3km above the first point source. The relative rupture time is 0.41s. We used the same small earthquake for phase characteristics for both point sources. The seismic moments and corner frequencies were determined in the same manner as the case of one point source as M1=0.7×10^{17}Nm, fc1=0.6Hz, M2=1.1×10^{17}Nm, fc2=0.9Hz. As a result, the amplification at OSK002 was improved and the characteristics of the Fourier spectra were also improved compared to the one point source case.

Keywords: 2018 Northern Osaka earthquake, Strong ground motion simulation, point source model