Simulation of strong ground motion for the 2004 Southwest-Off Kii Peninsula Earthquake with pseudo point-source model

*Atsushi Nozu[1]

1. Port and Airport Research Institute

We have been testing the applicability of a new simplified source model called the “pseudo point-source model”, which was aimed to calculate strong ground motions (Nozu 2012). The model is simpler, and involves much less model parameters than the conventional characterized source model, which itself is a simplified expression of an actual earthquake source. In the model, the spatio-temporal distribution of slip within a subevent is not modeled. Instead, the source spectrum associated with the rupture of a subevent is modeled and it is assumed to follow the omega-square model. By multiplying the source spectrum with the path effect and the site amplification factor, the Fourier amplitude at a target site can be obtained. Then, combining it with Fourier phase characteristics of a smaller event, the time history of strong ground motions from the subevent can be calculated. Finally, by summing up contributions from the subevents, strong ground motions from the entire rupture can be obtained. In this study, the model was applied to the main shock of the 2004 southwest-off Kii Peninsula earthquake (M_w7.4), which occurred on September 5, 2004, 23:57 (JST) near the Nankai Trough, within the subducting Philippine Sea plate (e.g., Park and Mori 2005; Bai et al. 2007). Because of its location, strong motion records obtained during the earthquakes are suitable for the validation of strong motion simulation techniques. The pseudo point-source model for the earthquake was developed by appropriately locating point sources on the fault plane, based on the results of the waveform inversion. Then the model was used to simulate strong ground motions in a wide region. It was found that, when the model is used with an appropriate path model, it can accurately simulate strong ground motions at remote stations, even when the stations are located on deep sedimentary basins such as the Osaka plain.

Keywords: The 2004 southwest-off Kii Peninsula earthquake, Pseudo point-source model, Strong motion simulation, Fourier phase, Path effect

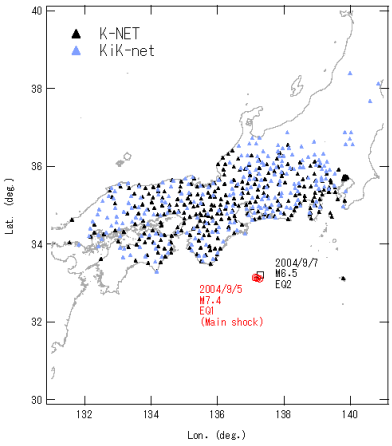

Figure 1. A total of 543 K-NET and KiK-net stations for which strong ground motions were simulated. Also plotted are the pseudo point-source model for the main shock and the epicenter of EQ2, which was used to evaluate Fourier phase characteristics.

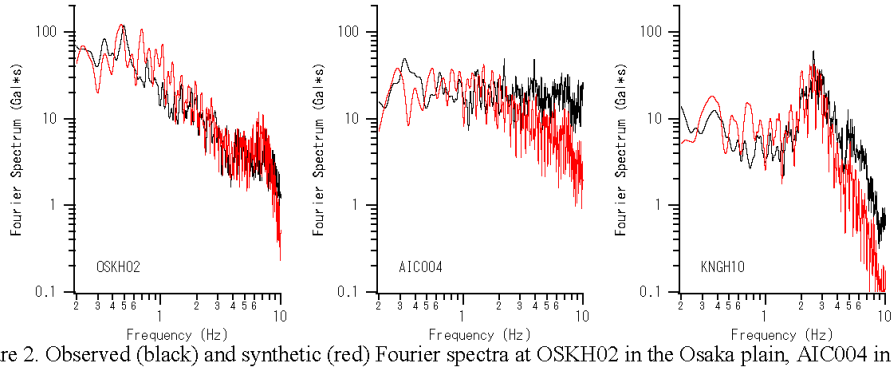

Figure 2. Observed (black) and synthetic (red) Fourier spectra at OSKH02 in the Osaka plain, AIC004 in the Nobi plain and KNGH10 in the Kanto plain.

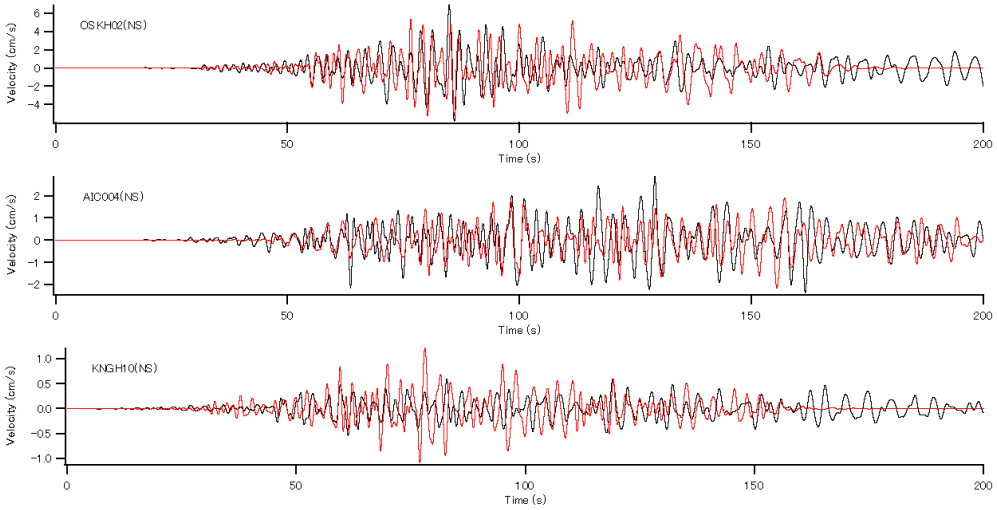

Figure 3. Observed (black) and synthetic (red) velocity waveforms (0.2-1 Hz) at OSKH02 in the Osaka plain, AIC004 in the Nobi plain and KNGH10 in the Kanto plain.

