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Source modeling and long-period ground motion simulation for the 1946 Nankai earthquake

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SUMMARY

Long-period ground motions over 2 seconds due to the 1946 Nankai earthquake are simulated. Minute 3-D crustal and sedimentary structure model developed by Petukhin et al. (2011) is employed for the simulation. Source model of the earthquake is reconsidered through source inversions with Green's functions calculated from the 3-D structure model.

Murotani (2007) proposed a source model of the 1946 Nankai earthquake from observed dataset of strong motion records, teleseismic records, and geodetic survey data. For the strong motion records, laboriously digitized vintage wave traces are used for source inversion. For calculating Green's functions at an observation site, 1-D crustal structure model reflecting a brief structure between source area and the site is employed, in a way used for crustal earthquakes, for which simplified 1-D velocity structures are valid. Although the source model of Murotani (2007) agrees well with previous results, the source model derived with 1-D structures could be improved for simulations in a wide target area covering whole subduction zone with a complex 3-D velocity structure.

We re-inverted a source model of the 1946 Nankai earthquake with Green's functions calculated from the 3-D crustal and sedimentary structure model. We employed reciprocal finite difference technique to reduce computational time to a reasonable level. Because many historical strong motion records were saturated and the station network was scarce, resolution of the source inversion were restricted to 20 km in space and 5 seconds in time. The source model was improved by adding a pulse to the slip-velocity time function of each subfault after Miyake et al. (2001) to produce ground motion up to 2 seconds. Amplitudes of the pulses were adjusted to match Fourier spectra and keep waveforms of the observed strong motion data, simultaneously.

Simulated long-period ground motions agree with results of Kamae and Irikura (1994) for response spectra longer than 2 seconds in the Osaka basin. They simulated broadband ground motion at JMA observation sites by empirical Green's function method and verified the results with JMA intensities. It suggests that our results may reproduce the long-period shake map due to the 1946 Nankai earthquake. Based on this study we are planning to simulate possible mega-earthquakes in the source region.

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