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Comparison of long-periods ground motion in Tokyo Bay area calculated from Tokai and Tokai-Tonankai coupled earthquake

Tomiichi Uetake^{1*}, Kazuhito Hikima¹, Yasushi Nukui¹, Takashi Hayakawa², Motofumi Watanabe²

¹Tokyo Electric Power Company, ²Osaka Research Institute

The evaluation of the long-period ground motions from great earthquakes occurred in the Suruga trough and the Nankai trough is important for seismic design or earthquake disaster prevention of long-period structures in Tokyo Bay area. Recently, the next Tokai earthquake is said to become an Aansei Type event that the focal region of Tokai earthquake and the focal region of Showa Tonankai earthquake will be outbreak in succession. However, there are few examples of the long-period ground motion simulations of the Ansei type event, and the influence of focal region coupling is unknown. Generally the response of long-period structure with low damping factor grows big if the duration time of vibration is long. When we thought about Tokyo Bay area, the region of the Tonankai earthquake may give a small influence because its distance from Tokyo bay area is longer than the region of Tokai Earthquake. Therefore, in this study, we calculated the long-period ground motion of Tokai-Tonankai coupled event and compared it with Tokai earthquake and evaluated the influence of coupled event.

The source fault model was made based on the model of Central Disaster Prevention Council. The start point of slip of Tokai event part and the Tonankai event part and the time lag (72.31 seconds) of slip start were the same as the model of Central Disaster Prevention Council too. The velocity structure model made by the Headquarters for Earthquake Research Promotion was used for calculation. We evaluated the long-period ground motion in period range more than 3.5 s using three dimensional finite difference methods. 17 points in Tokyo bay area were selected for wave evaluation.

Waveforms calculated from Tokai-Tonankai coupled event showed almost the same shape and amplitude as the waveforms of Tokai event. In the Tokyo Bay area, the influence of the Tonankai region is small and the influence of the Tokai earthquake region is big. The peak ground velocities of the horizontal motion are 20-30cm/s in west side and 40-60cm/s in the east side of the Tokyo Bay. There was the point where the case of the coupled event was about 30% bigger than Tokai event but there was the point where Tokai event was bigger. The peak ground velocity of coupled event was about 3% big on the 17 points average. The peak ground velocities of vertical motion are 10-30cm/s and coupled event case was almost the same as Tokai event case.

Comparing the response velocity spectra of 1% damping factor, coupled event and single event are almost same in period range shorter than six s. As for the peak of response spectra in period of 6-10 s, the coupled event was about 20-40% bigger than Tokai event at many evaluation points, but Tokai event was bigger than coupled event at some points. In period range over 10 s, the case of coupled event is bigger at almost evaluation points but there are the periods where the Tokai event case is bigger than coupled event case.

The ground motion during the Tokai-Tonankai coupled event was the results of the complex interference between the wave from Tokai region and Tonankai region.

Keywords: Long-Period Ground Motion, Tokai Earthquake, Tokai-Tonankai Coupled Earthquake, Finite Difference Method, Tokyo Bay Area