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# Tsunami simulation in the Western Pacific Ocean and East China Sea from the Tokai and Nankai earthquakes

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Two large earthquakes of Mw 7.7 and Mw 7.4 (Global CMT) off the New Guinea Island, Indonesia, generated tsunamis in the Western Pacific Ocean. The Japan Meteorological Agency issued tsunami watch on the Japanese coast, and the tsunami was recorded on Japanese tide gauges. At the time of the 1996 Irian Jaya earthquake of Mw 8.2 (Harvard CMT), which took place about 500 km east of the 2009 events, JMA issued tsunami warning on the Japanese coast. These indicate that great earthquake along the Nankai trough, which is anticipated to occur in the near future, will generate large tsunami in the Western Pacific Ocean. Thus, it is important for disaster prevention to evaluate tsunami heights in this region.

As for tsunamis in the Eastern China Sea, Harada and Ishibashi (2005, 2006, and 2007) concluded that the tsunami heights from the past great Nankai events on the coast around Shanghai in China were not significant. However, their computations were made on the limited coasts of the East China Sea. Moreover, they used old fault models of the great Nankai events (Ando, 1975; Aida, 19 81a, 1981b). Hence, it is necessary to evaluate tsunami heights on the entire East China Sea coast using more recent fault models.

In this study, we carried out numerical simulations of tsunami propagation in the Western Pacific Ocean and East China Sea by using recent fault models of Tokai and Nankai earthquakes. We used static fault models proposed by An'naka et al. (2003) for the past seven Tokai and Nankai earthquakes including the 1605 Keicho earthquake (tsunami earthquake) and the 1707 Ho'ei earthquake (simultaneous rupture of Tokai and Nanaki segments). Tsunami propagations were computed by the finite-difference method for the liner long-wave equations (Satake, 1995) in the area from 115 to 155 degrees E and from 10 degrees S to 40 degrees N using GEBCO 1-minute bathymetry data. The time step of the computation is 3.0 sec to satisfy the stability condition. Initial conditions of tsunami propagation are ocean bottom deformation due to earthquake faulting, which were computed by Okada's (1992) program. As the boundary conditions, the total reflection on the coast and open boundary to outside the computational area were assumed. We simulated tsunamis for 20 hours after the earthquakes.

The simulation results show that, on the Western Pacific coasts, the 1605 and 1707 tsunami heights are the highest. Tsunami heights from the 1854 Nankai event are the second highest, close to those from the 1605 and 1707 events, because the slip amounts on the 1854 Nankai faults are close to those on the Nankai faults of the 1605 and 1707 events. The tsunami heights from the 185 4 Tokai earthquake are considerably low, because tsunamis from the Tokai fault propagate mainly toward the east of Ogasawara Islands and do not reach the Western Pacific Ocean coasts.

From the above simulations, it can be concluded that the tsunami heights on the Western Pacific coast mostly depend on the slip amounts on the Nankai fault and insensitive to the rupture on the Tokai fault. On the East China Sea coast, it is also found that tsunami heights mostly depend on

faulting in the Nankai region. Tsunami is highest around Shanghai in the East China Sea coasts, but not significant as Harada and Ishibashi (2005, 2006, 2007) concluded. Because the above results are based on the fault models of An'naka et al. (2003), different fault models need to be tested, particularly for the 1605 tsunami earthquake.

Keywords: tsunami numerical simulation, Tokai and Nankai earthquakes, Western Pacific Ocean, East China Sea, multi-segment rupture of the Tokai and Nankai earthquakes