Tsunami simulations for probabilistic tsunami hazard assessment in the Japan Trench, the Nankai Trough and the Sagami Trough

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NIED began a research project regarding probabilistic tsunami hazard assessment (PTHA) for Japan (Fujiwara et al., 2013, JpGU), and gave an overview of the assessment (Hirata et al., 2014, 2015, 2016, JpGU). Also, we presented preliminary simulation results that showed tsunami height along shorelines of the Pacific Ocean where earthquake source regions along the Japan Trench, the Nankai Trough and the Sagami Trough locate (Takayama et al., 2016, JpGU; Saito et al., 2016, SSJ). Aggregating these simulation results, in this study, we discuss the tsunami height along the coastal regions. Our research target includes not only the subduction earthquakes that are mainly considered by the possible tsunami-genic earthquake derived from a seismic slip on a plate boundary in subduction zone but also unspecified fault sources such as small and medium scale earthquakes without offshore active faults. In the previous studies, Toyama et al. (2014, 2015, JpGU) and Kito et al. (2016, JpGU) introduced how to build up a set of characterized earthquake fault models (CEFMs) on hypothesized earthquakes along the Japan Trench, the Nankai Trough and the Sagami Trough, referring to the “Long-term evaluation of seismic activity for the region from the off Sanriku to the off Boso (2nd edition, 2011)”, ”Long-term Evaluation of earthquakes in the Nankai Trough region (2nd edition, 2013)” and “the National Seismic Hazard Maps for Japan (2014)” respectively that are published by the Headquarters for Earthquake Research Promotion (HERP). We constructed a set of the 571 CEFMs for specified earthquakes and 1319 CEFMs for the others in 40 patterns of source regions along the Japan Trench, the 3897 CEFMs for specified earthquakes and 48 CEFMs for the others in 210 patterns of source regions along the Nankai Trough, and the 135 CEFMs for specified earthquakes and 928 CEFMs for the others in 12 patterns of source regions along the Sagami Trough. Then, the total number of the CEFMs reaches about 6900. With these CEFMs, a tsunami run-up simulation estimates tsunami wave height along the pacific coast from Kagosima to Hokkaido prefectures, solved by the non-linear shallow-water equation using a leap-frog scheme. These simulations are configured by a nested grid system consisting of four sub-regions from outer 1350 m to inner 50 m in a horizontal, landward inundation keeping, and transparent at the seaward edges. Initial wave height follows vertical displacement driven by seafloor deformation via Okada’s equation (Okada, 1992). The seafloor deformation consists of vertical and horizontal deformation. Toward research in the broad field of tsunami hazard we are planning to develop a database of coastal tsunami wave height provided in this study. This study was done as a part of the research project on probabilistic tsunami hazard assessment (PTHA) for Japan area by NIED.

Keywords: Tsunami hazard, Tsunami simulation, the Japan Trench, the Nankai Trough, the Sagami Trough

