Tsunami simulations toward probabilistic tsunami hazard assessment in the Nankai Trough

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NIED began a research project regarding probabilistic tsunami hazard assessment (PTHA) for Japan since 2012 (Fujiwara et al., 2013, JpGU). Hirata et al. (2014, JpGU) reported the concept of this study that a nation-wide PTHA is to obtained by aggregating evaluations performed for each region-wide PTHA such as shorelines along the Nankai Trough, the Japan Trench, etc. A region-wide PTHA is to analyze coastal hazard caused by tsunami wave heights estimated with a numerical simulation. Here, we show preliminary datasets of coastal tsunami wave heights in the shorelines between Kagoshima and Ibaraki prefectures computed by thousands of fault models on assumption of possible scenarios for Nankai Trough earthquakes.

We focus on Nankai Trough earthquakes which there are a concern that tsunami may arrive at coastal regions in future. 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.Toyama et al. (2015, JpGU) and Hirata et al. (2015, SSJ Fall Meeting) introduced how to build up a set of characterized earthquake fault models (CEFMs) on hypothesized earthquakes along the Nankai Trough, referring to the “Long-term Evaluation of earthquakes in the Nankai Trough region (2nd edition)” by the Headquarters for Earthquake Research Promotion (HERP, 2013), where we constructed a set of the 1442 simplified fault models in the 15 types of source regions described in the long-term evaluation, i.e. 1) the 24 basic fault models, in which we put a large slip area (LSA) on the basis of the configuration of the previous studies for the historical large earthquakes along the Nankai Trough, 2) the 1411 extended fault models, in which we put LSAs for variety of fault models, and 3) the 7 recurrence fault models, in which we put the source area corresponding to the historical tsunami-genic earthquakes evaluated by HERP. Additionally, a set of the other 2455 extended fault models in the other 70 types of source regions are newly constructed in this study. Then, the total number of the CEFMs reaches a little less than 4000.

With the around 4000 fault modes, initial wave heights are calculated from surface deformation via Okada’s equation (Okada, 1992). A tsunami run-up simulation estimates tsunami wave heights along pacific coast from Kagosima to Ibaraki 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.

The preliminary datasets of coastal tsunami wave heights contributes to implementing uncertainty into coastal probabilistic tsunami hazard (Abe et al., 2015, JpGU) and to constructing a database.

This study was done as a part of the research project on probabilistic tsunami hazard assessment (PTHA) for Japan area by NIED.

Keywords: Probabilistic tsunami hazard assessment (PTHA), Tsunami simulation, the Nankai Trough, Database

