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A set of characterized earthquake fault models for the probabilistic tsunami hazard assessment in the Nankai Trough

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A set of characterized earthquake fault models are necessary for nation-wide probabilistic tsunami hazard assessment in Japan (Fujiwara et al., 2013; Hirata et al., 2014). It should include all possible earthquakes in future and should take into account various types of uncertainty. We introduced our strategy to construct a set of characterized earthquake fault models for tsunami hazard assessment in Japan, showing examples of earthquake fault models along the Japan Trench (Toyama et al., 2014).

In this study, we introduce a set of characterized earthquake fault models for tsunami hazard assessment in the Nankai Trough region, referring to the ”Long-term Evaluation of earthquakes in the Nankai Trough region (2nd edition)” (2013/5/24) by the Headquarters for Earthquake Research Promotion(HERP), which was revised based on the lessons learned from the Great Tohoku earthquake.

At first, we classify tsunamigenic earthquakes into two categories as tsunami source fault specified or not.

And we classify specified tsunami source fault models as follows; 1) basic (typical) models, in which we put ”large slip area (LSA)” under the characterization rule a) we will mention later, referring to the LSA configuration of the previous studies for the past large earthquakes occurred in the Nankai Trough region, 2) extended models, in which we put LSAs in various and possible configuration.

In addition to these models, we make ”recurrence models”, in which we put the source area corresponding to the historical tsunamigenic earthquakes and the simplified LSAs configuration based on the previous studies for the past large earthquakes. The total number of assumed earthquakes becomes 85, the 15 kinds of earthquakes shown in the ”Long-term Evaluation” and possible 70 kinds of earthquakes.

Next, seismic moment, Mo, to a characterized earthquake fault model, is determined by an empirical scaling relation between Mo and fault area, S. We applied the relationship same as the one applied in the second phase report of the investigative commission for possible giant earthquake in the Nankai Trough region (2012) by Cabinet Office. There are some previous studies suggesting that rigidity is depth dependent, but we use a constant value of $5*10^{10}$(N/m^2) as rigidity.

We introduce inhomogeneity in earthquake fault slip to define LSA and ”extremely large slip area (ELSA)” by the same rule applied in a set of characterized earthquake fault models along the Japan Trench as follows: a) LSA has twice slip amount as average slip and 30% area of the entire fault area (Korenaga et al., 2014). b) LSA is allowed to be located half pitch for along-trench direction and basically 3 patterns for trench-normal direction. c) ELSA can be allowed to be located along the upper edge in a LSA when the LSA is located adjoined the trench axis and has 4 times slip amount as average slip. d) The overlap rate for LSA is about a half to three fourths. e) The overlap rate for ELSA is about a half.

For unspecified earthquakes, we consider only a LSA at the center of the entire fault area. In this case, variability of possible LSA location is taken into account by introducing an uncertainty value of possible LSA location in process of tsunami hazard curve calculation(Fujiwara et al., 2013; Hirata et al., 2014).

A set of characterized earthquake fault models that we place in the Nankai Trough region, spans from Mw 7.7 to 9.2 for 85 kinds of earthquakes. Total number of the models in the Nankai Trough region reaches a little less than 4,000 in total. We are conducting non-linear tsunami simulations for all characterized earthquake fault models now.

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Keywords: tsunami hazard assessment, probability, characterized earthquake fault model, Nankai Trough