Japan Geoscience Union Meeting 2014
(28 April - 02 May 2014 at Pacifico YOKOHAMA, Kanagawa, Japan)

HDS28-03 Room:312 Time:May 1 16:45-17:00

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

TOYAMA, Nobuhiko[1*] ; HIRATA, Kenji[1] ; FUJIWARA, Hiroyuki[1] ; NAKAMURA, Hiromitsu[1] ; MORIKAWA, Nobuyuki[1] ; OSADA, Masaki[1] ; MATSUYAMA, Hisanori[2] ; KITO, Tadashi[2]

[1]NIED, [2]OYO CORPORATION

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.

In general, origins of tsunamis include a volcano, a landslide as well as an earthquake, but as the first step we focus on tsunamis that are caused by only earthquakes occurring near Japanese Islands. We introduce our strategy to construct a set of earthquake fault models for tsunami hazard assessment in Japan, showing examples of earthquake fault models along the Japan Trench.

The ”Long-term Evaluation of earthquakes from Sanriku-oki to Boso-oki region (2nd edition)” (2011/11/25) by the Headquarters for Earthquake Research Promotion(HERP), Japanese government, defined 8 seismogenic segments along the Japan Trench. Based on these segmentations, we classify tsunamigenic earthquakes into 7 categories as follows; 1)”March 11, 2011 Tohoku earthquake-type” earthquakes, 2) maximum-sized class earthquakes, 3) other large-sized earthquakes, 4) earthquakes occurring in any single segment which HERP assessed its possible magnitude and/or location with recurrence interval, 5) tsunami earthquakes, 6) intra-plate earthquakes with normal faulting, and 7) moderated-sized earthquakes (HERP called this type ”earthquakes which we cannot expect its magnitude and size”). HERP assessed earthquake potentials only in categories 1), 4), 5), and 6). To enhance the entirety of tsunami hazard assessment, we newly add the categories 2), 3) and 7), though no previous earthquakes in categories 2), 3), and 7) are known yet. We place earthquake fault on the upper boundary of the subducting Pacific Plate except earthquakes of the category 6).

Seismic moment, Mo, to a characterized earthquake fault model, is determined by an empirical scaling relation between Mo and fault area, S. To determine the empirical relation we first make a list of tsunamigenic earthquakes from the data base of ”Size of tsunamis around Japan for 1498-2006” (http://wwweic.eri.u-tokyo.ac.jp/tsunamiMt.html) by Abe. Next we assign Mo and S to listed tsunamigenic earthquakes, referring in previous studies (Sato et al.,1989) and then derive an empirical Mo-S scaling relation for tsunamigenic earthquakes occurred in the area of the Pacific ocean side. 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 ”large slip area (LSA)” and ”extremely large slip area (ELSA)” by following a characterized ratio of high-slip area to entire fault area (Korenaga et al., 2014). For great earthquakes of Mw $>$˜8.4, LSA is allowed to be located 3 patterns for along-trench direction and 3 patterns for trench-normal direction, thus total of 9 basic configurations, for each characterized earthquake fault model. ELSA can be allowed to be located along the upper edge in a LSA when the LSA is located adjoined the trench axis. For large earthquakes with the magnitudes less than ˜8.3, that is the category 7), 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.

A set of characterized earthquake fault models that we place along the Japan Trench, spans from Mw 7.0 to 9.4 at every 0.1 or 0.2 magnitude intervals. Total number of the models along the Japan Trench reaches more than 1800. It takes whole three months to complete non-linear tsunami simulations for all characterized earthquake fault models.

This study was done as a part of ”Tsunami hazard assessment project for Japan”in NIED.

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