[JJ] Evening Poster | H (Human Geosciences) | H-DS Disaster geosciences

[H-DS10]Tsunami and Tsunami Forecast

convener:Naotaka YAMAMOTO CHIKASADA(National Research Institute for Earth Science and Disaster Resilience), Kentaro Imai(Japan Agency for Marine-Earth Science and Technology), Hiroaki Tsushima(気象庁気象研究所)

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This session discusses issues related to improving real-time and long-term prediction accuracy of tsunami from earthquakes, landslides, and volcanoes, which include such as a better understanding of tsunami dynamics, new real-time tsunami observing systems deployed in the open ocean and coastal waters, methodologies of more rapid and accurate prediction during tsunami emergencies, more extensive and accurate inundation maps, and long-term tsunami potential forecast.

[HDS10-P19]Characterized Earthquake Fault Models for Probabilistic Tsunami Hazard Assessment along the Southern Kuril Trench

*Kenshi Ohshima[1], Tadashi Kito[1], Kenji Hirata[2], Hiroyuki Fujiwara[2], Hiromitsu Nakamura[2], Nobuyuki Morikawa[2], Takahiro Maeda[2], Hisanori Matsuyama[1], Nobuhiko Toyama[1], Yasuhiro MURATA[3], Shin'ichi Akiyama[4] (1.OYO Corporation, 2.National Research Institute for Earth Science and Disaster Resilience, 3.KOKUSAI KOGYO CO., LTD., 4.ITOCHU Techno-Solitions Corporation)

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NIED (National Research Institute for Earth Science and Disaster Resilience) has been conducting the project on the probabilistic tsunami hazard assessment along the coastline in Japan (Fujiwara et al., 2013, JpGU). We have already constructed characterized earthquake fault models and assessed tsunami hazard along the coastline using tsunami heights estimated by tsunami simulation in the Japan Trench, Nankai Trough and Sagami Trough (Hirata et al., 2014, 2015, 2016, 2017, JpGU). In the project of the hazard assessment at NIED, earthquakes are generally classified into two types, the one evaluated in the long-term evaluation of earthquakes by Headquarters for Earthquake Research Promotion (HERP) and the other modeled without any knowledge about past large earthquakes such as the long-term evaluation. We have called the models of the latter earthquake type as the unspecified earthquake fault models. In December 2017, HERP published the “Long-term Evaluation of earthquakes in the Kuril Trench (the 3rd edition)”. In this study, however, we constructed only the unspecified earthquake fault models to conduct probabilistic tsunami hazard assessment independent of the long-term evaluation of earthquakes. We introduce our strategy to construct characterized earthquake fault models and show some of them.

Firstly, we specified the target area where earthquakes occurred. In the strike direction, we specified the target area to include four seismicity zones (the offshore of Tokachi, Nemuro, Shikotan Island and Iturup Island area) according to the “Long-term Evaluation of earthquakes in the Kuril Trench (the 2nd edition)” (HERP, 2004) and extended the northeast part of the offshore of Iturup Island area to consider “the Earthquake east of the Kuril Islands of 2006”. The extended area was called as the offshore of Simushir Island area. In the dip direction, we specified the target area between the Kuril Trench and the 60 km depth contour of the surface of the Pacific plate.

Secondly, we constructed the characterized earthquake fault models with the magnitude from Mw 7.0 to Mw 9.4. Since the unspecified earthquake fault models are modeled on the assumption that it is difficult to evaluate the magnitude, location and source area of past earthquakes, we considered simple square fault models as analogy of point sources. The area of each fault model was estimated by the scaling relation used for the probabilistic tsunami hazard assessment in the Japan Trench (Fujiwara et al., 2014). In the case of the magnitude under Mw 8.4, all square fault models were set within the target area. In the case of the magnitude over Mw 8.5, however, the width of some square fault models became larger than that of the target area in the dip direction. Therefore we modified these models by cutting the regions that exceeded to the top or bottom of the target area and adding the equivalent area of the cut regions to the west and east edges of the original models. Then we spread the square or modified fault models all over the target area shifting with an approximately half pitch interval from neighbor models.

Finally, we set a large slip area with 30 % of source area and 2 times of average slip amount in each fault model to consider a heterogeneous slip distribution. In the case of the magnitude over Mw 8.5, we set large slip areas shifting with an approximately half pitch interval in the strike direction and at most 3 locations (shallow, middle and deep) in the dip direction to take account of a diversity of heterogeneous slip distribution. In the case of the magnitude under Mw 8.4, we set a large slip area located at the center of each fault model and took account of a diversity of heterogeneous slip distribution by giving dispersion to tsunami heights in assessing tsunami hazard (Abe et al., 2018, JpGU). The shape of the large slip area was basically square, but when the large slip area located at the edge of the fault model, the side of the large slip area was adjusted to correspond with that of the fault model. Thus, we constructed 3,347 characterized earthquake fault models in the southern Kuril Trench.

The group of characterized earthquake fault models constructed in this study may include much uncertainty due to the lack of seismological knowledge about past large earthquakes in the Kuril Trench. We are currently constructing characterized earthquake fault models based on the “Long-term Evaluation of earthquakes in the Kuril Trench (the 3rd edition)”. Combining them with the group of fault models in this study, we will be able to conduct the probabilistic tsunami hazard assessment with less uncertainty.

This study is conducted as a part of the research project “Research on the hazard risk assessment” at NIED.