Japan Geoscience Union Meeting 2015
(May 24th - 28th at Makuhari, Chiba, Japan)

HDS27-22 Room:A04 Time:May 27 17:15-17:30

Probabilistic tsunami inundation hazard assessment using detailed surface model

SAITO, Ryu[1*] ; MURASHIMA, Yoichi[1] ; MURATA, Yasuhiro[1] ; INOUE, Takuya[1] ; TAKAYAMA, Jymnpei[1] ; AKIYAMA, Shinichi[2] ; MATSUYAMA, Hisanori[3] ; HIRATA, Kenji[4] ; FUJIWARA, Hiroyuki[4]

[1]KOKUSAI KOGYO CO., LTD., [2]CTC (ITOCHU Techno-Solutions Corporation), [3]OYO Corporation, [4]NIED (National Research Institute for Earth Science and Disaster Prevention)

A probabilistic tsunami inundation hazard for a city is described, as part of the probabilistic tsunami hazard assessment research work which has been promoted by NIED. Our study is primarily motivated by a need to understand that information of tsunami inundation hazard on a tsunami run-up area in a whole city contributes to the utility of disaster prevention plans and risk assessment.

The probabilistic tsunami hazard assessment for Japan has been conducted to estimate frequency of exceedance wave height along coastal regions [Hirata et al., 2014, JPGU], which is probabilistically derived from numerical modelling of tsunami sources as much consideration as possible. This tsunami run-up simulation has been implemented as a surface model at 50 m of minimum along coastal regions, however, which is not enough resolution to form an inhomogeneity of terrain topography and built structures, levees and seawalls, in finer resolution than 50 m. Then, a tsunami run-up simulation using higher spatial resolutions is important to quantify a tsunami inundation hazard for a city that includes several built structures and formation of inhomogeneous topography. With using the finer surface model above, different tsunami inundation hazards are quantified by a comparison between a potential inundation hazard without any structures and an inundation hazard protected with structures, which will be applicable for a performance of levees.

Here our study provides a technical note for quantification of probabilistic tsunami inundation hazard assessment for a city, Rikuzentakata one of example, using inundation information obtained from tsunami run-up simulation run at horizontal resolution 10 m with the many tsunami sources. A comparison between (1) a potential inundation hazard without any structures and (2) the other inundation hazard with structures is discussed. Earthquake scenarios used in this study are set by 1890 tsunami sources and occurrence frequencies around Japan trench [Touyama et al., 2014, JPGU], based on the long-term evaluation. The surface model of 10 m horizontal resolution is created from Airbone lider-derived high resolution surface model. This surface model contains built structures. The tsunami run-up simulation is curried out by a nested grid system consisting of five sub-regions from outer 2430 m to inner 10 m. The built structures are rigid, i.e. completely protect against tsunami overtopping and breaching levees, because of finding a simple interpretation of minimum inundation hazard compared to the potential inundation hazard, first of all. The probabilistic tsunami hazard assessment is quantified using much inundation information of area and depth in the city, resulted from the 1890 scenario's simulations.

We concluded that increasing model horizontal resolution clearly improved the tsunami inundation mapping and thus quantified the tsunami inundation hazard in detail. This ongoing study will lay a solid foundation for obtaining reliable tsunami inundation hazard in a city and for a cost-benefit analysis. Studies in probabilistic hazard analyses are also underway to implement uncertainty into tsunami inundation information [Abe et al. 2014, JPGU], which offers a more accurate estimates of the plausible inundation hazard.

Keywords: Tsunami, Inundation, Hazard assessment, Probability