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

HDS27-01 Room:A04 Time:May 27 09:30-09:45

Real-time tsunami inundation forecast system using S-net data

AOI, Shin[1*] ; YAMAMOTO, Naotaka[1] ; SUZUKI, Wataru[1] ; NAKAMURA, Hiromitsu[1] ; KUNUGI, Takashi[1] ; KUBO, Tomohiro[1] ; HIRATA, Kenji[1] ; MAEDA, Takahiro[1]

[1]NIED

One of the causes of escalation of damages during the 2011 megathrust Tohoku earthquake (M 9.0) was the underestimations of initial estimation for tsunami height of JMA forecast as well as the insufficient dissemination of the tsunami information to people due to power failures. To reduce the fatalities due to tsunamis, it is essentially important to deliver prompt and accurate forecast to the on-shore residences when a large tsunami is generated by a huge earthquake. At the time of the Tohoku earthquake, in the Pacific coasts of Kanto, Tohoku and Hokkaido districts, off-shore observations were insufficient and the observed data essential for efficient tsunami forecast was very poor. In response to this situation, Japanese government decided to construct S-net (Seafloor Observation Network for Earthquakes and Tsunamis along the Japan Trench; Kanazawa et al., 2012, JpGU; Uehira et al., 2014, AOGS; Uehira et al., 2015, JpGU) and NIED is now constructing this observation network under the sponsorship of MEXT, Japanese government. S-net consists of 150 ocean bottom observatories linked by ocean bottom fiber optic cables with the total length of approximately 5,700 km. This dense network covers the wide area of the Japan Trench and the southernmost Kuril Trench from Kanto to Hokkaido, and every source area of an earthquake of magnitude larger than 7.5 includes at least one observatory. One of the most important contributions of S-net is that we obtain additional lead time for earthquake and tsunami early warning. For the best case, the additional lead time by using data from S-net is about 20 minutes for a direct direction of a tsunami generated by an earthquake that occurs in the Japan Trench, and 30 seconds for earthquake early warning. To maximize the advantage of S-net, we are developing a new methodology of real-time tsunami inundation forecast system. Many tsunami forecast methods have been studied. For instance, Tsushima et al. (2012) proposed tFISH which estimates tsunami height by forward simulation using inverted source model and Baba et al. (2014) proposed a method using relationship of tsunami height between offshore and near coast. We select an approach to prepare tsunami scenario bank in advance for at least thousands of source scenarios and, when a tsunami occurs, a forecast is carried out by comparing observed ocean bottom pressure data and pre-calculated data, and selecting several possible scenarios to represent forecast uncertainties which can almost evenly explain observations according to a particular criteria (Yamamoto et al., 2014, AGU; Suzuki et al., 2015, JpGU), because inundation is a highly non-linear phenomenon and its calculation costs are rather heavy. An advantage of our method is that tsunami inundations are estimated explicitly without any source information which may have large estimation error, especially for real-time analysis. As the number of the tsunami scenarios stored in the bank is limited, due to heavy calculation loads for inundation simulations, for accurate forecast, it is important to appropriately assume the input source models. Therefore, we first carry out many calculations based on linear long-wave theory which only requires much less calculations comparing with nonlinear theory to check the sensitivities of the source models to coastal tsunami heights. Based on a large number of sensitivities analyses, we will construct the tsunami scenario bank that efficiently covers possible tsunami scenarios affecting the target region.

Keywords: tsunami, real-time tsunami forecast, tsunami inundation forecast, S-net