# Examination of model validity and sensitivity of tsunami sediment transport modeling using the 2011 Tohoku tsunami deposits in Iwate, Miyagi, and Fukushima Prefectures

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Sediment transport numerical models due to tsunami are continuously developed (e.g., Takahashi et al., 1999; 2011; Gusman et al., 2012; 2018). However, there are only few studies evaluating the tsunami sediment transport model validity and sensitivity. In this study, to examine the model validity and sensitivity of tsunami sediment transport simulation, we applied it to the 2011 Tohoku tsunami deposits at Numanohama marsh in Iwate Prefecture, Sendai plain in Miyagi Prefecture, and Idagawa lowland in Fukushima Prefecture.

One-dimensional sediment transport simulations with a single grain size and multiple grain sizes were used in this study. To consider the multiple-sized sediment transport, three representative diameters were selected based on a grain size distribution measured from tsunami deposits. The calculated sediment thickness for multiple grain sizes was defined as the sum of the computed sediment thickness for each single grain size with an assumption that the interaction between different particles is negligible. To examine the model sensitivity, a total of 11 tsunami source scenarios (Models 1 to 11) were also evaluated by modified Satake *et al.* (2013).

For Idagawa lowland and Sendai plain, the calculated results for a single grain size were much thinner than the observation. By considering the multiple grain sizes, the results computed from previously estimated models (Models 1 and 2) agreed with the observation, whereas the other models were underestimated or overestimated the observation. For Numanohama marsh, the agreement indexes for simulation using a single grain size was better than that for simulation using multiple grain sizes. This is probably because the 2011 Tohoku tsunami deposit in Numanohama marsh was generally coarser than those in Idagawa lowland and Sendai plain.

Our results show that the sediment transport modeling has a certain validity. Additionally, it is more effective and has higher sensitivity to constrain tsunami source model, than the technique that compares the maximum extent of tsunami deposit with the computed tsunami inundation distance (e.g., Satake *et al.*, 2008; Namegaya *et al.*, 2010; Namegaya and Satake, 2014). We are planning to further verify for the application to paleo-tsunami deposits.

Keywords: tsunami deposit, sediment transport modeling, 2011 Tohoku earthquake

 