Influence of coastal structures on probabilistic tsunami inundation assessments

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Studies on probabilistic hazard assessments are common in recent years to quantitatively understand the risks of disasters. For tsunami, probabilistic tsunami height assessments along the coast were conducted. But probabilistic tsunami inundation assessments are not shown yet because these need a huge number of tsunami calculations with highly resolved topographic data (~10m). However, recent developments of high-performance computers enable us to make a probabilistic tsunami inundation map if the study area narrowed down. We created a tsunami inundation database for Tokushima Prefecture along the Nankai Trough. Using the database, we estimated the probability of tsunami inundation on land by multiplying the occurrence probability based on the G-R law (Takeda et al., JpGU, 2019). Unlike the tsunami height on the coast, the inundations of the tsunami on land are greatly affected by the coastal structures. In this study, we created a new tsunami database without coastal structures to assess the contributions of coastal structures on the tsunami inundation probability.
Procedures for making the probability map without coastal structures were the same as that of the previous report except for non-considering coastal structures. We used Hirata et al. (2017)’ s 3967 faults models of the Nankai Trough earthquakes, and calculated tsunami propagations and inundations caused by the all fault models using the nonlinear shallow water equations. A nesting algorism was applied to improve the spatial resolution in the study area. Only the topographic data provided by the Cabinet Office was used. The coastal structure data was not involved in the calculations. We defined the relative weights among the earthquake fault models using the G-R law. The weights were used in superimposing all inundation maps to estimate the probabilities of tsunami inundation without the coastal structures. Comparing the probability maps with and without the coastal structures showed the great importance of the coastal structures reducing the tsunami impacts in the wide area. In particular, the probability of inundation was decreased very much in areas near the sea or river. The coastal structures reduced the probability by 60 % at the maximum near the estuary. However, it is surprising to us that, in some areas near the upstream, the probability of inundation was increased by about 30% with considering the coastal structures.
We will evaluate target earthquakes with a magnitude of 8.0 or more, evaluate tsunami arrival time, and analyze another area.
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Keywords: probabilistic hazard assessments, Nankai Trough, G-R law

