Probabilistic Approach For Tsunami Hazard Analyses in Tuzla, Istanbul Test Site Using Monte Carlo Simulations

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The aim of this study is to perform Probabilistic Tsunami Hazard Analysis (PTHA) for Tuzla, Istanbul in The Marmara Sea. Tuzla is one of the coastal district of Istanbul and located on the southernmost part of the city and the region is about 20 km away from the Prince Island Fault Zone which has a high potential to rupture in the next decades. Therefore, scenarios depend on the possible rupture of this fault zone within the next 50 and 100 years. In this study, the probabilistic seismic hazard analysis associates with tsunami numerical modelling. Due to the insufficiency of the historical tsunami catalogues, Monte Carlo (MC) simulation technique is used to generate synthetic earthquake catalogue. This catalogue includes 100 events with magnitudes between Mw 6.5 and 7.1. According to this earthquake catalogue, probability of occurrence, which depends on time-dependent probabilistic model, and associated tsunami wave heights are calculated for each event. Tsunami numerical modelling is performed using NAMI DANCE numerical code.

The results of the tsunami numerical modelling show that, the probability of exceedance of 1m wave height in Tuzla test site was calculated as 65% for the next 50 years and the probability increases up to 85% for the next 100 years. The situation for the inundation depth results demonstrate that the probability of exceedance of the same wave height threshold is 60% and 80% for next 50 and 100 years, respectively.

Tsunami waves with 0.3 m height have a potential to fall a person (Jonkman and Penning-Rowsell 2008; Takagi et al. 2016) and when this value is selected as threshold, probability of occurrence ranges between 10% and 75% for the next 50 and 100 years return periods. The maximum inundation distance is also calculated as 60 m among entire earthquake and tsunami scenarios for the test site.