High Resolution Tsunami Modeling and Assessment of Harbor Resilience; Case Study in Istanbul

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Ports and harbors are the major vulnerable coastal structures under tsunami attack. Resilient harbors against tsunami impacts are essential for proper, efficient and successful rescue operations and reduction of the loss of life and property by tsunami disasters. There are several critical coastal structures as such in the Marmara Sea. Haydarpasa and Yenikapı ports are located in the Marmara Sea coast of Istanbul. These two ports are selected as the sites of numerical experiments to test their resilience under tsunami impact. Cargo, container and ro-ro handlings, and short/long distance passenger transfers are the common services in both ports. Haydarpasa port has two breakwaters with the length of three kilometers in total. Yenikapi port has one kilometer long breakwater.

The accurate resilience analysis needs high resolution tsunami modeling and careful assessment of the site. Therefore, building data with accurate coordinates of their foot prints and elevations are obtained. The high resolution bathymetry and topography database with less than 5m grid size is developed for modeling. The metadata of the several types of structures and infrastructure of the ports and environs are processed. Different resistances for the structures/buildings/infrastructures are controlled by assigning different friction coefficients in a friction matrix. Two different tsunami conditions - high expected and moderate expected - are selected for numerical modeling. The hybrid tsunami simulation and visualization codes NAMI DANCE, STOC-CADMAS System are utilized to solve all necessary tsunami parameters and obtain the spatial and temporal distributions of flow depth, current velocity, inundation distance and maximum water level in the study domain. Finally, the computed critical values of tsunami parameters are evaluated and structural performance of the port components are discussed in regard to a better resilience.