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Investigation of Tsunami Effects on Harbor Structures with High Resolution Tsunami Modeling: Case study in the Biggest Port of Turkey in Istanbul

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Ports and harbors are critical marine transportation hubs which must survive and continue functions and operability after the disasters. Hence the recovery operations may continue without interruption. Tsunami is one of the important marine hazards and major impact of any tsunamis are observed mainly in the harbors. Therefore a complete assessment of tsunami behavior, tsunami amplification, abnormal agitation and related damage in ports and harbors is highly essential. Tsunami modeling with high resolution would be a proper approach to understand the effects of tsunamis on marine structures and harbor facilities. The tsunami mitigation plans can be developed using the results of high resolution modeling. The large scale industrial facilities of Turkey are located along the coasts of Marmara Sea in Turkey. Ambarli Port in Istanbul is known to be the biggest trade gate of Marmara region with seven different terminals and an offshore platform operated by different companies for container and cargo handling. The port is serving not only the megacity Istanbul but also the whole country.
Compiling the earthquake catalogs and historical records, possible earthquake locations in Marmara Sea are used to select the tsunami source scenarios for modeling. The high resolution bathymetric and topographic data for Ambarli Port region is also another necessary data which has been constructed with a resolution of less than 4m grid size. The sensitively digitized coastline and the sea and land structures with their coordinates and heights are also included in bathy/topo data. The tsunami modeling codes NAMIDANCE and STOC-CADMAS are used for the calculations of tsunami hydrodynamic parameters as the distributions of wave amplitude, current velocity, flow depth and inundation distance. The tsunami pressure exerted onto the terminal blocks are determined by tsunami modeling consisting of three-dimensional and non-hydrostatic calculation approaches. The results of each code are evaluated and used for the determination of structural resilience against tsunami waves and having a better understanding of tsunami preparedness and mitigation in ports and harbors.
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