Tsunami Inundation Mapping on the Upper East Coast of the US

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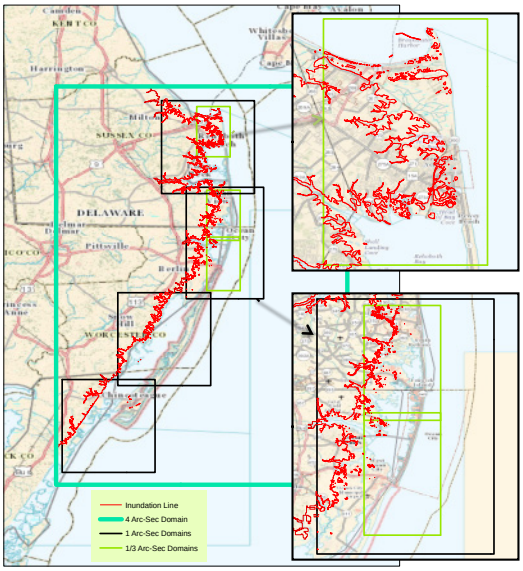
During the previous decade, the occurrence of the 2004 Indian Ocean tsunami and the 2010 Tohuku-oki tsunami reminded the world of the impacts associated with such events on coastal communities around the globe. Since 1995 the National Tsunami Hazard Mitigation Program (NTHMP) has conducted several studies to investigate the likelihood of impacts of tsunamis on US coastlines. Consequently, the United States Upper East Coast (USEC), as one of the most densely populated areas of the country, has become the focal point of several tsunami-related studies. In this work, we will concentrate on modeling tsunami inundation for the area from Ocean City, MD up to Nantucket, MA. In order to develop inundation maps based on Probable Maximum Tsunamis (PMT), seven tsunami sources were used as the initial conditions. Of the seven, two coseismic sources were used; the first being a large earthquake in the Puerto Rico Trench, in the well-known Caribbean Subduction Zone, and the second, an earthquake close to the Azores Gibraltar plate boundary known as the source of the biggest tsunami recorded in the North Atlantic Basin. In addition, four Submarine Mass Failure (SMF) sources located at different locations on the edge of the shelf break were simulated.. Finally, the Cumbre Vieja Volcanic (CVV) collapse, located in the Canary Islands, was studied. However, it must be noted that the process of obtaining initial conditions is not the focal point of the current presentation. The objective here is to discuss the modeling results of nearshore tsunami propagation, as well as onshore inundation mapping using the available initial conditions. Here, we will explain our methodology to simulate the inundation process and obtain the inundation line based on PMT analysis (Figure 1). A fully nonlinear Boussinesq model (FUNWAVE-TVD) is used to capture the characteristics of tsunami propagation, both nearshore and inland. A description of the nesting approach is discussed, which was used in order to refine the modeling resolution close to the shoreline. In addition to the inundation line being the main result of this work, tsunami quantities such as inundation depth, maximum momentum flux and maximum recorded velocities of each of the tsunami sources will be presented for the whole USEC area. Finally, a discussion about the differences between the impacts of different sources studied here will be provided using inundation simulation results.



Tsunami inundation line for the surrounding area of Ocean City, MD. Each box represents the resolution of performed simulation to capture the line in the surrounding area.