Is Continental Shelf Bathymetry the Main Control for Tsunami Inundation Patterns on the US East Coast?

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Tsunami hazard for different locations on the US East Coast (USEC) has been the subject of recent work funded by the National Tsunami Hazard and Mitigation Program (NTHMP). Tsunami inundation maps and other products have been developed for much of the Northeast coastline, as well as for more sparsely covered regions in the Southeast. The objective of this work is to locate the unmapped tsunami hot spots on the USEC for further detailed hazard analysis. A ray tracing analysis is used and is compared to results of tsunami inundation simulations to conclude that the continental shelf bathymetry is the main controlling factor in tsunami inundation patterns along the USEC, independent of the source location.

Detailed model results obtained using the Boussinesq model FUNWAVE-TVD have been used to estimate wave height distribution along the USEC 5-m depth contour. Despite different source magnitudes and locations, plots of wave height show a similar spatial pattern of wave height for all of the tsunamis studied. As a result, we hypothesize that the bathymetry of the continental shelf is the main factor controlling the propagation patterns of tsunamis. A ray tracing analysis was conducted over the continental shelf to test this hypothesis. The wave height distribution obtained from the ray tracing analysis was in good agreement with the results obtained from FUNWAVE-TVD, confirming the role of bathymetric features on tsunami inundation patterns along the USEC.

For this presentation, we first discuss tsunami impact along the USEC. Then, we demonstrate the ray tracing analysis procedure. Finally, after comparing the results of the two analyses, we conclude that locating tsunami hot spots on the USEC is independent of source location and mainly controlled by the bathymetry of the continental shelf.