

The Persistent High Waves of the 1945 Makran Coast Tsunami: Observations and Numerical Modeling

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Neetu et al. [*in preparation*, 2010] present the tide-gauge records of the historical Makran-coast tsunami of 27 November 1945 from Mumbai (in India) and Karachi (in Pakistan). An unresolved problem with this tsunami, as documented in many reports, is that the first wave that arrived soon after the earthquake at locations along the Makran coast and at Karachi was not sufficiently high to come far inland and inflict damage; the destructive waves, however, occurred $\sim 1.5 - 3.5$ hours after the first, implying that high waves persisted for many hours. The observation from Karachi establishes the long duration (more than ~ 7 hours) of high waves with maximum wave height occurring nearly at 2.8 hours after the first tsunami wave arrived. Numerical model simulation of the tsunami using the earthquake source parameters reproduces the observation well, including the high-amplitude waves that followed the first wave at Karachi, corroborating that this tsunami was primarily caused by the earthquake. Analysis of the model results indicates that the persistent high waves were the result of trapping of tsunami-wave energy on the continental shelf and their subsequent propagation as edge waves. The simulation reveals that more than half the energy of the tsunami was confined to a ~ 300 -km stretch of the continental shelf off the Makran coast, owing to longshore variations in shelf width. The simulation also demonstrates that the sea-level oscillations reported to have lasted for many hours at Port Victoria, Seychelles were mainly due to the trapping of tsunami energy over the shallow region surrounding the island. Our conclusions have important implications for the future tsunamigenic earthquakes on the shelves. In particular, our study demonstrates that the energetic edge-wave modes excited by the tsunamis could further be trapped in the along-shore direction due to variations in shelf topography leading to greater-than-expected, but localized damage.

Keywords: 1945 Makran-coast tsunami, tide-gauge data, tsunami modeling, coastally-trapped edge waves