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Numerical simulation of the July 2010 meteotsunami on the coast of Portugal: Implications for meteotsunami hazard in the NE Atlantic

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In the NE Atlantic Ocean, the tsunami hazard is mainly associated to large earthquakes occurring along the Azores-Gibraltar plate boundary, to submarine landslides, or even to the flank collapses in the volcanic Islands. The hazard posed by meteotsunami remains less understood in the region. Yet, the Atlantic coasts of Portugal, Spain and France have experienced at least two meteotsunamis on July 2010 and June 2011. On July 6th and 7th 2010, uncommon sea waves were observed along the coast of Portugal. The Portuguese tide-gauge network recorded the sea-level signals showing tsunami-like waves of heights varying from 0.14 to 0.6 m (crest-to-trough) and of periods in the range of 30 to 60 min. Analysis of both oceanic and atmospheric data revealed the occurrence of a meteotsunami on the night of July 6th that propagated from Lagos, south, up to Viana de Castelo, north. Here, we present the first investigation of the 2010 meteotsunami that struck the coast of Portugal. We use the atmospheric pressure data to force the sea surface and numerically generate the 2010 meteotsunami. We then simulate the 2010 meteotsunami propagation over high resolution bathymetric models using a validated NLSW code. The comparison of the simulated waveforms with the records shows satisfactory agreement of wave heights and periods in most stations. Taking the 2010 event as a reference of meteotsunamis along the Portuguese coast, we provide an insight on the meteotsunami hazard posed by events propagating from south to north of the country. This is done by considering a 2D Gaussian shape pressure disturbance that propagates along shelf under varying conditions of speed and incident angle. This allows identifying a number of “hot spots” on the coast of Portugal where the focus of meteotsunami energy is favorable. Our results suggest that meteotsunamis present a real threat on the highly occupied Portuguese coast and therefore should be considered in tsunami hazard and forecasting strategies of the NE Atlantic countries. This work was supported by the FCT funded project FAST- Development of new forecast skills for meteotsunamis on the Iberian shelf (PTDC/CTA-MET/32004/2017).