A PRAGMATIC APPROACH FOR THE NUMERICAL PREDICTION OF METEOTSUNAMIS IN CIUTADELLA HARBOUR (BALEARIC ISLANDS)

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ABSTRACT

The long and narrow inlet of Ciutadella (Menorca, Spain) is well known for the frequent occurrence of highly amplified seiches (periods of about 10.5 min) during the warm season. These atmospherically driven oscillations (locally referred to as "rissagas") might occasionally reach extreme wave heights, in the range 1.5 – 4 m, disrupting the port activities and inflicting damages on vessels up to catastrophic limits. Any step towards a better prediction of Ciutadella meteotsunamis has the potential to help anticipating these effects hours or days in advance and thus the adoption of proportional measures of protection.

We devise a pragmatic (and computationally inexpensive) numerical approach aimed at predicting the occurrence and magnitude of this phenomenon. The idea is to retain exclusively the responsible physical mechanisms pointed out by Šepić et al. (2015) and the consideration of contexts as simple as possible (e.g. initialization with a single observed or forecasted radiosounding and use of 2D geometries and flat bottom topography). The method involves the application of the nonhydrostatic fully compressible equations for the atmospheric step (generation and propagation of gravity waves) and the adaptation of the shallow water equations to simulate the subsequent oceanic response (Proudman resonance, shoaling effects and harbour resonance). We propose this strategy as an effective and affordable alternative to the application of full 3D high-resolution atmosphere-ocean coupled models.

The prognostic system is successfully tested for the available set of 128 rissaga events and for a complementary set of 600 ordinary situations. Our approach is able to recognize the rissaga prone situations and tends to correctly categorize the meteotsunami events among weak, moderate or strong cases. The method is now in operation, running daily driven by the GFS forecasted soundings for the next 3 days and providing probabilistic predictions (see http://meteo.uib.es/rissaga).