EGU2020-3447
https://doi.org/10.5194/egusphere-egu2020-3447
EGU General Assembly 2020

Design of a neural network aimed at predicting meteotsunamis in Ciutadella harbour (Balearic Islands, Spain)

Maria-del-Mar Vich and Romualdo Romero
Meteorology Grup, Physics Department, Universitat de les Illes Balears, Palma de Mallorca, Spain (mar.vich@uib.es)

This work explores the applicability of neural networks (NN) for forecasting atmospherically-driven tsunamis affecting Ciutadella harbor in Menorca (Balearic Islands). These meteotsunamis can lead to wave heights around 1 m, and several episodes in the modern history have reached 2-4 m with catastrophic consequences. A timely and skilled prediction of these phenomena could significantly help to mitigate the damages inflicted to the port facilities and moored vessels. We examine the relevant physical mechanisms that promote meteotsunamis in Ciutadella harbour and choose the input variables of the NN accordingly. Two different NNs are devised and tested: a dry and wet scheme. The difference between schemes resides on the input layer; while the first scheme is exclusively focused on the triggering role of atmospheric gravity waves (governed by temperature and wind profiles across the tropospheric column), the second scheme also incorporates humidity as input information with the purpose of accounting for the occasional influence of moist convection. We train both NNs using resilient backpropagation with weight backtracking method. Their performance is tested by means of classical deterministic verification indexes. We also compare both NN results against the performance of a substantially different prognostic method that relies on a sequence of atmospheric and oceanic numerical simulations. Both NN schemes show a skill comparable to that of computationally expensive approaches based on direct numerical simulation of the physical mechanisms. The expected greater versatility of the wet scheme over the dry scheme cannot be clearly proved owing to the limited size of the training database. The results emphasize the potential of a NN approach and open a clear path to an operational implementation, including probabilistic forecasting strategies.