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Modelling of extreme sea-level hazards: state-of-the-art and future challenges

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Meteotsunami events – tsunami-like ocean waves driven by atmospheric disturbances – are, by nature, rare, specific to certain geographical regions and highly variable in time. Consequently, the coastal hazards due to these types of events are known to be difficult to forecast with state-of-the art numerical models presently applied around the world.

In order to help the local communities to better prepare for these destructive events (e.g., set temporary protection against flooding and waves, avoid swimming, etc.) and minimize the losses, the Croatian Meteotsunami Early Warning System (CMeEWS) has been recently implemented in the Adriatic Sea in the testing mode. The CMeEWS is mostly based on the Adriatic Sea and Coast (AdriSC) modelling suite and uses an innovative deterministic-stochastic approach for extreme sea-level event predictions. It provides meteotsunami hazard forecasts depending on (1) daily deterministic forecasts by coupled kilometer-scale atmosphere-ocean models, (2) atmospheric observations and (3) stochastic forecasts of extreme sea-level distributions at endangered locations derived with a surrogate model approach. Some of these steps require substantial computational resources and needs an optimized data flow which, at end, defines the operability of the service.

Here, the advantages but also the drawbacks of such an approach will be presented through several applications of the AdriSC modelling suite during meteotsunami events in the Adriatic Sea. The future challenges concerning meteotsunami extreme sea-level modelling will be discussed and some potential avenues to further develop the model skills will be considered.