EGU21-15210
https://doi.org/10.5194/egusphere-egu21-15210
EGU General Assembly 2021


# A (semi-)probabilistic storm surge EWS implementation for the Emilia-Romagna region (Italy)

**Luis Germano Biolchi**[1], Silvia Unguendoli[1], Lidia Bressan[1], Beatrice Maria Sole Giambastiani[2], and Andrea Valentini[1]

[1]Hydro-Meteo-Climate Service of the Agency for Prevention, Environment and Energy of Emilia-Romagna (Arpae-SIMC), Bologna, Italy (lgbiolchi@arpae.it)

[2]University of Bologna (UNIBO) – Department of Biological, Geological, and Environmental Sciences (BiGeA)

The low lying and sandy coastal areas of the Emilia-Romagna region are heavily threatened by sea storms, often leading to flooding and coastal erosion events with severe impacts on citizens' quality of life, damages to the cultural heritage and effects on economic activities (e.g. aquaculture, fisheries, tourism, beach facilities). Climate change projections reinforce the need of strategies and tools to prevent damages and promptly react to extreme events. In this context and in the framework of non-structural mitigation measures, the Hydro-Meteo-Climate Service of Arpae Emilia-Romagna (Arpae-SIMC) developed and operationally manages a Coastal Early Warning System (EWS) for the Emilia-Romagna Region (Northeast Italy).

The EWS was developed during the EU Project FP7-MICORE and it is a state-of-the-art coastal forecasting system that follows a chain of operational numerical models: the meteorological model COSMO, the wave model SWAN-MEDITARE, the ocean model AdriaROMS, and the morphodynamic model XBeach. The latter is currently implemented on a series of cross-shore beach profiles covering eight locations distributed along the Emilia-Romagna shore. Deterministic daily forecasts (72-hours) are generated and Storm Impact Indicators (SIIs) used to assess sea-storm induced coastal risk along the region's littoral (geo.regione.emilia-romagna.it/schede/ews).

It is widely known that among the limitations of deterministic approaches, the lack of uncertainty estimation is often problematic as decision-makers might be misled if the only forecast available underestimates (or overestimates) incoming conditions. Hence, following the success of probabilistic forecasting in meteorological applications, storm surge EWSs following ensemble frameworks have been recently developed, allowing for more information available to sustain the decision-making process. Towards the new paradigm change, one of the foreseen outputs of the European Interreg Italy-Croatia CBC Programme project Strategic development of flood management (STREAM) involves the development of a "probabilistic EWS for coastal risk implemented and tested on at least one location along the Emilia-Romagna Coast".

The initial implementation of the (semi-)probabilistic framework benefits from the EU ADRION I-STORMS (Integrated Sea Storm Management Strategies) project outcomes, in which wave and sea level multi-model ensembles were developed for the Adriatic Sea giving origin to the Transnational

Multi-Model Ensemble (TMES). The TMES was made available as one of the six Integrated Web System (IWS) components, combining five wave and six sea level forecasting systems as means to provide 48-hour forecasts in terms of sea level and wave characteristics (Hs, Tm and Dm). Ensemble mean and standard deviation (SD) are calculated based on different forecasting systems' results. In the initial approach, four TMES combinations have been tested as XBeach forcing: the TMES mean; the mean minus one SD; the mean plus one SD; the mean plus two SDs. Two months were analyzed together with the already implemented deterministic system for two profiles along the region's coast.

The methodology followed for the test period will be shown as well as the results. Furthermore, the methodology under development will be also shown as means to enhance the discussion involving storm surge ensemble applications.