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Adriac, the Arpae-SIMC operational coupled wave-ocean forecasting model to support civil protection coastal warnings in Emilia-Romagna, Italy

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The coast of Emilia-Romagna (Italy) is affected by storm-induced erosion and flooding of the hinterland during extreme events because of its sandy and gently sloped beaches and the highly urbanized coastal areas. Arpae-SIMC is the weather service of the Emilia-Romagna region and provides weather warnings for the Region and for the Italian Civil Protection Department. For these activities, Arpae-SIMC runs a chain of operational meteorological, oceanographic, wave and coastal numerical models, providing tools, products and indicators for the evaluation of the impacts of storms and the issue of bulletins and warnings.
Coastal risk alerts of civil protection are based on the combined information of sea level and significant wave height, which are provided by the ocean and wave forecasts.
Up till now, the ocean model AdriaROMS (an Adriatic implementation of ROMS, Regional Ocean Modeling System) and the wave model SWAN-MEDITARE (SWAN, Simulating Waves Nearshore, implemented on three nested grids, from the Mediterranean and the Italian domain to a regional domain) were not coupled but run separately, both forced by the atmospheric model COSMO.
To improve sea level and wave forecasting, we developed a new coupled model for the Adriatic Sea, Adriac, which is an implementation of the COAWST model (Coupled-Ocean-Atmosphere-Wave-Sediment Transport Modeling System) that couples SWAN with ROMS. The model is characterized by 1km horizontal resolution and 30 sigma layers. It was initialized on the 1st January 2015 and was run in hindcast mode up to now using the analyses both for the atmospheric forcing and boundary field conditions. Adriac is driven at the boundary by the sea level, currents, temperature and salinity provided by the Copernicus CMEMS Mediterranean Forecasting System (MFS). This makes Adriac aligned with the MFS vertical reference for sea level, i.e. the long-term average of sea level tend towards the mean dynamic topography. However, for regional alerts and warnings, the reference level that must be used is the local mean sea level.
The results of the validation and the performance of the model are presented, together with the adopted procedure to downscale from a Mediterranean perspective to a local one.