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On the use of a very-high resolution atmosphere-ocean-wave coupled model to describe a flash-flood event over the North-East Italy

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An extremely intense precipitation event stroke the area between the Alps and the Venice Lagoon in the early hours of September 26, 2007.
Precipitations exceeding 320 mm were recorded during the short period comprised between 06 UTC and 12 UTC, in an area close to Venice and its inland area (Mestre).
This was the result of a mesoscale convective system formed in a convergence area between a north-easterly wind coming from the Alps and a south-easterly one over the Adriatic sea.
In this study we describe the flash-flood event using the modeling suite COAWST (Couple Ocean Atmospheric Wave Sediment Transport system), exploring the importance of various oceanic components (Sea Surface Temperature, mixed layers depth, waves, etc.).
COAWST is a complex framework that couples WRF (Weather Research ad Forecasting) atmospheric model, ROMS (Regional Oceanographic Model) ocean model and SWAN (Simulating Wave in Nearshore) wave model.
The configuration of the WRF grid is composed by 3 domains respectively at 9 km, 3 km, and 1km of horizontal resolution. ROMS and SWAN models were run at a 1 km resolution with computational grid that covers all the Adriatic Sea.
In the first phase of the study we used WRF in "standalone mode", using the SST obtained from the spectrum-radiometer RTG_SST at 8.3 km resolution.
As a second step, the WRF model received the SST derived from the oceanographic model "MyOcean" at 1 km of horizontal resolution, and the best physical configuration was explored by changing schemes of cumulus, microphysics, Planetary Boundary Layer, radiation and soil type and employing the basic Ocena Mixed Layer available in WRF.
In the last stage of the work, the best physical configuration identified was then used within the COAWST coupled system, namely WRF-ROMS and WRF-ROMS-SWAN.
Results suggest that the use of high resolution SST is necessary in order to realistically simulate the wind direction above the sea, and therefore the position and the intensity of the convergence line that generates the phenomenon. The over/under estimation of the SST in the basin area changed the rotation of the winds and consequently the position of the event. Also, the mixed layer depth was shown to play a key role in the localization of the phenomenon and its intensity, a fact that suggested the use of the coupled model.
Coupled model results highlighted that, especially in coastal areas where satellite data are often of poor quality, extreme events may be simulated more accurately both in time and position.
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