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A sensitivity study using the WRF model of a flash flood event occurred over southern Italy

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The present study aims to simulate the dynamics of the flooding event occurred in the Sannio Region (Southern Italy) on 14-15 October 2015, using the WRF model. The examined phenomenon, although very localized, was forced out by synoptic patterns: the studied area, due to a low-pressure system centered between France and Germany, was located along the boundary of two adjacent air masses, one cold of Atlantic origin and the other much warmer with sub-tropical continental characteristics. The interaction between the two air masses, together with a low-level wind convergence line and an upper-level divergence, caused intense and persistent convective updrafts. The latter produced, in about 6 hours, rainfall amounts ranging between 150 and 250 mm.
The sensitivity of WRF simulations with respect to different microphysics and Planetary Boundary Layer (PBL) schemes, as well as to 3DVAR data assimilation method, has been investigated using the dataset ECMWF 0.1°. The study gave a particular emphasis on the processes of air-sea interaction, using two different datasets of Sea Surface Temperature (SST) and an oceanographic simplified 1D model present in WRF. The performance of the simulations has been evaluated, with respect to the quantitative precipitation forecasts (QPF), using the following statistical indicators: accuracy (ACC), equitable threat score (ETS) and false alarm rate (FAR).
The results highlight the importance of the microphysics scheme used, but also the essential role played by SST, which regulates the processes of heat and water vapor exchange. Results suggest how coupled numerical models may help in disentangling different dynamical aspects of flash flood events.