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Real time probabilistic precipitation forecasts in the Milano urban area: comparison between a physics and pragmatic approach

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Precipitation forecasts from mesoscale numerical weather prediction (NWP) models often contain features that are not deterministically predictable. In particular, accurate forecasts of deep moist convection and extreme rainfall are arduous to be predicted in terms of amount, time and target over small hydrological basins due to uncertainties arising from the numerical weather prediction (NWP), physical parameterizations and high sensitivity to misrepresentation of the atmospheric state, therefore they require a probabilistic forecast approach.
Here, we examine some hydro-meteorological episodes that affected the Milano urban watersheds using a flood forecasting system which comprises the Flash–flood Event–based Spatially distributed rainfall–runoff Transformation, including Water Balance (FEST-WB) and the Weather Research and Forecasting (WRF) models.
The first approach is based on a hydrological ensemble prediction system (HEPS) designed to explicitly cope with uncertainties in the initial and lateral boundary conditions (IC/LBCs) and physical parameterizations of the NWP model. The second involves a pragmatic post-processing procedure by randomly shifting in space the precipitation field provided by the deterministic WRF model run in order to get a cluster of different simulations.
Although the physics-based approach needs a high computational cost, it outperforms the pragmatic set of configurations, which, however, turns out to be an acceptable low-budget alternative for real time flood forecasts over small urban basins when a single deterministic run is available.