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The use of meteorological analogues to account for LAM QPF uncertainty

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Abstract. Flood predictions based on quantitative precipitation forecasts (QPFs) provided by deterministic models do not account for the uncertainty in the outcomes. A probabilistic approach to QPF, one which accounts for the variability of phenomena and the uncertainty associated with a hydrological forecast, seems to be indispensable to obtain different future flow scenarios for improved flood management. A new approach based on a search for analogues, that is past situations similar to the current one under investigation in terms of different meteorological fields over Western Europe and East Atlantic, has been developed to determine an ensemble of hourly quantitative precipitation forecasts for the Reno river basin, a medium-sized catchment in northern Italy. A statistical analysis, performed over a hydro-meteorological archive of ECMWF analyses at 12:00 UTC relative to the autumn seasons ranging from 1990 to 2000 and the corresponding precipitation measurements recorded by the raingauges spread over the catchment of interest, has underlined that the combination of geopotential at 500 hPa and vertical velocity at 700 hPa provides a better estimation of precipitation. The analogue-based ensemble prediction has to be considered not alternative but complementary to the deterministic QPF provided by a numerical model, even when employed jointly to improve real-time flood forecasting. In the present study, the analogue-based QPFs and the precipitation forecast provided by the Limited Area Model LAMBO have been used as different input to the distributed rainfall-runoff model TOPKAPI, thus generating, respectively, an ensemble of discharge forecasts, which provides a confidence interval for the predicted streamflow, and a deterministic discharge forecast taken as an error-affected "measurement" of the future flow, which does not convey any quantification of the forecast uncertainty. To make more informative the hydrological prediction, the ensemble spread could be regarded as a measure of the uncertainty of the deterministic forecast.

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