Uncertainty sources in hydrometeorological forecasting chains: a comparison between synoptic-scale and mesoscale variability

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Hydrometeorological forecasting chains aim at the prediction of flood events. In small catchements, the chains include a stochastic component and are based on a sequence that links numerical weather prediction models, meteorological ensemble prediction systems (EPS or LEPS), stochastic rainfall downscaling procedures and rainfall-runoff models. This work attempts at quantitatively assessing the role of two main components responsible for prediction uncertainty, namely, the spread of the meteorological ensemble (which measures synoptic uncertainty) and the randomness introduced by the downscaling models (which measures the uncertainty associated with mesoscale and sub-mesoscale processes). To this end, we compare the internal variability of the Local Ensemble Prediction System to that generated by downscaling procedures, applying the recently-developed RainFARM stochastic downscaling procedure to LEPS forecasts of selected intense precipitation events in Northern Italy. We determine the variability of the precipitation volume at small scales and the total precipitation variance over individual events. The variability in these statistics due to the spread of the LEPS ensemble is compared with the distribution obtained from a large number of stochastically downscaled fields.