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# Calibration of limited-area ensemble precipitation forecasts for hydrological predictions

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The main objective of this study is to investigate the impact of calibration for limited-area ensemble precipitation forecasts, to be used for driving discharge predictions up to 5 days in advance. A reforecast dataset, which spans 30 years, based on the Consortium for Small Scale Modeling Limited-Area Ensemble Prediction System (COSMO-LEPS) was used for testing the calibration strategy. Three calibration techniques were applied: quantile-to-quantile mapping, linear regression, and analogs. The performance of these methodologies was evaluated in terms of statistical scores for the precipitation forecasts operationally provided by COSMO-LEPS in the years 2003-2007 over Germany, Switzerland, and the Emilia-Romagna region (northern Italy). The analog-based method seemed to be preferred because of its capability of correct position errors and spread deficiencies. A suitable spatial domain for the analog search can help to handle model spatial errors as systematic errors. However, the performance of the analog-based method may degrade in cases where a limited training dataset is available. A sensitivity test on the length of the training dataset over which to perform the analog search has been performed. The quantile-to-quantile mapping and linear regression methods were less effective, mainly because the forecast-analysis relation was not so strong for the available training dataset.
A comparison between the calibration based on the deterministic reforecast and the calibration based on the full operational ensemble used as training dataset has been considered, with the aim to evaluate whether reforecasts are really worthy for calibration, given that their computational cost is remarkable.
The verification of the calibration process was then performed by coupling ensemble precipitation forecasts with a distributed rainfall-runoff model. This test was carried out for a medium-sized catchment located in Emilia-Romagna, showing a beneficial impact of the analog-based method on the reduction of missed events for discharge predictions.