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Spatial Ensemble Postprocessing of Precipitation Forecasts Using High Resolution Analyses

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Ensemble prediction systems are designed to account for errors or uncertainties in the initial and boundary conditions, imperfect parameterizations, etc. However, due to sampling errors and underestimation of the model errors, these ensemble forecasts tend to be underdispersive, and to lack both reliability and sharpness. To overcome such limitations, statistical postprocessing methods are commonly applied to these forecasts.

In this study, a full-distributional spatial post-processing method is applied to short-range precipitation forecasts over Austria using Standardized Anomaly Model Output Statistics (SAMOS). Following Stauffer et al. (2016), observation and forecast fields are transformed into standardized anomalies by subtracting a site-specific climatological mean and dividing by the climatological standard deviation. Due to the need of fitting only a single regression model for the whole domain, the SAMOS framework provides a computationally inexpensive method to create operationally calibrated probabilistic forecasts for any arbitrary location or for all grid points in the domain simultaneously.

Taking advantage of the INCA system (Integrated Nowcasting through Comprehensive Analysis), high resolution analyses are used for the computation of the observed climatology and for model training. The INCA system operationally combines station measurements and remote sensing data into real-time objective analysis fields at 1 km-horizontal resolution and 1 h-temporal resolution. The precipitation forecast used in this study is obtained from a limited area model ensemble prediction system also operated by ZAMG. The so called ALADIN-LAEF provides, by applying a multi-physics approach, a 17-member forecast at a horizontal resolution of 10.9 km and a temporal resolution of 1 hour.

The performed SAMOS approach statistically combines the in-house developed high resolution analysis and ensemble prediction system. The station-based validation of 6 hour precipitation sums shows a mean improvement of more than 40% in CRPS when compared to bilinearly interpolated uncalibrated ensemble forecasts. The validation on randomly selected grid points, representing the true height distribution over Austria, still indicates a mean improvement of 35%. The applied statistical model is currently set up for 6-hourly and daily accumulation periods, but will be extended to a temporal resolution of 1-3 hours within a new probabilistic nowcasting system operated by ZAMG.