EGU21-12403
https://doi.org/10.5194/egusphere-egu21-12403
EGU General Assembly 2021

A comparison of two postprocessing approaches as part of the HEavy Precipitation forecast Postprocessing over India (HEPPI) project.

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Accurate predictions of heavy precipitation in India are vital for impact-orientated forecasting, and an essential requirement for mitigating the impact of damaging flood events. Operational forecasts from non-convection-permitting models can have large biases in the intensities and spatial structure of heavy precipitation, and while convection-permitting models can reduce biases, their operational use over large areas is not yet feasible. Statistical postprocessing can reduce these biases for relatively little computational cost, but few studies have focused on postprocessing monsoonal rainfall and the associated severe flooding events. As part of the Weather and Climate Science for Service Partnership India (WCSSP India), the HEavy Precipitation Forecast Postprocessing over India (HEPPI) project assesses the value of multiple postprocessing methods in this context.

Here, we present an evaluation of two postprocessing approaches to determine their suitability for heavy rainfall in India: Univariate Quantile Mapping (UQM) and Ensemble Model Output Statistics (EMOS). For each method, we apply the statistical postprocessing to daily precipitation in the NCMWF 12km forecast for the 2018 and 2019 monsoon seasons individually at each grid cell within the forecast. UQM leads by construction to rainfall distributions close to the observed ones, while EMOS optimises the spread of the postprocessed ensemble without guaranteeing realistic rainfall distributions. The choice of method is therefore to some degree dependent on end user requirements.

We use three rainfall observation data sets and different parametric distributions for UQM to determine the best setup. Mixed distributions, where gamma distributions are fitted separately to the bottom 90% and the top 10% of rainfall events are found to be the best choice because they are a better fit for the high rainfall values.

In several case studies, an overestimation of west coast rainfall in the forecasts is corrected by UQM. Although errors linked to forecasting rainfall in the wrong location or where no rainfall has been observed at all cannot be corrected by local statistical postprocessing, the overall forecast performance is improved by the UQM approach adopted here.

As in UQM, we use multiple observational datasets to determine the best EMOS setup. We select

the gamma distribution, due to its suitability for both low and heavy rainfall events. Unlike in UQM, mixed distributions are unnecessary as the distribution is fitted across ensemble members at each timestep. EMOS and UQM are verified against observations and compared to each other using a variety of metrics including case studies, the Receiver Operating Characteristic and the Continuous Rank Probability Score.