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Postprocessing of precipitation forecasts over India with Quantile Mapping and Ensemble Model Output Statistics

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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 of heavy precipitation, and while convection-permitting models can perform better, 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 forecasts of monsoonal rainfall.

As part of the UK Weather and Climate Science for Service Partnership India (WCSSP India), the HEavy Precipitation Forecast Postprocessing over India (HEPPI) project has evaluated and compared two popular postprocessing methods: Univariate Quantile Mapping (UQM) and Ensemble Model Output Statistics (EMOS). The project focuses on the suitability of the methods for postprocessing heavy rainfall in India. Both methods are applied to daily precipitation in the National Centre for Medium Range Weather Forecasting (NCMWF) 12km forecast for the 2018 and 2019 monsoon seasons. The evaluation is based on day 1 forecasts and fitting the methods individually for each location.

UQM leads by construction to precipitation distributions close to the observed ones, while EMOS optimises the spread of the postprocessed ensemble without guaranteeing realistic rainfall distributions, and it is not a priori clear which method is better suited for practical applications. The methods are therefore compared with respect to several aspects: local distributions, representation of temporal variability using the Continuous Ranked Probability Score, ensemble spread using Rank Histograms, and exceedance of heavy precipitation thresholds using Brier Scores, Reliability Diagrams, and Receiver Operating Characteristics curves.

EMOS performs not only best, as expected, with respect to correcting under- or overdispersive ensembles, but also with respect to scores for temporal variability, both for the whole range of rainfall values and specifically for heavy rainfall. UQM performs best, as expected, with respect to the local precipitation distributions. The ROC results are inconclusive and location dependent, although both postprocessing methods consistently outperform the raw forecast. These findings are independent of the choice of gridded precipitation data sets used for model fitting and

validation.

We recommend EMOS for operational application, as from a user perspective a good performance in forecasting values at a given time, in particular heavy precipitation events, can be expected to be more important than achieving a close match between the forecasted and observed local precipitation distributions.