

EGU2020-19476

<https://doi.org/10.5194/egusphere-egu2020-19476>

EGU General Assembly 2020

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Postprocessing heavy precipitation forecasts for India with Quantile Mapping

Martin Widmann¹, **Michael Angus**¹, Andrew Orr², and Gregor Leckebusch¹

¹University of Birmingham, School of Geography, Earth and Environmental Sciences, Birmingham, United Kingdom
(m.widmann@bham.ac.uk)

²British Antarctic Survey, Cambridge, United Kingdom

It is estimated that around 10% of India's population (or 130 million people) are acutely exposed to flooding resulting from intense rainfall, particularly during the main monsoon season (June to September). Such severe weather and accompanying flooding can result in considerable disruption to human communities and individuals by causing loss of life, damage to property, loss of livestock, destruction of crops and agricultural land, and deterioration of health conditions owing to waterborne diseases. To provide early warning of these heavy rainfall events, reliable impact-focused forecasting from operational weather forecasting centres such as NCMRWF (National Centre for Medium Range Weather Forecasting) and IMD (Indian Meteorological Department) is crucial.

Yet, despite the advances in numerical weather predictions and the state-of-the-art models used in India, accurately forecasting extreme weather at these scales is still difficult, and the intensity and spatial structure of predicted precipitation can both exhibit large errors. These errors are mainly caused by the limited resolution of weather forecasting models, and the resulting lack of adequate representation of small-scale processes. Some of them can be substantially reduced by statistical postprocessing of the forecasts taking into account past observations. However, currently no postprocessing methods for precipitation are applied to the weather forecasts over India.

Here, we present first results of postprocessing precipitation ensemble forecasts for India with local Quantile Mapping. Given our focus on heavy precipitation and the associated problem of a low number of cases and high sampling variability for the simulated and observed empirical Probability Density Functions (PDFs), we employ both standard, non-parametric PDFs but also parametric PDFs based on the Gamma and Generalised Extreme Value distributions.

This work is part of the 'Weather and Climate Science for Service Partnership India' (WCSSP-India) project 'Heavy Precipitation forecast Postprocessing over India (HEPPI)'. Quantile Mapping is a member-by-member postprocessing method that essentially retains the spatial structure of the raw simulation. Within HEPPI we will also test ensemble-based methods and methods that adjust the spatial structure. This work provides the basis for further integration of meteorological and hydrological predictions.

