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Wavelet-based post-processing of NWP precipitation forecasts

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Reliable flood forecasts are dependent on accurate quantitative precipitation forecasts. Despite improvements in the resolution and schematisation of Numerical Weather Prediction (NWP) models, there are still substantial biases in their precipitation forecasts. Biases are present at a range of time scales and correctly representing the multi-temporal scale properties of precipitation including its persistence and variability is vital. In this presentation a new method for post-processing NWP model precipitation forecasts is developed. The new method is based on continuous wavelet transforms (CWT) which correct the statistical characteristics of the precipitation forecasts across a range of time scales. The precipitation amounts are corrected using a simple quantile mapping of the amplitude of each time scale of the wavelet decomposition. To account for uncertainty in precipitation timing, we also adjust the phase of the CWT randomly to create an ensemble of post-processed forecasts. Spatial correlations are preserved by maintaining the same phase adjustments at each different precipitation forecast location.

The new method is demonstrated using hourly forecast data from the ACCESS model over the period March 2018 to September 2021 for a network of 158 gauges around Sydney, in eastern Australia. The new method improves the correlation of the forecasts and reduces the root mean square error. The spatial correlation structure of the post-processed forecasts is also improved. Correctly representing spatial patterns of precipitation is vital to ensure that catchment averaged precipitation and the resulting flood forecasts are correct.