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Canonical event based Bayesian model averaging for post-processing of multi-model ensemble precipitation forecasts

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Precipitation forecasts from numerical weather models usually contain biases in terms of mean and spread, and need to be post-processed before applying them as input to hydrological models. Bayesian Model Averaging (BMA) method is a widely used method for post-processing forecasts from multiple models. Traditionally, BMA is applied to time series of forecasts for a specific lead time directly. In this work, we propose to apply BMA based on "canonical events", which are precipitation events with specific lead times and durations to fully extract information from raw forecasts. For example, canonical events can be designed as the daily precipitation for day 1 to day 5, and the aggregation or average of total precipitation from day 6 to day 10, because forecasts beyond 5 day still have some skill but not as reliable as the first five days. Moreover, BMA parameters are traditionally calibrated using a moving window containing the forecast-observation pairs before a given forecast date, which cannot ensure similar meteorological condition when long training period is applied. In this work, the training dataset is chosen from the historical hindcast archive of forecast-observation pairs in a pre-specified time window surrounding a given forecast date. After all canonical events of different lead times and durations are calibrated for BMA models, ensemble members are generated from the calibrated probability forecasts using the Schaake shuffle to preserve the temporal dependency of forecasts for different lead times. This canonical event based BMA makes use of forecasts at different lead times more adequately and can generate continuous calibrated forecast time series for further application in hydrological modeling.