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Development of a post-processing methodology for reliable, skillful probabilistic quantitative precipitation forecasts with multi-model ensembles and short training data sets.

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While many previous studies have shown the benefits and improved forecast reliability from combining predictions from multi-model ensemble systems, our experience is that MMEs of global ensemble precipitation forecasts are still highly unreliable when verified against point observations of precipitation or against high-resolution precipitation analyses. This unreliability is caused by a lack of model resolution as well as systematic errors in the mean precipitation amount. These errors may vary from one ensemble prediction system to the next, and perhaps member by member for some ensemble systems. They can vary from one location to the next and the error is commonly different for light vs. heavy precipitation. MMEs also typically under-forecast the precipitation spread. Typically, producing skillful and reliable post-processed forecast guidance of probabilistic precipitation is challenging with short training data sets given the intermittency of precipitation and the relative rarity of high precipitation. Pooling of training data can increase the sample size needed for effective post-processing, but at the expense of providing geographically relevant adjustments for systematic error.

A novel approach for generating probabilistic precipitation forecasts is demonstrated here using global MMEs. The key component is the selective supplementation of training data at every location where a forecast is desired using the training data at other “supplemental locations”. These supplemental locations are chosen on the basis of a similarity of terrain characteristics and precipitation climatology, under the presumption that the forecast errors from coarse-resolution prediction systems are often related to mis-representation of terrain-related detail. With training sample size thus enlarged, post-processing is based on quantile mapping for removal of amount-dependent bias and best-member dressing for addressing spread issues. Algorithmic details and the results of the dramatically improved MME probabilistic forecasts over the US will be presented.