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Statistical ensemble postprocessing for precipitation forecasting during the West African Monsoon

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Precipitation forecasts for one up to several days are of high socioeconomic importance for agriculturally dominated societies in West Africa. In this contribution, we evaluate the performance of operational European Centre for Medium-Range Weather Forecasts (ECWMF) raw ensemble and statistically postprocessed against climatological precipitation forecasts for accumulation periods of 1 to 5 days for the monsoon periods (May to mid-October) from 2007 to 2014. We use Bayesian Model Averaging (BMA) and Ensemble Model Output Statistics (EMOS) as state-of-the-art postprocessing methods and verify against station and gridded Tropical Rainfall Measuring Mission (TRMM) observations. Based on a subset of past forecast—observation-pairs, statistical postprocessing corrects ensemble forecasts for biases and dispersion errors. For the midlatitudes, statistical postprocessing has demonstrated its added value for a wide range of meteorological quantities and this contribution is the first to apply it to precipitation forecasts over West Africa, where the high degree of convective organization at the mesoscale makes precipitation forecasts particularly challenging.

The raw ECMWF ensemble predictions of accumulated precipitation are poor compared to climatological forecasts and exhibit strong dispersion errors and biases. For the Guinea Coast, we find a substantial wet bias of the ECMWF ensemble and more than every second ensemble forecast fails to capture the verifying observation within its forecast range. Postprocessed forecasts clearly outperform ECMWF raw ensemble forecasts by correcting for biases and dispersion errors, but disappointingly reveal only slight, if any, improvements compared to climatological forecasts.

These results hold across verification regions and years, for 1 to 5-day accumulated precipitation forecasts, and for station and gridded observations. We investigate different spatial accumulation sizes from 0.25 x 0.25° to 5 x 2° longitude—latitude-boxes for gridded observations and find consistency in the results across the spatial aggregation size. This implies that the precipitation forecasts from the ECMWF, arguably one of the world's best numerical weather prediction centers, have major deficiencies over West Africa that can not only be attributed to dislocation errors of individual convective systems or dispersion errors and biases in the raw ensemble forecast. However, for the period 2007 to 2014 we find mild improvements in the quality of raw ensemble forecasts, which can be attributed to a better dispersion of the raw ensemble forecasts.