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The Predictability of Dry-Season Precipitation in Tropical West Africa

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Precipitation during the boreal winter dry season in tropical West Africa is rare but occasionally connected to high-impacts for the local population. Previous work has shown that these events are usually connected to a trough over northwestern Africa, an extensive cloud plume on its eastern side, unusual precipitation at the northern and western fringes of the Sahara, and reduced surface pressure over the southern Sahara and Sahel, which allows an inflow of moist southerlies from the Gulf of Guinea to feed the unusual dry-season rainfalls. These results also suggest that the extratropical influence enhances the predictability of these events on the synoptic timescale.

Here we further investigate this question for the 11 dry seasons (November–March) 1998/99–2008/09 using rainfall estimates from TRMM (Tropical Rainfall Measuring Mission) and GPCP (Global Precipitation Climatology Project), and operational ensemble predictions from the European Centre for Medium-Range Forecasts (ECMWF). All fields are averaged over the study area 7.5–15°N, 10°W–10°E that spans most of southern West Africa. For each 0000 UTC analysis time, the daily precipitation estimates are accumulated to pentads and compared with 120-hour predictions starting at the same time. Compared to TRMM, the ensemble mean shows a weak positive bias, whereas there is a substantial negative bias with regard to GPCP. Temporal correlations reach a high value of 0.8 for both datasets, showing similar synoptic variability despite the differences in total amount. Standard probabilistic evaluation methods such as relative operating characteristic (ROC) diagrams indicate remarkably good reliability, resolution and skill, particularly for lower precipitation thresholds. Not surprisingly, forecasts cluster at low probabilities for higher thresholds, but the reliability and ROC score are still reasonably high. The results show that global ensemble prediction systems are capable to predict dry-season rainfall events in southern West Africa well, at least on regional spatial and synoptic time scales. These results should encourage West African weather services to capitalize more on the valuable information provided by ensemble prediction systems during the dry season.