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Forecasting droughts in West Africa: Operational practice and refined seasonal precipitation forecasts

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Precipitation forecasts for the upcoming rainy seasons are one of the most important sources of information for an early warning of droughts and water scarcity in West Africa. The meteorological services in West Africa perform seasonal precipitation forecasts within the framework of PRESAO (the West African climate outlook forum) since the end of the 1990s. Various sources of information and statistical techniques are used by the individual services to provide a harmonized seasonal precipitation forecasts for decision makers in West Africa. In this study, we present a detailed overview of the operational practice in West Africa including a first statistical assessment of the performance of the precipitation forecasts for drought situations for the past 18 years (1998 to 2015). In addition, a long-term hindcasts (1982 to 2009) and a semi-operational experiment for the rainy season 2013 using statistical and/or dynamical downscaling are performed to refine the precipitation forecasts from the Climate Forecast System Version 2 (CFSv2), a global ensemble prediction system. This information is post-processed to provide user-oriented precipitation indices such as the onset of the rainy season for supporting water and land use management for rain-fed agriculture. The evaluation of the individual techniques is performed focusing on water-scarce regions of the Volta basin in Burkina Faso and Ghana. The forecasts of the individual techniques are compared to state-of-the-art global observed precipitation products and a novel precipitation database based on long-term daily rain-gage measurements provided by the national meteorological services. The statistical assessment of the PRESAO forecasts indicates skillful seasonal precipitation forecasts for many locations in the Volta basin, particularly for years with water deficits. The operational experiment for the rainy season 2013 illustrates the high potential of a physically-based downscaling for this region but still shows deficits regarding the simulation of monsoonal mechanism such as the northward progression of the rain belt. The outcomes of the hindcasts experiment highlight that a statistical algorithm using an ensemble-based quantile-quantile correction can clearly reduce the precipitation overestimation of CFSv2. These results can provide valuable early warnings of precipitation anomalies with a lead time of up to six months, particularly for the Sudan-Sahel zone of the study region.