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Skillful 0-3 month lead-time summer SPI-1 forecasts for West Africa using a new statistical post-processing scheme

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The standardized precipitation index (SPI) is one of the most convenient ways of representing precipitation in easy to operate dry and wet gradations. Specifically, the SPI transforms precipitation values into a normal distribution, making further calculations more efficient. In this work, we present an application of the SPI in terms of statistical forecasting of boreal summer monthly precipitation sums for West Africa. For this purpose, we have first studied the spatial patterns of cross-correlations between different climatological fields and our target variable (SPI-1) to identify informative co-variates potentially affecting monthly-scale precipitation variability. Subsequently, we have employed two different regression models based on statistical post-processing of regional climate model output. In the first model, we have considered all combinations of pairs of these previously identified predictors in a set of linear regression equations, which generates an ensemble of individual SPI-1 forecasts. A second model has been based on a multiple linear regression approach comprising the dependency between all predictor variables and the predictand (SPI-1) in a single equation. In our study, precipitation values have been obtained from the CAMS dataset, and then transferred into SPI-1 index values as our target variable. Potential predictor fields (surface temperature, mean sea-level pressure and 500 hPa geopotential height) have been extracted from hindcast simulations of the Climate Forecast System Version 2 (CFSv2) of the National Centers for Environmental Prediction (NCEP) with monthly resolution for 0-3 month lead-time forecasts. The resulting SPI-1 forecasts obtained from both regression models have been subsequently analyzed in both, deterministic and probabilistic ways, by means of various verification metrics. We find that, the first proposed model produces higher accuracy deterministic and probabilistic forecasts. We have particularly focused on the performance of both models with 0-3 month lead-time, in order to identify the limits of skillful forecasts. Interestingly, we do not observe a strong decrease in forecast accuracy with increasing lead-time. While the detailed climatological reasons for this persistent predictability across the boreal summer season still remains to be further investigated, we tentatively conclude that at least the first four months' outputs of ST, H500 and MSLP fields from the CFSv2 model can be used for statistical summer precipitation forecasting in West Africa.