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A multi-linear regression method for the interannual variability of the West Africa monsoon

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There is a link between the monsoonal precipitation in the West Africa and the SST of the Atlantic and Indian oceans, both on interannual and interdecadal time-scales.

We elaborate a statistical method to predict the intensity of the West Africa monsoon based on the rainfall data from CPC Merged Analysis of Precipitation (2.5° longitude-latitude resolution) and on the SST from NOAA Optimum Interpolation dataset (1.0° resolution).

In the period 1983 - 2004, a correlation analysis between the JAS rainfall in the Sudan-Sahel region (10°W - 10°E, 9°N - 18°N) and the SSTAs in the tropical Atlantic and Indian oceans, averaged within a sliding window of 3 months back to the foregoing monsoonal season, shows that the rainfall intensity is well correlated ($r > 0.6$) with the SST in the Gulf of Guinea in OND, in the South Atlantic in NDJ, and in the West Indian in JFM.

We use these 3 sub-basins as predictors for the interannual ariability of the West Africa monsoon in a lagged multi-linear regression analysis with cross validation. The correlation coefficient between observed and forecasted rainfall is r = 0.69. Defining a wet (dry) event a monsoonal season with the rainfall anomaly greater (less) than half a standard deviation, the percentage of detection is 1.00 for wet events, 0.67 for normal events and 0.80 for dry events.

Having removed the linear trends to rainfall and SST, applying the method, we obtain the set of the best predictors: Gulf of Guinea in NDJ, South Atlantic in OND, and East Indian in ASO, with a general reduction of the correlation coefficient with the Sudan-Sahel rainfall (r ˜ 0.5). The correlation coefficient between observed and forecasted rainfall is r = 0.57, the percentage of detection is 0.57 for wet events, 0.86 for normal

events and 0.50 for dry events. The reduced skill of this method in the prediction of the interannual variability confirms the importance of the ocean SST forcing on the interdecadal timescale.