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Predictability of the West African Monsoon

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In the context of the international project Climafrica, co-funded by the European Union under the 7th Framework Programme, we present a complete analysis on the predictability of the West African Monsoon (WAM) based on the seasonal prediction system at the Centro Euro-Mediterraneo per i Cambiamenti Climatici (CMCC-SPS). The system is founded on the CMCC general circulation model, initialized with the Optimal Interpolation assimilation for ocean temperature and salinity, and ERA-Interim Reanalysis for the atmosphere. The database consists of an ensemble of six-month-forecasts, run four times a year between 1989 and 2010.
We observe that the forecasts capture the seasonality of the monsoon, its onset and the average amount of precipitation. However, compared with observations the model tends to produce less precipitation south of 15°N, while simulated rainfall overextends northward, draining semi-arid regions.
First, we focus on the relationship between precipitation and dynamical features such as the Sahara Heat Low (SHL) and the African Easterly Jet (AEJ), that play a prominent role in the large scale circulation of the area. SHL forms in Western Sahara at the end of the spring due to high daytime temperatures, and its cyclonic circulation in the lower troposphere increases the southwesterly monsoon flow along its eastern flank, favoring the northward penetration of rainfall. SHL is also crucial for the intensity and the maintenance of the AEJ, whose position and strength determines the westward propagation of the Monsoon convective systems. The model internal variability of these dynamical elements and of precipitation is of the same magnitude of the interannual variability, possibly representing an intrinsic limit to predictability.
Besides, we assess the role played by land surface, in order to evaluate whether an enhanced representation of its status, i.e. through the initialization of soil moisture, could help to locate SHL and AEJ in space and intensity, improving the mean state and the predictability of the WAM in CMCC-SPS.