CRC contribution to the West African monsoon variability and predictability study in PROMISE EU program framework

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West African rainy season can be to some extent predicted with one-season advance with numerical and/or statistical schemes based on local (Atlantic) and remote (ENSO-related) Sea Surface conditions. However these models face the major problem of the instability of the underlying teleconnections during the 30-50 year training period, shown by some diagnostic studies. Numerical studies have successfully reproduced the increase of the impact of ENSO and the decrease of the meridional SST anomaly gradient in the tropical Atlantic in the 70's to mid 90's, according to the changes in the global SST context relatively to the earlier (50's-60's) period. The role of the Indian Ocean seems to be important and needs further investigations.

The West African monsoon interannual rainfall anomaly persistence also indicates a strong role of the continental conditions. The continental forcing has been addressed through an energetic approach involving significant modifications in the boundary layer Moist Static Energy (MSE) field during and before (April) the Sahelian rainy season. In the NCEP/NCAR reanalyses, stronger MSE gradients between the Guinean Gulf and the Sahara precede the wettest rainy seasons: they allow a stronger and deeper monsoon intrusion into the continent in summer. A statistical relationship between the previous 2nd Guinean and Sahelian rainy seasons highlights an inter-seasonal memory involving soil moisture and vegetation over Guinea then MSE content in spring. A series of simulations with ARPEGE-Climat Atmospheric General Circulation Model (AGCM) indicates that the model monsoon is sensitive to the modifications in the seasonal cycle of the prescribed vegetation over Guinean Coast region, leading to significant changes in the monsoon onset date. The results however are less robust than the SST forcing. A better representation of the vegetation characteristics, including the seasonal cycle, seems to be crucial for model's simulation of the West African Monsoon.

The predictability of the Sahelian rainfall was studied by comparing 24 runs from 5 AGCM forced by the same prescribed SST. Based on the skill of the ensemble mean, rainy seasons have been categorized into "SST-forced" and "non SST-forced" years. For some of the "non SST-forced" years, better skill is achieved by a statistical model including summer MSE information; it indicates the predominance of the continental forcing. An alternative statistical seasonal forecasting scheme was developed. Based on the Multiple Linear Regression method, the model is fed with April regional predictors as SST gradient over the South tropical Atlantic basin, MSE gradient between the gulf of Guinea and the Sahara margins and the previous 2nd Guinean rainy season. This simple model reproduces, in cross-validation mode, 55% of the Sahelian rainfall variability over the period 1968-1998. The 2000 and 2001 Sahelian rainy seasons real-time forecasts performed with this MLR model were correct as well as those made at a more local scale (2,5 x3,75).

Tuesday II (Talk)