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Variability in West African rainfall explained by ocean and land surface in a set of Climate Model simulations

Claudine Wenhaji Ndomeni (1,2), Stefano Materia (2), Silvio Gualdi (2,3)

(1) Universita' Ca' Foscari, Venezia, Italy, (2) Centro Euro-Mediterraneo per I Cambiamenti Climatici, Bologna, Italy, (3) Instituto Nazionale di Geofisica e Vulcanologia, Bologna, Italy

State of the art global climate models poorly simulate the West-African (WA) climate, as reported in the last IPCC report. The ability of the model to reproduce (1) realistic distribution of sea surface temperatures (SSTs) and modes of variability in the tropical ocean, (2) variability in the Inter-Tropical Convergence Zone position, (3) feedback and coupling between surface processes and the climate of the region have been identified as crucial for the understanding of observed model biases. Reported biases in the representation of WA climate also have implications for seasonal predictions long-term climate projections, with consequences on the societal needs of a population that mainly substations on rain-fed agriculture.

In this work, we make use of a set of model experiments, representing the past historical climate as simulated by the Centro Euro-Mediterraneo per I Cambiamenti Climatici (CMCC) global model. First we evaluate the variability of modeled West African Monsoon rainfall and dynamics explained by tropical SSTs. While the main modes of variability are fairly caught when the atmospheric model is forced with observed SSTs, the coupled model is not able to represent the observed variability. In a second stage, we consider the role of land surface in affecting WA climate. Through the use of recently published statistical techniques, we analyze the amount of variability explained by dynamical vegetation and soil moisture. Particular regard is given to land-atmosphere interaction and the coupling between the two components.