West African Monsoon Modeling and Evaluation (WAMME)

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Sahelian Africa is one of the areas in the world that has experienced a significant change in climate in the past century. Annual rainfall has persistently remained below the long-time average since the late sixties. Starting from the later 1980s, however, evidence shows that there has been some rainfall recovery relative to the very dry period. However, despite of some progress in understanding the effect of boundary forcing on West African monsoon (WAM) variability, the monsoon precipitation and associated important features, and impacts of oceanic, land processes, and aerosols are not well understood, due in part to lack of detailed observations, and to inability of GCM to simulate these features at different temporal and spatial scales, including diurnal cycle, intraseasonal evolution, and interannual variability.

West African Monsoon Modeling and Evaluation project (WAMME), A CIMS/CEOP initiative, uses GCMs and regional climate models (RCMs) to address issues regarding the role of land-ocean-atmosphere interaction, land-use and water-use change, vegetation dynamics, as well as aerosol, particularly dust, on WAM development as well as the long term drought and partial recovery. The WAMME also has close collaboration with the African Monsoon Interdisciplinary Analysis (AMMA) project and will apply AMMA field data for validation.

Sahel drought is known to be strongly influenced by sea surface temperature (SST) anomalies both globally and in regions adjacent to the African continent. Initial discoveries have focused the evidence in Atlantic Ocean and Indian Ocean. However, SSTs in the last decade in these two oceans have been increasing, which seems to contradict the general perception regarding the SST/Sahel rainfall relationship. A possible link between Mediterranean SSTs and Sahelian rainfall on timescales of a decade or more has been proposed. On the other hand, a preliminary GCM study suggests that dust-radiation-atmosphere feedback could cause the WAM to shift inland and may provide a mechanism for the recovery of the Sahel rainfall. Land surface processes through vegetation/atmosphere interactions, in particular land degradations, have also been considered a contributing factor to the persistent Sahel drought. A number of recently available satellite data and their products have indicated a close relationship between vegetation condition and Sahel climate variability at different scales. A strong increase in seasonal normalized difference vegetation index (NDVI) was observed over large areas in the Sahel during the period 1982-1999. The increase is interpreted as a vegetation recovery from the drought periods of the 1980s. Meanwhile, recent findings suggest that although the increasing vegetation greenness is certainly a response to the precipitation increase in the last decade, this does not fully explain the change. The precipitation in some sites with severe desertification does not show a rainfall recovery trend, which imply the anthropogenic effect plays a role.

This paper will present the current GCMs and RCMs' WAM simulations, preliminary evidences to support the hypotheses regarding the long-term WAM variability, general information of the WAMME project and the approaches that WAMME will take. The possible collaborations of WAMME with C20C will also be discussed.