JP4.1 THE IMPACT OF SOIL MOISTURE INITIALIZATION ON SEASONAL PRECIPITATION FORECASTS IN THE WEST AFRICAN SAHEL: PRELIMINARY TESTING OF THE HU-RSMCVS MODEL

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1. INTRODUCTION

Recent modeling studies have shown the significant impact of soil wetness on mean climate and atmospheric variability. The amount of soil moisture influences atmospheric conditions by changing the relative contributions of latent and sensible heat to the outgoing surface energy flux. Fluctuations of soil moisture lead to large variations in these fluxes (Delworth and Manabe, 1989).

Prior knowledge of soil moisture states could, under certain circumstances, contribute significantly to improving atmospheric predictability. However this is compounded by the poor spatial coverage of global soil moisture observations. Globally, in situ observations are scarce and the remote sensing of soil wetness is a developing technology. The use of model generated soil moisture is a natural choice, but it suffers from errors in model atmospheric forcing, particularly precipitation, evaporation and radiation. Therefore, a study based on realistic soil wetness fields is desirable and soil wetness analysis from land data assimilation projects such as GLDAS will aid this effort.

The Sahel geographically extends from the Atlantic Ocean to the African “Horn” and is the transition zone between the arid Sahara Desert to the north and the wetter tropical regions to the south. A key reason for studying this region is that studies have shown that soil moisture impact maybe most significant in transition zones such as the Sahel. This region has experienced persistent drought since the late 1960s and is characterized by sparse in situ data, therefore supplementing with satellite observations and accurate model predictions is necessary.

2. DATA AND METHODOLOGY

The Concurrent Systems Version (CVS) of the National Centers for Environmental Prediction (NCEP) Regional Spectral Model (RSM) was set up at Howard University (HU-RSMCVS). The model testing and validation consisted of one-month simulations for July and August 2002. These simulations were initialized and driven only by NCEP/DOE AMIP-II Reanalysis (R2) Data. After the model was implemented and compilation errors were eliminated, the model was tested using the sample initialization data that is downloaded with the model source code. The sample data provided was for March 3, 1990 with the default domain set up over North America at 60 km grid spacing.

In order to assess the model performance over West Africa, the model was then initialized with R2 data downloaded from the NCEP NOMADS server. The model domain was set up to cover latitudinal range 5°S to 20°N and longitudinal range 17.5° W-20°E. The resolution of the model grid spacing was set at 36 km and the integrations were for the months of July and August 2002.

3. PRELIMINARY RESULTS

The results shown here are for the July 2002 model integrations run over the West African domain described in the previous section. The figures are comparisons of the plots of HU-RSMCVS model results compared to plots of NCEP R2 data downloaded from NCEP NOMADS server. The meteorological fields compared are mean sea level pressure (Figure 1), 850 mb temperatures (Figure 2), 500 mb geopotential heights (Figure 3) and 200 mb zonal winds (Figure 4) averaged over the month of July 2002. Generally, the HU-RSMCVS model results compared favorably to the NCEP R2 plots.

4. FUTURE WORK

To conclude the model testing and validation, we will also be conducting a one month simulation for September 2002 that will be similar to those described for July and August 2002. The results from this simulation will be analyzed and compared to the plots of R2 data obtained from NCEP.

Further work to be done during Phase 1 of this study will consist of seasonal RSM runs where the land states will be initialized with data from other possible sources such as Global Land Data Assimilation (GLDAS) and Air Force Weather Agency Agricultural Meteorology Modeling System (AGRMET). The results from these simulations and

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the R2 initialized simulations will be compared with precipitation observations from various sources of satellite, gauge and merged satellite-gauge data.

Phase 2 of this study will consist of a sensitivity analysis to examine the atmosphere's response to changes in land surface states (soil moisture and possibly albedo and surface roughness).

5. REFERENCES

Delworth, T.L., and S. Manabe, 1989: The influence of soil wetness on near-surface atmospheric variability. *J. Clim*., **2**, 1447-1462

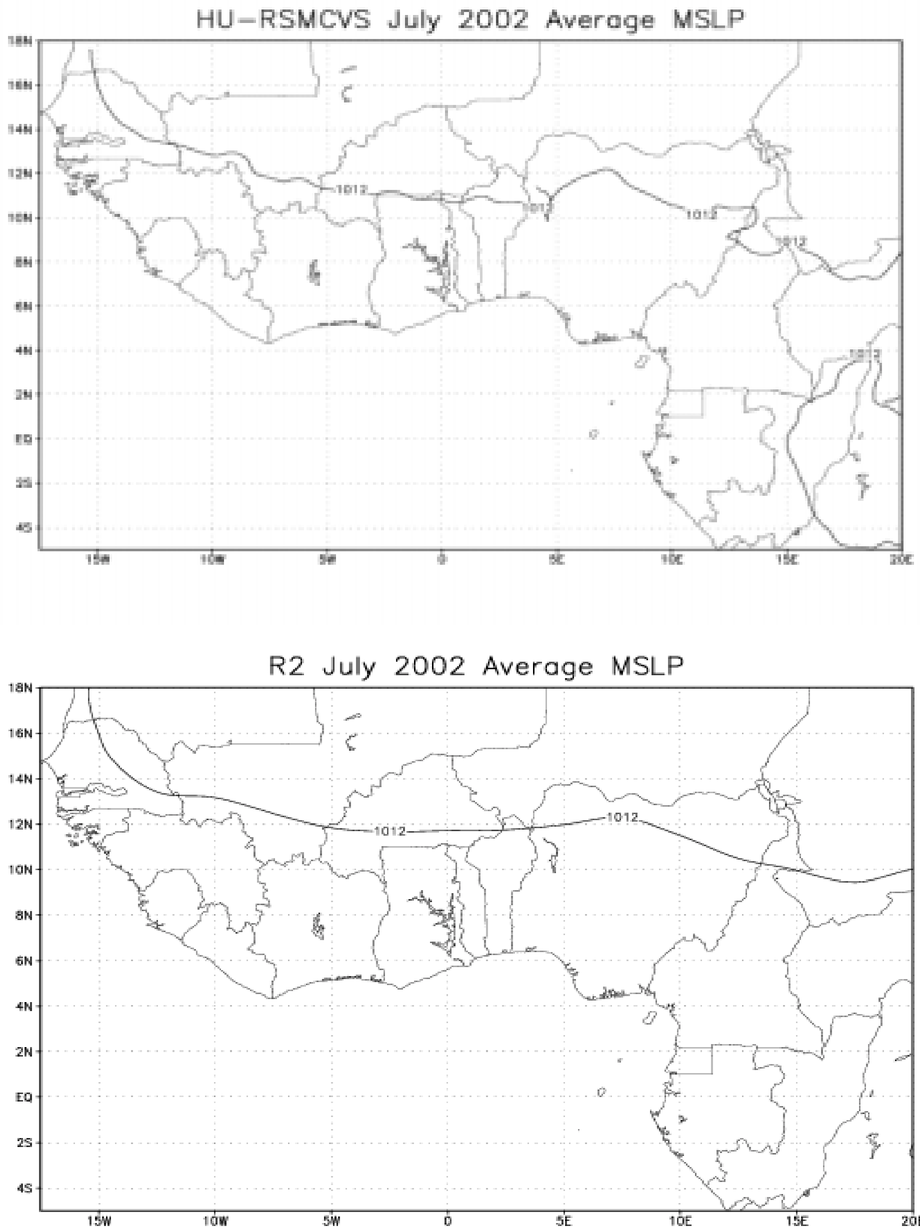


Figure 1: HU-RSMCVS (top) and NCEP R2 (bottom) 2002 average mean sea level pressure in mb for July 2002.

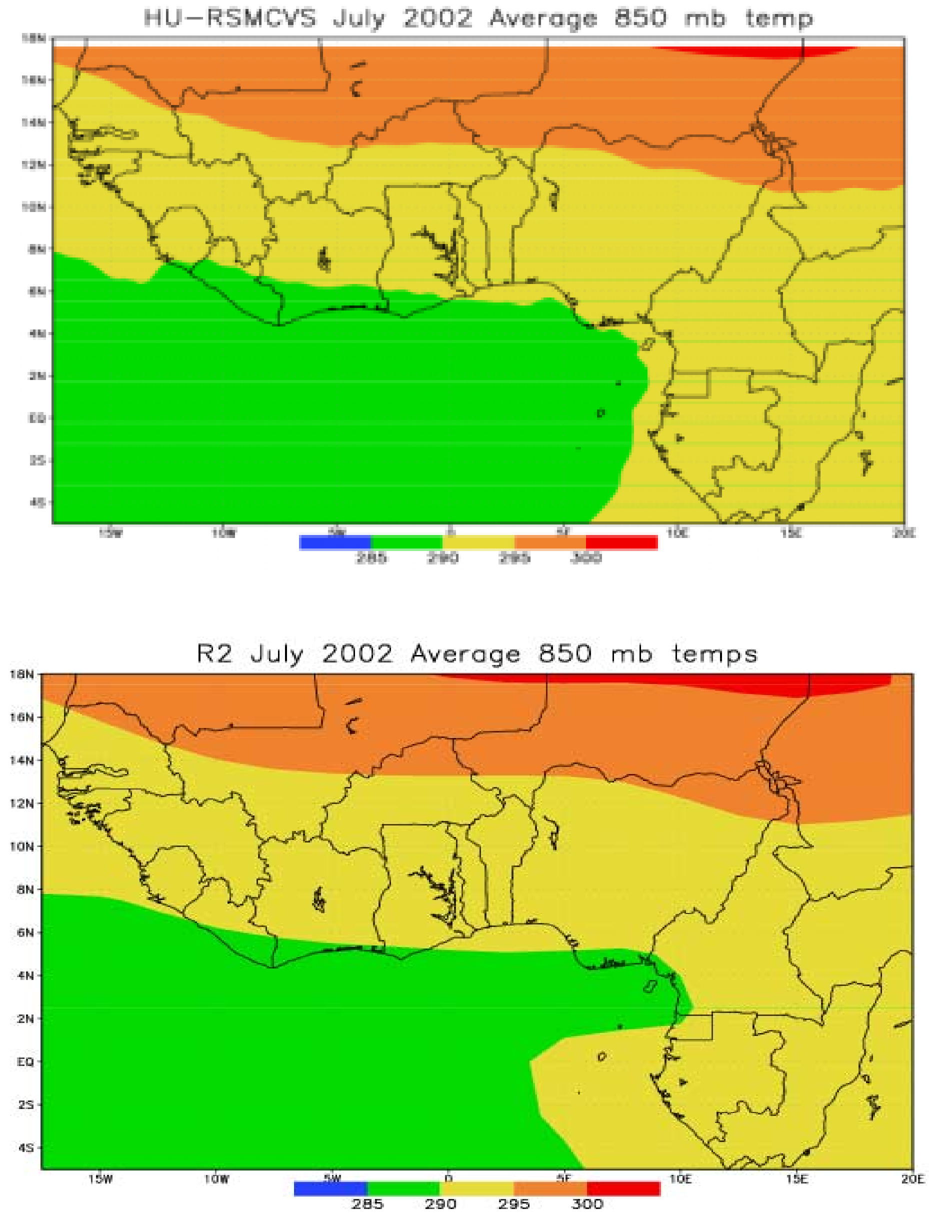


Figure 2: HU-RSMCVS (top) and NCEP R2 (bottom) plots of average 850 mb temperatures for July 2002.

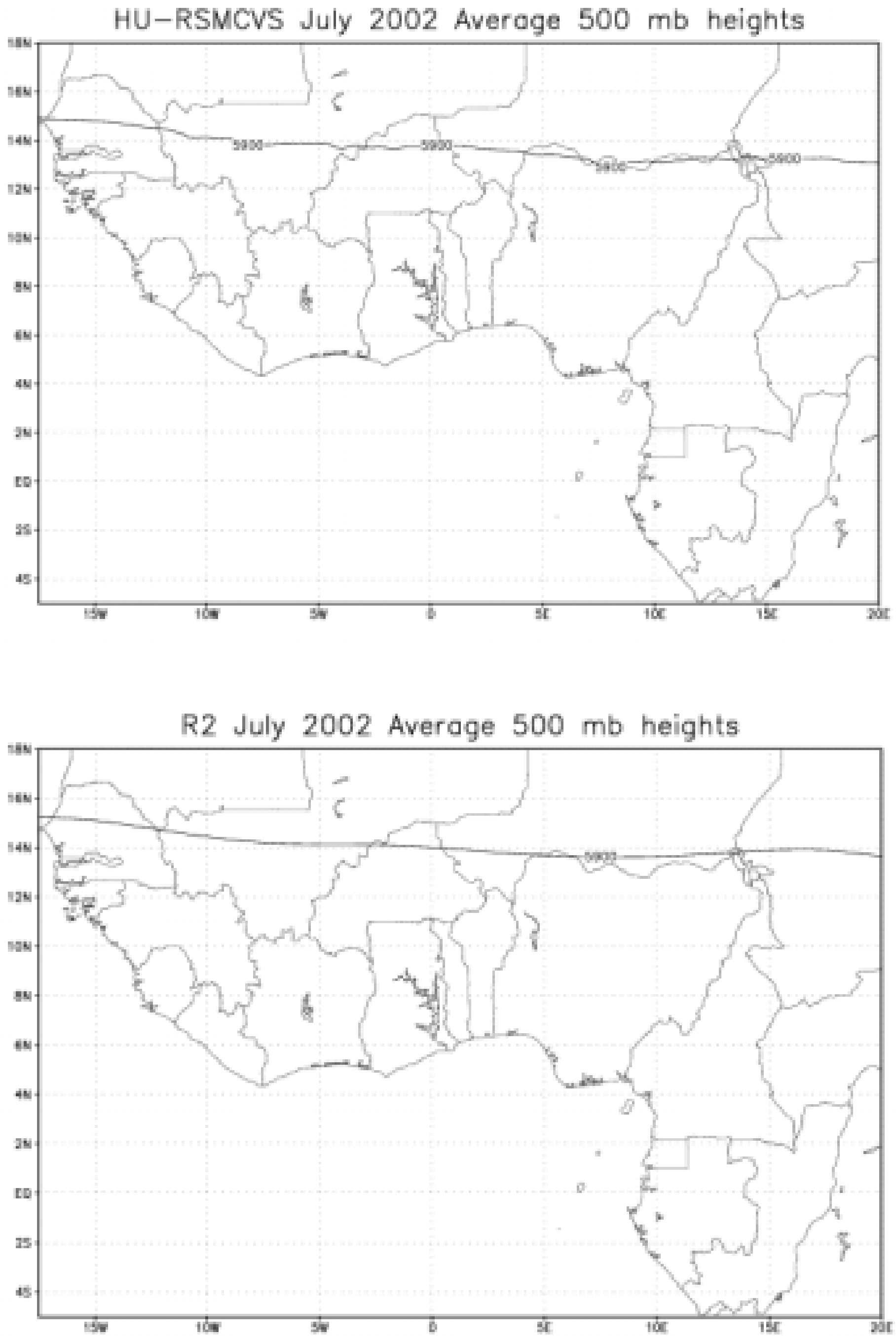
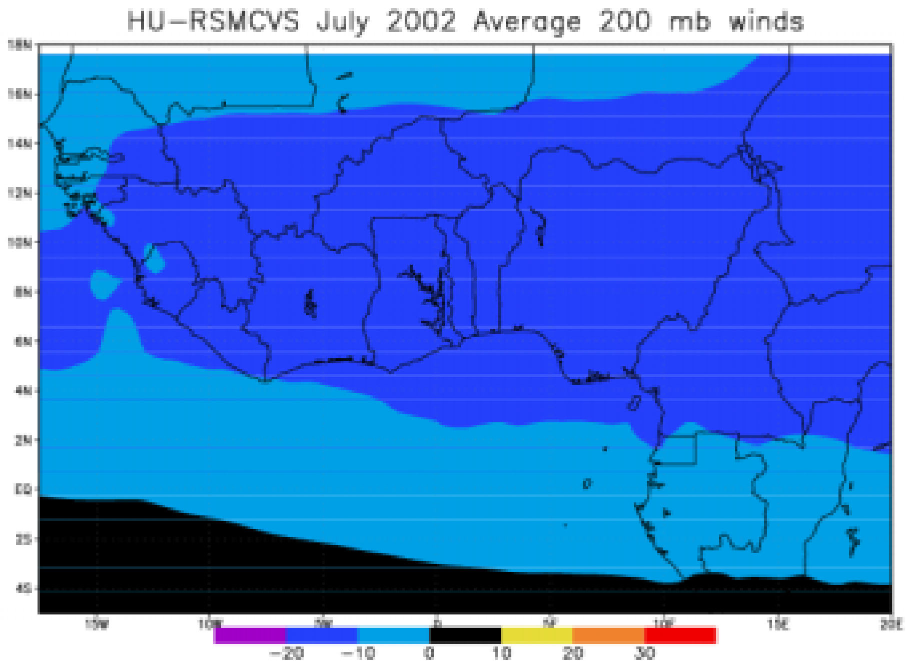


Figure 3: HU-RSMCVS (top) and NCEP R2 plots of average 500 mb geopotential heights for July 2002.



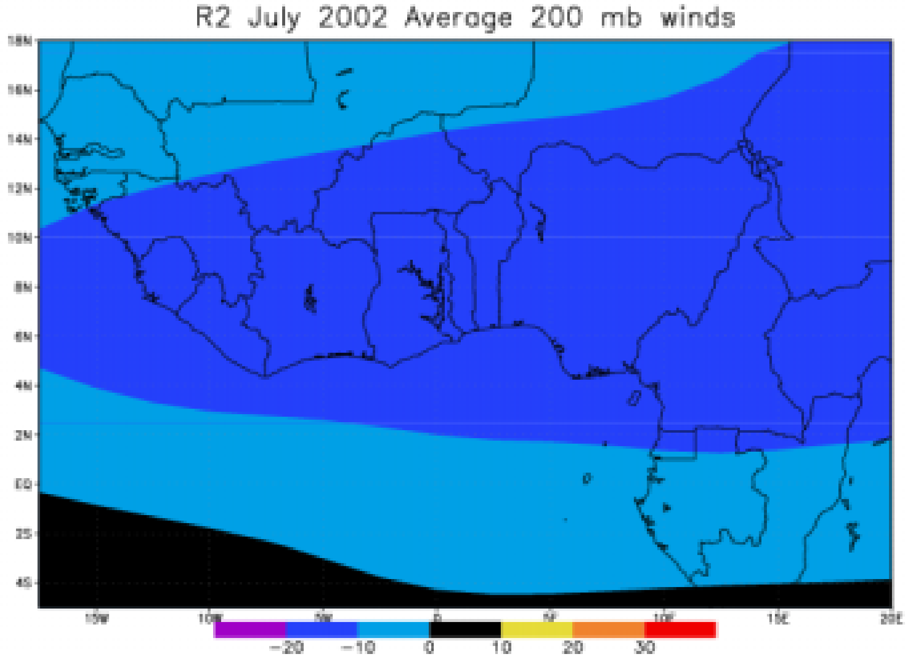


Figure 4: HU-RSMCVS (top) and NCEP R2 (bottom) plots of average 200mb zonal winds for July 2002.