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Predictability of the Moisture Regime Associated with the Preonset of Sahelian Rainfall

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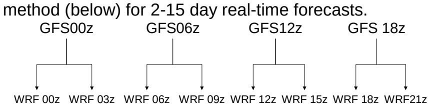
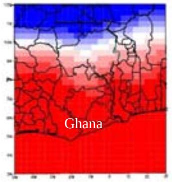
Introduction: The moisture regime associated with the preonset of the West African monsoon is of primary concern for the population in the region due to its influence in areas such as health. The end of meningitis outbreaks, for example, tends to coincide with influx of moisture at the end the dry season. This study will serve as a compliment to work currently under development at the University Corporation for Atmospheric Research (UCAR) Africa Initiative by evaluating the skill of WRF and other model forecasts of weather variables that are relevant to meningitis management in the region.

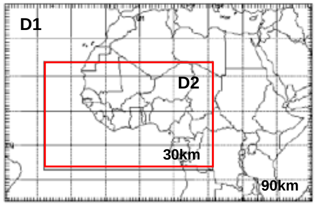
Ensemble prediction: We use physics parameter variation method for seasonal prediction and initial conditions method (below) for 2-15 day real-time forecasts.



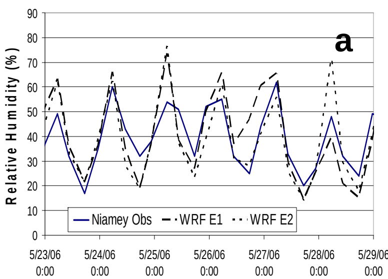


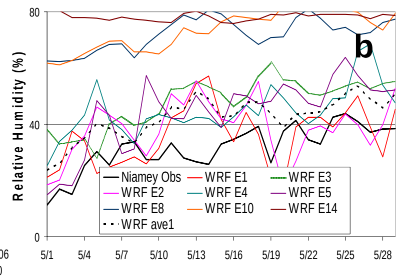
30 km resolution RH (%)

Model Domains and Resolution



Diurnal and intraseasonal variability: We use relative humidity (RH, %) as a variable due to its relationship with the disease. Downscaling of FNL reanalysis (varying-physics ensemble) shows the model can capture (a) diurnal variability as well as (b) intraseasonal. Shown below are simulations in May 2006 represented as area averages over Niamey, Niger. "E" + number denotes individual ensemble members





Conclusions and recommendations:

We find that WRF can be used to diagnose moisture regime preceding the West African Monsoon for health efforts in the region at the district level.

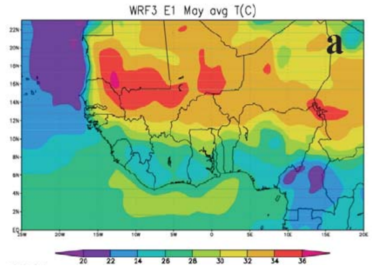
The model is able to capture diurnal and intraseasonal variability of moisture in the atmosphere.

Certain physics parameter combinations using the thermal diffusion land surface physics scheme greatly degrades model performance.

Large differences occur between using NCEP Final Analyses (FNL) skin temperature and the higher resolution NCEP real-time global (RTG) SSTs as lower boundary conditions.

From downscaled reanalysis and real-time ensemble forecasts, we find that westward-propagating systems have an important influence on the modulation of the moisture regime in West Africa at latitudinal and temporal scales.

Objectives: (1) Determine optimal combination of physics parameters for the Weather Research and Forecasting (WRF) model over West Africa. (2) Examine different ensembling techniques for short range and seasonal prediction. (3) Analyze model performance in capturing diurnal and intraseasonal variability (transient convective events) of moisture dynamics at synoptic and local levels.

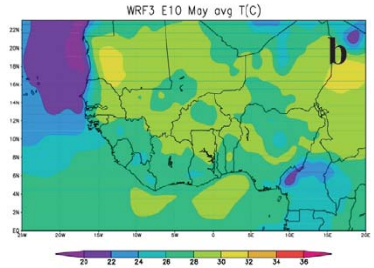


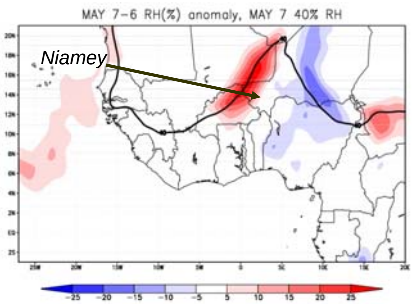
Model Physics Combinations

a.) Using Noah Land Surface Model

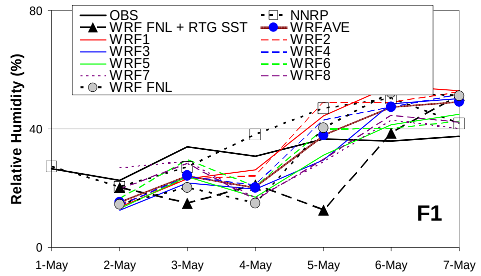
b.) Using Thermal diffusion

**note the markedly cooler temperatures in b*



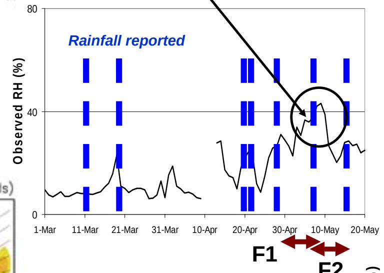


Transient convective systems

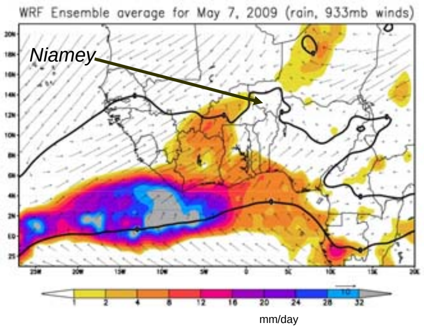


Increased Humidity event

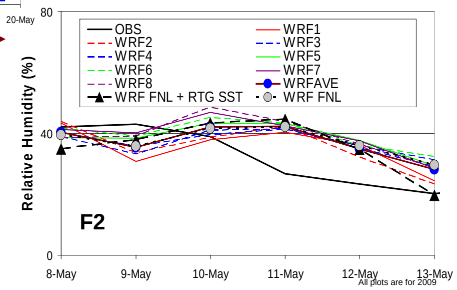
Extended 10-day forecast of event



Observed RH (%) and area averages of WRF simulations over Niamey, Niger



We used 8 ensemble members driven by real-time GFS boundary conditions for the forecasts. Subsequently we compared the forecast against observations and downscaled (FNL) reanalysis using WRF.



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