# J6.9 WEEKLY TO MONTHLY PREDICTABILITY OF THE EARLY-SUMMER PRECIPITAITON IN THE LSA-EAST

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## 1. Introduction

Warm-season precipitation plays an important role in the global hydrological cycle. Unfortunately, the progress in warm-season quantitative precipitation forecasts (QPFs) has been particularly slow due to the dominant weak dynamical forcing. Nevertheless, it is encouraging from recent real-data modeling studies that the warm-season QPFs could be significantly improved by simply incorporating high-grid resolution and realistic model (cloud and boundary-layer) physics (e.g., Zhang and Fritsch 1986; Zhang et al. 1989; Alexander and Cotton 1998). Similarly, recent regional climate modeling studies showed that the warm-season QPFs at the monthly to seasonal scales could be improved by using reasonable diabatic physics and land-surface parameterizations (Giorgi 1991; Xue et al. 1996; Paegle et al. 1996). In particular, some studies indicated the significant impact of land surface processes on the regional rainfall, depending upon the variation of vegetation. Moreover, our ability of remotely sensing the characteristics of the land surface has improved dramatically in the past decade, allowing much better data to be input into the more sophisticated parameterizations (Loveland et al. 1991; Lee et al. 1995; Walko 2000).

In this study, we use the PSU/NCAR MM5, coupled with the simplified Simple Biosphere (SSiB) scheme (Sellers et al., 1986; Xue et al. 1991), to study the weakly to monthly predictability of precipitation that occurred during June 1998 over the Large-Scale Area - East (LSA-E).

## 2. Model description

Major features of the model include: a) a two-way, triply nested-grid (45/15/5 km) technique with the finest 5 km resolution to cover the most part of the LSA-East; b) the simultaneous use of the most recent version of Kain-Fritsch (1990) convective parameterization and simple ice microphysics package; c) the simplified SSiB; and d) the MRF boundary layer scheme. The outmost mesh covers most of the North American continent. A total of 30 vertical layers is used.

The model is Initialized at 0000 UTC 1 June and continuously integrated up to 30 June 1998. The initial and the outermost lateral and bottom boundary conditions are specified from NCEP's Eta analyses, including the initial soil surface temperature and canopy temperature.

## 3. Results

The LSA-East in June 1998 was characterized by the passage of seven cyclones and the development of three mesoscale convective systems (MCSs), causing the regional widespread anomalous precipitation with local flooding conditions. Most of the precipitation appeared to be convective in nature, and generated by the frontal lifting and local surface conditions, thus exhibiting pronounced temporal and spatial variabilities in the storm development and rainfall distribution.

In general, the model captures quite well all the rainfall events, with the distribution and magnitude similar to the observed. The simulated time series of the area-averaged maximum and minimum surface temperatures over the LSA-East are also in good agreement with the observed (not shown). As an example, Fig. 1 compares the averaged time-longitude maps of three-hourly rainfall rates between observations and simulations.

The averages are obtained by taking algorithmic averages of the 30-day rainfall rates in a diurnal cycle and over the belt of 33 to 43$^0$N With a similar approach applied to the radar-derived rainfall, Carbone et al. (2001) and Ahijevych et al. (2001) found that a significant portion of rainfall episodes exhibits a phase-locked behavior, consistent with the combined effects of thermal and topographical forcings. It is apparent from Fig. 1 that the model captures almost all prominent rainfall streaks with reasonable timing, locations, duration and propagating speed, except for the rainfall to the west of 90$^0$W where a nocturnal maximum was observed. The eastward propagation of the rainfall originated from the north of the Mississippi River basin is well reproduced. Some regions appear to have a preferential period of precipitation in the diurnal cycle. Of our major concern is that the timing and intensity over the LSA East are generally consistent with the observed.

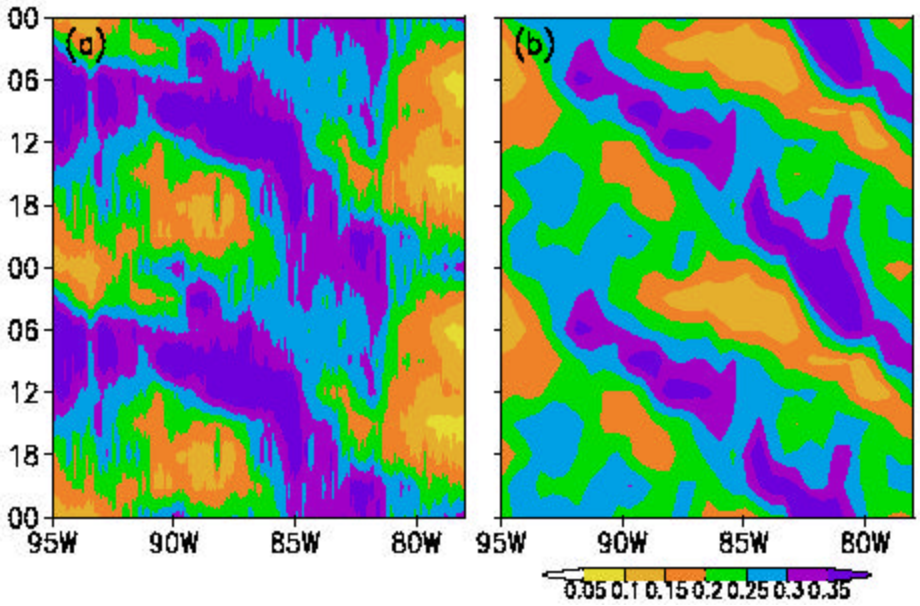


Fig. 1 Diurnal rainfall-frequency Hovmoller diagram for the period of 1 – 30 June 1998, following Carbone et al. (2001).

## 4. Summary and conclusions

In this study, the coupled MM5/SSiB model has been used to examine the weekly to monthly predictability of the early summer precipitation over the LAS-East. The model captures well the main features of daily variation of precipitation and .reproduces each rainfall event at nearly the right timing and location. Since the initial conditions in the present case have little impact on the simulations after a couple of days, the predictability of the storms and their pertinent precipitation would be largely determined by the large-scale dynamics through the lateral boundaries and the climate forcings at the surface. Our sensitivity studies, to be shown at the time of presentation, indicate that the model predictability of the rainfall events is highly dependent on the use of land-surface and cumulus parameterization schemes. The results appear to have important implications with respect to the weekly to monthly prediction of regional precipitation and climate over the US and other regions.


### Acknowledgements

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**References** are not provided due to the limited space.