Project to Intercompare Regional Climate Simulations

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The Project to Intercompare Regional Climate Simulations (PIRCS) provides a common simulation framework for evaluating mesoscale models run in climate mode, both versus each other and versus observations. PIRCS has developed with strong community involvement and participation is currently open to all modeling groups willing to perform the simulations and furnish the output in a standard format. Archived output will be available to the general community, though interested users are required to maintain contact with PIRCS and participating modelers to ensure clear understanding of what the models can and cannot do. Additional details can be found in Gutowski et al. (1998) and at the PIRCS Web site, http://www.pircs.iastate.edu

The simulation domain for Experiment 1 covers the continental United States with a specific focus on the central region. Simulations cover two periods of hydrologic extremes in the central US: 15 May - 15 July 1988 (drought) and 1 June - 31 July 1993 (flood). Atmospheric initial and boundary conditions were extracted from the NCEP/NCAR reanalysis interpolated to the model grids (nominal resolution of 60 km). Initial results are shown here from simulations of the summer 1988 drought over the central U.S.

Results indicate that limited-area models forced by large-scale information at the lateral boundaries are able to reproduce bulk temporal and spatial characteristics of meteorological fields. The root-mean-square difference (RMSD) of the predicted 500 hPa height field provides some evidence that model skill varies with the synoptic regime in a common way (Figure 1). Situations dominated by a ridge or zonal flow are well simulated by most models while situations characterized by development and migration of short-wave lows or troughs tend to have larger RMSD. There remain substantial variations from model to model and from case to case.

Analysis of predicted precipitation for the Upper Mississippi River basin (37 N - 47 N, 89 W - 99 W) indicates that simulations of precipitation episodes vary depending on the scale of the relevant dynamical forcing (Figure 2). Organized synoptic-scale precipitation systems are simulated deterministically in that precipitation occurs at close to the same time and location as observed (though the amounts may vary from the observations). Episodes of mesoscale and convective precipitation are represented in a more stochastic sense: general periods of scattered convective precipitation tend to be captured in the models, though with less precise agreement in temporal and spatial patterns than for the synoptically organized events.

Predicted daily maximum and minimum temperature (Figure 3) tend to reproduce the synoptic variability of the FIFE observations, though with bias (Betts and Ball 1998). Model bias in maximum temperature tends to vary with the mid-day, time-average Bowen ratios; i.e., models with relatively high Bowen ratio tend to have higher bias.

We find that there are some common strengths and deficiencies among the models and that no single model performs best in all comparisons. In keeping with the goals of PIRCS, the side-by-side assessments here help highlight more clearly specific areas where modeling groups individually and collectively may want to focus efforts to improve model performance.

Acknowledgment: PIRCS has been supported by funding from the Electric Power Research Institute, the International Institute of Theoretical and Applied Physics, and the Iowa Center for Global and Regional Environmental Research. Additional support for R.W. Arritt and C.J. Anderson was provided under NSF grant ATM-9616728. J. Roads and S. Chen were supported by NOAA grants NA77RJ0453 and NA37GP0372. We thank Eugenia Kalnay, Filippo Giorgi, Roger Pielke and Andrew Staniforth for advice and support in the design of the project.

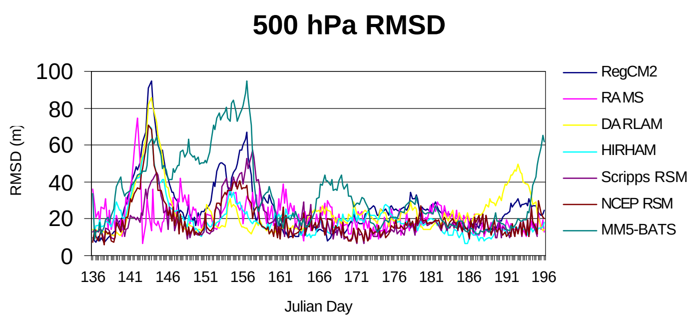

Figure 1. Time series of spatially averaged root-mean-square deviation of predicted 500 hPa heights compared with the NCEP/NCAR reanalysis.

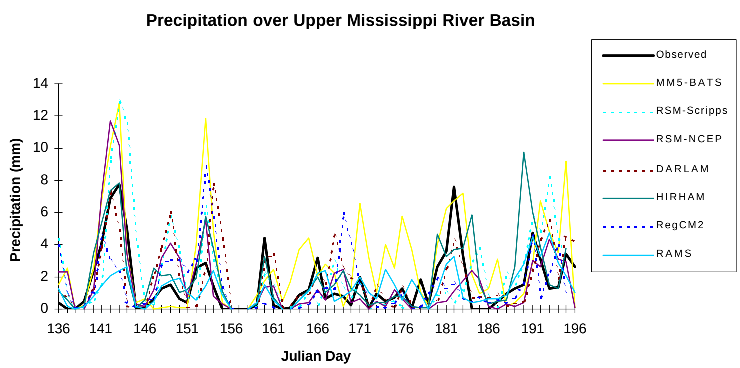

Figure 2. Time series of predicted precipitation over a portion of the upper Mississippi River basin (37-47 ^{o}N, 89-99^{o}W) compared with observations.

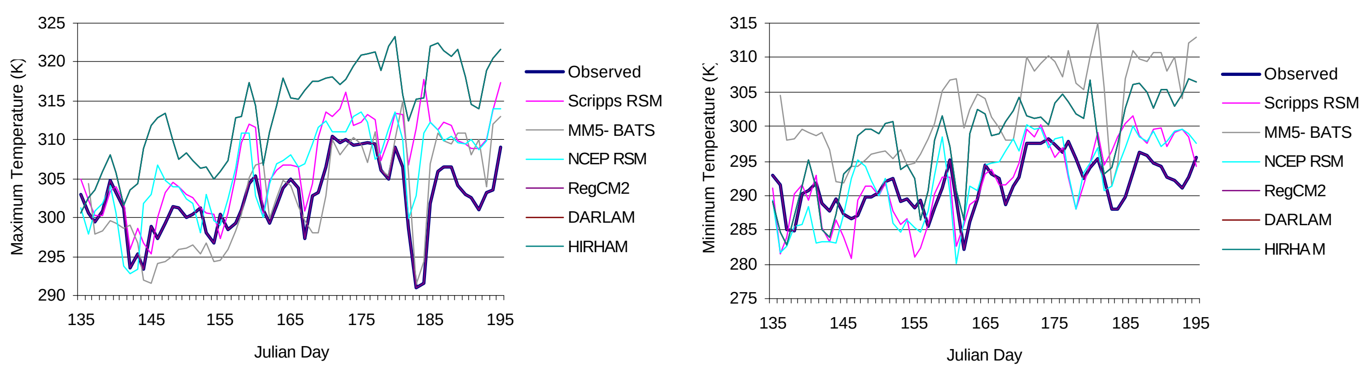

Figure 3. Time series of daily maximum temperature (left) and minimum temperature (right) from FIFE observations (Betts and Ball 1998) and from each model's gridpoint nearest the FIFE site.