A Comparison of Statistical and Dynamical Downscaling for Hydrologic Analysis

W.J. Gutowski, Jr.[1], R. L. Wilby[2,3], E. S. Takle[1], R.W. Arritt[1], Z. Pan[1], C.J. Anderson[1], R. Silva[1], D. Caya[4], S.-C. Chen[5], J.H. Christensen[6], S.-Y. Hong[7], H.-M. H. Juang[7], J.J. Katzfey[8], W.M. Lapenta[9], R. Laprise[4], G. Liston[10], P. Lopez[6], J. McGregor[8], R. Pielke, Sr.[10], and J.O. Roads[5]

[1]Iowa State University, Ames, Iowa, USA
[2]National Center for Atmospheric Research, Boulder, Colorado, USA
[3]Unversity of Derby, Derby, UK
[4]Université du Québec à Montréal, Montréal, Québec, Canada
[5]Scripps Institute of Oceanography, La Jolla, California, USA
[6]Danish Meteorological Institute, Copenhagen, Denmark
[7]National Centers for Environmental Prediction, Camp Springs, Maryland, USA
[8]Commonwealth Scientific and Industrial Research Organisation, Modialloc, Australia
[9]Marshall Space Flight Center, Huntsville, Alabama, USA
[10]Colorado State University, Fort Collins, Colorado, USA

Both the Limited Area Model (LAM) and statistical approaches to downscaling have been subjected to rigorous intercomparison and validation studies by their respective research communities. However, to date, no direct comparisons of the LAM and statistical methods have been published. The primary purpose of this project is to compare statistical (circulation-based) downscaling methods with LAM results for selected regions in the United States. This project builds on earlier studies focused on only one method, namely the Project to Intercompare Regional Climate Simulations (PIRCS) Experiment 1 and two recent statistical downscaling intercomparison projects. Here, LAM and statistical downscaling model time series of precipitation and daily min/max temperature are compared with each other and with observations for selected river basins, many of which are part of the U.S. National Assessment. Both the LAMs and the statistical downscaling are driven by the NCEP/NCAR reanalysis.

Initial comparison uses output from several limited-area models that performed PIRCS Experiment 1a, a 60-day simulation during the summer of 1988. Although the period is rather short, it provides a preliminary basis for comparing output from several LAMs with a statistical approach. Initial results suggest that the statistical approach tends to give more accurate reproduction of observed time series of daily minimum and maximum temperature, in part because its calibration removes bias error otherwise present in the LAM output. The LAMs, however, tend to simulate the sequence of precipitation events with greater fidelity to observations. We will report more extensive analysis of these tentative conclusions at the meeting.

Additional comparisons use output from 10-year LAM and statistical downscaling runs to give a more complete basis for comparing the two methods versus observations. Ultimately we intend to assess the capability of either approach to drive river discharge models in comparison with observed discharge.