

## Transferability Working Group (TWG)

Reporting Period: 1 September 2005 – 31 August 2006

Starting Date: September 2003

End Date: TBD

URL: <http://rcmlab.agron.iastate.edu/twg/>; <http://www.narccap.ucar.edu/>

Chair(s) and Dates of Terms: Eugene S. Takle 2003-2006

### Objective(s):

To improve understanding and prediction of water and energy cycle processes through systematic intercomparisons of ensembles of regional climate simulations on several continents with coordinated continental-scale observations and analyses.

### Status:

#### *Intercontinental simulations*

Initial paper describing TWG, its mission, and preliminary studies was completed, submitted to BAMS, revised, and now has been accepted. This paper overviews the concept of TWG and provides preliminary analysis of output from five models on three domains and demonstrates that multiple models simulating multiple domains exposes strengths and weaknesses of RCM that are not easily observed with single models on single domains, multiple models on a single domain, or single models on multiple domains. Numerous presentations were made at international meetings (see below), including EGU and the *Third ICTP Workshop on the Theory and Use of Regional Climate Models*.

#### *North American Regional Climate Change Assessment Program activities*

NARCCAP seeks to produce multiple regional climate model (RCM) runs driven by multiple GCM runs for the contemporary and future scenario climates for North America, including the US, Canada, and large portions of Mexico. Preliminary runs of the RCMs to evaluate model performance against observations is achieved by simulating a 30-year period at the end of the 20<sup>th</sup> century driven by reanalysis (NRR-2). Reanalysis simulations have been completed by Scripps (RSM), UQAM (CRCM), and PNL (MM5). The Hadley simulation (HadRM3) is expected to be completed in mid-October. UCSD (RegCM3) is expecting completion by end of September, and PNL (WRF) is into the 6th simulated year.

### New directions

#### *Intercontinental simulations*

Variables in addition to surface fluxes will be examined. Role of surface processes in boundary-layer development and cloud development will be evaluated. This will allow for more rigorous testing of hypotheses relating to model accuracy outside the home domain. Discussions have begun on a monsoon intercomparison that evaluates simulations of onset times and changes in diurnal properties with monsoon onset.

#### *NARCCAP activities*

Reanalysis-driven runs are targeted for completion by end of 2006 and then GCM-driven runs will be commenced.

### Future

Closer working relations with GMPP and ICTS are envisioned with the reorganization of GHP/CEOP. As more model output is added to the archive more robust testing of hypotheses relating to transferability issues can be accomplished.

GCM-driven runs of RCMs under NARCCAP will begin to provide a comprehensive suite of model simulations for addressing major issues of uncertainty in regional climates as simulated by regional models.

### Key results

The diurnal cycles of sensible and latent heat flux were evaluated for three domains containing CSEs (Baltex, GAPP, and LBA) using five models (RSM, RegCM3, CLM, RCA3, and GEM-LAM). Observed

sensible and latent heat fluxes at three CSE reference sites were compared to results of models for which 3-hourly fluxes were available. Preliminary conclusions drawn from these results and from comparisons of quartiles and extremes from box and whisker plots, suggest a weak "home domain advantage" for RCMs. Most models do well in determining the time of peak daytime sensible and latent heat flux, even though the observation sites have different peak times. Variability of latent heat flux seems overestimated for the warmer climate site and underestimated for the cooler climate site, whereas, variability of sensible heat flux seems overestimated for the cooler climate site and underestimated for the warmer climate site.

### **Issues and Recommendations**

Contributions to WCRP strategic framework (including overall strategy on observation, assimilation and modeling, and WCRP cross-cutting task teams). TWG investigates fundamental processes key to understanding water and energy exchanges at the earth's surface on scales not resolved by global models. Successes by TWG will help inform global modeling programs of refinements in simulating water and energy cycles at coarser resolutions.

### **Contributions to society and to WCRP/GEWEX visibility**

Activities of TWG seek to close the gap between global simulations of climate (present and future) and regional needs for climate information for a variety of societal needs relating to agriculture, human health, disaster management, health and performance of natural systems, and water resources.

### **Summary**

TWG, through analysis of data from the ICTS archive and publishing a signal paper in a major international journal, has demonstrated that the concept of transferability intercomparisons is a promising method for advancing understanding and modeling of the global water cycle and energy budget. The transferability framework goes beyond previous regional climate model intercomparisons to provide a global method for testing and improving model parameterizations by constraining the simulations within analyzed boundaries for several domains. Transferability intercomparisons expose the limits of our current regional modeling capacity by examining model accuracy on a wide range of climate conditions and realizations. A systematic intercomparison across models and domains more clearly exposes collective biases in the modeling process. By isolating particular regions and processes, regional-model transferability intercomparisons can more effectively explore the spatial and temporal heterogeneity of predictability. A general improvement of model ability to simulate diverse climates will provide more confidence that models used for future climate scenarios might be able to simulate conditions on a particular domain that are beyond the range of previously observed climates.

### **List of key publications**

Takle, E. S., J. Roads, B. Rockel, W. J. Gutowski, Jr., R. W. Arritt, I. Meinke, and C. Jones, 2005: Transferability: A global approach to regional climate simulations. *Bulletin of the American Meteorological Society* (in press).

Takle, E., B. Rockel, W. J. Gutowski, J. Roads, J. R.W. Arritt, and I. Meinke, 2005: Transferability: A Global Approach to Regional Climate Model Simulations. *Scientific Assembly of the International Association of Meteorology and Atmospheric Sciences (IAMAS)*, Beijing, China, 2-11 August 2005.

Rockel, B., J. Roads, I. Meinke, W.J. Gutowski, R.W. Arritt, and E.S. Takle, 2005: ICTS (Inter-CSE Transferability Study) of regional climate models within CEOP. *Fifth Conference, Global Energy and Water Cycle Experiment (GEWEX)*, Costa Mesa, CA, June 2005.

Takle, E. S., B. Rockel, W. J. Gutowski, Jr., J. Roads, R. W. Arritt, I. Meinke, and C. Jones, 2005: Transferability Working Group (TWG). GEWEX Hydrometeorology Panel Meeting (GHP-11) Melbourne, AU. 26-29 September.

Takle, E. S., J. Roads, B. Rockel, W. J. Gutowski, Jr., R. W. Arritt, I. Meinke, C. G. Jones, and A. Zadra, 2006: Diurnal cycle of surface-flux probability distributions in regional climate models. *EGU Annual Meeting*.

Takle, E. S., J. Roads, B. Rockel, W. J. Gutowski, Jr., R. W. Arritt, I. Meinke, C. G. Jones, and A. Zadra, 2006: Do regional climate models perform better on their home domains? A transferability intercomparison. *EGU Annual Meeting*.

Takle, E. S., B. Rockel, W. J. Gutowski, Jr., J. Roads, R. W. Arritt, I. Meinke, and C. Jones, 2006: Transferability Working Group (TWG) of the GEWEX Hydrometeorology Panel. *Third ICTP Workshop on the Theory and Use of Regional Climate Models*. International Centre for Theoretical Physics, Trieste, Italy 29 May – 9 June 2006. [Invited].

Arritt, R.W. for the NARCCAP Team: North American Regional Climate Change Assessment Program (NARCCAP): Producing regional climate change projections for climate impacts studies. American Geophysical Union 2006 Fall Meeting, 11–15 December 2006, San Francisco, CA, USA.

#### **List of meetings, workshops**

CL015 Generality of Climate Models and their Components, European Geophysical Union Annual Meeting, April 2006, Vienna. Convened by R. W. Arritt and M. Bosilovich, this meeting solicited a number of papers on transferability.

Transferability Working Group Splinter Session European Geophysical Union Annual Meeting April 2006, Vienna.

Transferability Session, *Third ICTP Workshop on the Theory and Use of Regional Climate Models*. International Centre for Theoretical Physics, Trieste, Italy 29 May – 9 June 2006.  
NARCCAP participants meeting, March 2006. Boulder, CO

#### **Planned meetings, workshops**

NARCCAP participants meeting October or November 2006, Boulder, CO  
TWG Splinter Meeting, EGU April 2007, Vienna (tentative)

#### **List of members and their term dates:**

R. W. Arritt	Sept 2006
W. J. Gutowski, Jr.	Sept 2006
J. Roads	Sept 2006
B. Rockel	Sept 2006
C. Jones	Sept 2008
E. S. Takle	Sept 2006