NARCCAP

North American Regional Climate Change Assessment Program

THE FIRST USERS' WORKSHOP

February 14 & 15, 2008
UCAR
Boulder, Colorado

AGENDA

NARCCAP USERS' MEETING

NCAR, Foothills Lab, EOL Atrium

THURSDAY FEBRUARY 14 2008

8:30 – 10:00	PIs' meeting (PIs only)
10:00 - 10:15	Break (Users join group, pick up badges, materials)
10:15 - 10:45	Welcome and Overview - Linda Mearns General Introductions Outline of meeting structure High-level overview of NARCCAP
10:45 - 12:30	User Introductions
	Each user has 5-7 minutes to give a brief explanation of his/her work and how he/she uses climate model results, and plans for using NARCCAP data
12:30 - 13:30	Lunch (salads and sandwiches brought into meeting room)
13:30 – 14:00	Putting NARCCAP in a broader context - the IPCC and Introduction to AOGCMS used in NARCCAP - Richard Jones
14:00 - 14:30	Time Slice Experiments -- Isaac Held, GFDL AM2.1; Phil Duffy, CAM3
	Preliminary climate change results from the two AGCM time slice experiments
14:30 - 15:00	About the Regional Climate Models (RCM) - various modeling group members
	Representative from each RCM modeling group will talk for ~15 minutes about the important features of their RCM and what users ought to know about them.
15:00 - 15:15	Break
15:15 - 16:15	About the RCMs, continued
16:15- 16:35	Overview of NCEP-driven RCM results – Bill Gutowski
16:35 – 17:15	Discussion with users (topics TBD)

17:20 - 18:00	Cocktail hour - Foothills Lab Atrium
18:00	Dinner – Foothills Lab Cafeteria
20:00	Return to Golden Buff

FRIDAY FEBRUARY 15 2008

9:00 - 9:20	Earth System Grid (ESG) Introduction - Don Middleton
9:20 - 10:00	Introduction to Model Output - Seth McGinnis and Larry McDaniel
	Description of data - formats, organization, useful tools
10:00 - 11:00	Data Lab - Seth McGinnis, Larry McDaniel, and Jennifer Boehnert
	Walk through downloading data, hands-on experimentation and troubleshooting, presentation of data in GIS
11:00 – 11:15	BREAK
11:15 - 11:45	Model Uncertainty - Steve Sain
11:45 - 13:00	Lunch (salads and sandwiches in atrium)
13:00 - 14:00	Feedback & Discussion 1
	Small groups for discussion about user needs, concerns and how they should be met
14:00 - 14:45	Feedback & Discussion 2
	Collect back into large group to summarize small group discussions and general roundtable discussion - collect user ideas for web site
14:45 – 15:00	Final Wrap Up
15:00	Meeting Ends Super Shuttle to the airport

PI Biographies

Linda Mearns

Sebastien Biner

Philip Duffy

William Gutowski

Isaac Held

Richard Jones

Ruby Leung

Larry McDaniel

Seth McGinnis

Don Middleton

John Roads

Stephan Sain

Lisa Cirbus Sloan

Eugene Takle

LINDA O MEARNS:

Linda O. Mearns is Director of the Institute for the Study of Society and the Environment and Senior Scientist at the National Center for Atmospheric Research, Boulder, Colorado. She holds a Ph.D. in Geography from UCLA. She has performed research and published mainly in the areas of climate change scenario formation, quantifying uncertainties, and climate change impacts on agro-ecosystems. She has particularly worked extensively with regional climate models. She has most recently published papers on the effect of uncertainty in climate change scenarios on agricultural and economic impacts of climate change, and quantifying uncertainty of regional climate change. She has been an author in the IPCC Climate Change 1995, 2001, and 2007 Assessments regarding climate variability, impacts of climate change on agriculture, regional projections of climate change, climate scenarios, and uncertainty in future projections of climate change. For the 2007 Report(s) she is Lead Author for the chapter on Regional Projections of Climate Change in Working Group 1 and for the chapter on New Assessment Methods in Working Group 2. She is also an author on two Synthesis Products of the US Climate Change Science Program. She leads the multi-agency supported North American Regional Climate Change Assessment Program (NARCCAP), which is providing multiple high-resolution climate change scenarios for the North American impacts community. She is a member of the National Research Council Climate Research Committee (CRC) and Human Dimensions of Global Change (HDGC) Committee. She was made a Fellow of the American Meteorological Society in January 2006.

SÉBASTIEN BINER:

Sébastian Biner is a climate simulation specialist for the Ouranos Consortium in Montréal, Canada. As such, he contributes to the production, analysis and improvement of the regional climate simulations used by Ouranos users and partners. Scientifically, he is particularly interested in studies related to the internal variability, added value and uncertainties of Regional Climate Models. He is also strongly involved in maintaining and improving the operational infrastructure at Ouranos and in the distribution of climate simulation data. Sébastian is co-supervising graduate students and supervising interns. He has a M.Sc in atmospheric sciences and a B.Sc in physics from the Université du Québec á Montréal. Sébastian is a father of two and a ski and cycling enthusiast.

PHILIP B. DUFFY:

Philip B. Duffy is a research scientist at the Lawrence Livermore National Laboratory. In addition, he is Associate Adjunct Professor in the school of Natural Sciences at U.C. Merced, and is Director of the University of California's Institute for Research on Climate Change and its Societal Impacts (IRCCSI). His primary research interest is in improving understanding of the societal impacts of climate change (impacts on water availability, air quality, human health, etc.), particularly as they affect California. With this goal in mind he has worked towards improving the regional-scale fidelity of global climate models, and uses these models to understand how climate change will affect our region. Dr. Duffy has a A.B. degree from Harvard in Astrophysics, and a Ph.D. from Stanford in Applied Physics. He has published papers in astrophysics, atomic physics, and climate research. He is the father of two children.

WILLIAM J. GUTOWSKI, JR.:

William J. Gutowski, Jr. is professor of meteorology in the Department of Geological and Atmospheric sciences at Iowa State University, with a courtesy appointment in agronomy.

Dr. Gutowski's research concentrates on the role of atmospheric dynamics in climate. Central focuses are the dynamics of the hydrologic cycle, regional climate and changes in extreme weather and climate. Because processes on a wide range of spatial and temporal scales are important for all of these, his research program entails a variety of modeling and data analysis approaches. The regional research uses models covering only a portion of the earth (limited-area models) and global models whose resolution varies with location (stretched-grid models). Data analysis approaches include study of spatial patterns and analysis of precipitation and energy spectra. His work includes regional modeling of African, Artic and East Asian climates and has significant collaboration with scientists in these regions. Much of his work is through the Regional Climate Modeling Laboratory, which he coordinates with Dr. Eugene Takle and Dr. Ray Arritt. Within NARCCAP, he is coordinating with Iowa State colleagues the NCEP-driven simulations and their analysis. He has also helped with development of the NARCCAP archive.

ISAAC HELD:

Dr. Isaac Held is a Senior Research Scientist at NOAA's Geophysical Fluid Dynamics Laboratory, where he conducts research on climate dynamics and climate modeling, and is head of the Weather and Atmospheric Dynamics Group. He is also a lecturer with rank of Professor at Princeton University, in its Atmospheric and Oceanic Sciences Program, and is an Associate Faculty member in Princeton's Applied and Computational Mathematics Program and in the Princeton Environmental Institute. Dr. Held is a Fellow of the American Meteorological Society (1991) and the American Geophysical Union (1995), and a member of the National Academy of Sciences (2003). He recently received the AMS Carl Gustav Rossby Gold Medal (2008). He was a lead author of Ch.11 of the WG1 AR4 report on regional projections. He is particularly interested in the connections between planetary scale aspects of climatic responses and regional issues. He has coordinated the contribution of GFDL to NARCCAP, working with Bruce Wyman both to provide time-resolution output from GFDL's AR4 model (CM2.1) for downscaling and to provide data over North America from a time slice simulation with a ~50km version of AM2.1, the atmospheric component of the GFDL model.

RICHARD JONES:

Richard Jones is manager of regional predictions at the Meteorological Office Hadley Centre. His main responsibilities are to provide state of the art regional climate modelling systems and to provide and analyse regional climate change scenarios and advice on these as required under contracts for various UK government departments and international bodies. He developed regional climate modelling in the Hadley Centre involving development of a consistent GCM/RCM modelling system; domain-size experiments; climate simulations driven by numerical weather prediction analyses; multi-decade regional climate change experiments; development of GCMs to provide high quality boundary conditions for RCMs; ensemble regional climate change experiments. He is a lead or major contributing author to many publications in regional climate modelling and was a lead author of the IPCC Assessment Reports Three and Four. He led the development of the regional climate modelling system PRECIS, has worked with many European institutes and is currently working with institutes across all continents in the fields of climate prediction and climate scenario development and application. In the NARCCAP project he is responsible for providing boundary conditions from Hadley Centre global climate model projections for downscaling by NARCCAP RCMs, for downscaling the GCMs used in NARCCAP with PRECIS and assisting with interpretation of the model projections.

RUBY LEUNG:

Ruby Leung is a Laboratory Fellow at the Pacific Northwest National Laboratory (PNNL) and an Affiliate Scientist at the National Center for Atmospheric Research. She received her MS and Ph.D. in Atmospheric Science from the Texas A&M University in 1988 and 1991. Her primary research focus is in regional climate modeling. In the early 1990's, Dr. Leung developed a regional climate model with special features that account for the subgrid scale effects of topography, lake and vegetation. Her model enables the coupling of climate and hydrologic processes in regions with complex orography. Dr. Leung has led several multi-disciplinary projects to examine the impacts of climate variability and change and the effects of aerosols on the regional hydrological cycle. In 2001, Dr. Leung organized the Workshop on "Regional Climate Research: Needs and Opportunities" co-sponsored by the National Science Foundation and Department of Energy to examine various approaches to modeling regional climate. More recently, she is working with collaborators at NCAR to develop regional climate modeling capability with the Weather Research and Forecasting (WRF) model. She organized the Workshop on "Research Needs and Directions of Regional Climate Modeling Using WRF and CCSM" in 2005. The workshop identified the needs to develop capability for high resolution modeling, regional earth system modeling and up scaling. Dr. Leung's role in NARCCAP is to perform dynamical downscaling using the WRF model, and to participate in evaluation and intercompari8son of dynamical downscaled climate change scenarios for North America.

LARRY MCDANIEL:

Larry McDaniel is a software engineer in ISSE who has worked on climate, climate change and climate impact on agriculture for the past twenty years here at NCAR. He prepares data sets (observed and model out put) for use in agricultural models, heat wave studies as well as other projects. Along with Seth McGinnis, he is doing the quality checking of the model data to be published on the Earth System Grid.

Larry plans to use the NARCCAP data for the above purposes as well as for health and city studies.

SETH MCGINNIS:

Seth McGinnis has worked as an Associate Scientist in ISSE at NCAR since 2003, shortly after he received his Ph.D. in geophysics from CU-Boulder. He has a strong background in computer programming and works on a variety of projects related to making atmospheric science data accessible and usable to end-users of all types. His role in NARCCAP, along with Larry McDaniel, is to quality check (QC) the model data as it is submitted for archiving and publication, checking for errors and ensuring that it meets the formatting and metadata requirements of the project.

DON MIDDLETON:

Don E. Middleton leads the Visualization and Enabling Technologies Section in NCAR's Computational and Information Systems Laboratory. He is responsible for developing and managing an emerging technologies program that encompasses data and knowledge management, analysis and visualization, collaborative visual computing environments, Grid computing, digital preservation, and education and outreach activities. Don's professional interests center on the frontiers of managing, preserving, and analyzing large, complex earth system datasets and communication using advanced visual technologies. Don is currently serving in a PI or co-PI capacity on a number of projects, including: the *Earth System Grid*, the *Earth System Curator*, the *Virtual Solar Terrestrial Observatory*, the *North American Regional Climate Change Assessment Program*, the *Cooperative Arctic Data and Information Service*, and NCAR's *Cyberinfrastructure Strategic Initiative.* Don recently completed a term on a National Research Council committee for NEES/NEESGrid and Earthquake Engineering and was a contributing author for the new publication, *The Visualization Handbook*.

JOHN ROADS:

Dr. John Roads is a Senior Scripps Research Meteorologist, Sr. Lecturer and Director of the Experimental Climate Prediction Center (ECPC) at the Scripps Institution of Oceanography, University of California, San Diego. He is also the co-chair of the Global Energy and Water-cycle Experiment (GEWEX) Coordinated Energy and water-cycle Project (CEOP). Dr. Roads was a previous chair of the National Centers For Environmental Research (NCEP) Regional Reanalysis Scientific Advisory Committee, several international Regional Spectral Model workshops, and the National Research Council GEWEX committee. He has also been a Principal Investigator on many NOAA, NASA, USFS; and other US agency grants. He is a Fellow of the AMS and has published more than 140 refereed articles. Dr. Roads is the ECPC principal investigator in charge of contributing the Regional Spectral Model (RSM) simulations to NARCCAP.

STEPHAN SAIN:

Stephan R. Sain is the head of the Geophysical Statistics Project in the Institute for Mathematics Applied to Geosciences at the National Center for Atmospheric Research. He received undergraduate degrees in mathematical sciences and statistics as well as a masters and PhD in statistics from Rice University in Houston, TX. His research area involves nonparametric function estimation, spatial statistics, statistical computing, environmental statistics, and applications in the geosciences. As a NARCCAP co-Pi, he is reasonable for the development of statistical methodology to assess and quantify uncertainty in addition to other statistical issues that arise in the design of the NARCCAP experiments and the analysis of the model output.

LISA CIRBUS SLOAN:

Lisa Cirbus Sloan is a Professor of Earth and Planetary Sciences and the Director of the Climate Change and Impacts Laboratory the University of California Santa Cruz (UCSC). She is also the Vice Provost and Dean of Graduate Studies at UCSC. Sloan received her B.S. from Allegheny College and her Ph.D. from Pennsylvania State University, and did postdoctoral work at the University of Michigan. Sloan joined the faculty at UCSC in 1995. Sloan has been the National Secretary of the American Geophysical Union's Ocean Sciences Section, a scientific Fellow of the David and Lucile Packard Foundation, Editor-in-Chief of the international journal *Global and Planetary Change*, editor of the international journal *Paleoceanography*, and has co-chaired the National Center for Atmospheric Research's Paleoclimate Working Group. She has served and continues to serve on and many national scientific advisory boards that deal with past and future climate change as well as scientific computing challenges. Sloan's research is concentrated in two broad areas: (1) understanding the mechanisms of climate changes in the geologic past and (2) studying and modeling future climate change at regional scales and investigating the possible impacts of future climate change on human and natural systems. She has authored or coauthored more than 60 peer-reviewed articles and book chapters, and is a frequent public speaker in California on issues of climate change. For more information, see http://www.es.ucsc.edu/~lcsloan/

EUGENE S. TACKLE:

Eugene S. Tackle is professor of Atmospheric Sciences and Agricultural Meteorology at Iowa State University.

Eugene's current climate-related research includes both basic research on climate change and impacts of climate change. Basic research centers on how the features of the earth surface influence turbulent flow and exchange processes that influence surface momentum, energy, and moisture fluxes. Research on climate-change impacts includes assessing the interactive roles of climate and land-manager choices on land-use/land-cover change in agricultural area, development and evaluation of downscaling tools for near-surface flow and impacts of climate change on wind power, evaluating effects of climate changes on Midwest agroecosystems using a climate-crop coupled model, and assessment of variability and trends in Iowa climate data on pavement performance by use of a mechanistic-empirical pavement design model. The land-use/land-cover project uses SWAT (Soil and Water Assessment Tool) to simulate streamflow in large complex watersheds in agricultural areas under current and future scenario climates. Changes in surface wind speed and wind power over the 20th and 21st Centuries are explored through use of statistical downscaling and regional climate models. By coupling crop models with regional climate models we explore the impact of crop selection on carbon uptake and evapotranspiration over the Midwest during the growing season. Roadways in Iowa have been designed under assumptions of average climate conditions that do not reflect actual climate variability or future climate change. Working with civil engineers we are using a standard pavement design model to explore expected changes in various roadway failure modes under actual variability and projected trends in climate over the next 60 years.

Eugene's role in NARCCAP is as part of the ISU team organizing and analyzing the reanalysis-driven runs and contributing to the scenario-driven runs. A central focus is promoting appropriate and effective use of regional climate model information in impacts studies.

User Biographies and Plans

Bruce Anderson
Christopher Anderson
Barry Baker
Melissa Bukovsky
Greg Carbone
Andres Flores
Philippe Gachon
Gregg Garfin
Mark Green
Radley Horton
Linda Mortsch
Victor Magaña
Martin Montero-Martinez
Trevor Murdock
Robert Oglesby
Jose Luis Perez Lopez
Alex Ruane
Eric Salathé, Jr.
Nadine Salzmann
Anji Seth
Chris Weaver

BRUCE T. ANDERSON:

Bruce T. Anderson is an Associate Professor in the Department of Geography and Environment at Boston University. He serves as a Research Consultant for the Northeast Climate Impacts Assessment (NECIA) project and heads the Experimental Center for Remote Observations of Production (ECROP). He has also served as the Associate Chair for the Department. He has been a Royal Society Visiting Fellow, a National Research Council Fellow and a NOAA Visiting Scientist Fellow. His research interests include: Regional impacts of climate variability; Large-scale and regional atmospheric dynamics and hydrology; Coupled ocean-atmosphere modes of variability; and Historic and future climate trends within observations and climate-simulation models. He received his Ph.D. from Scripps Institution of Oceanography in 1998 and graduated with a B.S. in Physics from University of California, Santa Barbara in 1994.

RESEARCH INTEREST:
We plan on using the NARCCAP data to help identify and analyze non-linear behavior in the time evolution of climate parameters derived from global and regional climate change predictions. While many climate parameters—such as global and regional temperatures- show a quasi-linear response to changes in radiative forcing associated with increasing greenhouse gas concentrations, other parameters—such as water availability, heat indices and extreme event occurrences—may behave in more complex ways. We have developed a method for using spatio-temporal data from global and regional climate forecasts to identify whether they show non-linear time evolutions. These non-linear evolutions can include increasing/decreasing sensitivity with time, as well as "turning" points in which initial responses differ in both sign and magnitude from longer-term responses. Preliminary results from regional climate forecasts for the Northeastern US, as well as from global climate forecasts for the Western US, indicate a strong non-linear response in soil moisture, with initial increases in both regions, followed by substantial drops once CO_2 concentrations reach twice pre-industrial levels. This type of information can subsequently be used for local and region mitigation and adaptation activities in response to global climate change.

We will also use the NARCCAP data to further investigate physical and socio-economic impacts that arise from regional climate variations resulting from increased greenhouse gas concentrations over the next century. Previous results have focused upon the summertime climate for the Northeastern US. In this region, overall summertime precipitation totals are expected to increase over the northern and southern portions of the domain but decrease across the central portions; heavy-rainfall events are expected to increase across almost the entire domain, both with respect to frequency as well as intensity. Increased evaporation combined with increased temperatures are also expected to significantly increase the daily maximum heat index for the region; in addition, the number of days with extremely high heat-index values are expected to increase by approximately 450% and for certain regions days with heat index values that reach 32.2ºC (90ºF)—the level of "extreme caution"—could occur approximately 40-50% of the time during summer. Future research will focus on refining these results using data derived from the NARCCAP. In addition, future work will examine similar hydrologic variations over the southwestern U.S., which is expected to be strongly and imminently impacted by anthropogenic-induced climate change. In these regions, the combination of warmer regional temperatures, recurrent drought, and increasing populations all point to future conflicts among water users.

CHRISTOPHER J. ANDERSON:

Christopher J. Anderson is Lead Mesoscale Modeler at the NOAA/ESRL/GSD in Boulder, CO.

For the past 2 years, his primary task has been to manage all weather forecast demonstration projects within ESRL/GSD/FAB. These typically include forecasts of 1-day to 3-day lead time. An effort has been established to develop regional climate modeling techniques for assessments of extremes in precipitation. Also, connections have been established with the Western Water Assessment. Prior to Christophers work at NOAA/ESRL, he was employed at Iowa State University where he contributed to the Project to Intercompare Regional Climate Simulations and the North American Regional Climate Change Assessment Project.

Intended uses of NARCCAP data:

(1) Examination of warm season precipitation extremes including daily rates and water cycle dynamics.
(2) Examination of Colorado River Basin variables that are critical to hydrological impacts, such as snow pack, run off, and summertime monsoon precipitation. Assess impacts by working with hydrologists and water managers.
(3) Examination of winter time precipitation and snow pack in the Sierra Mountains.

BARRY BAKER, PH.D.:

Barry Baker, Ph.D. is currently working as ecosystem scientist for The Nature Conservancy's Climate Change Team. He received his doctorate from Colorado State University in 1991 where his research focused on the effects of climate change on grassland/livestock ecosystems. More recently he has been using climate and dynamic vegetation models to identify potential impacts of climate change on ecosystems in northwestern Yunnan China. In addition he is working with several universities, and national laboratories in the US to conduct regional-scale climate change vulnerability and impact analyses and incorporating results into conservation planning. His research interests include bioclimatology, biogeography, and terrestrial ecosystem modeling for predicting the impacts of climate change on biodiversity especially in grassland and high altitude ecosystems.

Barry is collaborating with several vegetation modelling groups (SAGE, LPJ, MC1, and Century) to simulate impacts of climate change on terrestrial systems. He will be using the data provided by the NARCCAP as climate forcings for the various vegetation models. Results will be used to help guide conservation strategies and evaluate ecosystem processes.

MELISSA BUKOVSKY:

Melissa Bukovsky is currently working on a Ph.D. in Meteorology at the University of Oklahoma under the guidance of Dr. David Karoly. She finished a M.S. in meteorology at OU in 2004. A paper based on her Master's work was published in *Weather and Forecasting* in June 2006 and was entitled "Bowing convective systems in a popular operational model: Are they for real?" Before moving to Norman, OK, Melissa lived in the Chicago area where she completed a B.S. in meteorology at Northern Illinois University in 2002 after receiving an Associate in Science from the College of DuPage. Her current research is focused on precipitation in climate models. Specifically, Melissa is looking at the sensitivity of precipitation to convective parameterization and model resolution, potential future changes in regional precipitation in different climate change scenarios, and the implication of precipitation changes in surface hydrology.

RESEARCH PLANS:

The NARCCAP project and my current area of research are very closely related, so I plan to use NARCCAP data to expand my work. Since I am currently downscaling output from the CCSM using the WRF to look at the impact of climate change on warm-season precipitation on sub-continental scales, I would like to analyze my data alongside that which is produced by NARCCAP. I will be focusing on summertime convection: its intensity, distribution, frequency, diurnal cycle, etc. Assuming that we will be using different WRF setups, it will likely allow me to expand my sensitivity study on the impact of parameterization choice as well. NARCCAP data may also be used in the distributed hydrologic model I plan to run using my downscaled data. Due to computational limitations, I will only be downscaling warm-season months. Provided that it is available in time, NARCCAP data would allow me to run the hydrologic model for full years, which would be more appropriate in the basin I am studying (the upper Arkansas). I am also currently working on a side-project with two other graduate students from two different departments where we are statistically downscaling climate model output to look at the impact of climate change on species propagation in two different, biologically diverse regions of the world. This study could also be expanded to make use of the NARCCAP output, as it would certainly remove some of the uncertainties created by the degree to which we are currently downscaling model output that may not be capturing 20th century precipitation realistically to start.

GREG CARBONE:

Greg Carbone is Associate Professor of Geography, University of South Carolina, Columbia, SC, USA. His research interests center on climate variability and change and impacts on agriculture and water resources. Some of his recent research papers on these topics have appeared in *Agronomy Journal, Bulletin of the American Meteorological Society, Climatic Change, Integrated Assessment, Journal of Climate,* and *Journal of the American Water Resources Association.* He is a principal investigator for the Carolinas Integrated Science and Assessment group, part of the NOAA-RISA program. He holds a B.A. from Clark University, an M.A. from the University of Kansas, and a Ph. D from the University of Wisconsin.

The Carolinas Integrated Sciences and Assessments group is partnering with Dr. Larry Band at the University North Carolina to examine the impacts of climate variability and change on stream flow and water quality in the Carolinas. The project reflects our collective effort to understand the hydroclimatology of large watersheds in the Carolinas, and to develop related decision support tools for resource managers in these watersheds. The goals of this specific venture include: statistical evaluation of general circulation model (GCM) and regional climate model (RCM) output for the Carolinas, measurement of hydrologic model sensitivity to a suite of meteorological inputs, and comparison of output generated by the Soil and Water Assessment Tool (SWAT) and Hydrologic Simulation Program-Fortran (HSPF) models.

DR. PHILIPPE GACHON:

Research Scientist –Adaptation and Impacts Research Division
Atmospheric Science and Technology Directorate, **Environment Canada** @ McGill University, Montreal, Québec, Canada

Affiliations

- Adjunct Professor, Centre pour l'Étude et la Simulation du Climat à l'Échelle Régionale (ESCER), Department of Earth and Atmospheric Sciences, University of Québec at Montreal (UQAM), Montréal, Québec.
- Invited Professor, Institut National de la Recherche Scientifique, Eau-Terre-Environnement (INRS-ETE), University of Québec, Québec.
- Associated member, Global Environmental and Climate Change Centre (GEC3) at McGill University (www.mcgill.ca/gec3).

Current Research topic:

- High resolution extreme climate scenarios & Statistical downscaling methods
- Extremes analysis: temperature, precipitation, winds and hydrologic variables
- Dynamical downcaling
- Large/Mesoscale interactions under historical climate conditions

Main interests related to current project:

- Funded project by the National Sciences and Engineering Research Council, (NSERC, Canada) in which both dynamical downscaling model (RCMs) and statistical downscaling tool (multisite) will be used to develop probabilistic assessment of regional changes in climate variability and extremes over Canada, in collaboration with ENSEMBLES European (RT2B/RT3 group) & US NARCCAP.
  Team members (Canadian and *partners*) : Pr. VTV **Nguyen** (McGill), P. **Gachon** & X. **Zhang** (EC), Prs R. **Laprise** & C. **Jones** (UQAM), Prs TBMJ **Ouarda** & A. **St-Hilaire** (INRS-ÉTÉ), Pr. W. **Hsieh** (UBC), *C. **Goodess** (CRU, UK), L. **Mearns** (NCAR, US), J. **Christensen** (DMI, Danemark) & G. **Flato** (CCCma, Canada).*

Use of NARCCAP data and main objectives related to our current projects:
The main objectives and the current applications of RCMs simulations will be:

1) To analyse and validate the RCMs with others models over Canada based on climate extremes (current period)
2) To intercompare RCMs with the new generation of multisite statistical downscaling (SD) method developed in Canada and over regions in US in collaboration with NARCCAP;
3) To develop new series of predictors at the regional scale using the RCMs outputs and analyze the added values compared to GCMs atmospheric variables used in SD methods;
4) To discriminate the role of large versus regional scales influence in the occurrence, intensity and duration of extreme events over Canadian areas;
5) To construct high resolution climate changes across various selected regions in Canada with ensembles runs and with uncertainties analysis;

6) To evaluate and quantify the cascade of uncertainty from coarse scale (GCMs) to regional/local scale downscaling model (RCMs and SDs),
7) To help to develop reliable daily time series under climate change conditions for their applications in water resources, agriculture, risk management, and various areas in environmental modeling.

Table 1: Matrix of simulations from GCMs, RCMs, and SDs (downscaling method shows an X uses input from GCM, and/or a number uses input from GCM and RCM).

			Forced by							
			CGCM3 (CCCma)		GFDL	HadCM3 (Hadley)		CCSM (NCAR)		
RCM	1	MM5 (NARCCAP)			X	X				
	2	RegCM3 (NARCCAP)			X					
	3	HadRM3 (NARCCAP)				X				
	4	CRCM (Ouranos-EC)	X							
	5	RSM (NARCCAP)						X		
	6	WRF (NARCCAP)						X		
	7	Others from EC-UQAM-Ouranos	X, GEM							
SD	A	ASD: Multiple Linear Regression (CAG*)	X	2		X	2	X		
	B	ASD: IDF Curves (CAG*)	X	2		X	2	X		
	C	ASD: Neural Network (CAG*)	X	2		X	2	X		
	D	Neural Network - Genetic (CAG*)								
	E	Neural Network - Gaussian Kernel (UBC)								
	F	Canonical Correlation Analysis (CAG*)	X	2		X	2	X		
	G	Principal Components Analysis (CAG*)	X	2		X	2	X		

*(CAG): Climate Analysis Group; ASD : Automated Statistical Downscaling

Table 2. List of atmospheric predictor variables used to develop statistical downscaling methods and variables used to validate/compare downscaling model results.

VARIABLES	**DESCRIPTION**
Surface & Near-Surface : Temp, SHF, LHF, SW-LW, GC, snow & soil water content, Topo., MSLP & winds	Temperature (surface & 2 m), diabatic terms (heat, latent & radiation), ground cover (land/sea/sea-ice), snow/water (liquid/frozen), topography, Mean sea level pressure & 10m winds (U&V)
Pressure level (1000, 925, 850 700, 600, 500, 300 & 200-hPa,)	T, GZ, SH, U&V, and Cloud

All these variables must be available and shared from the full domain over North America.

GREGG GARFIN:

Dr. Garfin is a co-investigator on the Climate Assessment for the Southwest (CLIMAS) project. His CLIMAS work includes identifying climate services useful to assisting stakeholders mitigate, cope with, and adapt to climate-related risks. He is trained as a climatologist, dendroclimatologist, and geographer. His research interests include climate change, climate variability, and drought, and the effective delivery of climate science to decision makers. Much of his recent effort has been devoted to scientist-stakeholder processes that inform risk management and prepare for drought and adaptation to climate changes.

Dr. Garfin is a contributor to the U.S. Climate Change Science Program's Synthesis and Assessment Product 5.3. From 2003-2007, he served as co-chair of Arizona's drought monitoring technical committee. In 2004, he served as a member of the integrated team for the development of a National Integrated Drought Information System. He is also a climate science co-chair for the Arizona Water Institute.

NARCCAP DATA USE:
I am representating three projects with interests in using NARCCAP data: the Climate Assessment for the Southwest (CLIMAS) project, the University of Arizona Institute for the Study of Planet Earth (ISPE), and a National Institute for Climate Change Research (NICCR) project on future vegetation changes in the Colorado Plateau. My CLIMAS and ISPE colleagues propose to use NARCCAP data in the following ways:

1. To help stakeholders in the southwestern United States prepare for climate changes, in particular, water management and ecosystem management adaptation planning. As an example, we are working closely with the Arizona Department of Environmental Quality on a climate change adaptation plan for the state, and NARCCAP output will undoubtedly assist in this process.
2. We would like to present NARCCAP images, and perhaps data subsets, on our forthcoming climate change website. If feasible and permissible, we are interested in including NARCCAP output in a climate data explorer tool, which would allow users to peruse the data, in order to examine regions, parameters, and time periods of interest.
3. In public presentations about projected climate changes for the Southwest.
4. As inputs to research on potential climate change economic impacts to water resources, agriculture, tourism, and ranching. These projects are being conducted by CLIMAS colleagues Bonnie Colby and George Frisvold, as part of the CLIMAS 2007-2012 Phase III.

The NICCR project specifically requires fine spatial-scale data on projected temperature (minimum and maximum), precipitation, humidity, and evapotranspiration. These parameters will be input to a species-specific vegetation model, in order to project future changes in plant species range.

MARK B. GREEN:

Water Systems Analysis Group
Complex Systems Research Center
Institute for the Study of Earth, Oceans, and Space
University of New Hampshire
Work Phone: 603-862-1053
E-mail: mark.green@unh.edu

Mark researches the role of the hydrologic cycle in biogeochemical cycling. He is am particularly interested in how water pathways through the hydrologic cycle influence the ecological stoichiometry of nutrients in aquatic and terrestrial ecosystems. His educational background spans a biology undergraduate degree (Minnesota State U., Mankato), hydrology M.S. degree (U. of Nevada, Reno), and a Ph.D. in Water Resources Science (U. of Minnesota).

Mark is currently a post-doc working on a hydrologic synthesis project supported by NSF and the Consortium of Universities Allied in the Hydrologic Sciences, Inc. (CUAHSI) and hosted at the University of New Hampshire. We are addressing human-induced changes of the hydrologic cycle in the Northeast U.S. over the period 1600 to 2100, which we term “the 500-year challenge”. This 500-year challenge will be addressed using regional Earth system models, large basin watershed models, small-scale virtual watersheds, and hydro-system indicators. As synthesis, this project will rely solely on existing information and well-established data sets. NARCCAP will likely be a source of information that will be incorporated into our hydrologic synthesis project. More specifically, we see NARCCAP as a source of information to run future scenarios for the Northeast U.S. with our Earth system and large basin models.

Beyond our synthesis project, other members of the Water Systems Analysis group are active in modeling the hydrology and nitrogen biogeochemistry in basin of the Northeast U.S. NARCCAP products will be central in simulating future changes to the hydrology and nitrogen biogeochemistry of the New England region.

RADLEY HORTON:

Radley Horton is an Associate Research Scientist at the Center for Climate Systems Research at Columbia University, working with Cynthia Rosenzweig's Climate Impacts group. He conducted his graduate work with David Rind at NASA's Goddard Institute for Space Studies and Columbia University in New York. His Ph.D. research focused on regional impacts of climate variability and climate change as simulated by Global Climate Models. He has published on topics including polar climate, high-latitude climate variability and change, sea level rise, and adaptation to climate change. He is involved in current (and recent projects) in the New York Region examining impacts of climate change on the water system, transit systems, and Long Island coastal ecosystems. Additional projects include climate change impacts on agriculture in the Southeastern United States and Central America, alternative projections of 21st century sea level rise, and impacts of changing lower boundary conditions on Arctic meteorology. At the Center for Climate Systems Research, he helps conduct regional climate change scenario assessments for stakeholders around the globe.

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Of primary initial interest is the downscaled 20th Century climate scenario, followed by the A1B scenarios in the mid 21st Century.

LINDA MORTSCH:

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RESEARCH INTERESTS:

1) Climate change vulnerability, impacts and adaptation assessment in water resources (quantity and quality), and inland coastal wetland ecosystems
   - development of climate change scenarios for water resources planning and management
     - working with water resource practitioners in developing climate change scenarios for incorporation into strategic watershed planning (e.g., source water protection) and flood plain management and emergency preparedness
     - climate change scenarios applied in impact assessments for the Great Lakes basin have used GCM output; how can dynamical downscaling (regional climate model) results be applied in this context; how can we use multi-ensemble runs; how do the RCMs "behave" over the Great Lakes Basin
   - development of daily extreme precipitation scenarios for erosion, water quality and flooding impact and risk assessments
2) Climate change adaptation in community design and urban planning
   - adaptation to climate change would require significant changes to design standards for streets, buildings, open spaces, and infrastructure systems. Changes would likely be required at the scale of the region, the city, the district, and the site.
     - how can climate change scenarios be developed to understand impacts of a changing climate and to deveop

AFFILIATIONS:

Adjunct, Geography Department, Faculty of Environmental Studies, University of Waterloo

APPLICATIONS OF NARCCAP DATA**:**

1) Development of multiple, high resolution climate change scenarios for water resources and ecosystem modelling studies in selected regions in Canada;
2) Development of daily precipitation time series for applications in water quality modelling (e.g., erosion), hydrologic modelling for flooding impact assessment and assessment of adaptation strategies (e.g., design floods, detention ponds)

VICTOR MAGAÑA:

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Mexico City 04510
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Ph.D from the University of California Los Angeles
Currently at the National Autonomoius University of Mexico
Man interests on dynamics of climate in the Mexico, Central America and Caribbean region, and the use of climate information to reduce vulnerability on various socioeconomic sectors, including adaptation to climate change.

As part of the official plans of the Mexican government to respond to the challenge on Climate Change, there is a need to formulate adaptation plans at the state level. This requires downscaling climate change scenarios to the state level, and at times at the basin level, since the water sector is one of those considered as a priority in the adaptation process.

Members of the Tropical Meteorology group at the National University of Mexico have explored various venues on how to downscale GCM output and on how to consider the climate statistics to properly manage risk of climate change at the regional level. The most important lines of research include the use of statistical tools to downscale GCM climate change scenarios used for the IPCC AR4. There are two basic developments: 1) the statistical downscaling model, known as SDSM, to construct local climate change scenarios, and 2) the use of the Climate Predictability Tool (CPT) developed at the IRI to downscale monthly conditions using GCM output. Results from the CPT have been compared with output from mesoscale models as PRECIS from the Hadley Center and the Earth Simulator from the Meteorological Research Institute for the domain of Mexico and the Caribbean Sea.

At present, we are coupling a stochastic weather generator to explore changes in extreme events under climate change and compare with observational analyses of trends in severe storms and drought for the last one hundred years in Mexico.

MARTIN JOSE MONTERO-MARTINEZ

Profession: Atmospheric Physicist
Date and Place of Birth: January 30, 1968. Mexico City.
Working at IMTA since: February 2000
Education: BS in Physics (1989), Autonomous University of Puebla (Mexico)
MS in Geophysics (1993), National Autonomous University of Mexico
PhD in Atmospheric Sciences (1999), University of Arizona (USA)
Postdoc (1999-2000, 1 Yr) at University of Dalhousie (Canada)

Detailed Tasks Assigned:

- To perform research in the fields of aerosols (biomass burning), global climate change, atmospheric numerical modeling, and adaptation measurements to climate change.

Relevant projects:

- **2007 Climate impact effects and potential impacts on water resources in Mexico.**
  Funded by IMTA 2007. Responsible of providing IPCC (GCMs) analyzed data.
- **2007 Climate trends of extreme hydrometeorological phenomena in Mexico during the last 40 years.**
  Funded by CONACYT-CONAGUA 2007-2010. Principal Investigator.
- **2006 Implementation of the atmospheric model CAM3 in the USMN cluster.**
  Funded by CONAGUA 2005-06. Principal investigator.
- **2005 Climate change studies in the precipitation features due to land cover and use change in northwestern Mexico.**
  Funded by IMTA 2005. Principal investigator.
- **2004 PNUD/INE/CCA/IMTA: Promotion of capacities for stage 2 of climate change adaptation in Central America, Mexico and Cuba**
  Funded by GEF 2004-2006. Responsible for the water sector in the Mexican part.
- **2002 CONACYT/IMTA J38238-T: Monitoring biomass burning aerosols in Southeast Mexico to characterize their optical and radiative properties and determine their regional climate impacts**
  Funded by CONACYT 2002-2004. Principal Investigator (3 colaborators + 5 students)
- **2001 CONACYT/IMTA I35630-T: Estimate of the climate impact in Mexico due to the global biomass burning aerosols by using the model NCAR-CCM3**
  Funded by CONACYT 2001. Principal Investigator (individual).

Why I am interested in NARCCAP data?

Jose Luis Perez and myself currently are working in a project for the Mexican Meteorological Service in which we will need to use dynamical downscaling to regionalize scenarios data from the NCAR-CCSM model for all of Mexico. Thus, our interest in your data is based in which you cover some part of Mexico using different coupled GCMs regionalized with different regional models. Thus, one of our key questions is to know what kind of possibility would be that you could cover all of Mexico in NARCCAP future work. Other question is to know more about the downscaling process that you use, and based on that, to know once and for all if we are working in the right direction.

TREVOR MURDOCK:

Trevor Murdock is Associate Director of the Pacific Climate Impacts Consortium in Victoria, BC. For the past 12 years, he has worked on applications of climate research to assist decision-making and planning. Trevor's work has focused on climate scenarios and online mapping tools, downscaling to high resolution, analysis of historical climate data and improvement of seasonal climate predictions.

ROBERT J. OGLESBY:

Robert Oglesby is currently (since 2006) a Professor of Climate Modeling in the Department of Geosciences and the School of Natural Resources at the University of Nebraska, Lincoln. Prior to that he was a Senior Research Scientist at NASA's Marshall Space Flight Center from 2001-2005, and an Assistant and Associate Professor in the Department of Earth and Atmospheric Sciences at Purdue University from 1992-2000. He obtained his PhD in Geophysical Fluid Dynamics from Yale University in 1990, working under Prof. Barry Saltzman. Robert has particular research interests in land surface-atmosphere interactions, particularly how soil moisture and snow cover may provide some predictability of precipitation on seasonal and longer time scales. He is also interested in the role of the hydrologic cycle in potential future climate change, especially at regional scales. Robert also using regional models to evaluate the potential climatic effects of land use changes, e.g., a large-scale transition from growing corn to growing switchgrass for biofuels.

NARCCAP Data Plans:

Increasingly, my research group has been using regional climate models. We have particular interests in the US Great Plains, Southeast, and Southwest. The models we primarily use are MM5 and WRF; our research collaborators also use the RSM. My goal for this workshop is not to come in with a specific need, but rather to gain a better understanding of the wide range of models used for NARCCAP, the datasets that have been produced, and how they may assist my group in our ongoing research projects.

JOSE LUIS PEREZ LOPEZ:

Jose Luis Perez Lopez is a Physicist of the Faculty (Power) of Sciences of the National Autonomous University of Mexico (UNAM). From 2000 he received his Master Sciences in Atmospheric Physics at the Posgrado of Sciences of the Earth of the UNAM in 2000. Currently he is a student of doctorate in Atmospheric Physics inside the Posgrado of Sciences of the Earth of the UNAM. Since 2001 he is a researcher associated in Hidrometeorología's department of the Mexican Institute of Technology of the Water (IMTA). Jose Luis' thesis works has been on the generation of scenes (stages) of climatic change of rain and temperature for Mexico SRES 92 (1997), and on the simulation of the regional climate in the center of Mexico using the model MM5 (2000). His topics of interest are to study the climatic regional variability of Mexico and the interactions between the atmosphere and the ocean as part of the processes that determine the regional climate. In 2007 initiate together with the Dr. Montero the evaluation of the scenarios of climatic regional change for Mexico applying the algorithm REA of Giorgi and L. Mearns, considering the ensamble models that they took part in 4th report of the IPCC. Jose Luis possesses skills in the processing and analysis of meteorological and climatological information, also in the experimental design of diagnosis, forecast in real time and of sensibility experiments for changes in the landuse in several Mexican regions.

Plan to use NARCCAP's results:

With the information of NARCCAP we will use them to evaluate the anticipated impacts on the sector of water resources of the north of my country. In October 2007, he was in contact with Seth McGinnis, expressed that his group of work needs to generate the regional scenarios according to NARCCAP's plan, but for the whole region of Mexico, the Caribe and Central America, he defined it as Mesoamerica's domain. For the present Dr. Montero and Jose Luis are initiating the process of obtaining the scenes (stages) A2 and A1B of climatic change for Mesoamerica's region using the models MM5/WRF to a scale of 40 Kms.

ALEX RUANE:

Alex Ruane is an ORAU/NASA Postdoctoral Program Fellow working with Cynthia Rosenzweig at the NASA Goddard Institute for Space Studies (NASA GISS) in Manhattan. Previously, he received his B.S. in Atmospheric Sciences at Cornell University and did his doctoral dissertation with John Roads in the Climate Sciences group at the Scripps Institution of Oceanography in San Diego. Alex's dissertation work examined the atmospheric water cycle in global and regional reanalyses with a focus on high-frequency variations and comparisons to observation-based precipitation products. At NASA GISS he is downscaling multi-decadal climatologies over Central America from reanalyses and climate model scenarios, aiming to identify impacts of climate variability and change for stakeholders in the region. Similarly, the Southeastern USA and Metropolitan East Coast are other domains of interest for agriculture, energy, health, municipal applications, and water resource management.

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ERIC P. SALATHÉ JR.

Climate Impacts Group
Joint Institute for the study of the Atmosphere and Oceans (JISAO)
University of Washington, Seattle

BIOGRAPHY:

- September 1990 to September 1993: NASA Global Change Research Fellow, Yale University.
- October 1993 to June 1995:National Research Council Associate, NASA Goddard Laboratory for Atmospheres.
- July 1995 to July 1999: Research Associate, Department of Atmospheric Sciences, University of Washington.
- August 1999 to April 2007: Research Scientist, JISAO/CSES Climate Impacts Group, University of Washington.
- July 2005 to present: Affiliate Assistant Professor, Department of Atmospheric Sciences, University of Washington.
- May 2007 to present: Senior Research Scientist, Climate Impacts Group, JISAO, University of Washington.

RESEARCH INTERESTS:

The Climate Impacts Group conducts research on the regional-scale impacts of climate change on natural and human systems in the Pacific Northwest (PNW), USA. Climate scenarios for this research are derived from global climate model simulations available from other institutions, such as for the IPCC Fourth Assessment. High-resolution data are produced using statistical downscaling and a high-resolution regional climate model. The primary applications of regional climate information are for hydrology, water resources, air quality, fish ecology, forest ecology, agriculture, and human health.

Results from the NARCCAP project would be useful at many levels for our work. Simulations would be useful for basic understanding of climate change and uncertainty for the PNW. Results could also be downscaled using statistical methods or a regional climate model for direct input to other models.

Climate Impacts Group http://www.cses.washington.edu/cig/

Regional climate modeling at University of Washington
<http://www.atmos.washington.edu/~salathe/reg_climate_mod/>

NADINE SALZMANN:

Nadine Salzmann is currently a postdoctoral fellow at ISSE/NCAR in Boulder, CO, USA, where her work focuses on the analysis of NARCCAP runs concerning the dynamics of the seasonal snow regime of the Upper Colorado River Basin. She received her PhD degree at the University of Zurich, Switzerland, with the thesis "The use of results from Regional Climate Models for local-scale permafrost modeling in complex mountain topography – possibilities, limitations and challenges for the future". The RCM data that she was using for her PhD were mainly provided through the PRUDENCE project. In her MSc thesis she was using remote sensing techniques and GIS-modeling to assess the hazard potential of ice avalanches in the Swiss Alps. Beside her academic studies, she gained practical experience in the issues of climate change impact and natural hazards through several temporary employments e.g. with swissre (a reinsurance company in Switzerland), and internships e.g. at defense civil in Arequipa, Peru.

One of the main goals of Regional Climate Models (RCMs) is to provide high resolution climate (scenario) data for further use by the impact community. In this manner, NARCCAP will become a very valuable source of RCM data for North America. RCMs have been proven to be especially valuable over regions with heterogeneous surface such as mountain ranges. My main interest in the NARCCAP data is, thus, to analyze and evaluate the performance of the NCEP-driven NARCCAP runs in simulating cryospheric (mainly the dynamics of the snow regime) processes in high-mountain regions. Thereby, I am focusing on the Upper Colorado River Basin (UCRB). The Colorado River is the major water resource for millions of people living in the surrounding areas. The high elevation seasonal snow pack contributes about 70% of the annual runoff. On average, about 90% of the annual streamflow is generated in the UCRB. The perfomance analyses of the NCEP-driven runs are in progress and currently based on preliminary NARCCAP results, that is on data that have not yet been archived. The evaluation includes comparison with station data sets such as SNOTEL and reanalysis data such as NARR. In a second step, I will try to assess how the seasonal snow regime may changes in future (based on NARCCAP time-slice experiments) and what the impacts are for the Colorado River's hydrology runoff and finally the consequences for the people leaving in the area.

ANJI SETH:

Dr. Anji Seth is a Research Assistant Professor in the Department of Geography at the University of Connecticut. Her research seeks to understand how and why climate varies, and how changes in climate are likely to evolve in the next century in particular regions. This work employs global and regional 3-D physically based numerical climate models. Dr. Seth's research explores the relative roles of local and remote (large scale) forcing on regional climates with current projects considering ancient climates of Antarctica and the future of climate in the Andean Highlands and the Northeast US.Dr. Seth earned a B.S. in Mechanical Engineering at Worcester Polytechnic Institute, and a PhD in Atmospheric Sciences from the University of Michigan. She has held positions as Graduate Fellow and Visiting Scientist at the National Center for Atmospheric Research in Boulder, CO, and as Staff Scientist at the International Research Institute for Climate and Society at Columbia University. Dr. Seth also holds adjunct faculty positions at the University of Massachusetts in Amherst, and Columbia University in New York City.

RESEARCH PLAN:

Global coupled models now show coherent patterns of temperature and precipitation response to anthropogenic radiative forcing, but regional detail is lacking in low resolution climate models, and the margins between regions likely to gain and lose precipitation are especially uncertain during the warm season in North America. To advance the understanding of regional climate response to anthropogenic forcing this research will examine changes in 21st century climate across multiple scales and from the perspective of the Northeast United States. Several scale dependent mechanisms involved in warm season and cold season climate changes in the Northeast will be investigated. For example, mechanisms involved in potential summertime drying are hypothesized to have large scale components, enhanced poleward moisture transport and changes in the Atlantic sub-tropical anticyclone; a mesoscale dynamical component and changes in the low level moisture transport; and fine scale components related to variations in response between coastal and interior sub-regions. An approach is proposed which exploits medium resolution (50 km) *global* model time slices performed for the North American Regional Climate Change Assessment Program (NARCCAP) in addition to the Intergovernmental Panel on Climate Change Assessment Report Four (IPCC AR4) global coupled model (20th century and SRES A2) archives. The global integrations will be analysed for large scale and continental scale changes in circulation and moisture transport to the Northeast. The medium resolution integrations will provide boundary forcing for very high resolution (15 km) regional climate model experiments for the Northeast. The experiments combined with observational datasets for the recent period, constitute a multi-scale approach toward understanding the changing climate of the Northeast.

CHRIS WEAVER:

Chris Weaver is a Physical Scientist in the Global Change Research Program of the National Center for Environmental Assessment, located in the Office of Research and Development within the U.S. Environmental Protection Agency (EPA). He is also a Visiting Professor in the Department of Environmental Sciences and Center for Environmental Prediction at Rutgers University, where he currently has two Ph.D. students. Chris' background is as a climate scientist, with a Ph.D. from Scripps Institution of Oceanography. His research has focused on the role of clouds in the climate system, including the links between large-scale atmospheric dynamics and cloud properties and evaluating the representation of clouds in climate models, and land-atmosphere interactions (primarily via regional climate modeling), including the impacts of land-use/land-cover change, mesoscale land-atmosphere interactions, and the coupling between atmospheric processes and groundwater. At the EPA, Chris is involved in assessing the potential impacts of global change on U.S. air quality, water quality, human health, and ecosystems and improving the way we use climate information (including from models) to develop these assessments and more effectively support decision making about adaptation strategies.

Chris' interest in NARCCAP is from both a researcher's and a user's perspective. He is generally interested in regional climate modeling and dynamical downscaling. As a potential user, Chris is interested in evaluating the potential of the NARCCAP simulation output for supporting our impacts and adaptation assessment needs here in the EPA's Global Change Research Program.