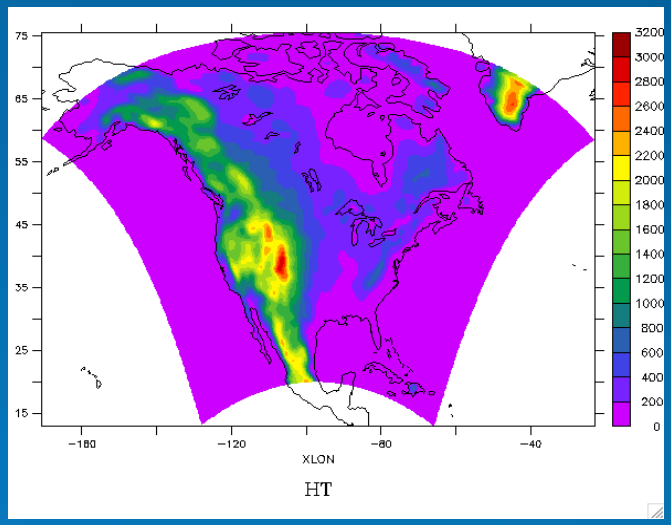
NARCCAP

NCAR

First Users' Workshop



Welcome!

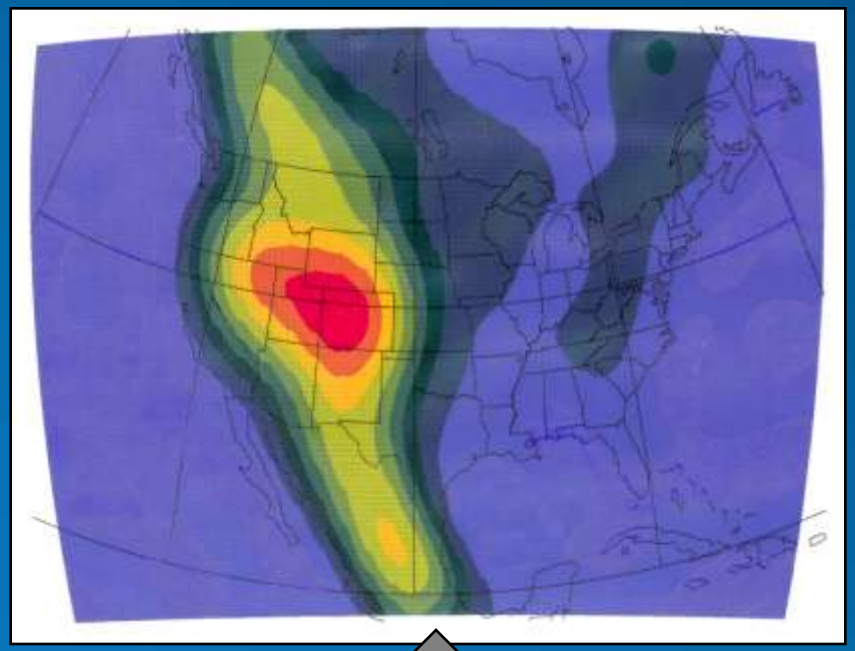
Workshop Goals

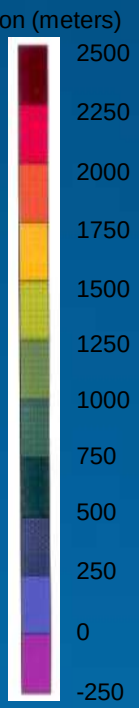
- Introduce initial group of users to NCARCCAP
- Provide opportunity of interaction between modelers and users to:
  - Better understand user needs
  - Improve quality of products provided
  - Build a user website that best responds to user needs
- Build NARCCAP User Community

Introduction to NARCCAP and the Use of High-resolution Modeling

L. O. Mearns
Institute for the Study of Society and Environment
National Center for Atmospheric Research

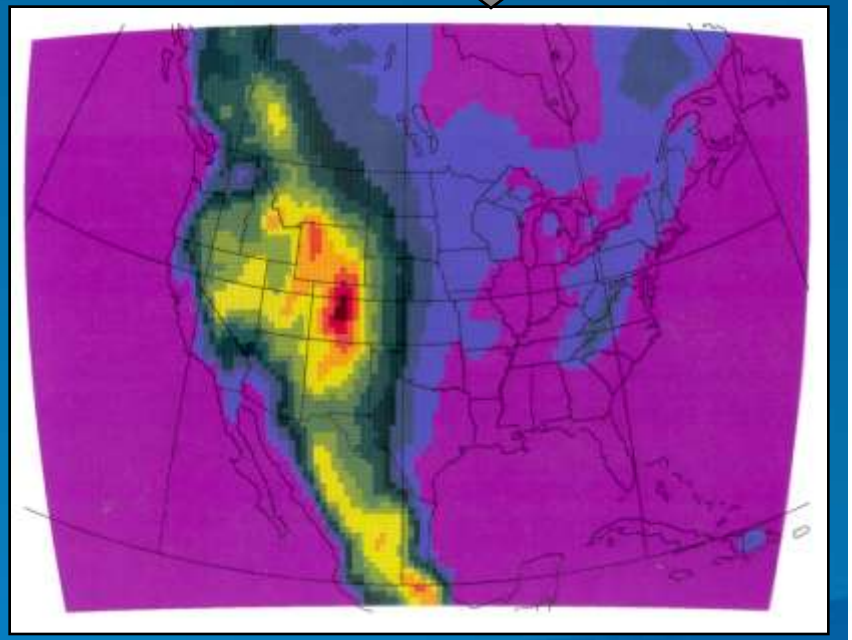
First NARCCAP Users' Meeting
February 14, 2008

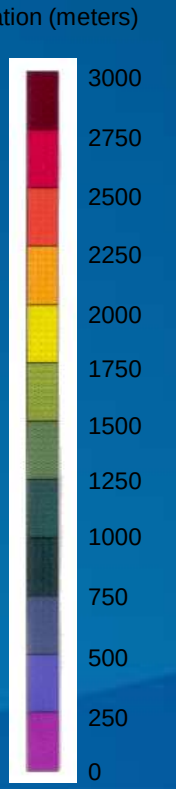




NCAR CSM Topography
2.8 deg. by 2.8 deg.

RegCM Topography
0.5 deg. by 0.5 deg.





Regional Modeling Strategy

Nested regional modeling technique

- Global model provides:
  - initial conditions – soil moisture, sea surface temperatures, sea ice
  - lateral meteorological conditions (temperature, pressure, humidity) every 6-8 hours.
  - Large scale response to forcing (100s kms)
- Regional model provides finer scale (10s km) response

Physical Contexts for Regional Modeling

- Regions with small irregular land masses (e.g., the Caribbean)
- Complex topography (mountains)
- Complex coastlines (e.g., Italy)
- Heterogeneous landscapes

Now that we can have more regional detail, what difference does it make in any given impacts assessment or adaptation study?

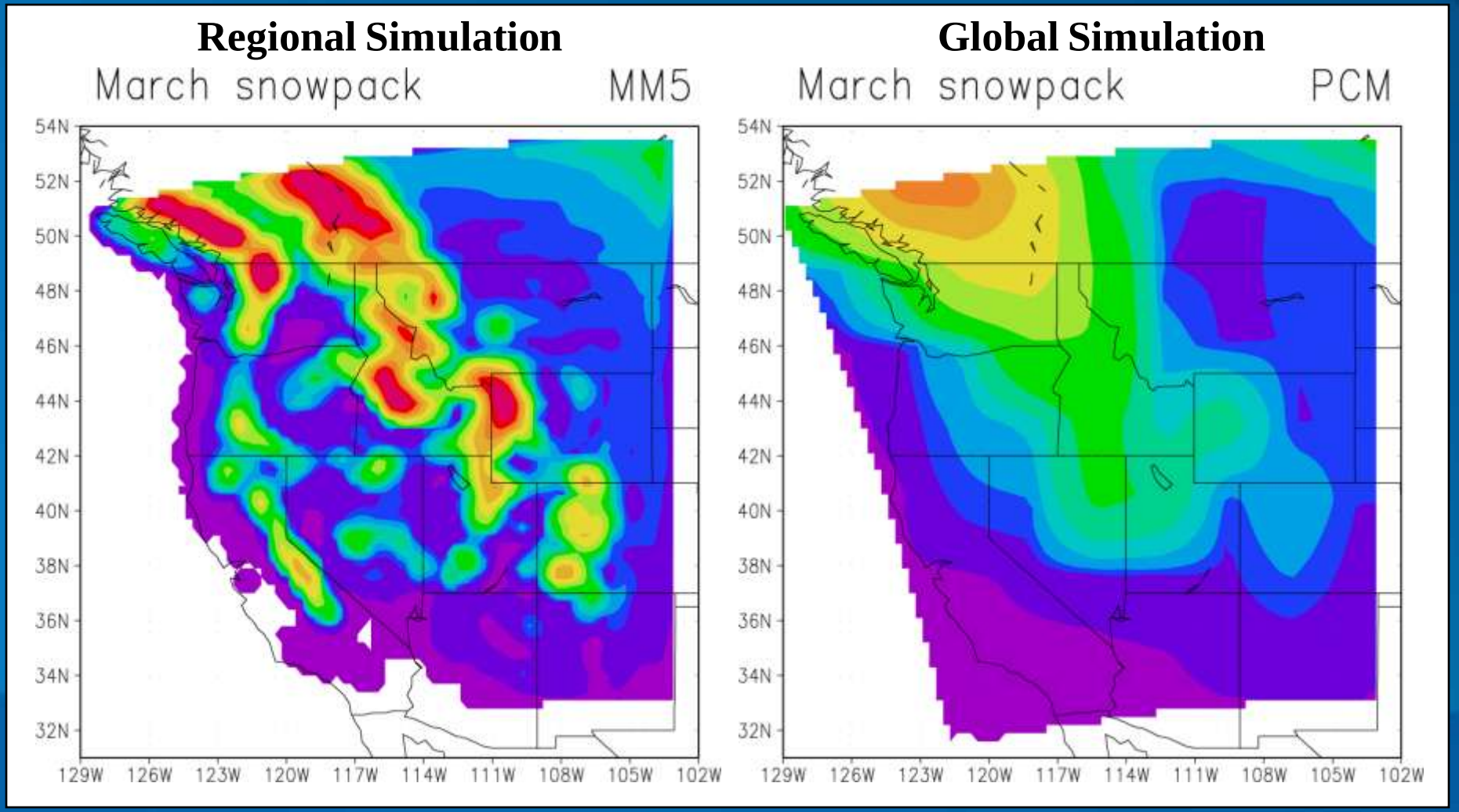
What is the added value?

Do we have more confidence in the more detailed results?

Global and Regional Simulations of Snowpack

NCAR

GCM under-predicted and misplaced snow



Use of Regional Climate Model Results for Impacts Assessments

NCAR

- **Agriculture:**

Brown et al., 2000 (Great Plains – U.S.)

Guereña et al., 2001 (Spain)

Mearns et al., 1998, 1999, 2000, 2001, 2003, 2004, 2005 (Great Plains, Southeast, and continental US, N. A.)

Carbone et al., Doherty et al., Tsvetsinskaya et al., 2003 (Southeast US)

Easterling et al., 2001, 2003 (Great Plains, Southeast)

Thomson et al., 2001 (U.S. Pacific Northwest)

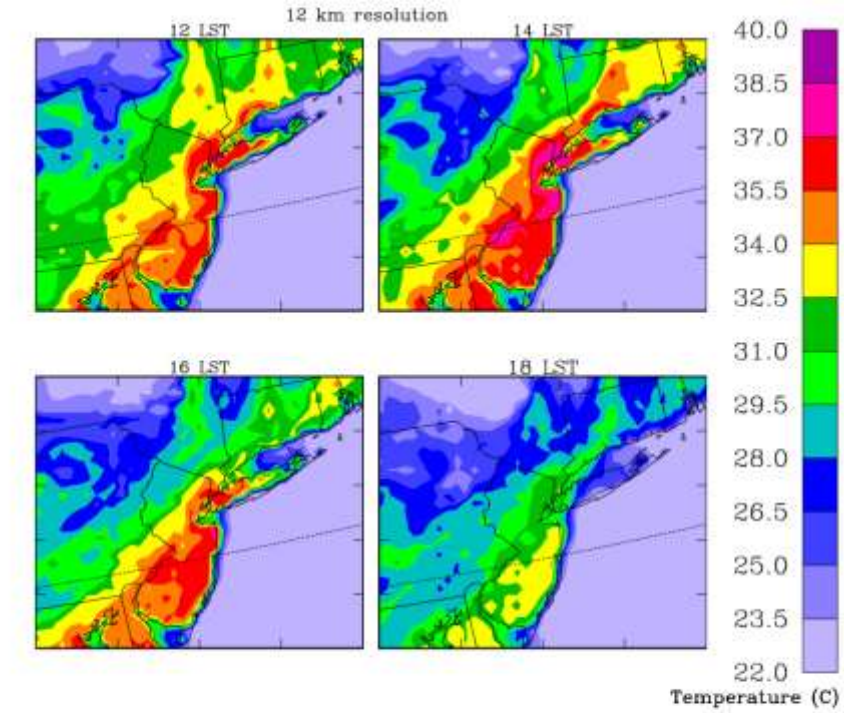
Olesen et al., 2007; Fronzek and Carter, 2007; Mínguez et al., 2007 (Europe)

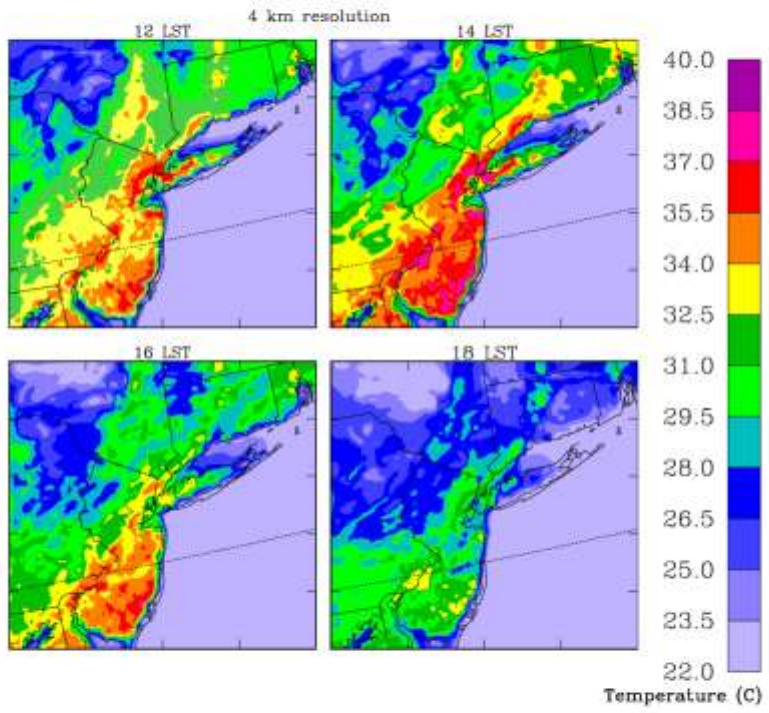
Use of RCM Results for Impacts Assessments 2

- **Water Resources:**
  - Leung and Wigmosta, 1999 (US Pacific Northwest)
  - Stone et al., 2001, 2003 (Missouri River Basin)
  - Arnell et al., 2003 (Southern Africa)
  - Miller et al., 2003 (California)
  - Wood et al., 2004 (Pacific Northwest)
  - Graham et al., 2007 (Europe)
- **Forest Fires:**
  - Wotton et al., 1998 (Canada – Boreal Forest)
- **Human Health:**
  - New York City Health Project (Hogrefe et al., 2005)
  - Halsnæs et al., 2007 (Europe)

New York Climate and Health Project
MM5 Tests with 12 and 4 km Resolution

NCAR





Hogrefe et al., 2005

Putting spatial resolution in the context of other uncertainties

- Must consider the other major uncertainties regarding future climate in addition to the issue of spatial scale – what is the relative importance of uncertainty due to spatial scale?
- These include:
  - Specifying alternative future emissions of ghgs and aerosols
  - Modeling the global climate response to the forcings (i.e., differences among GCMs)

Programs Exploring Multiple Uncertainties

- PRUDENCE - over Europe
- ENSEMBLES – over Europe
- NARCCAP – over North America
- CREAS: Cenários REgionais de Mudança de Clima para América do Sul

  (Regional Climate Change Scenarios for South America)

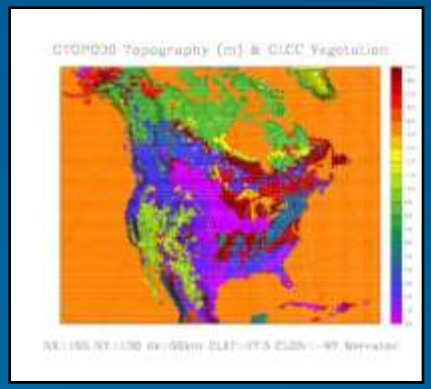
PRUDENCE

- European domain
- 8-10 RCMs
- 2 AOGCMs (HadCM3, ECHAM4) but also time slice experiments
- 2 emissions scenarios (A2, B2)
- Most RCMs used only one driving model, HadAM3H, with A2 emissions scenario
- 1961-90 and 2071-2100

The North American Regional Climate Change Assessment Program (NARCCAP)

NCAR

Initiated in FY06, it is an international program that will serve the climate scenario needs of the United States, Canada, and northern Mexico.



- Exploration of multiple uncertainties in regional model and global climate model regional projections.
- Development of multiple high resolution regional climate scenarios for use in impacts assessments.
- Further evaluation of regional model performance over North America.
- Exploration of some remaining uncertainties in regional climate modeling (e.g., importance of compatibility of physics in nesting and nested models).
- Program has been funded by NOAA-OGP, NSF, DOE – 3-4-year program

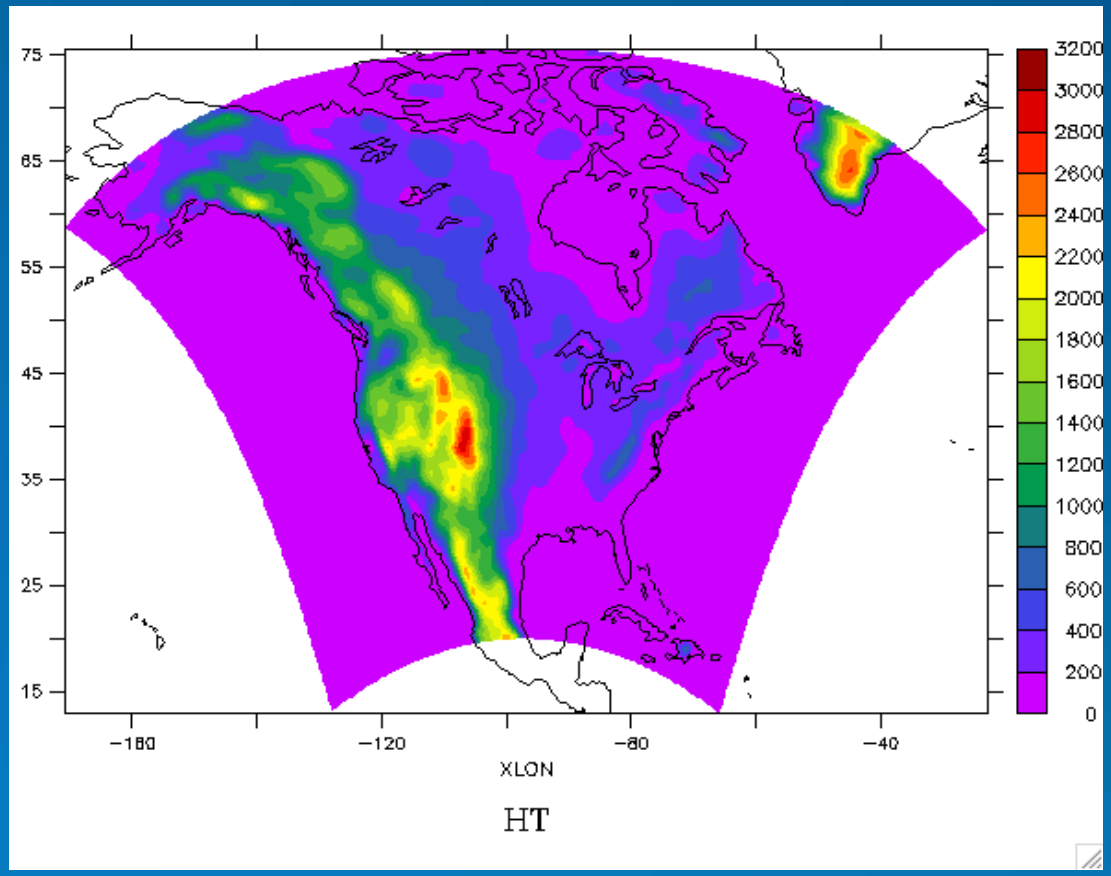
www.narccap.ucar.edu

NARCCAP - Participants

Linda O. Mearns, National Center for Atmospheric Research

Ray Arritt, Iowa State, Dave Bader, LLNL; Sébastien Biner, Ouranos; Erasmo Buono, Hadley Centre; Daniel Caya, Ouranos; Phil Duffy, LLNL; Filippo Giorgi, Abdus Salam ICTP; William Gutowski, Iowa State; Isaac Held, GFDL; Richard Jones, Hadley Centre; René Laprise, UQAM; Ruby Leung, PNNL; Don Middleton, NCAR; Ana Nuñes, Scripps; Doug Nychka, NCAR; John Roads, Scripps, Steve Sain, NCAR, Lisa Sloan, Mark Snyder, UC Santa Cruz; Ron Stouffer, GFDL; Gene Takle, Iowa State; Phil Rasch, Tom Wigley, NCAR

NARCCAP Domain



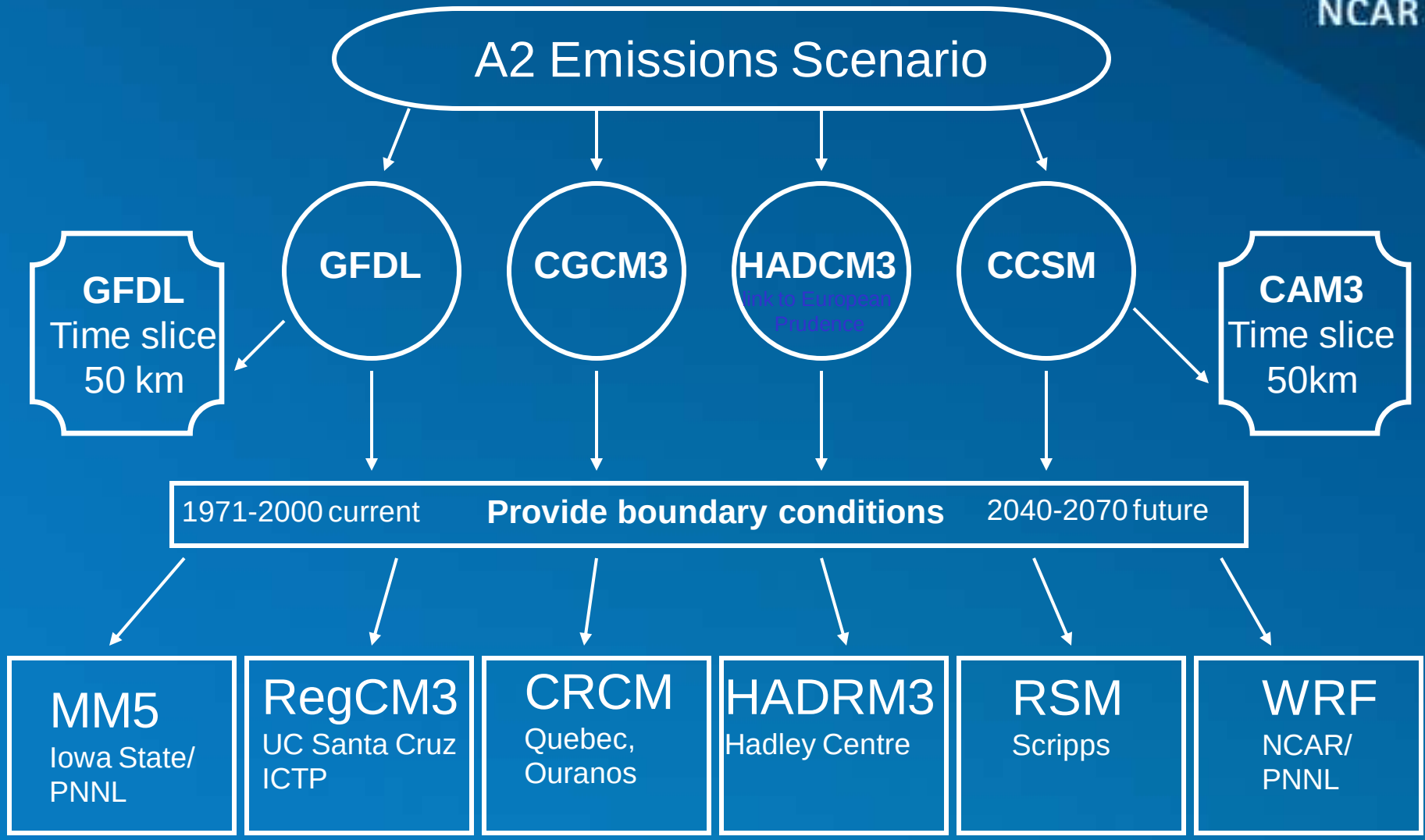
Organization of Program

- **Phase I: 25-year simulations using NCEP boundary conditions (1979—2004)**
- **Phase IIa: RCM runs (50 km res.) nested in AOGCMs current and future**
- **Phase IIb: Time-slice experiments at 50 km res. (GFDL AM2.1 and NCAR CAM3) – current and future**
- **Opportunity for double nesting (over specific regions) to include participation of other RCM groups (e.g., for NOAA OGP RISAs, CEC, New York Climate and Health Project)**
- **Scenario formation and provision to impacts community (led by NCAR)**

Phase I

- All RCMs have completed the reanalysis-driven runs.
- Configuration:
  - common North America domain (some differences due to horizontal coordinates)
  - horizontal grid spacing 50 km
  - boundary data from NCEP/DOE Reanalysis 2
  - boundaries, SST and sea ice updated every 6 hours

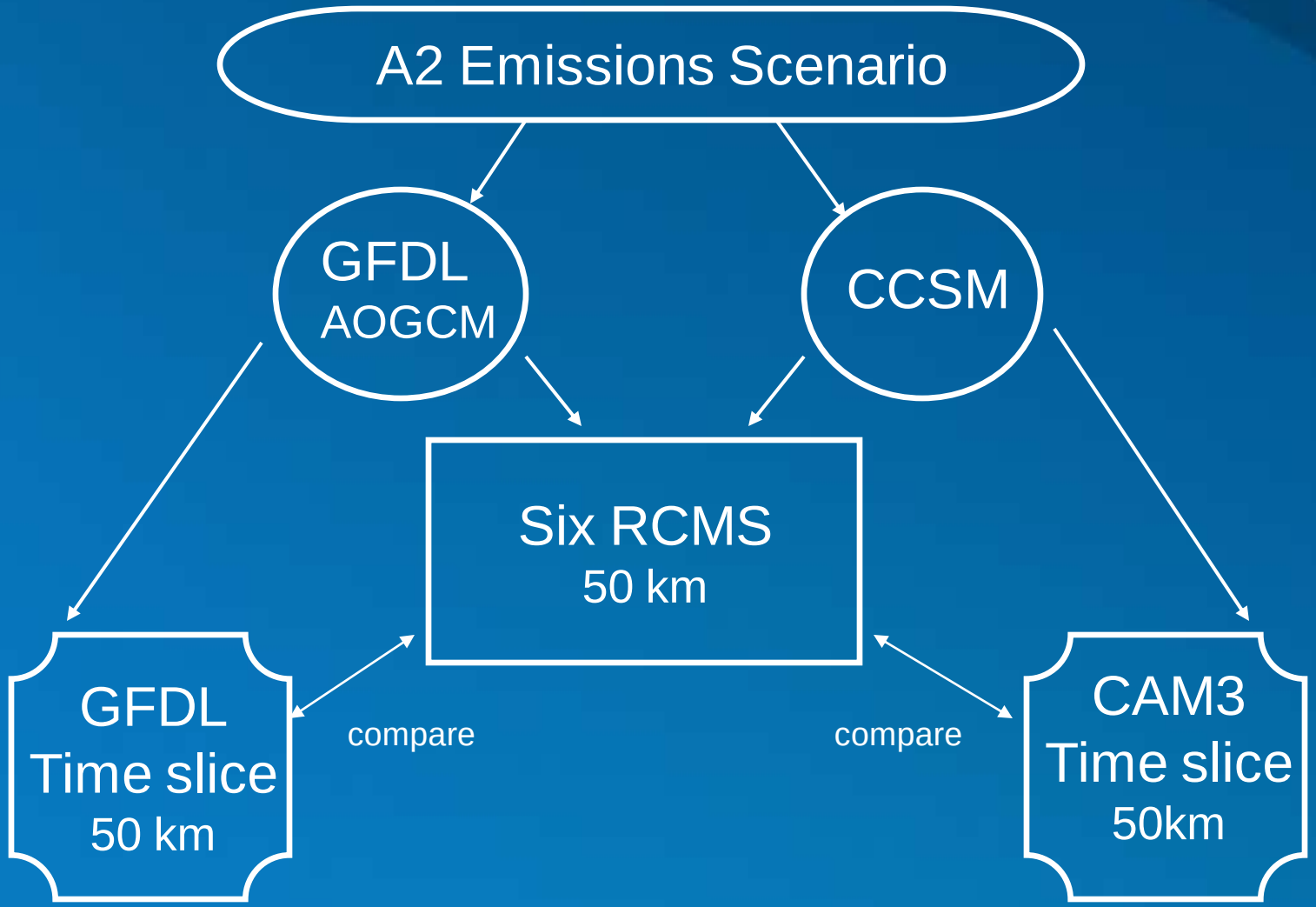
NARCCAP PLAN – Phase II



Global Time Slice / RCM Comparison

at same resolution (50km)

NCAR

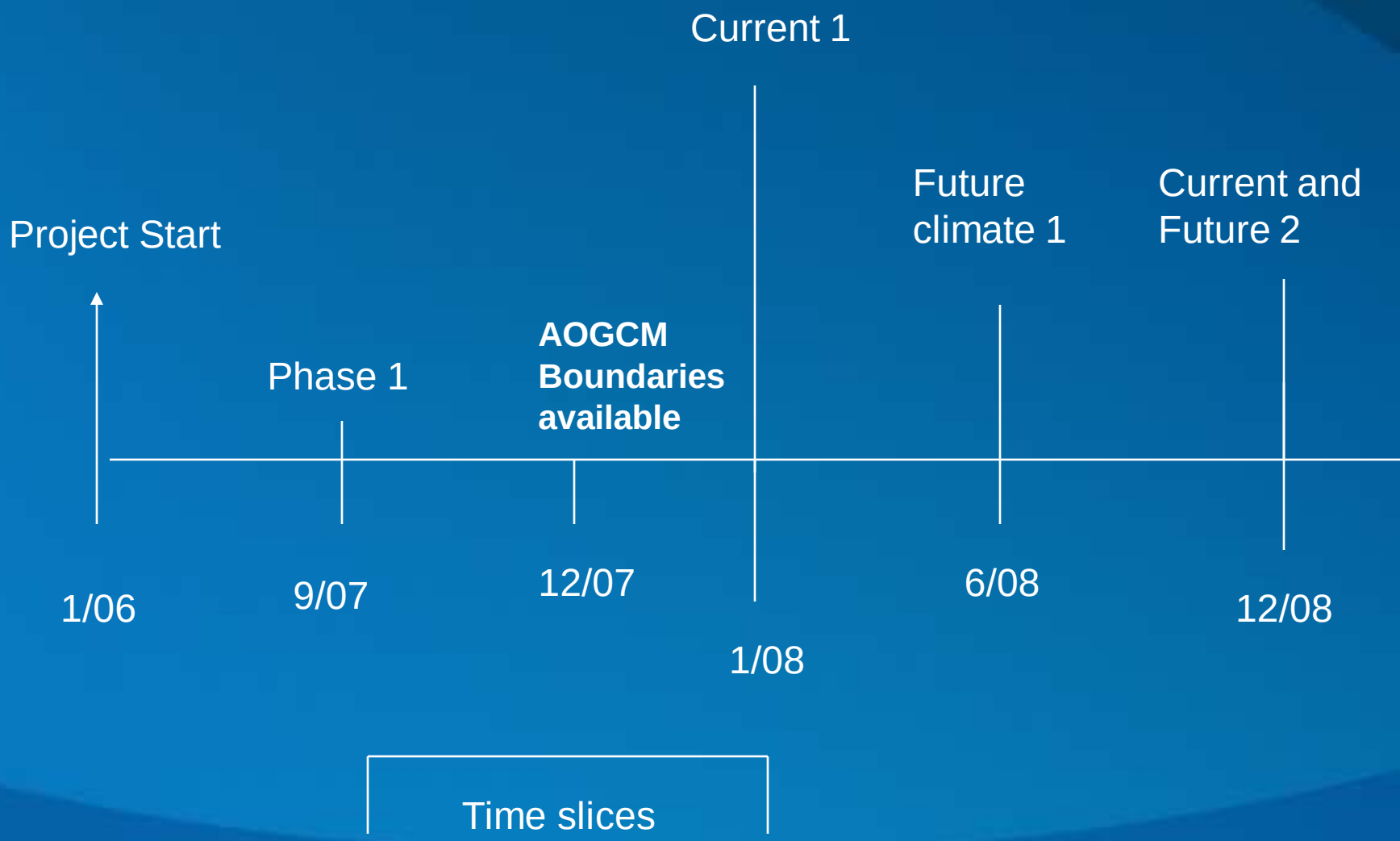


GCM-RCM Matrix

	GFDL	CGCM3	HADCM3	CCSM
MM5			X	X1
RegCM3	X	X		
CRCM		X1	X	
PRECIS	X	X	X1	X
RSM	X			X1
WRF	X	X		X1
CAM3				X
GFDL/AM2.	X			

1 = chosen first GCM

NARCCAP Project Timeline



NCAR

The NARCCAP User Community

Three user groups:

- Further dynamical or statistical downscaling
- Regional analysis of NARCCAP results
- Use results as scenarios for impacts studies

www.narccap.ucar.edu

Workshop Plan

- User introductions
- NARCCAP in broader context and AOGCMs
- Time slice experiments (atmospheric models)
- RCMs
- Results of Phase I – overview
- User discussions
- Data Archiving, Practicum, GIS
- Uncertainty Analysis
- In depth user group discussions

End