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Bill Mahoney, Deputy Director

Joanne Dunnebecke, Administrator

Liz Hoswell, Lab Administrator

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Bruce Carmichael, Director

Marcia Politovich & Bob Barron, Deputy Directors

National Security Applications Program (NSAP)

Scott Swerdlin, Director

Terri Betancourt, Deputy Director

Hydrometeorology Applications Program (HAP)

Roy Rasmussen, Director

Matthias Steiner & Gary Blackburn, Deputy Directors

Weather Systems Assessment Program (WSAP)

Sue Haupt, Director

Gerry Wiener & Sheldon Drobot, Deputy Directors

Joint Numerical Testbed (JNT)

Barb Brown, Director

Louisa Nance & Laurie Carson, Deputy Directors

Climate Science and Applications Program (CSAP)

Lawrence Buja, Director

Kathy Miller, Deputy Director

CLIMATE SCIENCE AND APPLICATIONS PROGRAM



*Enhancing adaptive capacity for society
in the context of changing weather and climate*

Caspar Ammann (for Lawrence Buja)
<http://www.ral.ucar.edu/csap>

Climate change or natural variability?



Texas



Mississippi

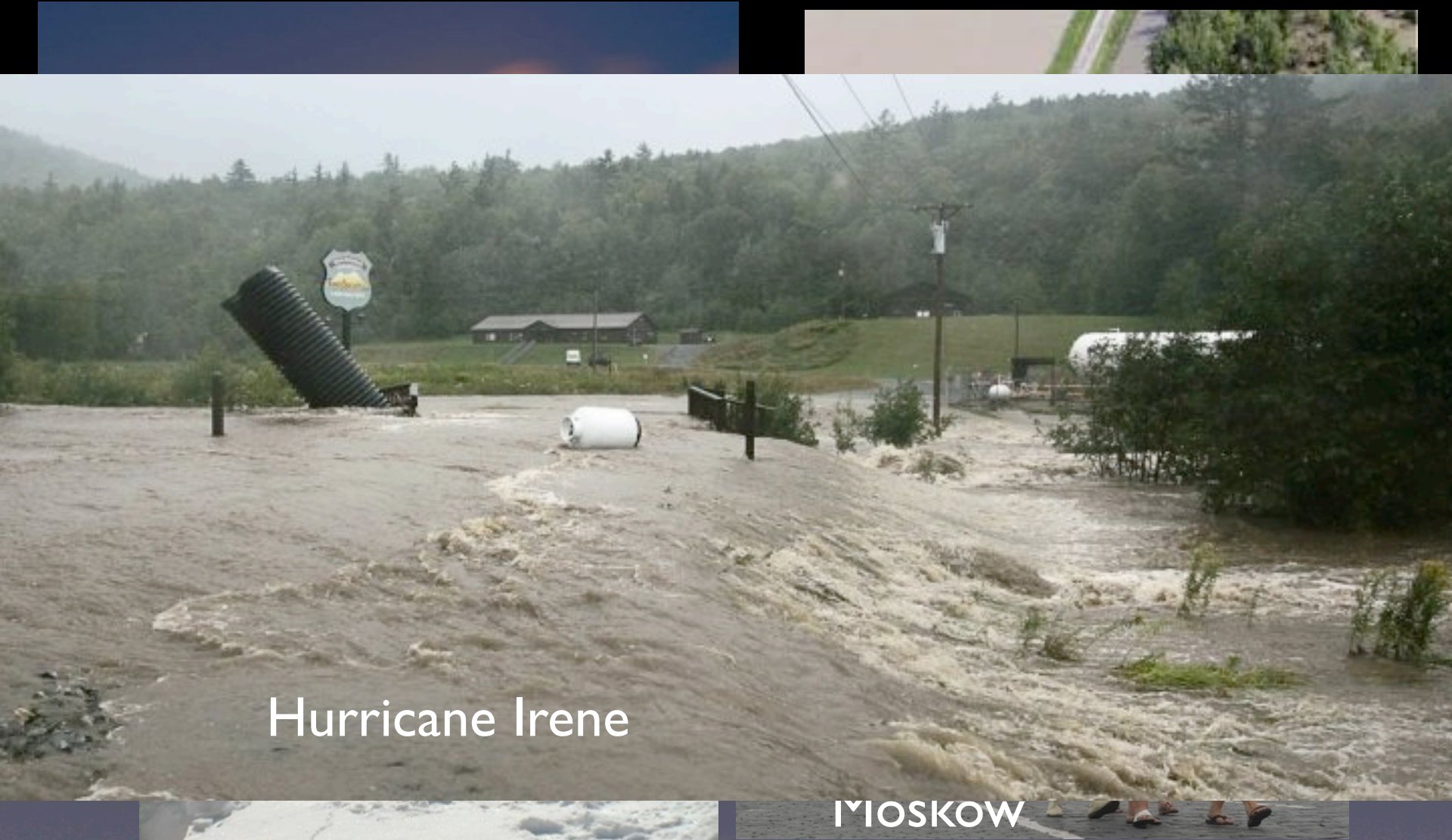


NY City



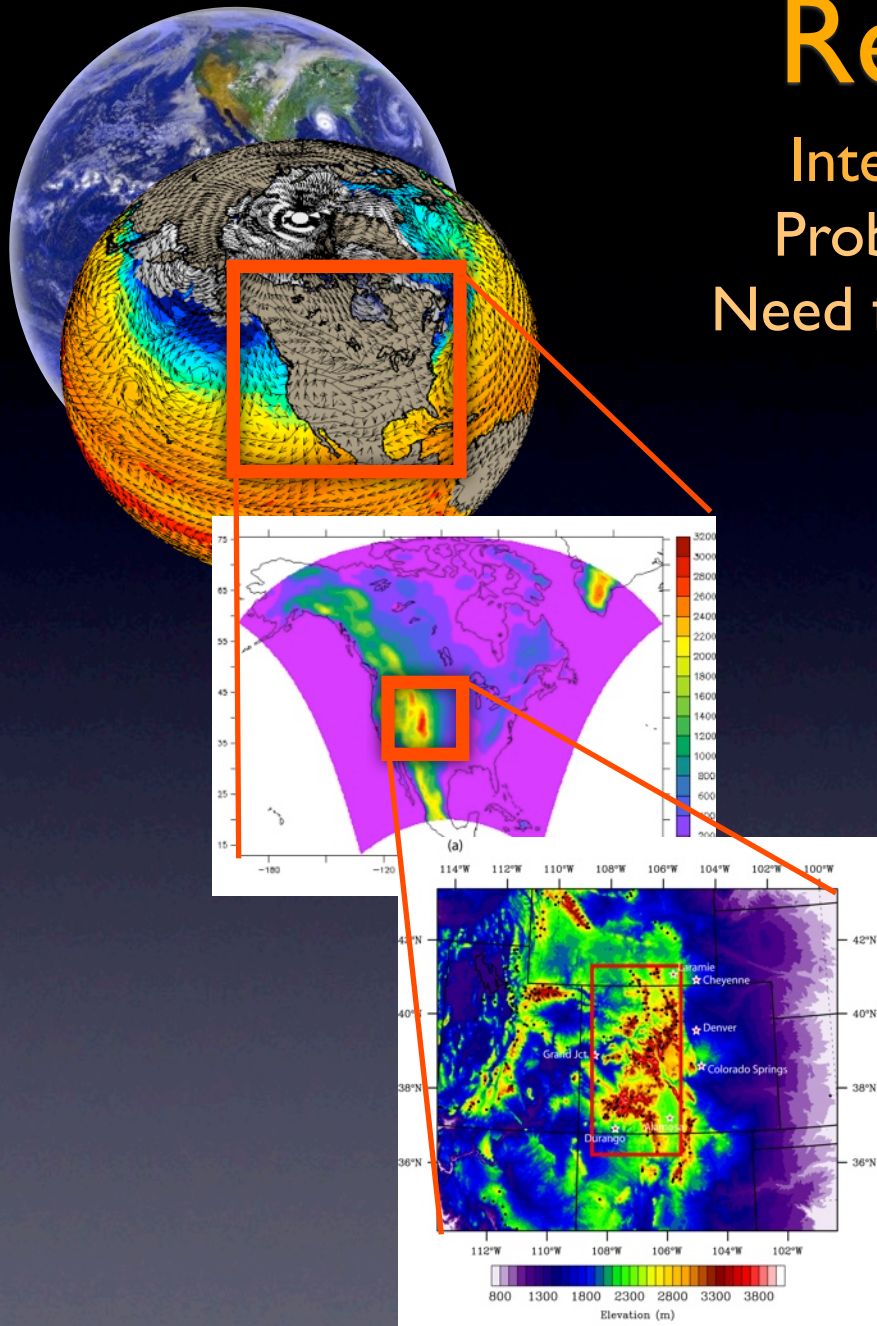
Moskow

Climate change or natural variability?



Regional Challenge

Integration of all data and knowledge
Problems are Global, Impacts are local
Need for sector specific data and solutions



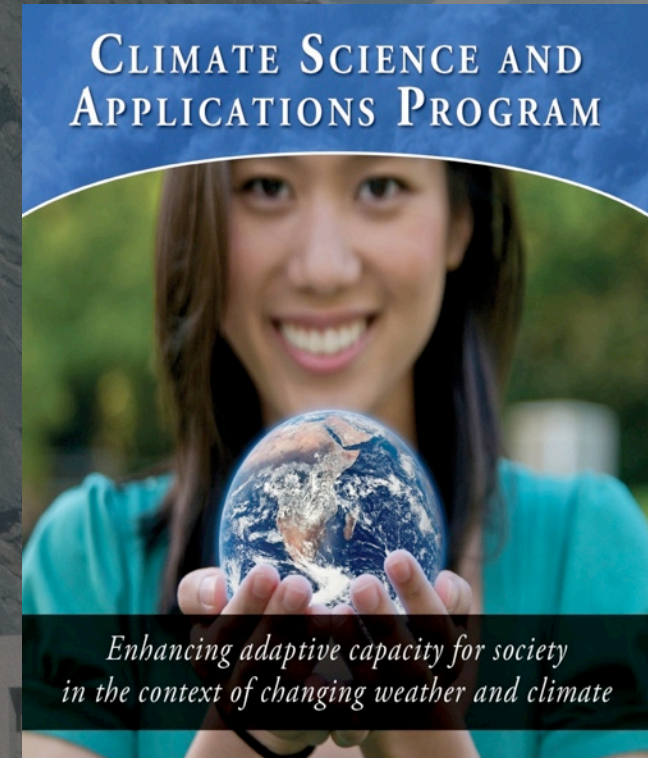
CLIMATE SCIENCE AND APPLICATIONS PROGRAM



“Science exists to serve human welfare. It’s wonderful to have the opportunity given us by society to do basic research, but in return, we have a very important moral responsibility to apply that research to benefiting humanity.” Walter Orr Roberts

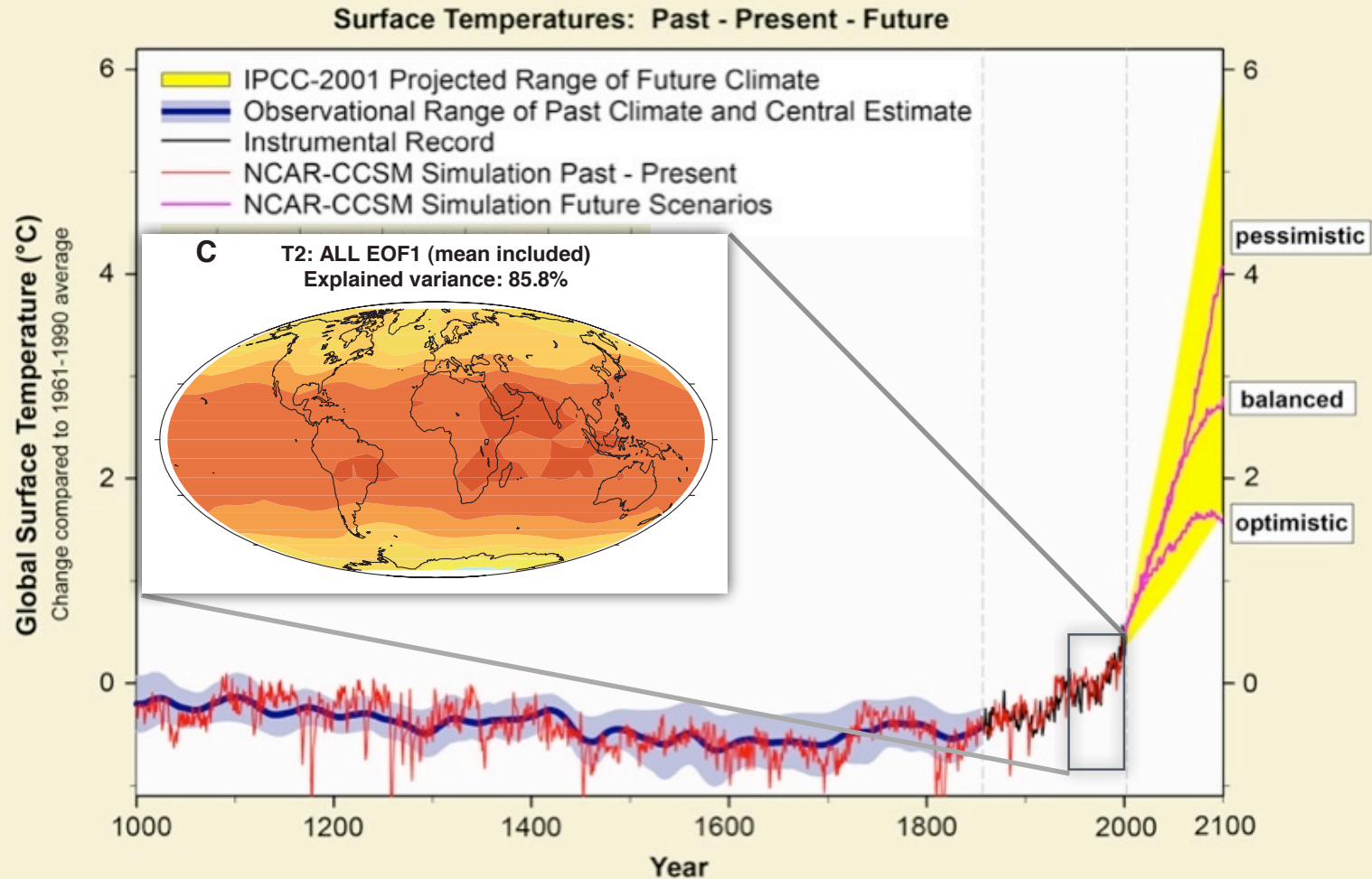
CLIMATE SCIENCE AND APPLICATIONS PROGRAM

- **Water Resources and Climate**
- **Weather, Climate and Health**
- **Resilient and Sustainable Cities**
- **Institutional Vulnerability and Adaptation**
- **Geographic Information Systems**
- **Climate services**
 - **Cross-Disciplinary Modeling**
 - **Engagement - Translation**
- **Capacity building at home and abroad**



“Science exists to serve human welfare. It’s wonderful to have the opportunity given us by society to do basic research, but in return, we have a very important moral responsibility to apply that research to benefiting humanity.” Walter Orr Roberts

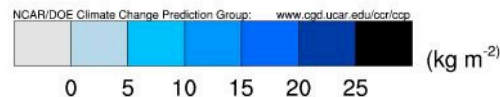
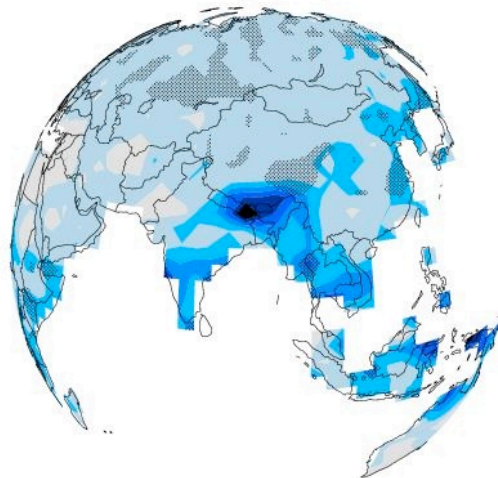
Global: Seamless Synthesis in Space and Time



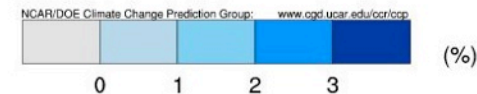
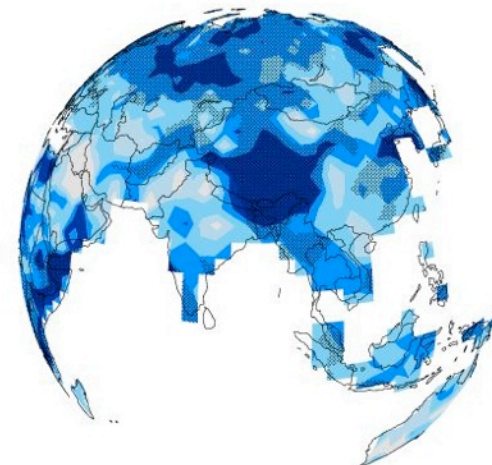
Precipitation 2030

Averages, Extremes

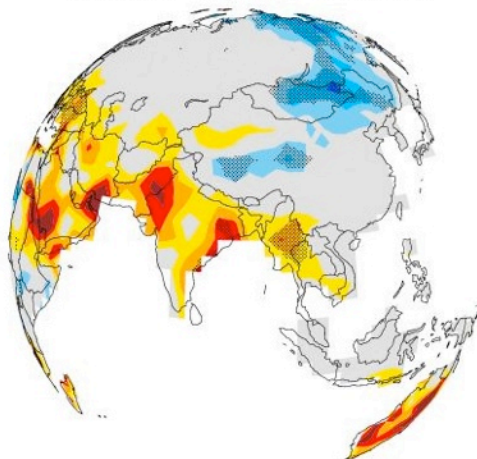
IPCC A1B 5-day Precip 2030-1990



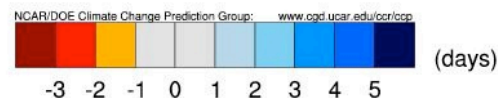
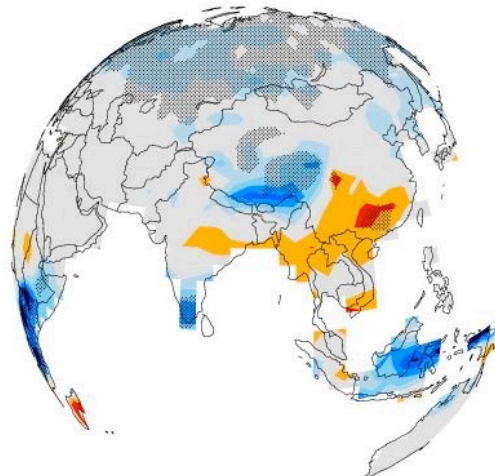
IPCC A1B Precip > 95th 2030-1990



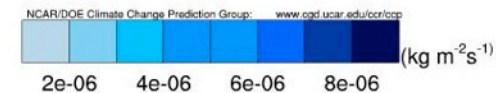
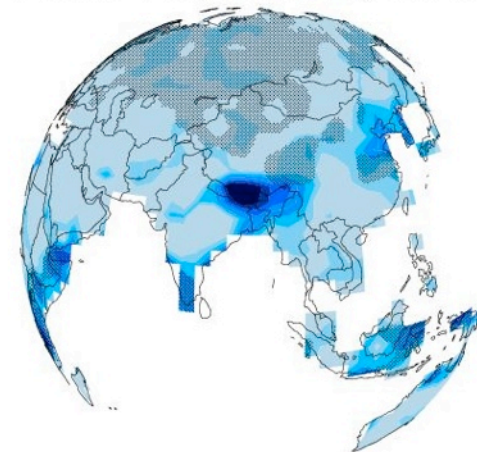
IPCC A1B Dry days 2030-1990



IPCC A1B Precip > 10 2030-1990



IPCC A1B Precipitation Intensity 2030-1990

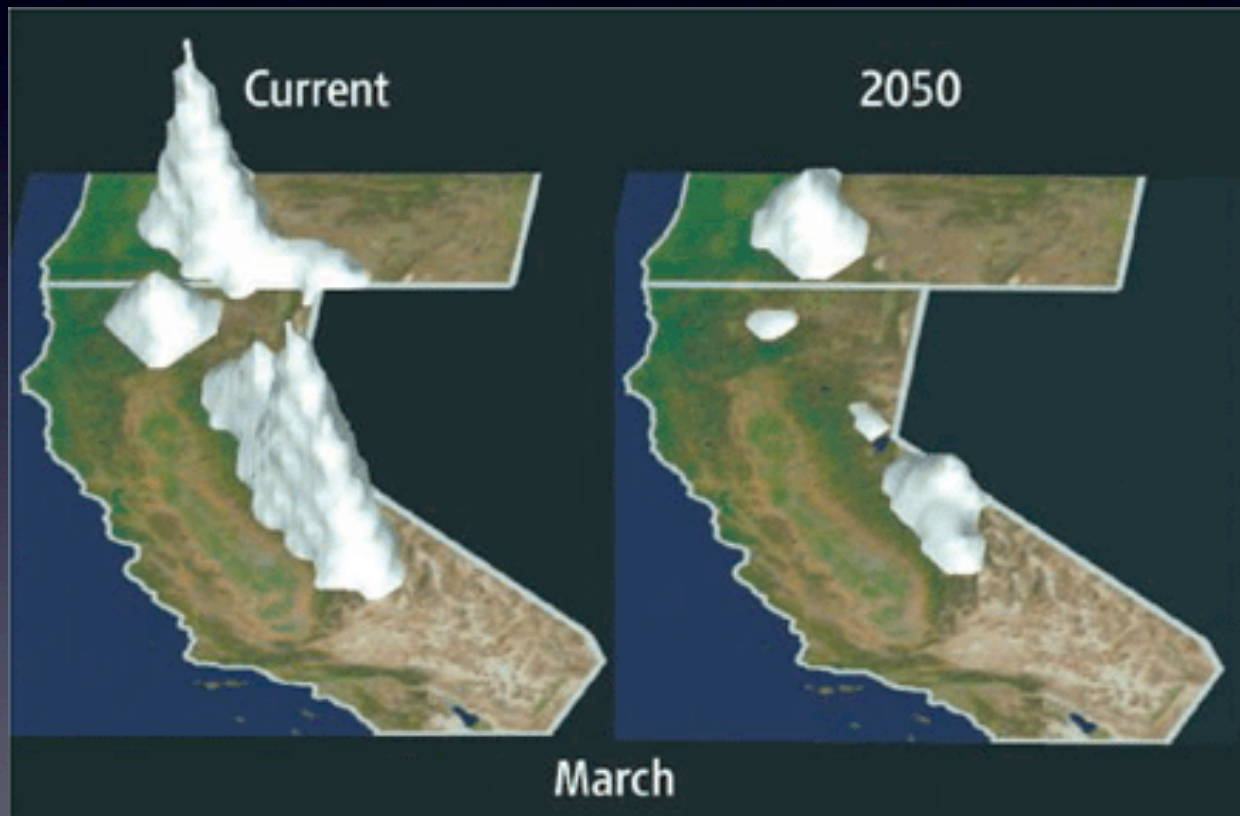


Outlook for Western Water / Snow

Changes in Seasonal Cycle of Snowmelt (T)

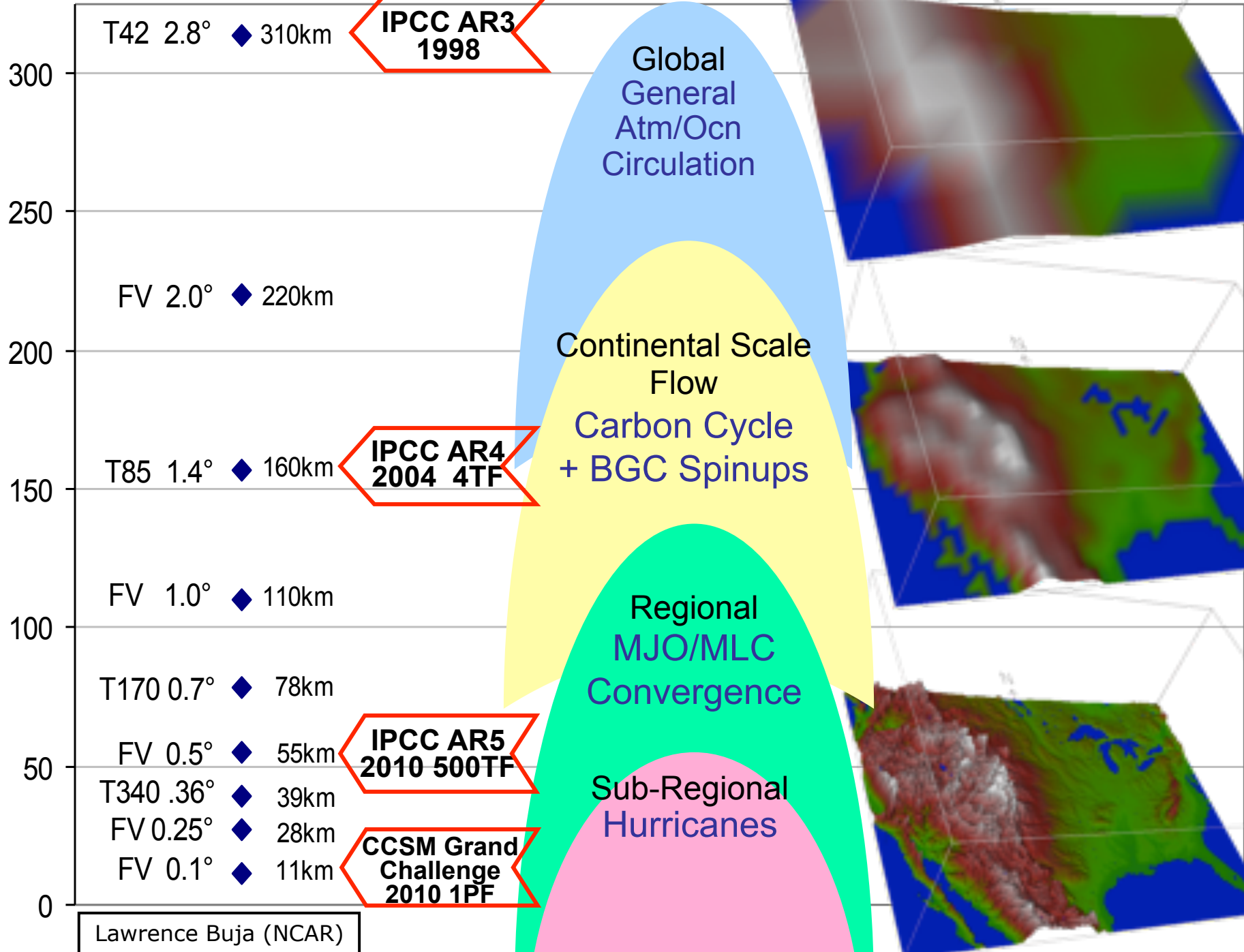
Shifts in Jet-stream leading to change in Precip (P), how much?

But: less water due to higher evaporation: dry summer season



Barnett et al. 2008

Horizontal Grid Size (Km)



RESOLUTION REQUIREMENTS: TERRAIN

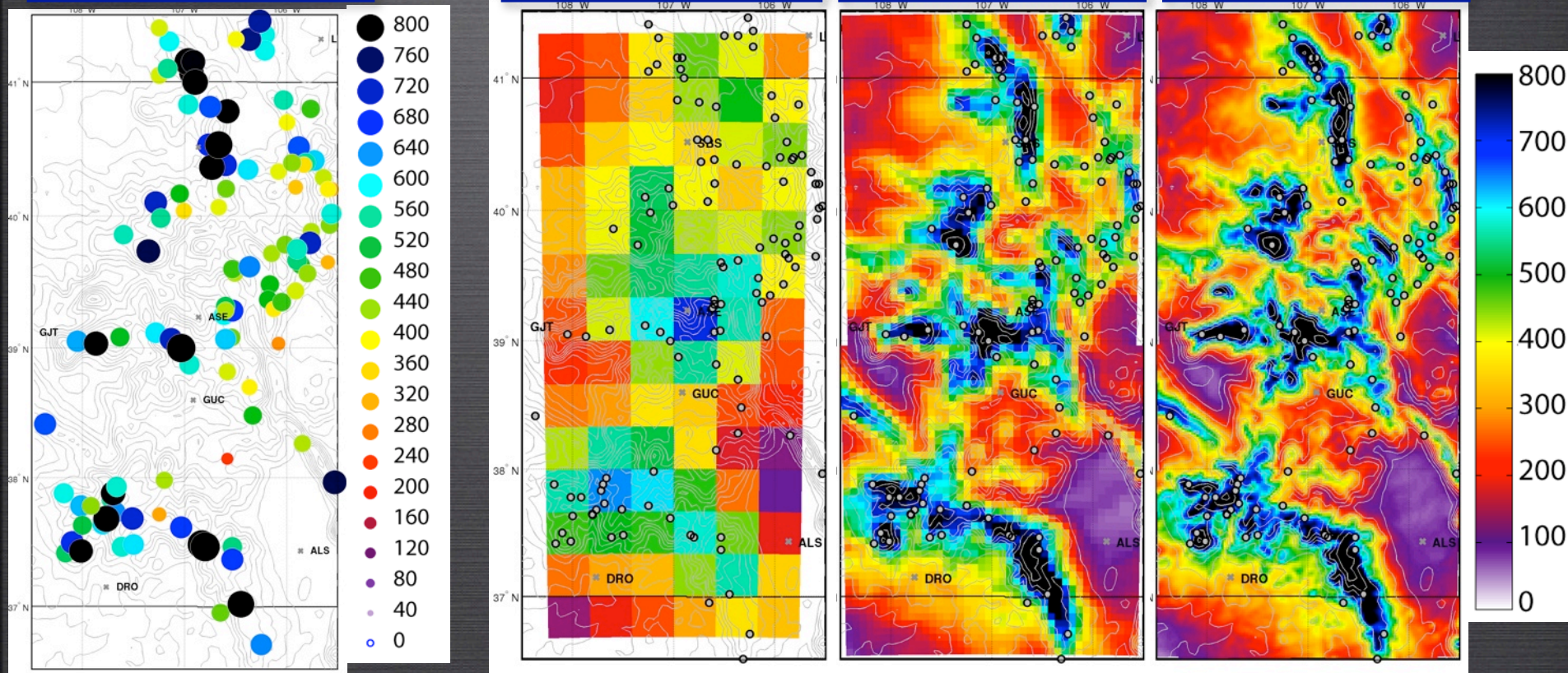
6-MO. TOTAL PRECIPITATION (MM) COMPARISON
1 Nov. 2007-1 MAY 2008

SNOTEL Obs.

36 km

6 km

2 km





IDB WRF TRAINING & SCENARIOS WITH UNIVERSITY OF NEBRASKA, LINCOLN



**WRF TRAINING
NCAR, JULY 2009**



**CLIMATE SCENARIOS
1. MEXICO CITY - JAN 2010
2. PANAMA – AUG 2010**

- **QUERETARO AND MEXICO: WATER RESOURCES LAND USE CHANGES, DENUDATION OF HILLSIDES.**
- **MORELOS: CONCERNS THAT VAST NATURAL SPRINGS MAY HAVE REDUCED**
- **TABASCO: INCREASE IN THE NUMBER, DURATION, AND MAGNITUDE OF THE FLOODS**
- **GUERRERO AND OAXACA: PRESERVING NATURAL RESOURCES UNDER FUTURE CLIMATE CHANGE**
- **YUCATAN: RISING SEA LEVEL & REDUCED PRECIPITATION/INCREASED EVAPORATION**
- **TAMAULIPAS: IMPACTS ON AGRICULTURE AND AQUACULTURE**

InterAmerican Development Bank Sustainable Energy & Climate Change Initiative

WEATHER RESEARCH AND
FORECASTING MODEL (WRF)
TUTORIAL AND CASE STUDIES
DEVELOPMENT

Boulder, Colorado
July 13-24, 2009



Water/Ag Olmos, Lambayeque, Peru
CCSM → WRF → Noah → WEAP

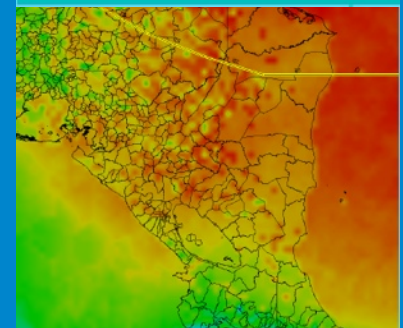
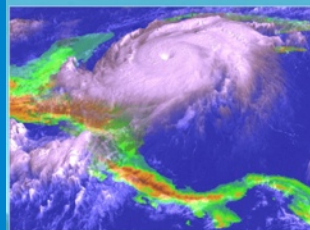
Belize - Costa Rica - El Salvador - Guatemala - Honduras - Nicaragua - Panama



Central American
Probabilistic Risk
Assessment
- CAPRA



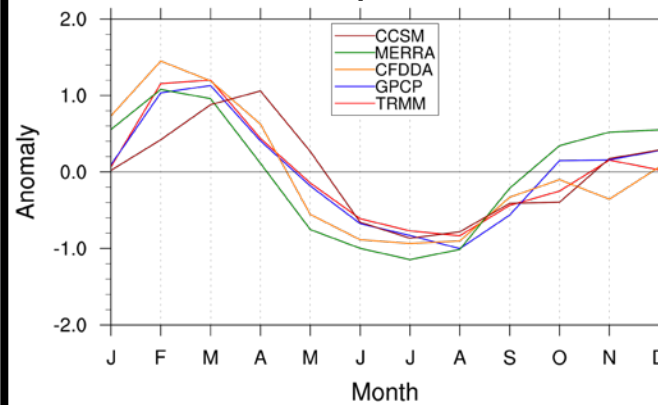
HURRICANE HAZARD



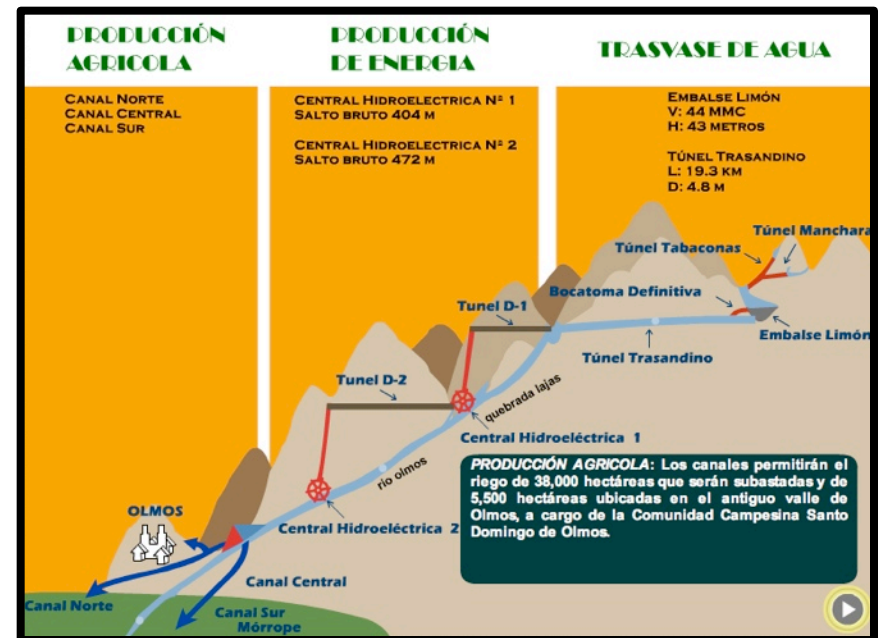
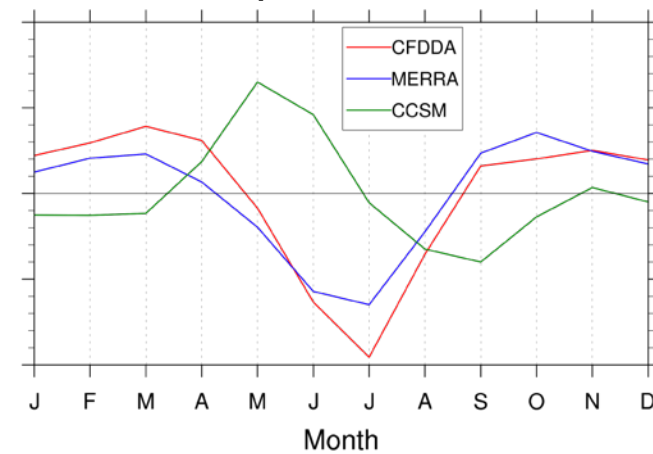


Water/Ag/Hydro Project in Peru

Precipitation



Temperature!!



Knowledge Innovation at the Science-Policy Interface

San Jose, Costa Rica, Spring 2010

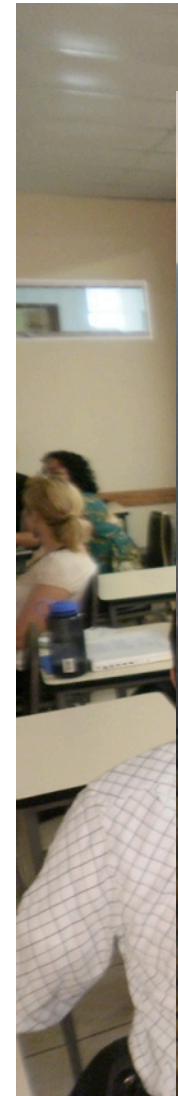
GIS Training



Knowledge Innovation at the Science-Policy Interface

San Jose, Costa Rica, Spring 2010

GIS Training



Knowledge Innovation at the Science-Policy Interface

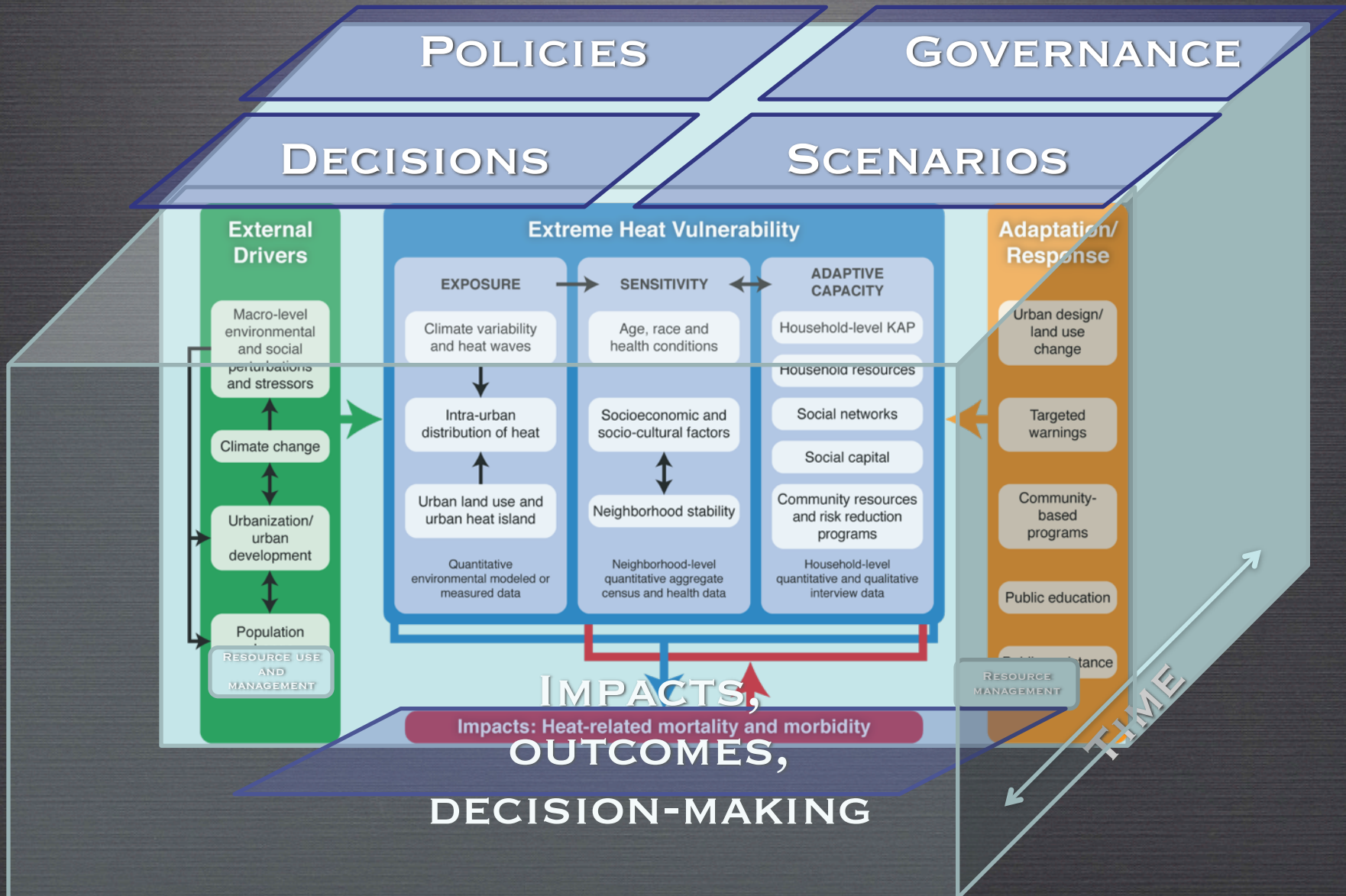
San Jose, Costa Rica, Spring 2010

GIS Training



QUANTIFYING SOCIETAL IMPACTS TO CLIMATE AND WEATHER RISKS

(N-VIA: NCAR - VULNERABILITY, IMPACTS, ADAPTATION)



Climate and Health

[UCAR](#) [NCAR](#)

[RAL home](#) [research](#) [technology](#) [people/org](#) [publications](#) [events](#) [pressroom](#) [for staff](#)

 **Research Applications Laboratory | RAL**

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You are here: [NCAR](#) • [RAL](#) • [CSAP](#) • *Fourth Biannual Colloquium on Climate and Health*

Fourth Biannual Colloquium On Climate And Health



[About](#) [Agenda](#) [Presenters & Attendees](#) [Documents](#) [Logistics](#) [Contacts](#)

THE 2011 NCAR/CDC COLLOQUIUM ON CLIMATE AND HEALTH

July 11-15, 2011 | NCAR Mesa Laboratory, Boulder, Colorado

The 2011 NCAR/CDC Workshop on Climate and Health will focus on vector-borne diseases related to human health. This multi-agency climate and health workshop will provide opportunities to address vector-borne disease concerns related to climate variability and change. The purpose of the workshop is to train health professionals and early career climate and health researchers (public health officials, graduate students, post-docs and early career scientists and faculty) on how to develop robust interdisciplinary research projects in the complex area of climate and health. The week long workshop will include lectures on relevant topics in climate and climate change and in public health and human health, vulnerability studies, statistics, and special tools for analysis (e.g., GIS). In addition, a few successful research projects will be highlighted, providing detailed analyses of the methods and components of the projects that led to their success. There also will be multiple opportunities for hands on activities related to project development to bring public health practitioners and climate scientists together to discuss integration of epidemiology, ecology, behavioral science, modeling and atmospheric science.



Fourth Biannual Colloquium on Climate and Health

VECTOR-BORNE DISEASES RELATED TO HUMAN HEALTH



Held:

July 11-15, 2011
NCAR Mesa Lab, Boulder, Colorado

[\(click here for directions\)](#)

Previous Colloquiums on Climate & Health

Summer Colloquium on Climate and Health, 2009
Summer Colloquia on Climate and Health, 2006
Summer Colloquium on Climate and Health, 2004

Sponsored by:

Centers for Disease Control and Prevention
Department of Health & Human Services
The National Aeronautics and Space Administration
National Center for Atmospheric Research
National Science Foundation
United States Global Change Research Program

12 July 2011

Modeling plague risk in Uganda

***Andrew J. Monaghan¹, Rebecca J. Eisen², Katherine MacMillan²,
Sean M. Moore^{1,2}, Kenneth L. Gage², Mary H. Hayden¹, and Paul Mead²***

¹National Center for Atmospheric Research, Boulder, CO

²Centers for Disease Control and Prevention, DVBID, Ft. Collins, CO

Funded by the U.S. Centers for Disease Control and Prevention and
the U.S. Agency for International Development

NCAR



Background

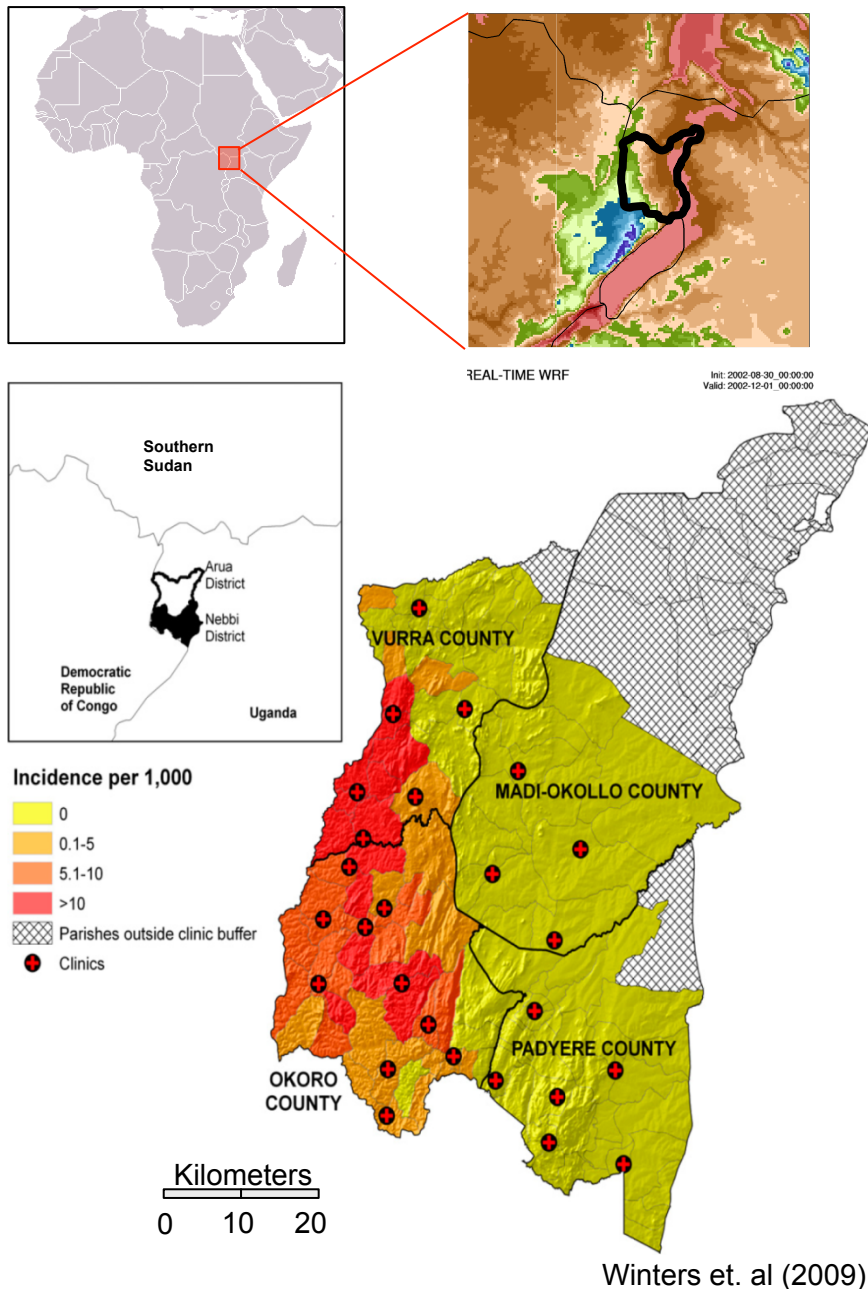
From 1999-2007, approximately 2,000 suspect human plague cases were reported from the West Nile Region in NW Uganda.

CDC is developing models based on ecological correlates with plague

NCAR is working with CDC to:

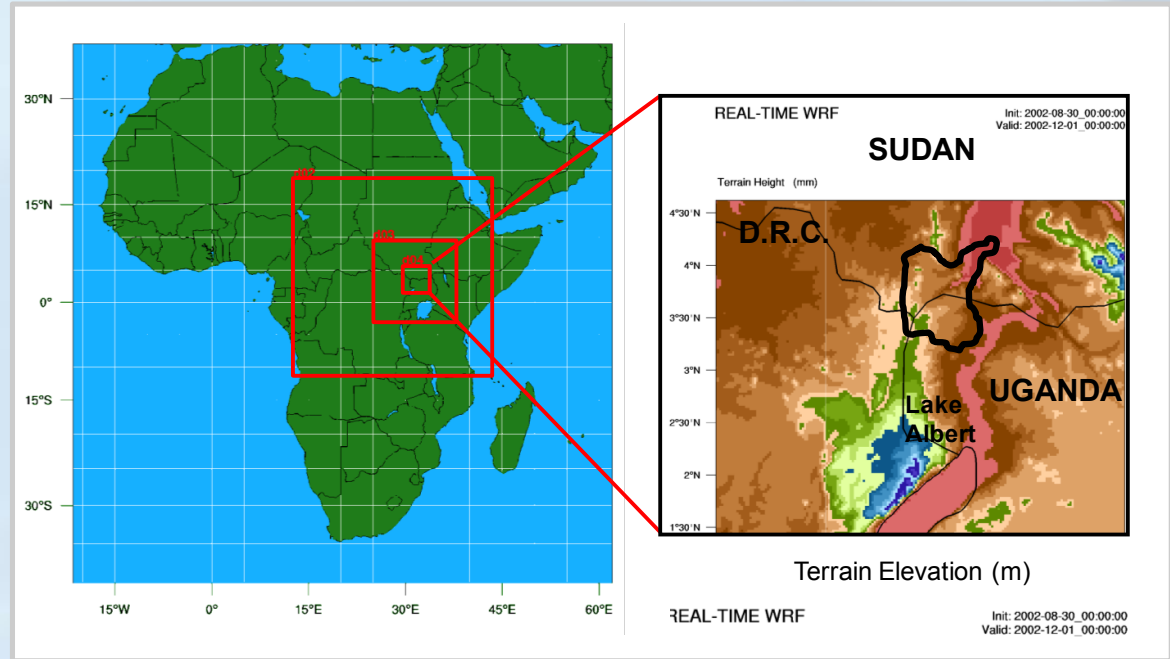
(1) Build an 11-year high resolution climate dataset over Uganda for development of models to simulate plague incidence

(2) Improve treatment of plague cases by training the regional network of clinicians and traditional healers in plague awareness

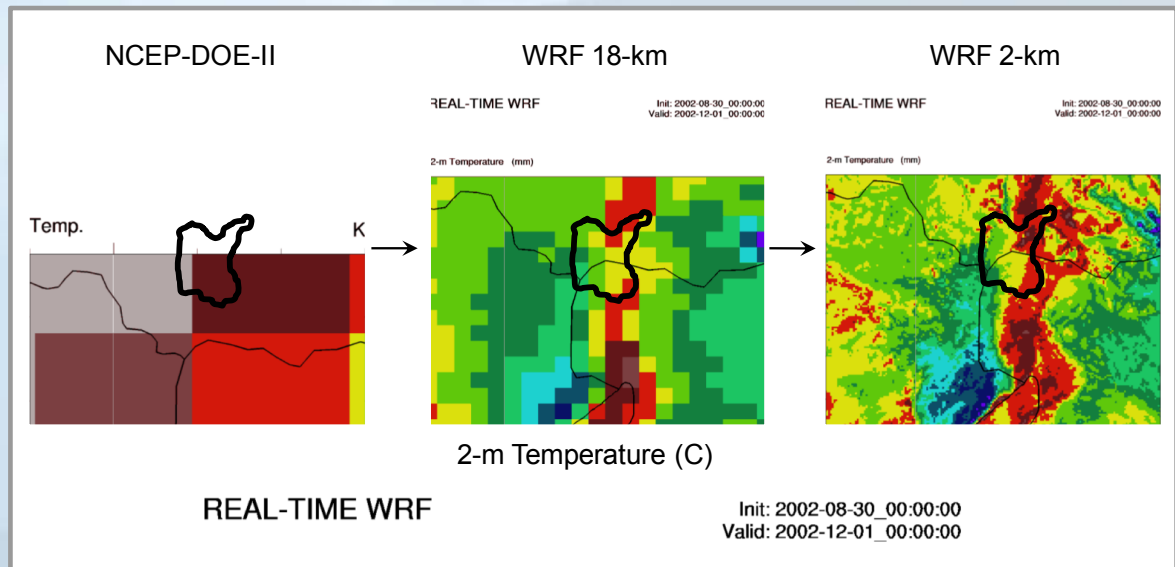


Modeling Work

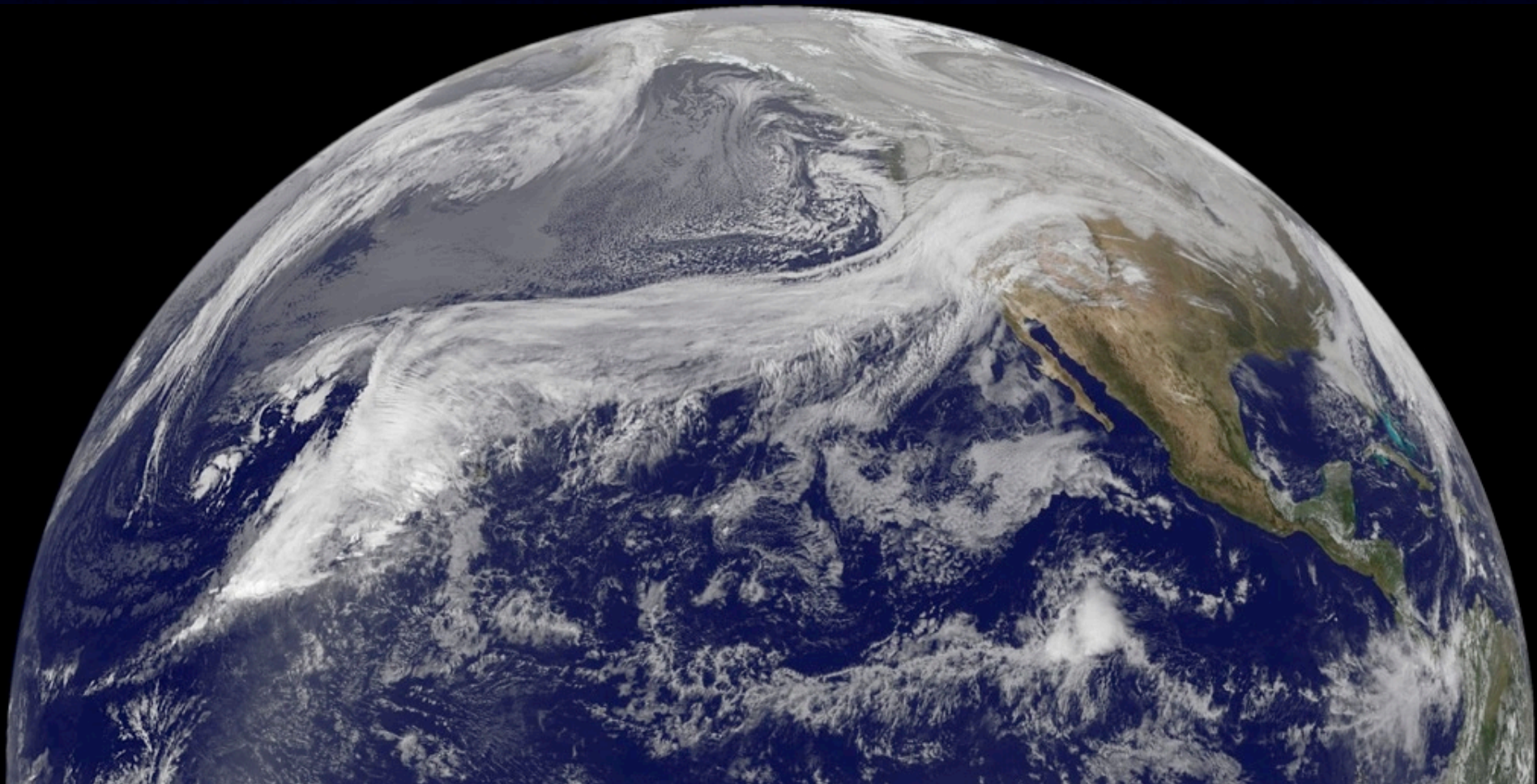
WRF Model Domain and Topography



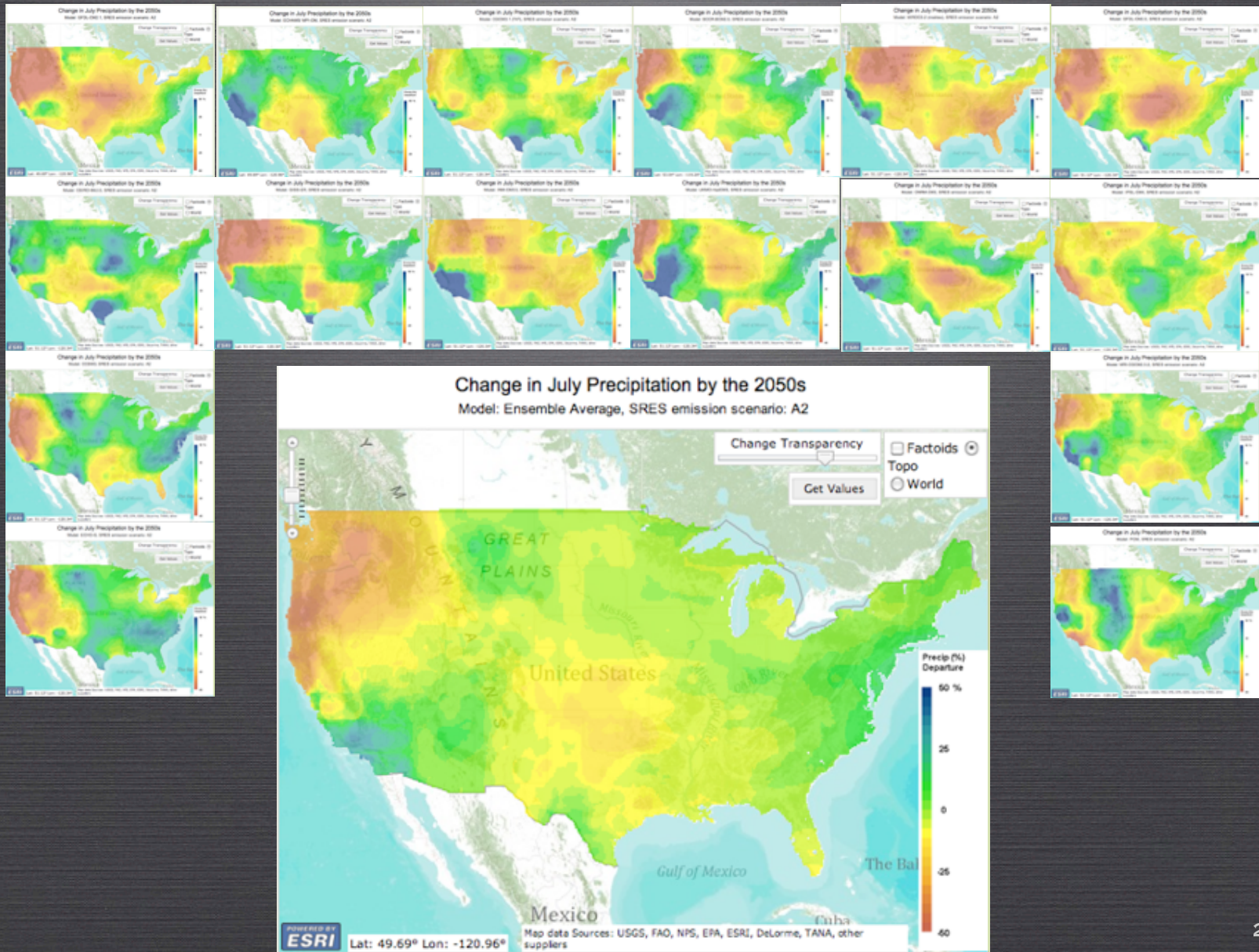
Example of downscaling 2-m temperature



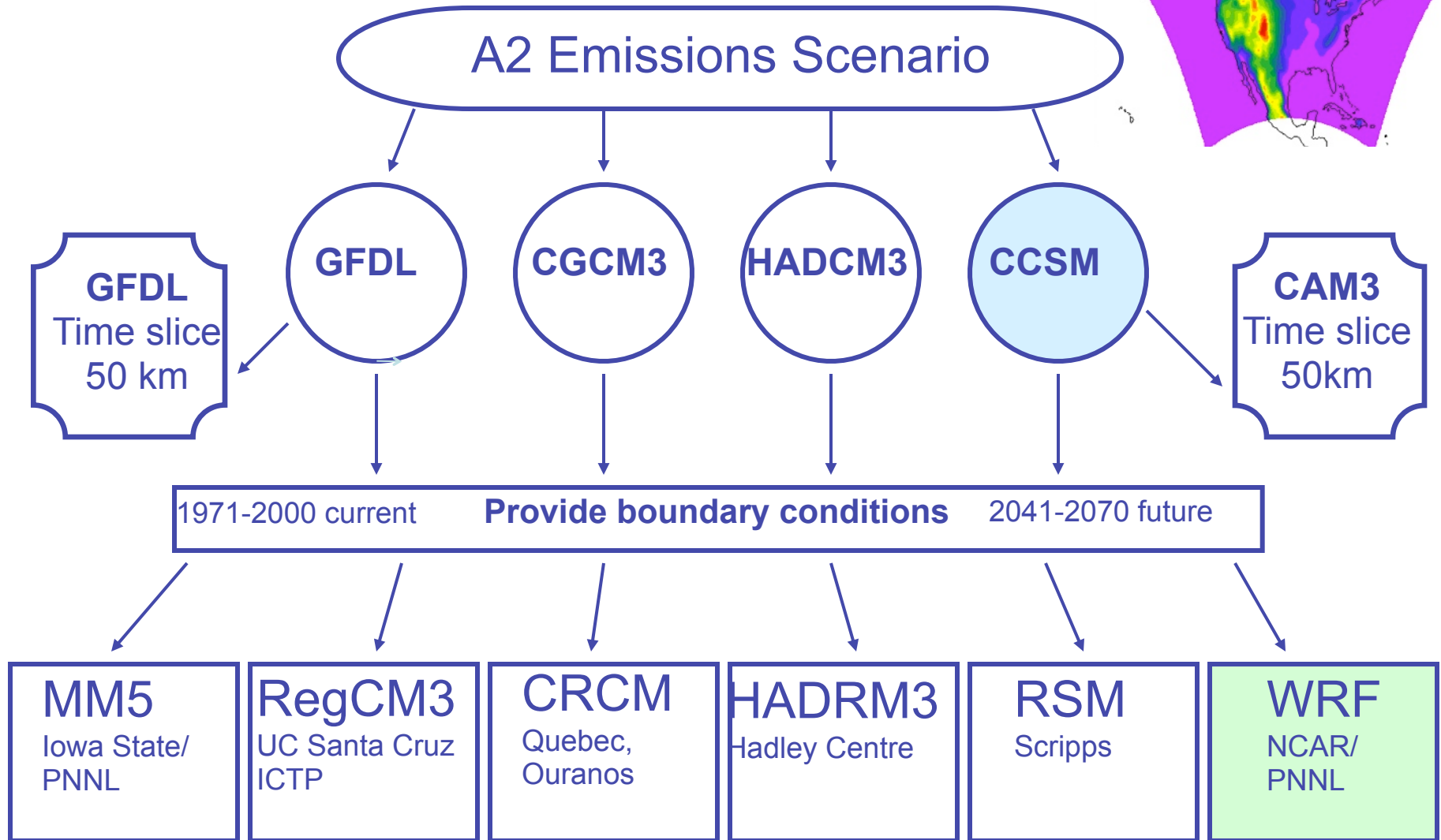
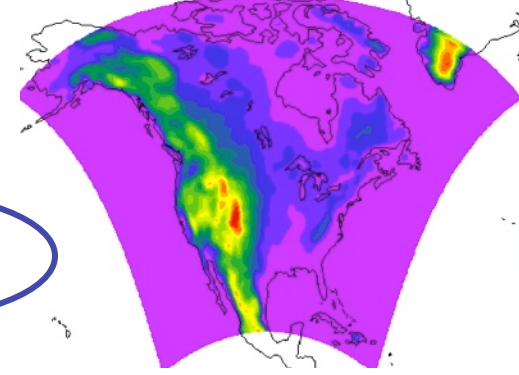
**Global processes well understood.
What does it mean for different regions?**



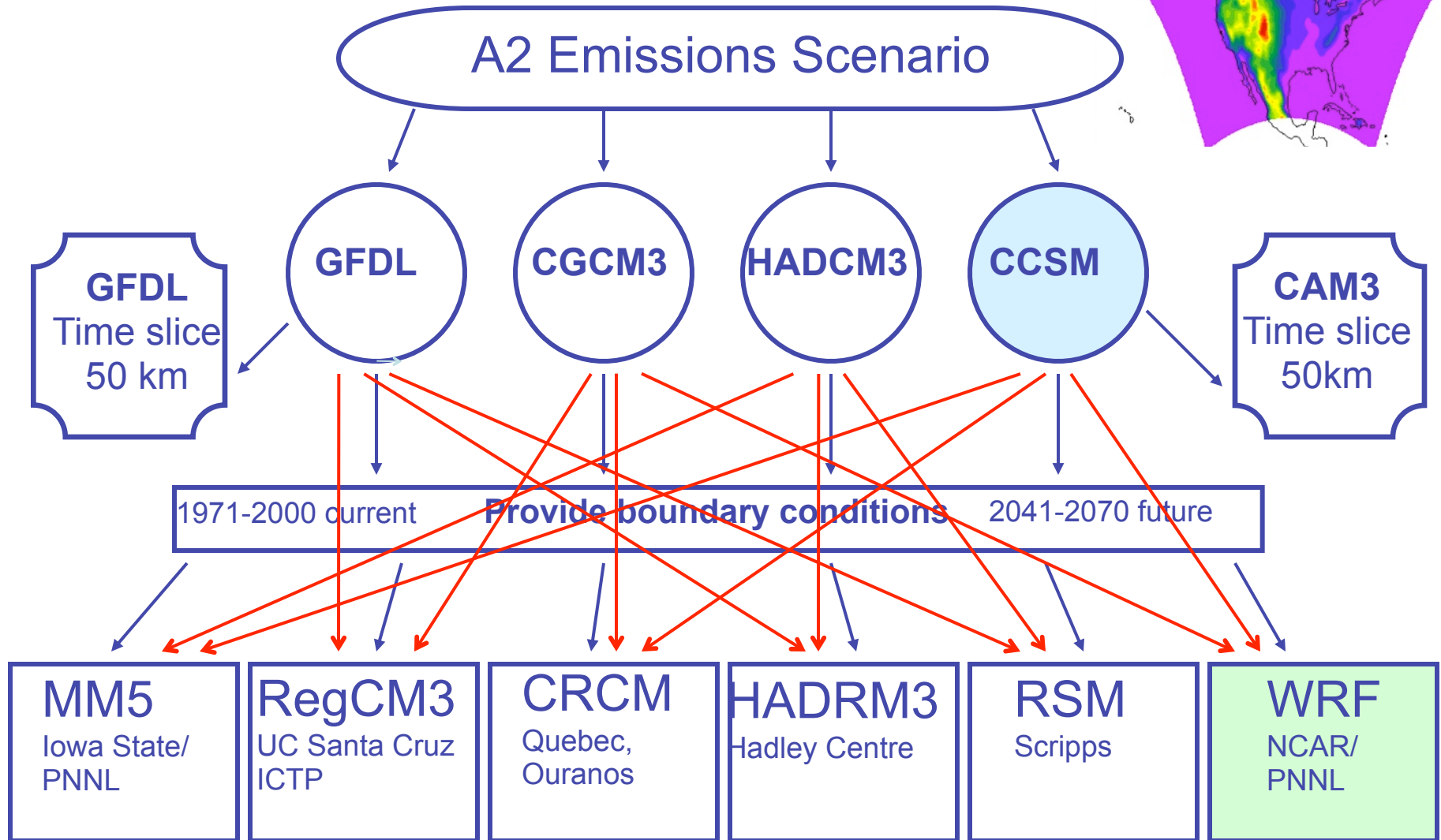
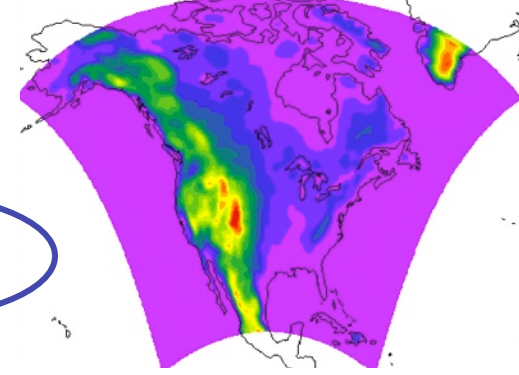
LARGE MODEL DIFFERENCES



NARCCAP PLAN – PHASE II



NARCCAP PLAN – PHASE II



CLIMATE SERVICES BRIDGING SCIENCE TO LOCAL NEEDS

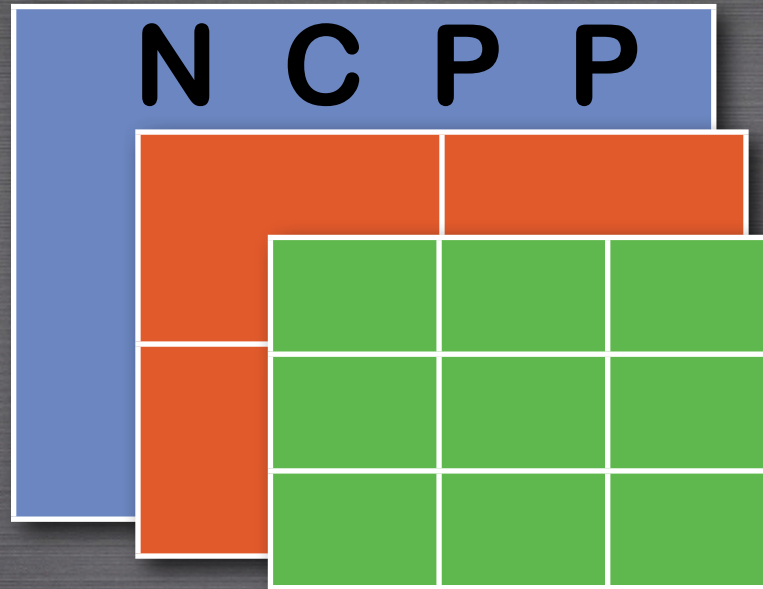
“The timely production and delivery of useful climate data, information and knowledge to decision makers”

(NRC, 2001)

“Give me information in such a way that I can make decisions at a local level. What does this mean for me in the next N years”

- Jargon-free, clear,
 - actionable,
 - expose the uncertainties
 - Science-brokers/translators are important
- (Pew Report “Lost in Translation”)

“Official” climate products & processes allow planners to make major, climate-informed, infrastructure decisions
....and stay out of court.



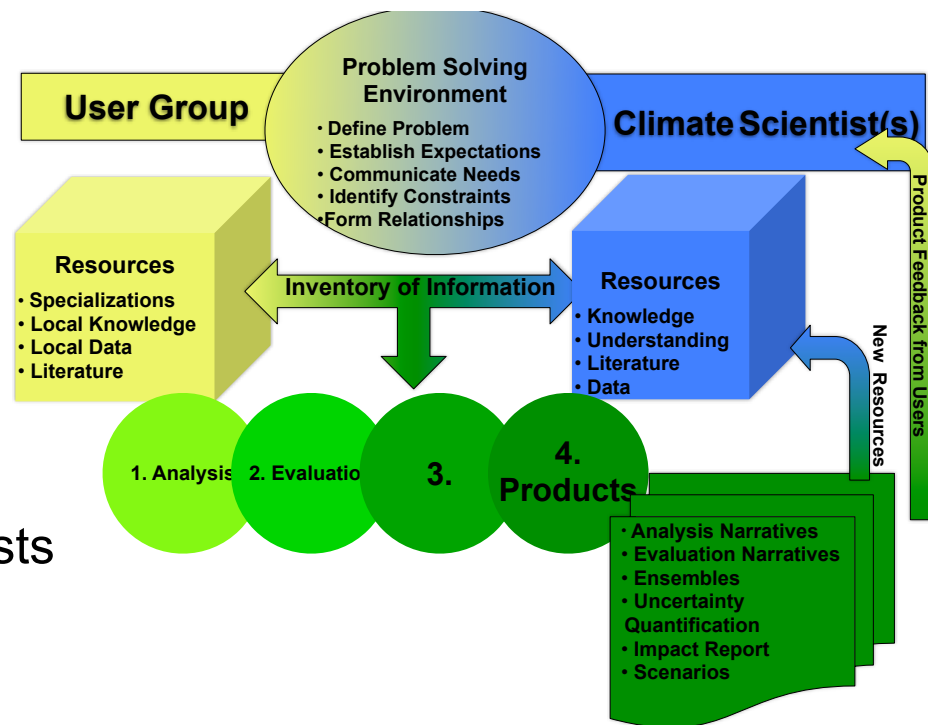
NATIONAL CLIMATE PREDICTION AND PROJECTIONS (NCP)

COMMUNITY FRAMEWORK TOWARDS CLIMATE SERVICES
BRIDGING SCIENCE TO LOCAL NEEDS

Mission and Strategy

Mission: Supports state-of-the-art approaches to develop and deliver comprehensive regional climate information and facilitate its use in decision making and adaptation planning.

Strategy: A community enterprise where climate information users, infrastructure developers, and scientists come together in a collaborative problem solving environment.

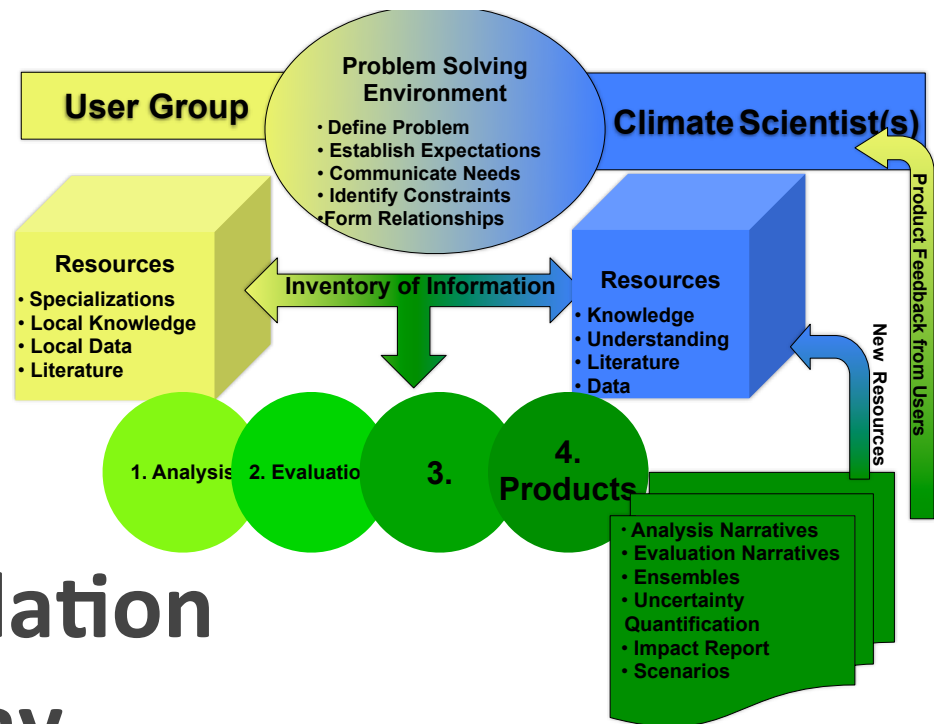


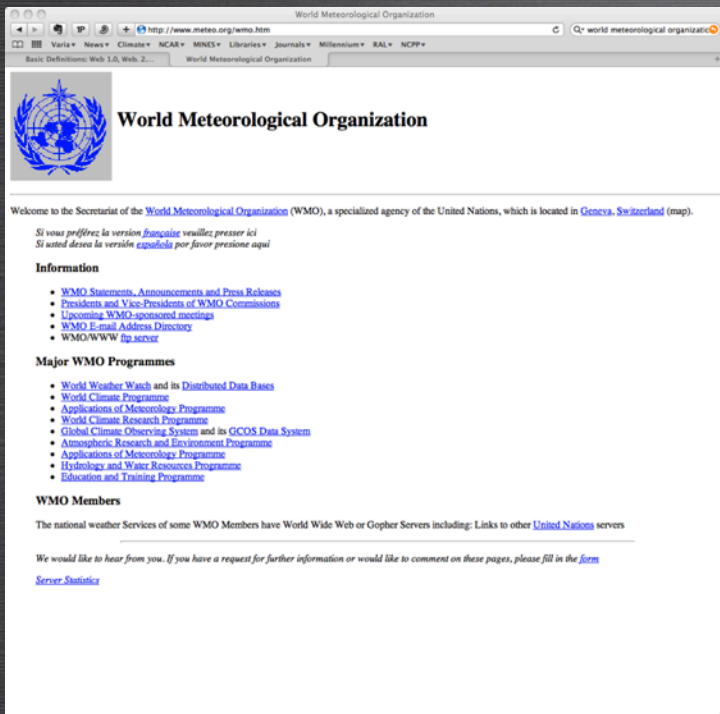
Three Pillars of NCPP

1: Data - Access

2: Science and Tools

3: Knowledge - Translation
in collaborative way





WEB 1.0 : STATIC WEB PAGES

“When I took office, only high energy physicists had ever heard of what is called the Worldwide Web... Now even my cat has its own page.” Bill Clinton

WEB AND CLIMATE SCIENCE



WEB 1.0 : STATIC WEB PAGES

WEB 2.0 : BLOGS/SOCIAL SITES

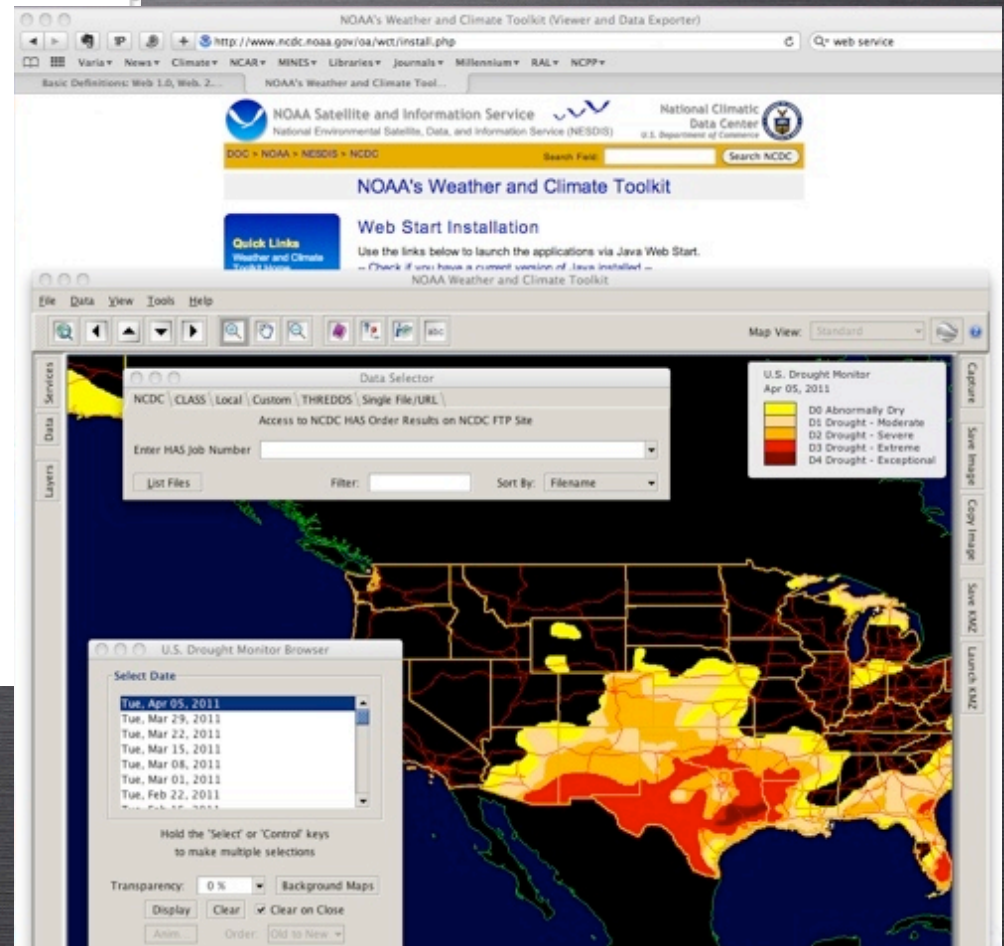
WEB AND CLIMATE SCIENCE



WEB 1.0 : STATIC WEB PAGES

WEB 2.0 : BLOGS/SOCIAL SITES

WEB 3.0 : WEB SERVICE



WEB AND CLIMATE SCIENCE

Access: Earth System Grid

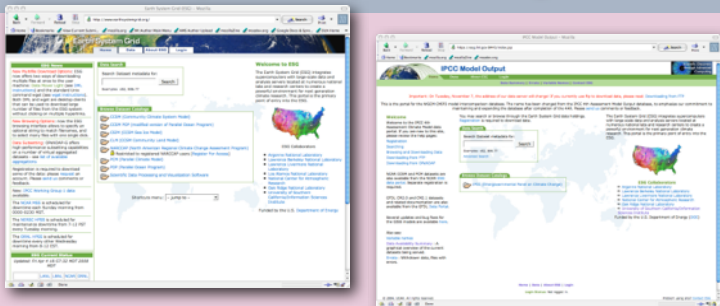


ESG Goals

- Petabyte-scale data volumes
- Globally federated sites
- “Virtual Datasets” created through subsetting and aggregation
- Metadata-based search and discovery
- Bulk data access
- Web-based and analysis tool access
- Increased flexibility and robustness

<http://www.earthsystemgrid.org>

<http://www.pcmdi.llnl.gov>



Current ESG Sites

Primary ESG Servers

Mass storage,
disk cache,
and computation

PMEL:
applications

NCAR: Climate
change
prediction and
data archive

LBLN/NERSC:
Climate
data archive

LLNL: Model
diagnostics and
inter-comparison

USC/ISI:
Globus, grid
applications, and
metadatabases

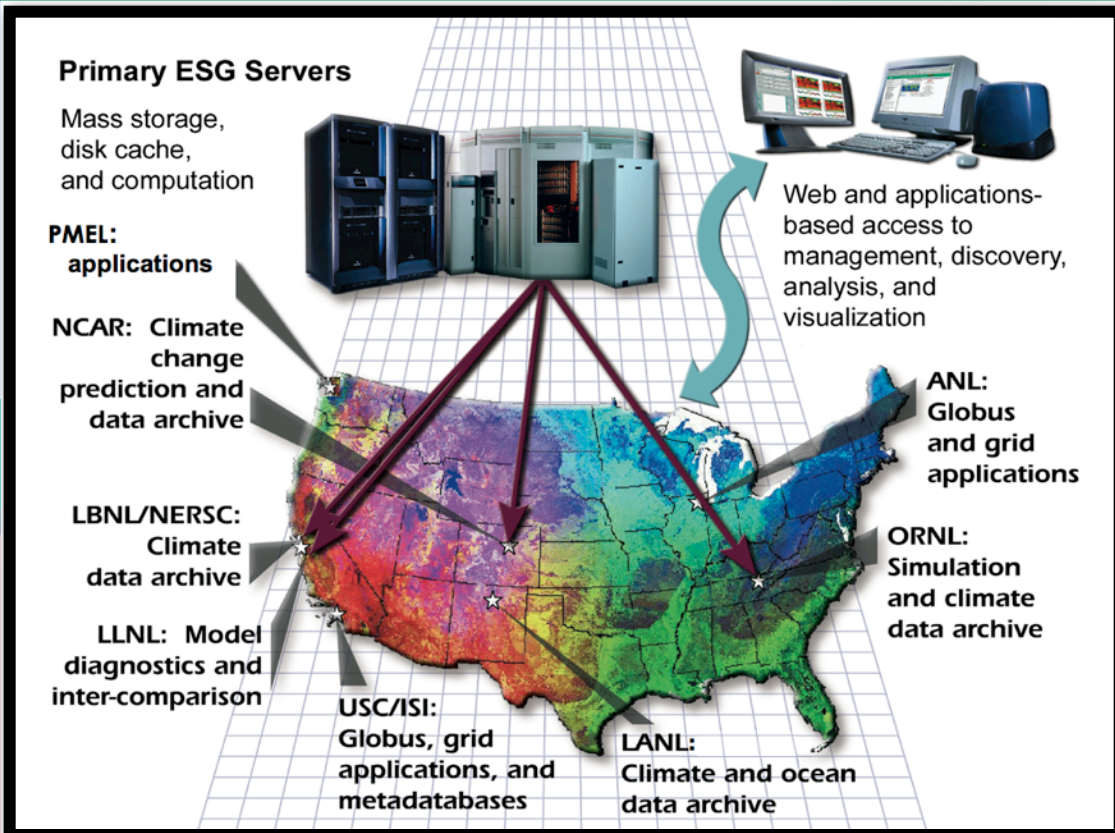
LANL:
Climate and ocean
data archive

ANL:
Globus
and grid
applications

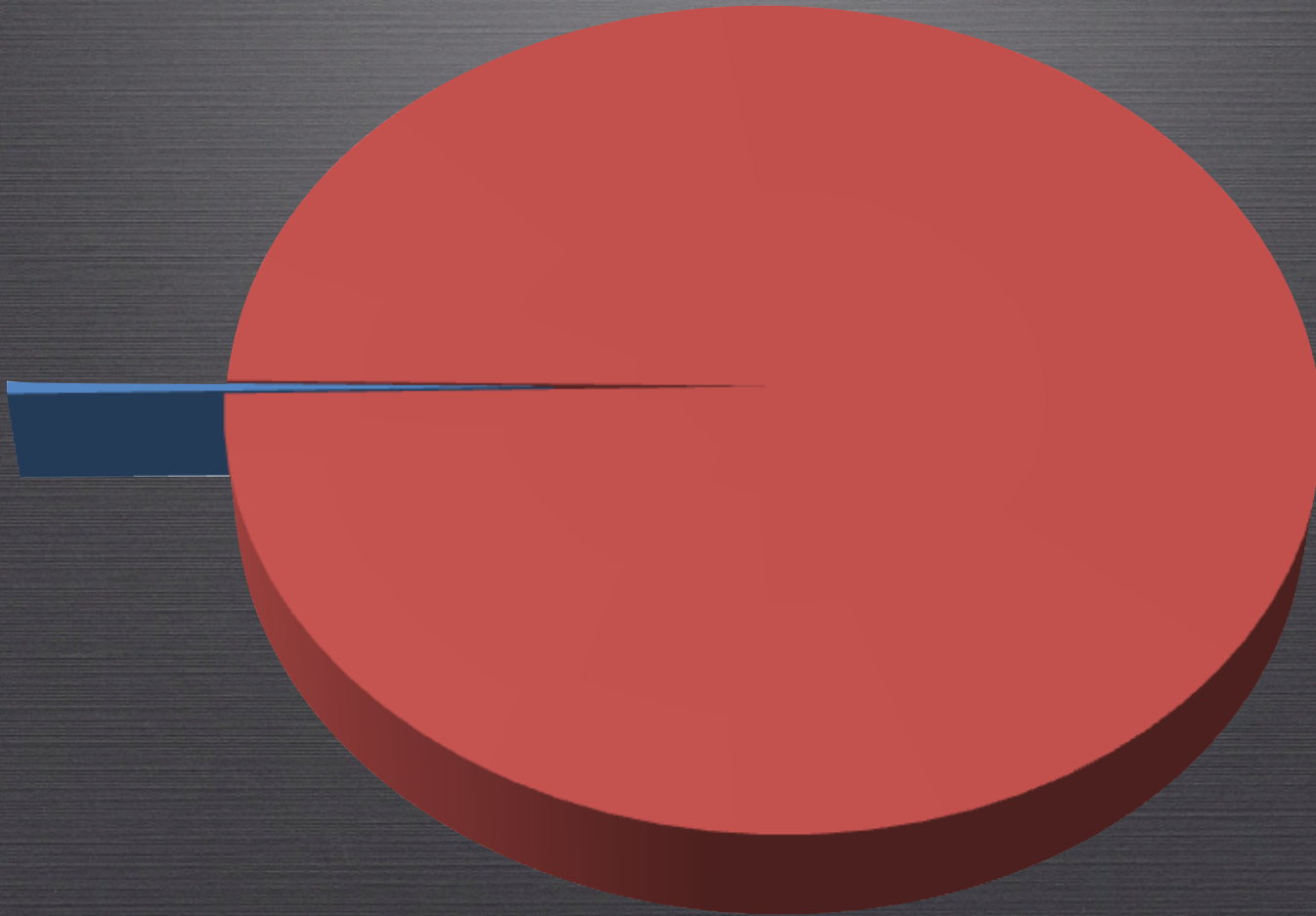
ORNL:
Simulation
and climate
data archive



Web and applications-
based access to
management, discovery,
analysis, and
visualization



REACHING OUT TO STAKEHOLDERS ...EVEN IF WE DON'T KNOW WHO THEY ARE



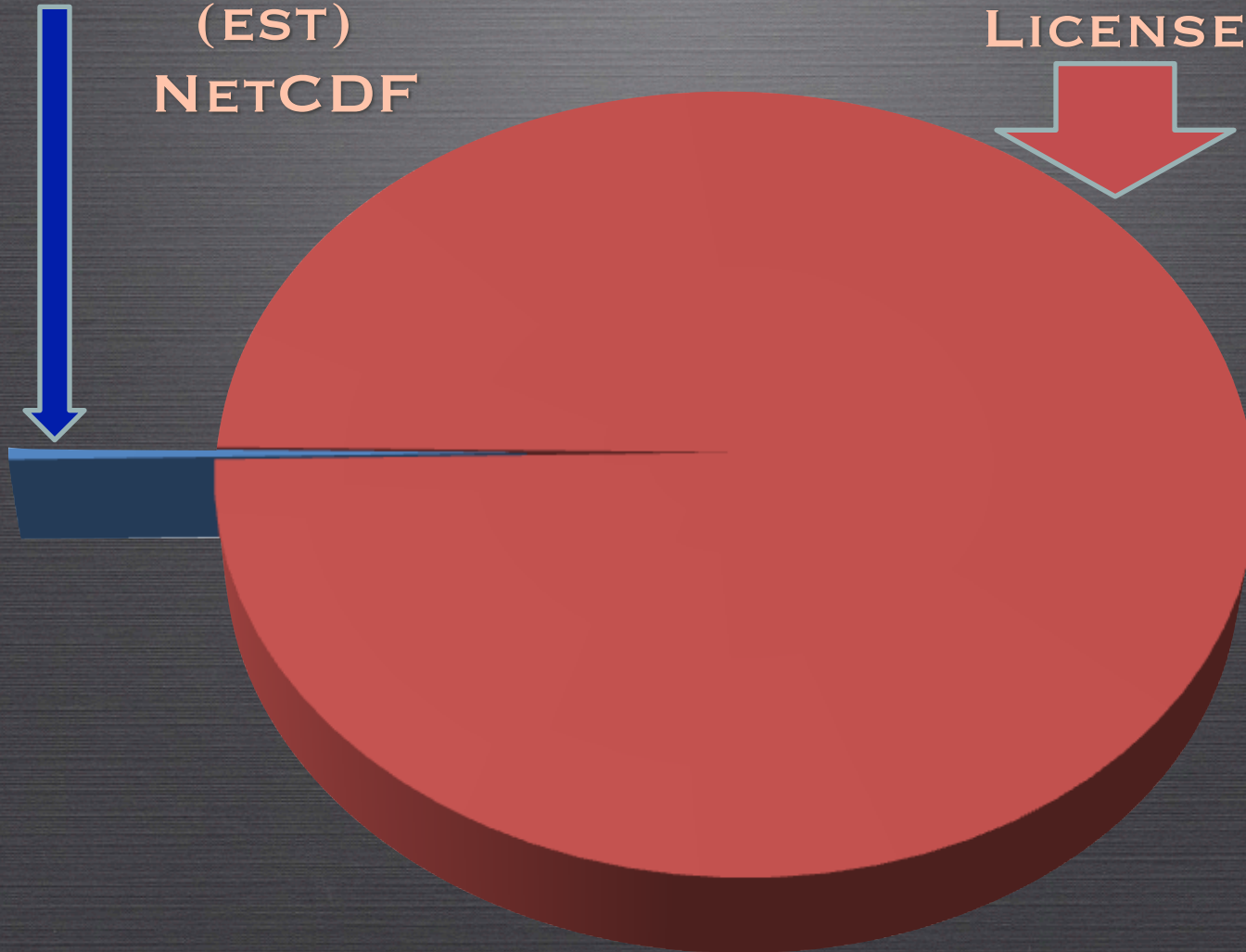
REACHING OUT TO STAKEHOLDERS

...EVEN IF WE DON'T KNOW WHO THEY ARE

20,000 CLIMATE SCIENTISTS

(EST)
NETCDF

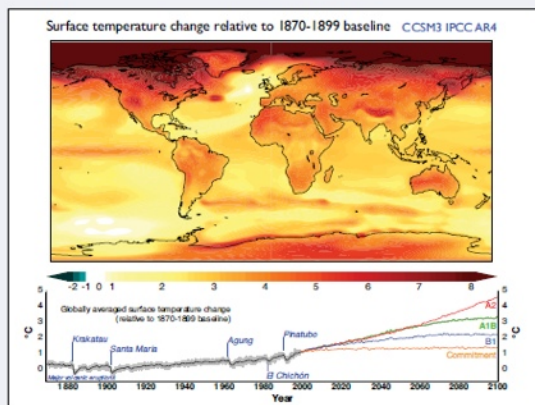
4,000,000 GIS
LICENSES



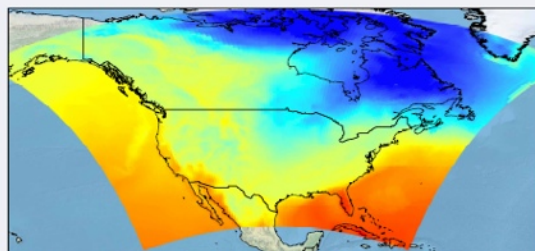
NCAR GIS PROGRAM

Climate Modeling

NCAR scientists carry out detailed, state-of-the-art climate simulations on some of the world's fastest supercomputers to develop insights on impacts of global and regional climate change affecting human and natural systems. Our GIS systems turn these petabytes of climate data into usable science for society.

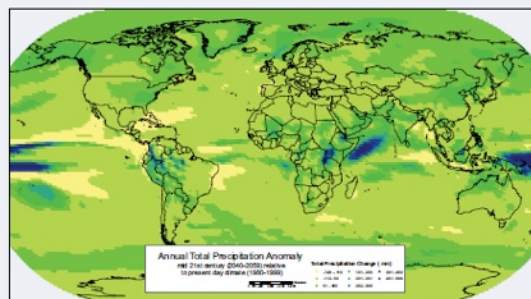


THE COMMUNITY CLIMATE SYSTEM MODEL (CCSM) IS A FULLY COUPLED GLOBAL MODEL OF THE EARTH'S PAST, PRESENT, AND FUTURE CLIMATE STATES [HTTP://WWW.CESM.UCAR.EDU](http://www.cesm.ucar.edu)

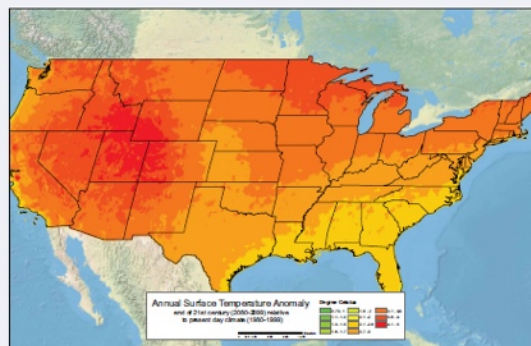


THE NORTH AMERICAN REGIONAL CLIMATE CHANGE ASSESSMENT PROGRAM IS AN INTERNATIONAL PROGRAM THAT PRODUCES HIGH RESOLUTION SIMULATIONS OF FUTURE CLIMATE ON A REGIONAL SCALE [HTTP://WWW.NARCCAP.UCAR.EDU](http://www.narccap.ucar.edu)

GIS Climate Change Portal

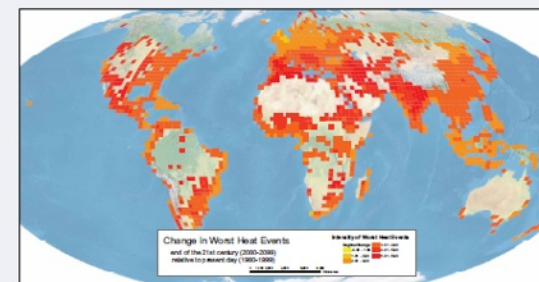


The GIS Program at NCAR provides access to climate change projections generated by the Community Climate System Model through the GIS Climate Change portal. The portal serves a community of GIS users interested in climate change research and applications.

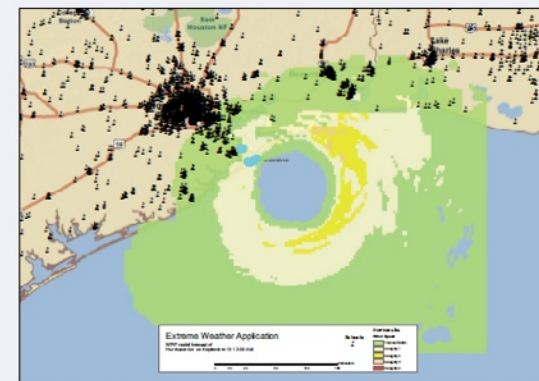


Research Enabled by GIS

NCAR scientists conduct research that integrates the Earth system and social sciences in a GIS. Research examples illustrate how simulations from global climate and weather forecast models are being analyzed in a GIS with respect to societal vulnerability to, for example, urban heat waves and tropical cyclones.



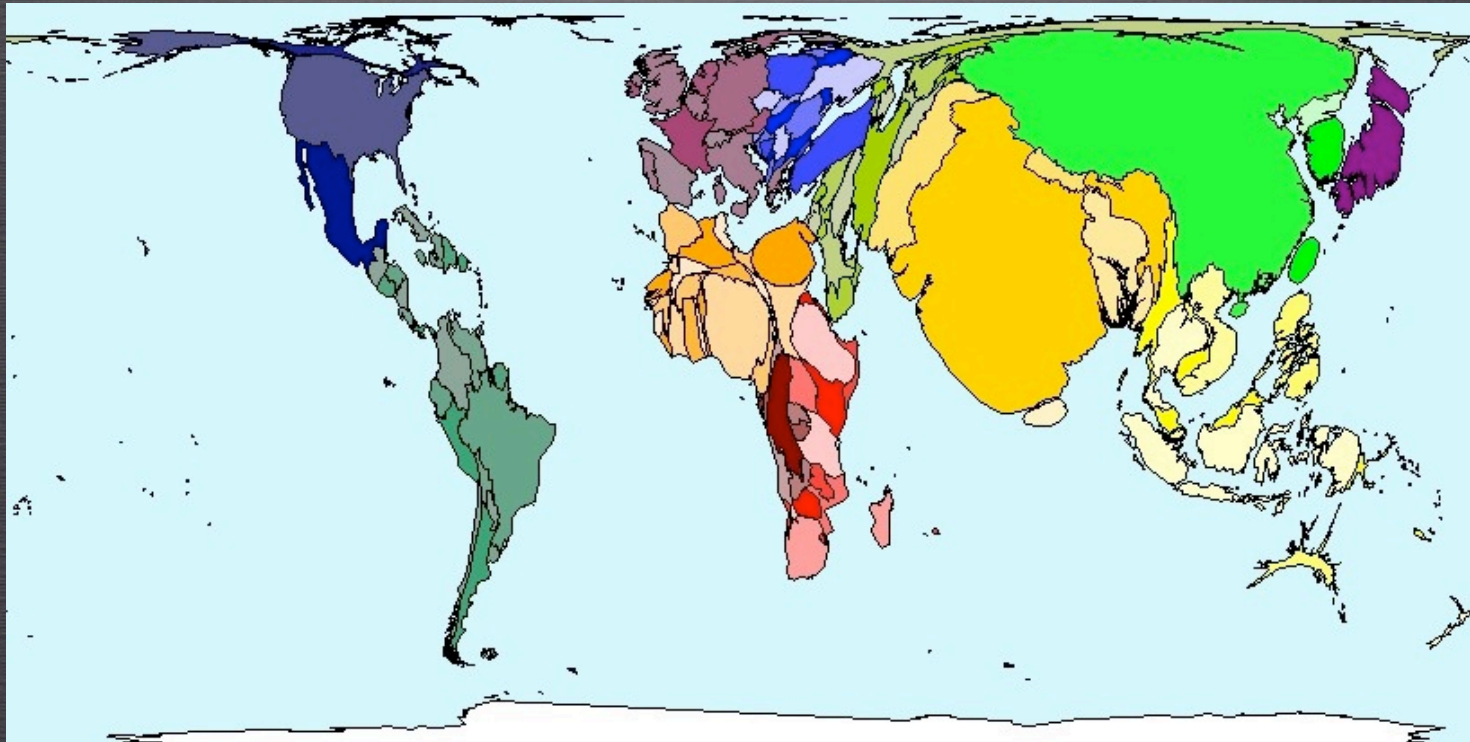
ANALYSIS OF CCSM SIMULATIONS OF PRESENT-DAY AND FUTURE CLIMATE WITH RESPECT TO THE URBAN HEAT ISLAND EFFECT AND FUTURE HEAT WAVES.



INTERACTIVE, ARCGIS SERVER-BASED WEB APPLICATION INTEGRATES WEATHER RESEARCH AND FORECASTING (WRF) HURRICANE FORECAST MODEL OUTPUT WITH SOCIOECONOMIC AND INFRASTRUCTURE DATA. [HTTP://WRF-MODEL.ORG](http://wrf-model.org)

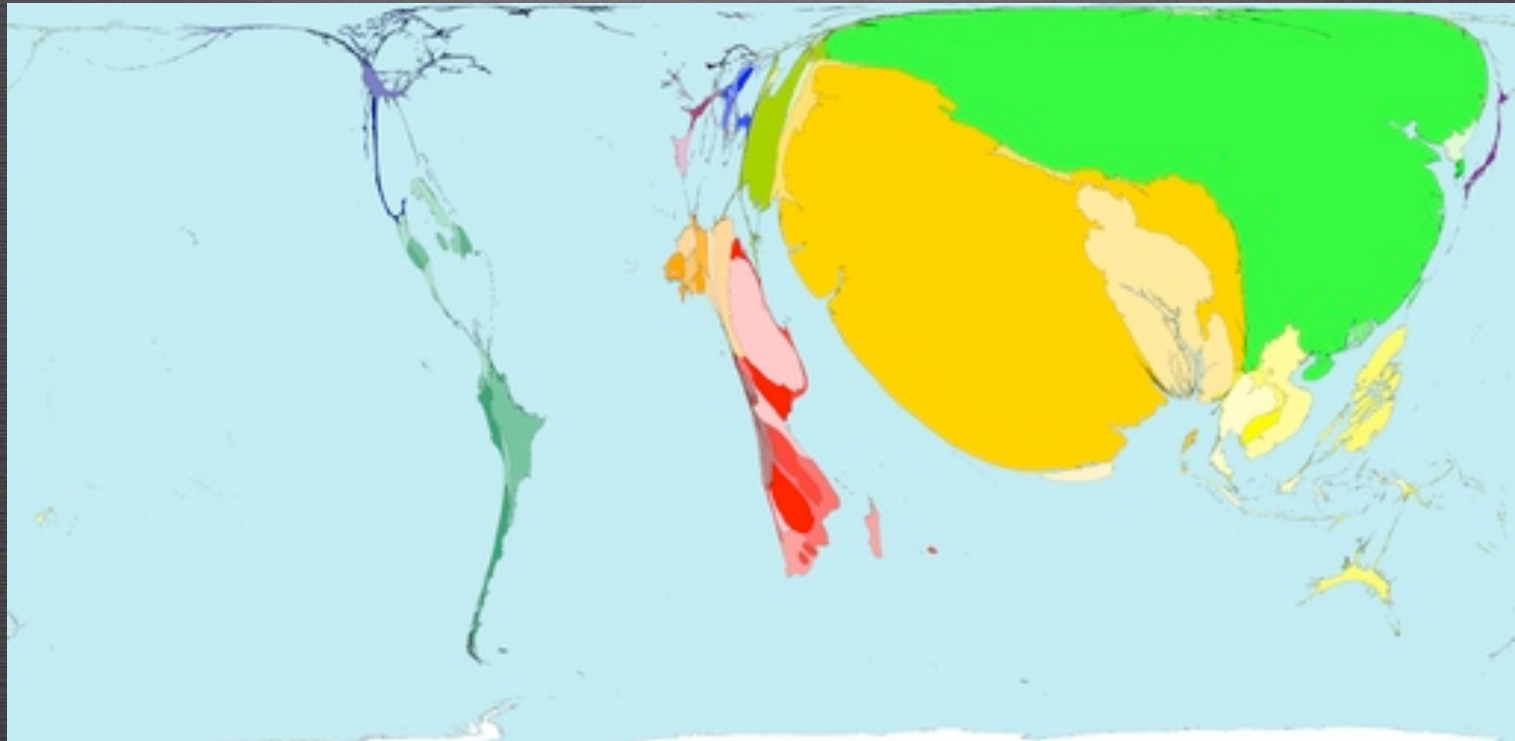
HELP PREPARE A WORLD AFFECTED BY DISASTERS 1975-2004

"We cannot prevent disasters (droughts, epidemics, volcanoes, storms, fires, and events caused by accidents or indirectly caused by wars.) ... What we hope to do is to be more proactive, to be better prepared so that we can react better, faster." Winston Choo, 2006

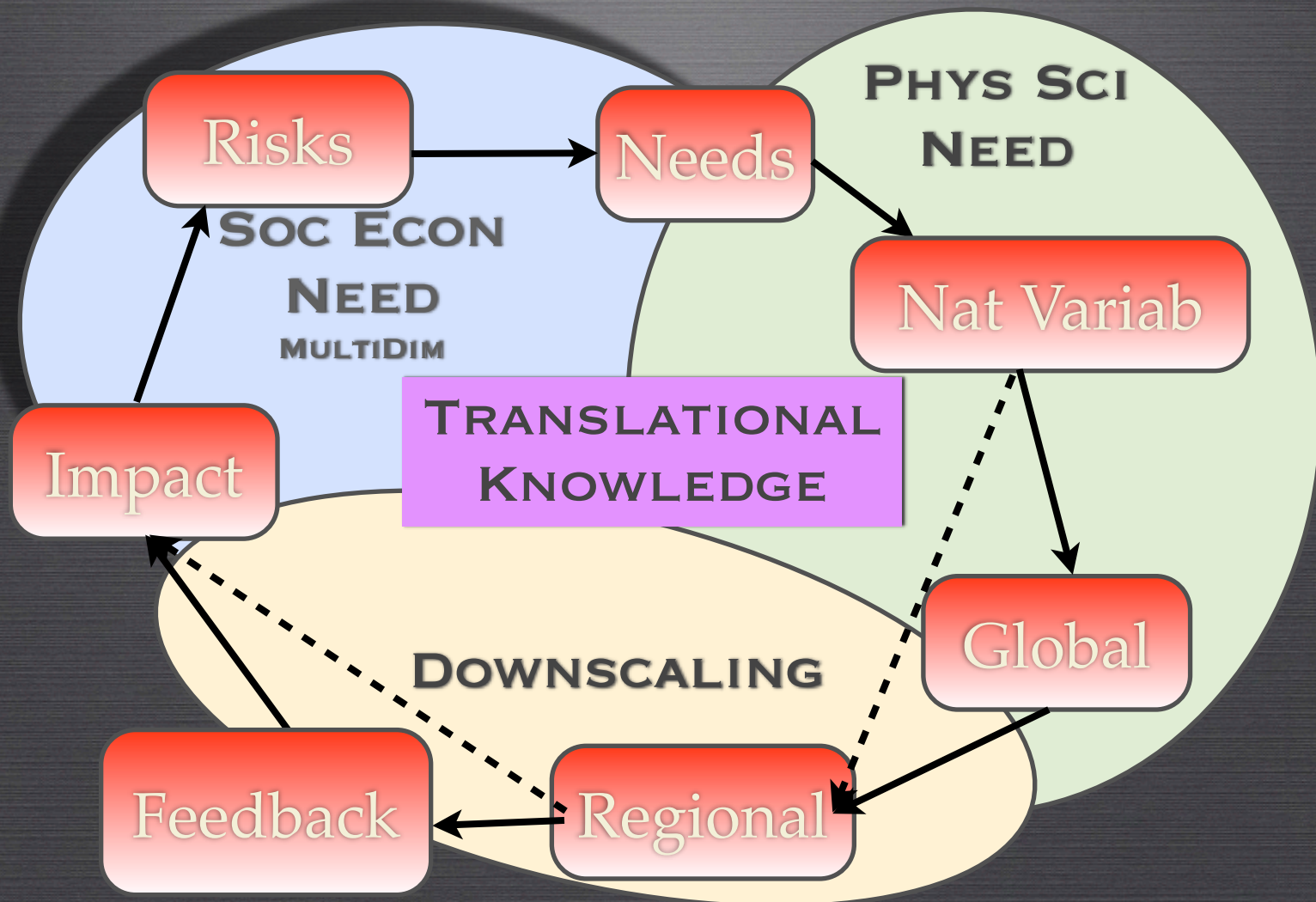


HELP PREPARE A WORLD AFFECTED BY DISASTERS 1975-2004

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END-TO-END - CAPACITY BUILDING



AMMANN, 2011



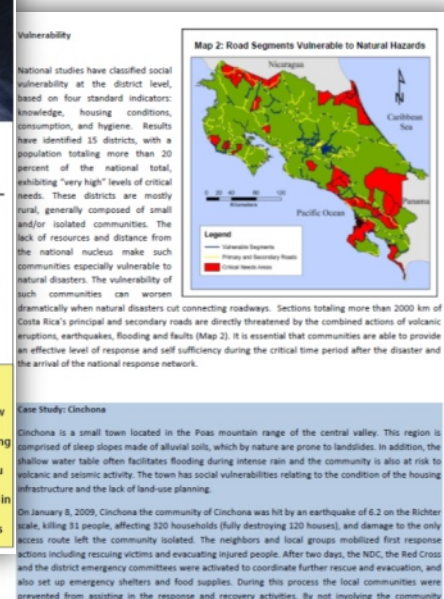
NCAR



IAI-NCAR Colloquium in Costa Rica

“Knowledge Innovation at the Science-Policy Interface”

- Climate Science enabled:
 - Perspectives on interdisciplinary science of global change and risk assessments
 - GIS skills
 - Effective communication at the science-policy interface (policy briefs)
 - Networking and future international collaborations
 - Capacity building



**“PREDICTION IS VERY DIFFICULT,
PARTICULARLY ABOUT THE FUTURE.”**

NIELS BOHR

“Society has three choices: Mitigate, Adapt or Suffer”

John Holdren (US Science Adviser)



**“PREDICTION IS VERY DIFFICULT,
PARTICULARLY ABOUT THE FUTURE.”**

NIELS BOHR

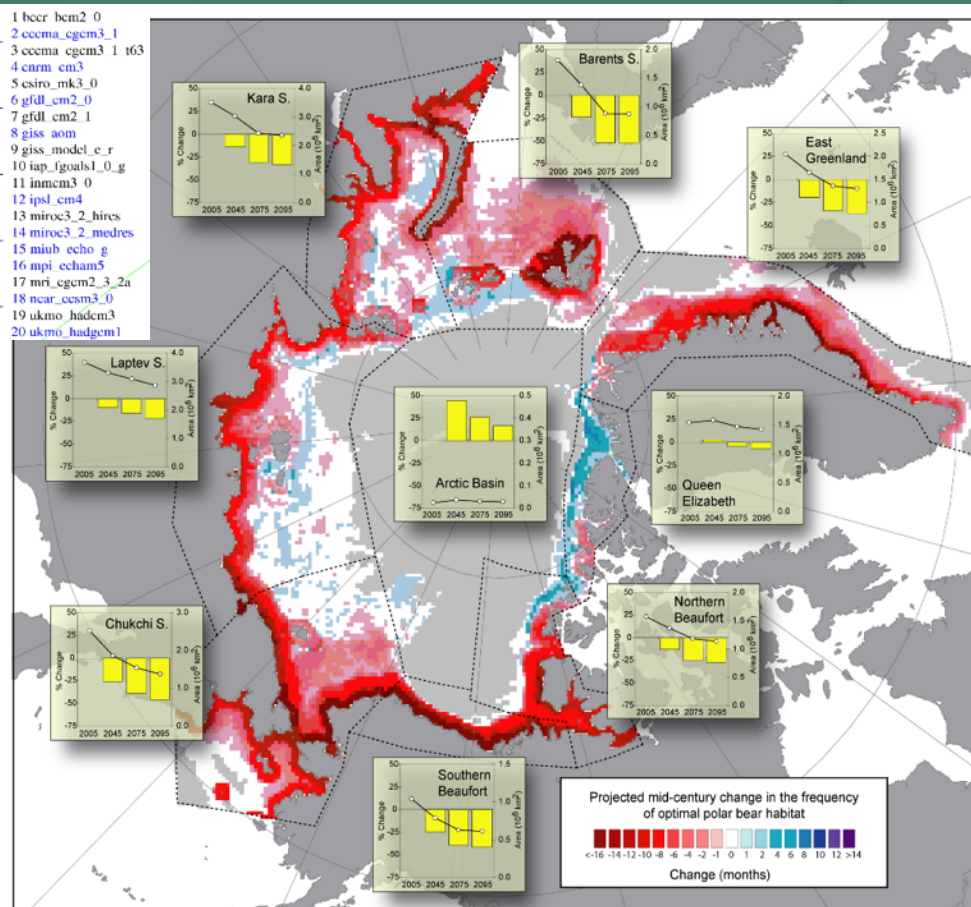
**NEED FOR A NEXT GENERATION:
DATA, KNOWLEDGE EXCHANGE,
INTERDISCIPLINARY PARTNERSHIPS**

“Society has three choices: Mitigate, Adapt or Suffer”

John Holdren (US Science Adviser)

Briefing on Results:

USGS Science Strategy to Support U.S. Fish & Wildlife Service Polar Bear Endangered Species Listing Decision



CLIMATE SCIENCE AND APPLICATIONS PROGRAM



*Enhancing adaptive capacity for society
in the context of changing weather and climate*