Climate Observations and Services:

Complementary Roles Across Government, Academia, and the Private Sector

Antonio J. Busalacchi

How are Government-University-Industry Partnerships best structured to achieve an impact on the environment?

- Background
- Report from Room 203
- Some Partnership Examples
- Summary

Background

- The Earth System will experience real climate change over the next 50 years, exceeding the scope of natural climate variability.
- A paramount question facing society is how to adapt to this certainty of climate variability and change in the next half century (this question is apart from the issue of mitigation).
- In response, NOAA is considering how comprehensive climate services would best inform decisions about adaptation.
- Similarly, NASA is considering the optimal configuration of the next generation of Earth, environmental, and climate observations to be deployed over the coming 10-20 years.
- Moreover, much of the added-value information for specific climate-related decisions will be provided by private, academic and non-governmental organizations.

- As such, the needs for coping with climate variability and adapting to climate change represent a real and emerging challenge to the Nation.
- While present government, private sector and academic structures exist to address several elements of this complex challenge, numerous gaps exist.
- Yet, there exists no coherent, comprehensive strategy or structure to deal with climate information in an integrated and focused manner.

- The Climate Change Science Program integrates federal research on climate and global change, as sponsored by 13 federal agencies (e.g., NOAA, NASA, EPA, USGS, USDA, etc.) and overseen by OSTP, CEQ, the National Economic Council and OMB.

- Last month the NAS/NRC Committee on Strategic Advice to the Climate Change Science Program released a study that criticized the CCSP for failing to adequately communicate its research with stakeholders

- "Efforts to identify or engage in a two-way dialogue with state and local officials, nongovernmental organizations, and the climate change technology community have generally been limited and ad hoc"

- NASA and NOAA are the two largest agencies within the CCSP
- NASA provides a space-based global perspective of Earth as a system
- NOAA provides atmosphere-ocean based observations and climate prediction models
- NOAA is in the process of developing a strategy for the development of Climate Information Services

- The deliverance of climate observations and services involves the transition across basic research, applied research, operations, applications, and engagement with the user community
- Most of the effort to date has been focused on the physical climate system and not product driven
- However, climate impacts and services involve business, finance, agriculture, engineering, public health, public policy, etc.
- No single agency covers this spectrum, hence the need for an enterprise or partnership approach(es)

Report from Room 203

Options to Ensure the Climate Record from the NPOESS and GOES-R Spacecraft

- "The combined protections of ITAR regulations, brown-outs and black-outs associated with government procurements, firewalls to separate programs and people, and competitive pressures combine to create a significant obstacle to the sharing of sensor information, and stifle the collaboration of industry, government, academia, and nations in climate observations.

- Creating mechanisms for collaboration and partnership could greatly benefit climate science."

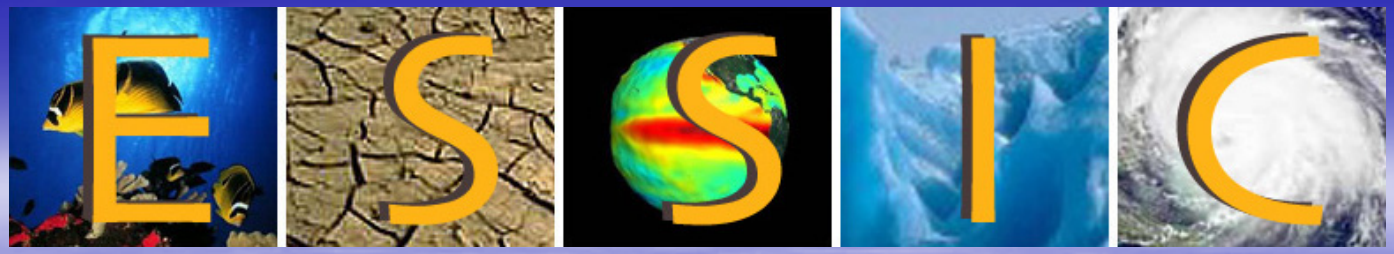
Options to Ensure the Climate Record from the NPOESS and GOES-R Spacecraft

- "Algorithms and science applications represent the intellectual core of the process that turns sensor observations (inputs) into climate, weather, and other environmental products and services (outputs) – and ultimately socioeconomic benefits.
- It is critical that communities of interest, often government-academic-contractor teams with careers spent in the field, be at the center of the algorithm development process"

Options to Ensure the Climate Record from the NPOESS and GOES-R Spacecraft

- "When systems are procured in a turn-key fashion, decisions are often dominated by the highest cost- and schedule-risk items (e.g., spacecraft, launch, sensor, computing system).
- As a consequence, a less-than-optimal algorithm development solution may be selected without community input or oversight. When algorithm development becomes decoupled from the communities of interest and practice, higher-cost, high-risk, and lower-performing solutions can be unintended but unavoidable consequences."

Some Partnership Examples



- ESSIC started as a joint center between the University of Maryland Departments of Meteorology, Geology, and Geography together with the Earth Sciences Directorate at the NASA/Goddard Space Flight Center.

- ESSIC now also administers the Cooperative Institute for Climate Studies (CICS) which is joint with NOAA's National Centers for Environmental Prediction (NCEP) and the National Environmental Satellite and Data Information Service (NESDIS).

- ESSIC also works within an MOU with Noblis Inc. (formerly Mitretek Systems) at the public-private interface

- The goal of ESSIC is to enhance our understanding of how the atmosphere-ocean-land-biosphere components of the Earth interact as a coupled system and the influence of human activities on this system.

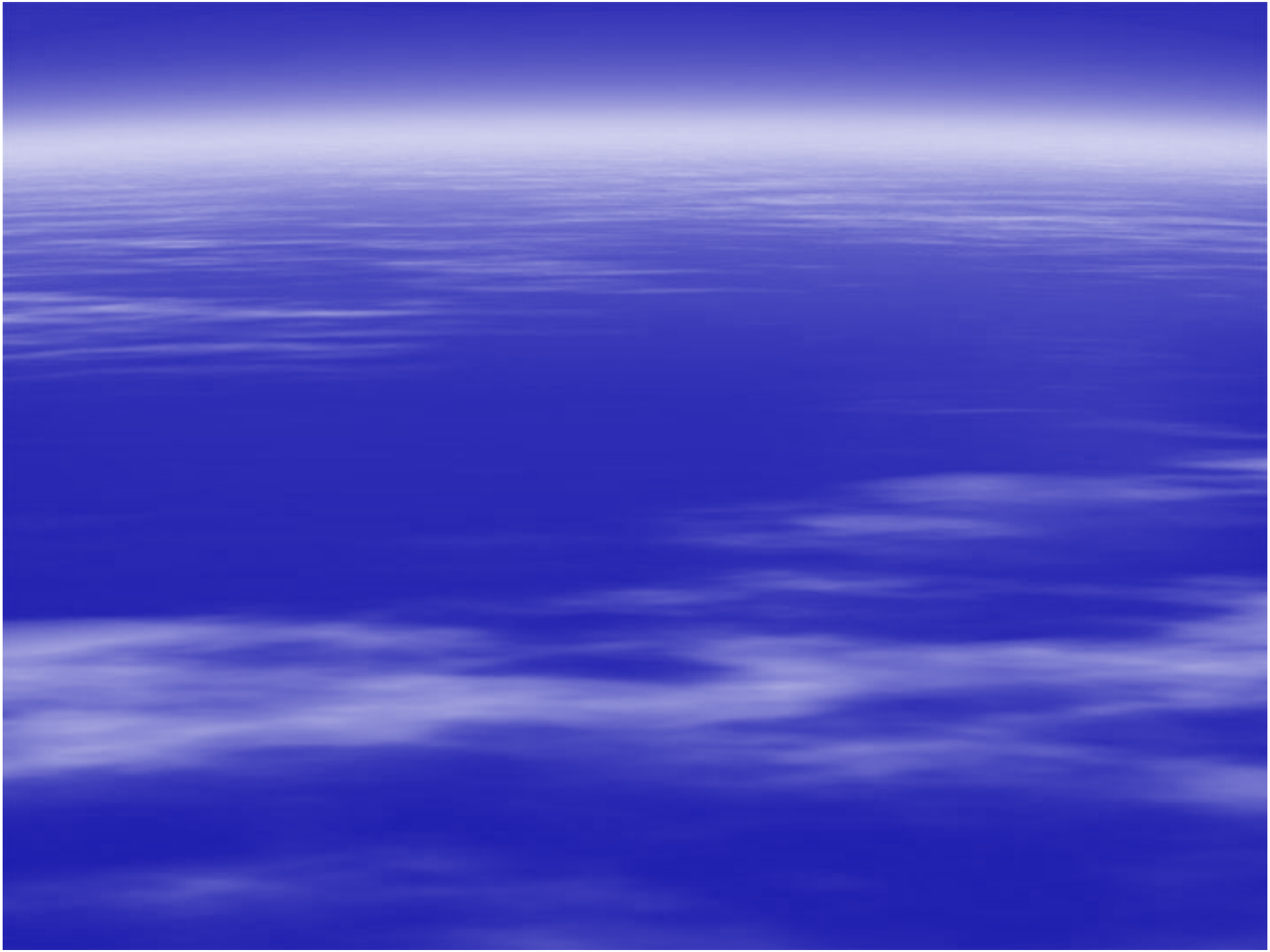
Chesapeake Bay Forecast System

- **Objective:** Develop a fully integrated, coupled physical – biogeochemical model of the Chesapeake Bay and its watershed that assimilates *in-situ* and satellite-derived data by adapting and connecting existing models

- **Purpose:**
  - Near-Real Time Applications: Nowcasting and forecasting of the Bay circulation, ecosystem, pathogens, harmful algal blooms, waves and inundation.
  - Climate Projections: Estimating effect of climate change, between now and 2050, on the health of the Bay and its watershed.

SeaWiFS true-color image of Mid-Atlantic Region from April 12, 1998.

Image provided by the SeaWiFS Project, NASA/Goddard Space Flight Center and ORBIMAGE



CIRUN

Climate Information: Responding to User Needs

Climate Information: Responding to User Needs

Bringing Observations, Data Management, Modeling, and Prediction into the Decision Process

A national workshop sponsored by the University of Maryland in partnership with NOAA, NASA, and the American Meteorological Society

Workshop Co-Chairmen:

James R. Mahoney, Environmental Consultant and former Director, U.S. Climate Change Science Program (2002 – 2006)

Antonio J. Busalacchi, Earth System Science Interdisciplinary Center, University of Maryland

The Earth System will experience real climate change over the next 50 years, substantially exceeding the scope of natural variability. A paramount question facing society is how to adapt to these changes. Success will require unprecedented collaborations and powerful partnerships between climate scientists and the consumers of climate information - businesses, government agencies from federal to local, policy organizations and planning offices that need specific kinds of information to ensure the best decisions in adapting to climate change.

CIRUN

Climate Information: Responding to User Needs

October 22-23 Plenary Speakers
www.climateneeds.umd.edu

Norman Augustine, former CEO of Lockheed Martin

R. James Woolsey, former Director of Central Intelligence Agency

James Mahoney, former Director, Climate Change Science Program

Gregory Hobbs, Justice of Colorado Supreme Court

Bryan Hannegan, Vice President of Electric Power Research Institute

Cristina Rumbaitis del Rio, Rockefeller Foundation

Amr ElSawy, Incoming President, Noblis Inc.

Bob Ryan, NBC meteorologist and former President of AMS

Joseph Tydings, U.S. Senator from Maryland 1965-1971

Monday Oct. 22
Morning Panels

Terrestrial Ecosystems

Fred Norbury/National Forest Service
James Rattling Leaf/Rep. Native Lands
Lara Hansen/World Wildlife Fund
John Musinsky/Conservation International

Insurance/investment

F. Nutter/President, Reinsurance Assoc Amer.
R. Flynn/Travelers
R. Tyler/Maryland Insurance Commissioner
Larry Johnson/Allstate
L. Gritzo/FM Global
S. Steinmetz/Fireman's Fund

Parks & Recreation

Julie Thomas/National Park Service
William Maloney/Am. Society of Travel Agents
Mark Wenzler/Natl Parks & Conservation Assn

Agriculture

Carolyn Olson/USDA
Toby Halkovich/Cakebread Cellars
Ghassem Asrar/USDA
Charles Walthall/USDA
Jim Nugent/Michigan State Univ. Extension

Monday Oct. 22
Afternoon Panels

Energy

Ray Keane/Timmons Design Engineering
Steve Heins/Orion Energy Systems
Jeff Harris/Alliance to Save Energy
Michael Eckhart/Amer Council on Renewable Energy
Armin Rosencrantz/Stanford

National Security

Richard Engel/Natl Intelligence Council
Gary Geernaert/Los Alamos Natl Laboratory
Linda Wennerberg/NASA
Lawrence Farrell/Natl Defense Industrial Assn
Robert Brammer/Northrop Grumman

State/Local/Municipal

Cynthia Rosenzweig/NASA
Doug Duncan/former County Executive Montgomery County
Doug Erickson/Amer Hosp Assoc
George Nichols/Metro Washington Council of Govts

Coastal / Marine Ecosystems

Barry Stamey/Noblis Inc.
Beth McGee/Ches. Bay Foundation
Richard Beamish/Amer Fisheries Society
Lori Arguelles/Natl Marine Sanctuary Fdn
Spokesman/Coastal States Organization

Tuesday Oct. 23
Morning Panels

Water

Gerry Galloway/UMD
Jeanine Jones/Calif Dept Water Resources
Michael Shapiro/EPA
John Promise/No Central Texas COG
Eugene Stakhiv/US Army Corps of Engineers

Commerce & Manufacturing

Randy Overbey, former exec. Alcoa
John Carberry/Dupont
Jon Malay/Lockheed Martin
Dave Crowe/National Assn of Home Builders

Human Health

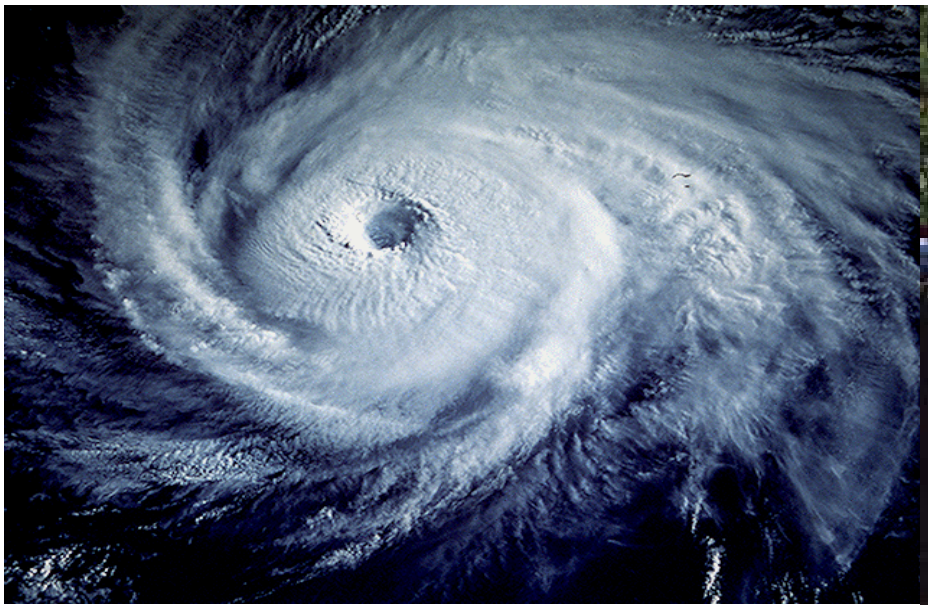
Georges Benjamin/President, Amer Public Health Assn
Dennis Lang/Natl Inst of Environ. Health Sciences
Lynn Goldman/Johns Hopkins Univ.

Transportation

Howard Aylesworth/Aerospace Industries Assn
Rob Lempert/RAND Corp.
John Porcari/MD Secy of Transportation
Joanne Potter/Cambridge Systematics
Burr Stewart/Seattle Port Authority
Rob Padgette/Amer Public Trans Assn

IRI
INTERNATIONAL RESEARCH INSTITUTE FOR CLIMATE PREDICTION

Linking Science to Society



The IRI Mission

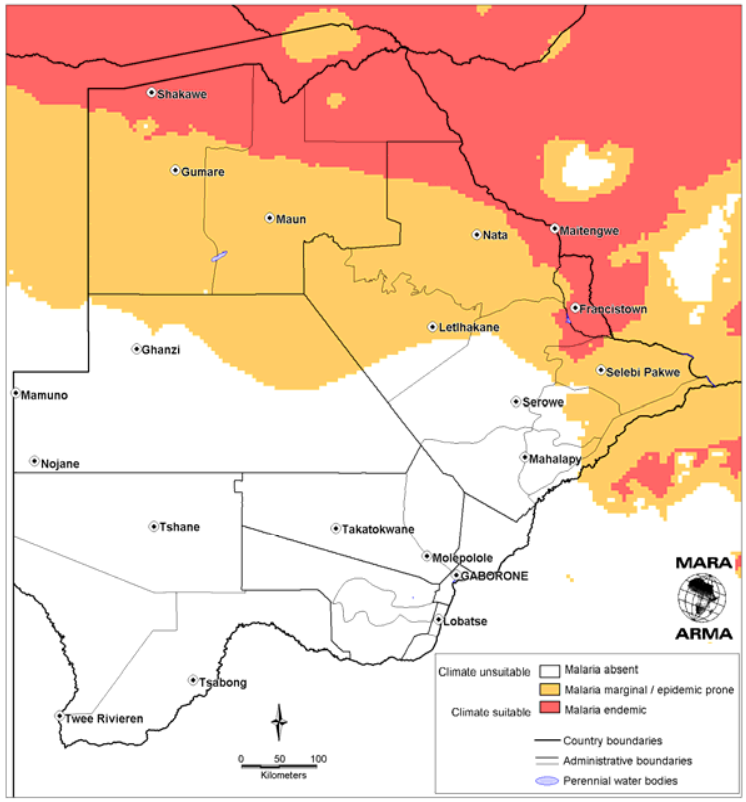
IRI’s mission is to enhance society's capability to understand, anticipate and manage the impacts of seasonal climate fluctuations, in order to improve human welfare and the environment, especially in developing countries.

Approach

- Problem focus
- Partnerships/collaboration
- Research/learning
- Tailoring of information/tools development
- Demonstration of potential value
- Capacity building
- Improved decisions

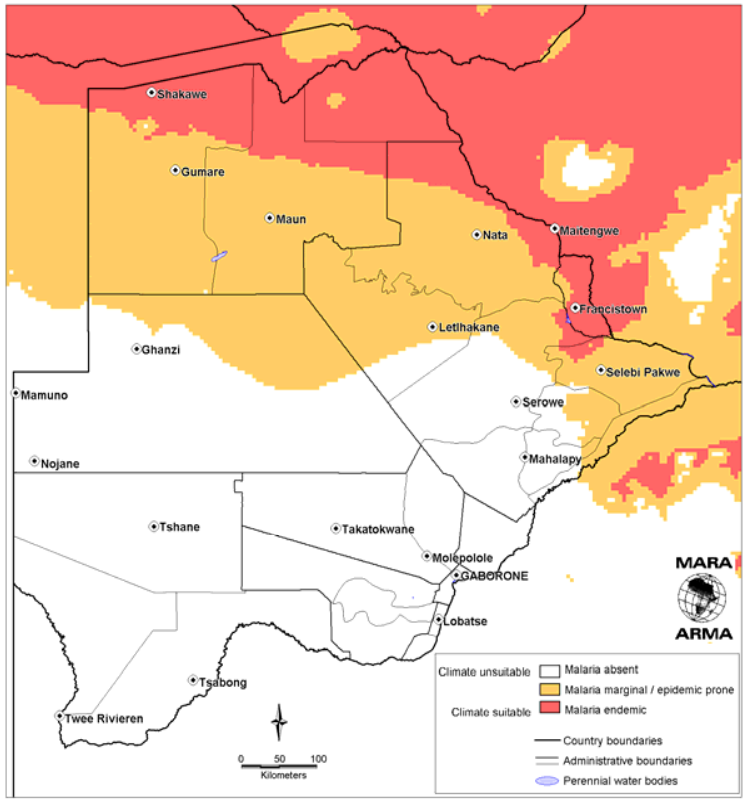
Public Health

Malaria in Botswana



- Epidemic prone country
- Good surveillance system for epidemics
- 20 years of data for historic analysis
- Interested in incorporating seasonal climate forecasts into malaria control planning (Currently: observed climate anomalies)

RBM MoH WHO



Activities:

Demonstrate the use of climate information in malaria control

Expected Output

Malaria Early Warning System

RBM MoH WHO

NOAA Regional Integrated Sciences and Assessments (RISA) Program

A goal of the RISA program is to enable decision-support that will:

- ***reduce vulnerability*** *to seasonal to centennial climate variation (and change)*
- ***create opportunities*** *in the face of climate variation (and change)*
- ***enable the best return*** *for climate science investment*

The Regional Integrated Sciences and Assessments (RISA) Program

ARE stakeholder-driven

ARE all about partnership

- *with stakeholders*
- *with federal, state and local agencies (funding, research and operations)*

ARE interdisciplinary, place-based and multi-stress oriented

ARE focused on a RISA research process:

- *assessments and problem identification*
- *integrated/interdisciplinary research*
- *provision and assessment of prototype information, methods and tools*

The Regional Integrated Sciences and Assessments (RISA) Program

ARE NOT just climate change science (instead, the focus is on seasonal to centennial-scale climate variability)

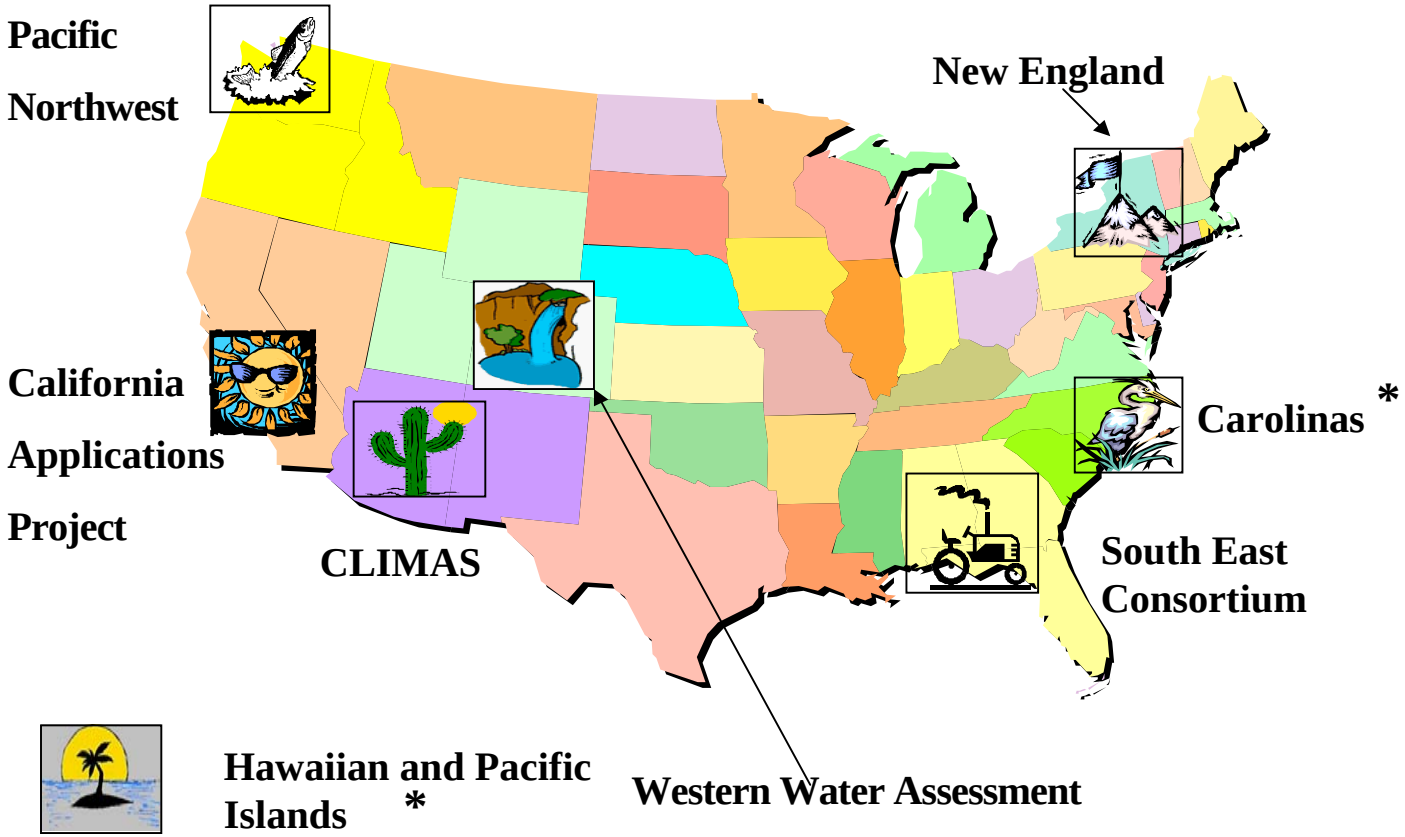
ARE NOT climate change assessment (instead, the focus is on assessing stakeholder needs and how well we can meet them)

ARE NOT basic or applied research (instead, the focus is on "user-driven research")

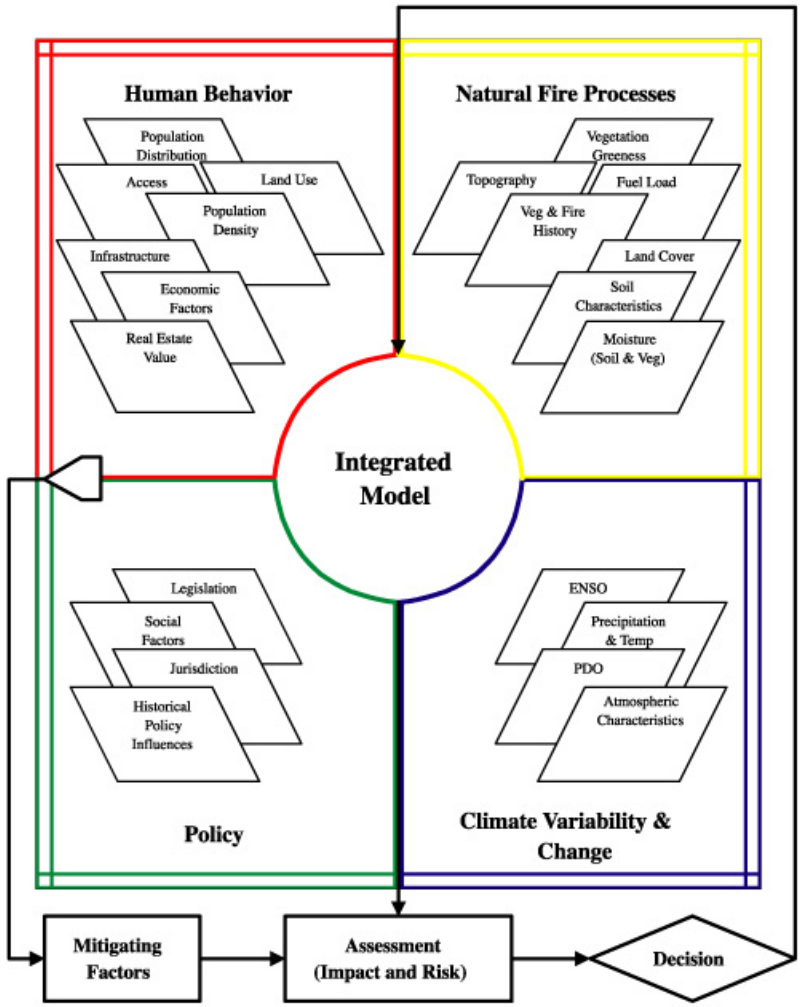
ARE NOT an operational program (instead, the focus is on iterative process of translational research, prototyping and assessment)

RISA's are…

Spreading to regions that can benefit from improved climate decision-support…



Integrated Fire-Climate-Society Model 1



THE UNIVERSITY OF ARIZONA.
TUCSON ARIZONA

The Regional Integrated Sciences and Assessments (RISA) Program

- **Lessons learned**

It isn't just climate: *multi-stress approach is key*

Decision-driven "place-based" climate science works (demand exists and *is growing*)

Development and maintenance of stakeholder *partnerships can only take place at local to regional scales*

Regional stakeholder partnerships must be sustained to ensure credibility (and maintain trust) with partners (otherwise, partnerships are at risk)

Summary

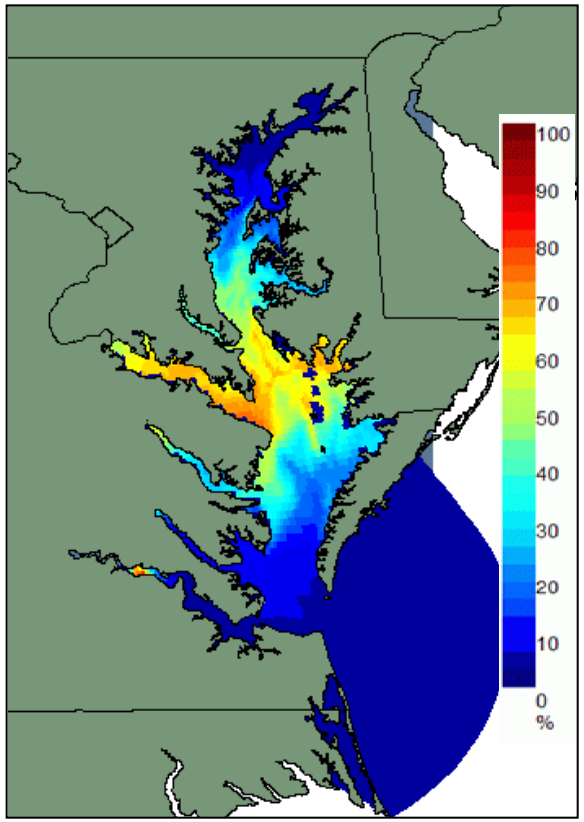
- Present government, private sector and academic structures exist to address several, and separate, elements of the climate problem
- There are several successful examples of relevant government-university partnerships
- Relatively few that involve partnerships with industry
- Interdisciplinary breadth of universities (e.g., finance and business schools) provide a foundation to bridge the gap between:
  - 1) government and industry in a partnership mode, and
  - 2) the physical climate system and user needs for climate information

CIRUN
Climate Information: Responding to User Needs

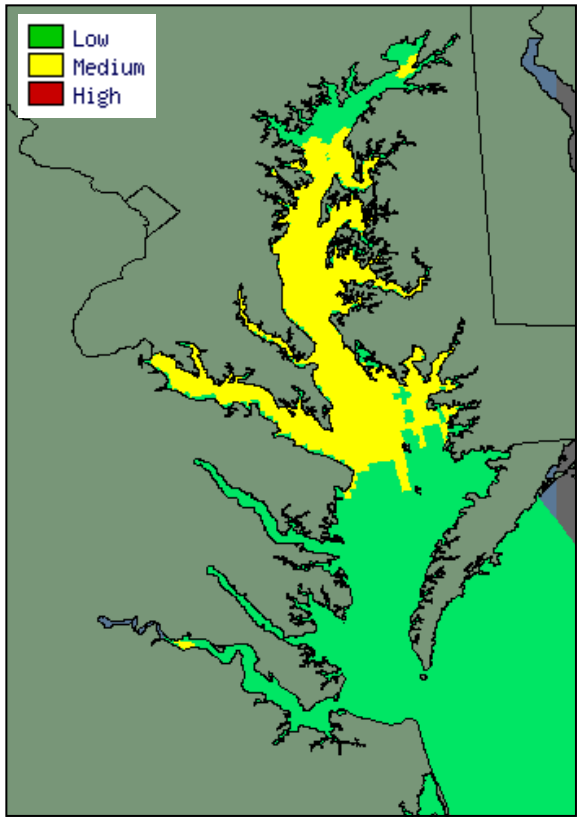
- **What new commercial opportunities will open in response to climate change?**
- As a result of increased temperature extremes, what new products, such as high-grade insulation, will be required in building construction?
- What are the expected population shifts in response to climate change?
- What aspects of climate change will have the most rapid and visible impact on public attitudes, and which will be most likely to prompt stringent government regulation?
- What will be the changes in type and location of pest populations?
- What emerging infectious diseases will be induced by a changing climate?
- What specifications will be required for future seed design as a result of climate change?

Ecological Prediction in Chesapeake Bay: *Current Capabilities*

- Generate daily nowcasts of jellyfish, the harmful algal bloom *Karlodinium veneficum,* and *Vibrio cholerae* in Chesapeake Bay
- Nowcasts created by identifying the locations where ambient conditions coincide with the preferred environment (= habitat) of the organism
- Ambient environmental conditions required to drive habitat models



Predicted chance of encountering sea nettle, *C. quinquecirrha*, on August 17, 2007



Predicted relative abundance of *Karlodinium veneficum* on August 17, 2007

Led by Chris Brown of NOAA