

Collaborative Climate Science: A User's Perspective on Need, Communication and Application

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San Francisco Public Utilities Commission

Water Utility Climate Alliance

World Climate Research Programme Open Science Conference

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San Francisco
Water Power Sewer

Services of the San Francisco Public Utilities Commission



WUCA
Water Utility Climate Alliance

Symbiosis





The Stakes on Climate Change: Water and Clean Water Sector Only

2011-2031: Without Adaptation

Drinking Water
Infrastructure Investment

\$335 Billion¹

Clean Water
Infrastructure Investment

\$298 Billion²

2010-2050: With Adaptation

Drinking Water + Clean Water Sector:

\$448 - 944 Billion³

Needed from Ratepayers through 2050:

\$1.7 - 2.2 Trillion

¹ "2009 Drinking Water Infrastructure Needs Survey and Assessment: Third Report to Congress." USEPA Office of Water, 2005. ² "Clean Watersheds Needs Survey 2008: Report to Congress." USEPA, May 2010. ³ "Confronting Climate Change: An Early Analysis of Water and Wastewater Adaptation Costs," Association of Metropolitan Water Agencies, National Association of Clean Water Agencies, 2009.



The Stakes on Climate Change

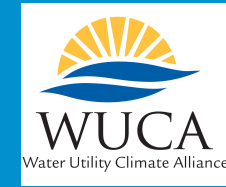
\$1.7 - 2.2

Trillion

Water and Clean Water Sectors Only



Water Utility Climate Alliance



43 million drinking water customers

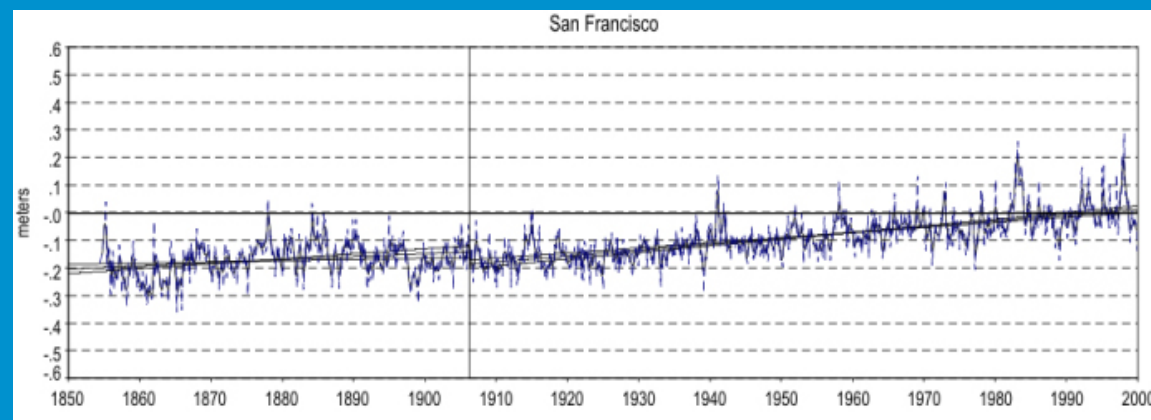


A core objective...

“Actionable Science”

A Working Definition:

Data, analysis, and forecasts that are sufficiently predictive, accepted and understandable to support decision-making, including capital investment decision-making.





The Stakes on Climate Change

\$1.7 - 2.2

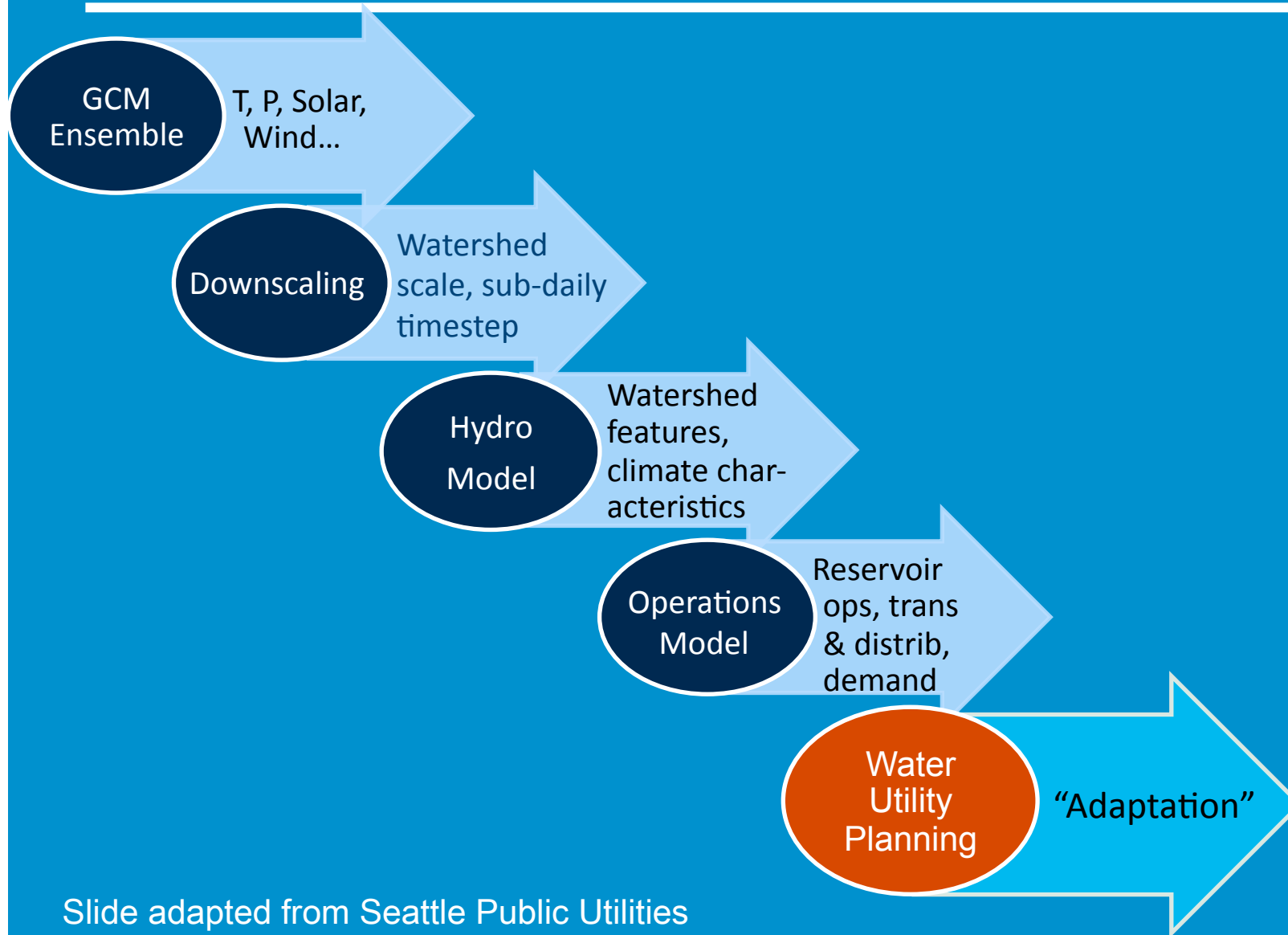
Trillion

Water and Clean Water Sectors Only



San Francisco
Water
Power
Sewer

Chain of Models



Slide adapted from Seattle Public Utilities



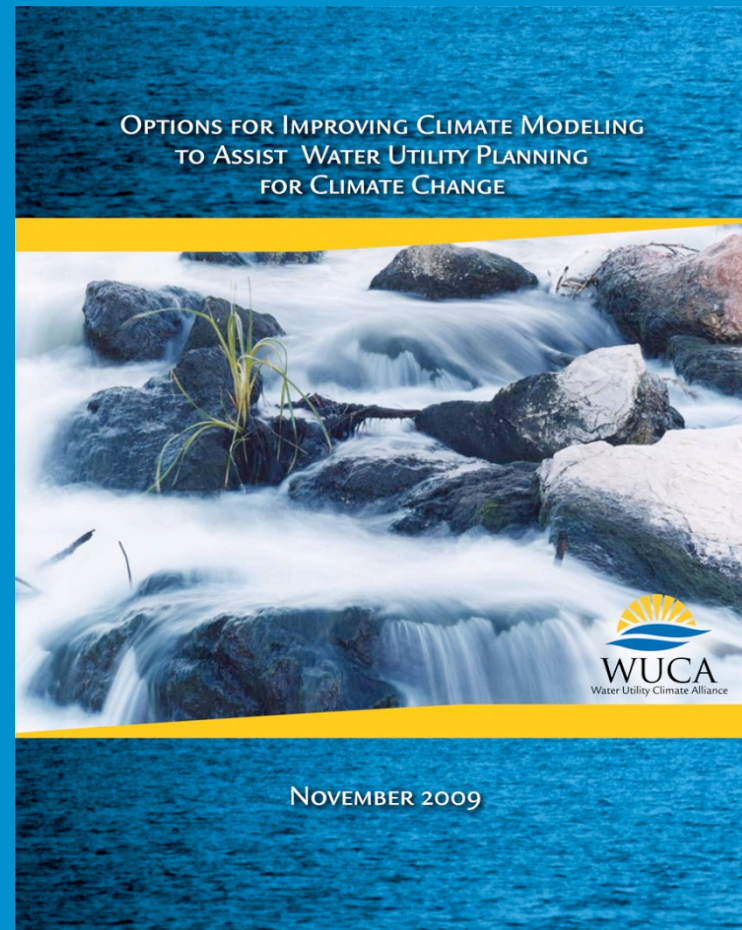
Climate Modeling White Paper

“Options for Improving Climate Modeling to Assist Water Utility Planning for Climate Change”

Authors:

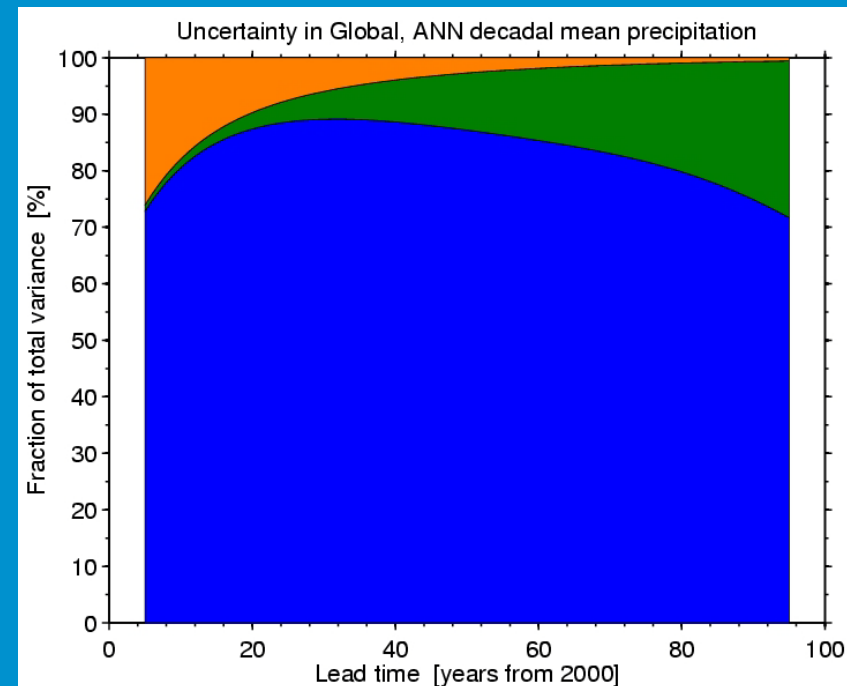
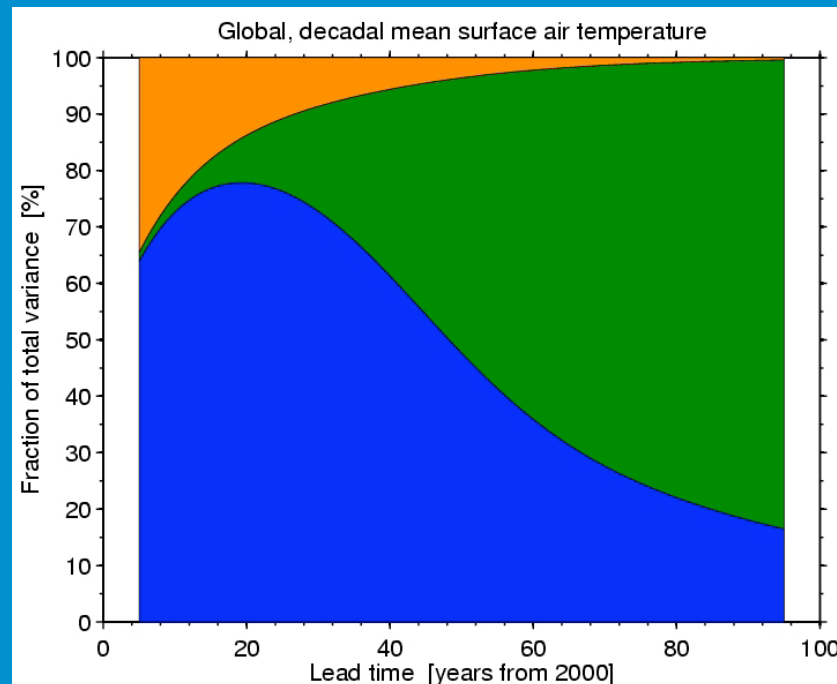
Joe Barsugli, Chris Anderson,
Joel Smith, Jason Vogel

Available at
www.wucaonline.org



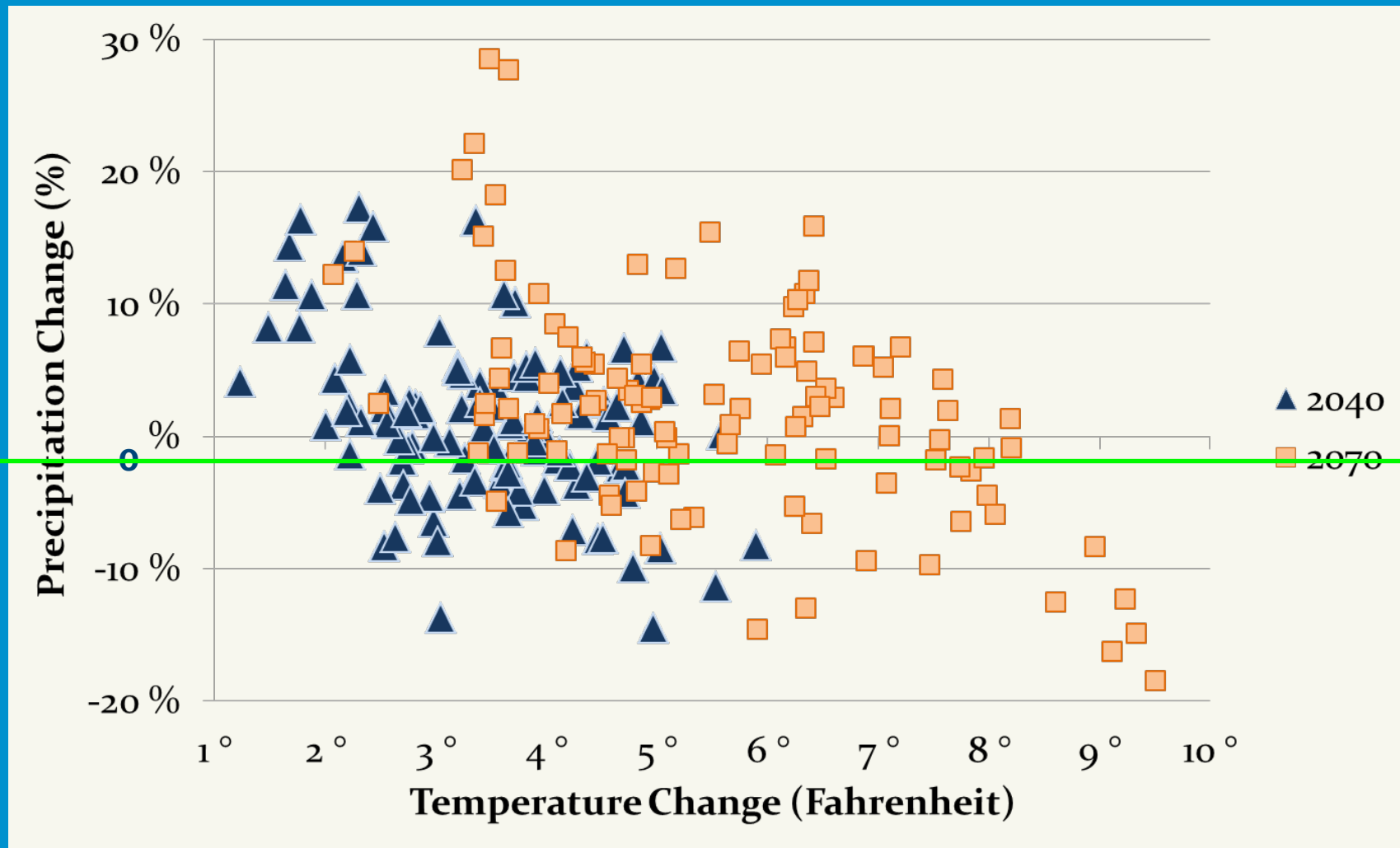
Uncertainty: Natural variability/ Emissions scenario/Model uncertainty

- Emissions uncertainty
- Internal variability
- Model uncertainty

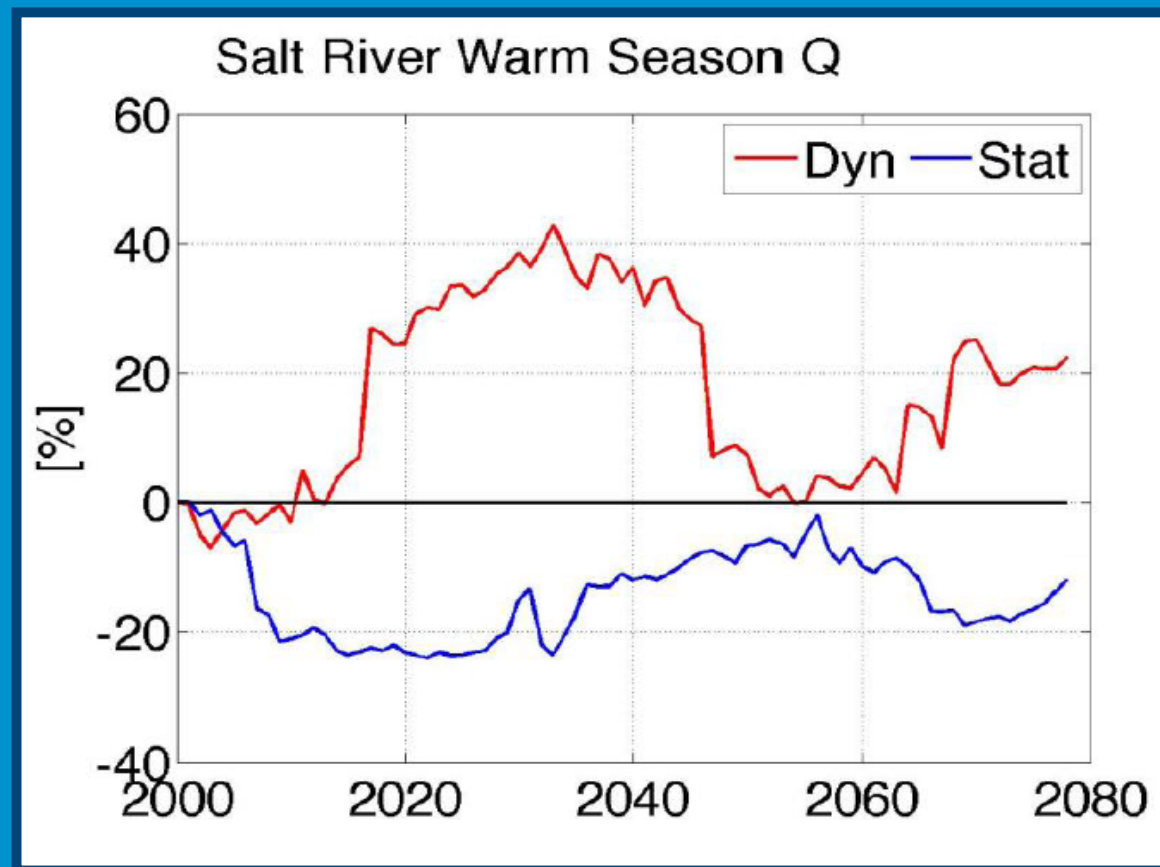


*From Hawkins & Sutton 2009
(BAMS) and 2010 (Climate
Dynamics)*

Projected Changes for Denver's Watershed



Southwestern United States: Salt River



Boundary conditions from HadleyCM3.

Statistically DS data from Maurer et al; dynamically DS data generated using nested WRF

Dominguez, Rajagopal, Castro, Troch, Demaria, Gupta, Durcik, Chang, University of Arizona.
Slide courtesy Gregg Garfin, Institute of the Environment, University of Arizona

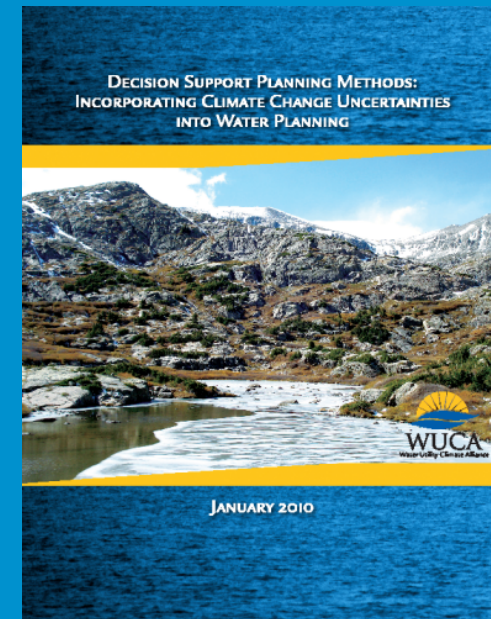


Sensitivity Analysis

| | 2040 | 2070 | 2100 |
|------------------------------|----------------------|----------------------|----------------------|
| Temperature Precipitation | + 0.6 deg C + 0% | + 1.3 deg C + 0% | + 2 deg C + 0% |
| Temperature Precipitation | + 1 deg C + 0% | + 2.2 deg C + 0% | + 3.4 deg C + 0% |
| Temperature Precipitation | + 1 deg C - 5% | + 2.2 deg C - 10% | + 3.4 deg C - 15% |
| Temperature Precipitation | + 1 deg C + 2% | + 2.2 deg C + 4% | + 3.4 deg C + 6% |
| Temperature Precipitation | + 1.65 deg C + 0% | + 3.5 deg C + 0% | + 5.4 deg C + 0% |
| Temperature Precipitation | + 1.65 deg C -5% | + 3.5 deg C -10% | + 5.4 deg C -15% |

- Classic decision analysis
- Traditional scenario planning
- Robust decision making
- Real options
- Portfolio planning

“Decision Support Planning Methods: Incorporating Climate Change Uncertainties into Water Planning,” Means, Laurier, Kaatz, Waage, January 2010,

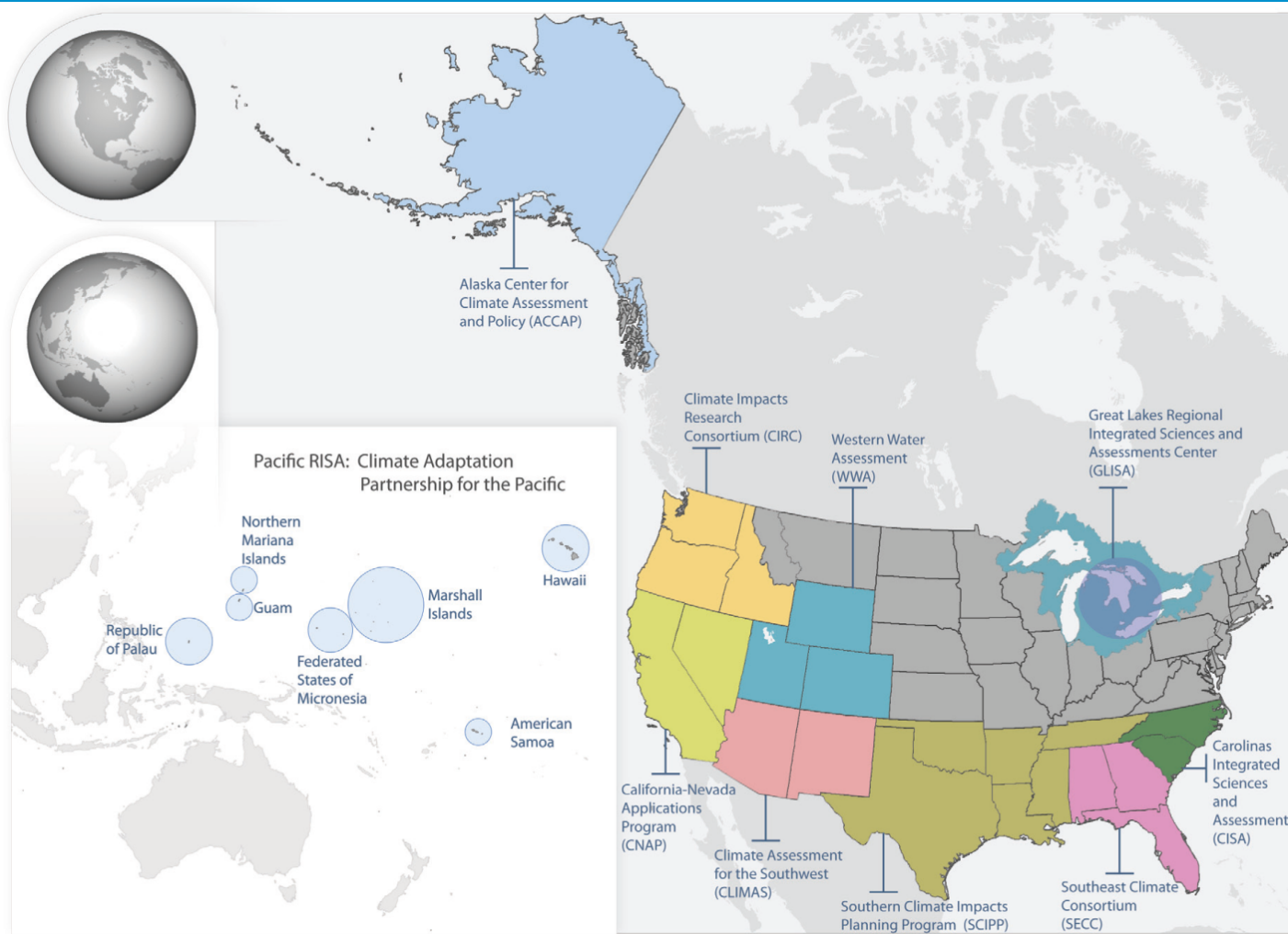


A bit like the Wild West out there...



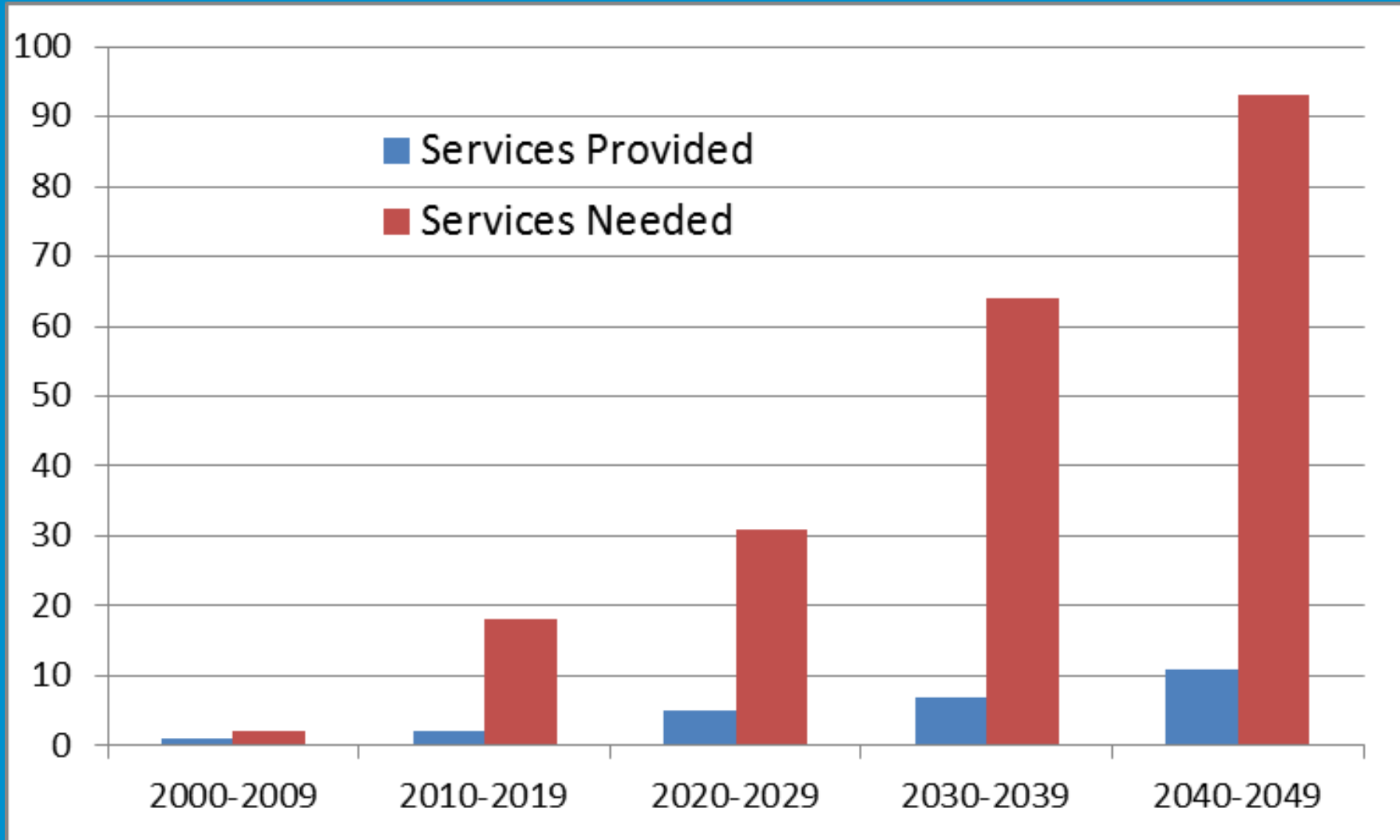


Regional Integrated Sciences and Assessments (RISA) Program



“supports research that addresses complex climate sensitive issues of concern to decision-makers and policy planners at a regional level.”

A Climate Services Scenario (A2)



Not peer reviewed



Piloting Utility Modeling Applications (PUMA): An “Assessment Expedition”

Five Utilities

San Francisco PUC
Seattle Public Utilities
Tampa Bay Water
Portland Water Bureau
New York City DEP

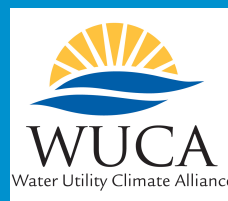
Four RISAs

Cal-Neva (Scripps – Cayan, Dettinger)
NE (Columbia, et al – Palmer, Horton)
SE (Univ of Fla, FSU – Graham, Martinez)
NW (Oregon State, et al – Mote, Dello)

Modeling Advisory Committee (MAC)

Phil Duffy (Climate Central); Ed Maurer (Santa Clara); Tom Johnson (EPA); Levi Brekke (BoR); Linda Mearns (NCAR); John Abatzaglou (U. Idaho); Mike Dettinger (Scripps); Claudia Tebaldi (Climate Central); Joe Barsugli (Western Water Assessment)

Project Mgr, WUCA: David Behar



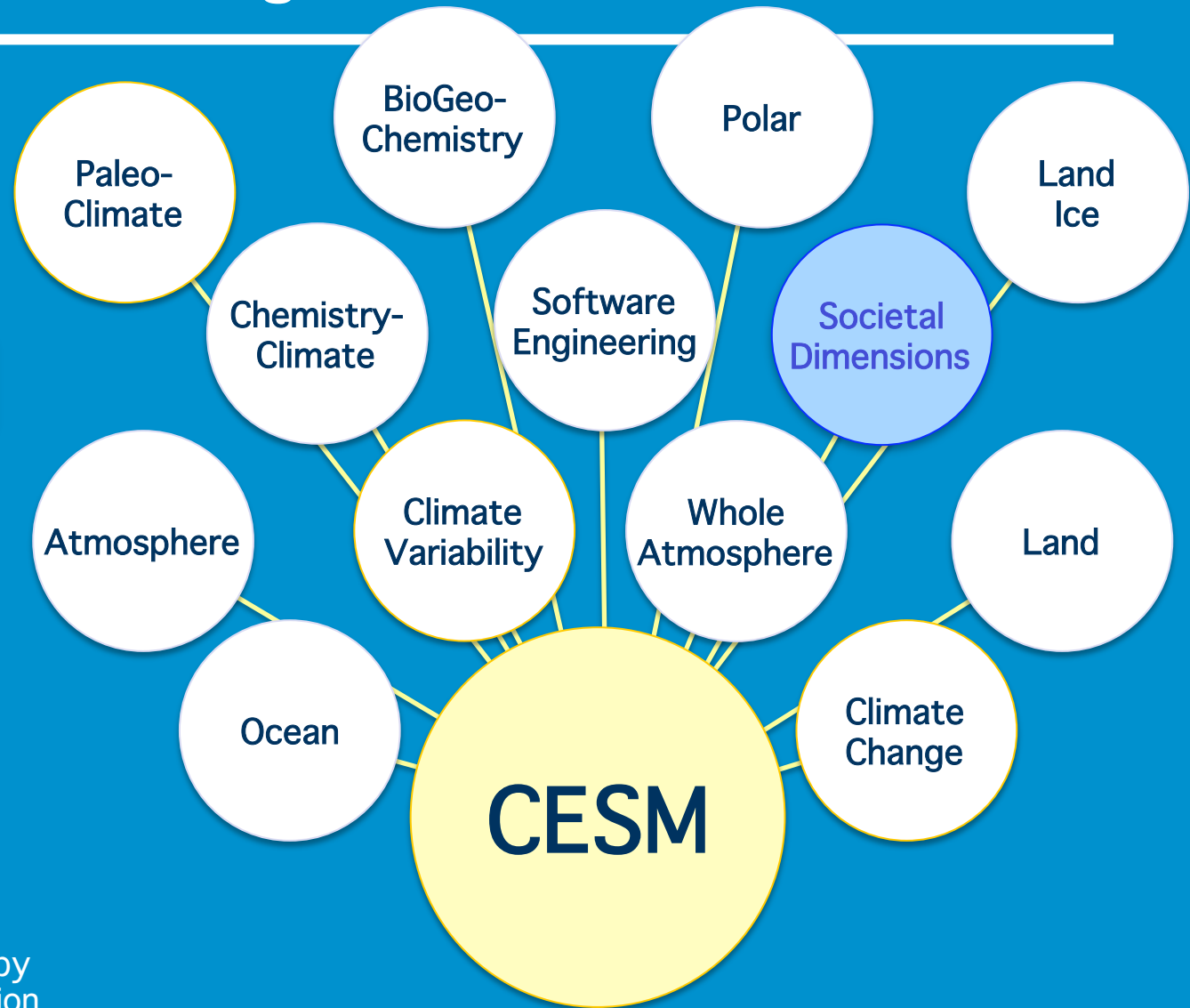
Project Mgr, RISAs: Phil Mote



Community Involvement: CESM Management

CESM Advisory Board

CESM Scientific Steering Committee



CESM is primarily sponsored by the National Science Foundation and the Department of Energy

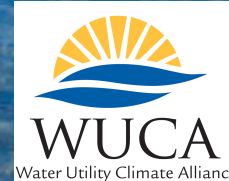
<http://www.cesm.ucar.edu/management>

Thank you

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Priorities

- T, P, Wind, Solar: What we care about most
- Subdaily saved data: Can we make it available?
- Higher resolution GCM runs: Next best thing?
- Focus on central latitude precipitation: Continued improvement to Tropical Pacific, etc.
- Improved characterization of uncertainty
- “Community” archived datasets: Accessible multi-model ensembles
- Dynamical, other downscaling experiments that respond to our scale needs
- CORDEX-inspired experiments

Provided to National Academies Committee on Future of Climate Modeling in the US next 20 years