



Climate Change and Water Working Group



# CLIMATE SCIENCE TO ENGINEERING OPERATIONS FOR WATERSHED MANAGEMENT

## A CCAWWG WORKSHOP FOR SCIENTISTS, ENGINEERS, AND WATER RESOURCE MANAGERS

August 25-27, 2015

University of Washington

Fisheries Science Building, Seattle, WA

# Welcome and Acknowledgments

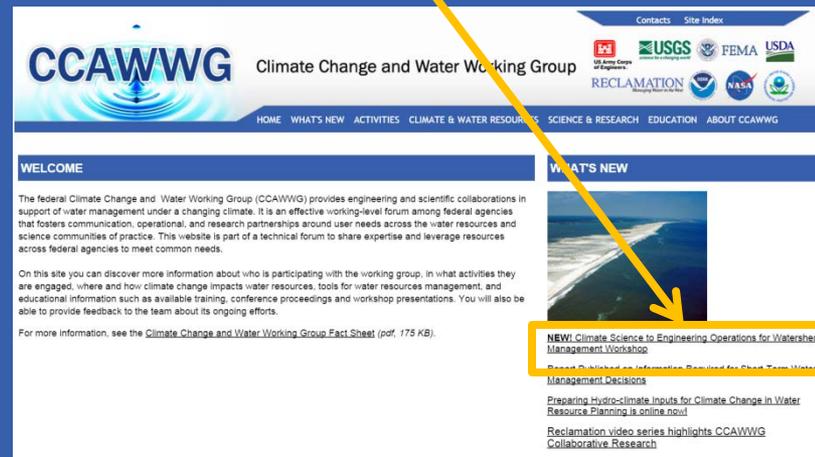
## Hosts:

- Joint Institute for the Study of the Atmosphere and Oceans (JISAO)
- University of Washington Fisheries Sciences

## Planning Committee:

- Forrest Melton, NASA
- Jeff Arnold, USACE
- Karen Methis, EPA
- Kevin Werner, NOAA
- Levi Brekke, BOR
- Subhrendu Gangopadhyay, BOR
- Tim Green, USDA

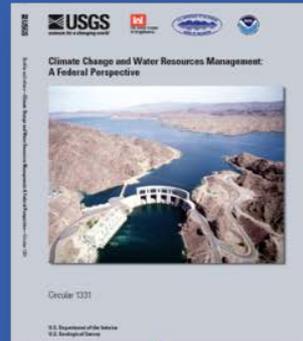
Information at: [www.ccaawwg.us](http://www.ccaawwg.us)



## About CCAWWG ([www.ccawwg.us](http://www.ccawwg.us))

- Provides engineering and scientific collaborations in support water management in a changing climate.
  - Working-level forum among federal agencies, focused on operational and research partnerships.
  - Initiated in 2008 as a Colorado Front Range network
  - Broadened nationally in 2009 (USGS Circular 1331)
- Objectives
  - **Assess user needs and develop science strategies**
  - Engage in collaborative R&D
  - Host workshop on emerging topics (e.g., Nonstationarity)
  - Develop climate training resources

### USGS Circular 1331 (2009)



*Immediate Needs*

*User Needs & Science Response*

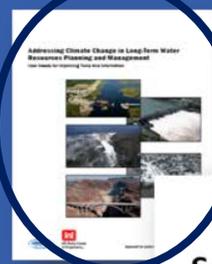
**Nonstationarity**



**Portfolio of Approaches**

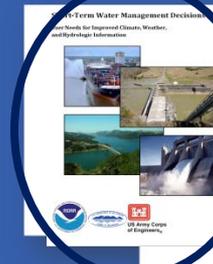


**Long-Term Horizon**



**Science Strategy**

**Short-Term Horizon**



**Science Strategy**

**Long-Term Doc (2011):** This report IDs user needs for decisions that look ahead more than 5 years.

**Short-term Doc (2013):** This report IDs user needs for decisions that look ahead less than 5 years.

# Short-Term Doc identifies needs for improved monitoring, forecasting, and metadata

- Characterizes decision processes and associated operations outlooks that span range of scales
  - Finer: hourly schedules out days
  - Medium: daily schedules out weeks
  - Coarser: monthly schedules out seasons
- Describes state of hydroclimate information services
- Summarizes perspectives from Reclamation and USACE operators on:
  - use of current services and products
  - attempted pilots of new information
  - perceptions about information needs
- Summarizes key needs related to:
  - Monitoring Products
  - Forecasting Products (different scales & variables)
  - Understanding and using these Products in Water Management
  - Information Services Enterprise

**Short-Term Water Management Decisions**

User Needs for Improved Climate, Weather, and Hydrologic Information

NOAA  
NATIONAL OCEANIC AND ATMOSPHERIC ADMINISTRATION  
U.S. DEPARTMENT OF COMMERCE

U.S. DEPARTMENT OF THE INTERIOR  
BUREAU OF RECLAMATION

US Army Corps of Engineers®

# Long-Term Doc needs are organized by **eight technical areas** of a vulnerability assessment

## Preliminaries

1. Summarize Relevant Literature
2. Obtaining Climate Projections Data (*Downscaled Climate Projections, Improved Downscaling methods*)

## Making Planning Assumptions

3. Make Decisions about How to Use Climate Information in Planning (*Paleoclimate to Projected Climate*)
4. Assess Natural Systems Response (*Hydrology, Ecosystems, Fisheries, Crop Water Use, Sedimentation, Water Quality, Land Cover*)
5. Assess Socioeconomic and Institutional Response

## Conducting Planning Evaluations and Supporting Decisions

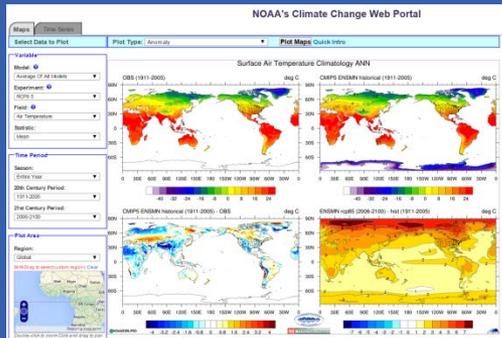
6. Assess Systems Risk and Evaluate Alternatives
7. Assess and Characterize Uncertainties
8. Communicate Results and Uncertainties to Decision-Makers

**Addressing Climate Change in Long-Term Water Resources Planning and Management**  
 User Needs for Improving Tools and Information  
 Executive Summary

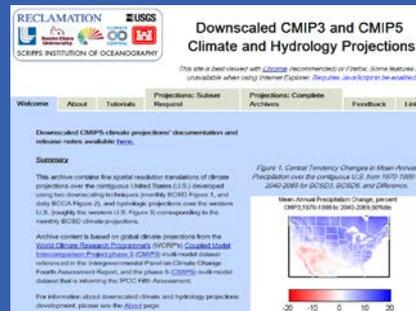




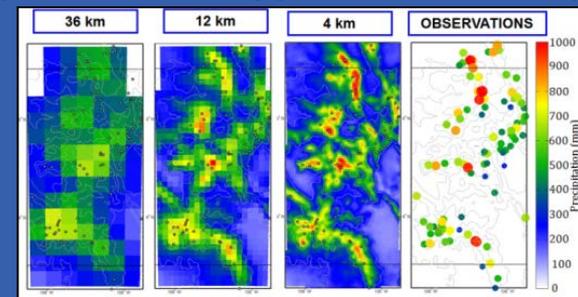

January 2011  
 Approved for public release; distribution is unlimited



Web-tool for judging Global Climate Model skill, information for planning (NOAA, CIRES, BOR, USACE)

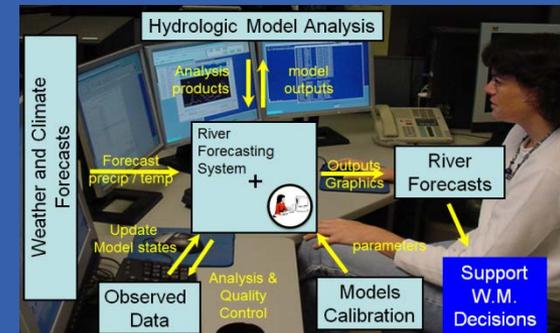


Improve Methods for Projecting Future Climate and Hydrology (NCAR, USACE, BOR); collaboratively serve Results (... USGS, Scripps, LLNL, others)

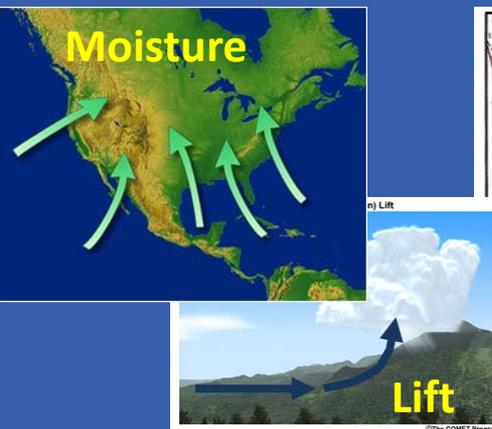


## Response to Long-Term Doc: Collaborative R&D

Airborne Snow Monitoring: Value in Spring Water Management? (NASA, BOR)



Addressing Flood and Drought preparedness through streamflow forecasting research (NCAR, USACE, BOR)



Improving extreme precipitation estimation and climate change projections using regional and high-resolution model simulations (NOAA, CIRES, BOR)

# Status and Challenges

- Progress since 2011
  - Practitioners: increased ability to evaluate vulnerabilities and adaptation options; leverage best available science
  - Scientists: progress on advancing assessment methods and understanding about uncertainties; primarily associated with climate projections and natural systems impacts
- Challenges going forward...
  - Addressing persistent climate science issues that limit our ability to mainstream climate change where it makes sense.
  - Recognizing emergent climate science issues.
  - Understanding what available information is actionable; and to what degree for different **communities of practice**.

# Example Communities of Practice

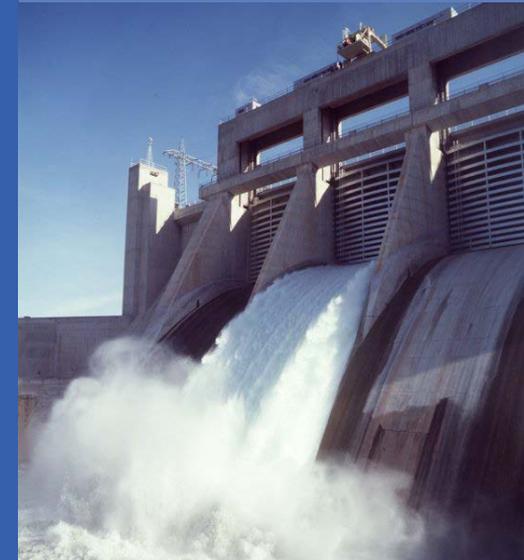
## Infrastructure Management



## Species Recovery and Adaptive Management



## Reservoir Operations



## Dam Safety



# Workshop Purpose: Bring scientists, engineers, and managers together to...

- review and discuss research and applications begun since 2011 that support adaptation goals
- present and share perspectives on recurring and emerging needs for climate change science → inform **Long-Term Doc update**
- provide attendees with a fuller scope and context for their mainstreaming work

# Workshop Structure

- Day 1 – Discuss Progress and Status
  - CCAWWG Agencies' use of 2011 Long-Term Doc in their Climate Change Preparedness and Resilience Work: What Worked? What Still Needs Attention? What's New or Needs Adding?
  - Climate Science Networks' research and progress relevant to the 2011 Long-Term Doc

## Workshop Structure

- Day 2 – Breakout Discussions on recent science progress, current/future science needs, and potential research opportunities
  - Four Breakout Groups, rotating through four Themes
  - Theme 1) Changes in Basin Climate
  - Theme 2) Changes in Wet-weather Extremes
  - Theme 3) Effects at Coasts and Shorelines
  - Theme 4) Effects in Watershed Ecosystems

# Workshop Structure

- Day 3 – Synthesis and Next Steps
  - Reports from Breakout Groups
  - Plenary Discussion about Messages Heard
  - Final Summary, Next Steps toward Long-Term Doc update

# Guiding Thoughts

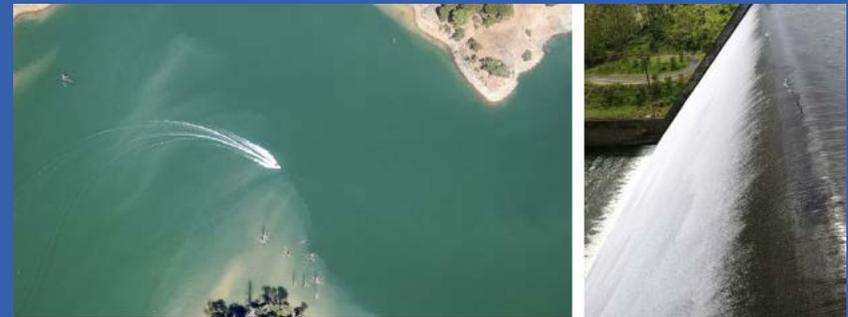
- We have always dealt with climate variability. Our challenge going forward is how do we prepare for potential drifts in variability?
  - Prepare for **different floods and droughts**
  - Balance **changing supplies and demands**
  - Factor changing climate into **adaptive environmental stewardship**
  - **Manage infrastructure and safety** under changing Climate Extremes
- Management of water and water-related involves many considerations – climate change is just one additional consideration.
- Our response to the challenges posed by Climate Change:
  - is about preparing for the future, and factoring climate change into our traditional approaches for planning, conservation, operations, and science.
  - is about different communities discussing and sharing approaches.
  - is not about abandoning all the good things we've always done and replacing them with reinvented ways to manage water and related resources.

## About CCAWWG ([www.ccawwg.us](http://www.ccawwg.us))

- Provides engineering and scientific collaborations in support water management in a changing climate.
  - Working-level forum among federal agencies, focused on operational and research partnerships.
  - Initiated in 2008 as a Colorado Front Range network
  - Broadened nationally in 2009 (USGS Circular 1331)
- Objectives
  - Assess user needs and develop science strategies
  - Engage in collaborative R&D
  - Host workshop on emerging topics (e.g., Nonstationarity)
  - **Develop climate training resources**

# CCAWWG and UCAR COMET Climate Training Pilot Courses

- NEXT OFFERING!
- Hydrologic Impacts under Climate Change, October 20-22, 2015
- Learn about:
  - hydrological modeling,
  - developing hydrology model inputs for range of future climate scenarios,
  - generating and interpreting hydrology model results under climate change for different watersheds
- See Handout



## Hydrologic Impacts Under Climate



Preparing Hydro-climate Inputs



**October 20-22**  
**9 am-4 pm MDT**

The COMET Program and the Climate Change and Water Working Group (CCAWWG) are producing this online, instructor-led course, developed with financial support from the US Bureau of Reclamation and the US Army Corps of Engineers. The course is part of the series "Assessing Natural Systems Impacts Under Climate Change."

<http://courses.comet.ucar.edu/course/info.php?id=158>