



NOAA's Water Cycle Science Challenge Workshop

**F. Martin Ralph and Robert E. Davis
(Co-Chairs)**

30 August – 1 September, 2011

NOAA/Earth System Research Laboratory, Boulder, CO

Workshop Website: <http://www.esrl.noaa.gov/psd/events/2011/water-cycle-science.html>



Background

- This Workshop is a follow-up to a 2010 NOAA report “Strengthening NOAA Science” sponsored by Dr. Jane Lubchenko that identified the following NOAA Science Grand Challenge:
- ***“Improve understanding of the water cycle at global to local scales to improve our ability to forecast weather, climate, water resources and ecosystem health.”*** This has been included in NOAA’s Next Generation Strategic Plan.



Context: The 2010 NOAA Science Workshop



- **Topic-specific Grand Challenges**

- Acquire and incorporate knowledge of **human behavior** to enhance our understanding of the interaction between human activities and the Earth system
- Understand and quantify the interactions between atmospheric composition and **climate variations and change**
- Understand and characterize the role of the **oceans in climate** change and variability and the effects of climate change on the ocean and coasts
- Assess and understand the roles of **ecosystem processes** and biodiversity in sustaining ecosystem services
- Improve understanding and predictions of the **water cycle** at global to local scales
- Develop and evaluate approaches to substantially **reduce environmental degradation**
- Sustain and enhance atmosphere-ocean-land-biology and human **observing systems**

- **Cross-Cutting Challenges**

- Characterize the **uncertainties** associated with scientific information
- **Communicate** scientific information and its associated uncertainties accurately and effectively to policy makers, the media, and the public at large

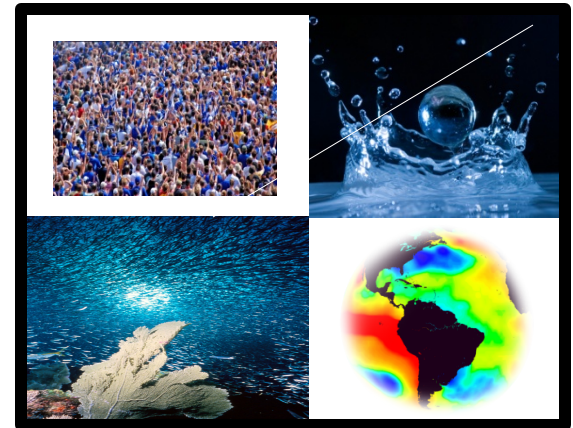


Context: The 2011 Science Challenge Workshops



- Based on 4 themes representing combinations of related topic-specific grand challenges:

- Human Behavior
- Water Cycle
- Climate Variability and Change
- Ecosystems Research



- Considering observing systems and cross-cutting challenges within each of the 4 above



Water Cycle Science Challenge Workshop Purpose



- To discuss and develop recommendations to NOAA Leadership, including the NOAA Research Council, that will inform the next NOAA 5-Year Research Plan on the topic of:
“Understanding and predicting conditions associated with either too much or too little water”



NOAA Research Council Guidance: Scope



- Encompass the current state of understanding
- Identify gaps that can be addressed over the next 5-yr
- Identify NOAA's role in filling those gaps in concert with external partners and other institutions over the next 5-yr
- Outline the expected benefits of filling the gaps

The Workshop will also:

- Consider implications for relevant observing systems
- Characterize uncertainties associated with water cycle science information
- Discuss how best to communicate water cycle science information and associated uncertainties accurately and effectively to policy makers, the media, and the public at large.



The Workshop Planning Process



- The NOAA Research Council formed an internal cross-NOAA Water Cycle Workshop Committee (including OAR, NWS, NESDIS).
- The NOAA Water Cycle Committee invited representatives from the external community to be on the Program Committee.
- The Program Committee developed a draft plan for the workshop, with specific technical topics, key questions, rough agenda and timeframe.
- The NOAA Research Council reviewed and approved the draft Water Cycle Workshop plan.
- The Program Committee developed the invitation list, is implementing the Workshop and will generate input into the White Paper.



Water Cycle Program Committee



Name	Affiliation
Marty Ralph (Co-Chair)	NOAA Earth System Research Laboratory/Physical Sciences Div.
Bert Davis (Co-Chair)	US Army Corps of Engineers CRREL
Gary Bardini	California-Department of Water Resources (with Mike Anderson)
Curt Brown	Bureau of Reclamation (with Levi Brekke)
Mike Dettinger	US Geological Survey
Ralph Ferraro	NOAA NESDIS/STAR
Dave Jorgensen	NOAA National Severe Storms Laboratory
Jim McNamara	Idaho State University
Christa Peters-Lidard	NASA
Pedro Restrepo	NOAA National Weather Service
Robin Webb	NOAA Earth System Research Laboratory/Physical Sciences Div.

Workshop Coordinators: Shawn Dowd, Barb Deluisi, Rhonda Lange, Carol Knight



2011 Water Cycle Workshop



- Dates: 30 Aug. – 1 Sept. at ESRL, Boulder, CO
- Focus:
 - ***“understanding & predicting conditions associated with either too much or too little water”***
- Science themes:
 - Next generation hydrologic models
 - Hydrometeorological forcings for models
 - Physical processes
 - Climate dimensions





Broad Agenda

730 AM Tuesday, Wednesday, Thursday: **Light Breakfast**

1200 Noon Tuesday, Wednesday, Thursday: **Lunch**

- **Tuesday 30 Aug (815 AM – 500 PM)**
 - Overview of emerging user needs and science directions
 - Program Committee and Rapporteurs meet for dinner at 600 PM
- **Wednesday 31 Aug (800 AM – 345 PM)***
 - Breakout groups - brainstorming and feedback
 - Program Committee meets from 345 – 545 PM
 - *A group photo will be taken at 1140 AM in the ESRL Lobby
- **Thursday 1 September (830 AM – 300 PM)**
 - Discussion and synthesis including two panels
 - Program Committee meets from 330 – 500 PM



Breakout Sessions Wednesday



Attendees will be broken into 4 groups (randomly)

Each “Breakout Group” will rotate through each “Breakout Theme”

Each “Breakout Group” spends 1 h 20 minutes in each “Breakout Theme”

A Workshop coordinator will chaperone each group to its next session

Breakout Themes and Leaders, Rapporteurs and Rooms

- Next generation hydrologic models (room 1D-708)
 - P. Restrepo and L. Brekke (leads), L. Johnson (Rapporteur)
- Hydrometeorological forcings (room GC-402)
 - C. Lidard and A. White (Leads), D. Novak (Rapporteur)
- Physical processes (room GB-124)
 - J. MacNamara and D. Jorgensen (Leads), R. Cifelli (Rapporteur)
- Climate Dimensions (room 3B-504)
 - M. Dettinger and R. Webb (Leads), K. Mahoney (Rapporteur)



Water Cycle Science Challenge

“Primary Technical Topics”

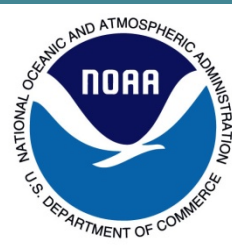


- What are the “forcings” needed for NOAA hydrologic prediction services of the future, and for external partners? “Forcings” here refers to those inputs needed to drive explicit stream flow prediction models typically forecasting out hours to days or weeks, e.g., precipitation, soil moisture, snow pack, evapotranspiration, base flow.
- What methods and basis are best for estimating extreme meteorological and hydrological event possibilities, deterministically or probabilistically, in a changing climate?
- How to jointly utilize the longer-term climate variability from observed records, paleoclimate, and projected climate information when portraying drought and surplus possibilities in planning?
- What will NOAA’s future hydrologic models consist of and how to develop them under the Integrated Water Resources Science and Services (IWRSS) interagency framework?
- What scientific inputs are needed on water cycle extremes, normals, predictability, climate trends and uncertainty information for policy makers dealing with major infrastructure planning, typically for decades into the future (e.g., water supply and flood control) and/or endangered species (e.g., salmon)?
- How to make better use of existing and future weather & seasonal/annual climate predictions related to the water cycle?



Water Cycle Science Challenge

“Questions”



What are the major deficiencies in our understanding of the physics of heavy rain systems and what does it imply about uncertainties in prediction? Are these gaps primarily in our understanding of cloud microphysics?

What are the major gaps in our understanding of the meteorological and climatic underpinnings of droughts? What do we need to know in order to predict the onset, persistence, depth, and cessations of droughts? How well do we forecast these aspects of meteorological drought?

What are the implications for needs for observing systems? What are the gaps? What could be the path to closing the gaps (both near and long term)? What interagency opportunities exist?

What are needs for process understanding and model development, including NOAA's models for weather, climate and hydrology, especially factors affecting precipitation and steam flow?

What field or modeling experiments might be useful for addressing key questions, and what are their requirements?

What computing and information systems are required for high-resolution hydrologic and water resources monitoring, predictions and understanding nationwide and for their associated meteorological inputs, e.g., surface, profiles, radar, satellite, numerical weather predictions?

What are the primary mechanisms by which water-cycle variations on meteorological time scales establish climatic variations and changes? What are the influences of climate-scale variations and changes on the water cycle at meteorological time scales? That is, what do we need to know to better understand (and ultimately predict) the weather-climate interface?

Water yields and the demand side of the water cycle question: Do we have the instrumentation to adequately measure and have the observing networks to monitor evapotranspiration and evaluate predictions of water demand? Looking beyond just temperature and precipitation, how well do model forecasts and projections represent the full complement of surface water/energy budget variables (e.g, the variables used in Penman Montheith or Priestly Taylor calculations) for use in hydrologic modeling? Can these weather/ climate/atmospheric model calculated variables be effectively downscaled and/or bias corrected.



Next Steps After Workshop



Deliver White Paper to NOAA Research Council October 2011

- 2 September
 - Program Committee members work together writing sections on the four science themes, including inputs from presentations on day-1, breakout sessions on day-2, and panel discussions on day-3
- 12 September
 - Workshop Co-Chairs provide draft White paper to Program Committee
- 19 September
 - Program Committee comments provided to Co-Chairs
- Early October
 - NOAA Research Council receives workshop white paper (10-20 pages)