



NOAA RESEARCH • ESRL • PHYSICAL SCIENCES DIVISION

Theme 1: Observing the Physical System

Water Cycle - Overview

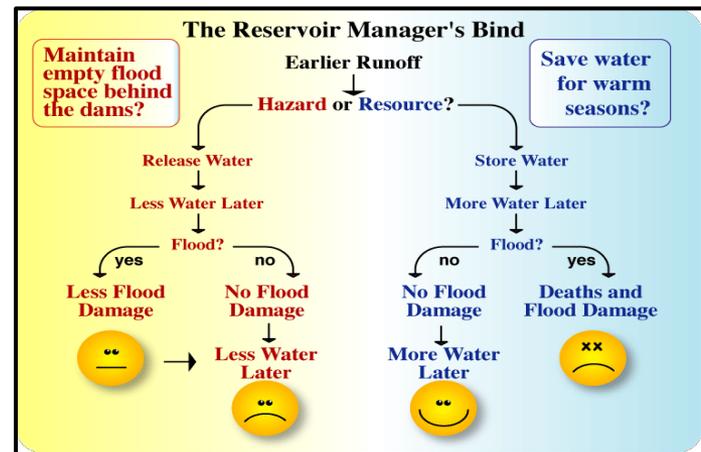
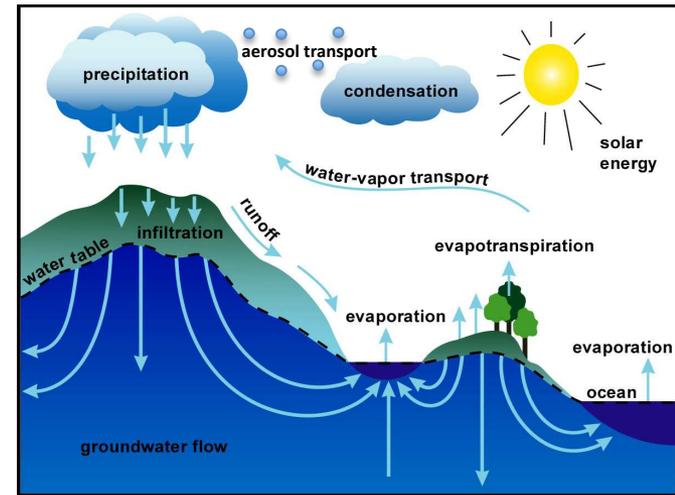
Allen B. White

Science Review
12-14 May 2015
Boulder, Colorado



Observing the Water Cycle

- Water is our most precious natural resource, yet there is not one single agency in the government who's mission is to observe, understand, and predict the water cycle across the various time and space scales that are needed.
- Maintaining adequate water supply, especially during drought, is a key societal problem.
- Part of PSD's water cycle research portfolio is focused on observationally-based physical process understanding.
- This endeavor is made possible, in part, by PSD's unique observing assets.

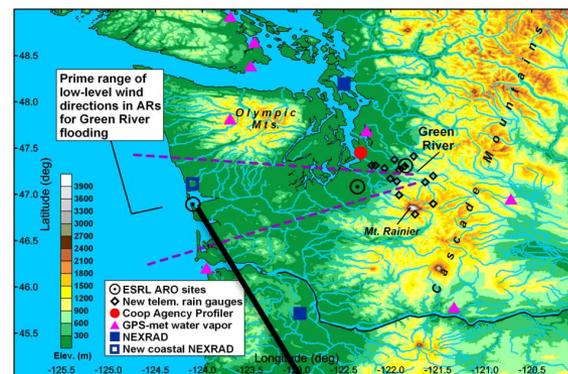


Strategic Context

- **NOAA Strategic Goals Addressed**
 - NOAA Goal: Weather Ready Nation: society is prepared for and responds to weather-related events
 - NOAA 5-yr Objective: Exploit emerging data types and observing capabilities to satisfy NOAA's observing requirements and to support new and improved applications, products, and services
 - OAR Science Question: How can we improve forecasts, warnings, and decision support for high-impact weather events?
- **PSD's 2010 Strategic Goal Addressed**
 - Improved observations and understanding of Earth system processes

Two Examples of How PSD has Helped Meet Stakeholder Water-related Needs

- Howard A. Hanson dam near Seattle was significantly damaged in 2009
- PSD and NWS led a rapid response effort to help mitigate the urgent societal threat
 - Coordination among federal, state, and local agencies
 - Enhanced and integrated observations
 - Extended range and probabilistic QPF
 - Extended range flood guidance
 - Web portal for single access to forecasts, observations, dam, and flood information
 - Forecaster and stakeholder training
 - End user feedback



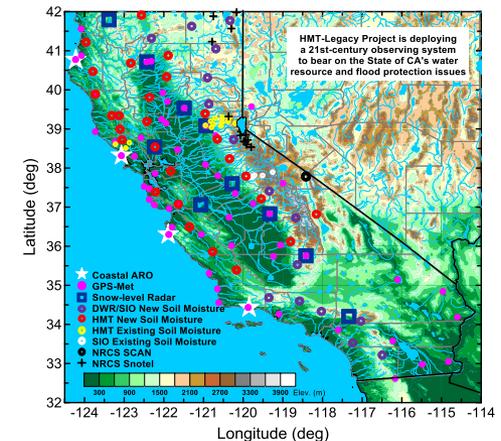
2011 NOAA Bronze Medal

see [White et al. 2012 \(BAMS\)](#)

Two Examples of How PSD has Helped Meet Stakeholder Water-related Needs

- The CA Dept. of Water Resources signed a five-year MOU with PSD to establish a 21st-century observing system to help meet their water resource and flood protection goals
- Integrated observational strategy includes:
 - Two ground-based remote sensing technologies developed by PSD/CIRES engineers
 - Modifying existing GPS receiver sites in the NSF Plate Boundary Observatory to measure integrated water vapor
 - Soil moisture sensors (*in situ*) to determine ability of ground to absorb storm rainfall (see poster by Bob Zamora)

see [White et al. 2013 \(JTech\)](#)

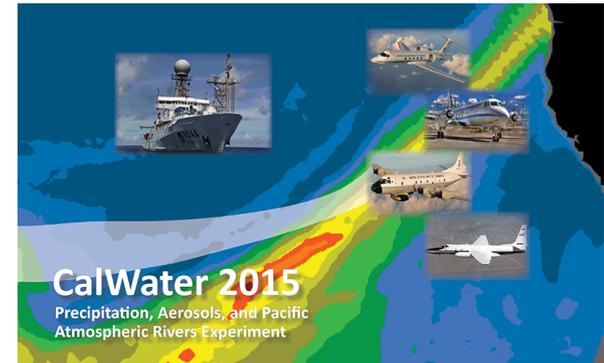


2011 CIRES Outstanding Performance Award

What You Will Hear in Observing the Physical System – Water Cycle

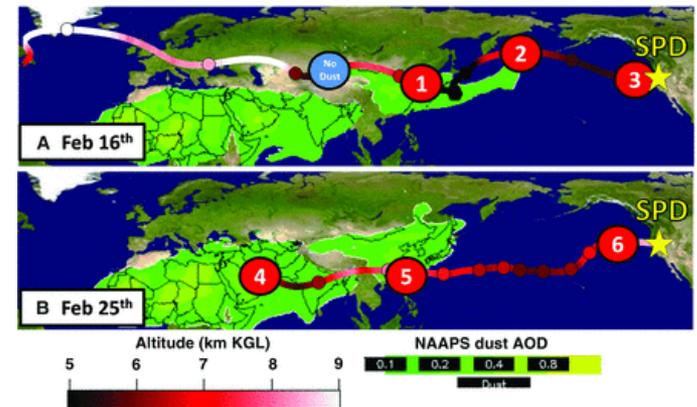
1-1. Ryan Spackman: CalWater 2015

Process understanding: PSD-led field campaign focused on how atmospheric rivers* and other related phenomena create extreme precipitation that can lead to flooding and/or increased water supply



1-2. Jessie Creamean: Linking aerosols and precipitation

Emerging science: PSD research on how transported dust and other anthropogenic and biologic aerosols impact the quantity and geographic distribution of precipitation



*[see poster by Darren Jackson](#)

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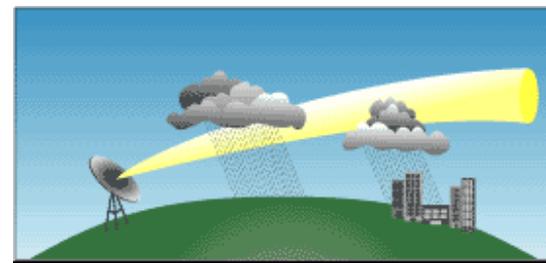
1-3. Chris Fairall: Advances from CALWATER2/VAMOS/DYNAMO campaigns

Technology development: PSD is using state-of-the-art shipborne and airborne observing equipment to learn more about air-sea interaction and cloud radiative forcing



1-4. Rob Cifelli: Role of gap-filling radars to improve QPE in complex terrain

Gap-filling observations: PSD is using non-NWS scanning radars and radar algorithm development to improve quantitative precipitation estimation (QPE), especially for regions where NEXRAD coverage is poor



What You Will Hear in Observing the Physical System – Water Cycle

1-5. Valery Zavorotny: Measurements of soil moisture and ocean wind using reflected GNSS signals

Innovation: PSD wave propagation experts are exploiting Global Navigation Satellite System (GNSS) technology to measure important atmospheric variables over land and sea

