Hydrometeorology Testbed (HMT)

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Overview

- HMT Overview
  - Mission and organization
- Examples from HMT-West
  - Atmospheric Rivers
  - California's HMT-Legacy Project
    - Observations
    - NWP
  - Collaborations with the Sonoma County Water Agency
    - Quantitative Precipitation Information (QPI)
    - Heat/Frost Information
- HMT Southeast Pilot Study (HMT-SEPS)
- Future Directions

NOAA Hydrometeorology Testbed (HMT)

The Hydrometerology Testbed (HMT) conducts research on precipitation and weather conditions that can lead to flooding, and fosters transition of scientific advances and new tools into forecasting operations. HMT's outputs support efforts to balance water resource demands and flood control in a changing climate. HMT aims to:

- accelerate the development and prototyping of advanced hydrometeorological observations, models, and physical process understanding
- foster infusion of these advances into operations of the National Weather Service (NWS) and the National Water Center (NWC)
- support the broader needs for 21st Century precipitation information for flood control, water management, and other applications

HMT
Hydrometeorology Testbed
NOAA

Hydrometeorology Testbed

hmt.noaa.gov

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New!



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New items posted 2-4 times per month

What's New...

March 15, 2013
A New Snow-Level Radar in Southern California Serves Dual Purposes



March 8, 2013
Four Coastal Atmospheric River Observatories to be Installed Along Central California Coast



February 28, 2013
New Study Finds Dust and Biological Particles Traveling from Sahara and Asia Influence Precipitation on West Coast



Major Activity Areas



Developing and prototyping 21st Century methods for observing precipitation



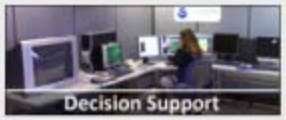
Addressing the challenge of extreme precipitation forecasting; from identifying gaps to developing new tools



Characterizing snow to address uncertainty in forecasting, flood control, and water management



Evaluating advanced observations of rain and snow, temperature, and soil moisture to provide best possible "forcings" for river prediction



Developing tools for forecasters and users of extreme precipitation forecasts

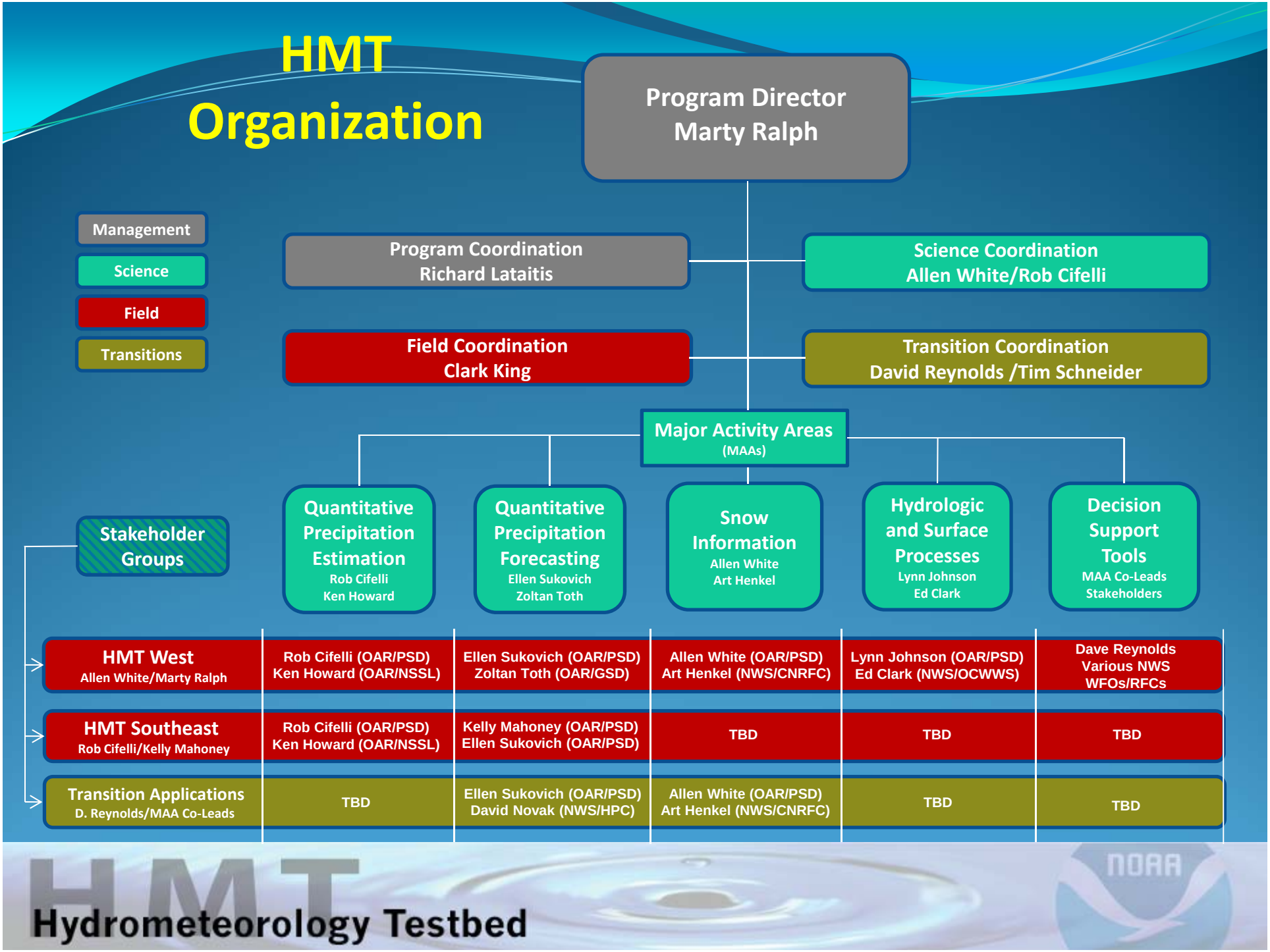
HMT is led by the ESRL Physical Sciences Division
with partners across NOAA, other agencies, and universities.

NOAA Hydrometeorology Testbed
Contact: Dr. F. Martin Ralph
NOAA Earth System Research Laboratory
R/PSD2 - 325 Broadway - Boulder, CO 80305

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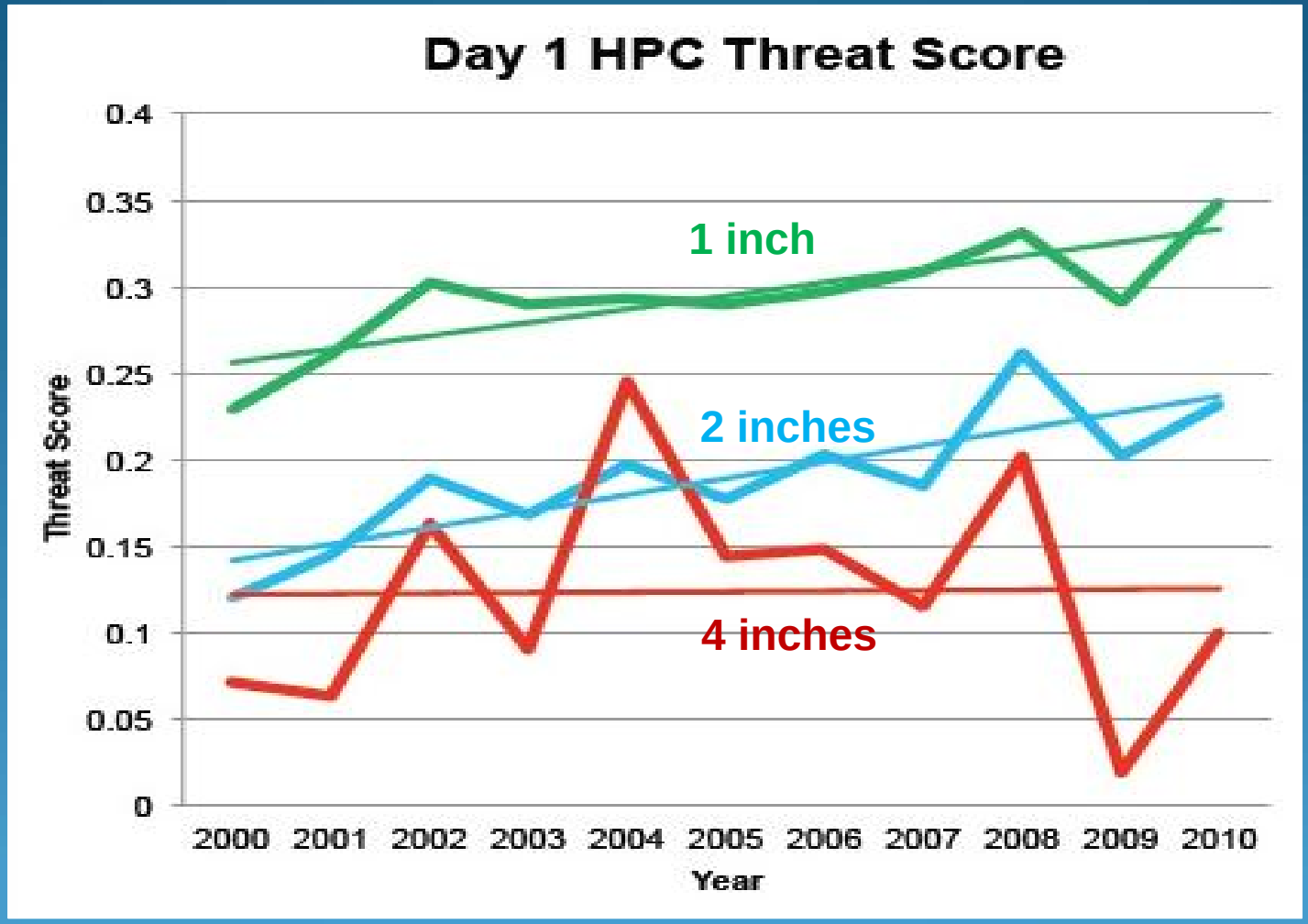
Hydrometeorology Testbed

HMT Organization



HMT Hydrometeorology Testbed

Why do we need HMT?
Example: Precipitation Forecast Skill



Courtesy Dave Novak, NOAA/NWS/WPC

Why Improve QPF?

Improving the amount, type, location and timing of quantitative precipitation forecasts (QPF) and probabilistic quantitative precipitation forecasts (PQPF) are key elements to enhance the information content and reliability of these forecasts.



Water Resource Managers



Emergency Management

Who needs accurate and reliable QPFs?



Public

See poster led by Ellen Sukovich on Wednesday afternoon:
Analyzing Extreme Quantitative Precipitation Forecast Performance



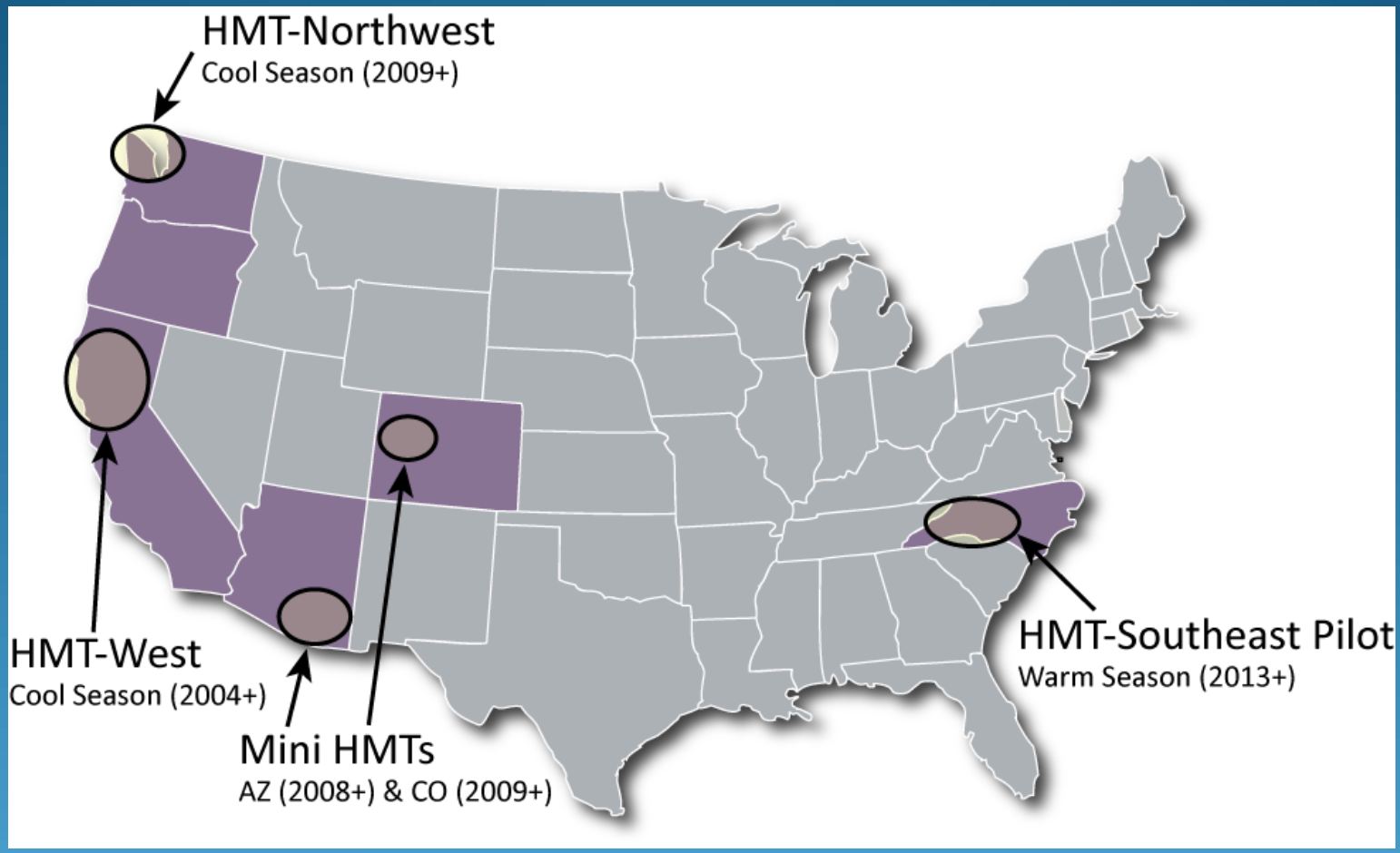
Transportation



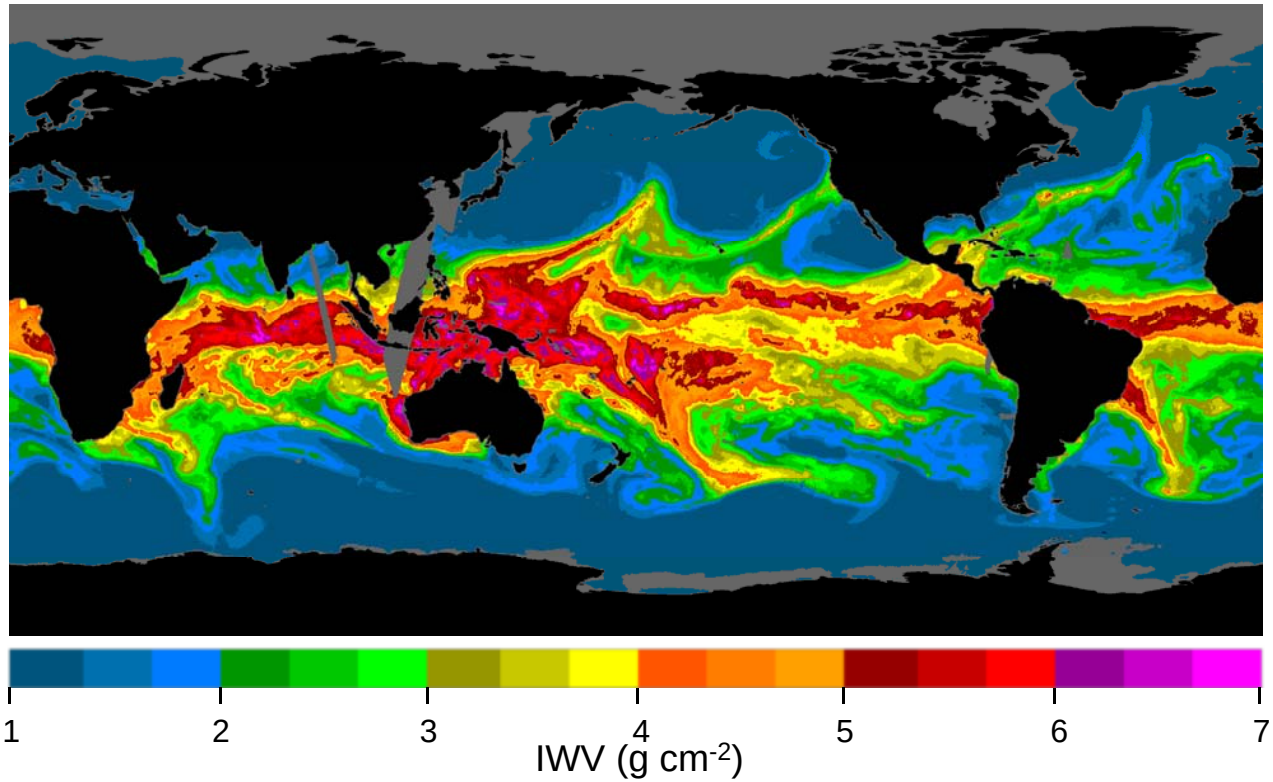
Agriculture

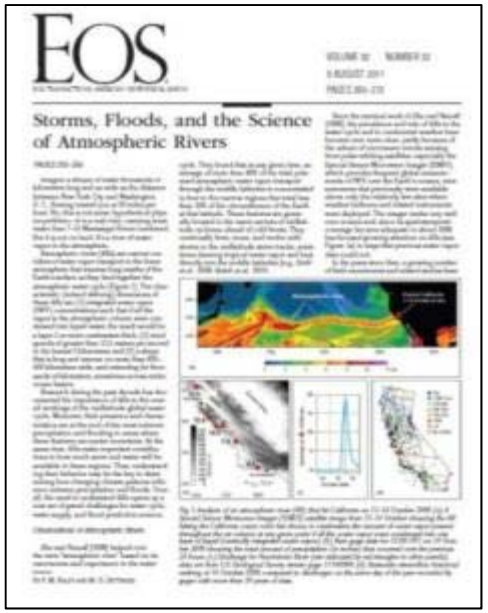
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HMT Locations



HMT-West Research has Identified Atmospheric Rivers (ARs) as the Primary Meteorological Cause of Extreme Precipitation & Flooding on U.S. West Coast




EOS

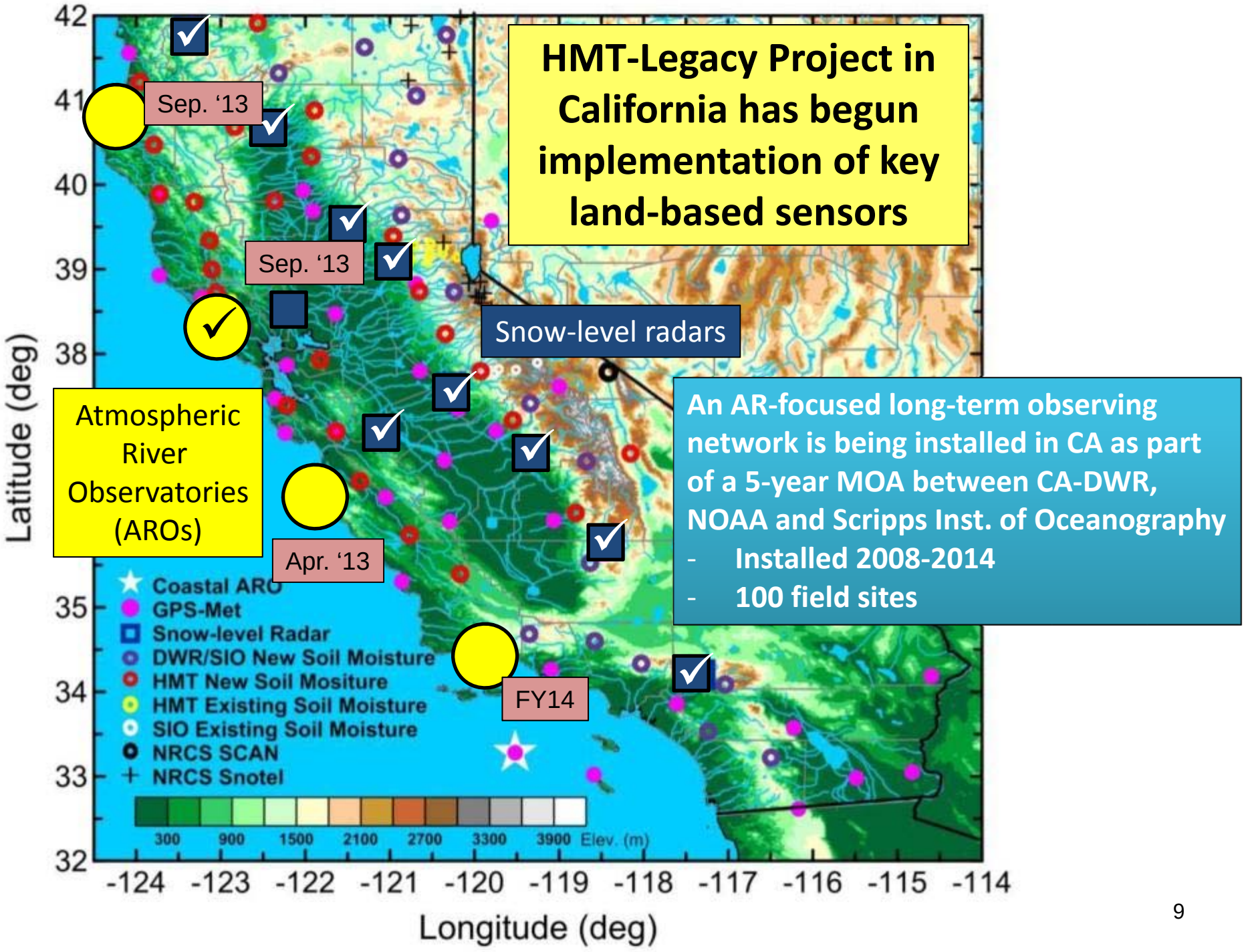
Storms, Floods, and the Science of Atmospheric Rivers

Ralph, F.M., and M.D. Dettinger, 2011: Storms, Floods and the Science of Atmospheric Rivers. *EOS, Transactions, Amer. Geophys. Union.*, **92**, 265-266.

Atmospheric River Information Page: http://www.esrl.noaa.gov/psd/atmrivers/

"On average, about 30-50% of annual precipitation in the west coast states occurs in just a few AR events."

"A strong AR transports an amount of water vapor roughly equivalent to 7.5–15 times the average flow of liquid water at the mouth of the Mississippi River."

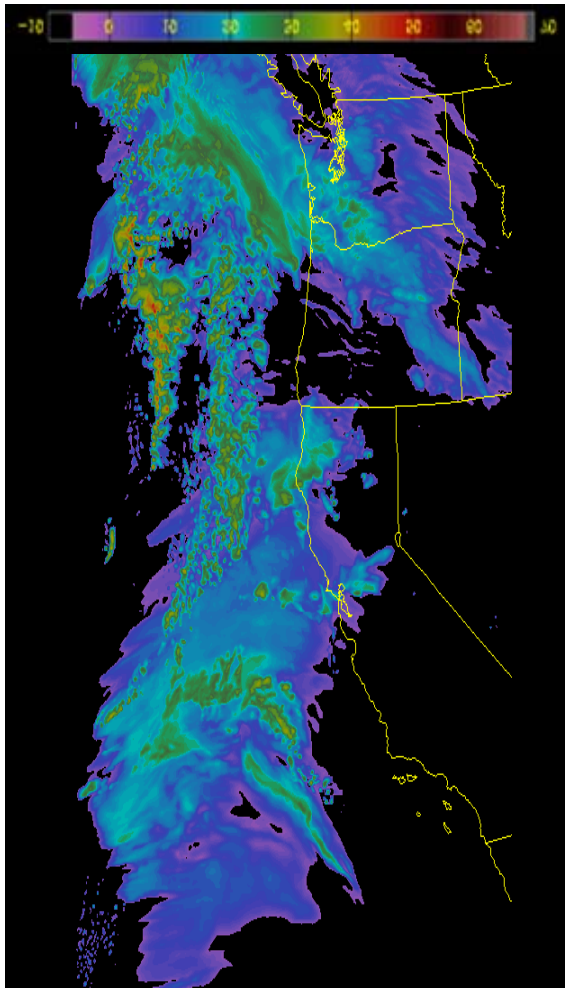

HMT-Legacy Project in California has begun implementation of key land-based sensors
Sep. '13
Sep. '13
Snow-level radars
Atmospheric River Observatories (AROs)
Apr. '13
FY14
An AR-focused long-term observing network is being installed in CA as part of a 5-year MOA between CA-DWR, NOAA and Scripps Inst. of Oceanography
- Installed 2008-2014
- 100 field sites
Coastal ARO
GPS-Met
Snow-level Radar
DWR/SIO New Soil Moisture
HMT New Soil Mositure
HMT Existing Soil Moisture
SIO Existing Soil Moisture
NRCS SCAN
NRCS Snotel
300 900 1500 2100 2700 3300 3900 Elev. (m)
Latitude (deg)
Longitude (deg)
42 41 40 39 38 37 36 35 34 33 32
-124 -123 -122 -121 -120 -119 -118 -117 -116 -115 -114



Phase I of Russian River Study with HMT and the Sonoma County Water Agency (SCWA):

- Improve Quantitative Precipitation Information (QPI) for the Russain River basin
  - Evaluate the benefit of TV radar (KPIX).
  - Determine best combination of radar and gauges to produce best possible QPE to drive hydro forecasts
- Provide high resolution temperature forecasts to mitigate Russian River draw down during frost and heat wave events

The HMT High-Resolution Deterministic Model



Five-hour forecast of composite reflectivity (dBZ) initialized on 3/19/13, 08 UTC.

PRIMARY APPLICATION: input for the HMT flux tool

CONFIGURATION: WRF-ARW

- 3-km grid spacing over west coast
- Initialized hourly; ran to 12 h
- Initialization: NAM + $LAPS_t$
- Boundary Conditions: NAM
- Microphysics: Thompson scheme

LAPS (Local Analysis and Prediction System)

- Blends a variety of in-situ and remote observations
- Has *hot start* capability to add clouds and vertical model at model initialization time
- $LAPS_t$: traditional (Barnes) analysis
- $LAPS_v$: multi-scale variational analysis

HMT Southeast Pilot Study (HMT-SEPS)

Management Structure



http://hmt.noaa.gov/field_programs/hmt-se/

Timeline-Location

- May 2013 – September 2014 in western North Carolina

Objectives

- Warm season QPE and QPF for extreme events
  - *Evaluation and improvement of QPE algorithms*
  - *Improved understanding of moisture sources and transport*

Partners

- NASA GPM
- NOAA GPM Proving Ground
  - NCEP CPC, NESDIS STAR, NWS OHD
- NWS Eastern & Southern Region & SERFC
- NC State, Duke, other Universities
- NSSL

HMT Future Work

- HMT-West
  - Finish HMT-Legacy observing system deployments in California
  - Formalize 2nd MOU with CA-DWR
  - SCWA follow-on activities
    - AR case studies for reservoir operations
    - Improved QPE for the Russian River Basin
    - Additional rain gauge/soil moisture monitoring sites
    - Benefits analysis
  - Establish agreement with City of San Francisco Public Utilities Commission
    - Improved precipitation monitoring (QPE) and short-term forecasting (QPF)
- Begin HMT-SEPS in North Carolina
  - NOAA component FY13-14
  - NASA component FY14