

# A 21st-Century Observing Network for California

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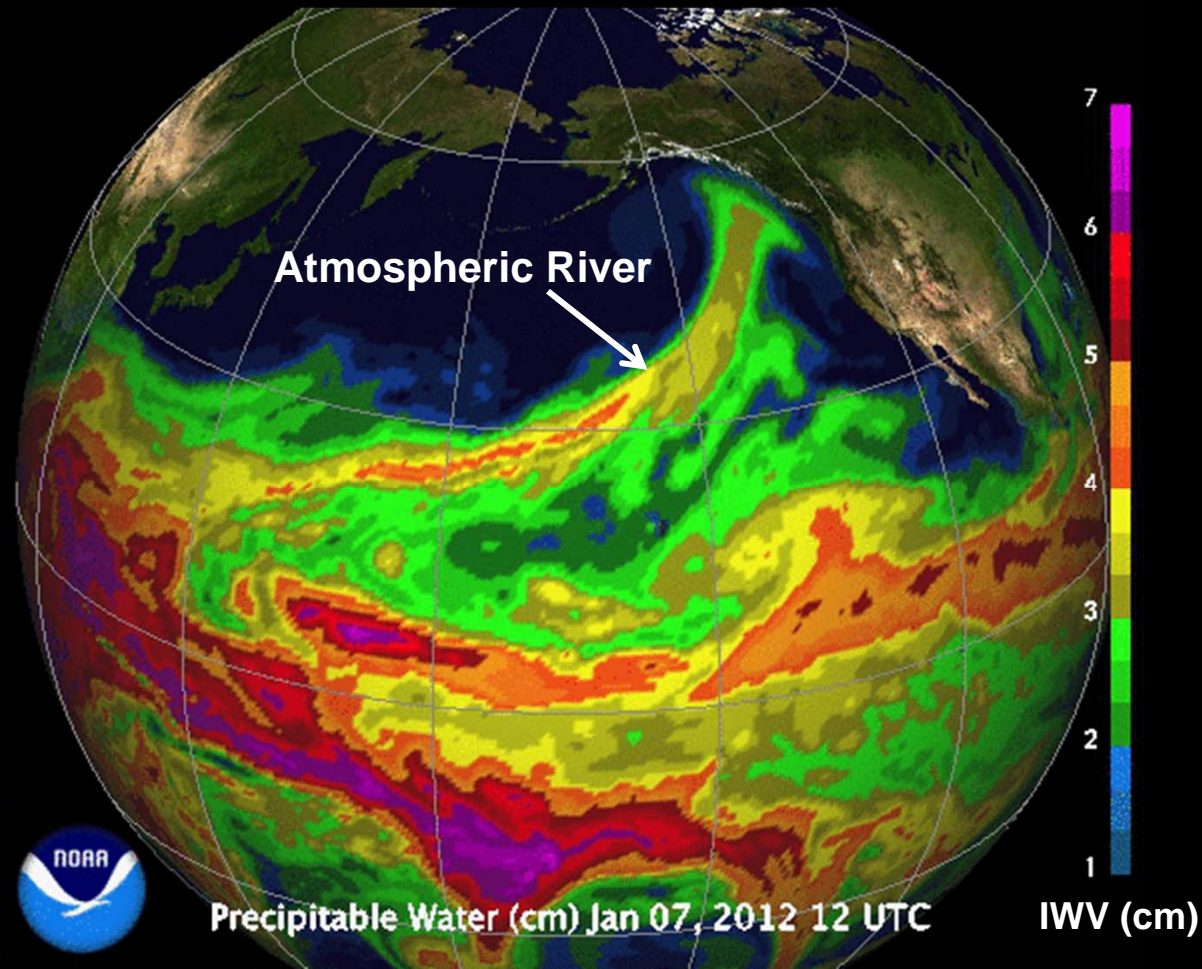
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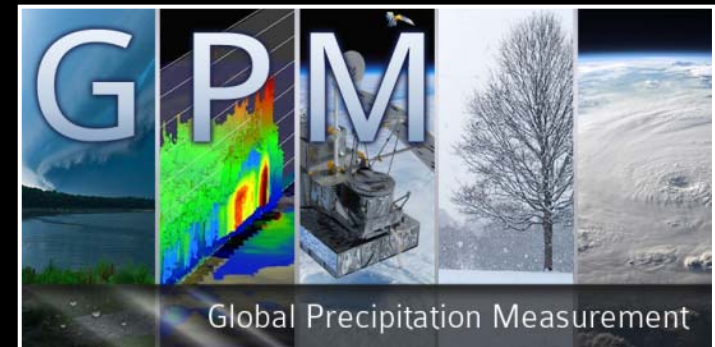
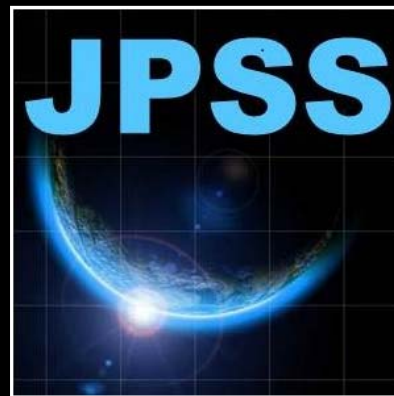
<sup>4</sup>Scripps Institution of Oceanography, La Jolla, CA

# MOTIVATION



Atmospheric Rivers (ARs) are responsible for wintertime floods and the bulk of California's water supply during the dry season. ARs and their resulting precipitation pose several forecast challenges (e.g., duration, intensity, location).

# MOTIVATION



More sophisticated sensors and satellite algorithms will require ground-truthing from ground-based validation sites. The permanent observing network being installed in California could help serve this purpose.

# OUTLINE

## 1. New California observing system networks with motivating research results from NOAA's Hydrometeorology Testbed (HMT)

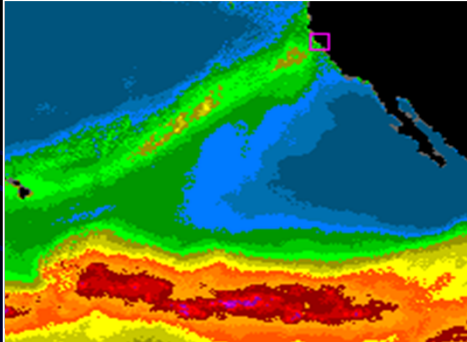
- GPS meteorology (IWV or TPW)
- Soil moisture
- Snow-level radars
- Coastal Atmospheric River Observatories

(Note: complementary projects in numerical modeling, display systems, and decision support will not be discussed in detail)

## 2. Summary



# A tiered approach for new obs to help address CA's water resource issues



**NOAA**

IV:  
Off-shore  
recon.

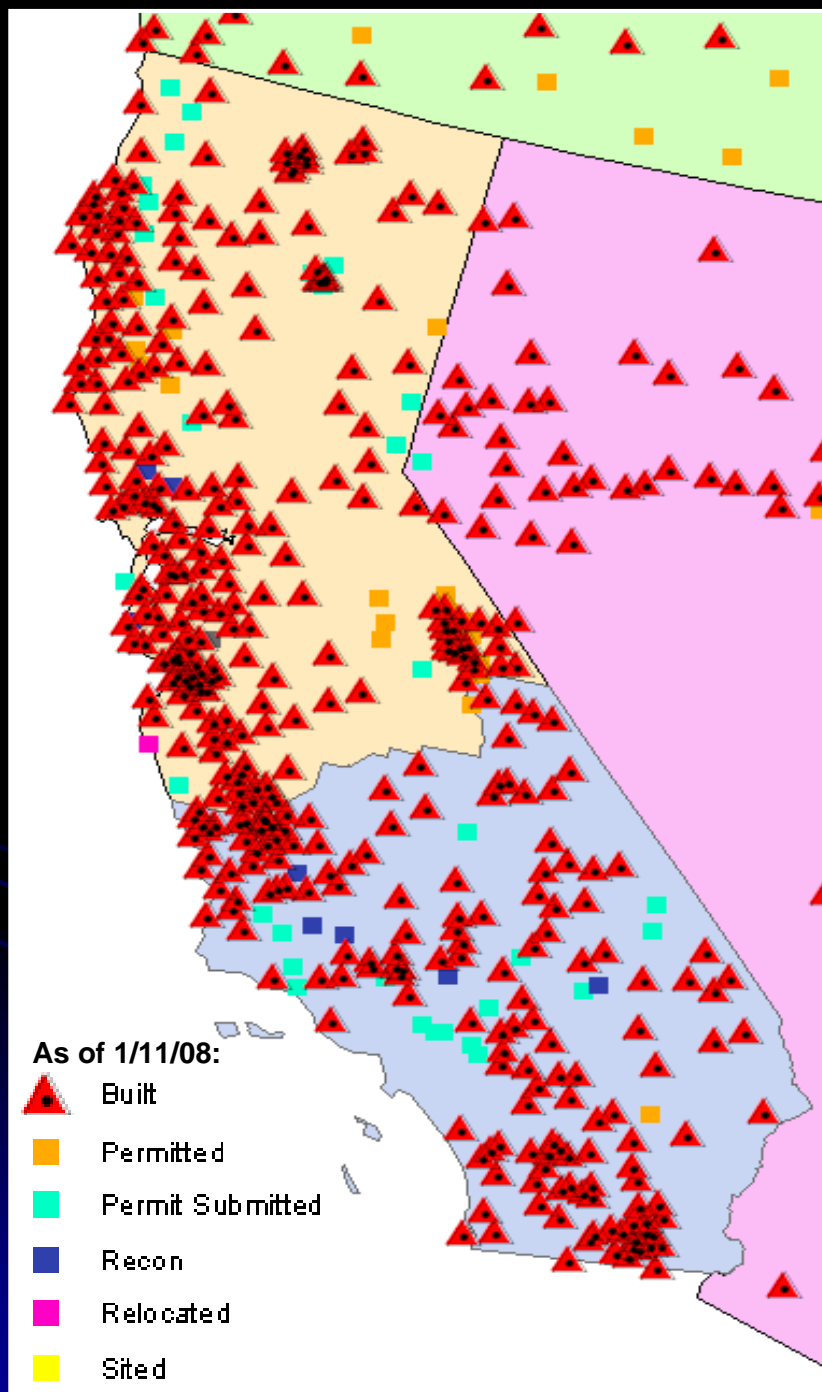
Tier III:  
Newer technology  
Ex: Gap-filling radars,  
Buoy-mounted WPs

**DWR**

Tier II: Expand on well-defined  
needs with proven technology  
Ex: Wind profilers, Coastal  
Atmospheric river observatory

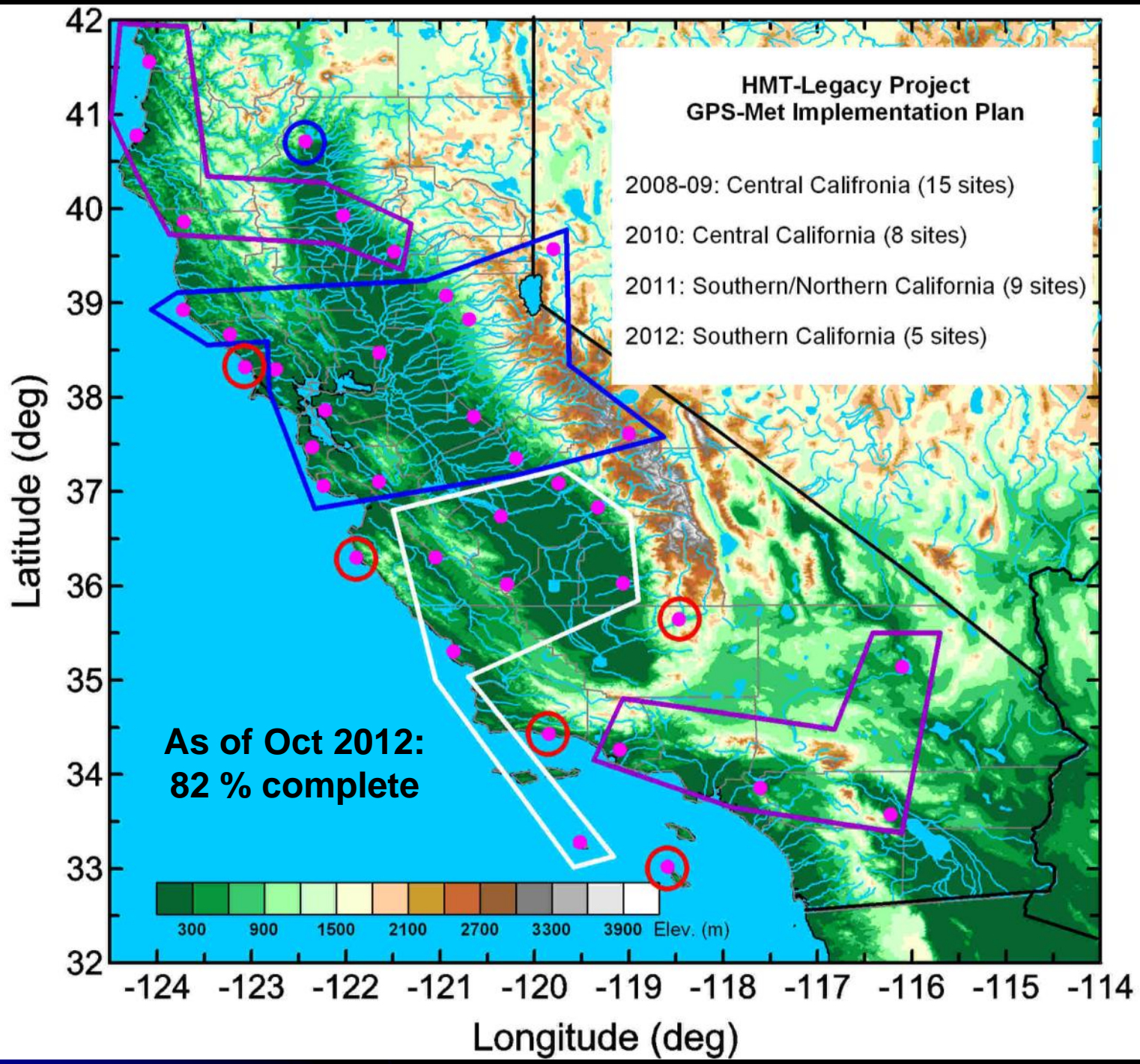
Tier I: Address well-defined needs with  
proven technology  
Ex: Soil moisture sensors at CIMIS sites, GPS  
receivers of opportunity, snow-level radars

## Tier 1: GPS receivers of opportunity

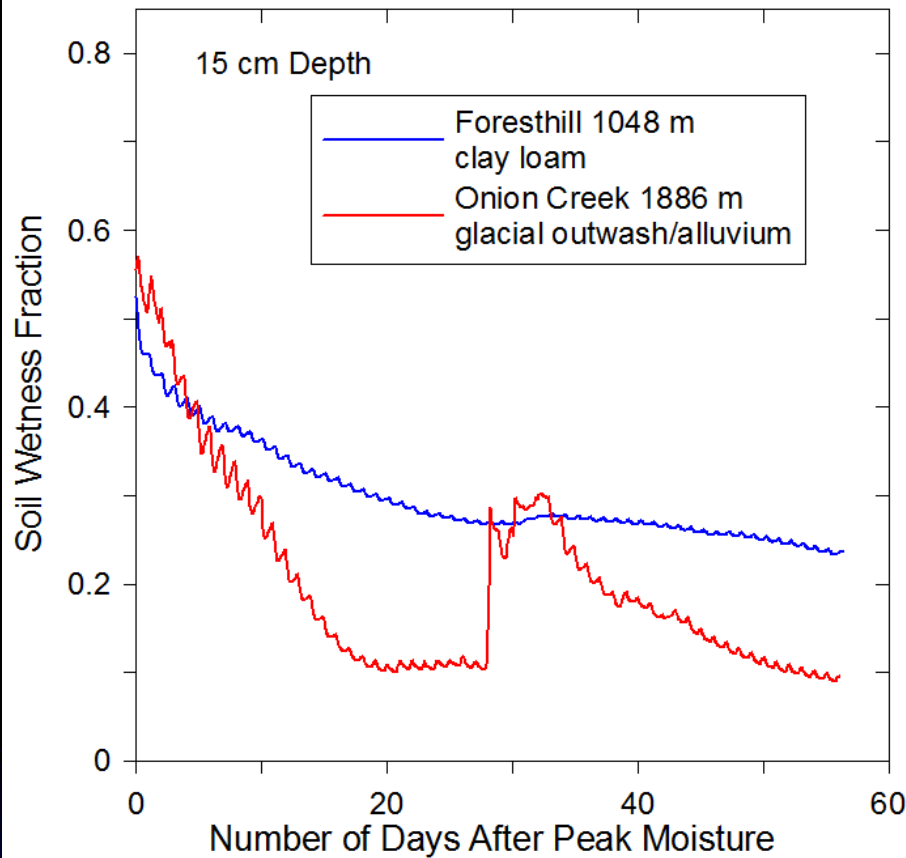


- NSF/UNAVCO Plate Boundary Observatory (PBO) network of GPS receivers for primarily geodetic applications
- **Installing surface temperature and pressure sensors at existing GPS receiver sites will allow the network to map out the horizontal distribution of vertically integrated water vapor (IWV)**
- Energy industry (electricity distribution) benefits because GPS receivers are used by Space Weather Center to monitor geomagnetic storms

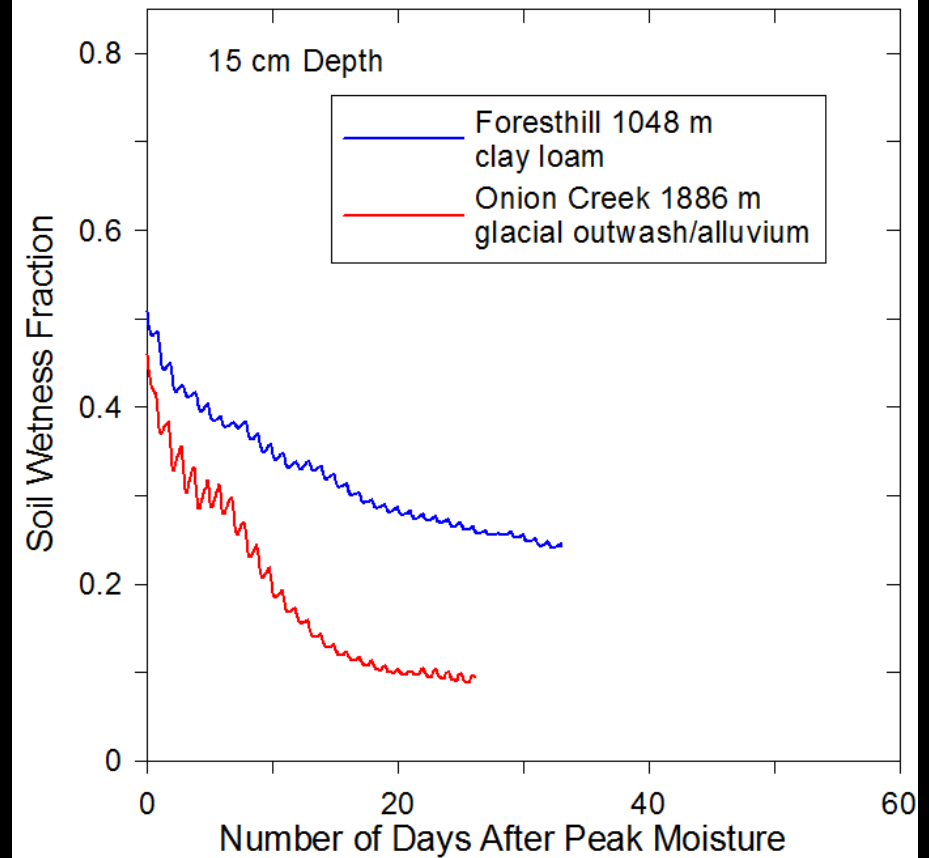




HMT 2009 American River Basin Soil Moisture

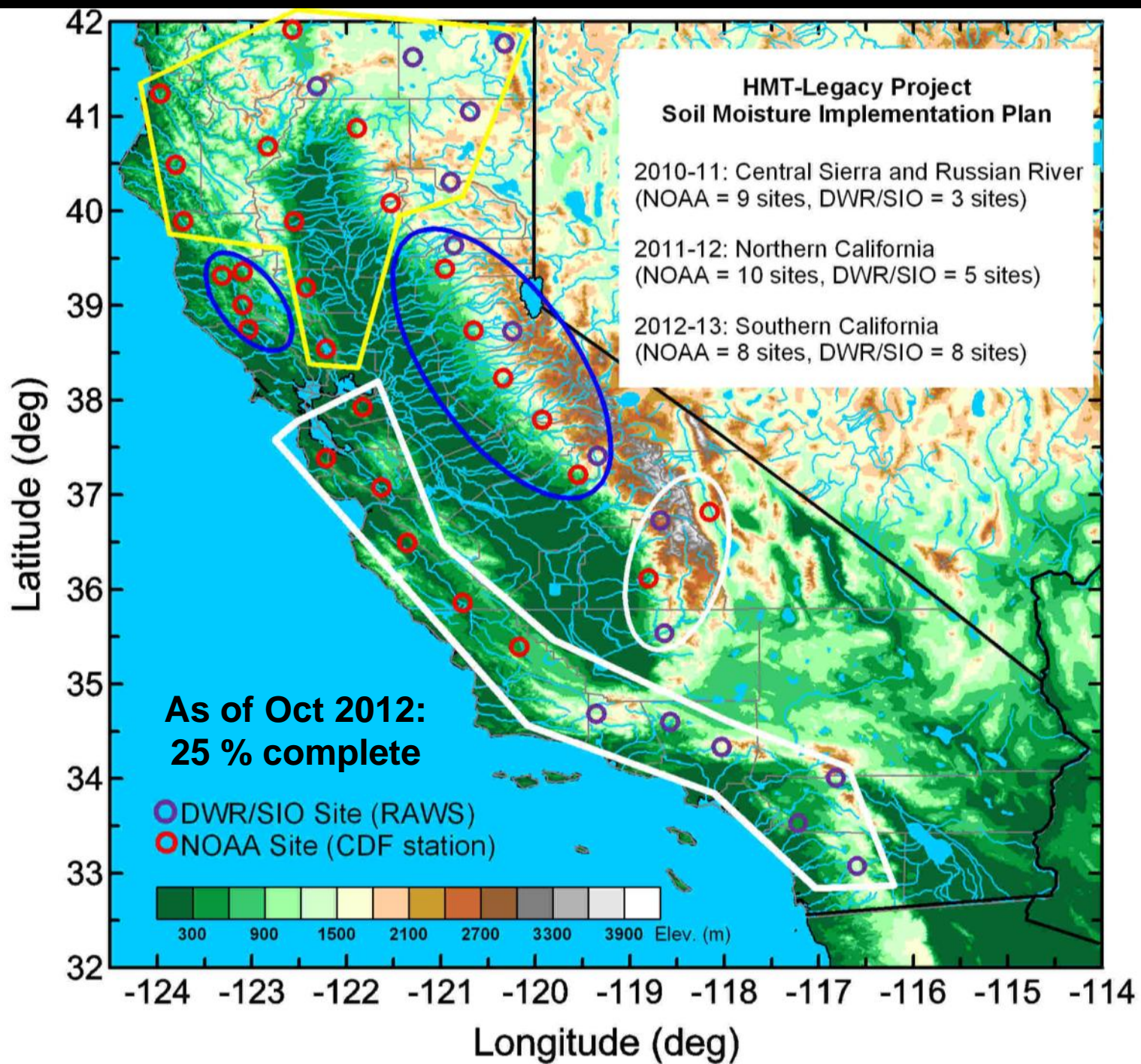


HMT 2010 American River Basin Soil Moisture

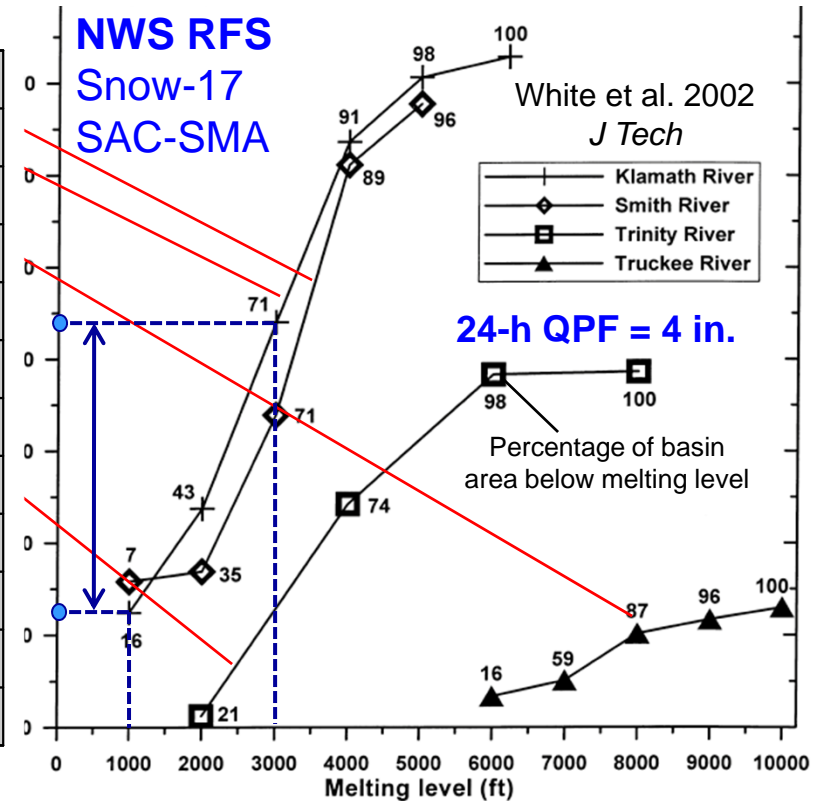
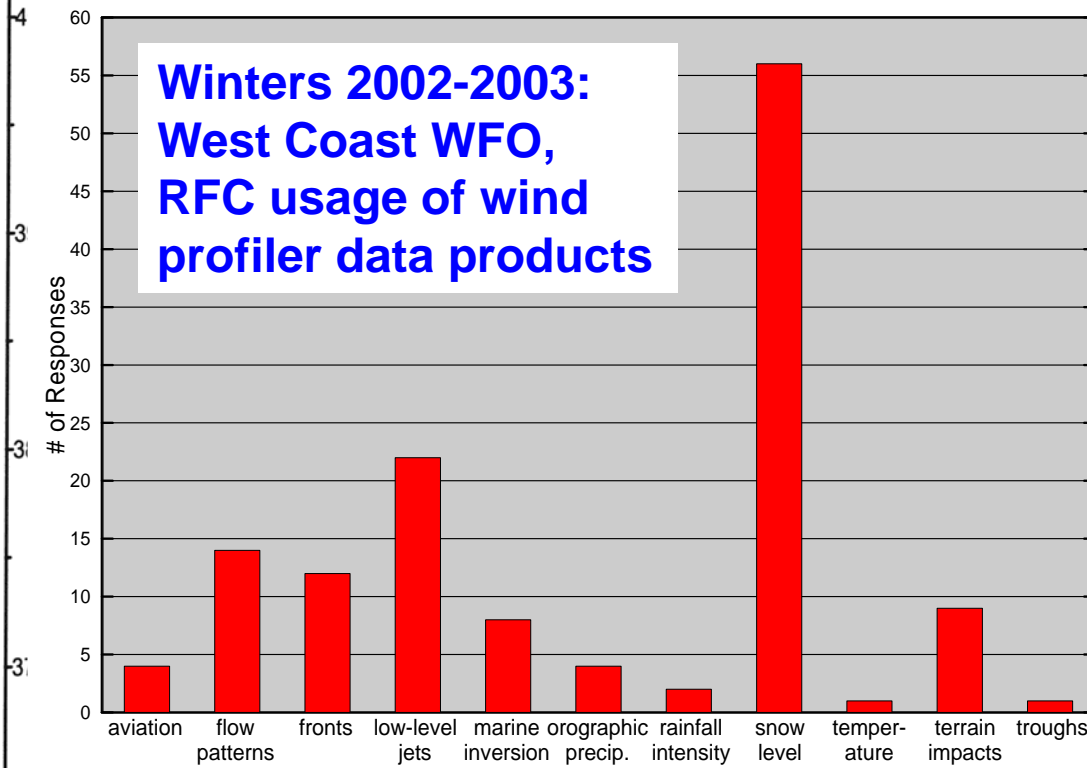
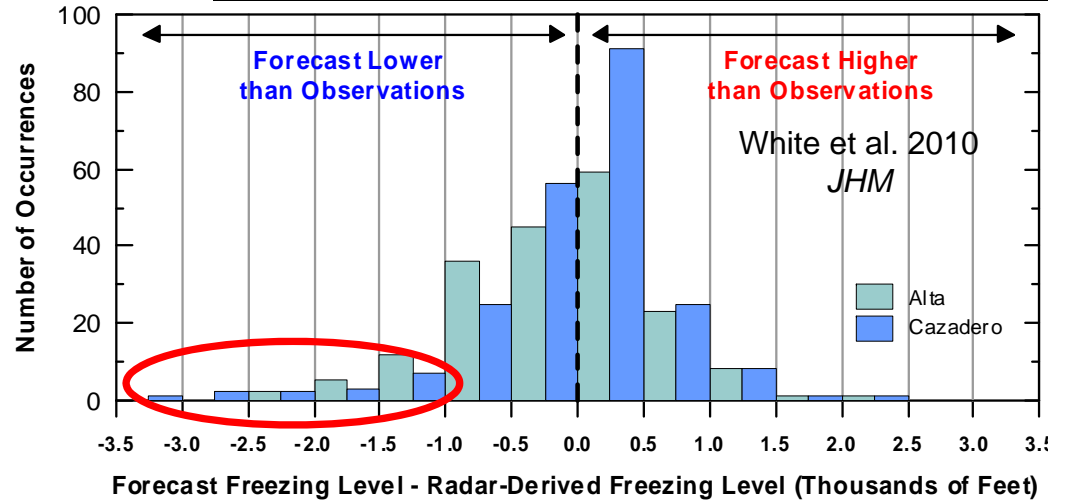
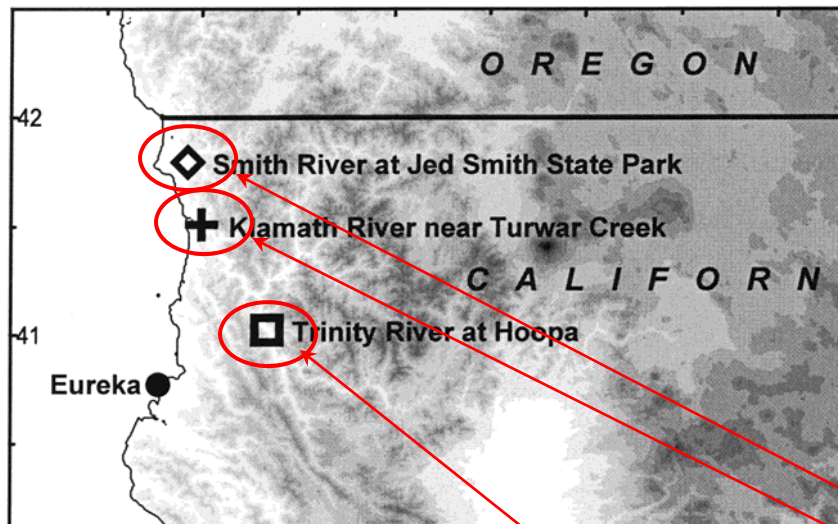


Upper Amer. Riv. basin with the glacial outwash/alluvium soil type has a much more rapid dry down and reduced storage capacity as compared to the lower basin with the clay/loam soil type. This suggests the need to monitor both altitude ranges in order to characterize soil moisture throughout the full basin.





# HMT Snow Level Research Results



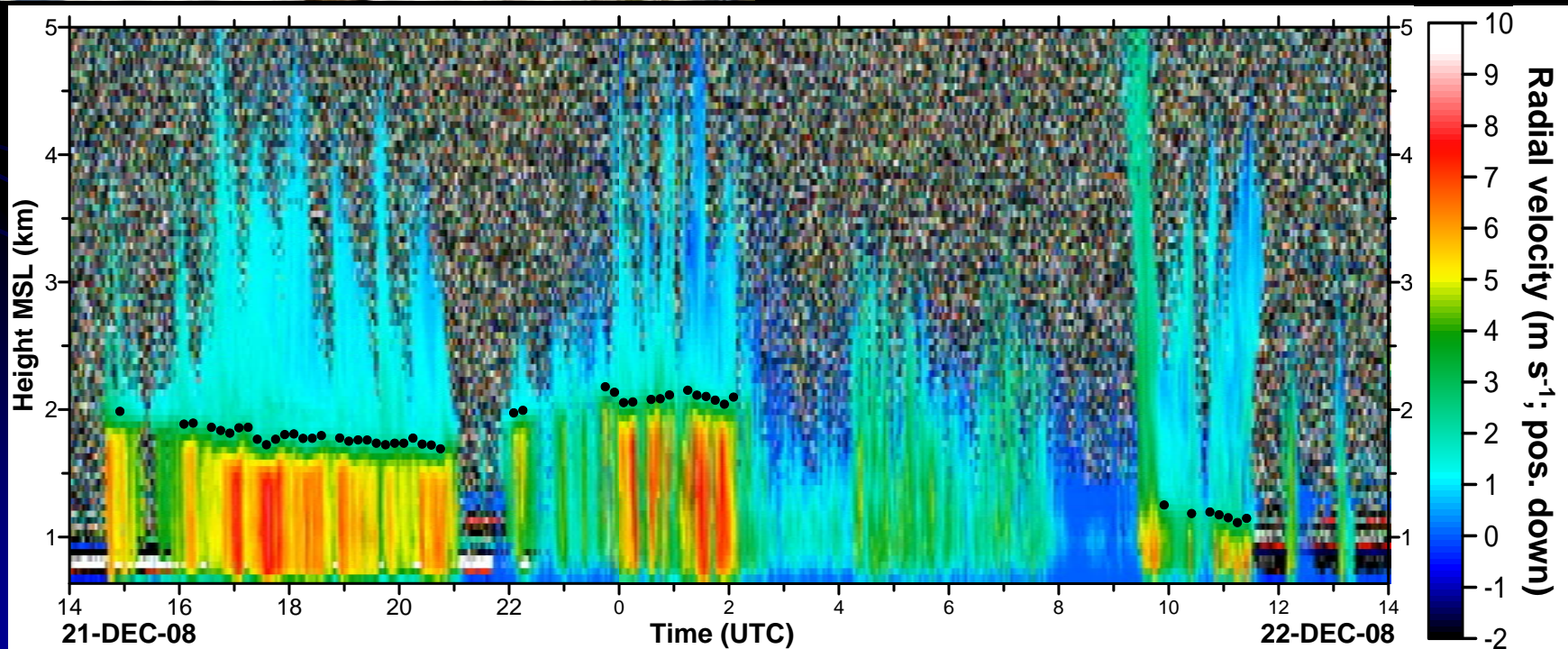


Colfax, CA  
Elev. 636 m

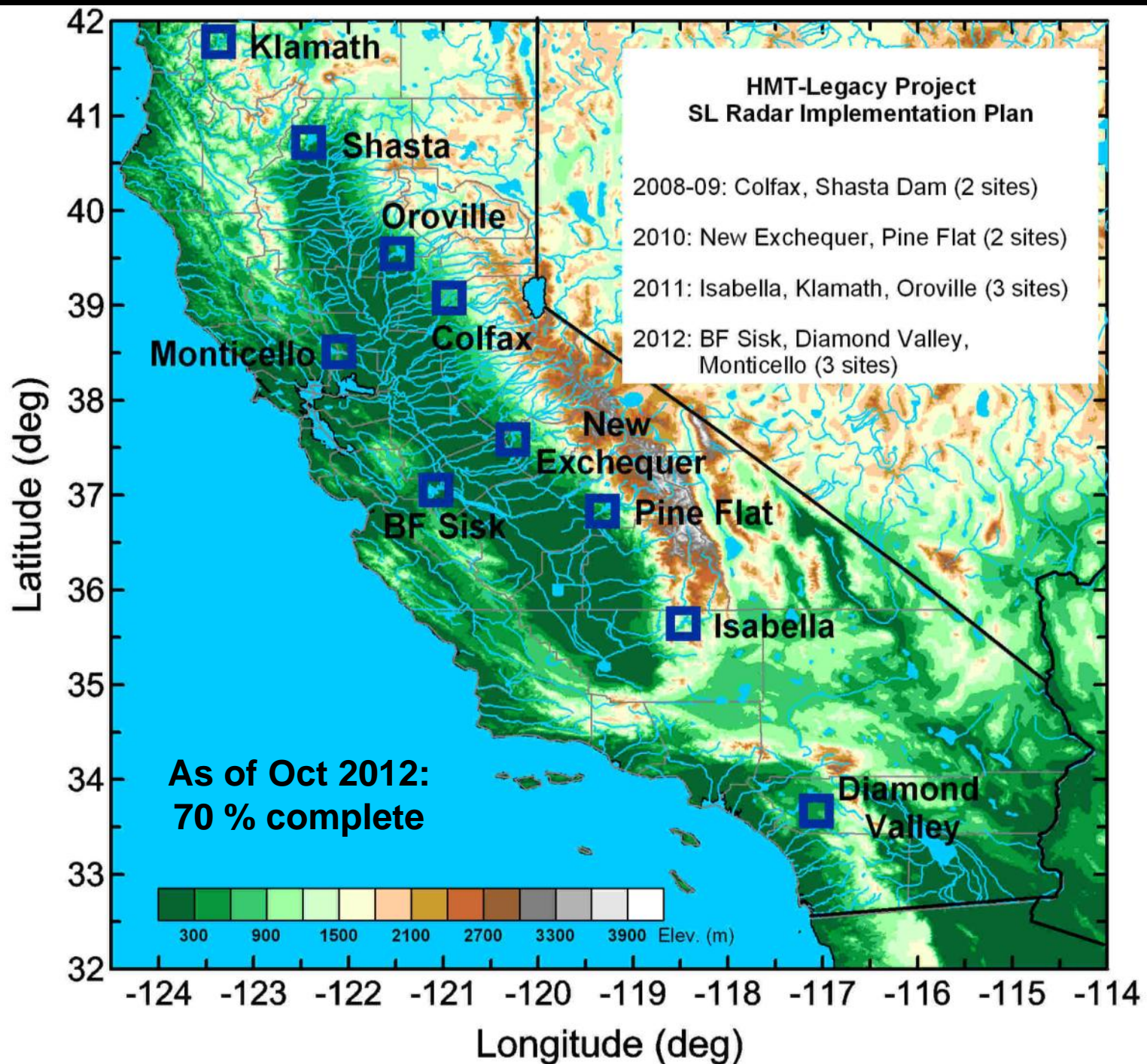


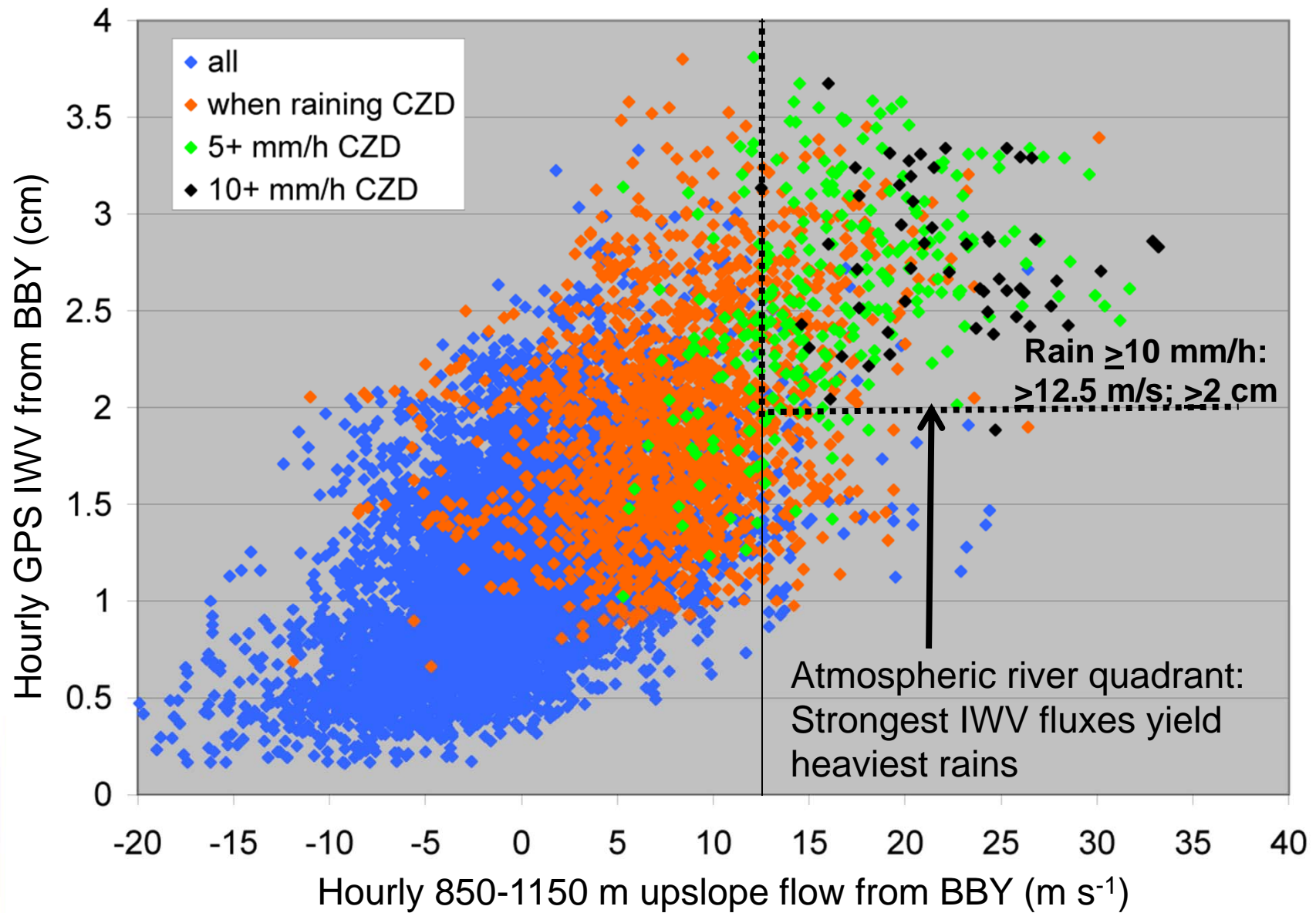
## Tier 1: Snow level radars

- Provides proxy snow-level height during precipitation events
- Utilizes proven FMCW technology to substantially lower cost
- **Uses the patented ESRL automated snow-level detection algorithm proven in nationwide field experiments**
- Less than 8' diameter footprint
- Low-power requiring minimal infrastructure











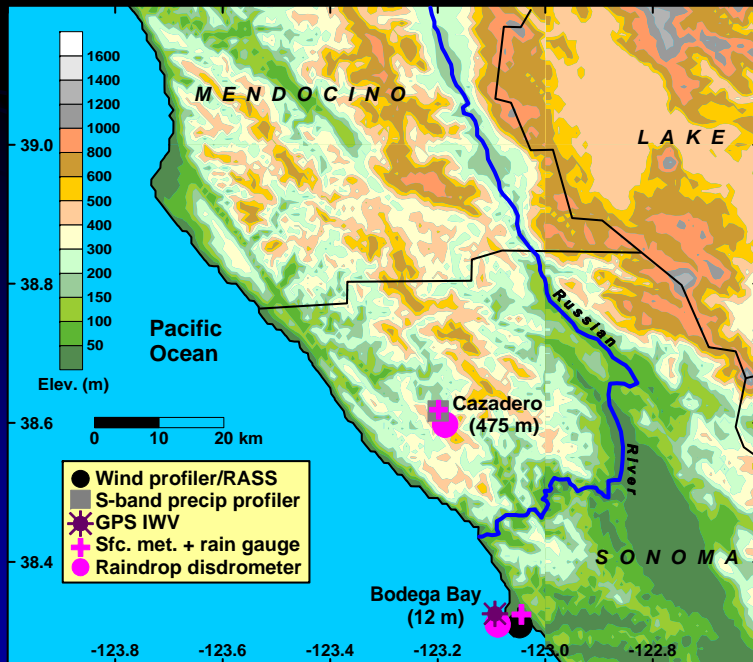
# Tier 2: Atmospheric River Observatory

## Atmospheric River (AR) Observatory: Russian River Prototype

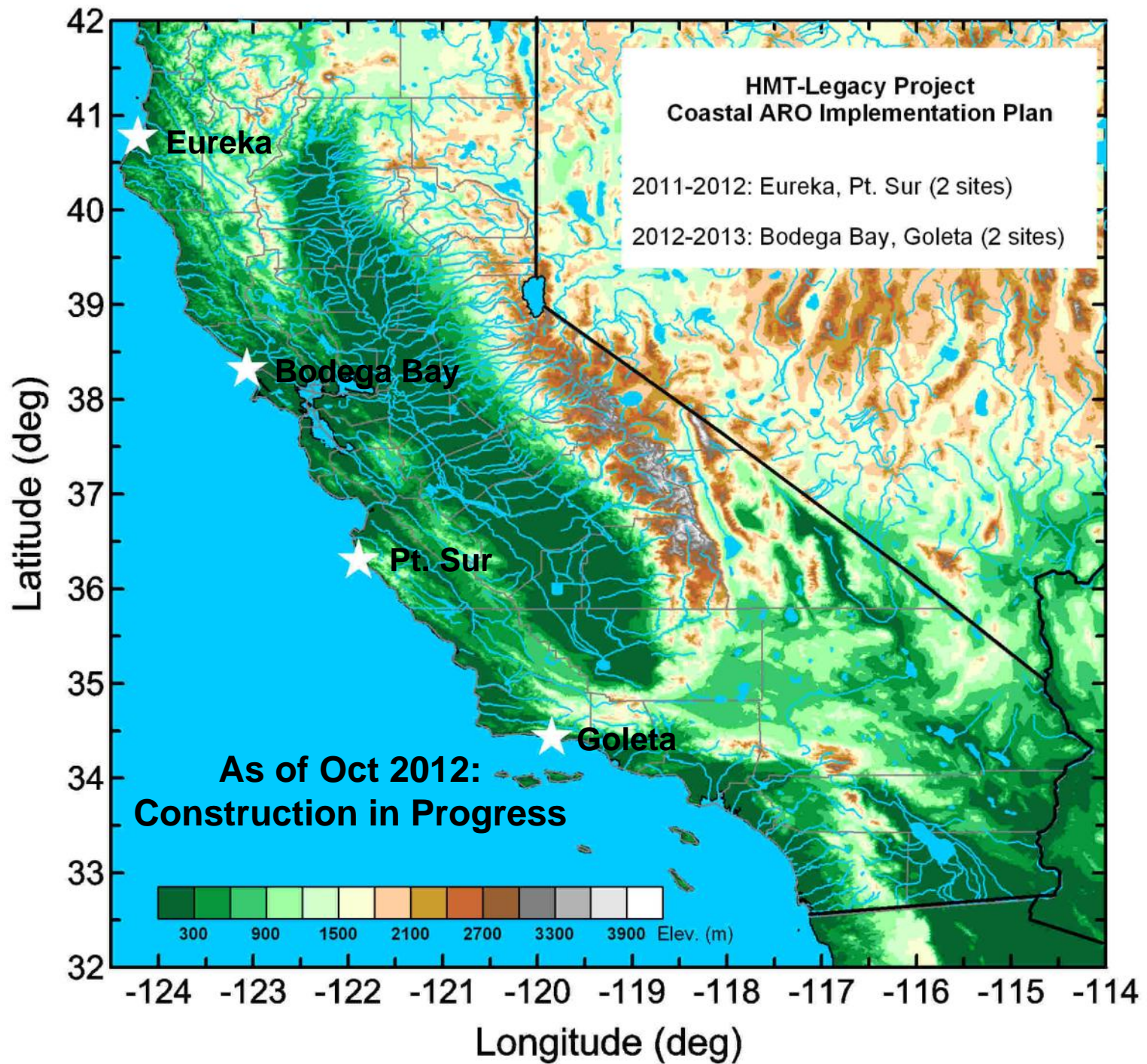
Objectives: Monitor key AR and precipitation characteristics.

### Observing systems:

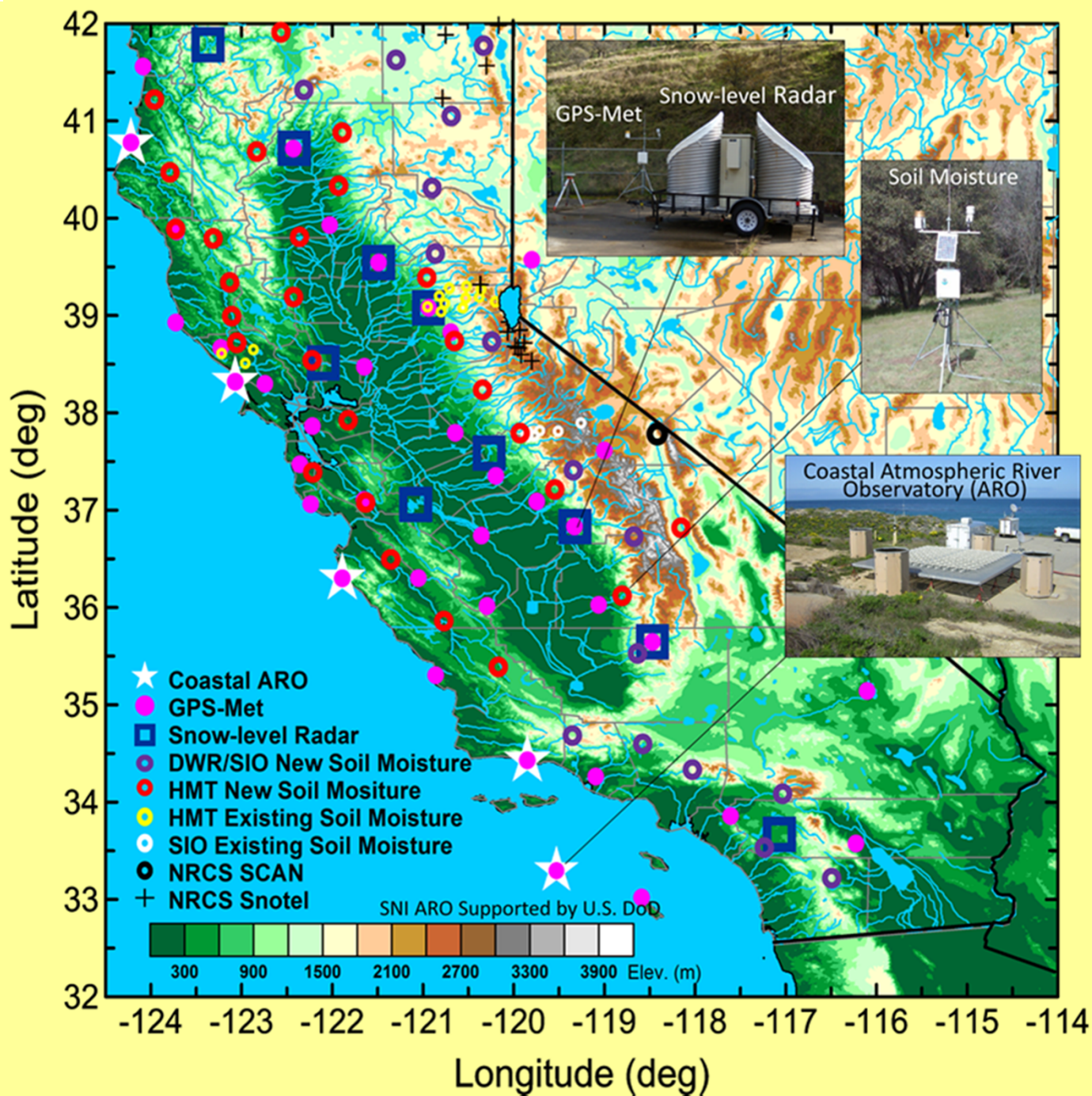
1. Wind profiler/RASS
2. S-band radar
3. Disdrometer
4. Surface met
5. GPS-IWV
6. Rain gauges











The easiest way to access data from this unprecedented network is to go to [hmt.noaa.gov](http://hmt.noaa.gov) and click on the data link. A pop up menu will then appear and you can choose the datasets you would like to view.

The screenshot shows the NOAA Hydrometeorology Testbed (HMT) website. At the top, the NOAA logo is on the right, and the HMT title is on the left. A navigation bar contains links for Home, About, Field Programs, Data, Meetings, Publications, News, and Resources. The 'Data' link is highlighted, and a dropdown menu is open, listing: Overview, Real-Time, Archive, GPS-Met, Soil Moisture, Models, and Satellite. An arrow points to the 'Data' link in the navigation bar. Below the navigation bar is a section titled 'Tools for Water in...' with a background image of a mountain landscape. To the right is a 'Major Activity Areas' section with six items, each with a small image and a description: 1. 'Quantitative Precipitation Estimates' (satellite dish) - Developing and prototyping 21st Century methods for observing precipitation. 2. 'Quantitative Precipitation Forecasting' (server racks) - Addressing the challenge of extreme precipitation forecasting; from identifying gaps to developing new tools. 3. 'Snow Information' (cars in snow) - Characterizing snow to address uncertainty in forecasting, flood control, and water management. 4. 'Hydrologic Applications' (river) - Evaluating advanced observations of rain and snow, temperature, and soil moisture to provide best possible "forcings" for river prediction. 5. 'Decision Support' (computer workstation) - Developing tools for forecasters and users of extreme precipitation forecasts. Below the 'Tools for Water in...' section is a 'What's New...' section with two entries: 'September 21, 2012 CNRFC Team Visits Medford Weather Forecast Office' (with a Medford sign image) and 'September 14, 2012 Experiment will Retrospectively Analyze Eight Major Atmospheric River Events' (with a weather map image).



# SUMMARY

- NOAA/ESRL is in the midst of a 5-year MOA with CA-DWR to bring 21<sup>st</sup>-century observation, display, modeling, and decision support capabilities to bear on the state's water resource and flood protection issues.
- Several scientists and technicians at SIO are coconspirators.
- This project will build an unprecedented network of hydrometeorological instrumentation that provides critical information on the forcings for high impact precipitation and runoff events as well as other weather phenomena.
- Data products are displayed in real-time and archived on web pages at DWR and NOAA.
- The building blocks for eventual decision support tools are being developed .
- **THIS IS YOUR NETWORK!** Use the datasets to help better serve your agency's needs.