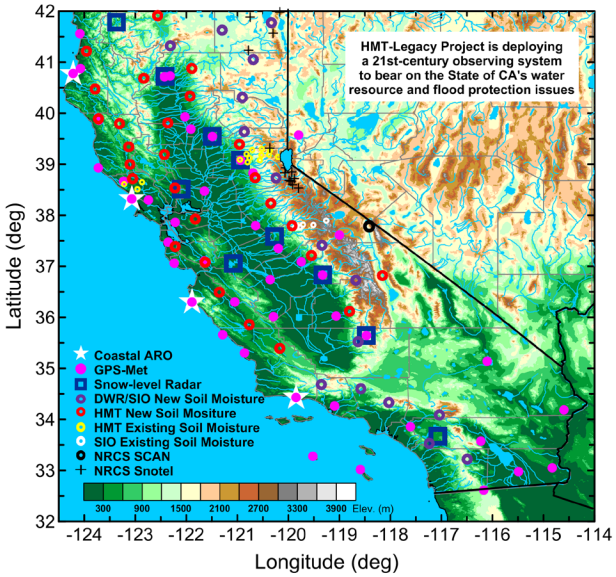
21st Century Observations and Modeling in California

Helping to Address Water Resource and Flood Protection Issues

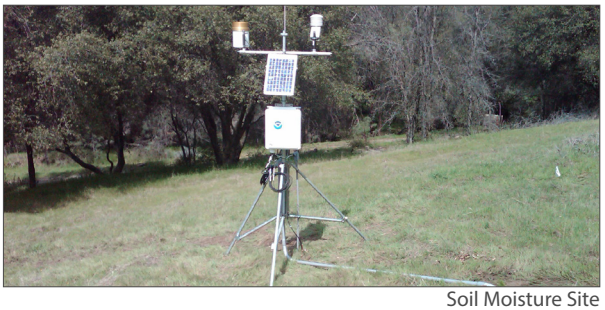
Since 2008, NOAA's Earth System Research Laboratory (ESRL) has partnered with the California Department of Water Resources (CA-DWR) to address water resource and flood protection issues. As part of CA-DWR's Enhanced Flood Response and Emergency Preparedness (EFREP) Program, ESRL and CA-DWR are working with the Scripps Institution of Oceanography to improve precipitation monitoring and prediction, especially for extreme events. The statewide deployment of observing systems and suite of highy detailed weather forecast models builds on lessons learned in NOAA's Hydrometeorology Testbed (HMT).



The Problem

During northern hemisphere winters, the western coast of North America is battered by landfalling storms. The impact of these storms is a paramount concern to CA, where water supply and flood protection infrastructure are being challenged by the effects of age, increased standards for urban flood protection, and projected climate change impacts. In addition, there is a built-in conflict between providing flood protection and the other functions of major water storage facilities in CA: water supply, water quality, hydropower generation, water temperature and flow for at risk species, and recreation. In order to improve reservoir management and meet the increasing demands on water, improved forecasts of precipitation, especially during extreme weather events, will be required.

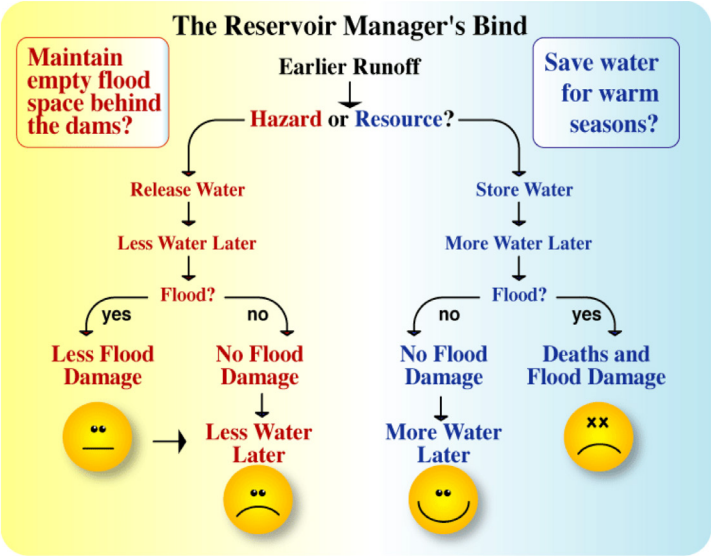
Snow-Level Radar



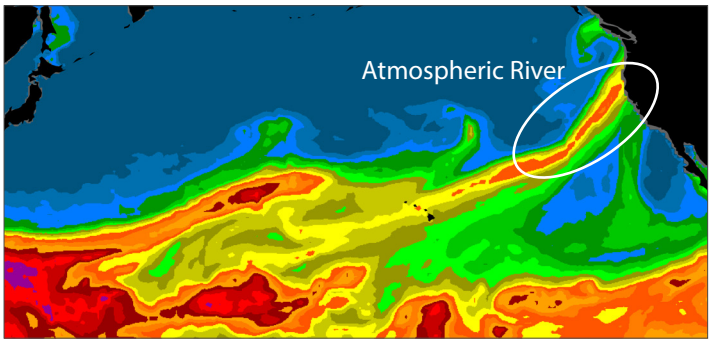
Soil Moisture Site

Working Towards a Solution

- Antecedent soil moisture can determine whether an extreme rainfall event produces a flood, so soil moisture sensors with other associated meteorological equipment are being placed at 43 new sites across CA.
- Water vapor fuels precipitation, and GPS technology provides a viable method of measuring the vertically integrated water vapor (IWV). HMT is partnering with UNAVCO, the operators of the Plate Boundary Observatory, where many GPS receivers already exist for geodetic purposes, to provide IWV measurements from over 50 locations in or near CA.
- The snow level is important with respect to flooding in mountainous watersheds because it determines the surface area throughout the watershed that is exposed to snow versus rain. ESRL engineers have invented a new, compact radar designed to measure the snow level at a much reduced cost compared to other radars used for this purpose. These "snow-level radars" are being installed in ten key watersheds across CA.
- A major finding from HMT is the role that atmospheric rivers, narrow regions of enhanced water-vapor transport, have in creating heavy precipitation that can lead to flooding. A picket fence of atmospheric river observatories (AROs) is being deployed along the CA coast. The AROs provide critical information on water vapor transport aloft and the snow level.
- Taking full advantage of the new measurements requires a complementary effort in data assimilation and weather forecast modeling.
- Decision support tools also are being developed to integrate the new information provided by the observations and models into flood forecasts, and to inform water management decisions and minimize water shortages due to drought.



Credit: Mike Dettinger, USGS/Scripps Institution of Oceanography



Satellite Image of an Atmosperic River. Credit: NOAA/ESRL/PSD

Atmospheric River Observatory in Bodega Bay, CA. Credit: Clark King, NOAA

On the Web

Hydrometeorology Testbed: http://hmt.noaa.gov
Atmospheric Rivers: https://www.esrl.noaa.gov/psd/arportal/
Real-time & Archived Data: https://www.esrl.noaa.gov/psd/data/obs/

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