Climate, Droughts and Floods in the Sierra

Insight Into California’s Future with Climate Change
California’s topography affects our weather and climate.
Key Phenomena Affecting California Water Supply/Flooding:

The size, number, and strength of atmospheric river events (ARs) result from the alignment of key processes.
4 Years of Drought

- Past 4 years in lowest 10 snowpacks since 1950
- Driest calendar year in last 120 years (2013)
- Record breaking temperatures (2014, 2015*)
- Lake Tahoe elevation falls below natural rim
- Forest impacts from pests and fires
NOAA Climate Division 2 Calendar Year Data

1895-2014

Annual Precipitation (inches)
Annual Average Temperature (deg F)

Record warmth
2012
2014
2015?
Record dry
2013

Source: NOAA Climate Division 2 Calendar Year Data
Sierra Snowpack vs Winter Temperature 1950-2015

Sierra Winter (DJF) Average Minimum Temperature (degrees Fahrenheit)

Temperature Data from California Climate Tracker, WRCC

April 1 Snowpack Percent of Average From California Cooperative Snow Surveys

9 Years Below 50%

Sierra Region
HMT-Legacy Project is deploying a 21st-century observing system to bear on the State of CA's water resource and flood protection issues.

http://hmt.noaa.gov/
Flood Conditions During Epic Drought
Feb 6 2015
Water Vapor Imagery from Satellite

Rainfall at Donner Summit
PSD Near Realtime Observations - Map

SurfaceMet Data
- Temperature (F)
- Integrated Water Vapor (cm)
- Snow Depth (in)
- Wind Speed & Direction (mph)
- Accumulated Precipitation (in)
- Soil Moisture Saturation (%)

Wind and Precipitation Radar Data
- Snow Level (kft msl)
- Profiler Wind Speed And Direction (mph)
- Height (m msl):
- Integrated Water Vapor Flux (cm)(m/s)

NEXRAD Data
- Radar Reflectivity Mosaic

02/06/2015 22:15 UTC

= Data Missing  = No Valid Data
• 2 AR events in 5 days
• Rapid rises on rivers
• Minor flooding due to dry conditions
• Sierra Barrier Jet Present
• Freezing Elevations between 7,000 and 9,000 feet
Flood and Drought Together

- Because Atmospheric River events (ARs) are central to California’s water supply and flood potential, both flood and drought can co-exist.
- Warmer temperatures mean higher snow lines and more potential water vapor transport (ARs can be bigger and stronger).
- Potential exists for fewer ARs (drought) with individual ARs being stronger (flood).
Climate Change and California

Increasing Temperatures

There are many components to the climate system that will evolve which will have an impact on the Sierra and California – increasing understanding is a key to adaptation.
Adapting as Climate Changes

• Extreme events provide new observations confirming what has been presumed to be plausible

• As climate continues to evolve, the extreme observations are expected to then become intermittent before becoming “the new normal”

• Adaptation can benefit from observations of extremes using such events as planning scenarios