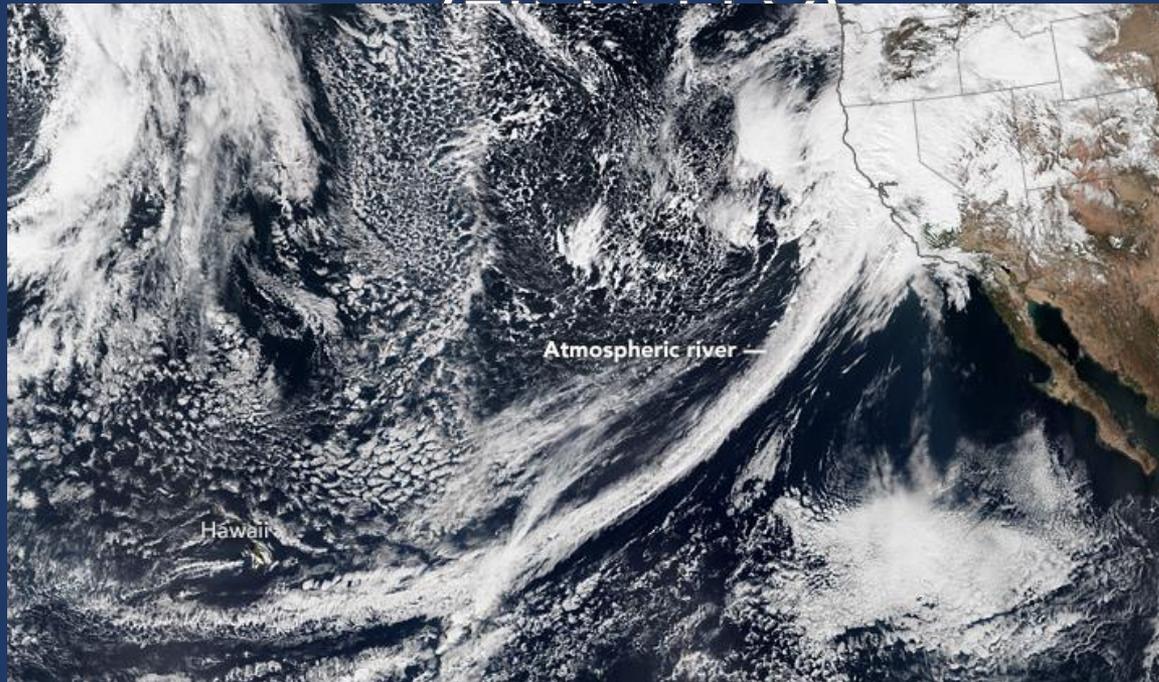
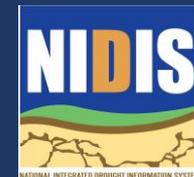


FLOODING DURING DROUGHT: DROUGHT RELIEF IN CALIFORNIA



AMANDA SHEFFIELD
SIO/CNAP/NIDIS



APRIL 4, 2017

U.S. DROUGHT MONITOR FORUM



CA-NV USDM RECOMMENDATION PROCESS

- CA-NV DROUGHT MONITOR CALL EMAIL LIST SERVE
- BI-WEEKLY OR MONTHLY PHONE CALL (ORGANIZED BY SACRAMENTO WFO)
- ROUND-ROBIN STYLE
 - NWS WFOs & CNRFC
 - STATE CLIMATOLOGISTS
 - PARTNER AGENCIES (FSA, USFS, NRCS, DOD, WRCC, CNAP)
 - USDM AUTHOR
- RECOMMENDATIONS EMAILED TO CA-NV LIST SERVE & AUTHORS

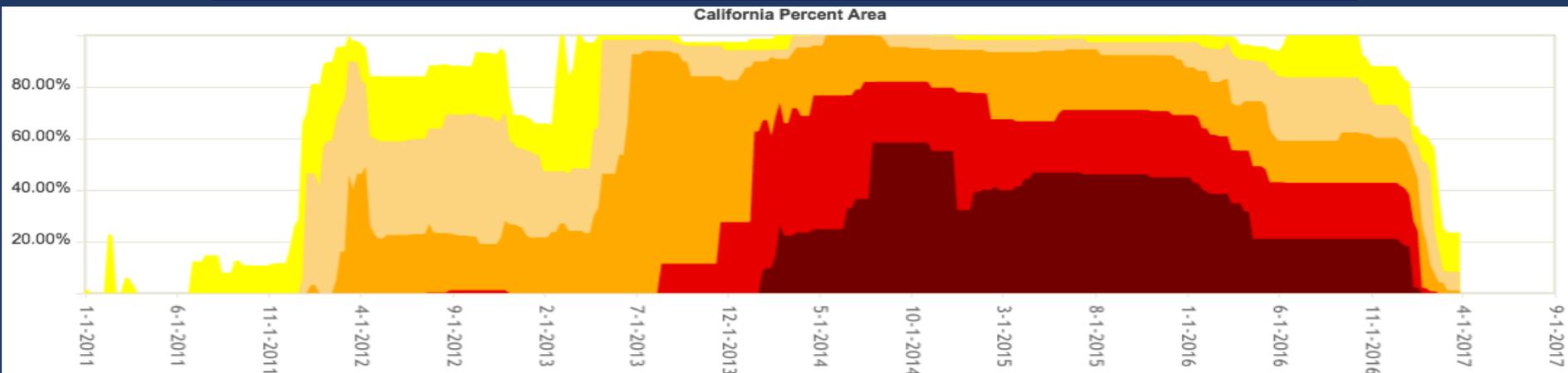
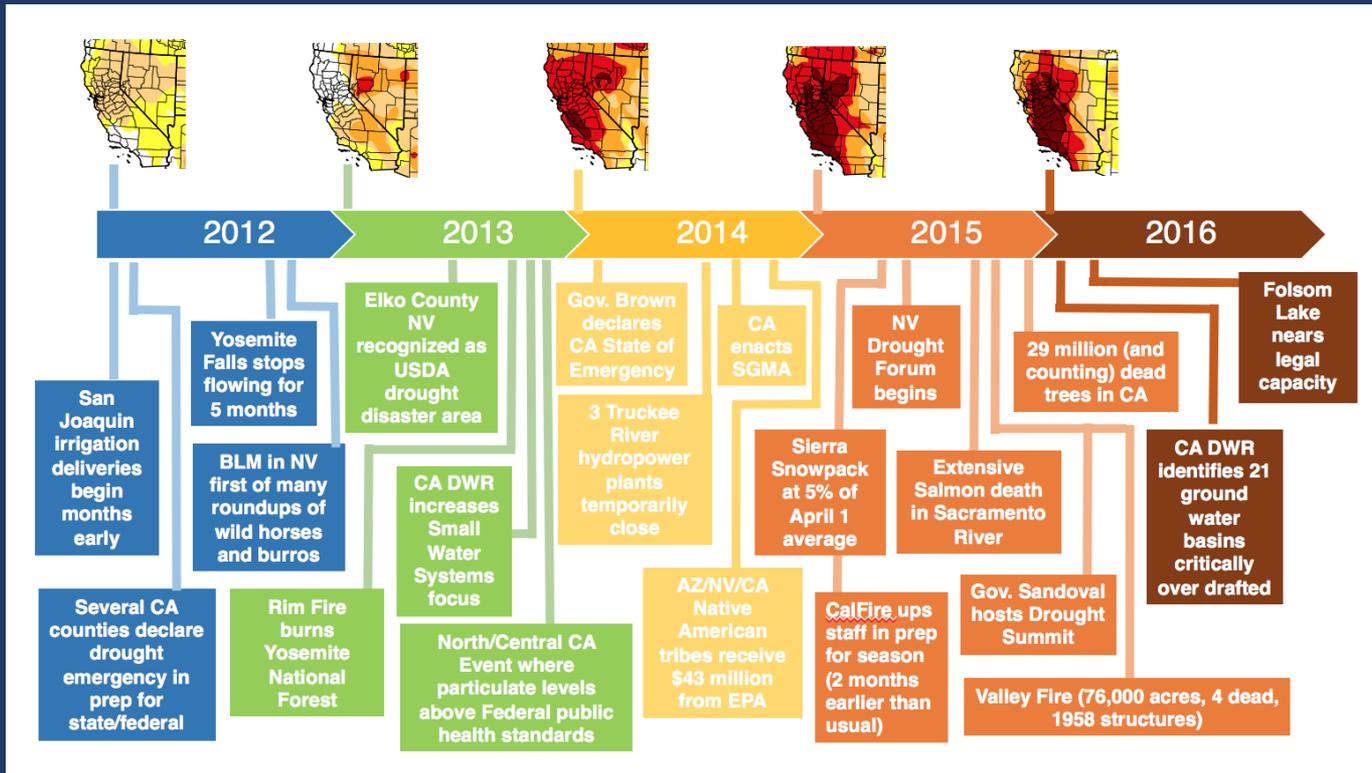


CA-NV USDM RECOMMENDATION PROCESS

- CA-NV DROUGHT MONITOR CALL EMAIL LIST SERVE
- BI-WEEKLY OR MONTHLY PHONE CALL (ORGANIZED BY SACRAMENTO WFO)
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 - USDM AUTHOR
- RECOMMENDATIONS EMAILED TO CA-NV LIST SERVE & AUTHORS



5+ YEARS OF REGIONAL DROUGHT

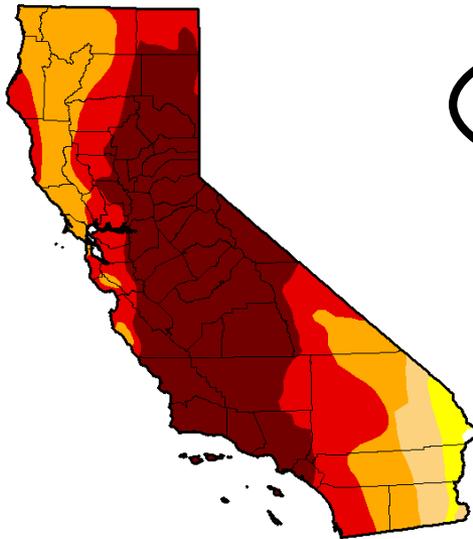


WATER YEAR 2016 & START OF WATER YEAR 2017

October 6, 2015

(Released Thursday, Oct. 8, 2015)

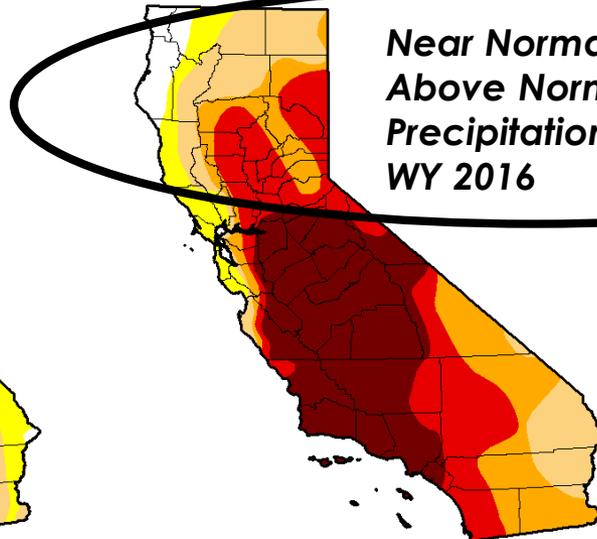
Valid 8 a.m. EDT



April 5, 2016

(Released Thursday, Apr. 7, 2016)

Valid 8 a.m. EDT

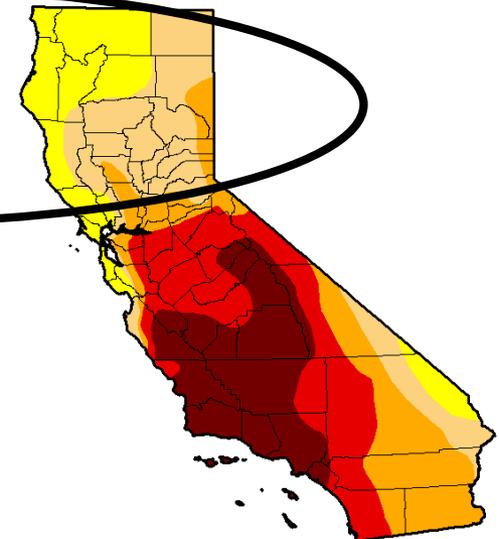


**Near Normal to
Above Normal
Precipitation in
WY 2016**

October 4, 2016

(Released Thursday, Oct. 6, 2016)

Valid 8 a.m. EDT



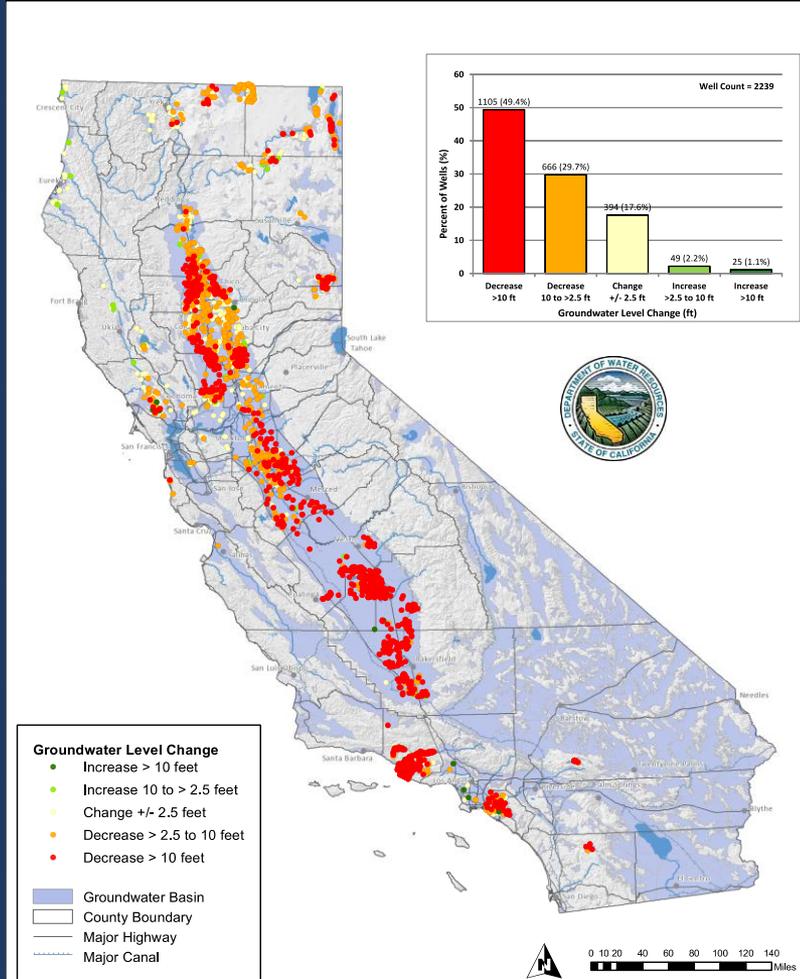
Intensity:



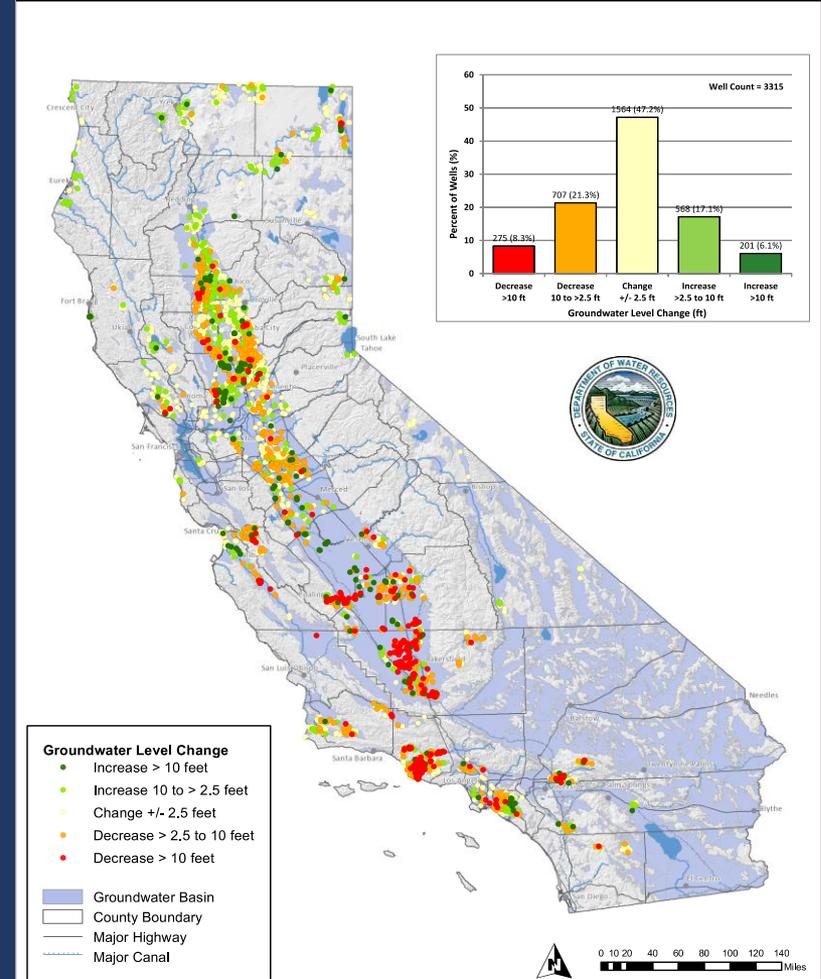
*The Drought Monitor focuses on broad-scale conditions.
Local conditions may vary. See accompanying text summary
for forecast statements.*

WATER YEAR 2016 & START OF WATER YEAR 2017

Groundwater Level Change* - Spring 2011 to Spring 2016



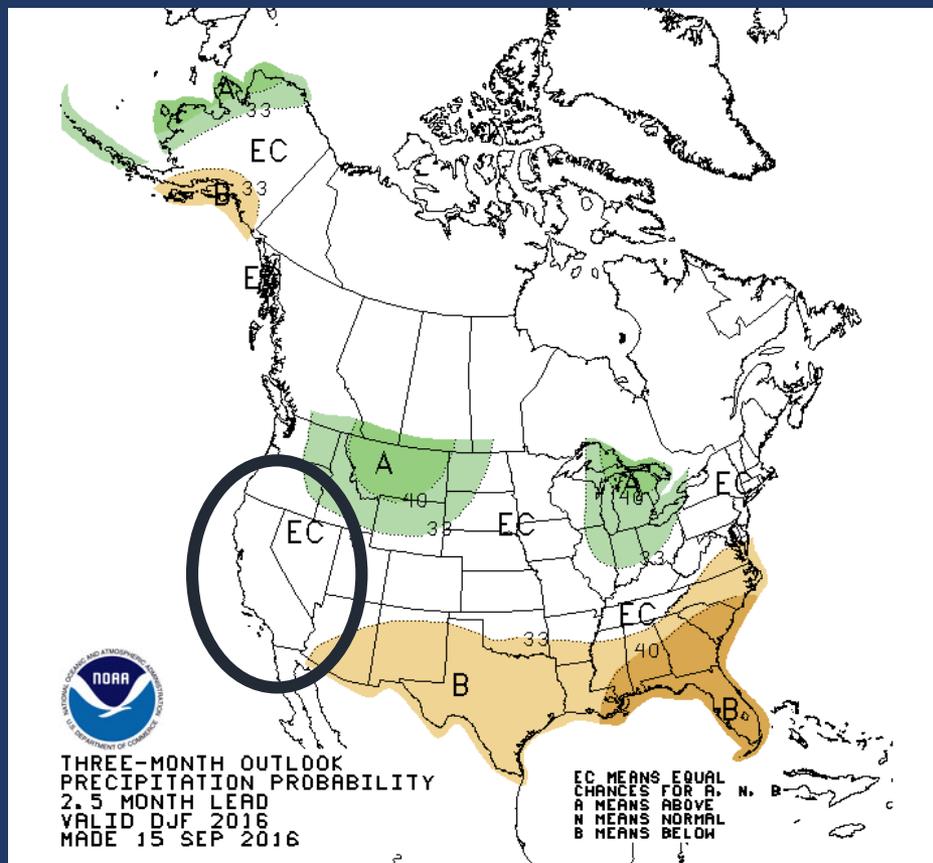
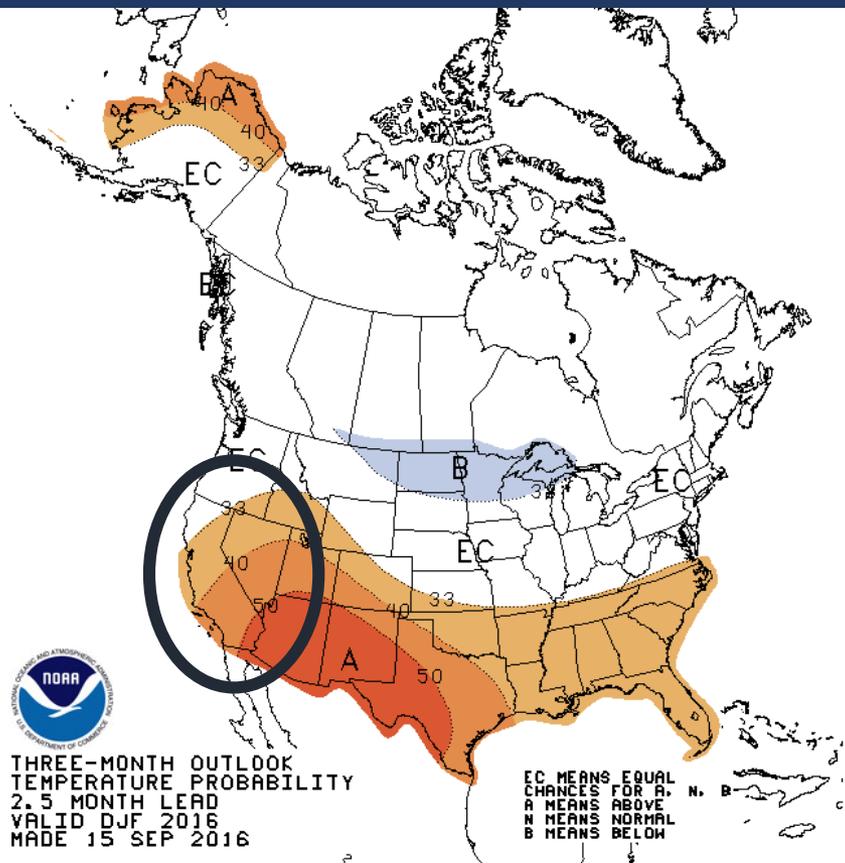
Groundwater Level Change* - Spring 2015 to Spring 2016



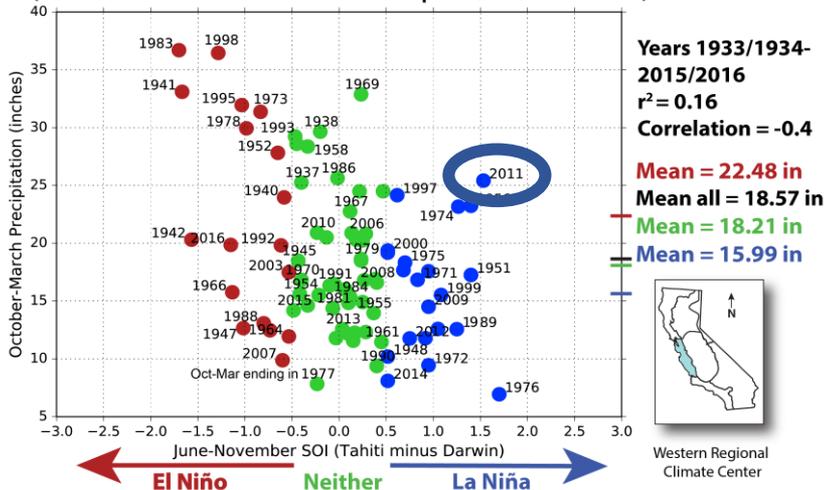
*Groundwater level change determined from water level measurements in wells. Map and chart based on available data from the DWR Water Data Library as of 04/26/2016. Document Name: DOTMAP_DRAFT_S1611 Updated: 4/27/2016 Data subject to change without notice.

*Groundwater level change determined from water level measurements in wells. Map and chart based on available data from the DWR Water Data Library as of 04/26/2016. Document Name: DOTMAP_DRAFT_S1615 Updated: 4/27/2016 Data subject to change without notice.

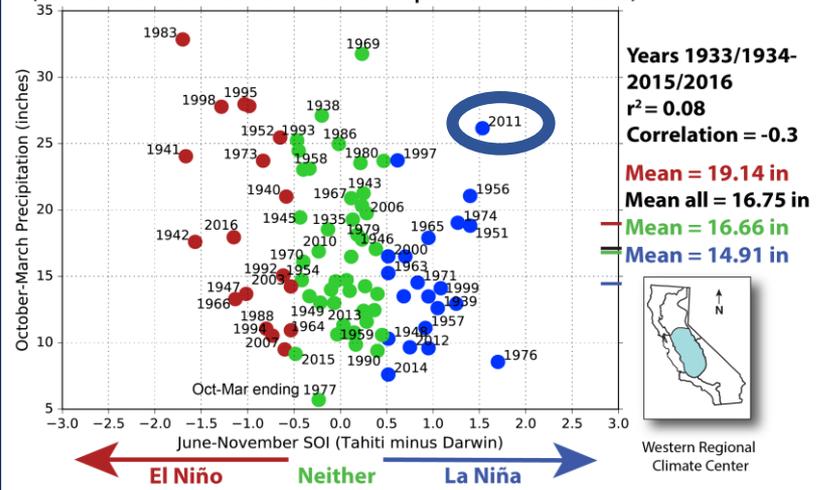
WY 2017 FORECASTS – WEAK LA NIÑA TO ENSO NEUTRAL



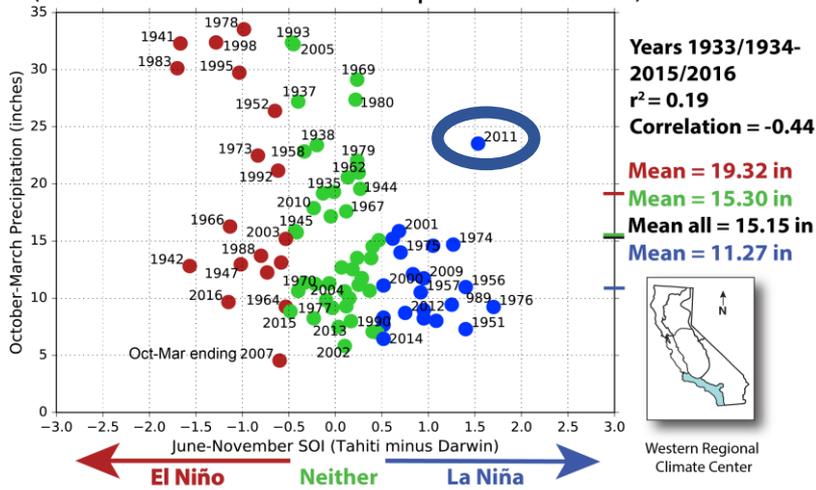
CA Division 4 October-March Precipitation (versus Southern Oscillation Index for prior June-November)



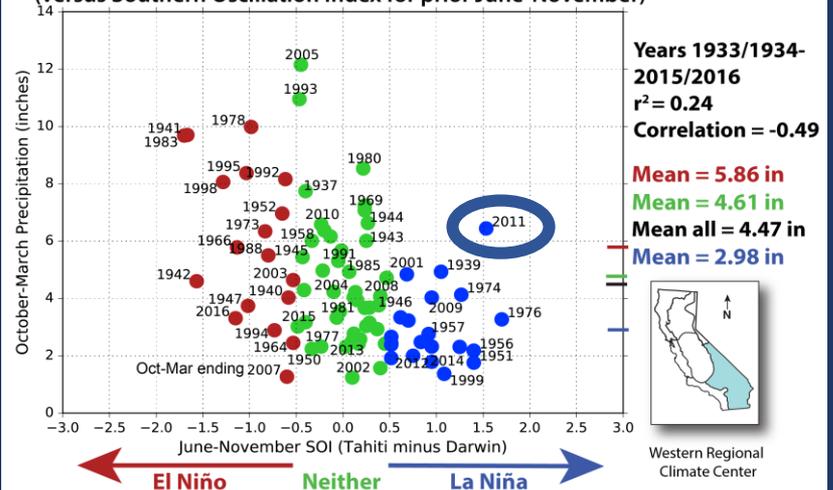
CA Division 5 October-March Precipitation (versus Southern Oscillation Index for prior June-November)



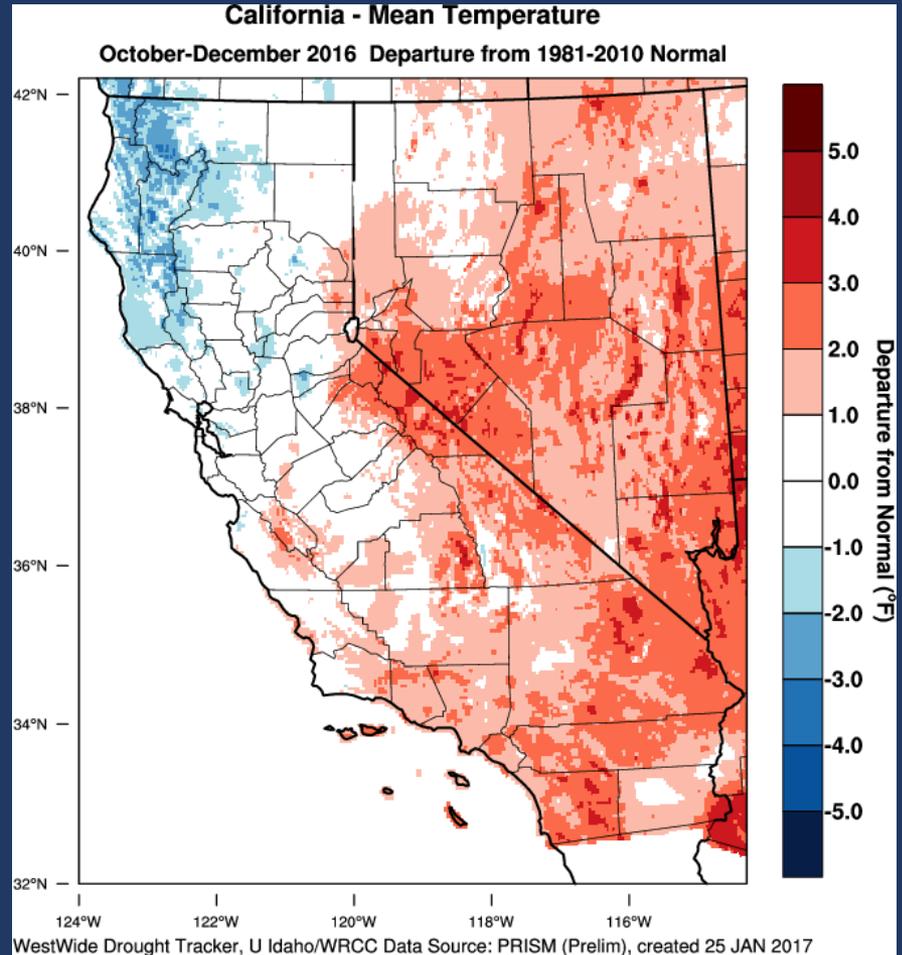
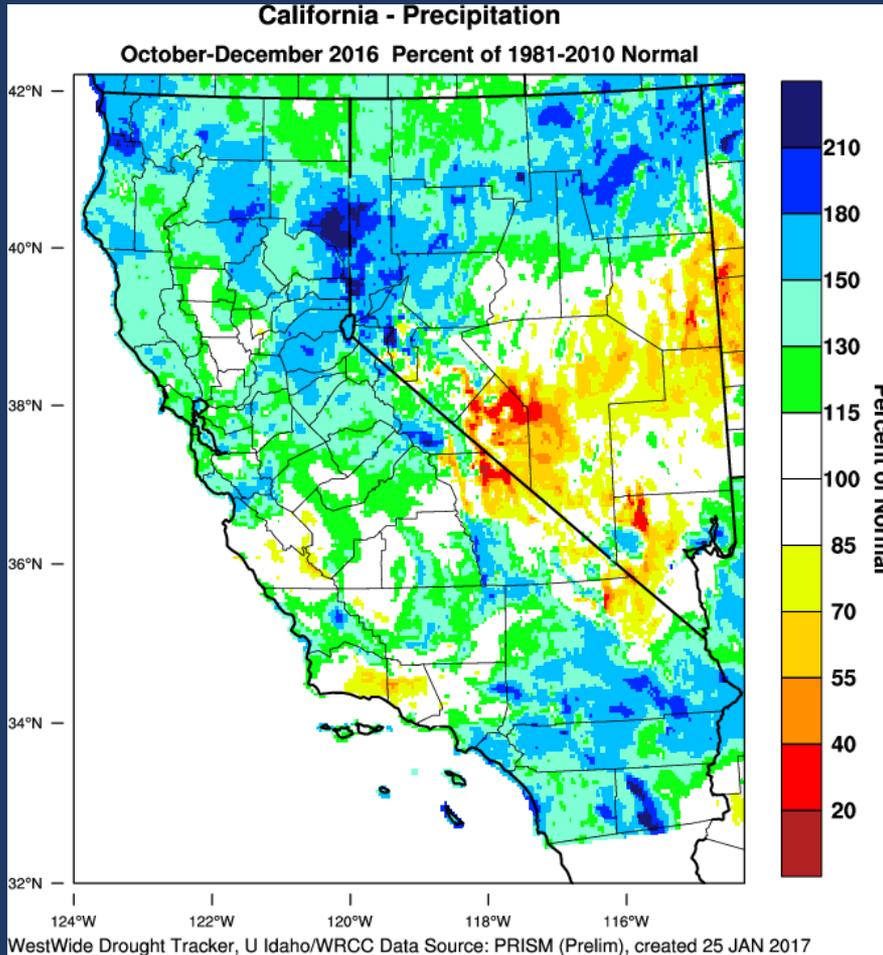
CA Division 6 October-March Precipitation (versus Southern Oscillation Index for prior June-November)



CA Division 7 October-March Precipitation (versus Southern Oscillation Index for prior June-November)

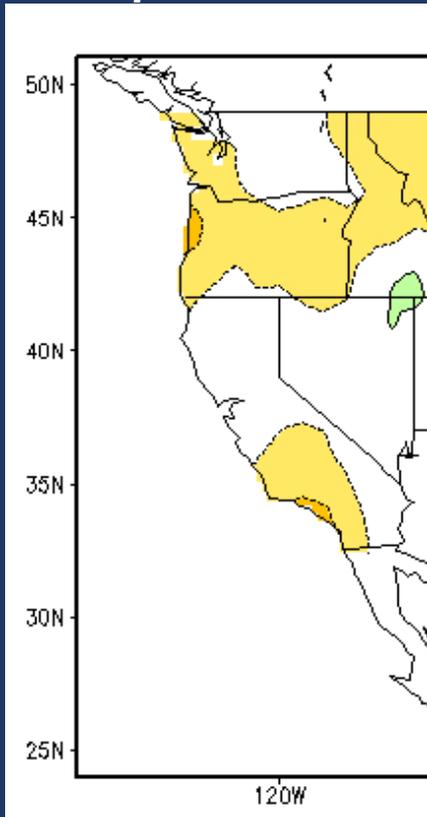


WARM WET END OF 2016

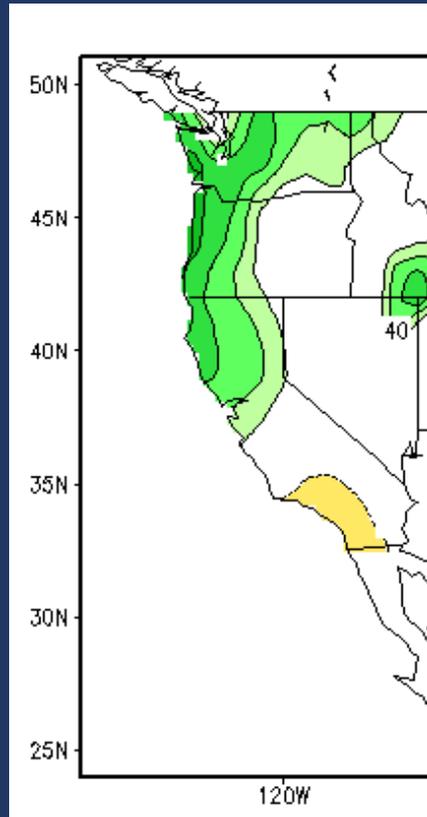


IMPROVED SOIL MOISTURE ANOMALY (MM)

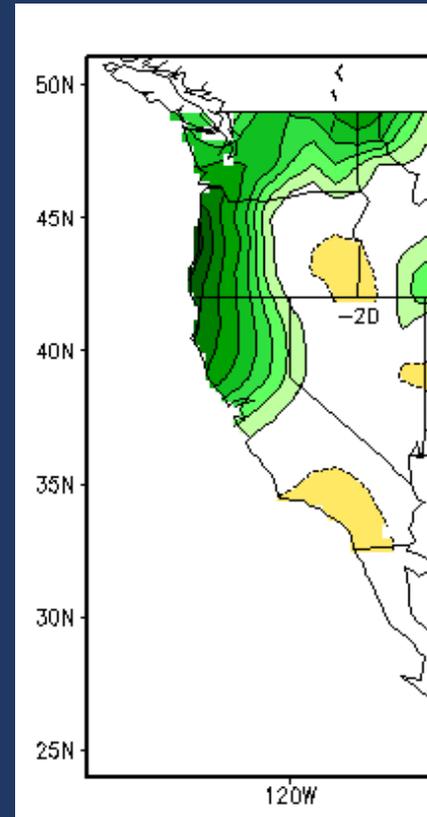
September



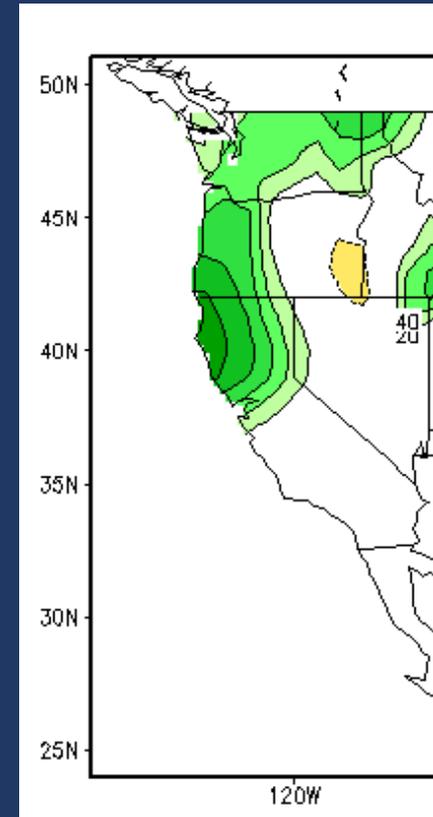
October



November

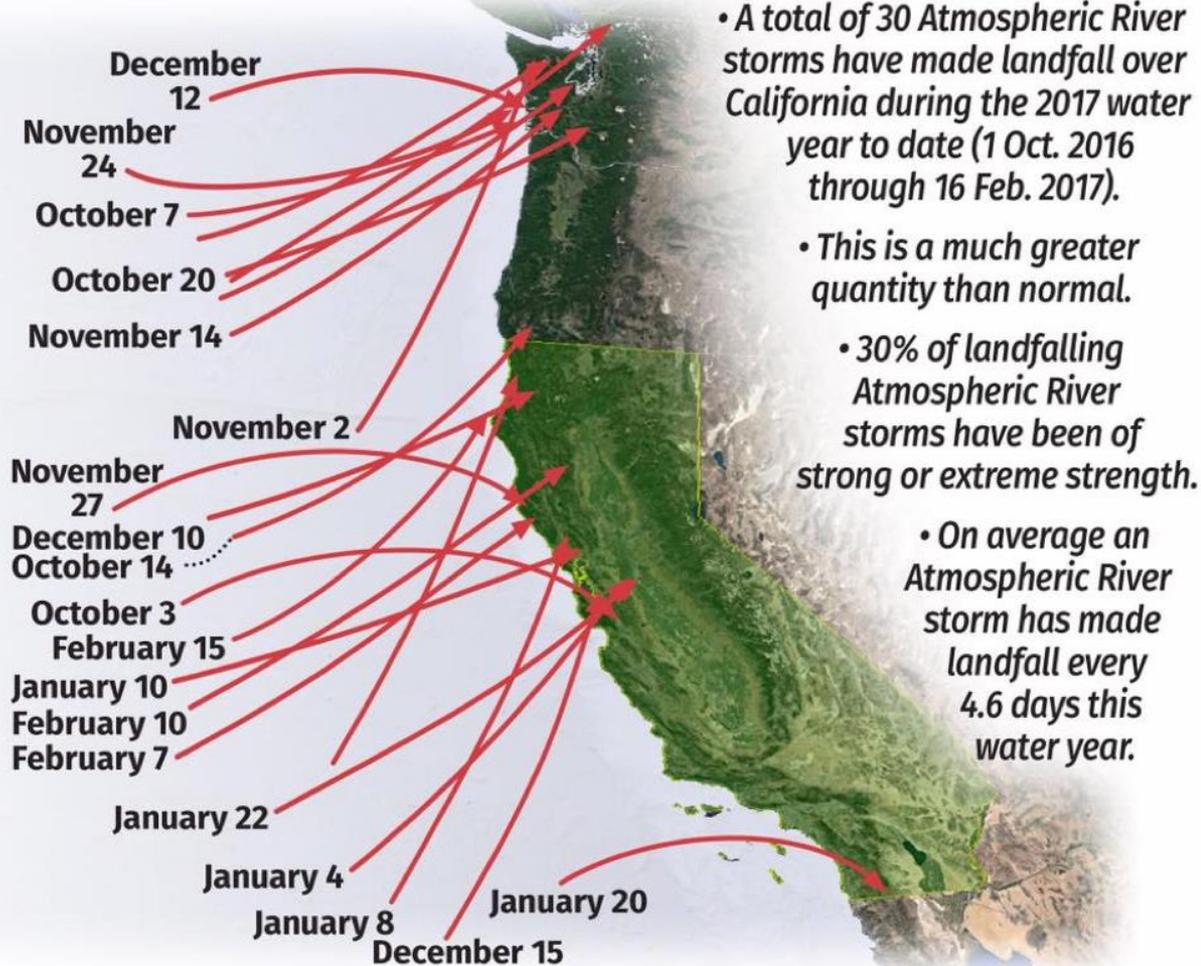


December



Atmospheric Rivers during Water Year 2017

(1 October 2016 through 16 February 2017)



Some AR landfalls are not shown due to graphical overlap.

Source: Center for Western Weather & Water Extremes at Scripps



Center for Western Weather
and Water Extremes

SCRIPPS INSTITUTION OF OCEANOGRAPHY
AT UC SAN DIEGO

JANUARY'S ATMOSPHERIC RIVERS

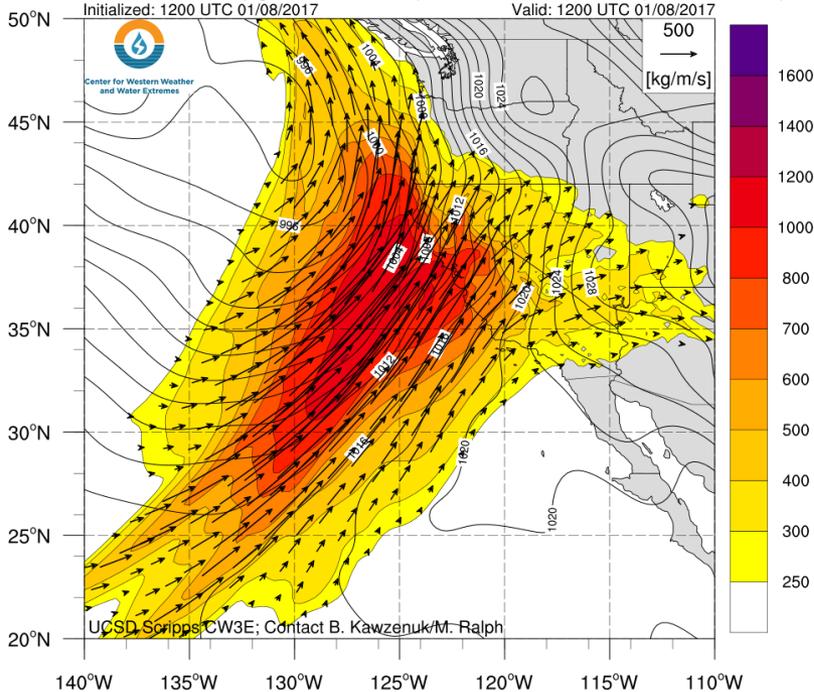
CW3E Atmospheric River Update – Summary & Outlook



Strong Atmospheric River makes landfall over CA, with a second AR on the way

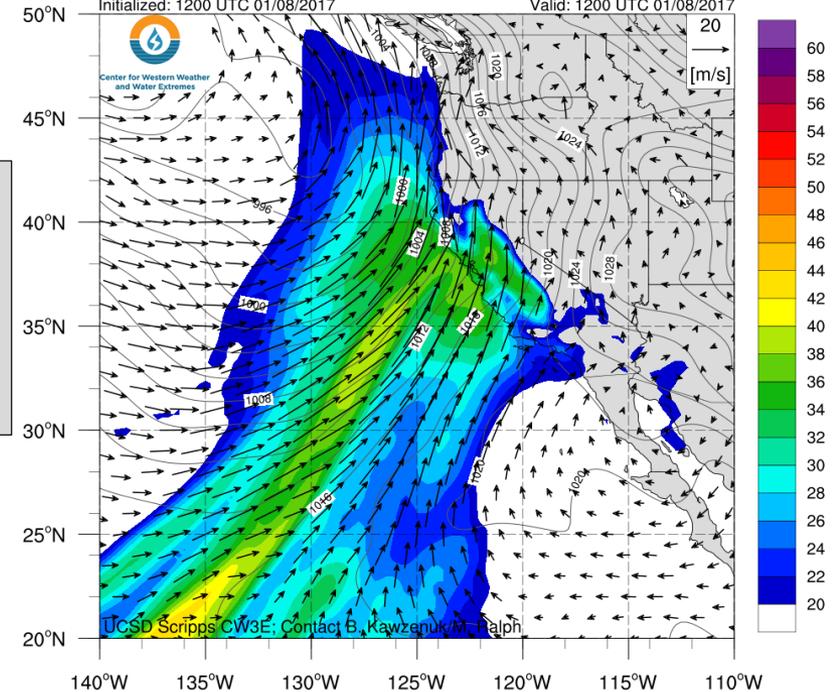
- A strong Atmospheric River (AR) made landfall over the U.S. West Coast on 8-9 January 2017
- The AR had $>1000 \text{ kg m}^{-1} \text{ s}^{-1}$ of Integrated Water Vapor Transport (IVT) and $>35 \text{ mm}$ of Integrated Water Vapor (IWW)
- As of Monday afternoon several locations received over 12 inches of precipitation in 72 hours (R-Cat 2)

NCEP GFS IVT ($\text{kg m}^{-1} \text{ s}^{-1}$; shaded), IVT Vector, and SLP (hPa; contours)
Initialized: 1200 UTC 01/08/2017 Valid: 1200 UTC 01/08/2017



Strong AR making landfall with very large water vapor content and transport

NCEP GFS IWW (mm; shaded), 850-hPa Wind (vectors), and SLP (hPa; contours)
Initialized: 1200 UTC 01/08/2017 Valid: 1200 UTC 01/08/2017



Summary by B. Kawzenuk, C. Hecht, and F.M. Ralph 3 pm 9 Jan 2017

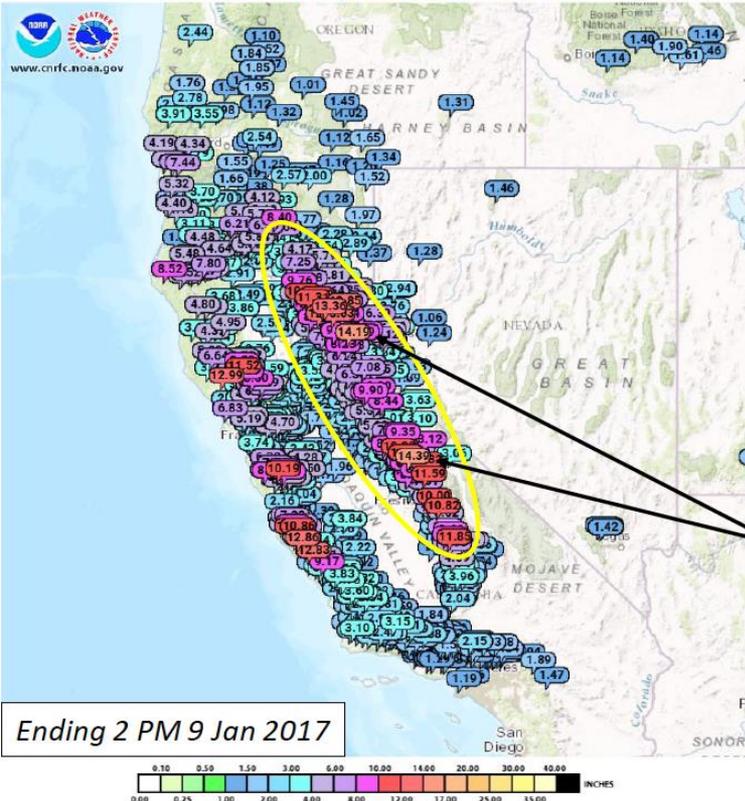
JANUARY'S ATMOSPHERIC RIVERS

Observed Precipitation



CNRFC Observed Precipitation

Observed Precip - Last 72 Hours - Raw

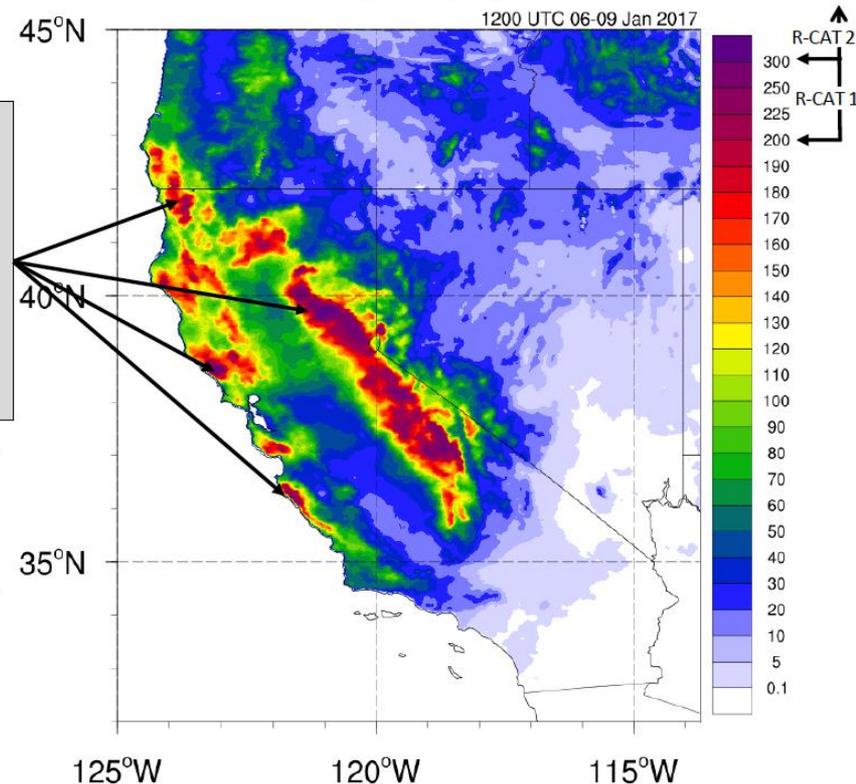


>300 mm (R-CAT 2)
Over large portions
of the Sierra
Nevada Mtns. and
several locations
over the CA Coastal
Mtns.

Maximum gauge
measurements
>14 inches

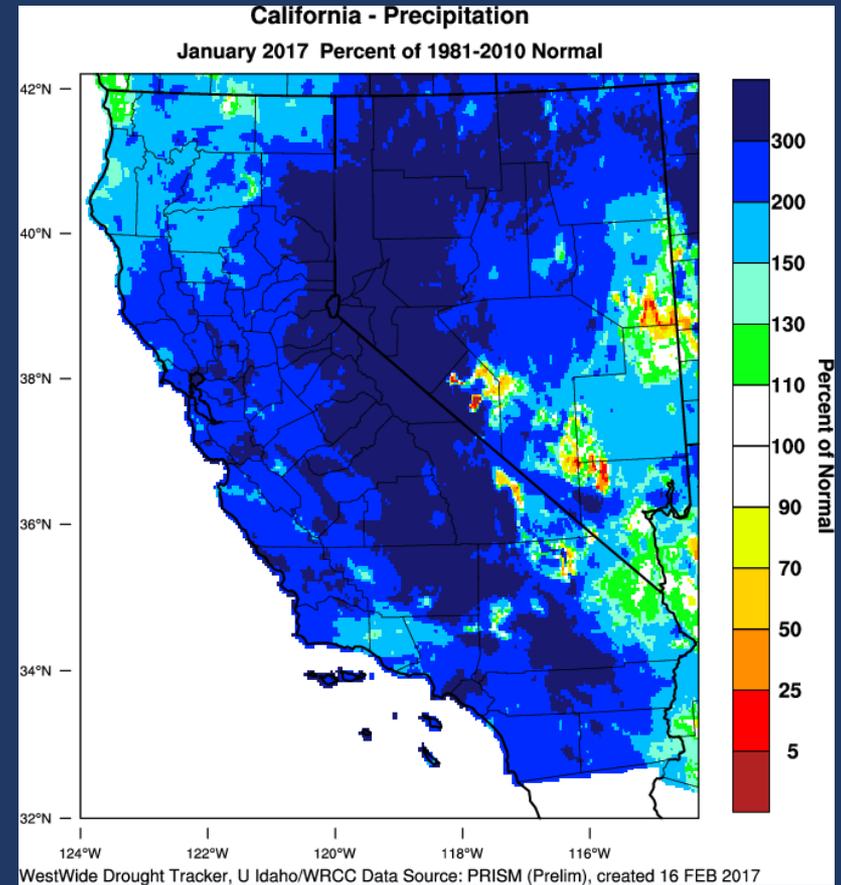
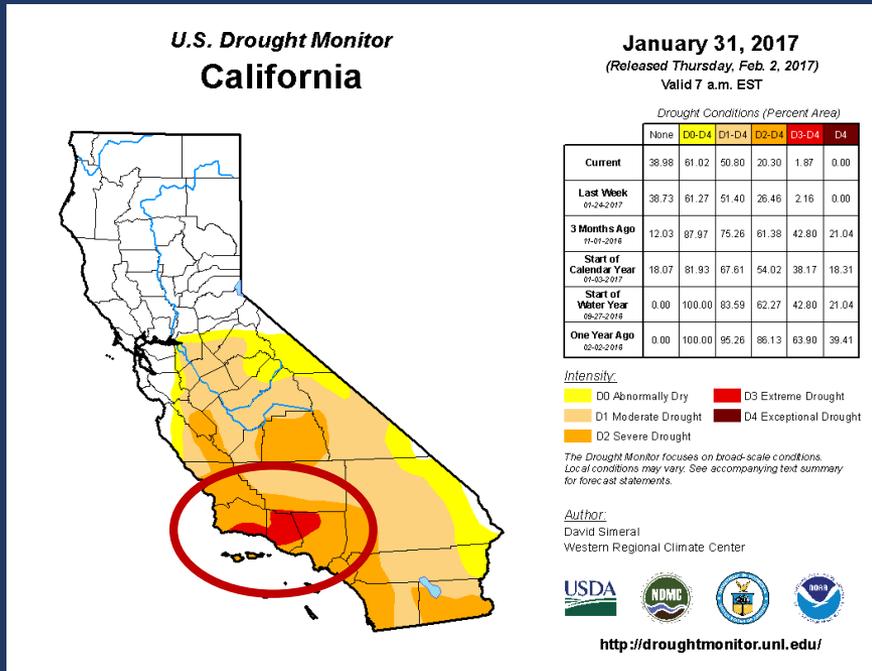
National Stage IV Quantitative Precipitation Estimate

72-h Accumulated Precipitation (mm)

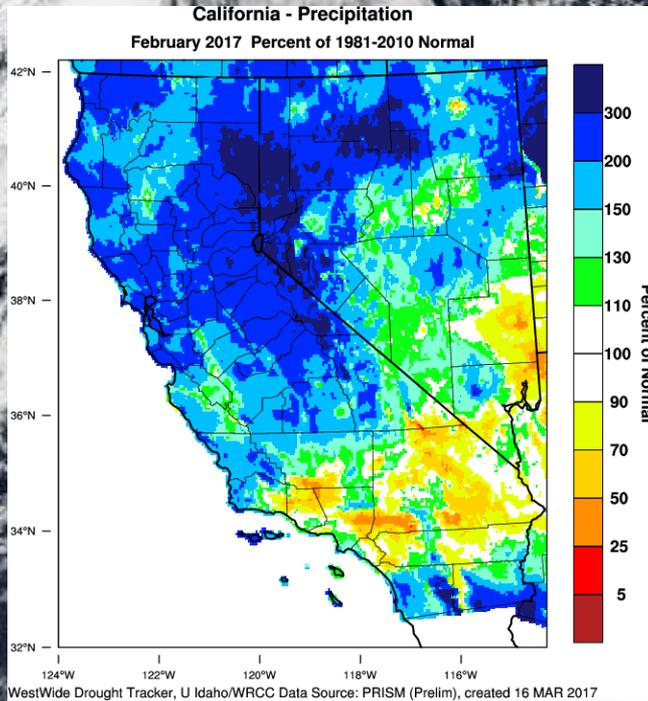


Summary by B. Kawzenuk, C. Hecht, and F.M. Ralph 3 pm 9 Jan 2017

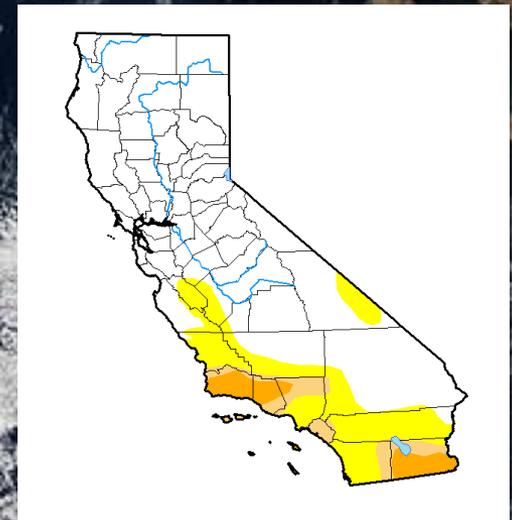
FLOODING DURING DROUGHT



FEBRUARY'S ATMOSPHERIC RIVERS



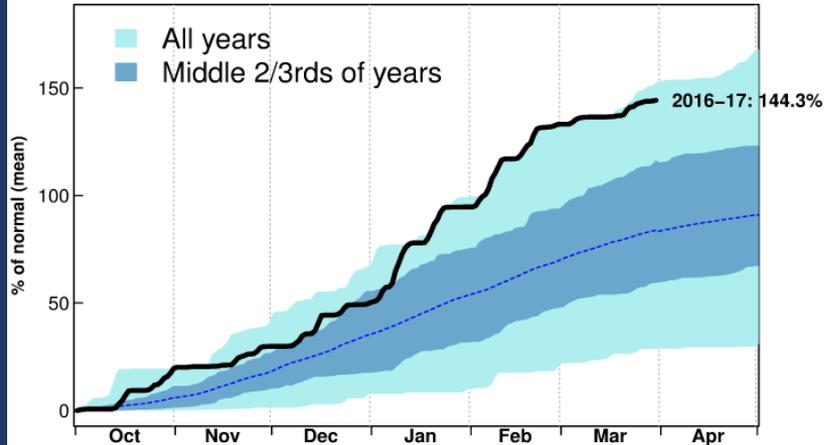
Atmospheric river —



500 km

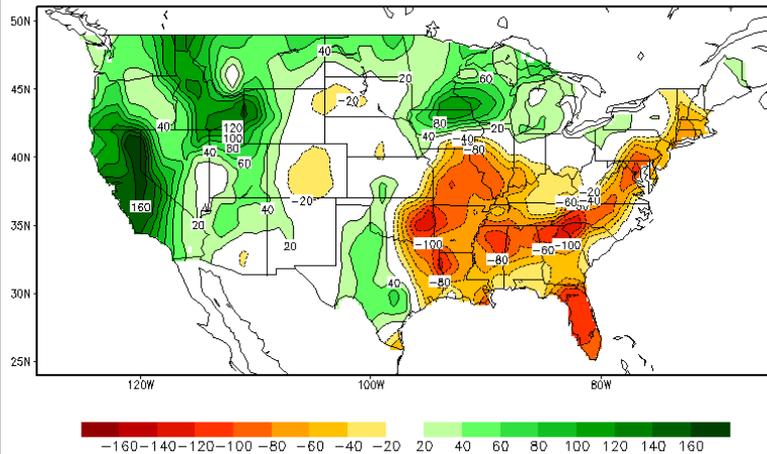
WHERE ARE WE NOW?

% of Normal Precip for CA 3/30/2017



<https://scripps.ucsd.edu/programs/cnap>

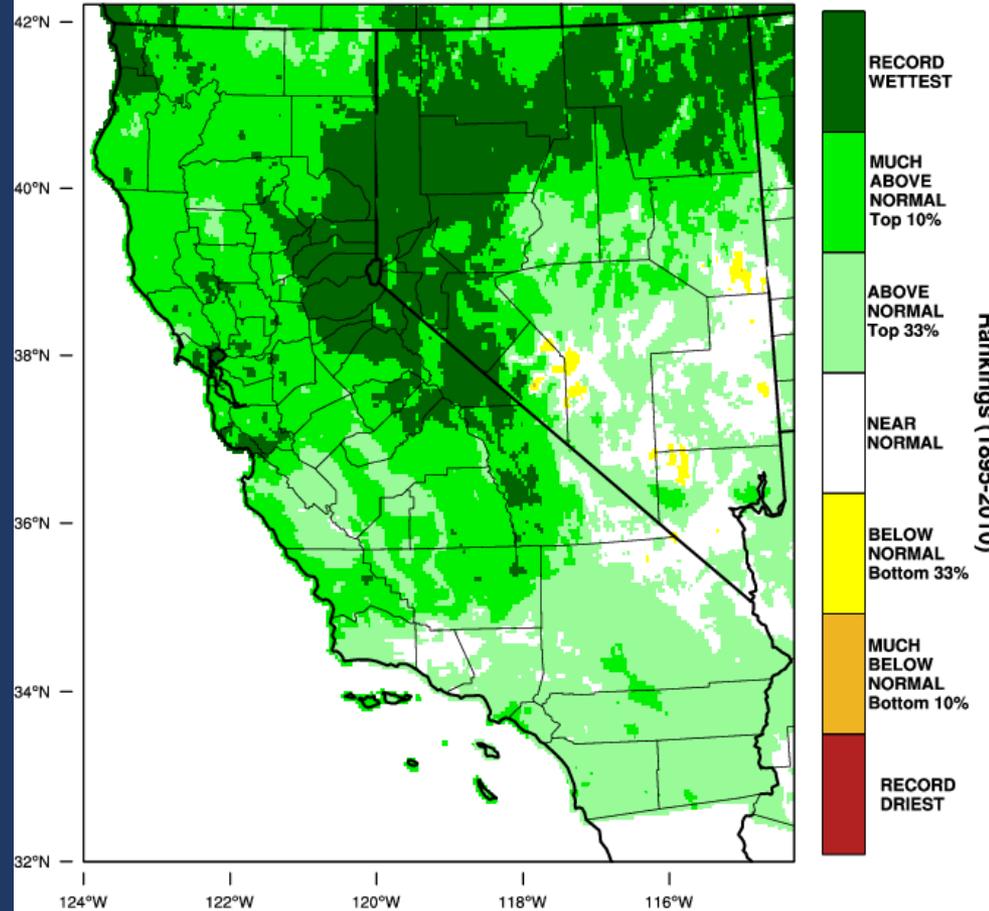
Calculated Soil Moisture Anomaly (mm) MAR, 2017



<http://www.cpc.ncep.noaa.gov>

California - Precipitation

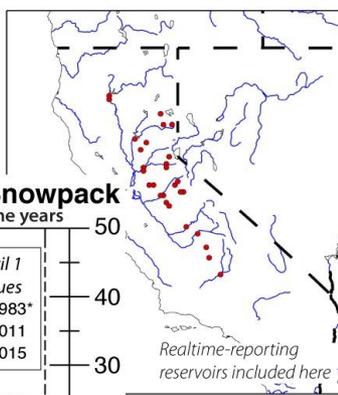
October-March 2017 Percentile



WestWide Drought Tracker, U Idaho/WRCC Data Source: PRISM (Prelim), created 2 APR 2017

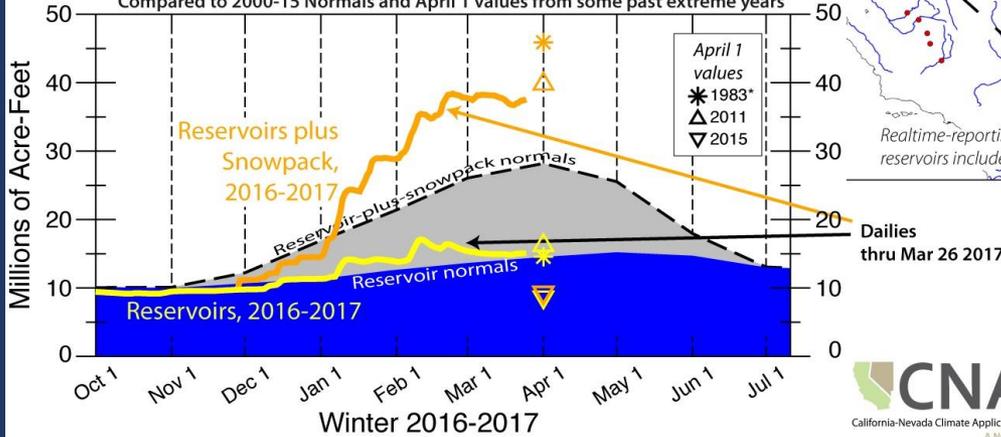
<http://www.wrcc.dri.edu/wwdt>

<https://scripps.ucsd.edu/programs/cnap/water-storage-tracking-in-california/>



Water Stored in 28 Western Sierra Reservoirs plus Snowpack

Compared to 2000-15 Normals and April 1 values from some past extreme years



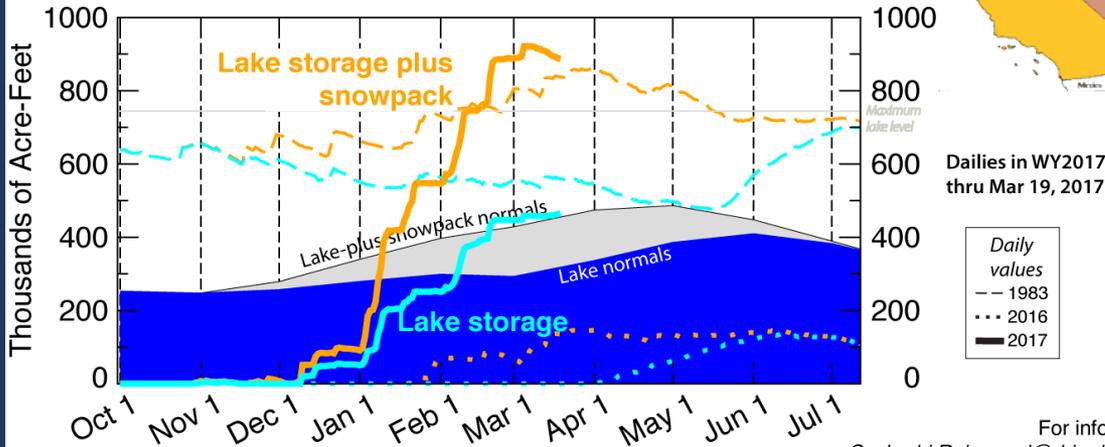
* 1983 values do not include Cherry Valley, Terminus & Exchequer storage

For info: mddettin@usgs.gov

APRIL 1ST
SNOWPACK:
RECORD
PRECIPITATION, NOT
RECORD
SNOWPACK

Water Stored in Lake Tahoe (above rim) plus Snowpack

Based on PRMS SWE & Obsvd Lake Levels (and Compared to 1981-2010 Normals)

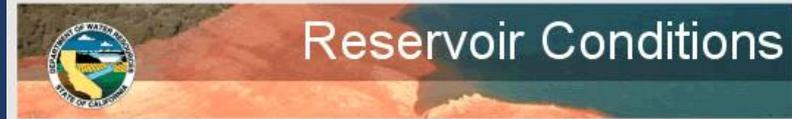
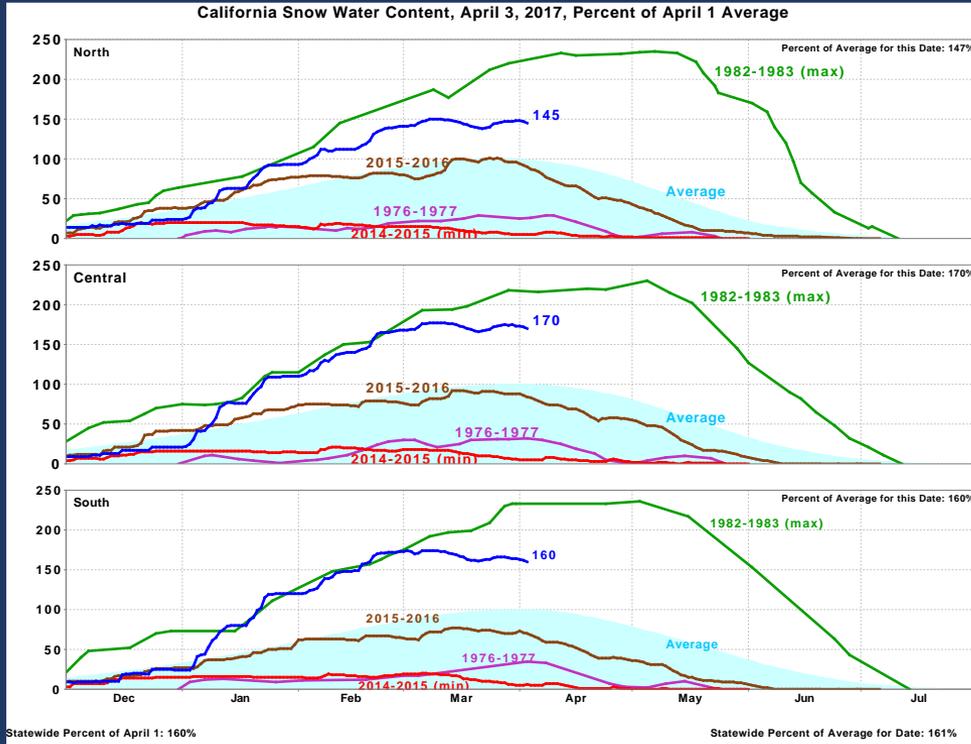


For info:
Seshadri.Rajagopal@dri.edu
& mddettin@usgs.gov



3/30 CA DWR Phillips Snow Course Manual Measurement:
46.1 inches SWE; 183% of long term average

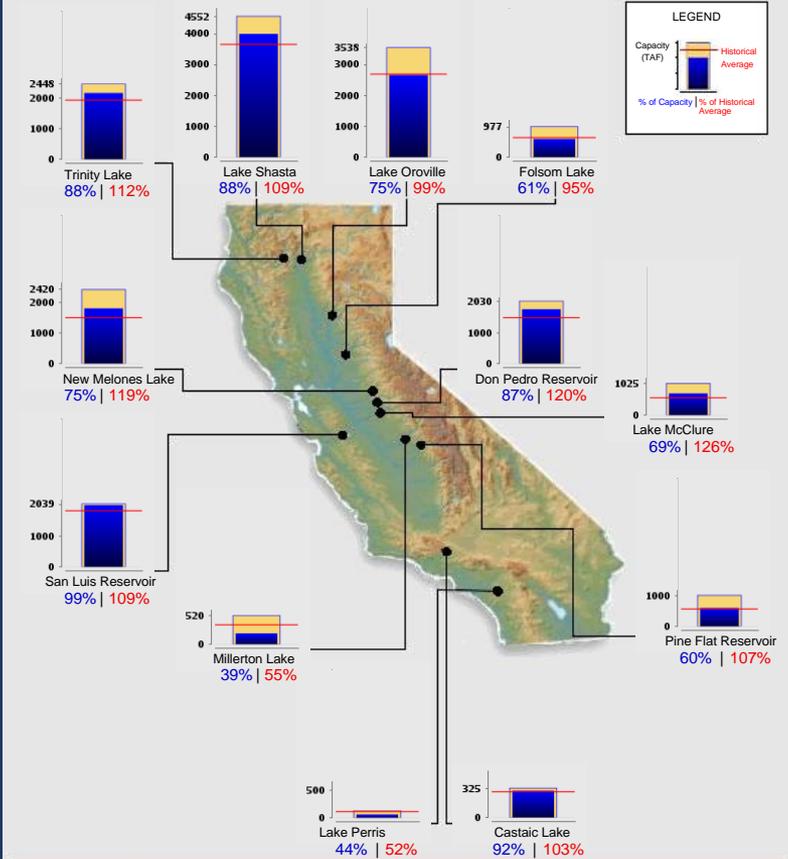
WHERE ARE WE NOW?



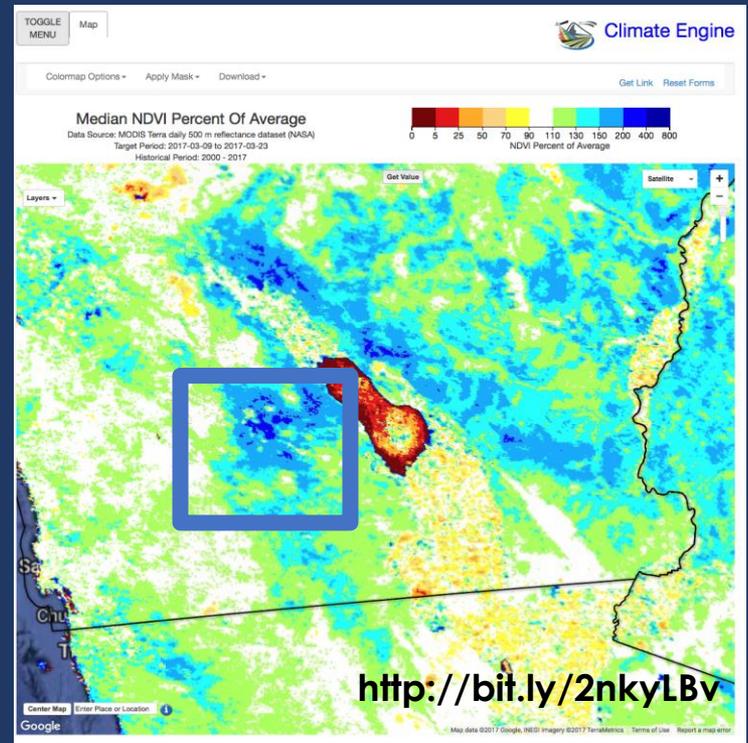
Reservoir Conditions

Ending At Midnight - March 29, 2017

CURRENT RESERVOIR CONDITIONS



“FLOWERGEDDON”



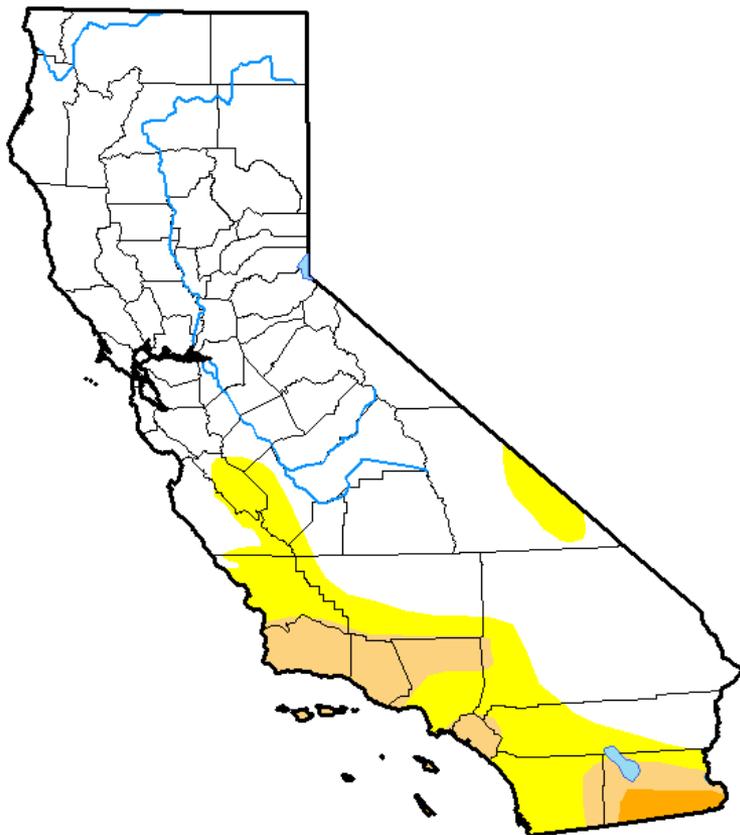
Anza-Borrego Desert State Park



Photo by Shai Kalansky

WHERE ARE WE NOW?

U.S. Drought Monitor California



March 28, 2017

(Released Thursday, Mar. 30, 2017)

Valid 8 a.m. EDT

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	76.54	23.46	8.24	1.06	0.00	0.00
Last Week <i>03-21-2017</i>	76.54	23.46	8.24	1.06	0.00	0.00
3 Months Ago <i>12-27-2016</i>	17.47	82.53	68.87	57.79	40.60	18.31
Start of Calendar Year <i>01-03-2017</i>	18.07	81.93	67.61	54.02	38.17	18.31
Start of Water Year <i>09-27-2016</i>	0.00	100.00	83.59	62.27	42.80	21.04
One Year Ago <i>03-29-2016</i>	3.55	96.45	90.58	72.82	55.25	34.74

Intensity:

- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

Author:

Eric Luebehusen
U.S. Department of Agriculture



<http://droughtmonitor.unl.edu/>

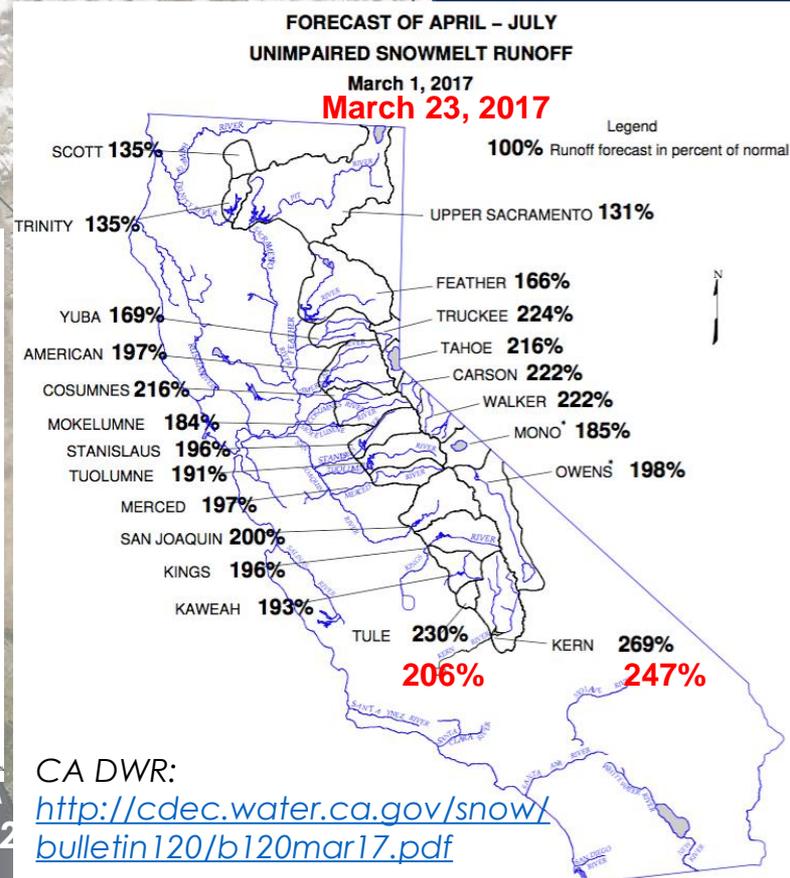
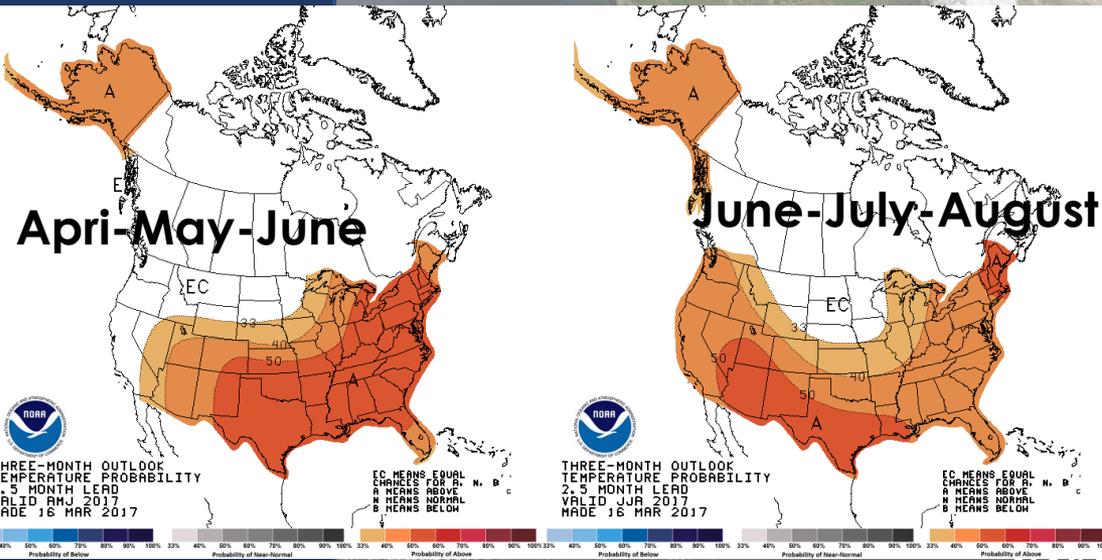
GOING FORWARD

- **STATE DROUGHT DECLARATION & SWRCB RESTRICTIONS (STAY TUNED)**
- **CVP WATER ALLOCATIONS (3/22/2017)**
([HTTPS://WWW.USBR.GOV/MP/CVP-WATER/INDEX.HTML](https://www.usbr.gov/mp/cvp-water/index.html))
 - **NORTH OF DELTA & IN DELTA: 100%**
 - **SOUTH OF DELTA: 90% (WATER SERVICE), 65% (AG)**
- **SWP WATER ALLOCATIONS (1/18/2017)**
([HTTP://WWW.WATER.CA.GOV/NEWS/NEWSRELEASES/2017/011817SWP_ALLOCATION.PDF](http://www.water.ca.gov/news/newsreleases/2017/011817SWP_allocation.pdf))
 - **60% ALLOCATION (INCREASE FROM 45% IN DECEMBER)**
 - **LAKE OROVILLE COULD IMPACT ALLOCATIONS – DWR HOLDING OFF ON INCREASES**
- **GROUNDWATER RECOVERY TBD**

*NASA MODIS Image from
3/31/2017 (@NWSBayArea)*

GOING FORWARD

- LONG TERM DROUGHT IMPACTS: GROUNDWATER, TREE MORTALITY, SALMON, AGRICULTURE
- ABILITY TO MANAGE SURPLUS WATER
- SUMMER RUNOFF & TEMPERATURE FORECASTS
- IS EL NINO COMING?



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Disneyland Electrical Parade extended to August

How these shipping containers converted to housing have affected homeless veterans

Military warriors feel again surfing at San O Beach

TOP NEWS

NEWS

Emergency declared as Los Angeles Aqueduct to see massive Sierra runoff

March 20, 2017 | Updated 3:18 p.m.

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WATER & DROUGHT MARCH 30, 2017 12:14 PM

Will 'very substantial' snowpack prompt Gov. Jerry Brown to declare the drought over?

IN DELTA: 100%

Los Angeles Times

L.A. Now

California: This just in

LOCAL / L.A. Now

California snowpack is one of the biggest ever recorded, and now poses a flooding risk

News Deeply WATER DEEPLY

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MANAGEMENT & SUPPLY DP-EDS

Why California's Wet Year Won't Have Record Delta Water Exports

A record wet year in California won't automatically translate to record exports of water from the Sacramento-San Joaquin Delta because of infrastructure damage and a lack of storage, writes U.C. Davis' Jay Lund.

WRITTEN BY Jay Lund PUBLISHED ON Mar. 30, 2017 READ TIME Approx. 3 minutes

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GROUNDWATER RECOVERY TBD (CA DWR SPRING GROUNDWATER LEVEL CHANGE ABILITY)

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AGRICULTURE CLIMATE & WEATHER D&A

Heavy Rain Means New Challenges for California Farmers

The drought may be easing, but that doesn't mean hardships are over for California's farmers. Instead, flooding caused by weeks of wet weather creates a different set of risks for growers, explains agronomist Karen Lowell.

WRITTEN BY Matt Weiser PUBLISHED ON Mar. 28, 2017 READ TIME Approx. 6 minutes

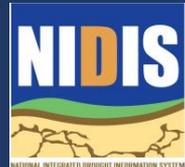
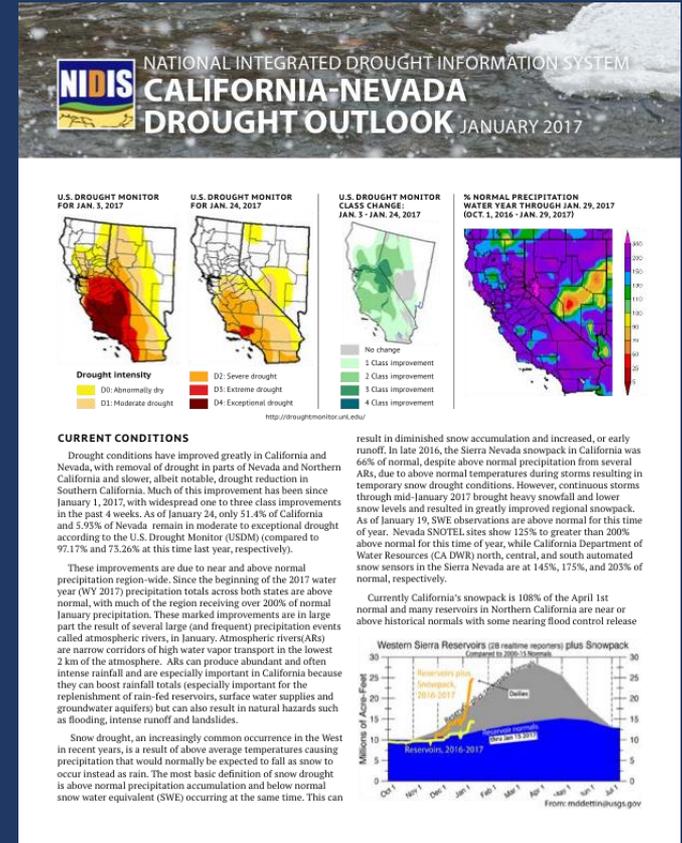
Never miss an update. Sign up for our newsletter to receive weekly updates, special reports and featured insights as we cover one of the most critical issues of our time.

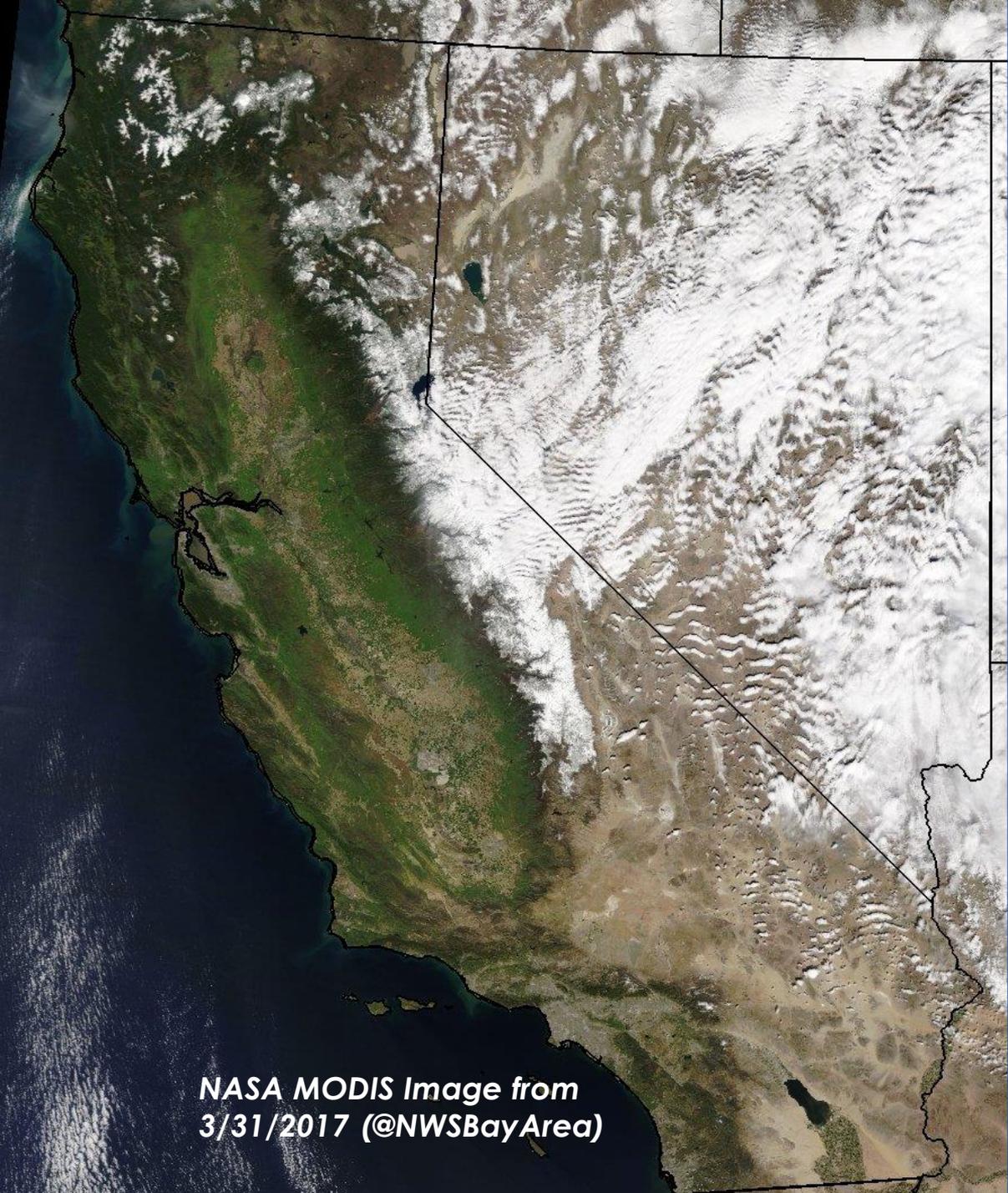


CA-NV DROUGHT EARLY WARNING SYSTEM

- CA-NV DEWS STAKEHOLDER MEETINGS:
 - JAN 2016; FEB 2017 – SAN DIEGO
 - SEPT/OCT 2016 – RIVERSIDE, SEASIDE, FRESNO
 - BI-MONTHLY WEBINARS
- UPCOMING:
 - JUNE 2 NOAA NCEI DROUGHT AMELIORATION TOOL STAKEHOLDER
 - JUNE 20-21 OR JUNE 21-22 CA-NV DEWS FIRST ANNUAL COORDINATION MEETING

<https://www.drought.gov/drought/dews/california-nevada>





**NASA MODIS Image from
3/31/2017 (@NWSBayArea)**

THANK YOU!

**AMANDA
SHEFFIELD**

**SIO/UCSD/CNAP/NIDIS
AMSHEFFIELD@UCSD.EDU**

