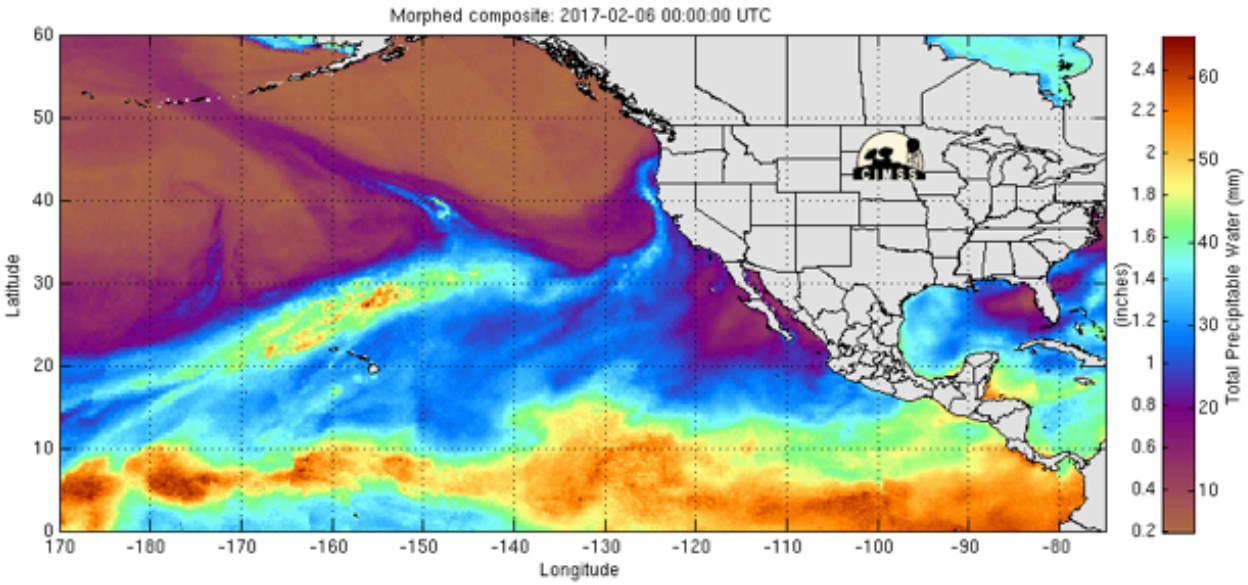
California Climate and Drought Update



Dan McEvoy

Regional Climatologist,

Postdoctoral Fellow, Applied Climatology

Western Regional Climate Center

Desert Research Institute

California-Nevada Drought Early Warning System
Southern California Winter Status Update

February 9, 2017

Scripps Institution of Oceanography, UCSD

La Jolla, CA

DRI Desert Research Institute

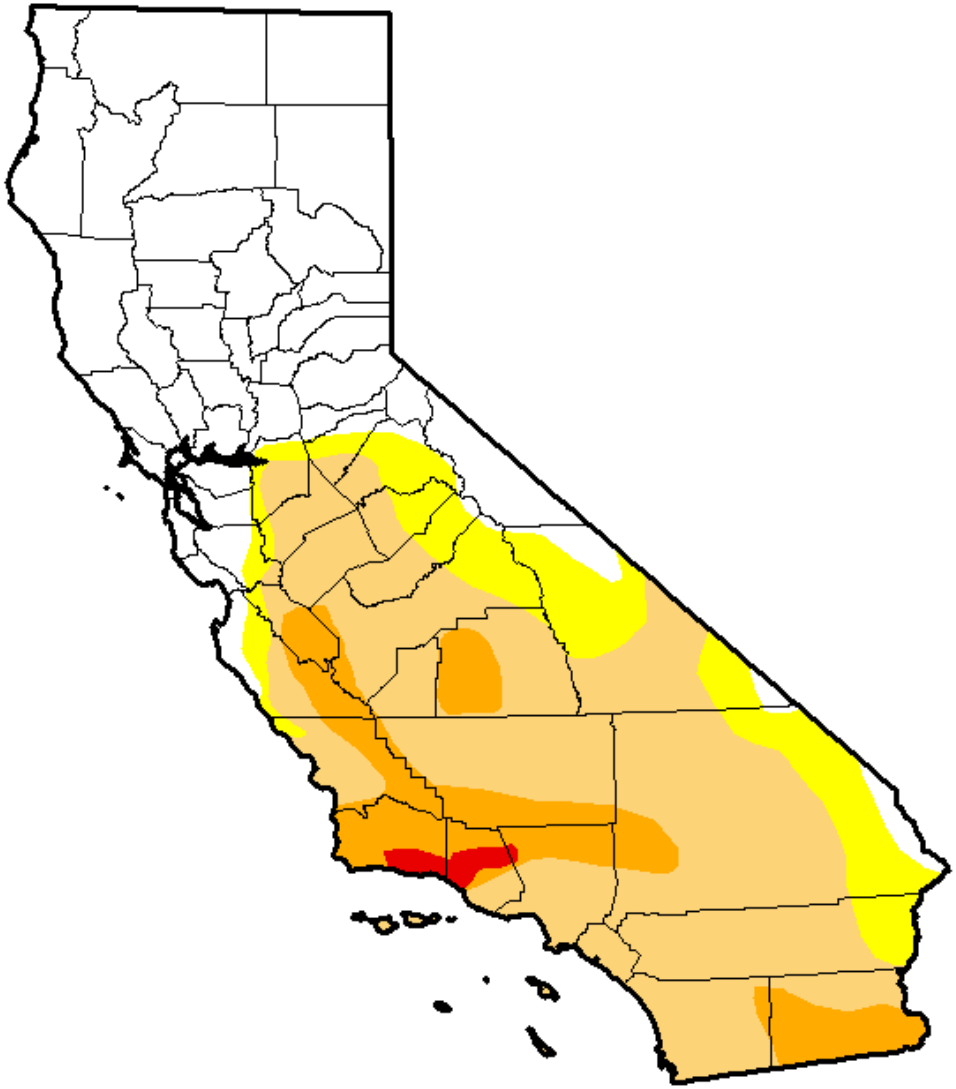
Western Regional Climate Center
Providing climate services since 1986

CNAP
California-Nevada Climate Applications Program
A NOAA RISA team

NIDIS

U.S. Drought Monitor

California



February 7, 2017

(Released Thursday, Feb. 9, 2017)

Valid 7 a.m. EST

Drought Conditions (Percent Area)

	None	D0	D1	D2	D3	D4
Current	41.46	11.56	36.05	10.20	0.73	0.00
Last Week *1/31/2017*	38.98	10.22	30.51	18.42	1.87	0.00
3 Months Ago *11/8/2016*	12.03	14.93	12.77	17.47	21.76	21.04
Start of Calendar Year *1/3/2017*	18.07	14.32	13.59	15.85	19.87	18.31
Start of Water Year *9/27/2016*	0.00	16.41	21.31	19.47	21.76	21.04
One Year Ago *2/9/2016*	0.22	5.01	12.95	20.42	22.93	38.48

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:

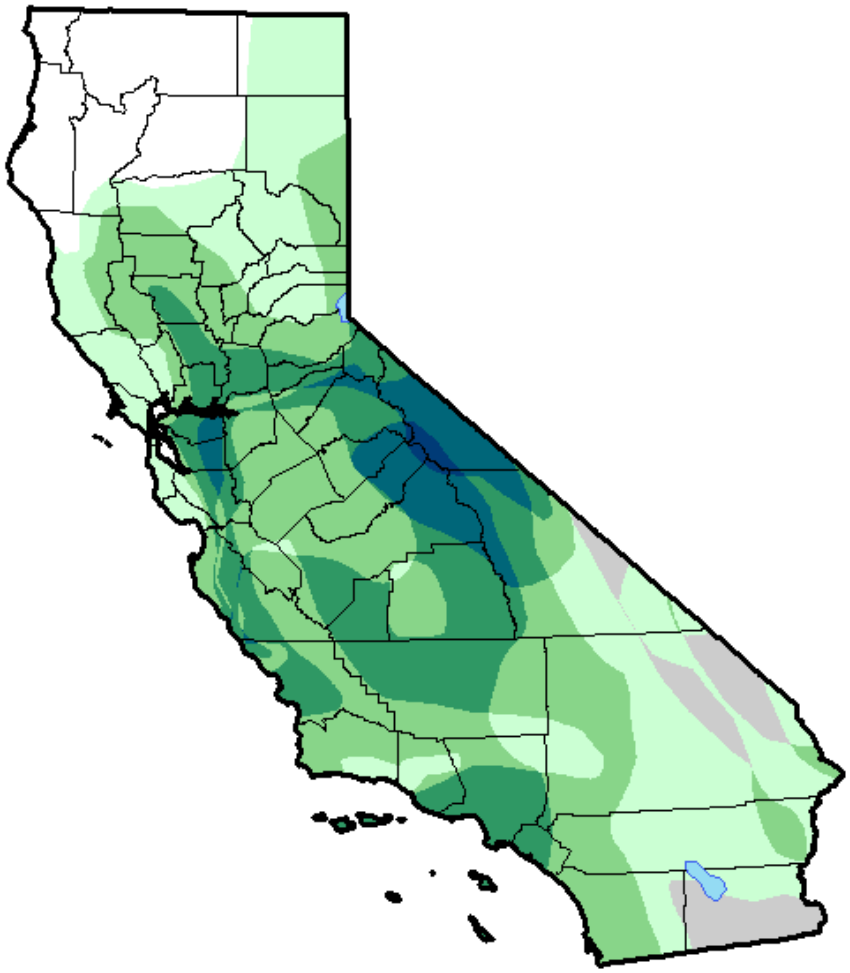
David Simeral

Western Regional Climate Center

http://droughtmonitor.unl.edu/

U.S. Drought Monitor Class Change - California

3 months



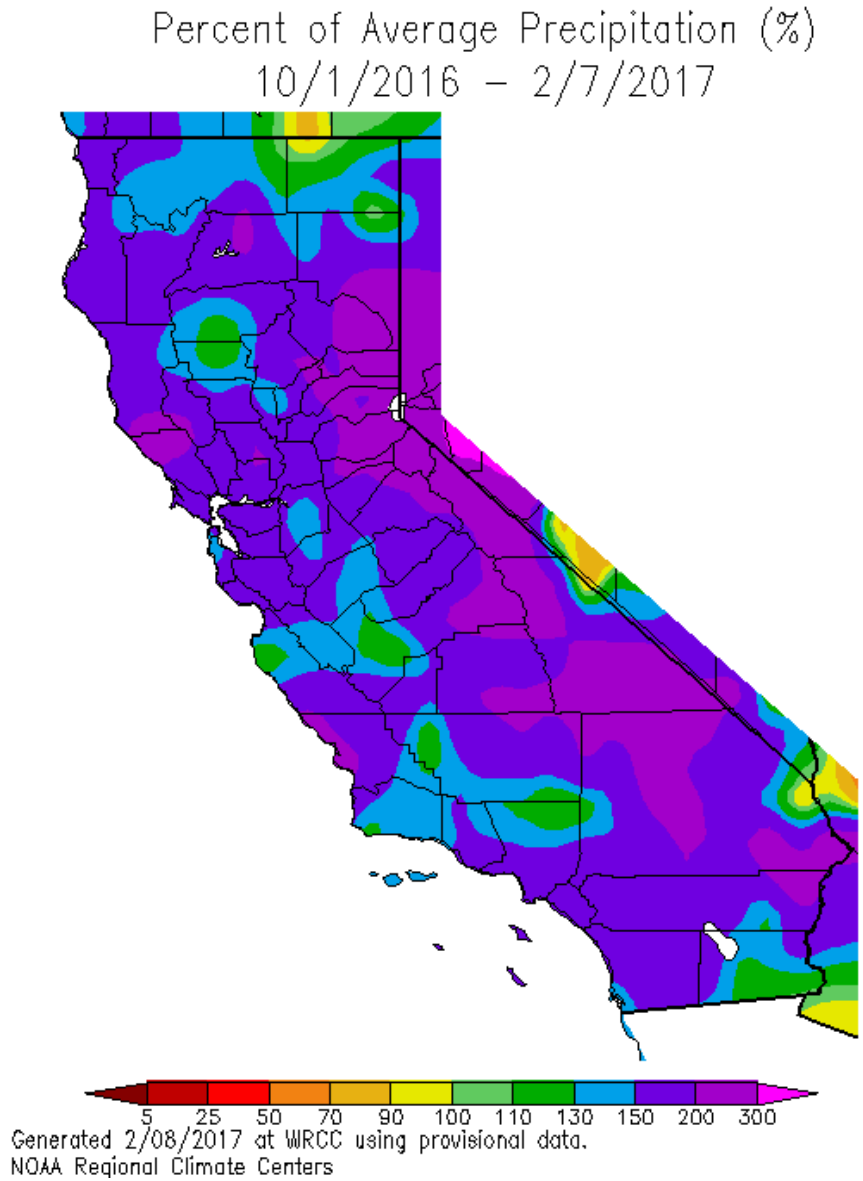
February 7, 2017
compared to
November 15, 2016

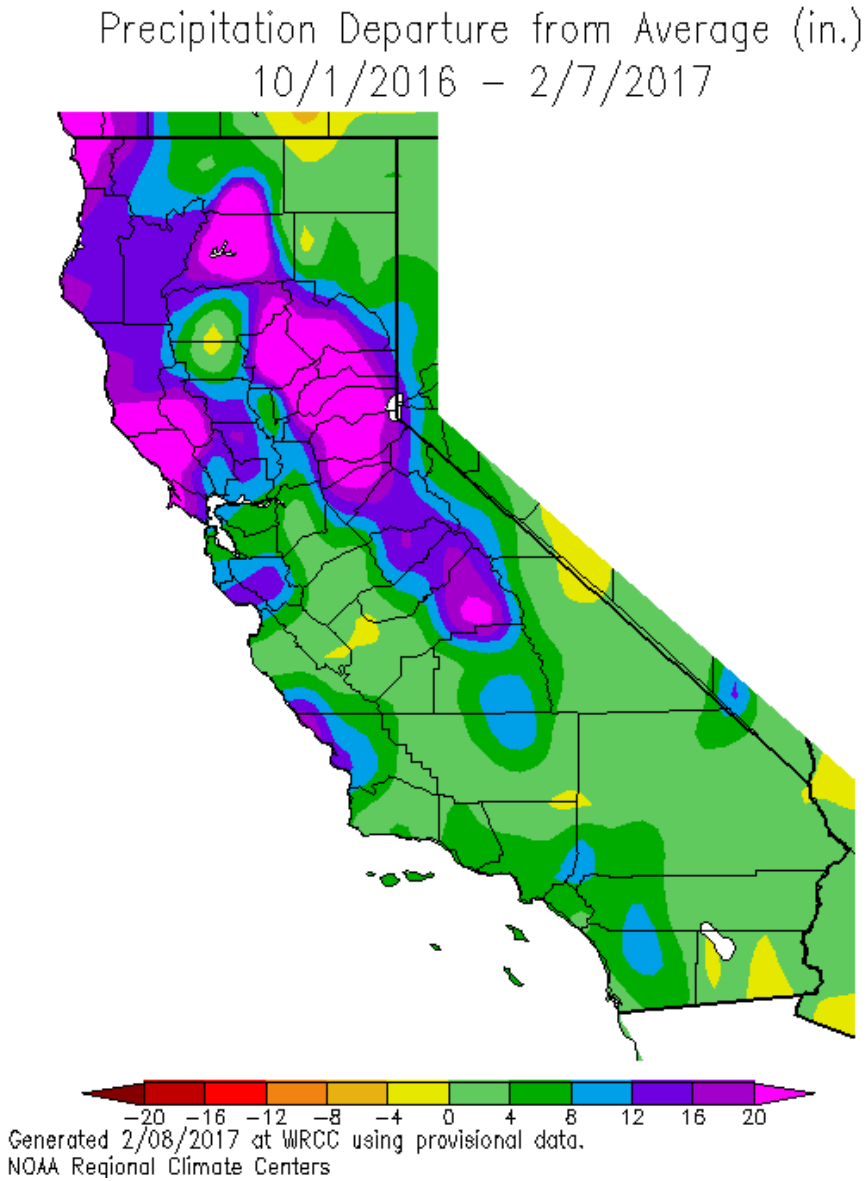
National Drought Mitigation Center

- 5 Class Degradation
- 4 Class Degradation
- 3 Class Degradation
- 2 Class Degradation
- 1 Class Degradation
- No Change
- 1 Class Improvement
- 2 Class Improvement
- 3 Class Improvement
- 4 Class Improvement
- 5 Class Improvement

http://droughtmonitor.unl.edu

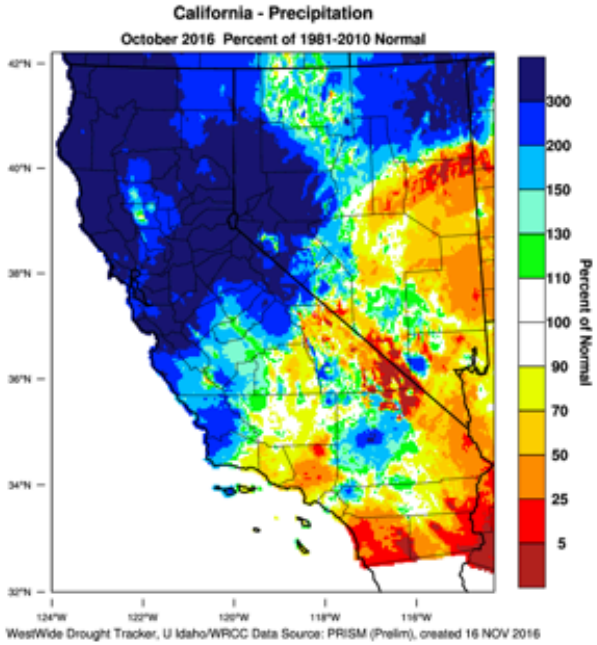
Precipitation



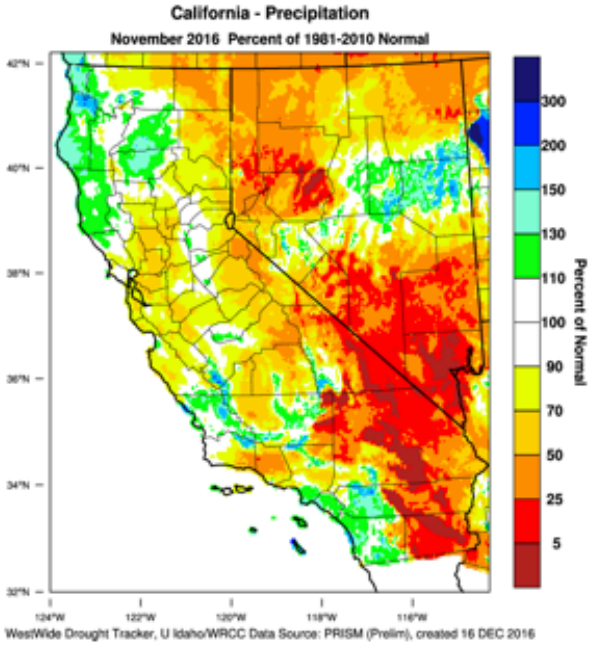


Percent of Normal Precipitation

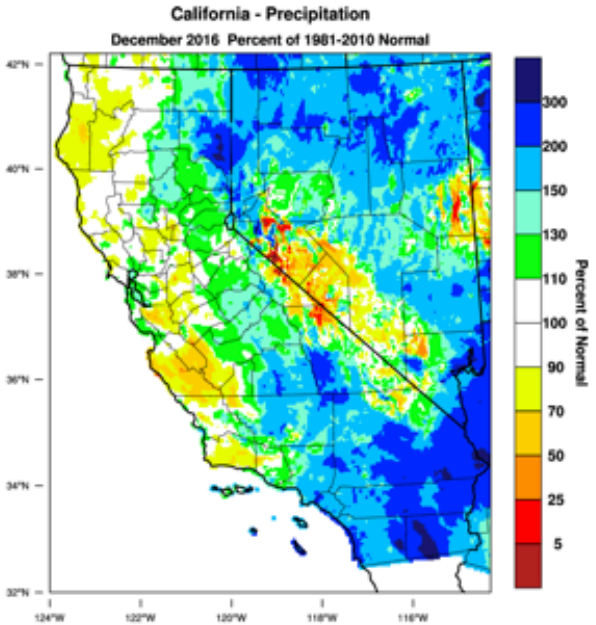
October 2016



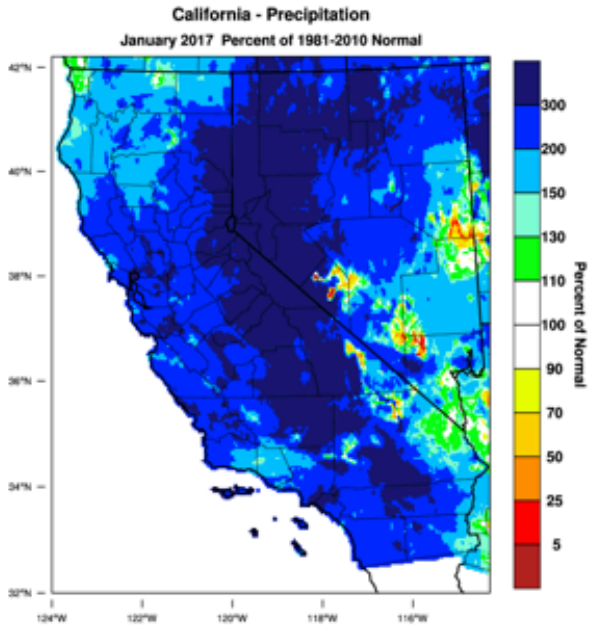
November 2016



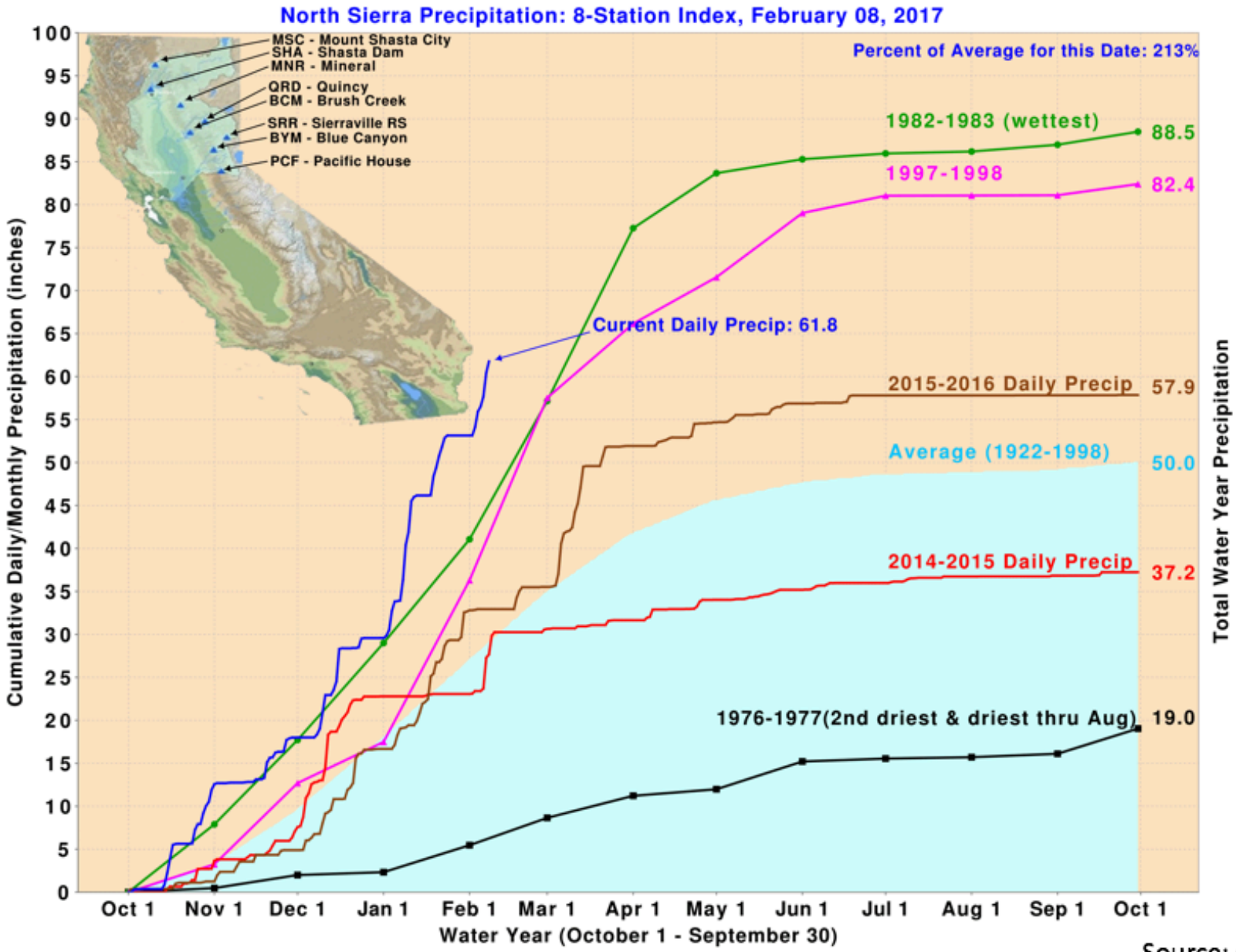
December 2016



January 2016

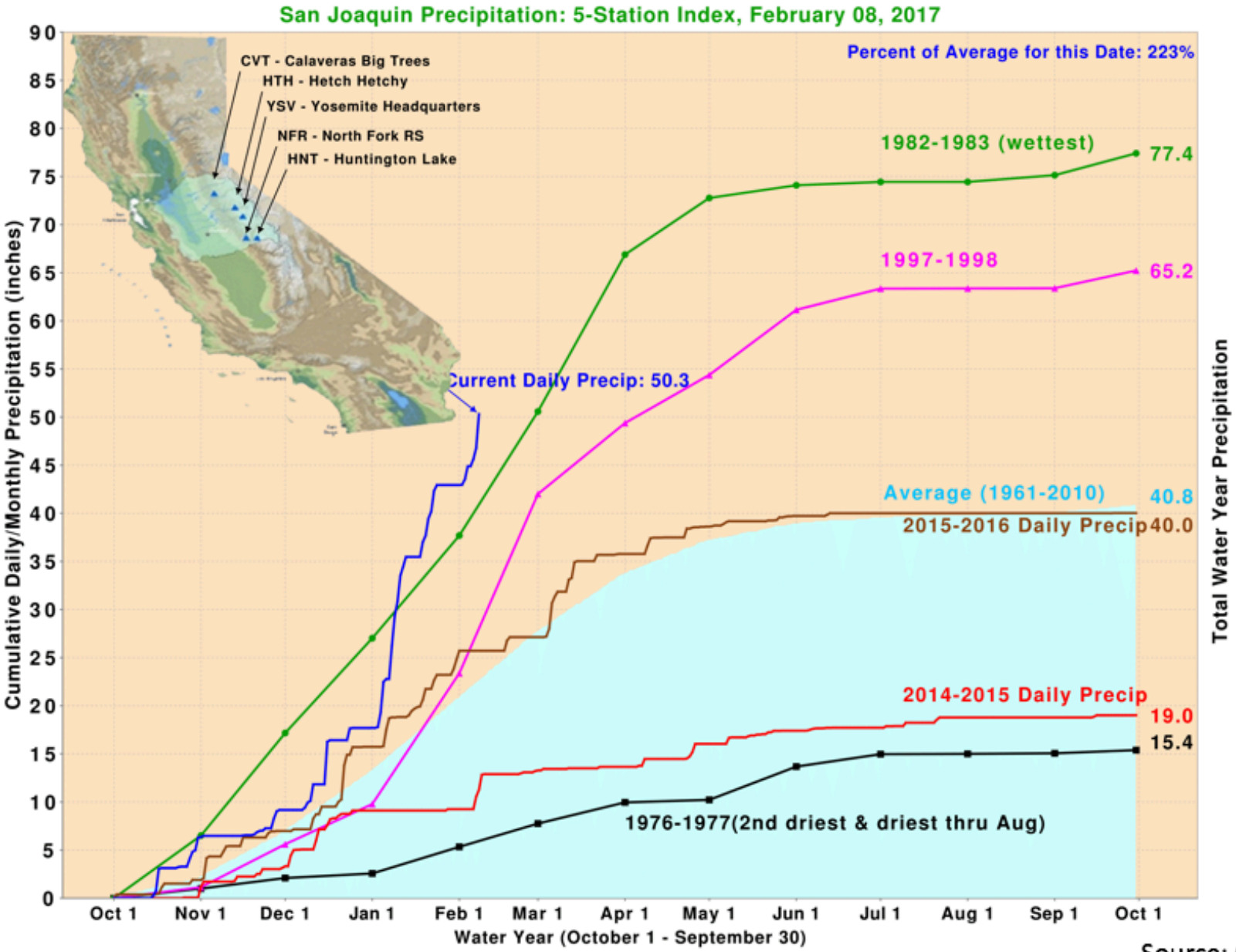


Precipitation



Source: CA DWR

Precipitation



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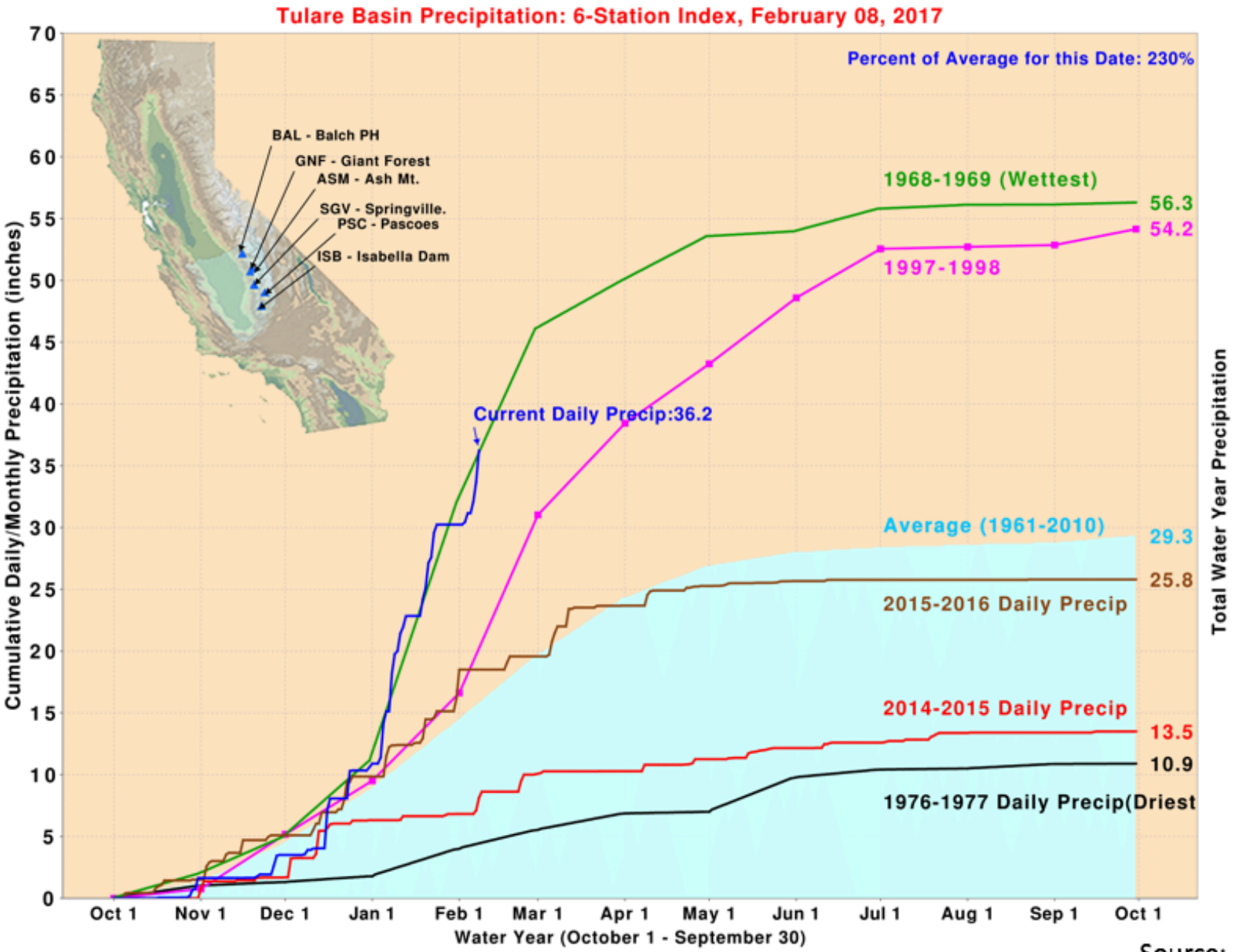
Precipitation



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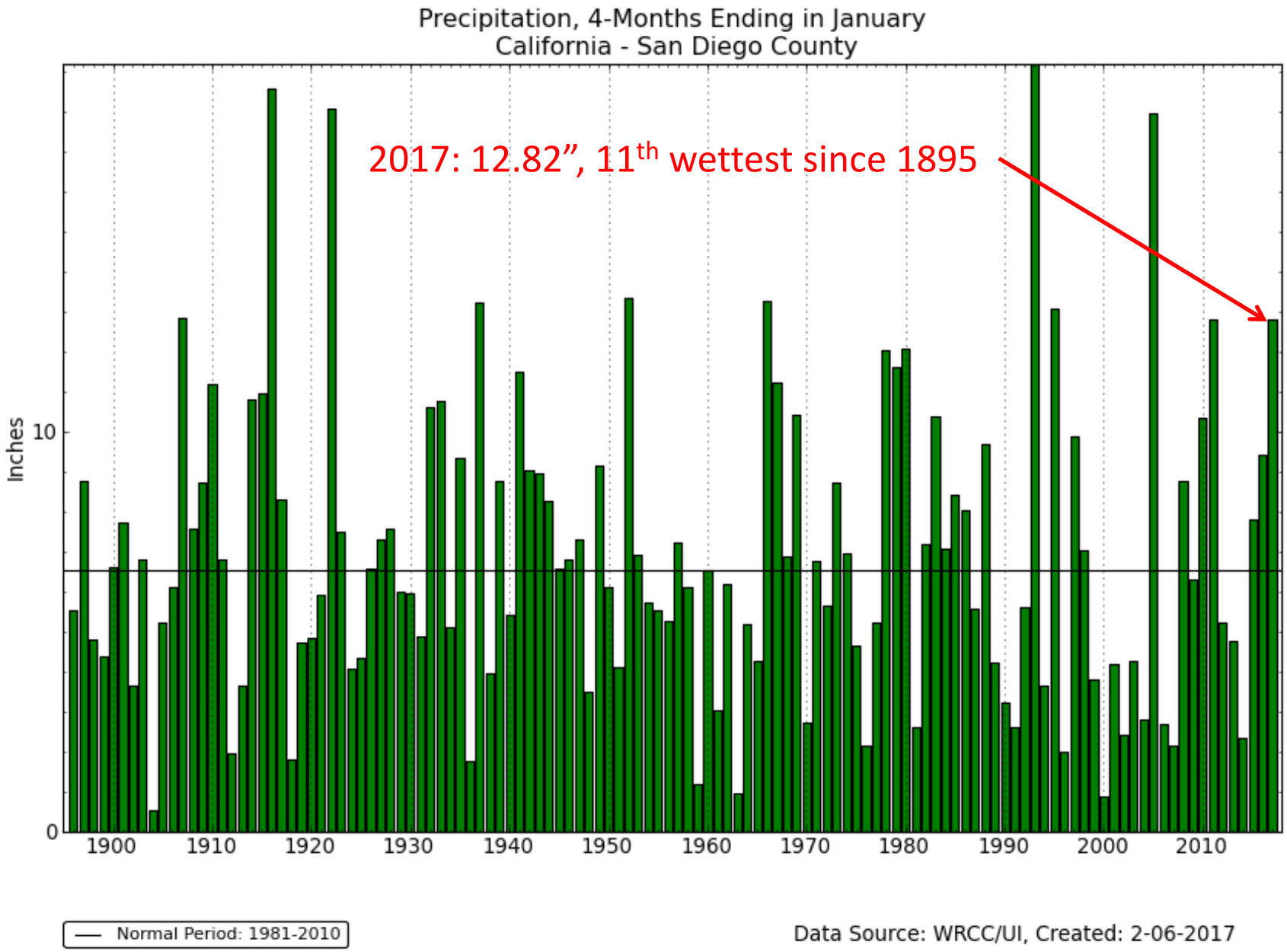
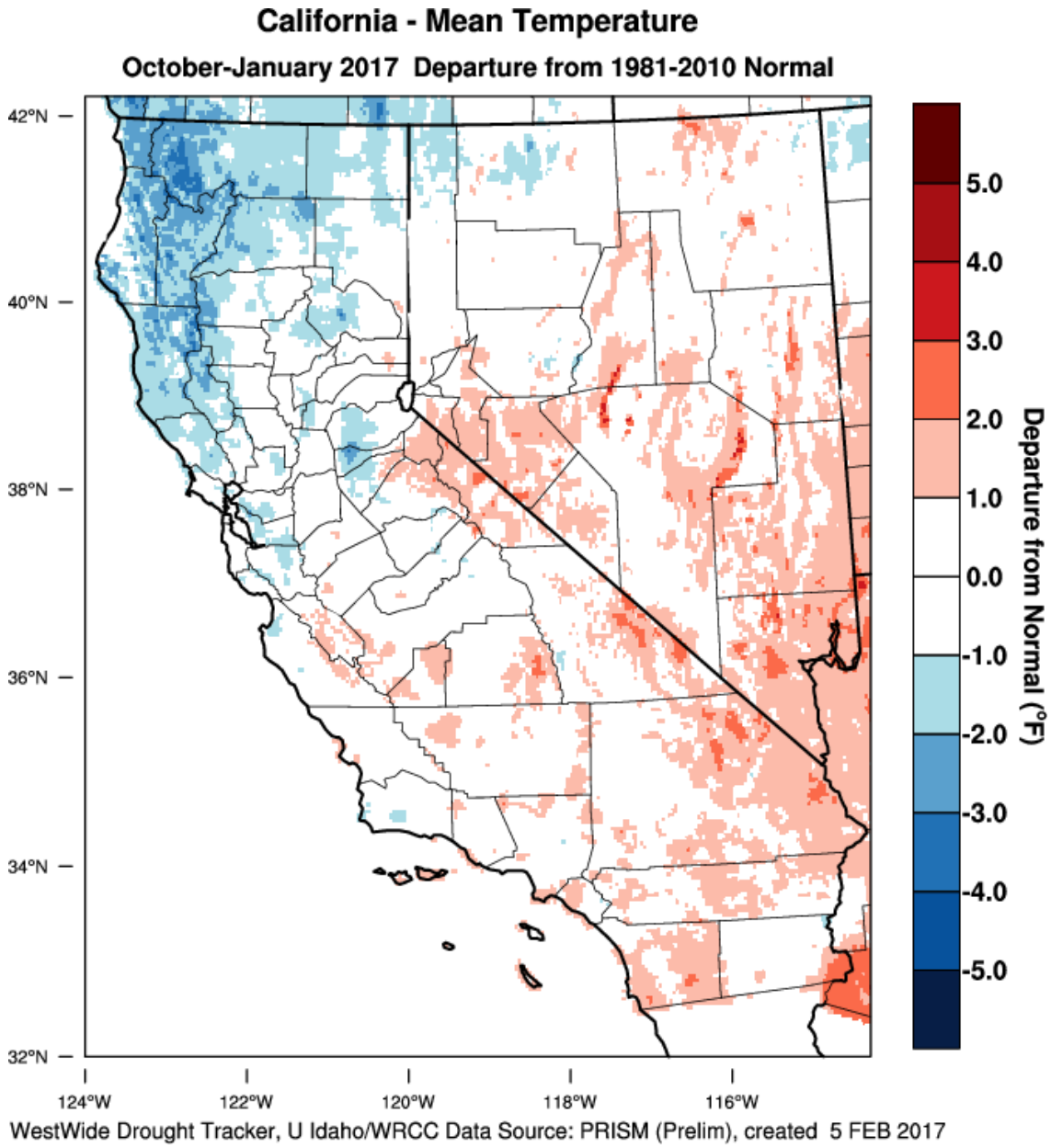


Temperature



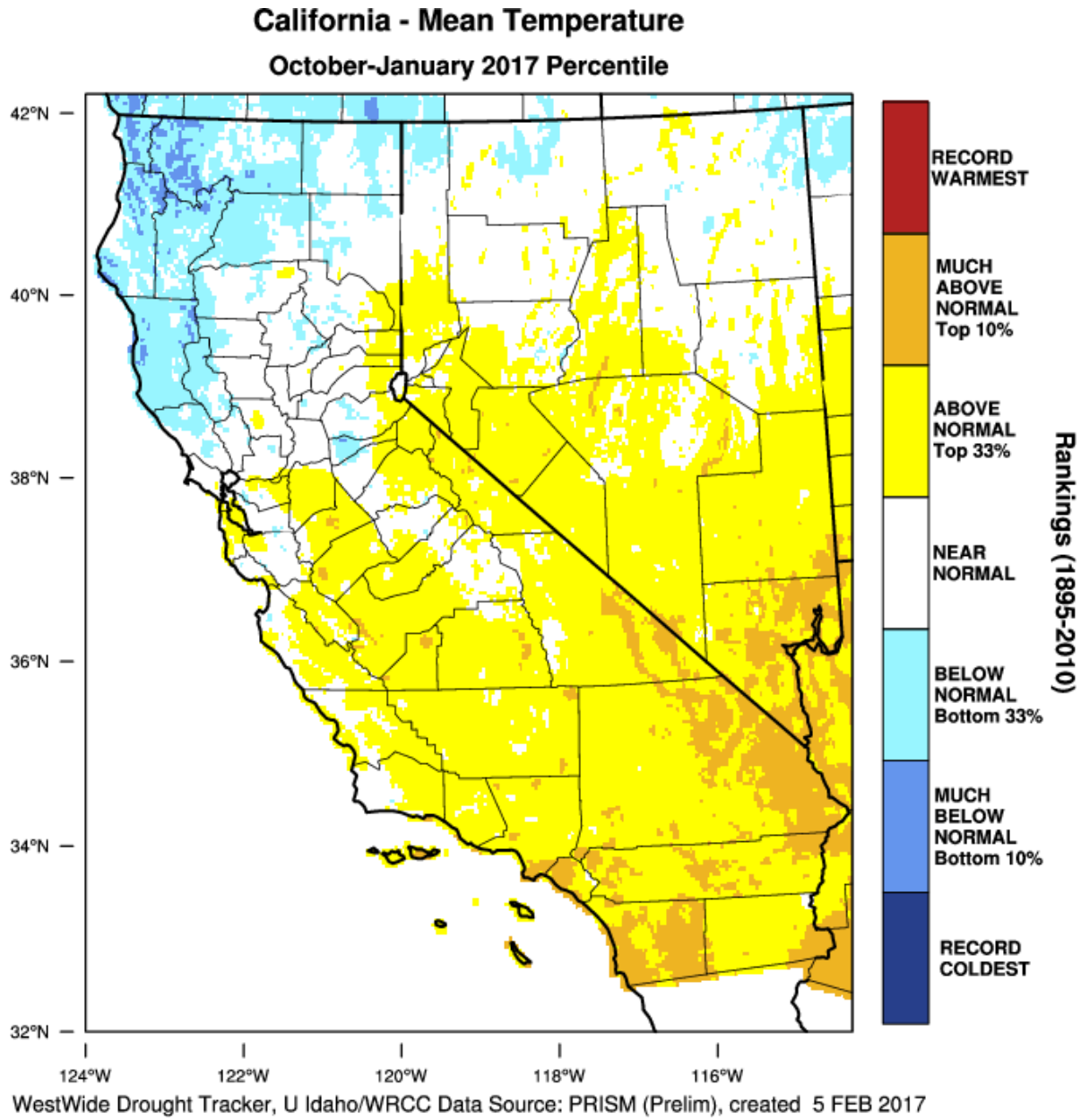
- October – January 2017 temperature anomalies

- Blue = colder
- Red = warmer

Warmer =

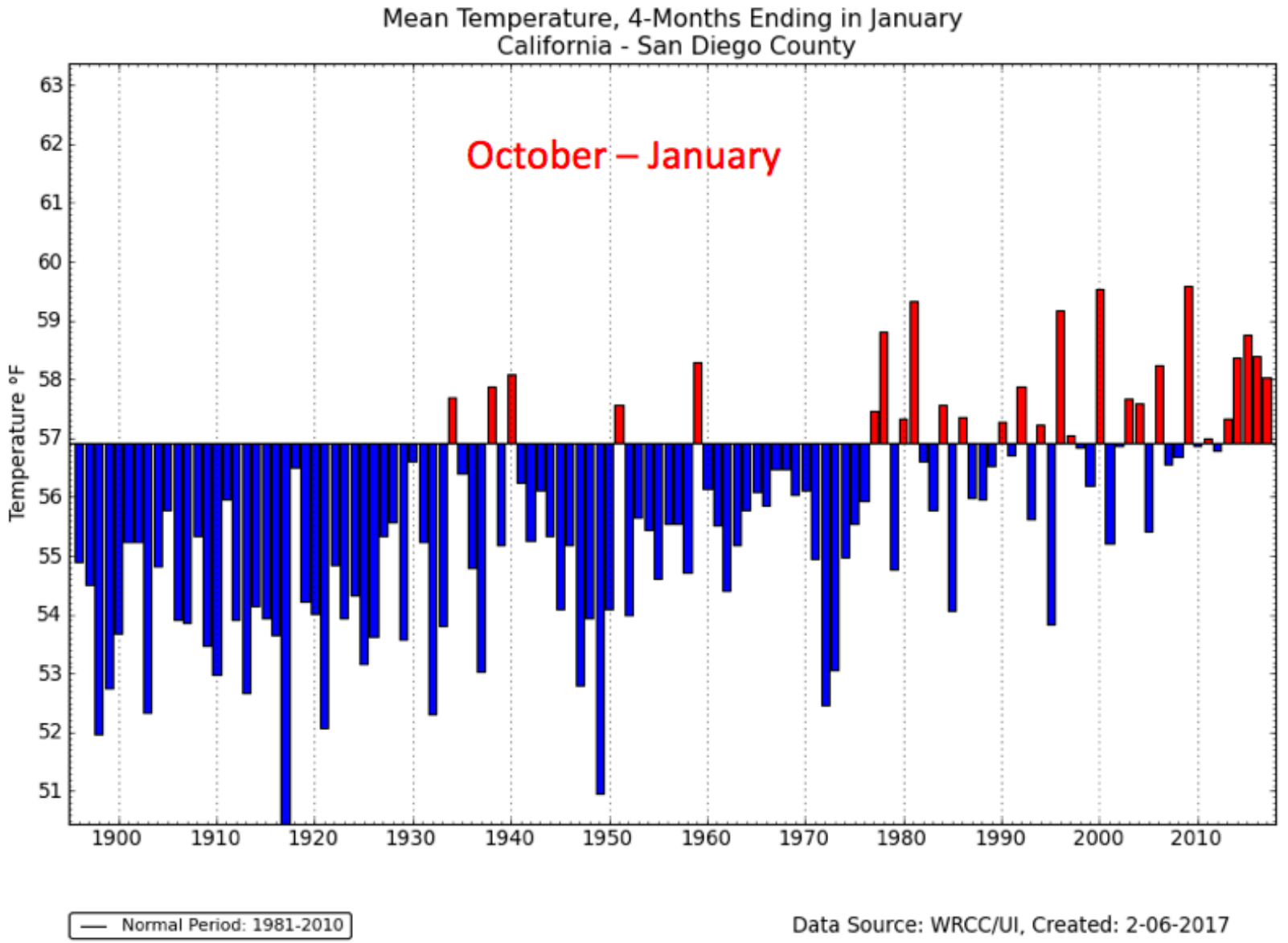
- Higher snow levels
- More precip. falling as rain
- Less snow accumulation
- Less spring/summer runoff
- Higher evaporative demand
- Soil moisture will dry out faster
- Greater vegetative stress

Temperature

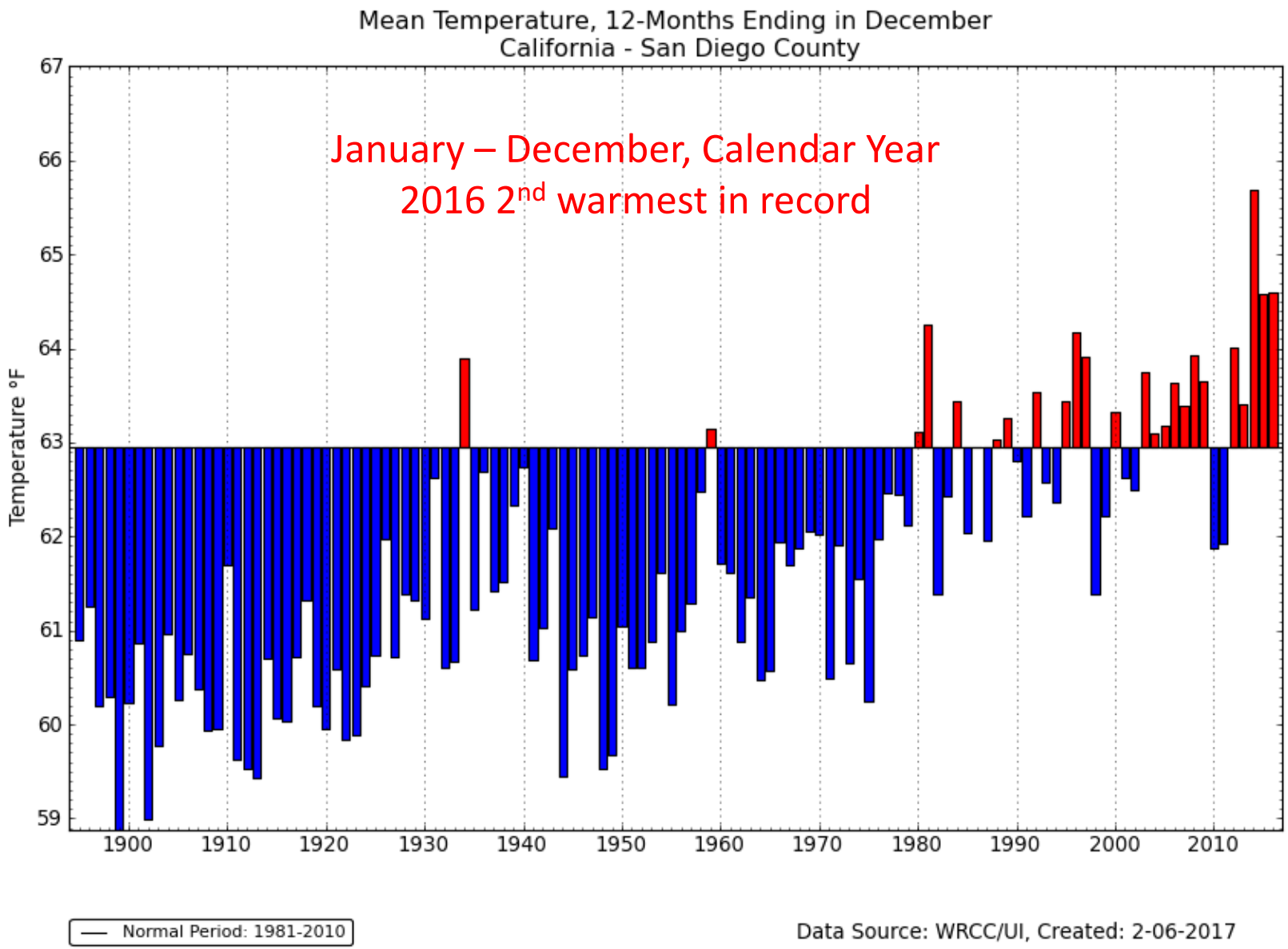


- October – January 2017 temperature percentile rankings
- Much of San Diego county in top 10% warmest since 1895

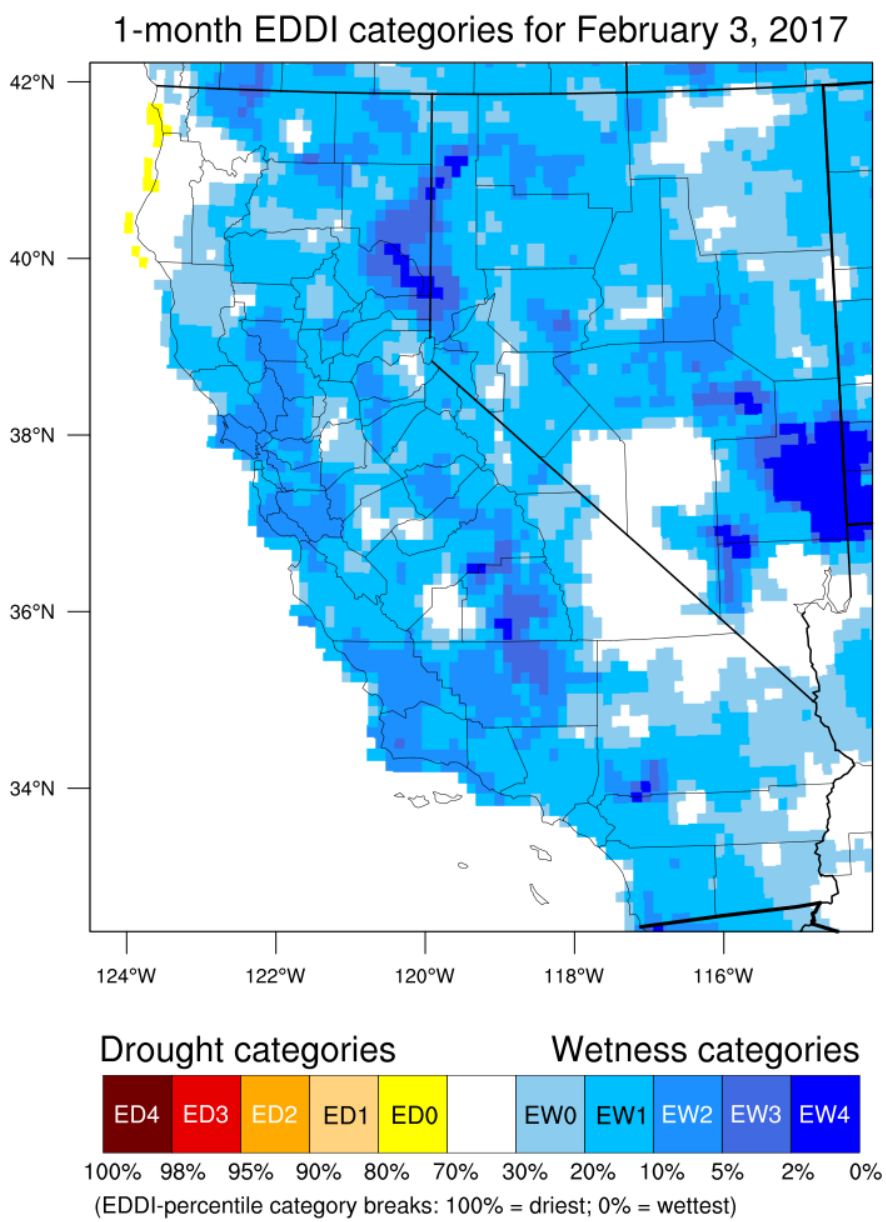
Temperature

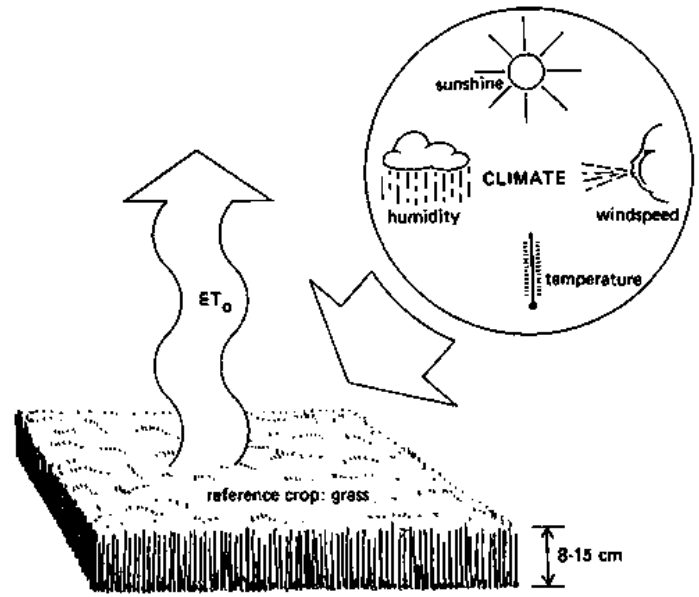


Temperature



Evaporative Demand Drought Index (EDDI)



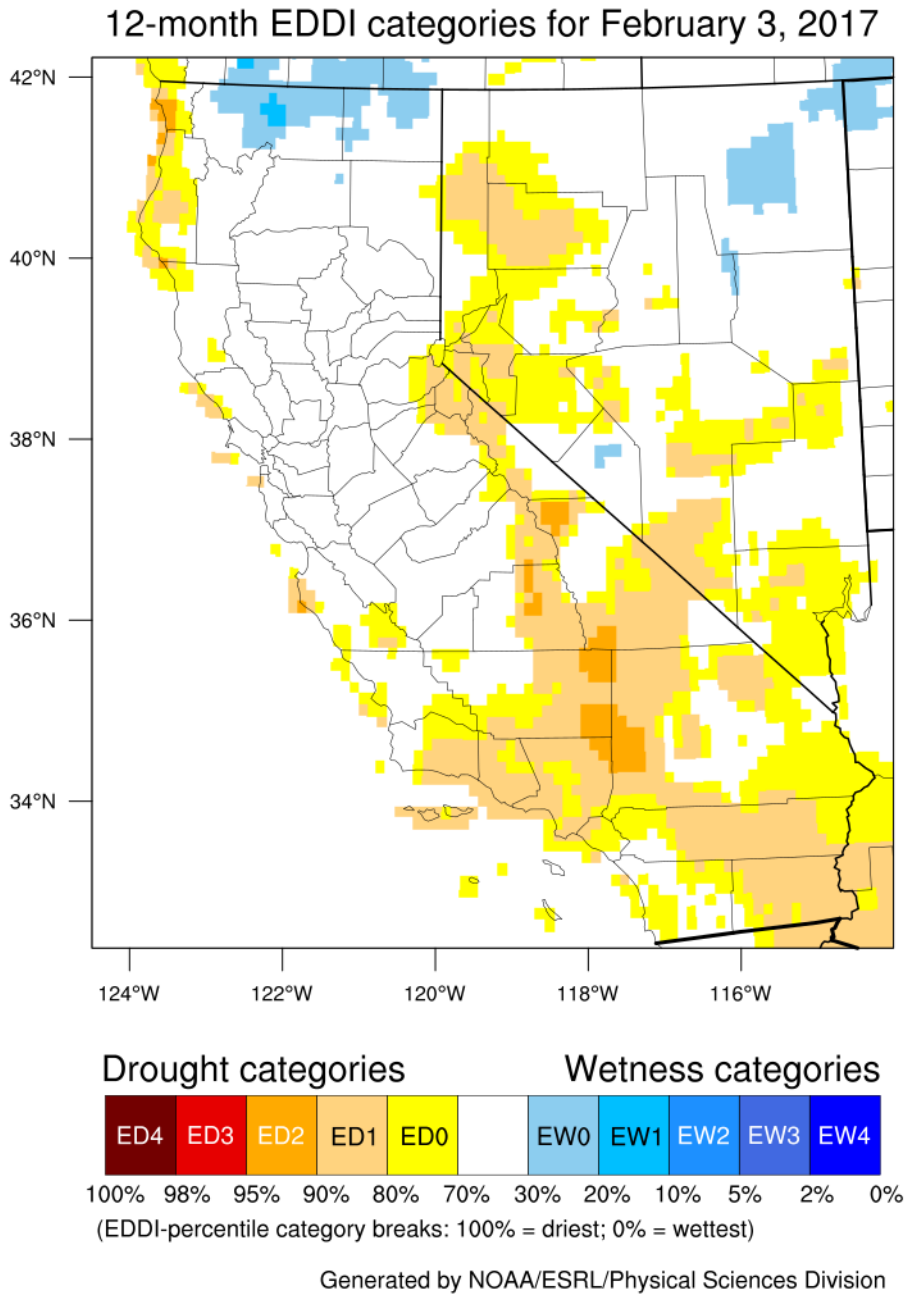


- Penman-Monteith evaporative demand
- Temperature, humidity, wind, solar radiation
- Wind and humidity often contribute more than temperature in So. Cal. (Hobbins 2016)

- **Atmospheric thirst**

[EDDI: Hobbins et al. 2016, McEvoy et al. 2016]

Evaporative Demand Drought Index (EDDI)



- 12-month EDDI
- February 2016 through January 2017 (actually ending February 3, 2017)

- Evaporative demand remains high over parts of Sierra Nevada and southern California

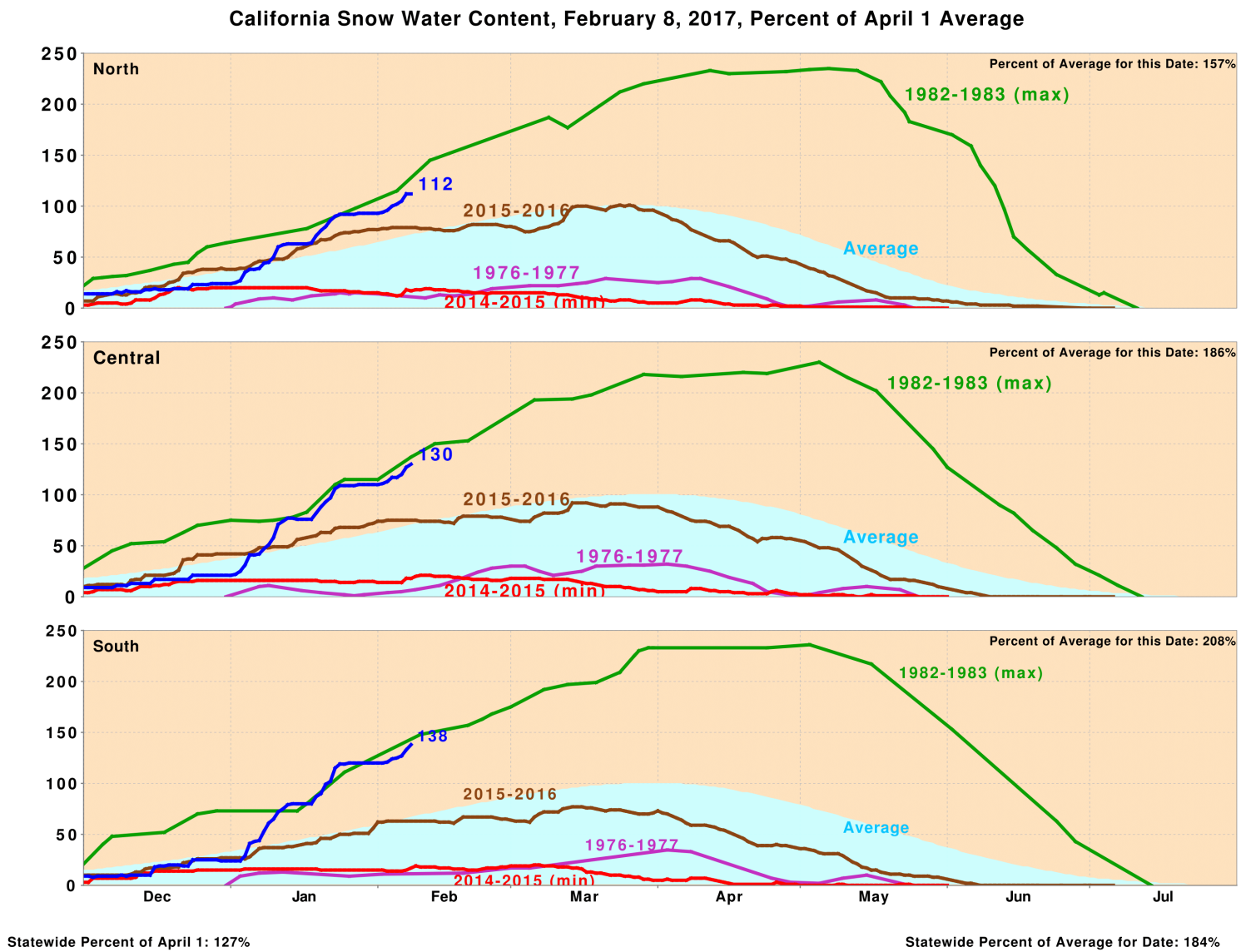
- NOAA R2O grant: transition EDDI from experimental to operational, 2017-2019

- EDDI maps: ftp://ftp.cdc.noaa.gov/pub/Public/mhobbins/EDDI/

- CA/NV zoomed in maps: ftp://ftp.cdc.noaa.gov/pub/Public/mhobbins/EDDI/CN_DEWS/

[EDDI: Hobbins et al. 2016, McEvoy et al. 2016]

Snowpack



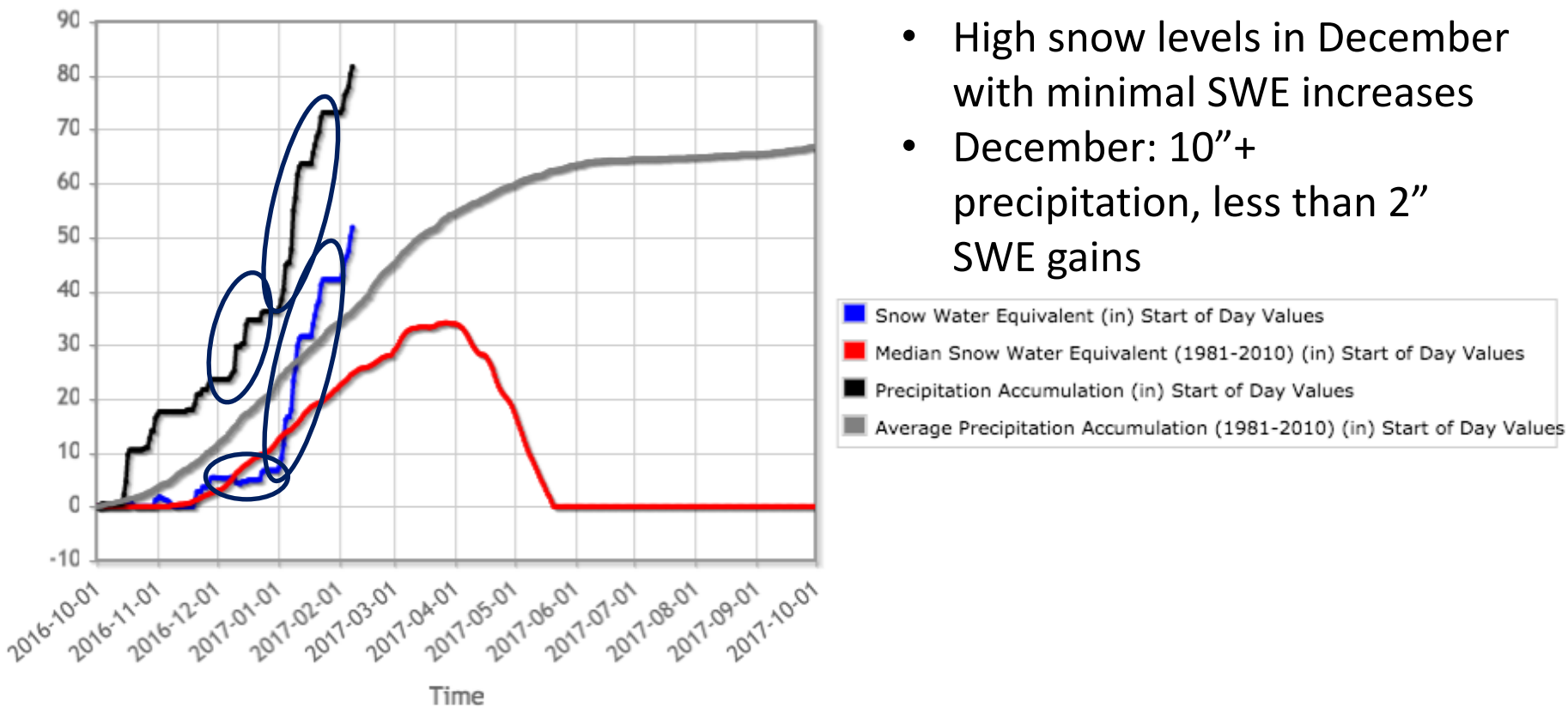
- Well above 1982/1983 for precipitation but ***NOT*** for snowpack

Snowpack

- January 1, 2017 SWE = 6.7 inches
- January 31, 2017 SWE = 42.1 inches
- One month SWE increase of 35.4 inches!

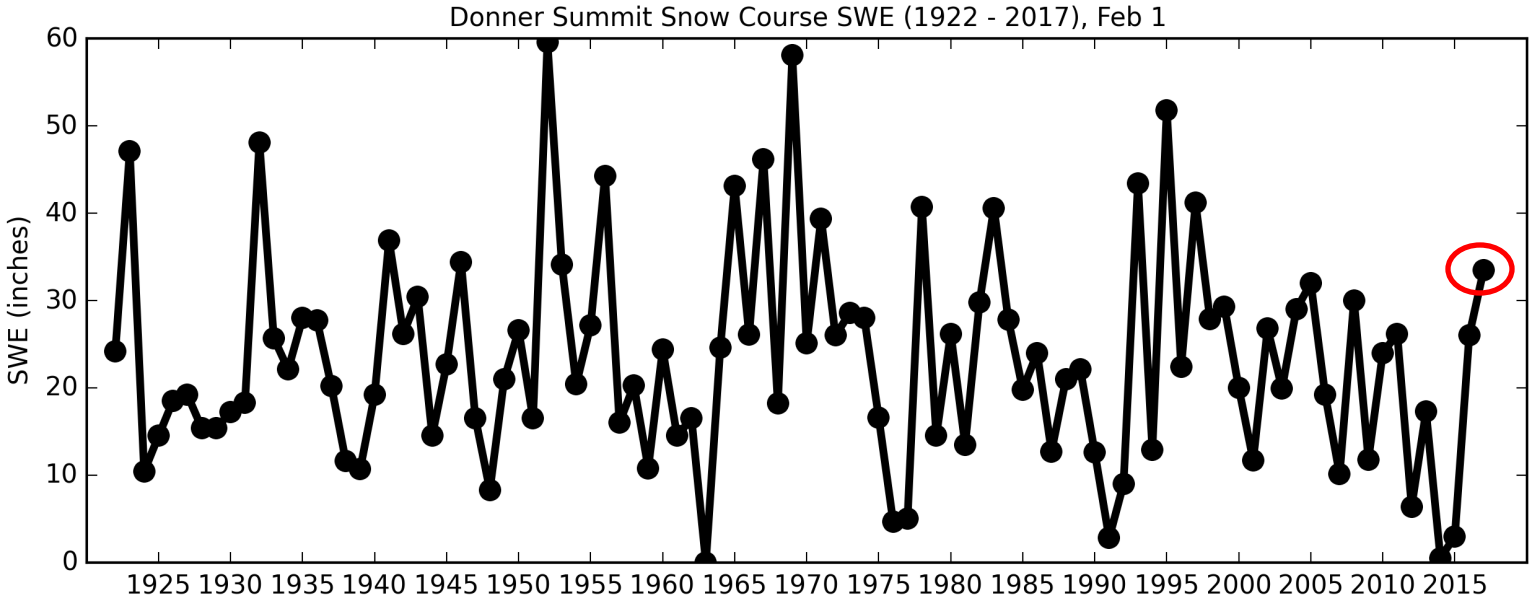
- April 1 normal SWE = 33.9 inches
- February 8, 2017 SWE = 51.8 inches

Css Lab (428) California SNOTEL Site - 6855 ftReporting Frequency: Daily; Date Range: 2016-10-01 to 2017-09-30



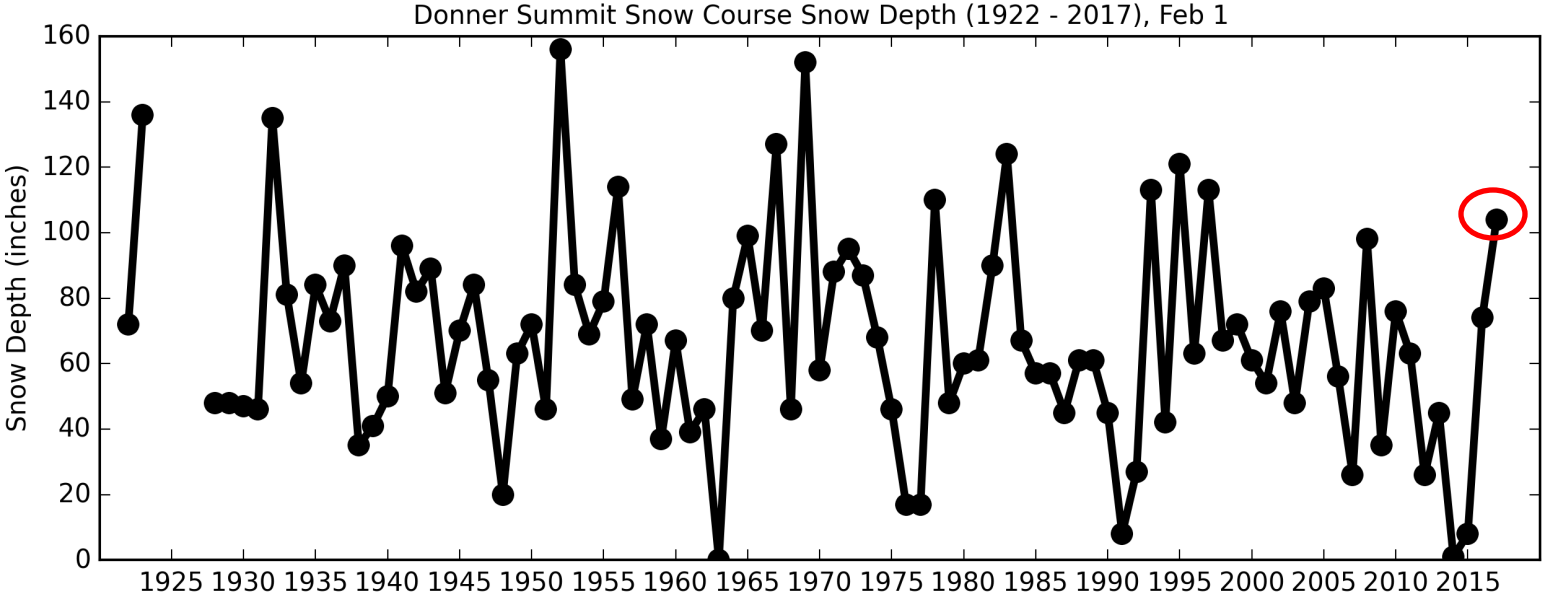
- High snow levels in December with minimal SWE increases
- December: 10”+ precipitation, less than 2” SWE gains

Snowpack



February 1, 2017

17th greatest SWE since 1922

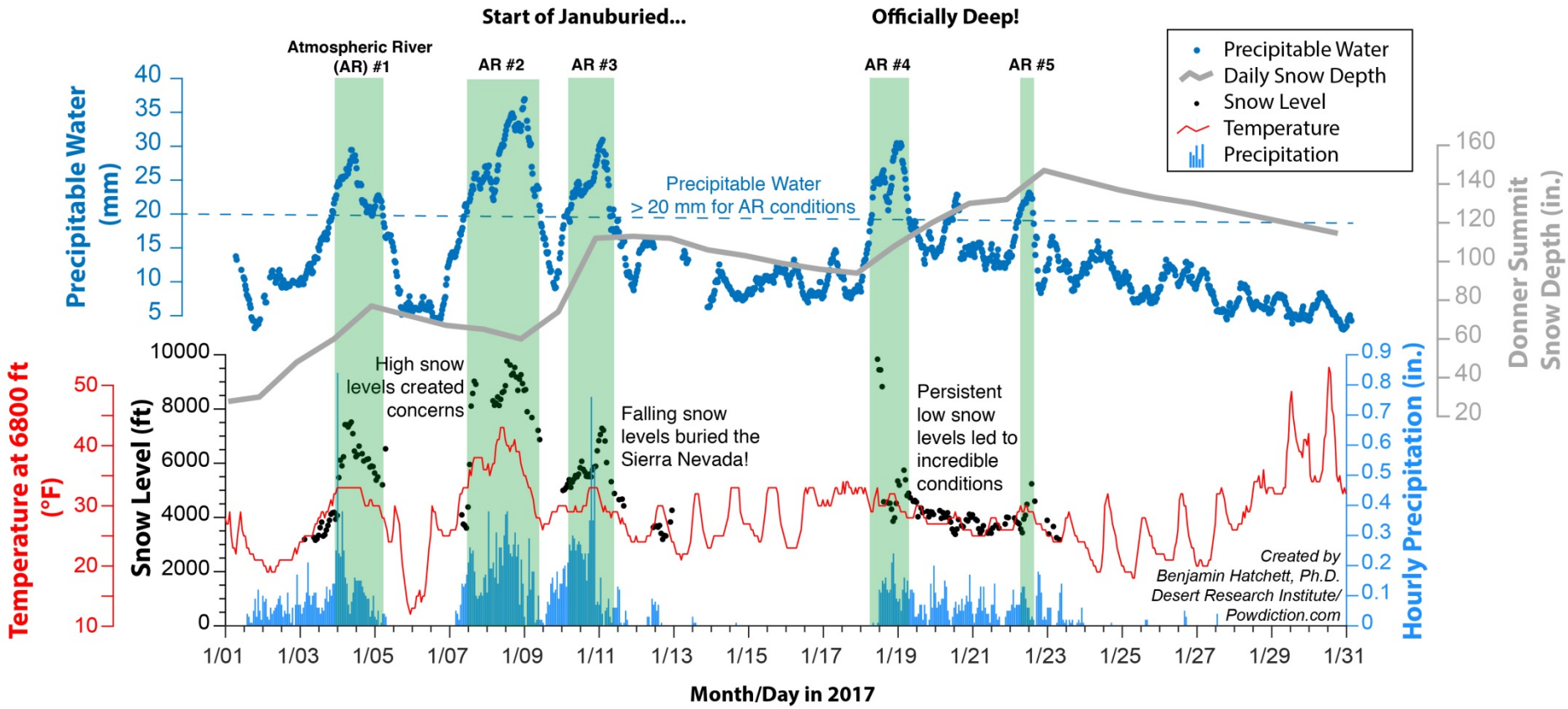


February 1, 2017

12th greatest snow depth since 1922

Snow course data from NRCS

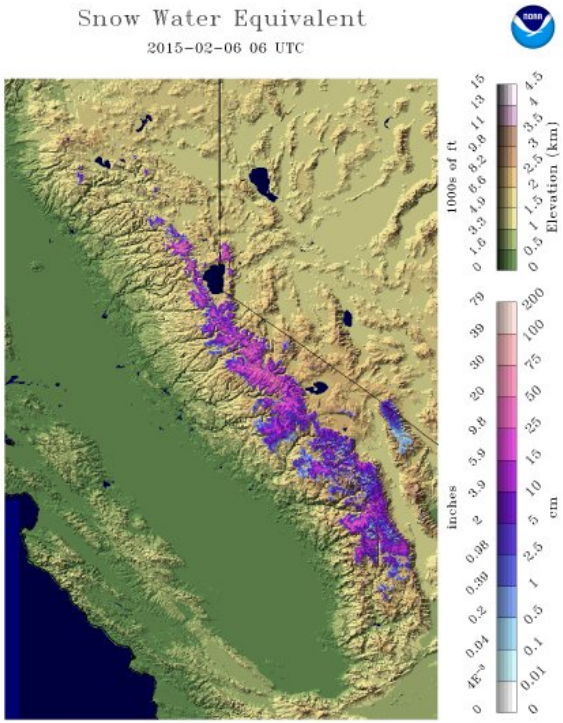
Januburied



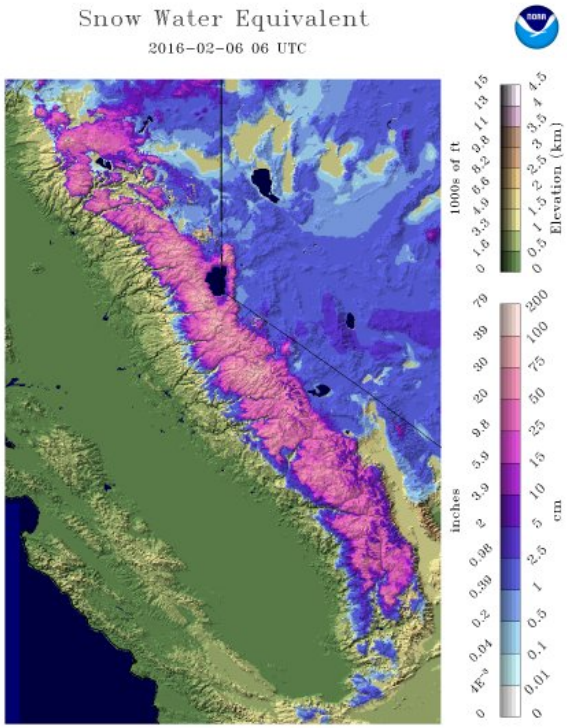
- Precipitable water: Bodega Bay, CA
- Snow level radar: Colfax, CA
- Precipitation: Blue Canyon, CA
- Snow depth: Donner Summit, CA
- Temperature: Huysink, CA

Snowpack

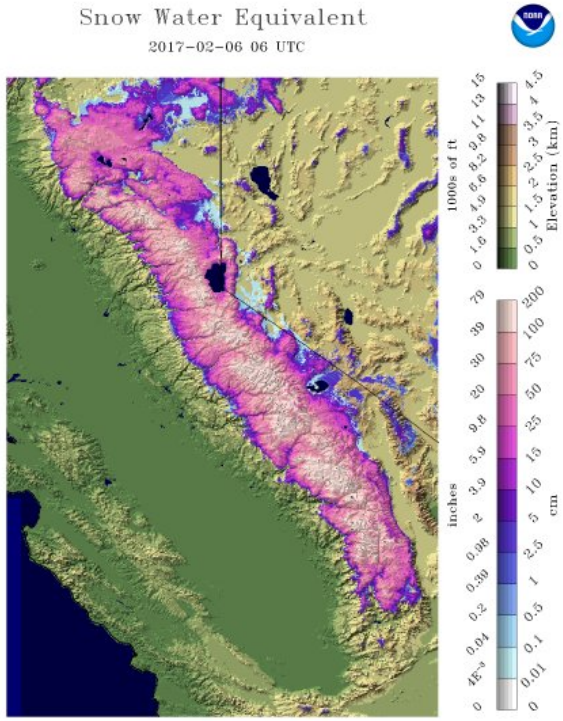
February 6, 2015
SWE



February 6, 2016
SWE

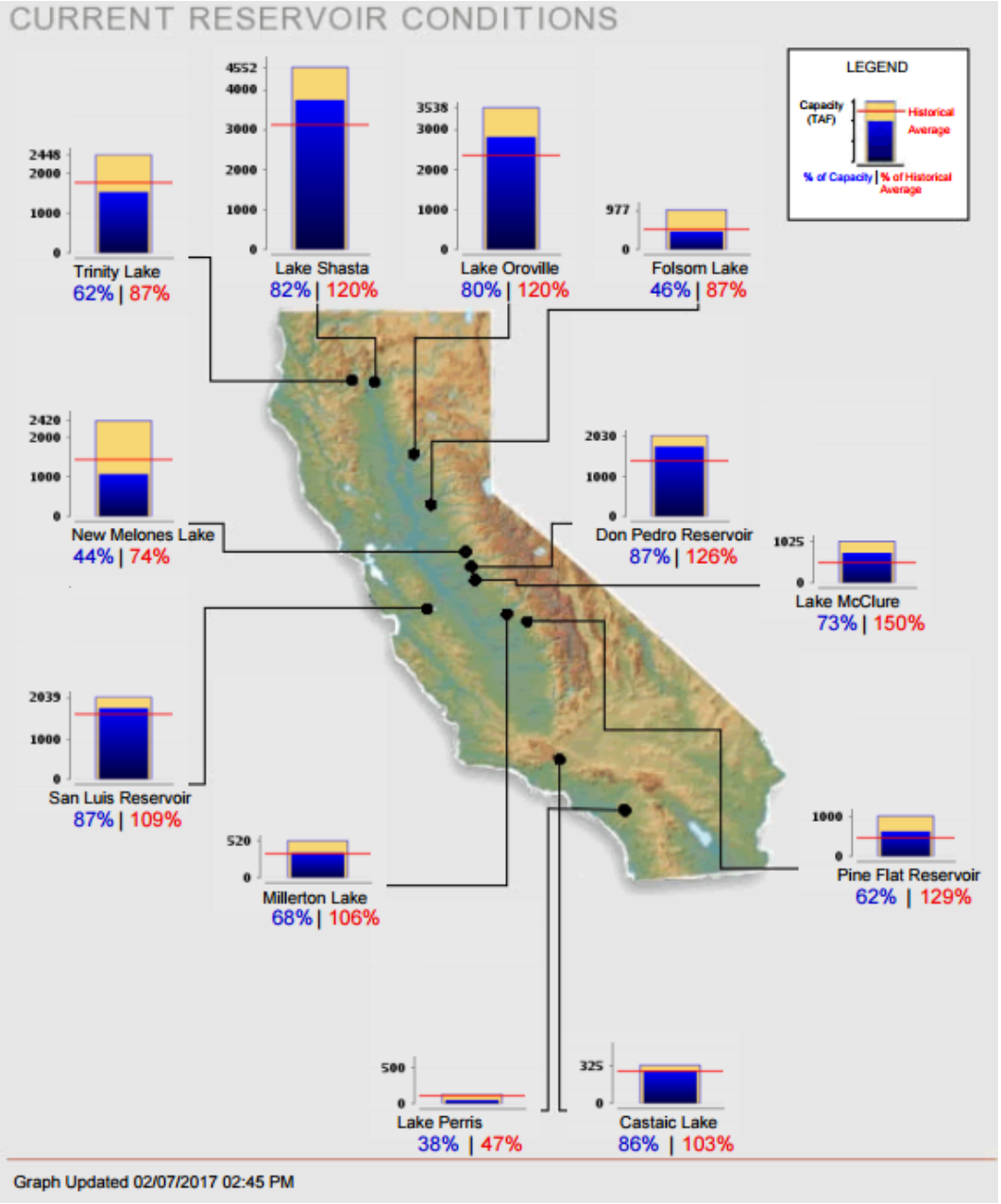


February 6, 2017
SWE



NOAA National Snow Analysis: https://www.nohrsc.noaa.gov/nsa/

Reservoirs



Source: CA DWR

Lake Orville Dam

Photos: Sac Bee/CA DWR

San Diego County Reservoirs

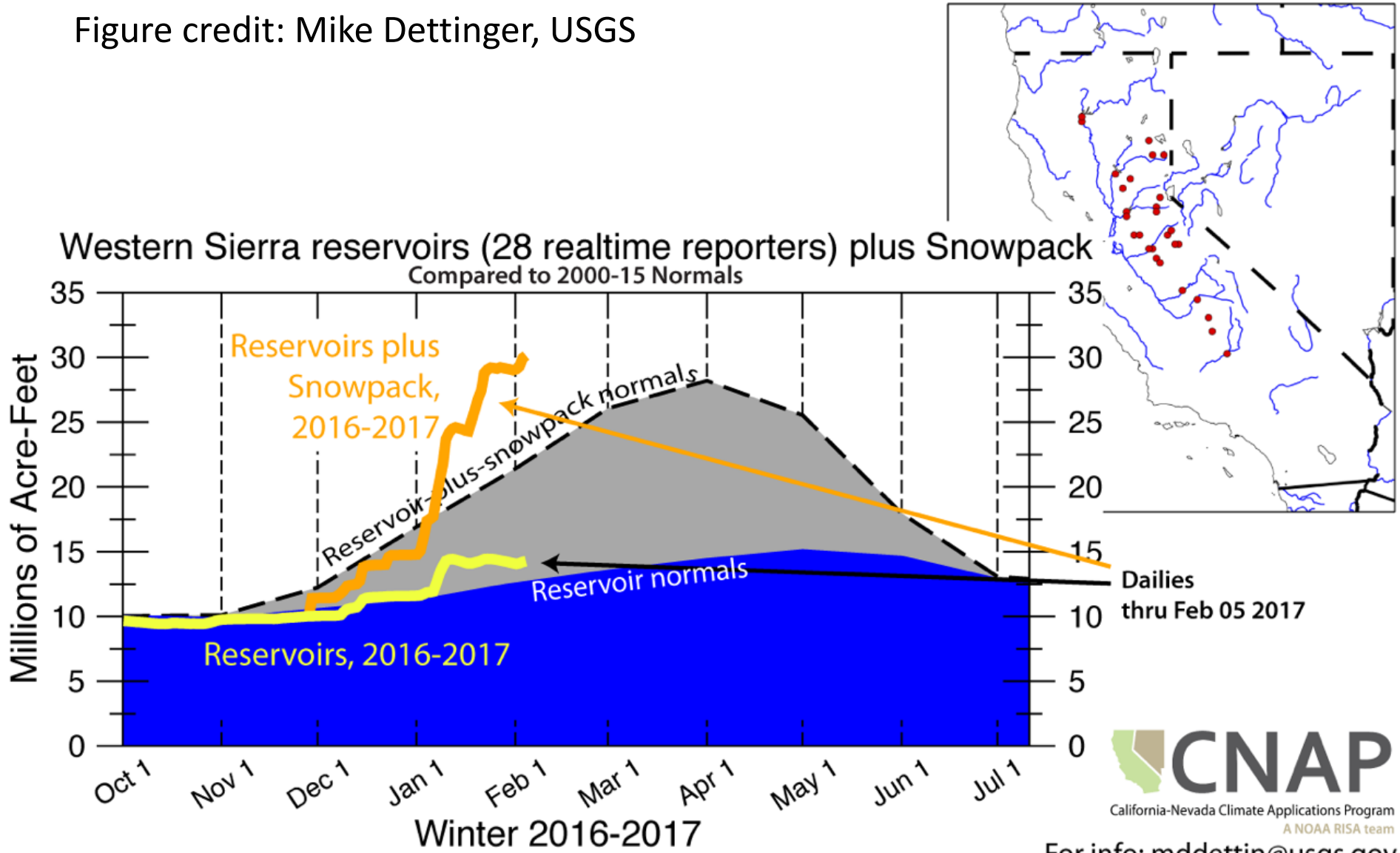
Data from February 6, 2017

Reservoir	Depth When Full	Current Depth	Storage Capacity	Current Storage	**Percent Full**	Spill MGD
Barrett	160.88 ft	97.93 ft	34,805.5	5,563.2	**16.0**	0
El Capitan	197.00 ft	126.58 ft	112,806.9	33,440.0	**29.6**	0
Hodges	115.00 ft	98.88 ft	30,632.6	16,031.0	**52.6**	0
Miramar	114.00 ft	105.80 ft	6,682.4	5,437.9	**81.4**	0
Morena	157.00 ft	85.05 ft	50,694.0	1,973.9	**3.9**	0
Murray	95.00 ft	91.550 ft	4,684.2	4,121.2	**88.0**	0
Lower Otay	137.50 ft	132.90 ft	49,848.9	42,559.1	**85.4**	0
San Vicente	306.00 ft	264.78 ft	249,358.0	185,015.8	**74.2**	0
Sutherland	145.00 ft	80.47 ft	29,508.1	5,307.5	**18.0**	0

Source: City of San Diego, https://www.sandiego.gov/water/recreation/levels

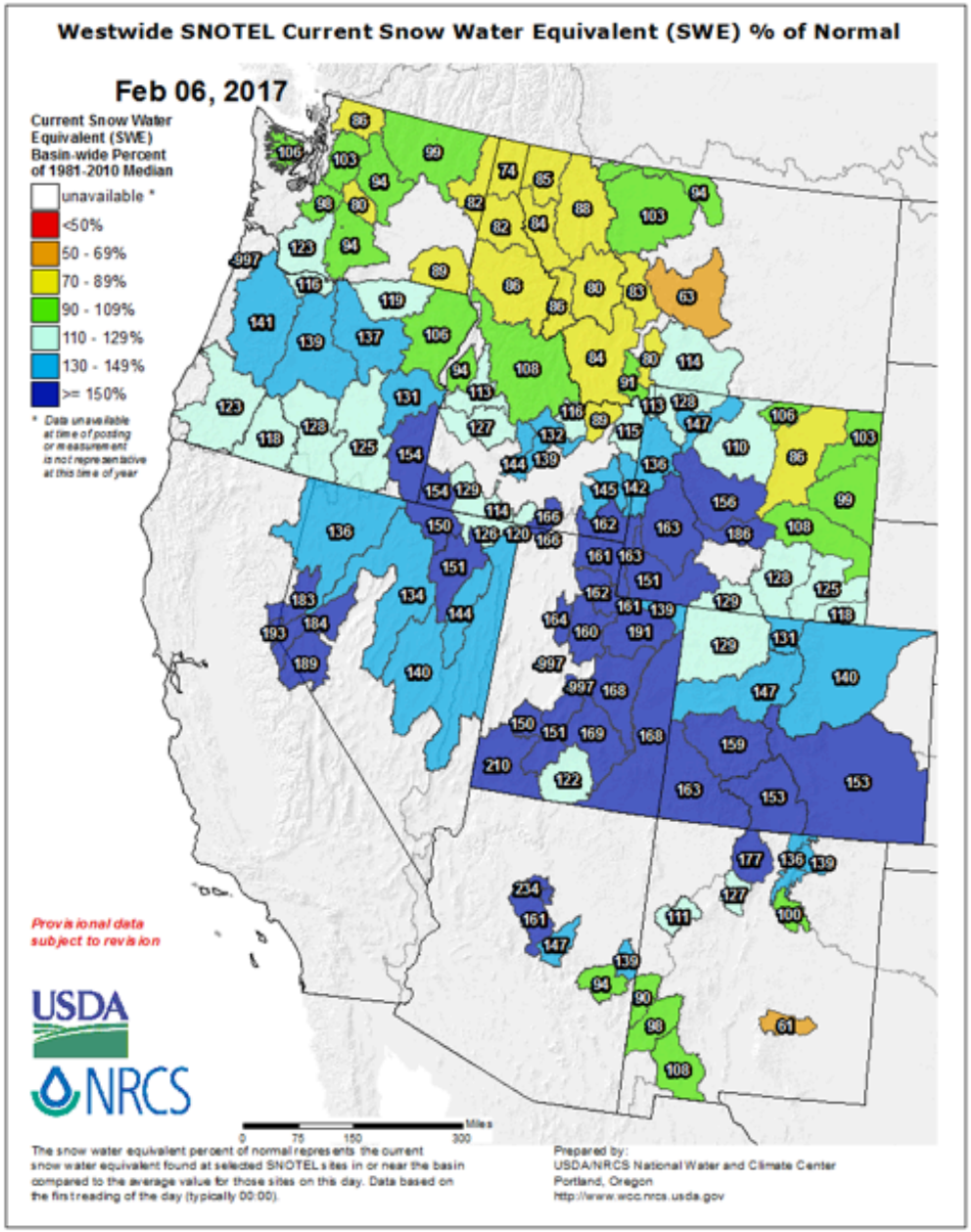
Snowpack + Reservoirs

Figure credit: Mike Dettinger, USGS



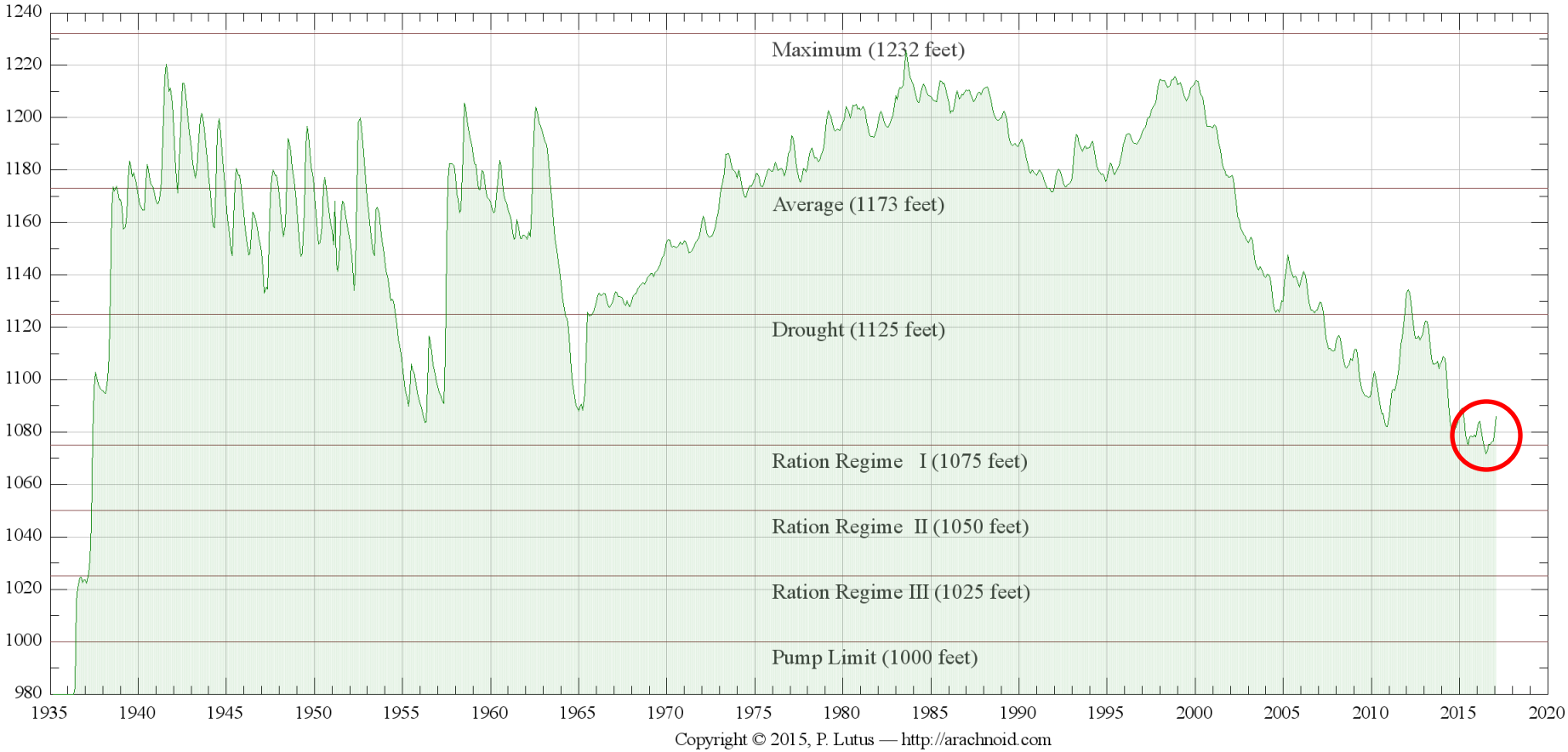
For info: mddettin@usgs.gov

Colorado River Basin Snowpack



- Upper and Lower Colorado River Basin snowpack currently in excellent shape overall

Lake Mead



- February 5, 2017 elevation: 1086.70 feet
- June, 2016 elevation: record low of 1071.64

Lake Mead data from USBR

Lake Mead

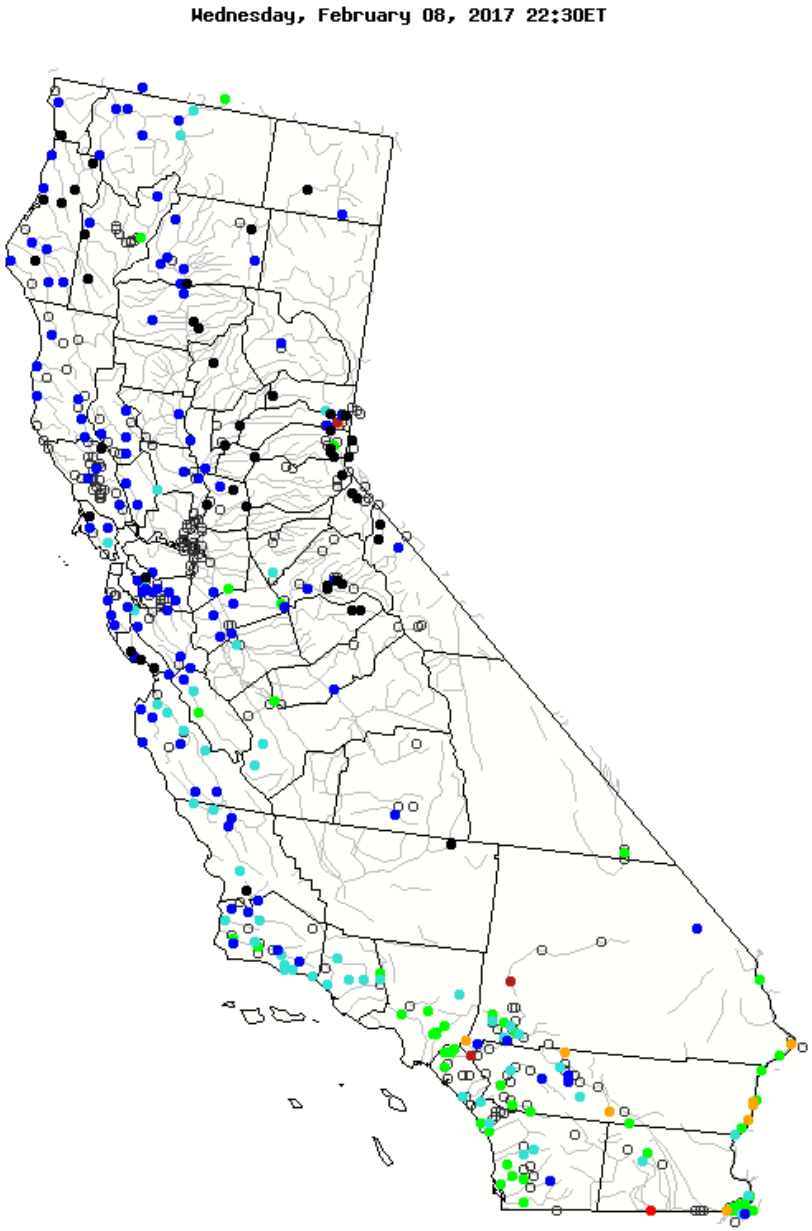
From National Weather Service, Las Vegas Drought Information statement on January 28, 2017:

"THE LAKE IS EXPECTED TO REMAIN AROUND 1085 FEET THROUGH MARCH BEFORE LOWERING TO AROUND 1072 FEET IN JULY.

THE LATEST U.S. BUREAU OF RECLAMATION GIVES LAKE MEAD 0 PERCENT CHANCE OF FALLING INTO SHORTAGE - 1ST LEVEL NEXT YEAR (MEAD ELEVATION 1075-1050 FEET), BUT THAT CHANCE RISES TO 48 PERCENT IN 2018 AND 60 PERCENT IN 2019. THE U.S. BUREAU OF RECLAMATION DECLARES A SHORTAGE WHENEVER AN ANNUAL STUDY PROJECTS THE RESERVOIR LEVEL WILL BE LESS THAN 1075 FEET ABOVE SEA LEVEL ON JANUARY 1. A SHORTAGE COULD FORCE ARIZONA, NEVADA, AND CALIFORNIA TO IMPLEMENT WATER RESTRICTIONS, AND SOME ARIZONA FARMERS WOULD LOSE THE WATER THAT FLOWS TO THEM THROUGH THE CENTRAL ARIZONA PROJECT CANAL."

https://water.weather.gov/ahps/water/textprods/view.php?wfo=vef&prod=DGT

Streamflow



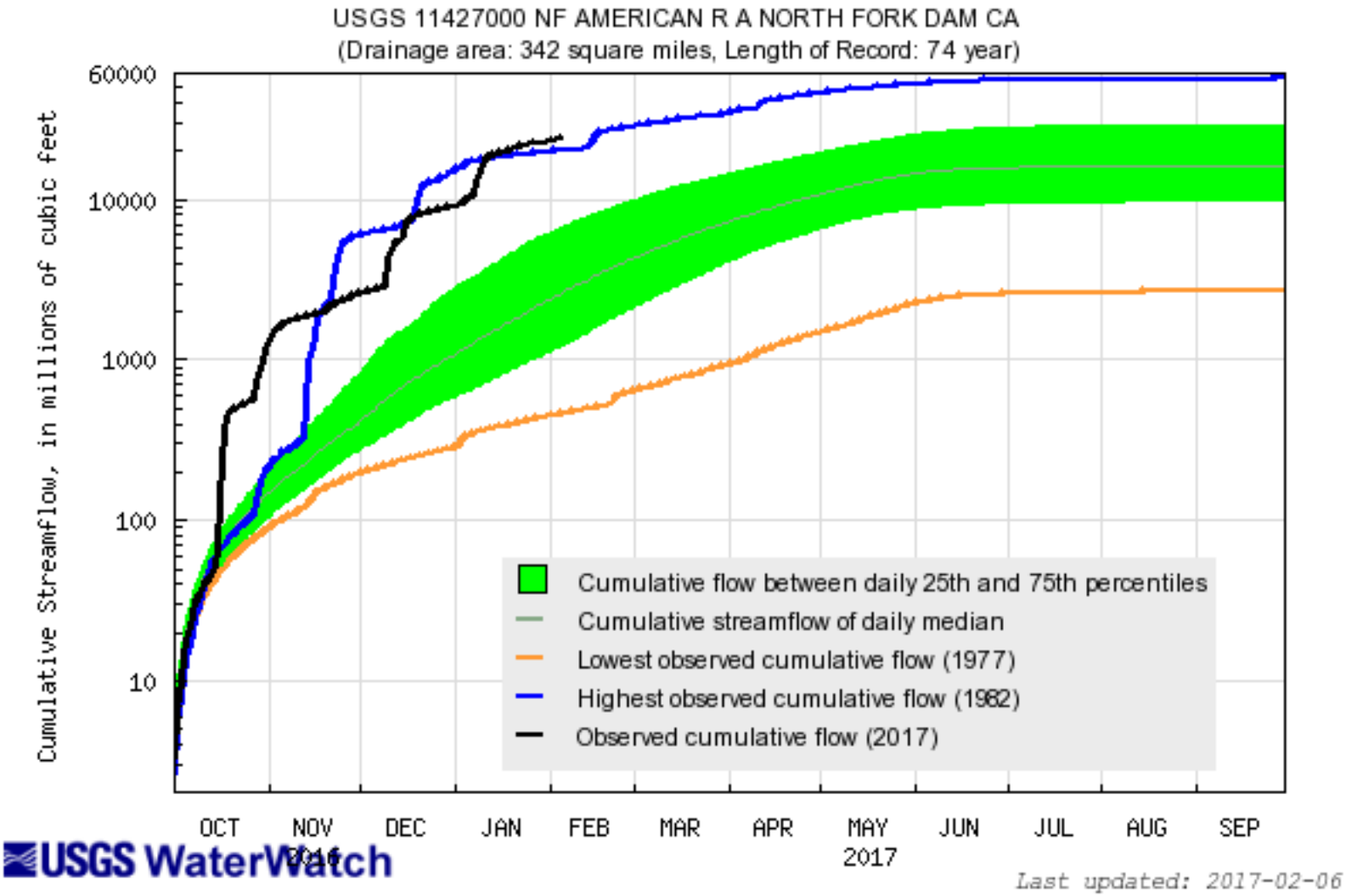
- Daily streamflow percentiles on February 8, 2017
- Lots of blue: >90th percentile
- San Diego county most near normal, green, 25th – 75th percentile

Explanation - Percentile classes							
Low	<10	10-24	25-75	76-90	>90	High	Not-ranked
	Much below normal	Below normal	Normal	Above normal	Much above normal		

USGS

Streamflow

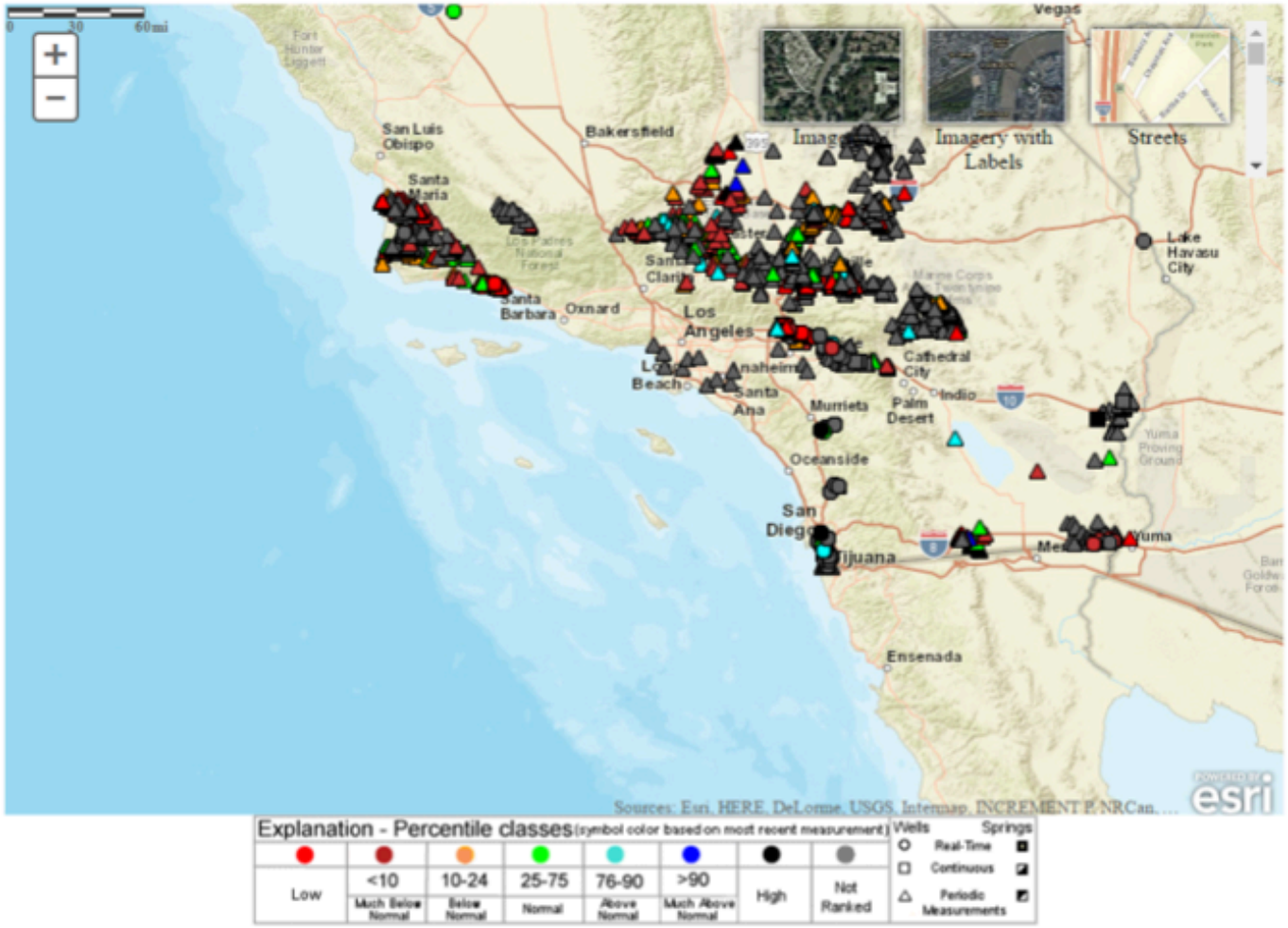
North Fork American River (west slope of Sierra Nevada near Lake Tahoe)
1944 – 2017



Groundwater

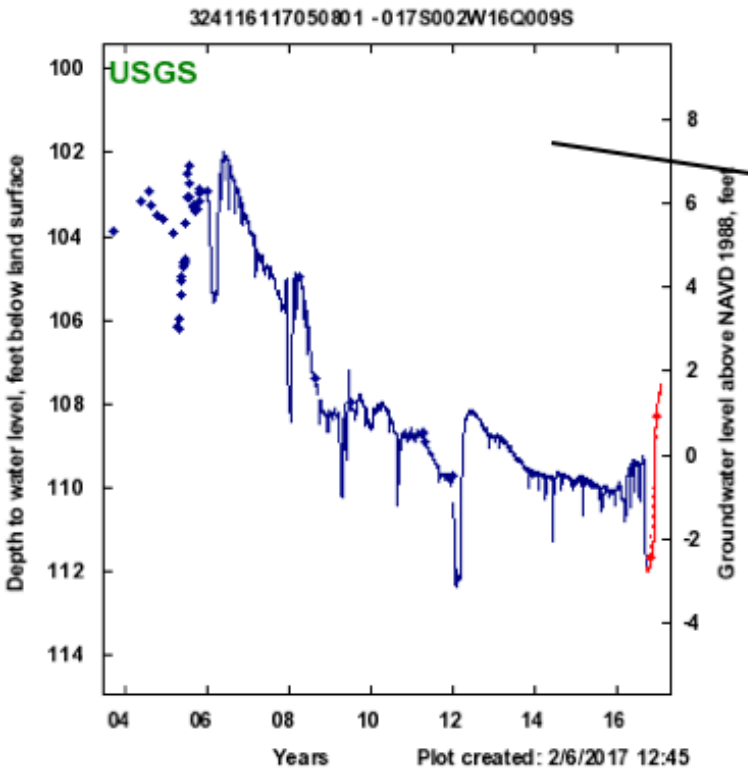
California Active Water Level Network

Click site symbol to open information pop-up. Click Station ID in pop-up for county information and site selection.
Map loading slowly? Try a different browser. Web browser performance varies significantly.



https://groundwaterwatch.usgs.gov/StateMap.asp?sa=CA&sc=06

Groundwater

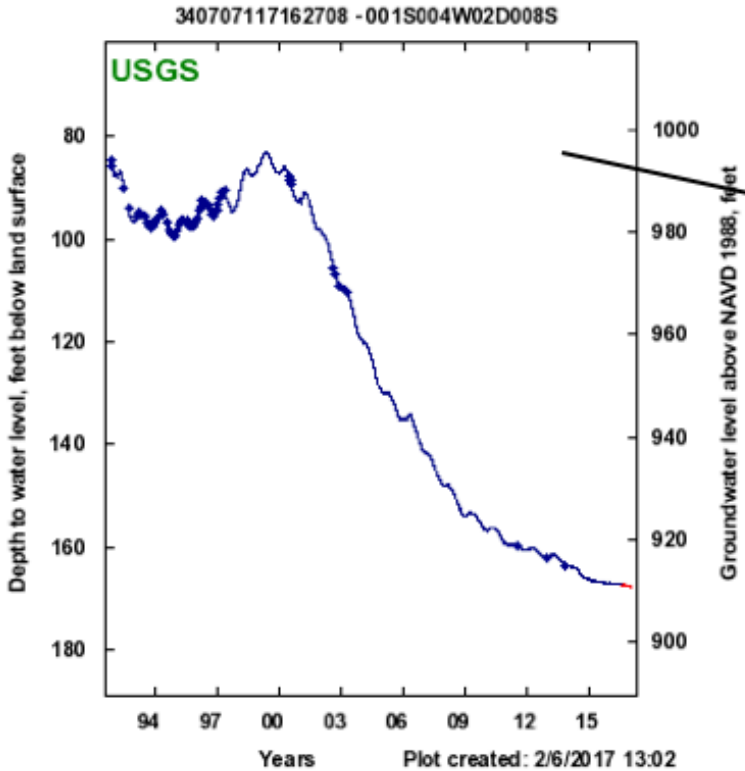


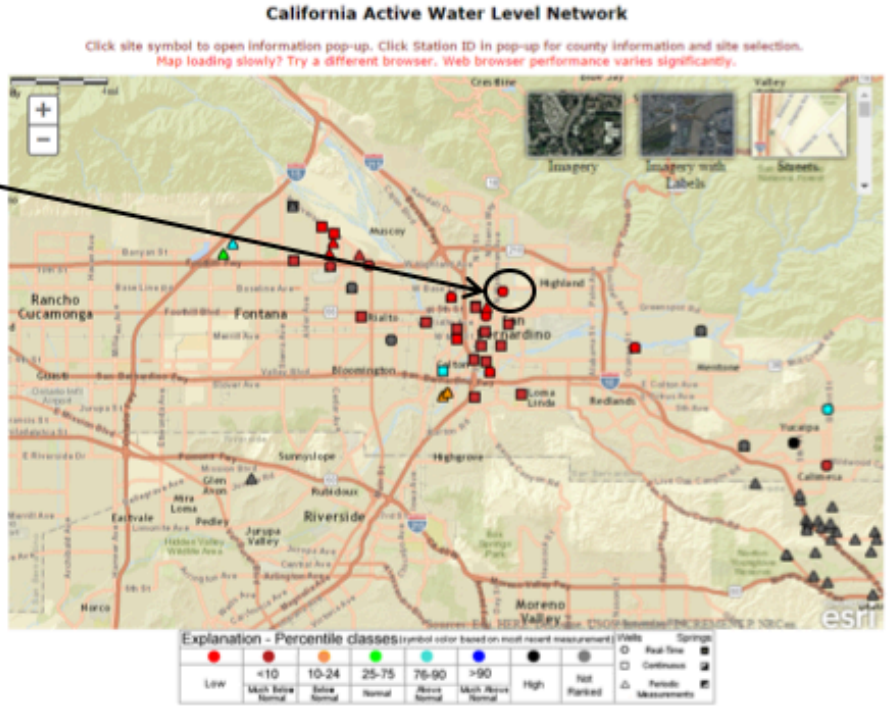
Site near San Diego

Last measurement: 02/02/2017

Start of record: 09/12/2003

Groundwater





Site near Riverside

Last measurement: 02/02/2017

Start of record: 10/21/1991

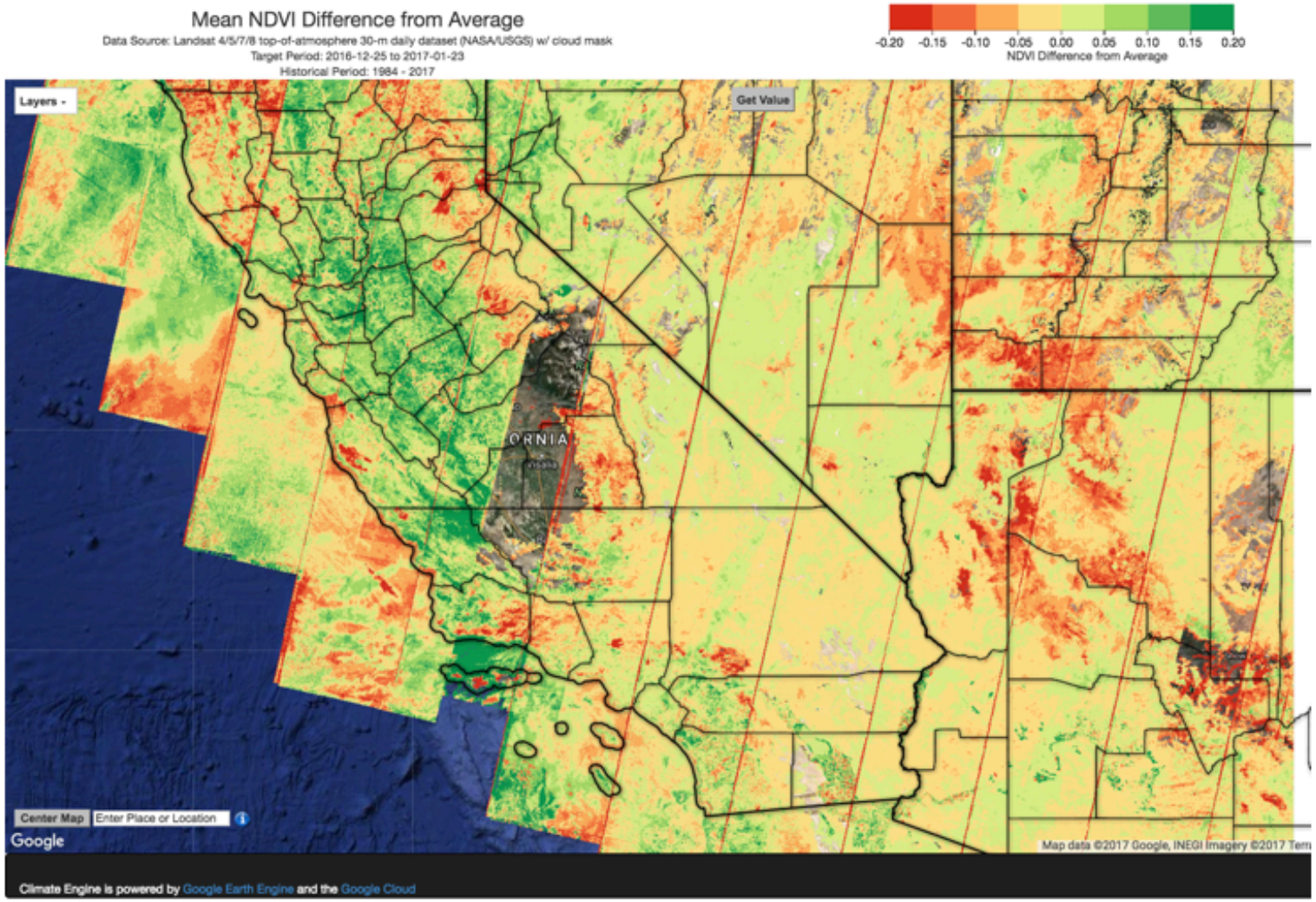
Vegetation

Landsat 4/5/7/8 Normalized Difference Vegetation Index (NDVI) Anomaly
12-25-2016 to 01-23-2017, Historical period: 1984-2017

Green = healthy/greener vegetation

Red = stressed and browner vegetation

NDVI has no meaning in snow covered mountains



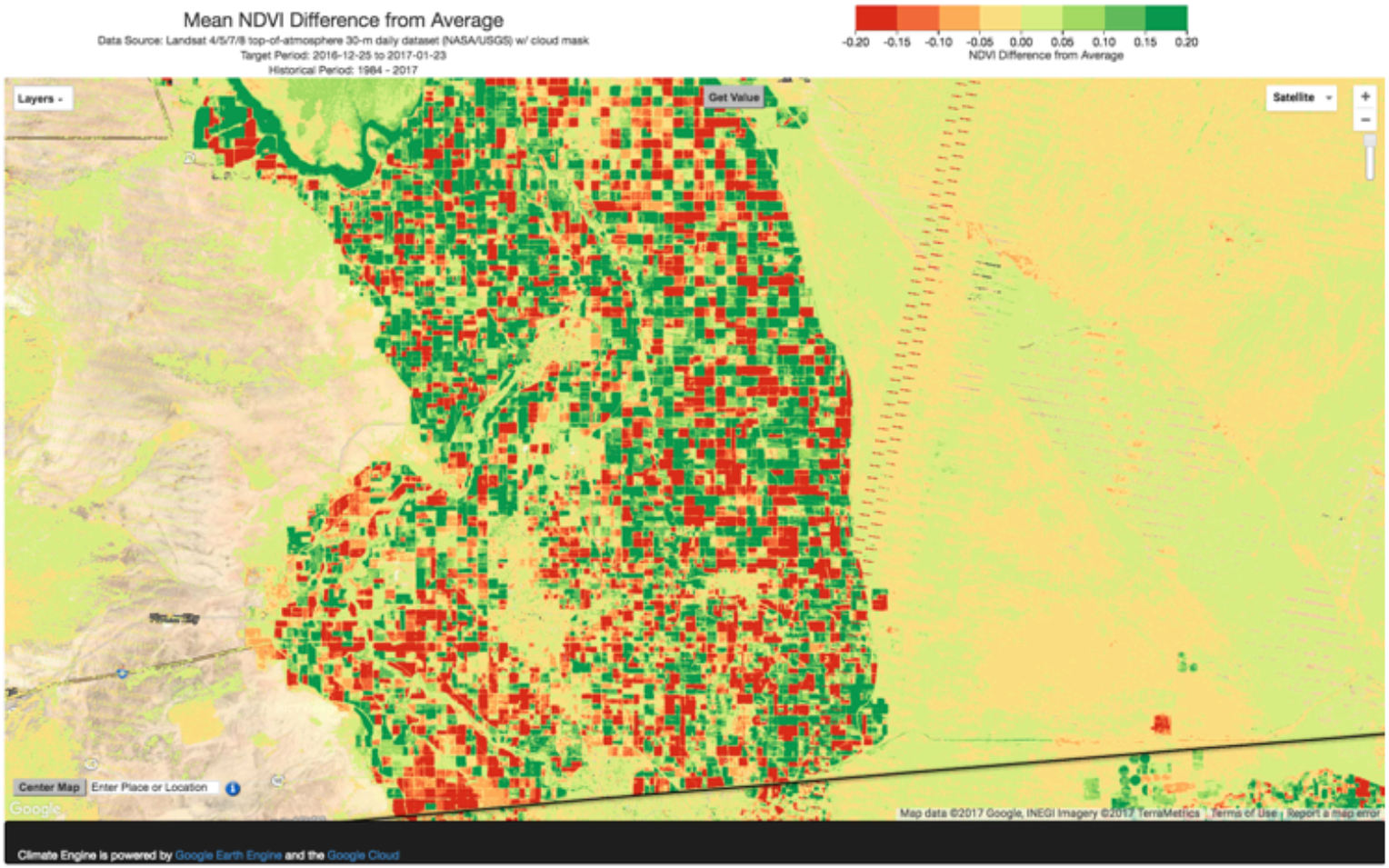
Climate Engine: http://clim-engine.appspot.com/

Imperial Valley NDVI

Landsat 4/5/7/8 Normalized Difference Vegetation Index (NDVI) Anomaly
12-25-2016 to 01-23-2017, Historical period: 1984-2017

Green = likely healthy active fields

Red = likely fallowed or stressed fields



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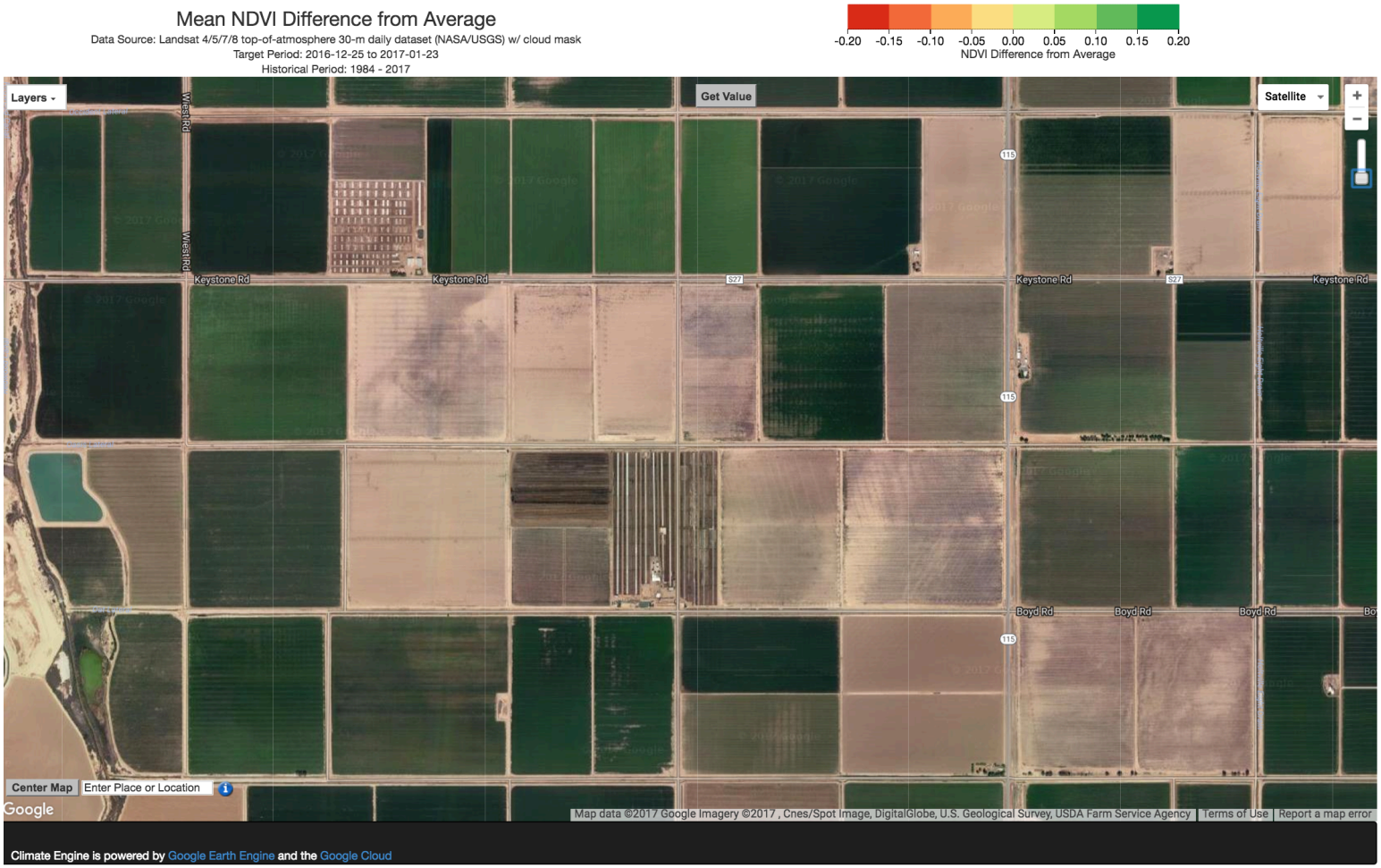

Climate Engine: http://clim-engine.appspot.com/

Final Thoughts

- California surface water drought is quickly coming to end this winter
- Big unknowns:
  - Groundwater
  - Ecosystem impacts and response to wet winter
  - Will the wet winter continue?
  - Moisture and weather can “turn off” as fast as it “turned on” in California

Thank you!

Questions?

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