Contributors

Ben McMahan
SWCO Editor; Assistant Research Scientist
CLIMAS, Institute of the Environment

Mike Crimmins
UA Extension Specialist

Dave Dubois
New Mexico State Climatologist

Gregg Garfin
Founding Editor and Deputy Director of Outreach, Institute of the Environment

Nancy J. Selover
Arizona State Climatologist

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April Southwest Climate Outlook

March Precipitation and Temperature: March precipitation was average to above-average across most of Arizona, New Mexico and west Texas, while the upper basin of the Colorado River was much above-average (Fig. 1a). March temperatures were average to above-average in Arizona and New Mexico, despite most of the United States being average to below-average (Fig. 1b).

Seasonal Precipitation and Temperature: Jan-Mar precipitation demonstrated a distinct pattern; Arizona and most of the Southwest recorded above-average to much above-average precipitation, while most of New Mexico and west Texas were average to below-average (Fig. 2a). Temperatures for the same period were average to above-average in New Mexico and west Texas, and average to below-average in Arizona and much of the rest of the Southwest (Fig. 2b). Water year precipitation (since Oct. 1) highlights wetter-than-average conditions in the west, with most of Arizona and New Mexico above normal (top 33-percent) or much above-normal (top 10-percent) (Fig. 3).

Drought: The Apr. 9 U.S. Drought Monitor (USDM) continues to show improvements in drought conditions in the western United States. Arizona is mostly clear of drought designations, and the intense drought in the four corners region and northern New Mexico have shown additional improvements in the USDM drought categorization compared to last month (Fig. 4).

Snowpack & Water Supply: Snow water equivalent (SWE) for stations in southern and central Arizona and New Mexico are below 25-percent of average, although late season calculations can be deceptive given low average values. The northern (higher elevation) stations in AZ and NM range from 110- to over 200-percent of average (Fig. 5), and the lower Colorado River Basin stations range from 125- to over-200 percent of average (See streamflow forecasts on p. 5).

Wildfire, Health, and Safety: Wildfire risk maps reflect the wet winter, with normal to below-normal fire risk in the Southwest in May, but above-normal risk across southern Arizona in June (Fig. 6), an increase tied to concerns over senescence of abundant fine fuels in lower elevations. Wet winter conditions and a warm spring also catalyzed a tremendous wildflower season in the Southwest, although allergy sufferers will note the trade-offs associated with air quality and abundant pollen.

El Niño Tracker: Atmospheric and oceanic conditions are in line with a weak El Niño, and the sea surface temperature (SST) anomalies officially reached the threshold for an El Niño event spanning from late 2018 to present. The current discussion is focused on when these conditions might revert to normal, likely in mid-to-late 2019, but with the possible persistence of this El Niño through 2019 and into early 2020 (see El Niño tracker on p. 3).

Precipitation and Temperature Forecast: The three-month outlook for May through July calls for increased chances of above-normal precipitation in eastern Arizona and western New Mexico, and increased chances of below-normal precipitation in western Arizona, eastern New Mexico, and west Texas (Fig. 7, top). The three-month temperature outlook calls for equal chances of normal, above-normal, and below-normal temperatures across Arizona, New Mexico, and Northern Mexico (Fig. 7, bottom).

Tweet Apr 2019 SW Climate Outlook

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APR2019 @CLIMAS_UA SW Climate Outlook, El Niño Tracker, Streamflow Forecasts, AZ & NM Reservoir volumes, CLIMAS colloquium videos, bit.ly/2DjAmR8 #SWclimate #AZWX #NMWX

April 2019 SW Climate Outlook

Online Resources

Figures 1-2
National Centers for Environmental Information
ncei.noaa.gov

Figures 3,5
Western Regional Climate Center
wrcc.dri.edu

Figure 4
U.S. Drought Monitor
droughtmonitor.unl.edu

Figure 6
National Interagency Fire Center
droughtmonitor.unl.edu

Figure 7
International Research Institute for Climate and Society
iri.columbia.edu

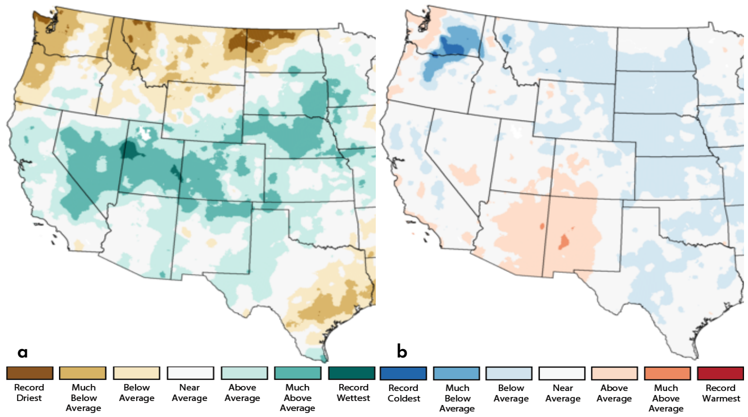


Figure 1: March 2019 Precipitation (a) & Temperature Ranks (b)

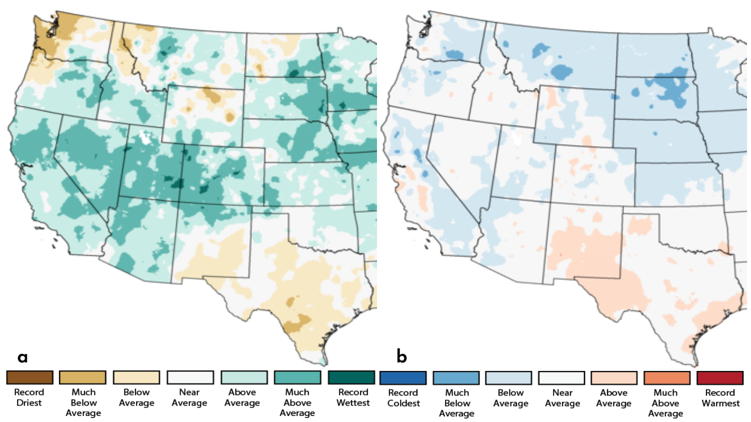


Figure 2: Jan 2019 - Mar 2019 Precipitation (a) & Temperature Ranks (b)

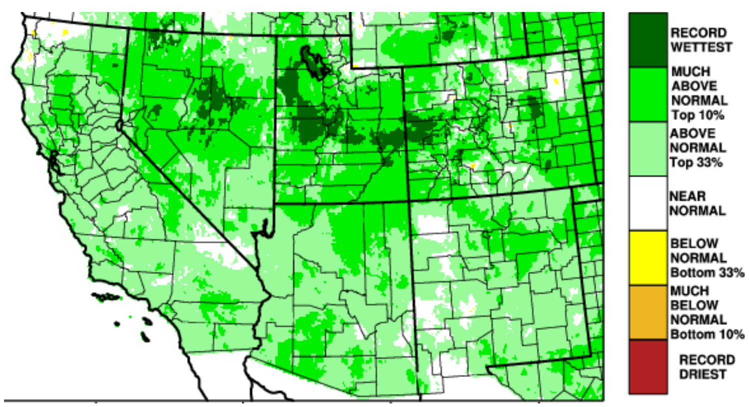


Figure 3: Oct 2018 - Mar 2019 - Precipitation Rankings

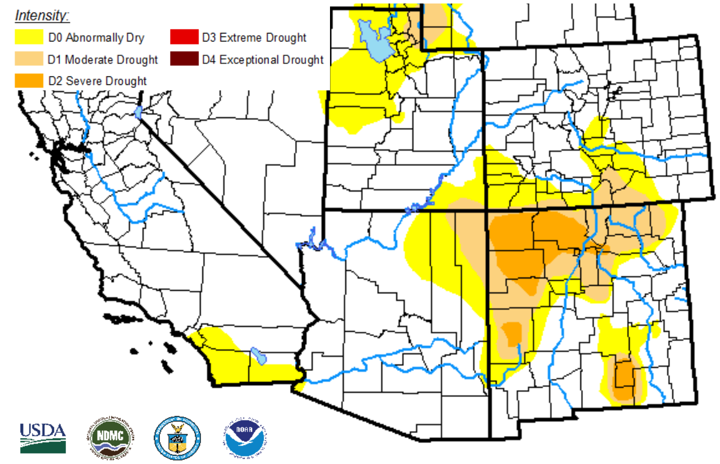


Figure 4: US Drought Monitor - Apr 9, 2019

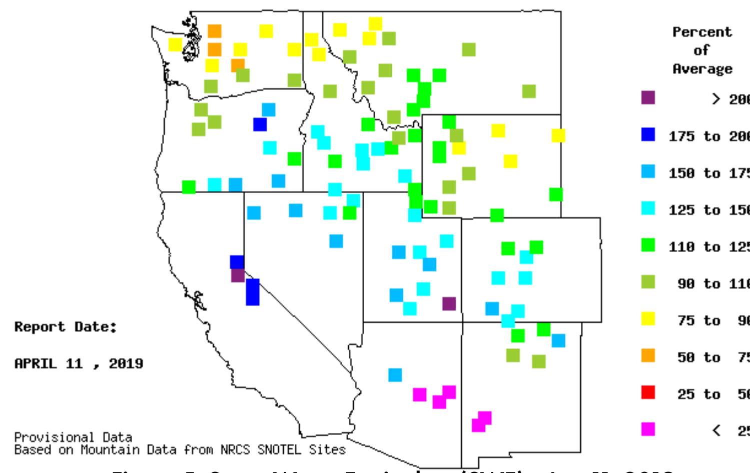


Figure 5: Snow Water Equivalent (SWE) - Apr 11, 2019

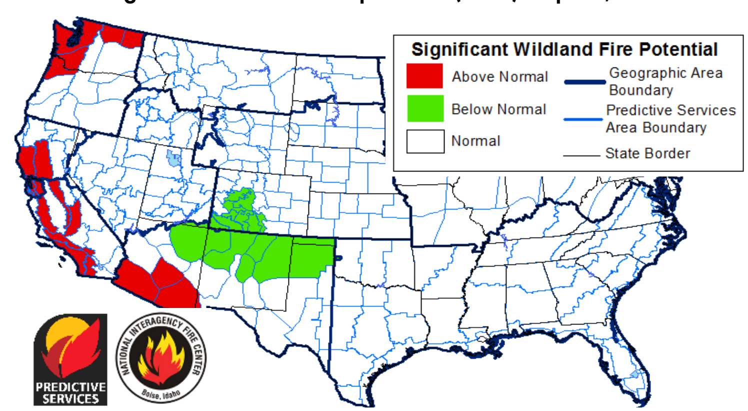


Figure 6: Significant Wildland Fire Potenatial June 2019

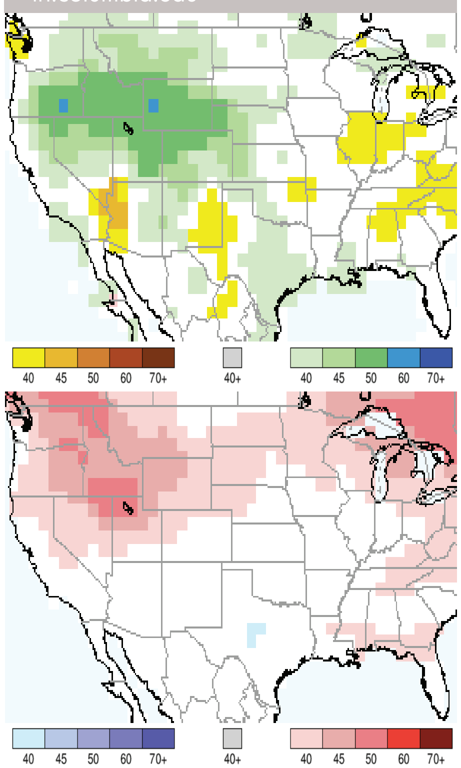


Figure 7: Three-Month (MJJ) Forecast for Precipitation (top) and Temperature (bottom)

Online Resources

Figure 1
International Research Institute for Climate and Society
iri.columbia.edu

Figure 2
NOAA - Climate Prediction Center
cpc.ncep.noaa.gov

Figure 3
Australian Bureau of Meteorology
bom.gov.au/climate/enso

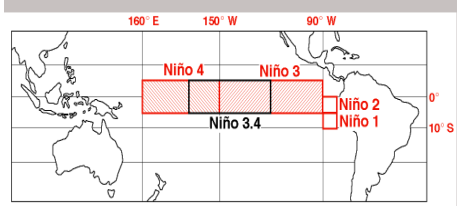
Figure 4
NOAA - Climate Prediction Center
cpc.ncep.noaa.gov

El Niño / La Niña

Information on this page is also found on the CLIMAS website:

climas.arizona.edu/sw-climate/el-niño-southern-oscillation

Equatorial Niño Regions



For more information: ncdc.noaa.gov/teleconnections/enso/indicators/sst/

Image source: aoml.noaa.gov/

El Niño Tracker

Seasonal outlooks and forecasts emphasize clear atmospheric and oceanic conditions that are consistent with a weak El Niño event, and the discussion has shifted to how long the event will last. On Apr. 10, the Japanese Meteorological Agency (JMA) highlighted that El Niño conditions had persisted in March, and with an 80-percent chance of these conditions lasting until summer. On Apr. 11, the NOAA Climate Prediction Center (CPC) maintained their El Niño advisory, identifying both oceanic and atmospheric conditions consistent with a weak El Niño event. Their outlook maintained a 65-percent chance of El Niño lasting through summer, and 50- to 55-percent of it lasting through fall. On Apr. 11, the International Research Institute (IRI) issued an ENSO Quick Look (Fig. 1), highlighting above-average sea surface temperatures (SSTs) and atmospheric conditions consistent with El Niño over the past few months. On Apr. 16, the Australian Bureau of Meteorology elevated their tracker to an El Niño alert, with a 70-percent chance of an El Niño event in the coming months. The North American Multi-Model Ensemble (NMME) points toward a weak El Niño lasting into fall 2019 (Fig. 2).

Summary: Sea surface temperatures (SSTs) are above-average across most of the equatorial Pacific (Figs. 3-4) and atmospheric conditions further indicate an established El Niño. The event officially met the diagnostic criteria at the end of March, with five consecutive months or greater where the 3-month SST anomalies were above the threshold of 0.5 C. What does this mean for the region? The first three months of 2019 support the idea that El Niño brings enhanced precipitation to the region (see Fig. 2 on p. 2), but we are also approaching a warmer and drier time of year, so there is less of a precipitation signal to influence. El Niño conditions are also associated with enhanced eastern Pacific tropical storm activity, which could see tropical storms increase our warm season precipitation totals in direct ways (i.e. storms that push into the region) or that provide additional moisture and instability that enhances monsoon activity. The uncertainty associated with forecasts during the so called "spring predictability barrier" make predictions more speculative than certain, but the persistence of an El Niño would seem to suggest additional opportunities for precipitation events over the warm season. These additional opportunities could augment monthly and seasonal totals, and depending on timing and intensity, help mitigate wildfire risk or boost reservoir storage.

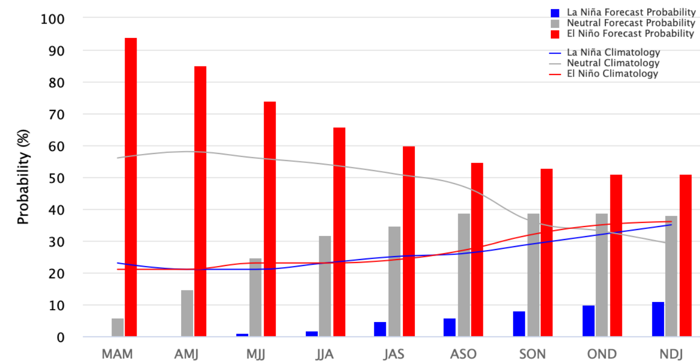


Figure 1: Early-Apr IRI/CPC Model-Based Probabilistic ENSO Forecast

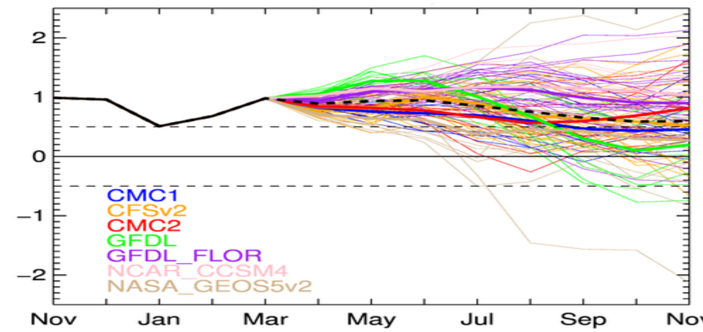


Figure 2: North American Multi-Model Ensemble Forecast for Niño 3.4

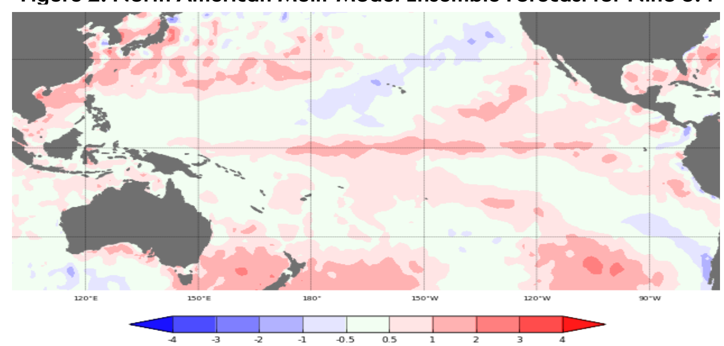


Figure 3: March 2019 Sea Surface Temperature (SST) Anomalies

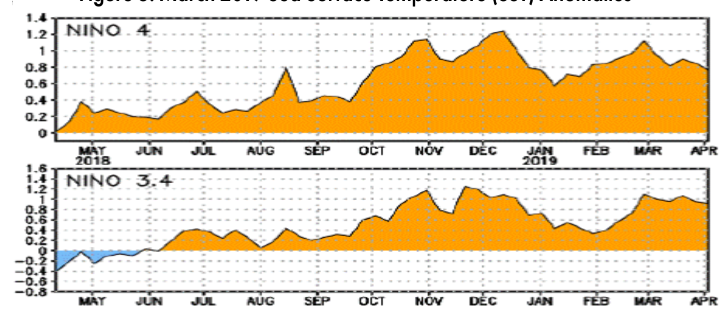


Figure 4: SST Anomalies in Niño Regions 3.4 & 4 (NCDC)

Online Resources

Figure 1
Natural Resources Conservation Service
nrcs.usda.gov

Figures 2-3
Western Regional Climate Center
wrcc.dri.edu

April 2019 Streamflow Forecast

Streamflow estimates as of April 1, 2019 (Fig. 1) reflect the precipation patterns observed over winter and early spring (Fig. 2). This highlights the extent to which UT, NV – and portions of CO and CA – saw much above-average precipitation during this period.

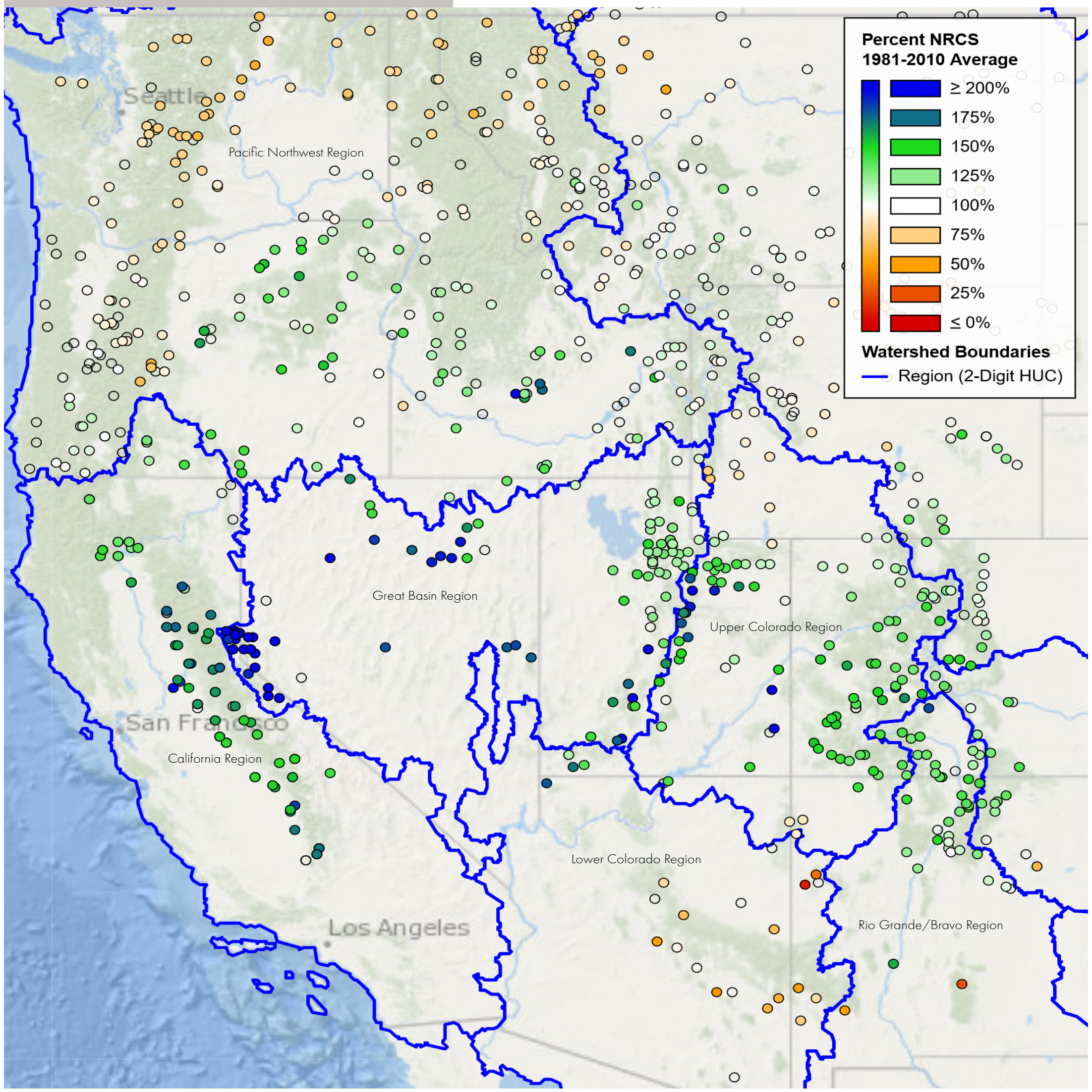


Figure 1: Forecast Volume - 50% Exceedance Probability (Apr 1, 2019)

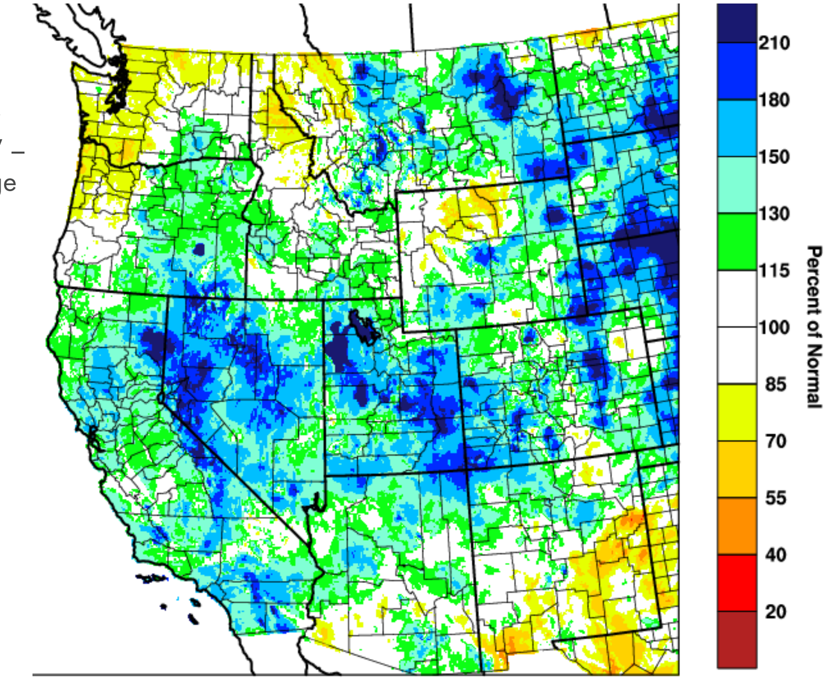


Figure 2: Percent of Normal Precipitation - Dec 2018 - Mar 2019

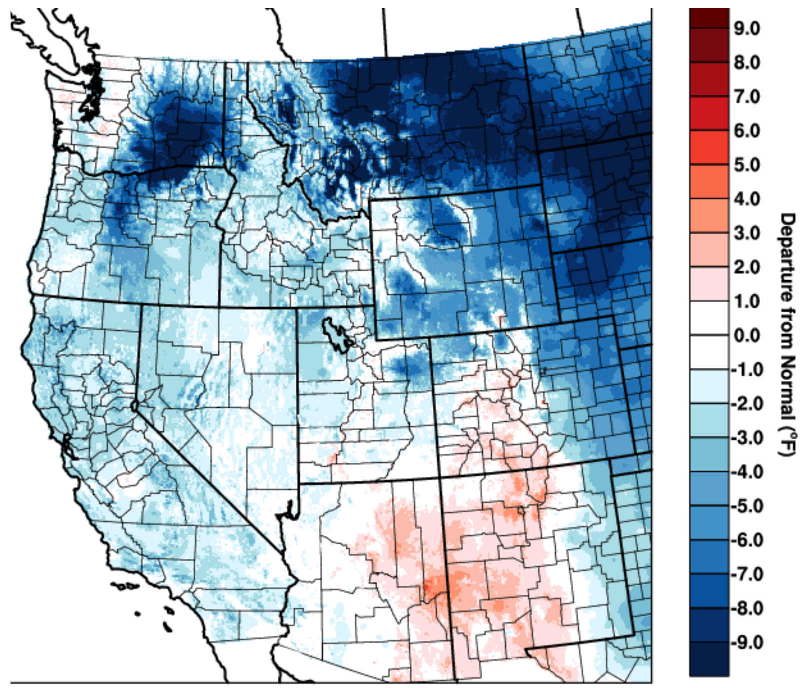


Figure 3: Mean Temperature Departure from Normal - Mar 2019

Online Resources

Portions of the information provided in this figure is available at the Natural Resources Conservation Service
www.wcc.nrcs.usda.gov/BOR/basin.html

Contact Ben McMahan with questions/comments.

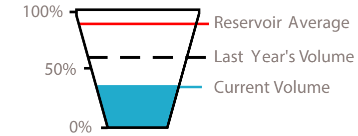
The map gives a representation of current storage for reservoirs in Arizona and New Mexico. Reservoir locations are numbered within the blue circles on the map, corresponding to the reservoirs listed in the table. The cup next to each reservoir shows the current storage (blue fill) as a percent of total capacity. Note that while the size of each cup varies with the size of the reservoir, these are representational and not to scale. Each cup also represents last year's storage (dotted line) and the 1981–2010 reservoir average (red line).

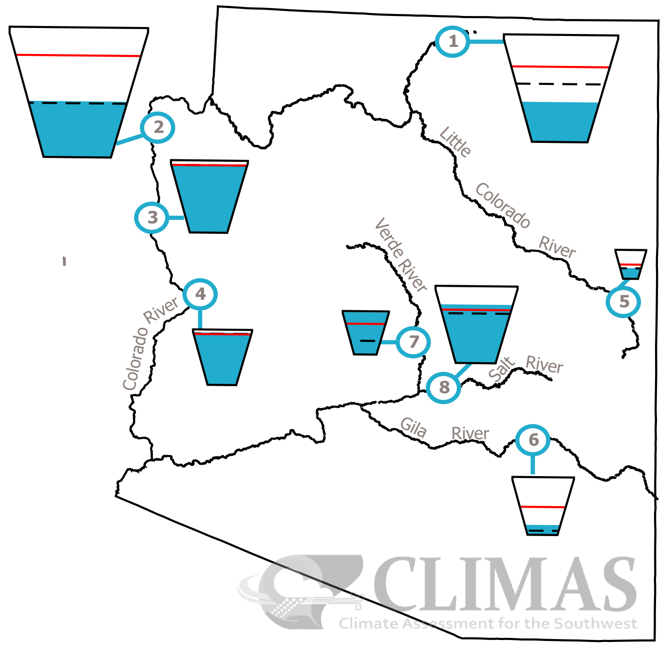
The table details more exactly the current capacity (listed as a percent of maximum storage). Current and maximum storage are given in thousands of acre-feet for each reservoir. One acre-foot is the volume of water sufficient to cover an acre of land to a depth of 1 foot (approximately 325,851 gallons). On average, 1 acre-foot of water is enough to meet the demands of four people for a year. The last column of the table lists an increase or decrease in storage since last month. A line indicates no change.

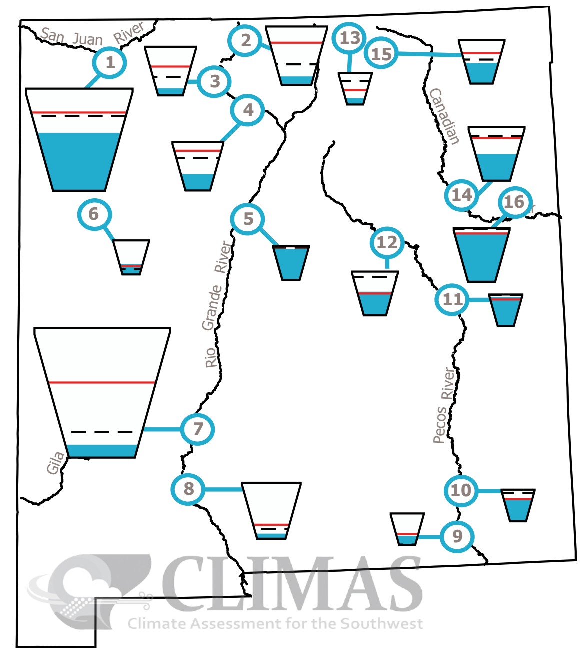
These data are based on reservoir reports updated monthly by the National Water and Climate Center of the U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS).

Reservoir Volumes

DATA THROUGH APR 1, 2019
Data Source: National Water and Climate Center, Natural Resources Conservation Service







* in KAF = thousands of acre-feet

Reservoir	Capacity	Current Storage*	Max Storage*	One-Month Change in Storage*
1. Lake Powell	37%	9,049.0	24,322.0	-211.7
2. Lake Mead	42%	10,877.0	26,159.0	195.0
3. Lake Mohave	93%	1,687.0	1,810.0	-17.0
4. Lake Havasu	94%	579.4	619.0	6.0
5. Lyman	37%	11.1	30.0	7.4
6. San Carlos	17%	149.1	875.0	81.9
7. Verde River System	98%	280.5	287.4	27.9
8. Salt River System	75%	1,520.3	2,025.8	330.3

*KAF: thousands of acre-feet

Reservoir	Capacity	Current Storage*	Max Storage*	One-Month Change in Storage*
1. Navajo	56%	955.5	1,696.0	90.3
2. Heron	15%	59.2	400.0	2.4
3. El Vado	14%	25.7	190.3	9.8
4. Abiquiu	34%	63.3	186.8	-7.7
5. Cochiti	91%	45.6	50.0	-0.6
6. Bluewater	30%	11.6	38.5	7.5
7. Elephant Butte	10%	219.6	2,195.0	48.8
8. Caballo	9%	31.1	332.0	3.4
9. Lake Avalon	29%	1.3	4.5	0.0
10. Brantley	71%	29.8	42.2	-2.0
11. Sumner	92%	32.9	35.9	-0.9
12. Santa Rosa	54%	57.5	105.9	4.8
13. Costilla	19%	3.0	16.0	-0.1
14. Conchas	50%	128.1	254.2	-0.3
15. Eagle Nest	46%	36.6	79.0	2.6
16. Ute Reservoir	92%	184	200	0.0

Online Resources

Figure 1
Climate Program Office
cpo.noaa.gov

RISA Program Homepage
cpo.noaa.gov/Meet-the-Divisions/Climate-and-Societal-Interactions/RISA

UA Institute of the Environment
environment.arizona.edu

New Mexico Climate Center
weather.nmsu.edu

CLIMAS Research & Activities

CLIMAS Research
climas.arizona.edu/research

CLIMAS Outreach
climas.arizona.edu/outreach

Climate Services
climas.arizona.edu/climate-services

CLIMAS
Climate Assessment for the Southwest
A NOAA RISA TEAM

The Climate Assessment for the Southwest (CLIMAS) program was established in 1998 as part of the National Oceanic and Atmospheric Administration's Regional Integrated Sciences and Assessments program. CLIMAS—housed at the University of Arizona's (UA) Institute of the Environment—is a collaboration between UA and New Mexico State University. The CLIMAS team is made up of experts from a variety of social, physical, and natural sciences who work with partners across the Southwest to develop sustainable answers to regional climate challenges

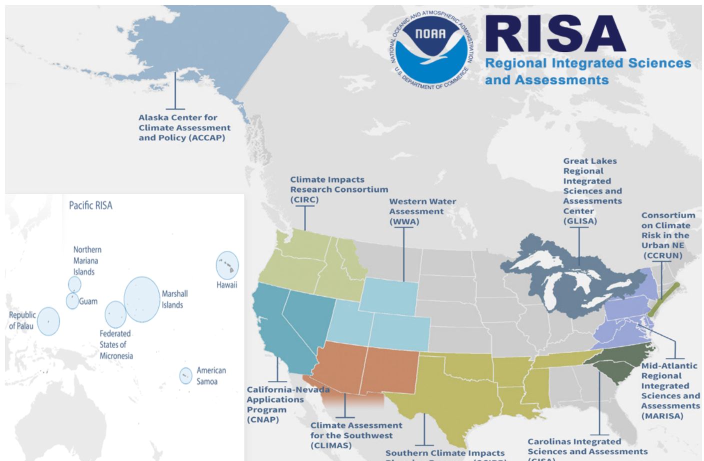


Figure 1: NOAA Regional Integrated Sciences and Assessments Regions

What does CLIMAS do?

The CLIMAS team and its partners work to improve the ability of the region's social and ecological systems to respond to and thrive in a variable and changing climate. The program promotes collaborative research involving scientists, decision makers, resource managers and users, educators, and others who need more and better information about climate and its impacts. Current CLIMAS work falls into six closely related areas: 1) decision-relevant questions about the physical climate of the region; 2) planning for regional water sustainability in the face of persistent drought and warming; 3) the effects of climate on human health; 4) economic trade-offs and opportunities that arise from the impacts of climate on water security in a warming and drying Southwest; 5) building adaptive capacity in socially vulnerable populations; and 6) regional climate service options to support communities working to adapt to climate change.

RISA Program Video on CLIMAS Dust Research

https://youtu.be/ENylO-coRKg

CLIMAS Colloquium Presentations on YouTube

Dave DuBois and Jaylen Fuentes: Preparing for the next dust storm: Collaborations with state and federal agencies with roadway dust hazards

https://youtu.be/2csJSTl1YBA

Zahra (Vida) Ghodisidah: Modeling of Dust Emissions over the Chihuahuan Desert

https://youtu.be/kFmIGqZv8EU

Josue Gutierrez: Dust Classification from Weather Observation Stations and Remote Sensing

https://youtu.be/WIou8gsOSJQ

Heidi Brown: Water Harvesting as Maladaptation with Respect to Vector-borne Diseases

https://youtu.be/KfVzZpnK_M0

Ladd Keith: Evaluating the Use of Urban Heat Island and Heat Increase Modeling in Land Use and Planning Decision-Making

https://youtu.be/0sg43EZ97Zk

Ben McMahan: Visualization and Analysis Tools for the North American Monsoon - Integrating Citizen Science Data and Observations

https://youtu.be/gG_kdCRwCts