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January 2021 Southwest Climate Outlook

December Precipitation and Temperature: Precipitation was near normal to record driest across most of Arizona and New Mexico in December (Fig. 1), while temperatures ranged between above and below normal in most of Arizona and New Mexico (Fig. 2).

2020 Precipitation and Temperature: Annual precipitation totals ranged between below average and record driest in Arizona and New Mexico (Fig. 3a). Mean annual temperature was much above average in most of the Southwest, with a few pockets of record warmest (Fig. 3b). See Fig. 1 on page 5 highlighting daily, record, and normal high and low temperatures, for select weather stations from around the region.

Drought: The Jan 12 U.S. Drought Monitor (USDM) for the U.S. Southwest ranges from moderate drought (D1) to exceptional drought (D4), but a vast majority of the region is in D3 or D4 (Fig. 4).

Snowpack and Water Supply: Snow water equivalent (SWE) data from the NRCS highlights how snow conditions deviate from the 1981-2010 median (Fig. 5). Many of the region's reservoirs are at or below the values recorded at this time last year, and most are also below their long-term average (see Arizona and New Mexico reservoir storage on p. 7). The implications for the current conditions and the La Niña forecast are also reflected in streamflow forecasts (Fig. 6).

ENSO Tracker: Moderate La Niña conditions are present and are expected to continue through winter (see ENSO-tracker on p. 3 for details). If the region records below-average precipitation, as is forecast in most monthly and seasonal outlooks (see below, Fig. 7), this does not bode well for drought conditions in the Southwest.

Precipitation and Temperature Forecast: The three-month outlook for Feb through Apr calls for increased chances for below-normal precipitation across the southwestern U.S. and northern Mexico (Fig. 7, top). The three-month temperature outlook calls for increased chances of above-normal temperatures across much of the southwestern U.S. and northern Mexico (Fig. 7, bottom).

Tweet Jan 2021 SW Climate Outlook

JAN2021 @CLIMAS_UA SW Climate Outlook, La Niña Outlook, 2020 SW Temps & Precip Recap, AZ & NM Reservoirs https://bit.ly/2Y5ewe9 #SWclimate #AZWx #NMWx

Jan 2021 SW Climate Outlook

Online Resources

Figures 1-2
West Wide Drought Tracker
wrcc.dri.edu/wwdt

Figure 3
National Centers for Environmental Information
ncdc.noaa.gov/sotc

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

Figures 5-6
National Resource Conservation Service
nrcs.usda.gov

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

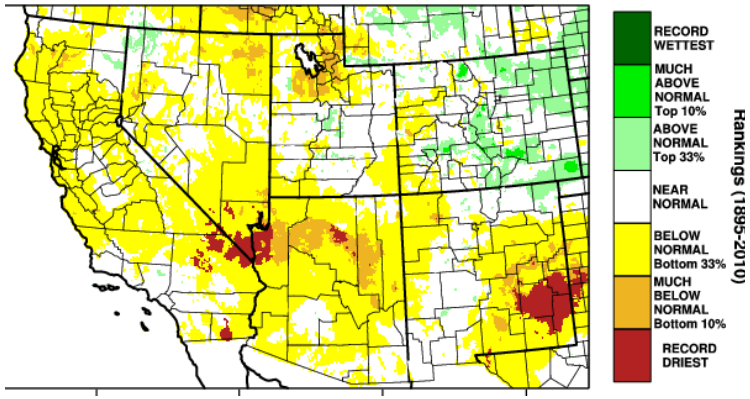


Figure 1: December 2020 Precipitation Rankings

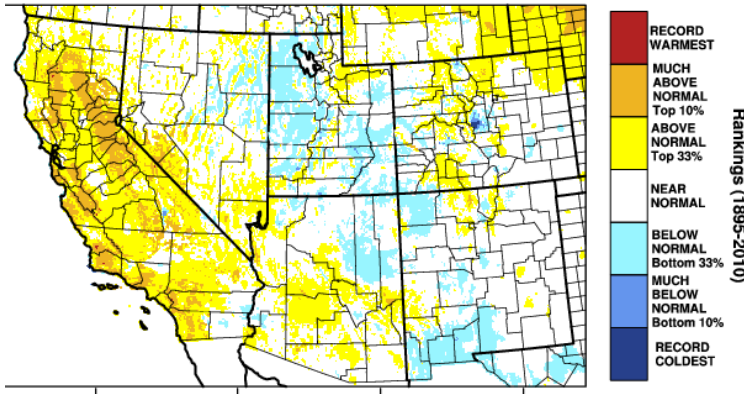


Figure 2: December 2020 Temperature Rankings

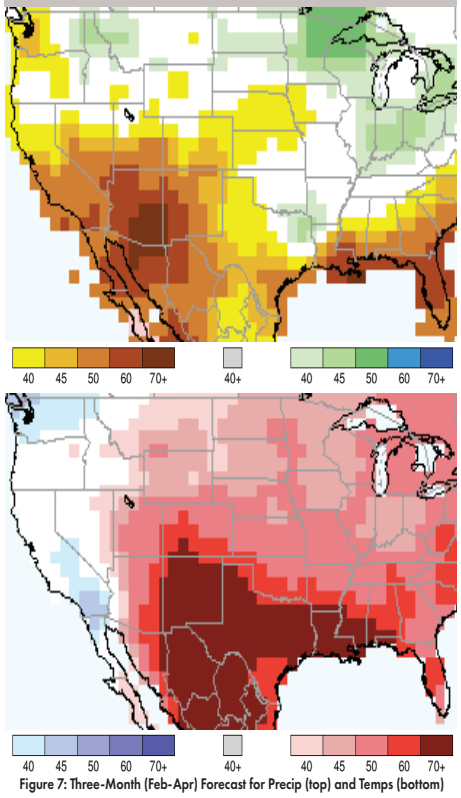


Figure 7: Three-Month (Feb-Apr) Forecast for Precip (top) and Temps (bottom)

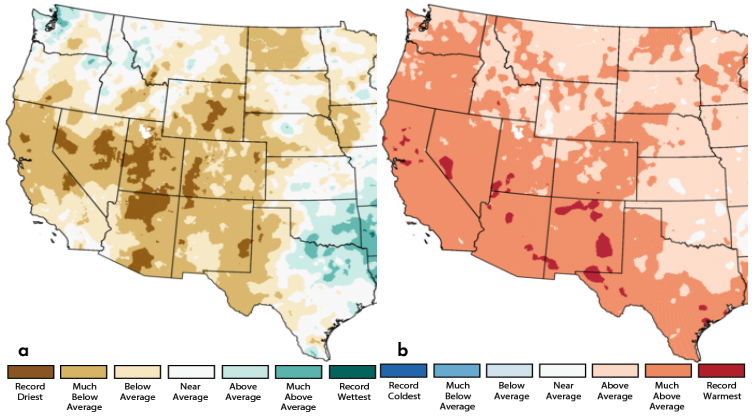


Figure 3: 2020 Annual Precipitation (a) & Temperature Ranks (b)

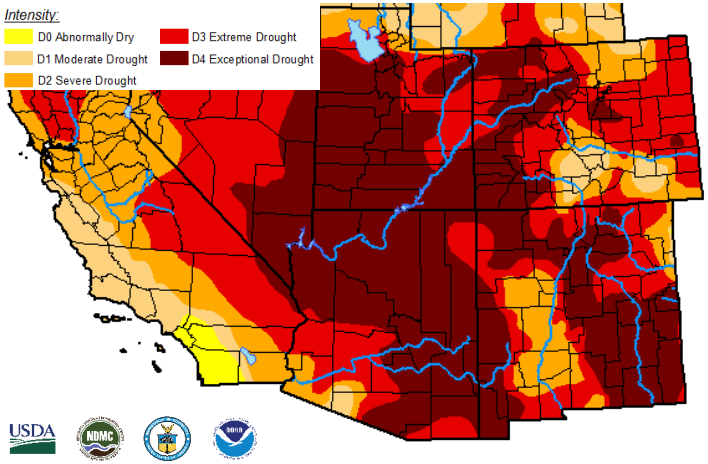


Figure 4: US Drought Monitor - Jan 12, 2021

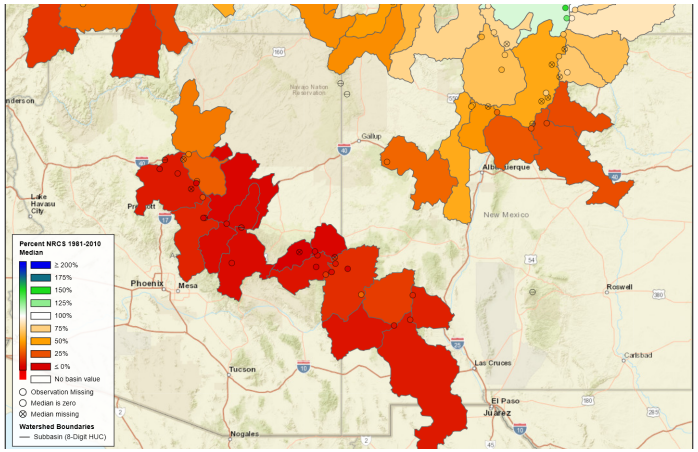


Figure 5: Snow Water Equivalent Percent of 1981-2010 Median (Jan 18, 2021)

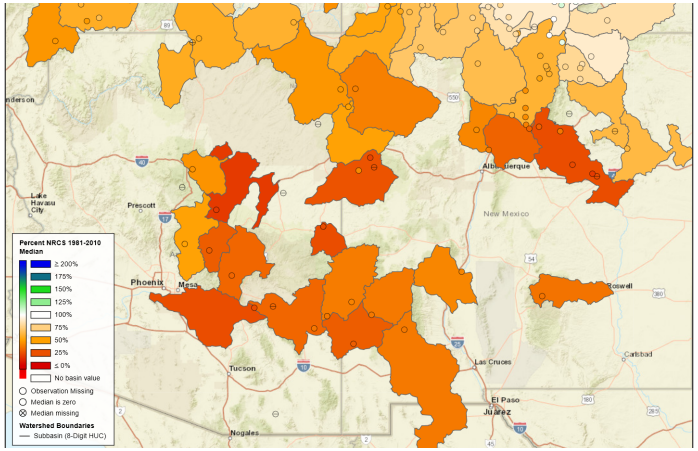


Figure 6: Jan 18 Streamflow Forecast Percent of Median 50% Exceedence Prob.

Online Resources

Figure 1
Australian Bureau of Meteorology
bom.gov.au/climate/enso

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

Figure 3
International Research Institute for Climate and Society
iri.columbia.edu

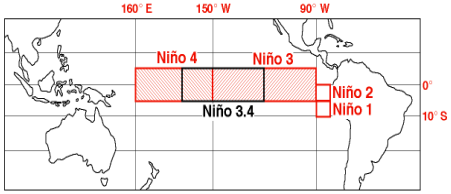
Figure 4
NOAA - Climate Prediction Center
cpc.ncep.noaa.gov

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/

ENSO Tracker

Sea surface temperature (SST) forecasts for February 2021 call for below-normal conditions across the equatorial Pacific (Fig. 1), extending the trend of the last 4-5 months (Fig. 2). International climate outlooks generally see La Niña conditions persisting through winter 2020-2021 before returning to ENSO-neutral conditions over spring 2021.

Forecast Roundup: On Jan 12, the Japanese Meteorological Agency (JMA) maintained its observation of an ongoing La Niña event, and with a 50-percent chance of this event either continuing or a return to ENSO-neutral conditions. On Jan 14, the NOAA Climate Prediction Center (CPC) ENSO status was at La Niña Advisory. The CPC called for a 95-percent chance of La Niña continuing through March and a 55-percent chance of transition to neutral during late spring or early summer. On Jan 14, the International Research Institute (IRI) issued an ENSO Quick Look (Fig. 3), noting "the east-central Pacific is roughly 1.2 degrees C below average, and all key atmospheric variables are consistent with La Niña conditions". On Jan 19, the Australian Bureau of Meteorology was at official La Niña status and noted, "La Niña is likely to have reached its peak with respect to sea surface temperature patterns in the eastern and central Pacific Ocean", but that impacts are expected to persist into spring. The North American Multi-Model Ensemble (solid and dashed black line, Fig. 4) indicates moderate La Niña conditions are expected for the next few months, with a return towards ENSO-neutral conditions by late spring or early summer.

Summary: La Niña conditions are present and likely to remain in place through winter or early spring. The monthly and seasonal climate outlooks suggest drier than normal conditions over the same period, consistent with La Niña events in the U.S. Southwest. Drier than normal does not mean zero precipitation, however (for example, there is a large event forecast for the region at the time of this writing). Still, the likely outcome would be less frequent events and lower seasonal totals, consistent with long-term averages for La Niña winters.

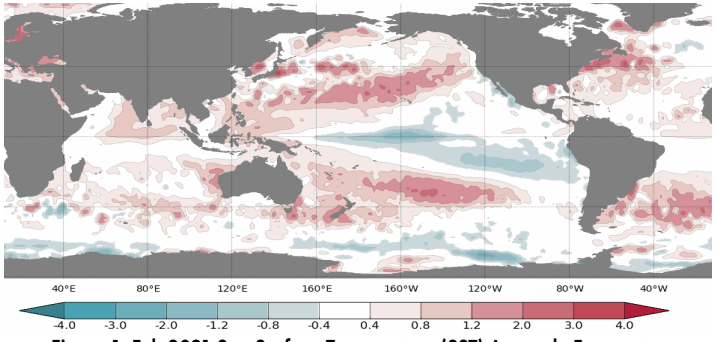


Figure 1: Feb 2021 Sea Surface Temperature (SST) Anomaly Forecast

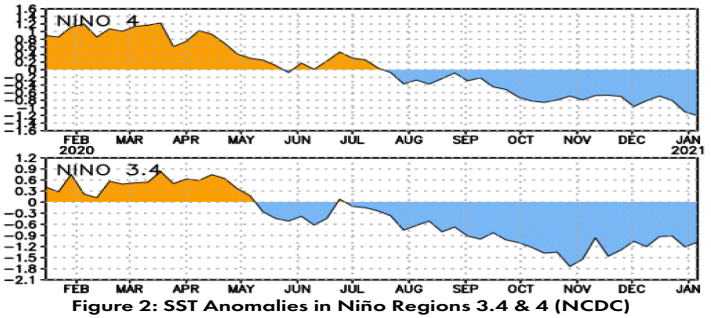


Figure 2: SST Anomalies in Niño Regions 3.4 & 4 (NCDC)

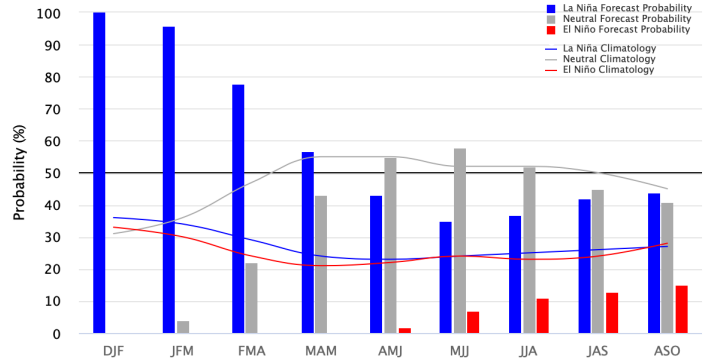


Figure 3: Early-Jan IRI/CPC Model-Based Probabilistic ENSO Forecast

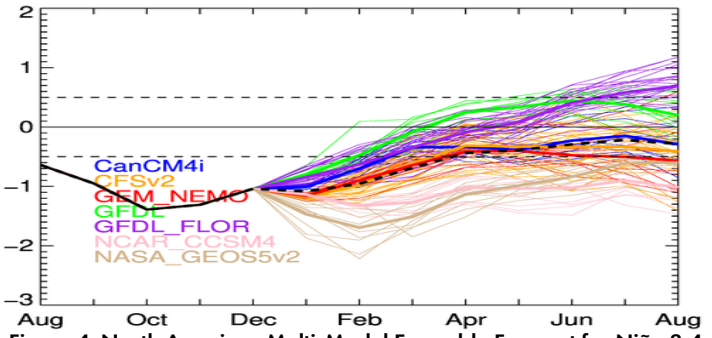


Figure 4: North American Multi-Model Ensemble Forecast for Niño 3.4

Online Resources

Figure 1
CLIMAS: Climate Assessment for the Southwest
climas.arizona.edu - data: RCC-ACIS

Figure 2
West Wide Drought Tracker
wrcc.dri.edu/wwdt

Figure 3
U.S. Drought Monitor
droughtmonitor.unl.edu

2020 Recap: Precipitation around the Southwest

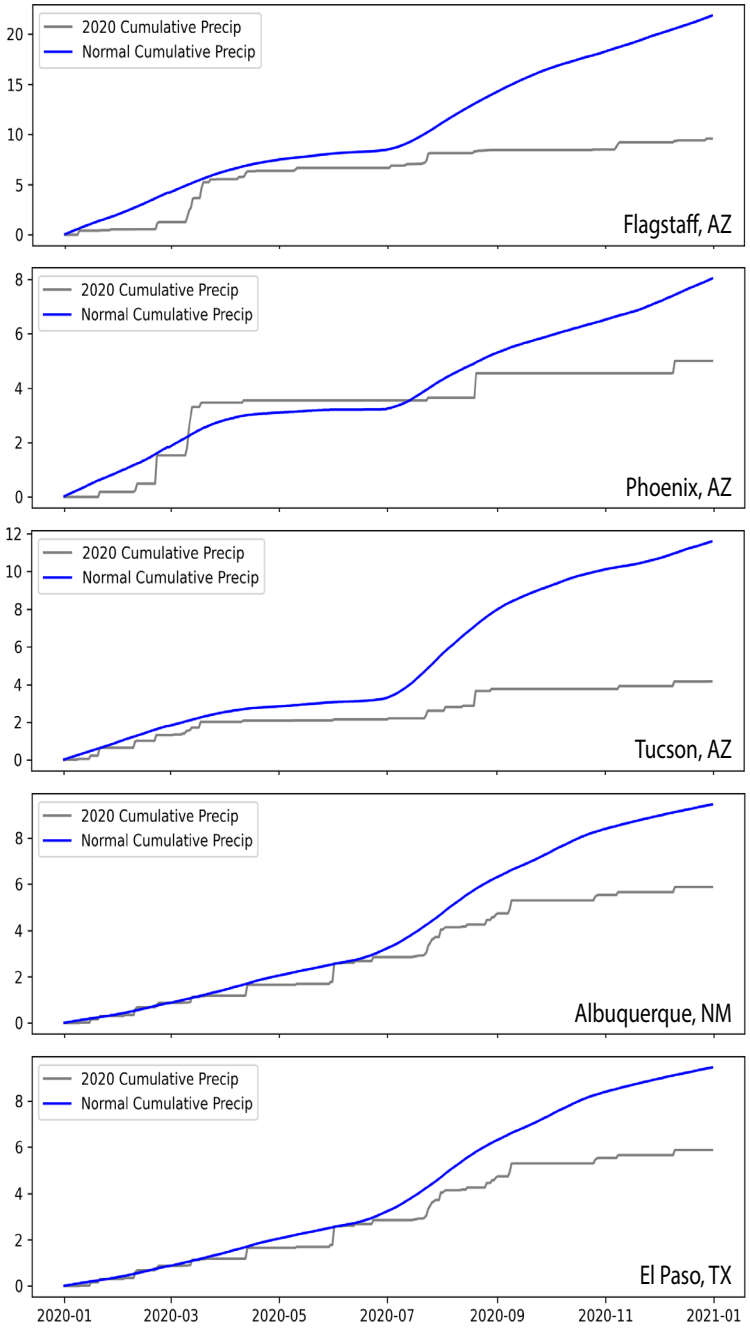


Figure 1: 2020 Cumulative/Normal Daily Precip, Jan 1 - Dec 31, 2020

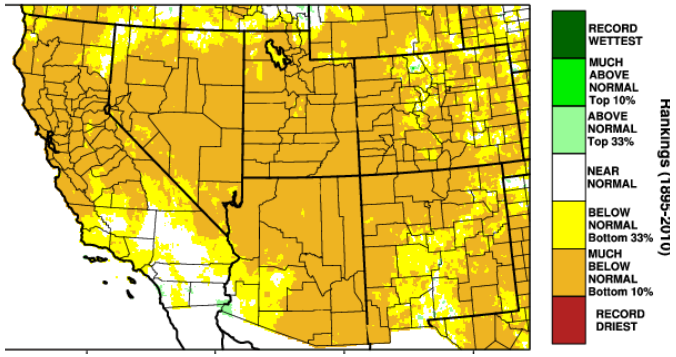


Figure 2: 2020 Precipitation Rankings

Cumulative annual precipitation at most stations was near- or below-normal for the first half of the year and then lagged further behind during the monsoon and into winter 2020 (Fig. 1). Annual precipitation rankings for 2020 highlight how widespread these conditions were in the Southwest (Fig. 2).

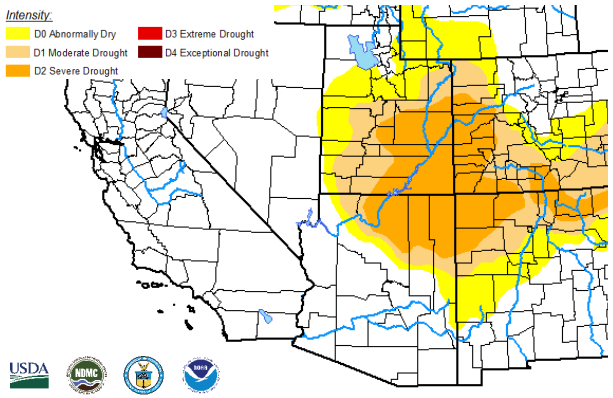


Figure 3: US Drought Monitor - Dec 31, 2019

One clear implication, particularly in the latter half of 2020, was the escalation of drought conditions in the Southwest (see Fig. 4, on p. 2). This stands in stark contrast to the much less expansive drought characterizations from the end of 2019 (Fig. 3, above). Note the persistent drought conditions observed in the Four Corners region across both time periods.

Online Resources

Figure 1
CLIMAS: Climate Assessment for the Southwest
climas.arizona.edu

data: RCC-ACIS

2020 Recap: Temperatures Around the Southwest

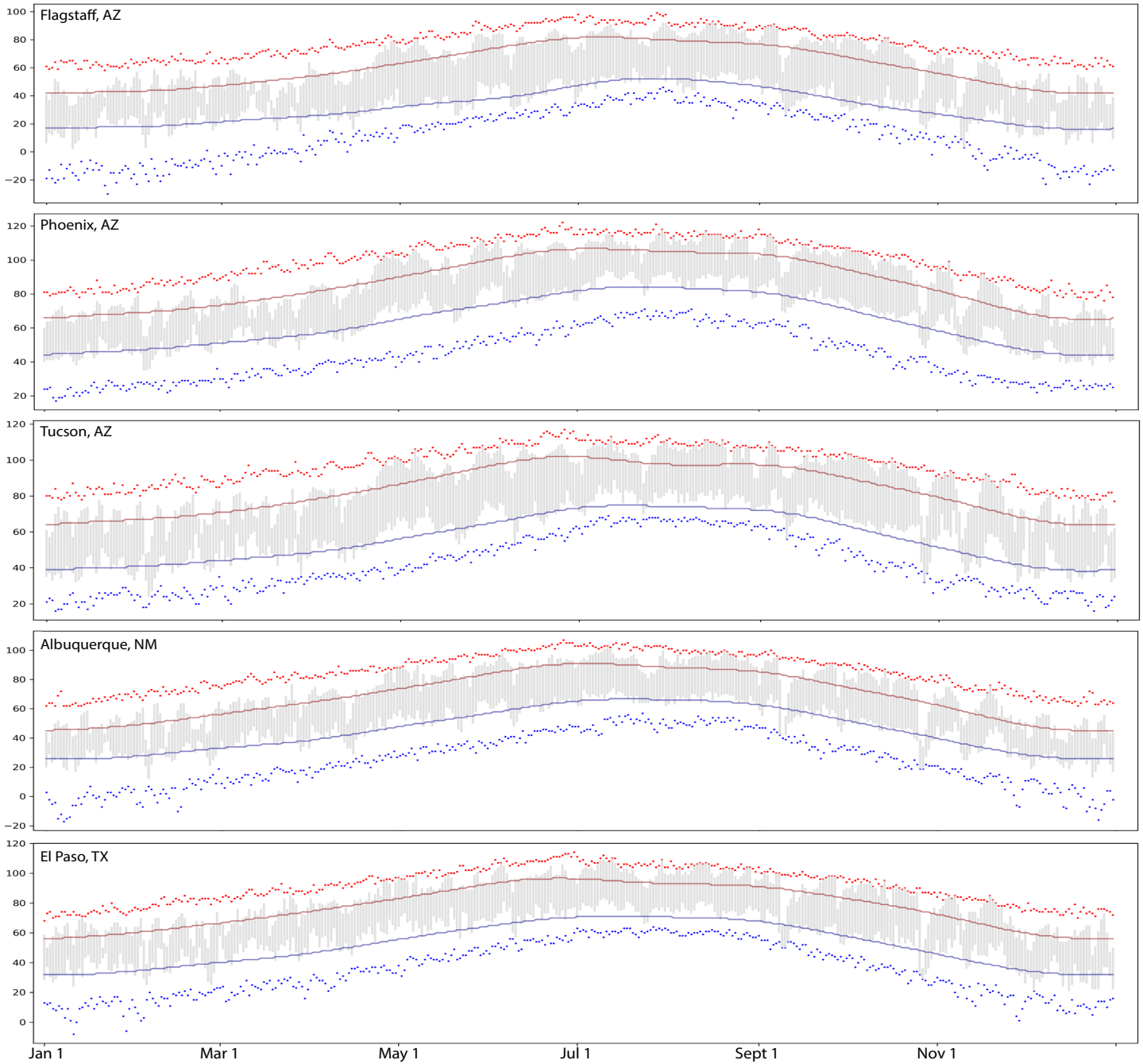


Figure 1: 2020 Daily Average, Normal, and Record High/Low Temperatures, Jan 1 - Dec 31, 2020

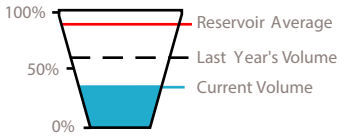
Online Resources

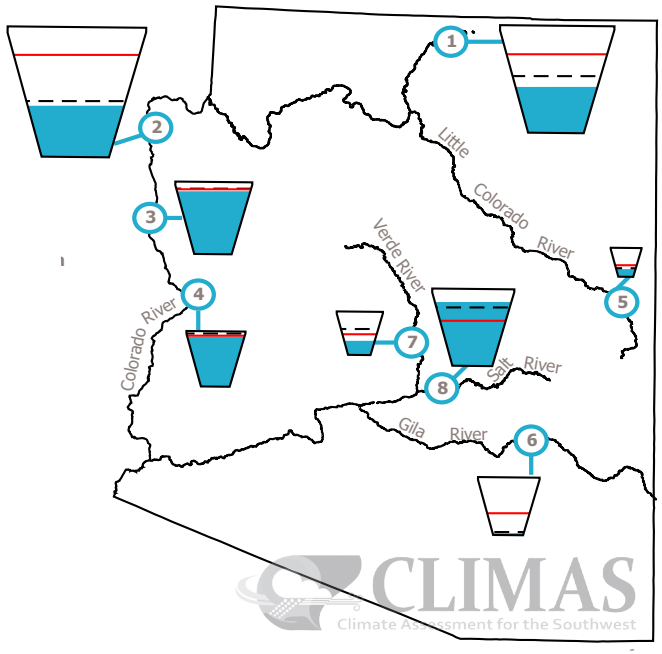
Portions of the information provided in this figure is available at the Natural Resources Conservation Service
www.wcc.nrcs.usda.gov/BOR/basin.html

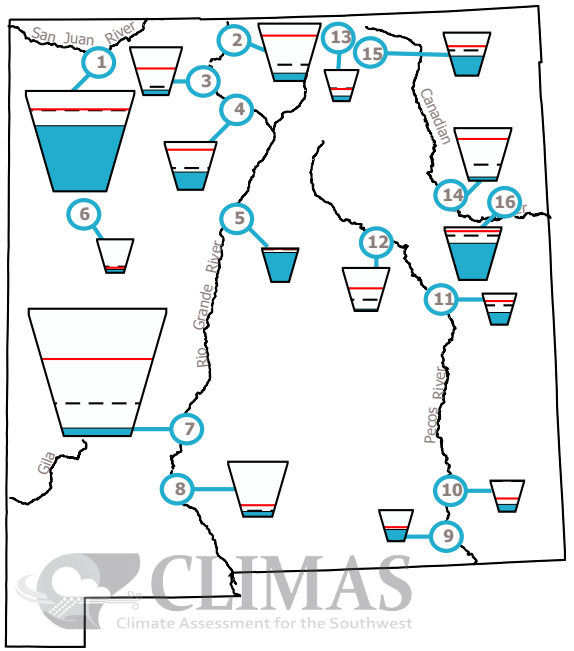
Contact Ben McMahan with questions/comments.

Reservoir Volumes

DATA THROUGH JAN 1, 2021
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	42%	10,130.0	24,322.0	-485.3
2. Lake Mead	39%	10,328.0	26,159.0	228.0
3. Lake Mohave	87%	1,581.0	1,810.0	-30.0
4. Lake Havasu	89%	553.2	619.0	-19.4
5. Lyman	26%	7.7	30.0	-0.1
6. San Carlos	2%	19.6	875.0	-4.7
7. Verde River System	32%	93.4	287.4	-11.8
8. Salt River System	82%	1,666.8	2,025.8	-1.9

*KAF: thousands of acre-feet

Reservoir	Capacity	Current Storage*	Max Storage*	One-Month Change in Storage*
1. Navajo	64%	1,079.5	1,696.0	-15.0
2. Heron	13%	53.3	400.0	-0.6
3. El Vado	10%	18.6	190.3	-3.0
4. Abiquiu	36%	66.4	186.8	2.6
5. Cochiti	85%	42.4	50.0	-1.1
6. Bluewater	9%	3.3	38.5	-0.1
7. Elephant Butte	6%	127.3	2,195.0	27.1
8. Caballo	9%	29.4	332.0	0.7
9. Lake Avalon	36%	1.6	4.5	0.5
10. Brantley	22%	9.3	42.2	2.7
11. Sumner	38%	13.6	35.9	3.2
12. Santa Rosa	3%	3.7	105.9	0.0
13. Costilla	15%	2.4	16.0	0.3
14. Conchas	6%	15.5	254.2	-1.0
15. Eagle Nest	44%	35.1	79.0	-0.3
16. Ute Reservoir	68%	137	200	-1.0

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).

Southwest Climate Podcast

climas.arizona.edu/media/podcasts

iTunes

https://apple.co/3kHh8bf

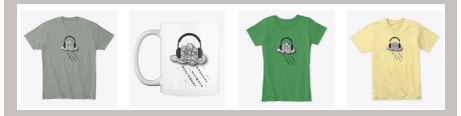
Android

https://bit.ly/2ILYHos

Stitcher

https://bit.ly/3nEWhHd

We also finally have podcast gear (shirts and mugs).



Order at: teespring.com/stores/the-southwest-climate-podcast.

Prices are the wholesale cost, so we don't make any money, but if you are interested in showing your support - or enjoying the (lack of a) monsoon in style, this is one way to do so.

The Southwest Climate Podcast

Dec 2020 - Tracking Drought Conditions, La Niña Forecasts, and What 2021 Might Bring

In the December edition of the CLIMAS Southwest Climate Podcast, Mike Crimmins and Zack Guido sit down to discuss drought, La Nina, and what to expect (or at least hope for) in 2021. First, they recap the event that swept through on Dec 9-11, to talk through how different locations in the region fared in terms of precip. Next, they transition into the drought situation, which is currently looking pretty dire for the region - and discuss 'just how much worse can it get' - given much of the region is at Exceptional Drought (D4, the highest category on the US Drought Monitor), looking to some past events for comparison. They wrap things up with some 2021 predictions - things they think could (or hope might) happen in 2021.

https://bit.ly/2IV7Awl

Previous Episodes

Nov 2020 - Unprecedented or Uncommon, A La Niña Winter after a Failed Monsoon

In the November episode of the CLIMAS Southwest Climate Podcast, Mike Crimmins and Zack Guido sit down to discuss weather and climate in the Southwest, including what we might expect over the next few months. They discuss La Niña and what this might mean for the Southwest, including implications of La Niña following a much drier than average monsoon and what the historical record says about just how unprecedented this pattern might be (dry monsoon, dry winter). Finally, they take a closer look at fire, and how the season has progressed in the Southwest, given the lack of rain, and what we might watch for going into next year's fire season.

https://bit.ly/35HCMYI

Oct 2020 - Monsoon 2020 Recap and Bracing for La Niña This Winter

In the October 2020 edition of the CLIMAS Southwest Climate Podcast, Mike Crimmins and Zack Guido open up with something fun - with a quick rundown of the Monsoon Game 2020, congratulating Mike (for his CLIMAS podcast team victory, with 33 points) and Aaryn O with his overall victory (56 points). Next, they look back on the monsoon, and try to make sense of some of the reasons that might have contributed to the widespread below average (or even record driest) conditions in the Southwest. They take a closer look at some of the mechanisms that might be in play and review a few papers that address the role of climate change in a changing monsoon. Finally, they look forward (begrudgingly) at winter 2020-2021, which is lining up to be either a moderate or strong La Niña, and the discuss the implications of forecasts for a drier than average winter stacking on top of a very dry monsoon.

https://bit.ly/3pEAEc3

Online Resources

Figure 1
Climate Program Office
cpo.noaa.gov

RISA Program Homepage

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

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 Institute of the Environment—is a collaboration between the University of Arizona 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

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.

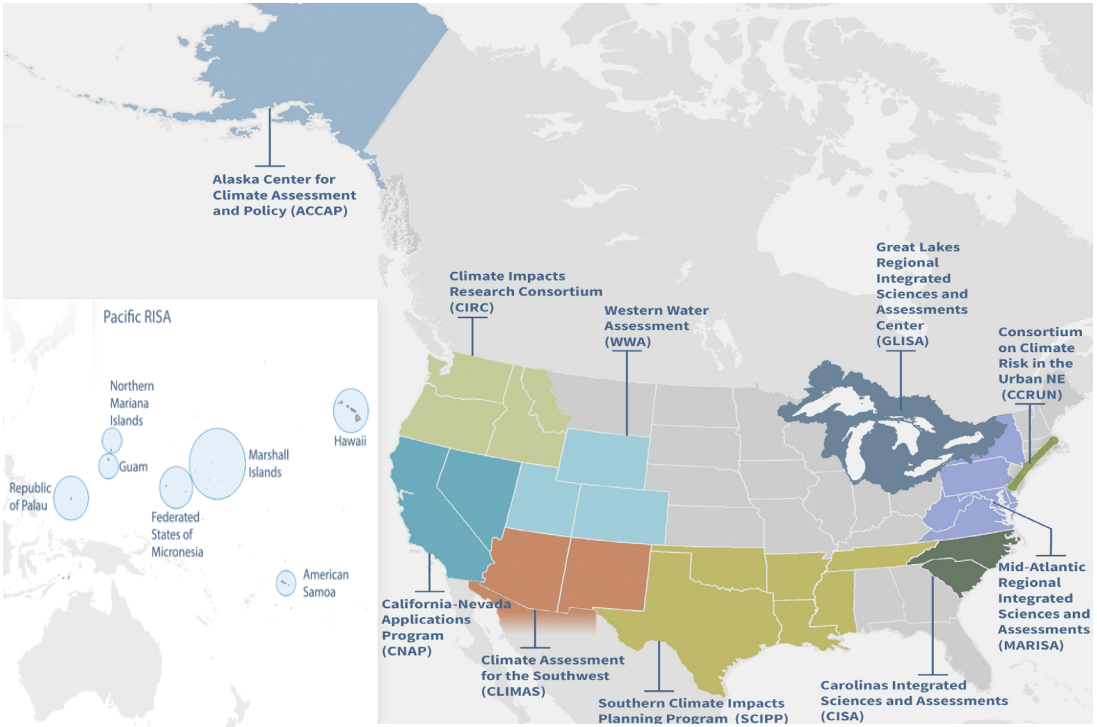


Figure 1: NOAA Regional Integrated Sciences and Assessments Regions