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December Southwest Climate Outlook

Monthly Precipitation and Temperature: November precipitation was average to below average across most of Arizona and New Mexico (Fig. 1a). November temperatures were above average to much above average in most of Arizona and New Mexico (Fig. 1b), with a pocket of record warm conditions in west Texas. The daily average temperature anomalies for Nov. 1 – Dec. 12 (Fig. 2) highlight the fluctuations at select stations around the region.

Fall 2020 Precipitation and Temperature: Total precipitation percentile for fall 2020 (Sept-Oct-Nov) ranged between below average and record driest in Arizona, and between average and record driest in New Mexico (Fig. 3a). Mean temperature for the same period (Sept-Oct-Nov 2020) was between above average and record warmest in most of the Southwest (Fig. 3b).

Drought: The Dec. 8 U.S. Drought Monitor (USDM) expanded drought characterizations in the Southwest. Continuation of dry conditions (e.g. driest June-Nov period on record for AZ and second driest for NM) have led to continued degradation in drought conditions across the Southwest to the most intense category D4 across much of AZ and NM. Most of Arizona and over half of New Mexico is categorized as experiencing exceptional drought (D4) (Fig. 4).

Snowpack and Water Supply: The SnowView map from the University Arizona shows the Snow Water Artificial Neural Network (SWANN) estimate of snow water equivalent (SWE) across Arizona and New Mexico as of Dec 12, 2020 (Fig. 5). The anomaly map (Fig. 6) highlights how station observations and basin estimates of SWE deviate from 1981-2010 median values. Many of the reservoirs in the region are at or below the values recorded at this time last year. Most are below their long-term average (see Arizona and New Mexico reservoir storage on p. 6).

ENSO Tracker: 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), this does not bode well for drought conditions in the Southwest.

Precipitation and Temperature Forecast: The three-month outlook for January through March 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 Dec 2020 SW Climate Outlook

DEC2020 @CLIMAS_UA SW Climate Outlook, La Niña Outlook, Fall Temperatures, AZ & NM Reservoirs https://bit.ly/2IZN5Pf #SWclimate #AZWx #NMWx

Dec 2020 SW Climate Outlook

Online Resources

Figures 1,3
National Centers for Environmental Information
ncei.noaa.gov

Figure 2
Climate Assessment for the Southwest
climas.arizona.edu

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

Figure 5
University of Arizona SnowView
climate.arizona.edu/snowview

Figure 6
National Resource Conservation Service
nrcs.usda.gov

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

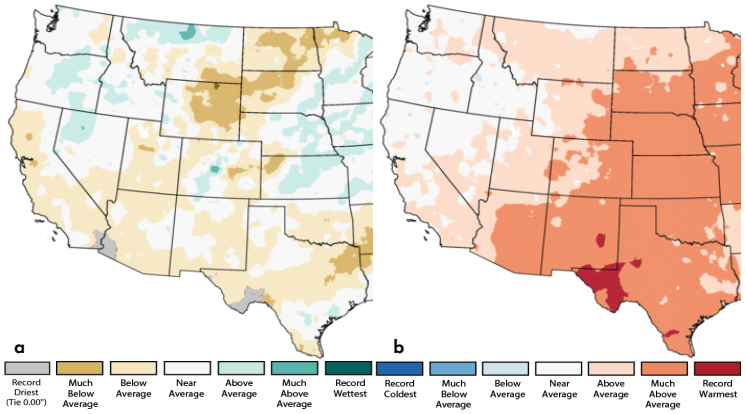


Figure 1: Nov 2020 Precipitation (a) & Temperature Ranks (b)

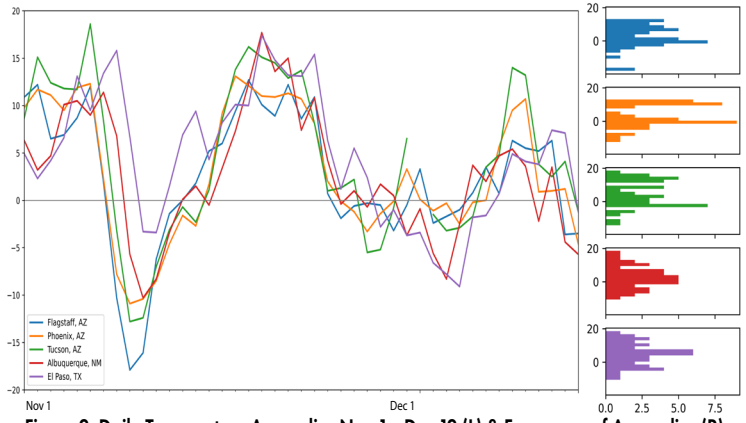


Figure 2: Daily Temperature Anomalies Nov 1 - Dec 12 (L) & Frequency of Anomalies (R)

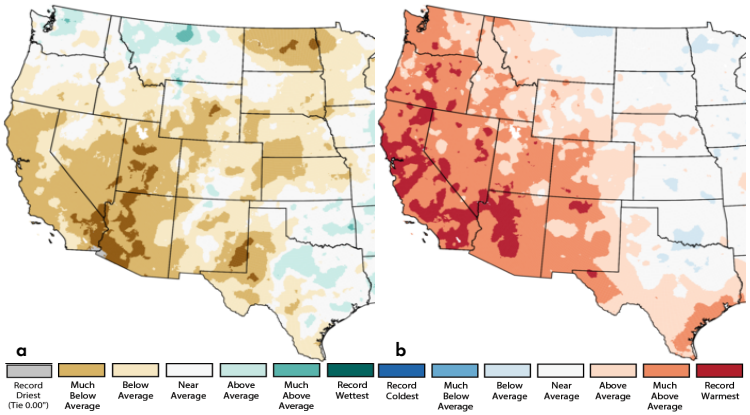
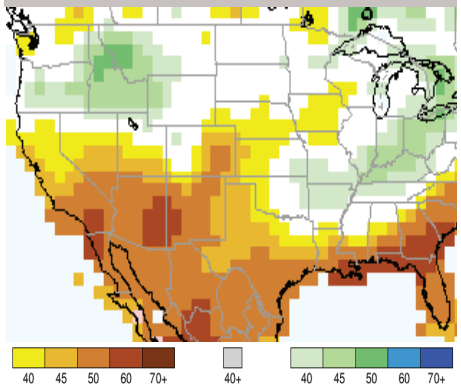


Figure 3: Fall 2020 (Sept-Nov) Precipitation (a) & Temperature Ranks (b)



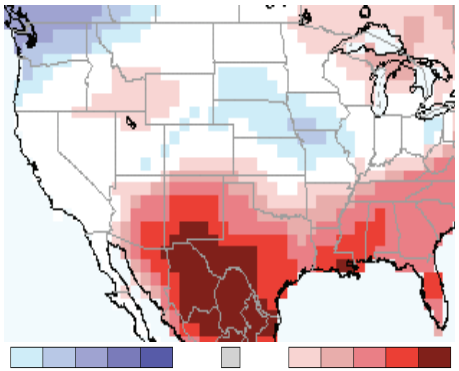


Figure 7: Three-Month (Jan-Mar) Forecast for Precip (top) and Temps (bottom)

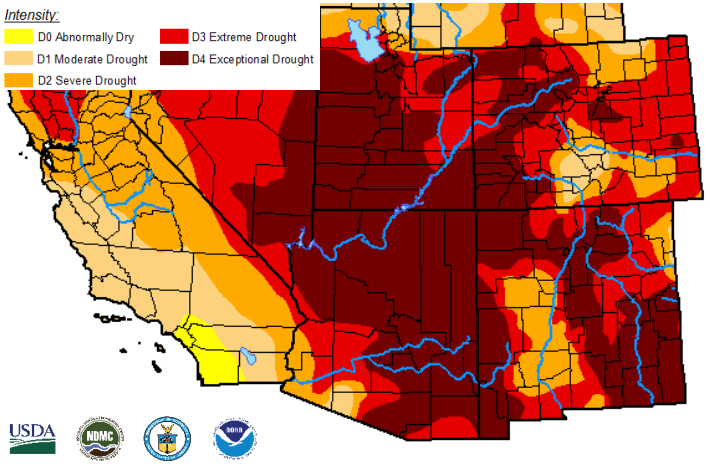


Figure 4: US Drought Monitor - Dec 8, 2020

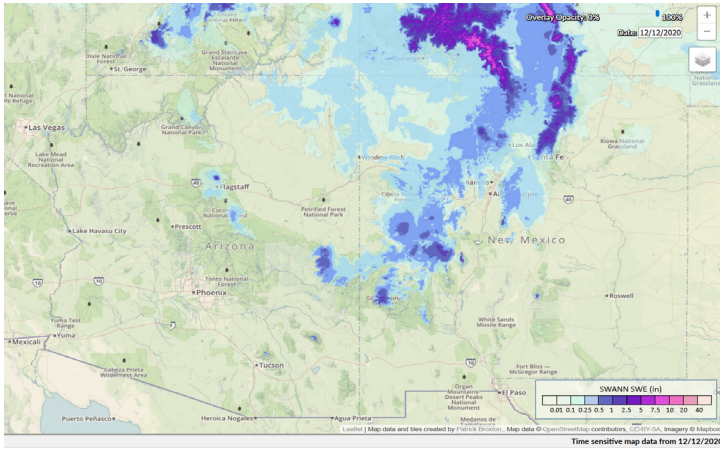


Figure 5: UArizona SnowView - SWANN Snow Water Equivalent Dec 12, 2020

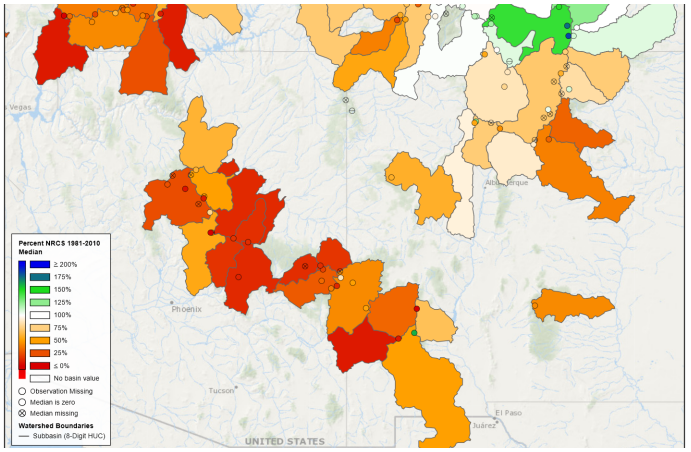


Figure 6: Snow Water Equivalent Percent of 1981-2010 Median (Dec 13, 2020)

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

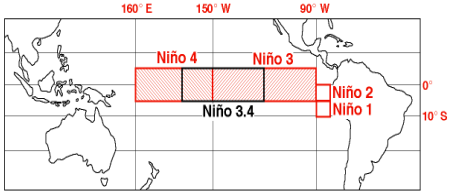
Figure 4
NOAA - Climate Prediction Center
cpc.ncep.noaa.gov

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 Jan 2021 are below normal across the equatorial Pacific (Fig. 1), extending the trend of the last 4-5 months (Fig. 2). Climate outlooks generally have La Niña conditions persisting through winter 2020-2021 before returning to normal conditions over spring 2021.

Forecast Roundup: On Dec 8, the Australian Bureau of Meteorology was at official La Niña status and noted: "oceanic and atmospheric conditions reflect a mature La Nina with little variation...(suggesting) the event will peak at moderate levels". On Dec 10, the Japanese Meteorological Agency (JMA) maintained its forecast of a 90-percent chance of La Niña conditions through winter. On Dec 10, 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 50-percent chance of transition to neutral during late spring or early summer. On Dec 10, the International Research Institute (IRI) issued an ENSO Quick Look (Fig. 3), noting "the east-central Pacific is roughly 1 degree C below average, and all key atmospheric variables are consistent with La Niña conditions". The North American Multi-Model Ensemble (solid and dashed black line, Fig. 4) indicates moderate La Niña conditions for the next few months, with a shift to ENSO-neutral by late spring or early summer.

Summary: La Niña conditions are present and according to most ENSO forecasts and outlooks, they look to remain in place through winter or early spring. The monthly and seasonal climate outlooks suggest drier than normal conditions over winter. This would exacerbate the precipitation deficits already observed over the last six months (Jun-Nov): a period that was record driest for Arizona and second driest for New Mexico. The seasonal totals during La Niña events are often lower than average (see next page for detailed plots of cool-season precipitation). This of course does not mean zero precipitation will fall, but the likely outcome would be less frequent events and lower seasonal totals if the typical pattern for a La Niña winter pans out.

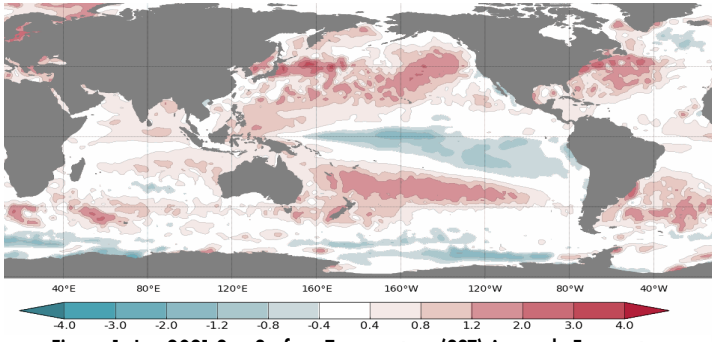


Figure 1: Jan 2021 Sea Surface Temperature (SST) Anomaly Forecast

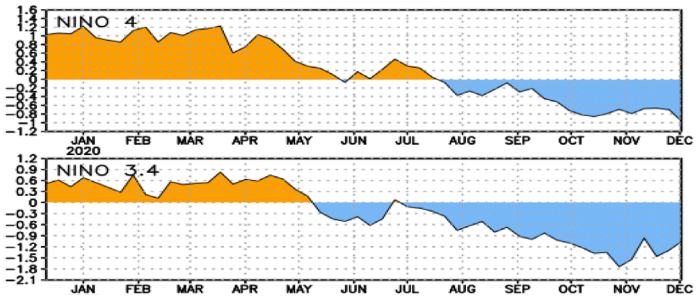


Figure 2: SST Anomalies in Niño Regions 3.4 & 4 (NCDC)

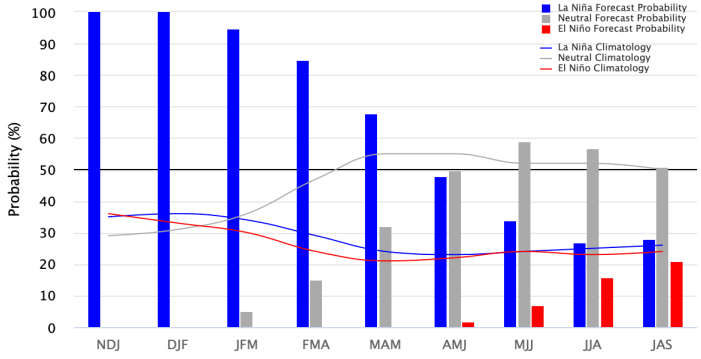


Figure 3: Early-Dec IRI/CPC Model-Based Probabilistic ENSO Forecast

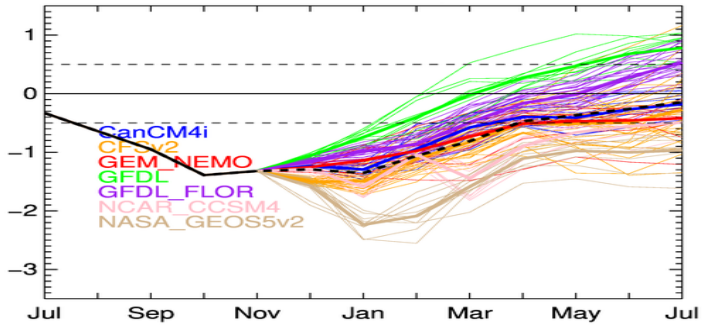
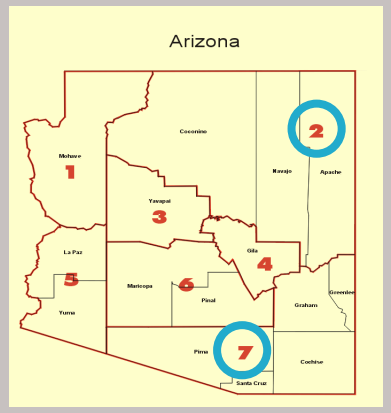


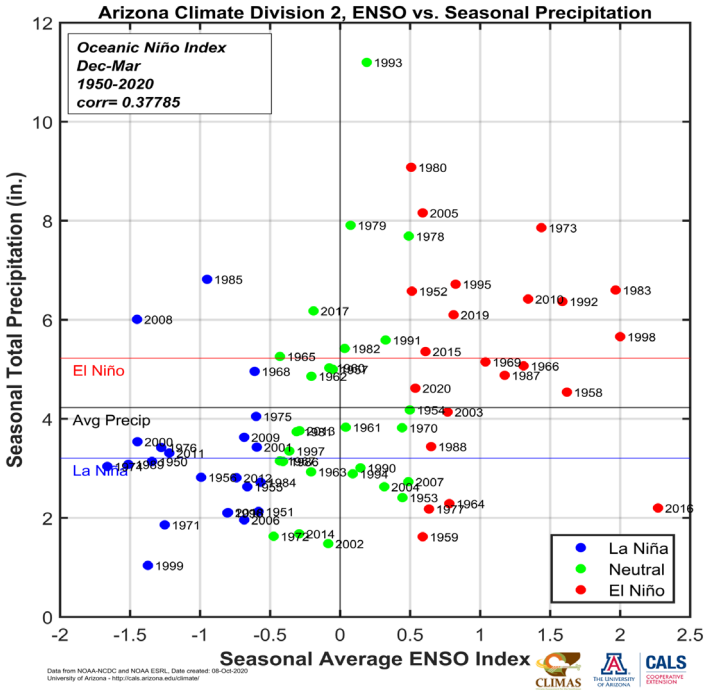
Figure 4: North American Multi-Model Ensemble Forecast for Niño 3.4

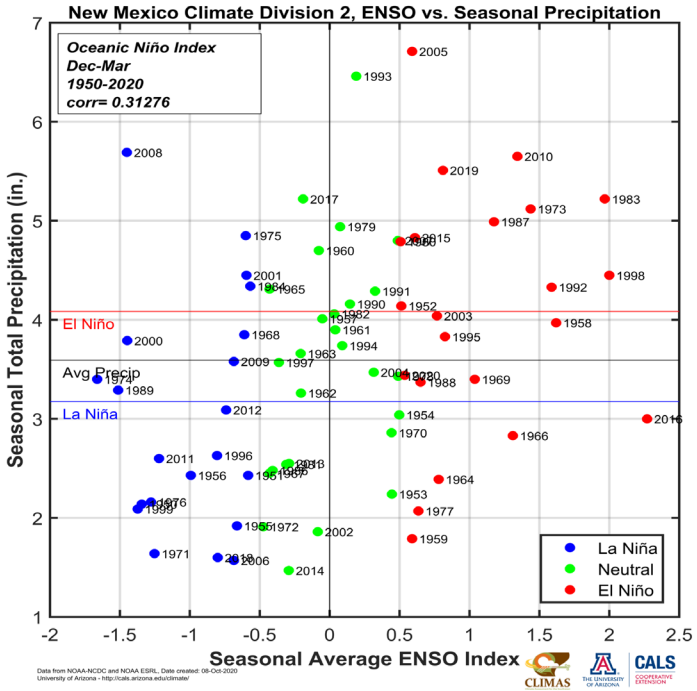
Online Resources

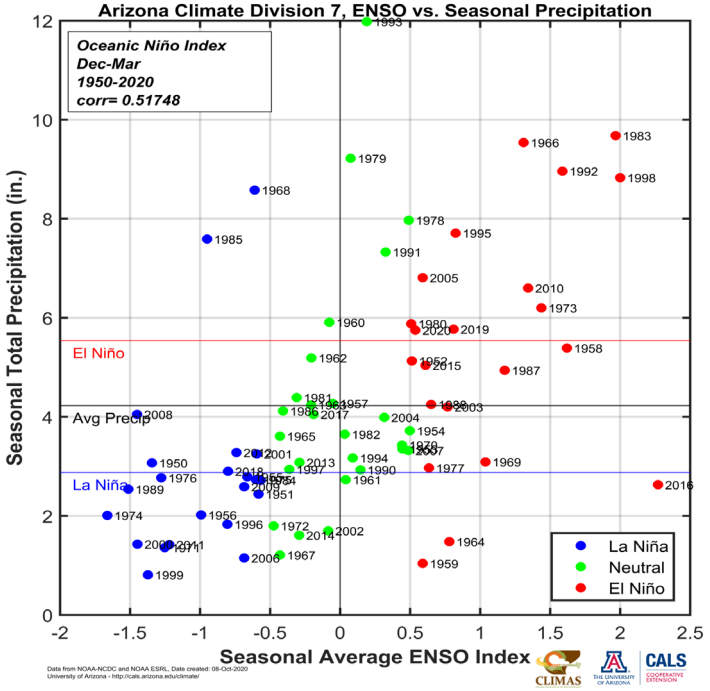
Figures & Maps
Climate Science Applications Program
cals.arizona.edu/climate/

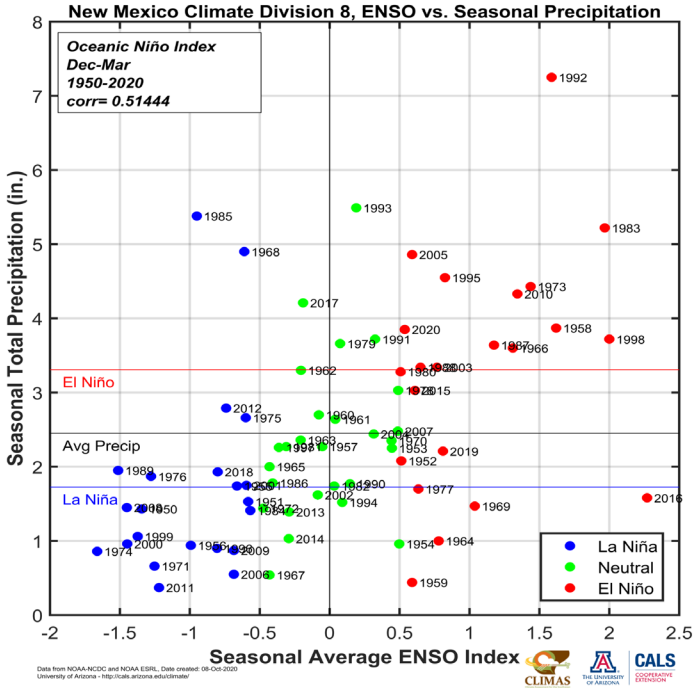


La Nina Winters in Arizona (climate division 2 & 7) and New Mexico (climate division 2 & 8)









Online Resources

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

data: RCC-ACIS

Sept 1 - Nov 30 Temperatures: Seasonal Patterns of (Mostly) Above-Normal/Record Temps

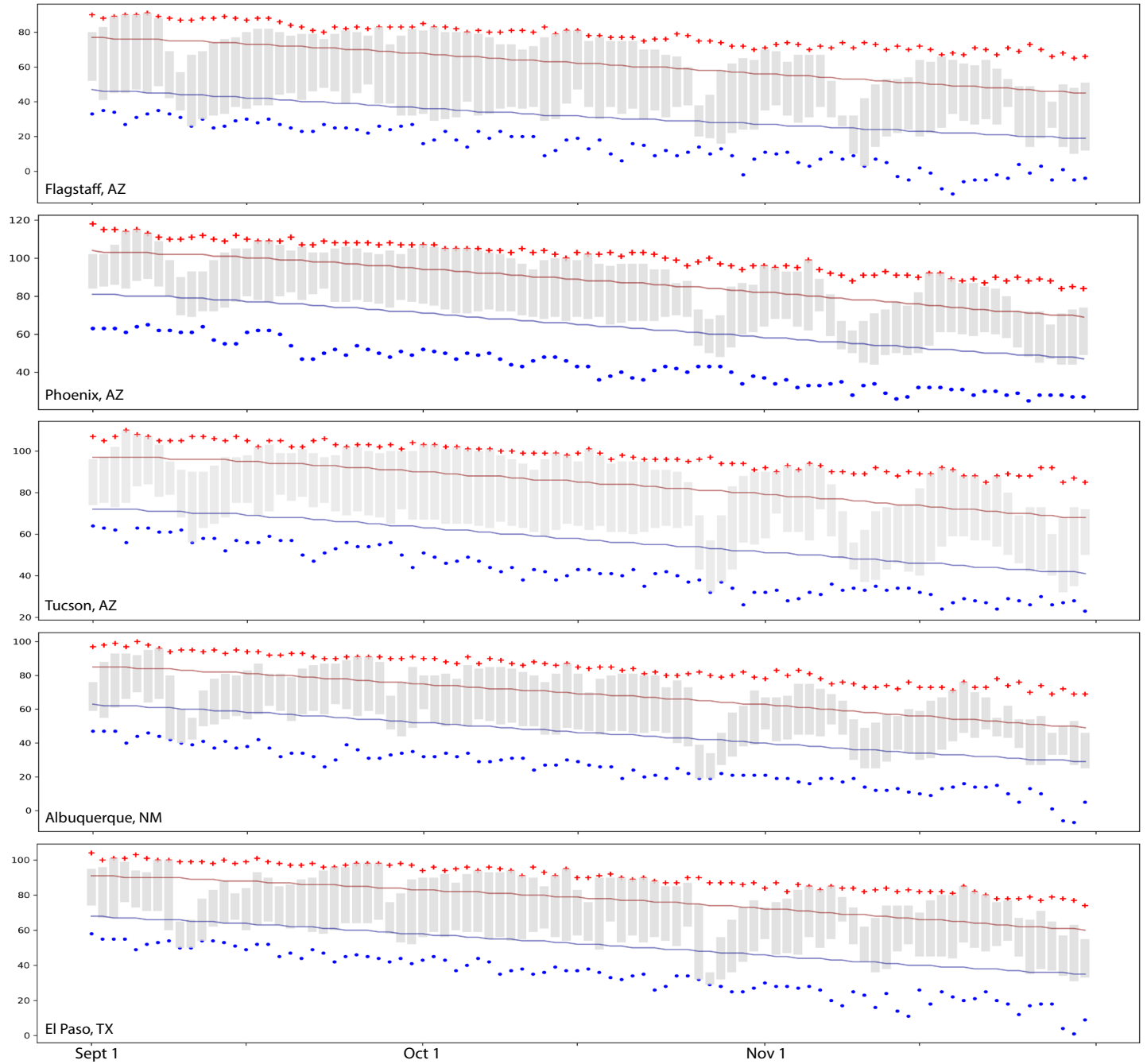


Figure 1: Daily Average and Record High/Low Temperatures, 2020 Temperature Range, Sept 1 - Nov 30, 2020

Online Resources

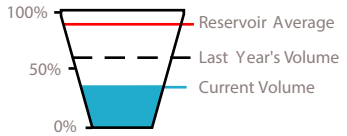
Portions of the information provided in this figure is available at the Natural Resources Conservation Service
www.wcc.nrcs.usda.gov/BOR/basin.html

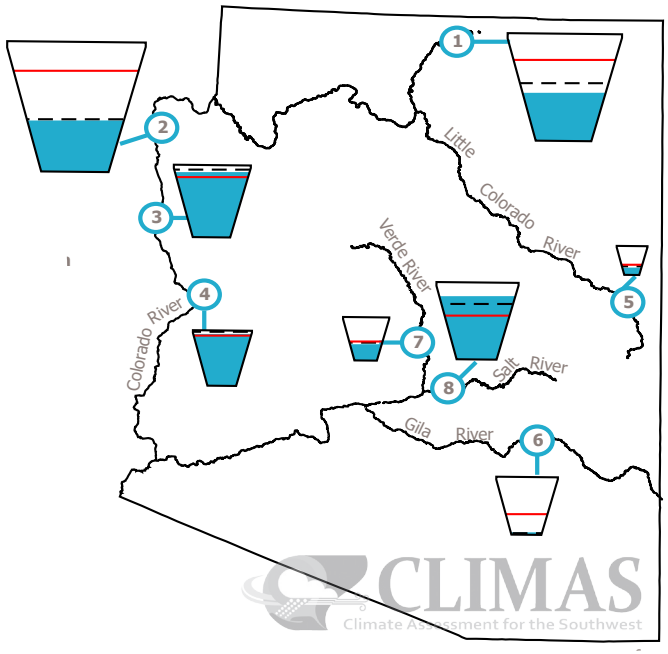
Contact Ben McMahan with questions/comments.

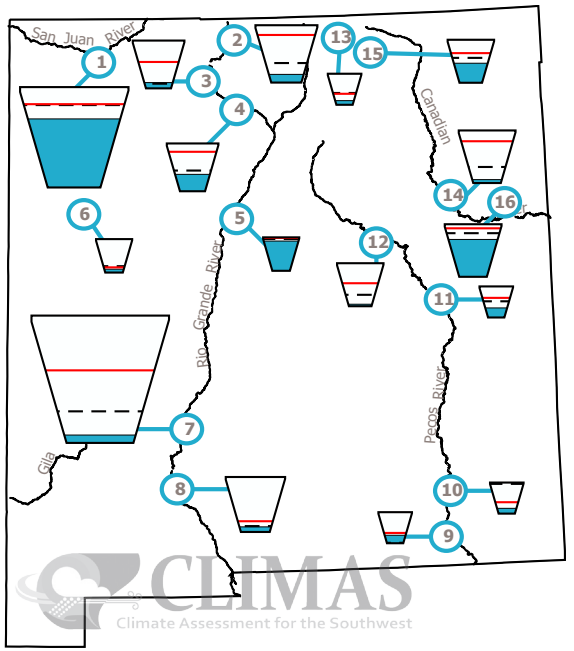
Reservoir Volumes

DATA THROUGH DEC 1, 2020

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	44%	10,615.4	24,322.0	-361.6
2. Lake Mead	39%	10,100.0	26,159.0	-67.0
3. Lake Mohave	89%	1,611.0	1,810.0	-110.0
4. Lake Havasu	93%	572.6	619.0	-5.3
5. Lyman	26%	7.9	30.0	0.0
6. San Carlos	3%	24.3	875.0	-1.7
7. Verde River System	37%	105.2	287.4	-15.4
8. Salt River System	82%	1,668.6	2,025.8	-16.

*KAF: thousands of acre-feet

Reservoir	Capacity	Current Storage*	Max Storage*	One-Month Change in Storage*
1. Navajo	65%	1,094.4	1,696.0	-8.6
2. Heron	13%	53.9	400.0	-0.1
3. El Vado	11%	21.6	190.3	-2.7
4. Abiquiu	34%	63.9	186.8	2.1
5. Cochiti	87%	43.5	50.0	0.3
6. Bluewater	9%	3.4	38.5	-0.1
7. Elephant Butte	5%	100.2	2,195.0	12.7
8. Caballo	9%	28.8	332.0	0.4
9. Lake Avalon	24%	1.1	4.5	0.3
10. Brantley	16%	6.6	42.2	2.3
11. Sumner	29%	10.3	35.9	3.4
12. Santa Rosa	3%	3.7	105.9	0.1
13. Costilla	13%	2.1	16.0	0.4
14. Conchas	7%	16.5	254.2	-1.5
15. Eagle Nest	45%	35.4	79.0	-0.6
16. Ute Reservoir	70%	138	200	-11.0

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

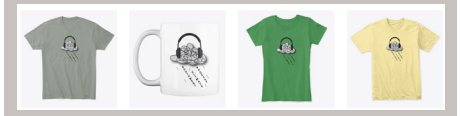
Android

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.

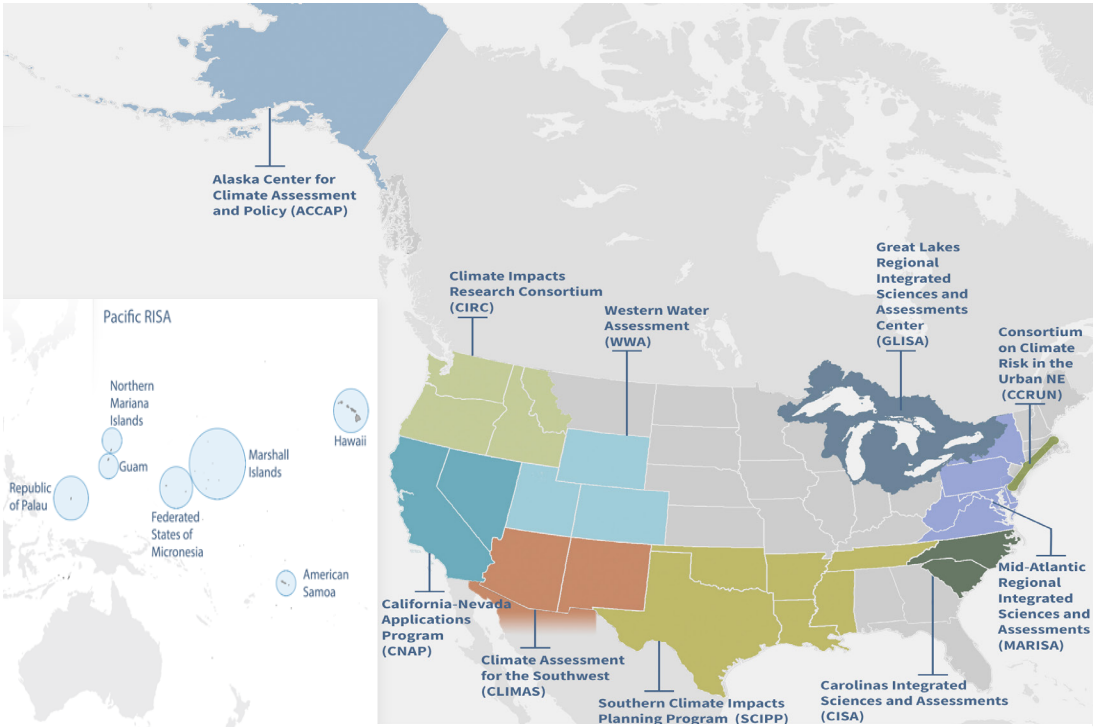


Figure 1: NOAA Regional Integrated Sciences and Assessments Regions