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September Southwest Climate Outlook

Monthly Precipitation and Temperature: August precipitation ranged between record driest and below average in most of Arizona and New Mexico (Fig. 1a). August temperatures were record warmest in all of Arizona and much of New Mexico (Fig. 1b). The daily average temperature anomalies for Aug 1 – Sept 15 (Fig. 2) highlight the fluctuations at select stations around the region, including the very warm temperatures in most of August and early September, as well as the steep drop in temperatures across the Southwest in the second week of September.

Seasonal Precipitation and Temperature: Summer (June-July-August) precipitation ranged from record driest to below average in Arizona and from record driest to average in New Mexico (Fig. 3a). Temperatures during the same period were much above average to record warmest in Arizona and New Mexico (Fig. 3b).

Water Supply: Water year precipitation to date (Oct 2019 – Aug 2020) was near normal to above normal in southwestern Arizona, southern New Mexico, west Texas, and southern California; while the Four Corners, northern New Mexico, and southern Colorado were below normal or much below normal (Fig. 4). Many of the reservoirs in the region are at or below the values recorded at this time last year, and most are below their long-term average (see Arizona and New Mexico reservoir storage on p. 7).

Drought: The Sept 4 U.S. Drought Monitor (USDM) showed widespread expansion of extreme drought (D3) across Arizona and New Mexico, along with much of Utah and Colorado (Fig. 5). This reflects the below average monsoon precipitation as well as accumulated long term precipitation deficits.

Wildfire: 2020 is a very active fire year in Arizona; wildfire acres burned for 2020 are well above mean and median (1990-2015), and have exceeded the totals for lightning- and human-caused fires in the past 5 years. New Mexico remains below mean and near median, especially human caused wildfire (Fig. 6, data updated as of Sept 13). Widespread fire activity in California, Oregon, and Washington has also spread smoke across the west, including Arizona.

ENSO Tracker: La Niña conditions are present and are expected to continue through winter (see ENSO-tracker on p. 3 for details).

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

Tweet Sept 2020 SW Climate Outlook

SEPT2020 @CLIMAS_UA SW Climate Outlook, La Niña Outlook, SW Monsoon (and lack thereof), Summer Heat, AZ & NM Reservoirs, https://bit.ly/3klut9g #SWclimate #AZWx #NMWx

Sept 2020 SW Climate Outlook

Online Resources

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

Figures 2,6
Climate Assessment for the Southwest
climas.arizona.edu

Figure 4
West Wide Drought Tracker
wrcc.dri.edu/wwdt

Figure 5
U.S. Drought Monitor
droughtmonitor.unl.edu

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

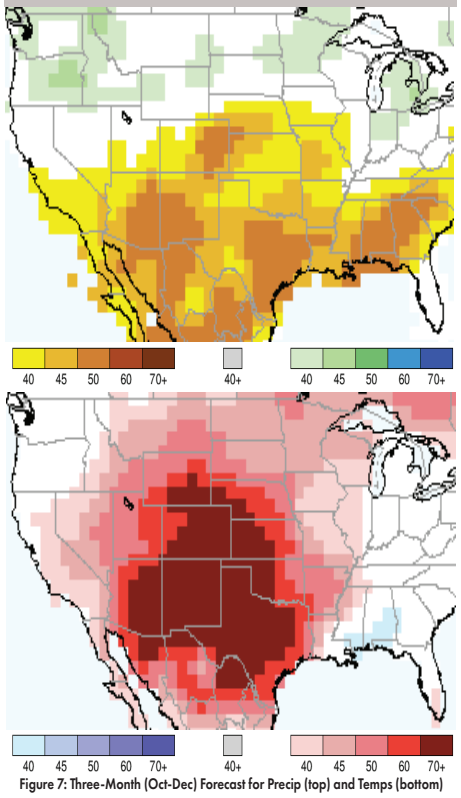


Figure 7: Three-Month (Oct-Dec) Forecast for Precip (top) and Temps (bottom)

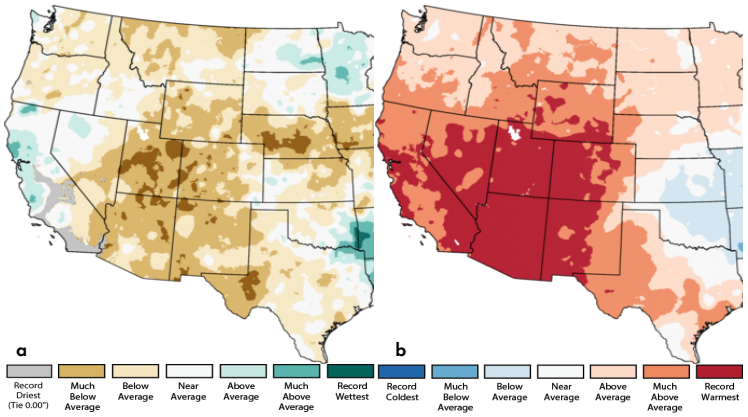


Figure 1: August 2020 Precipitation (a) & Temperature Ranks (b)

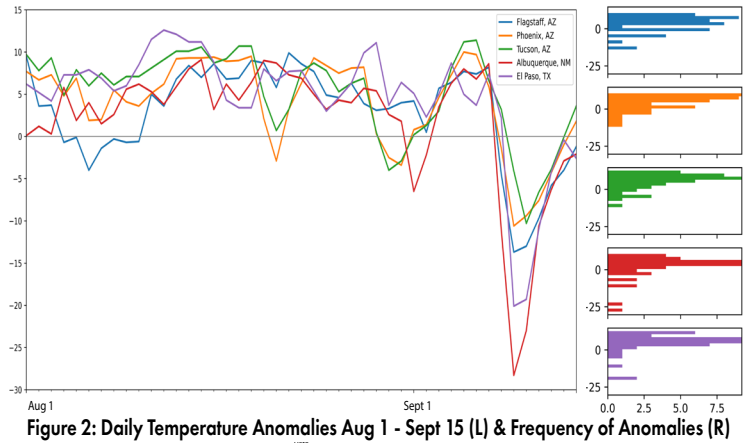


Figure 2: Daily Temperature Anomalies Aug 1 - Sept 15 (L) & Frequency of Anomalies (R)

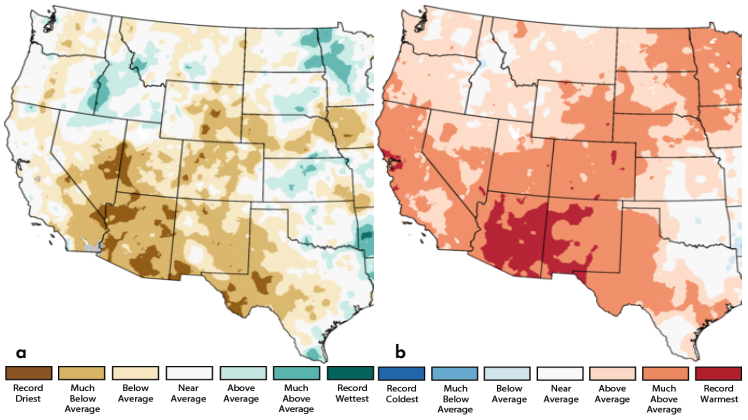


Figure 3: Jun - Aug 2020 Precipitation (a) & Temperature Ranks (b)

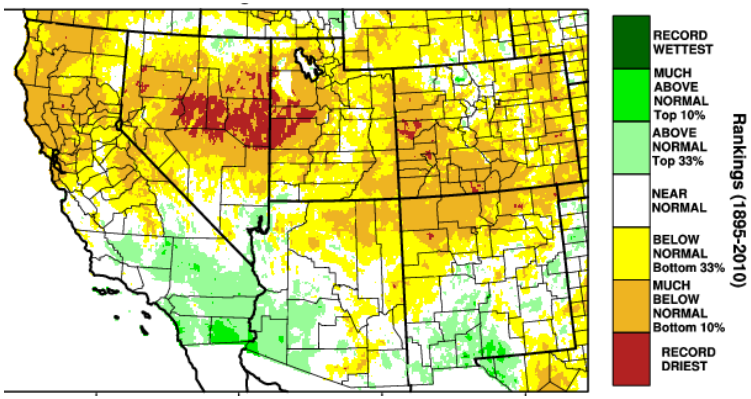


Figure 4: Water Year Precipitation (Oct 2019 - Aug 2020)

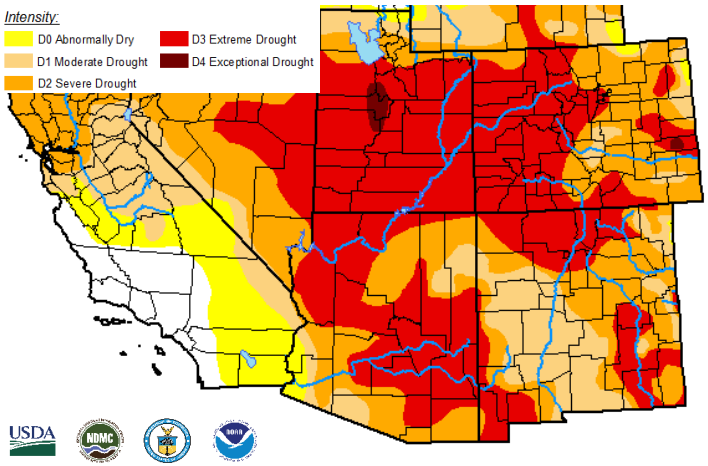


Figure 5: US Drought Monitor - Sept 8, 2020

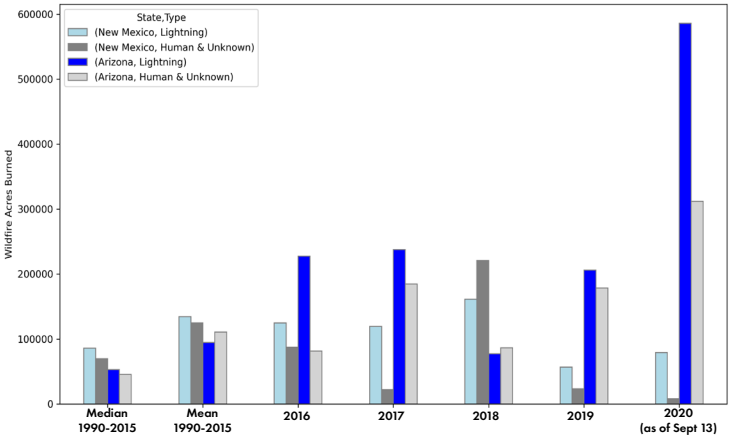


Figure 6: Lightning and Human-Caused Wildfire - AZ and NM

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

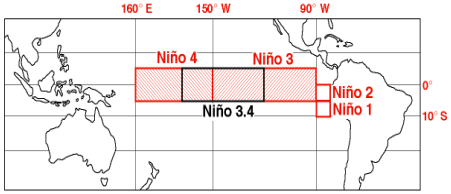
Figure 4
NOAA - Climate Prediction Center
cpc.ncep.noaa.gov

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 show cooling across the equatorial Pacific (Fig. 1), extending the pattern of the last few months (Fig. 2). La Niña conditions are now considered to be present by most major outlooks. These conditions are forecast to remain a La Niña event through winter 2020.

Forecast Roundup: On Sept 10, the NOAA Climate Prediction Center (CPC) ENSO status was at La Niña Advisory. The CPC called for a 75-percent chance of La Niña continuing through winter 2020-2021. On Sept 10, the International Research Institute (IRI) issued an ENSO Quick Look (Fig. 3), noting "SSTs in the east-central Pacific are below average, and most of the atmospheric variables are consistent with La Niña conditions". On Sept 10, the Japanese Meteorological Agency (JMA) maintained its call for a 70-percent chance of La Niña conditions to last through winter 2020-2021. On Sept 15, the Australian Bureau of Meteorology extended a La Niña alert, noting further cooling in both the observed SSTs and the models and outlooks for the rest of 2020 and into 2021. The North American Multi-Model Ensemble (dashed black line, Fig. 4) has moved into La Niña territory, and is projected to remain there until early 2021.

Summary: La Niña conditions are observed to be present, and most forecasts and outlooks call for these conditions to last through winter 2020-2021. La Niña tends to suppress tropical storm activity in the eastern pacific (and enhance that activity in the Atlantic), and so far 2020 has generally followed that pattern. La Niña events also tend to result in drier than normal conditions over winter in the Southwest, a pattern that is represented in the monthly and seasonal outlooks. This will exacerbate accumulated precipitation deficits from the below average monsoon of 2020. It should be noted that La Niña conditions do not guarantee a drier than normal winter, but that this is the expected pattern, particularly when the strength of the event is either moderate or strong.

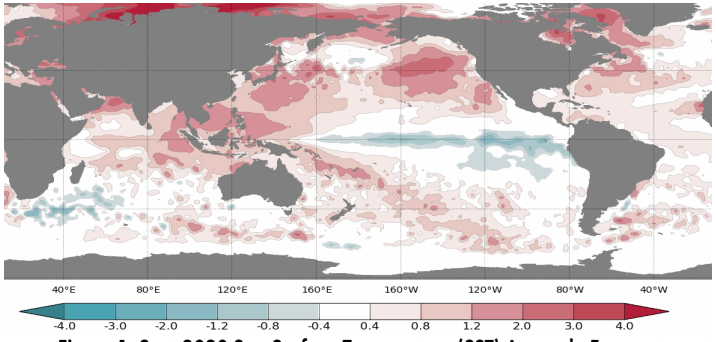


Figure 1: Sept 2020 Sea Surface Temperature (SST) Anomaly Forecast

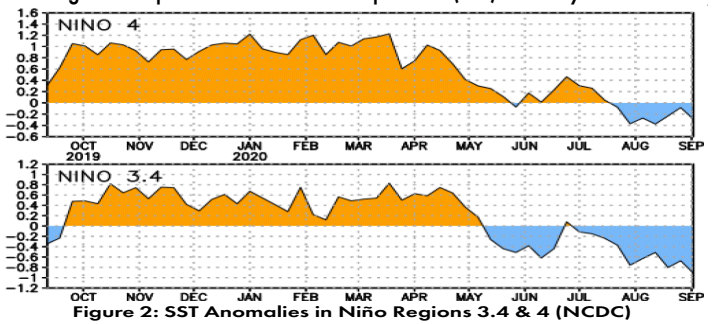


Figure 2: SST Anomalies in Niño Regions 3.4 & 4 (NCDC)

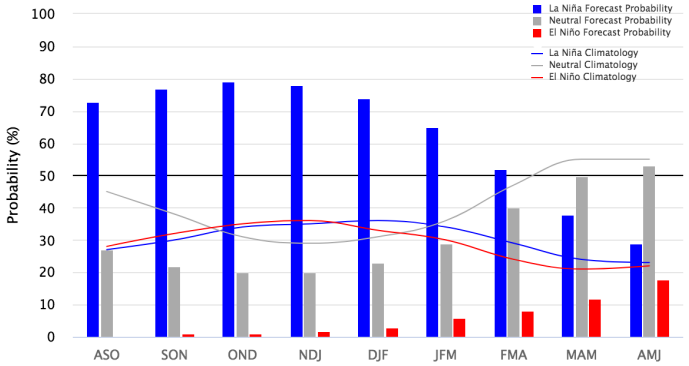


Figure 3: Early-Sept IRI/CPC Model-Based Probabilistic ENSO Forecast

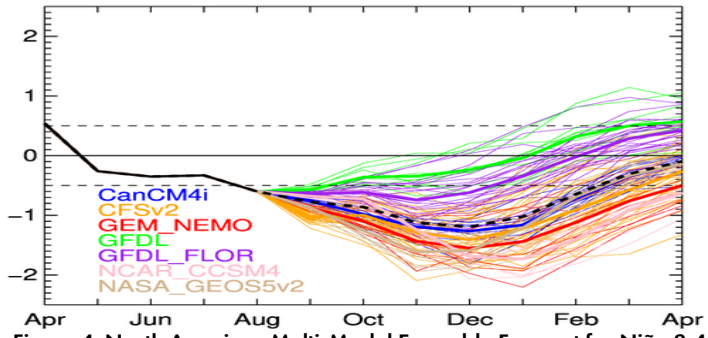


Figure 4: North American Multi-Model Ensemble Forecast for Niño 3.4

Online Resources

Figures 1,3
UArizona Climate Science Applications Program
cals.arizona.edu/climate/

data: PRISM Climate Group

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

data: RCC-ACIS

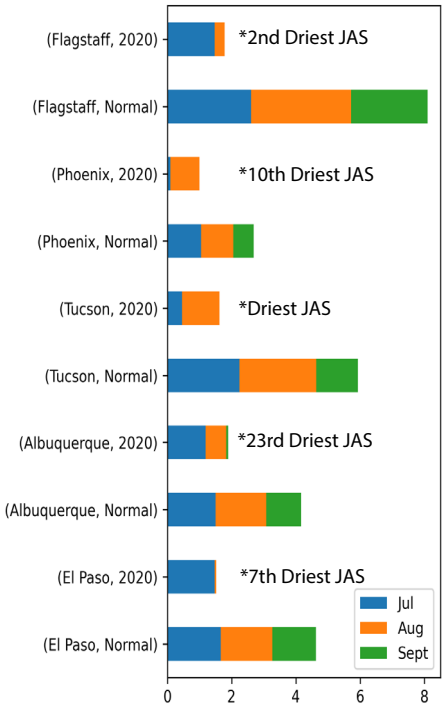


Fig 02: Monsoon Precip July-Aug-Sept

Monsoon 2020: Well Below Average or Historically Dry?

Monsoon precipitation for Arizona and New Mexico is generally below average (Fig. 1). Precipitation to date at stations (Fig. 2) and maps of percent of days with rain (Fig. 3), both illustrate features of a relatively dry monsoon. There is not much time left, and little rain on the forecast horizon, so the rest of September will determine just how dry the 2020 monsoon turns out to be.

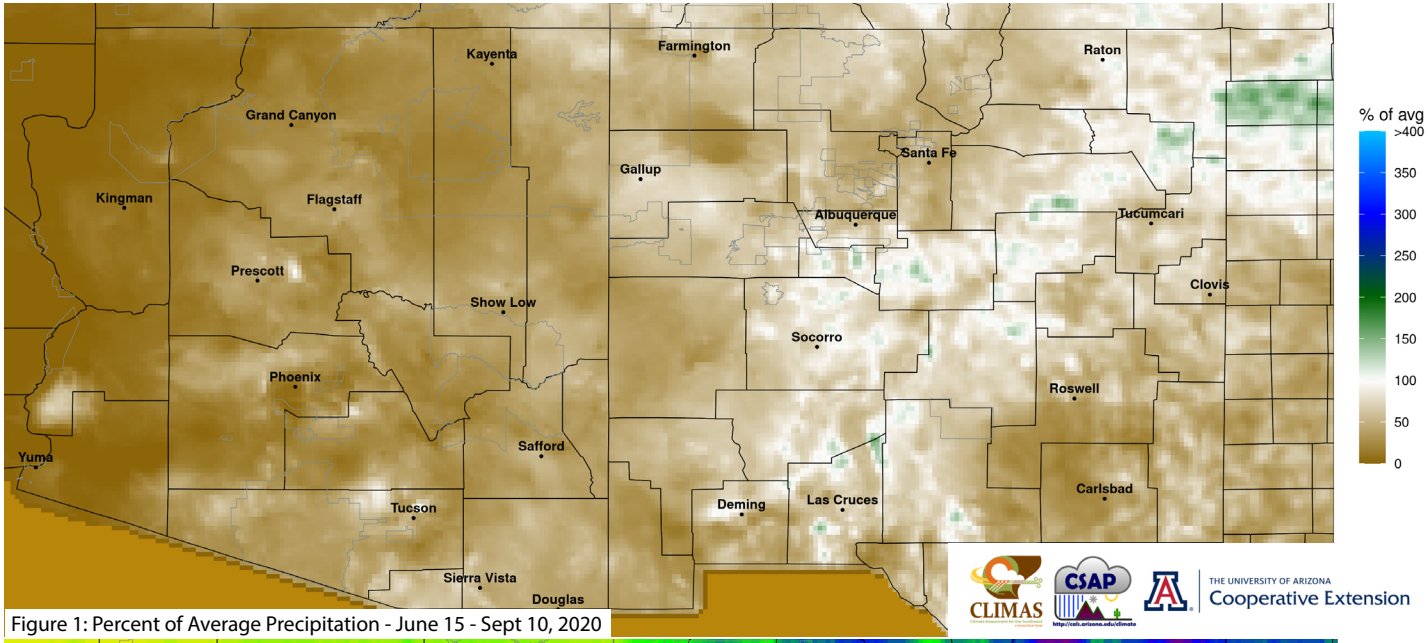


Figure 1: Percent of Average Precipitation - June 15 - Sept 10, 2020

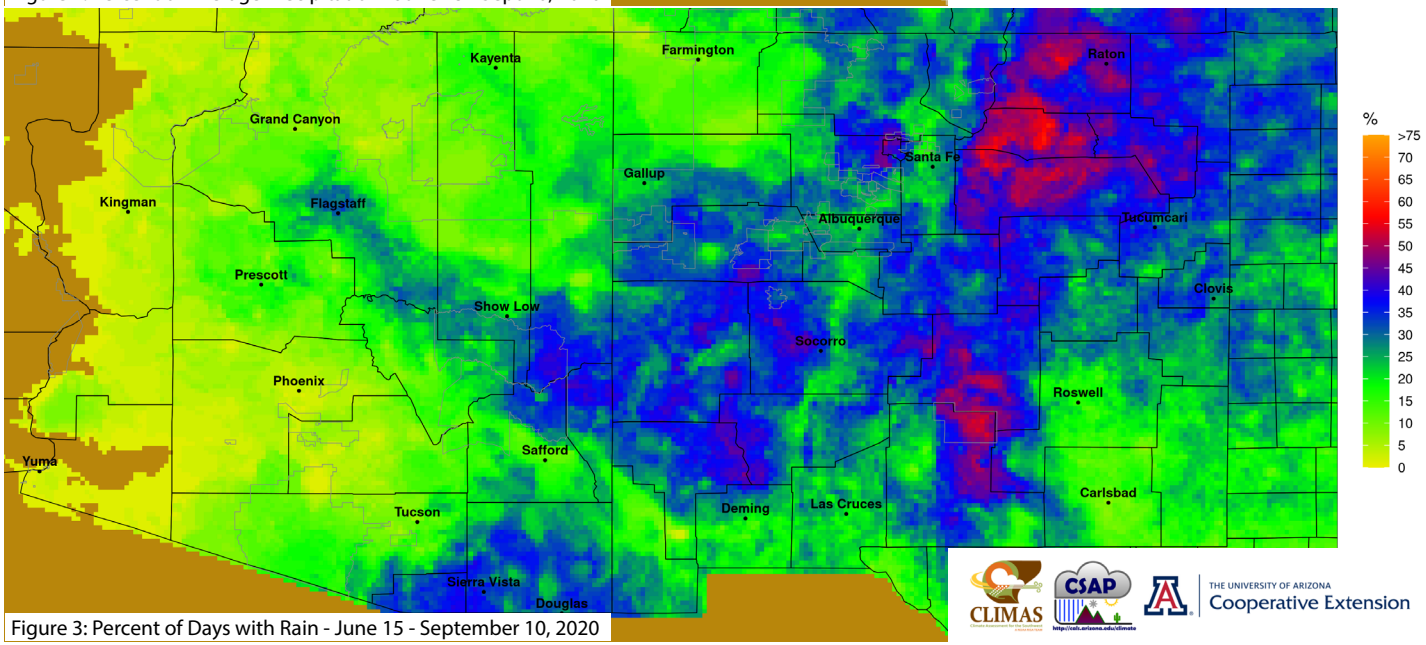


Figure 3: Percent of Days with Rain - June 15 - September 10, 2020

Online Resources

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

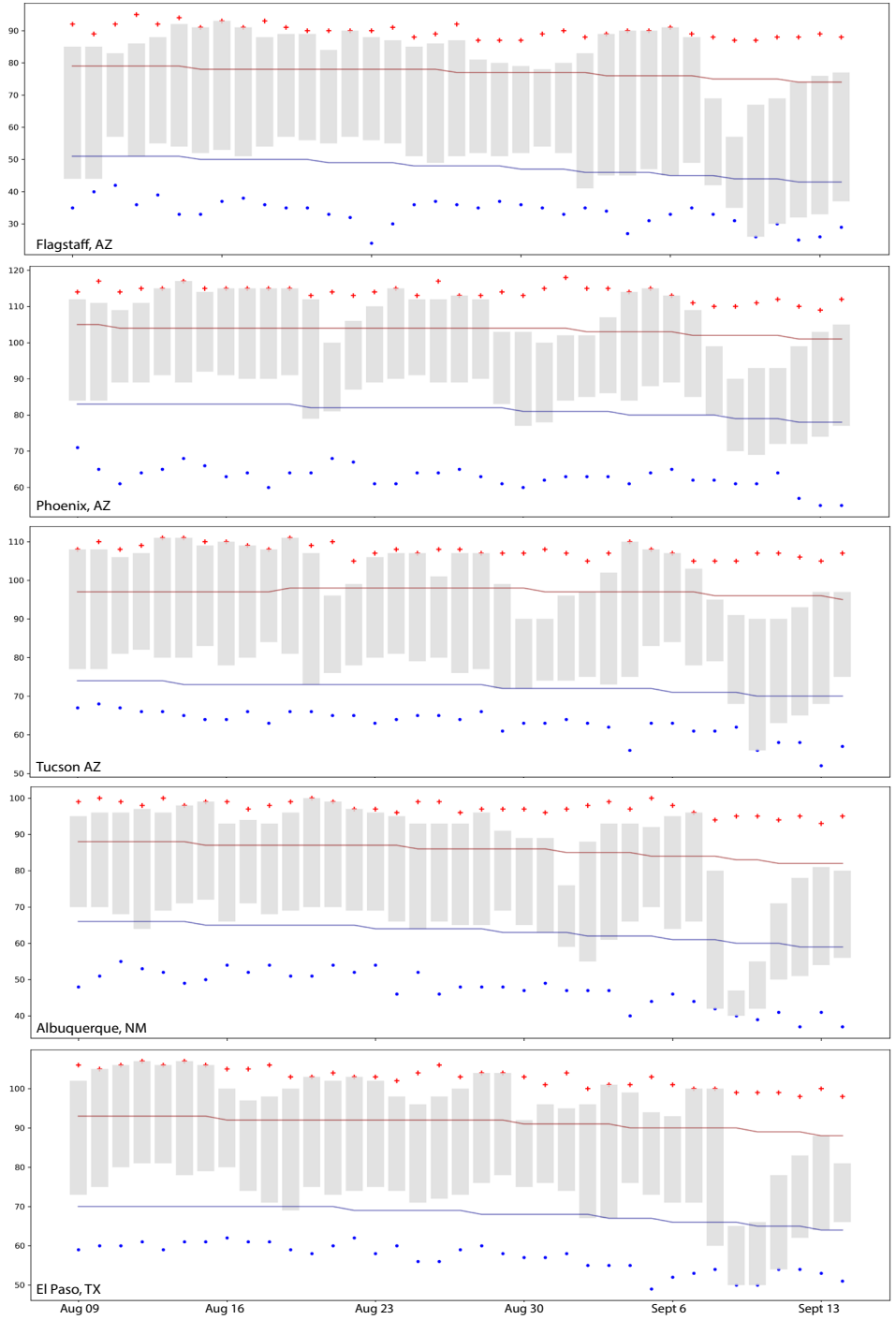


Figure 1: Daily Temperature Aug 9 - Sept 15 - 2020 Temp Range, Normal High/Low, and Record High/Low

Aug-Sept Temperatures

The continued lack of monsoon activity was reflected in persistent heat that lingered across the US Southwest for much of August and into September (Fig. 1). As mentioned last month, high pressure and sub-optimal ridge position continued to help boost daily temperatures and prevented optimal flow of moisture into the region. There have been some intermittent storm events, but little widespread storm activity that we often associate with a more typical monsoon. This lack of rain is contributing to the much warmer than normal temperatures across the Southwest, as rain events provide some relief from the summer heat.

Mid-to-late August and early September both included periods of sustained record high temperatures across the region. This joins July10-13, and late July into early August, as periods where temperatures remained well above normal, including several record high temperatures (see July and Aug 2020 SWCO for details).

The second week of September brought a welcome but short-lived break from these high temperatures, as numerous locations across the region swung from record highs to record lows in just a few days (Fig. 1).

Southwest Climate Podcast

climas.arizona.edu/media/podcasts

Sept 2020 Edition:
Working Through the 5 Stages of Grief on this Years (lack of) Monsoon

In the September 2020 edition of the CLIMAS Southwest Climate Podcast, Mike Crimmins and Zack Guido reflect on this year's monsoon. The monsoon is not over, but at this point it is clear it will come in on the dry side of things. They discuss some of the reasons why, and how this below average monsoon compares across the region and to other years. Zack also recounts some of our Slack/text conversations about the monsoon and maps them onto the 5 stages of grief framework. They also discuss tropical storm activity in the eastern Pacific and talk through the monsoon game for August. There is not much on the horizon for the rest of September, but we have been surprised before, so here's hoping!

climas.arizona.edu/podcast/sept-2020-southwest-climate-podcast-working-through-5-stages-grief-years-lack-monsoon

Close Only Counts in Horseshoes (and the Monsoon)

Ben, Zack, and Mike developed a monsoon game that anyone can play by submitting their entry for five cities in the US Southwest (Phoenix, Tucson, Flagstaff, Albuquerque, and El Paso). There are ten precipitation ranges for each city to choose from (deciles), based on the distribution of monthly precipitation totals for each station (1950-2019).

Points are awarded each month based on how close each guess was to the actual value (see the survey link for details). Winners get bragging rights and their name (or pseudonym) at the top of the leaderboard.

Congrats to Nich with his top score for Aug (Fig. 1), and we'll have results for Sept entries (Fig. 2) in early October.

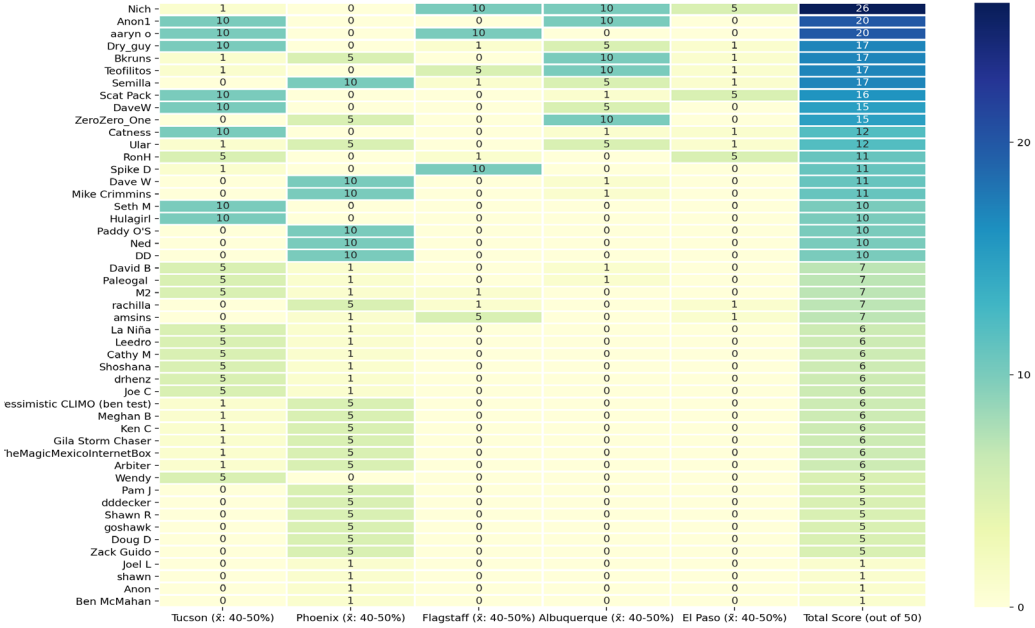


Figure 1: Heat Map of Monsoon Game Scores for Aug 2020

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.

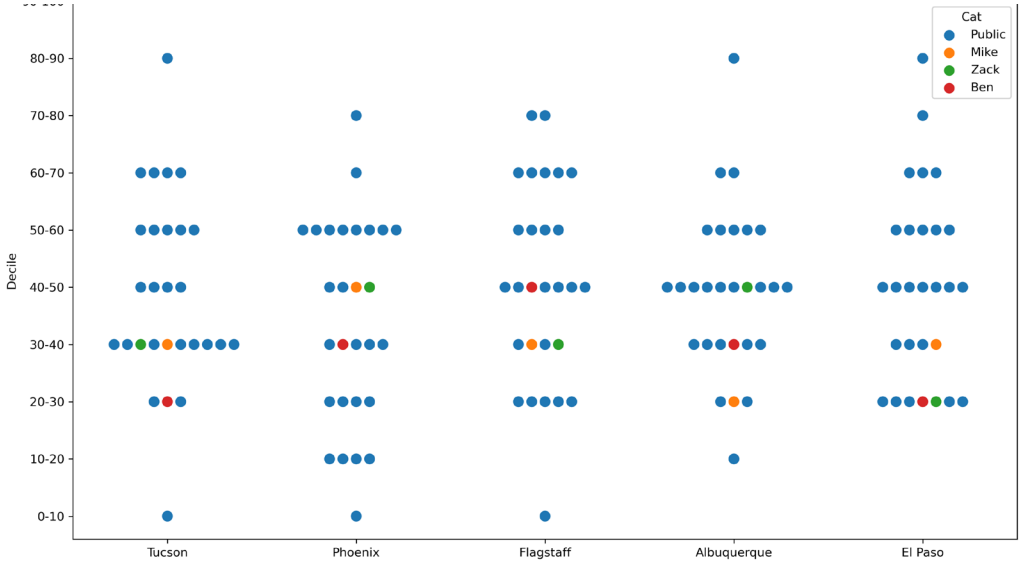


Figure 2: Range/Distribution of Guesses for Each of the Five Cities (Sept 2020 Guesses)

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).

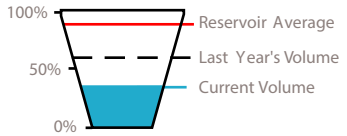
The table details more exactly the current capacity (listed as a percent of maximum storage). Current and maximum storage are given in thousands of acre-feet for each reservoir. One acre-foot is the volume of water sufficient to cover an acre of land to a depth of 1 foot (approximately 325,851 gallons). 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.

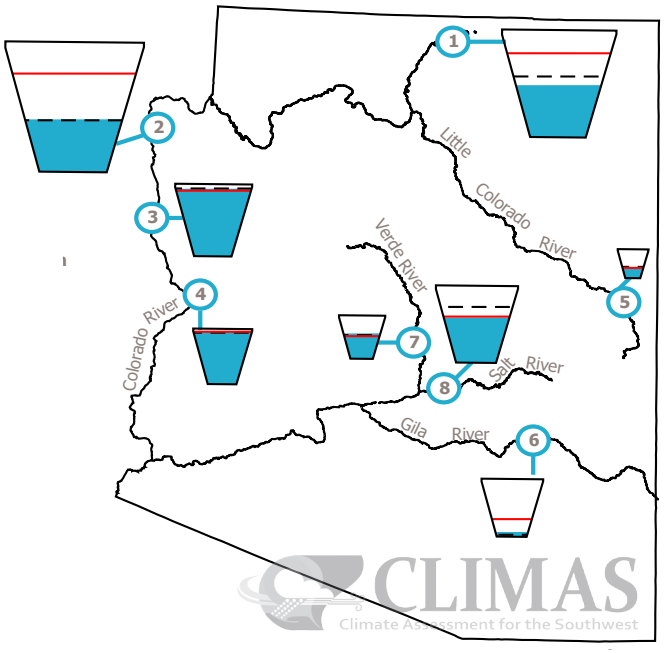
These data are based on reservoir reports updated monthly by the National Water and Climate Center of the U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS).

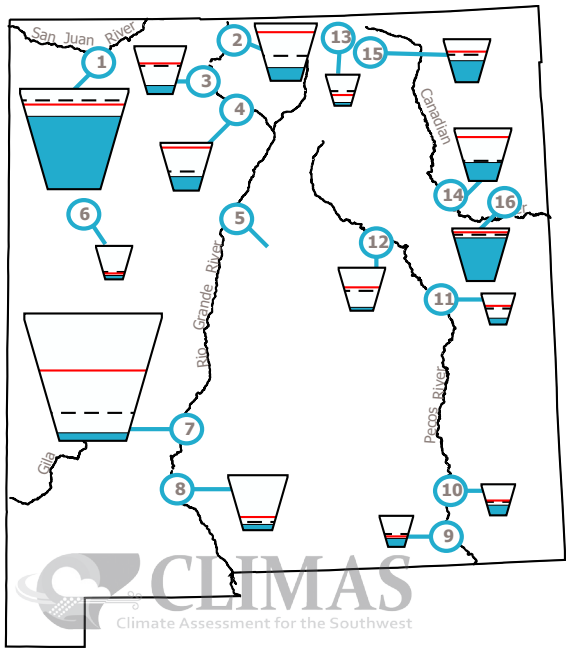
Reservoir Volumes

DATA THROUGH SEPT 1, 2020

Data Source: National Water and Climate Center, Natural Resources Conservation Service







Reservoir	Capacity	Current Storage*	Max Storage*	One-Month Change in Storage*
1. Lake Powell	48%	11,723.4	24,322.0	-633.2
2. Lake Mead	40%	10,349.0	26,159.0	-44.0
3. Lake Mohave	93%	1,688.0	1,810.0	-14.0
4. Lake Havasu	94%	584.0	619.0	9.9
5. Lyman	32%	9.6	30.0	-2.0
6. San Carlos	7%	58.0	875.0	-37.5
7. Verde River System	58%	167.0	287.4	-9.0
8. Salt River System	58%	1,179.2	2,025.8	-679.0

*KAF: thousands of acre-feet

* in KAF = thousands of acre-feet
** missing data for Jul and/or Aug 2020.

Reservoir	Capacity	Current Storage*	Max Storage*	One-Month Change in Storage*
1. Navajo	71%	1,202.4	1,696.0	-83.0
2. Heron	22%	87.2	400.0	-22.7
3. El Vado	16%	29.8	190.3	-14.0
4. Abiquiu	28%	51.8	186.8	-2.0
5. Cochiti	**	**	50.0	**
6. Bluewater	10%	3.8	38.5	-0.5
7. Elephant Butte	5%	108.6	2,195.0	-67.2
8. Caballo	10%	32.8	332.0	-26.8
9. Lake Avalon	27%	1.2	4.5	1.2
10. Brantley	31%	13.1	42.2	-6.9
11. Sumner	19%	6.9	35.9	-3.9
12. Santa Rosa	7%	7.5	105.9	**
13. Costilla	9%	1.5	16.0	-1.9
14. Conchas	35%	87.6	254.2	**
15. Eagle Nest	49%	38.6	79.0	**
16. Ute Reservoir	79%	158	200	-6.0

Online Resources

Figure 1
Climate Program Office
cpo.noaa.gov

RISA Program Homepage

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

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.

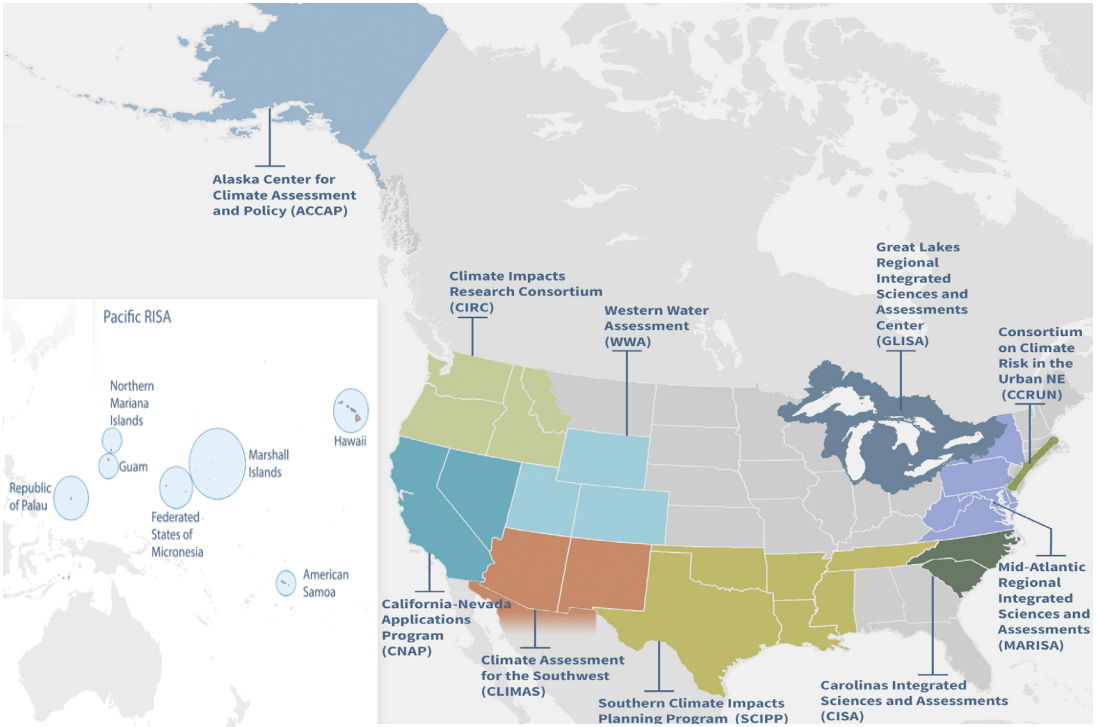


Figure 1: NOAA Regional Integrated Sciences and Assessments Regions