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June Southwest Climate Outlook

Monthly Precipitation and Temperature: May precipitation ranged between record driest and average in most of Arizona, and between much below average and average in most of New Mexico (Fig. 1a). May temperatures were above average in nearly all of Arizona and New Mexico (Fig. 1b). The daily average temperature anomalies for May 1 – Jun 14 (Fig. 2) highlight the fluctuations at select stations around the region.

Seasonal Precipitation and Temperature: Mar-May precipitation ranged from average to much-above average in most of Arizona and from much below average to above average in most of New Mexico (Fig. 3a). Mar-May temperatures were above average to much above average across most of the U.S. Southwest (Fig. 3b).

Water Supply & Drought: Water year precipitation to date (Oct 1, 2019 – May 31, 2020) is above normal to much above normal across most of Arizona and New Mexico (along with west Texas and southern California), while the Four Corners and much of southern Colorado is below normal or much below normal. Many of the reservoirs in the region are at or above the values recorded at this time last year, but most are below their long-term average (see Arizona and New Mexico reservoir storage on page 7). The Jun 9 U.S. Drought Monitor (USDM) maintains drought characterizations in the Four Corners region while expanding severe and extreme drought characterizations (D2 and D3, respectively) in southern Colorado, and northern and eastern New Mexico. (Fig. 4).

Wildfire: Arizona, eastern New Mexico, southwestern Colorado, and most of Utah and Nevada are forecast for above-normal wildfire risk in July (Fig. 5). Currently, there are numerous fires burning in Arizona and New Mexico including the Bighorn Fire near Tucson, the Sawtooth and Bush Fires near Phoenix, and the Mangum Fire in northern Arizona (See inciweb.nwcg.gov for up to date information on fire activity). Fig. 6 shows wildfire acres burned in 2020 (as of June 17) compared to recent years and long term averages.

ENSO Tracker: Current conditions are ENSO-neutral, and are expected to remain neutral through summer 2020, with roughly equal chances of an ENSO-neutral or a La Niña event this fall (see ENSO-tracker for details).

Precipitation and Temperature Forecast: The three-month outlook for July through Sept calls for equal chances of above- or below-normal precipitation in Arizona, New Mexico, most of Texas, and northern Mexico (Fig. 7, top). The three-month temperature outlook calls for increased chances of above-normal temperatures across most of the western U.S. and northern Mexico (Fig. 7, bottom).

Tweet June 2020 SW Climate Outlook

JUN2020 @CLIMAS_UA SW Climate Outlook, ENSO Tracker, AZ & NM Reservoirs, Monsoon Timing, Onset, Climatology, https://bit.ly/3hA1GgC #SWclimate

June 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
U.S. Drought Monitor
droughtmonitor.unl.edu

Figure 5
National Interagency Fire Center
nifc.gov

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

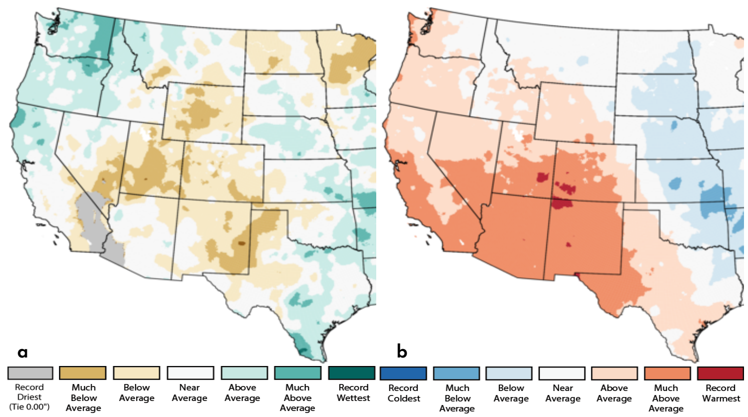


Figure 1: May 2020 Precipitation (a) & Temperature Ranks (b)

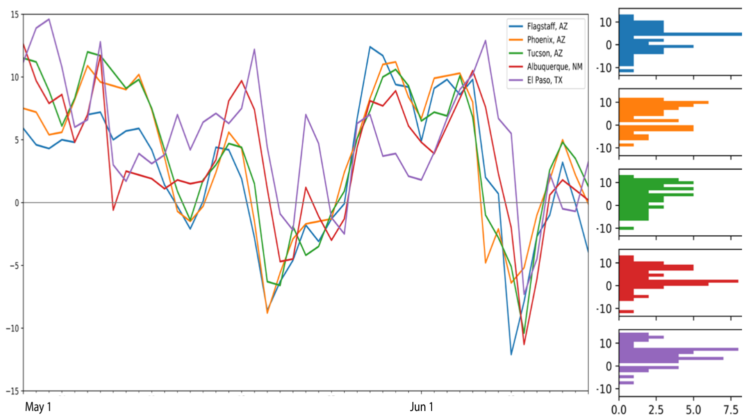


Figure 2: Daily Temperature Anomalies May 1 - Jun 14 (L) & Frequency of Anomalies (R)

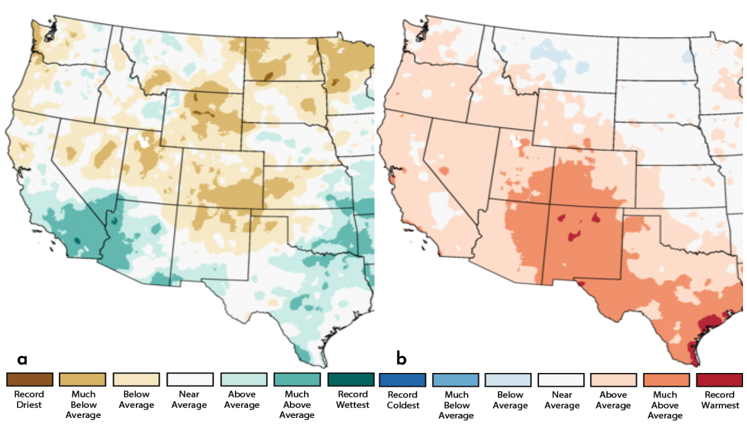


Figure 3: Mar - May 2020 Precipitation (a) & Temperature Ranks (b)

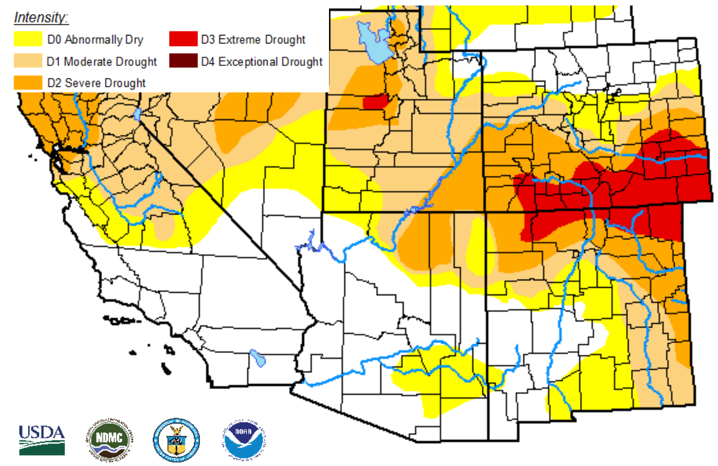


Figure 4: US Drought Monitor - Jun 9, 2020

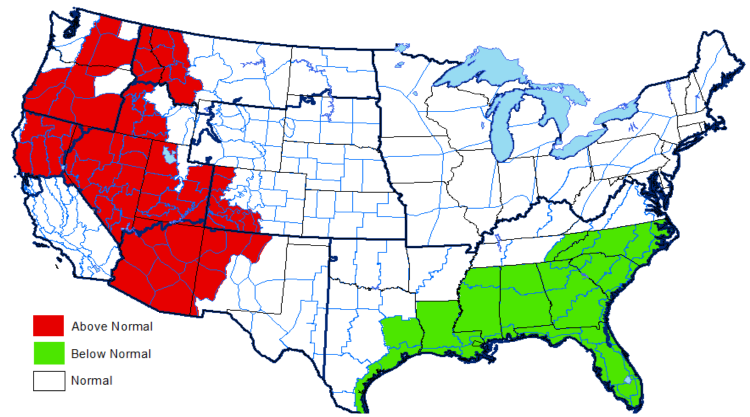


Figure 5: NIFC.gov Significant Wildland Fire Potential - July 2020

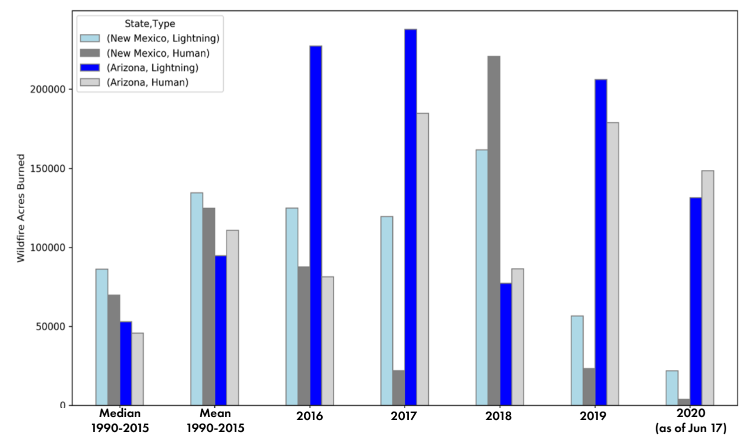


Figure 6: Lightning and Human-Caused Wildfire - AZ and NM

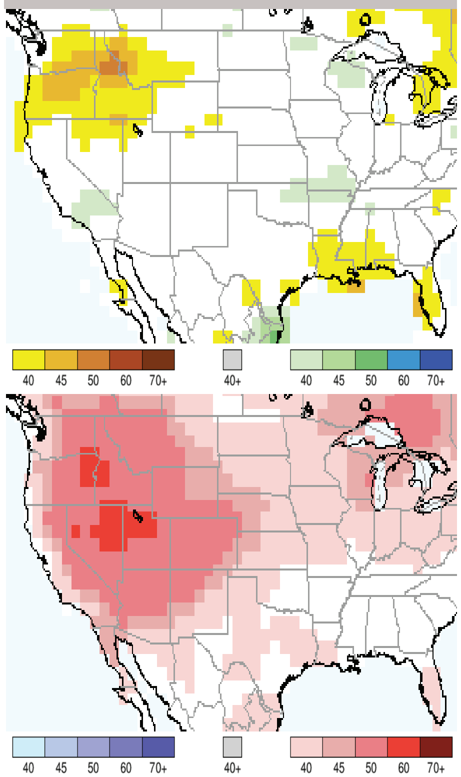


Figure 7: Three-Month (Jul-Sept) Forecast for Precip (top) and Temps (bottom)

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

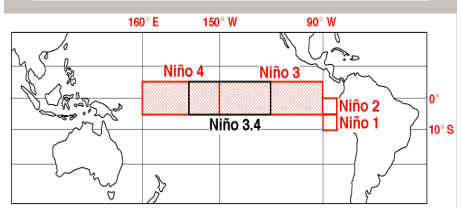
Figure 4
NOAA - Climate Prediction Center
cpc.ncep.noaa.gov

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 temperatures (SSTs) are near normal across most of the equatorial Pacific (Figs. 1-2). Conditions are forecast to remain ENSO-neutral through summer 2020, while some outlooks point to a possible La Nina event later in 2020.

Forecast Roundup: On June 9, the Australian Bureau of Meteorology maintained their ENSO outlook at an inactive status. They higlighted that a few models indicate a possible La Niña in 2020, and are monitoring these conditions to determine La Niña watch status. On June 10, the Japanese Meteorological Agency (JMA) maintained its call for a 60-percent chance of ENSO-neutral conditions through summer 2020. On June 11, the NOAA Climate Prediction Center (CPC) issued its ENSO diagnostic discussion with an inactive alert status. The CPC called for a 60-percent chance of ENSO-neutral through summer 2020, and with "roughly equal chances" between ENSO-neutral and La Niña for fall 2020. On June 11, the International Research Institute (IRI) issued an ENSO Quick Look (Fig. 3), noting "model forecasts favor coolish but neutral SST conditions into summer, becoming more strongly below-average, and possibly in weak La Niña territory." The North American Multi-Model Ensemble (NMME) mean forecast is within the range of neutral, but is projected to move closer to borderline La Niña conditions later in 2020 (dashed black line, Fig. 4).

Summary: The oceans cooled over the past few months, and overall, oceanic and atmospheric conditions were in the range of ENSO-neutral during this period. Most forecasts call for these conditions to remain ENSO-neutral through the summer, but by fall, it is effectively a toss-up between ENSO-neutral and La Niña. ENSO status tends to have a weak relationship with monsoon precipitation (at least in our current understanding). La Niña is associated with suppressed tropical storm activity in the Pacific during the fall, and drier than normal conditions in the winter.

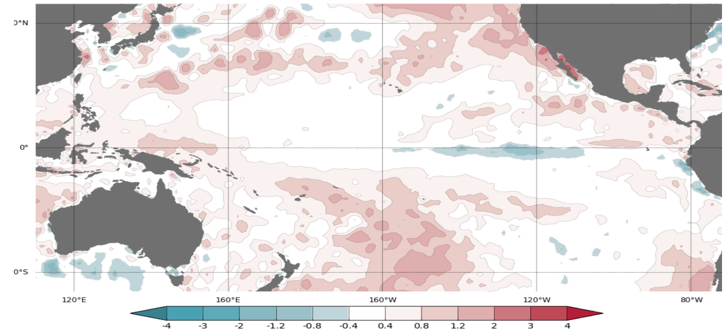


Figure 1: May 2020 Sea Surface Temperature (SST) Anomalies

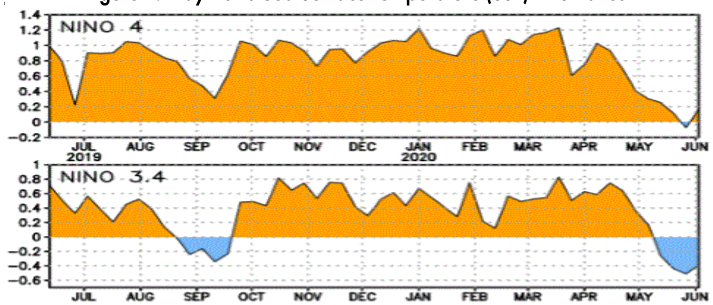


Figure 2: SST Anomalies in Niño Regions 3.4 & 4 (NCDC)

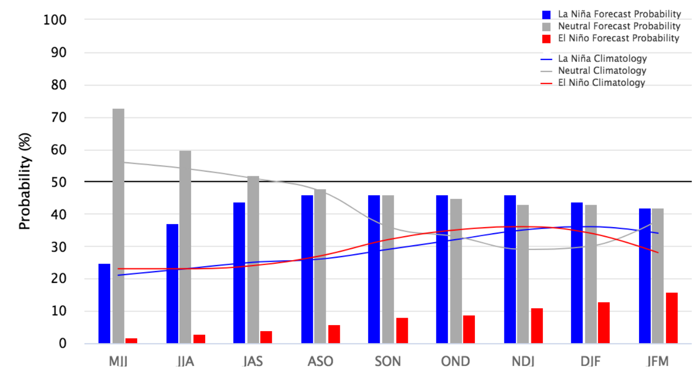


Figure 3: Early-Jun IRI/CPC Model-Based Probabilistic ENSO Forecast

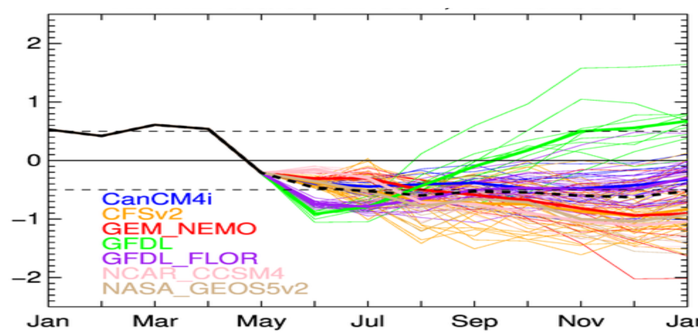


Figure 4: North American Multi-Model Ensemble Forecast for Niño 3.4

Online Resources

Figure 1
International Research Institute for Climate and Society
journals.ametsoc.org/doi/abs/10.1175/2007JCLI1762.1

Figures 2a-2b
Monsoon Definition & Progression
National Weather Service - Tucson
wrh.noaa.gov/twc/monsoon/monsoon.php

Figure 3
CLIMAS: Climate Assessment for the Southwest
climas.arizona.edu

NWS Tucson has an excellent extended explanation of seasonal atmospheric dynamics that drive monsoon progression.
wrh.noaa.gov/twc/monsoon/monsoon_info.php

Southwest Climate Podcast
climas.arizona.edu/media/podcasts

Monsoon Onset

In 2008, the National Weather Service (NWS) changed the definition of the start of the Southwest monsoon from a variable date based on locally measured conditions to a fixed date of June 15 (and a fixed end date of Sept 30). This allowed for a clear delineation of the period of monsoon activity (108 days) and focused NWS's messaging strategy as it pertains to the expected hazards during that period, which include extreme heat, strong winds, dust storms, flash flooding, lightning, and wildfires (see monsoon safety awareness hub at NWS Tucson).

Prior to 2008, the flexible start date reflected the seasonal progression of the monsoon, with a considerable temporal gradient across the region (Fig. 1).

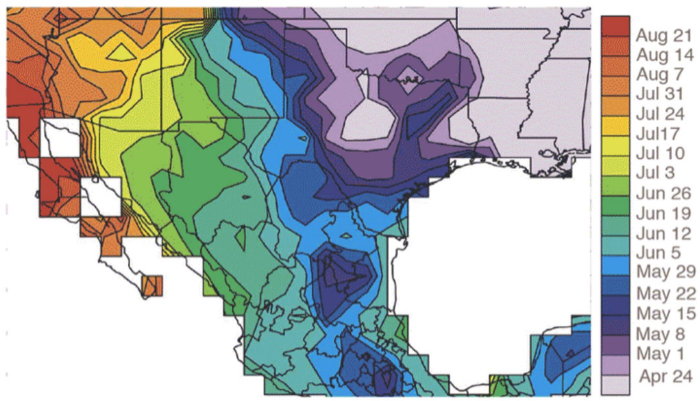


Figure 1: Historical Monsoon Onset Date

This gradient is linked to seasonal atmospheric patterns and the establishment of the "monsoon ridge" in the Southwest (Figs. 2a-b, also see sidebar for link to NWS pages). The heating of the complex topography of the western U.S. with the increasing sun angle and contrast with the cooler water of the adjacent Pacific Ocean lead to the establishment of this upper-level ridge of high pressure over the Southwest U.S. (also known as Four Corners High). The flow around this upper-level ridge shifts from a dry southwesterly fetch in May to a moisture-rich southerly-southeasterly fetch in late June/early July (see figures, right).

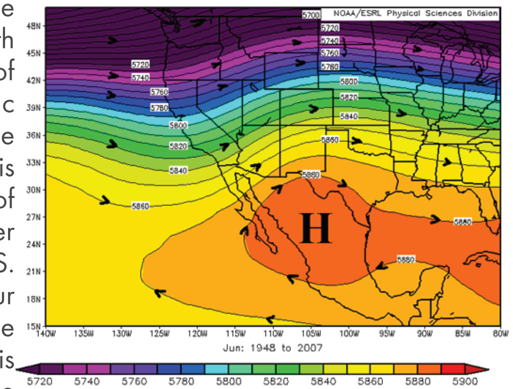


Figure 2a: NCEP/NCAR Mean 500mb Geopotential Height - Jul (1948-2007)

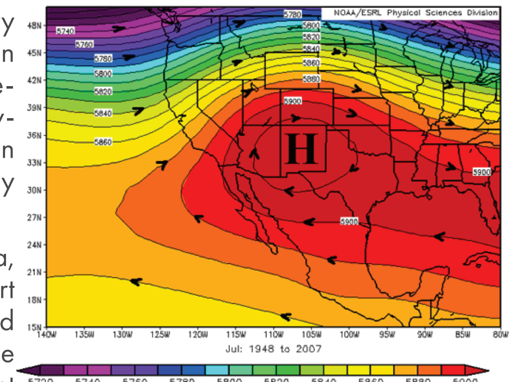


Figure 2b: NCEP/NCAR Mean 500mb Geopotential Height - Jul (1948-2007)

In Southern Arizona, the monsoon start date was based on the average daily dewpoint temperature. Phoenix and Tucson NWS offices used the criteria of three consecutive days of daily average dewpoint temperature above a threshold (55 degrees in Phoenix, 54 degrees in Tucson) to define the start date of the monsoon. As shown in Figure 3 the dewpoint temperature criterion produced start dates ranging from mid-June to late July over the period of record (1949-2016).

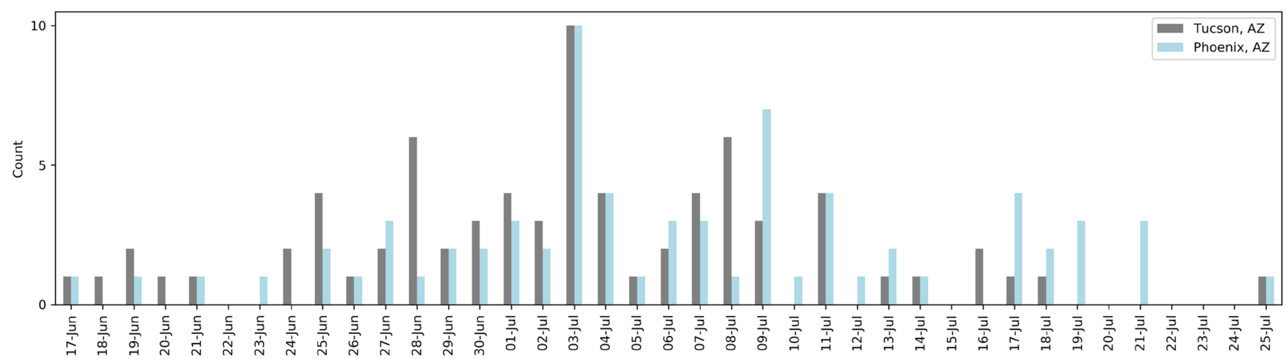


Figure 3: Date of Monsoon Onset Using Dewpoint Definition for Tucson (54 F) and Phoenix (55 F)

Online Resources

Figures 4,6
CLIMAS: Climate Assessment for the Southwest
climas.arizona.edu

data: National Weather Service

Figure 5
UArizona Climate Science Applications Program
cals.arizona.edu/climate/

data: PRISM Climate Group

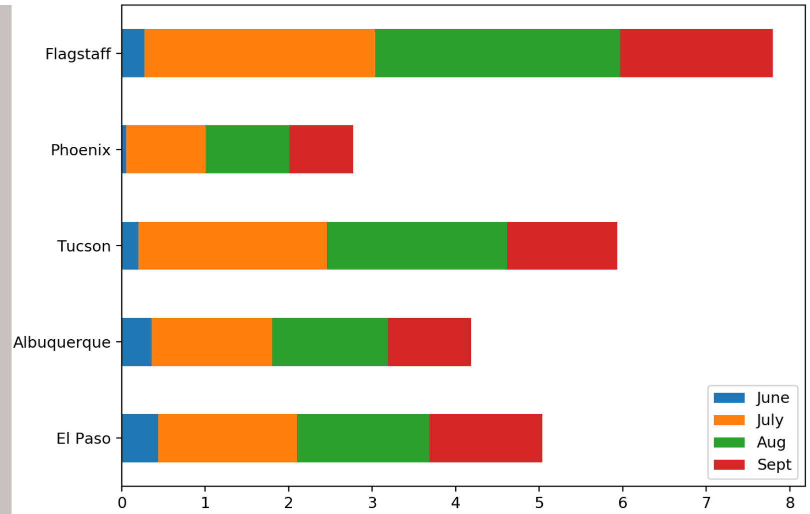


Figure 4: Southwest U.S. Monthly Average Monsoon Precipitation

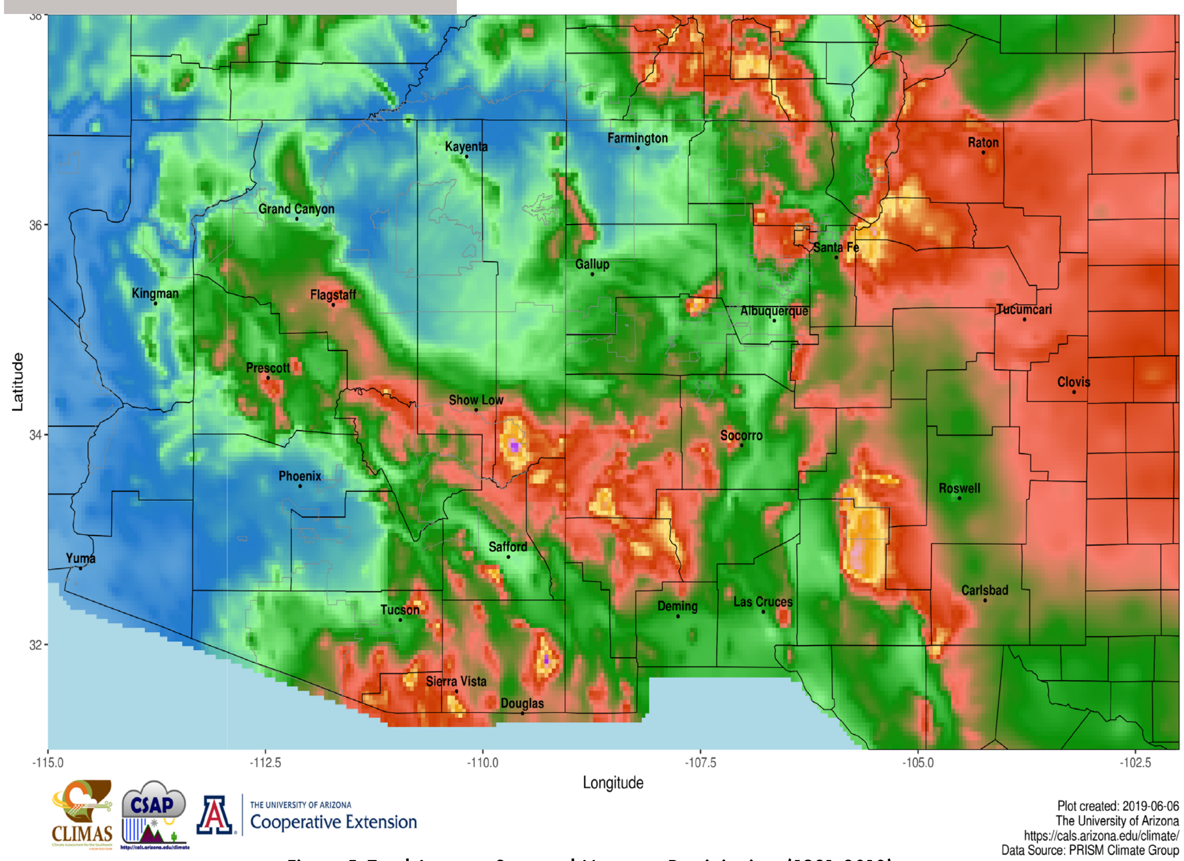


Figure 5: Total Average Seasonal Monsoon Precipitation (1981-2010)

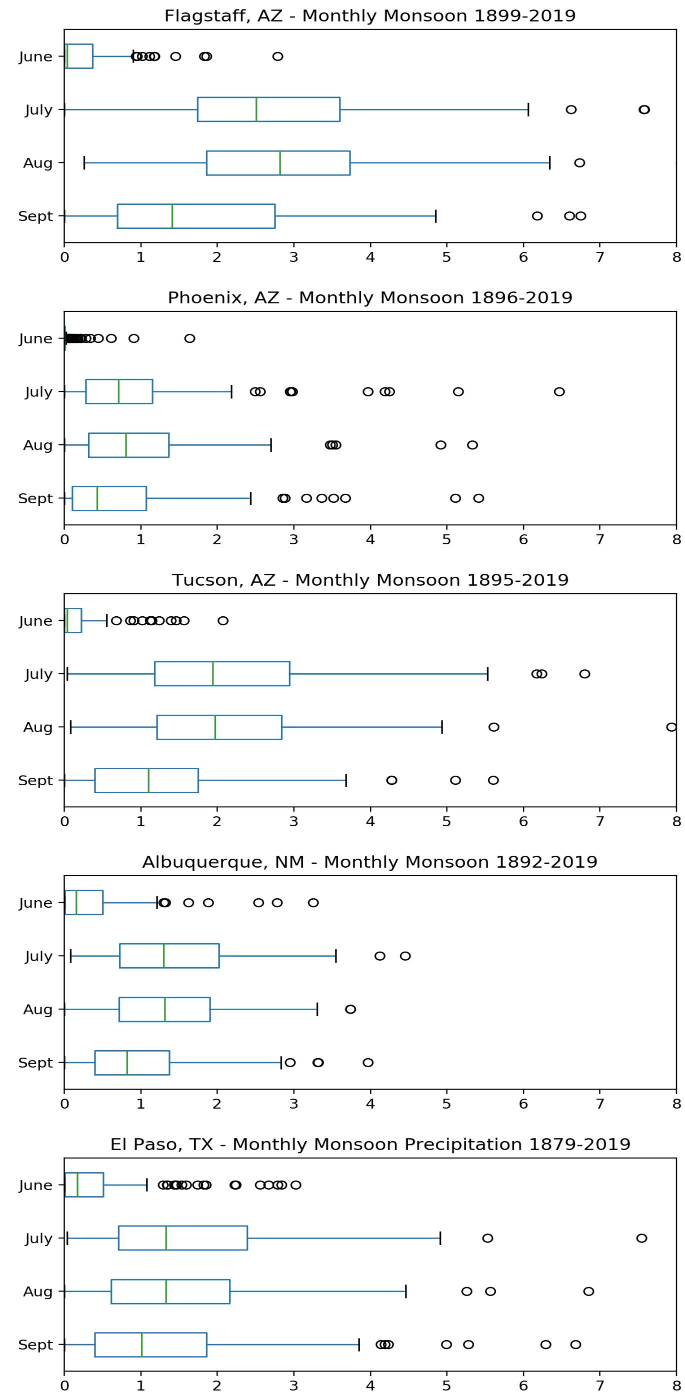


Figure 6: Monthly Monsoon Precipitation - Select SW Stations

Online Resources

Figure 7
UArizona Climate Science Applications Program
cals.arizona.edu/climate/

data: PRISM Climate Group

CLIMAS Research & Activities

CLIMAS Research

climas.arizona.edu/research

CLIMAS Outreach

climas.arizona.edu/outreach

Climate Services

climas.arizona.edu/climate-services

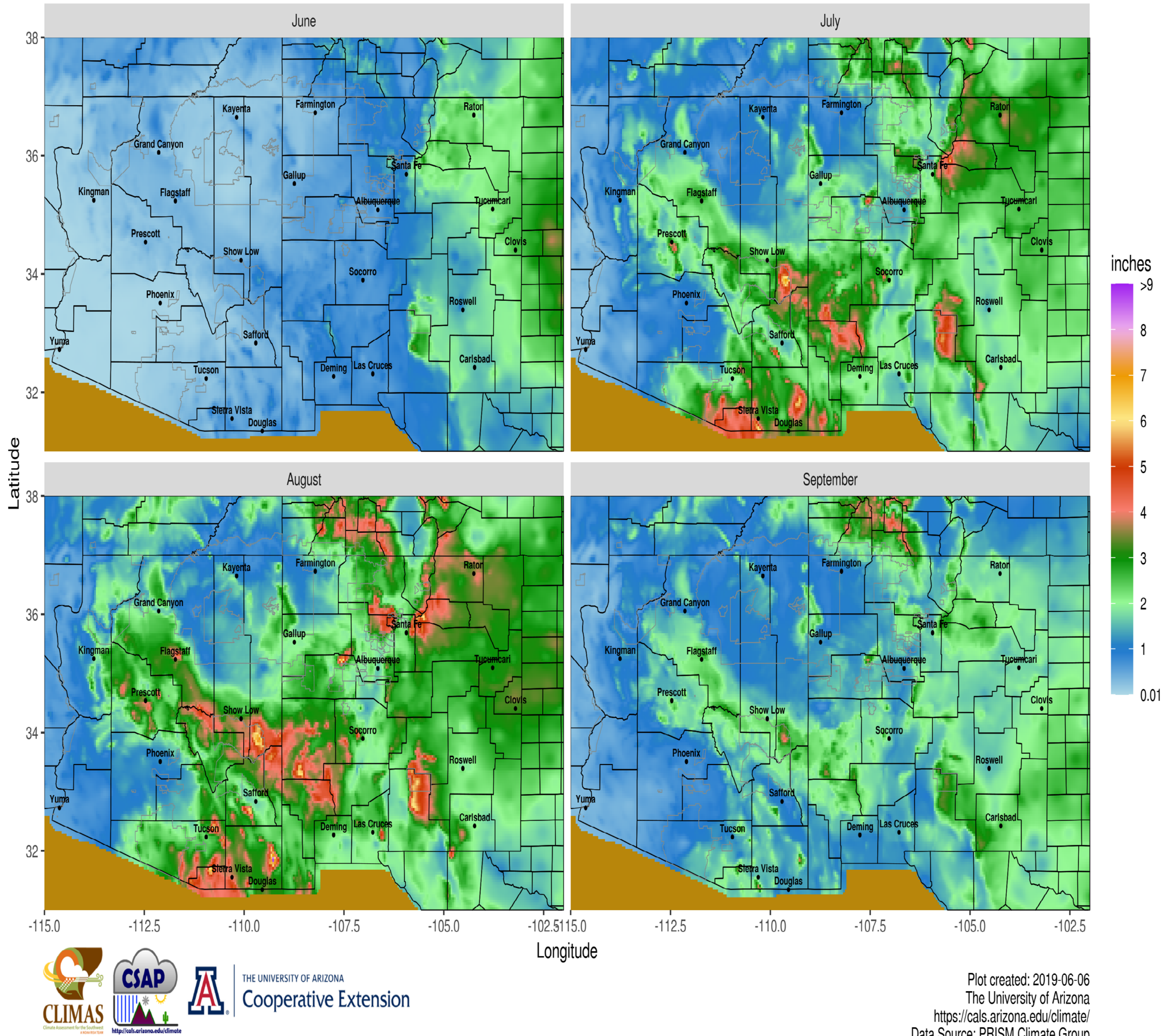


Figure 7: Monthly Average Monsoon Precipitation (1981-2010)

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.

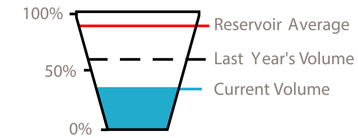
The map gives a representation of current storage for reservoirs in Arizona and New Mexico. Reservoir locations are numbered within the blue circles on the map, corresponding to the reservoirs listed in the table. The cup next to each reservoir shows the current storage (blue fill) as a percent of total 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).

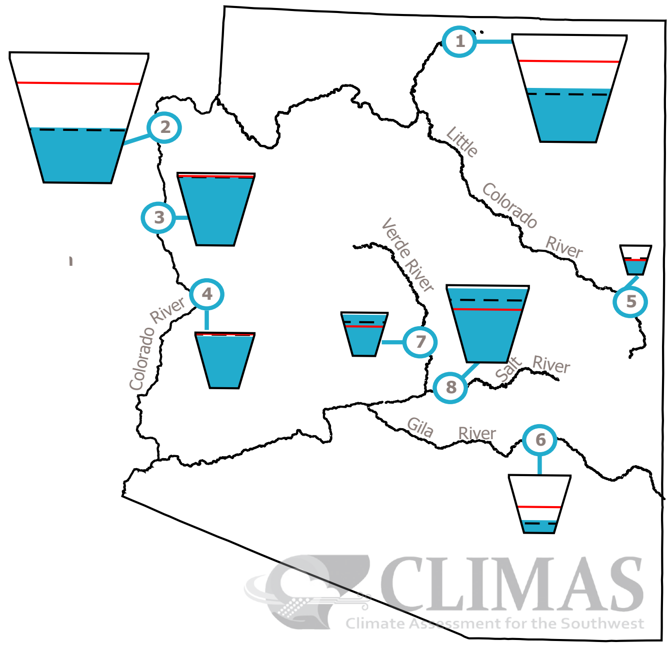
The table details more exactly the current capacity (listed as a percent of maximum storage). Current and maximum storage are given in thousands of acre-feet for each reservoir. One acre-foot is the volume of water sufficient to cover an acre of land to a depth of 1 foot (approximately 325,851 gallons).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

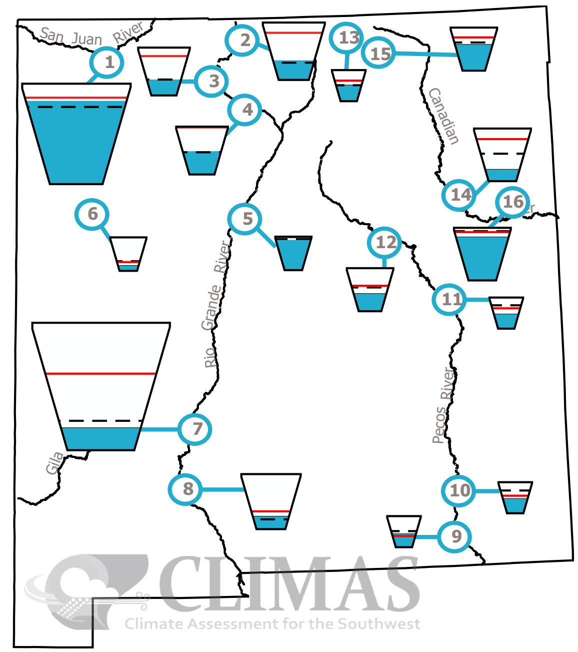
These data are based on reservoir reports updated monthly by the National Water and Climate Center of the U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS).

Reservoir Volumes

DATA THROUGH JUNE 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	50%	12,238.5	24,322.0	553.2
2. Lake Mead	42%	10,971.0	26,159.0	-444.0
3. Lake Mohave	94%	1,707.0	1,810.0	7.0
4. Lake Havasu	93%	573.2	619.0	1.9
5. Lyman	52%	15.7	30.0	-1.6
6. San Carlos	21%	187.1	875.0	-17.7
7. Verde River System	94%	268.9	287.4	-16.0
8. Salt River System	96%	1,947.7	2,025.8	-23.7

*KAF: thousands of acre-feet

Reservoir	Capacity	Current Storage*	Max Storage*	One-Month Change in Storage*
1. Navajo	81%	1366.7	1,696.0	69.9
2. Heron	33%	133.0	400.0	18.8
3. El Vado	32%	60.4	190.3	19.0
4. Abiquiu	48%	90.1	186.8	2.2
5. Cochiti	89%	44.6	50.0	-1.2
6. Bluewater	15%	5.6	38.5	-1.0
7. Elephant Butte	18%	402.2	2,195.0	-98.3
8. Caballo	23%	77.4	332.0	3.9
9. Lake Avalon	42%	1.9	4.5	-0.2
10. Brantley	47%	19.7	42.2	-11.5
11. Sumner	46%	16.6	35.9	-5.6
12. Santa Rosa	40%	42.5	105.9	8.7
13. Costilla	51%	8.1	16.0	-0.2
14. Conchas	23%	57.2	254.2	-10.9
15. Eagle Nest	59%	46.7	79.0	-1.4
16. Ute Reservoir	81%	161	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

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.

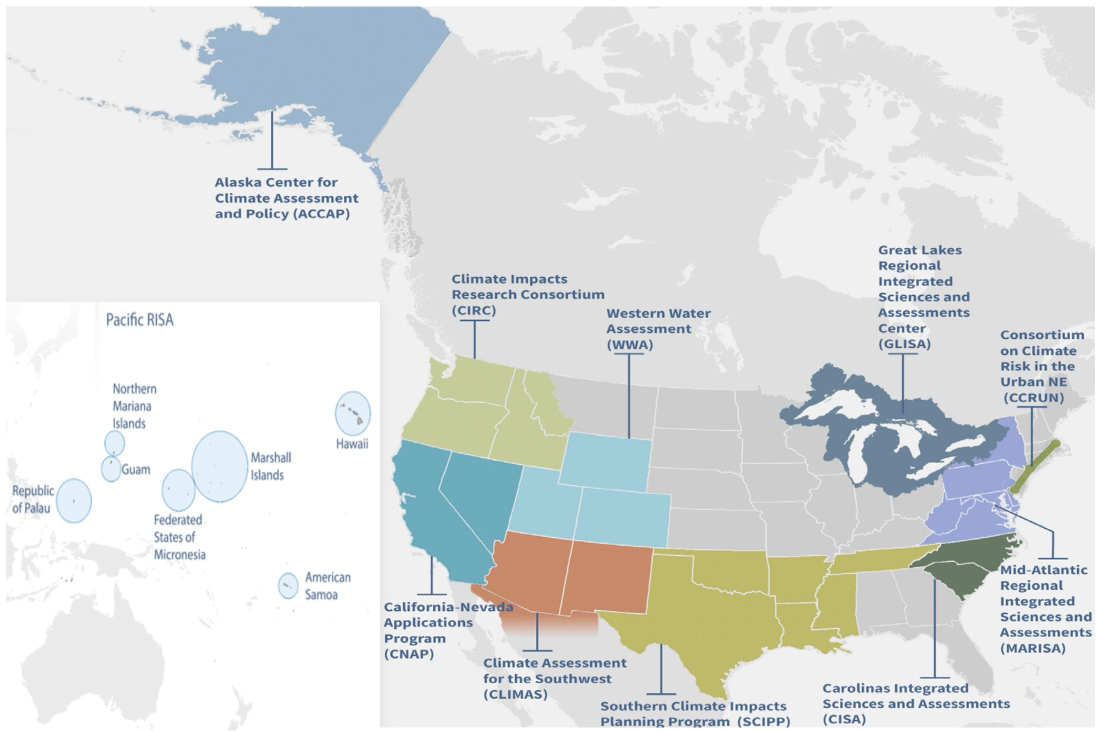


Figure 1: NOAA Regional Integrated Sciences and Assessments Regions