August Southwest Climate Outlook

Precipitation and Temperature: July precipitation ranged from below average in the southwest corner of Arizona to average to much-above average across the rest of the state (Fig. 1a). Central New Mexico recorded mostly below-average precipitation in July, while the northern and southwestern portions of the state recorded average to much-above average precipitation (Fig. 1a). July temperatures were average to much-above average in Arizona and New Mexico (Fig. 1b), although regular monsoon events helped tamp down daily average temperatures in southeastern Arizona and southwestern New Mexico. Year-to-date precipitation ranks reveal mostly average to above-average precipitation in Arizona and New Mexico, with drier pockets in the borderlands region of Arizona and in central and southeastern New Mexico (Fig. 2a). Year-to-date temperature ranks are much-above average across the Southwest (Fig. 2b), with small areas of Arizona and much of the Rio Grande Basin in New Mexico recording record-warm yearly average temperatures (Jan-July 2017).

Monsoon Tracker: The monsoon started a bit later than average in 2017 but more than made up for the delayed start with numerous precipitation events throughout much of July and early August (see Monsoon Tracker for details). Notably, Tucson recorded its wettest July on record and second-wettest month on record, and it and many other stations across the region have surpassed their normal cumulative values, with some approaching or even exceeding their seasonal (June 15 – Sept. 30) climatological average (Fig. 3).

Drought & Water Supply: With monsoon precipitation catching up in the northern halves of Arizona and New Mexico, the U.S. Drought Monitor (USDM) has removed those regions from the short-term drought designation of the previous month. However, the borderlands region of southern Arizona remains designated as either D0 (abnormally dry) or D1 (moderate drought), emphasizing long-term drought conditions linked to below-average winter precipitation that are not typically ameliorated by monsoon precipitation (Fig. 4).

Health & Environmental Safety: Wildfire season is effectively over in Arizona and New Mexico, with monsoon precipitation and increased relative humidity tamping down fire risk across the region. Wildfire totals for the 2017 season are approximately 370,000 acres burned in Arizona (roughly 220,000 acres attributed to lightning ignition and the remainder to human causes), and approximately 128,000 acres burned in New Mexico (105,000 acres due to lightning and 23,000 acres from humans). With the return of the monsoon, the region has also seen an uptick in pollen counts from plants that take advantage of seasonal moisture: chenopod and ragweed pollen are particularly severe following abundant monsoon precipitation.

El Niño Southern Oscillation: Models and forecasts continue to suggest the most likely outcome is ENSO-neutral conditions through winter 2017-2018 (85 percent chance through the fall, then 55 percent chance over winter). The chances of El Niño or La Niña this winter are fairly low, at 15-20 percent and 25-30 percent, respectively.

Precipitation and Temperature Forecast: The Aug. 17 NOAA Climate Prediction Center's outlook for September calls for equal chances of above- or below-average precipitation in Arizona and New Mexico, and increased chances of above-average temperatures in most of Arizona. The three-month outlook for September through November calls for equal chances of above- or below-average precipitation in Arizona and New Mexico (Fig. 5, top). Increased chances of above-normal temperatures are forecast for the entire United States (Fig. 5, bottom).

Tweet August SW Climate Outlook CLICK TO TWEET

AUG2017 @CLIMAS_UA Climate Outlook, ENSO Tracker, Monsoon Tracker, Reservoir vol. http://
http://bit.ly/2w6K9HZ #SWclimate #AZWX #NMWX #SWCO

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Online Resources

Figures 1-2
National Center for Environmental Information
http://www.ncdc.noaa.gov

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

Figure 4
U.S. Drought Monitor
http://droughtmonitor.unl.edu/

Figure 5
NOAA - Climate Prediction Center
http://www.cpc.ncep.noaa.gov/

CLIMAS YouTube Channel

Visit our YouTube channel for videos of content pulled from the podcast.

www.youtube.com/user/UACLIMAS/

Podcasts

Visit our website or iTunes to subscribe to our podcast feed.

www.climas.arizona.edu/media/podcasts

August 2017 SW Climate Outlook

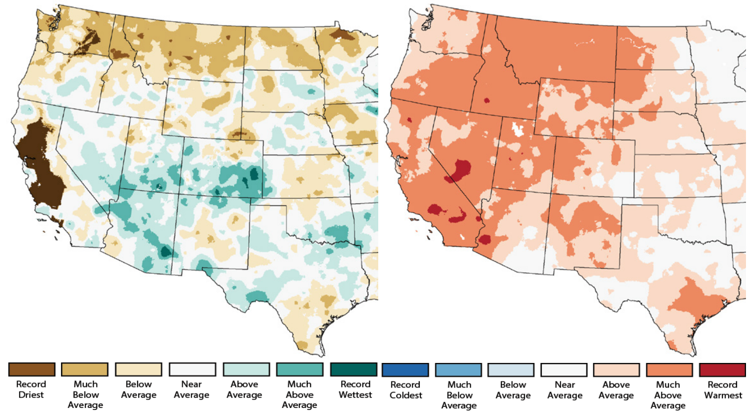


Figure 1: July 2017 Precipitation (a) & Temperature Ranks (b)

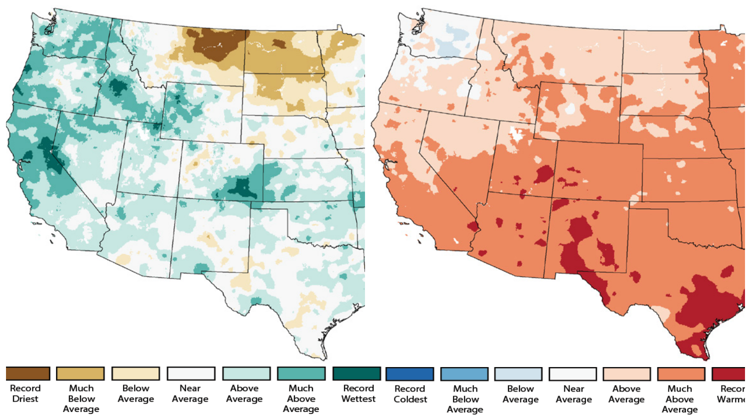


Figure 2: Jan-Jul 2017 Precipitation (a) & Temperature Ranks (b)

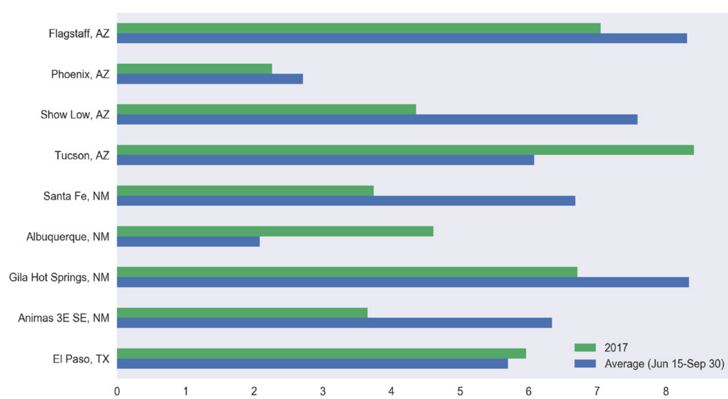


Figure 3: Monsoon Precip to Date (Aug 16, 2017) vs. Seasonal Average Total (Jun 15-Sep 30)

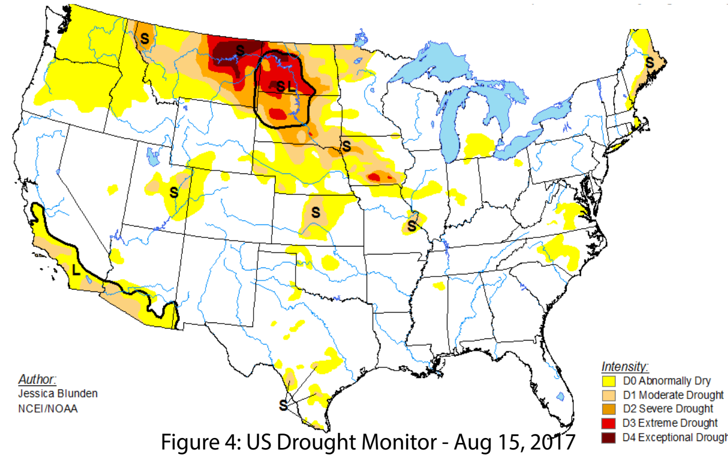


Figure 4: US Drought Monitor - Aug 15, 2017

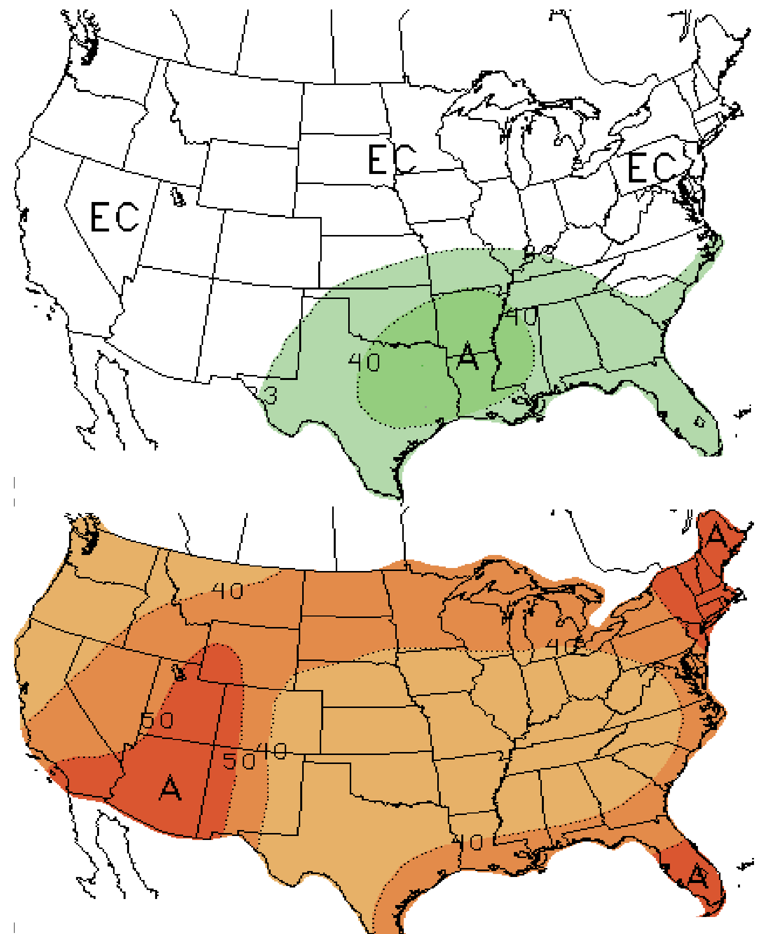


Figure 5: Three-Month Outlook - Precipitation (top) & Temperature (bottom) - Aug 17, 2017

Online Resources

Figures 1-2
Climate Science Applications Program
cals.arizona.edu/climate/

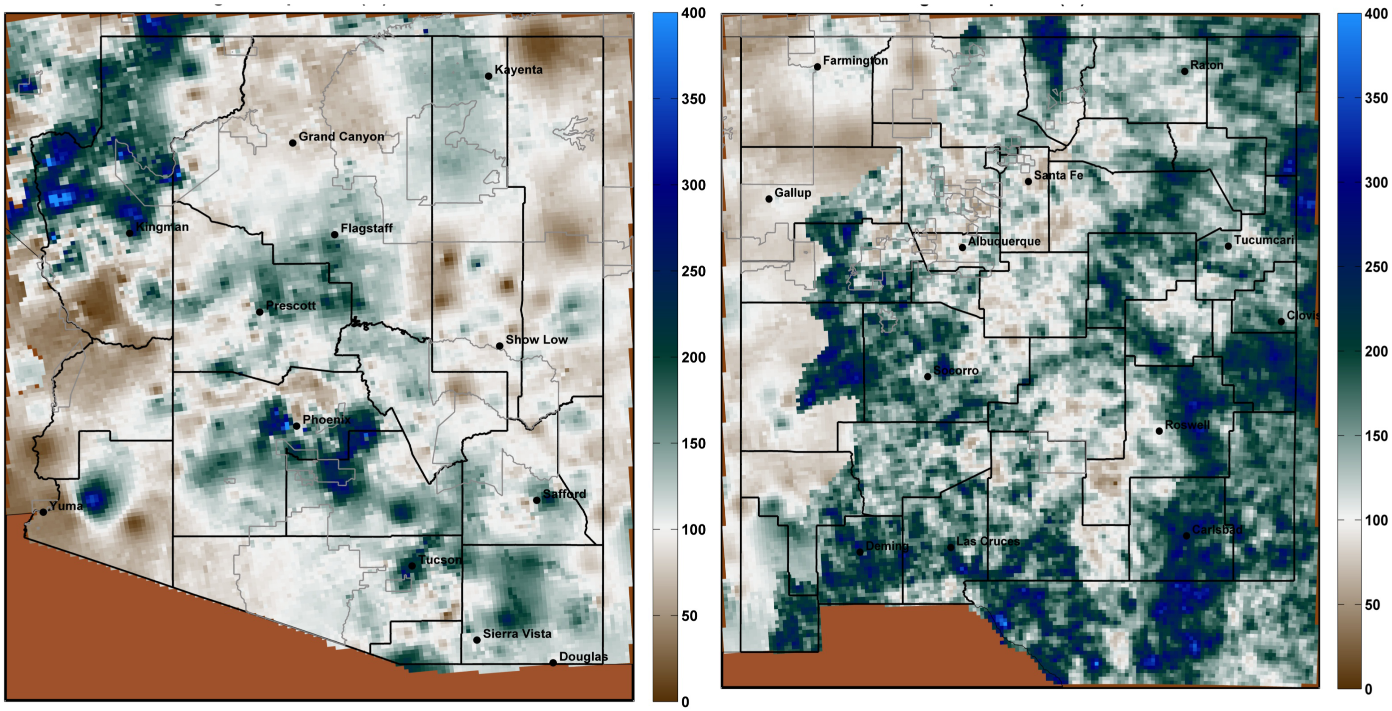
CLIMAS Monsoon Hub

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

www.climas.arizona.edu/sw-climate/monsoon

Southwestern Monsoon Tracker

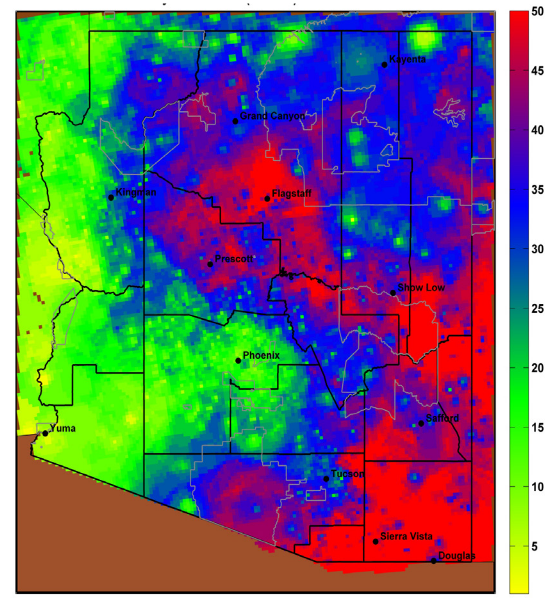
After a relatively late start to the monsoon across much of the Southwest, early-mid July through early August saw an impressive run of storms. Above-average cumulative (through Aug. 14) precipitation is widespread across much of Arizona (Fig. 1a) and New Mexico (Fig. 1b). Exceptions—regions with average and below-average precipitation—occur mostly in Arizona and include the southwest portion of the state, the highlands of the Mogollon Rim, and the north rim of the Grand Canyon, as well as the Four Corners region. These figures highlight the spatial variability of monsoon precipitation and the difficulty of scoring or grading the monsoon performance using single stations or summary maps (but we're still trying!). Another useful metric that characterizes a different aspect of the monsoon is the percent of days with rain, which, when used with the precipitation maps, distinguishes areas that have received more frequent and moderate precipitation from those in which just a few extreme events boosted seasonal totals. In Arizona, the eastern two-thirds of the state has seen consistent precipitation, ranging from 35 percent to as high as 50 percent of days (Fig. 2a). In contrast, Phoenix and the western edge of the state have had far fewer days with rain. Precipitation frequency is even more uniform across New Mexico, with nearly the entire state recording precipitation on 30 to 50 percent of days (Fig. 2b).



Map produced using daily total precipitation estimates from the NOAA National Weather Service Advanced Hydrologic Prediction Service (AHPS). Data information available at http://water.weather.gov/precip/about.php. Date created: 17-Aug-2017 University of Arizona - http://cals.arizona.edu/climate/

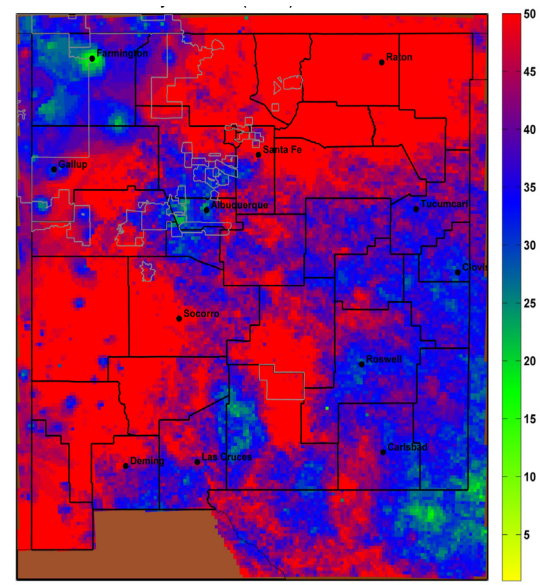
Map produced using daily total precipitation estimates from the NOAA National Weather Service Advanced Hydrologic Prediction Service (AHPS). Data information available at http://water.weather.gov/precip/about.php. Date created: 17-Aug-2017 University of Arizona - http://cals.arizona.edu/climate/

Figure 1a-b: Percent of Average Precipitation - Jun 15 - Aug 16, 2017



Map produced using daily total precipitation estimates from the NOAA National Weather Service Advanced Hydrologic Prediction Service (AHPS). Data information available at http://water.weather.gov/precip/about.php. Date created: 17-Aug-2017 University of Arizona - http://cals.arizona.edu/climate/

Figure 2a: Percent of Days With Rain (>0.01") - Jun 15 - Aug 17



Map produced using daily total precipitation estimates from the NOAA National Weather Service Advanced Hydrologic Prediction Service (AHPS). Data information available at http://water.weather.gov/precip/about.php. Date created: 17-Aug-2017 University of Arizona - http://cals.arizona.edu/climate/

Figure 2b: Percent of Days With Rain (>0.01") - Jun 15 - Aug 17

Online Resources

Figures 1-3
CLIMAS: Climate Assessment for the Southwest
climas.arizona.edu

CLIMAS Monsoon Hub

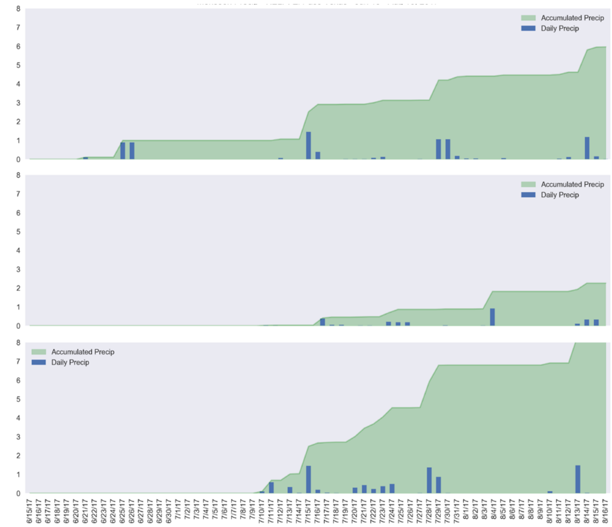
Information on this page is also found on the CLIMAS website:

www.climas.arizona.edu/sw-climate/monsoon

Southwestern Monsoon Tracker (cont.)

Comparison of the current totals at regional weather stations to normal precipitation-to-date and average seasonal totals gives a better sense of how locations across the region are faring in the monsoon (Fig. 1). Most of the stations in Fig. 1 recorded average to above-average precipitation to date, and a few (El Paso and Tucson) exceeded the monsoon seasonal average (June 15 – Sept 30). Daily cumulative precipitation plots (Figs. 2a-c) show how stations reached their current totals, documenting the intensity of individual days, as well as their contribution to the seasonal total.

Individual station values provide insight into the regional variability of the monsoon, but what about the local variability? Looking at the Pima County ALERT network sensors (Fig. 3) reveals just how variable the monsoon can be within a region, as well as the fact that daily & cumulative single-station values may not reflect the range of precipitation values observed in the monsoon.



Figures 2a-c: Daily-Cumulative Precipitation Plots - El Paso, TX (top), Phoenix, AZ (middle), Tucson, AZ (bottom)

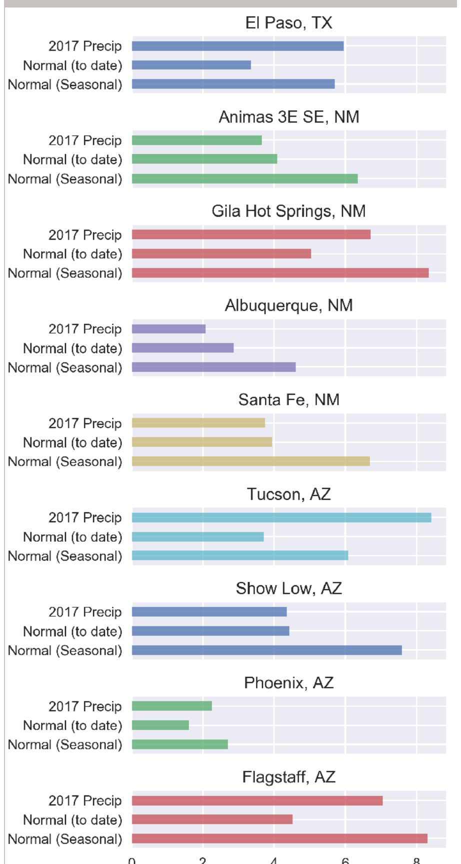


Figure 1: 2017 Monsoon Precip vs. Normals (To-Date & Seasonal)

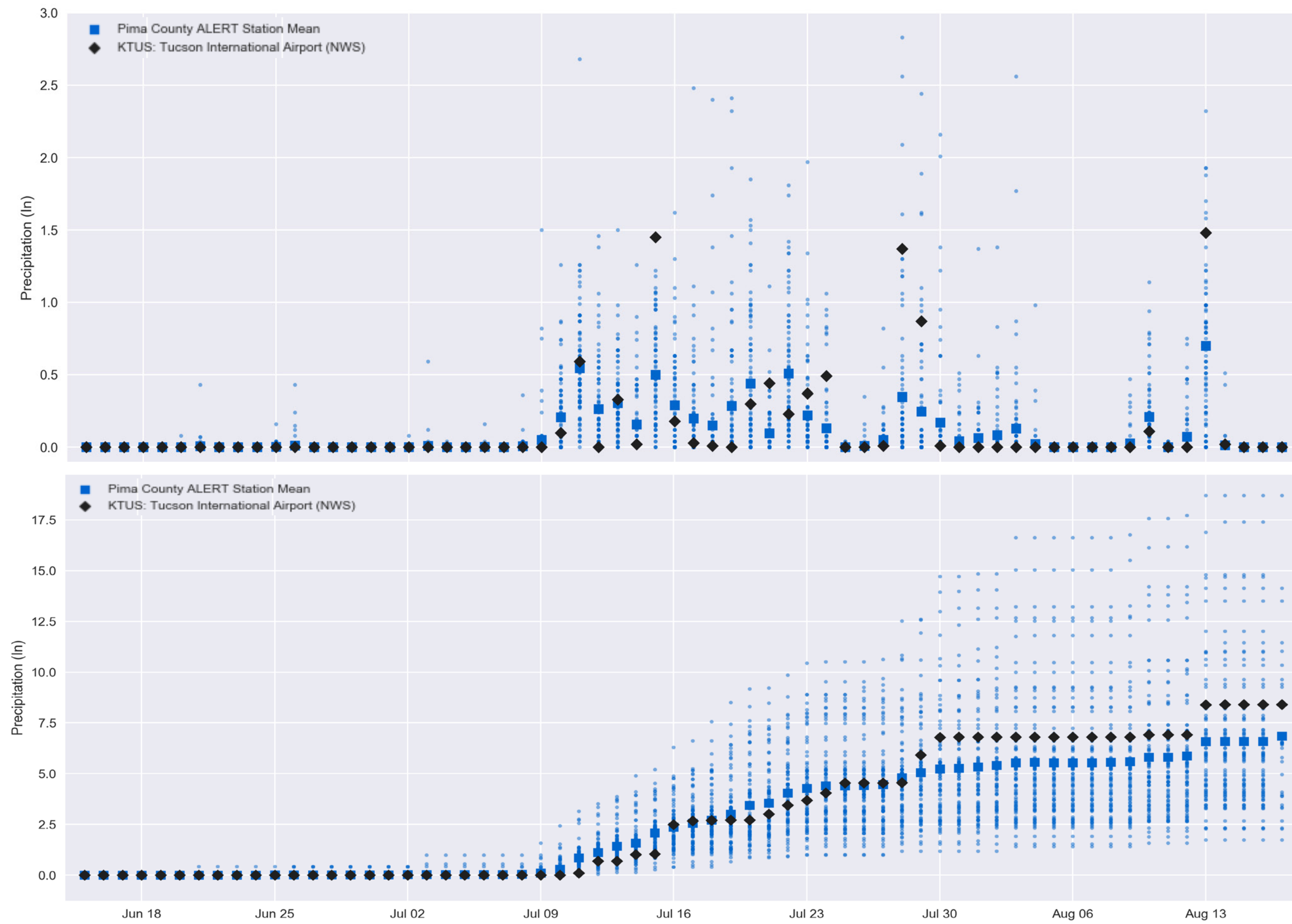


Figure 3: Monsoon Precipitation - Daily (top) & Cumulative (bottom)- Pima County ALERT Network (Blue) & Tucson International Airport (Black)

Online Resources

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

Figure 2
NOAA - Climate Prediction Center
http://www.cpc.ncep.noaa.gov/

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

Figure 4
NOAA - Climate Prediction Center
http://www.cpc.ncep.noaa.gov/

Figure 5
CLIMAS: Climate Assessment for the Southwest
http://www.climas.arizona.edu/

International Research Institute for Climate and Society
http://iri.columbia.edu - #IRIforecast

El Niño / La Niña

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

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

El Niño-Southern Oscillation (ENSO) - Tracker

Oceanic and atmospheric indicators remain within the range of neutral (Figs. 1-2). Seasonal outlooks and forecasts generally agree that ENSO-neutral conditions are the most likely outcome through winter 2017-2018. On Aug. 10, the Japanese Meteorological Agency (JMA) identified a continuation of ENSO-neutral conditions with a 60-percent chance of El Niño conditions until winter 2017-2018. On Aug. 10, the NOAA Climate Prediction Center (CPC) observed that oceanic and atmospheric conditions remained within the range of ENSO-neutral conditions, and that "the majority of models favor ENSO-neutral for the remainder of 2017." They identified an 85-percent chance of neutral conditions through September 2017, and a 55-percent chance through February 2018. On Aug. 15, the Australian Bureau of Meteorology ENSO tracker remained at neutral/inactive, highlighting that every indication (models and forecasts) suggested ENSO-neutral conditions through 2017. On July 20, the International Research Institute for Climate and Society (IRI) and CPC identified a high likelihood of ENSO neutral conditions for the rest of 2017 (Fig. 3). The North American Multi-Model Ensemble (NMME) is ENSO-neutral as of August 2017. The model spread indicates a range of outcomes for the rest of 2017 (Fig. 4), but the ensemble mean indicates ENSO-neutral as the most likely outcome.

Summary: As with last month, ENSO indicators remain well within the bounds of ENSO-neutral, and there is little to suggest any other outcome in winter 2017-2018. An interesting detail has emerged from a few of the forecast discussions, however: the appearance of a slight uptick in the likelihood of a La Niña event in 2017-2018, running counter to discussion of the last few months. What's going on? In Fig. 3, subtracting the current forecast percentage (bars) from the seasonal climatological probability percentage (lines) flattens the plot and reveals the deviation from normal climatology these forecast percentages represent (Fig. 5). Under this formulation, neutral conditions are forecast well above their climatological average through winter 2017-2018, while both El Niño and La Niña conditions are below their climatological average. This corresponds with current forecasts discussed above, and given the expected uncertainty associated with longer-term forecasts, the forecast percentages converge on climatological averages by the Mar-Apr-May period of 2018.

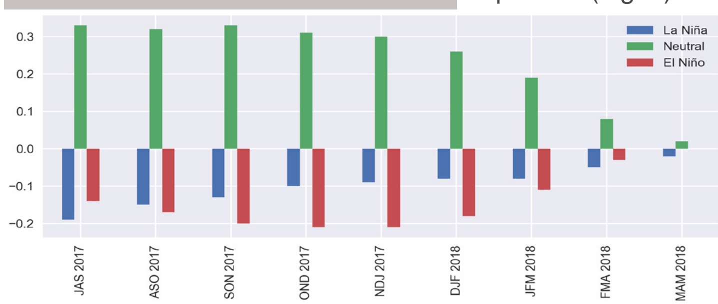


Figure 5: Seasonal Forecast Deviations from ENSO Climatology

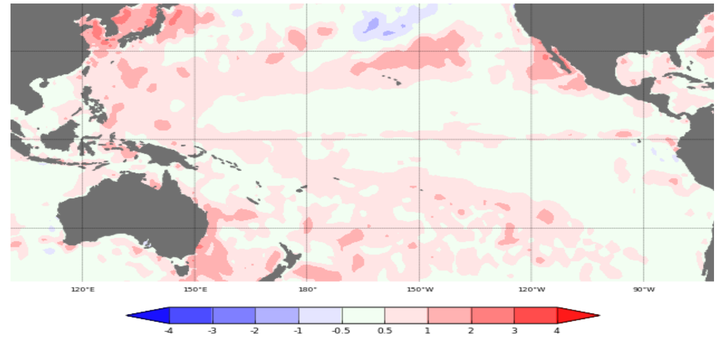
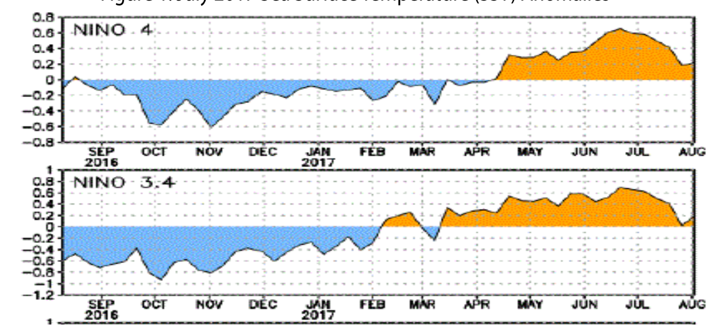


Figure 1: July 2017 Sea Surface Temperature (SST) Anomalies



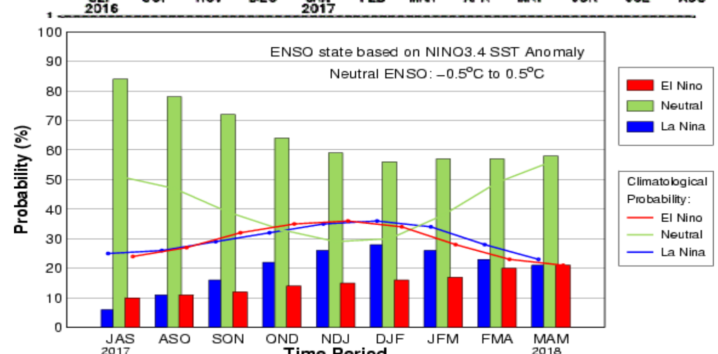


Figure 3: Early-Aug IRI/CPC Model-Based Probabilistic ENSO Forecast

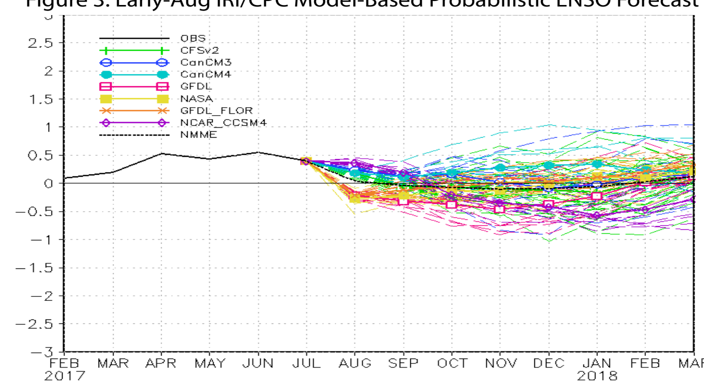


Figure 4: North American Multi-Model Ensemble Forecast for Niño 3.4

Online Resources

Portions of the information provided in this figure can be accessed at the Natural Resources Conservation Service

Arizona: http://1.usa.gov/19e2BdJ

New Mexico: http://www.wcc.nrcs.usda.gov/cgibin/resv_rpt.pl?state=new_mexico

Contact Ben McMahan with any questions or comments about these or any other suggested revisions.

Notes

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).

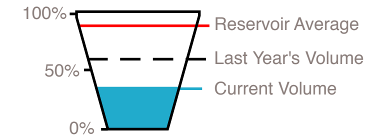
The table details more exactly the current capacity (listed as a percent of maximum storage). Current and maximum storage are given in thousands of acre-feet for each reservoir. One acre-foot is the volume of water sufficient to cover an acre of land to a depth of 1 foot (approximately 325,851 gallons).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

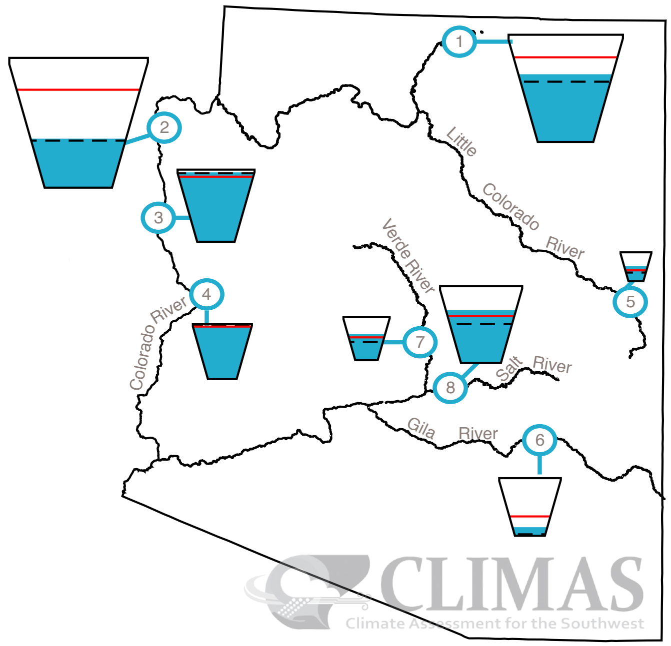
These data are based on reservoir reports updated monthly by the National Water and Climate Center of the U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS).

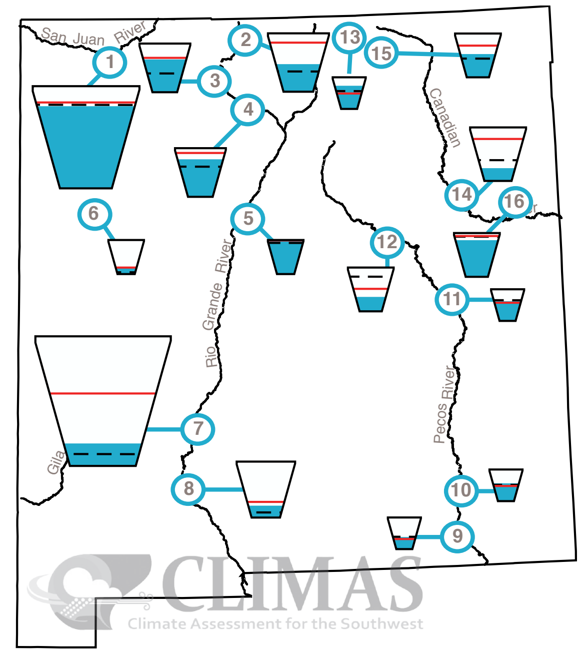
Reservoir Volumes

DATA THROUGH JULY 31, 2017

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	63%	15,384.7	24,322.0	-23.0
2. Lake Mead	38%	9,931.0	26,159.0	-43.0
3. Lake Mohave	96%	1,744.3	1,810.0	44.3
4. Lake Havasu	96%	593.5	619.0	3.4
5. Lyman	52%	15.5	30.0	-0.8
6. San Carlos	15%	127.0	875.0	-25.3
7. Verde River System	60%	173.8	287.4	-1.0
8. Salt River System	69%	1,406.1	2,025.8	-29.2

*KAF: thousands of acre-feet

* in KAF = thousands of acre-feet
**Reservoirs with updated "Max Storage"

Reservoir	Capacity	Current Storage*	Max Storage*	One-Month Change in Storage*
1. Navajo	80%	1,360.6	1,696.0	-37.6
2. Heron	48%	193.0	400.0	-1.9
3. El Vado	68%	129.1	190.3	-12.2
4. Abiquiu	77%	143.6	186.8**	-4.1
5. Cochiti	98%	49.2	50.0**	3.2
6. Bluewater	21%	8.2	38.5	-1.1
7. Elephant Butte	17%	366.9	2,195.0	-103.0
8. Caballo	21%	68.5	332.0	-2.4
9. Lake Avalon	38%	1.7	4.5**	-0.8
10. Brantley	56%	23.5	42.2**	6.9
11. Sumner	62%	22.4	102.0**	-1.9
12. Santa Rosa	33%	34.5	105.9**	-8.9
13. Costilla	73%	11.7	16.0	-2.3
14. Conchas	24%	61.2	254.2	-11.9
15. Eagle Nest	53%	42.2	79.0	-1.0
16. Ute Reservoir	83%	166	200	-1.0

Online Resources

Figure 1
Climate Program Office
http://cpo.noaa.gov/

RISA Program Homepage

http://cpo.noaa.gov/ClimateDivisions/ClimateandSocietalInteractions/RISAProgram.aspx

UA Institute of the Environment

http://www.environment.arizona.edu/

New Mexico Climate Center

http://weather.nmsu.edu/

CLIMAS Research & Activities

CLIMAS Research

www.climas.arizona.edu/research/

CLIMAS Outreach

www.climas.arizona.edu/outreach

Climate Services

www.climas.arizona.edu/climate-services

CLIMAS
Climate Assessment for the Southwest
A NOAA RISA TEAM

What is CLIMAS?

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.

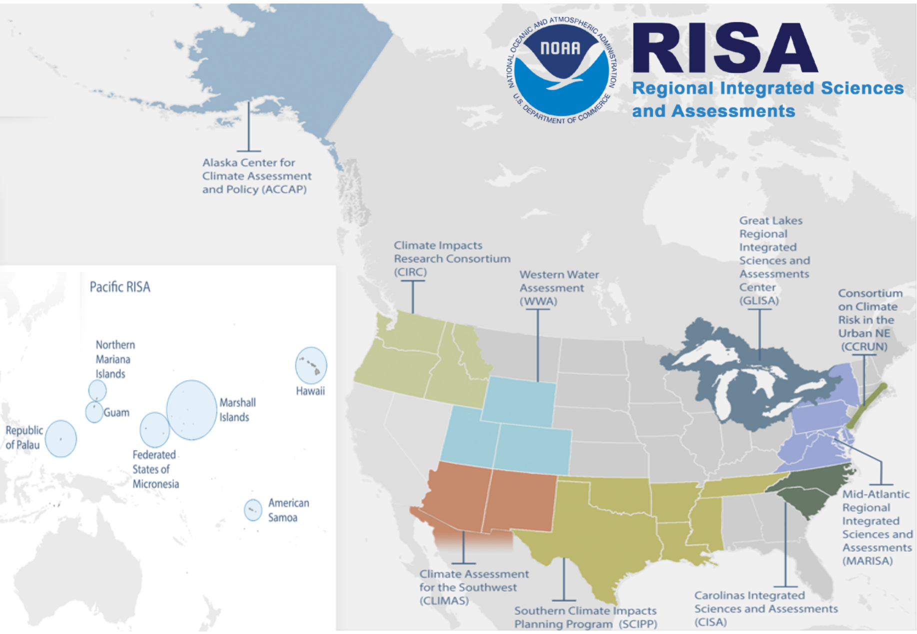


Figure 1: NOAA Regional Integrated Sciences and Assessments Regions

What does CLIMAS do?

The CLIMAS team and our 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.

Why is this work important?

Climate variability and the long-term warming trend affect social phenomena such as population growth, economic development, and vulnerable populations, as well as natural systems. This creates a complex environment for decision making in the semi-arid and arid southwestern United States. For example, natural resource managers focused on maintaining the health of ecosystems face serious climate-related challenges, including severe sustained drought, dramatic seasonal and interannual variations in precipitation, and steadily rising temperatures. Similarly, local, state, federal, and tribal governments strive to maintain vital economic growth and quality of life within the context of drought, population growth, vector-born disease, and variable water supplies. Uncertainties surrounding the interactions between climate and society are prompting decision-makers to seek out teams of natural and social scientists—like those that comprise CLIMAS—for collaborations to help reduce risk and enhance resilience in the face of climate variability and change.