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November Southwest Climate Outlook

Monthly Precipitation and Temperature: October precipitation ranged from record driest to below average in most of Arizona and from below average to above average in most of New Mexico (Fig. 1a). October temperatures were above average to record warmest in Arizona and near average to record warmest in most of New Mexico (Fig. 1b). The daily average temperature anomalies for Oct. 1 – Nov. 15 (Fig. 2) highlight the fluctuations at select stations around the region (see detailed station data on p. 5).

Annual Precipitation and Temperature: 2020 total precipitation percentiles for Jan-Oct ranged between record driest and below average in most of Arizona and New Mexico, with a similar pattern across most of the Southwest (Fig. 3a). 2020 mean temperature percentiles for Jan-Oct were above average to record warmest across the Southwest (Fig. 3b).

Drought: The Nov 10 U.S. Drought Monitor (USDM) showed widespread areas of extreme drought (D3) and growing pockets of exceptional drought (D4) across Arizona, New Mexico, Nevada, Utah, and Colorado (Fig. 4). A major driver for this drought characterization was well below average monsoon precipitation, lagging fall precipitation, and accumulated long term precipitation deficits. Unlike in some years, the Southwest did not see substantial incursions of moisture from tropical storm activity (Fig. 5; p. 6).

Snowpack and Water Supply: Snow Water Equivalent (SWE) as of Nov 15, 2020 was highly variable across Arizona and New Mexico (Fig. 6). This reflects some areas with early storm activity and other areas lagging behind normal. Note: these basin average and station SWE maps are sensitive to early season storms that can boost totals relative to long term averages, or lag behind owing to slow starts to seasonal precipitation. They will however, provide more meaningful information as the winter season progresses. 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. 7).

ENSO Tracker: Moderate La Niña conditions are present and expected to last through winter, with a chance of a strong event, resulting in clear signals in seasonal outlooks (see ENSO-tracker on p. 3-4).

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

NOV2020 @CLIMAS_UA SW Climate Outlook, La Niña Outlook, Fall Temperatures, Tropical Storm Reports, AZ & NM Reservoirs https://bit.ly/3nDwH5r #SWclimate #AZWx #NMWx

ARIZONA · CLIMAS Climate Assessment for the Southwest, A NOAA RISA TEAM · The University of Arizona College of Agriculture & Life Sciences Cooperative Extension · NM State University · NIDIS

Nov 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
National Hurricane Center
nhc.noaa.gov

Figure 6
National Resource Conservation Service
nrcs.usda.gov

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

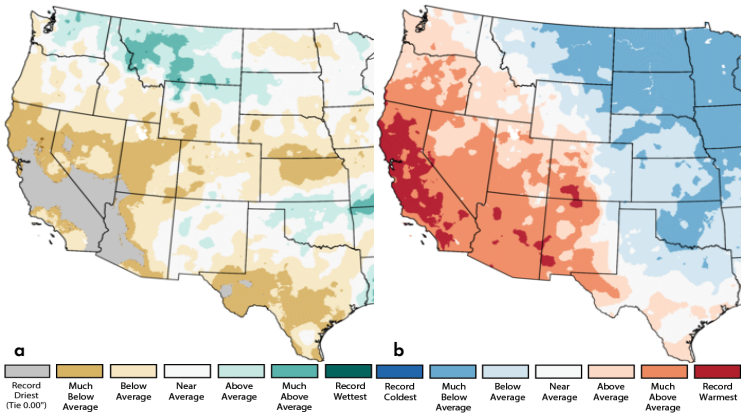


Figure 1: Oct 2020 Precipitation (a) & Temperature Ranks (b)

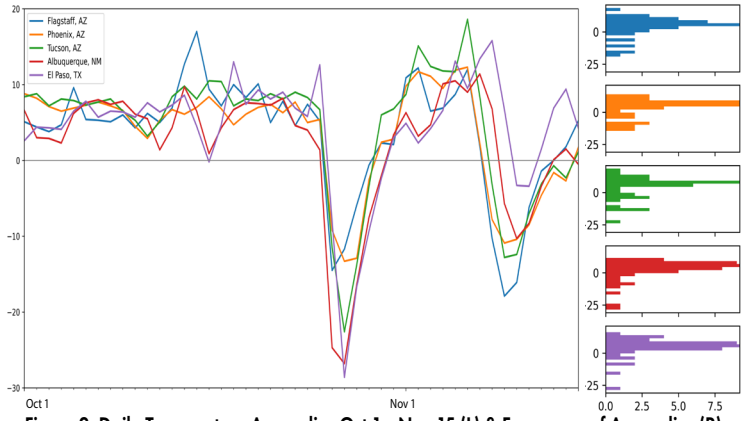


Figure 2: Daily Temperature Anomalies Oct 1 - Nov 15 (L) & Frequency of Anomalies (R)

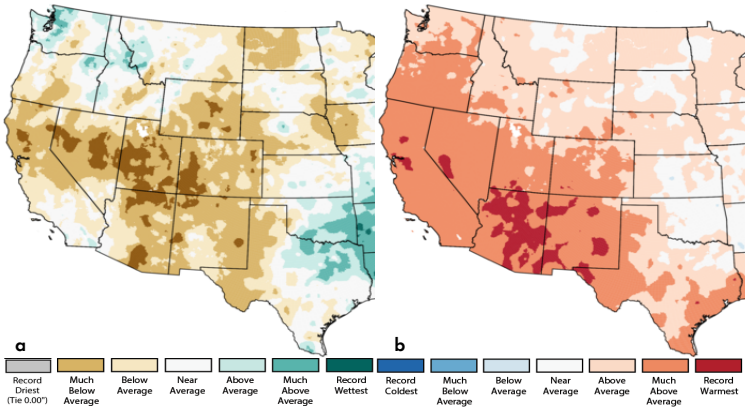
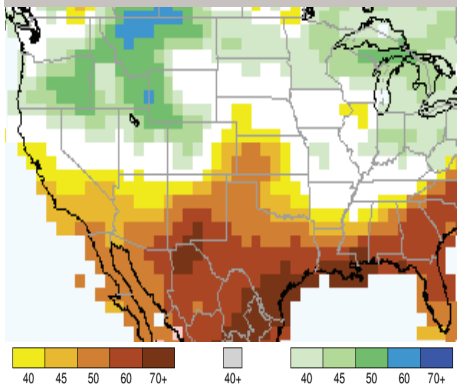


Figure 3: 2020 (Jan-Oct) Precipitation (a) & Temperature Ranks (b)



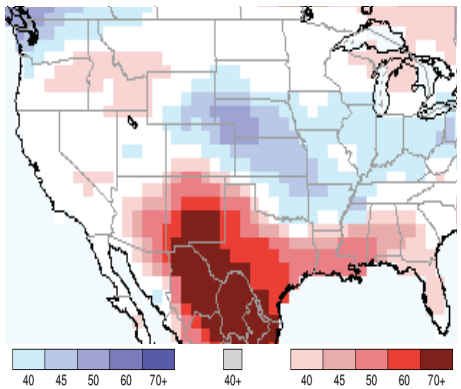


Figure 7: Three-Month (Dec-Feb) Forecast for Precip (top) and Temps (bottom)

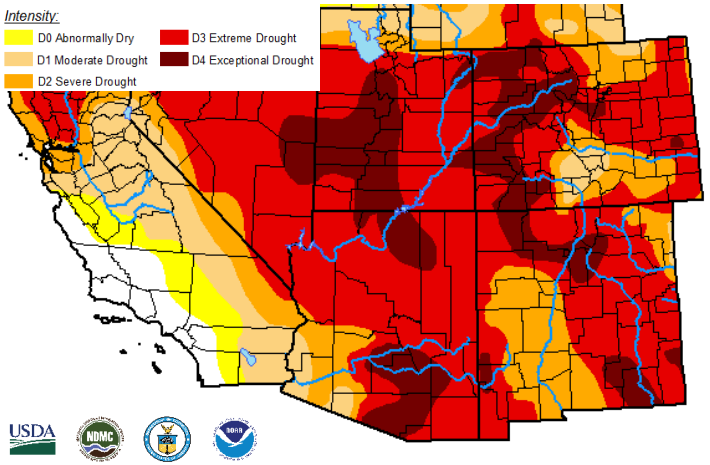


Figure 4: US Drought Monitor - Nov 10, 2020

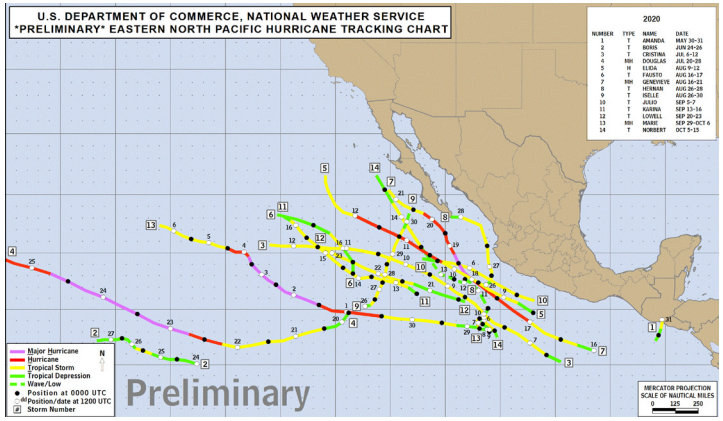


Figure 5: 2020 NWS Eastern North Pacific Hurricane Tracking Chart

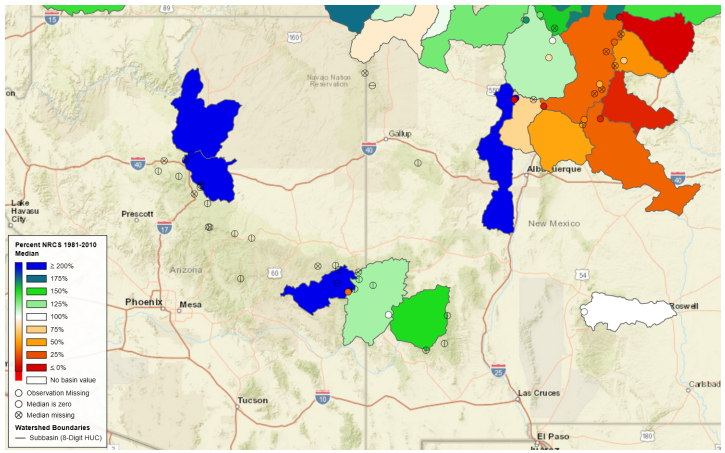


Figure 6: Snow Water Equivalent Percent of 1981-2010 Median (Nov 15, 2020)

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

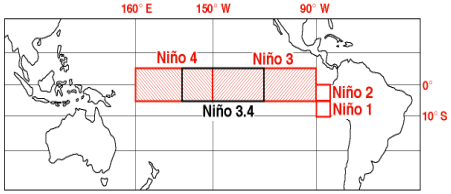
Figure 4
NOAA - Climate Prediction Center
cpc.ncep.noaa.gov

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 December through February call for below normal conditions across the equatorial Pacific (Fig. 1), extending the trend of the last 3-4 months (Fig. 2). International climate outlooks describe La Niña conditions as forecast to remain a La Niña event through winter 2020.

Forecast Roundup: On Nov 10, the Australian Bureau of Meteorology was at official La Niña status and noted that models still indicate the possibility of it reaching strong status, and likely to peak in Dec 2020 or Jan 2021. On Nov 10, the Japanese Meteorological Agency (JMA) maintained its forecast at a 90-percent chance of La Nina conditions to last through winter 2020-2021. On Nov 12, the NOAA Climate Prediction Center (CPC) ENSO status was at La Niña Advisory. The CPC called for an 95-percent chance of La Niña continuing through winter 2020-2021 and a 65-percent chance of lasting through May 2021. On Nov 12, the International Research Institute (IRI) issued an ENSO Quick Look (Fig. 3), noting "A large majority of the model forecasts exceeds the threshold of La Niña SST conditions through the winter, dissipating during spring". The North American Multi-Model Ensemble (solid and dashed black line, Fig. 4) is in moderate to borderline-strong La Niña territory for the next few months, and projections indicate conditions will remain La Niña through at least winter 2020-2021.

Summary: Moderate La Niña conditions are present, and most forecasts and outlooks call for these conditions to last through winter and possibly well into spring, with a possibility of a strong event. La Niña events tend to result in drier than normal conditions over winter (see details on following page), a pattern also currently found in most monthly and seasonal climate outlooks. If this forecast for a drier than normal winter is correct, it will further exacerbate the precipitation deficits from the monsoon and bring about the uncommon circumstances where consecutive periods of rainfall for the Southwest (in this case, summer 2020, then winter 2020-2021) are both drier than average.

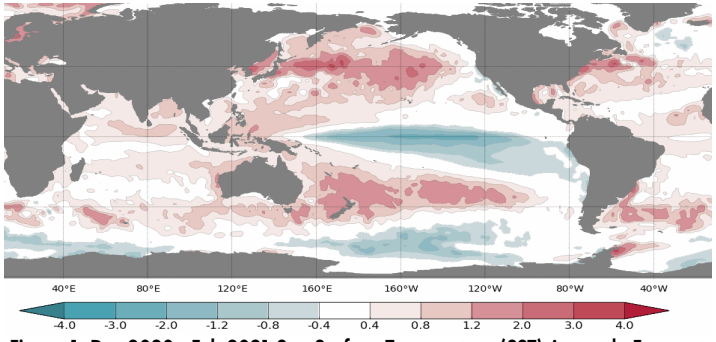


Figure 1: Dec 2020 - Feb 2021 Sea Surface Temperature (SST) Anomaly Forecast

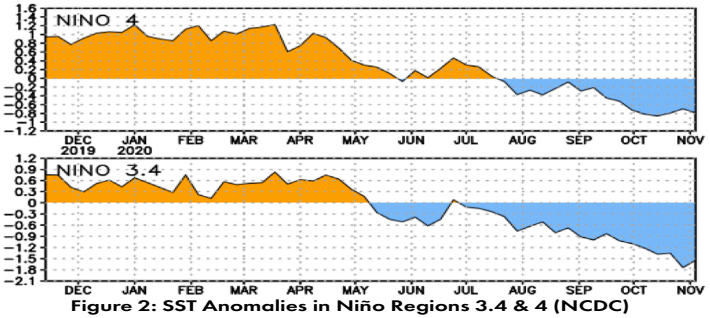


Figure 2: SST Anomalies in Niño Regions 3.4 & 4 (NCDC)

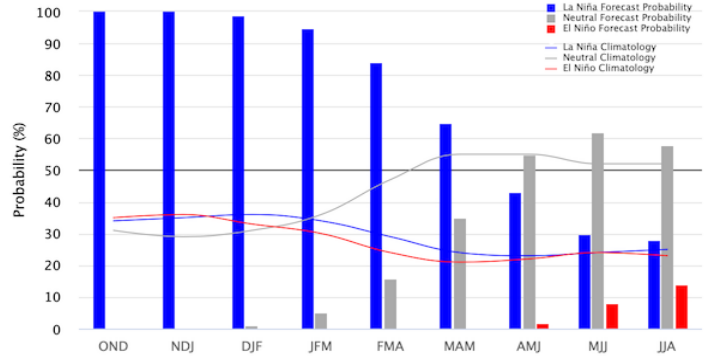


Figure 3: Early-Nov IRI/CPC Model-Based Probabilistic ENSO Forecast

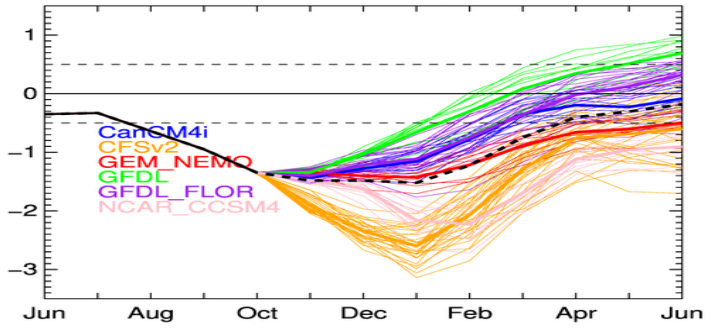
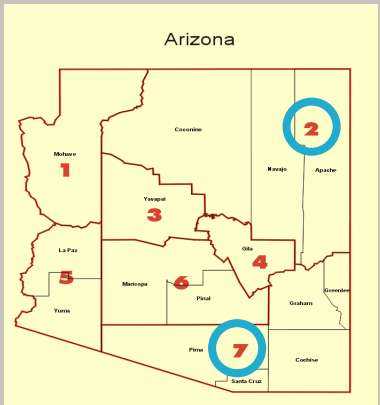


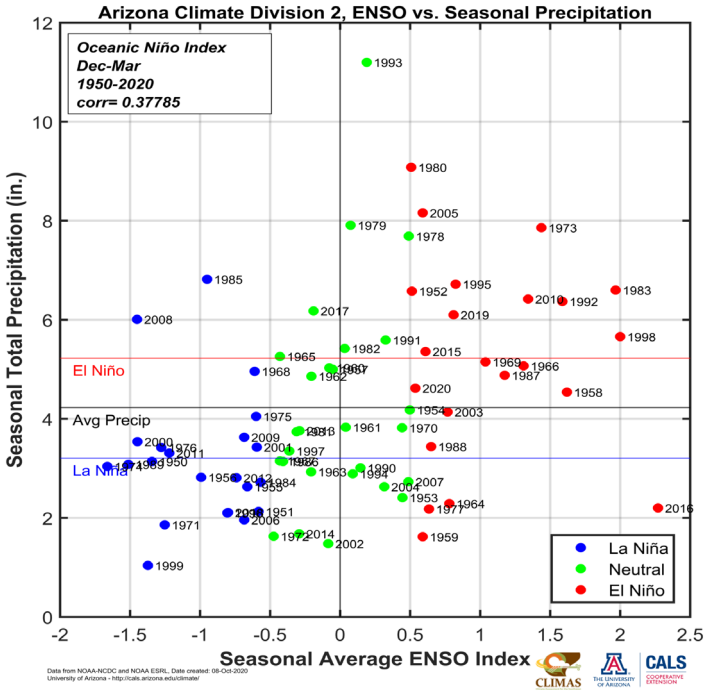
Figure 4: North American Multi-Model Ensemble Forecast for Niño 3.4

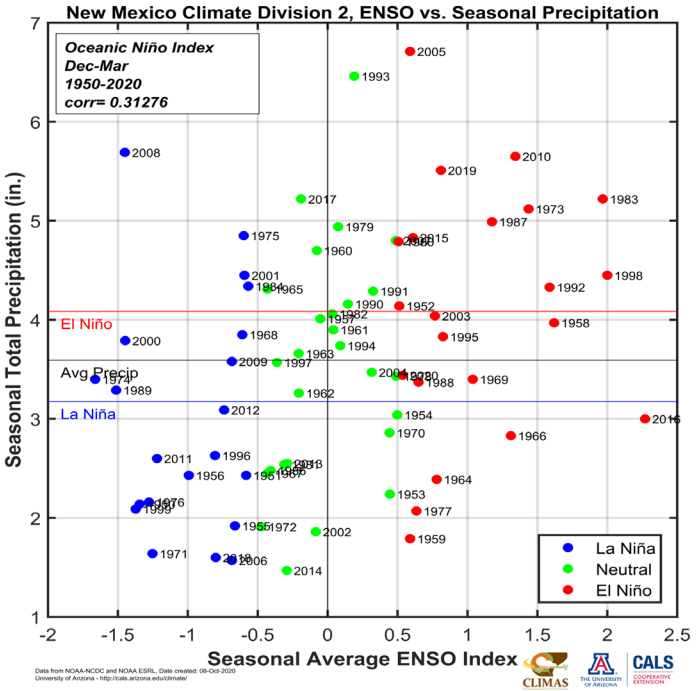
Online Resources

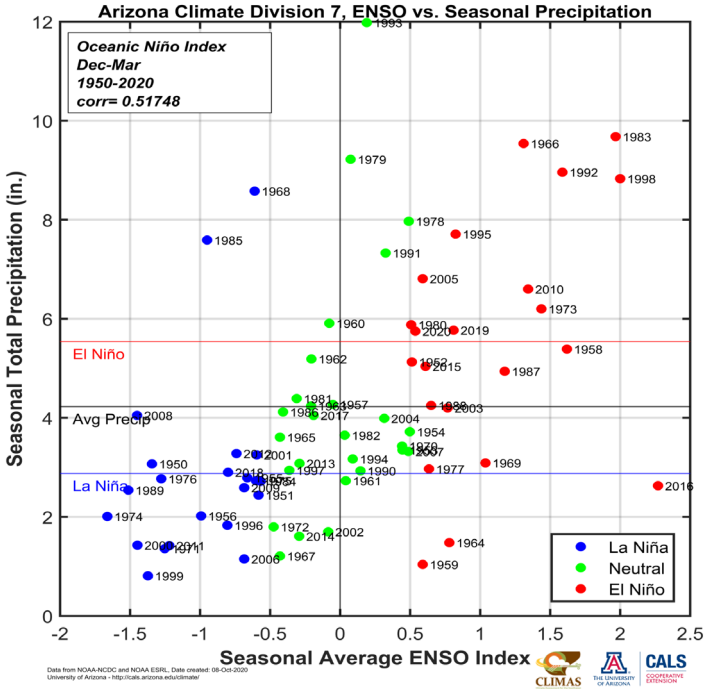
Figures & Maps
Climate Science Applications Program
cals.arizona.edu/climate/

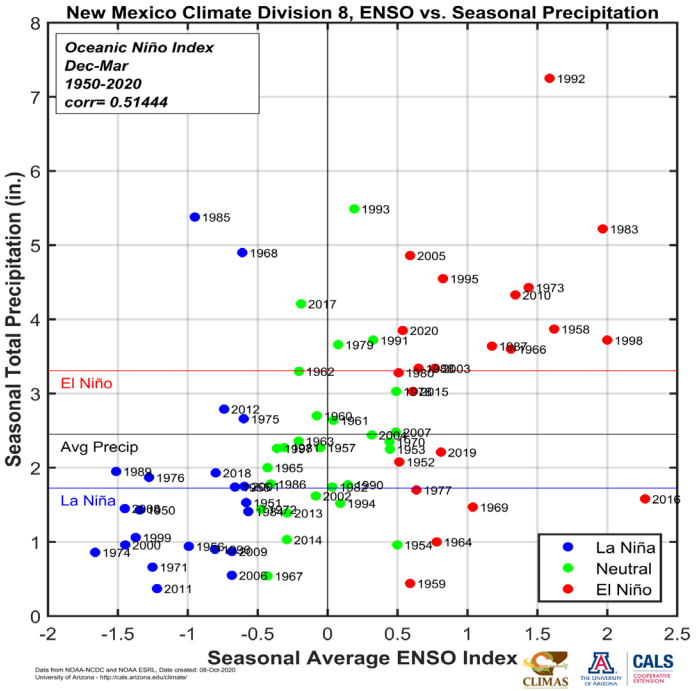


La Nina Winters in Arizona (climate division 2 & 7) and New Mexico (climate division 2 & 8)









Online Resources

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

data: RCC-ACIS

Oct 1 - Nov 17 Temperatures: (Mostly) Above-Average to Record Warm

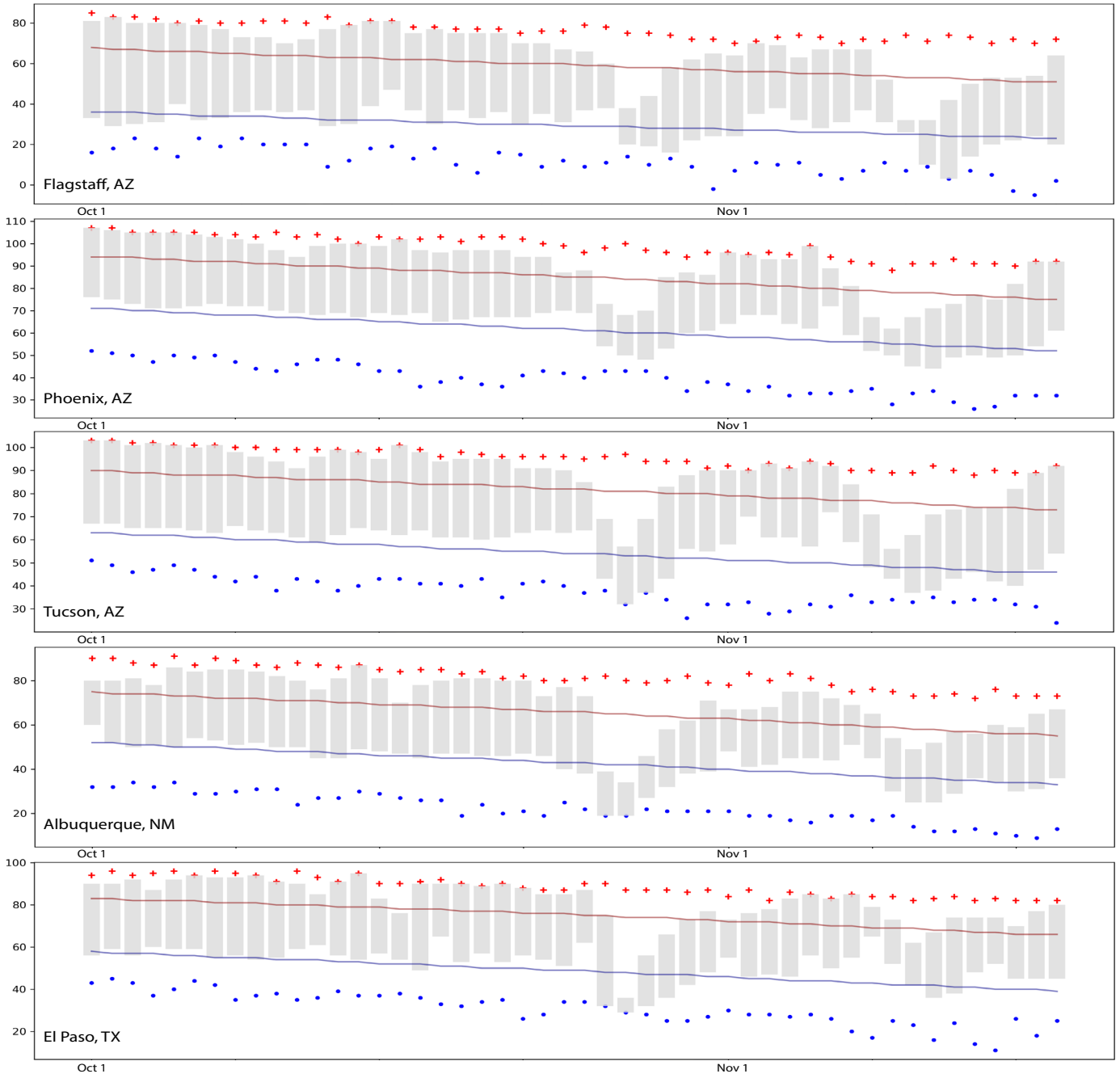


Figure 1: Daily Average and Record High/Low Temperatures, 2020 Temperature Range, Oct 1 - Nov 17, 2020

Online Resources

Figures 1,3
NOAA/NWS National Hurricane Center
nhc.noaa.gov

Figures 2,4
CSU Tropical Cyclone Activity Tracker
tropical.atmos.colostate.edu

Tropical Storm Activity

Tropical storm and hurricane activity in 2020 highlights an expected pattern for La Niña conditions, with suppressed activity in the Pacific, and enhanced activity in the Atlantic. As of the time of this writing, the Eastern North Pacific region has seen 16 named storms (Fig. 1, which does not include Odalys or Polo), which is very close to the average number of named storms, but the accumulated cyclone energy (ACE) is running well behind climatology (Fig. 2). The North Atlantic has recorded a record 30 named storms (Fig. 3, which does not include Eta, Theta, or Iota), which is well above the average of ~10 named storms, and the ACE is running well ahead of climatology as well (Fig. 4).

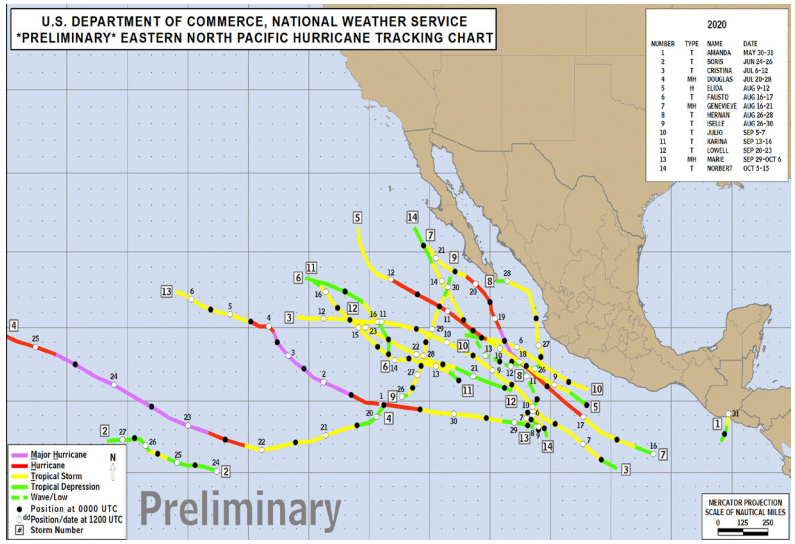


Figure 1: 2020 NWS Eastern North Pacific Hurricane Tracking Chart

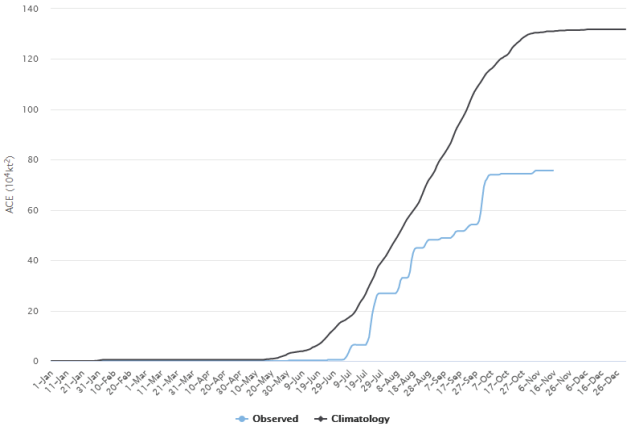


Figure 2: 2020 Eastern North Pacific Hurricane Accumulated Cyclone Energy (ACE)

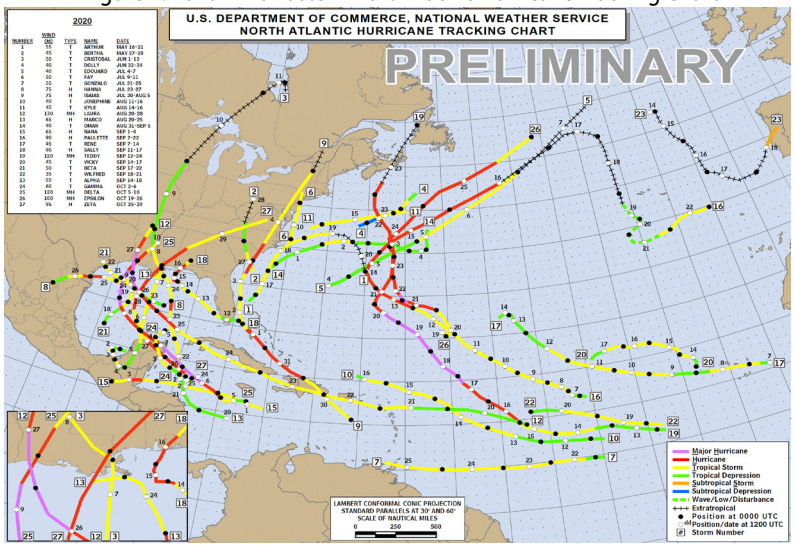


Figure 3: 2020 NWS North Atlantic Hurricane Tracking Chart

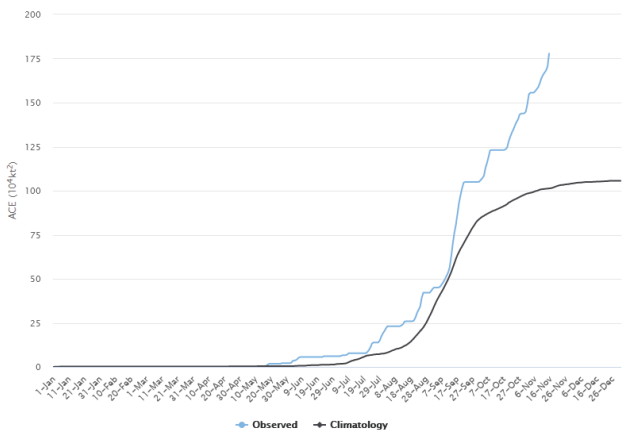


Figure 4: 2020 North Atlantic Hurricane Accumulated Cyclone Energy (ACE)

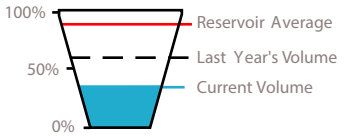
Online Resources

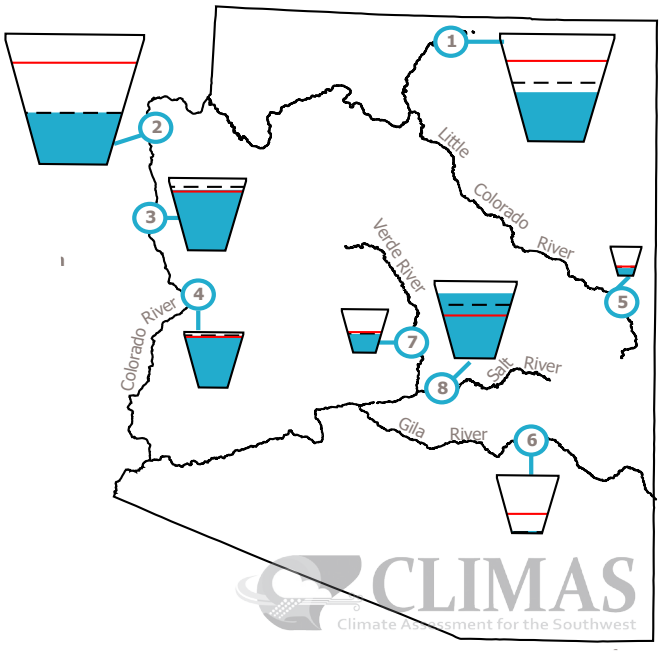
Portions of the information provided in this figure is available at the Natural Resources Conservation Service
www.wcc.nrcs.usda.gov/BOR/basin.html

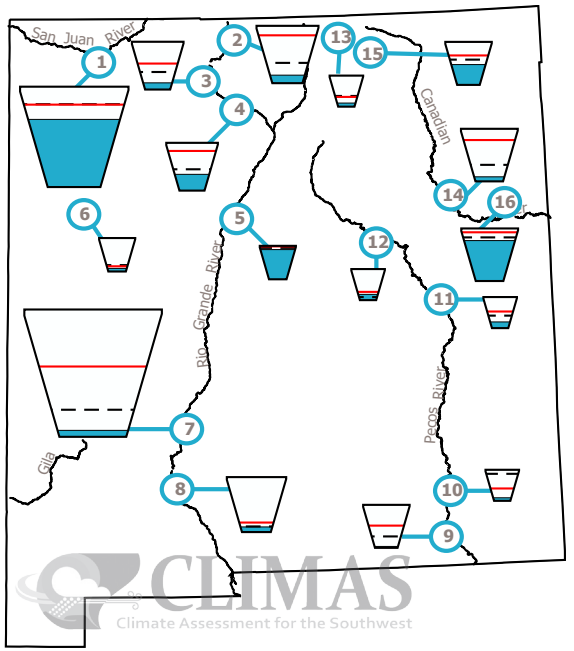
Contact Ben McMahan with questions/comments.

Reservoir Volumes

DATA THROUGH NOV 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	45%	10,976.9	24,322.0	-393.6
2. Lake Mead	39%	10,167.0	26,159.0	-112.0
3. Lake Mohave	83%	1,501.0	1,810.0	-24.0
4. Lake Havasu	93%	577.9	619.0	22.3
5. Lyman	26%	7.9	30.0	-0.5
6. San Carlos	3%	26.1	875.0	-10.1
7. Verde River System	42%	120.6	287.4	-38.4
8. Salt River System	83%	1,685.6	2,025.8	-22.4

*KAF: thousands of acre-feet

Reservoir	Capacity	Current Storage*	Max Storage*	One-Month Change in Storage*
1. Navajo	68%	1,149.2	1,696.0	-53.2
2. Heron	14%	54.2	400.0	-33.0
3. El Vado	15%	29.5	190.3	-0.3
4. Abiquiu	33%	61.9	186.8	10.1
5. Cochiti	86%	43.1	50.0	43.1
6. Bluewater	9%	3.6	38.5	-0.2
7. Elephant Butte	4%	82.8	2,195.0	-25.7
8. Caballo	8%	27.8	332.0	-5.0
9. Lake Avalon	22%	1.0	4.5	-0.2
10. Brantley	17%	7.3	42.2	-5.7
11. Sumner	16%	5.8	35.9	-1.0
12. Santa Rosa	6%	6.7	105.9	-0.8
13. Costilla	9%	1.4	16.0	-0.1
14. Conchas	8%	21.4	254.2	-66.2
15. Eagle Nest	47%	37.2	79.0	-1.4
16. Ute Reservoir	76%	152	200	-6.0

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

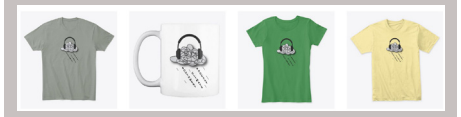
Android

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

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

Previous Episodes

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

Sept 2020 - 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!

https://bit.ly/3nzR7wf

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.

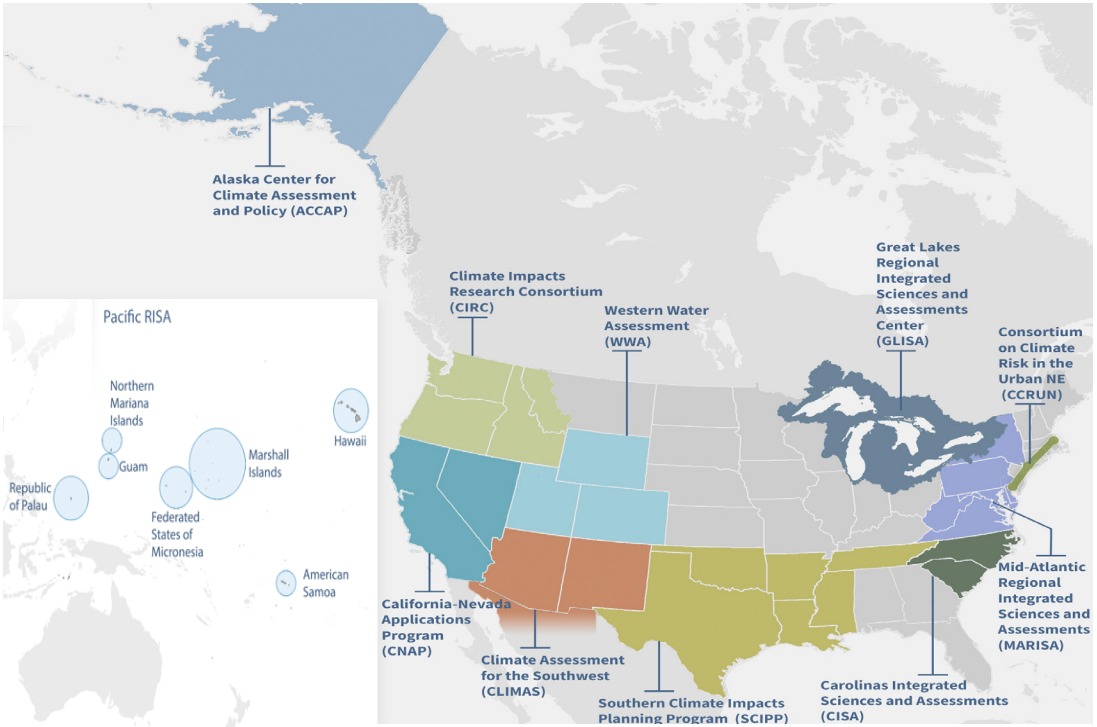


Figure 1: NOAA Regional Integrated Sciences and Assessments Regions