# December 2023: Southwest Climate Outlook

**Stacie Reece**
**December 21, 2023**

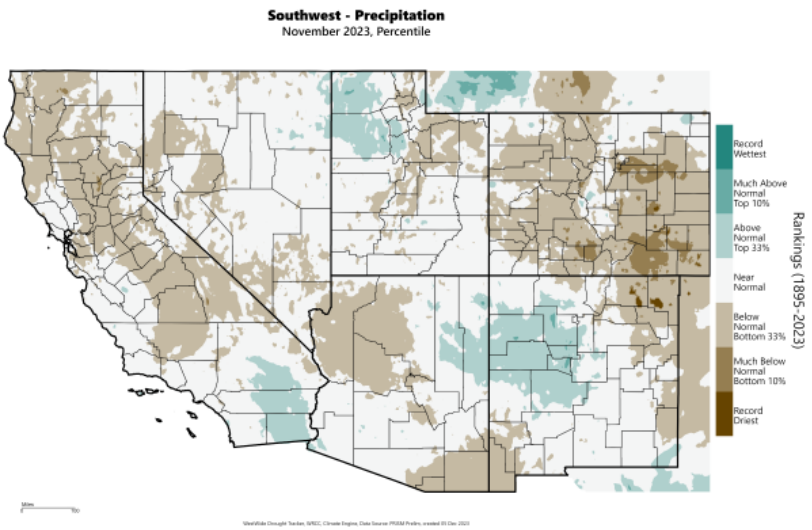
https://climas.arizona.edu/

The Southwest Climate Outlook is published by the Climate Assessment for the Southwest (CLIMAS), with support from University of Arizona Cooperative Extension, and the New Mexico State Climate office.

*Questions/Contact: Stacie Reece, sreece@arizona.edu*

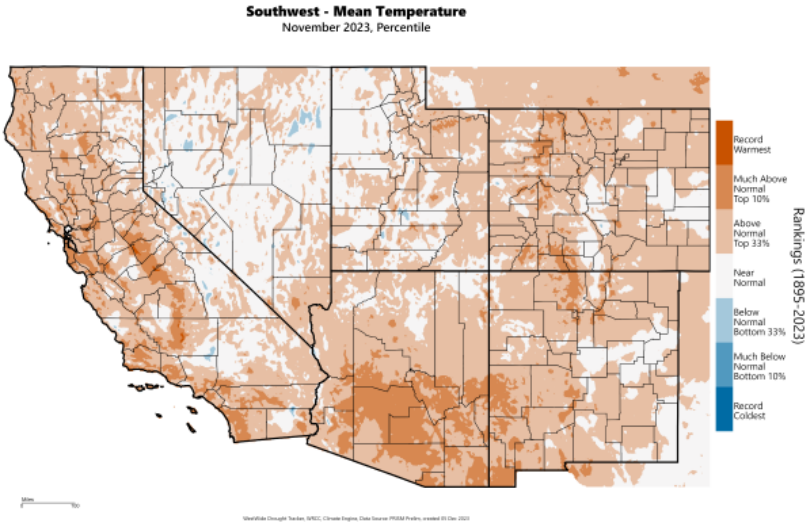
## Precipitation and Temperature

November precipitation was near normal across much of Arizona and New Mexico. Areas of western New Mexico and eastern Arizona received above-normal precipitation. Areas that fell short of normal precipitation included northwestern Arizona, eastern New Mexico, and the area of southeastern Arizona and New Mexico's bootheel.



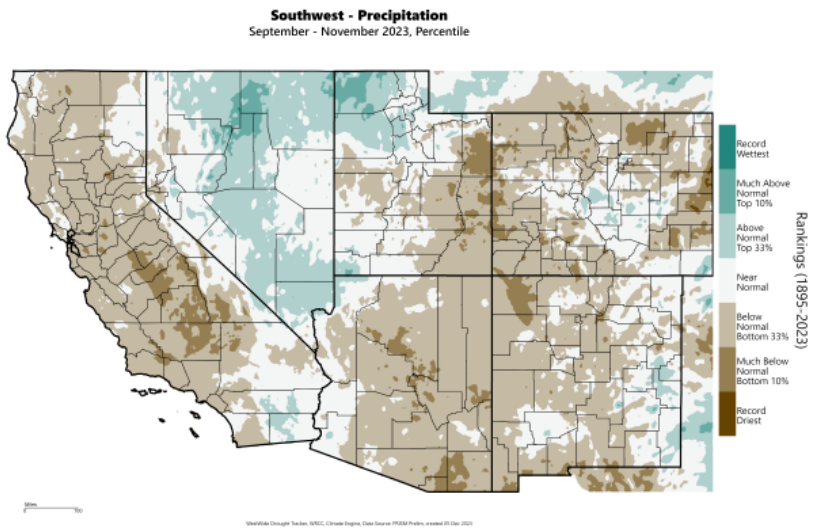

Source: WestWide Drought Tracker

November temperatures were above normal or much above normal for the majority of Arizona and New Mexico.



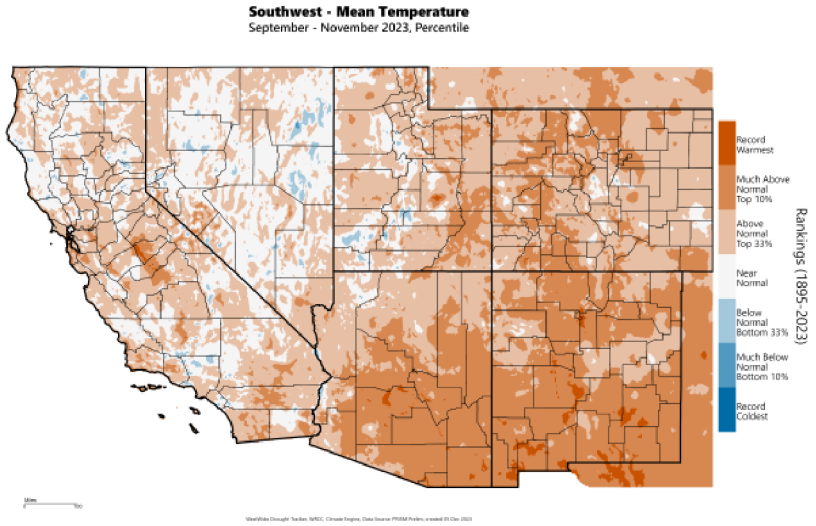

Source: WestWide Drought Tracker

September-November three-month precipitation totals were below normal for most of Arizona and New Mexico.



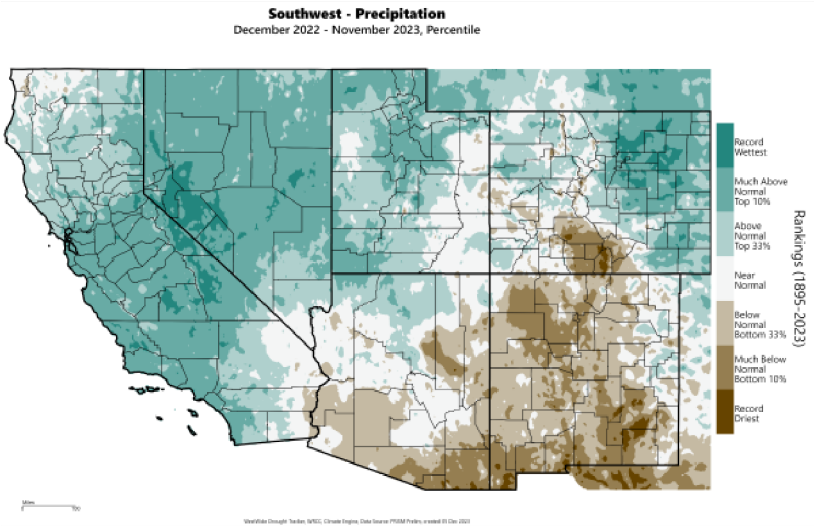

Source: WestWide Drought Tracker

September-November three-month mean temperatures were much above normal across Arizona and New Mexico, and in some places, it was the warmest Sep-Nov on record.




Source: WestWide Drought Tracker

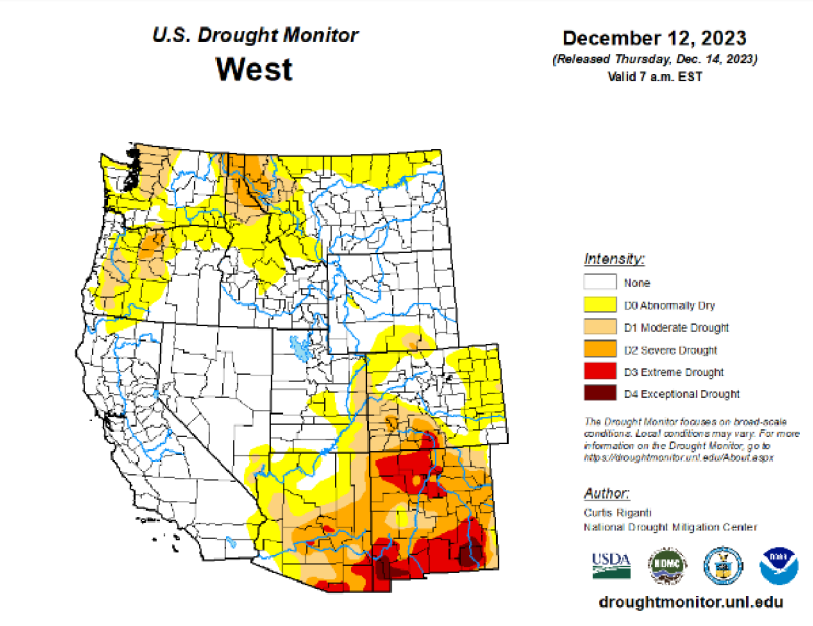
Twelve-month (Dec 2022 – Nov 2023) precipitation totals show most of New Mexico and southern and eastern Arizona having received below normal or much-below normal precipitation. Northern Arizona totals range from near normal to above normal.




Source: WestWide Drought Tracker

## Drought

Drought conditions have not improved in Arizona and New Mexico. In over 90% of Arizona and nearly all of New Mexico, conditions are categorized as abnormally dry or worse—drought is severe to exceptional for 85% of New Mexico and 35% of Arizona. The hardest-hit areas include southern and northwestern New Mexico, and central and southeastern Arizona.




Source: U.S. Drought Monitor

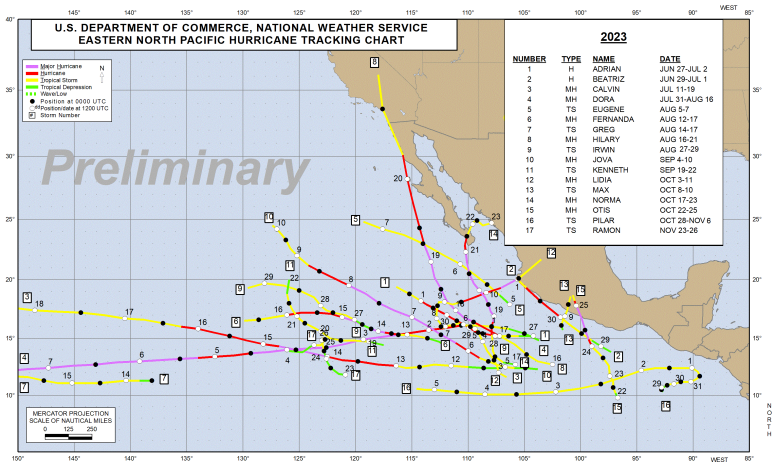
**NIDIS Improved and Expanded State Pages on Drought.Gov**

Arizona

New Mexico

## Hurricanes & Tropical Storms

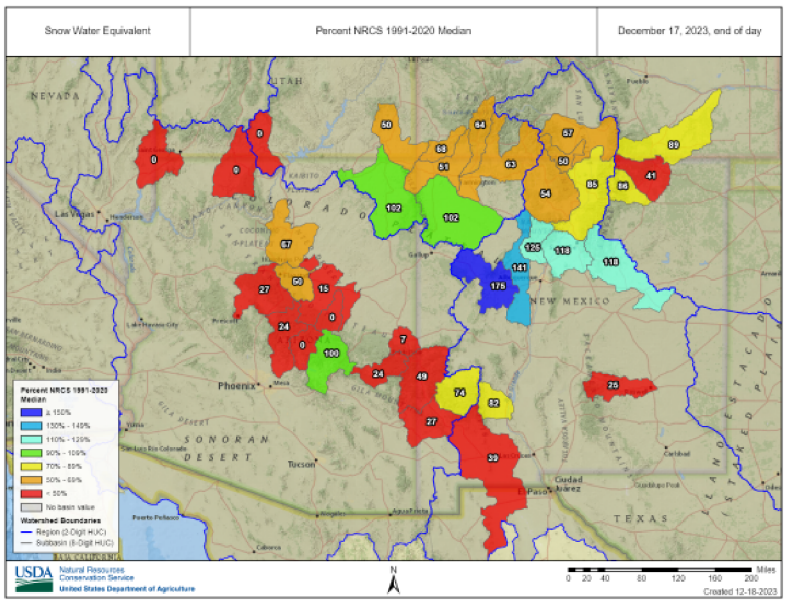
With the late-November tropical storm Ramon, the 2023 eastern North Pacific hurricane season count of named storms reached 17, which is near normal. In terms of storm strength, however, the season was unusually active—more storms achieved hurricane-strength, and major-hurricane strength, than would normally be expected. In terms of Accumulated Cyclone Energy (ACE), a measure that integrates the strength and duration of multiple storms, this season was 20% more energetic than the long-term average. Notably, and related to the lackluster monsoon and general dryness in the Southwest over the past several months, only one of this season's tropical cyclones traveled north of 25°N latitude—Hilary in late August. That storm primarily affected areas of California and Nevada, but it also watered parts of northern Arizona, keeping summer precipitation totals there near or above normal levels.




NOAA - National Hurricane Center

## Snowpack

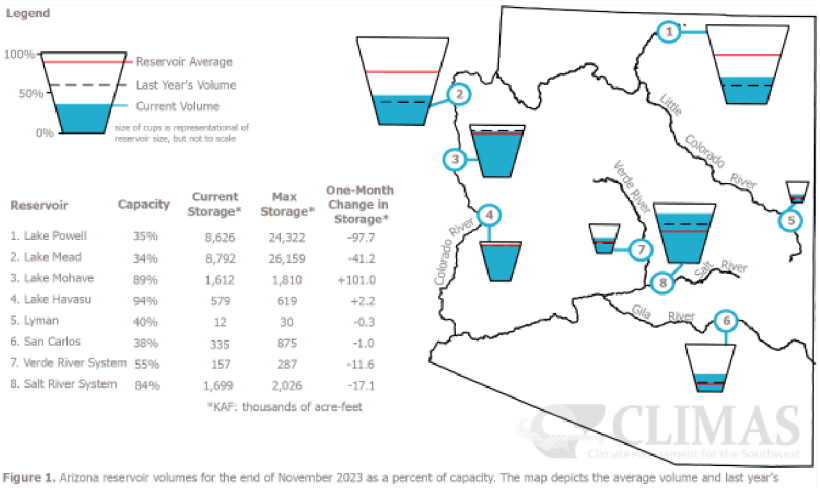
Arizona-New Mexico snow water equivalent (SWE) is below normal for most reporting watersheds as of mid-December. Lower Colorado River Basin watersheds are generally far-below normal SWE, but watersheds feeding the middle Rio Grande and the San Juan River vary from around one half of expected SWE for this time of year to near-normal and above-normal normal SWE.




USDA-NRCS: National Water and Climate Center

## Water Supply

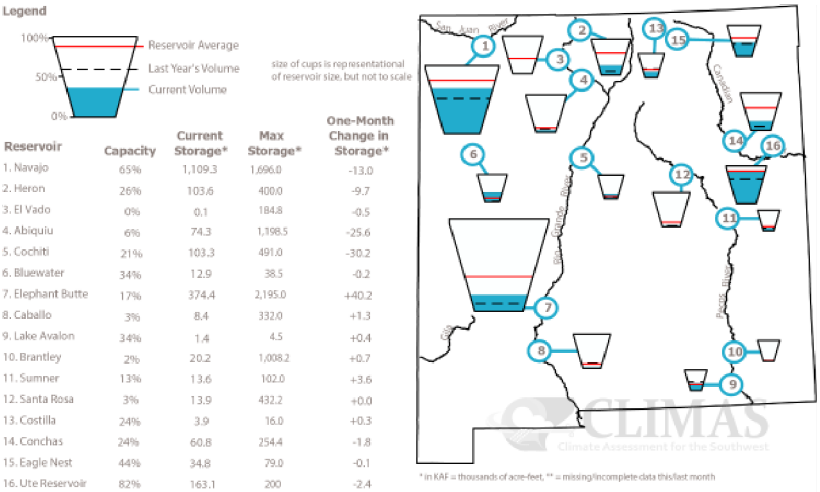
Water storage in Arizona and New Mexico is broadly in a better place than it was at this time last year. Lakes Mead and Powell are still around half as full as the long-term average but have levels well above last year's for this time of year. Other Arizona reservoirs are holding amounts at or well above the long-term average. New Mexico reservoirs are generally holding more water than they were at this time last year, but less water than would be expected from the long-term average. Ute reservoir in eastern New Mexico is a notable exception where levels are meeting the long-term average.




| Reservoir | Capacity | Current Storage* | Max Storage* | One-Month Change in Storage* |
|---|---|---|---|---|
| 1. Lake Powell | 35% | 8,626 | 24,322 | -97.7 |
| 2. Lake Mead | 34% | 8,792 | 26,159 | +41.2 |
| 3. Lake Mohave | 89% | 1,612 | 1,810 | +101.0 |
| 4. Lake Havasu | 94% | 579 | 619 | +2.2 |
| 5. Lyman | 40% | 12 | 30 | -0.3 |
| 6. San Carlos | 38% | 335 | 875 | -1.0 |
| 7. Verde River System | 55% | 157 | 287 | -11.6 |
| 8. Salt River System | 84% | 1,699 | 2,026 | -17.1 |

*KAF: thousands of acre-feet

**Figure 1.** Arizona reservoir volumes for the end of November 2023 as a percent of capacity. The map depicts the average volume and last year's storage for each reservoir. The table also lists current and maximum storage, and change in storage since last month.




| Reservoir | Capacity | Current Storage* | Max Storage* | One-Month Change in Storage* |
|---|---|---|---|---|
| 1. Navajo | 65% | 1,109.3 | 1,696.0 | -13.0 |
| 2. Heron | 26% | 103.6 | 400.0 | -9.7 |
| 3. El Vado | 0% | 0.1 | 184.8 | -0.5 |
| 4. Abiquiu | 6% | 74.3 | 1,198.5 | -25.6 |
| 5. Cochiti | 21% | 103.3 | 491.0 | -30.2 |
| 6. Bluewater | 34% | 12.9 | 38.5 | -0.2 |
| 7. Elephant Butte | 17% | 374.4 | 2,195.0 | +40.2 |
| 8. Caballo | 3% | 8.4 | 332.0 | +1.3 |
| 9. Lake Avalon | 34% | 1.4 | 4.5 | +0.4 |
| 10. Brantley | 2% | 20.2 | 1,008.2 | +0.7 |
| 11. Sumner | 13% | 13.6 | 102.0 | +3.6 |
| 12. Santa Rosa | 3% | 13.9 | 432.2 | +0.0 |
| 13. Costilla | 24% | 3.9 | 16.0 | +0.3 |
| 14. Conchas | 24% | 60.8 | 254.4 | -1.8 |
| 15. Eagle Nest | 44% | 34.8 | 79.0 | -0.1 |
| 16. Ute Reservoir | 82% | 163.1 | 200 | -2.4 |

**Figure 2.** New Mexico reservoir volumes for end of November 2023 as a percent of capacity. The map depicts the average volume and last year's storage for each reservoir. The table also lists current and maximum storage, and change in storage since last month.

*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 1991–2020 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 Natural Resources Conservation Service - National Water and Climate Center (USDA)*

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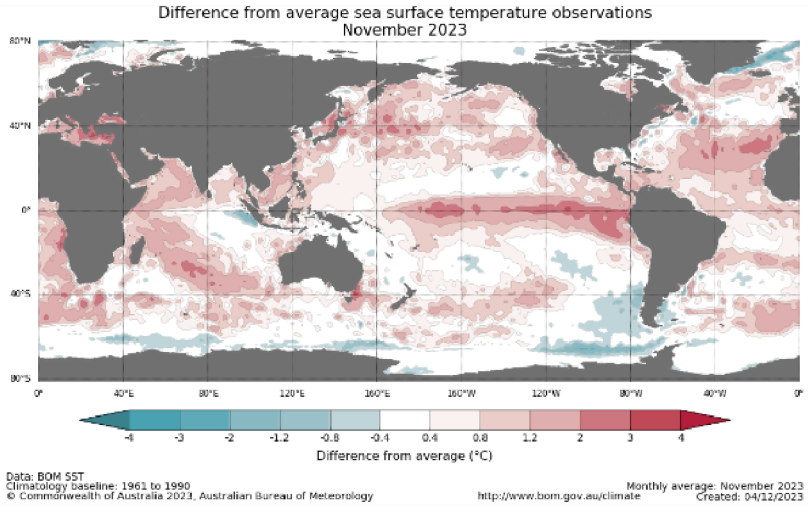
**BOM: New Mexico Dashboard**

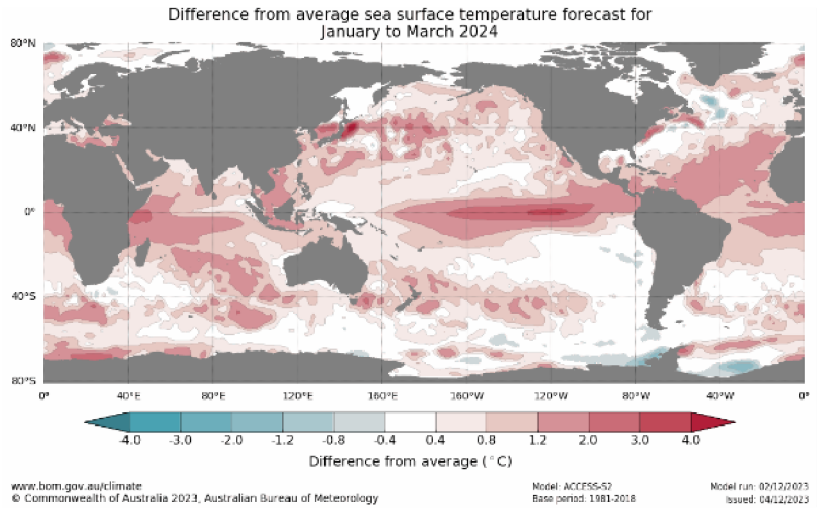
## ENSO Tracker

November sea surface temperatures (SSTs) in the Pacific reflect ongoing strong El Niño event conditions, with SSTs in the central and eastern equatorial Pacific more than 2°C above normal.



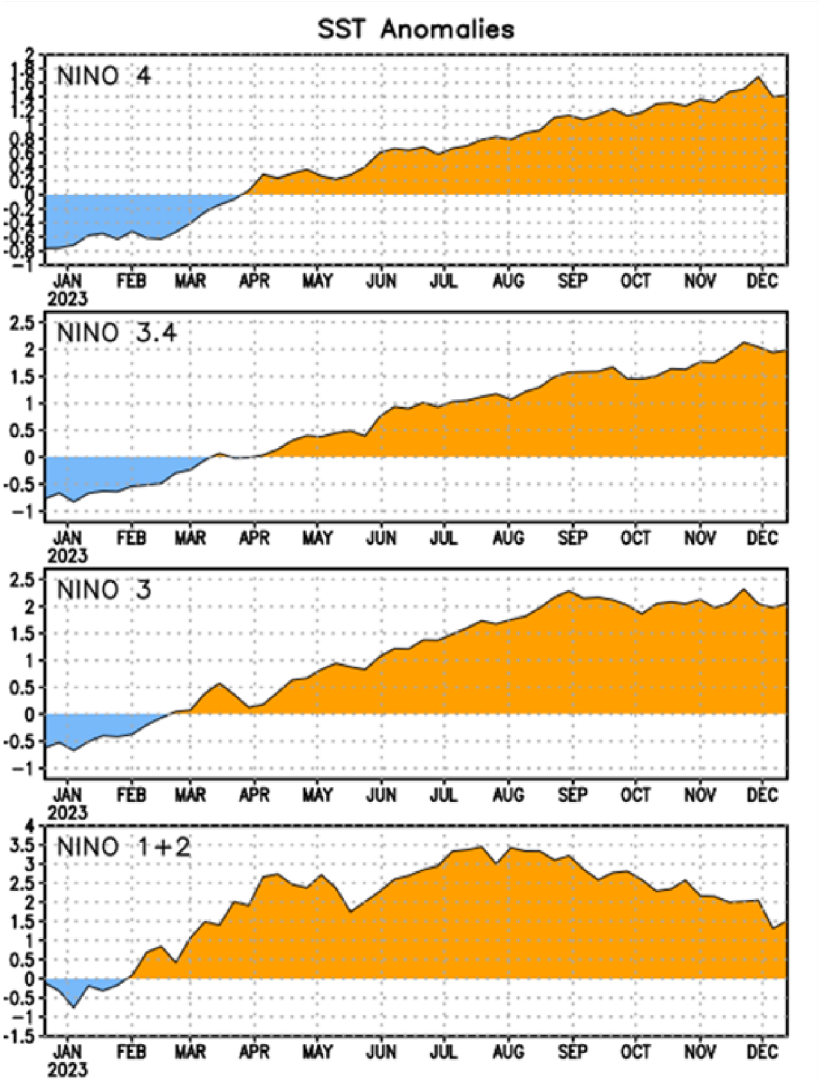

Source: Australian Bureau of Meteorology

The January-March forecast SST pattern shows strengthening warm anomalies in the central and eastern equatorial Pacific, but also a decline toward normal SSTs in the cold-upwelling region along the coast of Peru, hinting at a slowdown of reinforcing feedbacks in the ENSO cycle, and consistent with a projected return to ENSO-neutral conditions later in 2024. Nevertheless, this pattern indicates El Niño will remain strong and exert influence on weather in North America through winter.



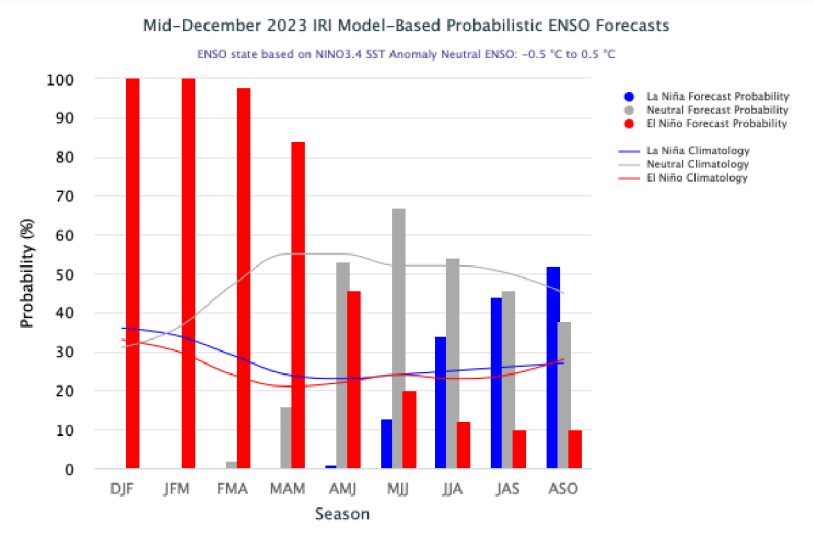

Source: Australian Bureau of Meteorology

SSTs in all ENSO diagnostic regions have shown signs of a slowdown in their warming trends, with the latest weekly departures-from-average falling short of peak SST measurements from late November. The most recent weekly departures for eastern and central Pacific diagnostic regions Niño 3 and Niño 3.4 remain exceptionally high at 2.1°C and 2°C respectively; even if SSTs in these regions have peaked, these conditions indicate that the current El Niño will be comparable to the most notable El Niño events in the observed record.



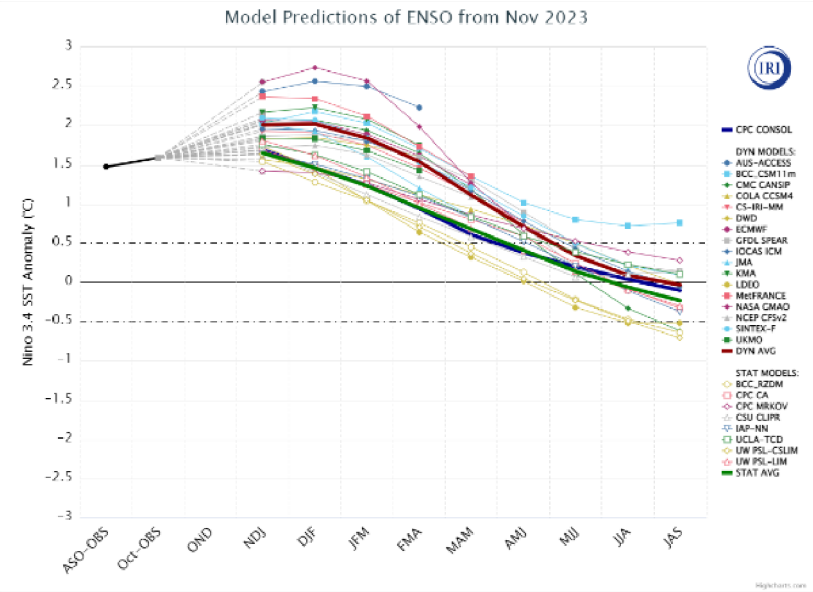

Source: Climate Prediction Center (NOAA)

ENSO forecasts indicate a likely return to ENSO-neutral conditions in the Pacific by May-July 2024. El Niño conditions will very likely (probability > 80%) persist into the March-April-May but will just-as-likely-as-not fade to ENSO-neutral for April-May-June. Long-run forecasts very slightly favor transition to La Niña after summer 2024.




Source: The International Research Institute for Climate and Society, Columbia University Climate School

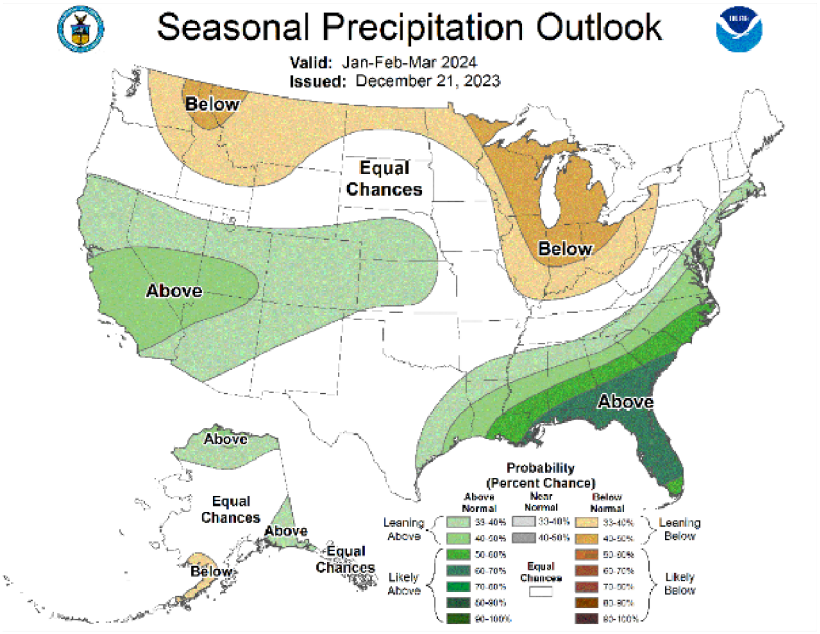
Individual ENSO forecast models agree near-unanimously regarding a return to ENSO-neutral by summer 2024. The largest uncertainty suggested by the spead of model predictions is about the peak strength of the current El Niño, and whether the peak (represented by the three-month-average SST departure from normal in Niño region 3.4) has already occurred, or if it is yet to occur. All models agree the peak will occur no later than the December-February season, if not sooner. The model central estimate for peak strength is right around the current Niño 3.4 SST, suggesting we may have already entered the plateau of peak strength. A few models predict peak strength of >2.5°C for Dec-Feb Niño 3.4 average SST anomaly—that would only happen if the warming trend were to pick back up from an apparent present slow-down and not let up again for a few months—a low-confidence prediction.




Source: The International Research Institute for Climate and Society, Columbia University Climate School

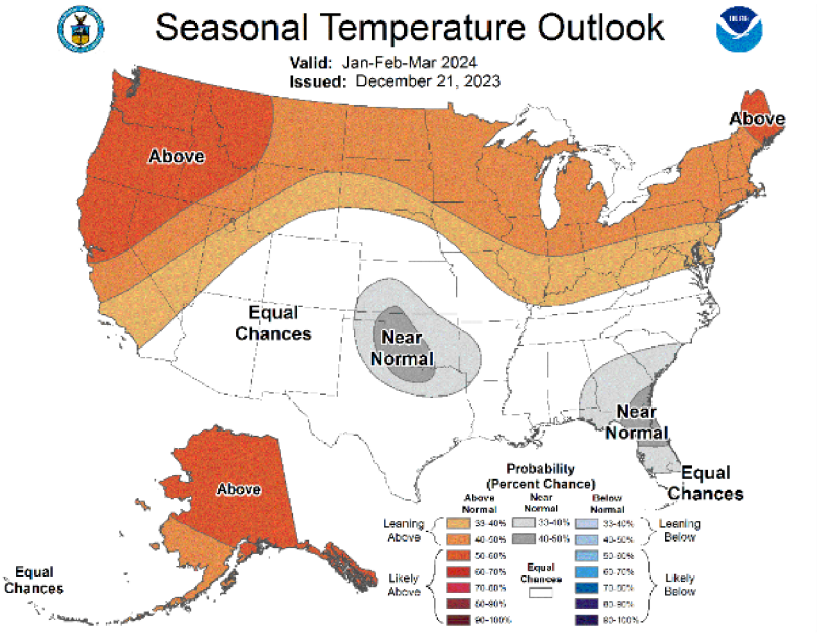
## Seasonal Forecasts

The January-March seasonal precipitation forecast is leaning toward above-normal precipitation for most of Arizona and northwest New Mexico, as part of a region of increased likelyhood of above-normal precipitation that includes California and several other Western states. This pattern is related to a configuration of jet-stream winds over the Pacific, something the forecast models are in good agreement about, and which is an expected feature during El Niño.




Source: Climate Prediction Center (NOAA)

The January-March seasonal temperature forecast gives Arizona and New Mexico equal chances of above-normal, near-normal, or below-normal temperatures. Here there are competing influences on expected seasonal temperatures, with El Niño tending to tilt toward cooler than normal in the Southwest, and the long-term warming trend that suggests there is a good chance any given season will be warmer than the average of those seasons in the past.




Source: Climate Prediction Center (NOAA)

## Public Health Corner

Welcome to the Public Health Corner, a new quarterly section in the Southwest Climate Outlook dedicated to exploring the intersection between climate change and public health in Arizona and New Mexico! In this section, we will dive into the various health impacts of climate change that are affecting our communities and explore strategies to mitigate and adapt to these challenges.

This quarter we focus on the impacts of El Niño on health in Arizona and New Mexico. This year we're experiencing a strong El Niño event, which is expected to persist and strengthen through the next few months. An El Niño event is typically associated with extreme weather events such as extreme heat, drought, and flooding. For Arizona and parts of New Mexico this typically means above-average winter precipitation between October and March. While this welcome rain helps us to recharge reservoirs and aquifers, flooding can cause significant damage to infrastructure and extreme precipitation events have been associated with water-borne disease outbreaks. There is also some evidence that El Niño events exacerbate vector-borne diseases like West Nile Virus, and shifts in precipitation may lead to the emergence of new diseases. This year's El Niño likely played a role in the extreme heat experienced in the Southwest and around the globe this summer leading to heat-related illnesses and death.

CLIMAS researchers are working on the complex interactions of environmental phenomena like drought, heat, and flooding and their effects on community health and resilience. While we typically think of heat or drought as its independent processes, they are complex and interact. For example, future heat wave predictions are not just for increased temperature, rather increased heat with higher humidity, and drought is not an absence of rain, rather prolonged lower than usual precipitation with future predictions including a combination of decreasing precipitation and increasing temperatures. Further, these climate processes have complex downstream health impacts: for example the recent Lancet Countdown projects not only increased heat-related deaths (370% increase expected) but also economic effects (50% labor loss) and food security (an additional 524.9 million people to experience

moderate to severe food insecurity). As communities prepare for climate sensitive health hazards, it is important to recognize that these health effects will land on already overburdened health infrastructure. CLIMAS researchers are working to support health infrastructure through training and a new initiative to investigate multiple hazards. In the words of the Lancet Countdown: “Health-centered climate action is essential today, and could render immediate health benefits.”

Join us next quarter in the Public Health Corner as we explore the health impacts of climate change in Arizona and New Mexico, and discover ways we can all work together to create a healthier and more resilient future.

Map: Billion-Dollar Weather and Climate Disasters (NOAA)

## Southwest Climate Podcast

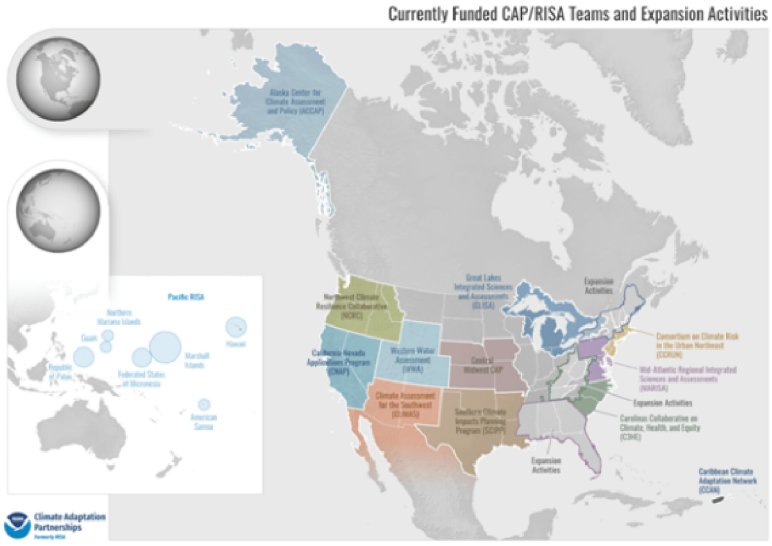
### December 2023 – Special MailBag Episode


Zack Guido and Mike Crimmins sharpened their pencils, hit the library, and did their homework to bring you a very special MailBag episode of the Southwest Climate Podcast for this month.  Thank you to all the listeners for sending in your questions and for trying to stump our hosts.  This episode is not to be missed - so grab a cup of coffee and get ready to be schooled before heading off for the end of semester break.  And have a Happy Holidays from the Southwest Climate Podcast crew!

Listen Here

## About CLIMAS

The Climate Assessment for the Southwest (CLIMAS) program was established in 1998 as part of the National Oceanic and Atmospheric Administration's Climate Adaptation Partnerships (CAP) Program (formerly known as Regional Integrated Sciences and Assessments, or RISA). 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.




Learn more about the NOAA CAP program here

## Disclaimer

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| **Southwest Climate Outlook contributors:** | Mike Crimmins & Matt Meko |