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## November Southwest Climate Outlook

**Precipitation:** Over the past 30 days, much of Arizona and most of New Mexico recorded above-average precipitation (Fig. 1), as a number of storm systems brought moisture into the region. October rainfall was well above average across most of the southwestern U.S., with top 10 precipitation totals in Texas, New Mexico, and Nevada, and top 15 precipitation totals in Arizona (Fig. 2). November rainfall has been varied, with a mix of above and below-average precipitation.

**Temperature:** November has been cooler than average, particularly in Arizona and most of New Mexico (Fig. 3). These temperatures represent a stark change from October, which was warmer than average in both states. 2015 is set to rival 2014 as the warmest year on record, and we will watch to see whether early November reflects a short-term swing back towards 'normal' cooler winter temperatures, or whether the rest of 2015 will warm back up to make a run at the record.

**Snowpack & Water Supply:** Early season snowfall has resulted in some impressive values on snow water equivalent (SWE) percent of average maps (Fig. 4) but also highlights the variability of early season snow coverage across the West. It remains to be seen whether forecasted increases to winter storm activity will occur in the Southwest, and the role that temperature will play in terms of how precipitation will fall (snow vs. rain) and how long snowfall will last before being lost to runoff or sublimation.

**Drought:** Drought conditions remain across much of Arizona and small portions of eastern New Mexico (Fig. 5), but the above-average precipitation this fall and a near-average 2015 water year have helped scale back the intensity of drought characterizations across Arizona and New Mexico. If the current El Niño event brings above-average winter precipitation to the Southwest, it will further help temper the effects of years of drought.

**Tropical Storm Activity:** In the second half of October, two major hurricanes, Olaf and Patricia, formed in the eastern Pacific Ocean; Patricia escalated to a category 5 storm and made landfall in Mexico. As of Nov. 20, Rick is off the Pacific coast, and earlier models showed it had potential to push into the Southwest. The eastern Pacific tropical storm season has been very active, and the National Hurricane Center reported that accumulated cyclone energy (ACE) through the end of October was approximately 50 percent higher than the 1981–2010 median value. An above-average eastern Pacific tropical storm season was forecasted this year, with the strong El Niño event being a major component of that forecast.

**Precipitation & Temperature Forecasts:** The Nov. 19 NOAA-Climate Prediction Center seasonal outlook predicts above-average precipitation for most of the Southwest this fall into winter, with progressively increasing chances of above-average precipitation to the south (Fig. 6, top). Temperature forecasts are split, with elevated chances for above-average temperatures along the West Coast and extending to the western edge of Arizona, and increased chances for below-average temperatures centered over Texas and extending across most of southeastern New Mexico (Fig. 6, bottom).



### Tweet Nov SW Climate Outlook

CLICK TO TWEET

Nov2015 @CLIMAS\_UA SW Climate Outlook - Climate, El Niño, Reservoir Volumes, Seasonal Forecast <http://bit.ly/1XfoXIH> swclimateoutlook



## Online Resources

**Figure 1**  
National Weather Service - AHPS  
<http://water.weather.gov/precip>

**Figure 2**  
NOAA National Centers for Environmental Information  
<https://www.ncdc.noaa.gov/>

**Figure 3**  
High Plains Regional Climate Center - HPRCC  
<http://www.hprcc.unl.edu/>

**Figure 4**  
Western Regional Climate Center  
<http://www.wrcc.dri.edu/>

**Figure 5**  
U.S. Drought Monitor  
<http://droughtmonitor.unl.edu/>

**Figure 6**  
NWS Climate Prediction Center  
<http://www.cpc.ncep.noaa.gov/>

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# November Southwest Climate Outlook

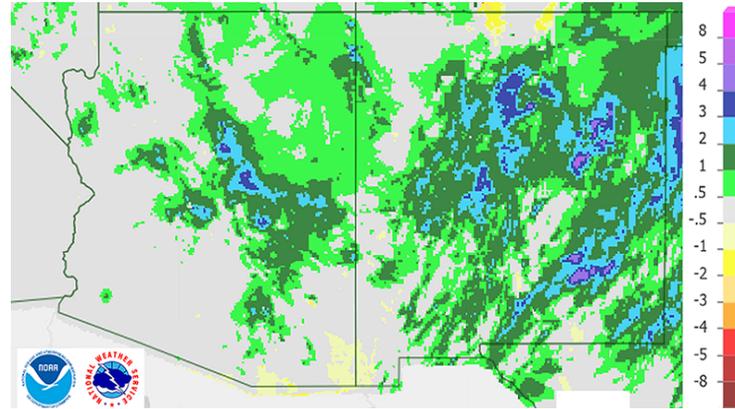


Figure 1: Departure from Normal Precipitation - Past 30 Days

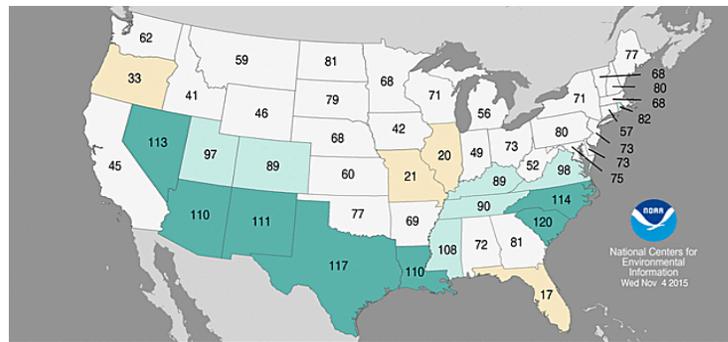


Figure 2: Statewide Precipitation Ranks - October 2015

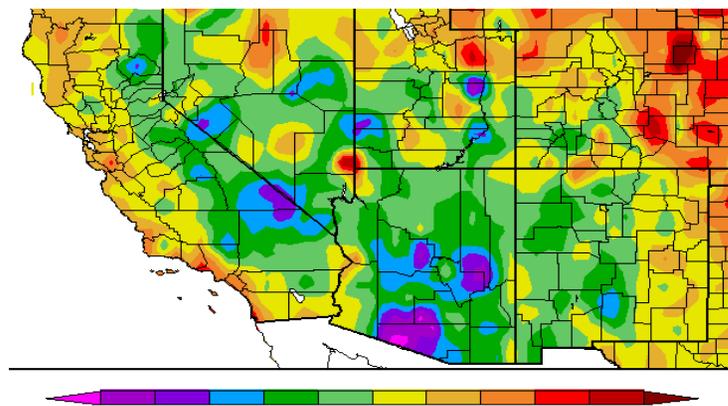


Figure 3 - Departure from Normal Temperature Oct 21 - Nov 19, 2015

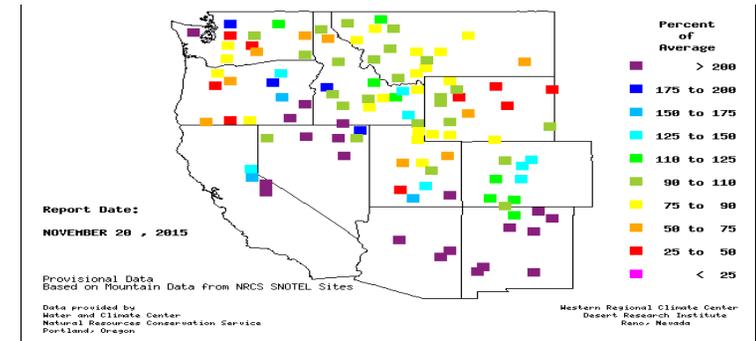


Figure 4: Basin Average Snow Water Content - Nov 20, 2015

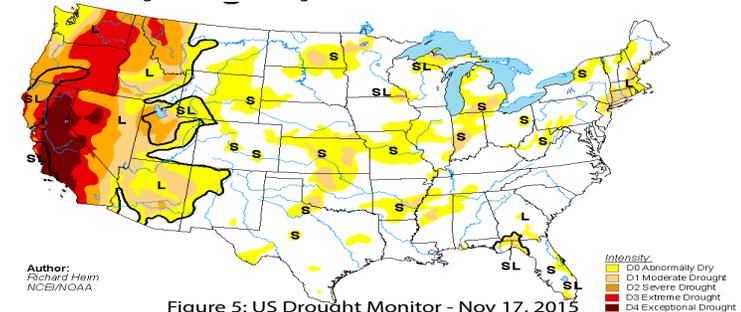


Figure 5: US Drought Monitor - Nov 17, 2015

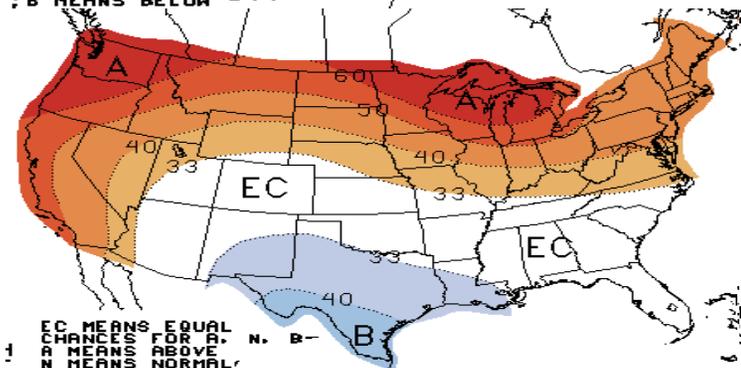
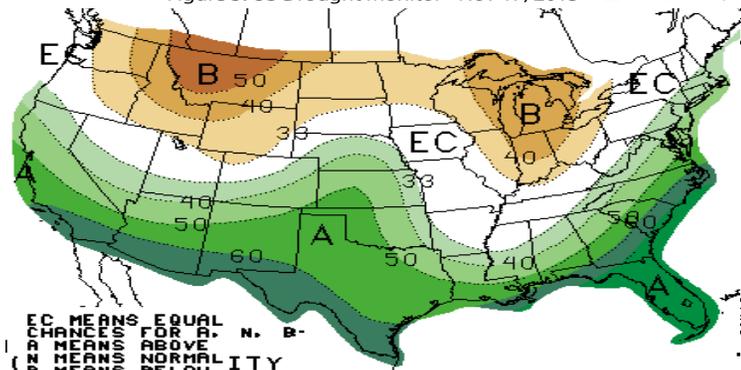


Figure 6: Three-Month Precipitation & Temperature Outlook - Nov 19, 2015

## Online Resources

### Figure 1

#### Australian Bureau of Meteorology

<http://www.bom.gov.au/climate/enso/index.shtml>

### Figure 2

#### NOAA - National Climatic Data Center

<http://www.ncdc.noaa.gov/teleconnections/enso/>

### Figure 3

#### International Research Institute for Climate and Society

<http://iri.columbia.edu/our-expertise/climate/forecasts/enso/>

## El Niño

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

[www.climas.arizona.edu/sw-climate/el-niño-southern-oscillation](http://www.climas.arizona.edu/sw-climate/el-niño-southern-oscillation)

# El Niño 2015-2016

We spent the better part of 2014 (and the first part of 2015) waiting in anticipation for an El Niño event that was initially forecast to be one of the stronger events on record. By early 2015, the event in question had not yet materialized, and some questioned whether El Niño would ever arrive. Eventually it did, and has been going strong for months, with most forecasts indicating that it will remain a strong event through the winter. As this event unfolds, there are numerous impacts we might expect to see across the Southwest over the course of our cool season (approximately Oct - Mar). In the coming months, CLIMAS will aggregate news, information, and commentary about the possible and expected impacts of El Niño, from the perspective of what is most relevant and applicable to the Southwest. This will include what we have learned from past events, and what forecasting and models can tell us about planning for this event.

For more information, please visit [www.climas.arizona.edu/sw-climate/el-niño-southern-oscillation](http://www.climas.arizona.edu/sw-climate/el-niño-southern-oscillation), our repository for El Niño related materials, which we will update with timely and relevant information about El Niño throughout the winter.

## 2015 El Niño Tracker

El Niño conditions continued for a ninth straight month, and models continue to forecast a strong El Niño event that likely will last through spring 2016 and remain strong through the early part of the year. Forecasts focused on the persistence of sea-surface temperature (SST) anomalies (Figs.1–2) and weakened trade winds, enhanced convective activity in the central and eastern Pacific, and El Niño-related ocean-atmosphere coupling.

On Nov 10, 2015, the Japan Meteorological Agency identified ongoing El Niño conditions in the equatorial Pacific, and in particular “remarkably above normal” SST anomalies and atmospheric convective activity, with projections that El Niño would remain in place through spring 2016. On Nov 10, 2015, the Australian Bureau of Meteorology maintained its tracker at official El Niño status, remarking on the persistent strength of oceanic and atmospheric indicators. On Nov 12, 2015, the NOAA-Climate Prediction Center (CPC) extended its El Niño advisory, and identified the current atmospheric and oceanic anomalies as reflecting “a strong and mature El Niño episode”. Their models indicate the El Niño event will persist through winter, with a transition to ENSO neutral conditions by late spring or early summer. On Nov 19, the International Research Institute for Climate and Society (IRI) and CPC forecasts indicated that both sea surface temperature anomalies and atmospheric variables were indicative of a strong El Niño event, with consensus centering on strong El Niño conditions that might strengthen even more into early winter 2015-2016, before gradual weakening into spring 2016 (Fig. 3).

(cont. on next page)

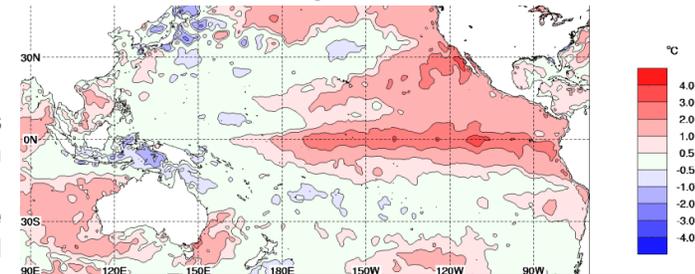


Figure 1: Oct 2015 Sea Surface Temperature (SST) Anomalies

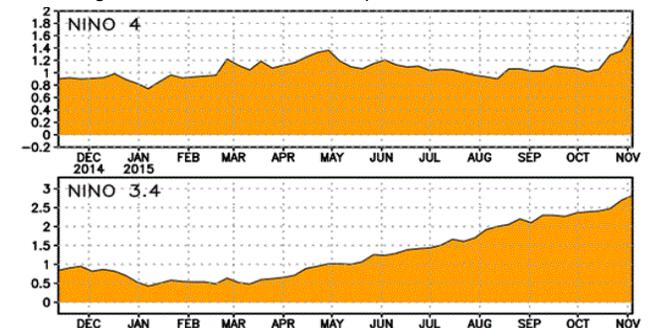


Figure 2: SST Anomalies in Niño Regions 3.4 & 4 (NCDC)

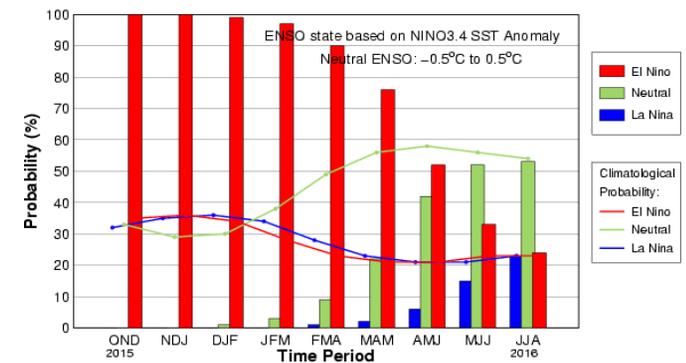


Figure 3: Early-Nov IRI/CPC Consensus Probabilistic ENSO Forecast

## Online Resources

**Figure 4**  
**NOAA - Climate Prediction Center**  
<http://www.cpc.ncep.noaa.gov/products/NMME/current/plume.html>

**Figures 5-8**  
**Westwide Drought Tracker**  
<http://www.wrcc.dri.edu/wwdt/>

# 2015 El Niño Tracker

The North American multi-model ensemble currently shows a strong event extending into 2016 with gradual weakening heading into spring (Fig. 4). The ocean and atmosphere are indicative of a strong El Niño event that shows no sign of weakening, and current forecasts that have it pegged as one of the strongest events on record. There is little doubt that El Niño will remain on the current trajectory in the near term, and we will see one of the top three strongest events on record since 1950.

What does this mean for the Southwest? Seasonal forecasts and past events suggest we should see well above-average cumulative precipitation totals over the cool season. We should not expect a winter of daily rains, however, as there will likely be periods of inactivity between storms. Looking at the 1997–1998 event—the strongest El Niño event on record—most of Arizona and New Mexico received above-average precipitation in December but below-normal precipitation for all of January before returning to normal or above-normal precipitation in February and March (Figs. 5–8).

In order to track this variability and provide data and analysis regarding possible impacts of El Niño on the Southwest, CLIMAS has created an El Niño hub:

[climas.arizona.edu/sw-climate/el-niño-southern-oscillation](http://climas.arizona.edu/sw-climate/el-niño-southern-oscillation)

This is our repository for news and information about the expected impacts of El Niño, from the perspective of what is most relevant and applicable to the Southwest. This includes what we have learned from past El Niño events, and what forecasting and models can tell us about planning for the ongoing event.

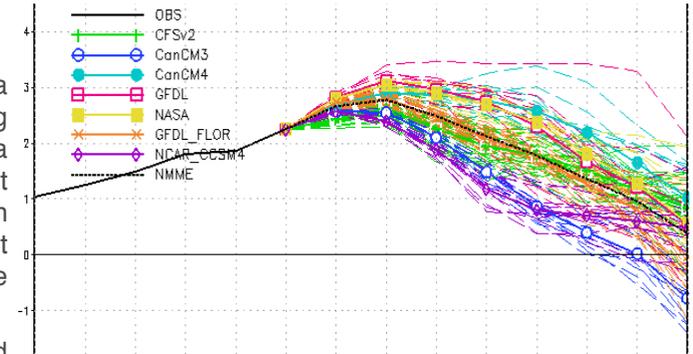


Figure 4: North American Multi-Model Ensemble Forecast for Niño 3.4

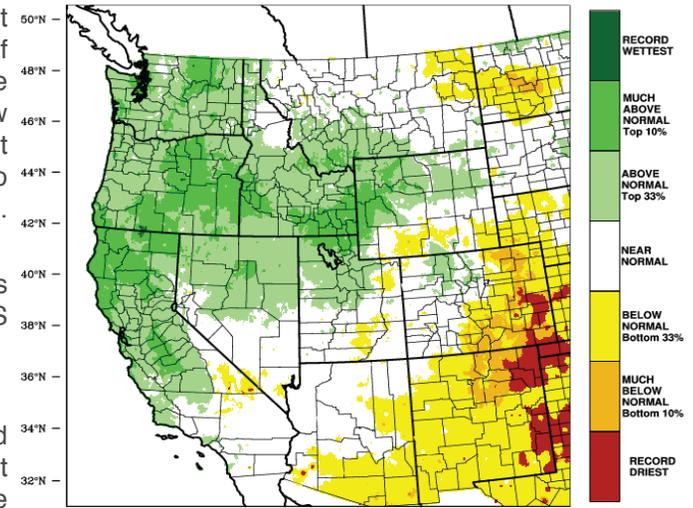


Figure 6: January 1998 Precipitation Percentile - WestWide Drought Tracker

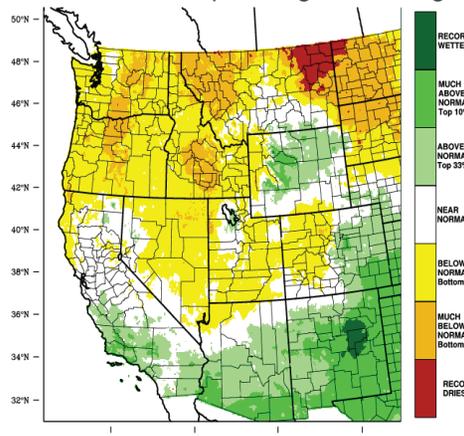


Figure 5: December 1997 Precipitation Percentile - WestWide Drought Tracker

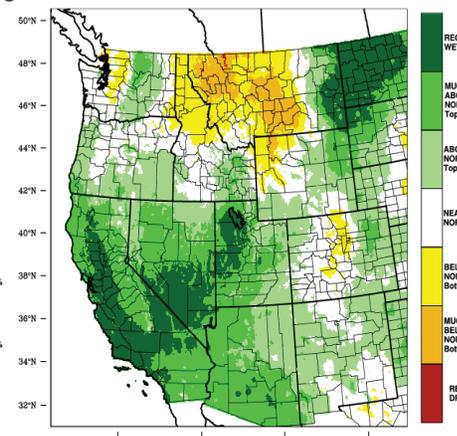


Figure 7: February 1998 Precipitation Percentile - WestWide Drought Tracker

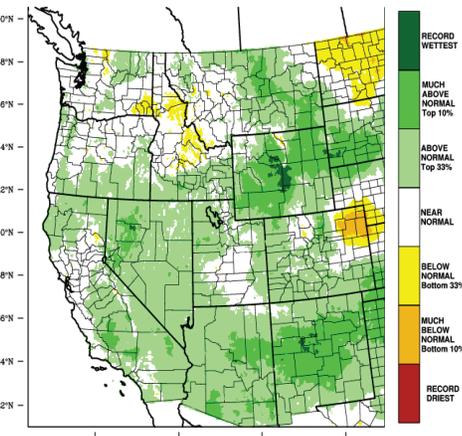


Figure 8: March 1998 Precipitation Percentile - WestWide Drought Tracker

## El Niño

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[www.climas.arizona.edu/sw-climate/el-niño-southern-oscillation](http://www.climas.arizona.edu/sw-climate/el-niño-southern-oscillation)

## 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](http://www.wcc.nrcs.usda.gov/cgibin/resv_rpt.pl?state=new_mexico)

We are updating our 'max storage' values for numerous NM reservoirs based on conservation storage vs. maximum flood capacity. This alters the percent full calculations, even while 'current storage' numbers are unchanged. 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).

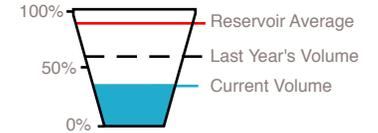
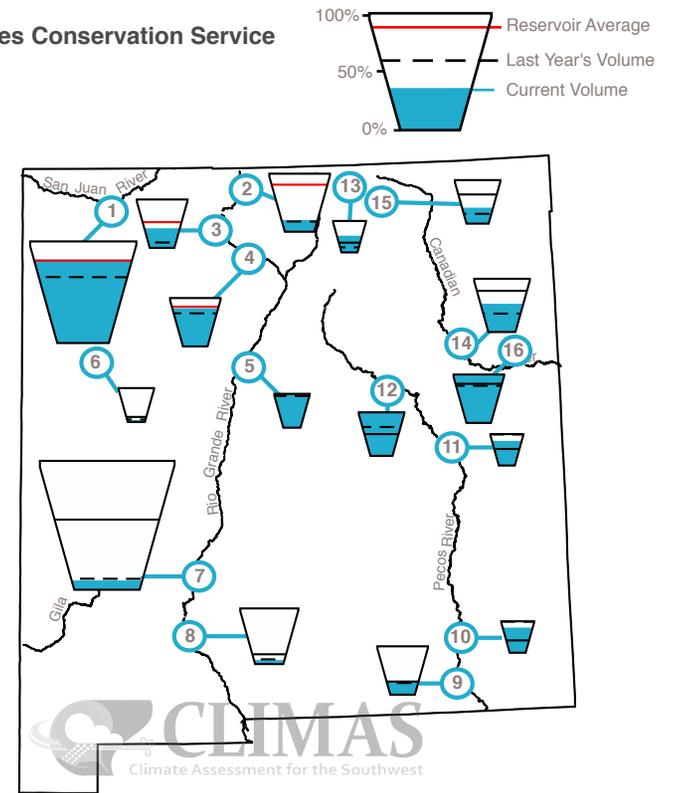
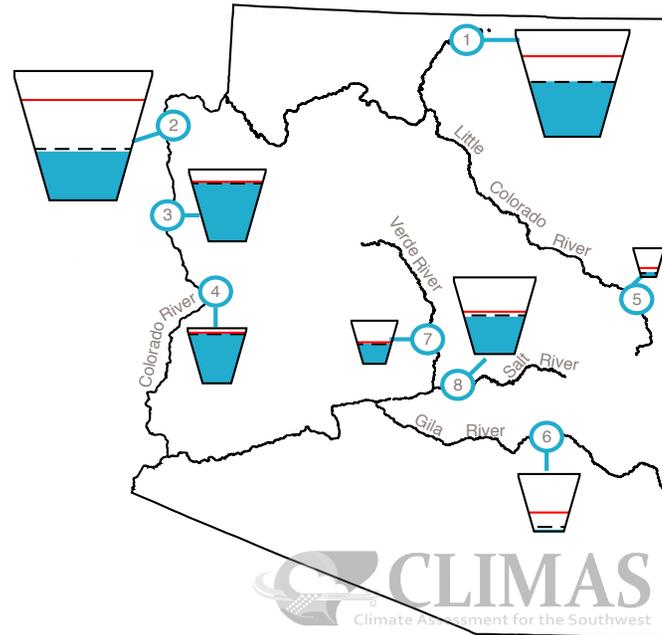
The table details more exactly the current capacity (listed as a percent of maximum storage). Current and maximum storage are given in thousands of acre-feet for each reservoir. One acre-foot is the volume of water sufficient to cover an acre of land to a depth of 1 foot (approximately 325,851 gallons). 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 OCTOBER 31, 2015

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	51%	12,375.3	24,322.0	6.9
2. Lake Mead	38%	9,932.0	26,159.0	78.0
3. Lake Mohave	83%	1,503.4	1,810.0	-102.4
4. Lake Havasu	92%	569.8	619.0	-10.9
5. Lyman	16%	4.9	30.0	0.4
6. San Carlos	3%	27.1	875.0	12.3
7. Verde River System	47%	136.3	287.4	-10.3
8. Salt River System	48%	975.1	2,025.8	-10.3

\*KAF: thousands of acre-feet

Reservoir	Capacity	Current Storage*	Max Storage*	One-Month Change in Storage*
1. Navajo	82%	1,392.0	1,696.0	0.2
2. Heron	20%	81.3	400.0	-2.7
3. El Vado	40%	75.7	190.3	-11.7
4. Abiquiu	79%	147.5	186.8**	5.9
5. Cochiti	95%	47.3	50.0**	0.3
6. Bluewater	5%	2.1	38.5	-0.1
7. Elephant Butte	8%	183.1	2,195.0	14.7
8. Caballo	8%	25.1	332.0	1.3
9. Lake Avalon	27%	1.2	4.5**	-3.9
10. Brantley	79%	33.4	42.2**	12.3
11. Sumner	78%	28.1	102.0**	-2.9
12. Santa Rosa	100%	106.1	105.9**	5.9
13. Costilla	53%	8.5	16.0	0.5
14. Conchas	53%	134.7	254.2	19.7
15. Eagle Nest	37%	29.2	79.0	-0.4
16. Ute Reservoir	98%	195	200	12.0

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## Nov 2015 SW Climate Podcast - The Hunt for Wet October

In the Nov 2015 episode of the CLIMAS Southwest Climate Podcast, Zack Guido and Mike Crimmins look back on an anomalously wet October, and in particular the effect of one system that made two visits to the Southwest. They also talk about Hurricane Patricia, and the speed at which that tropical system escalated to one of the strongest storms on record. They also talk about October weather in terms of the seasonal transition (between monsoon summer and fall/winter patterns) and the impact of tropical storm systems, as well as the difficulty of attributing specific weather events to longer term patterns (i.e. the El Niño Southern Oscillation). They wrap up by talking about El Niño and the seasonal forecasts, which include projections of above average precipitation in the southwest, as well as a number of global impacts.

*Listen: <http://www.climas.arizona.edu/podcast/nov-2015-climas-sw-climate-podcast-hunt-wet-october>*

## El Niño is here, what does that mean for Arizona and New Mexico?

Ben McMahan & Mike Crimmins, Originally published on the CLIMAS blog, Sept 24, 2015

“El Niño” has been all over the news lately, even garnering comparisons to a Godzilla. This characterization is in response to the near-record strength of this El Niño event, which is exciting for climate enthusiasts but leaves most people wondering what a strong El Niño event actually means for Arizona and New Mexico.

*Read more: <http://www.climas.arizona.edu/blog/el-niño-here...what-exactly-does-mean-arizona-and-new-mexico>*

## Oct 2015 SW Climate Podcast - Monsoon Recap

In this episode of The Southwest Climate Podcast, Mike Crimmins & Zack Guido recap the 2015 monsoon, (and revisit some of their predictions from earlier this summer). In part 1, they give a quick overview of the monsoon, before taking a closer look at the month by month progression, to track the overall season for what stood out (and what was underwhelming). In part 2, they talk about nuances associated with the monsoon, including the impacts of El Niño, and eastern pacific tropical storm activity. They conclude with a discussion of the variable nature of the monsoon, and what makes this such an exciting place to live as we watch the season unfold.

*Listen: <http://www.climas.arizona.edu/podcast/oct-2015-sw-climate-podcast-monsoon-recap>*

## Sept 2015 SW Climate Podcast - El Niño Super-Podcast

In this edition of the CLIMAS Southwest Climate Podcast, Zack Guido and Mike Crimmins focus specifically on El Niño and what we can expect going into this fall and winter, given the “strong” status of this El Niño event.

Part 1: A look at the El Niño signal, including a look back at what happened in 2014 (and why El Niño didn’t start when we thought it would), as well as a look forward for what El Niño might mean regionally and globally. Part 2: A close look at the 97-98 El Niño event, and what happened in the Southwest during the last “strong” El Niño event...Can we expect more of the same? What might be different? Part 3: A look at the El Niño models going into Fall 2015 and Winter 2016 - How certain are we about increased precipitation this winter? When might we see this increase? Any chance for a “boringly average” year, despite the El Niño signal?

*Listen: <http://www.climas.arizona.edu/podcast/sw-climate-podcast-el-niño-super-podcast>*

