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February Southwest Climate Outlook

Precipitation: The borderlands region of southern Arizona and portions of southern, central, and northeastern New Mexico all recorded above-average precipitation, but most of Arizona and New Mexico received average or below-average precipitation in the past 30 days despite a number of January storms (Fig. 1).

Temperature: After a record year for Arizona (and a top five year for New Mexico), temperatures remained well above average in the Southwest over the past 30 days (Fig. 2). This means pleasant weather compared to the frigid and snowy conditions in the eastern and central U.S. but has implications for drought, water storage, phenology, and human health.

Snowpack: Snow water equivalent (SWE) is low across Arizona, ranging from 1 to 62 percent of average. New Mexico is also quite low, ranging from 32 to 85 percent of average (Fig. 3). Well above-average temperatures are a significant factor, as many precipitation events fell primarily as rain, with the snowline as high as 8,000 feet in some cases.

Water Supply: In January, total reservoir storage was 45 percent in Arizona (compared to 46 percent last year) and 23 percent in New Mexico (same as last year) (see reservoir storage on page 5, for details). Unseasonably warm temperatures mean more precipitation falling as rain and an early start to snowmelt runoff. This may increase reservoir storage in the short term, but losses to evaporation/sublimation may counter these gains in the long term.

Drought: The 2014 monsoon, along with an active eastern Pacific tropical storm season, provided temporary relief to regional drought but did little to change long-term conditions. The U.S. Drought Monitor (USDM) expanded the drought designations in Arizona and New Mexico following variable and generally below-average precipitation (Fig. 4).

Plant Ecology & Human Health: Above-average temperatures and winter rains jumpstarted plant activity across the region. Plant enthusiasts are anticipating a banner year for wildflowers, but this comes at a cost. Pollen counts are already at levels that affect most allergy sufferers, a pattern almost certain to extend through the spring.

ENSO: The NOAA-Climate Prediction Center maintained a 50–60% probability of an El Niño event this winter and into early spring. Declines in sea surface temperatures, especially in the Niño 1-2 region, were partially offset by increased atmospheric activity. Consensus is on a borderline weak event extending into early spring, with the potential for a resurgence of El Niño conditions later in 2015 (see ENSO tracker on page 3, for more details).

Precipitation & Temperature Forecasts: The Feb. 19 NOAA-Climate Prediction Center seasonal outlook continues to predict above-average precipitation through the winter and into spring for most of the Southwest (Fig. 5). It remains to be seen how much this forecast depends on El Niño conditions, which are currently trending weak to neutral. Temperature forecasts remain split across the region, with elevated chances for above-average temperatures along the West Coast and into Arizona and increased chances for below-average temperatures along the Gulf Coast into New Mexico (Fig. 6).

Tweet Feb SW Climate Outlook CLICK TO TWEET

Feb 2014 @CLIMAS_UA SW Climate Outlook - SW Climate, ENSO Tracker, QA re cold east vs. warm west, AZ-NM Reservoirs http://bit.ly/1EZ3JjY

February Southwest Climate Outlook

Online Resources

Figure 1
NOAA/NWS - Advanced Hydrologic Prediction Service
http://water.weather.gov/precip/

Figure 2
High Plains Regional Climate Center
http://www.hprcc.unl.edu/

Figure 3
Natural Resources Conservation Service
http://www.wcc.nrcs.usda.gov/gis/snow.html

Figure 4
National Drought Mitigation Center
http://droughtmonitor.unl.edu/

Figure 5-6
NOAA - Climate Prediction Center
http://www.cpc.ncep.noaa.gov/products/forecasts/

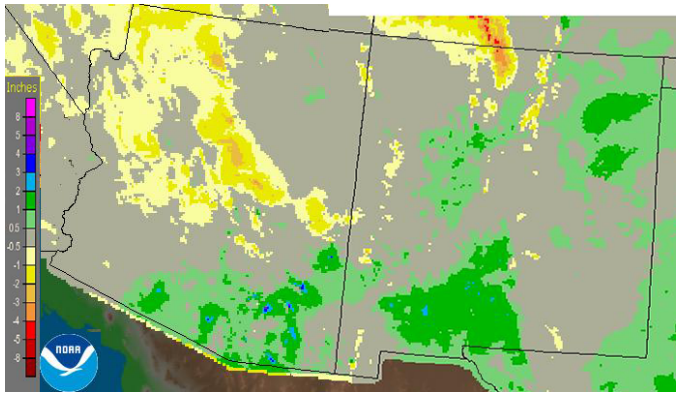


Figure 1: Departure from Normal Precipitation - Past 30 Days

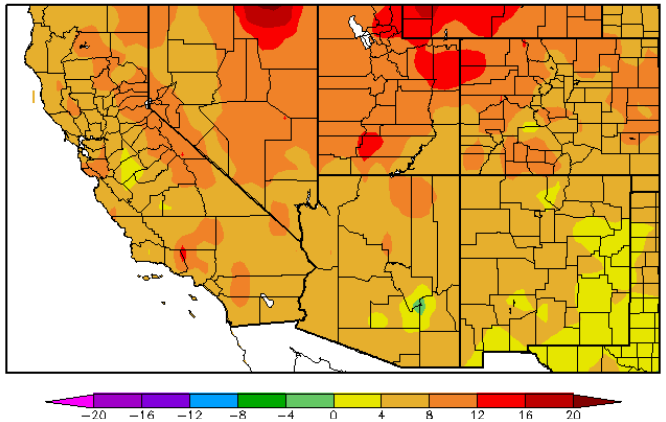


Figure 2: Departure from Normal Temp (F) - Jan 20 - Feb 18, 2015

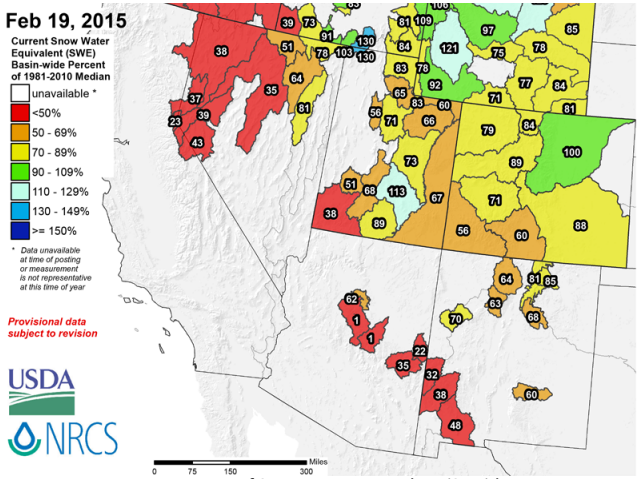


Figure 3: Percent of Snow Water Equivalent (SWE) by Basin

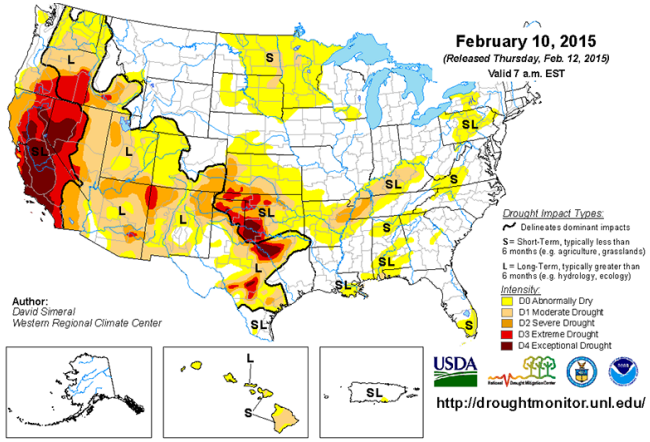


Figure 4: U.S. Drought Monitor - Feb 10, 2015

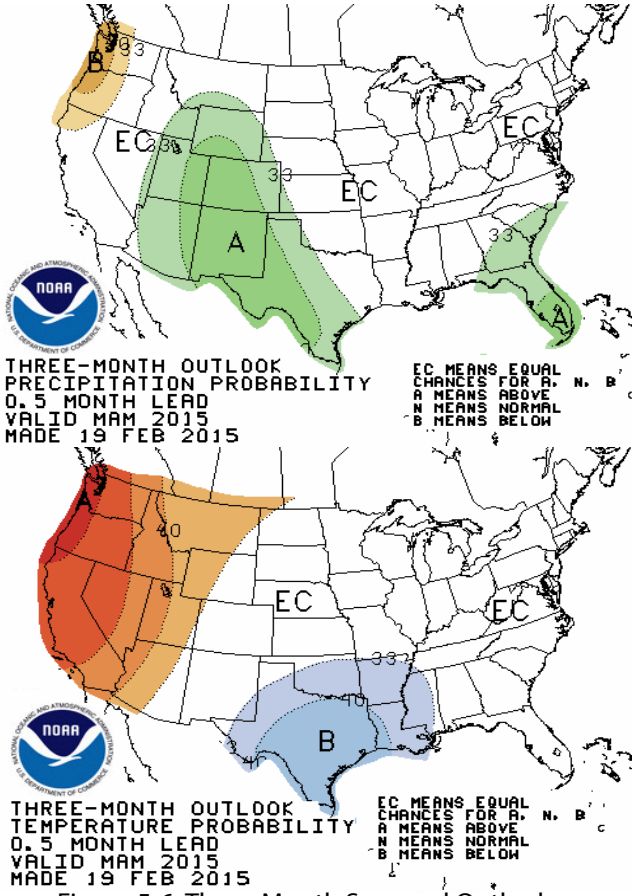


Figure 5-6: Three-Month Seasonal Outlook

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/

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

2014-15 El Niño Tracker

A definitive 2014–2015 El Niño forecast remains elusive. Weak El Niño conditions have continued in 2015, but recent backsliding in SST anomalies (Fig. 1), especially in the Niño 1-2 regions (Fig. 2), along with the ongoing lack of coordination between atmospheric and oceanic conditions, give little confidence that the 2014–2015 event will be characterized as anything more than a weak El Niño.

The most recent forecasts dialed back the probabilities for El Niño this winter and spring, and hinted we could swing to ENSO-neutral by late spring. On Feb. 5, the NOAA-Climate Prediction Center (CPC) issued another El Niño Watch, maintaining a 50–60 percent probability of an El Niño event, most likely a weak event extending into late winter or early spring. On Feb. 10, the Japan Meteorological Agency continued its assessment that El Niño conditions had been present in the equatorial Pacific for multiple months. They noted uncertainty as to the length or intensity of an El Niño event, with emphasis on a weak event that would transition to ENSO-neutral by early spring. On Feb. 17, the Australian Bureau of Meteorology kept its El Niño tracker status at neutral, given the fade in SST anomalies and lack of clear atmospheric signal. On Feb. 19, the International Research Institute for Climate and Society (IRI) and CPC reasserted a 50–60 percent probability of an El Niño event (Fig. 3). Given the declining SST anomalies and lack of clear atmospheric signal, they characterized this event as a "borderline El Niño" that would last through early spring 2015. The North American multi-model ensemble shows a weak event that extends into summer (Fig. 4). This graph highlights the possibility of a continuation of a stronger El Niño signal into 2015 (a possibility that was discussed in the IRI-CPC forecast event), depending on how ocean and atmospheric conditions progress from summer into fall. The dynamical models currently favor a resurgence of El Niño conditions, while the statistical models suggest an ENSO-neutral state.

As with last month, we remain in "El Limbo" with seasonal forecasts still indicating an increased chance of above-average precipitation across the Southwest for winter and early spring. These forecasts are linked to the projected influence of El Niño conditions, but impacts associated with weak El Niño events are less certain than those associated with moderate or strong events (past weak events have brought both dry and wet conditions to the Southwest during the winter). A number of storm events have moved through the Southwest in late 2014 and early 2015, but conditions have not converged to produce widespread above-average precipitation over an extended period of time. For this El Niño event to be of some utility in mitigating longer-term drought conditions, we would hope to see this convergence this winter into spring, with more widespread and sustained precipitation events.

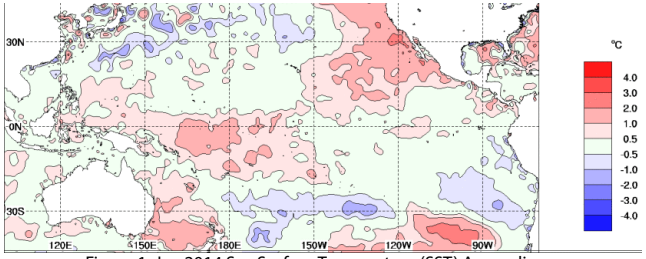


Figure 1: Jan 2014 Sea Surface Temperature (SST) Anomalies

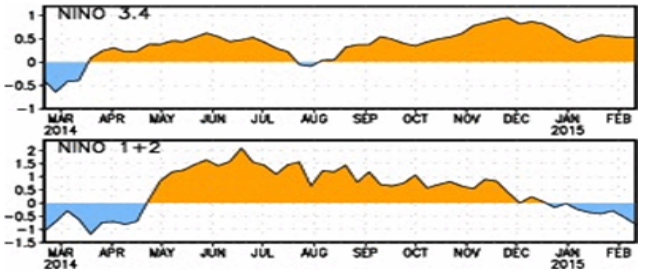


Figure 2: SST Anomalies in Niño 1-2 & 3.4 Regions (NCDC)

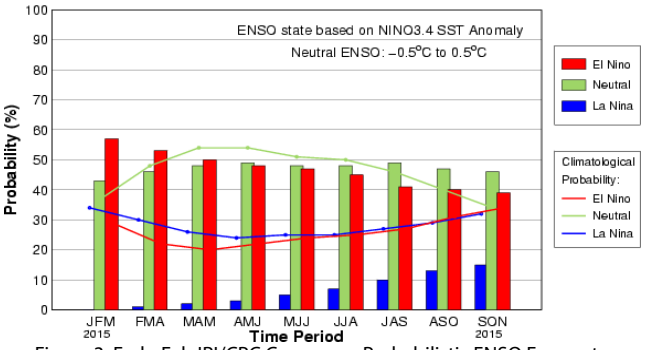


Figure 3: Early-Feb IRI/CPC Consensus Probabilistic ENSO Forecast

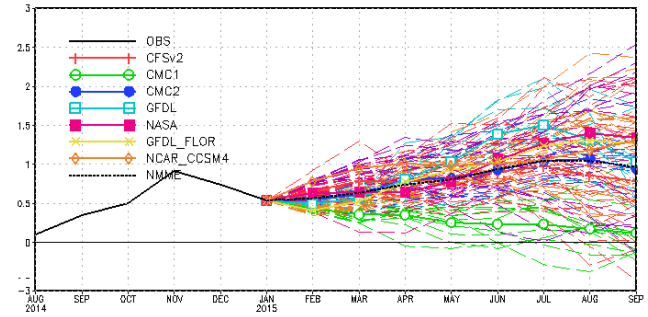


Figure 4: North American Multi-Model Ensemble Forecast for Niño 3.4

Online Resources

Figure 1.
NOAA - Earth Systems Resarch Laboratory (ESRL)
http://www.esrl.noaa.gov/

Figure 2.
NOAA - ESRL & Climate.gov
http://www.climate.gov/

Additional Resouces

1. Meridional: In meteorology, a flow, average, or functional variation taken in a direction that is parallel to a line of longitude; along a meridian; northerly or southerly; as opposed to zonal.
http://glossary.ametsoc.org/wiki/Meridional

2. U.S. temperature extremes and the polar jet stream
http://www.climate.gov/news-features/event-tracker/us-temperature-extremes-and-polar-jet-stream

3. Evidence for a wavier jet stream in response to rapid Arctic warming
http://iopscience.iop.org/1748-9326/10/1/014005

4. Record-breaking winters and global climate change
http://www.sciencemag.org/content/344/6186/803

5. Synoptic Discussion - January 2015
http://www.ncdc.noaa.gov/sotc/synoptic/2015/1

Ask An Applied Climatologist Q&A

Mike Crimmins, UA Extension Specialist

Why has it been so cold on the East Coast, and so warm in the Southwest? Where does this fit into climatic patterns? And is this extraordinary or just variability?

The weather pattern across the U.S. has been pretty extreme over the past weeks, with record cold and snow across the East and record to near-record warmth in the West. Why is the country so divided? In short, a wavy jet stream is to blame (Fig. 1). This high-altitude stream of fast-moving winds has been carving a circuitous path around the globe for much of the winter. The path of the winter mid-latitude jet stream around the globe (in both hemispheres) can give a good indication of where storms are tracking and where warm and cold spots at the surface are emerging. If the jet stream gets stuck in any position, then places getting storms can continue to see a parade of storms, while warm and dry places stay warm and dry.

This winter, the mid-latitude jet stream in the Northern Hemisphere has been very wavy, or **meridional [1]**, with ridges—large-scale bulges—to the north and troughs to the south. Ridges are associated with warm and dry conditions, while troughs are associated with cold and possibly snowy or rainy conditions. Over the past several weeks, this warm West/cold East pattern has dominated, with a persistent ridge of high pressure across the West and a very cold trough across the East (Fig. 2). Last year, similar conditions drove California and much of the Southwest deeper into drought and unleashed **record-setting cold [2]** in the eastern U.S. This year, these conditions have broken down on occasion, allowing for storms to bring some precipitation to the West and for the East to warm up for brief periods.

Researchers are trying to determine why this dichotomous pattern has emerged and persisted over the past couple of years. **Some climate scientists propose that a warming Artic and declining sea ice [3]** are contributing to an increasing frequency of wavy and stuck jet stream events. **Other scientists argue that warming water [4]** in the tropics and shifts in tropical convection are at play in impacting the winter jet stream pattern. This winter appears to be a **complex interaction of many different factors [5]** and will be studied in more detail over the coming year to see how it fits into these active areas of research.

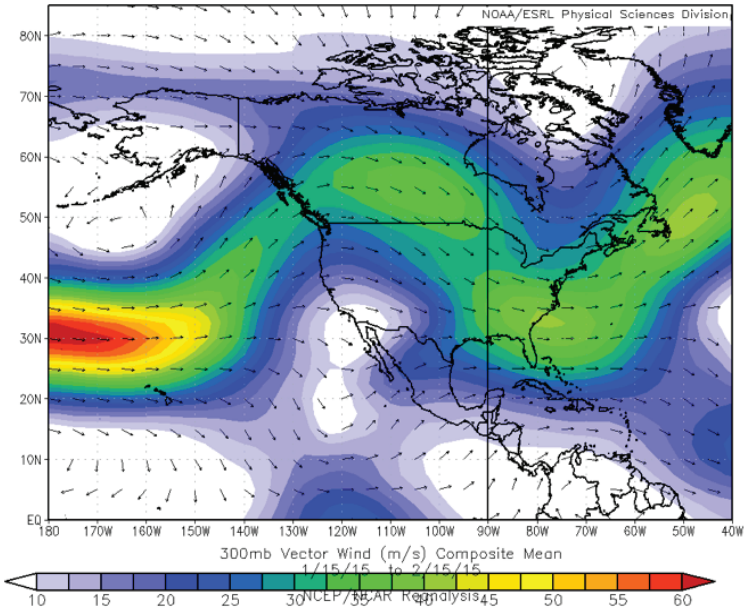


Figure 1: 300mb Vector Wind (m/s) Composite Mean (NOAA/ESRL)

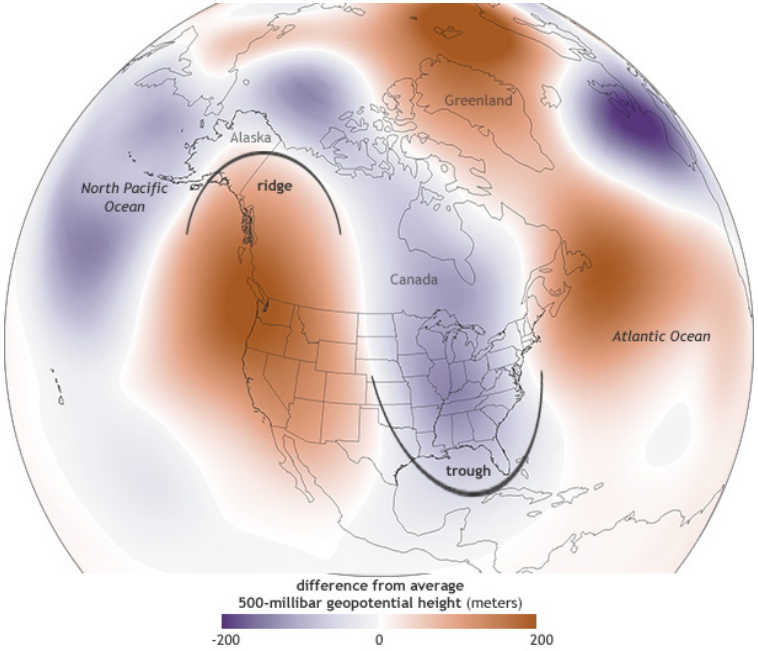


Figure 2: 500mb Difference - Ave Geopotential Height (NOAA/ESRL)

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

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).

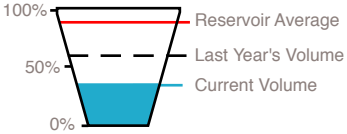
The table details more exactly the current capacity (listed as a percent of maximum storage). Current and maximum storage are given in thousands of acre-feet for each reservoir. One acre-foot is the volume of water sufficient to cover an acre of land to a depth of 1 foot (approximately 325,851 gallons). On average, 1 acre-foot of water is enough to meet the demands of 4 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.

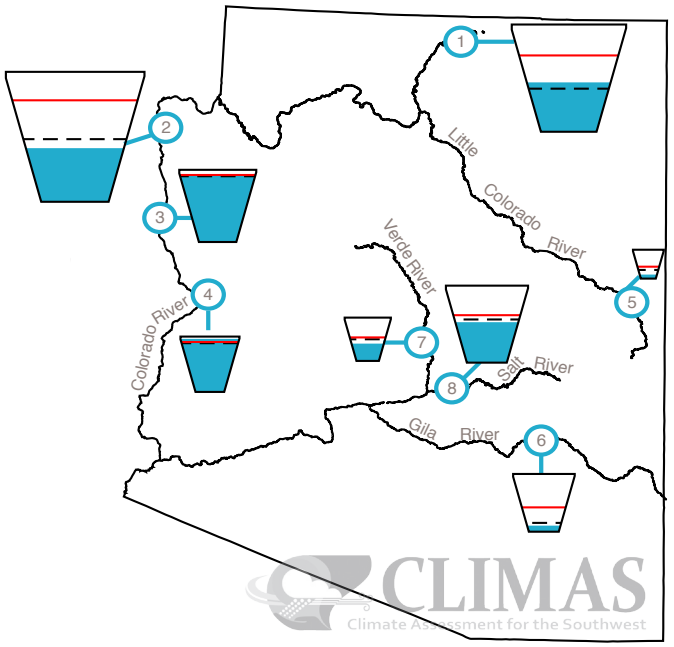
These data are based on reservoir reports updated monthly by the National Water and Climate Center of the U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS).

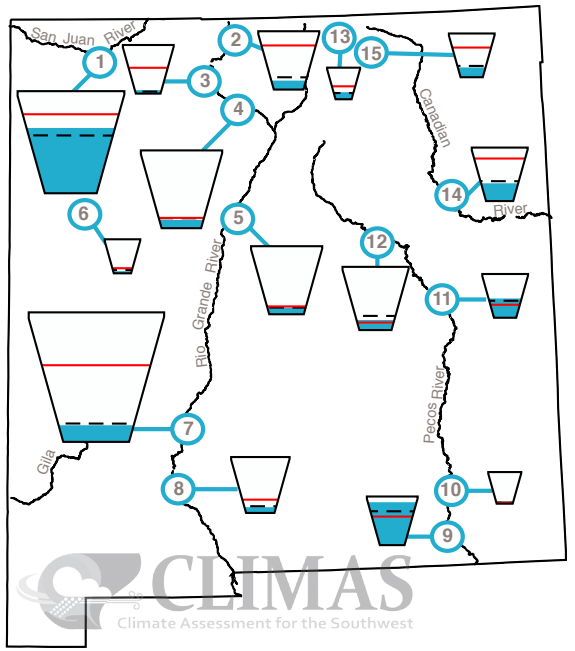
Reservoir Volumes

DATA THROUGH JAN 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	46%	11,146.0	24,322.0	-377.0
2. Lake Mead	41%	10,739.0	26,159.0	63.0
3. Lake Mohave	94%	1,697.0	1,810.0	137.3
4. Lake Havasu	95%	585.2	619.0	24.1
5. Lyman	14%	4.1	30.0	0.1
6. San Carlos	10%	88.7	875.0	14.4
7. Verde River System	40%	115.5	287.4	5.5
8. Salt River System	52%	1,054.6	2,025.8	34.1

*KAF: thousands of acre-feet

Reservoir	Capacity	Current Storage*	Max Storage*	One-Month Change in Storage*
1. Navajo	65%	1090.7	1,696.0	0.2
2. Heron	15%	61.9	400.0	-2.4
3. El Vado	7%	13.3	190.3	-0.2
4. Abiquiu	11%	132.2	1,192.8	3.6
5. Cochiti	10%	48.2	491.0	2.4
6. Bluewater	6%	2.4	38.5	0.0
7. Elephant Butte	13%	291.1	2,195.0	34.7
8. Caballo	10%	33.9	332.0	1.4
9. Lake Avalon	88%	3.5	4.0	0.9
10. Brantley	8%	82.9	1,008.2	1.8
11. Sumner	44%	45.0	102.0	3.5
12. Santa Rosa	16%	69.5	438.3	0.3
13. Costilla	23%	3.6	16.0	0.3
14. Conchas	33%	84.6	254.2	0.7
15. Eagle Nest	22%	17.6	79.0	0.4

* in KAF = thousands of acre-feet

Southwestern Oscillations

Be sure to visit our blog, Southwestern Oscillations

http://www.climas.arizona.edu/blog

CLIMAS YouTube Channel

Visit our new YouTube channel for mini-videos of content/discussion pulled from the podcast

https://www.youtube.com/user/UACLIMAS/

CLIMAS Podcasts

Visit our website or iTunes to subscribe to our podcast feed

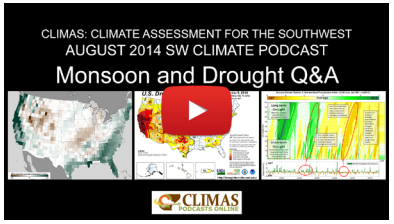
www.climas.arizona.edu/media/podcasts

https://itunes.apple.com/us/itunes-u/climate-in-the-southwest/id413143045

Notes from the Podcast - New Mini-Podcast Videos

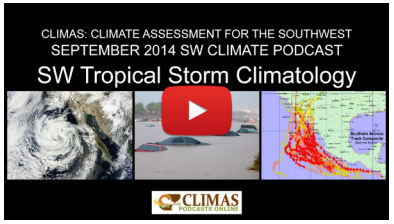
Regular podcast listeners will know that we cover a wide range of Southwest climate topics in a conversational manner. To make these discussions even more accessible and useful, we are pulling small segments from the podcasts and adding maps, images, and video to supplement the content. These offer an opportunity to quickly digest key points from the podcast and also serve as stand-alone teaching/illustration tools that are suitable for a wide range of audiences. You can find the videos and subscribe to the YouTube channel at https://www.youtube.com/user/UACLIMAS/.

We already have posted several mini-video podcasts:



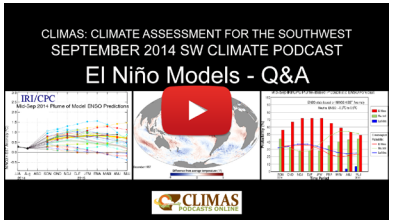
Monsoon and Drought Q&A

https://www.youtube.com/watch?v=Dk001_Yr-7k



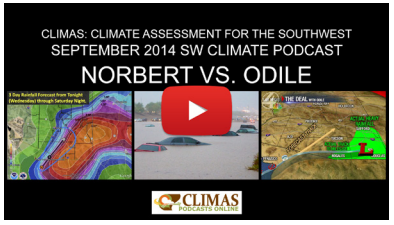
Southwest Tropical Storm Climatology

https://www.youtube.com/watch?v=IPRQxKI_jrw



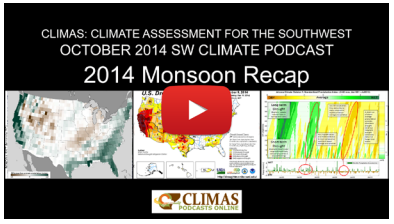
El Niño Forecast Models Q&A

https://www.youtube.com/watch?v=4kkQoArI8ck



Norbert vs. Odile - Tropical Storms in the Southwest

https://www.youtube.com/watch?v=UZpfyV2YCtw



2014 Monsoon Recap

https://www.youtube.com/watch?v=xkB7zHHpypU