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December Southwest Climate Outlook

November Precipitation and Temperature: After a wetter- and cooler than-average October, November was closer to long-term averages. Precipitation ranged from average to below-average in Arizona and New Mexico (Fig. 1a). Temperatures were mostly within the range of average, with some below-average observations in eastern New Mexico and the Four Corners region, and with a region of above-average temperatures on the Arizona/California border (Fig. 1b).

Seasonal & Annual Precipitation and Temperature: Autumn (Sept-Nov) precipitation was average to much-above average, save for a small pocket of below-average rainfall in northwestern New Mexico (Fig. 2a), while temperatures for the same period were average to above average throughout Arizona and New Mexico (Fig. 2b). Year-to-date precipitation ranges from record driest to much-above average, with the marked precipitation deficit continuing in the Four Corners region (Fig. 3a). Year-to-date temperature maps reduce the effect of monthly variability and reveal much-above-average temperatures across most of the Southwest, including some local areas of record-warmest conditions (Fig. 3b).

Drought: The Dec. 11 U.S. Drought Monitor (USDM) highlights the presence of drought across the entire Southwest, with persistent and severe drought conditions in the Four Corners region (Fig. 4). Drought in the Southwest poses a challenge in mapping different timescales and intensities of drought on a weekly basis. In a region already characterized by dry conditions, where accumulated precipitation deficits build over seasons and years, these drought characterizations can struggle to capture all of these inputs. The 36-month standardized precipitation index (SPI) for the Southwest (Fig. 5) highlights differential patterns of drought and precipitation deficit.

Snowpack & Water Supply: Snow water equivalent (SWE) has fluctuated considerably in southern Arizona and New Mexico this fall, with current values generally near or below average as of Dec. 15 (Fig. 6). Reservoir storage remains a persistent concern, as water levels have been impacted by long-term drought and accumulated precipitation deficit. Most of the reservoirs are at or below their long-term averages, and a few of the Rio Grande reservoirs are especially low (see Arizona and New Mexico reservoir storage, p. 4).

El Niño Tracker: An El Niño event appears imminent, with oceanic indicators now well into El Niño territory while atmospheric indicators continue to lag behind. Most forecasts noted a lack of coupling between ocean and atmosphere but remain confident of an El Niño event during winter 2018-2019, with forecast probabilities hovering around an 80- to 90-percent likelihood (see El Niño Tracker, p. 3).

Precipitation and Temperature Forecast: The three-month outlook for December through February calls for increased chances of above-normal precipitation in most of Arizona, New Mexico, and northern Mexico (Fig. 7, top), and mostly equal chances of above- or below-average temperatures for the southwestern United States and northern Mexico (Fig. 7, bottom).

Tweet Dec 2018 SW Climate Outlook

CLICK TO TWEET

DEC2018 @CLIMAS_UA SW Climate Outlook, El Niño Tracker, AZ & NM Reservoir volumes
https://bit.ly/2rJO3D2 #SWclimate #AZWX #NMWX

December 2018 SW Climate Outlook

Online Resources

Figures 1-3
National Centers for Environmental Information
ncei.noaa.gov

Figure 4
U.S. Drought Monitor
droughtmonitor.unl.edu

Figures 5-6
Western Regional Climate Center
wrcc.dri.edu

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

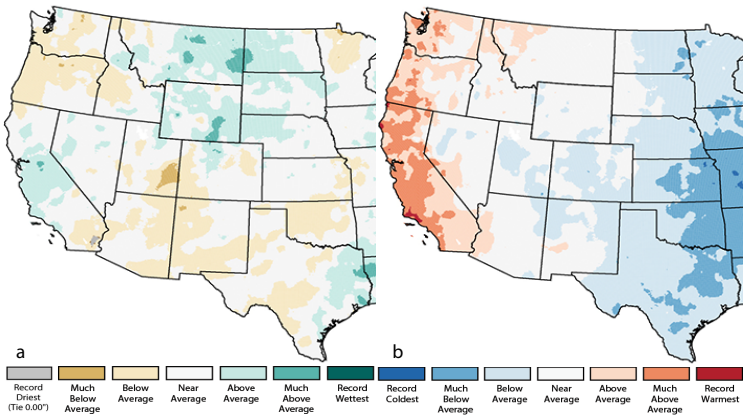


Figure 1: November 2018 Precipitation (a) & Temperature Ranks (b)

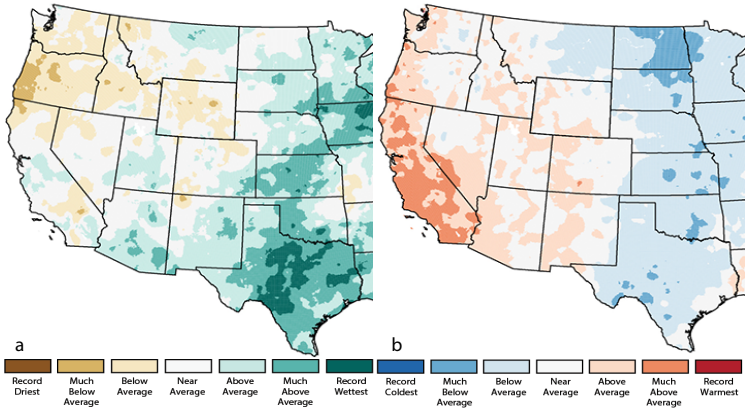


Figure 2: Sept-Nov 2018 Precipitation (a) & Temperature Ranks (b)

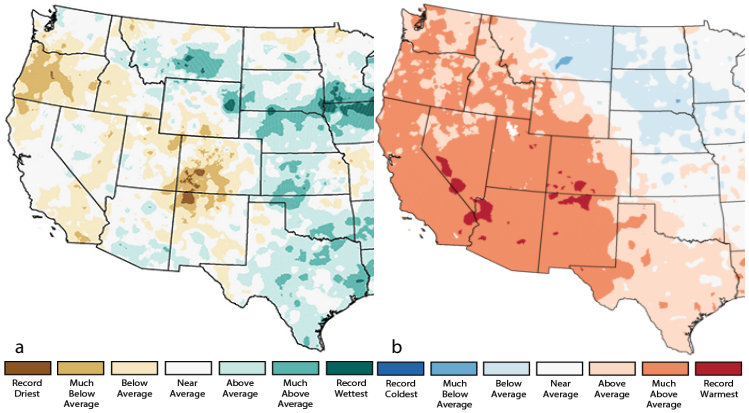


Figure 3: Jan-Nov 2018 Precipitation (a) & Temperature Ranks (b)

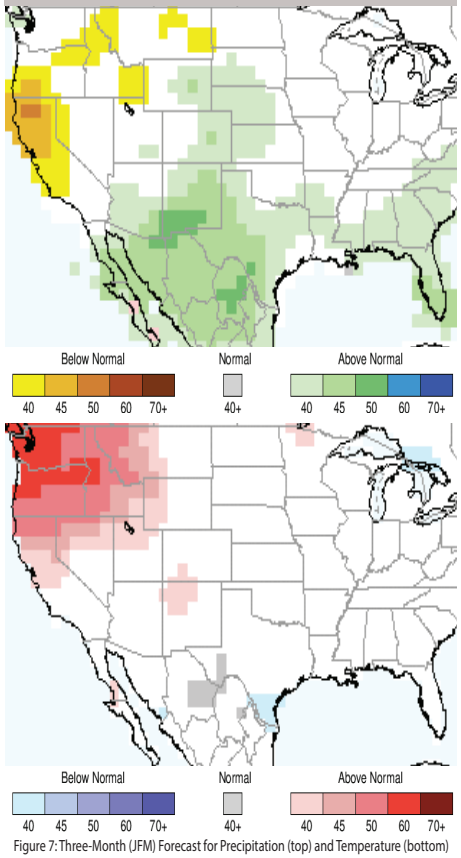


Figure 7: Three-Month (JFM) Forecast for Precipitation (top) and Temperature (bottom)

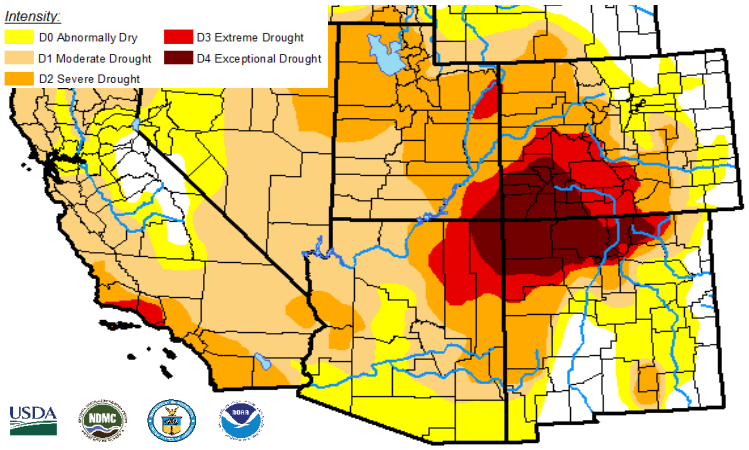


Figure 4: US Drought Monitor - Dec 11, 2018

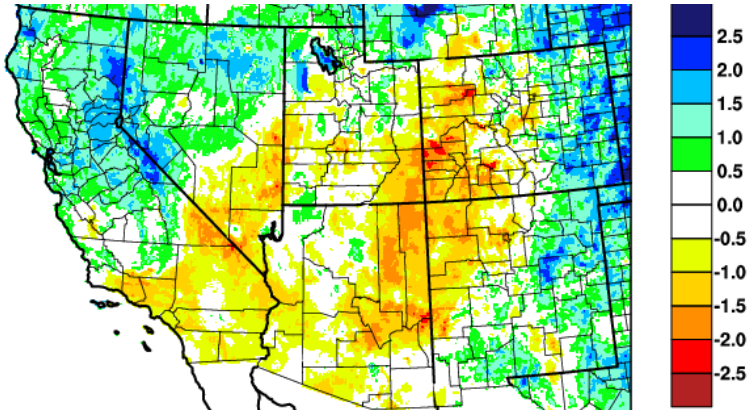


Figure 5: Nov 2018 - 36 Month Standardized Precipitation Index

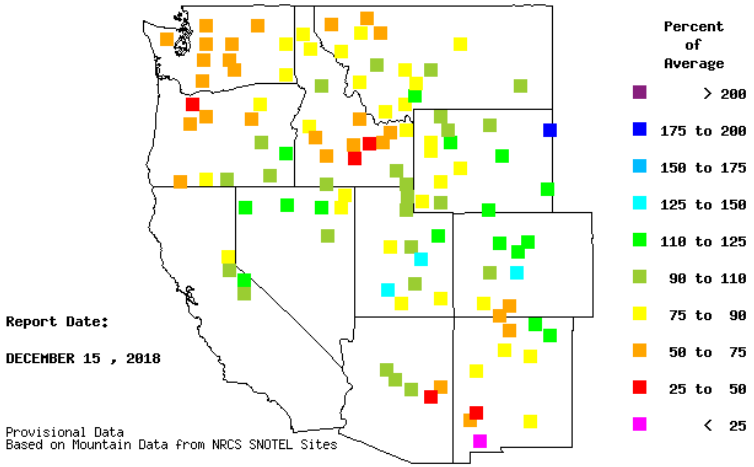


Figure 6: Snow Water Equivalent (SWE) - Dec 15, 2018

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

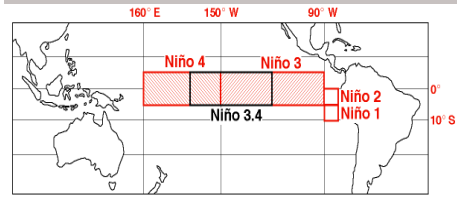
Figure 4
NOAA - Climate Prediction Center
cpc.ncep.noaa.gov

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/

El Niño Tracker

Sea-surface temperatures (SSTs) are above-average across the equatorial Pacific (Figs. 1-2). The coupling between oceanic and atmospheric conditions that typically characterizes an El Nino event continues to be lacking, however, as atmospheric conditions lag behind. Forecasts and outlooks remain bullish on the emergence of an El Niño, and project atmospheric conditions to catch up with oceanic conditions. On Dec. 4, the Australian Bureau of Meteorology highlighted persistent above-average oceanic temperatures, but noted "the atmosphere has yet to show a consistent El Niño signal," with a lack of coupling between oceanic and atmospheric conditions. The agency maintained its ENSO Outlook at an "El Niño Alert," with a 70-percent chance of its formation in 2018—three times the normal likelihood. On Dec. 8, the International Research Institute (IRI) issued an ENSO Quick Look that reflected the warmer-than-average oceanic temperatures and lagging atmospheric conditions, but still maintained a greater-than-80-percent chance of an El Niño event by the end of 2018 (Fig. 3). On Dec. 10, the Japanese Meteorological Agency (JMA) maintained its assertion of the presence of El Niño conditions in the equatorial Pacific and called for an 80-percent chance of these conditions lasting through spring 2019. This was despite the general absence of atmospheric conditions consistent with El Niño, but which saw SSTs and sub-surface temperatures above normal across the equatorial Pacific. On Dec. 13, the NOAA Climate Prediction Center (CPC) continued its El Niño watch, stating "despite the above-average ocean temperatures, the overall coupled ocean-atmosphere system remained ENSO-neutral." CPC's outlook calls for a 90-percent chance of an El Niño event developing this winter, and a 60-percent chance of it lasting through spring. The North American Multi-Model Ensemble (NMME) continues to point toward a weak-to-moderate El Niño at present, lasting through spring 2018 (Fig. 4).

Summary: Equatorial SSTs (and sub-surface temperatures) are well within the range of an El Niño event, but the ongoing delay in the development of atmospheric conditions is the main factor preventing a more definitive declaration. Based on a limited number of past events from which to compare, this is a late start for an El Niño event. Despite the delay, most forecasts have us on the cusp of an El Niño event that is expected to last through spring 2019. Cool-season precipitation totals (Oct – March) in the Southwest during previous El Niño events reveal considerable variability under weak events, including some drier-than-average seasonal totals. However, under moderate-intensity events, drier-than-average cool seasons have been rare, and it is not difficult to understand why there is eager anticipation for anything that might increase our chances of more winter rain.

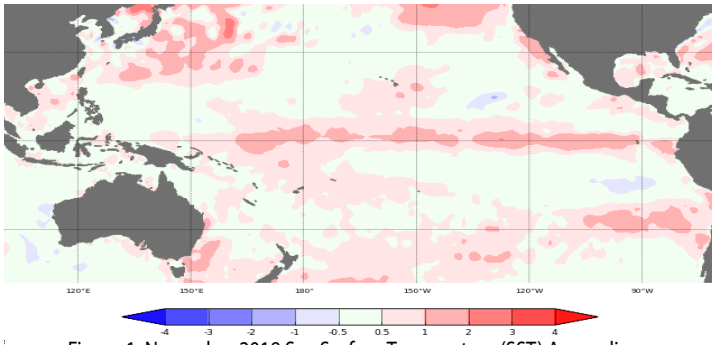


Figure 1: November 2018 Sea Surface Temperature (SST) Anomalies

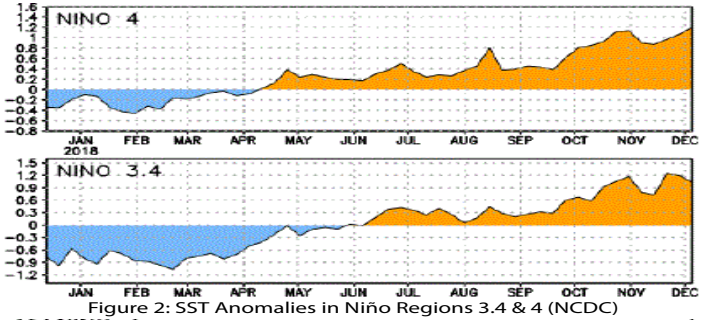


Figure 2: SST Anomalies in Niño Regions 3.4 & 4 (NCDC)

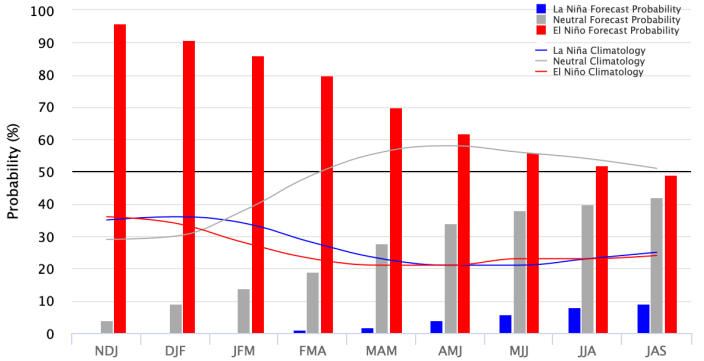


Figure 3: Early-Dec IRI/CPC Model-Based Probabilistic ENSO Forecast

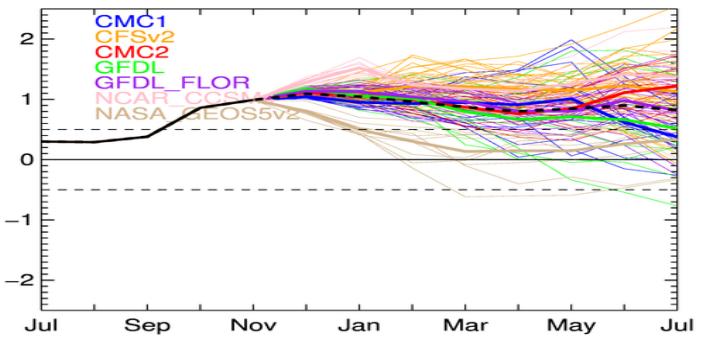


Figure 4: North American Multi-Model Ensemble Forecast for Niño 3.4

Online Resources

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

www.wcc.nrcs.usda.gov/BOR/basin.html

Contact Ben McMahan with any questions or comments.

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).

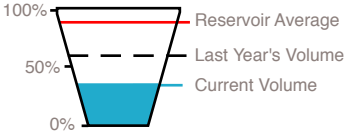
The table details more exactly the current capacity (listed as a percent of maximum storage). Current and maximum storage are given in thousands of acre-feet for each reservoir. One acre-foot is the volume of water sufficient to cover an acre of land to a depth of 1 foot (approximately 325,851 gallons).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

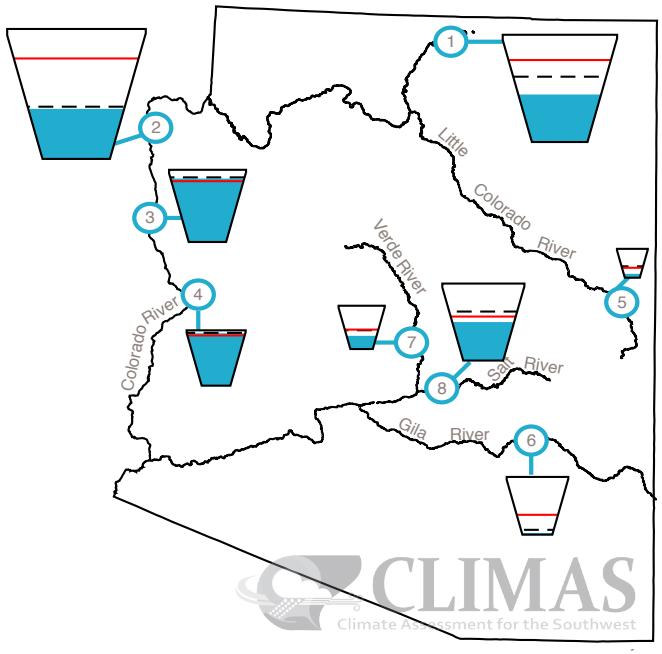
These data are based on reservoir reports updated monthly by the National Water and Climate Center of the U.S. Department of Agriculture's Natural Resources Conservation Service (NRCS).

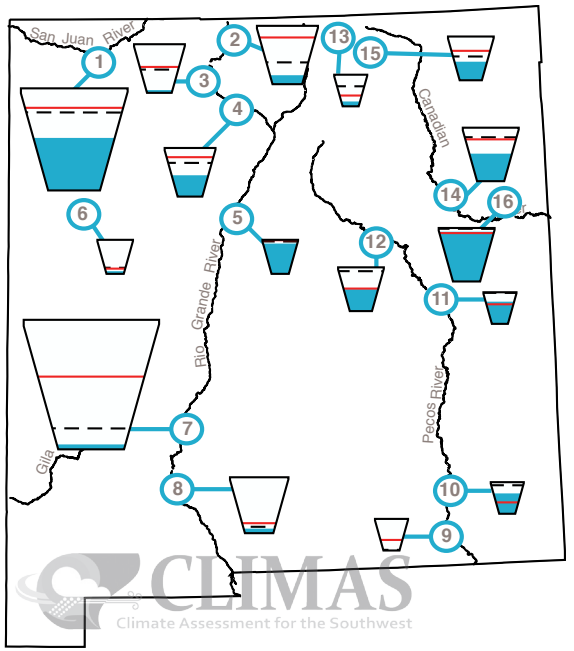
Reservoir Volumes

DATA THROUGH DEC 1, 2018

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	43%	10,506.6	24,322.0	-355.6
2. Lake Mead	38%	9,872.0	26,159.0	-17.0
3. Lake Mohave	87%	1,579.0	1,810.0	39.0
4. Lake Havasu	94%	582.1	619.0	-3.2
5. Lyman	13%	3.8	30.0	-0.5
6. San Carlos	2%	14.9	875.0	3.8
7. Verde River System	30%	87.4	287.4	-7.2
8. Salt River System	49%	987.6	2,025.8	4.2

*KAF: thousands of acre-feet

* in KAF = thousands of acre-feet

Reservoir	Capacity	Current Storage*	Max Storage*	One-Month Change in Storage*
1. Navajo	52%	888.1	1,696.0	-8.4
2. Heron	15%	58.6	400.0	-2.4
3. El Vado	6%	10.5	190.3	0.2
4. Abiquiu	44%	81.7	186.8	-0.8
5. Cochiti	89%	44.7	50.0	-0.1
6. Bluewater	8%	3.2	38.5	-0.1
7. Elephant Butte	4%	89.4	2,195.0	17.0
8. Caballo	8%	25.9	332.0	0.1
9. Lake Avalon	0%	0	4.5	-1.3
10. Brantley	64%	27.2	42.2	3.4
11. Sumner	70%	25.1	35.9	3.9
12. Santa Rosa	50%	53.3	105.9	-0.3
13. Costilla	15%	2.4	16.0	0.3
14. Conchas	51%	129.3	254.2	-1.6
15. Eagle Nest	42%	33.2	79.0	-0.3
16. Ute Reservoir	93%	186	200	-1.0

Online Resources

Figure 1
Climate Program Office
cpo.noaa.gov

RISA Program Homepage

http://cpo.noaa.gov/Meet-the-Divisions/Climate-and-Societal-Interactions/RISA

UA Institute of the Environment

environment.arizona.edu

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 (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

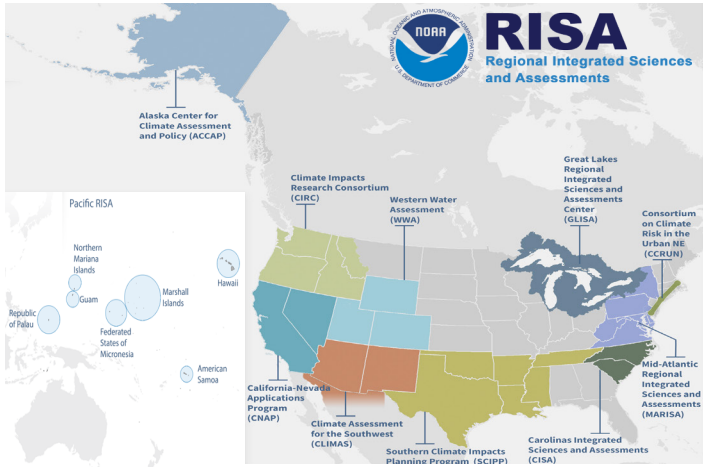


Figure 1: NOAA Regional Integrated Sciences and Assessments Regions

What does CLIMAS do?

The CLIMAS team and 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.

RISA Program Video on CLIMAS Dust Research

Interstate 10 traverses southwest New Mexico connecting Las Cruces with El Paso, TX and Tucson, AZ. Dust storms in the Southwest can create dangerous and fatal driving conditions, reducing visibility to near zero with very little warning. Interstate 10 is especially vulnerable to dangerous dust-related driving conditions as it passes through a dry lake bed west of Lordsburg, near the Arizona border.

The Climate Assessment for the Southwest (CLIMAS), a NOAA RISA team, built on existing partnerships with state transportation managers from New Mexico and Arizona to address the impacts of extreme drought and dust storms on transportation systems. The team characterized and documented the climatic and visual conditions that exist during these storms through interviews, time-lapse camera imagery, and dashboard cameras and worked closely with the New Mexico Department of Transportation, NWS Weather Forecast Offices, and trucking companies to improve education and warning about dangerous dust storm events.

https://youtu.be/ENylO-coRKg