Tracking climate and drought across Southeast Arizona

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Arizona Cooperative Extension
The University of Arizona

Presentation Overview

- Tools for your drought and climate monitoring toolbox
- US Drought Monitor – What is it and how is it made?
- Drought monitoring in practice

Tools for the toolbox

Tracking regional to local drought conditions: *WestWide Drought Tracker*

Leave Feedback

WestWideDroughtTracker

About | Current Maps | Archived Maps | Time Series | Download

Alert: WWDT now updated new
M datasets. (March 2014)

Current Product:
PRISM > Palmer Drought Severity Index > Western US

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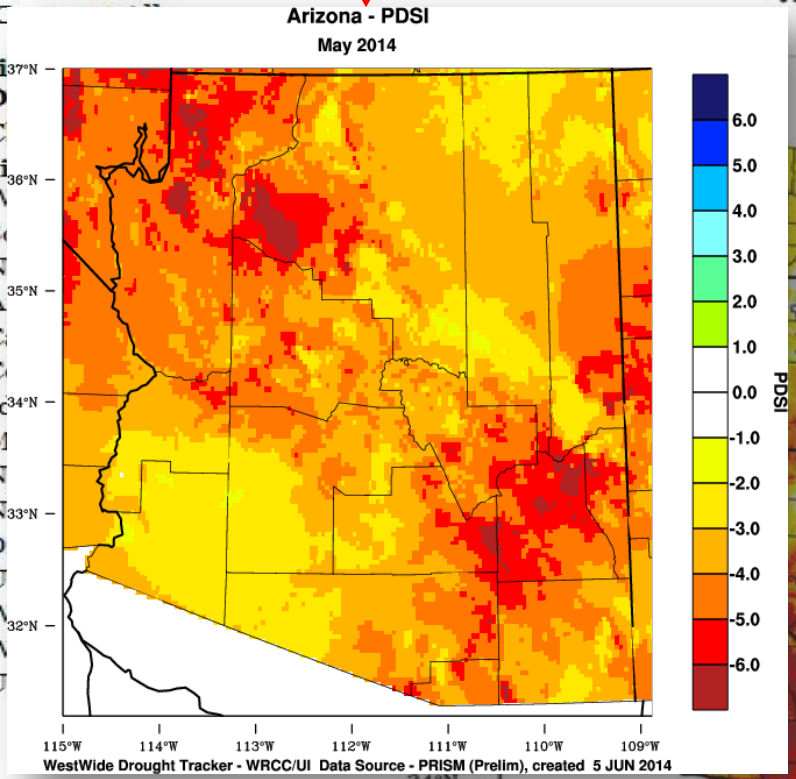
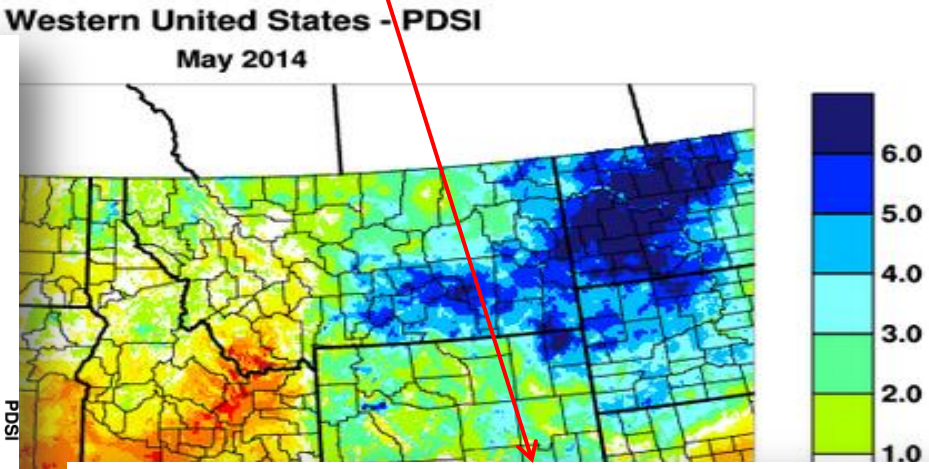
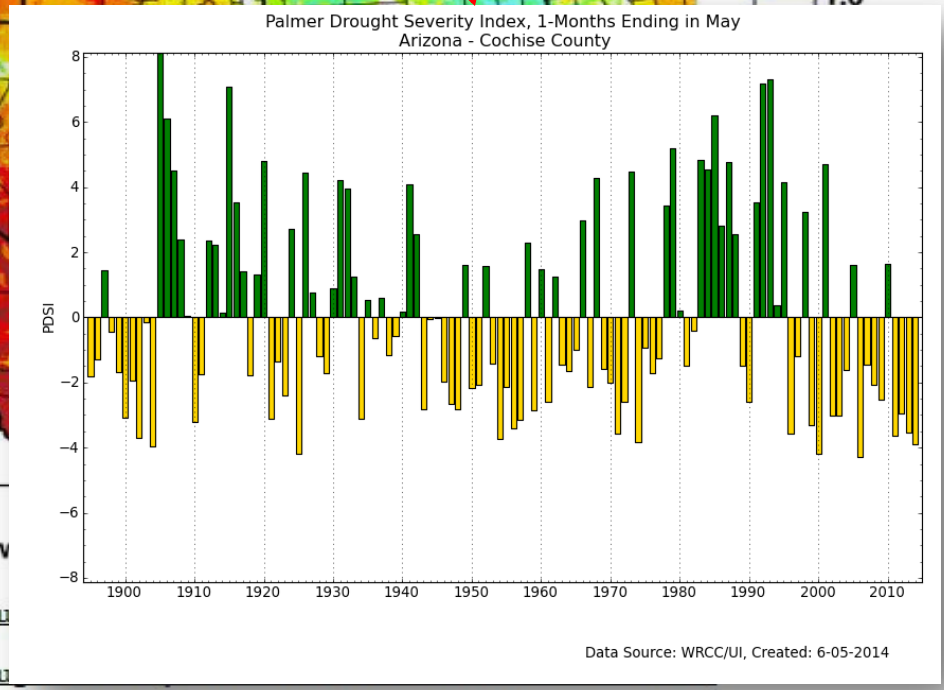






34°N
32°N
120°W
WestWide Drought Tracker -

I Palmer Drou

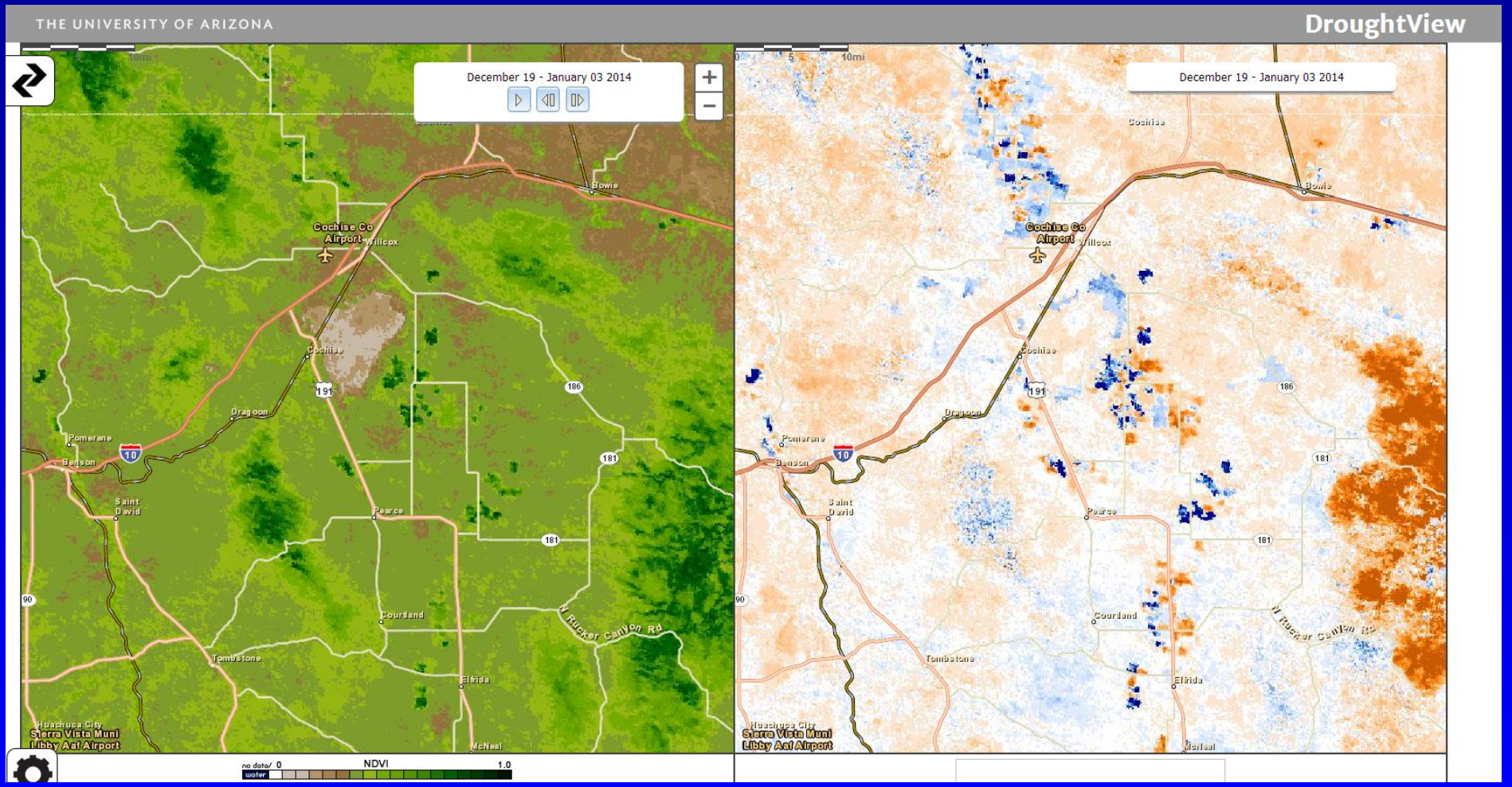
Download PRISM Palmer Drou

http://www.wrcc.dri.edu/wwdt

Tools for the toolbox

Tracking regional to local drought conditions: *DroughtView*

DroughtView: Remote sensing (vegetation 'greenness') visualization tool



http://droughtview.arizona.edu/

Tools for the toolbox

Tracking drought at different timescales: *Experimental multiscale SPI plots*

Climate Science Applications Program
University of Arizona Cooperative Extension
http://cals.arizona.edu/climate

http://cals.arizona.edu/climate/misc/spi/spi_contour.html

Data source: NOAA National Climatic Data Center
ftp://ftp.ncdc.noaa.gov/pub/data/cirs/climdiv
Base Period= 1900-2014 Date created: 02-Jun-2014

Tools for the toolbox

Climate and drought summaries:
Southwest Climate Outlook

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

Southwest Climate Outlook

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

May Southwest Climate Outlook

Precipitation: An active jet stream has brought several moisture-starved storms into the Southwest in the last 30 days, delivering windy conditions but little rain. While dry conditions are normal during this time of year, most of the Southwest has received less than 50 percent of average precipitation since April 15.

Temperature: Temperatures in the last 30 days were mostly below average in Arizona and New Mexico except in southwest Arizona, where temperatures were above average. Below-average temperatures across the Southwest were caused in part by several moisture-starved storms wafting in from colder, northern regions.

Snowpack: Snowpacks have melted in nearly all of Arizona and New Mexico. In the Colorado portion of the Upper Colorado River Basin, several storms—the same ones that delivered windy conditions to the Southwest—boosted snowpacks; that area has also received above-average precipitation since January 1. On the other hand, below-average snowpacks are present in the Rio Grande headwaters; precipitation there has been mostly below average since January 1.

Water Supply: Total reservoir storage decreased by about 380,600 acre-feet in Arizona in April; Lake Mead fell by about 648,000 acre-feet. Storage stands at 44 percent of capacity in Arizona and is lower than it was one year ago. In New Mexico, storage increased by 50,300 acre-feet in April. Storage is at 24 percent of capacity and is greater than it was one year ago.

Drought: Drought conditions intensified in some regions of Arizona and New Mexico. Moderate drought expanded in southwest Arizona and severe drought expanded in central New Mexico. In northeastern New Mexico, extreme drought deteriorated into exceptional drought. Compared to one year ago, drought conditions are similar in Arizona and less intense in New Mexico.

ENSO: Sea surface temperatures and atmospheric conditions continue to indicate the likelihood that an El Niño event will form. There is greater than a 60 percent chance that an El Niño will develop during the summer.

Precipitation Forecasts: The NOAA-Climate Prediction Center (CPC) is calling for slightly increased chances for above-average precipitation across the Four Corners region during the June–August period. While many dynamical models simulate increased precipitation in the monsoon region, El Niño in the past has beer
These mixed signals cause greater uncertainty in the monsoon region.

Temperature Forecasts: The CPC forecasts high chances for above-aver
June–August period based on many different signals, including dynamical

Fire Forecasts: Above-normal fire potential for the May–June period is foc
southwest New Mexico west of the Continental Divide. This forecast is bas
availability of dry fine fuels, the heightened potential for warm and dry conc

Tweet May's SW Climate Snapshot

CLICK T

It is not a question of if but when will El Niño arrive and wha
and SW climate @ http://bit.ly/1nPNmRQ

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Online Resources

Figure 1.
International Research Institute for Climate and Society
http://iridl.ldeo.columbia.edu/maproom/ENSO/#tabs-4

Figure 2.
International Research Institute for Climate and Society
http://iri.columbia.edu/wp-content/uploads/2014/05/quick_look_composite_may142.pdf

El Niño Watch

A strong pulse of warm water traversed the equatorial Pacific Ocean from west to east during the last several months, setting in motion the emergence of a possible El Niño event. Consequently, the NOAA Climate Prediction Center (NOAA-CPC) issued an El Niño Watch in March. El Niño events are characterized by unusually warm sea surface water from the middle Pacific Ocean (near the International Date Line) to South America. Very warm water has emerged this spring along the coast of Peru and into the Pacific Ocean along the equator (Figure 1). The timing and pattern of these warm waters resembles conditions in 1997, a year in which El Niño became one of the strongest on record. NASA recently released satellite images that showed similarities in sea surface height anomalies between this May and those of May 1997; height anomalies are related to sea surface temperatures (http://1.usa.gov/QMZwfE). While it is too early to estimate the strength of this year's nascent El Niño, wind conditions suggest it will continue to strengthen. Near the surface around the equator, winds typically blow westward, pushing warm water towards Indonesia. Recent observations indicate these winds have weakened and at times even reversed direction. These changes can help reinforce the pooling of warm water in the eastern Pacific by enabling the warm water in the west to move east. The slackened winds give rise to the belief that it's not a question of if, but when an official El Niño will be declared.

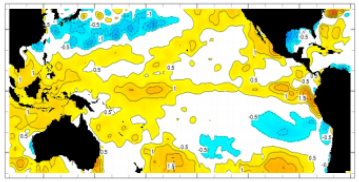


Figure 1. Sea surface temperature anomalies during May 4-10, 2014.

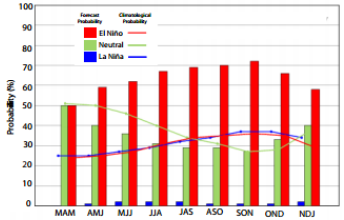


Figure 2. Seasonal probabilities for ENSO phases. ENSO states based on Niño 3.4 sea surface temperature anomalies, with El Niño anomalies greater than 0.5 degrees C and La Niña anomalies less than -0.5 C.

For an El Niño event to be designated official, SSTs in the mid-Pacific Ocean along the equator need to remain above average for several consecutive months. According to the ENSO forecast issued by the NOAA-CPC and International Research Institute for Climate and Society (IRI) in mid-May, chances for an El Niño event occurring in coming months rises sharply, from 48 percent in the May–July period to 69 percent in the September–November period (Figure 2). The chance of a La Niña event returning during this time is very small, and neutral conditions also look unlikely. Even though El Niño seems a near lock, climate model simulations in May struggle to determine the short-term evolution of El Niño. Nonetheless, confidence is growing that at least a weak to moderate event is very likely to persist through the 2014–2015 winter. Moreover, there are hints that this event could become strong, similar to 1997–1998.

The speed and eventual strength of the burgeoning El Niño event will influence the impact on the Southwest in coming months. If the event quickly gains strength and persists through the winter, changes in weather patterns across Arizona and New Mexico may include the weakening of the monsoon ridge and a delay in monsoon precipitation; enhanced late summer and early fall tropical storm activity in the eastern Pacific Ocean, which increases the risk of storms striking land and drenching the Southwest; and increased winter storm activity starting in December and persisting through February or March.

Tools for the toolbox

Climate and drought summaries:
Southeast Arizona Climate Summary

Southeast Arizona Climate Information

Welcome to the SE AZ Climate Information Clearinghouse page! Here you will find climate information specific to southeast Arizona in support of climate sensitive operations and activities.

Southeast Arizona is specifically
county area including Pima, San
Graham and Greenlee counties.
comprise Arizona climate divisio
designated by the National Clima
climate information provided bel
geographic area.

Tucson

SE AZ

Southeast Arizona Climate Bulletins

- Fall 2002-Winter 2003 (~1 mb)
- Winter-Early Spring 2003 (~1 mb)
- Spring-Summer 2003 (~2 mb)
- Late Summer-Fall 2003 (~0.5 mb)
- Winter-Early Spring 2004 (~0.25 mb)
- Spring 2004 (~0.25 mb)
- Winter-Early Spring 2005 (~0.25 mb)
- Spring 2005 (~0.1 mb)
- Summer 2005 (~0.1 mb)
- Fall 2005 (~0.1 mb)
- Winter 2006 (~0.1 mb)
- Spring 2006 (~0.1 mb)
- Fall 2006 (~0.1 mb)
- Spring 2007 (~0.1 mb)
- Spring-summer 2007 (~5mb, improved graphics quality)

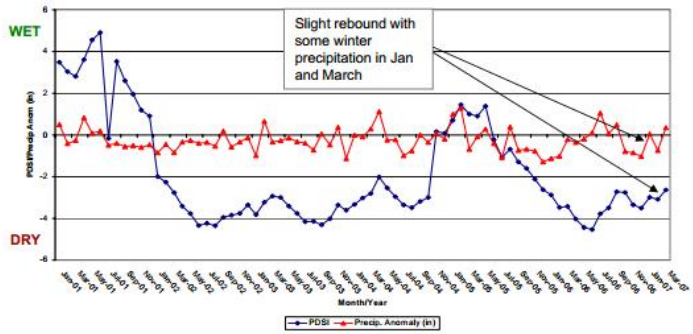
Spring-summer 2014….need help in designing new version!

Southeast Arizona Climate Summary
Spring 2007

April 16, 2007 – Overall the winter of 2006-07 was another dry one with total precipitation amounts generally below-average across southeast Arizona. Patterns of above-average precipitation accompanying the much anticipated El Niño event developed just south and east of the Arizona, bringing an exceptionally wet winter to much of New Mexico. Far-eastern Cochise, Graham and Greenlee counties were clipped several times by winter storms that pulled this moisture up into New Mexico in January and again in March. This storm track left much of the rest of southeast Arizona on the cool, windy and dry side of these passing storms. February was exceptionally dry with most of the region seeing less than 25% of average precipitation while Santa Cruz county only saw 2% of average for the month. Several cold snaps brought sub-freezing temperatures to most of southeast Arizona this past winter, but an early season heat wave in March brought +90 °F temps to the western desert areas. Overall temperatures were near to slightly-above average for the period of Jan-March.

…te Prediction Center indicate that the …res and equal chances of above, below, …attern that plagued much of Arizona this …attern was split with a northerly storm … This pattern was weakly connected to the …uth for Arizona to benefit. The position of …g much of the region with below-average …t this circulation pattern is expected to …s indicate that temperatures will again be …re information on forecasts can be found at http://www.cpc.noaa.gov).

Southeast Arizona Palmer Drought Severity Index and Precip. Anomaly: Jan. 2001 - March 2007



Precipitation amounts were generally below-average from last fall through early winter 2007. Average to slightly above-average precipitation in January and March helped boost PDSI values slightly indicating a minor improvement in short-term drought conditions. A closer examination of precipitation patterns across the area (next page) shows that most of this improvement occurred in far southeastern Arizona.

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COLLEGE OF AGRICULTURE AND LIFE SCIENCES

http://cals.arizona.edu/climate/proj/seaz/index.htm

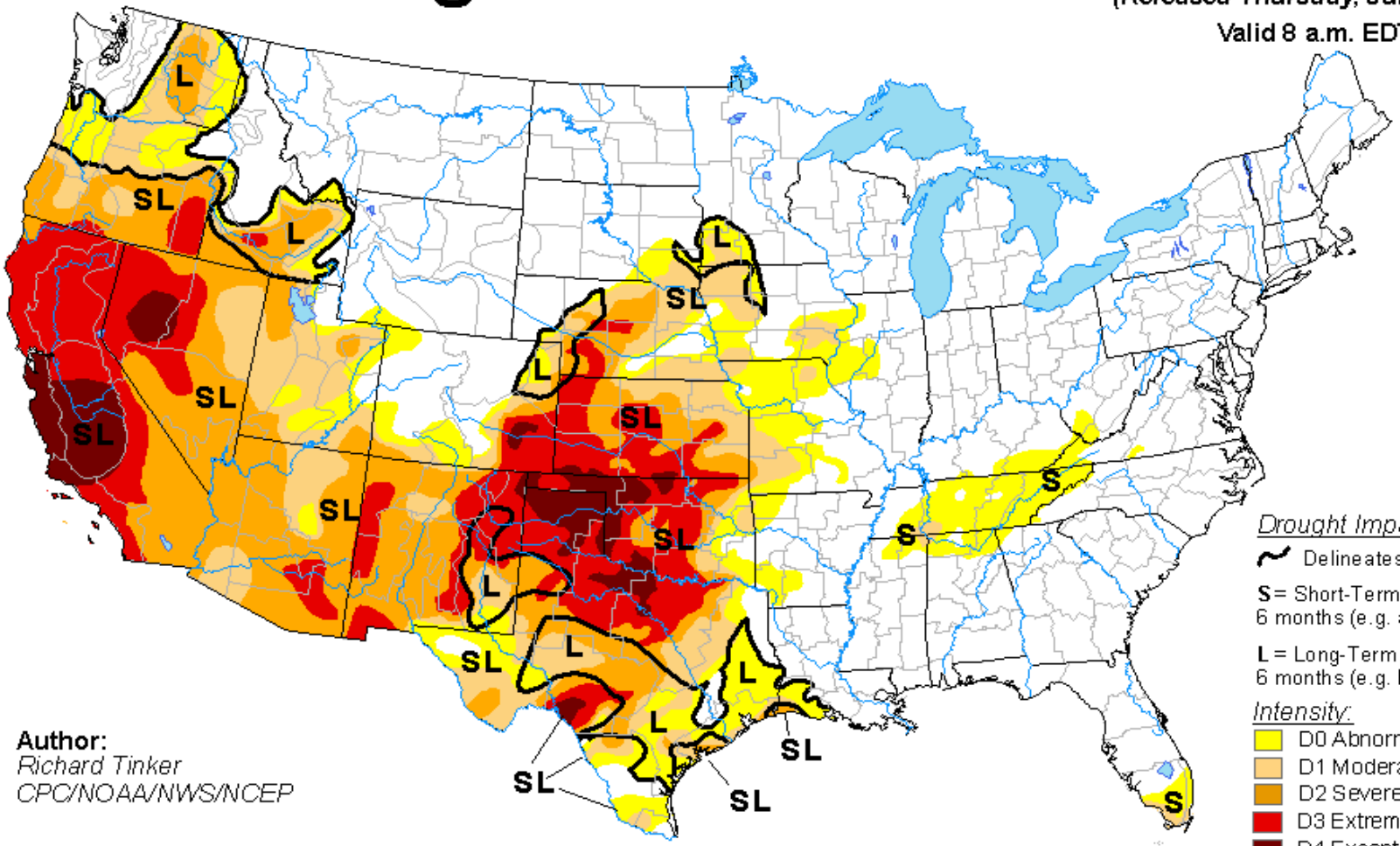
US Drought Monitor

U.S. Drought Monitor

June 3, 2014

(Released Thursday, Jun. 5, 2014)

Valid 8 a.m. EDT



Author:
Richard Tinker
CPC/NOAA/NWS/NCEP

Drought Impact Types:

~ Delineates dominant impacts

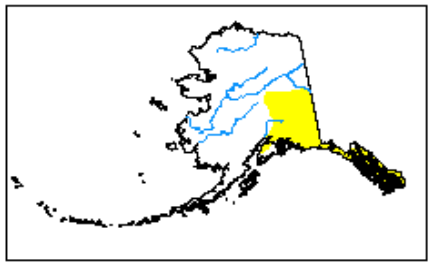
S = Short-Term, typically less than 6 months (e.g. agriculture, grasslands)

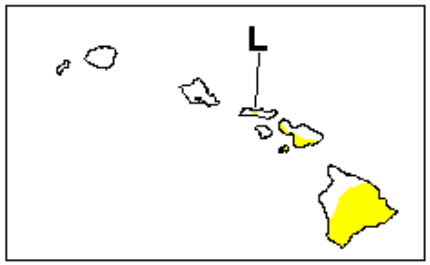
L = Long-Term, typically greater than 6 months (e.g. hydrology, ecology)

Intensity:

- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

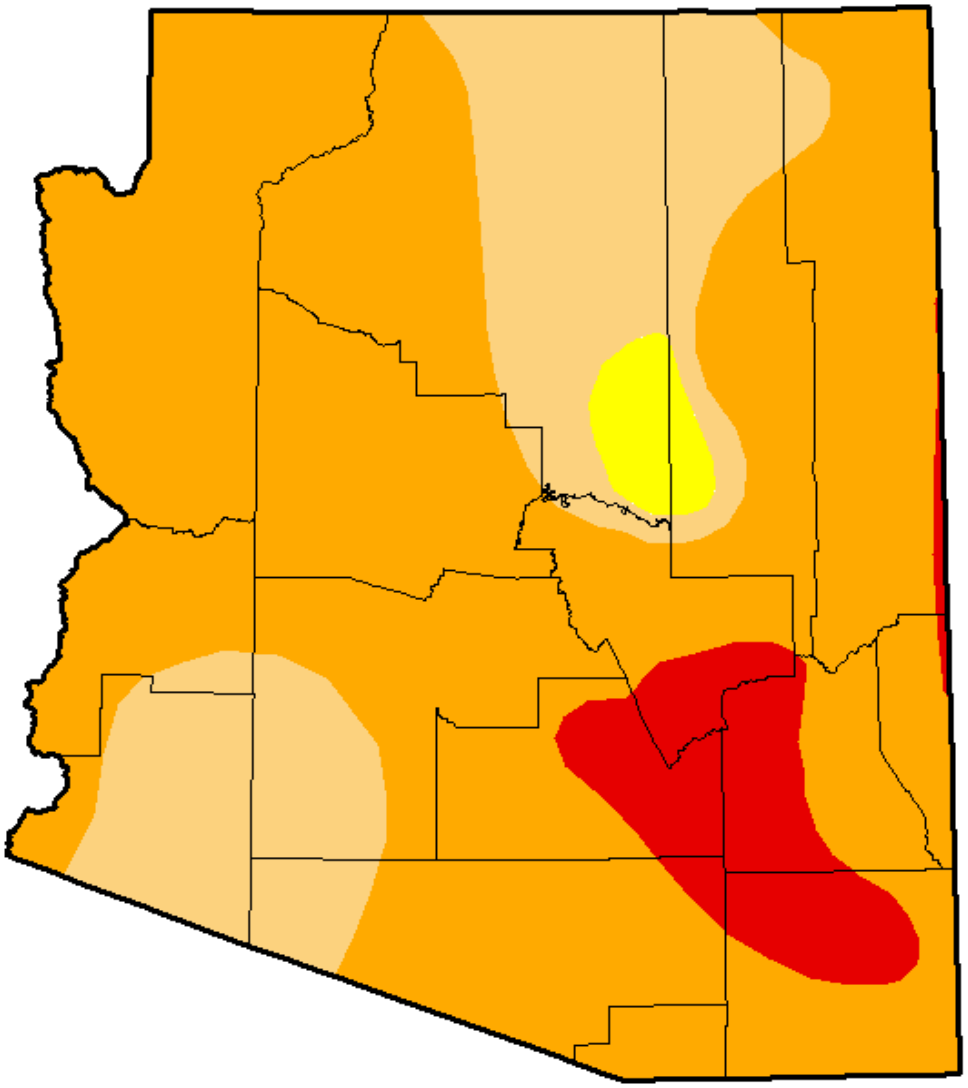




USDA National Drought Mitigation Center

http://droughtmonitor.unl.edu/

U.S. Drought Monitor
Arizona



June 3, 2014

(Released Thursday, Jun. 5, 2014)

Valid 8 a.m. EDT

Drought Conditions (Percent Area)

	None	D0-D4	D1-D4	D2-D4	D3-D4	D4
Current	0.00	100.00	98.17	76.28	7.69	0.00
Last Week 5/27/2014	0.00	100.00	98.17	76.28	7.69	0.00
3 Months Ago 3/4/2014	6.18	93.82	77.26	54.71	5.18	0.00
Start of Calendar Year 12/31/2013	20.72	79.28	53.58	14.73	0.00	0.00
Start of Water Year 10/1/2013	14.83	85.17	61.91	25.28	0.00	0.00
One Year Ago 6/4/2013	0.00	100.00	92.49	72.53	19.67	0.00

Intensity:

- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought

The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

Author:
Richard Tinker
CPC/NOAA/NWS/NCEP

http://droughtmonitor.unl.edu/

US Drought Monitor is *the* official drought status product

USDA **Disaster Assistance**

UNITED STATES DEPARTMENT OF AGRICULTURE
FARM SERVICE AGENCY

2014 FARM BILL
FACT SHEET

February 2014

Livestock Forage Disaster Program

Overview

The 2014 Farm Bill makes the Livestock Forage Disaster Program (LFP) a permanent program and provides retroactive authority to cover eligible losses back to Oct. 1, 2011. LFP provides compensation to eligible livestock producers who have suffered grazing losses due to drought or fire. LFP payments for drought are equal to 60 percent of the monthly feed cost for up to five months. LFP payments for fire on federally managed rangeland are equal to 50 percent of the monthly feed cost for the number of days the producer is prohibited from grazing the managed rangeland, not to exceed 180 calendar days. The grazing losses must have occurred on or after Oct. 1, 2011.

Sign-up will begin on or before April 15, 2014, at any local Farm Service Agency (FSA) service center. Additional details on the types of information required for an application will be provided as part of the sign-up announcement. Some eligibility restrictions may apply. Please consult your local FSA office for details.

Eligible Counties for Drought

An eligible livestock producer that owns or leases grazing land or pastureland physically located in a county rated by the U.S. Drought Monitor http://droughtmonitor.unl.edu/ as having a:

- D2 (severe drought) in a county for eight consecutive weeks or more during the normal grazing period: assistance equals **one monthly payment**;
- D3 (extreme drought) in a county anytime during the normal grazing period: assistance equals **three monthly payments**;
- D3 (extreme drought) in a county for four weeks or more during the normal grazing period or D4 (exceptional drought) anytime during the normal grazing period: assistance equals **four monthly payments**;
- D4 (exceptional drought) in a county for four weeks (consecutive weeks unnecessary) during the normal grazing period: assistance equals **five monthly payments**.

Counties eligible for LFP assistance can be found at fsa.usda.gov. The Drought Mitigation Center has developed a tool to assist producers in determining potential LFP eligibility that may be found at: http://droughtmonitor.unl.edu/fsa/FsaEligibility-County.aspx

Additional information regarding LFP or other FSA programs can be found by visiting a nearby FSA Service Center or online at fsa.usda.gov.

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If you wish to file a Civil Rights program complaint of discrimination, complete the USDA Program Discrimination Complaint Form, found online at http://www.ascr.usda.gov/complaint_filing_cust.html, or at any USDA office, or call (866) 632-9992 to request the form. You may also write a letter containing all of the information requested in the form. Send your completed complaint form or letter by mail to U.S. Department of Agriculture, Director, Office of Adjudication, 1400 Independence Avenue, S.W., Washington, D.C. 20250-9410, by fax (202) 690-7442 or email at program.intake@usda.gov.

USDA is an equal opportunity provider and employer.

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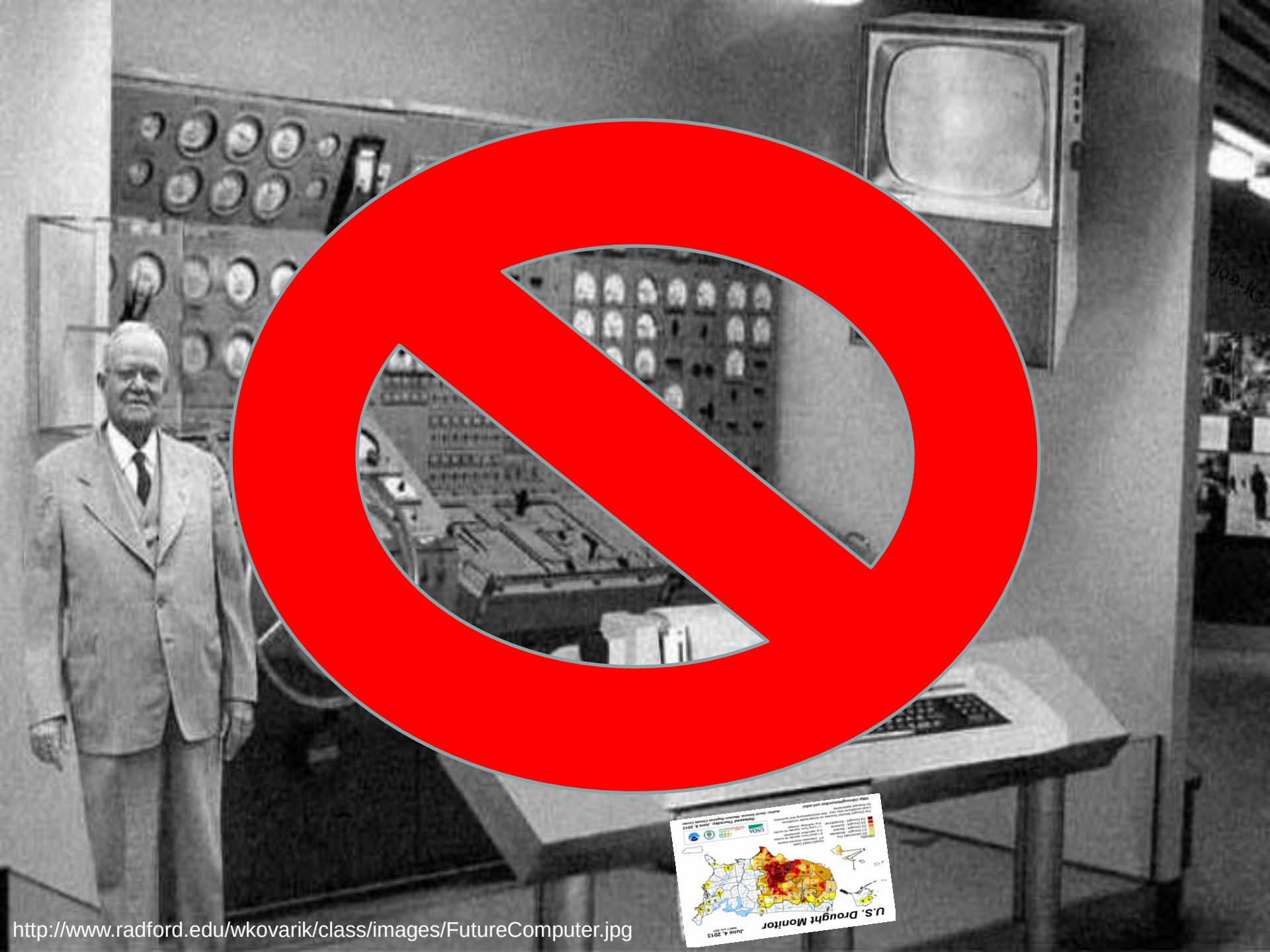
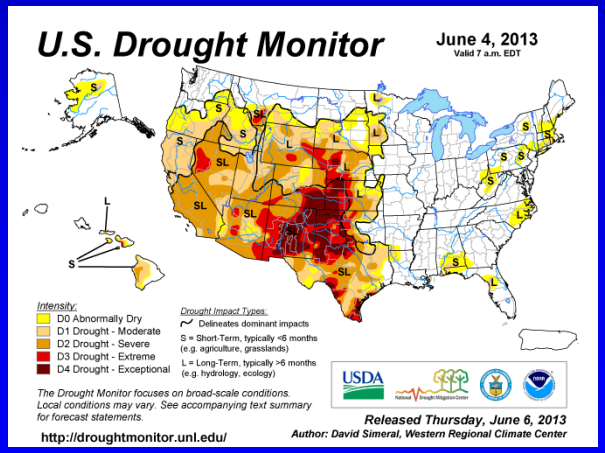
http://www.fsa.usda.gov/Internet/FSA_File/lfp_2014_fbill.pdf



http://www.radford.edu/wkovarik/class/images/FutureComputer.jpg

"U.S. Drought Monitor: State-of-the-Art Blend of Science and Subjectivity"

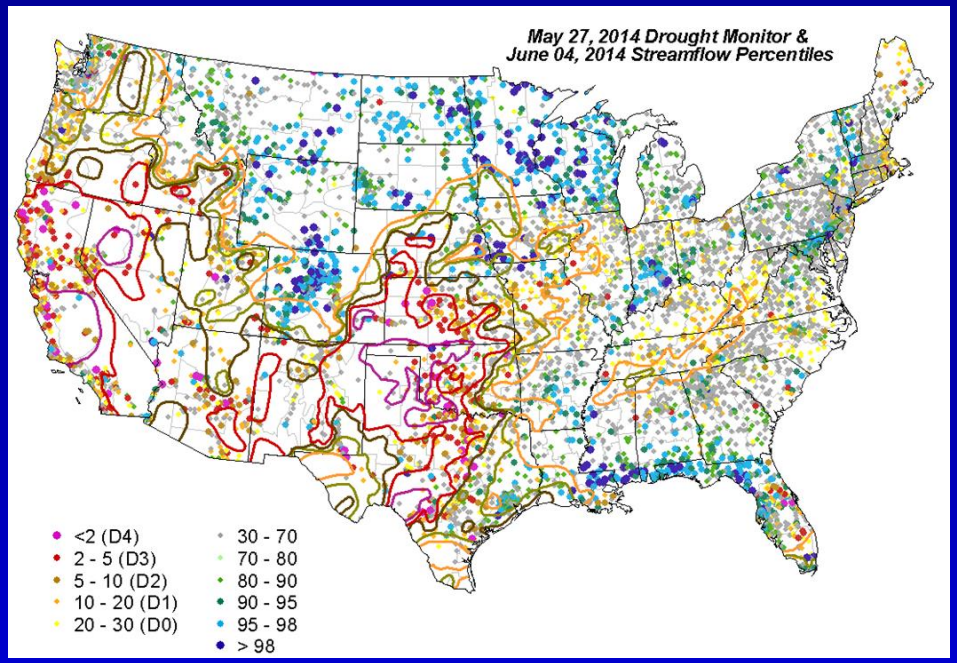
- The definitive drought map for the United States…used across all federal agencies and in many state level drought plans
- Produced weekly by one of ten rotating authors
  - NOAA CPC – Washington, DC
  - NOAA NCDC – Asheville, NC
  - WRCC – Reno, NV
  - USDA – Washington, DC
  - NDMC – Lincoln, Nebraska
- Consulting numerous products as well as facilitating email discussion

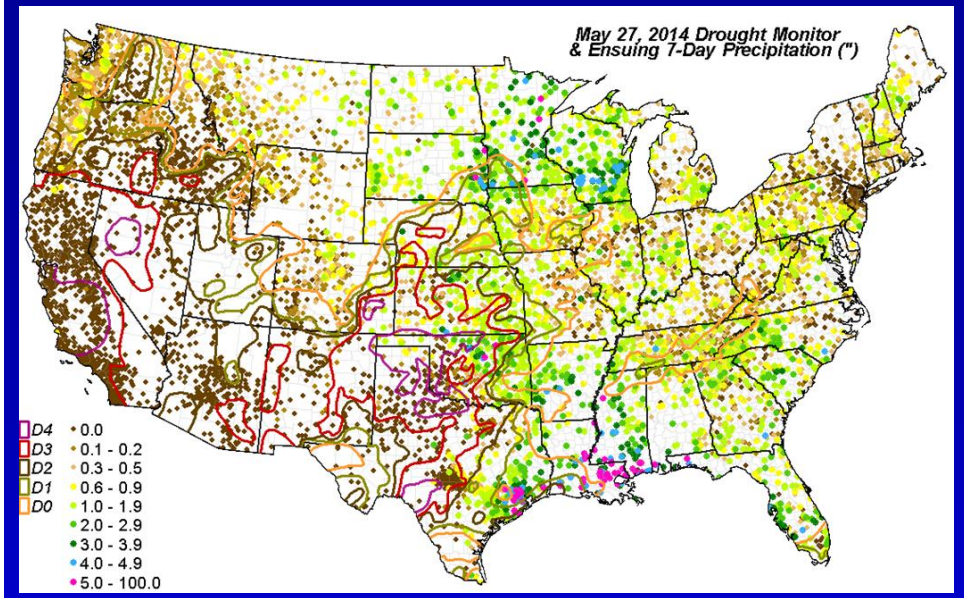


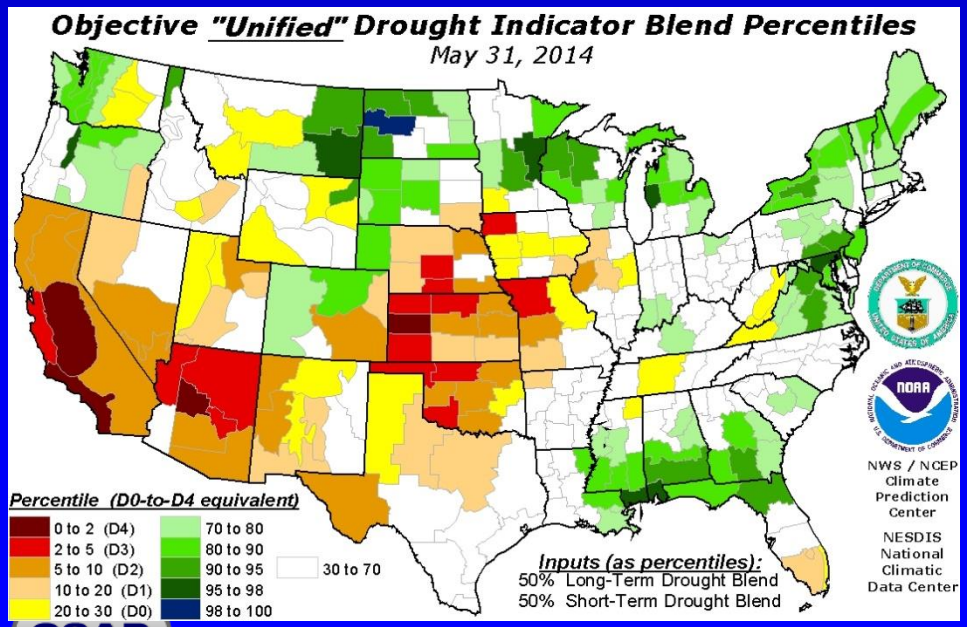
http://droughtmonitor.unl.edu/classify.htm

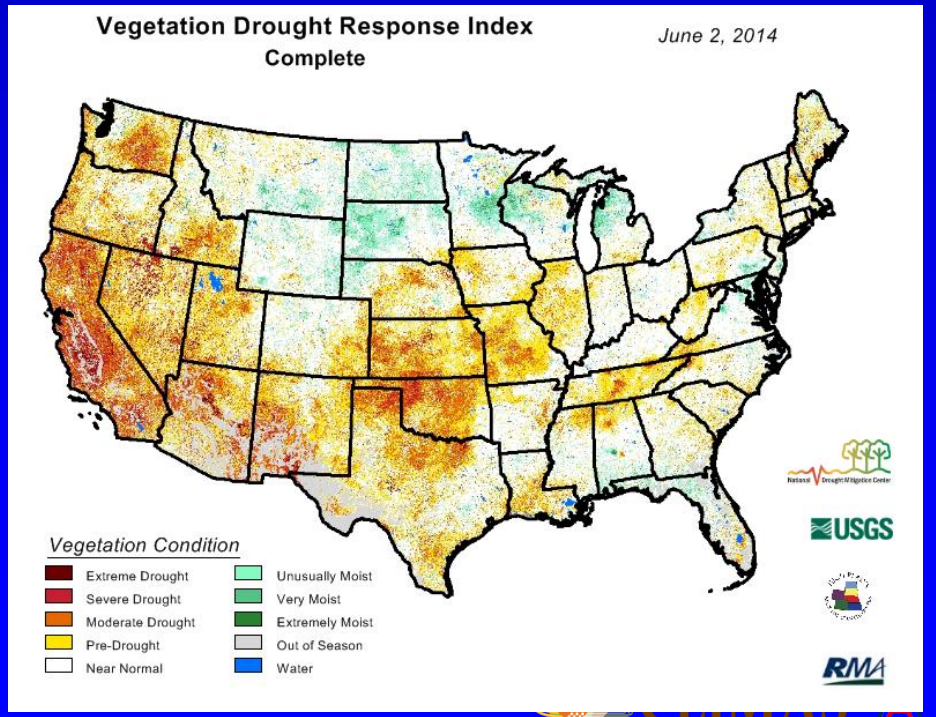
National Drought Monitor

- All areas of the US are classified into 1 of 5 drought categories or ‘No drought’
- Multiple national level monitoring products including precipitation, streamflow, soil moisture, vegetation conditions and modeled drought indices are used to guide drawing of maps
- Guidance from local experts and reports of local impacts even more critical in production of maps!


May 27, 2014 Drought Monitor &
June 04, 2014 Streamflow Percentiles
<2 (D4)
2 - 5 (D3)
5 - 10 (D2)
10 - 20 (D1)
20 - 30 (D0)
30 - 70
70 - 80
80 - 90
90 - 95
95 - 98
> 98

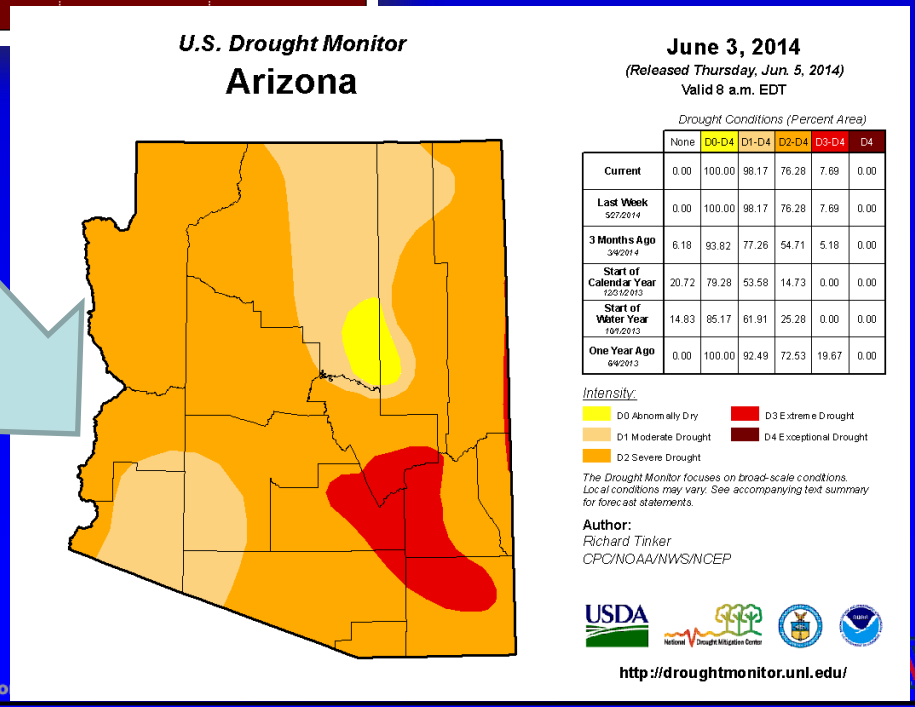

May 27, 2014 Drought Monitor
& Ensuing 7-Day Precipitation (")
D4
D3
D2
D1
D0
0.0
0.1 - 0.2
0.3 - 0.5
0.6 - 0.9
1.0 - 1.9
2.0 - 2.9
3.0 - 3.9
4.0 - 4.9
5.0 - 100.0


Objective "Unified" Drought Indicator Blend Percentiles
May 31, 2014
Percentile (D0-to-D4 equivalent)
0 to 2 (D4)
2 to 5 (D3)
5 to 10 (D2)
10 to 20 (D1)
20 to 30 (D0)
30 to 70
70 to 80
80 to 90
90 to 95
95 to 98
98 to 100
Inputs (as percentiles):
50% Long-Term Drought Blend
50% Short-Term Drought Blend
NWS / NCEP
Climate
Prediction
Center
NESDIS
National
Climatic
Data Center


Vegetation Drought Response Index
Complete
June 2, 2014
Vegetation Condition
Extreme Drought
Severe Drought
Moderate Drought
Pre-Drought
Near Normal
Unusually Moist
Very Moist
Extremely Moist
Out of Season
Water
USGS
RMA

Drought Severity Classification

		Ranges					
Category	Description	Possible Impacts	Palmer Drought Index	CPC Soil Moisture Model (Percentiles)	USGS Weekly Streamflow (Percentiles)	Standardized Precipitation Index (SPI)	Objective Short and Long-term Drought Indicator Blends (Percentiles)
D0	Abnormally Dry	Going into drought: short-term dryness slowing planting, growth of crops or pastures. Coming out of drought: some lingering water deficits; pastures or crops not fully recovered	-1.0 to -1.9	21-30	21-30	-0.5 to -0.7	21-30
D1	Moderate Drought	Some damage to crops, pastures; streams, reservoirs, or wells low, some water shortages developing or imminent; voluntary water-use restrictions requested	-2.0 to -2.9	11-20	11-20	-0.8 to -1.2	11-20
D2	Severe Drought	Crop or pasture losses likely; water shortages common; water restrictions imposed	-3.0 to -3.9	6-10	6-10	-1.3 to -1.5	6-10
D3	Extreme Drought	Major crop/pasture losses; widespread water shortages or restrictions	-4.0 to -4.9	3-5	3-5	-1.6 to -1.9	3-5
D4	Exceptional Drought	Exceptional and widespread crop/pasture losses; shortages of water in reservoirs, streams, and wells creating water emergencies	-5.0 [illegible]s	0-2	0-2	-2.0 or less	0-2



http://droughtmonitor.unl.edu/classify.htm

More than just rain gauges…

- Impact information is a critical, but often limited data stream in operational drought monitoring
- Drought indices are guidance, but need to be backed up by actual impacts to assess true drought status.
- Drought monitor discussion critically needs local expert assessments of drought conditions

We need you!!..to make a good drought map

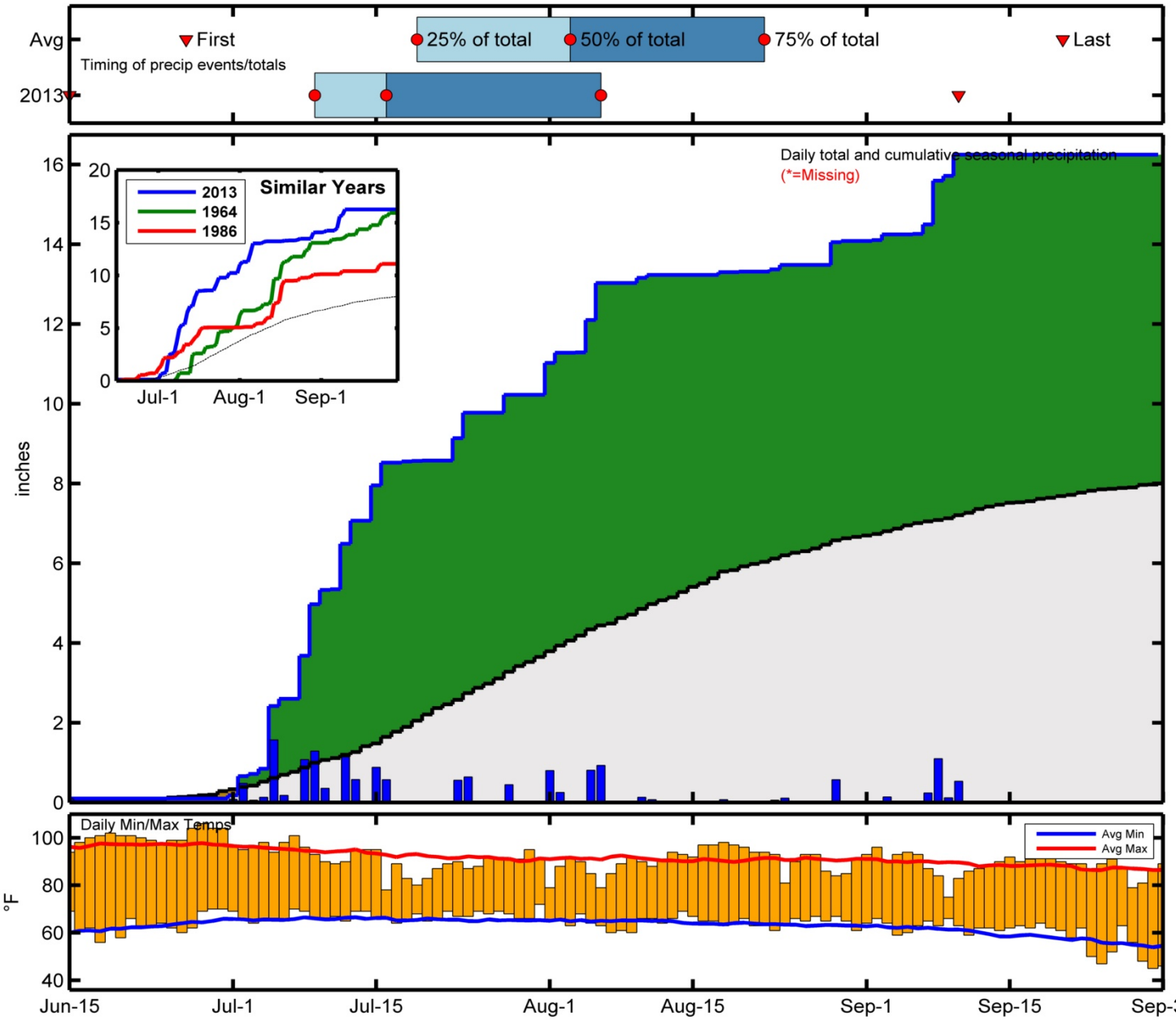
- Note impact observations and cross-reference them against drought indices and metrics…what matches and what doesn't?
- Share impact information and observations through in email listservs (AZ Drought Task Force, USDM) to directly share/communicate [**email crimmins@email.arizona.edu**]
- Submit impact reports through online tools like U.S. Drought Impact Reporter (*http://droughtreporter.unl.edu/*), AZ DroughtWatch (*http://azdroughtwatch.org*)
- Participate in other data collection efforts like CoCoRAHS and Rainlog.org

Thanks!

crimmins@email.arizona.edu

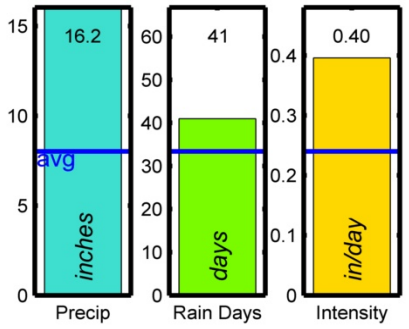
http://cals.arizona.edu/climate

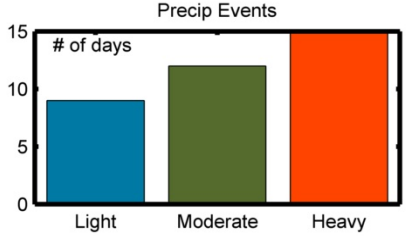
2013 Monsoon Summary



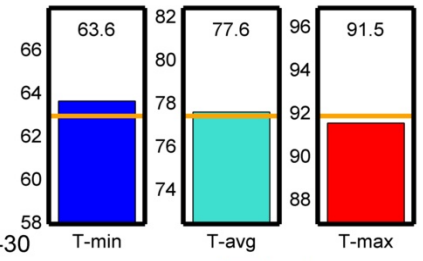
DOUGLAS BISBEE INL AP

Elevation: 1251m
Period of record: 1950-2013
Years in record: 64
Precip rank: 1 (1,wettest)
Temp rank: 24 (1,warmest)
Missing in 2013: 0 days





Dry Spells
Avg length: 3 days (avg: 4)
Max length: 15 days (avg: 13)



http://cals.arizona.edu/climate/misc/monsoon/monsoon_summaries.html

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University of Arizona Cooperative Extension
http://cals.arizona.edu/climate
Date created: 07-Nov-2013

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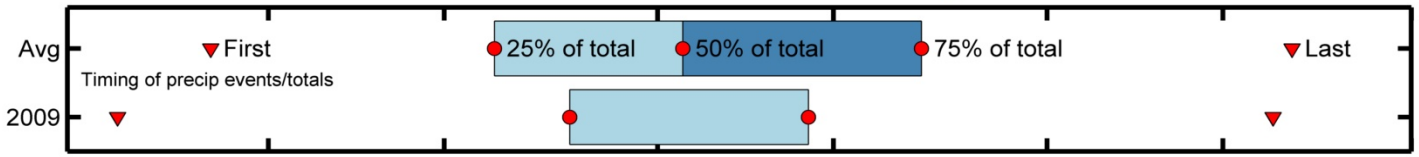
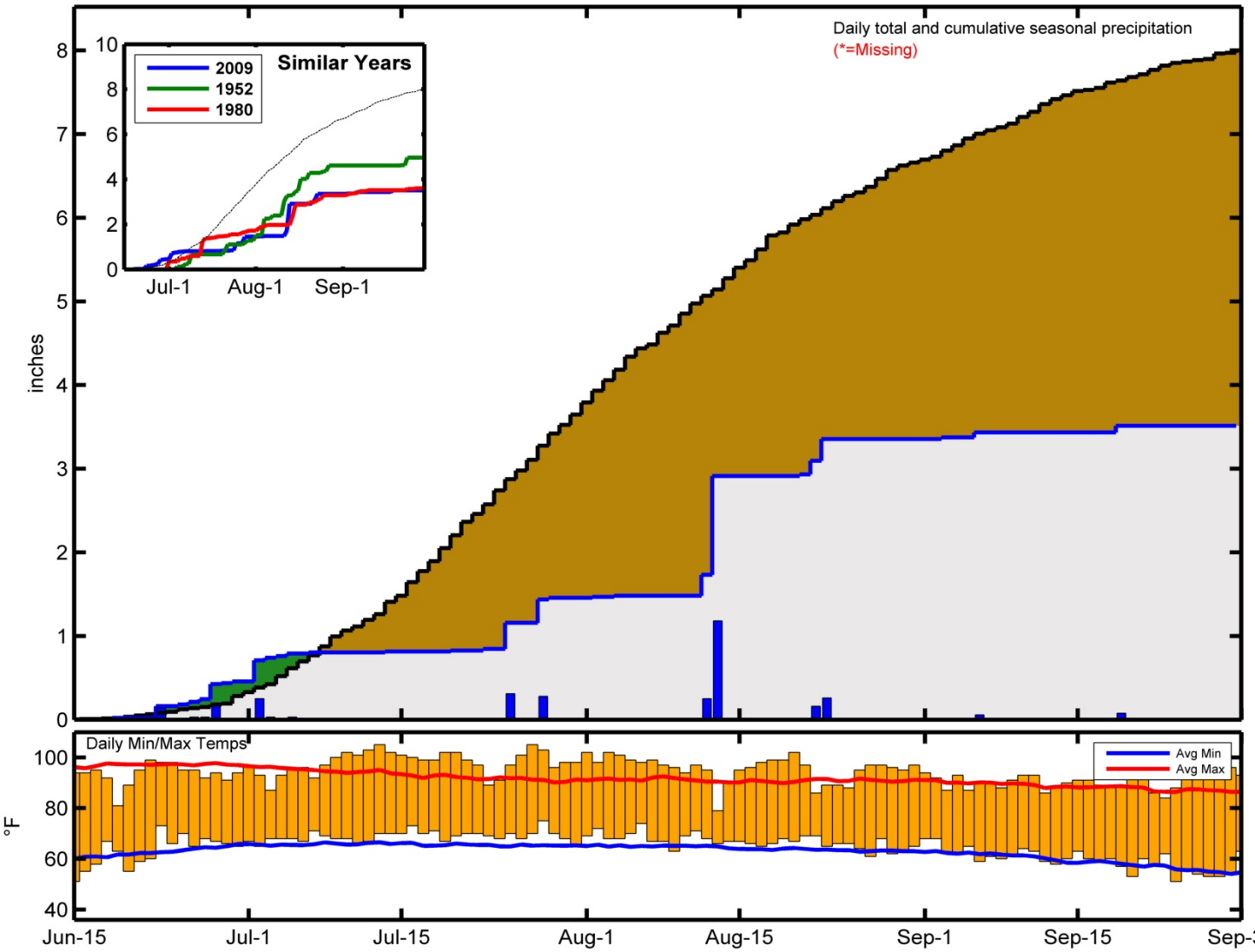
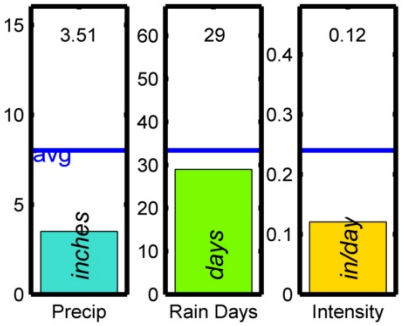
2009 Monsoon Summary

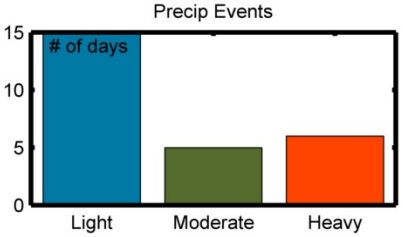




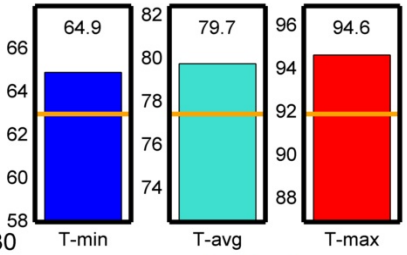
DOUGLAS BISBEE INL AP

Elevation: 1251m
Period of record: 1950-2013
Years in record: 64
Precip rank: 63 (1,wettest)
Temp rank: 3 (1,warmest)
Missing in 2009: 0 days





Dry Spells
Avg length: 4 days (avg: 4)
Max length: 12 days (avg: 13)



http://cals.arizona.edu/climate/misc/monsoon/monsoon_summaries.html

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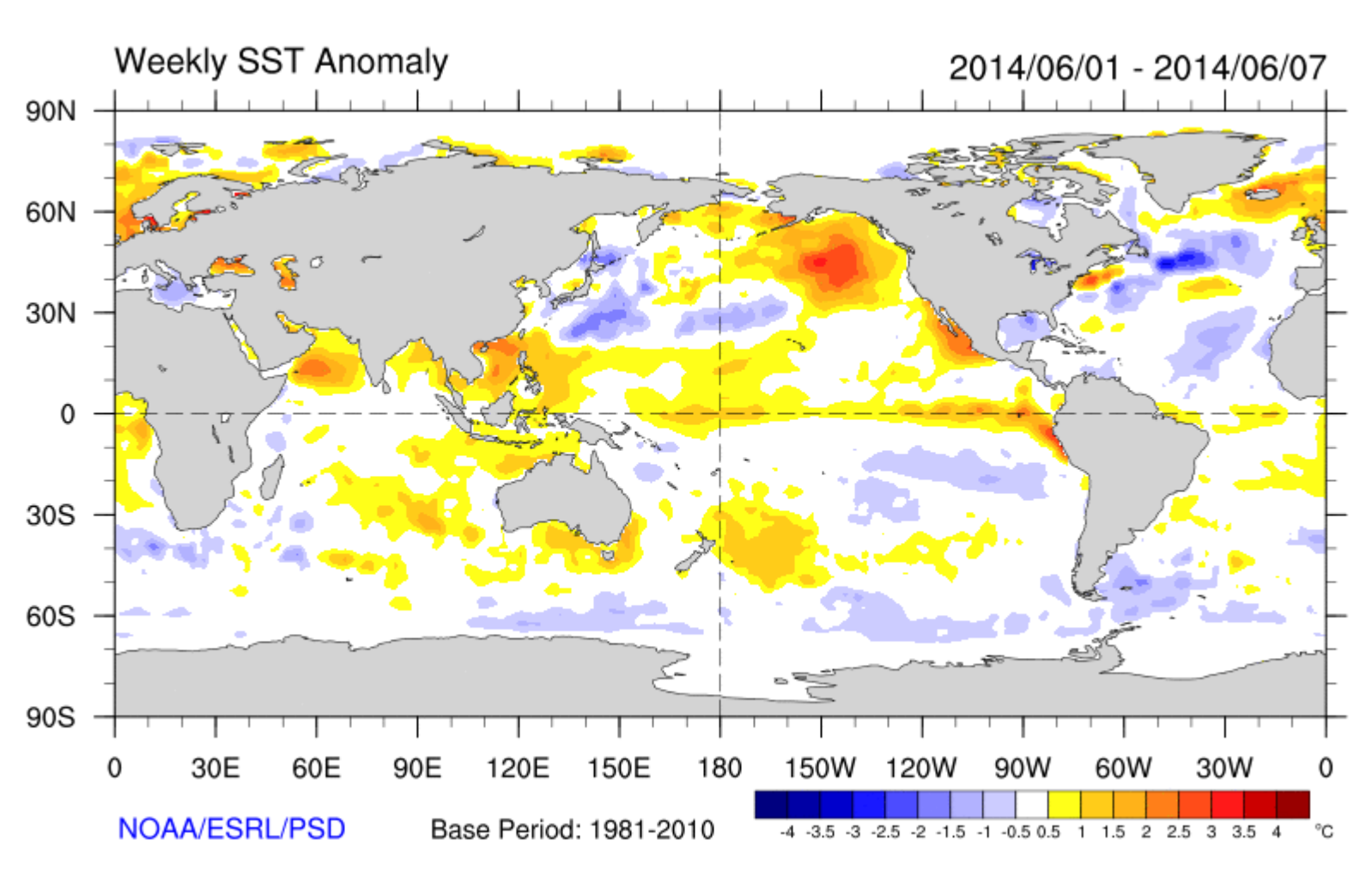
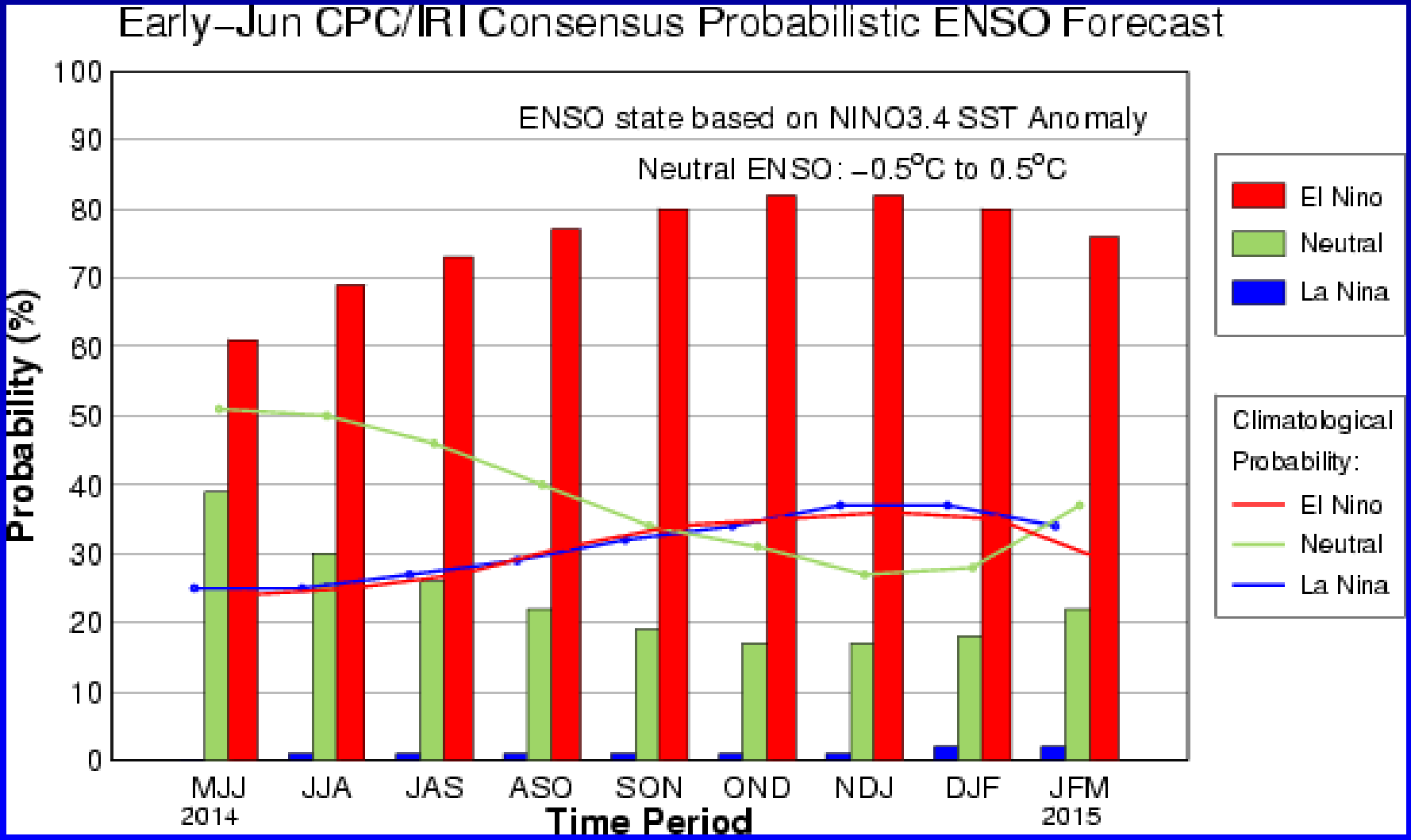
http://cals.arizona.edu/climate
Date created: 03-Oct-2013

Current Sea Surface Temperature Patterns

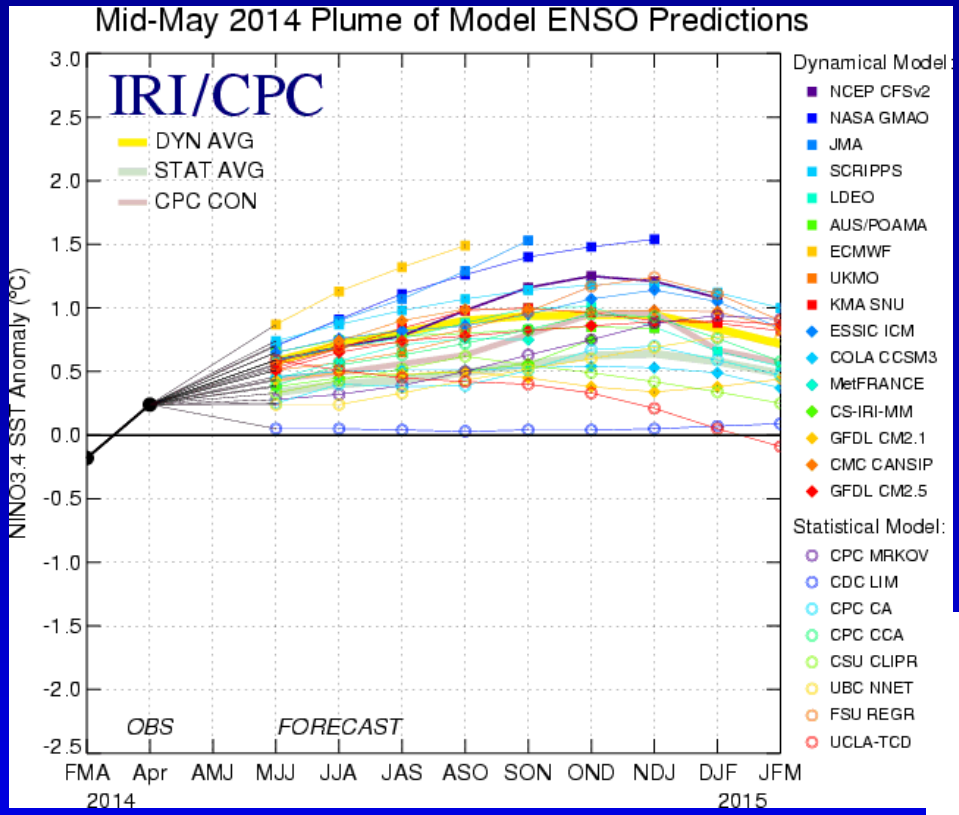


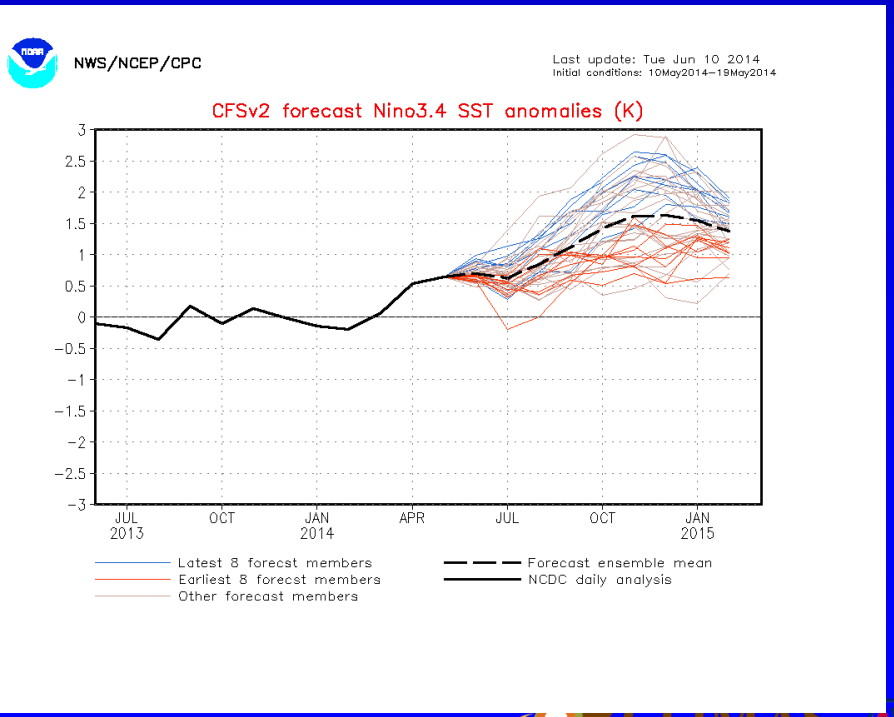
http://www.esrl.noaa.gov/psd/map/clim/sst.shtml

El Niño Forecast

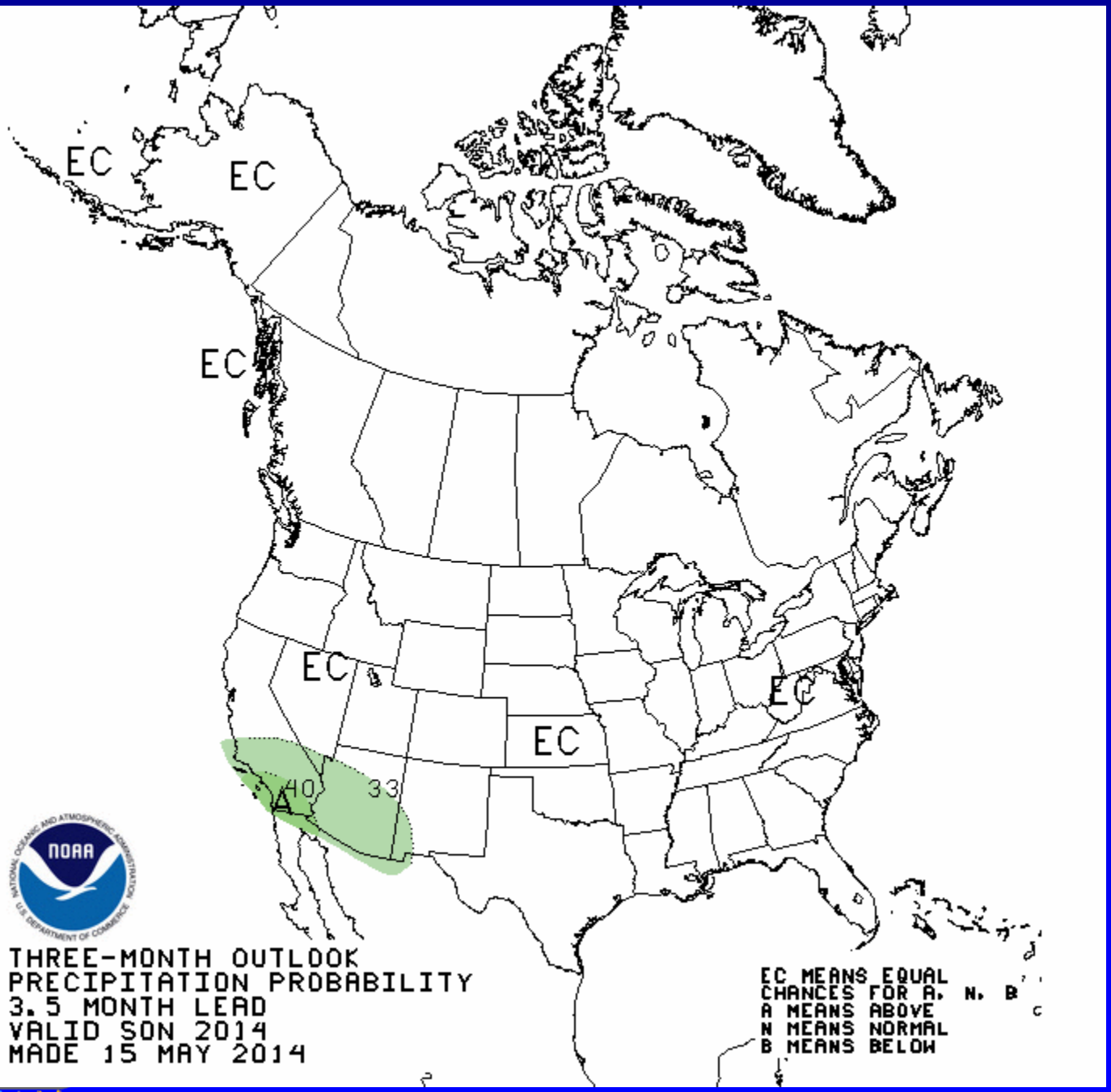


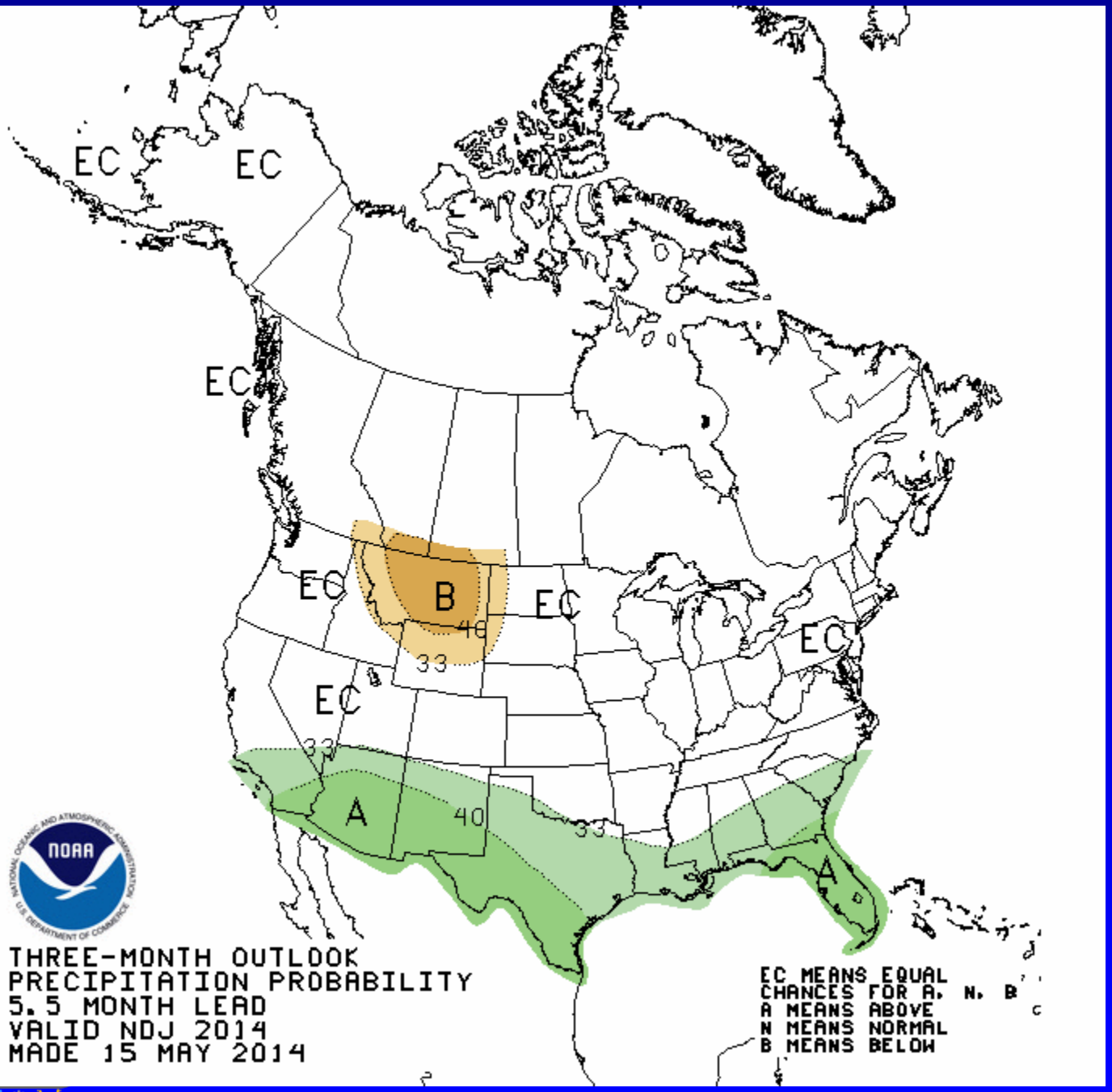
El Niño Forecast



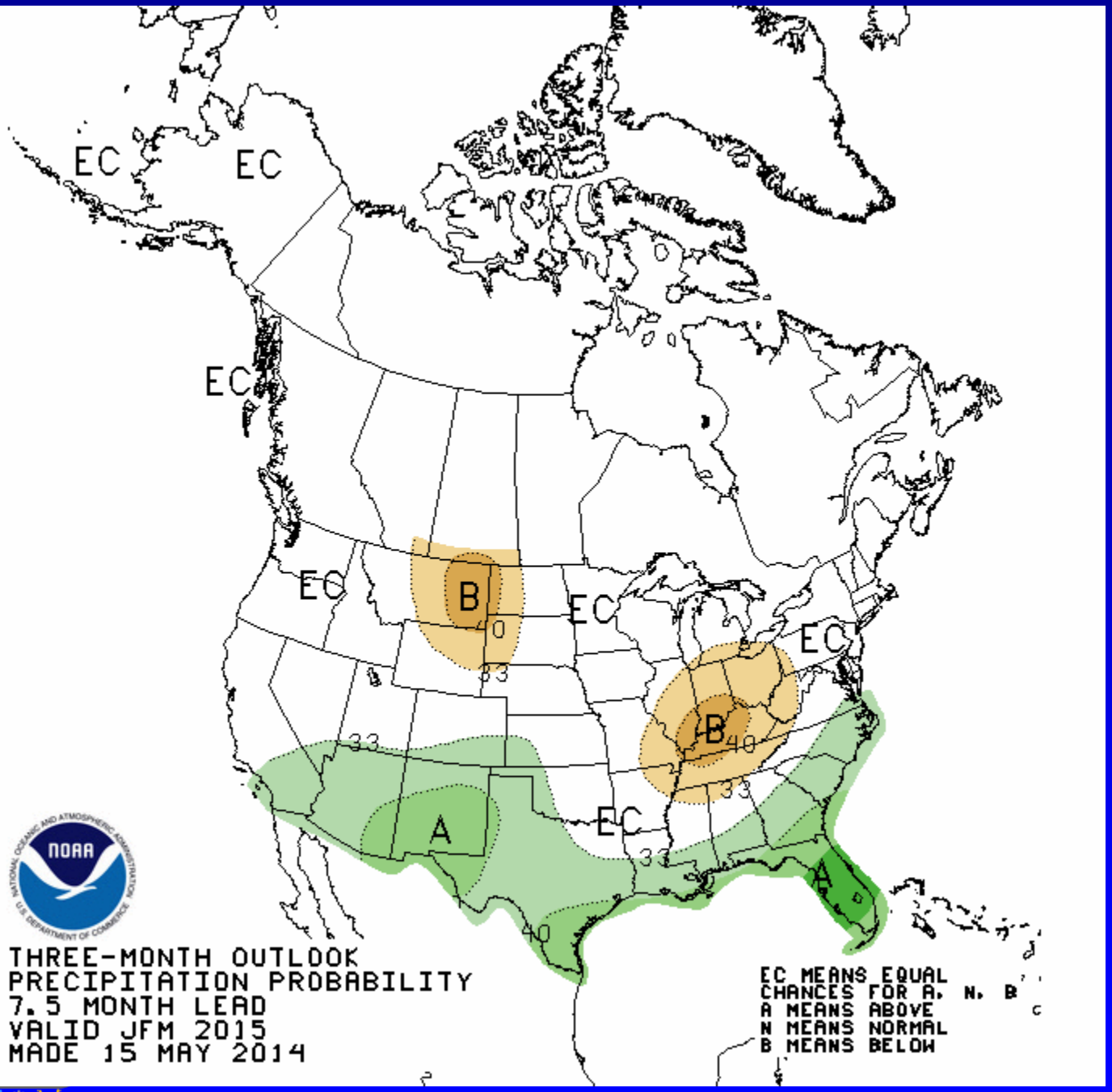


Sept-Oct-Nov Precipitation Outlook





Nov-Dec-Jan Precipitation Outlook



Jan-Feb-Mar Precipitation Outlook