

Will it rain in Texas?



Robert E. Mace, Ph.D., P.G.

Texas **Water** Development Board

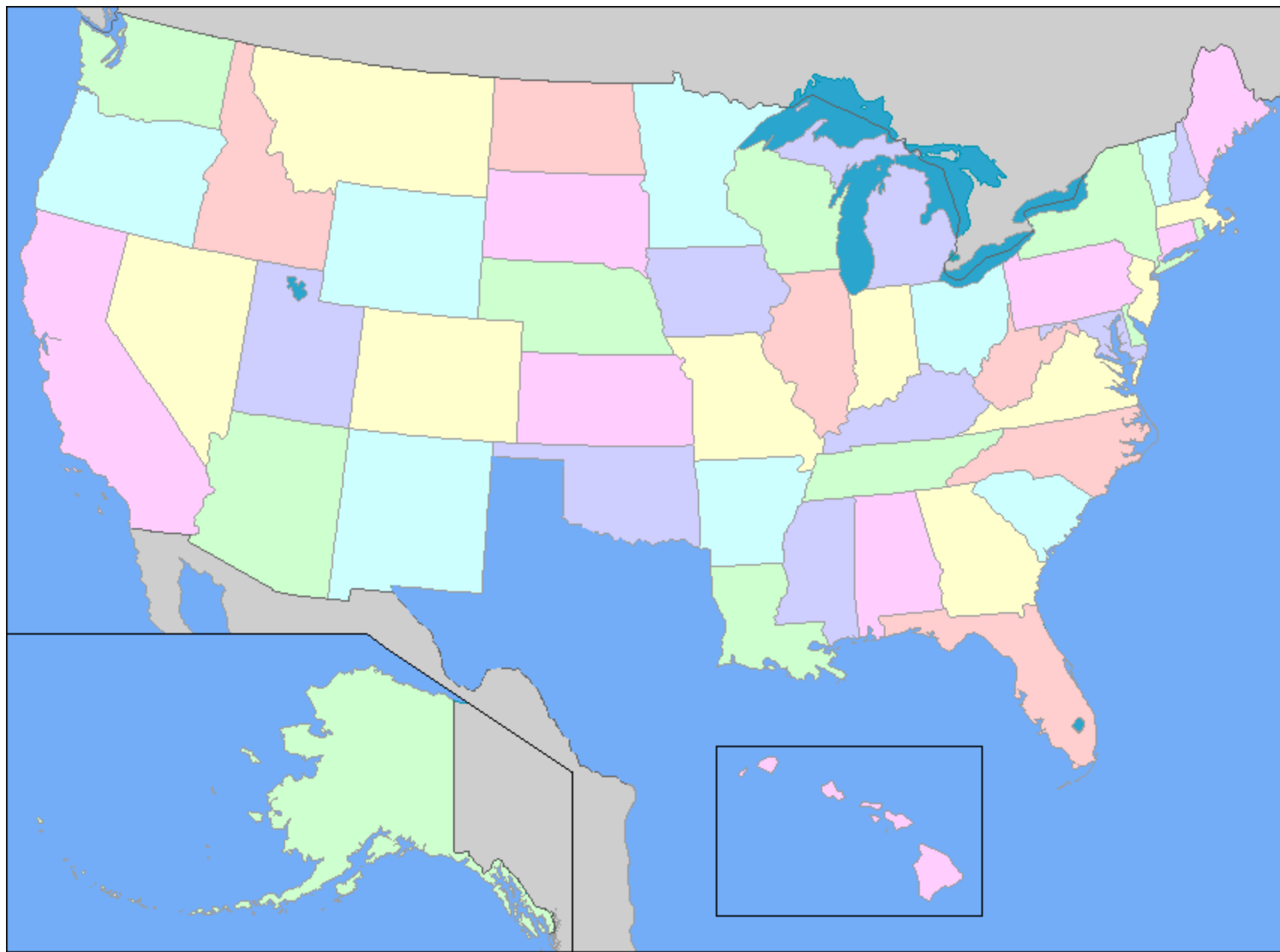
presented at the

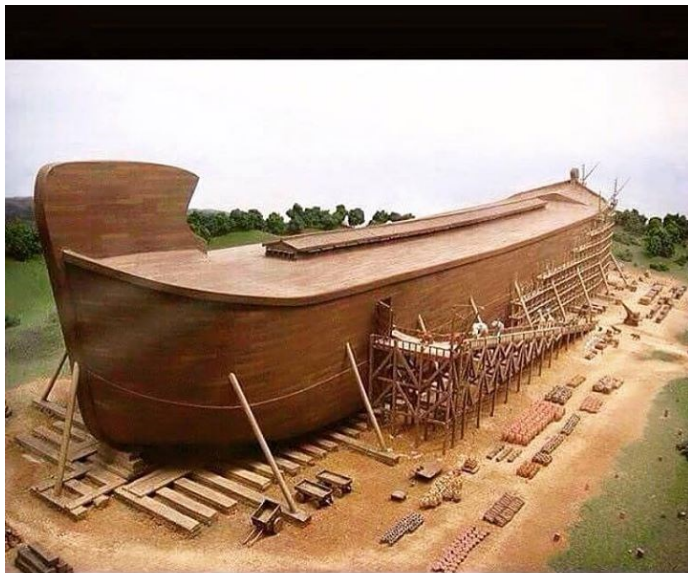
Workshop for Improving Sub-Seasonal and Seasonal Precipitation
Forecasting for Drought Preparedness

sponsored by the

Western States **Water** Council
and the California Department of **Water** Resources

May 28, 2015; San Diego, California





Meanwhile in Texas...



Meanwhile in Houston...



MEANWHILE,

IN NORTH TEXAS.....

imgflip.com

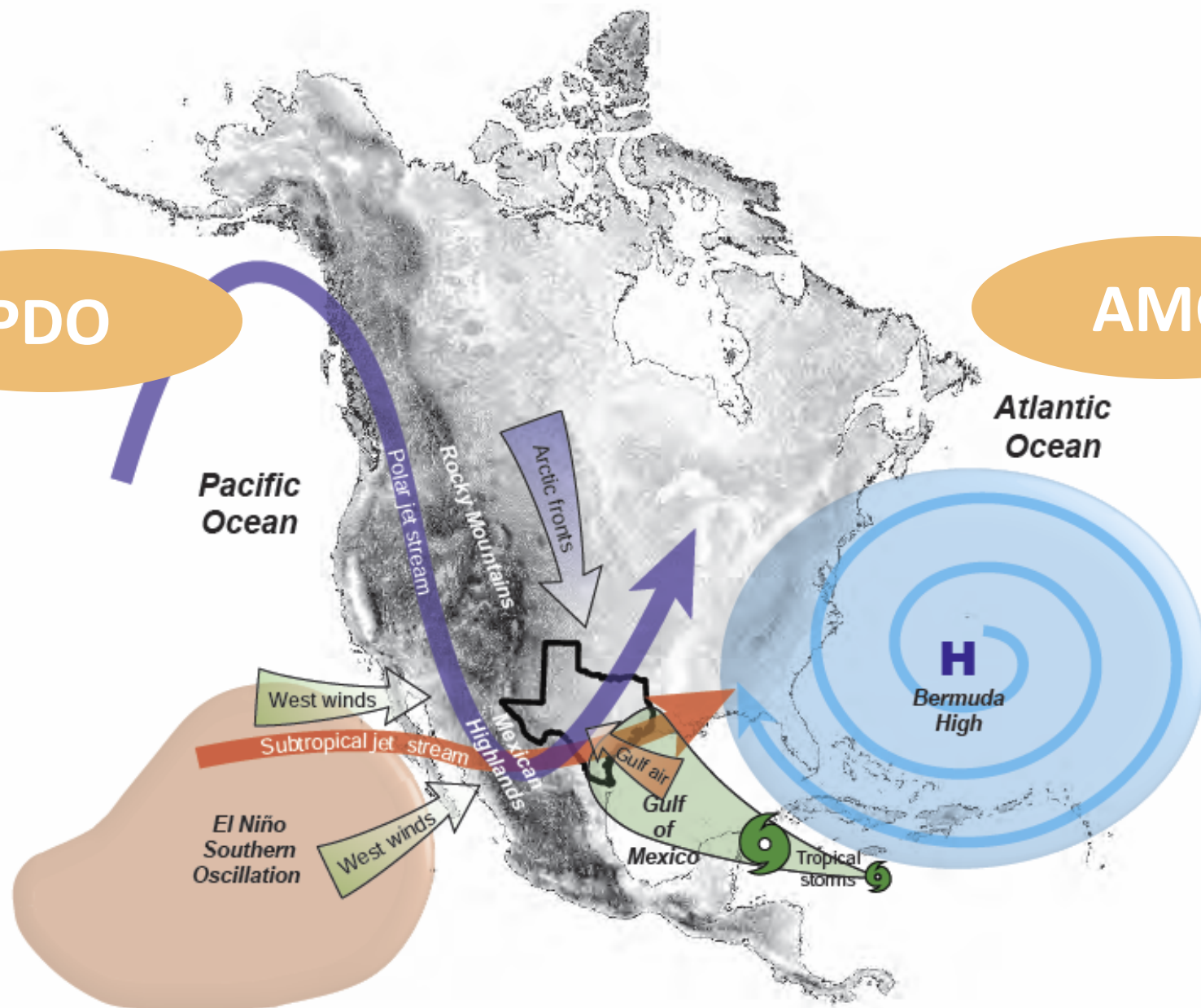


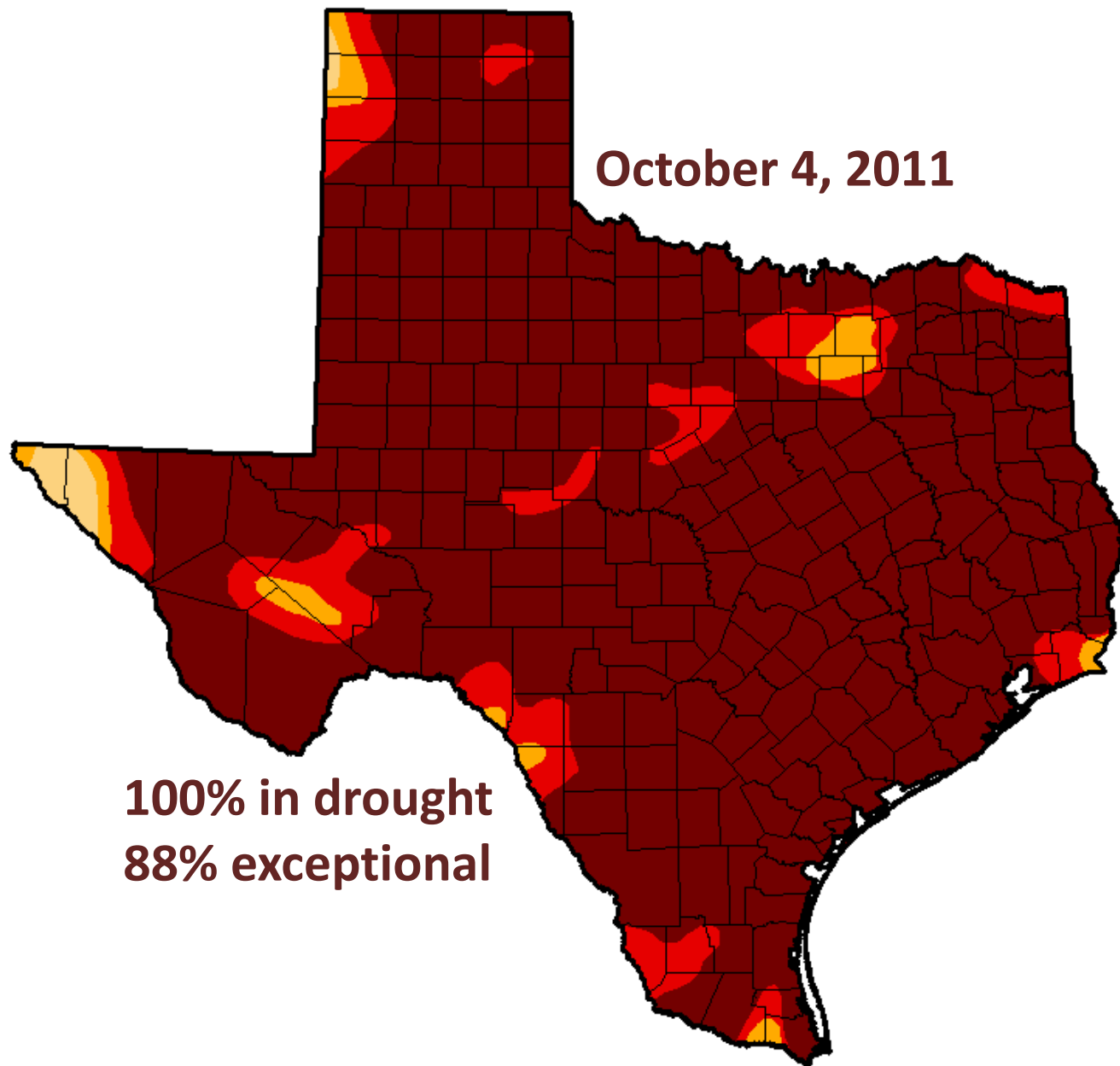
CHECKED ON
MY TOMATOES TODAY

SO FAR SO GOOD!

PDO

AMO





October 4, 2011

**100% in drought
88% exceptional**





Photo By Christina Gomez-Mira/FOR THE CHRONICLE

◀ 2 of 2 ▶

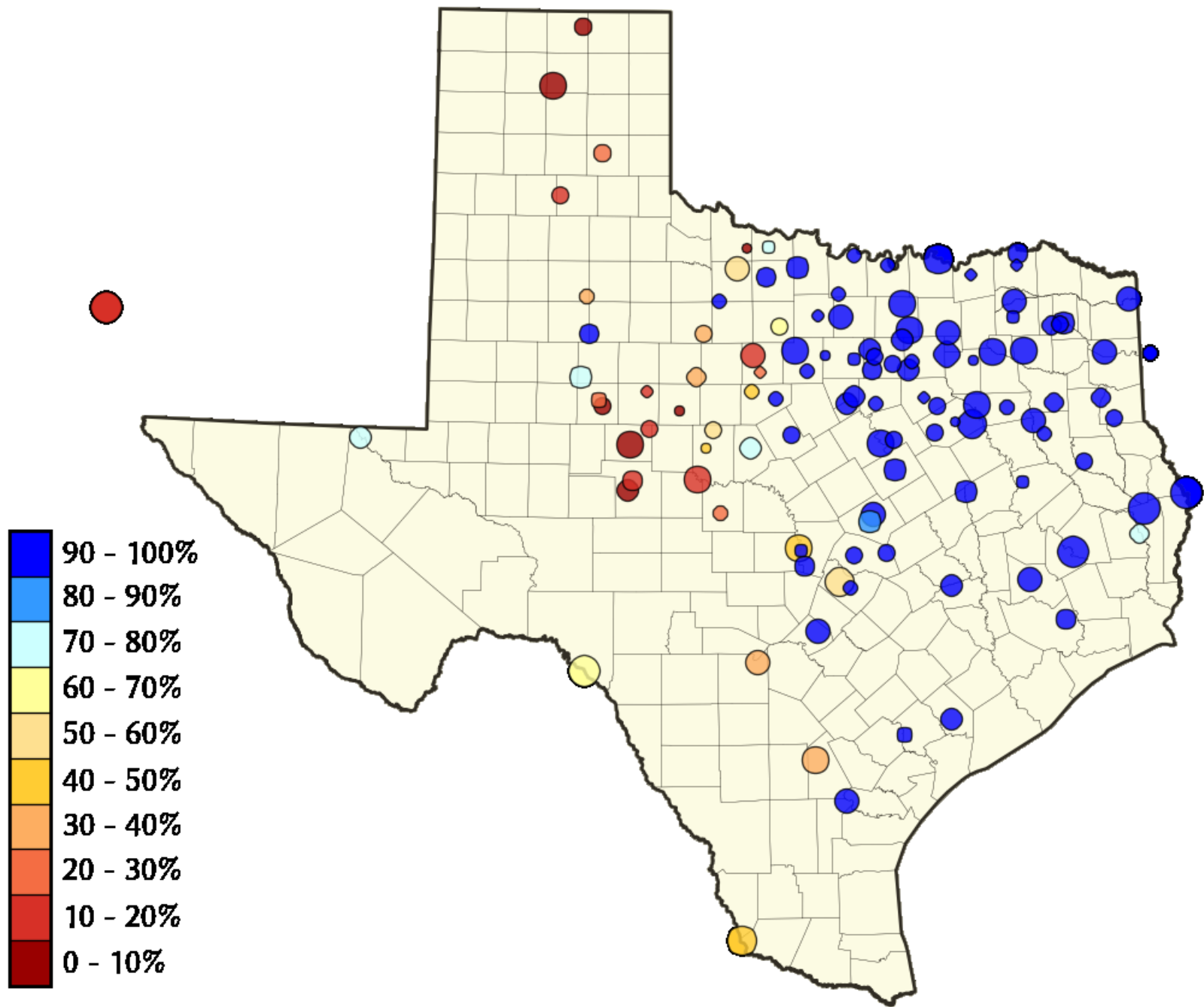
Wayland Clark gives water to his many cats in Dripping Springs. The drought has run his well dry, forcing him to have water delivered to him.

Established in Milwaukee 1844

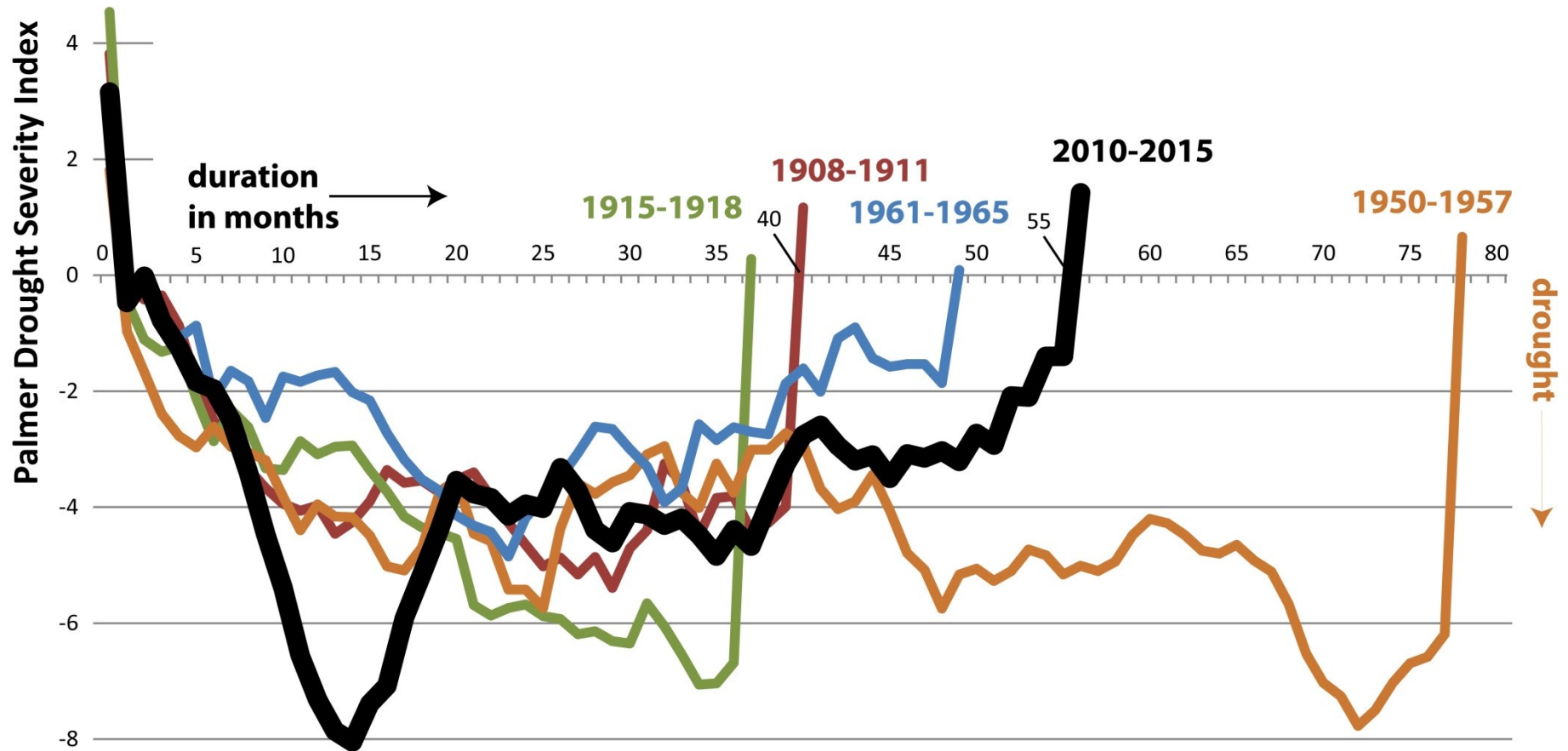
Direct
Potable Reuse



*This is the **ORIGINAL** Pabst Blue Ribbon Beer. Nature's
choicest products provide its prized flavor. Only the finest of
hops and grains are used. Selected as America's Best in 1893*



Five Worst State-Wide Droughts in Texas



based on information from John Nielsen-Gammon

Why is Robert a happy camper?



- Irrational exuberance?
- Day drinking?

- **Climate scientist imbed**
- Direct connection with regional NOAA

expert opinion!

The Imbed

**Postdocs Applying Climate
Expertise (PACE)**

via

**University Corporation for
Atmospheric Research**

in cooperation with

**The University of Texas
at Austin**

with funding from

**the aboves and the
U.S. Army Corps of
Engineers**



The Connection

CPC Monthly Outlook and Drought Outlook for May....

victor.murphy@noaa.gov>

Sent: Thu 4/30/2015 4:26 PM

To: Stermolle, Gabriela; Brenner Brown; Chapa, Mario; Sam.Marie Hermitte; Robert Mace; Trav

Retention Policy: Default 90 day permanent Delete (90 days) Expires: 7/29/2015



.....both contain great news for TX.

The NWS Climate Prediction Center (CPC) issued two products today which spell great news for TX from a drought perspective.

The first is the May temperature and precipitation outlook.

<http://www.cpc.ncep.noaa.gov/products/predictions/30day/>

As you can see, there is a rather strong tilt for above normal rainfall for TX i improvements as I told you into June. Also, the temperatures are forecast to for area lakes. In summary, I would look for continued improvements in TX

The second product is the Monthly Drought Outlook. In concert with the al ending by May 31st statewide. Even more importantly, no new areas of dro

http://www.cpc.ncep.noaa.gov/products/expert_assessment/month_drought.

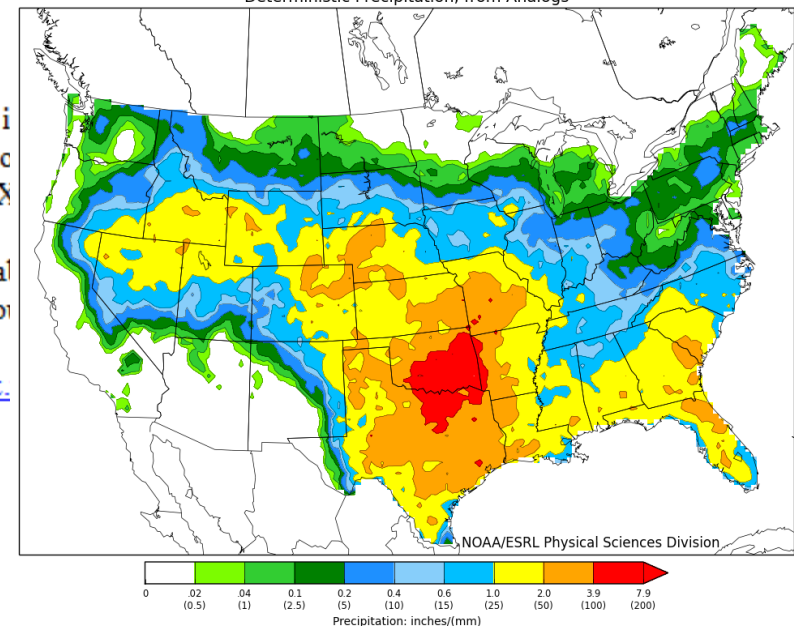
If you have any questions, feel free to let me know.

Victor

120-240hr fcst from 00Z Fri May 15. Valid 00Z Wed May 20 - 00Z Mon May 25

Calibrated with 1985-2010 Reforecast2 data.

Deterministic Precipitation, from Analogs



days

0.1

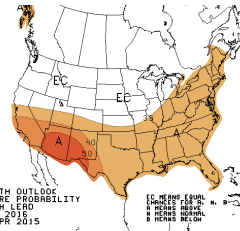
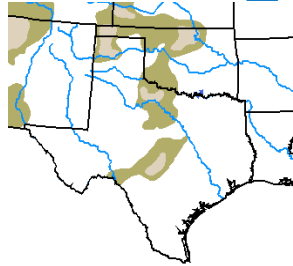
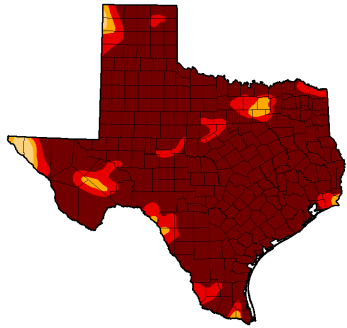
1

10

100

1000

10000



PDO

AMO



<http://www.waterdatafortexas.org/drought/>

North American Drought Monitor

April 30, 2015

Released: Thursday, May 14, 2015

<http://www.ncdc.noaa.gov/nadm.html>

Analysts:

Canada - Trevor Hadwen
Makenzie Costabile
Dwayne Chobanik*
Mexico - Adelina Albanil
Minerva Lopez
U.S.A. - Anthony Artusa

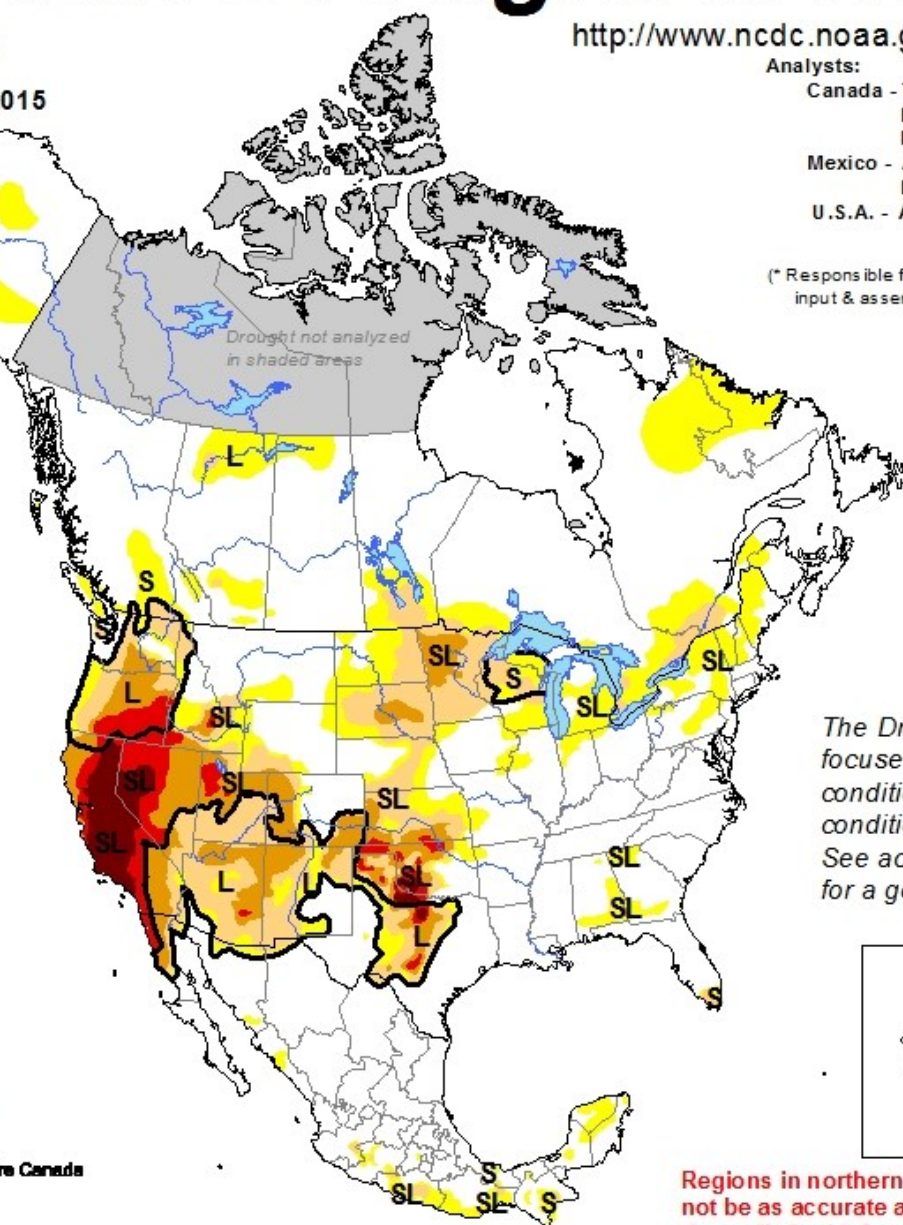
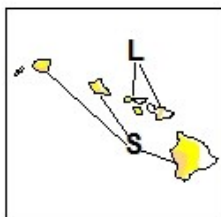
(* Responsible for collecting analysts' input & assembling the NADM map)

Intensity:

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

Drought Impact Types:

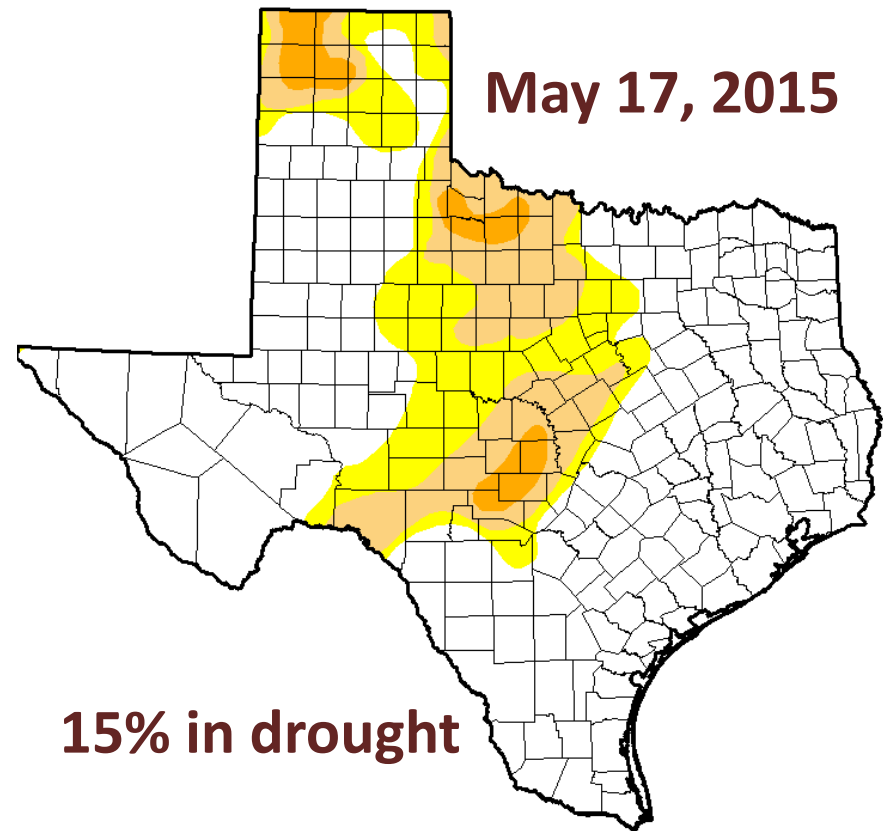
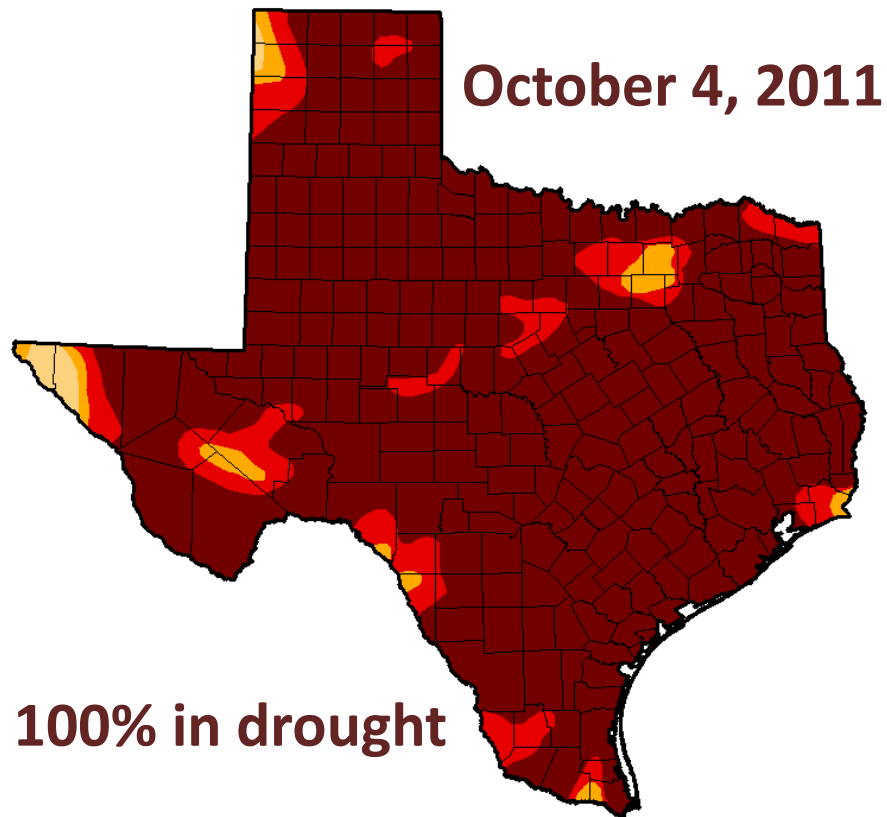
- ~ Delineates dominant impacts
- S = Short-Term, typically <6 months
(e.g. agriculture, grasslands)
- L = Long-Term, typically >6 months
(e.g. hydrology, ecology)



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



Regions in northern Canada may not be as accurate as other regions due to limited information.



What the hell is this?



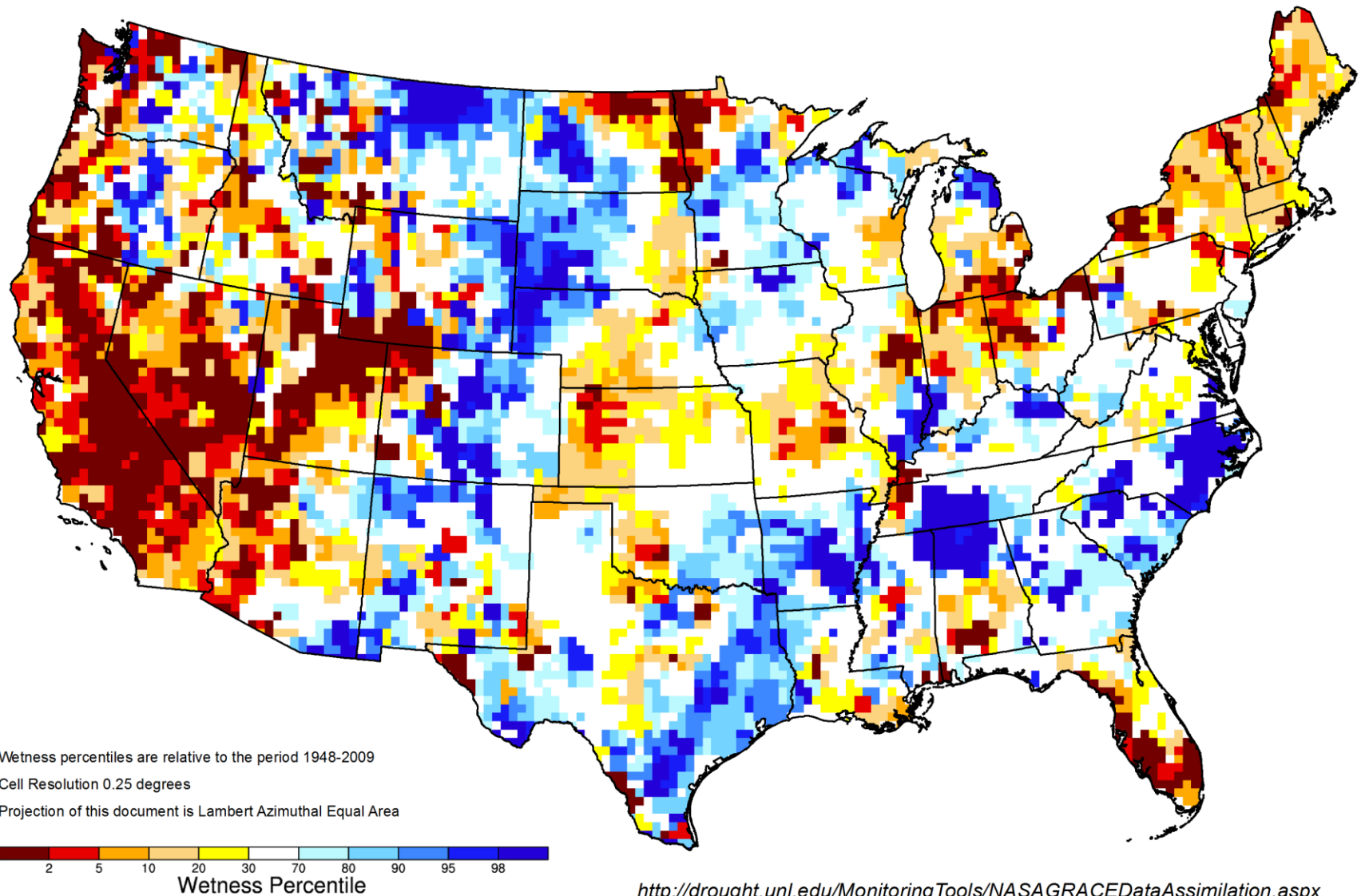
Intensity:

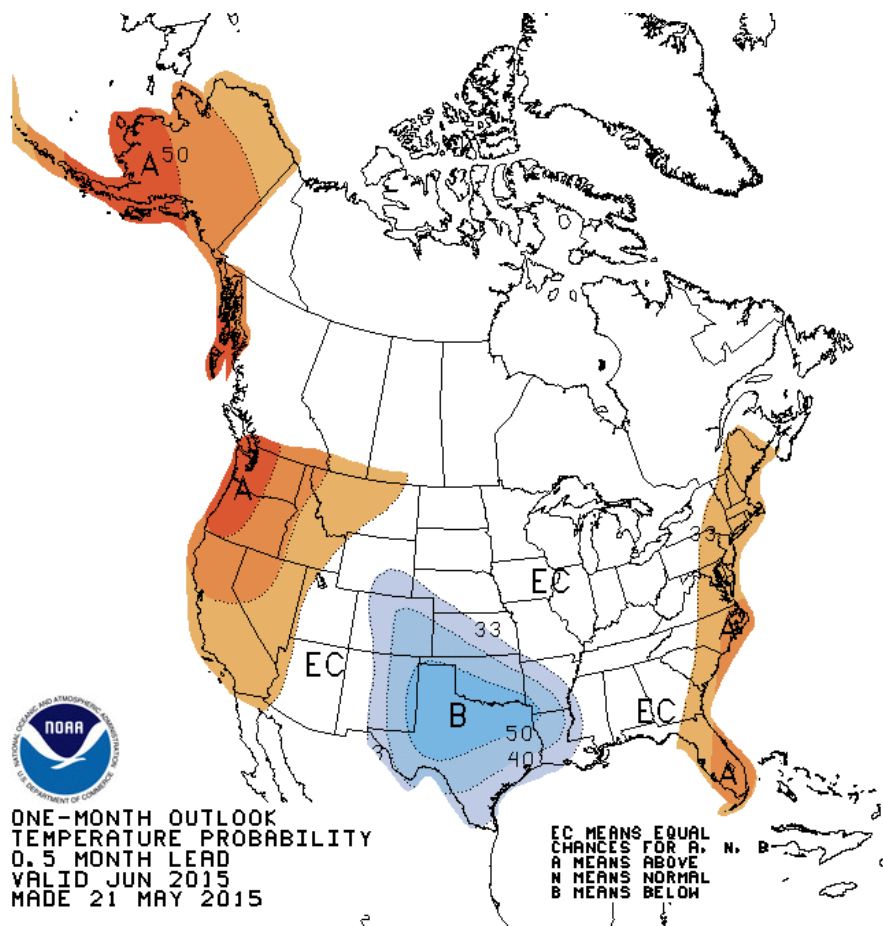
- D0 Abnormally Dry
- D1 Moderate Drought
- D2 Severe Drought
- D3 Extreme Drought
- D4 Exceptional Drought



GRACE-Based Shallow Groundwater Drought Indicator

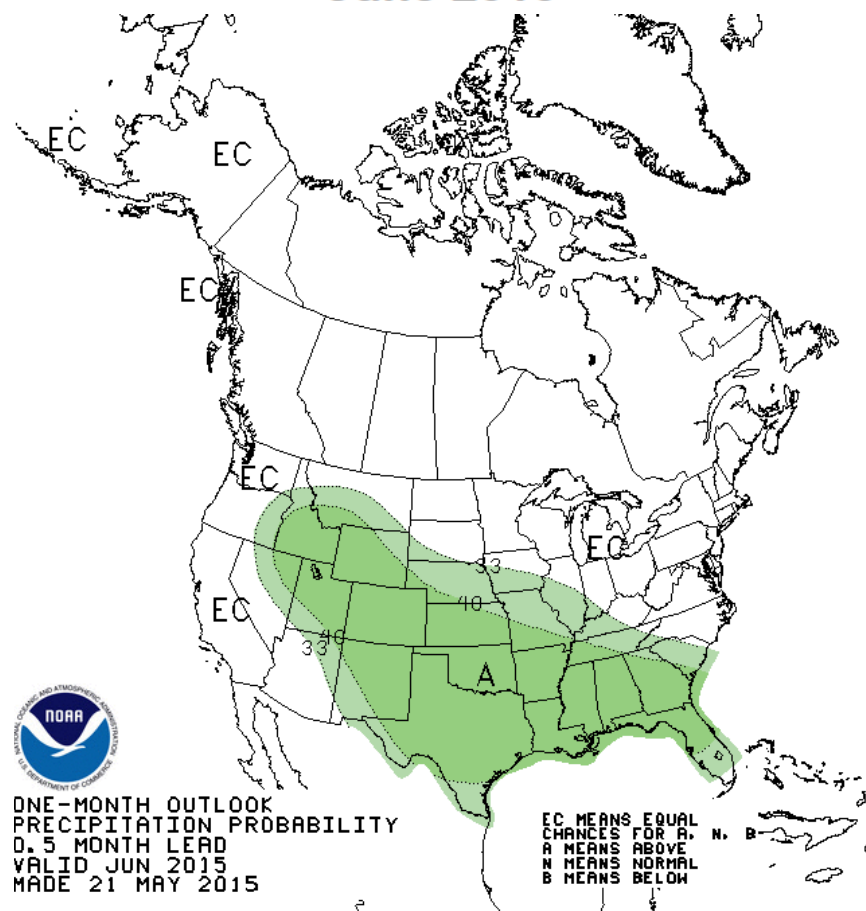
May 18, 2015





One-Month Outlook OFFICIAL Forecasts

June 2015

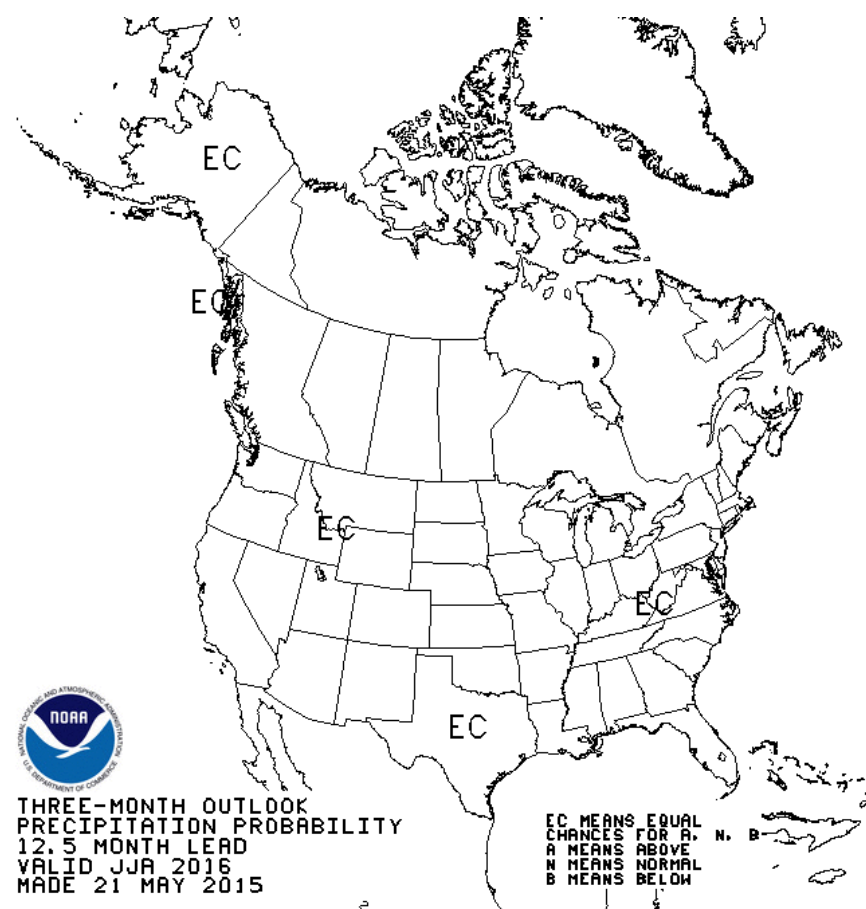
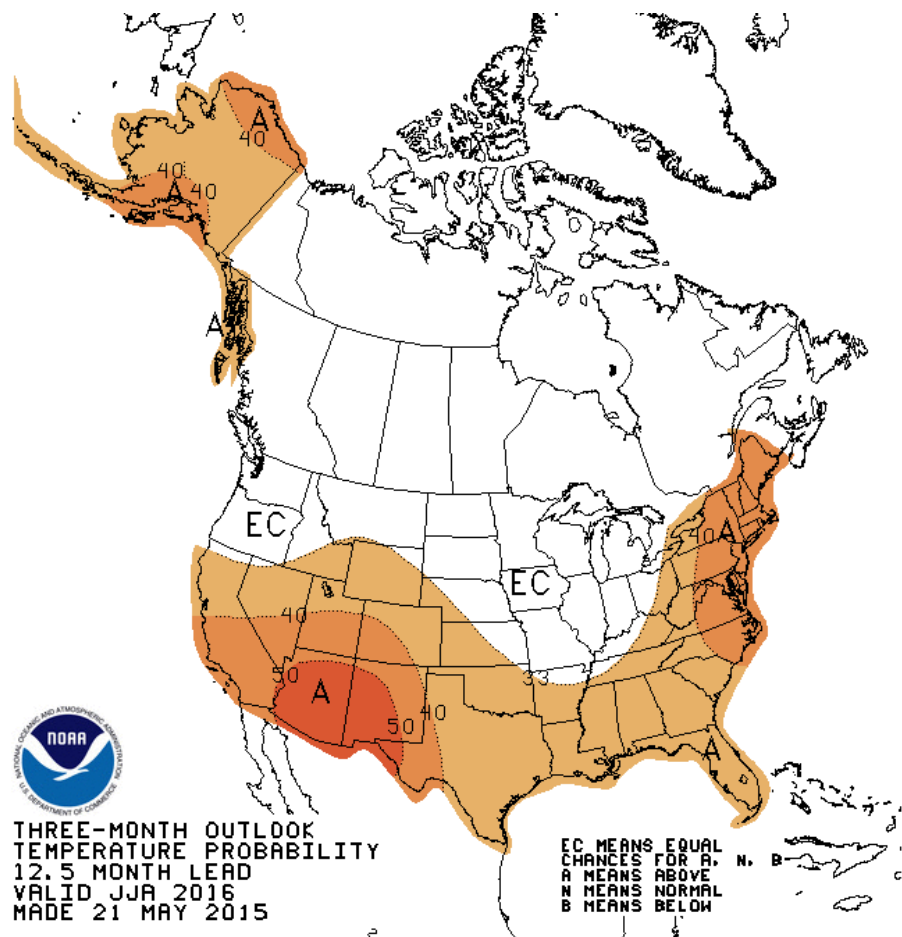


Nelun uses something fancier... (NMME)
North American Multi-Model Ensemble Forecasts

Three-Month Outlooks

OFFICIAL Forecasts

Jun-Jul-Aug 2016

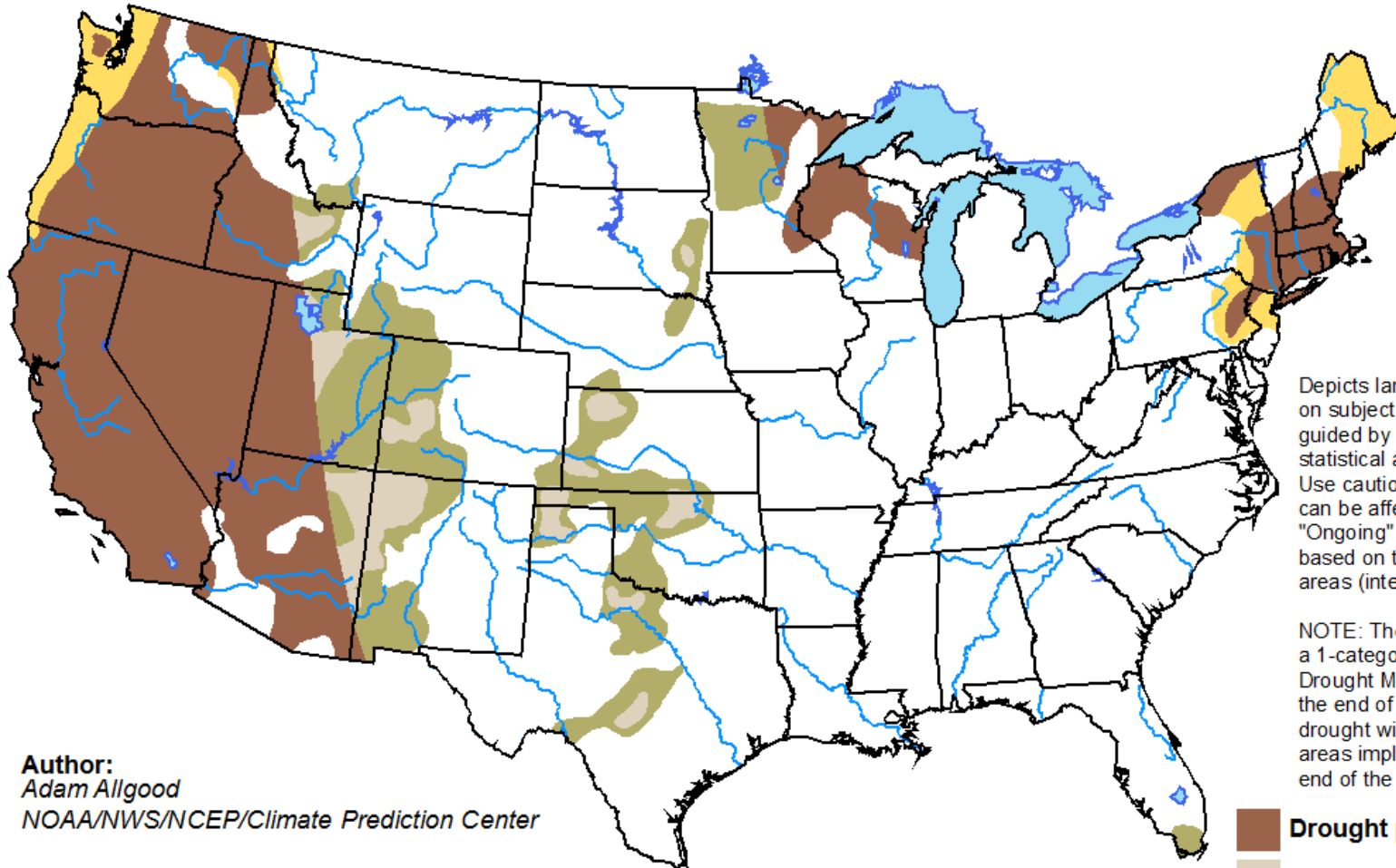


Is this accurate? What is the uncertainty?

U.S. Seasonal Drought Outlook

Drought Tendency During the Valid Period

Valid for May 21 - August 31, 2015
Released May 21, 2015



Author:
Adam Allgood
NOAA/NWS/NCEP/Climate Prediction Center

Depicts large-scale trends based on subjectively derived probabilities guided by short- and long-range statistical and dynamical forecasts. Use caution for applications that can be affected by short lived events. "Ongoing" drought areas are based on the U.S. Drought Monitor areas (intensities of D1 to D4).

NOTE: The tan areas imply at least a 1-category improvement in the Drought Monitor intensity levels by the end of the period, although drought will remain. The green areas imply drought removal by the end of the period (D0 or none).

-  Drought persists/intensifies
-  Drought remains but improves
-  Drought removal likely
-  Drought development likely

North American Seasonal Drought Outlook?



<http://go.usa.gov/hHTe>



2014 Atlantic Hurricane Outlook Update

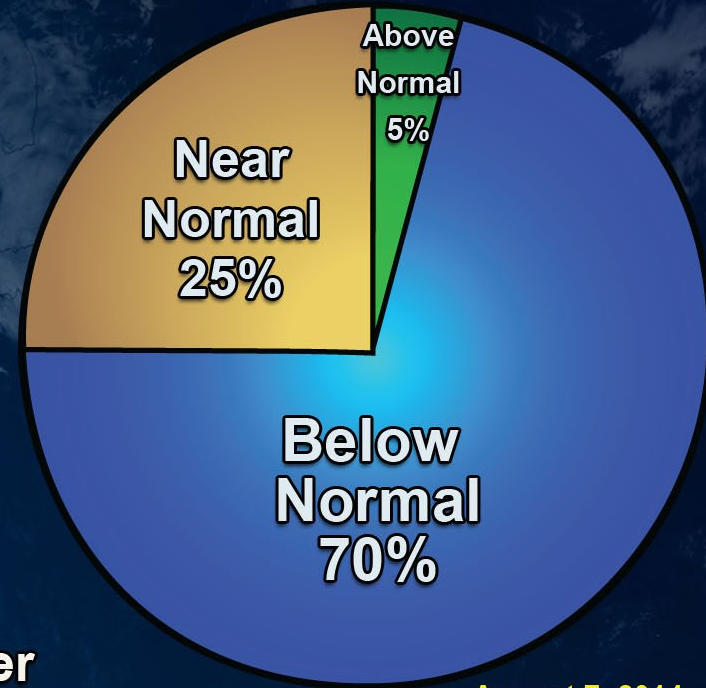
70% Probability of:

Named Storms: 7 - 12

Hurricanes: 3 - 6

Major Hurricanes: 0 - 2

Outlook
Probability



Be prepared: Visit hurricanes.gov
and follow @NWS and @NHC_Atlantic on Twitter

August 7, 2014

Gulf of Mexico Predictions?

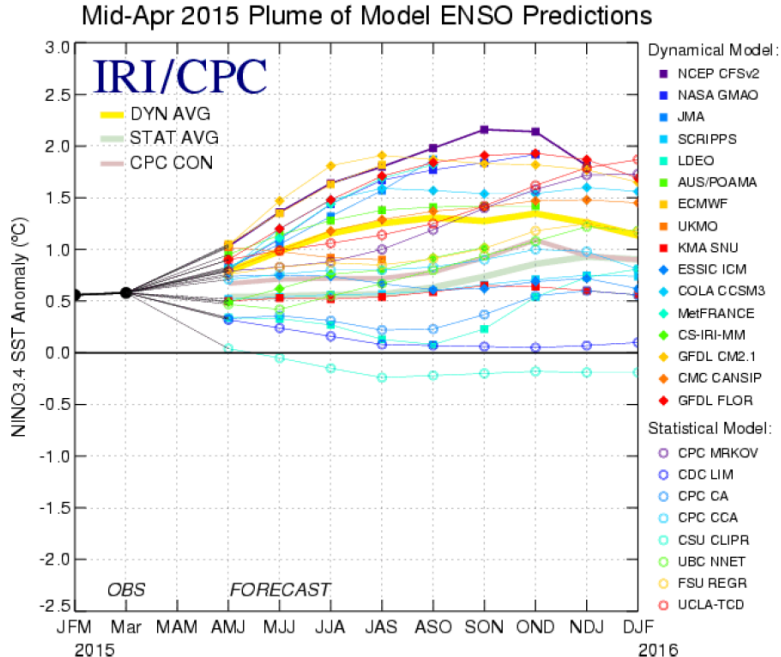
EL NIÑO/SOUTHERN OSCILLATION (ENSO) DIAGNOSTIC DISCUSSION

issued by

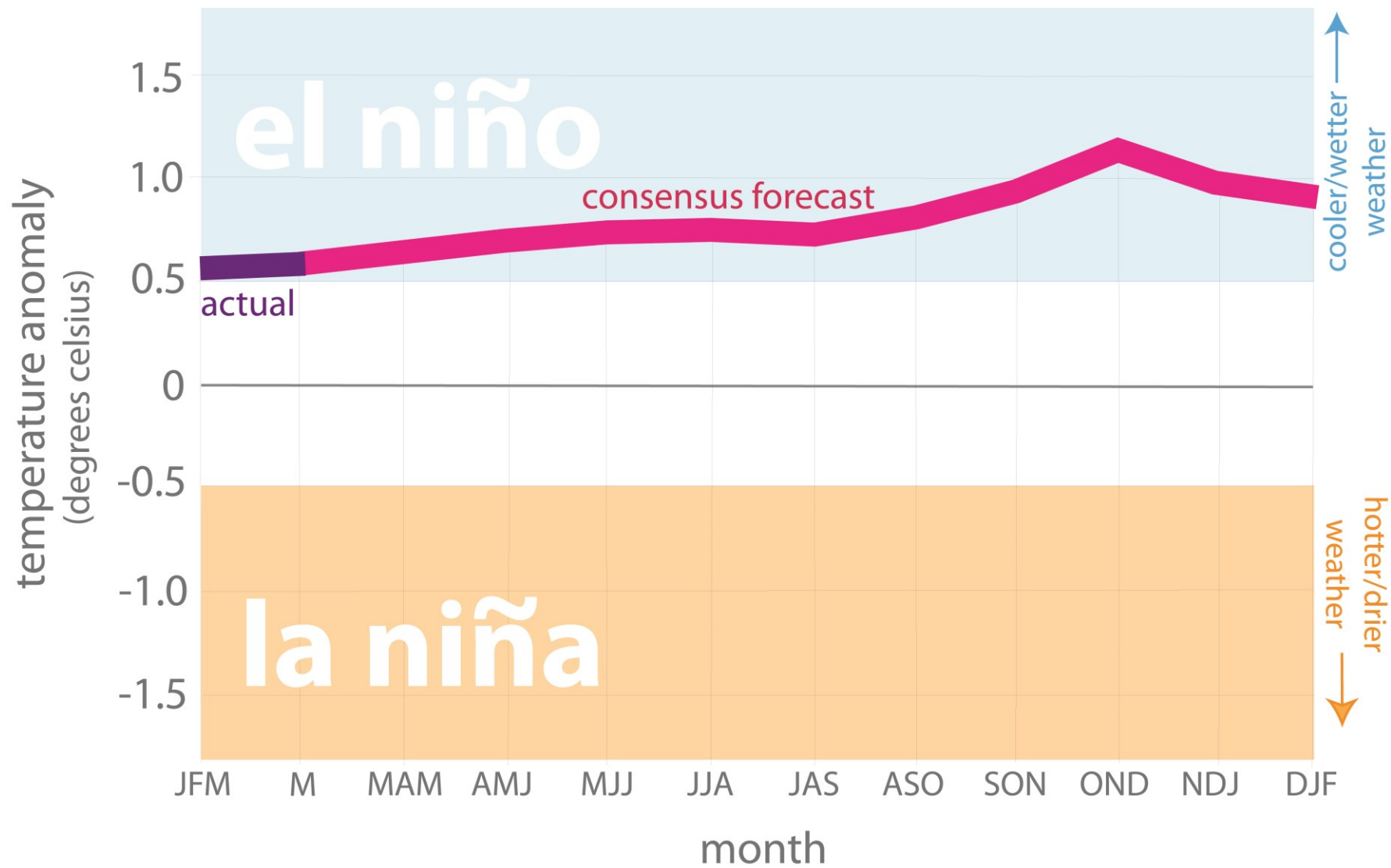
CLIMATE PREDICTION CENTER/NCEP/NWS
and the International Research Institute for Climate and Society
14 May 2015

ENSO Alert System Status: El Niño Advisory

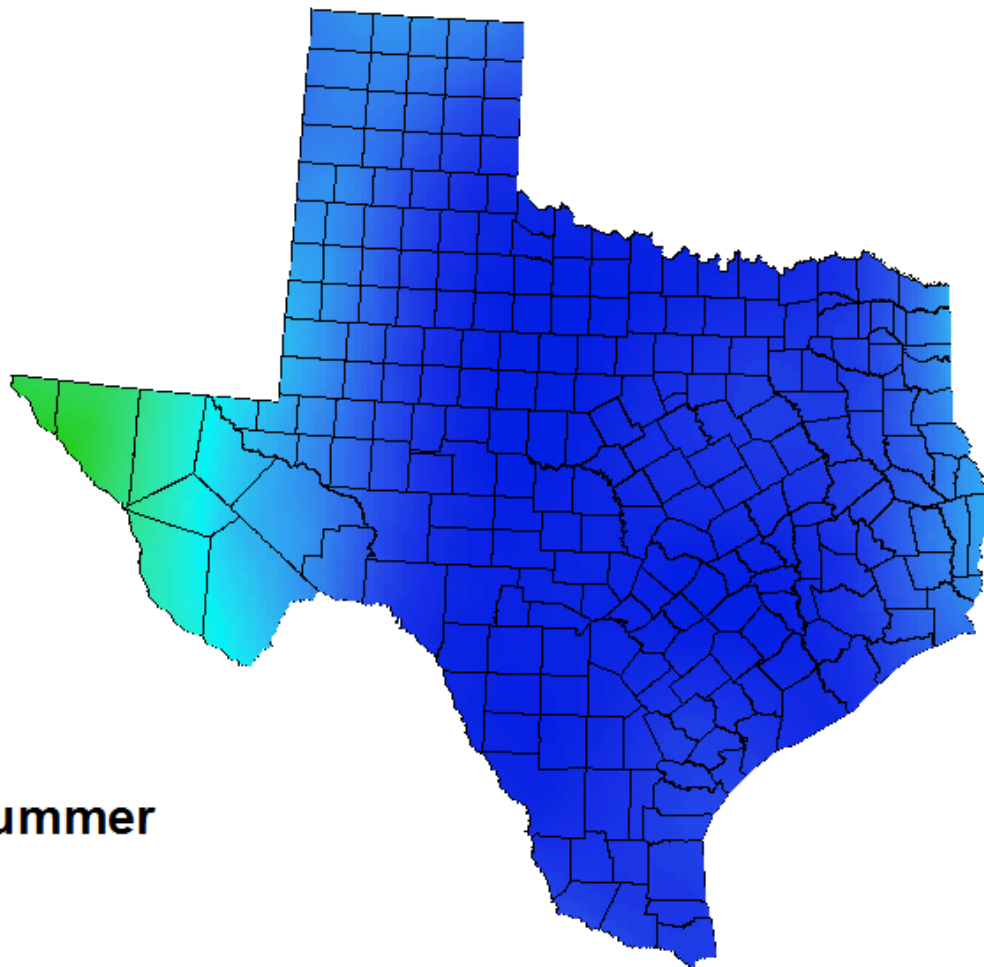
Synopsis: There is an approximately 90% chance that El Niño will continue through Northern Hemisphere summer 2015, and a greater than 80% chance it will last through 2015.



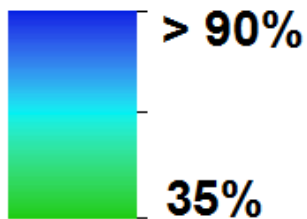
Uncertainty?



2015: May through July (MJJ) rainfall probability

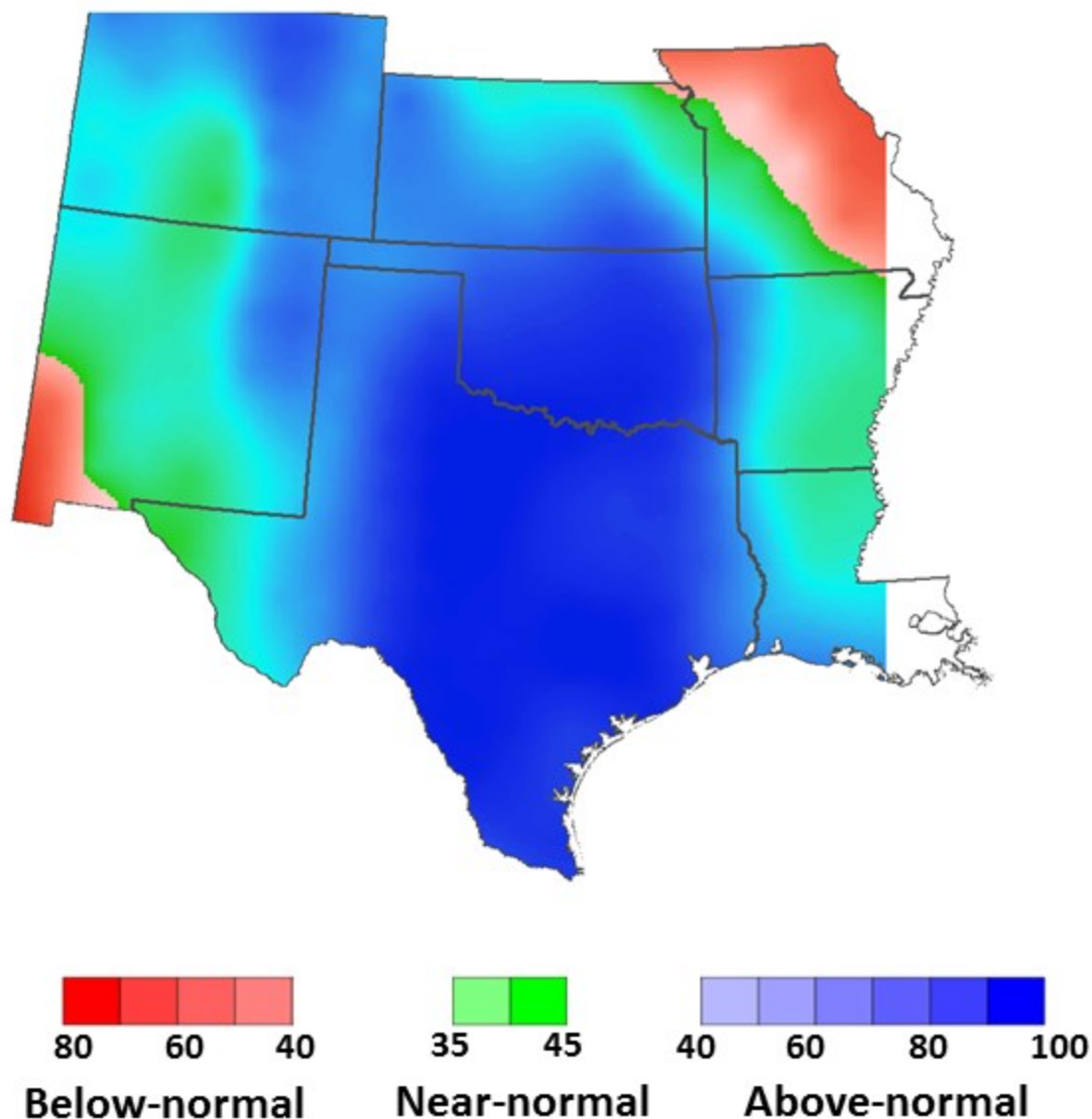


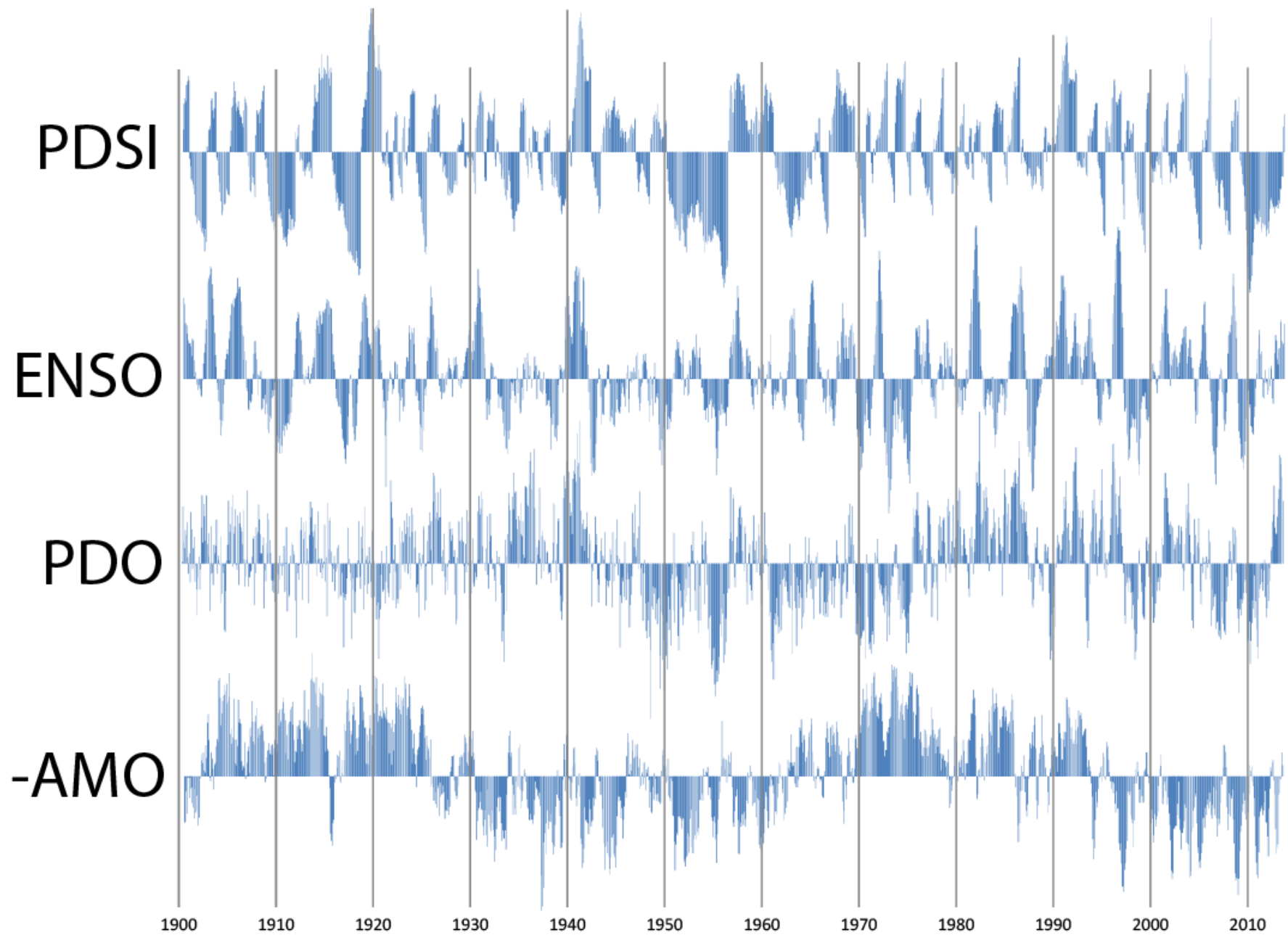
Probability of a wet summer



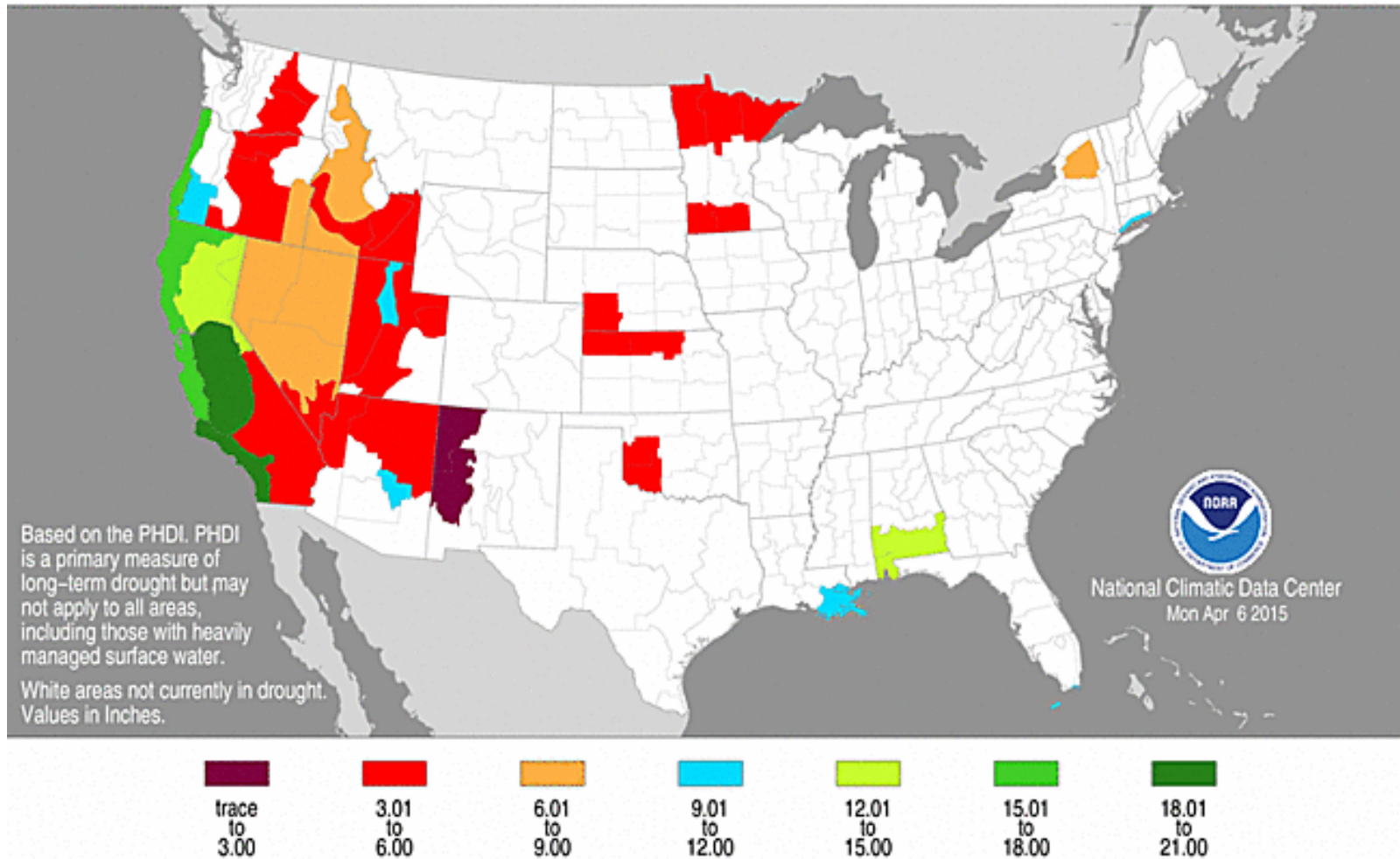
Legacy?

Forecast 2015 MJJ rainfall
(with April CFS reanalysis data and SMAP soil moisture)





Precipitation Required to End Current
Drought Conditions in One Month
March 2015

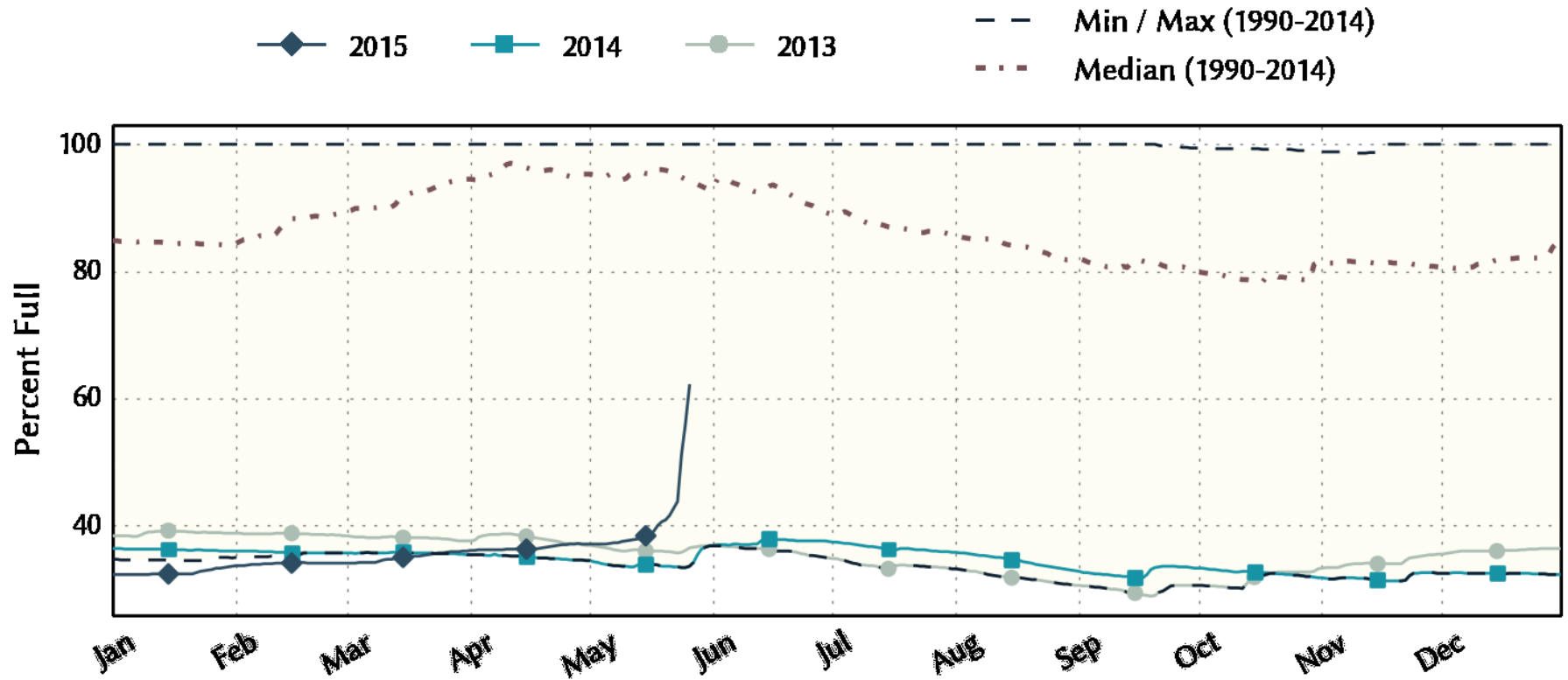


Who chooses these colors?

Is this accurate?

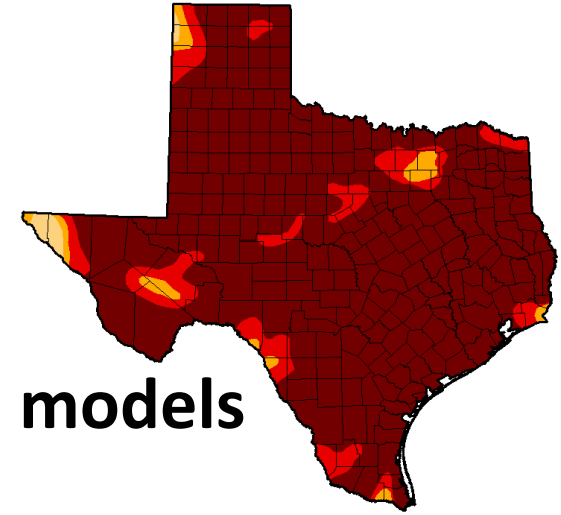
Rainfall to get runoff?

Lake Travis



May 26, 2015

In Summary...



- Projections for Northern Mexico
- More state-/regional-scale statistical models
- Runoff to fill reservoirs
- Expressions of uncertainty
- Clear expression of reliable v. experimental tools
- Careful promotion of experimental tools (GRACE)
- Edward Tufte
- Scalable information

For states:

- Consider hiring a climate scientist
- Develop a close relationship with regional NOAA

Will it **rain** in Texas?



Robert E. Mace, Ph.D., P.G.

Texas **Water** Development Board

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