Texas Drought Outlook: The Long and the Short of It

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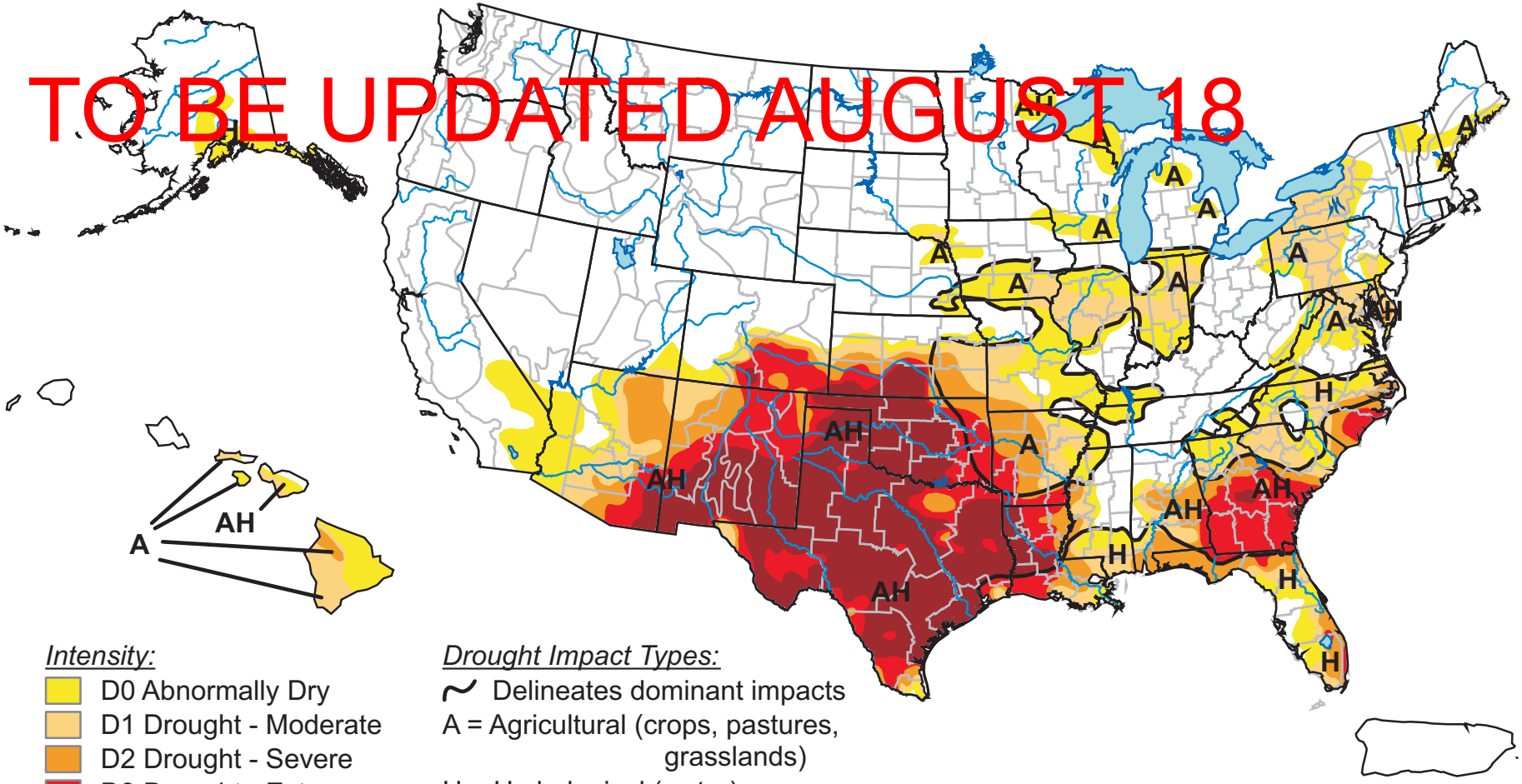
U.S. Drought Monitor

August 9, 2011
Valid 8 a.m. EDT

TO BE UPDATED AUGUST 18



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

Drought Impact Types:
- ~ Delineates dominant impacts
- A = Agricultural (crops, pastures, grasslands)
- H = Hydrological (water)

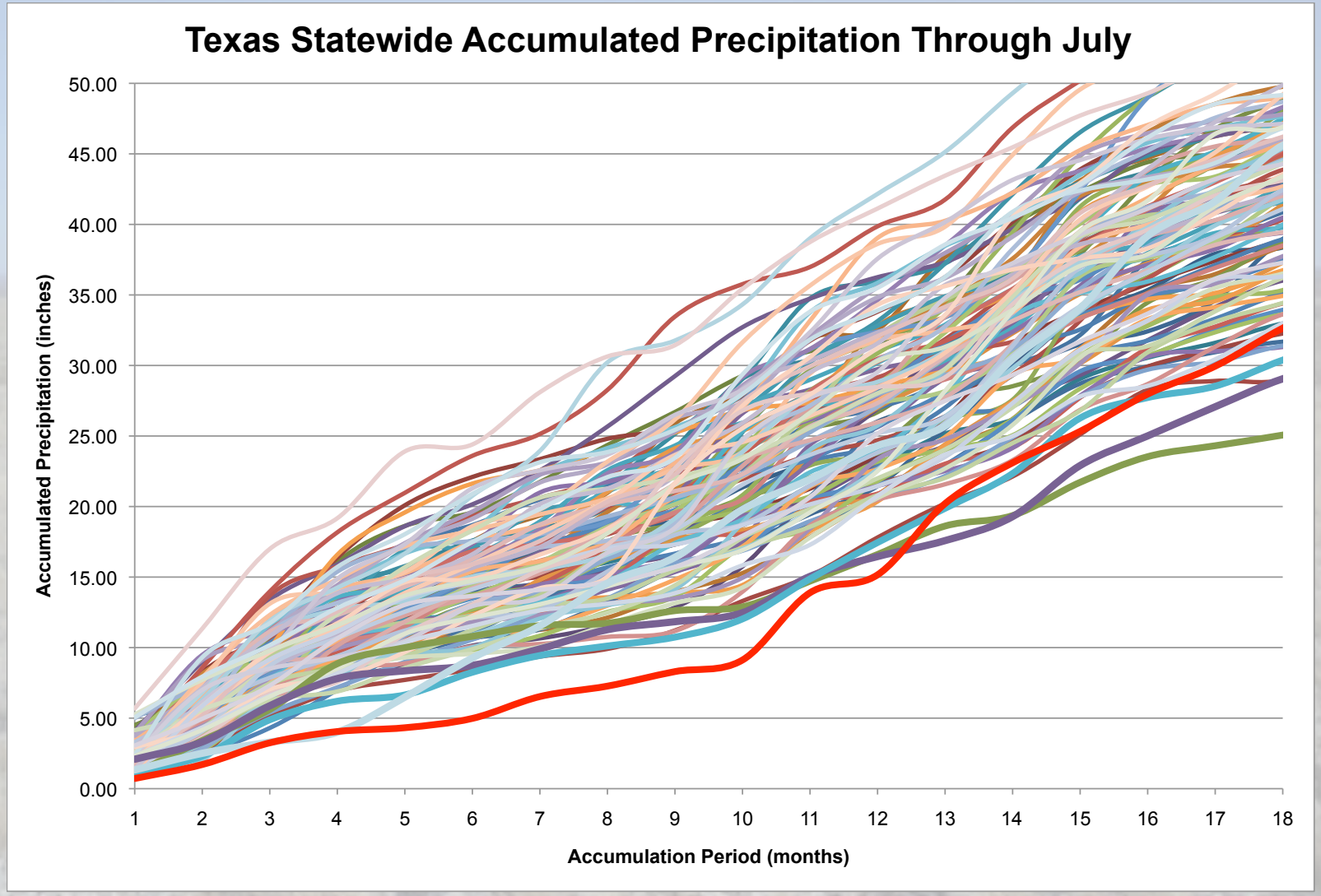
The Drought Monitor focuses on broad-scale conditions. Local conditions may vary. See accompanying text summary for forecast statements.

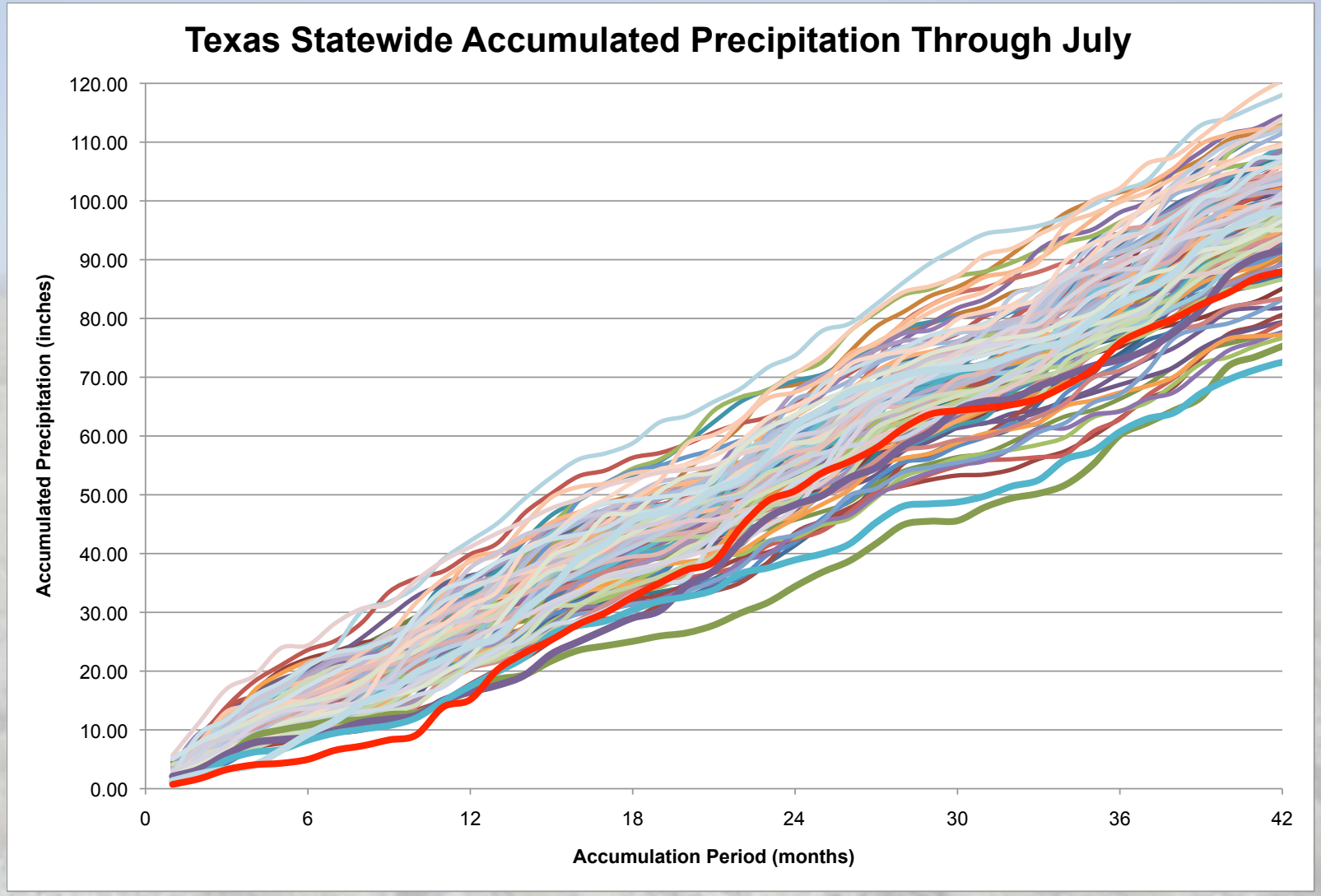
http://drought.unl.edu/dm

USDA National Drought Mitigation Center

Released Thursday, August 11, 2011

Author: Laura Edwards, Western Regional Climate Center

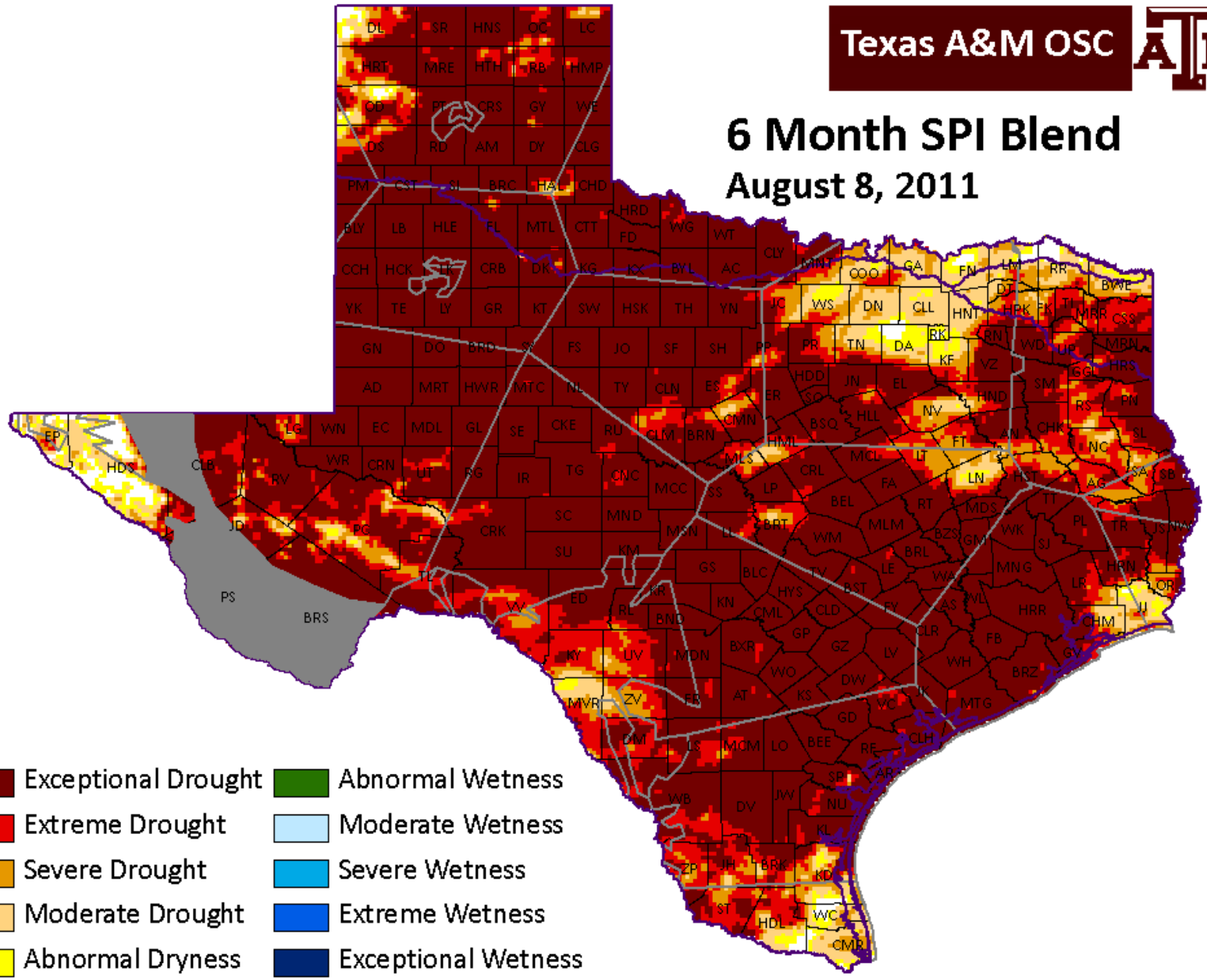

Texas Statewide Accumulated Precipitation Through July
Accumulated Precipitation (inches)
50.00
45.00
40.00
35.00
30.00
25.00
20.00
15.00
10.00
5.00
0.00
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
Accumulation Period (months)


Texas Statewide Accumulated Precipitation Through July
Accumulated Precipitation (inches)
120.00
110.00
100.00
90.00
80.00
70.00
60.00
50.00
40.00
30.00
20.00
10.00
0.00
0
6
12
18
24
30
36
42
Accumulation Period (months)

Texas A&M OSC

6 Month SPI Blend

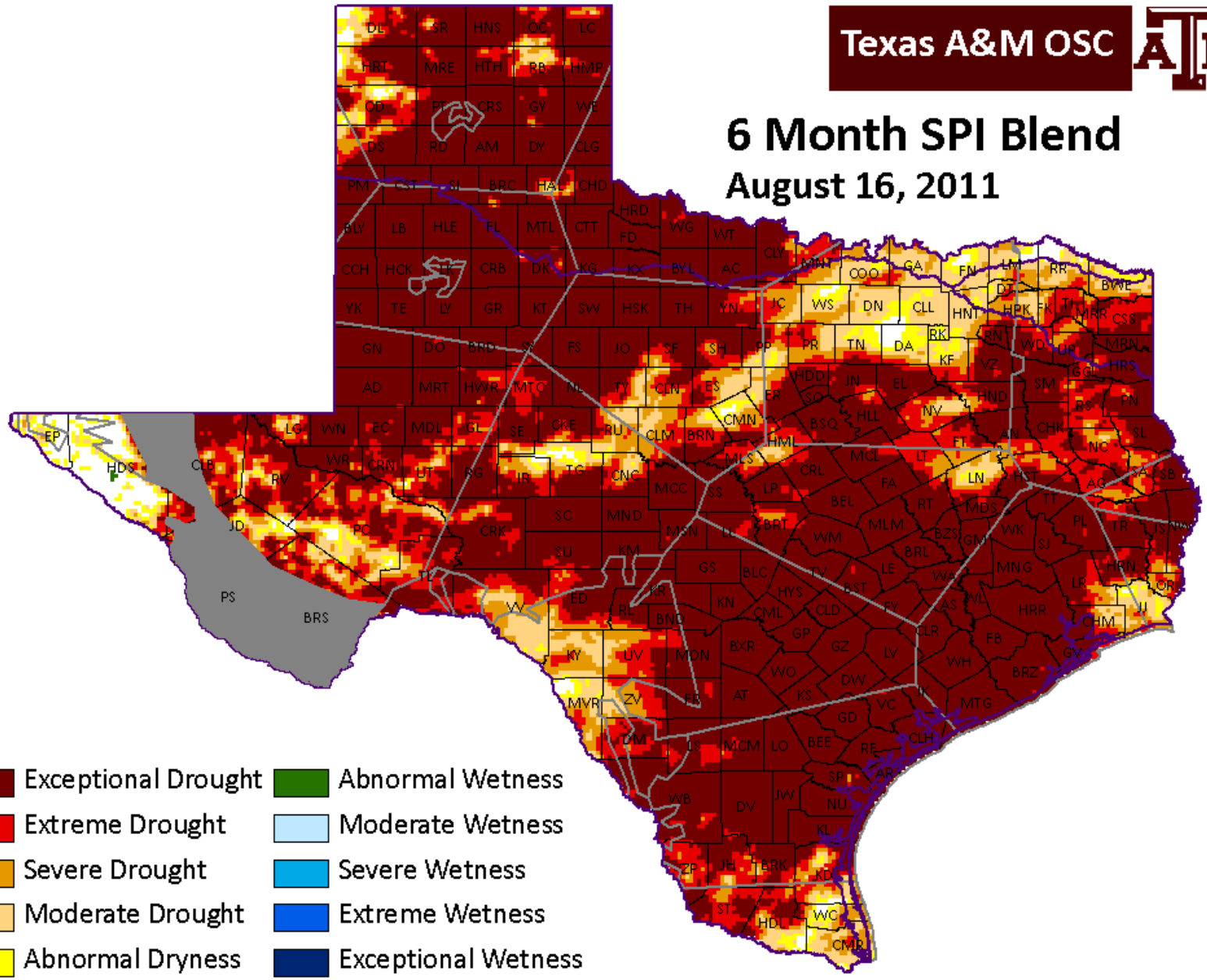
August 8, 2011

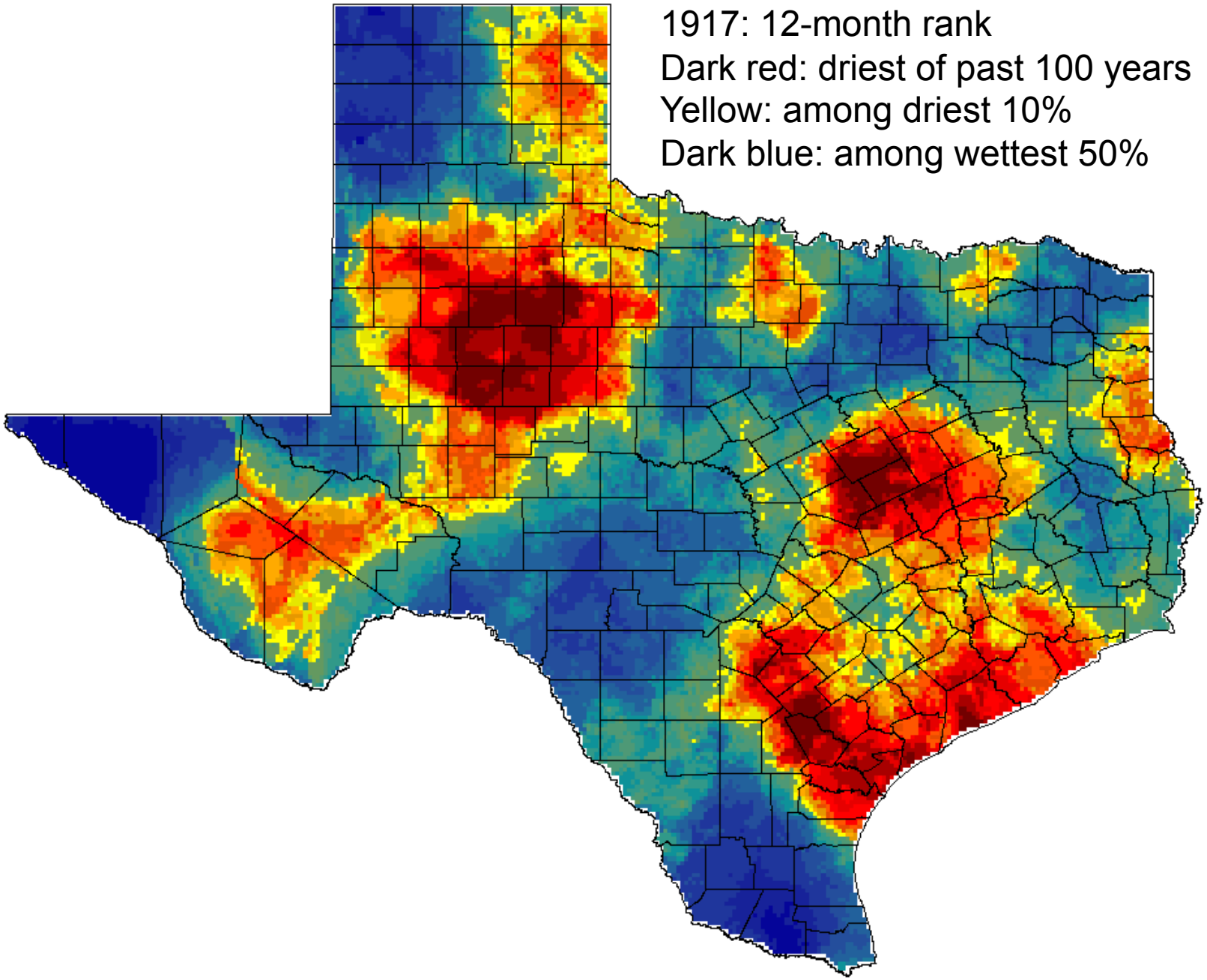


Texas A&M OSC

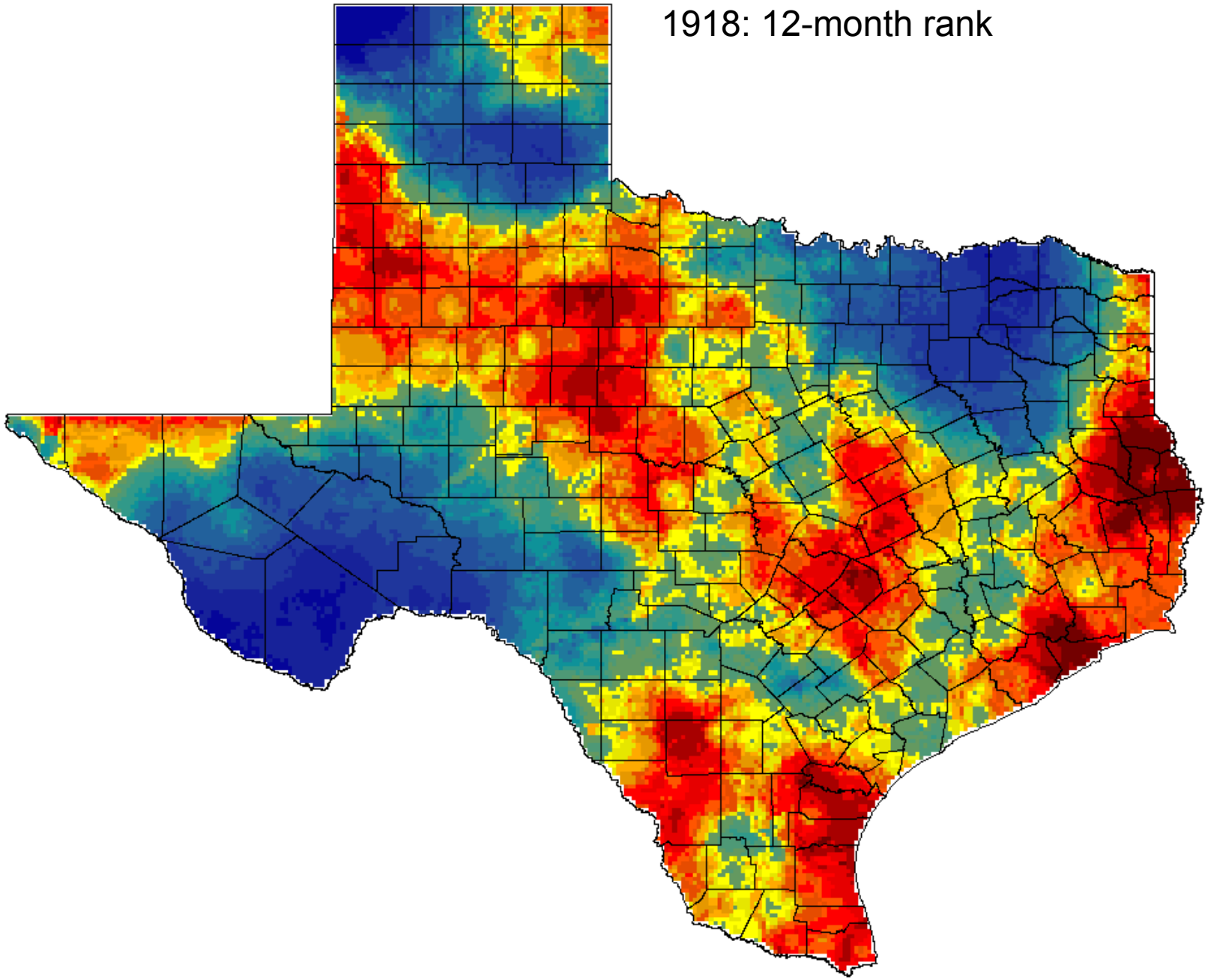
6 Month SPI Blend

August 16, 2011

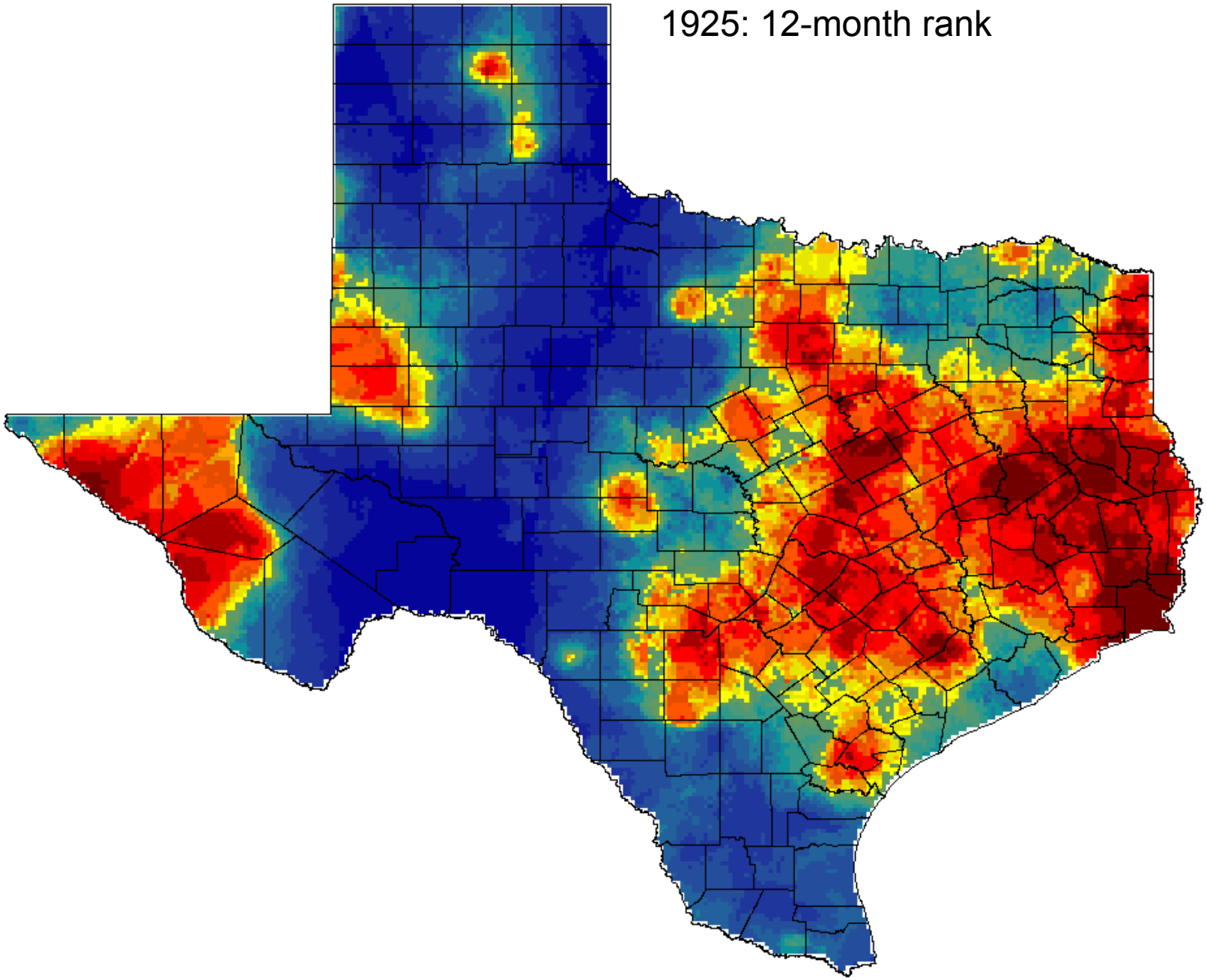



1917: 12-month rank
Dark red: driest of past 100 years
Yellow: among driest 10%
Dark blue: among wettest 50%

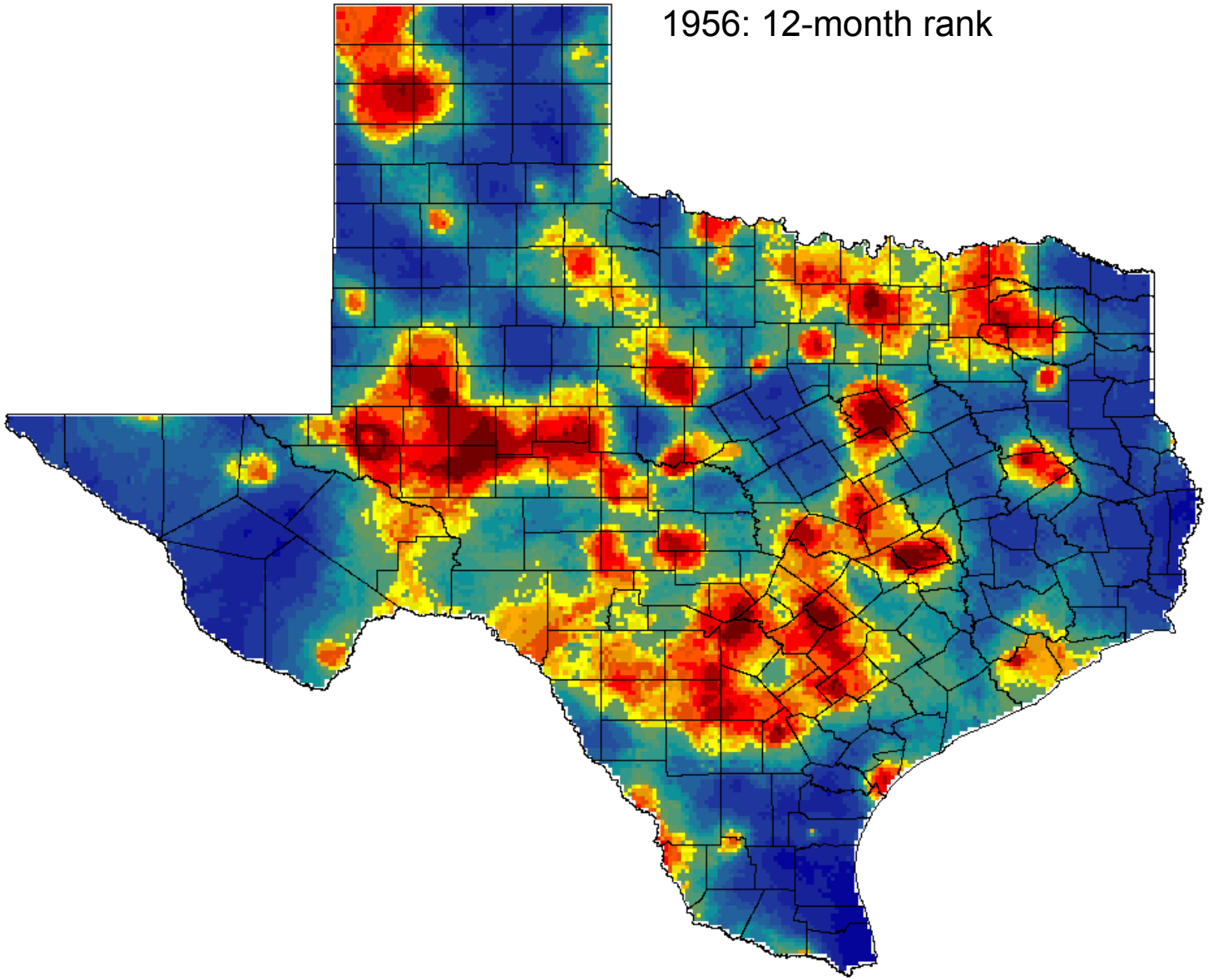
1918: 12-month rank

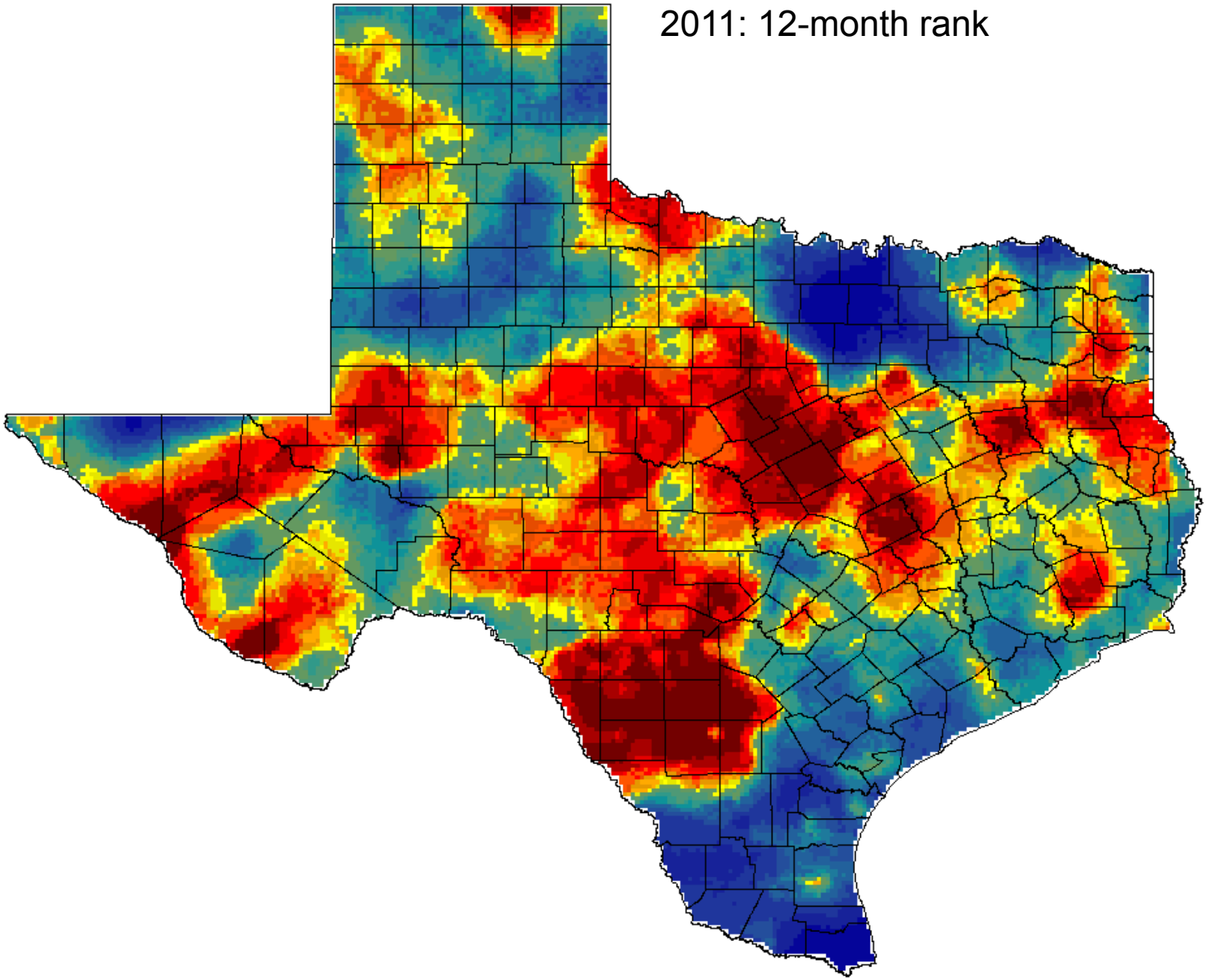


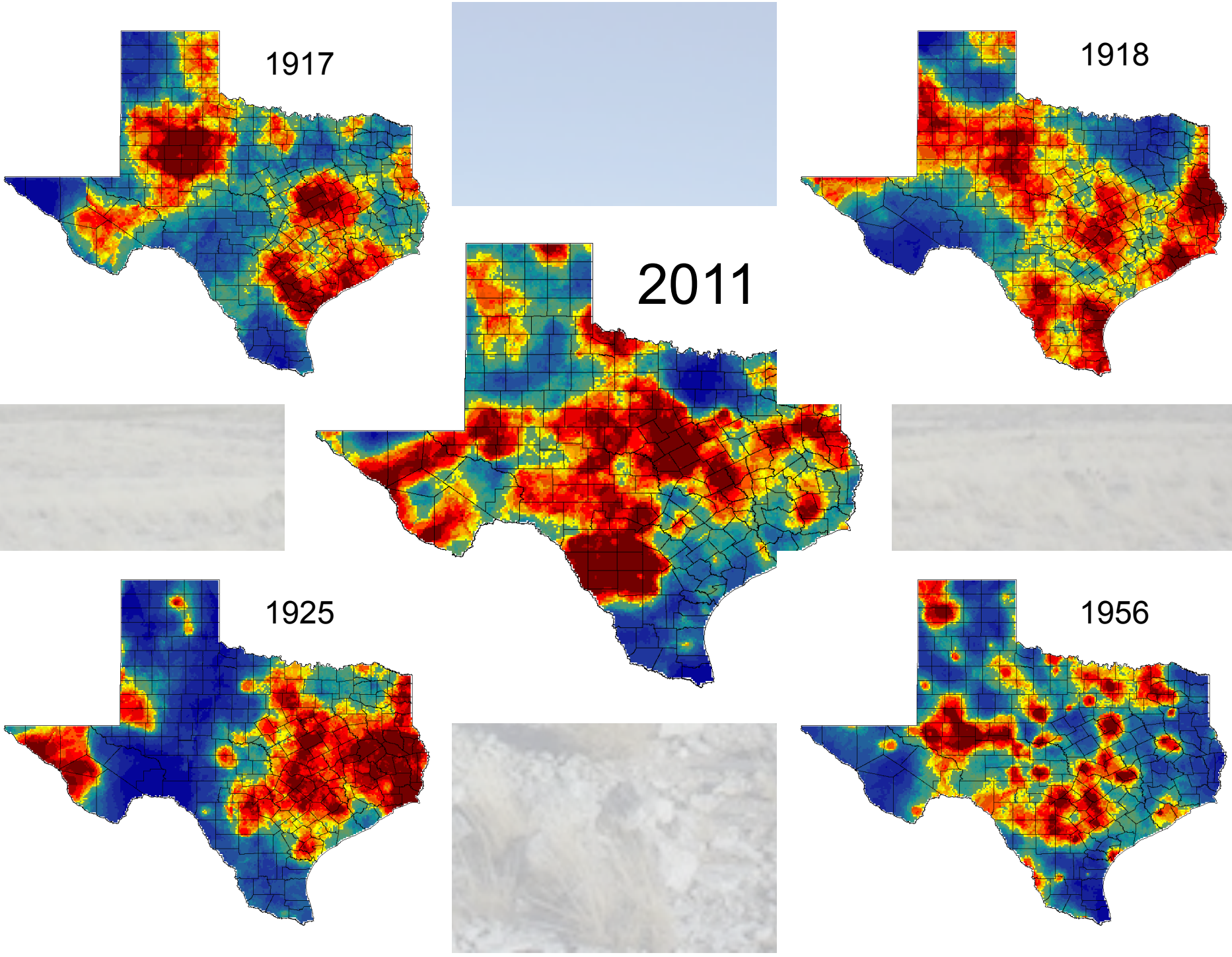
1925: 12-month rank

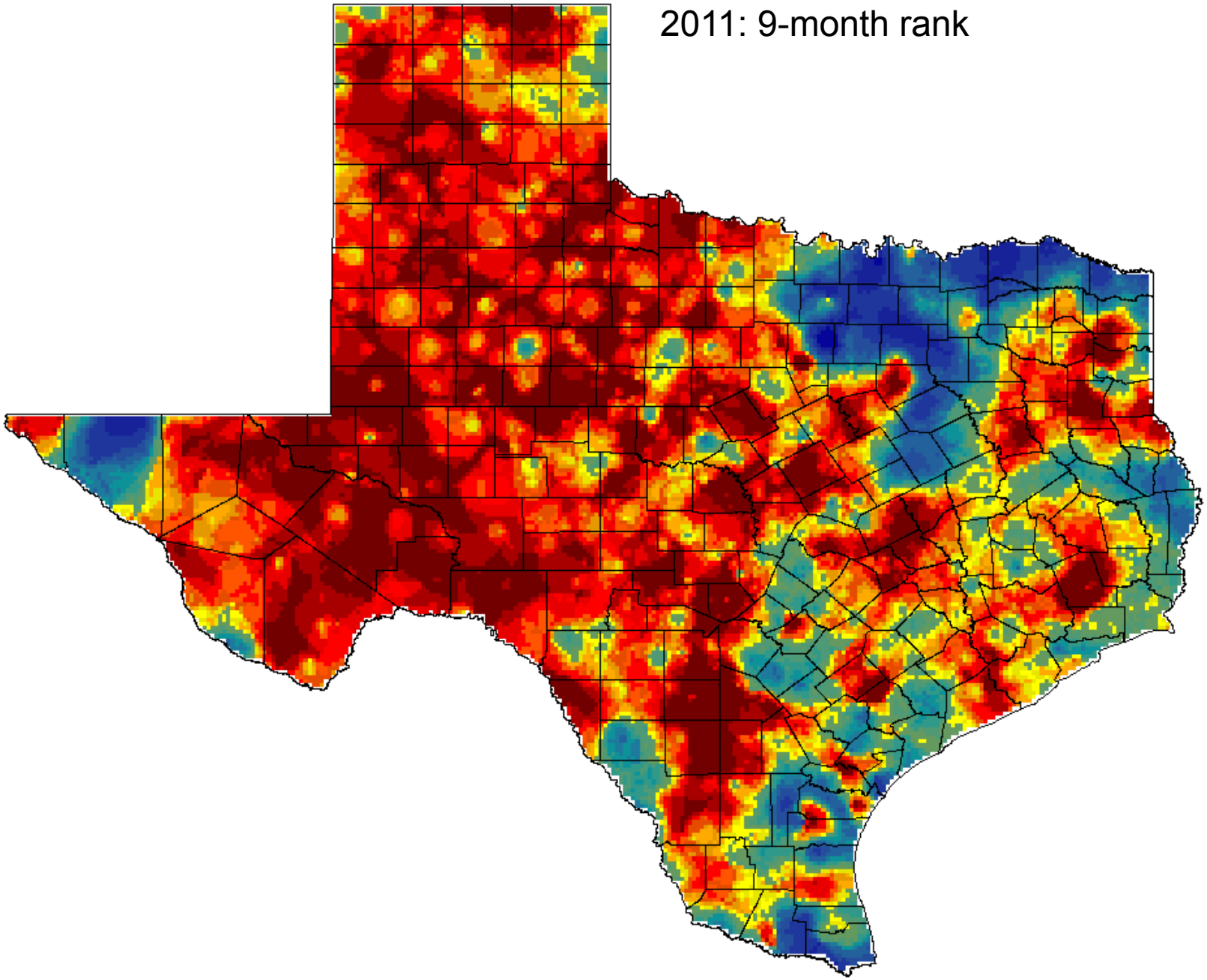


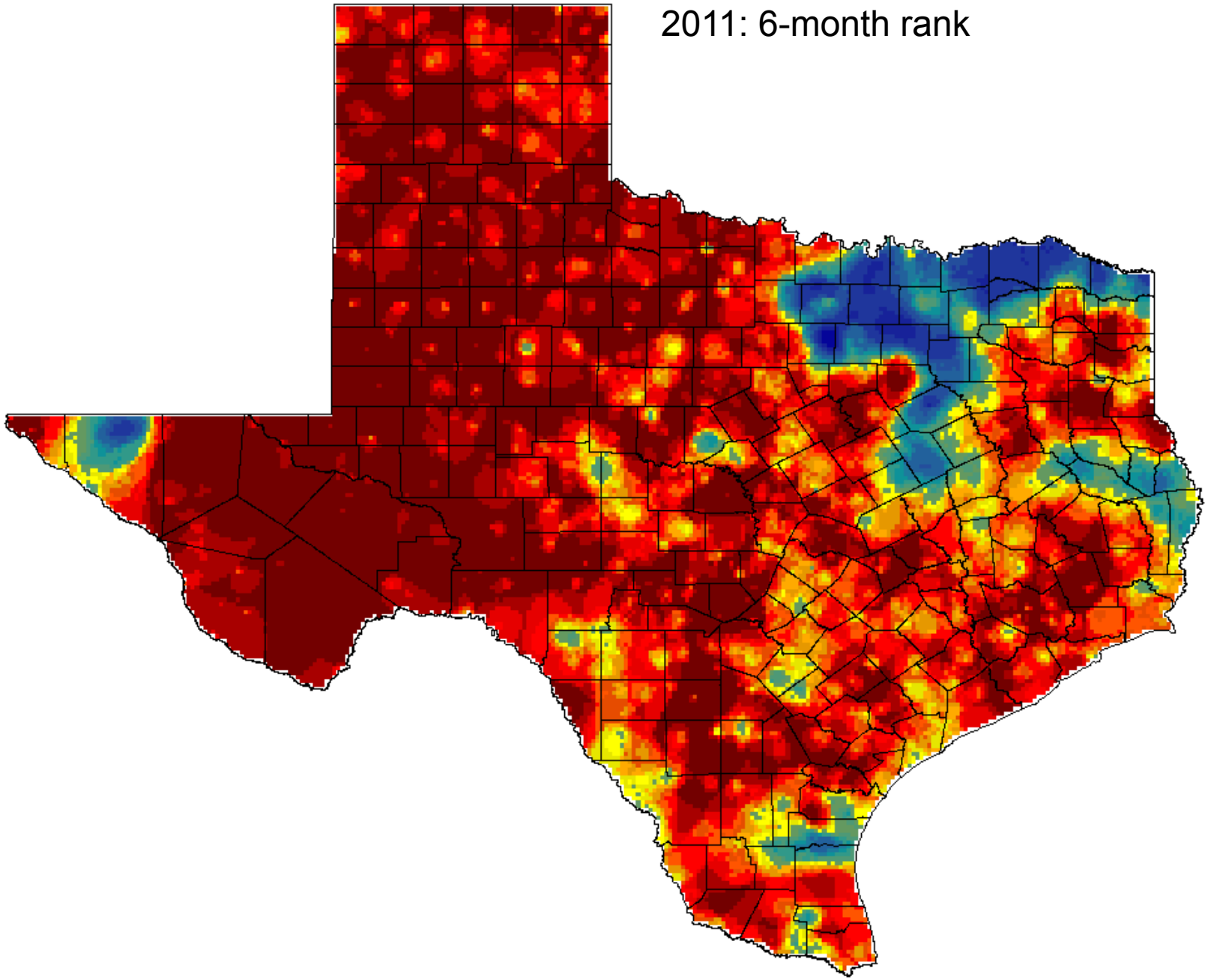
1956: 12-month rank




2011: 12-month rank

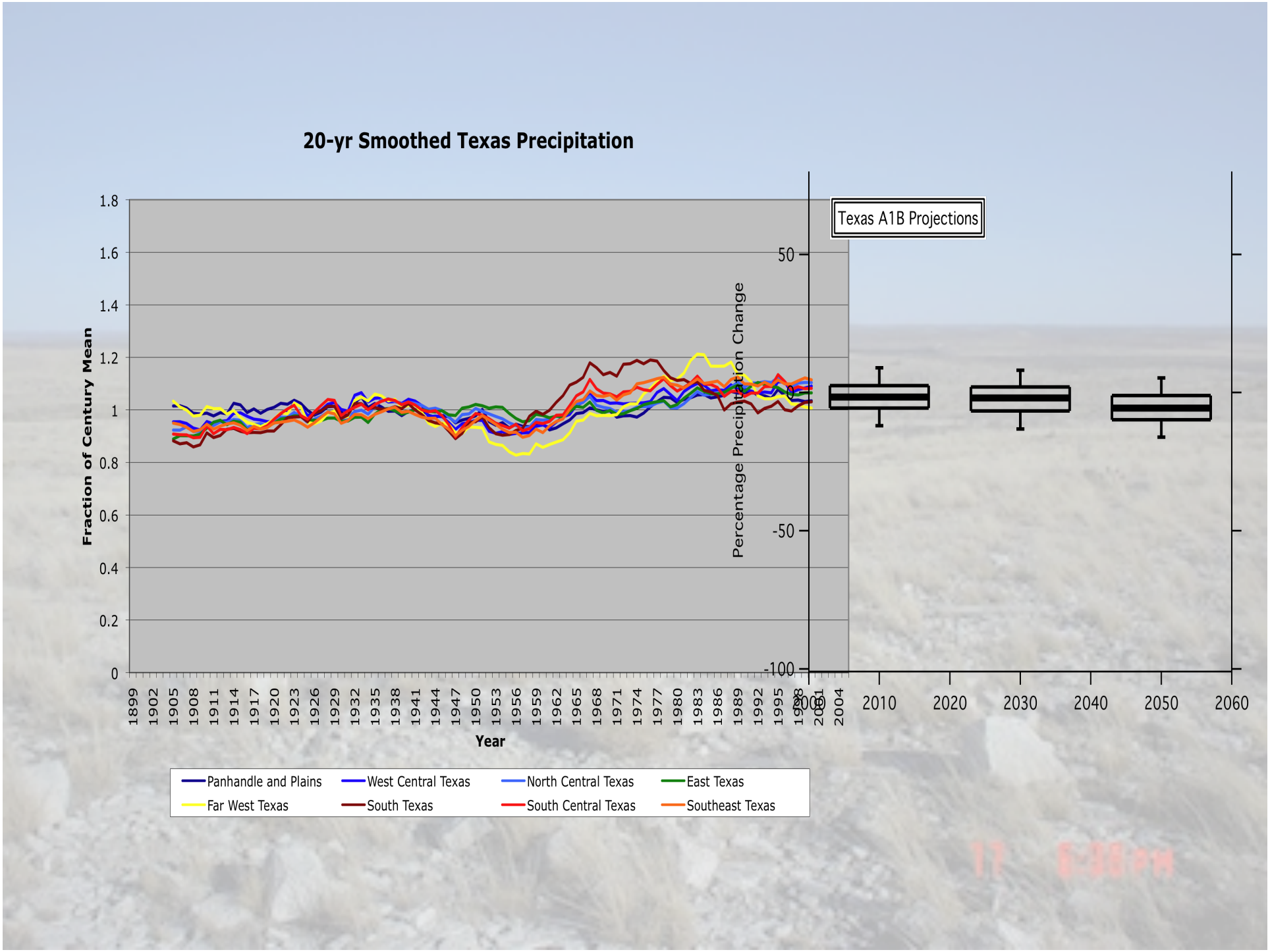

1917
1918
2011
1925
1956

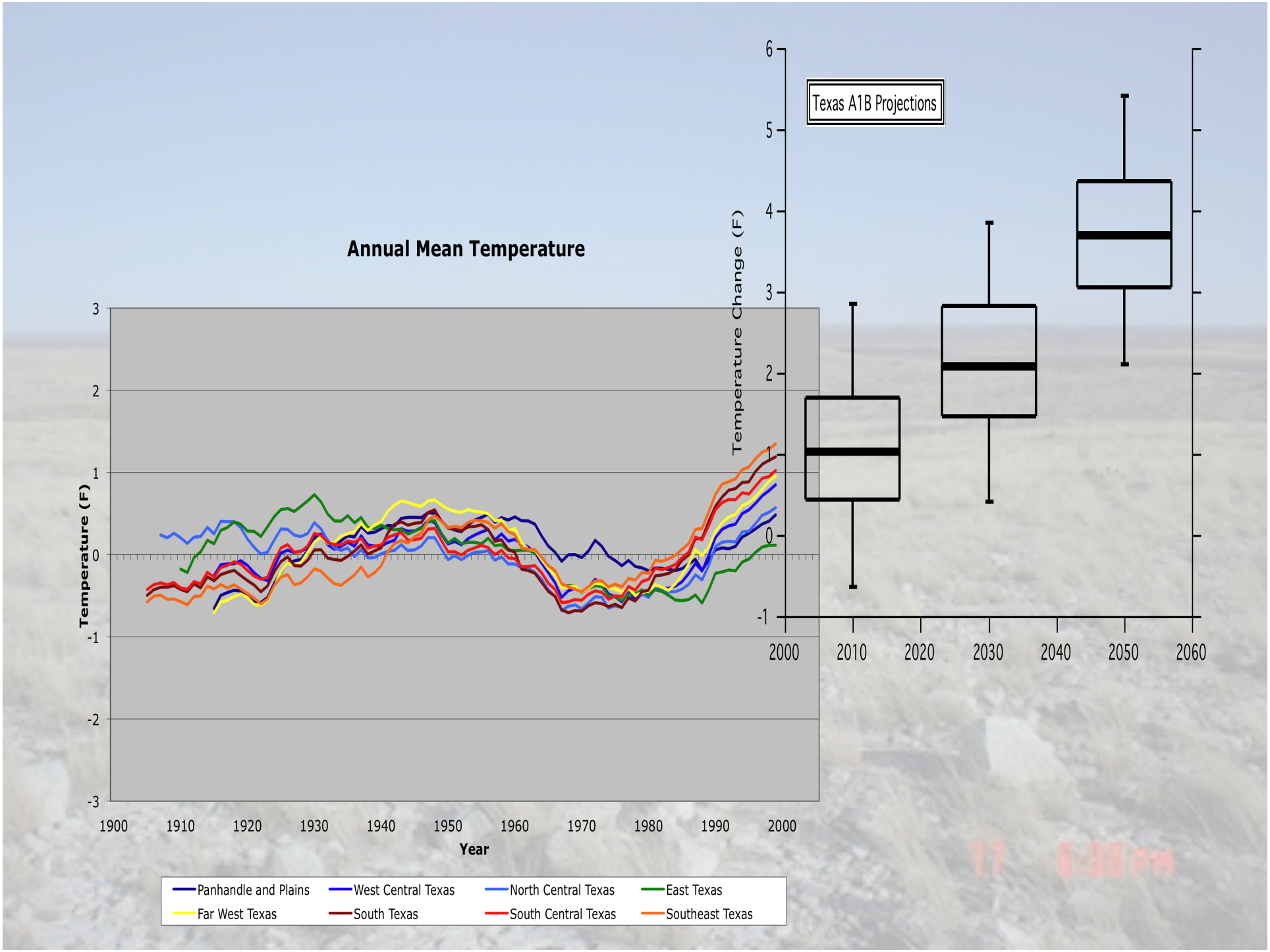

2011: 9-month rank


2011: 6-month rank

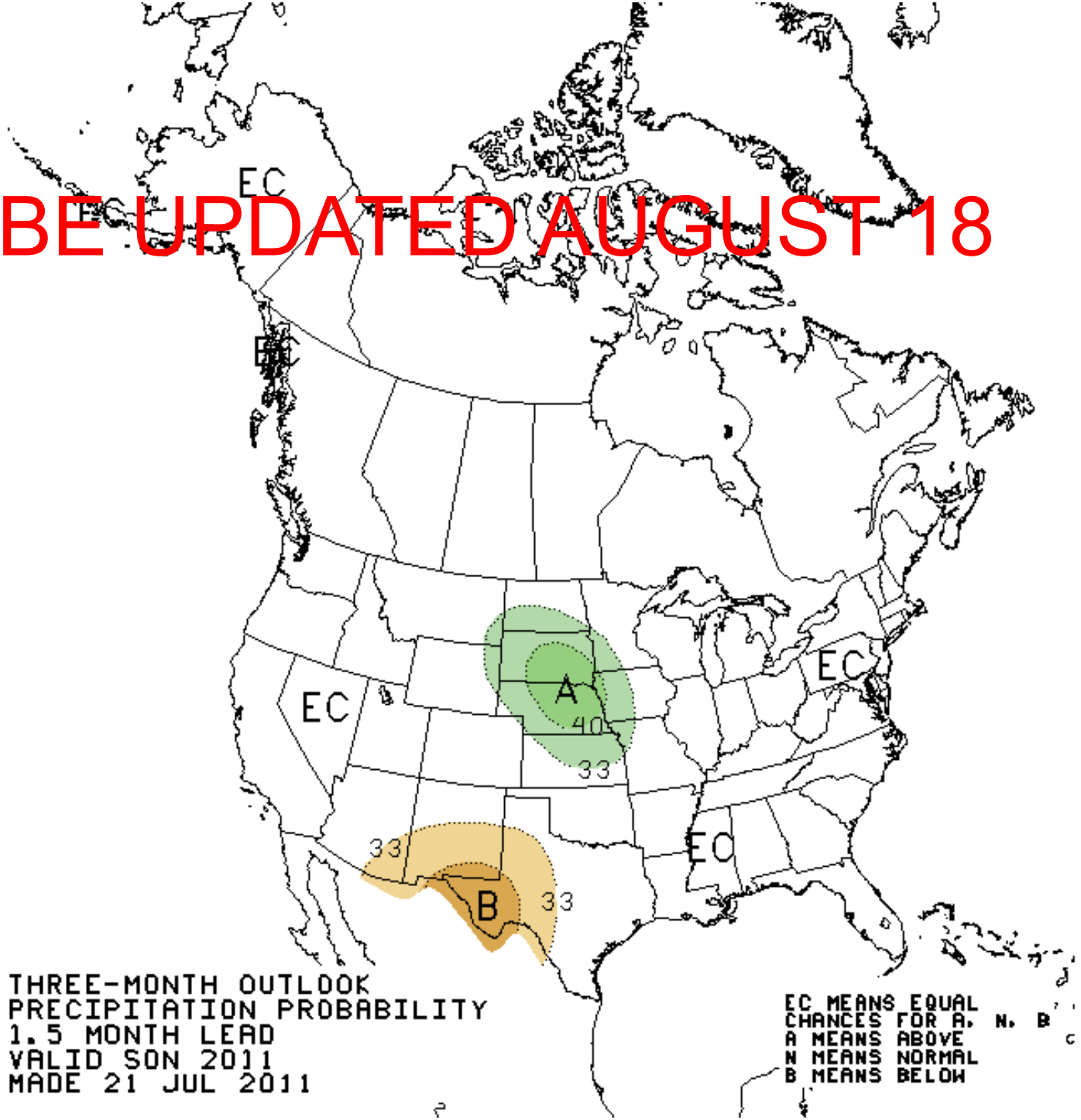
Drought Causes

- La Niña (trigger)
- Stable jet stream (bad luck)
- Soil moisture feedback and high desert air
- Climate change (1-2 °F add-on)


20-yr Smoothed Texas Precipitation
Fraction of Century Mean
1.8
1.6
1.4
1.2
1
0.8
0.6
0.4
0.2
0
1899
1902
1905
1908
1911
1914
1917
1920
1923
1926
1929
1932
1935
1938
1941
1944
1947
1950
1953
1956
1959
1962
1965
1968
1971
1974
1977
1980
1983
1986
1989
1992
1995
1998
2001
2004
Year
Texas A1B Projections
Percentage Precipitation Change
50
0
-50
-100
2010
2020
2030
2040
2050
2060
Panhandle and Plains
West Central Texas
North Central Texas
East Texas
Far West Texas
South Texas
South Central Texas
Southeast Texas


Annual Mean Temperature
Temperature (F)
3
2
1
0
-1
-2
-3
1900
1910
1920
1930
1940
1950
1960
1970
1980
1990
2000
Year
Panhandle and Plains
West Central Texas
North Central Texas
East Texas
Far West Texas
South Texas
South Central Texas
Southeast Texas
Texas A1B Projections
Temperature Change (F)
6
5
4
3
2
1
0
-1
2000
2010
2020
2030
2040
2050
2060

TO BE UPDATED AUGUST 18



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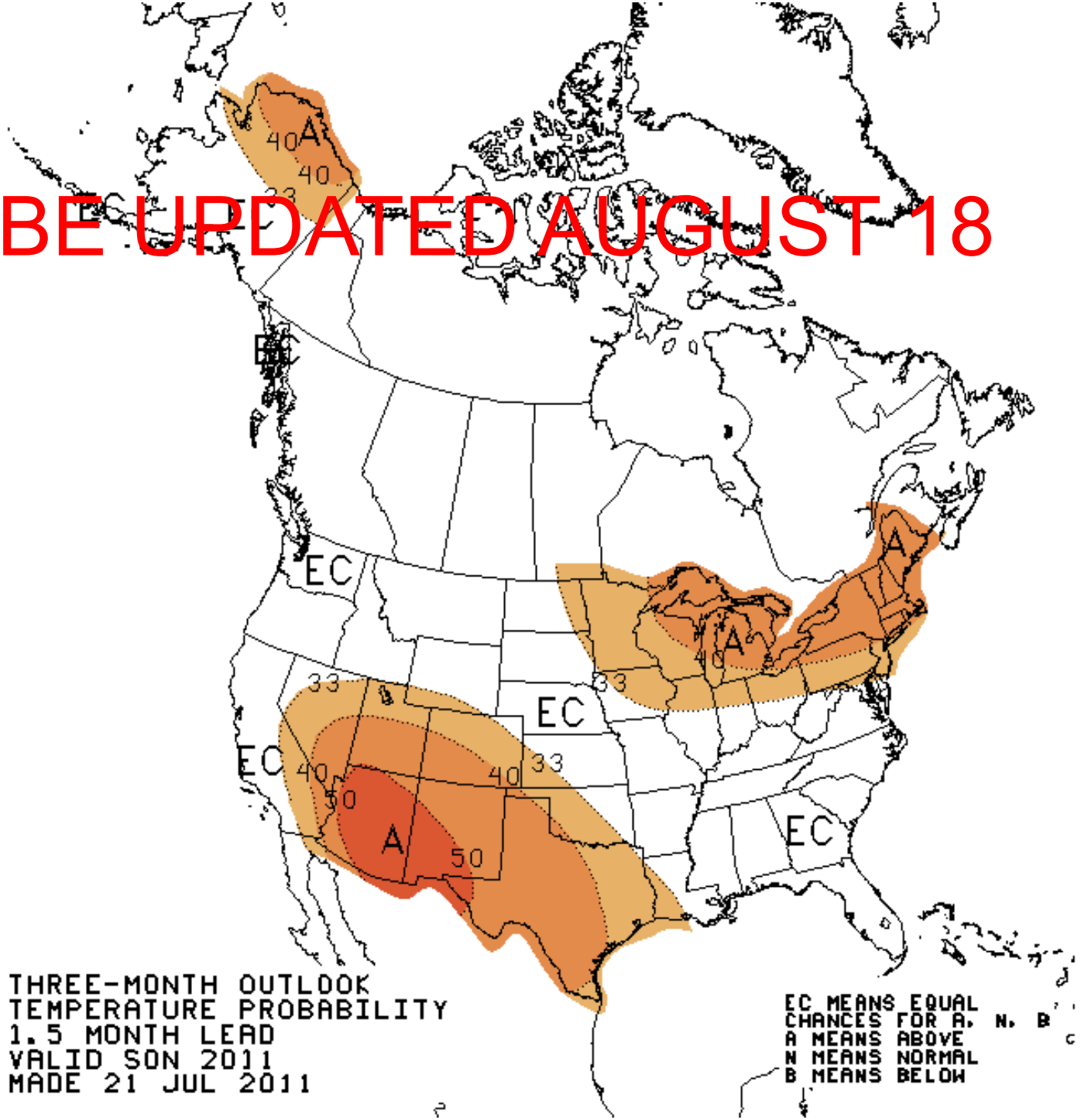

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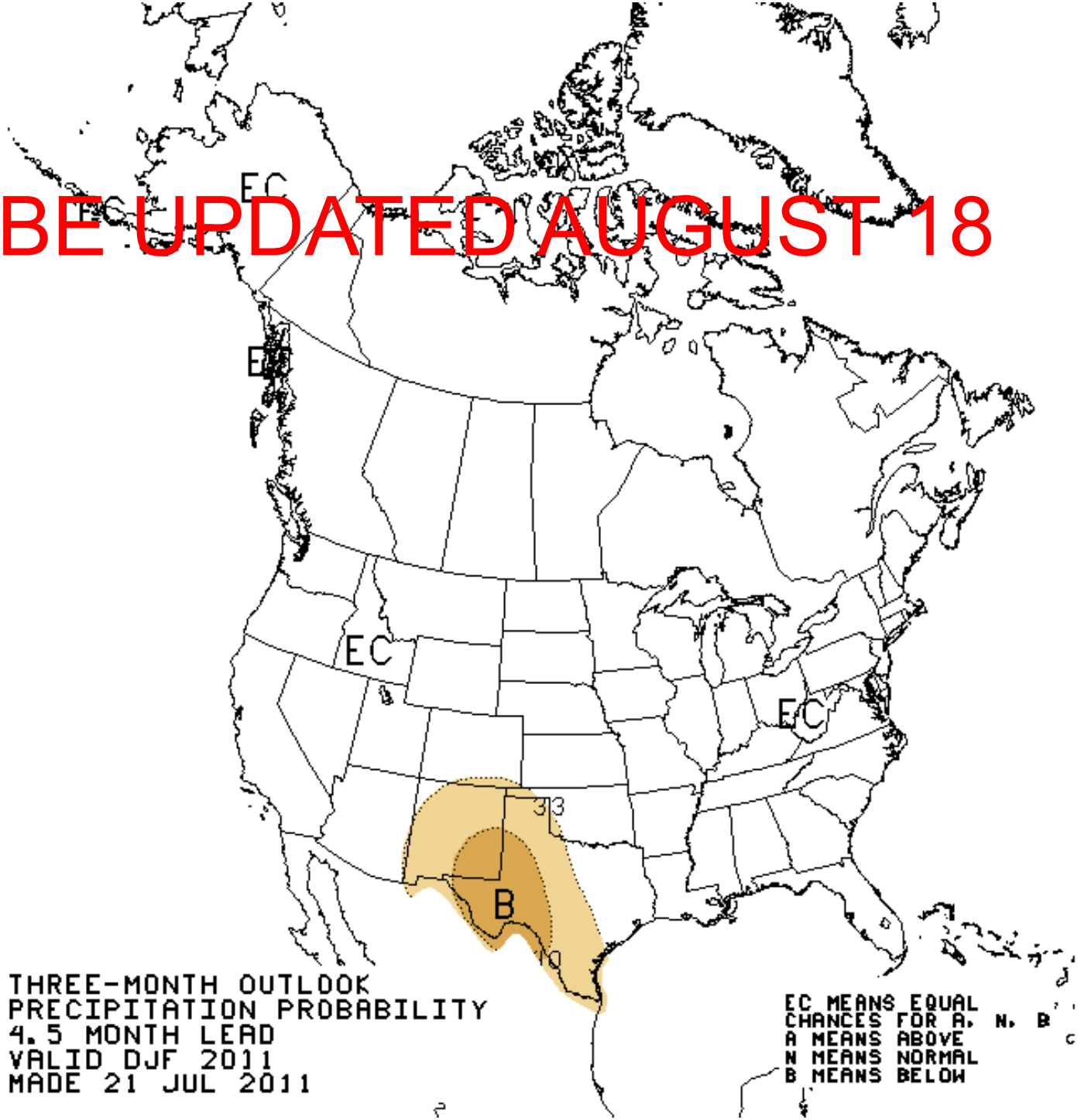

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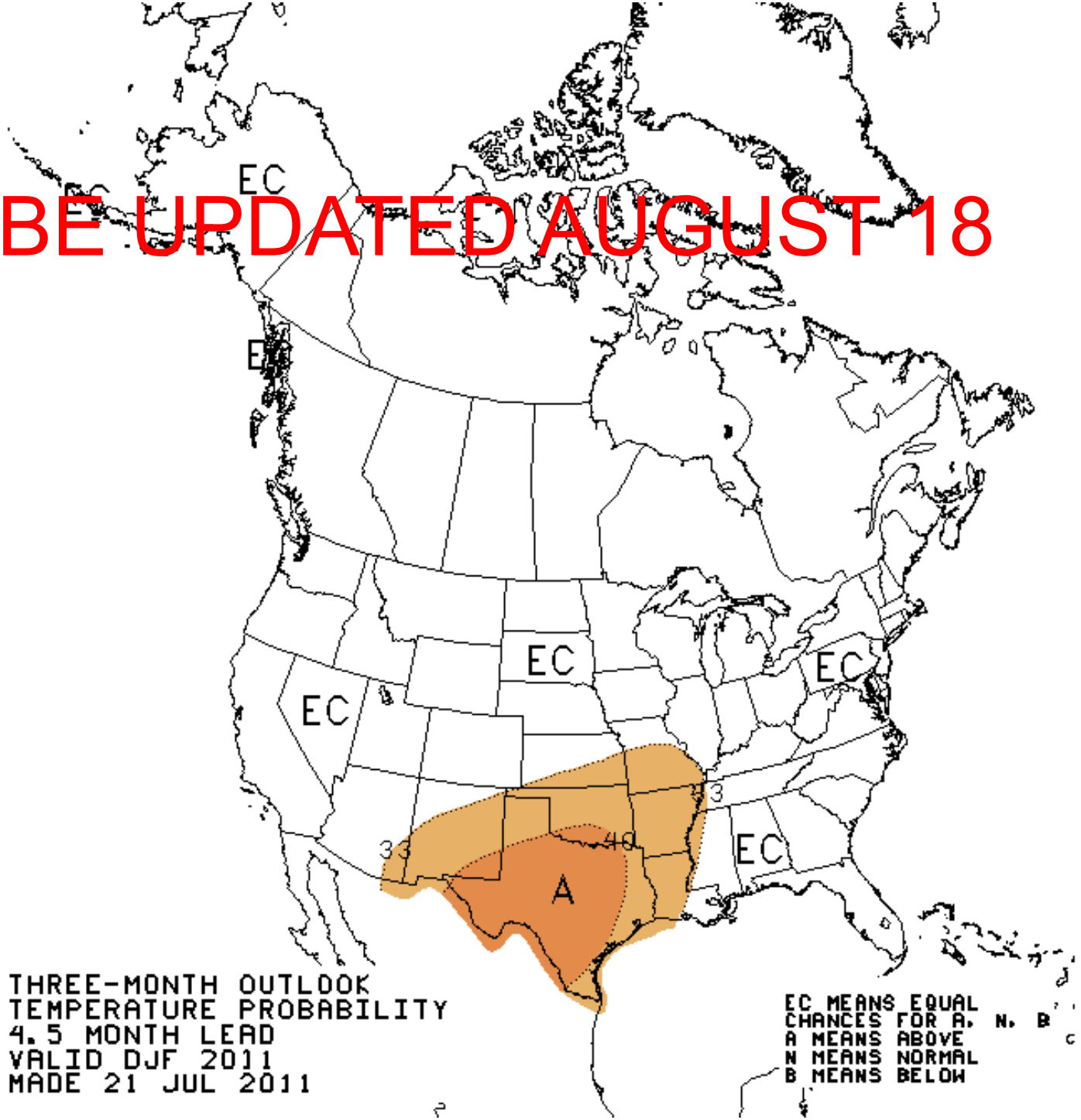
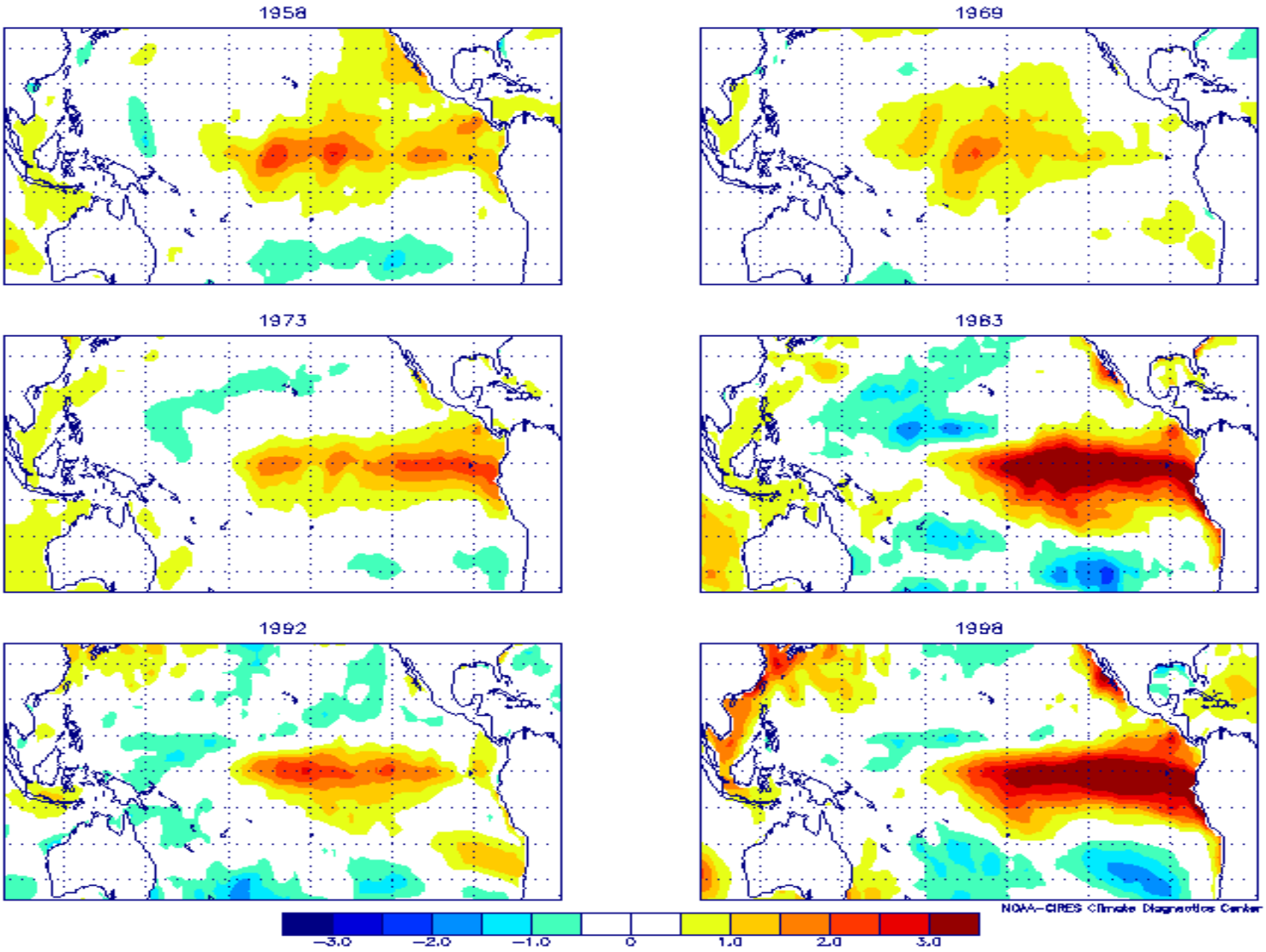
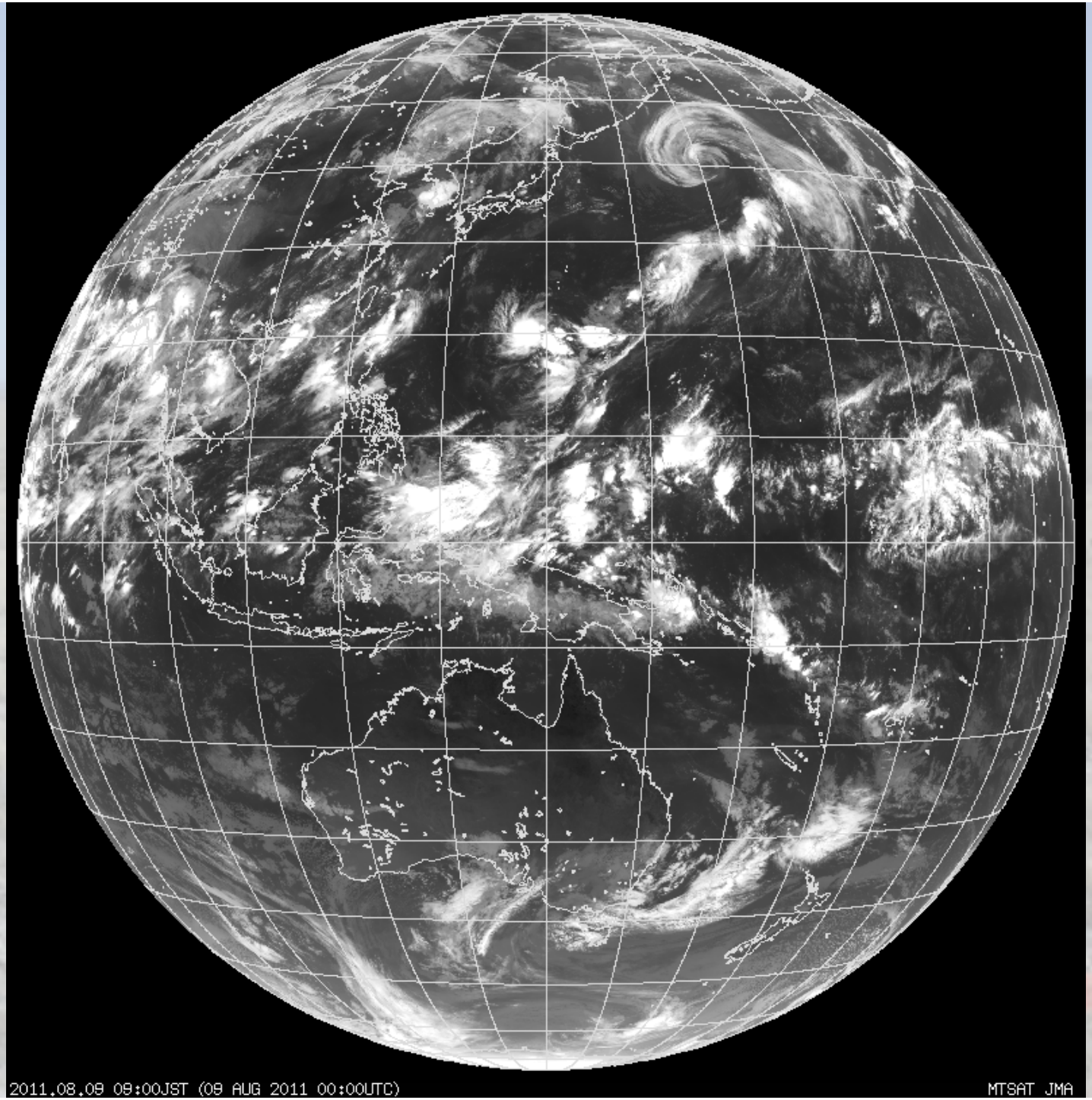


Immediate Drought Outlook

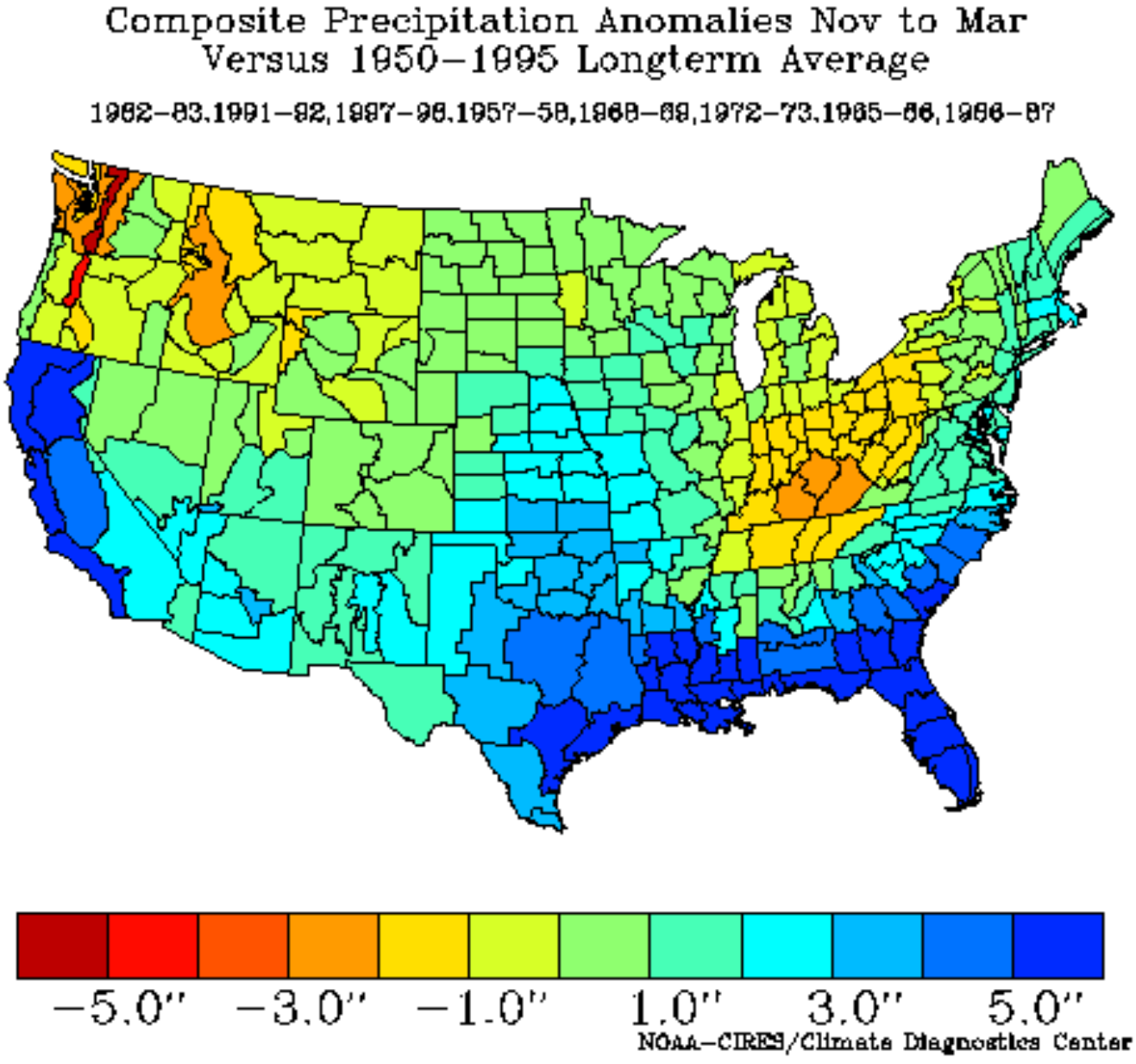
- Short-term relief or flooding *possible* from:
  - Approaching cold fronts
  - Tropical disturbances
- Rest of fall and winter: will La Niña return?
- Many parts of the state: continued drought through summer 2011

Sea Surface Temperature Anomalies: El Nino Years



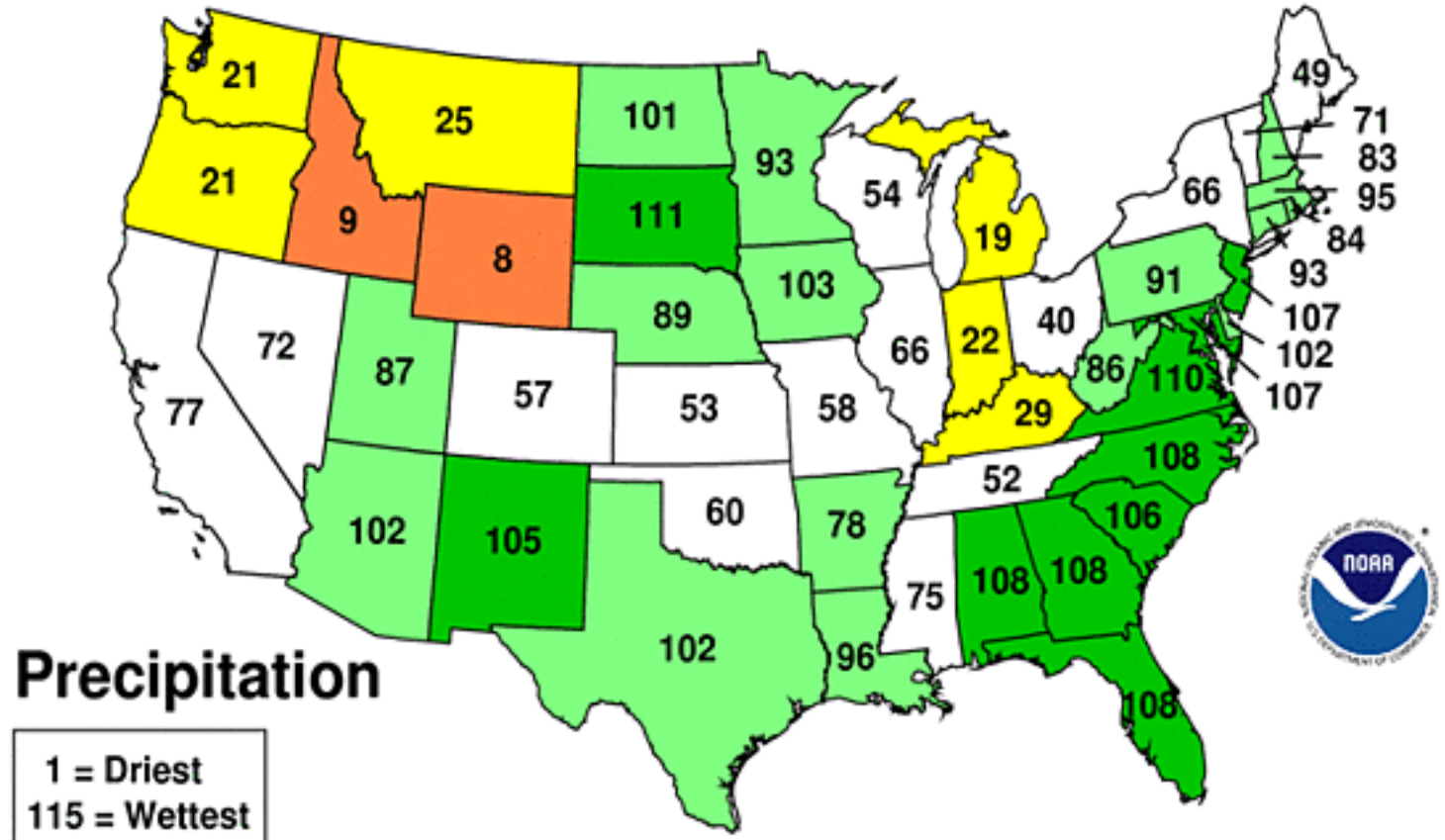

2011.08.09 09:00JST (09 AUG 2011 00:00UTC)
MTSAT JMA

El Nino Cool-Season Precipitation



Dec 2009-Feb 2010 Statewide Ranks

National Climatic Data Center/NESDIS/NOAA

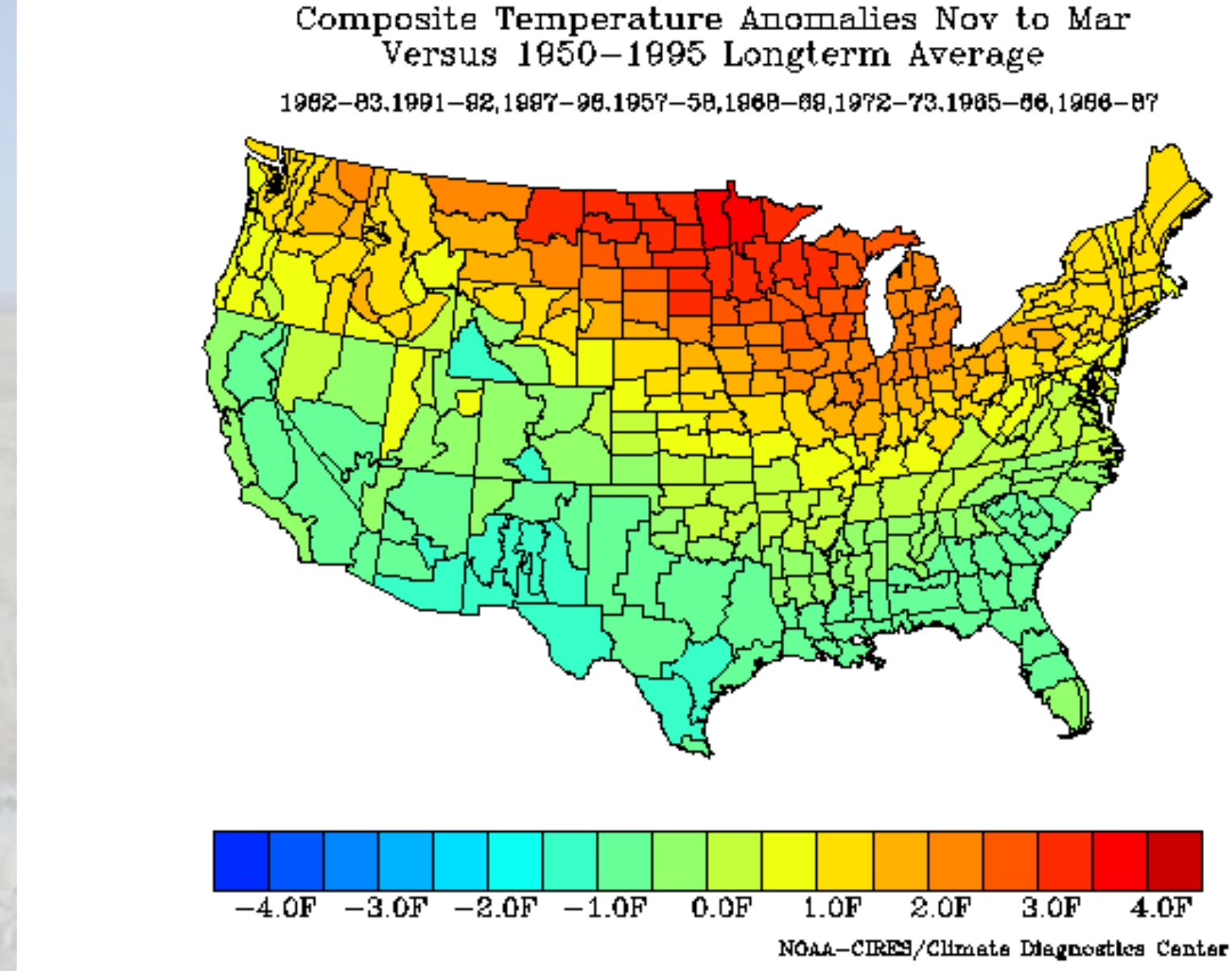


Precipitation

1 = Driest
115 = Wettest

Record Driest	Much Below Normal	Below Normal	Near Normal	Above Normal	Much Above Normal	Record Wettest

El Nino Cool-Season Temperature



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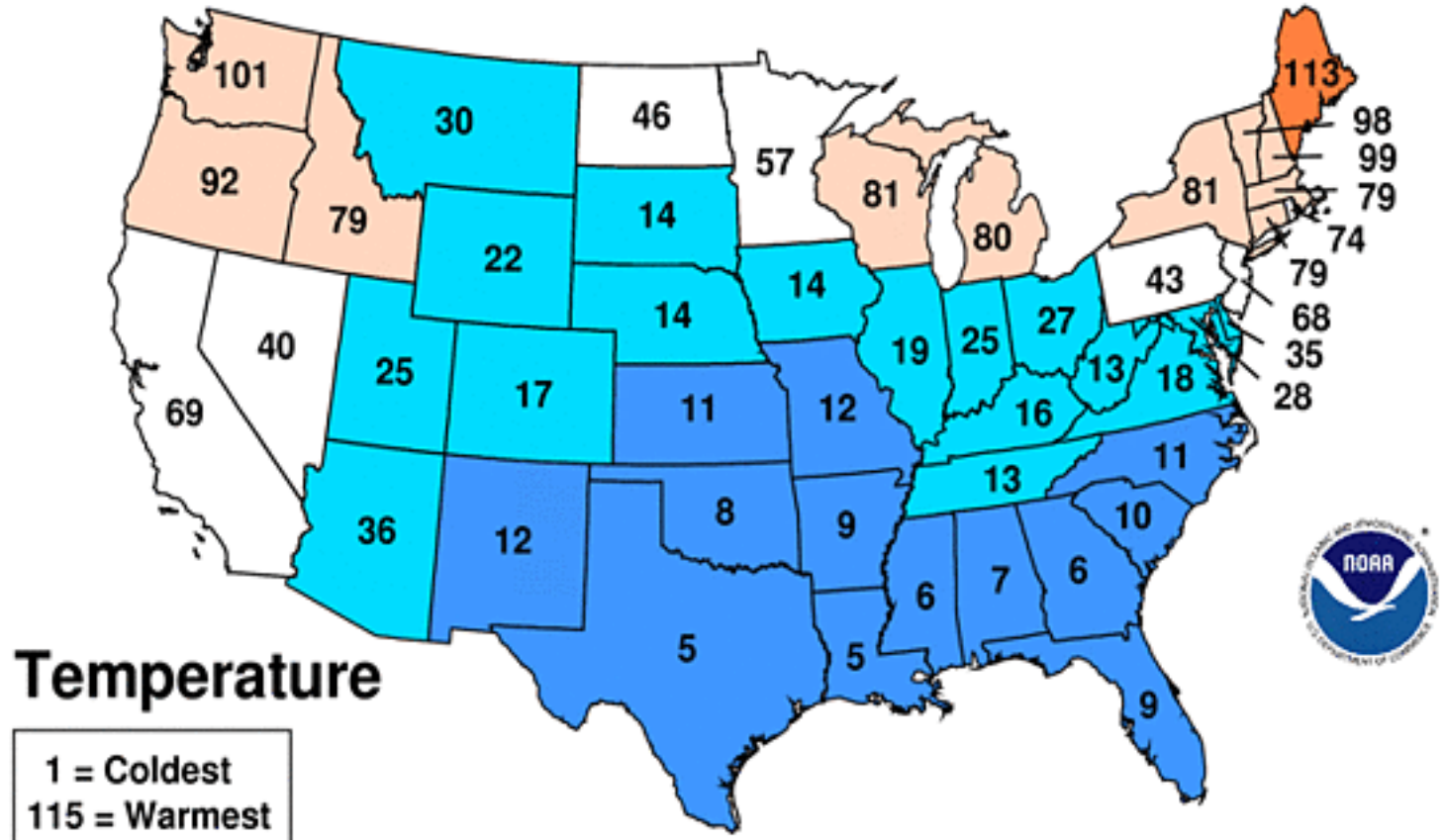
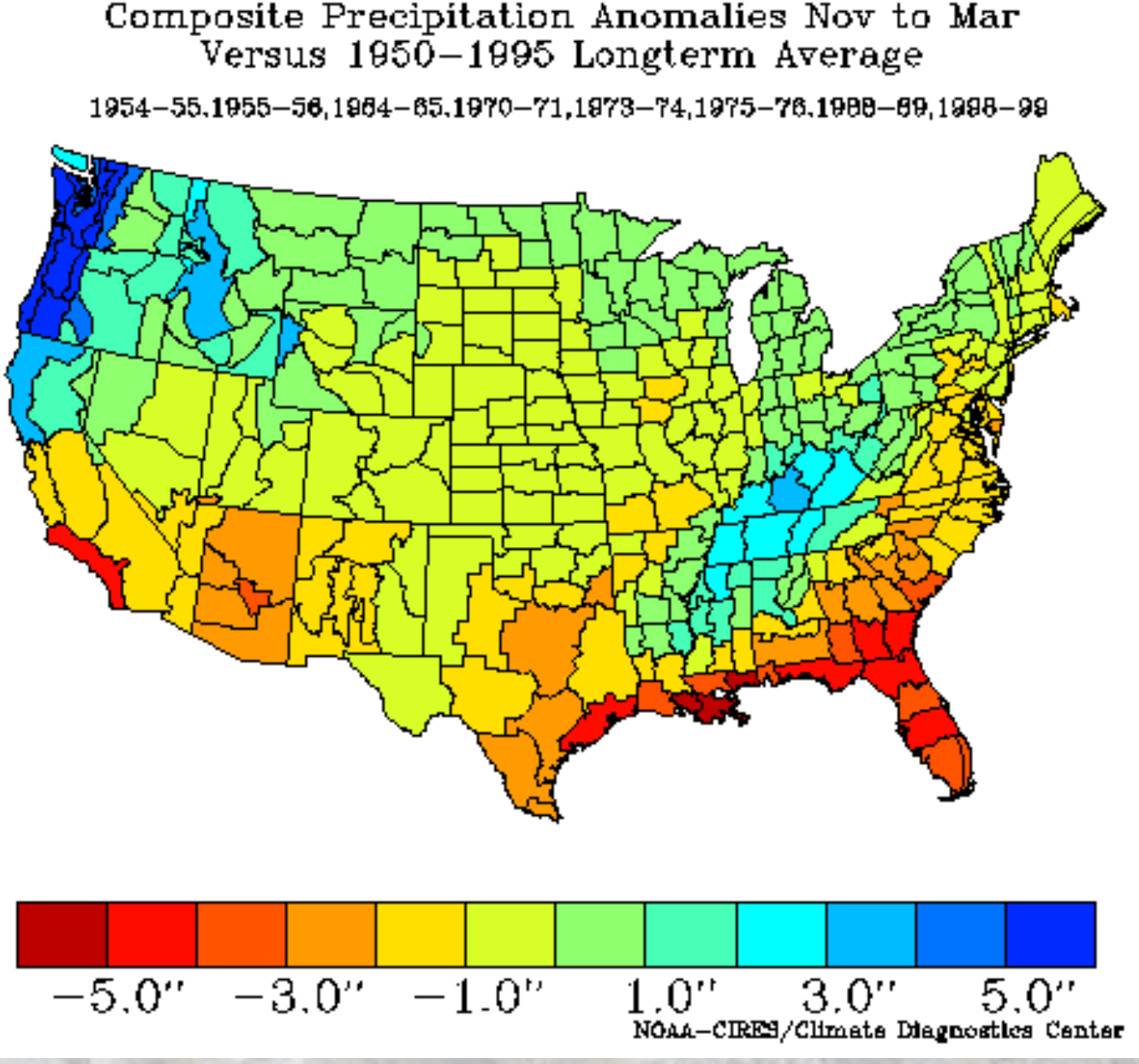


Temperature

1 = Coldest
115 = Warmest

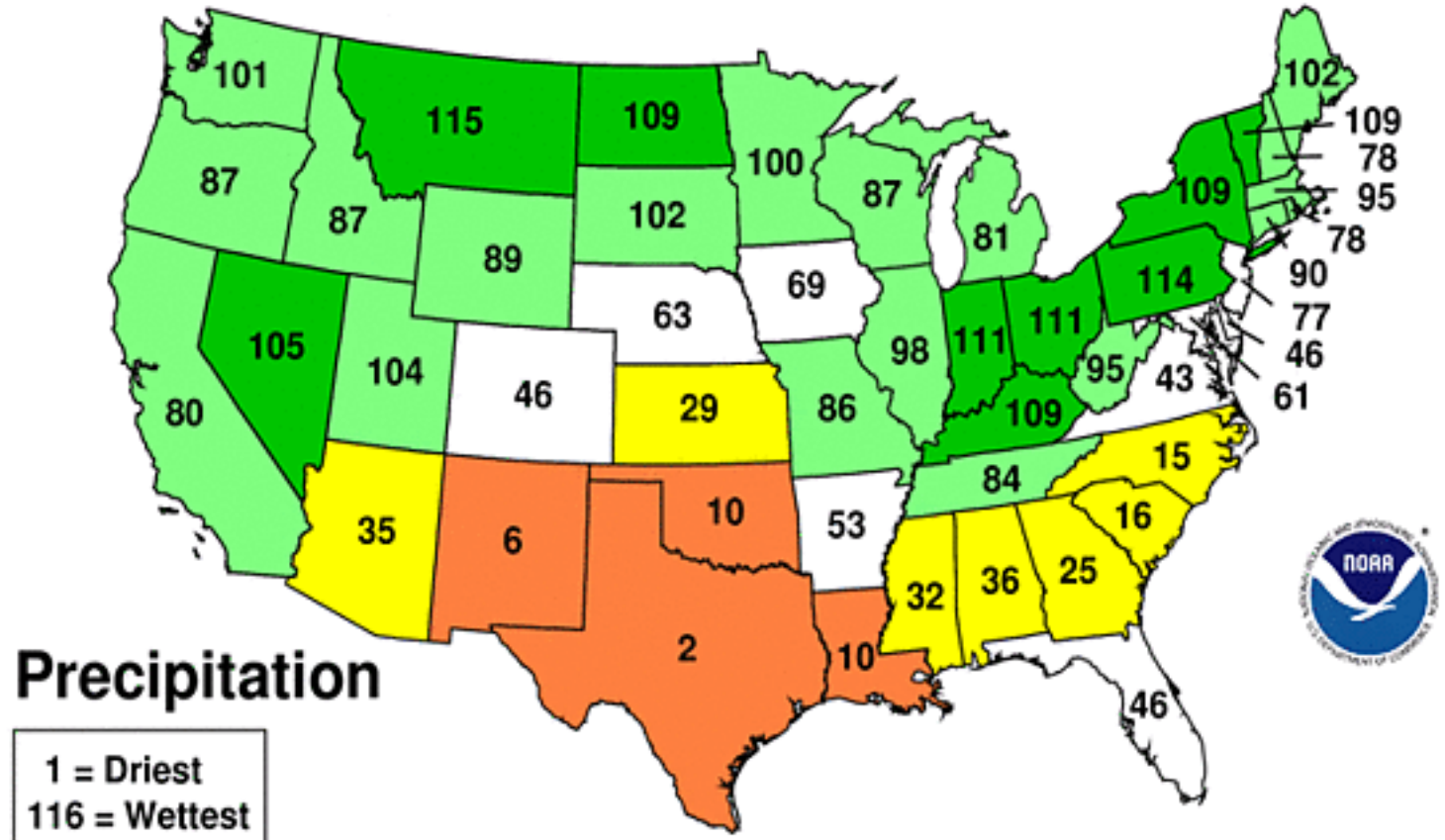
Record Coldest	Much Below Normal	Below Normal	Near Normal	Above Normal	Much Above Normal	Record Warmest

La Nina Cool-Season Precipitation



Nov 2010-Apr 2011 Statewide Ranks

National Climatic Data Center/NESDIS/NOAA

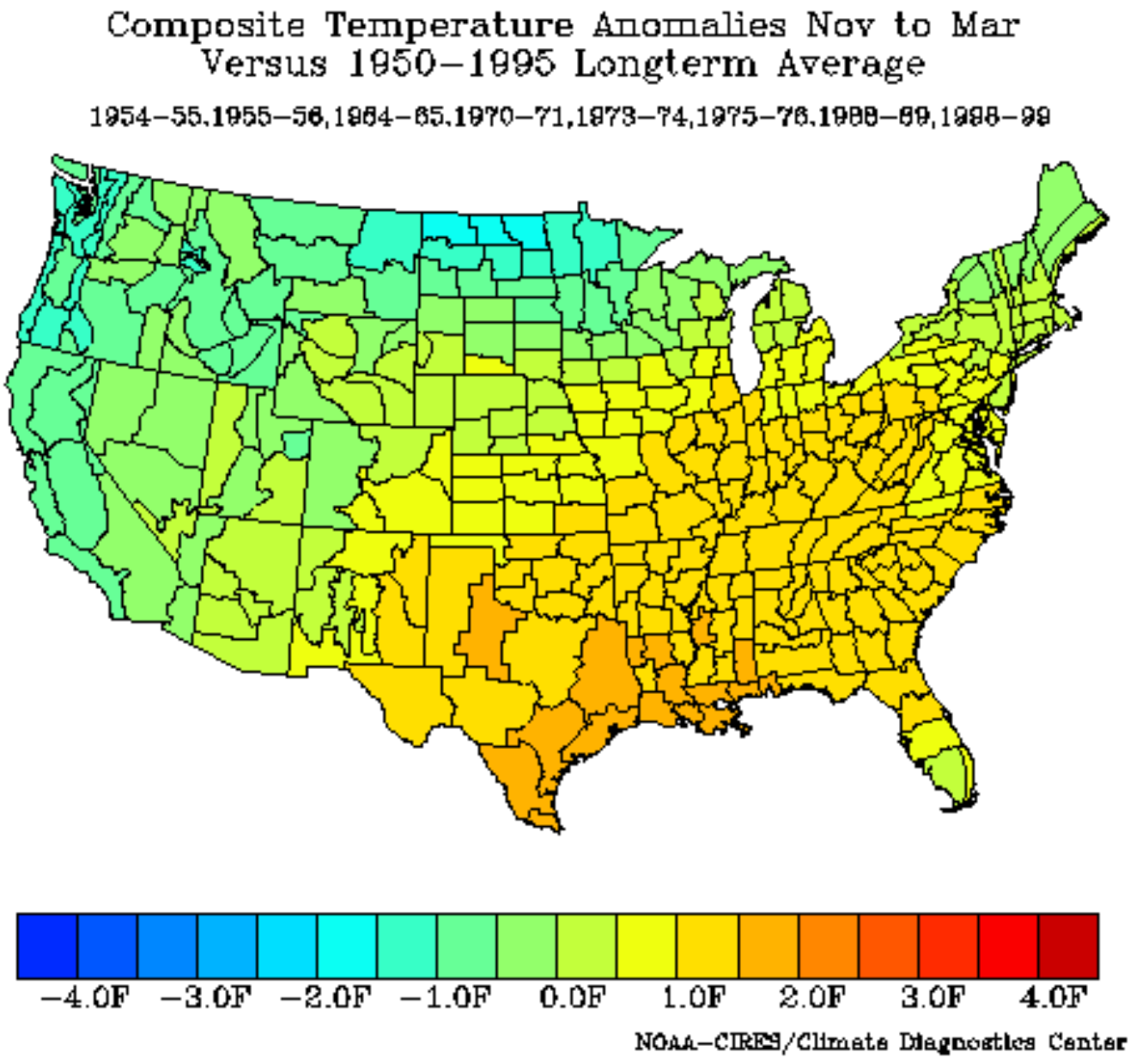


Precipitation

1 = Driest
116 = Wettest

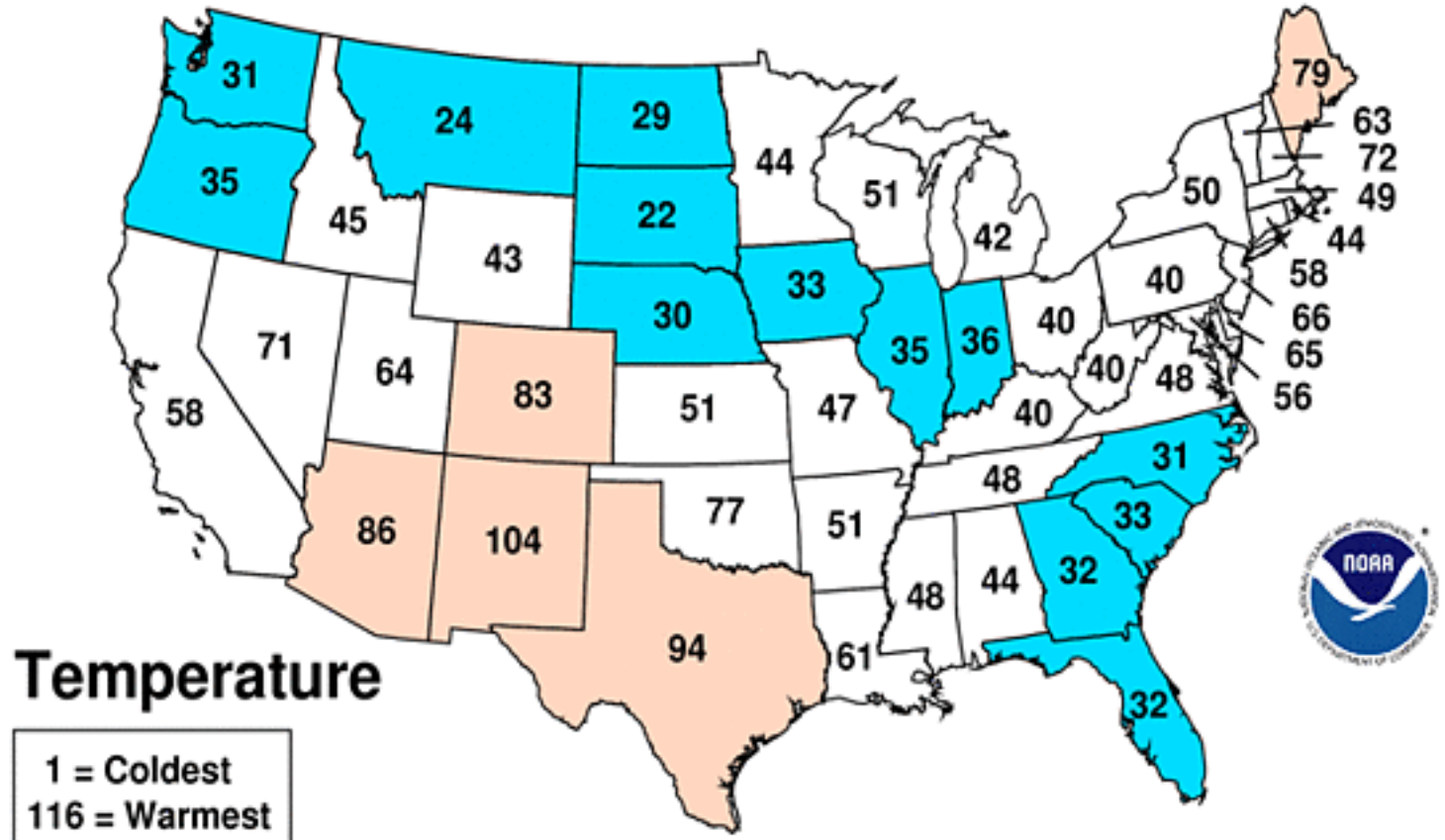
Record Driest	Much Below Normal	Below Normal	Near Normal	Above Normal	Much Above Normal	Record Wettest

La Nina Cool-Season Temperature



Nov 2010-Apr 2011 Statewide Ranks

National Climatic Data Center/NESDIS/NOAA



Temperature

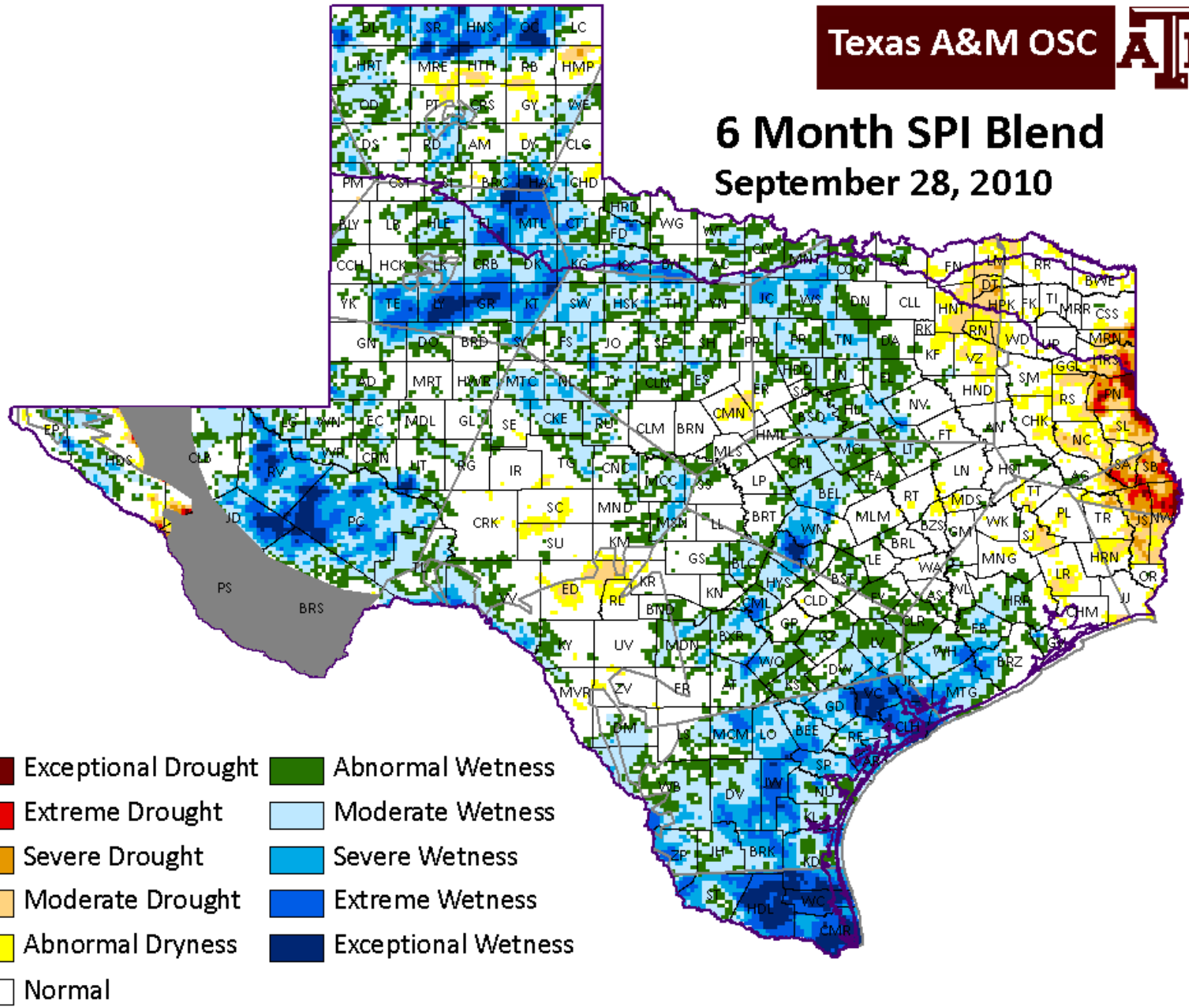
1 = Coldest
116 = Warmest

Record Coldest	Much Below Normal	Below Normal	Near Normal	Above Normal	Much Above Normal	Record Warmest

Texas A&M OSC

6 Month SPI Blend

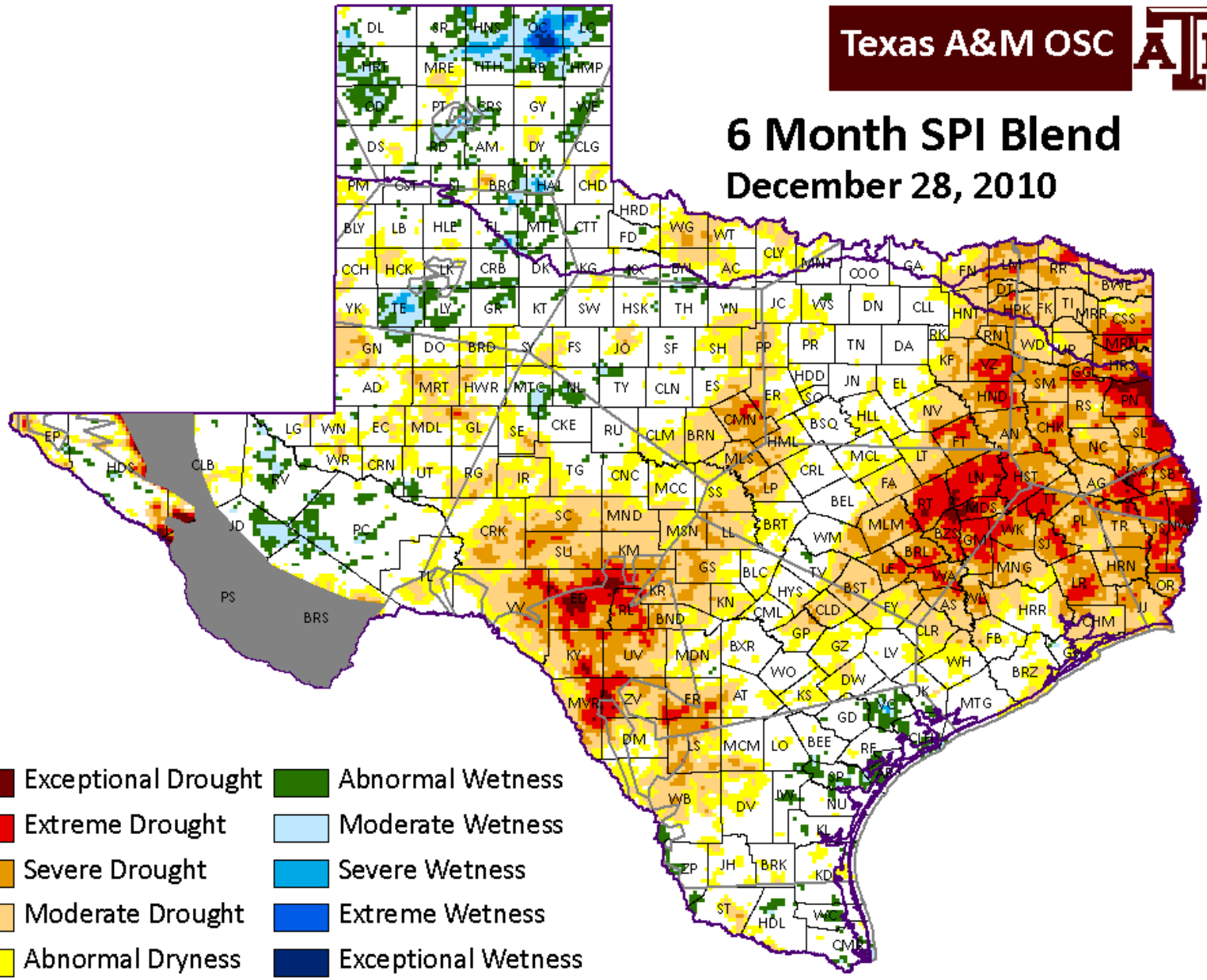
September 28, 2010



Texas A&M OSC

6 Month SPI Blend

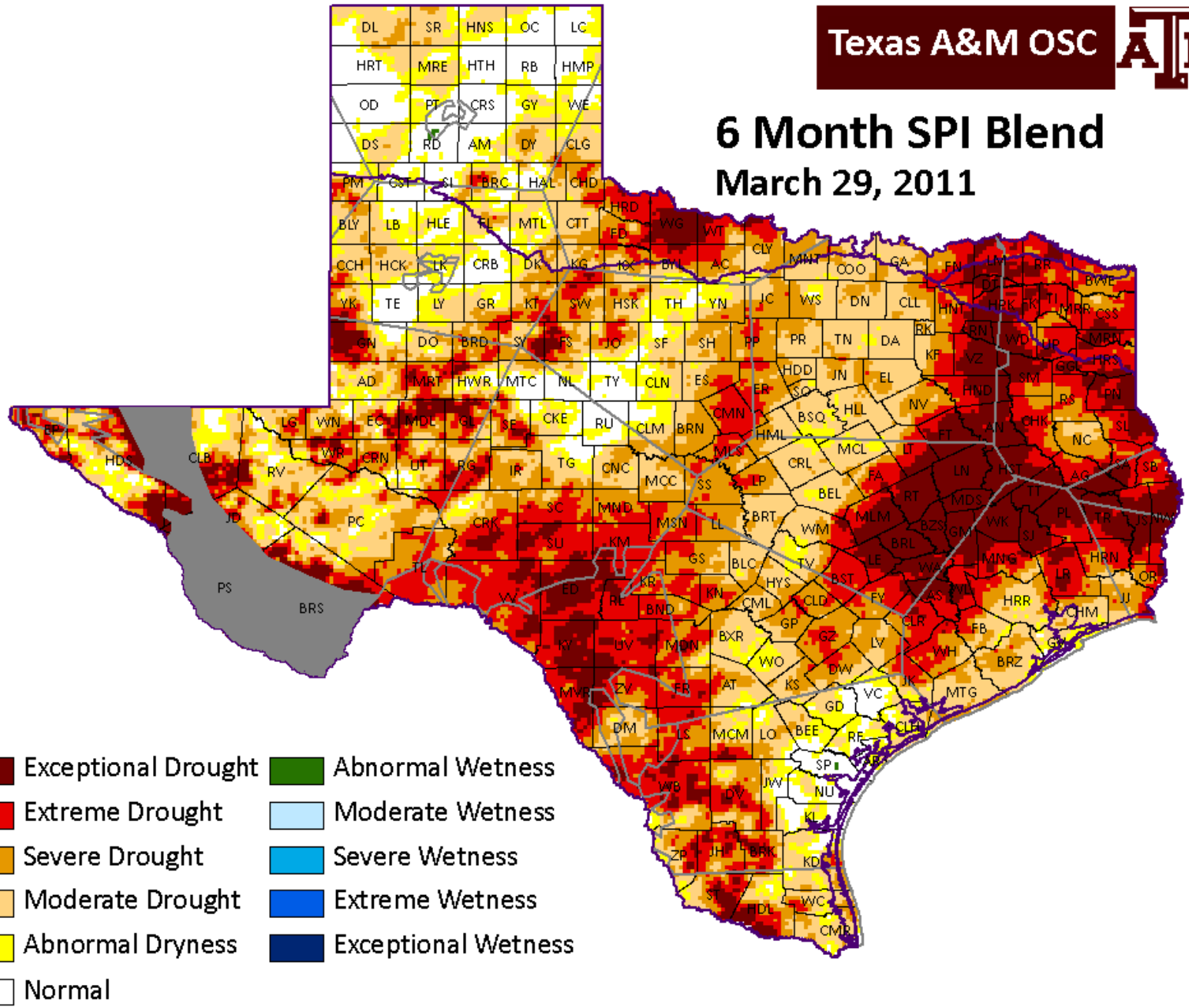
December 28, 2010



Texas A&M OSC

6 Month SPI Blend

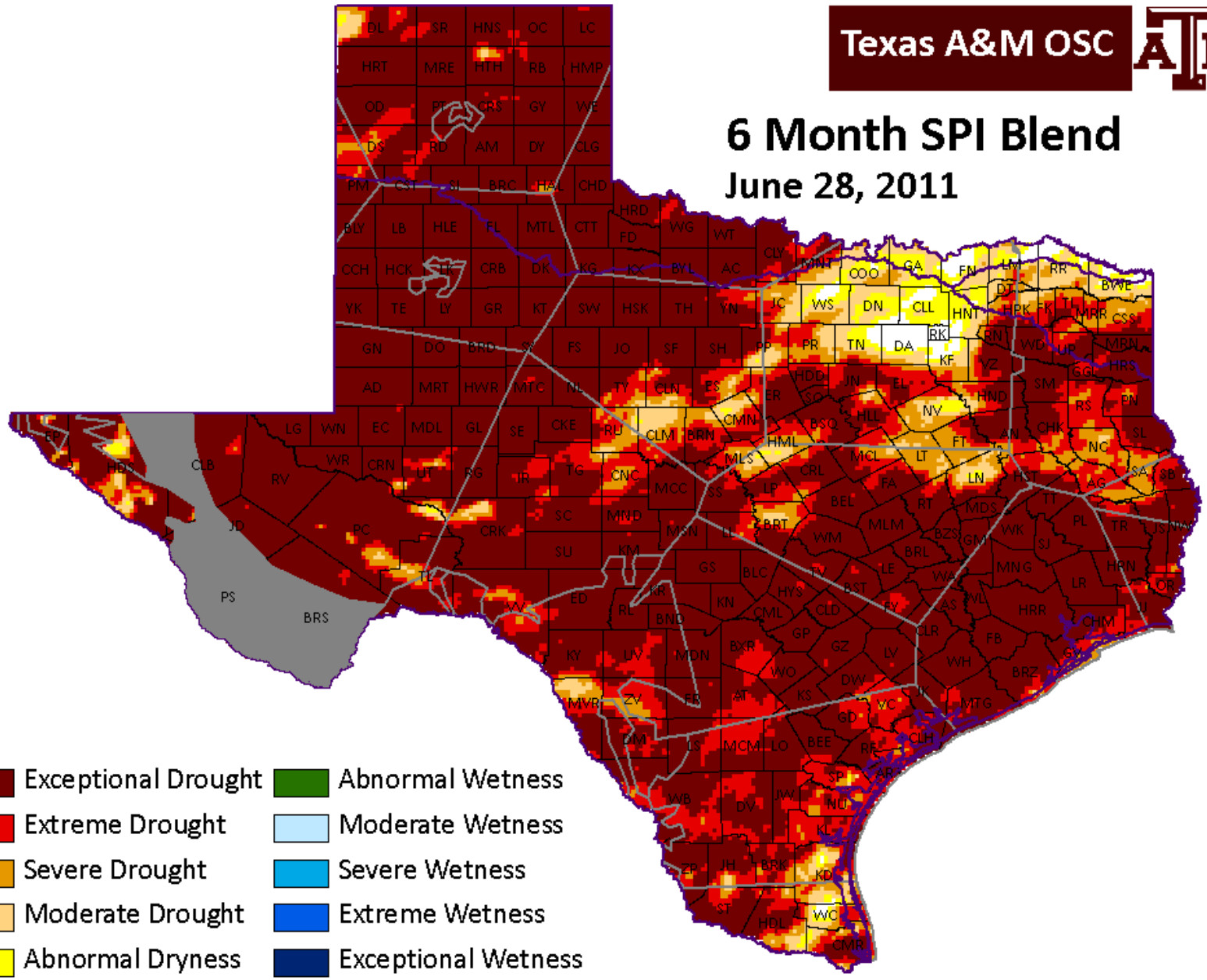
March 29, 2011



Texas A&M OSC

6 Month SPI Blend

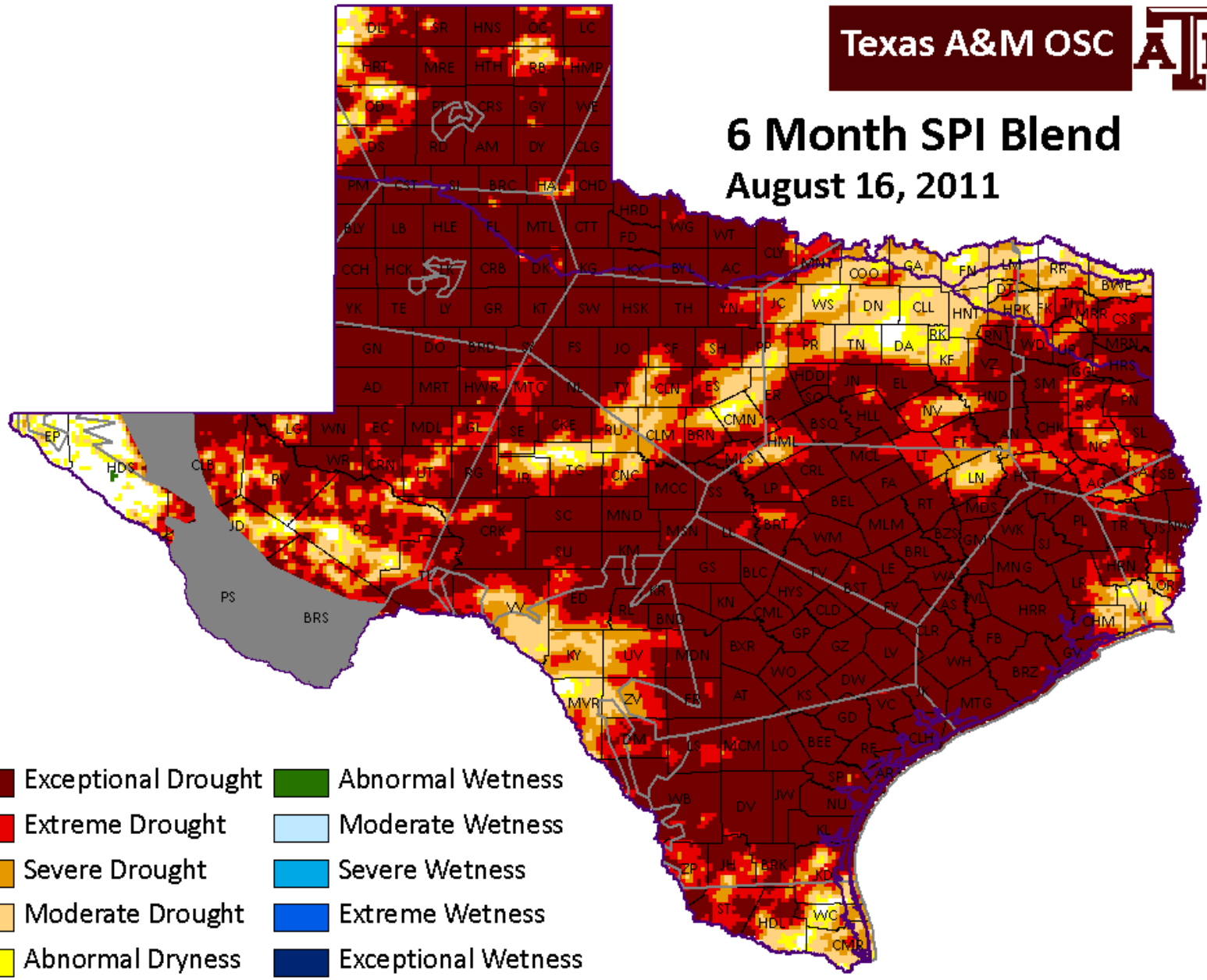
June 28, 2011



Texas A&M OSC

6 Month SPI Blend

August 16, 2011



Texas Summer Drought Feedback

- Dry soil
- Very little evaporation
- Few thunderstorms
- Drier soil
- Even less evaporation
- Even fewer thunderstorms

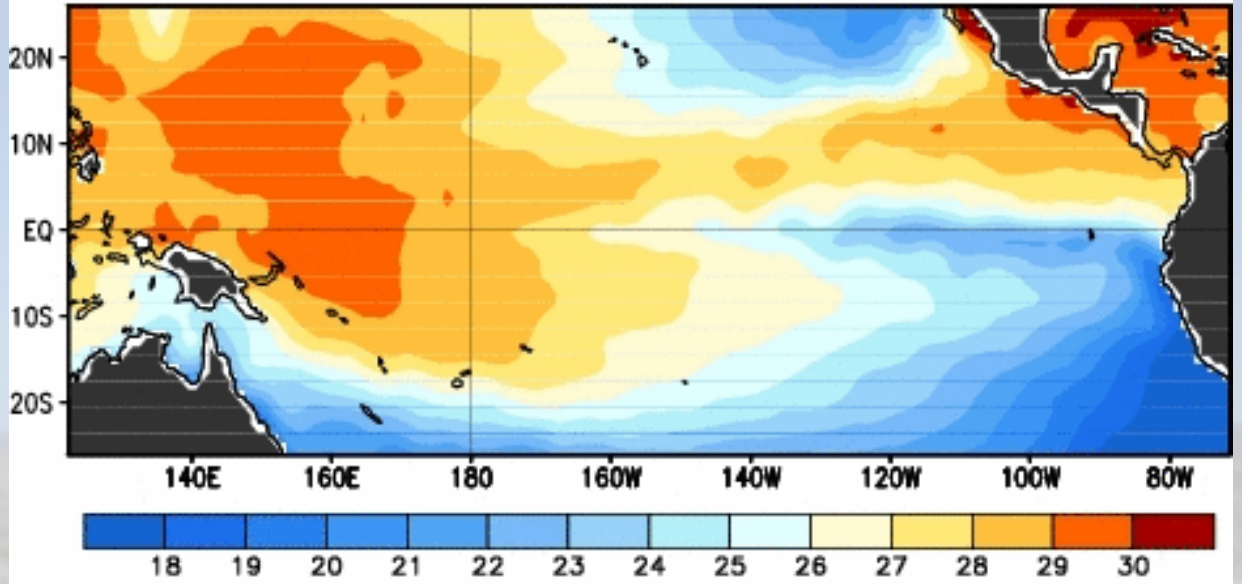
- Dry soil
- Very little evaporation
- Plenty of heating
- Hot temperatures
- Even more evaporation
- Even greater water demand

Texas Summer Drought Feedback

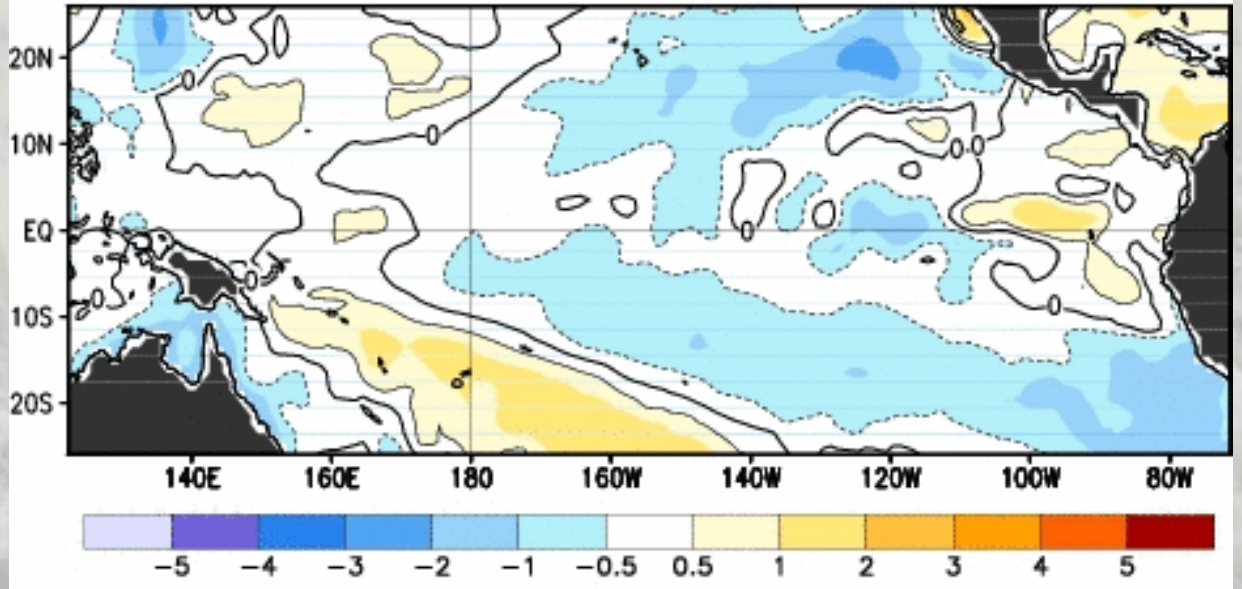
- Hot temperatures
- High pressure aloft
- Air from desert southwest circles overhead
- Even fewer thunderstorms
- Even hotter temperatures

- Tropical disturbance
  - Tropical wave
  - Tropical depression
  - Tropical storm
  - Hurricane
- Widespread rain
  - Lower temperatures
  - More water vapor
  - More thunderstorms
  - Cycle is broken

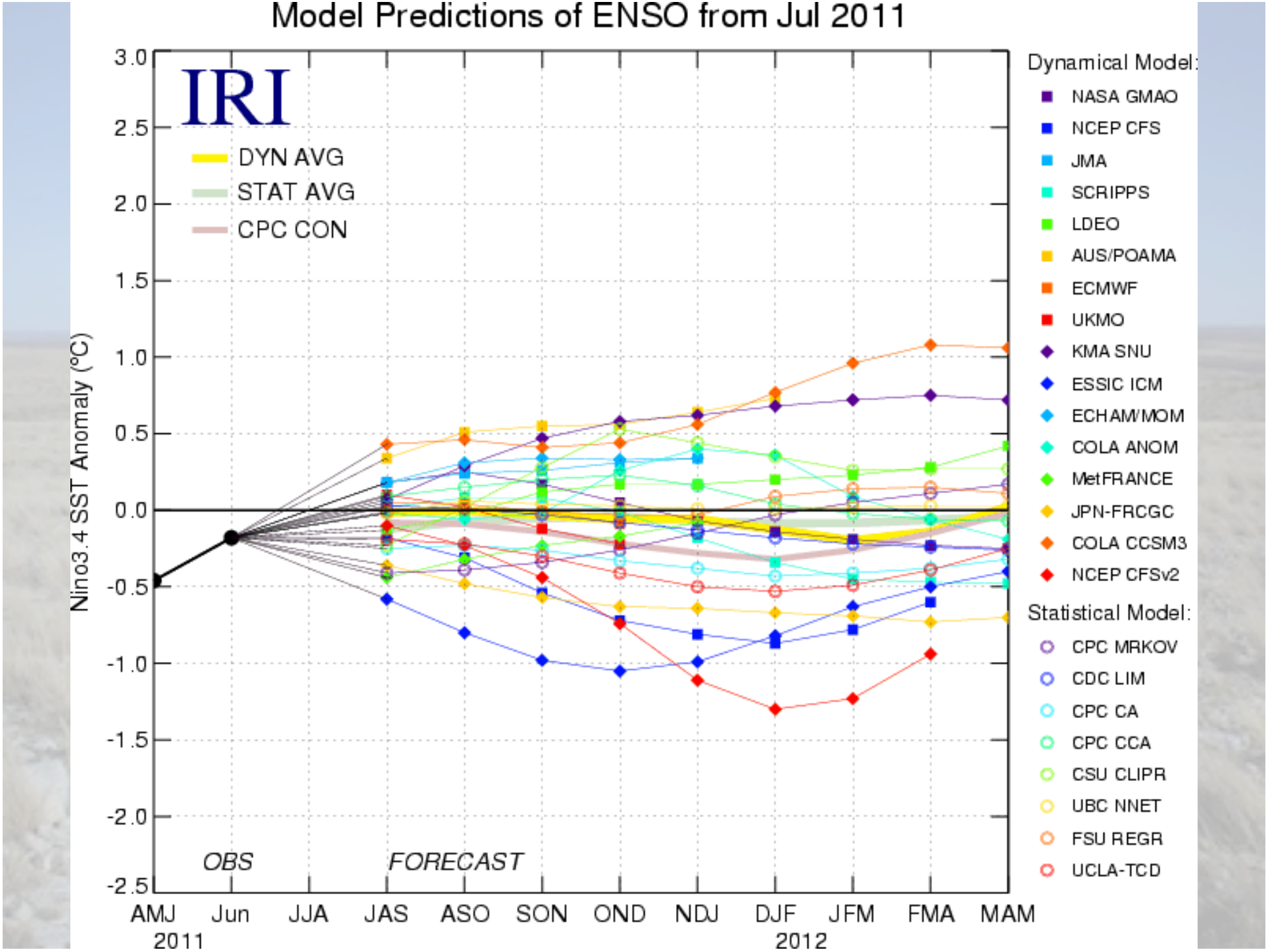
Observed Sea Surface Temperature (°C)

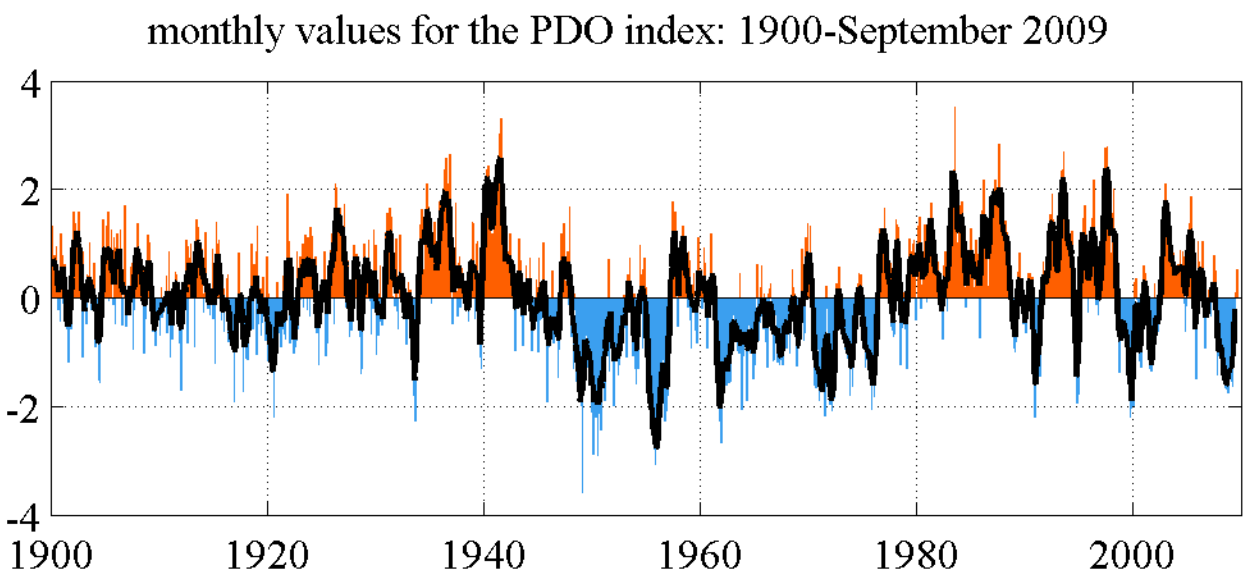


Observed Sea Surface Temperature Anomalies (°C)



7-day Average Centered on 03 August 2011

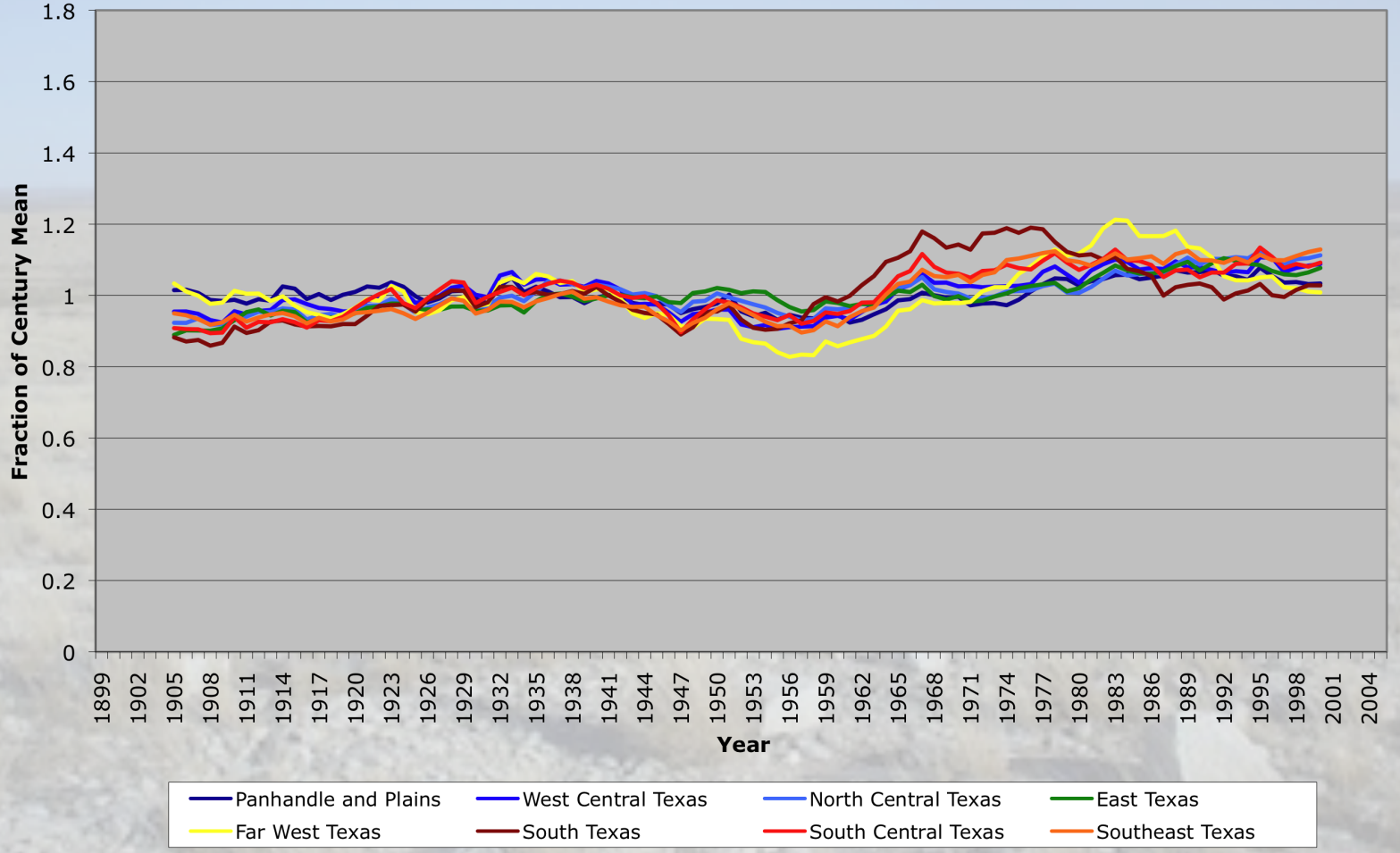

Model Predictions of ENSO from Jul 2011
IRI
DYN AVG
STAT AVG
CPC CON
Nino3.4 SST Anomaly (°C)
3.0
2.5
2.0
1.5
1.0
0.5
0.0
-0.5
-1.0
-1.5
-2.0
-2.5
OBS
FORECAST
AMJ
Jun
JJA
JAS
ASO
SON
OND
NDJ
DJF
JFM
FMA
MAM
2011
2012
Dynamical Model:
NASA GMAO
NCEP CFS
JMA
SCRIPPS
LDEO
AUS/POAMA
ECMWF
UKMO
KMA SNU
ESSIC ICM
ECHAM/MOM
COLA ANOM
MetFRANCE
JPN-FRCGC
COLA CCSM3
NCEP CFSv2
Statistical Model:
CPC MRKOV
CDC LIM
CPC CA
CPC CCA
CSU CLIPR
UBC NNET
FSU REGR
UCLA-TCD



Pacific Decadal Oscillation

Positive: Wet Texas Negative: Dry Texas

20-yr Smoothed Texas Precipitation



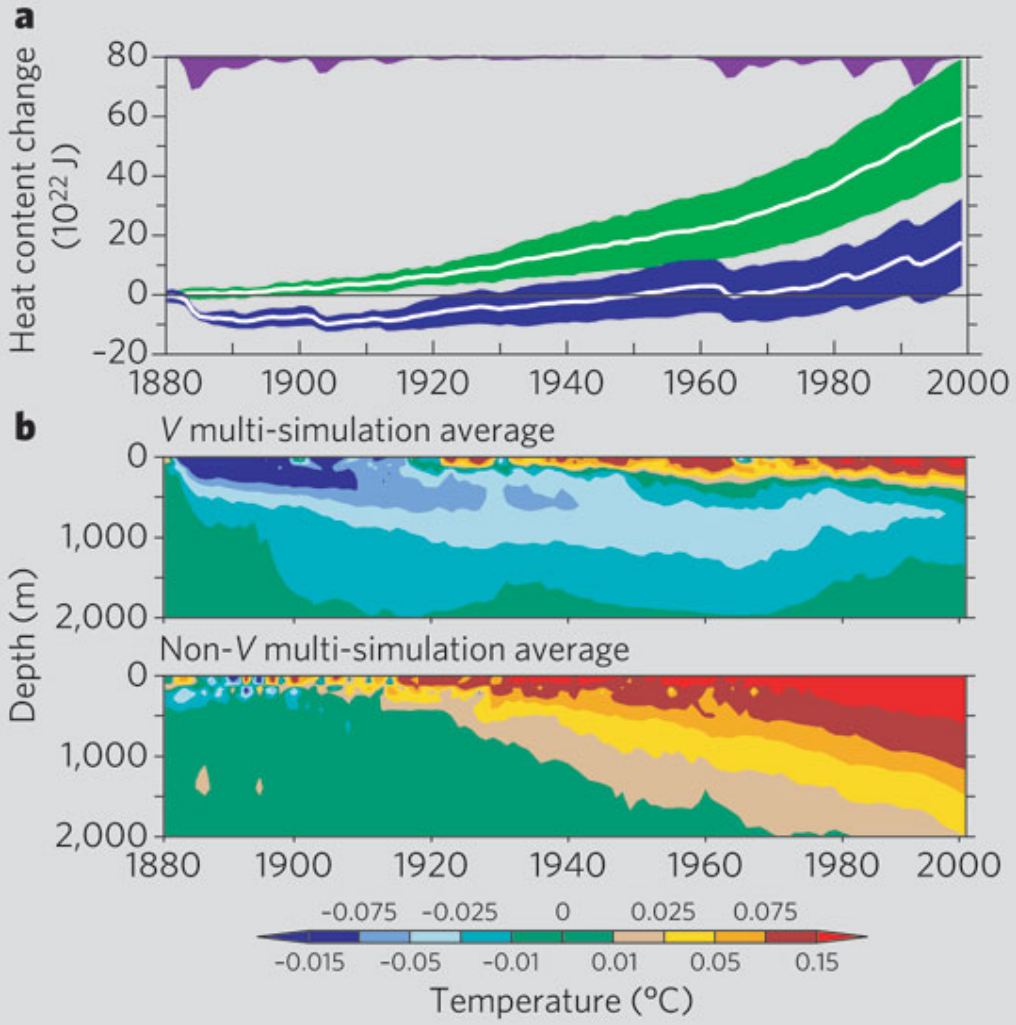
Recap

- Texas Weather is produced by…
  - Mountains to the west
  - Cold air from the north
  - Warm, moist air from the south
- Texas Weather is changed by…
  - El Nino/La Nina
  - Other sea surface temperature patterns
  - Land use, greenhouse gases, sun, volcanoes, pollution…

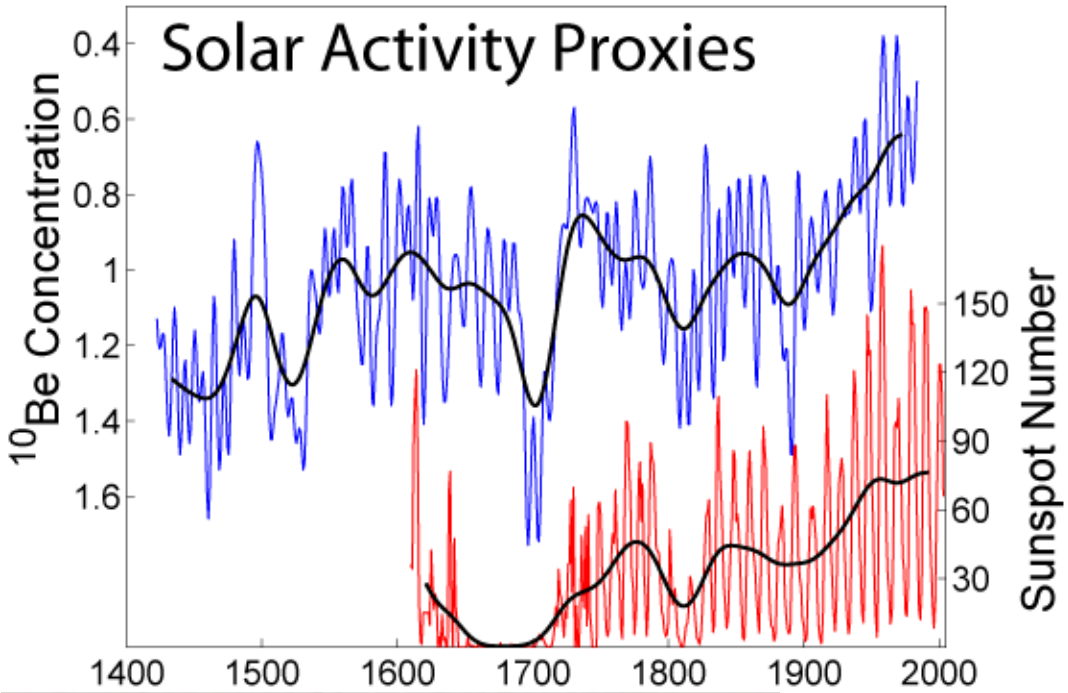
How to Make a Drought

- Start with La Nina
- Get unlucky with the weather
- Dry out soil and keep it dry
- Repel tropical disturbances
- Enhance with global warming
- Repeat

Additional Climate Change Slides

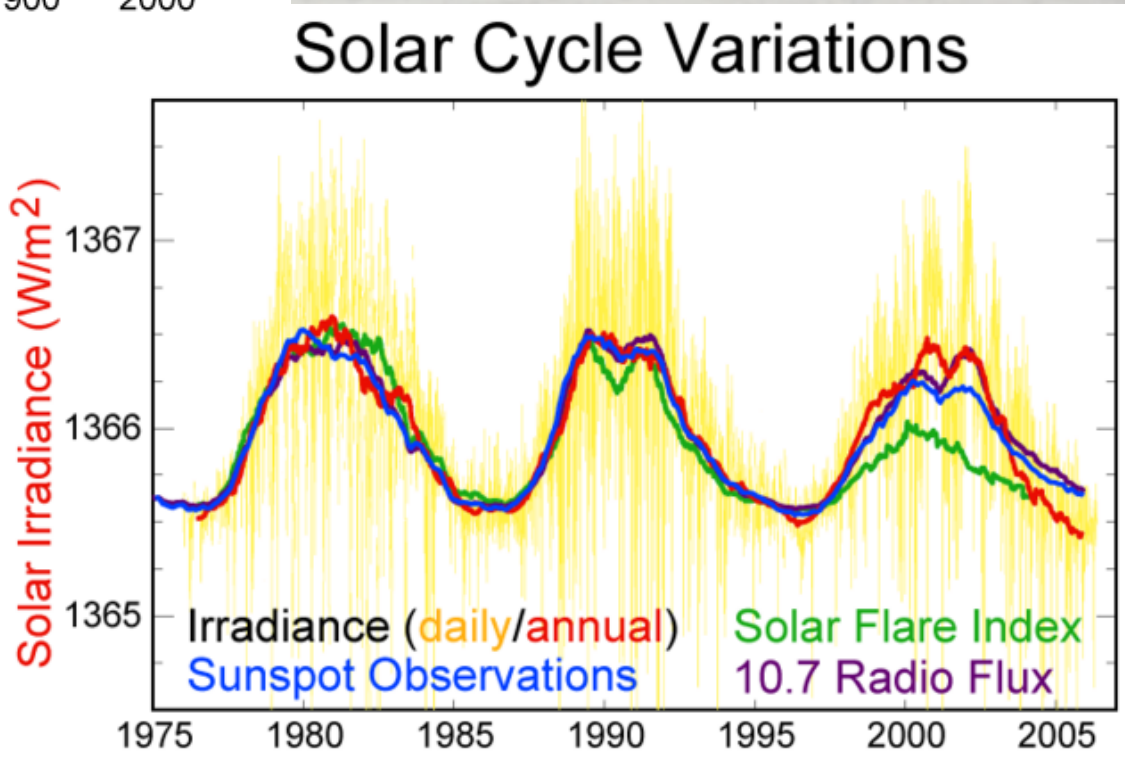


Source: http://www.nature.com/nature/journal/v439/n7077/images/439675a-f1.2.jpg

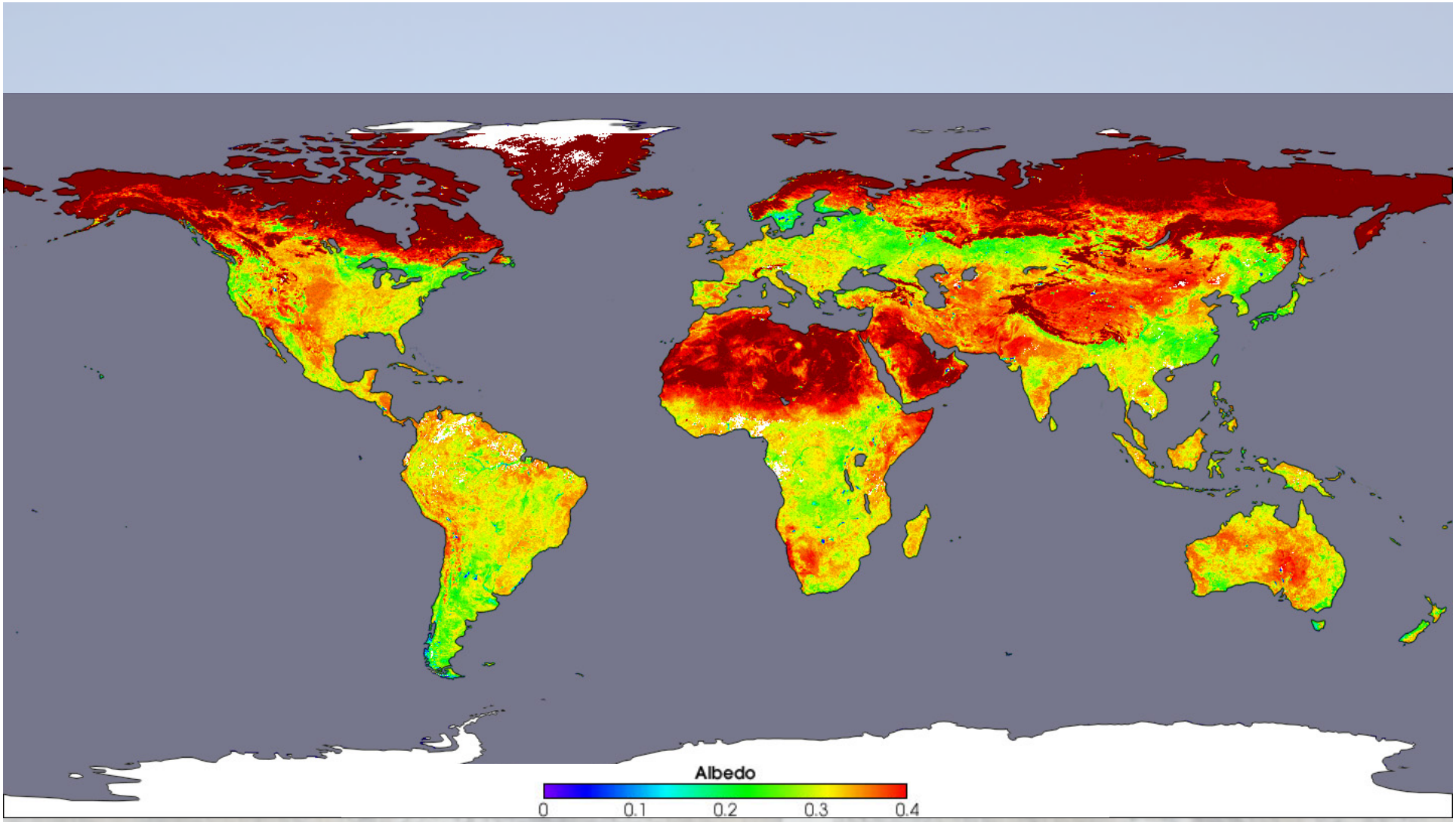


Source: http://www.globalwarmingart.com/wiki/Image:Solar_Activity_Proxies_png

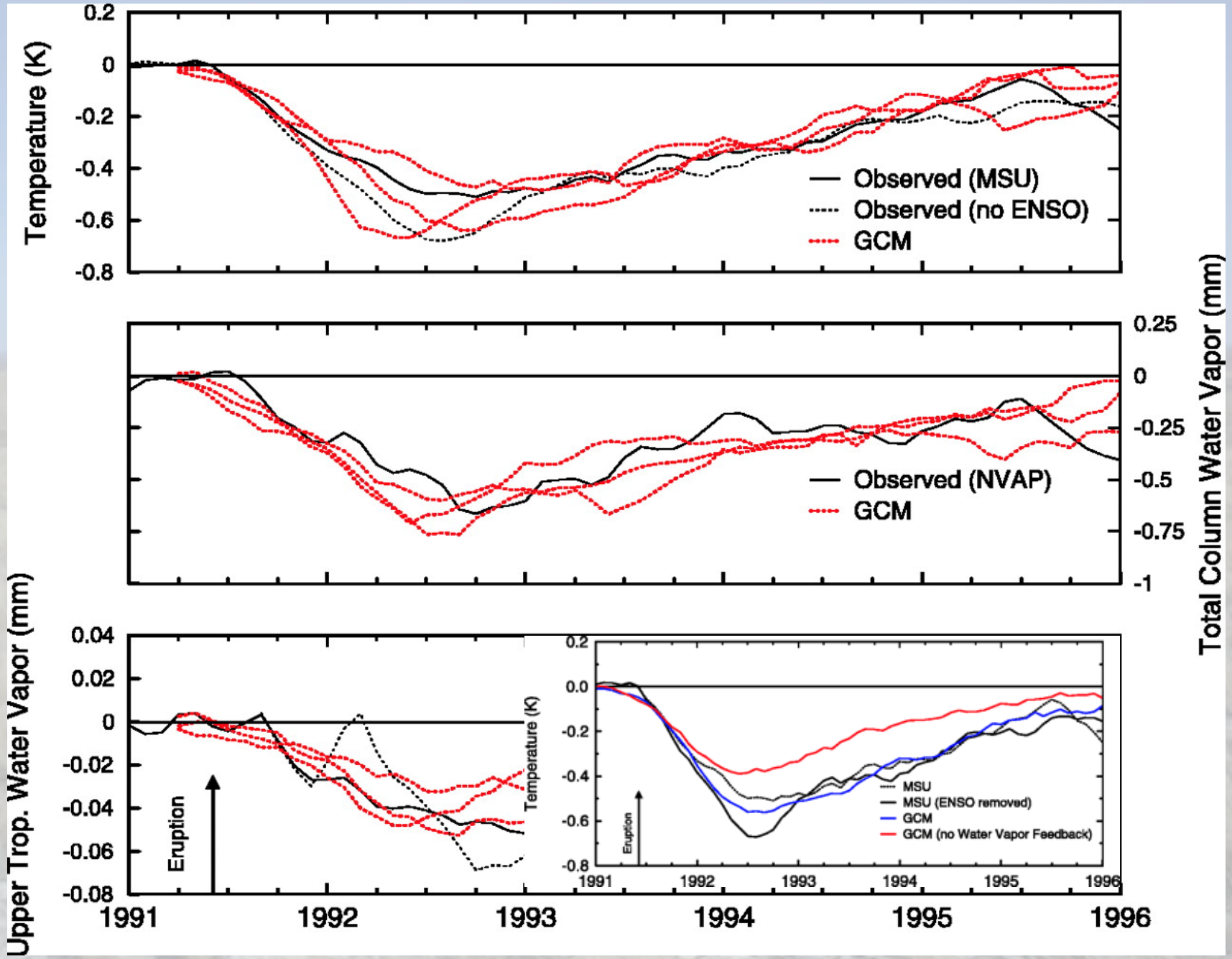
Source: http://www.globalwarmingart.com/wiki/Image:Solar_Cycle_Variations_png



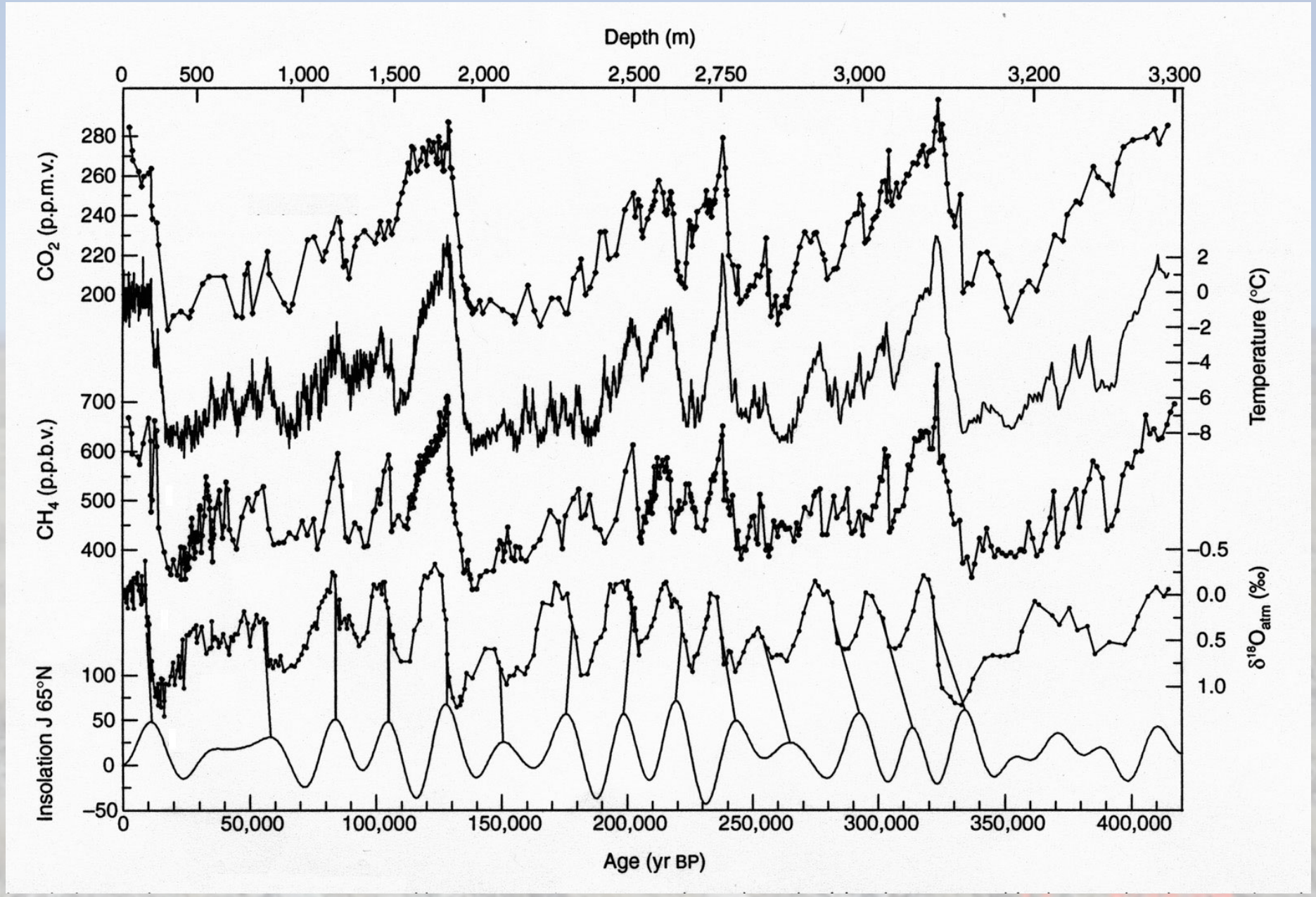
Source: http://www.sciencepoles.org/index.php?s=2&rs=home&uid=625&lg=en



Source: http://earthobservatory.nasa.gov/Newsroom/NewImages/Images/modis_albedo_lrg.jpg

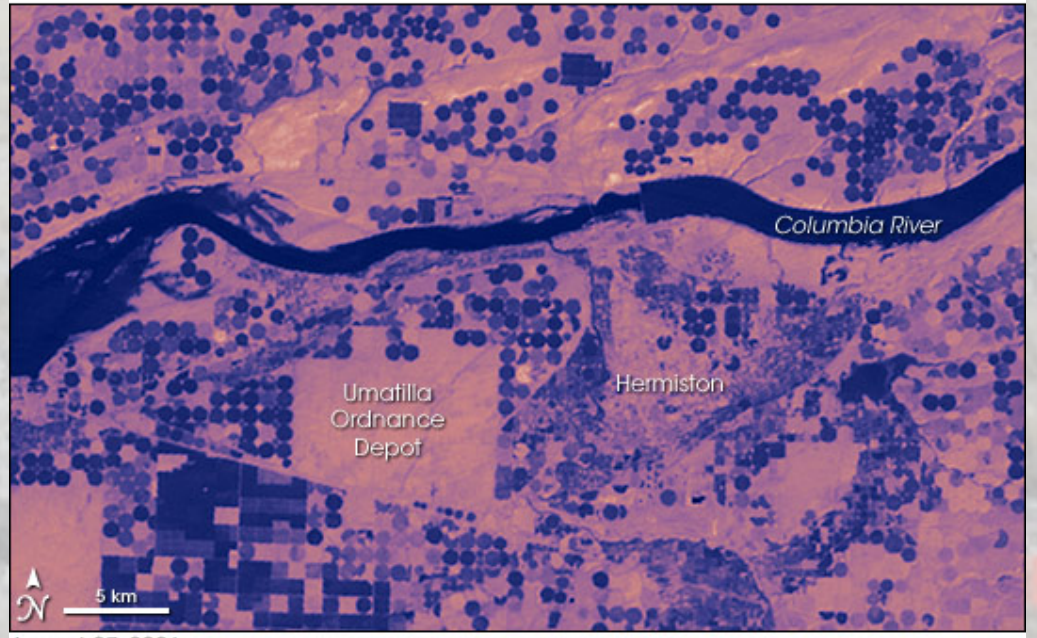


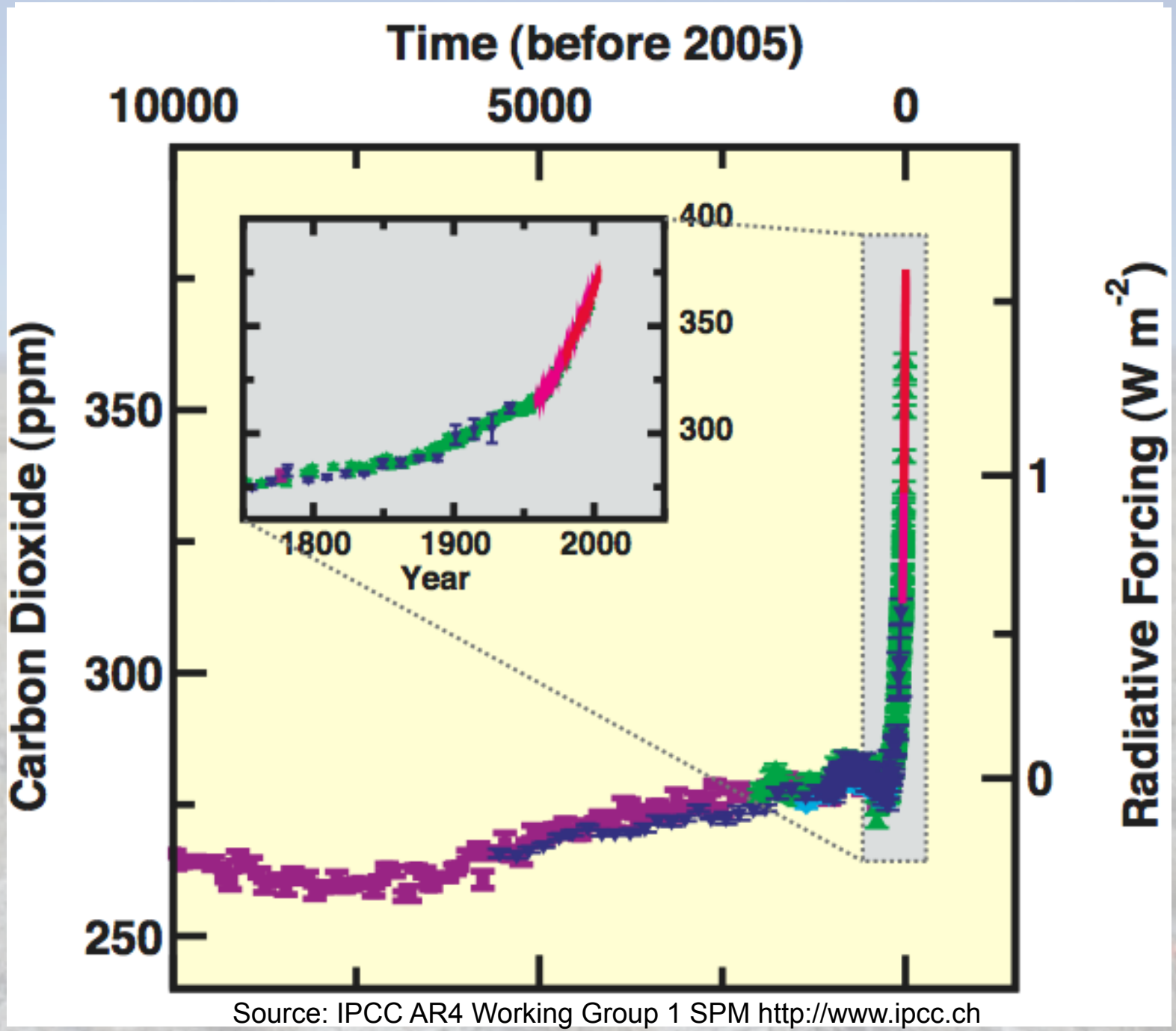
Source: Soden et al. 2002 http://www.sciencemag.org/cgi/content/full/296/5568/727



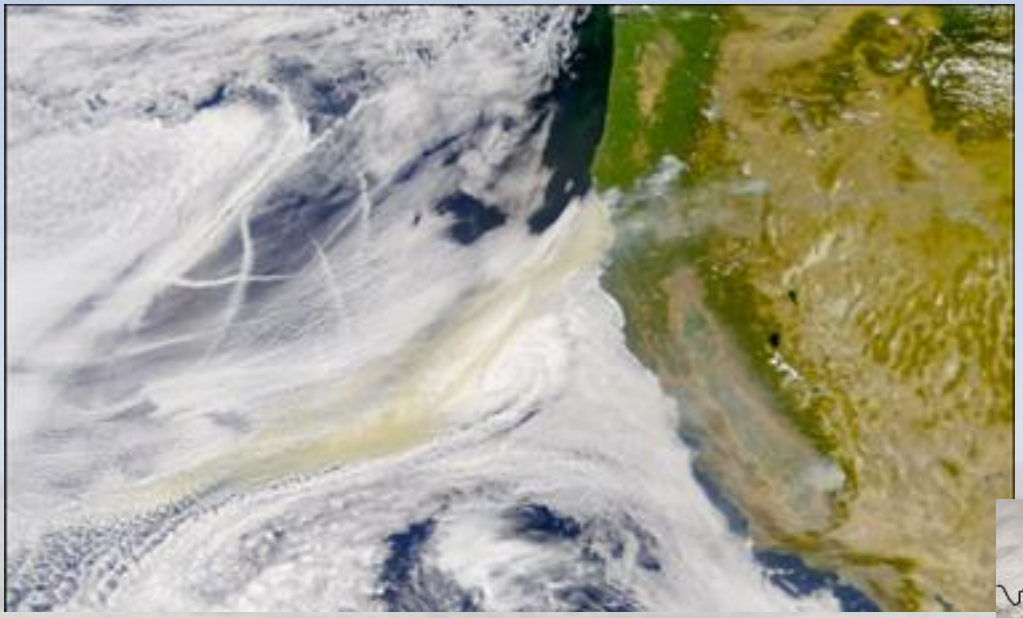
Source: http://www.usgcrp.gov/usgcrp/images/Vostok.jpg

Source: http://earthobservatory.nasa.gov/Newsroom/NewImages/images.php3?img_id=17486



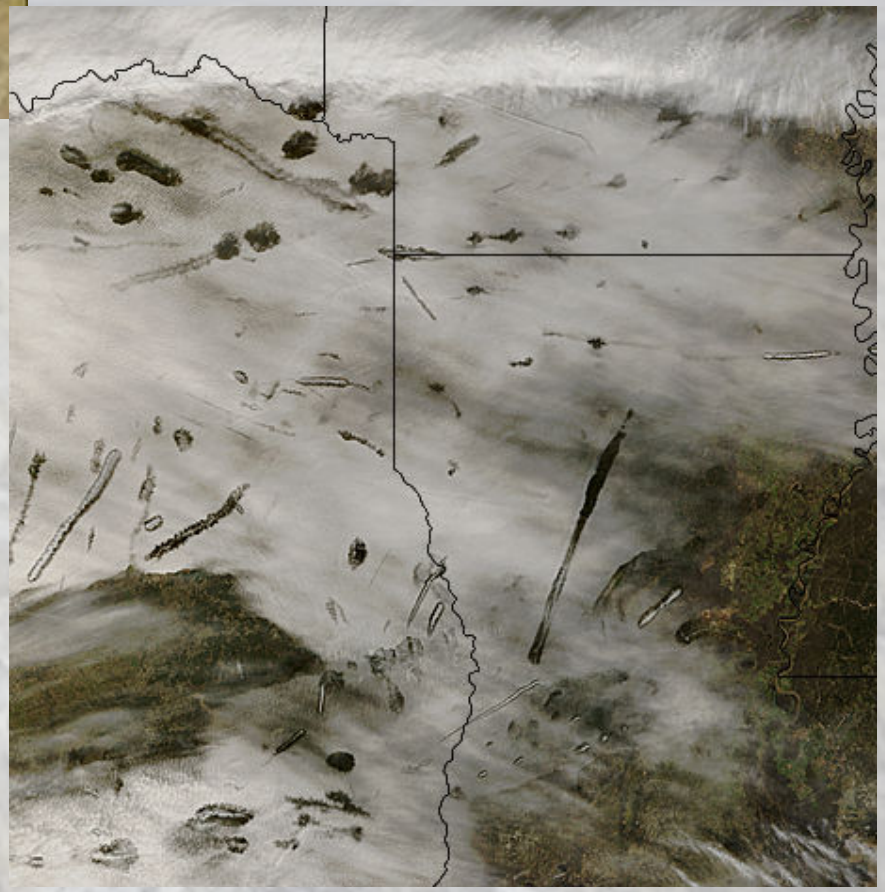


Source: IPCC AR4 Working Group 1 SPM http://www.ipcc.ch

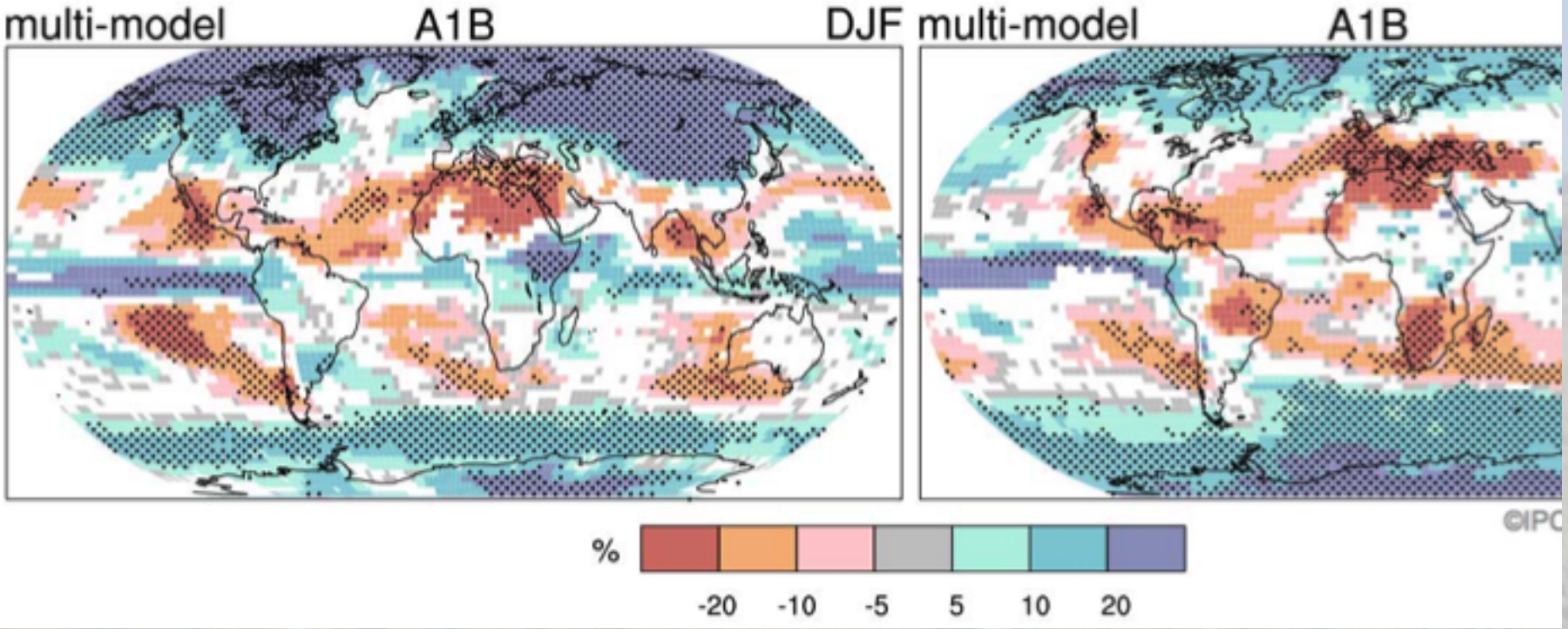


Source: http://rapidfire.sci.gsfc.nasa.gov/subsets/?USA7/2007029/

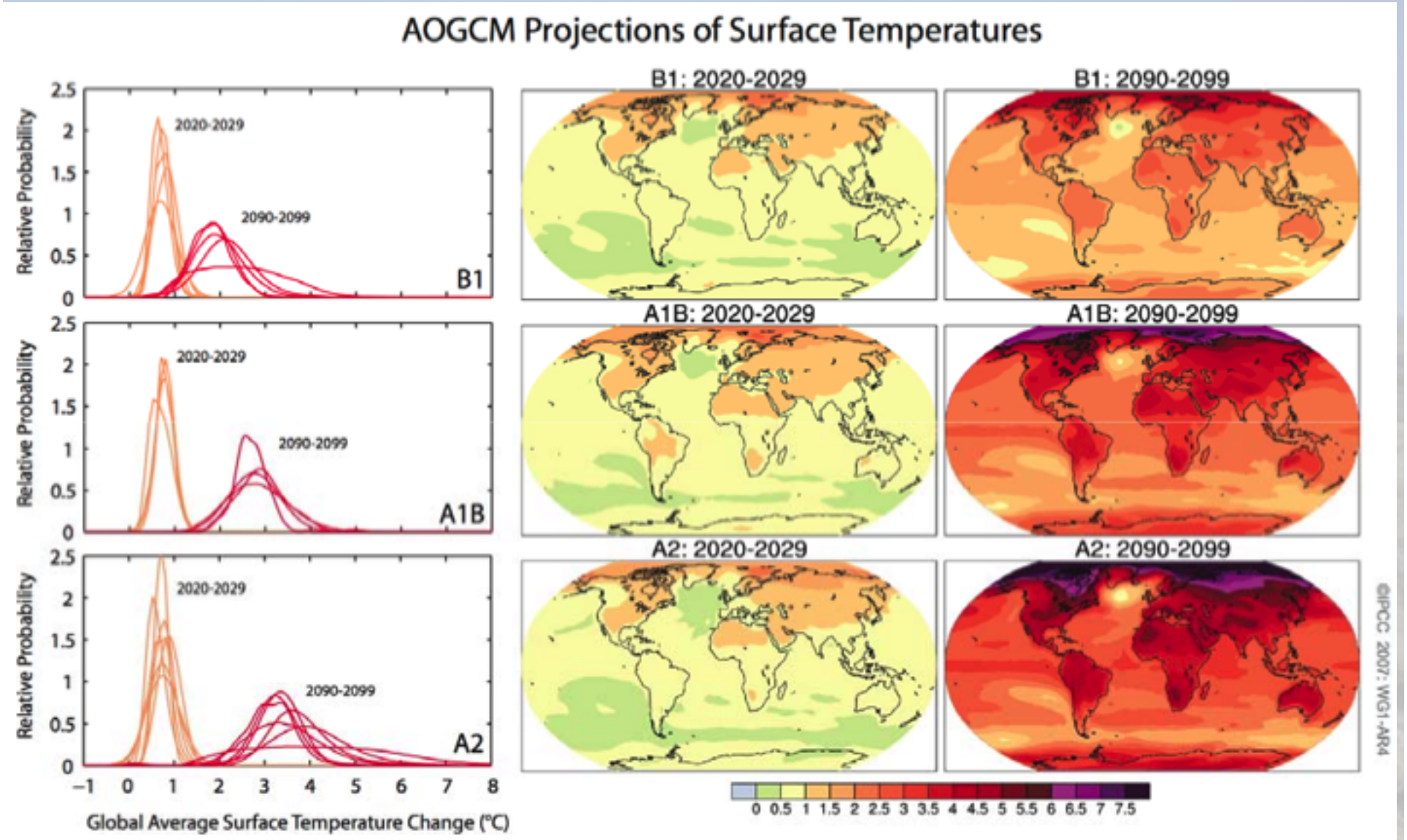
Source: http://www.geog.cam.ac.uk/research/projects/aerosolsclimate/



Projected Patterns of Precipitation Changes



Source: IPCC AR4 Working Group 1 SPM http://www.ipcc.ch



Source: IPCC AR4 Working Group 1 SPM http://www.ipcc.ch