Anatomy of an Extreme Event

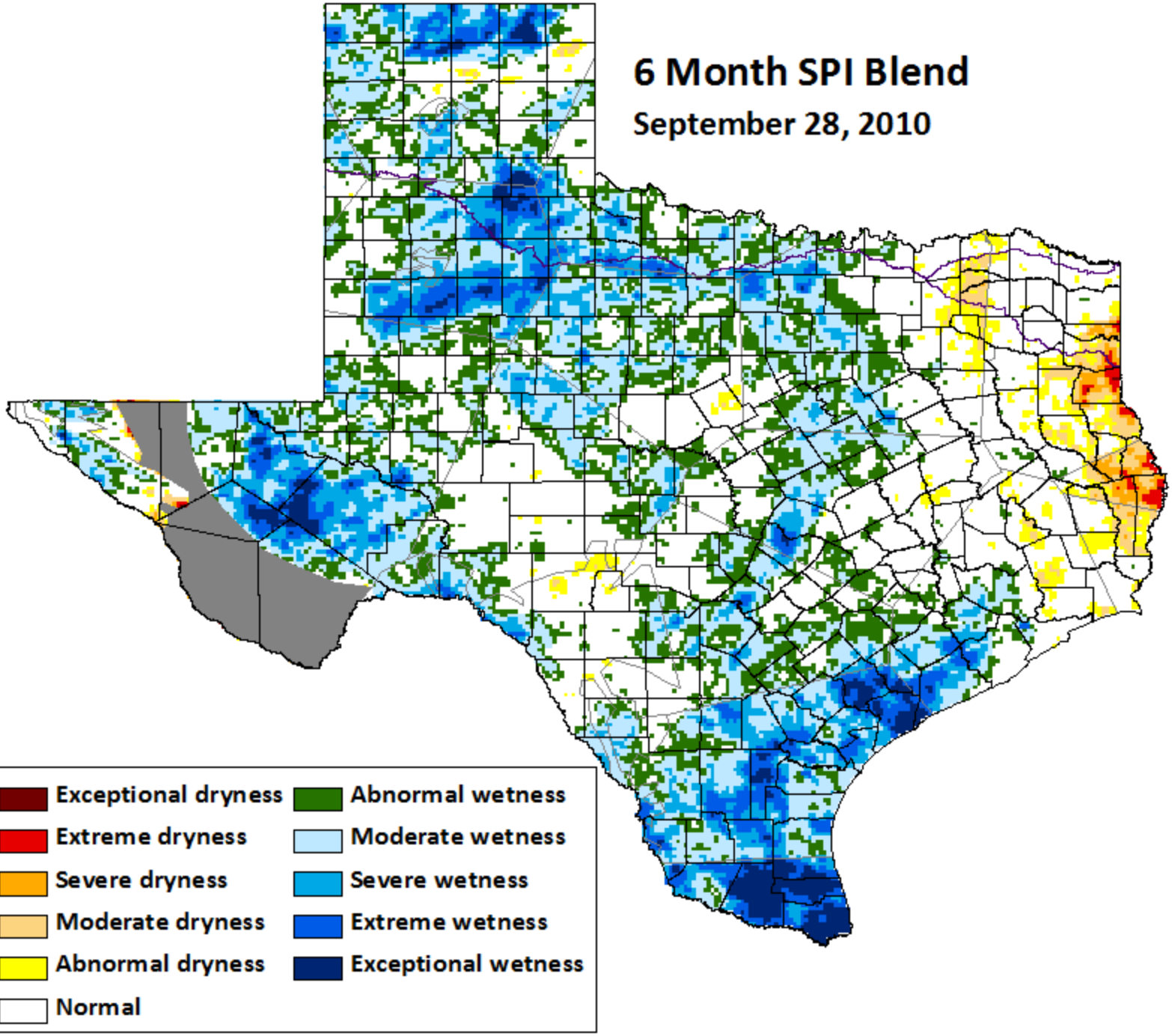
John W. Nielsen-Gammon
Texas State Climatologist

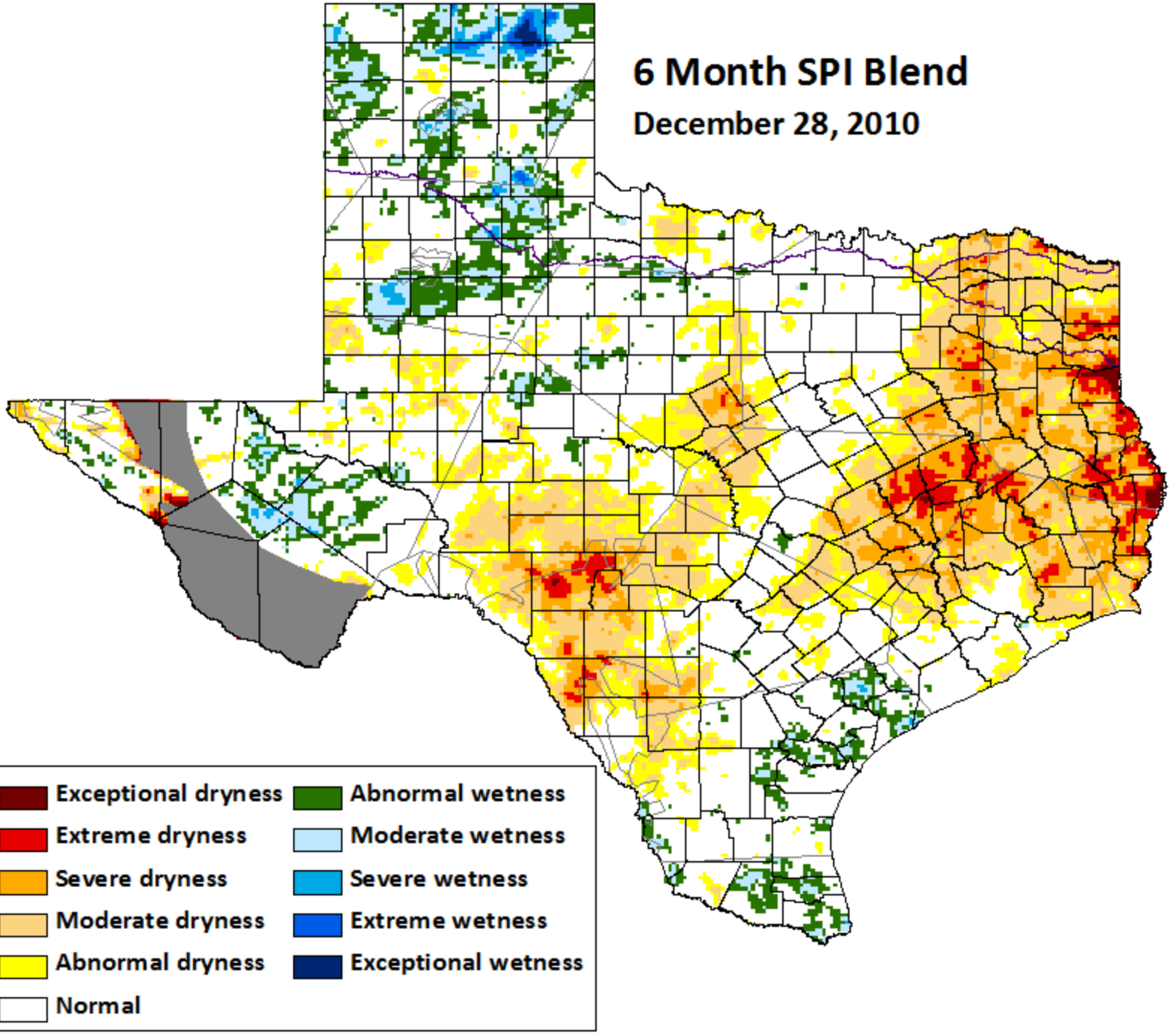
Texas Drought Outlook, August 2010

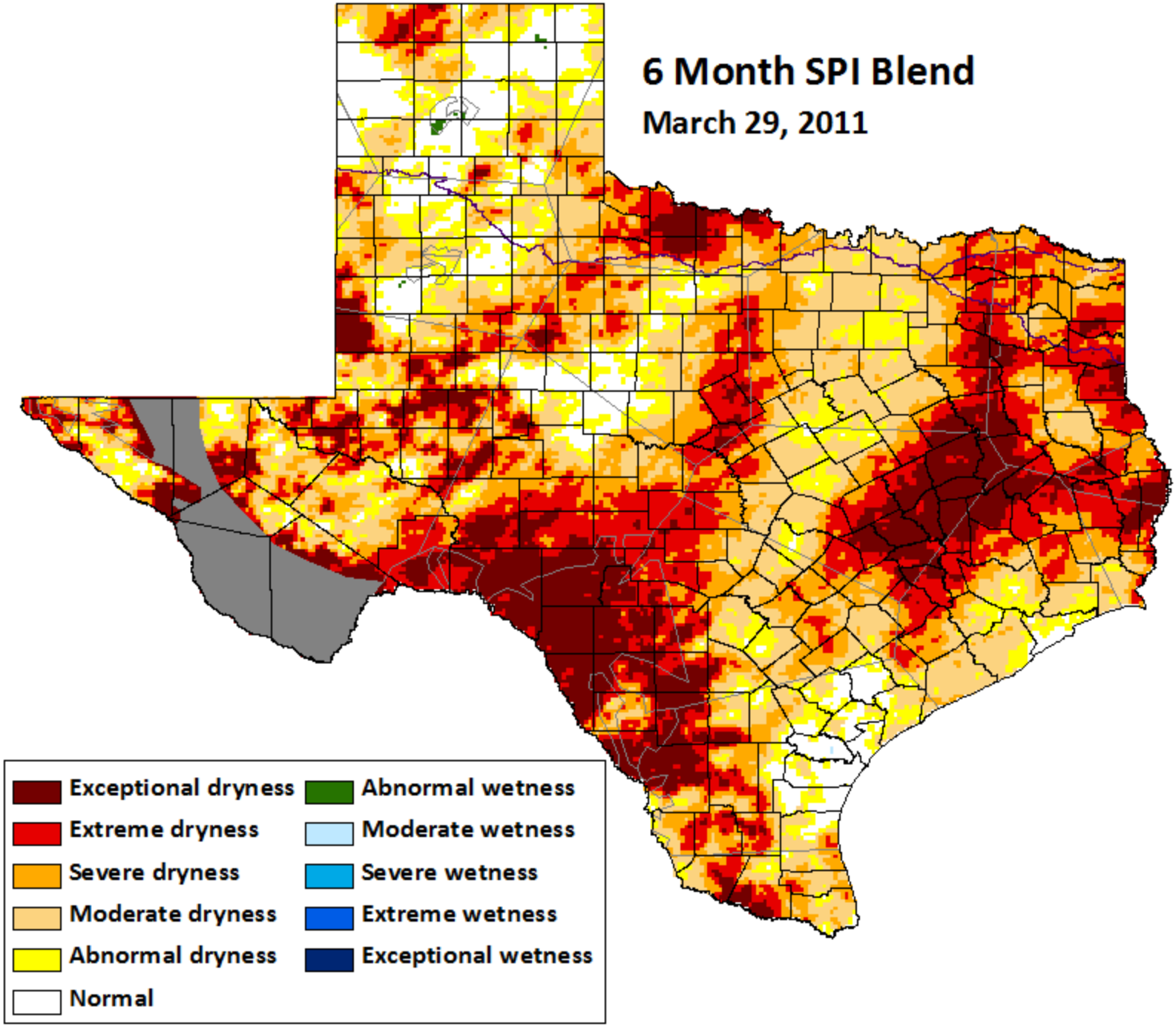
- Precipitation shortage is not a lock, but it's a good bet
- Some areas will probably get lucky
- Odds start tilting around November-December
- La Nina "signal" remains strong until Spring

6 Month SPI Blend

September 28, 2010

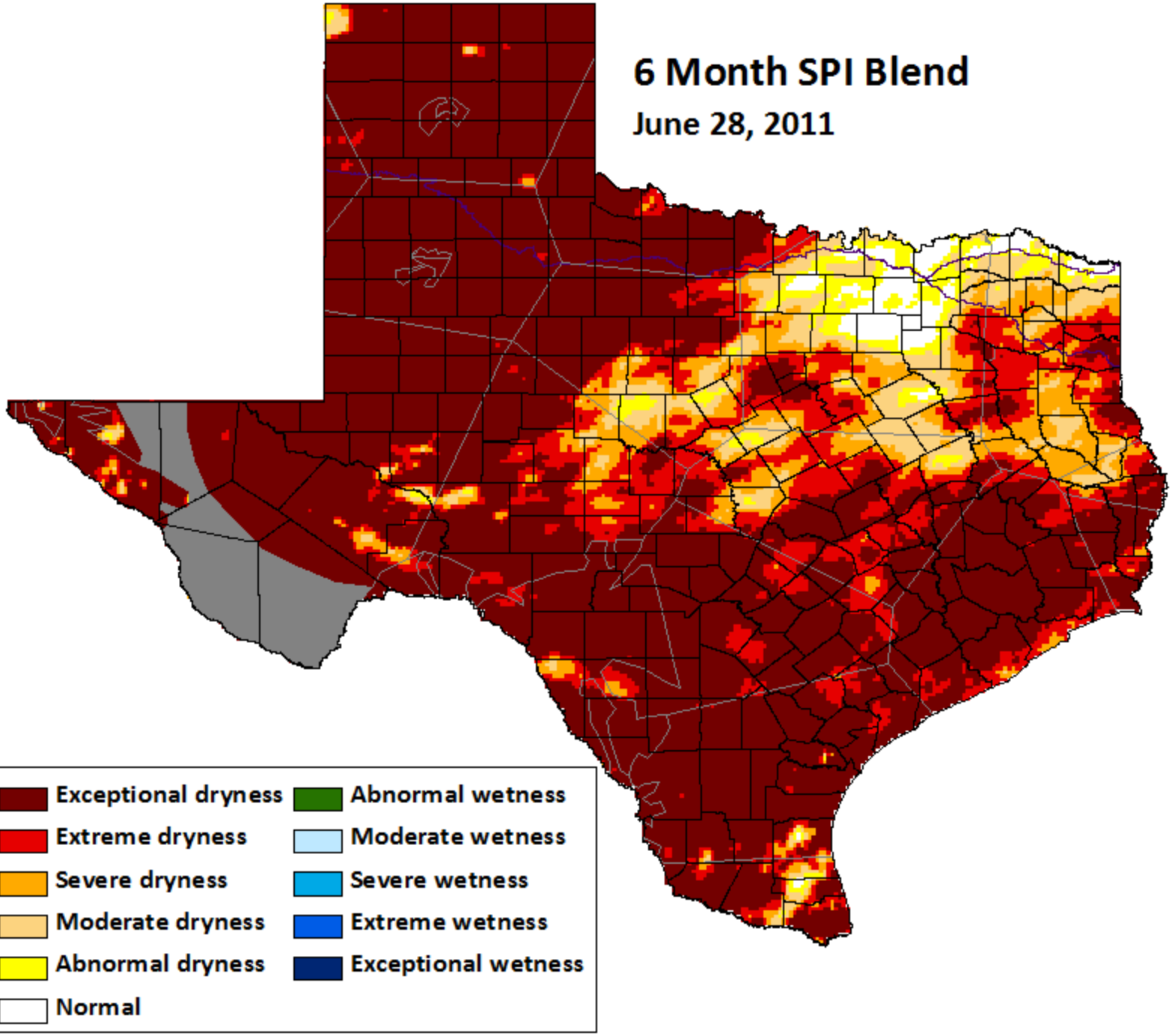



6 Month SPI Blend
December 28, 2010
Exceptional dryness
Extreme dryness
Severe dryness
Moderate dryness
Abnormal dryness
Normal
Abnormal wetness
Moderate wetness
Severe wetness
Extreme wetness
Exceptional wetness


6 Month SPI Blend
March 29, 2011
Exceptional dryness
Extreme dryness
Severe dryness
Moderate dryness
Abnormal dryness
Normal
Abnormal wetness
Moderate wetness
Severe wetness
Extreme wetness
Exceptional wetness

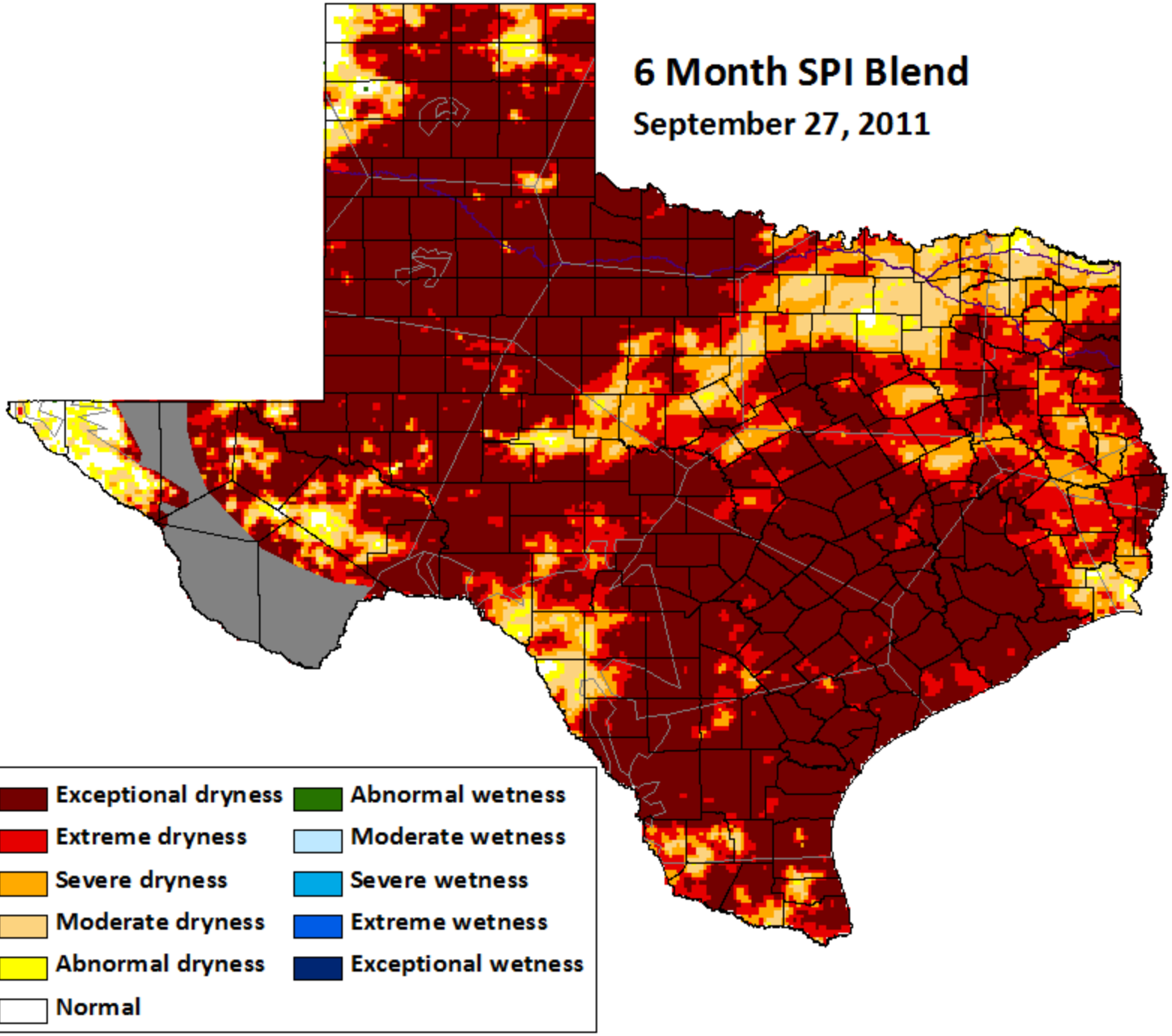
6 Month SPI Blend

June 28, 2011



6 Month SPI Blend

September 27, 2011

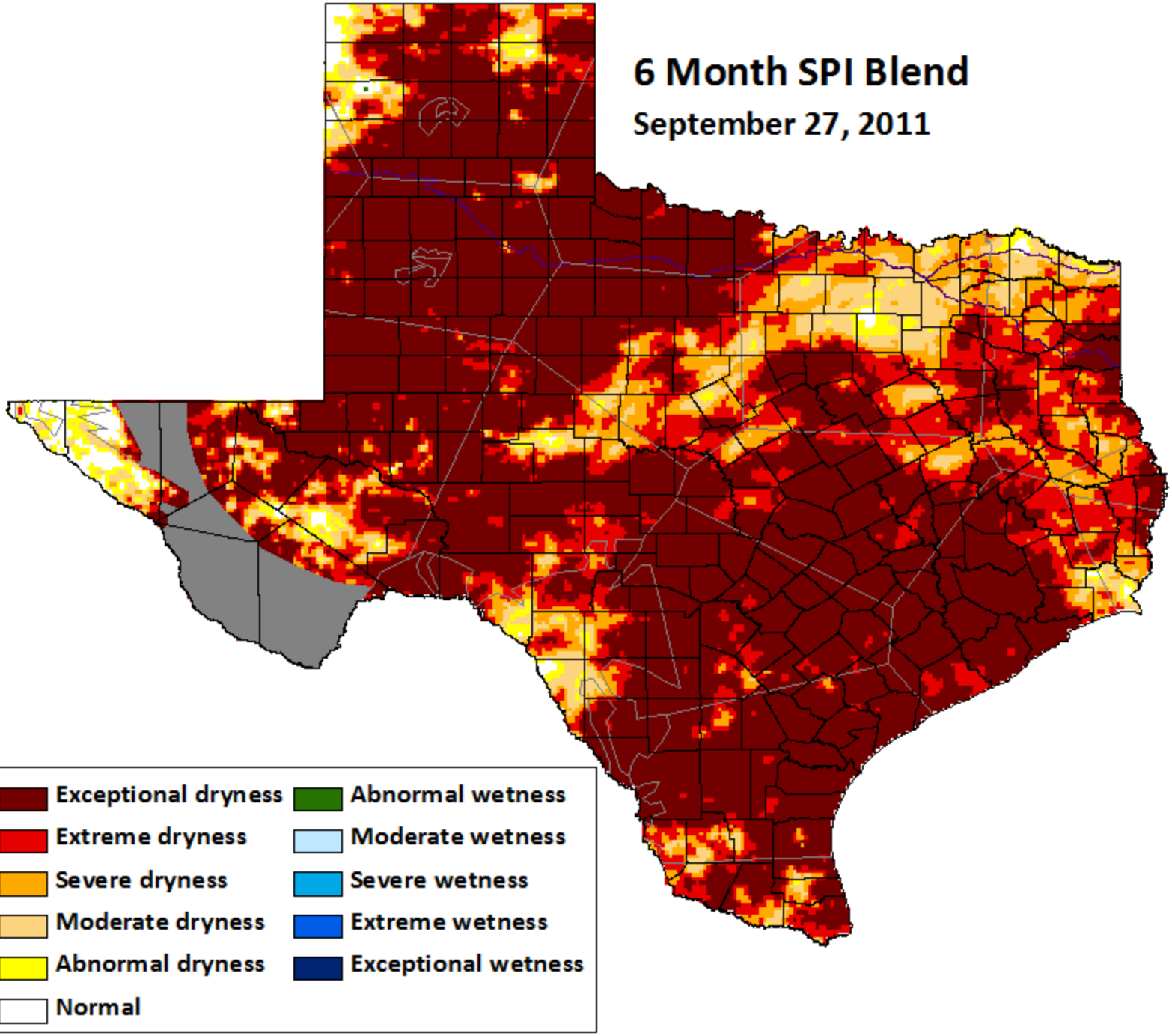


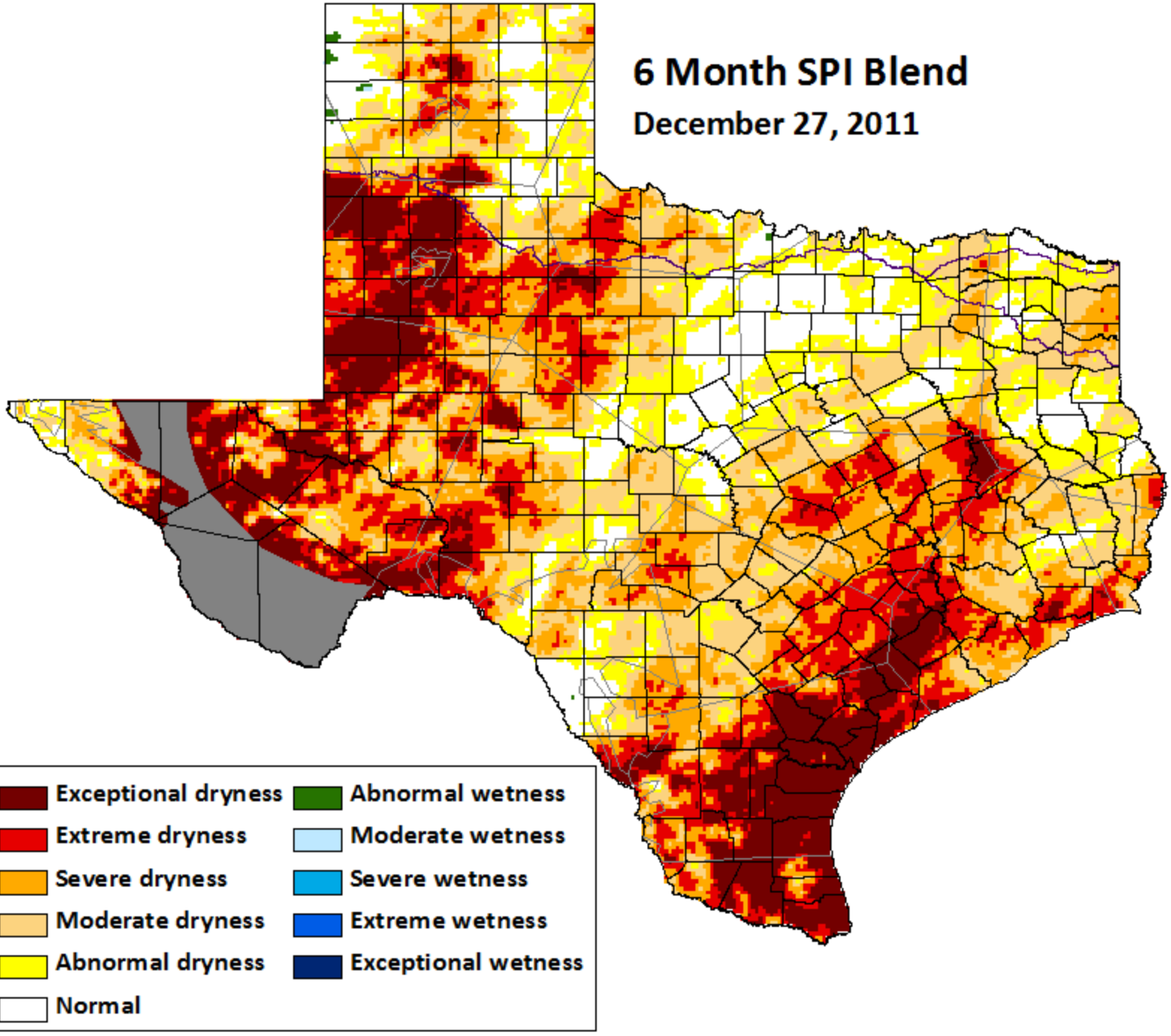
Texas Drought Outlook, October 2011

- Returning La Niña
  - Drought likely to continue

6 Month SPI Blend

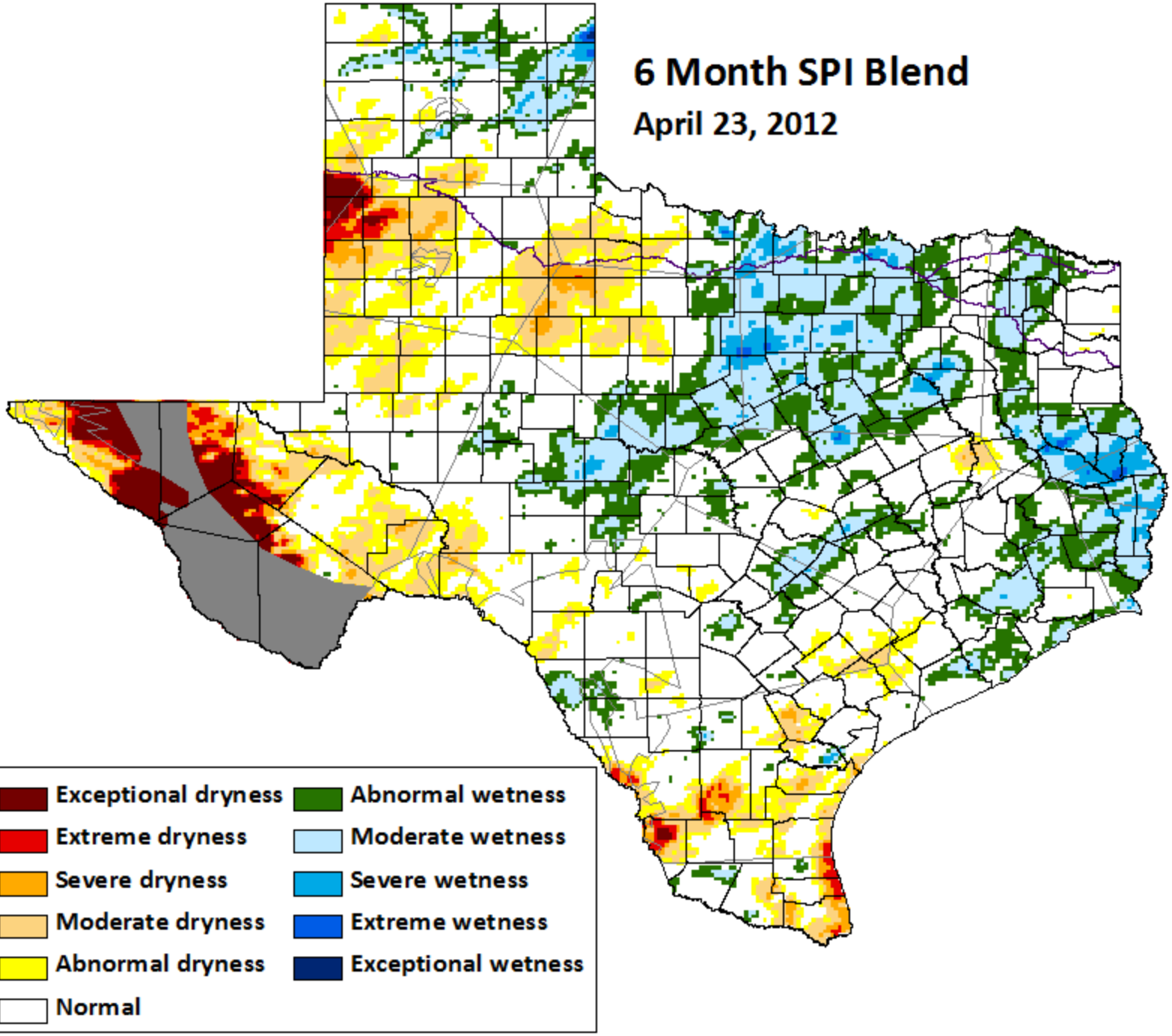
September 27, 2011

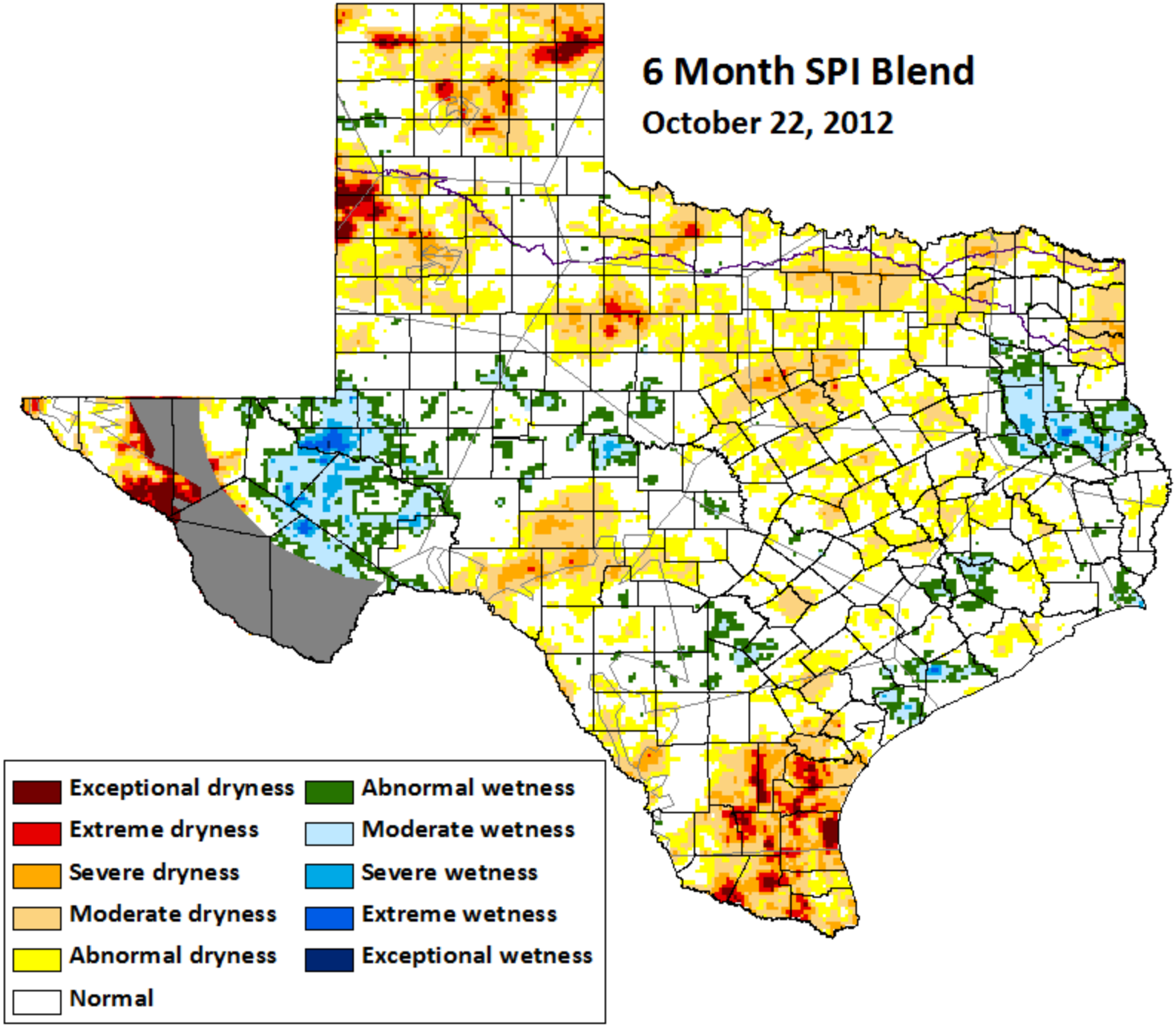



6 Month SPI Blend
December 27, 2011
Exceptional dryness
Extreme dryness
Severe dryness
Moderate dryness
Abnormal dryness
Normal
Abnormal wetness
Moderate wetness
Severe wetness
Extreme wetness
Exceptional wetness

6 Month SPI Blend

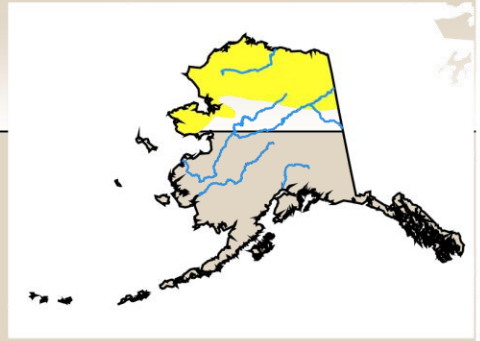
April 23, 2012

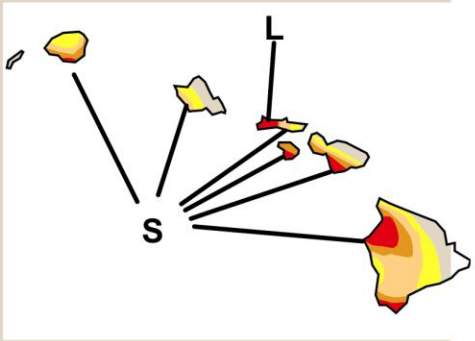


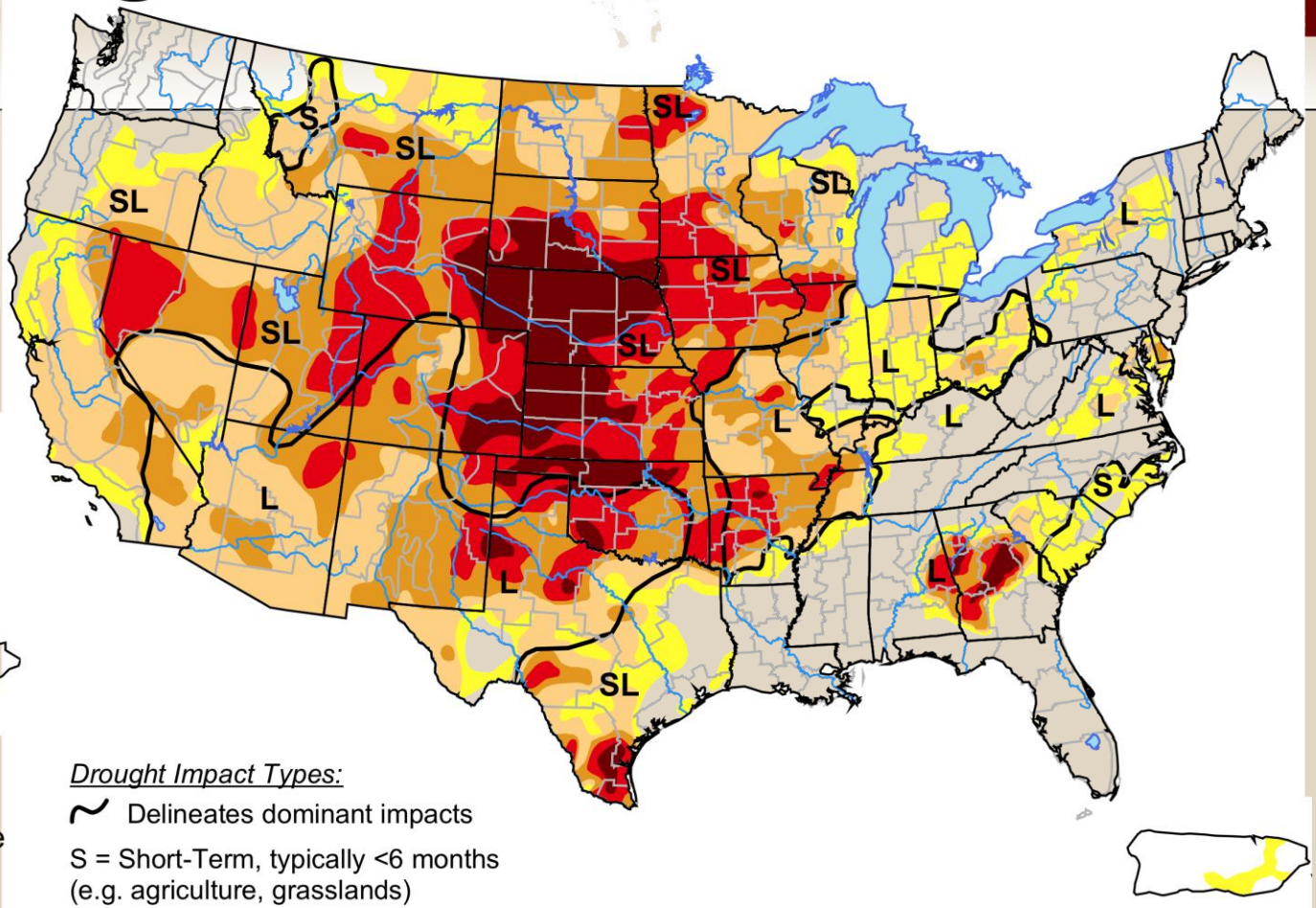

6 Month SPI Blend
October 22, 2012
Exceptional dryness
Extreme dryness
Severe dryness
Moderate dryness
Abnormal dryness
Normal
Abnormal wetness
Moderate wetness
Severe wetness
Extreme wetness
Exceptional wetness

U.S. Drought Monitor

October 16, 2012
Valid 7 a.m. EDT







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 summary for forecast statements.

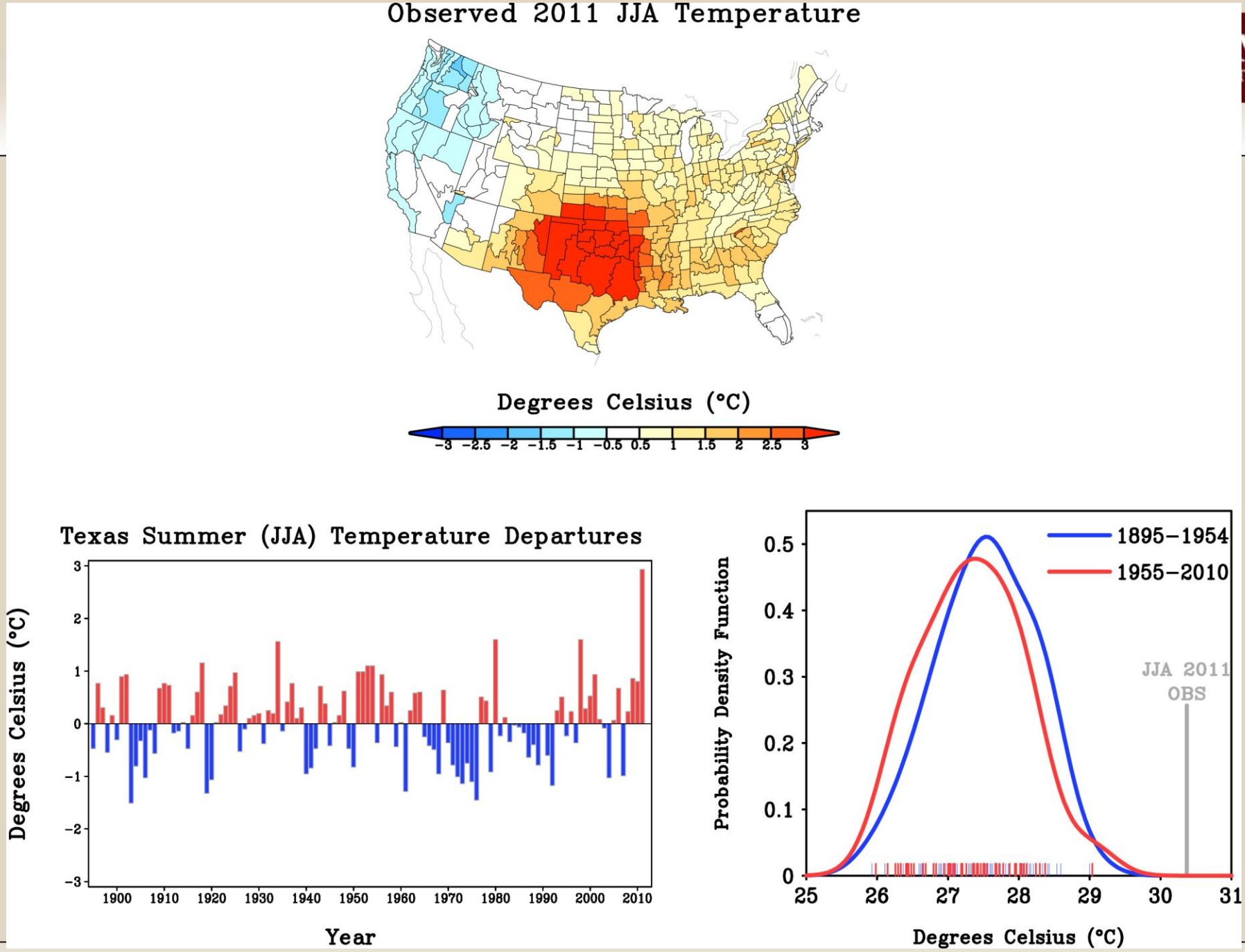
http://droughtmonitor.unl.edu/

Released Thursday, October 18, 2012

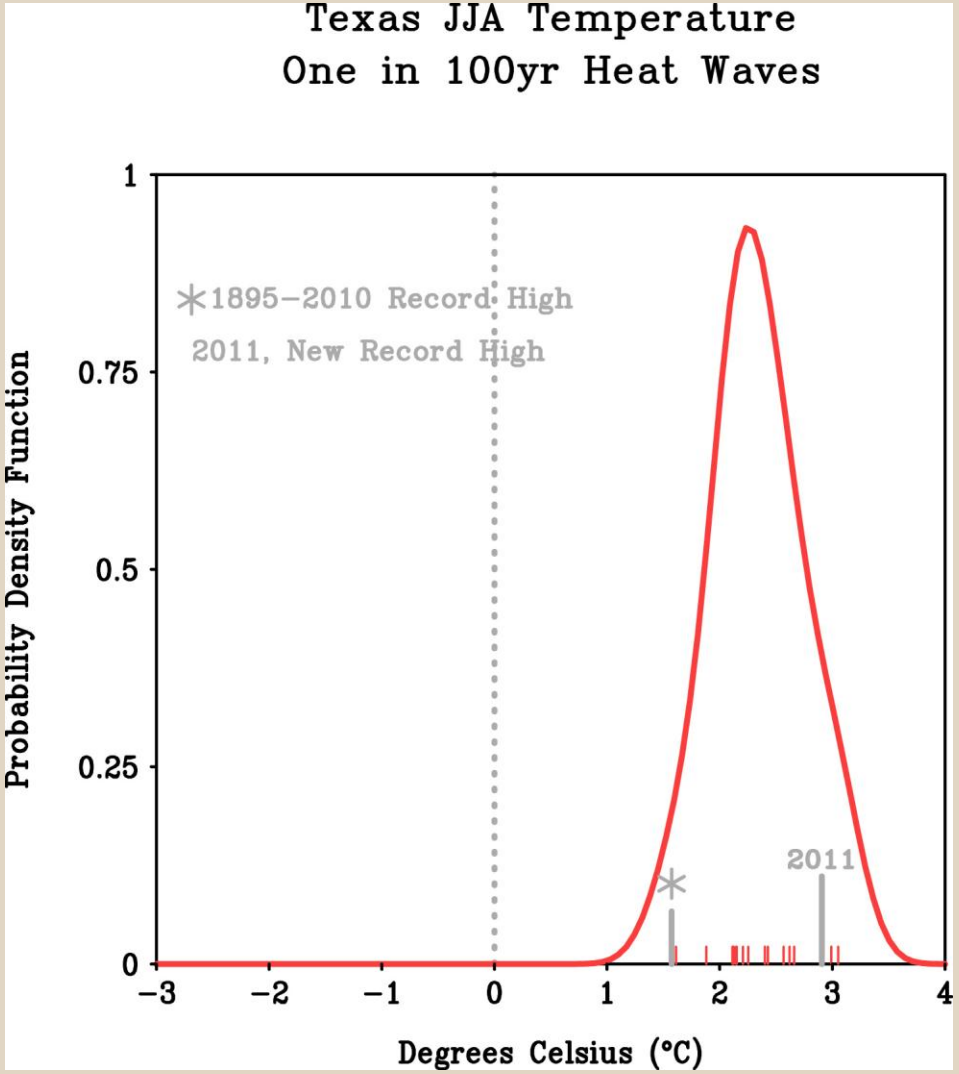
Author: Matthew Rosencrans, NOAA/NWS/NCEP/CPC

Why the 2011 Heat Wave/Drought? New Science

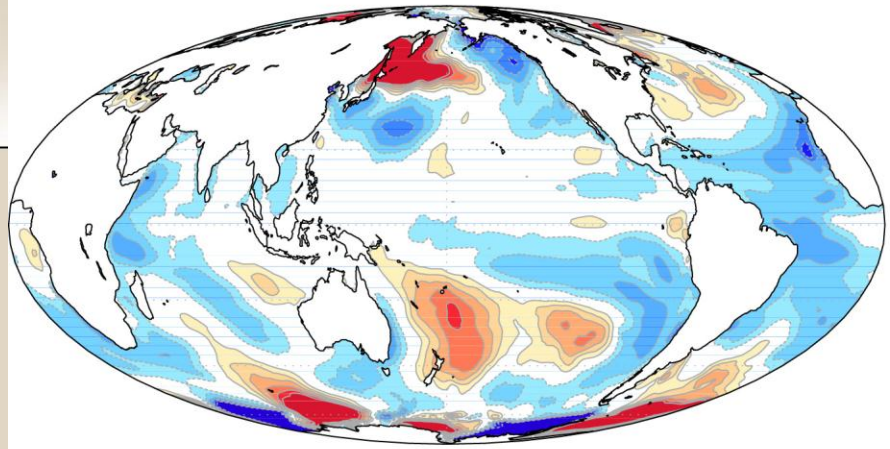
- Teamed up with NOAA's Earth System Research Laboratory and Climate Prediction Center
- Broke down the 2011 heat wave into its root causes
- And now, for the (second) time…


Observed 2011 JJA Temperature
Degrees Celsius (°C)
−3 −2.5 −2 −1.5 −1 −0.5 0.5 1 1.5 2 2.5 3
Texas Summer (JJA) Temperature Departures
Degrees Celsius (°C)
3 2 1 0 −1 −2 −3
1900 1910 1920 1930 1940 1950 1960 1970 1980 1990 2000 2010
Year
Probability Density Function
0.5 0.4 0.3 0.2 0.1 0
1895–1954
1955–2010
JJA 2011
OBS
25 26 27 28 29 30 31
Degrees Celsius (°C)

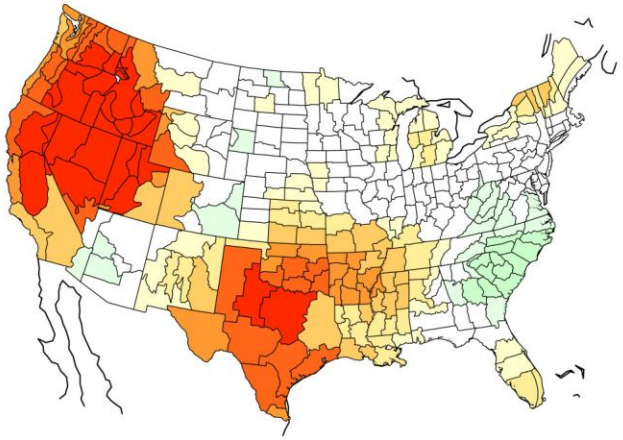
From 1500-year “pre-industrial” simulation of CCSM4



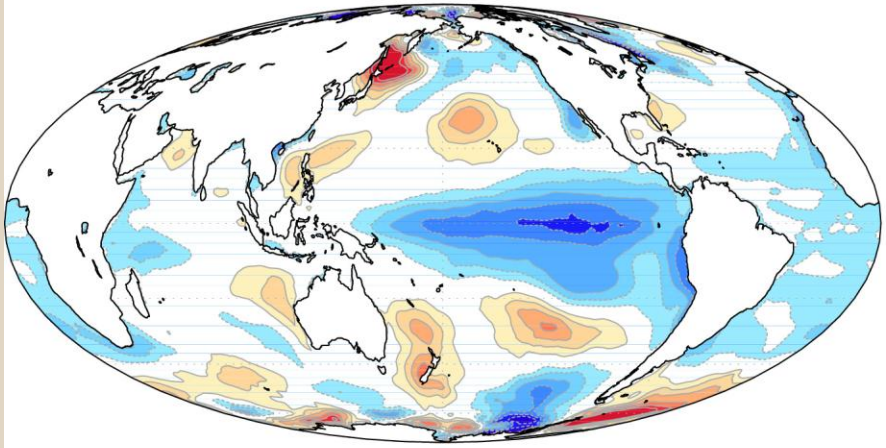
CCSM4 SST JJA



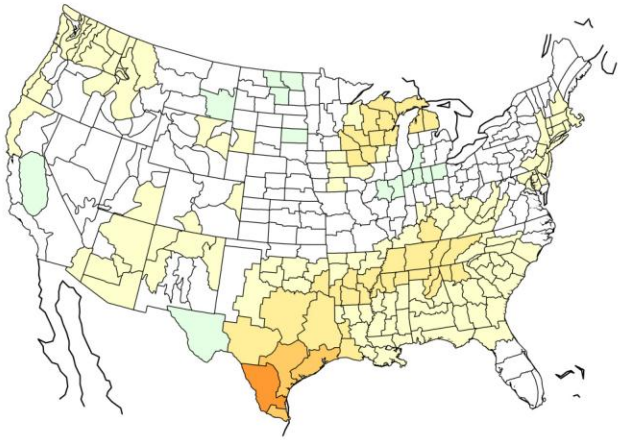
CCSM4 Pcpn JJA



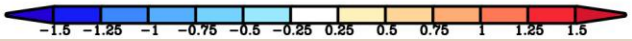
CCSM4 SST Oct–May



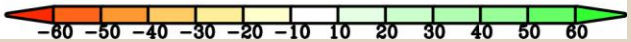
CCSM4 Pcpn Oct–May



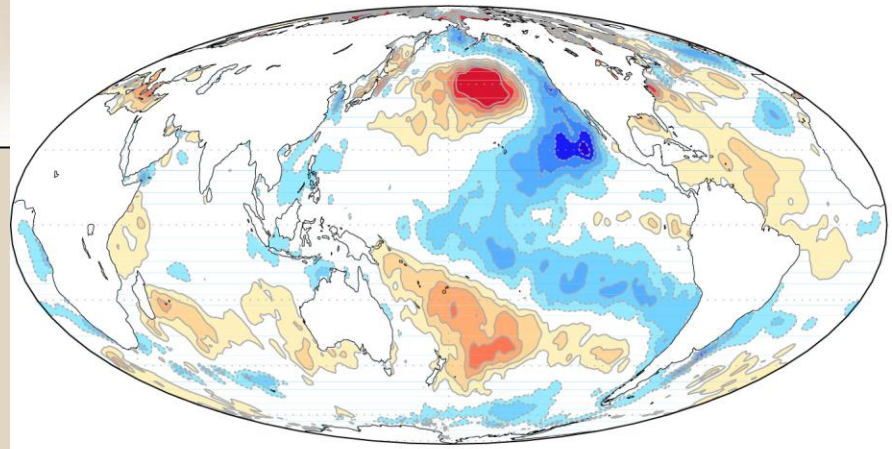
Degrees Celsius



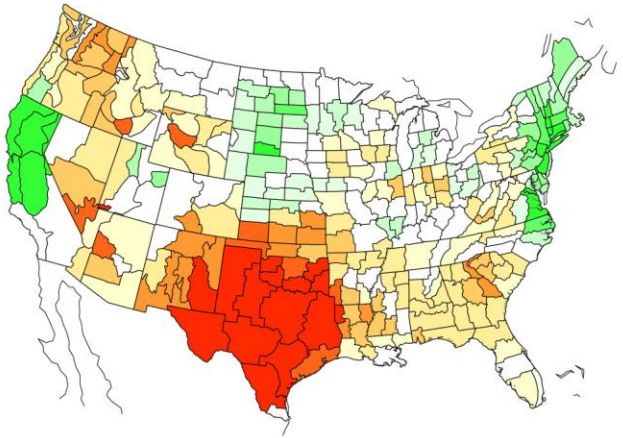
Percent of Climatology (%)



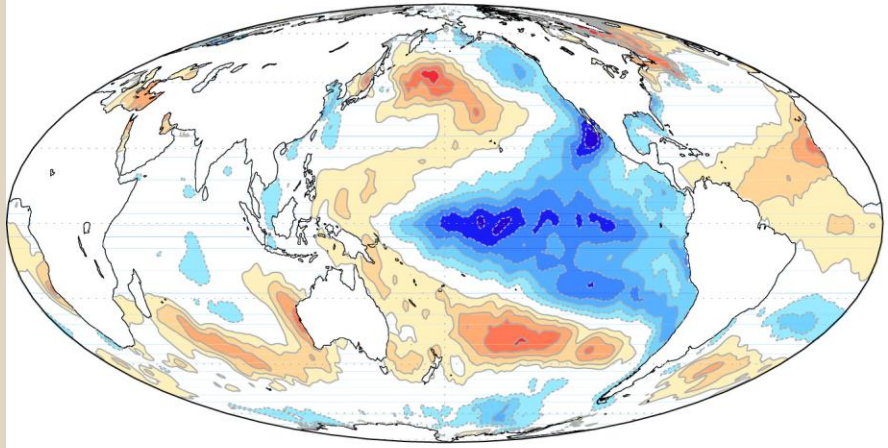
Observed SST JJA 2011



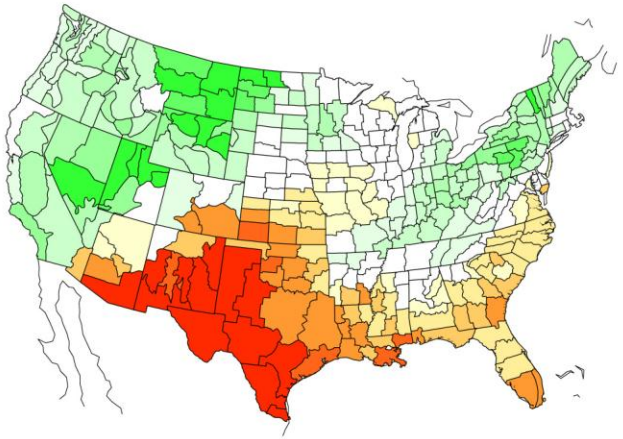
Observed Pcpn JJA 2011



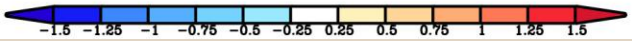
Observed SST Oct–May 2011



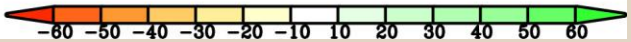
Observed Pcpn Oct–May 2011



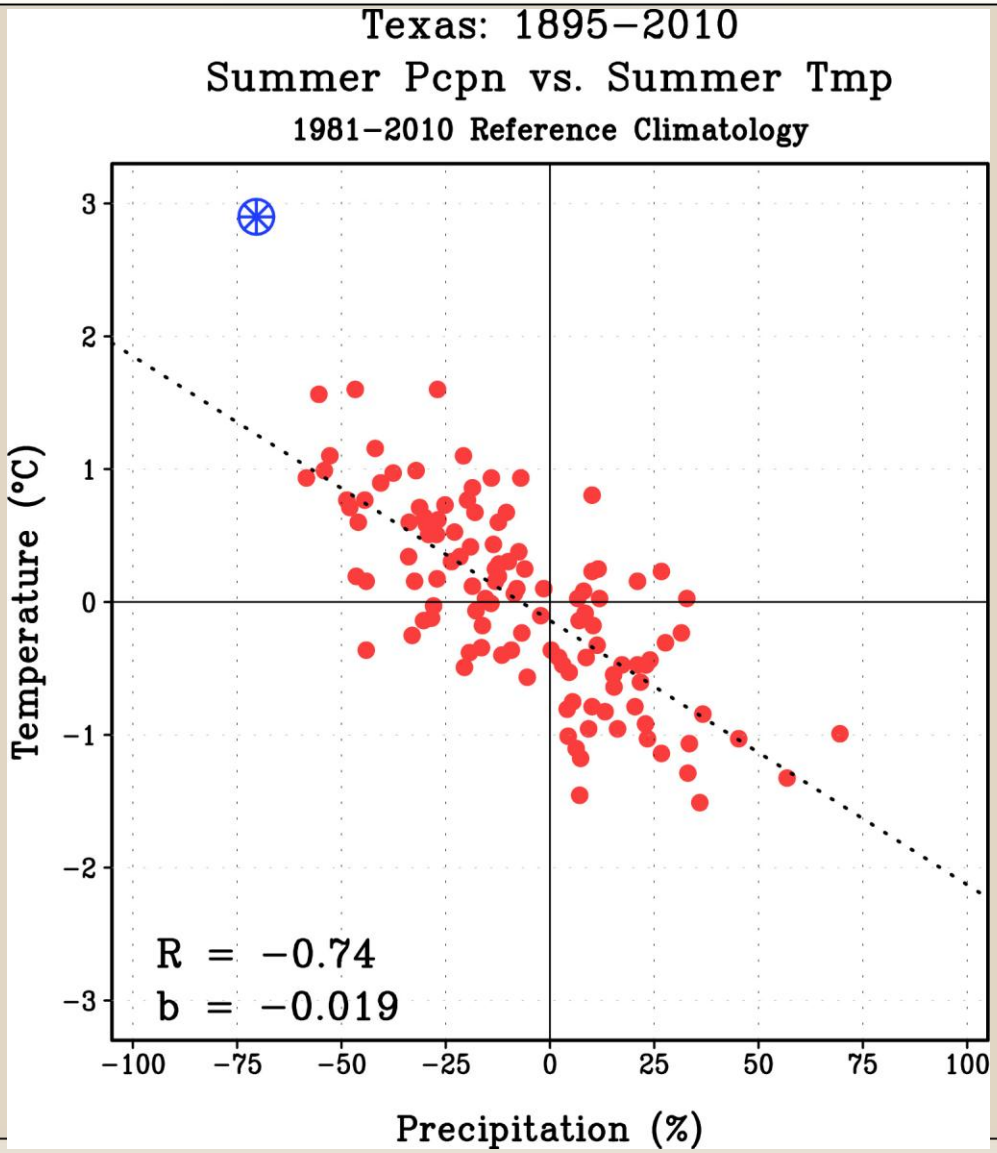
Degrees Celsius

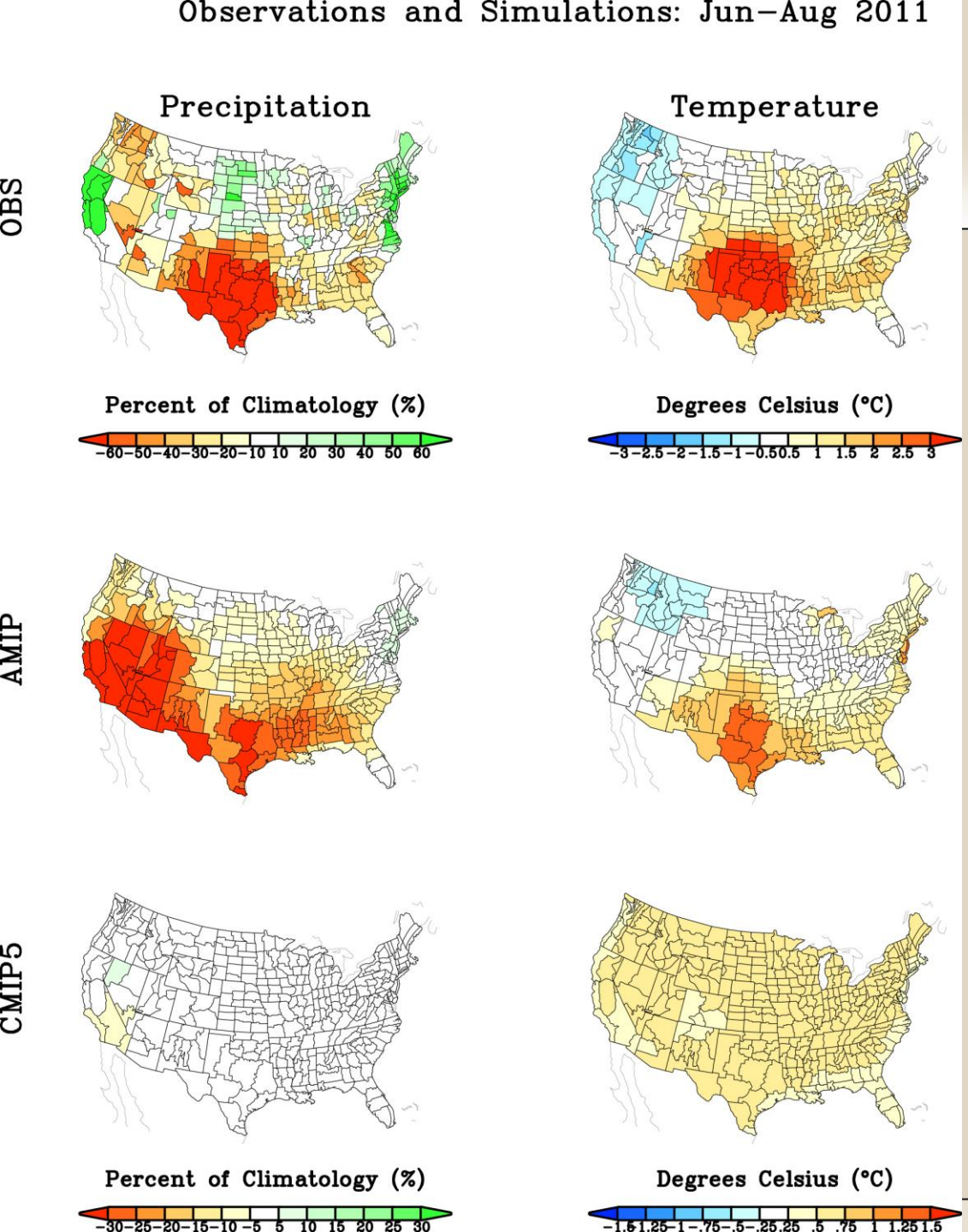


Percent of Climatology (%)



Historical relationship: Summer Precipitation and Temperature





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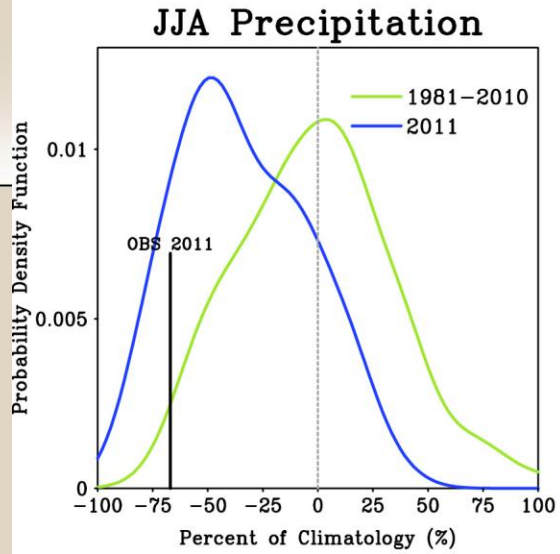
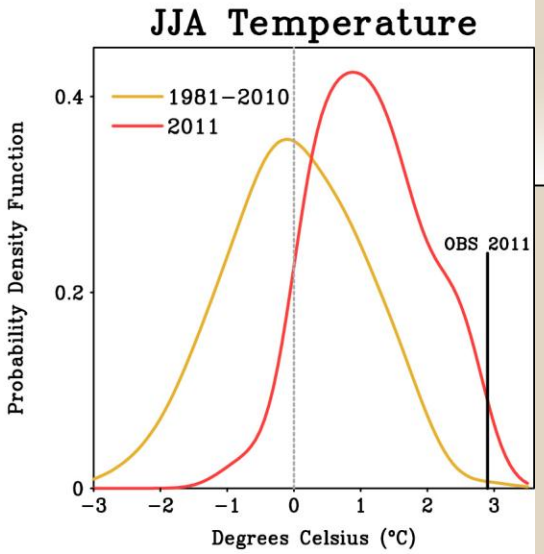
Atmosphere-only model, observed sea surface temperatures

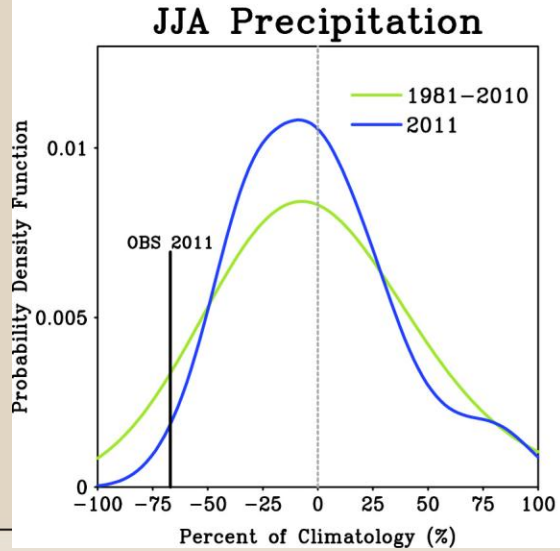
Atmosphere-Ocean model, observed climate forcings

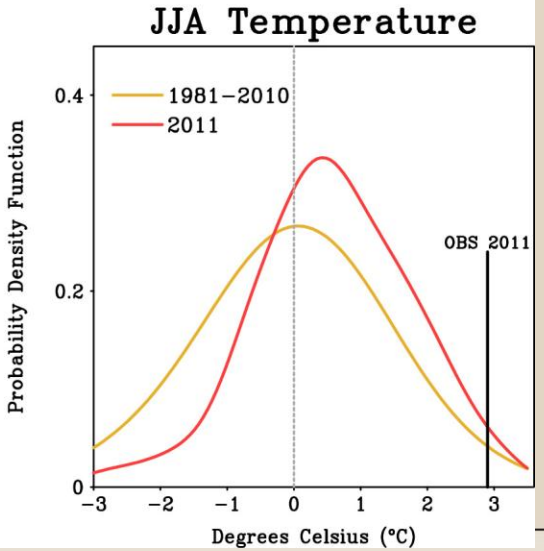
AMIP


JJA Precipitation
1981–2010
2011
OBS 2011
Probability Density Function
0.01
0.005
0
−100 −75 −50 −25 0 25 50 75 100
Percent of Climatology (%)


JJA Temperature
1981–2010
2011
OBS 2011
Probability Density Function
0.4
0.2
0
−3 −2 −1 0 1 2 3
Degrees Celsius (°C)

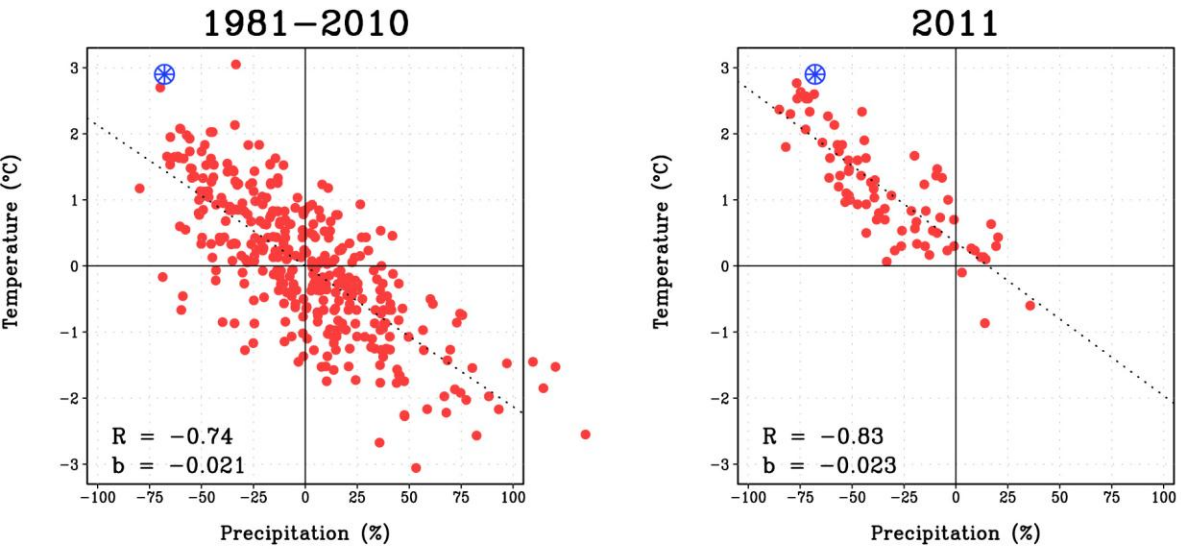
CMIP5


JJA Precipitation
1981–2010
2011
OBS 2011
Probability Density Function
0.01
0.005
0
−100 −75 −50 −25 0 25 50 75 100
Percent of Climatology (%)


JJA Temperature
1981–2010
2011
OBS 2011
Probability Density Function
0.4
0.2
0
−3 −2 −1 0 1 2 3
Degrees Celsius (°C)

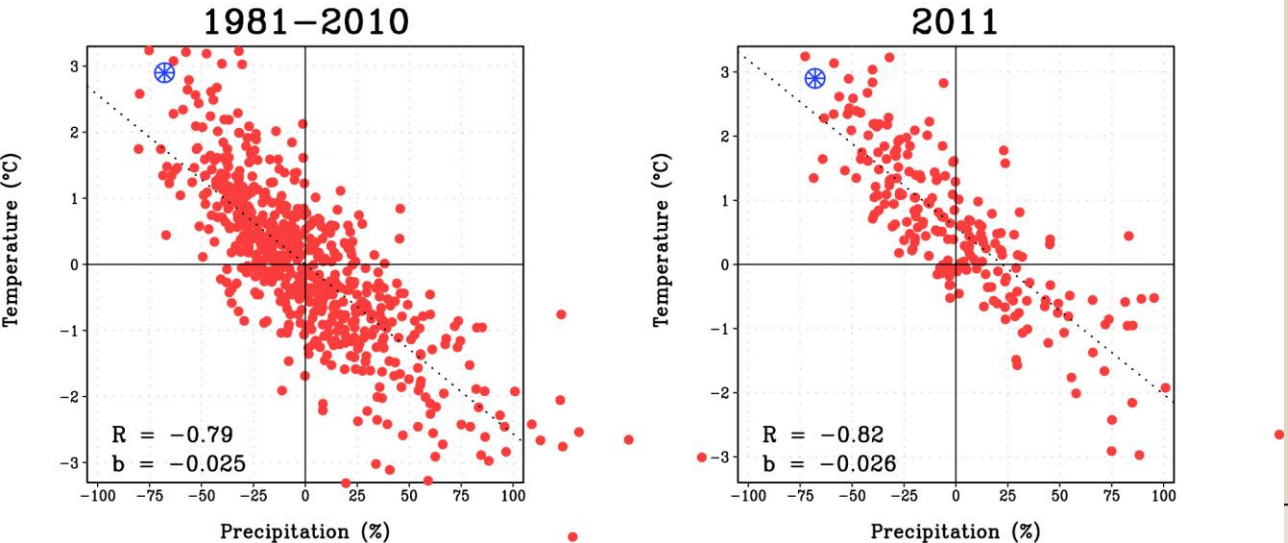
AMIP

Summer Tmp vs. Summer Pcpn

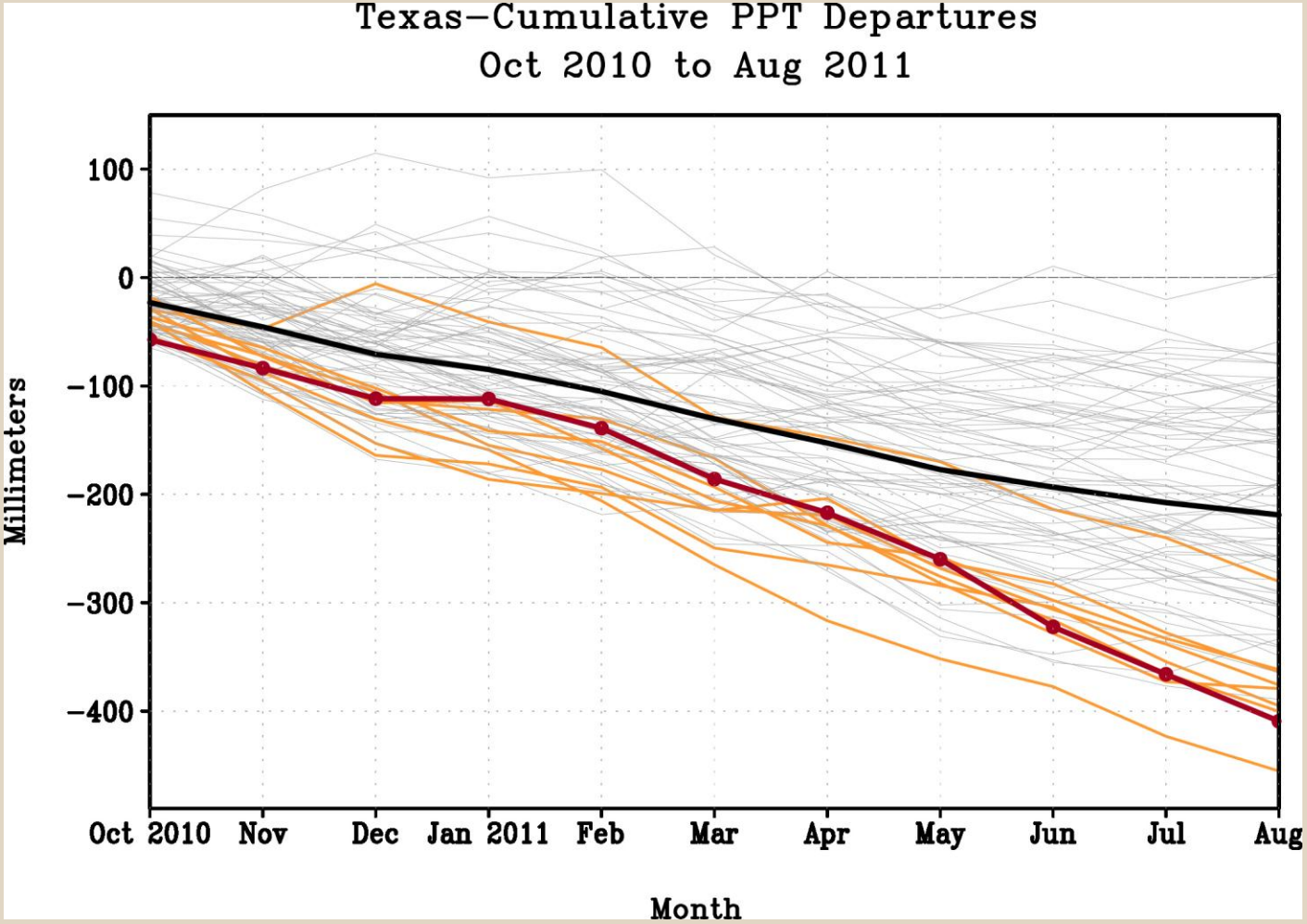


CMIP5

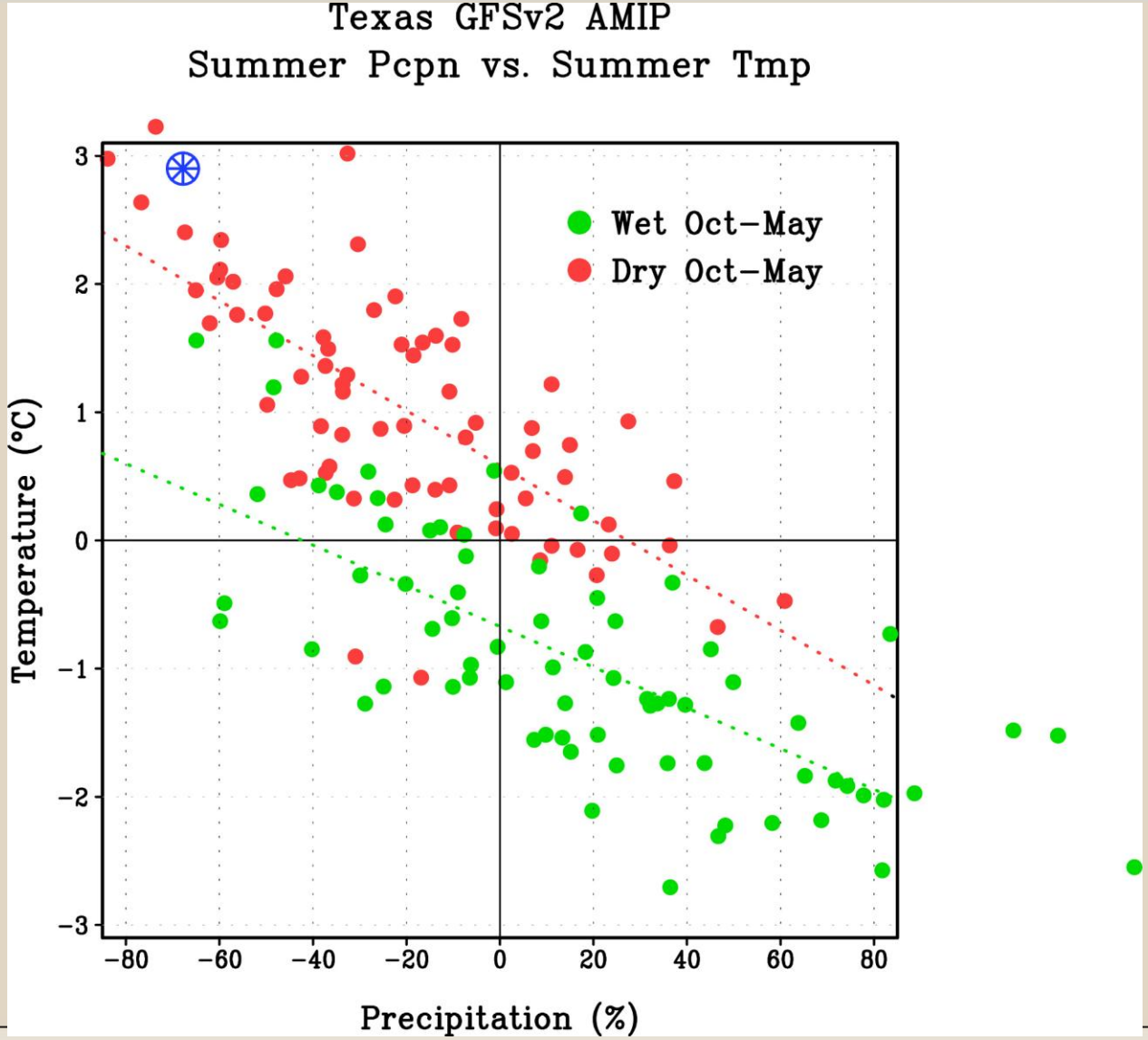
Summer Tmp vs. Summer Pcpn



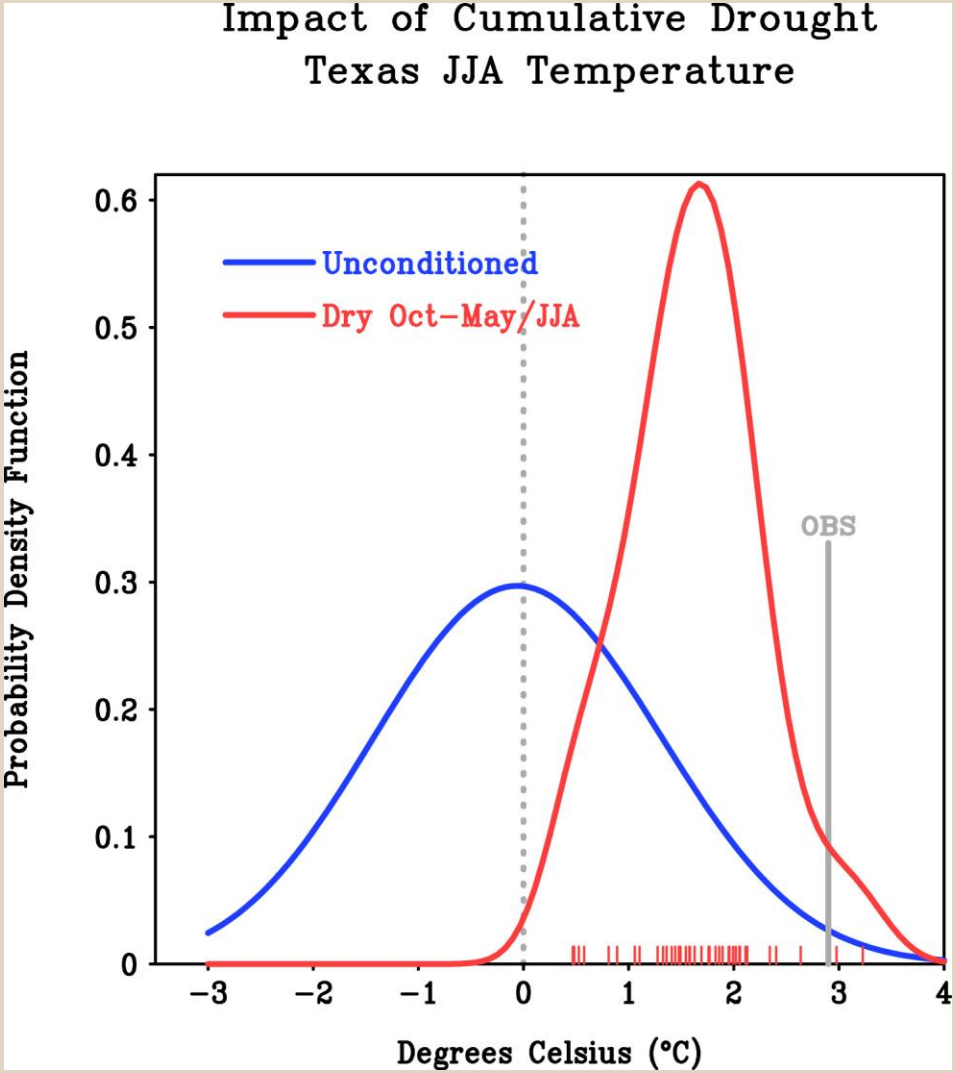
Precipitation from eight hottest AMIP runs



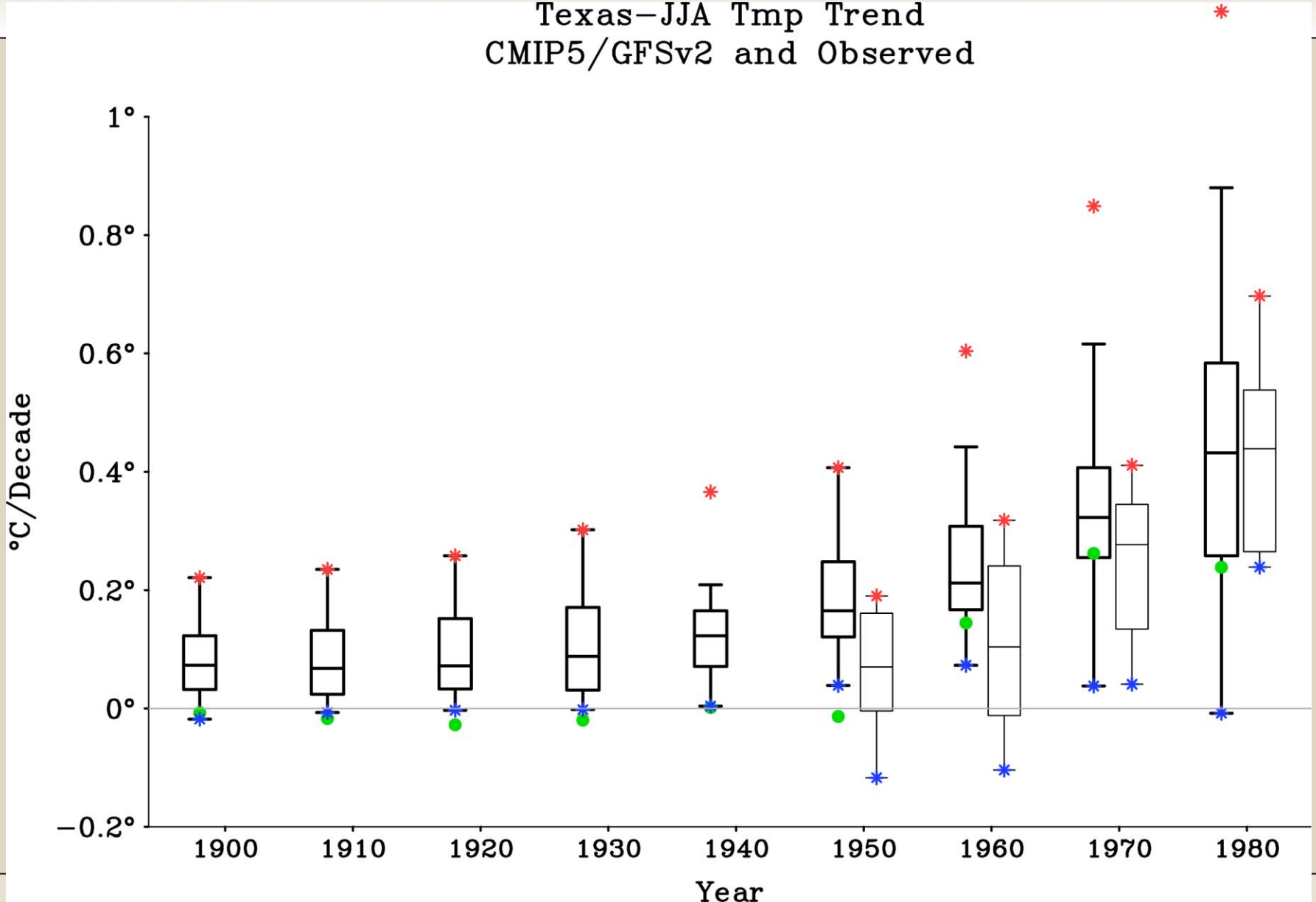
Simulations of 1950-2010

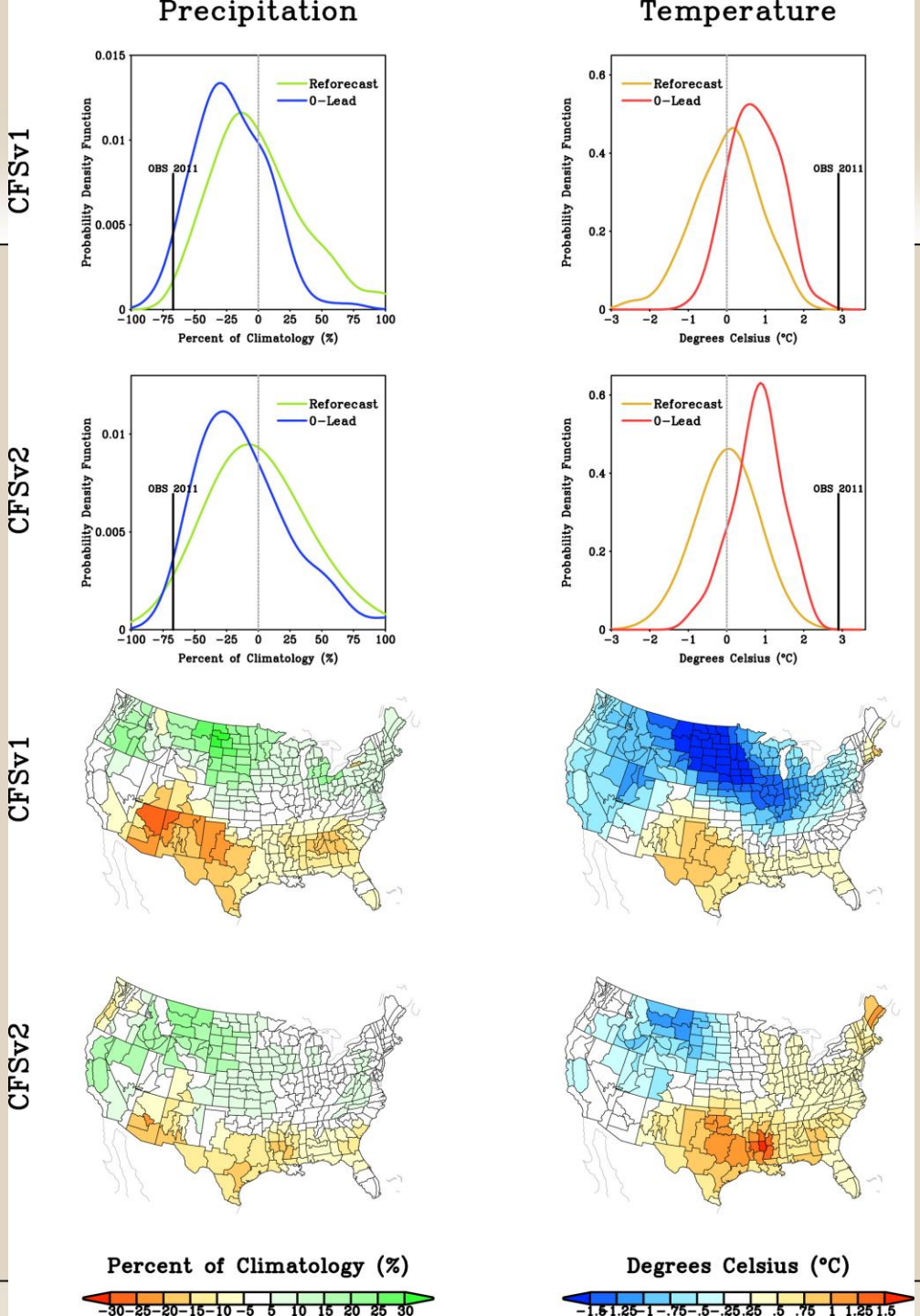


Dry going in, hot going through



Warming in Texas





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Global operational forecast models, initialized in May 2011

Results

- Not impossible through natural effects alone
- The lack of rain was natural
- 40% of heat due to sea surface temps
- 40% of heat due to weather randomness
- 20% of heat due to global warming

P.S. Latest Texas Outlook

- El Niño probably not going to happen
- Little tilting of the odds this winter
- Maybe best chance to break drought before possible La Niña next year

Contact Information

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