



Managing Weather Risk in Production Agriculture Disruptive Weather – Consistency in Chaos



Jan 9, 2019

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Nutrien
Ag Solutions™

Austria Jan 6-7, 2019



Double Microburst





Marshalltown, IA



@ThomasPatrickWx



@NStewCBS2 Nick Stewart

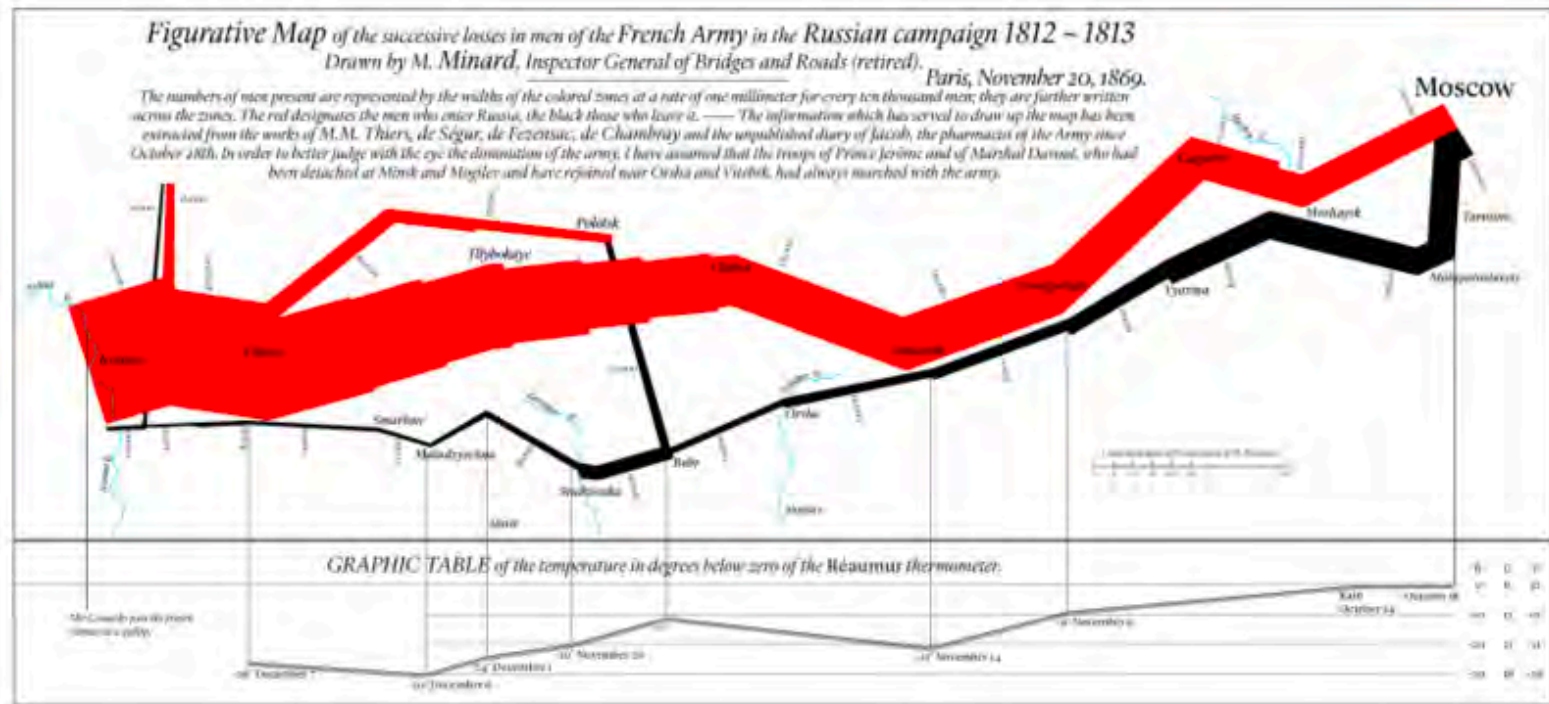
Bondurant, IA



@StormChaserTodd

Can we “weaponize” weather?

Can weather become part of your strategy rather than a disruption to your strategy?



June 5, 1944 was a “no-go”

The postponement of D-Day. Needed calm winds and perfect tide conditions. Eisenhower listened to his meteorologists and June 6 was a go.



James Martin Staag (Royal Air Force)



Normandy Landings

Can we weatherproof production agriculture?

This guy should have just bought insurance...



Using weather information to optimize time and minimize the frequency of bad decisions.



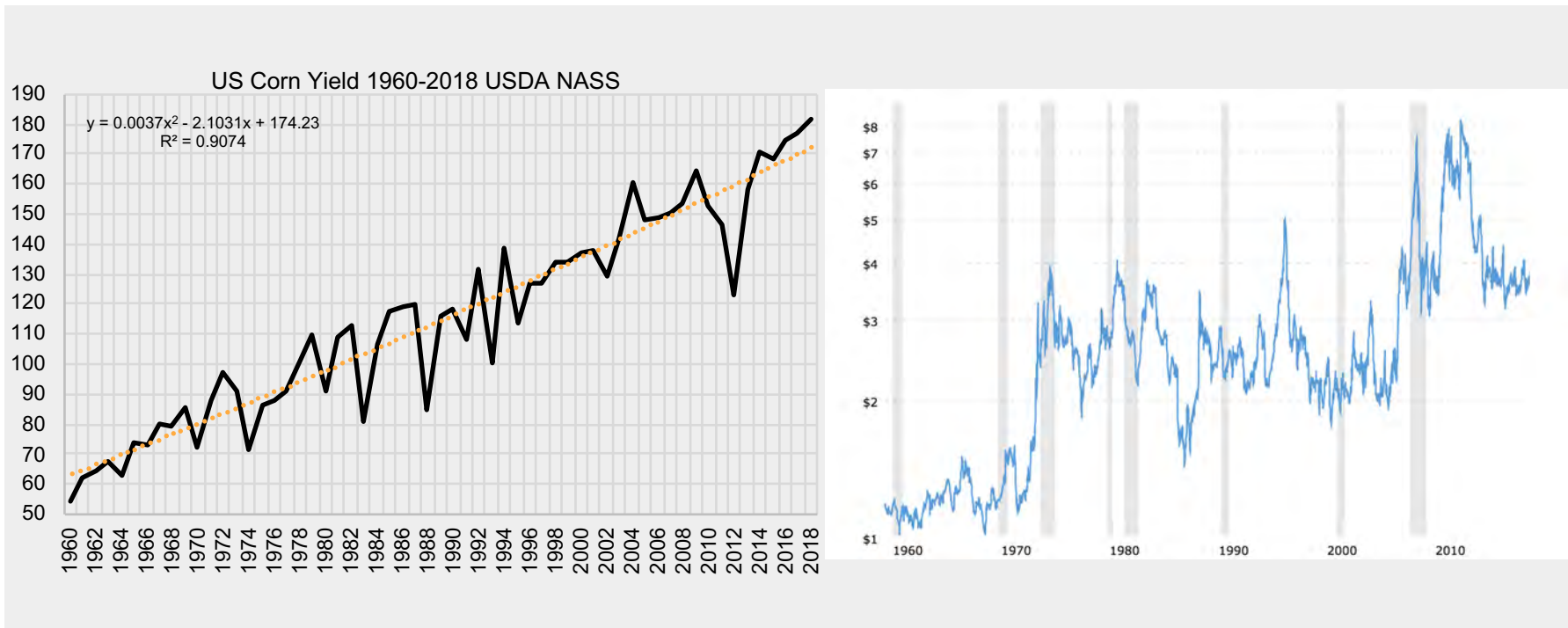
Lessons learned

Jon LeBrun @LeBrunJon

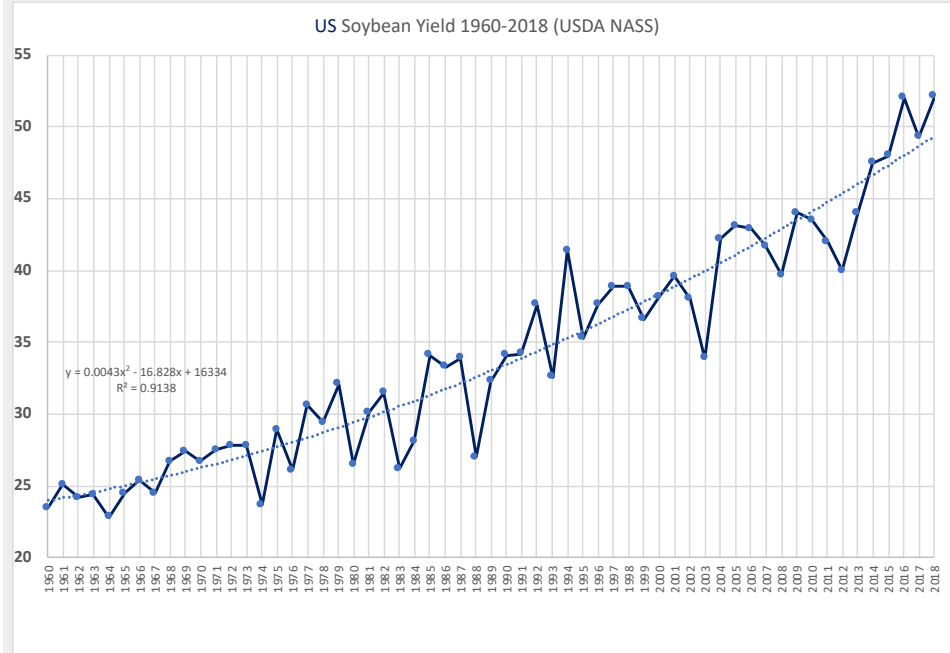


The Cornbelt had a 6th straight year of excellent growing season weather

Why should you care? ~20% of the last 58 years have had significantly below trend yields



US Soybean Yields 1960-2018



Law of Averages...

Does not apply to agricultural yields, but people think we are due for a big drought (and that is extremely valuable to know).

The screenshot shows the Mega Millions website interface. At the top, there's a navigation bar with links: Winning Numbers, How To Play, Where to Play, Winners Gallery, About Us, and FAQs. The main content area features a large yellow banner for the "Next Estimated Jackpot: \$1.60 BILLION" with a cash option of \$913 million. To the right, it says "Next Drawing: 11 pm ET TUESDAY 10/23/2018". Below this, the "10/19/2018 WINNING NUMBERS" are displayed as 15, 23, 53, 65, 70, and 7. A large central graphic shows the Mega Millions logo and the winning numbers in large white circles on a blue background, with "MEGAPLIER 2x" and "10/19/2018 Winning Numbers" text. On the right sidebar, there are links for "How to play", "Where to play" (with a state selector), "Download the App", "Beware of Lottery Scams!", "Meet the winners!" (with a photo of a winner holding a \$1,000,000 check), and "Mega Millions News".

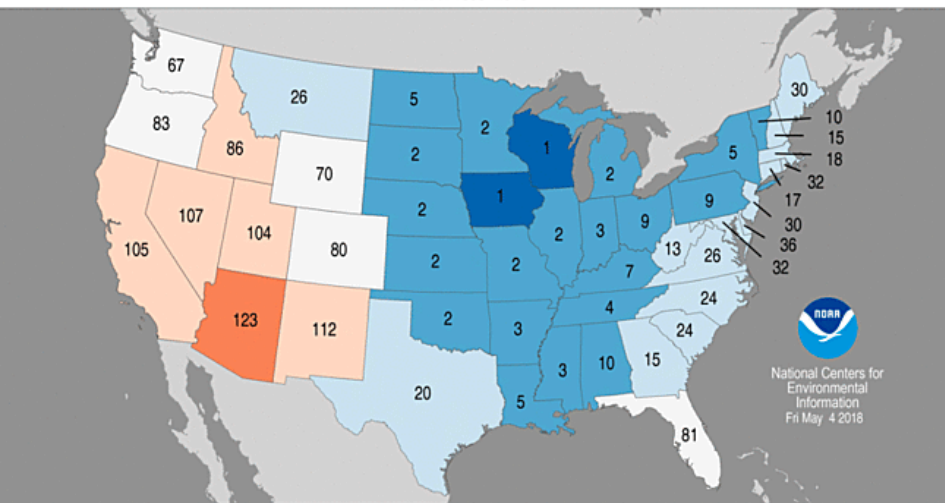
What did we learn from 2018

A late start that didn't matter

Statewide Average Temperature Ranks

April 2018

Period: 1895–2018

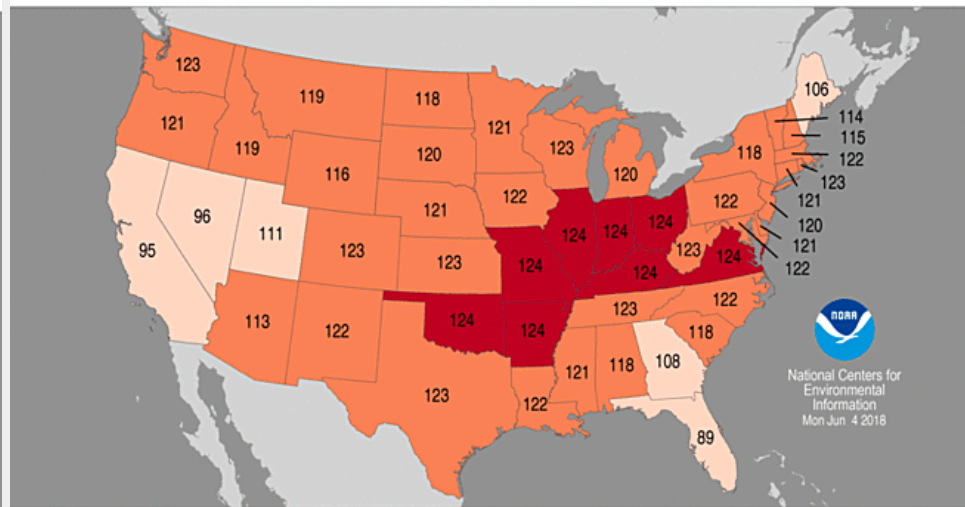


Record Coldest (1)
Much Below Average
Below Average
Near Average
Above Average
Much Above Average
Record Warmest (124)

Statewide Average Temperature Ranks

May 2018

Period: 1895–2018



Record Coldest (1)
Much Below Average
Below Average
Near Average
Above Average
Much Above Average
Record Warmest (124)

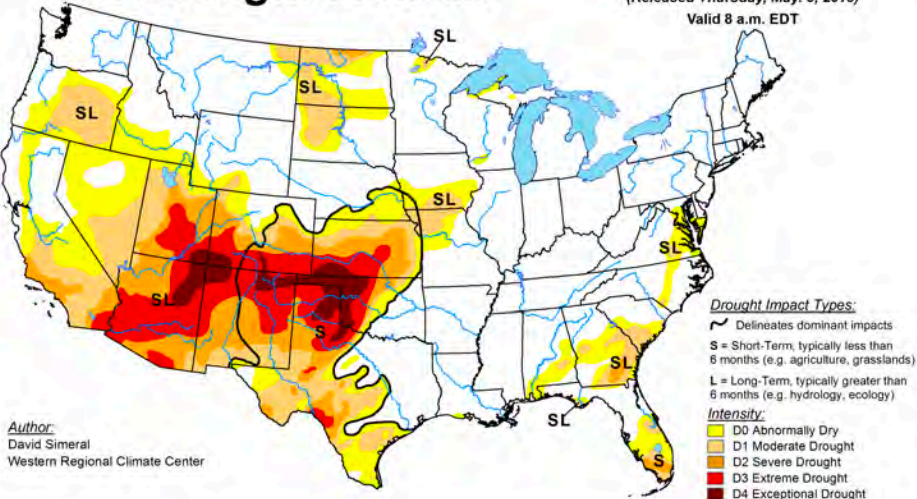
Migrating Drought

U.S. Drought Monitor

May 1, 2018

(Released Thursday, May 3, 2018)

Valid 8 a.m. EDT

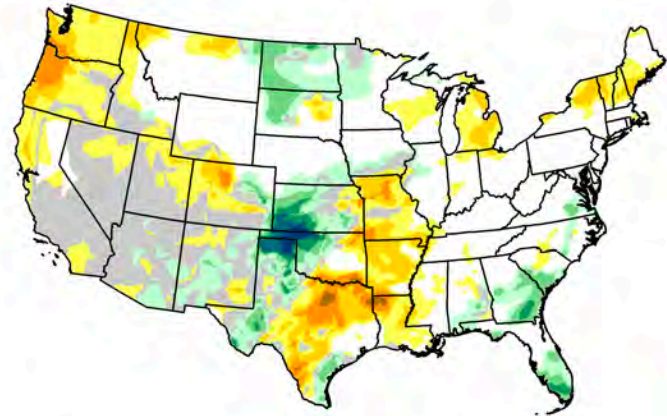


Author:
David Simmer
Western Regional Climate Center



<http://droughtmonitor.unl.edu/>

U.S. Drought Monitor Class Change - CONUS 3 Months



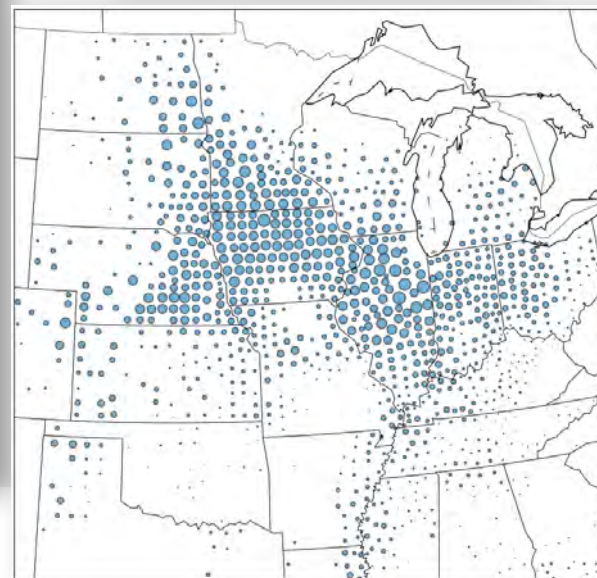
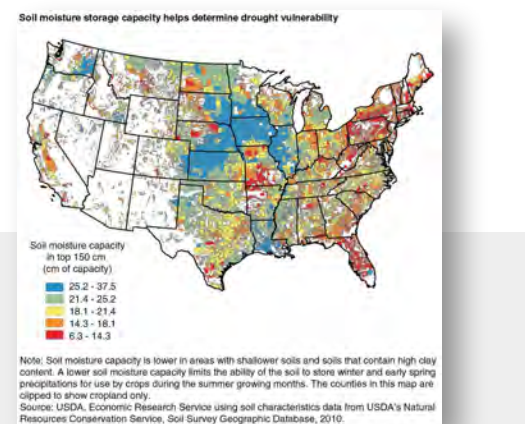
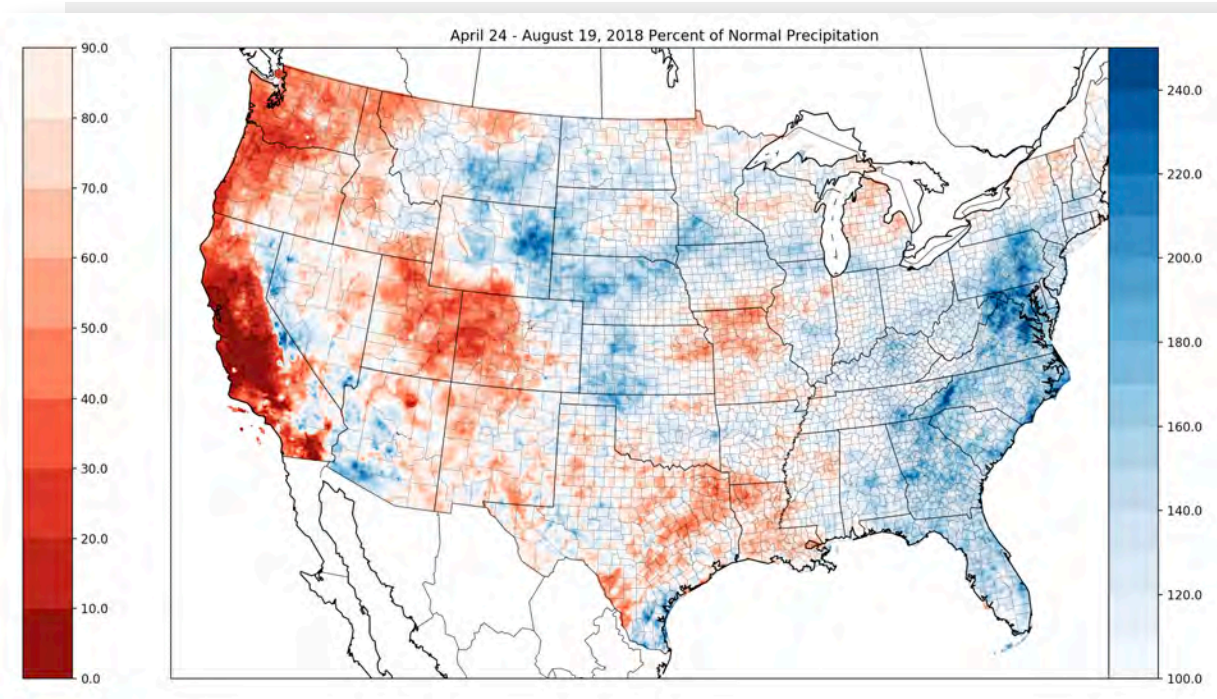
July 31, 2018
compared to
May 8, 2018

<http://droughtmonitor.unl.edu>



- 5 Class Degradation
- 4 Class Degradation
- 3 Class Degradation
- 2 Class Degradation
- 1 Class Degradation
- No Change
- 1 Class Improvement
- 2 Class Improvement
- 3 Class Improvement
- 4 Class Improvement
- 5 Class Improvement

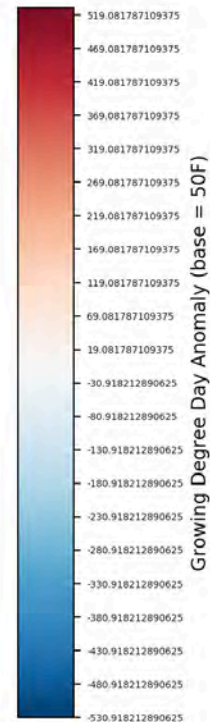
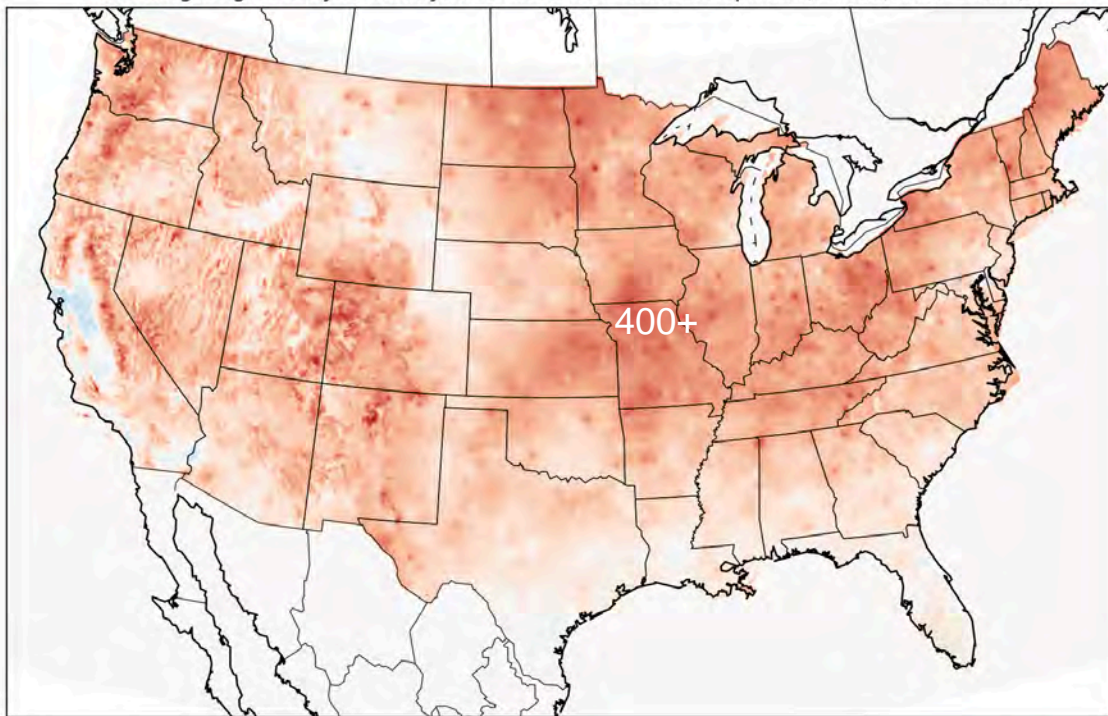
Precipitation Analysis April 24 – August 19



Growing Degree Day Anomaly

This crop is grew fast

Growing Degree Day Anomaly as of 08/14/2018 Since April 24,2018 (base = 50F)

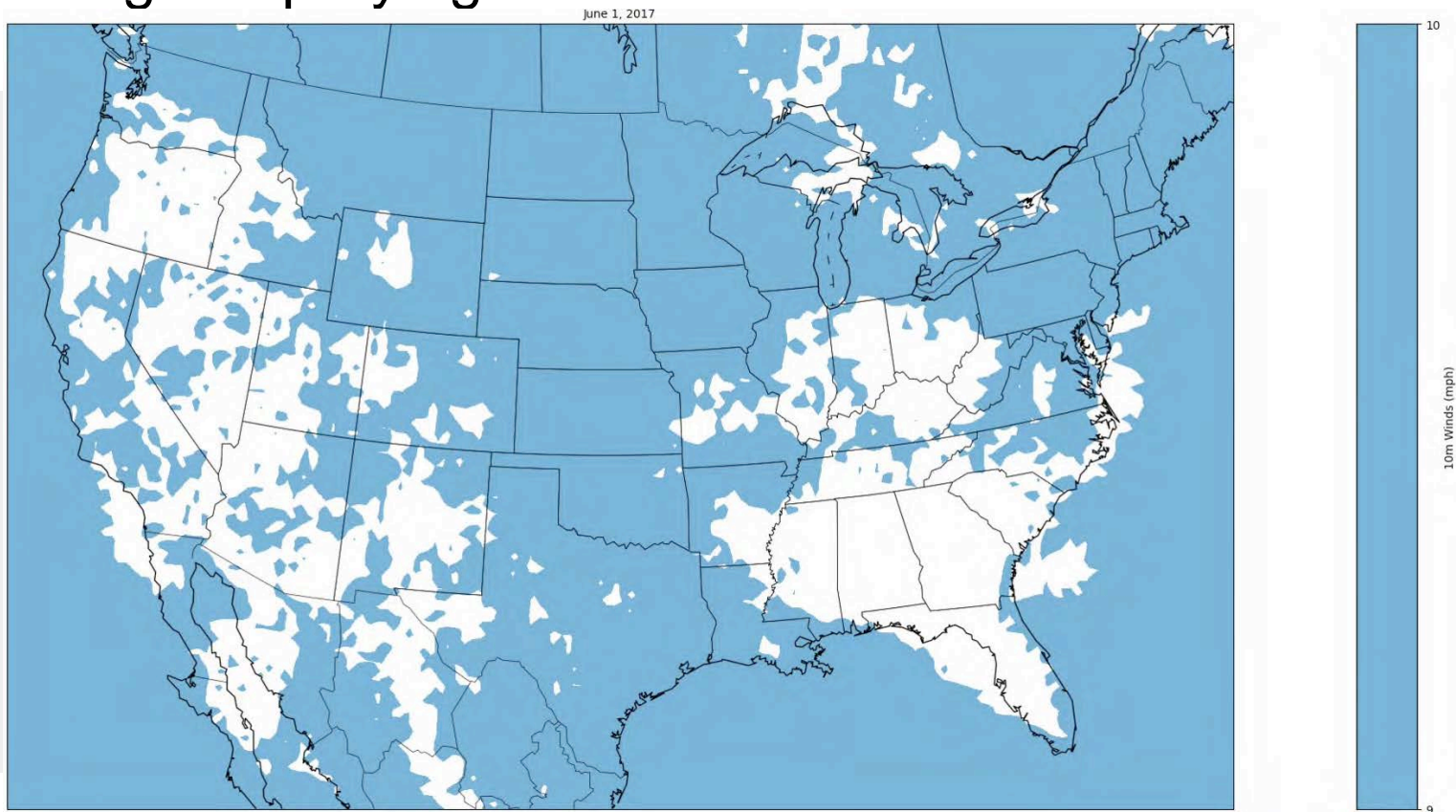


Spray Painting Corn

Thank you twitter...



Speaking of Spraying...

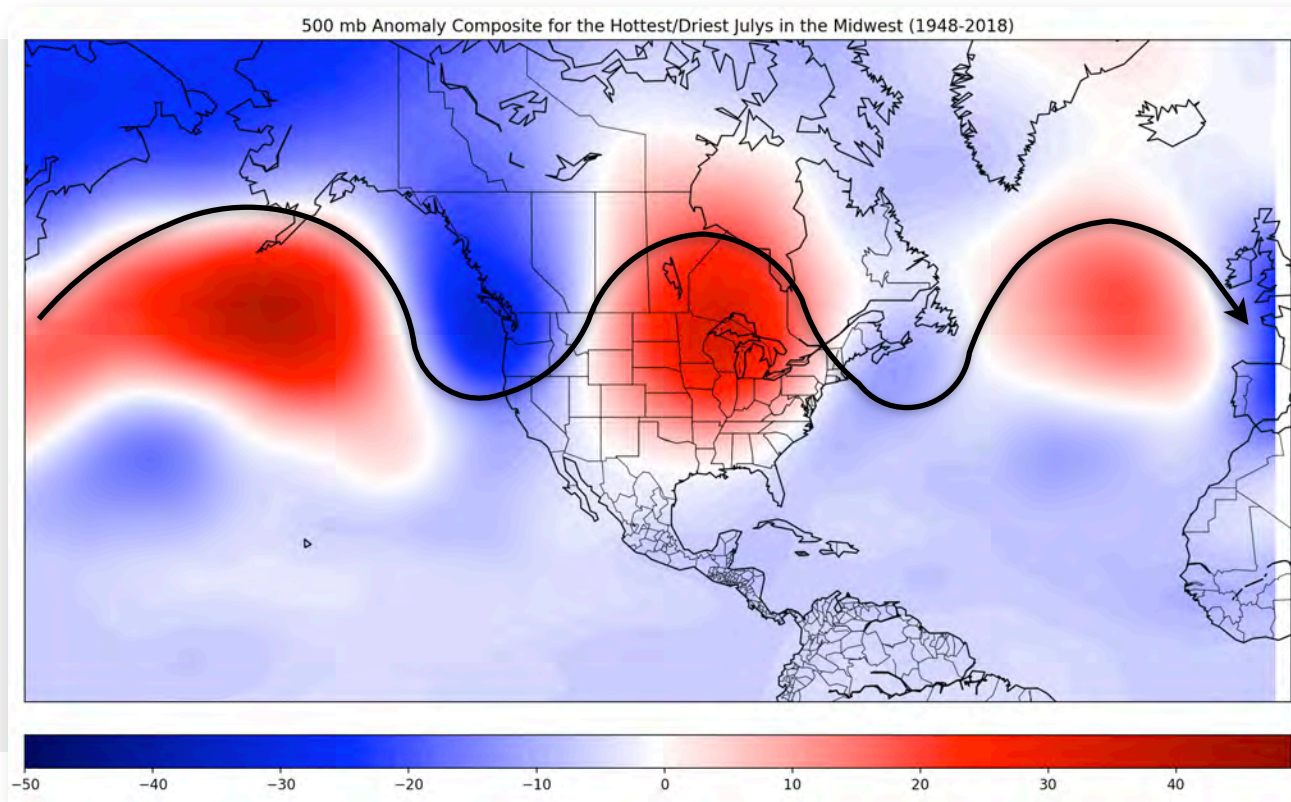




Aaron Horinek

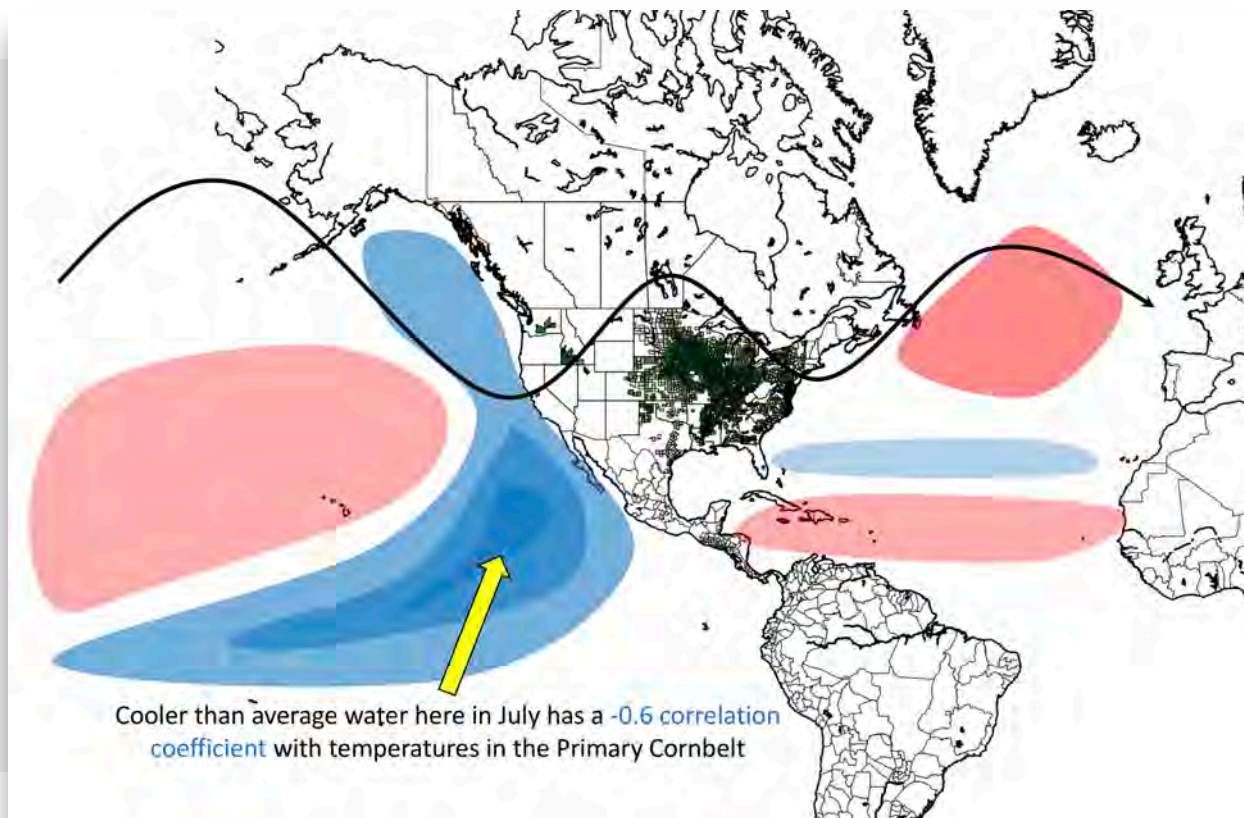
July Ridges - top 10 driest/hottest

Blocked Weather Patterns = Persistent Ridging leads to a Positive Feedback cycle

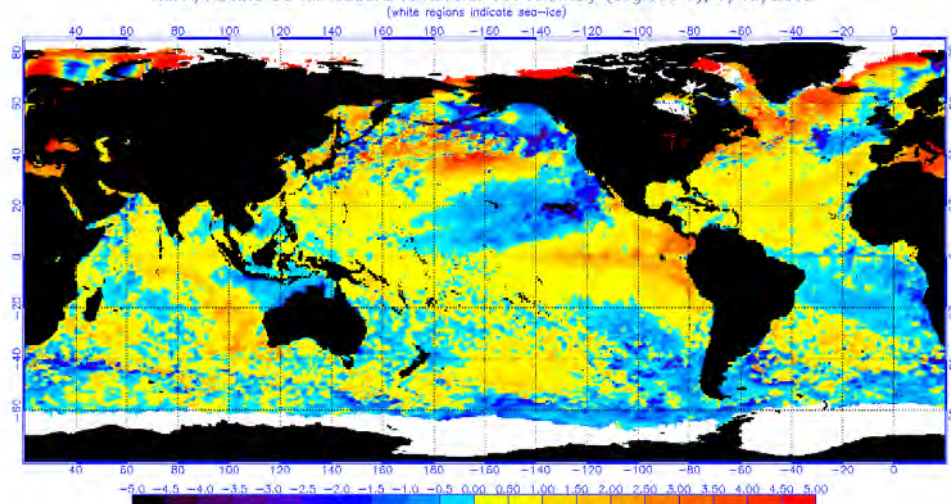


Are their long term predictors for hot/dry July weather across the Cornbelt?

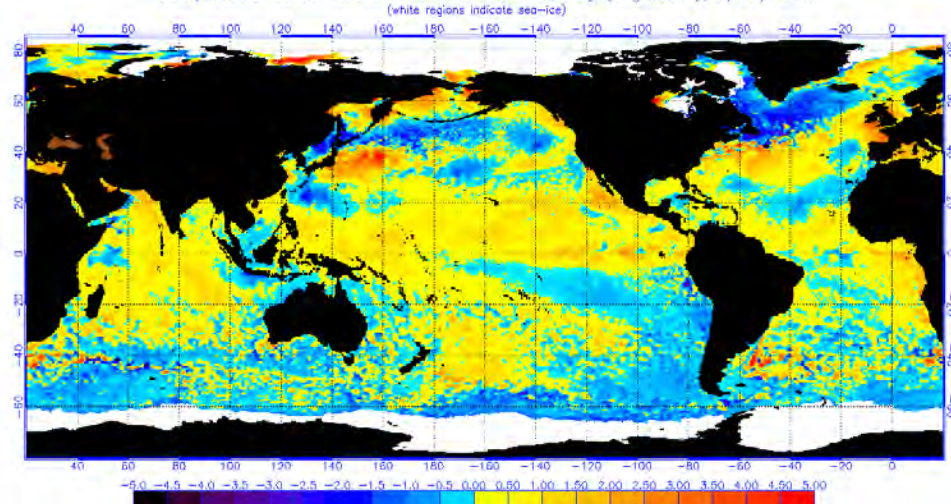
70-year analysis



NOAA/NESDIS 50 KM GLOBAL ANALYSIS: SST Anomaly (degrees C), 7/12/2012



NOAA/NESDIS 50 KM GLOBAL ANALYSIS: SST Anomaly (degrees C), 7/12/2018

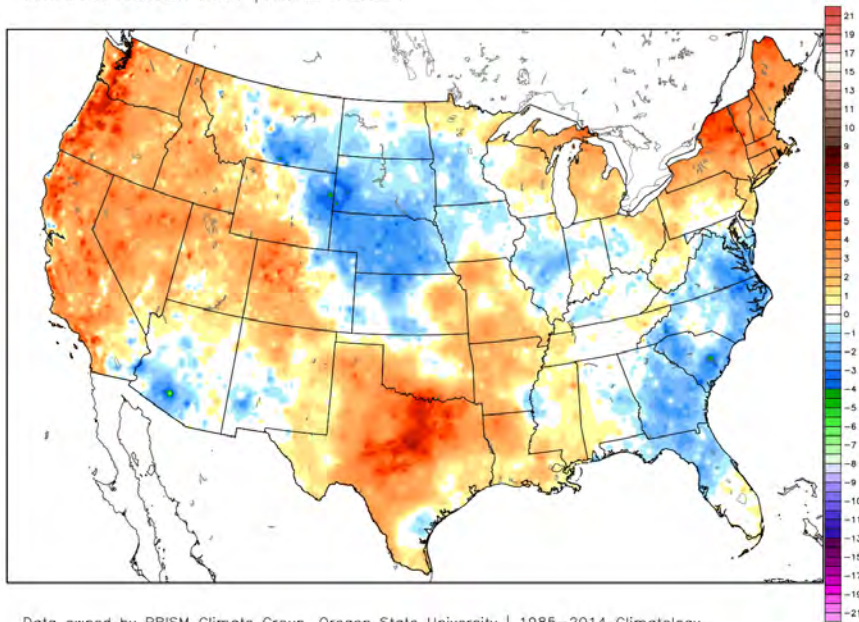


<https://www.ospo.noaa.gov/Products/ocean/sst/anomaly/>

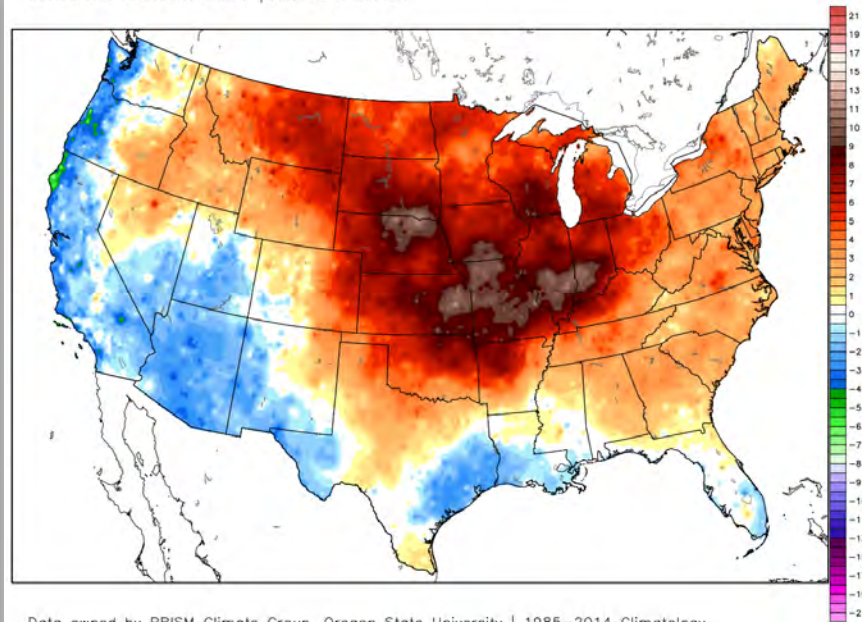
July 2018 vs July 2022

July 1 – 30 temperature anomalies

PRISM 2-m MAXIMUM TEMPERATURE [°F] ANOMALY Jul 1–30, 2018
CONUS AVG ANOMALY: 0.97°F | ACTUAL T: 87.58°F

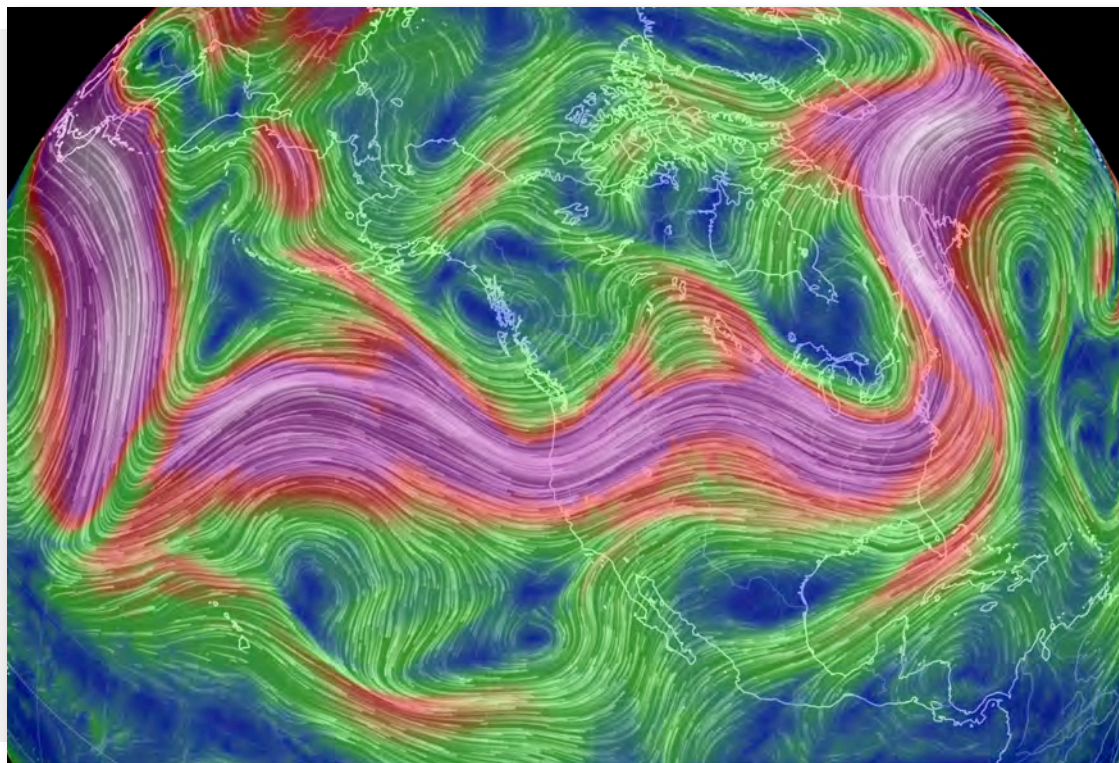


PRISM 2-m MAXIMUM TEMPERATURE [°F] ANOMALY Jul 1–30, 2012
CONUS AVG ANOMALY: 2.83°F | ACTUAL T: 89.43°F

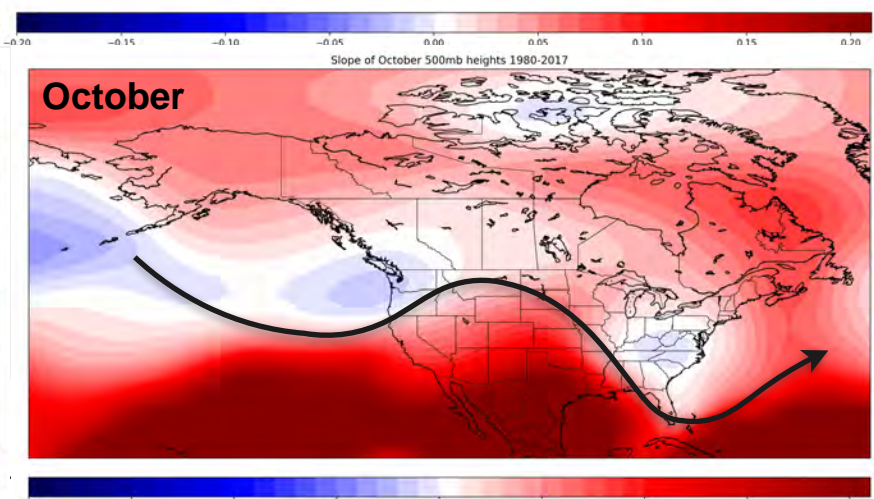
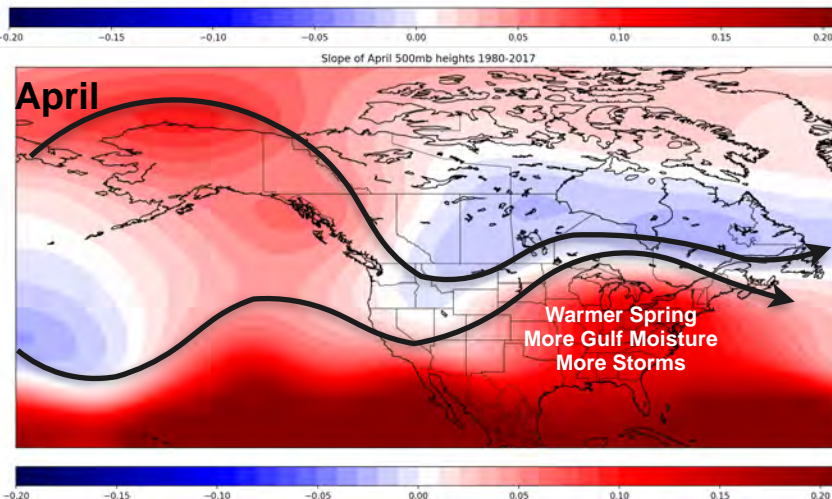
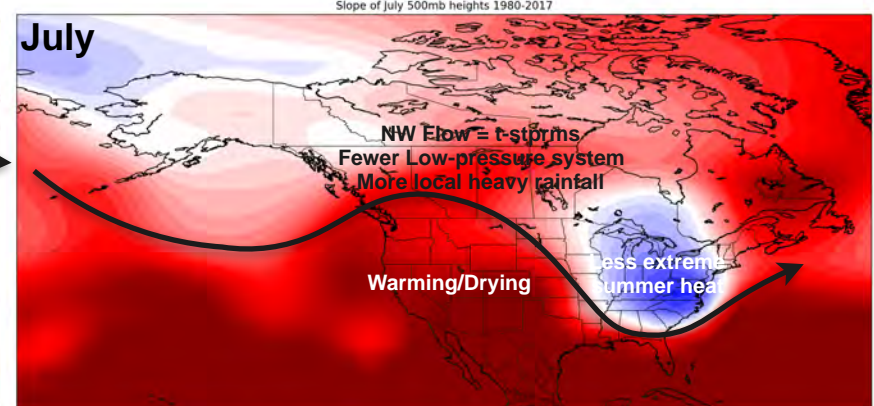
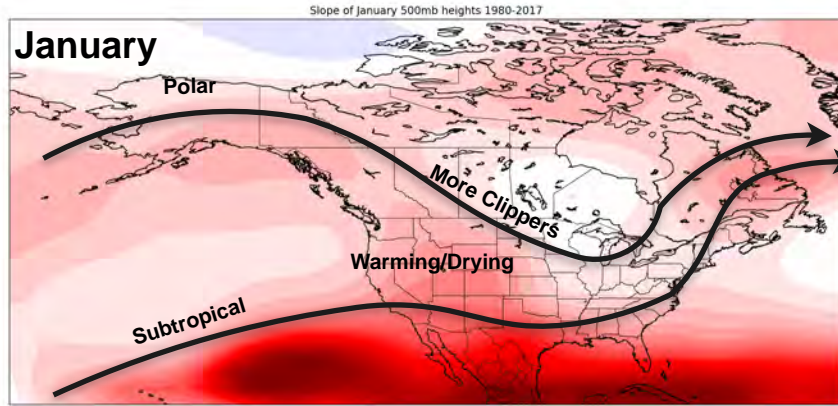


Why do I talk all the time about troughs and ridges?

Because of the average wavelength of a Rossby Wave - "If there is a ridge out west, we will make huge yields."

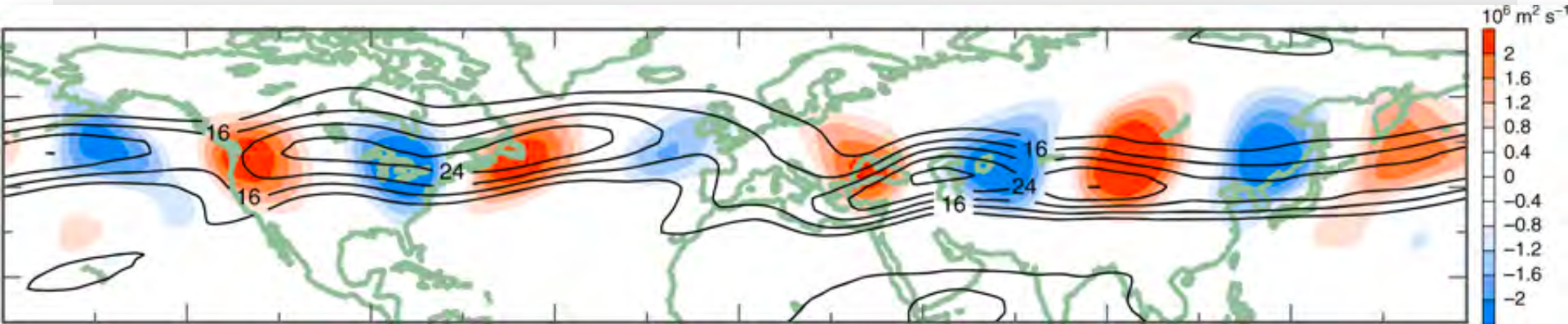


What are the long term, seasonal trends in the flow of the jet stream?



Long term trends in summer jet stream pattern

<https://www.nature.com/articles/s41467-018-05256-8>



Westward trending ridges and fire threat

Summer 2017 and 2018 western US fires. 5-70% reduction in visible light.

<https://weather.cod.edu/satrad/exper/>

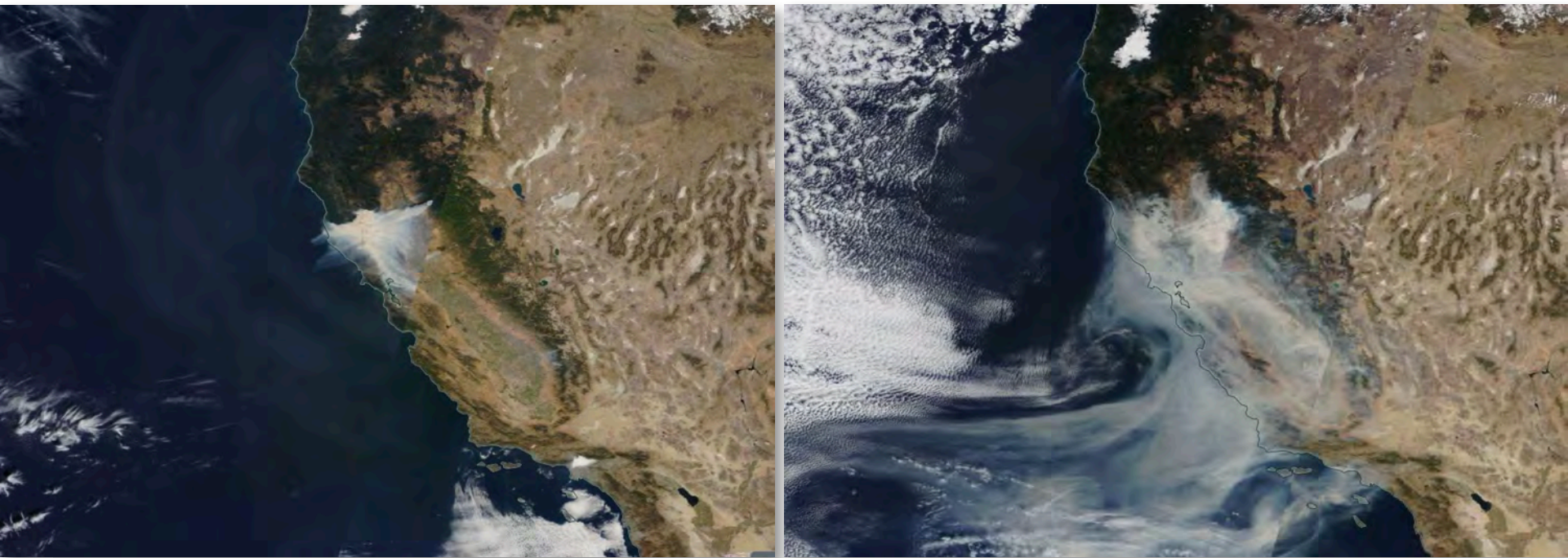


Pyrocumulus over Delta Fire (Sept 8, 2018)





<https://worldview.earthdata.nasa.gov/>



California Whiplash

2017 Forest Fires in Santa Rosa → Landslides

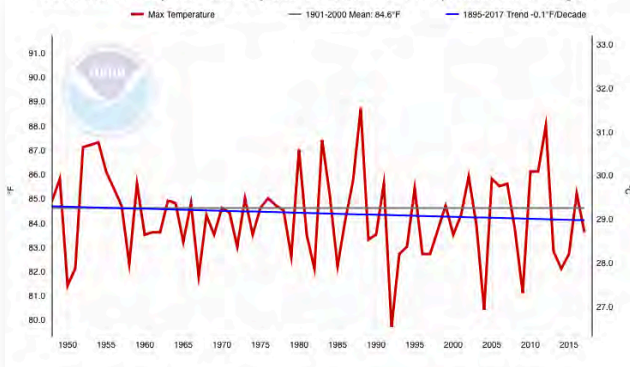


Climate shifts impacting production agriculture

Primary Cornbelt June-August Max, Min, Average Temperatures since 1948

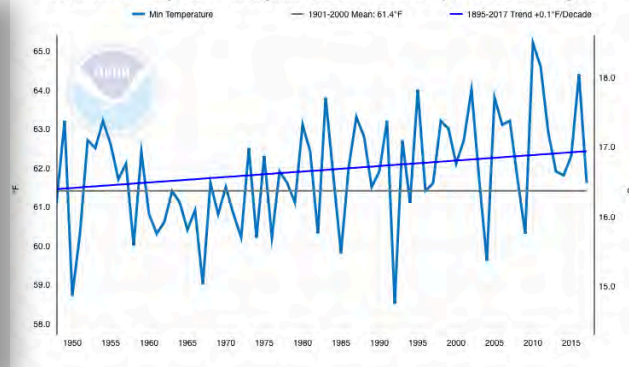
Maximum Temperatures (-0.5°F)

Area-Wtd Primary Corn and Soybean Belt, Maximum Temperature, June-August



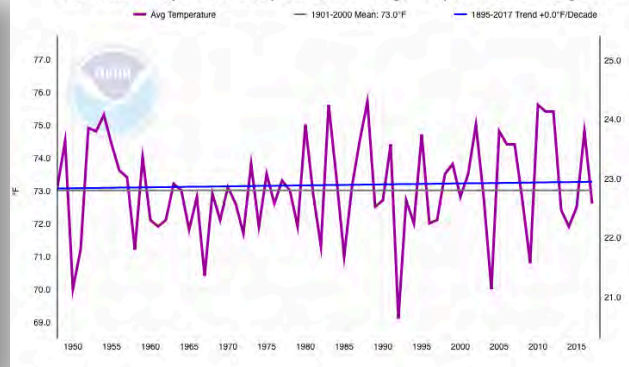
Minimum Temperatures (+1°F)

Area-Wtd Primary Corn and Soybean Belt, Minimum Temperature, June-August



Average Temperatures (Flat)

Area-Wtd Primary Corn and Soybean Belt, Average Temperature, June-August



<https://www.ncdc.noaa.gov/cag/statewide/time-series>

Statewide Minimum Temperature Ranks

May 2018

Period: 1895-2018



Statewide Minimum Temperature Ranks

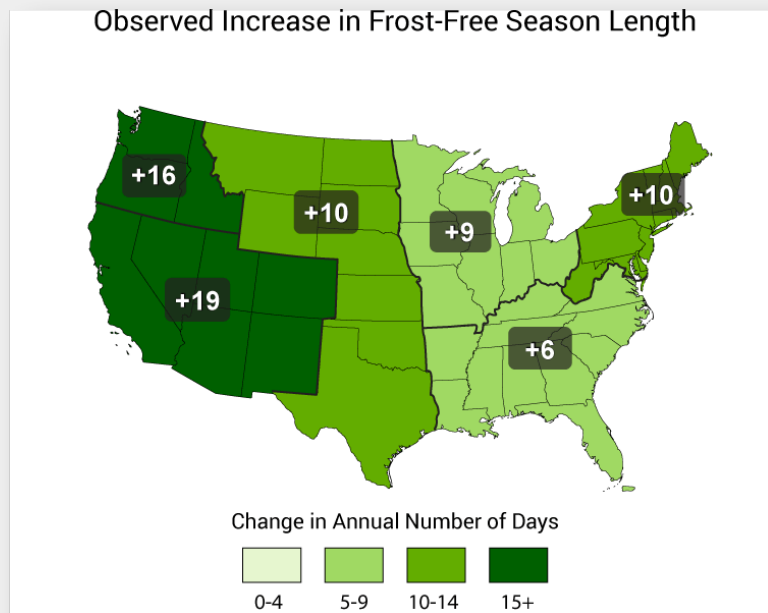
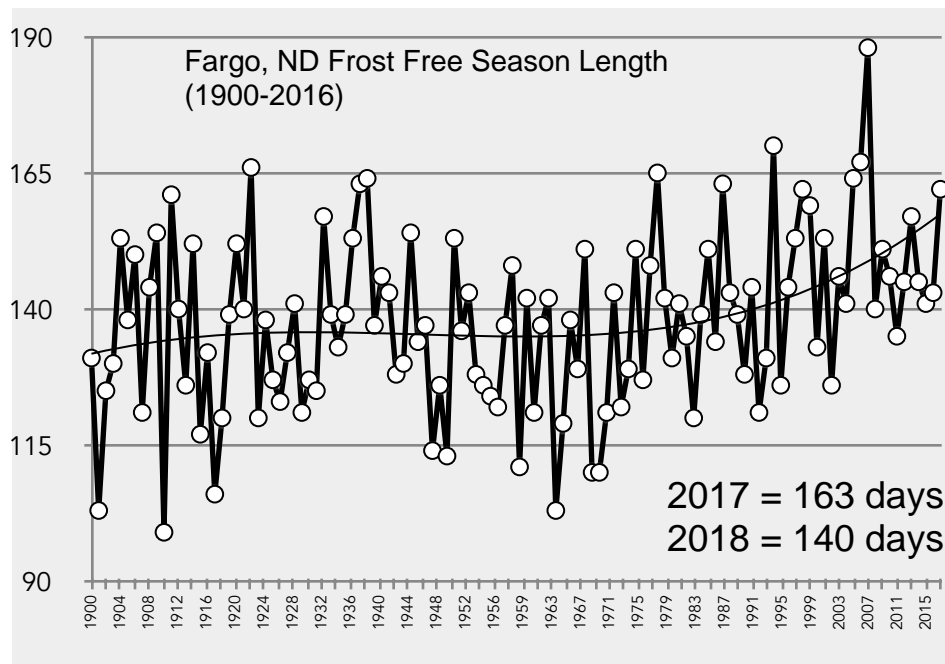
June 2018

Period: 1895-2018



Climate shifts impacting production agriculture

North America summer temperature distributions – increase in frost free season → Biggest changes are in overnight low temperatures



National Climate Assessment

<https://science2017.globalchange.gov/>

Climate shifts impacting production agriculture

Changes in soybean production

Change in Soybean Acres 1990-2018
(USDA NASS)

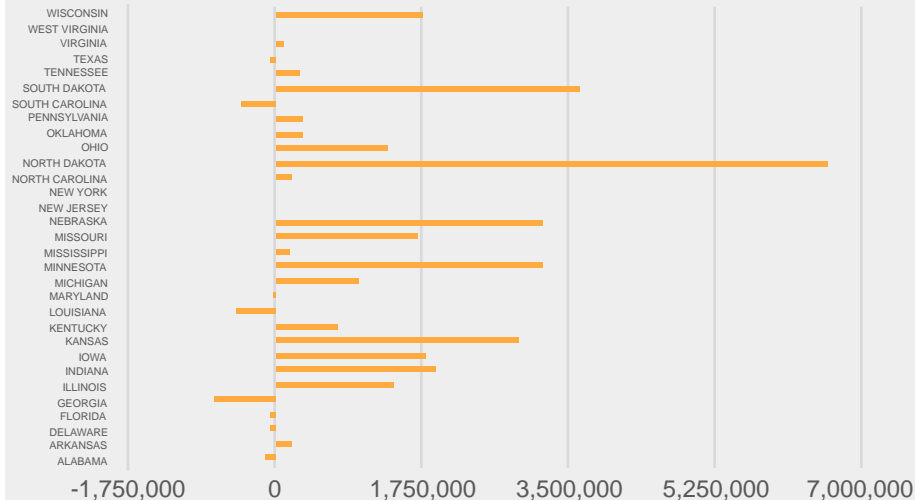
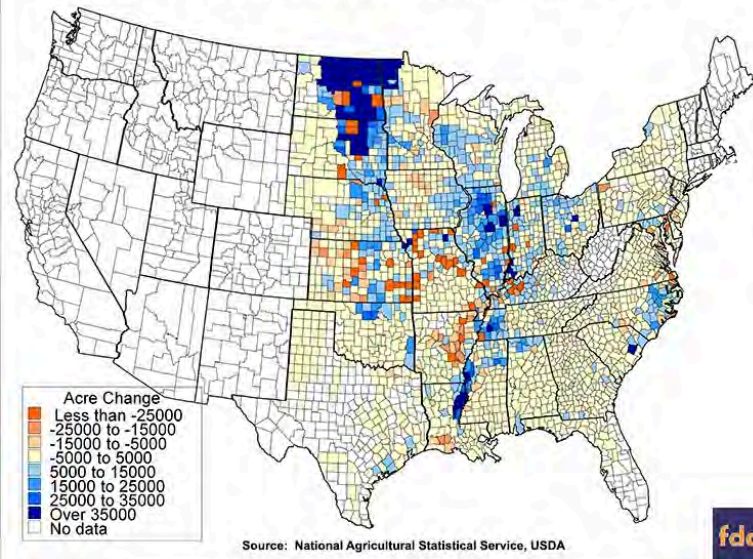


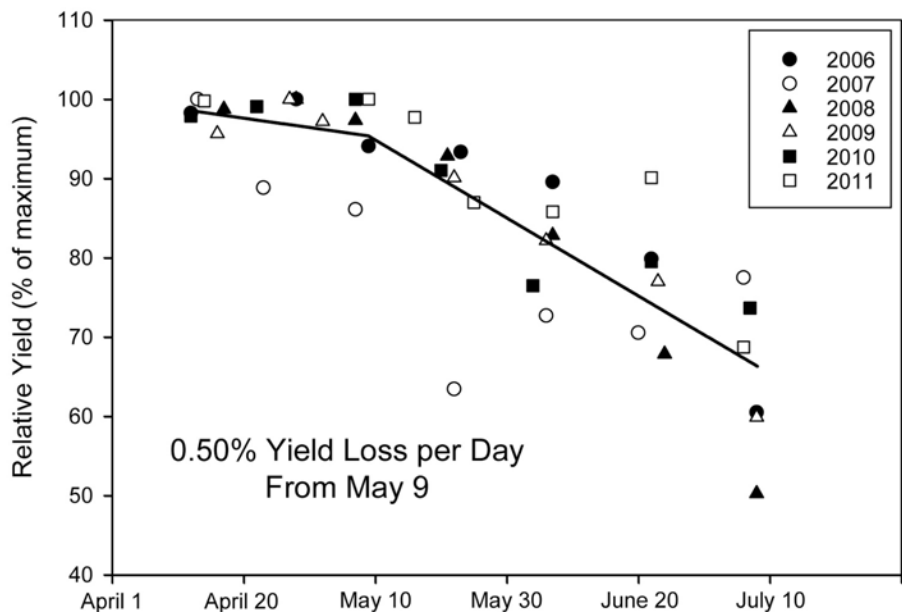
Figure 3. Change in Planted Soybean Acres from 2011 to 2016



Soybean Maturing Group and Planting Date Research

<https://graincrops.blogspot.com/2016/07/soybean-yield-expectations-when.html>

https://lib.dr.iastate.edu/cgi/viewcontent.cgi?referer=https://www.google.com/&httpsredir=1&article=1192&context=extension_ag_pubs



Carrie Knott, 2016, University of Kentucky Extension Agronomist

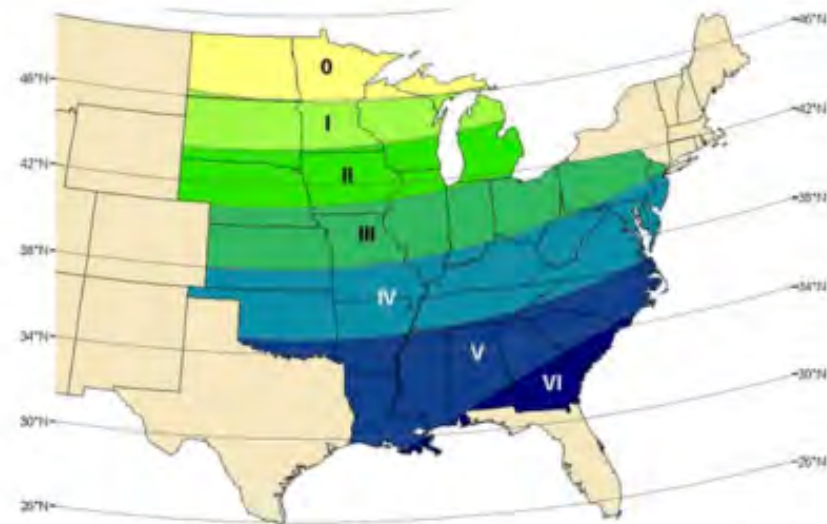
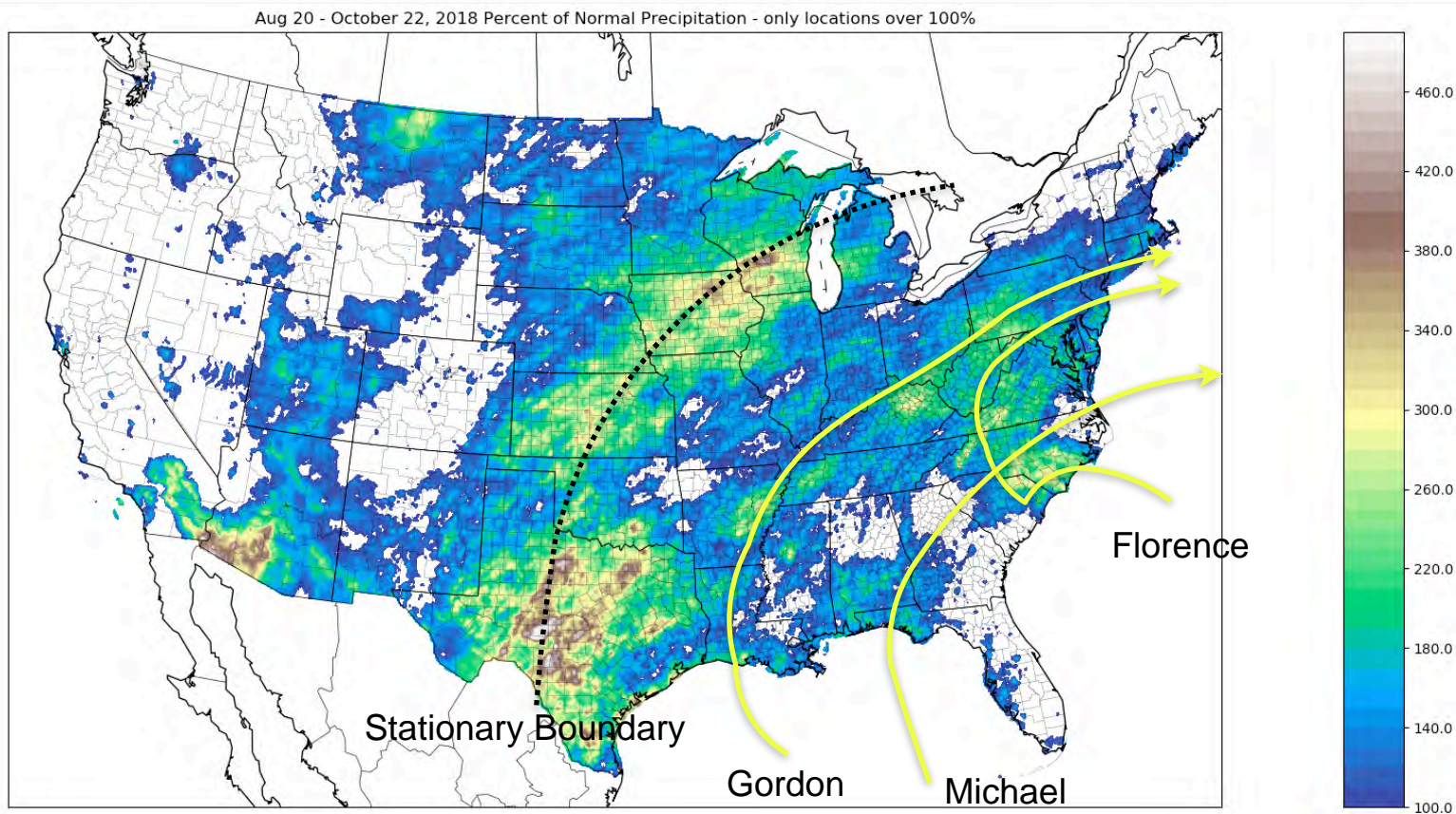
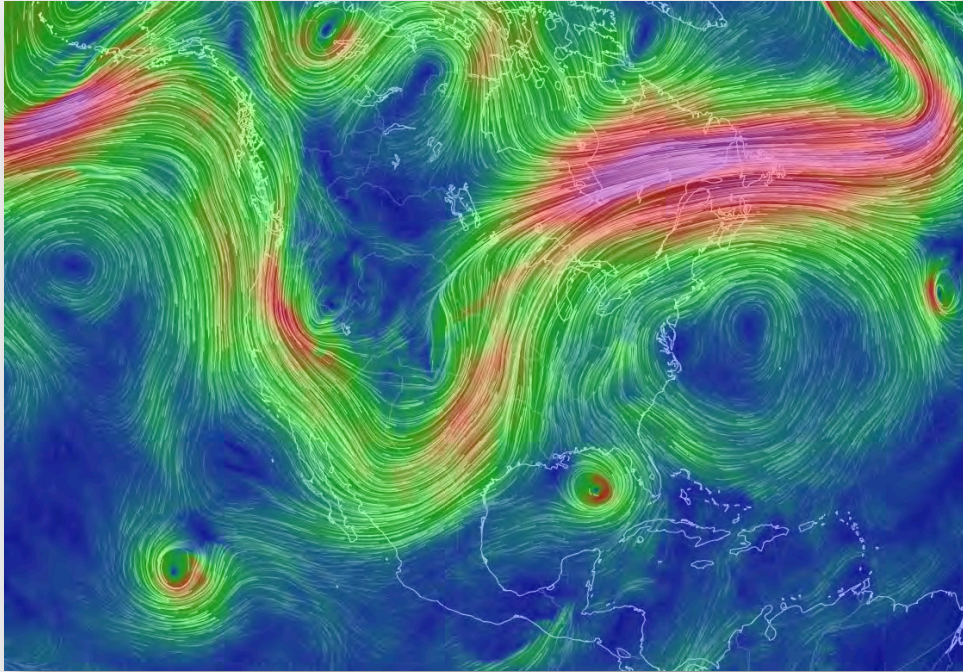


Figure 1. Soybean maturity groups of the United States as developed by Zhang and coworkers (8).

Back to the end of our growing season...

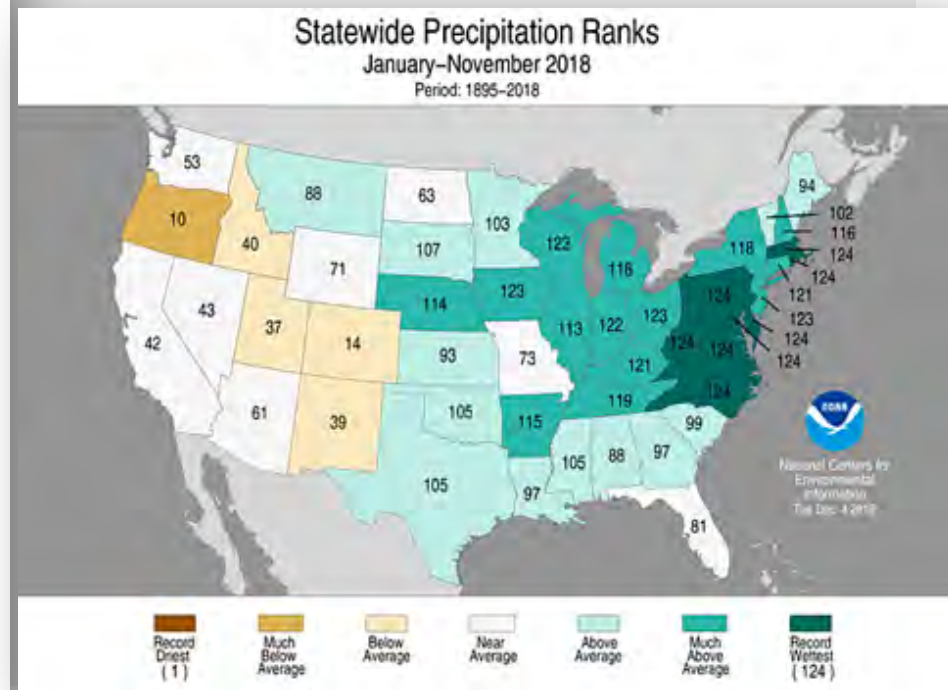
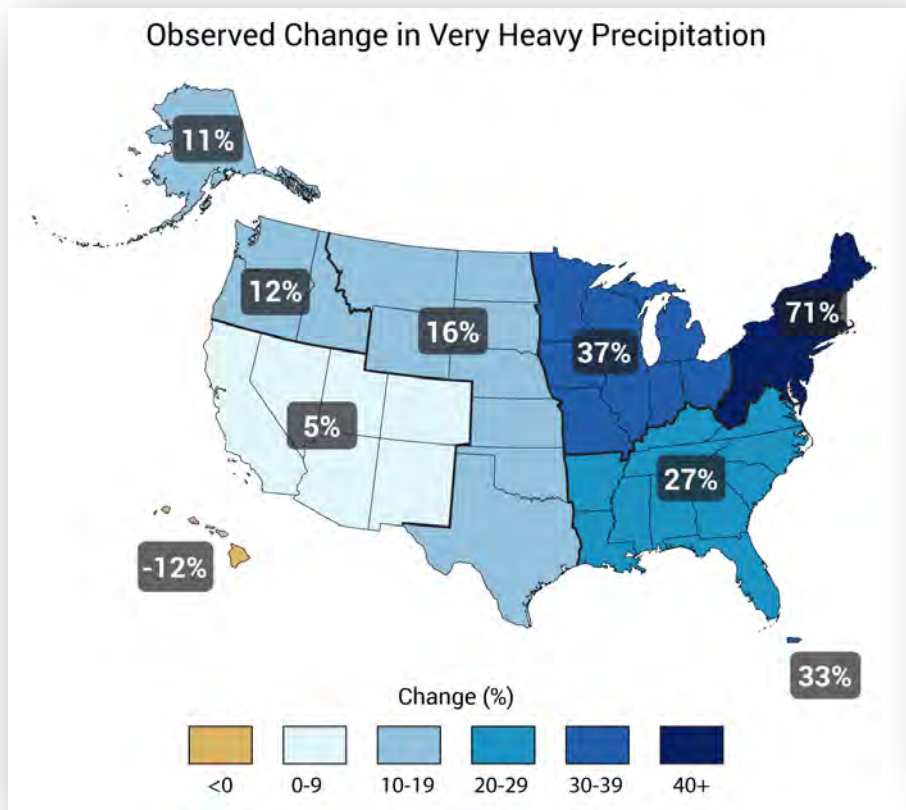


Fall Jet Stream Pattern



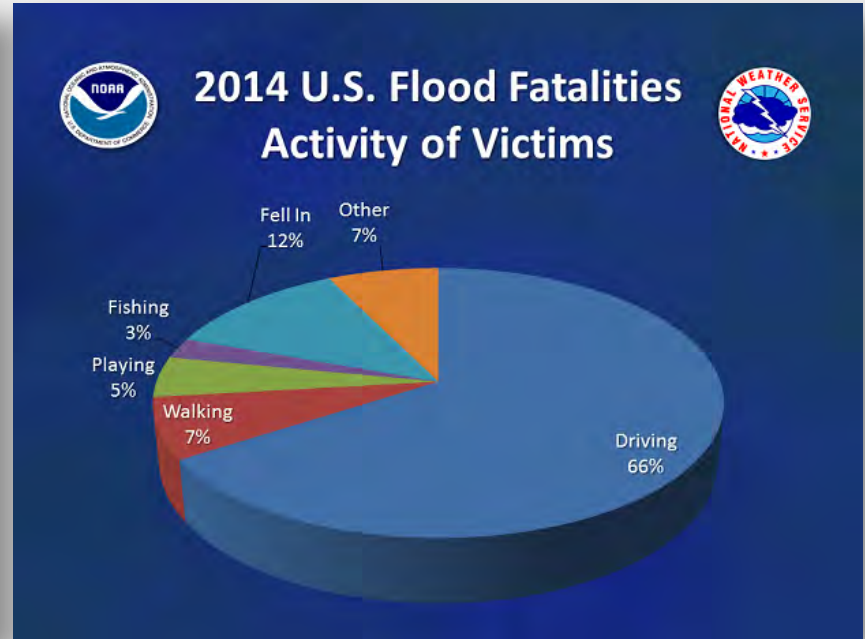
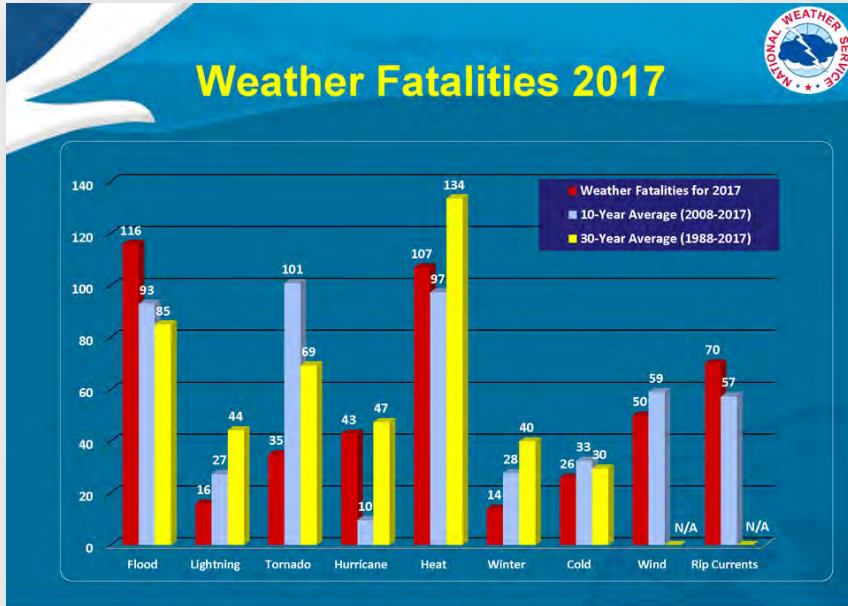
Are we seeing more rainfall from big events?

Change in observed heavy rainfall events



Flooding

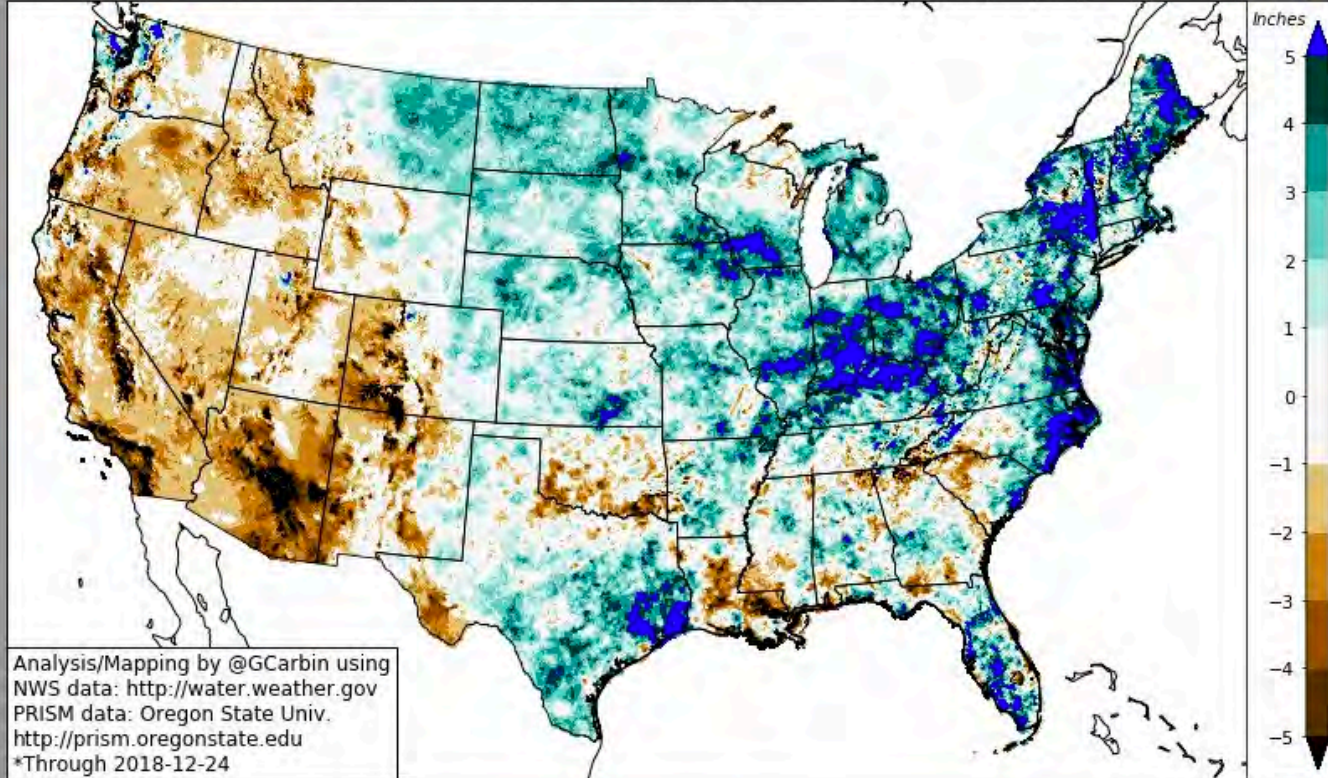
Second most deadly form of weather in the US





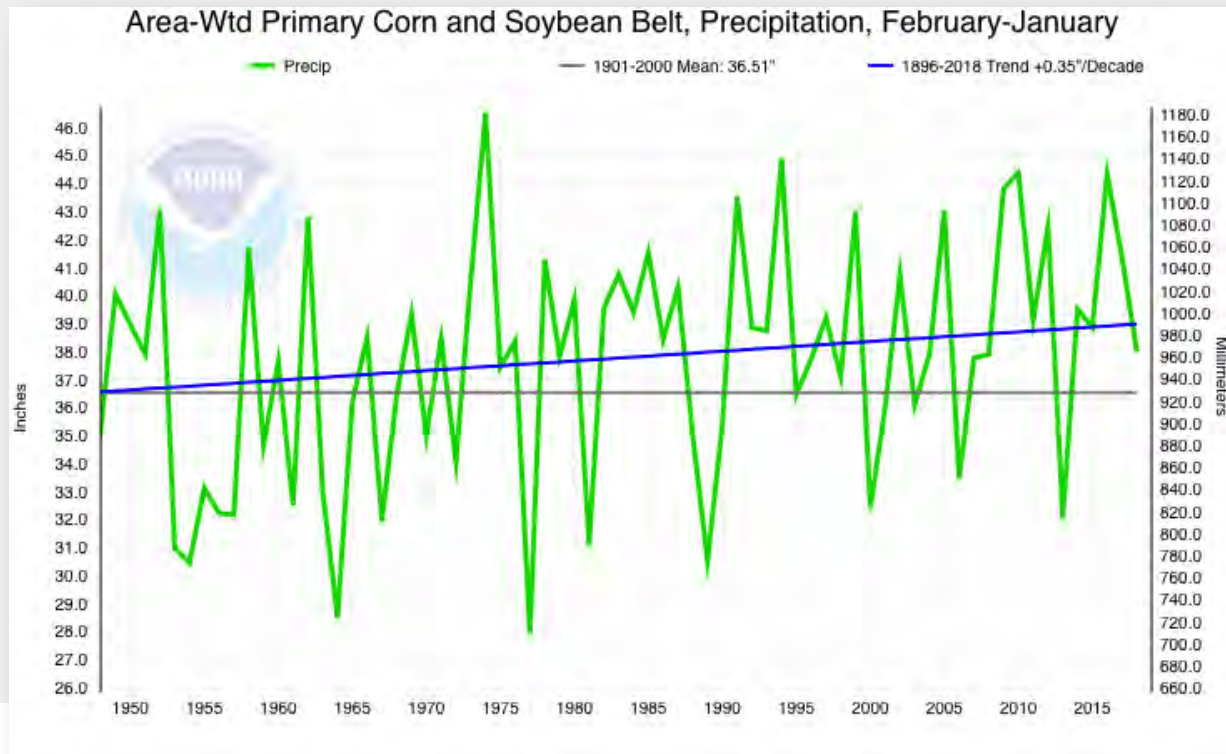
1977-1997 vs 1998-2018 (via Grant Carbin and PRISM)

Change in Annual Precipitation Means, (21y: 1998-2018*) - (21y: 1977-1997)



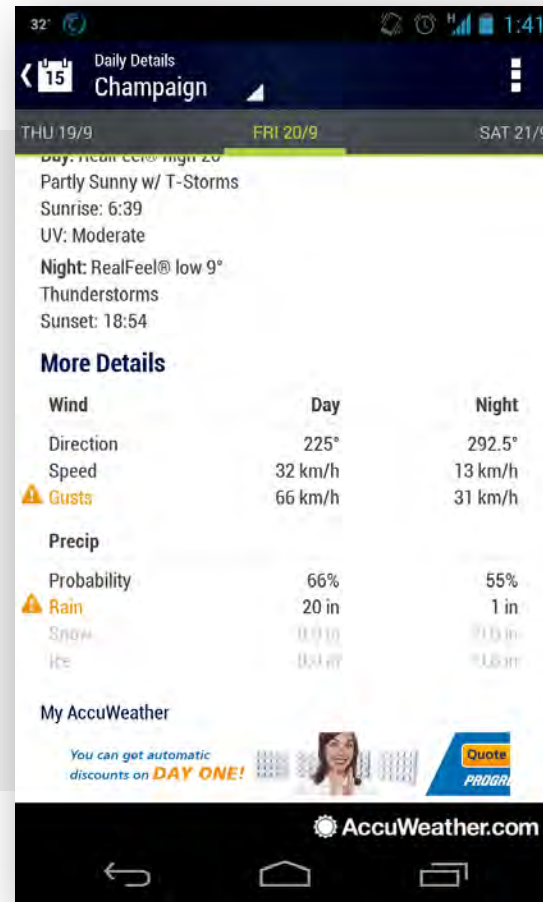
Trends in Annual Precipitation for the Cornbelt

NOAA Analysis since 1948 positive trends in both **amount and variance**. Greatest in the eastern cornbelt

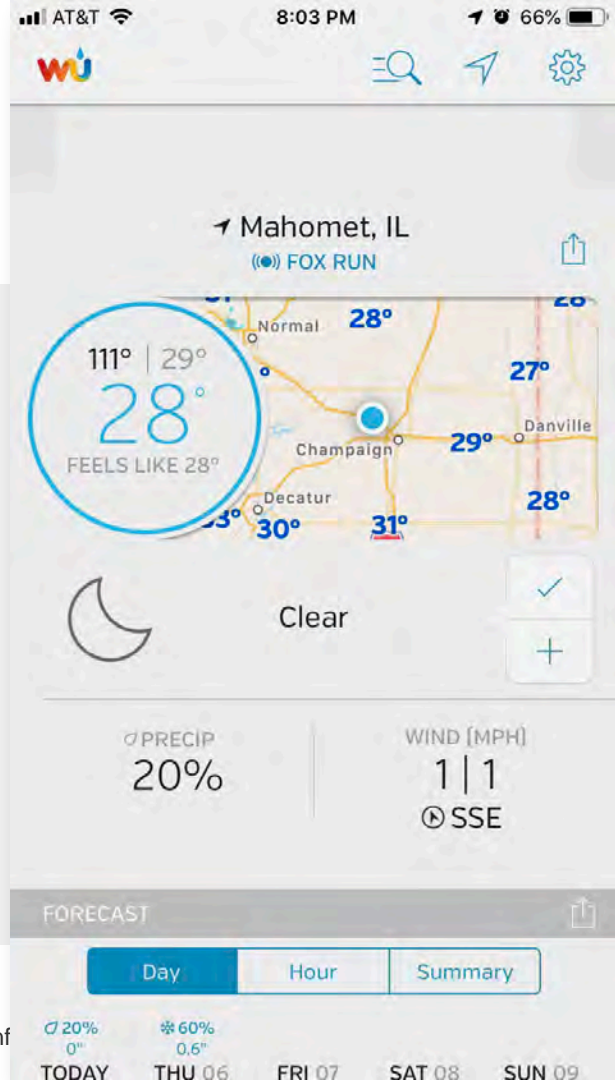


What are the best weather forecast tools?

Apps don't always deliver what we need.



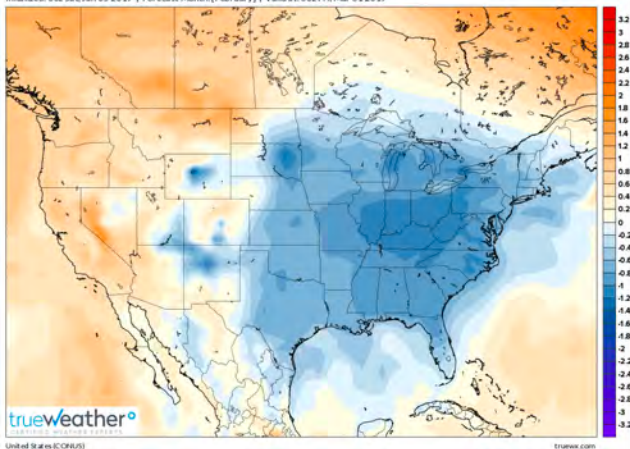
Wife's weather app recently...



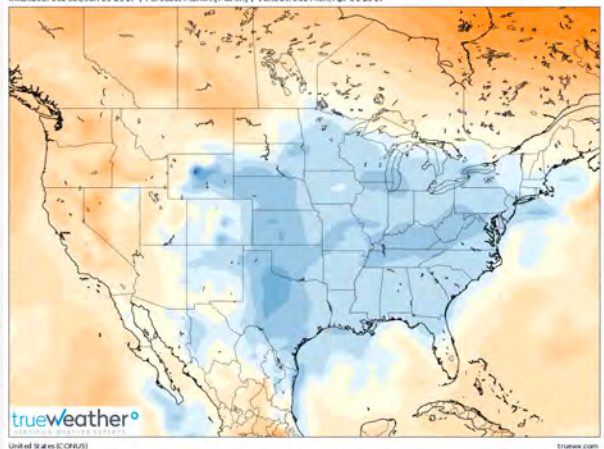
Long-Range European Model – Feb-Mar-April Temperature Anomalies

This model does not exhibit high skill, but it is the best on earth. So it is always considered.

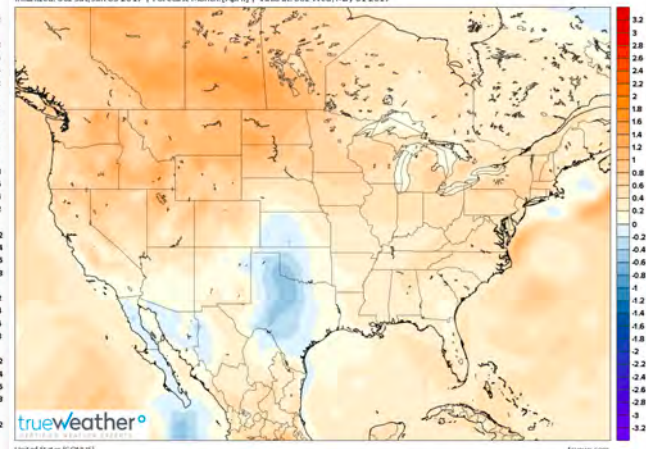
ECMWF-Monthlies (Mean) | February Avg. 2-Meter Temperature Anomaly
Initialized: 00z Sat, Jan 05 2019 | Forecast Month: [February] | Valid at: 00z Fri, Mar 01 2019



ECMWF-Monthlies (Mean) | March Avg. 2-Meter Temperature Anomaly
Initialized: 00z Sat, Jan 05 2019 | Forecast Month: [March] | Valid at: 00z Mon, Apr 01 2019



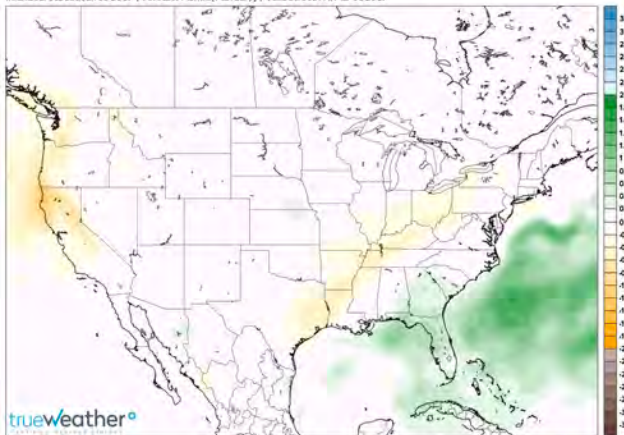
ECMWF-Monthlies (Mean) | April Avg. 2-Meter Temperature Anomaly
Initialized: 00z Sat, Jan 05 2019 | Forecast Month: [April] | Valid at: 00z Wed, May 01 2019



Long-Range European Model – Feb-Mar-April Precipitation Anomalies

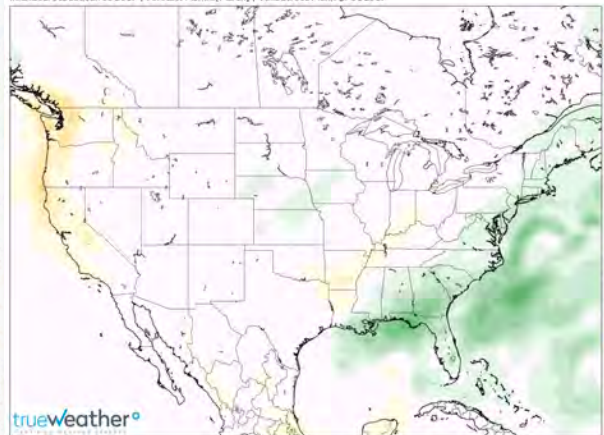
ECMWF-Monthlies (Mean) | February Avg. Precipitation Anomaly (Inches)

Initialized: 00z Sat, Jan 05 2019 | Forecast Month: [February] | Valid at: 00z Fri, Mar 01 2019



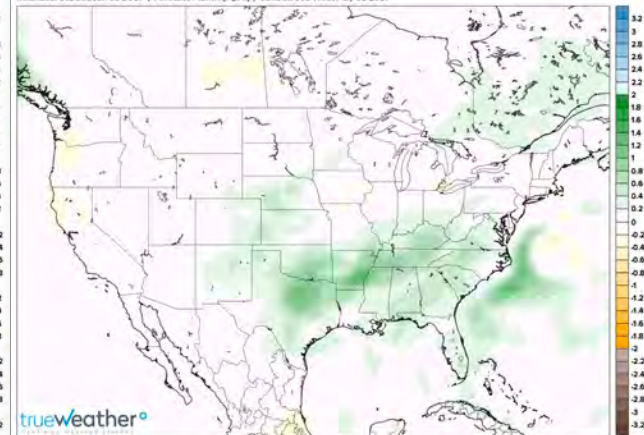
ECMWF-Monthlies (Mean) | March Avg. Precipitation Anomaly (Inches)

Initialized: 00z Sat, Jan 05 2019 | Forecast Month: [March] | Valid at: 00z Mon, Apr 01 2019



ECMWF-Monthlies (Mean) | April Avg. Precipitation Anomaly (Inches)

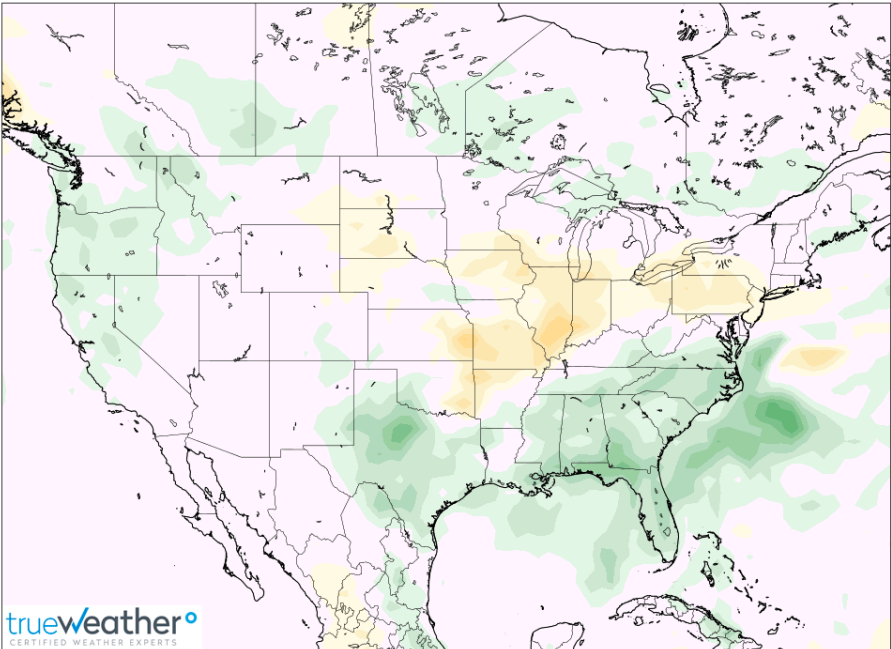
Initialized: 00z Sat, Jan 05 2019 | Forecast Month: [April] | Valid at: 00z Wed, May 01 2019



Long-Range European Model May 2019

ECMWF-Monthlies (Mean) | May Avg. Precipitation Anomaly (Inches)

Initialized: 00z Sat, Jan 05 2019 | Forecast Month:[May] | Valid at: 00z Sat, Jun 01 2019

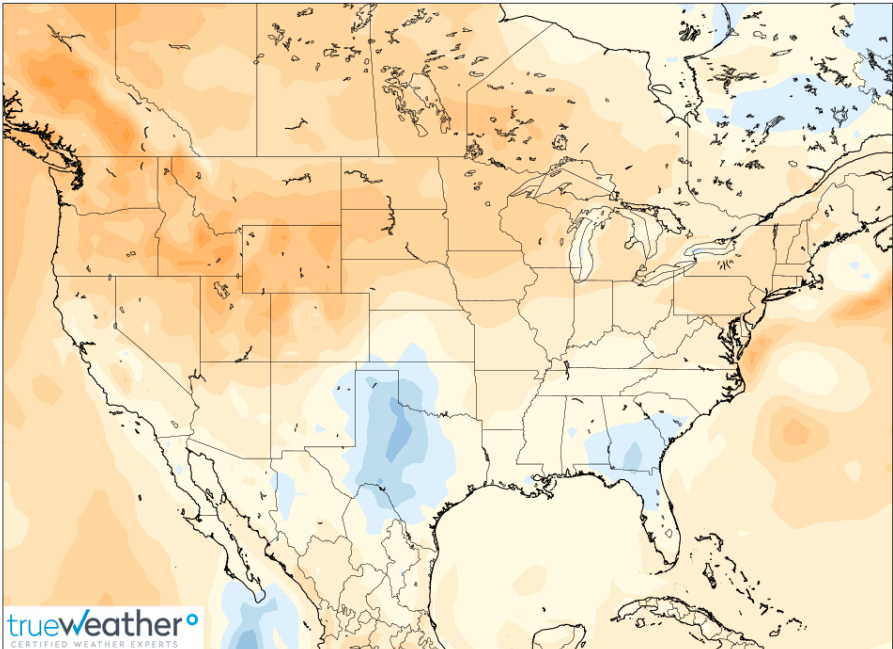


United States (CONUS)

truewx.com

ECMWF-Monthlies (Mean) | May Avg. 2-Meter Temperature Anomaly

Initialized: 00z Sat, Jan 05 2019 | Forecast Month:[May] | Valid at: 00z Sat, Jun 01 2019

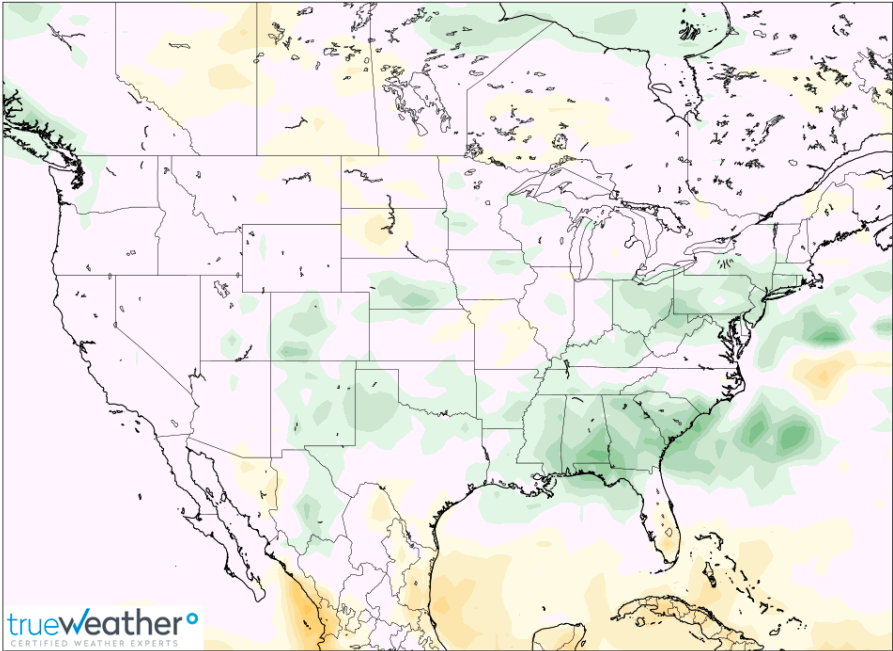


United States (CONUS)

truewx.com

Long-Range European Model - July 2019 (take with a large grain of salt)

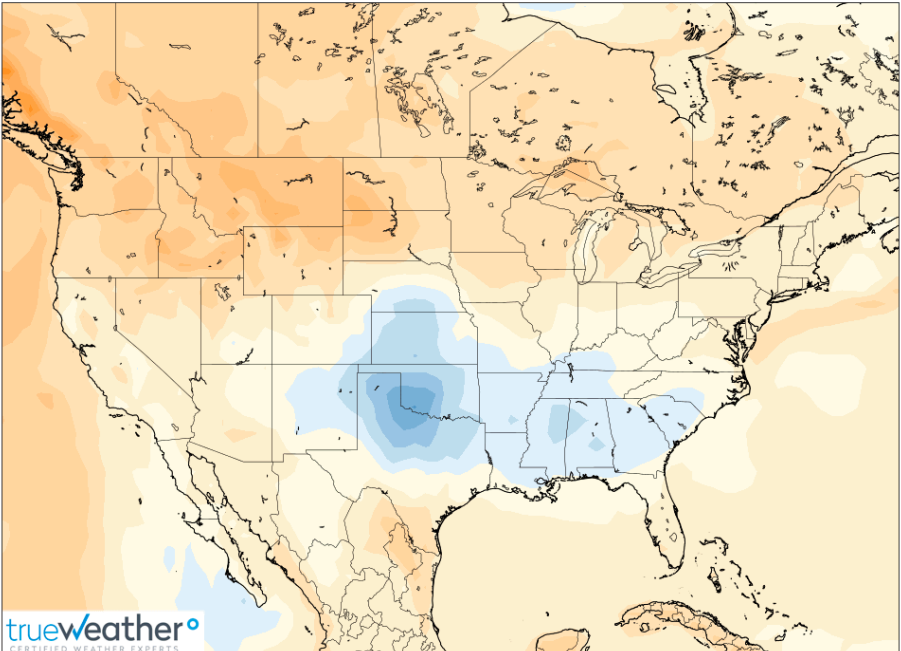
ECMWF-Monthlies (Mean) | July Avg. Precipitation Anomaly (Inches)
Initialized: 00z Sat, Jan 05 2019 | Forecast Month: [July] | Valid at: 00z Thu, Aug 01 2019



United States (CONUS)

truewx.com

ECMWF-Monthlies (Mean) | July Avg. 2-Meter Temperature Anomaly
Initialized: 00z Sat, Jan 05 2019 | Forecast Month: [July] | Valid at: 00z Thu, Aug 01 2019

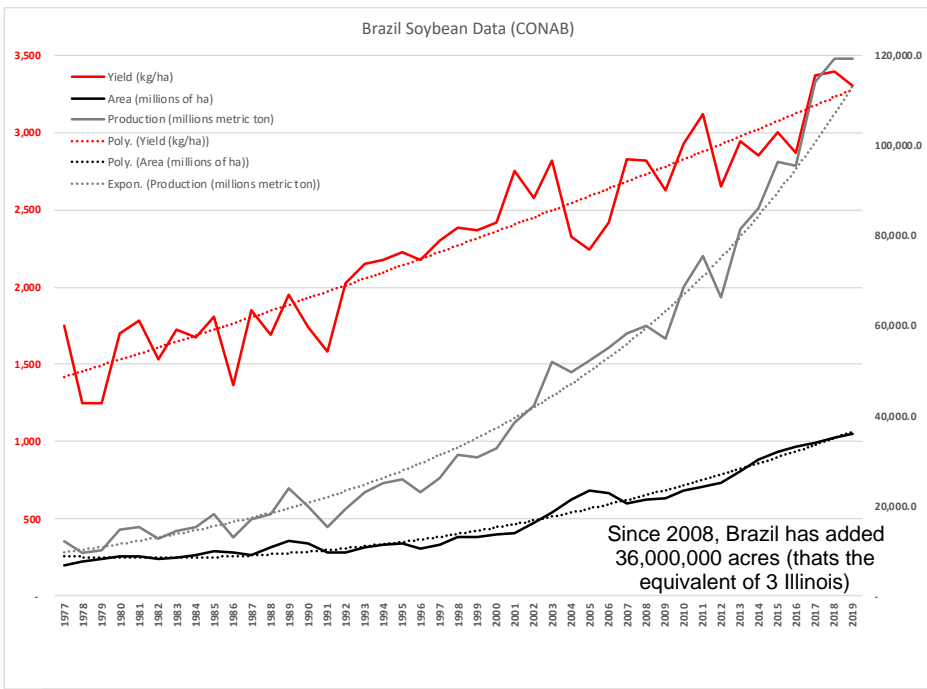


United States (CONUS)

truewx.com

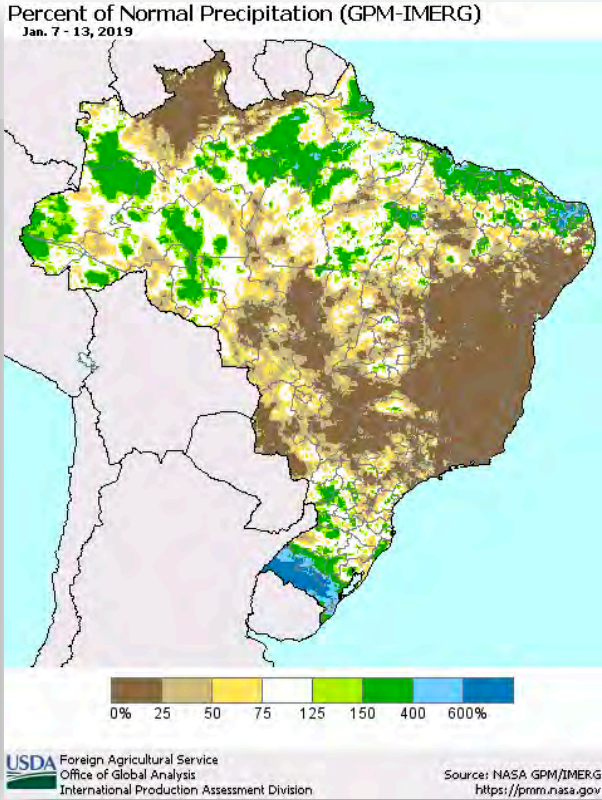
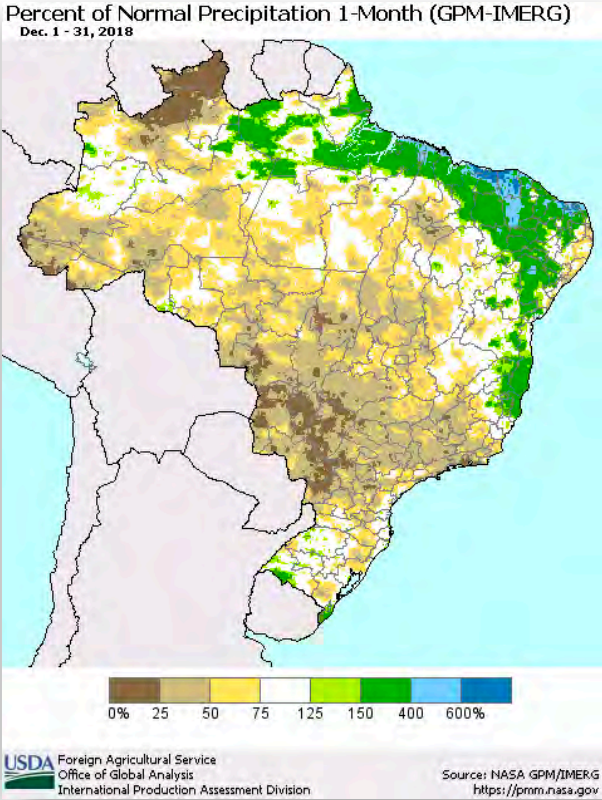
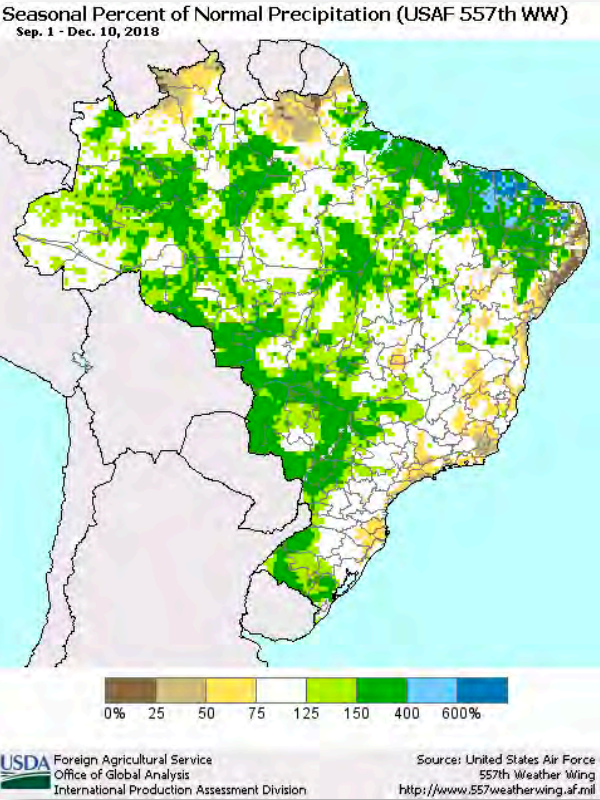
Global competition – shifts in agricultural productivity

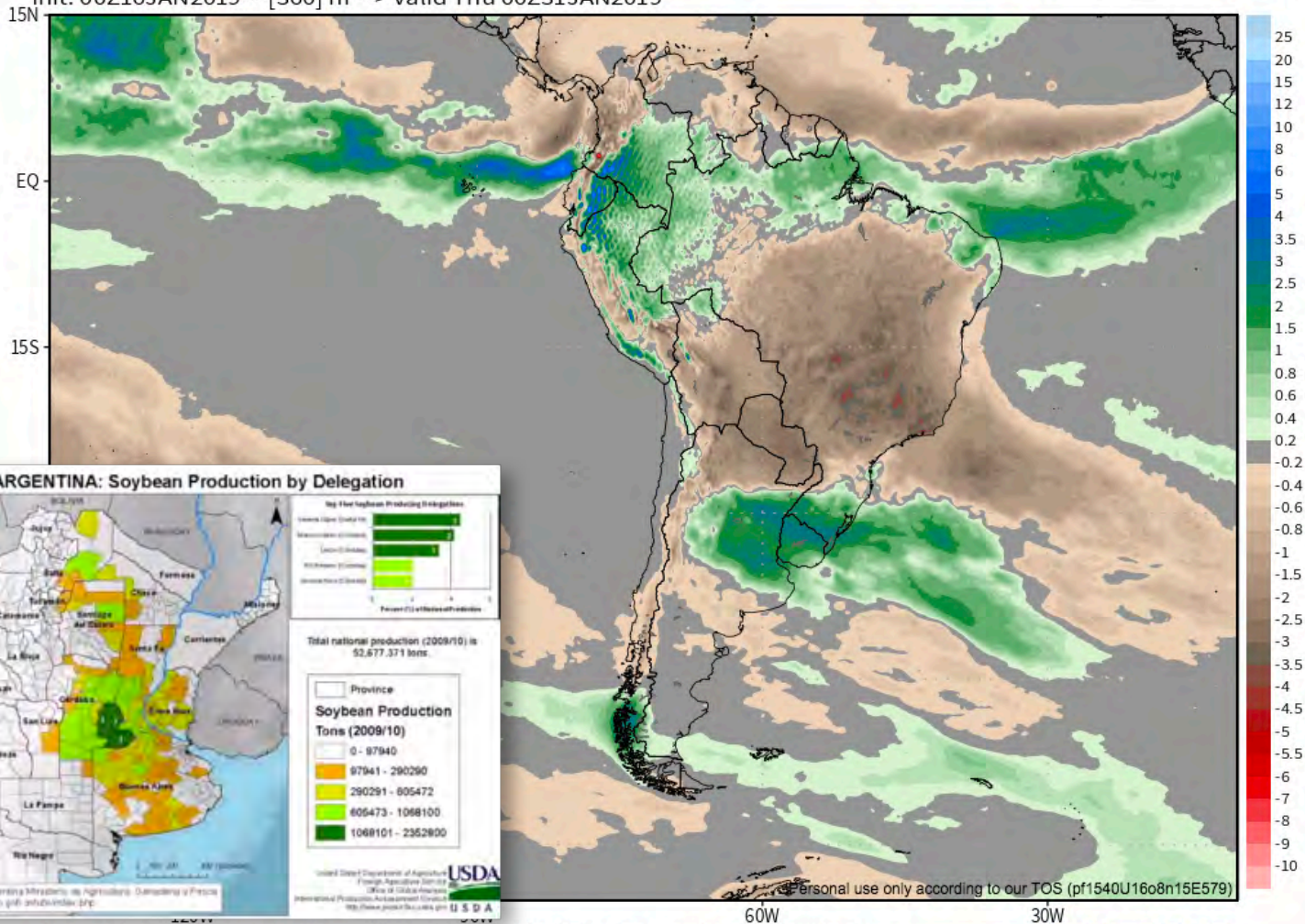
Brazilian Soybean Production – 2018 Production = 119 MMT (largest ever)



<http://www.soybeansandcorn.com/>

Brazil



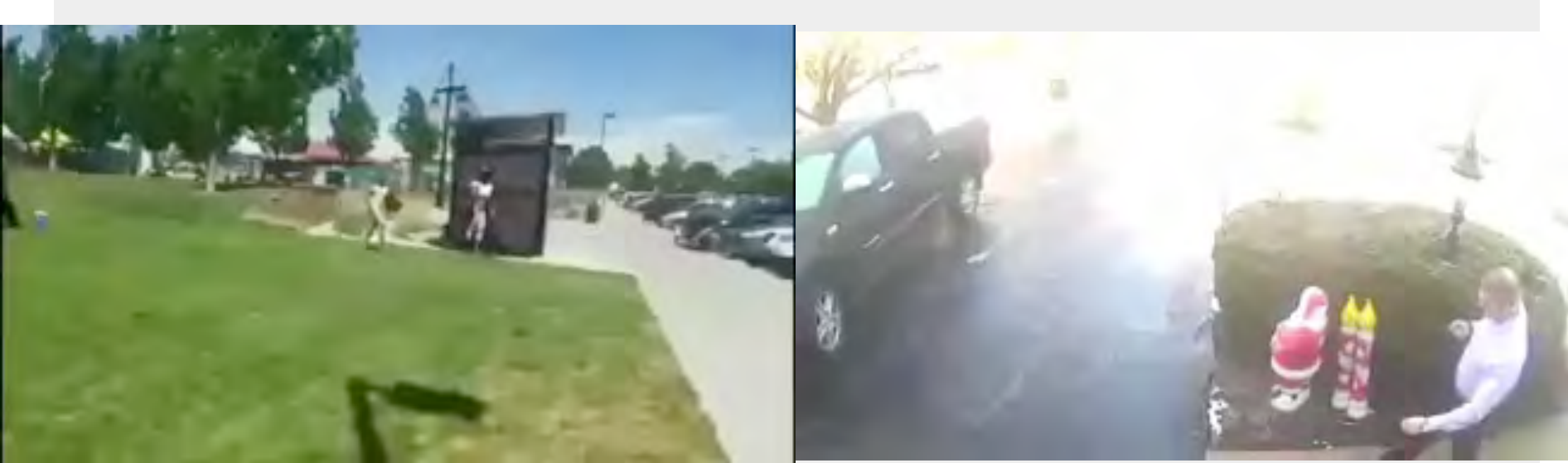




Turbulent start to the growing season in Argentina



Even with great insight, patience, and understanding, chaos still happens



My favorite weather resources

Apps:

Pocket Rain Gauge
Pocket Spray Smart

RadarScope (\$)
Dark Sky
Weather Underground
WTForecast

Websites:

www.agribile.com

<https://www.tropicaltidbits.com/analysis/models/>

<http://www.pivotalweather.com/>

<https://weathermodels.com/> (\$\$)

<http://www.spc.noaa.gov>

<http://www.weather.gov>