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

Jan 9, 2019
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Austria Jan 6-7, 2019

Double Microburst

Marshaltown, IA

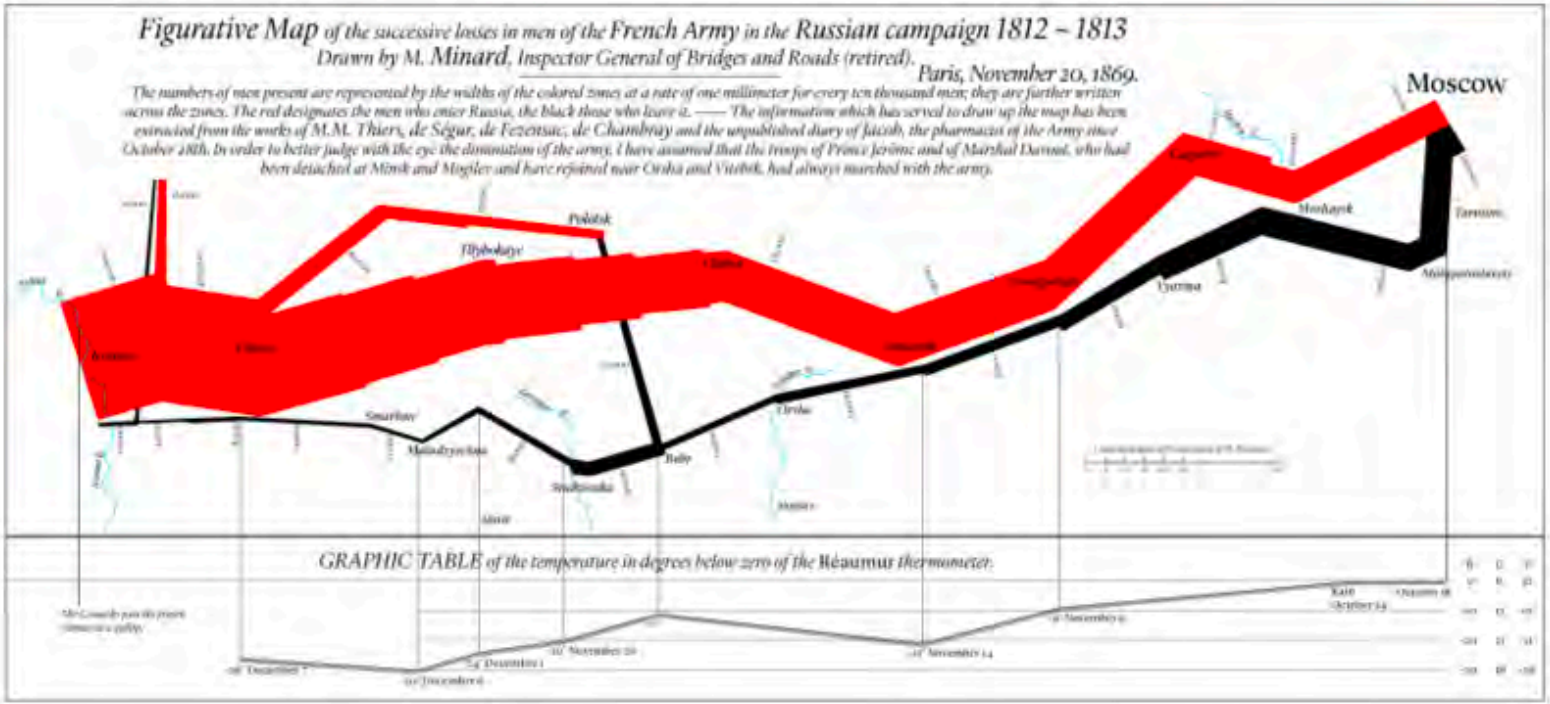
@ThomasPatrickWx

@NStewCBS2 Nick Stewart

Bondurant, IA

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…

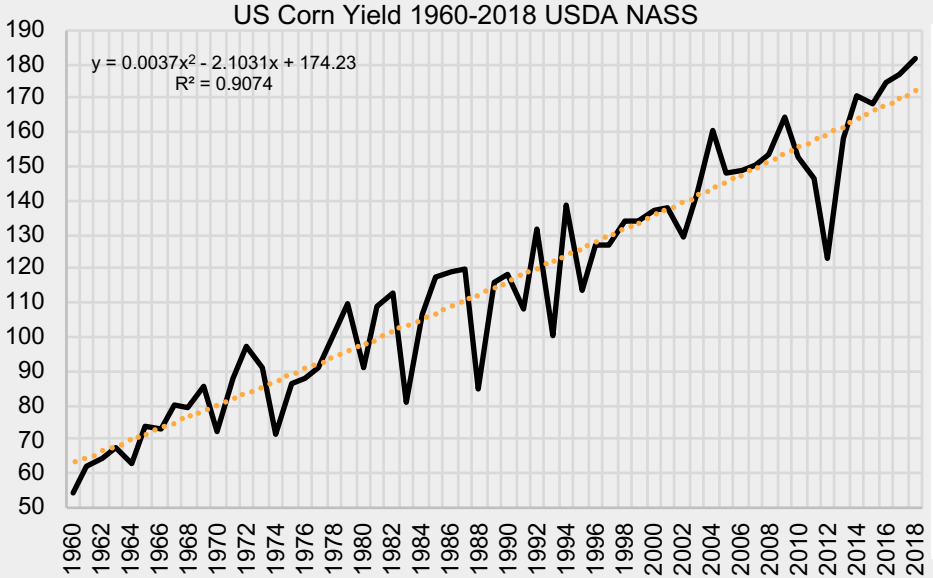
Using weather information to optimize time and minimize the frequency of bad decisions.

Lessons learned

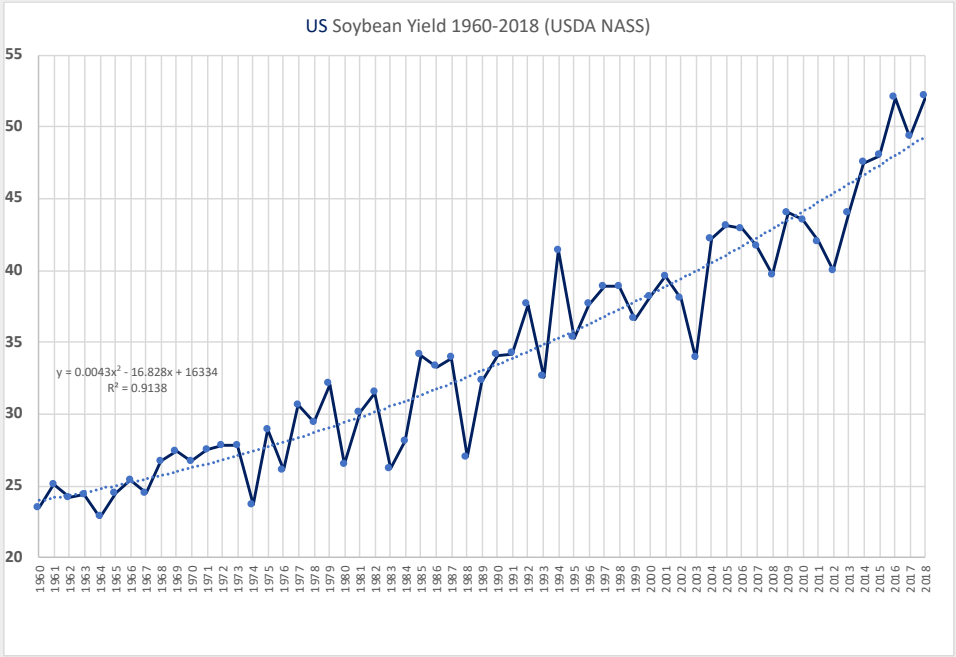
Jon LeBrun @LeBrunJon

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

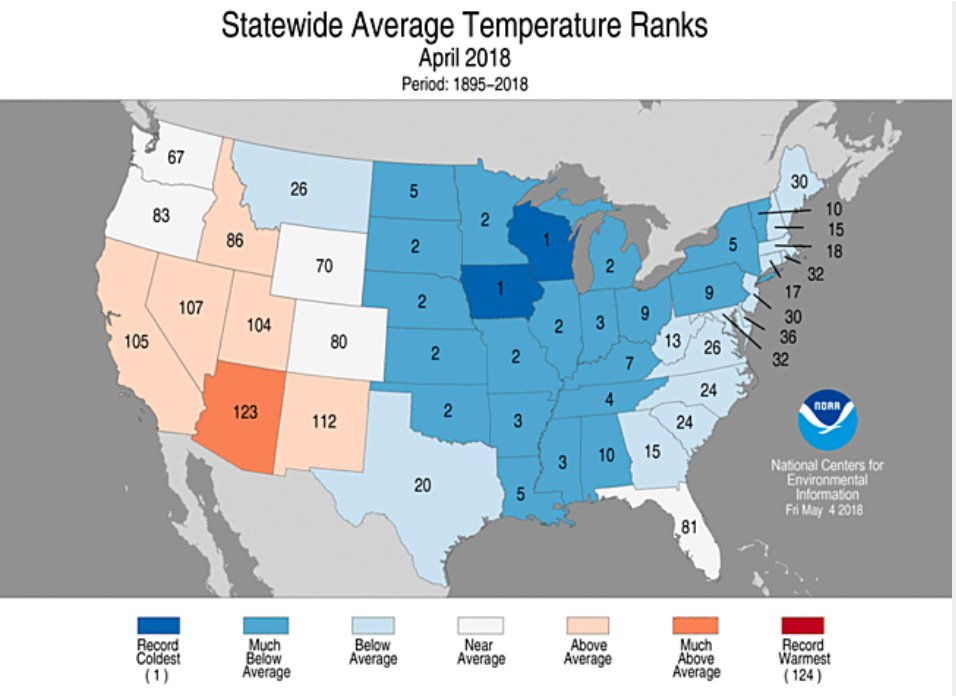


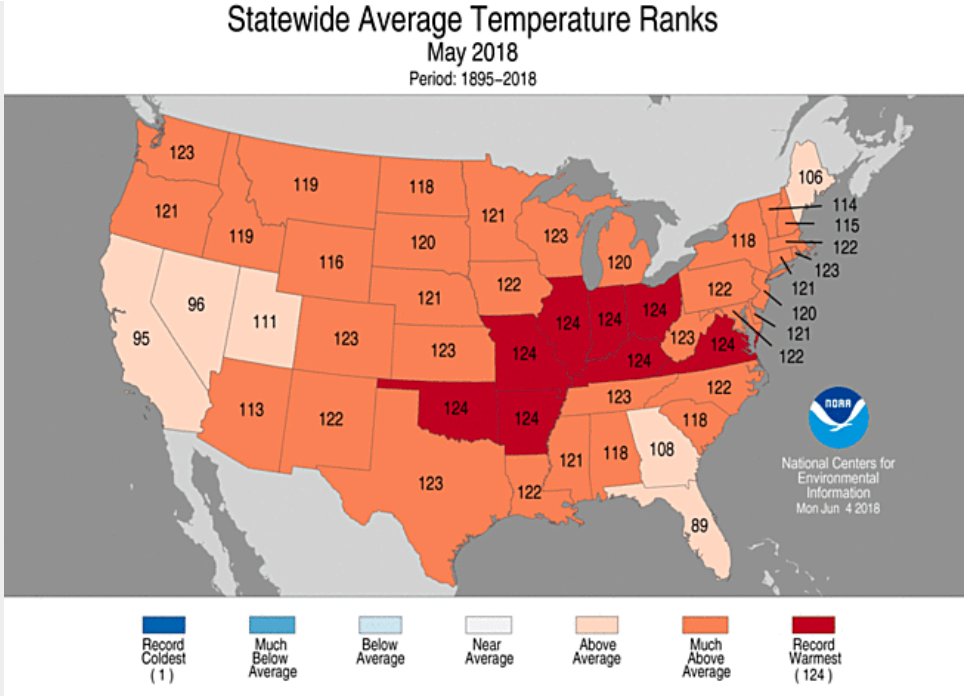
Law of Averages…

Does no apply to agricultural yields, ***but people think we are due for a big drought*** (and that is extremely valuable to know).

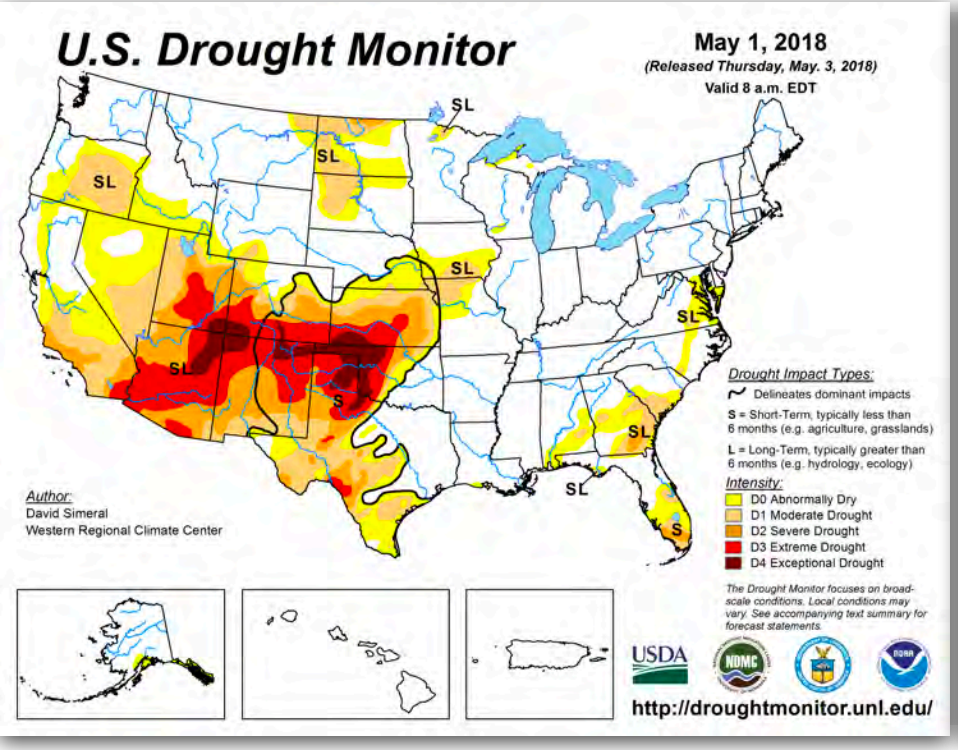
What did we learn from 2018

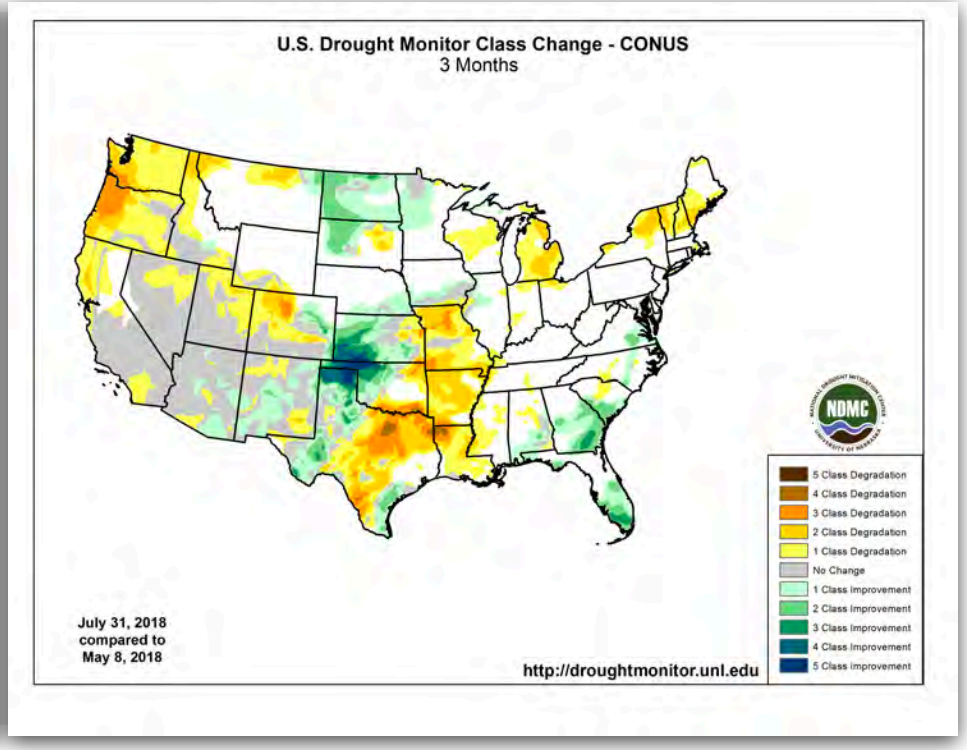
A late start that didn't matter



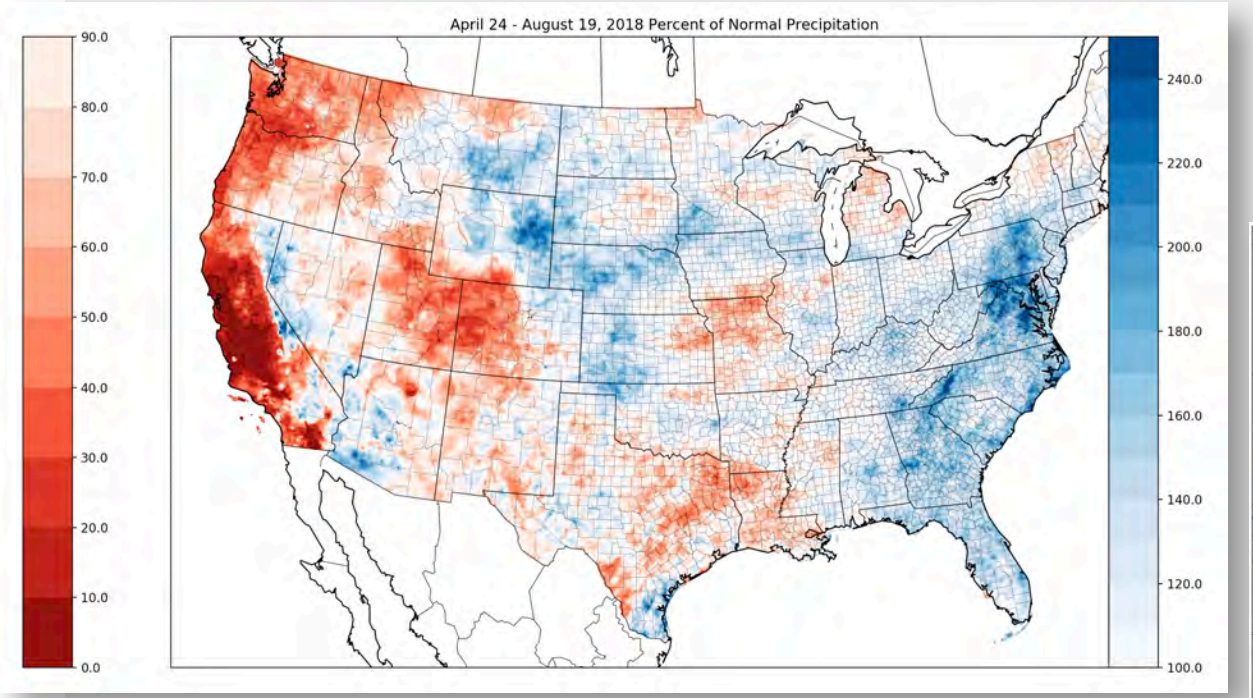


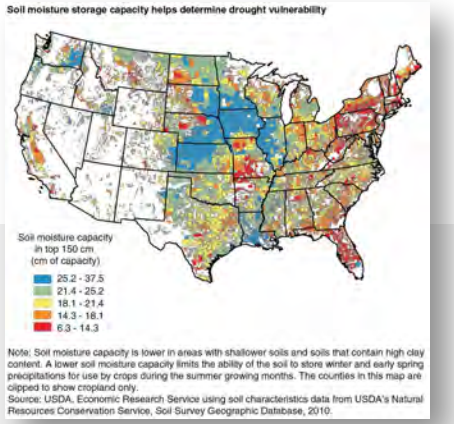
Migrating Drought

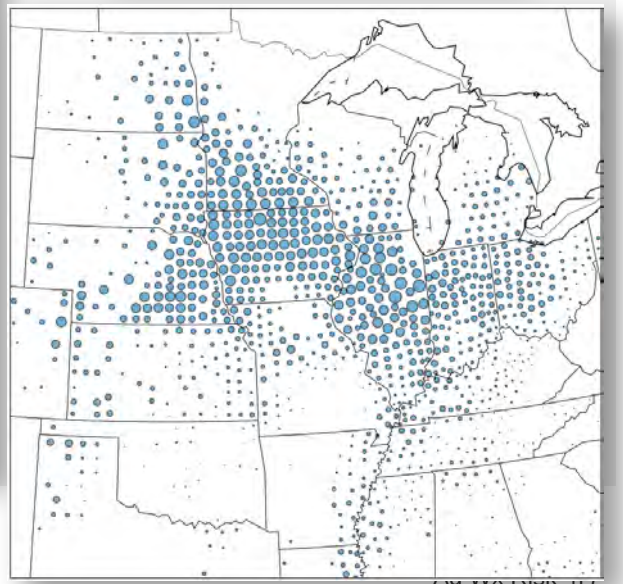




Precipitation Analysis April 24 – August 19

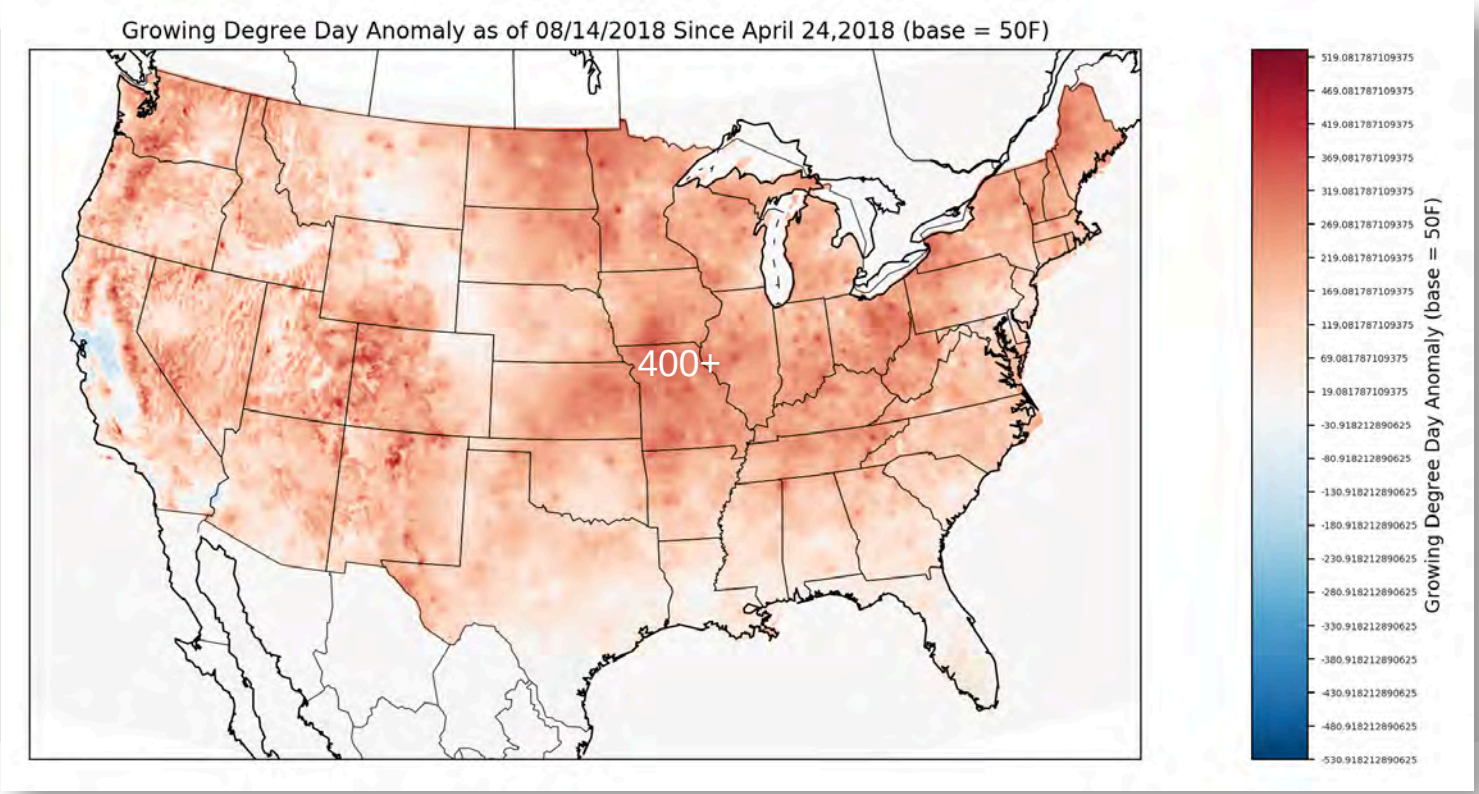






Growing Degree Day Anomaly

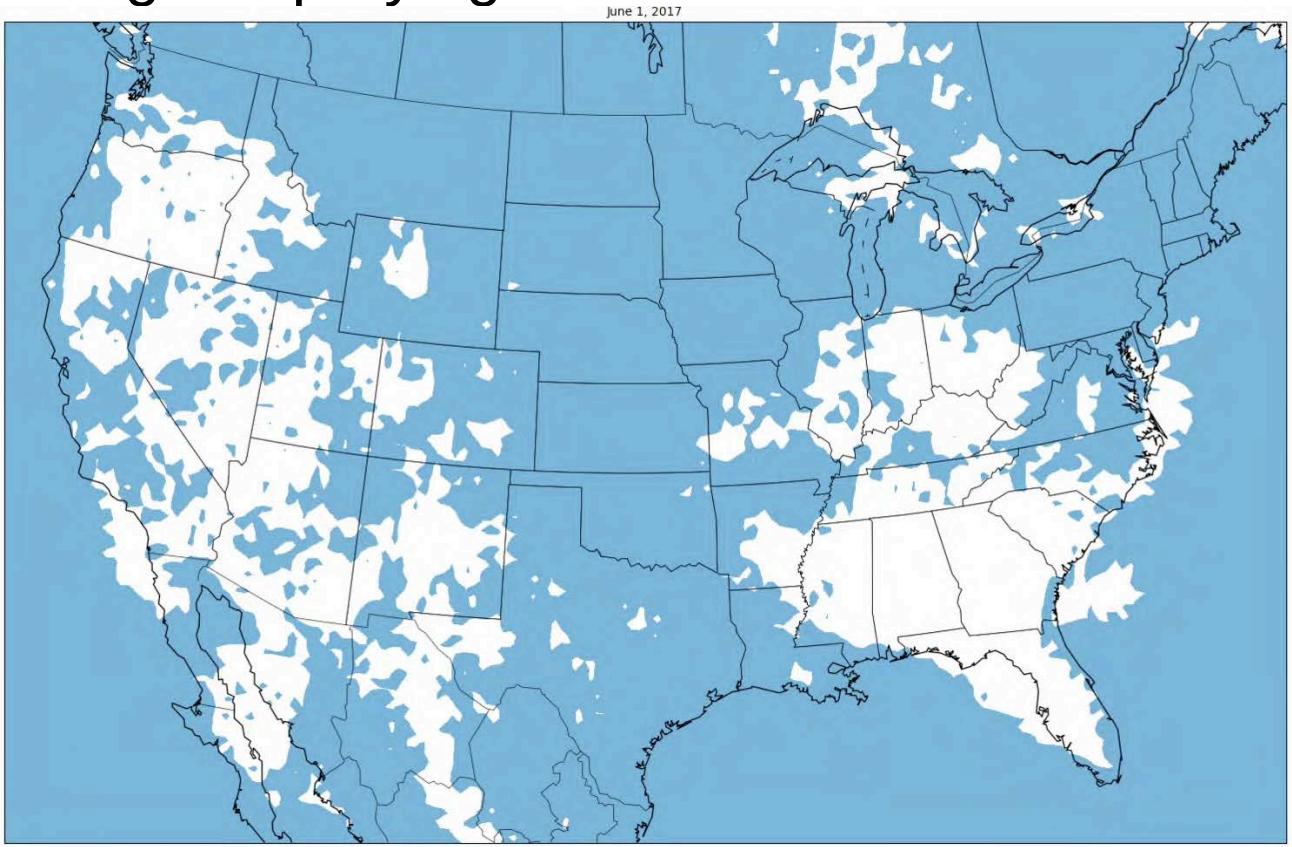
This crop is grew fast

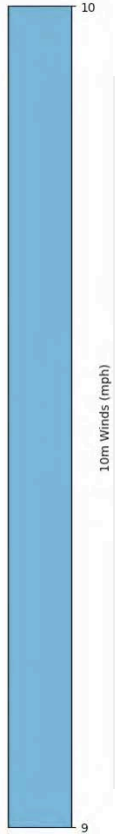


Spray Painting Corn

Thank you twitter…

Speaking of Spraying…

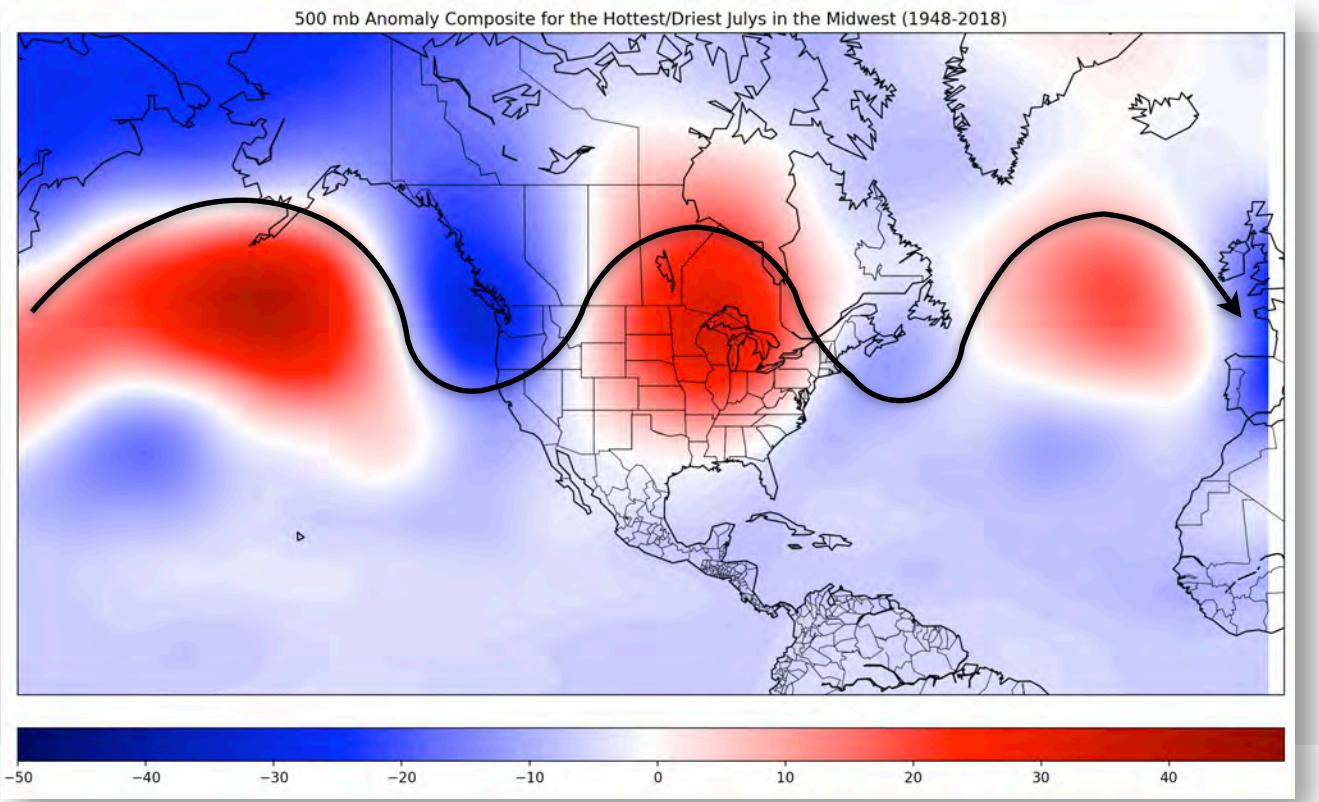




Aaron Horinek

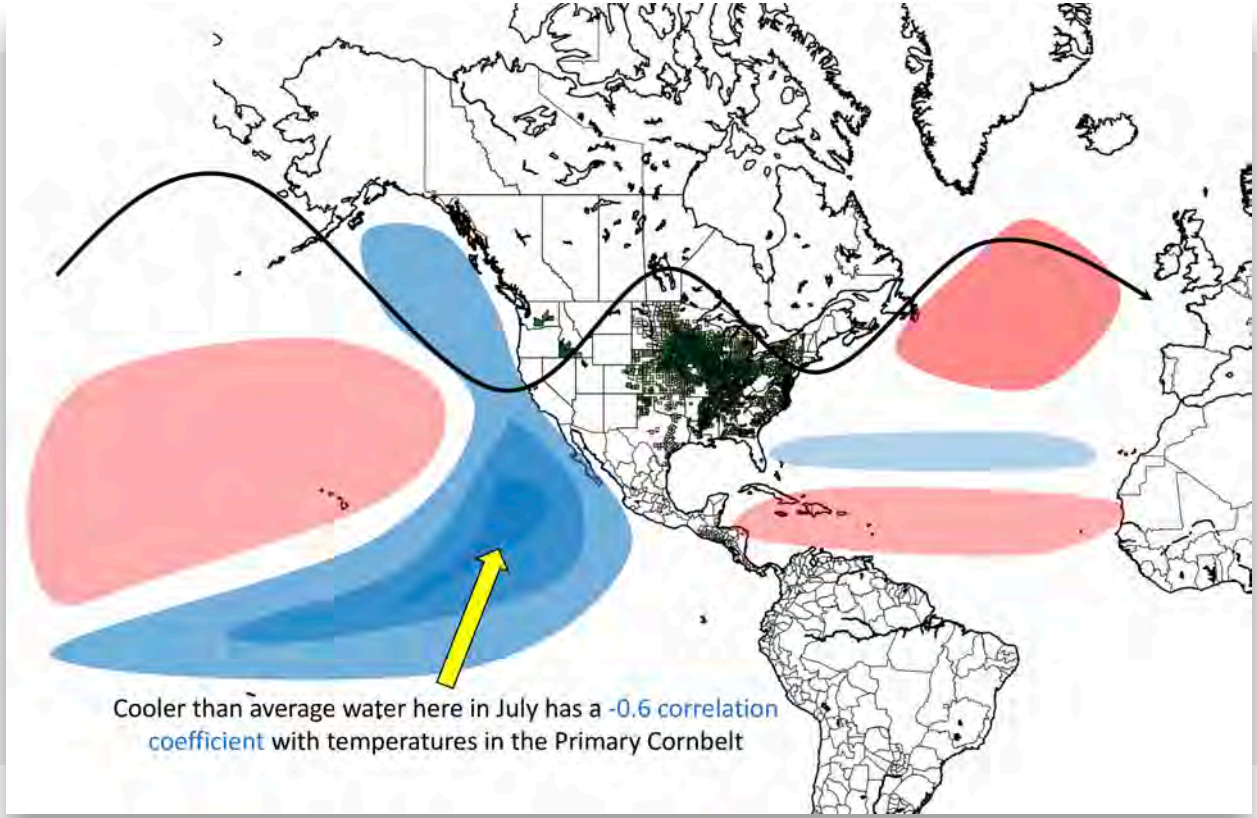
July Ridges - top 10 driest/hottest

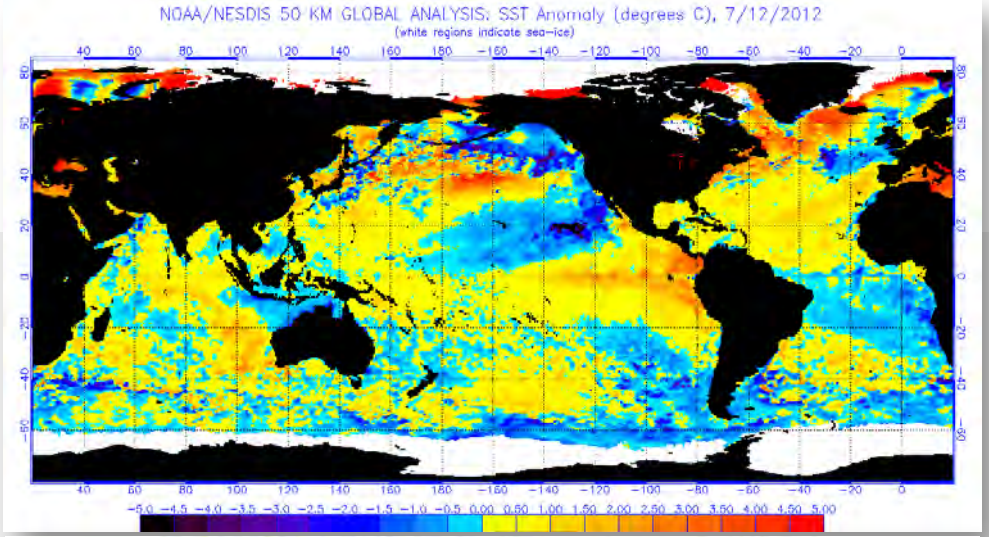
Blocked Weather Patterns = Persistent Ridging leads to a Positive Feedback cycle

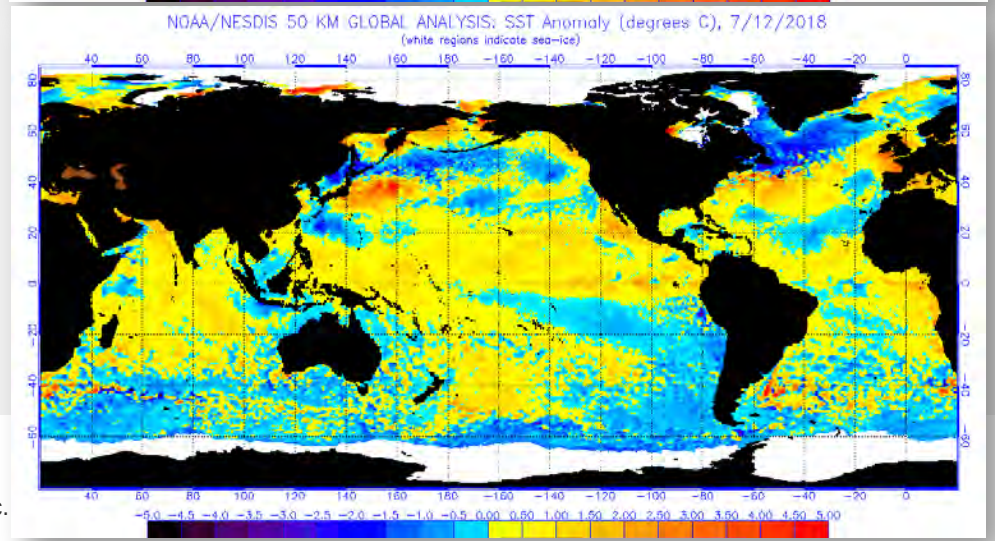


Are their long term predictors for hot/dry July weather across the Cornbelt?

70-year analysis



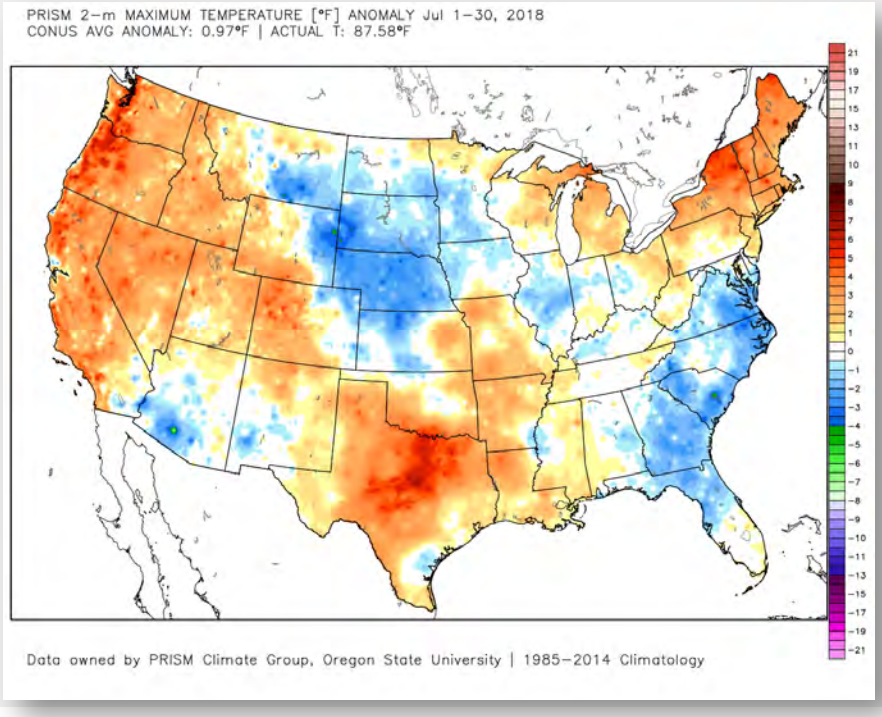


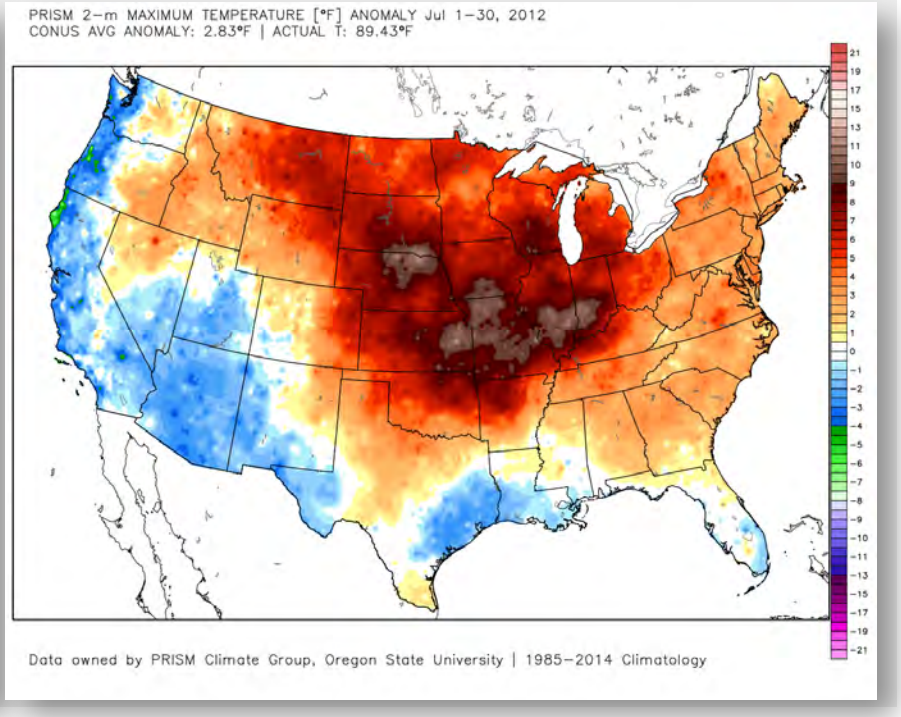


https://www.ospo.noaa.gov/Products/ocean/sst/anomaly/

July 2018 vs July 2012

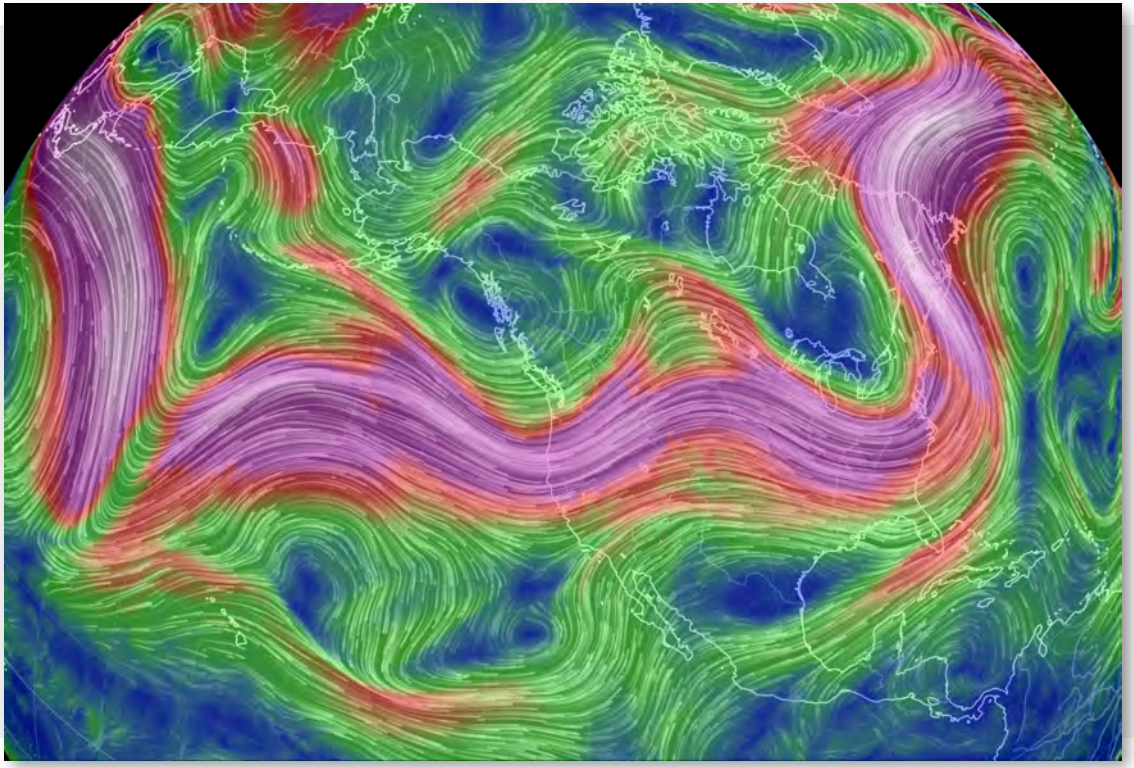
July 1 – 30 temperature anomalies



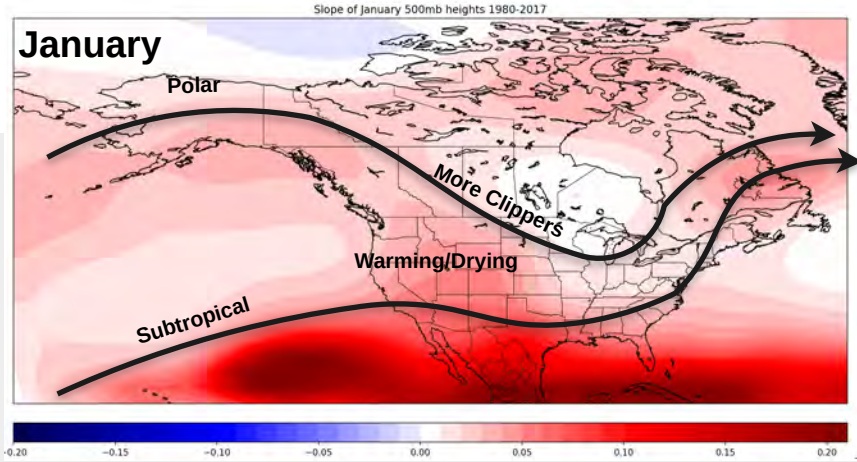


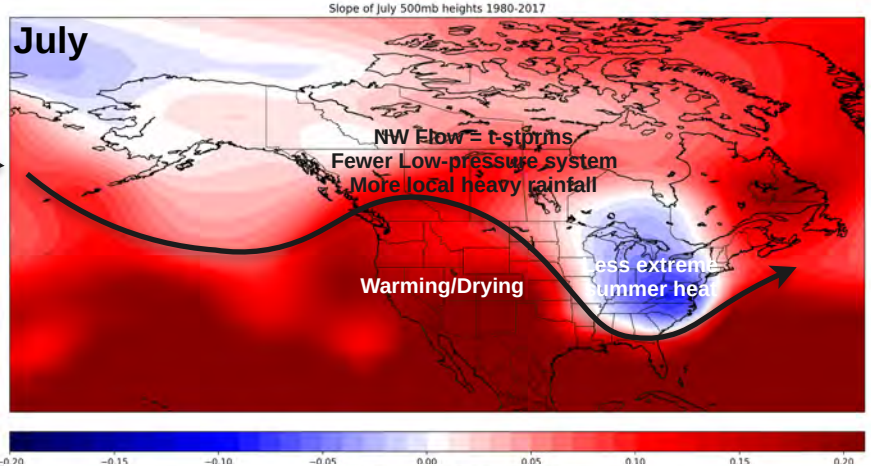
Why do I talk all the time about troughs and ridges?

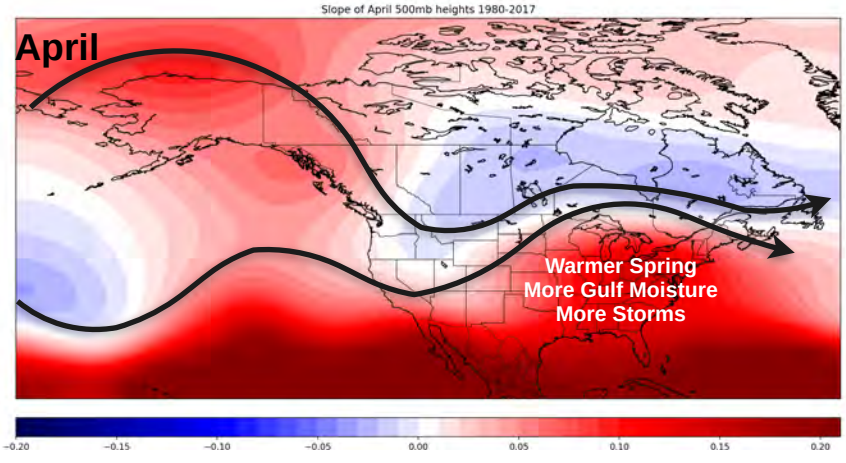
Because of the average wavelength of a Rossby Wave - “If there is a ridge out west, we will make huge yields.”

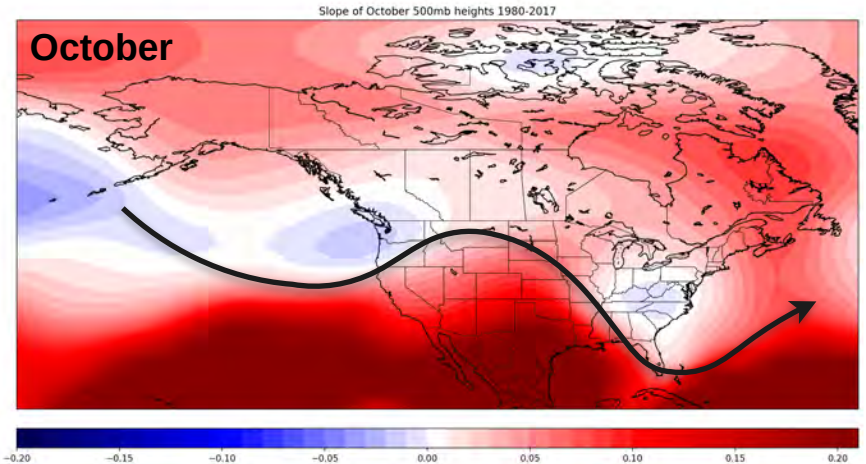


What are the long term, seasonal trends in the flow of the jet stream?



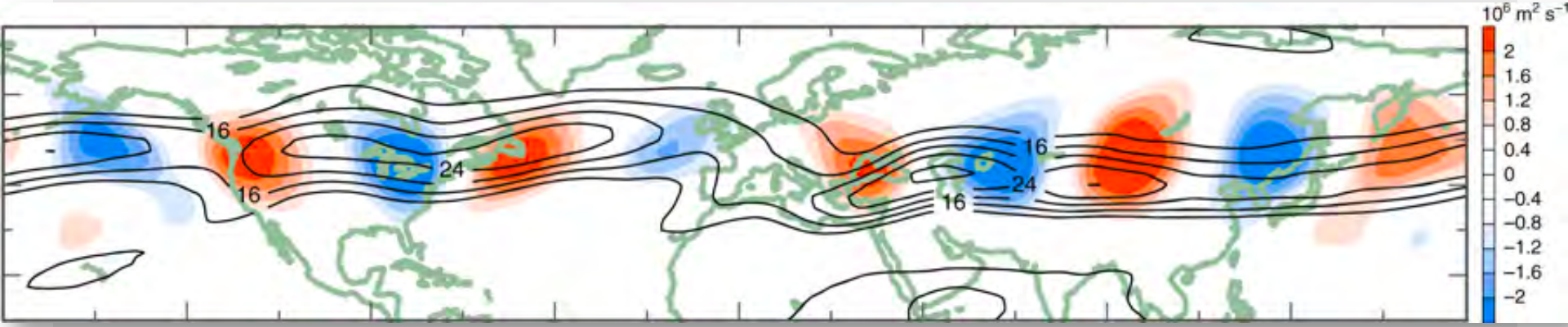






Long term trends in summer jet stream pattern

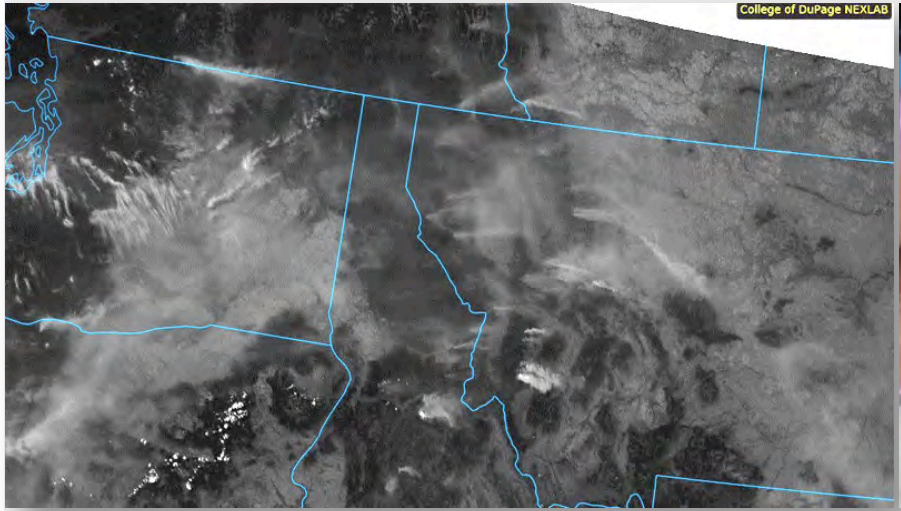
https://www.nature.com/articles/s41467-018-05256-8



Westward trending ridges and fire threat

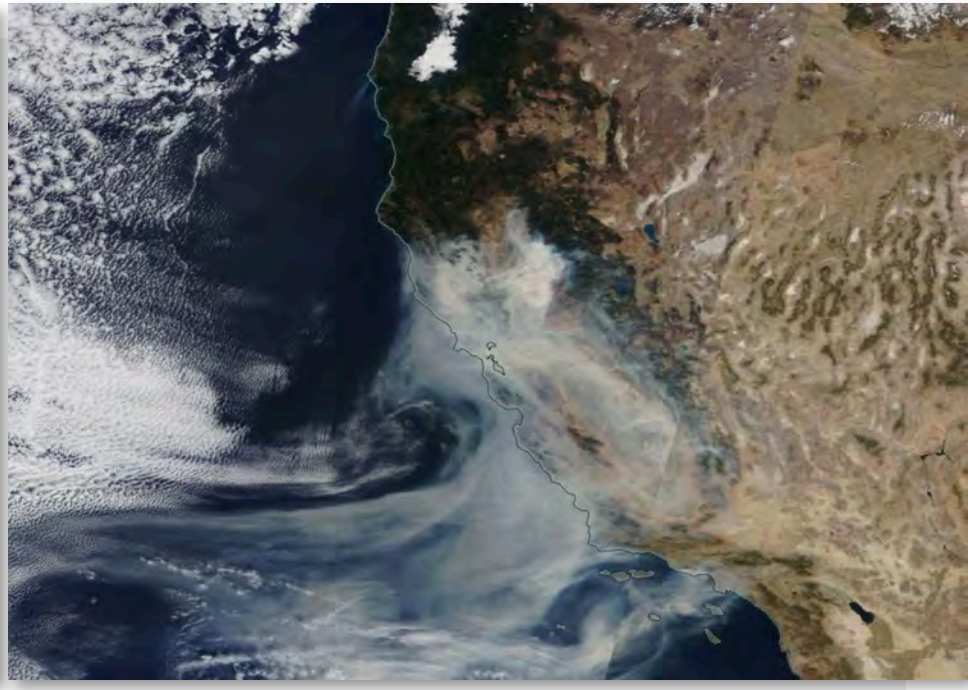
Summer 2017 and 2018 western US fires. 5-70% reduction in visible light.

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



Pyrocumulus over Delta Fire (Sept 8, 2018)

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



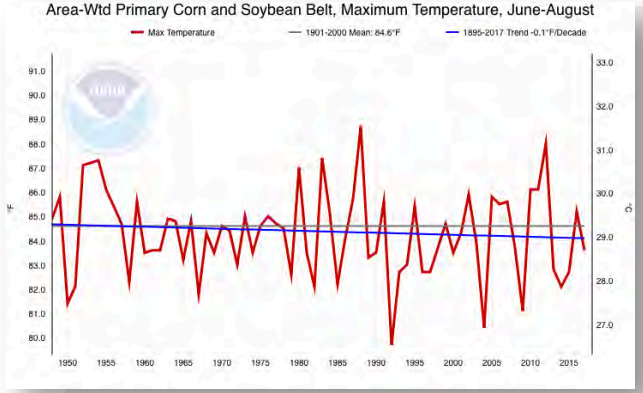
California Whiplash

2017 Forest Fires in Santa Rosa → Landslides

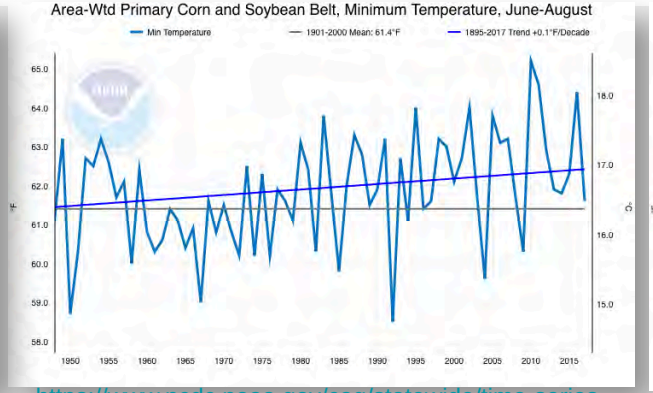
Climate shifts impacting production agriculture

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

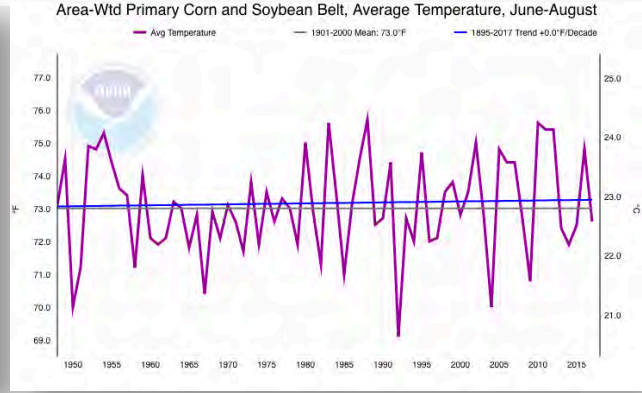
Maximum Temperatures (-0.5°F)



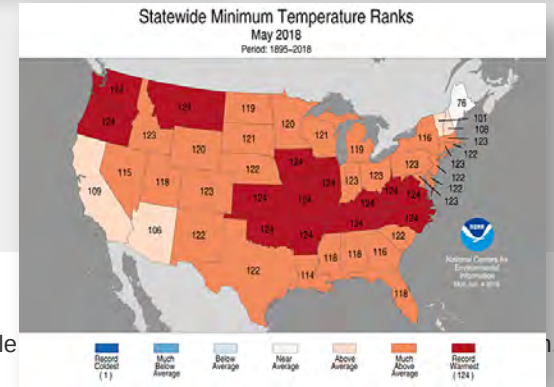
Minimum Temperatures (+1°F)

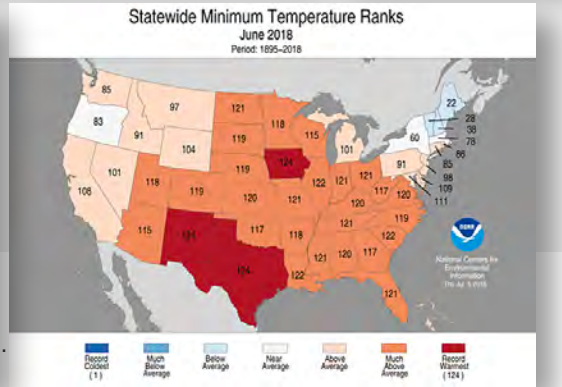


Average Temperatures (Flat)



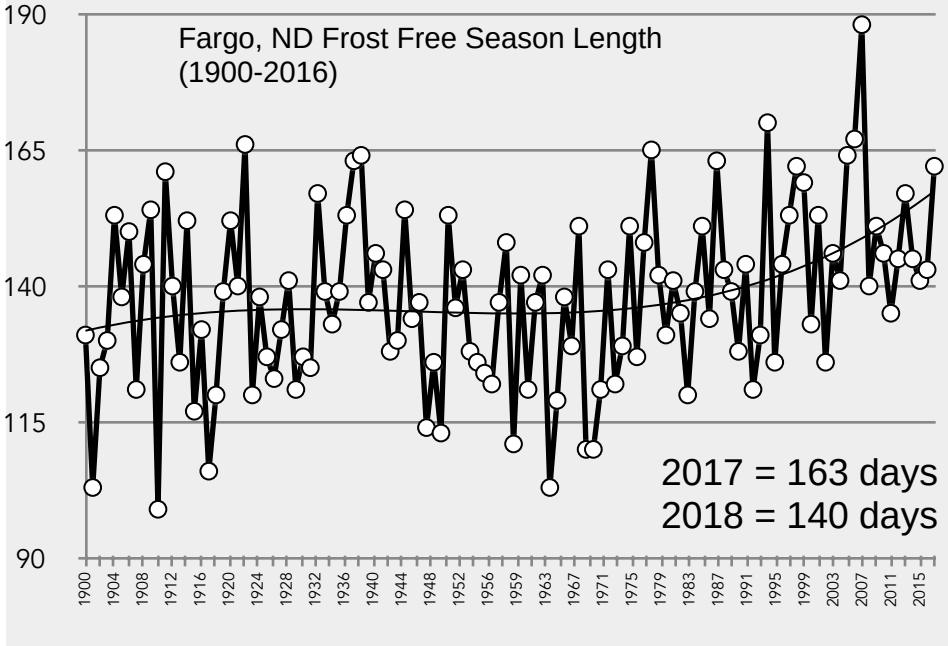
https://www.ncdc.noaa.gov/cag/statewide/time-series

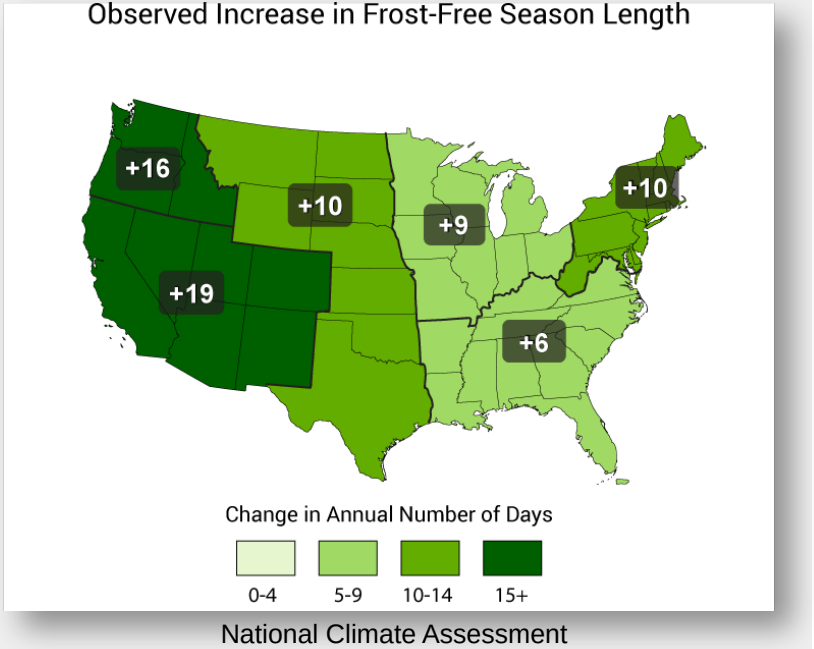




Climate shifts impacting production agriculture

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

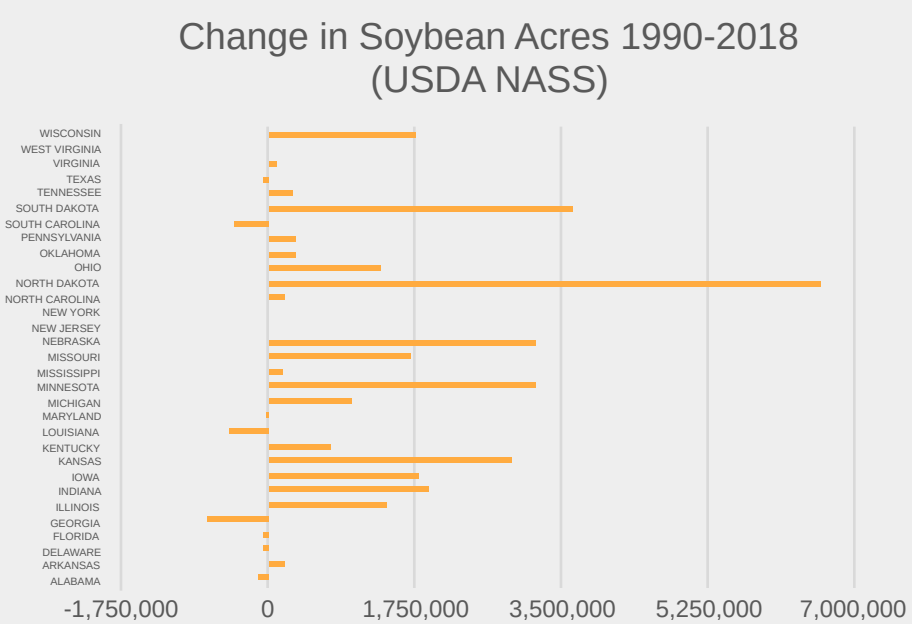


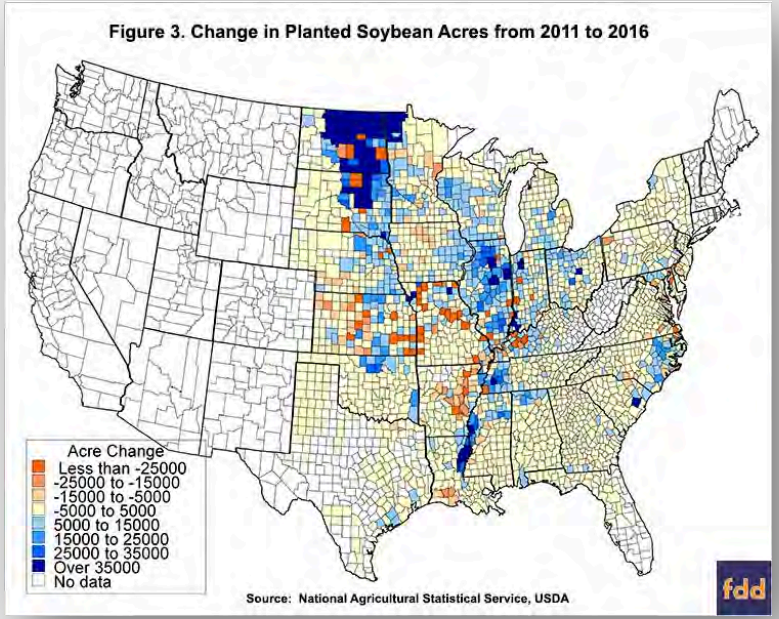


National Climate Assessment
https://science2017.globalchange.gov/

Climate shifts impacting production agriculture

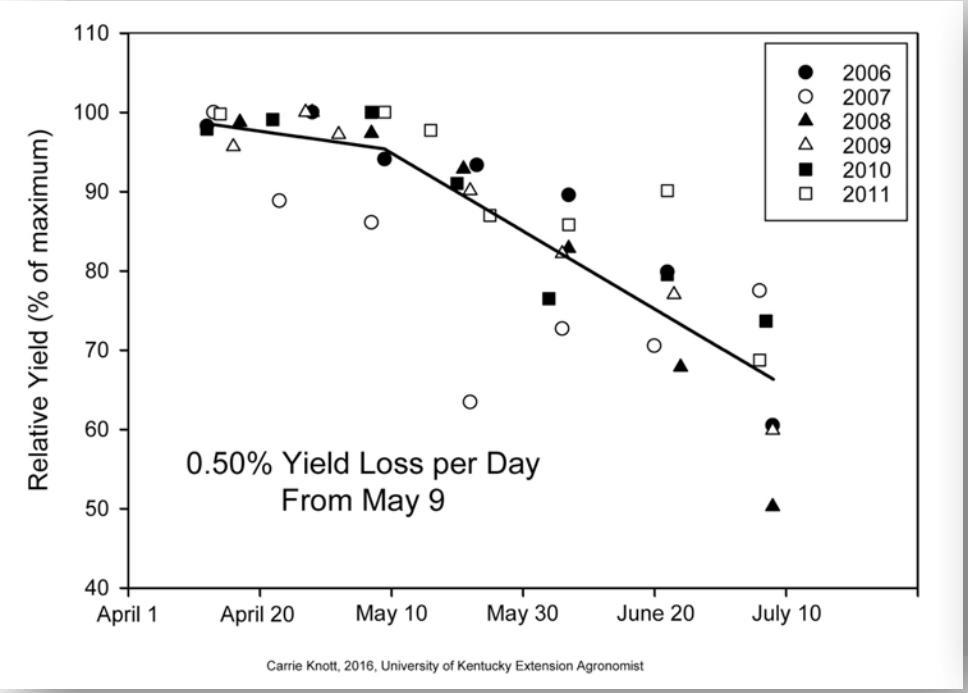
Changes in soybean production





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



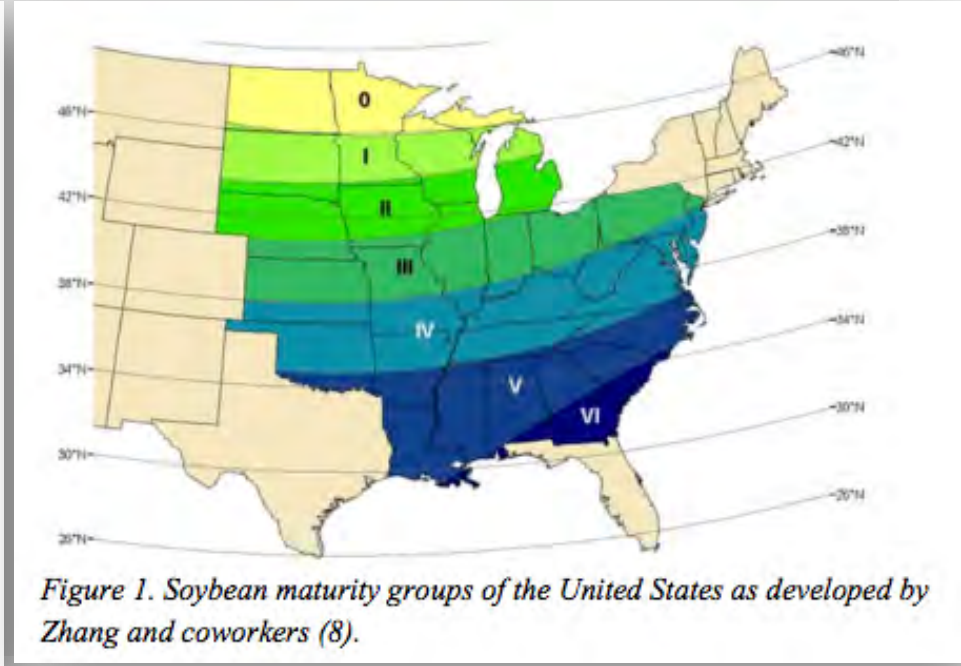
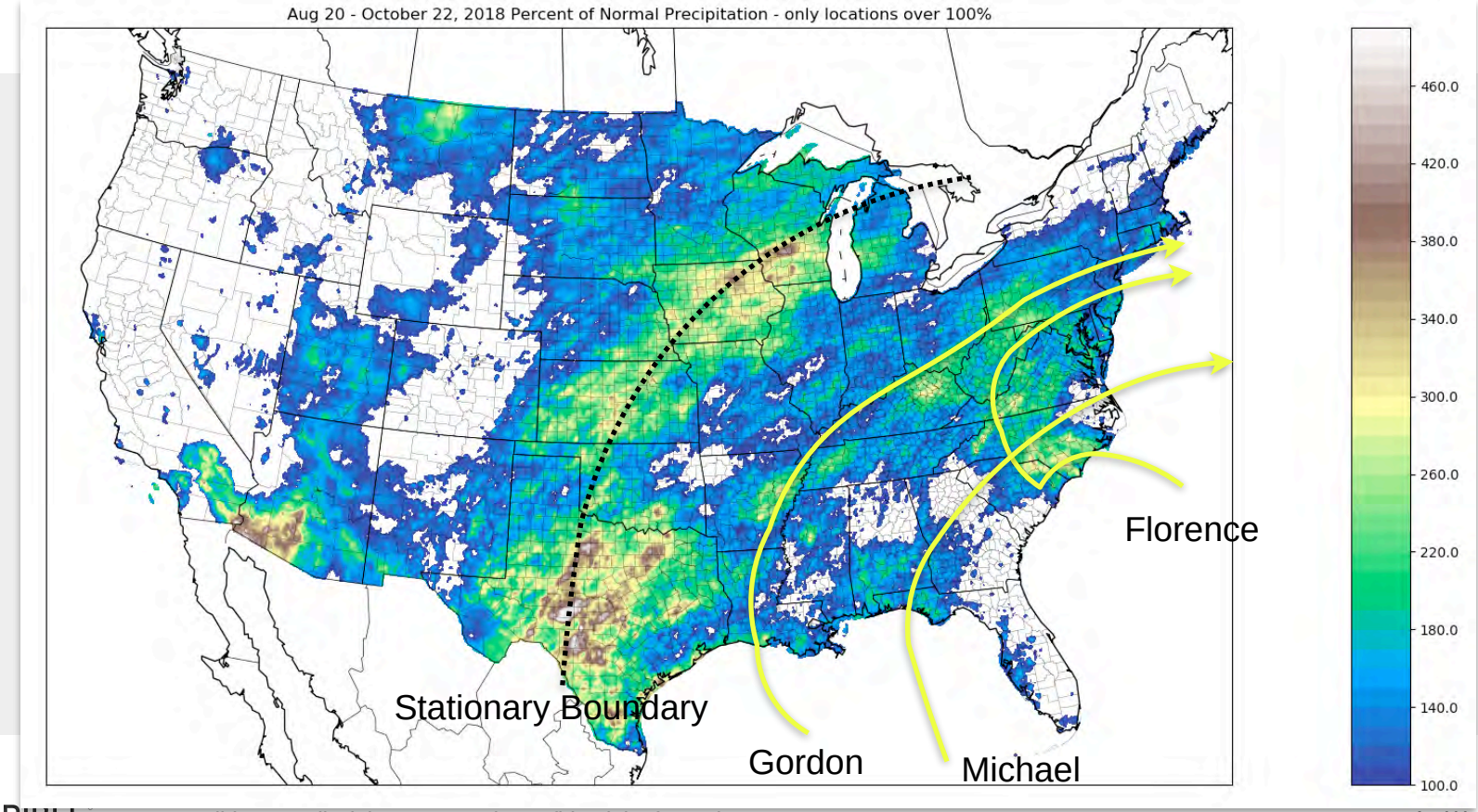
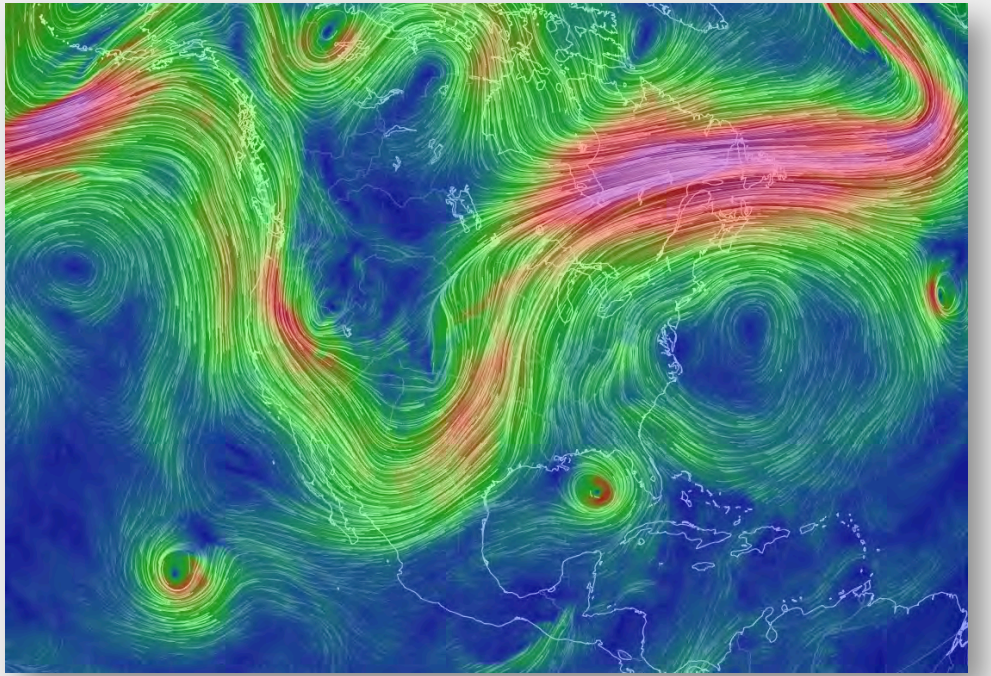


Figure 1. Soybean maturity groups of the United States as developed by Zhang and coworkers (8).

Back to the end of our growing season…

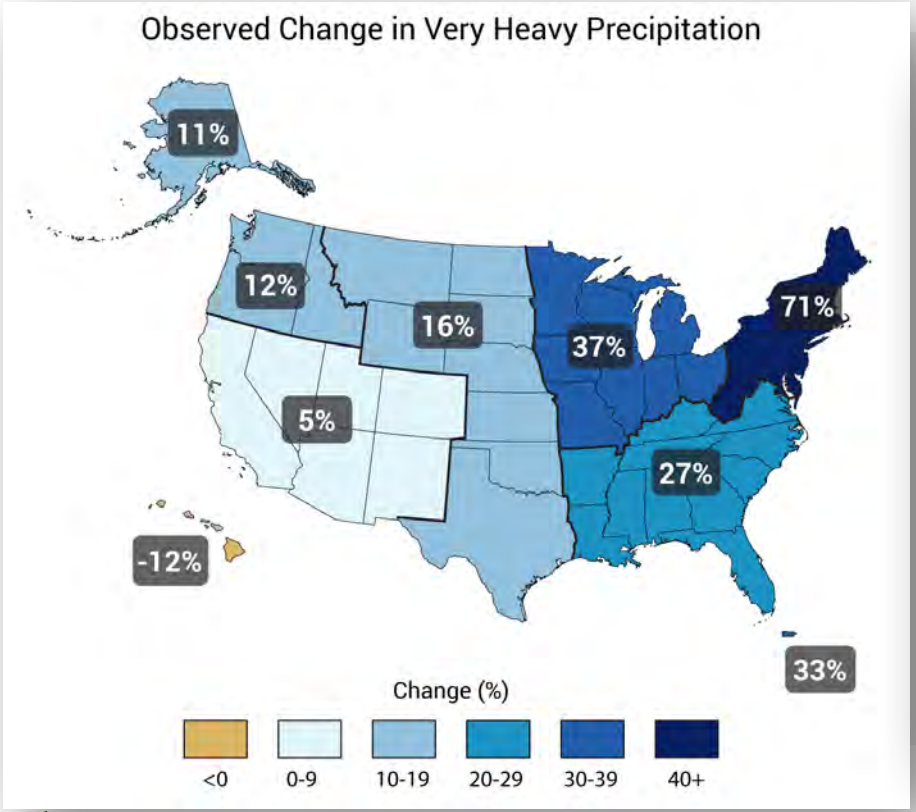


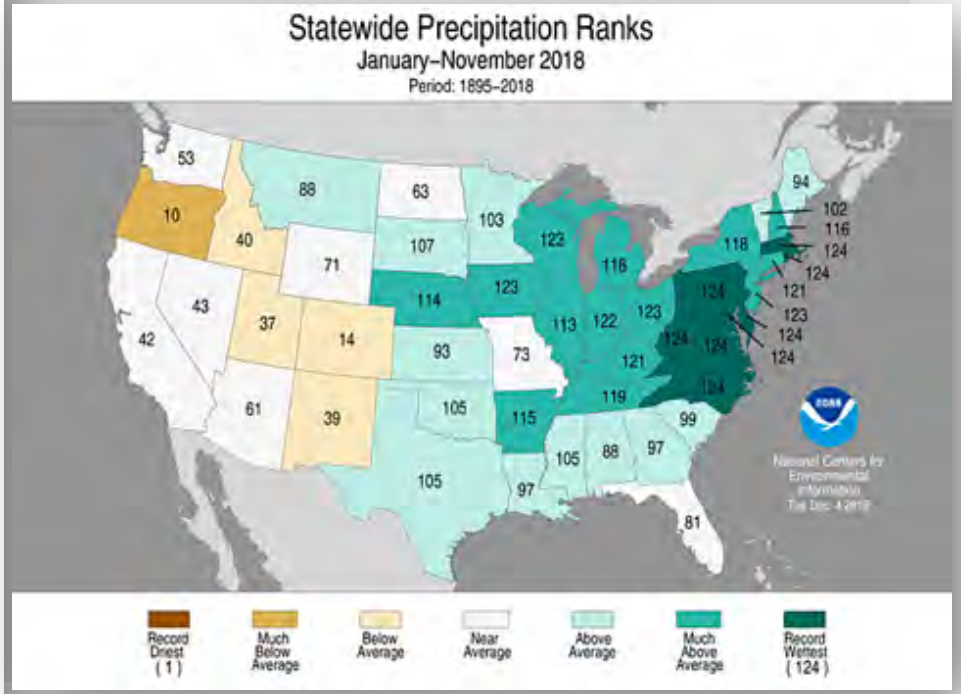
Fall Jet Stream Pattern



Are we seeing more rainfall from big events?

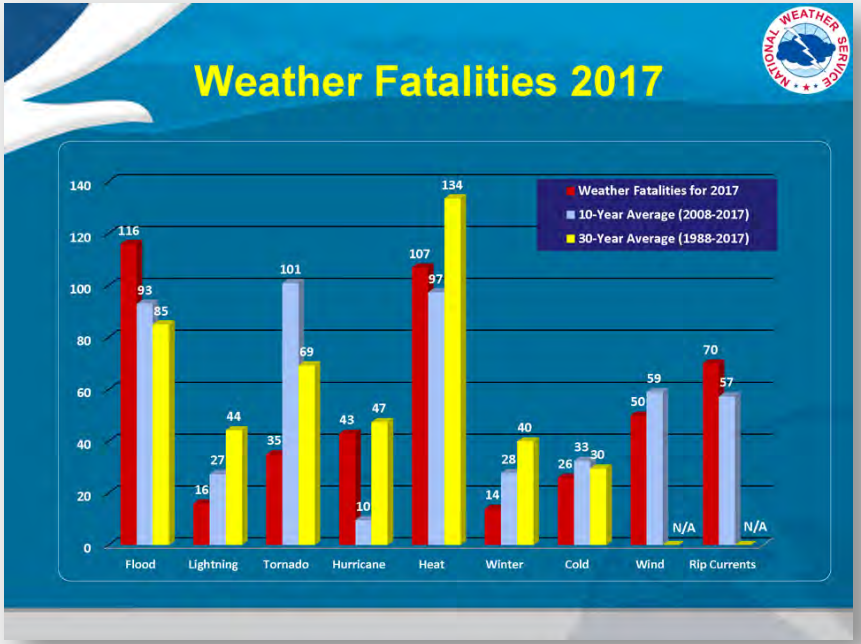
Change in observed heavy rainfall events

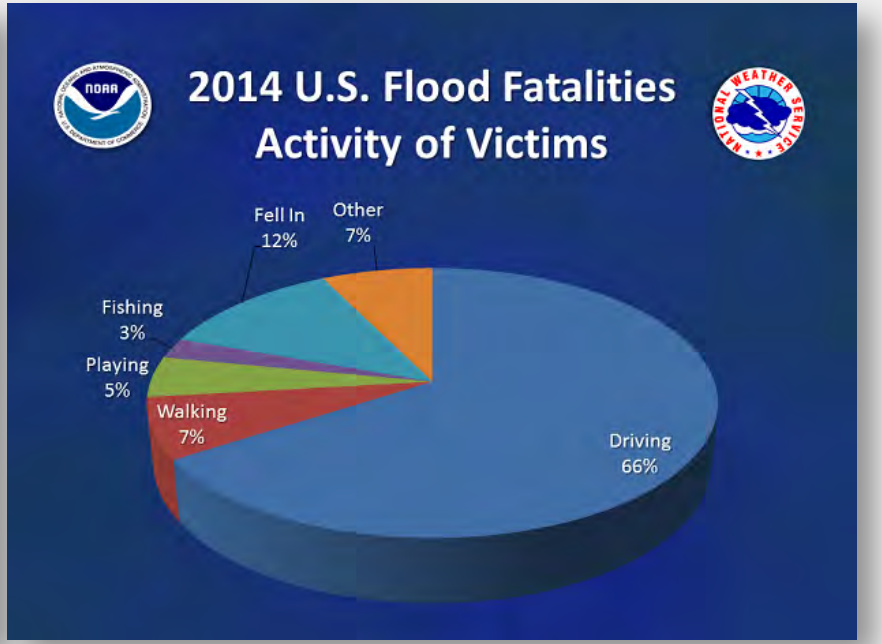




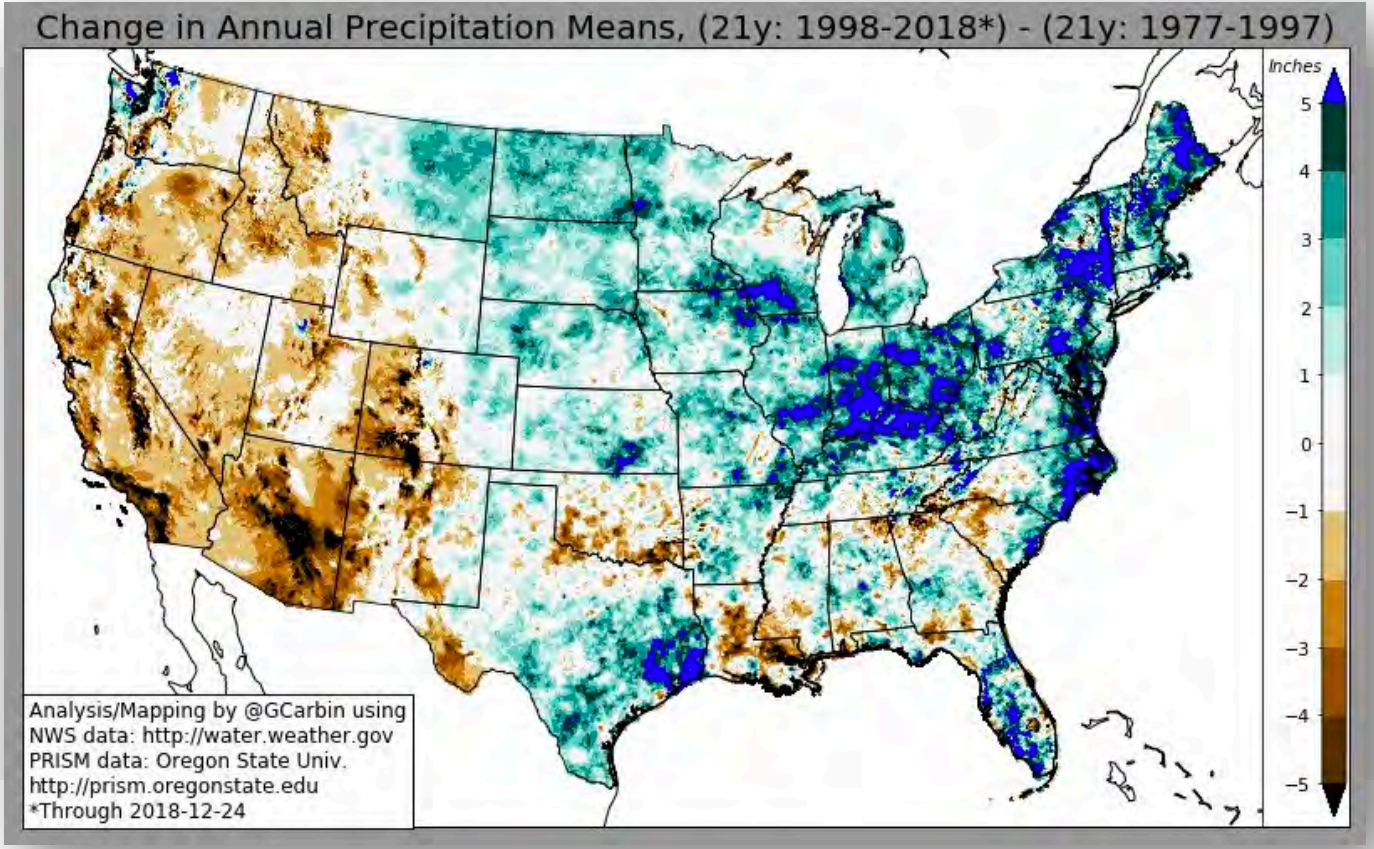
Flooding

Second most deadly form of weather in the US



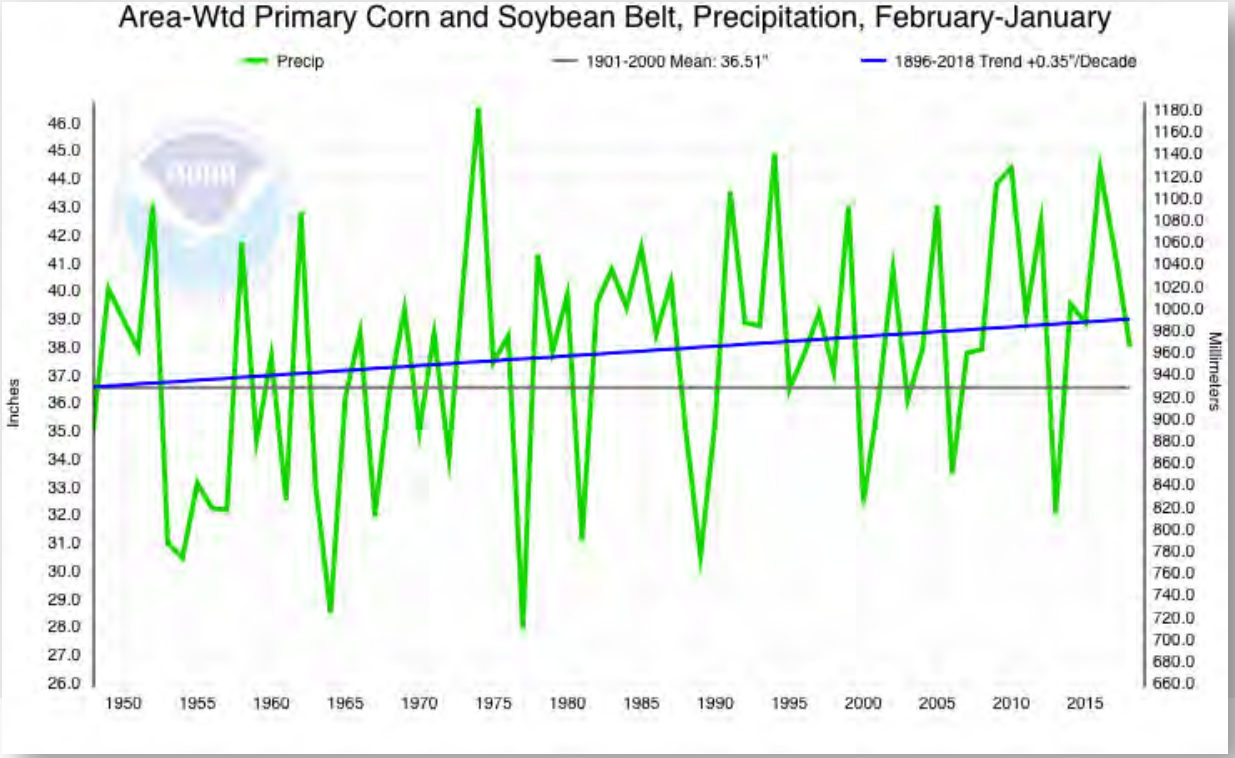


1977-1997 vs 1998-2018 (via Grant Carbin and PRISM)



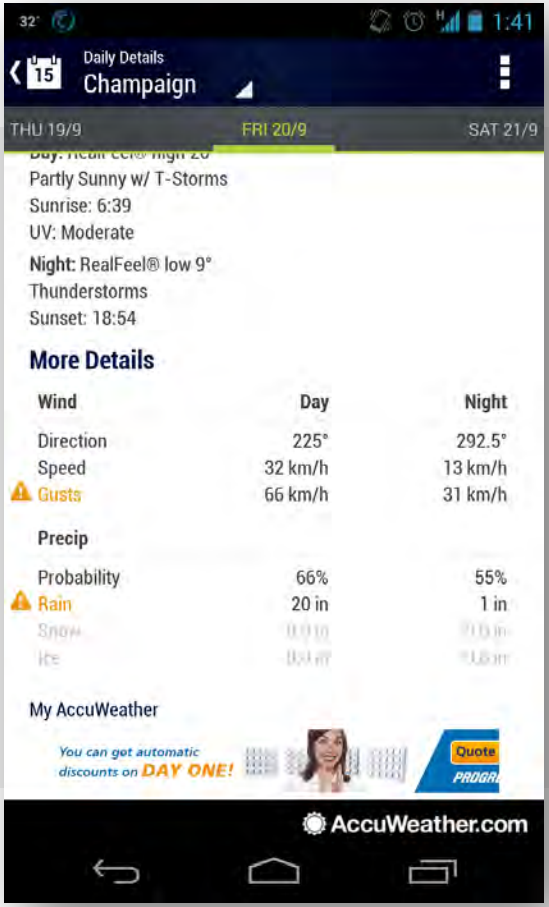
Trends in Annual Precipitation for the Cornbelt

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

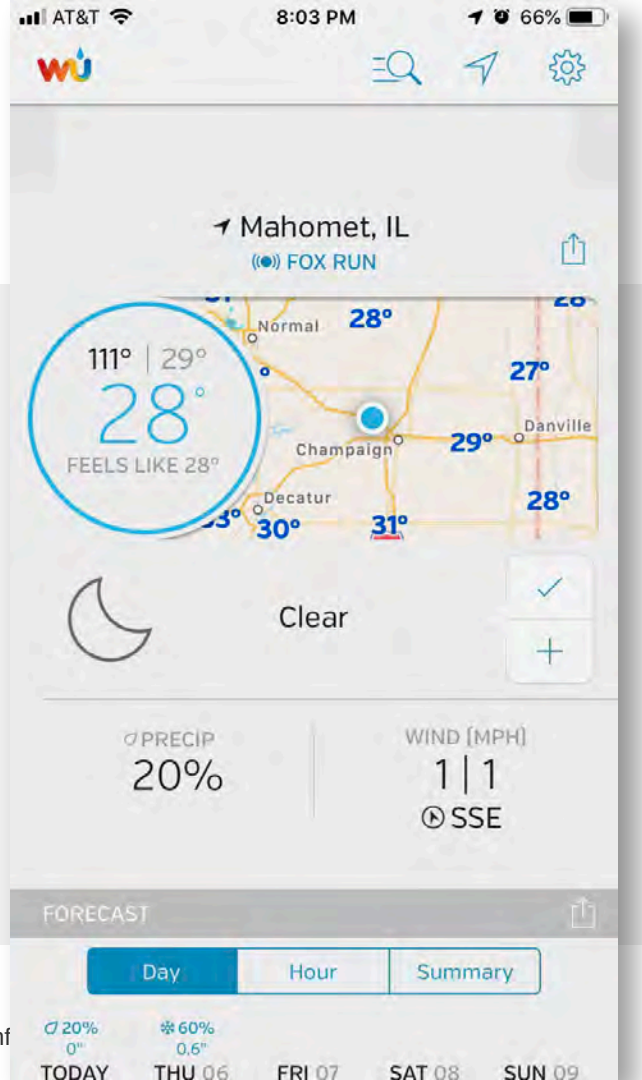


What are the best weather forecast tools?

Apps don’t always deliver what we need.

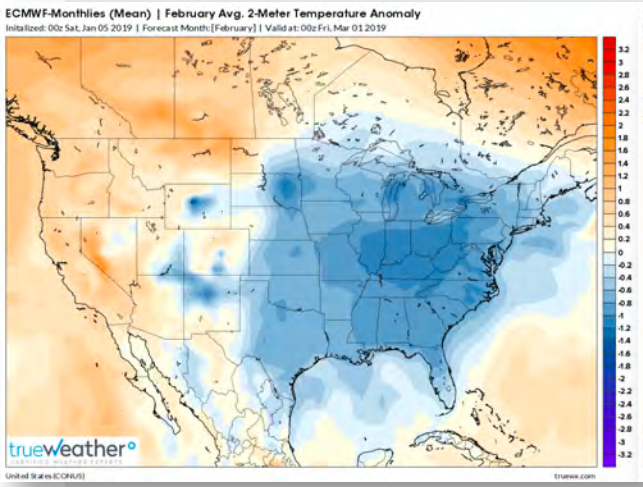


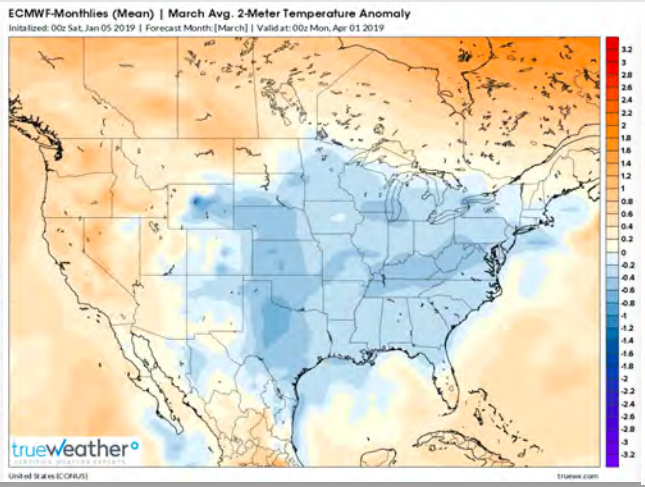
Wife’s weather app recently…

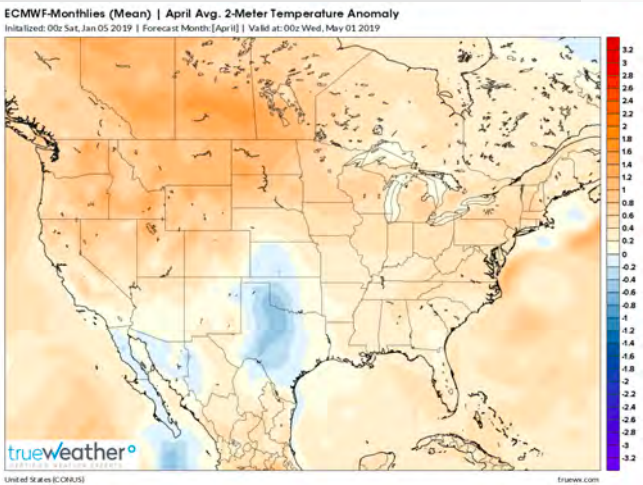


Long-Range European Model – Feb-Mar-April Temperature Anomalies

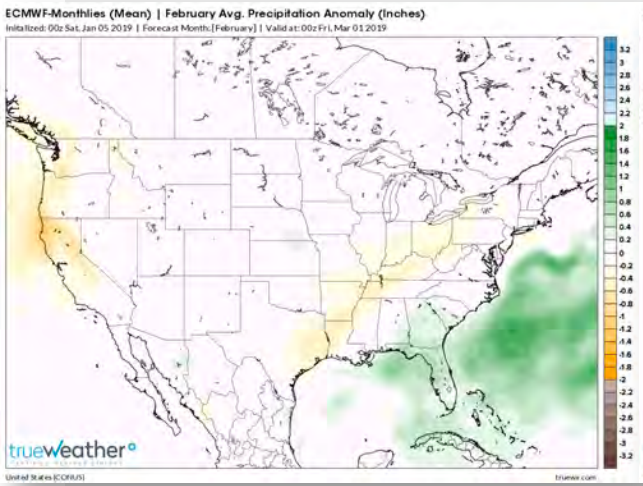
This model does not exhibit high skill, but it is the best on earth. So it is always considered.

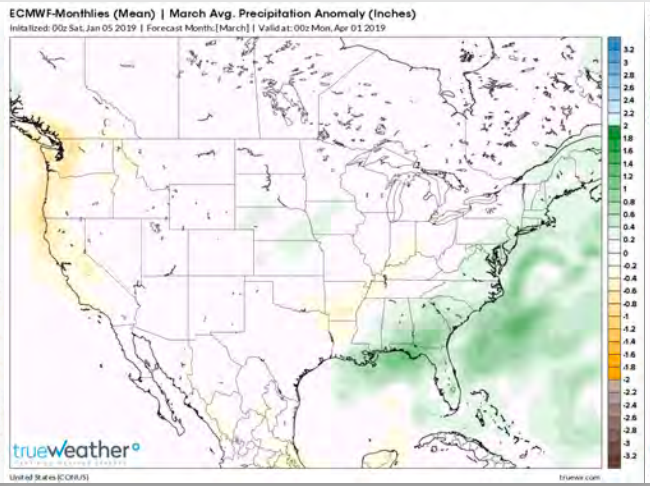


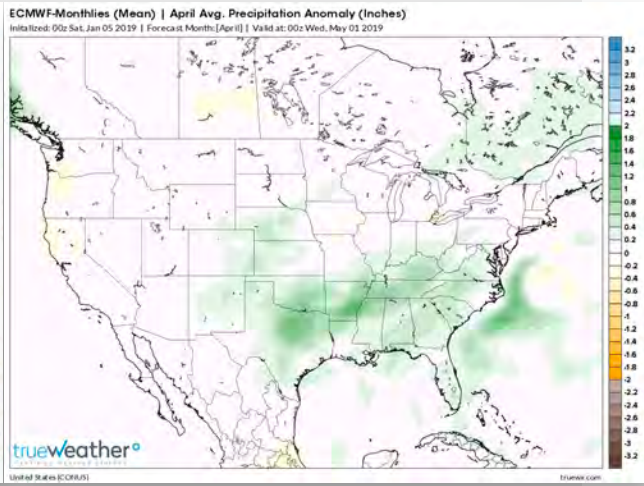




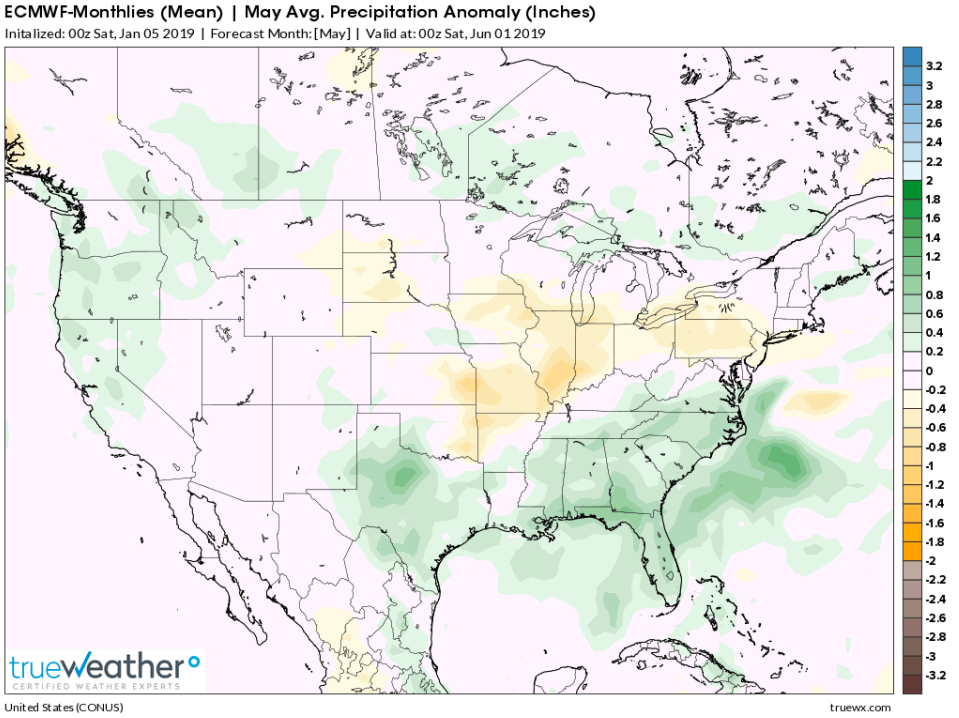
Long-Range European Model – Feb-Mar-April Precipitation Anomalies

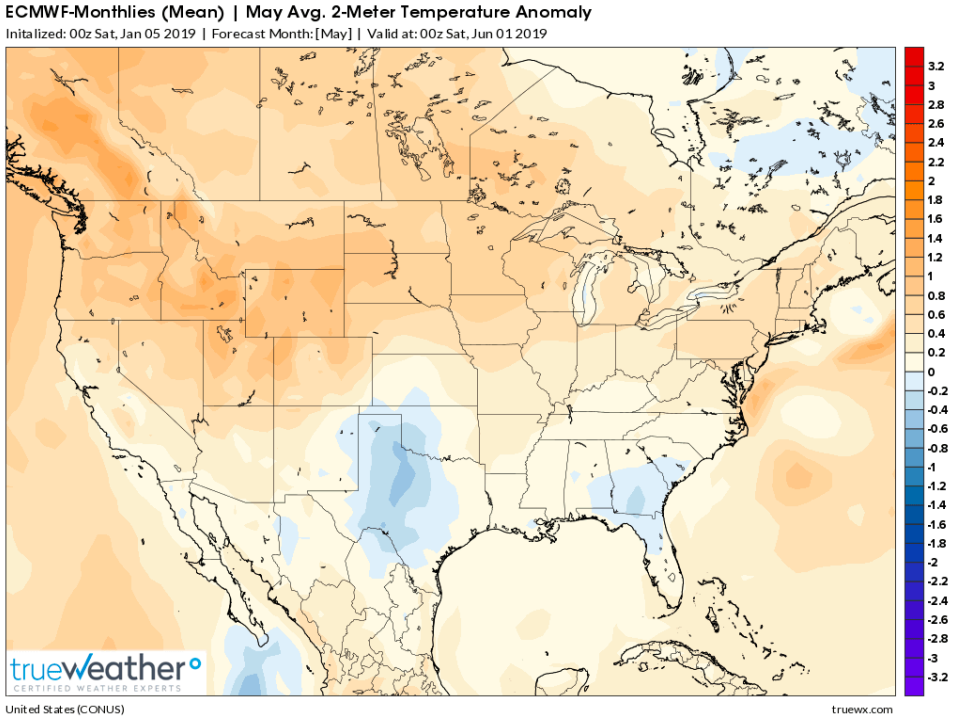




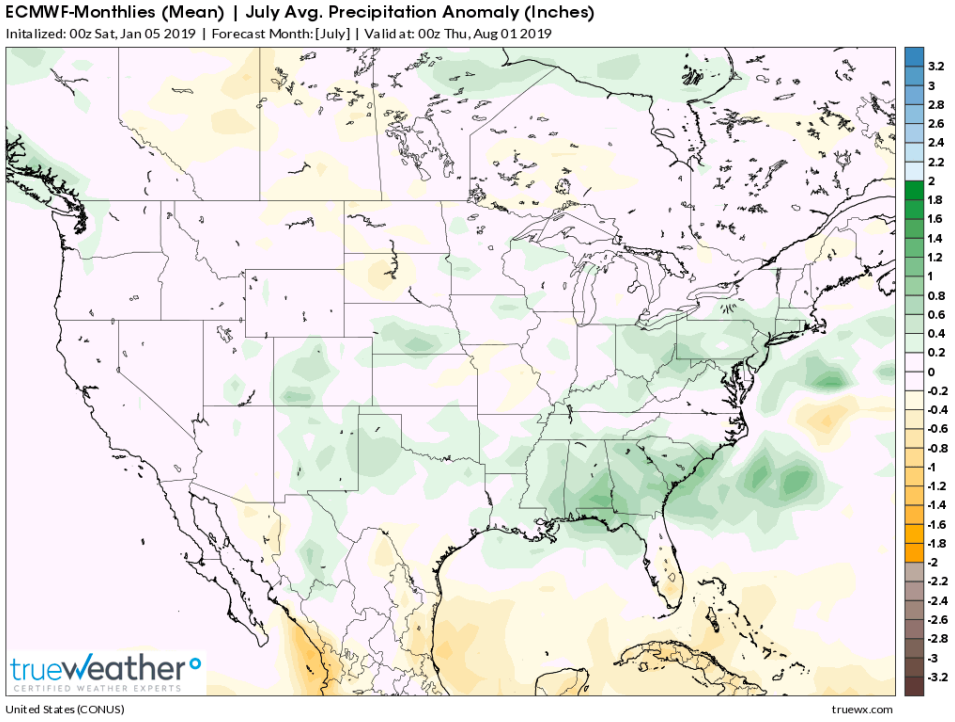


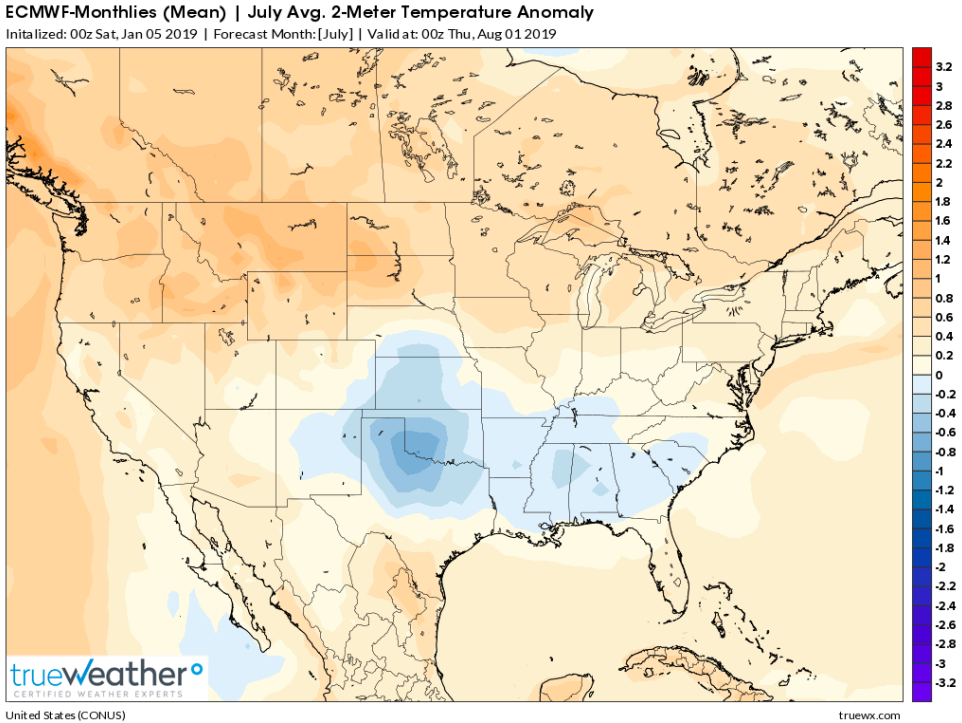
Long-Range European Model May 2019





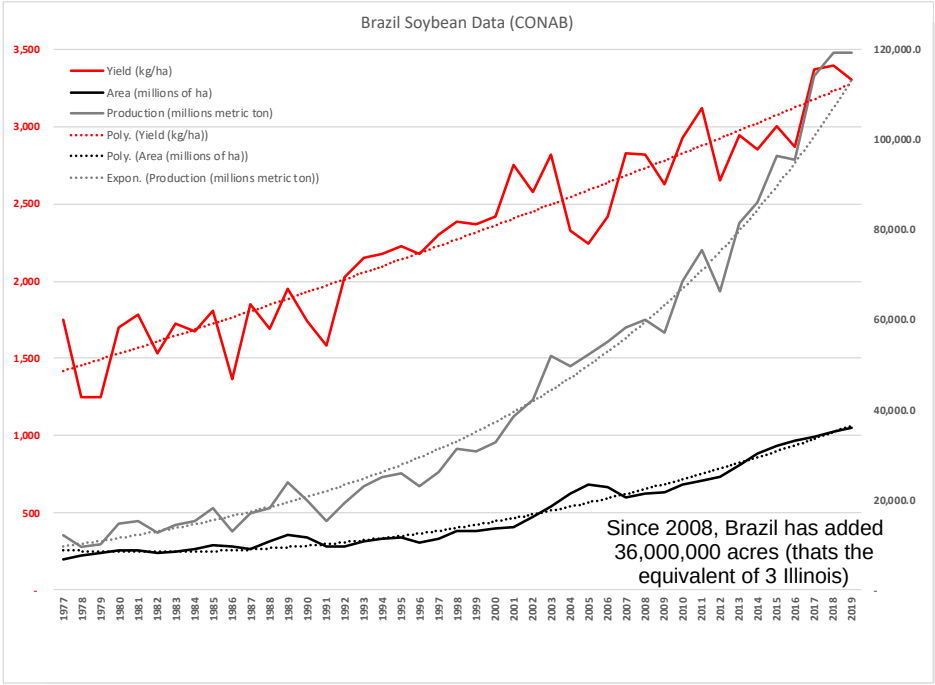
Long-Range European Model - July 2019 (take with a large grain of salt)





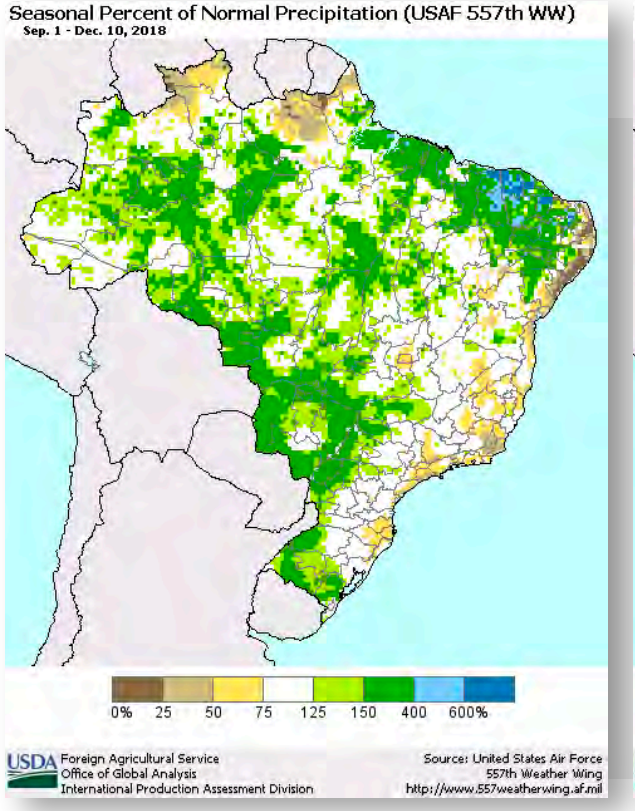
Global competition – shifts in agricultural productivity

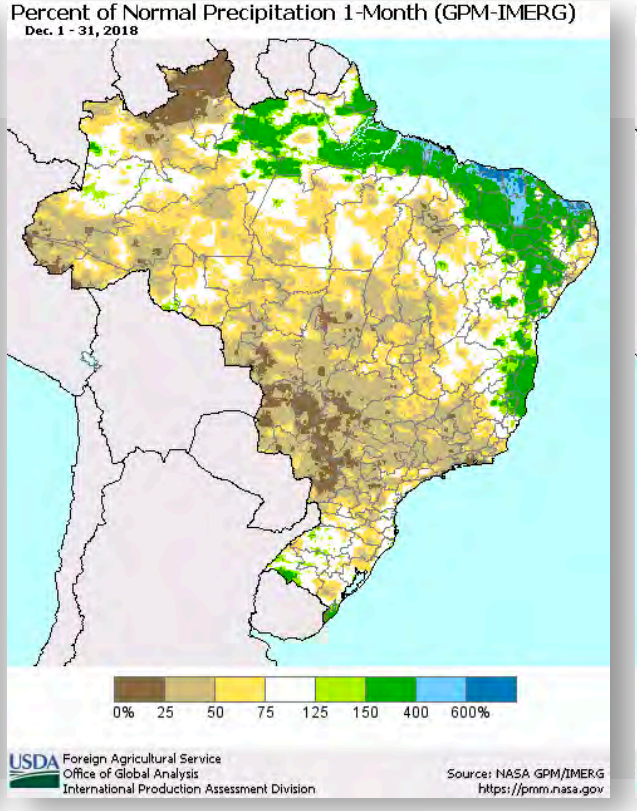
Brazilian Soybean Production – 2018 Production = 119 MMT (largest ever)

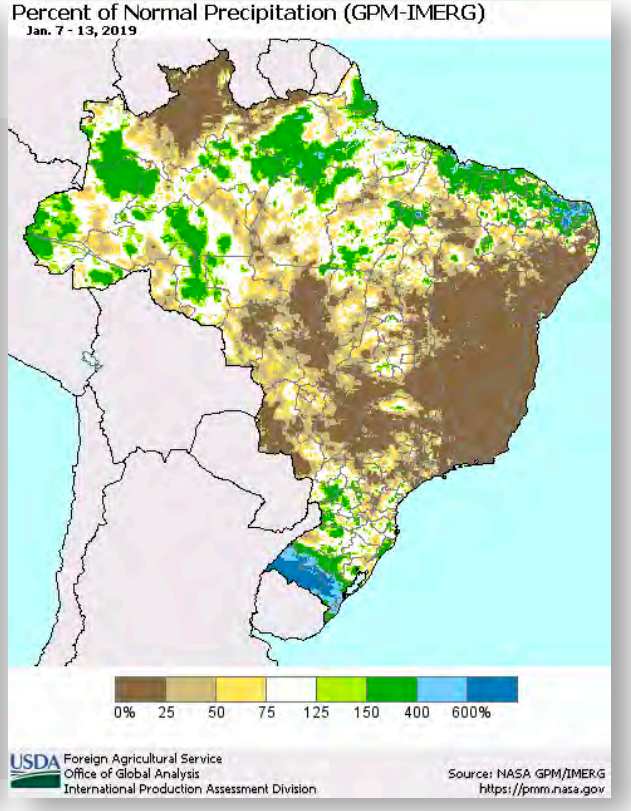


http://www.soybeansandcorn.com/

Brazil







ECMWF EPS Total Precipitation Anomaly [inches] | Ensemble Mean
Init: 00Z16JAN2019 -- [360] hr --> Valid Thu 00Z31JAN2019

MIN|MAX: -9.37 | 9.13 INCH

15N
EQ
15S

60W
30W

25
20
15
12
10
8
6
5
4
3.5
3
2.5
2
1.5
1
0.8
0.6
0.4
0.2
-0.2
-0.4
-0.6
-0.8
-1
-1.5
-2
-2.5
-3
-3.5
-4
-4.5
-5
-5.5
-6
-7
-8
-9
-10

This service is based on data and products of the European Centre for Medium-range Weather Forecasts (ECMWF)

TormentasDelLitoral @TDLtiempo Buenos Aires

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.agrible.com

https://www.tropicaltidbits.com/analysis/models/
http://www.pivotalweather.com/
https://weathermodels.com/ ($$)
http://www.spc.noaa.gov
http://www.weather.gov