



Weather Risk in Production Agriculture



June 26, 2018

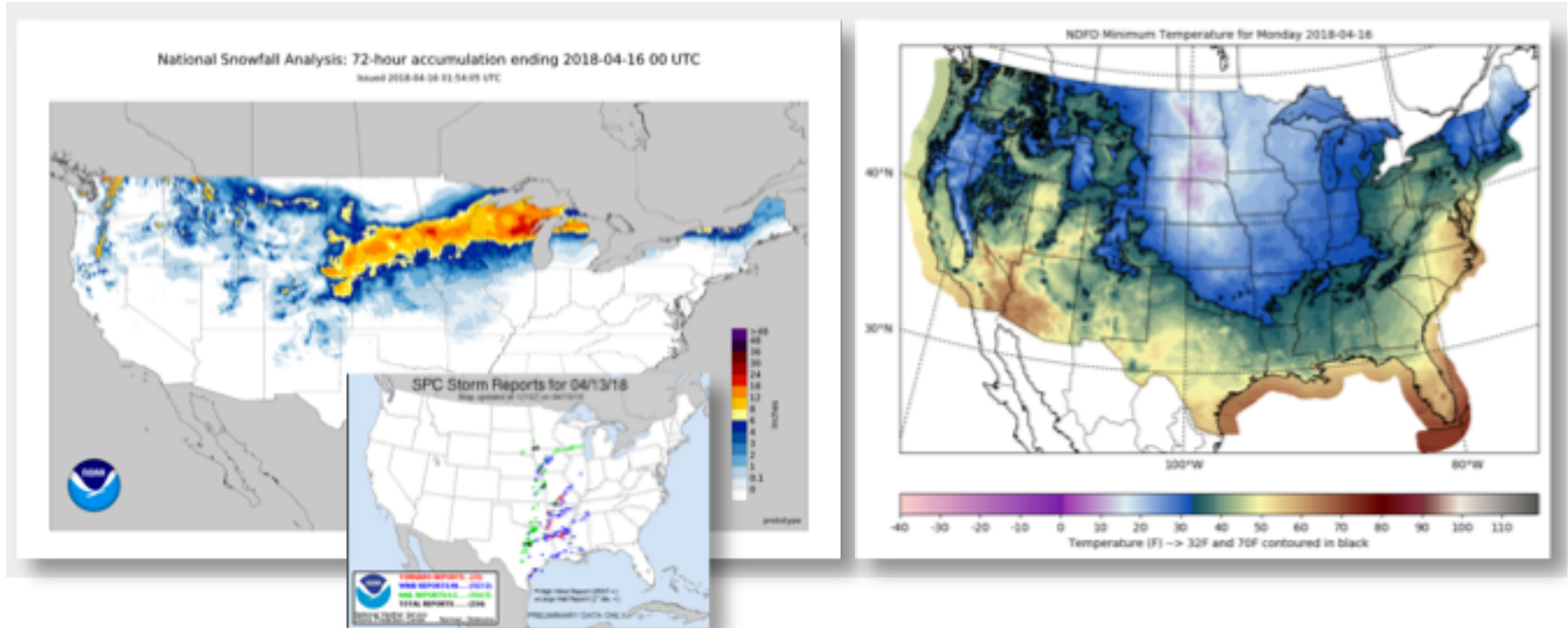
Eric Snodgrass

Director of Undergraduate Studies, Atmospheric Science University of Illinois
Co-Founder and Senior Atmospheric Scientist at Agrible, Inc



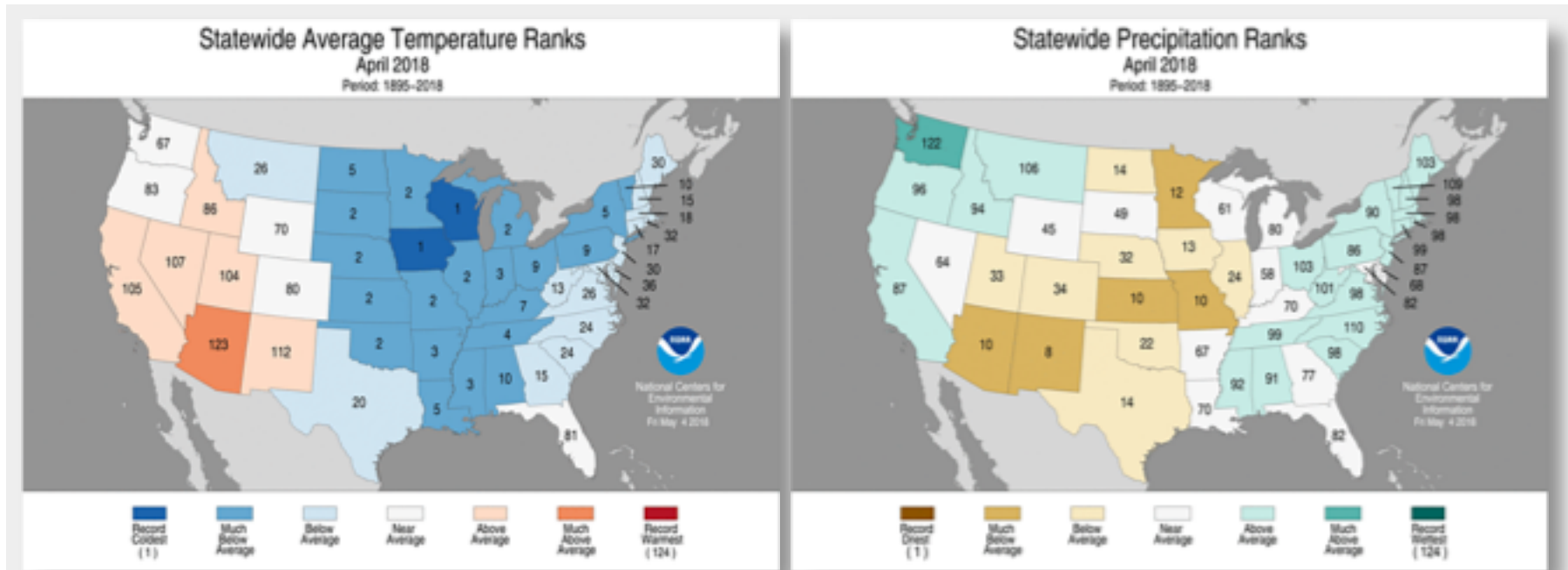
A Cold Start – April 2018

Growing season begins with a blizzard



April 2018 Temperature and Precipitation Ranks

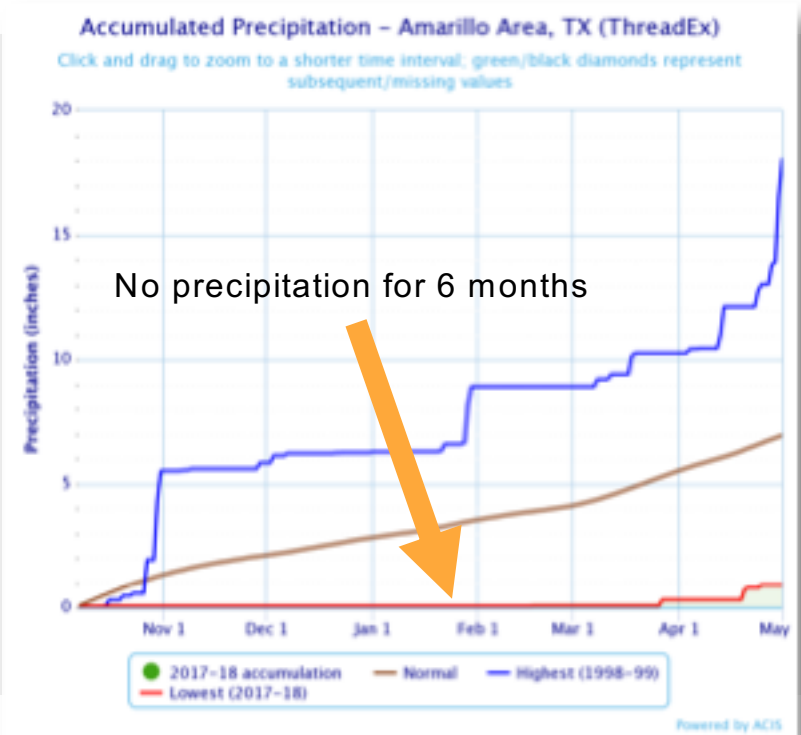
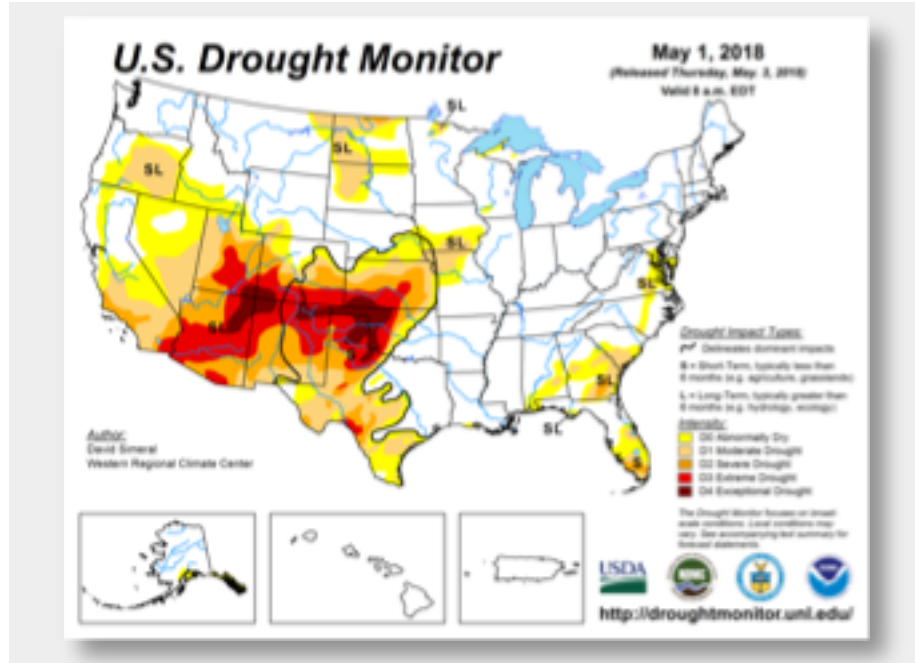
One for the record books – 13th coldest on the 124 year record for the US



<https://www.ncdc.noaa.gov/>

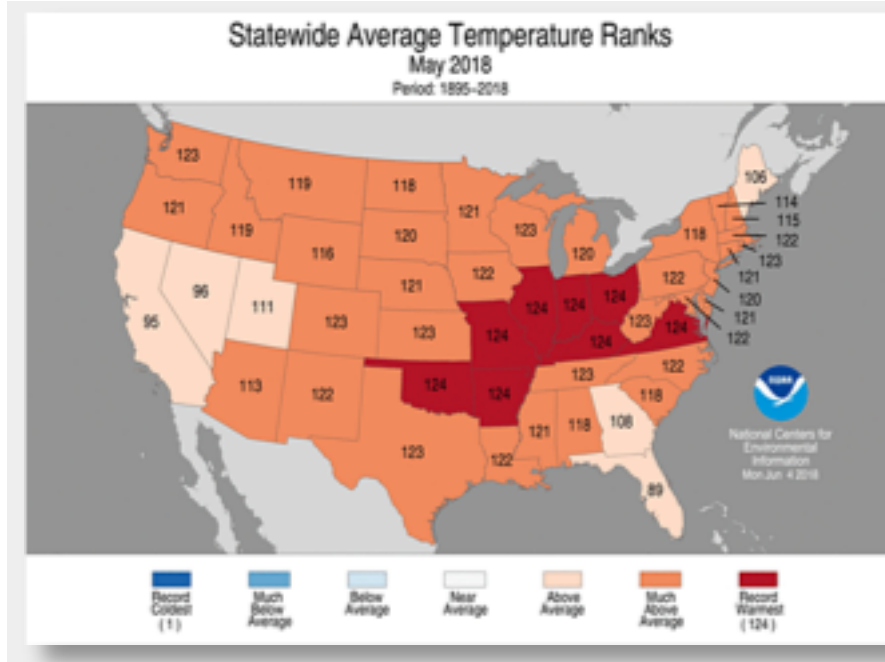
We were also concerned about drought

Extremely dry in the states near Texas – but spring rains can undo all of winter's sins



May 2018 – warmest may on US record (124 years)

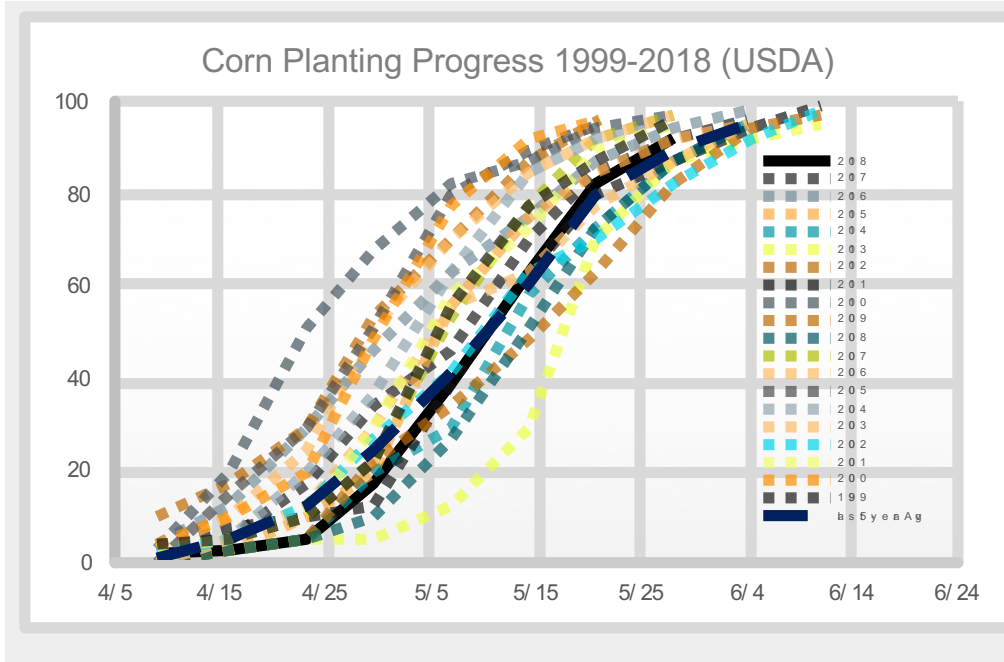
Forget Spring, Summer is here.



<https://www.producer.com/2014/06/seeder-reach-stretches-160-feet/>

Corn Planting Progress 2018

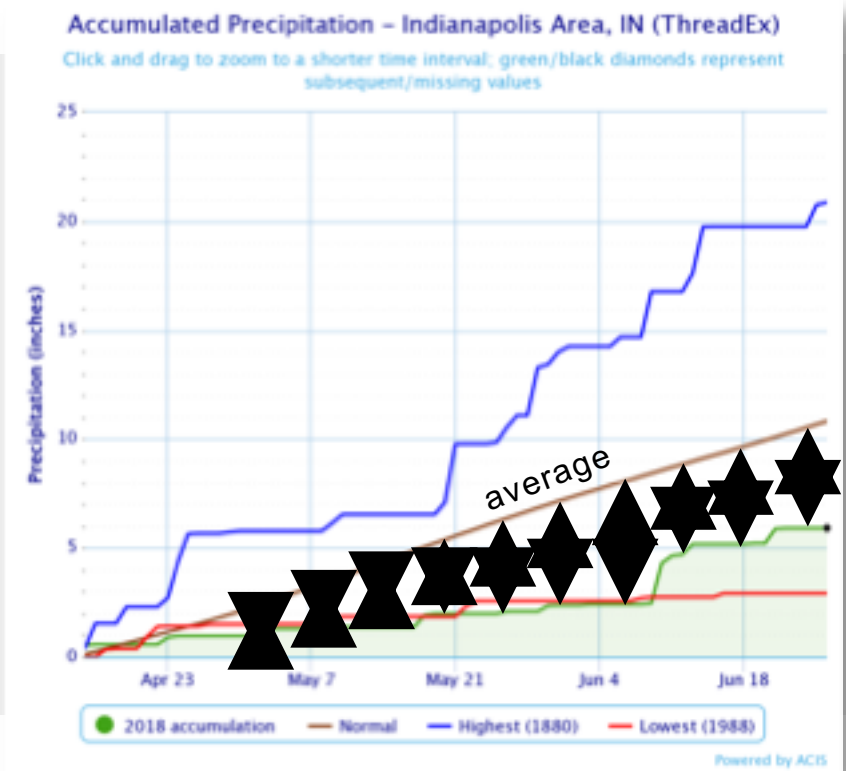
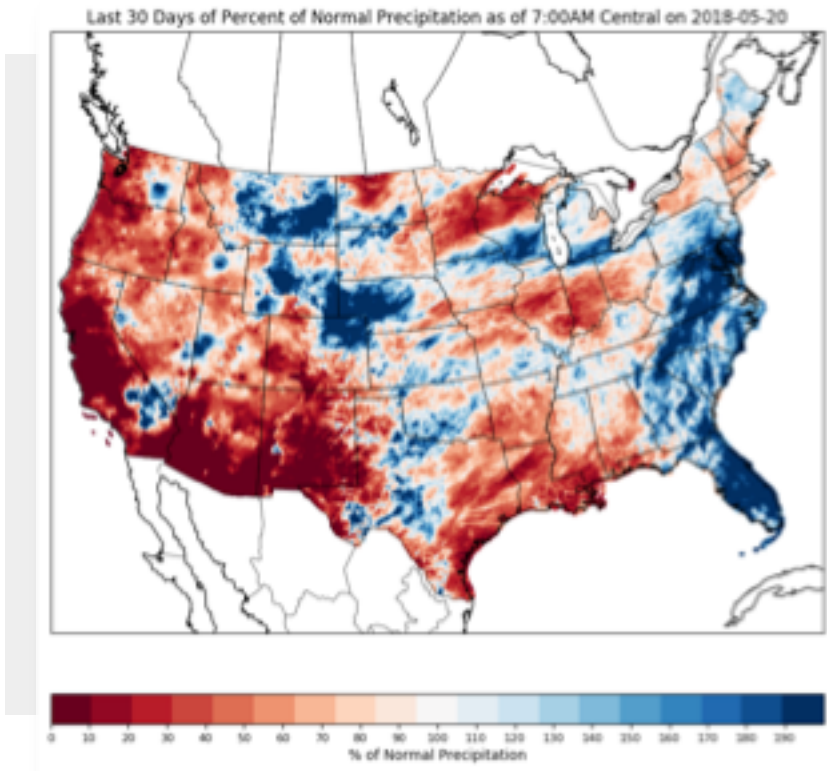
Pace was rapid in early May



Illinois planted 70% of its 11.2 million acres in two weeks. That's 390 acres planted per minute.

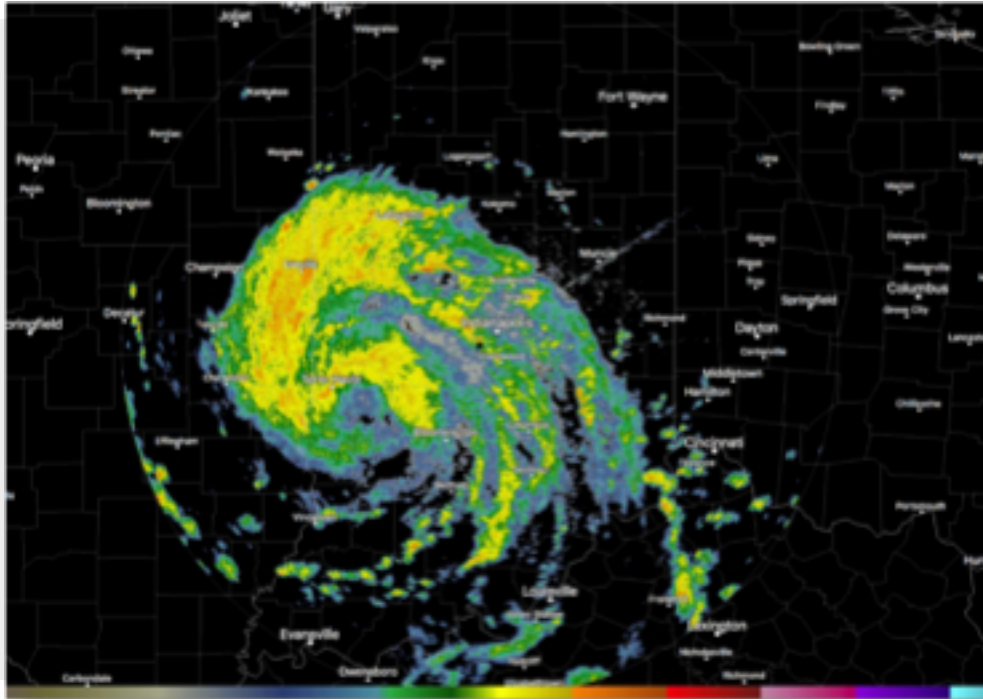
Early season rainfall

Before Alberto – some dry pockets in the eastern cornbelt

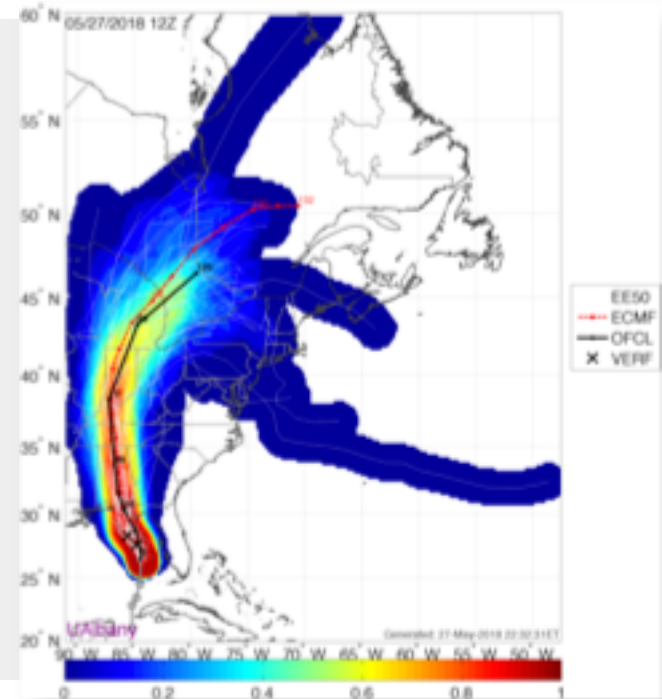


Tropical Storm Alberto

Is this rare?



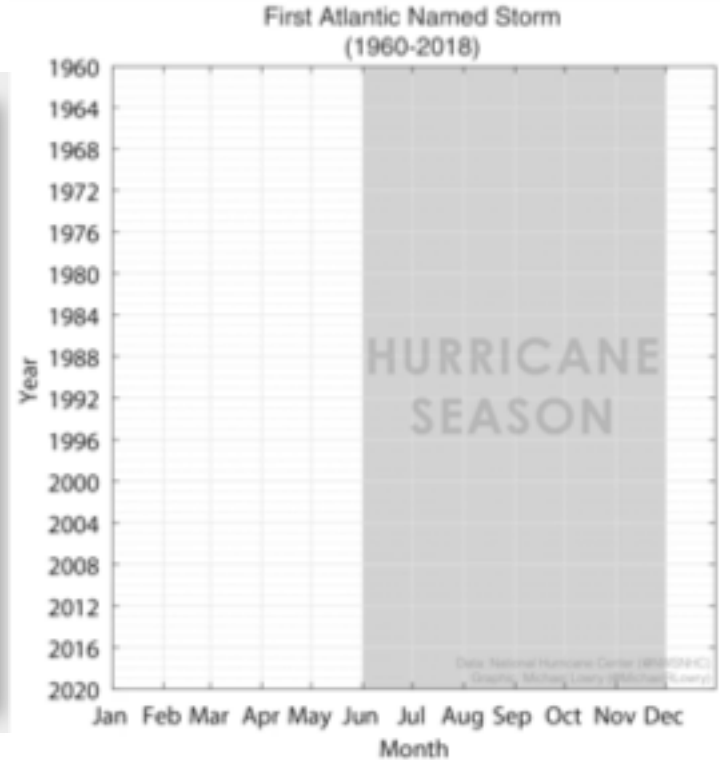
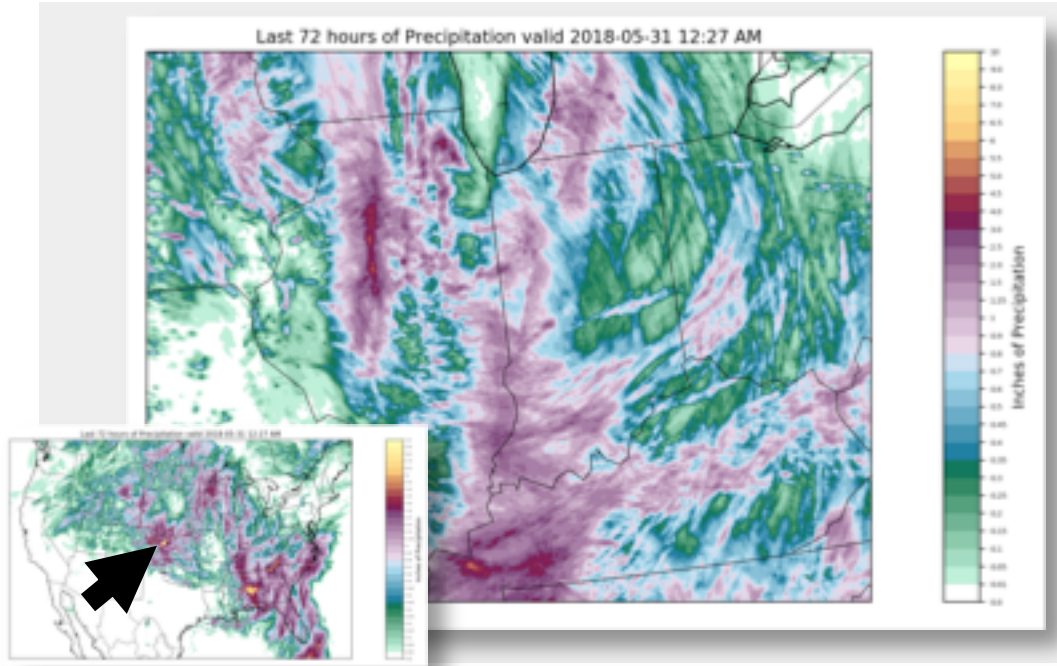
RadarScope



<http://www.atmos.albany.edu/facstaff/tano/tcguidance/>

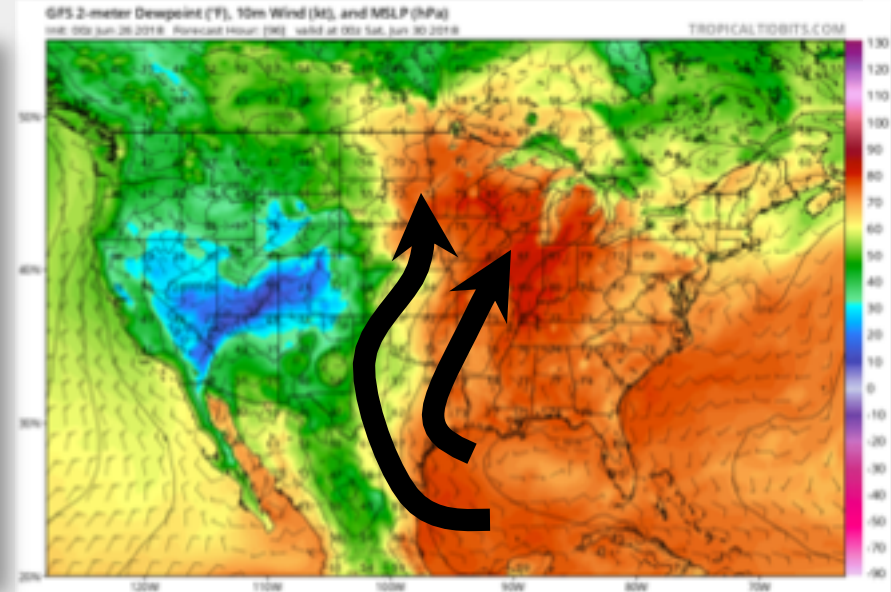
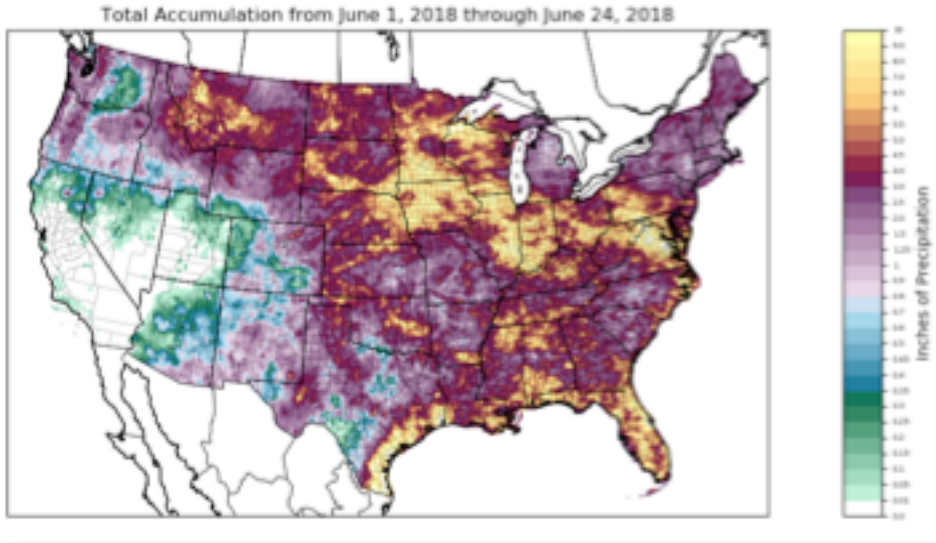
May Tropical Activity

A little early but certainly welcome



Northwest Flow, 2 Lows, 1 TS and an open Gulf of Mexico

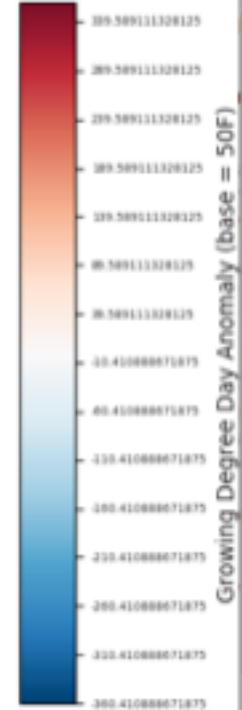
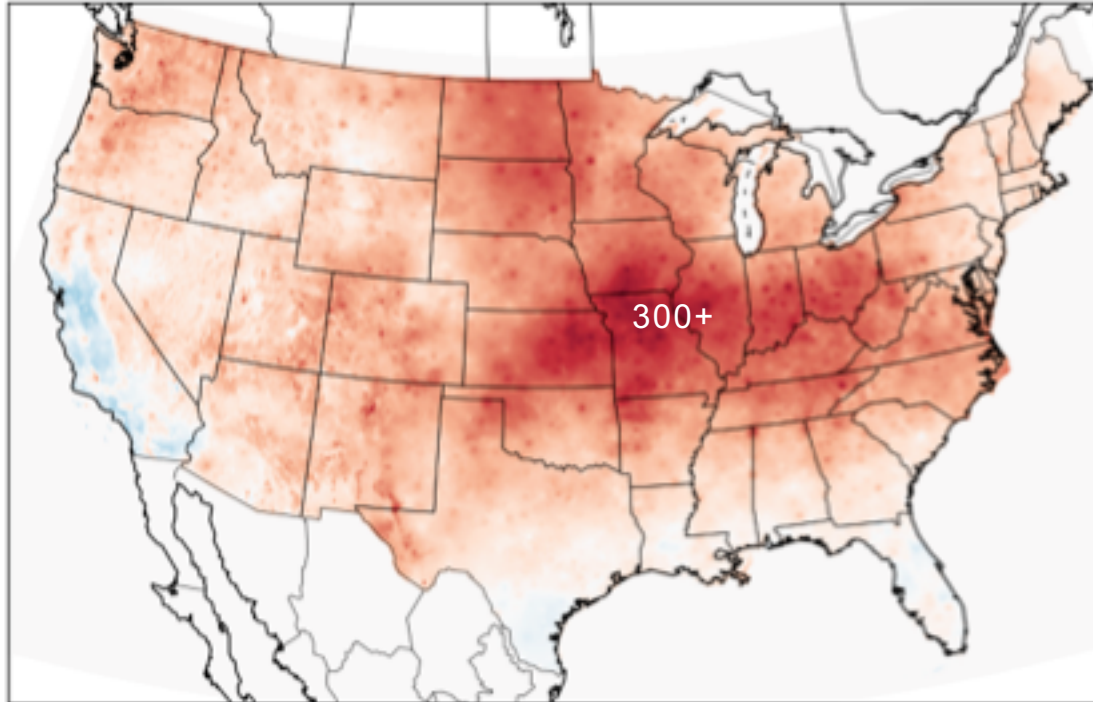
A recipe for storms



Growing Degree Day Anomaly

This crop is growing fast

Growing Degree Day Anomaly as of 06/24/2018 Since April 24,2018 (base = 50F)



Spray Painting Corn

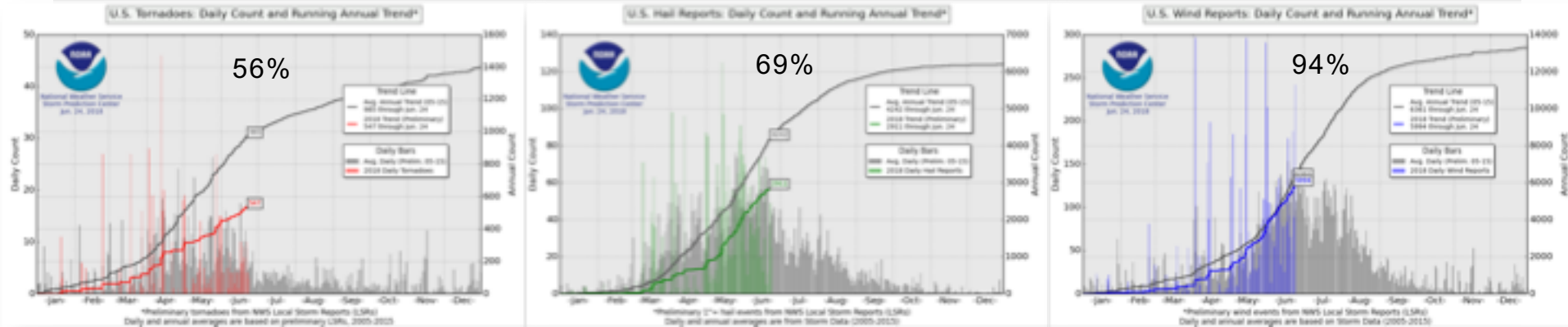
Thank you twitter...



Aaron Horinek

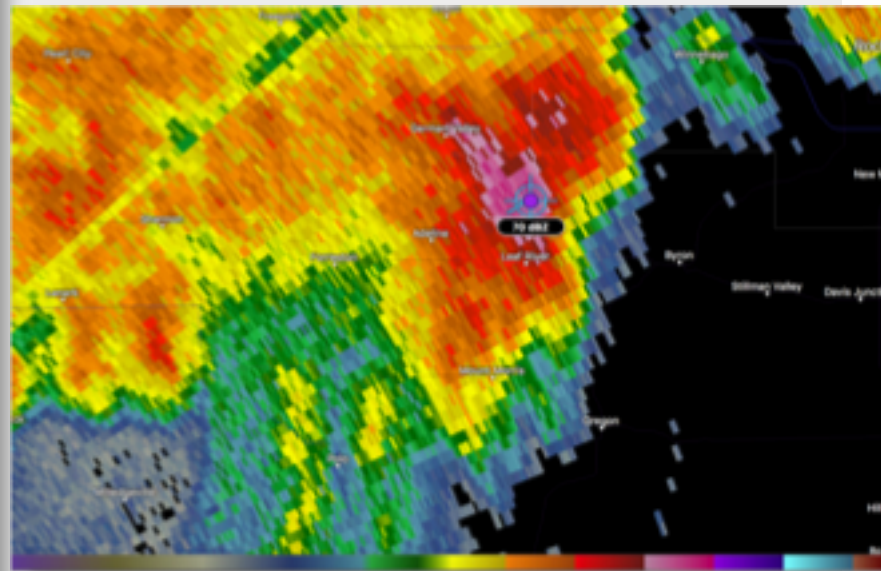
2018 Severe Weather

Record 10-year low on tornado activity



Hail Damage – A Lesson In Radar Imagery

Hail damage in northern IL → 70 dBZ hail core



@skporter Stephanie Porter Credit: Bryce Sandahl

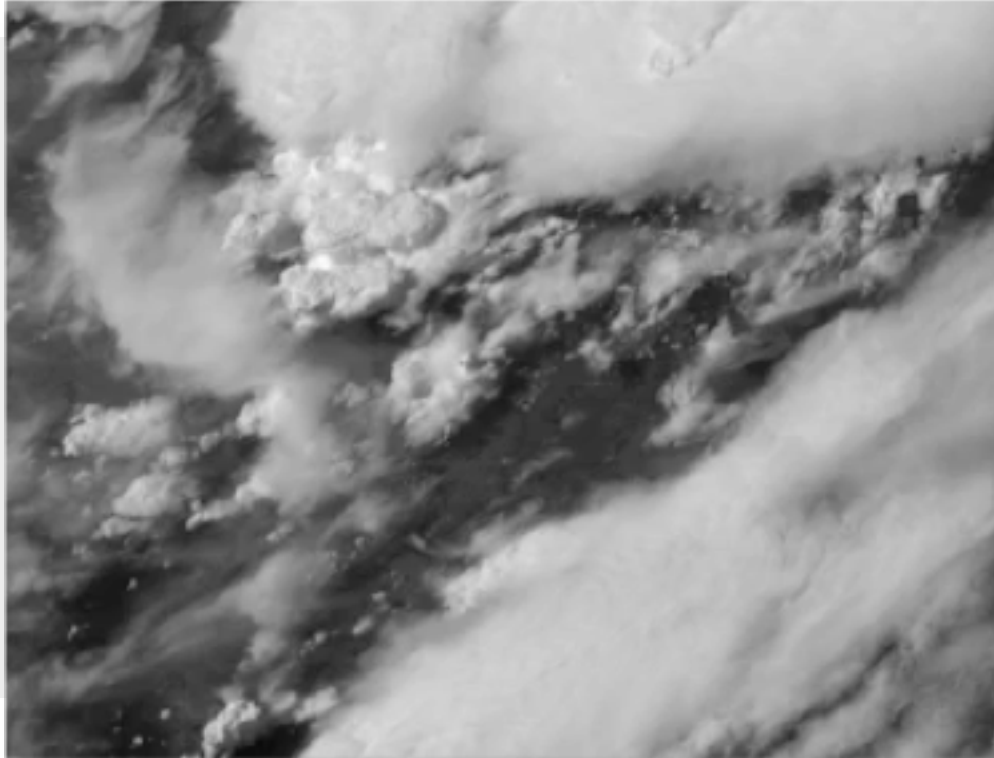
Hail damage in Colorado

Colorado has the highest frequency of hail events in the US



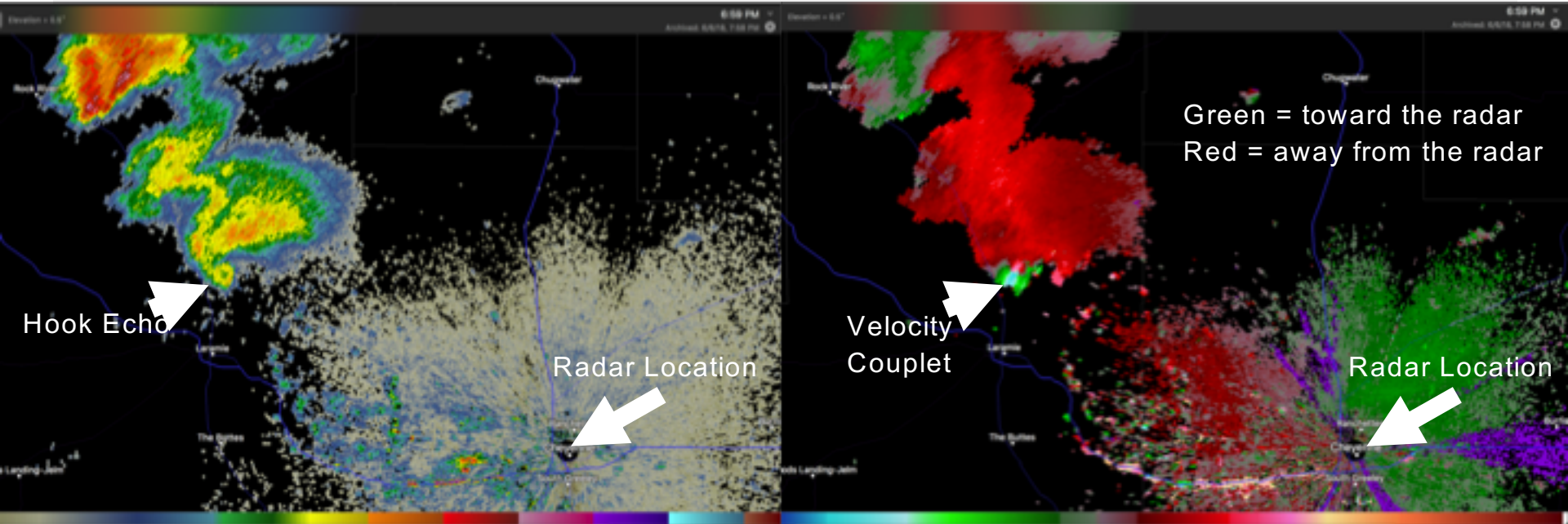
A boring storm chasing year, but...

High Impact/Low Frequency – Laramie Wyoming LP Supercell and Tornado → June 6, 2018



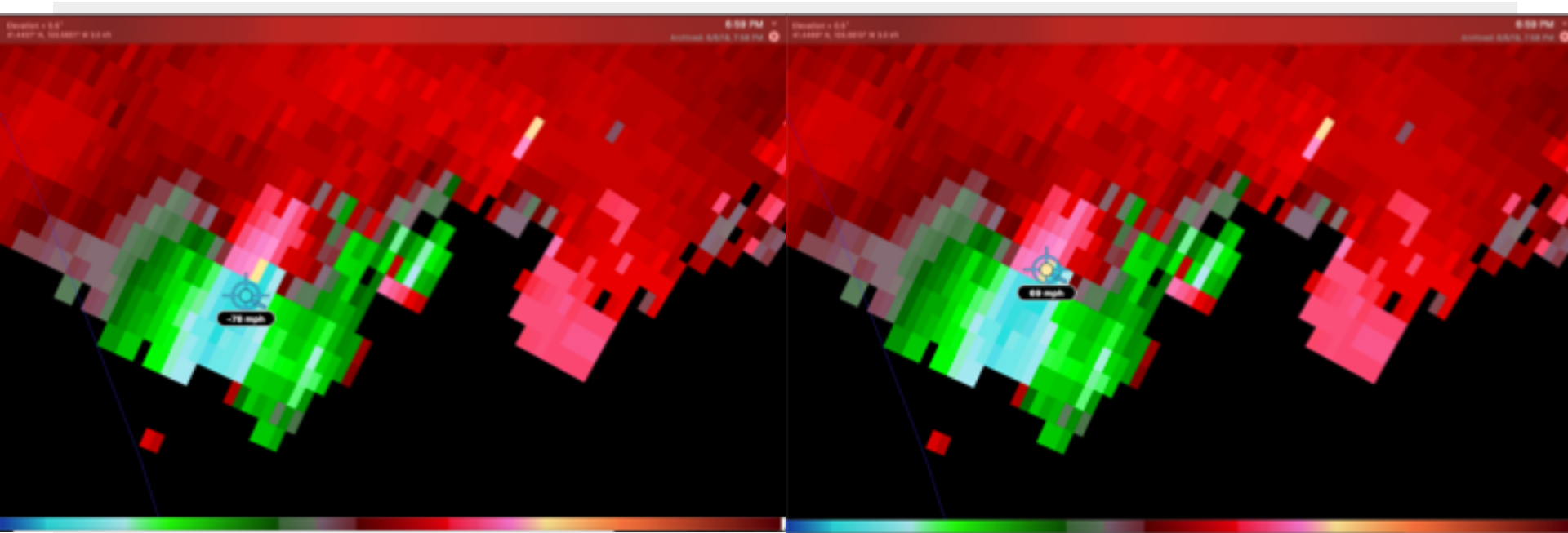
A quick radar lesson with an LP Supercell

Hook echoes and velocity couplets



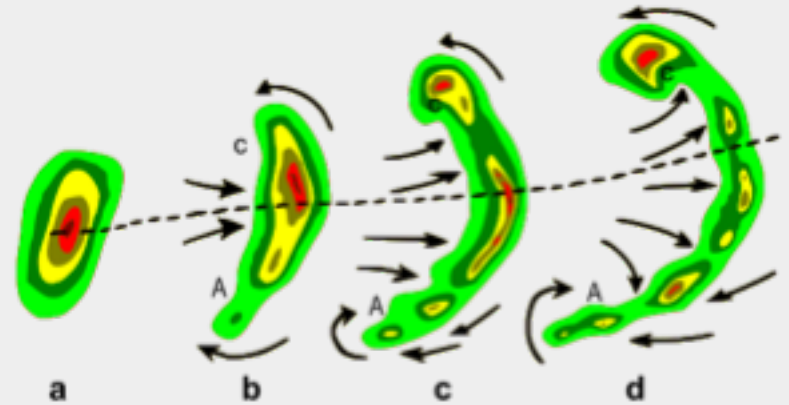
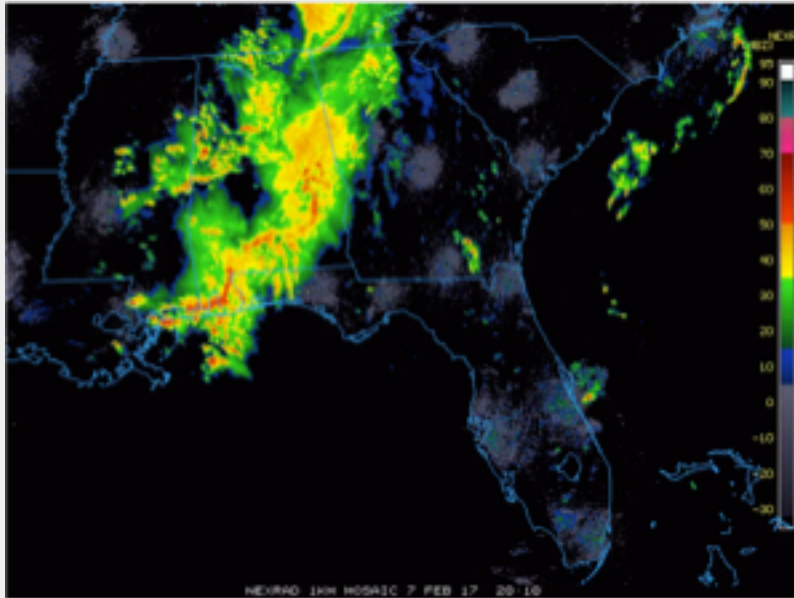
A quick radar lesson with an LP Supercell

Tornadic Vortex Signature



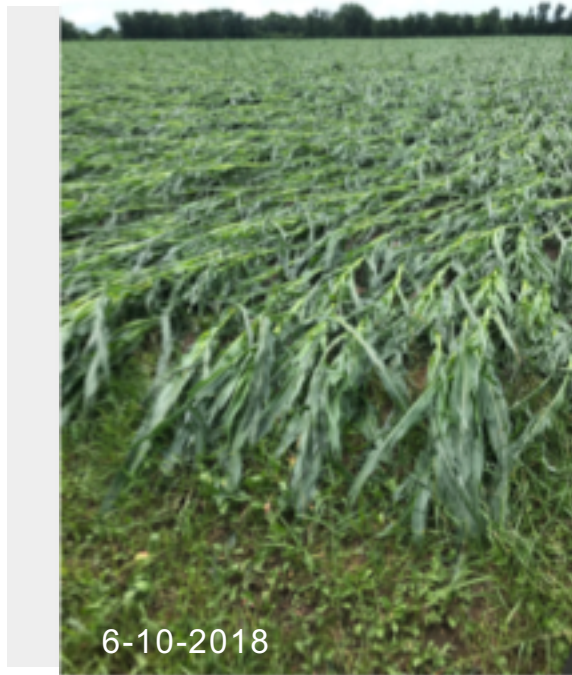
Squall Lines and Derechos

Bow Echoes



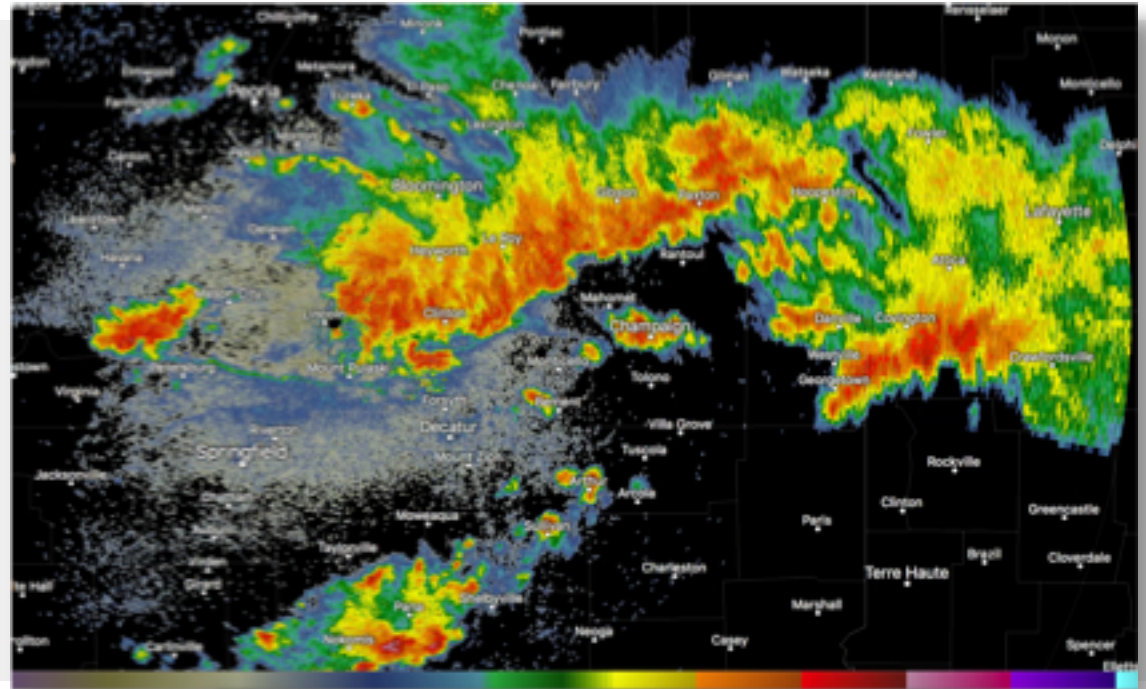
Squall Lines – Straight Line Wind Damage

Sangamon County wind damage + an east central Illinois squall line/bow echo → 6-10-2018



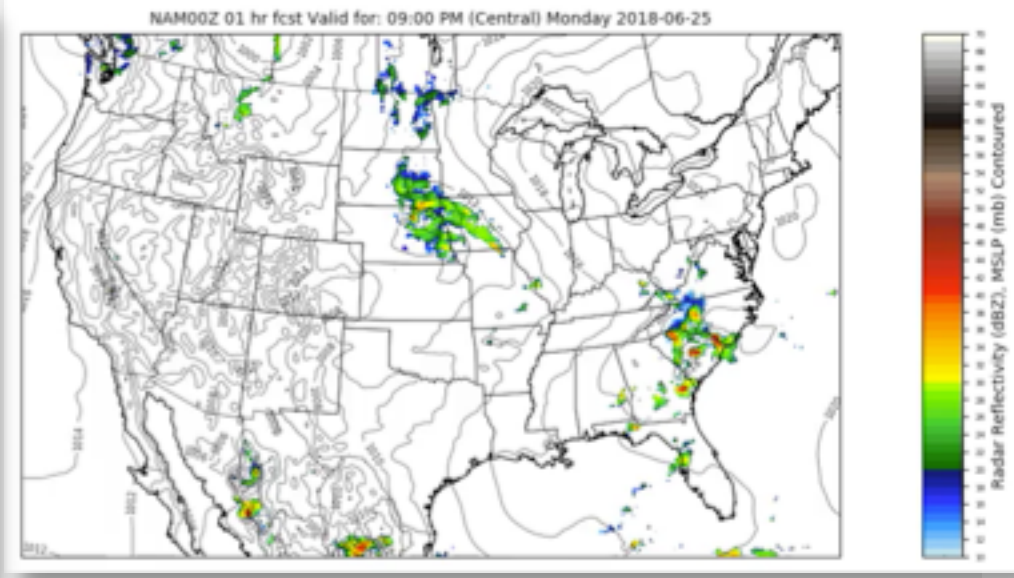
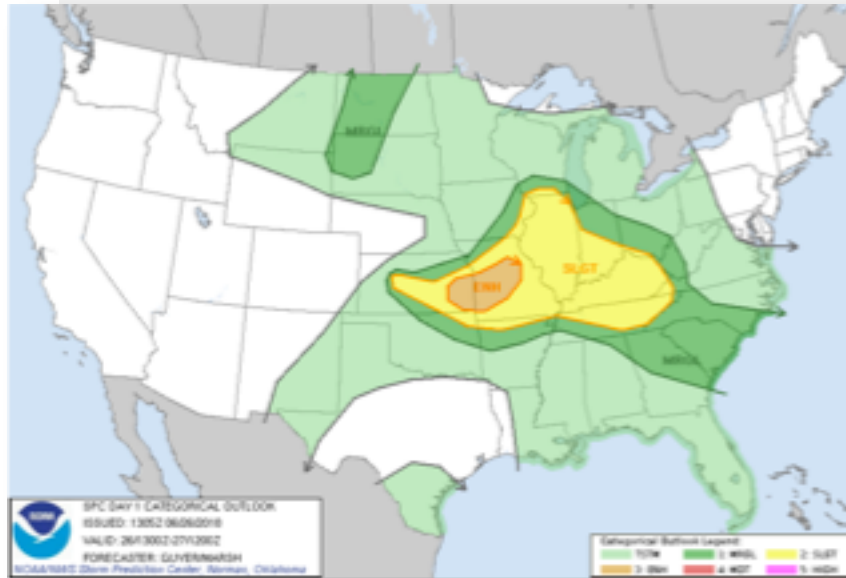
6-10-2018

Roger Pfeiffer @Clayhunter



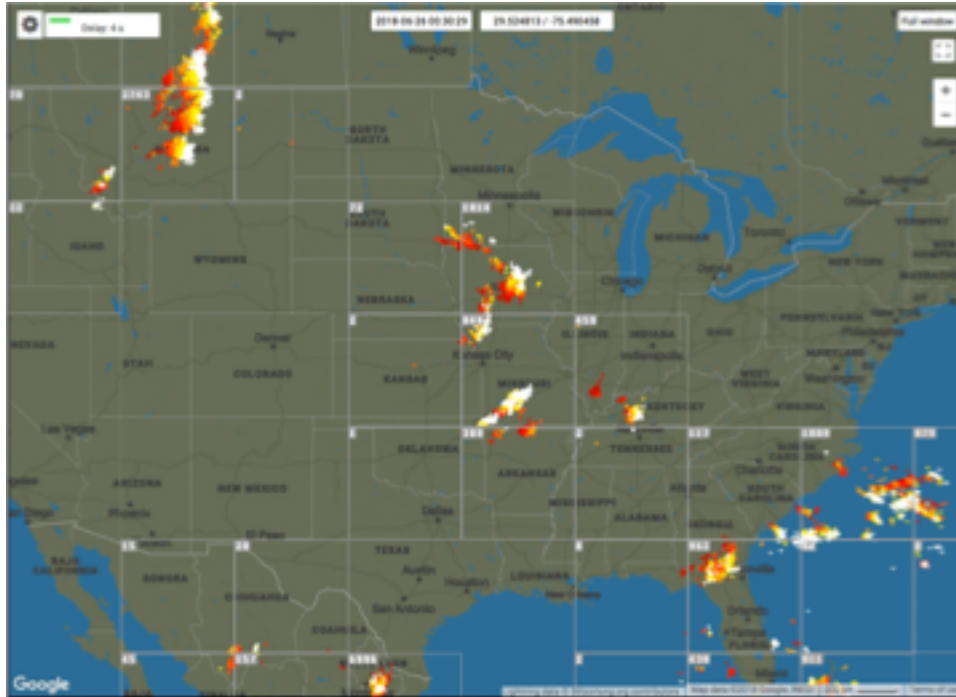
Storm Prediction Center

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



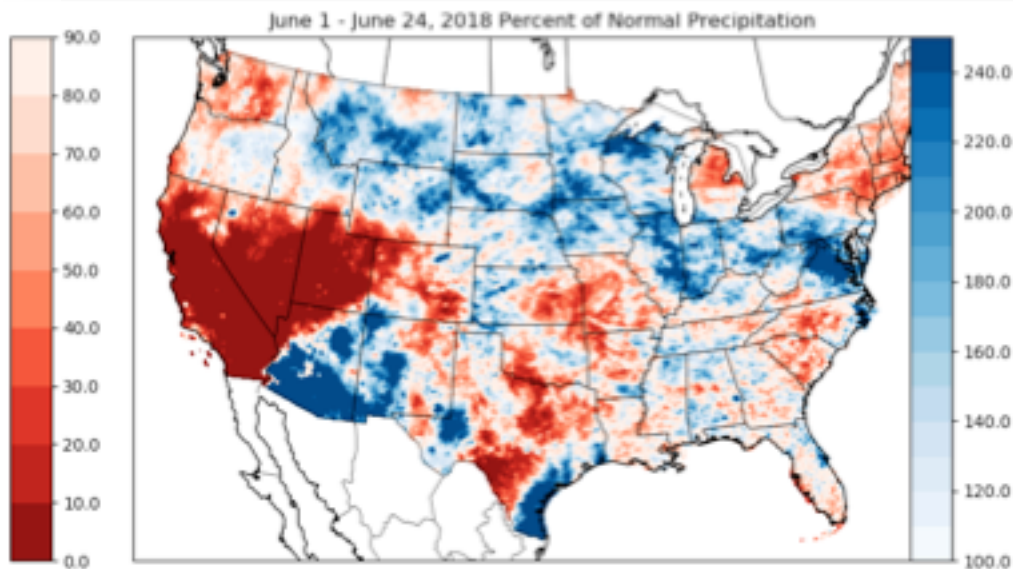
Lightning → 1:700,000 + 1:8,000 + 80%

http://en.blitzortung.org/live_dynamic_maps.php

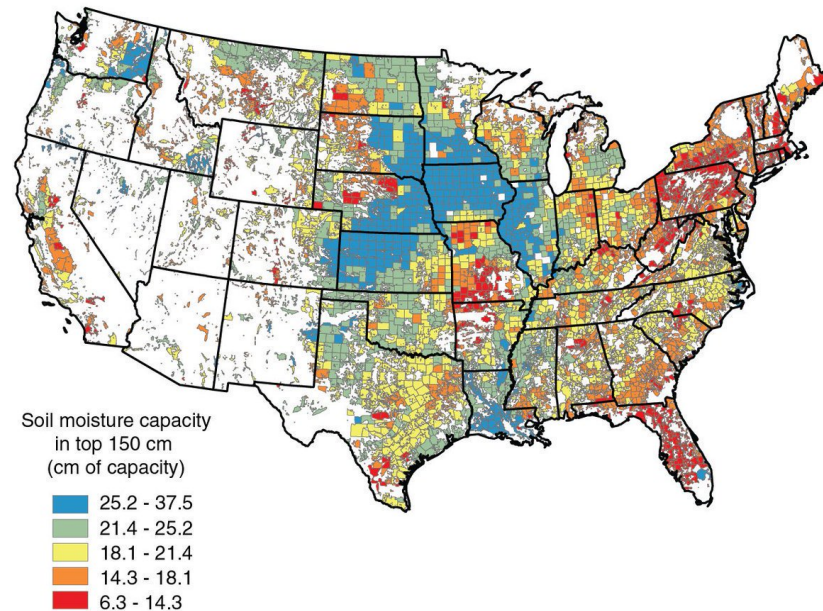


Back to our growing season

Holding Capacity



Soil moisture storage capacity helps determine drought vulnerability

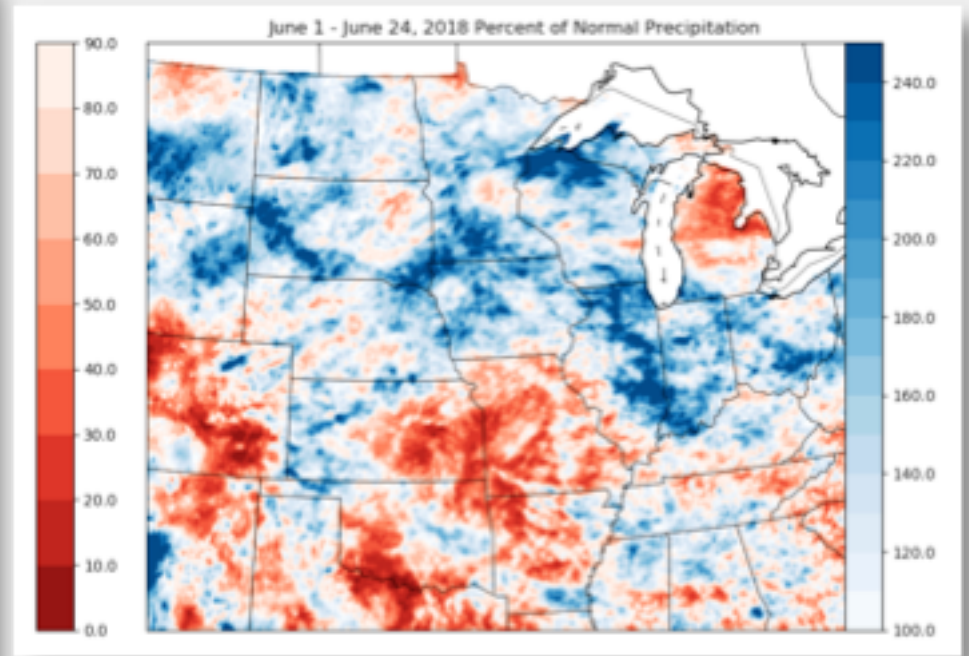
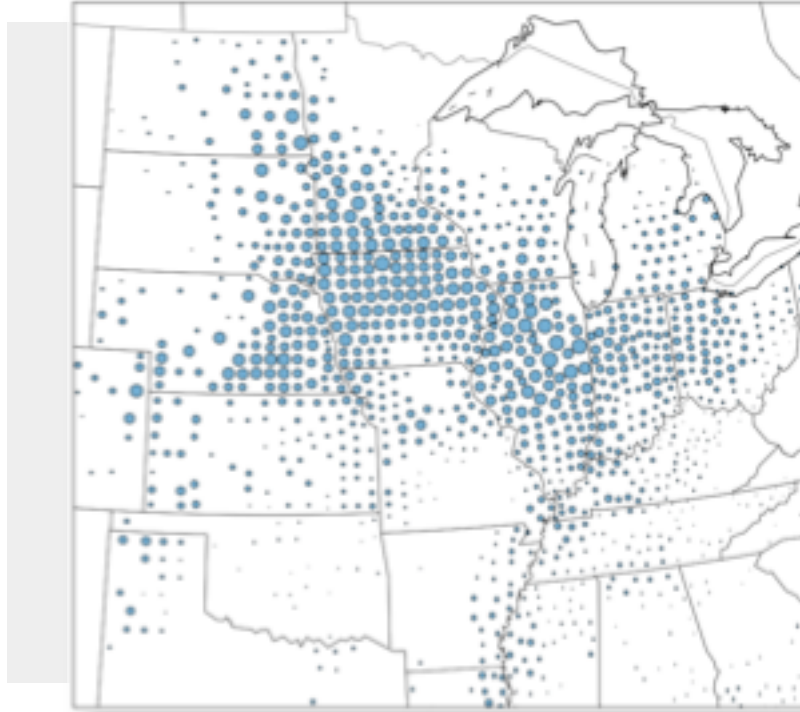


Note: Soil moisture capacity is lower in areas with shallower soils and soils that contain high clay content. A lower soil moisture capacity limits the ability of the soil to store winter and early spring precipitations for use by crops during the summer growing months. The counties in this map are clipped to show cropland only.

Source: USDA, Economic Research Service using soil characteristics data from USDA's Natural Resources Conservation Service, Soil Survey Geographic Database, 2010.

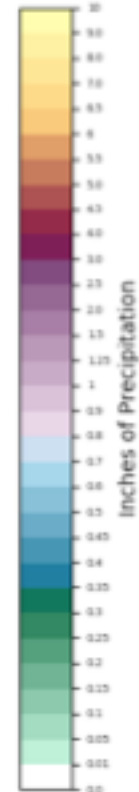
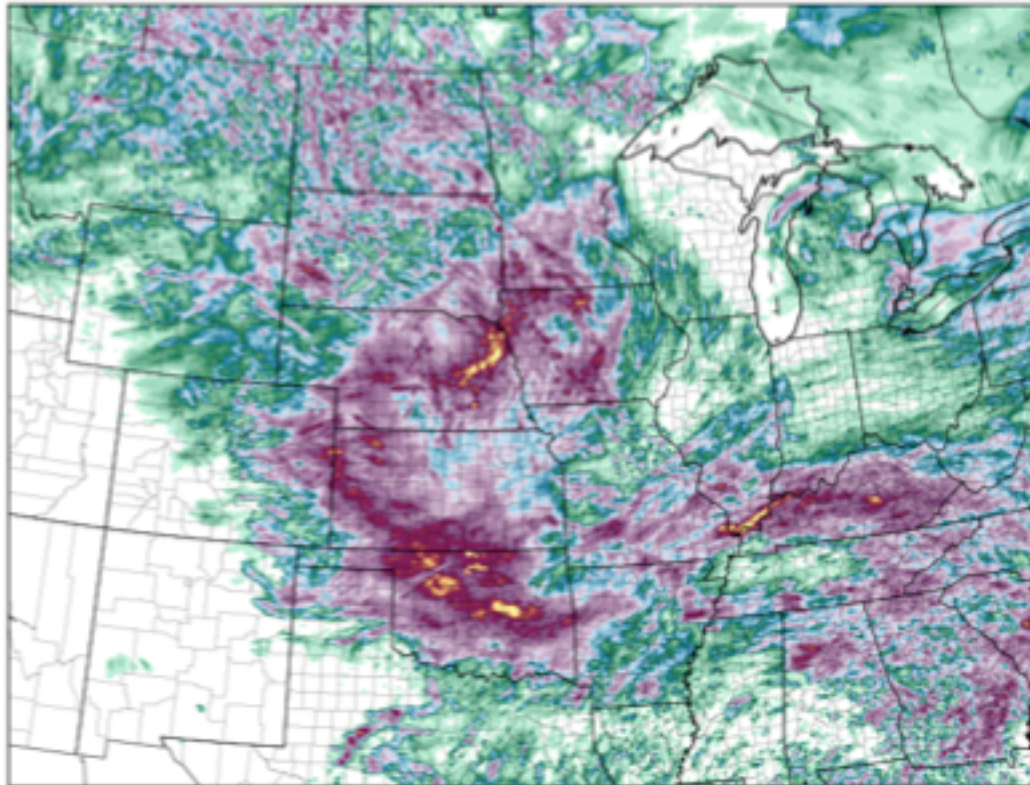
Are we in a great position?

2017 Corn Production by County



Oh, and we just added this in the last 3 days

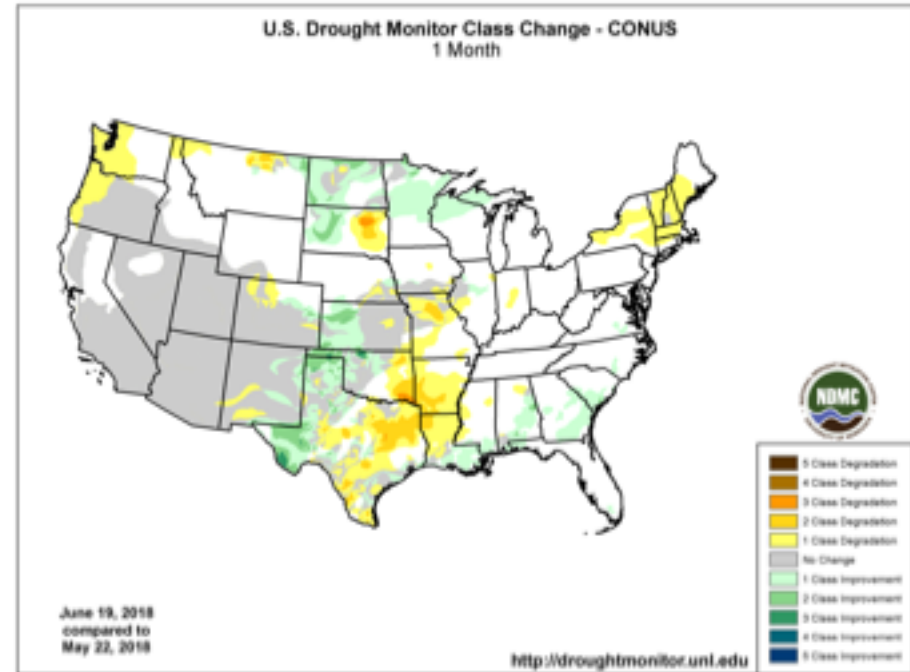
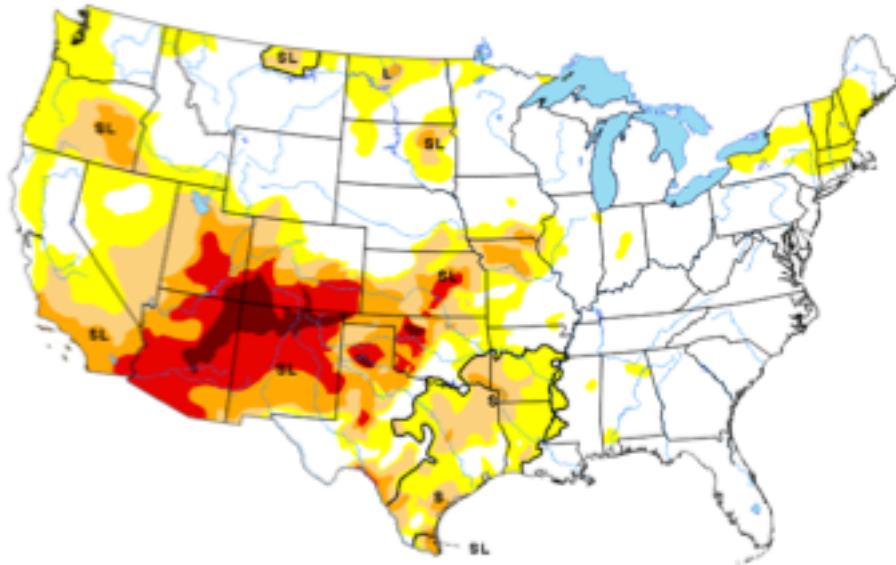
Last 72 hours of Precipitation valid 2018-06-26 09:29 AM



Our current drought situation

Map for June 21, 2018

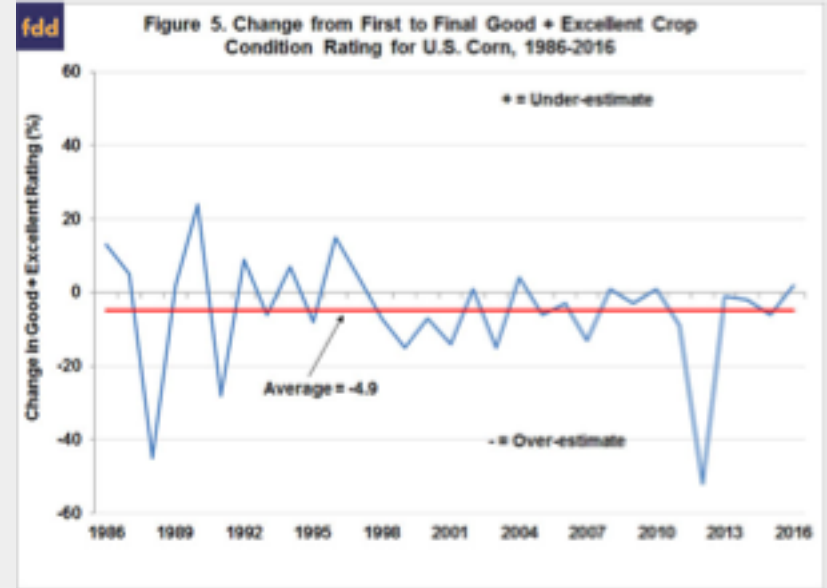
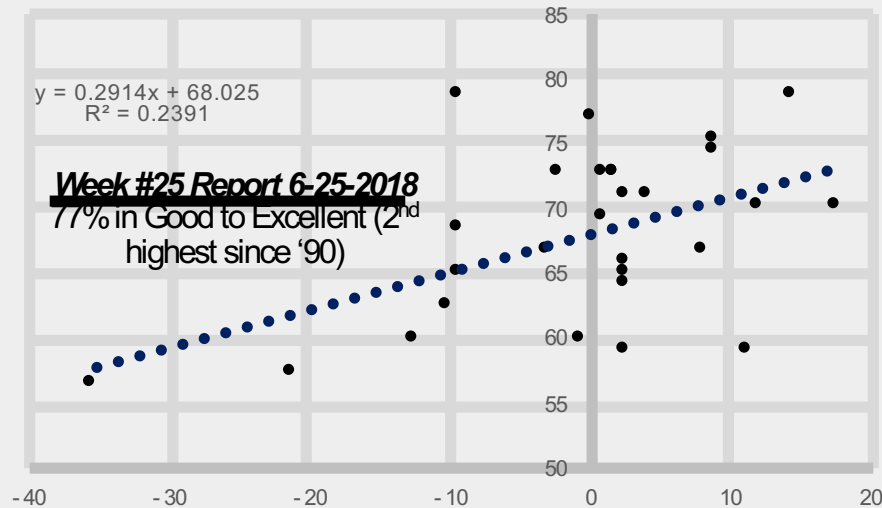
Data valid: June 19, 2018 | Author: [Brian Fuchs](#), National Drought Mitigation Center



A quick look at crop conditions

USDA NASS

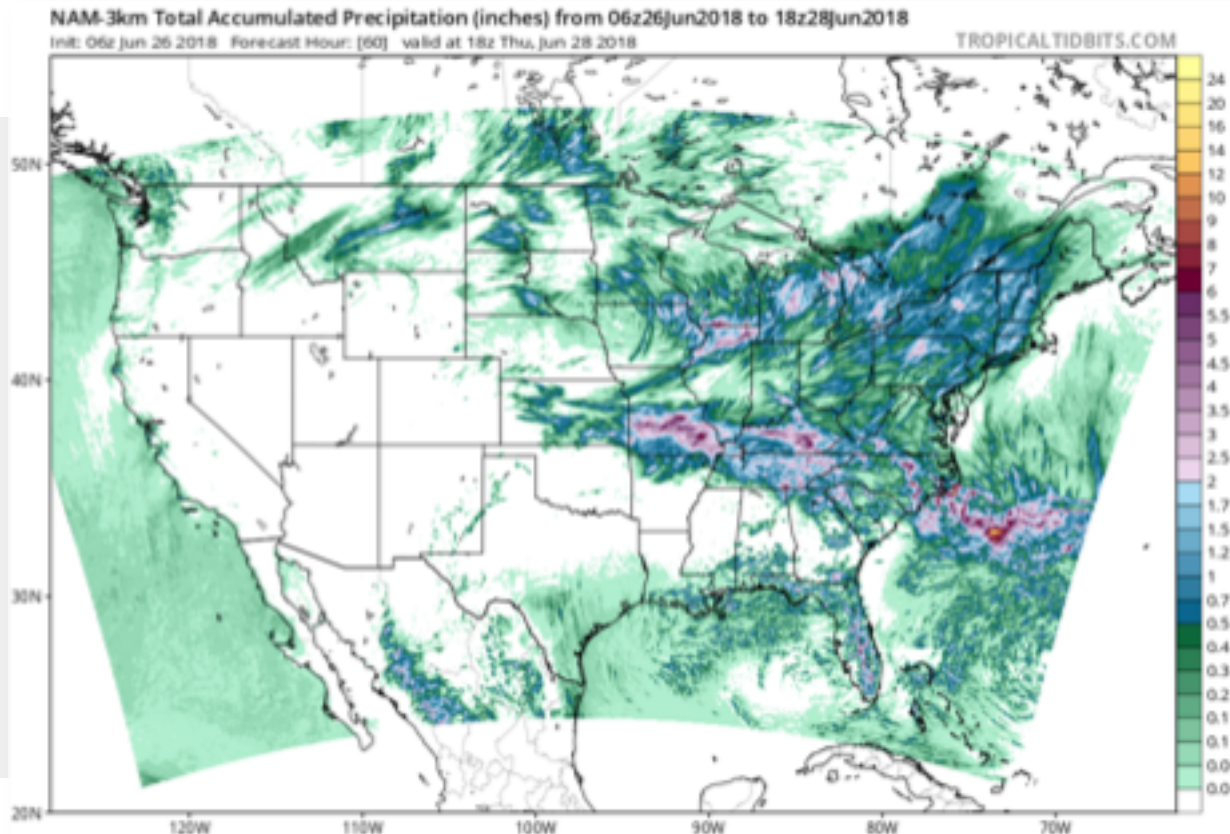
Week #25 (~June 25) G-E Ratings 1990-2018 vs. US Corn Yield Anomaly



<https://farmdocdaily.illinois.edu/2017/06/how-to-use-within-season-crop-condition-ratings.html>

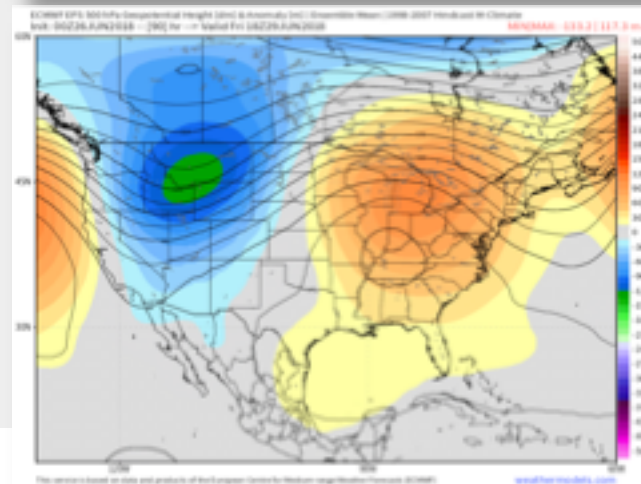
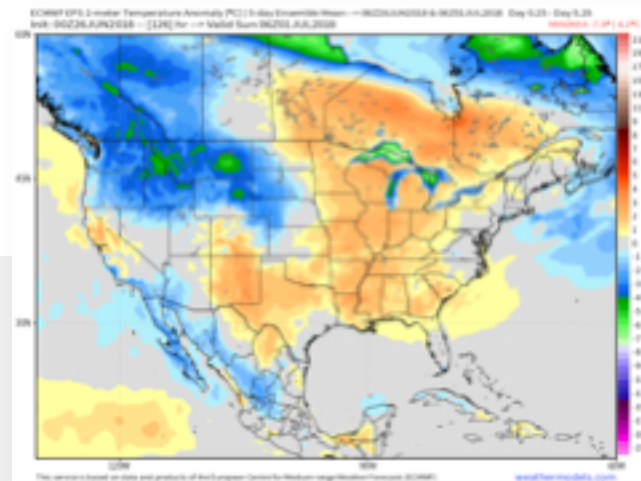
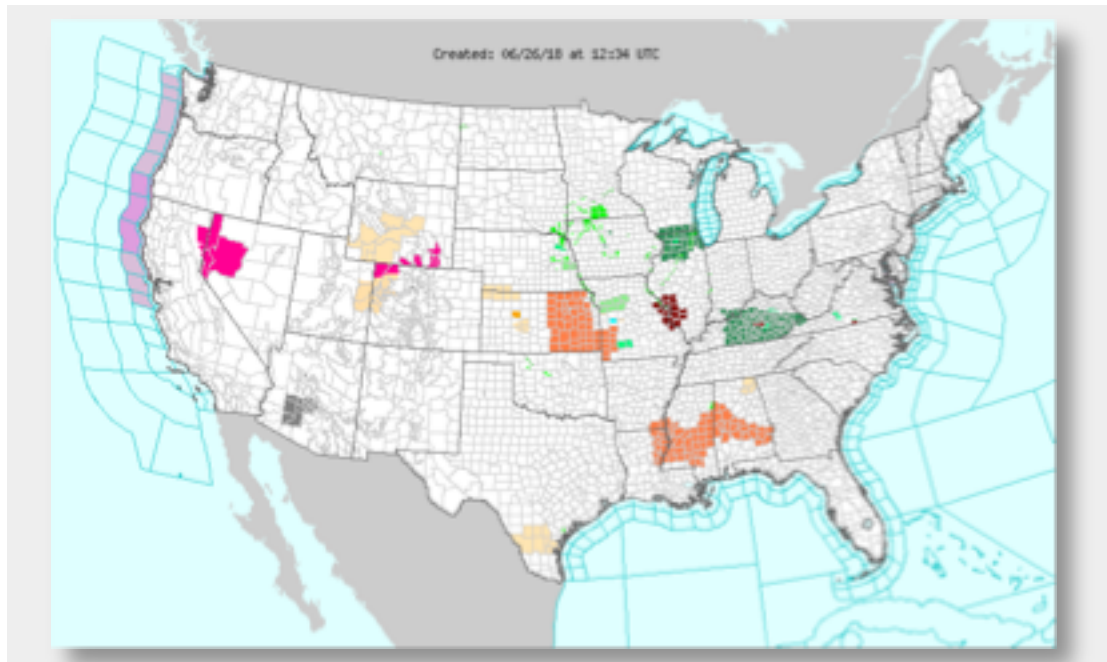
Next 60 hours

More storms...



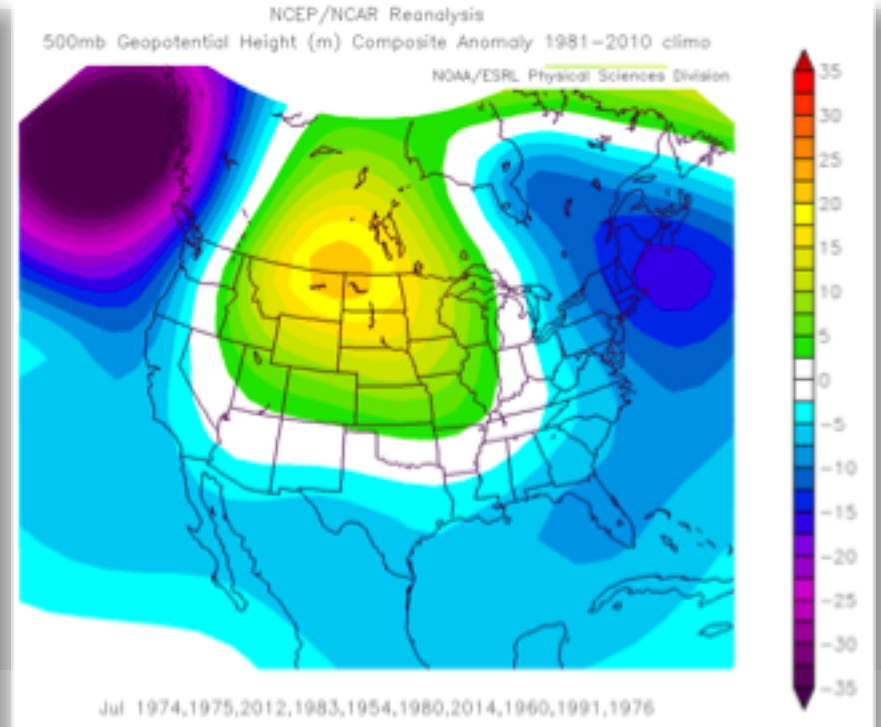
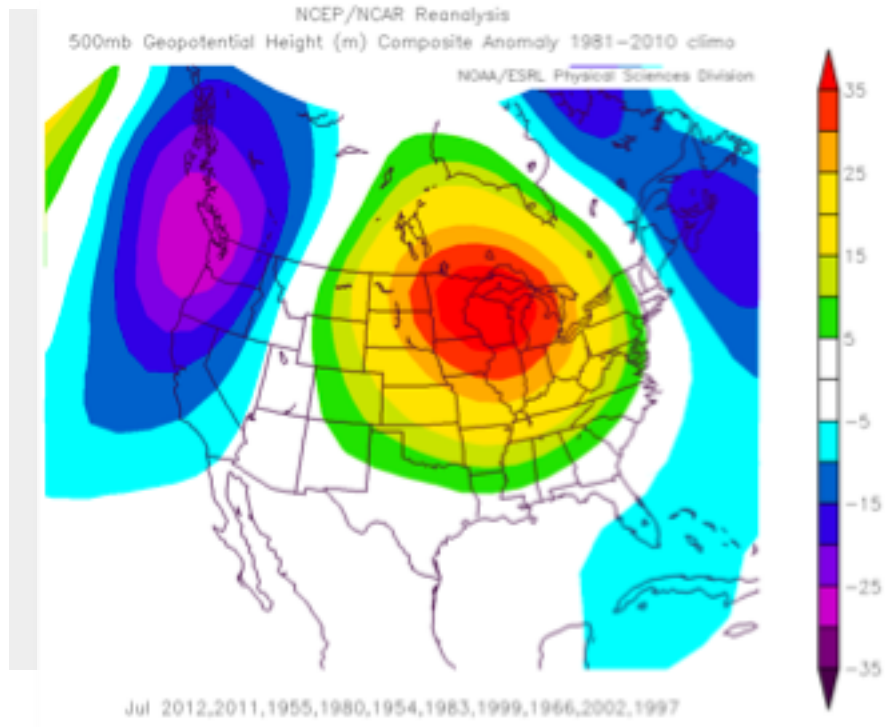
Heat is coming

Eastern US Ridge Developing

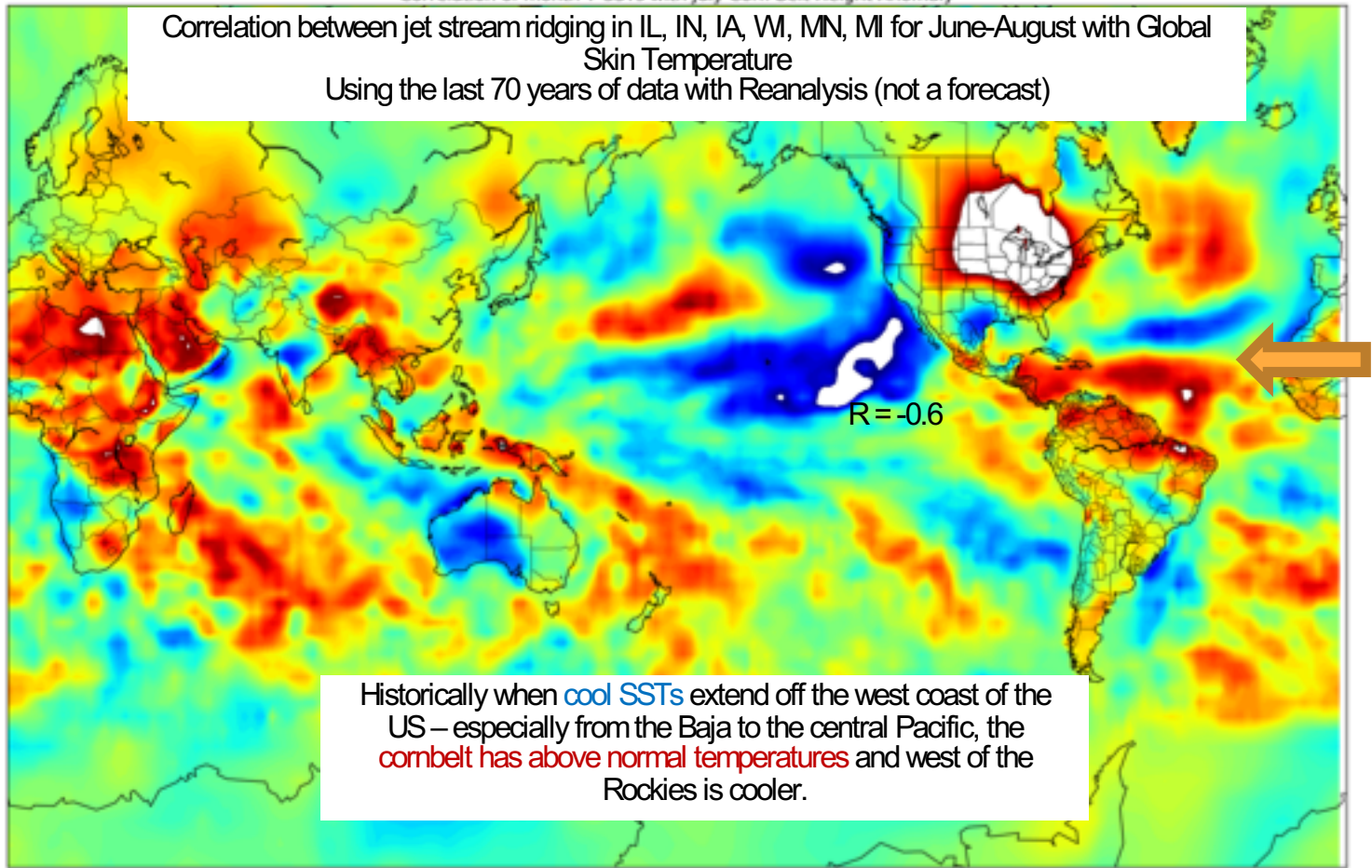


July Cornbelt Ridges: What do the hottest/Driest Julys look like?

500 mb analysis of the top 10 hottest and driest Julys since 1948 for the cornbelt – average yield during those years was -10 bu below trend
July isn't the only month that matters, but it is highly correlated with corn yield



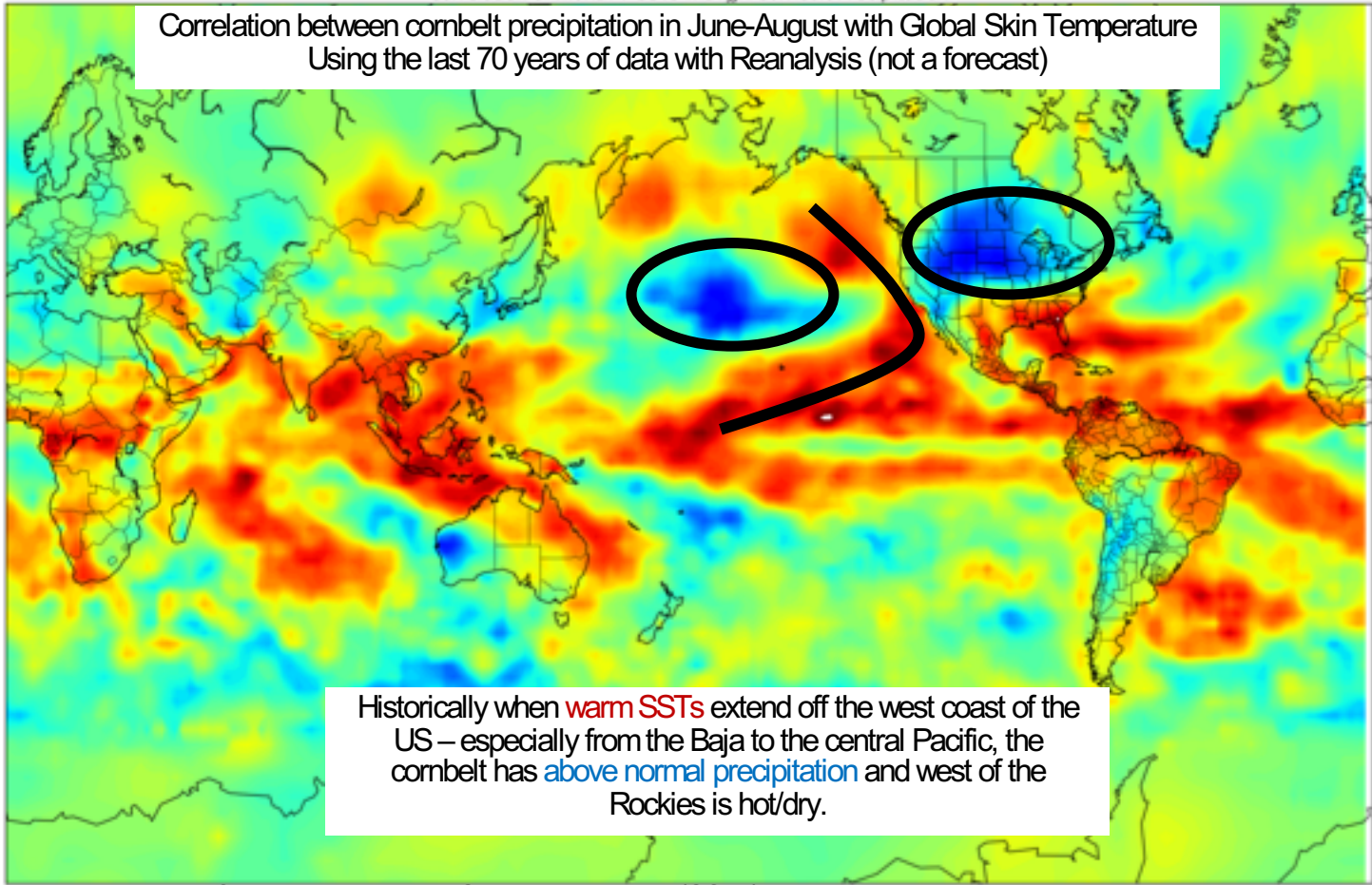
Correlation between jet stream ridging in IL, IN, IA, WI, MN, MI for June-August with Global Skin Temperature
Using the last 70 years of data with Reanalysis (not a forecast)



Historically when cool SSTs extend off the west coast of the US – especially from the Baja to the central Pacific, the cornbelt has above normal temperatures and west of the Rockies is cooler.

Correlation between Skin Temperature (SSTs) and July Ridge over central Cornbelt

Correlation between cornbelt precipitation in June-August with Global Skin Temperature
Using the last 70 years of data with Reanalysis (not a forecast)

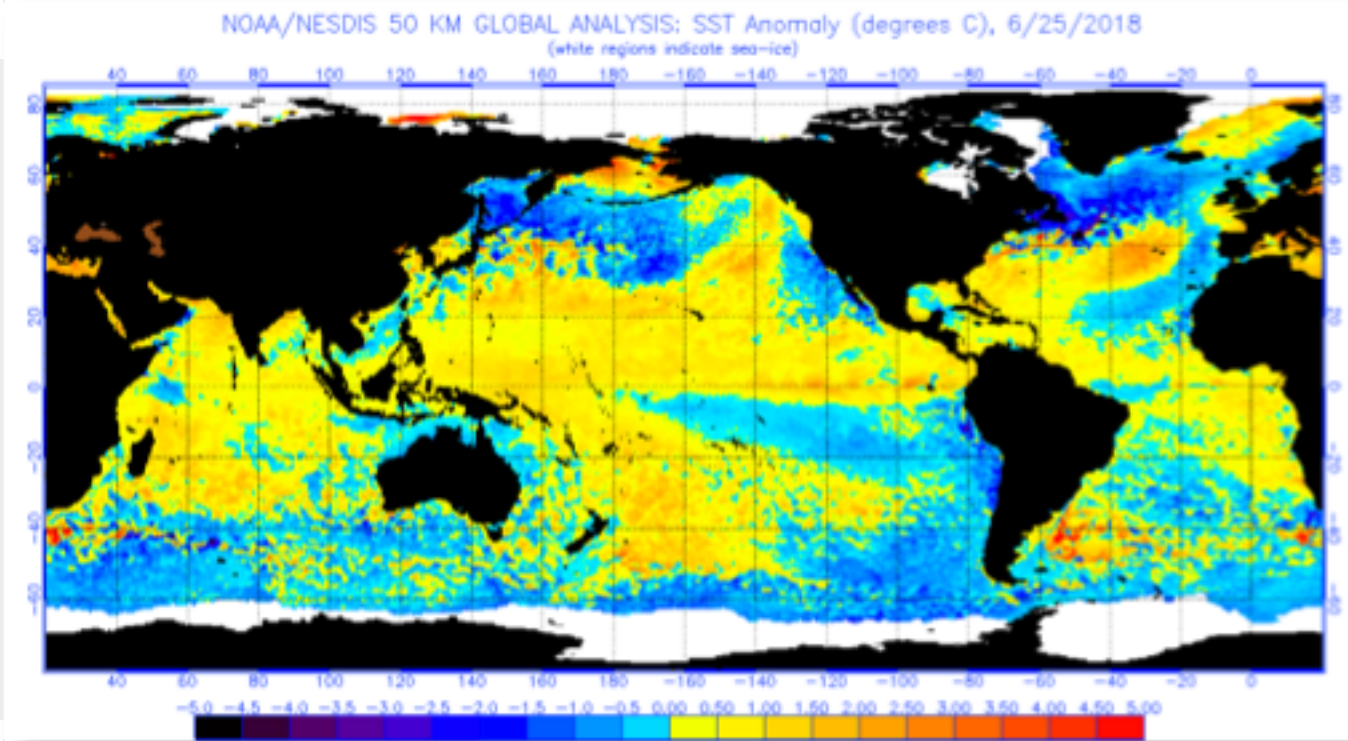


Historically when **warm SSTs** extend off the west coast of the US – especially from the Baja to the central Pacific, the cornbelt has **above normal precipitation** and west of the Rockies is hot/dry.

Correlation between Skin Temperature (SSTs) and JJA Precipitation

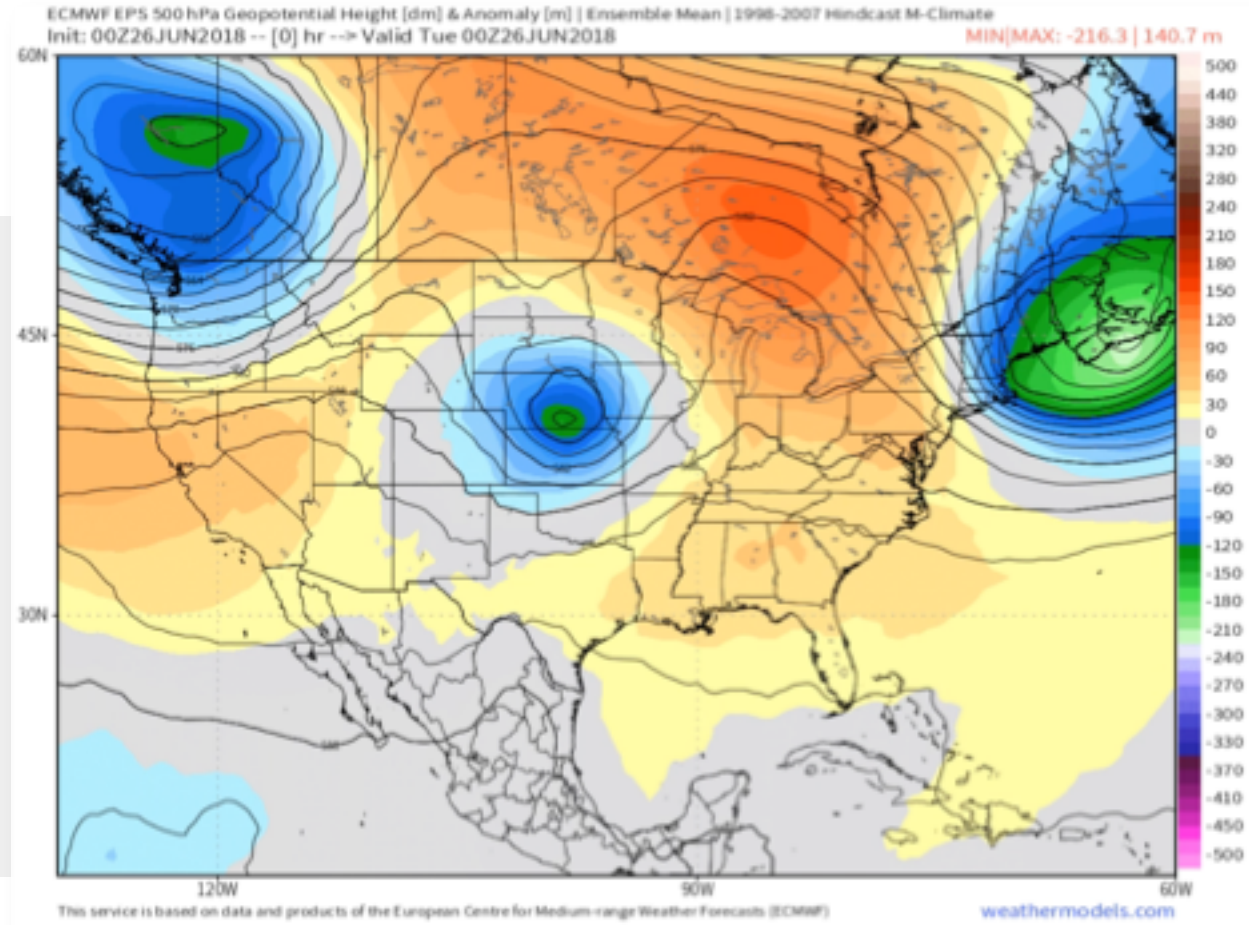
Current Global Sea Surface Temperature Anomalies

A good long range predictor



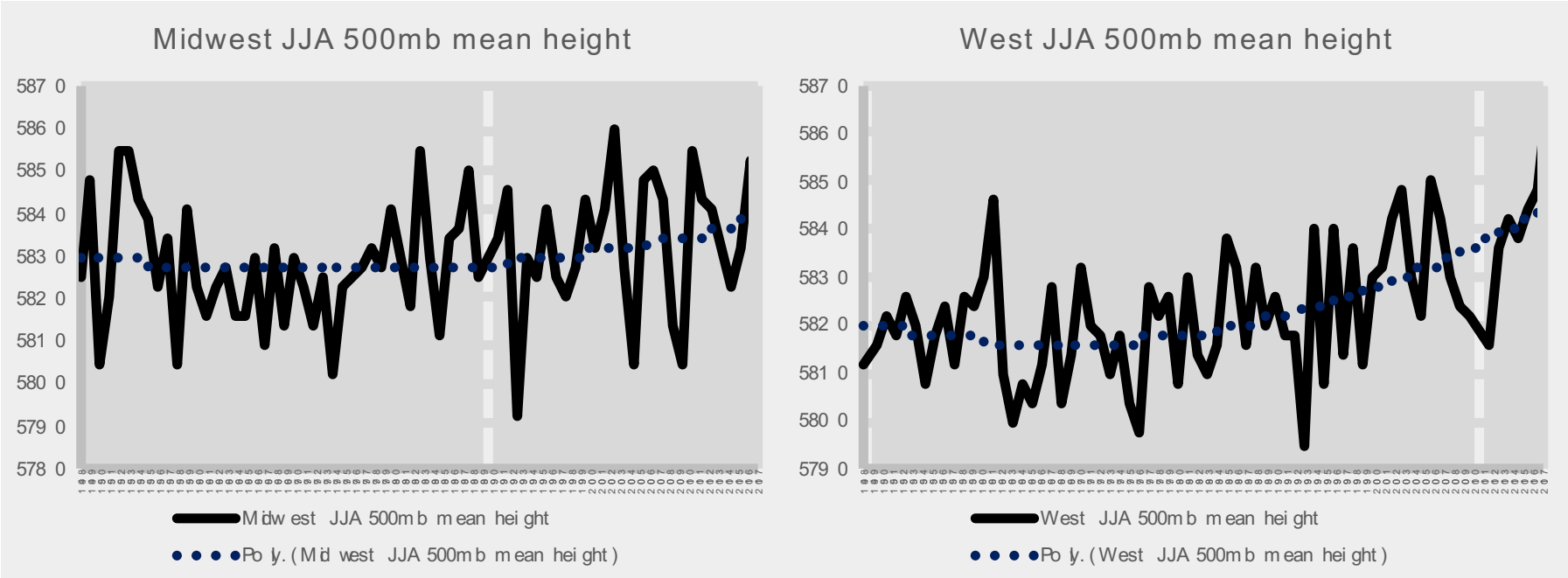
Moving Target

Ridge migrates west



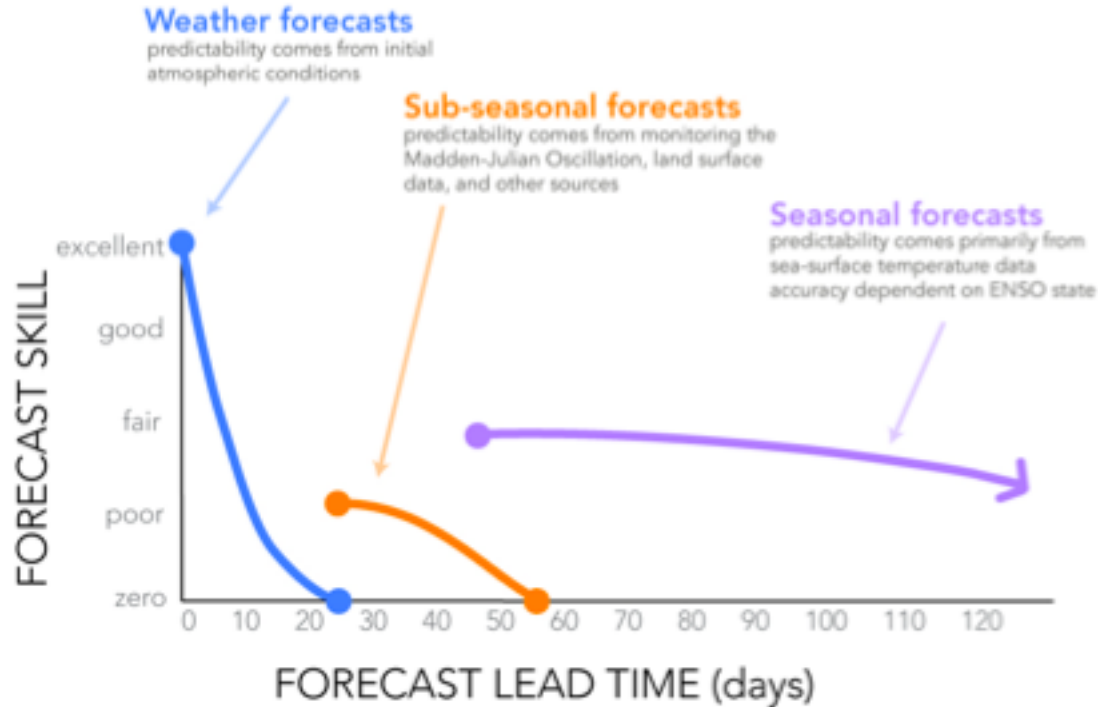
Midwest vs. West

A shift in the summer ridge



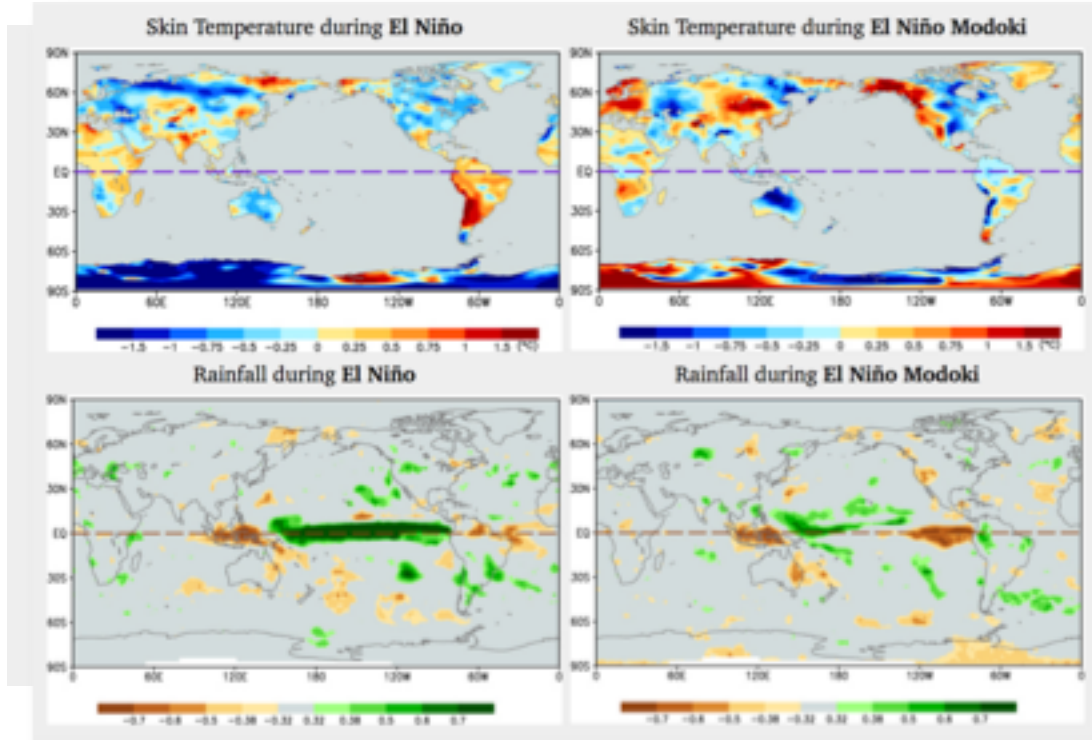
Long Range Prediction – non-linearity and chaos

No Man's Land

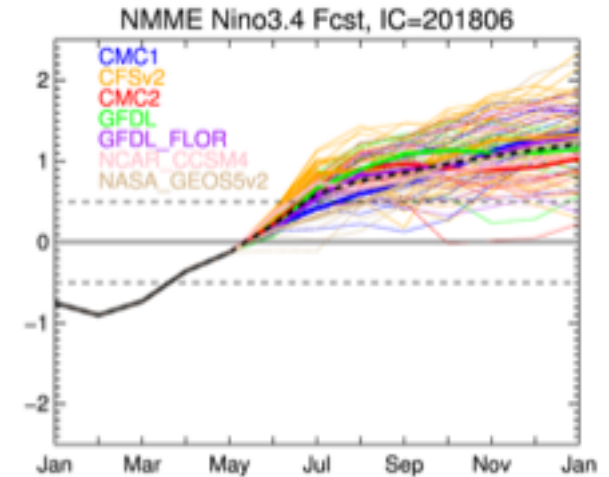


What are the other major players?

Modoki El Niño – A much bigger player with winter weather, but at times it has an influence



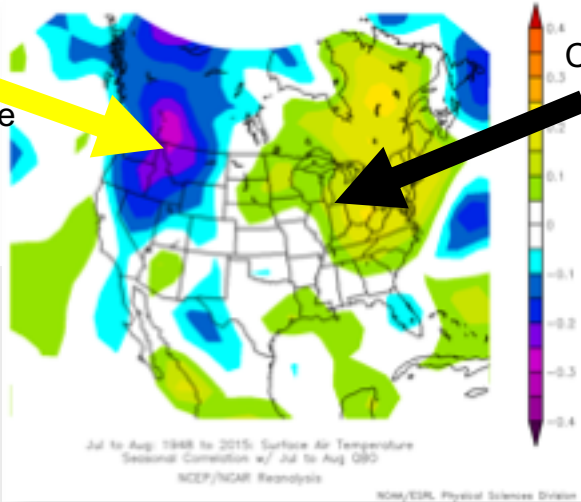
Very weak correlations with summer weather



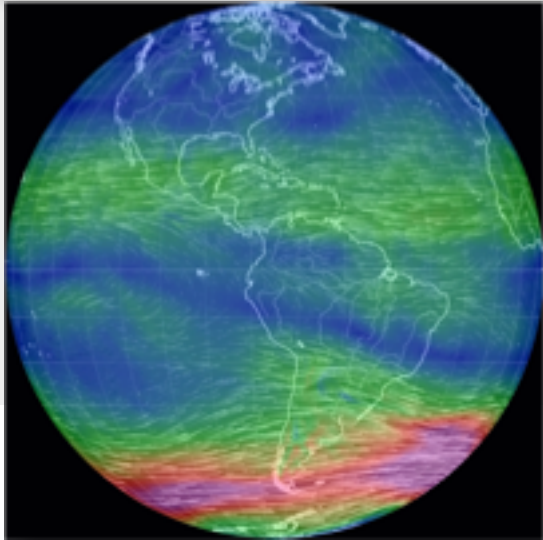
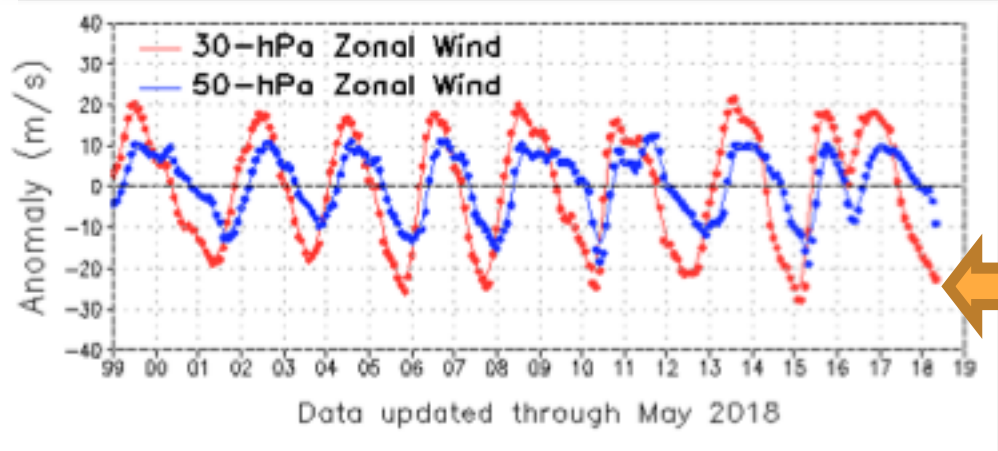
QBO vs. Summer Weather

A big atmospheric circulation – but the correlation is weak

Warm when
QBO is negative

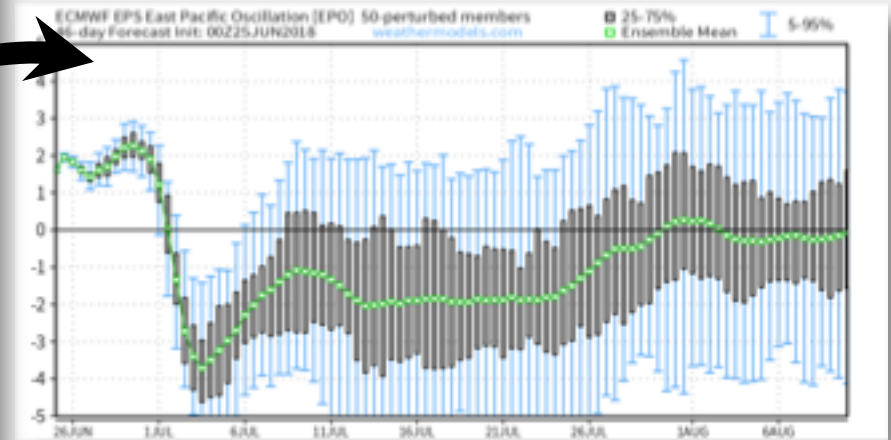
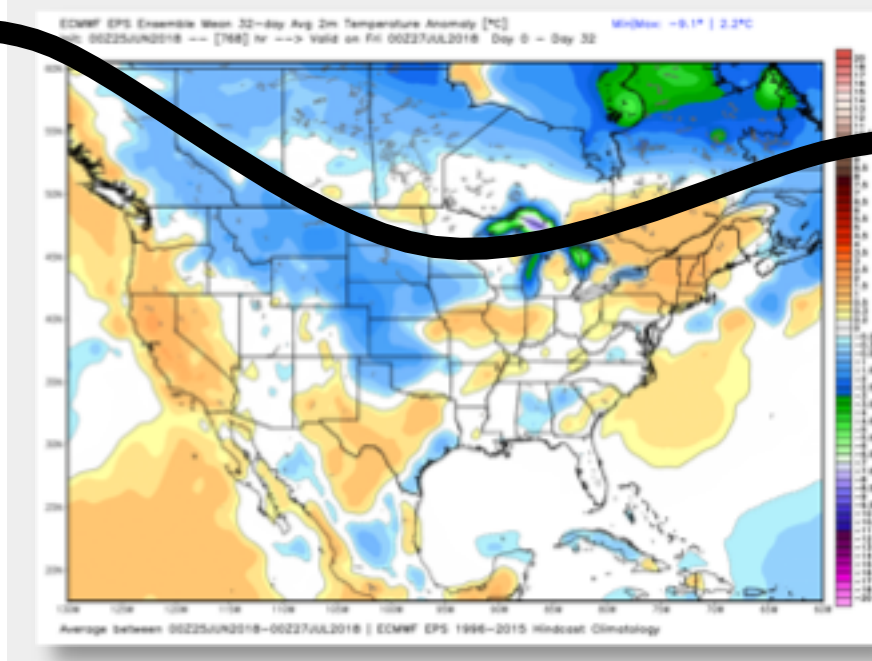


Cool when
QBO is
negative



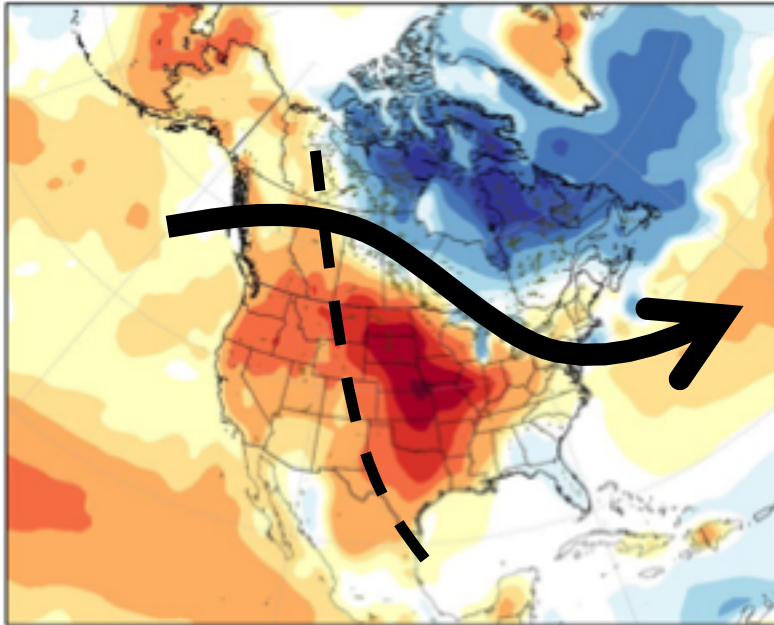
ECMWF 32 – 46 Day Outlook

Has already busted twice this summer, so use with caution. It has also had a cool bias so far this summer

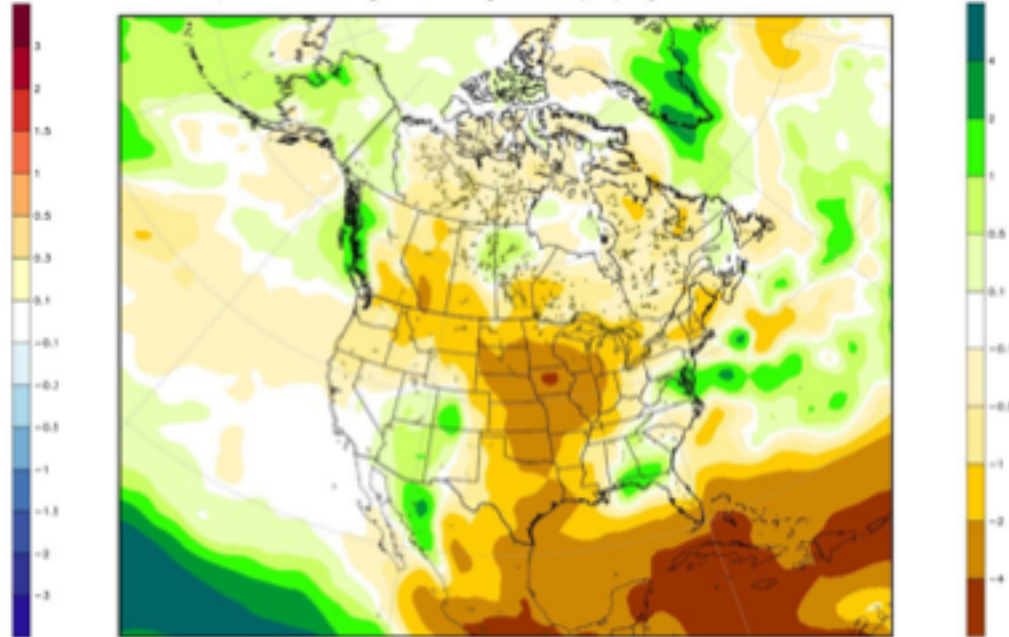


ECMWF – 3 month Forecast for June-August

ECMWF–Seasonal Init: June 2018 2-m Temperature Anomaly [°C]
Seasonal Mean | Ensemble Mean [51-members] --> Jun/Jul/Aug 2018

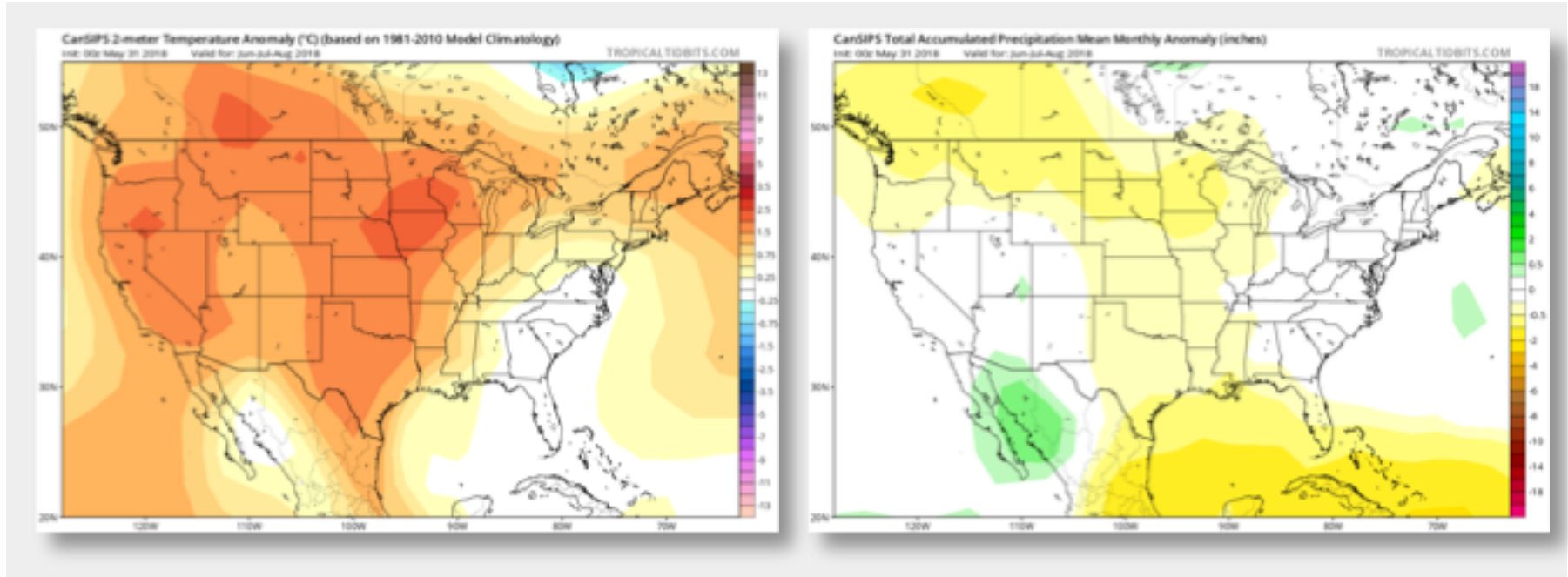


ECMWF–Seasonal Init: June 2018 QPF Precipitation Anomaly [inch]
Seasonal Mean | Ensemble Mean [51-members] --> Jun/Jul/Aug 2018

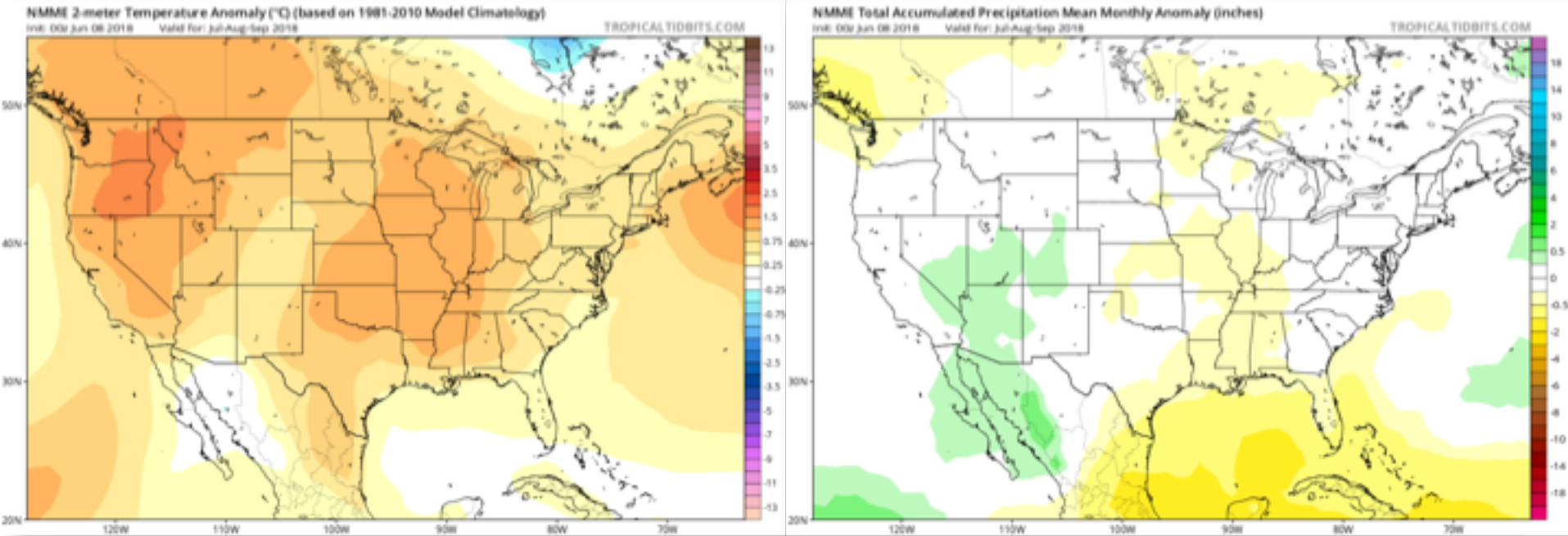


The Canadians (CANSIPS)

Aligned with Europe



National Multi-Model Ensemble (8-North American Models)



Putting it all together

What do we know:

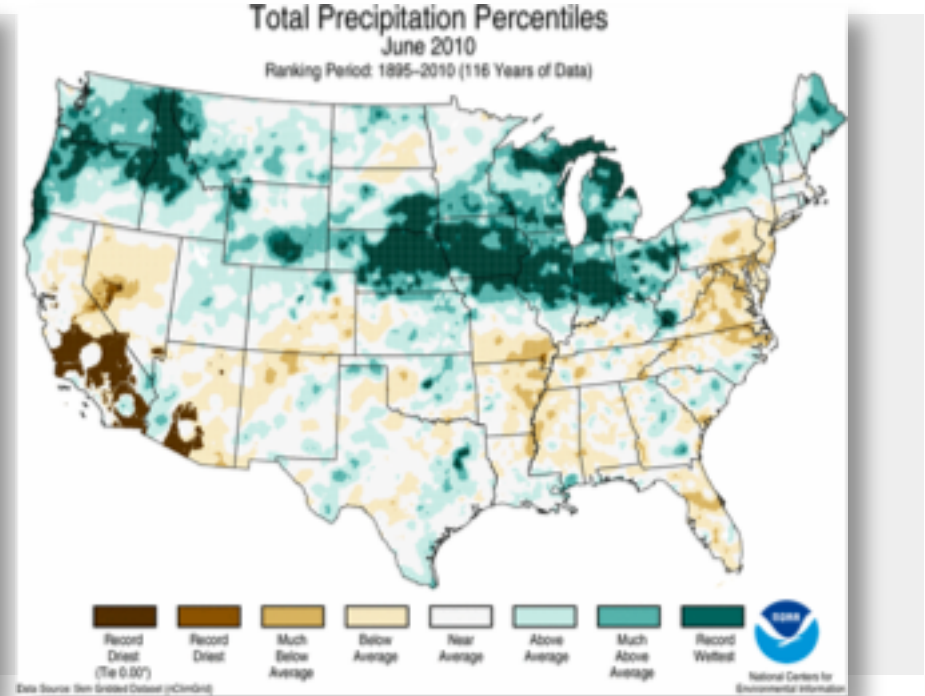
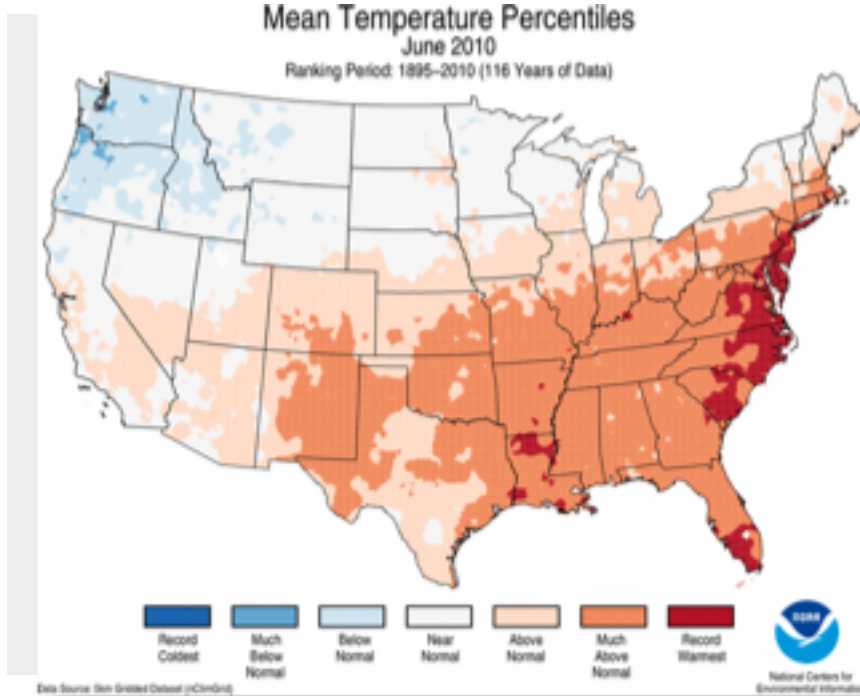
1. June was warm and wet – the crop is ahead with high ratings
2. Background state is wishy-washy (Modoki El Niño, QBO, AAM etc.)
3. Dynamical models agree (for the most part)
4. Higher probability of above average temperatures and below
5. Evolving SST patterns suggest it stays warm summer
6. If the Gulf stays open – ridge riding storms save the day

Conclusion:

We must diligently monitor the 2-week forecast everyday. This is a highly volatile pattern.

Is 2010 an analog year – preparing for warm nights???

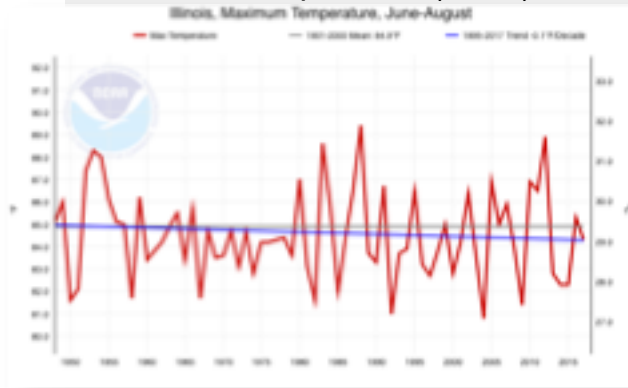
It is not wise to use just 1 year as an analog... But, 2010 lost yield at the end due to warm nights



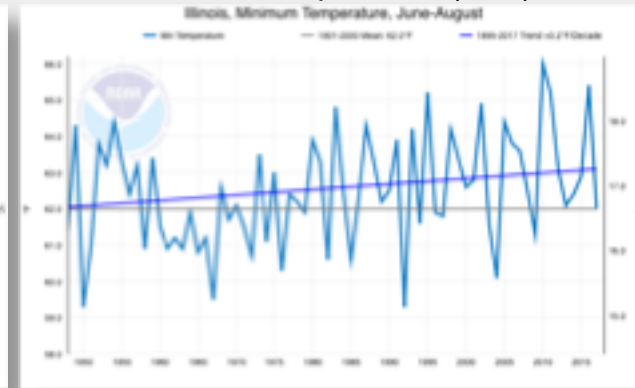
Trends in temperatures impacting production agriculture

Illinois June-August Max, Min, Average Temperatures since 1948

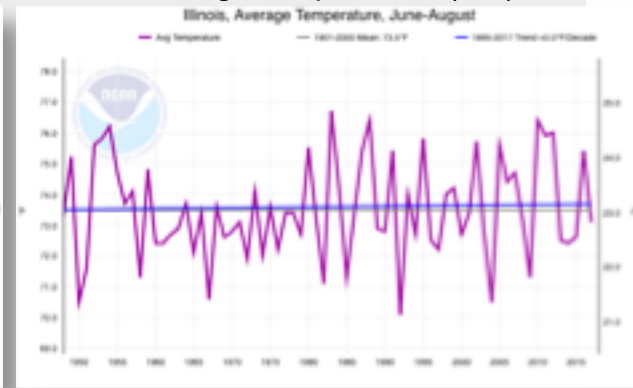
Maximum Temperatures (-0.5°F)



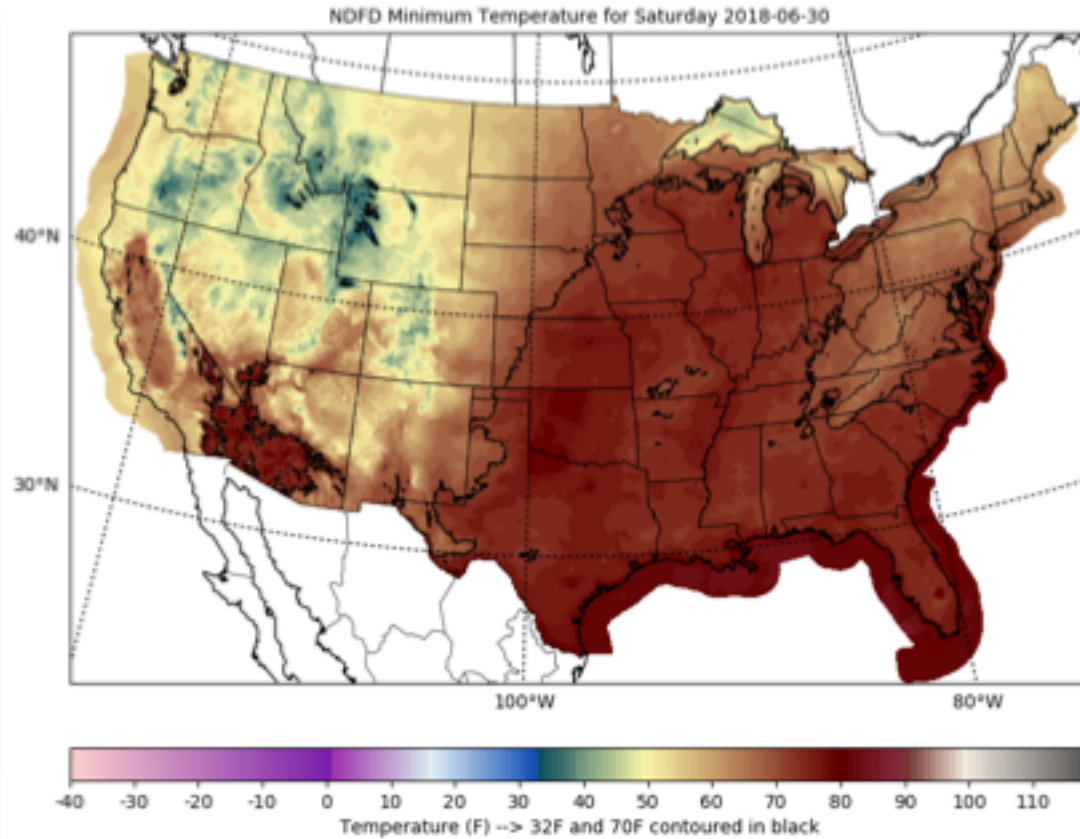
Minimum Temperatures (+1°F)



Average Temperatures (Flat)

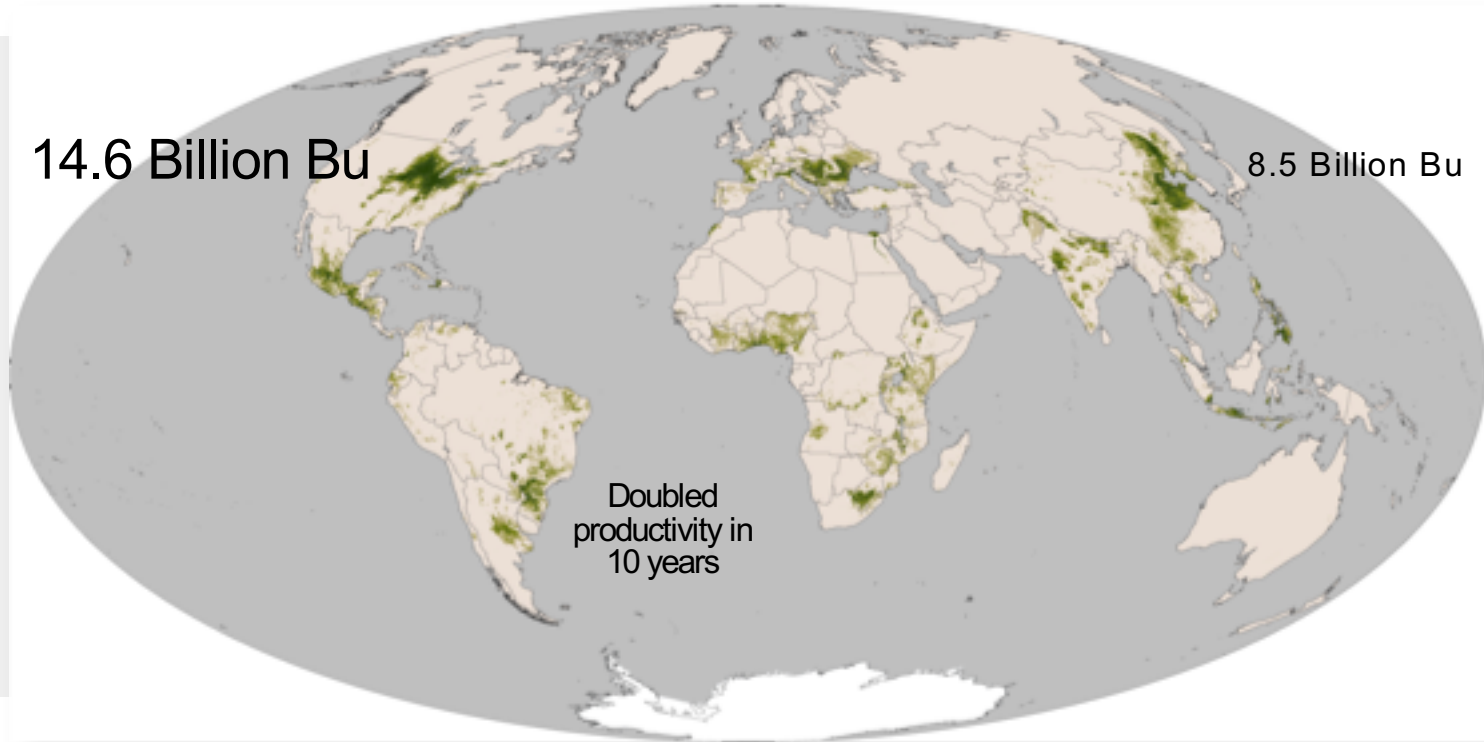


With an open Gulf comes high dew points and warm lows

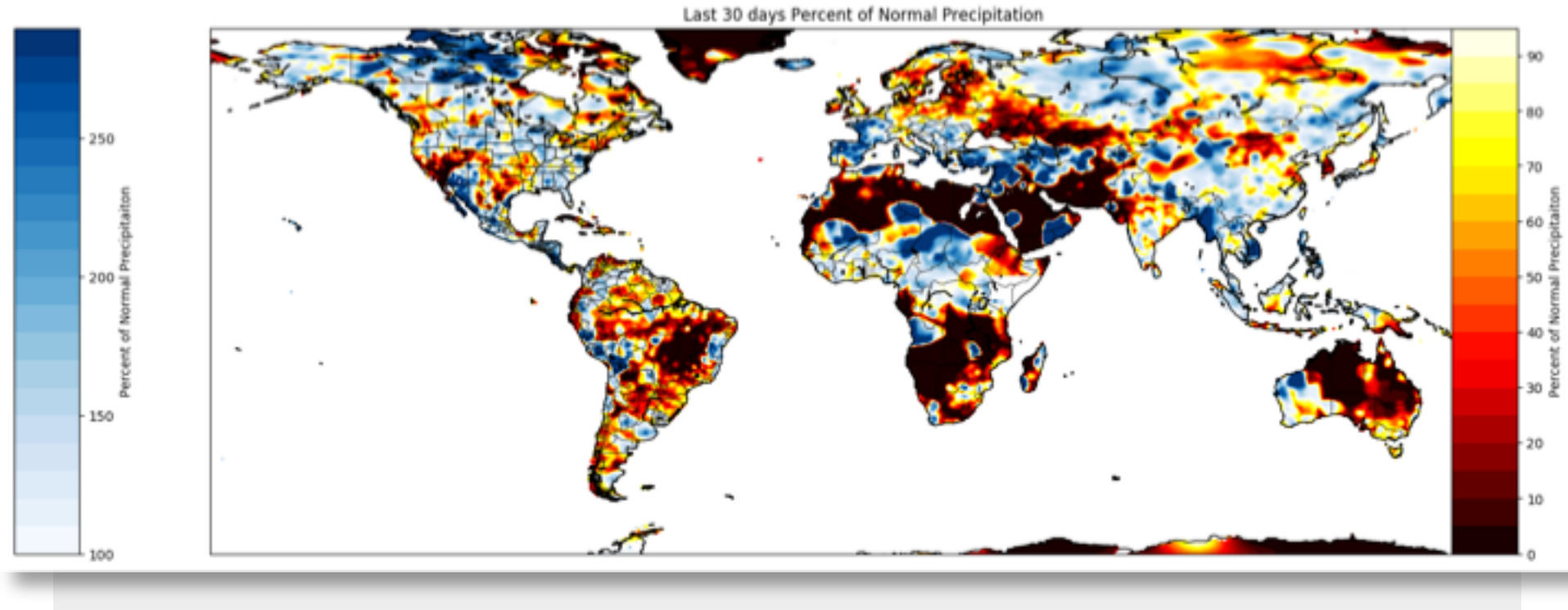


Global competition – shifts in agricultural productivity

Global Corn Production



Last 30-days of Precipitation (CPC)



Global competition – shifts in agricultural productivity

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

