Title: Weather Risk in Production Agriculture

June 26, 2018
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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

No precipitation for 6 months
May 2018 – warmest may on US record (124 years)

Forget Spring, Summer is here.
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/tang/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
Spray Painting Corn

Thank you twitter...

Aaron Horinek
2018 Severe Weather

Record 10-year low on tornado activity

- Tornado activity: 56%
- Hail activity: 69%
- Wind activity: 94%
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

Green = toward the radar
Red = away from the radar
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 $\mapsto 1:700,000 + 1:8,000 + 80\%$

http://en.blitzortung.org/live_dynamic_maps.php
Back to our growing season

Holding Capacity

Soil moisture storage capacity helps determine drought vulnerability

June 1 - June 24, 2018 Percent of Normal Precipitation

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.

Are we in a great position?

2017 Corn Production by County
Oh, and we just added this in the last 3 days
Our current drought situation
A quick look at crop conditions

USDA NASS

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

\[
y = 0.2914x + 68.025 \\
R^2 = 0.2391
\]

Week #25 Report 6-25-2018
77% in Good to Excellent (2nd highest since '90)

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.
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.
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.
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
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

14.6 Billion Bu

8.5 Billion Bu

Doubled productivity in 10 years
Last 30-days of Precipitation (CPC)
Global competition – shifts in agricultural productivity

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