

# Some Long Range Forecasts

ANTHONY R. LUPO

ATMOSPHERIC SCIENCES PROGRAM / MISSOURI CLIMATE CENTER

302 E ABNR

UNIVERSITY OF MISSOURI – COLUMBIA

COLUMBIA, MO 65211

# Our forecast – Summer – 2020 – Mid-MO Flashback

- ▶ A little above normal temperatures (about +0.5 sigma from normal – which is +1.1 F), with more humid conditions. **It was actually +1.2 F – OK we'll take a 1 point hit on this.**
- ▶ We leaned below normal on precipitation, thinking that the system will move more toward La Nina. This could be a bust if we stay where the models are now. (about - 0.5 sigma to +0.5 sigma; about -2.5 inches to +1.25 inches). **It was actually 13.53 inches or +1.69 inches (1 point).**
- ▶ Reasoning: We are coming out of warm Neutral to close to El Nino (Modoki). El Nino forecast to go toward La Nina and it's moving that way. Newberry et al. (2016) suggests these patterns are favorable for a warmer summer. Two years that look similar summer 1995 and summer 2000, more like 1995, but will the system move more toward La Nina? But, both these summers were wet! **A strict evaluation of our forecast gives 2 of 4 points for last summer, but it was a pretty good 2 of 4 points. (borderline 3 pointer).**

# Our forecast – Winter 2020-2021

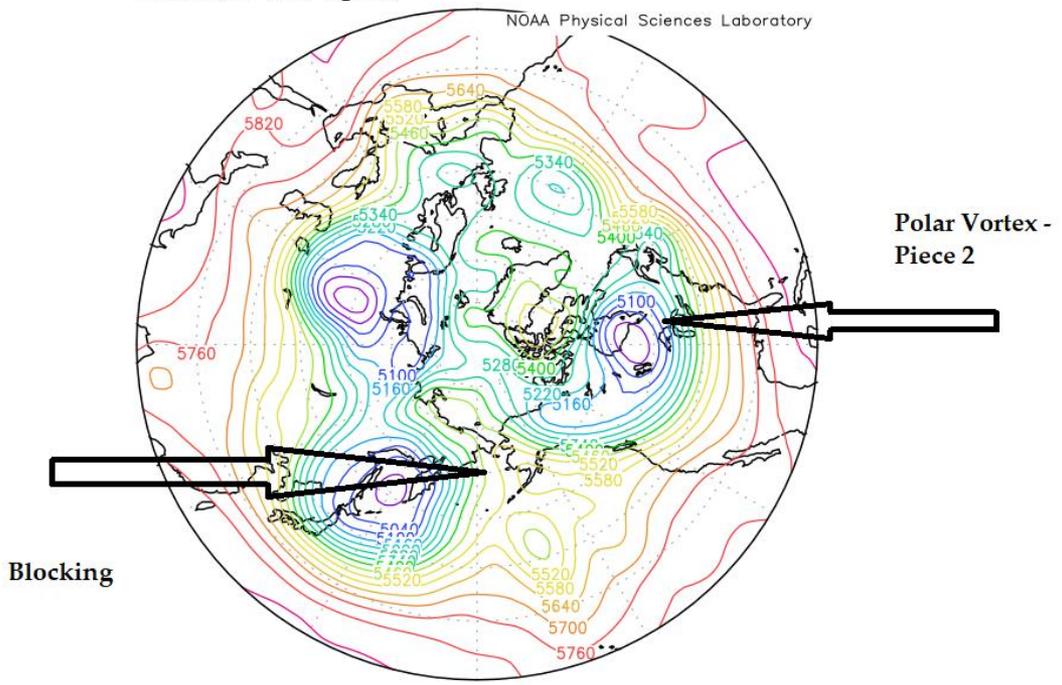
- ▶ Winter Temperatures: We'll forecast these to be 0.5 sigma below normal to maybe slightly above normal. ( $-1.5^{\circ}$  F below to  $0.5^{\circ}$  F above). **The Record setting Polar Vortex of Feb 6 – 19 ( $-20^{\circ}$  to  $-25^{\circ}$  F below normal across MO – saved our 'bacon' much like 2014 – 2015. In Columbia it was  $-0.4^{\circ}$  F. Let's take the 2 pt 'bucket'. Note: The other 11 weeks were about  $4.1^{\circ}$  F above normal.**
- ▶ Last Year – the flow was unusually zonal (rivalling early 1988 - 1989). We didn't expect to see a repeat and we were not disappointed.

# Our forecast – Winter 2020-2021

- ▶ The Polar Vortex
- ▶ (The Great Polar Vortex of 2021)

lon: plotted from 0.00 to 360  
lat: plotted from 20 to 90.00  
t: Feb 8 2021 12 Z  
lev: 500

Individual Obs hgt m



MAX=5918  
MIN=4878

NCEP Reanalysis GrADS image

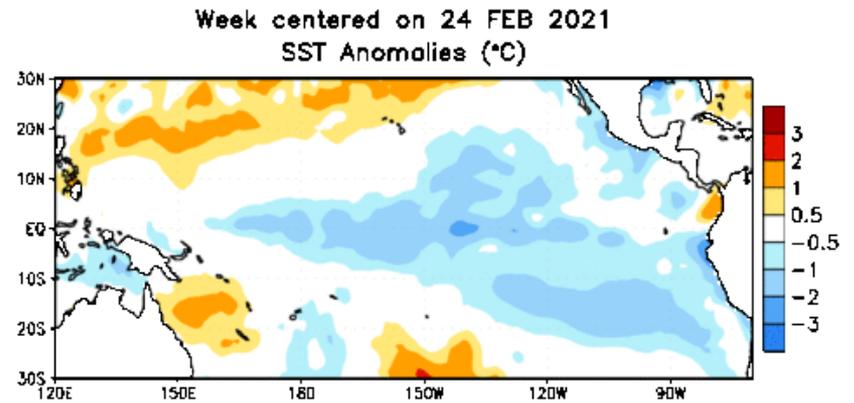
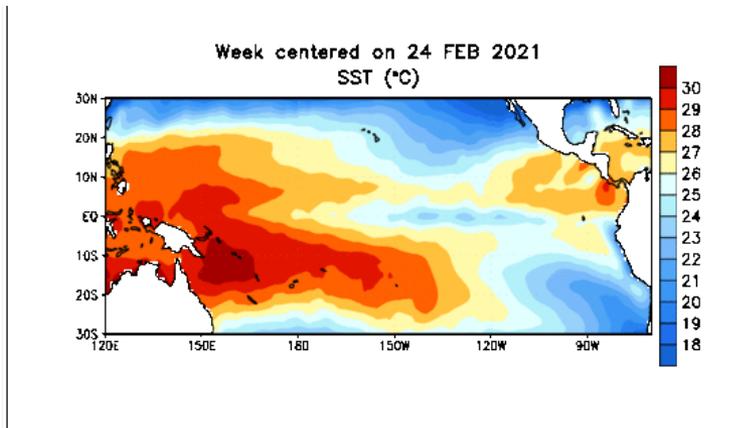
# Our forecast – Winter 2020-2021

- ▶ At 11 Days below 20 F – in Columbia we tied February 1936 and February 1899.
- ▶ Precipitation: we're going to stay slightly on the wet side of normal, up to 0.5 sigma above normal. (from about -0.5 inches to +1.1 inches). The observations were 5.18 inches, or -0.57 inches. We'll take the 1 point hit on this.
- ▶ In spite of cool conditions being the rule, these winters tend to have little snow, but some monster years. We'll say 15 inches of snow this year. The observations are 13.3 inches for Dec – Feb, and 13.7 for winter. We'll take it!
- ▶ Overall – our forecast netted 3 of 4 points. Thank you Polar Vortex!

# Summer Forecast 2021 (mid-MO)

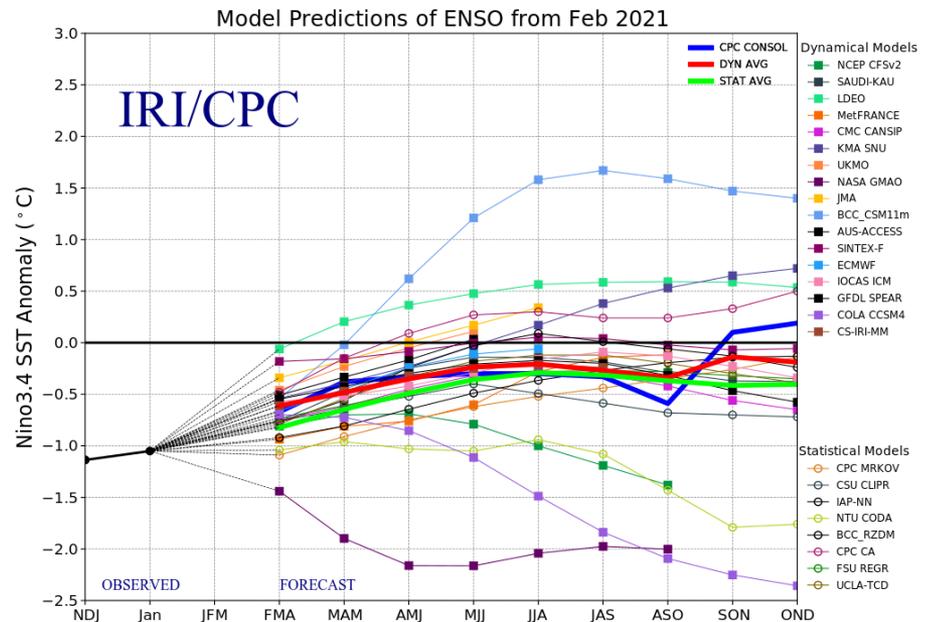
- ▶ La Nina conditions currently.
- ▶ 24 February 2021 (SST)

Anomaly



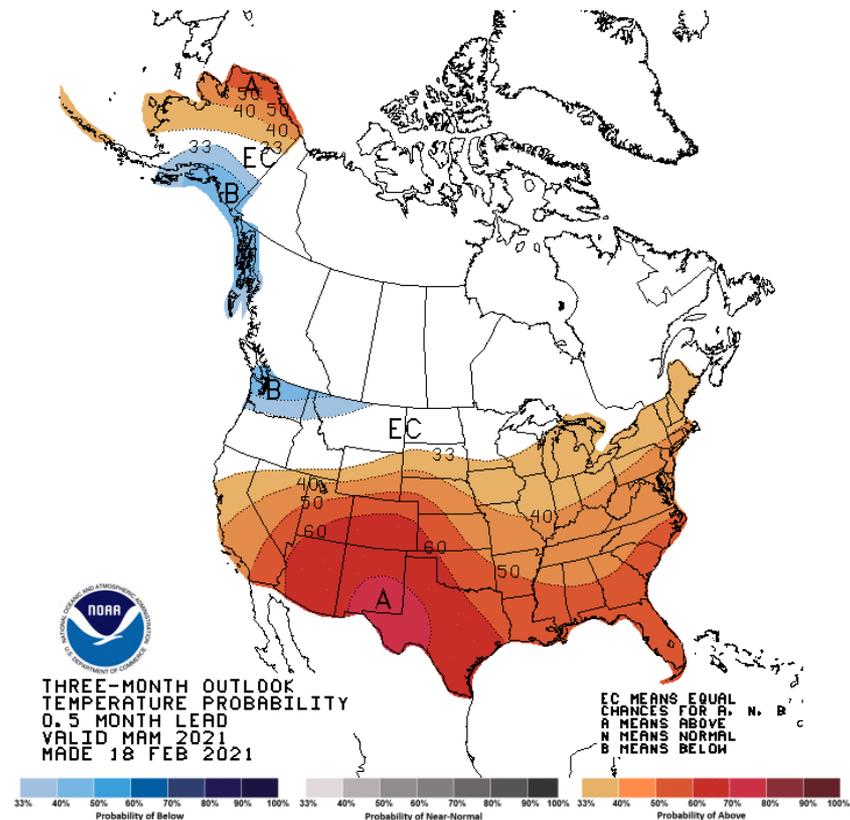
# Summer Forecast 2021

- ▶ Models looking to slowly decay the current La Nina conditions and push toward cold neutral conditions.



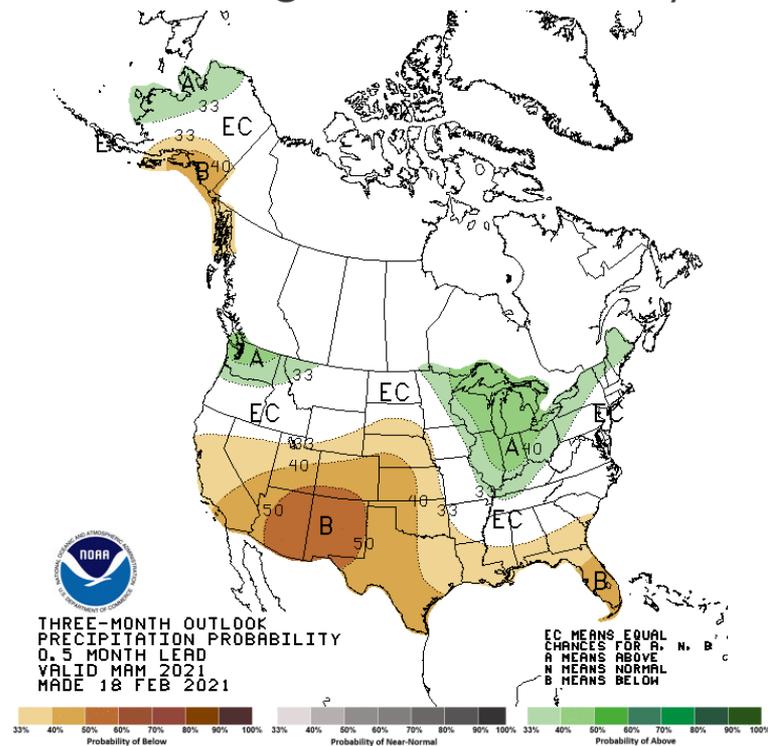
# Spring 2021

- ▶ Spring Temps – MAM (near-to-above normal temperatures here – See Newberry et al. 2016.)



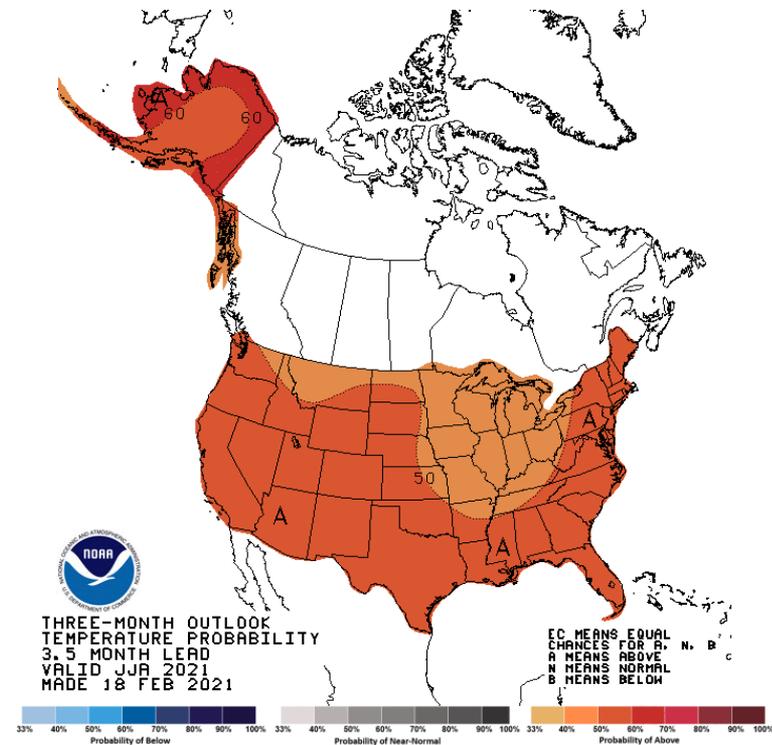
# Spring 2021

- ▶ Spring Precipitation: MAM(should be near normal – but southwest and west drought is worrisome. )



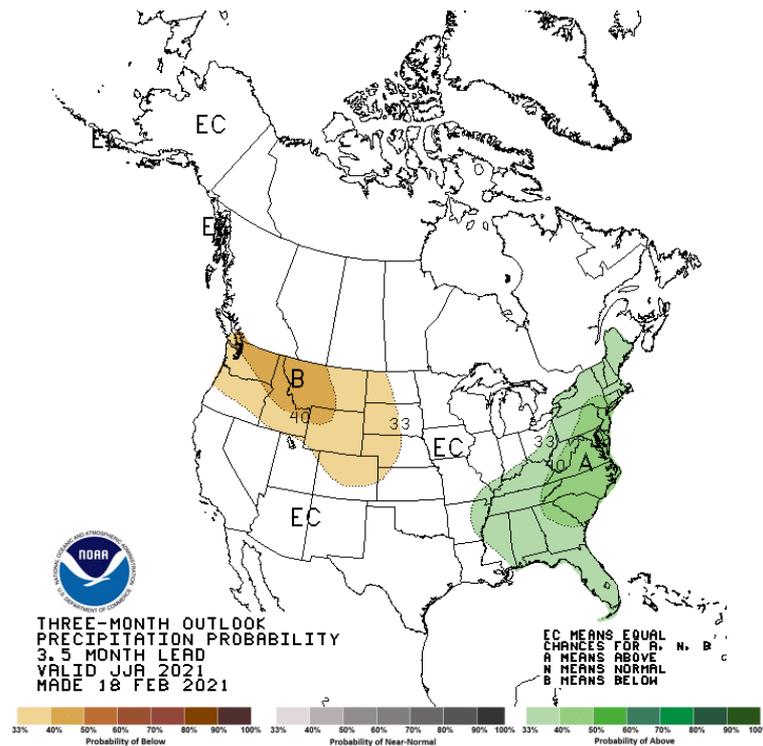
# Summer - 2021

- ▶ CPC Summer temps – JJA (could be a warm one?  
Hot in the Southwest)



# Summer - 2021

- ▶ CPC Summer Precipitation JJA (Dry northwest and wet east? )



# Summer - 2021

- ▶ CPC forecast is for a warm summer temperature-wise, but hot again in the southwest. They are going for dry in the northwest and wet in the east. But, we're in a slowly fading La Nina, and 2011 is one analog (hot, but moist). The last 20 years have seen some back and forth between hot and cool summers.
- ▶ In the Spring and Summer 2020, La Nina conditions are in place, and projected to drift toward cool-neutral. The last 5 analogues are two warm and drier summers (including 2011, 2017), normal and dry (1999), and cool and wet (2000, 2008).

# Our forecast – Summer - 2021

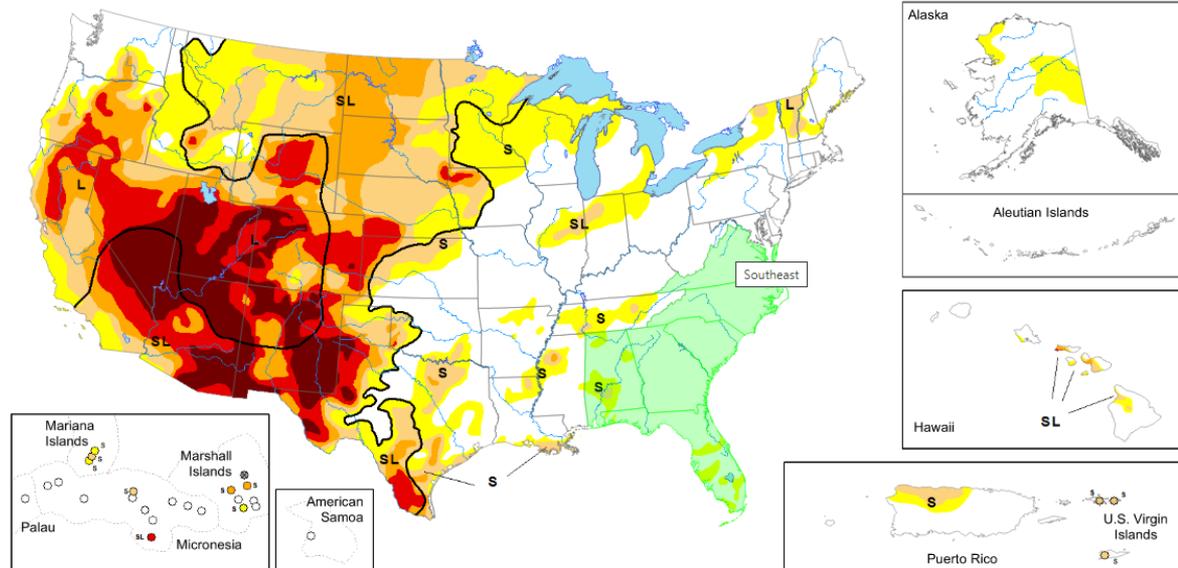
- ▶ We're going to go toward the warm side on this one with above normal temperatures (about +1.0 sigma from normal – which is +2.1F), with more humid conditions.
- ▶ We're going to lean toward precipitation in the range of normal following 2011. This is the closest analogue. (about - 0.5 sigma to +0.5 sigma: about -2.6 inches to +2.6 inches), this is somewhat good news for agriculture, depending on how spring goes. The winter has been somewhat dry across MO.
- ▶ Reasoning: We are coming out of La Nina conditions and drifting toward cold neutral conditions. This looks a lot like 2011. Newberry et al. (2016) suggests these patterns are favorable for a warmer summer. The dry conditions in the southwest are worrisome.

# National drought map

For about a year, the west has been very dry. During fall and early winter, these conditions moved into MO. April and May will tell the tale for summer.

**Map released: February 25, 2021**

**Data valid: February 23, 2021**



# Summer 2021 Crop Forecast

- ▶ Summer 2020 – Crop Yield Projections
- ▶ IRI/CPC Ensemble Plume of ENSO Predictions for Fall 2021:
- ▶ February 2021: Dynamical and Statistical Model average NINO3.4 SST Anomaly is roughly  $-0.4^{\circ}\text{C}$ .



# Summer 2021 Crop Forecast

- ▶ Feb. 2021: Dynamical and Statistical Model average NINO3.4 SST Anomaly is roughly -0.4.
- ▶ The IRI/CPC outlook is leaning towards cold – neutral for fall 2021.
- ▶ ([iri.columbia.edu/our-expertise/climate/forecasts/enso/current/](http://iri.columbia.edu/our-expertise/climate/forecasts/enso/current/))

# Summer 2021 Crop Forecast

- ▶ According to the JMA definition of La Nina (used in my research), an anomaly below  $-0.5^{\circ}\text{C}$  is considered an La Nina event. Therefore, projections for crop yields are based on the projection of La Nina being cold neutral by Fall 2021.
- ▶ Also according to the JMA, PDO has been near zero or cool in 2020 (<http://research.jisao.washington.edu/pdo/PDO.latest.txt>) Therefore, crop yield projections will be based on the assumption that Fall 2021 will be a negative **PDO**.

# Summer 2021 Crop Yield Forecasts

- ▶ Corn Yields: (1.0 sigma is 23 BU/Acre (1990-2013 data) for Div 1, and 26,26,23,19, and 17 BU / Acre for Divs 2,3,4,5,6)
- ▶ Climate Division 1: 0.6 sigma - 0.8 sigma above average
- ▶ 2: 0.4 sigma – 0.6 sigma above average
- ▶ 3: 0.1 sigma – 0.3 sigma above average
- ▶ 4: 0.1 sigma – 0.3 sigma above average
- ▶ 5: Same as Division 2
- ▶ 6: Same as Division 2

# Summer 2021 Crop Yield Forecasts

- ▶ Soybean Yields (1.0 Sigma is 5.5 BU / Acre (1990-2013 data) for Div 1, and 5, 6.5, 6.7, 4.1, and 5.3 BU/Acre for Divs 2,3,4,5,6)
- ▶ Climate Division 1: 0.0 – 0.3 sigma below average
- ▶ 2: 0.0 – 0.2 sigma below average
- ▶ 3: 0.4 – 0.6 sigma below average
- ▶ 4: 0.1 – 0.3 sigma above average
- ▶ 5: 0.3 sigma – 0.5 sigma above average
- ▶ 6: 0.5 sigma – 0.7 sigma above average

# Summer 2021 Crop Yield Forecasts

- ▶ For Summer 2021, Missouri corn and soybean yields are projected to be near average to 0.4 sigma above average, generally. One exception: soybean yields for climate division 1 - 3 are projected to be near average to slightly below average.

# CoCoRaHs

- ▶ Please consider joining CoCoRaHs. This data will be used by agencies to decide crop loss information. It's worth it to you to join Missouri CoCoRaHs. (State Climatologist Patrick Guinan)
- ▶ <http://www.cocorahs.org>
- ▶ Email: [lupoa@missouri.edu](mailto:lupoa@missouri.edu)

