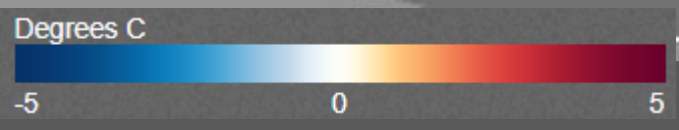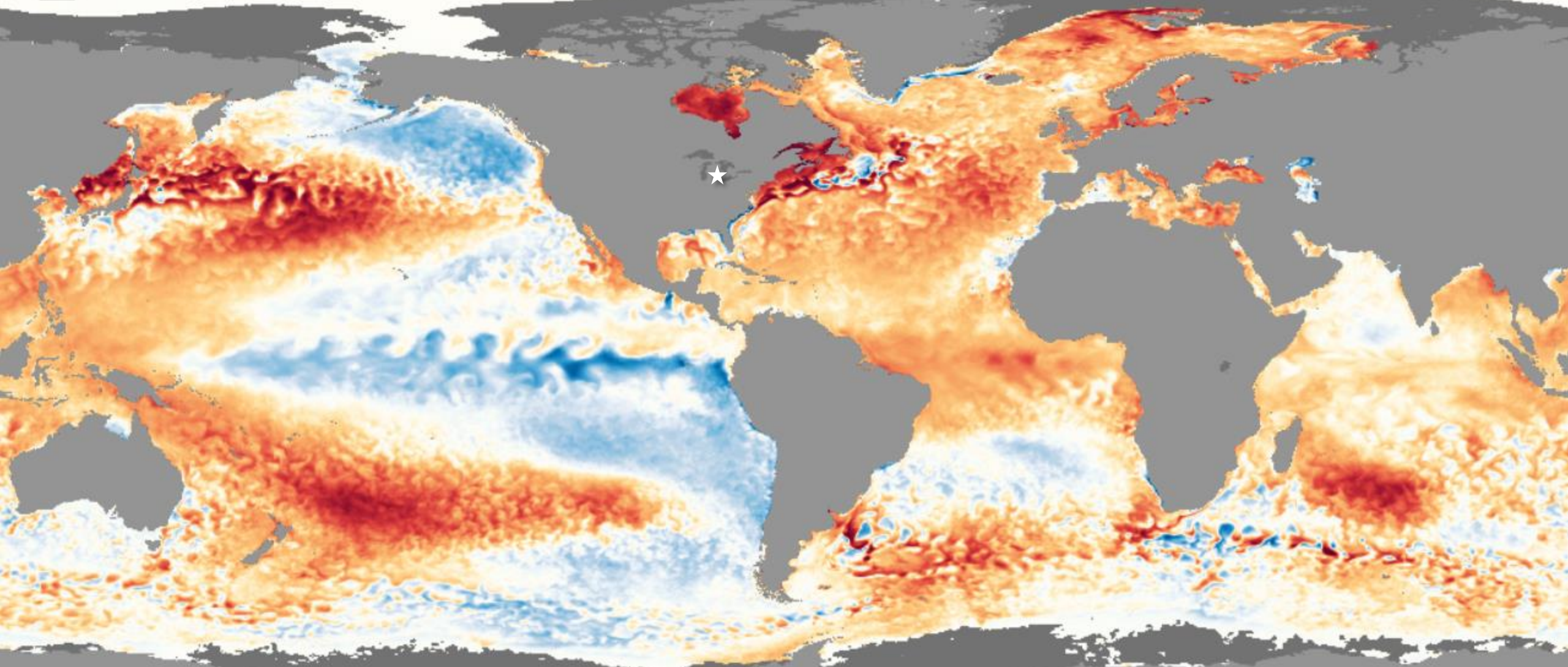# 2021-2022 Winter Outlook for Southeast Michigan

90 Day Outlook Valid December 1, 2021 to February 28, 2022

Weather Forecast Office
Detroit, MI

Degrees C

-5   0   5

Sea Surface Temperature Anomaly – November 15-21, 2021   Image Courtesy NOAA View

NWSDetroit   weather.gov/dtx

December

- Temperatures: Near normal
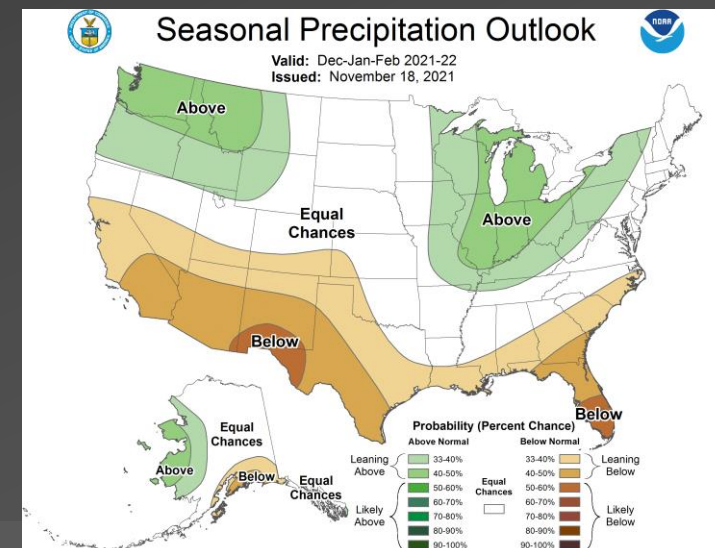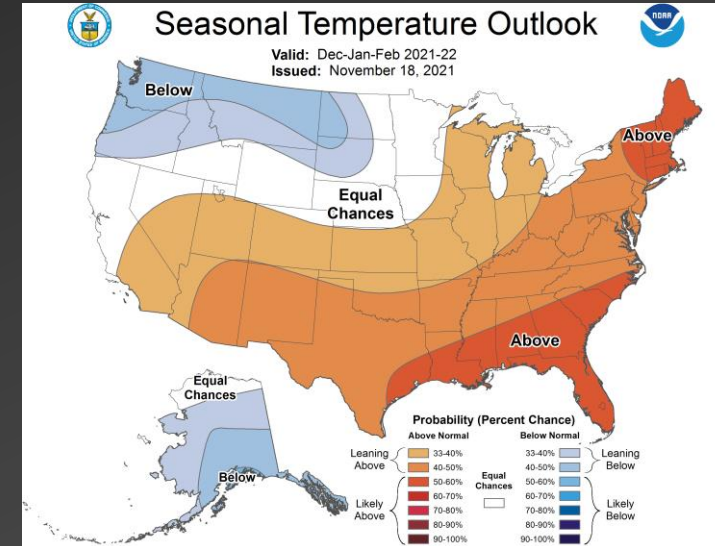- Precipitation: Above normal
- Snowfall: Near normal

January

- Temperatures: Near to above normal
- Precipitation: Above normal
- Snowfall: Near to above normal

February

- Temperatures: Above normal
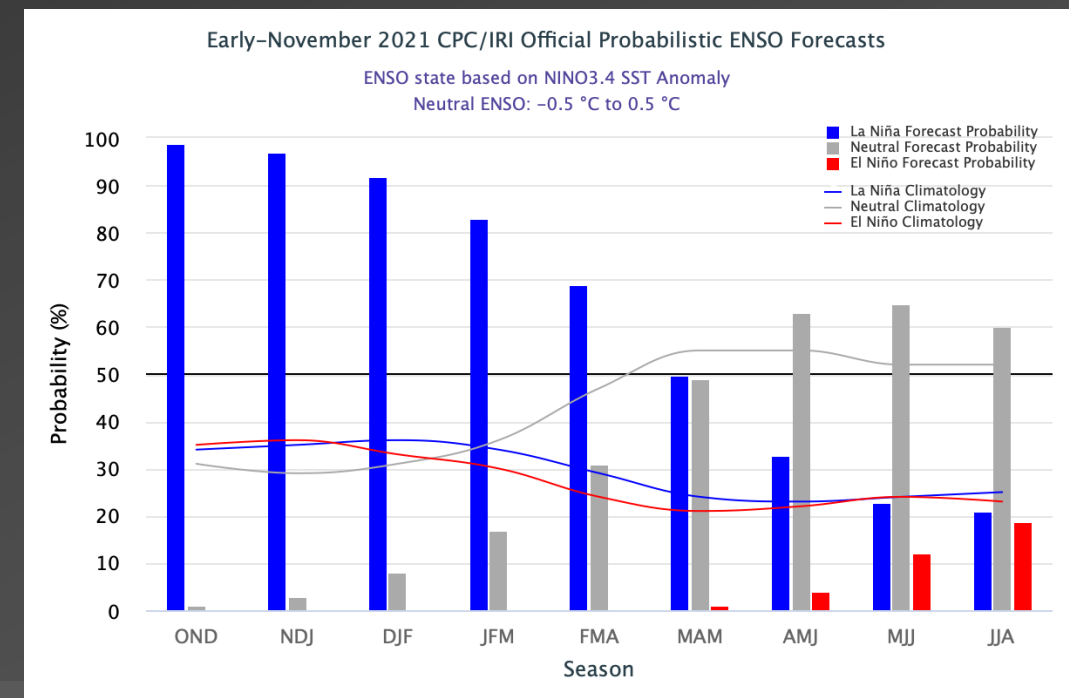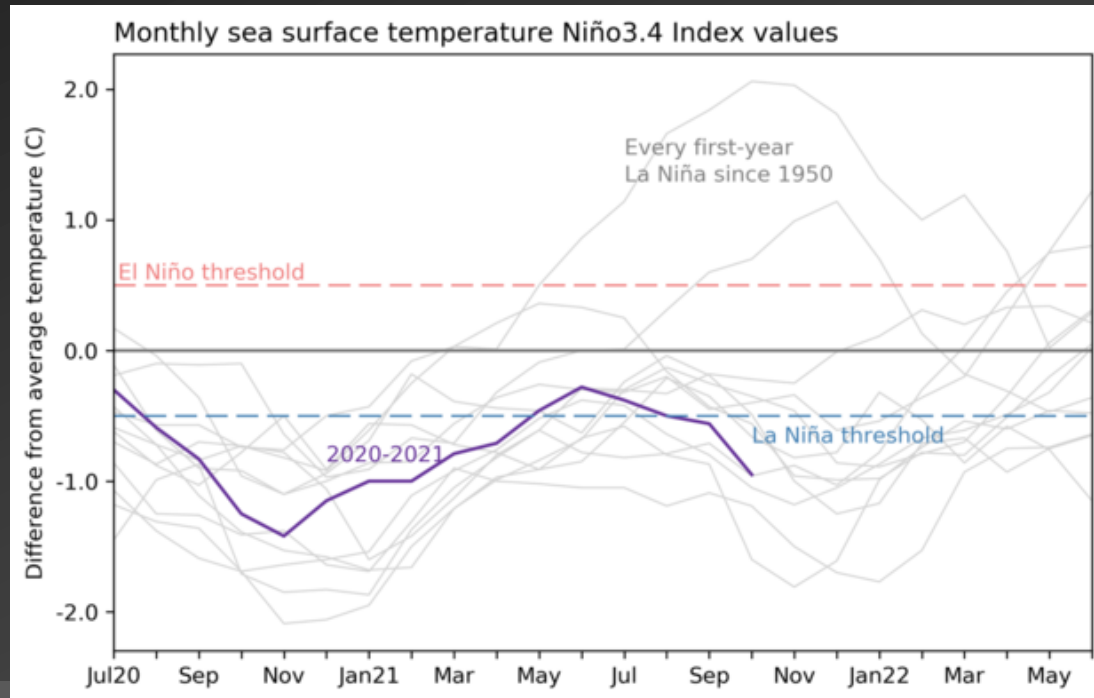- Precipitation: Above normal
- Snowfall: Near to above normal

CPC Winter Outlook

Seasonal Temperature Outlook
Valid: Dec-Jan-Feb 2021-22
Issued: November 18, 2021

Seasonal Precipitation Outlook
Valid: Dec-Jan-Feb 2021-22
Issued: November 18, 2021

La Niña is back for a "double-dip" this winter with cool anomalies noted in the sea surface temperature in the central and east-central equatorial Pacific (see first page of this PDF). The typical coupled atmospheric processes have been observed as well.

The Climate Prediction Center gives high likelihood for La Niña to continue through the winter and into spring 2022. Read more about the La Niña Advisory and the latest forecast from CPC here (updated weekly).

Monthly sea surface temperature Niño3.4 Index values

Early–November 2021 CPC/IRI Official Probabilistic ENSO Forecasts

As a result, La Niña will again be the main driver for the wintertime atmospheric circulation pattern, with implications on the local conditions for the Great Lakes. In the "typical" La Niña wintertime setup, blocking high pressure develops over the northern Pacific Ocean which sets up a ridge over the eastern Pacific and western United States. Downstream of this, a longwave troughing pattern is typically favored over the eastern US. This would point to a more active winter for the Great Lakes with the jet stream helping to direct numerous storm systems through the region.
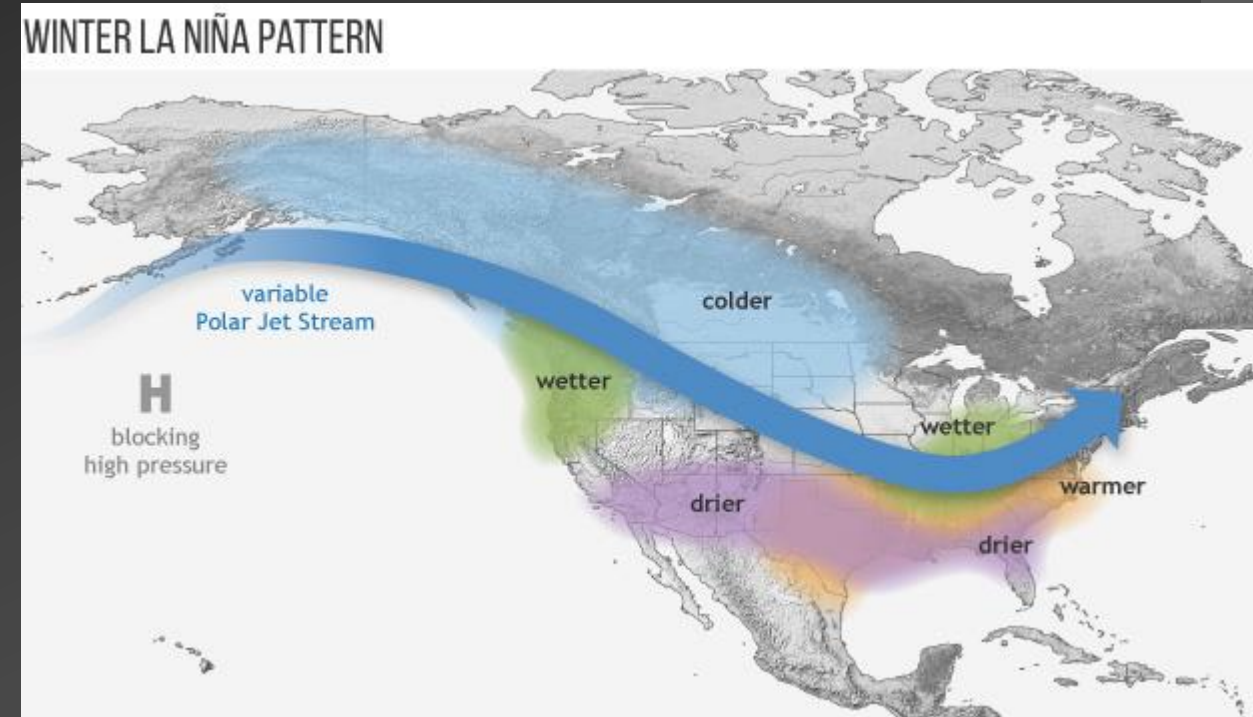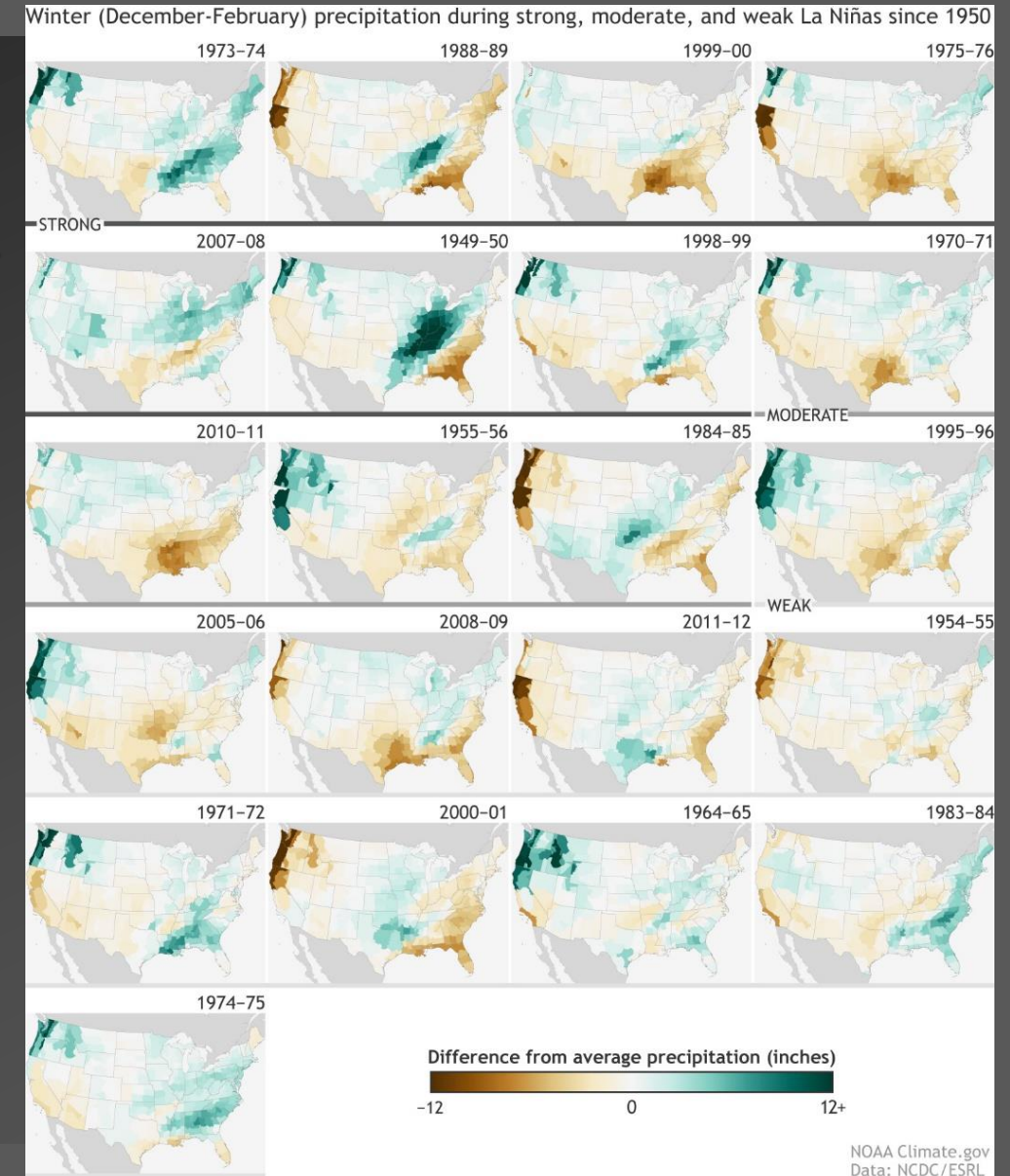

WINTER LA NIÑA PATTERN

Composites of historical La Niña winters (that also account for climate trends in recent decades) show that approximately 50 to 60% of them had <u>higher than normal precipitation</u> across SE Michigan and about 40 to 50% of them saw <u>higher than normal snowfall</u>. Signal is not particularly strong for either above or below normal temperatures for La Niña winters, but recent data do suggest a warming trend regardless of ENSO (i.e. La Niña or El Niño).

These composites show us what has occurred most often in the past, but are not enough to predict how this specific winter will unfold. Not all La Niñas behave the same and our sample of past events is relatively small*. There are also other smaller-scale climate processes and oscillations not accounted for that are only predictable a week or two in advance.

*only dating back to 1950

Winter (December-February) precipitation during strong, moderate, and weak La Niñas since 1950

Difference from average precipitation (inches)
-12 0 12+

NOAA Climate.gov
Data: NCDC/ESRL

Climate models and ensembles can help resolve some of the uncertainty from using ENSO pattern recognition and composites/analogs alone.

The latest runs of the North American Multi-Model Ensemble (NMME) support the general trends suggested by composites of past La Niñas and trends in recent decades: There is signal for <u>above normal precipitation</u> and <u>above normal temperatures</u>. It should be however noted that the models that go into the ensemble system generally have limited temperature forecast skill over the southern Great Lakes in this setup.

The European Copernicus (C3S) multi-system ensemble advertises similar probabilities this winter.

NMME Ensemble Forecasts of Winter 2021-2022 Temp & Precip Anomalies w/ Skill Mask Applied
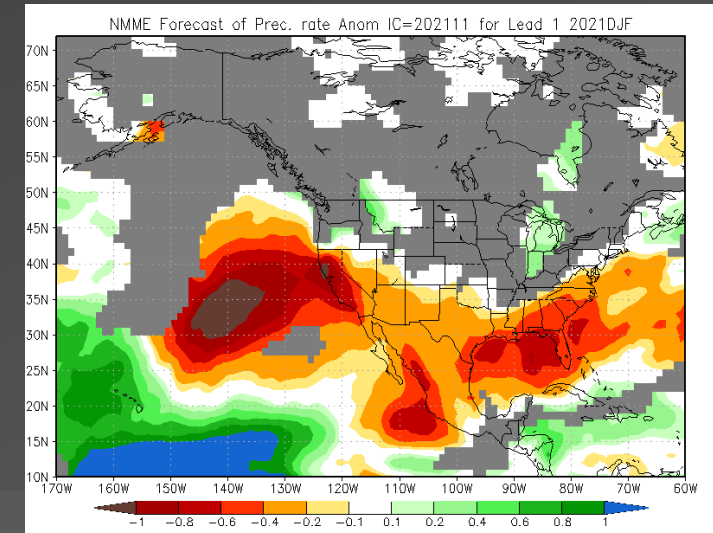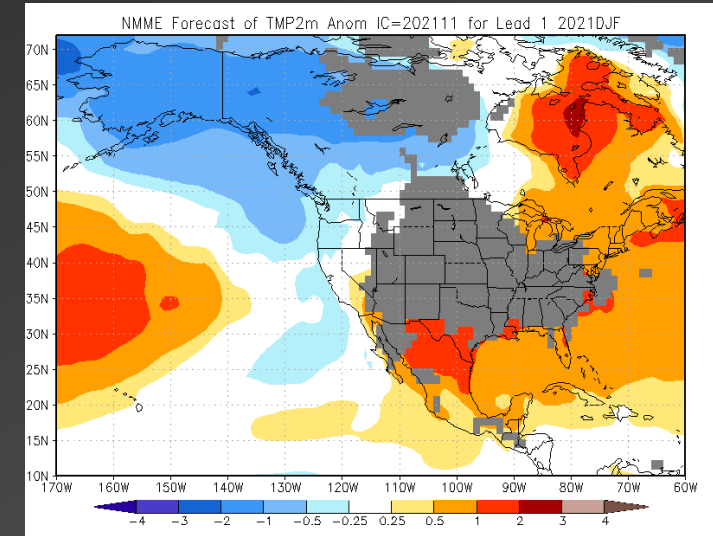
Last winter was also a La Niña winter and the 2020-2021 outlook gave a higher chance for above normal precipitation. It ended up being the 16th driest winter on record at Detroit! So, what happened?

- The atmospheric pattern over North America did not behave like it does during a typical La Niña, despite the La Niña signal in the tropics.

- Shorter-term climate patterns like the NAO and AO (both negative last winter) were likely able to exert some influence on the local pattern. This may have contributed to the jet stream/storm track not taking its "typical" place over the Great Lakes for parts of the winter.

- There are other factors including tropospheric/stratospheric interactions, internal variability, and the atmosphere's inherent chaos that can always come into play and win out over the ENSO signal. These are areas that are actively being researched and do not currently provide the same skill that the state of ENSO does. In fact, over the long term, using ENSO patterns provides some of the best skill in seasonal forecasting (along with recent temperature trends). That means that if we base the seasonal outlook primarily on the state of ENSO, it may bust some years (like last year), but in most years it will still come out on top.
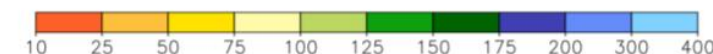
Observed Precipitation from Last Winter

Accumulated Precipitation: Percent of Mean
December 1, 2020 to February 28, 2021

Detroit: -2.58"(16th Driest)
Flint: -0.56" (38th Driest)
Saginaw: -1.39" (26th Driest)
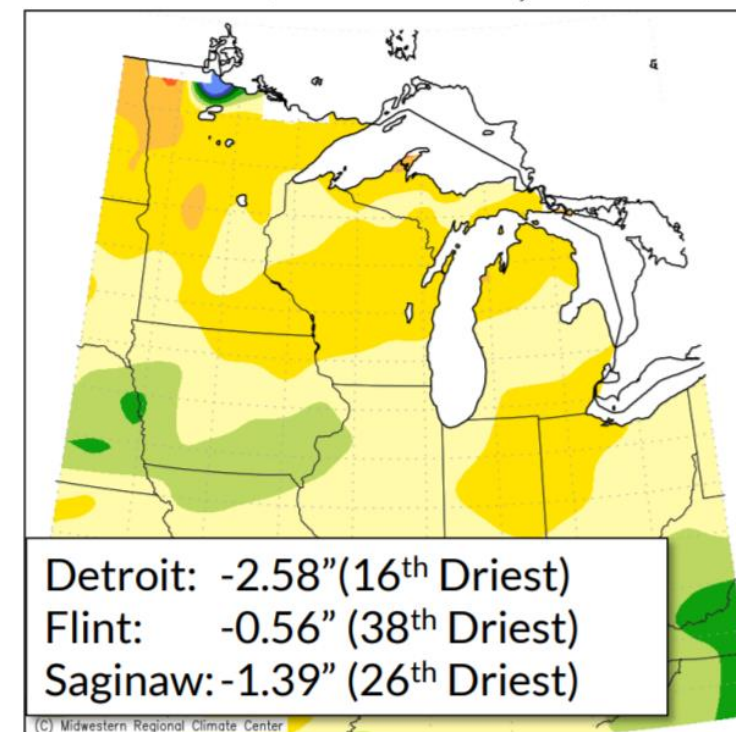
(C) Midwestern Regional Climate Center

Mean period is 1981–2010.

10 25 50 75 100 125 150 175 200 300 400

Midwestern Regional Climate Center
Illinois State Water Survey, Prairie Research Institute
University of Illinois at Urbana–Champaign

- La Niña is expected be a primary driver of the upper air pattern this winter.

- This setup favors an active storm track over the Great Lakes, with better chances for above normal precipitation across Southeast Michigan. Snowfall will likely be near or above normal. Slightly warmer than normal lakes may also contribute to more lake effect precipitation.

- The nature of the La Niña pattern will allow for shorter-term features like the Arctic Oscillation and North Atlantic Oscillation to dominate periodically which increases the chance for temporary warm and cold spells throughout winter. However, the recent trend toward warmer winters in general with support from ensembles and climate models gives higher confidence for warmer than normal temperatures for the season as a whole.

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