

Winter Outlook 2022-23 NWS Louisville

*Background Photo:
Parklands of Floyds Fork, Louisville, KY*



NATIONAL WEATHER SERVICE, LOUISVILLE

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Upfront - The Takeaways

Climate Prediction Center (CPC) Outlook

CPC Temperature Outlook:

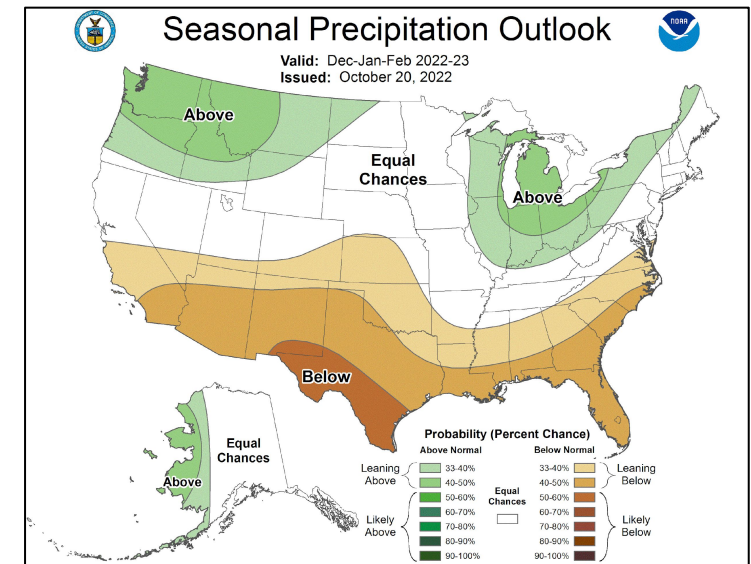
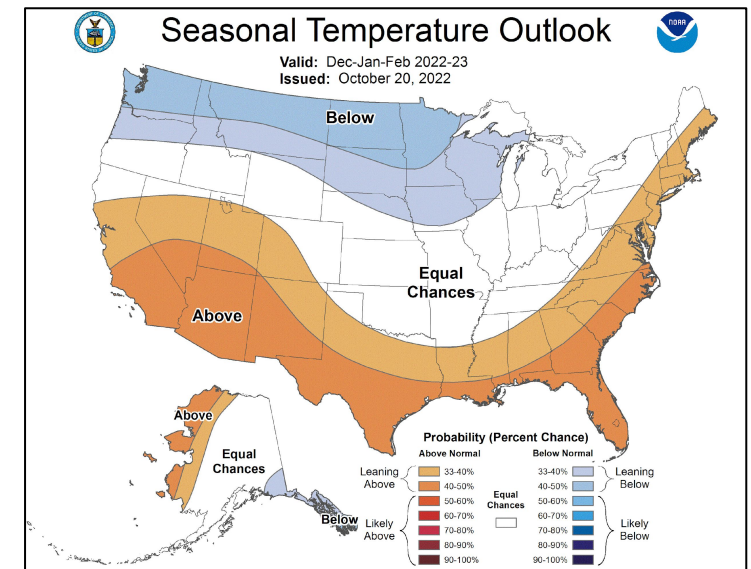
- Enhanced chances for **above-normal** temperatures across the southern United States & East Coast.
- Enhanced chances for **below-normal** temperatures from the Pacific Northwest into the western Great Lakes.
- Elsewhere, there are equal chances of **above-**, **near-**, and **below-normal** temperatures.

CPC Precipitation Outlook:

- Enhanced chances for **wetter-than-normal** conditions from the Great Lakes region into New England, and from the Pacific Northwest into western North Dakota.
- Enhanced chances for **drier-than-normal** across the southern United States.
- Elsewhere, there are equal chances of **above-**, **near-**, and **below-normal** precipitation.

What's Uncertain

- La Niña will **not** be the only player this winter. Temperatures could be highly variable throughout the winter. Snow storms will likely occur at times this winter. However, the frequency, number, and intensity of these events cannot be predicted on a seasonal timescale.



The **CPC winter forecasts above show only the most likely outcome** where there is greater confidence, but this is **not** the only possible outcome.

Rationale for the CPC Winter Outlook Issued on October 20, 2022

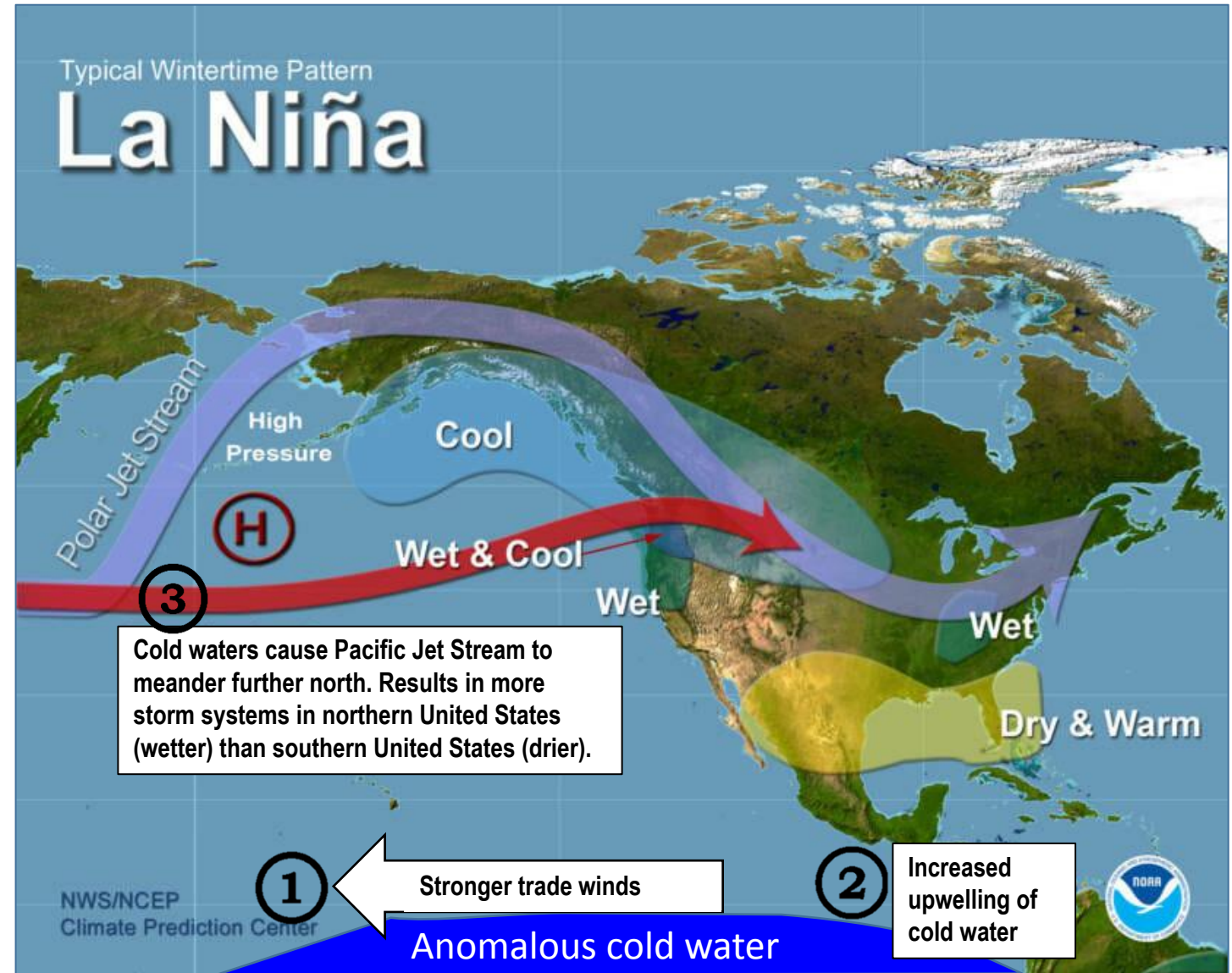
- ✓ There is a **75% chance of La Niña during the Northern Hemisphere winter (December-February) 2022-23**, with a 54% chance for ENSO-neutral in February-April 2023.
- ✓ La Niña is anticipated to affect temperature and precipitation across the United States during the upcoming months, so the **CPC temperature and precipitation outlooks reflect La Niña impacts**.
- ✓ **Greatest La Niña impacts typically occur in February & March.**
- ✓ La Niña has impacted the past 2 winters (both moderate strength). Since 1949-50, there have **only been 2 times that we have seen 3 consecutive winters impacted by La Niña** (1973-74 to 1975-76 & 1998-99 to 2000-01).
- ✓ This La Niña will likely be weakening during the winter, so its strength is highly uncertain. There is a **75% chance of at least a weak (-0.5 to -0.9°C) La Niña**, **34% chance that it could be at least a moderate (-1.0 to -1.4°C) La Niña**, and **just a 7% chance that it could be a strong (-1.5°C or colder) La Niña**. The strength of La Niña can impact temperatures, precipitation, and even seasonal snowfall.
- ✓ **Recent temperature & precipitation trends were also considered.** Since 1990, La Niñas have been highly variable with winter temperatures in the Northern Plains & western Great Lakes, so some uncertainty there. In addition, the storm track can be highly variable in the Great Lakes during La Niñas. This can impact the northern & western extent of the above-normal precipitation in the Great Lakes.



La Niña– What is it?

La Niña is anomalously cool water in the central and eastern tropical Pacific Ocean. During these events...

- 1) The normal easterly winds (trade winds) along the equator become even stronger, so they push more warm water toward Asia.
- 2) Meanwhile, off the west coast of the Americas, an increase in upwelling sends cold water toward the surface.
- 3) Cold waters cause the Pacific jet stream to meander further north more frequently than normal, guiding winter storms into the northern tier of the United States.





La Niña – What's Expected This Winter

Strength: **Weak to Moderate**

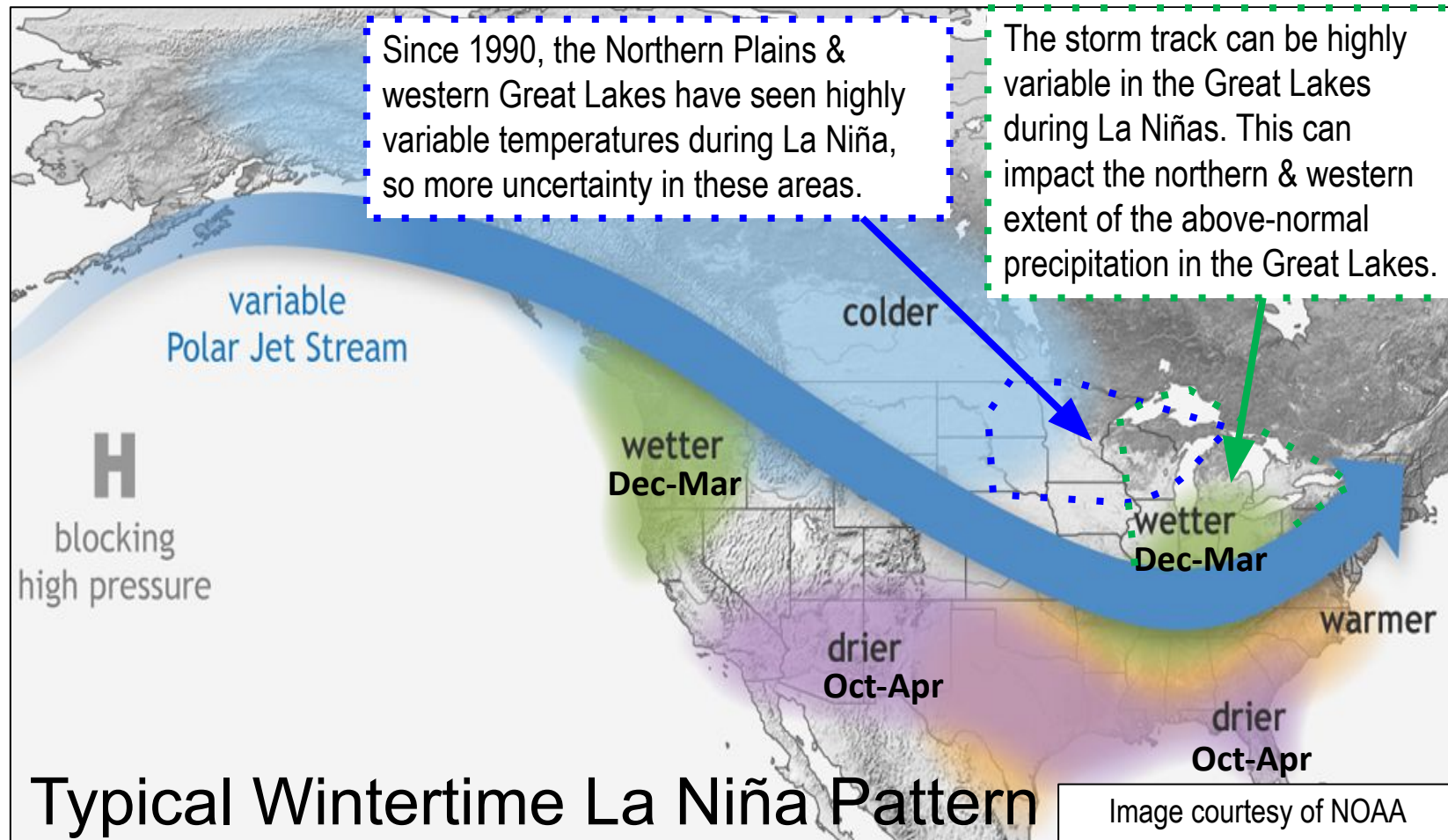
Typical Impacts

Temperatures:

- ✓ There tends to be a strong tendency for **colder-than-normal** conditions from southeast Alaska southeast into the Northern Plains.
- ✓ There is a strong tendency for **warmer-than-normal** conditions across the southern and eastern United States.

Precipitation:

- ✓ There is a strong tendency for **wetter-than-normal** conditions from the Tennessee/Ohio river valleys into the southern Great Lakes & Pacific Northwest
- ✓ There is a strong tendency for **drier-than-normal** conditions across the southern United States.



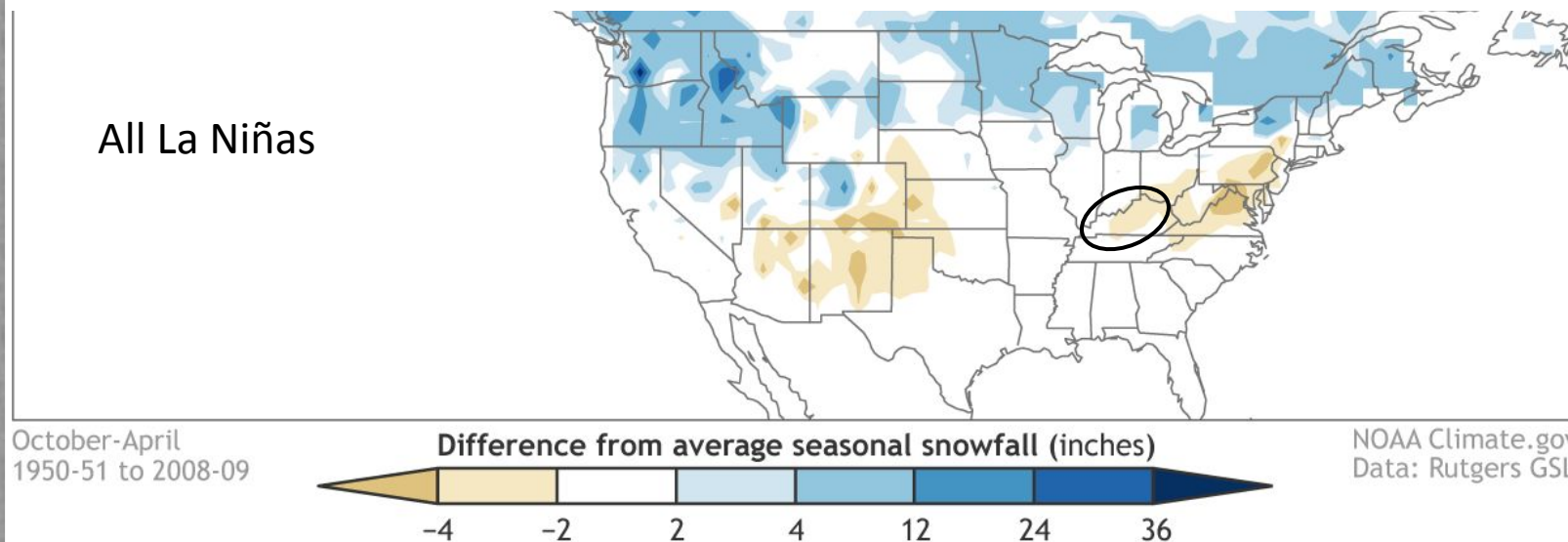
Weak La Niña Winters: 1954-55, 1964-65, 1971-72, 1974-75, 1983-84, 1995-1996, 2000-01, 2005-06, 2008-09, 2011-12, and 2017-18.

Moderate La Niña Winters: 1955-56, 1970-71, 1984-85, 2010-11, 2020-21, and 2021-22.

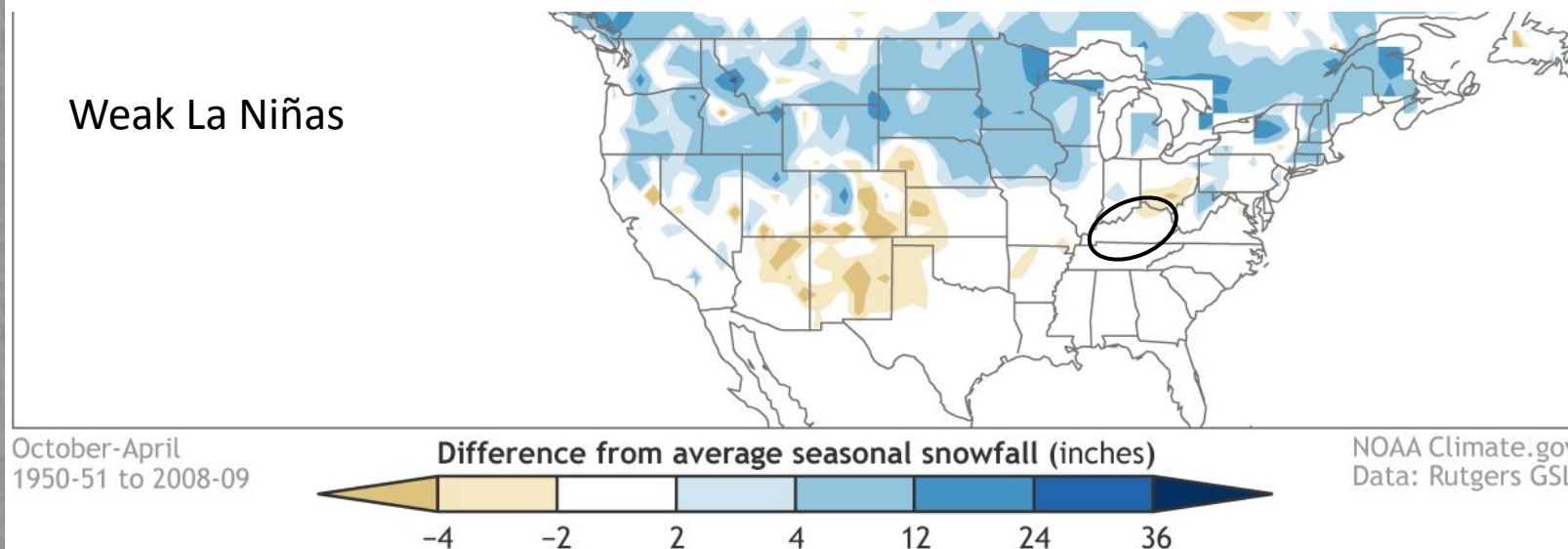


La Niña and Snowfall

All La Niñas



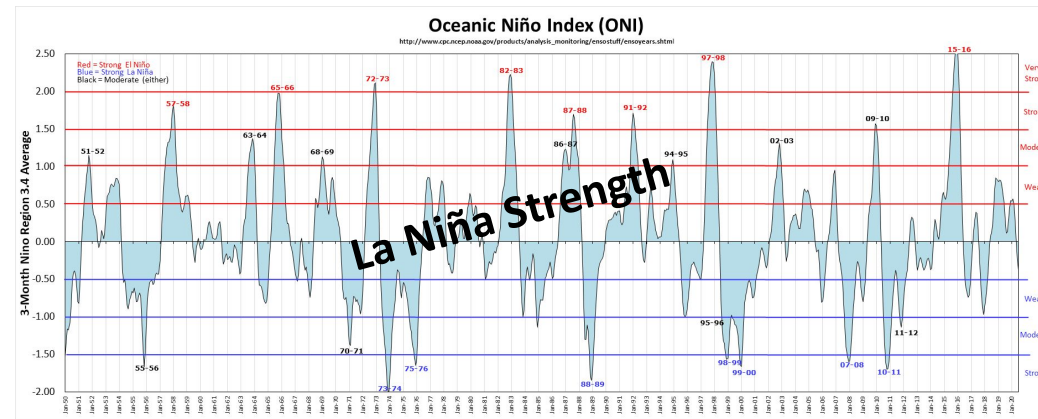
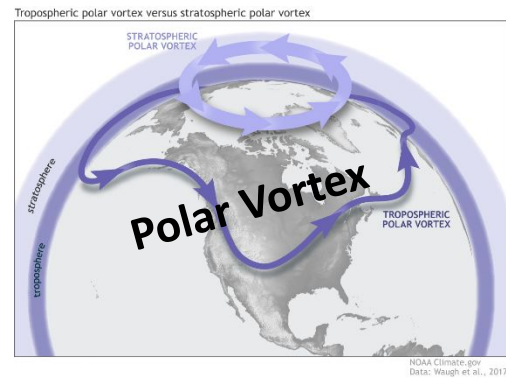
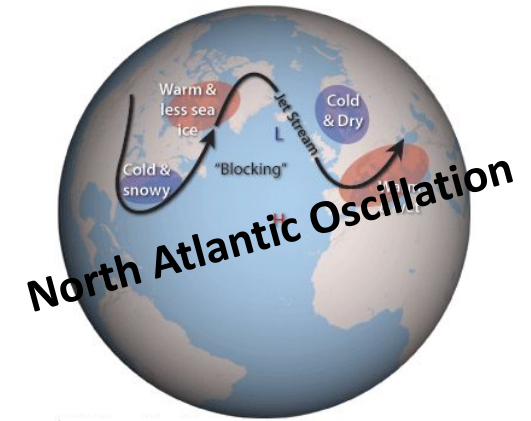
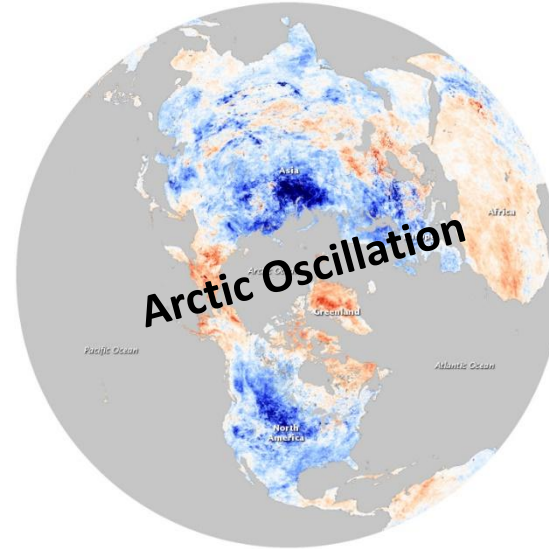
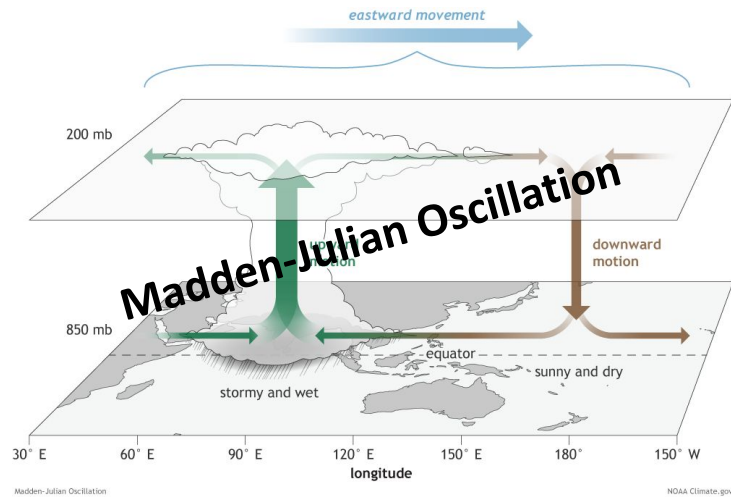
Weak La Niñas



La Niña tends to favor slightly reduced snowfall in the Ohio Valley. La Niña also favors increased precipitation. This implies that the Ohio Valley tends to see increased rainfall during La Niña winters. This can lead to an increase in spring flooding.



In Addition to La Niña, Many Other Factors Come Into Play



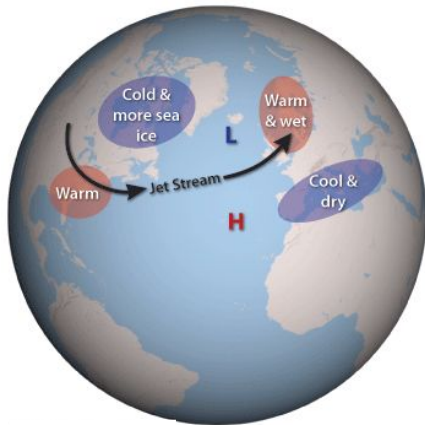
...and more!

There are many patterns in the atmosphere that combine to give us the weather we experience. Many of these patterns, including the polar vortex and the oscillations shown above, occur over the space of days, weeks, or a month or two. These patterns are extremely difficult to forecast more than a few weeks in advance. This makes the construction of a forecast for an entire season very challenging.



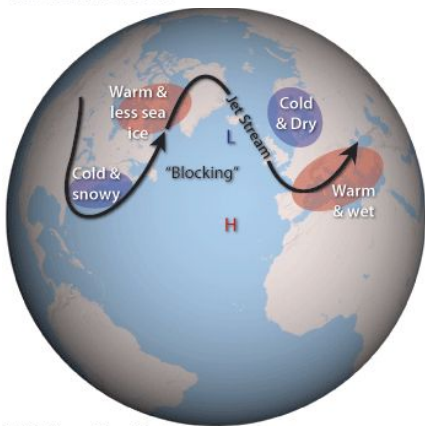
La Niña + North Atlantic Oscillation in the Ohio Valley

Positive NAO



La Niña + Negative NAO

Negative NAO



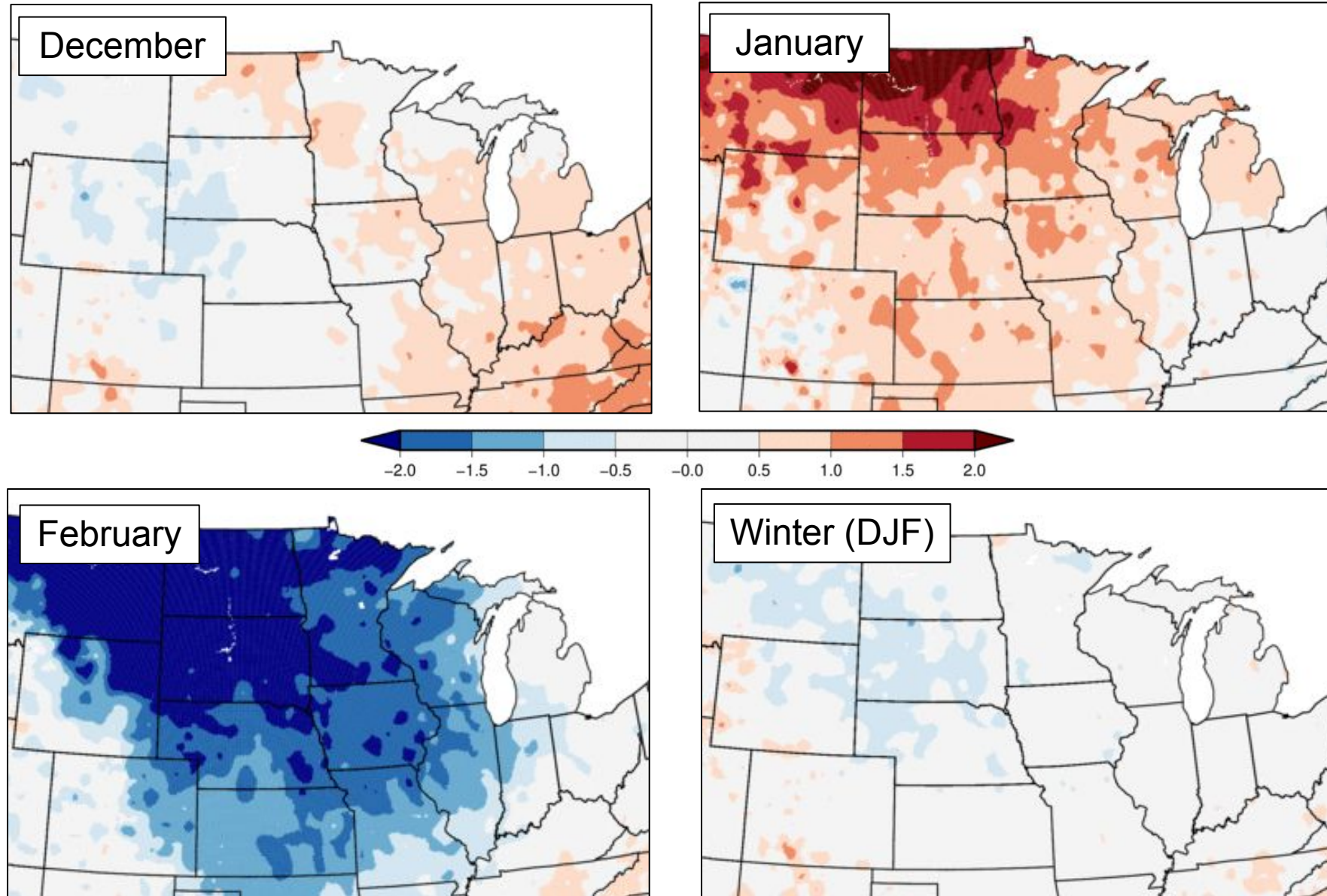
La Niña + Positive NAO

ENSO/NAO Category	New OHV Description	New TNV Description	Detailed
Neg/Neg	slightly wetter and snowier	slightly wetter and snowier	Slightly more precip in OHV and TNV, snowier, temps variable
Neutral/Neg	drier, slightly snowier, colder	drier, slightly snowier, colder	Slightly less precip in OHV and even less in TNV, both slightly snowier, colder
Pos/Neg	drier, slightly snowier in E, cooler	drier, slightly snowier in E, colder	Overall drier, slightly snowier more so in E OHV and TNV, slightly colder OHV and cooler TNV
Neg/Pos	wetter, much less snowy, much warmer	wetter, much less snowy, much warmer	Overall wetter, much less snow, much warmer
Neutral/Pos	slightly wetter, less snowy, slightly warmer	wetter, much less snowy, much warmer	Slightly more wet OHV and very wet TNV, less snow in OHV and much less in TNV, slightly warmer OHV and warmer TNV
Pos/Pos	slightly wetter, slightly snowier E and slightly less snow W, slightly warmer	slightly drier, slightly snowier E and slightly less snow W, slightly warmer	Slightly wetter OHV and slightly drier TNV, slightly snowier W OHV and TNV and less snowy E OHV and TNV, slightly warmer

A local study investigated the combined effects of La Niña with phases of the North Atlantic Oscillation (NAO), outlined in the red boxes. The NAO is a pattern of pressure and wind over the north Atlantic, as shown in the figure above. Its phase (positive or negative) is generally only forecastable 2-4 weeks in advance.



Average Temperature Trends 1991-2020



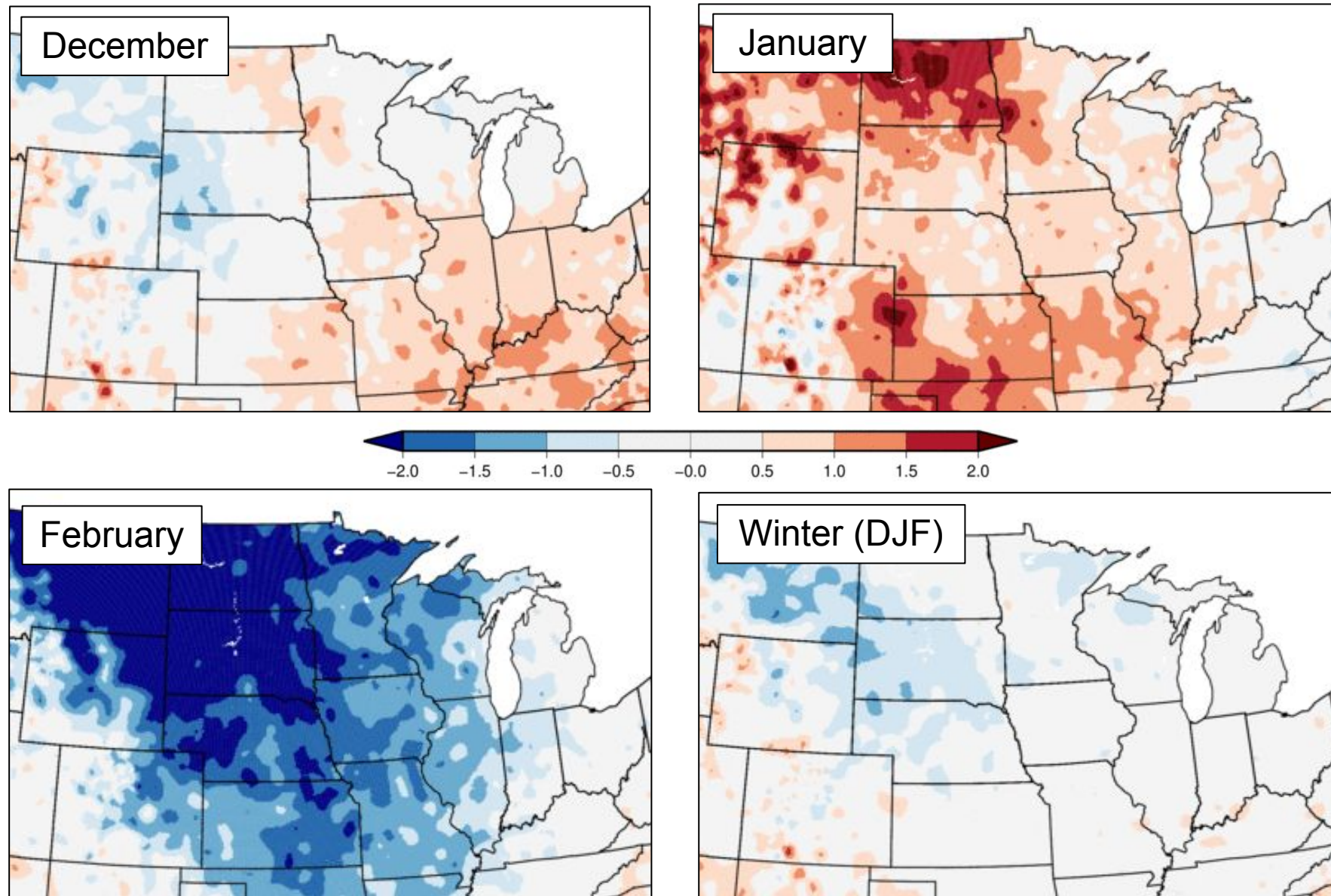
Key Points

- **December** has been trending slightly warmer east of the Mississippi River & slightly colder from Wyoming into western Nebraska & western South Dakota.
- **January** is warmer across much of Central Region. Strongest warming in the Northern Plains.
- **February** swings the other way, showing appreciable cooling, especially in the Northern Plains.
- There has been a slight cooling during **meteorological winter** (DJF) in the Northern & Central Plains. Elsewhere little change.

Data Source: 5km Gridded Dataset (nClimGrid)
National Centers for Environmental Information



Maximum Temperature Trends 1991-2020



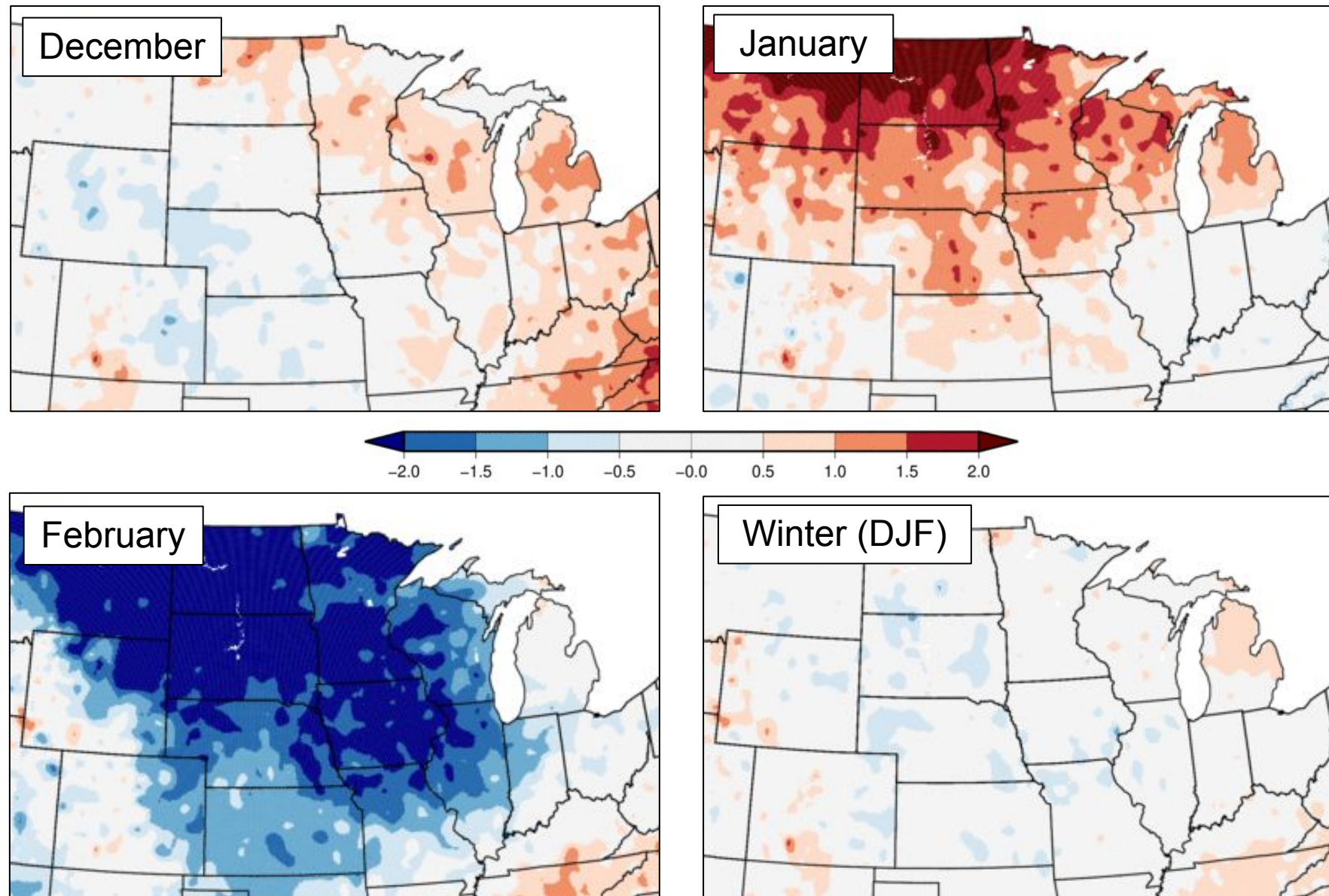
Key Points

- **December** has been trending slightly warmer east of the Mississippi River & slightly colder from Wyoming into western Nebraska & western South Dakota.
- **January** is warmer across much of Central Region. Strongest warming in the Northern Plains.
- **February** swings the other way, showing colder across Central Region. Strongest cooling in the Northern Plains.
- There has been a slight cooling during **meteorological winter** (DJF) from Wyoming into Upper Michigan.

Data Source: 5km Gridded Dataset (nClimGrid)
National Centers for Environmental Information



Minimum Temperature Trends 1991-2020



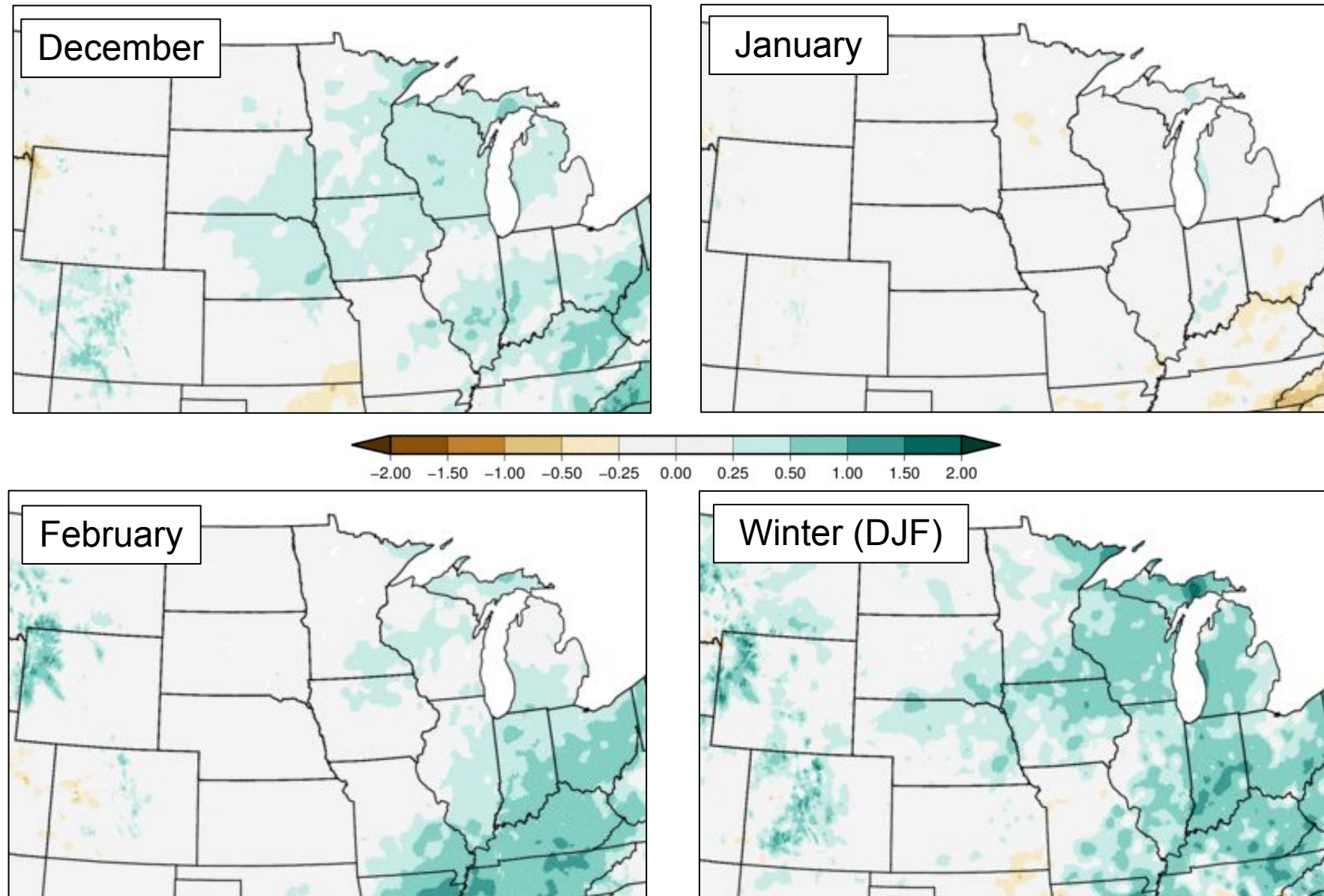
Key Points

- **December** has been trending slightly warmer from the Northern Plains southeast into Kentucky. Slight cooling from Wyoming into Kansas.
- **January** is warmer across much of Central Region. Strongest warming in the Northern Plains.
- **February** swings the other way, showing colder across Central Region. Strongest cooling in the Northern Plains.
- **Meteorological winter (DJF)** there has been generally little change.

Data Source: 5km Gridded Dataset (nClimGrid)
National Centers for Environmental Information



Precipitation Trends 1991-2020



Key Points

- **December** shows a trend toward increasing precipitation across much of Central Region.
- **January** has been essentially unchanged.
- **February** shows an increase in precipitation from southeast Missouri northeast into Michigan, & across western Wyoming.
- The **meteorological winter** (DJF) shows an increase in precipitation across much of Central Region.

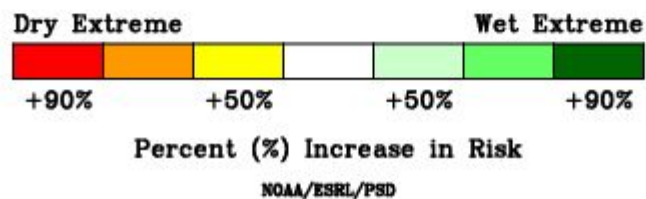
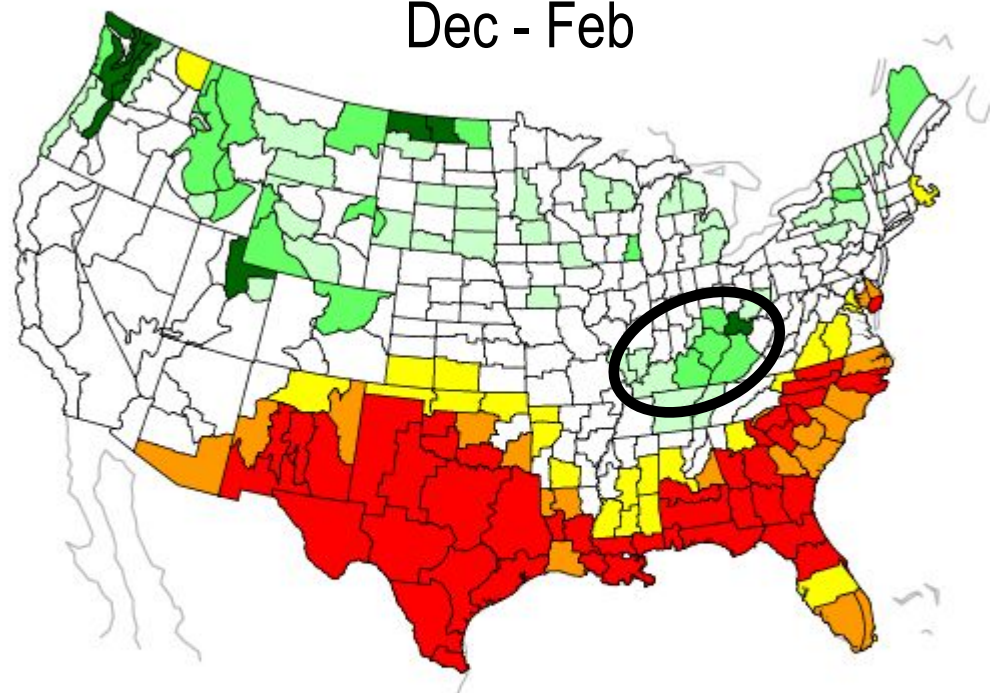
Data Source: 5km Gridded Dataset (nClimGrid)
National Centers for Environmental Information



Increased Risk of Wet Extremes Dec – Mar in the Ohio Valley During La Niña

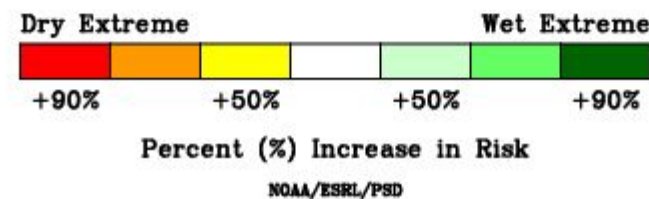
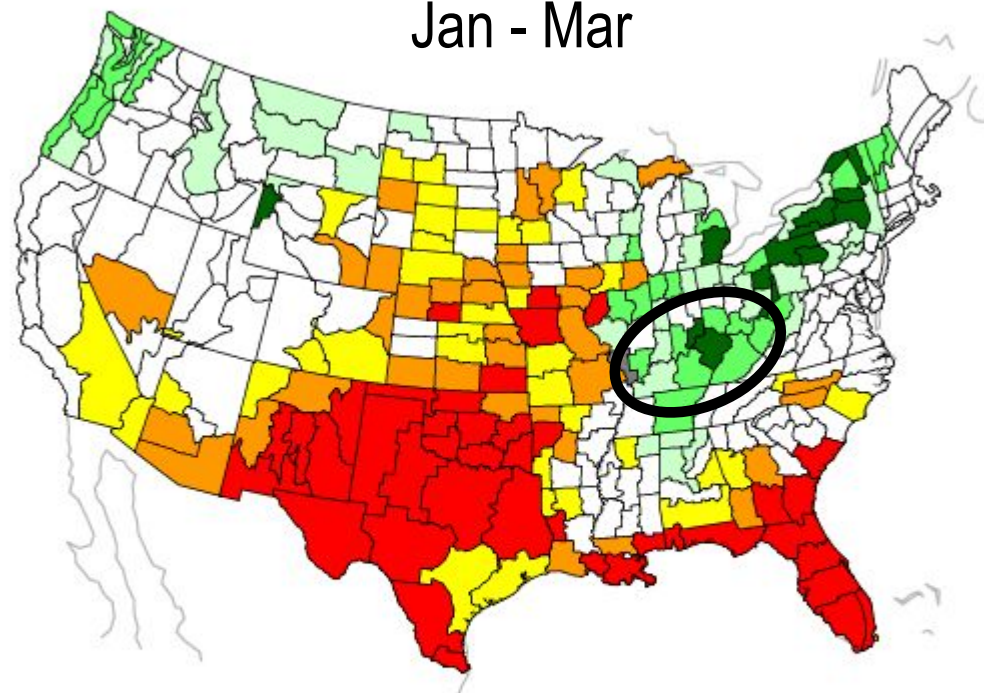
DJF Precipitation During La Nina
Increased Risk of Wet or Dry Extremes

Dec - Feb



JFM Precipitation During La Nina
Increased Risk of Wet or Dry Extremes

Jan - Mar





Composites of Past Weak, Moderate, and Strong La Niñas

La Niña

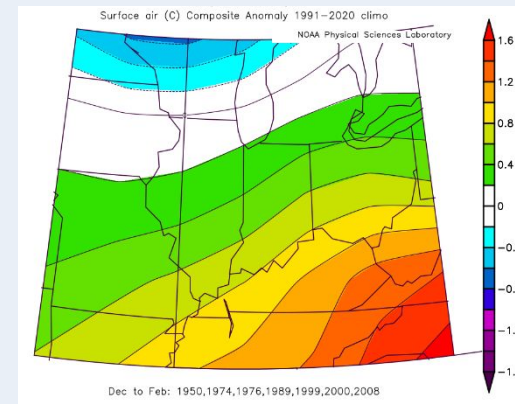
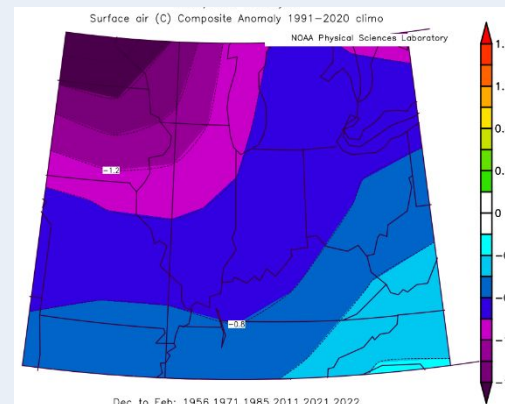
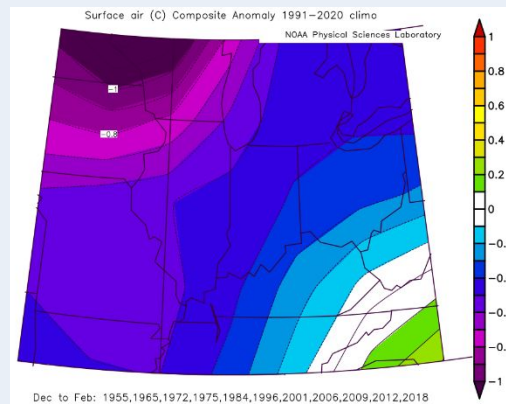
Weak

Moderate

Strong

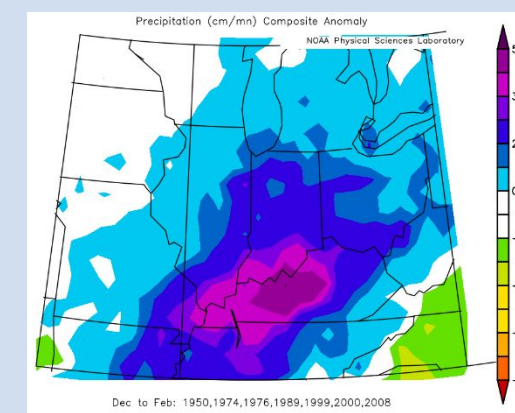
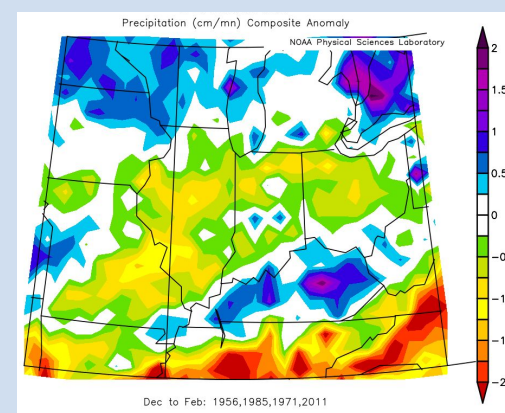
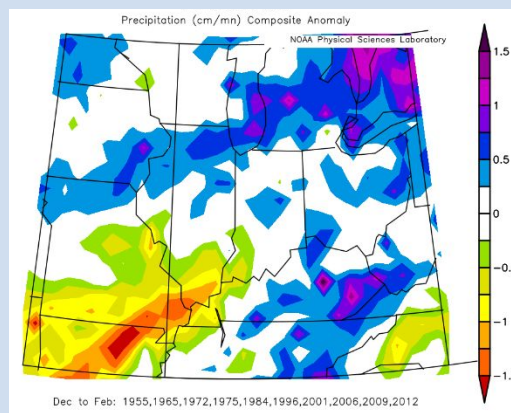
Temperature

Below normal temperatures have been typical for weak and moderate La Niñas, with above normal temperatures for strong La Niñas.



Precipitation

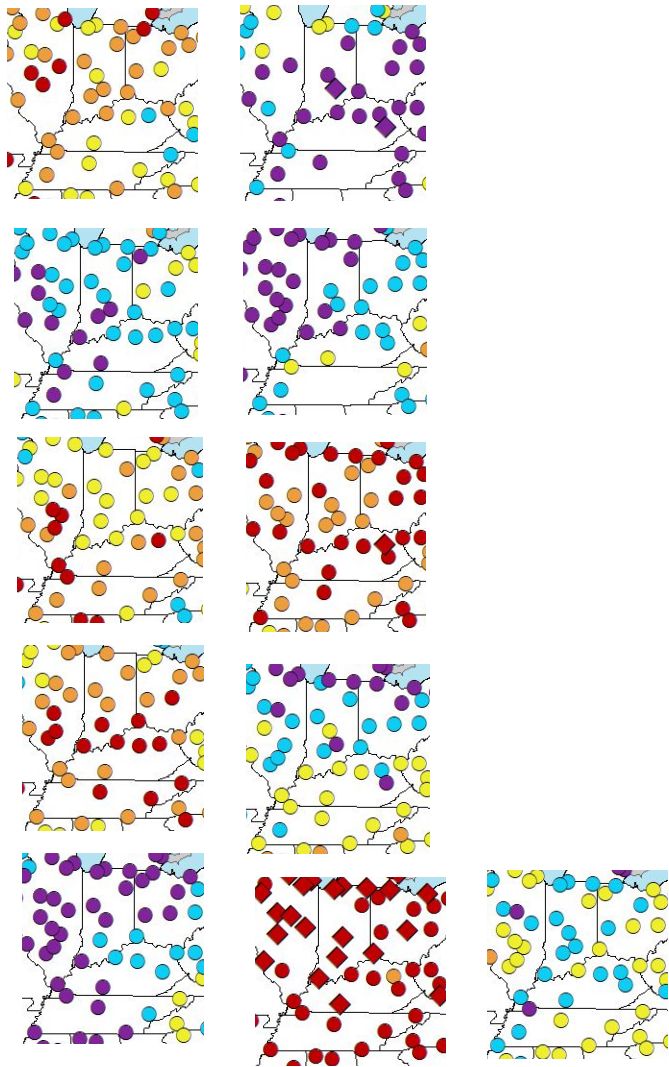
La Niña favors wetter than normal conditions, especially during strong La Niñas.



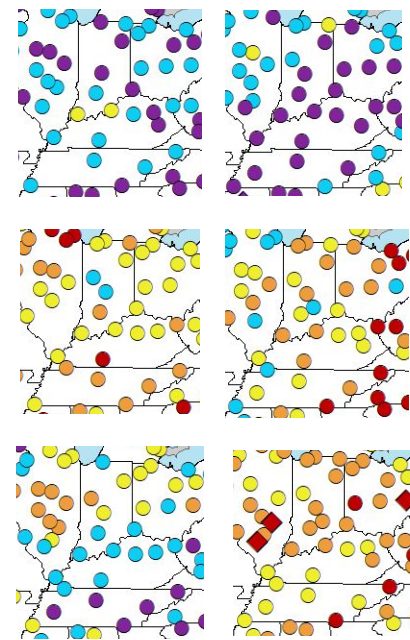


La Niña and Winter Severity

Past Winters during Weak La Niña



Past Winters During Moderate La Niña



These maps illustrate winter severity at select locations in the Ohio Valley. Winter severity is measured using temperature, snowfall, and snow depth. The wide variety of winters shown in these maps, from extreme to mild, indicate that weak and moderate La Niñas have had no correlation to the *overall severity* of the winter. This is likely a result of La Niña having little correlation to our wintertime temperatures, and only a slight correlation with snowfall.



Thoughts About the Upcoming Winter in the Ohio Valley

- The Climate Prediction Center relies heavily on El Niño and La Niña (ENSO) because ENSO is well understood and can be forecast well in advance.
- However, the effects of La Niña on the Ohio Valley are weak, especially with respect to temperature and snowfall. That is why other atmospheric patterns are so important to the forecast. With La Niña there is a slightly more robust relationship with precipitation (rain + snow), showing a tendency for wetter than normal conditions for December through February as a whole during La Niña.
- At this time, it appears that warm conditions may continue into the first half of November before turning colder late November into December.
- Confidence is higher for early November temperatures, lower for late November into December.
- January and February may lean warm and wet, with an increased risk of late winter and early spring flooding.

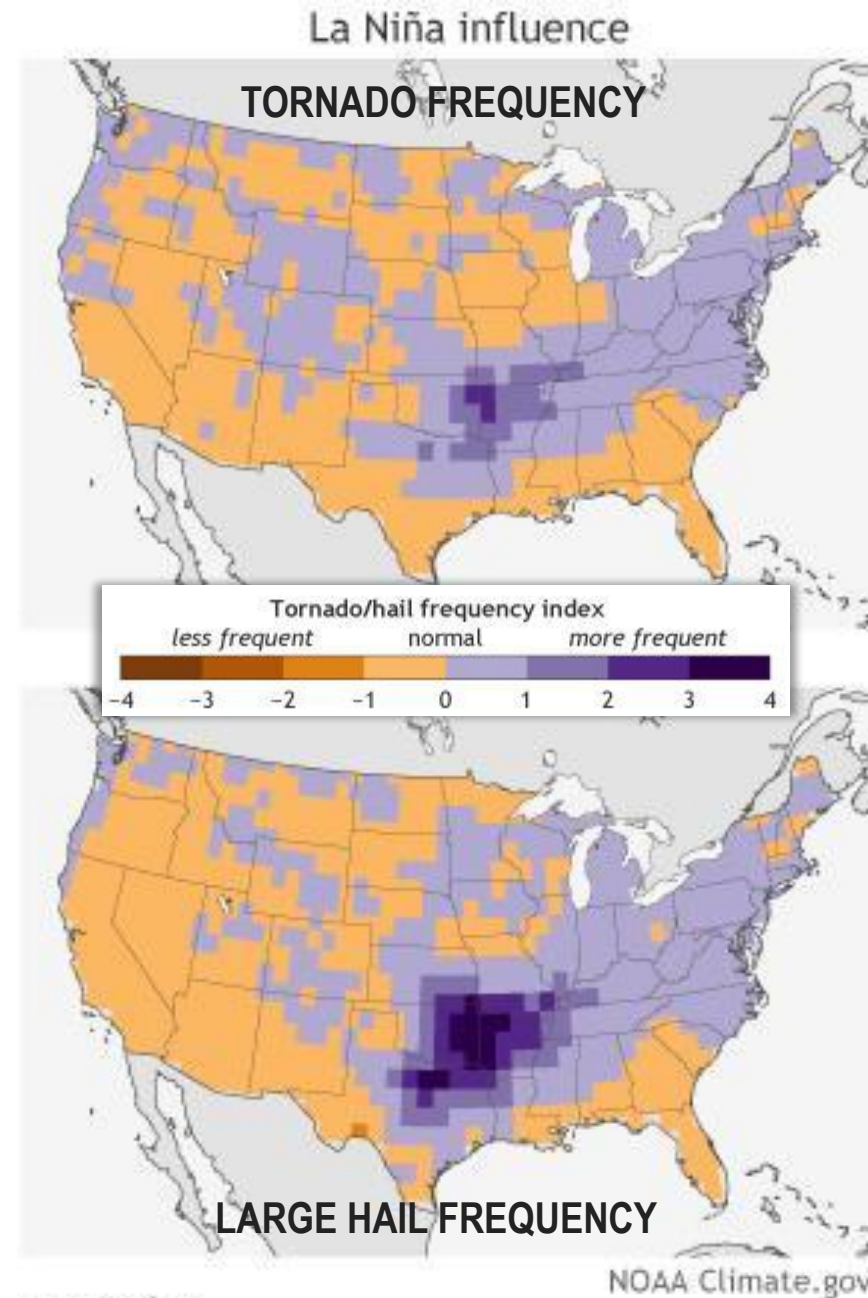
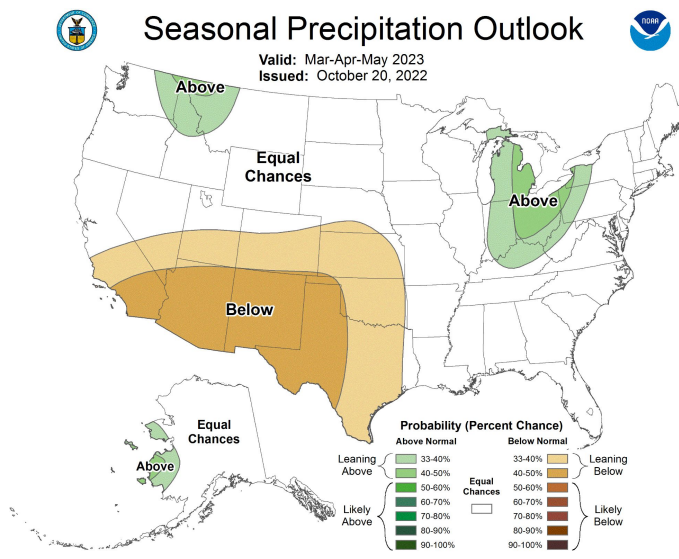
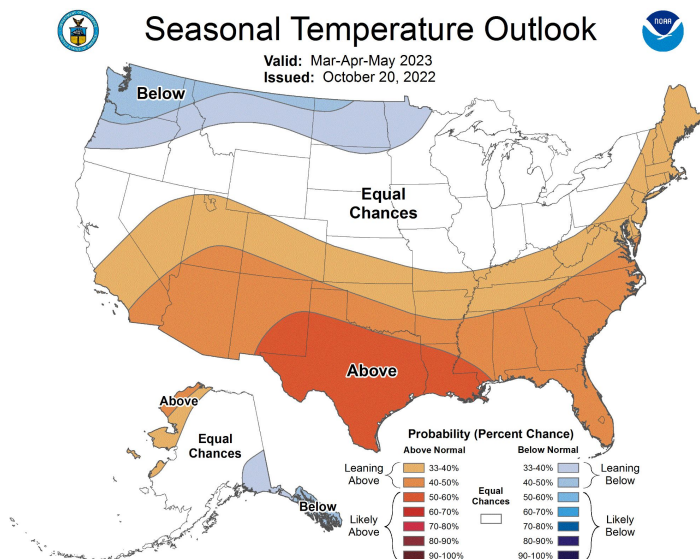


Severe Spring?

The maps on the right show tornado and hail frequencies for the spring months (March-May) following La Niña. Purple favors higher storm event frequency, brown favors lower storm event frequency. Specifics vary, but in general, springtime tornadoes and hailstorms are more frequent during La Niña from the southern Plains through the Ozarks to the lower Ohio Valley.

There are no guarantees, however. For example, Winter 2020-21 was a La Niña winter but we did not have a particularly active severe weather season in spring 2021 in southern Indiana or central Kentucky.

Spring Outlook

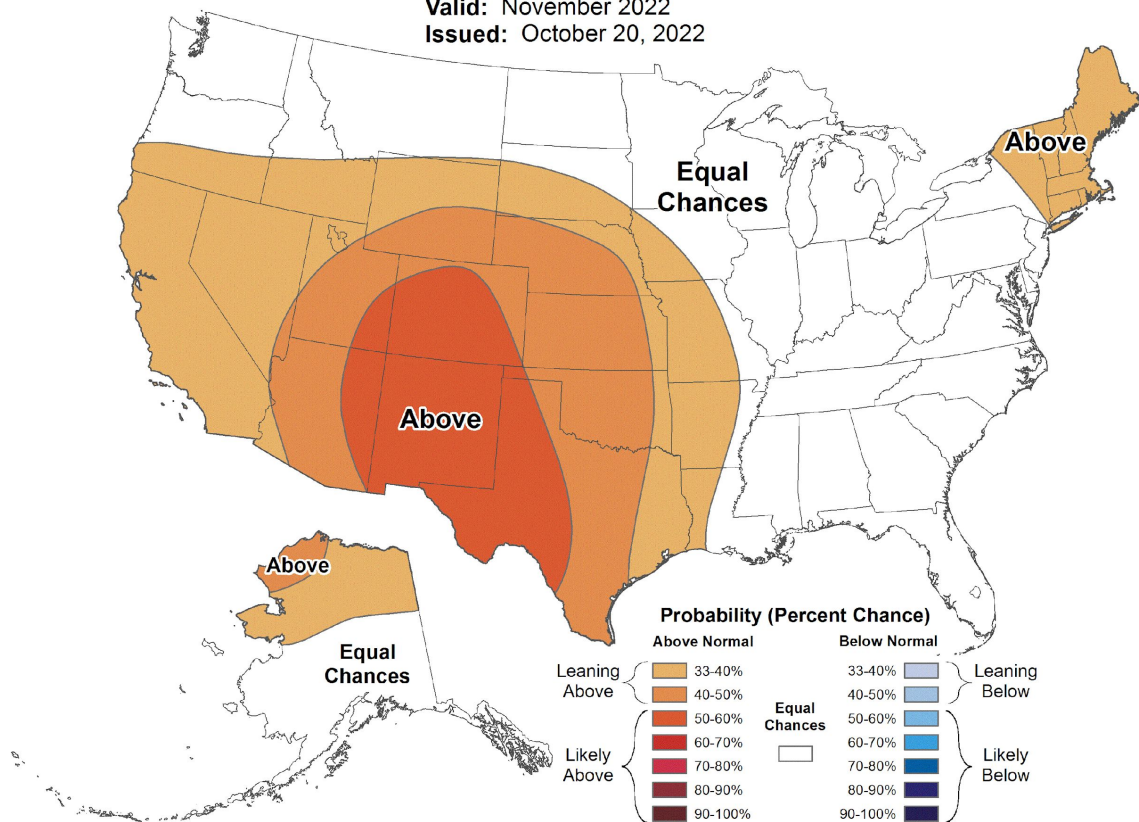


Climate Prediction Center November Outlook



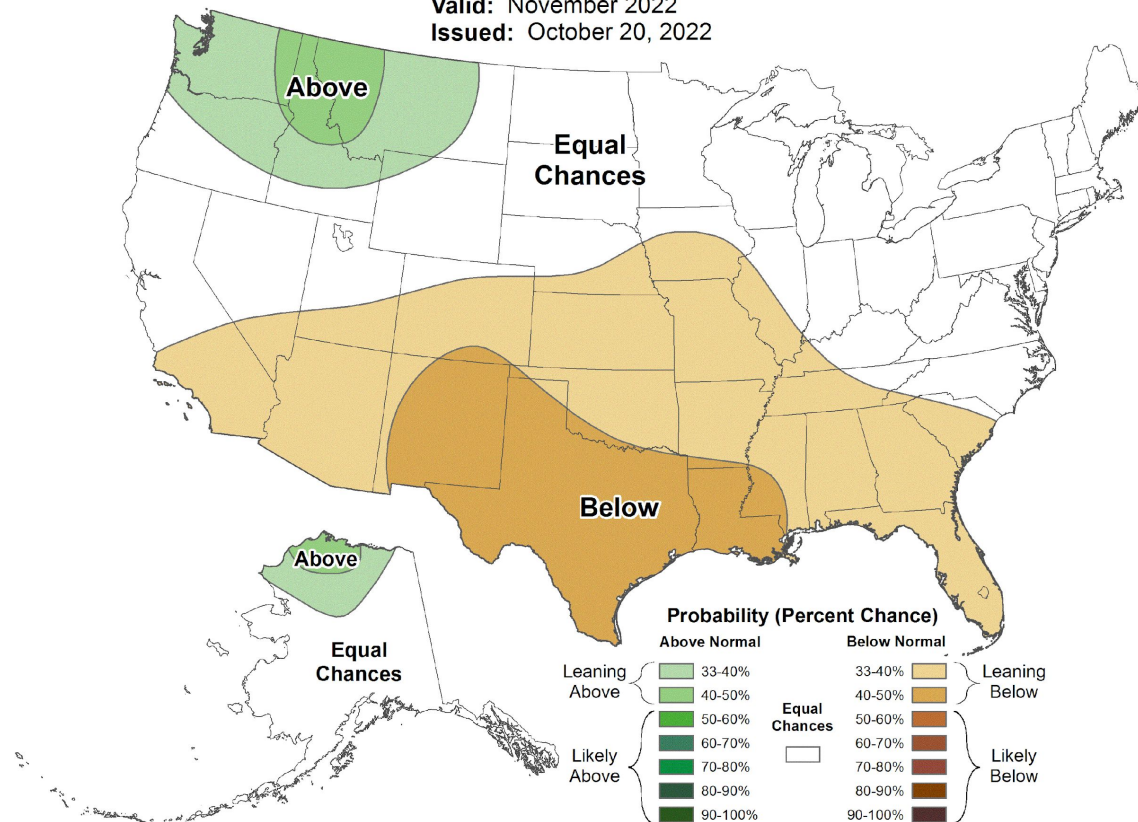
Monthly Temperature Outlook

Valid: November 2022
Issued: October 20, 2022



Monthly Precipitation Outlook

Valid: November 2022
Issued: October 20, 2022

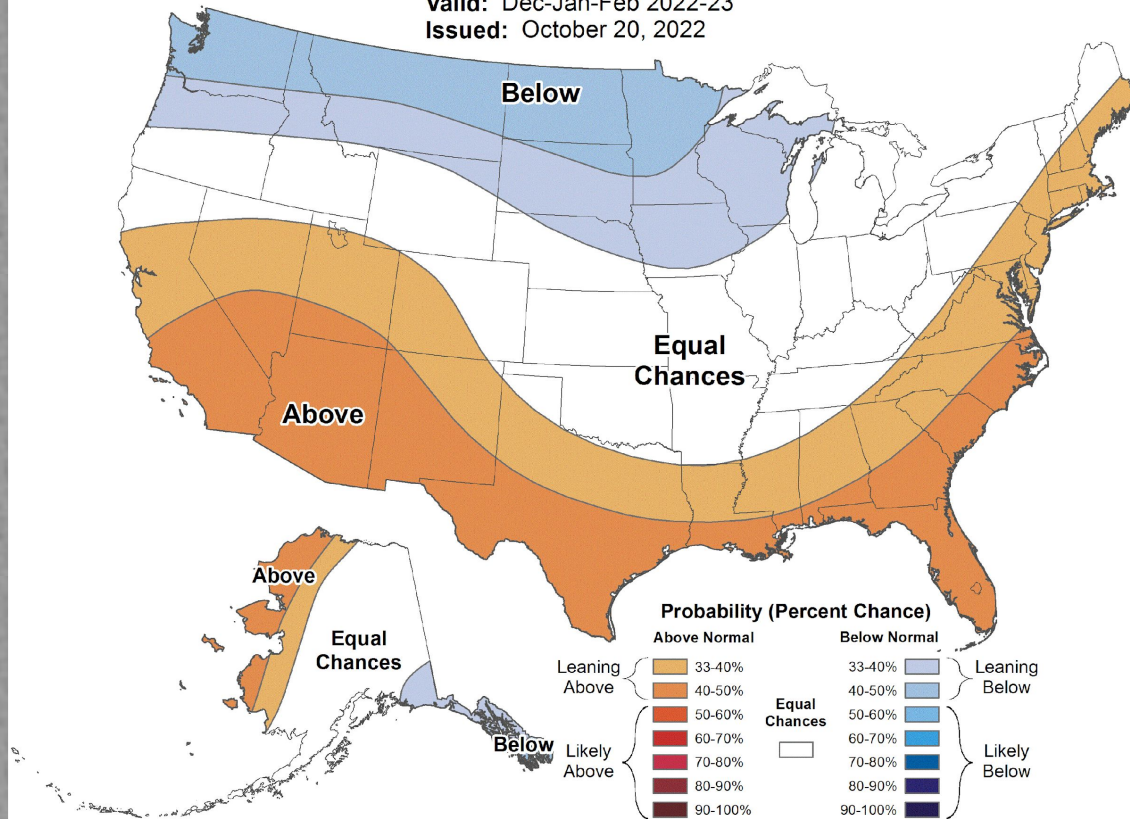


Images courtesy of the Climate Prediction Center (CPC)



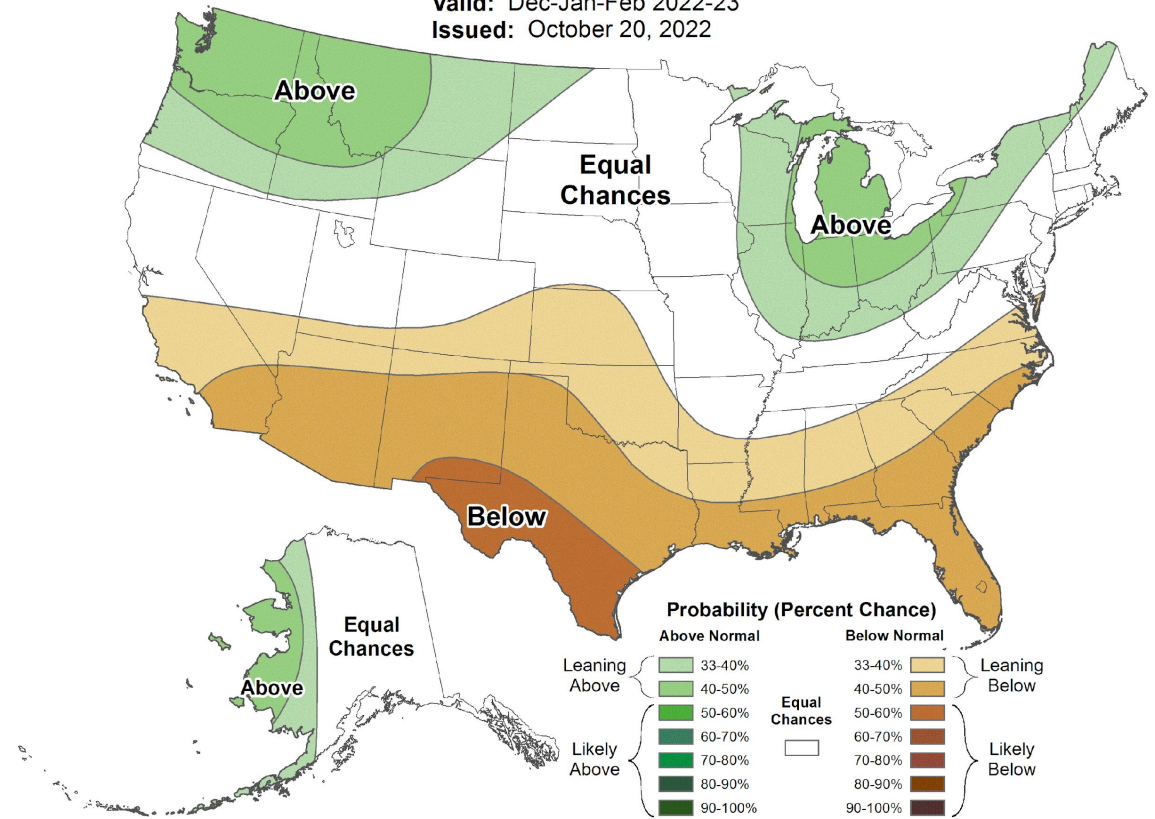
Seasonal Temperature Outlook

Valid: Dec-Jan-Feb 2022-23
Issued: October 20, 2022



Seasonal Precipitation Outlook

Valid: Dec-Jan-Feb 2022-23
Issued: October 20, 2022



Images courtesy of the Climate Prediction Center (CPC)



Summary

What's Currently Expected

- La Niña is expected to impact the 2022-23 Meteorological Winter (December 1-February 28).
- Enhanced chances for **above-normal** temperatures across southern United States & East Coast.
- Enhanced chances for **below-normal** temperatures from the Pacific Northwest into the western Great Lakes.
- Enhanced chances for **wetter-than-normal** conditions from the Great Lakes region into New England, and from the Pacific Northwest into western North Dakota.
- Enhanced chances for **drier-than-normal** conditions across the southern United States.

What's Uncertain

- On shorter time scales, other—less predictable—climate patterns can cancel out or amplify the typical influence of La Niña.
- Strong Arctic Oscillation episodes typically last a few weeks and are difficult to predict more than 1 to 2 weeks in advance.
- The mean storm track in the northern US will likely be more active than normal. This will result in more frequent, changeable weather. However, any more additional detail on specific storms and storm characteristics is beyond our ability to discern.

The next CPC Winter Outlook will be issued on Thursday, November 17.

Questions / Comments?

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