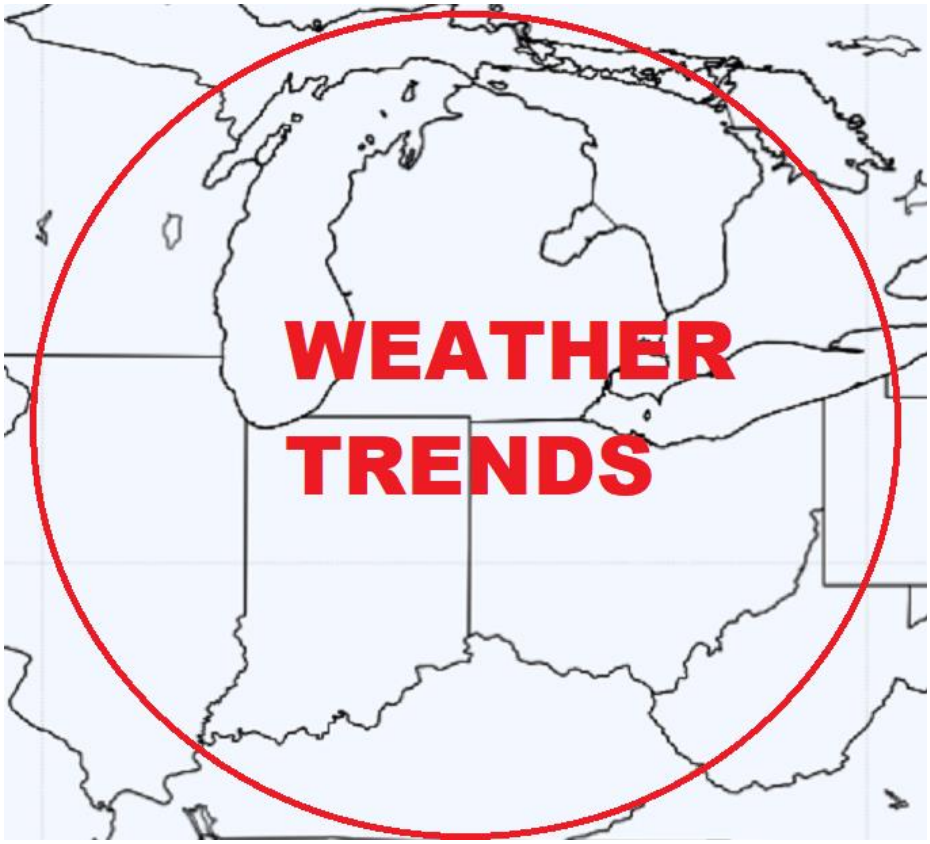
WINTER OUTLOOK

FAX-ALERT WEATHER SERVICE

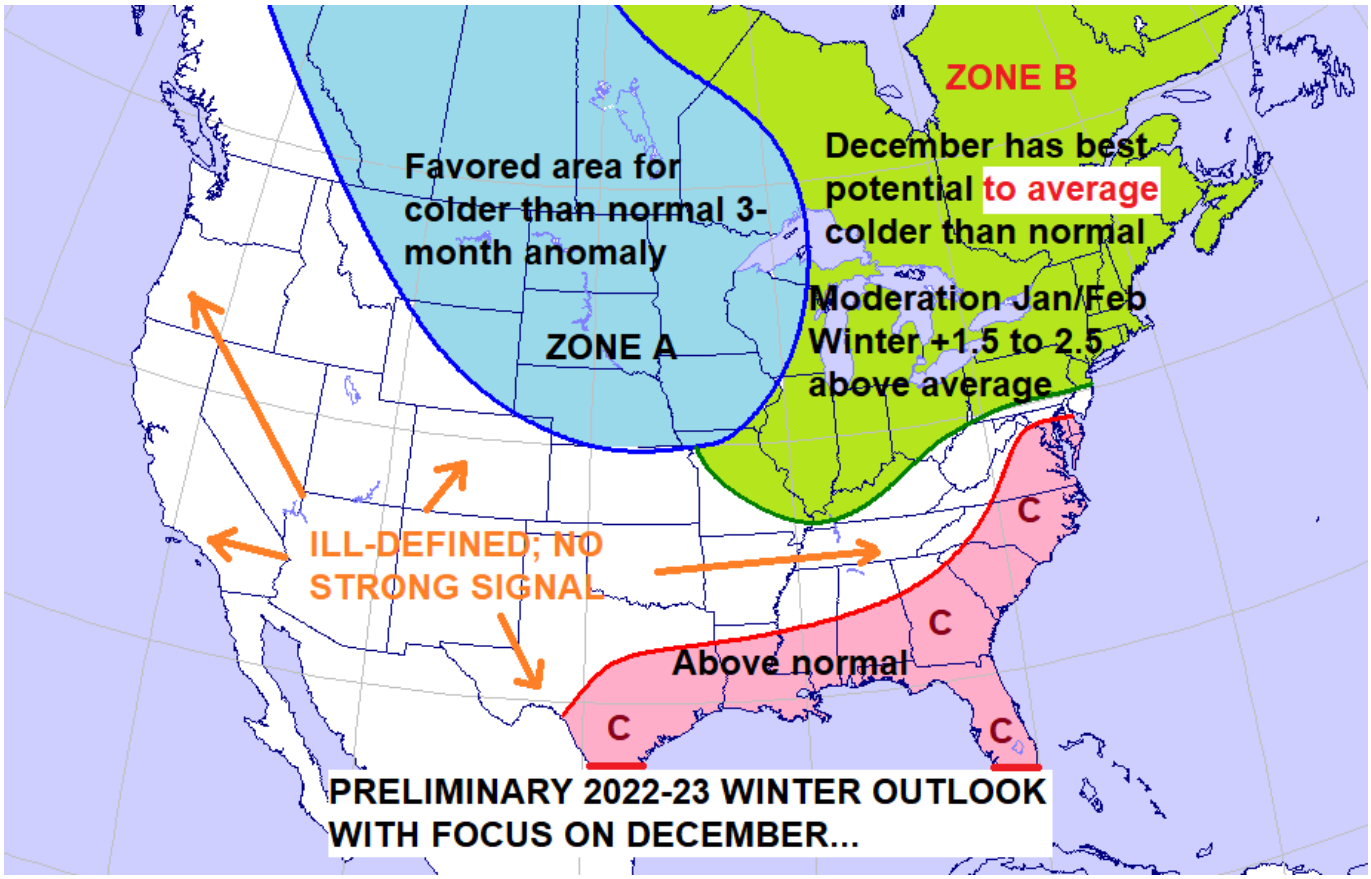


WINTER 2022-23 FIRST CALL

OHIO, MICHIGAN AND INDIANA

Issued: Thursday, September 22, 2022

3rd Year LA NINA IN PLAY!



General Overview:

I will get into the weeds a bit deeper later on in this discussion, but first just a couple general comments. This will be the 3rd consecutive winter season will a La Nina signature in place across the equatorial Pacific. It appears there have only been 3 other similar scenarios to this Pacific signal; 1956-57, 1975-76 and 2000-01.

While these 3 analog years will be used as a baseline, ongoing climate change factors mean it is unlikely the 2022-23 winter season will mimic these analogs perfectly, but they should offer some guidance.

It will also be noted that given we are still dealing with a La Nina, many of the statements and graphics I have used in the past 2 winter season outlooks will be posted again.

We are still very early in the winter season forecasting game so it is critical to understand this is a very preliminary outlook. I suspect we will need to adjust and modify this discussion, maybe significantly, as we move through October and early November.

But it will highlight the core conclusions of the upcoming 2022-23 winter season given some early season modeling trends; especially as it relates to the December period.

First, let me give a quick overview of my "first call" map above and then follow that with an analysis of the factors that are likely to drive the pattern.

ZONE BREAKDOWN

Zone A: Many, not all, La Nina winters try to manufacture a solidly colder than normal zone from the Northern Rockies on south and east across the central and Northern Plains into portions of the western and northern sections of the Midwest and western Great Lakes. This zone lies just to the west of the OH/IN/MI area and only a slight shift int the large-scale pattern could have significant impacts on the Midwest area.

I see no reason not to look at ZONE A, as the zone most likely, or having the historically greatest chance, of seeing a colder than normal winter season (3-month average).

As I have stated many times in the past, La Nina winters usually produce significant temperature anomaly shifts from month to month. I would expect ZONE A to see a 1-month period that is sufficiently colder than normal to skew the winter average to the cold side of normal; even if there is significant moderation during the other winter months. As to which month or which period that might be, I will leave that discussion for later. The bottom line is that the area from the Northern Rockies on south and east across the central and northern portions of the Plains and western areas of the Midwest / Great Lakes is where I suspect the overall best cold potential exist.

Zone B: Once into the central portions of the Midwest and Great Lakes on eastward on across the Ohio Valley, northern Middle Atlantic region, NY and New England, I think the 2022-23 winter season will be quite variable, as competing forces of the La Nina battle it out. In the past you have heard me talk about the cold versus the warm mode of La Nina winters, as well as the inherent instability of La Nina winters. I will also get into those discussions in the analysis section of the discussion.

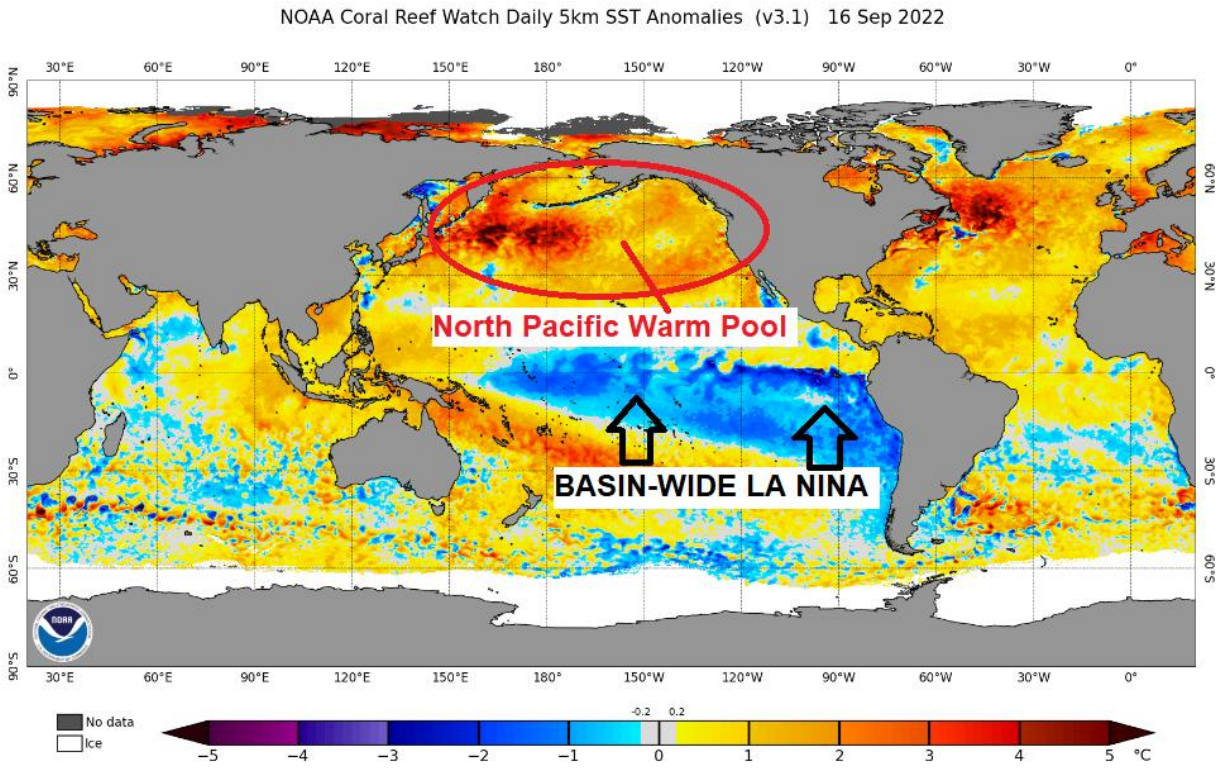
While my current take is to keep the 3-month winter average across Zone B, which includes the vast majority of the Northeast, in the +1.5 to +2.5, how we get there is a complex issue. Almost all La Nina winters feature a significantly colder than normal period. And I expect one such period this winter. Right now, there is multi-model support for December 2022 to be the coldest month of the 3-month period (average-wise).

How cold it will be and how quickly the reversal into a normal or solidly warmer than normal pattern evolves once into the new year (Jan. / Feb. 2023) is the tough call. Again, lots to talk about later in the discussion, but for now, given that it is still September, I think the main point is that right now there are multiple signals at least for a normal, if not significantly colder than normal December; followed by some degree of moderation once into the new year.

Zone C: I have chosen to highlight only a fairly small area where there appears high confidence for above normal winter temps. Most La Nina events eventually go on to produce extensive warmer than normal zones. But right now, I am not overly confident where those areas will develop. Central and southern California on eastward across the southern Rockies into the Southern Plains could be a good candidate, but for now, southeastern Texas on along the Gulf coast into Virginia is my call.

ANALYSIS / CAVEATS AND WHAT IF'S

A. Here is a recent image of the sea-surface temperature anomalies. The La Nina signature is about as solid, as I have ever seen; stretching from the west coast of South America westward to almost 150-East. For intents and purposes, we are dealing with a BASIN-WIDE event. There had been some thought late last spring that we would be transitioning into either a fading, weak La Nina or a weak El Nino (warm equatorial Pacific). But that is not the case! This is just another example of the uncertainty we have when trying to make long range predictions about the state of the ocean or atmosphere.



I don't think any of the so-called experts were thinking a strong, basin-wide La Nina would be in place this fall on into the early winter. We are likely going to see some steady weakening of the La Nina as we progress through the winter season. How could we not! The cold anomalies associated with the La Nina are about as cold as they get on a widespread basis. There is nowhere to go but up!

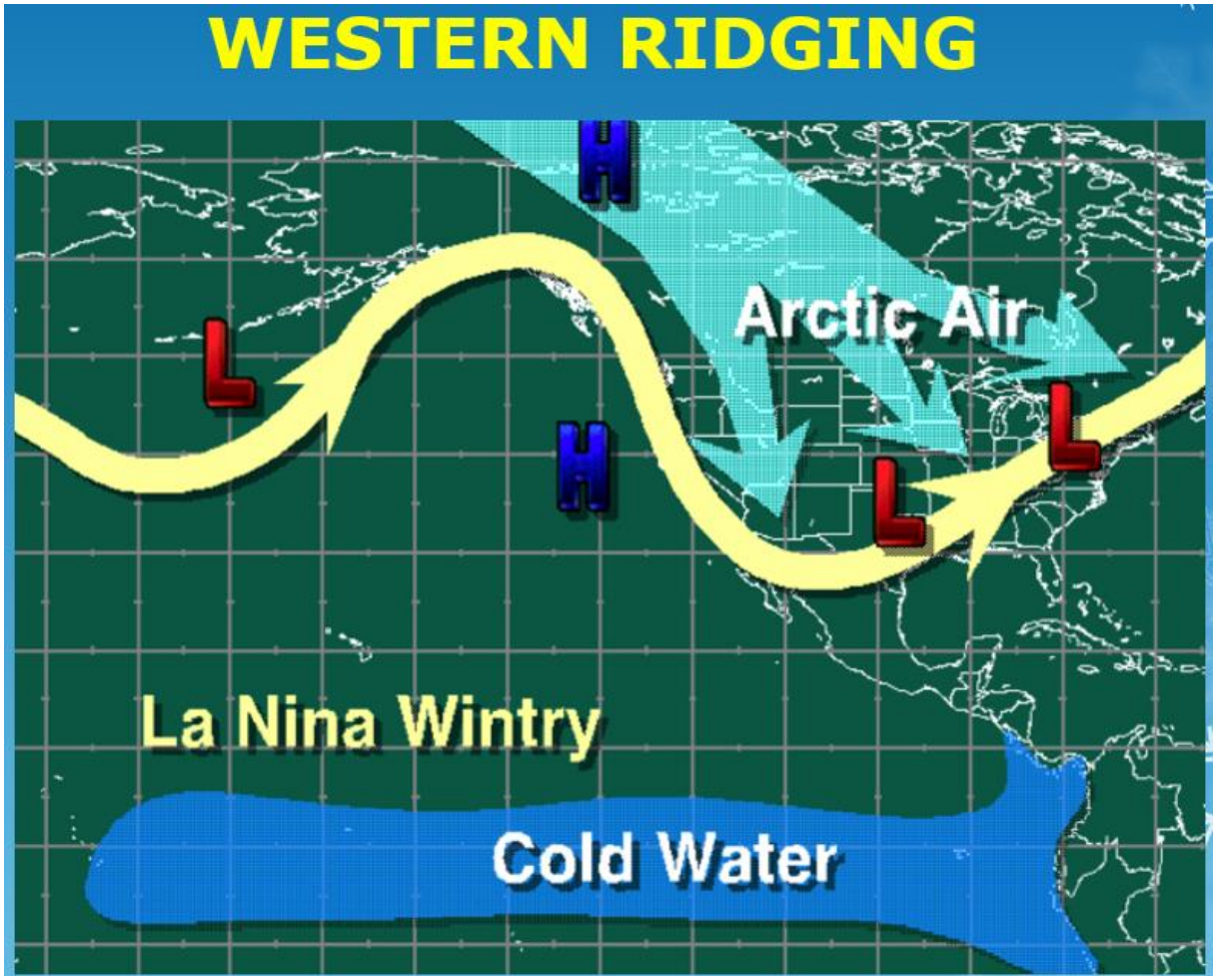
- Once again, we are noting the extensive warm anomalies across the North Pacific. Many times, in the past, I have chatted about the connection these warm anomalies have to persistent western upper-level ridge. I have always viewed the warm anomalies favorably in terms of cold air delivery into the U.S. But in the recent past they have failed me and have not lived up to the billing or my expectations.

- I like seeing the warm anomalies across the North Pacific, but I am no longer viewing them as a strong signal or lock that they ensure frequent cold air delivery into the U.S. I don't think they hurt and I'm glad to see them, but it has become obvious they are not the

“be all, end all” to cold winters. Also, just because they are present in September, does not guarantee they will be around come January.

B. One of the most important keys to a La Nina winter is the position and strength of the eastern Pacific / western Canadian upper-level ridge. When it is close to the western Canadian coastline or even a bit inland, it opens the door to direct discharges of arctic air into the north-central U.S. What follows is a repeat of what I have harped about for the past 2 winters…

See below…



- How far northward into the polar regions that ridge extends will greatly impact the intensity of the intensity of arctic intrusions.

- If the pattern favoring far eastern Pacific upper-level ridging is a frequent occurrence, it can change the entire tenor of the winter season since arctic intrusions would become common place. Moving forward into early December, one of the keys will be charting the frequency of the eastern Pacific / western Canadian ridge setup.

C. When the eastern Pacific pattern favors upper-level troughing the outcome reverses!

- If upper-level troughing exists across eastern Pacific, or if the Pacific pattern goes flat (zonal), the pattern across the country tends to feature widespread milder than normal conditions.

- The presence of an eastern Pacific trough allows Pacific air streams to dominate North American pattern.

- This essentially shuts off the arctic intrusions and allows Pacific based air masses to control the temperature pattern across the Lower-48.

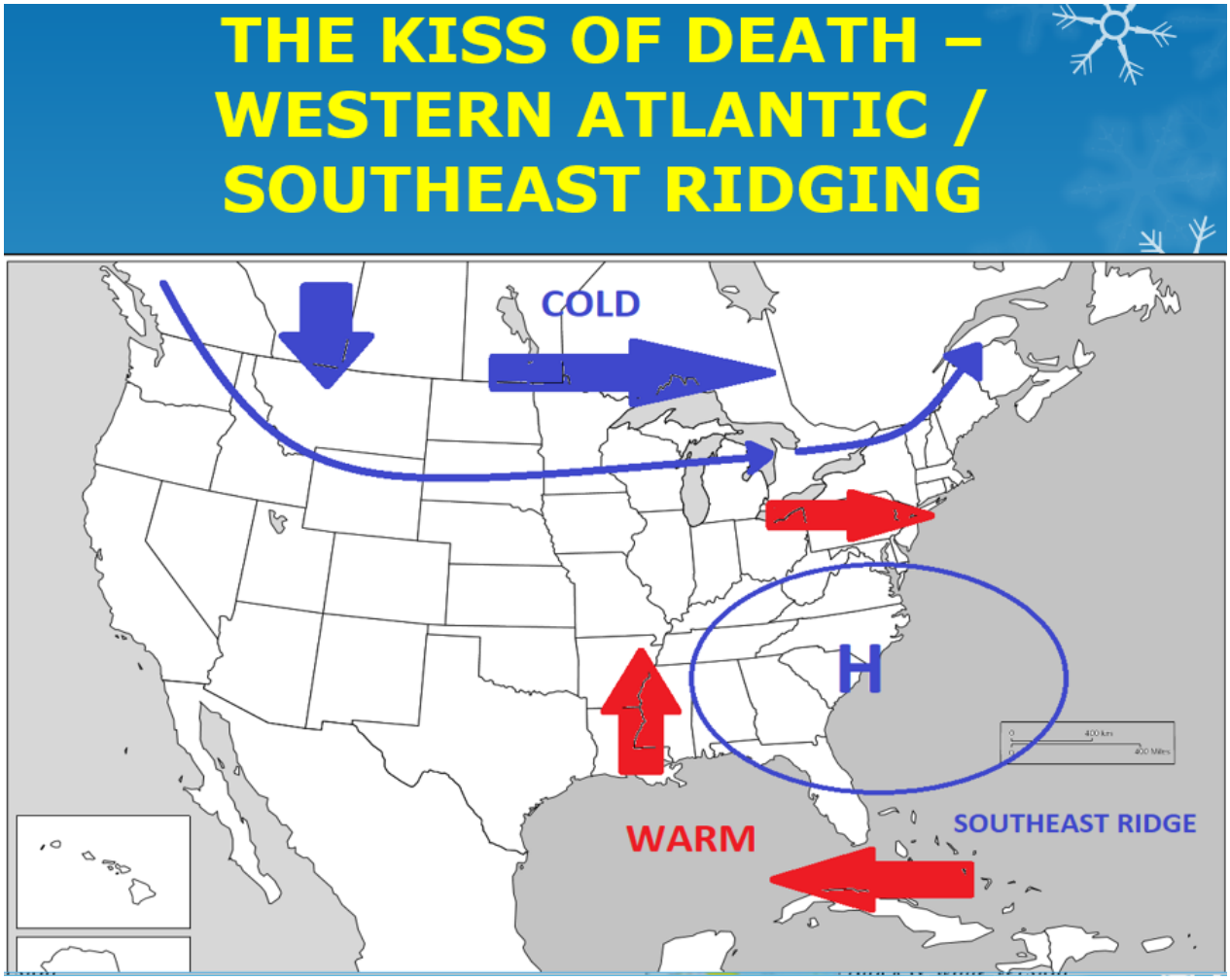
Most La Nina winters feature alternating periods of eastern Pacific ridging and troughing.

If upper-level ridging periods are more frequent than troughing periods, the potential for the winter to feature more widespread and persistent cold conditions increases.

But, if upper level troughing (across the eastern Pacific) is the favored mode, milder conditions will have the upper hand.

D. Southeast Ridging… A major factor in how effectively cold air can spread eastward across the northern tier and central portions of the U.S. during a La Nina winter has to do with the strengthen, position and frequency of the Southeast Ridge.

If you want extended cold periods across the eastern and northeastern sectors of the country during the winter season, a strong Southeast / West Atlantic ridge is usually the "Kiss of Death".



- A strong Southeast ridge effectively blocks cold air masses from moving east and southeastward out of the Northern Rockies and Northern Plains, and forces them on a more east/northeasterly heading across southern Canada. This tends to prevent extended colder than normal periods from becoming established across most of the eastern U.S., including part of the Midwest & Ohio Valley regions.

- If the ridge stays just far enough offshore, arctic intrusions during the upper-level ridge cold mode of the La Nina winter can get into portions much of the Midwest & Great Lakes, including OH/IN/MI areas.

- La Nina winters have historically produced periods of Southeast ridging so there is always a risk of extended milder than normal periods. But small shifts in the intensity and location of the Southeast ridge can allow for portions of the Northeast and Upper Midwest to stay close to normal or even somewhat colder than normal.

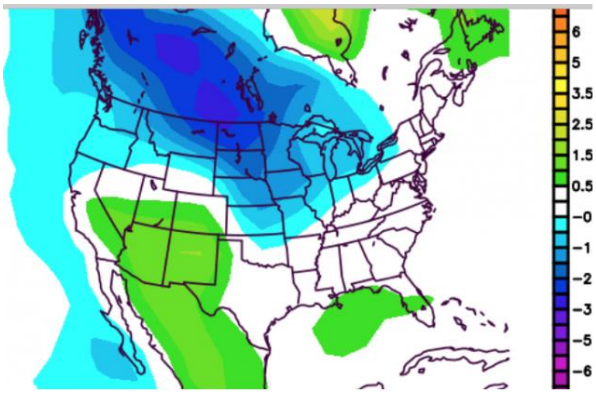
- But there is no denying the warming role a Southeast ridge can play during a La Nina winter.

E: High Latitude Blocking: Whether or not the high latitude jet stream flow becomes blocky (well defined, closed upper-level troughs and/or ridges), or features a steady, fast-moving west to east flow is a critical question.

High latitude blocking is usually favorable for arctic intrusions into the mid-latitudes. Fast west to east flows across the high latitudes is not good for blocking and often leads to milder than normal conditions. High latitude blocking is usually very poorly forecasted weeks or months in advance. I do think we will see some periods of blocking, but how long-lasting and how effective it is in maintaining arctic intrusions is unknown.

I will expand upon this further in a bit, but there are early signs of a strong North Atlantic Blocking (-NAO) episode early this winter (late November & December). If that becomes the case, it would be reasonable to favor a cold & early start to the winter across portions of the Midwest and Northeast, including New England.

F. La Nina Analogs… As for a general analog, this basin-wide La Nina composite is a good starting point. Here is the temperature composite.



- Note the general cold air zone mimics what I plotted on my First Call Map…

- It is interesting to note there is a lack of widespread above normal zones across the east. There is a hint of warming along the Gulf coast, which I increased in coverage on my map. The Southwest and southern Rockies are projected as the warmest zone overall, but I have not been as bullish there.

- The cold air bleeding southeastward from western Canada into and across the northern Rockies, Northern Plains into the western Midwest and Great Lakes shows up nicely on

the composite map. This is very typical of La Nina winters. The question then becomes how intense will be cold periods be across these areas? Then the next question is how effective will the cold transport be into the Midwest.

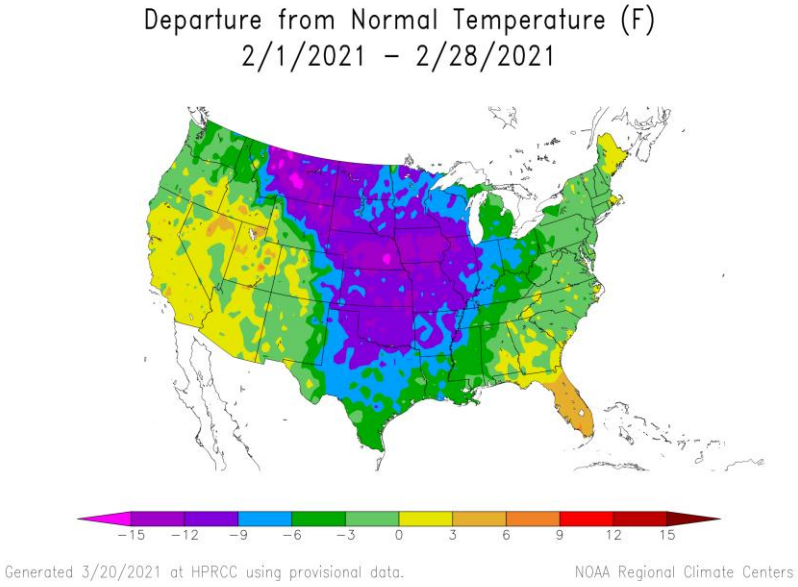
- It must always be remembered that the composite is a snapshot of the 90-day (3-month) average. La Nina patterns, as I have stated many times before, are a tug-of-war between cold and warm periods. It never means a particular region is continually colder than normal, nor warmer than normal. Big month to month reversals, or maybe I should say, big 3-to-4-week reversals are the norm.

G. What can the 2020-21 and 2021-22 La Nina winters tell us?

While both of our past 2 winters featured La Nina events, they took different tracks. Both featured significant cold to warm or warm to cold reversals, and both featured an extended cold period.

- Winter 2020-21 featured a warm December, a transitional January, followed by a very cold February.

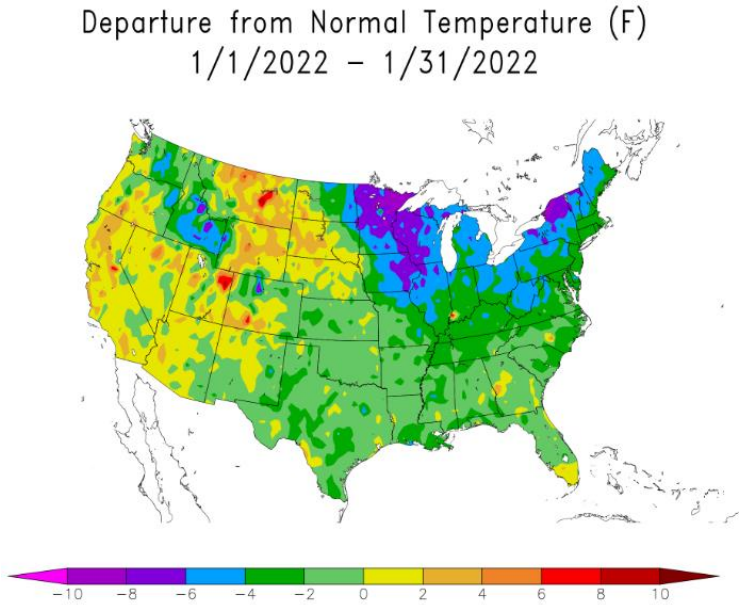
Here is February 2021.



- Note the widespread cold outcome, centered on the central U.S.

- Winter 2021-22 also featured a warm December but January 2022 when on to become the coldest month of the winter season.

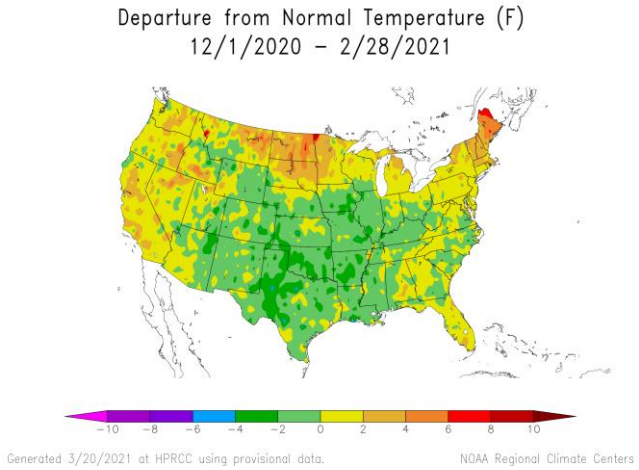
Here is January 2022.



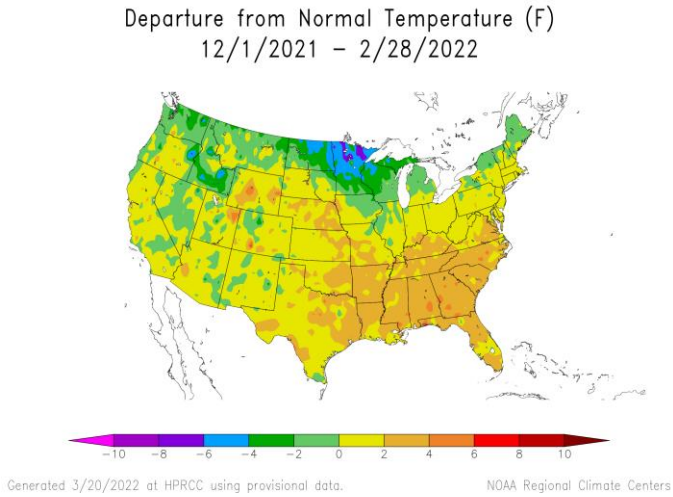
- Once again, we see a large area of colder than normal conditions across the central and eastern U.S. with the core of the cold running from the Northern Plains on into and across the Midwest.

The past 2 winter 3-month averages featured zones of significantly colder than normal conditions, along with some well above normal areas. The 2020-21 winter was warm along the northern tier on into the Northeast, even though a widespread cold to bitter cold February occurred. Meanwhile, the 2021-22 winter saw a decidedly colder than normal 3-month average across the far northern tier of the U.S., with even parts of far northern New England & NY averaging a bit colder than normal.

Here is how the 2020-21 winter averaged out.



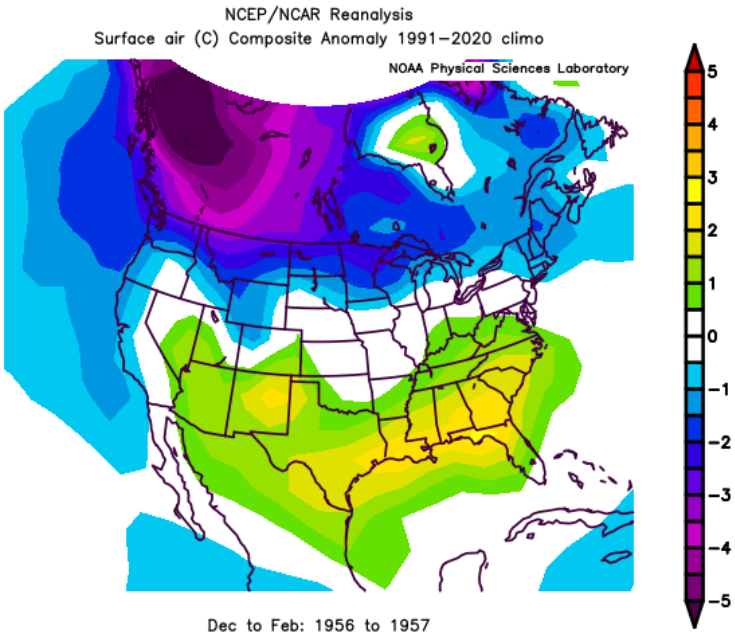
And here is how the 2021-22 winter ended up.



- Once again, on a national scale, the winter season averaged above normal. But parts of far the Northern Plains, northern Great Lakes into Michigan managed to average on the cold side of normal.

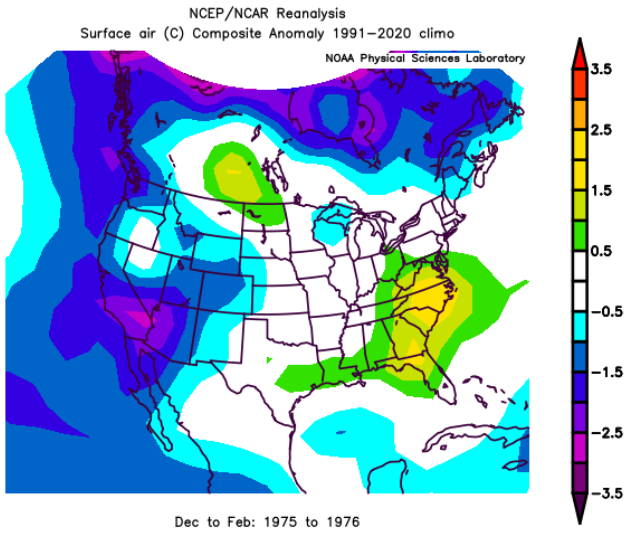
H. Now let's see how other 3rd year La Nina winters events ended up.

Here is the 1956-57 winter.



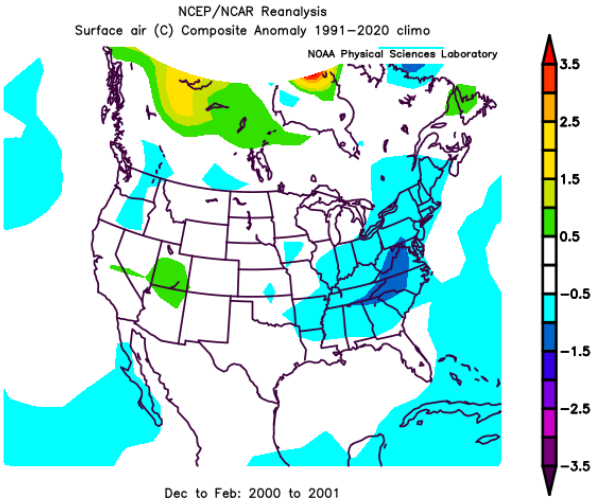
- Very cold across Canada, warm across the southern U.S., and cool/cold across the northern tier. Tons of cold across Canada but Southeast ridging kept it there!

Here is the 1975-76 winter.



- Cold once again bottled up across Canada with the warmth shown across the Southeast likely reflecting a strong or at least frequent Southeast ridge.

Lastly, here is the 2000-01 winter.



- Cold across the Southeast and East suggest the Southeast ridge was not a big player. Canada looks fairly bland, which means poor western ridging.

All 3 analog winters for 3rd year La Nina events featured at least one solid cold period during the January / February period.

I. December Factor?

The more interesting thing about the analog winters, is that 2 out of the 3 featured a solidly colder to much colder than normal December?

- December 1975 was modestly colder than normal, while December 2000 was very cold.

- December 1956 featured normal to slightly warmer than normal conditions.

***** I bring up the December Factor since we have multi-model agreement that December 2022 will feature colder than normal conditions across the Midwest, Great Lakes and Northeast; assuming a persistent -NAO develops???**

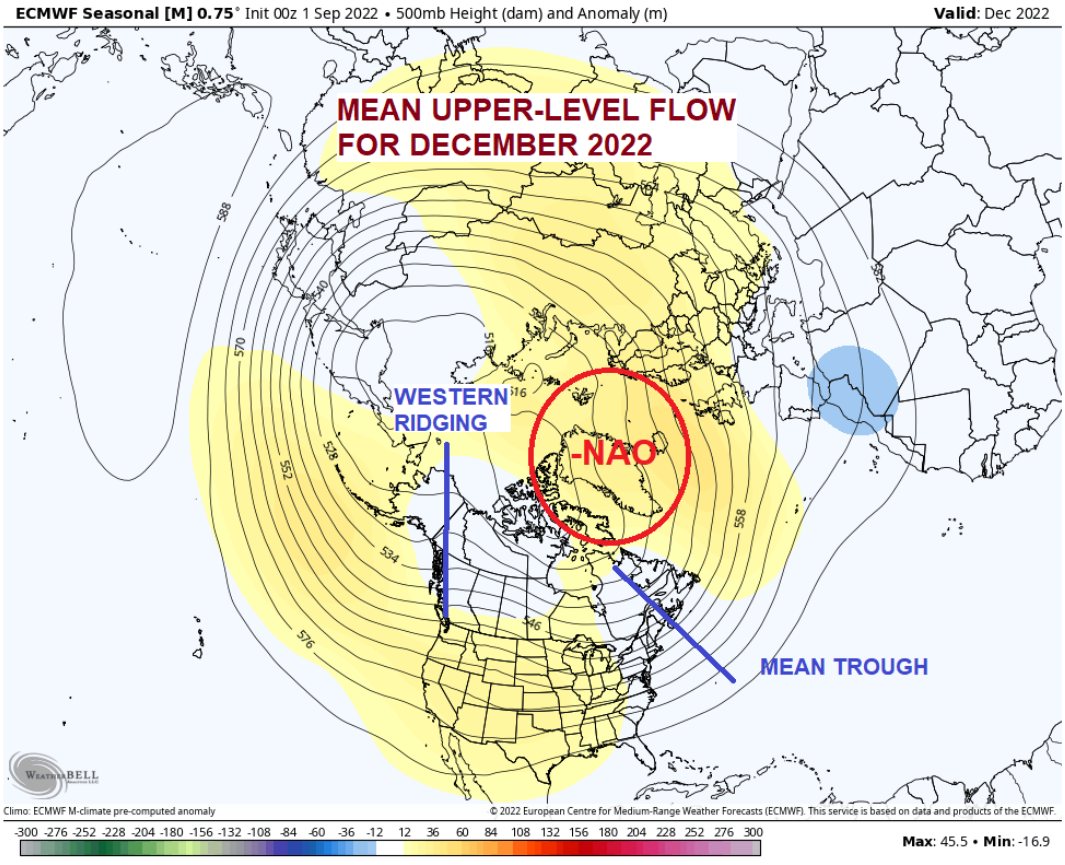
Whether or not the model agreement about December is correct, is tough to say with high confidence right now. But all of the modeling is showing strong North Atlantic blocking (-NAO) starting in late November and continuing well into, if not, through December.

Decembers have struggled to run colder than normal for several years now, and it is tough to go all in on the cold being suggested by the modeling. But it also hard to ignore and it must be seriously considered.

Last year there appeared to be multiple analogs suggesting a cold December, but that failed miserably.

This year is a little bit different since the December forecast for cold is predicated on multiple model suites and runs predicting North Atlantic Blocking (NAO). It is not based on an analog method. If the modeling is correct about the North Atlantic blocking (NAO), a cold December will ensue.

Here is the European model mean upper-level flow for December 2022



- The first thing to remember is that the map represents a 31-day average. This tends to flatten the anomalies. It is likely that the main features will actually be more amplified during several day periods during the course of the month.

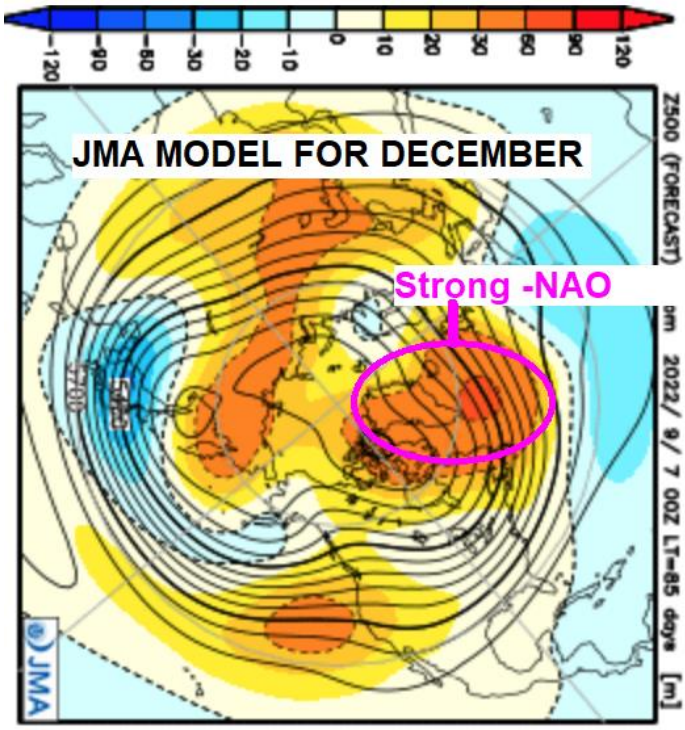
- The red oval represents higher than normal upper-level heights over Greenland. This is the predicted North Atlantic Block (-NAO).

- It also shows a mean trough extending southward from eastern Canada to just of the East Coast, along with a mean upper-level ridge across western Canada.

- If this map verifies, December 2022 would feature a significant cold anomaly building across western Canada with cold air spreading east and southeast into the Great Lakes and Upper Midwest regions, before spilling eastward on across the Northeast, including the Northern Middle Atlantic region.

The European model is not alone in its prediction of above normal jet stream heights across the Greenland area with the Canadian model and the Japanese model also agreeing with the -NAO for December.

Here is the JMA (Japanese) model upper-level look for December!



- As with the European model, it shows a very impressive -NAO block across Greenland, along with some western ridging.

If these 2-model forecasts verify anywhere close to their December projections, the odds of a colder than normal December will increase markedly.

OCTOBER / NOVEMBER THOUGHTS

***** First a quick message about the October / November period. I do not see any strong signals for October to verify colder than normal. I'm confident there will be the occasional cold intrusion, similar to what we will see later this week, but overall, the signs point toward October featuring warmer than normal conditions for the majority of the Northeast and Midwest.**

As for November, I'm wary of ending the warm fall pattern too early. But the first impacts of the expected December -NAO could start showing up during November, especially the second half of November. Right now, I would stick close to normal or somewhat warmer than normal, but if the December puzzle pieces start moving early, we could transition into a cold second half of November. Obviously, I will be closely monitoring the November pattern signals as we move into October and I would leave all options on the table for now.

FIRST CALL SUMMARY POINTS

1. Basin-wide La Nina expected this winter.

2. The OH/IN/MI sector is expected to have a 3-month temperature anomaly of 1.5 to +2.5 degrees; but it will be on the edge of the likely colder than normal zone, so little pattern shifts can and may well make for significant changes to the current outlook.

3. Greatest potential for extended colder than normal conditions across the Northeast sector is favored to occur from very late November on through December.

4. The Midwest January / February period likely to feature variable conditions with multiple transitions in and out of above normal conditions and colder than normal conditions over 7-to-10-day periods. Overall, this period is expected to average at least modestly warmer than normal (+2.0 to +3.5 degrees) across the Northeast.

5. While at least one extended solidly colder than normal period is likely across the Northeast during the second half of the winter, I would still expect a noteworthy warm period to develop across the Midwest, as has been the case the last 2 La Nina events. There has been a tendency for La Nina warm periods to be under-estimated each of the last 2 years and we should be wary of this happening again.

6. Coldest area of the country this winter is expected to run from the Northern Plains east/southeast into portions of the Midwest & Great Lakes. How effectively the cold can filter eastward on into and across the OH/IN/MI areas during the second half of the winter is a tough call and it will be dependent on keeping the Southeast Ridge weak.

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