

Arctic Oscillation and Polar Vortex Analysis and Forecasts

November 22, 2021

Dear AO/PV blog readers:

We have shifted the public release of the Arctic Oscillation/Polar Vortex blog to Wednesdays weekly through the winter season.

For those who would like an early look on Mondays, we will be offering at a nominal price (US \$25) a PDF version of the upcoming blog, and we will be rolling out in the coming weeks access to the datasets used in the production of this blog. At present we plan to make available in comma-separated values the timeseries of the Polar Cap Height and the timeseries of the Wave Activity Flux (vertical component), though we would appreciate to hear your suggestions for additional data of interest to you all.

Special blog on winter 2018/2019 retrospective can be found here
- <http://www.aer.com/winter2019>

Special blog on winter 2017/2018 retrospective can be found here
- <http://www.aer.com/winter2018>

Special blog on winter 2016/2017 retrospective can be found here
- <http://www.aer.com/winter2017>

Special blog on winter 2015/2016 retrospective can be found here
- <http://www.aer.com/winter2016>

Dr. Judah Cohen from Atmospheric and Environmental Research (AER) embarked on an experimental process of regular research, review, and analysis of the Arctic Oscillation (AO) and Polar Vortex (PV). This analysis is intended to provide researchers and practitioners real-time insights on one of North America's and Europe's leading drivers for extreme and persistent temperature patterns.

During the winter schedule the blog is updated once every week. Snow accumulation forecasts replace precipitation forecasts. Also, there is renewed emphasis on ice and snow boundary conditions and their influence on hemispheric weather. With the start of spring we transition to a spring/summer schedule, which is once every two weeks. Snow accumulation forecasts will be replaced by precipitation forecasts. Also, there will be less emphasis on ice and snow boundary conditions and their influence on hemispheric weather.

Subscribe to our email list or follow me on Twitter (@judah47) for notification of updates.

The AO/PV blog is partially supported by NSF grant AGS: 1657748.

Summary

- The Arctic Oscillation (AO) is currently neutral and is predicted to slowly trend negative this week and then trend positive next week with mixed pressure/geopotential height anomalies across the Arctic and mixed pressure/geopotential height anomalies across the mid-latitudes. The North Atlantic Oscillation (NAO) is currently negative and is predicted to also trend negative as pressure/geopotential height anomalies become increasingly positive across Greenland but the NAO is predicted to turn positive next week as pressure/geopotential height anomalies are predicted to turn negative across Greenland next week.
- This week ridging/positive geopotential height anomalies across Greenland will favor troughing/negative geopotential height anomalies coupled with normal to below temperatures across Northern and Western Europe including the United Kingdom (UK). However next week the return of troughing/negative geopotential height anomalies across Greenland will promote ridging/positive geopotential height anomalies coupled with normal to above normal temperatures across Western Europe including the UK with troughing/negative geopotential height anomalies coupled with normal to below normal temperatures across Eastern Europe.
- The predicted general pattern across Asia this week is troughing/negative geopotential height anomalies coupled with normal to below temperatures in Western and East Asia with ridging/positive geopotential height anomalies coupled with normal to above normal temperatures across much of Siberia. However next week troughing/negative geopotential height anomalies coupled with normal to below temperatures will persist in Western Asia and East Asia with ridging/positive geopotential height anomalies coupled with normal to above normal temperatures across Central Asia.
- The pattern across North America this week is troughing/negative geopotential height anomalies coupled with normal to below normal temperatures extending from Alaska into the Eastern US with ridging/positive geopotential height anomalies coupled with normal to above temperatures draped across the Western United States (US). However, next week strengthening ridging/positive geopotential height anomalies near the Aleutians will force troughing/negative geopotential height anomalies coupled with normal to below normal temperatures across western North America with strengthening ridging/positive geopotential height anomalies coupled with normal to above temperatures in Eastern Canada and the Eastern US.
- In the *Impacts* section I discuss why I see a likely mild start to the Northern Hemisphere (NH) winter in part due to a strong stratospheric polar vortex (PV).

- *Impacts* section I discuss what I see as mixed signals and uncertainty for the winter forecast.

Plain Language Summary

For several weeks now the signals for the upcoming winter seemed mixed to me. But more recently the signals are all starting to align themselves to a mild start to the winter in the Eastern US and Northern Asia with the exception being Europe. However even for Europe the cold period seems limited. I see the probability of an overall mild December accelerating. If the pattern is going to reverse the origins will first appear in Asia. There are some small signs of that happening but not enough to make a appreciable difference just yet.

Impacts

I will admit to feeling pretty good about my forecast, albeit admittedly speculative, of cold November in eastern North America in the [October 25, 2021 blog](#) (though looking back I didn't explicitly say "eastern" though all analysis on a stretched polar vortex show the largest negative temperature anomalies are east of the Rockies). The negative temperature anomalies are not likely to be impressive (see **Figure i**) for a November estimate so far) but they become more impressive when compared to record or near record warmth observed the past few months. I also continue to believe that there is the increasing possibility of an overall mild to even very mild December east of the Rockies. The thinking of a colder (relative to normal) November followed by a milder December was based on analysis down since last winter, so who says that you can't teach an old dog new tricks? But I will stop now breaking my arm to pat myself on the back because that rarely ends well.

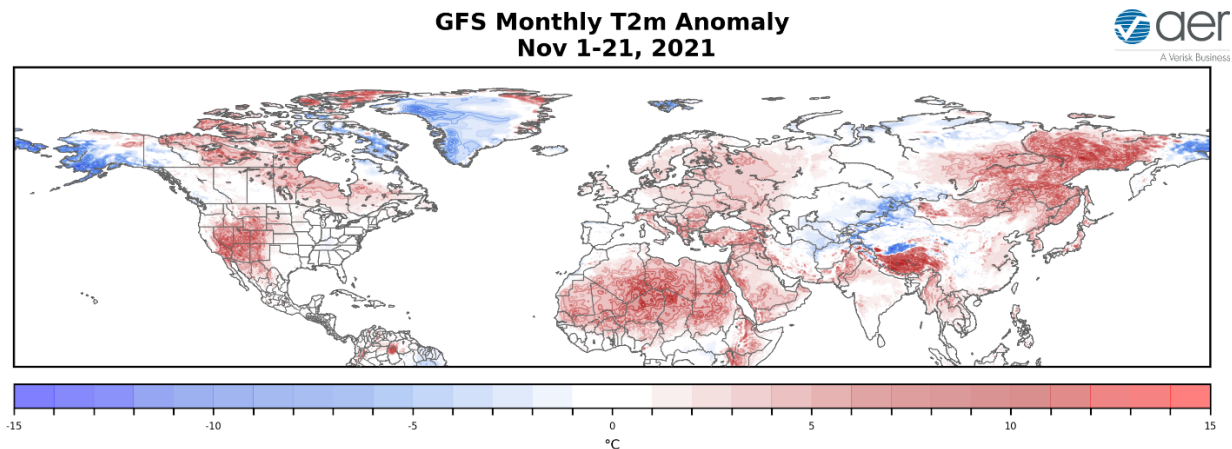


Figure i. Observed temperature anomalies (°C; shading) across the Northern Hemisphere for November 2021 based on the GFS analysis through November 22.

Much of my research over my career has focused on demonstrating that weather conditions across Eurasia but mostly Asia are at a minimum precursors to weather across the Northern Hemisphere but mostly North America and could even force North American weather. The idea can be neatly summarized as “Eurasia sneezes and North America catches a cold.” The research is nicely bookended so far by [Cohen and Entekhabi 1999](#) and [Cohen et al. 2021](#). I strongly feel that signs of legitimate winter weather in the Eastern US will first appear in Asia. Overall temperatures are predicted to be mild across much of Asia the next week or so with possibly more widespread cold temperatures in two weeks, though there is much uncertainty in the longer-range forecast. And if meaningful cold does become established in Asia, it would probably take at least two weeks and maybe longer to appear in the Eastern US. Therefore, I do believe the probability of a mild and possibly very mild December in the Eastern US is increasing.

In addition, cold air is pooling in Alaska. If that air mass does head south, then I think that the odds favor that it will eventually settle in the Western US and therefore would be coupled with mild weather in the Eastern US. The models are increasingly suggestive that high pressure/ridging will settle near the Aleutians with low pressure/troughing in the Gulf of Alaska. That coupling tends to favor colder weather in western North America with much milder weather in eastern North America. Also, the dominance of low heights across the Central Arctic and Greenland not only in the troposphere but the stratosphere as well predicted by the models in early December, is favorable for milder weather in the Eastern US. Though admittedly the models seem to suggest that at least some of the colder temperatures in Alaska will bleed off into the Northeastern US for the foreseeable future.

I also believe Ural blocking/high pressure is key to bringing cold weather to the Eastern US. Looking at our estimate of the SLP anomalies for November shows a pattern that is just the opposite and instead is highly favorable for strengthening the stratospheric PV with low pressure centered near the Urals and high pressure in the North Atlantic and East Asia (see **Figure ii**). That is the exact inverse of the circulation pattern shown to be most favorable for disrupting the PV (see for example Figure 4 from [Cohen et al. 2014](#)). Some ridging is predicted to return in the GFS forecasts (see **Figure 8**) and even in the latest CFS (see Figure 15) but at least the GFS predicted pattern still isn't optimal for disrupting the PV.

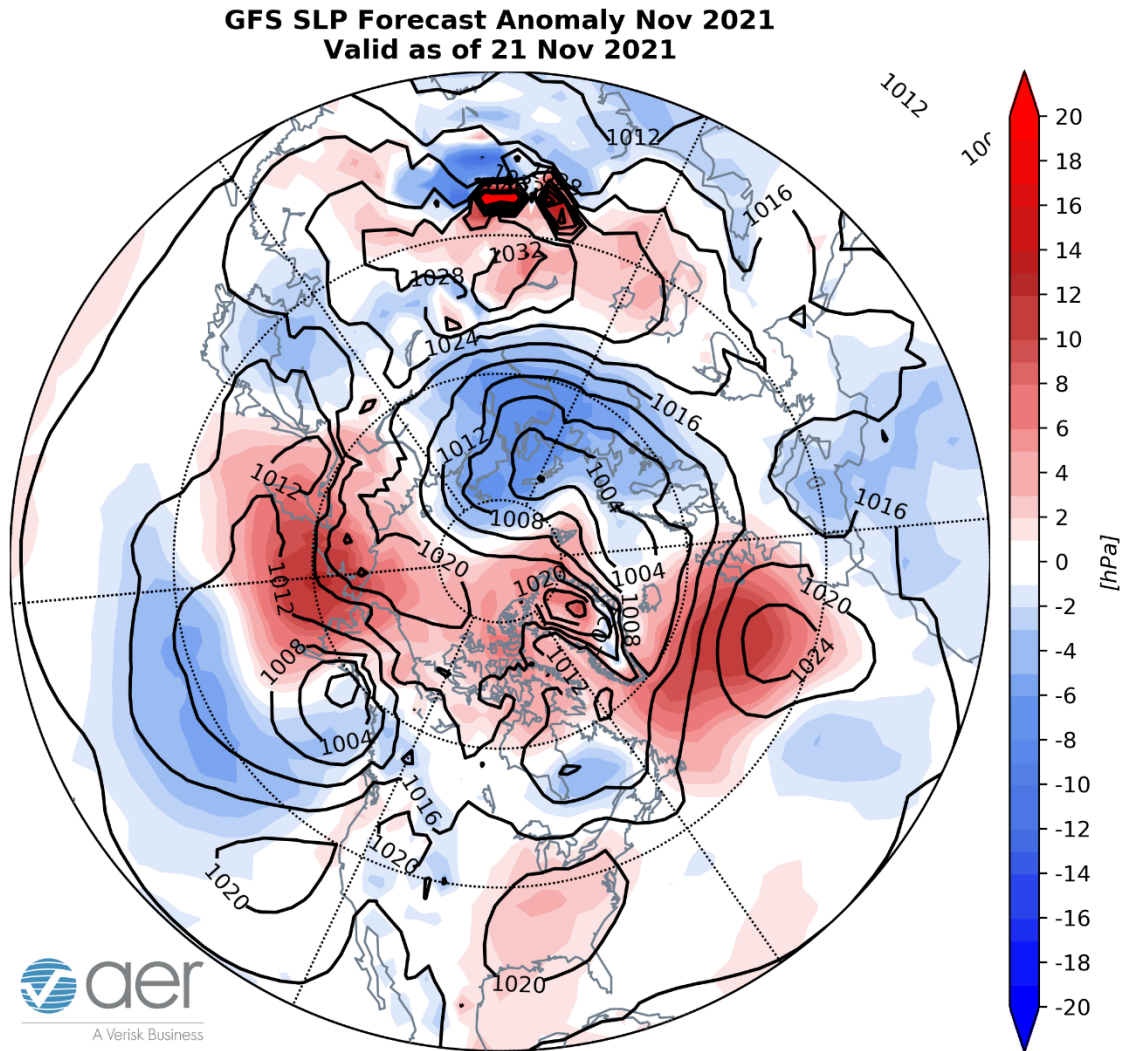


Figure ii. Estimated sea level pressure (hPa; contours) and anomalies (hPa; shading) across the Northern Hemisphere for November 2021 based on the GFS analysis through November 22 and forecast.

Though the return of quasi-Ural ridging seems sufficient to at least initiate some perturbation of the PV. In fact, the latest plot of the polar cap geopotential height anomalies (PCHs) shows stratosphere-troposphere coupling with a strong PV coupled with a positive surface AO that is highly favorable for widespread mild temperatures across the NH (see **Figure 11**). And though the predicted return of Ural blocking is sub-optimal for disrupting the PV, it might just be enough to prevent a self-perpetuating coupling of a strong PV and strongly positive surface AO that would result for an extended period of mild weather similar to 2019/2020. Though this scenario remains a possibility and needs to be monitored.

In the short-term Europe is looking colder. The predicted ridging/high pressure will contribute to deepening troughing/low pressure in Europe accompanied by cold temperatures. Also predicted cold temperatures in the polar stratosphere are also favorable for colder weather in Europe in early December. Still even for Europe a predicted return of low pressure to Greenland seems to favor milder weather eventually even for Europe.

Overall Arctic boundary forcings are becoming less favorable for disrupting the stratospheric PV. As I discussed briefly in last week's blog Arctic sea ice extent is on a tear and is getting close to what could be considered on the low end of the long term normal. A lot of new ice has been forming in the Barents-Kara seas, making the lack of sea ice in that region less of a factor for disrupting the PV. Snow cover extent is above normal across Asia and snow depth across Siberia is above normal (see [NH snow depth](#)) but not impressively so. But I will be monitoring both to see if those conditions turn more or less favorable for disrupting the PV in the coming weeks even months. Maybe I am being overly pessimistic or dramatic and winter has not started yet but I do think it is appropriate to ask, has the old man gone missing? But I do strongly believe, if we are going to find him, he will show up in Asia first and that is where my attention will be focused. This is prejudiced on all my years of research. There is one exception and that is the North American Arctic which looks to be cold and is inversely related to temperatures elsewhere across the NH.

I have been sharing a little on Twitter our experimental subseasonal forecast model (weeks 3-4). It has been consistently predicting a mild start to December across much of the US. Today's run for the first time is predicting temperatures closer to normal in the Northcentral and Northeastern US and even pockets of below normal as we head into the middle of the month. It is just one run, and I will be checking for consistency but something to watch.

1-5 day

The AO is predicted to be neutral to negative this week (**Figure 1**) as geopotential height anomalies are predicted to be mostly mixed across the Arctic but positive across Greenland with mixed geopotential height anomalies across the mid-latitudes of the NH (**Figure 2**). And with mostly positive geopotential height anomalies predicted across Greenland (**Figure 2**), the NAO is predicted to be negative this week (**Figure 1**).

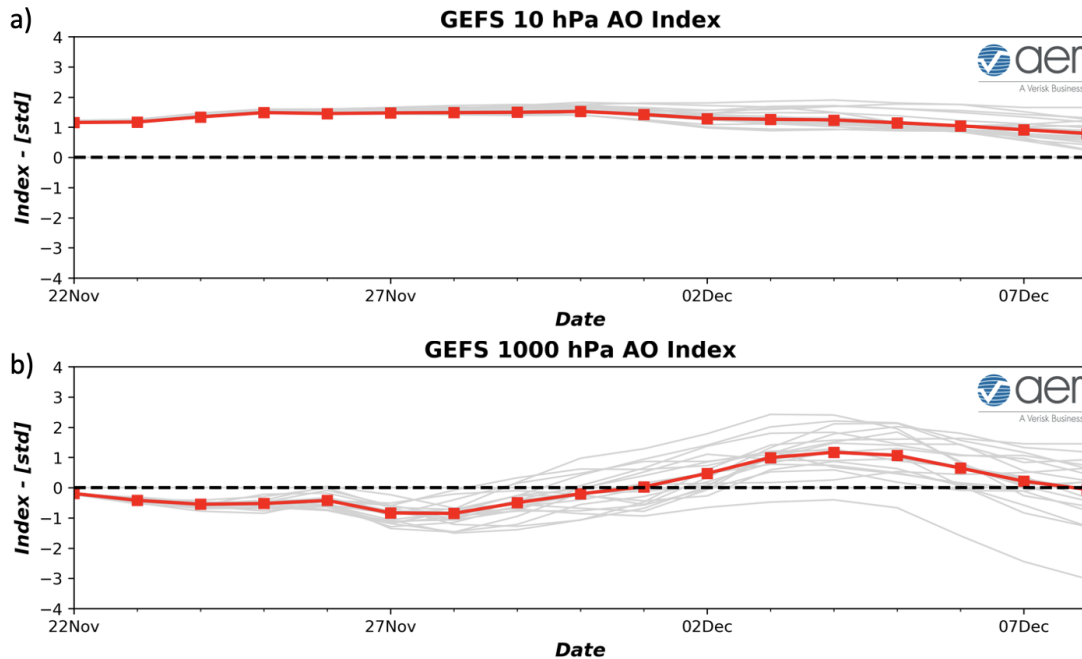


Figure 1. (a) The predicted daily-mean AO at 1000 hPa from the 00Z 22 November 2021 GFS ensemble. (b) The predicted daily-mean near-surface AO from the 00Z 22 November 2021 GFS ensemble. Gray lines indicate the AO index from each individual ensemble member, with the ensemble-mean AO index given by the red line with squares.

This week, strengthening ridging/negative geopotential height anomalies just south of Greenland will partially force troughing/negative geopotential height anomalies across much of Europe including the UK this period (**Figures 2**). This will result in normal to below normal temperatures across Northern and Western Europe including the UK with normal to above normal temperatures across Southeastern Europe under southwesterly flow (**Figure 3**). Deep troughing/negative geopotential height anomalies are predicted over Northwestern Asia will contribute to ridging/negative geopotential height anomalies over much of Siberia with troughing/negative geopotential height anomalies East Asia this period (**Figure 2**). This pattern favors normal to below normal temperatures in Northwestern and East Asia with normal to above normal temperatures across much of Siberia, Southern and Central Asia (**Figure 3**).

GEFS 1-5 Day Forecast 500 mb GPH/GPH Anomaly
INIT: 00Z 11/22/2021 FCST: 11/23/2021 to 11/27/2021

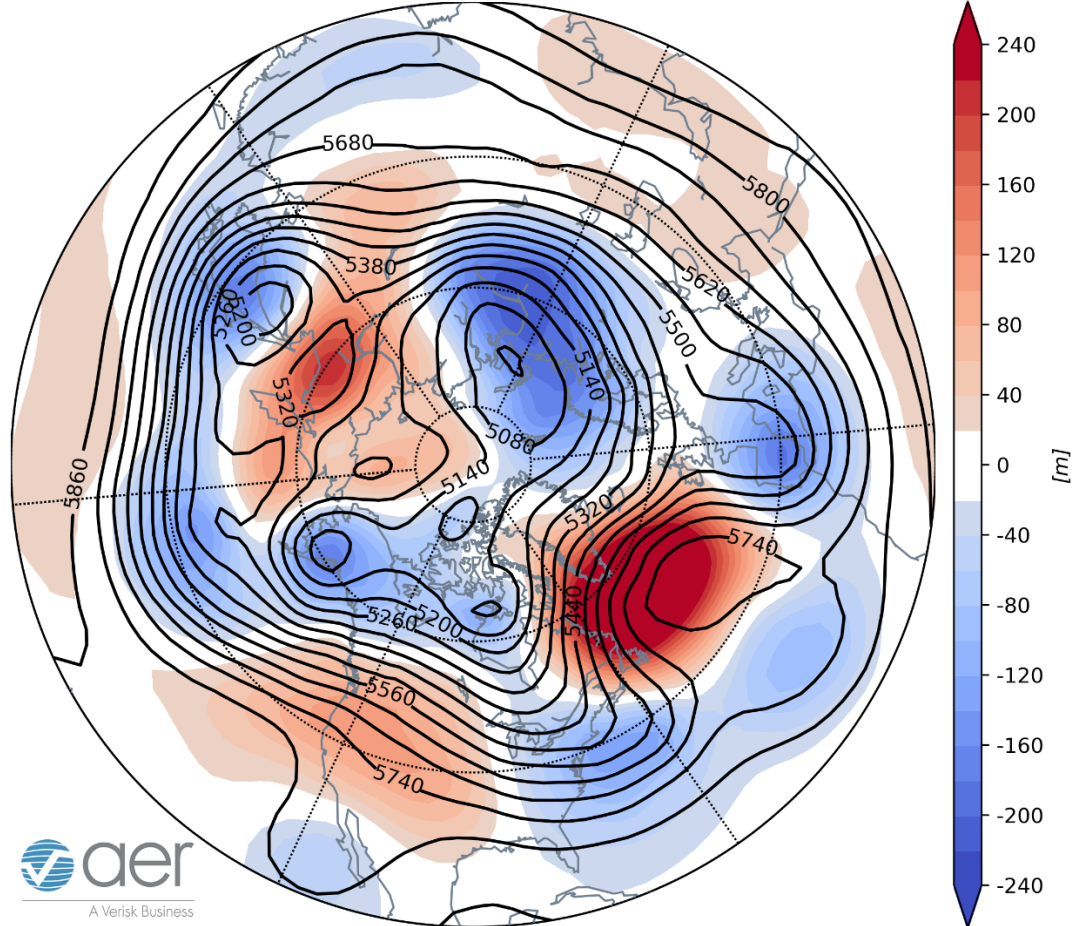


Figure 2. Forecasted average 500 mb geopotential heights (dam; contours) and geopotential height anomalies (m; shading) across the Northern Hemisphere from 23 – 27 November 2021. The forecasts are from the 00z 22 November 2021 GFS ensemble.

The general pattern this week across North America is troughing/negative geopotential height anomalies across Alaska that extends southwestward into eastern Canada and the Eastern US with ridging/positive geopotential height anomalies across the Western US (**Figure 2**). This pattern is predicted to bring normal to below normal temperatures across Alaska, Northwestern and Central Canada and the Eastern US with normal to above normal temperatures across Southwestern and Northeastern Canada and the Western US (**Figure 3**).

GFS 1-5 Day Forecast T2m Anomaly
INIT: 00Z 11/22/2021 FCST: 11/23/2021 to 11/27/2021

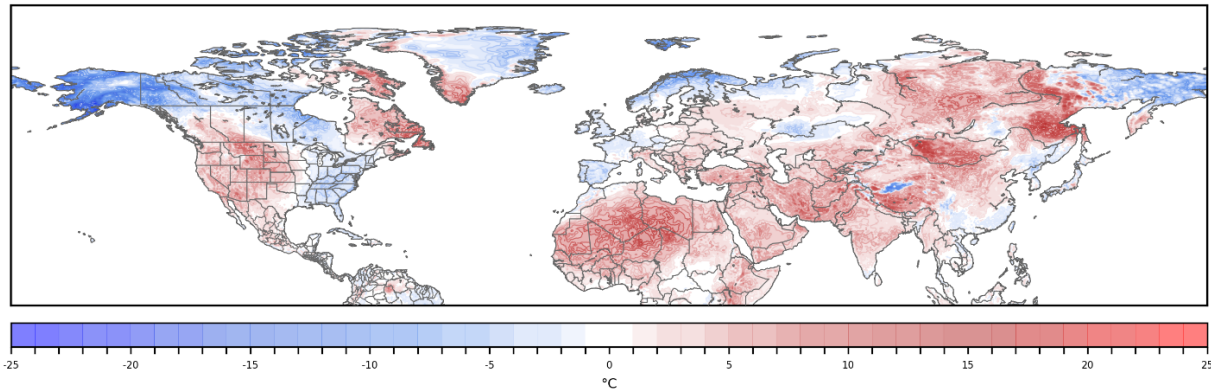


Figure 3. Forecasted surface temperature anomalies (°C; shading) from 23 – 27 November 2021. The forecast is from the 00Z 22 November 2021 GFS ensemble.

Trounging and/or cold temperatures are predicted to support new snowfall across Northern Scandinavia, higher elevations of Europe and Northwestern Asia while mild temperatures promote snowmelt in Western Russia (**Figure 4**). Trounging and/or cold temperatures are predicted to support new snowfall across Eastern Alaska and Western Northcentral and Eastern Canada while mild temperatures promote snowmelt in the US Canadian Plains and Labrador (**Figure 4**).

GEFS 1-5 Day Forecast SNOD Change
INIT: 00Z 11/22/2021 FCST: 11/23/2021 to 11/27/2021

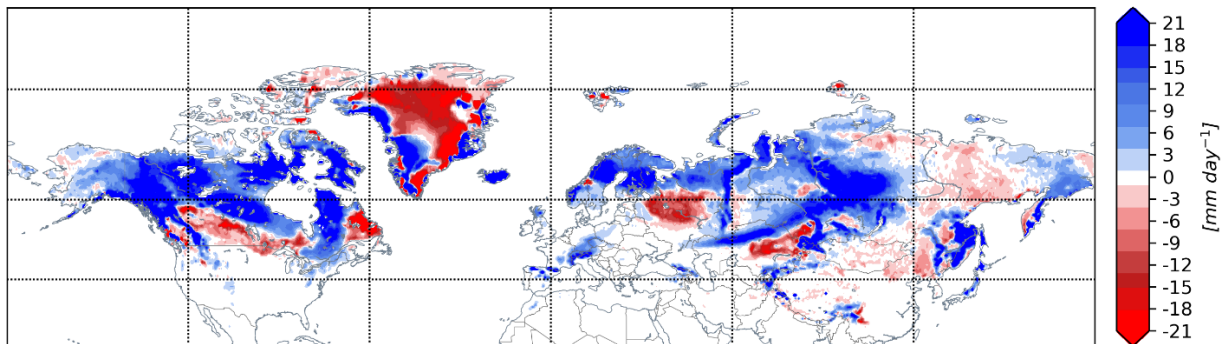


Figure 4. Forecasted snow depth changes (mm/day; shading) from 23 – 27 November 2021. The forecast is from the 00Z 22 November 2021 GFS ensemble.

Mid-Term

6-10 day

The AO is predicted to transition from negative to positive this period (**Figure 1**) as geopotential height anomalies remain mixed across the Arctic but turn negative across Greenland with mixed geopotential height anomalies across the mid-latitudes of the NH (**Figure 5**). And with geopotential height anomalies transitioning from positive to negative across Greenland (**Figure 5**), the NAO is predicted to trend positive this period.

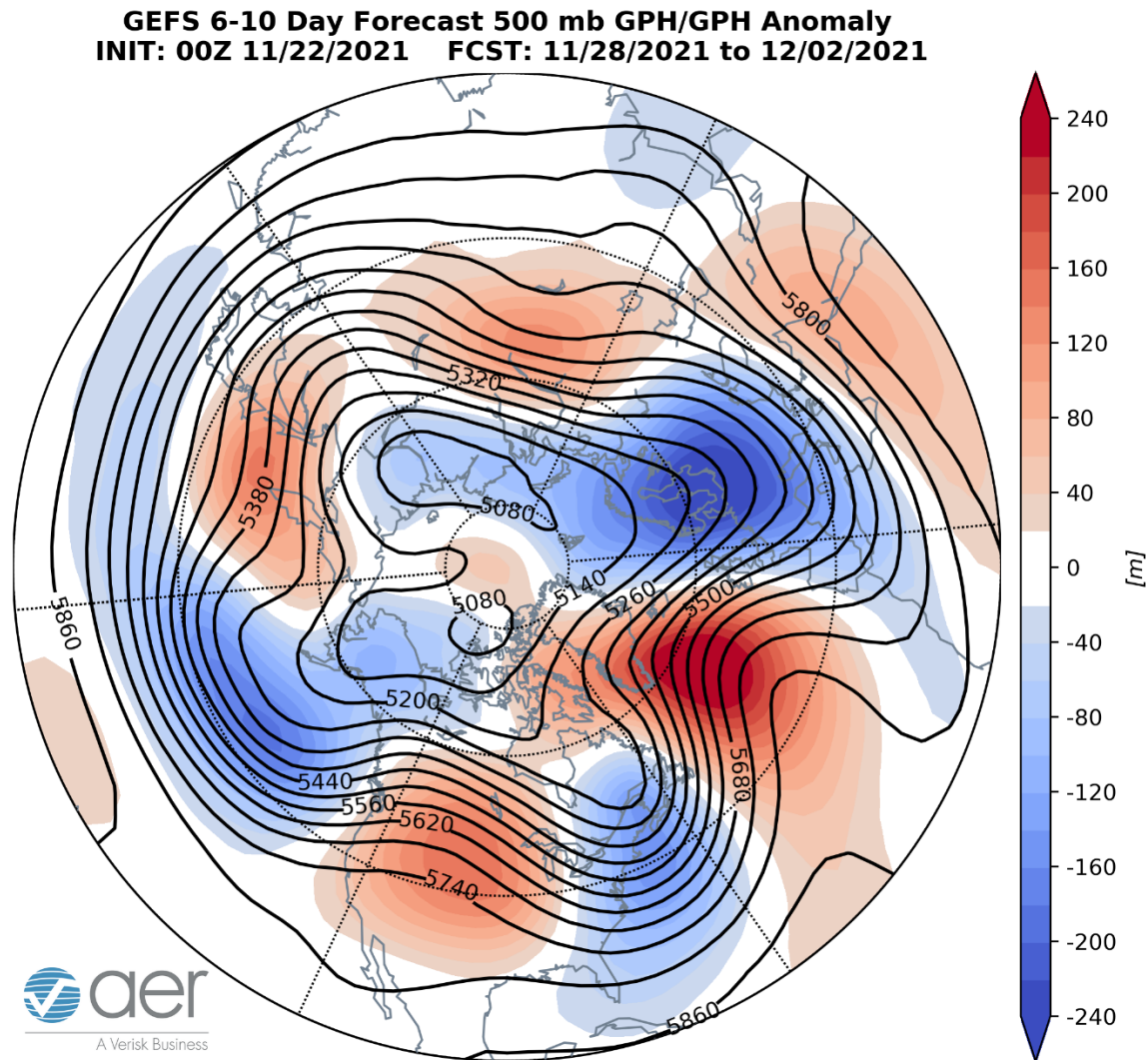


Figure 5. Forecasted average 500 mb geopotential heights (dam; contours) and geopotential height anomalies (m; shading) across the Northern Hemisphere from 28 November – 2 December 2021. The forecasts are from the 00z 22 November 2021 GFS ensemble.

Ridging/positive troughing/negative geopotential height anomalies persisting for much of the period south of Greenland and Iceland will contribute to anchoring troughing/negative geopotential height anomalies and northerly flow across Northern and Western Europe with southwesterly flow across Southeastern Europe this period

(**Figure 5**). This will result in normal to below normal temperatures across much of Western and Northern Europe including the UK with normal to above normal temperatures limited to Southeastern Europe (**Figure 6**). Deep troughing/negative geopotential height anomalies in Western Asia will contribute to strengthening ridging/positive geopotential height anomalies centered in Central Siberia with more troughing/negative geopotential height anomalies in East Asia (**Figure 5**). This pattern favors normal to below normal temperatures across Western and East Asia with normal to above normal temperatures in Southern and Central Asia and much of Siberia (**Figure 6**).

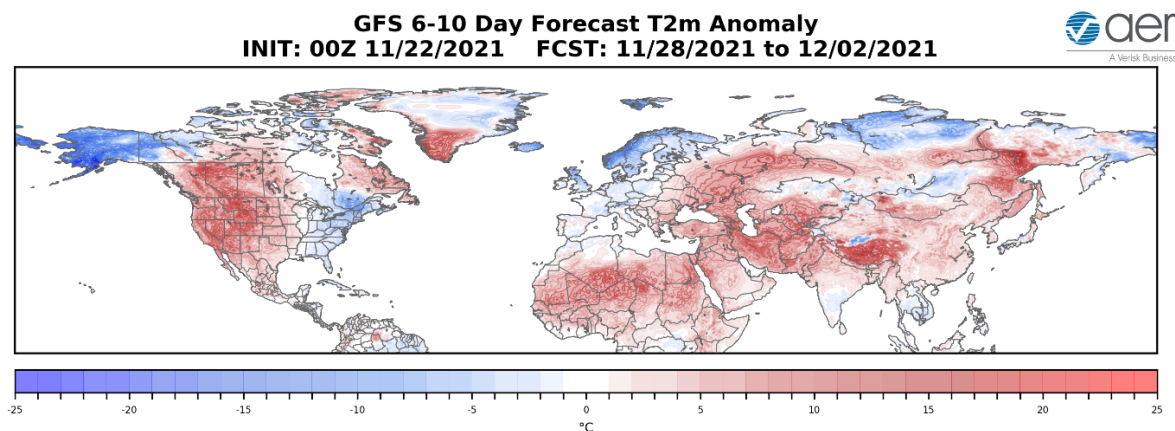


Figure 6. Forecasted surface temperature anomalies ($^{\circ}\text{C}$; shading) from 28 November – 2 December 2021. The forecasts are from the 00Z 22 November 2021 GFS ensemble.

Persistent troughing/negative geopotential height anomalies across Alaska and south of the Aleutians will continue to favor downstream ridging/positive geopotential height anomalies across the Western US with persistent troughing/negative geopotential height anomalies in the Eastern US this period (**Figure 5**). This will favor normal to below normal temperatures across Alaska and Northwestern Canada into Southeastern Canada and the Eastern US with normal to above normal temperatures in Southwestern Canada, the Western US and Northeastern Canada (**Figure 6**).

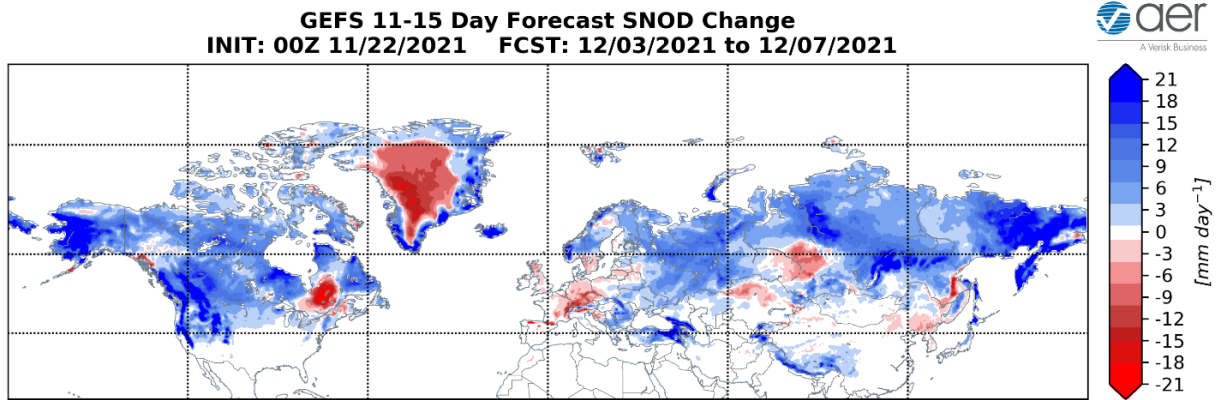


Figure 7. Forecasted snow depth changes (mm/day; shading) from 28 November – 2 December 2021. The forecast is from the 00Z 22 November 2021 GFS ensemble.

Trouging and/or cold temperatures are predicted to support new snowfall across Scandinavia, the Alps, Northeastern Europe and Northern Asia while milder temperatures promote snowmelt across Central Asia (**Figure 7**). Trouging and/or cold temperatures are predicted to support new snowfall across Alaska, much of Canada and the higher elevations of the US West Coast (**Figure 7**).

11-15 day

With mostly negative geopotential height anomalies predicted across the Arctic including Greenland and mixed geopotential height anomalies across the mid-latitudes of the NH (**Figure 8**), the AO should remain positive this period (**Figure 1**). With predicted negative pressure/geopotential height anomalies across Greenland (**Figure 8**), the NAO is forecasted to turn positive this period as well.

GEFS 11-15 Day Forecast 500 mb GPH/GPH Anomaly
INIT: 00Z 11/22/2021 FCST: 12/03/2021 to 12/07/2021

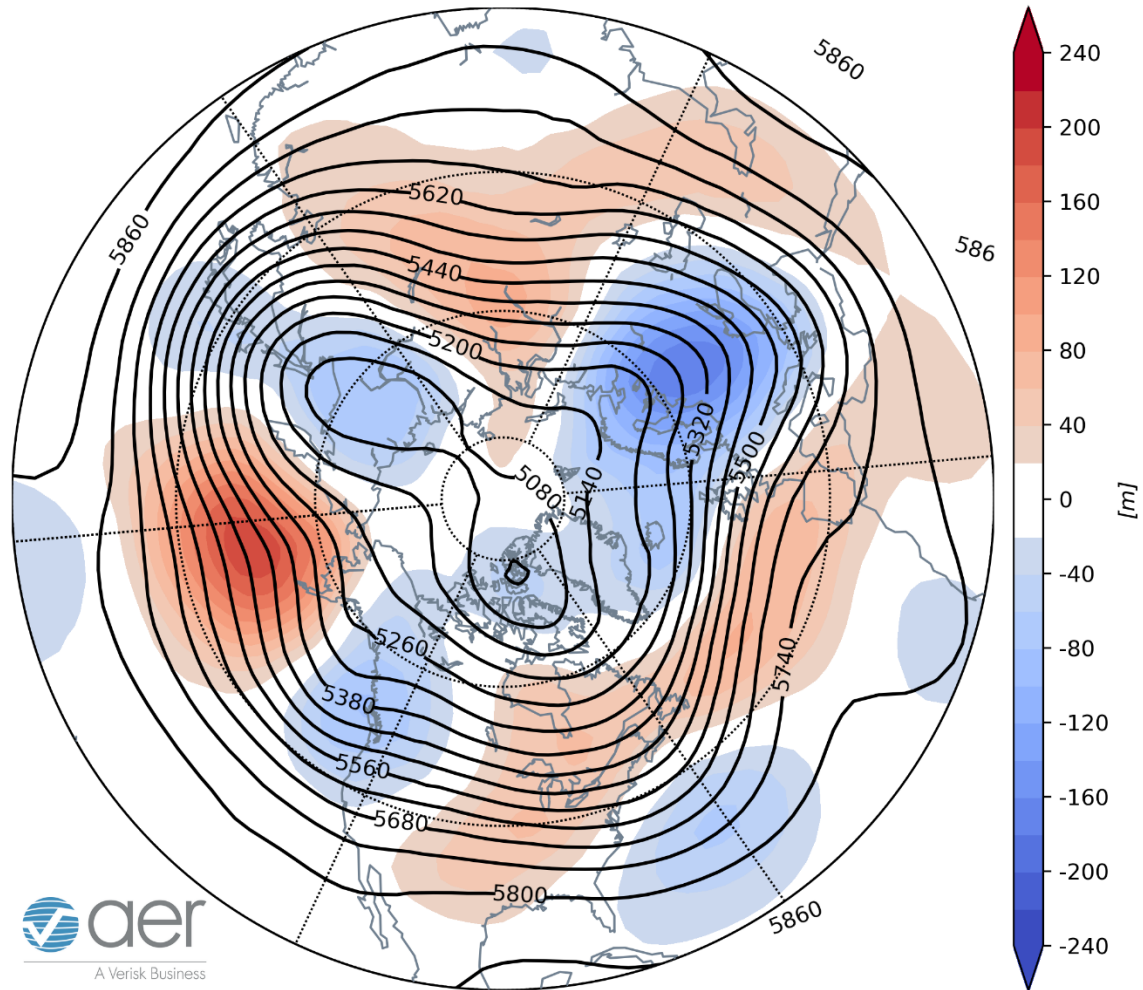


Figure 8. Forecasted average 500 mb geopotential heights (dam; contours) and geopotential height anomalies (m; shading) across the Northern Hemisphere from 3 – 7 December 2021. The forecasts are from the 00z 22 November 2021 GFS ensemble.

Europe including the UK with normal to below normal temperatures across Northern and Eastern Europe this period (**Figures 9**). The omega pattern with ridging/positive geopotential height anomalies in Central Asia sandwiched by troughing/negative geopotential height anomalies in West and East Asia is predicted to persist this period (**Figure 8**). This pattern favors widespread normal to above normal temperatures across much of Asia except for normal to below normal temperatures across Northwestern and East Asia this period (**Figure 9**).

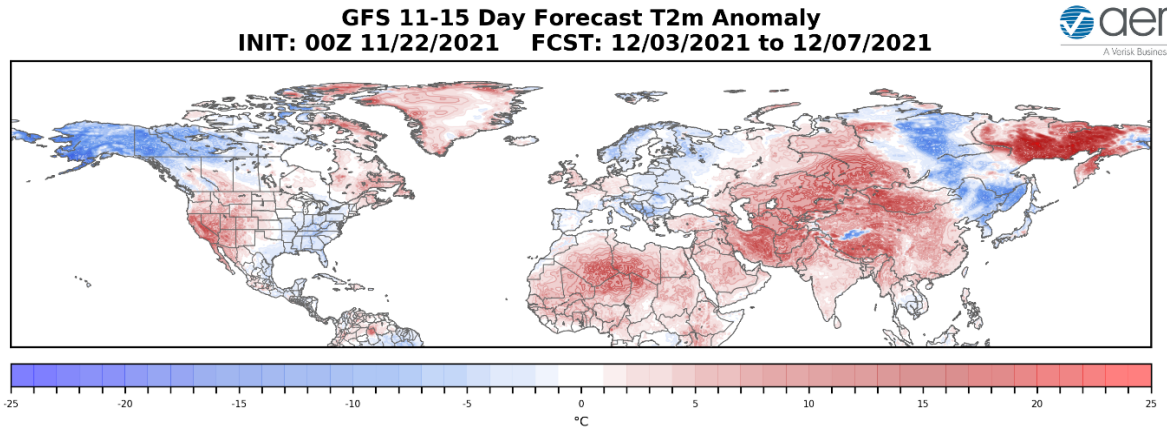


Figure 9. Forecasted surface temperature anomalies (°C; shading) from 3 – 7 December 2021. The forecasts are from the 00z 22 November 2021 GFS ensemble.

Strengthening ridging/positive geopotential height anomalies near the Aleutians will contribute to deepening troughing/negative geopotential height anomalies western North America with strengthening ridging/positive geopotential height anomalies across eastern North America this period (**Figure 8**). This pattern favors normal to below normal temperatures widespread across Alaska, Western Canada and the US West Coast with normal to above normal temperatures in Eastern Canada and the US from the Rockies eastward (**Figure 9**).

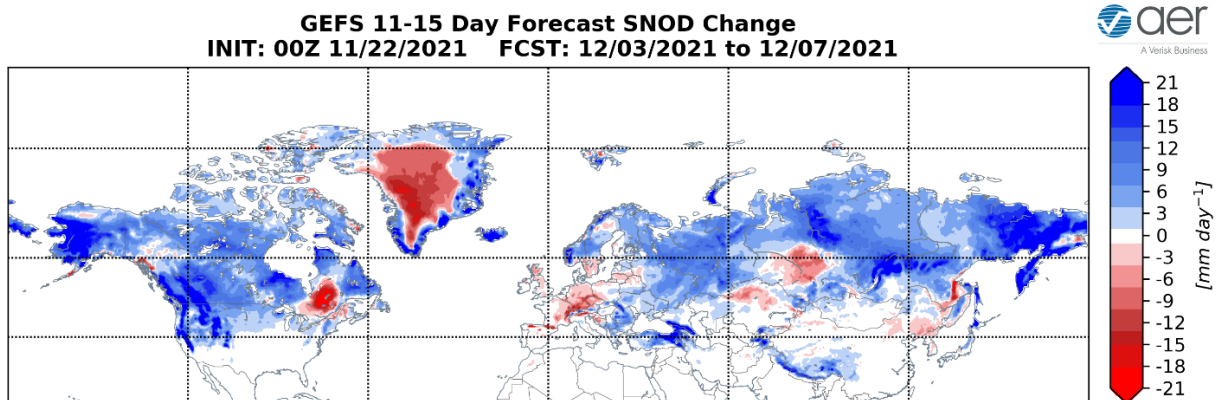


Figure 10. Forecasted snow depth changes (mm/day; shading) from 3 – 7 December 2021. The forecast is from the 00Z 22 November 2021 GFS ensemble.

Troughing and/or cold temperatures are predicted to support possible new snowfall across Northern and Eastern Europe and Northern Asia while milder temperatures promote snowmelt across the Alps and Central Asia (**Figure 10**). Troughing and/or cold temperatures are predicted to support possible new snowfall across Alaska, much of

Northern and Western Canada and the Northern and Western US while milder temperatures promote snowmelt across Southeastern Canada (**Figure 10**).

Longer Term

30-day

The latest plot of the polar cap geopotential height anomalies (PCHs) currently shows normal to cold/negative PCHs in the stratosphere and upper troposphere with warm/positive PCHs in the lower troposphere (**Figure 11**). However, cold/negative PCHs in the upper troposphere are predicted to descend to the surface next week (**Figure 11**). This is potentially the first stratosphere-troposphere coupling event in a while and certainly the first of winter 2021/22 but likely not the last.

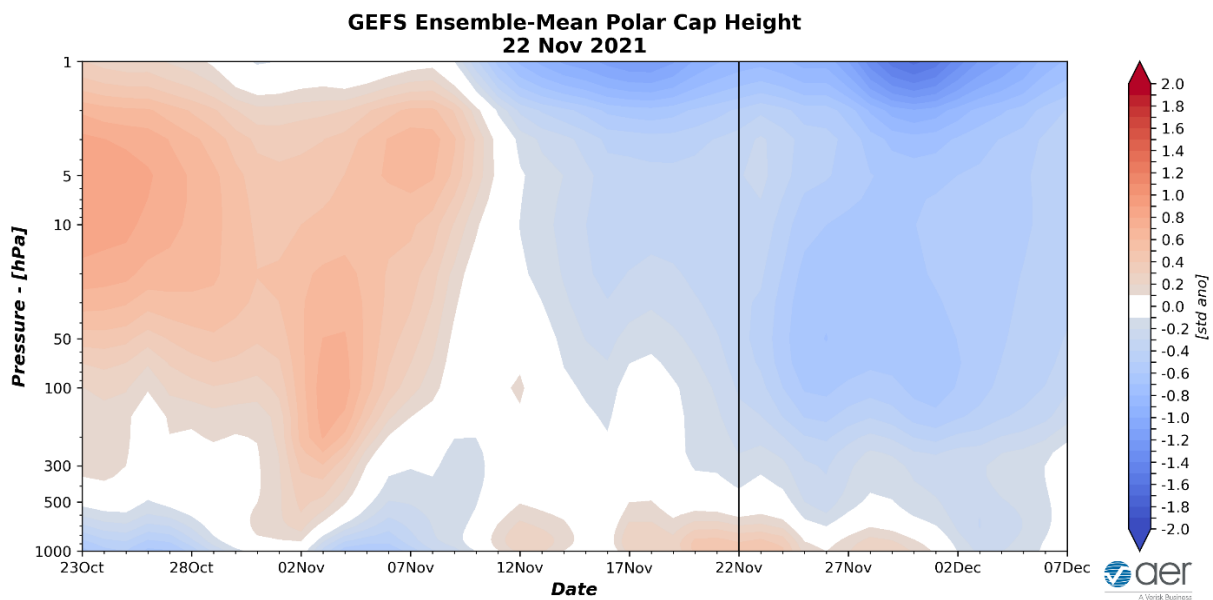


Figure 11. Observed and predicted daily polar cap height (i.e., area-averaged geopotential heights poleward of 60°N) standardized anomalies. The forecast is from the 00Z 22 November 2021 GFS ensemble.

The current above normal PCHs in the lower tropospheric are consistent with the predicted weak negative surface AO this week (**Figure 1**). However, as PCHs transition to cold/negative in the lower troposphere next week, the surface AO will likely turn positive next week (**Figure 1**). A fully coupled strong stratospheric polar vortex and positive surface AO is a favorable environment for widespread mild temperatures in the Eastern US, Northern Europe and Northern Asia. The winter is likely to kick off mild in tow of those three regions with the exception of Northern Europe.

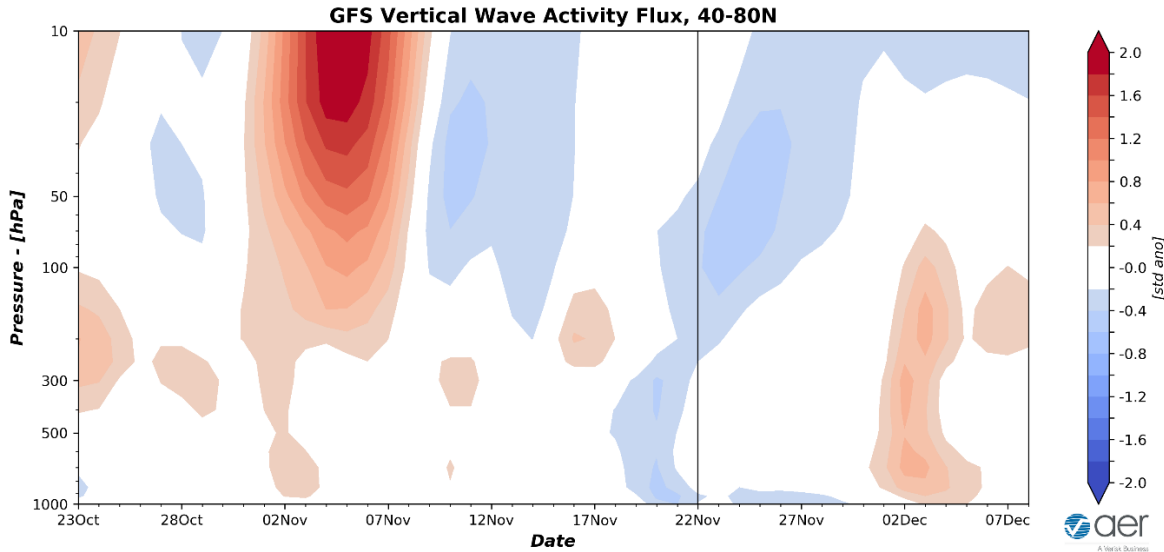


Figure 12. Observed and predicted daily vertical component of the wave activity flux (WAFz) standardized anomalies, averaged poleward of 40-80°N. The forecast is from the 00Z 22 November 2021 GFS ensemble.

The vertical Wave Activity Flux (WAFz) from the troposphere to the stratosphere or poleward heat transport in the stratosphere has been below normal and this should continue this week (**Figure 12**). Relatively weak WAFz anomalies allows the polar vortex to strengthen. However, WAFz is predicted to become somewhat more active in early December (**Figure 12**).

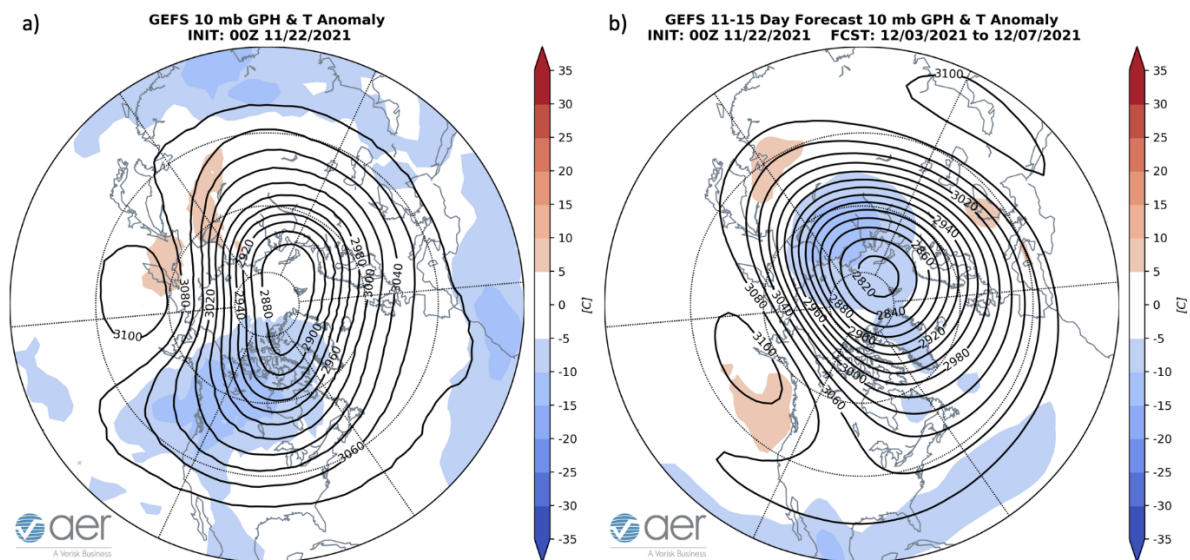


Figure 13. (a) Initialized 10 mb geopotential heights (dam; contours) and temperature anomalies (°C; shading) across the Northern Hemisphere for 22 November 2021. (b)

Same as (a) except forecasted averaged from 3 – 7 December 2021. The forecasts are from the 00Z 22 November 2021 GFS model ensemble.

The recent quiet WAFz has allowed the stratospheric PV to strengthen with the PV currently centered near the North Pole (**Figure 13**). The relatively strong PV is resulting in a positive stratospheric AO (**Figure 11**). The relatively quiet WAFz will contribute to a relatively strong PV centered near the North Pole over the next two weeks (**Figure 13**) coupled with a persistent positive stratospheric AO this week into next week (**Figure 11**).

The more active WAFz could begin to disrupt the stratospheric PV but the most recent forecast continues to predict a relatively strong PV centered near the North Pole and a relatively cold polar stratosphere for the first week of December (**Figure 13**). This should favor a mild start to winter across the NH continents.

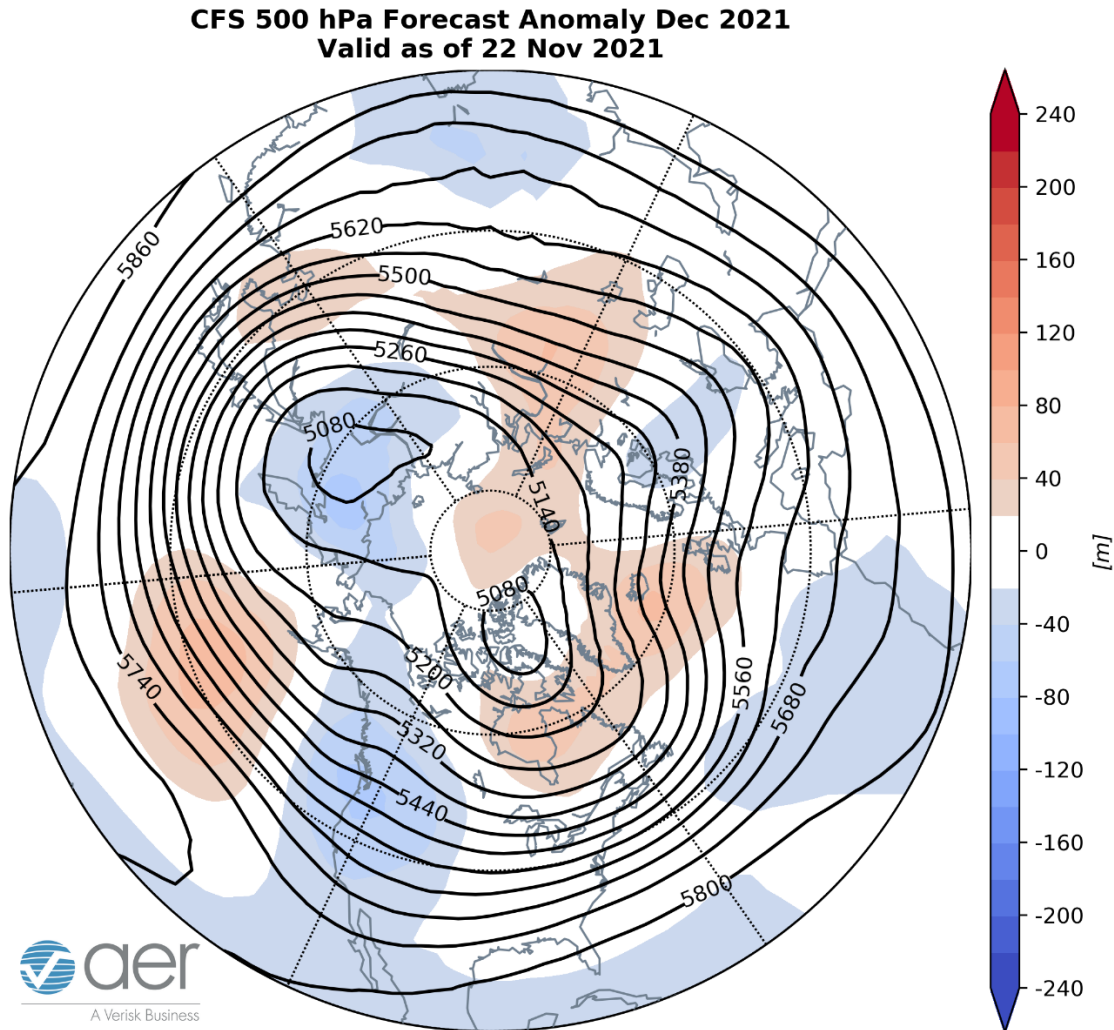


Figure 14. Forecasted average 500 mb geopotential heights (dam; contours) and geopotential height anomalies (m; shading) across the Northern Hemisphere for December 2021. The forecasts are from the 00Z 22 November 2021 CFS.

I include in this week's blog the monthly 500 hPa geopotential heights (**Figure 14**) and surface temperatures for December (**Figure 15**) from the Climate Forecast System (CFS; the plots represent yesterday's four ensemble members). The forecast for the troposphere is ridging centered near Iceland, the Urals, south of the Aleutians and Hudson Bay with troughing in Eastern Europe, Eastern Asia and western North America (**Figure 14**). This pattern favors seasonable to relatively warm temperatures widespread across Western Asia, Eastern Canada and the Eastern US with seasonable to relatively cold across Western Europe, East Asia, Western Canada and the Western US (**Figure 15**). If the CFS pattern verifies, I would consider it a turn to more favorable conditions for disrupting the PV and a turn to more widespread cold temperatures across the NH.

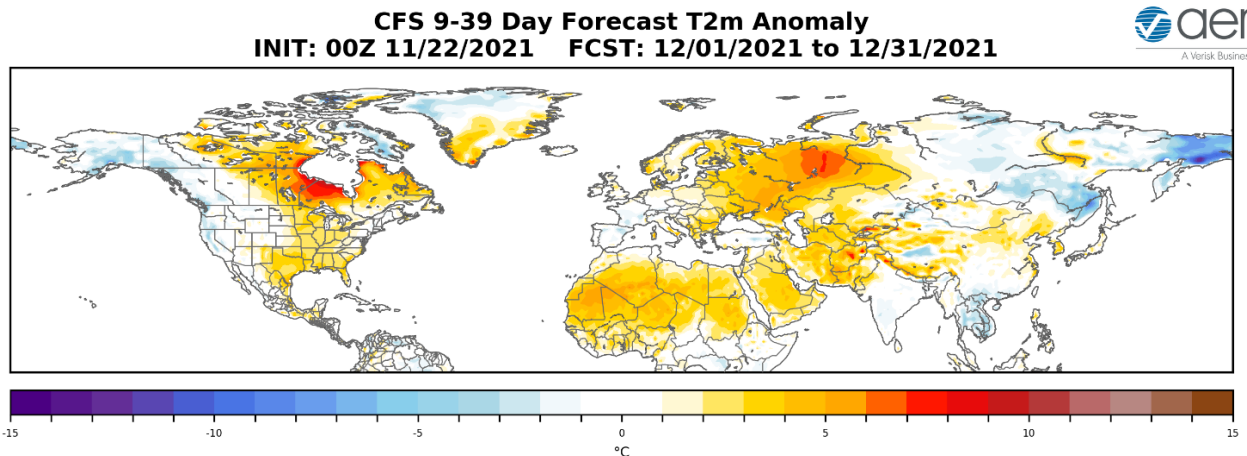


Figure 15. Forecasted average surface temperature anomalies ($^{\circ}\text{C}$; shading) across the Northern Hemisphere for December 2021. The forecasts are from the 00Z 22 November 2021 CFS.

Surface Boundary Conditions

Arctic Sea ice

Arctic sea ice is growing but remains below normal east of Greenland but especially in Baffin Bay and in the Barents-Kara Seas but has been getting closer to normal. Sea ice is close to normal in the Canadian Archipelagos and in the Chukchi Sea. Below normal sea ice in the Barents-Kara seas favors cold temperatures in Central and East Asia, while below normal sea ice in Baffin Bay favors cold temperatures in the Eastern Europe and Northern Europe however this topic remains controversial. Recent research has

shown that the regional anomalies that are most highly correlated with the strength of the stratospheric PV are across the Barents-Kara seas region where low Arctic sea ice favors a weaker winter PV. Low sea ice in the Chukchi, Beaufort and Bering seas may favor colder temperatures across North America but has not been shown to weaken the PV.

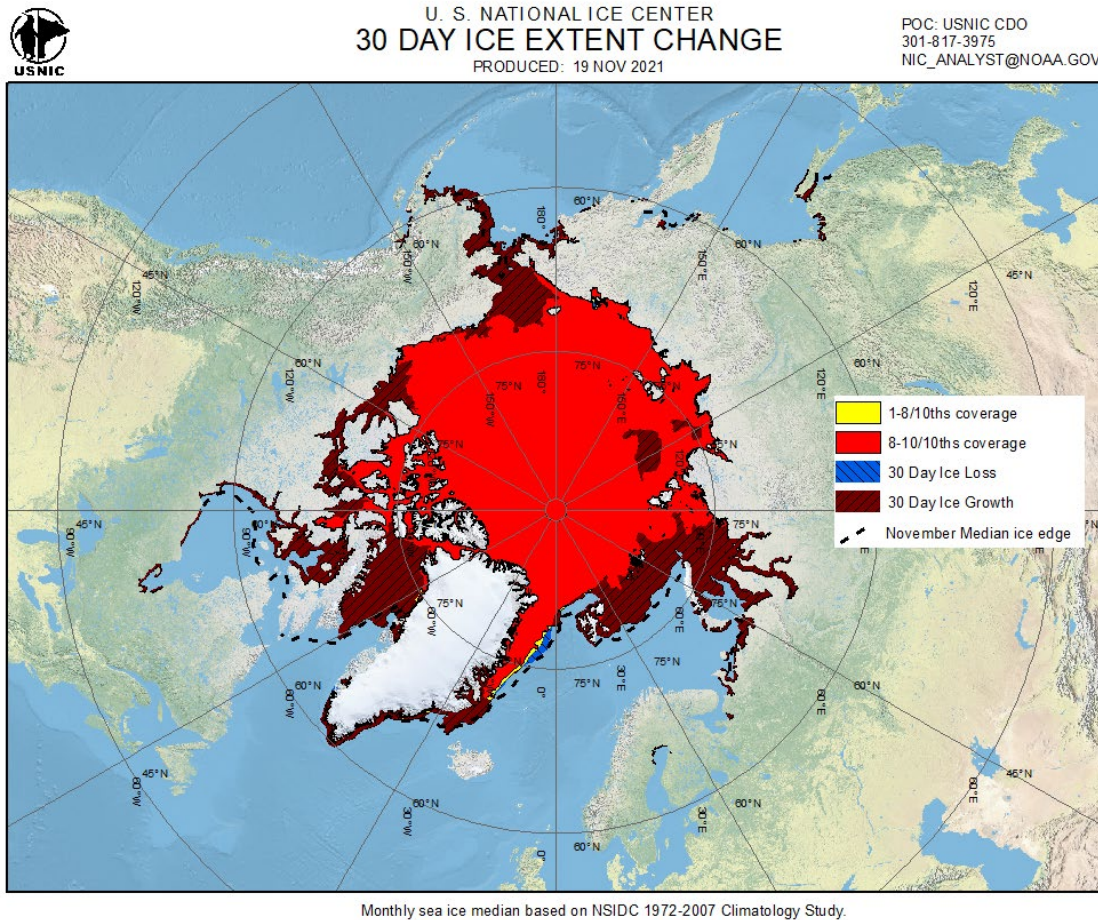


Figure 16. Observed Arctic sea ice extent on 19 November 2021 (white). Orange line shows climatological extent of sea ice based on the years 1981-2010. Image from the National Snow and Ice Data Center (NSIDC). Snow and Ice Data Center (NSIDC) so instead it is from the National Ice Center <https://usicecenter.gov/Products/ArcticHome>.

SSTs/El Niño/Southern Oscillation

Equatorial Pacific sea surface temperatures (SSTs) anomalies are below normal and we continue to observe weak La Niña conditions (**Figure 17**) and La Niña conditions are expected through the winter. Observed SSTs across the NH remain well above normal especially in the central North Pacific (west of recent years), the western North Pacific and offshore of eastern North America though below normal SSTs exist regionally especially in the North Pacific. Not my expertise but the SST pattern in the North Pacific

are strongly resembling a negative Pacific Decadal Oscillation (PDO) pattern that favors colder temperatures across northwestern North America and milder temperatures across southeastern North America.

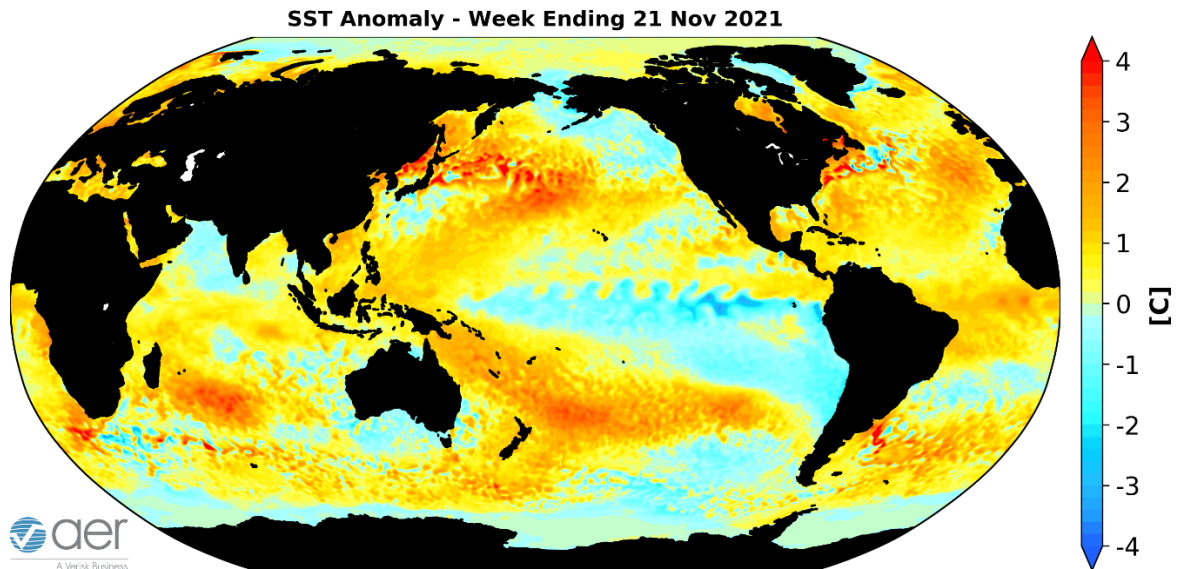


Figure 17. The latest weekly-mean global SST anomalies (ending 21 November 2021). Data from NOAA OI High-Resolution dataset.

Currently no phase of the Madden Julian Oscillation (MJO) is favored (**Figure 18**). The forecasts are for the MJO to remain weak where no phase is favored until next when it finally emerges into phases six and seven. MJO phases six and seven favor high latitude blocking including Alaska with transitioning ridges and troughs in the US. It seems to me that it is unlikely that the MJO is contributing significantly to the predicted weather pattern across North America over the next two weeks but admittedly this is outside of my expertise.

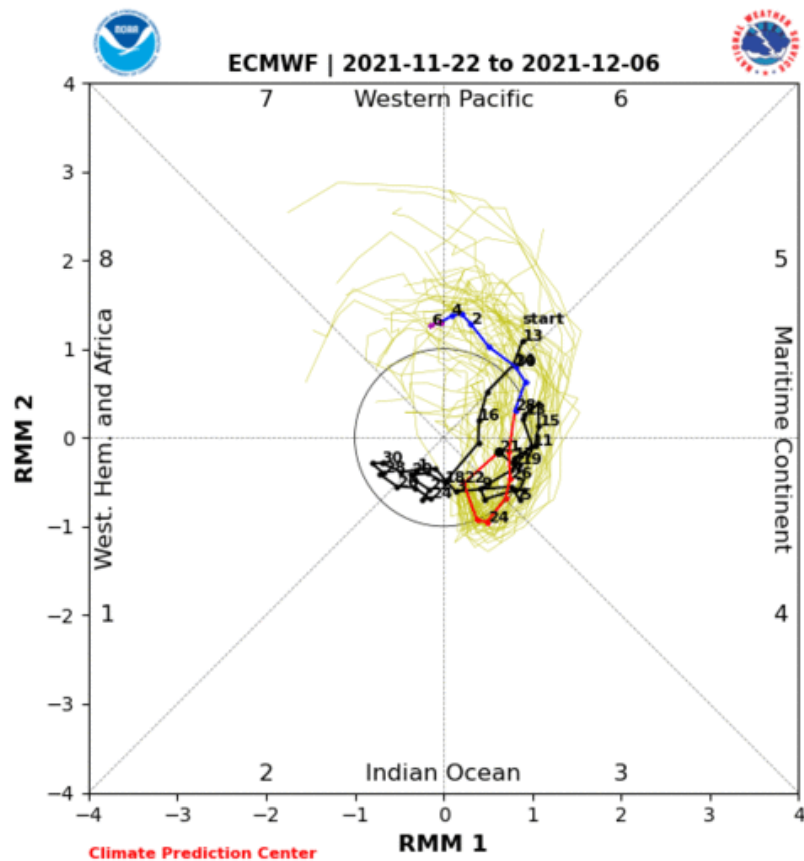


Figure 18. Past and forecast values of the MJO index. Forecast values from the 00Z 22 November 2021 ECMWF model. Yellow lines indicate individual ensemble-member forecasts, with the green line showing the ensemble-mean. A measure of the model “spread” is denoted by the gray shading. Sector numbers indicate the phase of the MJO, with geographical labels indicating where anomalous convection occurs during that phase. Image

source: <http://www.atmos.albany.edu/facstaff/roundy/waves/phasediags.html>

Get Detailed Seasonal Weather Intelligence with **sCast**

We appreciate your taking the time to read the public Arctic Oscillation blog from Dr. Judah Cohen and the AER Seasonal Forecasting team.

Dr. Cohen’s detailed monthly seasonal forecast, **sCast**, is also available for purchase. **sCast** provides a monthly 30-60-90-180-day outlook into temperature and precipitation, solar flux and wind anomalies across the globe, and regional population weighted cooling and heating degree forecasts for the US.

Our sCast principal engineer, [Karl Pfeiffer](#), can help you use sCast and other AER seasonal forecast products to deliver important, long-lead time weather intelligence to your business. Please reach out to Karl today!