

# Arctic Oscillation and Polar Vortex Analysis and Forecasts

February 20, 2024

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. In late 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

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

## Summary

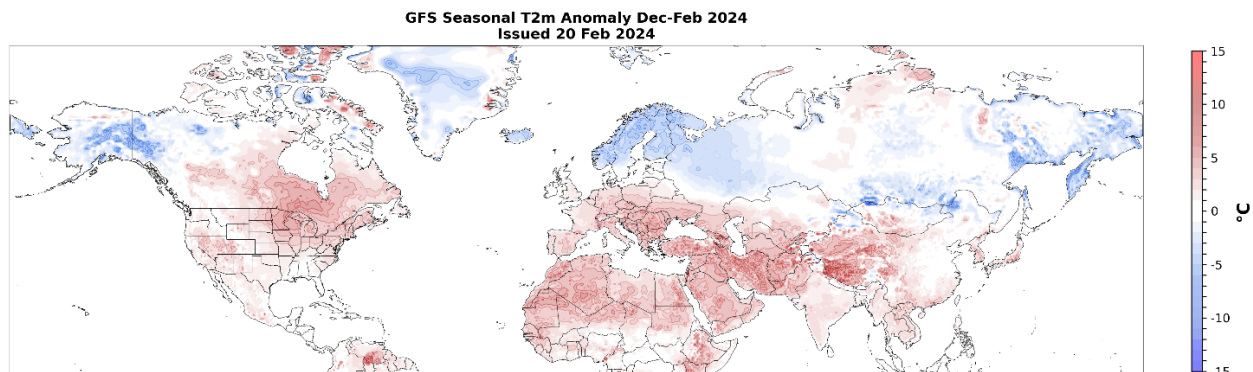
- The Arctic Oscillation (AO) is currently positive and is predicted to remain positive this week but trend towards neutral as pressure/geopotential height anomalies across the Arctic are currently mostly negative and are predicted to become remain negative to mixed over the next two weeks. The North Atlantic Oscillation (NAO) is currently positive with mostly negative pressure/geopotential height anomalies across Greenland and the NAO is predicted to be positive to neutral the next two weeks as pressure/geopotential height anomalies turn more mixed across Greenland.
- The general pattern across Europe this week is troughing/negative geopotential height anomalies across Northern Europe with ridging/positive geopotential height anomalies across Southern Europe. The quasi-zonal pattern will support normal to above normal temperatures across much of Europe including the United Kingdom (UK) this week. However, starting next week increasing ridging/positive geopotential

height anomalies in the North Atlantic will support deepening troughing and colder temperatures slowly spreading south across Western Europe including the UK while temperatures remain mild across Central and Eastern Europe.

- The general predicted pattern across Asia the next two weeks is strengthening ridging/positive geopotential height anomalies centered over the Urals forcing troughing/negative geopotential height anomalies across Northern Asia this week and then East Asia next week. This pattern favors widespread normal to above normal temperatures across Western and Southern Asia with normal to below normal temperatures across Siberia and Central Asia this week but will sink south across East Asia the next two weeks.
- The predicted pattern across North America this week is ridging/positive geopotential height anomalies across Alaska and Western Canada forcing troughing/negative geopotential height anomalies across Eastern Canada. This pattern favors normal to above normal temperatures across Alaska, Western Canada and much of the United States (US) with normal to below normal temperatures across Eastern Canada. However next week troughing/negative geopotential height anomalies will deepen across western North America forcing strengthening ridging/positive geopotential height anomalies across eastern North America. Therefore, next week cold temperatures are predicted to become more widespread across Alaska, Western Canada and the Western US as temperatures turn much milder across Eastern Canada and the Eastern US.
- In the Impacts section I discuss a complex weakening polar vortex (PV) and the impacts to Northern Hemisphere (NH) weather as winter winds down.

## Plain Language Summary

Now that we have made it to the third week of February the temperature pattern for winter 2023/24 is pretty much fully baked. Widespread warmth rules but also relatively cold in Alaska and adjacent Canada, Scandinavia, Northwest Russia, widespread across Siberia and possibly Eastern China when is said and done (see **Figure**).



**Figure.** Estimate of the observed surface temperatures (°C; shading) from 1 December 2023 – 20 February 2024 based on GFS initializations and the GFS forecast from the 20 February 2024 forecast.

Some cold for the Eastern US and Scandinavia but main action is looking to be in East Asia (see **Figure 9**). Could eventually turn colder for Northern Europe and then the Eastern US but still lots of certainty due to second large polar vortex disruption in two months.

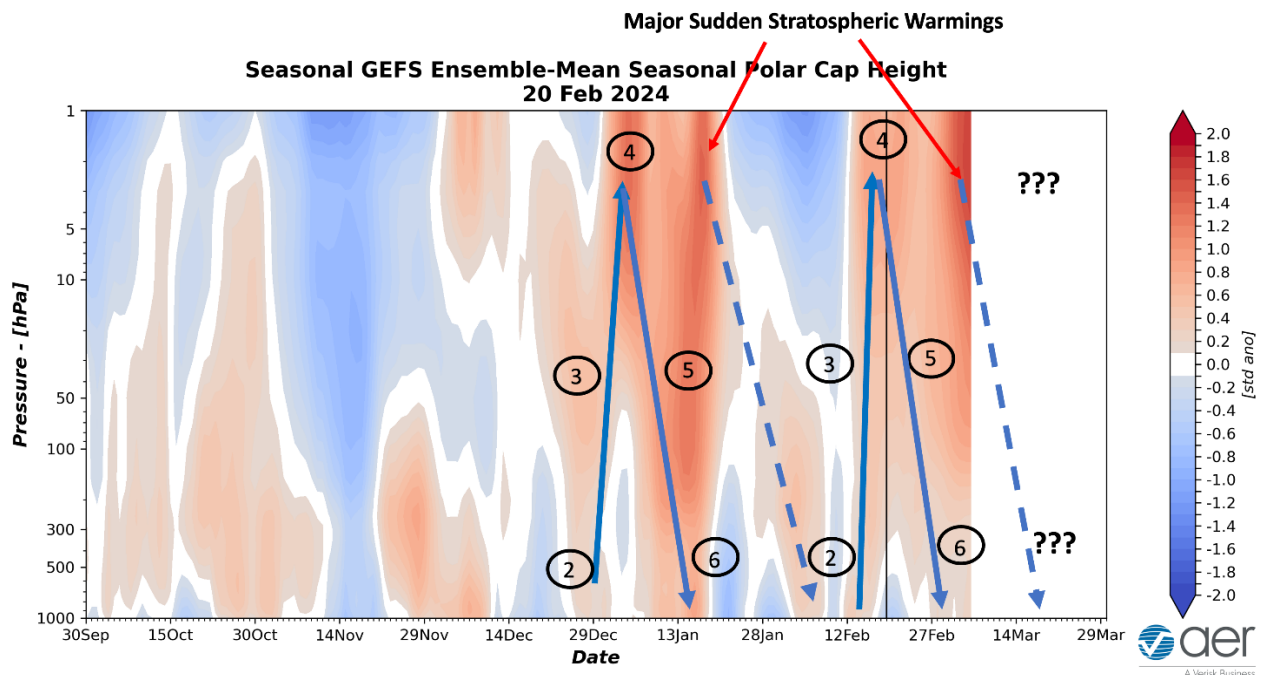
## Impacts

I will start off with something less than profound, winter is running out of runway. So even though all the models are predicting an ongoing large polar vortex (PV) disruption the impacts to our weather are questionable. Given the strengthening sun will it result in cold and white or just cool and wet? The late SSWs of last winter and March 2016 did not produce much snow, instead just made for less than stellar springs. A disappointing prospect snow lovers and haters can both agree on.

Even though the zonal mean zonal wind at 60°N and 10hpa did reverse from westerly to easterly/from positive to negative (the definition of a major sudden stratospheric warming or SSW) for at least part of the day yesterday, as far as I can tell it did not average below zero for a whole twenty-four-hour period. Instead, the PV disruption will likely achieve major warming status in early March with the ECMWF predicting a date around March 4<sup>th</sup>. Oh well, it would have been nice to achieve SSWs in both January and February but then again given the lack of winter weather, maybe it is more appropriate for it not to happen.

As a quick tangent the SSW predicted for early March could be defined as a final warming and not as a major warming if the winds don't return to westerly before next fall. But I think that this is a technical issue and the impact to our weather is identical whether it is a major or final warming because it is clearly dynamically driven thanks to predicted strong Ural ridging (see **Figure 5**).

In **Figure i**, I show again the seasonal polar cap geopotential height anomalies (PCHs) with the upward and downward influences in large PV disruptions shown in solid arrows and also the downward propagation of the major SSWs. Ironically in January the impact on our weather seems to have been stronger from the minor SSW (or if you prefer the SSW that came up short) rather than from the major SSW about two weeks later. A lesson for everyone out there aspiring to do great things, don't let arbitrary labels define or limit your potential!



**Figure ii.** Seasonal and observed and predicted daily polar cap height (i.e., area-averaged geopotential heights poleward of 60°N) standardized anomalies. Blue Arrows indicate troposphere-stratosphere-troposphere coupling. Numbers explained in 4 December 2023 blog. The forecast is from the 00Z 20 February 2024 GFS ensemble.

We have another upcoming major SSW. Like in January the models were predicting the event to peak in February and then for the PV strengthen just for what is more likely to occur – the weakening in February is a precursor and the main weakening of the PV is delayed until early March. Not to get too distracted but I raised this on Twitter/X because it may be common for SSWs to peak in the upper stratosphere first and then peak in the mid-stratosphere later on despite the weather model forecasts. This has now happened twice this winter. It is important because it could very well delay the impact to our weather. Rather than starting the two-week countdown from the upper stratosphere peak it is delayed until the mid-stratosphere peak in the PV disruption. But please keep in mind that it is only recently that I have looked at PCHs as high as 1 hPa so I don't have much experience or data points to draw from.

One theme from the blog this winter is that the PV has been so active quickly transitioning between different PV disruptions so much so that the influence of one PV state or phase is overlapping, intersecting, and interfering with other PV states in close proximity in time.

Certainly, seems to me that the weather models have really struggled in February, and at least for me symbolized by the failed snowstorm in Boston last week. The models were predicting as recently as a week ago, strong high latitude blocking including simultaneous Greenland and Alaskan blocking for it just to vanish into thin air. My explanation would be that the models were

predicting strong high latitude blocking in association with downward propagation of the major warming at the end of January that “dripped” or descended down from the stratosphere to the surface shown in the first dashed arrow. But maybe why that fizzled is because of the strong upward Wave Activity Flux (WAF) in the vertical direction last week and this week that dominated the high latitude circulation. Strong upward WAF contributes to warm, high pressure in the polar stratosphere but cold, low pressure in the tropospheric Arctic and the upward WAF ruled the day and dominated the downward propagation from the major SSW two weeks earlier.

But what comes next. The latest PCH forecast suggest the downward propagation from the minor SSW over the weekend will reach the surface the end of February and we can see an increase in high latitude blocking at the very end of February and early March (see **Figure 8**). The blocking predicted is not terribly impressive and not strong enough to support cold in the Eastern US and/or Northern Europe. But just like the model over predicted the high latitude blocking for mid-February the models can equally be underpredicting the high latitude blocking for late February and into early March. The models are equal opportunity when it comes to poor forecasts.

And then regardless, there is the potential downward propagation from the major SSW in early March shown by the second dashed arrow. Given that at least I am so uncertain about the possible impact of the minor SSW, hard to interpret the impact of the ensuing major SSW.

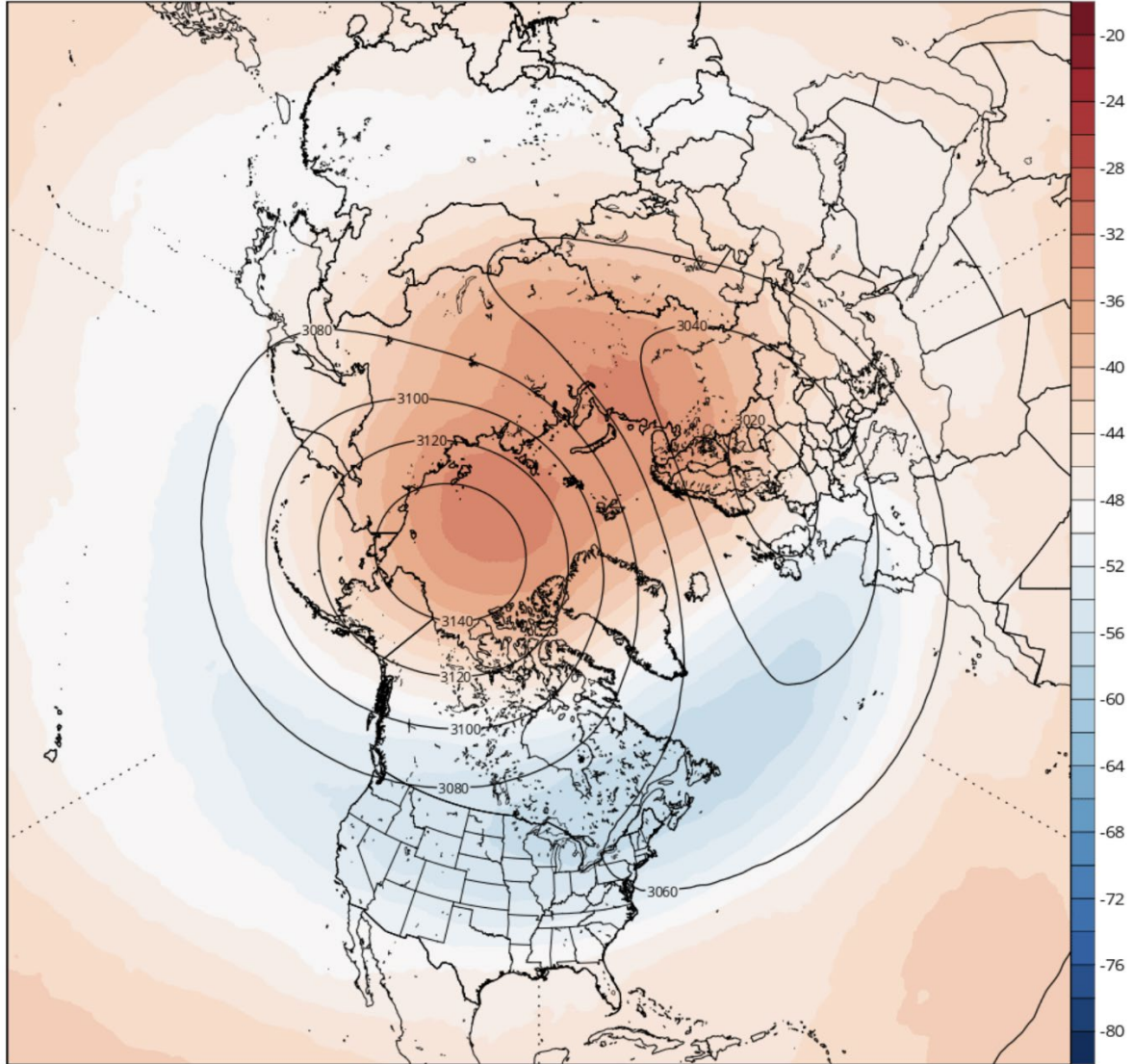
Seems like everyone is on the warm train (and I really can't make a strong argument against that sentiment) but let me play devil's advocate and make some arguments for a colder solution first in the Eastern US than current thinking. All models are predicting cold temperatures to pool over Alaska and Western Canada. It is within striking distance of the Eastern US and it would only take a slight shift in the position of the North American wave eastward to bring the colder air east of the Rockies. SSWs are supportive of wave reflection and stretched PVs that favors colder weather east of the Rockies (though for now no signs of one in the weather models so only hypothetical). Finally with the predicted upcoming SSW, some of the coldest temperature anomalies in the stratosphere extend from the UK to the Northeastern US. This could be suggestive of a cold pool in the troposphere as well over the Northeastern US.

For Europe the argument for cold is harder. First as far as I know there no analogous wave reflection over Europe as there is for North America and if there is, it must be much less common. Also, we just had a large buildup of cold air in Siberia, but it unloaded into East Asia where once again I am seeing reports of record cold and snowstorms. So, the best reservoir for cold air for Europe to tap into, is now depleted. From what I can tell it is mostly a GFS forecast but some model runs are forecasting easterly flow over Northern Europe (see for example PV animation tweeted out with announcement of the blog being available). Or alternatively for the PV center to be displaced over Europe (for an example see **Figure ii**) If this same flow can translate to the mid-troposphere, it would turn much colder in Europe. But this is a big if!

GEFS 10mb Temperature (°C, shaded) & Geopotential Height (dam, contour)

Init: 12z Feb 20 2024 Forecast Hour: [384] valid at 12z Thu, Mar 07 2024

TROPICALTIDBITS.COM

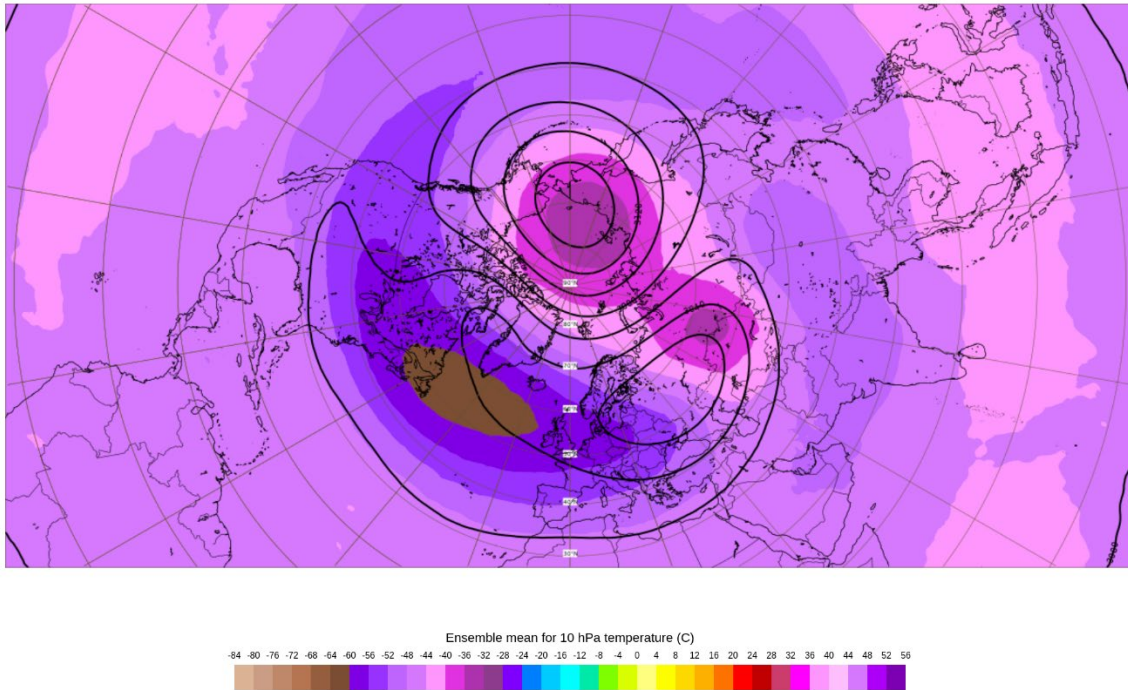


**Figure iii.** Forecasted average 10 mb geopotential heights (dam; contours) and temperature anomalies (°C; shading) across the Northern Hemisphere for 6 March 2024. The forecasts are from the 12z 20 February 2024 GFS ensemble. Plot taken from <https://www.tropicaltidbits.com/analysis/models/>.

I had to also include the latest ECMWF forecast as well (see **Figure iii**) as it illustrates the potential of both my ideas, the PV center over Europe and favorable for easterly flow and the cold pool over the Northeastern US.

## Ensemble mean for 10 hPa temperature and geopotential

Base time: Tue 20 Feb 2024 12 UTC Valid time: Wed 06 Mar 2024 12 UTC (+360h) Area : North Pole



© 2024 European Centre for Medium-Range Weather Forecasts (ECMWF)  
Source: [www.ecmwf.int](https://www.ecmwf.int)  
Licence: CC BY 4.0 and ECMWF Terms of Use (<https://apps.ecmwf.int/datasets/licences/general/>)  
Created at 2024-02-20T20:24:42.388Z

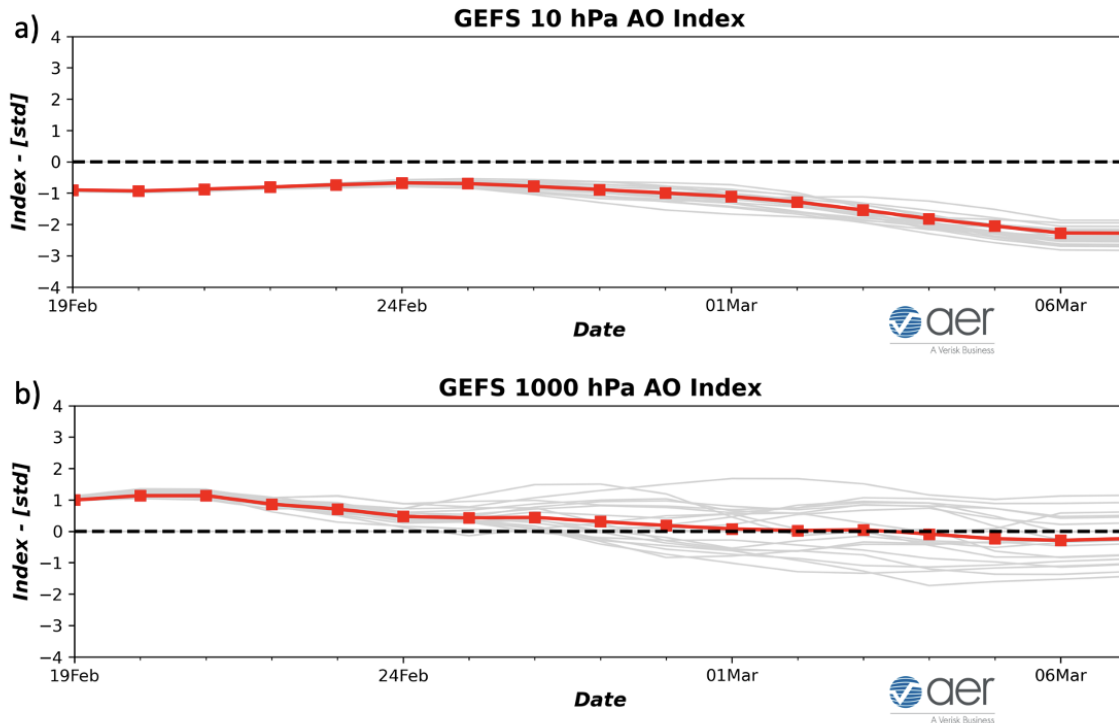


**Figure iv.** Forecasted average 10 mb geopotential heights (dam; contours) and temperature anomalies ( $^{\circ}\text{C}$ ; shading) across the Northern Hemisphere for 6 March 2024. The forecasts are from the 12z 20 February 2024 EPS ensemble. Plot taken from <https://charts.ecmwf.int/>.

## Near-Term

### *This week*

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

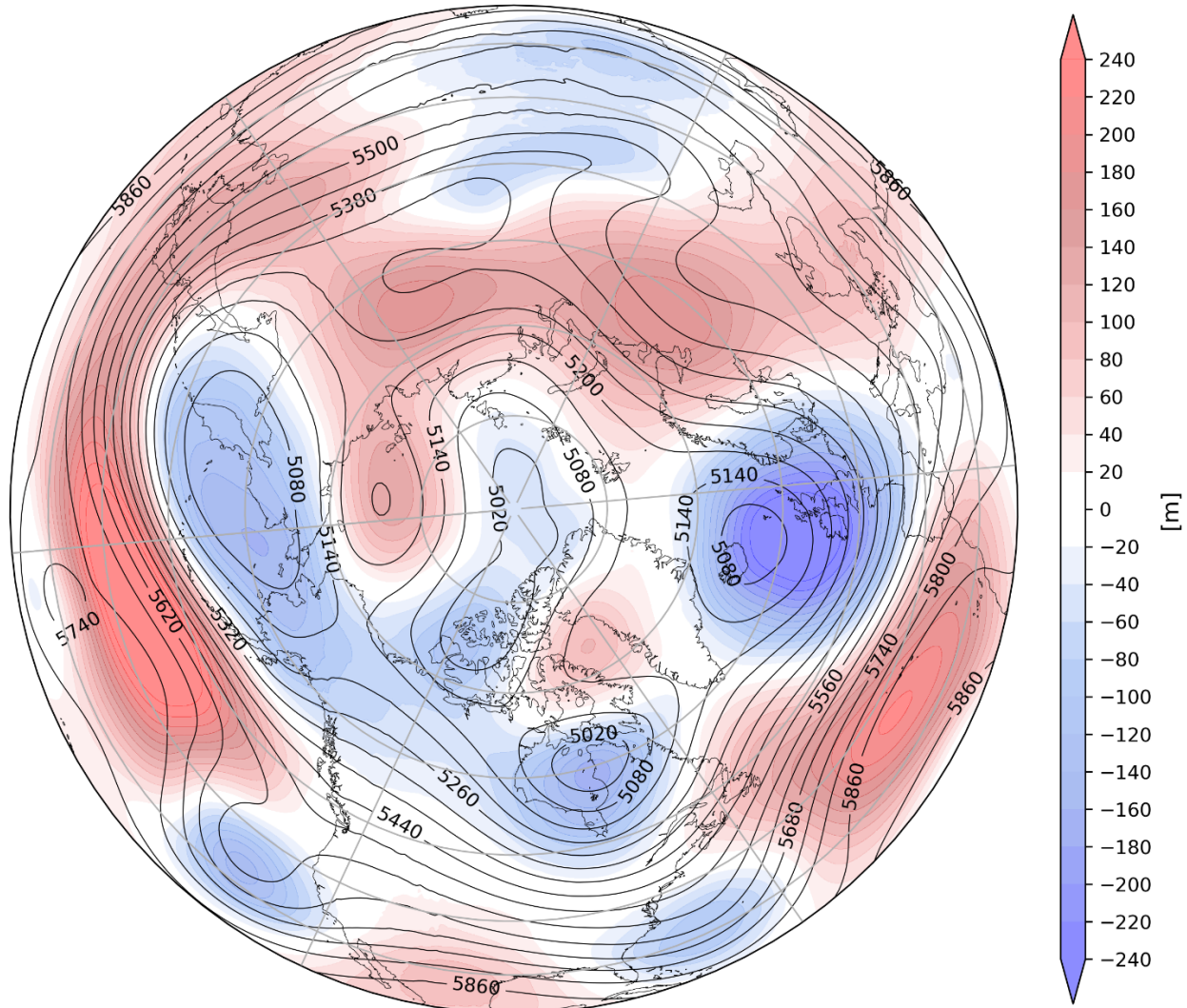


**Figure 1.** (a) The predicted daily-mean AO at 1000 hPa from the 00Z 20 February 2024 GFS ensemble. (b) The predicted daily-mean near-surface AO from the 00Z 20 February 2024 GFS ensemble. Gray lines indicate the AO index from each individual ensemble member, with the ensemble-mean AO index given by the red line with squares.

This week, the predicted pattern across Europe is troughing/negative geopotential height anomalies across Northern Europe with ridging/positive geopotential height anomalies across Southern Europe this week (**Figures 2**). This zonal pattern favors widespread normal to above normal temperatures across Europe including the UK (**Figure 3**). Predicted ridging/positive geopotential height anomalies centered in the Laptev Sea and Western Russia will support troughing/negative geopotential height anomalies across Siberia and Central Asia with more ridging/positive geopotential height anomalies across Southern Asia this period (**Figure 2**). This pattern favors widespread normal to above normal temperatures across far Northern Siberia, Western and Southern Asia with normal to below normal temperatures across much of Siberia and Central Asia (**Figure 3**).

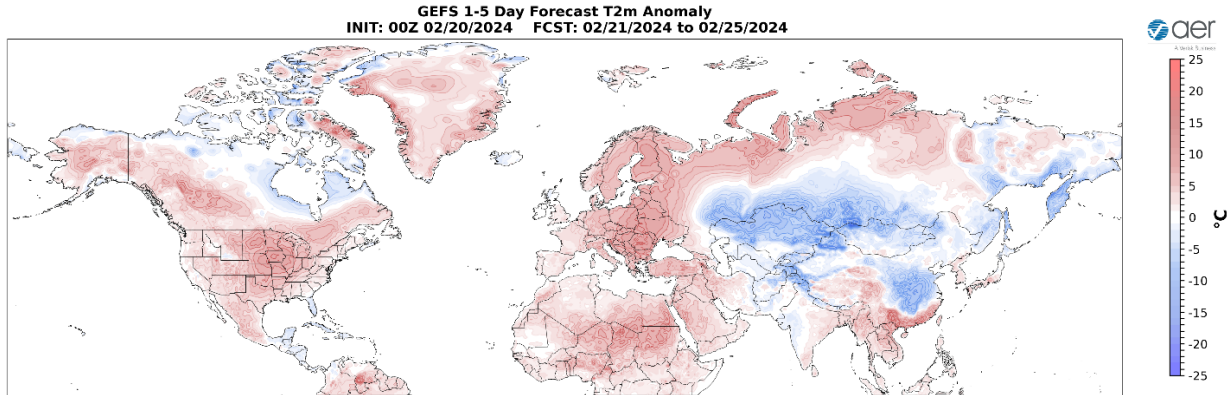


**GEFS 1-5 Day Forecast 500 hPa Anomaly**  
**INIT: 00Z 02/20/2024 FCST: 02/21/2024 to 02/25/2024**



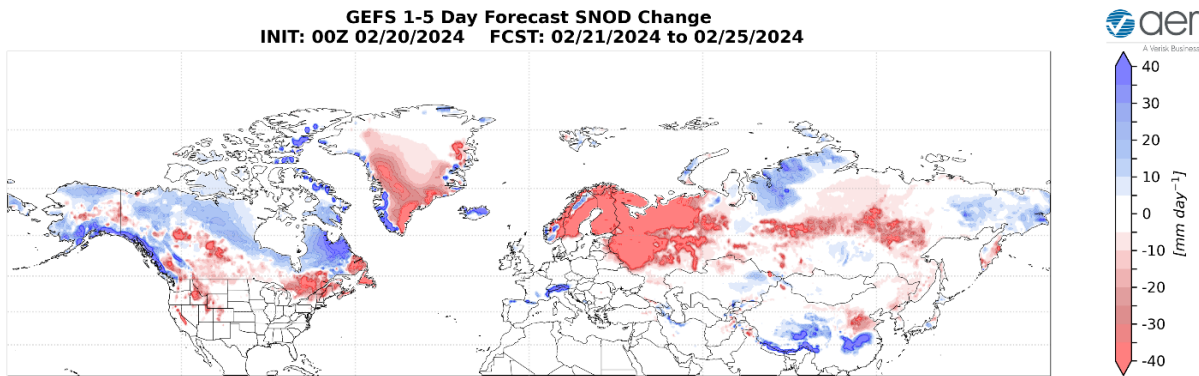
**Figure 2.** Forecasted average 500 mb geopotential heights (dam; contours) and geopotential height anomalies (m; shading) across the Northern Hemisphere from 21 – 25 February 2024. The forecasts are from the 00z 20 February 2024 GFS ensemble.

The pattern this week across North America is ridging/positive geopotential height anomalies centered across Alaska and Western Canada forcing troughing/negative geopotential height anomalies across Eastern Canada with zonal flow across the US (**Figure 2**). This pattern will favor normal to above normal temperatures across Alaska, Western Canada and the US with normal to below normal temperatures limited to Eastern Canada and Florida (**Figure 3**).



**Figure 3.** Forecasted surface temperature anomalies (°C; shading) from 21 – 25 February 2024. The forecast is from the 00Z 20 February 2024 GFS ensemble.

Trouching and/or cold temperatures will support new snowfall across parts of Norway, the Alps, parts of Siberia and East Asia while mild temperatures will support snowmelt across the Scandinavia, parts of Eastern Europe, Western Russia and parts of Siberia this week (**Figure 4**). Trouching and/or cold temperatures will support new snowfall across Alaska, Northern and Eastern Canada while mild temperatures will support snowmelt across Western and Southern Canada, the Western and Northeastern US this week (**Figure 4**).



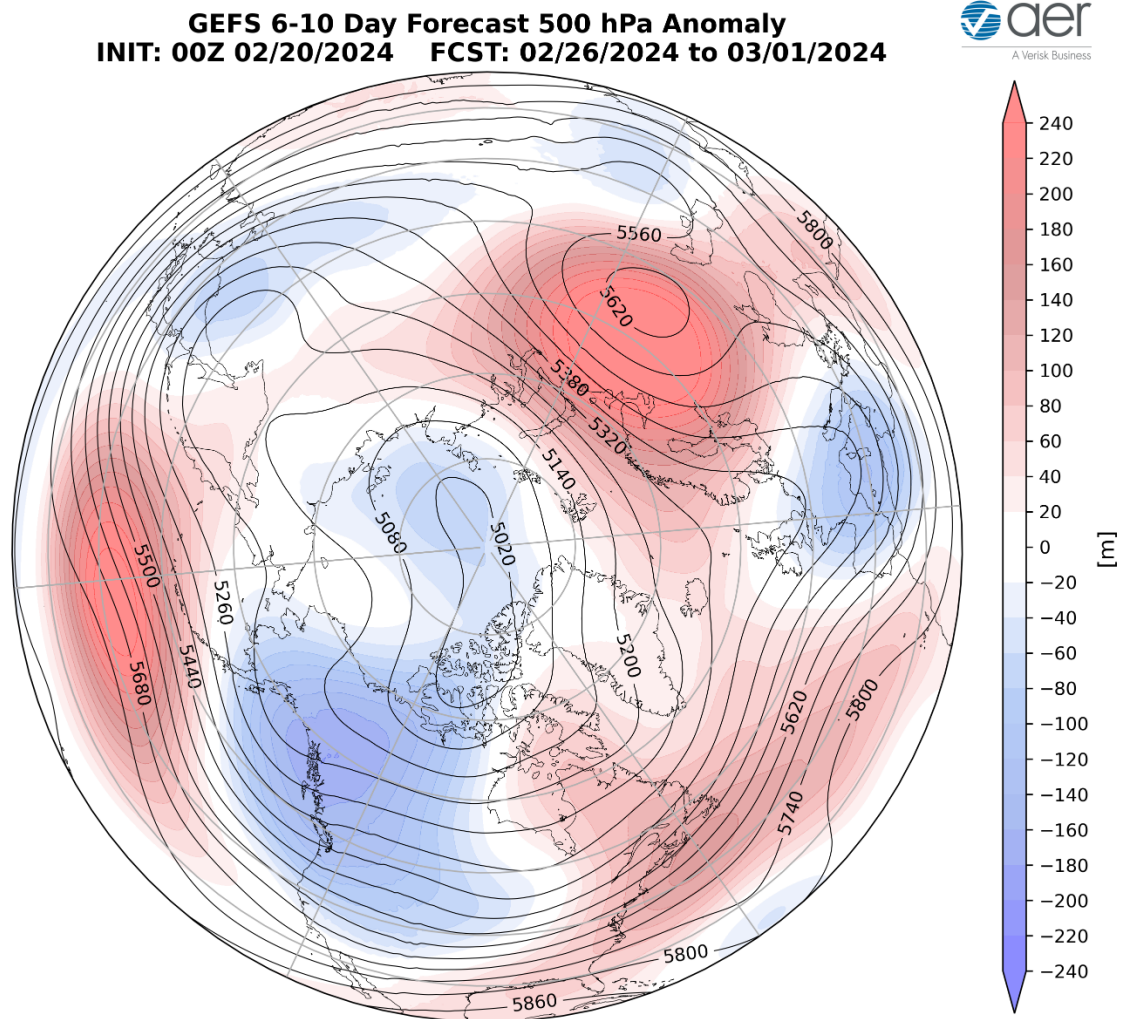
**Figure 4.** Forecasted snow depth changes (mm/day; shading) from 21 – 25 February 2024. The forecast is from the 00Z 20 February 2024 GFS ensemble.

## Near-Mid Term

### *Next week*

With geopotential height anomalies becoming increasingly mixed across the Arctic and with mixed geopotential height anomalies across the mid-latitudes this period (**Figure 5**), the AO will be positive to neutral this period (**Figure 1**). With pressure/geopotential height

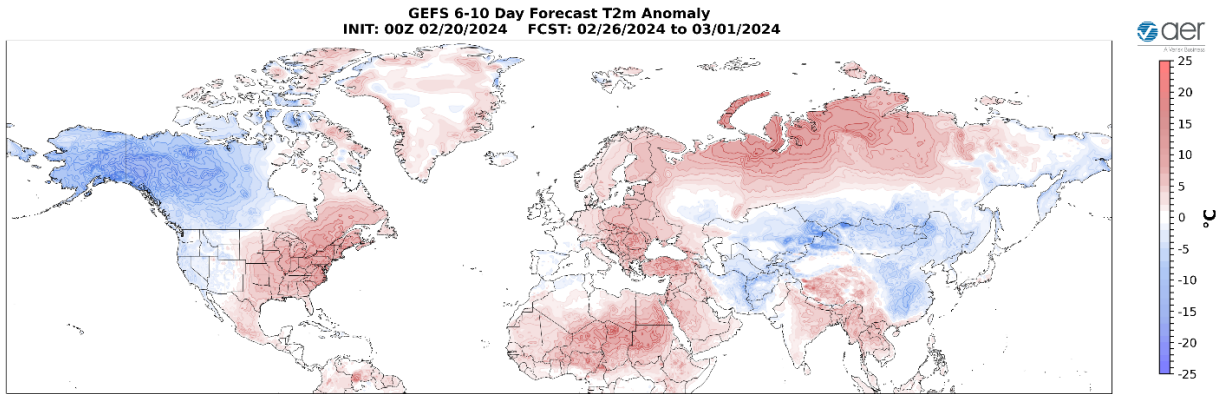
anomalies across Greenland also turning more mixed (Figure 5), the NAO will be positive to neutral as well this period.



**Figure 5.** Forecasted average 500 mb geopotential heights (dam; contours) and geopotential height anomalies (m; shading) across the Northern Hemisphere from 26 February – 1 March 2024. The forecasts are from the 00z 20 February 2024 GFS ensemble.

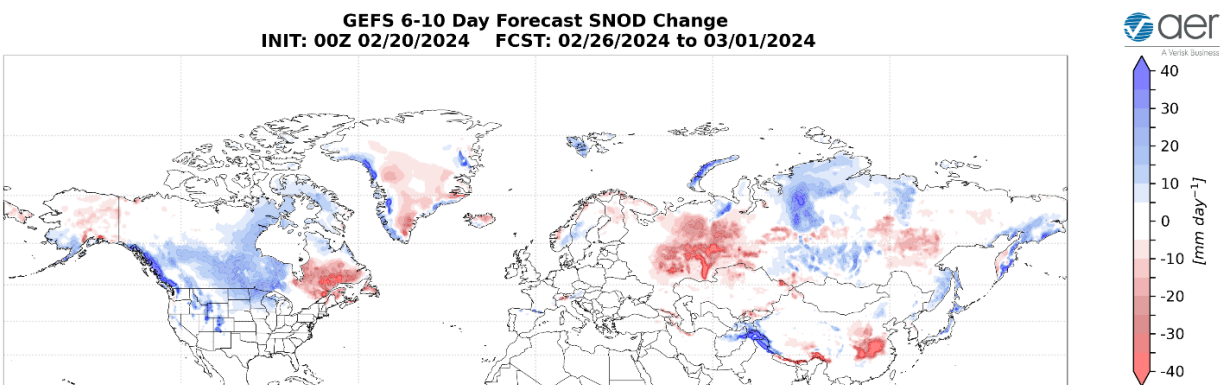
Increasing ridging/positive geopotential height anomalies in the North Atlantic will support deepening troughing/negative geopotential height anomalies across Western Europe with more ridging/positive geopotential height anomalies retreating into Eastern Europe this period (Figure 5). This pattern will favor widespread normal to above normal temperatures across Central and Eastern Europe with normal to below normal temperatures spreading across Western Europe including the UK (Figures 6). Predicted strengthening ridging/positive geopotential height anomalies centered on the Urals will support deepening

troughing/negative geopotential height anomalies across Siberia and now spreading into East Asia with more ridging/positive geopotential height anomalies across Southern Asia this period (**Figure 5**). This pattern favors widespread normal to above normal temperatures across Northern, Southern and Western Asia with normal to below normal temperatures in Central Asia and spreading out across Southern Siberia and East Asia this period (**Figure 6**).



**Figure 6.** Forecasted surface temperature anomalies ( $^{\circ}\text{C}$ ; shading) from 26 February – 1 March 2024. The forecasts are from the 00z 20 February 2024 GFS ensemble.

Predicted strengthening ridging/positive geopotential height anomalies near the Aleutians will support deepening troughing/negative geopotential height anomalies across Alaska, Western Canada and the Western US with more ridging/positive geopotential height anomalies across eastern North America this period (**Figure 5**). This favors normal to below normal temperatures across Alaska, Western Canada and the Western US with normal to above normal temperatures across much of Canada and the US east of the Rockies (**Figure 6**).



**Figure 7.** Forecasted snow depth changes (mm/day; shading) from 26 February – 1 March 2024. The forecast is from the 00Z 20 February 2024 GFS ensemble.

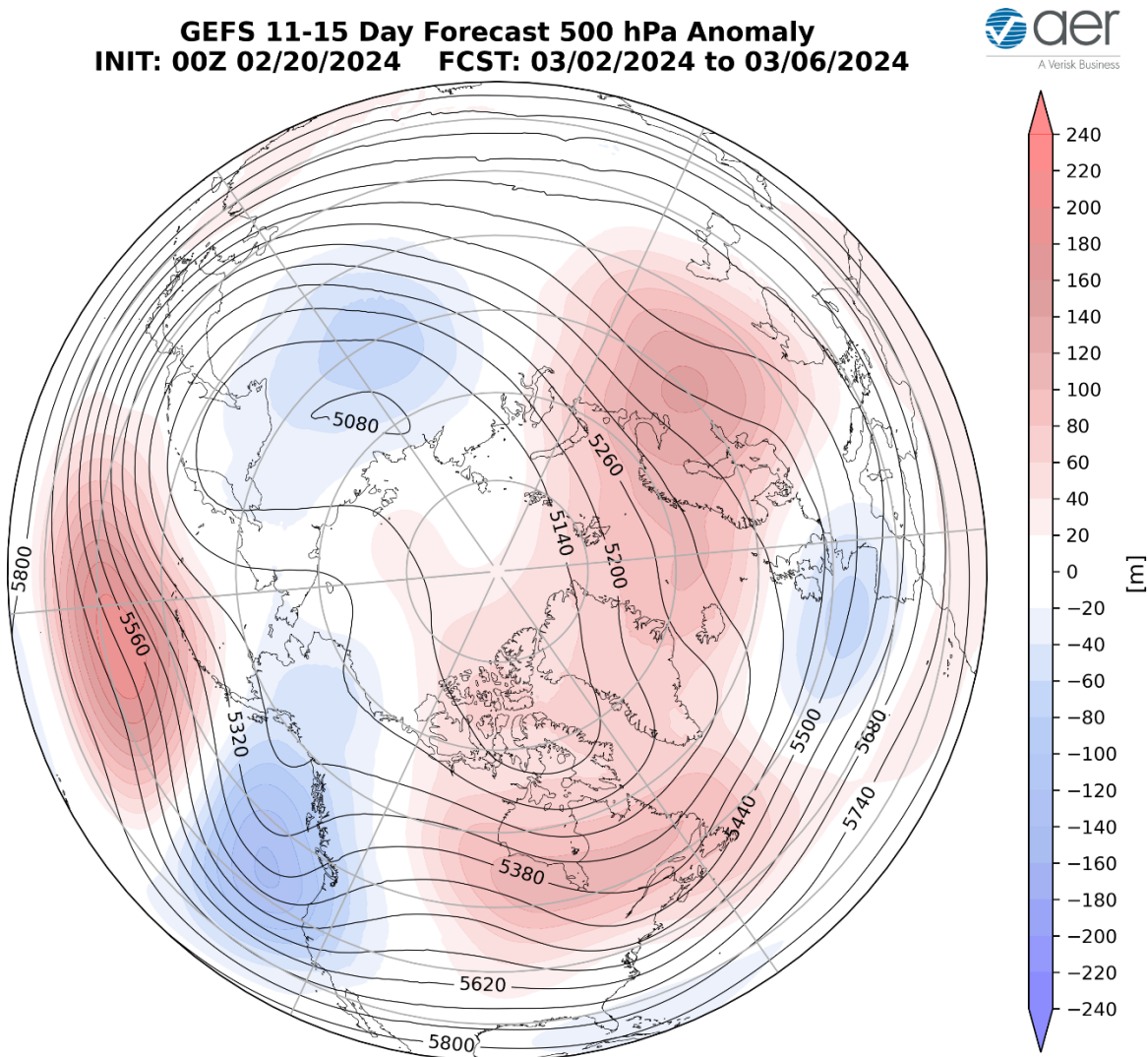
Troughing and/or cold temperatures will support new snowfall across parts of Siberia, the Tibetan Plateau and East Asia while mild temperatures will support snowmelt in Scandinavia,

Northwestern Russia, and parts of Siberia and China this period (**Figure 7**). Troughing and/or cold temperatures will support new snowfall in Western and Central Canada and the Western US while mild temperatures will support snowmelt in across Southeastern Canada and the Northeastern US this period (**Figure 7**).

## Mid Term

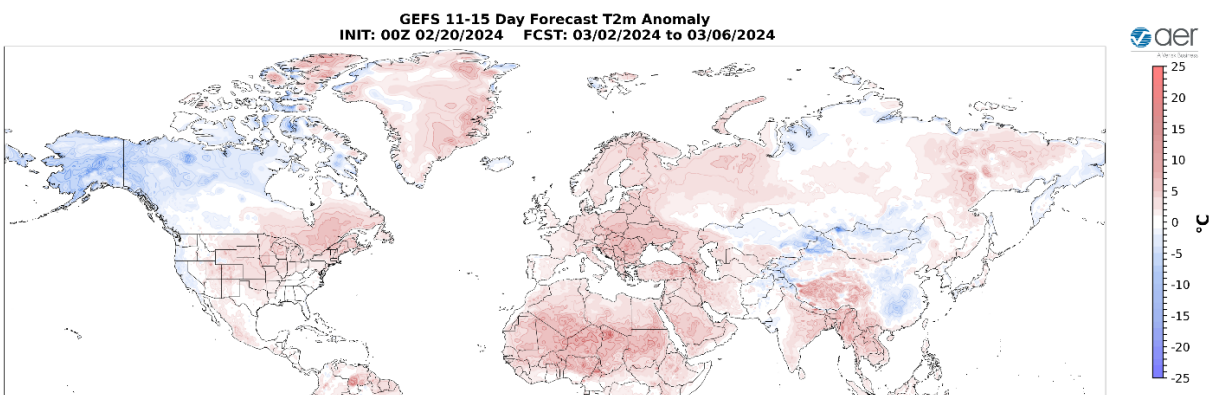
### Week Two

With mixed geopotential height anomalies across the Arctic and mixed geopotential height anomalies across the mid-latitudes this period (**Figure 8**), the AO will likely remain near neutral this period (**Figure 1**). With weak and mixed pressure/geopotential height anomalies across Greenland (**Figure 8**), the NAO should be negative as well this period.



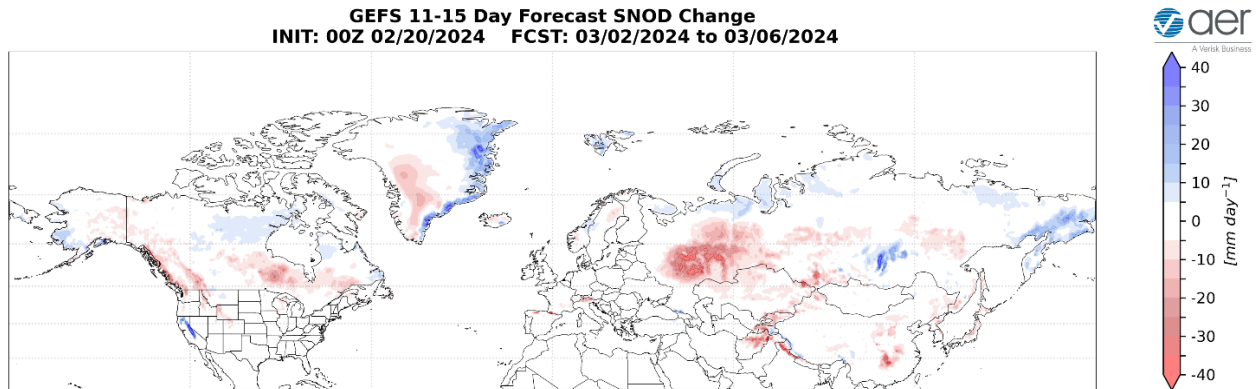
**Figure 8.** Forecasted average 500 mb geopotential heights (dam; contours) and geopotential height anomalies (m; shading) across the Northern Hemisphere from 2 – 6 March 2024. The forecasts are from the 00z 20 February 2024 GFS ensemble.

Persistent ridging/positive geopotential height anomalies across the North Atlantic will continue to support troughing/negative geopotential height anomalies across Western Europe with more ridging/positive geopotential height anomalies across Eastern Europe this period (**Figure 8**). This pattern should favor normal to below normal temperatures across Western Europe including the UK with normal to above normal temperatures across Central and Eastern Europe this period (**Figures 9**). Persistent ridging/positive geopotential height anomalies centered across the Urals will continue to support troughing/negative geopotential height anomalies across East Asia with more ridging/positive geopotential height anomalies across Southern Asia this period (**Figure 8**). The predicted pattern favors widespread normal to above normal temperatures across Northern, Southern and Western Asia with normal to below normal across Central and Eastern Asia this period (**Figure 9**).



**Figure 9.** Forecasted surface temperature anomalies (°C; shading) from 2 – 6 March 2024. The forecasts are from the 00z 20 February 2024 GFS ensemble.

With ridging/positive geopotential height anomalies anchored near the Aleutians will support troughing/negative geopotential height anomalies across Alaska, Western Canada and the Western US with more ridging/positive geopotential height anomalies across eastern North America this period (**Figure 8**). This pattern favors normal to below normal temperatures across Alaska, Northern and Western Canada and the Western US with normal to above normal temperatures across Southeastern Canada and the Eastern US this period (**Figure 9**).



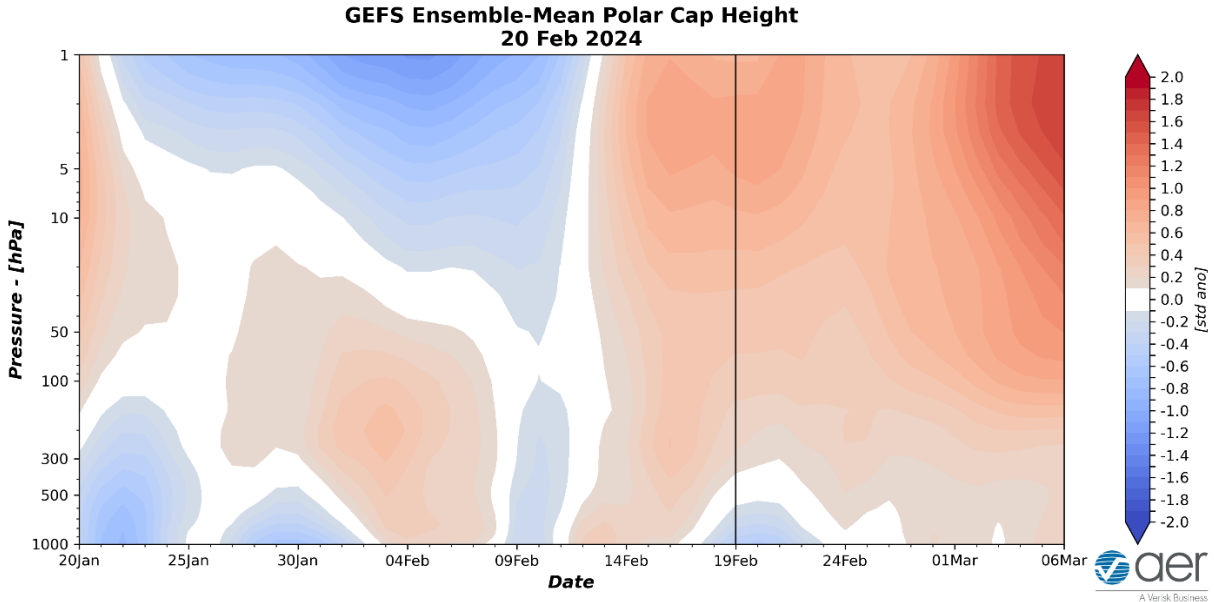
**Figure 10.** Forecasted snow depth changes (mm/day; shading) from 2 – 6 March 2024. The forecast is from the 00Z 20 February 2024 GFS ensemble.

Trouging and/or cold temperatures will support new snowfall across the Tibetan Plateau, Siberia and Northeast Asia while mild temperatures will support snowmelt in Scandinavia and Northwest Russia this period (**Figure 10**). Trouging and/or cold temperatures will support new snowfall across California, Northern and Eastern Canada. Mild temperatures will support snowmelt along the West Coast of Canada, Southern Canada and the US Rockies this period (**Figure 10**).

## Longer Term

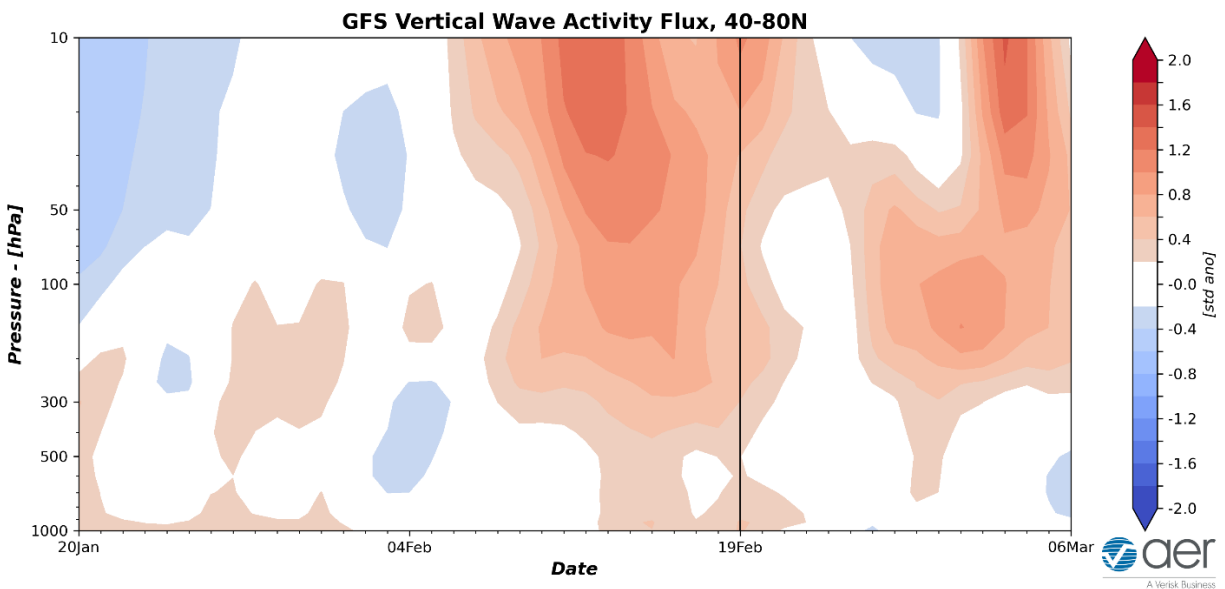
### *30-day*

The latest plot of the polar cap geopotential height anomalies (PCHs) currently shows cold/negative PCHs throughout the mid and lower troposphere with warm/positive PCHs in the stratosphere and upper troposphere (**Figure 11**). However, for much of the next two weeks warm/positive PCHs will dominate both the stratosphere and troposphere (**Figure 11**). The increasing warm/positive throughout the stratosphere (**Figure 11**) is related to the PV becoming increasingly disrupted while warming/positive PCHs in the troposphere are associated with descent of the warm/positive PCHs associated with the PV disruption in the stratosphere.



**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 20 February 2024 GFS ensemble.

The predicted cold/negative PCHs in the lower troposphere for this week (**Figure 11**) are consistent with the predicted positive surface AO this week (**Figure 1**). However, as the warm/positive PCHs begin to descend from the stratosphere to the troposphere the AO is more likely to dip into negative territory.

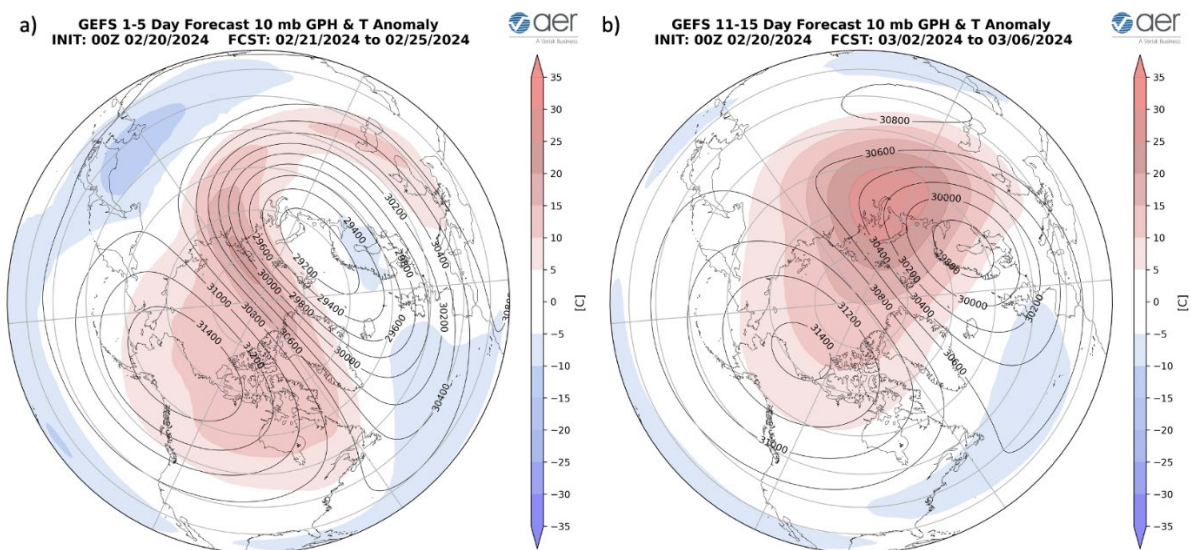




**Figure 12.** Observed and predicted daily vertical component of the wave activity flux (WAFz) standardized anomalies, averaged poleward of 40-80°N. The forecast is from the 00Z 20 February 2024 GFS ensemble.

Also shown in **Figure 1** is the stratospheric AO. The stratospheric AO is currently negative and is predicted to be negative for the next two weeks. This is consistent with increasingly warm/positive stratospheric PCHs in the mid-stratosphere associates with a weakening PV that is dynamically consistent with a sudden stratospheric warming.

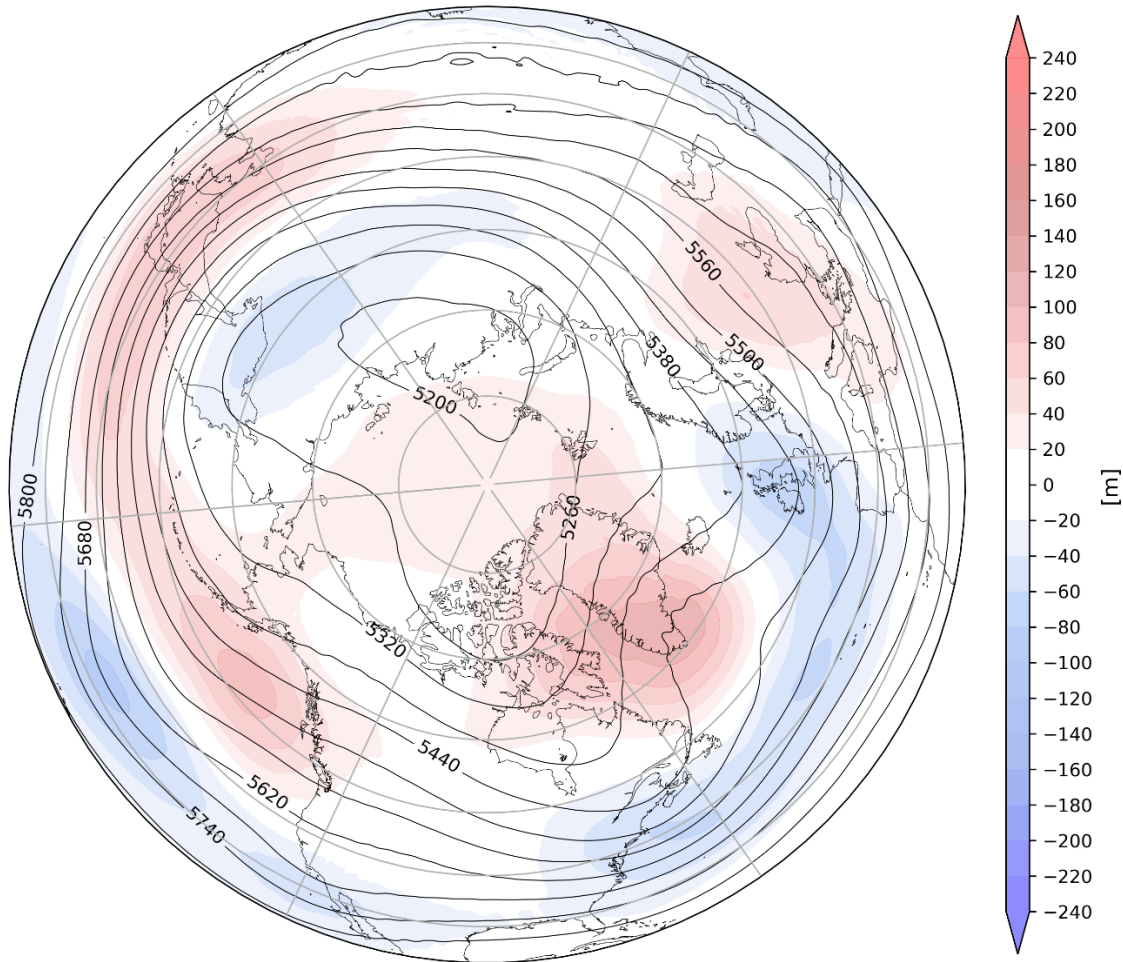
Vertical Wave Activity Flux (WAFz) from the troposphere to the stratosphere or poleward heat transport in the stratosphere has been relatively quiet since mid-January (**Figure 12**). However, the quieter WAFz ended last week and has been much more active since the second week of February and continuing into this week (**Figure 12**). This should result in a weakening PV. The strongest pulse of WAFz is winding down but another strong pulse is predicted next week.



**Figure 13.** (a) Forecasted 10 mb geopotential heights (dam; contours) and temperature anomalies (°C; shading) across the Northern Hemisphere from 21 – 25 February 2024 . (b) Same as (a) except forecasted averaged from 2 – 6 March 2024. The forecasts are from the 00Z 20 February 2024 GFS model ensemble.

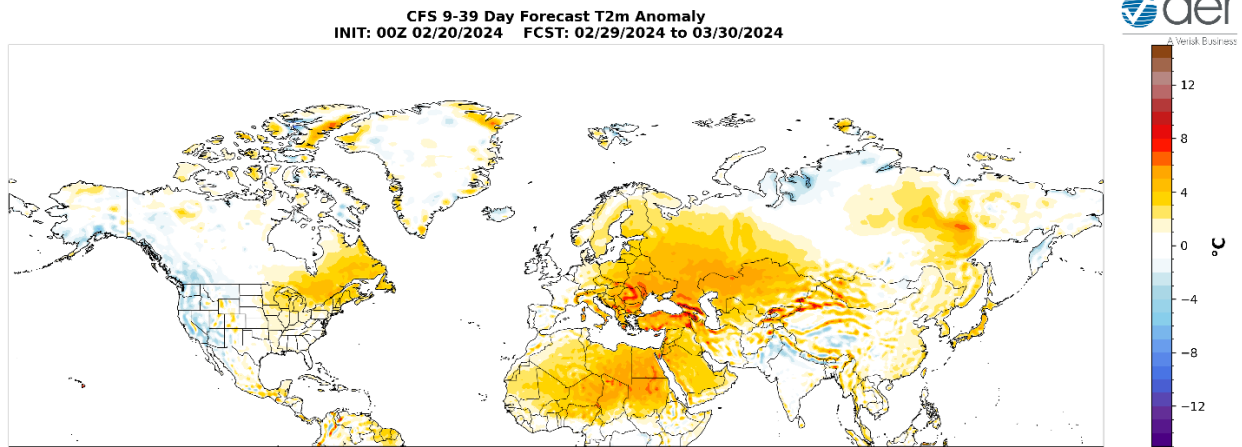
This week the polar vortex (PV) is predicted to be shifted south of the North Pole centered over the Barents-Kara Seas with an elongated shape from Western Siberia to Greenland (**Figure 13a**). The ridging in the polar stratosphere is centered over Alaska with the greatest warming aimed at the North Pole. This is consistent with an SSW. For the first week of March the PV center is predicted to drift even further south over Scandinavia, the ridging is predicted to remain over Alaska and with more warming aimed at the North Pole (**Figure 13b**).

**CFS 500 hPa Forecast Anomaly Mar 2024**  
**Valid as of 20 Feb 2024**



**Figure 14.** Forecasted average 500 mb geopotential heights (dam; contours) and geopotential height anomalies (m; shading) across the Northern Hemisphere for March 2024. The forecasts are from the 00Z 20 February 2024 CFS.

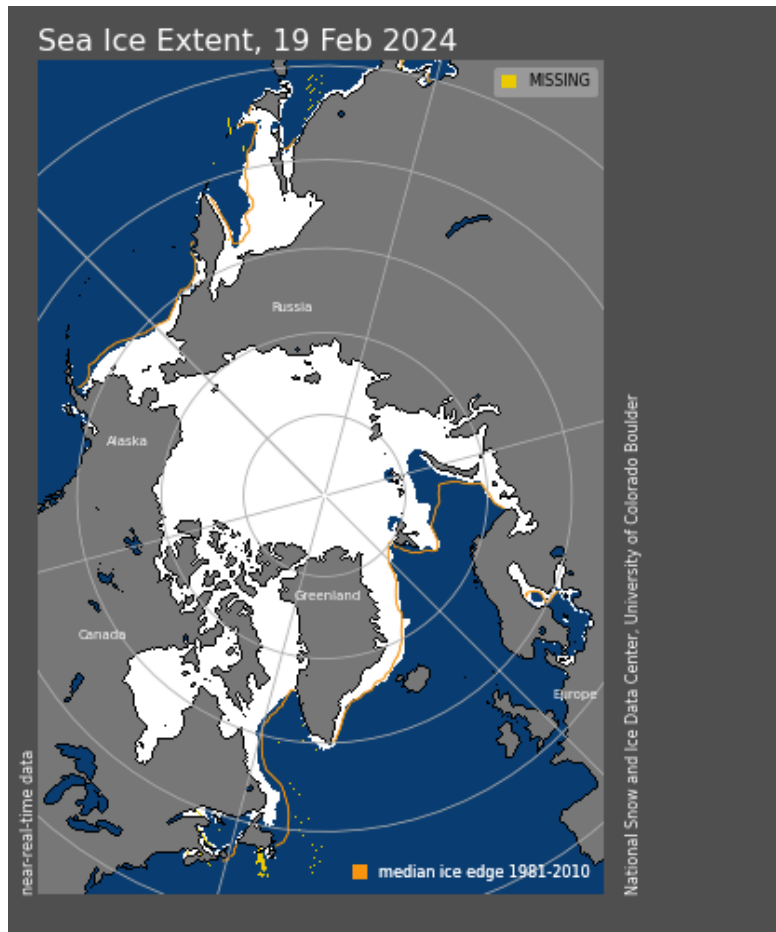
I include in this week's blog the monthly 500 hPa geopotential heights (**Figure 14**) and surface temperatures for March (**Figure 15**) from the Climate Forecast System (CFS; the plots represent yesterday's four ensemble members). The forecast for the troposphere is ridging centered over Greenland, Eastern Europe, Eastern Siberia, the Gulf of Alaska and Western Canada with troughing in Western Europe, Siberia, Northeast Asia, the Southwestern US, Eastern Canada and the Northeastern US (**Figure 14**). This pattern favors seasonable to relatively warm temperatures across Eastern Europe, Western Asia, Southeastern Asia, Alaska, Western Canada and the Central US with seasonable to relatively cold temperatures across Western Europe, Siberia, Northeast Asia, Central Canada, the Western US and the Southeastern US (**Figure 15**).



**Figure 15.** Forecasted average surface temperature anomalies ( $^{\circ}\text{C}$ ; shading) across the Northern Hemisphere for March 2024. The forecasts are from the 00Z 20 February 2024 CFS.

#### *Arctic sea ice extent*

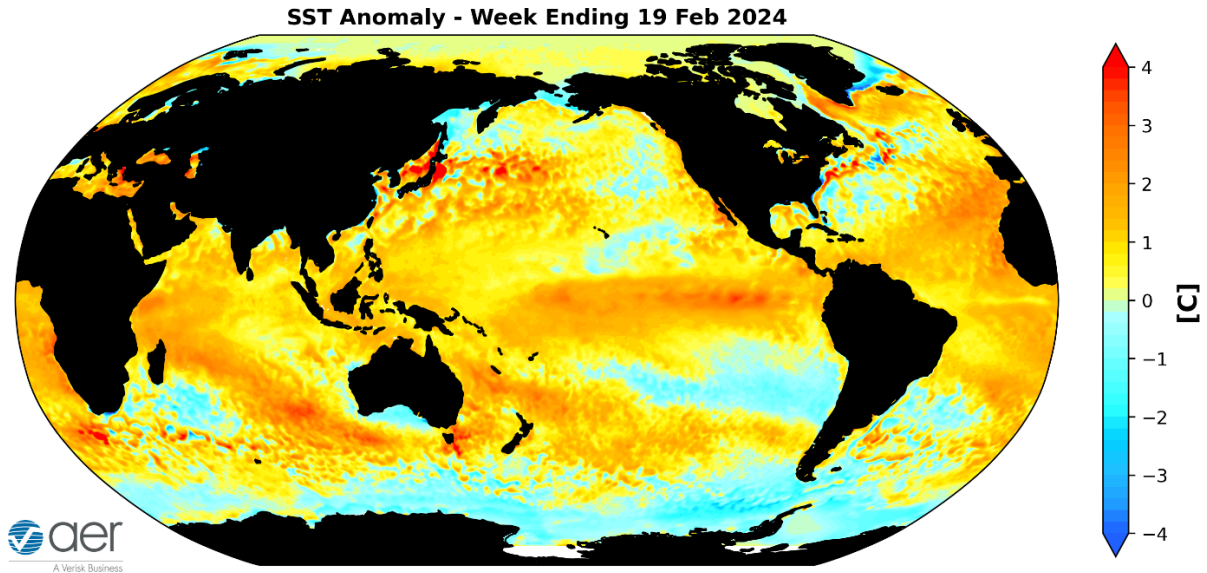
Arctic sea ice extent grew very little this week. I continue to expect that the negative sea ice anomalies will remain focused in the North Atlantic sector, which is currently more so than previously this winter. Blocking in the Barents-Kara sea region is critical for weakening the PV that is favorable for widespread and meaningful cold in Northern Eurasia and eastern North America, which can persist for weeks.



**Figure 16.** Observed Arctic sea ice extent on 19 February 2024 (white). Orange line shows climatological extent of sea ice based on the years 1981-2010. Image courtesy of National Snow and Ice Data Center (NSIDC). Snow and Ice Data Center (NSIDC).

### *SSTs/El Niño/Southern Oscillation*

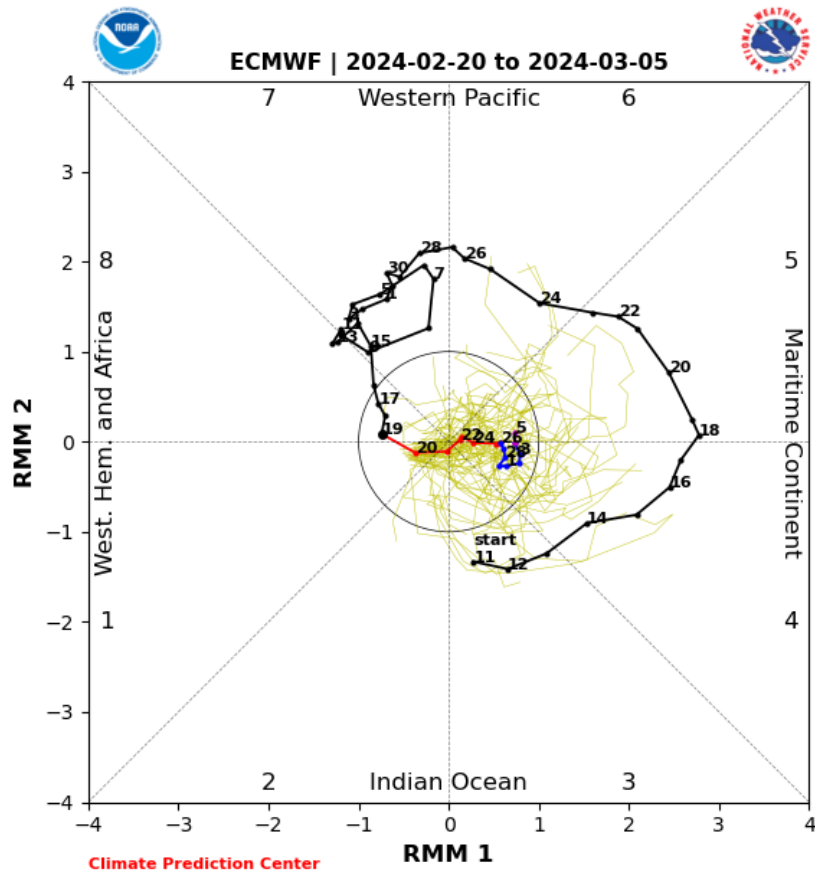
Equatorial Pacific sea surface temperatures (SSTs) anomalies are well above normal, especially along the South America coast, indicating that and El Niño remains strong (**Figure 17**) and El Niño conditions are expected through the end of the winter. Observed SSTs across the NH remain well above normal especially in the central North Pacific (west of recent years), the western North Pacific, the eastern North Atlantic and offshore of eastern North America though below normal SSTs exist regionally especially in the South and North Pacific and the North Atlantic.



**Figure 17.** The latest weekly-mean global SST anomalies (ending 19 February 2024). Data from NOAA OI High-Resolution dataset.

### *Madden Julian Oscillation*

Currently the Madden Julian Oscillation (MJO) is weak where no phase is favored (**Figure 18**). The forecasts are for the MJO to remain weak where no phase is favored. Therefore is having little influence on the weather across North America weather this week and next week. But admittedly this is outside of my expertise.



**Figure 18.** Past and forecast values of the MJO index. Forecast values from the 00Z 20 February 2024 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:

[https://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/CLIVAR/clivar\\_wh.shtml](https://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/CLIVAR/clivar_wh.shtml)

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