

# Arctic Oscillation and Polar Vortex Analysis and Forecasts

February 8, 2021

*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.

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

## **Summary**

- The Arctic Oscillation (AO) is currently negative and is predicted to remain negative the next two weeks as pressure/geopotential height anomalies are predicted to remain positive across the Arctic but especially the North Atlantic side of the Arctic the next two weeks.

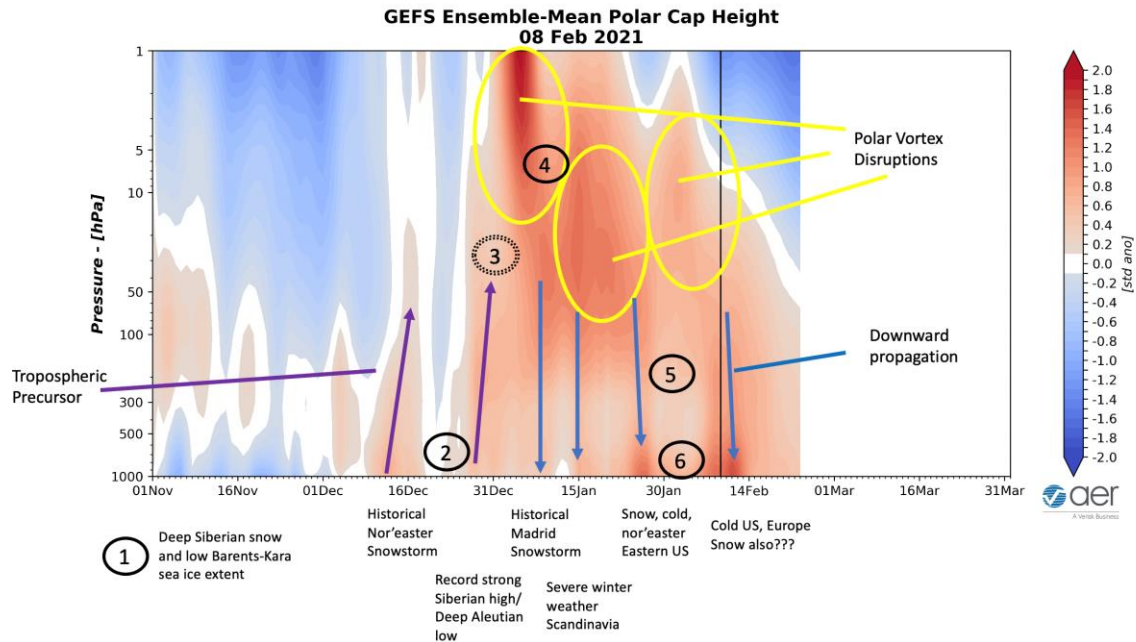
- The current negative AO is reflective of positive pressure/geopotential height anomalies across the Arctic with mixed pressure/geopotential height anomalies across the mid-latitudes. The North Atlantic Oscillation (NAO) is currently neutral with weak pressure/geopotential height anomalies across Greenland and Iceland; and the NAO is predicted to remain neutral to negative as positive pressure/geopotential height anomalies are predicted to persist across Greenland the next two weeks.
- Over the next two weeks predicted ridging/positive geopotential height anomalies tethered near Greenland will favor troughing/negative geopotential height anomalies across Europe. This week Europe will be divided along an east to west line with normal to below normal temperatures across Northern Europe including the United Kingdom (UK) and normal to above normal temperatures for Southern Europe. However persistent northerly flow will allow cold temperatures to slowly expand across much of Europe.
- Over the next two weeks, persistent ridging/positive geopotential height anomalies in the Arctic, especially focused across Greenland will anchor troughing/negative geopotential height anomalies across Northern Asia with ridging/positive geopotential height anomalies to the south. This pattern favors normal to below normal temperatures across Northern and Eastern Asia, with the exception of Eastern Siberia, with normal to above normal temperatures across Southern and Western Asia.
- Across North America, ridging/positive geopotential height anomalies in the Gulf of Alaska, in the Central Arctic and especially across Greenland will anchor broad and deep troughing/negative geopotential height anomalies across North America the next two weeks. This pattern favors normal to below normal temperatures widespread across Canada and the United States (US) with the exceptions of normal to above normal temperatures across Northeastern Canada the next two weeks, the Southern US this week and Alaska next week.
- In the Impacts section I discuss the potential duration of the impacts/influence from this winter's polar vortex (PV) disruption on the weather across the Northern Hemisphere (NH).

### ***Impacts***

Given the winter weather many are experiencing or already experienced of cold and/or snow in East Asia, Europe and North America, I think that it is safe to conclude that the six step model that I present every fall from [Cohen et al. \(2007\)](#) and last shown in the [December 14, 2020](#) blog has completed the cycle. I tweeted out a similar graph on Friday, but the extended polar cap geopotential height anomalies (PCHs) plot shows nicely four of the six steps and four of the five atmospheric steps. The five atmospheric steps can be independent of surface forcing but as I have been doing most of my career, I argue that Arctic surface or boundary forcings of both extensive/deep Siberian snow cover and contracted Barents-Kara sea ice cover favors the phase of the cycle that includes a weak stratospheric polar vortex (sudden stratospheric warming or SSW),

increased high latitude blocking (that often projects on to a negative AO) and increased likelihood of severe winter weather (snow and/or cold) across the mid-latitudes of the NH (see Box B2 in [Cohen et al. 2014](#)).

The first step is extensive/deep Siberian snow cover and/or low Barents-Kara sea ice cover, which was shown in the [December 21, 2020](#) blog. In **Figure i** we can see step 2 or what I like to refer to as the tropospheric precursor and is most commonly characterized by a northwestward expansion of the Siberian high. This step is represented by warm/positive PCHs limited to the troposphere and during this winter season was most prominently observed in December and are marked with purple up arrows (since they force upward propagating energy). The next and third step is the increased vertical Wave Activity Flux (WAFz and is proportional to poleward heat transport), which was active much of December and January. It is represented by a dash oval since it is best seen in the WAFz and not the PCH plot and the end of the active period can still be seen in **Figure 12**. The fourth step is the weakening of the PV or an SSW and can be seen in the plot by spikes in the PCH values in the stratosphere. I have identified three either separate PV disruptions or three maximums of one event by yellow ovals. The fifth step is the downward propagation of the PCH spike or increases from the stratosphere to the surface. This is often referred to as “dripping paint.” And finally, the sixth step is when the downward propagation results in a spike or maximum of PCHs in the mid- to lower troposphere. This represents an increase in high latitude blocking, often in a dip in the AO and as I discussed often coincides with an increased (and often a large increase) in severe winter weather in the mid-latitudes (East Asia, Europe and the US). And I have highlighted some of the more notable events this winter below the pots. These severe winter weather events can occur whenever mid- to low-tropospheric PCHs are elevated whether during the tropospheric precursors or the dripping PCHs from the stratosphere to the troposphere.



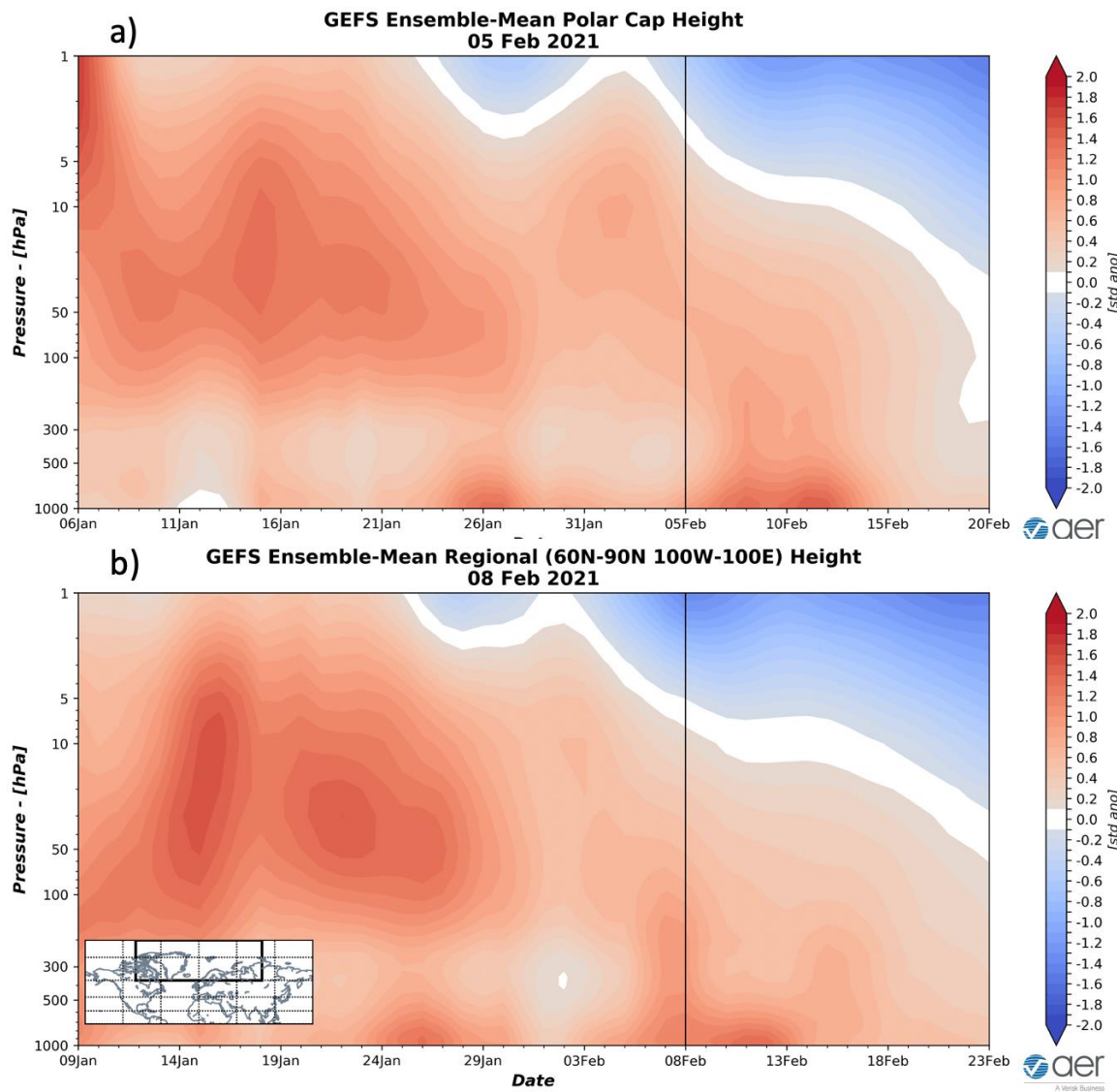
**Figure i.** Observed and predicted daily polar cap height (i.e., area-averaged geopotential heights poleward of 60°N) standardized anomalies. The forecast is from the 00Z 8 February 2021 GFS ensemble. Purple arrows show tropospheric precursors, blue arrows show downward propagation of PCHs and yellow ovals show PV disruptions. Numbers correspond to six-step model from [Cohen et al. \(2007\)](#).

Now that I believe that I have established that the six-step cycle has made it to the end, the obvious question is how long will the impacts last? In the literature it is argued that the impacts last on the order of four to eight weeks. If we mark the Madrid snowstorm as the beginning of the PV impacts on the weather, then we could be at the very end. However, it is obvious from the forecasts in this week's blog, it should last for at least another two weeks.

Furthermore, though the weather impacts from these large PV disruptions begin in Eurasia as shown in [Kretschmer et al. \(2018\)](#) they often eventually include North America and it seems to me often the weather impacts will linger longer or end in North America. This can even be seen on the Figure ii from the [January 18, 2021](#) blog and copied from [Zhang et al. \(2016\)](#).

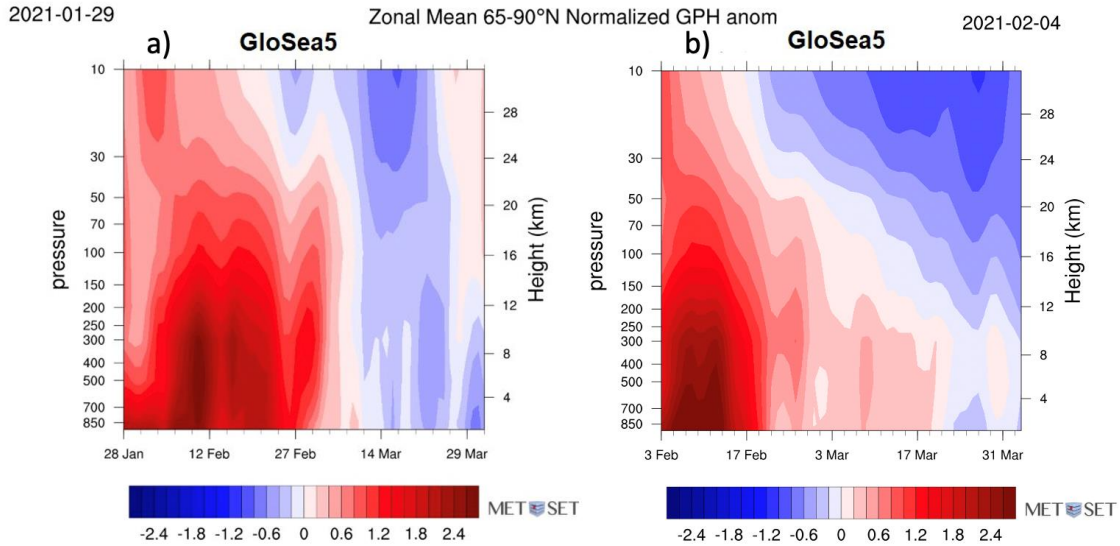
Some model forecasts seem to suggest that the impacts from the PV disruption will end in February. However, my expectations are that in general the weather forecast models will try to end the influence from the PV disruptions prematurely. You can already see this by comparing the GFS PCH forecast from this past Friday and today in **Figure ii**. In Friday's forecast the GFS predicted the complete absence of positive PCHs in the stratosphere and quickly fading in the troposphere as well (where positive

PCHs represent high latitude blocking critical for delivering severe winter weather to the mid-latitudes). This is no longer true in today's GFS forecast.



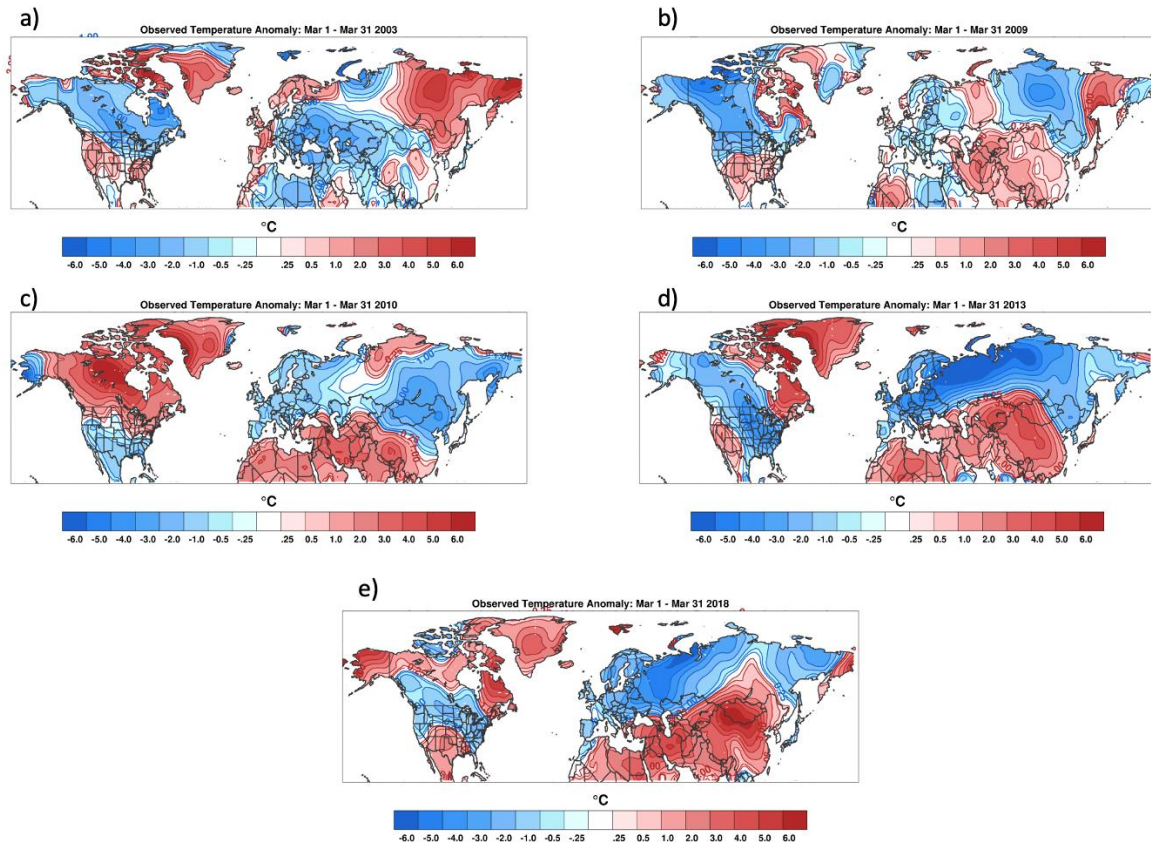
**Figure ii.** a) Observed and predicted daily polar cap height (i.e., area-averaged geopotential heights poleward of 60°N) standardized anomalies. (a) The forecast is from the 00Z 5 February 2021 GFS ensemble. (b) The forecast is from the 00Z 8 February 2021 GFS ensemble.

Something similar is seen with the weekly forecasts from the UKMet Office weather forecast model (see **Figure iii**) courtesy of @Met-Set\_UK. It too was predicting the positive PCHs in the troposphere to end in February from the forecast right at the end of January. The forecast from a week later extends the tropospheric PCHs into mid-March.



**Figure iii.** Predicted daily polar cap height (i.e., area-averaged geopotential heights poleward of 65°N) standardized anomalies. **(a)** The forecast is from the 00Z 29 January 2021 GFS ensemble. **(b)** The forecast is from the 4 February 2021 GloSea5 (from the UK Met office) model. Taken from the twitter account of [https://twitter.com/Met\\_Set\\_UK](https://twitter.com/Met_Set_UK).

I believe the current PV disruption is most analogous with timing (and assuming a PV split rather than a displacement) to 2003, 2009, 2010 and 2013. I show the NH temperature anomalies for the month of March in **Figure iv**. And for good measure I threw in March 2018, though that PV disruption is later than the others (though just a few days later than in 2010). All four or five years show relatively cold temperatures in Europe, especially Northern and Central Europe and for North America but there seems to be more event-to-event variability across the US and Canada than Europe. Still if the Greenland blocking persists, and right now all indications are that it will, it should favor relatively cold temperatures in the Eastern US. I just peeked at the EPS weeklies and it too is more confident that the relative cold temperatures persist across Europe than the Eastern US. But I have been and remain very skeptical of the EPS forecasts beyond the second week across North America.

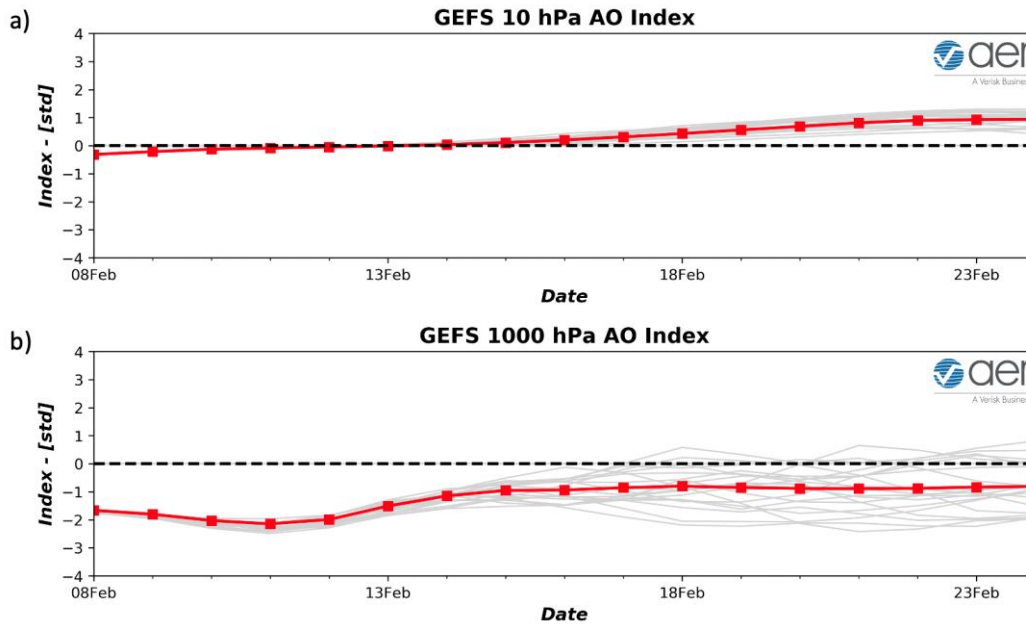


**Figure iv.** (a) Observed NH surface temperatures for March (a) 2003, (b) 2009, (c) 2010, (d) 2013 and (e) 2018.

Finally, I do think towards both the end of summer and winter persistence becomes a bigger factor in guiding temperature anomalies. In winter a robust snow cover will also help to amplify and prolong cold anomalies.

*1-5 day*

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

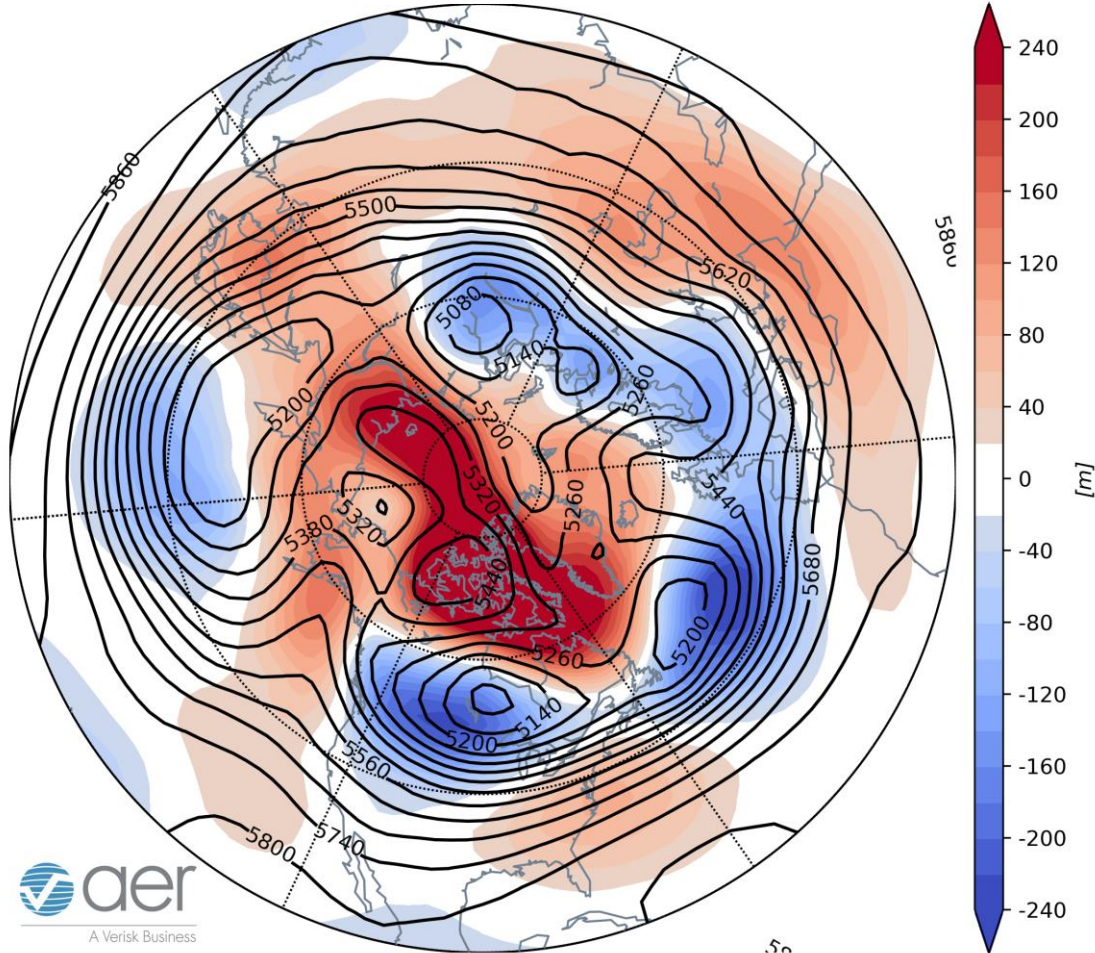


**Figure 1.** (a) The predicted daily-mean AO at 10 hPa from the 00Z 8 February 2021 GFS ensemble. (b) The predicted daily-mean near-surface AO from the 00Z 8 February 2021 GFS ensemble. Gray lines indicate the AO index from each individual ensemble member, with the ensemble-mean AO index given by the red line with squares.

This week, ridging/positive geopotential height anomalies centered near Greenland are predicted to force downstream troughing/negative geopotential height anomalies across Europe (**Figure 2**). However, with Greenland high pressure/blocking centered across the Canadian Archipelagos, this will allow a westerly component to the winds across Southern Europe bringing milder, maritime air. This pattern favors normal to below normal temperatures across Northern Europe including much of the UK as heights remain low but across Southern Europe a mild westerly flow will favor normal to above normal temperatures (**Figure 3**). This week, ridging/positive geopotential height anomalies centered over the Central Arctic will help to anchor troughing/negative geopotential height anomalies across Northern Asia but especially across Northwestern Asia with ridging/positive geopotential height anomalies across Southern Asia (**Figure 2**). This pattern favors normal to below normal temperatures for Northern and Western Asia with normal to above normal temperatures for Eastern and Southern Asia (**Figure 3**).

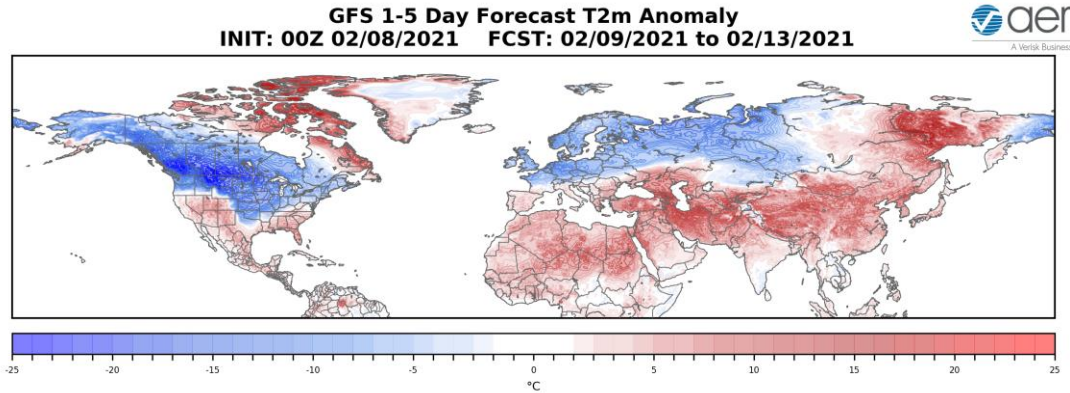


**GEFS 1-5 Day Forecast 500 mb GPH/GPH Anomaly**  
**INIT: 00Z 02/08/2021 FCST: 02/09/2021 to 02/13/2021**



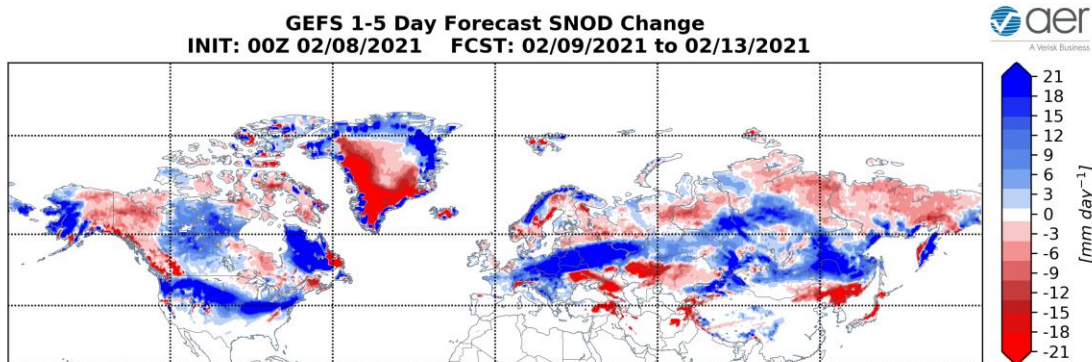
**Figure 2.** Forecasted average 500 mb geopotential heights (dam; contours) and geopotential height anomalies (m; shading) across the Northern Hemisphere from 9 – 13 February 2021. The forecasts are from the 00z 8 February 2021 GFS ensemble.

This week ridging/positive geopotential height anomalies across the Canadian Archipelagos and the Gulf of Alaska will force troughing/negative geopotential height anomalies across most of Southern Canada, the Western and Central US (**Figure 2**). This pattern is predicted to bring widespread normal to below normal temperatures across Alaska, Western and Southern Canada and the Northern US with normal to above normal temperatures across Northeastern Canada and the Southern US (**Figure 3**).



**Figure 3.** Forecasted surface temperature anomalies (°C; shading) from 9 – 13 February 2021. The forecast is from the 00Z 8 February 2021 GFS ensemble.

Trounging and/or colder temperatures are predicted to support new snowfall across Central and Southeastern Europe and Central Asia while warmer temperatures will cause snow melt in Southwestern and Northeastern Asia (**Figure 4**). Trounging and/or colder temperatures are predicted to support new snowfall across Western Alaska, Central Canada, Quebec and the Northern US while warmer temperatures will cause snow melt in parts of Western Canada and the Canadian Maritimes (**Figure 4**).



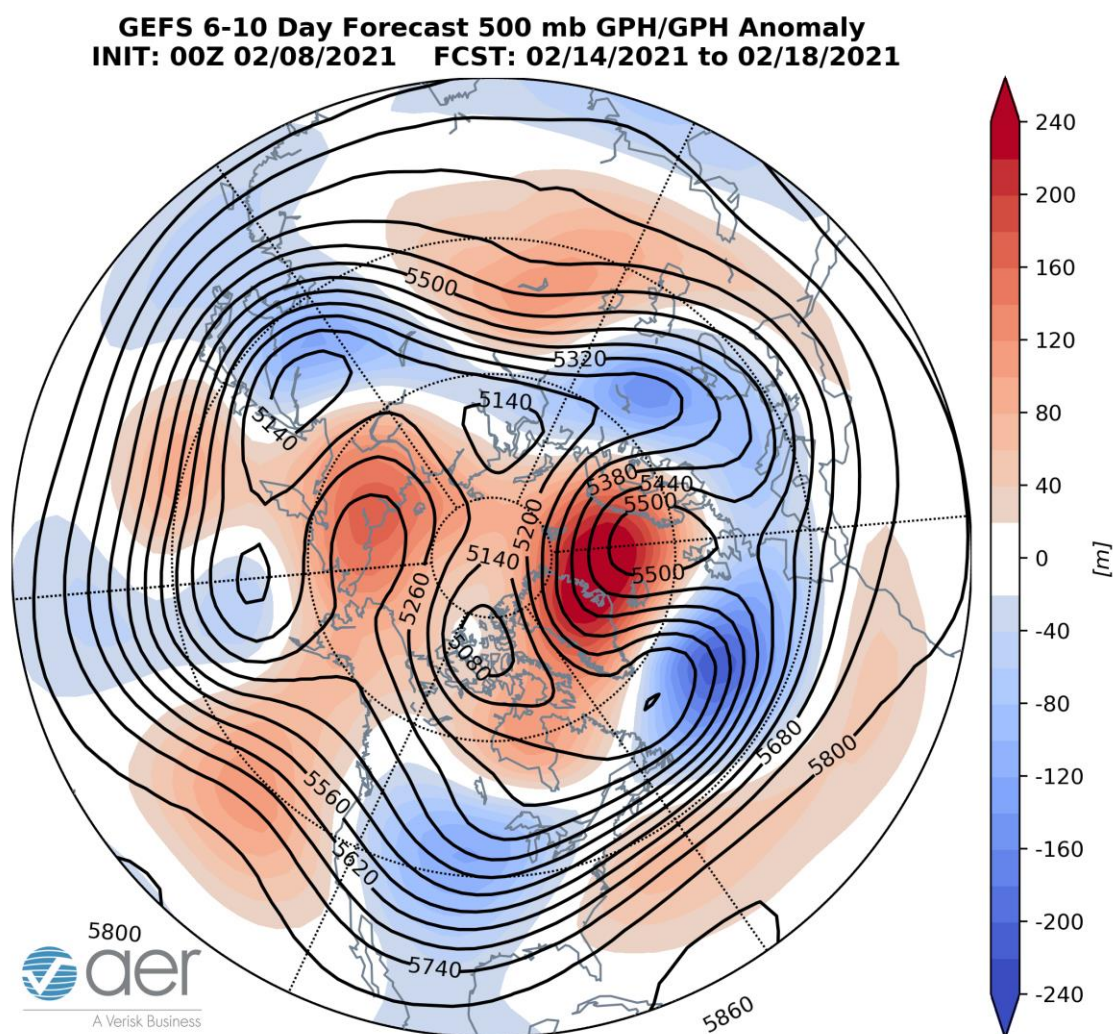
**Figure 4.** Forecasted snow depth changes (mm/day; shading) from 9 – 13 February 2021. The forecast is from the 00Z 8 February 2021 GFS ensemble.

*Mid-Term*

*6-10 day*

The AO is predicted to remain negative next week (**Figure 1**) as positive geopotential height anomalies strengthen across the North Atlantic side of the Arctic and in the Central Arctic with mixed geopotential height anomalies across the mid-latitudes of the

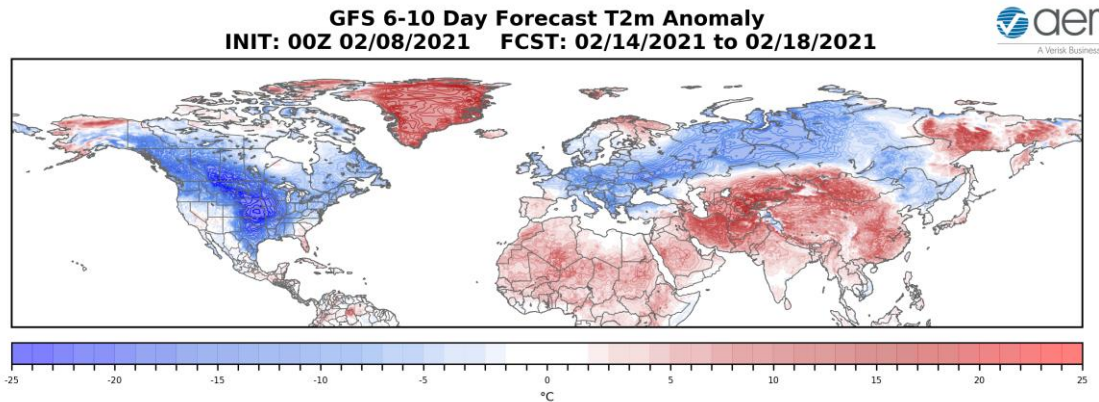
NH (**Figure 5**). And with positive geopotential height anomalies predicted across Greenland (**Figure 5**), the NAO is predicted to also remain negative to neutral.



**Figure 5.** Forecasted average 500 mb geopotential heights (dam; contours) and geopotential height anomalies (m; shading) across the Northern Hemisphere from 14 – 18 February 2021. The forecasts are from the 00z 8 February 2021 GFS ensemble.

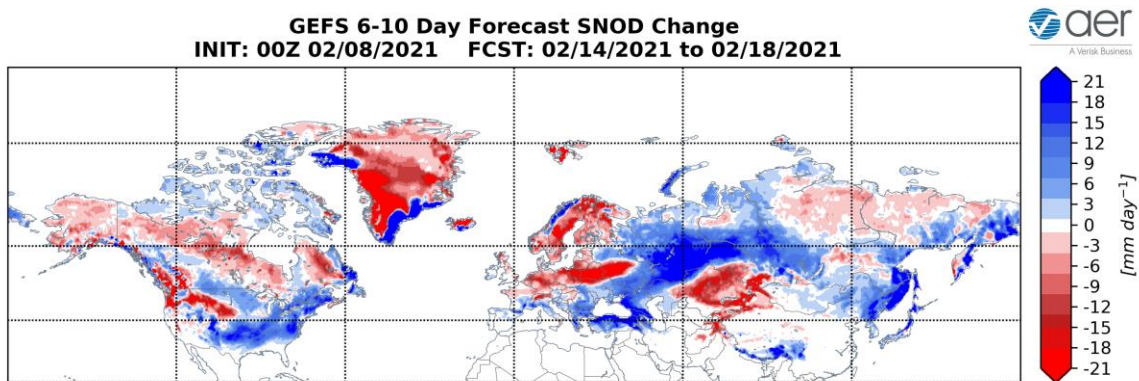
With ridging/positive geopotential height anomalies previously centered across the Canadian Archipelagos predicted to become centered between Greenland and Iceland, troughing/negative geopotential height anomalies will deepen across Europe and the flow will become increasingly northerly this period (**Figures 5**). **This will allow** normal to below normal temperatures to become more widespread across Europe including the UK with normal to above normal temperatures limited to Spain and near the Arctic circle across Scandinavia (**Figure 6**). Persistent ridging/positive geopotential height anomalies in the Arctic will anchor troughing/negative geopotential height anomalies across northern and Eastern Asia with ridging/positive geopotential height anomalies

across Southern and Western Asia this period (**Figure 5**). This is predicted to favor widespread normal to below normal temperatures across much of Northern and Eastern Asia with normal to above normal temperatures in Southern and Western Asia and Eastern Siberia (**Figure 6**).



**Figure 6.** Forecasted surface temperature anomalies ( $^{\circ}\text{C}$ ; shading) from 14 – 18 February 2021. The forecasts are from the 00Z 8 February 2021 GFS ensemble.

Ridging/positive geopotential height anomalies in the Gulf of Alaska and near Greenland will persist broad troughing/negative geopotential height across much of North America this period (**Figure 5**). This pattern is predicted to bring widespread normal to below normal temperatures across much of Canada and the US with normal to above normal temperatures limited to the North American Arctic and Florida (**Figure 6**).



**Figure 7.** Forecasted snow depth changes ( $\text{mm}/\text{day}$ ; shading) from 14 – 18 February 2021. The forecasts are from the 00Z 8 February 2021 GFS ensemble.

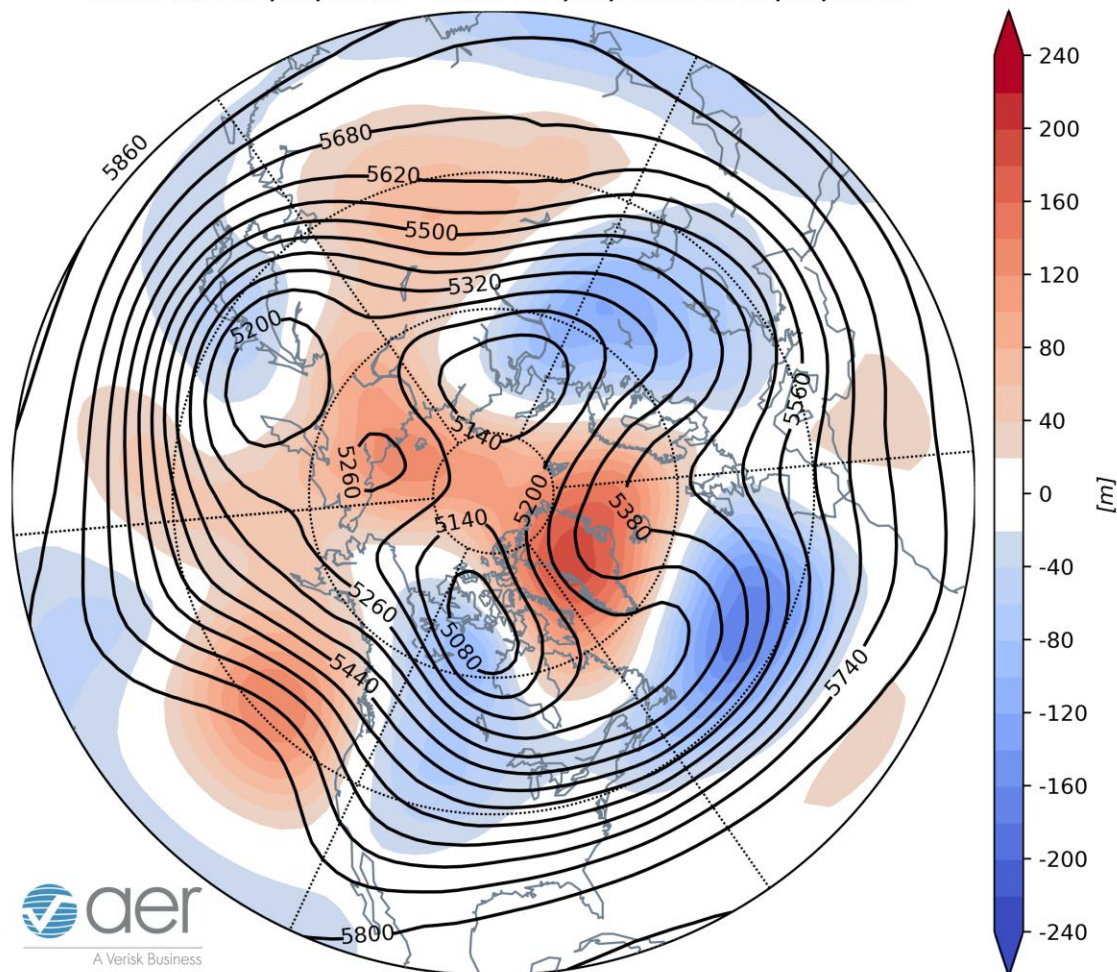
Troughing and/or colder temperatures are predicted to potentially support new snowfall across parts of Southern Europe, the Himalayas, Western, Central and Eastern Asia while warmer temperatures will cause regionalized snow melt in Northern Europe and

Central Asia (**Figure 7**). Troughing and/or colder temperatures are predicted to support the potential for new snowfall across much of Central and Eastern US while warmer temperatures will cause possible snow melt in the Northwestern US (**Figure 7**).

11-15 day

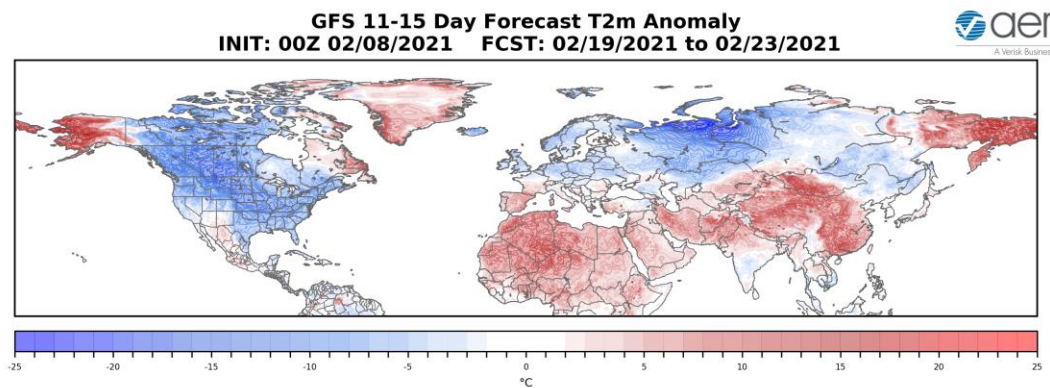
As geopotential height anomalies are predicted to remain positive on the North Pacific side but especially the North Atlantic side of the Arctic with mixed geopotential height anomalies across the mid-latitudes of the NH (**Figure 8**), the AO should remain negative this period (**Figure 1**). With continued positive pressure/geopotential height anomalies spread across Greenland (**Figure 8**), the NAO is predicted to remain neutral to negative this period as well.

**GEFS 11-15 Day Forecast 500 mb GPH/GPH Anomaly**  
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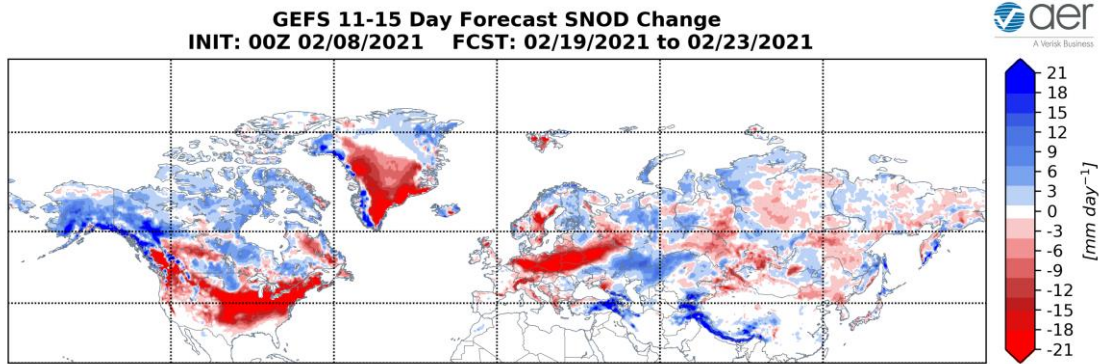
**Figure 8.** Forecasted average 500 mb geopotential heights (dam; contours) and geopotential height anomalies (m; shading) across the Northern Hemisphere from 19 – 23 February 2021. The forecasts are from the 00z 8 February 2021 GFS ensemble.

With persistent ridging/positive geopotential height anomalies near Greenland, this will anchor troughing/negative geopotential height anomalies across Europe this period (**Figures 8**). The forecast remains for widespread normal to below normal temperatures across Europe, normal to above normal temperatures may return to Southern Europe this period (**Figures 9**). Ridging/positive geopotential height anomalies across the Arctic and over Eastern Siberia will help persist troughing/negative geopotential height anomalies across Northern and East Asia with ridging/positive geopotential height anomalies across Southern Asia this period (**Figure 8**). This pattern favors normal to below normal temperatures across Northern and Eastern Asia with normal to above normal temperatures across Eastern Siberia, Western and Southern Asia (**Figure 9**).



**Figure 9.** Forecasted surface temperature anomalies (°C; shading) from 19 – 23 February 2021. The forecasts are from the 00z 8 February 2021 GFS ensemble.

Persistent ridging/positive geopotential height anomalies in the Gulf of Alaska and Greenland will contribute to broad troughing/negative geopotential height anomalies across North America this period (**Figure 8**). This pattern favors widespread normal to below normal temperatures for much of Canada and the US with normal to above normal temperatures mostly limited to Alaska and Northeastern Canada (**Figure 9**).



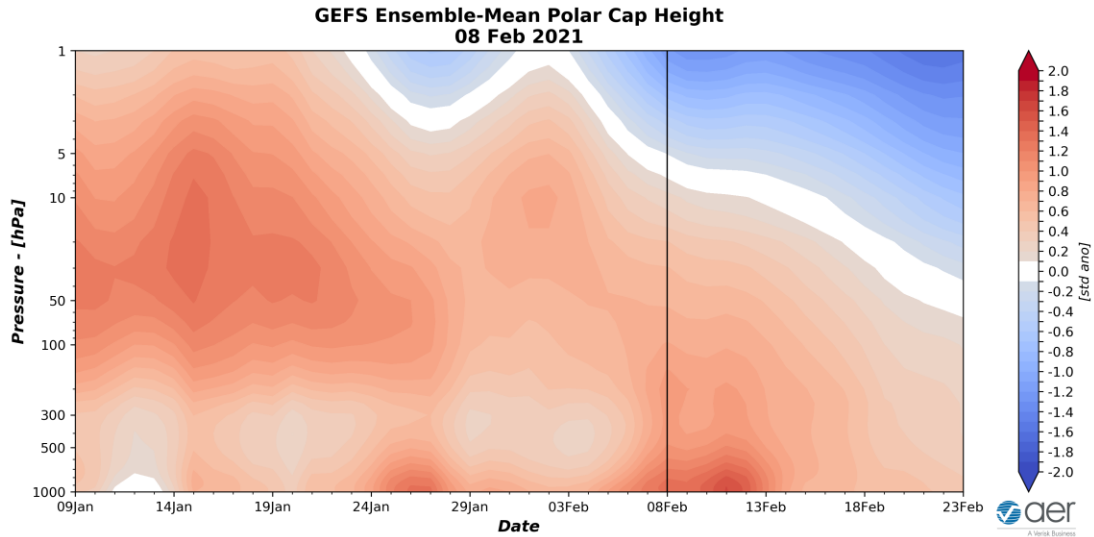
**Figure 10.** Forecasted snow depth changes (mm/day; shading) from 19 – 23 February 2021. The forecasts are from the 00z 8 February 2021 GFS ensemble.

Trouging and/or colder temperatures are predicted to support new snowfall across Turkey and the Himalayas while warmer temperatures will cause snowmelt in Northern Europe (**Figure 10**). Trouging and/or colder temperatures are predicted to support new snowfall across Alaska and much of Canada while warmer temperatures will result in snowmelt in much of the Eastern US (**Figure 10**). Though based on the temperature forecast this seems way overdone.

### *Longer Term*

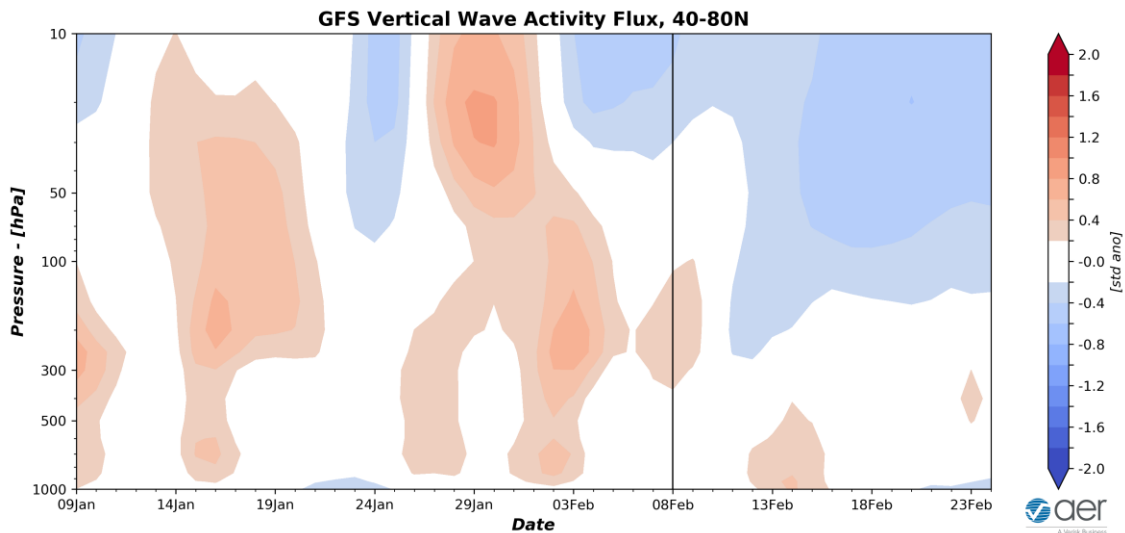
#### *30-day*

The latest plot of the polar cap geopotential height anomalies (PCHs) currently shows warm/positive PCHs throughout the troposphere and mid- to lower stratosphere (**Figure 11**). The warm positive PCHs are predicted to persist for the next two weeks across the lower stratosphere and troposphere. In the upper stratosphere, PCHs are currently cold/negative and are predicted to intensify and descend into the mid-stratosphere this week as the PV recovers from the long and/or multiple PV disruptions.



**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 8 February 2021 GFS ensemble.

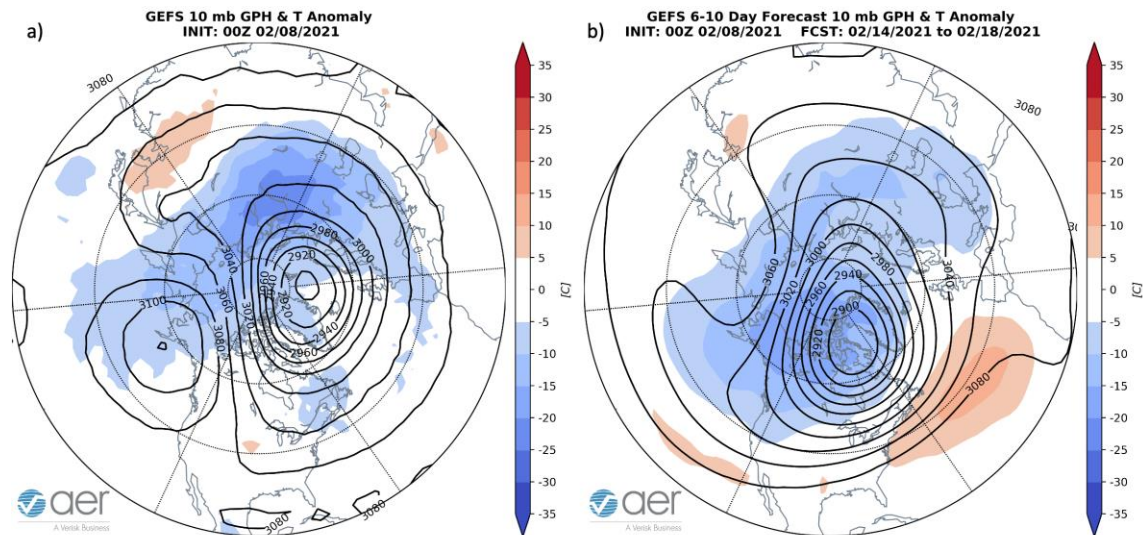
Normal to warm/positive PCHs in the lower troposphere are consistent with the predicted negative surface AO the next two weeks (**Figure 1**). Warm/positive PCHs in the mid-stratosphere are consistent with the negative to neutral stratospheric AO (at 10 hPa) this week (**Figure 1**). However, the stratospheric AO is predicted to turn positive next week as PCHs turn cold/negative as the stratospheric PV recovers.



**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 8 February 2021 GFS ensemble.

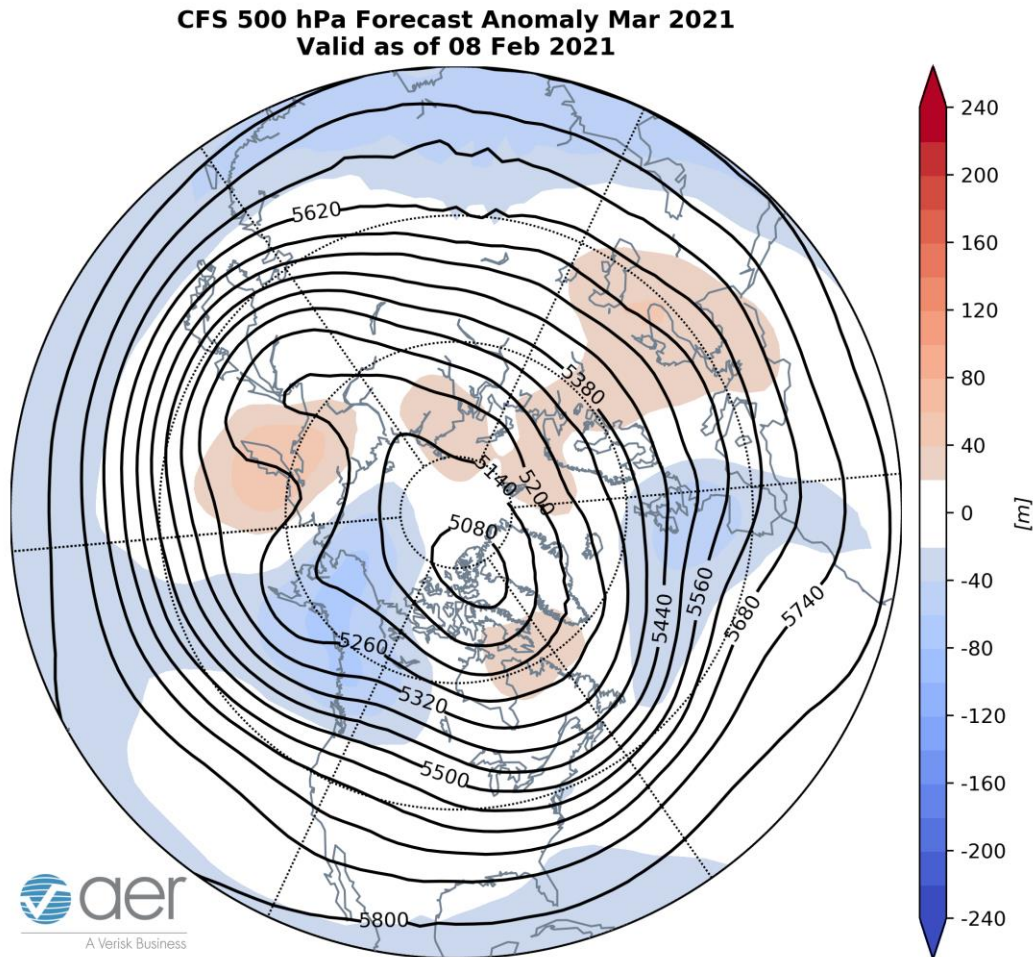


The plot of the Wave Activity Flux (WAFz and is proportional to poleward heat transport) forecast is currently showing near normal WAFz in the stratosphere and troposphere (**Figure 12**). Overall, the WAFz is predicted to be quiet, consistent with the weeks following major mid-winter warmings (MMWs where the zonal winds reverse from westerly to easterly at 60°N and 10 hPa) allowing the stratospheric PV to recover.



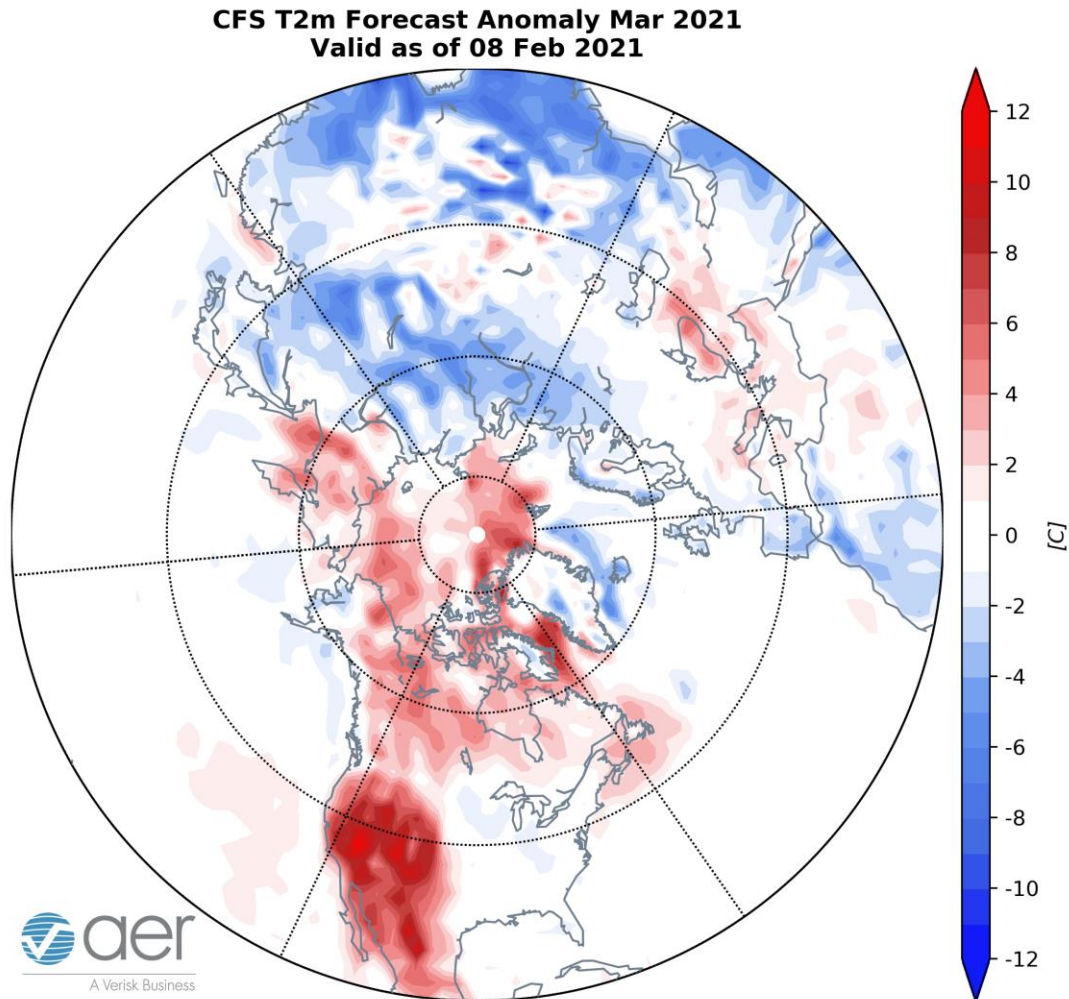
**Figure 13.** (a) Observed 10 mb geopotential heights (dam; contours) and temperature anomalies (°C; shading) across the Northern Hemisphere for 8 February 2021. (b) Same as (a) except forecasted averaged from 14 – 18 February 2021. The forecasts are from the 00Z 8 February 2021 GFS model ensemble.

The PV has returned to being whole with the vortex centered between Greenland and Svalbard (**Figure 13**). High pressure centered near the Aleutians is preventing the PV center from returning to the North Pole, at least in the short term (**Figure 13**). The PV center is predicted to migrate over towards Baffin Bay (**Figure 13**). I believe the PV center over North America and the oblong shape of the PV inducing cross polar flow from Siberia to Canada supports cold temperatures in North America (**Figure 13**).



**Figure 14.** Forecasted average 500 mb geopotential heights (dam; contours) and geopotential height anomalies (m; shading) across the Northern Hemisphere for March 2021. The forecasts are from the 00Z 8 February 2021 CFS.

I include in this week's blog the monthly 500 hPa geopotential heights (**Figure 14**) and the surface temperatures (**Figure 15**) forecast for March from the Climate Forecast System (CFS; the plots represent yesterday's four ensemble members). The forecast for the troposphere is ridging across Baffin Bay, Western Asia and Eastern Siberia with troughing in Western Europe, East Asia and the Gulf of Alaska (**Figure 14**). This pattern favors relatively cold temperatures for Northern and Western Europe, Northern and Eastern Asia, Southeastern Canada and the Eastern US with seasonable to relatively warm temperatures for Southern Europe, Central Asia, Alaska, Western and Northern Canada and the Western US (**Figure 15**). The temperature forecast is consistent with my own thinking but seems inconsistent with the predicted tropospheric circulation that is zonal and projects onto a positive AO. It could be that the CFS temperature forecast is heavily weighted by persistence.



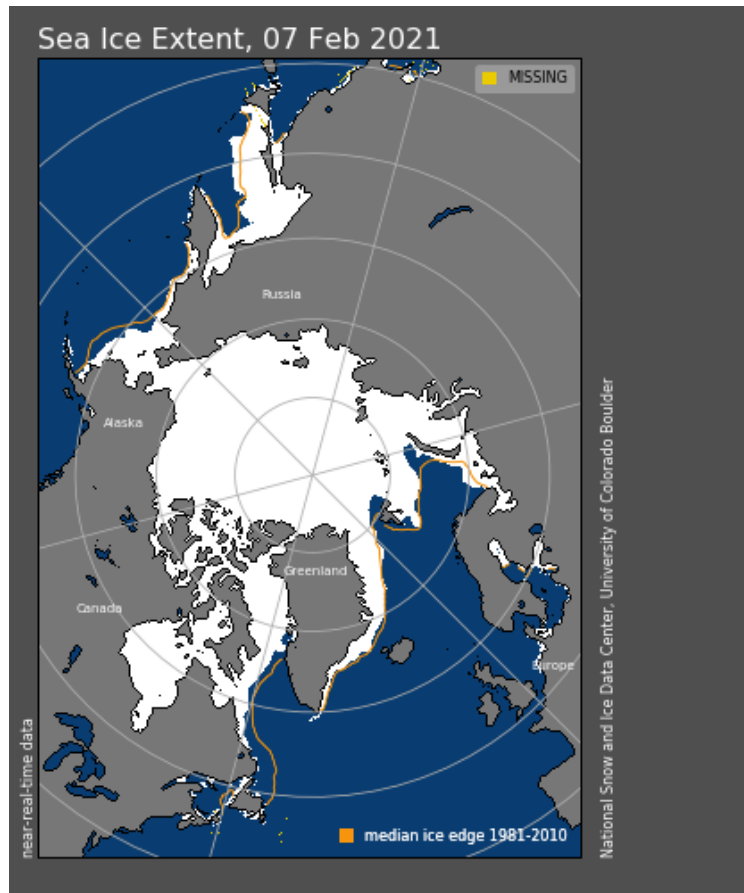
**Figure 15.** Forecasted average surface temperature anomalies ( $^{\circ}\text{C}$ ; shading) across the Northern Hemisphere for March 2021. The forecasts are from the 00Z 8 February 2021 CFS.

### *Surface Boundary Conditions*

#### *Arctic sea ice extent*

Arctic sea ice continues to grow but currently remains below normal but more extensive than recent winters. Negative sea ice anomalies exist in the Bering Sea, now in Baffin Bay and in the Barents-Kara Seas (**Figure 16**). A cold winter in Siberia has resulted in above normal sea ice in the Sea of Okhotsk. Below normal sea ice in the Barents-Kara seas favor Ural blocking and cold temperatures in Central and East Asia, 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 and Bering seas may favor colder temperatures across North America but have not been shown to weaken the PV. Sea ice should continue to grow in this region based on the forecast.

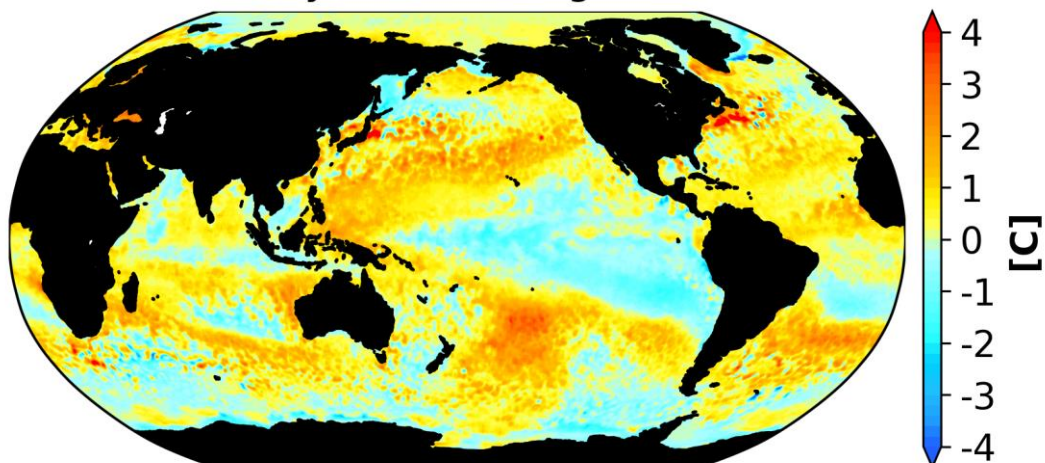


**Figure 16.** Observed Arctic sea ice extent on 7 February 2021 (white). Orange line shows climatological extent of sea ice based on the years 1981-2010. Image courtesy of National Snow and Ice Data Center (NSIDC).

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

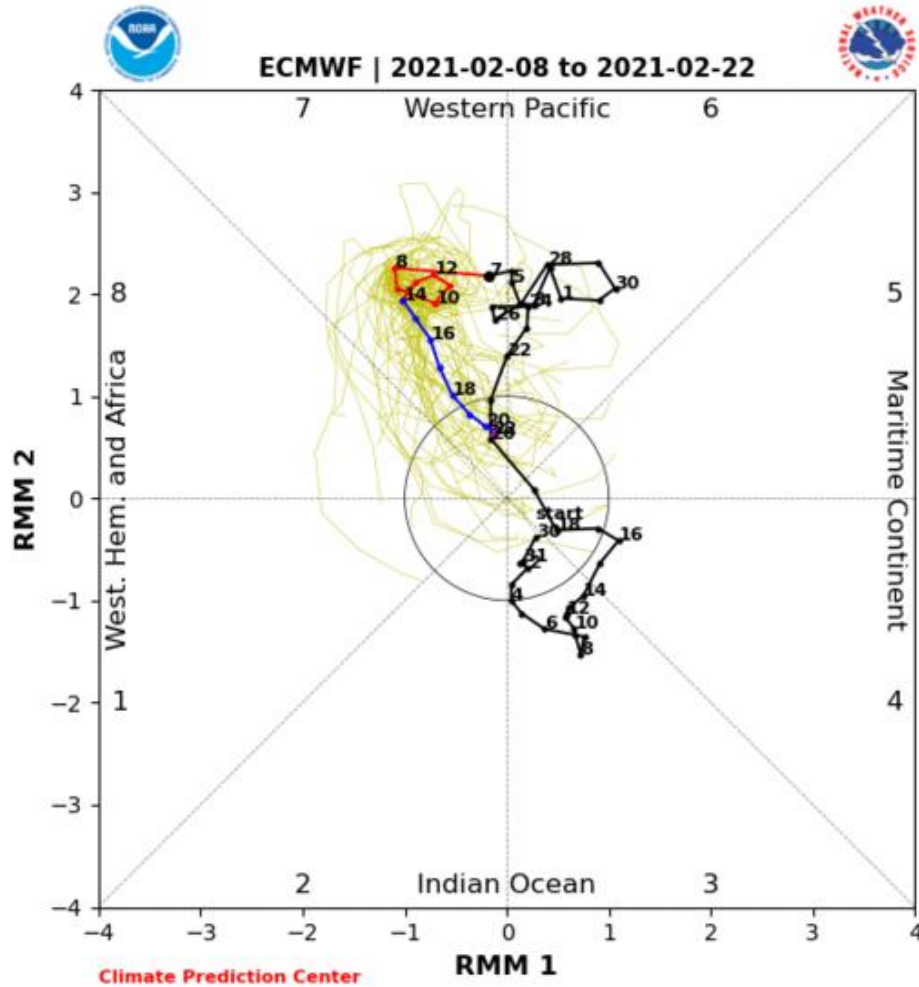
Equatorial Pacific sea surface temperatures (SSTs) anomalies remain negative and we continue to observe a weak La Niña conditions (**Figure 17**) and La Niña is expected to persist and remain weak through the winter. Observed SSTs across the NH remain well above normal especially near Alaska and in the Gulf of Alaska, the western North Pacific and offshore of eastern North America though below normal SSTs exist regionally especially in the Southern Hemisphere and south of Iceland. Warm SSTs in the Gulf of Alaska may favor mid-tropospheric ridging in the region.

### SST Anomaly - Week Ending 07 Feb 2021



**Figure 17.** The latest weekly-mean global SST anomalies (ending 7 February 2021). Data from NOAA OI High-Resolution dataset.

Currently the Madden Julian Oscillation (MJO) is in phase six (**Figure 18**). The forecasts are for the MJO to quickly transition from phase six into phase seven and then weaken. Phases six and seven favor ridging in eastern North America but eventually favors blocking across Northern Canada and troughing in the Eastern US. The MJO could eventually contribute to a colder pattern across eastern North America but admittedly this is outside of my expertise.

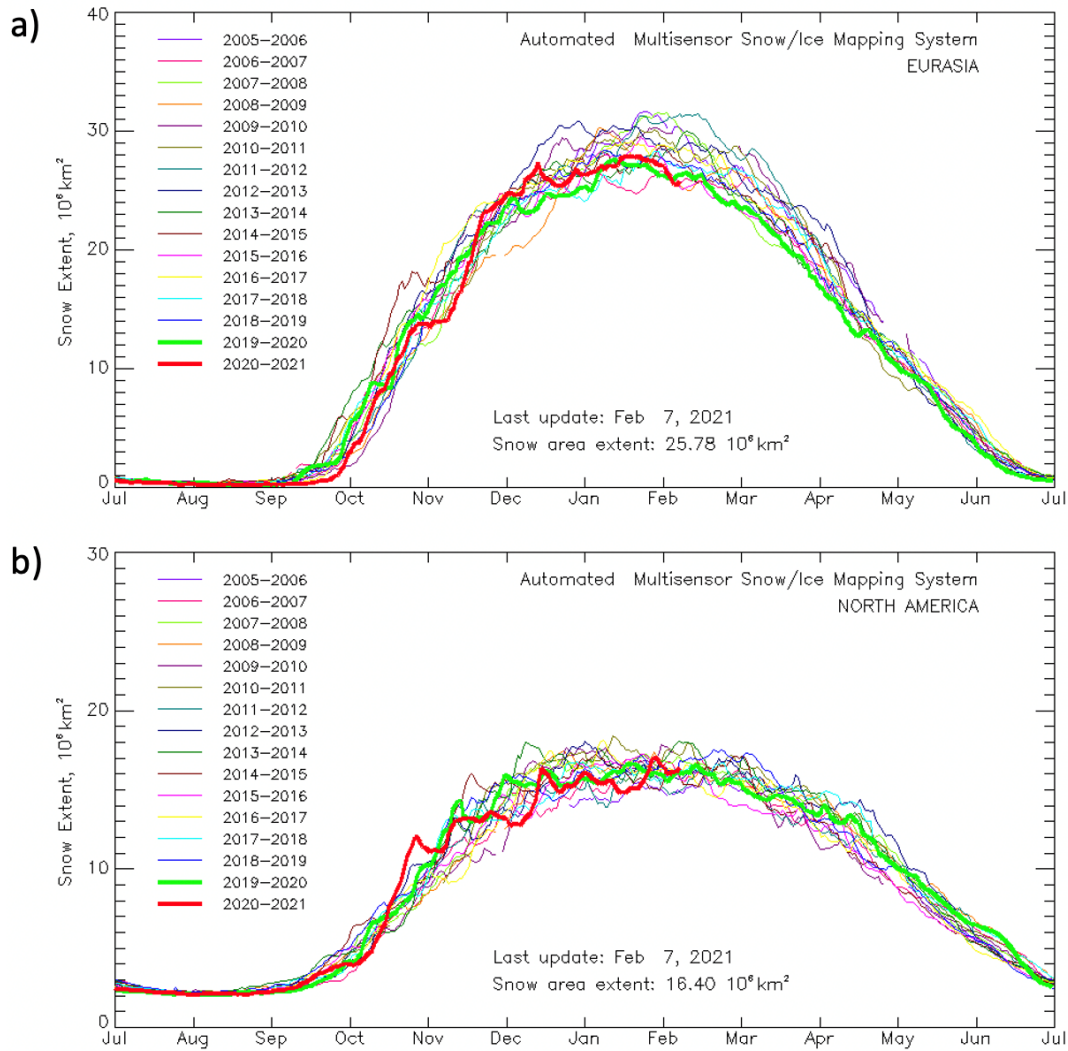


**Figure 18.** Past and forecast values of the MJO index. Forecast values from the 00Z 8 February 2021 ECMWF model. Yellow lines indicate individual ensemble-member forecasts, with the green line showing the ensemble-mean. A measure of the model “spread” is denoted by the gray shading. Sector numbers 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>

### Northern Hemisphere Snow Cover

Snow cover extent declined over the past week across Eurasia despite advances in Europe and is near decadal lows. Snow cover advance will likely continue to increase especially across Europe next week. Above normal snow cover extent in October, favors a strengthened Siberian high, cold temperatures across northern Eurasia and a weakened polar vortex/negative AO this upcoming winter followed by cold temperatures across the continents of the NH.



**Figure 19.** Observed Eurasian (top) and North American (bottom) snow cover extent through 7 February 2021. Image source: [https://www.star.nesdis.noaa.gov/smcd/emb/snow/HTML/snow\\_extent\\_plots.html](https://www.star.nesdis.noaa.gov/smcd/emb/snow/HTML/snow_extent_plots.html)

North American snow cover declined slightly over the past week and is near decadal means. And snow cover could advance further over the next two weeks. The advance of snow cover will help amplify colder temperatures across North America.