

# Arctic Oscillation and Polar Vortex Analysis and Forecasts

*March 17, 2026*

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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## Summary

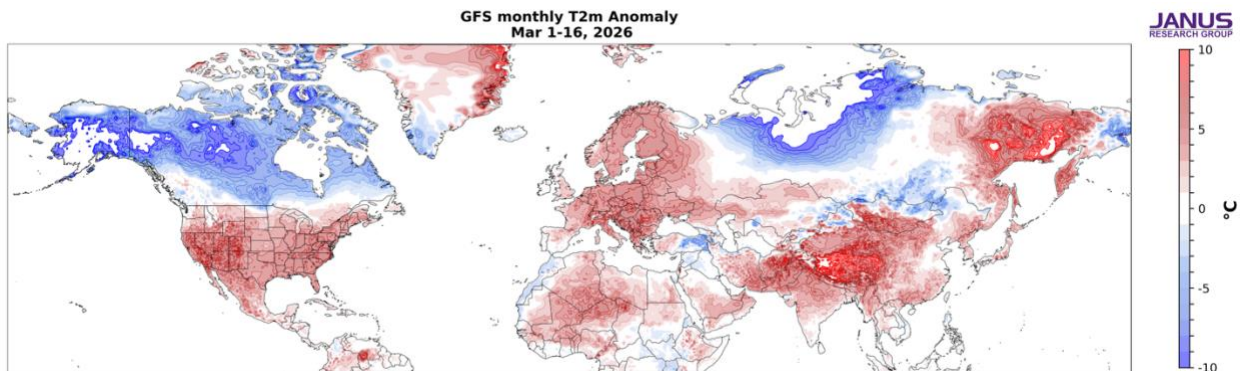
- The Arctic Oscillation (AO) is currently positive and is predicted to remain positive to neutral as pressure/geopotential height anomalies across the Arctic are currently mostly negative and are predicted to remain mixed to mostly negative the next two weeks. The North Atlantic Oscillation (NAO) is currently positive with negative pressure/geopotential height anomalies across Greenland, and the NAO is predicted to remain positive to neutral the next two weeks as pressure/geopotential height anomalies are predicted to remain mostly mixed to negative across Greenland the next two weeks.
- Troughing/negative geopotential height anomalies across Greenland will support ridging/positive geopotential height anomalies across much of Europe the next two weeks. However starting next week strengthening ridging between Iceland and United Kingdom (UK) will support deepening troughing across Western Europe. This pattern will favor normal to above normal temperatures across most of Europe including the UK this week but with normal to below normal temperatures across Western Europe including the UK starting next week while temperatures remain above normal across Eastern Europe.
- The general pattern across Asia over the next two weeks is ridging/positive geopotential height anomalies across Western and Eastern Asia supporting troughing/negative geopotential height anomalies across Western Siberia the next two weeks. This pattern favors mostly normal to above normal temperatures across much of Asia with normal to

below normal temperatures mostly limited to Western Siberia the next two weeks.

- The predicted atmospheric pattern across North America the next two weeks is troughing/negative geopotential height anomalies across Alaska, and much of Canada with ridging/positive geopotential height anomalies United States (US) but centered in the Western US. This pattern will support normal to below normal temperatures in Alaska and much of Canada with normal to above normal temperatures across the US but especially the Western US.
- Polar vortex (PV) is undergoing yet another split next week that could be the Final Warming or the demise of the PV until next fall. My thoughts are below.

## Plain Language Summary

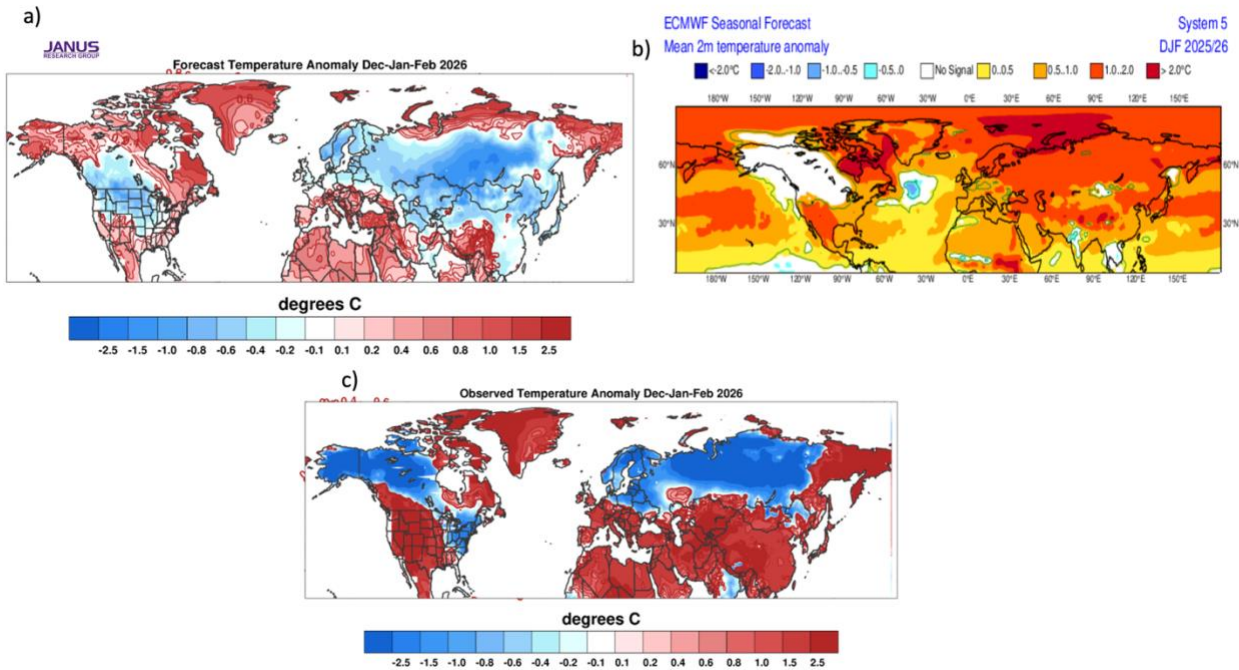
Meteorological spring has begun and so far can be summed up as relatively cold temperatures for Siberia, Alaska and much of Canada and mild to very mild for the mid-latitudes including the population centers of the Northern Hemisphere (see **Figure**). The forecast for the next two weeks can be summarized as more of the same with cold predicted parts of Siberia, Alaska and Canada but mild in the US, Europe and East Asia (see **Figures 3, 6 and 9**). The polar vortex (PV) has transitioned from one of constant stretching to one of repeated splits that may result in its demise. But even as the PV exits for the season it could still impact our weather and looking for Greenland blocking that could result in chillier spring weather for Europe and the Eastern US.



**Figure.** Estimate of the observed surface temperatures (°C; shading) from 01 Mar to 16 Mar 2026 based on GFS initializations and the GFS forecast from the 17 Mar 2026 run.

## Impacts

As I usually do at the end of the winter, I post verification of the winter forecast that I presented back in November, shown in **Figure i**. The Janus winter forecast of temperature anomalies are shown in panel a, the ECMWF winter forecast of surface temperature anomalies are shown in panel b and my estimated observed temperature anomalies based on ERA5 are shown in panel c. I think the observed temperatures based on the GFS initializations shown in the previous blog matched our forecast better than our estimate based on ERA5 but the theme remains the same. The Janus forecast correctly predicted relatively cold temperatures in Northeastern Europe, Siberia into Northeast Asia, Canada and the US Great Lakes. The cold in the forecast was shifted on both continents relative to the observations. It seems that temperature shift resulted in the forecast errors. The model missed with the cold temperatures in the Northeastern US and I do think that the model estimated the influence of Siberian snow cover this winter, that is my opinion. Regardless, in contrast the ECMWF forecast much less accurate only predicting normal to above normal temperatures only for both North America and Eurasia and in my opinion really does not reflect the temperature variability of winter 2025/26.

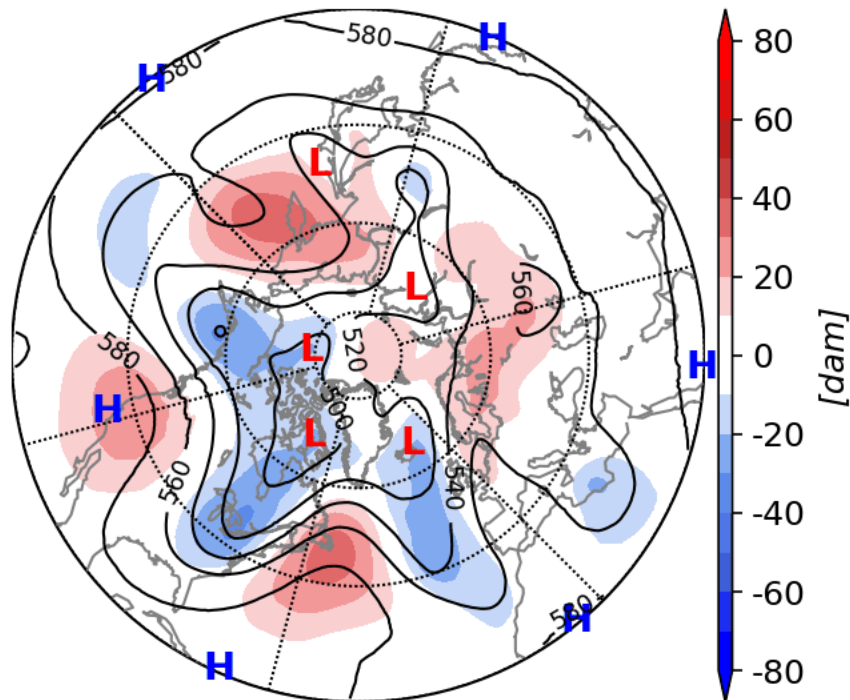


**Figure i.** a) The temperature anomaly forecast for December, January and February 2026 from the Janus model, b) the ECMWF temperature anomaly forecast for December, January and February 2026 and c) the observed temperature anomalies for December, January and February 2026 based on ERA5.

Besides a more accurate or skillful seasonal winter forecast or AI subseasonal model won the winter season AI Weather Quest sponsored by ECMWF fairly decisively. Finally, and off course not the most objective source, but I felt that the blog has been ahead of the weather models in anticipating weather transitions all winter long.

Now on to our regular scheduled programming. For most of the two weeks the mid-tropospheric circulation is characterized by low pressure centered near the North Pole and high-pressure ridging floating around the mid- to high-latitudes (see **Figure ii**). This week once again the dominant high latitude blocking will be centered in the North Pacific sector. Currently the models have one blocking center in Eastern Siberia but a second one sets up in the Western US. The ridging in the Western US can truly be considered as a heat dome with summer like heat in March across the Western US. Then next week blocking is predicted to develop in the North Atlantic sector centered near Iceland. This blocking appears to be a response to the PV split, which has occurred in two parts (see **Figures 12** in this week and the most recent blog from early March).

### Initialized 00Z 500 hPa HGT/HGTa 17-Mar-2026

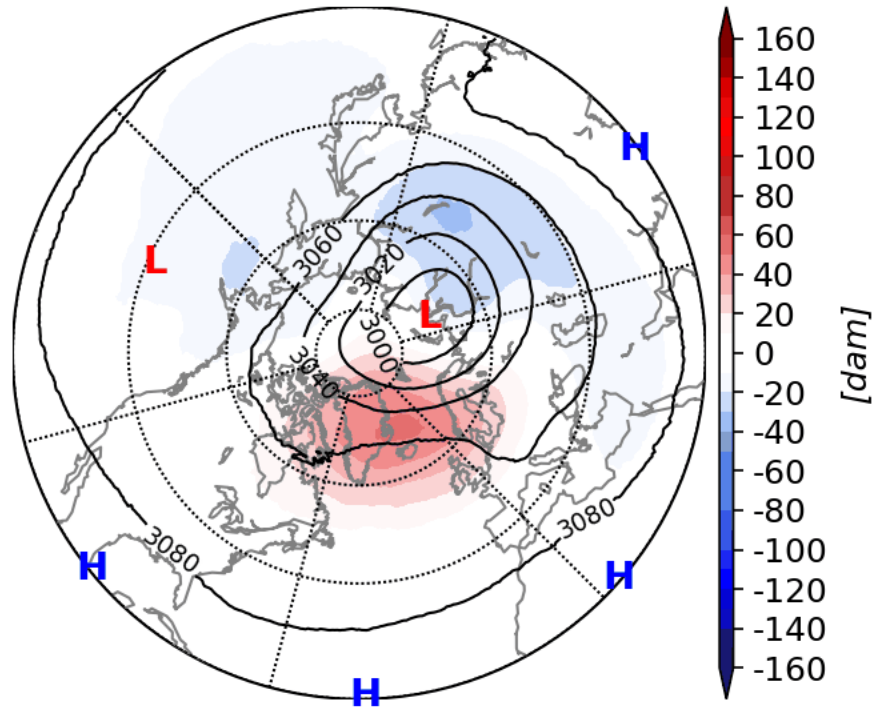


**Figure ii.** Initialized 500 mb geopotential heights (dam; contours) and decameter anomalies (dam; shading) across the Northern Hemisphere for 17 Mar 2026 and forecasted from 18 Mar 2026 to 1 Apr 2026. The forecasts are from the 00Z 17 Mar 2026 GFS model.

**Figure iii** presents the latest PV animation. Initially there is one PV center somewhat elongated or stretched from Western Asia to Canada. Though I admit the stretch isn't impressive looking and is likely a consequence of the PV overall being very weak so late in the season. This brief PV stretch is bringing one last and brief Arctic outbreak to the Central and Eastern US along with the historic blizzard. Then starting over the weekend, the PV splits into two centers one over Siberia and the other over Canada, At least in the animation the two PV centers never merge and

reconstitute one PV center and could be signaling this PV split will result in the Final Warming as occurred last March.

### Initialized 00Z 10 hPa HGT/HGTa 17-Mar-2026

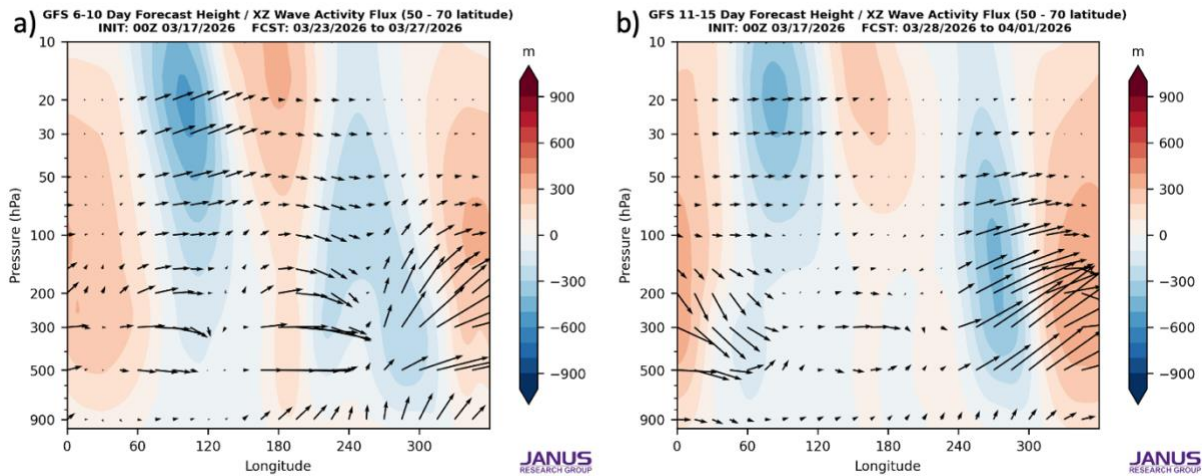


**Figure iii.** Forecasted average 10 mb geopotential heights (dam; contours) and geopotential height anomalies (m; shading) across the Northern Hemisphere for 17 Mar 2026 and forecasted from 18 Mar 2026 to 1 Apr 2026. The forecasts are from the 00Z 17 Mar 2026 GFS model.

The PV split earlier this month already resulted in a sudden stratospheric warming (SSW - defined as a reversal of the wind from westerly to easterly at 60°N and 10 hPa) last week. It appears that another SSW is likely (but will only be counted as one SSW as 20 days are needed to be counted as two SSWs). This could be the Final Warming, and if it occurs within 20 days of the initial SSW then it seems to me that the whole event will just be defined as a Final Warming and not an SSW. But this will be up to other people how this is all defined.

As I shared on social media our AI model, developed with my former MIT postdoc Mostafa Hamouda, predicts that the SSW/Final Warming will likely result in the classical tropospheric response of a negative NAO/Greenland blocking, though the uncertainty is relatively high compared to other cases. So far the GFS ensembles are the most enthusiastic about the development of negative NAO/Greenland blocking compared to the Canadian and ECMWF ensembles. But if a negative NAO/Greenland blocking does materialize, then Europe and/or Eastern US can expect a return to chillier weather in the spring, possibly for an extended period.

So once again, I present the wave diagnostics in **Figure iv** that I show every week. I don't believe we really have a stretched PV over the next two weeks (with the possible exception of early this week) and therefore the type of wave reflection so common the past two winters is not found in the next two weeks. But I have often wondered whether Greenland blocking that follows an SSW is also a product of wave reflection but in a different sector. I don't have the answer but based on the wave diagnostics from today suggest it is possible at least part of the time. In both **Figure iva** and **Figure ivb** we can observe wave energy goes up and east over North America, reflect off of the lower stratospheric PV and heads down and east over the North Atlantic and Europe. The energy is absorbed in the polar stratosphere where it builds the Greenland block. In addition, the standing wave over North America, which has tilted eastward so often this winter is tilting westward and instead the eastward tilting wave develops over the European sector where troughing deepens and connects to the Eurasian major PV center.



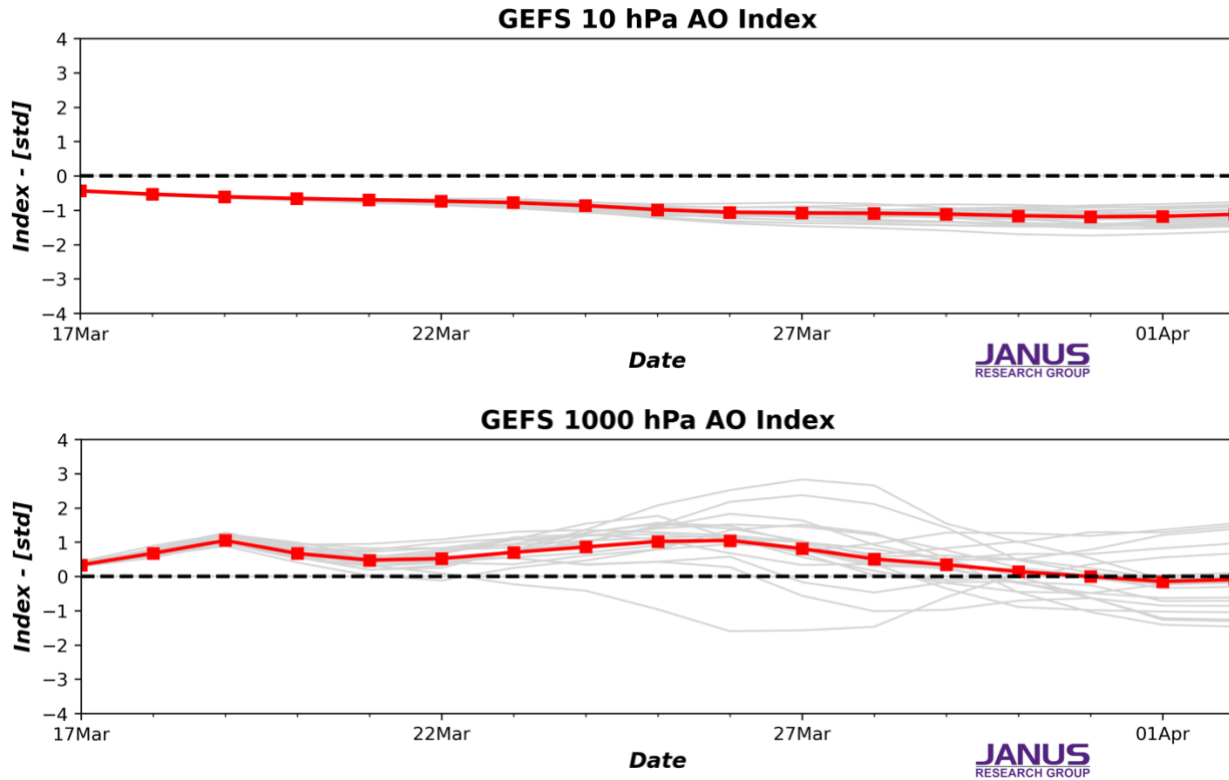
**Figure iv. a)** Predicted longitude-height cross section of geopotential eddy height anomalies (shading) and wave activity flux (vectors) averaged 23 March through 27 March 2026 **b)** same as **a)** but forecast from 28 March through 1 April 2026. The forecast is from the 00Z 17 March 2026 GFS operational.

This is just a tease of a new understanding of stratosphere-troposphere coupling that obviously needs much more analysis and research.

## Near-Term

### This week

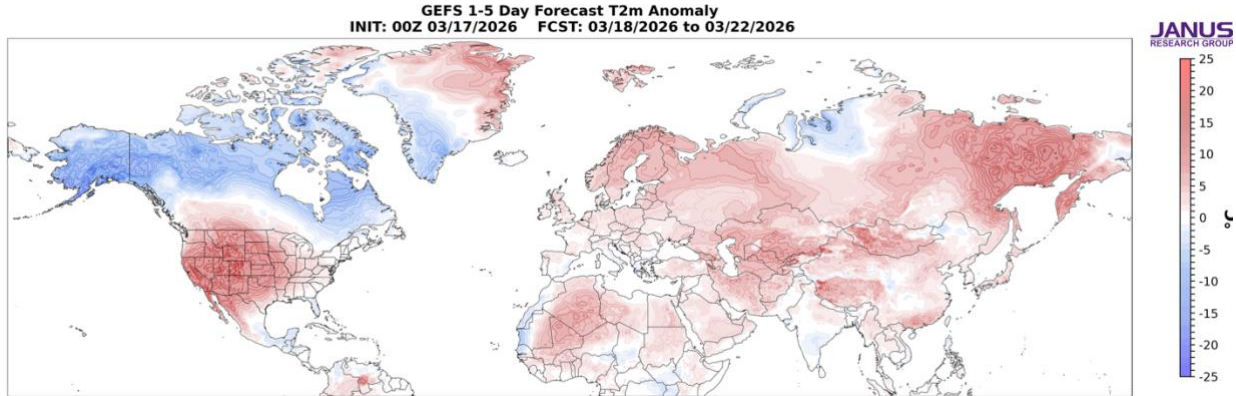
The AO is predicted to be positive this week (**Figure 1**) with mostly negative geopotential height anomalies currently across the Arctic and mixed geopotential height anomalies across the mid-latitudes of the NH (**Figure 2**). With predicted negative geopotential height anomalies across Greenland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



**Figure 1.** The predicted daily-mean AO at a) 10 hPa and b) 1000 hPa from the 00Z 17 Mar 2026 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.

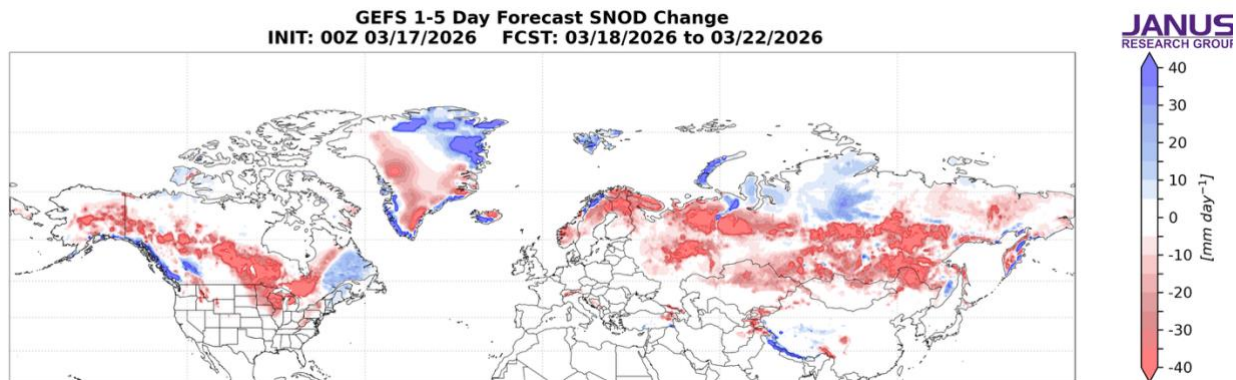
Trounging/negative geopotential height anomalies across Gereenland will support widespread ridging/positive geopotential height anomalies across Europe with trounging/negative geopotential height anomalies in the Mediterranean Sea (**Figure 2**). This pattern will support normal to above normal temperatures across much of Europe including the UK with the exception of normal to below normal tempeartures along the Mediterranean coast this week (**Figure 3**). This week the general pattern across Asia is ridging/positive geopotential height anomalies across Western and Eastern Asia bookending trounging/negative geopotential height anomalies centered on Western Siberia this week (**Figure 2**). This pattern favors widepserad normal to above normal temperatures across most of Asia with normal to below normal temperatures limited to Western Siberia this week (**Figure 3**).





**Figure 3.** Forecasted surface temperature anomalies ( $^{\circ}\text{C}$ ; shading) from 18 Mar 2026 to 22 Mar 2026. The forecasts are from the 00Z 17 Mar 2026 GFS ensemble.

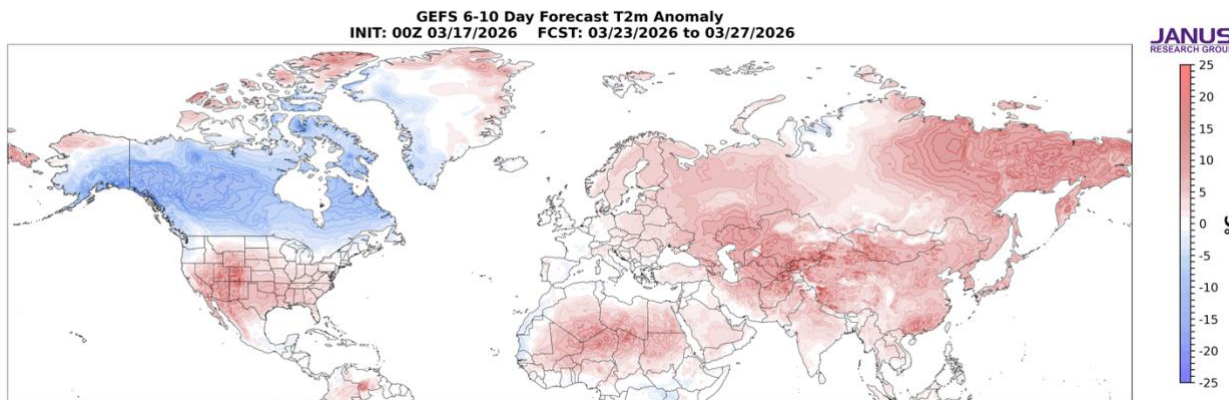
Trouging and/or cold temperatures will support new snowfall across parts of Siberia and the Tibetan Plateau while milder temperatures will support snowmelt across the Alps, Scandinavia, the Baltic States, Western Russia and parts of Siberia this week (**Figure 4**). Trouging and/or cold temperatures will support new snowfall across the higher elevations of Western Canada and the Canadian Maritimes while milder temperatures will support snowmelt across parts of Southern Canada and the Northwestern and Northeastern US this week (**Figure 4**).



**Figure 4.** Forecasted snowfall ( $\text{mm}/\text{day}$ ; shading) from 18 Mar 2026 to 22 Mar 2026. The forecasts are from the 00Z 17 Mar 2026 GFS ensemble.

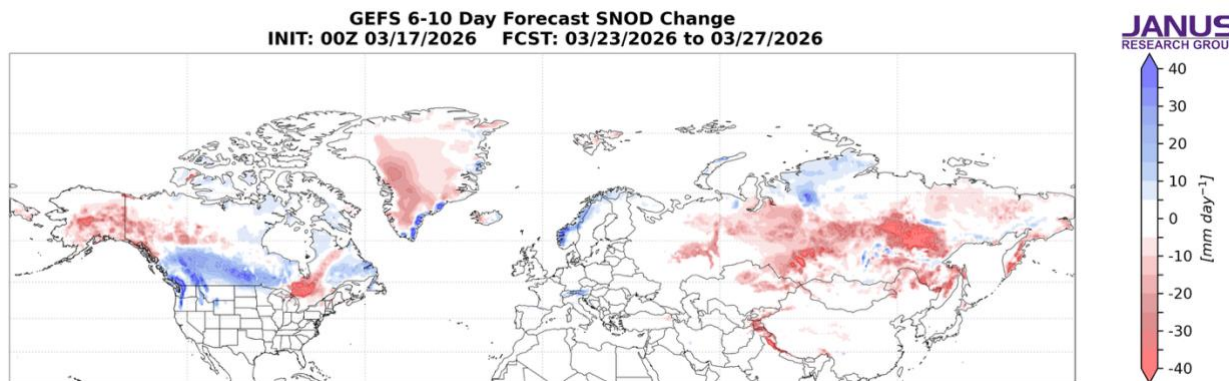


temperatures across the Mediterranean countries this period (**Figure 6**). Across Asia the persistent pattern of ridging/positive geopotential height anomalies across Western and Eastern Asia with troughing/negative geopotential height anomalies centered on Western Siberia is predicted to continue this period (**Figure 5**). This pattern favors widespread normal to above normal temperatures widespread across much of Asia especially Central Asia with normal to below normal temperatures limited to Western Siberia this period (**Figure 6**).



**Figure 6.** Forecasted surface temperature anomalies ( $^{\circ}\text{C}$ ; shading) from 23 Mar 2026 to 27 Mar 2026. The forecasts are from the 00Z 17 Mar 2026 GFS ensemble.

Across North America the persistent pattern of ridging/positive geopotential height anomalies across the US with troughing/negative geopotential height anomalies across Alaska and Canada is predicted to continue this period (**Figure 5**). This pattern will favor normal to below normal temperatures across Alaska, much of Canada and into the Northeastern US with normal to above normal temperatures across the US but once again especially the Western US (**Figure 6**).



**Figure 7.** Forecasted snowfall rate ( $\text{mm}/\text{day}$ ; shading) from 23 Mar 2026 to 27 Mar 2026. The forecasts are from the 00Z 17 Mar 2026 GFS ensemble.

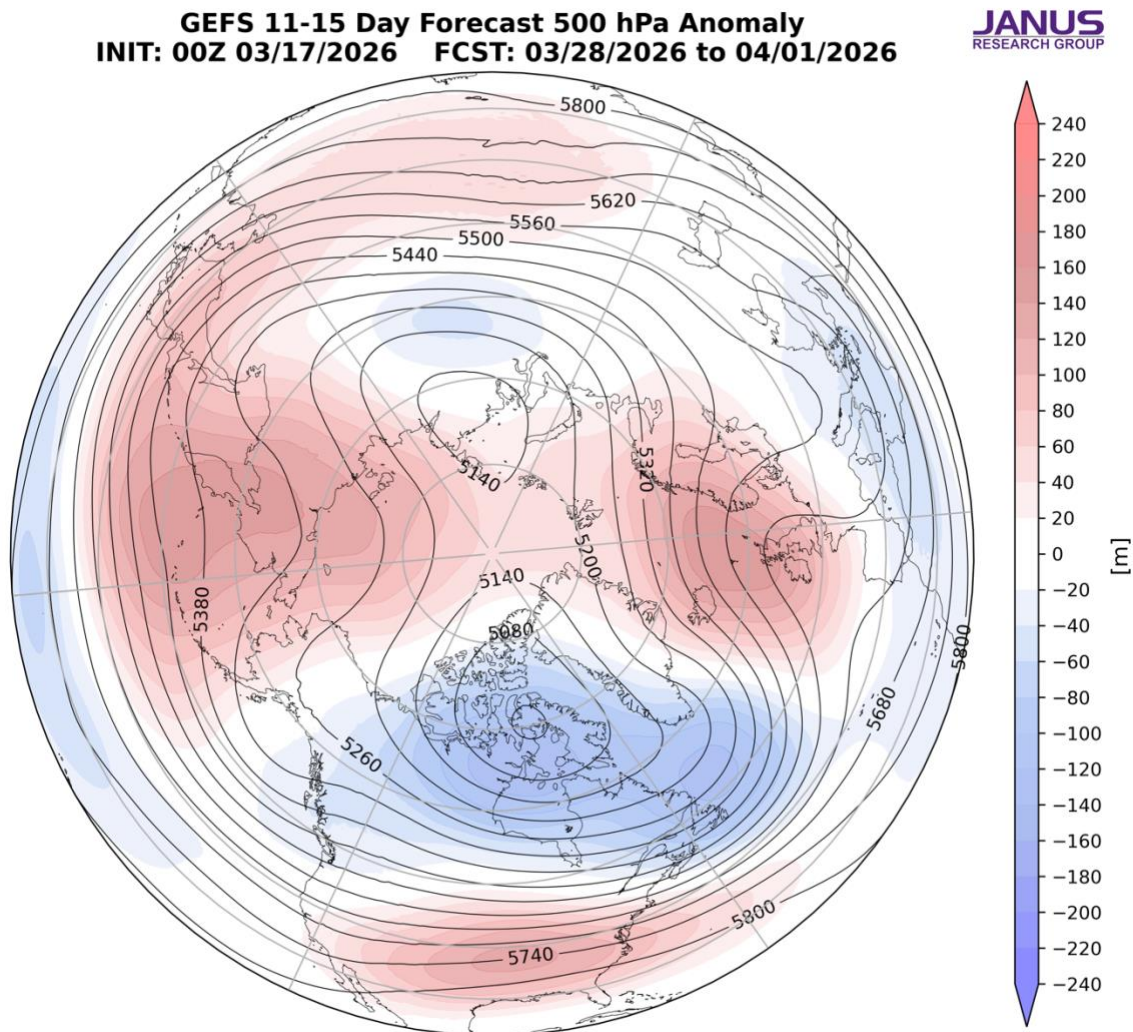
Troughing and/or cold temperatures will support new snowfall in the Alps, Norway and parts of Siberia while milder temperatures will support snowmelt in parts of Western Russia, parts of Siberia, the Tibetan Plateau and Northeast Asia this period (**Figure 7**). Troughing and/or cold

temperatures will support new snowfall Southern Canada and in the higher elevations of the Northwestern US while milder temperatures will support snowmelt in Alaska and parts of Canada this period (**Figure 7**).

## Mid Term

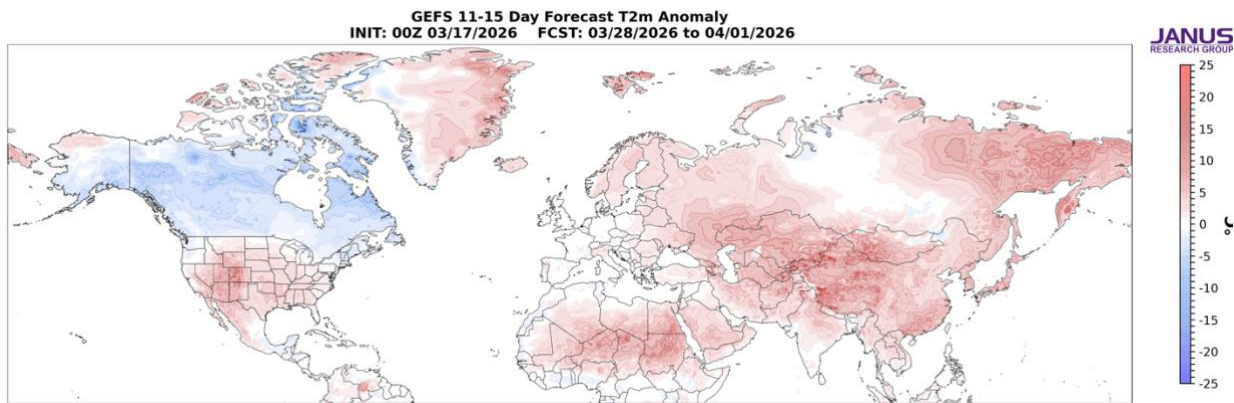
### Week Two

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



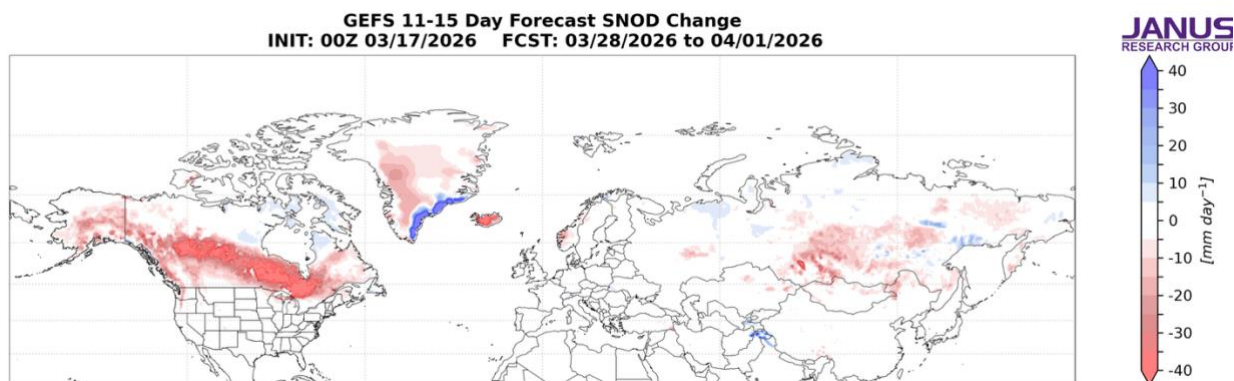
**Figure 8.** Forecasted average 500 mb geopotential heights (dam; contours) and geopotential height anomalies (m; shading) across the Northern Hemisphere from 28 Mar to 1 Apr 2026. The forecasts are from the 00Z 17 Mar 2026 GFS ensemble.

Strengthening ridging/positive geopotential height anomalies between Iceland and Scandinavia will support weak troughing/negative geopotential height anomalies across Western Europe this period (**Figure 8**). This pattern should favor normal to above normal temperatures across Eastern Europe with with normal to below normal temperatures across Western Europe including the UK this period (**Figures 9**). Predicted ridging/positive geopotential height anomalies across Eastern and Western Asia will continue to support troughing/negative geopotential height anomalies across Western Siberia this period (**Figure 8**). This pattern favors widespread normal to above normal temperatures across Asia including Western Asia, Eastern Siberia, Central and Eastern Asia and the Tibetan Plateau normal to below normal temperatures mostly limited to Western Siberia with this period (**Figure 9**).



**Figure 9.** Forecasted surface temperature anomalies ( $^{\circ}\text{C}$ ; shading) from 28 Mar to 1 Apr 2026. The forecasts are from the 00Z 17 Mar 2026 GFS ensemble.

The persistent pattern of ridging/positive geopotential height anomalies across the US with troughing/negative geopotential height anomalies across Alaska and Canada is yet again predicted to continue this period (**Figure 8**). This pattern supports normal to below normal temperatures across Alaska, much of Canada and possibly the Northeastern US with normal to above normal temperatures across much of the US this period (**Figure 9**).



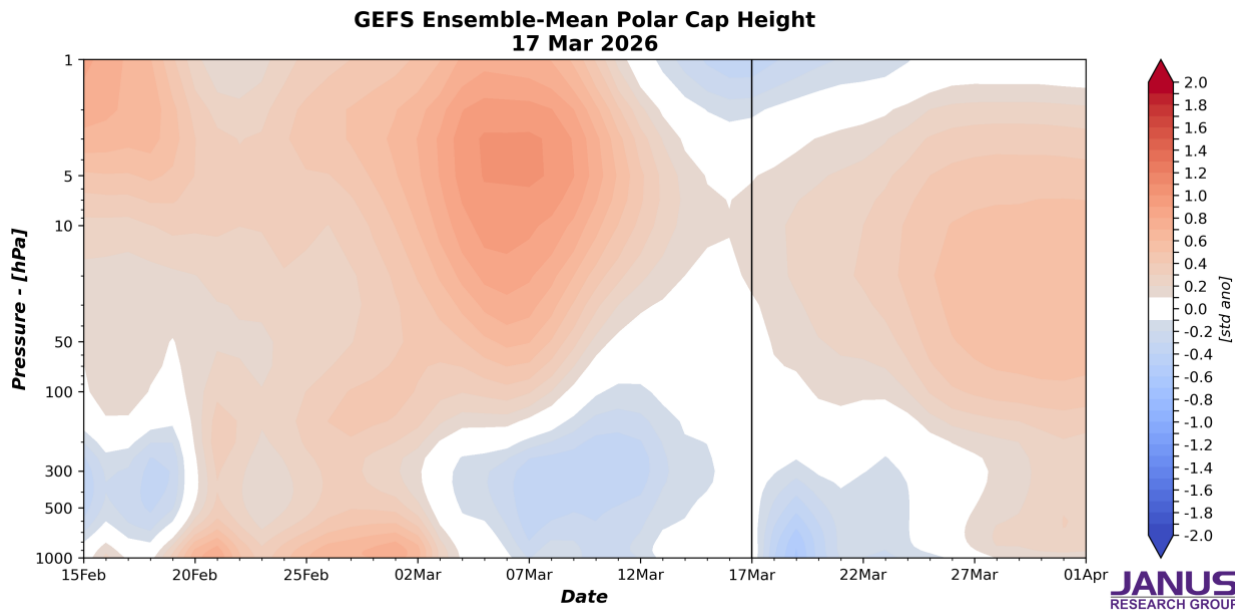
**Figure 10.** Forecasted snowfall (mm/day; shading) from 28 Mar to 1 Apr 2026. The forecasts are from the 00Z 17 Mar 2026 GFS ensemble.

Trouthing and/or cold temperatures will support some possible new snowfall in parts of Norway, parts of Siberia and the Tibetan Plateau while milder temperatures will support snowmelt in parts of Scandinavia and Southern Siberia this period (**Figure 10**). Trouthing and/or cold temperatures will support new snowfall across near Hudson Bay while milder temperatures will support snowmelt in Alaska, Western, Central and Southern Canada this period (**Figure 10**).

## Longer Term

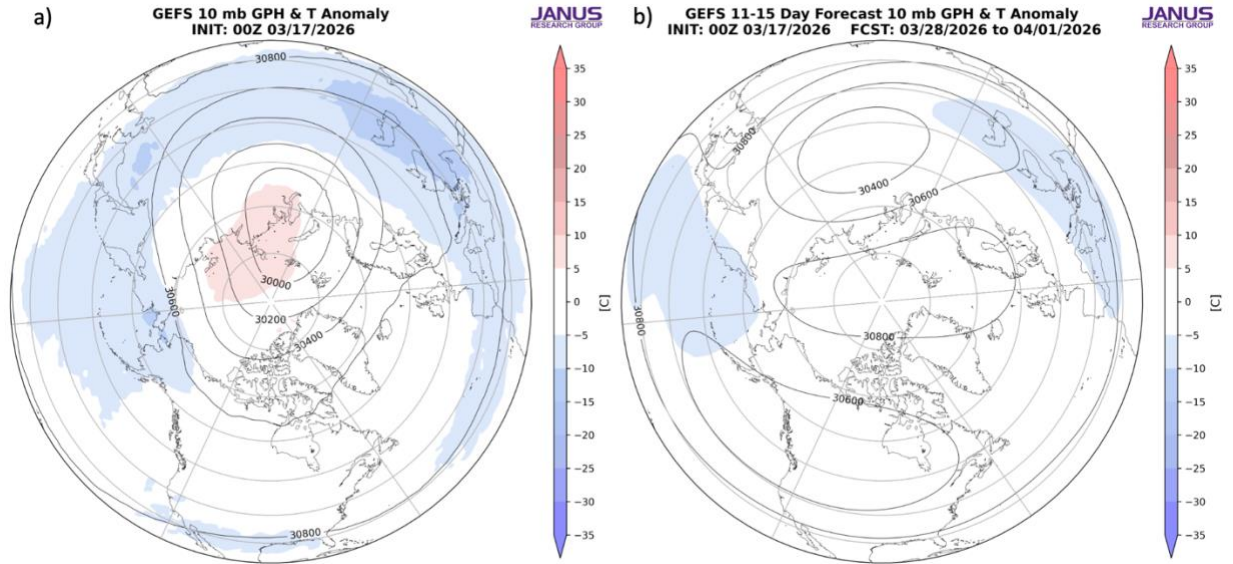
### 30-day

Today's polar cap geopotential height anomalies (PCHs) plot currently shows near normal and weak PCHs throughout the stratosphere and the troposphere (**Figure 11**). Then next week cold/negative PCHs are predicted to develop in the troposphere while warm/positive PCHs are predicted to build in the stratosphere and then begin to descend into the troposphere the last few days of March.



**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 17 Mar 2026 GFS ensemble.

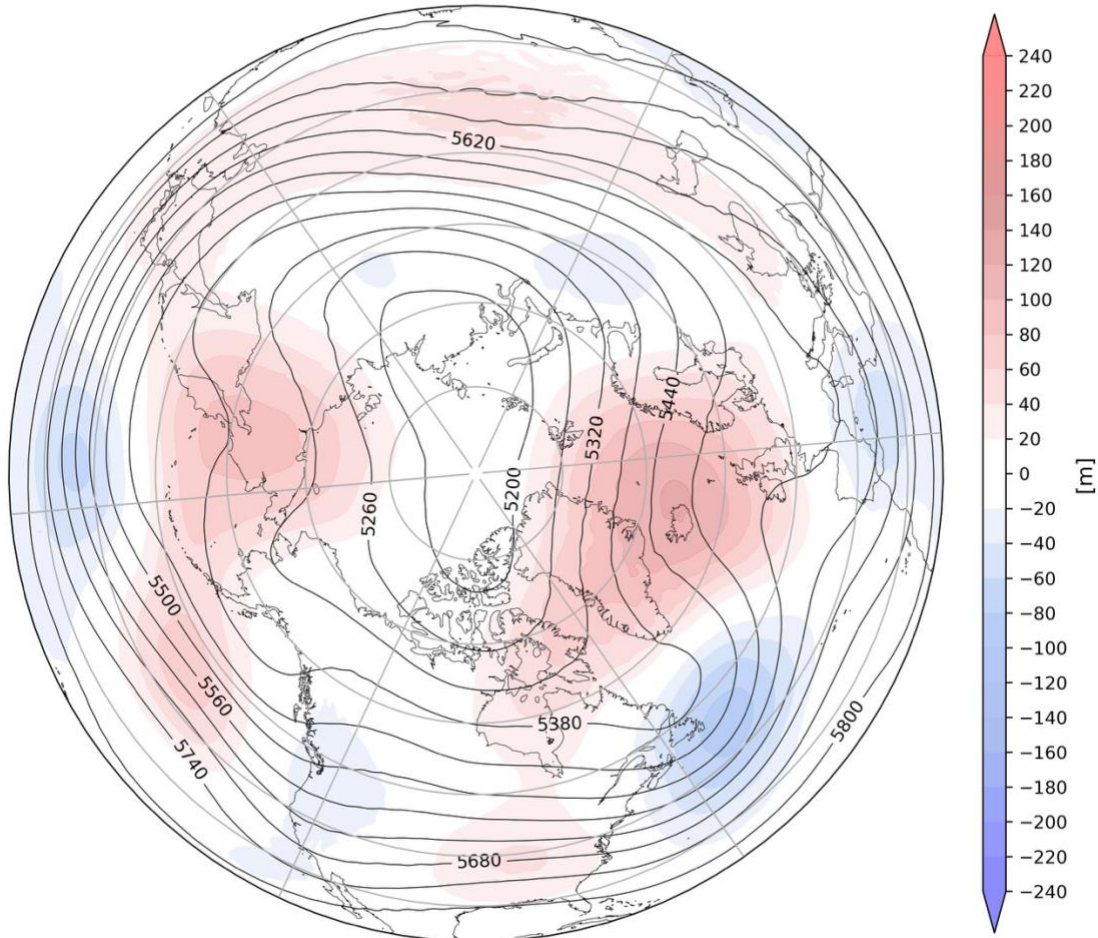
The predicted cold/negative PCHs in the lower troposphere this week (**Figure 11**) are consistent with the predicted positive AO this week (**Figure 1**). Then next week the forecast of warm/positive PCHs in the lower troposphere (**Figure 11**) are consistent with a near neutral AO (**Figure 1**).



**Figure 12.** Observed 10 mb geopotential heights (dam; contours) and temperature anomalies ( $^{\circ}\text{C}$ ; shading) across the Northern Hemisphere averaged from 17 Mar. (b) Same as (a) except forecasted averaged from 28 Mar to 1 Apr 2026. The forecasts are from the 00Z 17 Mar 2026 GFS ensemble.

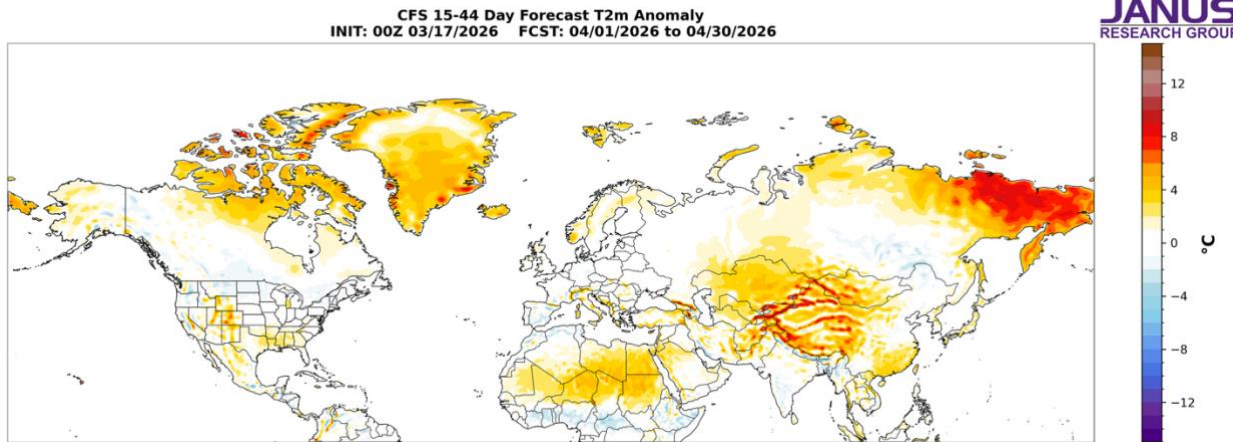
This week the polar vortex (PV) has regrouped into one PV center and is elongated in shape from the Urals to Central Canada with the main PV center over the Urals with relatively cold temperatures focused over Southern Eurasia and relatively warm temperatures centered over the Laptev Sea in the polar stratosphere (**Figure 12a**). Then during the last week of March, the PV is predicted to split into two PV centers with one center over Central Asia and a second center over Western Canada with high pressure centered in between centered over the North Pole with cold temperatures over Southern Europe and the western North Pacific in the polar stratosphere (**Figure 12b**). This is a clear PV split. The stratospheric AO in **Figure 1** this week is predicted to remain negative to strongly negative the next two weeks with the large PV disruption.

**CFS 500 hPa Forecast Anomaly Apr 2026**  
**Valid as of 17 Mar 2026**



**Figure 13.** Forecasted average 500 mb geopotential heights (dam; contours) and geopotential height anomalies (m; shading) across the Northern Hemisphere for Apr 2026. The forecasts are from the 00Z 17 Mar 2025 CFS.

I include in this week's blog the monthly 500 hPa geopotential heights (**Figure 13**) and surface temperatures for April (**Figure 14**) from the Climate Forecast System (CFS; the plots represent yesterday's four ensemble members). I do want to emphasize unless I say otherwise, I find the CFS forecasts of low confidence and most often don't match my own thinking. The forecast for the troposphere is ridging stretching from Greenland, to Scandinavia, Eastern Siberia, the Aleutians and the Eastern US with troughing in the Southwestern Mediterranean, across Northern and into Northeastern Asia, Western Canada into the Western US and the Canadian Maritimes (**Figure 13**). This pattern favors seasonable to relatively warm temperatures across Northern Europe, Northern Siberia, Southern, Central and Eastern Asia, including the Middle East, eastern China the Tibetan Plateau, Pakistan and Afghanistan, Eastern Siberia, Northeastern Canada and the Southern US with seasonable to relatively cool temperatures across Southern Siberia, Northeast Asia, Alaska, Western and Southern Canada and the Northern US (**Figure 14**).



**Figure 14.** Forecasted average surface temperature anomalies ( $^{\circ}\text{C}$ ; shading) across the Northern Hemisphere for Apr 2026. The forecasts are from the CFS 00Z 17 Mar 2025.

## Boundary Forcings

### Arctic Sea Ice

I am and will continue to watch Arctic sea ice. Current conditions are shown in **Figure 15**. Arctic sea ice anomalies continue to show a strong focus or weighting of negative anomalies towards the North Atlantic sector relative to the North Pacific sector and this is a robust signal of an overall weaker PV this winter. The negative anomalies are distributed between the Eurasian sector, i.e., Barents Kara Seas and the North American sector, now mostly in Baffin Bay (see **Figure 15**). Large negative sea ice anomalies have also developed in the Sea of Okhotsk and could be a result of but also supporting blocking in the region. Meanwhile sea ice extent seems to be far south of normal in the Bering Sea, likely reflective of the very cold winter in Alaska.

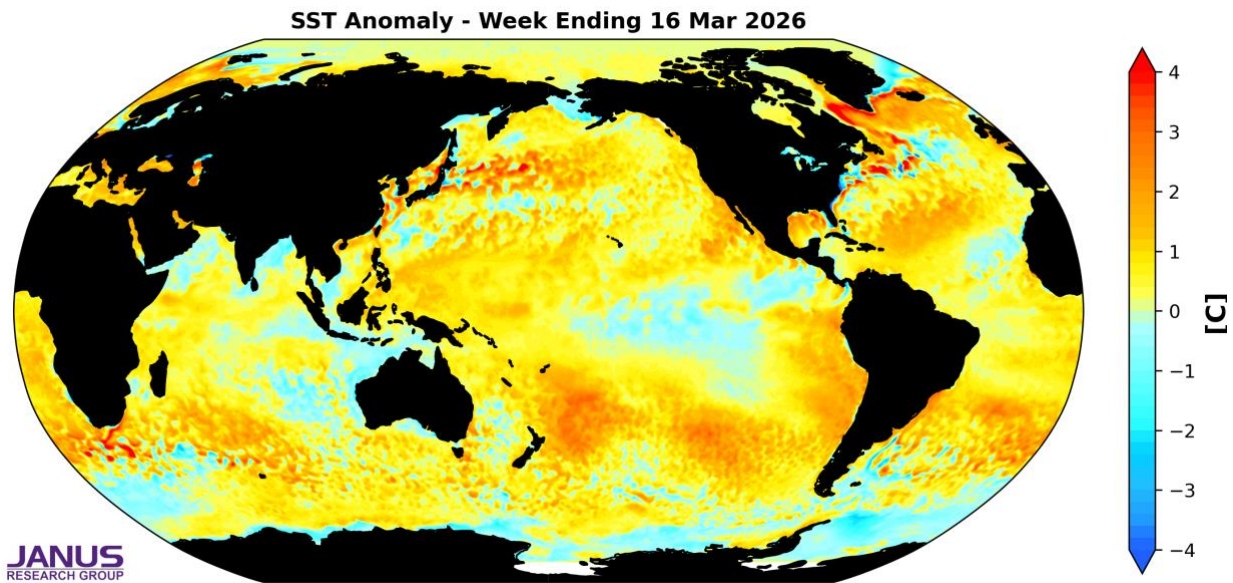


**Figure 15.** Arctic sea ice cover extent for 16 Mar 2026. White depicts ice covered areas and the orange contour the climatological extent of Arctic sea ice for the date. Plot taken from: <https://nsidc.org/sea-ice-today>

### SSTs/El Niño/Southern Oscillation

Equatorial Pacific sea surface temperatures (SSTs) anomalies are below normal, along the equatorial Pacific (**Figure 15**) consistent with La Niña conditions for much of the winter, however warming has appeared near the South American coast and could be a sign of a developing El Niño conditions. Observed SSTs across the NH remain well above normal especially in the North Pacific and much of the North Atlantic, though below normal SSTs

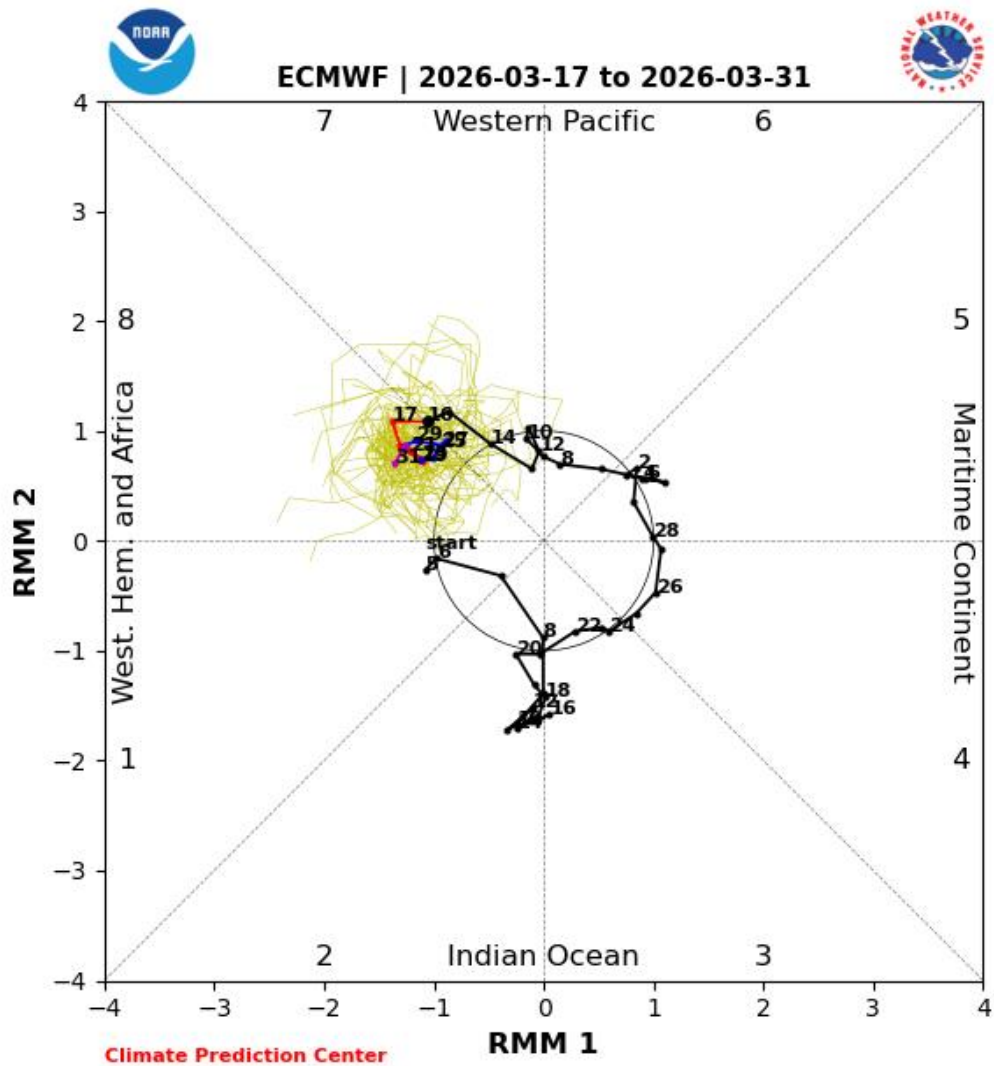
exist regionally especially in the South Pacific. The very warm SSTs in both ocean basins could be supporting the predicted blocking in both basins.



**Figure 16.** The latest daily-mean global SST anomalies for week ending 16 Mar 2026.

### **Madden Julian Oscillation**

Currently the Madden Julian Oscillation (MJO) is currently in phase eight (**Figure 17**) and the forecasts are for the MJO to hang out in phase eight the next two weeks (**Figure 17**). Phase eight favors ridging across Canada with troughing across the US, the opposite of forecasts and therefore, it seems that the MJO is having little influence on North American weather this week and next week. But admittedly this is outside of my expertise.



**Figure 17.** Past and forecast values of the MJO index. Forecast values from the 00Z 17 Mar 2026 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/ecmf.shtml>

### 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. [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.

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