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Arctic Oscillation and Polar Vortex Analysis and Forecasts

April 27, 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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The AO/PV blog is partially supported by NSF grant AGS: 1657748

Summary

- The Arctic Oscillation (AO) is currently neutral as pressure/geopotential height anomalies across the Arctic are currently mostly mixed and the AO is predicted to remain near neutral to negative the next two weeks as pressure/geopotential height anomalies are predicted to remain mixed to mostly positive the next two weeks. The North Atlantic Oscillation (NAO) is currently negative but will pop positive this week with weakly negative pressure/geopotential height anomalies across Greenland, and the NAO is predicted to trend negative the next two weeks as pressure/geopotential height anomalies are predicted to become increasingly positive across Greenland the next two weeks.
- Previous ridging/positive geopotential height anomalies across Greenland will continue to support troughing/negative geopotential height anomalies across Eastern Europe with ridging/positive geopotential height anomalies across Western Europe this week however next week the flow will become increasingly zonal across Europe. This pattern will favor normal to above normal temperatures across Western Europe including the United Kingdom (UK) with normal to below normal temperatures across Eastern Europe this week, however starting next week normal to above normal temperatures will become more widespread across Europe.
- An omega block pattern is predicted across Asia this week with ridging/positive geopotential height anomalies centered in Central Asia bookended by troughing/negative

geopotential height anomalies across Western and Eastern Asia this week and then next week the pattern across Asia is predicted to become more zonal. This pattern favors mostly normal to above normal temperatures across much of Asia focused on Central Asia with normal to below normal temperatures across Western and Eastern Asia this week but starting next week above normal temperatures will become more widespread across Asia.

- The predicted atmospheric pattern across North America the next two weeks is troughing/negative geopotential height anomalies across Central and Southeastern Canada and the Eastern United States (US) with ridging/positive geopotential height anomalies across Western and Northeastern Canada and the Western US. This patten will support normal to below normal temperatures across Central and Southeastern Canda and the Eastern US with normal to above normal temperatures across the Alaska, Western and Northeastern Canada and the Western US the next two weeks.
- The Final Warming of the polar vortex (PV) happened two weeks ago. Though gone, the PV's infleucne remains fro a little while longer. I present my estimate for how much longer below.

Plain Language Summary

About two thirds through meteorological spring can be summed up as relatively cold temperatures for Western Siberia and especially Alaska and much of Canada and mild to very mild for the mid-latitudes and across the population centers of the Northern Hemisphere including the US, Europe and East Asia (see **Figure**). The forecast for the next two weeks can be summarized as a breakout of the cool temperatures into Eastern Europe and the Eastern US (see **Figures 3, 6** and **9**). This is likely the dissipation of the two cold pools in Asia and North America. So what comes next? I share my latest thoughts below.

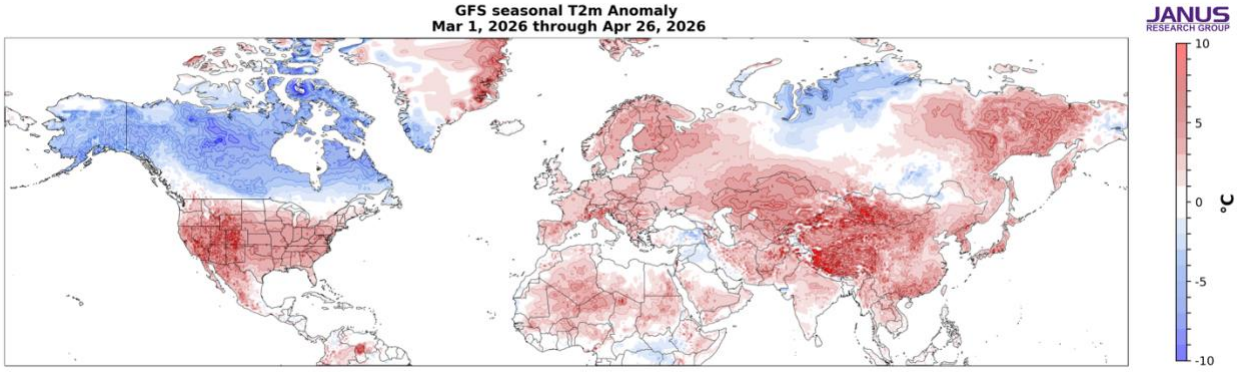

Figure. Estimate of the observed surface temperatures (°C; shading) from 01 Mar to 26 Apr 2026 based on GFS initializations and the GFS forecast from the 27 Apr 2026 run.

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Impacts

The polar vortex (PV) indeed experienced its Final Warming on 9 April and won't return until late August or early September. The Final Warming was about two weeks earlier than average but still a month later than last year. Though the PV is gone for its summer holiday its influence or impact lingers. When the PV weakened (more than the winter favorite – the PV stretch) splitting at least two times end finally just rolling over and exiting, cold air across the Northern Hemisphere retreated to higher latitudes in Siberia, Alaska and Canada. Though the PV was weakening and the polar stratosphere was warming for much of March, the tropospheric AO strengthened (or turned consistently positive), the higher latitudes cooled and the mid-latitudes warmed up. In winter the pooling of cold air across Arctic land areas is almost certainly a precursor for one or multiple Arctic outbreaks to the mid-latitudes. I thought the same would happen with the pooling of cold air in Siberia and Canada but I was a bit less certain. But from today's blog it can be confirmed the pooling of cold air in Siberia has discharged to Eastern Europe and the pooling of cold air in Canada has discharged to the Eastern US. Of course it is late April and soon early May and the sweeping of Arctic air southward doesn't quite have the same bite as in January and February. I was in NYC over the weekend and Saturday was as an unpleasant late April day as I can remember with temperatures in the low 40's and an all day rain but not a two foot blizzard as occurred exactly two months earlier.

A big reason for the breaking of the "cold (or cool) air dam" has been the downward influence of the PV splits of March. The downward influence rarely comes in one fell swoop but tends to be episodic or the tentacles of warm/positive polar cap geopotential height anomalies (PCHs), drip down from the stratosphere to the troposphere and provide the appearance of dripping paint as seen in **Figure 11**. When the "drip" of warm/positive PCHs reaches the mid to low troposphere, high latitude blocking increases often in the form of Greenland blocking. We just had one episode of Greenland blocking end, but as can be seen from the mid-troposphereic circulation animation in **Figure I**, Greenland blocking is predicted to return. Though admittedly in the animation the Greenland blocking is not very impressive looking. The Greenland blocking looks more consequential in the GFS ensembles as seen in **Figures 5** and **8**. Besides high-latitude bocking in the Greenland-Northeast Canada region, high-latitude blocking is predicted to develop across Alaska and Western Canada. The tag team of Alaskan and Greenland blocking looks to ensure a cool period in the Eastern US at least over the next two weeks and likely beyond. The Greenland blocking has brought some cooler temperatures to Europe as well but doesn't look as widespread or as persistent as in Canada and the US. And that may simply be because the cold pool source in Siberia was more limited in area than the cold possl source that stretched across Alaska and most of Canada (see above **Figure**).

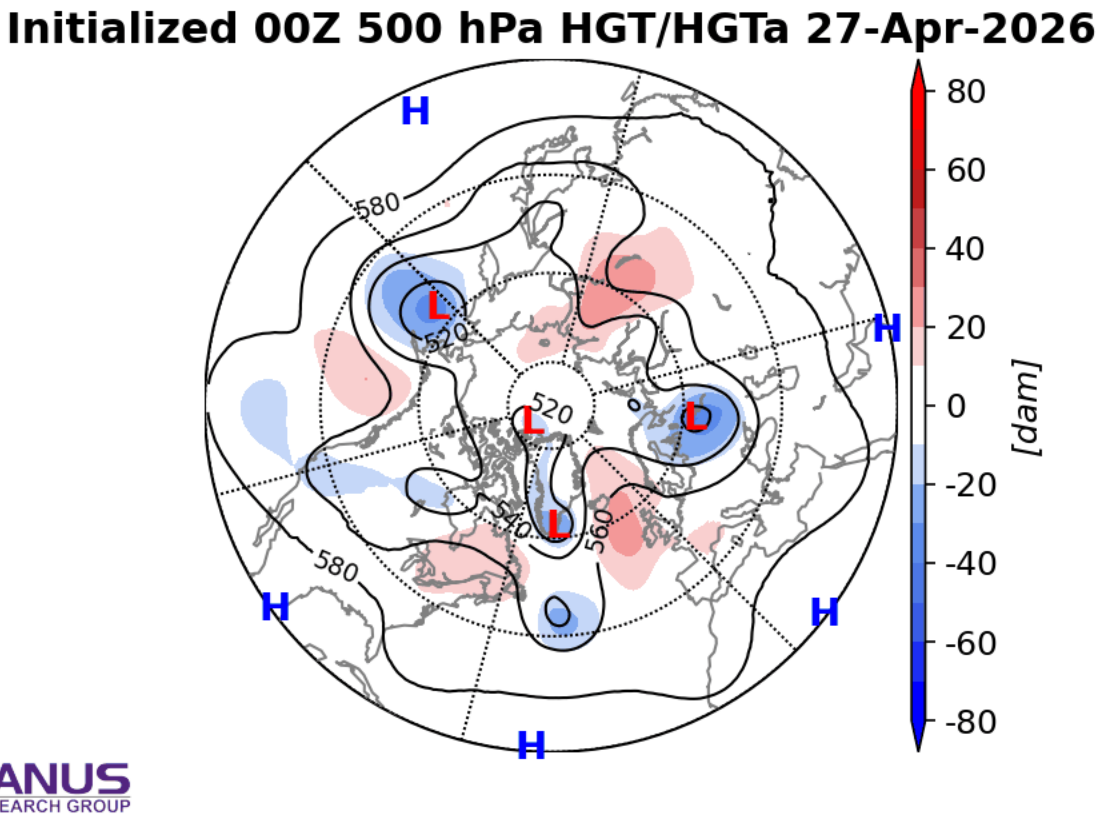

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Figure i. Initialized 500 mb geopotential heights (dam; contours) and decameter anomalies (dam; shading) across the Northern Hemisphere for 27 Apr 2026 and forecasted from 28 Apr 2026 to 12 May 2026. The forecasts are from the 00Z 27 Apr 2026 GFS model.

From **Figure 11**, it could be inferred that the influence of the PV split/Final Warming has ended or is about to end. First I am not sure the PCH forecast presented in **Figure 11** will verify. But regardless, the forecast of the PCH limited to the North Atlantic sector (see **Figure ii**) provides a an alternative interpretation that indeed the upcoming predicted return of Greenland blocking is another “drip” from the PV disruption of March and the Greenland blocking is a manifestation of more downward influence.

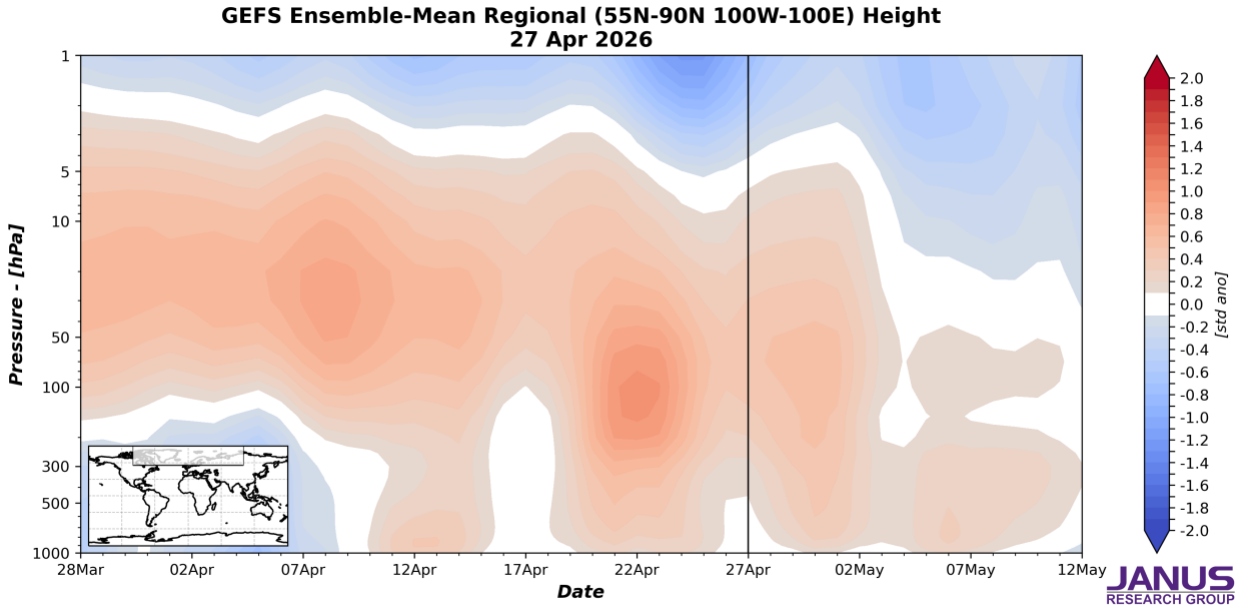

Figure ii. Observed and predicted daily polar cap height (i.e., area-averaged geopotential heights poleward of 60°N) standardized anomalies limited to the North Atlantic sector (see insert). The forecast is from the 00Z 27 Apr 2026 GFS ensemble.

In the previous blog I had shared the lowest temperature quintile probabilities for late April and early May (see **Figure iii**) from our experimental artificial intelligence (AI) model. The model was predicting below normal temperatures in Southern Canada and into the Northeastern US for the upcoming two week period. That forecast based on the shorter range models looks to have been very good (see **Figures 3, 6** and **9**), despite some uncertaintyon my part expressed in the blog. The flow of cold air starting in Alaska, across Canada and into the Northeastern US has been the dominant pattern since late November and likely into early May at least. The biggest exception was March when the US was record warm but even in March, Alaska and Canada remained cold. The cold pool in Alaska has been impressively persistent and Fairbanks has just experienced its coldest December through March on record. But I think the cold pool in Canada might even be more impressive and will continue even as Alaska warms up. I don't know the reason for the persistent cold air in Canada but seems to me a link to a boundary forcing makes a lot fo sense. Snow cover is above normal in Canada so far in April and from our analysis snowfall was above normal across much of Canada for the winter. So that is certainly one candidate. But I also wonder how much of a role sea surface temperatures (SSTs) have played. SSTs have been well above normal in the central North Pacific all winter and it is possible that the SSTs excited a Rossby wave train that anchored a trough over Canada for multiple months that resulted in the impressively long stretch of cold temperatures in Canada despite the widespread warmth across much of the rest of the globe especially in global oceans.

So now that the AI model did well in its forecast fro this upcoming period what does the AI say abut the cold beyond early May? The model still seems to hold on the cold pool for mid-May but then the probabilities weaken for third week of May. So the Canadian cold (or cool) pool that has

often bled into the Northeastern US might finally be coming to an end in the second half of May. We shall see but an impressive run none the less.

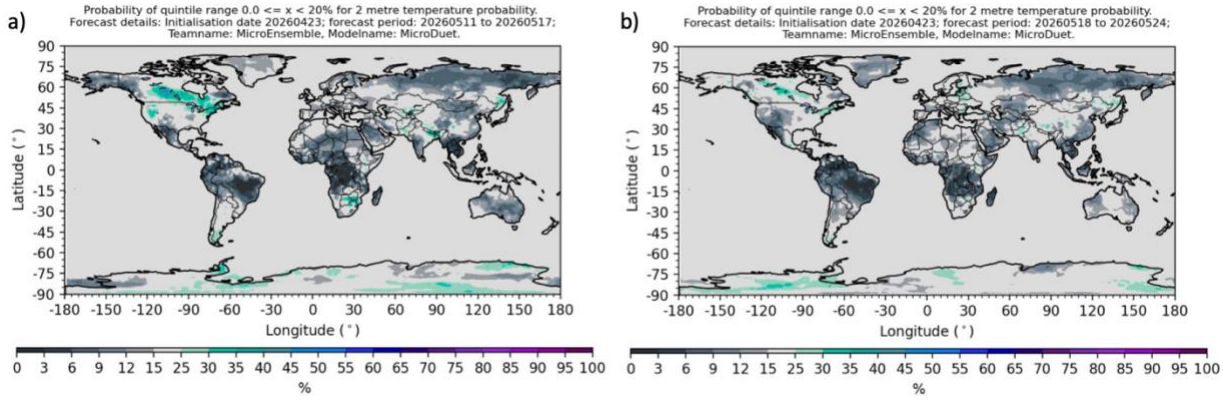

Figure iii. a) Predicted probability of lowest 20 percent or bottom quintile for surface air temperature for the week of 11 May to 17 May 2026. b) same as a but for the week of 18 May to 24 May 2026. Model initialized with data from 23 April 2026. Forecast posted at https://aiweatherquest.ecmwf.int/.

Near-Term

This week

The AO is predicted to be neutral this week **(Figure 1**) with mostly mixed 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 postive this week.

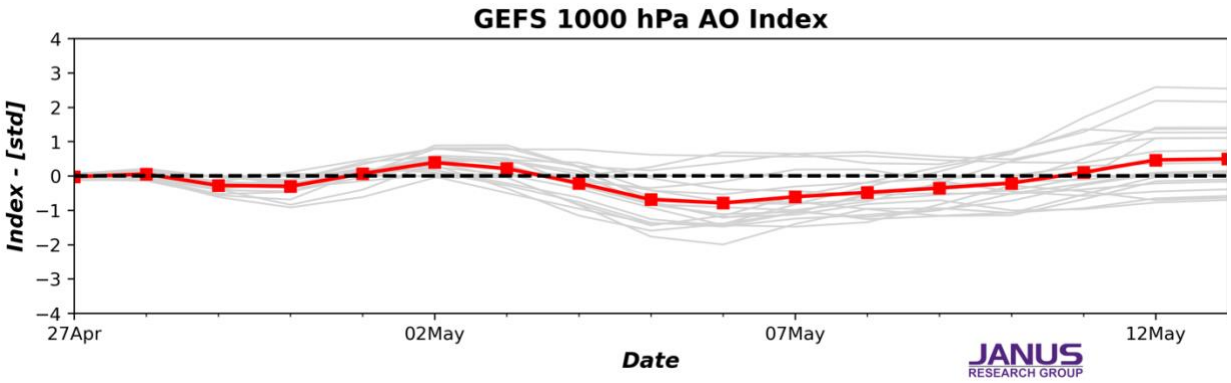

Figure 1. The predicted daily-mean AO at 1000 hPa from the 00Z 27 Apr 2026 GFS ensemble. Gray lines indicate the AO index from each individual ensemble member, with the ensemble mean AO index given by the red line with squares.

Recent ridging/positive geopotential height anomalies across Greenland will continue to support troughing/negative geopotential height anomalies across Eastern Europe with ridging/positive geopotential height anomalies across Europe across Eastern Europe (**Figure 2).** This pattern will support normal to above normal temperatures across Western Europe including the UK with normal to below normal temperatures across Central and Eastern Europe this week (**Figure 3**). This week the general pattern across Asia is ridging/positive geopotential height anomalies centered in Asia sandwiched by troughing/negative geopotential height anomalies across Western and Eastern Asia this week (**Figure 2**). This pattern favors widepserad normal to above normal temperatures across most of Asia but focused in Western Siberia with normal to below normal temperatures across far Western and Eastern Asia this week **(Figure 3**).

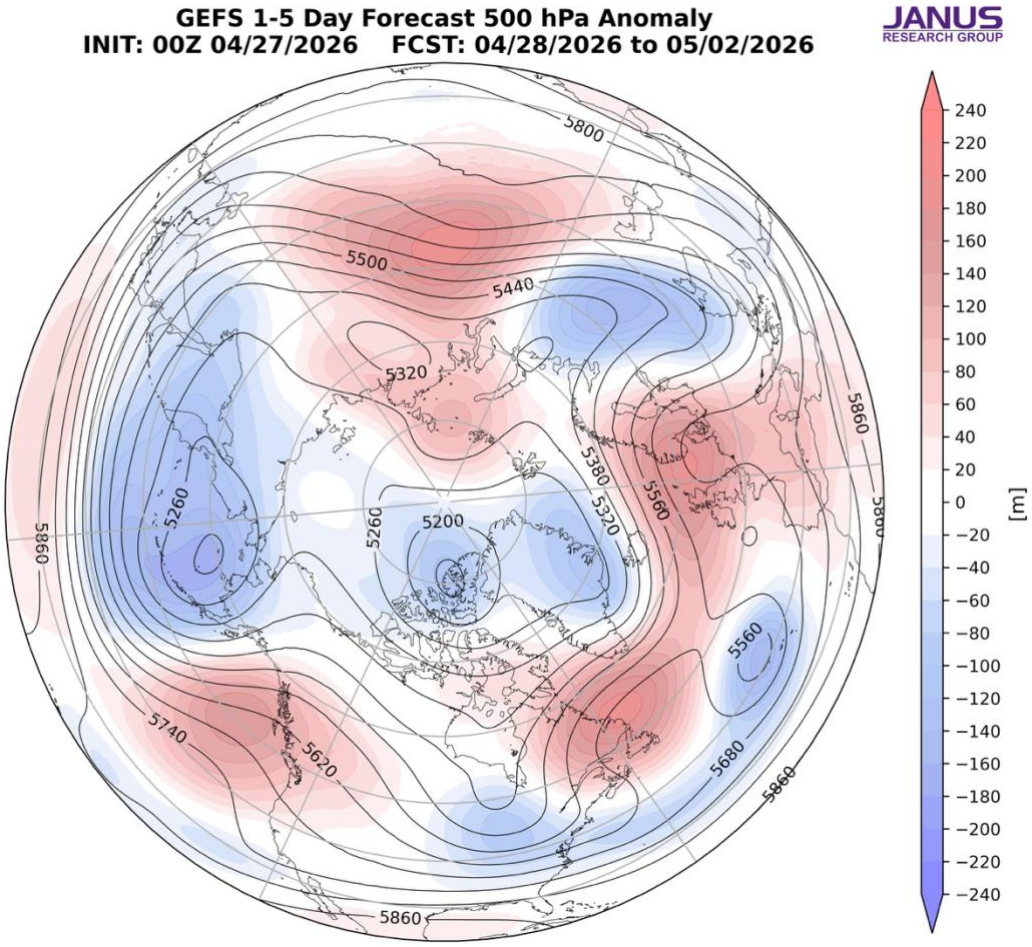

Figure 2. Forecasted average 500 mb geopotential heights (dam; contours) and geopotential height anomalies (m; shading) across the Northern Hemisphere from 28 Apr 2026 to 02 May 2026. The forecasts are from the 00Z 27 Apr 2026 GFS ensemble.

The predicted pattern across North America this week is troughing/negative geopotential height anomalies across Central Canada and the Eastern US with ridging/positive geopotential height anomalies across Western and Northeastern Canada and the Western US this week (**Figure 2**). This patten will favor normal to below normal temperatures across

Central Canada and the Central and Eastern US with normal to above normal temperatures across Alaska, Western and Eastern Canada and the Western US this week (**Figure 3**).

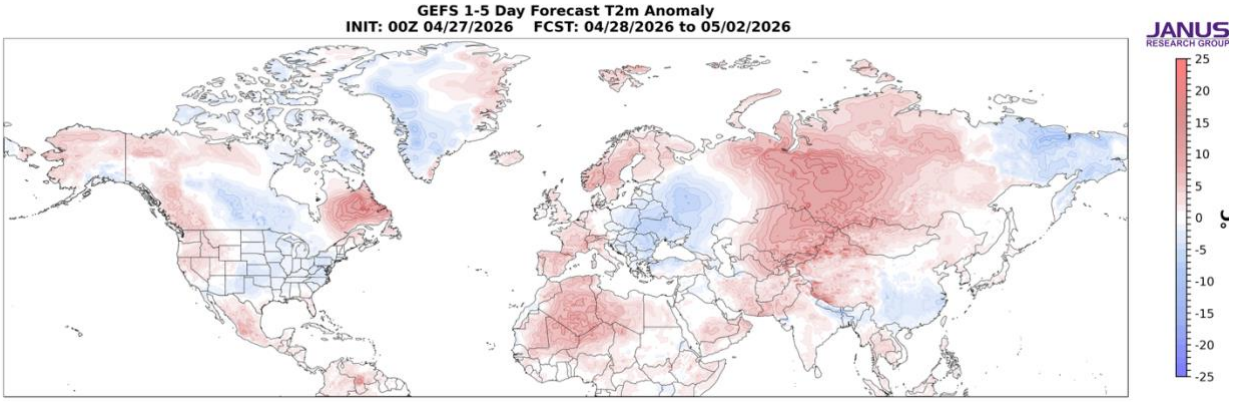

Figure 3. Forecasted surface temperature anomalies (°C; shading) from 28 Apr 2026 to 02 May 2026. The forecasts are from the 00Z 27 Apr 2026 GFS ensemble.

Troughing will support new rainfall across Turkey and the Caucuses, Iraq, northweastern Iran and the Tibetan Plateau with mostly dry conditions across much of Europe and Asia (**Figure 4**). Troughing will support new rainfall across southern Alaska, Hudson Bay, Southeastern Canada, from the Southeastern US into the Great Lakes and into New England with mostly dry conditions across much of North America this week (**Figure 4**).

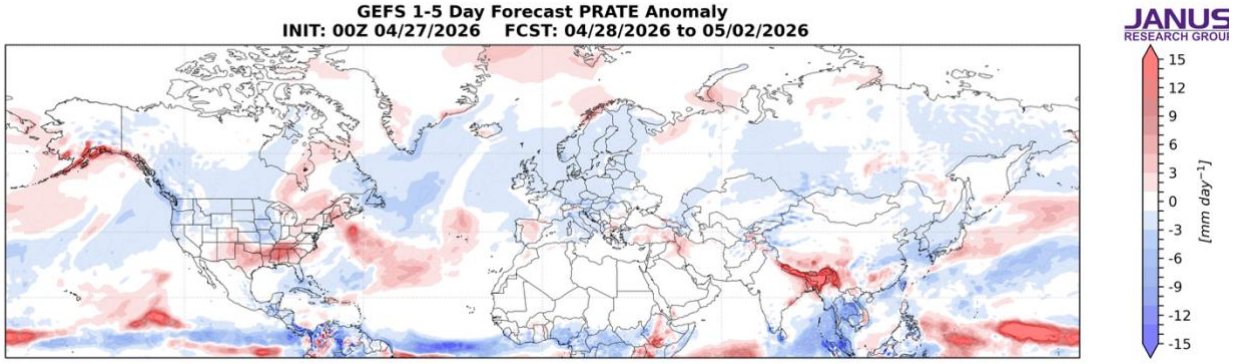

Figure 4. Forecasted precipitation (mm/day; shading) from 28 Apr 2026 to 02 May 2026. The forecasts are from the 00Z 27 Apr 2026 GFS ensemble.

Near-Mid Term

Next week

With geopotential height anomalies remaining mixed to mostly positive across the Arctic and with mixed geopotential height anomalies across the mid-latitudes this period (**Figure 5**), the AO will likely be neutral to negative this period (**Figure 1**). With mostly positive pressure/geopotential height anomalies across Greenland (**Figure 5**), the NAO will likely be negative this period.

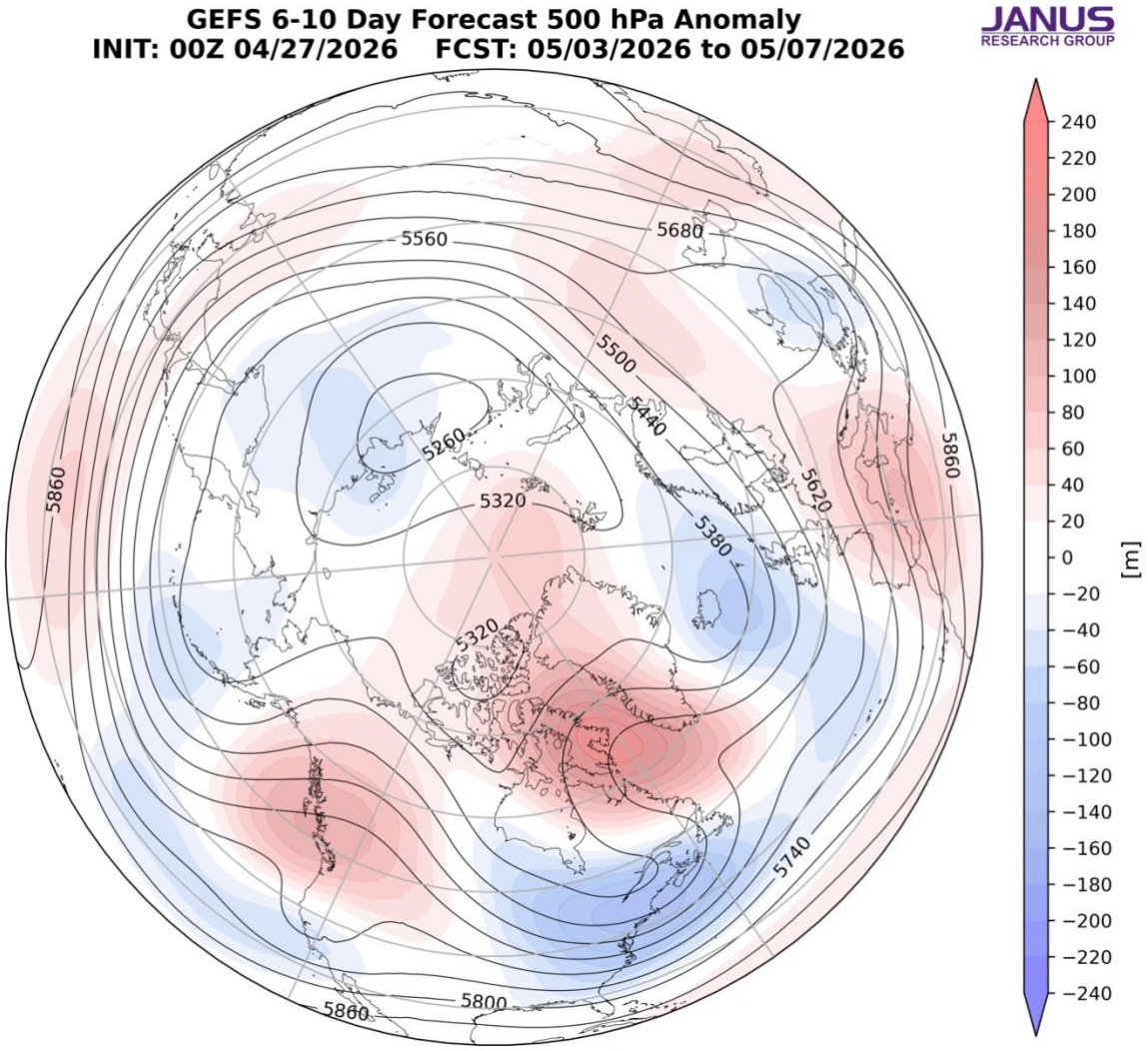

Figure 5. Forecasted average 500 mb geopotential heights (dam; contours) and geopotential height anomalies (m; shading) across the Northern Hemisphere from 03 May 2026 to 07 May 2026. The forecasts are from the 00Z 27 Apr 2026 GFS ensemble.

The atmospheric circulation is undergoing a transition this period across the North Atlantic and Europe will result in a mostly zonal flow across Europe with troughing/negative geopotential height anomalies across Northern Europe with ridging/positive geopotential height anomalies across Southern Europe (**Figure 5**). The pattern will support widespread

normal to above normal temperatures across Europe including the UK with the exception of normal to below normal temperatures across Southeastern Europe this period (**Figure 6**). Across Asia the predicted strengthening of ridging/positive geopotential height anomalies centered in Northwestern Asia will support troughing/negative geopotential height anomalies across both the Middle East and Siberia with more ridging across Southeast Asia 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 Northern and Eastern Siberia and the Middle East this period (**Figure 6**).

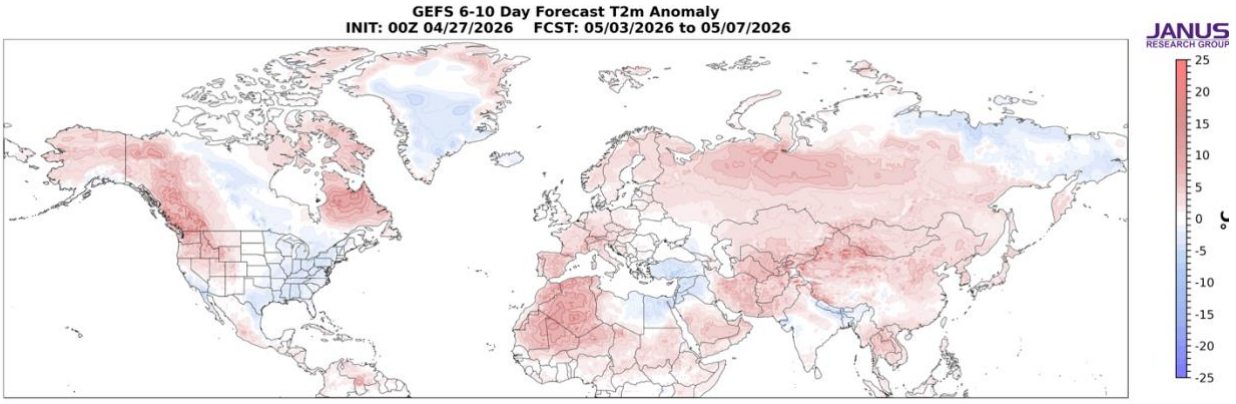

Figure 6. Forecasted surface temperature anomalies (°C; shading) from 03 May 2026 to 07 May 2026. The forecasts are from the 00Z 27 Apr 2026 GFS ensemble.

Across North America the predicted pattern is ongoing ridging/positive geopotential height anomalies across Alaska, Western and Northeastern Canada and the Western US with troughing/negative geopotential height anomalies across Central and Southeastern Canada and the Eastern US this period (**Figure 5**). This pattern will favor normal to above normal temperatures across Alaska, Western and Northeastern Canada and the Western US normal to above normal temperatures across the Central and Southeastern Canada, the Eastern US and the Desert Southwest this period (**Figure 6**).

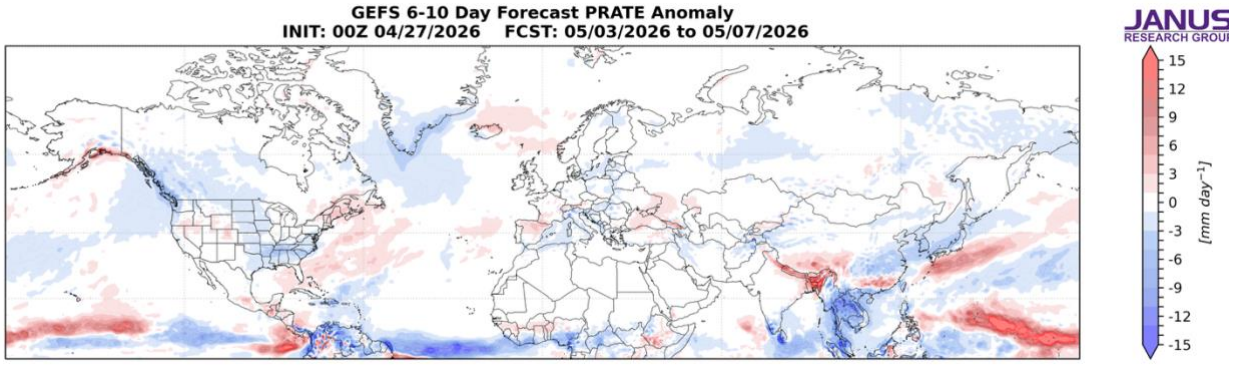

Figure 7. Forecasted rainfall rate (mm/day; shading) from 03 May 2026 to 07 May 2026. The forecasts are from the 00Z 27 Apr 2026 GFS ensemble.

Troughing will support new rainfall across the Iberian Peninsula, around the Black Sea and the Tibetan Plateau with mostly dry conditions across much of Europe and Asia (**Figure 7**). Troughing will support new rainfall across southern Alaska, the US Rockies, New England and the Canadian Maritimes with mostly dry conditions across much of North America this week (**Figure 7**).

Mid Term

Week Two

With predicted mostly positive 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 negative to neutral this period (**Figure 1**). With predicted positive pressure/geopotential height anomalies across Greenland (**Figure 8**), the NAO will likely remain negative this period.

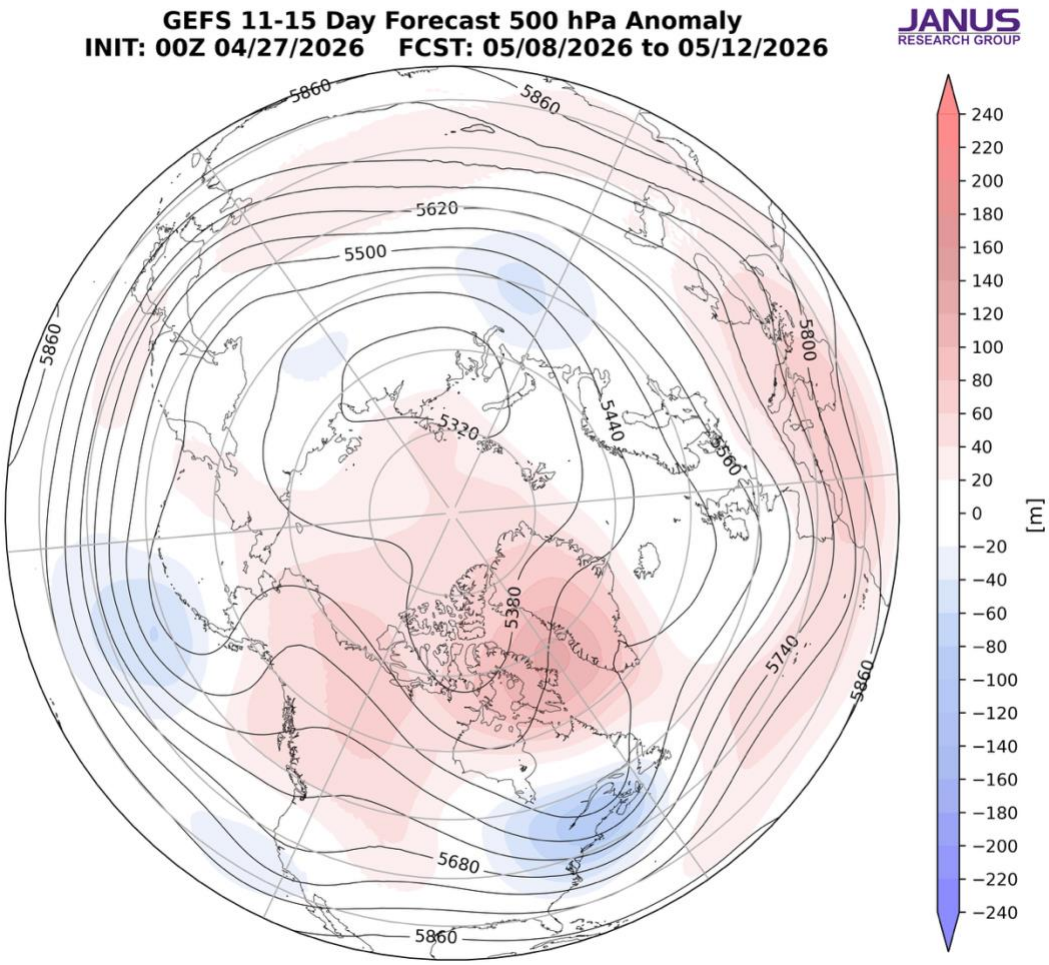

Figure 8. Forecasted average 500 mb geopotential heights (dam; contours) and geopotential height anomalies (m; shading) across the Northern Hemisphere from 08 May to 12 May 2026. The forecasts are from the 00Z 27 Apr 2026 GFS ensemble.

The mostly zonal flow across Europe is predicted to persist with ridging/positive geopotential height anomalies across Southernn Europe and troughing/negative geopotential height anomalies across Northern Europe this period (**Figure 8**). This pattern will continue to favor widespread normal to above normal temperatures across much of Europe including the UK though normal to below normal temperatures might linger in parts of Eastern Europe this period (**Figures 9**). Similarly a zonal flow pattern is predicted across Asia with ridging/positive geopotential height anomalies across Southern Asia with troughing/negative geopotential height anomalies across Northern Asia this period (**Figure 8**). This pattern favors widespread normal to above normal temperatures across Asia including the Middle East, Central and Eastern Asia and Southern Siberia with normal to below normal temperatures limited to parts of Northern Siberia the Tibetan Plateau and the Indian subcontinent with this period (**Figure 9**).

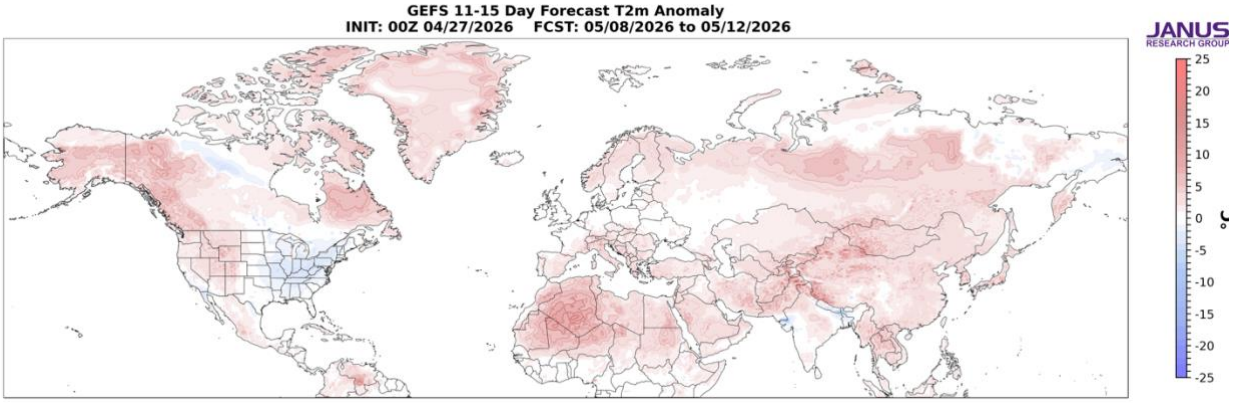

Figure 9. Forecasted surface temperature anomalies (°C; shading) from 08 May to 12 May 2026. The forecasts are from the 00Z 27 Apr 2026 GFS ensemble.

Ridging/positive geopotential height anomalies across Greenland is predicted to once again strengthen this period and will support persistent troughing/negative geopotential height anomalies across Southeastern Canada and the Eastern US with more ridging across western North America (**Figure 8**). This pattern supports normal to above normal temperatures across Alaska, much of Canada and the Western US with normal to below normal temperatures across Southeastern Canada and the Eastern US this period (**Figure 9**).

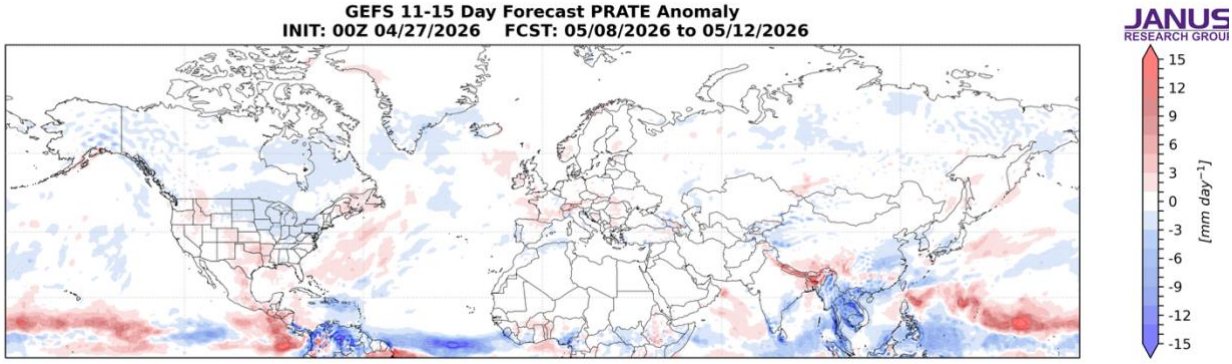

Figure 10. Forecasted rainfall (mm/day; shading) from 08 May to 12 May 2026. The forecasts are from the 00Z 27 Apr 2026 GFS ensemble.

Troughing will support new rainfall across the parts of Western Europe, the Alps and the Tibetain Plateau and southwest China with mostly dry conditions across much of Europe and Asia (**Figure 10**). Troughing will support new rainfall in the Northern Rockies, the Central and Southern Plains, the Southeastern US, New England and the Canadian Maritimes with mostly dry conditions across much of North America this week (**Figure 10**).

Longer Term

30–day

Today's polar cap geopotential height anomalies (PCHs) plot currently shows cold/negative PCHs in the upper stratosphere with warm/positive PCHs in the mid and lower stratosphere and the troposphere (**Figure 11**). Then next week cold/negative PCHs will descend throughout the stratosphere and into the troposphere. Then during the second week of May the warm/positive PCHs could make a return to the troposphere.

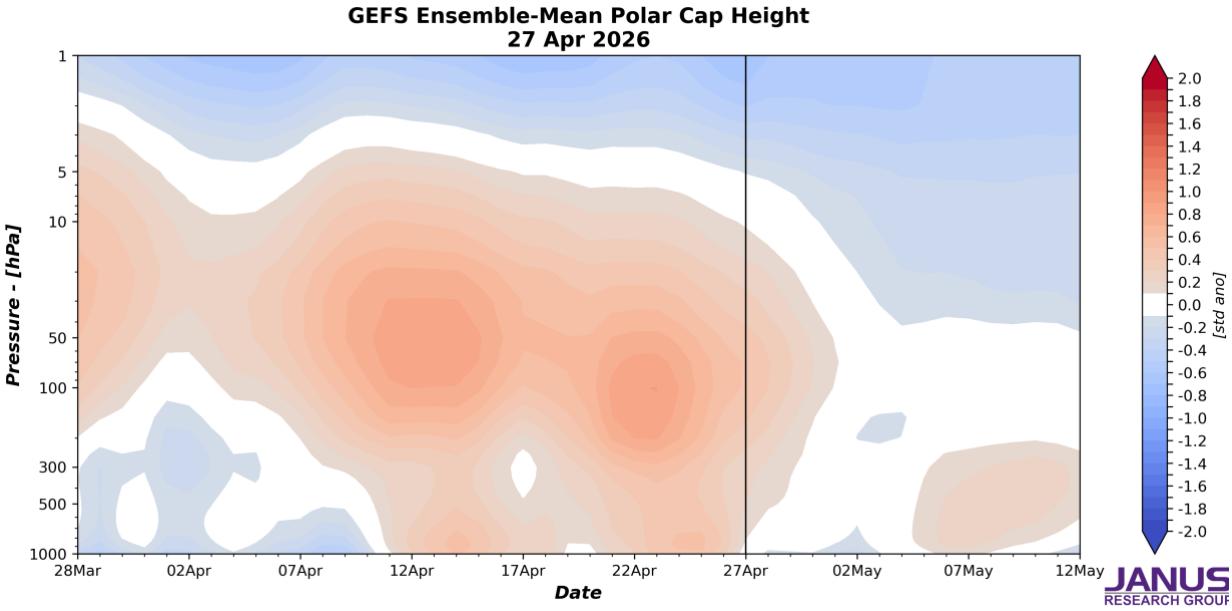

Figure 11. Observed and predicted daily polar cap height (i.e., area-averaged geopotential heights poleward of 60°N) standardized anomalies. The forecast is from the 00Z 27 Apr 2026 GFS ensemble.

The predicted weak and alternating PCHs in the lower troposphere the next two weeks (**Figure 11**) are consistent with the predicted near neutral AO the next two weeks (**Figure 1**).

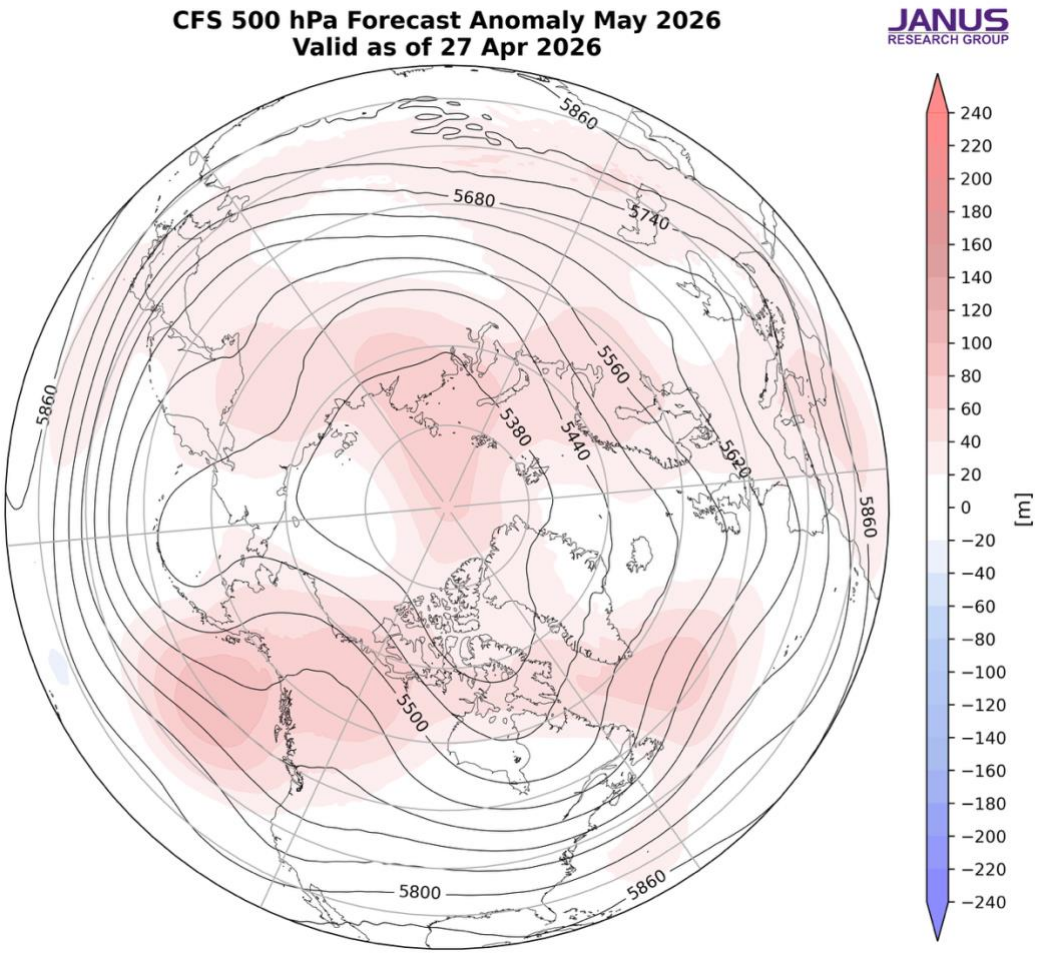

Figure 12. Forecasted average 500 mb geopotential heights (dam; contours) and geopotential height anomalies (m; shading) across the Northern Hemisphere for May 2026. The forecasts are from the 00Z 27 Apr 2025 CFS.

I include in this week's blog the monthly 500 hPa geopotential heights (**Figure 12**) and surface temperatures for May (**Figure 13**) 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 south of Greenland, Northern Europe, the Laptev Sea, Eastern Asia, Alaska, Western Canada and the Western US with troughing across Western Europe,

Western Siberia, Central Asia, the Dateline, Eastern Canada and the Northeastern US (**Figure 12**). This pattern favors seasonable to relatively warm temperatures across Northern Europe, Northern Siberia, Western and Central Asia, including the Middle East and the Tibetan Plateau, Pakistan and Afghanistan, Eastern Siberia, Alaska, Western and Northern Canada and the Western US with seasonable to relatively cool temperatures across Western Europe, the Baltic States, Southwestern Russia, Southeastern Canada and the Eastern US (**Figure 13**).

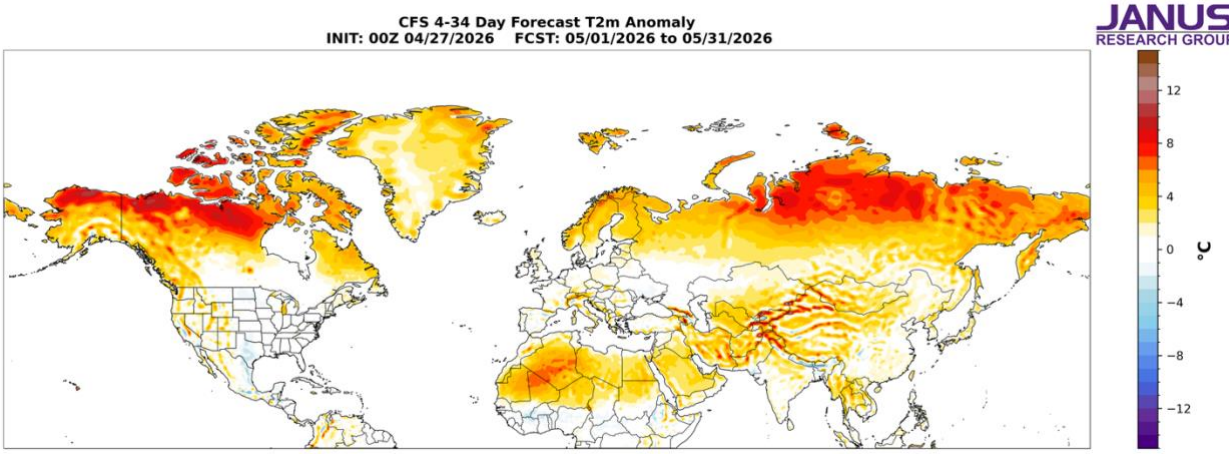

Figure 13. Forecasted average surface temperature anomalies (°C; shading) across the Northern Hemisphere for May 2026. The forecasts are from the 00Z 27 Apr 2025 CFS.

Boundary Forcings

SSTs/El Niño/Southern Oscillation

Equatorial Central Pacific sea surface temperatures (SSTs) anomalies are below normal, however the cold anomalies are waning and warming continues to increase along the South American coast (see **Figure 14**), signs 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 Southern Ocean.

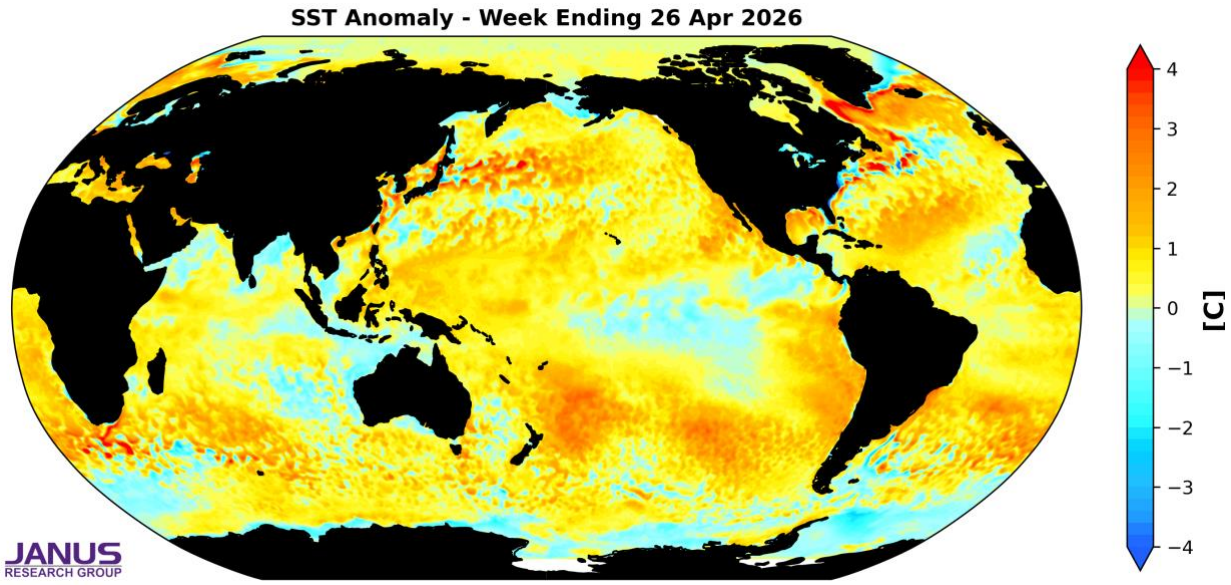

Figure 14. The latest daily-mean global SST anomalies for week ending 26 Apr 2026.

Madden Julian Oscillation

Currently the Madden Julian Oscillation (MJO) is in phase two (**Figure 15**) and the forecasts are for the MJO to quickly weaken where no phase is favored the next two weeks (**Figure 15**). Phase two favors ridging across high latitude Canada with troughing across the US consistent with forecasts therefore, it seems that the MJO could be having some weak influence on North American weathermostly this week. But admittedly this is outside of my expertise.

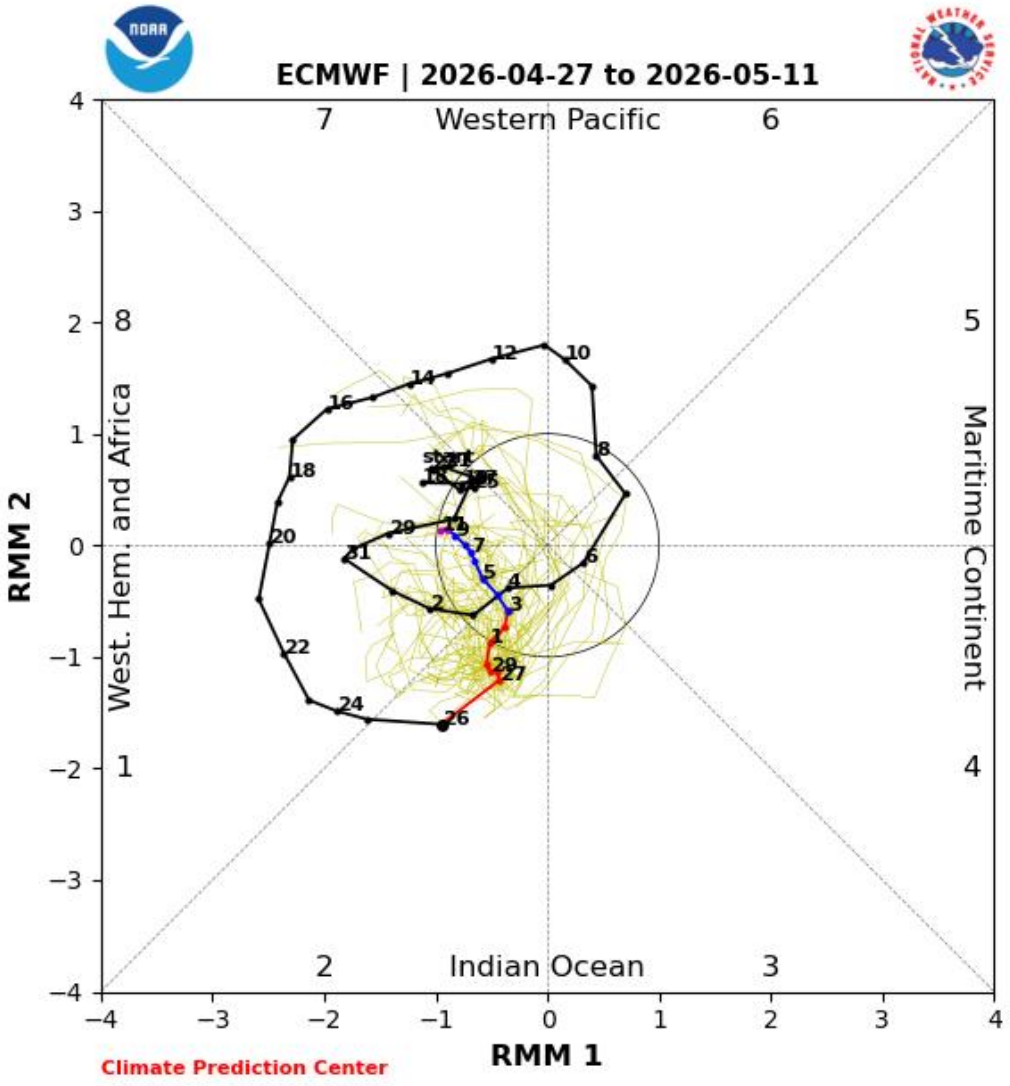

Figure 15. Past and forecast values of the MJO index. Forecast values from the 00Z 27 Apr 2026 ECMWF model. Yellow lines indicate individual ensemble-member forecasts, with the green line showing the ensemble-mean. A measure of the model 'spread' is denoted by the gray shading. Sector numbers indicate 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

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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.

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