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Arctic Oscillation and Polar Vortex Analysis and Forecasts

April 13, 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 negative as pressure/geopotential height anomalies across the Arctic are currently mostly positive and the AO is predicted to remain negative to neutral 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 positive 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 troughing/negative geopotential height anomalies across Greenland will continue to support ridging/positive geopotential height anomalies across much of Europe this week however strengthening Geenland blocking will support increasing troughing/negative geopotential height anomalies across Europe. This pattern will favor normal to above normal temperatures across much of Europe including the United Kingdom (UK) the next two weeks, however starting next week normal to below normal temperatures will begin to filter from Siberia into Eastern Europe.
- The general pattern across Asia over the next two weeks is ridging/positive geopotential height anomalies centered in the Barents-Kara and East Siberian Seas supporting troughing/negative geopotential height anomalies across Siberia and in the Middle East with

more ridging across much of Southern Asia the next two weeks. This pattern favors mostly normal to above normal temperatures across much of Asia focused on Central Asia with normal to below normal temperatures across Siberia and eventually into Northeast Asia the next two weeks and and the Middle East next week.

- The predicted atmospheric pattern across North America this week is troughing/negative geopotential height anomalies across much of Canada and the Western United States (US) with ridging/positive geopotential height anomalies across the Eastern US. However increasing Greenland blocking next week will force troughing in the Eastern US while ridging builds across western North America. This patten will support normal to below normal temperatures across Alaska, much of Canda and the Western US with normal to above normal temperatures across the Eastern US this week. However next week cooler temperatures will filter down from Canada into the Eastern US.
- The Final Warming of the polar vortex (PV) appears to have occurred last Thursday. Though gone, the PV is not forgotten and I discuss the continuing impacts to our weather in the coming weeks below.

Plain Language Summary

About halfway though meteorological spring can be summed up as relatively cold temperatures for Northwestern 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 an expansion of the cold across much of Siberia and into the Eastern US and likely Europe (see **Figures 3, 6** and **9**). The polar vortex (PV) has left for summer vacation early but its impacts continue to linger. Though March was record warm in the US the streak of well above normal temperatues looks to be paused in the coming weeks in parts of Canada and the US and possibly even parts of Europe.

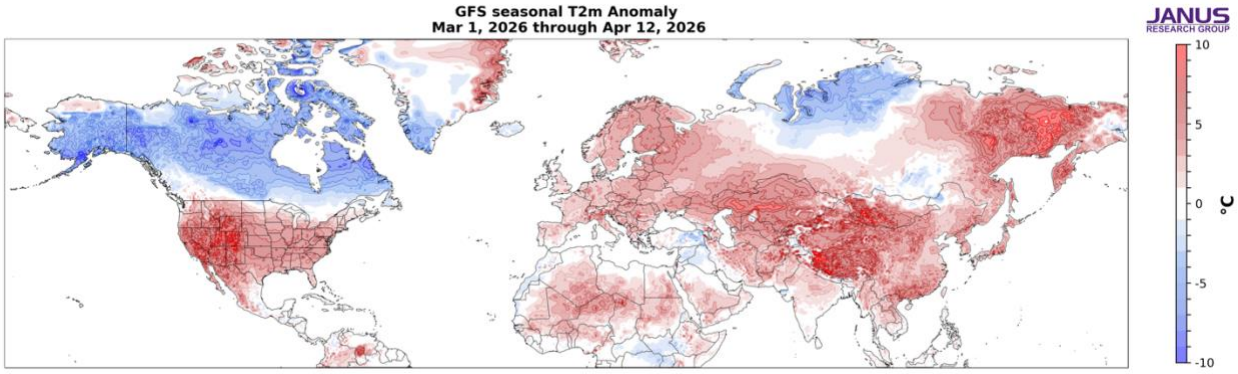

Figure. Estimate of the observed surface temperatures (°C; shading) from 01 Mar to 12 Apr 2026 based on GFS initializations and the GFS forecast from the 13 Apr 2026 run.

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Impacts

Continuing my discussion from the last blog on polar vortex (PV) splits. March was dominated by a PV split regime. One occurred the first week of March, the PV recovered briefly and then a second PV split occurred the last wek of March. The PV recovered yet again before yeat another PV split the beginning of the second week of April and that looks to be the Final Warming. As a sidenote I am curious how this will all be categorized. The PV has to recover for at least twenty days to be classified as a unique event. I do believe that the PV recovery between the first and second PV split was just a few days shy of twenty days. Then the PV recovery between the second PV plit and the Final Warming was even shorter. Since there was never a full twenty days of PV recovery between the first PV split around March 7 and the Final Warming around April 9, it could be argued we only had a Final Warming starting on March 7. I certainly hope that is not the case as clearly we first had a sudden stratospheric warming (SSW) in early March and then the Final Warming in early April. In general I think the categorizing of SSWs in early March as a Final Warming is always a misnomer, as dynamically they should be treated as SSWs. But my pet peeve is admittedly mostly academic.

But getting back to the weather, the PV splits are related to or accomplished a somewhat rare phennmenon these days, a quasi cold Arctic/warm continents pattern. It seems to me that the Cenral Arctic remained warm but did cool throught the month, but at least the Arctic land areas were below normal while it was incredibly warm across the mid-latitudes (see **Figure** above). Folks could argue with me, but since 2015, seems to me there have been no lack of SSWs but overwhelmingly they have occurred late in the winter and there biggest winter impact is to bring widespread warmth with the more traditional influence of Greenland blocking accompanied by cooler temperatures across the mdi-latitudes delayed until spring. Not sure if this is just a limited period related to natural variability or the beginnings of a trend but really is curious to me.

And sure enough looking at the forecasts we see the return of Greenland blocking throught the forecast period over the next two weeks (see **Figure i**). As is common, for most of the two weeks the mid-tropospheric circulation is characterized by low pressure centered near the North Pole but clearly it si no longer dominating the high-latitudes, with high-pressure ridging floating around the mid- to high-latitudes. And for the first time ina. while the dominant high latitude blocking will not be centered in the North Pacific sector but rather the North Atlantic sector. There is high latitude blocking mostly near the Aleutians in the North Pacific but the dominant high-latitude blocking starts off in the Barents-Kara Seas and drifts west to Greenland over the next two weeks. Credit the AI models for the win as the predicted classical downward influence (see **Figure 11**) and Greenland blocking has materialized as predicted with the pair of AI models that I shared over the past month. It didn't take the two weeks we all have come to expect but rather more like six weeks, again a trend I believe of the past decade.

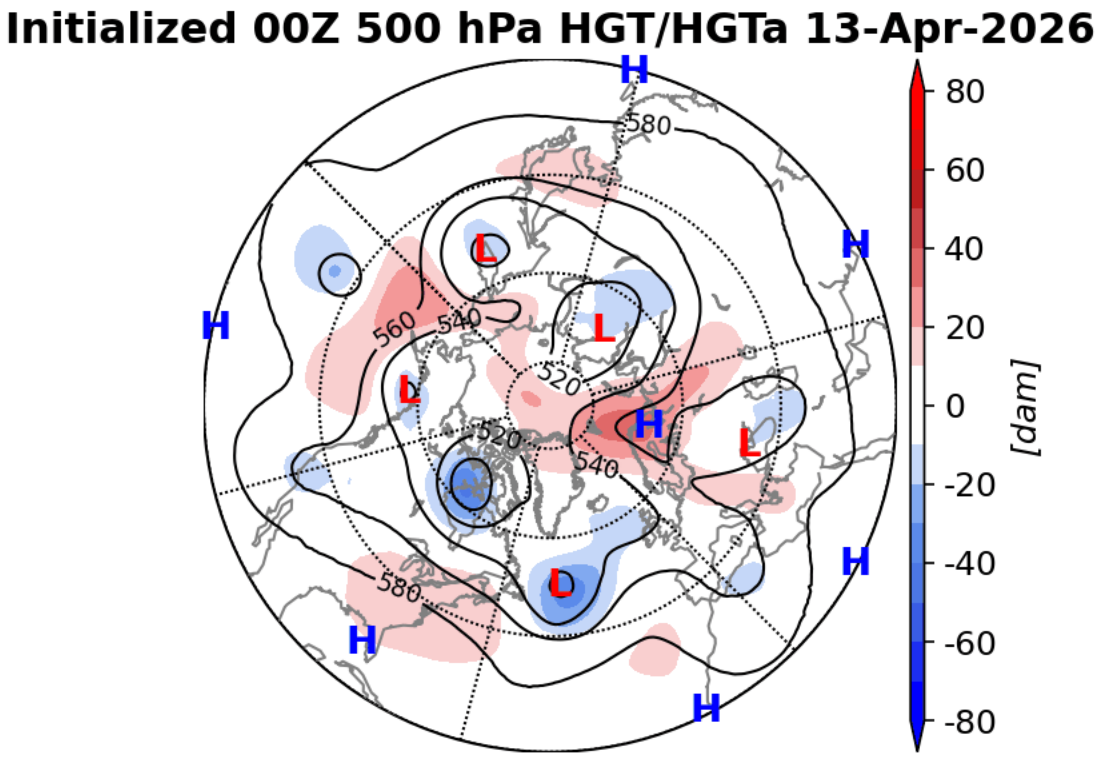

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Figure i. Initialized 500 mb geopotential heights (dam; contours) and decameter anomalies (dam; shading) across the Northern Hemisphere for 13 Apr 2026 and forecasted from 14 Apr 2026 to 28 Apr 2026. The forecasts are from the 00Z 13 Apr 2026 GFS model.

Figure ii presents the latest PV animation and this will be the last PV animation that I share until the fall. The PV seems to remain in a split at least at the beginning and the PV becomes increasingly diffuse around the mid-laittudes as high pressure sets up shop at the North Pole consistent with a Final Warming.

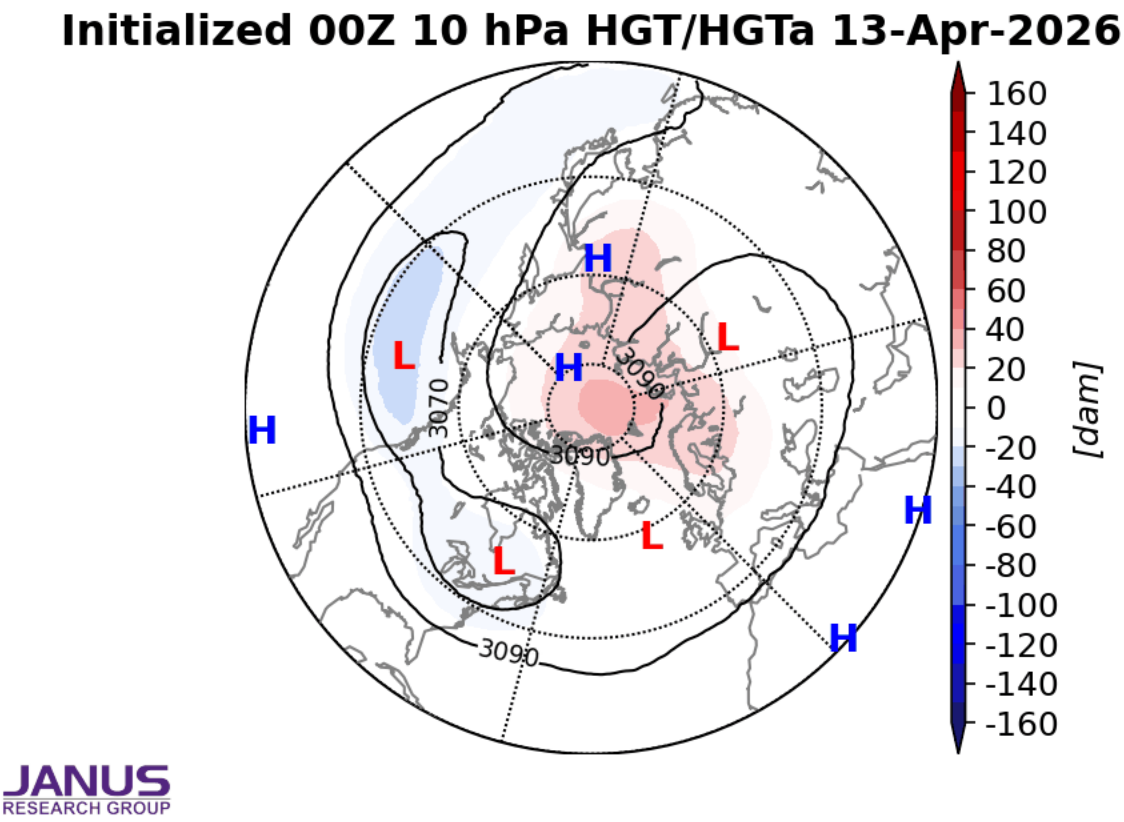

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Figure ii. Forecasted average 10 mb geopotential heights (dam; contours) and geopotential height anomalies (m; shading) across the Northern Hemisphere for 13 Apr 2026 and forecasted from 14 Apr 2026 to 28 Apr 2026. The forecasts are from the 00Z 13 Apr 2026 GFS model.

As I shared on social media on March 27th, though the US was quite warm the cold Alaska and Canada raised the risk of colder weather to the US east of the Rockies. Sure enough the weather models are predicting a colder period for the Eastern US starting next week. So far nothing all the impressive is predicted, but I wold expect the forecast to cool with time. It is spring and temperature variability is dampened compared to winter so no reason to expect anything extreme. So if you are hoping to get into a pool or beach early, you might find the cooler weather annoying. Also, though the temperature forecast across Europe remains quite mild, I would expect the temperature forecast across Europe to turn cooler as well with time.

Since the AI model that we are competing (and won the fall and winter seasons but we are so far slipping in spring) with in the ECMWF AI Weather Quest contest did well predicting the Greenland blocking, I thought to end with the lowest temperature quintile probabilities for late April and early May (see **Figure iii**). The model is predicting below normal temperatures in Southern Canada and into the Northeastern US for the two week period. When I share the same forecasts in winter, I feel more confident based on my own understanding of the PV, which is no longer the case in spring. So I would contextualize **Figure iii** as more what is possible rather than a reliable forecast.

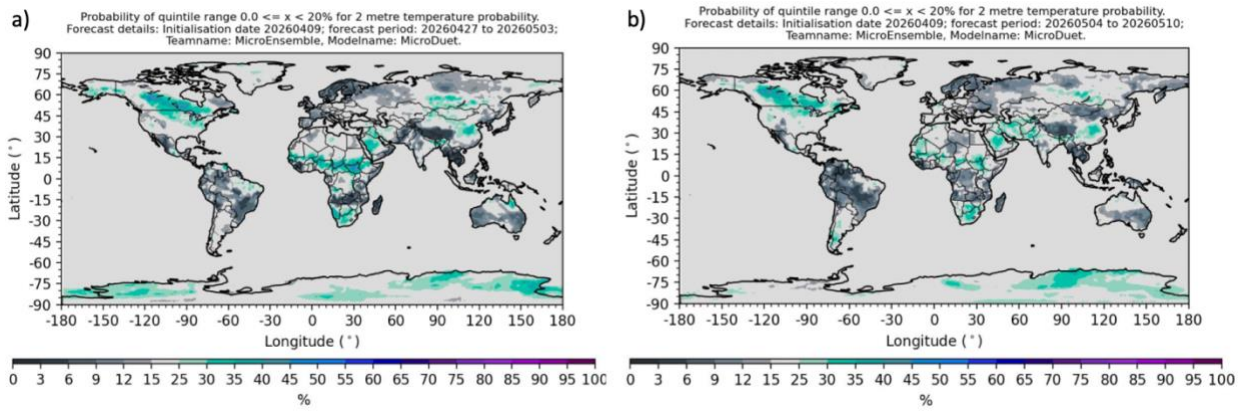

Figure iii. a) Predicted probability of lowest 20 percent or bottom quintile for surface air temperature for the week of 27 April to 3 May 2026. B) same as a but for the week of 4 May to 10 May 2026. Model initialized with data from 9 April 2026. Forecast posted at https://aiweatherquest.ecmwf.int/.

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 postive this week.

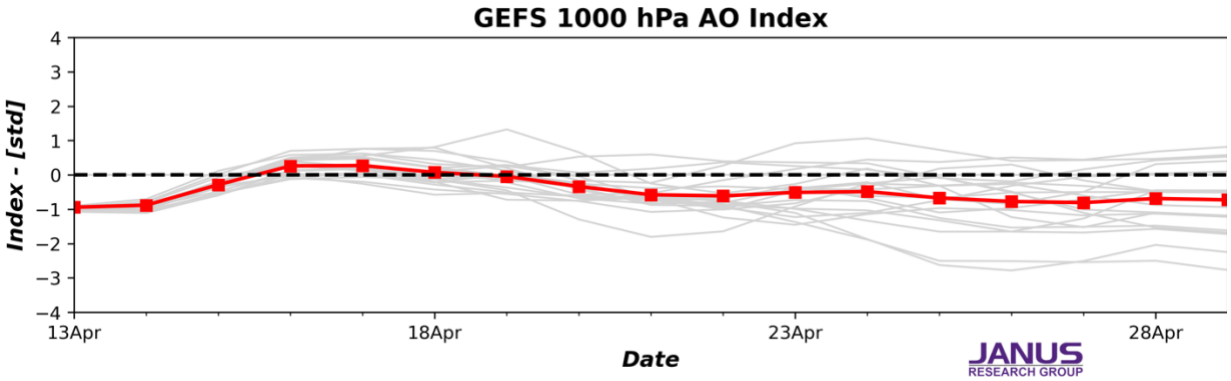

Figure 1. The predicted daily-mean AO at 1000 hPa from the 00Z 13 Apr 2026 GFS ensemble. Gray lines indicate the AO index from each individual ensemble member, with the ensemble mean AO index given by the red line with squares.

Recent troughing/negative geopotential height anomalies across Greenland will continue to support widespread ridging/positive geopotential height anomalies across Europe with troughing/negative geopotential height anomalies limited to the Mediterranean Sea (**Figure**

2). This pattern will support normal to above normal temperatures across much of Europe including the UK this week (**Figure 3**). This week the general pattern across Asia is ridging/positive geopotential height anomalies centered in the Barents-Kara and East Siberian Seas supporting troughing/negative geopotential height anomalies across Siberia and Southwest Asia with more ridging across Southeast Asia this week (**Figure 2**). This pattern favors widepserad normal to above normal temperatures across most of Asia with normal to below normal temperatures across Siberia and parts of Southwest Asia this week **(Figure 3**).

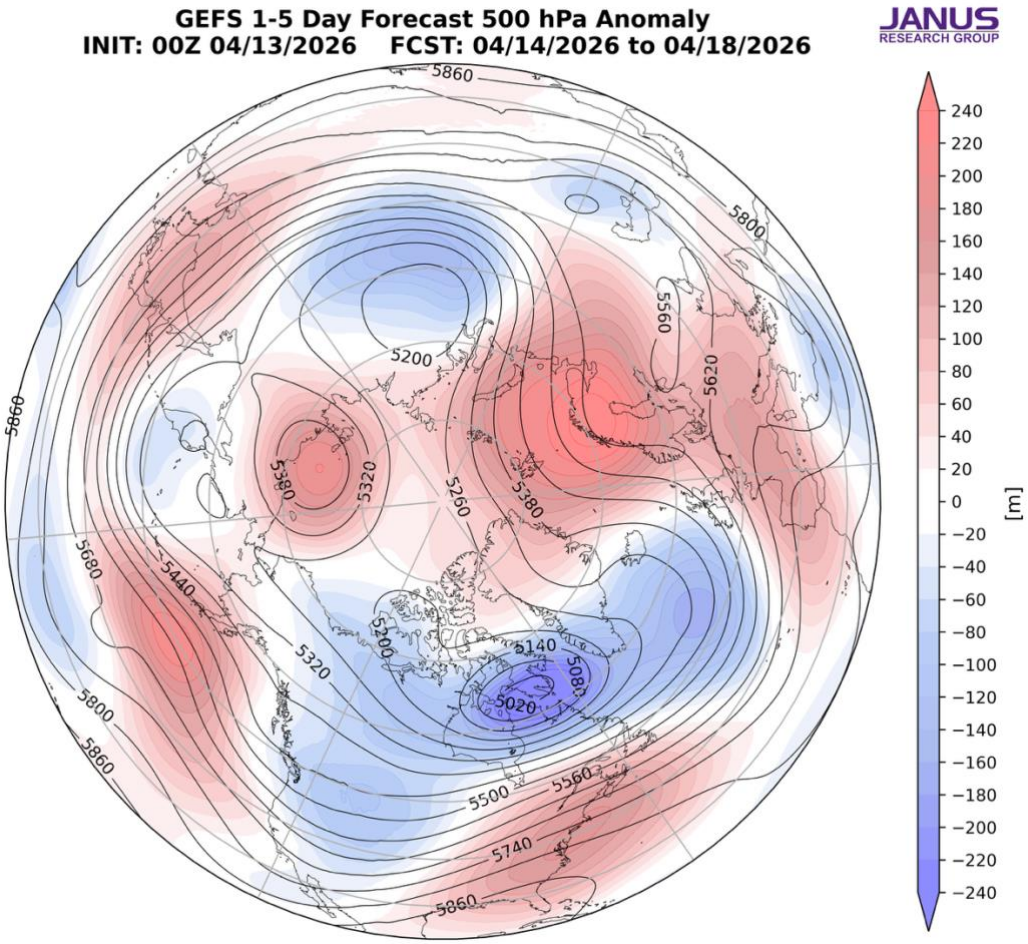

Figure 2. Forecasted average 500 mb geopotential heights (dam; contours) and geopotential height anomalies (m; shading) across the Northern Hemisphere from 14 Apr 2026 to 18 Apr 2026. The forecasts are from the 00Z 13 Apr 2026 GFS ensemble.

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

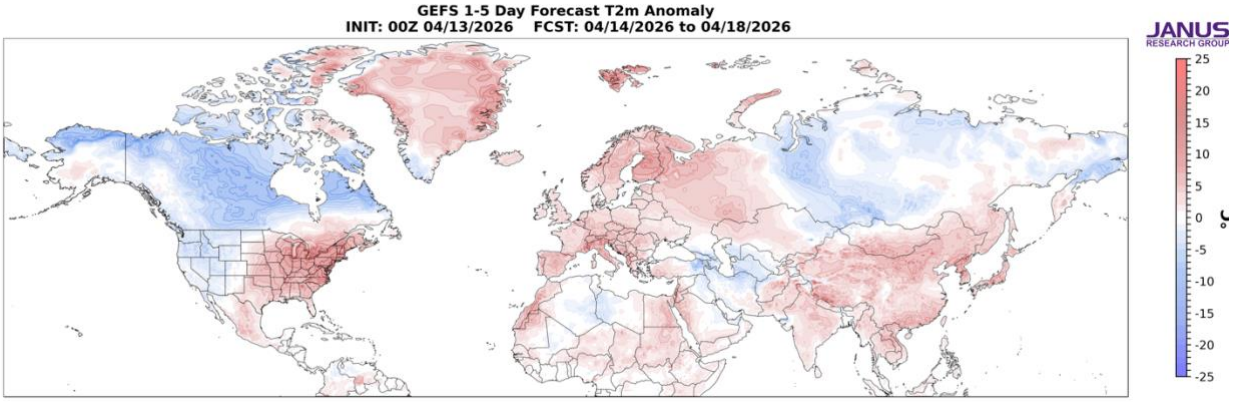

Figure 3. Forecasted surface temperature anomalies (°C; shading) from 14 Apr 2026 to 18 Apr 2026. The forecasts are from the 00Z 13 Apr 2026 GFS ensemble.

Troughing will support new rainfall across the Caucuses, Iraq, Saudia Arabia and eastern China with mostly dry conditions across much of Europe and Asia (**Figure 4**). Troughing will support new rainfall stretching from the Pacific Northwest to southern Hudson Bay, and from Texas into the Great Lakes and into New England with mostly dry conditions across much of North America this week (**Figure 4**).

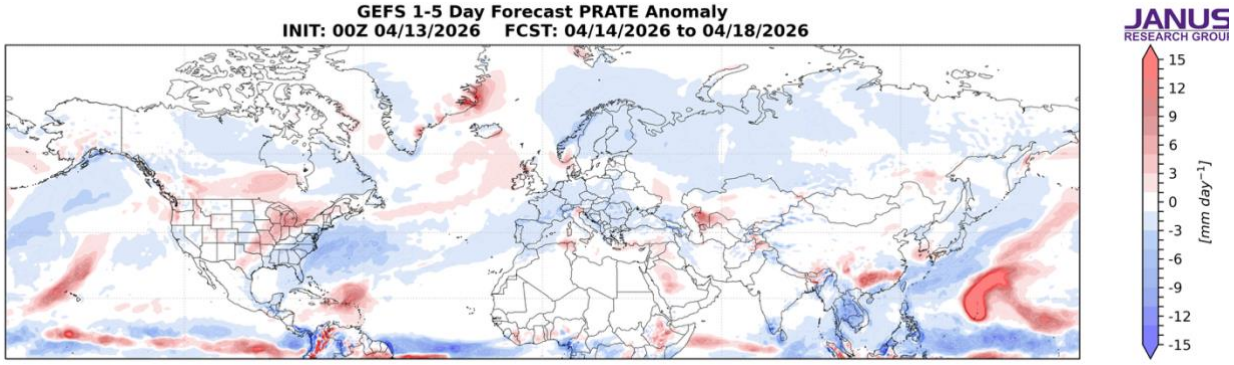

Figure 4. Forecasted precipitation (mm/day; shading) from 14 Apr 2026 to 18 Apr 2026. The forecasts are from the 00Z 13 Apr 2026 GFS ensemble.

Near-Mid Term

Next week

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

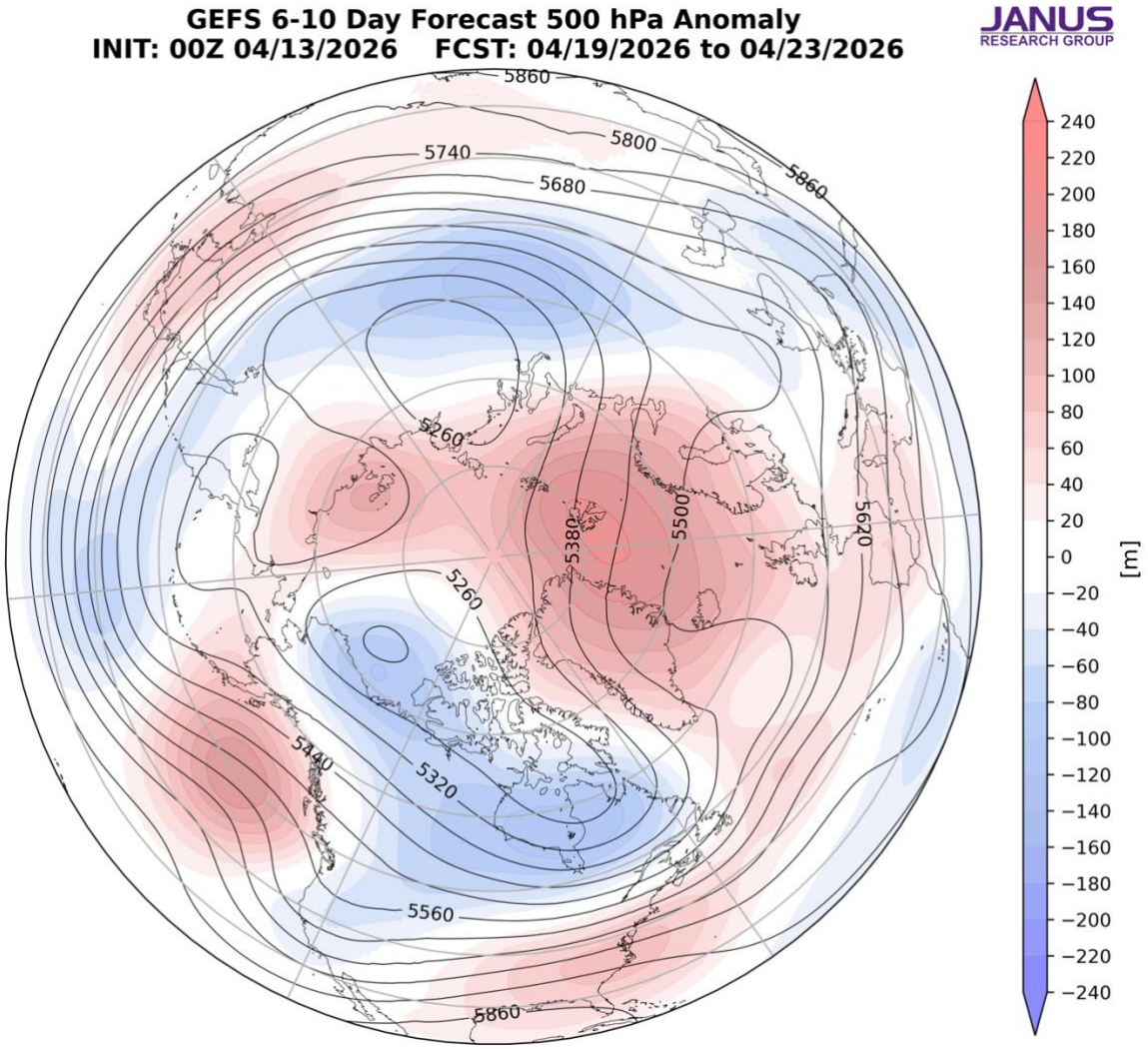

Figure 5. Forecasted average 500 mb geopotential heights (dam; contours) and geopotential height anomalies (m; shading) across the Northern Hemisphere from 19 Apr 2026 to 23 Apr 2026. The forecasts are from the 00Z 13 Apr 2026 GFS ensemble.

The atmospheric circulation is undergoing a transition this period across the North Atlantic and Europe will result in a mostly zonal flow across Europe (**Figure 5**). The pattern will support widespread normal to above normal temperatures across Europe including the UK this period (**Figure 6**). Across Asia the persistent pattern of ridging/positive geopotential

height anomalies centered in the Barents-Kara and East Siberian Seas will continue to support troughing/negative geopotential height anomalies across Siberia and the Middle East 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 across all of Siberia and the Middle East this period (**Figure 6**).

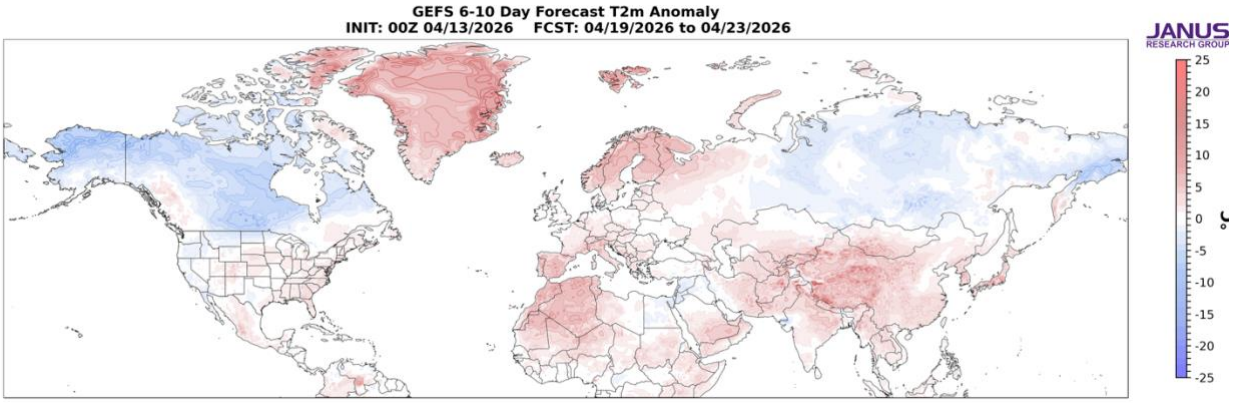

Figure 6. Forecasted surface temperature anomalies (°C; shading) from 19 Apr 2026 to 23 Apr 2026. The forecasts are from the 00Z 13 Apr 2026 GFS ensemble.

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

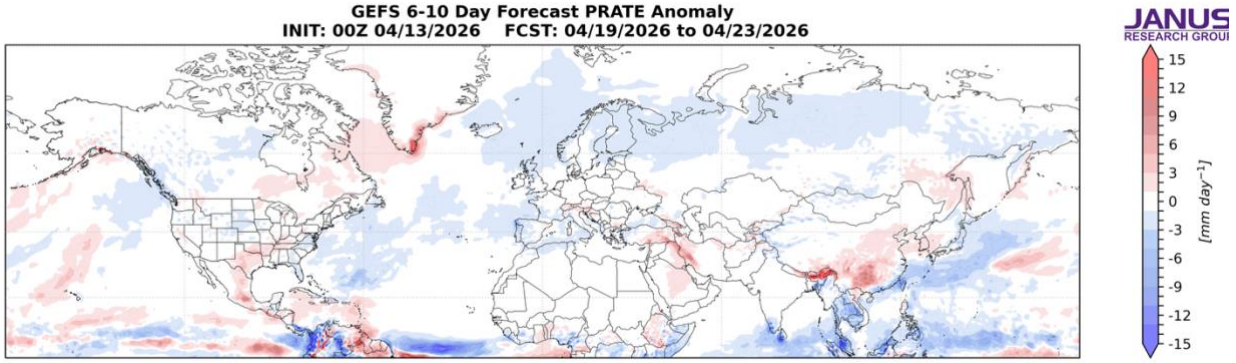

Figure 7. Forecasted rainfall rate (mm/day; shading) from 19 Apr 2026 to 23 Apr 2026. The forecasts are from the 00Z 13 Apr 2026 GFS ensemble.

Troughing will support new rainfall across eastern Turkey, northern Syria and Iraq, western Iran and eastern China with mostly dry conditions across much of Europe and Asia (**Figure 7**). Troughing will support new rainfall stretching from the Southeastern US and Eastern Canada 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 this period (**Figure 1**). With predicted positive pressure/geopotential height anomalies across Greenland (**Figure 8**), the NAO will likely turn decisively negative this period.

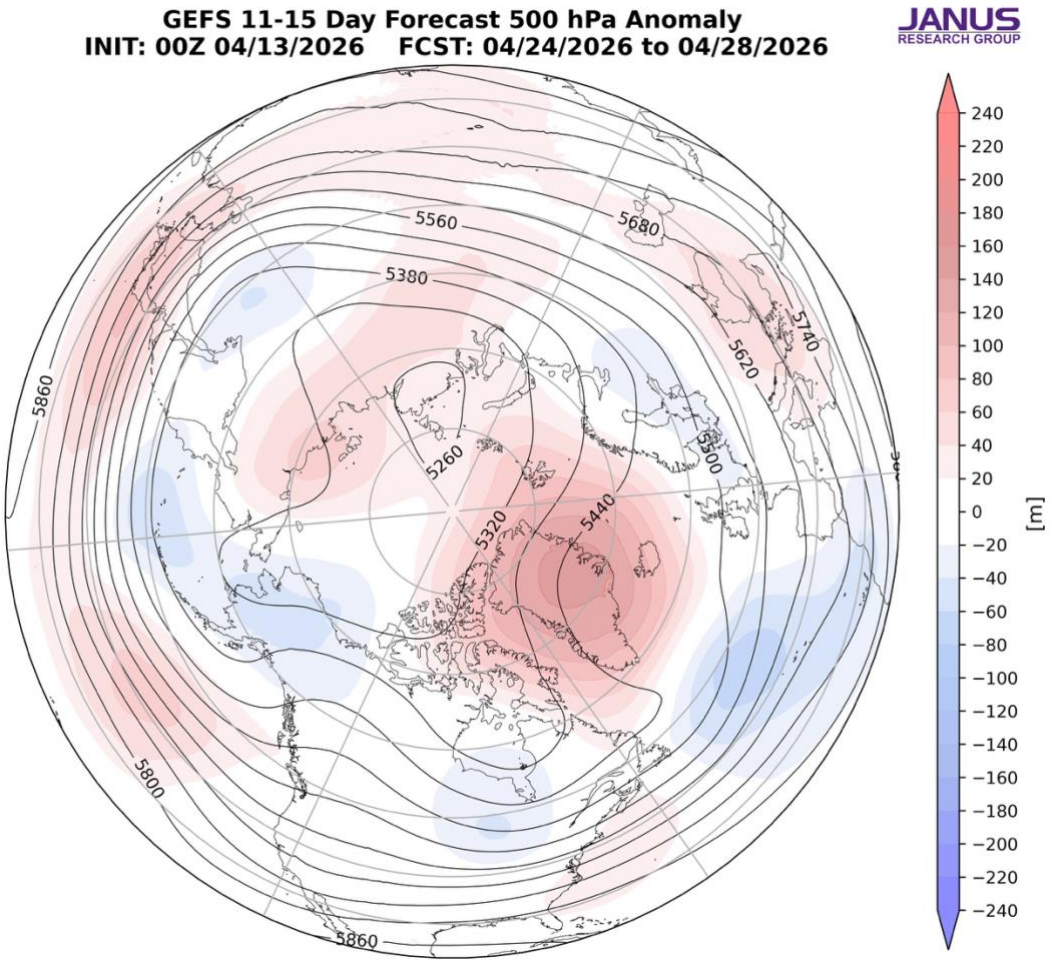

Figure 8. Forecasted average 500 mb geopotential heights (dam; contours) and geopotential height anomalies (m; shading) across the Northern Hemisphere from 24 Apr to 28 Apr 2026. The forecasts are from the 00Z 13 Apr 2026 GFS ensemble.

Strengthening ridging/positive geopotential height anomalies across Greenland will support deepening troughing/negative geopotential height anomalies across Northern Europe with ridging/positive geopotential height anomalies across Southern Europe this period (**Figure 8**). This pattern will continue to favor widespread normal to above normal temperatures across much of Europe including the UK this though normal to below normal temperatures wil beging to filter into Easern Europe period (**Figures 9**). Consolidation of ridging/positive geopotential height

anomalies centered on Greenland will support troughing/negative geopotential height anomalies across Northern Asia with ridging across Southern Asia this period (**Figure 8**). This pattern favors widespread normal to above normal temperatures across Asia including Western, Central and Eastern Asia and the Tibetan Plateau with normal to below normal temperatures across Siberia and into Northeastern Asia with this period (**Figure 9**).

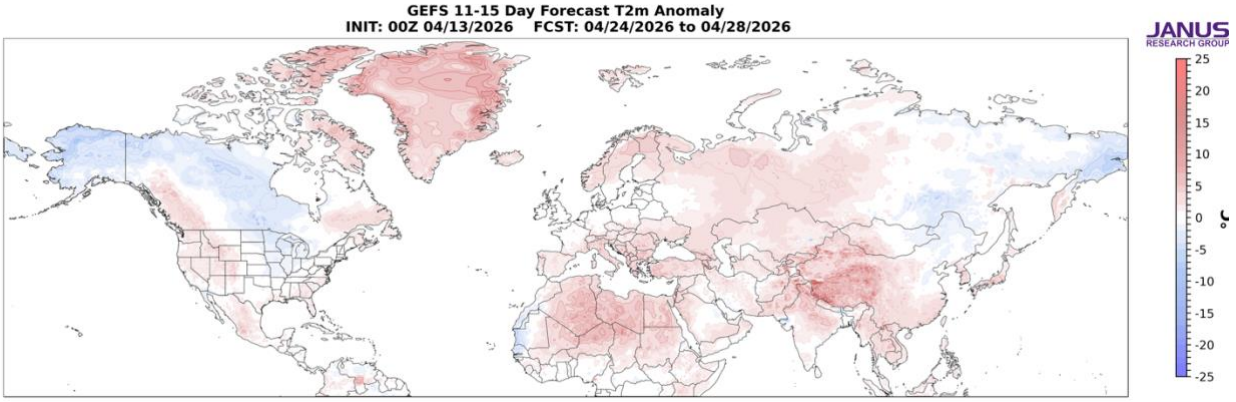

Figure 9. Forecasted surface temperature anomalies (°C; shading) from 24 Apr to 28 Apr 2026. The forecasts are from the 00Z 13 Apr 2026 GFS ensemble.

Strengthening ridging/positive geopotential height anomalies across Greenland will support deepening troughing/negative geopotential height anomalies across Eastern Canada and the Eastern US with developing ridging across western North America this period (**Figure 8**). This pattern supports normal to below normal temperatures across Alaska, much of Canada, the US Palins and the Northeastern US with normal to above normal temperatures across Western Canada and the Western US this period (**Figure 9**).

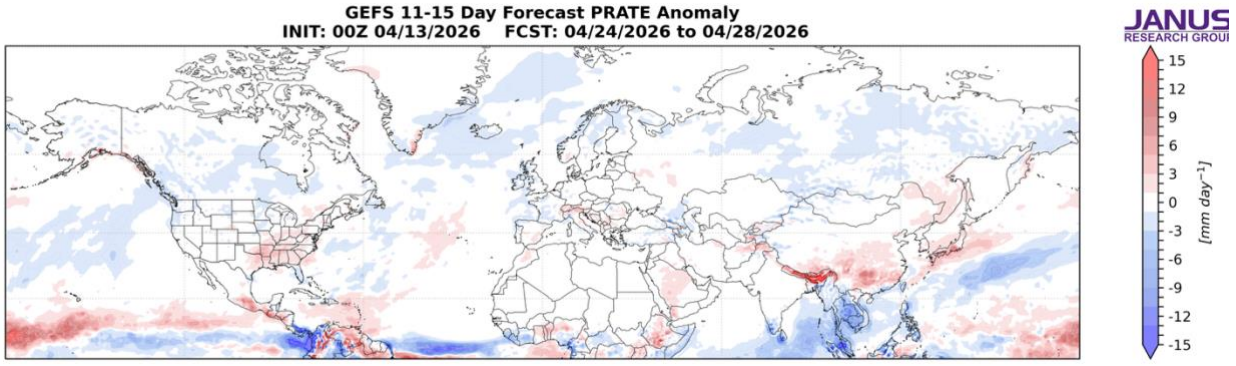

Figure 10. Forecasted rainfall (mm/day; shading) from 24 Apr to 28 Apr 2026. The forecasts are from the 00Z 13 Apr 2026 GFS ensemble.

Troughing will support new rainfall across the Alps, Central Asia, the Tibetain Plateau and China with mostly dry conditions across much of Europe and Asia (**Figure 10**). Troughing will support

new rainfall in the Southeastern US, the Great Lakes and New England 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 especially the lower stratosphere and the troposphere (**Figure 11**). Then next week warm/positive PCHs in the lower stratosphere will continue to descend or "drip" into the troposphere are predicted while cold/negative PCHs in the upper stratosphere are predicted to persist.

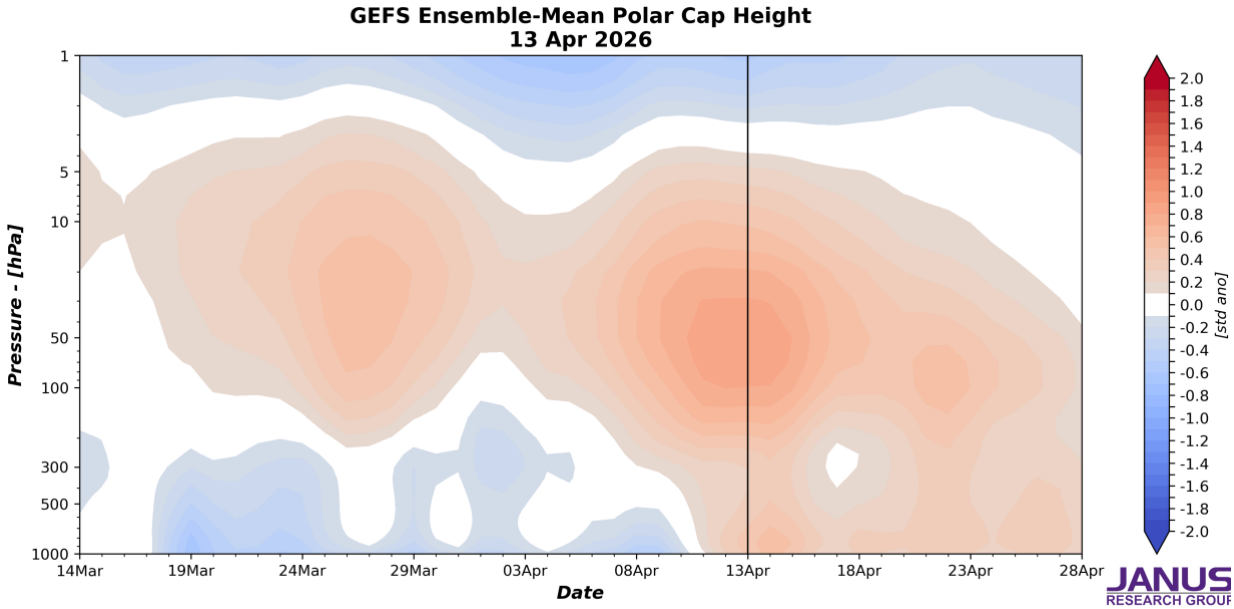

Figure 11. Observed and predicted daily polar cap height (i.e., area-averaged geopotential heights poleward of 60°N) standardized anomalies. The forecast is from the 00Z 13 Apr 2026 GFS ensemble.

The predicted warm/positive PCHs in the lower troposphere the next two weeks (**Figure 11**) are consistent with the predicted negative to neutral AO the next two weeks (**Figure 1**).

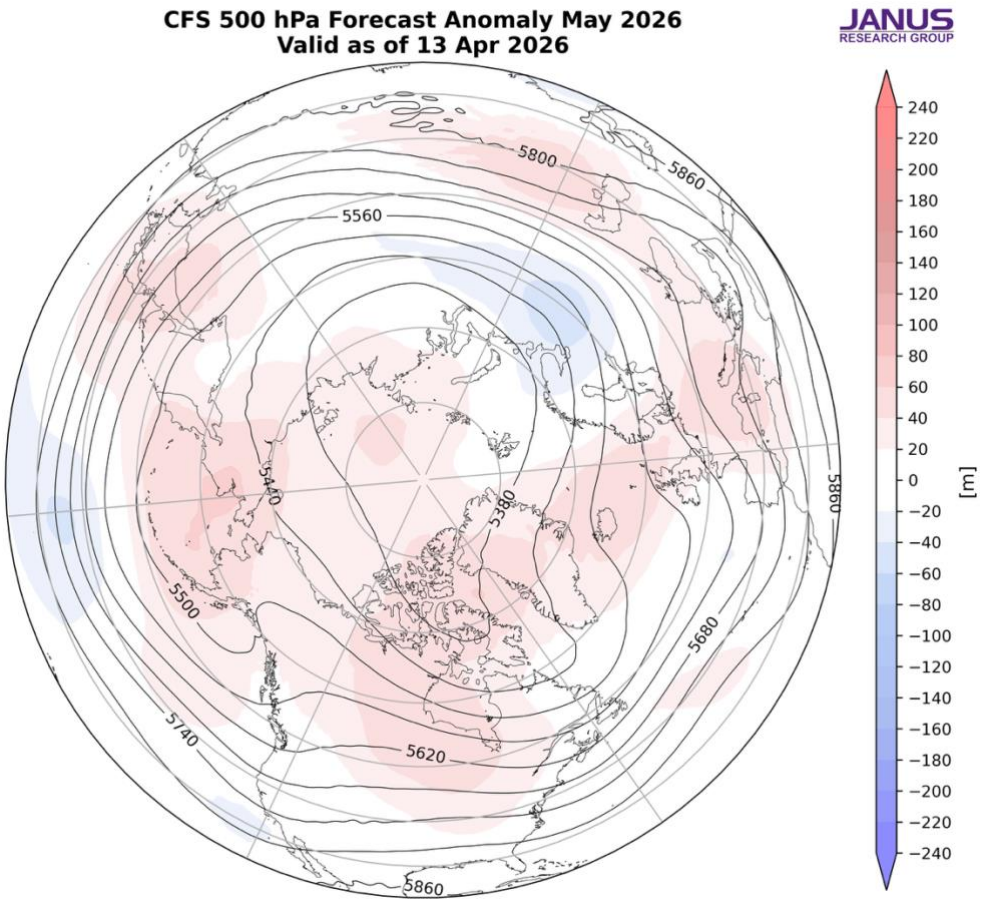

Figure 12. Forecasted average 500 mb geopotential heights (dam; contours) and geopotential height anomalies (m; shading) across the Northern Hemisphere for May 2026. The forecasts are from the 00Z 13 Apr 2025 CFS.

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 stretching from Greenland to Iceland and Central Europe, Central and Eastern Asia, Alaska, Western Canada and the Central US with troughing across Scandinavia, much of Northern Asia, the Gulf of Alaska, Eastern Canada and Baffin Bay into the Canadian Maritimes (**Figure 12**). This pattern favors seasonable to relatively warm temperatures across much of 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 the Baltic States, Western Russia, Southern Siberia, Southern Canada and the Eastern US (**Figure 13**).

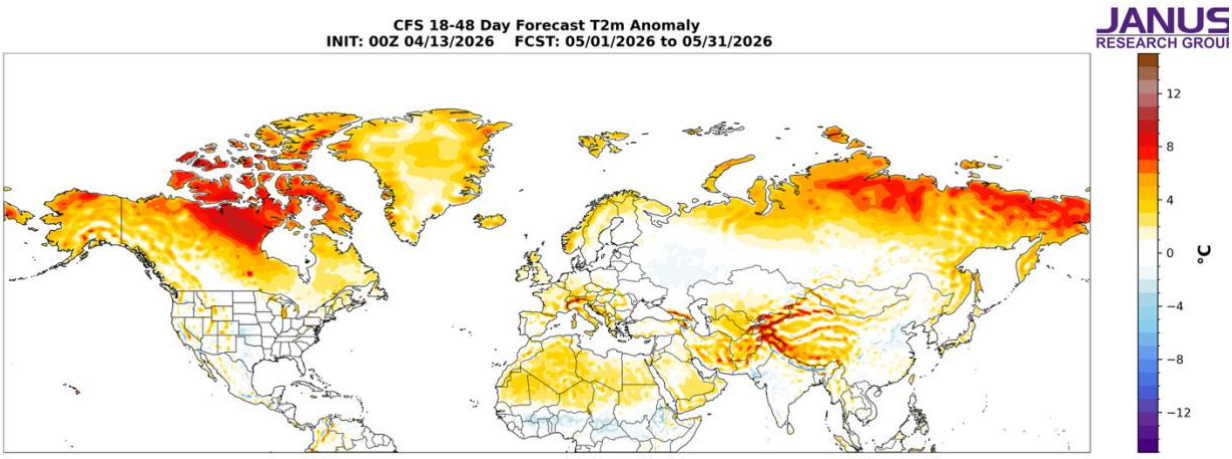

Figure 13. Forecasted average surface temperature anomalies (°C; shading) across the Northern Hemisphere for May 2026. The forecasts are from the 00Z 13 Apr 2025 CFS.

Boundary Forcings

SSTs/El Niño/Southern Oscillation

Equatorial Pacific sea surface temperatures (SSTs) anomalies are below normal, along the equatorial Pacific (**Figure 14**) consistent with La Niña conditions for much of the winter, however the cold anomalies are waning and warming has appeared near the South American coast, 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 South Pacific.

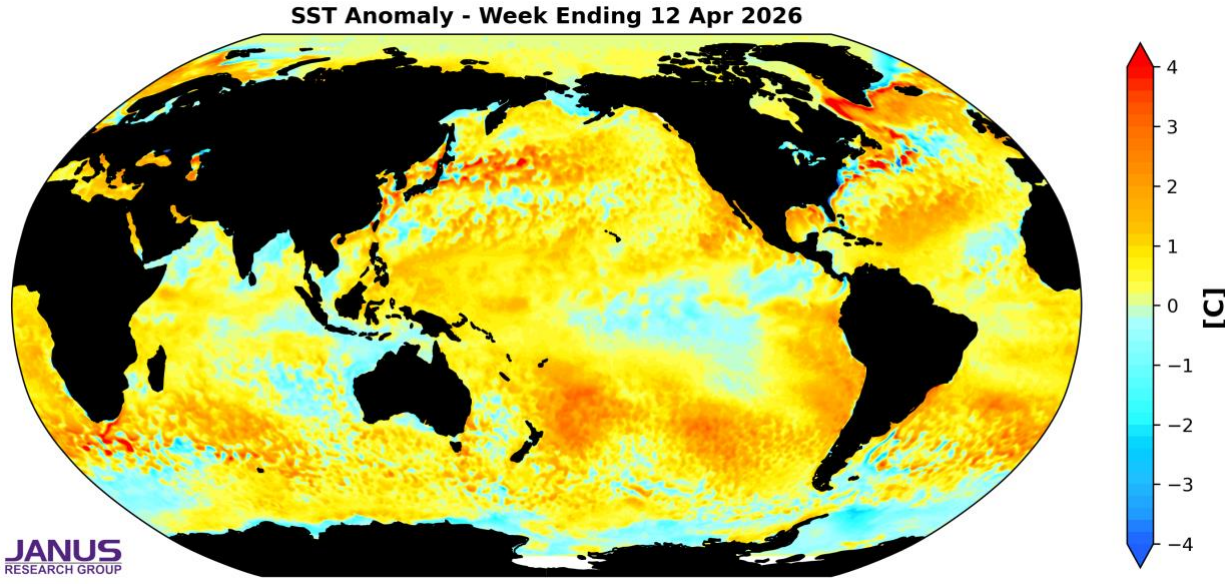

Figure 14. The latest daily-mean global SST anomalies for week ending 12 Apr 2026.

Madden Julian Oscillation

Currently the Madden Julian Oscillation (MJO) is currently in phase seven (**Figure 15**) and the forecasts are for the MJO to quickly move into phases eight anmd one phase the next two weeks (**Figure 15**). Phases seven through one favor ridging across high latitude Canada with troughing across the US especially the Eastern US, consistent with forecasts for next week and therefore, it seems that the MJO is having influence on North American weather starting next week. But admittedly this is outside of my expertise.

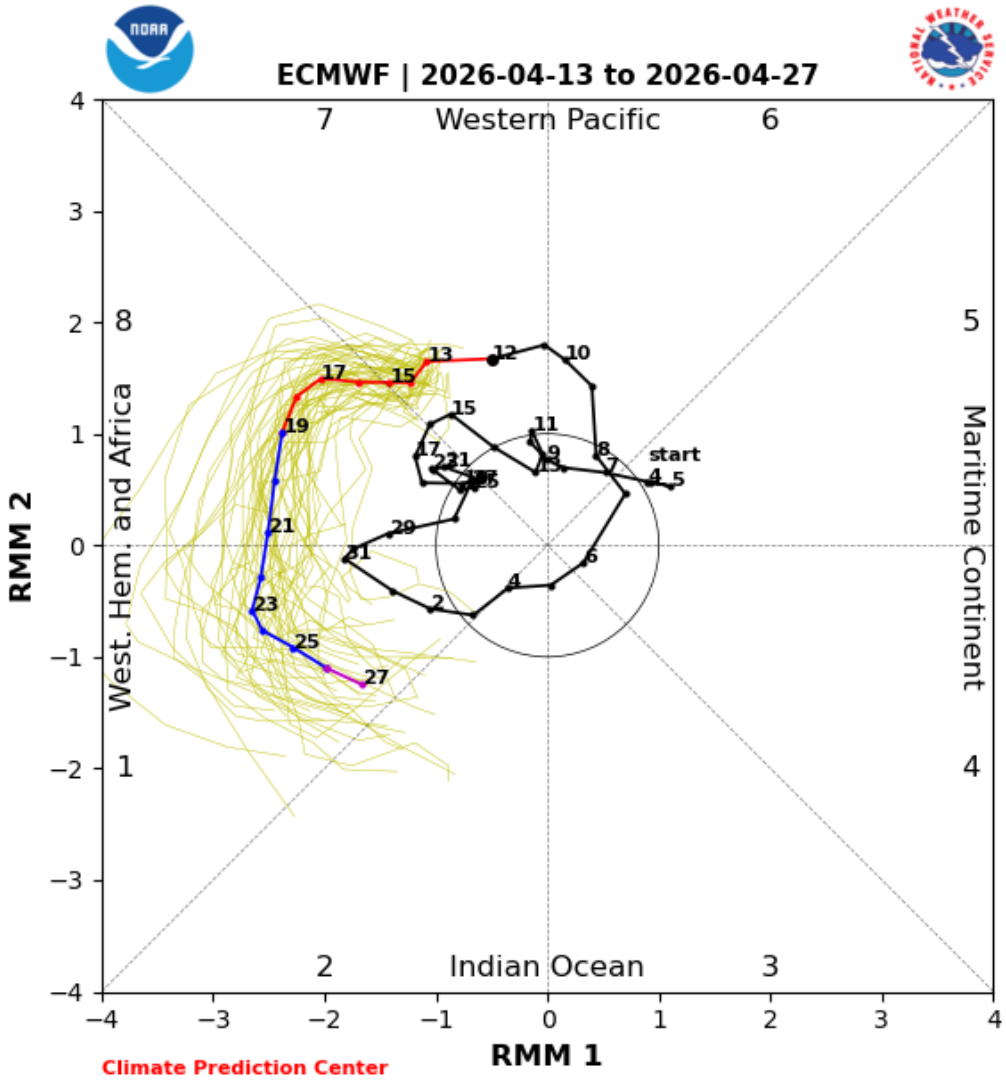

Figure 15. Past and forecast values of the MJO index. Forecast values from the 00Z 13 Apr 2026 ECMWF model. Yellow lines indicate individual ensemble-member forecasts, with the green line showing the ensemble-mean. A measure of the model 'spread' is denoted by the gray shading. Sector numbers indicate 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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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.

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!