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Arctic Oscillation and Polar Vortex Analysis and Forecasts

May 11, 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 positive as pressure/geopotential height anomalies across the Arctic are currently mostly negative and the AO is predicted to trend towards neutral and even possibly 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 positive with negative pressure/geopotential height anomalies across Greenland, and the NAO is predicted to trend neutral and then 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 Europe this week however next week the pattern will transition to ridging/positive geopotential height anomalies across Northern European and troughing/negative geopotential height anomalies across Southern Europe. This pattern will favor normal to below normal temperatures across much of Europe including the United Kingdom (UK) with normal to above normal temperatures limited to Scandinavia this week, however starting next week normal to above normal temperatures will become more widespread across all of Northern Europe including the UK.
- The predicted pattern across Asia the next two weeks is troughing/negative geopotential

height anomalies centered in Central Asia bookended by ridging/positive geopotential height anomalies across Western and Eastern Asia. This pattern favors mostly normal to above normal temperatures across much of Asia with normal to below normal temperatures across Central Asia mostly encompassing Kazakhstan and Mongolia.

- The predicted atmospheric pattern across North America this week is troughing/negative geopotential height anomalies across Eastern Canada and the Eastern United States (US) with ridging/positive geopotential height anomalies across Western Canada and the Western US. Then next week a new trough will deepen across Central Canada and the Central US and slowly slide eastward. 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 this week and then next week cooler temperatures will develop across Central Canada and the Northcentral US and slowly spread eastward.
- Looks like the atmosphere across the Northern Hemisphere (NH) is settling into its summer pattern common in recent summers. What might that translate into temperatures across the NH continents? Some initial thoughts below.

Plain Language Summary

With only three weeks left to meteorological spring, it can be summed up as relatively cold temperatures for Northwestern Siberia and especially Alaska and much of Canada,nicking the US Northern Plains and the Middle East with 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 cooler temperatures for much of Europe but becoming increasingly confined to Southern Europe with time and the Central and Eastern US (see **Figures 3, 6** and **9**). Now that it seems the influence from the polar vortex has ended, what comes next? I share my latest thoughts below.

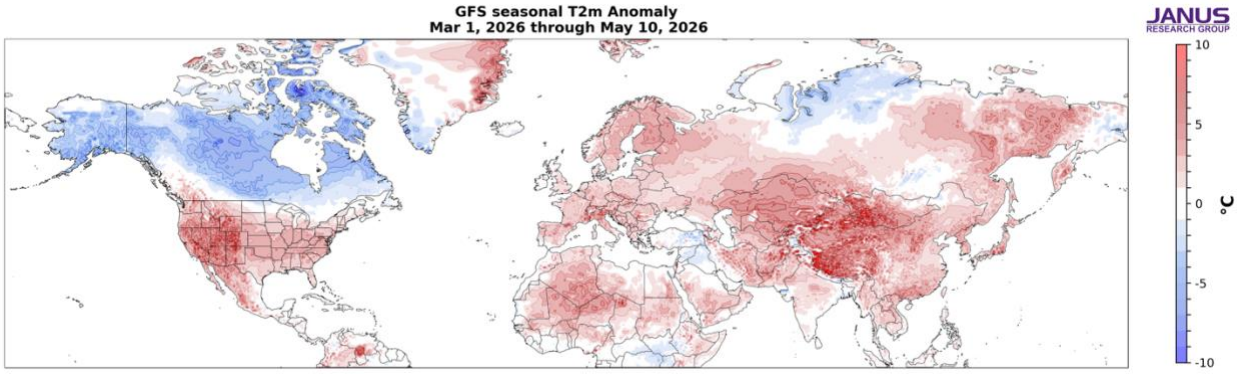

Figure. Estimate of the observed surface temperatures (°C; shading) from 01 Mar to 10 May 2026 based on GFS initializations and the GFS forecast from the 11May 2026 run.

Impacts

Like I discussed in the previous blog, the polar vortex (PV) experienced its Final Warming on 9 April and won't return until late August or early September. But despite the Final Warming being in early April the downward influence of the PV weakening, episodically influenced the weather through high latitude blocking often in the form of Greenland blocking. The high latitude blocking delivered periods of cooler weather to the Eastern US and Europe, and seems to have peaked in early May. We just had one episode of Greenland blocking end, but as can be seen from the mid-tropospheric circulation animation in **Figure I**, Greenland blocking is predicted to return. Besides high-latitude bocking in the Greenland-Northeast Canada region, high-latitude blocking is predicted to develop across western North America, the Eastern US, East Asia and Northern Europe over the next two weeks. Overall relatively warm temperatures can be expected across the NH continents. But the regions of ridging should help to support periodic troughing and relatively cool temperatures in parts of Europe, Canada and the US mostly east of the Rockies (see **Figures 3, 5** and **8**).

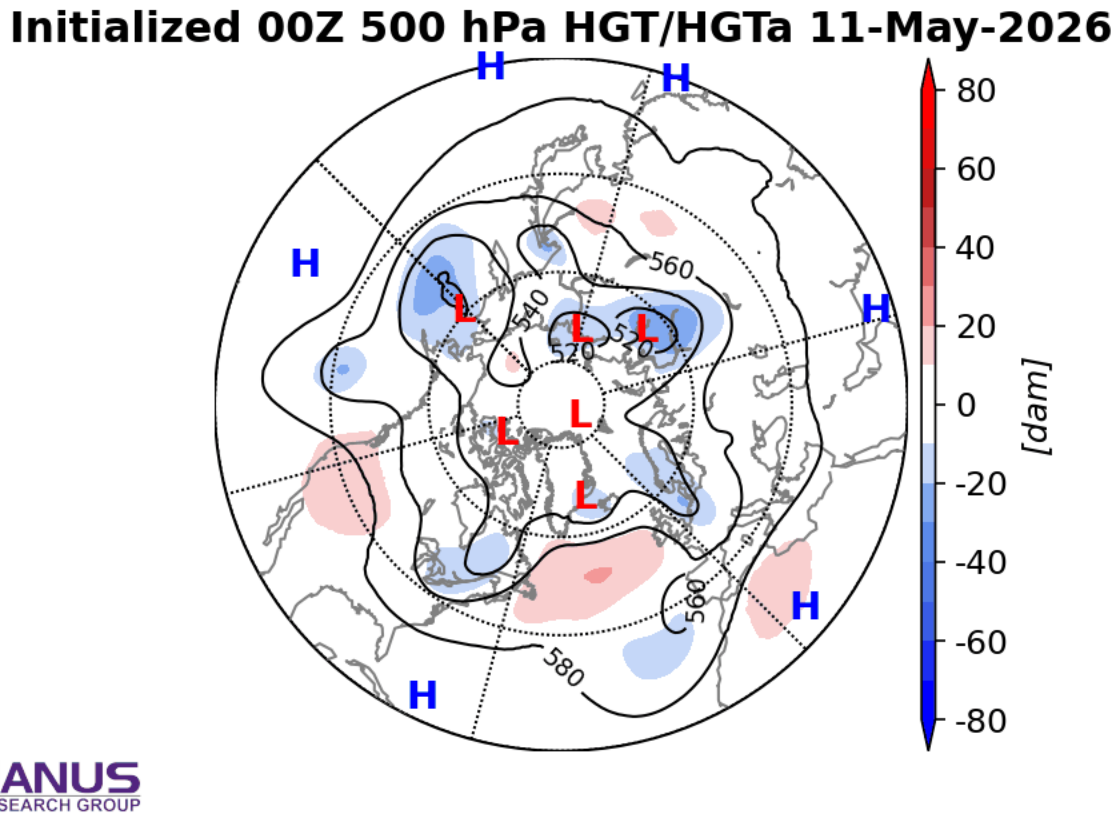

Figure i. Initialized 500 mb geopotential heights (dam; contours) and decameter anomalies (dam; shading) across the Northern Hemisphere for 11 May 2026 and forecasted from 11 May to 26 May 2026. The forecasts are from the 00Z 11 May 2026 GFS model.

As I discussed in the previous blog, I do think that the influence from the PV did continue into easrly May, and in fact May so far has been impressively cool in Eastern Canada and the Eastern and less so in parts of Europe (see **Figure ii**). With more Greenland blcking predicted (see **Figure i**) is that still the influence of the PV?

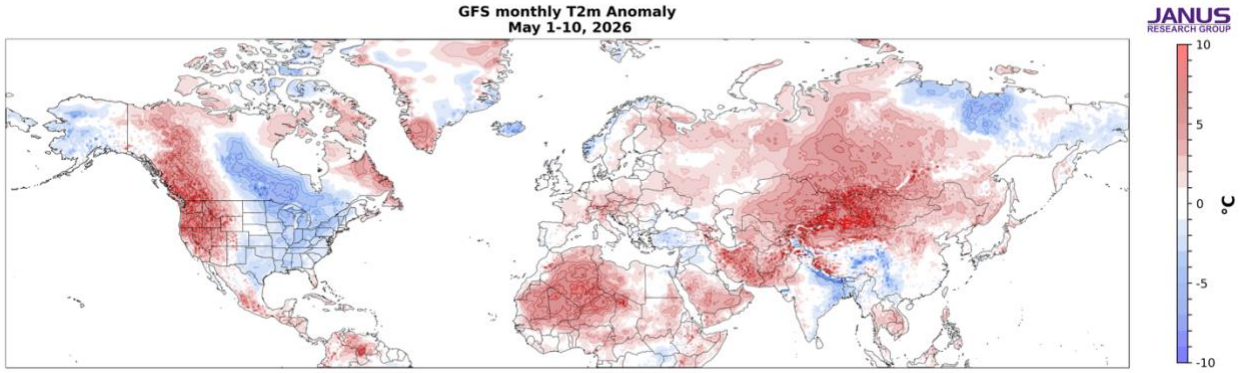

Figure ii. Estimate of the observed surface temperatures (°C; shading) from 01 May to 10 May 2026 based on GFS initializations and the GFS forecast from the 11May 2026 run.

From **Figure 11**, it appears that the influence of the PV split/Final Warming has ended this week with cold/negative polar cap height standardized geopotential height anomalies (PCHs) throughout the stratosphere and tropsophere. Last week I used the PCH limited to the North Atlantic sector to argue the ongoing influence of the PV split and today's plot (see **Figure iii**) does not provide any longer an alternative interpretation but rather any further influence of the PV will have to wait until next fall. Though I think this does need to be qualified as my interpretation rather than being fully objective.

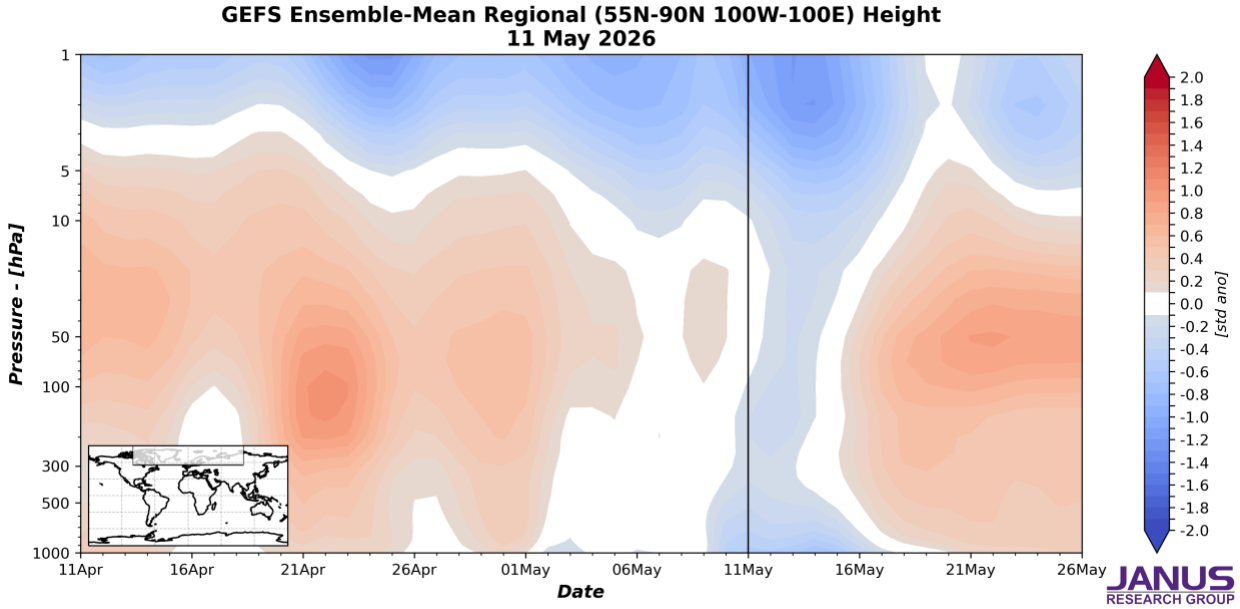

Figure iii. Observed and predicted daily polar cap height (i.e., area-averaged geopotential heights poleward of 60°N) standardized anomalies limited to the North Atlantic sector (see insert). The forecast is from the 00Z 11 May 2026 GFS ensemble.

So then why the return of Greenland blocking predicted by the weather models in the second half of May? In my opinion this is just the return to the NH atmospheric pattern that we have observed over the past several years where we see episodic pulsating of warm/positive PCHs mostly in the troposphere but can extend upward into the lower troposphere, characteristic of high-latitude blocking. But unlike during the winter when high latitude blocking often includes the Central Arctic, in summer the high latitude blocking often is centered over the northern edges of the NH continents. This has often included Northern and/or Eastern Europe, East Asia, western North America and along the East Coast of the US coupled with widespread hot temperatures in these regions. These ridges have also supported downstream troughs in Western Asia, and central North America and even have included troughing in Western Europe. These troughs resulted in islands of below normal temperatures in otherwise a large sea of warmth.

Based on the weather model forecasts, it does seem to appear that the NH atmospheric circulation wants to gravitate to this very solution, or the trend is your friend. There has been a lot of hype about the impending super El Niño but right now I don't see any reason why this would necessarily cause a deviation from this overall pattern but not terribly confident in this argument. It is my hope to include the summer temperature forecast in the next blog but not a guarantee.

Of course appearances can be deceiving and remaining open to surprises in the weather is always prudent. I actually recently reviewed a paper that provided a dynamical explanation for the Western Asia trough in recent years during the warm season that seemed very plausible to me, but I think that I am ethically constrained from saying more.

I think anyone that reads the blog understands that my visibility and certainly confidence in longer range forecasts in summer is less than in winter mostly due to the absence of the polar vortex so take what I say next with a grain of salt. But as is often the case with the forecast of Greenland blocking I would look for forecasts to cool in the Eastern US (especially the Northeastern US) and/or parts of Europe if and when the Greenland blocking becomes established at the end of the month.

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.

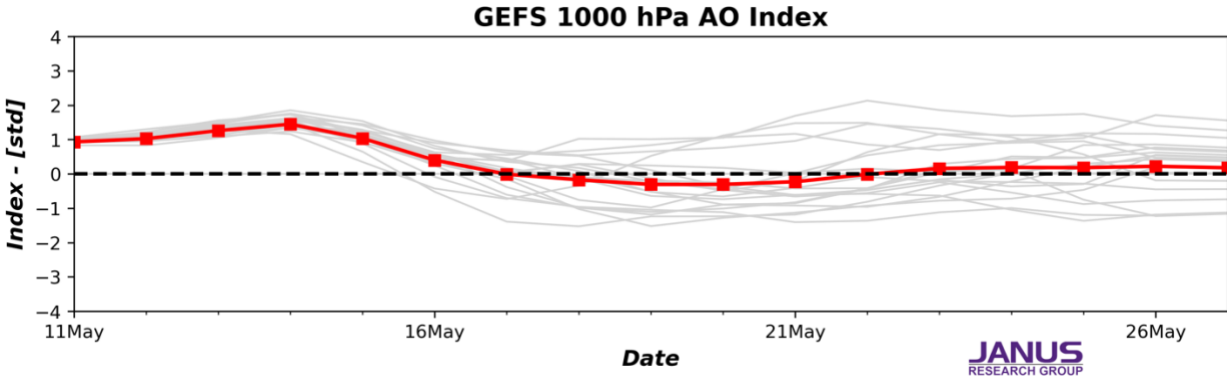

Figure 1. The predicted daily-mean AO at 1000 hPa from the 00Z 11 May 2026 GFS ensemble. Gray lines indicate the AO index from each individual ensemble member, with the ensemble mean AO index given by the red line with squares.

Recent ridging/positive geopotential height anomalies across Greenland will continue to support troughing/negative geopotential height anomalies across much of Europe with ridging/positive geopotential height anomalies limited to Scandinavia this week (**Figure 2).** This pattern will support normal to below normal temperatures across much of Europe including the UK with normal to above normal temperatures limited to Scandinavia this week (**Figure 3**). This week the general pattern across Asia is troughing/negative geopotential height anomalies centered in Central Asia sandwiched by ridging/positive 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 with normal to below normal temperatures across Central Asia and a good portion of Siberia this week **(Figure 3**).

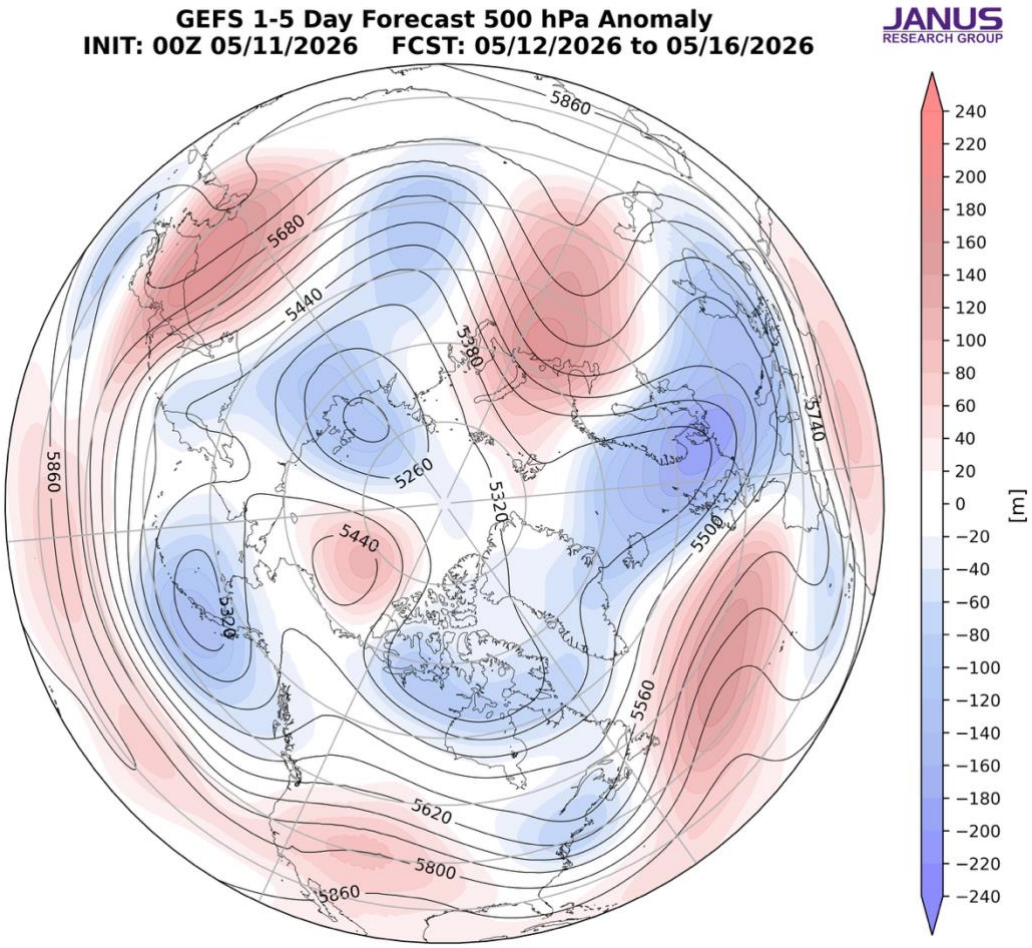

Figure 2. Forecasted average 500 mb geopotential heights (dam; contours) and geopotential height anomalies (m; shading) across the Northern Hemisphere from 12 May 2026 to 16 May 2026. The forecasts are from the 00Z 11 May 2026 GFS ensemble.

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

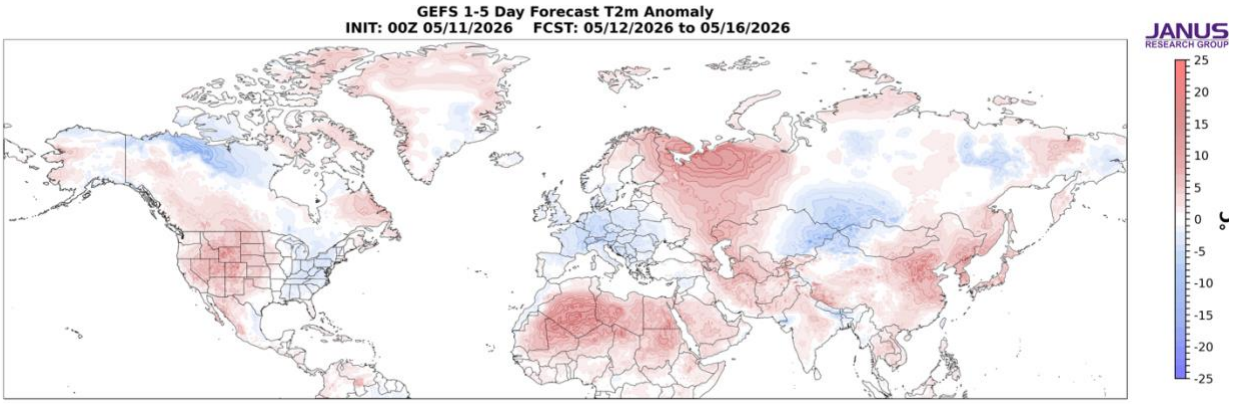

Figure 3. Forecasted surface temperature anomalies (°C; shading) from 12 May 2026 to 16 May 2026. The forecasts are from the 00Z 11 May 2026 GFS ensemble.

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

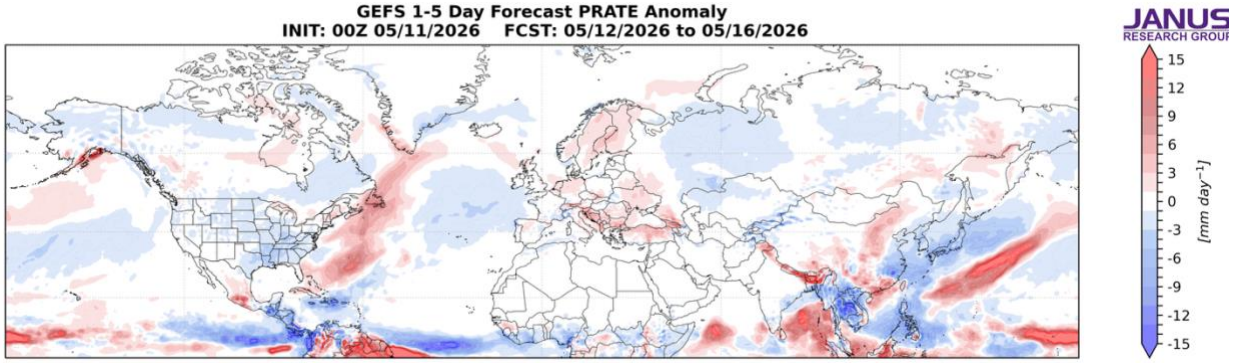

Figure 4. Forecasted precipitation (mm/day; shading) from 12 May to 16 May 2026. The forecasts are from the 00Z 11 May 2026 GFS ensemble.

Near-Mid Term

Next week

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

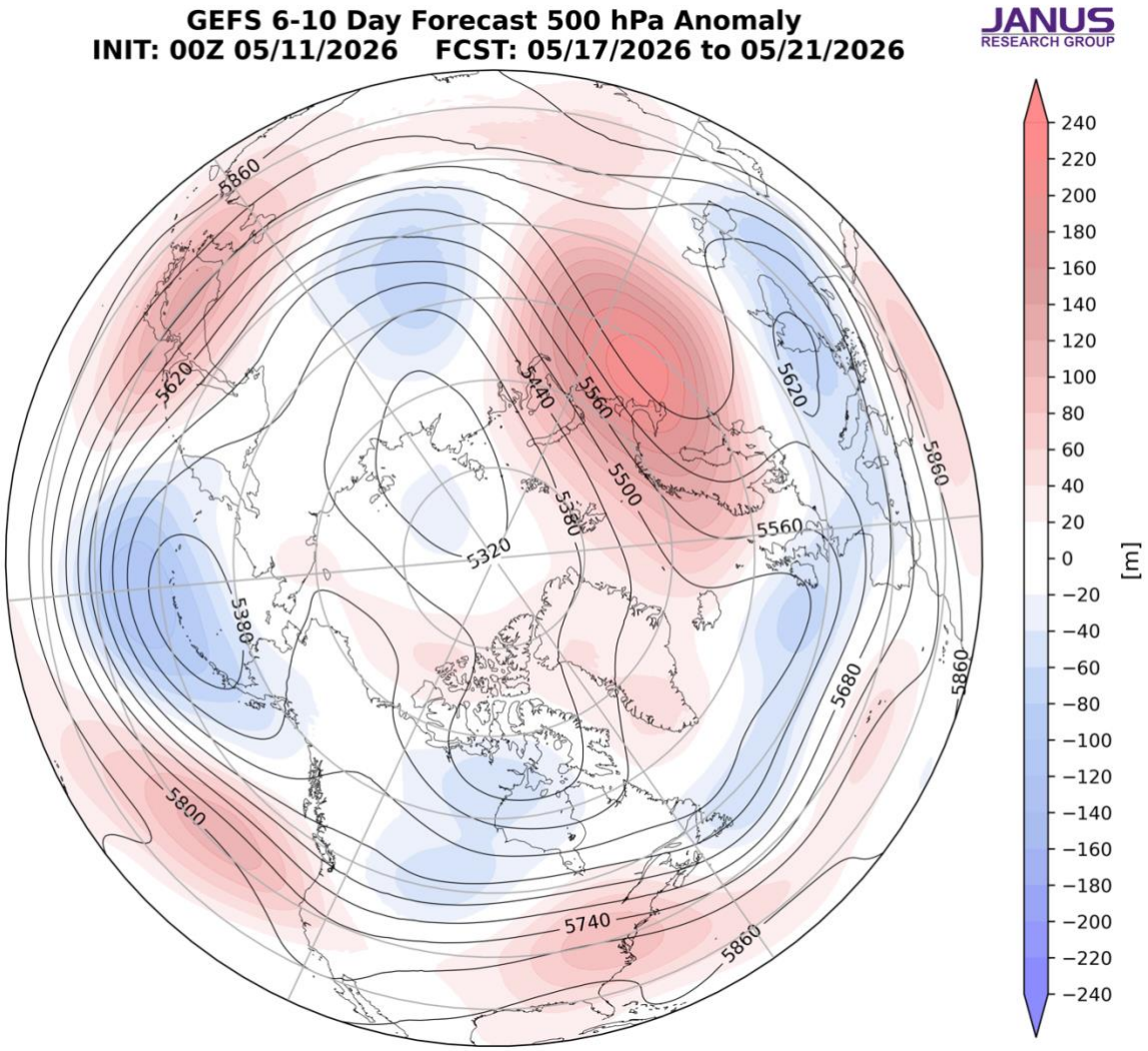

Figure 5. Forecasted average 500 mb geopotential heights (dam; contours) and geopotential height anomalies (m; shading) across the Northern Hemisphere from 17 May 2026 to 21 May 2026. The forecasts are from the 00Z 11 May 2026 GFS ensemble.

The atmospheric circulation is undergoing a transition this period across the North Atlantic and Europe that will result in strengthening ridging/positive geopotential height anomalies across Northern Europe and troughing/negative geopotential height anomalies across

Southern Europe (**Figure 5**). The pattern will support normal to above normal temperatures across Northern Europe with normal to below normal temperatures across Central and Southern Europe while the UK remains on the edge with near normal temperatures this period (**Figure 6**). Across Asia the persistent pattern of ridging/positive geopotential height anomalies across Western and Eastern Asia bookending troughing/negative geopotential height anomalies across Central Asia is predicted this period (**Figure 5**). This pattern favors widespread normal to above normal temperatures widespread across much of Asia especially Western Asia with normal to below normal temperatures limited to Western Siberia, Mongolia and the Middle East this period (**Figure 6**).

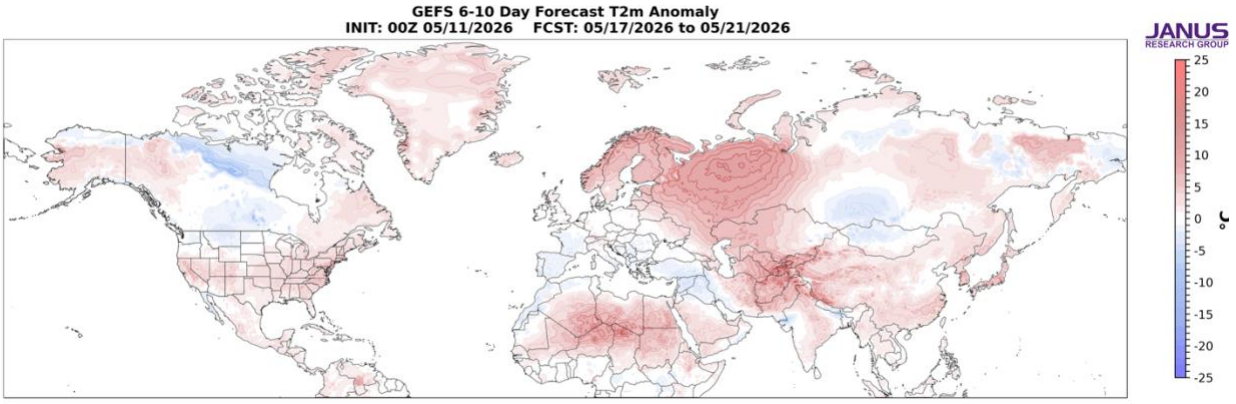

Figure 6. Forecasted surface temperature anomalies (°C; shading) from 17 May to 21 May 2026. The forecasts are from the 00Z 11 May 2026 GFS ensemble.

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

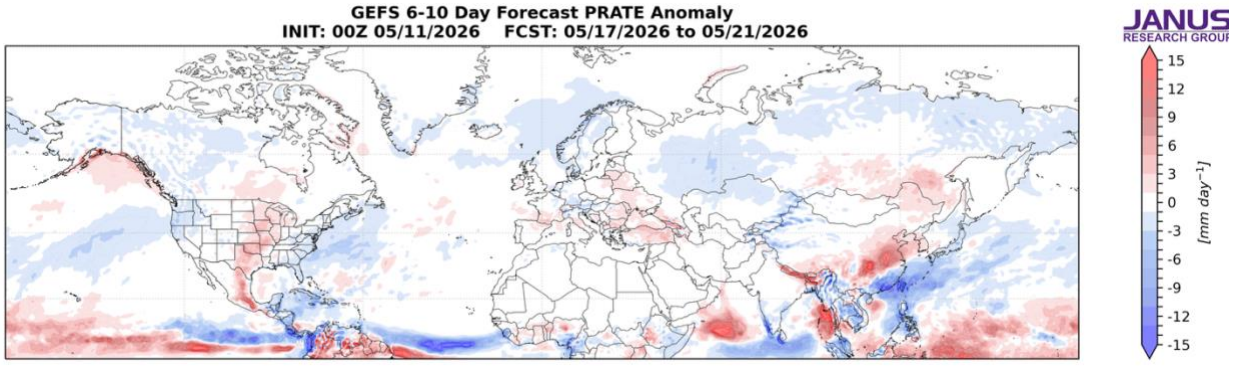

Figure 7. Forecasted rainfall rate (mm/day; shading) from 17 May to 21 May 2026. The forecasts are from the 00Z 11 May 2026 GFS ensemble.

Troughing will support new rainfall across Eastern Europe, around the Black Sea, the Tibetan Plateau and eastern China with mostly dry conditions across much of Europe and Asia (**Figure 7**). Troughing will support new rainfall across southern Alaska and the Central US with mostly dry conditions across much of North America this week (**Figure 7**).

Mid Term

Week Two

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

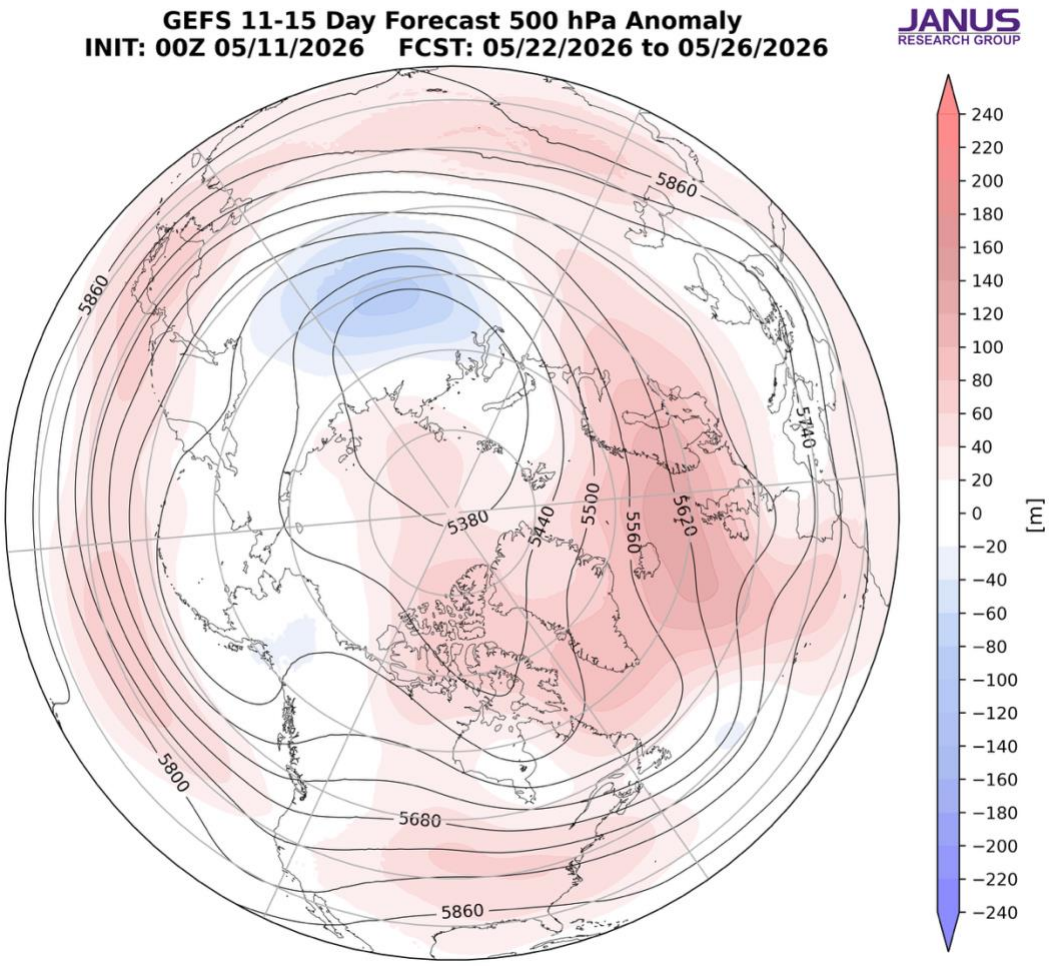

Figure 8. Forecasted average 500 mb geopotential heights (dam; contours) and geopotential height anomalies (m; shading) across the Northern Hemisphere from 22 May to 26 May 2026. The forecasts are from the 00Z 11 May 2026 GFS ensemble.

The dipole pattern across Europe is predicted to persist with ridging/positive geopotential height anomalies across Northern Europe and troughing/negative geopotential height anomalies across Southern Europe this period (**Figure 8**). This pattern will favor widespread normal to above normal temperatures across much of Europe including the UK though normal to below normal temperatures might yet linger along the Meditteranean this period (**Figures 9**). The persistent pattern is predicted across Asia with ridging/positive geopotential height anomalies across Western and Eastern Asia bookending troughing/negative geopotential height anomalies across Central Asia is predicted to continue this period (**Figure 8**). This pattern favors widespread normal to above normal temperatures across Asia now including the Middle East, Central and Eastern Asia and Northern Siberia with normal to below normal temperatures limited to parts of Southern Siberia and the parts of the Indian subcontinent this period (**Figure 9**).

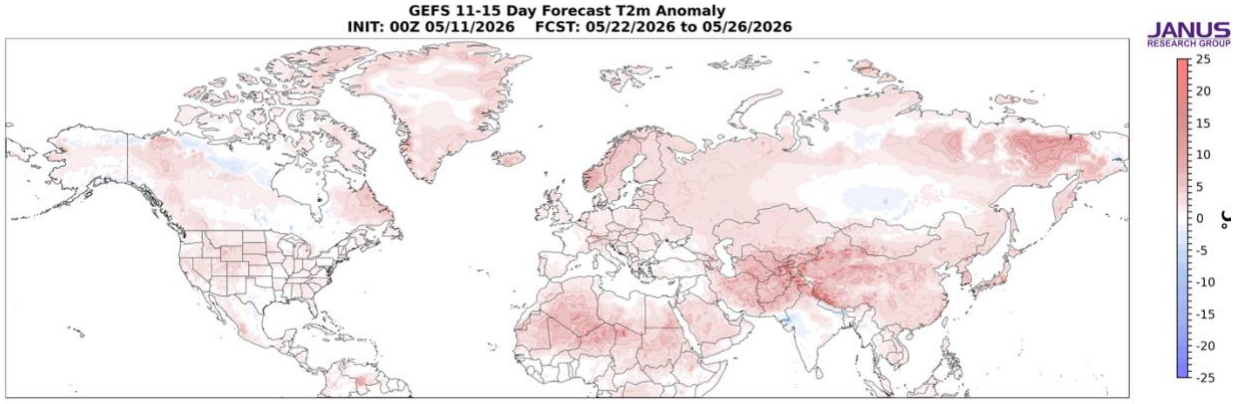

Figure 9. Forecasted surface temperature anomalies (°C; shading) from 22 May to 26 May 2026. The forecasts are from the 00Z 11 May 2026 GFS ensemble.

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

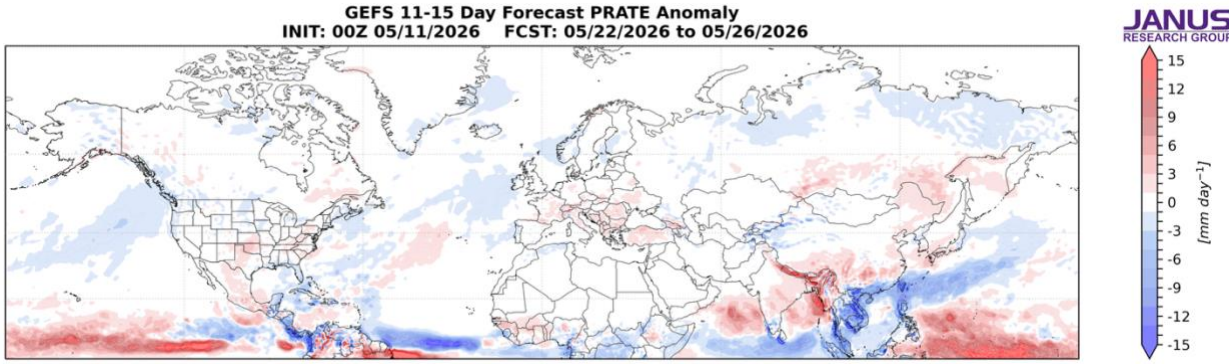

Figure 10. Forecasted rainfall (mm/day; shading) from 22 May to 26 May 2026. The forecasts are from the 00Z 11 May 2026 GFS ensemble.

Troughing will support new rainfall across the parts of Southern Europe, the Alps, India, the Tibetain Plateau into southwest China and parts of Northeast Asia with mostly dry conditions across much of Europe and Asia (**Figure 10**). Troughing will support new rainfall in the US Southern Plains, Southeastern US and into Appalachia 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 throughout the stratosphere and the troposphere (**Figure 11**). Then next week warm/positive PCHs should make a return throughout the troposphere and possibly eventually extending into the stratosphere.

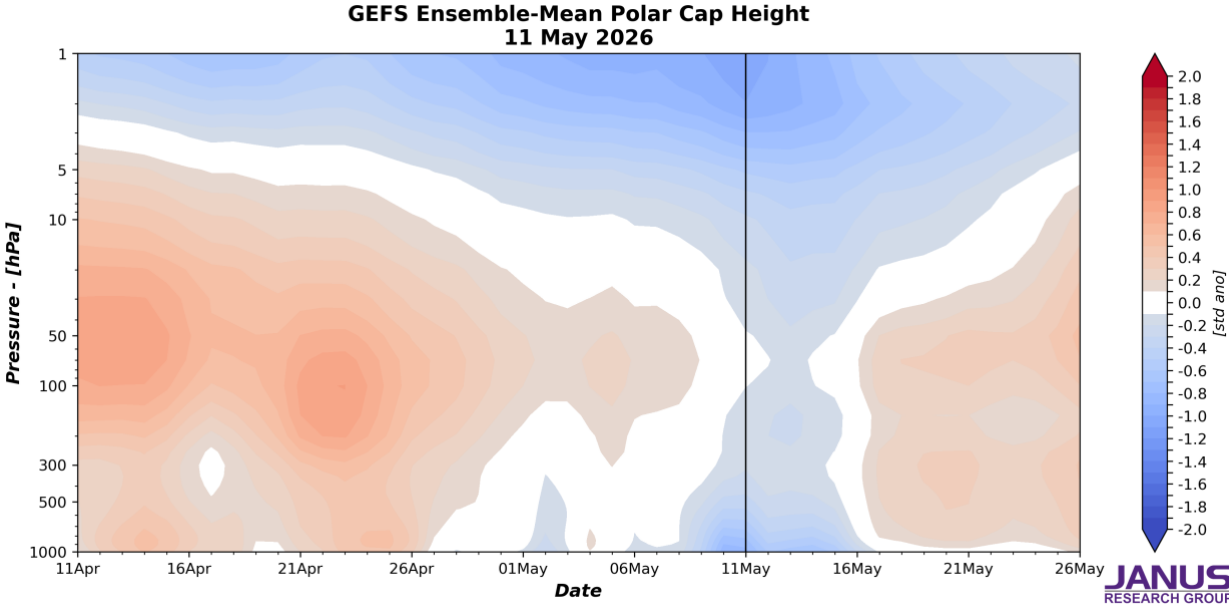

Figure 11. Observed and predicted daily polar cap height (i.e., area-averaged geopotential heights poleward of 60°N) standardized anomalies. The forecast is from the 00Z 11 May 2026 GFS ensemble.

This week the predicted negative cold PCHs in the troposphere (**Figure 11**) are consistent with the predicted positive surface AO (**Figure 1**). Then next week the predicted weak and alternating PCHs in the lower troposphere (**Figure 11**) are consistent with the predicted near neutral AO heading into the second half of May (**Figure 1**).

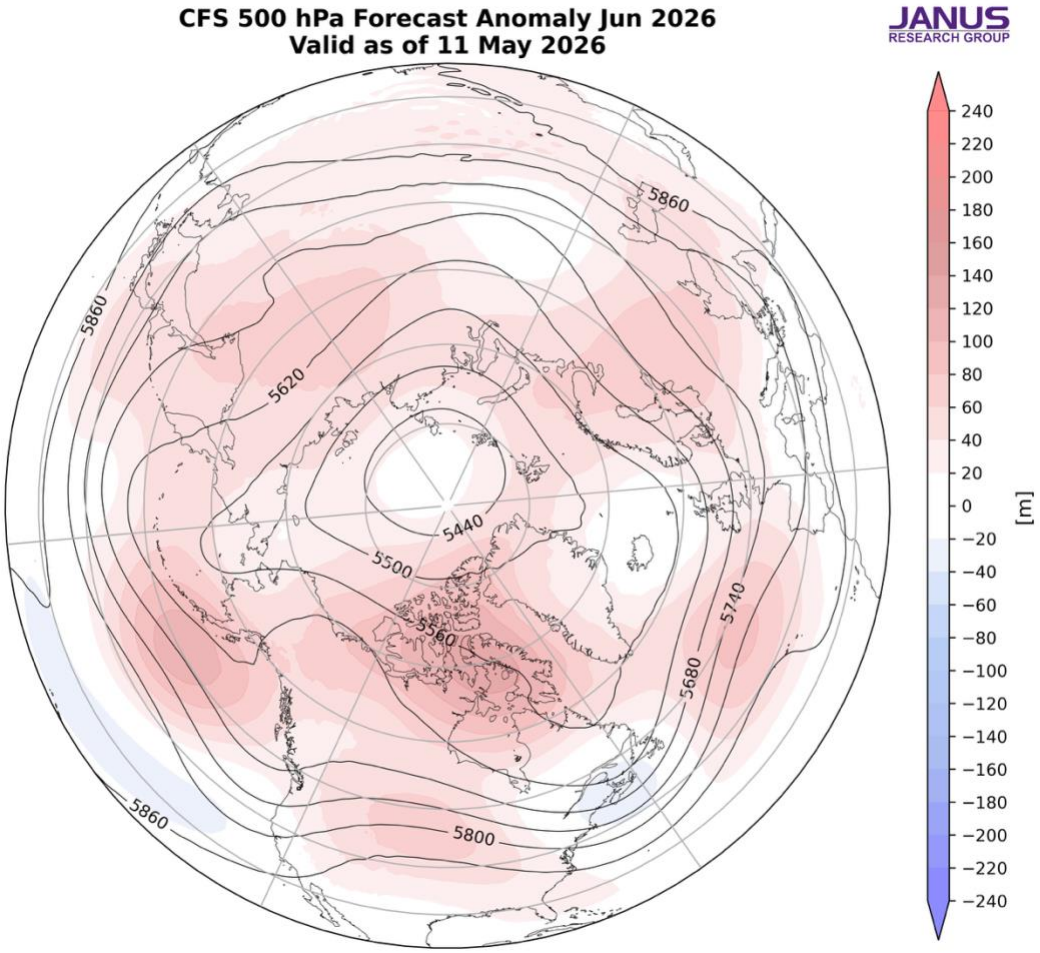

Figure 12. Forecasted average 500 mb geopotential heights (dam; contours) and geopotential height anomalies (m; shading) across the Northern Hemisphere for Jun 2026. The forecasts are from the 00Z 11 May 2025 CFS.

I include in this week's blog the monthly 500 hPa geopotential heights (**Figure 12**) and surface temperatures for June (**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 centered in Baffin Bay, Eastern Europe, Siberia and much of Eastern Asia, the Aleutians, Western Canada and the Central US with troughing across Southern Europe, near the Urals, 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, Central and Eastern Siberia, Alaska, Western and Northern Canada and the Western US with seasonable to relatively cool temperatures across Southern Europe, Southwestern Russia and into Kazakhstan, Southeastern Canada and the Eastern US (**Figure 13**).

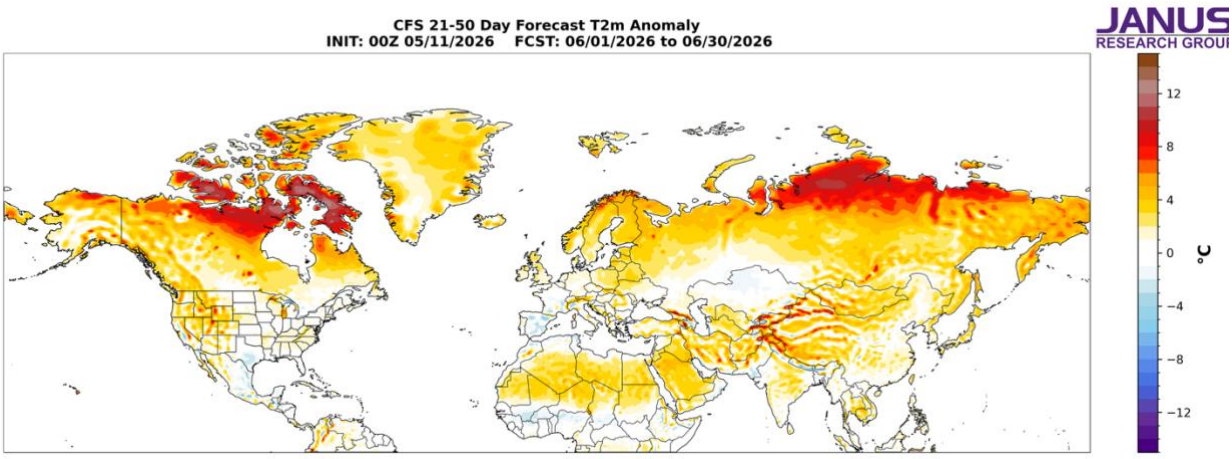

Figure 13. Forecasted average surface temperature anomalies (°C; shading) across the Northern Hemisphere for Jun 2026. The forecasts are from the 00Z 11 May 2026 CFS.

Boundary Forcings

SSTs/El Niño/Southern Oscillation

Equatorial Central Pacific sea surface temperatures (SSTs) anomalies are now above normal, with the warming focused along the South American coast (see **Figure 14**), signs of developing El Niño conditions. In fact a possible "super" El Niño this fall and winter has been receiving much attention in the media. 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.

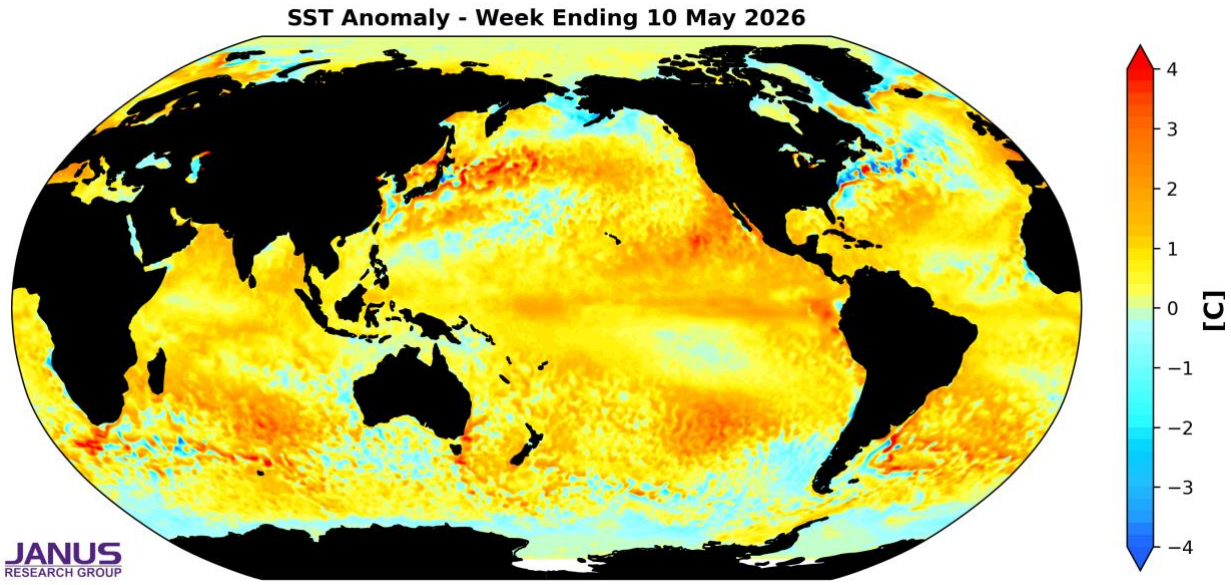

Figure 14. The latest daily-mean global SST anomalies for week ending 10 May 2026.

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 in the Eastern US with troughing across Canada and the Western US somewhat consistent with forecasts next week therefore, it seems that the MJO could be having some weak influence on North American weather mostly next week. But admittedly this is outside of my expertise.

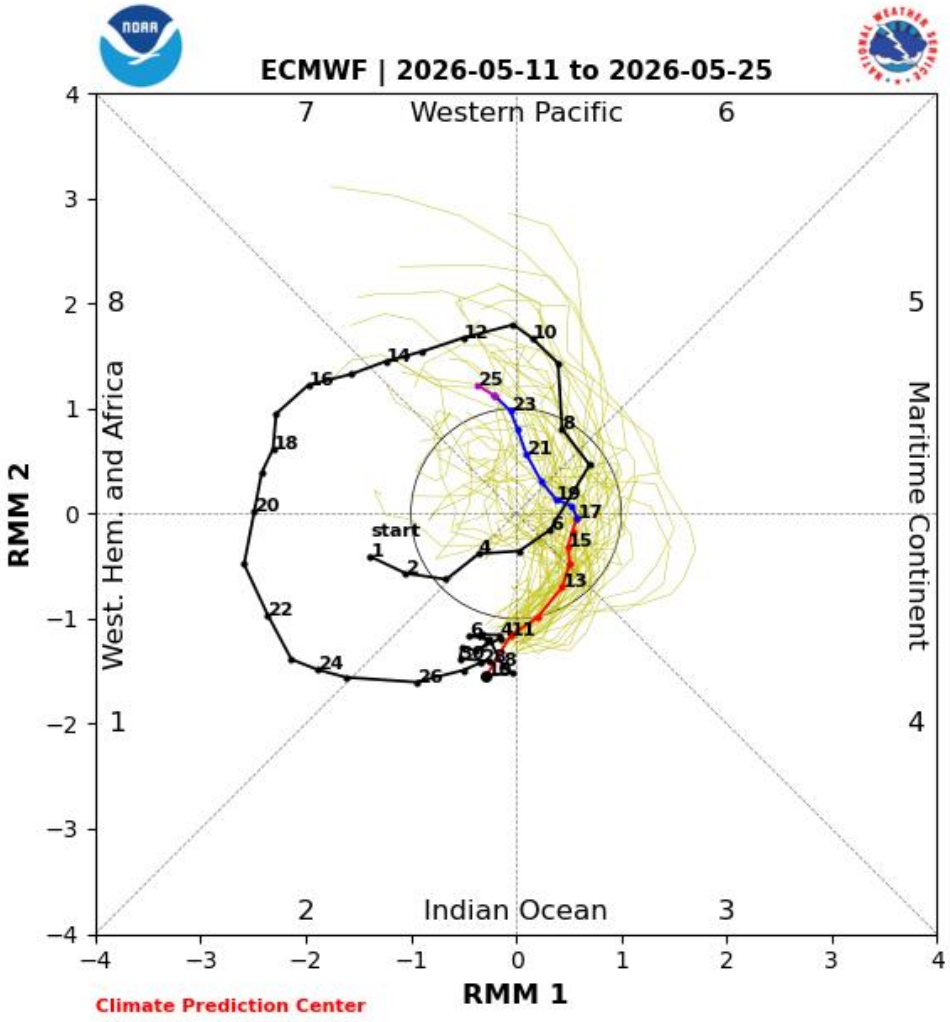

Figure 15. Past and forecast values of the MJO index. Forecast values from the 00Z 11 May 2026 ECMWF model. Yellow lines indicate individual ensemble-member forecasts, with the green line showing the ensemble-mean. A measure of the model 'spread' is denoted by the gray shading. Sector numbers indicate 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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