

Arctic Oscillation and Polar Vortex Analysis and Forecasts

August 31, 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 neutral as pressure/geopotential height anomalies across the Arctic are currently mostly mixed and the AO is predicted to trend positive the next two weeks as pressure/geopotential height anomalies are predicted to become increasingly negative the next two weeks. The North Atlantic Oscillation (NAO) is currently near neutral with weakly negative pressure/geopotential height anomalies across Greenland, and the NAO is predicted to remain neutral to slightly negative the next two weeks as pressure/geopotential height anomalies are predicted to remain mostly mixed across Greenland the next two weeks.
- In general, the theme across the Northern Hemisphere is increasingly zonal and therefore mild flow across the continents. The next two weeks the general predicted pattern across Europe is ridging/positive geopotential height anomalies across Southern Europe with troughing/negative geopotential height anomalies across Northern Europe. This zonal flow pattern will favor normal to above normal temperatures across most of Europe including the United Kingdom (UK) with normal to above normal temperatures limited to northern Scandinavia.
- The predicted pattern across Asia this week is an omega pattern with ridging/positive geopotential height anomalies centered across Central Siberia bookended by troughing/negative geopotential height anomalies across Western and far Eastern Siberia.

However next week ridging will dominate much of Asia centered on Siberia. This pattern favors widespread normal to above normal temperatures across Asia the next two weeks apart from normal to below normal temperatures across Western Siberia and Kazakhstan this week.

- This week the predicted atmospheric pattern across North America is forcing troughing/negative geopotential height anomalies across Western Canada and the Western United States (US) forcing ridging/positive geopotential height anomalies across eastern North America centered across Hudson Bay. However, next week the pattern will become increasingly zonal with weak ridging across the US and weak troughing in Canada. This pattern will support widespread normal to above normal temperatures across much of North America the next two weeks apart from normal to below normal temperatures across Alaska, Western Canada and the Western US this week.
- Summer is officially over today but relatively warm temperatures still reign supreme for the foreseeable future. I also include some early thoughts on the polar vortex (PV).

Plain Language Summary

With just one day left for summer 2026, the summer can be summed up as heat domes predominantly across Western Europe, Western Siberia into Central Asia, the Western US and Eastern Canada favoring some relatively cool temperatures at lower latitudes in parts of Eastern Europe into Western Russia, Northeast Asia, Southcentral Canada, the Central US and the Great Lakes (see **Figure**). For fall the atmospheric pattern is becoming much less amplified or a mostly west to east fast flow of air across the Northern Hemisphere. Therefore, the overall pattern looks relatively warm across most regions including the population centers (see **Figures 3, 6 and 9**). This is not too surprising given the recent strong warming trends observed in the month of September.

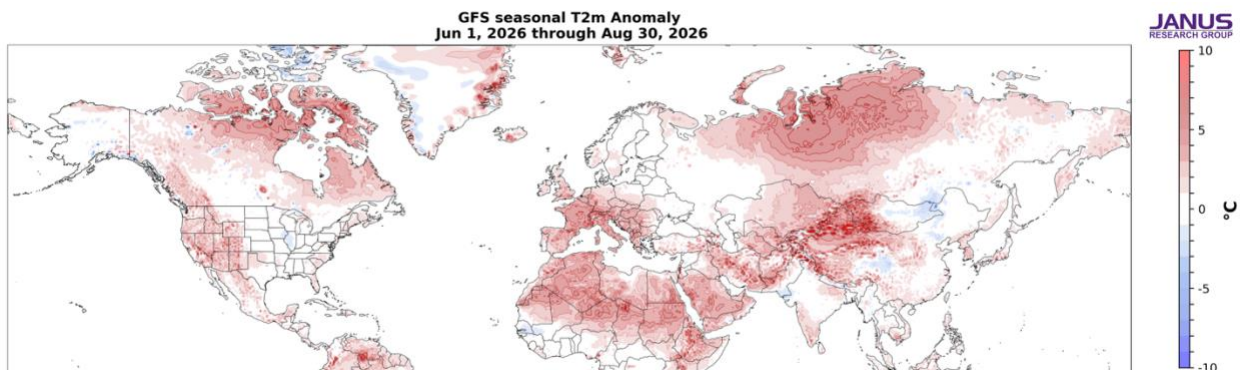


Figure. Estimate of the observed surface temperatures (°C; shading) from 01 Jun to 30 Aug 2026 based on GFS initializations and the GFS forecast from the 30 Aug 2026 run.

Impacts

I guess the atmosphere is trying its best to make me look good, as I started the last blog writing how September should be promoted to a summer month and no longer a shoulder month given the strong warming trends and therefore, I don't expect summer warmth to fade fast. The forecast from today's weather models is warmth, warmth and more warmth (see **Figures 3, 6** and **9**). And it seems to me for the foreseeable future, warm temperatures will reign supreme.

The warm temperatures are in large part supported by the developing zonal flow across the entire Northern Hemisphere (NH). In general, I will begin the discussion moving forward with the polar vortex (PV) animation as that sets the table for the mid-tropospheric circulation and the weather (at least in my head). However, for today's blog I don't find it that informative about the weather since as far as I can tell, stratosphere-troposphere coupling has not begun yet.

Initialized 00Z 500 hPa HGT/HGTa 31-Aug-2026

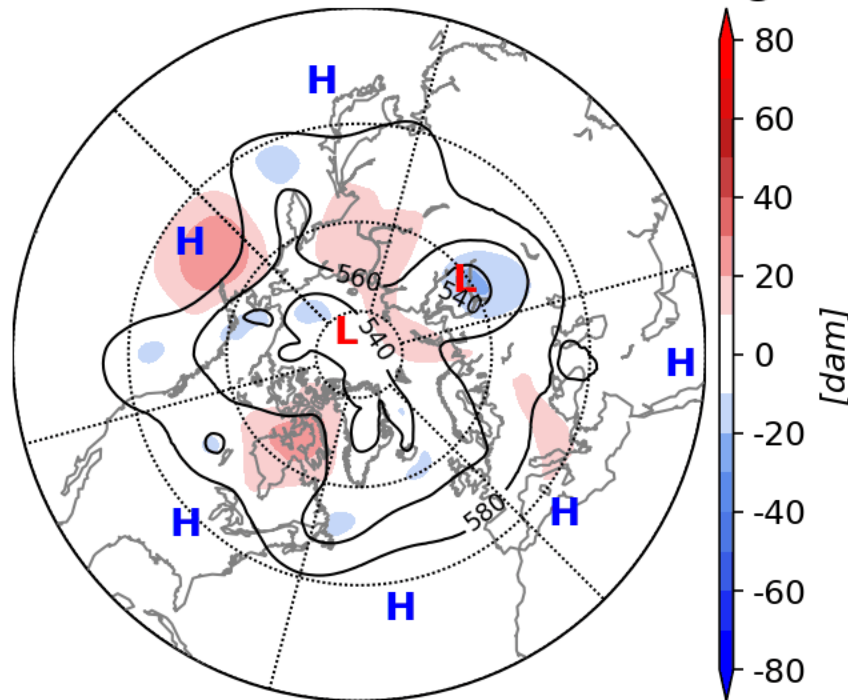


Figure i. Initialized 500 mb geopotential heights (dam; contours) and decameter anomalies (dam; shading) across the Northern Hemisphere for 31 Aug 2026 and forecasted from 01 Sep to 15 Sep 2026. The forecasts are from the 00Z 31 Aug 2026 GFS model.

The look ahead at the two-week forecast of the mid-tropospheric circulation animation in **Figure i** shows a familiar pattern of low pressure in the Arctic mostly over the North Pole encircled or surrounded by bubbles of high-pressure ridging centered on either side of 60°N and could be described as heat domes, though not for much longer. Early on there are three dominant regions

of high-pressure ridging centered over Siberia, the Aleutians and the most impressive being over Hudson Bay. The heat dome over Hudson Bay has been a frequent actor this summer leading to not only relatively warm air temperatures over Eastern Canada but also relatively very warm water temperatures in Hudson and Baffin Bays. The warm water temperatures in Hudson Bay have been a common feature of recent falls, and I think has favored ridging over the region in the fall months. No reason to expect anything different this fall though this atmospheric feature seems to be a feature of El Niño winters. Bringing this back to the PV this would also be more likely to occur during Canadian Warmings. Canadian Warmings tend to be associated with very warm temperatures in Eastern Canada and the Eastern US. Not saying just yet this winter will be mild in eastern North America because of this since Canadian Warmings are often a transitory state of the PV to a colder solution in eastern North America but something to keep an eye on.

Eventually the high-latitude high pressure centers all fade with time, though not clear from the animation but more so from the ensembles. The forecast maps for the mid-troposphere are strong examples, even a “poster child” if you like of strong zonal flow, a positive AO or Northern Annular Mode (see **Figures 5** and especially **8**). This flow pattern is associated with mild temperatures across the NH continents as mild, marine air floods the continents. And given how warm ocean temperatures are, this is not hard to accomplish. It seems to me that zonal flow is an unstable flow and will be interesting to watch how long it lasts or if it really happens at all. For the ensembles to settle into a zonal flow pattern could mostly mean high uncertainty in the forecast. And in fact, the 12z suite of models seems to be suggesting a more amplified pattern across North America that would suggest cooler eventually in eastern North America. However, I still see no change in Siberia, which in the early fall is a more important indicator for long term.

Though I did say that the PV is not coupled to the mid and lower troposphere, the stratospheric circulation also shows a relatively fast west-to-east flow of air like the troposphere (see **Figure ii**). I don’t want to make too much of this since it is very early on, but it does seem that the PV is getting off to a fast start with few speed bumps in the early going.

Initialized 00Z 10 hPa HGT/HGTa 31-Aug-2026

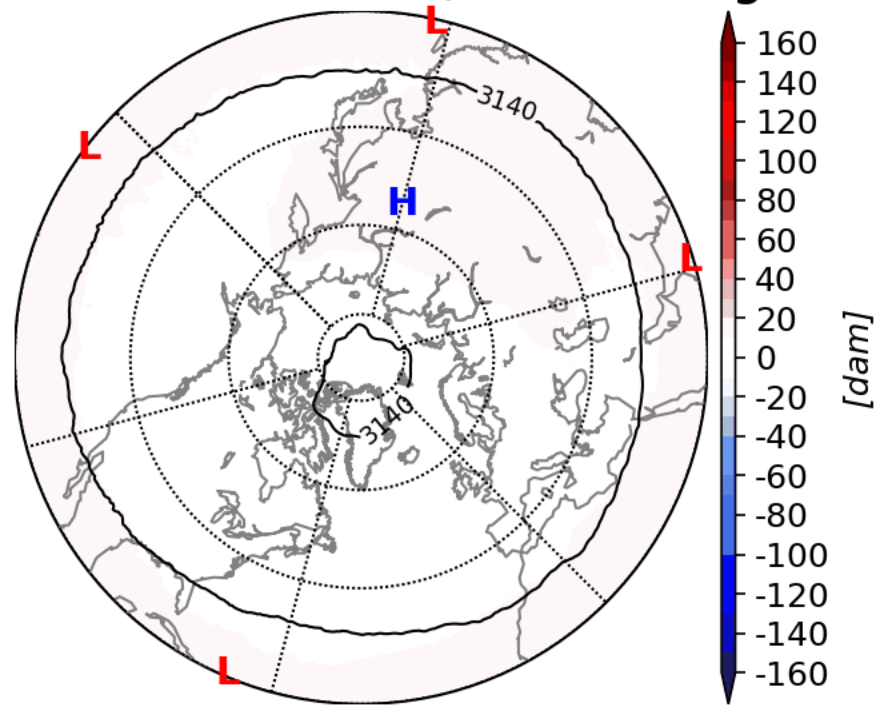


Figure ii. Initialized 10 mb geopotential heights (dam; contours) and decameter anomalies (dam; shading) across the Northern Hemisphere for 31 Aug 2026 and forecasted from 01 Sep to 15 Sep 2026. The forecasts are from the 00Z 31 Aug 2026 GFS model.

The relatively strong and possibly record strong PV contrasts with last fall, when the PV was weak to record weak (see **Figure iii**). This culminated with the earliest sudden stratospheric warming (SSW) in the observational record that set the stage for early cold in eastern Asia and North America. So far, no signs of a repeat. One difference between this fall and last fall is the phase of the quasi-biennial oscillation (QBO). Last fall we had an easterly or negative QBO which favors a weaker PV. This fall we have a westerly or positive QBO which favors a stronger PV. Also looking at the polar cap geopotential height anomalies (PCHs) shown in **Figure 11**, the blue team is clearly winning with cold/negative PCHs strengthening with time and warm/positive PCHs waning with time. This all consistent with a strengthening PV, a positive AO and an overall milder pattern across the NH.

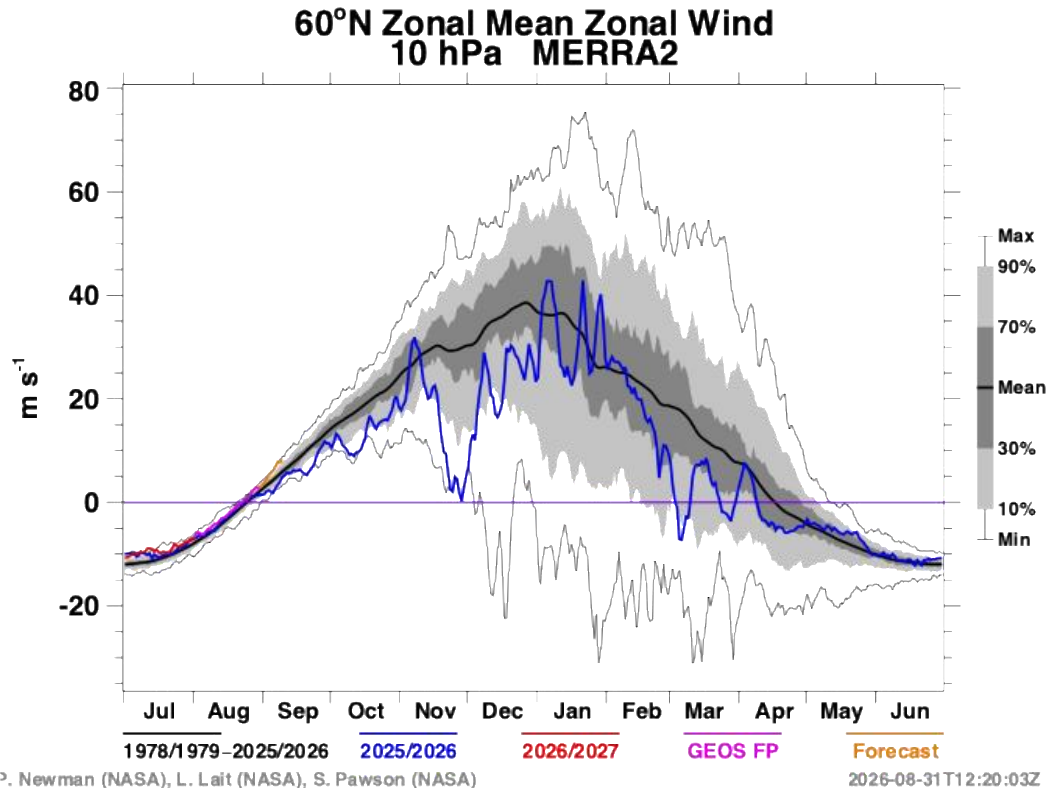


Figure iv. Zonal mean zonal wind at 10 hPa and 60°N. Solid thick black bar shows climatology with shading showing different percentiles and the thin black line showing daily extreme values. Plot taken from: https://acd-ext.gsfc.nasa.gov/Data_services/met/ann_data.html

But if you look at the blog from last year in early September the predicted atmospheric circulation didn't look that much different. However, one important difference is that Siberia was clearly much colder heading into mid-September. Right now, the forecasts are for sprawling high-pressure ridging to dominate Siberia which means a very mild September, which is an important difference! Still let's see where things stand in two weeks.

A strong positive AO is conducive to Arctic sea ice preservation, so I would expect the sea ice melt season is quickly ending. Sea ice melt seems to have slowed in recent weeks (see **Figure iv**), and the minimum is not that far off. It is looking like a similar Arctic sea ice minimum to last year. Of course, Arctic sea ice is well below normal. An impressive amount of ice disappeared in the North Pacific side of the Arctic, and it is important where the low sea ice is focused whether in the North Atlantic or North Pacific sectors of the Arctic. It has been shown that less sea ice in the North Atlantic sector of the Arctic weakens the polar vortex while less sea ice in the North Pacific sector strengthens the polar vortex. Sea ice should grow much faster in the North Pacific sector of the Arctic in the coming weeks and months, but again probably best not to make too many conjectures at this time.

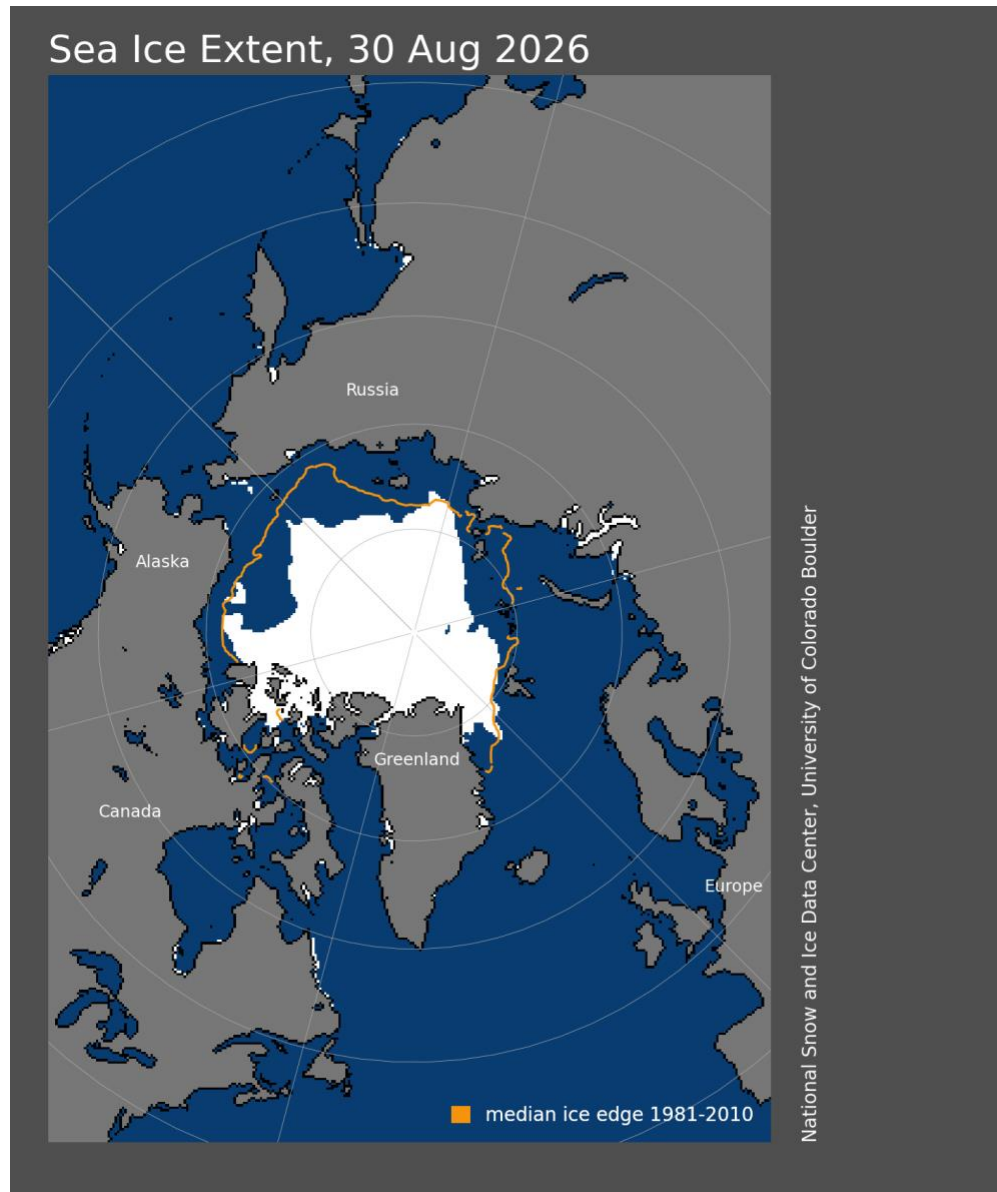


Figure iv. Arctic sea ice cover extent for 31 Aug 2026. White depicts ice covered areas and the orange contour the climatological extent of Arctic sea ice for the date. Plot taken from: <https://nsidc.org/sea-ice-today>

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 mixed geopotential height anomalies across Greenland (**Figure 2**), the NAO is predicted to be mostly neutral to slightly negative this week.

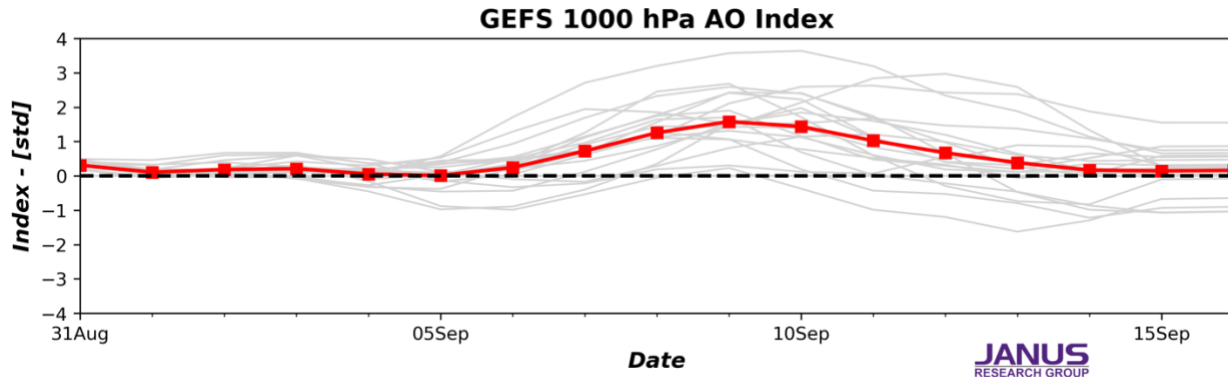


Figure 1. The predicted daily-mean AO at 1000 hPa from the 00Z 31 Aug 2026 GFS ensemble. Gray lines indicate the AO index from each individual ensemble member, with the ensemble mean AO index given by the red line with squares.

A zonal flow pattern is predicted for Europe for the foreseeable future with ridging/positive geopotential height anomalies across Southern Europe with troughing/negative geopotential height anomalies across Northern Europe this week (**Figure 2**). This pattern will support widespread normal to above normal temperatures across Europe including the UK this week (**Figure 3**). This week the general pattern across Asia is on omega pattern with troughing/negative geopotential height anomalies centered on Western Siberia sandwiched by ridging/positive geopotential height anomalies across Western Russia and Central Siberia this week (**Figure 2**). This pattern favors widespread normal to above normal temperatures across much of Asia with normal to below normal temperatures across Western Siberia and eastern Kazakhstan this week (**Figure 3**).

GEFS 1-5 Day Forecast 500 hPa Anomaly
INIT: 00Z 08/31/2026 FCST: 09/01/2026 to 09/05/2026

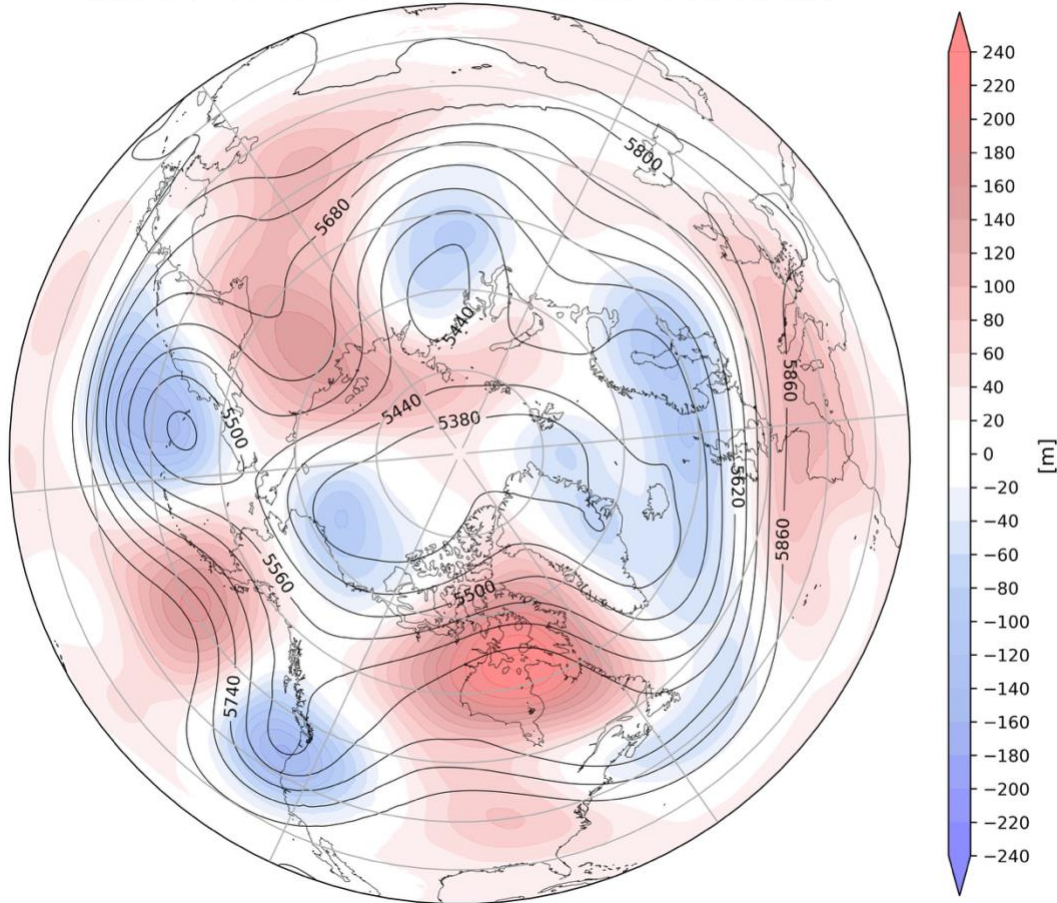


Figure 2. Forecasted average 500 mb geopotential heights (dam; contours) and geopotential height anomalies (m; shading) across the Northern Hemisphere from 01 Sep 2026 to 05 Sep 2026. The forecasts are from the 00Z 31 Aug 2026 GFS ensemble.

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

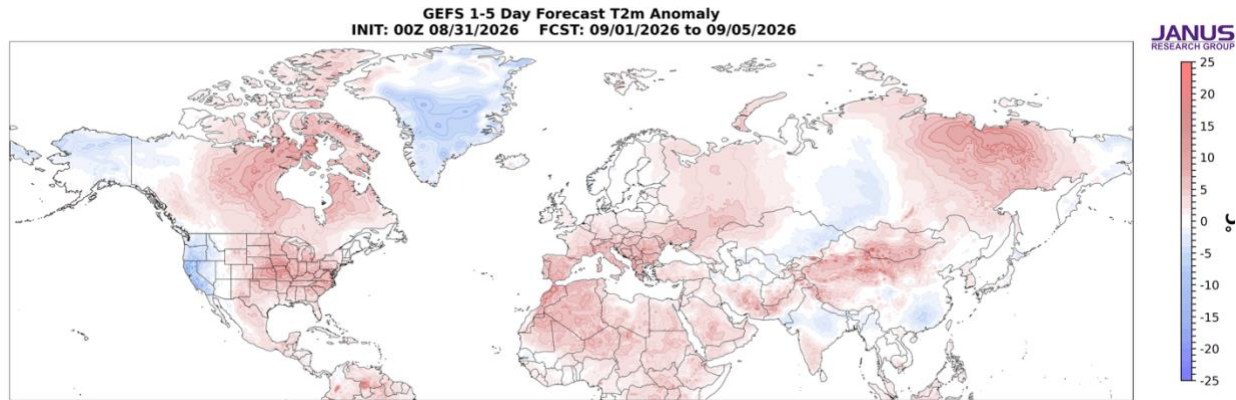


Figure 3. Forecasted surface temperature anomalies ($^{\circ}\text{C}$; shading) from 01 Sep 2026 to 05 Sep 2026. The forecasts are from the 00Z 31 Aug 2026 GFS ensemble.

Troughing will support new rainfall across Northern and Eastern Europe, Western Siberia and the Tibetan Plateau with mostly dry conditions across much of Europe and Asia (**Figure 4**). Troughing will support new rainfall across western Alaska, Western Canada and the northern corners of the US this week (**Figure 4**).

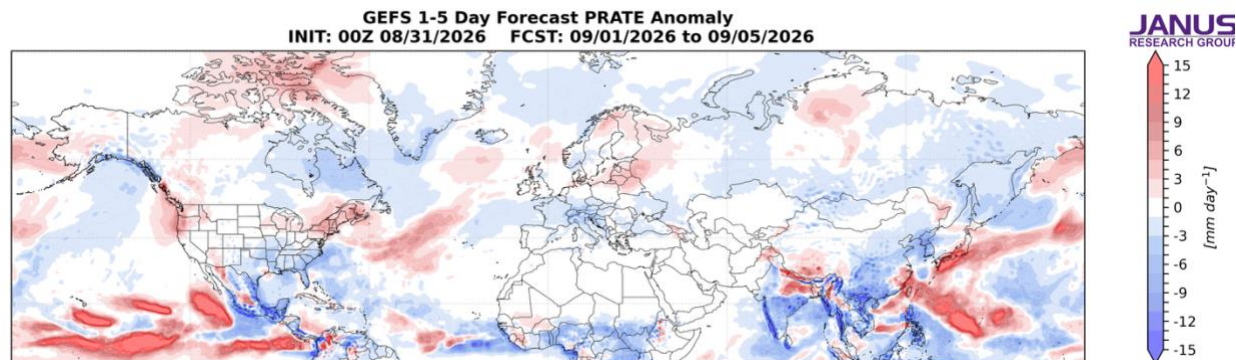


Figure 4. Forecasted precipitation (mm/day; shading) from 01 Sep 2026 to 05 Sep 2026. The forecasts are from the 00Z 31 Aug 2026 GFS ensemble.

Near-Mid Term

Next week

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

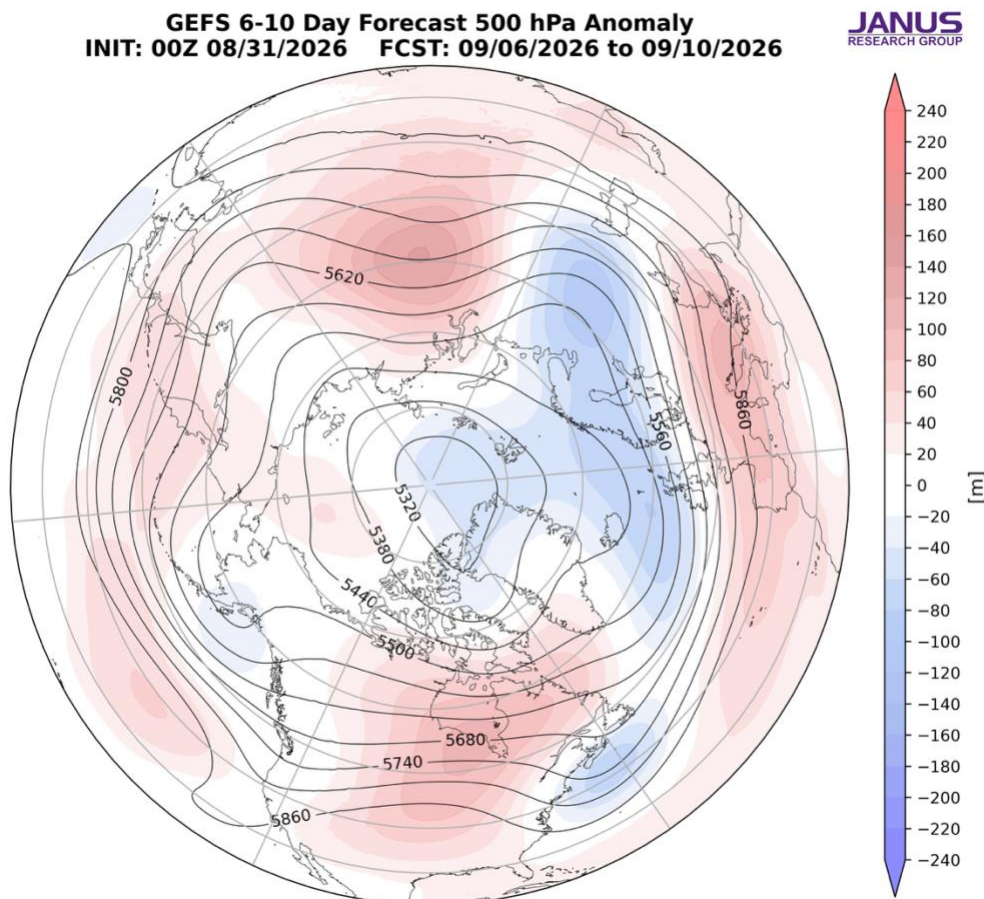


Figure 5. Forecasted average 500 mb geopotential heights (dam; contours) and geopotential height anomalies (m; shading) across the Northern Hemisphere from 06 Sep 2026 to 10 Sep 2026. The forecasts are from the 00Z 31 Aug 2026 GFS ensemble.

Once again, the pattern will be mostly zonal across Europe with ridging/positive geopotential height anomalies across Southern Europe with troughing/negative geopotential height anomalies across Northern Europe this period (**Figure 5**). The pattern will support widespread normal to above normal temperatures across Europe including the UK with normal to below temperatures limited to northern Scandinavia this period (**Figure 6**). The omega pattern across Asia is predicted to drift west with ridging/positive geopotential height anomalies now centered across Western Siberia with

troughing/negative geopotential height anomalies across Western Russia and Central Siberia and into Northeastern Asia with more ridging across Southern Asia this period (**Figure 5**). This pattern favors widespread normal to above normal temperatures widespread across Asia but especially Western Siberia and Central Asia with normal to below normal temperatures limited to Western Russia and Central Siberia and into Northeast Asia this period (**Figure 6**).

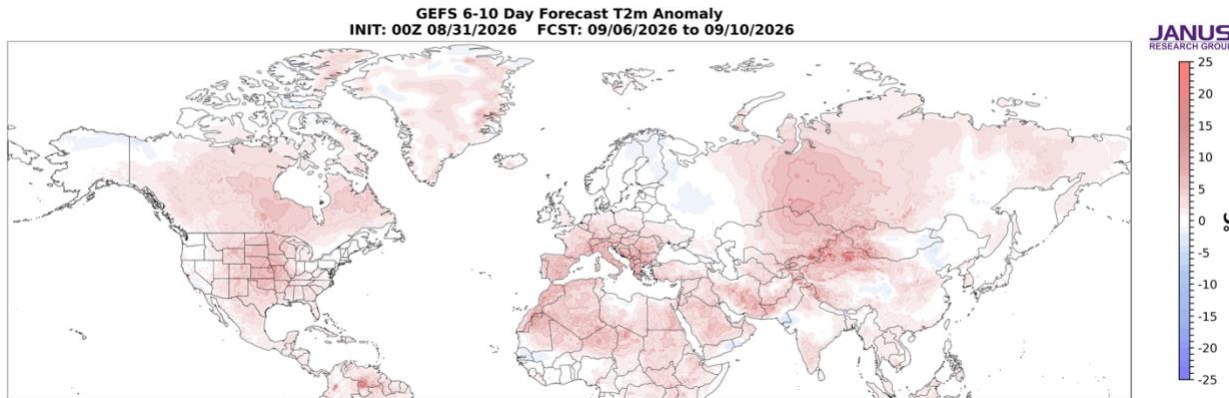


Figure 6. Forecasted surface temperature anomalies ($^{\circ}\text{C}$; shading) from 06 Sep 2026 to 10 Sep 2026. The forecasts are from the 00Z 31 Aug 2026 GFS ensemble.

Across North America the pattern is becoming more zonal as well with troughing/negative geopotential height anomalies in the Gulf of Alaska that will support widespread ridging/positive geopotential height anomalies across much of Canada and the US still centered on Hudson Bay this period (**Figure 5**). This pattern will favor normal to above normal temperatures widespread across southern Alaska, Canada and the and the US apart from normal to below normal temperatures mostly limited to the northern Alaska and the US West Coast this period (**Figure 6**).

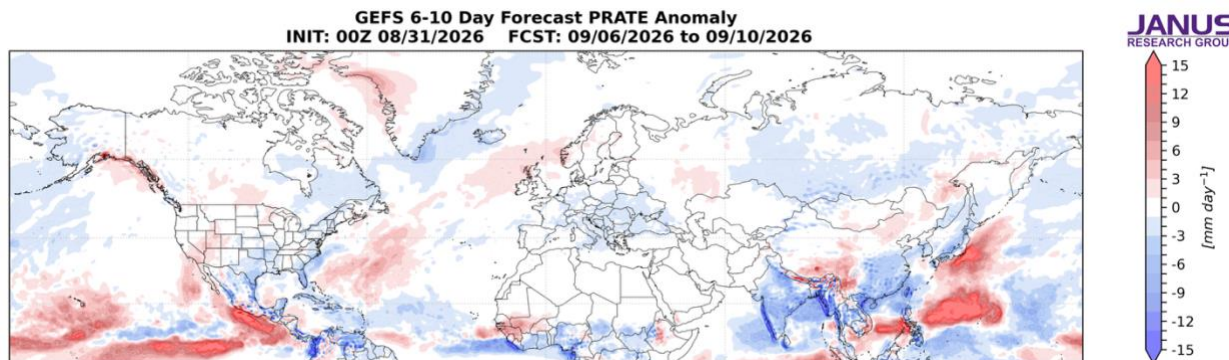


Figure 7. Forecasted rainfall rate (mm/day; shading) from 06 Sep 2026 to 10 Sep 2026. The forecasts are from the 00Z 31 Aug 2026 GFS ensemble.

Troughing will support new rainfall across Scotland into Norway, western Russia, Northeastern China, Southwestern China and the Tibetan Plateau with mostly dry conditions across much of Europe and Asia (**Figure 7**). Troughing will support new rainfall across the Alaska panhandle, the

Canadian Plains and the Southwestern US with mostly dry conditions across much of North America this week (**Figure 7**).

Mid Term

Week Two

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

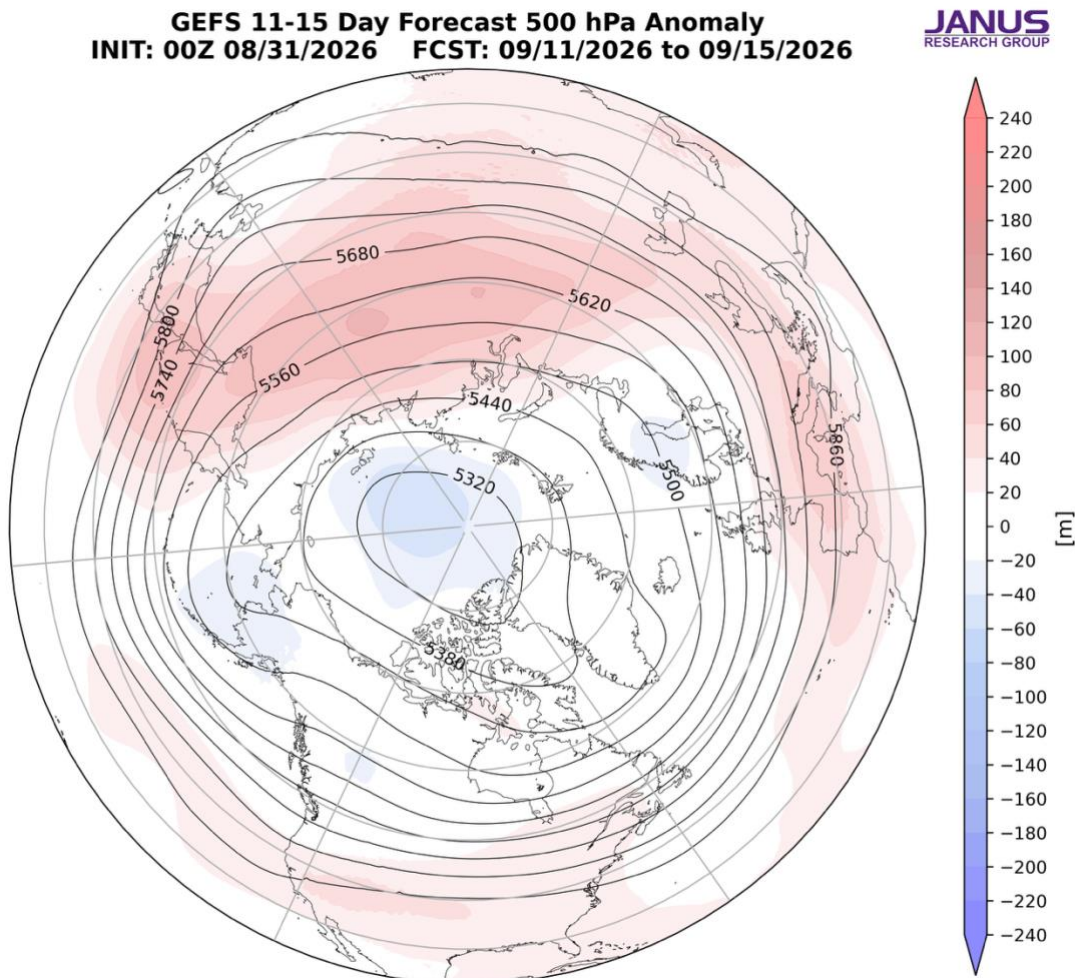


Figure 8. Forecasted average 500 mb geopotential heights (dam; contours) and geopotential height anomalies (m; shading) across the Northern Hemisphere from 11 Sep to 15 Sep 2026. The forecasts are from the 00Z 31 Aug 2026 GFS ensemble.

Yet again the zonal pattern rages across Europe with ridging/positive geopotential height anomalies across Southern Europe with troughing/negative geopotential height anomalies persisting across Northern Europe this period (**Figure 8**). This pattern will favor widespread normal to above normal temperatures across much of Europe including the UK apart from except for normal to below normal temperatures across northern Scandinavia this period (**Figures 9**). The European zonal flow pattern will spread across Asia as well with widespread ridging/positive geopotential height anomalies centered across Siberia this period (**Figure 8**). This pattern favors widespread normal to above normal temperatures across most of Asia especially western China and into western Mongolia with normal to below normal temperatures limited to central China and northern India this period (**Figure 9**).

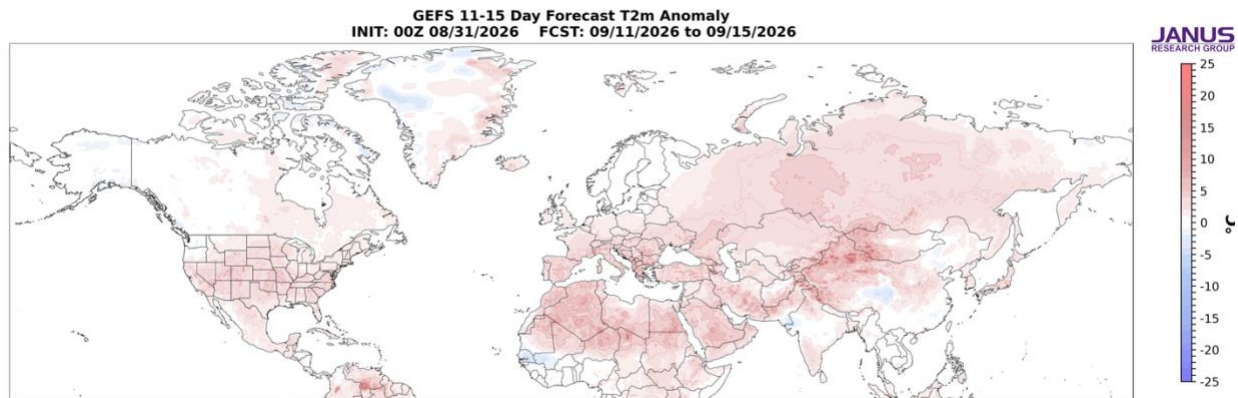


Figure 9. Forecasted surface temperature anomalies (°C; shading) from 11 Sep to 15 Sep 2026. The forecasts are from the 00Z 31 Aug 2026 GFS ensemble

Not to be left out, zonal flow will take over North America as well with ridging/positive geopotential height anomalies are predicted to dominate the US with troughing/negative geopotential height anomalies across Canada this period (**Figure 8**). This pattern supports widespread normal to above normal temperatures across Alaska, much of Canada and the US with the limited exception of regional normal to below normal temperatures across the Canadian Plains this period (**Figure 9**).

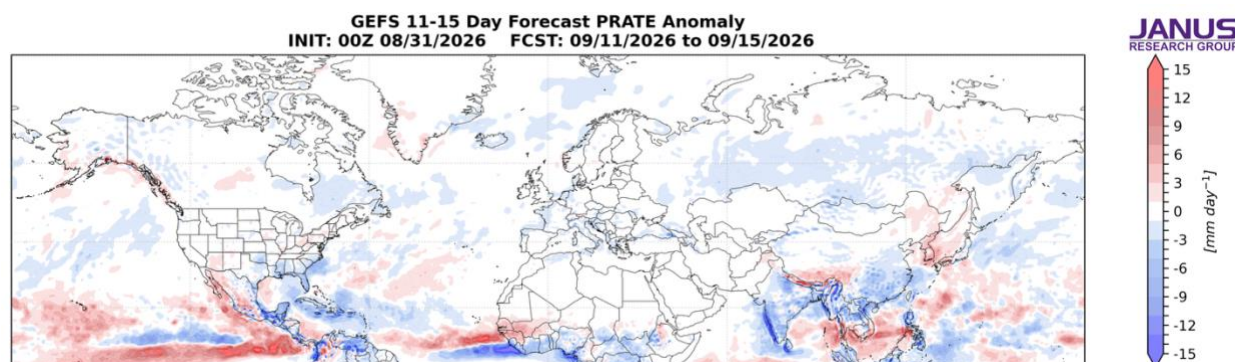


Figure 10. Forecasted rainfall (mm/day; shading) from 11 Sep to 15 Sep 2026. The forecasts are from the 00Z 31 Aug 2026 GFS ensemble

Troughing will support new rainfall across northeastern China, the Tibetan Plateau and into southwest China with mostly dry conditions across much of Europe and Asia (**Figure 10**). Troughing will support new rainfall across the Canadian Plains, the Southwestern US and possibly the Great Lakes 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 lower stratosphere and the troposphere (**Figure 11**). However next week, the cold/negative PCHs in the upper stratosphere will descend into the mid-stratosphere while the warm/positive PCHs in the lower stratosphere and troposphere weaken and even flips cold/negative in the lower troposphere.

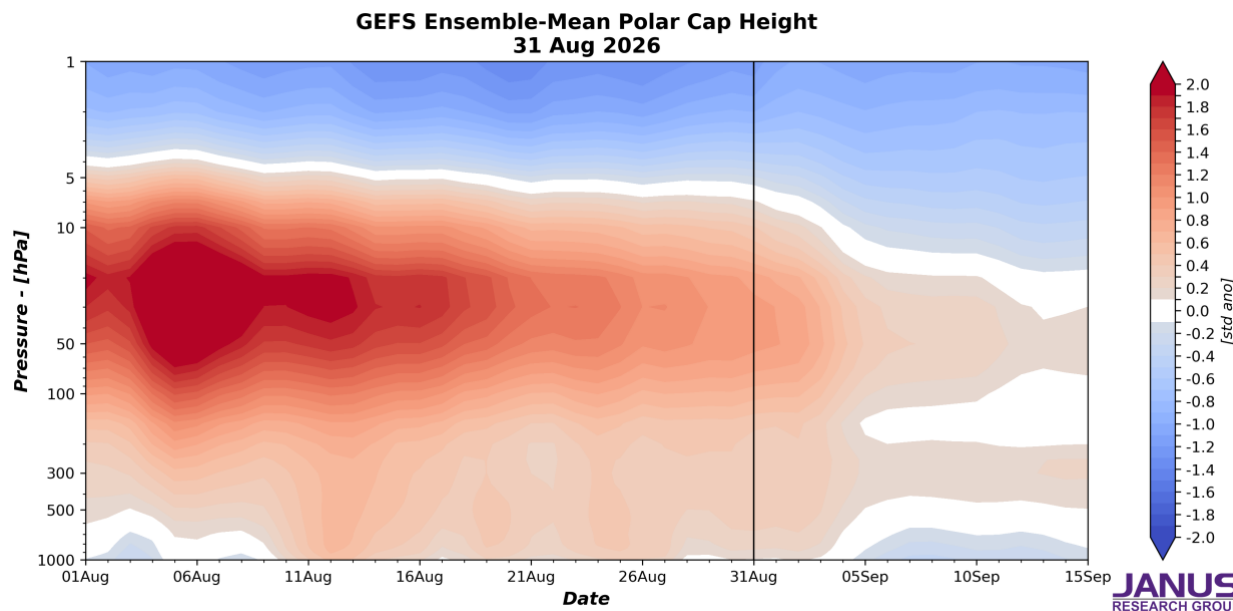


Figure 11. Observed and predicted daily polar cap height (i.e., area-averaged geopotential heights poleward of 60°N) standardized anomalies. The forecast is from the 00Z 31 Aug 2026 GFS ensemble.

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

CFS 500 hPa Forecast Anomaly Sep 2026
Valid as of 31 Aug 2026

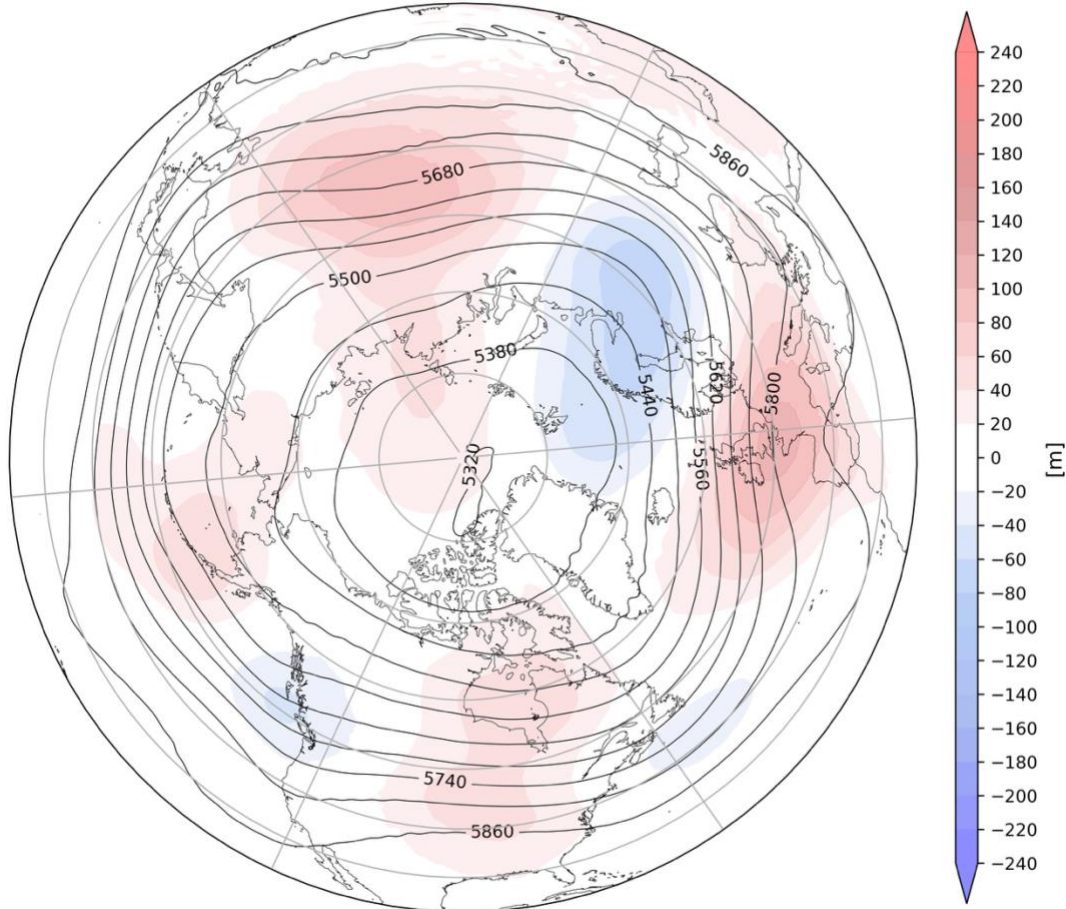


Figure 12. Forecasted average 500 mb geopotential heights (dam; contours) and geopotential height anomalies (m; shading) across the Northern Hemisphere for Sep 2026. The forecasts are from the 00Z 31 Aug 2025 CFS.

I include in this week's blog the monthly 500 hPa geopotential heights (**Figure 12**) and surface temperatures for September (**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 on the UK, Central Asia, the Aleutians and Eastern Canada with troughing across Western Russia, eastern Siberia into East Asia, the Gulf of Alaska, Western Canada and the Western US (**Figure 12**). This pattern favors seasonable to relatively warm temperatures across Western Europe, Western Siberia, much of Asia including the Middle East, the Tibetan Plateau, Pakistan and Afghanistan, Northeastern Siberia, Alaska, Eastern Canada and much of the US with seasonable to relatively cool temperatures across Western Russia, Southeast Siberia and into Northeast Asia, Alaska, Western Canada and the US West Coast (**Figure 13**).

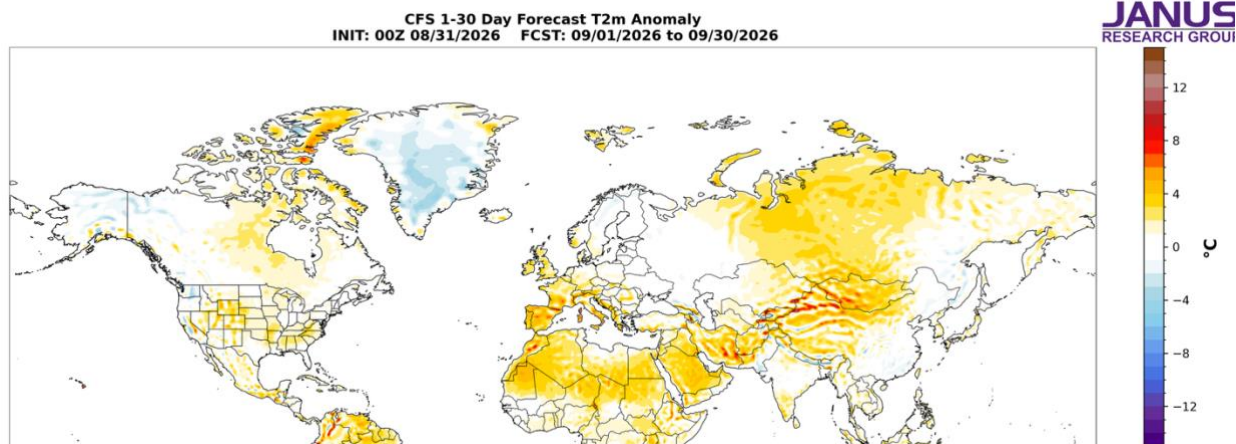


Figure 13. Forecasted average surface temperature anomalies ($^{\circ}\text{C}$; shading) across the Northern Hemisphere for Sep 2026. The forecasts are from the 00Z 31 Aug 2026 CFS.

Boundary Forcings

SSTs/El Niño/Southern Oscillation

Equatorial Central Pacific sea surface temperatures (SSTs) anomalies are well above normal, with the warming focused along the South American coast and out to the Dateline (see **Figure 14**), clear signs of El Niño conditions. In fact, a possible “super” El Niño is increasingly likely 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 especially near Europe, though below normal SSTs exist regionally especially in the Southern Ocean. The widespread above normal SSTs remain impressive.

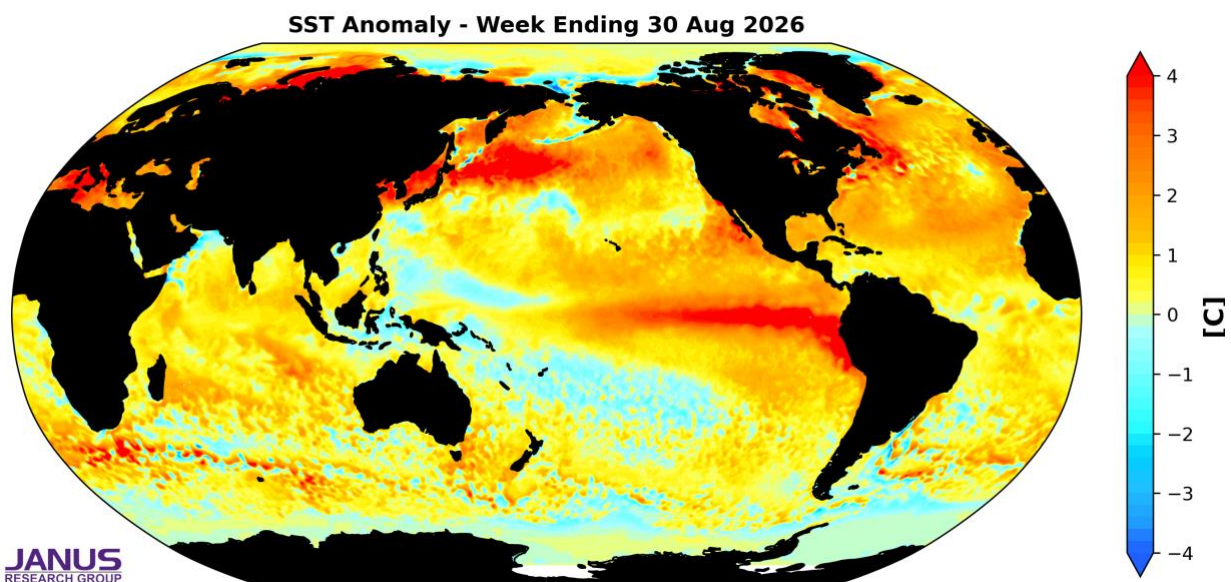


Figure 14. The latest daily-mean global SST anomalies for week ending 31 Aug 2026.

Madden Julian Oscillation

Currently the Madden Julian Oscillation (MJO) is weak where no phase is favored (**Figure 15**), and the forecasts are for the MJO to remain weak where no phase is favored the next two weeks (**Figure 15**). Therefore, it seems that the MJO will have little influence on North American weather next week. But admittedly this is outside of my expertise.

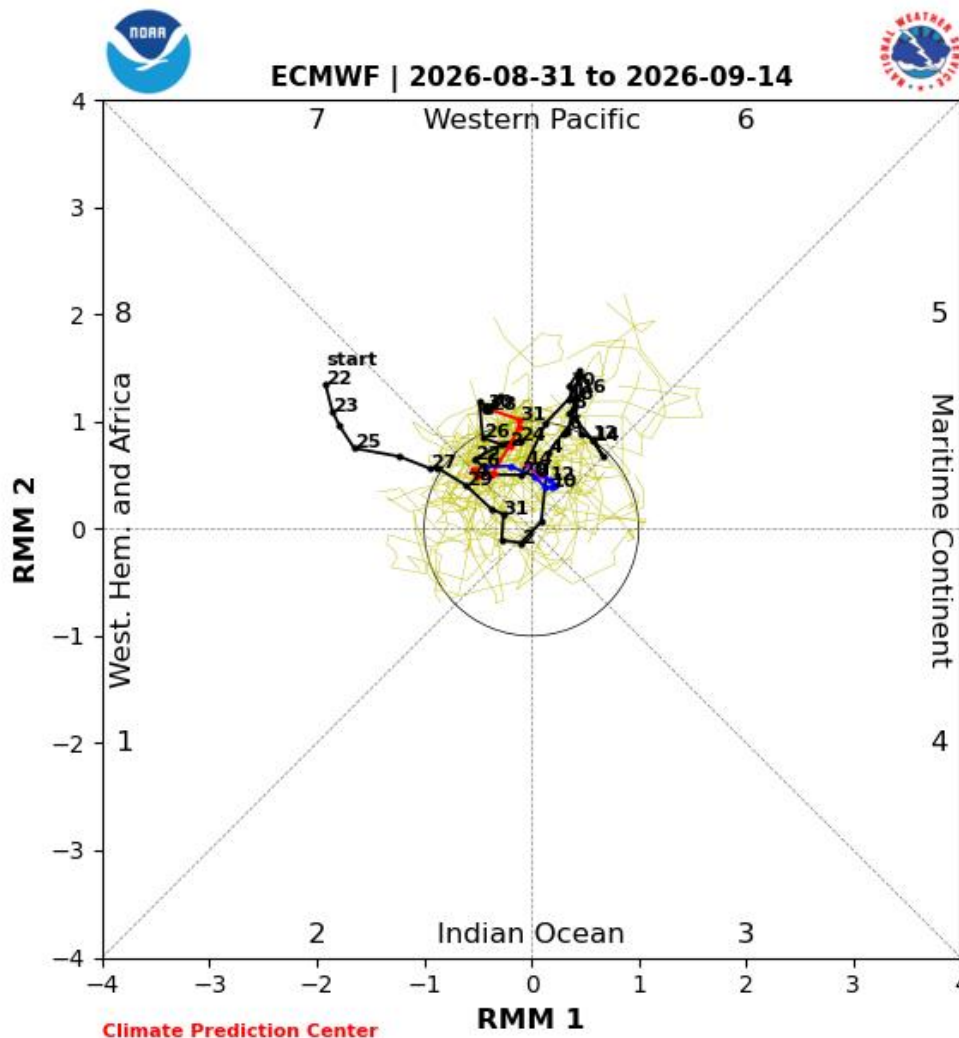


Figure 15. Past and forecast values of the MJO index. Forecast values from the 00Z 31 Aug 2026 ECMWF model. Yellow lines indicate individual ensemble-member forecasts, with the green line showing the ensemble-mean. A measure of the model 'spread' is denoted by the gray shading. Sector numbers indicate 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.

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