

Arctic Oscillation and Polar Vortex Analysis and Forecasts

September 28, 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.

Subscribe to our email list or follow me on Twitter (@judah47) for notification of updates.

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 trend mostly positive the next two weeks as pressure/geopotential height anomalies are predicted to become increasingly negative and then mixed the next two weeks. The North Atlantic Oscillation (NAO) is currently negative with mostly negative pressure/geopotential height anomalies across the mid-latitudes of the North Atlantic, and the NAO is predicted to trend positive the next two weeks as pressure/geopotential height anomalies are predicted to remain mostly negative across Greenland the next two weeks.
- The next two weeks predicted troughing/negative geopotential height anomalies across Greenland will favor ridging/positive geopotential height anomalies across much of Europe centered on Northern Europe except for troughing/negative geopotential height anomalies across Southeastern Europe. This pattern will favor normal to above normal temperatures across most of Europe including the United Kingdom (UK) except for normal to below normal temperatures in the Balkan States and Turkey.
- Ridging/positive geopotential height anomalies initially centered across the Urals will drift westward into Northern Europe will support expanding troughing/negative geopotential height anomalies first limited to Northeast Asia but then across Siberia and Kazakhstan. This pattern favors widespread normal to above normal temperatures across Asia the next two

weeks except for normal to below normal temperatures across Northeast Asia this week and then most of Siberia and Kazakhstan next week.

- This week the predicted atmospheric pattern across North America is troughing/negative geopotential height anomalies across Alaska and Western Canada will support ridging/positive geopotential height anomalies forcing across Eastern Canada and the Eastern United States (US). However, next week the pattern will flip with ridging in western North America and troughing in eastern North America. This pattern will support widespread normal to above normal temperatures across much of the US and Eastern Canada with normal to below normal temperatures across Alaska and Western Canada but then next week normal to above normal temperatures across Alaska, Western Canada and the Western US with normal to below normal temperatures across Eastern Canada and the Eastern US.
- We have our first robust stretched polar vortex of the 2026/27 season predicted for the next two weeks, a sign for the upcoming winter? Some early thoughts below.

Plain Language Summary

September has been an incredibly warm month relative to normal across the Northern Hemisphere (see **Figure**). However, the first robust stretched polar vortex of the season will unfold the next two weeks. These events favor cooler than normal temperatures in Central and/or East Asia and eastern North America while it tends to remain milder than normal in Europe, Western Asia, the Western US and Western Canada consistent with the upcoming temperature forecast (see **Figures 3, 6 and 9**). These events usually don't last more than two weeks, so what follows is challenging to know just yet.

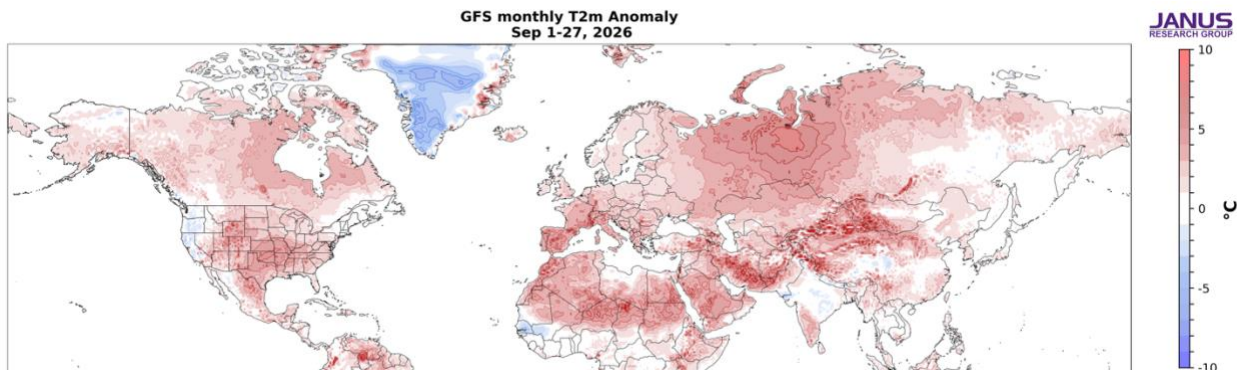


Figure. Estimate of the observed surface temperatures (°C; shading) from 01 Sep to 27 Sep 2026 based on GFS initializations and the GFS forecast from the 28 Sep 2026 run.

Impacts

In last week's post, I did something unusual I highlighted the CFS forecast in the Impacts section as rather than just the usual persistence forecast (as in this week's blog) it predicted a large pattern change with ridging in Western Europe forcing troughing and a cooler pattern across Siberia and ridging in western North America and troughing with cooling in Eastern Canada and the Eastern US. Though not a perfect forecast but to first order the forecast is looking pretty good. It certainly correctly predicted the pattern change. I want to give credit where credit is due.

In my opinion the catalyst for the pattern change is the area of high-pressure ridging sliding west from Siberia to the Urals and then Scandinavia. This is an ideal position to excite a stretched polar vortex (PV). It seems to me that this is the second of the season but the first truly robust event. Stretching has dominated the behavior of the PV the past two winters and it's a little intriguing to see a stretched PV make a debut relatively early in this year's PV season. The event begins with cold and snow in Siberia and parts of Northern Asia but will culminate with cold even some snow in Eastern Canada and the Eastern US.

The Ural blocking of high-pressure ridging can be seen at the beginning of the animation of the Northern Hemisphere (NH) mid troposphere circulation (see **Figure i**). It then slides west over Scandinavia. High-pressure ridging over the Urals and/or Scandinavia is conducive to disrupting the PV, often in the form of stretching. If the ridging is persistent and strong enough it could eventually lead to the larger PV disruption, a sudden stratospheric warming (SSW). Eventually in the animation the high-pressure ridging finds itself over Greenland. It is my impression that the weather models are struggling to resolve the pattern in the second week of October and I have low confidence in any of the model forecasts.

Initialized 00Z 500 hPa HGT/HGTa 28-Sep-2026

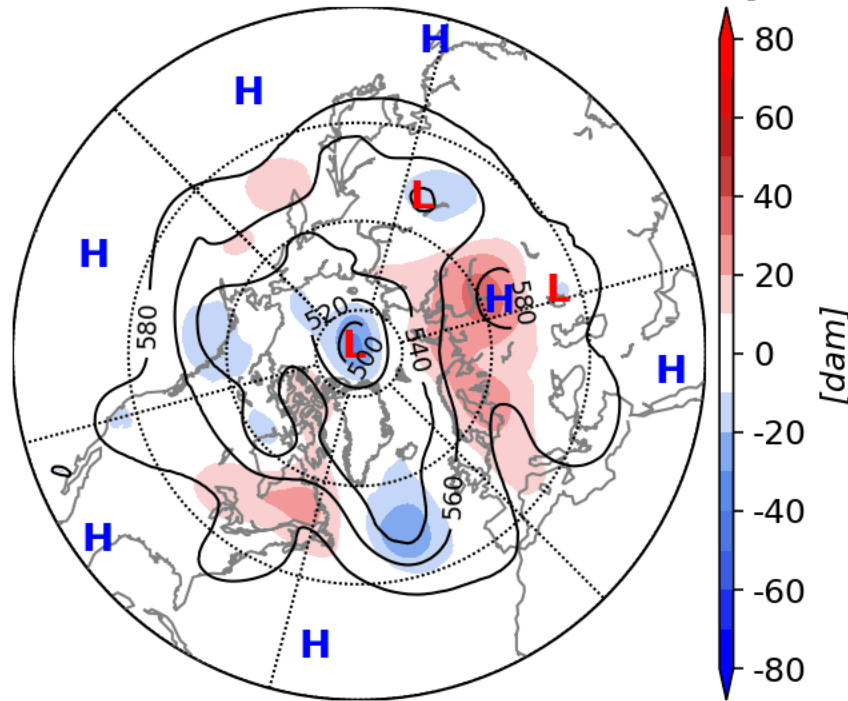


Figure i. Initialized 500 mb geopotential heights (dam; contours) and decameter anomalies (dam; shading) across the Northern Hemisphere for 28 Sep 2026 and forecasted from 29 Sep to 13 Oct 2026. The forecasts are from the 00Z 28 Sep 2026 GFS model.

Beginning the first week of October but maturing in the second week of October, a western North America ridge-eastern North America trough dipole takes shape. This will likely bring record warm temperatures to western North America and finally allow the calendar to catch up to Eastern Canada, where summer just won't let go. Another region where summer is acting like the dinner guest that doesn't know when to leave is in the Southeastern US and maybe the eastern trough will finally usher in a more fall like pattern. The Western ridge/eastern trough pattern is the culmination or mature stage of a stretched PV. But given that the lifespan of stretched PVs is days or weeks and not months, I am not prepared to declare summer 2026 has left the building so to speak.

Unlike in the previous blog, the PV stretch is more visibly and easy to discern in the latest PV animation (see in **Figure ii**) than in last week's animation. At the beginning of the animation, the PV is circular in shape and consistent with a relatively strong PV. However, over the next two weeks the PV elongates from Siberia to Central Canada with the strongest lowering of geopotential heights takes place over Canada with high-pressure ridging building near the Dateline. It still might be early October but that is a good-looking PV stretch. From what I have

seen the temperature forecast for the Eastern US are not that impressive as far as cold, but I would expect forecasts to trend colder as we get closer to the event.

Initialized 00Z 10 hPa HGT/HGTa 28-Sep-2026

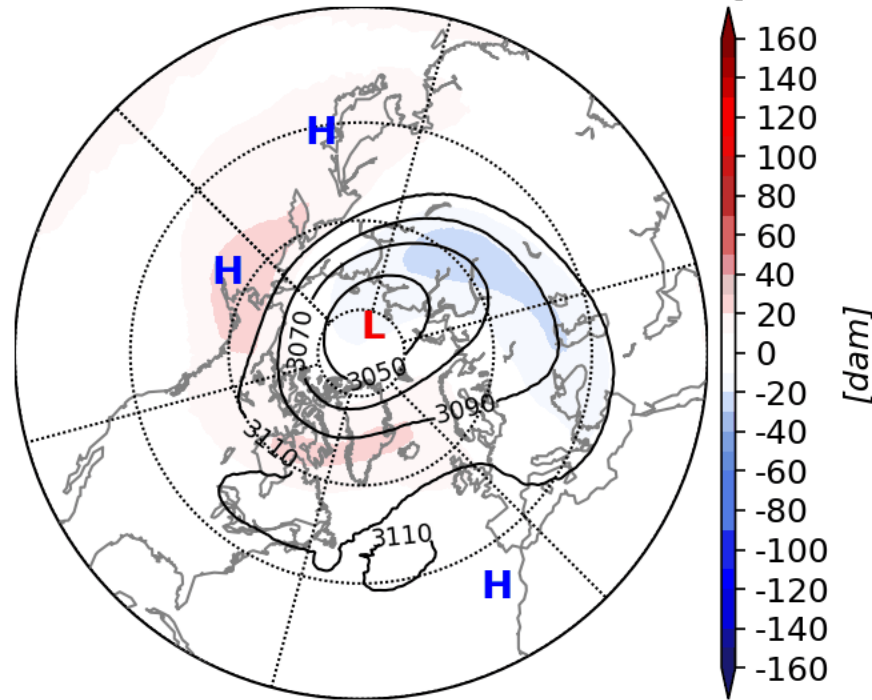


Figure ii. Initialized 10 mb geopotential heights (dam; contours) and decameter anomalies (dam; shading) across the Northern Hemisphere for 14 Sep 2026 and forecasted from 15 Sep to 29 Sep 2026. The forecasts are from the 00Z 14 Sep 2026 GFS model.

What is a tantalizing question for me - does this stretched PV have any significance beyond this early October event. Is it one and done or a preview of the winter? Somewhere in between? I don't know and I assume no one else does either but if you do, please fill me in! My own (along with collaborators) analysis has shown that stretched PVs have been increasing in frequency. To me a critical year or a pivotal shift in PV behavior is 2013. Let's say between 2000 and 2013 PV behavior was dominated by SSWs coupled with the canonical response of Greenland blocking/negative -NAO and the cold temperatures focused in Northern Eurasia and then since 2013, PV behavior has been dominated by PV stretching and North Pacific blocking and a negative North Pacific Oscillation with the cold focused in East Asia and central North America. These two statements are of course generalizations and are not true for all winters in those periods but seem to me to be true on average. And this change in PV behavior has contributed to different temperature patterns across the Northern Hemisphere. So, is winter 2026/27 going to follow the trend? As much as I like to write the trend is your friend, obviously I don't know.

Since 2013 there was one moderate El Niño in winter 2023/24 and a Super El Niño in 2015/16. While there was PV stretching in both winters, the overall winter does not fit the generalization I just described above and, in both winters, North America was quite mild and the winters fit the typical El Niño temperature pattern. There was also a weak El Niño in 2018/19 and that winter I think fits nicely my generalization of PV stretching dominant winters (though I admit an impressive SSW did occur in January 2019, so it is a bit more complicated than my simple categorization).

So, while it might be easy to jump on the PV stretching train based on the forecast, I am resisting the temptation for now and I want to see more. But I do think this early PV stretch at least teases with what is possible. But recent El Niño in winters argue for something different. But if nothing else to me the winter forecast is not straightforward.

As I mentioned in the previous blog, my expectations were that the end of the sea ice melt season was imminent. The sea ice minimum was called right around the publication of the blog and as I also wrote the looked very similar to the Arctic sea ice minimum of last year, and indeed they were nearly identical at 4.6 million sq/km². Sea ice is well below normal both in the North Pacific side of the Arctic and North Atlantic sector of the Arctic (see **Figure iii**). 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. I will just note that last fall sea ice grew much faster on the North Pacific side of the Arctic and in late fall and during the winter anomalies were strongly focused in the North Atlantic. For now, I see little reason to expect something different this fall and winter.

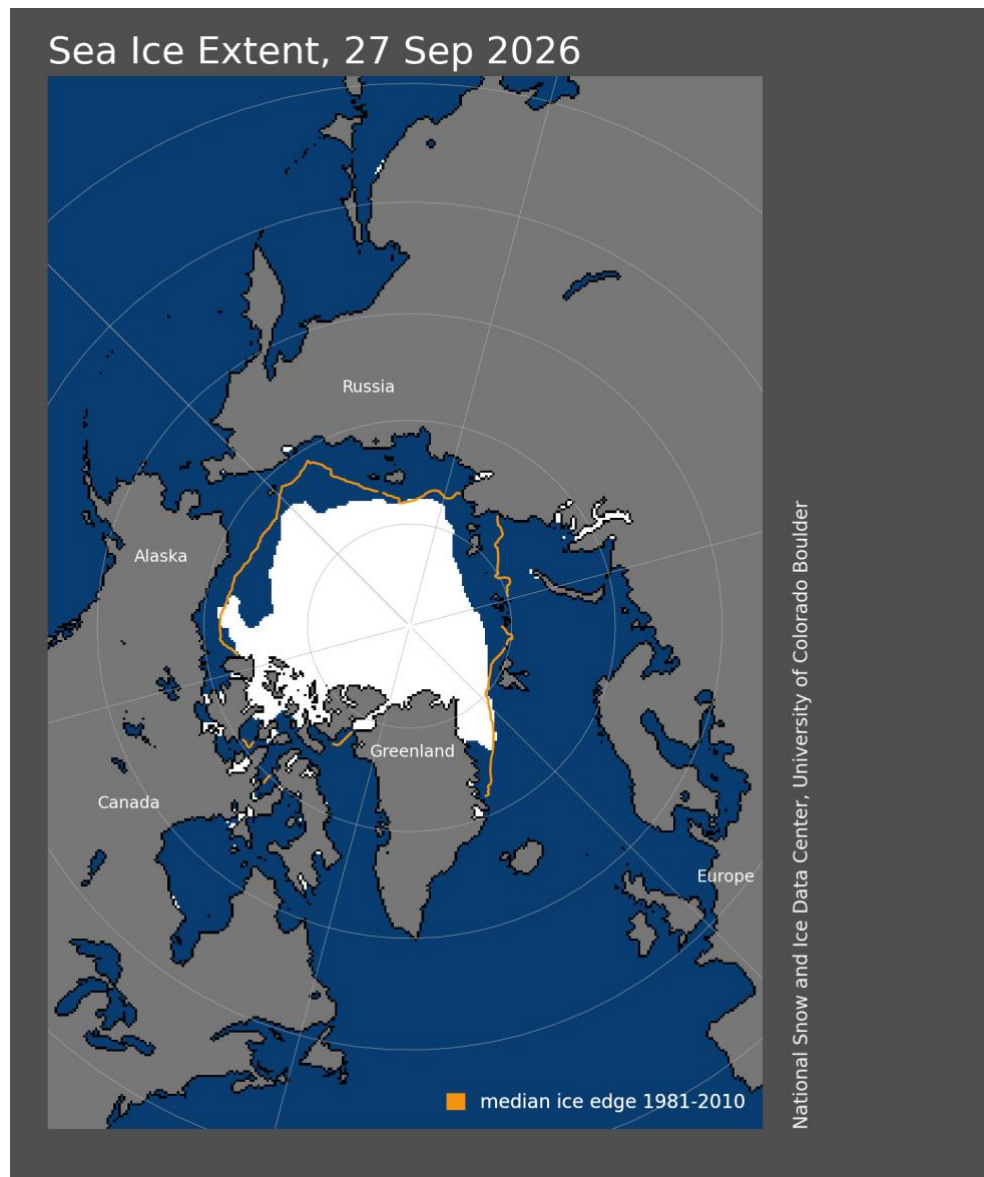


Figure iii. Arctic sea ice cover extent for 27 Sep 2026. White depicts ice covered areas and the orange contour the climatological extent of Arctic sea ice for the date. Plot taken from: <https://nsidc.org/sea-ice-today>

With October beginning this week, my attention will of course be turning to Siberian snow fall. Currently the story is mixed but it is very early. I do think the potential exists for a rapid start to the month but forecasting snow in Siberia is challenging so you can't use the models to predict too far into the future. El Niño falls tend to favor more extensive advances of Siberian snow cover, though over the past six years the variability has flatlined, so I think where the final number ends up is an open question. I will just end that I am becoming more convinced that it is not just the total number that is important but the pattern of snow cover. Last winter I think the pattern of snow cover was a better predictor than the total number.

Near-Term

This week

The AO is predicted to be near 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 but weak geopotential height anomalies across Greenland (**Figure 2**), the NAO is predicted to oscillate either side of neutral this week.

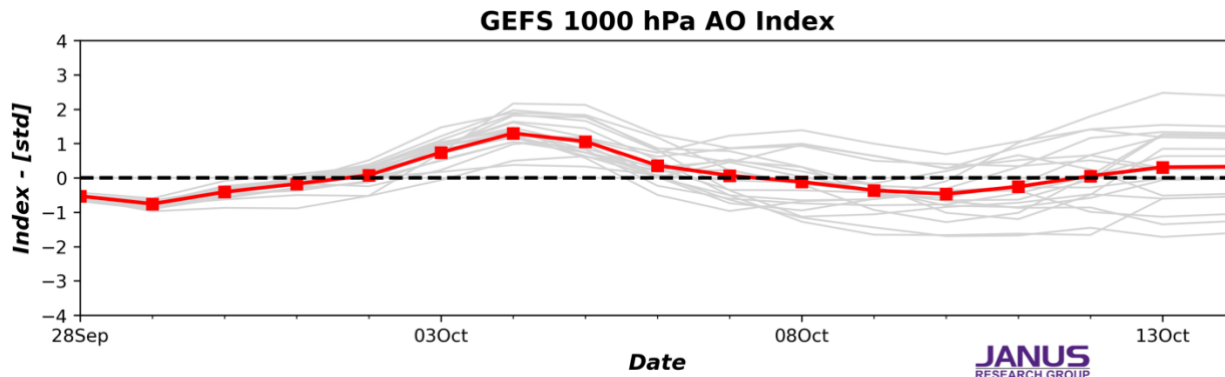


Figure 1. The predicted daily-mean AO at 1000 hPa from the 00Z 14 Sep 2026 GFS ensemble. Gray lines indicate the AO index from each individual ensemble member, with the ensemble mean AO index given by the red line with squares.

Predicted troughing/negative geopotential height anomalies across Greenland is predicted to support ridging/positive geopotential height anomalies across much of Europe centered on Scandinavia with troughing to the south across the Eastern Mediterranean this week (**Figure 2**). This pattern will support widespread normal to above normal temperatures across much of Europe including the UK except for normal to below normal temperatures across the Balkans and Turkey this week (**Figure 3**). This week the general pattern across Asia is ridging/positive geopotential height anomalies centered across Scandinavia forcing broad troughing/negative geopotential height anomalies Northern Asia with two tentacles in Southwest and Northeast Asia 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 and Northeast Asia this week (**Figure 3**).

GEFS 1-5 Day Forecast 500 hPa Anomaly
INIT: 00Z 09/28/2026 FCST: 09/29/2026 to 10/03/2026

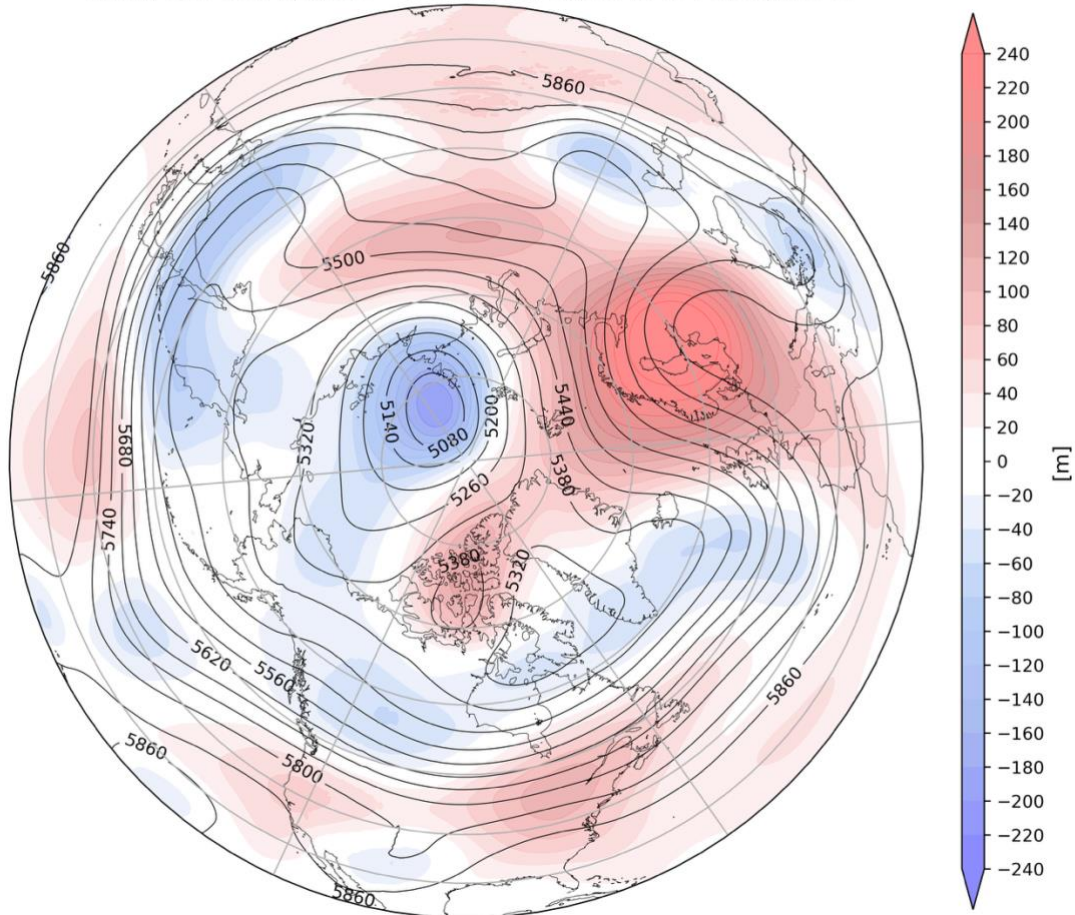


Figure 2. Forecasted average 500 mb geopotential heights (dam; contours) and geopotential height anomalies (m; shading) across the Northern Hemisphere from 29 Sep 2026 to 3 Oct 2026. The forecasts are from the 00Z 28 Sep 2026 GFS ensemble.

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

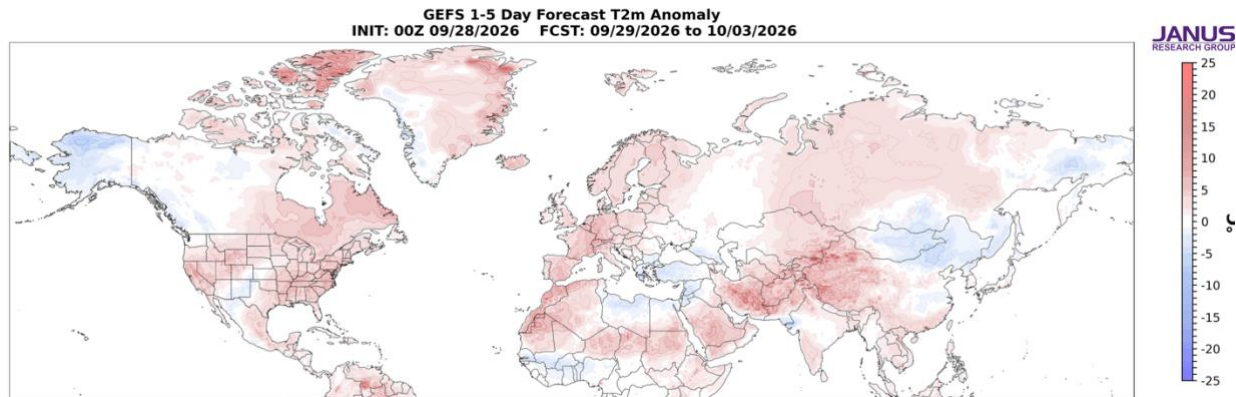


Figure 3. Forecasted surface temperature anomalies ($^{\circ}\text{C}$; shading) from 29 Sep 2026 to 3 Oct 2026. The forecasts are from the 00Z 28 Sep 2026 GFS ensemble.

Troughing will support new rainfall across Southern Europe, the Eastern Mediterranean, Northern Siberia, Northeast Asia and Southeast Asia with mostly dry conditions across much of Europe and Asia (**Figure 4**). Much of the above normal rainfall in North America is associated with a cold front interacting with the remains of Hurricane Polo across Northern Mexico and the Central US with mostly dry conditions across much of Alaska and Canada this week (**Figure 4**).

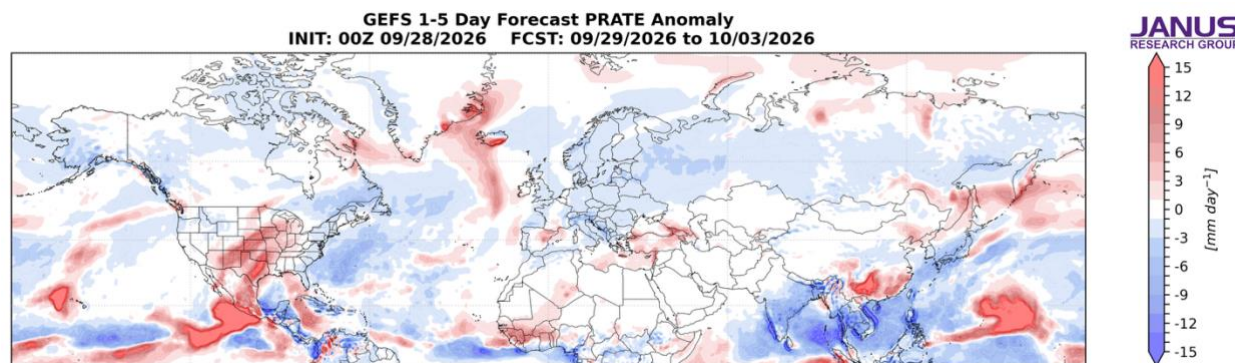


Figure 4. Forecasted precipitation (mm/day; shading) from 29 Sep 2026 to 3 Oct 2026. The forecasts are from the 00Z 28 Sep 2026 GFS ensemble.

Near-Mid Term

Next week

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

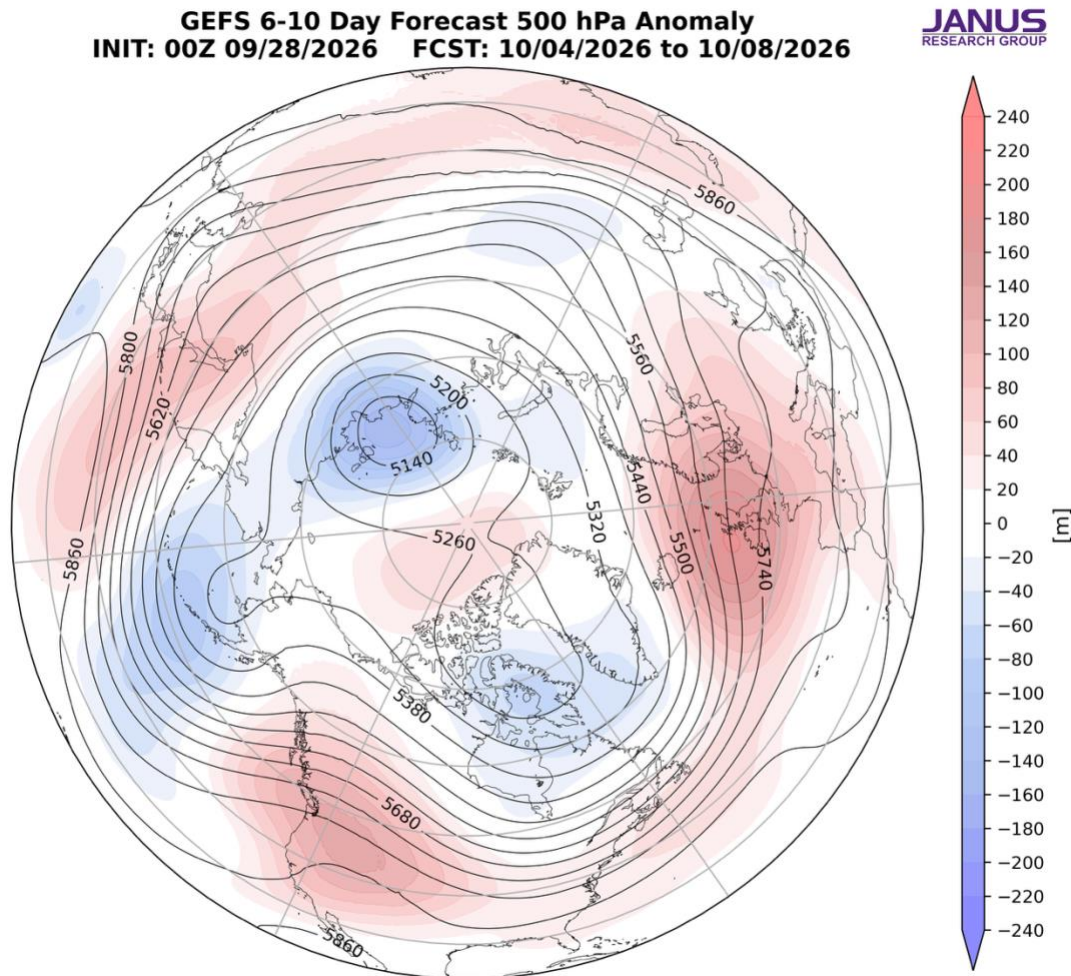


Figure 5. Forecasted average 500 mb geopotential heights (dam; contours) and geopotential height anomalies (m; shading) across the Northern Hemisphere from 4 Oct 2026 to 8 Oct 2026. The forecasts are from the 00Z 28 Sep 2026 GFS ensemble.

Persistent troughing/negative geopotential height anomalies across Greenland is predicted to support ridging/positive geopotential height anomalies across much of Europe centered on the UK with remnant troughing to the south across the Eastern Mediterranean this week (**Figure 5**). The pattern will support widespread normal to above normal temperatures across Europe including the UK except for normal to below normal temperatures across the Balkans and Turkey this period (**Figure 6**). The ridging/positive geopotential height

anomalies centered across Northern Europe will continue to support broad troughing/negative geopotential height anomalies across Northern Asia with the deepest south extension Central Asia more ridging across Southern Asia this period (**Figure 5**). This pattern favors widespread normal to above normal temperatures widespread across Asia but especially Western China with normal to below normal temperatures across Siberia and Kazakhstan this period (**Figure 6**).

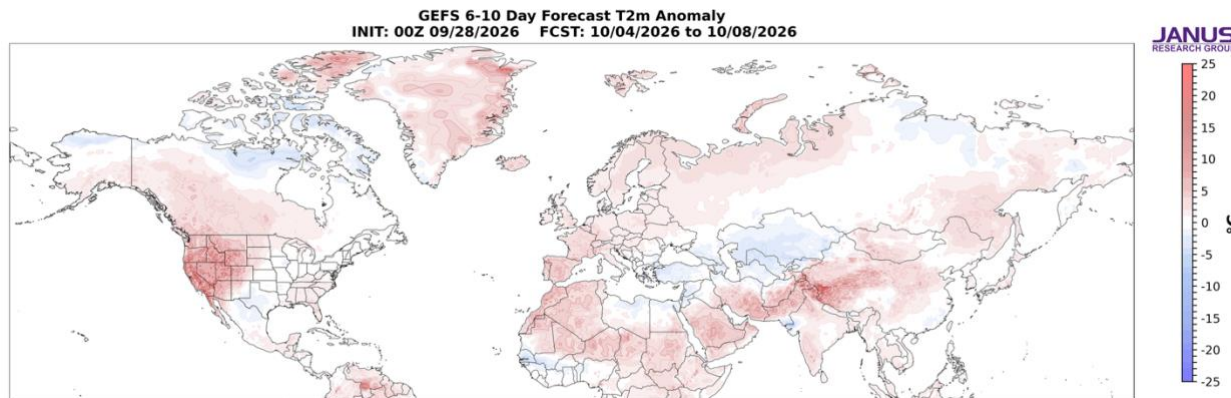


Figure 6. Forecasted surface temperature anomalies ($^{\circ}\text{C}$; shading) from 4 Oct 2026 to 8 Oct 2026. The forecasts are from the 00Z 28 Sep 2026 GFS ensemble.

In response to a stretched PV, across North America previous ridging/positive geopotential height anomalies in eastern North America will take hold instead across Alaska, Western Canada and the Western US with troughing/negative geopotential height anomalies across Eastern Canada and the Eastern US this period (**Figure 5**). This pattern will favor normal to above normal temperatures widespread across Alaska, Western Canada and the Western US with colling temperatures across Northern and Eastern Canada and the Eastern US this period (**Figure 6**).

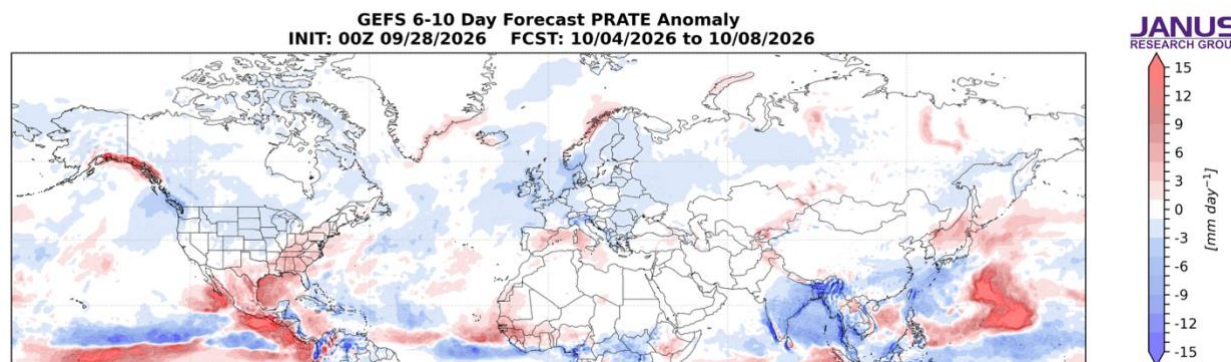


Figure 7. Forecasted rainfall rate (mm/day; shading) from 4 Oct 2026 to 8 Oct 2026. The forecasts are from the 00Z 28 Sep 2026 GFS ensemble.

Troughing will support new rainfall across Spain, Norway, Eastern Siberia and Central Asia with mostly dry conditions across much of Europe and Asia (**Figure 7**). Troughing will support new rainfall across the Alaskan Panhandle, the US Southern Plains and the Eastern US with mostly dry conditions across much of North America this week (**Figure 7**).

Mid Term

Week Two

With predicted mostly mixed geopotential height anomalies across the Arctic and mixed geopotential height anomalies across the mid-latitudes this period (**Figure 8**), the AO will likely remain near neutral 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.

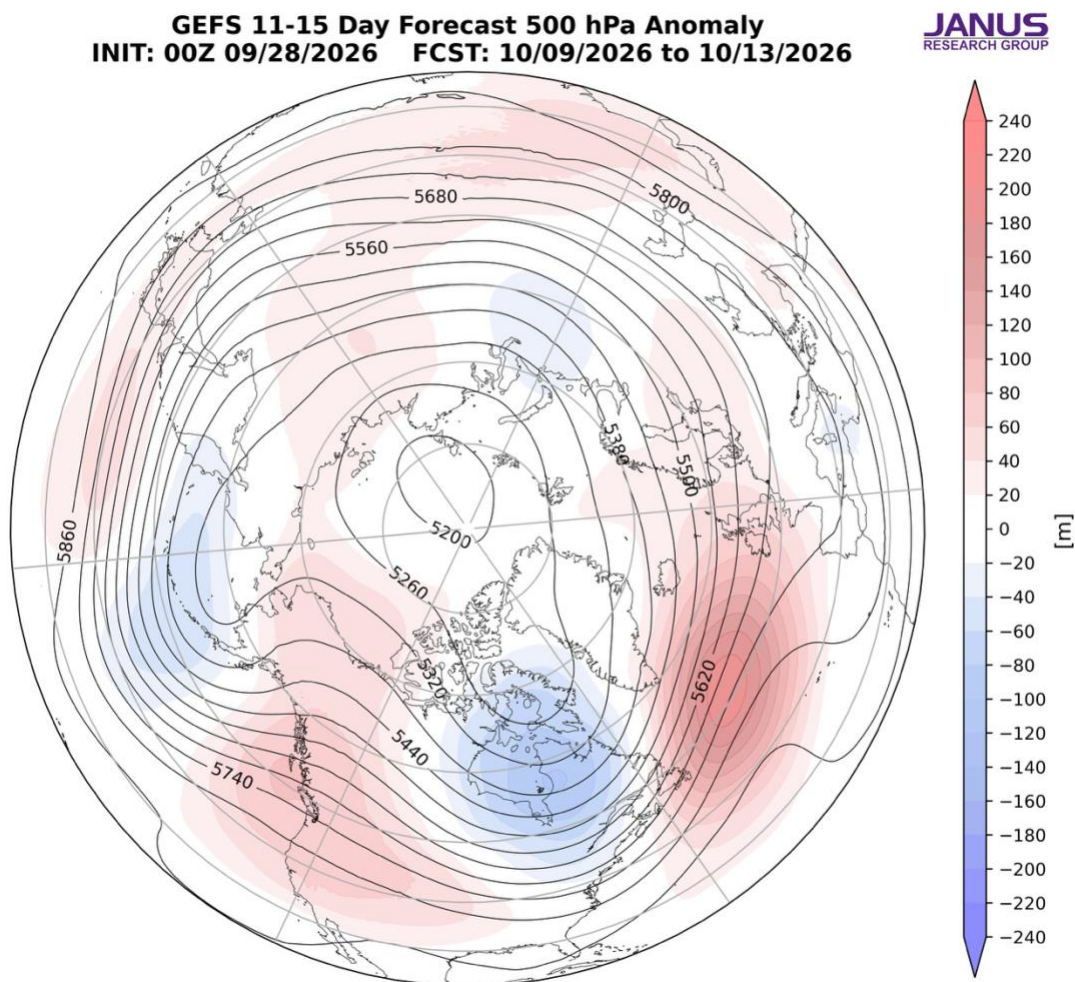


Figure 8. Forecasted average 500 mb geopotential heights (dam; contours) and geopotential height anomalies (m; shading) across the Northern Hemisphere from 9 Oct to 13 Oct 2026. The forecasts are from the 00Z 28 Sep 2026 GFS ensemble.

As the former ridging/positive geopotential height anomalies across Northern Europe continues to slide west, a more zonal flow pattern is predicted across Europe this period (**Figure 8**). This pattern will favor widespread normal to above normal temperatures across much of Europe

including the UK this period (**Figures 9**). The zonal flow pattern from Europe is predicted to extend across Asia as well with ridging/positive geopotential height anomalies centered across Southern Asia with broad troughing/negative geopotential height anomalies across Northern Asia this period (**Figure 8**). This pattern favors widespread normal to above normal temperatures across most of Asia especially Western Siberia and Central Asia with normal to below normal temperatures limited to Western Russia, Eastern Siberia and Northeast Asia India this period (**Figure 9**). I think the models are struggling with the overall pattern across Eurasia, and I am skeptical of the forecast.

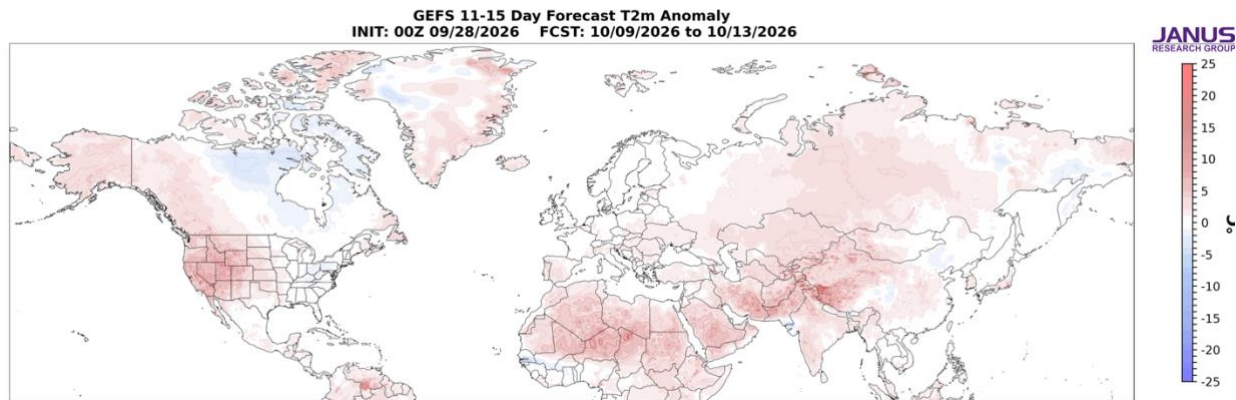


Figure 9. Forecasted surface temperature anomalies ($^{\circ}\text{C}$; shading) from 9 Oct to 13 Oct 2026. The forecasts are from the 00Z 28 Sep 2026 GFS ensemble.

Ridging/positive geopotential height anomalies are predicted to persist across Alaska, Western Canada and the Western US forcing troughing/negative geopotential height anomalies across Eastern Canada and the Eastern US this period (**Figure 8**). This pattern supports widespread normal to above normal temperatures across Alaska, Western Canada and the Western US with normal to below normal temperatures across Eastern Canada and Eastern US this period (**Figure 9**).

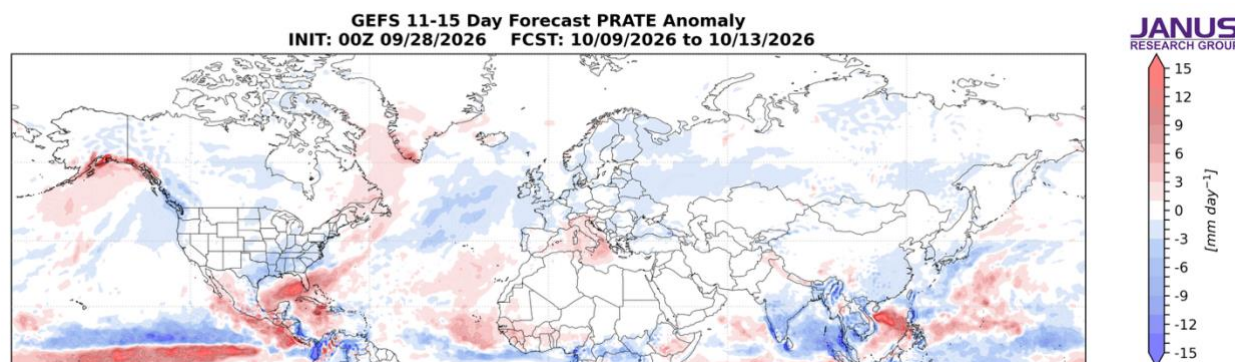


Figure 10. Forecasted rainfall (mm/day; shading) from 9 Oct to 13 Oct 2026. The forecasts are from the 00Z 28 Sep 2026 GFS ensemble.

Troughing will support new rainfall across Italy and the Tibetan Plateau and into northern India with mostly dry conditions across much of Europe and Asia (**Figure 10**). Troughing will support new rainfall across southern Alaska, the Canadian Maritimes and Florida with mostly dry conditions across much of North America this week (**Figure 10**).

Longer Term

30-day

The PCH plot did not generate today or any recent day. Please ignore the figure and text in this section.

Today's polar cap geopotential height anomalies (PCHs) plot currently shows cold/negative PCHs in the upper stratosphere and lower troposphere with warm/positive PCHs in the lower stratosphere and the upper troposphere (**Figure 11**). However next week, the warm/positive PCHs in the lower stratosphere and troposphere weaken and even flips cold/negative in the upper troposphere.

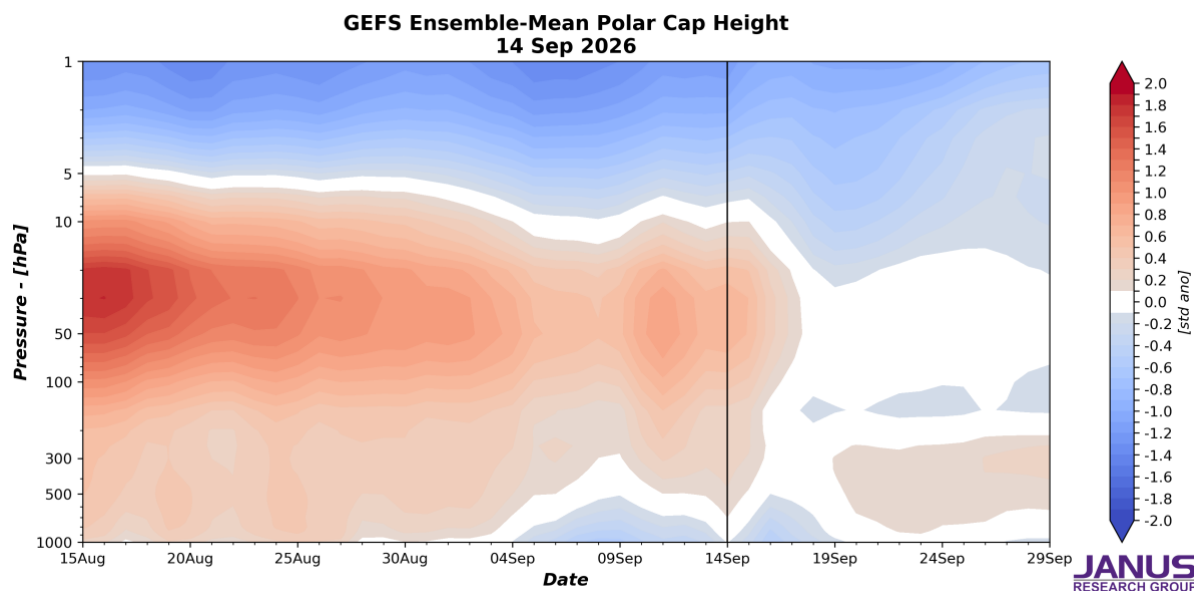


Figure 11. Observed and predicted daily polar cap height (i.e., area-averaged geopotential heights poleward of 60°N) standardized anomalies. The forecast is from the 00Z 14 Sep 2026 GFS ensemble.

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

CFS 500 hPa Forecast Anomaly Oct 2026
Valid as of 28 Sep 2026

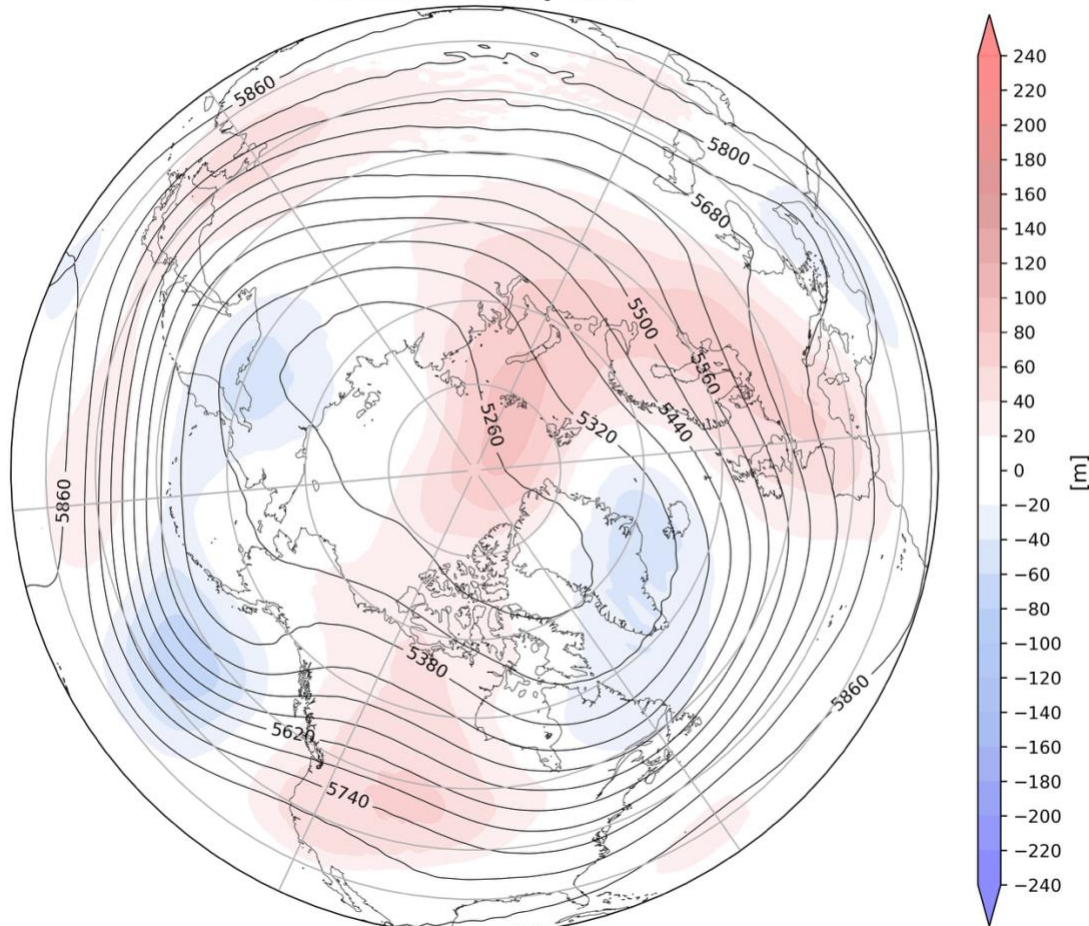


Figure 12. Forecasted average 500 mb geopotential heights (dam; contours) and geopotential height anomalies (m; shading) across the Northern Hemisphere for Oct 2026. The forecasts are from the 00Z 28 Sep 2025 CFS.

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 across Northern Europe and into the Barents-Kara Seas, Southeast Asia, the Western US Western Canada and the Central Arctic with troughing across the Eastern Mediterranean, Siberia, the Gulf of Alaska, Eastern Canada and the Eastern US (**Figure 12**). This pattern favors seasonable to relatively warm temperatures across Europe, much of Central and Southern Asia including the Arabian Peninsula, the Tibetan Plateau, Pakistan and Afghanistan, Northeastern Siberia, Alaska, Western and Central Canada and the Western US with seasonable to relatively cool temperatures across the Eastern Mediterranean, much of Siberia and into Northeast Asia, Eastern Canada and the Eastern US (**Figure 13**).

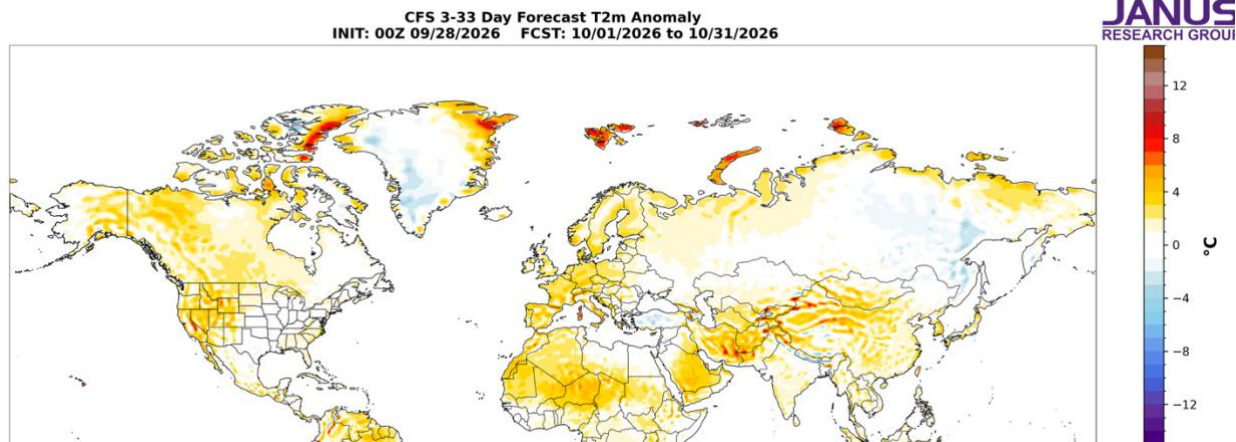


Figure 13. Forecasted average surface temperature anomalies ($^{\circ}\text{C}$; shading) across the Northern Hemisphere for Oct 2026. The forecasts are from the 00Z 28 Sep 2026 CFS.

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.

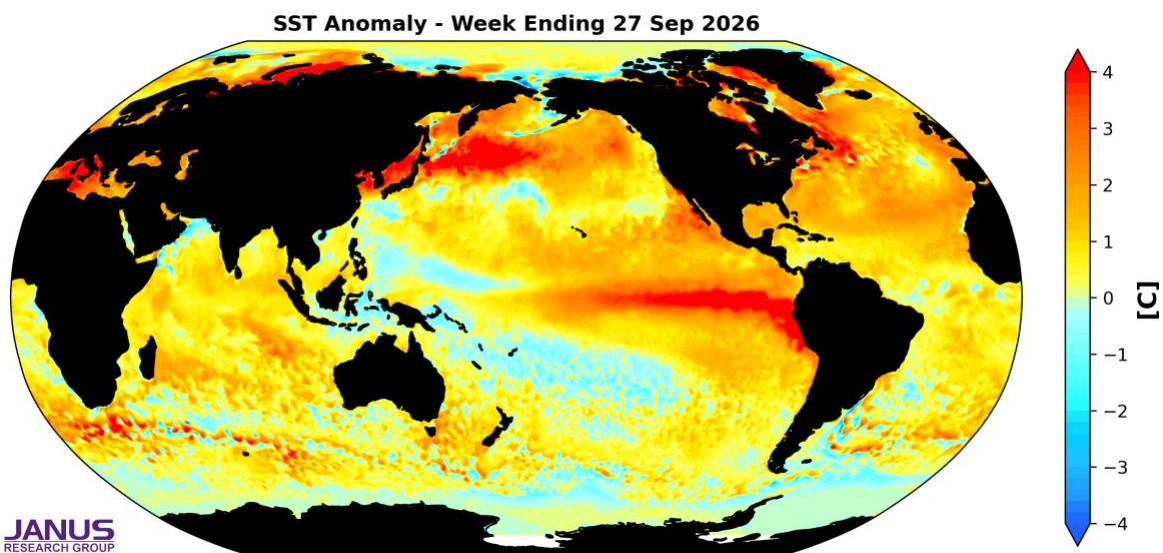


Figure 14. The latest daily-mean global SST anomalies for week ending 27 Sep 2026.

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 mostly no phase is favored but may briefly pop into phases eight or one but barely the next two weeks (**Figure 15**). Neither phase seems to favor strong ridging over western North America, therefore, it seems that the MJO is having little influence on North American weather next week. But admittedly this is outside of my expertise.

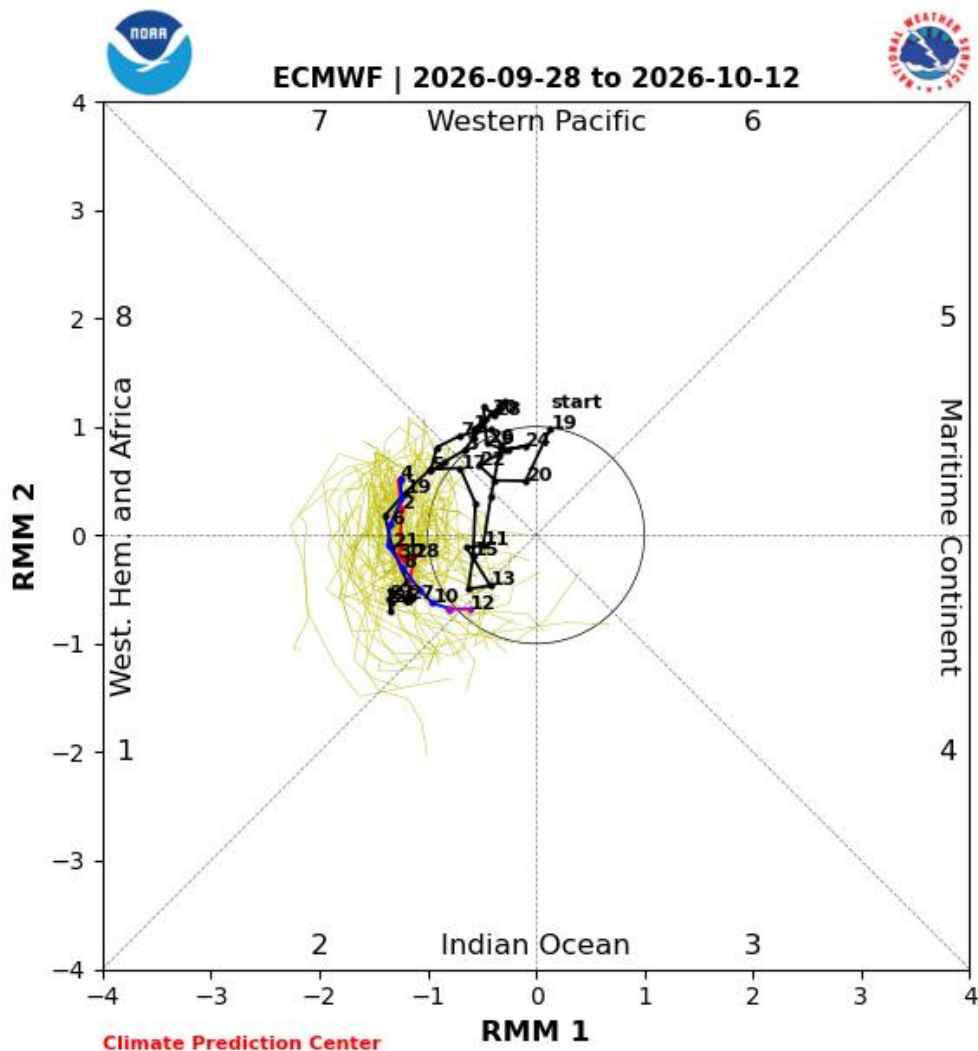


Figure 15. Past and forecast values of the MJO index. Forecast values from the 00Z 28 Sep 2026 ECMWF model. Yellow lines indicate individual ensemble-member forecasts, with the green line showing the ensemble-mean. A measure of the model 'spread' is denoted by the gray shading. Sector numbers indicate the phase of the MJO, with geographical labels

indicating where anomalous convection occurs during that phase. Image source
<https://www.cpc.ncep.noaa.gov/products/precip/CWlink/MJO/CLIVAR/ecmf.shtml>

Get Detailed Seasonal Weather Intelligence with [sCast](#)

We appreciate your taking the time to read the public Arctic Oscillation blog from Dr. Judah Cohen and the AER Seasonal Forecasting team.

Dr. Cohen's detailed monthly seasonal forecast, sCast, is also available. [sCast](#) provides a monthly 30-60-90-180-day outlook into temperature and precipitation, solar flux and wind anomalies across the globe, and regional population weighted cooling and heating degree forecasts for the US.

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!