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Arctic Oscillation and Polar Vortex Analysis and Forecasts

December 29, 2025

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 and is predicted to trend to near neutral the next two weeks as pressure/geopotential height anomalies across the Arctic are currently mostly positive and are predicted to remain mostly positive this week and then turn mostly mixed next week. The North Atlantic Oscillation (NAO) is currently negative as positive pressure/geopotential height anomalies dominate across Greenland, and the NAO is predicted to remain negative the next two weeks as pressure/geopotential height anomalies are predicted to remain mostly positive across Greenland the next two weeks.
- Strong ridging/positive geopotential height anomalies across Greenland will support deep troughing/negative geopotential height anomalies across Europe the next two weeks. This pattern will favor normal to below normal temperatures across much of Europe including the United Kingdom (UK) this week and then retreating to Northern and Western Europe including the UK with normal to above normal temperatures across Southern and Eastern Europe next week.
- The general pattern across Asia the next two weeks is an omega block with troughing/negative geopotential height anomalies across Western and Eastern Asia with ridging/positive geopotential height anomalies across Central Asia. This pattern favors normal to below normal temperatures across Western and parts of Eastern Asia with normal to above normal temperatures across Southern and especially Central Asia.

- The general pattern across North America the next two weeks is ridging/positive geopotential height anomalies centered initially near the Dateline that slowly slides east to near Alaska and centered over Greenland and Baffin Bay that will support troughing/negative geopotential height anomalies across Western North America and the Eastern US. This patten will favor normal to below normal temperatures across Alaska, Western and Southeastern Canada and the Northeastern US with normal to above normal temperatures across Northeastern Canda and much of the US.
- I have been discussing how the polar vortex (PV) can walk through three doors and therefore the weather. The PV took a step towards to but decided to keep door number one closed, so which door is the PV now heading towards, door number two or three? My thoughts below.

Plain Language Summary

Winter has made a quick appearance in Western and Central Siberia, Alaska, Canada and the Northeastern US (see **Figure**). In contrast it has been slow to start in Europe, Western, Central and Eastern Asia, Eastern Siberia and the Western and Southern US (see **Figure**). The forecast heading into the New Year can quickly summarized as an expansion of the cold across Europe thanks to Greenland blocking and a continuation of the pattern across North America with some changes (see **Figures 3, 6** and **9**). In a break from the entire polar vortex (PV) season so far, the PV is predicted to become circular and strong, which favors relatively mild temperatures across the Northern Hemisphere (NH). However I am still riding the "rinse, lather, repeat" PV and weather pattern for the foreseeable future. Basically, alternating stretched PVs (cold) and relaxation to a more circular PV (mild). The jet stream seems to be evolving into a pattern that will keep the PV tap dancing in early January 2026 that delivers more cold.

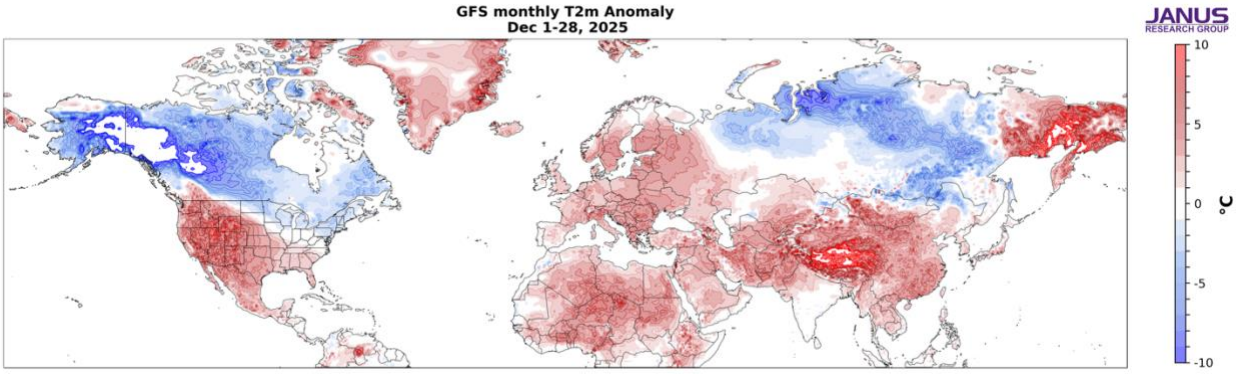

Figure. Estimate of the observed surface temperatures (°C; shading) from 01 Dec to 21 Dec 2025 based on GFS initializations and the GFS forecast from the 29 Dec 2025 run.

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Impacts

As is my habit this season I first discuss the two-week forecast for the mid-tropospheric circulation, which helps set the table for what I am expecting with the polar vortex (PV) and our weather. In addition, I tweeted about the mid-tropospheric circulation yesterday about the possibility of the trifecta of high latitude blocking centered near Alaska, Greenland and the Urals. Cold air advection or the southerly transport of cold air takes place downstream or east of the centers of high-pressure ridging given the clockwise circulation so therefore if blocking high pressure is located on the western edges of the continents, that is a supportive setup for cold across the eastern edges of the continents. Alaskan blocking favors cold temperatures across North America east of the Rockies, Greenland blocking favors cold temperatures across Europe (Greenland is really part of North America but given the short distance to Europe and the relatively small size of Europe the dynamics still work the same) and finally Ural blocking favors cold temperatures across Central and/or East Asia.

I do write many papers these days arguing that winter has been more resilient or tenacious across the mid-latitudes compared to our expectations or model predictions. However, it also seems to me that there is no arguing that the pool of cold or Arctic air at high latitudes is contracted today compared to 40 or 50 years ago (with the cold becoming stingiest with Europe). So, I think it was always hard to get cold air outbreaks to two but especially three regions simultaneously but it is even more challenging today. So of the forecasts of a trifecta or three simultaneous or in close temporal proximity high pressure blocking in Alaska, Greenland and the Urals would be rare event and could bring an unusually expansive amount of Arctic air to the population centers of the Northern Hemisphere (NH). But this remains speculative and always good to be skeptical of rare weather events.

Once again, the mid-tropospheric circulation is characterized by low pressure centered near the North Pole and high-pressure ridging floating around the mid- to high-latitudes (see **Figure i**). Initially, there are two dominant high latitude blocking high pressure centers one centered near the Dateline and the other currently centered over Iceland. In short, the circulation pattern over the next two weeks can be characterized by ocean ridging in both the North Atlantic and North Pacific with continent troughing mostly at the higher latitudes of both Eurasia (with the exception of Central Asia) and North America. And overall, we are seeing winter conditions continue across North America and finally expanding beyond Siberia especially into Europe. By the end of the animation the “trifecta” can be seen with blocking near Alaska, Greenland and the Urals. Though admittedly the Ural blocking is not very impressive but shows up better in **Figure 8**. But even in **Figure 8**, the Ural blocking is not as distinctive as over Alaska and Greenland.

Last week, I wrote how the tropospheric pattern, did exhibit a wave-two signature that normally supports either a PV split or PV stretching, which is easier to achieve. However, the wave-2 pattern was in quadrature to the ridge/trough axis to either force a large stretched-PV and/or a PV split and therefore not necessarily conducive to forcing a weakening of the PV and there was the possibility of a strengthening PV.

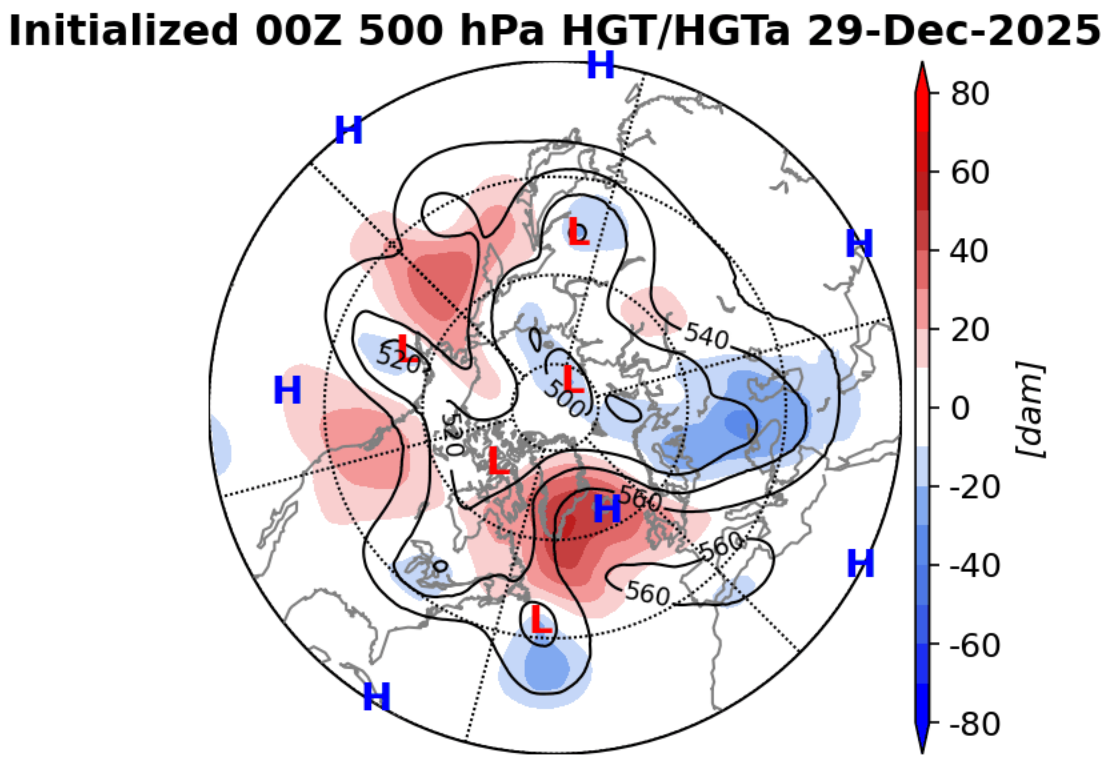

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Figure i. Initialized 500 mb geopotential heights (dam; contours) and decameter anomalies (dam; shading) across the Northern Hemisphere for 29 Dec 2025 and forecasted from 30 Dec 2025 to 13 Jan 2026. The forecasts are from the 00Z 29 Dec 2025 GFS model ensemble.

Last week a strengthening trend of the PV was clearly evident in the weather model forecasts, with all models predicting a clear strengthening and more circular shape of the PV. Therefore, I wrote that in my opinion the PV has taken a deliberate move towards a strengthening PV *or door number one) and by New Year the PV will be turning the handle and opening the door. I was especially concerned about possible blocking high pressure over Siberia, a feature very supportive of a strengthening PV.

But in the end, I was still riding the door number three train or what I like to call a “rinse, lather, repeat” PV and weather pattern for the foreseeable future. Basically, alternating stretched PVs and relaxation to a more circular PV and oscillating or alternating cold and mild periods for East Asia and or North America, that can feature some wild temperature swings. The number one reason why I was still favoring a return of a stretched PV in early January was the forecast of Greenland blocking, which is a fairly reliable predictor of a stretched PV about two weeks later.

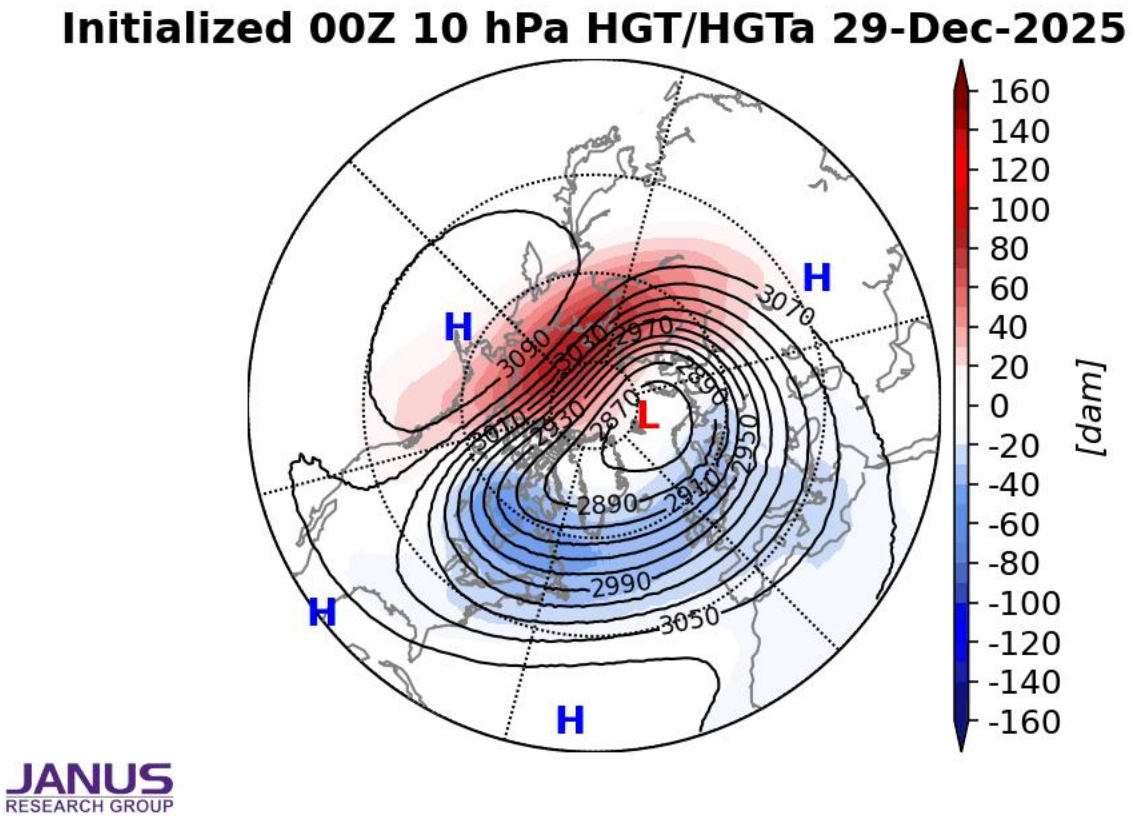


Figure ii. Forecasted average 10 mb geopotential heights (dam; contours) and geopotential height anomalies (m; shading) across the Northern Hemisphere for 29 Dec 2025 and forecasted from 30 Dec 2025 to 13 Jan 2026. The forecasts are from the 00Z 29 Dec 2025 GFS model ensemble.

But some subtle changes in the tropospheric circulation forecasts over the course of the week, once again favor more PV stretching rather than a strengthening PV. I think most importantly is Ural blocking replacing Siberian blocking. But also important is Alaskan blocking replacing Dateline blocking. These two features are ideal for triggering PV stretching. And therefore, not surprising looking at **Figure ii**, the weather models are once again predicting a weakening of the PV for the second week of January following the strengthening of the PV the first week of January. The ensembles are all predicting another stretched PV (see **Figure 12**) but some of the operational models are predicting more of a Canadian warming (including as shown in **Figure ii**, though this seems to have disappeared from the 12z suite of model runs), which is a larger PV disruption. But Canadian warmings themselves often transition to a stretched PV so regardless that seems a strong possibility. A transition to a sudden stratospheric warming (SSW) is also possible but not biting just yet on that scenario.

And as I have been routinely doing, looking at the wave diagnostics in **Figure iii** continues to display wave reflection in early January. Not yet textbook or classic but is looking better than last

week. For both periods shown, wave energy goes up and east over Asia, reflects off the stratospheric PV and then heads down and east over North America where the energy is re-absorbed and could potentially amplify the standing wave over North America and deliver cold air from the Arctic south, east of the Rockies. There is westward wave tilt with height over Asia. And now also eastward wave tilt with height over North America but still not perfect. Though it seems to be just developing the end of the first week of January and becomes better defined the second week of January.

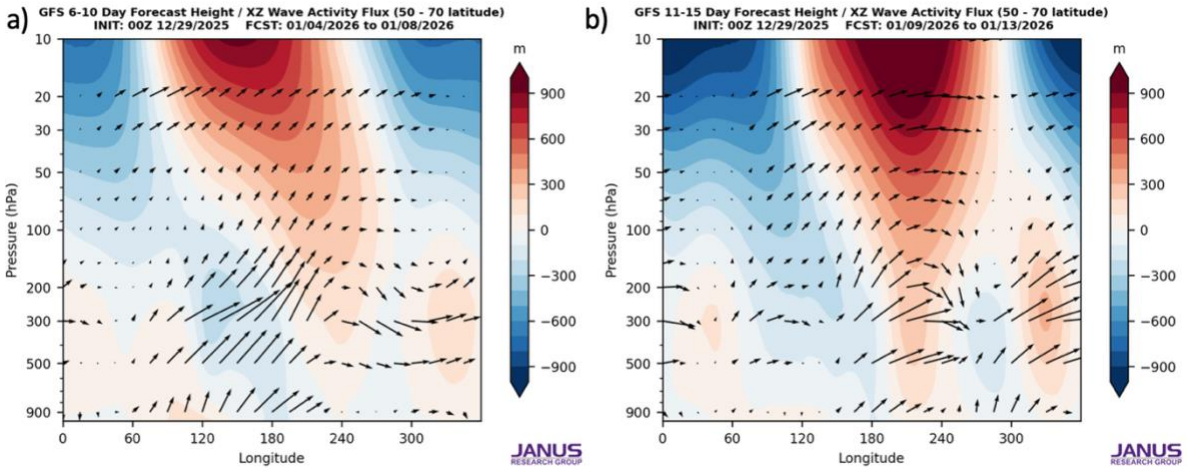


Figure iii. **a)** Longitude-height cross section of geopotential eddy height anomalies (shading) and wave activity flux (vectors) forecasted for 05 December through 4 January through January 2026. **b)** same as a) but for 9 January through 13 January 2026. The forecasts are from the 00Z 22 December 2025 GFS ensemble.

For the past five weeks (and I alluded to it above) I have been doing my best Monty Hall from "Let's Make a Deal" impression. However, again I will keep it short this week. The three doors are: door number one - the reflective layer in the stratosphere that gave rise to the stretched PV also protects the PV from subsequent upwelling energy from the troposphere and allows the PV to strengthen. The second door is, though there is short-term strengthening of the PV, high-latitude blocking resumes its assault on the PV and we see more stretched PVs and/or Canadian Warmings (that often transition to stretched PVs) until finally there is knockout punch and a true sudden stratospheric warming (SSW) either in January or February. And finally, the third scenario is that the stretched PVs just keep repeating for much of the winter punctuated or separated by a relatively strong PV and or Canadian warmings.

At least in my opinion the likelihood or probability of which door is chosen by the PV has changed yet again this week. In my opinion the consistent frontrunner or highest probability remains door number three or alternating stretched PVs and relaxation to a more circular PV and oscillating or alternating cold and mild periods for East Asia and or North America, that can feature some wild temperature swings. I do think both North America and Asia are truly experiencing wild temperature swings (one notable exception is the Northeastern US. Some of the temperature

extremes and swings in temperature and weather in the Central US have been truly head-spinning. @WeatherProf has been good at highlighting many of them.

The second most likely scenario based on current forecasts of the tropospheric circulation is door number two or an eventual SSW. If Ural blocking can persist and strengthen, this scenario becomes increasingly likely. In past blogs I have discussed our polar vortex model. I haven't discussed it this winter because it has pretty consistently been predicting a relatively strong PV. However, it has finally started to predict a weaker PV in late January. The model is heavily flawed but does seem to indicate something has clearly changed.

Least likely now in my opinion is door number one or the runaway strengthening PV coupled with a lack of high latitude blocking and widespread mild temperatures across the mid-latitudes. Weather is a blood sport and drop in rankings can be swift and severe. But once again just subtle changes in the position of the chess pieces across the board can make a big difference. Especially given how notoriously difficult it is for models to predict high-latitude blocking. So, door number one is down but not out, and I think wise to keep it as a consideration rather than completely write it off.

I have consistently favored door number three or what I like to call a "rinse, lather, repeat" PV and weather pattern for the foreseeable future. Basically, alternating stretched PVs and relaxation to a more circular PV and oscillating or alternating cold and mild periods for East Asia and or North America, that can feature some wild temperature swings. Eventually the pattern could transition to either door number one, persistently strong PV or door number two, a major SSW. As I wrote earlier door number one is currently not on the table. Last week I didn't think that the circulation pattern would support a runaway train of a PV (i.e., strong PV) and the models are now consistent with this thinking.

As I have been writing in the recent blogs, it is my belief that the true face of winter tends to reveal itself around the New Year. Given the likelihood of another stretched PV, cold in parts of North America looks like a good bet for the winter mean. Alaska and Western Canada have been extremely cold, and it would take a lot to erase a deficit of that magnitude. But I think the Northeastern US is another region that just might buck the recent decadal trend of large warming and average cold for the winter as a whole. The region of below normal temperatures in the Eastern US shrunk by an impressive amount given the recent incredible stretch of record warm temperatures. Also, the caveats that I have been sharing with stretched PVs still applies for the second week of January, the models are always playing catch up and it is often much colder than first predicted by the models.

Europe is more difficult or even more interesting. Early January looks certainly to be cold and is especially impressive relative to recent winters. However, as I discuss below, I don't think that it is related to the downward influence from the stratosphere and is therefore likely to be transient. I think this is especially likely if we get a textbook stretched PV that energizes the North Atlantic jet and floods Europe with relatively mild, maritime air. This scenario is suggested by the GFS. The Canadian and ECMWF models show Greenland blocking hanging in longer and persisting the

cold in Europe longer. I also posted on social media or AI forecast of the probability of extreme cold across the globe for mid-January. A surprising region where the possibility of extreme cold was elevated was Europe. Obviously, this scenario is most likely according to the ECMWF and Canadian models and not at all according to the GFS. As far as the behavior of the PV, this would be supported by a Canadian warming much more than a stretched PV, especially if the Canadian warming transitions to an SSW, then the cold in Europe could persist for much of the remainder of winter. I don't believe this scenario is most likely right now but certainly plausible and something to watch.

I did want to end today's discussion on a more academic note because I think it is very interesting and it is a continuation of the discussion from the 15 Dec 2025 blog. As I have been discussion and plenty of others for over a month now there was much hype paid to whether a major sudden stratospheric warming (SSW - defined as a reversal of the wind from westerly to easterly at 60°N and 10 hPa) occurred in late November at the peak of the PV disruption. I of course framed it as an extreme stretched PV that I thought provided a better framework for temperature forecasts. I certainly try to make the weather pattern as simple as possible when deciding on a forecast. That is how both advantages and disadvantages. Now that we can look back on the whole moth of December, that simplified thinking was justified as it was cold Alaska, Western Canada and in the Northeastern US. In the eastern hemisphere it has been relatively cold in Siberia and into Northeast Asia but very mild in Europe. This temperature pattern is consistent with a stretched PV and not really an SSW, though could be (seems to happen with a PV displacement). But certainly, when you average over all stretched PVs and all SSWs, it matches nicely with stretched PVs and clearly not SSWs. However, in the 1 Dec 2025 blog I did conceded it might be a hybrid of sorts. There is the question of whether it qualified as a major SSW and I think that has not been fully answered yet.

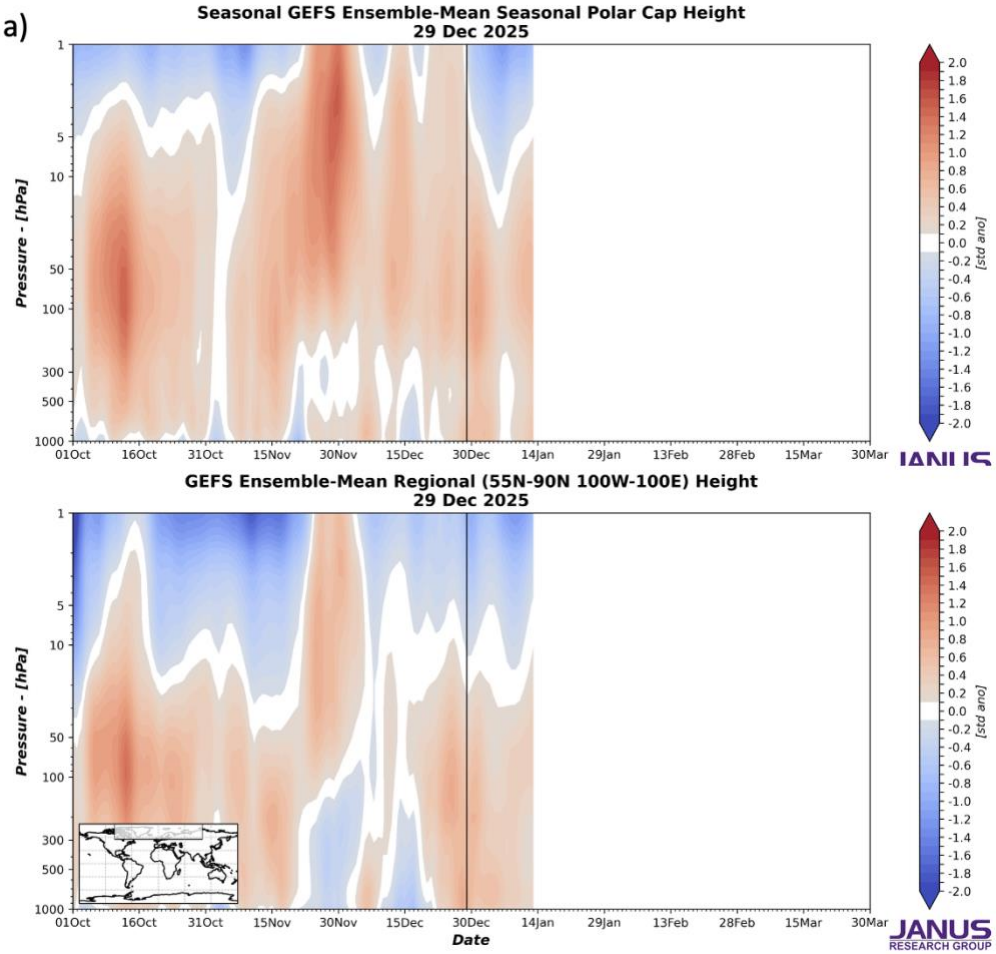


Figure iv. a) Observed and predicted daily polar cap height (i.e., area-averaged geopotential heights poleward of 60°N) standardized anomalies. The forecast is from the 00Z 29 Dec 2025 GFS ensemble. **b)** same as **a)** but for the North Atlantic sector of the arctic only (see insert). Both plots are for more extended seasonal period.

I bring this up today once again because I saw on social media linking the predicted Greenland block with the SSW in November and referring to it as the classical response to an SSW. I don't think this is necessarily wrong, but I also caution to agreeing with this argument. I concede when looking at the polar cap geopotential height anomalies (PCHs) below in **Figure 11**, it gives the appearance of the classical dripping paint plot associated with (absorbing) SSW events in the polar stratosphere. I can't recall something similar with pure wave reflecting events. I have not been following stretched PVs for that long and certainly not as long as SSWs, but I really can't recall something similar with other stretched PVs.

But now why I am not ready to concede it is a classic SSW and response. First the Greenland blocking is occurring more than a month after the SSW, not within two weeks of the SSW as demonstrated in previous studies. But what is even more compelling to me is looking at the seasonal PCHs for the full Arctic and for the PCHs limited to the North Atlantic sector of the Arctic in **Figure iv**. When looking at the full Arctic PCHs, the upcoming period of high latitude

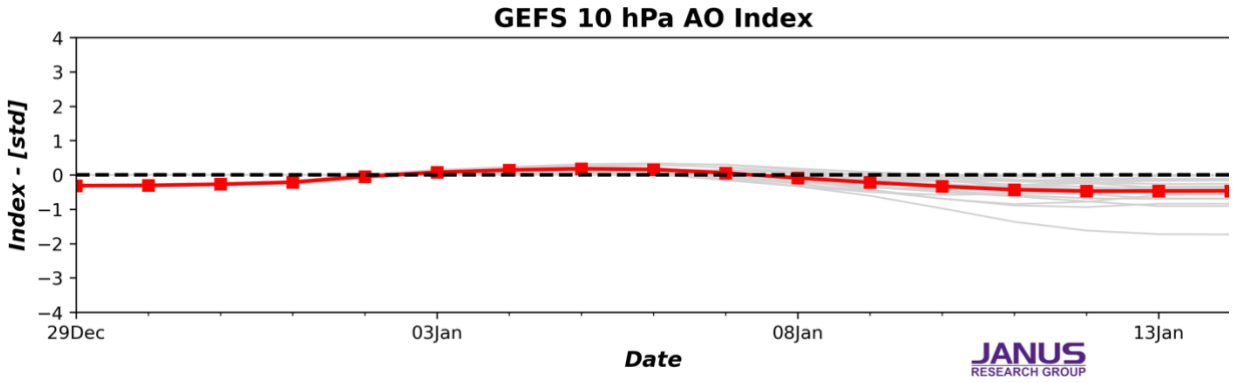
blocking and warm/positive tropospheric PCHs there is an unbroken connection to the warm/positive stratospheric PCHs that occurred during the SSW in question in late November. However, the story looks different when looking at the warm/positive PCHs limited to the North Atlantic sector of the Arctic. For the upcoming period of high latitude blocking and warm/positive tropospheric PCHs (dominated by the Greenland blocking) there is no continuous connection to the warm/positive stratospheric PCHs that occurred during the SSW in question in late November. The SSW is still visible in late November but the upcoming period of warm/positive tropospheric PCHs seems to be independent of the SSW and really a tropospheric only phenomenon.

This seems to be a very interesting case an in my opinion with no easy or simple way to categorize it. It is challenging to fit into a pre-conceived and designed cookie cutter description of stratospheric tropospheric coupling or downward influence. Also, a sobering reminder that our record of the weather and the atmosphere is relatively short with limited samples when we make generalizations.

Near-Term

This week

The AO is predicted to be negative this week **(Figure 1**) with mostly positive geopotential height anomalies currently across the Arctic and mixed geopotential height anomalies across the mid-latitudes of the NH (**Figure 2**). With predicted positive geopotential height anomalies across Greenland (**Figure 2**), the NAO is predicted to be negative this week.



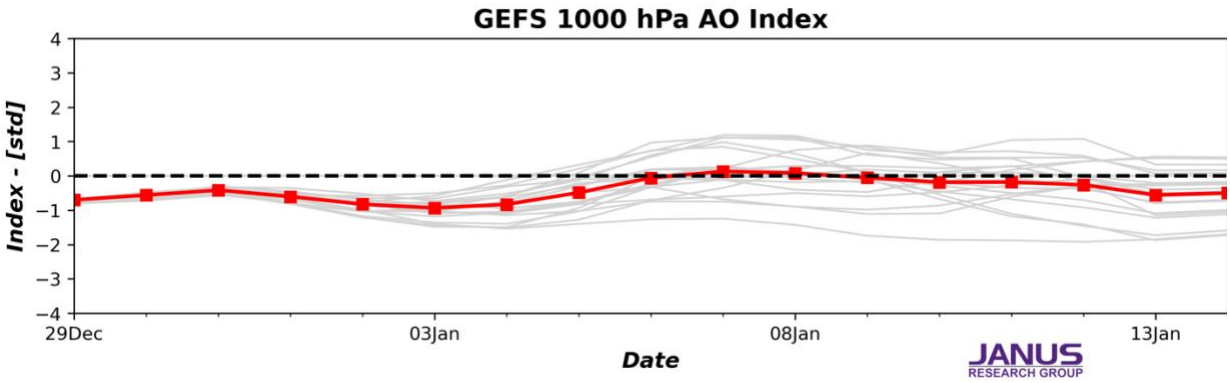


Figure 1. The predicted daily-mean AO at a) 10 hPa and b) 1000 hPa from the 00Z 29 Dec 2025 GFS ensemble. Gray lines indicate the AO index from each individual ensemble member, with the ensemble mean AO index given by the red line with squares.

Strong ridging/positive geopotential height anomalies centered on Greenland will support troughing/negative geopotential height anomalies across Europe (**Figure 2).** This pattern will support widespread normal to below normal temperatures across much of Europe including the UK and Turkey this week (**Figure 3**). This week an omega block will dominate Asia troughing/negative geopotential height anomalies across Western and Eastern Asia bookending ridging/positive geopotential height anomalies across Central Asia this week (**Figure 2**). This pattern favors normal to above normal temperatures widespread across much of Asia but especially Central Asia and Eastern Siberia with normal to below normal temperatures across Western and parts of Northeast Asia this week **(Figure 3**).

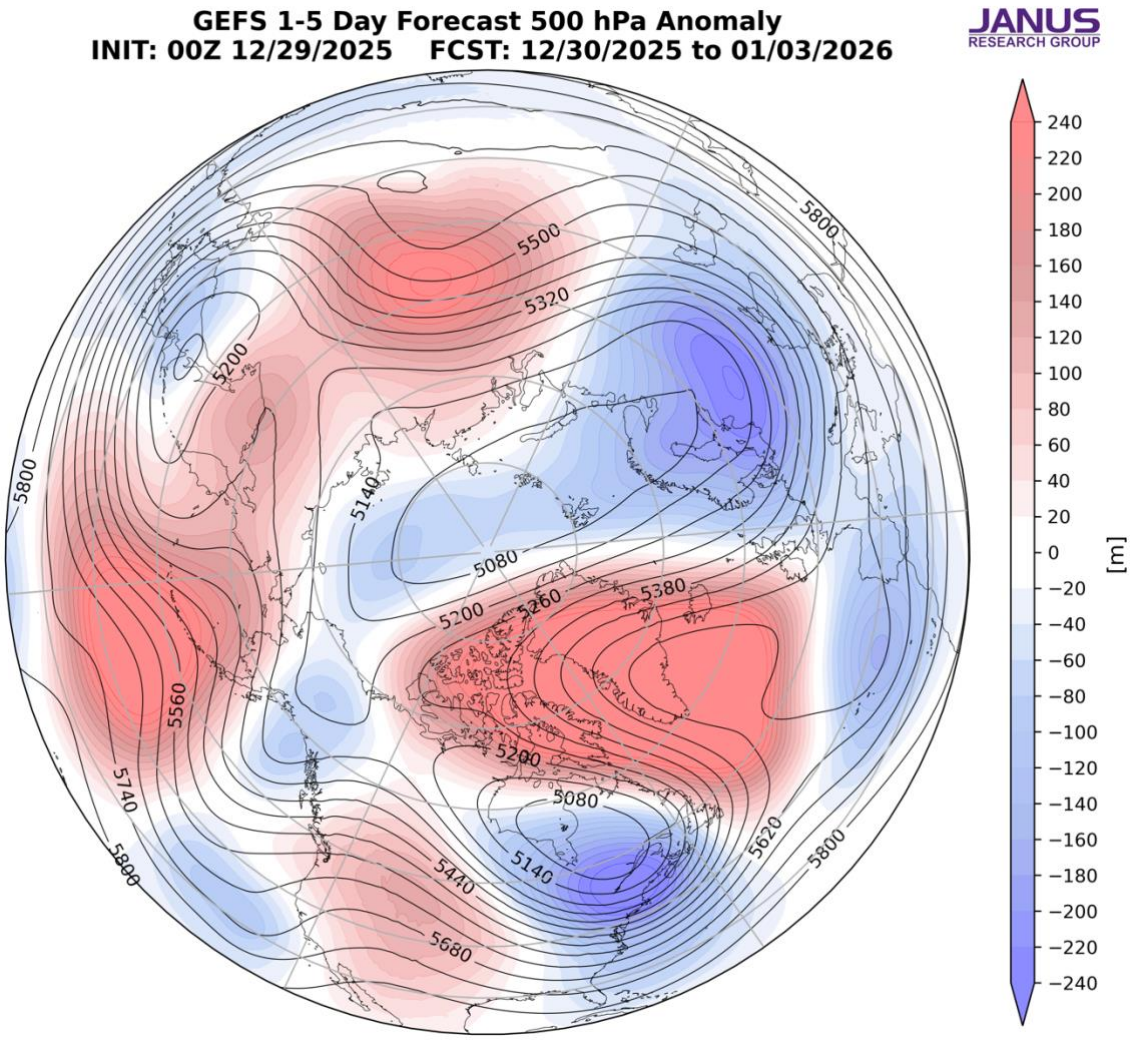


Figure 2. Forecasted average 500 mb geopotential heights (dam; contours) and geopotential height anomalies (m; shading) across the Northern Hemisphere from 30 Dec 2025 to 3 Jan 2026. The forecasts are from the 00Z 29 Dec 2025 GFS ensemble.

This week ridging/positive geopotential height anomalies centered on the Dateline supporting troughing/negative geopotential height anomalies across Alaska into the Gulf of Alaska while more ridging in the Western US and across Greenland will support troughing in Southeastern Canada and the Eastern US this week (**Figure 2**). This patten will favor widespread normal to below normal temperatures stretching from Alaska across Western Canada and into Southeastern Canada and the Eastern US with normal to above normal temperatures across Northeastern Canada and the Western US this week (**Figure 3**).

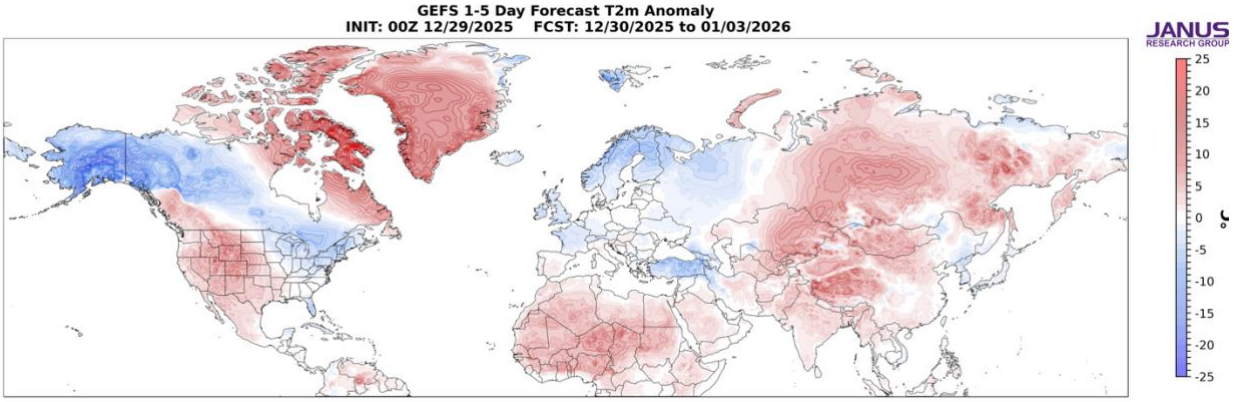


Figure 3. Forecasted surface temperature anomalies (°C; shading) from 30 Dec 2025 to 3 Jan 2026. The forecasts are from the 00Z 29 Dec 2025 GFS ensemble.

Troughing and/or cold temperatures will support new snowfall across Scotland, Scandinavia, Central and Eastern Europe including the Alps, Turkey, Western Russia, parts of Siberia, Northeast Asia and Japan while milder temperatures will support snowmelt across Central Asia this week (**Figure 4**). Troughing and/or cold temperatures will support new snowfall across much of Southern and Northeastern Canada, the higher elevations of British Columbia and the Great Lakes and northern New England while milder temperatures will support snowmelt widespread across the higher elevations of the Northwestern US this week (**Figure 4**).

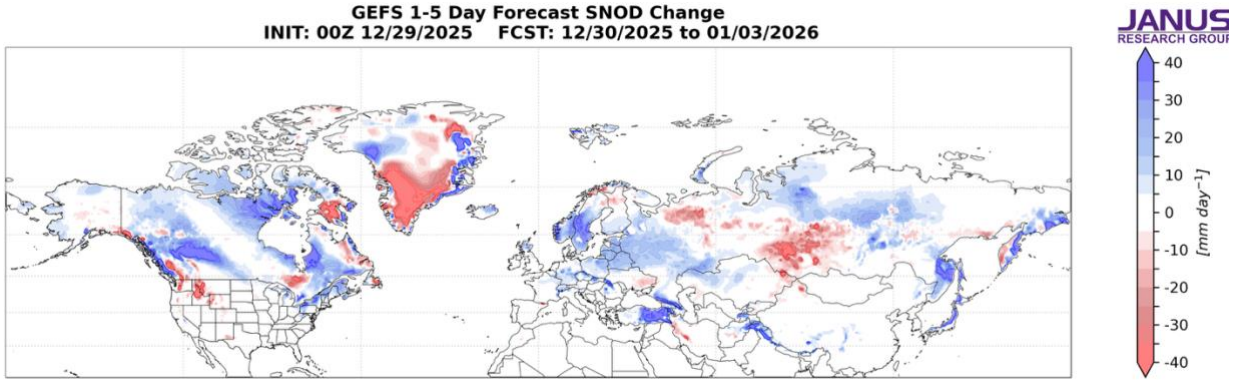


Figure 4. Forecasted snowfall (mm/day; shading) from 30 Dec 2025 to 3 Jan 2026. The forecasts are from the 00Z 29 Dec 2025 GFS ensemble.

Near-Mid Term

Next week

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

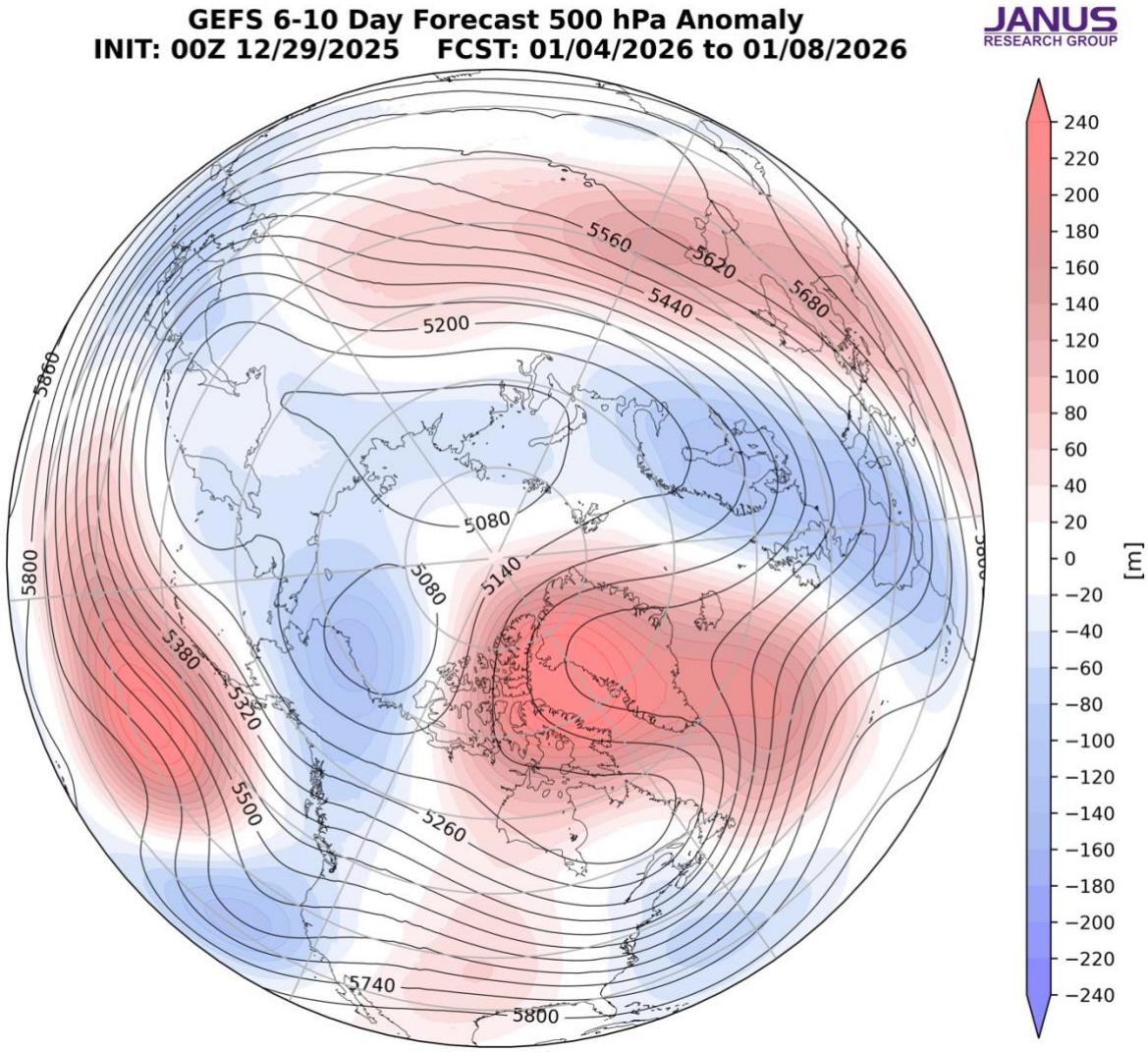


Figure 5. Forecasted average 500 mb geopotential heights (dam; contours) and geopotential height anomalies (m; shading) across the Northern Hemisphere from 4 Jan to 8 Jan 2026. The forecasts are from the 00Z 29 Dec 2025 GFS ensemble.

Persistent ridging/positive geopotential height anomalies across Greenland will support widespread troughing/negative geopotential height anomalies across much of Europe this period (**Figure 5**). The pattern will support normal to below normal temperatures across

Western and Northern Europe including the UK while southwesterly flow will support normal to above normal temperatures across Southern and Eastern Europe this period (**Figure 6**). Once again this period an omega block will dominate Asia troughing/negative geopotential height anomalies across Western and Eastern Asia bookending ridging/positive geopotential height anomalies across Central Asia (**Figure 5**). This pattern favors normal to above normal temperatures widespread across much of Asia but especially Central Asia and Mongolia with only regional normal to below normal temperatures across Northwestern Russia and parts of Northeast Asia this period (**Figure 6**).

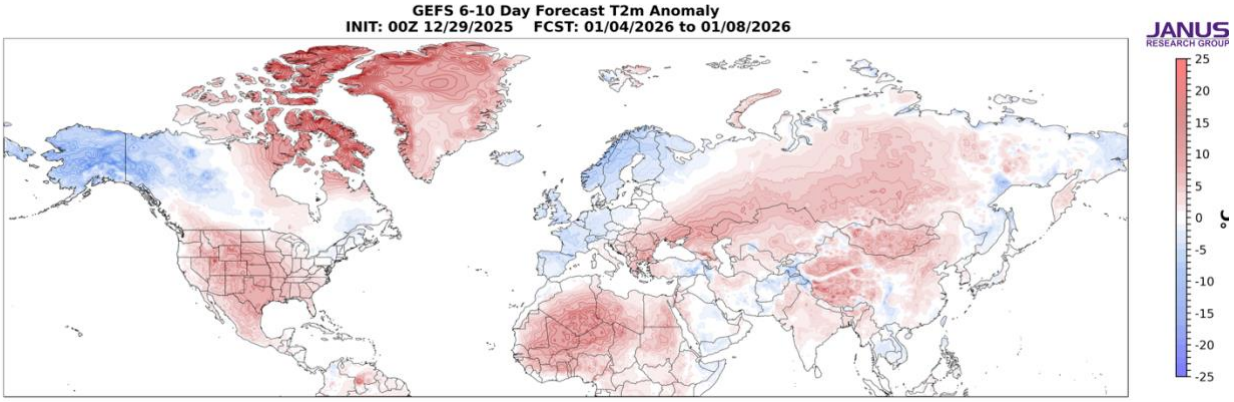


Figure 6. Forecasted surface temperature anomalies (°C; shading) from 4 Jan to 8 Jan 2026. The forecasts are from the 00Z 29 Dec 2025 GFS ensemble.

Persistent ridging/positive geopotential height anomalies centered near the Dateline will slide east this period to south of the Aleutians will support troughing/negative geopotential height anomalies stretching across Alaska and the Gulf of Alaska while more ridging centered near Baffin Bay will support troughing in Southeastern Canada and the Northeastern US this period (**Figure 5**). This pattern will favor normal to below normal temperatures across Alaska, much of Western, Central and Southeastern Canda and New England with normal to above normal temperatures across Northeastern Canada and much of the US (**Figure 6**).

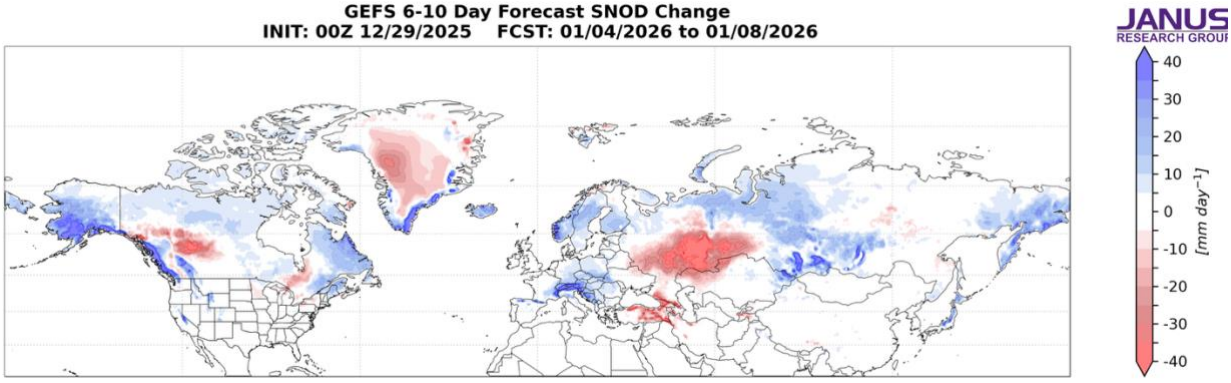


Figure 7. Forecasted snowfall rate (mm/day; shading) from 4 Jan to 8 Jan 2026. The forecasts are from the 00Z 29 Dec 2025 GFS ensemble.

Troughing and/or cold temperatures will support new snowfall in Scandinavia, the Alps, Central Europe, parts of Siberia and Northeast Asia while milder temperatures will support snowmelt in parts of Northwest Russia and the Caucuses this period (**Figure 7**). Troughing and/or cold temperatures will support new snowfall in western Alaska, the coastal mountains of Western Canada, much of Central and Eastern Canada, the Sierra Nevada, the Northern Rockies and northern New England while milder temperatures will support snowmelt in Western Canada and New England and Ontario this period (**Figure 7**).

Mid Term

Week Two

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

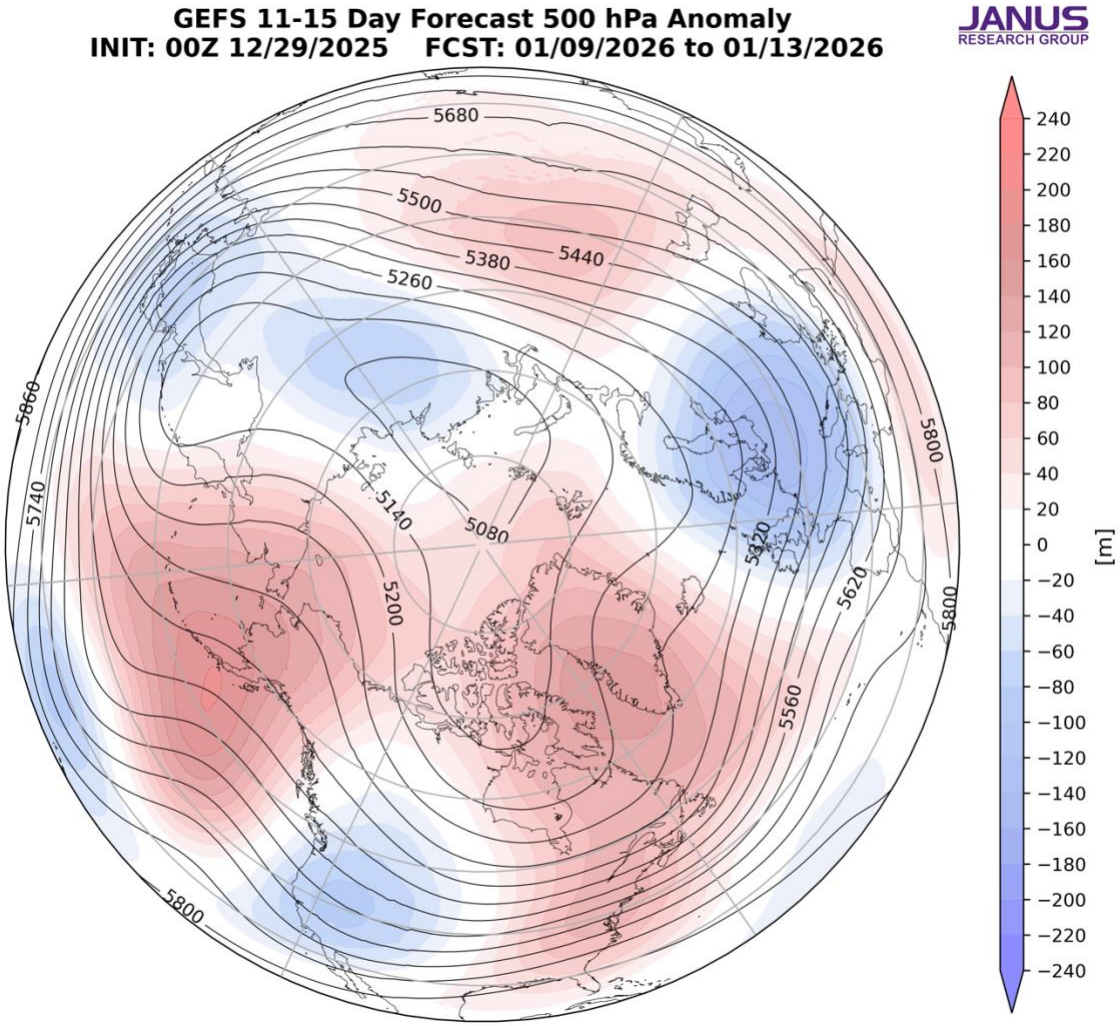


Figure 8. Forecasted average 500 mb geopotential heights (dam; contours) and geopotential height anomalies (m; shading) across the Northern Hemisphere from 9 Jan to 13 Jan 2026. The forecasts are from the 00Z 29 Dec 2025 GFS ensemble.

Persistent ridging/positive geopotential height anomalies across Greenland will continue to support troughing/negative geopotential height anomalies across much of Europe this period (**Figure 8**). This pattern should favor normal to below normal temperatures across much of Europe including the UK with the exception of Southeastern Europe under southwesterly flow this period (**Figures 9**). Yet again this period an omega block will dominate Asia troughing/negative geopotential height anomalies across Western and Eastern Asia bookending ridging/positive geopotential height anomalies across Central Asia (**Figure 8**). This pattern favors normal to above normal temperatures widespread across much of Asia but especially Central Asia and Mongolia with only regional normal to below normal temperatures across Northwestern Russia and parts of Northern Siberia and Northeast Asia this period (**Figure 9**).

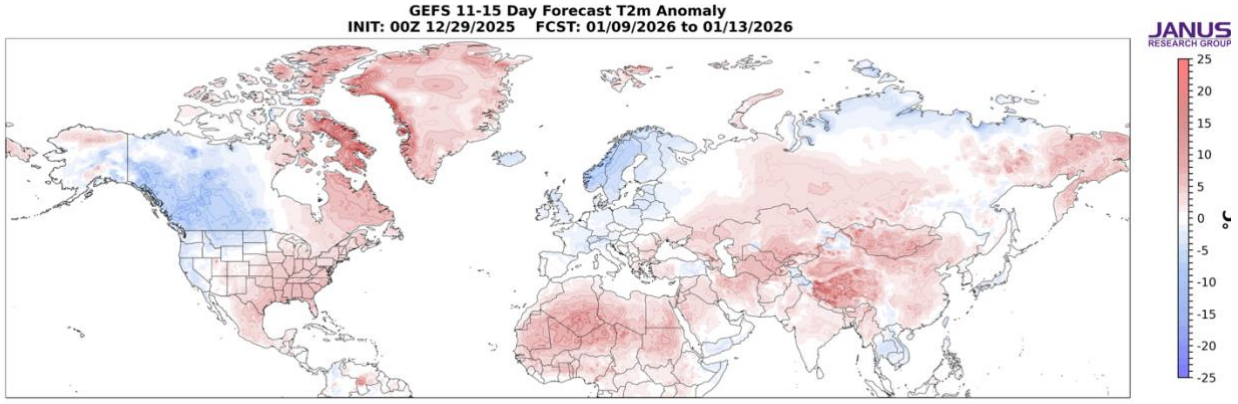


Figure 9. Forecasted surface temperature anomalies (°C; shading) from 9 Jan to 13 Jan 2026. The forecasts are from the 00Z 29 Dec 2025 GFS ensemble.

Persistent ridging/positive geopotential height anomalies centered previously near the Dateline will continue to slide east now in the Gulf of Alaska supporting downstream troughing/negative geopotential height anomalies stretching from Western Canada and into the Western US with more ridging across Eastern Canada and the Eastern US this period (**Figure 8**). This pattern supports widespread normal to below normal temperatures across eastern Alaska, much of Western and Central Canada and the Northwestern US with normal to above normal temperatures across Eastern Canda and much of the Central and Eastern US this period (**Figure 9**). I consider this period of high uncertainty and use any forecast with caution.

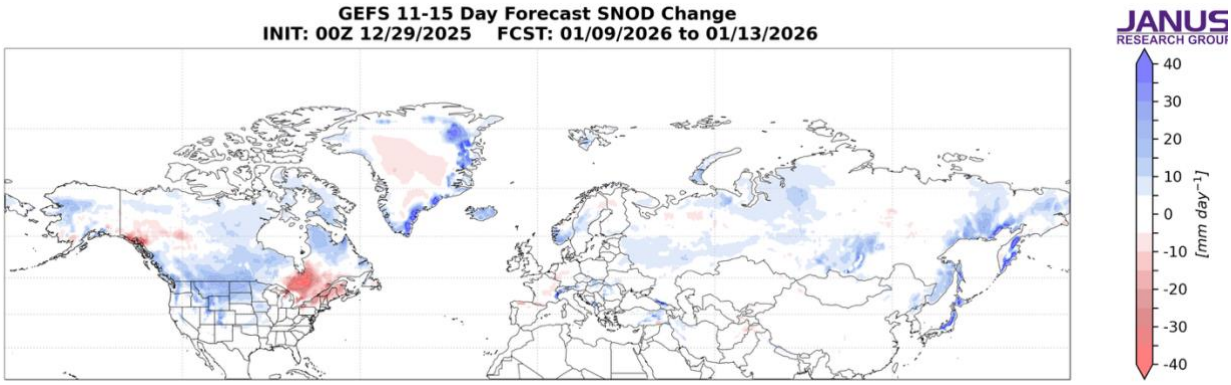


Figure 10. Forecasted snowfall (mm/day; shading) from 9 Jan to 13 Jan 2026. The forecasts are from the 00Z 29 Dec 2025 GFS ensemble.

Troughing and/or cold temperatures will support some possible new snowfall in Scandinavia, the Alps, Central and Eastern Europe the Caucuses, Siberia and parts of Northeastern Asia and Japan while milder temperatures will support snowmelt in parts of France and Siberia this period (**Figure 10**). Troughing and/or cold temperatures will support new snowfall in Western Alaska, much of Canada, the higher elevations of the Western US and the Northern Plains while milder temperatures will support snowmelt in Southeastern Canada and New England this period (**Figure 10**).

Longer Term

30–day

The most recent polar cap geopotential height anomalies (PCHs) show warm/positive PCHs in the middle to lower stratosphere and throughout the troposphere with cold/negative PCHs in the upper stratosphere (**Figure 11**). Then for the next two weeks cold/negative PCHs in the stratosphere are predicted to descend to the mid-stratosphere while PCHs in the troposphere are predicted to remain mostly warm/positive.

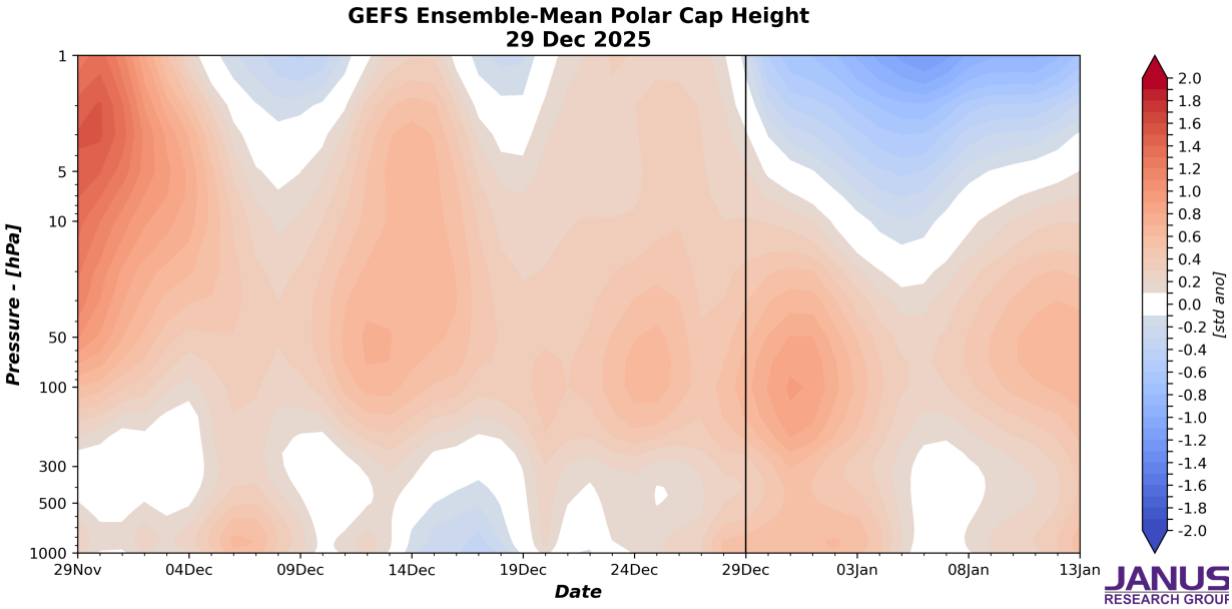


Figure 11. Observed and predicted daily polar cap height (i.e., area-averaged geopotential heights poleward of 60°N) standardized anomalies. The forecast is from the 00Z 29 Dec 2025 GFS ensemble.

The predicted warm/positive PCHs in the lower troposphere this week (**Figure 11**) are consistent with the predicted negative AO this week (**Figure 1**). Then next week the forecast of neutral to warm/positive PCHs into the lower troposphere (**Figure 11**) should favor a near neutral to even possibly negative AO next week (**Figure 1**).

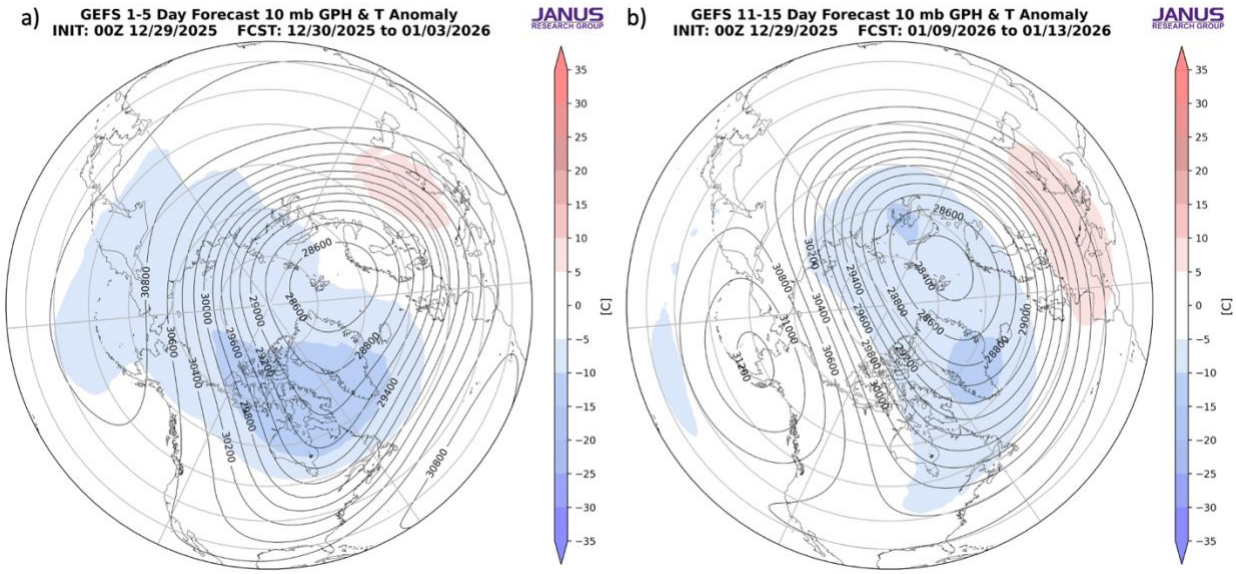


Figure 12. (a) Predicted 10 mb geopotential heights (dam; contours) and temperature anomalies (°C; shading) across the Northern Hemisphere averaged for 30 Dec 2025 to 3 Jan 2026. (b) Same as (a) except forecasted averaged from 9 Jan to 13 Jan 2026. The forecasts are from the 00Z 29 December 2025 GFS model ensemble.

This week the polar vortex (PV) is predicted to be elongated in shape, from Siberia to Hudson Bay, with the PV center near Svalbard with relatively cold temperatures focused in Hudson Bay and with high pressure centered near the Dateline and relatively warm temperatures across Europe in the polar stratosphere (**Figure 12a**). The elongated shape in appearance, signals a perturbed and stretched PV, even if minor. Then during the second week of January the PV center is predicted to be centered in the Barents Kara Seas with high pressure centered over Alaska and plenty of cold temperatures in the polar stratosphere with relatively warm temperatures remaining over Europe (**Figure 12b**). This also resembles a stretched PV configuration but in general the PV is starting to look increasingly disrupted. The stratospheric AO in **Figure 1** this week is predicted to remain somewhat negative then neutral and then back to negative next week, signaling once again a weakening PV.

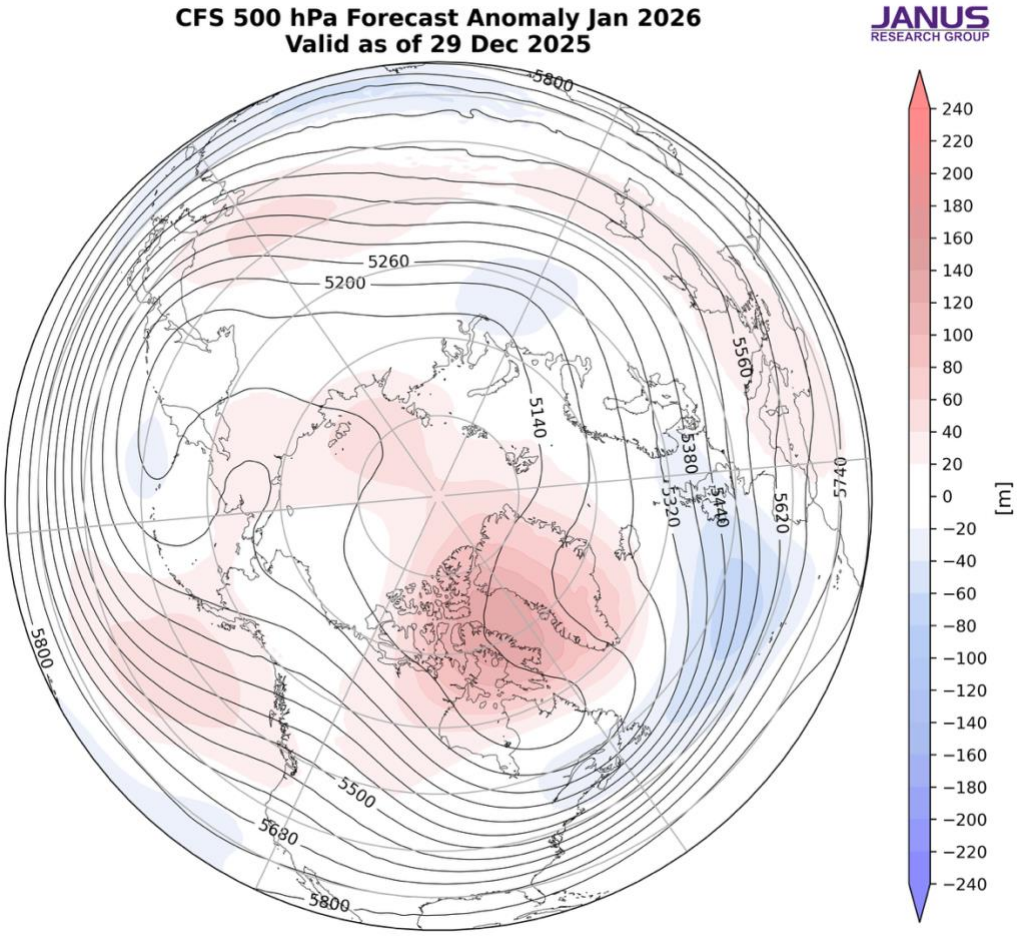


Figure 13. Forecasted average 500 mb geopotential heights (dam; contours) and geopotential height anomalies (m; shading) across the Northern Hemisphere for January 2025. The forecasts are from the 00Z 29 Dec 2025 CFS.

I include in this week's blog the monthly 500 hPa geopotential heights (**Figure 13**) and surface temperatures for January (**Figure 14**) 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 over Baffin Bay and into the Laptev Sea, the Southwestern Mediterranean Central Asia and western North America with troughing across the Urals, Northern and Eastern Asia, Eastern Canada and the Eastern US (**Figure 13**). This pattern favors seasonable to relatively warm temperatures across Southern Europe, Southern and Central Asia, including the Middle East, eastern China the Tibetan Plateau, Pakistan and Afghanistan, Eastern Siberia and much of Canada and the US with seasonable to relatively cool temperatures across Northern and Eastern Europe, Northern Asia into Northeast Asia, Alaska Southeastern Canada and the Northeastern US (**Figure 14**).

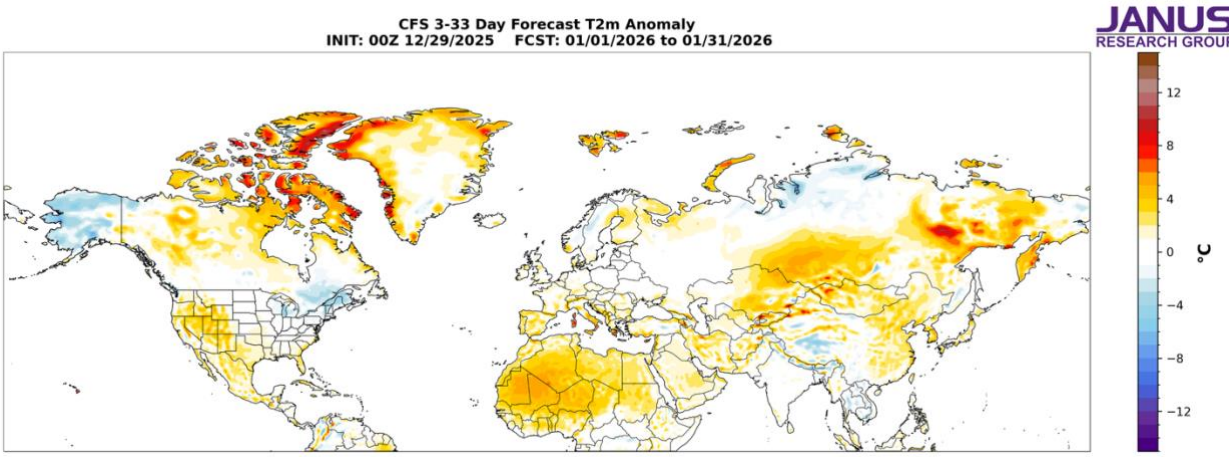


Figure 14. Forecasted average surface temperature anomalies (°C; shading) across the Northern Hemisphere for January 2025. The forecasts are from the CFS 00Z 29 Dec 2025.

Boundary Forcings

Arctic Sea Ice

I am and will continue to watch Arctic sea ice. Current conditions are shown in **Figure 15**. 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. Arctic sea ice anomalies continue to show a strong focus or weighting of negative anomalies towards the North Atlantic sector relative to the North Pacific sector and this is a robust signal of an overall weaker PV this winter. The negative anomalies have become increasingly focused in the Eurasian sector, i.e., Barents Kara Seas but still exist in the North American sector, now mostly in Baffin Bay (see **Figure 15**). Therefore, I do think that low sea ice in the Barents-Kara Seas favoring Ural/Scandinavian blocking is emerging as the dominant signal but not showing up in any forecasts.

Figure 15. Arctic sea ice cover extent for 27 December 2025. 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

SSTs/El Niño/Southern Oscillation

Equatorial Pacific sea surface temperatures (SSTs) anomalies are below normal, along the equatorial Pacific (**Figure 15**) consistent with La Niña conditions for much of the winter but current forecasts show some uncertainty but for now mostly favor weak La Niña conditions this winter. 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. The very warm SSTs in both ocean basins could be supporting the predicted mid-ocean ridging in both basins.

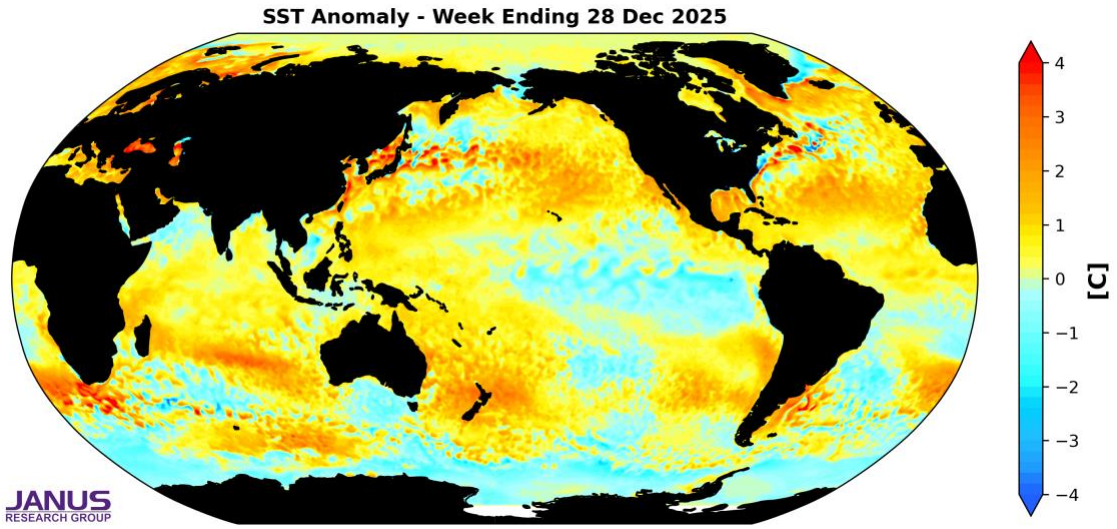


Figure 16. The latest daily-mean global SST anomalies for week ending 28 Dec 2025.

Madden Julian Oscillation

Currently the Madden Julian Oscillation (MJO) is currently weak where no phase is favored (**Figure 17**) and the forecasts are for the MJO to remain weak where no phase is favored over the next two weeks (**Figure 17**). Therefore, it seems that the MJO is having little influence on North American weather in the next two weeks. But admittedly this is outside of my expertise.

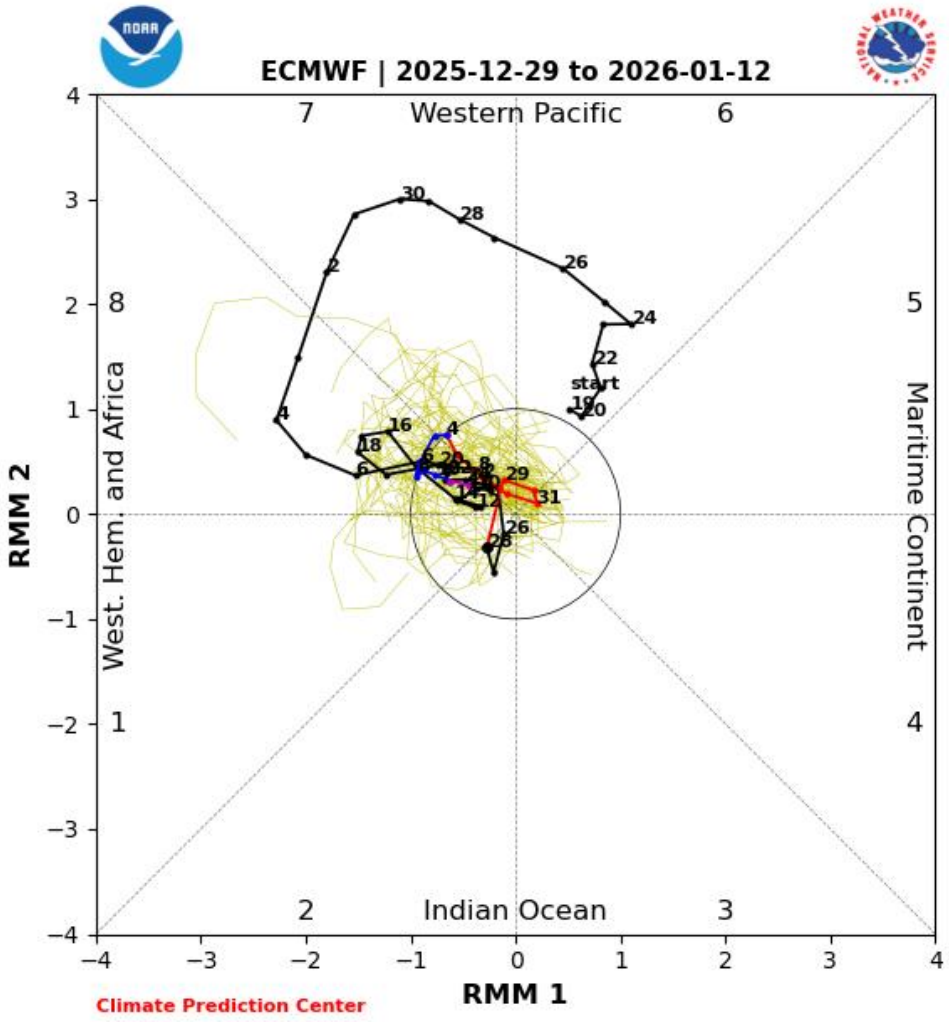


Figure 17. Past and forecast values of the MJO index. Forecast values from the 00Z 29 Dec 2025 ECMWF model. Yellow lines indicate individual ensemble-member forecasts, with the green line showing the ensemble-mean. A measure of the model 'spread' is denoted by the gray shading. Sector numbers indicate 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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