Arctic Oscillation and Polar Vortex Analysis and Forecasts

January 20, 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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Summary

- The Arctic Oscillation (AO) is currently neutral and is predicted to remain positive the next two weeks as pressure/geopotential height anomalies across the Arctic are currently mostly mixed and are predicted to remain mostly mixed to negative over the next two weeks. The North Atlantic Oscillation (NAO) is currently negative with mostly positive pressure/geopotential height anomalies across Greenland and the NAO is predicted to be mostly positive the next two weeks as pressure/geopotential height anomalies are predicted to reverse to negative across Greenland.
- The next two weeks troughing/negative geopotential height anomalies across Greenland will support ridging/positive geopotential height anomalies across much of Europe with the exception of troughing/negative geopotential height anomalies across Northern Europe this week. This pattern will support mostly normal to above normal temperatures across much of Europe including the United Kingdom (UK) with the exception of normal to below normal temperatures across Scandinavia and the UK this week under low heights.
- The next two weeks ridging/positive geopotential height anomalies are predicted to dominate Asia with the exception troughing/negative geopotential height anomalies across the Urals and far northern Siberia this week and then Western Siberia pushing into East Asia next week. This pattern favors widespread normal to above normal

temperatures across much of Asia, with normal to below normal temperatures across the Urals and far northern Siberia this week and then Western Siberia pushing into East Asia next week.

- The general pattern across North America this week is ridging/positive geopotential height anomalies centered in Alaska, and the Gulf of Alaska supporting troughing/negative geopotential height anomalies across Central Canada and the Eastern United States (US). The next week troughing will return to Alaska and spread across Canada with ridging across the US. This pattern favors normal to above normal temperatures across Alaska and Northern and Western Canada with normal to below normal temperatures across Southern and Eastern Canada and much of the US this week. However, next week above normal temperatures will become more widespread across Canada and the US with normal to below normal temperatures limited to Alaska, Northwestern Canada and the Northeastern US.
- This winter has been all about the polar vortex (PV) alternating among three different states: strong, a Canadian warming but most of all a stretched PV. This pattern looks to continue through January but could it all change in February? Also still watching the battle between high latitude blocking and a strong PV, which has been at a stalemate all winter long. Models are predicting near record strong PV will it finally gain the upper hand?

Plain Language Summary

What you see is what you get seems to be the theme of the weather this winter. Overall looks mild for Europe while I see more opportunities for cold in Canada and the US for the end of January and heading into February. I also think that a realignment of the atmospheric circulation favors an Arctic outbreak into East Asia the end of January and into early February. But overall, I don't see why the parade of stretched polar vortex events this winter that has focused the relative cold in the US this past January (see **Figure**) won't continue into February. Northern Europe has also been cold this month so far, but it does seem that the catalyst for the cold, Greenland blocking, shows no signs of returning for the foreseeable future.

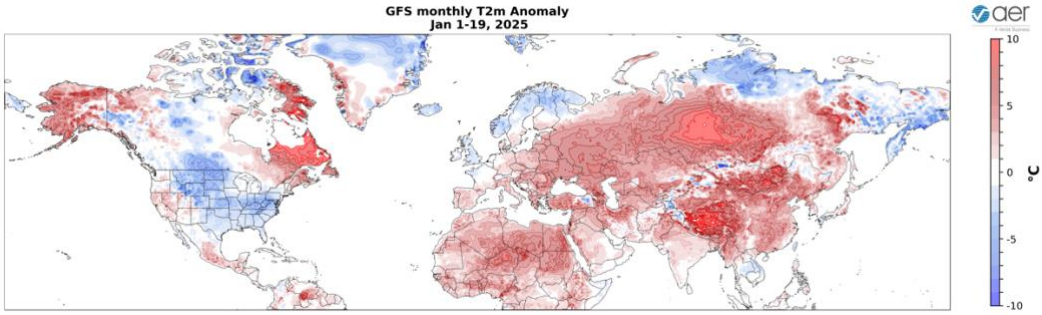


Figure. Estimate of the observed surface temperatures (°C; shading) from 1 January 2025 – 19 January 2025 based on GFS initializations and the GFS forecast from the 20 January 2025 forecast.

Impacts

It is really amazing how it feels like I can just change the date on the blog (update by seven days) and then hit publish. This really is the winter of the stretched polar vortex (PV) and in quick even accelerating succession and seemingly in an infinite loop of "lather, rinse repeat." The stretched PV events or periods are punctuated by either a more circular or strong PV or a Canadian warming. Two more stretched PVs are predicted by the end of January bringing the monthly total to four (about once a week) and the seasonal total since the end of November to eight. The rapid transitions of the PV to different modes or phase can be seen in the latest PV animation in **Figure i**. There is the seventh stretched PV of the season on the 20-24 January and then the eighth stretched PV after 27 January through the end of the animation on 4 February. Though I will admit in the animation it just looks like one long stretched PV. And though at the end of last week it looked to me like two separate events, now I am not sure.

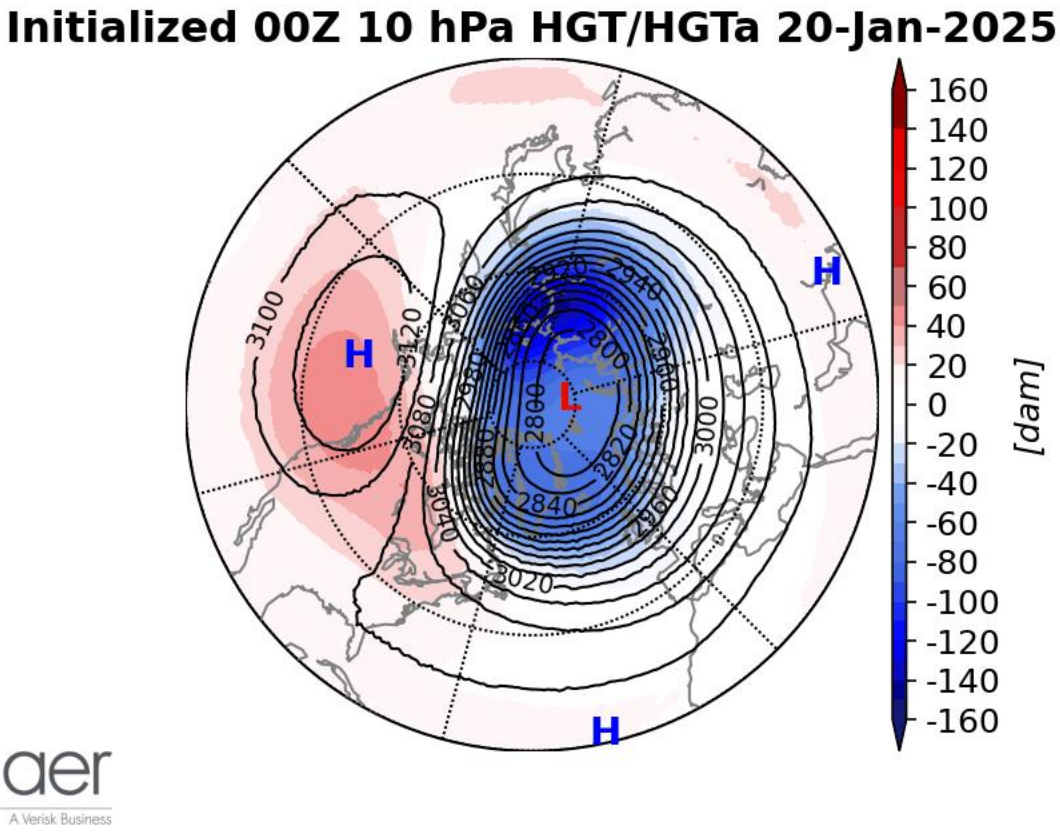


Figure i. Initialized 10 mb geopotential heights (dam; contours) and temperature anomalies (°C; shading) across the Northern Hemisphere for 20 January 2025 and forecasted from 21 January to 04 February 2025. The forecasts are from the 00Z 20 January 2025 GFS model ensemble.

In the blog over the past several weeks I have been focusing on the wave reflection diagnostics and show it again in today's blog. Wave reflection is the physical underpinning of stretched PV events, and it has seemed it has occurred continuously throughout the month of January. During

wave reflection, wave energy goes up over Asia, bouncing off the stratospheric PV and then downward over North America. The downward wave energy amplifies the ridge-trough wave over North America and determines the strength or amplitude of the North American wave and the axis or position (see **Figure ii**). Once again, the wave reflection seems to be uninterrupted for the next two weeks. Wave reflection is supportive of two more or maybe one continuous stretched PV right through the end of January. One reason that I am considering them as two separate events is because it is cold this week in the Eastern US (see **Figure 3**), it turns milder for part of next week (see **Figure 6**) and then the cold returns clearly focused in the Northeastern US for the last two days of January. The cold looks more impressive in the European ensembles than the American models and I do believe that the European model has the best handle on the 7-14 day time period.

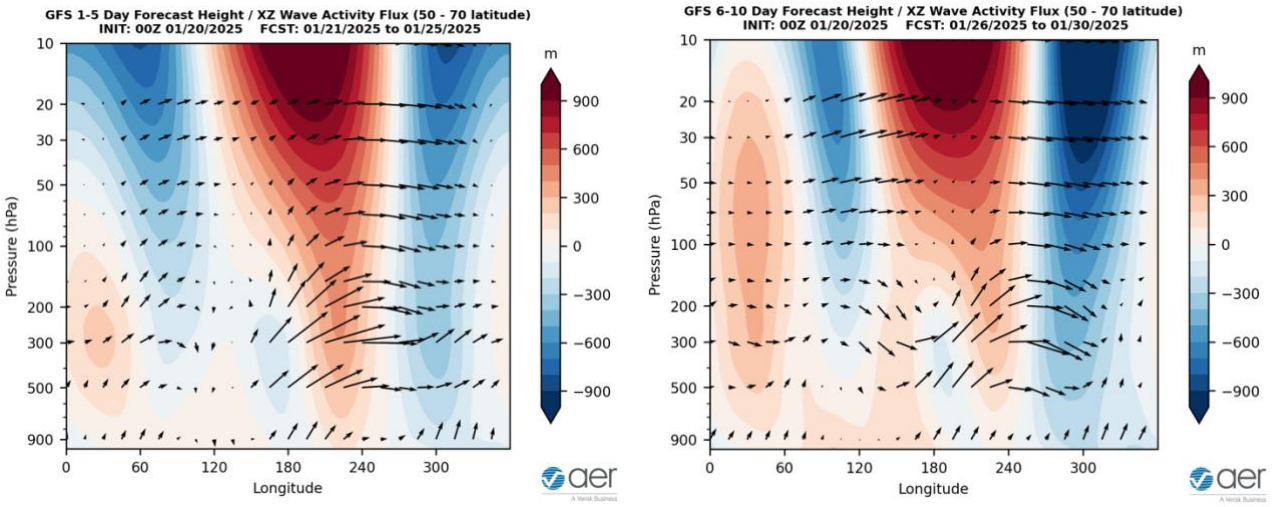


Figure ii. Longitude-height cross section of geopotential eddy height anomalies (shading) and wave activity flux (vectors) forecasted for a) 21 January through 25 January 2025 and b) 26 January through 30 January 2025. The forecasts are from the 00Z 20 January 2025 GFS ensemble.

Stretched PVs deliver severe winter weather not only to North America but also East Asia but clearly nothing as impressive as what is transpired across North America this month (see **Figure** in Plain Language summary). But as can be seen in the animation of 500hPa geopotential heights shown in **Figure iii**, the high latitude blocking is predicted to become spread across the Eurasian Arctic and disappear across the North American Arctic. This should favor East Asia for an Arctic outbreak for the end of January and even into early February. However, with low heights draped across the North American Arctic cold air should build up across Alaska and Northwestern Canada, potentially setting up a future Arctic outbreak into the US.

The weather models are predicting the absence of Greenland blocking and with Greenland troughing instead for the foreseeable future (see **Figure iii**). This should allow high pressure ridging over Europe and an overall milder pattern for at least the next two weeks (see **Figures 3,**

6 and **9**). For now, I don't see much evidence for a return to colder weather, unless models push the European ridging further north into the Arctic.

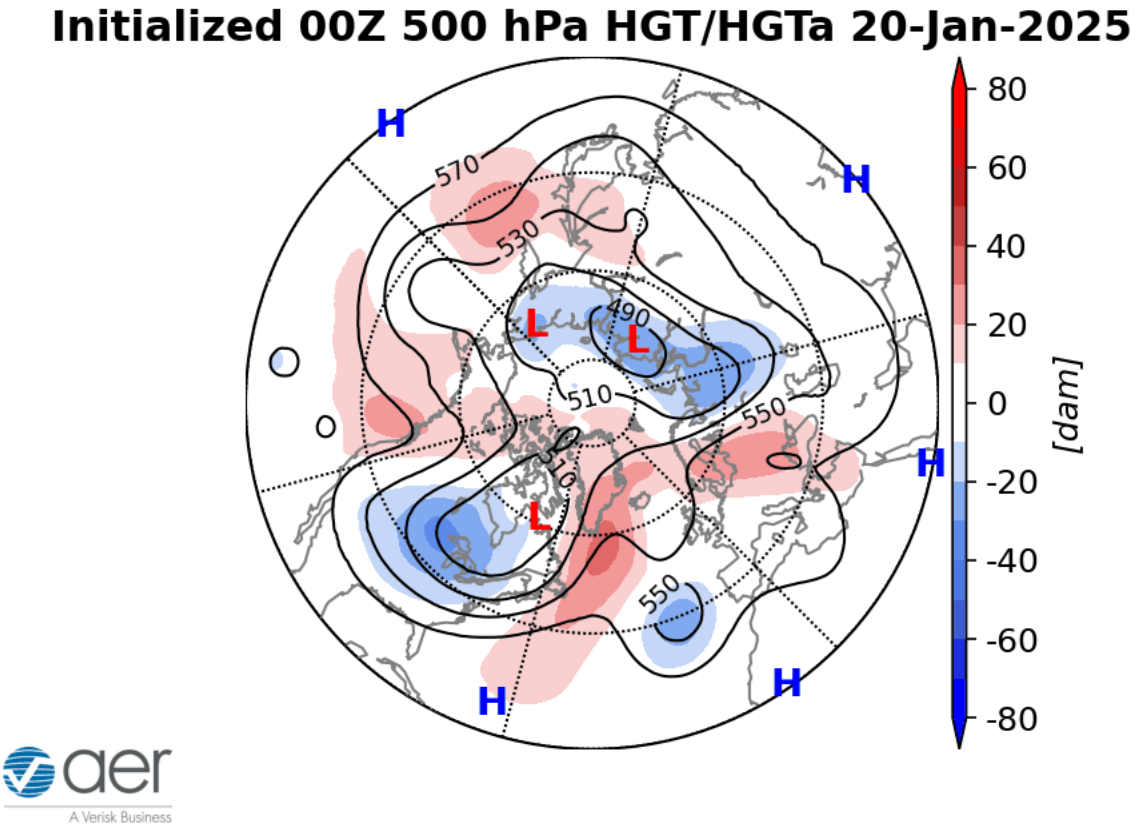


Figure iii. Initialized 500 mb geopotential heights (dam; contours) and decameter anomalies (dam; shading) across the Northern Hemisphere for 20 January 2025 and forecasted from 21 January to 04 February 2025. The forecasts are from the 00Z 14 January 2025 GFS model ensemble.

In last week's blog I discussed the possibility of cold air making it into the Eastern US as January comes to a close. The European has committed to this solution much more so than the American models with the European predicting a decent shot of cold air into the Northeastern US the last couple of days of January but limited in space. Certainly, the cold is much more limited than this week's historic Arctic outbreak. I think this makes sense given that the northwesterly flow in the stratosphere is really directed at the Northeastern US and Southeastern Canada and not the Plains. The American models are much more tepid in their forecasts of cold air (see **Figure 9**), but from what I have seen, the European model has been performing the best (I guess no surprise there).

Looking ahead into February, I believe that the forecast remains complicated and challenging. There are two major factors that are making the forecast of US temperatures heading into February especially challenging. Both the GFS and European ensembles are predicting a near record strong PV (see **Figure 1**). It is very difficult to get cold in the Eastern US with a PV that

strong instead, if there is cold it is much likely to be in the Western US. However, when I look certainly at some but not all the operational models, they are suggestive of yet another stretched PV the first week of February (see **Figure iv**). But admittedly there is no consistency in any of the operational forecasts and no support from the ensembles.

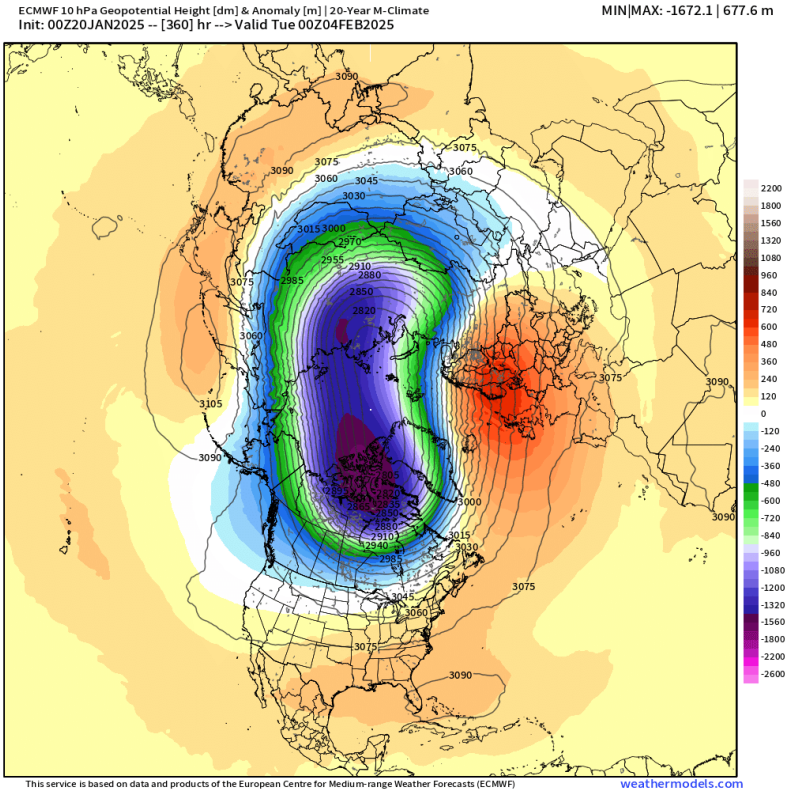


Figure iv. Forecasted 10 mb geopotential heights (dam; contours) and anomalies (meters; shading) across the Northern Hemisphere for 4 February 2025. The forecasts are from the 0Z 20 January 2025 ECMWF operational model. Plot taken from https://weathermodels.com.

I think the pattern most supportive of stretched PVs is ridging across northwestern Eurasia (Scandi-Ural blocking) and Alaskan and Gulf of Alaska ridging. Instead, the models are predicting ridging to stretch from Europe to Eastern Siberia or across the entire Eurasian Arctic (see **Figures 5** and **8**). I don't know for sure, but this pattern seems less supportive of stretched PVs. A pattern that is less supportive of disrupting the PV and the never-ending wave reflection seems to be the key factors for the predictions of a near record a strong PV. With a PV that strong and especially if it becomes circular in shape a mild pattern across not just the US but the entire mid-latitudes has to be strongly considered.

The second complicating factor is the tropical convection. Tropical convection is currently supportive of cold in the Western US and mild in the Eastern US at least into early February (see **Figure 18**). The models keep predicting the cold to shift into the Western US just to eventually lose it just like Lucy and her yanking the football away every time Charlie Brown goes to kick it. Just last Friday, the 0Z European ensembles had all this cold air in western North America at the

end of January that evaporated in the 12Z run and instead shifted some of that cold into the Northeastern US. For now, my focus remains on the variability in the PV.

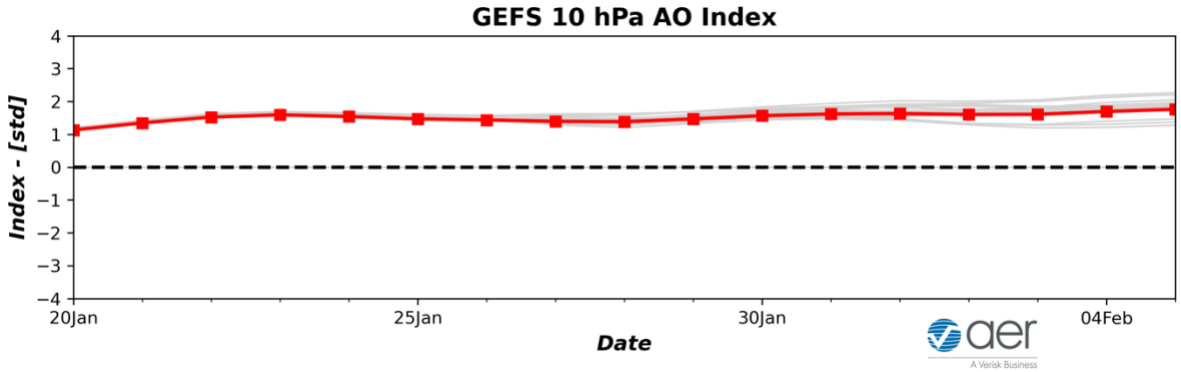
At least for the foreseeable future, I still think that the PV will be supportive of cold in the Eastern US, at least when it stretches. Into February, I still favor a continuation of the pattern we have seen all winter, stretched PVs that most likely favor cold in the Eastern US and some kind of relaxation. The ensembles are predicting the most circular PV of the season so far for early February and there is every reason to expect a fairly mild pattern for the US for the end of January and into early February with the possible exception of the Northeastern US. However, I am expecting another stretched PV either at the end of the first week or second week of February based on the wave reflection, the return of ridging to the Gulf of Alaska (right now purely inferred by me from the model forecasts) and the predicted buildup of Arctic air in Alaska and Western Canada. If I am wrong and the PV does not stretch, then a much milder solution for the US should be expected for at least the first half of February and maybe all of February.

I was happy to receive my 5 and bit inches of snow last night in Boston. But that is fairly routine and only seems less so because of our two and a half year snow drought. But similar amounts of snow could fall along the Gulf of Mexico from Houston to New Orleans and Tallahassee. Will be interesting to see if it materializes where it would be an historic snowstorm. Will cause havoc down there but meteorologically incredibly interesting.

Near-Term

This week

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



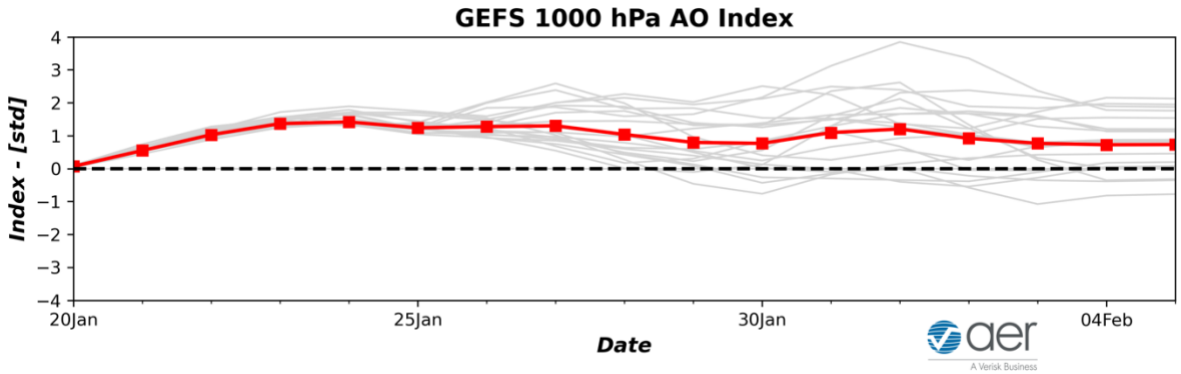


Figure 1. a) The predicted daily-mean AO at 10 hPa from the 00Z 20 January 2025 GFS ensemble. b) The predicted daily-mean AO at 1000 hPa from the 00Z 20 January 2025 GFS ensemble. Gray lines indicate the AO index from each individual ensemble member, with the ensemble mean AO index given by the red line with squares.

This week, deepening troughing/negative geopotential height anomalies across Greenland will support strengthening ridging/positive geopotential height anomalies across much of Europe with the exception of troughing/negative geopotential height anomalies across far Northern Europe (**Figures 2).** This pattern will favor widespread normal to above normal temperatures across Europe with normal to below normal temperatures across Scandinavia and the UK under low heights this period (**Figure 3**). This week the predicted pattern across Asia is widespread ridging/positive geopotential height anomalies with troughing/negative geopotential height anomalies mostly confined to far Northern Siberia and the Urals (**Figure 2**). This pattern favors normal to above normal temperatures widespread across much of Asia with normal to below normal temperatures limited to far Northern Siberia and centered on the Urals **(Figure 3**).

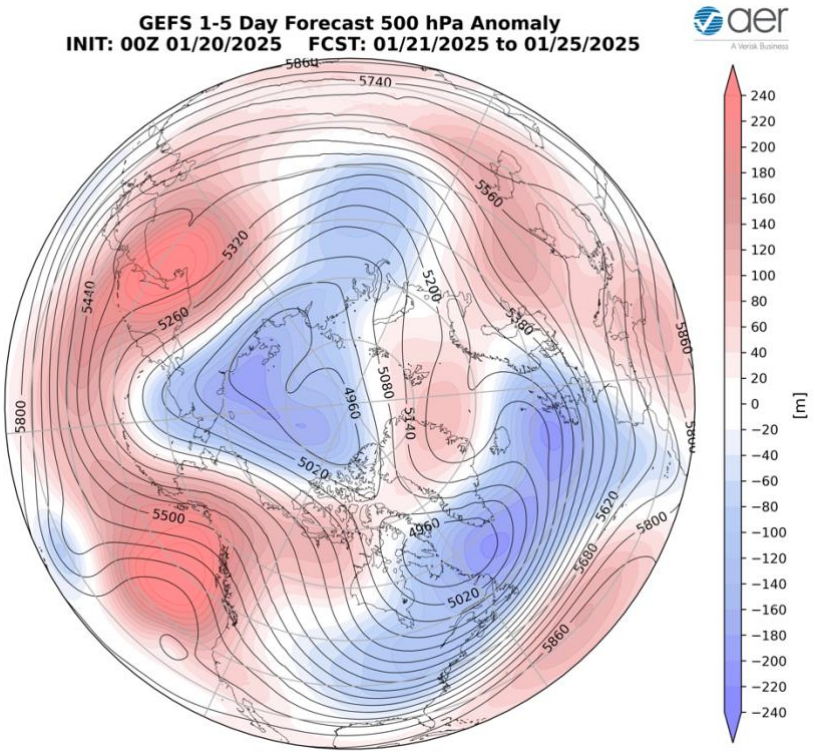


Figure 2. Forecasted average 500 mb geopotential heights (dam; contours) and geopotential height anomalies (m; shading) across the Northern Hemisphere from 21 Jan to 25 Jan 2025. The forecasts are from the 00Z 20 January 2025 GFS ensemble.

This week ridging/positive geopotential height anomalies spread across Alaska, the Gulf of Alaska and Northeastern Canada will support troughing/negative geopotential height anomalies across Central and Eastern Canda and most of the US. (**Figure 2**). This pattern favors normal to above normal temperatures across Alaska and Northern and Western Canada with normal to below normal temperatures across Southern and Eastern Canada and most of the US (**Figure 3**).

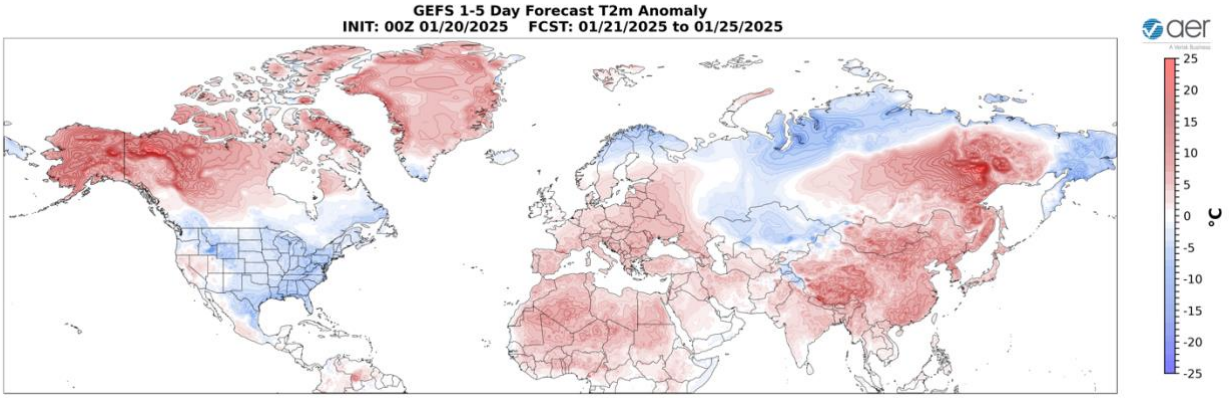


Figure 3. Forecasted surface temperature anomalies (°C; shading) from 21 Jan to 25 Jan 2025. The forecast is from the 00Z 20 January 2025 GFS ensemble.

Troughing and/or cold temperatures will support new snowfall in parts of Scandinavia, Siberia, Central Asia and the Tibetan Plateau while warm temperatures will support snowmelt in Southern Siberia this week (**Figure 4**). Troughing and/or cold temperatures will support new snowfall across western Alaska, Northern and Eastern Canada, the higher elevations of the Canadian West Coast, New England and possibly the deep Southern US while warm temperatures will support snowmelt in Western Canada and the Western US this week (**Figure 4**).

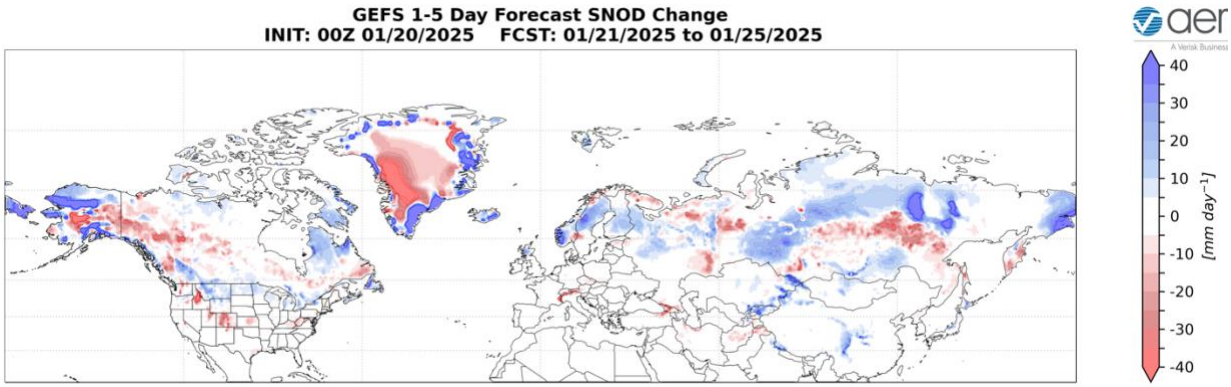


Figure 4. Forecasted snow depth changes (mm/day; shading) from 21 Jan 2025 to 25 Jan 2025. The forecast is from the 00Z 20 January 2025 GFS ensemble.

Near-Mid Term

Next week

With geopotential height anomalies remaining 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 predicted mostly negative pressure/geopotential height anomalies across Greenland (**Figure 5**), the NAO will likely be positive this period as well.

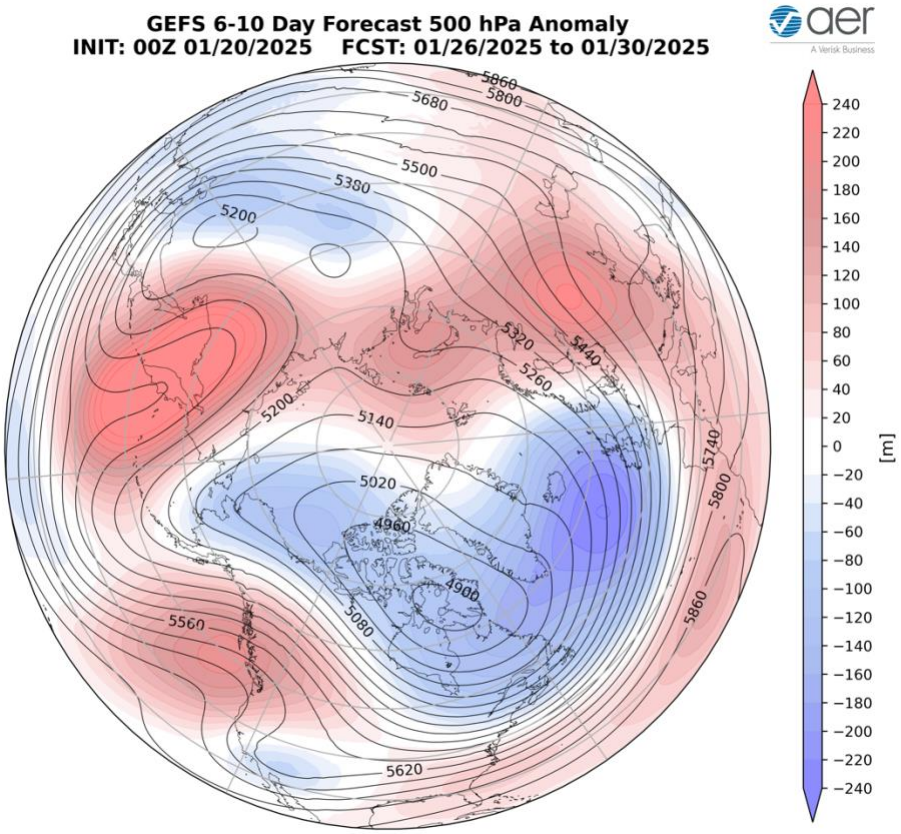


Figure 5. Forecasted average 500 mb geopotential heights (dam; contours) and geopotential height anomalies (m; shading) across the Northern Hemisphere from 25 Jan to 30 Jan 2025. The forecasts are from the 00Z 20 January 2025 GFS ensemble.

Troughing/negative geopotential height anomalies across Greenland will continue to support ridging/positive geopotential height anomalies across much of Europe this period (**Figure 5**). This pattern favors normal to above normal temperatures across much of Europe including the UK this period (**Figure 6**). Once again ridging/positive geopotential height anomalies are predicted to dominate Asia with troughing/negative geopotential height anomalies limited to Western Siberia and Central Asia (**Figure 5**). This pattern favors widespread normal to above normal temperatures across Asia with normal to below normal temperatures mostly limited to Western Siberia and parts of Central Asia this period (**Figure 6**).

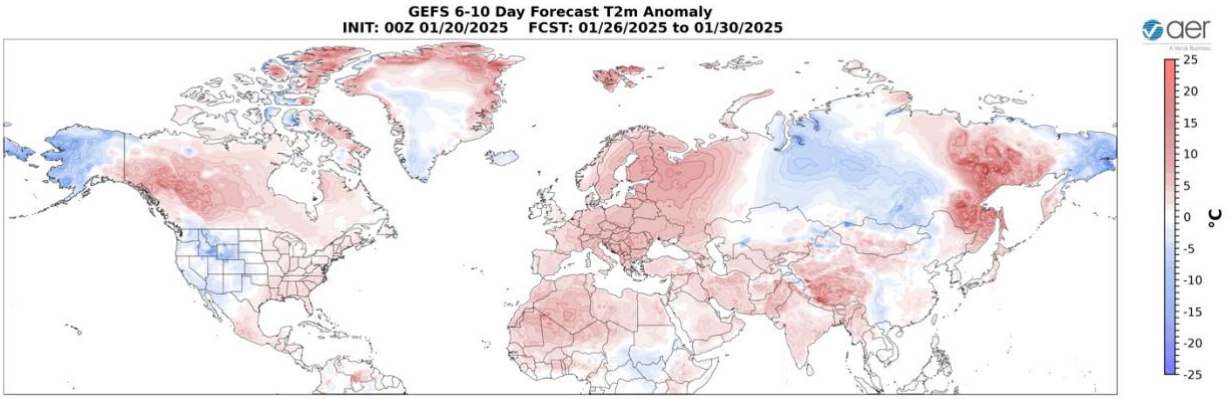


Figure 6. Forecasted surface temperature anomalies (°C; shading) from 26 Jan to 30 Jan 2025. The forecast is from the 00Z 20 January 2025 GFS ensemble.

A less amplified pattern is predicted to return to North America with ridging/positive geopotential height anomalies predicted across the Gulf of Alaska and Western Canada Maritimes with troughing/negative geopotential height anomalies across Central and Eastern Canada and the Southwestern and Eastern US this period (**Figure 5**). This pattern will favor widespread normal to above normal temperatures across eastern Alaska, much of Canada and the Central US with normal to below normal temperatures across western Alaska and the Western and Eastern US (**Figure 6**).

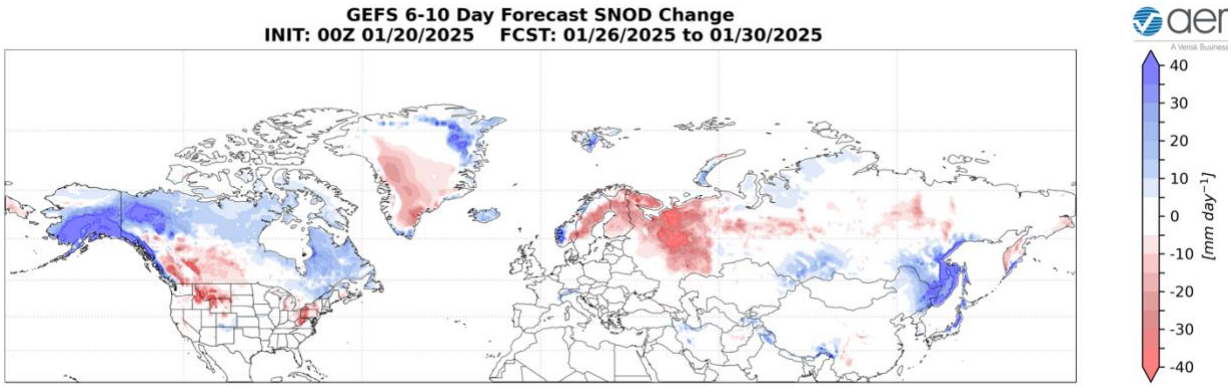


Figure 7. Forecasted snow depth changes (mm/day; shading) from 26 Jan to 30 Jan 2025. The forecast is from the 00Z 20 January 2025 GFS ensemble.

Troughing and/or cold temperatures will support new snowfall across Norway, Western Siberia, Northeast Asia and the Tibetan Plateau while warm temperatures will support snowmelt in parts of Scandinavia and Western Russia this period (**Figure 7**). Troughing and/or cold temperatures will support new snowfall across southern Alaska, the higher elevations of the Canadian West Coast, Northern and Eastern Canada and New England while warm temperatures will support snowmelt in Western Canada, the Western US and the Appalachians this period (**Figure 7**).

Mid Term

Week Two

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

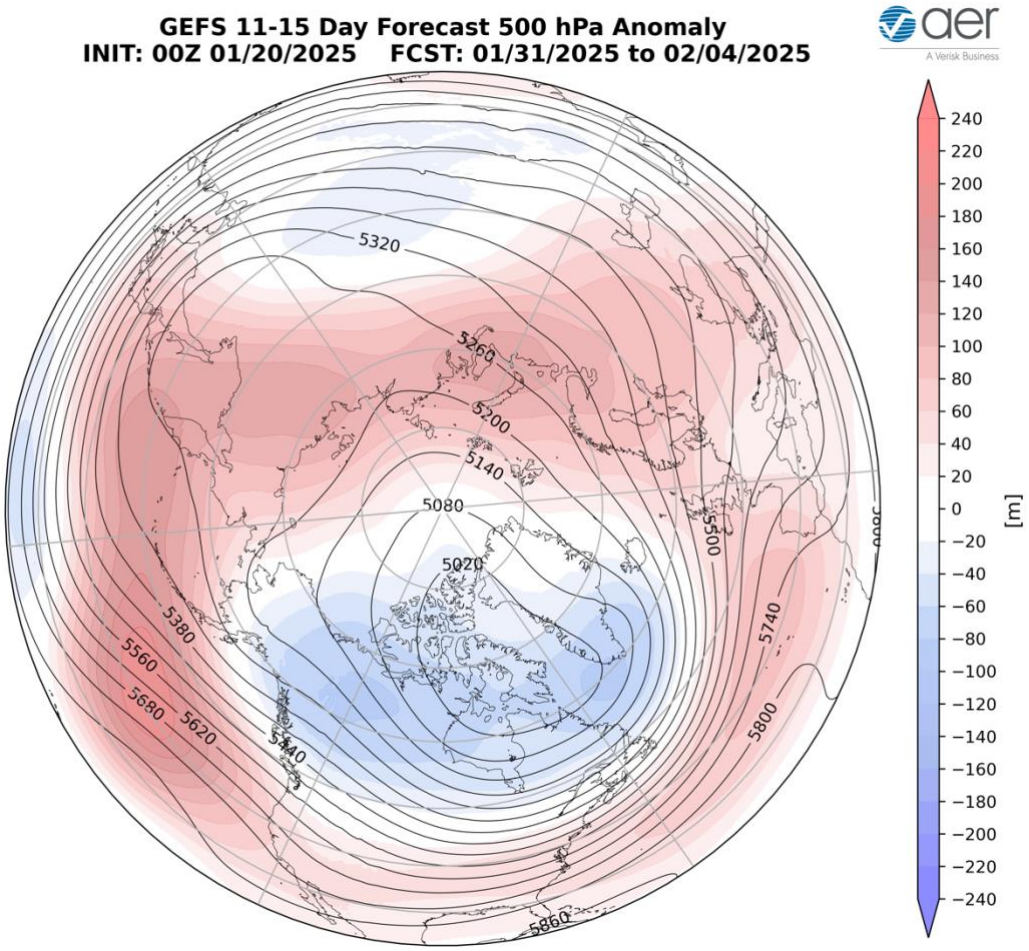


Figure 8. Forecasted average 500 mb geopotential heights (dam; contours) and geopotential height anomalies (m; shading) across the Northern Hemisphere from 31 Jan to 04 Feb 2025. The forecasts are from the 00Z 20 January 2025 GFS ensemble.

Persistent troughing/negative geopotential height anomalies across Greenland is predicted to continue supporting ridging/positive geopotential height anomalies across Europe (**Figure 8**). This pattern should favor widespread normal to above normal temperatures across much of Europe including the UK this period (**Figures 9**). The persistent ridging/positive geopotential height anomalies across Europe is predicted to spread across all of Northern Eurasia supporting

deepening troughing/negative geopotential height anomalies across Central and East Asia this period (**Figure 8**). The predicted pattern favors widespread normal to above normal temperatures across much of Asia with normal to below normal temperatures expanding across Western Siberia and into Northeast Asia this period (**Figure 9**).

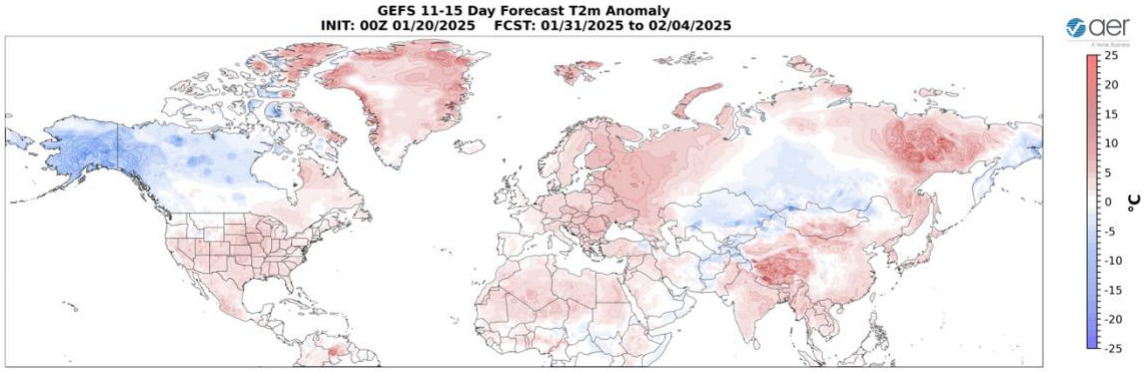


Figure 9. Forecasted surface temperature anomalies (°C; shading) from 31 Jan to 04 Feb 2025. The forecast is from the 00Z 20 January 2025 GFS ensemble.

Ridging/positive geopotential height anomalies south of the Aleutians will support troughing/negative geopotential height anomalies across Alaska and much of Canada with more ridging/positive geopotential height anomalies across the US this period (**Figure 8**). Below normal temperatures will spread south and east out of Alaska into Western Canada and into the Northeastern US with normal to above normal temperatures will dominate Eastern Canada and most of the US this period (**Figure 9**).

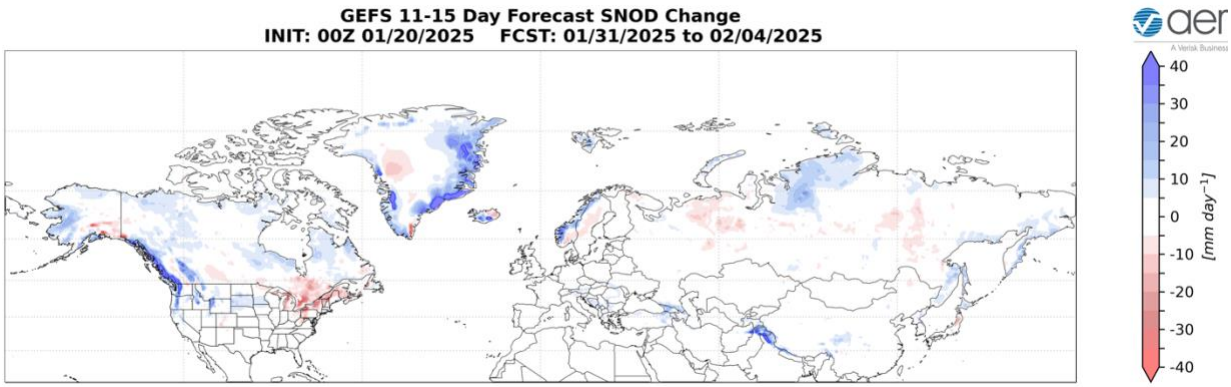


Figure 10. Forecasted snow depth changes (mm/day; shading) from 31 Jan to 04 Feb 2025. The forecast is from the 00Z 20 January 2025 GFS ensemble.

Troughing and/or cold temperatures will support new snowfall across Scandinavia, Siberia, the Tibetan Plateau and Northeastern Asia while warm temperatures will support snowmelt in Western Russia and Central Siberia this period (**Figure 10**). Troughing and/or cold temperatures will support new snowfall across Western and Eastern Canada and the Northwestern US while warm temperatures will support snowmelt in the Northeastern US this period (**Figure 10**).

Longer Term

30–day

The latest plot of the polar cap geopotential height anomalies (PCHs) currently shows warm/positive PCHs in the troposphere with cold/negative PCHs in the stratosphere (**Figure 11**). The cold/negative PCHs from the stratosphere are predicted to persist and strengthen the next two weeks while the warm/positive PCHs in the troposphere are predicted to alternate with cold/negative PCHs. The contrast between cold/negative PCHs in the stratosphere and warm/positive PCHs in the troposphere continues for yet another two weeks (**Figure 11**). For now, this suggests that the stratosphere and troposphere are mostly uncoupled. At least in the models, it looks like once again the strong PV is dominating high latitude blocking.

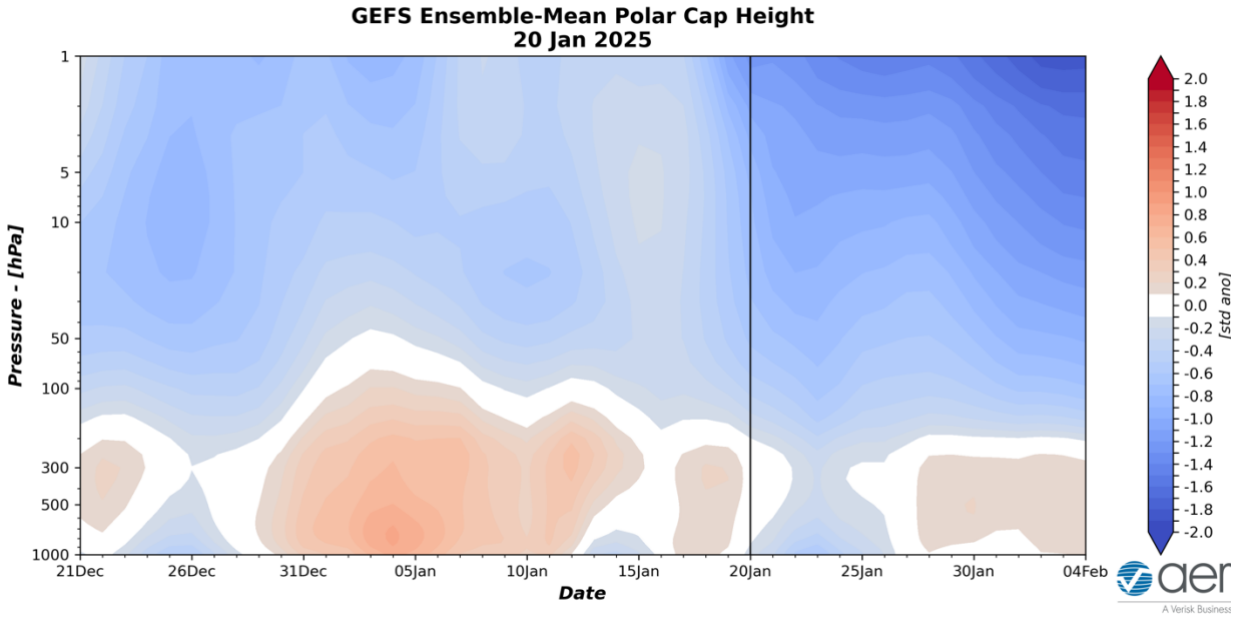


Figure 11. Observed and predicted daily polar cap height (i.e., area-averaged geopotential heights poleward of 60°N) standardized anomalies. The forecast is from the 00Z 20 January 2025 GFS ensemble.

The predicted alternating warm/positive and cold/negative PCHs in the lower troposphere the next two weeks (**Figure 11**) are consistent with the predicted neutral to positive surface AO this week and next week (**Figure 1**). Still waiting to see if the warm/positive PCHs in the troposphere could force a larger polar vortex disruption or the cold/negative PCHs in the stratosphere consistently couple to the surface. Still, lots of questions and no definitive signs.

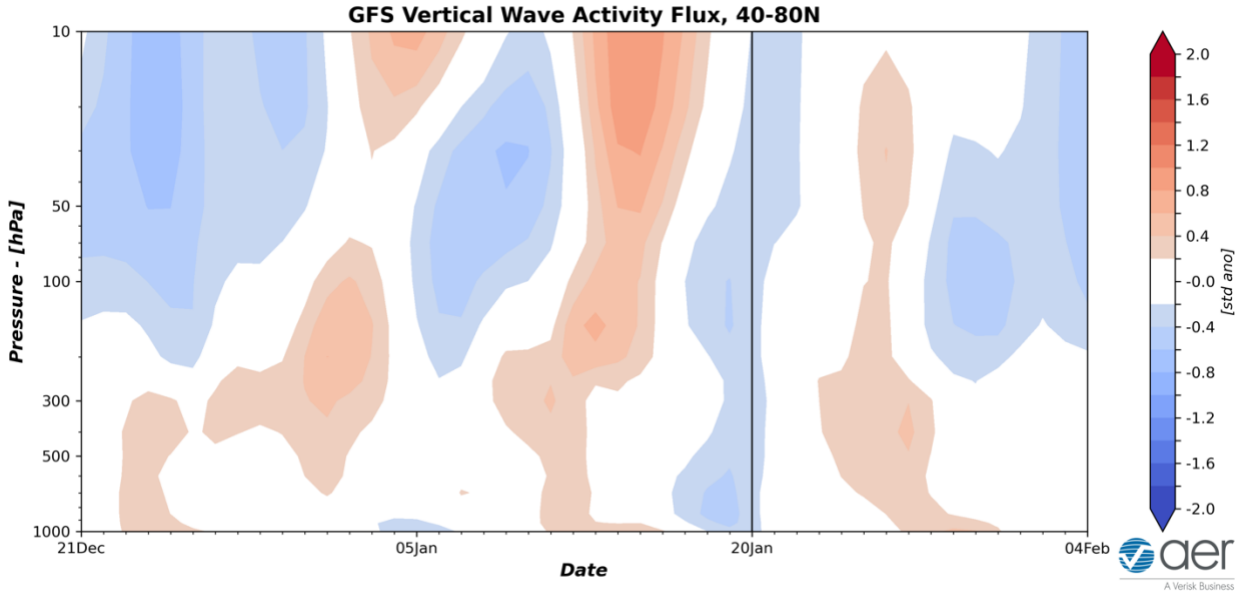


Figure 12. Observed and predicted daily vertical component of the wave activity flux (WAFz) standardized anomalies, averaged poleward of 40-80°N. The forecast is from the 00Z 20 January 2025 GFS ensemble.

Vertical Wave Activity Flux (WAFz) from the troposphere to the stratosphere or poleward heat transport in the stratosphere has been relatively quiet this season (**Figure 12**). However, the alternating positive (red) and negative (blue) WAFz anomalies is predicted to continue for another two weeks and is characteristic of wave reflection associated with stretched PVs (**Figure 12**). What is unusual is the rapidity of the changes. The alternating anomalies of WAFz are predicted to continue through the end of January, signaling to me, at least two more stretched PVs for the last ten days of January.

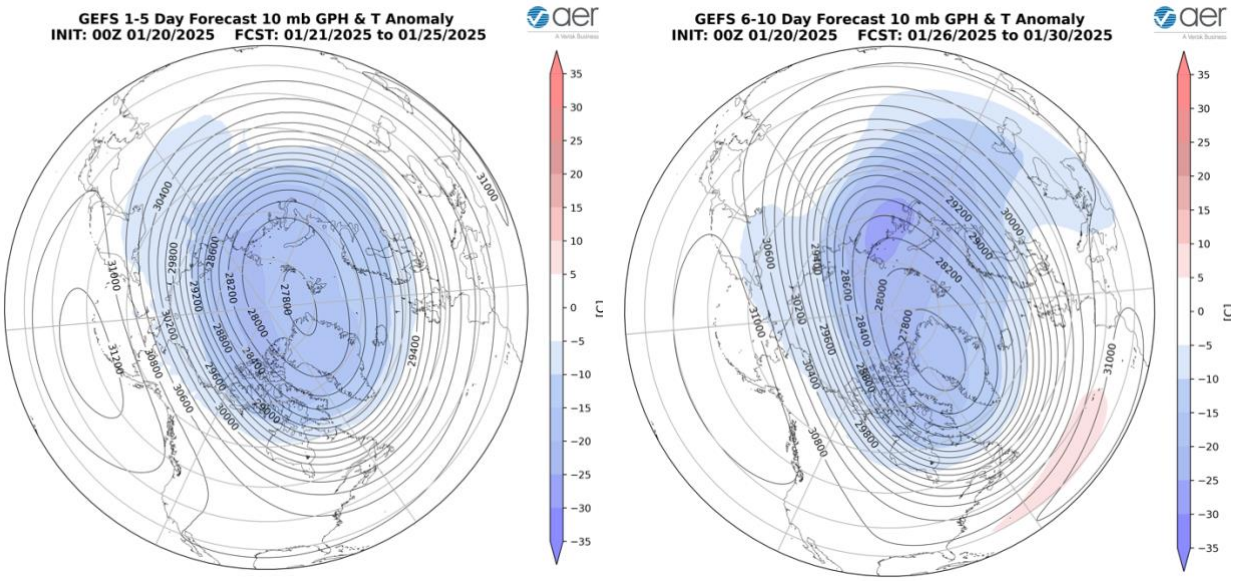


Figure 13. (a) Forecasted 10 mb geopotential heights (dam; contours) and temperature anomalies (°C; shading) across the Northern Hemisphere for 21 Jan to 25 Jan 2025. (b) Same as (a) except forecasted averaged from 26 Jan to 30 Jan 2025. The forecasts are from the 00Z 20 January 2025 GFS model ensemble.

This week the polar vortex (PV) is predicted to move between the North Pole and Svalbard and become more elongated in shape with relatively coldest temperatures across the Arctic in the polar stratosphere (**Figure 13a**). This is consistent with a yet another stretched PV (for those keeping score at home, the seventh of the season). The next week the PV is predicted to be centered over Greenland yet again to become more elongated in shape with relatively coldest temperatures across the Arctic in the stratosphere (**Figure 13b**). For those keeping score at home, the eighth of the season. The stratospheric AO in **Figure 1** this week continues to show that despite the repeated stretched PVs, overall, the PV remains strong and possibly record strong, and any cold air outbreaks should remain brief with each individual stretched PV event, on the order of a week or so.

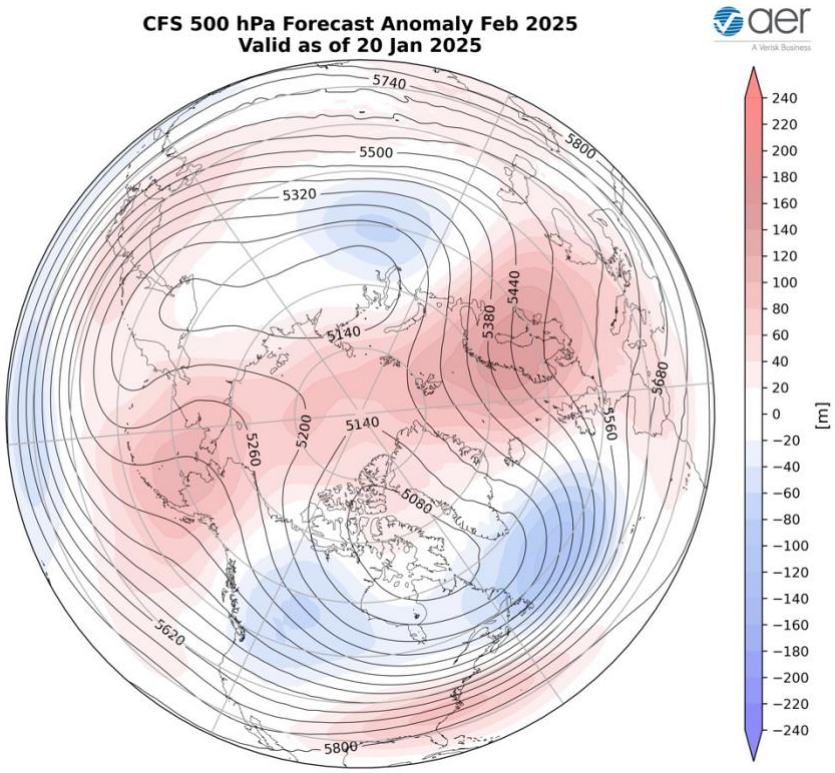


Figure 14. Forecasted average 500 mb geopotential heights (dam; contours) and geopotential height anomalies (m; shading) across the Northern Hemisphere for February 2025. The forecasts are from the 00Z 20 January 2025 CFS.

I include in this week's blog the monthly 500 hPa geopotential heights (**Figure 14**) and surface temperatures for February (**Figure 15**) from the Climate Forecast System (CFS; the plots represent yesterday's four ensemble members). The forecast for the troposphere is ridging centered on Northern Europe, the Barents-Kara Seas, centered on Alaska and into Eastern Siberia and the Southeastern US with troughing across Baffin Bay and Greenland, Northern and Eastern Asia, Western Canada and the Western US (**Figure 14**). This pattern favors seasonable to relatively warm temperatures across Europe, Western and Southern Asia, Eastern Siberia and the Southern US with seasonable to relatively cold temperatures across Western Siberia, Northeast Asia, Alaska, much of Canada but especially Western Canada and the Northern US (**Figure 15**).

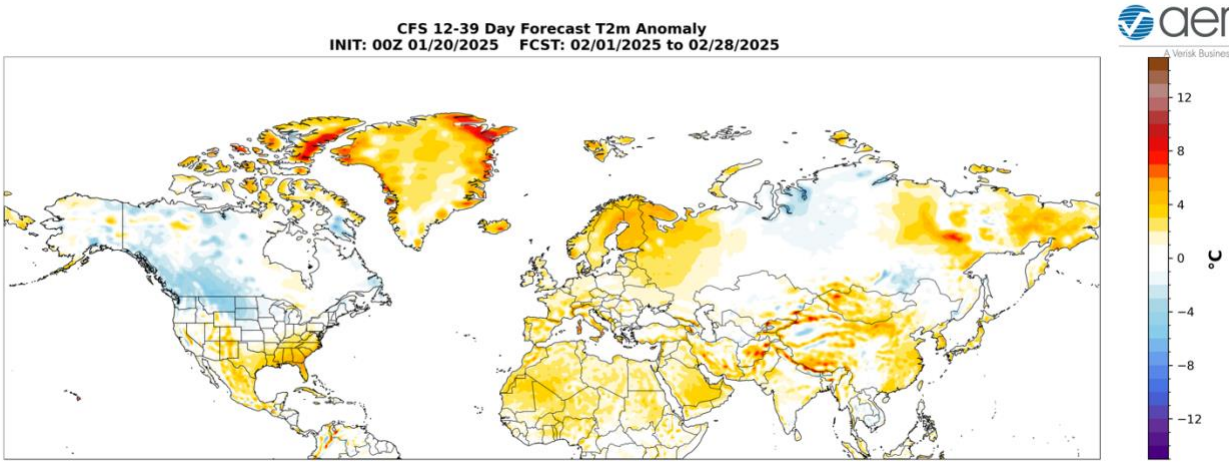


Figure 15. Forecasted average surface temperature anomalies (°C; shading) across the Northern Hemisphere for February 2025. The forecasts are from the 00Z 20 Jan 2025.

Boundary Forcings

Arctic Sea Ice

Sea ice growth continues relatively slowly with negative anomalies in the Barents-Kara Seas, the Sea of Okhotsk and the Labrador Sea (see **Figure 16**). The lack of sea ice in the that favors a weak PV and colder temperatures across the interior of the NH continents. The influence of sea ice on remote weather is likely waning.

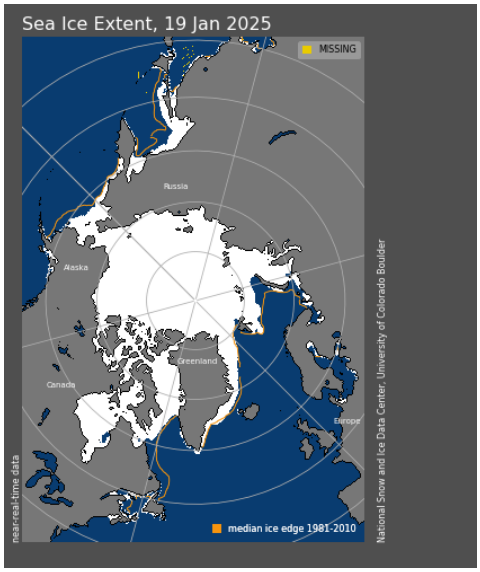


Figure 16. Observed Arctic sea ice extent on 19 January 2025 (white). Orange line shows climatological extent of sea ice based on the years 1981-2010. Image from the National Snow and Ice Data Center (NSIDC). URL: https://nsidc.org/sea-ice-today

SSTs/El Niño/Southern Oscillation

According to Jennifer Francis this plot has stopped updating.

Equatorial Pacific sea surface temperatures (SSTs) anomalies are below normal, between the Dateline and the South America coast, indicating that a La Niña event is emerging (**Figure 17**) and weak La Niña conditions are expected through the winter. Observed SSTs across the NH remain well above normal especially in the central North Pacific centered on the Dateline and the western North Pacific, much of the North Atlantic and offshore of the Canadian Maritimes though below normal SSTs exist regionally especially in the South Pacific. I do wonder if the warmer SSTs this year relative to recent years along the west coast of North America is favoring the cold air further to the east this winter compared to the past decade.

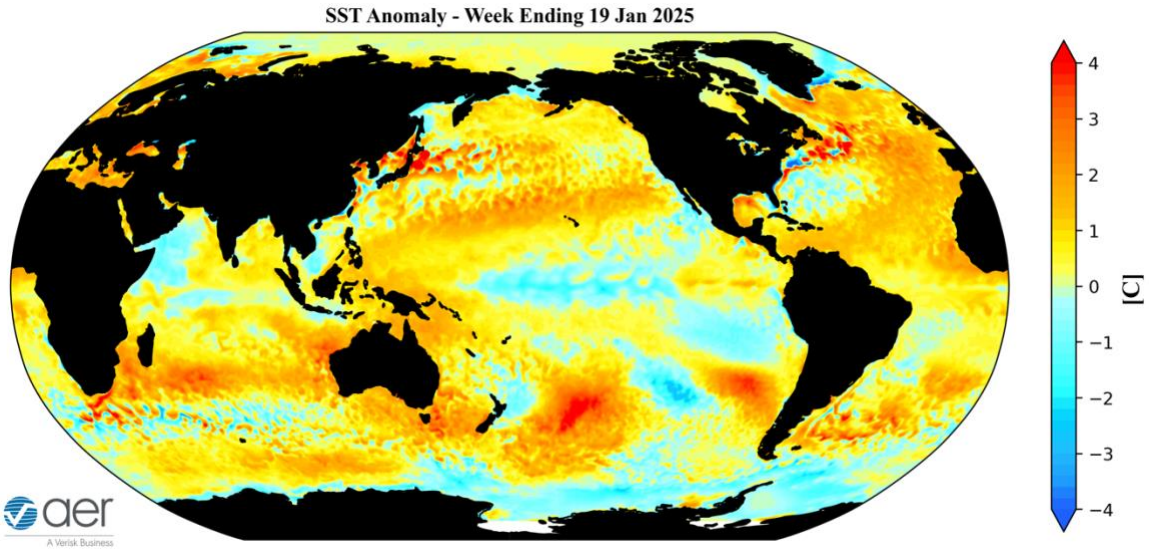


Figure 17. The latest daily-mean global SST anomalies (ending 19 Jan 2025). Data from NOAA OI High-Resolution dataset. Source https://psl.noaa.gov/map/clim/sst.shtml

Madden Julian Oscillation

Currently the Madden Julian Oscillation (MJO) is in phase two (**Figure 18**). The forecasts are for the MJO to quickly move through phases three and four and then weaken to where no phase is favored. Phases three and four favor ridging in the Western US and troughing in the Eastern US. Therefore, it seems that the MJO may be having some influence on North American weather the next couple of weeks. But admittedly this is outside of my expertise.

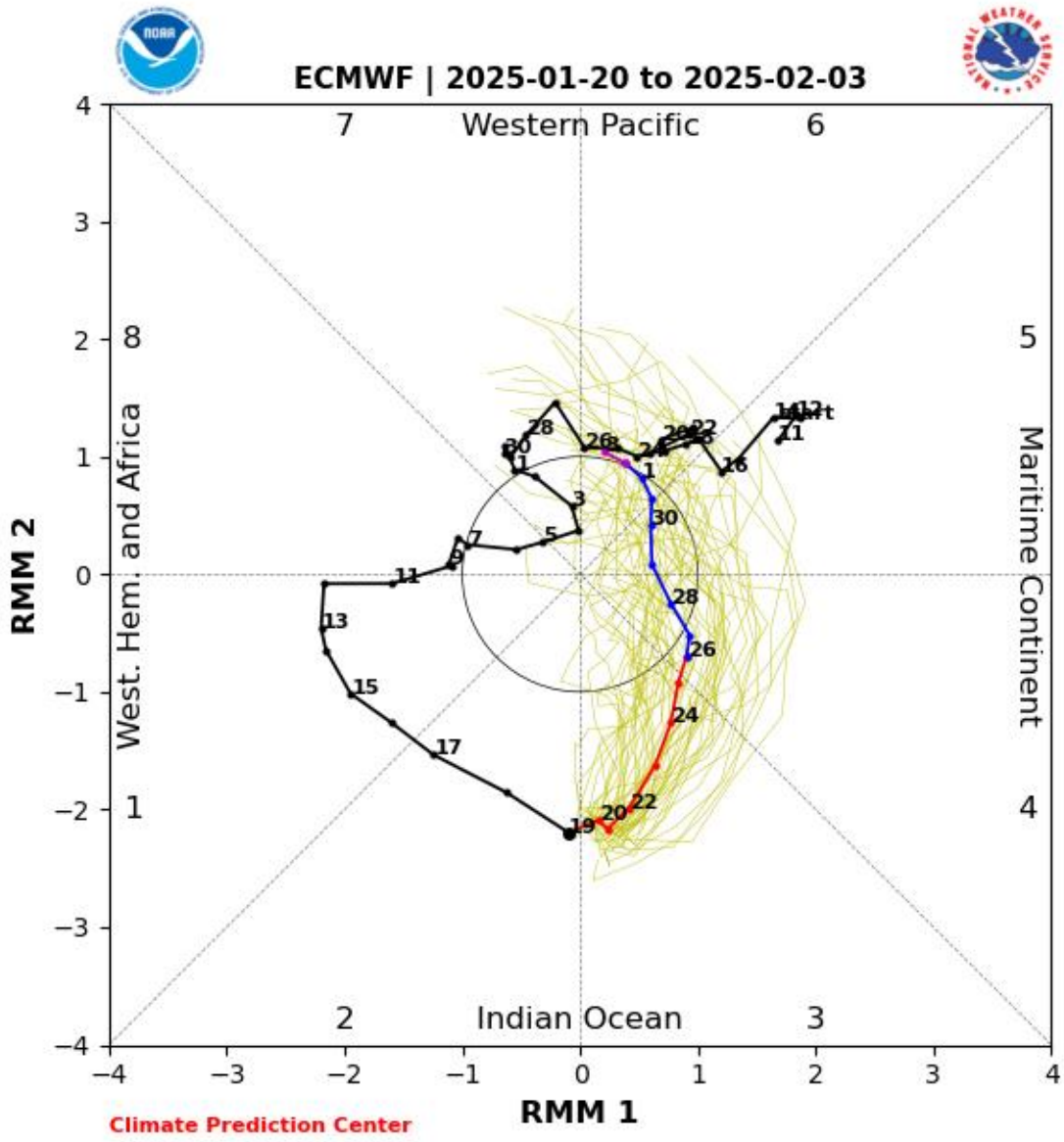


Figure 18. Past and forecast values of the MJO index. Forecast values from the 00Z 20 January 2025 ECMWF model. Yellow lines indicate individual ensemble-member forecasts, with the green line showing the ensemble-mean. A measure of the model 'spread' is denoted by the gray shading. Sector numbers indicate 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

Atmospheric and Environmental Research

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