JANUS RESEARCH GROUP

Arctic Oscillation and Polar Vortex Analysis and Forecasts

June 8, 2026

Dr. Judah Cohen from Atmospheric and Environmental Research (AER) embarked on an experimental process of regular research, review, and analysis of the Arctic Oscillation (AO) and Polar Vortex (PV). This analysis is intended to provide researchers and practitioners real-time insights on one of North America's and Europe's leading drivers for extreme and persistent temperature patterns.

During the winter schedule the blog is updated once every week. Snow accumulation forecasts replace precipitation forecasts. Also, there is renewed emphasis on ice and snow boundary conditions and their influence on hemispheric weather. In late Spring, we transition to a spring/summer schedule, which is once every two weeks. Snow accumulation forecasts will be replaced by precipitation forecasts. Also, there will be less emphasis on ice and snow boundary conditions and their influence on hemispheric weather.

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The AO/PV blog is partially supported by NSF grant AGS: 1657748

Summary

- The Arctic Oscillation (AO) is currently positive as pressure/geopotential height anomalies across the Arctic are currently mostly negative and the AO is predicted to trend towards neutral and then rmain tethered to neutral the next two weeks as pressure/geopotential height anomalies are predicted to remain mixed to mostly negative the next two weeks. The North Atlantic Oscillation (NAO) is currently neutral with mixed pressure/geopotential height anomalies across Greenland, and the NAO is predicted to drift negative the next two weeks as pressure/geopotential height anomalies are predicted to remain mostly positive across Greenland the next two weeks.
- Over the next two weeks ridging/positive geopotential height anomalies across the northern North Atlantic will favor troughing/negative geopotential height anomalies moving from west to east across Europe the enxt two weeks. This pattern will favor normal to below normal temperatures across Western Europe including the United Kingdom (UK) with normal to above normal temperatures across Eastern Europe this week, however next week normal to above normal temperatures will become more widespread across Western Europe Europe with normal to below normal temperatures across Eastern Europe.
- The predicted pattern across Asia the next two weeks is ridging/positive geopotential height anomalies centered across Western Asia favoring troughing/negative geopotential height anomalies across Eastern Asia. This pattern favors mostly normal to above normal

temperatures across Western and Central Asia with normal to below normal temperatures across East Asia.

- The predicted atmospheric pattern across North America the next two weeks is ridging/positive geopotential height anomalies centered in the Gulf of Alaska and Baffin Bay supporting troughing/negative geopotential height anomalies just downstream of the Rockies and slowly sliding eastward. This patten will support this week normal to below normal temperatures across the Plains of Canda and the United States (US) with normal to above normal temperatures elsewhere across Canada and the US that will slowly spread into the Eastern US next week.
- Looks like the atmosphere across the Northern Hemisphere (NH) continues to settle into its summer pattern common in recent years, which includes heat domes along the northern edges of the continents btu with some surprising twits for the early part of the summer. My thoughts below.

Plain Language Summary

The beginning of summer can be summed up as heat domes across Western Siberia and Eastern Canada favoring some relatively cool temperatures at lower latitudes in parts of Southern Canada, the Eastern US and especially East Asia (see **Figure**). The forecast for much of June can be summarized as a continuation of heat domes near Greenland, near the Urals and the Gulf of Alaska supporting relatively cool temperatures in Europe, East Asia and the Eastern US respectively (see **Figures 3, 6** and **9**).

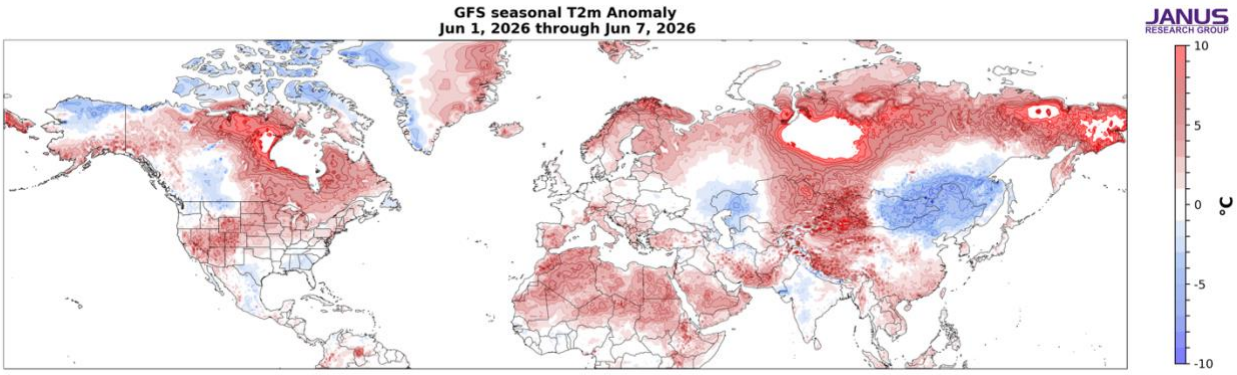

Figure. Estimate of the observed surface temperatures (°C; shading) from 01 Mar to 07 Jun 2026 based on GFS initializations and the GFS forecast from the 08 Jun 2026 run.

Impacts

As usual I begin the discussion with a look at the two week forecast of the mid-tropospheric circulation animation in **Figure I**. As is often the case, we can fairly easily discern a general pattern of low pressure in the Arctic centered right over the North Pole encircled or surrounded by bubbles of high-presure ridging along the northern edges of the continents and could be described as heat domes. Though at the end of the animation high pressure invades the Central Arctic. If that patern persisted for much of the summer that would be an almost shocking pattern for the summer and I don't think it is a dominant pattern that we should expect.

There are three main regions of high-pressure ridging with one center near the Urals, another in the Gulf of Alaska and the third across the North Atlantic side of the Arctic including Greenland. These three features strongly contribute to widespread warmth across the northern continents (see **Figures 3, 5** and **8**). Though these high-pressure centers are also helping to push south into the mid-latitudes relatively cool temperatures downstream into Northeast Asia, Eastern Canada and the Eastern US and even sweeping across Europe (see **Figures 3, 5** and **8**). I do think that this general type of pattern will be with us for much of the winter.

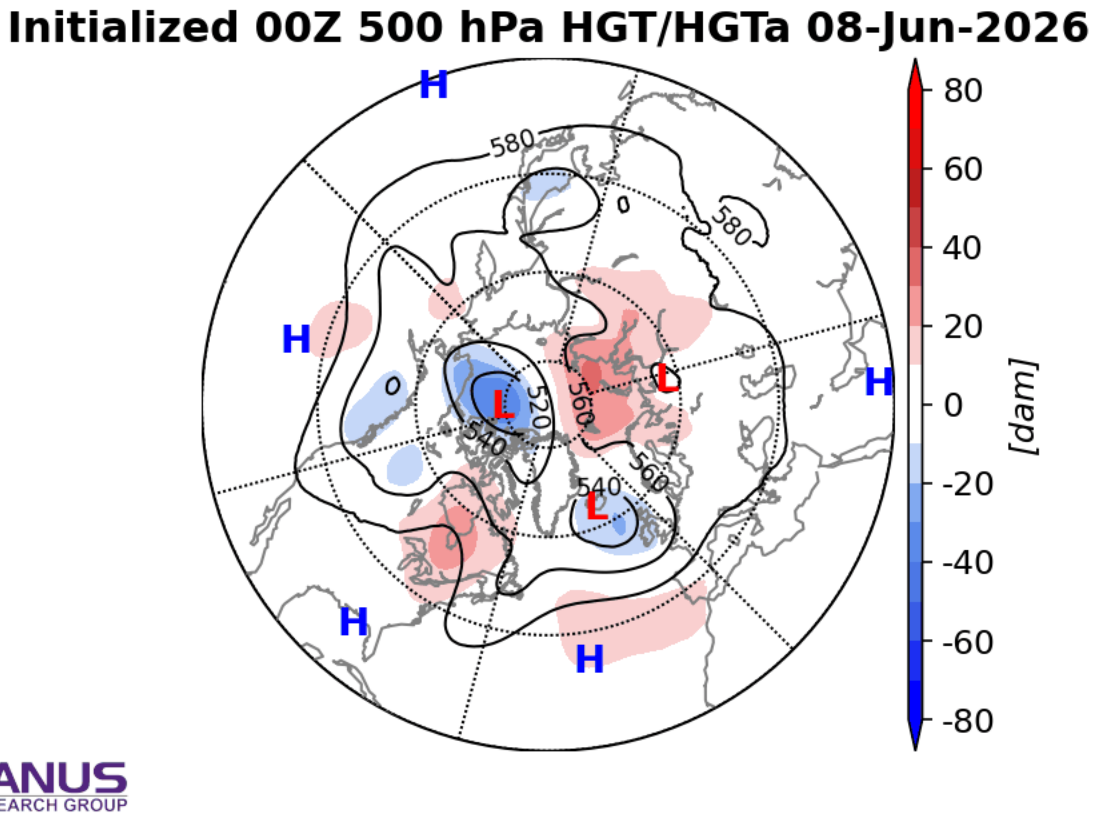

Figure i. Initialized 500 mb geopotential heights (dam; contours) and decameter anomalies (dam; shading) across the Northern Hemisphere for 11 May 2026 and forecasted from 09 Jun to 23 Jun 2026. The forecasts are from the 00Z 08 Jun 2026 GFS model.

How much the weather pattern in the early summer is foreshadowing for much of the summer across North America, Europe and Asia hard to know just yet. But of those three regions, I am most confident of the North American pattern generally persisting. I can certainly see high pressure ridging dominating the region of western North America for much of the summer with weak downstream troughing east of the Rockies. That would likely produce a hot summer across a large portion of western North America. It would also likely produce a relatively cool or at least a near seasonable summer somewhere east of the Rockies but does that mean the Plains, the Southeast and/or Northeastern US is still hard to predict.

lt never ceases to amaze me that Europe is one of the fastest, if not the fastest warming region on the planet. And we have witnessed some impressive heat waves across different regions of Europe over the past several summers. So far in the early going, overall it hasn't been too hot across Europe based on this past week's weather and next week's. Though there are local exceptions. It will be interesting to see if the early forecasts of Greenland blocking can persist for long periods of the upcoming summer. That could result in a more seasonable summer for parts of Europe and I would think especially Western Europe. And at least looking at the polar cap geopotential height anomalies (PCHs) in the Greenland region, does suggest Greenland blocking could persist beyond the next two weeks. But I also don't want to overstate the usefullness of this diagnostic. Though It does seem that the Honga Tonga summers featuring a PCH sandwich of cold/negative PCHs in the upper stratosphere and near the surface with warm/positive PCHs in between in the upper troposphere and lower stratosphere does not seem to be in the cards for this summer. And unlike in winter, the tropospheric warm/positive PCHS are not being driven by high pressure ridging over the Central Arctic but instead by high pressure ridging over the northern continents.

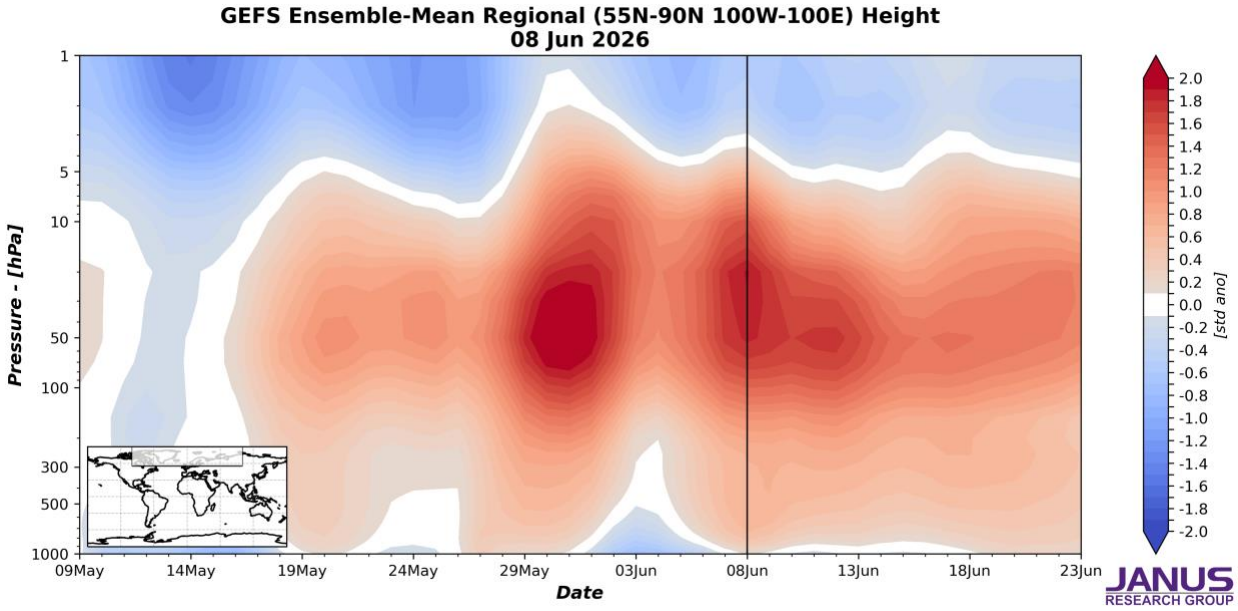

Figure ii. Observed and predicted daily polar cap height (i.e., area-averaged geopotential heights poleward of 60°N) standardized anomalies for the North Atlantic sector only (see insert). The forecast is from the 00Z 08 Jun 2026 GFS ensemble.

The region I am least confident where the upcoming predicted pattern will persist for much of the summer is Asia. A farily reliable feature of recent summers is troughing and relatively cool temperatures in Western Russia with heat domes to the west in Europe and to the east including Siberia and East Asia. So far the opposite pattern is predicted. If the near term pattern across Asia can persist for much of the summer, that would be an "upset" of sorts since cool in Western Asia and hot in Central and/or Eastern Asia has been maybe been the most reliable summer pattern of late.

Near-Term

This week

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

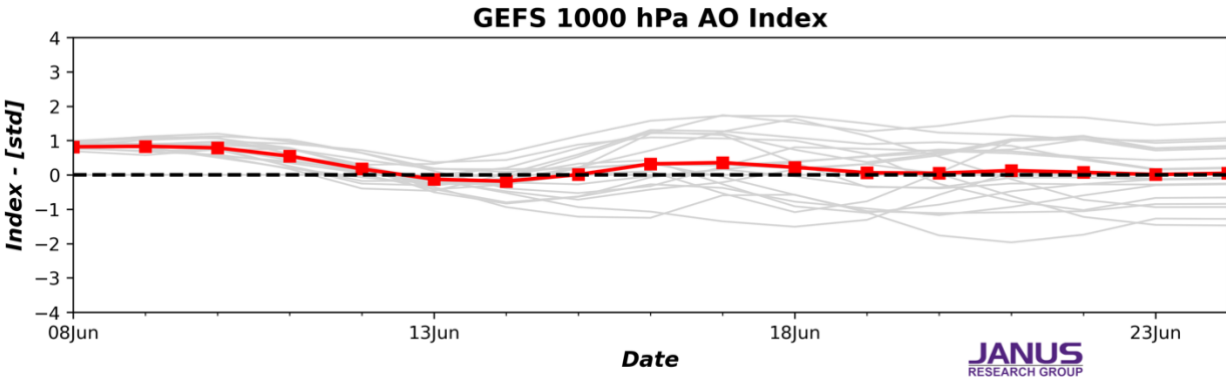

Figure 1. The predicted daily-mean AO at 1000 hPa from the 00Z 08 Jun 2026 GFS ensemble. Gray lines indicate the AO index from each individual ensemble member, with the ensemble mean AO index given by the red line with squares.

Ridging/positive geopotential height anomalies strung out across the northern North Atlantic including Greeenland will support troughing/negative geopotential height anomalies across Northwestern Europe with more ridging across Southern Europe this week (**Figure 2).** This pattern will support normal to below normal temperatures across Northwestern Europe including the UK with normal to above normal temperatures across Southern and Eastern Europe this week (**Figure 3**). This week the general pattern across Asia is ridging/positive geopotential height anomalies centered in Northwest Asia supporting troughing/negative geopotential height anomalies across Eastern Asia this week (**Figure 2**). This pattern favors

widespread normal to above normal temperatures across Western, Central and Southern Asia with normal to below normal temperatures across East Asia this week **(Figure 3**).

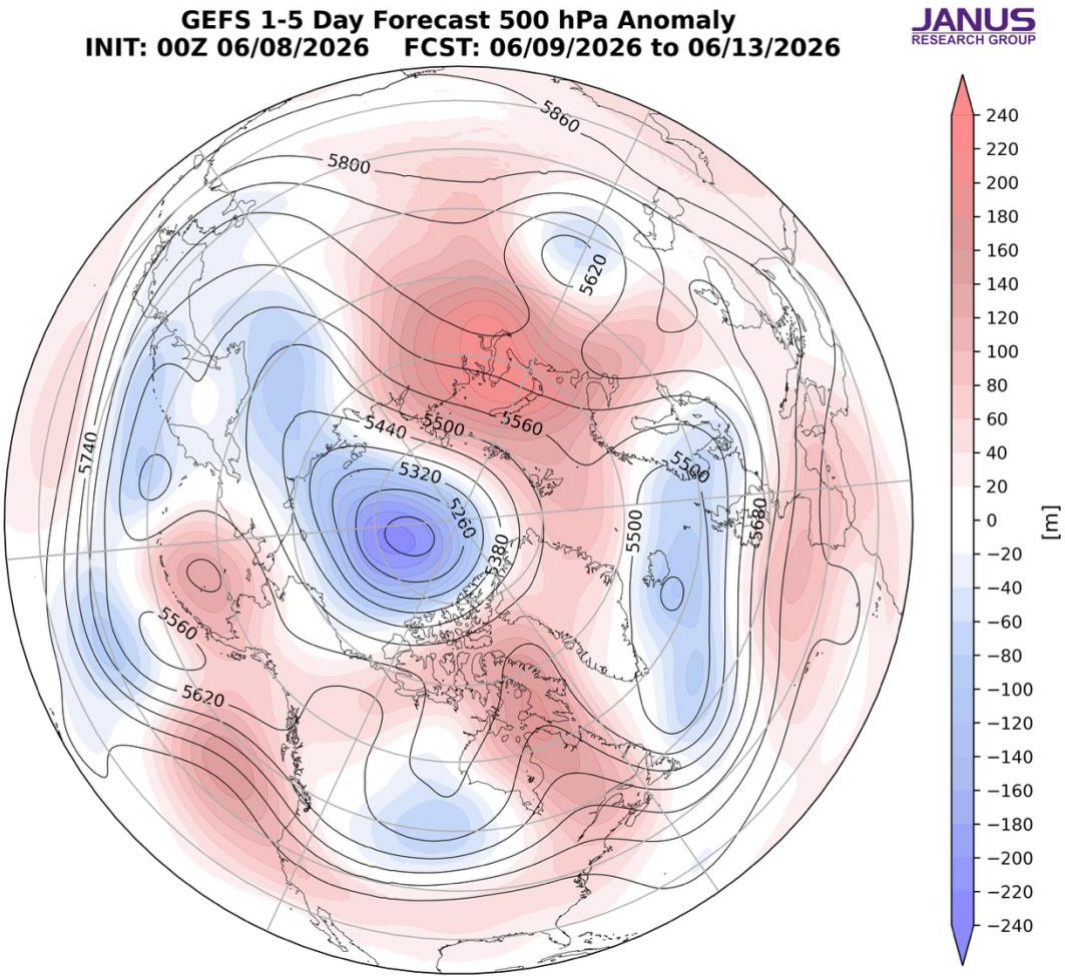

Figure 2. Forecasted average 500 mb geopotential heights (dam; contours) and geopotential height anomalies (m; shading) across the Northern Hemisphere from 09 Jun 2026 to 13 Jun 2026. The forecasts are from the 00Z 08 Jun 2026 GFS ensemble.

The predicted pattern across North America this week is ridging/positive geopotential height anomalies centered in the Gulf of Alaska and Baffin Bay supporting troughing/negative geopotential height anomalies just downstream of the Rockies this week (**Figure 2**). This patten will favor normal to below normal temperatures across parts of Alaska, the Plains of Canada and the US Northern Plains with normal to above normal temperatures Western and Eastern Canada and the Southern and Eastern US this week (**Figure 3**).

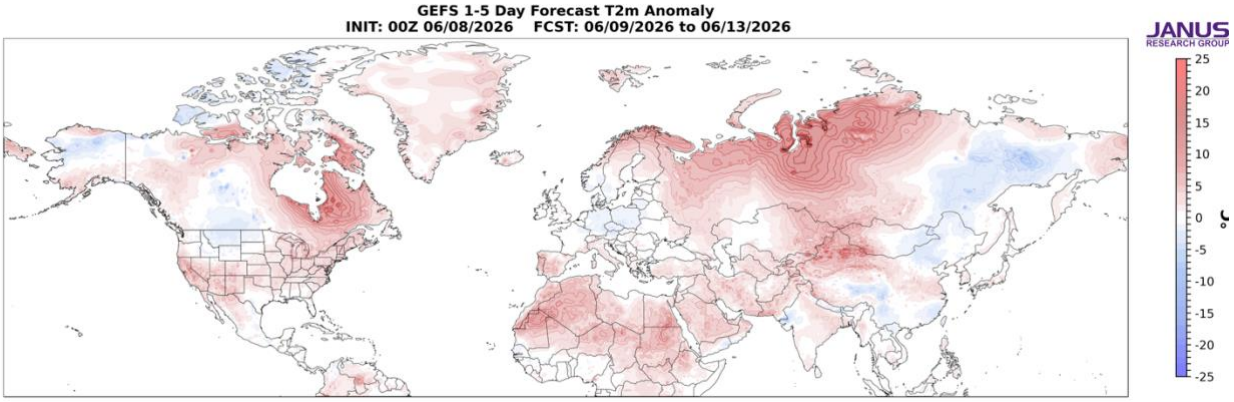

Figure 3. Forecasted surface temperature anomalies (°C; shading) from 09 Jun 2026 to 13 Jun 2026. The forecasts are from the 00Z 08 Jun 2026 GFS ensemble.

Troughing will support new rainfall across Scandinavia, Eastern Europe, the Southern Urals, Eastern Siberia and the Tibetan Plateau with mostly dry conditions across much of Europe and Asia (**Figure 4**). Troughing will support new rainfall across the Canadian Rockies, Central Canada and the Great Lakes with mostly dry conditions across much of North America this week (**Figure 4**).

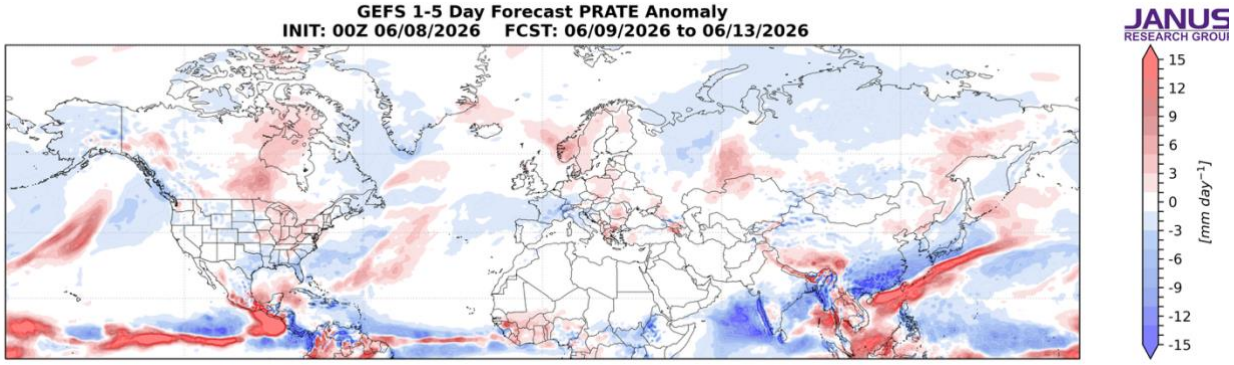

Figure 4. Forecasted precipitation (mm/day; shading) from 09 Jun 2026 to 13 Jun 2026. The forecasts are from the 00Z 08 Jun 2026 GFS ensemble.

Near-Mid Term

Next week

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

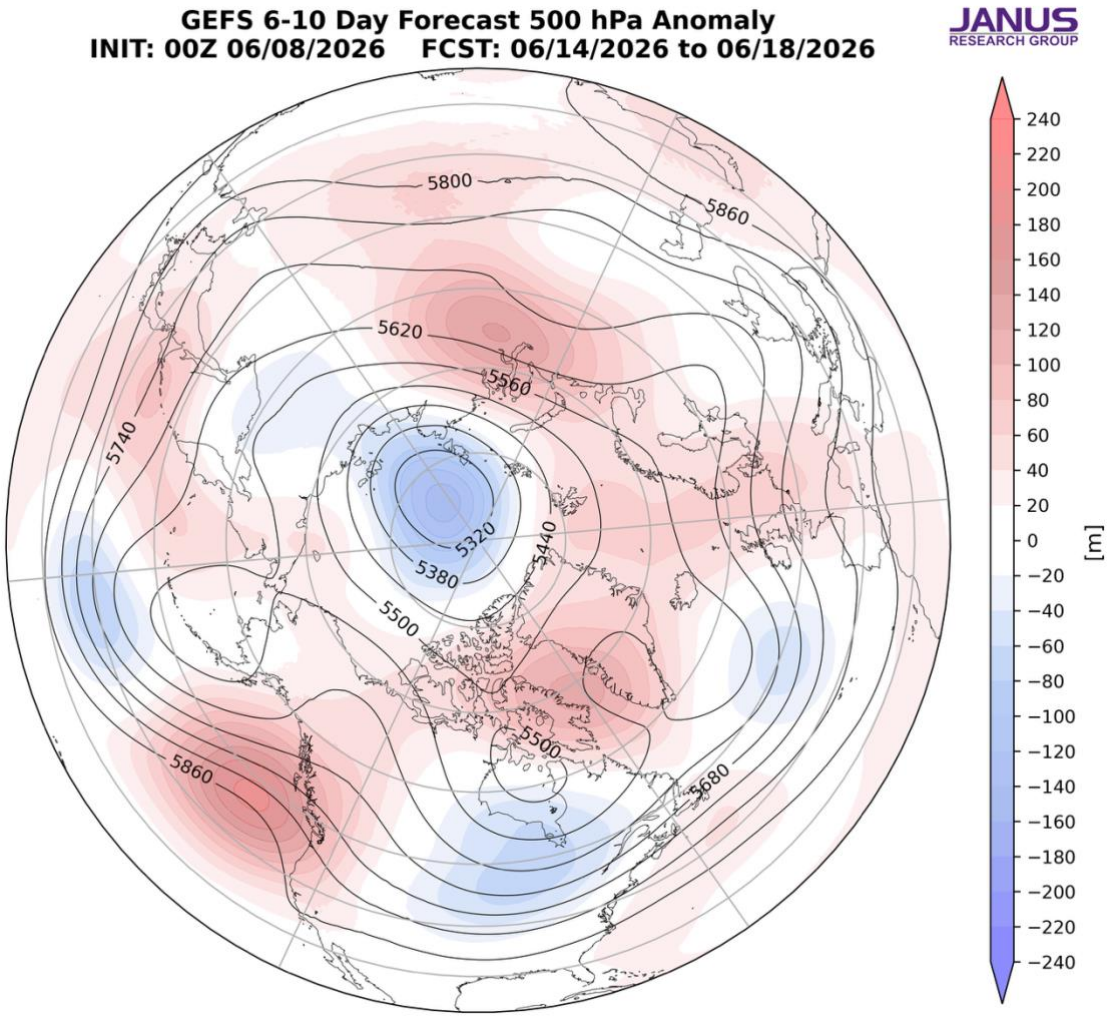

Figure 5. Forecasted average 500 mb geopotential heights (dam; contours) and geopotential height anomalies (m; shading) across the Northern Hemisphere from 14 June 2026 to 18 June 2026. The forecasts are from the 00Z 08 Jun 2026 GFS ensemble.

The ridging/positive geopotential height anomalies across the northern North Atlantic will expand into Western Europe pushing troughing/negative geopotential height anomalies Eastern Europe this period (**Figure 5**). The pattern will support normal to above normal temperatures across Western Europe including the UK with normal to below temperatures in the Eastern Europe this period (**Figure 6**). Across Asia the persist persistent of

ridging/positive geopotential height anomalies across Western Asia supporting troughing/negative geopotential height anomalies across Eastern Asia is predicted to continue this period (**Figure 5**). This pattern favors widespread normal to above normal temperatures widespread across much of Asia especially Central Asia with normal to below normal temperatures limited to Eastern Siberia and into Northeast Asia and parts of India this period (**Figure 6**).

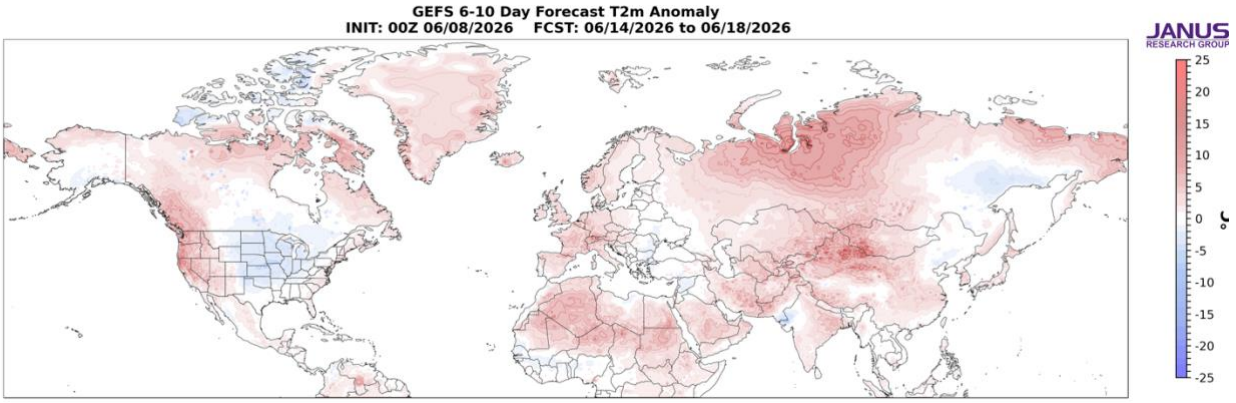

Figure 6. Forecasted surface temperature anomalies (°C; shading) from 14 Jun 2026 to 18 Jun 2026. The forecasts are from the 00Z 08 Jun 2026 GFS ensemble.

Across North America the pattern is also predicted to persist with ridging/positive geopotential height anomalies centered in the Gulf of Alaska and the Baffin Bay supporting troughing/negative geopotential height anomalies across eastern North America this period (**Figure 5**). This pattern will favor normal to above normal temperatures across northen Alaska, Western and Northern Canada and the Western US normal to below normal temperatures across southern Alaska, the Southern and Eastern Canada and the Eastern US this period (**Figure 6**).

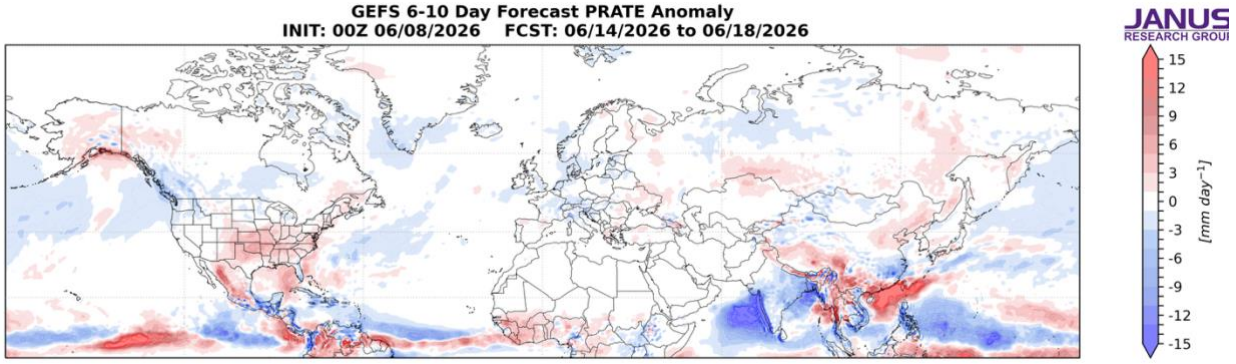

Figure 7. Forecasted rainfall rate (mm/day; shading) from 14 Jun 2026 to 18 Jun 2026. The forecasts are from the 00Z 08 Jun 2026 GFS ensemble.

Troughing will support new rainfall across Eastern Europe, the Southern Urals, Eastern Siberia, Northeastern Asia, Southwestern China and the Tibetan Plateau with mostly dry conditions across much of Europe and Asia (**Figure 7**). Troughing will support new rainfall across Alaska,

Northwestern Canada the US Plains and 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 be 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.

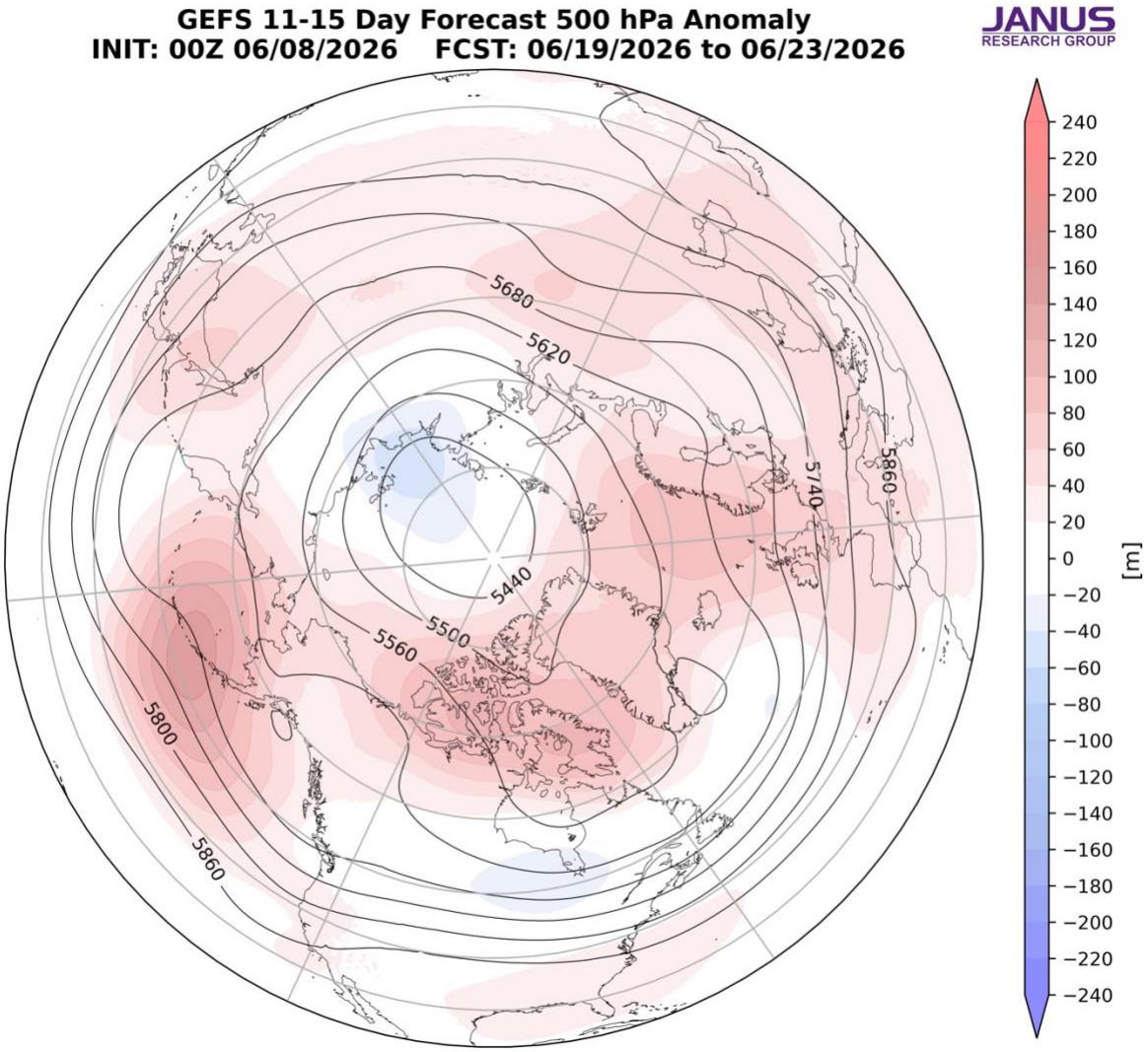

Figure 8. Forecasted average 500 mb geopotential heights (dam; contours) and geopotential height anomalies (m; shading) across the Northern Hemisphere from 19 Jun to 23 Jun 2026. The forecasts are from the 00Z 08 Jun 2026 GFS ensemble.

Ridging/positive geopotential height anomalies is predicted to continue to spread across much of Europe with only weak troughing/negative geopotential height anomalies across far Eastern 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 persistent pattern is predicted to continue across Asia with ridging/positive geopotential height anomalies centered near the Urals Asia supporting weak troughing/negative geopotential height anomalies across East Asia this period (**Figure 8**). This pattern favors widespread normal to above normal temperatures across most of Asia especially Northern Siberia and Central Asia with normal to below normal temperatures limited to parts of Northeast Asia and the parts of the Indian subcontinent this period (**Figure 9**).

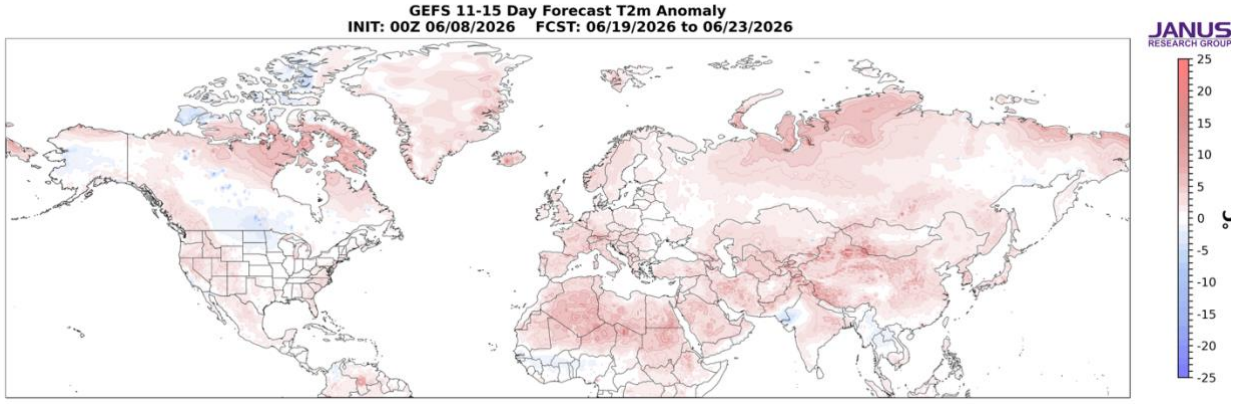

Figure 9. Forecasted surface temperature anomalies (°C; shading) from 19 Jun to 23 Jun 2026. The forecasts are from the 00Z 08 Jun 2026 GFS ensemble.

Ridging/positive geopotential height anomalies previously in the Gulf of Alaska are predicted to slide westward to the Aleutians and continue in the Baffin Bay support troughing/negative geopotential height anomalies across eastern North America this period (**Figure 8**). This pattern supports normal to above normal temperatures across northern Alaska, Western and Northern Canada and the Western US with normal to below normal temperatures across southern Alaska, Southern and Eastern Canada and the Eastern US this period (**Figure 9**).

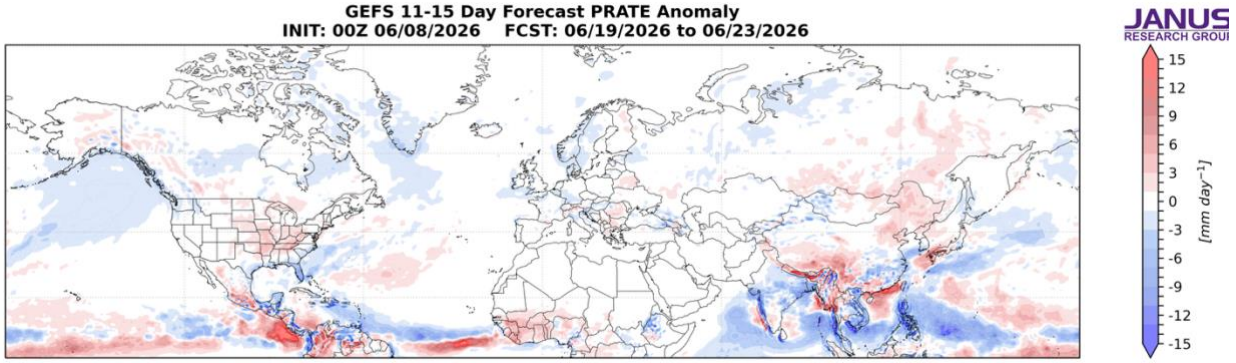

Figure 10. Forecasted rainfall (mm/day; shading) from 19 Jun to 23 Jun 2026. The forecasts are from the 00Z 08 Jun 2026 GFS ensemble.

Troughing will support new rainfall across Southeastern Europe, Southern and Eastern Siberia, Northeast Asia, Japna, the Tibetain Plateau and into southwest China with mostly dry conditions across much of Europe and Asia (**Figure 10**). Troughing will support new rainfall across Alaska, the Canadian Rockies, the US Plains, the Great Lakes and the Southeastern US with mostly dry conditions across much of North America this week (**Figure 10**).

Longer Term

30–day

Today's polar cap geopotential height anomalies (PCHs) plot currently shows cold/negative PCHs in the the upper stratosphere and the low-troposphere with warm/positive warm/positive PCHs in the lower stratosphere and the mid to upper troposphere (**Figure 11**). Then next week warm/positive PCHs should extend episodically downward into the lower troposphere.

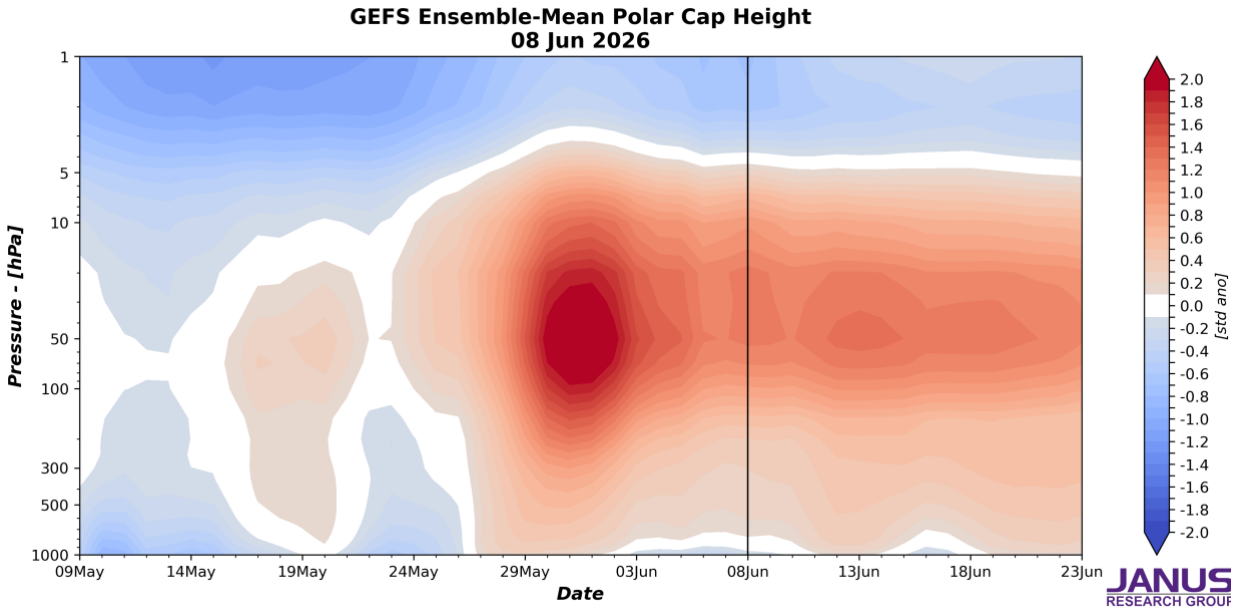

Figure 11. Observed and predicted daily polar cap height (i.e., area-averaged geopotential heights poleward of 60°N) standardized anomalies. The forecast is from the 00Z 08 Jun 2026 GFS ensemble.

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

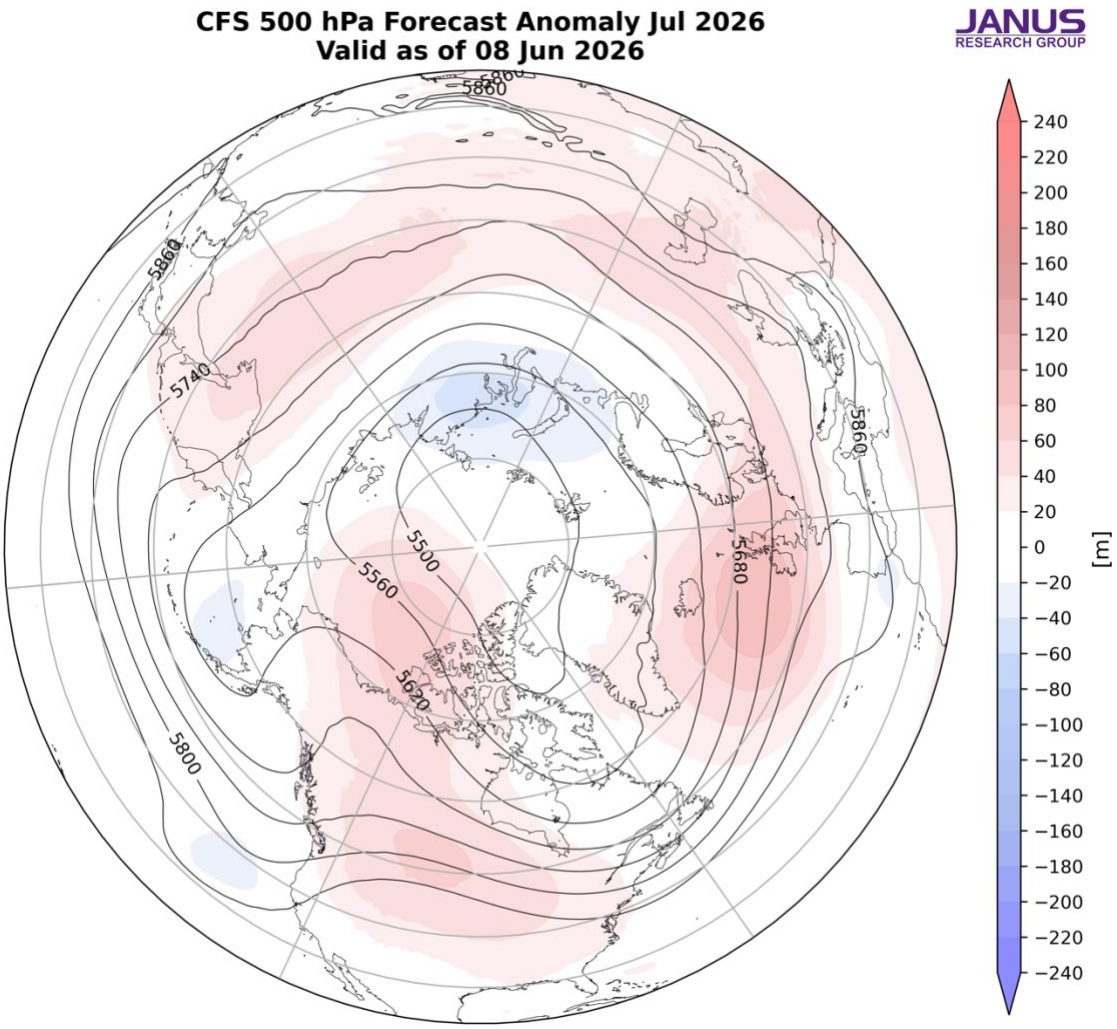

Figure 12. Forecasted average 500 mb geopotential heights (dam; contours) and geopotential height anomalies (m; shading) across the Northern Hemisphere for Jul 2026. The forecasts are from the 00Z 08 Jul 2025 CFS.

I include in this week's blog the monthly 500 hPa geopotential heights (**Figure 12**) and surface temperatures for July (**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 extending from Iceland to the British Isles, Western Asia, Alaska, Western Canada and the Western US with troughing across the Iberian Penninsula, Western Asia, the Aleutians, Eastern Canada and the Northeastern US (**Figure 12**). This pattern favors seasonable to relatively warm temperatures across most of Europe, Southern and Eastern Asia including the Middle East, the Tibetan Plateau, Pakistan and Afghanistan, Alaska, Western and Northern Canada and the Western US with seasonable to relatively cool temperatures across Southewestern Europe, Western Russia and into northern Kazakhstan, Southeastern Canada and the Eastern US (**Figure 13**).

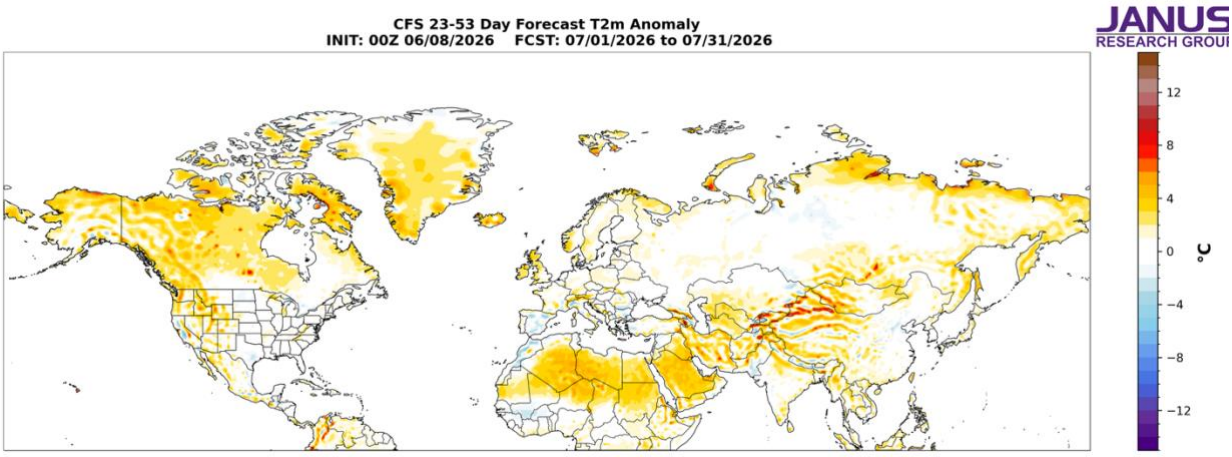

Figure 13. Forecasted average surface temperature anomalies (°C; shading) across the Northern Hemisphere for Jul 2026. The forecasts are from the 00Z 08 Jun 2026 CFS.

Boundary Forcings

SSTs/El Niño/Southern Oscillation

Equatorial Central Pacific sea surface temperatures (SSTs) anomalies are above normal, with the warming focused along the South American coast (see **Figure 14**), signs of developing El Niño conditions. In fact a possible "super" El Niño this fall and winter has been receiving much attention in the media. Observed SSTs across the NH remain well above normal especially in the North Pacific and much of the North Atlantic, though below normal SSTs exist regionally especially in the Southern Ocean and in the western North Atlantic.

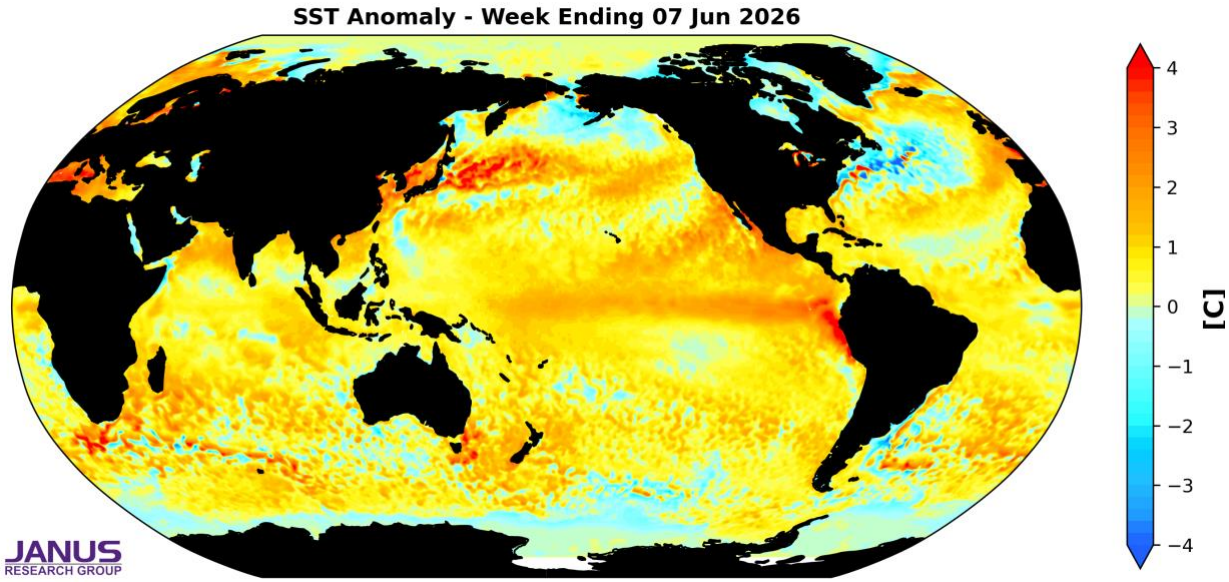

Figure 14. The latest daily-mean global SST anomalies for week ending 07 Jun 2026.

Madden Julian Oscillation

Currently the Madden Julian Oscillation (MJO) is in phase eight (**Figure 15**) and the forecasts are for the MJO to slowly move into phase one and then weaken to where no phase is favored the next two weeks (**Figure 15**). Phase eight favors ridging across much of Canada and the Western US with troughing across the Eastern US, consistent with forecasts this week and into the following week. Therefore it seems that the MJO is likely having some influencing on North American weather. But admittedly this is outside of my expertise.

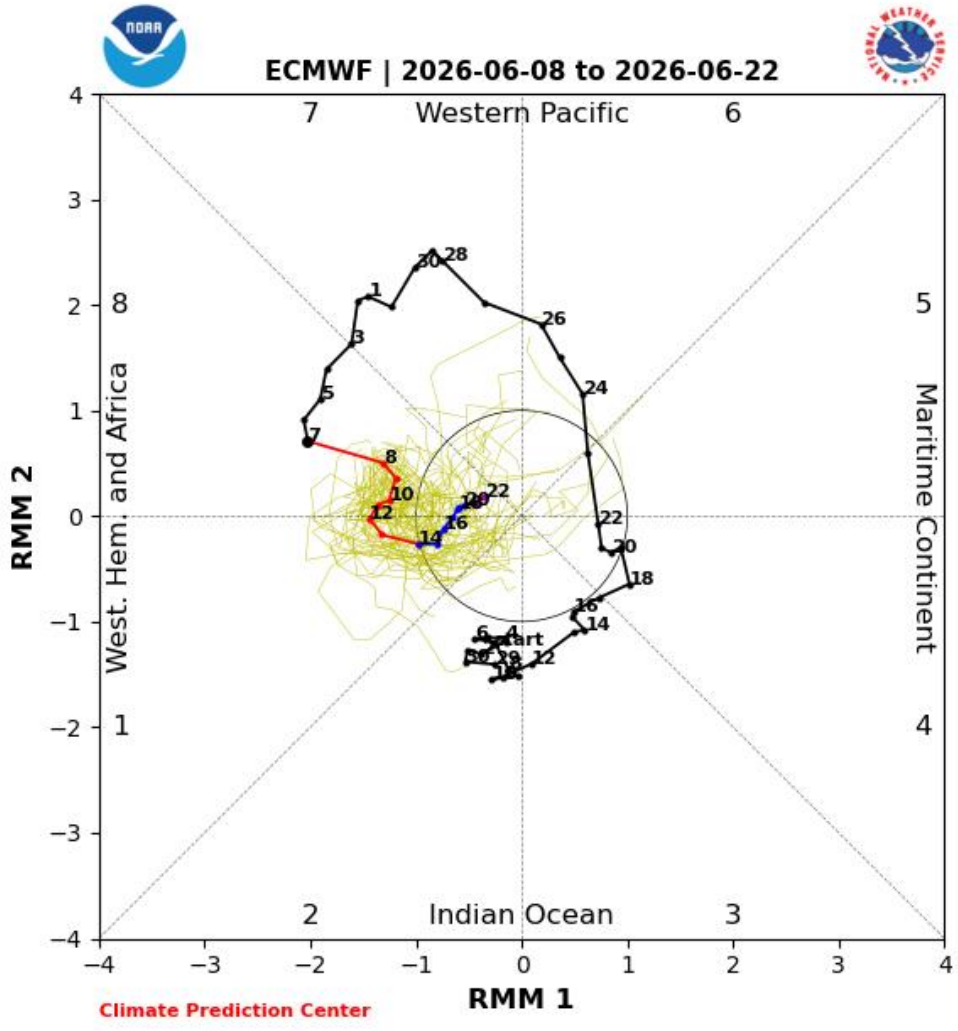

Figure 15. Past and forecast values of the MJO index. Forecast values from the 00Z 08 Jun 2026 ECMWF model. Yellow lines indicate individual ensemble-member forecasts, with the green line showing the ensemble-mean. A measure of the model 'spread' is denoted by the gray shading. Sector numbers indicate the phase of the MJO, with geographical labels

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

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