

Arctic Oscillation and Polar Vortex Analysis and Forecasts

June 25, 2026

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

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

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Summary

- The Arctic Oscillation (AO) is currently positive as pressure/geopotential height anomalies across the Arctic are currently mostly negative and the AO is predicted to remain positive 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 positive with negative pressure/geopotential height anomalies across Greenland, and the NAO is predicted to also remain positive the next two weeks as pressure/geopotential height anomalies are predicted to remain mostly negative across Greenland the next two weeks.
- Over the next two weeks troughing/negative geopotential height anomalies anchored Greenland will favor ridging/positive geopotential height anomalies dominating Europe the next two weeks, though admittedly the relationship is not as strong in summer as in winter. This pattern will favor normal to above normal temperatures across Europe including the United Kingdom (UK) and even record warm temperatures continuing the next week in Western Europe before finally breaking. One exception to the above normal temperatures will be Scandinavia where some of the troughing from Greenland will reach Scandinavia next week and bring with it some below normal temperatures.
- The predicted pattern across Asia the next two weeks is yet again another omega block pattern with ridging/positive geopotential height anomalies centered across Western

Siberia bookended by troughing/negative geopotential height anomalies across Western and Northeastern Asia. This pattern favors mostly normal to above normal temperatures across Central Asia with normal to below normal temperatures across Western and Northeast Asia.

- Over the coming week the predicted atmospheric pattern across North America is ridging/positive geopotential height anomalies across eastern North America with troughing/negative geopotential height anomalies in western North America, with the troughing in the Western United States (US) unusually deep for summer. Then next week the ridging in eastern North America will slide west. This pattern will support this week normal to below normal temperatures across Alaska, the West Coast of Canada and the Western US. with normal to above normal temperatures elsewhere across much of Canada and the US east of the Rockies. Then next week the biggest change will be warming temperatures in the Western US and cooling temperatures in the Eastern US.
- Looks like the atmosphere across the Northern Hemisphere (NH) is in full summer mode with some surprises but mostly has settled into a familiar pattern. My thoughts below.
- The next scheduled blog is July 6; however I will be enroute to Germany so expect more delays/disruptions in the blog in the coming weeks.

Plain Language Summary

The beginning of summer can be summed up as heat domes across Europe, Western Siberia and Eastern Canada favoring some relatively cool temperatures at lower latitudes in parts of Central Canada, the Eastern US and especially East Asia (see **Figure**). The forecast features a continuation of heat domes across Europe, Western Siberia and Eastern Canada supporting relatively cool temperatures in Western and Northeastern Asia and the Western US (see **Figures 3, 6 and 9**). However the cool temperatures in the Western US seem to be temporary.

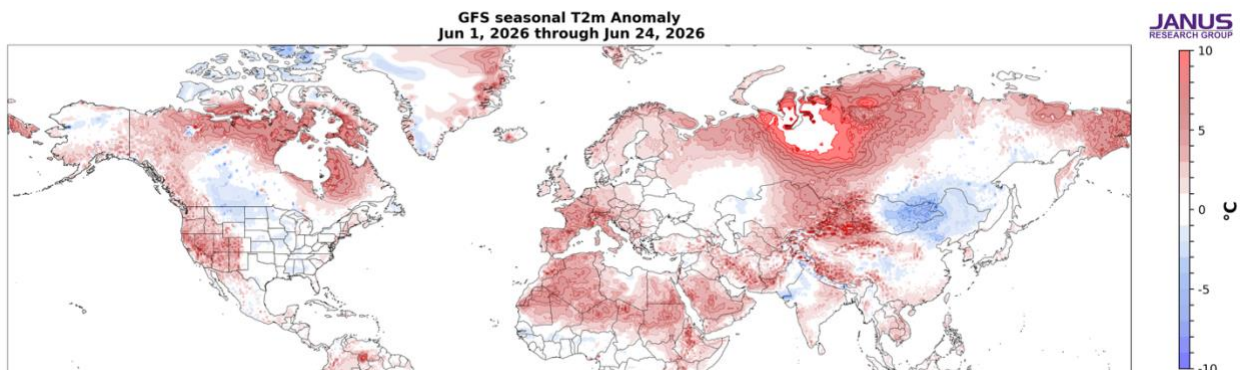


Figure. Estimate of the observed surface temperatures (°C; shading) from 01 Jun to 24 Jun 2026 based on GFS initializations and the GFS forecast from the 25 Jun 2026 run.

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 easily discern a general pattern of low pressure in the Arctic centered right over the North Pole encircled or surrounded by bubbles of high-pressure ridging along the northern edges of the continents and could be described as heat domes. In the last blog I expressed great surprise at the forecast of high pressure invading the Central Arctic. None of that with this week's forecast, which is more consistent with recent summer circulation patterns.

There are three main regions of high-pressure ridging with one center over Western Siberia, another over Hudson Bay and the third over Western Europe. These three features strongly contribute to widespread warmth across the northern continents (see **Figures 3, 6 and 9**). The heat dome over Europe is making the most news this week with record breaking hot temperatures and unfortunately fatalities. Looking back at our summer forecast and that from the C3S, I am liking our forecast with the heat centered further west in Europe compared to the C3S. Though these high-pressure centers are also helping to push south into the mid-latitudes relatively cool temperatures downstream into Western and Northeast Asia and especially the Western US (see **Figures 3 and 6**).

Initialized 00Z 500 hPa HGT/HGTa 25-Jun-2026

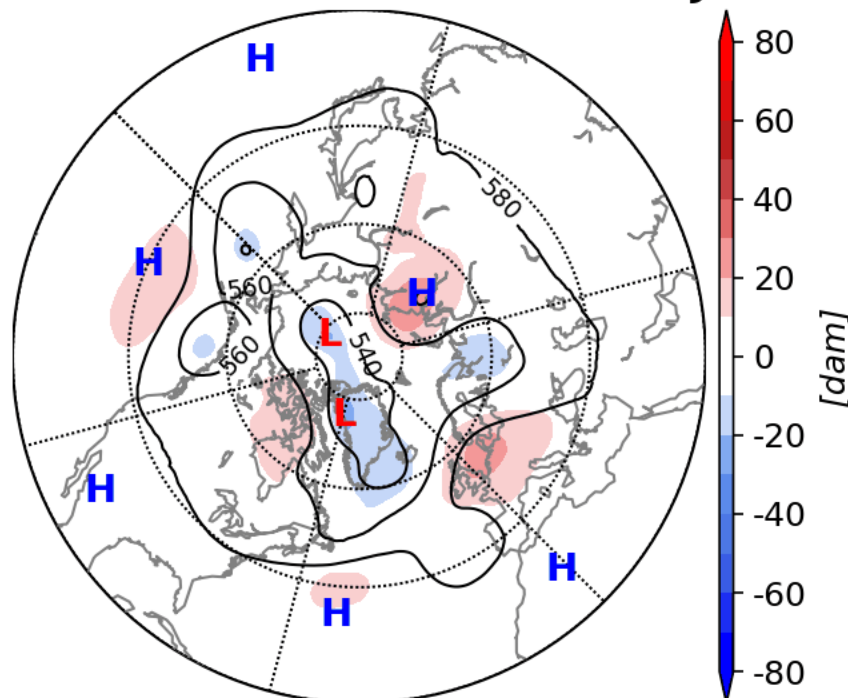


Figure i. Initialized 500 mb geopotential heights (dam; contours) and decameter anomalies (dam; shading) across the Northern Hemisphere for 25 June 2026 and forecasted from 26 June to 10 July 2026. The forecasts are from the 00Z 25 June 2026 GFS model.

Looking at the NH temperature anomalies so far this summer (see above **Figure**), I think the general pattern could in the end match the full summer temperature pattern across North America, Europe and Asia. I am leery of making overly confident weather statements but a hot summer for Europe is as much a sure thing as we have in seasonal prediction and the only question is where the heat is most intense. Last summer it was Scandinavia and this summer it seems to be Western Europe.

Also a reliable expectation is for cool summer temperatures in Western Russia and warmer to the east across parts of Siberia and Central Asia, often extending into East Asia. In the last blog I talked about an “upset” with the opposite pattern unfolding this summer. Well over two weeks later, the upset is looking a lot less likely with once again a relatively cool summer in Western Russia and the heat focused downstream to the east.

In the coming week, the biggest surprise in the predicted temperature pattern are the very cool temperatures predicted in the Western US (see **Figures 3**). Given that summers of late have featured extreme heat, large wildfires and lots of smoke over western North America this is a welcome departure from what we have come to expect but doesn’t look to last. Much like Europe and Asia, the temperature pattern across North America is settling into a familiar pattern of summers of late – warm in western North America and even much of Canada with relatively cool temperatures in the Plains and/or the Southeastern US. Our model did predict cool in the Southeastern US but not in the Plains but still looking better than the C3S.

I do wonder if I had the full suite of predictors for the model if the model would have produced more widespread cooling in the Eastern US. But regardless the large-scale pattern of this summer is looking very consistent with past recent summers. If the magnitude of the cool temperatures in parts of East Asia continue that could be considered a surprise or departure from the recent past. Also a cool summer in Alaska would be a departure as well. I believe that the last two summers featured normal to below normal temperatures in Alaska, which I think is more consistent with La Niña summers and therefore another cool summer could be a residual of La Niña influence. It was cold in Alaska in summer 2023 so maybe the hot summer in Alaska is not as reliable as I first thought or a cool summer all that surprising.

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

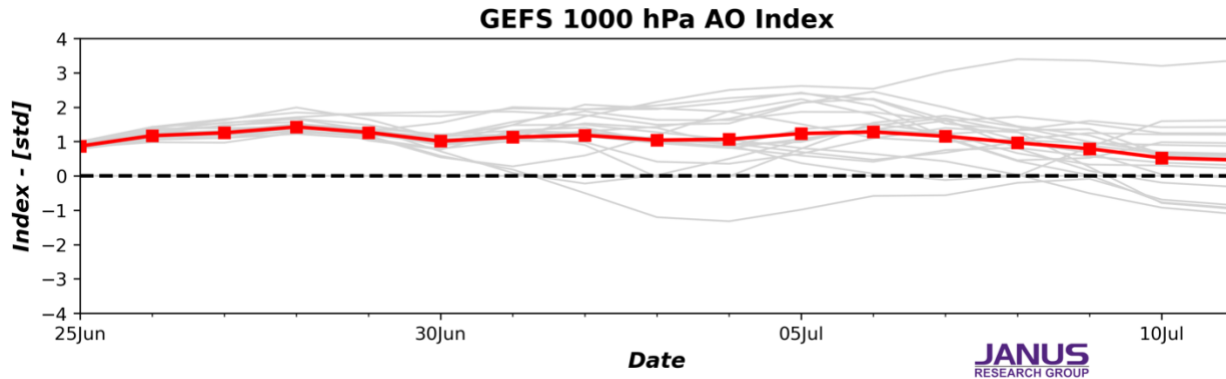


Figure 1. The predicted daily-mean AO at 1000 hPa from the 00Z 25 Jun 2026 GFS ensemble. Gray lines indicate the AO index from each individual ensemble member, with the ensemble mean AO index given by the red line with squares.

Troughing/negative geopotential height anomalies across Greenland will help to support ridging/positive geopotential height anomalies across almost all of Europe this week (**Figure 2**). This pattern will support widespread normal to above normal temperatures across Europe including the UK with some temperatures being record breaking this week (**Figure 3**). This week the general pattern across Asia is ridging/positive geopotential height anomalies centered in Western Siberia sandwiched by troughing/negative geopotential height anomalies across Western and Northeastern Asia this week (**Figure 2**). This pattern favors widespread normal to above normal temperatures across Central Asia but especially Western Siberia with normal to below normal temperatures across Western and Eastern Asia this week (**Figure 3**).

GEFS 1-5 Day Forecast 500 hPa Anomaly
INIT: 00Z 06/25/2026 FCST: 06/26/2026 to 06/30/2026

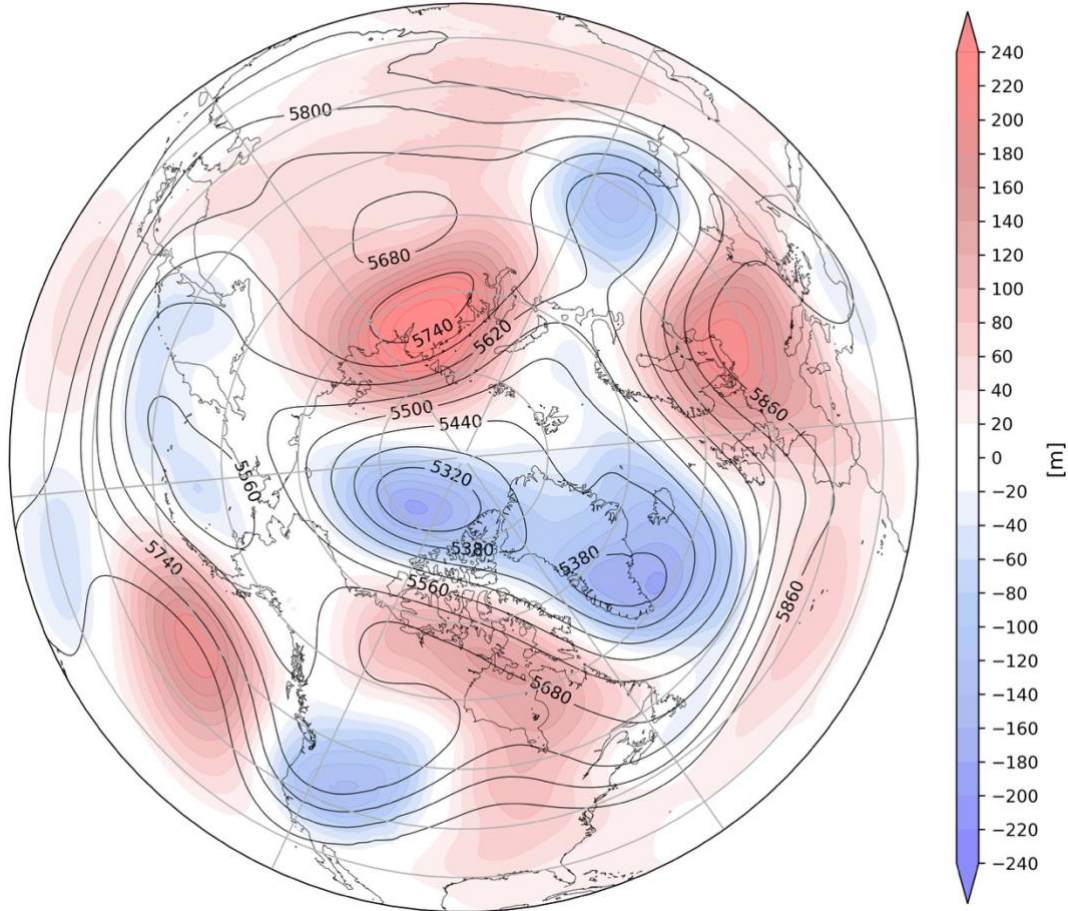


Figure 2. Forecasted average 500 mb geopotential heights (dam; contours) and geopotential height anomalies (m; shading) across the Northern Hemisphere from 26 Jun 2026 to 30 Jun 2026. The forecasts are from the 00Z 25 Jun 2026 GFS ensemble.

The predicted pattern across North America this week is ridging/positive geopotential height anomalies centered in Hudson Bay and including the Eastern US with troughing/negative geopotential height anomalies in western North America and deepest in the Rockies this week (**Figure 2**). This pattern will favor normal to below normal temperatures across parts of Alaska, the West Coast of Canada and especially the Western US with normal to above normal temperatures across much of Canada and the Eastern US this week (**Figure 3**).

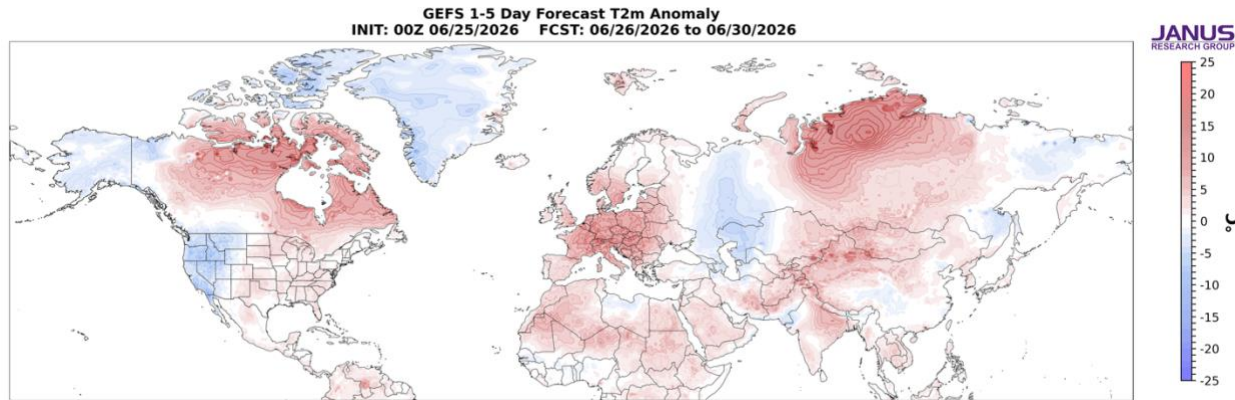


Figure 3. Forecasted surface temperature anomalies ($^{\circ}\text{C}$; shading) from 26 Jun 2026 to 30 Jun 2026. The forecasts are from the 00Z 25 Jun 2026 GFS ensemble.

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

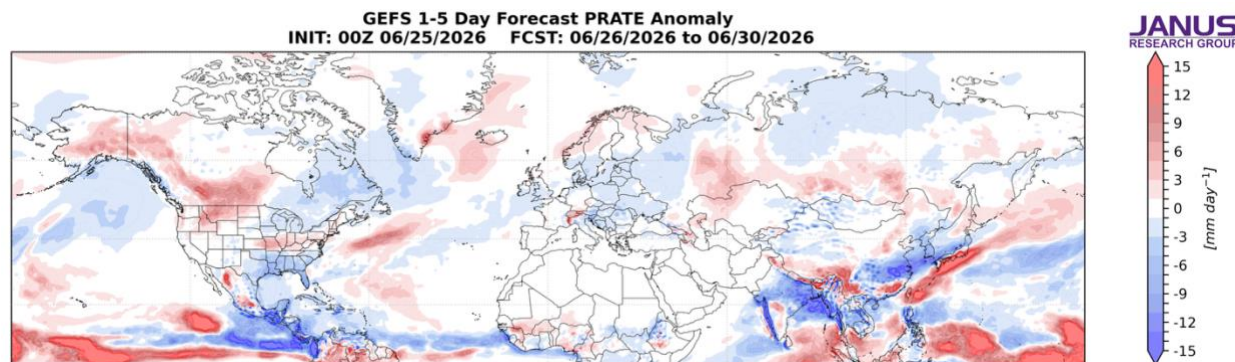


Figure 4. Forecasted precipitation (mm/day; shading) from 26 June 2026 to 30 June 2026. The forecasts are from the 00Z 25 June 2026 GFS ensemble.

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

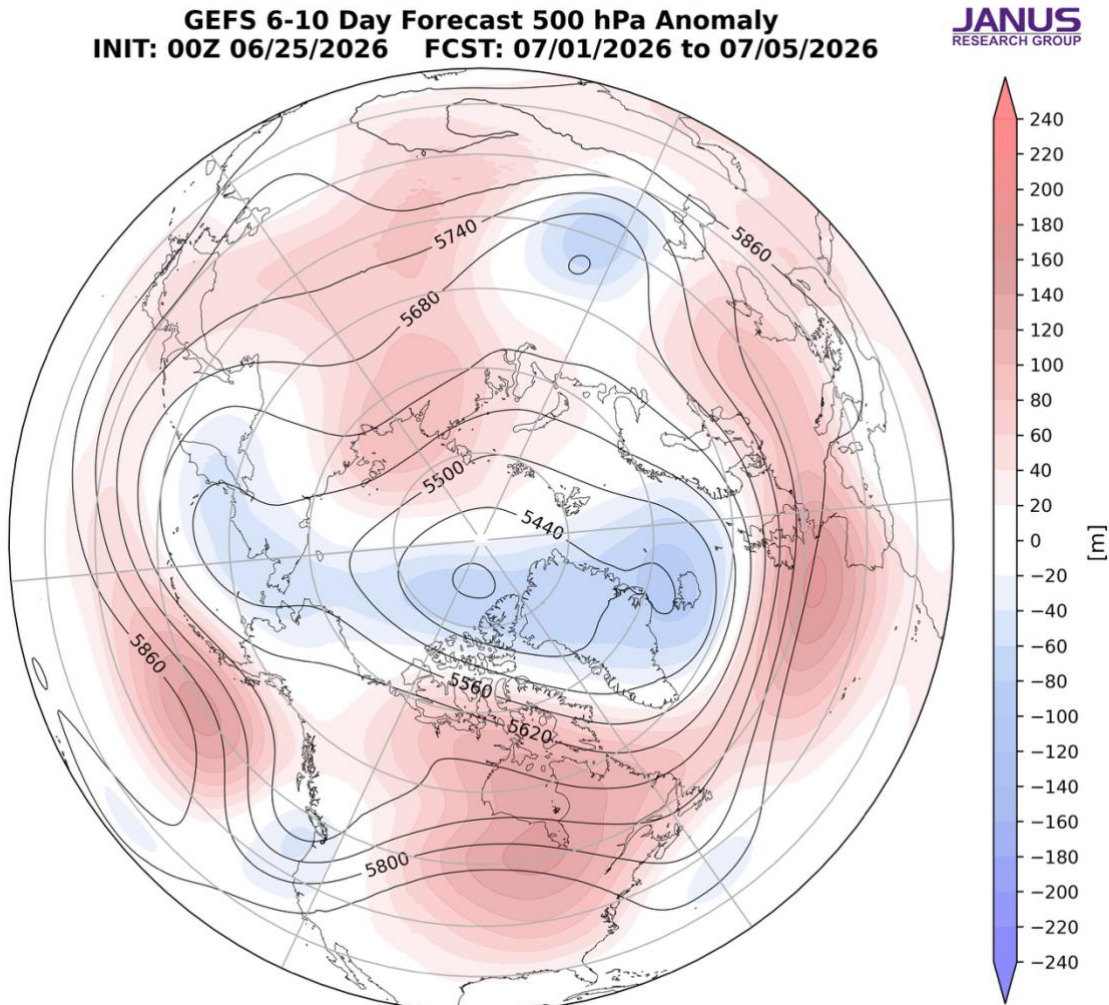


Figure 5. Forecasted average 500 mb geopotential heights (dam; contours) and geopotential height anomalies (m; shading) across the Northern Hemisphere from 01 July 2026 to 05 July 2026. The forecasts are from the 00Z 25 Jun 2026 GFS ensemble.

The troughing/negative geopotential height anomalies across Greenland will persist but now extend to Scandinavia continuing to support widespread ridging/positive geopotential height anomalies Europe this period (**Figure 5**). The pattern will support normal to above normal temperatures across most of Europe including the UK except for normal to below temperatures in Scandinavia this period (**Figure 6**). Across Asia the omega block pattern of

ridging/positive geopotential height anomalies across Western Siberia bookended by troughing/negative geopotential height anomalies across Western and Northeastern Asia is predicted to continue this period (**Figure 5**). This pattern favors widespread normal to above normal temperatures widespread across Central Asia with normal to below normal temperatures across Western and Northeast Asia this period (**Figure 6**).

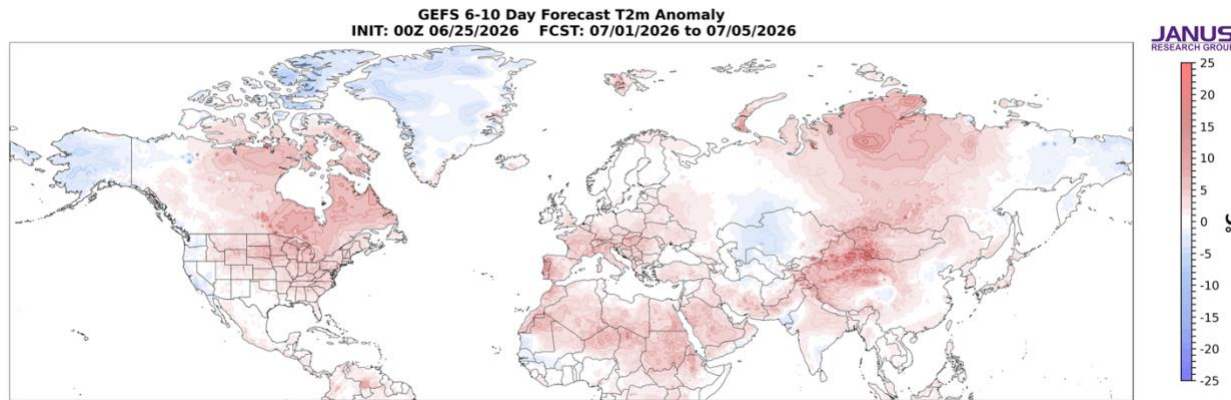


Figure 6. Forecasted surface temperature anomalies (°C; shading) from 01 July 2026 to 05 July 2026. The forecasts are from the 00Z 25 June 2026 GFS ensemble.

Across North America the pattern is also predicted to persist with ridging/positive geopotential height anomalies centered in southern Hudson Bay with troughing/negative geopotential height anomalies across western North America this period (**Figure 5**). This pattern will favor normal to above normal temperatures across Canada and the US east of the Rockies normal to below normal temperatures across Alaska, Western Canada and the Western US this period (**Figure 6**).

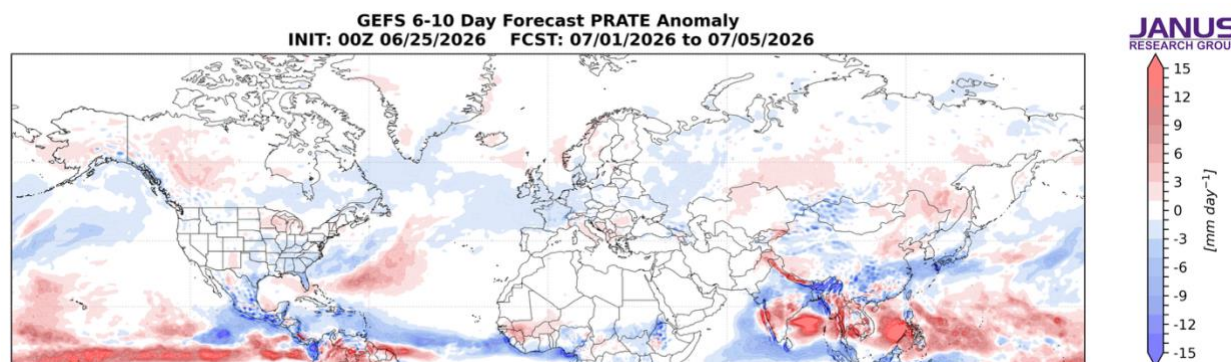


Figure 7. Forecasted rainfall rate (mm/day; shading) from 01 July 2026 to 05 July 2026. The forecasts are from the 00Z 25 June 2026 GFS ensemble.

Troughing will support new rainfall across Southeastern Europe, Southern Siberia, Northeastern China, Southwestern China and the Tibetan Plateau with mostly dry conditions across much of Europe and Asia (**Figure 7**). Troughing will support new rainfall across Alaska, Western Canada the US Upper Midwest with mostly dry conditions across much of North America this week (**Figure 7**).

Mid Term

Week Two

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

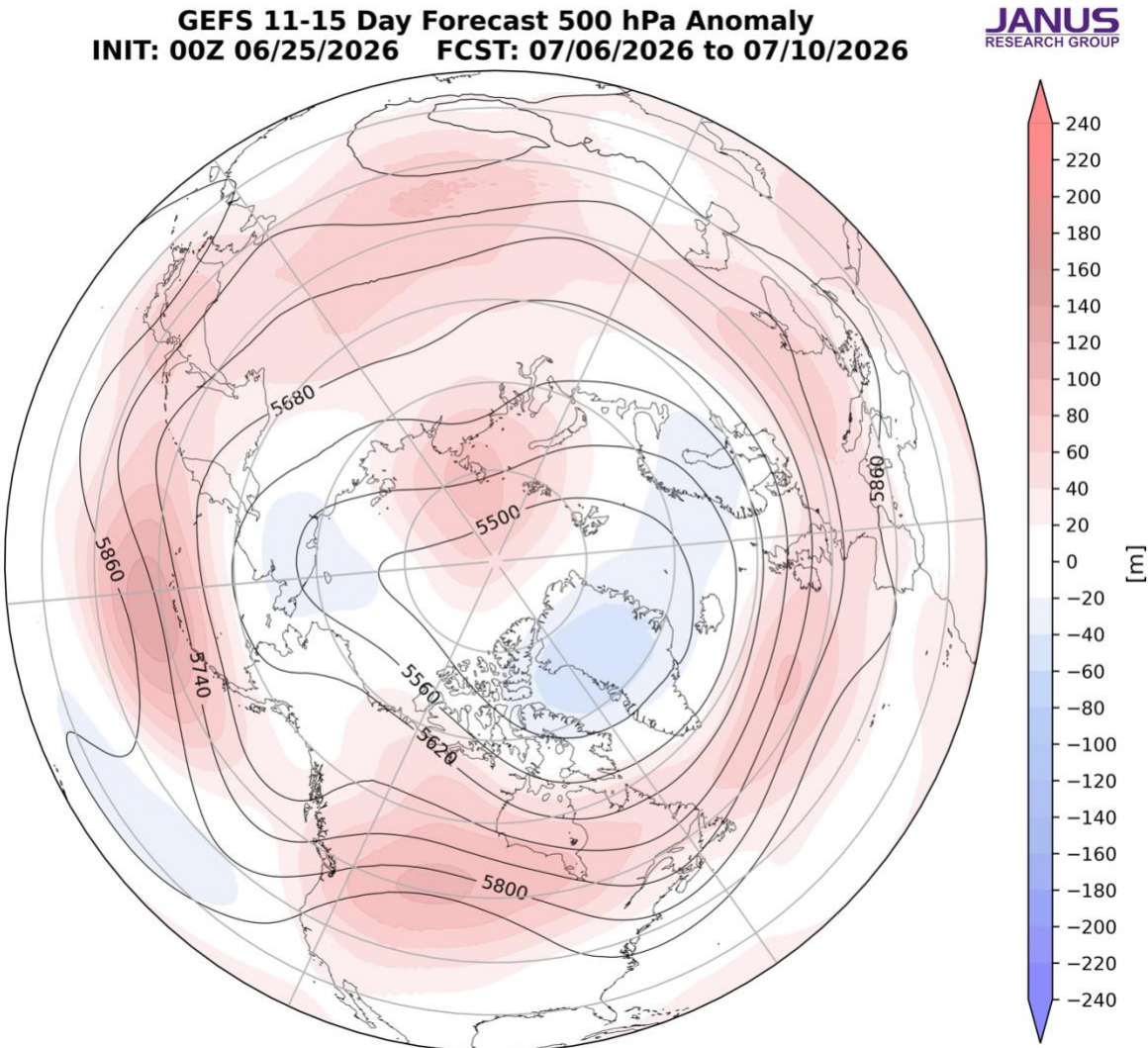


Figure 8. Forecasted average 500 mb geopotential heights (dam; contours) and geopotential height anomalies (m; shading) across the Northern Hemisphere from 06 July to 10 July 2026. The forecasts are from the 00Z 25 June 2026 GFS ensemble.

Troughing/negative geopotential height anomalies is predicted to continue to spread from Greenland across Northern Europe with ridging/positive geopotential height anomalies persisting across Southern Europe this period (**Figure 8**). This pattern will favor widespread

normal to above normal temperatures across much of Europe including the UK except for normal to below normal temperatures across Scandinavia and the Baltic States this period (**Figures 9**). The persistent omega block pattern is predicted to continue across Asia with ridging/positive geopotential height anomalies centered over Central Asia bookended by troughing/negative geopotential height anomalies across Western and Northeastern 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 Western Russia and Eastern Siberia this period (**Figure 9**).

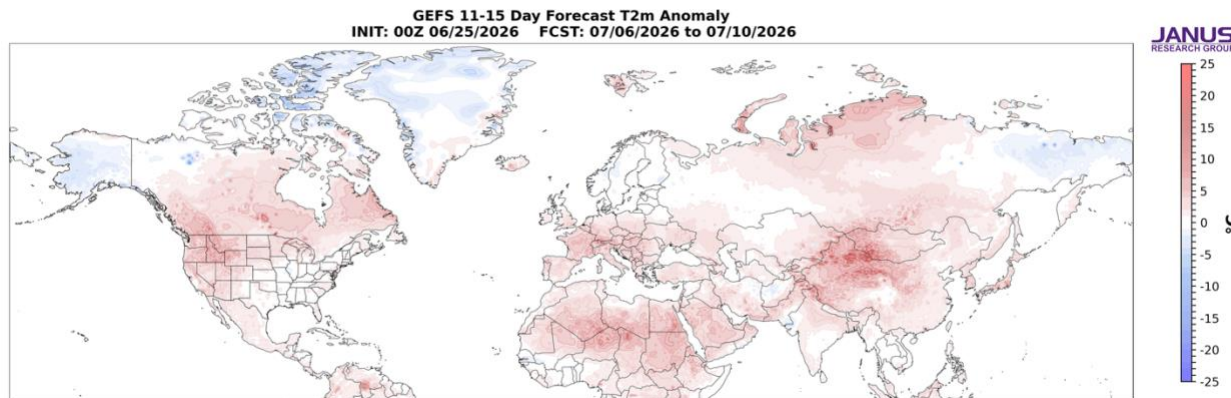


Figure 9. Forecasted surface temperature anomalies ($^{\circ}\text{C}$; shading) from 06 July to 10 July 2026. The forecasts are from the 00Z 25 Jun 2026 GFS ensemble.

Ridging/positive geopotential height anomalies previously in Eastern Canada are predicted to slide westward centered over the Rockies now supporting deepening troughing/negative geopotential height anomalies across the Eastern US this period (**Figure 8**). This pattern supports normal to above normal temperatures across much of Canada and the Western US with normal to below normal temperatures across Alaska, and the Eastern US this period (**Figure 9**).

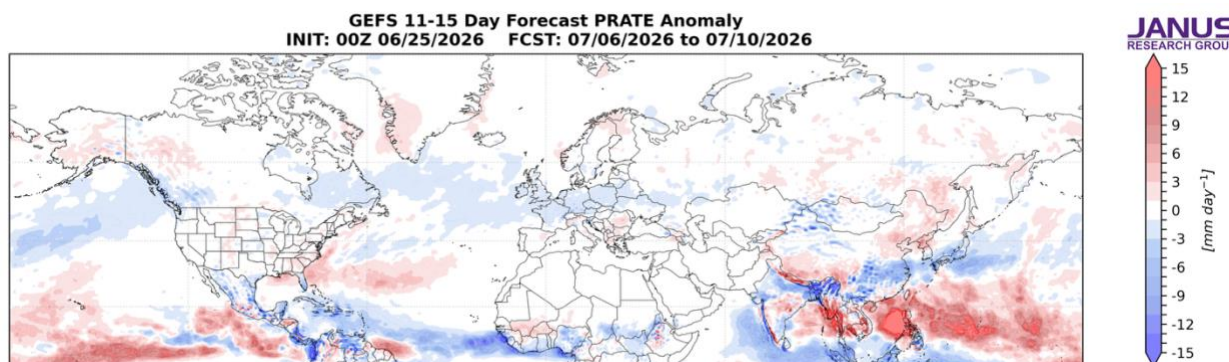


Figure 10. Forecasted rainfall (mm/day; shading) from 06 July to 10 July 2026. The forecasts are from the 00Z 25 June 2026 GFS ensemble.

Troughing will support new rainfall across Scandinavia, Southeastern Europe, Southern and Eastern Siberia, Northeast Asia, the Tibetan Plateau and into southwest China with mostly dry conditions across much of Europe and Asia (**Figure 10**). Troughing will support new rainfall across Alaska, the Western Canada, the US Plains 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 upper stratosphere and the lower troposphere with warm/positive warm/positive PCHs in the lower stratosphere and the mid to upper troposphere (**Figure 11**). Though currently not predicted, the warm/positive PCHs should extend episodically downward into the lower troposphere.

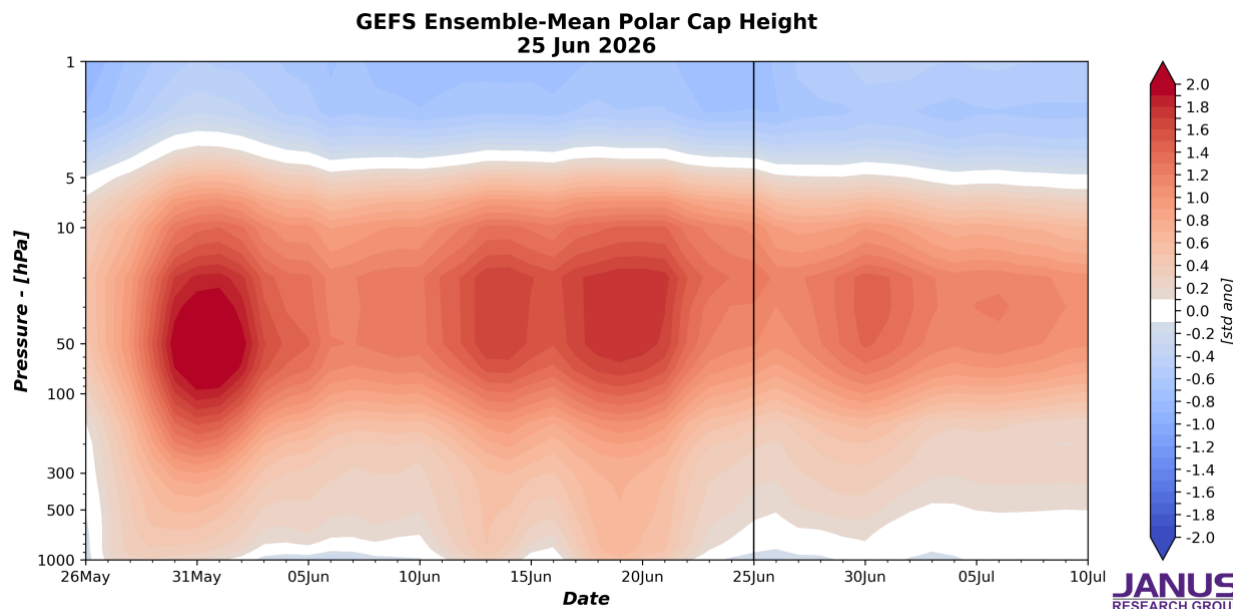


Figure 11. Observed and predicted daily polar cap height (i.e., area-averaged geopotential heights poleward of 60°N) standardized anomalies. The forecast is from the 00Z 25 Jun 2026 GFS ensemble.

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

CFS 500 hPa Forecast Anomaly Jul 2026
Valid as of 25 Jun 2026

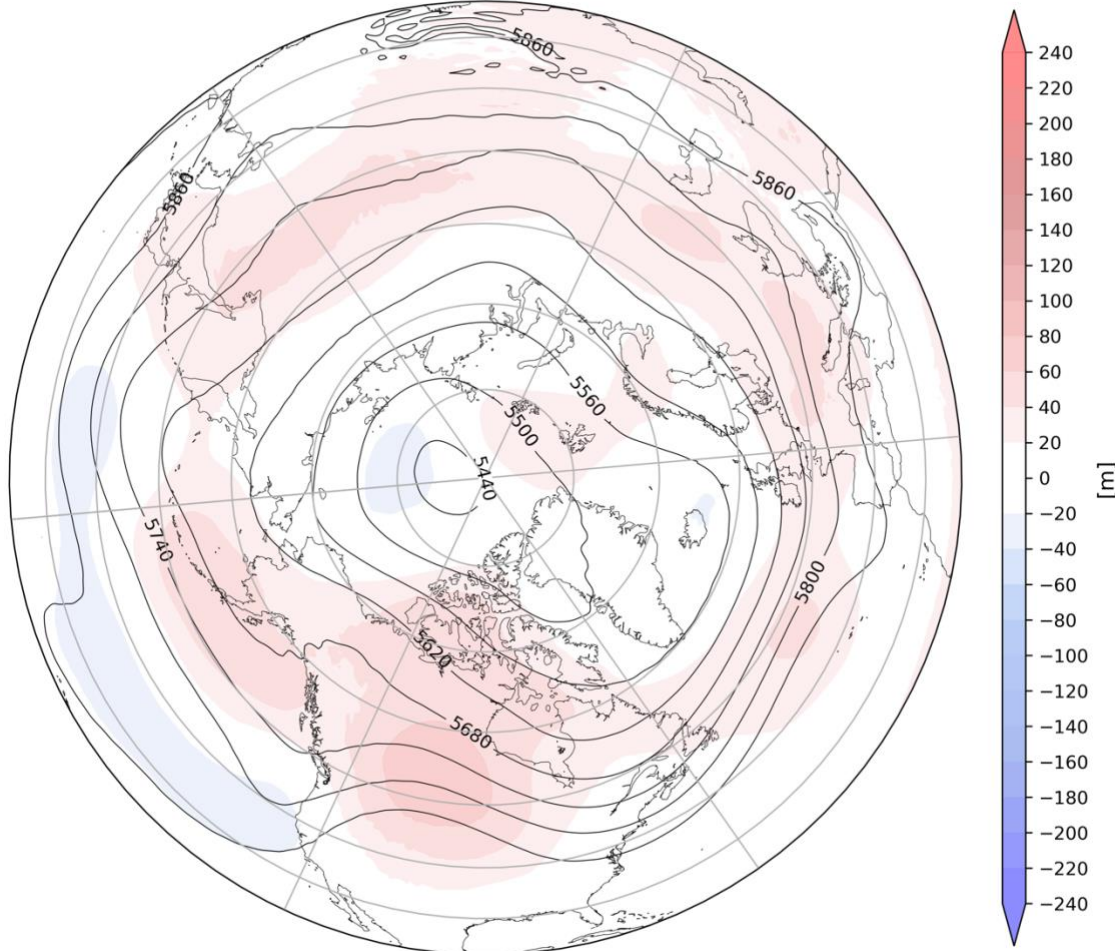


Figure 12. Forecasted average 500 mb geopotential heights (dam; contours) and geopotential height anomalies (m; shading) across the Northern Hemisphere for Jul 2026. The forecasts are from the 00Z 25 June 2025 CFS.

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 across Europe, Western and Eastern Asia, Western Canada and the Western US with troughing across the Iberian Peninsula, Western Siberia, west of the Dateline, the US West Coast, Eastern Canada and the Northeastern US (**Figure 12**). This pattern favors seasonable to relatively warm temperatures across most of Europe, much of 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 Western Russia and into northern Kazakhstan, Southeastern Canada and the Eastern US (**Figure 13**).

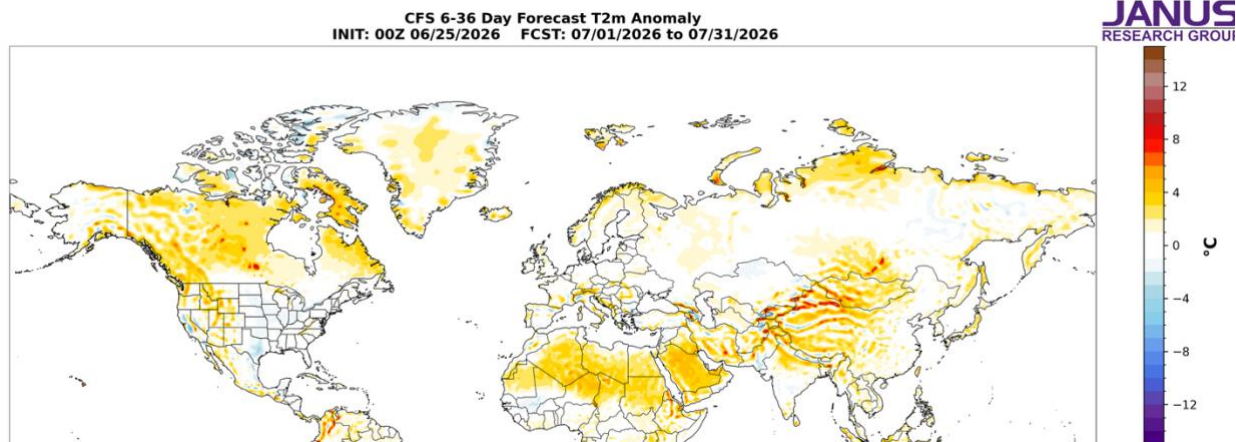


Figure 13. Forecasted average surface temperature anomalies (°C; shading) across the Northern Hemisphere for Jul 2026. The forecasts are from the 00Z 25 Jun 2026 CFS.

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**), clear signs of 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 especially near Europe, though below normal SSTs exist regionally especially in the Southern Ocean and in the western North Atlantic.

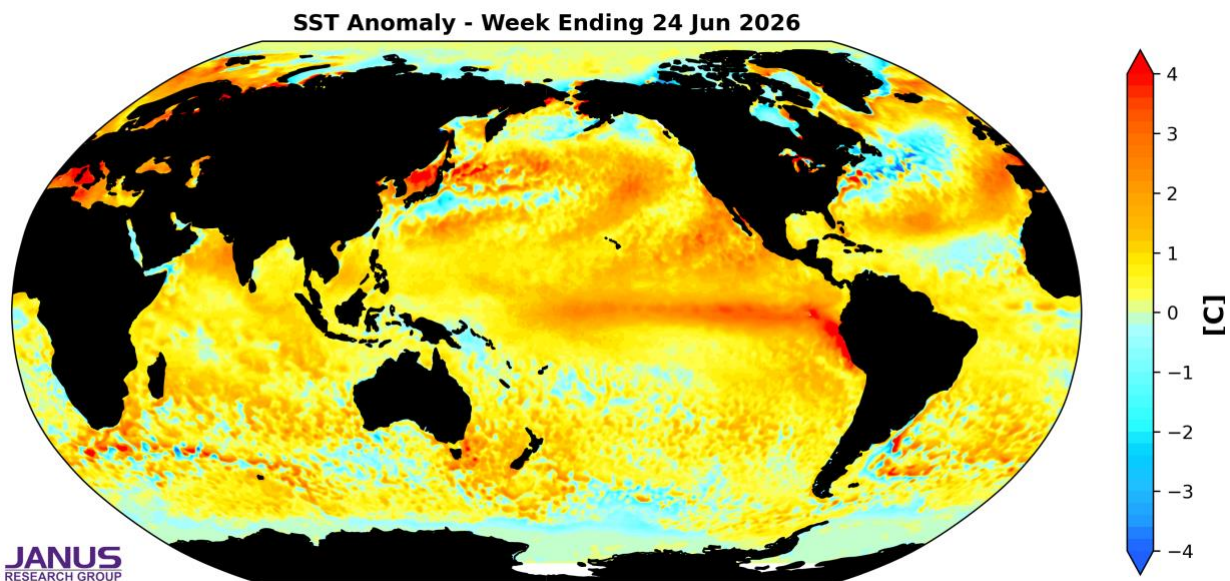


Figure 14. The latest daily-mean global SST anomalies for week ending 24 Jun 2026.

Madden Julian Oscillation

Currently the Madden Julian Oscillation (MJO) is weak where no phase is favored (**Figure 15**), and the forecasts are for the MJO to move into phase six and seven but remain overall weak the next two weeks (**Figure 15**). Phase six favors ridging western North America with troughing across the Eastern US, consistent with forecasts starting next week and into the following week. Therefore it seems that the MJO could have some influencing on North American weather heading into July. But admittedly this is outside of my expertise.

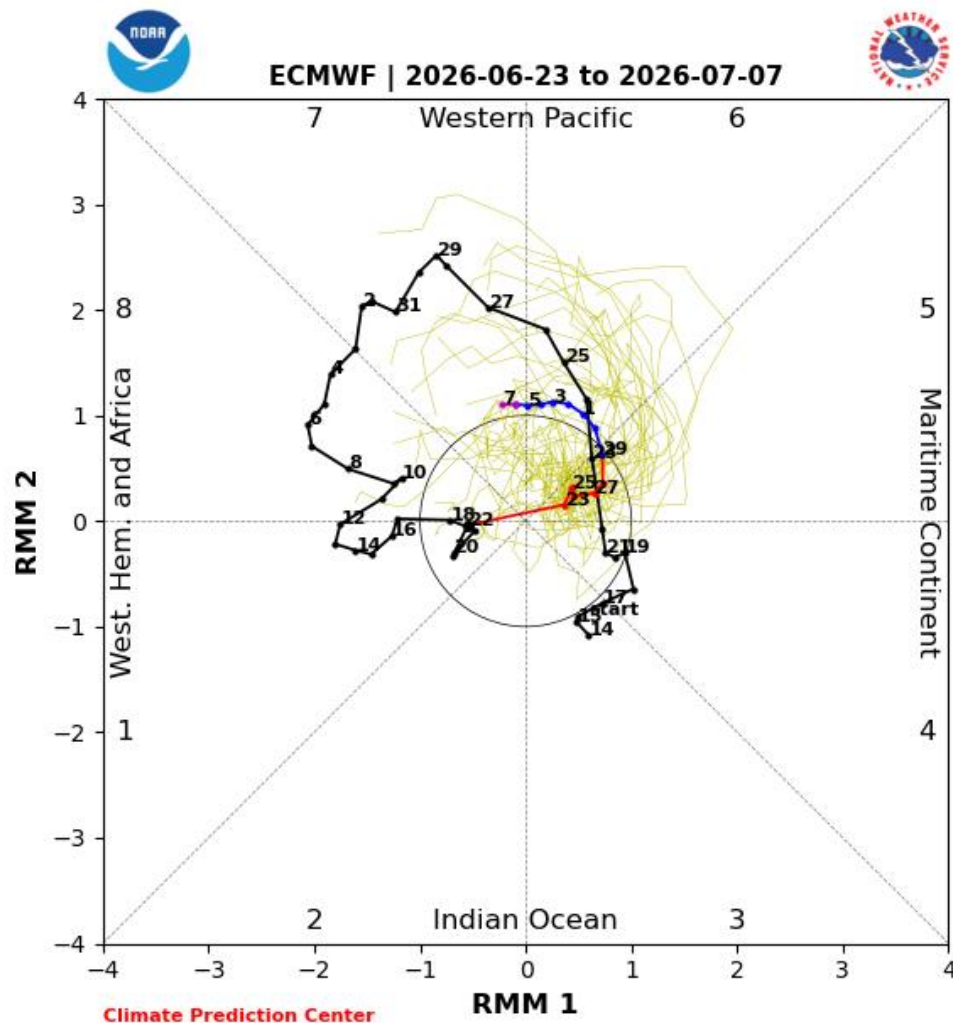


Figure 15. Past and forecast values of the MJO index. Forecast values from the 00Z 23 Jun 2026 ECMWF model. Yellow lines indicate individual ensemble-member forecasts, with the green line showing the ensemble-mean. A measure of the model 'spread' is denoted by the gray shading. Sector numbers indicate 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>

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

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

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

Our sCast principal engineer, [Karl Pfeiffer](#), can help you use sCast and other AER seasonal forecast products to deliver important, long-lead time weather intelligence to your business. Please reach out to Karl today!