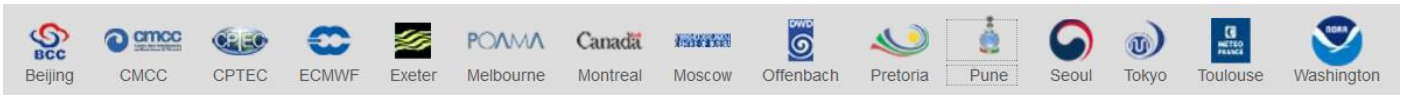
WEATHER CLIMATE WATER

WORLD METEOROLOGICAL ORGANIZATION

GLOBAL SEASONAL CLIMATE UPDATE

TARGET SEASON: September-October-November 2024

Issued: 20 August 2024



Summary

During May-July, the Pacific Niño sea-surface temperature (SST) index in the eastern Pacific (Niño 1+2) declined into below-normal territory. Of the other three Niño indices only the Niño 4, the westernmost index, stayed above normal while SST conditions in the equatorial central and eastern Pacific were in the ENSO-neutral condition. The observed Indian Ocean Dipole (IOD) was near-zero. Both the North Tropical Atlantic (NTA) and South Tropical Atlantic (STA) SST indices were above-normal and reflected widespread warmth in the tropical Atlantic. In general, the observed SST anomalies in global oceans were positive[1].

Above-normal sea-surface temperature anomalies in the Niño 3.4 and Niño 3 regions are predicted to decline during September-November 2024 and are predicted to reach weak La Niña conditions. Farther west in the Niño 4 region, the sea-surface temperature anomaly is predicted to be near-normal. The strength of the Indian Ocean Dipole (IOD) index is also predicted to return to near normal. In the equatorial Atlantic, SSTs are predicted to be above-normal in both the northern (NTA) and the southern (STA) areas during the season with larger values positive anomalies for NTA.

Consistent with the anticipated persistence of widespread above-normal sea-surface temperatures in all ocean basins outside of the near-equatorial eastern Pacific Ocean, there is widespread prediction of above-normal temperatures over almost all land areas. Exceptions to this widespread warmth are South America south of about 40° S, the south-western coast of North America and in the vicinity of the Bering Sea, and the interior western region of the Indian subcontinent. Extensive areas of large increases in probabilities for above-normal temperatures include almost all of Africa, and within about 45° N of the equator over Europe, south of 45o N over Asia, and within about 25° over Northern, Central and South America and the Caribbean. Northern Australia, New Zealand, and most of the islands in the South Pacific have moderate to strongly increased probabilities for above-normal temperatures. North of about 60° N, North America, Europe and Asia have weak to moderately increased probabilities for above-normal temperature. In coastal areas of southern South America and extending north along the west coast to just north of the equator and into the eastern Pacific, below-normal temperatures are expected, consistent with the predicted emergence of weak La Niña conditions.

Predictions for rainfall are, in part, similar to the impacts of the early stages of La Niña, which is expected to emerge during September-November 2024. Enhanced probabilities for near- or below-normal rainfall are predicted over a narrow band along or just north and south of the equator extending eastward from 150o E to the southern region of Central America. There are additional bands of prediction for enhanced probabilities for below-normal rainfall spanning the width of the Pacific. The Northern Hemisphere band located around 30o N extends into north-western Central America and the south-western part of North America. The Southern Hemisphere band is more extensive, extending to cover a wide swath of western coast of South America centred around 30o S and then across into the South Atlantic. Probabilities for above-normal rainfall are moderately enhanced over the central and eastern Maritime Continent. Over Africa, between about 10° and 25° N and east of 0°, there are increased probabilities for above-normal rainfall. These probabilities strengthen towards the east where the area of above-normal rainfall probability dips southward to reach 15o S. The probabilities for above-normal rainfall are enhanced over the Indian subcontinent which to the east extends all the way to Southeast Asia and then extends northward along the coastal regions of East Asia. To the west, there is enhancement in probabilities for below-normal rainfall over Central Asia extending into the Arabian Peninsula. Over South America, except for a few regions in the interior of the continent extending from the west coast to the east coast where there is no clear signal, almost all South America has increased probabilities for below-normal rainfall. Probabilities for above-normal rainfall are weakly enhanced over an area that extends from southern Central America over to most of the Caribbean. A region of enhanced probability for below-normal rainfall is predicted over the interior and southern regions of North America west of 90o W with regions of stronger probability located over the southwest crossing into northern Central America. For most of Europe there is no clear signal.

[1] https://www.cpc.ncep.noaa.gov/products/people/mchen/AttributionAnalysis/images/Attribution202407.pdf

Surface Air Temperature, SON 2024 **Rainfall, SON 2024**

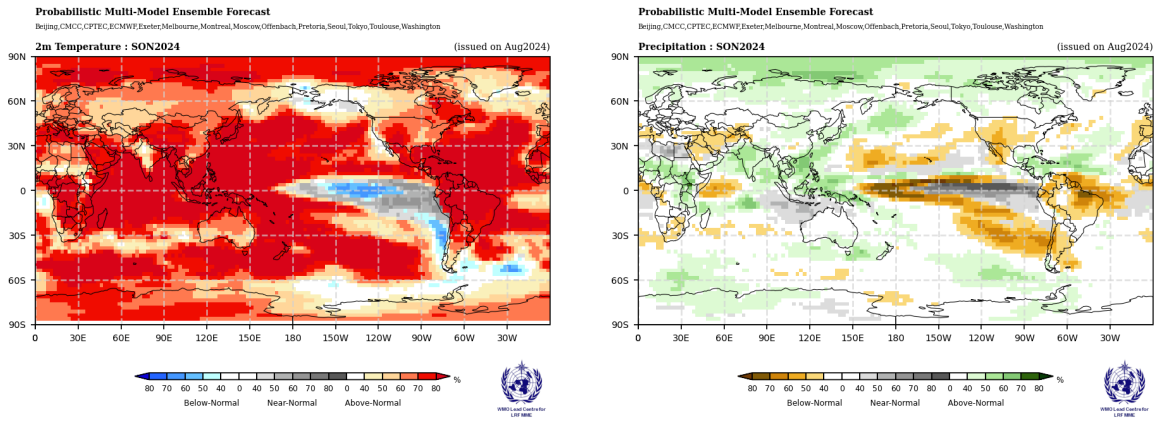


Figure 1. Probabilistic forecasts of surface air temperature and rainfall for the season September-November 2024. The tercile category with the highest forecast probability is indicated by shaded areas. The most likely category for below-normal, above-normal, and near-normal is depicted in blue, red, and grey shadings respectively for temperature, and orange, green and grey shadings respectively for rainfall. White areas indicate equal chances for all categories in both cases. The baseline period is 1993–2009.

1. Observations: May-July 2024

In the following sections, observed temperature and rainfall patterns for the previous season are discussed. For more detailed information about regional and local climate anomalies, the reader is referred to the concerned WMO Regional Climate Centres (RCCs) or RCC Networks, listed in Section 5.

1.1 Large-scale sea-surface temperature (SST) indices

During May-July 2024, the Pacific Niño sea-surface temperature (SST) index in the eastern Pacific (Niño 1+2) declined into below-normal territory. Of the other three Niño indices only the Niño 4, the westernmost index, stayed above normal while SST conditions in the equatorial central and eastern Pacific were in the ENSO-neutral condition. The observed Indian Ocean Dipole (IOD) was near-zero. Both the North Tropical Atlantic (NTA) and South Tropical Atlantic (STA) SST indices were above-normal and reflected widespread warmth in the tropical Atlantic. In general, the observed SST anomalies in global oceans were positive.

Month	Niño 1+2	Niño 3	Niño 4	Niño 3.4	IOD	NTA	STA
May 2024	-0.7	0.0	0.7	0.3	0.2	1.5	1.0
June 2024	-0.7	-0.1	0.7	0.2	-0.1	1.5	0.6
July 2024	-0.4	-0.1	0.6	0.2	-0.4	1.2	0.3
May-July 2024	-0.6	-0.1	0.7	0.2	-0.1	1.4	0.6

Table 1. Large-scale oceanic indices (˚C). Anomalies are with respect to the 1991–2020 average. (*Source:* U.S. Climate Prediction Center)

1.2 Observed temperature

Over the land areas, temperature anomalies for May-July 2024 were generally above-normal with a few regions of below-normal temperatures interspersed in between (Figure 2, top). In the northern hemisphere, the largest positive land-temperature anomalies occurred over western and southwestern North America extending along the eastern coast to northeast, northern regions of Central America, eastern and northern Europe, western and northern Africa extending into the southern Europe, northern part of the Indian subcontinent extending northeastward to Arctic latitudes. In the southern hemisphere positive land-temperature anomalies occurred over South America north of 30° S, and over most of southern Africa. Regions of negative temperature anomaly were observed over South America south of 30° S, northwestern extreme of North America, a band over central Asia extending northeast, and over southeastern Australia.

Over the oceans, in the equatorial Pacific extending from 130° W to the western coastal regions of South America and extending further south along the coastal regions, below-normal temperature anomalies were observed. These temperature anomalies reflected the possibility of a weak La Niño during Northern winter. In the extratropical southern Pacific Ocean between (60°-30° S, 150°-60° W), below average temperatures were observed. Temperature anomalies in the northern Pacific along 45° N and in the southern Pacific along 45° S (extending up to 120° W) were above-normal. Throughout the Indian Ocean basin, above-normal temperature anomalies prevailed. The temperature in the Atlantic Ocean was generally warm with the largest positive anomalies located north of the equator.

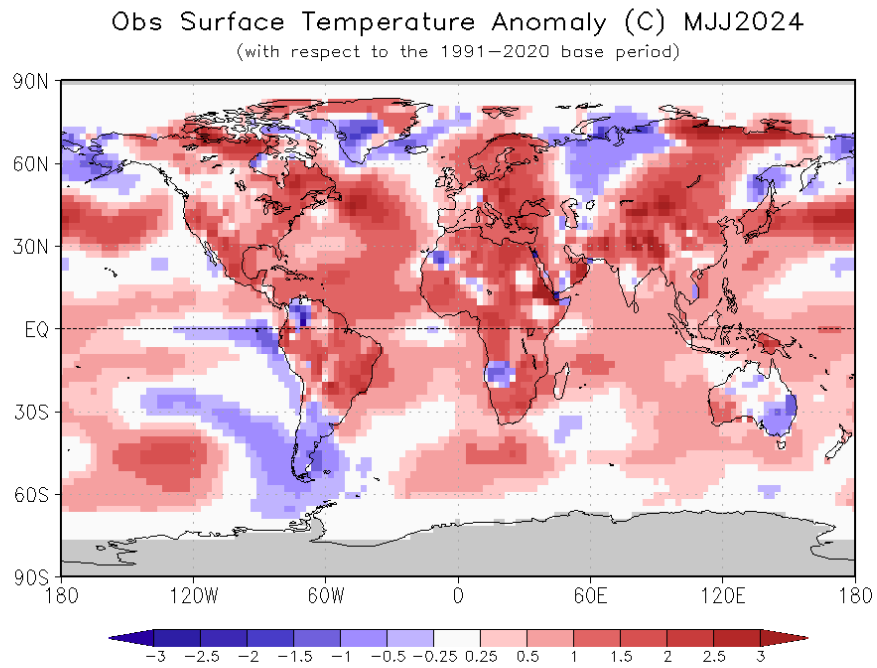
Over the land areas, patches of warm extremes (exceeding all seasonal mean temperatures observed during 1991–2020), occurred over the northern region of Central America, equatorial Africa, and parts of Eastern Asia. Larger regions of warm extremes were located over the oceans – the Gulf of Mexico extending westward into the Atlantic and then extending further into the northern and southern Atlantic, an east-west band in extratropical Pacific along 45° N, regions in extratropical southern Pacific between 60°-30° S, and southwestern Indian Ocean in the vicinity of Madagascar. No systematic regions with cold extremes were observed.

1.3 Observed rainfall

For May-July 2024, the rainfall anomalies in the equatorial Pacific started to reflect the influence of below-normal SST anomalies in the eastern equatorial Pacific and warmer anomalies in the western Pacific. The enhanced east-west gradient in SST anomalies is reflected in below normal rainfall anomalies west of 150° E in the equatorial tropical Pacific. These anomalies extended into the northwestern Pacific. Starting from the Date Line, a band of below-normal rainfall extended southwestward towards the southern tip of South America. Over the Indian Ocean, positive rainfall anomalies occurred over west while negative anomalies were observed over the east and reached northwest coastal regions of Australia. Over the Atlantic, a narrow band of negative rainfall straddled the eastern coastal region of North America. In the southern Atlantic, the eastern coastal regions of South America above 30°S also experienced negative rainfall anomalies. Positive rainfall anomalies were observed over the Caribbean. A band of negative rainfall anomalies stretched along 60° S in the southern oceans.

Over the land regions, negative rainfall anomalies dominated South America (except for a narrow coastal band in the northwest). Positive rainfall occurred in the northern regions of Central America continuing northward into the eastern regions of North America. Negative rainfall anomaly dominated the western half of North America except over the extreme northwest where rainfall was above-normal. Negative rainfall anomaly was observed over the western half of equatorial Africa and was flanked by positive rainfall anomalies to its north. Positive rainfall anomalies occurred over the Indian subcontinent and extended into southeastern and eastern Asia. Positive rainfall anomalies also occurred over the Maritime continent, eastern Europe, and patchy regions over North Asia.

Only a few patchy regions of dry extremes (drier than all seasonal mean rainfall observed during 1991-2020) occurred and included northeast North America, and southern Pacific south of Australia and New Zealand. Similarly, patchy regions of wet extremes occurred over interior regions of western Africa, northern Atlantic off the eastern coast of Greenland, and over Asia.



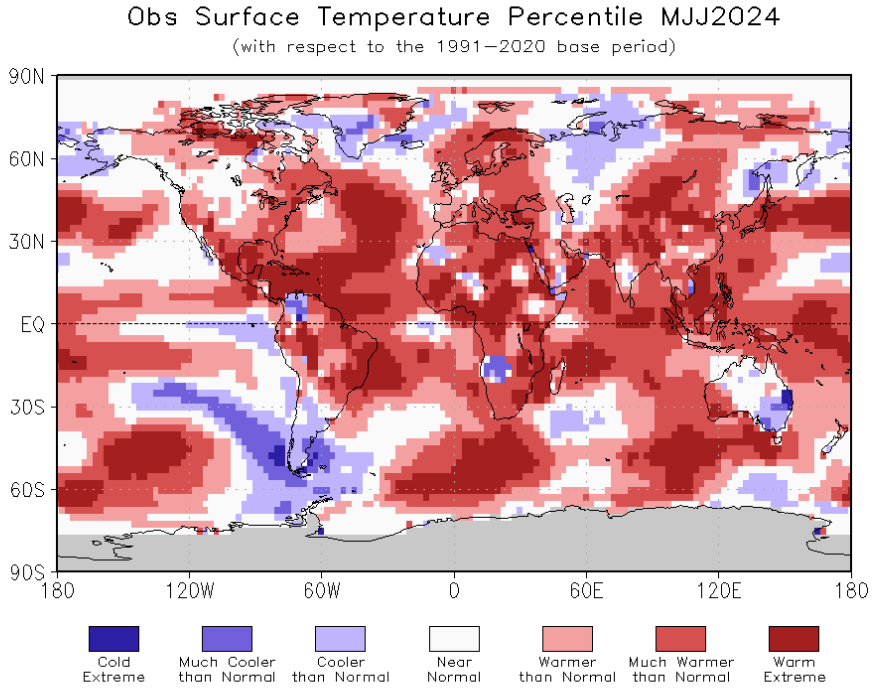
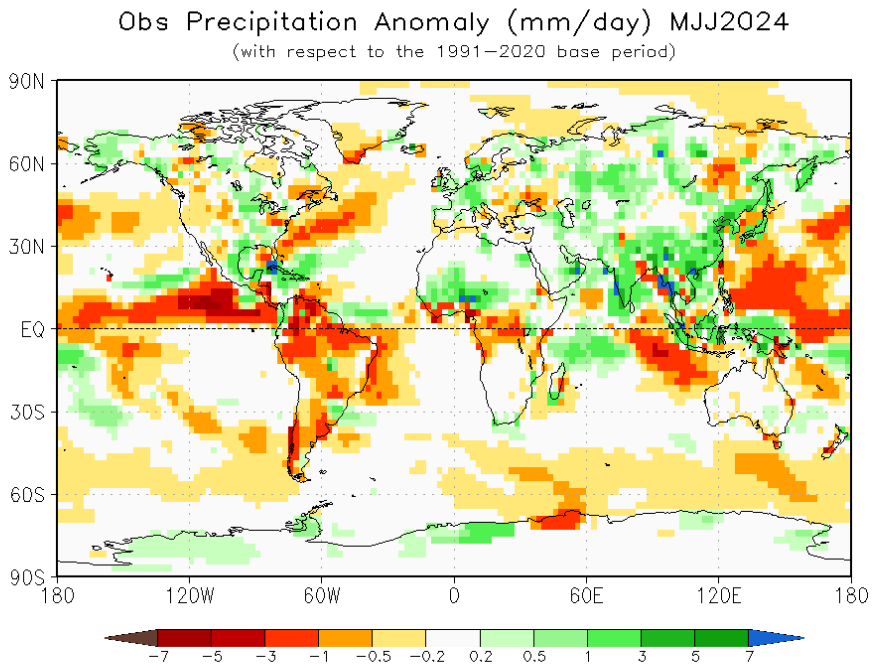


Figure 2. Observed May-July 2024 near-surface temperature anomalies relative to 1991–2020 (top). The *Cooler than Normal, Near Normal, and Warmer than Normal* shadings on the percentile map (bottom) indicate that seasonal mean anomalies were in the bottom, middle, and upper tercile of the 1991–2020 distribution, respectively. Regions with anomalies in the lowest and highest decile (or 10%) of the distribution are marked as *Much Cooler than Normal* and *Much Warmer than Normal*, respectively. The *Cold Extreme* and *Warm Extreme* shadings indicate that the anomalies exceeded the coldest and warmest temperature values of the 1991–2020 period for the season. Grey shading indicates areas where observational analysis was not available. (*Source:* U.S. Climate Prediction Center).



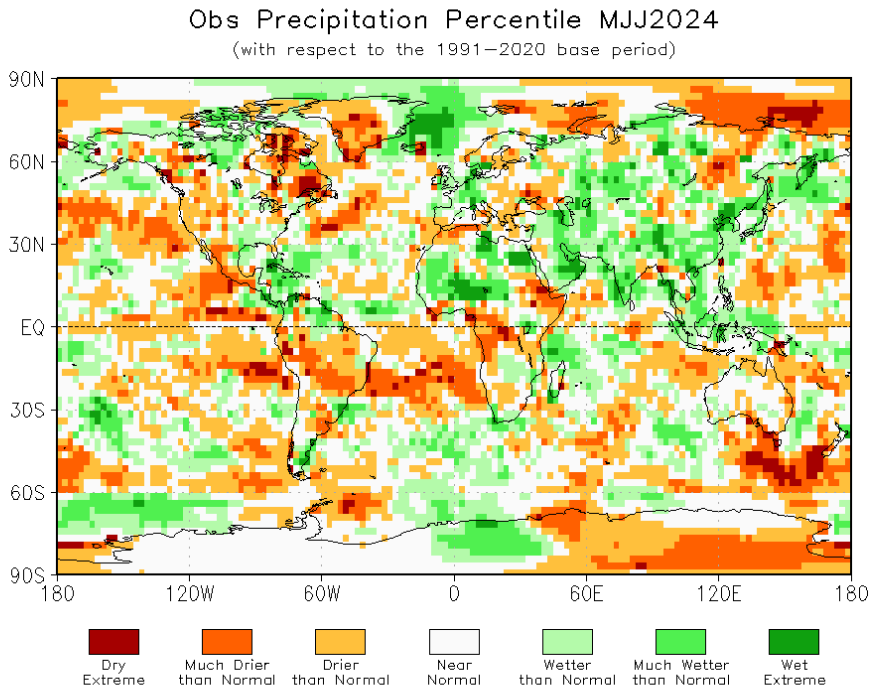


Figure 3. Observed rainfall anomalies for May-July 2024, relative to 1991–2020 base period (top). The *Drier than Normal*, *Near Normal and Wetter than Normal* shadings on the percentile map (bottom) indicate that seasonal mean anomalies were in the bottom, middle, and upper tercile of the 1991–2020 distribution, respectively. Regions with anomalies in the lowest and highest decile (or 10%) of the distribution are marked as *Much Drier than Normal* and *Much Wetter than Normal*, respectively. The *Dry Extreme* and *Wet Extreme* shadings indicate that the anomalies exceeded the driest and wettest values of the 1991–2020 period for the season.
(*Source:* U.S. Climate Prediction Center).

2. Potential evolution of the state of the climate over the next three months (September-November 2024)

2.1 Large-scale SST-based indices, September-November 2024

Month	Nino 1+2	Nino 3	Nino 4	Nino3.4	IOD	NTA	STA
September 2024	-0.1±0.3	-0.4±0.3	-0.0±0.2	-0.4±0.3	0.2±0.3	0.8±0.1	0.3±0.2
October 2024	-0.2±0.3	-0.4±0.3	-0.2±0.3	-0.5±0.4	0.0±0.3	0.7±0.1	0.3±0.2
November 2024	-0.1±0.3	-0.5±0.4	-0.2±0.3	-0.6±0.4	-0.1±0.2	0.7±0.1	0.4±0.2
September-November 2024	-0.1±0.3	-0.4±0.3	-0.1±0.3	-0.5±0.4	0.1±0.3	0.7±0.1	0.3±0.2

Table 2: Multi-model forecasts for oceanic indices (°C), with standard deviation. Values are the equal-member-weighting average of those derived, using each GPC model's own hindcast climate mean, from the GPCs supplying SST forecasts (GPC Beijing, CMCC, ECMWF, Exeter, Melbourne, Montreal, Offenbach, Seoul, Tokyo, Toulouse, Washington). The standard deviation is calculated on all ensemble members. The latitude/longitude bounds of the regions are given in the supplementary information section.

Above-normal sea-surface temperature anomalies in the Niño 3.4 and Niño 3 regions are predicted to decline during September-November 2024 and are predicted to reach weak La Niña conditions. Farther west in the Niño 4 region, the sea-surface temperature anomaly is predicted to be near-normal. The strength of the Indian Ocean Dipole (IOD) index is also predicted to return to near normal. In the equatorial Atlantic, SSTs are predicted to be above-normal in both the northern (NTA) and the southern (STA) areas during the season with larger values positive anomalies for NTA.

2.2 Predicted temperature, September-November 2024

For information on the construction of the multi-model forecast maps, refer to the supplementary information section. (Note: Maps indicating forecast consistency among GPC models are available in the supplementary information[2]).

[2] File with supplementary information can be downloaded from https://ftp.cpc.ncep.noaa.gov/mingyue/GSCUWMO/Forecasts/GSCU_SON2024_supplementary_info_LC-LRFMME.docx

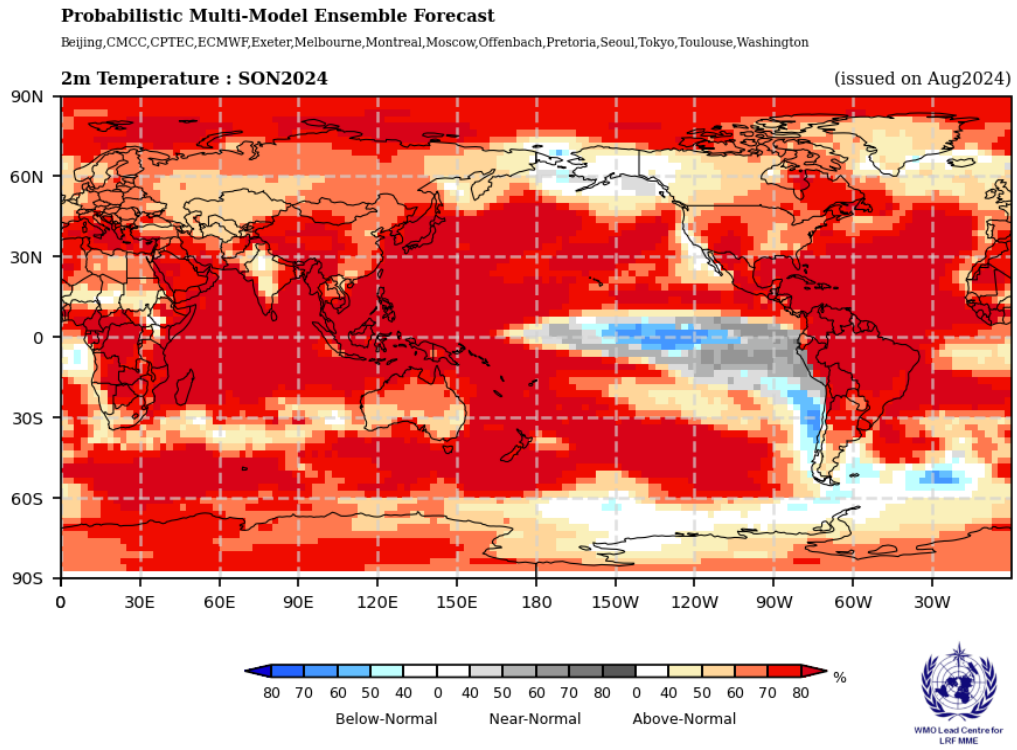


Figure 4. Probabilistic forecasts of surface air temperature for September-November 2024. The tercile category with the highest forecast probability is indicated by shaded areas. The most likely category for below-normal, above-normal, and near-normal is depicted in blue, red, and grey shadings, respectively. White areas indicate equal chances for all categories in both cases. The baseline period is 1993–2009. Figure is generated by The WMO Lead Centre for Long-Range Forecast Multi-Model Ensemble.

Consistent with the anticipated persistence of widespread above-normal sea-surface temperatures in all ocean basins outside of the near-equatorial eastern Pacific Ocean, there is widespread prediction of above-normal temperatures over almost all land areas. Exceptions to this widespread warmth are South America south of about 40º S, the south-western coast of North America and in the vicinity of the Bering Sea, and the interior western region of the Indian subcontinent. Extensive areas of large increases in probabilities for above-normal temperatures include almost all of Africa, and within about 45º N of the equator over Europe, south of 45º N over Asia, and within about 25º over Northern, Central and South America and the Caribbean. Northern Australia, New Zealand, and most of the islands in the South Pacific have moderate to strongly increased probabilities for above-normal temperatures. North of about 60º N, North America, Europe and Asia have weak to moderately increased probabilities for above-normal temperature. In coastal areas of southern South America and extending north along the west coast to just north of the equator and into the eastern Pacific, below-normal temperatures are expected, consistent with the predicted emergence of weak La Niña conditions.

RA I (Africa): Enhanced probabilities of above-normal temperatures are indicated over all of mainland Africa and Madagascar with smallest increase in probability along 15º N. The model consistency is strong along bands located at 30º N, 15º S, and along the eastern coastal regions of southern Africa. Elsewhere, model consistency is moderate.

RA II (Asia): Enhanced probabilities for above-normal temperatures are indicated over all of mainland Asia, with higher probabilities south of 45º N, but the model consistency is high only in the western half of East and Southeast Asia. North of this region, enhancement in the probability for above-normal temperatures is moderate, or, between about 30º and 90º E is weak. There is also a weak enhancement for above-normal temperatures probability in the interior west of the Indian subcontinent where model consistency is also low. The probability for above-normal temperature is strongly enhanced off the coastal regions of East Asia near 40º N. In the far northeast, and in the vicinity of the Bering Sea, the probabilities for below-normal temperature are weakly enhanced.

RA III (South America): Strongly enhanced probabilities for above-normal temperatures are indicated over South America north of about 40º S with the exception of the narrow coastal strip in the southern Pacific. Model consistency is very high in this region. Further south, the probabilities for above-normal temperature are weakly enhanced and the model consistently is moderate to weak.

RA IV (North America, Central America, and the Caribbean): With the exception of the narrow Pacific coast, the area near the Bering Sea, and southwest of Greenland, there are enhanced probabilities for above-normal temperatures over almost all of Central and North America and the Caribbean. The probabilities for above-normal temperatures are strongest over Central America, the Caribbean south, southwestern and northeastern regions of North America, and moderate to strong over the rest of the region but becoming weak in the far northwest and between Greenland and mainland North America. Model consistency is high south of about 45° N. Along the Pacific coast between about 15° and 40° N, the signal is weak.

RA V (Southwest Pacific): Widespread and strongly enhanced probabilities for above-normal temperatures are predicted throughout the region and the model consistency is mostly high. This area of predicted warmth extends to about Date Line, marking the western edge of a narrow tongue of below-normal temperatures associated with the predicted La Nina. Probabilities and model consistency weaken going from northern to southern Australia. The area of warmth extends into the eastern Pacific in four prongs. One extension is a narrow band at about 15° N that connects all the way to Central America. North of this area is a band between about 30 ° and 60 ° N that weakens towards North America. A third extension at about 10° S reaches about 120° W, and the southernmost extension approaches 90° W and 60° S. The northern and southern bands are separated by areas of enhancement in probabilities for near- and below-normal temperatures, the strongest of which is along the equator. The region of below-normal temperature probability extends to the western coast of equatorial South America and extends southward along the coast.

RA VI (Europe): The probabilities for above-normal temperatures are increased over all of Europe with highest probabilities south of about 45° N. The model-to-model consistency is patchy, but mostly weak to moderate.

2.3 Predicted rainfall, September-November 2024

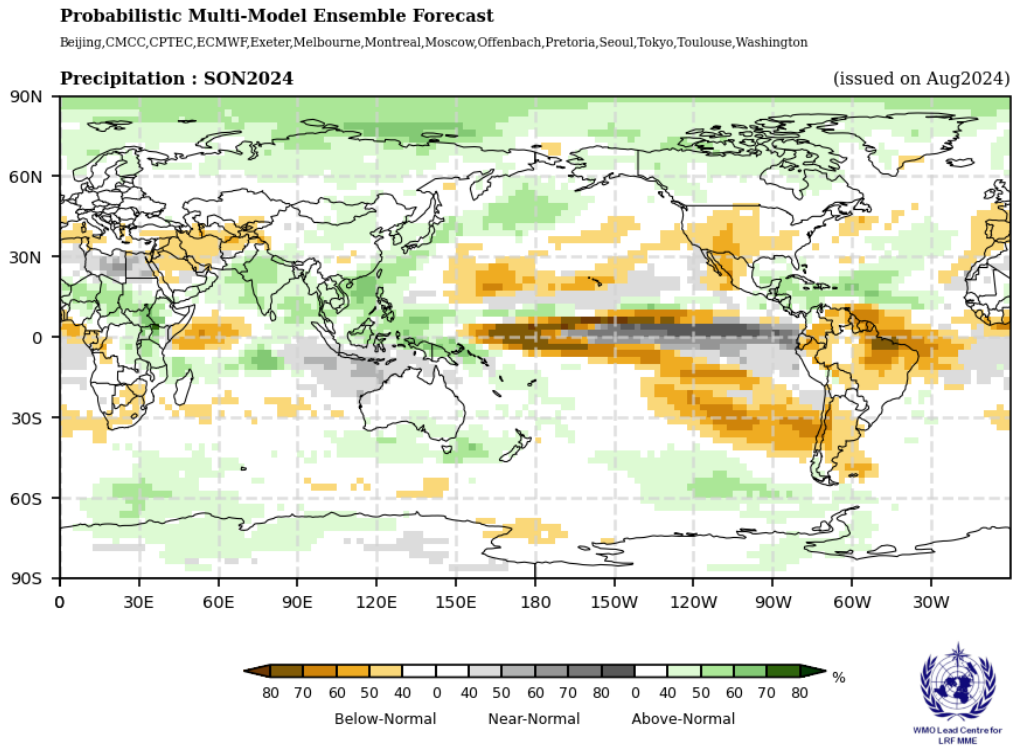


Figure 5. Probabilistic forecasts of rainfall for the season for September-November 2024. The tercile category with the highest forecast probability is indicated by shaded areas. The most likely category for below-normal, above-normal, and near-normal is depicted in orange, green and grey shadings, respectively. White areas indicate equal chances for all categories in both cases. The baseline period is 1993-2009. Figure is generated by The WMO Lead Centre for Long-Range Forecast Multi-Model Ensemble.

Predictions for rainfall are, in part, similar to the impacts of the early stages of La Niña, which is expected to emerge during September-November 2024. Enhanced probabilities for near- or below-normal rainfall are predicted over a

narrow band along or just north and south of the equator extending eastward from 150º E to the southern region of Central America. There are additional bands of prediction for enhanced probabilities for below-normal rainfall spanning the width of the Pacific. The Northern Hemisphere band located around 30º N extends into north-western Central America and the south-western part of North America. The Southern Hemisphere band is more extensive, extending to cover a wide swath of western coast of South America centred around 30º S and then across into the South Atlantic. Probabilities for above-normal rainfall are moderately enhanced over the central and eastern Maritime Continent. Over Africa, between about 10º and 25º N and east of 0º, there are increased probabilities for above-normal rainfall. These probabilities strengthen towards the east where the area of above-normal rainfall probability dips southward to reach 15º S. The probabilities for above-normal rainfall are enhanced over the Indian subcontinent which to the east extends all the way to Southeast Asia and then extends northward along the coastal regions of East Asia. To the west, there is enhancement in probabilities for below-normal rainfall over Central Asia extending into the Arabian Peninsula. Over South America, except for a few regions in the interior of the continent extending from the west coast to the east coast where there is no clear signal, almost all South America has increased probabilities for below-normal rainfall. Probabilities for above-normal rainfall are weakly enhanced over an area that extends from southern Central America over to most of the Caribbean. A region of enhanced probability for below-normal rainfall is predicted over the interior and southern regions of North America west of 90º W with regions of stronger probability located over the southwest crossing into northern Central America. For most of Europe there is no clear signal.

RA I (Africa): Between about 10º and 25º N and east of 0º, there are increased probabilities for above-normal rainfall. The probabilities strengthen towards the east where the area of above-normal rainfall probability dips southward to reach 15º S. Model consistency is weak to moderate. South of about 20º S, and southwest Indian Ocean, below-normal rainfall probabilities are increased. An area of increased probability for below-normal rainfall is predicted over the southern regions of West Africa in the vicinity of Gulf of Guinea.

RA II (Asia): The probabilities for above-normal rainfall are enhanced over the Indian subcontinent with a larger signal towards the west. Farther west, there is enhancement in probabilities for below-normal rainfall over Central Asia extending into the Arabian Peninsula. East of the Indian subcontinent there is an enhancement in the probabilities for above-normal rainfall that extends all the way to Southeast Asia and then extends northward along the coastal regions of East Asia. Probabilities for above-normal rainfall are generally enhanced north of 60º N. The regions with strongest model consistency are along the coastal regions of East Asia, Central Asia, western regions of the Indian subcontinent, and over northernmost regions of Asia.

RA III (South America): Except for few regions in the interior of the continent extending from the west coast to the east coast, and at the southern tip of the continent where there is no clear signal, almost all South America has increased probabilities for below-normal rainfall. The probabilities are highest in the northeast and in the western regions south of 30º S along the Andes extending south-eastward towards the east coast and crossing into the southern Atlantic. The model consistency for these regions is moderate to high.

RA IV (North America, Central America, and the Caribbean): Probabilities for above-normal rainfall are weakly enhanced over an area that extends from southern Central America over to most of the Caribbean and to the northwestern tip of South America and the model consistency is moderate. Probabilities for above-normal rainfall are also enhanced north of 60º N over North America extending down to 45º N in the west and the model consistency is moderate. A region of enhanced probability for below-normal rainfall is predicted over the interior and southern regions of North America west of 90º W with regions of stronger probability located over the southwest crossing into northern Central America. The model consistency over this region is strong.

RA V (Southwest Pacific): Probabilities for above-normal rainfall are moderately enhanced over the central and eastern Maritime Continent. To the south, this region of above-normal rainfall probability, with a break between the Date Line and 150ºW, extends south-eastward across the Pacific to below the southern tip of South America. The area of enhanced probability of above-normal also extends north of the Maritime Continent, and confined along a narrow strip at 10º N, stretches across the Pacific to the southern coast of Central America. The model consistency over all these regions is moderate. Over the eastern parts of the Maritime Continent extending to northern Australia, probability for near-normal rainfall is enhanced, although the model consistency is low. East of the 150º E, regions with enhanced probabilities for near- or below-normal rainfall form complex zones of contrasting rainfall anomalies across the Pacific Ocean. East of 150º E an equatorial band of below-normal rainfall becomes a prediction for enhanced probability for near-normal rainfall east of the Date Line and continues all the way to South America. This

narrow equatorial tongue is bracketed by a narrow strip of below-normal rainfall to its north and south. The southern strip of enhanced probability for below-normal rainfall, at about 150º W, swings southwest to reach the west coast of South America. There is another band of enhanced probability for below-normal rainfall that extends eastward from about 150º E and 15º N and extends to 150º W where it swings northeast to western coast of North America. South of this band there is yet another narrow band of enhanced probability for near-normal rainfall. Except over the south-eastern Australia where probability for above-normal rainfall is weakly enhanced, there is no clear signal over the rest of Australia and New Zealand.

RA VI (Europe): Most of Europe has no clear signal for rainfall prediction.

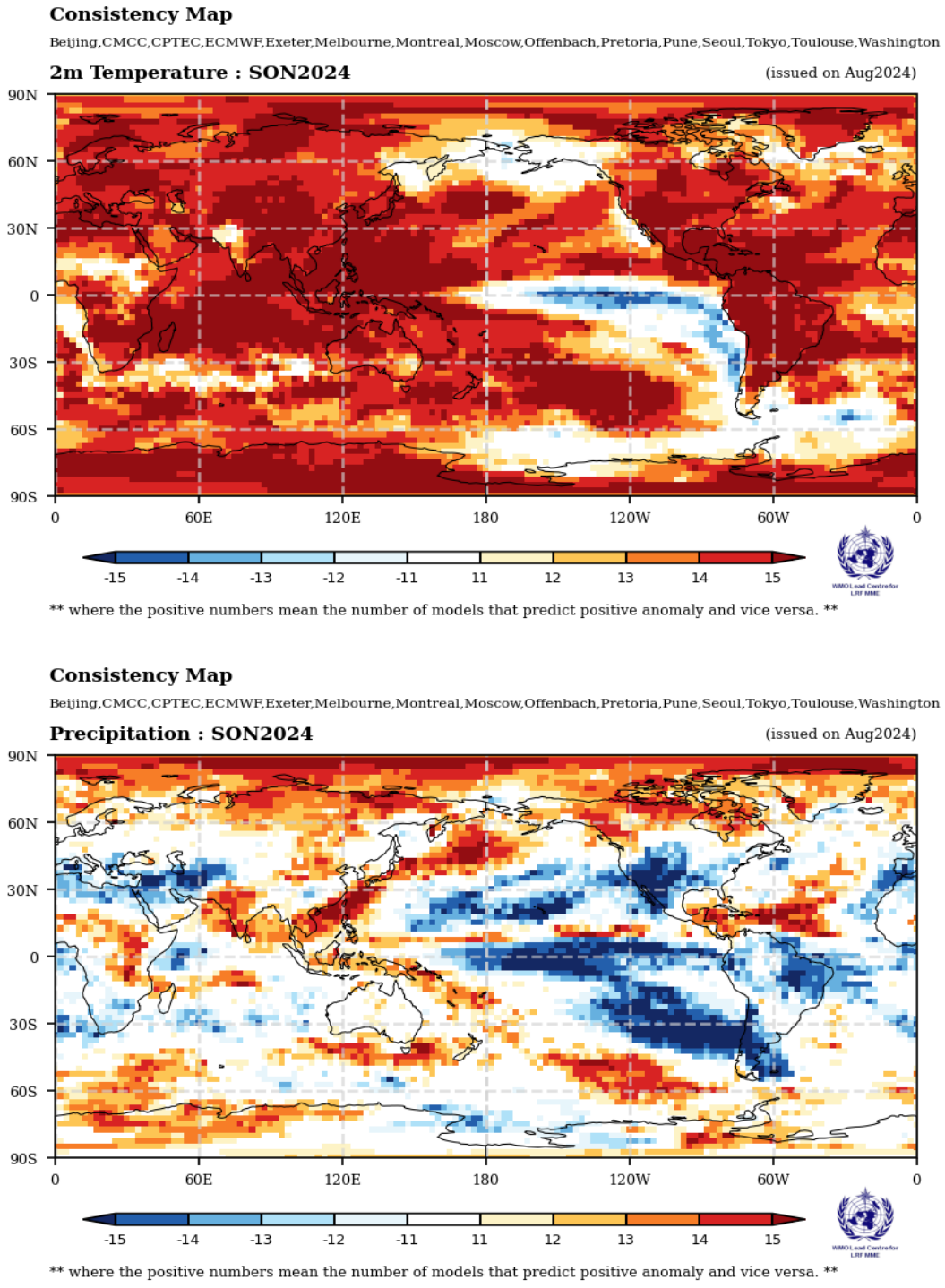


Figure 6. Consistency maps for sign of ensemble mean anomalies for the seasonal mean of September-November 2024 for surface air temperature (top) and rainfall (bottom) from different model forecasts. The consistency map is constructed using the following procedure: At each grid point the number of models with positive or negative anomaly is counted and the number that is larger in plotted on the map. For example, if the number of models with positive (negative) anomaly is larger then the count is plotted on the map using the red (blue) scale. Darker (lighter) colours imply that there is a higher (lower) consistency in the sign of anomalies between models.

3. Latest updates for monitoring and prediction information

Each month, the latest updates for the real-time monitoring and seasonal mean predictions included in GSCU can be found at:

Monitoring:

https://ftp.cpc.ncep.noaa.gov/mingyue/GSCUWMO/

Predictions:

www.wmolc.org/board/downloadExt?fn=WMOLC_T2M.png

http://www.wmolc.org/board/downloadExt?fn=WMOLC_PREC.png

4. How to use the Global Seasonal Climate Update

The GSCU is intended as guidance for RCCs, Regional Climate Outlook Forums (RCOFs) and National Meteorological and Hydrological Services (NMHSs). It does not constitute an official forecast for any region or nation. Seasonal outlooks for any region or nation should be obtained from the relevant RCCs (see below for contact details) or NMHS.

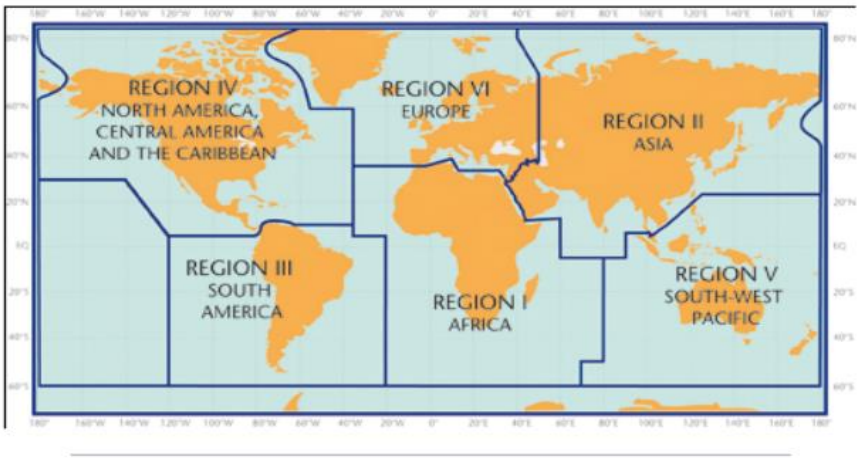
Figure 4 shows the spatial pattern of seasonal mean surface air temperature forecast probabilities. Probabilities are calculated for the average temperature for the season being in the highest third (above-normal or warm), middle third (normal) or lowest third (below-normal or cold) ranges of the baseline record (1993-2009) at each location. Colour code is indicated only for the category that has the highest probability of occurrence. For example, for regions highlighted in red, the most likely forecast category for seasonal mean surface air temperature to occur is warmer than normal. Similarly, the blue colour highlights regions where the seasonal mean surface air temperature forecast indicates the colder than normal category as most likely, while grey colour highlights regions where the seasonal mean temperature forecast indicates the near normal category as most likely. Deeper shades of respective colours highlight increasing probability for the seasonal mean temperature to be in the indicated category. White areas indicate equal chances for all categories.

A particular colour does not assure that the seasonal mean temperature is “certain” to be observed in the most likely forecast category that is shown, but rather its probability of being in that category. As a consequence, the observed seasonal mean temperatures have a non-negligible probability to be observed in a category different from the category indicated on the map as most likely. Users need to take the probabilistic nature of seasonal forecasts into account when making decisions. It should also be noted that the absolute values for the surface air temperature corresponding to the definitions of the above normal (warm), normal or below normal (cold) categories depend on the climatology (historical information) at the location, and therefore, is location dependent.

The interpretation of the probabilities for the rainfall forecast (Figure 5) is the same as that for the seasonal mean surface air temperature except that green and brown colours indicate whether the forecasted seasonal mean rainfall is most likely to be in the wet or dry category. As for surface temperature, grey colour highlights regions where the seasonal mean rainfall forecast indicates the near normal category as the most likely.

The skill of seasonal forecasts is substantially lower than that of weather timescales and skill may vary considerably with region and season. It is important to view the forecast maps together with the skill maps provided in the supplementary material.

For reference, the six WMO Regional Associations domains are depicted in the figure below.



5. Designated and developing WMO Regional Climate Centres and Regional Climate Centre Networks

- https://public.wmo.int/en/our-mandate/climate/regional-climate-centres

6. Resources

Sources for the graphics used in the GSCU:

- The WMO Lead Centre for Long-Range Forecast Multi-Model Ensemble (LC-LRFMME): http://www.wmolc.org
- WMO portal to the Global Producing Centres for Long-range Forecasts (GPCs-LRF): https://public.wmo.int/en/programmes/global-data-processing-and-forecasting-system/global-producing-centres-of-long-range-forecasts
- WMO portal for Regional Climate Outlook Forums https://public.wmo.int/en/our-mandate/climate/regional-climate-outlook-products
- International Research Institute for Climate and Society (IRI): https://iri.columbia.edu/
- NOAA Climate Prediction Centre (CPC): http://www.cpc.ncep.noaa.gov ; https://www.cpc.ncep.noaa.gov/products/people/mchen/AttributionAnalysis/

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