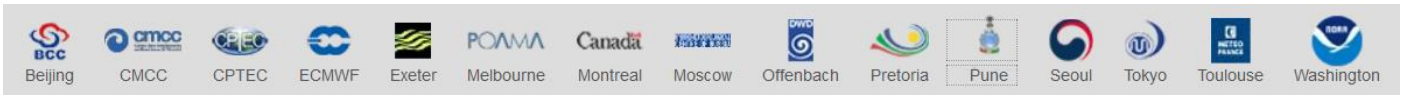
WEATHER CLIMATE WATER

WORLD METEOROLOGICAL ORGANIZATION

GLOBAL SEASONAL CLIMATE UPDATE

TARGET SEASON: December-January-February 2024-25

Issued: 20 November 2024



Summary

During August-October 2024, the observed SST anomalies in global oceans, in general, were above average. The Pacific Niño sea-surface temperature (SST) index anomaly in the eastern Pacific (Niño 1+2) was negative. Of the other three Niño indices anomaly for the westernmost index (Niño 4) was above zero while other two indices in the equatorial central and eastern Pacific were near-zero. Overall, the SST state in the equatorial central and eastern Pacific was ENSO-neutral. The observed Indian Ocean Dipole (IOD) anomaly was near-zero. Both the North Tropical Atlantic (NTA) and South Tropical Atlantic (STA) SST index anomalies were above-zero and reflected widespread warmth in the tropical Atlantic[1].

Sea-surface temperature anomalies in the Niño 3.4 and Niño 3 regions are predicted to decline during December-February 2024-25 and are predicted to reflect weak La Niña conditions. Farther west in the Niño 4 region, the sea-surface temperature anomaly is also predicted to decline and become negative. The strength of the IOD index is predicted to be near-average. In the equatorial Atlantic, SSTs are predicted to be above-normal in both the northern (NTA) and the southern (STA) regions during the season with a prediction for larger positive anomalies for NTA.

Consistent with the anticipated continuation of widespread above-normal sea-surface temperatures in all oceans except for the near-equatorial eastern Pacific Ocean, there is prediction of above-normal temperatures over almost all land areas. A few exceptions to this widespread warmth include land areas in the vicinity of the Bering Sea and the Gulf of Alaska, and Baja California. Extensive areas of large increases in probabilities for above-normal temperatures include South America (and particularly north of 15° S), the Caribbean, Central America, southern, eastern, and extreme northeast parts of North America, northern Europe. between 15° S – 10° N over Africa, western coastal and northeast regions of the Indian subcontinent, northern parts of eastern Asia, the Maritime continent, and New Zealand. Regions with moderate to weaker increase in probabilities for above-normal temperatures include northwestern North America, Greenland, southern Europe and northern Africa, Central Asia, southeast Asia, and Australia. 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, consistent with the predicted emergence of weak La Niña, below- or near-normal temperatures are expected.

Predictions for rainfall for December-February 2024-25 are consistent with the enhanced positive east to west sea surface temperature gradient typically observed during La Niña. 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 150° E to the western coast of South America. Below the equator, there is a band of enhanced probabilities for below-normal rainfall starting from 150° W and extending south-eastwards to reach the western coast of South America and crossing into the southern Atlantic. Enhanced probabilities for below-normal rainfall are also predicted over the northeast South America extending into the Atlantic, North America below 45° N, the Arabian Peninsula extending eastward into Central Asia, and over the Greater Horn of Africa extending into the Indian Ocean to 90° E. Enhanced probabilities for above-normal rainfall are anticipated over the region centred over the Maritime Continent extending to cover the entire Australia and extending further eastward into the western Pacific to 150° W, southern regions of Central America and the Caribbean, Arctic circle north of 60° N, and regions below 60°S in the Southern Hemisphere. Other regions of enhanced probabilities for above-normal rainfall include a band off the coast of eastern Asia extending north-eastward to the Bering Sea and the Gulf of Alaska.

[1] https://www.cpc.ncep.noaa.gov/products/people/mchen/AttributionAnalysis/images/Attribution202410.pdf

Surface Air Temperature, DJF 2024-25 **Rainfall, DJF 2024-25**

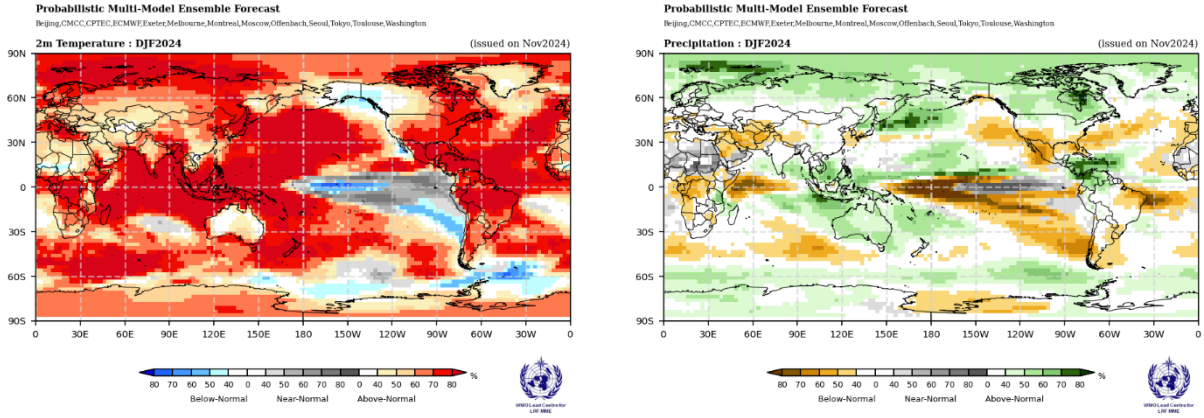


Figure 1. Probabilistic forecasts of surface air temperature and rainfall for the season December-February 2024-25. The tercile category with the highest forecast probability is indicated by shaded areas. The most likely category for below-normal, above-normal, and near-normal is depicted in blue, red, 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: August-October 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 August-October 2024, the observed SST anomalies in global oceans, in general, were above average. The Pacific Niño sea-surface temperature (SST) index anomaly in the eastern Pacific (Niño 1+2) was negative. Of the other three Niño indices anomaly for the westernmost index (Niño 4) was above zero while other two indices in the equatorial central and eastern Pacific were near-zero. Overall, the SST state in the equatorial central and eastern Pacific was ENSO-neutral. The observed Indian Ocean Dipole (IOD) anomaly was near-zero. Both the North Tropical Atlantic (NTA) and South Tropical Atlantic (STA) SST index anomalies were above-zero and reflected widespread warmth in the tropical Atlantic.

Month	Niño 1+2	Niño 3	Niño 4	Niño 3.4	IOD	NTA	STA
August 2024	-0.3	-0.3	0.5	-0.1	0.3	1.1	0.3
September 2024	-0.7	-0.2	0.3	-0.2	0.1	1.1	0.4
October 2024	-0.3	-0.1	0.1	-0.3	-0.4	1.0	0.4
August-October 2024	-0.4	-0.2	0.3	-0.2	0.0	1.1	0.4

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 August-October 2024 were generally above-normal with a few regions of below-normal temperatures interspersed in between (Figure 2, top). The largest positive land-temperature anomalies occurred over eastern two-thirds of North America, Europe, an east-west band along 30° N over Asia, central regions of South America, and northern and central parts of Australia. Above-normal temperature anomalies were also observed over the northern and eastern Asia, the Indian subcontinent, northern and equatorial Africa, Central America, the Caribbean, and the Maritime continent. A few regions of negative temperature anomaly were observed over the extreme northwest North America, eastern parts of Greenland, Central Asia, extreme northwest parts of South America, some regions over Africa, and Madagascar.

Over the oceans, in the equatorial Pacific extending from 130° W to the western coastal parts of South America extending further south along the coastal regions, below to near-normal temperature anomalies were observed. These temperature anomalies reflected the ENSO-neutral state and the possibility of the emergence of a weak La Niño during Northern winter. Few other regions of negative temperature anomalies were observed in northern Atlantic extending from the eastern coast of Greenland to British Isles, the southern tip of South America, and Bering Sea. Above-normal temperature anomalies were present over the Indian Ocean and extended into the western Pacific, equatorial and northern Atlantic extending to 60° N, a band along 60° N in the southern oceans, and off the coast of South American in the southern Atlantic.

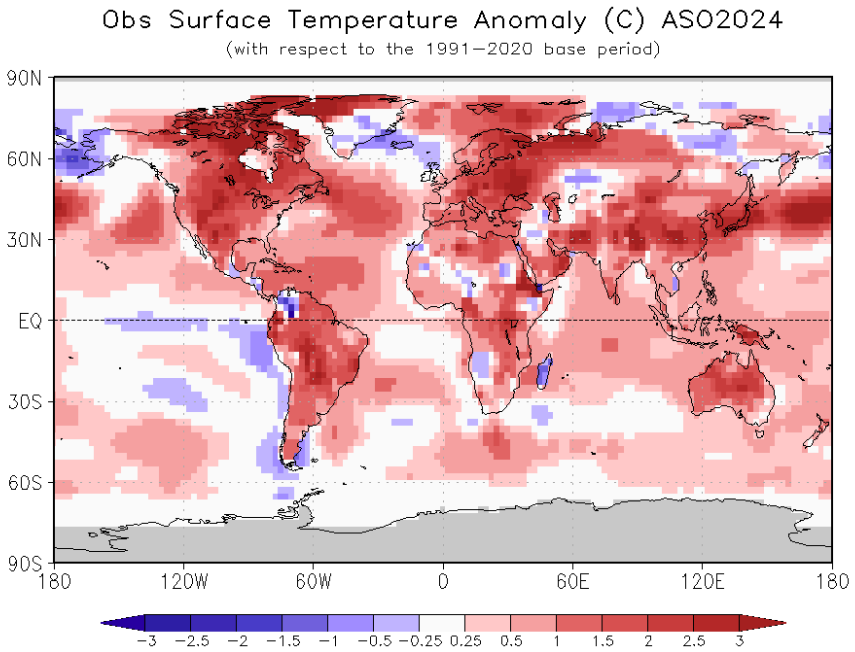
Over the land areas, warm extremes (exceeding all seasonal mean temperatures observed during 1991–2020), occurred over western and extreme northern regions of North America, the Caribbean, inland regions of northwest South America, equatorial Africa, an east-west band along 30°N over Asia, northern regions of Australia. Over the oceans, warm extremes were observed in the western tropical Atlantic extending and along 30° N, equatorial eastern Indian Ocean, and in the southern Pacific along 60° S between 0-120° E. No systematic regions with cold extremes were observed.

1.3 Observed rainfall

For August-October 2024, the rainfall anomalies in the equatorial Pacific began to reflect the influence of near to below-normal SST anomalies in the eastern equatorial Pacific and warmer anomalies in the western Pacific resulting in an enhanced positive east to west gradient typically observed during La Niña. Below-average rainfall anomalies were observed east of 120° E in the equatorial tropical Pacific and extended to the southern regions of Central America. West of 120° E and over the oceans adjacent to the Maritime continent, patchy regions of above-average rainfall anomalies were observed that gave way to below-average rainfall anomalies in the eastern Indian Ocean and over the Bay of Bengal. In the southern ocean, northern Atlantic, extratropical northern Pacific, rainfall was generally below-average.

Over the land regions, negative rainfall anomalies dominated South America with larger values in the northwest. Below-average rainfall anomalies were generally observed over North America with larger values in the southwest and eastern regions. Other regions with below-average rainfall anomalies included southern coastal regions of northwestern North America along the Bering Sea, southern Greenland, eastern Caribbean, equatorial Africa, and northeastern Europe. Land regions with positive rainfall anomalies included western regions of Indian subcontinent, along 15° N over Africa, patchy regions scattered over Asia, the Maritime continent, western and southern Europe, and western regions of the Caribbean extending into the central regions of Central America.

Regions of dry extremes (drier than all seasonal mean rainfall observed during 1991-2020) included northeastern regions of North America extending into southern Greenland, over northeastern Europe, and between 120°W and western coastal regions of South America below the equator. Regions with wet extremes were observed between 10-30° N over Africa, parts of northwestern Indian subcontinent extending into eastern and northern Asia, and over the oceans east of northern Greenland.



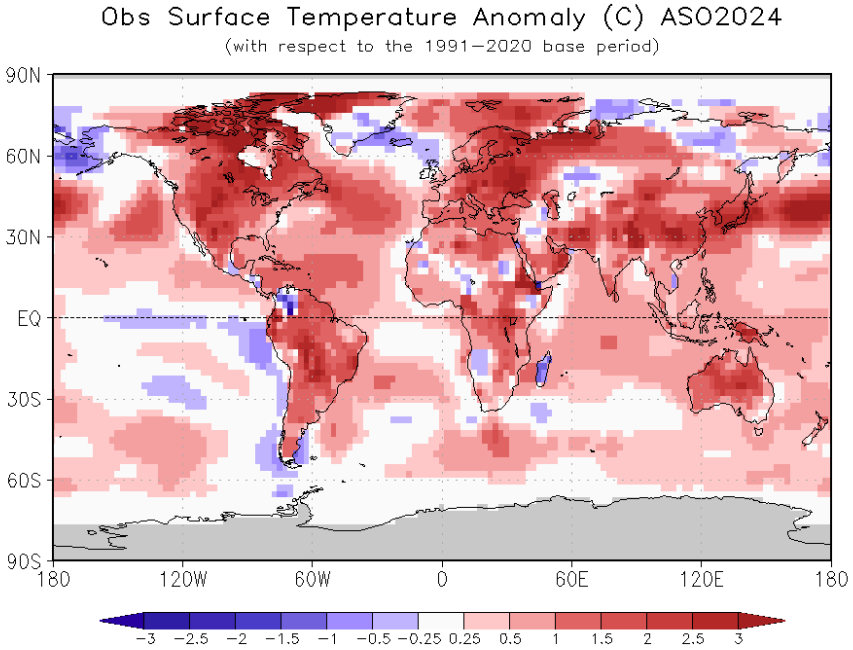
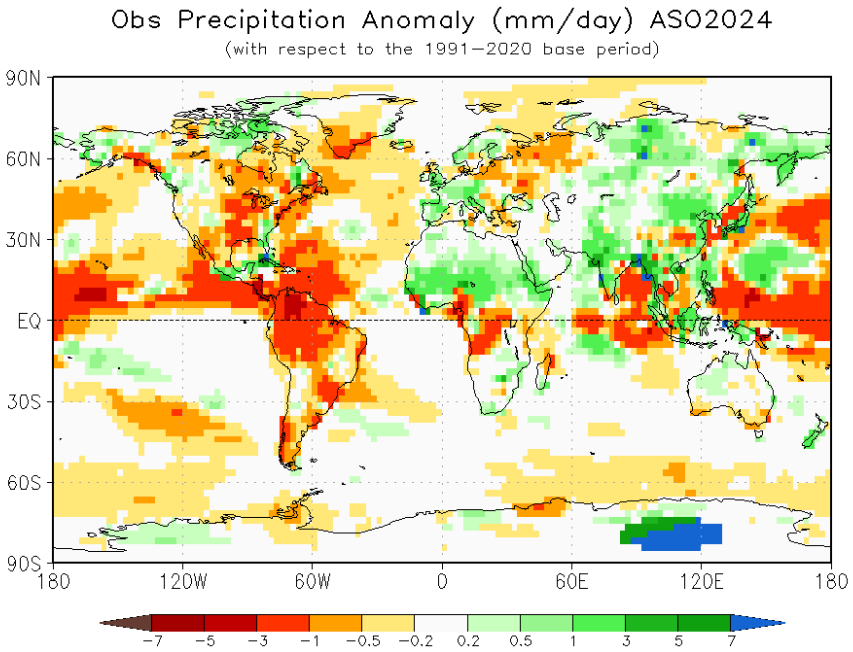


Figure 2. Observed August-October 2024 near-surface temperature anomalies relative to 1991–2020 (top). The *Cooler than Normal, Near Normal, and Warmer than Normal* shadings on the percentile map (bottom) indicate that seasonal mean anomalies were in the bottom, middle, and upper tercile of the 1991–2020 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).



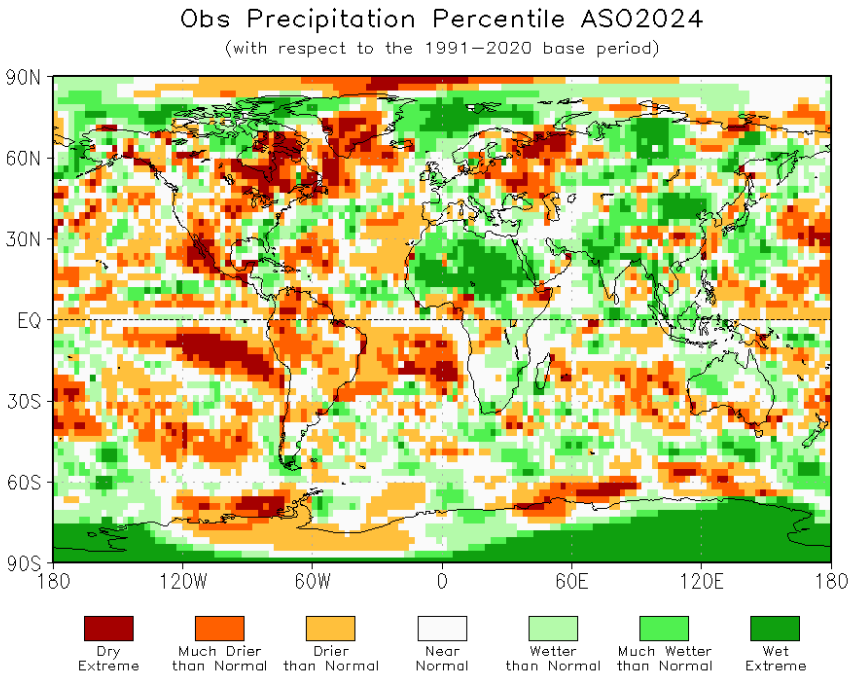


Figure 3. Observed rainfall anomalies for August-October 2024, relative to 1991–2020 base period (top). The *Drier than Normal, Near Normal and Wetter than Normal* shadings on the percentile map (bottom) indicate that seasonal mean anomalies were in the bottom, middle, and upper tercile of the 1991–2020 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 December-February 2024-25)

2.1 Large-scale SST-based indices, December-February 2024-25

Month	Nino 1+2	Nino 3	Nino 4	Nino3.4	IOD	NTA	STA
December 2024	-0.4±0.3	-0.4±0.3	-0.3±0.2	-0.5±0.3	-0.4±0.3	0.6±0.1	0.1±0.2
January 2025	-0.3±0.3	-0.4±0.3	-0.2±0.3	-0.5±0.4	-0.2±0.3	0.6±0.1	0.1±0.2
February 2025	-0.1±0.3	-0.3±0.4	-0.0±0.3	-0.4±0.4	0.0±0.2	0.5±0.1	0.1±0.2
DJF 2024-25	-0.3±0.3	-0.4±0.3	-0.2±0.3	-0.5±0.4	-0.2±0.3	0.6±0.1	0.1±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.

Sea-surface temperature anomalies in the Niño 3.4 and Niño 3 regions are predicted to decline during December-February 2024-25 and are predicted to reflect weak La Niña conditions. Farther west in the Niño 4 region, the sea-surface temperature anomaly is also predicted to decline and become negative. The strength of the IOD index is predicted to be near-average. In the equatorial Atlantic, SSTs are predicted to be above-normal in both the northern (NTA) and the southern (STA) regions during the season with a prediction for larger positive anomalies for NTA.

2.2 Predicted temperature, December – February 2024-25

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_DJF2024_supplementary_info_LC-LRFMME.docx

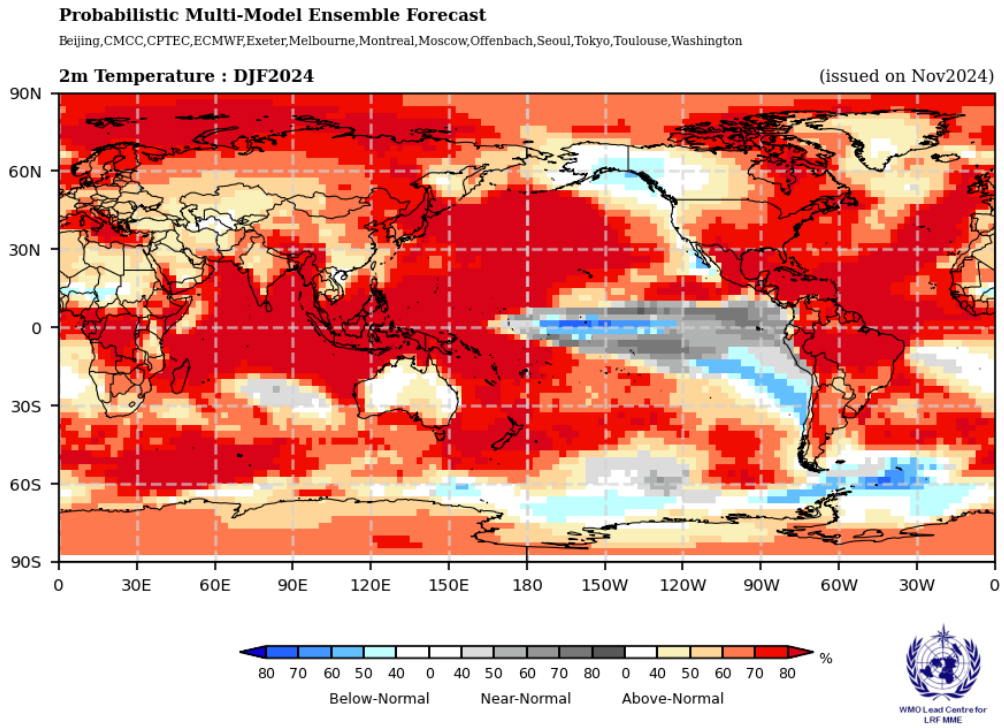


Figure 4. Probabilistic forecasts of surface air temperature for December-February 2024-25. The tercile category with the highest forecast probability is indicated by shaded areas. The most likely category for below-normal, above-normal, and near-normal is depicted in blue, red, and grey shadings, respectively. 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 continuation of widespread above-normal sea-surface temperatures in all oceans except for the near-equatorial eastern Pacific Ocean, there is prediction of above-normal temperatures over almost all land areas. A few exceptions to this widespread warmth include land areas in the vicinity of the Bering Sea and the Gulf of Alaska, Baja California. Extensive areas of large increases in probabilities for above-normal temperatures include South America (and particularly north of 15° S), the Caribbean, Central America, southern, eastern, and extreme northeast parts of North America, northern Europe. between 15° S – 10° N over Africa, western coastal and northeast regions of the Indian subcontinent, northern parts of eastern Asia, the Maritime continent, and New Zealand. Regions with moderate to weaker increase in probabilities for above-normal temperatures include northwestern North America, Greenland, southern Europe and northern Africa, Central Asia, southeast Asia, and Australia. 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, consistent with the predicted emergence of weak La Niña, below- or near-normal temperatures are expected.

RA I (Africa): Enhanced probabilities of above-normal temperatures are indicated almost over the entirety of mainland Africa and Madagascar with largest increase in probabilities south of 10° N with moderate to strong model consistency. A weaker increase in probabilities for above-normal temperature is predicted north of 15° N but model consistency is weak. A small region of probabilities for below-normal temperature is predicted along 15° N.

RA II (Asia): Enhanced probabilities for above-normal temperatures are indicated over all of mainland Asia with the largest increase in the probabilities along the coastal regions of Indian subcontinent where along the east coast the area of above-normal probability extends to northeast and curves downward to cover regions of southeastern Asia. Higher probabilities of above-normal temperature are also indicated over northeast Asia extending northward to 60° N where they extend westward along the Arctic circle. The model consistency over all these regions is moderate to high. A moderate increase in probability for above-normal temperatures is predicted over western and central Asia, interior regions of Indian subcontinent and southeast Asia although the model consistency is low.

RA III (South America): Strongly enhanced probabilities for above-normal temperatures are indicated over South America north of about 30° S apart from the narrow coastal strip along the western coastal regions. Model consistency

is high over these regions. Further south, the probabilities for above-normal temperature are weakly enhanced and the model consistently is moderate to high.

RA IV (North America, Central America, and the Caribbean): A strong increase in the probability for above-normal temperatures is predicted over the Caribbean, Central America, along the southern and eastern regions of North America extending northward to cover the northeast and then curving westward along the Arctic circle to reach 120º W. The model consistency over these regions is moderate to strong. Prediction for an increase in the probability for below-normal temperatures is indicated over the coastal regions of Gulf of Alaska, and the land adjacent to the west of Gulf of California. Over the other regions of northwestern North America, the predicted signal is weak.

RA V (Southwest Pacific): Widespread and strongly enhanced probabilities for above-normal temperatures are predicted throughout the western parts of 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 prediction of La Nina. The area of warmth extends into the eastern Pacific in four prongs. One extension is a narrow band at about 15º N that connects all the way to Central America. North of this area is a band between about 30º and 60º N that weakens towards the coastal regions of North America. A third extension at about 10º S reaches to about 120º W, and the southernmost extension approaches 90º W and 60º 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 dips southward along the coast.

RA VI (Europe): The probabilities for above-normal temperatures are increased over all of Europe with highest probabilities north of about 45º N and in the southern regions. The model-to-model consistency is mostly moderate to strong.

2.3 Predicted rainfall, December-February 2024-25

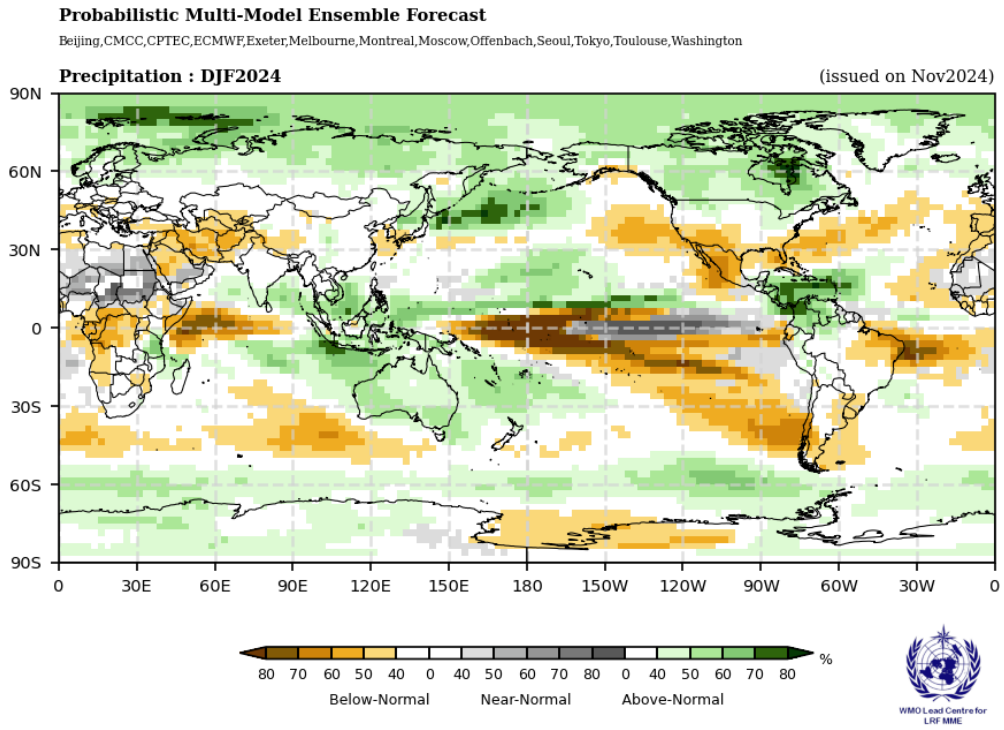


Figure 5. Probabilistic forecasts of rainfall for the season for December-February 2024-2025. The tercile category with the highest forecast probability is indicated by shaded areas. The most likely category for below-normal, above-normal, and near-normal is depicted in orange, green and grey shadings, 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 for December-February 2024-25 are consistent with the enhanced positive east to west sea surface gradient typically observed during La Niña. 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 150° E to the western coast of South America. Below the equator, there is a band of enhanced probabilities for below-normal rainfall starting from 150° W and extending south-eastwards to reach the western coast of South America and crossing into the southern Atlantic. Enhanced probabilities for below-normal rainfall are also predicted over the northeast South America extending into the Atlantic, North America below 45° N, the Arabian Peninsula extending eastward into Central Asia, and over the Greater Horn of Africa extending into the Indian Ocean to 90° E. Enhanced probabilities for above-normal rainfall are anticipated over the region centred over the Maritime Continent extending to cover the entire Australia and extending further eastward into the western Pacific to 150° W, southern regions of Central America and the Caribbean, Arctic circle north of 60° N, and regions below 60°S in the Southern Hemisphere. Other regions of enhanced probabilities for above-normal rainfall include a band off the coast of eastern Asia extending north-eastward to the Bering Sea and the Gulf of Alaska.

RA I (Africa): Probabilities for below to near-normal rainfall is predicted over most of Africa with weak to moderate model consistency. Enhanced probabilities for near-normal rainfall are predicted north of 10° N while over the region to its south extending to about 15° S, probability for below-normal rainfall is enhanced. A small region with enhancement in the probability for above-normal rainfall is located over the coastal regions of eastern Africa extending over to the northern parts of Madagascar.

RA II (Asia): There is a prediction for enhancement in probabilities for below-normal rainfall over the Arabian Peninsula extending eastward into Central Asia and the model consistency is weak to moderate. Enhanced probability for prediction for above-normal rainfall include a band off the coast of eastern Asia extending north-eastward to the Bering Sea and the Gulf of Alaska where is merges with an increase in probability for above-normal rainfall and over the Arctic circle. The model consistency over these regions is moderate to strong. Another region with enhancement

in the probability for above-normal rainfall is over the eastern parts of the Arabian Peninsula crossing over to the southern parts of the Indian subcontinent into the Bay of Bengal and extending to southeast Asia, the model consistency, however, is generally weak.

RA III (South America): There is an enhancement in the probability for above-normal rainfall over the northeast part of South America and the model consistency is strong. Regions with an increase in the probability for below-normal rainfall (with moderate model consistency) include northeast region extending into the Atlantic Ocean, along the eastern coastal regions below 30º S extending to the southern tip of the continent.

RA IV (North America, Central America, and the Caribbean): Probabilities for above-normal rainfall are 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 50º N over North America 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 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 extends to cover Australia, and further, extends south-eastward across to 150º W. 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. 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 the Date Line and extends to 120º W where it swings northeast to western coast of North America.

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

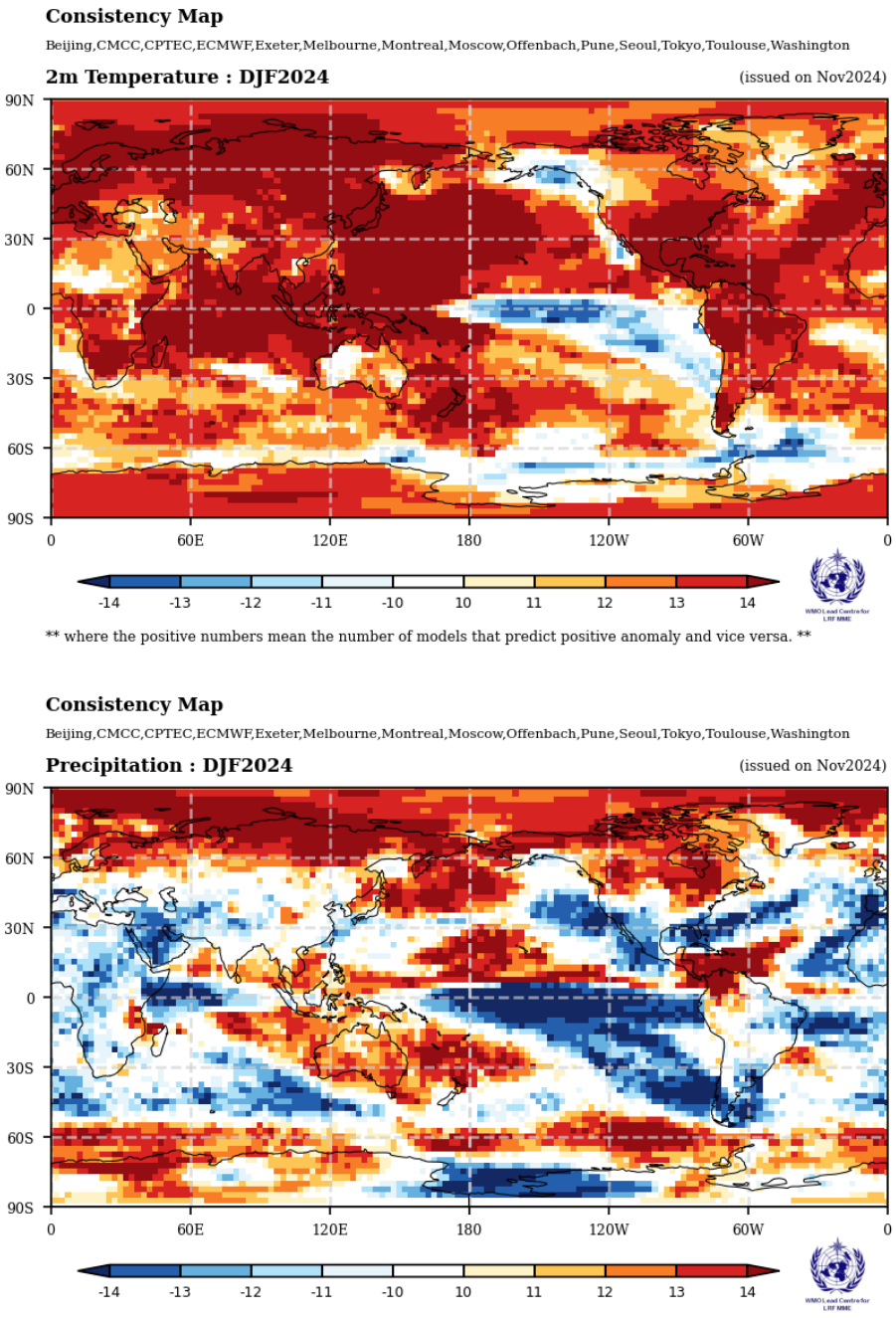


Figure 6. Consistency maps for sign of ensemble mean anomalies for the seasonal mean of December-February 2024-2025 for surface air temperature (top) and rainfall (bottom) from different model forecasts. The consistency map is constructed using the following procedure: At each grid point the number of 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.

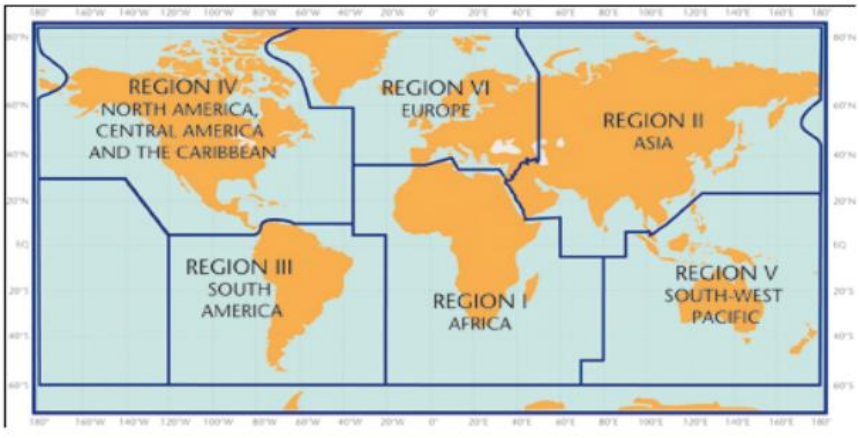
Figure 4 shows the spatial pattern of seasonal mean surface air temperature forecast probabilities. Probabilities are calculated for the average temperature for the season being in the highest third (above-normal or warm), middle third (normal) or lowest third (below-normal or cold) ranges of the baseline 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/

7. Acknowledgements

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- WMO Lead Centre for Long-Range Forecast Multi-Model Ensemble (LC-LRFMME), Korea Meteorological Administration, NOAA National Centers for Environmental Prediction
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