WEATHER CLIMATE WATER

WORLD METEOROLOGICAL ORGANIZATION

GLOBAL SEASONAL CLIMATE UPDATE

TARGET SEASON: December-January-February 2021-2022

Issued: 25 November 2021

Summary

During August-October 2021, the four Pacific Niño sea-surface temperature (SST) indices in the central and eastern Pacific were near-normal. The observed SST conditions were characterized by an ENSO neutral state in the equatorial tropical Pacific. The Indian Ocean Dipole (IOD) over the observed period was negative. The North Tropical Atlantic (NTA) SST index was near-zero, and the South Tropical Atlantic (STA) SST index was positive.

For the December-February 2021-2022 season, SST in the central and eastern equatorial Pacific is predicted to be below average with values of approximately -0.9 ºC for Niño 3.4 and -0.8 ºC for Niño 3 SST indices. These conditions indicate a prediction for weak La Niña conditions.

Although weak La Niña conditions are predicted to return in the equatorial central and eastern Pacific, the widespread warmer-than-average sea surfaces elsewhere are predicted to dominate the forecast of air temperatures for December–February 2021-2022. Positive temperature anomalies are expected over most of the land areas in the Northern Hemisphere, with the only large exceptions being north-western North America, the Indian subcontinent, the Indochinese Peninsula, and Australia. The largest land air-temperature anomalies are expected over the far northern and north-eastern parts of Asia and the Arctic, and in eastern parts of North America, where the models are consistent in predicting an anomalously warm December-February 2021-2022. The models are most consistent in their predictions of an anomalously warm winter over the north-eastern parts of Asia, and in south-eastern parts of North America including much of the Caribbean. Consistency for above-normal temperature is also high over much of Europe, Africa north of the equator, and over south-west Asia, although the predicted positive anomalies are not as high in these areas. Models are consistent in predicting below-normal temperatures over the coastal Pacific areas of north-western North America. In near-equatorial latitudes and the Southern Hemisphere, positive temperature anomalies are predicted with high consistency over a large area from the Maritime subcontinent extending into the South Pacific, as well as over near equatorial Africa extending south-eastwards over Madagascar and beyond. Near-normal or below-normal temperatures are predicted for most of South America north of about 15° S, while much of the west coast of South America has predictions of below-normal temperature, with high consistency. Other areas with high consistency in predictions of below-normal temperatures are the central and eastern tropical Pacific, reflecting the presence of weak La Niña conditions, the southern and south-eastern Pacific, and a small area in the central South Atlantic Ocean. There is weaker consistency in predictions of below-normal temperatures over much of Australia, south-eastern Southern Africa, and some northern parts of South America.

Because of weak La Niña conditions that are predicted for December-February 2021-2022, some canonical rainfall impacts of La Niña are expected. There are increased chances of unusually dry conditions along the equator centred near the dateline and extending towards the southernmost part of South America; along the equator in the Pacific Ocean east of about 160° W, negative rainfall anomalies are predicted, but probabilities are highest for near-normal rainfall. Anomalously wet conditions are predicted in much of the Maritime subcontinent immediately north of the equator and extending into the south-west Pacific and north central Pacific. The areas of increased probability for unusually wet conditions extend over much of Australia, but model consistency is weak here. The only other areas of notable predicted increases in rainfall are north-eastern and the far north-western part of South America, and there are weaker indications of unusually wet conditions over part of western North America and over some parts of Southern Africa. There are moderately strong indications of below-normal rainfall across the southern part of Northern America, part of south-eastern South America, the far eastern part of Asia, north-western parts of Southern Africa, and over much of the central western Indian Ocean. Over much of the rest of Africa, Europe and Asia, there is little consistency in predicted rainfall.

Surface Air Temperature, DJF 2021-2022 **Precipitation, DJF 2021-2022**

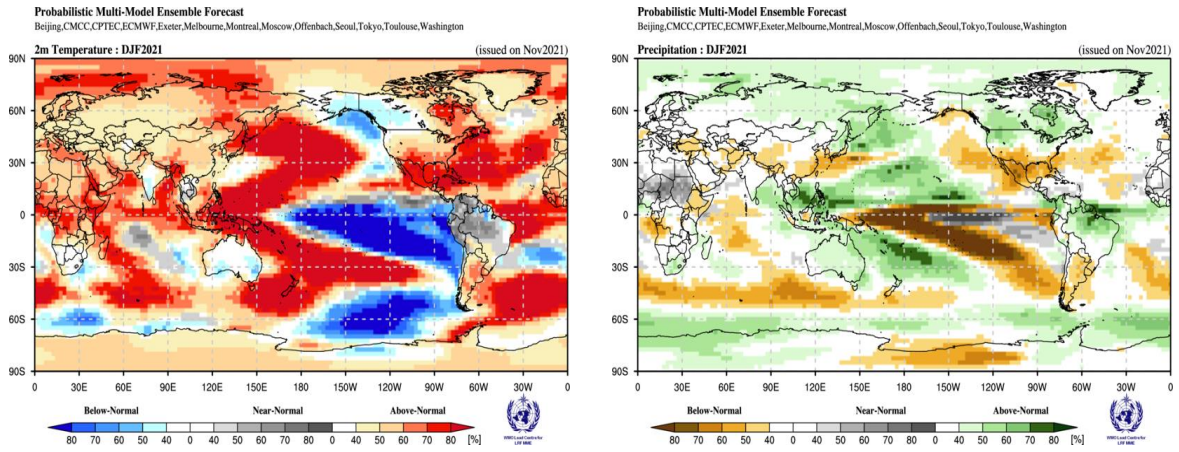


Figure 1. Probabilistic forecasts of surface air temperature and precipitation for the season December-February 2021-2022. The tercile category with the highest forecast probability is indicated by shaded areas. The most likely category for below-normal, above-normal and near-normal is depicted in blue, red and grey shadings respectively for temperature, and orange, green and grey shadings respectively for precipitation. White areas indicate equal chances for all categories in both cases. The baseline period is 1993–2009.

1. Observations: August-October 2021

In the following sections, observed temperature and precipitation patterns for the period August-October 2021 are briefly described. 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 2021, the four Pacific Niño sea-surface temperature (SST) indices in the central and eastern Pacific were near-normal. The observed SST conditions were characterized by an ENSO neutral state in the equatorial tropical Pacific. The Indian Ocean Dipole (IOD) over the observed period was negative. The North Tropical Atlantic (NTA) SST index was near-zero, and the South Tropical Atlantic (STA) SST index was positive. In summary, none of the SST indices had large deviations from zero.

Month	Niño 1+2	Niño 3	Niño 4	Niño 3.4	IOD	NTA	STA
August 2021	0.2	-0.2	-0.2	-0.4	-0.3	-0.2	0.7
September 2021	0.1	-0.3	-0.4	-0.3	-0.1	0.1	0.5
October 2021	-0.2	-0.5	-0.7	-0.8	-0.7	0.1	0.4
August-October 2021	0.0	-0.3	-0.4	-0.5	-0.4	0.0	0.5

Table 1. Large-scale oceanic indices (°C). Anomalies are with respect to the 1981–2010 average. (*Source:* U.S. Climate Prediction Center)

1.2 Observed temperature

Over land, temperature anomalies across the globe continued their general tendency of warmer-than-normal conditions for the season of August-October 2021 (Figure 2, top), and in general, above-normal temperatures dominated the global land areas. The most strongly positive land-temperature anomalies occurred over north-northeast regions of North America, central and southern regions of South America, central Africa, regions in the vicinity of the Geater Horn of Africa, and north-eastern Asia. Positive temperature anomalies also occurred over much of the rest of Africa and Asia, Greenland, and northern Australia. August-October 2021 also had some regions with below-normal temperature anomalies including southern regions of Australia, and New Zealand.

Over the oceans, the south of the eastern Pacific below the equator had cooler or near normal temperatures. In the extratropical southern oceans near-to-below average temperatures generally prevailed. SSTs in the equatorial central Pacific indicated ENSO-neutral conditions, with positive anomalies in the western equatorial Pacific and a tendency towards negative anomalies in the central and eastern Pacific - a pattern that indicates enhanced zonal SST gradients across the equatorial Pacific. SST anomalies in the extratropical North Pacific and Atlantic were generally positive. A notable region having the largest observed warm ocean-temperature anomaly was in the northeast Pacific.

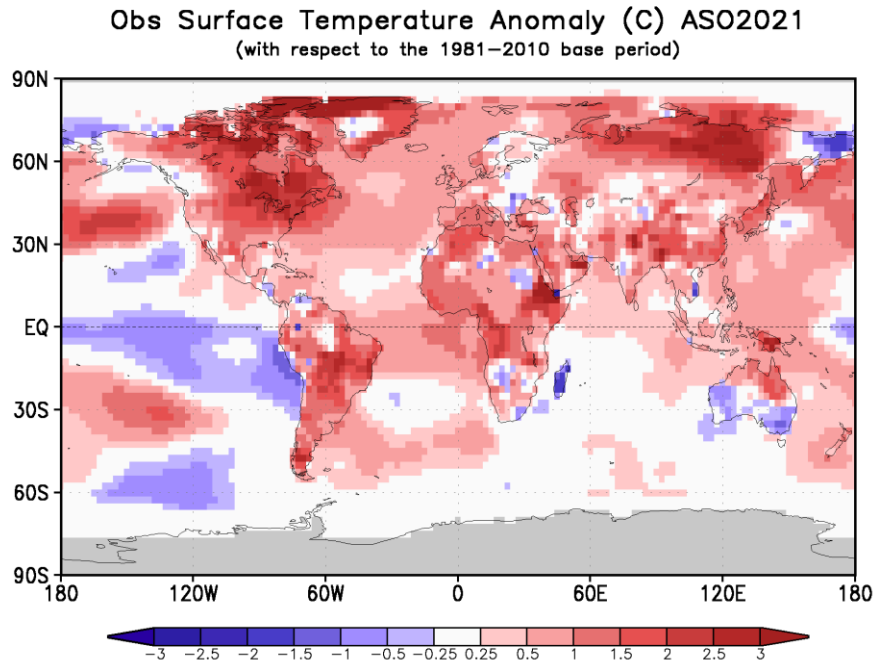
Consistent with the seasonal mean anomalies, warm extremes dominated (Figure 2, bottom panel). Warm extremes (exceeding all seasonal mean temperatures observed during 1981–2010) occurred over north-eastern regions of North America, along 15°S in South America, and over portions of western and central Africa. No widespread extreme cold temperature was found over land areas. Some oceanic regions also had warm extremes, notably the extratropical northeast Pacific, the eastern and southern equatorial Atlantic, regions in the western equatorial Pacific, and along 30°S in the southeast Pacific.

1.2 Observed precipitation

For August-October 2021, the largest negative precipitation anomalies were in the equatorial Pacific near the date-line extending into the western Pacific with a narrower equatorial band extending into the eastern Pacific, and a band extending into the southern Pacific towards South America (Fig. 3, top panel). Below-normal precipitation anomalies also occurred in the equatorial Indian Ocean, much of the Atlantic, and western Pacific along 30° N. Positive precipitation anomalies occurred in the oceanic regions in the vicinity of the Indonesian Archipelago.

Over land, negative precipitation anomalies were observed in northeast North America, while positive precipitation anomalies occurred in equatorial Africa, the Indonesian Archipelago, and Indian subcontinent extending into eastern Asia. Over other land areas no large-scale systematic departures in precipitation anomalies of either sign were observed.

Except over a small region in northeast North America where precipitation was extremely dry, no large-scale systematic regions with dry or wet extremes (precipitation below or above all seasonal totals observed during 1981-2010) over land occurred.



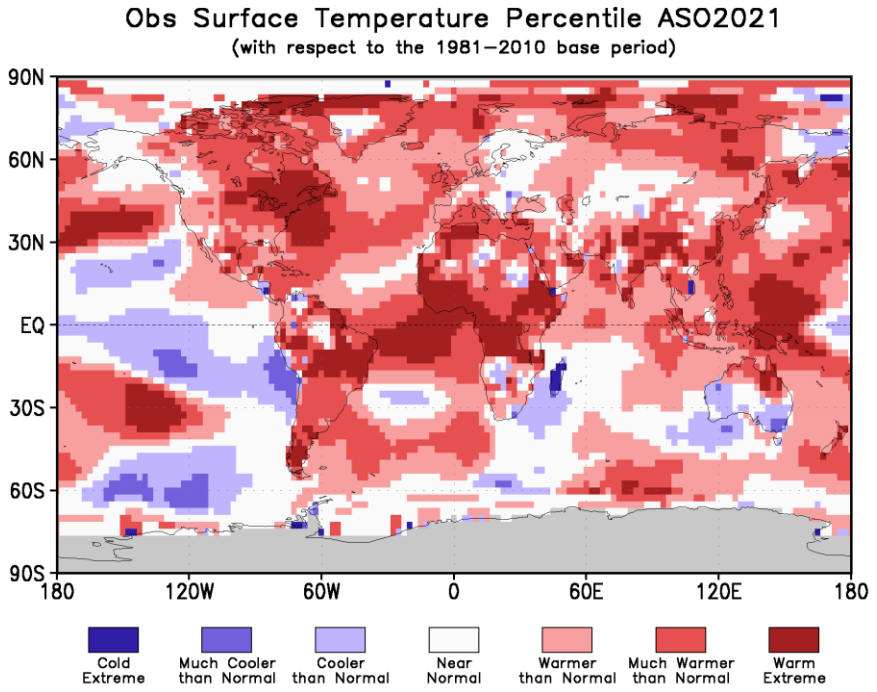
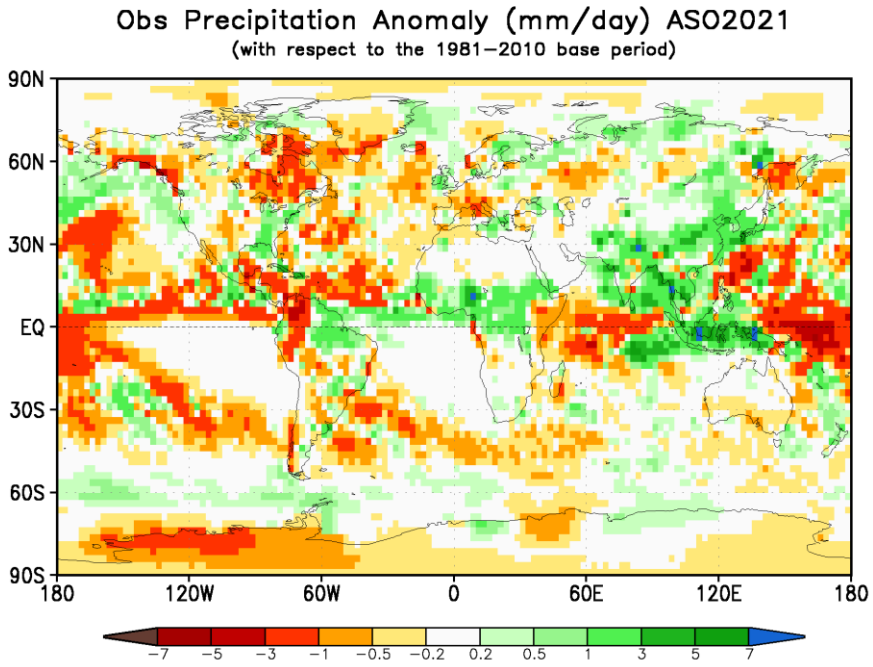


Figure 2. Observed August-October 2021 near-surface temperature anomalies relative to 1981–2010 (top). The *Cooler than Normal, Near Normal, and Warmer than Normal* shadings on the percentile map (bottom) indicate that seasonal mean anomalies were in the bottom, middle, and upper tercile of the 1981–2010 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 1981–2010 period for the season. Grey shading indicates areas where observational analysis was not available. (*Source:* U.S. Climate Prediction Center).



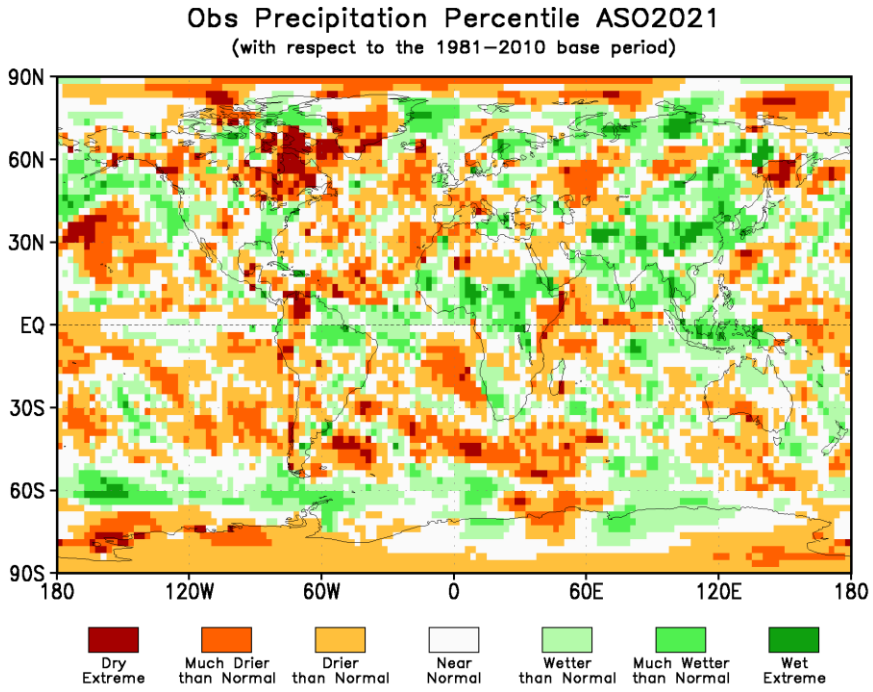


Figure 3. Observed precipitation anomalies for August-October 2021, relative to 1981–2010 base period (top). The *Drier than Normal, Near Normal and Wetter than Normal* shadings on the percentile map (bottom) indicate that seasonal mean anomalies were in the bottom, middle, and upper tercile of the 1981–2010 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 1981–2010 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 2021-2022)

2.1 Large-scale SST-based indices, December-February 2021-2022

Month	Nino 1+2	Nino 3	Nino 4	Nino3.4	IOD	NTA	STA
December 2021	-1.0±0.3	-1.0±0.4	-0.8±0.2	-1.0±0.3	-0.1±0.2	0.3±0.2	-0.2±0.1
January 2022	-0.9±0.3	-0.9±0.4	-0.6±0.3	-1.0±0.5	0.0±0.1	0.2±0.1	-0.2±0.1
February 2022	-0.5±0.3	-0.6±0.4	-0.4±0.3	-0.7±0.4	0.1±0.1	0.2±0.2	-0.1±0.1
December - February 2021-22	-0.9±0.4	-0.8±0.4	-0.6±0.3	-0.9±0.4	0.0±0.1	0.2±0.2	-0.2±0.1

Table 2: Multi-model forecasts for oceanic indices (℃), 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 CPTEC, ECMWF, Exeter, Melbourne, Montreal, Moscow, 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.

Observed sea surface temperatures in the central tropical Pacific were in the ENSO Neutral condition during August-September 2021. Below-normal sea-surface temperature anomalies in the Niño 3.4 and Niño 3 regions with values of approximately -0.9ºC (Niño 3.4) and -0.8 (Niño 3) are predicted during the December-February 2021-2022 season and indicate weak La Niña conditions. Farther west in the Niño 4 region, the sea-surface temperature anomaly is also predicted to be negative, with a value of about -0.6°C. The DJF 2021-22 prediction, therefore, indicates a return to weak La Niña conditions in the central tropical Pacific. The IOD is predicted to be near-normal over the three months DJF 2021-2022. In the equatorial Atlantic, SSTs are predicted to be near-normal in both the northern (NTA) and the southern (STA) areas during the season.

2.2 Predicted temperature, December-February 2021-2022

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[1]).

[1] File with supplementary information can be downloaded from https://ftp.cpc.ncep.noaa.gov/mingyue/GSCUWMO/Forecasts/GSCU_DJF2021_supplementary_info_LC-LRFMME.docx

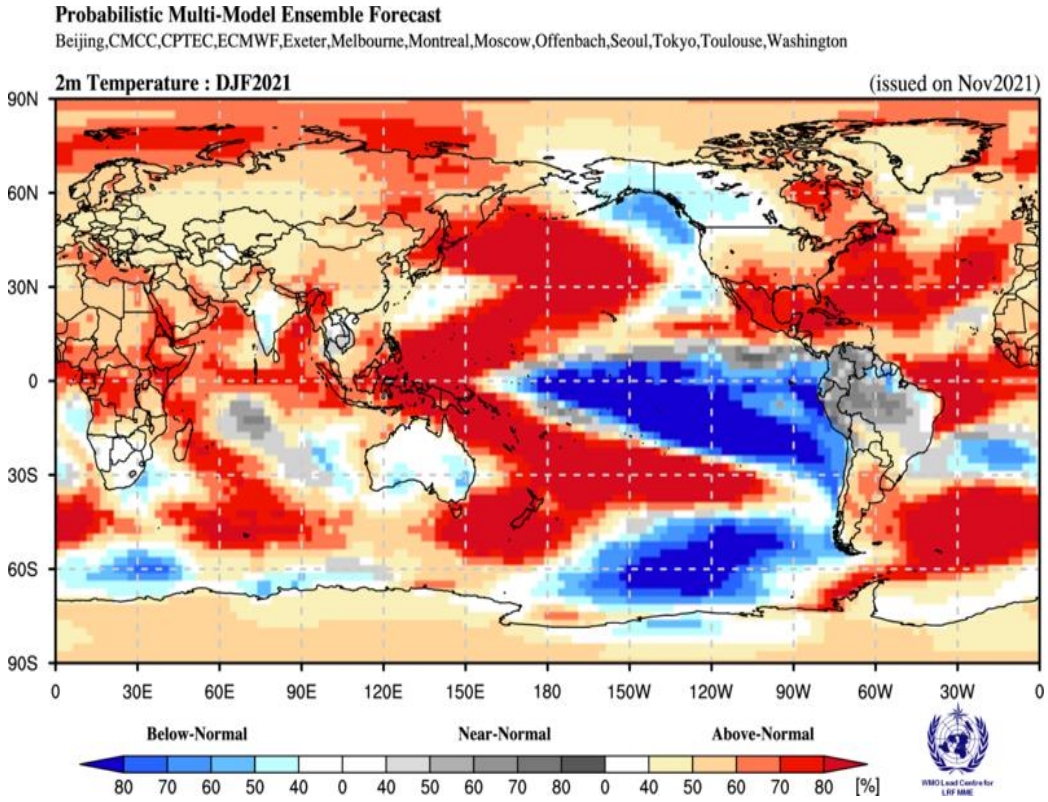


Figure 4. Probabilistic forecasts of surface air temperature for December-February 2021-2022. The tercile category with the highest forecast probability is indicated by shaded areas. The most likely category for below-normal, above-normal and near-normal is depicted in blue, red and grey shadings respectively. 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.

Although weak La Niña conditions are predicted to return in the equatorial central and eastern Pacific, the widespread warmer-than-average sea surfaces elsewhere are predicted to dominate the forecast of air temperatures for December–February 2021-2022. Positive temperature anomalies are expected over most of the land areas in the Northern Hemisphere, with the only large exceptions being north-western North America, the Indian subcontinent, the Indochinese Peninsula, and Australia. The largest land air-temperature anomalies are expected over the far northern and north-eastern parts of Asia and the Arctic, and in eastern parts of North America, where the models are consistent in predicting an anomalously warm December-February 2021-2022. The models are most consistent in their predictions of an anomalously warm winter over the north-eastern parts of Asia, and in south-eastern parts of North America including much of the Caribbean. Consistency for above-normal temperature is also high over much of Europe, Africa north of the equator, and over south-west Asia, although the predicted positive anomalies are not as high in these areas. Models are consistent in predicting below-normal temperatures over the coastal Pacific areas of north-western North America. In near-equatorial latitudes and the Southern Hemisphere, positive temperature anomalies are predicted with high consistency over a large area from the Maritime subcontinent extending into the South Pacific, as well as over near equatorial Africa extending south-eastwards over Madagascar and beyond. Near-normal or below-normal temperatures are predicted for most of South America north of about 15° S. Other areas with high consistency in predictions of below-normal temperatures are the central and eastern tropical Pacific, reflecting the presence of weak La Niña conditions, the southern and south-eastern Pacific, and a small area in the central South Atlantic Ocean. There is weaker consistency in predictions of below-normal temperatures over much of Australia, south-eastern Southern Africa, and some northern parts of South America.

RA I (Africa): Enhanced probabilities of above-normal temperatures are indicated over almost the entire mainland of Africa north of about 15° S, over Madagascar and extending further south-east to the central southern Indian Ocean. Model consistency is moderate to high over these areas. Probabilities are strongest in near-equatorial regions expanding over Central Africa and much of the Greater Horn. Probabilities are also high over Madagascar, and model consistency is strongest here. In southern Africa probabilities there is no clear indication for a signal (and model consistency is also weak).

RA II (Asia): Enhanced probabilities for above-normal temperatures are indicated over the whole of Asia, except for the Indian subcontinent and parts of southeast Asia, where there are no clear indications for the temperature signal. The probabilities for above-normal temperatures are highest over the northern regions of east Asia and over the Maritime continent. Although the probabilities for above-normal temperature are only moderately increased, the model-to-model consistency is high over most of the continent, and most notably over much of the eastern and northern regions, as well as in the south-west.

RA III (South America): Enhanced probabilities for above-normal temperatures are indicated over South America south of about 20° S, except along the western coastal regions. The probabilities and model-to-model consistency increase south of about 30° S, but do not extend beyond about 50° S. The probabilities for above-normal temperature are also high along coastal areas in the north-east of the continent. Over most of the northern half of the continent, normal or below-normal temperatures are predicted as the most likely outcome. However, model-to-model consistency is weak except along the Pacific coast because of proximity to the predicted La Niña conditions here.

RA IV (North America, Central America and the Caribbean): There are enhanced probabilities for above-normal temperatures over the eastern half of North America and across Central America into the Caribbean. The probabilities for above-normal temperatures are highest over the northern part of the Caribbean and much of Central America. Model-to-model consistency is high over most areas south of about 40° N. Over part of north-western North America there are increased probabilities of unusually cold conditions, and model consistency is strong here. The only other part of the region where above-normal temperatures are not predicted with highest probability is the southernmost tip of Central America, where normal temperatures are predicted immediately north of the cold oceanic area associated with the expected weak La Niña conditions.

RA V (Southwest Pacific): Strongly enhanced probabilities for above-normal temperatures are predicted in a band from north of Australia, extending to the central South Pacific, and along about 40° S from south of Australia towards the eastern Pacific to about 100° W. The Indonesian Archipelago and many of the southwest Pacific islands lie within this band of above-normal temperatures, and model-to-model consistency is strong over most of the area. There is a sharp transition to an area of predicted below-normal temperature to the northeast, which coincides with the distribution of predicted negative sea-surface temperature anomalies associated with the expected weak La Niña conditions. Model-to-model consistency in this cold area is strong. Along about 10° N and east of the dateline, probability for near-normal temperatures dominate. Over most of Australia, there is no indication for a clear signal except over small regions in the south and south-east where it is predicted to be below-normal with weak model-to-model consistency.

RA VI (Europe): The probabilities for above-normal temperatures are increased over almost all of Europe and are fairly uniform across the entire region. The model-to-model consistency is strongest in northern and north-western Europe, and over north-eastern Greenland.

2.3 Predicted precipitation, December-February 2021-2022

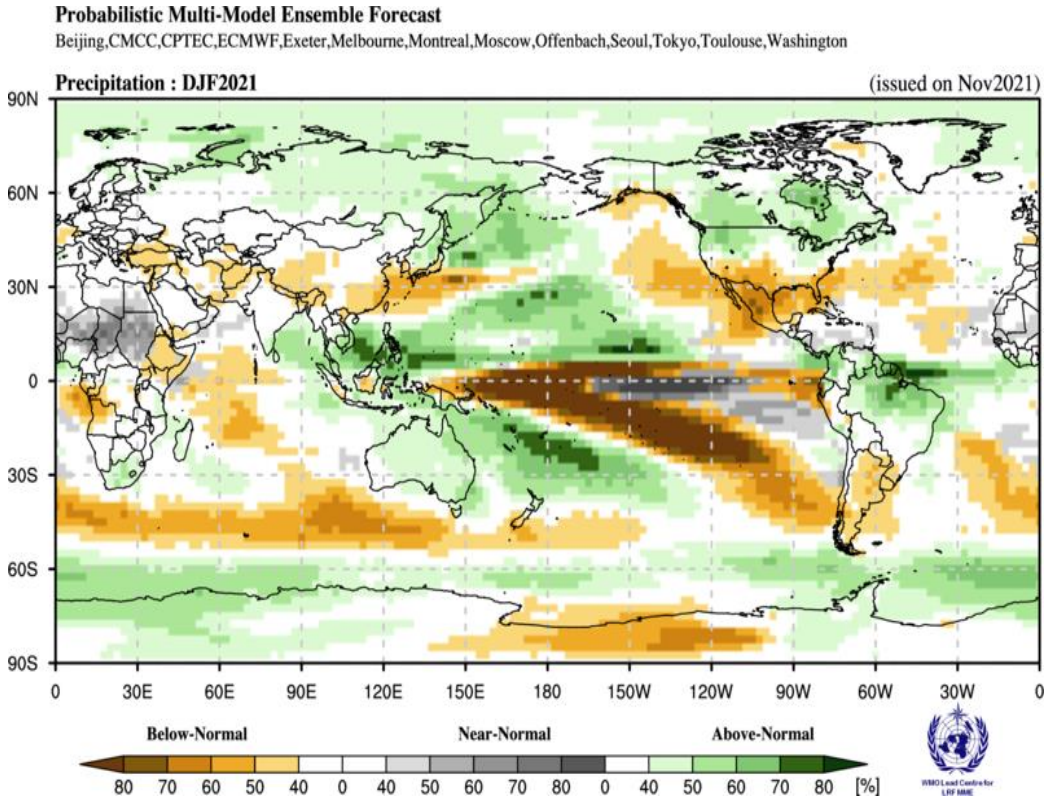


Figure 5. Probabilistic forecasts of precipitation for the season for December - February 2021-2022. The tercile category with the highest forecast probability is indicated by shaded areas. The most likely category for below-normal, above-normal and near-normal is depicted in orange, green and grey shadings 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.

Because of weak La Niña conditions that are predicted for December-February 2021-2022, some canonical rainfall impacts of La Niña are expected. There are increased chances of unusually dry conditions along the equator centred near the dateline and extending towards the southernmost part of South America; along the equator in the Pacific Ocean east of about 160° W, negative rainfall anomalies are predicted, but probabilities are highest for near-normal rainfall. Anomalously wet conditions are predicted in much of the Maritime subcontinent immediately north of the equator and extending into the south-west Pacific and north central Pacific. The areas of increased probability for unusually wet conditions extend over much of Australia, but model consistency is weak here. The only other areas of notable predicted increases in rainfall are north-eastern and the far north-western part of South America, and there are weaker indications of unusually wet conditions over part of western North America and over some parts of Southern Africa. There are moderately strong indications of below-normal rainfall across the southern part of Northern America, part of south-eastern South America, the far eastern part of Asia, north-western parts of Southern Africa, and over much of the central western Indian Ocean. Over much of the rest of Africa, Europe and Asia, there is little consistency in predicted rainfall.

RA I (Africa): Enhanced probabilities for below-normal precipitation are predicted over part of the Greater Horn of Africa north of the equator, and over the north-westernmost part of Southern Africa, extending into part of Central Africa. Model-to-model consistency is weak over most of these areas. Over much of Africa north of the equator, the forecast indicates increased probabilities for near-normal rainfall, but most of these areas are desert. There are increased probabilities for above-normal rainfall over the southern coast of West Africa, the far southern parts of the continent, and over a north-west to south-east band the southern part of the Greater Horn over Madagascar and into the southern Indian Ocean. The probabilities are only weakly enhanced, but model-to-model consistency is moderate. Over the rest of Africa, there is no clear indication for rainfall signal.

RA II (Asia): There is a weak and intermittent band of enhanced probability for below-normal rainfall extending east-southeast from south-west Asia into eastern Asia where the signal is strongest at about 30º N. Model consistency is also patchy along this band but is strong in the far eastern area. Enhanced probabilities for above-normal precipitation are indicated over northern and north-eastern Asia, broadly matching the areas of increased probability for above-normal temperatures; there is moderate consistency among models in these regions. Model consistency is greater over the Maritime continent north of the equator, where above-normal rainfall is predicted. This anomalously wet area extends into part of the Indochinese peninsula and to the far southern tip of the Indian subcontinent.

RA III (South America): Most of South America north of 15º S and east of the Andes is predicted to have above-normal rainfall (model-to-model consistency is mostly moderate to strong). South of 30º S there is a small increase in probability of below-normal rainfall, but model consistency is strong.

RA IV (North America, Central America and the Caribbean): Enhanced probabilities for below-normal precipitation are predicted for much of Central America and southern North America between about 15º and 35º N, with high model consistency. Further north, there are weaker indications of increased chances of above-normal rainfall and model consistency is moderate. There are no clear signals over the Caribbean, which lies between a zone of increased chances of above-normal rainfall to the south, and one of below-normal rainfall to the north.

RA V (Southwest Pacific): Probabilities for above-normal rainfall are enhanced over an area extending from north of the equator over the Indonesian Archipelago into the Southwest Pacific to an area northeast of New Zealand. The model consistency weakens in this band towards the equator. The band extends over most of the Australian continent, but the probabilities are only weakly enhanced here. Over the central Pacific there is an area of strongly increased probabilities for below-normal rainfall that straddles the equator. This anomalously dry area extends from about 160º E towards the southeast reaching as far as South America, but the probabilities weaken east of about 100º W. The dry area also extends eastwards to the north of equator. Model-to-model consistency is strong throughout most of this region. Along the equator across most of the Pacific Ocean east of 165º W, probabilities are highest for near-normal rainfall.

RA VI (Europe): Except over the far north-eastern portion of Europe where probabilities for above-normal precipitation are weakly enhanced and model consistency is moderate, there is no clear rainfall signal over Europe.

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

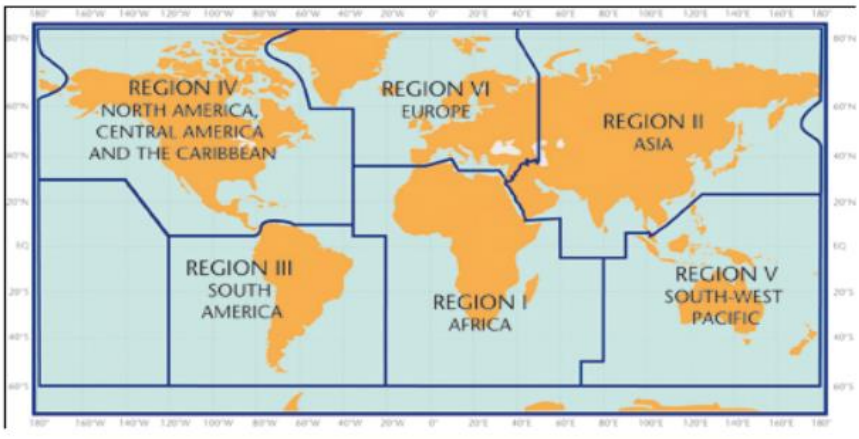
The GSCU is intended as guidance for RCCs, Regional Climate Outlook Forums (RCOFs) and National Meteorological and Hydrological Services (NMHSs). It does not constitute an official forecast for any region or nation. Seasonal outlooks for any region or nation should be obtained from the relevant RCCs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

Seasonal forecasts are probabilistic in nature. Although the text and figures used in the GSCU highlight the tercile categories that is predicted with the highest probability, it is important to recognize that the other tercile categories may also have substantial (though lower) probability.

The geographical areas occupied by the forecast signals should not be considered precise. Similarly, signals with small spatial extent may be unreliable.

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 appendices.

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): http://portal.iri.columbia.edu/portal/server.pt
- NOAA Climate Prediction Centre (CPC): http://www.cpc.ncep.noaa.gov

7. Acknowledgements

This Global Seasonal Climate Update was jointly developed by the WMO Commission for Climatology and Commission for Basic Systems with contributions from:

- WMO Lead Centre for Long-Range Forecast Multi-Model Ensemble (LC-LRFMME), Korea Meteorological Administration, NOAA National Centers for Environmental Prediction
- WMO Global Producing Centres for Long-Range Forecast (GPCs-LRF): GPC-Beijing (China Meteorological Administration), GPC-CPTEC (Center for Weather Forecast and Climate Studies, Brazil), GPC-ECMWF (European Center for Medium-Range Forecast), GPC-Exeter (UK Met Office),GPC- Melbourne (Bureau of Meteorology), GPC-Montreal (Meteorological Services of Canada), GPC-Moscow (Hydro meteorological Center of Russia), GPC-Offenbach Deutscher Wetterdienst), GPC-Pretoria (South African Weather Services), GPC-Seoul (Korea Meteorological Administration), GPC-Tokyo (Japan Meteorological Agency), GPC-Toulouse (Météo-France), GPC-Washington (National Centers for Environmental Prediction), GPC-Bologna (Centro Euro-Mediterraneo sui Cambiamenti Climatici).
- International Research Institute for Climate and Society (IRI)