WEATHER CLIMATE WATER

WORLD METEOROLOGICAL ORGANIZATION

GLOBAL SEASONAL CLIMATE UPDATE

TARGET SEASON: March-April-May 2021

Issued: 24 February 2021

Summary

Observed sea surface temperatures (SSTs) in the central tropical Pacific were in a La Niña condition during November 2020 – January 2021. The Indian Ocean Dipole (IOD) remained in a near-neutral condition and is predicted to continue being neutral. The below-normal sea-surface temperature anomalies in the Niño 3.4 and Niño 3 regions are predicted to return towards normal reaching values of approximately -0.3ºC (Niño 3.4) and -0.2 (Niño 3) during the March-May 2021 season. Farther west in the Niño 4 region, the sea surface temperature anomaly is also predicted to weaken to a value of -0.3°C. The MAM 2021 prediction, therefore, indicates a return to near-normal conditions in the central tropical Pacific.

Apart from a large area of the tropical eastern Pacific Ocean, sea-surface temperatures over most of the Pacific and Indian oceans are expected to be near or above-average for March-May 2021. Sea surface temperatures in the tropical and northern Atlantic Ocean, and northern Pacific are also expected to be normal to above-normal. The continuing impacts of the 2020/21 La Niña, and of the predicted warmer global sea-surface temperature anomalies more generally, on air temperatures over land are expected to be strongest in the maritime continent, over the southern half of North America, central America, and Caribbean, where temperatures are most likely to be above-normal. Above-normal temperatures are also likely over much of the northern high latitudes (except over north-western North America). In the Northern Hemisphere, other areas where above-normal temperatures are most likely include Arabian Peninsula, much of south Asia, southern Europe and North Africa. Below-normal temperatures are predicted for South-east Asia. In the Southern Hemisphere, north-western part of South America and southern regions of Africa below 20ºS are predicted to have normal to below-normal temperatures. Also in the Southern Hemisphere, there is more uncertainty about the expected air temperatures, although there is a higher chance that the southern and central parts of South America will be above-normal. Central Africa, and along about 15 °S, are also predicted to be above-normal. Over Australia, in general, there is no clear signal while New Zealand is expected to have above-normal temperature.

Many of the predicted rainfall anomalies for March-May 2021 represent continuation of typical (canonical) La Niña impacts. These canonical impacts include increased chances of unusually wet conditions over parts of the maritime continent, Australia, northwestern North America, and northern South America, plus unusually dry conditions over parts of the Greater Horn of Africa, subtropical latitudes of North America, and some parts of southeastern South America. Probabilities for below-normal rainfall also extend through Asia along about 30 °N. Central Africa is also predicted to be dry. There are increased probabilities of above-normal rainfall (and possibly as snow) over much of the Northern Hemisphere north of about 45 °N. There is a weak signal in rainfall over southern Africa.

Surface Air Temperature, MAM 2021 **Precipitation, MAM 2021**

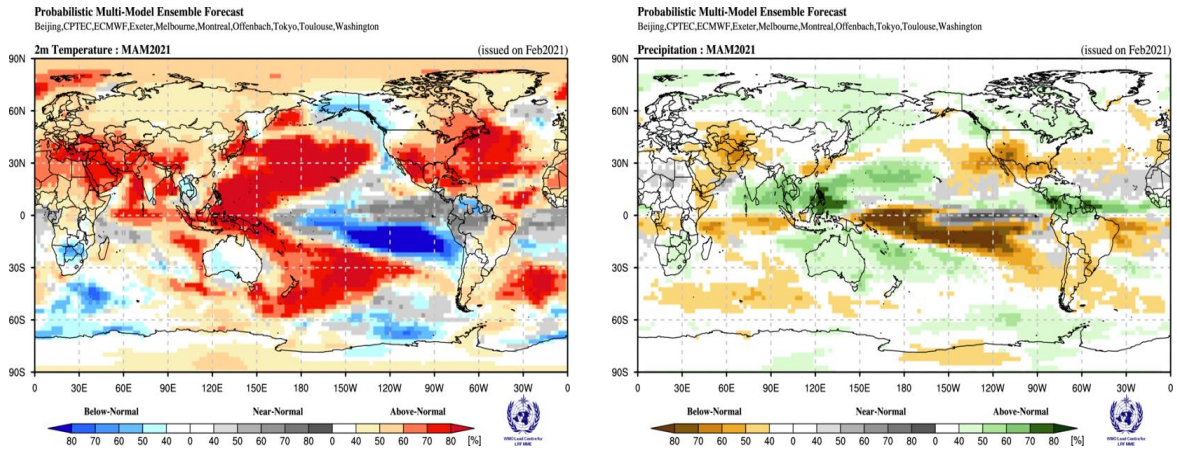


Figure 1. Probabilistic forecasts of surface air temperature and precipitation for the season MAM 2021. The tercile category with the highest forecast probability is indicated by shaded areas. The most likely category for below-normal, above-normal and near-normal is depicted in blue, red and grey shadings 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: November 2020 – January 2021

In the following sections, observed temperature and precipitation patterns for the period November 2020-January 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 November 2020 – January 2021, the four Niño sea surface temperature (SST) indices in the central and eastern Pacific were negative, with larger negative values in the central Pacific. The SST conditions generally characterized a La Niña condition in the equatorial tropical Pacific. The Indian Ocean Dipole (IOD) over the period was near zero. The North Tropical Atlantic (NTA) SST index was slightly positive, and the South Tropical Atlantic (STA) SST index was near zero. The largest SST anomalies in the equatorial oceans, therefore, were associated with the La Niña.

Month	Niño 1+2	Niño 3	Niño 4	Niño 3.4	IOD	NTA	STA
November 2020	-0.7	-1.2	-0.7	-1.3	0.2	0.2	-0.2
December 2020	-0.7	-0.8	-0.8	-1	0.3	0.4	-0.4
January 2021	-0.8	-0.7	-1.2	-1	0.3	0.7	-0.1
November 2020 – January 2021	-0.7	-0.9	-0.9	-1.1	0.3	0.4	-0.2

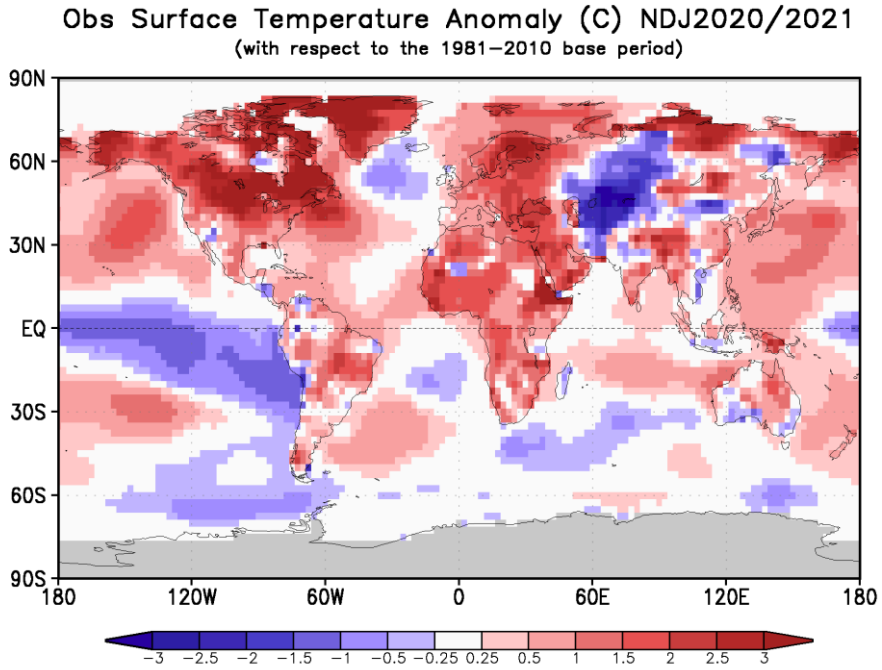
Table 1. Large-scale oceanic indices (°C). Anomalies are with respect to the 1981–2010 average. (*Source:* U.S. Climate Prediction Center)

1.2 Observed temperature

Over land, temperature anomalies across the globe continued their trend of warmer-than-normal conditions for the season of November 2020 – January 2021 (Figure 2, top), and in general, above-normal temperatures dominated the global land areas. The most strongly positive land temperature anomalies occurred over western Africa, northern Europe, Arabian Peninsula, parts of North Asia and the northern regions of North America. Positive temperature anomalies also occurred over much of central and South America, Indian subcontinent and eastern Asia, New Zealand and parts of Australia. Exceptions to positive land anomalies were negative temperature anomalies over central Asia and in some regions in southern Australia.

Over the oceans, the eastern equatorial Pacific and southwest Indian Ocean (off the southeast coast of southern Africa) had cooler-than-normal temperatures. In the extratropical southern oceans near-to-below average temperatures generally prevailed. SSTs in the equatorial central Pacific indicated a La Niña condition, with positive anomalies in the western equatorial Pacific and negative anomalies in central and eastern Pacific; a pattern that indicates enhanced zonal SST gradients across the equatorial Pacific. SST anomalies throughout the extratropical North Pacific and equatorial Atlantic Ocean 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 southeast and northern Europe, western and central Africa and along 10-15ºS in South America. No significant extreme cold temperature was found over land areas. Some oceanic regions also had warm extremes, notably sub-tropical northwest Pacific, extratropical northeast Pacific and north-western Atlantic off the coast of North America.



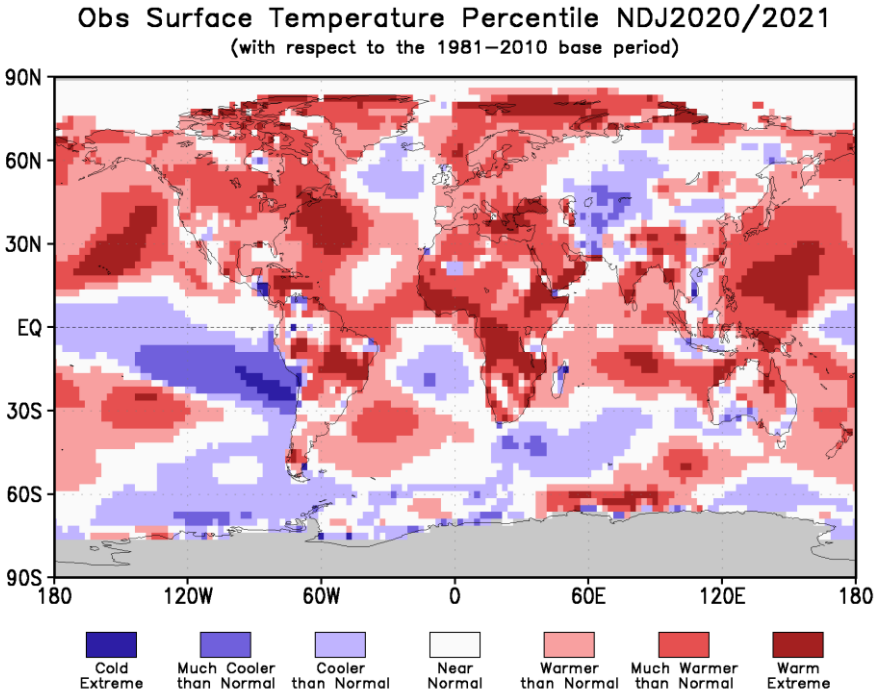
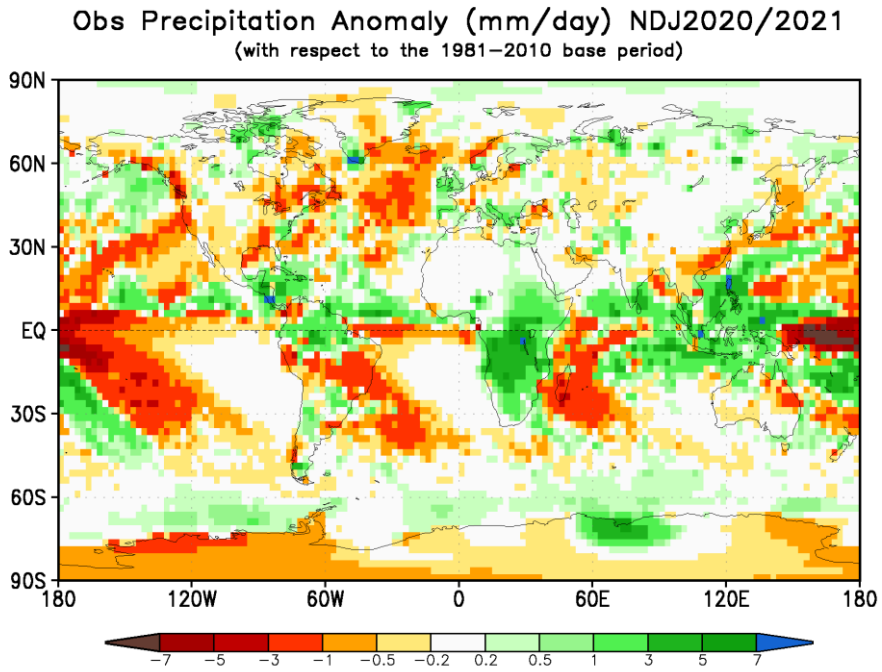


Figure 2. Observed November 2020 – January 2021 near-surface temperature anomalies relative to 1981–2010 (top). The *Cooler than Normal*, *Near Normal*, *and Warmer than Normal* shadings on the percentile map (bottom) indicate that seasonal mean anomalies were in the bottom, middle, and upper tercile 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).



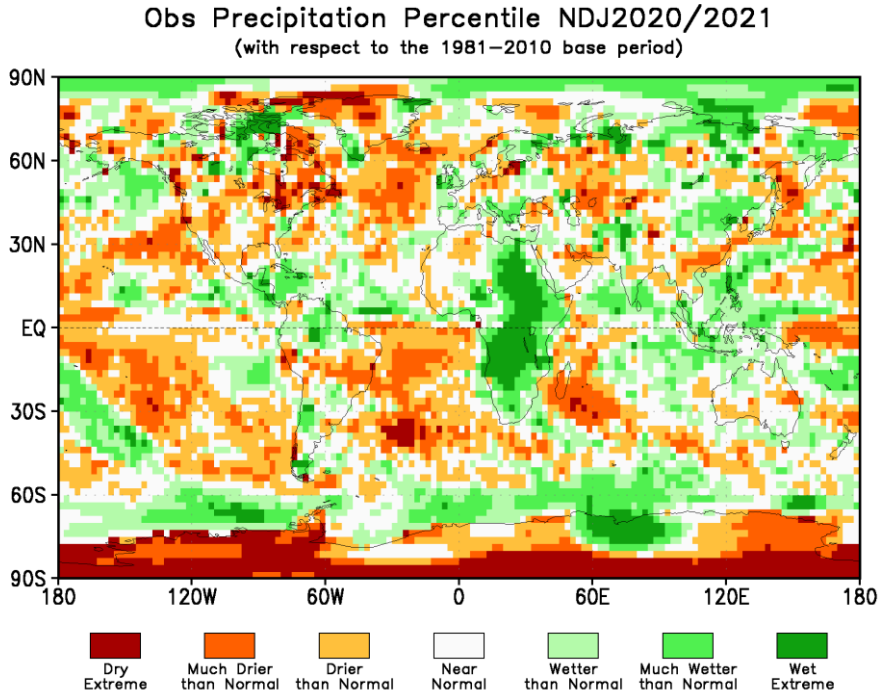


Figure 3. Observed precipitation anomalies for November 2020 – January 2021, relative to 1981–2010 base period (top). The *Drier than Normal, Near Normal and Wetter than Normal* shadings on the percentile map (bottom) indicate that seasonal mean anomalies were in the bottom, middle, and upper tercile 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).

1.3 Observed precipitation

For November 2020 – January 2021, the largest negative precipitation anomalies were in the equatorial Pacific near the date line extending into the western Pacific with a narrower band extending into the eastern Pacific, a band extending into the southern Pacific towards South America and another band extending in the northern Pacific towards the west coast of North America. West of the negative anomalies in the equatorial western Pacific, positive precipitation anomalies stretched from the Indonesian Archipelago into the Bay of Bengal, Indian subcontinent and north and west of the Korean Peninsula. Positive precipitation anomalies were also observed in the southern regions of Africa below the equator, equatorial South America, southern regions of central America and Caribbean. The spatial structure of precipitation anomalies extending from the eastern Indian to equatorial Pacific was consistent with the La Niña conditions.

Below-normal precipitation anomalies generally dominated eastern parts of North America. A band of negative precipitation anomalies extended from the eastern coastal region of South America into the southern Atlantic Ocean. Off the eastern coastal regions of southern Africa, negative precipitation anomalies occurred in the southwestern Indian ocean.

No large-scale systematic regions with dry or wet extremes (precipitation below or above all seasonal totals observed during 1981-2010) over land occurred, with the exception of a north-south band of wet extreme around equatorial Africa. An extreme dry region was observed in the far northeast region of North America.

2. Potential evolution of the state of the climate over the next three months (March-May 2021)

2.1 Large-scale SST-based indices, March-May 2021

Month	Nino 1+2	Nino 3	Nino 4	Nino3.4	IOD	NTA	STA
March 2021	-0.4±0.2	-0.3±0.1	-0.5±0.2	-0.5±0.2	0.0±0.2	0.3±0.1	-0.1±0.1
April 2021	-0.4±0.3	-0.3±0.2	-0.3±0.2	-0.3±0.2	0.1±0.1	0.3±0.1	-0.0±0.1
May 2021	-0.1±0.4	-0.0±0.4	-0.2±0.3	-0.2±0.3	-0.2±0.2	0.3±0.1	0.00±0.1
March-April-May 2021	-0.3±0.3	-0.2±0.3	-0.3±0.3	-0.3±0.3	-0.0±0.2	0.3±0.1	-0.0±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 models 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 La Niña conditions during November 2020 – January 2021. The below-normal sea-surface temperature anomalies in the Niño 3.4 and Niño 3 regions are predicted to return towards normal reaching values of approximately -0.3ºC (Niño 3.4) and -0.2 (Niño 3) during the March-May 2021 season. Farther west in the Niño 4 region, the sea surface temperature anomaly is also predicted to weaken to a value of -0.3°C. The MAM 2021 prediction, therefore, indicates a return to near-normal conditions in the central tropical Pacific. The IOD is predicted to be close to zero when averaged over the three months MAM 2021. In the equatorial Atlantic, SSTs are predicted to be slightly above average in the north (NTA) and near zero in the southern (STA) areas during the season.

2.2 Predicted temperature, March-May 2021

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]).

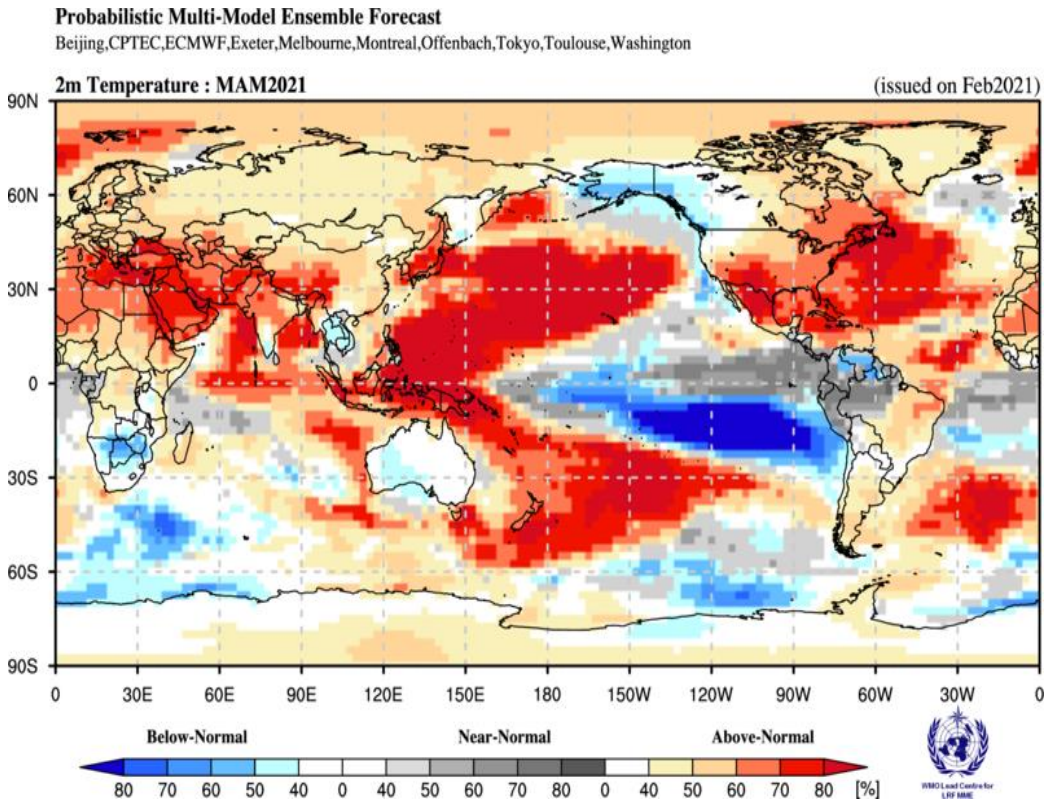


Figure 4. Probabilistic forecasts of surface air temperature for March-May 2021. The tercile category with the highest forecast probability is indicated by shaded areas. The most likely category for below-normal, above-normal and near-normal is depicted in blue, red and grey shadings respectively. White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

The continuing impacts of the 2020/21 La Niña, and of the predicted warmer global sea-surface temperature anomalies more generally, on air temperatures over land are expected to be strongest in the maritime continent, over the southern half of North America, central America, and Caribbean, where temperatures are most likely to be above-normal. Above-normal temperatures are also likely over much of the northern high latitudes (except over north-western North America). In the Northern Hemisphere, other areas where above-normal temperatures are most likely include Arabian Peninsula, much of south Asia, southern Europe and North Africa. Below-normal temperatures are predicted for South-east Asia. In the Southern Hemisphere, north-western part of South America and southern regions of Africa below 20°S are predicted to have normal to below-normal temperatures. Also in the Southern Hemisphere, there is more uncertainty about the expected air temperatures, although there is a higher chance that the southern and central parts of South America will be above-normal. Central Africa is also predicted to be above-normal. Over Australia, in general, there is no clear signal while New Zealand is expected to have above-normal temperature.

[1] File with supplementary information can be downloaded from https://ftp.cpc.ncep.noaa.gov/mingyue/GSCUWMO/Forecasts/GSCU_MAM2021_supplementary_info_LC-LRFMME.docx

RA I (Africa): Enhanced probabilities of above-normal temperature are indicated over most of North Africa, extending along the coastal areas of West Africa, and into Central Africa. Above-normal temperatures are also predicted for much of the Greater Horn north of the equator, for Southern Africa north of 20 ºS and over Madagascar. Most of these regions show moderate to high levels of model-to-model consistency. The regions with strongest probability for above-normal temperature are over Northern Africa. A small area along the west coast of Southern Africa is predicted to have increased probability of normal temperature. Temperatures in southern Africa below 20ºS are predicted to have normal to below-normal and the model consistency is moderate to low, In general, expected conditions north of 20ºS are a continuation of warm temperatures observed in November 2020 – January 2021.

RA II (Asia): Strongly enhanced probabilities for above-normal temperature are indicated over Arabian Peninsula, central Asia and much of the eastern part of south Asia. Model-to-model consistency for most of these regions is also high. There are weak probabilities of above-normal temperature over much of the rest of Asia, except over southeastern Asia. In these locations, there is weak to moderate model consistency.

RA III (South America): Weakly enhanced probabilities for below-normal temperature are indicated over the far northern part of South America. Over much of the rest of the northwestern third of the continent, temperatures are predicted to be normal. However, the level of model consistency for the inland areas is not high. Much of the rest of the continent is predicted to experience above-normal temperatures, although model consistency is mostly weak to moderate. In general, prediction of above-normal temperature is a continuation of warmer temperatures observed in November 2020 – January 2021.

RA IV (North America, Central America and the Caribbean): Enhanced probabilities for above-normal temperature are indicated over much of North America south of about 50 ºN. Temperatures are also predicted to be above-normal in central America and Caribbean. The strongest tilts in the odds for above-average temperatures are located at around 30ºN in the southwestern region of North America extending into the northern regions of central America. Strong odds for above-normal temperature are also in southeastern North America extending into the Caribbean. Over all these areas model-to-model consistency is strong. Increased chances for above-normal temperature are also indicated for much of the northeastern part of North America, but the probabilities and level of model-to-model consistency are weaker than for areas further south. Predictions for the northwestern part of the continent indicate weakly enhanced probabilities for below-normal temperature. Model-to-model consistency is moderate-to-strong for this area.

RA V (Southwest Pacific): Strongly enhanced probabilities for above-normal temperature are predicted in a band from north of Australia, extending to New Zealand, and along about 30 ºS towards the eastern Pacific. 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 closely represents the distribution of predicted negative sea-surface temperature anomalies. Model-to-model consistency in this cold area is very strong. The predictions over the ocean areas broadly represent a continuation of warm observed anomalies for November 2020 – January 2021. Over Australia, there is no consistency in the temperature predictions. A tilt of odds towards below-normal temperature is predicted over part of the southwestern Australia, with weak to moderate model consistency.

RA VI (Europe): The probabilities for above-normal temperature are increased over virtually all of Europe. The increased probabilities are strongest towards southern Europe where model-to-model consistency is also very strong. There is also very strong model-to-model consistency over the Mediterranean, and throughout mainland Europe consistency is strong. Over the far northwestern parts of Europe, including Greenland, there are increased probabilities of above-normal temperature, but model-to-model consistency is mostly weak to moderate.

2.3 Predicted precipitation, March-May 2021

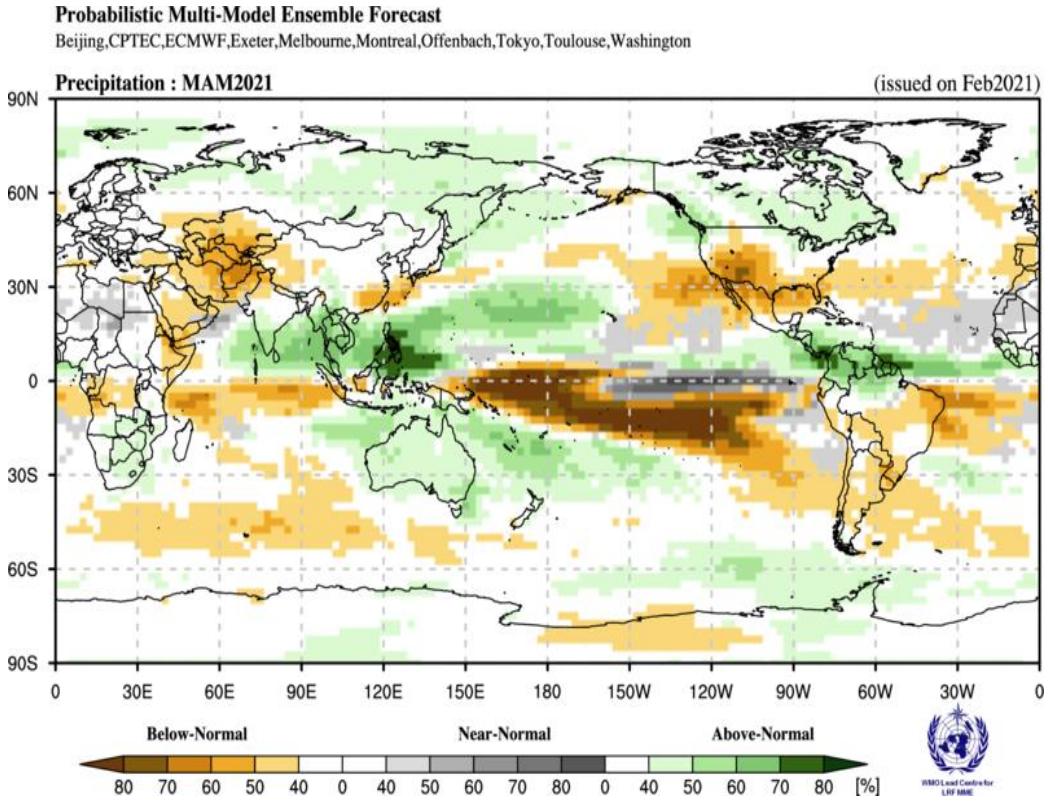


Figure 5. Probabilistic forecasts of precipitation for the season for MAM 2021. The tercile category with the highest forecast probability is indicated by shaded areas. The most likely category for below-normal, above-normal and near-normal is depicted in orange, green and grey shadings respectively.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

Many of the predicted rainfall anomalies for March-May 2021 represent continuation of typical (canonical) La Niña impacts. These canonical impacts include increased chances of unusually wet conditions over parts of the maritime continent, Australia, northwestern North America, and northern South America, plus unusually dry conditions over parts of the Greater Horn of Africa, subtropical latitudes of North America, and some parts of southeastern and eastern South America. Probabilities for below-normal rainfall also extend through Asia along about 30 °N. Central Africa is also predicted to be dry. There are increased probabilities of above-normal rainfall (and possibly as snow) over much of the Northern Hemisphere north of about 45 °N. There is a weak signal in rainfall over southern Africa.

RA I (Africa): Enhanced probabilities for below-normal precipitation are predicted over eastern part of the Greater Horn north of the equator, and Central Africa below the equator. Model-to-model consistency is strongest in the Greater Horn. Over much of the rest of Africa north of the equator, the forecast indicates increased probabilities for normal rainfall, but most of these areas are desert and/or experiencing their dry season. The far southern part of the continent is indicated to have weakly increased chances of above-normal rainfall, but the model-to-model consistency for this signal is moderate.

RA II (Asia): There is a large area of enhanced probability for below-normal precipitation over much of Arabian Peninsula and central Asia. This predicted dry band extends eastwards, with some breaks, along about 30 ºN immediately north of South Asia, and extending along the continent's east coast. The model-to-model consistency is particularly strong in the southwest of the continent, and off the east coast. In the far southeast, and at the southern tip of the Indian subcontinent, there are increased probabilities of above-normal rainfall, and model-to-model consistency is strong. All along the Arctic coast and other regions of north Asia probabilities for above-normal precipitation (possibly as snow) are indicated. Model-to-model consistency is strong, both for precipitation and temperature, indicating a relatively warm and wet spring. Most of the large remaining areas of the continent, including those between about 45 and 60 ºN, shows no discernible forecast signal.

RA III (South America): Most of South America along and north of the equator are predicted to have above-normal rainfall (model-to-model consistency is mostly strong). In the far northeastern coastal parts of South America rainfall is predicted to be below-normal and model consistency is strong. Over the rest of South America there is a weak tilt towards below-normal rainfall and model-to-model consistency is low. The forecast in the northern area represents a continuation of above-normal observed there in November 2020 – January 2021.

RA IV (North America, Central America and the Caribbean): An enhanced probability for below-normal precipitation is predicted for the south-central regions of North America, with moderate model consistency. With indications for above-normal precipitation, the forecasts for northern parts of North America represent a contrast to the below-average rainfall observed during November 2020 – January 2021. In the southernmost part of North America, there is an increased chance of below-normal rainfall and the model consistency is strong. Further south over central America there are enhanced probabilities of above-normal precipitation, specifically in the southernmost parts. In each area, the model-to-model consistency is moderate to strong.

RA V (Southwest Pacific): Probabilities for above-normal rainfall are strongly enhanced over the off-shore islands of southeast Asia and in the Southwest Pacific in an area north of New Zealand. The model consistency is very strong in both areas. The southern parts of the maritime subcontinent and Australia are also predicted to have above-normal rainfall, but probabilities of wet and the model-to-model consistency are weaker. In a narrow band along the equator in the eastern parts of the maritime continent the rainfall signal is unclear, but east of about 130 ºE the equatorial zone is expected to be unusually dry. This dry area expands towards the southeast, but there is a small area corresponding approximately with the Niño 3 region where normal rainfall has the highest probability. In the western region of the Indonesian Archipelago there is a weak tilt towards below-normal rainfall. South of about 40 ºS there is another band of increased probabilities for below-normal rainfall extending from the Indian Ocean to just near the dateline.

RA VI (Europe): Over Europe there is not much of a consistent signal in the predicted precipitation. North of about 60 ºN (except in the northwestern part of Europe) the probabilities for above-normal precipitation (possibly as snow) are weakly enhanced.

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:
https://www.wmolc.org/modules/data/plot/autograds4/download_PMME.php?filename=wmo/WMOLC_T2M.gif

https://www.wmolc.org/modules/data/plot/autograds4/download_PMME.php?filename=wmo/WMOLC_PREC.gif

4. How to use the Global Seasonal Climate Update

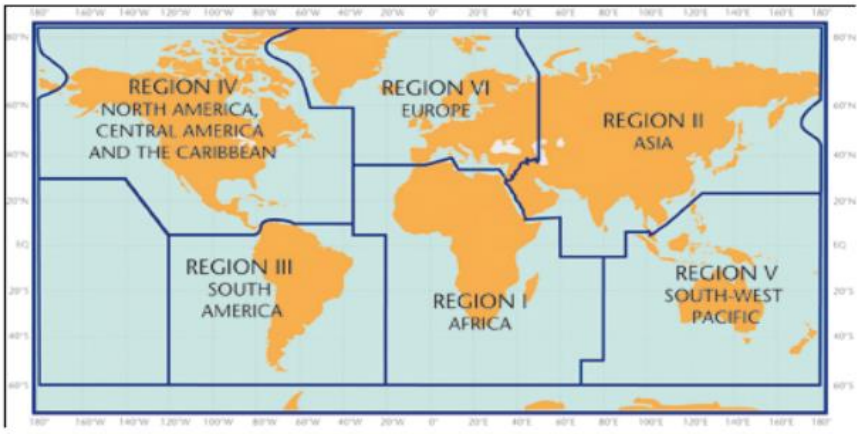
The GSCU is intended as guidance for RCCs, Regional Climate Outlook Forums (RCOFs) and National Meteorological and Hydrological Services (NMHSs). It does not constitute an official forecast for any region or nation. Seasonal outlooks for any region or nation should be obtained from the relevant RCCs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

- RA I: http://www.wmo.int/pages/prog/wcp/wcasp/RCC-Africa.html
- RA II: http://www.wmo.int/pages/prog/wcp/wcasp/RCC-Asia.html
- RA III: http://www.wmo.int/pages/prog/wcp/wcasp/RCC-SouthAmerica.html
- RA IV: http://www.wmo.int/pages/prog/wcp/wcasp/RCC-NorthAmerica.html
- RA V: http://www.wmo.int/pages/prog/wcp/wcasp/RCC-SouthwestPacific.html
- RA VI: http://www.wmo.int/pages/prog/wcp/wcasp/RCC-Europe.html

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): http://www.wmo.int/pages/prog/wcp/wcasp/clips/producers_forecasts.html
- WMO GSCU portal http://www.wmo.int/pages/prog/wcp/wcasp/LC-LRFMME/index.php
- WMO portal for Regional Climate Outlook Forums (RCOFs): 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 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)
- International Research Institute for Climate and Society (IRI)