WEATHER CLIMATE WATER

WORLD METEOROLOGICAL ORGANIZATION

GLOBAL SEASONAL CLIMATE UPDATE

TARGET SEASON: March-April-May 2022

Issued: 24 February 2022

Summary

During November-January 2021/22, the four Pacific Niño sea-surface temperature (SST) indices in the central and eastern Pacific were below-normal. The observed SST conditions in the equatorial Pacific were characterized by a weak La Niña state. The Indian Ocean Dipole (IOD) over the observed period was weakly negative. The North Tropical Atlantic (NTA) SST index was near-zero, and the South Tropical Atlantic (STA) SST index was positive.

For the March-May 2022 season, below-normal sea-surface temperature anomalies in the Niño 3.4 and Niño 3 regions with values of approximately -0.5° C (Niño 3.4) and -0.5° C (Niño 3) are predicted indicating a return to near-normal conditions.

Although near-normal ENSO conditions are predicted to return in the equatorial central and eastern Pacific, the widespread warmer-than-average sea surface temperatures elsewhere are predicted to dominate the forecast of air temperatures for March-May 2022. Positive temperature anomalies are expected over most of the land areas in the Northern Hemisphere, with the exceptions being north-western North America, southern Greenland, the Indian subcontinent, and southeast Asia. The largest land air-temperature anomalies are expected over the far northern and north-eastern parts of Asia and the Arctic, southern parts of North America, central America, Caribbean, and in the western and northern Europe where the models are consistent in predicting likelihood for anomalously warm March-May 2022. The models are most consistent in their predictions of higher probabilities for warm conditions over the northern and eastern parts of Asia, and in southern parts of North America including much of the Caribbean. Consistency for likelihood for above-normal temperature is also high over much of Europe. Models are consistent in predicting higher probabilities for below-normal temperatures over the coastal Pacific areas of north-western North America. In near-equatorial latitudes and the Southern Hemisphere, likelihood for positive temperature anomalies is 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. Near-normal or below-normal temperatures are predicted for most of South America north of about 30° S. Other areas with high consistency in the likelihood of predictions of below-normal temperatures are the central and eastern tropical Pacific, reflecting the presence of below-average SST conditions, and south-eastern Pacific. There is weaker consistency in the likelihood of predicting below-normal temperatures over much of Australia, and southern Africa. Over north-western South America temperature is predicted to be near-normal, however, model consistency is low.

Because of below-average SST conditions associated with declining La Niña that are predicted for March-May 2022, together with an enhanced east-west SST gradient, some of the predicted rainfall patterns are similar to canonical rainfall impacts of La Niña. There are increased chances of unusually dry conditions along the equator centred near the dateline and extending towards the southernmost part of South America. 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. The other areas of notable predicted increases in rainfall are north-eastern and the far north-western part of South America, northern Asia, southern regions of the Indian subcontinent and southeast Asia. There are weaker indications of unusually wet conditions over part of north-western North America and over some parts of southern Africa. There are moderately strong indications of below-normal rainfall across the southern part of North America, part of South America south of 20° S, the western and the far eastern regions of Asia, eastern parts of Central Africa, western and southern Europe, and the central western Indian Ocean. Over much of the rest of Africa, there is little consistency in predicted rainfall.

Surface Air Temperature, MAM 2022 **Precipitation, MAM 2022**

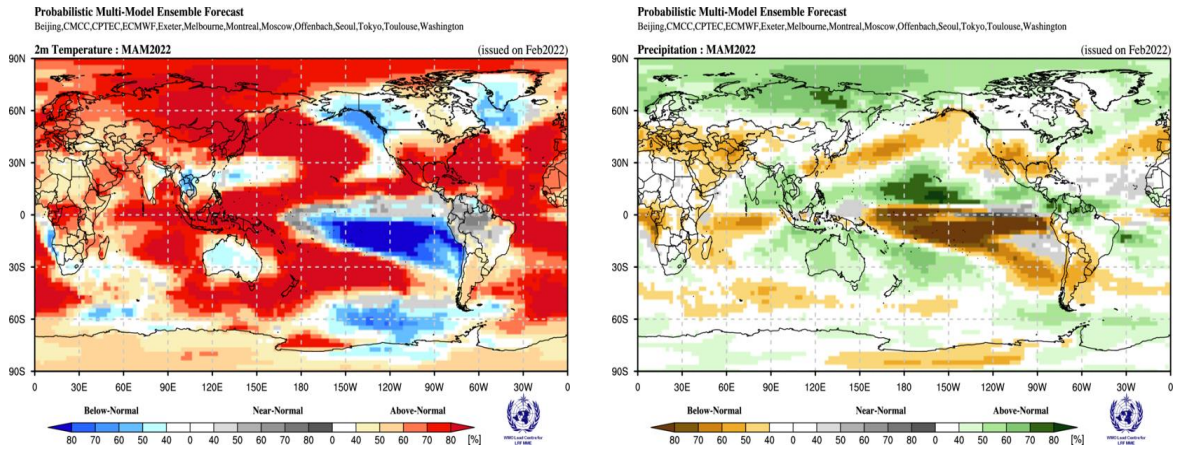


Figure 1. Probabilistic forecasts of surface air temperature and precipitation for the season March-April 2022. The tercile category with the highest forecast probability is indicated by shaded areas. The most likely category for below-normal, above-normal and near-normal is depicted in blue, red and 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: November–January 2021/22

In the following sections, observed temperature and precipitation patterns for the period November-January 2021/22 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-January 2021/22, the four Pacific Niño sea-surface temperature (SST) indices in the central and eastern Pacific were below-normal. The observed SST conditions in the equatorial Pacific were characterized by a weak La Niña state. The Indian Ocean Dipole (IOD) over the observed period was weakly negative. The North Tropical Atlantic (NTA) SST index was near-zero, and the South Tropical Atlantic (STA) SST index was positive.

Month	Niño 1+2	Niño 3	Niño 4	Niño 3.4	IOD	NTA	STA
November 2021	-1.0	-0.7	-0.6	-0.8	-0.4	0.1	1.0
December 2021	-1.5	-1.2	-0.9	-1.1	-0.2	0.1	0.0
January 2022	-1.2	-1.4	-0.4	-0.9	-0.3	0.2	0.3
November-January 2021/22	-1.2	-1.1	-0.6	-0.9	-0.3	0.1	0.4

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 November-January 2021/22 (Figure 2, top), and in general, above-normal temperatures dominated the global land areas. The most strongly positive land-temperature anomalies occurred over Eastern Europe, western, central and Northern Asia, New Zealand, Central and Southern regions of North America, and regions straddling equatorial Africa. Positive temperature anomalies also occurred over southeast Asia, the Indonesian Archipelago, Central America, and the Caribbean, and over much of South America. November-January 2021/22 also had some regions with below-normal temperature anomalies including northwest North America, the southernmost region of Africa, and parts of Australia.

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 a weak La Niña, with positive anomalies in the western equatorial Pacific and 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 positive ocean-temperature anomaly was in the northwest 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 New Zealand, the Caribbean, and central and extreme western Africa. Some oceanic regions also had warm extremes, notably the extratropical Pacific around 40° N, western regions of southern Pacific along 30° S, and northwest Atlantic. No widespread extreme cold temperature was found over land areas.

1.2 Observed precipitation

For November-January 2021/22, 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, northeast Pacific, western and northeast Atlantic. Positive precipitation anomalies occurred in the oceanic regions in the vicinity of the Indonesian Archipelago.

Over land, negative precipitation anomalies were observed in south-eastern and eastern North America, western Europe, and in South America both in the northwest and along about 30 S. Positive precipitation anomalies occurred over much of Africa south of 15°N, the Indian subcontinent, the Indonesian Archipelago, southeast Australia, and eastern regions of South America between the equator and 20° S. Over much of Asia no large-scale systematic departures in precipitation anomalies of either sign were observed.

Except over a small region in western and central Africa which was extremely wet, no large-scale systematic regions with dry or wet extremes (precipitation below or above all seasonal totals observed during 1981-2010) over land occurred.

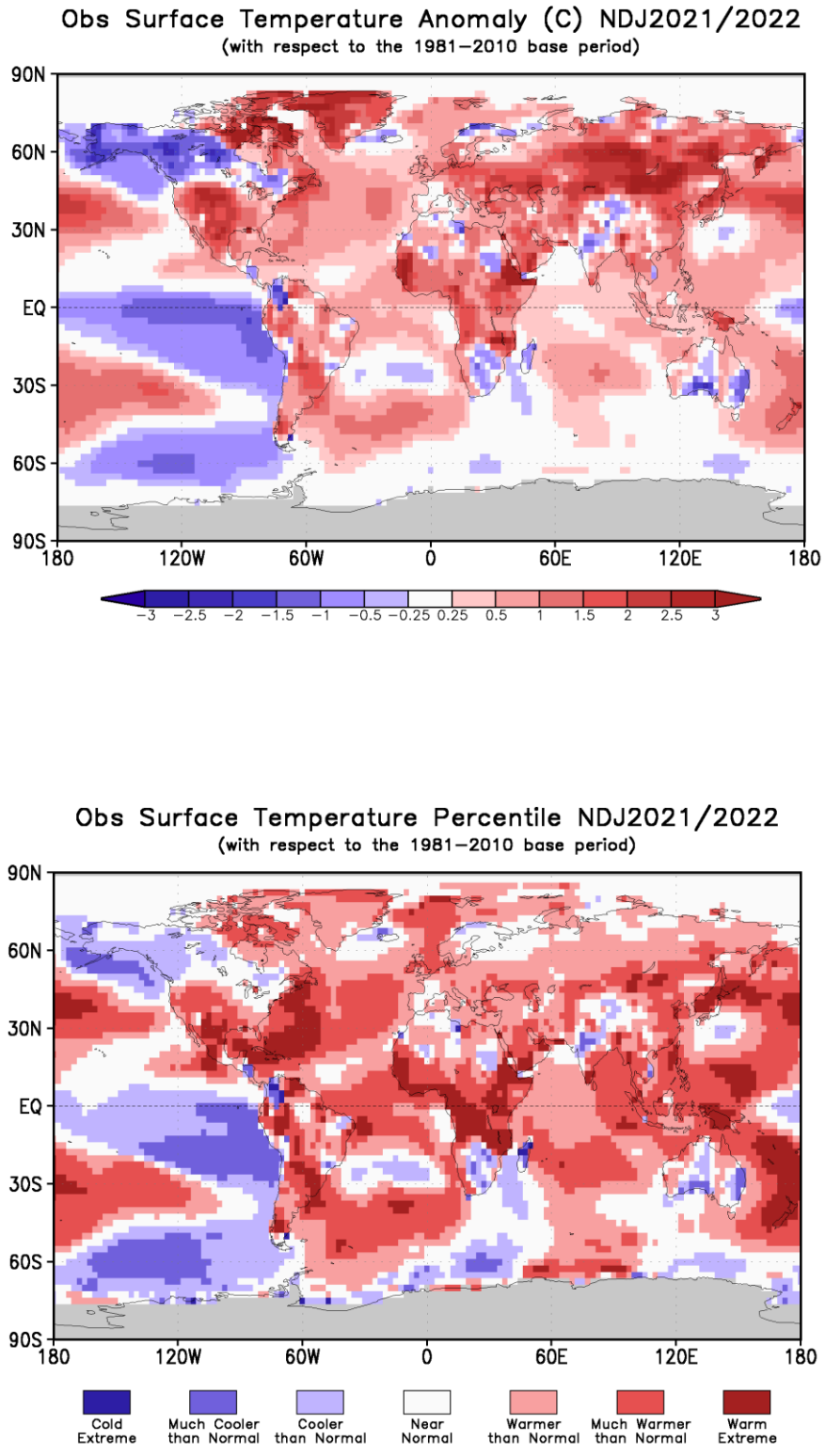
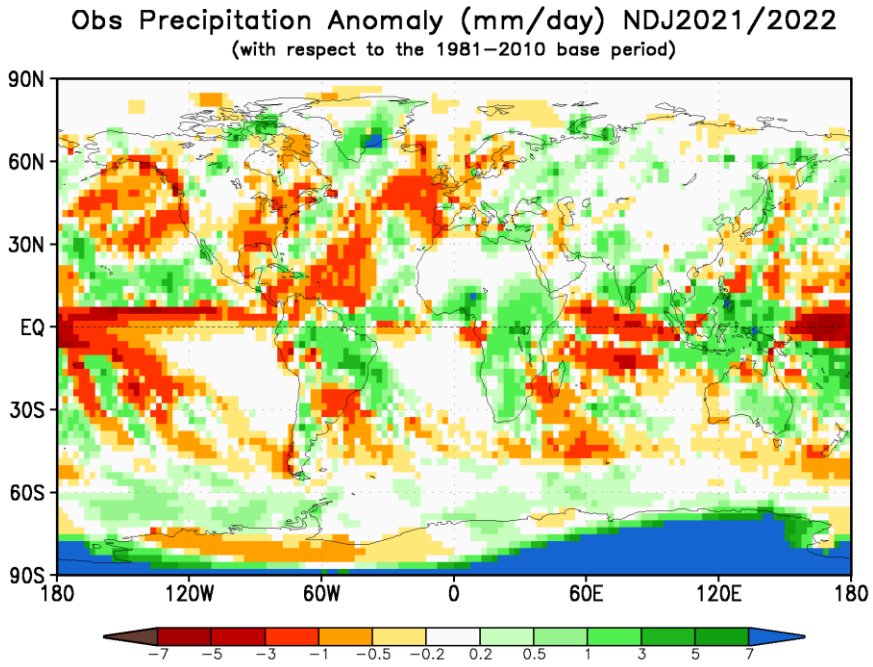


Figure 2. Observed November-January 2021/22 near-surface temperature anomalies relative to 1981–2010 (top). The *Cooler than Normal, Near Normal, and Warmer than Normal* shadings on the percentile map (bottom) indicate that seasonal mean anomalies were in the bottom, middle, and upper tercile of the 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).



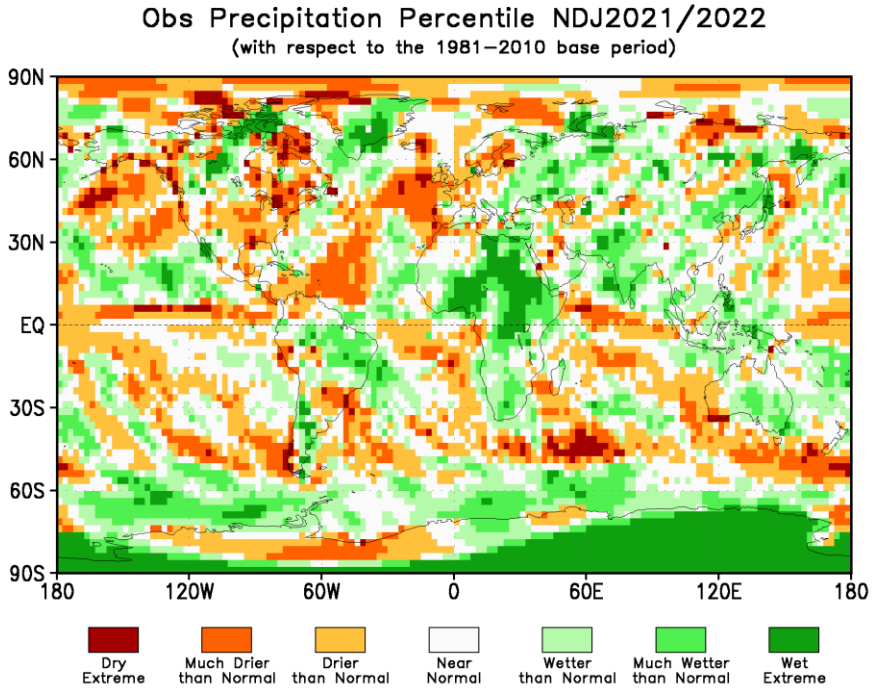


Figure 3. Observed precipitation anomalies for November-January 2021/22, relative to 1981–2010 base period (top). The *Drier than Normal*, *Near Normal and Wetter than Normal* shadings on the percentile map (bottom) indicate that seasonal mean anomalies were in the bottom, middle, and upper tercile of 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 (March–May 2022)

2.1 Large-scale SST-based indices, March–May 2022

Month	Nino 1+2	Nino 3	Nino 4	Nino3.4	IOD	NTA	STA
March 2022	-0.9±0.3	-0.6±0.2	-0.3±0.2	-0.6±0.2	-0.0±0.1	0.5±0.1	-0.2±0.1
Apil 2022	-0.4±0.5	-0.4±0.3	-0.2±0.2	-0.5±0.3	0.0±0.1	0.5±0.1	-0.1±0.1
May 2022	-0.3±0.6	-0.2±0.5	-0.2±0.3	-0.3±0.4	-0.2±0.1	0.4±0.1	-0.0±0.1
March-May 2022	-0.5±0.5	-0.4±0.4	-0.2±0.2	-0.5±0.3	-0.1±0.1	0.5±0.1	-0.1±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 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.

Observed sea-surface temperatures in the central tropical Pacific were in a weak La Niña condition during November-January 2021/22. Below-normal sea-surface temperature anomalies in the Niño 3.4 and Niño 3 regions with values of approximately -0.5° C (Niño 3.4) and -0.5° C (Niño 3) are predicted during the March-May 2022 season indicating a return to near-normal conditions. Farther west in the Niño 4 region, the sea-surface temperature anomaly is also predicted to decline to near-normal, with a value of about -0.2° C. The MAM 2022 prediction, therefore, indicates a return to near-normal ENSO conditions in the central tropical Pacific. The IOD is predicted to be near-normal over MAM 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, March–May 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_MAM2022_supplementary_info_LC-LRFMME.docx

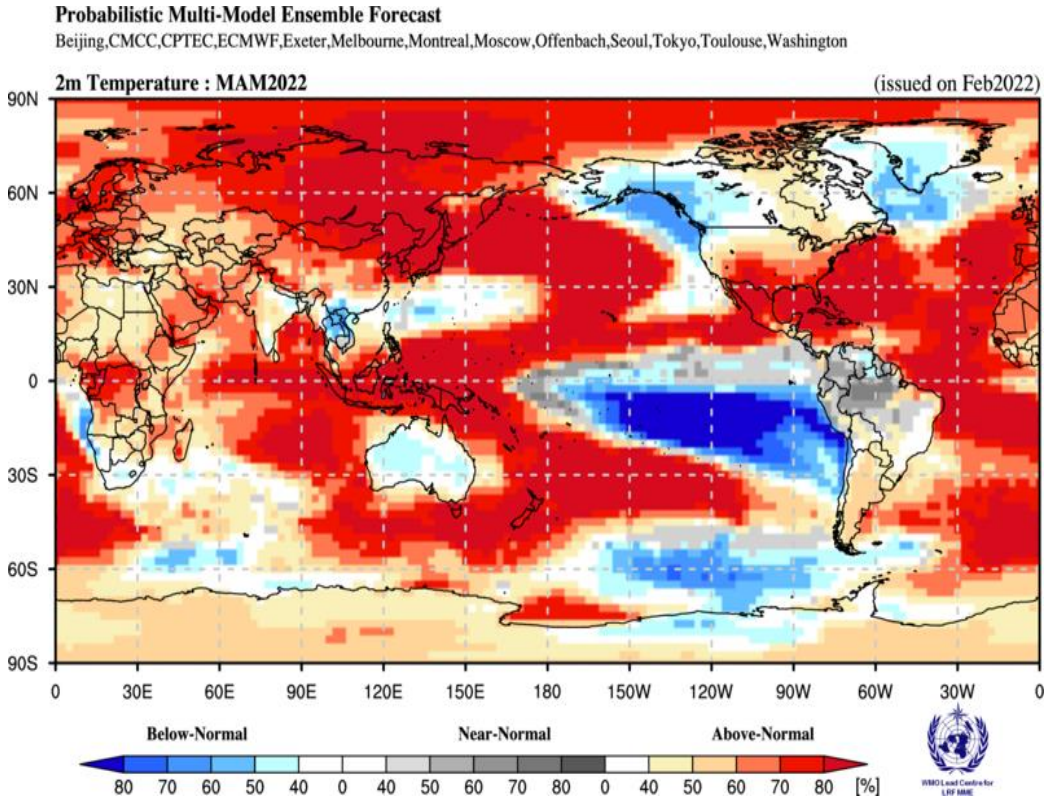


Figure 4. Probabilistic forecasts of surface air temperature for March – May 2022. The tercile category with the highest forecast probability is indicated by shaded areas. The most likely category for below-normal, above-normal and near-normal is depicted in blue, red and grey shadings respectively. 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 near-normal ENSO conditions are predicted to return in the equatorial central and eastern Pacific, the widespread warmer-than-average sea surface temperatures elsewhere are predicted to dominate the forecast of air temperatures for March-May 2022. Positive temperature anomalies are expected over most of the land areas in the Northern Hemisphere, with the exceptions being north-western North America, southern Greenland, the Indian subcontinent, and southeast Asia. The largest land air-temperature anomalies are expected over the far northern and north-eastern parts of Asia and the Arctic, southern parts of North America, central America, Caribbean, and in the western and northern Europe where the models are consistent in predicting likelihood for anomalously warm March-May 2022. The models are most consistent in their predictions of higher probabilities for warm conditions over the northern and eastern parts of Asia, and in southern parts of North America including much of the Caribbean. Consistency for likelihood for above-normal temperature is also high over much of Europe. Models are consistent in predicting higher probabilities for below-normal temperatures over the coastal Pacific areas of north-western North America. In near-equatorial latitudes and the Southern Hemisphere, likelihood for positive temperature anomalies is 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. Near-normal or below-normal temperatures are predicted for most of South America north of about 30° S. Other areas with high consistency in the likelihood of predictions of below-normal temperatures are the central and eastern tropical Pacific, reflecting the presence of below-average SST conditions, and south-eastern Pacific. There is weaker consistency in the likelihood of predicting below-normal temperatures over much of Australia, and southern Africa. Over north-western South America temperature is predicted to be near-normal, however, model consistency is low.

RA I (Africa): Enhanced probabilities of above-normal temperatures are indicated over almost the entire mainland of Africa north of about 30° S, and over Madagascar. Model consistency is moderate to low over these areas. Probabilities are strongest in near-equatorial regions expanding over western regions of Central Africa, and over northwest Africa. In southern Africa, 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 parts of southeast Asia, where the forecast is for below-normal temperatures, however, the model consistency is low. The probabilities for above-normal temperatures are highest over the north and north-eastern regions of east Asia and over the Maritime continent. The model-to-model consistency for above-normal temperature is high over most of the continent, and most notably over much of the eastern and northern regions, the Maritime continent, as well as in the south-west over the Arabian Peninsula.

RA III (South America): Weak enhanced probabilities for above-normal temperatures are indicated over South America south of about 20° S, model-to-model consistency, however, is low. 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 below-average SSTs.

RA IV (North America, Central America, and the Caribbean): There are enhanced probabilities for above-normal temperatures over the southern half of North America and across Central America into the Caribbean. The probabilities for above-normal temperatures are highest over the Caribbean and much of northern 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 cold conditions, and model consistency is moderate here. The only other part of the region where above-normal temperatures is 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 decaying 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 prediction for declining La Niña conditions. Model-to-model consistency in this cold area is strong. Along about 10° N and east of the dateline, probabilities for near-normal temperatures dominate. Over most of Australia, there is no strong indication for a clear signal and there is also no model-to-model consistency.

RA VI (Europe): The probabilities for above-normal temperatures are increased over almost all of Europe with the largest probabilities over western and northern Europe. The model-to-model consistency is also strongest in northern and western Europe. Probability for below-normal is most likely over southern Greenland but the model-to-model consistency is low.

2.3 Predicted precipitation, March–May 2022

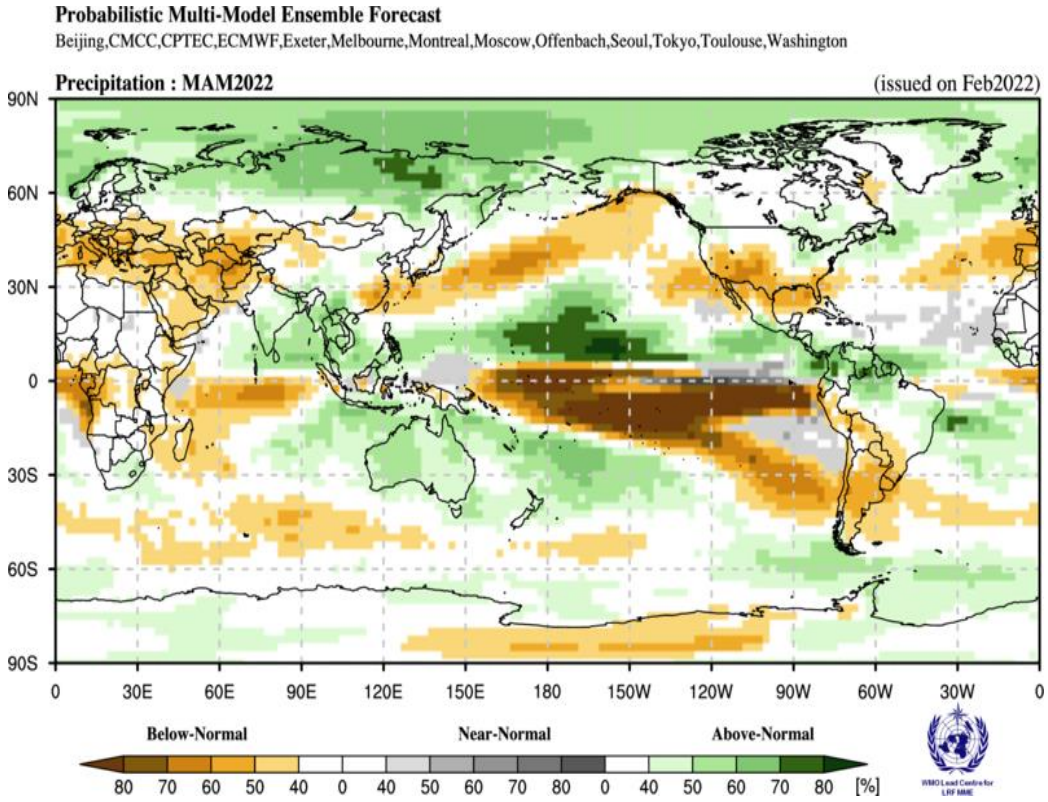


Figure 5. Probabilistic forecasts of precipitation for the season for March-May 2022. The tercile category with the highest forecast probability is indicated by shaded areas. The most likely category for below-normal, above-normal and near-normal is depicted in orange, green and grey shadings respectively. 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 below-average SST conditions associated with declining La Niña that are predicted for March-May 2022, together with an enhanced east-west SST gradient, some of the predicted rainfall patterns are similar to canonical rainfall impacts of La Niña. There are increased chances of unusually dry conditions along the equator centred near the dateline and extending towards the southernmost part of South America. 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. The other areas of notable predicted increases in rainfall are north-eastern and the far north-western part of South America, northern Asia, southern regions of the Indian subcontinent and southeast Asia. There are weaker indications of unusually wet conditions over part of north-western North America and over some parts of southern Africa. There are moderately strong indications of below-normal rainfall across the southern part of North America, part of South America south of 20° S, the western and the far eastern regions of Asia, eastern parts of Central Africa, western and southern Europe, and the central western Indian Ocean. Over much of the rest of Africa, there is little consistency in predicted rainfall.

RA I (Africa): Enhanced probabilities for below-normal precipitation are predicted over the western coastal regions of Central Africa, and the model consistency is moderate to high. Over the rest of Africa, there is no clear indication for rainfall signal.

RA II (Asia): Enhanced probabilities for above-normal rainfall are predicted over the northern regions of Asia with high model-to-model consistency. Likelihood of above-normal rainfall is also enhanced over southern portions of the Indian subcontinent extending into southeast Asia, with moderate model-to-model consistency. Enhanced probabilities for below-normal rainfall are predicted over western and central Asia, and coastal far-eastern Asia; model consistency for this area of predicted dryness is moderate is moderate.

RA III (South America): Northern regions of South America are predicted to have above-normal rainfall (model-to-model consistency is mostly moderate to strong). South of 15° S there is a small increase in probability of below-normal rainfall, and model consistency is moderate to 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 15° and 35° N, with moderate to 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. The southern region of Central America has an enhanced probability for above-normal rainfall with moderate model-to-model consistency.

RA V (Southwest Pacific): Probabilities for above-normal rainfall are enhanced over an area extending from south 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. Probabilities for above-normal rainfall also extend 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 160° E towards the southeast reaching as far as South America, but the probabilities weaken east of about 100° W. The dry area also extends eastwards to the north of the equator. Model-to-model consistency is strong throughout most of this region.

RA VI (Europe): Over southern and western Europe probabilities for below-normal precipitation are weakly enhanced and model consistency is moderate. There is no clear rainfall signal over northern 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

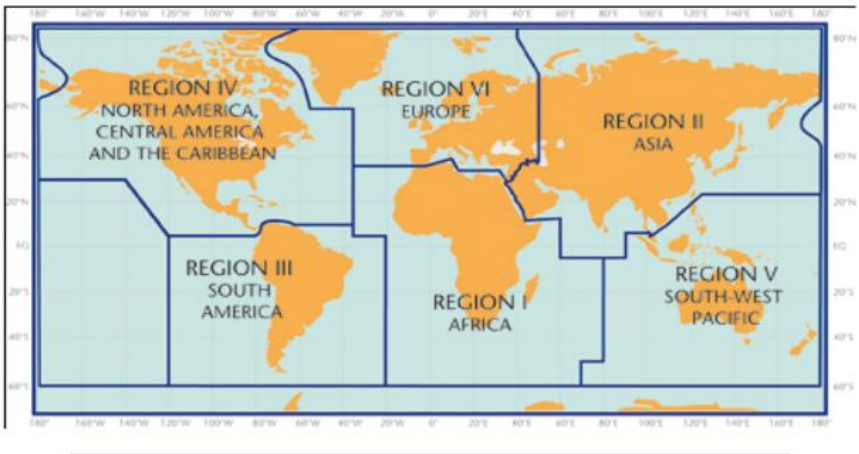
The GSCU is intended as guidance for RCCs, Regional Climate Outlook Forums (RCOFs) and National Meteorological and Hydrological Services (NMHSs). It does not constitute an official forecast for any region or nation. Seasonal outlooks for any region or nation should be obtained from the relevant RCCs (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-CMCC (Centro Euro-Mediterraneo sui Cambiamenti Climatici).
- International Research Institute for Climate and Society (IRI)