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வளிமண்டலவியல் திணைக்களம்
DEPARTMENT OF METEOROLOGY
ශ්‍රී ලංකාව இலங்கை SRI LANKA

Consensus Seasonal Weather Outlook
November, December and January(NDJ2023/24)
Seasonal Rainfall and Temperature for Sri Lanka

These forecasts are prepared using

- The prevailing global climate conditions.
- Forecasts from different climate models from around the world.
- Statistical downscaling of GCM output using CPT

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and

Research Division

1. Prevailing global climate conditions

During the last four weeks, equatorial SSTs were above average across most of the Pacific Ocean, in the western Indian Ocean, and across much of the Atlantic Ocean. Equatorial SSTs were below average in the central and eastern Indian Ocean and around Indonesia.

El Nino and La Nina update

El Niño conditions are observed. Equatorial sea surface temperatures (SSTs) are above average across the central and eastern Pacific Ocean. The tropical Pacific atmospheric anomalies are consistent with El Niño. El Niño is anticipated to continue through the Northern Hemisphere spring (with an 80% chance during March-May). Scientists are expected a 75-85% chance it will become a strong (NOAA Climate.Gov) event 2024.

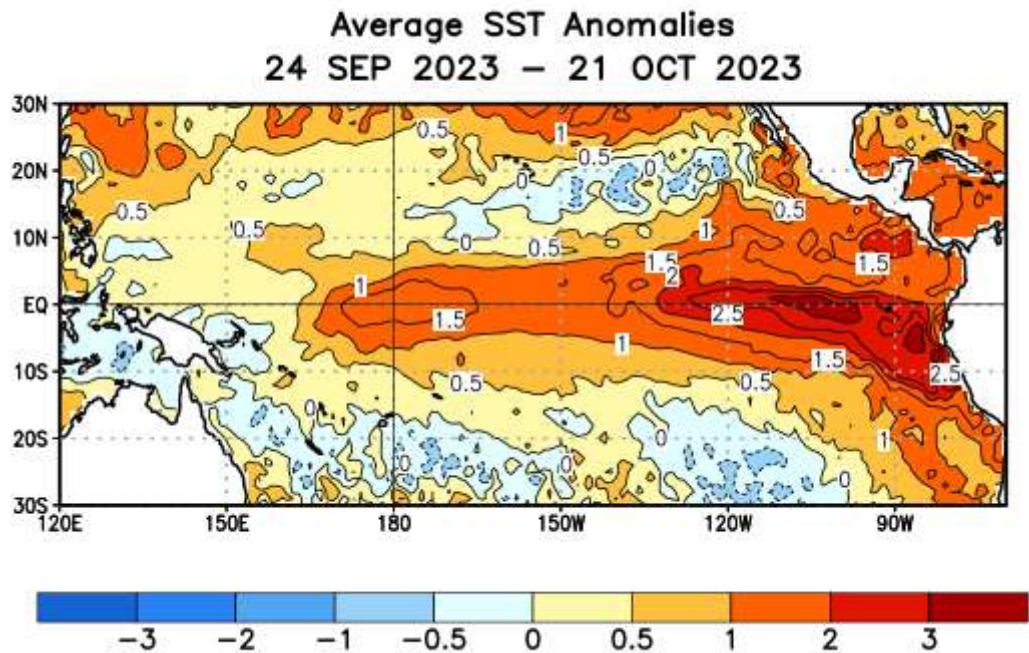


Fig 1: Observed Average sea surface temperature (SST) anomalies (°C)

Weekly SST Anomalies (DEG C)

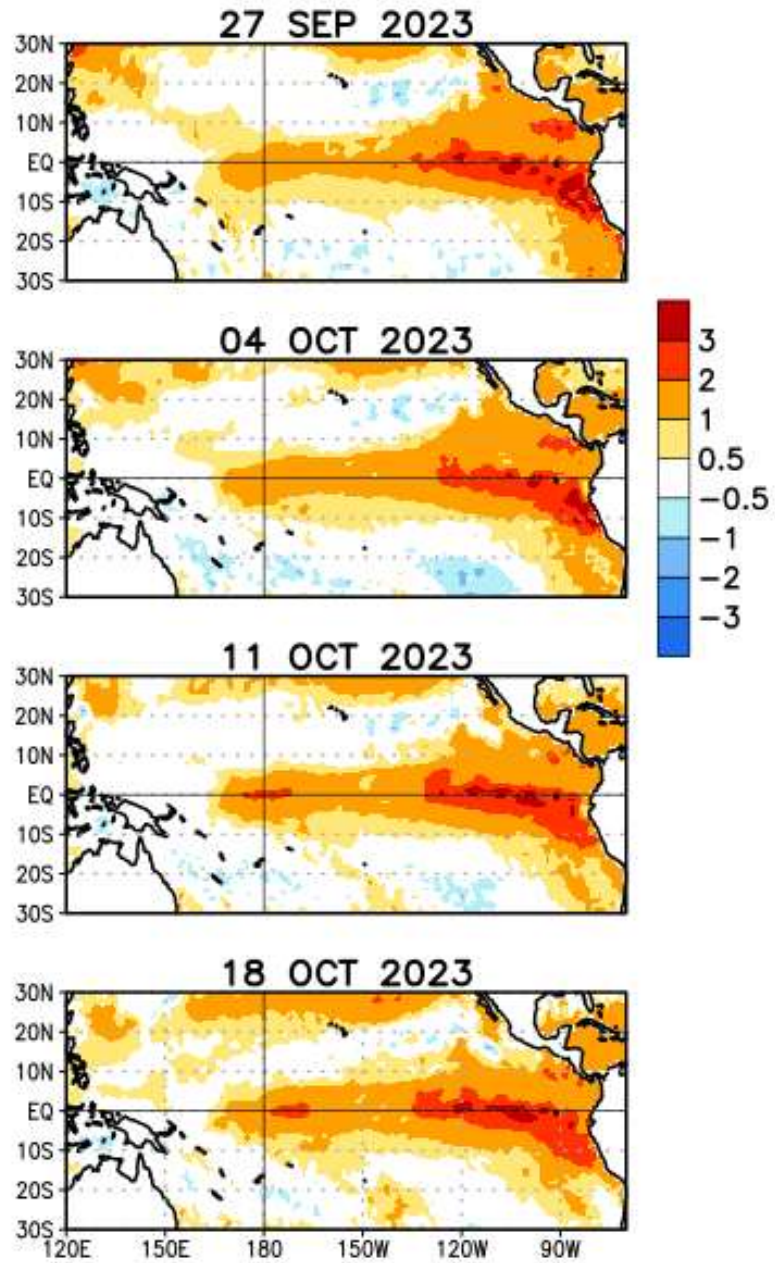


Fig 2: Weekly Observed Average sea surface temperature (SST) anomalies (°C)

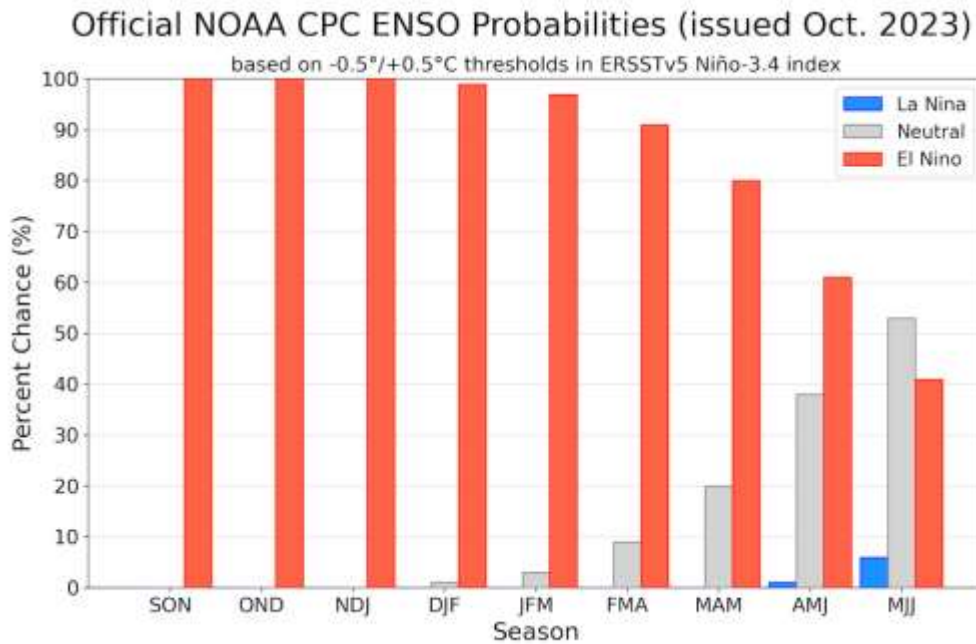


Fig 3a: ENSO forecast from Climate Prediction Center (CPC)/ IRI Forecast

1.1.1 Impacts of El-Niño on monthly rainfall anomaly during November, December and January

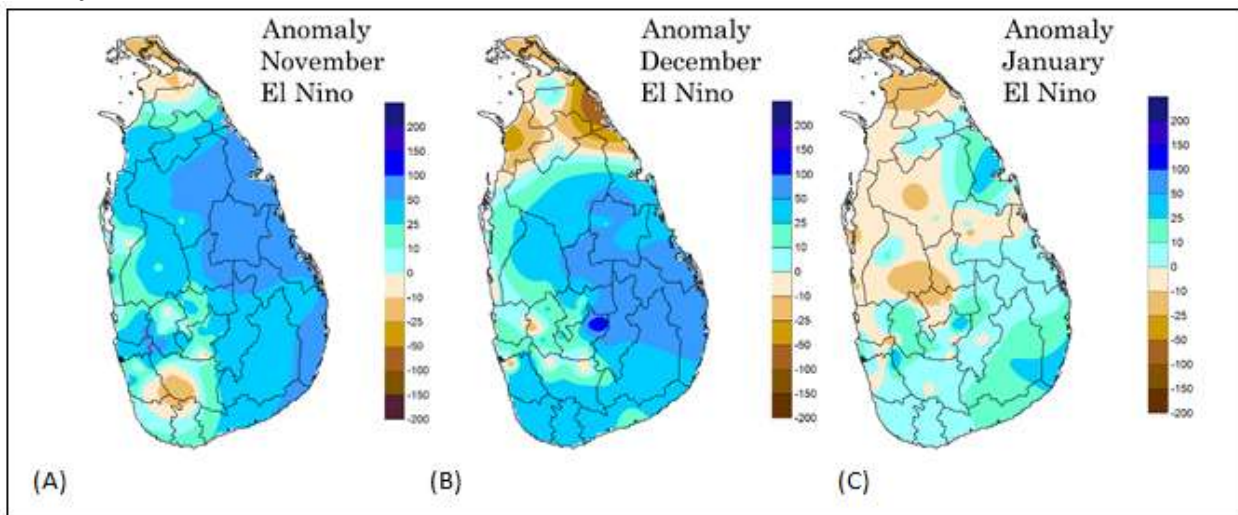


Fig 3b: Monthly Rainfall Anomaly maps of the months of November(A), December (B) and January (C) during El-Niño years (Hapuarachchi et al 2016)

Previous studies conducted by the Department of Meteorology, identified that, during El-Niño years, above normal rainfalls are likely over most parts of the country, while below normal rainfalls are expected in some areas in Jaffna, Killnochchi, Rathnapura, Kalutara, Galle and Mathara districts during the month of November (Fig 3b(A)). During the month of December above normal rainfalls are likely over most parts except northern province, where below normal rainfalls are likely (Fig 3b(B)). During the month of January above normal rainfalls are likely over Southern, Sabaragamuwa and Uva provinces and some areas in Nuwara Eliya, Ampara, Trincomalee, Kalutara and Vavuniya districts. Below normal rainfalls are possible in most of the remaining areas when El-Niño conditions were persisting (Fig 3b(C)).

1.2 The Indian Ocean Dipole (IOD) update

A positive Indian Ocean Dipole (IOD) is underway. All models indicate that this positive IOD will likely be sustained to at least December 2023.

(BOM-Australia).

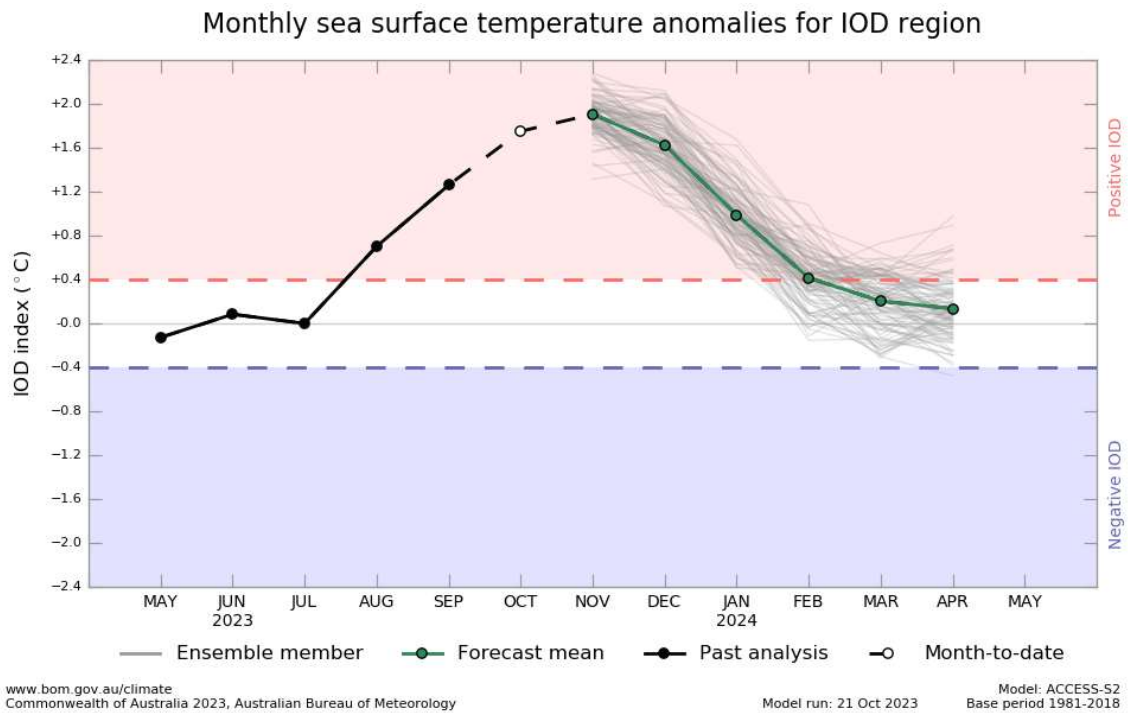


Figure 4a: IOD forecast from Australian Bureau of Meteorology

1.2.1 Impacts of positive IOD on monthly rainfall anomaly during November, December and January

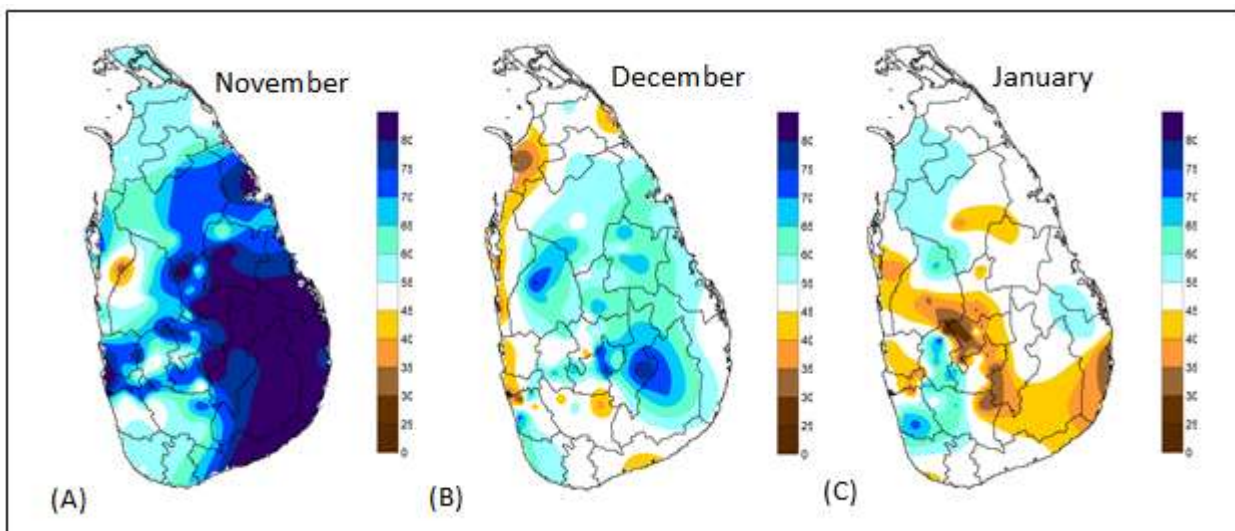


Fig 4b: Median Based Composite maps of Monthly Rainfall during November(A), December (B) and January (c) during positive IOD years (Hapuarachchi et al 2018)

Previous studies conducted by the Department of Meteorology identified that there is a higher probability of getting above normal rainfalls in most of the areas of the country during the month of November (Fig 4b(A)). During the month of December near or above normal rainfalls are possible except Western coastal areas (Fig 4b (B)) under the positive IOD condition. During the month of January it is showing the higher probability of getting below normal rainfall all over some parts in North western, Central and Uva provinces as well as Colombo, Gampaha, Anuradhapura, Ampara and Hambantota districts under the positive IOD condition (Fig 4b (C)).

2. Forecasts from different climate models from around the world.

2.1 November to January (NDJ) 2023/24 season

Figure 5 shows the probabilistic multi model ensemble forecast which prepared by using dynamical models from 13 Global Producing Centers (GPC) for NDJ season. It can be expected above normal rainfalls over most parts of the country except northern province, where no clear signal indicated. Accordingly below or about or above normal rainfall can be expected over northern province during November–January (NDJ) 2023/24 season.

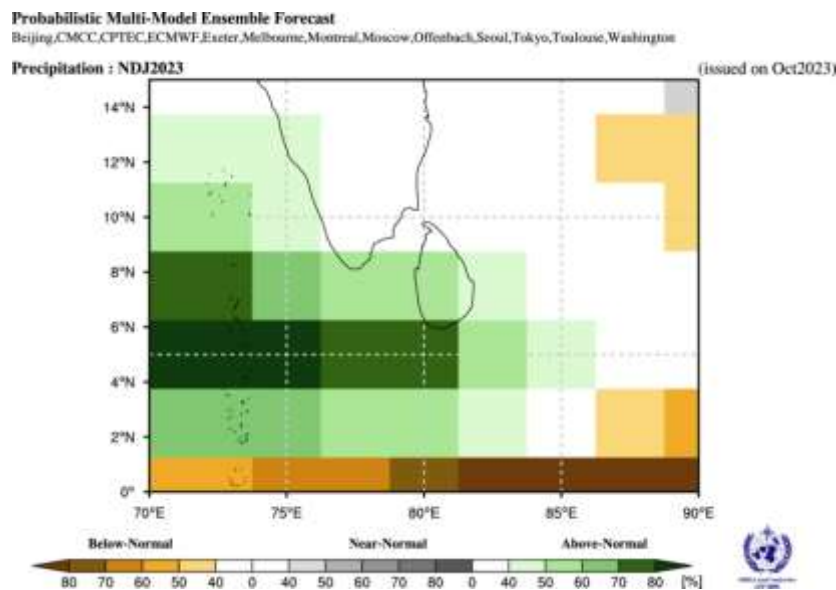


Fig 5: Probabilistic multi model ensemble forecast for NDJ using dynamical models from 13 WMO global producing centers (GPC).

Figure 6 depicts individual forecasts provided by same GPC centers for the NDJ season. Out of 13 GPC individual models, 8 models predicted above normal rainfall over the country and there were no clear signal indicated in 5 models. Accordingly above normal rainfalls are likely over the country during NDJ 2023/24 season.

Lat : -15.0~40.0, Lon : 50.0~160.0
Precipitation : NDJ2023

[Unit: mm]
(issued on Oct2023)

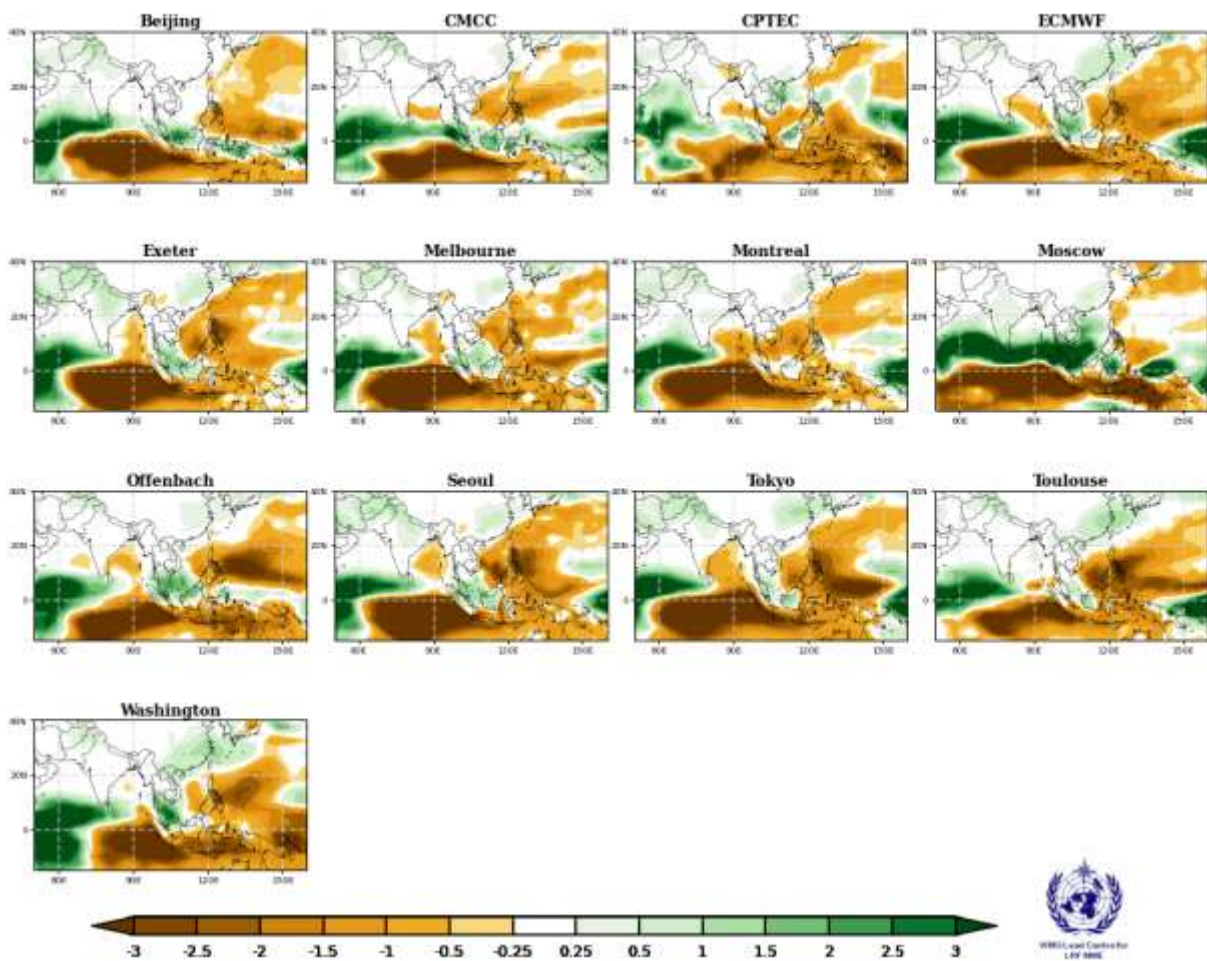


Fig 6: Individual forecasts for NDJ 2023/24 season by dynamical models from 13 WMO global producing centers (GPC).

2.2 Monthly Forecast for November, December 2023 and January 2024

Figure 7 shows the probabilistic multi model ensemble forecasts, which are prepared by using dynamical models from 13 global producing centers (GPC), for the months of November, December 2023 and January 2024. According to that during the month of November it can be expected above normal rainfall over the country except Northern and Eastern part where no clear signal indicated. During the month of December it can be expected above normal rainfall over the country except northern part of the country, where is no clear signal indicated. During the month of January it can be expected near normal rainfall over northern part of the country and there exists no clear signal for remaining areas of the country. Accordingly above, about or below normal rainfall can be expected over no signal area during the season.

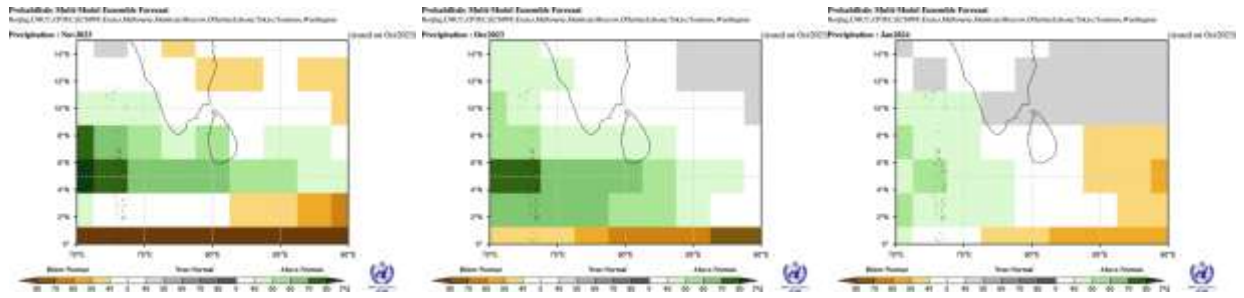


Fig 7: Probabilistic multi model ensemble forecast for November(left), December (middle) and January (right) 2023 using dynamical models from 13 WMO global producing centers (GPC).

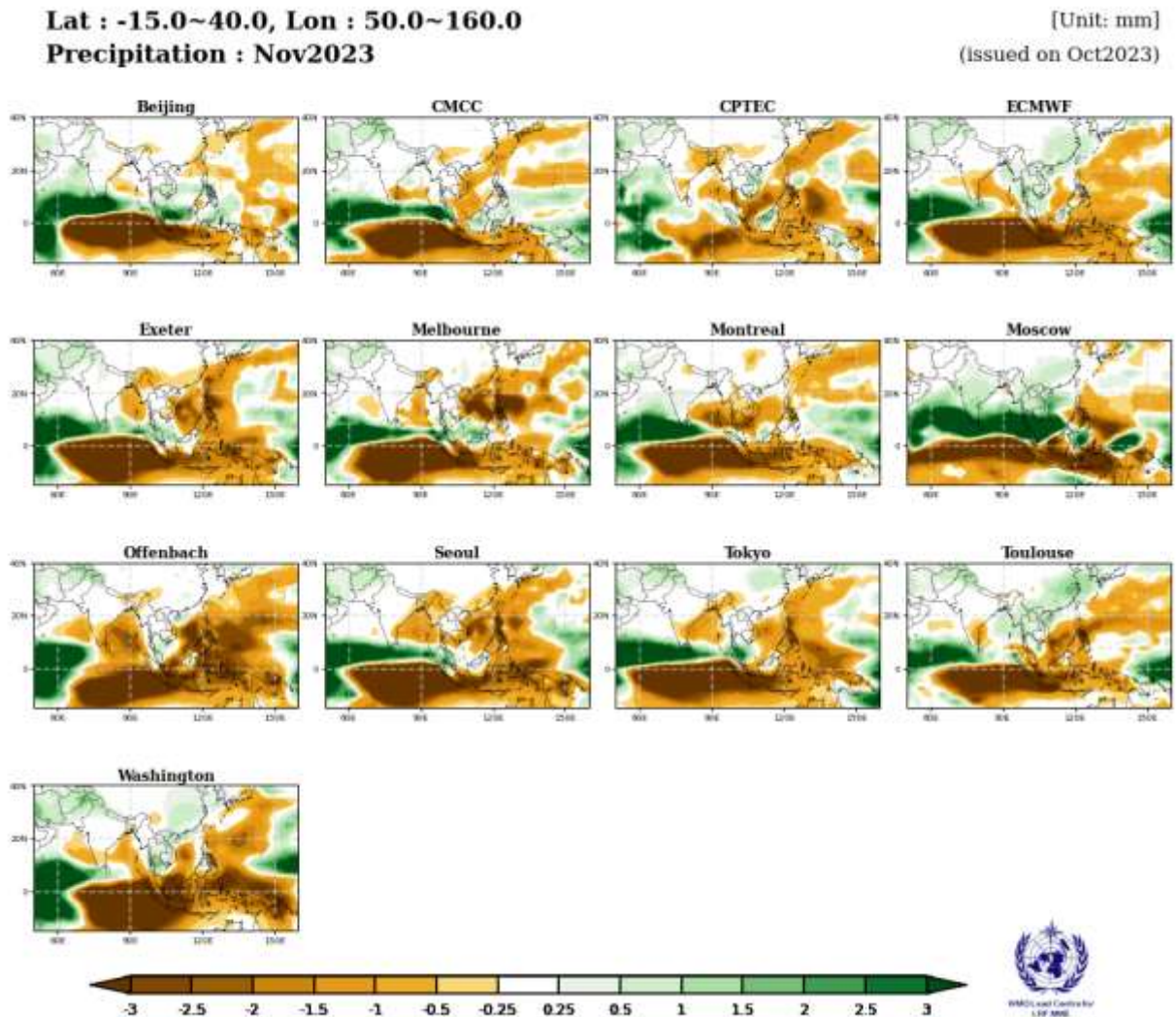


Fig 8: Individual forecast for November 2023 by dynamical models from 13 WMO global producing centers (GPC).

Figure 8 shows the 13 monthly forecasts from individual global producing centers (GPC) for November 2023. Out of 13 GPC forecasts, 8 GPC models predicted above normal rainfalls and one GPC model predicted below normal rainfall over the country. Accordingly above normal rainfalls are expected over the country during the month of November 2023.

Lat : -15.0~40.0, Lon : 50.0~160.0
Precipitation : Dec2023

[Unit: mm]
(issued on Oct2023)

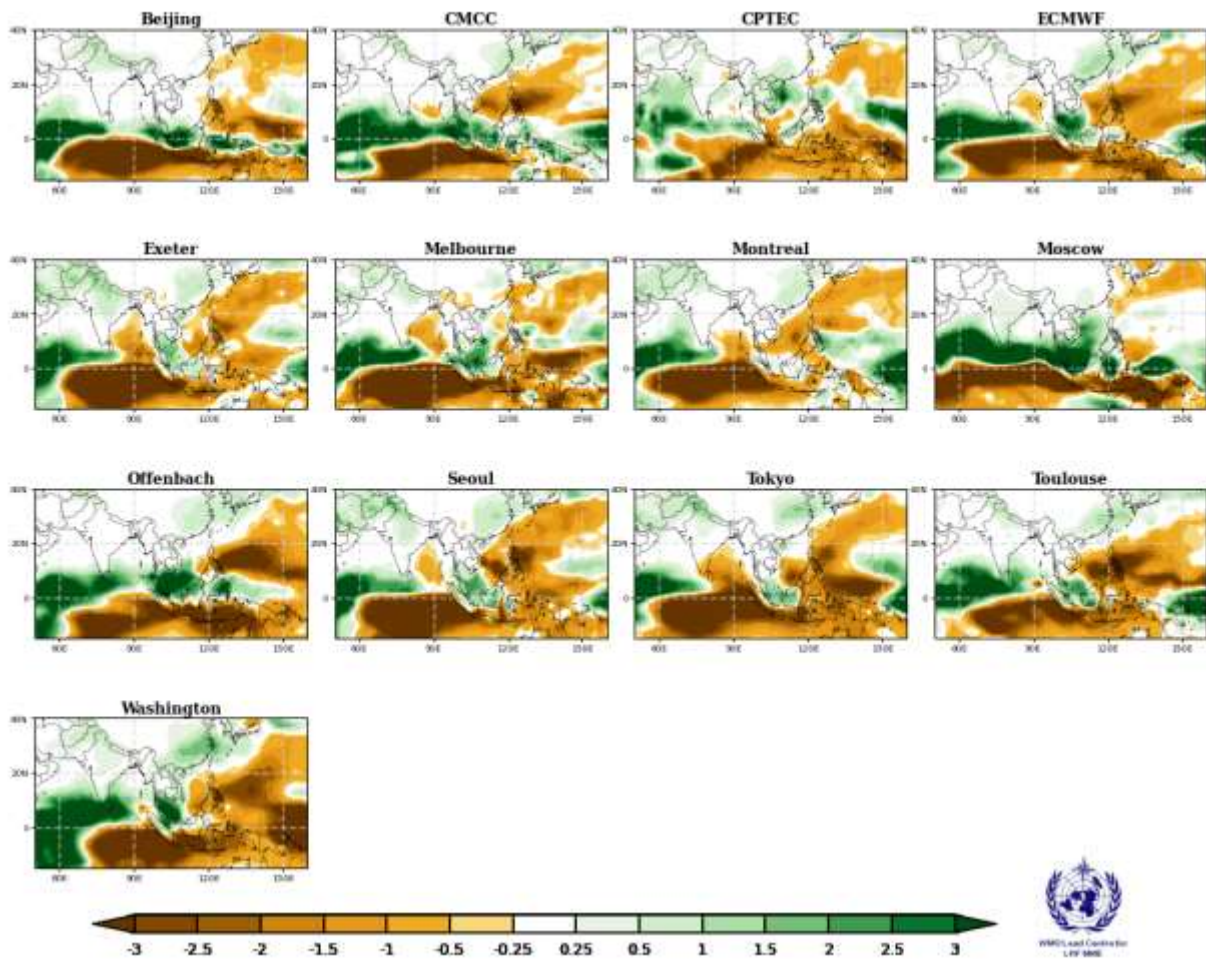


Fig 9: Individual forecast for December 2023 by dynamical models from 13 WMO global producing centers (GPC).

Figure 9 shows the monthly forecasts from individual global producing centers (GPC) for December 2023. Out of 13 GPC forecasts, 8 GPC models predicted above normal rainfalls and one model predicted below normal rainfall over the country. There is no clear signal indicated in 4 GPC models. Accordingly above normal rainfalls can be expected over the country during the month of December 2023.

Lat : -15.0~40.0, Lon : 50.0~160.0
Precipitation : Jan2023

[Unit: mm]
(issued on Oct2023)

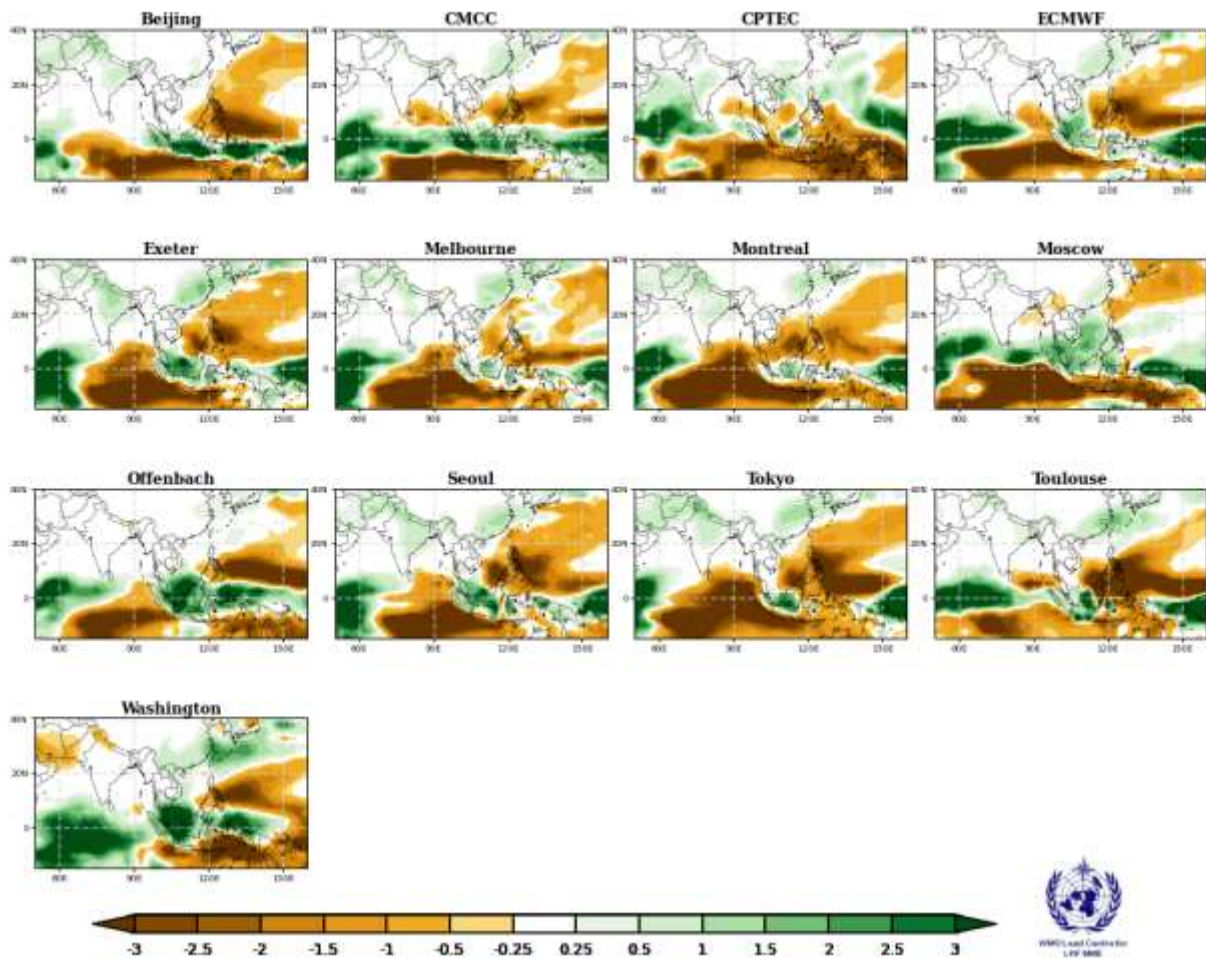


Fig 10: Individual forecast for January 2024 by dynamical models from 13 WMO global producing centers (GPC).

Figure 10 shows the monthly forecasts from 13 individual global producing centers (GPC) for January 2024. Out of 13 GPC forecasts, 2 GPC models indicate above normal rainfall and 3 GPC models indicate below normal rainfall over the country. There is no clear signal indicated in 9 GPC models. Accordingly it can be expected below or near or above normal rainfall over the country during the month of January 2024.

3. Statistical downscaling of CFSv2 global forecast output

3.1 Probabilistic rainfall forecast for NDJ season 2023/24 using Climate Predictability tool (CPT)

The following district wise probabilistic rainfall forecasts for the season of NDJ 2023/24 have been prepared with the multi model ensemble method to downscale, SST data of CFSv2, CCSM4, GFDL and ECMWF by using CPT.

The district wise 30 year average rainfalls during NDJ season are given in the column 2 of the table 1. Chance (probability) of receiving below/about/above average is given in the columns 3, 4, and 5 respectively in the table 1.

District	Average rainfall (mm) –NDJ	Probability%		
		Below	Normal	Above
Colombo	609.8	40	25	35
Kalutara	783.8	55	25	20
Galle	745.5	55	25	20
Matara	697.7	25	30	45
Hambantota	452.6	20	20	60
Ampara	832.5	30	30	40
Batticaloa	885.5	35	30	35
Trincomalee	766.1	40	25	35
Mullaithivu	680.6	30	25	45
Jaffna	652.9	45	25	30
Killinochchi	680.3	40	25	35
Mannar	503.1	30	30	40
Puttalam	406.3	25	25	50
Gampaha	507.9	25	35	40
Kegalle	660.0	25	25	50
Ratnapura	718.7	20	20	60
Monaragala	672.8	20	25	55
Badulla	915.8	50	25	25
Pollonnaruwa	826.5	40	30	30
Vavuniya	603.1	30	30	40
Anuradapura	557.8	40	30	30
Kurunegala	483.8	30	30	40
Matale	868.7	60	20	20
Kandy	811.1	45	25	30
Nuwaraeliya	694.3	30	25	45

Table 1: Probabilistic Rainfall Forecast for NDJ season 2023/24 using CPT

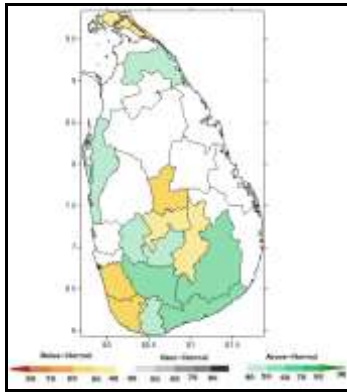


Fig 11: Probabilistic rainfall forecast for November –January 2023/24 using CPT

According to the CPT (Fig 11 and table 01), above normal rainfalls can be expected in Kegalle, Rathnapura, Nuwar Eliya, Mathara, Hambantota, Monaragala, Puttalam and Mullativu Districts and below normal rainfall can be expected in Kalutara, Galle, Mathale, Kandy, Badulla and Jaffna districts. There is no clear signal indicated for remaining areas of the country. Accordingly equal chances exist of receiving below, about or above normal rainfall over no signal areas for NDJ Season 2023/24.

3.2 Multi-model ensemble mean forecast of NMME models

This probabilistic forecast is developed by combining direct Forecasts from 5 NMME models (CFS, CanSIPS, GFDL, COLA and NASA) with the forecasts obtained by statistically processing of each models.

According to the model no clear signal indicated over the country(Figure 12) during the NDJ Season 2023/24. Accordingly Below or near or above normal rainfall can be expected over the country during the season.

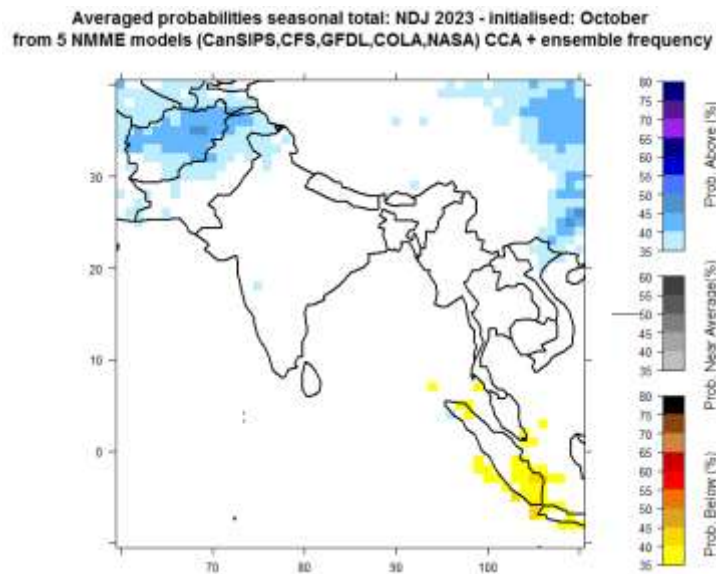


Fig 12. Average probability forecast of NMME models for NDJ 2023/24

3.3 Probabilistic rainfall forecast for NDJ 2023/24 season using RIMES FOCUS System

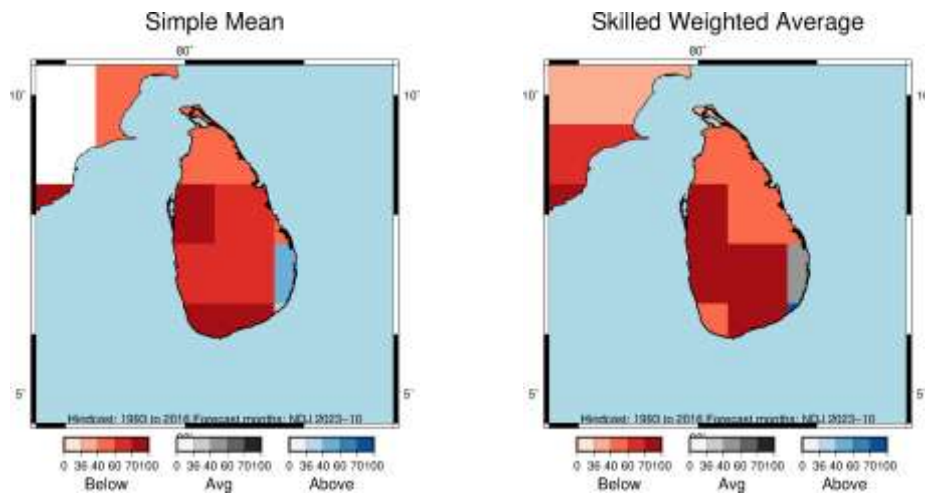


Fig 13. Probabilistic rainfall forecast for November-January 2023/24 using RIMES FOCUS System

Figure 13 depicts the Probabilistic rainfall forecast for NDJ 2023/24 season, which has been prepared by using RIMES FOCUS System. According to the model outputs below normal rainfalls are likely over most parts of the country for NDJ season 2023/24.

4. SUMMARY :

SUMMARY of MODEL FORECAST for NDJ 2023/24 season for SRI LANKA						
Season	WMO LC MME	WMO GPC	CPT	FOCUS	Impact of Global conditions	Final Rainfall Forecast
NDJ season 2023/24	No Signal- Northern part AN- Elsewhere	AN	AN- Rathnapura, Kegalle, Mathara, Nuwar Eliya, Hambantota, Mullativu Monaragala, Puttalam, BN- Kalutara, Galle, Mathale, Kandy, Badulla, Jaffna	BN		Below normal over Northern province, above normal over Western, Southern, Sabaragamuwa, Uva and Central provinces and in Ampara and Batticaloa districts and No signal for remaining areas.
November 2023	No Signal- Northern and Eastern part AN- Elsewhere	AN				Above normal over Western, Southern, Sabaragamuwa, Central, Uva and Northwestern provinces and Batticaloa, Polonnaruwa and Ampara districts. Near normal over Anuradhapura and Trincomalee districts. No signal for Northern province.
December 2023	No Signal- Northern part AN- Elsewhere	AN				Below normal over Northern province, above normal over Southern and Uva provinces and in Batticaloa and Ampara districts. Near or slightly above normal over Western, Central, Sabaragamuwa and Northwestern provinces. No signal for Northcentral province.
January 2024	NN- Northern part No Signal- Elsewhere	No Signal				Near normal over Uva and Southern provinces and in Batticaloa and Ampara districts. No signal for remaining areas.

Table 2: Summary of Model Forecasts for NDJ season 2023/24

4.1 Summary of prevailing global climate conditions

The tropical Pacific atmospheric anomalies are consistent with El Niño. El Niño is anticipated to continue through the Northern Hemisphere spring (March-May 2024) with an 75-80% chance of a strong event.

A positive Indian Ocean Dipole (IOD) is underway. All models indicate that this positive IOD will likely be sustained to at least December 2023.

5. Consensus Seasonal outlook for November, December 2023 and January 2024

Considering the prevailing global climate conditions, forecasts from different global climate models and statistical downscaling of GCM output using CPT, consensus forecasts for November 2023 to January 2024 season is concluded as follows.

5.1 Rainfall forecast for the three months period during November-December 2023-January 2024 (NDJ 2023/24)

There is a possibility of having below normal rainfall over Northern province and above normal over Western, Southern, Sabaragamuwa, Uva and Central provinces and in Ampara and Batticaloa districts. There is no signal for remaining areas, where there is an equal probability for having below or near or above normal rainfalls during NDJ 2023/24 season as a whole. (Fig. 14).

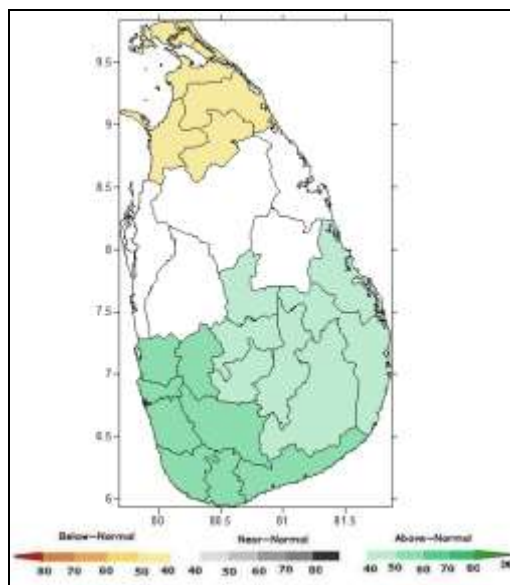


Fig 14. Consensus Probabilistic rainfall forecast for November 2023–January 2024

5.2 Rainfall forecast for November 2023

There is a higher chance of having above normal rainfall over Western, Southern, Sabaragamuwa, Central, Uva and Northwestern provinces and Batticaloa, Polonnaruwa and Ampara districts. Near normal rainfall are likely over Anuradhapura and Trincomalee districts. There is no clear signal indicated for Northern province, where there is an equal probability for having below or near or above normal rainfalls during the month of November 2023.

However there is a possibility for developing low level atmospheric disturbances and depressions during the month, if so rainfalls can be enhanced over most parts of the country.

5.3 Rainfall forecasts for December 2023

There is a chance of having below normal rainfall over Northern province and above normal rainfall over Southern and Uva provinces and in Batticaloa and Ampara districts with a possibility for near or slightly above normal rainfall over Western, Central, Sabaragamuwa and Northwestern provinces. There is no clear signal indicated for Northcentral province, where there is an equal probability for having below or near or above normal rainfalls, during the month of December 2023.

However there is a possibility for developing synoptic scale systems like low level atmospheric disturbances, depressions and cyclones in the vicinity of Sri Lanka and in Bay of Bengal during the month of December, if so rainfalls forecast can be deviate with a chance of enhancing rainfall over the country.

5.4 Rainfall forecasts for January 2024

There is a possibility of having near normal rainfall over Uva and Southern provinces and in Batticaloa and Ampara districts. There is no clear signal indicate for remaining areas, where there is an equal probability for having below or near or above normal rainfalls, during the month of January 2024. In general wavy type disturbances which could enhance rainfall over the country is possible during the month.

**In addition, the predictability is also limited due to strong day-to-day atmospheric variability caused by the passage of the synoptic scale systems such as lows and depressions. Intraseasonal Oscillations such as Madden Julian Oscillations (MJO) is also another atmospheric phenomena which can't be underestimated.

5.5 Probabilistic Temperature Forecast from November 2023 to January 2024 (NDJ 2023/24)

The probabilistic Temperature forecast for November, December 2023 and January 2024 season (NDJ 2023/24) for Sri Lanka as given below.

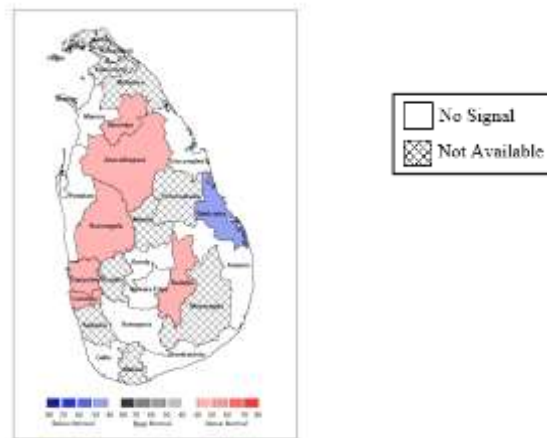


Fig 15: Probabilistic forecast for Maximum Temperatures for NDJ season 2023/24

Fig 15 and Table 3 show the probabilistic forecast for Maximum Temperatures during NDJ season 2023/24.

There is a higher chance of experiencing slightly above the normal Maximum Temperatures in Vavuniya, Anuradhapura, Kurunegala, Colombo, Gampaha, and Badulla districts and slightly below the normal Maximum Temperatures in Batticaloa district (Fig 15) for the NDJ 2023/24 season.

The district wise average Maximum Temperatures are given in the column 2 of the table 3 and the chance (probability) of receiving below/about/above averages are given in the columns 3, 4, and 5 respectively.

District	Average Maximum Temperature (⁰ C) – (NDJ)	Probability %		
		Below	Normal	Above
Anuradhapura	29.7	30	30	40
Badulla	25.8	35	30	35
Batticaloa	28.4	40	30	30
Colombo	30.4	30	30	40
Galle	29.0	35	30	35
Hambantota	29.7	35	30	35
Katugastota	29.7	35	30	35
Katunayake	31.4	30	25	45
Mannar	29.0	35	30	35
MahaIlluppallama	29.6	35	30	35
NuwaraEliya	19.7	35	30	35
Pottuvil	29.6	35	30	35
Puttalam	30.3	35	30	35
Ratnapura	32.1	35	30	35
Ratmalana	30.7	35	30	35
Trincomalee	28.3	35	30	35
Vavuniya	29.4	35	25	40
Kurunegala	30.6	20	35	45
Bandarawela	22.8	35	30	35

Table 3: probabilistic forecast for Maximum Temperature for NDJ season 2023/24

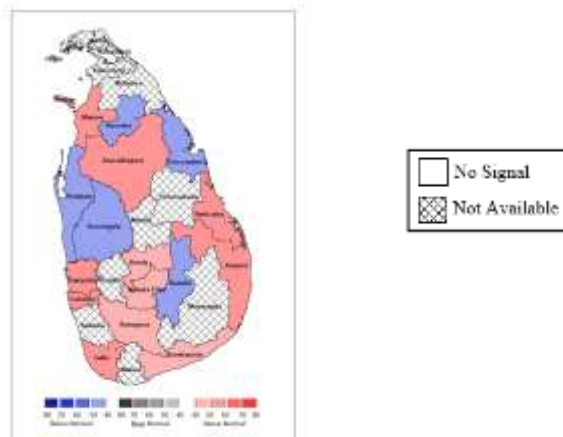


Fig 16: Probabilistic forecast for Minimum Temperatures for NDJ season 2023/24

District	Average Minimum Temperature (°C) – (NDJ)	Probability %		
		Below	Normal	Above
Anuradhapura	21.8	25	25	50
Badulla	18.3	45	25	30
Batticaloa	23.5	20	30	50
Colombo	22.8	25	20	55
Galle	23.1	20	30	50
Hambantota	23.2	20	35	45
Katugastota	19.3	25	35	40
Katunayake	22.3	30	20	50
Mannar	24.1	20	35	45
MahaIlluppallama	21.3	25	25	50
NuwaraEliya	10.6	30	25	45
Pottuvil	22.5	30	20	50
Puttalam	22.0	40	30	30
Ratnapura	22.2	30	30	40
Ratmalana	22.3	25	25	50
Trincomalee	24.2	45	35	20
Vavuniya	21.2	40	30	30
Kurunegala	21.5	40	30	30
Bandarawela	15.0	45	25	30

Table 4: Probabilistic forecast for Minimum Temperatures for NDJ season 2023/24

Fig 16 and Table 4 provide the probabilistic forecast for Minimum Temperatures during NDJ season 2023/24.

Accordingly, there is a higher chance of experiencing slightly above the normal Minimum Temperatures in Mannar, Anuradhapura, Colombo, Gampaha, Rathnapura, Hambantota, Galle, Kandy, Nuwara Eliya, Ampara and Batticaloa districts and slightly below the normal Minimum Temperatures in Vavunia, Kurunegala, Badulla , Trincomalee and Puttalam districts (Fig 16) during NDJ 2023/24 season.

Note- Temperature forecasts are not available in **Matara, Kegalle, Kalutara, Monaragala, Polonnaruwa, Jaffna, Killinochchi, Mullativu and Mathale** districts due to unavailability of Climate data.