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வளிமண்டலவியல் திணைக்களம்
DEPARTMENT OF METEOROLOGY
ශ්‍රී ලංකාව இலங்கை SRI LANKA

Consensus Seasonal Weather Outlook

November, December and January(NDJ)

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

Equatorial sea surface temperatures (SSTs) were below average across most of the Pacific Ocean. However, strong positive SST anomalies are presented in the North Pasific and North Atlantic Oceans. Further, positive SST anomalies persited in the eastern Indian Ocean. Negetive SST anomaly tendencies were observed in the central and eastern equatorial Pasific and in the western Indian Ocean during the last four weeks. (CPC-USA) (Fig.1 & 2)

1.1 El Nino and La Nina update

The tropical Pacific atmosphere is consistent with La Niña conditions. Except for Niño3.4, other Niño indices cooled and Negative Niño3.4 persisted in September 2022 , with Niño3.4 is equal to -0.9 C. Chances of La Niña gradually decrease through the Northern Hemisphere fall and winter, with ENSO-neutral favored beginning in February-April 2023. A majority of models predict SSTs to remain below-normal at the level of a La Niña until Dec-Feb 2023 and return to ENSOneutral thereafter. There is a 75% chance of La Niña during the Northern Hemisphere winter (December-February) 2022-23, with a 54% chance for ENSO-neutral in February-April 2023. (source-CPC-USA) (Fig.3a).

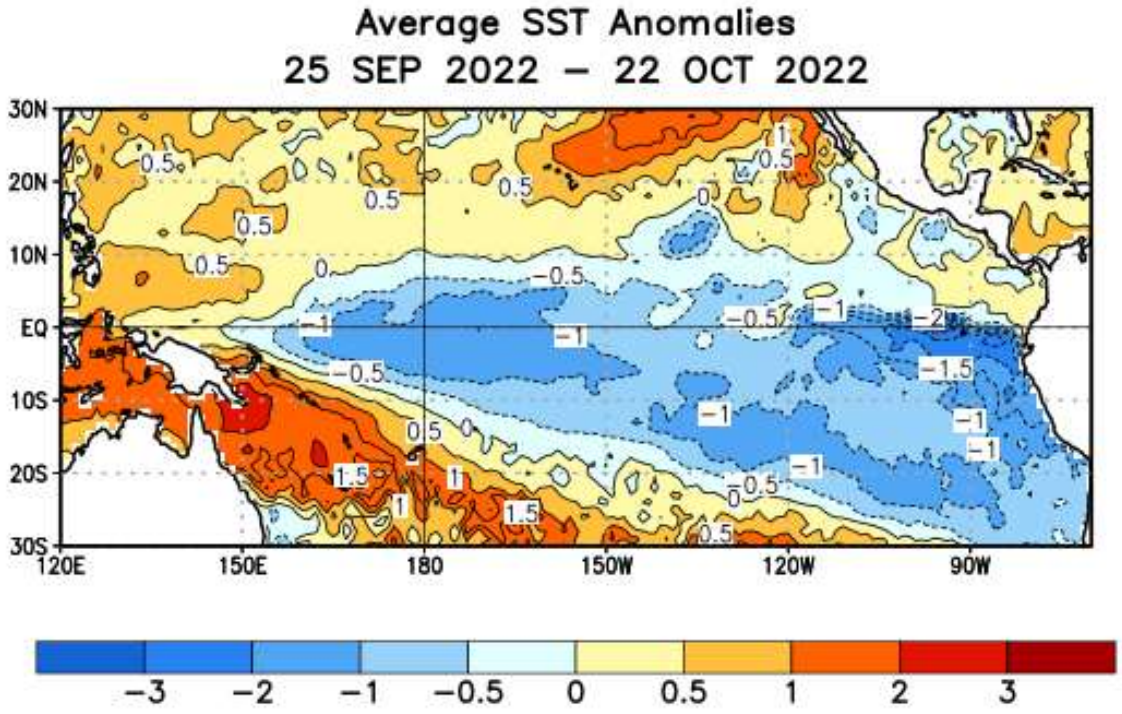

Fig 1: Observed Average sea surface temperature (SST) anomalies (°C)

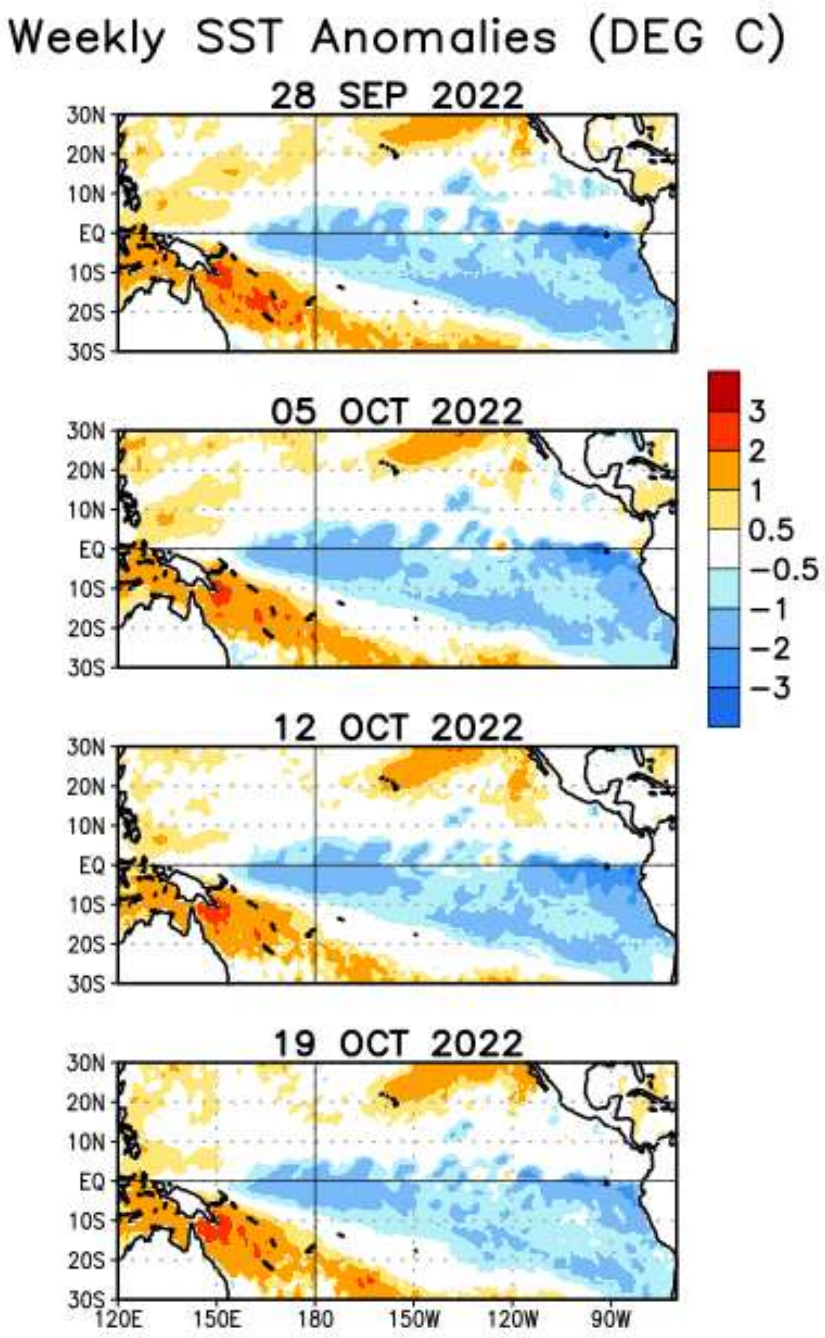

Fig 2: Weekly Observed Average sea surface temperature (SST) anomalies (°C)

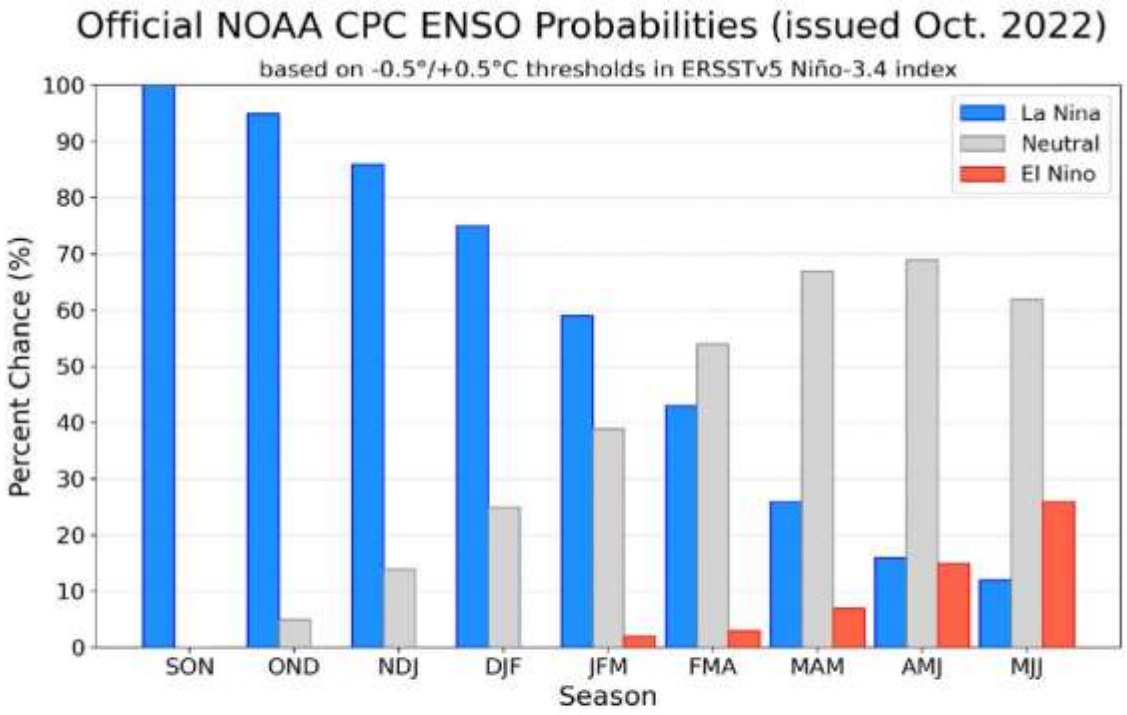

Fig 3a: ENSO forecast from Climate Prediction Center (CPC)/ IRI Forecast

1.1.1 Impacts of La-Nina on monthly rainfall anomaly during November, December and January

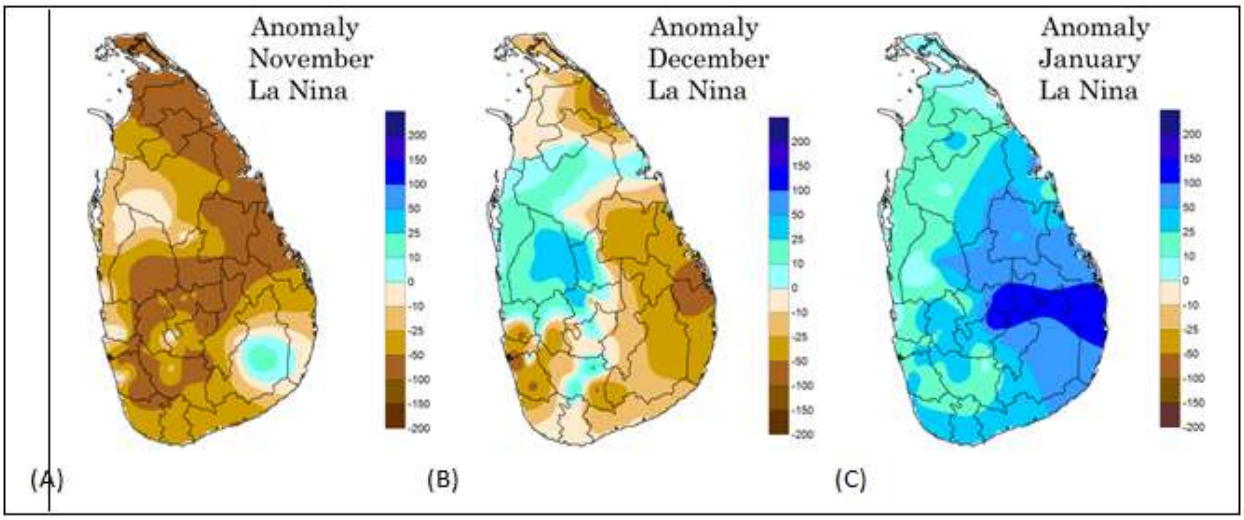

Fig 3b: Monthly Rainfall Anomaly maps of the months of November (A), December (B) and January(C) during La-Nina years (Hapuarachchi et al 2016)

Previous studies conducted by the Department of Meteorology, identified that, during La-Nina years, below normal rainfalls are observed over the country except some areas in Monaragala district where above normal rainfalls were observed during the month of November (Fig 3a). During the month of December below normal rainfalls were observed over most of the parts of

the Western, Sabaragamuwa, Southern, Uva, Eastern and Northern provinces and in Polonnaruwa district. Above normal rainfalls were observed over remaining areas of the country. During the month of January above normal rainfalls were observed most parts of the country when La-nina conditions were persistent.

1.2 The Indian Ocean Dipole (IOD) update

Slightly above normal Sea surface temperatures (SSTs) were observed over the eastern tropical Indian Ocean and slightly below normal Sea Surface temperatures (SSTs) were observed in the western Indian Ocean and, the Indian Ocean Dipole (IOD) is proceding negative limits. Since June, negetive Indian Ocean Dipole Mode index continued to well below the -0.4C threshold, and all NMME models predict the negative IOD condition last through November 2022. The latest Indian Ocean 3Dipole (IOD) index value, for the week ending 23 October 2022, was −0.73 °C. (Source-Bureau of Meteorology, Australia).

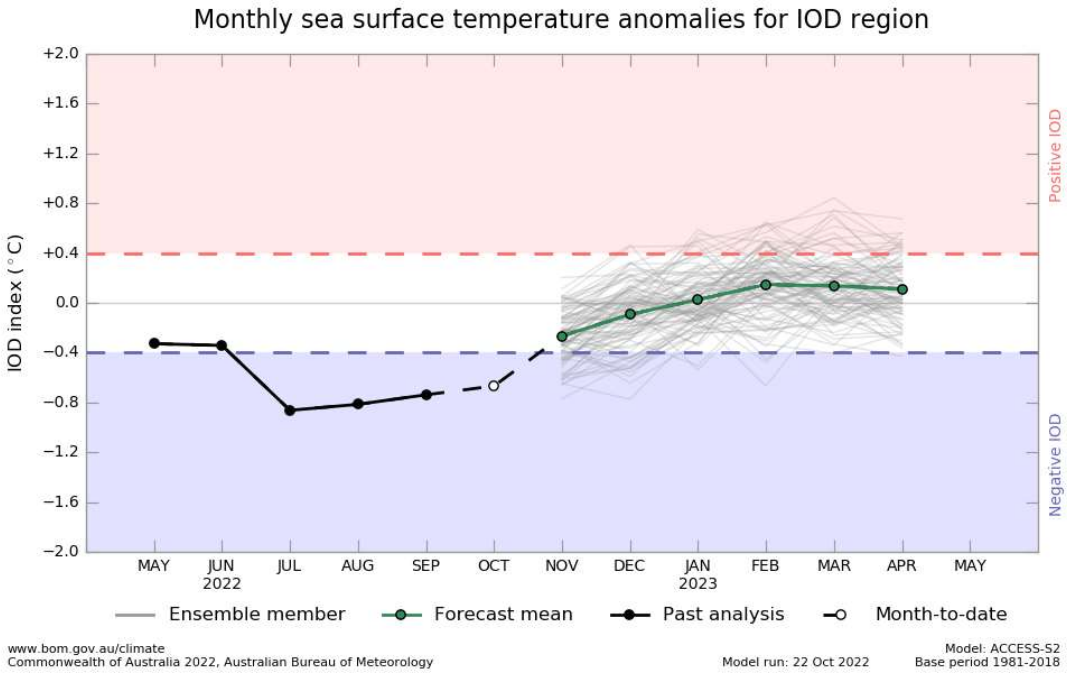

Figure 4a: IOD forecast from Australian Bureau of Meteorology

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

2.1 November to January(NDJ) 2022/23 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. According to that below normal rainfall can be expected over eastern and southern parts of the country and above normal rainfall over northern part. There is no clear signal indicated over remaining areas and accordingly below or about or above normal rainfall can be expected over these area during November–January(NDJ) 2022/23 season.

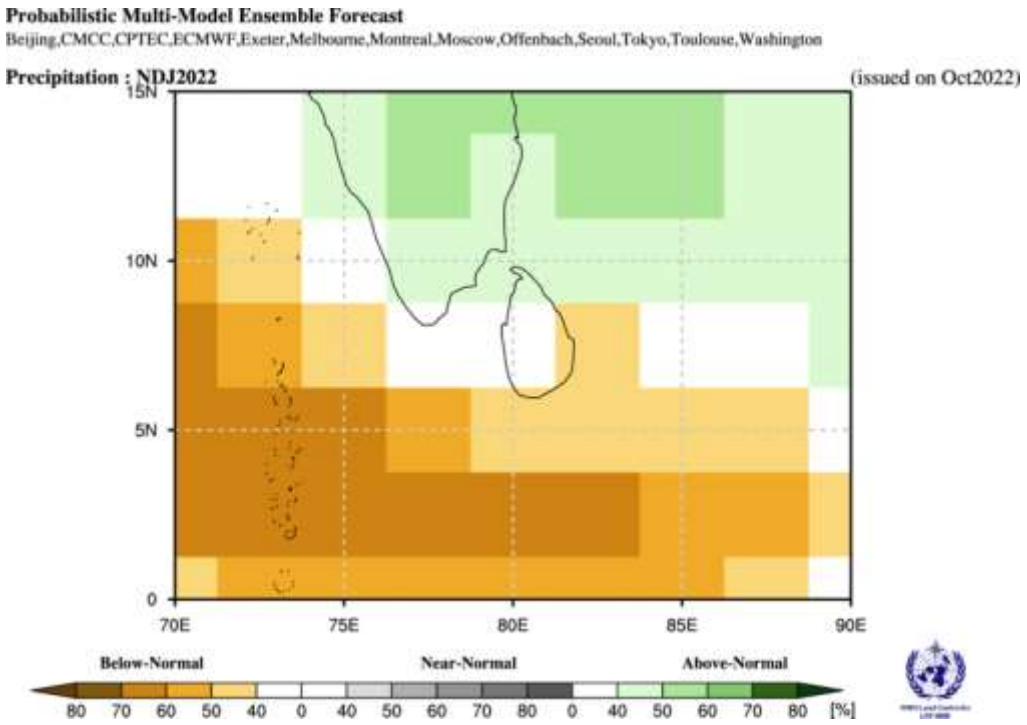

Fig 5: Probabilistic multi model ensemble forecast for NDJ using dynamical models from 13 WMO global producing centers (GPC).

Figure 6 depicts individual forecasts provided by same GPC centers for the NDJ season. Out of 12 GPC individual models, 2 models predicted slightly below normal rainfall and another 2 models predicted above normal rainfall over the country. There is no clear signal indicated in 8 GPC models. Accordingly there is a possibility of having below, about or above normal rainfall over the country during NDJ 2022/23 season.

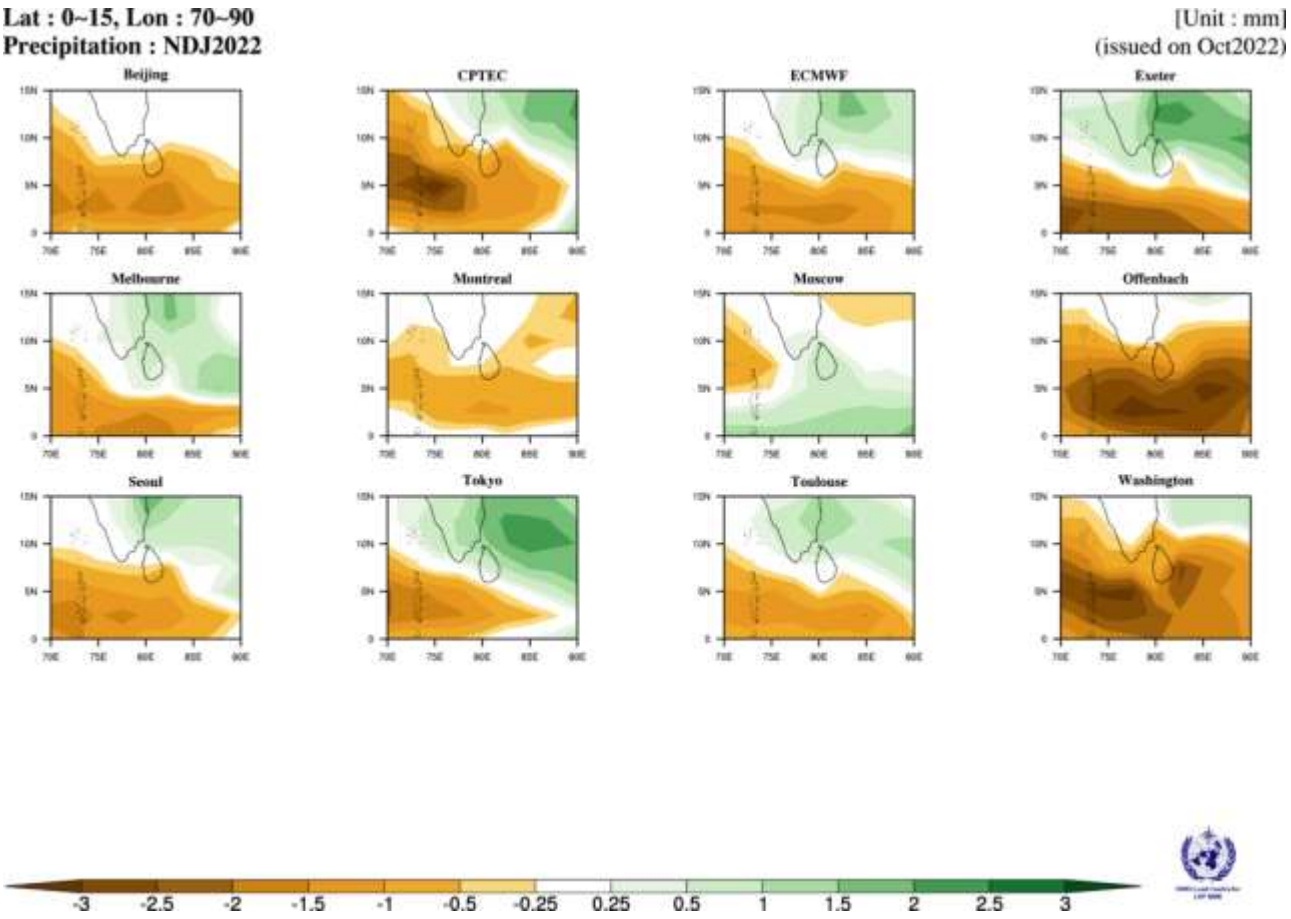

Fig 6: Individual forecasts for NDJ 2022 season by dynamical models from 12 WMO global producing centers (GPC).

2.2 Monthly Forecast for November, December 2022 and January 2023

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 2022 and January 2023. According to that during the month of November and December, it can be expected slightly below normal rainfall over Eastern and Southern parts. There is no clear signal for remaining ares of the country. During the month of January above normal rainfall can be expected over most parts of the country except Southren part where no clear signal indicated. Accordingly above or about or below normal rainfall can be expected in no signal areas.

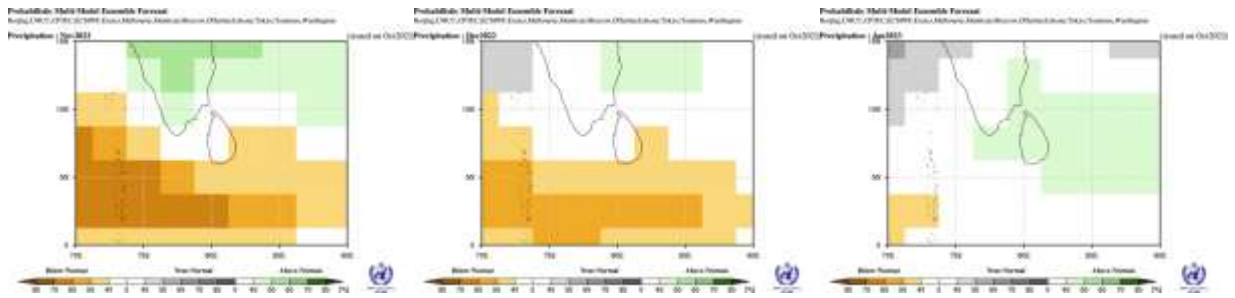

Fig 7: Probabilistic multi model ensemble forecast for November (left), December (middle) and January (right) 2022 using dynamical models from 13 WMO global producing centers (GPC).

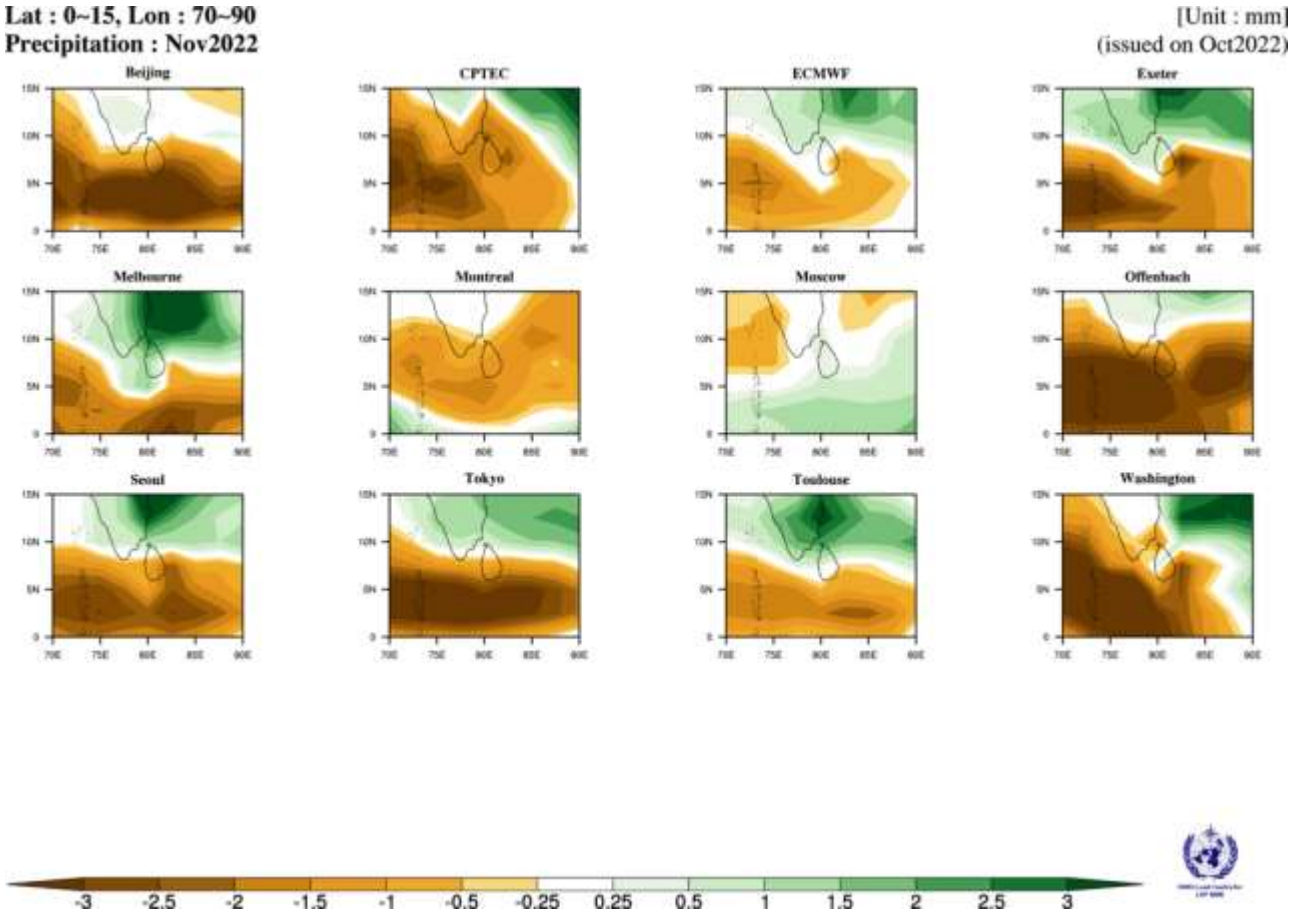

Fig 8: Individual forecast for November 2022 by dynamical models from 12 WMO global producing centers (GPC).

Figure 8 shows the 12 monthly forecasts from individual global producing centers (GPC) for November 2022. Out of 12 GPC forecasts, 3 GPC models predicted below normal rainfall over the country. There is no clear signal indicated in 9 GPC models. Accordingly below, near or above normal rainfalls can be expected over the country during the month of November 2022.

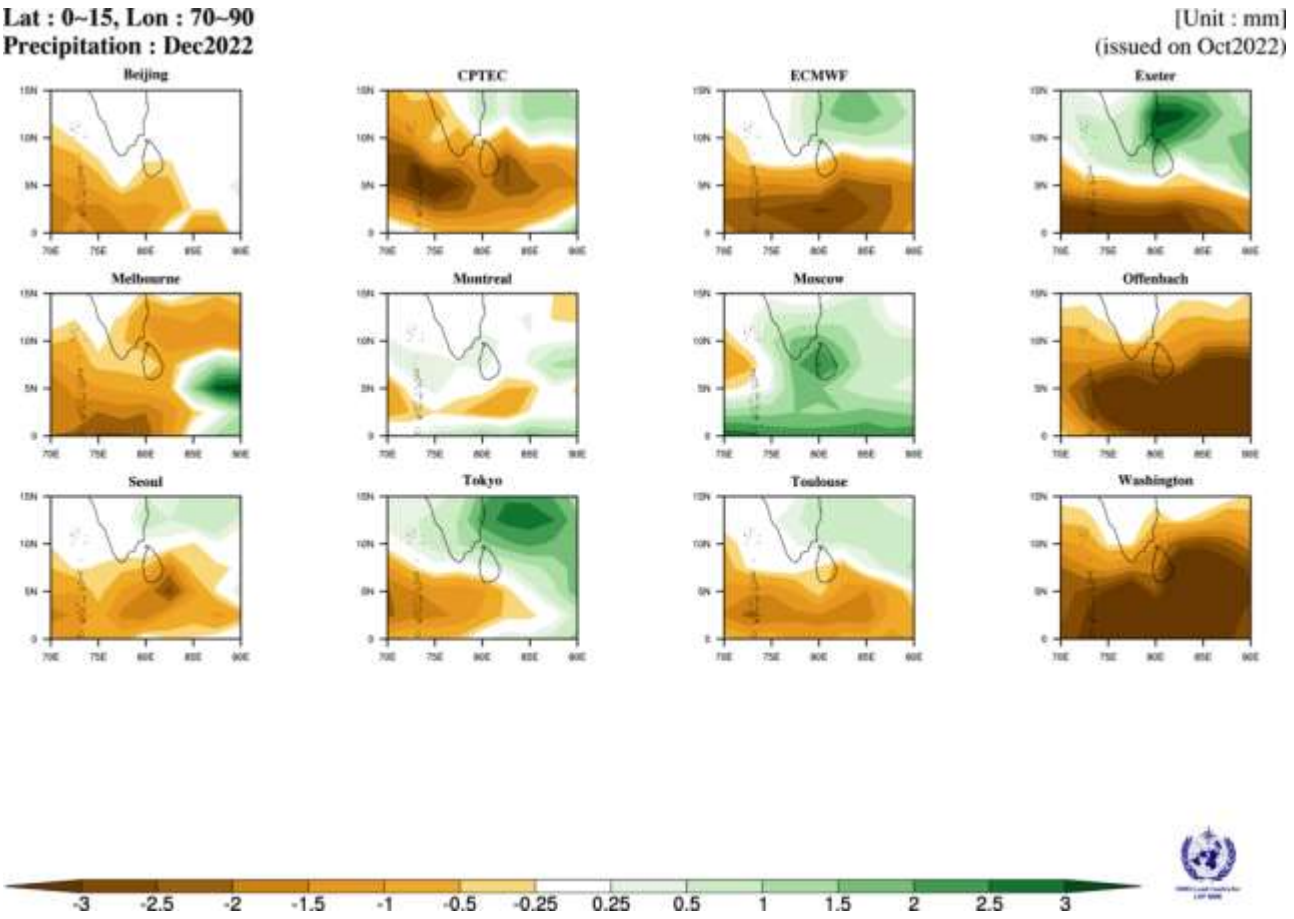

Fig 9: Individual forecast for December 2022 by dynamical models from 12 WMO global producing centers (GPC).

Figure 9 shows the monthly forecasts from individual global producing centers (GPC) for December 2022. Out of 12 GPC forecasts, 4 GPC models predicted below normal rainfall and 1 GPC model predicted above normal rainfall over the country. There is no clear signal indicated in 7 GPC models. Accordingly below or about or above normal rainfall can be expected over the country during the month of December 2022.

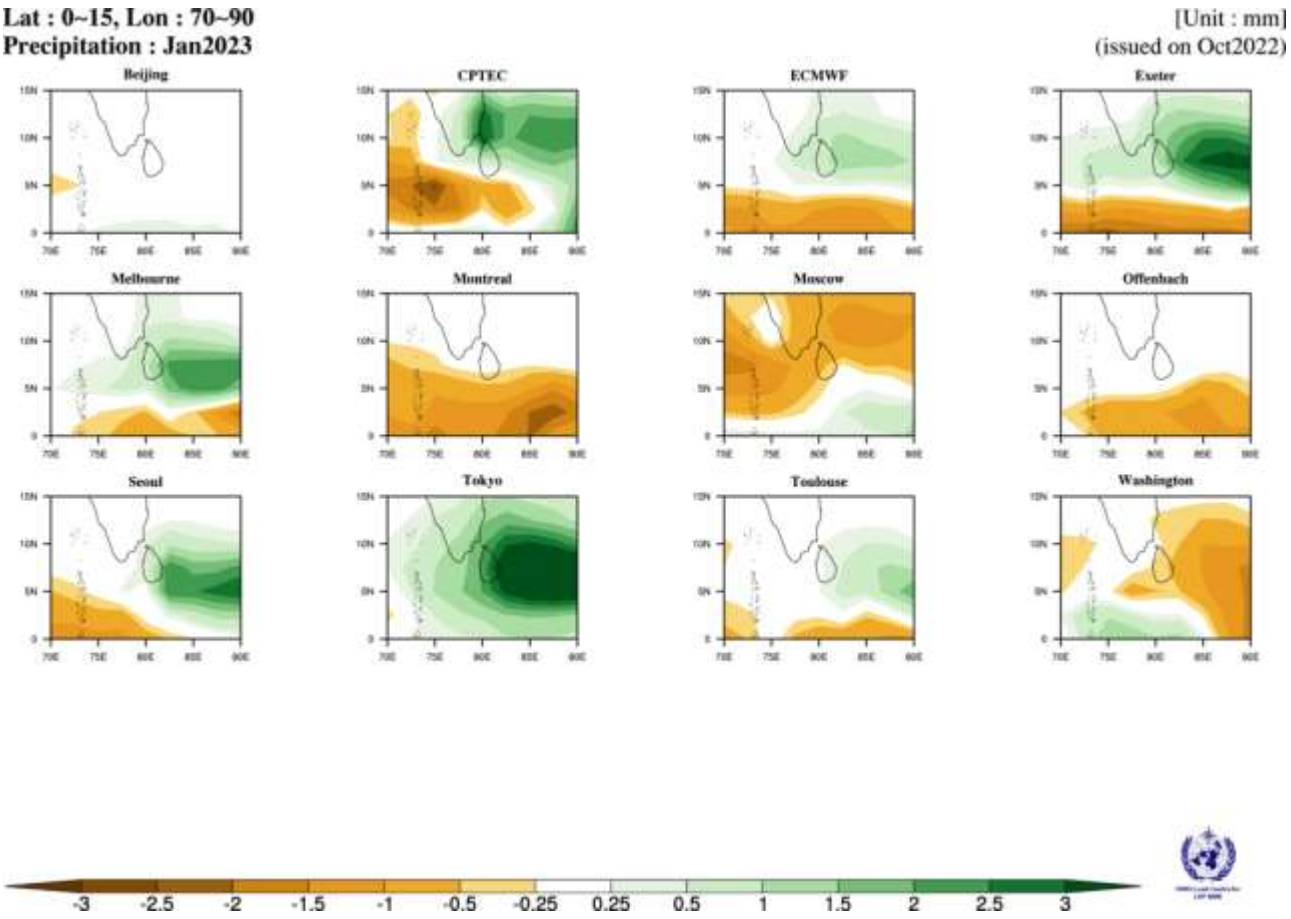

Fig 10: Individual forecast for January 2023 by dynamical models from 12 WMO global producing centers (GPC).

Figure 10 shows the monthly forecasts from 12 individual global producing centers (GPC) for January 2023. Out of 12 GPC forecasts, 05 GPC models indicate slightly above normal rainfall and 1 GPC model indicate below normal rainfall over the country. There is no clear signal indicated in 6 GPC models. Accordingly there is a higher possibility of having below or about or above normal rainfall over the country during the month of January 2023.

3. Statistical downscaling of CFSv2 global forecast output

3.1 Probabilistic rainfall forecast for NDJ season 2022/23 using Climate Predictability tool (CPT)

The following district wise probabilistic rainfall forecasts for the season of NDJ 2022 have been prepared with the multi model ensemble method to downscale, SST data of CFSv2, CCSM4, 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	924.3	30	30	40
Kalutara	1124.8	50	25	25
Galle	1038.8	40	30	30
Matara	900.8	20	20	60
Hambantota	556.1	20	25	55
Ampara	794.8	45	30	25
Batticaloa	873.4	45	25	30
Trincomalee	846.8	35	30	35
Mullaithivu	804.2	25	25	50
Jaffna	809.5	20	25	55
Killinochchi	814.6	20	25	55
Mannar	634.5	20	25	55
Puttalam	590.6	20	20	60
Gampaha	816.7	25	30	45
Kegalle	1043.5	25	30	45
Ratnapura	973.2	15	25	60
Monaragala	780.5	30	30	40
Badulla	954.4	55	25	20
Pollonnaruwa	880.1	45	30	25
Vavuniya	757.2	25	30	45
Anuradapura	699.3	35	30	35
Kurunegala	708.8	30	30	40
Matale	927.2	60	20	20
Kandy	961.0	45	30	25
Nuwaraeliya	871.7	30	30	40

Table 1: Probabilistic Rainfall Forecast for NDJ season 2022/23 using CPT

Fig 11: Probabilistic rainfall forecast for November –January 2022/23 using CPT

According to the CPT (Fig 11 and table 01), above normal rainfalls can be expected in Jaffna, Killinochchi, Mullativu, Mannar, Vavuniya, Puttalam, Gampaha, Kegalle, Rathnapura, Matara and Hambantota districts. Below normal rainfalls can be expected in Kalutara, Matale, Kandy, Badulla, Polonnaruwa, Ampara and Batticaloa districts. There is no clear signal for remaining 7 districts for NDJ season 2022/23. Therefore equal chances exist of receiving below, about or above normal rainfall over those districts for NDJ Season 2022/23.

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.

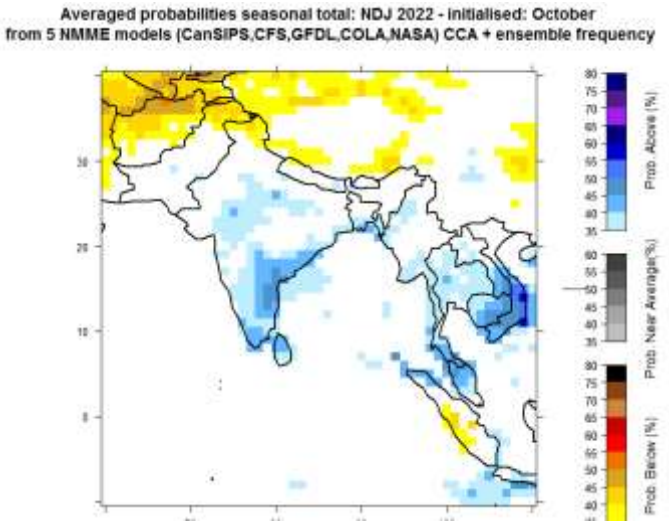

Fig 12. Average probability forecast of NMME models for NDJ 2022/23

According to the Figure 12 above normal rainfalls can be expected in northern parts of the country during the NDJ Season 2022/23

4. SUMMARY :

SUMMARY of MODEL FORECAST for NDJ 2022 season for SRI LANKA					
Season	**WMO LC MME**	**WMO GPC**	**CPT**	**Impact of Global conditions**	**Final Rainfall Forecast**
NDJ season 2022	BN-Eastern and Southern AN-Northern Part No Signal - Elsewhere	No Signal	**AN-** Jaffna, Killinochchi, Mullativu, Mannar, Vavuniya, Puttalam, Gampaha, Kegalle, Rathnapura, Matara and Hambantota BN- Kalutara, Matale, Kandy, Badulla, Polonnaruwa, Ampara and Batticaloa No Signal-Elsewhere		Near or slightly above normal over Northern province and in Trincomalee district and near or slightly below normal over other areas
November 2022	BN-Eastern and Southern No Signal - elsewhere	No Signal	**No Signal**		Near or Slightly above normal over Northern province and in Trincomalee district with the possibility for below normal rainfalls in Batticaloa,Ampara,Hambanthota and Monaragala distrcits. Near or slightly below normal rainfalls are likely elsewhere
December 2022	BN-Eastern and Southern No Signal - elsewhere	No Signal			Near or slightly above over Northern and Northwestern provinces and in Trincomalee and Anuradhapura distrcits. No signal for other areas
January 2022	**AN**	No Signal			Near or slightly above normal over most parts

BN: Below Normal **NN**: Near Normal **AN**: Above Normal **CP**: Climatological Probability

Table 2: Summery of Model Forecasts for NDJ season 2022

4.1 Summery of prevailing global climate conditions

The tropical Pacific atmosphere is consistent with La Niña conditions. Chances of La Niña gradually decrease through the Northern Hemisphere fall and winter, with ENSO-neutral favored beginning in February-April 2023.

Indian Ocean Dipole (IOD) is proceeding negative limits. All NMME models predict the negative IOD condition last through November 2022 and it is likely to decaying afterwards. The latest Indian Ocean Dipole (IOD) index value, for the week ending 23 October 2022, was −0.73 °C.

5. Consensus Seasonal outlook for November, December and January 2022

Considering the prevailing global climate conditions, forecasts from different global climate models and statistical downscaling of GCM output using CPT, consensus forecasts for November 2022 to January2023 are concluded as follows.

5.1 Rainfall forecast for the three months period during November-December-January (NDJ) 2022/23

Near or slightly above normal rainfalls are likely over Northern province and in Trincomalee district and near or slightly below normal rainfalls over remaining areas during NDJ 2022/23 (Fig. 13).

Generally low level atmospheric disturbances or a wavy type disturbances are possible over and vicinity of Sri Lanka during November to January season. If so rainfall can be enhanced.

5.2 Rainfall forecast for November 2022

Near or Slightly above normal rainfalls over Northern province and in Trincomalee district with the possibility for below normal rainfalls in Batticaloa, Ampara, Hambanthota and Monaragala districts. Near or slightly below normal rainfalls are likely elsewhere during the month of November 2022.

However, generally low level atmospheric disturbances are possible over and vicinity of Sri Lanka during the month of November. If so rainfall can be enhanced.

In addition to that, due to the prevailing low level atmospheric disturbance in the vicinity of Sri Lanka rainy condition is expected enhanced over most parts of the country particularly over Northern, North-central, Eastern, Uva and Central provinces during the first week of November 2022.

5.3 Rainfall forecasts for December 2022

There is a possibility for near or slightly above normal rainfall over Northern and Northwestern provinces and in Trincomalee and Anuradhapura districts and there is no signal for other areas, where there are equal probabilities for having below or near or above normal rainfalls during the month of December 2022.

However, generally wavy type disturbances and cyclones are possible over and vicinity of Sri Lanka during the month of December. If so the forecast may be varied.

5.4 Rainfall forecasts for January 2023

Near or slightly above normal rainfalls are likely over most parts during the month of January

2023.

In addition to that, in general, low level atmospheric disturbances or wavy type disturbances are possible over and vicinity of Sri Lanka during the month January. If so rainfall can be enhanced.

**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 phenomina which can't be underestimated.

Fig 13. Consensus Probabilistic rainfall forecast for November–January2022/23

5.5 Probabilistic Temperature Forecast from November to January 2022/23 (NDJ)

The probabilistic Temperature forecast for November, December and January season (NDJ) 2022/23 for Sri Lanka as given below.

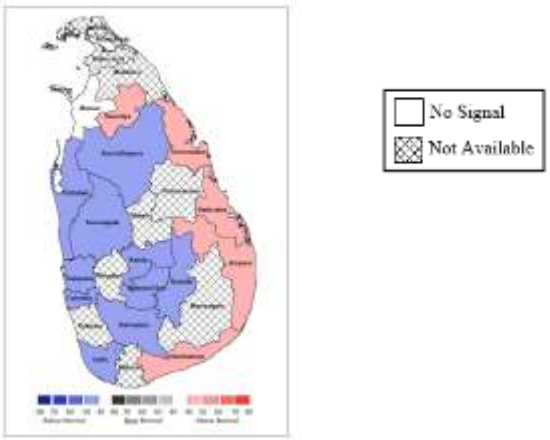

Fig 14: Probabilistic forecast for Maximum Temperatures for NDJ season 2022/23

Fig 14 and Table 3 show the probabilistic forecast for Maximum Temperatures during NDJ season 2022/23.

There is a higher chance of experiencing slightly below the normal Maximum Temperatures in Anuradhapura, Puttalam, Kurunegala, Gampaha, Colombo, Galle, Ratnapura, Kandy, Badulla and Nuwara Eliya districts and above the normal Maximum temperatures in Vavuniya, Trincomalee, Batticaloa, Ampara, and Hambantota districts(Fig 14) for the NDJ season 2022/23.

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	40	30	30
Badulla	25.8	40	30	30
Batticaloa	28.4	30	30	40
Colombo	30.4	45	25	30
Galle	29.0	45	25	30
Hambantota	29.7	25	25	50
Katugastota	29.7	40	30	30
Katunayake	31.4	45	35	20
Mannar	29.0	35	35	30
MahaIlluppallama	29.6	40	30	30
NuwaraEliya	19.7	45	25	30
Pottuvil	29.6	30	30	40
Puttalam	30.3	40	30	30
Ratnapura	32.1	40	30	30
Ratmalana	30.7	40	30	30
Trincomalee	28.3	25	30	45
Vavuniya	29.4	30	30	40
Kurunegala	30.6	40	30	30
Bandarawela	22.8	40	30	30

Table 3: probabilistic forecast for Maximum Temperature for NDJ season 2022/23

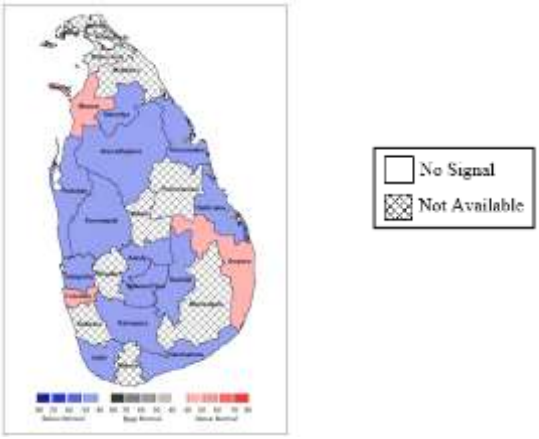

Fig 15: Probabilistic forecast for Minimum Temperatures for NDJ season 2022/23

District	Average Minimum Temperature (^{0}C) – (NDJ)	Probability %		
		Below	Normal	Above
Anuradhapura	21.8	40	30	30
Badulla	18.3	40	30	30
Batticaloa	23.5	40	30	30
Colombo	22.8	30	25	45
Galle	23.1	45	25	30
Hambantota	23.2	40	30	30
Katugastota	19.3	40	30	30
Katunayake	22.3	40	35	25
Mannar	24.1	30	30	40
MahaIlluppallama	21.3	40	30	30
NuwaraEliya	10.6	40	30	30
Pottuvil	22.5	30	30	40
Puttalam	22.0	40	30	30
Ratnapura	22.2	40	30	30
Ratmalana	22.3	25	30	45
Trincomalee	24.2	45	20	35
Vavuniya	21.2	40	30	30
Kurunegala	21.5	40	30	30
Bandarawela	15.0	40	30	30

Table 4: Probabilistic forecast for Minimum Temperatures for NDJ season 2022/23

Fig 15 and Table 4 provide the probabilistic forecast for Minimum Temperatures during NDJ season 2022/23.

Accordingly, there is a higher chance of experiencing slightly below the normal Minimum Temperatures in Vavuniya, Puttalam, Anuradapura, Kurunegala, Gampaha, Galle, Hambantota, Rathnapura, Kandy, Nuwara Eliya, Badulla,Trincomalee and Batticaloa districts and slightly above the normal Minimum Temperatures in Mannar, Ampara and Colombo districts (Fig 15) during NDJ season 2022/23.

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