Weather Synopsis –December 2022.

About or Above normal rainfall was reported at most of the principal meteorological stations except Jaffna, Polonnaruwa, Batticaloa, Potthuvil, Hambantota, Badulla, and Nuwara Eliya, where below normal rainfall was reported for month of December (Fig 8). Further above normal rainy days were reported from most of the principal meteorological stations except Badulla where below above normal rainy days were reported (Fig 10) . Highest cumulative rainfall was 464 mm at Kukuleganga . Highest rainfall received during 24hours, was 270mm at Handapanagala on 22nd December.

High lightning density was reported from Mahaoya, Udubaddawa, Pannala, Divulapitiya, Mahara, Biyagama, Gampaha, Ruwanwella, Attanagalla, Bulathkohupitiya, Kalutara, Dodangoda, Madurawala, Bulathsinhala, and Elpitiya (Fig 1).

Above normal rainfall was reported from most of the hydro catchment stations except Victoria where below above normal rainfall was reported (Fig 9).

Northeast monsoon was established around 19th December with fairly widespread rainfall activity over northeastern, eastern and southeastern parts with isolated very heavy falls exceeding 100mm . Mainly fair weather was reported from 25th to 28th (Table 1).

Table 1 stations received above 100mm rainfall during December 2022		
01st December 2022	KUTTAPITIYA TEA FAC	**107.5**
03rd December 2022	Ilubuluwa Estate	**135.5**
03rd December 2022	**Kukuleganga**	**110.0**
04th December 2022	Bandaragama	**117.0**
04th December 2022	Elston	**113.7**
04th December 2022	**Rathmalana**	**106.1**
08th December 2022	Elephant pass	**180.4**
08th December 2022	WELLIPUNAM	**177.2**
08th December 2022	KILINOCHCHI	**167.9**
08th December 2022	NEDUNKERNI	**136.3**
08th December 2022	**Trincomalee**	**130.0**
08th December 2022	Kuchcheweli	**125.1**
08th December 2022	SL NAVY TCO	**119.8**
08th December 2022	PEDURUTUDUWA	**112.5**
18th December 2022	Handessa	**105.4**

19th December 2022	Kantale Tank	**167.7**
19th December 2022	**Anuradhapura**	**106.6**
19th December 2022	Huruliveva	**103.6**
19th December 2022	Hope	**101.5**
19th December 2022	Mihinthale	**100.5**
21st December 2022	Norochcholai	**100.0**
22nd December 2022	Handapanagala	**270.0**
22nd December 2022	**Monaragala**	**144.8**
23rd December 2022	Tampana	**123.5**
24th December 2022	Passikuda Estate	**132.0**
24th December 2022	Vakanari Wewa	**130.5**
24th December 2022	Batalagoda	**116.5**
24th December 2022	Matale – PWD	**115.0**
24th December 2022	KIRAN	**114.7**
24th December 2022	Wagolla	**107.0**
24th December 2022	**Katugasthota**	**106.5**
25th December 2022	Dodangaslanda	**140.5**
25th December 2022	Undugoda	**113.8**
25th December 2022	Weweltalawa	**110.7**

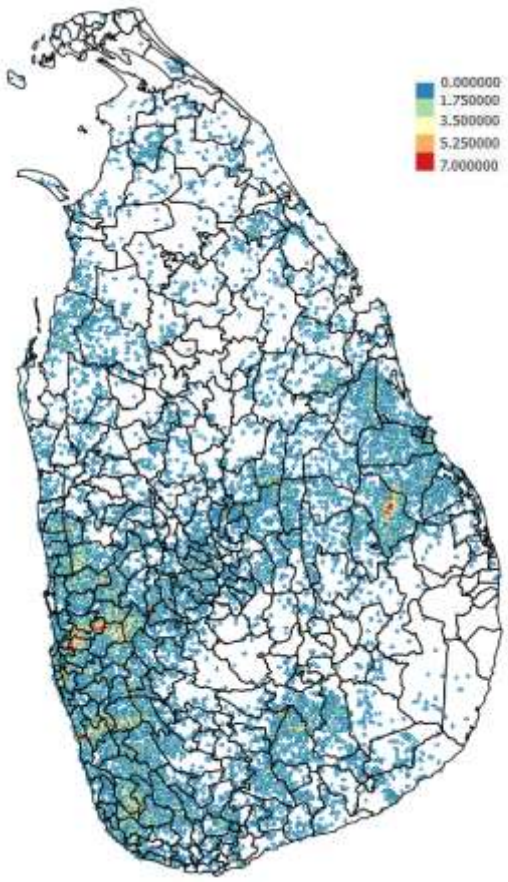

Fig 1: Lightning density map for December 2022

Weather Systems

(1) Cyclonic Storm " Mandous"

A Low Pressure Area developed over south Andaman Sea on 5th December , intensified into a Depression on 06th , then in to a deep depression on 07th morning and intensified into the cyclonic storm "Mandous" over Southwest & adjoining Southeast BoB on 07th evening (Fig 2). The cyclonic storm "Mandous" intensified further into a Severe Cyclonic storm while moving closer to northeast coast causing multiple hazards such as deterioration of air quality over Sri Lanka, very heavy falls over northern parts and strong gusty winds across Sri Lanka on 08th December. Central Dense Overcast of Mandous shielded Sri Lanka from 07th onwards blocking incoming solar radiation for 3 days from 07th (Fig 2) experiencing significantly below normal day temperatures from 07th to 09th and significantly below normal night temperatures from 08th to 09th .

Further regional wind pattern feeding in to the cyclonic storm Mandous transport highly concentrated P.M 2.5 air towards Sri Lanka from 06th December to 09th December increasing air pollution in several cities . This highly concentrated PM 2.5 particles further scattered incoming solar radiation. Strong winds and cold temperatures brought windchills over northern part of the country. Heavy rain together with windchill killed above 1600 livestock northern farms.

According to Disaster Management Centre, 03 deaths and one missing person were reported while 7169 Families, and 25480 people were affected. 6 s were fully damaged , 6608 houses were partly damaged, 53 small and medium enterprises were affected and 41 Critical Infrastructure were damaged following this event.

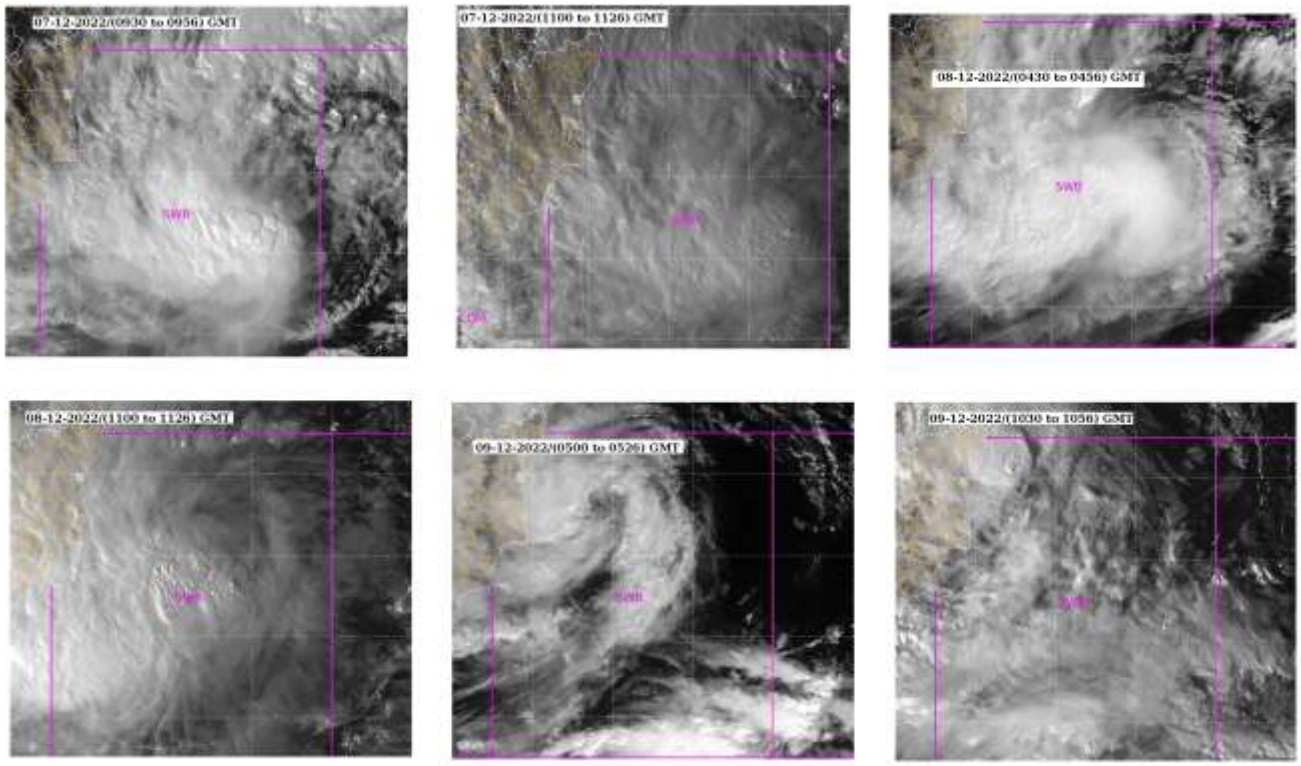

Fig 2: Cloud Images from December 07th to 9th , 2023.

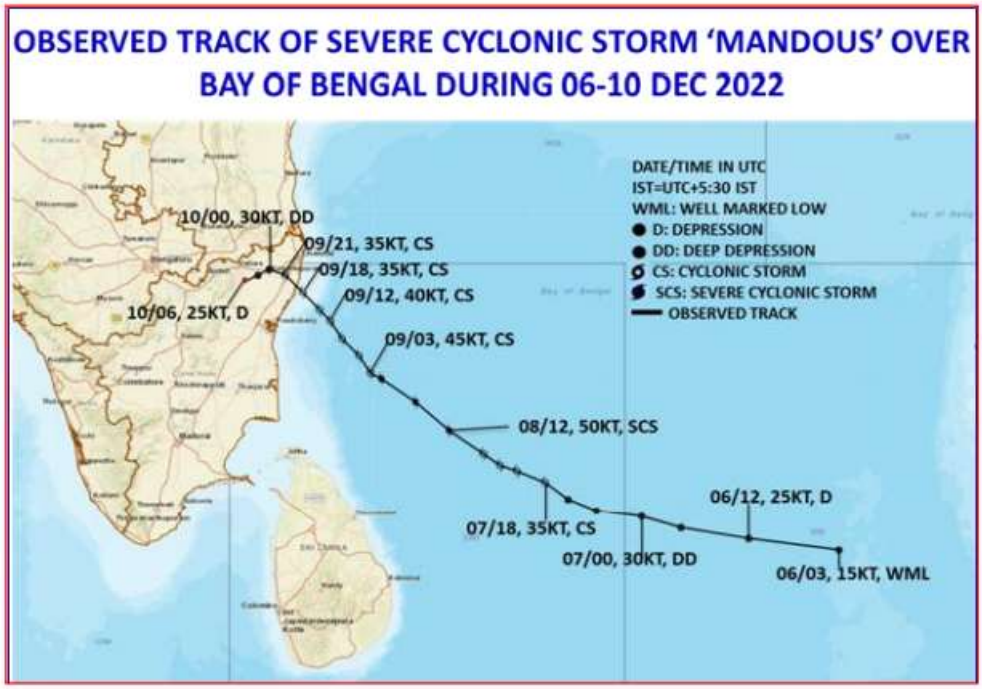

Fig 3: Observed track of the Severe Cyclonic storm "MANDOUS" 2022 (Source: India Meteorological Department).

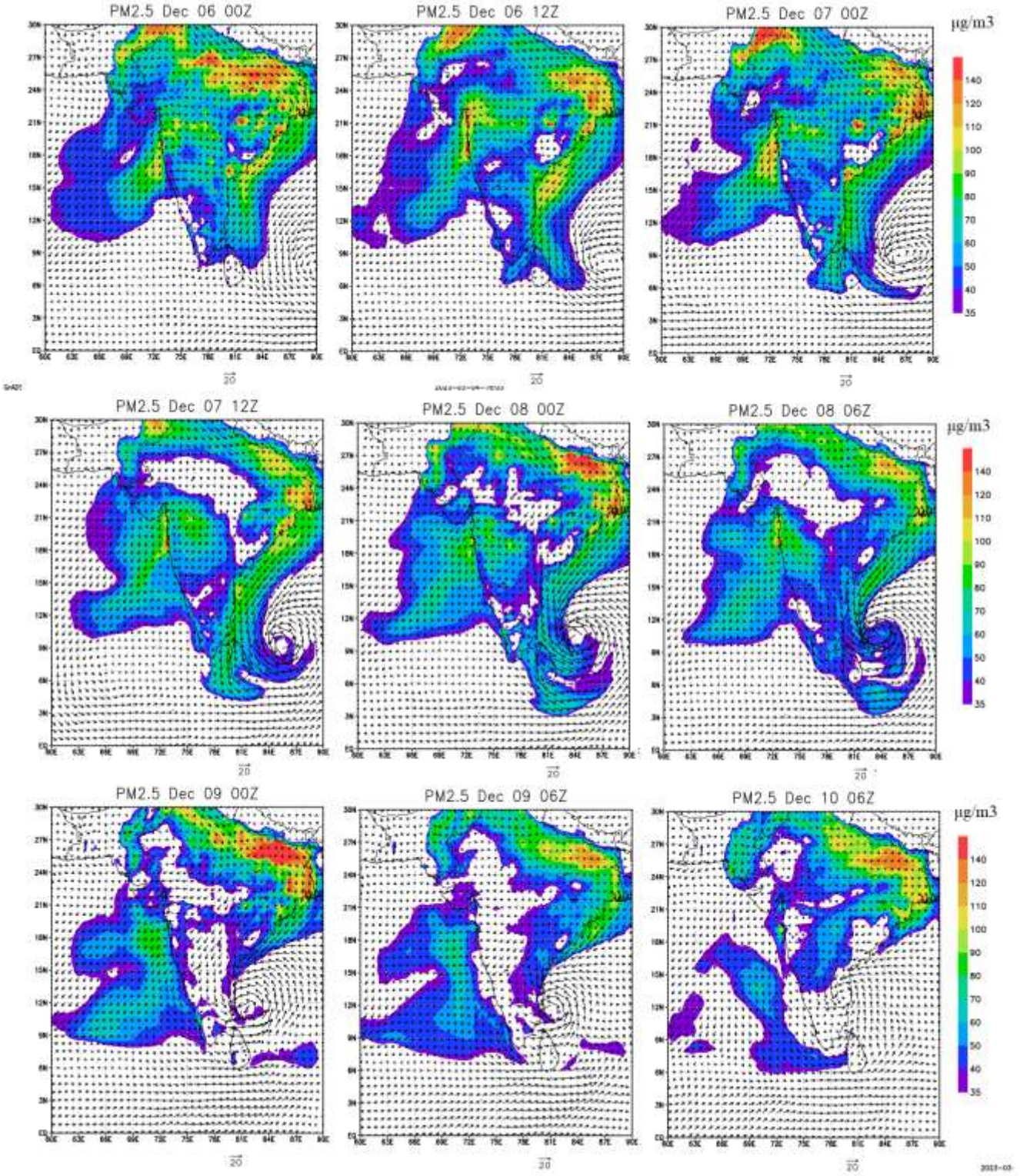

Fig 4 : PM 2.5 concentration at 00z, 06z and 12z from 06th to 10th December 2022 (Data from **Copernicus** Atmosphere Monitoring Service)

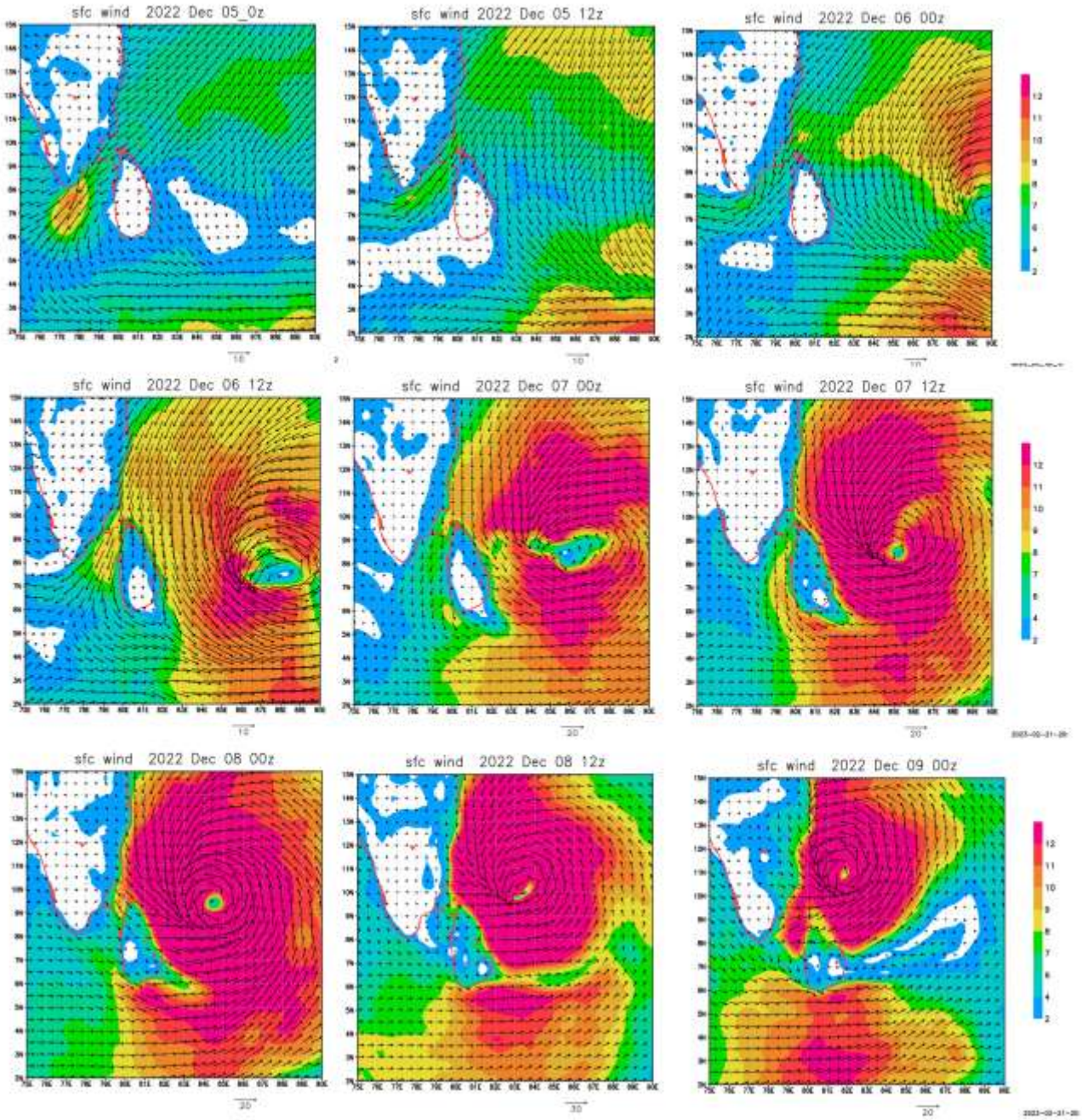

Fig 5 : ERA5 surface wind at 00z and 12z from 05th to 09th December 2022.

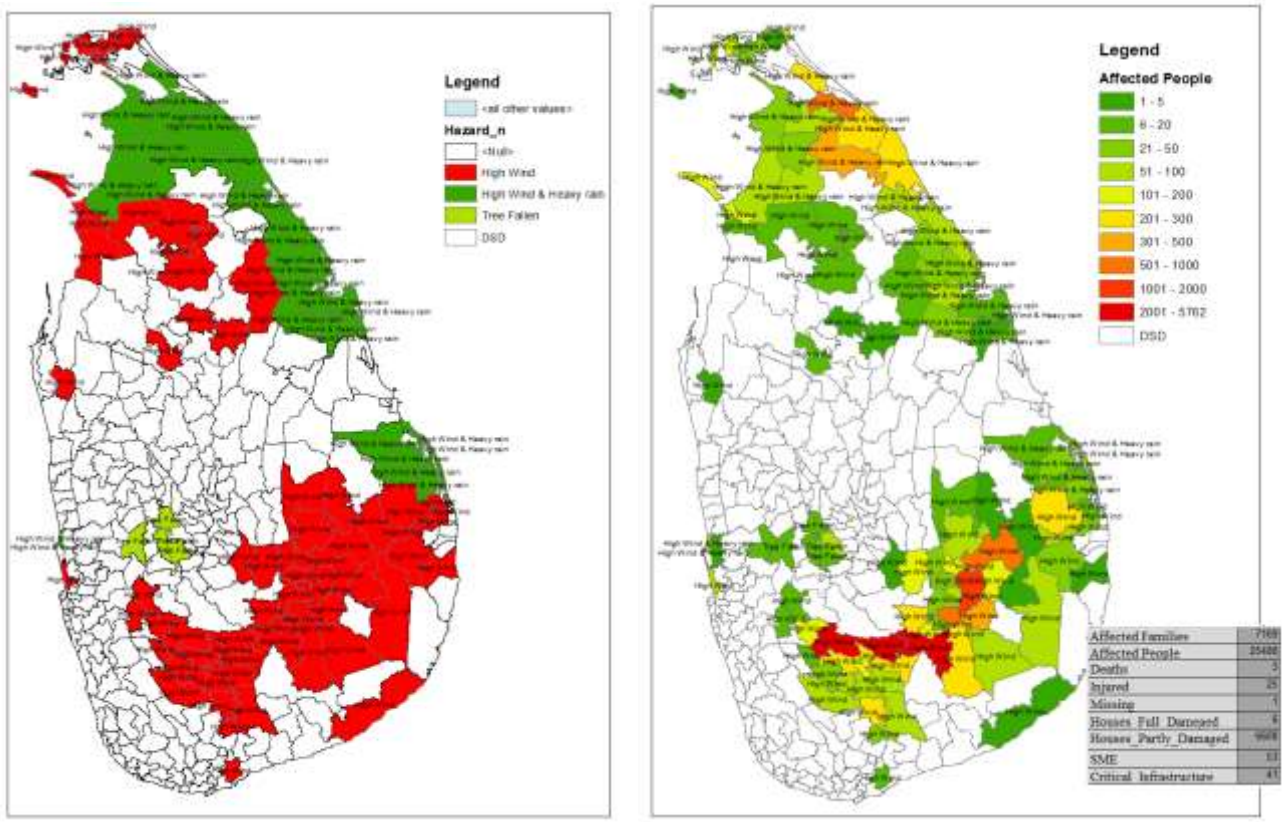

Fig 6 : Hazards caused and Affected people from the severe cyclonic storm "Mandous" 2023

(2) Depression crossed Sri Lanka

A low-pressure area formed over southeast Bay of Bengal and adjoining equatorial Indian Ocean on 14th December afternoon. It persisted over the same region during 15th to 17th December 2022. It moved slowly westwards and lay over central parts of South Bay of Bengal during 18th to 20th December 2022. It became a Well-Marked Low-Pressure area over Southwest Bay of Bengal on 21st December 2022 early morning. The system has intensified into a depression on 22nd December morning over southwest Bay of Bengal near latitude 9.0°N and longitude 85.0°E. The depression maintained its intensity, initially moved northwestwards till mid night of 22nd and then moved slowly and recurved east-northeastwards till 23rd evening, the made a clockwise loop and then moved west-northwestwards till 24th December morning, there after the depression started to recurve slowly west-southwestwards towards Sri Lanka coast. The Depression crossed Sri Lanka coast to the south of Trincomalee near latitude 8.35°N and longitude 81.4°E (Fig 7) on 25th December and thereafter weakened into a well-marked low pressure area over Sri Lanka (Source : IMD, India).

This system brought heavy falls above 100mm in the Eastern, Central and North western provinces on 24th and 25th . Kandy Railway Yard was inundated due to heavy rains and train operations along the upcountry railway line were hampered. According to Disaster Management Centre, 02 deaths were reported while 1936 Families, and 3233 people were affected. 1 house was fully damaged , 365 houses were partly damaged and 09 small and medium enterprises were affected following this event.

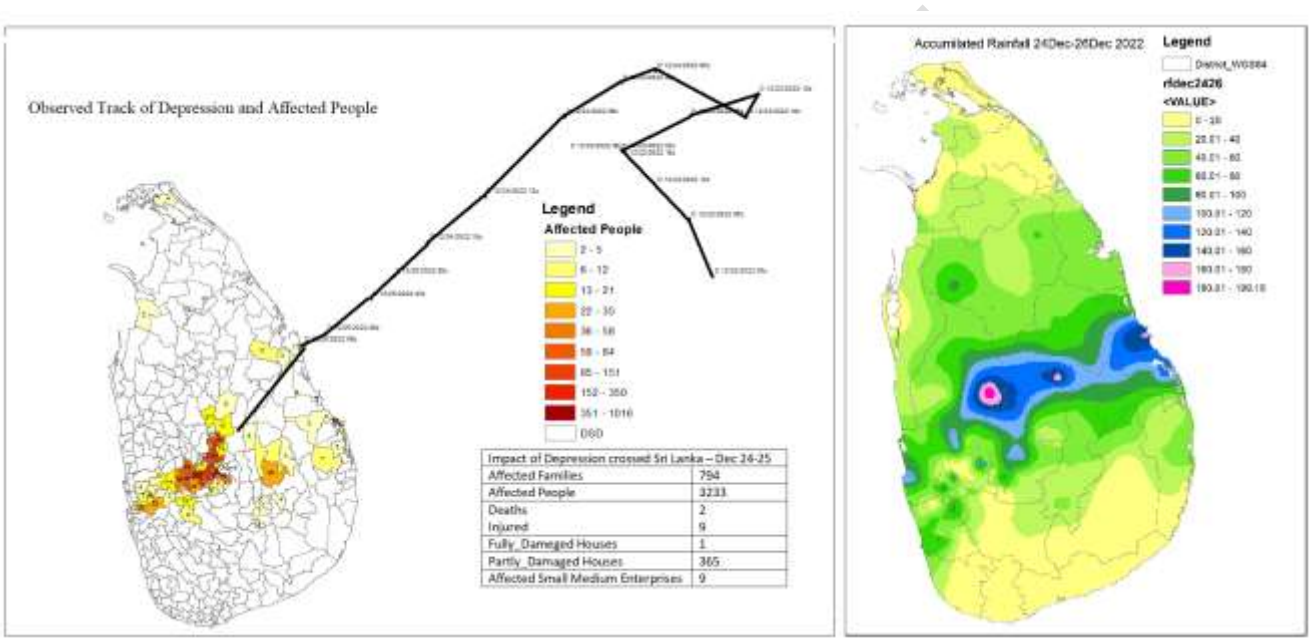

Fig 7 : Affected people from the Depression crossed Sri Lanka 24th to 25th December 2023

The maximum temperatures were mostly above normal except from 07th to 10th when Sri Lanka is covered by intense thick clouds of severe cyclonic storm Mandous blocking incoming solar radiation, from 18th to 19th during the onset of northeast monsoon and from 24th to 25th when depression crossed Sri Lanka (Fig 17). Minimum temperatures over most parts were above normal during the month except from 08th to 10th and from 30th to 31st when below normal night temperatures were experienced over most parts of the island (Fig 18). Exceptionally below normal day temperatures were reported from Katugastota, Kurunegala , Nuwara Eliya, Trincomalee, Batticaloa, Maha Iluppallama, Katunayake, and Vavuniya on 08th ; Maha Iluppallama, and Anuradhapuraya on 09th ; considerably below normal day temperature were experienced from Anuradhapuraya, Rathnapura , Puttalam, and Colombo on 08th ; Katugastota , Kurunegala, Nuwara Eliya , Vavuniya, and Puttlam on 09th ; and Nuwara Eliya , and Rathnapura on 10th .

Exceptionally below normal night temperatures were reported from Trincomalee, Batticaloa, Mannar, and Vavuniya on 09th ; Considerably below normal day temperature were experienced at Trincomalee, Katugastota, Anuradhapuraya, Badulla, Kurunegala, Katunayake, Maha Iluppallama and Rathnapura on 09th ; Trincomalee and Batticaloa on 10th .

La Niña persisted during December, as indicated by well below-average sea surface temperatures (SSTs) extending from the Date Line to the eastern Pacific Ocean . Ocean Nino Index is -0.9, and -0.8 during October-November-December; and November-December-January (NOAA Climate prediction Center). Neutral IOD was observed during December 2022 (BoM, Australia). Cooler Sea surface waters can be seen over sea areas surrounding Sri Lanka coast(Fig. 12)

Two shearlines were appeared with ITCZ in between them. The average position of the shear line in north Indian Ocean was laid between Equator 03^0N50^0E, $04^0N\ 60^0E$, 05^0N70^0E , 06^0N80^0E, 02^0N100^0E and 01^0N120^0E while the average position of the shear line in south Indian Ocean was laid between 10^0S60^0E, 10^0S80^0E , 11^0S80^0E, 10^0S100^0E, and 15^0S120^0E. The average position of the Inter-Tropical Convergence zone (ITCZ) was laid between 05^0S50^0E, 05^0S80^0E, 07^0S100^0E and 06^0S120^0E (Fig 11).

Madden-Julian Oscillation (MJO) was weak till 06th , became strong at the 3 on 07th , propagate to phase 4 from 08th to 11th , weaken again from 12th to 20th . MJO became strong again at phase 4 on 21st , propagated to phase 5 from 23rd to 28th , and entered to phase 6 from 29th to 31st (Fig.13).

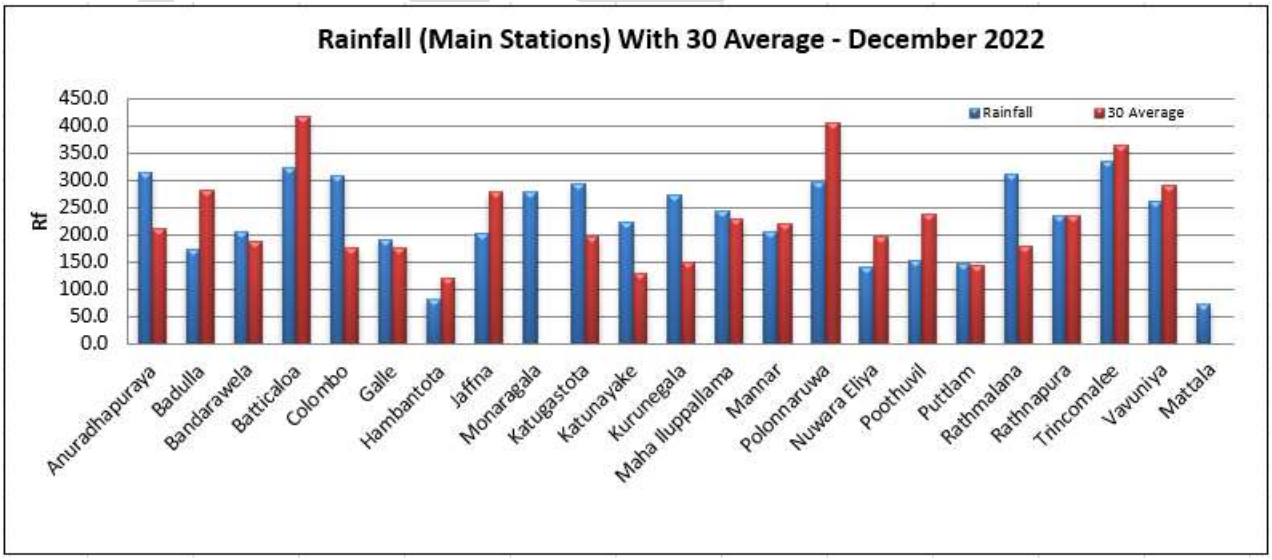

Fig 8: Monthly Total Rainfall (mm) with 30 year average (1961-1990) at Main Meteorological stations areas during December 2022

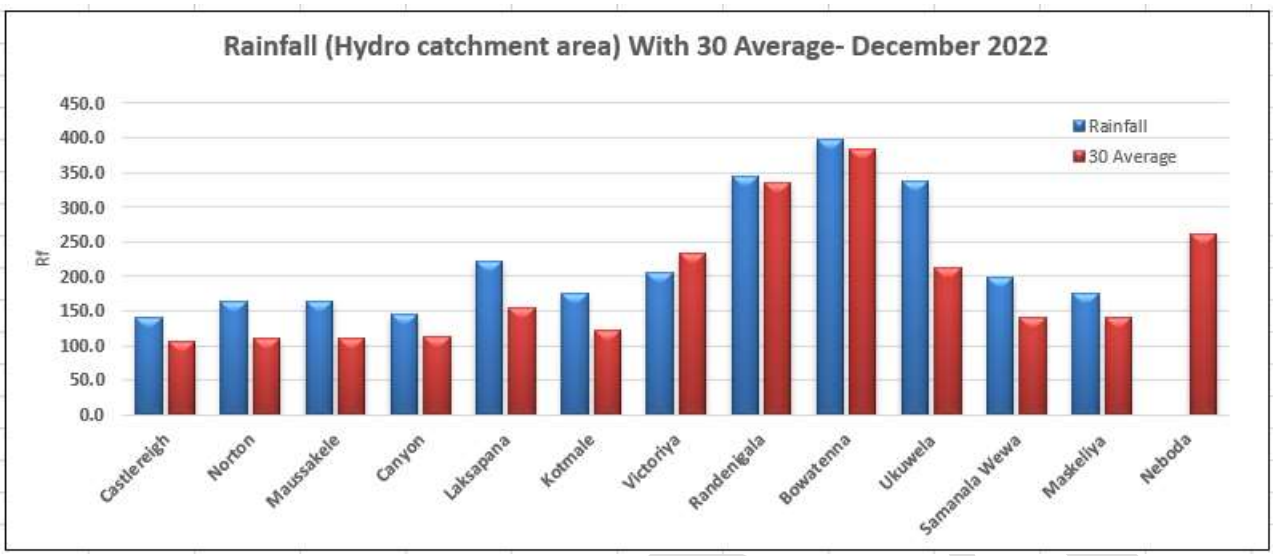

Fig 9: Monthly Total Rainfall (mm) with 30 year average (1961-1990) at Hydro catchment areas during December 2022

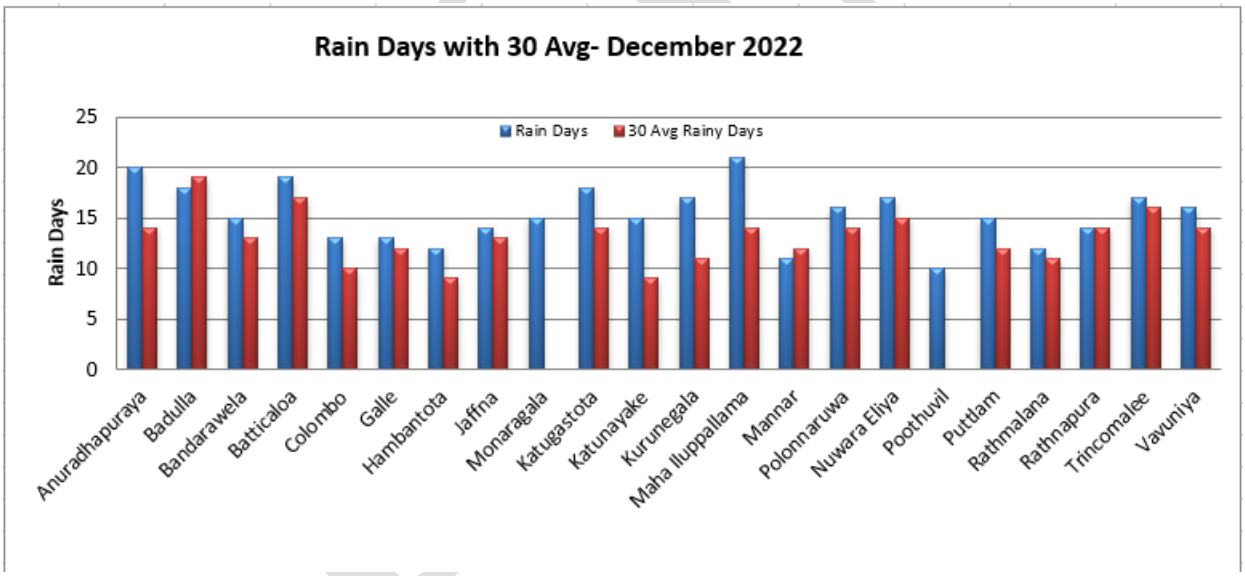

Fig 10: monthly total number of rainy days with 30 year average (1961-1990) at main Meteorological stations during December 2022

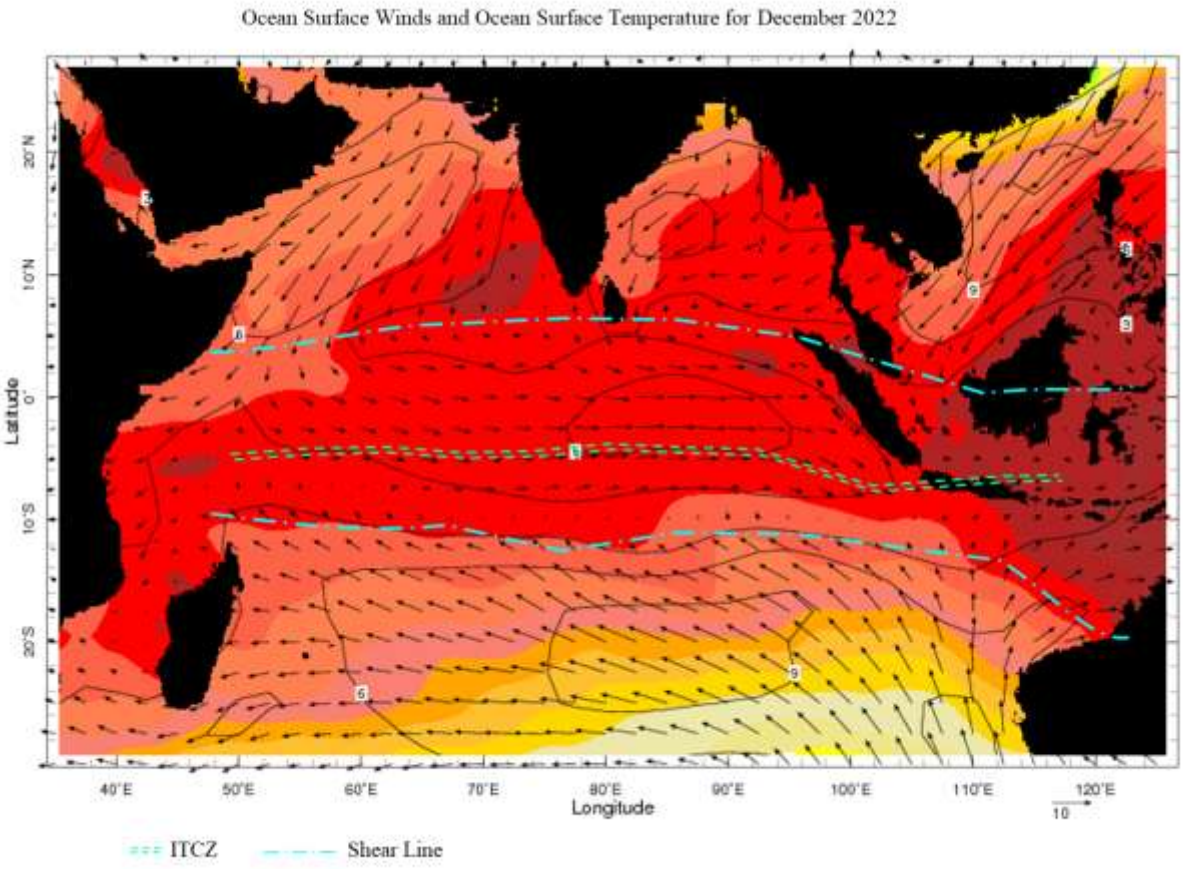

Fig 11: Ocean Surface Winds and Ocean Surface Temperature for December 2022

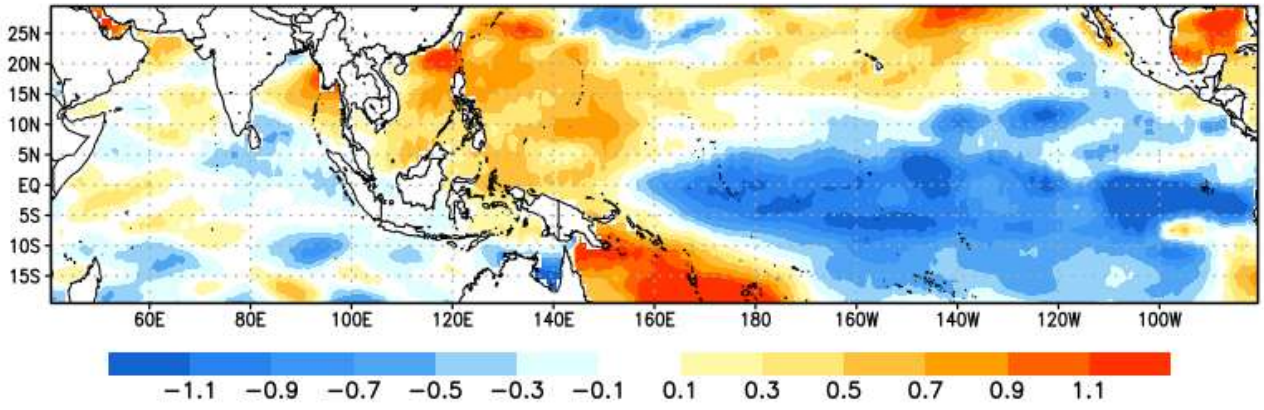

Fig 12: Sea Surface Temperature anomalies for December 2022

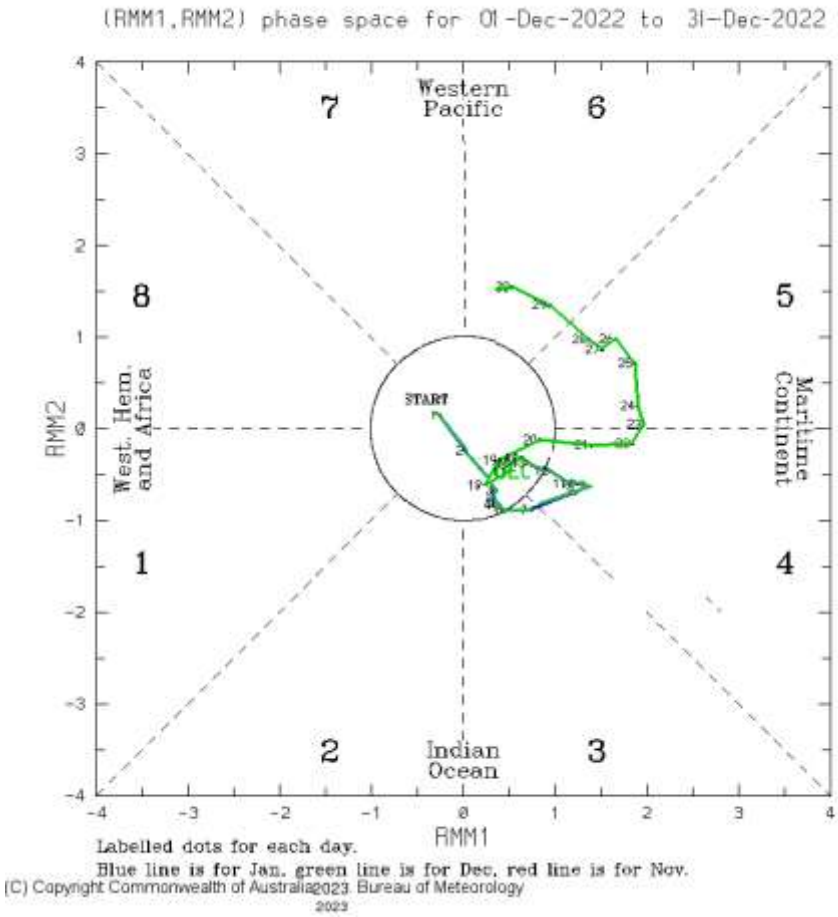

Fig 13: Phase diagram of MJO Index

Surface pressure and winds: The surface pressure was below average except on 05th and from 27th to 31st when it was about or above average. Pressure gradient was mild on 07th , on 10th , on 11th , and from 23rd to 25th . Pressure gradient was moderate on 08th and steep on 09th . Pressure distribution was even or fairly even during remaining days of December . The surface wind was Northeasterly in direction during most of month of December. Strong winds about 25 knots were reported on o8th and 09th due to the influence of Severe Cyclonic storm Mandous.

Upper winds:

At 850hPa, Northeasterly wind flow is dominated over the island. Anomalous westerly flow appeared across Sri Lanka at 850mb level indicate the weaking of north monsoon flow (Fig 14).

At 700 hPa, Northeasterly wind flow is dominated over the island. Anomalous east-west oriented trough is appeared across Sri Lanka (Fig 15).

At 500 hPa, Northeasterly wind flow is dominated over the island. Anomalous northerly flow appeared across Sri Lanka at 500mb level (Fig 16).

The 200 hpa the upper tropospheric ridge was laid from 05^0N40^0E, EQ70^0E, 09^0N80^0E, and 14^0N120^0E

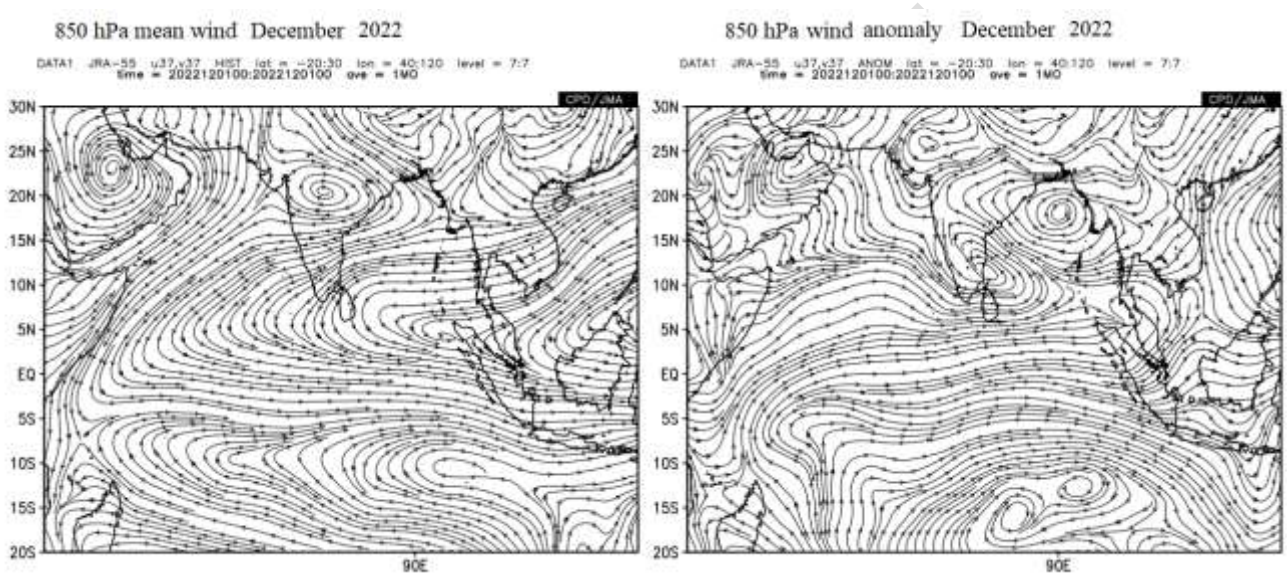

Fig. 14: Monthly average wind pattern at 850hpa level during the month of December 2022 (JRA55)

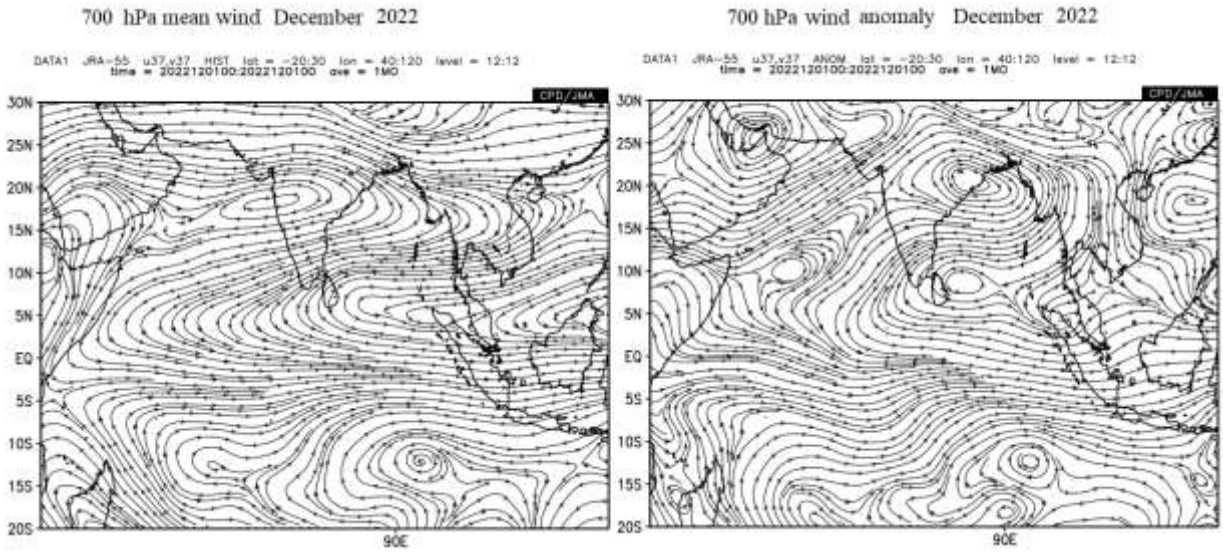

Fig. 15: Monthly average wind pattern at 700hpa level during the month of December 2022 (JRA55)

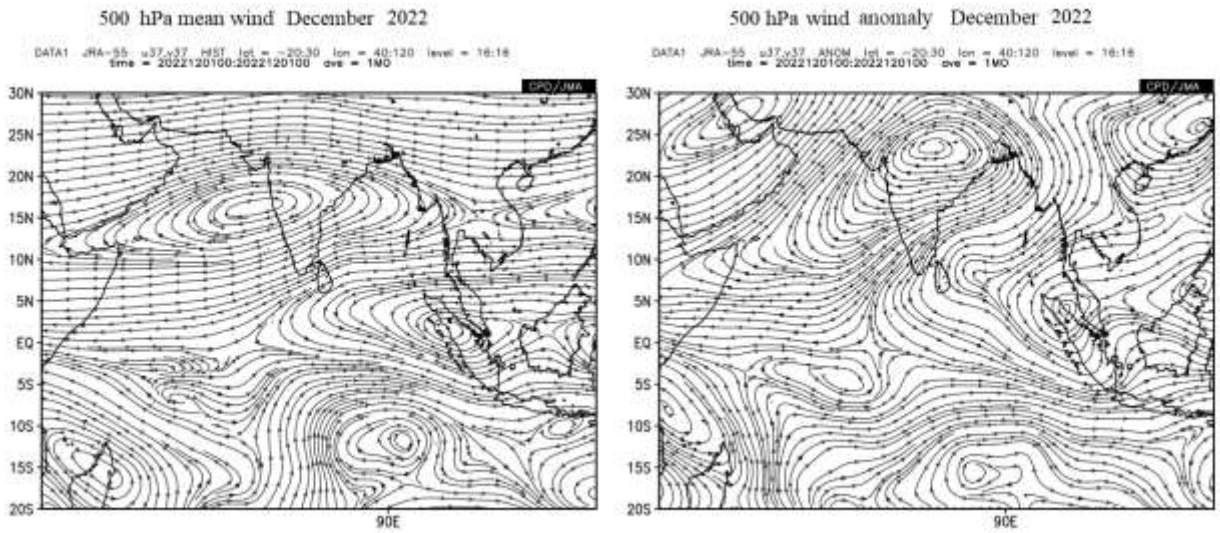

Fig. 16: Monthly average wind pattern at 500hpa level during the month of December 2022 (JRA55)

Temperature Field:

The maximum temperatures were mostly above normal except from 07th to 10th when Sri Lanka is covered by intense thick clouds of severe cyclonic storm Mandous blocking incoming solar radiation, from 18th to 19th during the onset of northeast monsoon and from 24th to 25th when depression crossed Sri Lanka (Fig 17). Highest recorded maximum temperature for the month of December 2022 was 34.1^{0}C at Ratnapura on 27th and 30th (Table 4a).

(Fig 11). Minimum temperatures over most parts were above normal during the month except from 08th to 10th ; and from 30th to 31st when below normal night temperatures were experienced over most parts of the island (Fig 18). Lowest recorded minimum temperature was 5.4^{0}C at Nuwara Eliya on 30th (Table 4b).

Maximum and Minimum departures from normal day/night temperature were shown in table 4.

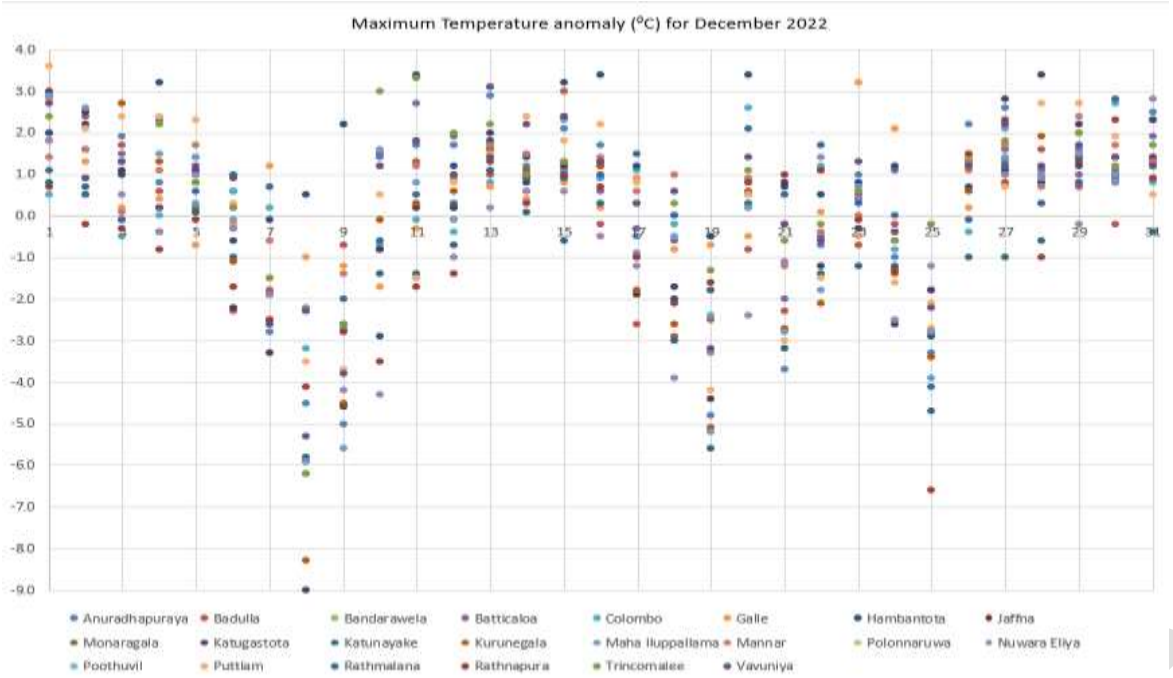

Fig 17: Maximum Temperature anomaly (^{0}C) for December 2022

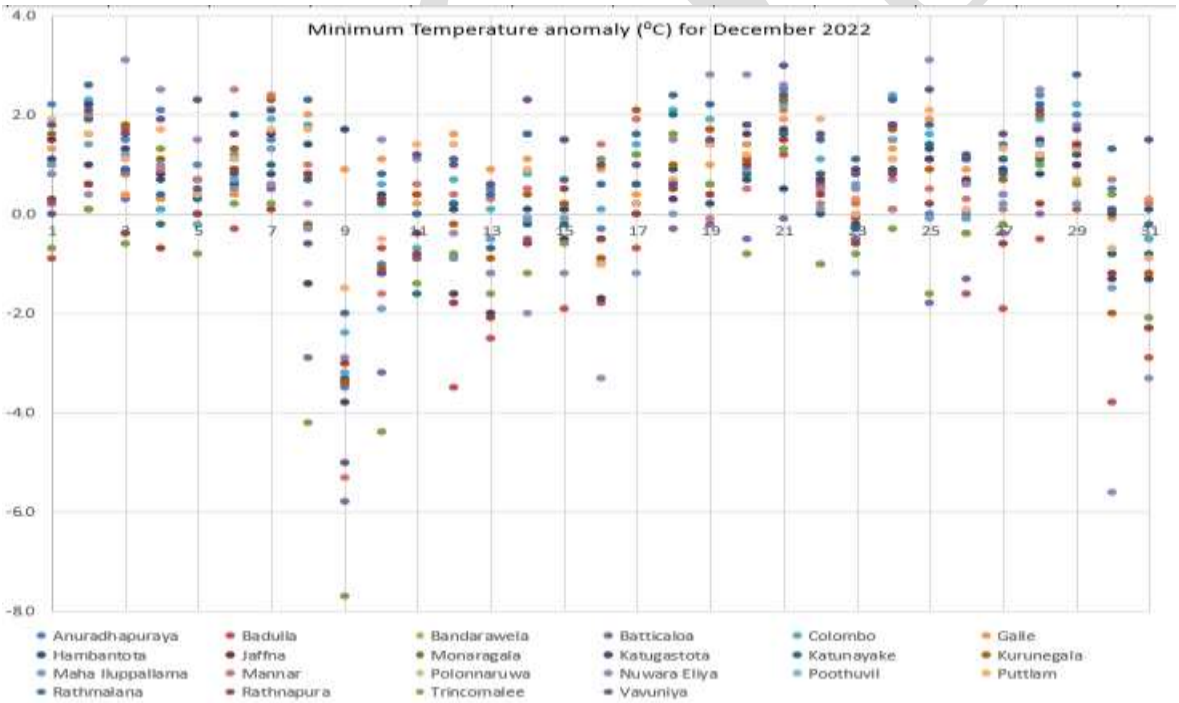

Fig 18: Minimum Temperature anomaly (^{0}C) for December 2022

About or Above normal rainfall was reported at most of the principal meteorological stations except Jaffna, Polonnaruwa, Batticaloa, Potthuvil, Hambantota, Badulla, and Nuwara Eliya, where below normal rainfall was reported for month of December (Fig 8). Maximum percentage was reported from Kurunegala (183.4%) while minimum from Badulla station (61.5%) (Table 3). Further above normal rainy days were reported from most of the principal meteorological stations except Badulla where below above normal rainy days were reported (Fig 10) . Highest cumulative rainfall was 464 mm at Kukuleganga . Highest rainfall received during 24hours, was 270mm at Handapanagala on 22nd December.

Above normal rainfall was reported from most of the hydro catchment stations except Victoria where below above normal rainfall was reported (Fig 9).

The monthly total rainfall and the number of rain days at the principal meteorological stations, total rainfall at hydro catchment areas, are shown in tables 2 and 3.

Table-01-Monthly Total Rainfall (mm) with 30 years (1961-1990) of their averages at Hydro catchment areas

Hydro Catchment	Dec 2022	Average	% (percentage of average)
Castlereigh	139.6	105.9	131.8%
Norton	162.7	110.0	147.9%
Maussakele	163.9	110.2	148.7%
Canyon	145.0	113.1	128.2%
Laksapana	221.9	154.5	143.7%
Kotmale	174.6	121.5	143.8%
Victoriya	204.2	233.8	87.3%
Randenigala	344.4	335.9	102.5%
Bowatenna	396.9	383.8	103.4%
Ukuwela	337.2	212.9	158.4%
Samanala Wewa	197.5	140.2	140.9%
Maskeliya	174.7	140.4	124.4%
Neboda		261.8	

Note that the meteorological day in this text is reckoned as the 24hr period from 08.30hrs to 08.30hrs following day

Table-03- The monthly total rainfall and the number of rain days at the principal meteorological stations recorded in the month against the respective averages (1961-1990).

Meteorological station	Monthly Total rainfall(mm)			Monthly Total No of rainy Days		
	2023-Dec	Average	%	2023-Dec	Average	%
Anuradhapuraya	313.8	210.9	148.8%	20	14	142.9%
Badulla	173.1	281.5	61.5%	18	19	94.7%
Bandarawela	206.4	186.2	110.8%	15	13	115.4%
Batticaloa	323.5	418.5	77.3%	19	17	111.8%
Colombo	309.6	175.3	176.6%	13	10	130.0%
Galle	190.4	176.9	107.6%	13	12	108.3%
Hambantota	81.4	121.1	67.2%	12	9	133.3%
Jaffna	201.8	278.2	72.5%	14	13	107.7%
Monaragala	278.1			15		
Katugastota	292.2	195.7	149.3%	18	14	128.6%
Katunayake	223.1	129.7	172.0%	15	9	166.7%
Kurunegala	273.2	149.0	183.4%	17	11	154.5%
Maha Iluppallama	243.9	230.0	106.1%	21	14	150.0%
Mannar	205.2	221.2	92.8%	11	12	91.7%
Polonnaruwa	297.9	404.2	73.7%	16	14	114.3%
Nuwara Eliya	141.4	196.0	72.2%	17	15	113.3%
Poothuvil	152.3	237.1	64.2%	10	na	#VALUE!
Puttlam	146.6	142.7	102.8%	15	12	125.0%
Rathmalana	312.4	177.8	175.7%	12	11	109.1%
Rathnapura	234.9	235.3	99.8%	14	14	100.0%
Trincomalee	334.1	364.5	91.7%	17	16	106.3%
Vavuniya	261.3	289.6	90.2%	16	14	114.3%
Mattala	71.8			14		

Table 4(a) - Extremes of Maximum Temperatures December 2022				
	Maximum			Highest Std.Div
		Offsets		
	Value	(-)	(+)	
Value	34.1^{0}C	-9.0	3.6	2.67
Station	Ratnapura	Katugastota	Puttalum	Katugastota
Date	27/12, 30/12	08/12	01/12	

Table 4(b) -Extremes of Minimum Temperature December 2022				
	Minimum			Highest Std.Div
		Offsets		
	Value	(-)	(+)	
Value	5.4^{0}C	5.8	3.1	2.02
Station	NuwaraEliya	Batticoloa	NuwaraEliya	NuwaraEliya & Mullaitiv
Date	30/12	09/12	03/12 & 25/12	

Prepared by National Meteorological Centre (NMC)
Department of Meteorology