Weather Synopsis –September 2021.

Above normal rainfall was reported at the principal meteorological stations except stations located along north western, western and southwestern coast such as Colombo Katunayake Puttlam Rathmalana and Galle as well as in MahaIluppallama, Jaffna, NuwaraEliya, Badulla and Batticaloa (Fig 3). Number of rainy days was above normal over most of the principal meteorological stations except MahaIluppallama and Puttalum where nearly 80% of rainy days were reported.

Hydro catchment stations located along western slopes of the central hills such as Castlereigh Norton Maussakele Canyon Laksapana and Kotmale reported above normal rainfall. However most of the hydro catchment stations located along eastern slopes of the central hills such as Victoria, Randenigala, Bowatenna Ukuwela and Samanalawewa reported below normal rainfall.

Highest cumulative rainfall was **942.4**mm at Wewelthalawa . Highest rainfall received during 24hours, was 210.2 mm at Wewelthalawa on 24th September.

Showers were reported from southwest quarter during first week of the month. Afternoon thunderstorms occurred at North Eastern and Eastern parts of the country on 18th , 19th , 21st and 22nd. A deep low level trough enhanced showery conditions over most parts of the island on 24th September. With the formation of low-pressure area subsequent cyclonic storm "Gulab" in the northwest Bay of Bengal (Figs 1and 2)) southwest monsoon flow strengthens across Sri Lanka from 25th to 27th bringing very heavy falls exceeding 150 in Kegalle district. According to Disaster Management Centre, 734 people were affected by the strong winds and heavy rain from 24 to 27th September.

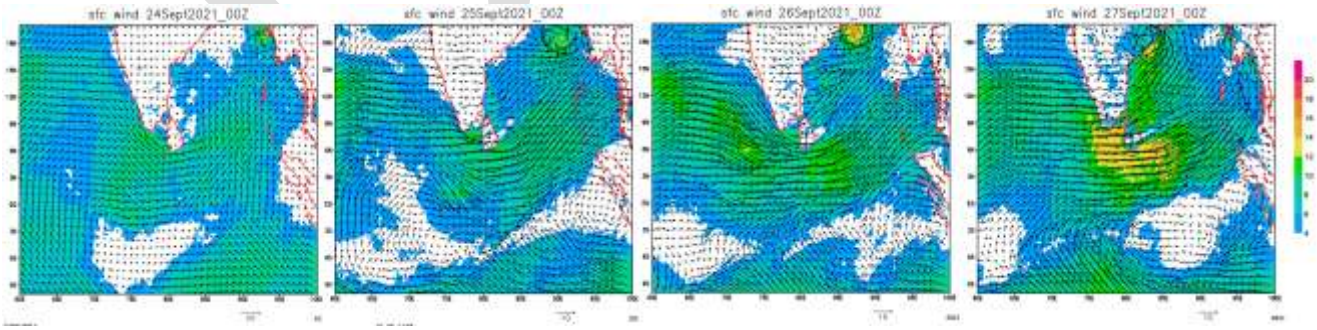

Fig 1: ECMWF 10m wind from 00z 24th to 27th September 2021.

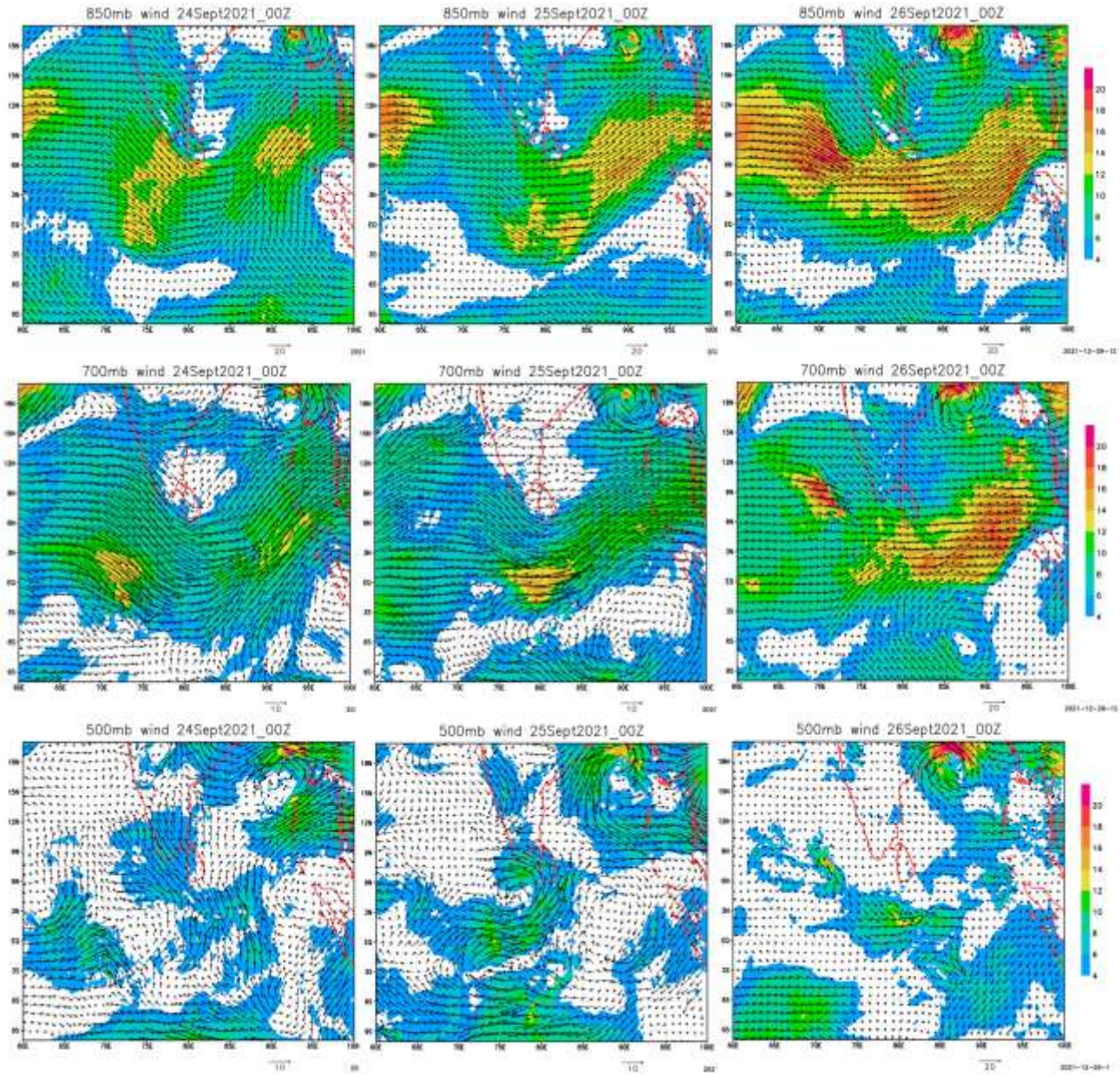

Fig 2: ECMWF 850 mb wind , 700 mb wind and 500 mb wind from 00z 24th to 27th September 2021.

Generally above normal maximum temperatures and minimum temperatures were reported from majority of stations. However below normal night temperatures were reported from Badulla during most of the days. Reported maximum temperature was 38.2^{0}C at Polonnaruwa on 17th and reported minimum temperature was 10.6^{0}C at NuwaraEliya on 10th.

Borderline La Nina conditions were observed during Month of September 2021. Ocean Nino Index was -.5 during July August and September and 0.7 during August, September and October (NOAA

Climate prediction Center). IOD neutral condition was observed during September2021 (BoM, Australia). Sea surface waters in Bay of Bengal were warmer than average. Slightly warmer sea surface waters were apparent over west of Sri Lanka (Fig. 7)

The average position of the shear line was laid about Equator from 40^0E to50^0E, about 01^0S from 50^0E to100^0E, and laid about Equator from 100^0E to 120^0E, (Fig 6).). It was fluctuated about 02-03 ^{0} northand south of average position.

Madden-Julian Oscillation (MJO) was weak during first week of September, became strong at phase 3 during 2nd and 3rd weeks, weaken again from 23rd to 25th and re-strengthen at the phase 4 from 26th to 30th September (Fig.8).

Weather Systems

A low pressure area formed over eastcentral and adjoining northeast Bay of Bengal (BoB) in the early morning of 11th September, 2021. Under the favourable environmental and oceanic conditions, it concentrated into a depression over northwest BoB and adjoining Odisha coast in the evening of 12th. Moving west-northwestwards, it intensified into a deep depression over northwest BoB very close to Odisha coast in the early morning of 13th and crossed north Odisha coast, between 0530 & 0630 am as a deep depression (Source : India Meteorological Department) .

A low pressure area formed over east-central Bay of Bengal (BoB) and neighbourhood in the morning of 24th September. Under favourable environmental and Sea conditions, it concentrated into a depression over eastcentral and adjoining northeast BoB in the same evening of 24th September. Moving west-northwestwards, it further intensified into a deep depression in the early morning of 25th September and intensified into the Cyclonic Storm “GULAB” in the same evening of 25th September, 2021. It crossed North Andhra Pradesh and adjoining south Odisha coasts near Lat. 18.4°N/ Long. 84.2°E between 1930 to 2030 hours of 26th September. Thereafter, it weakened into a deep depression in the early hours of 27th September and further weakened into a well marked Low pressure area over western parts of Vidarbha and neighbourhood around noon of 28th September. The remnant of cyclonic storm Gulab emerged as a well marked low pressure area into south Gujarat region in the morning of 29th September. Under favourable environmental and sea conditions, it concentrated into a depression over northeast Arabian Sea & adjoining Kutch, in the morning of30th September. Moving

west-northwestwards, it further intensified into a deep depression over the same region in the midnight of 30th September. Thereafter it moved westwards and intensified into cyclonic storm "Shaheen" over the northeast Arabian Sea off Gujarat coast in the morning of 1st October, 2021 (Source : India Meteorological Department) .

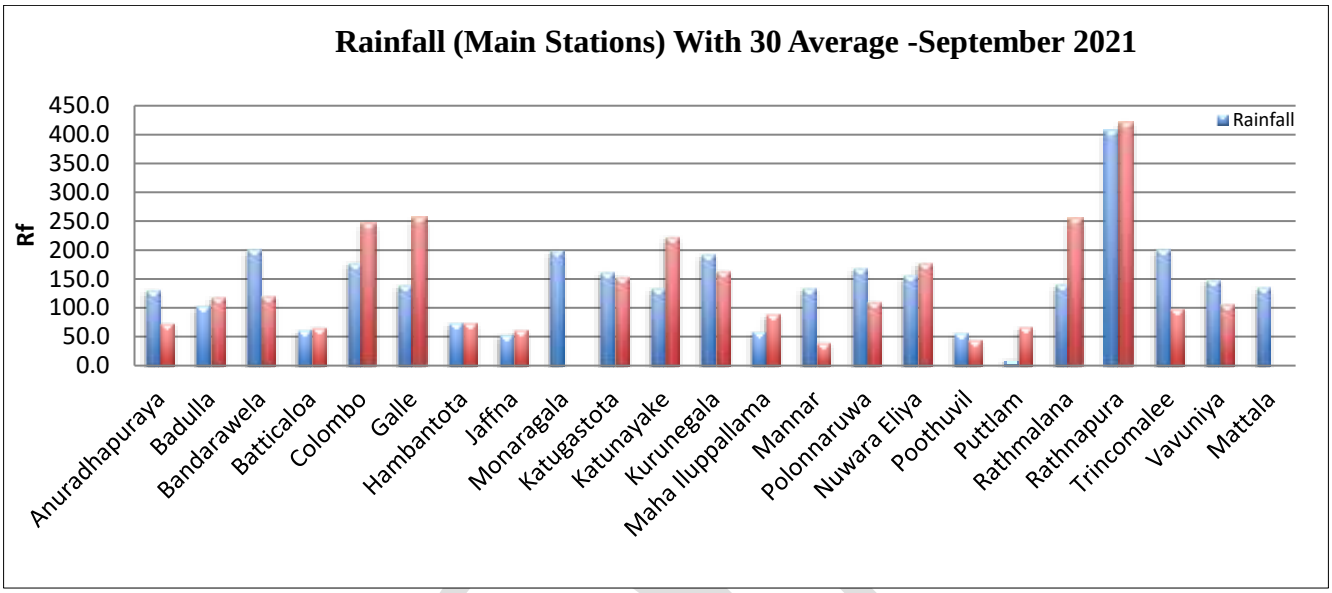

Fig 3: Monthly Total Rainfall(mm) with 30 years (1961-1990) of their averages at Main Meteorological stations areas duringSeptember2021

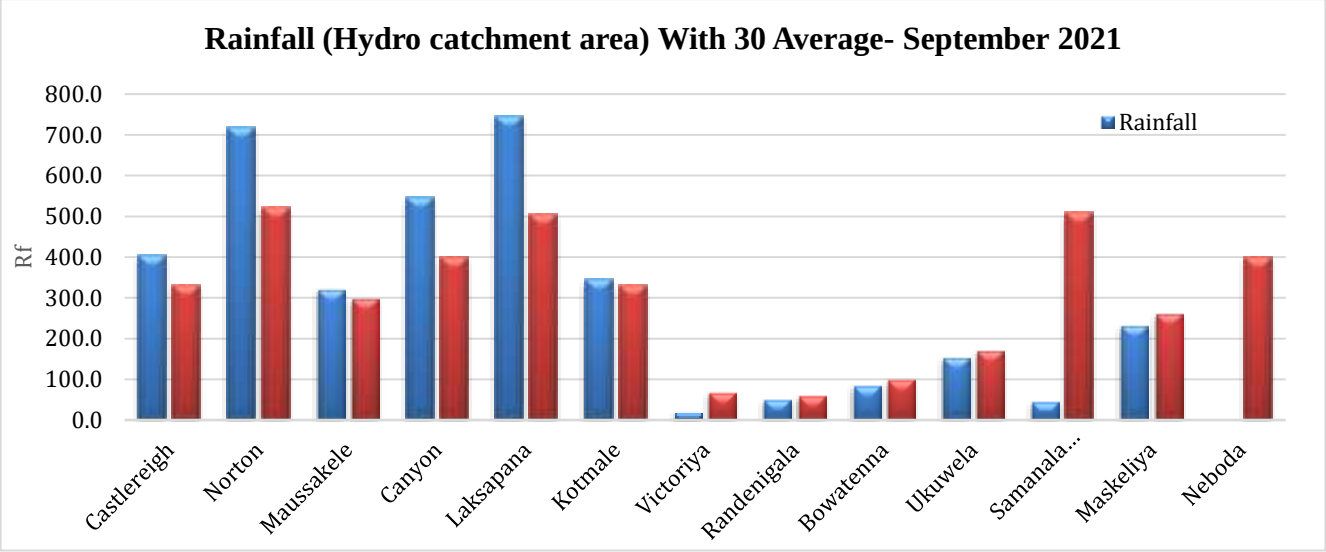

Fig 4: Monthly Total Rainfall(mm) with 30 years (1961-1990) of their averages at Hydro catchment areas during September 2021

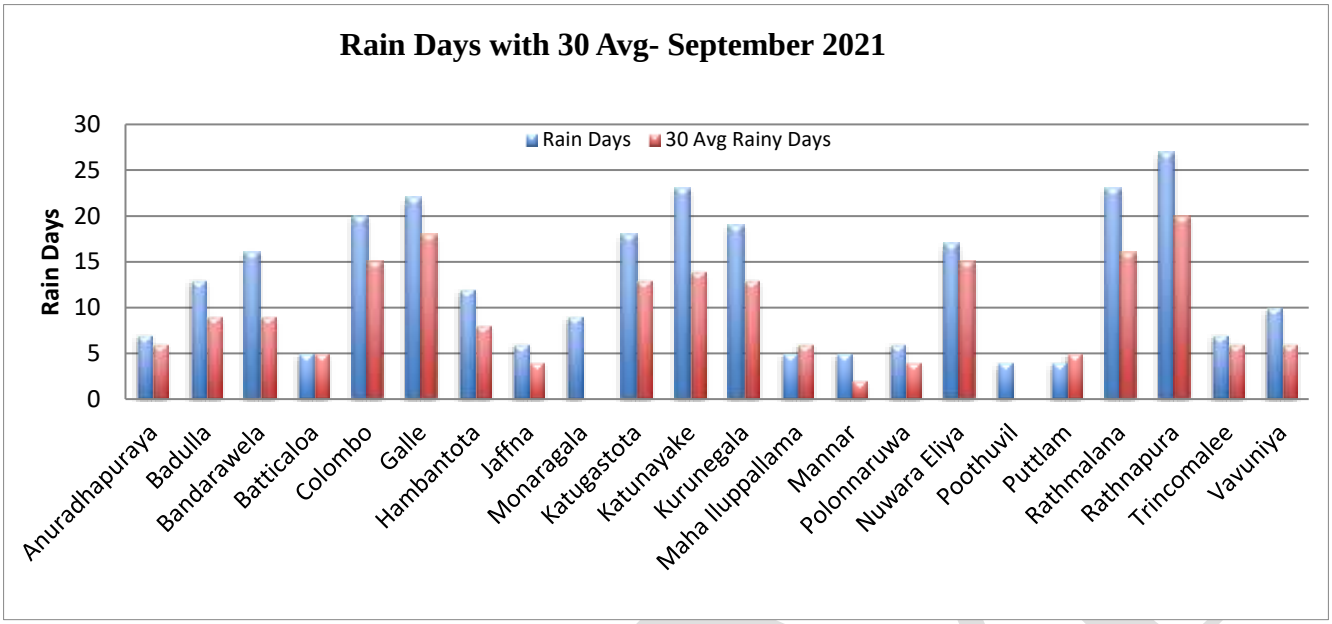

Fig 5: monthly total no of rainy days with 30 years (1961-1990) of their averages at main Meteorological stations during September 2021

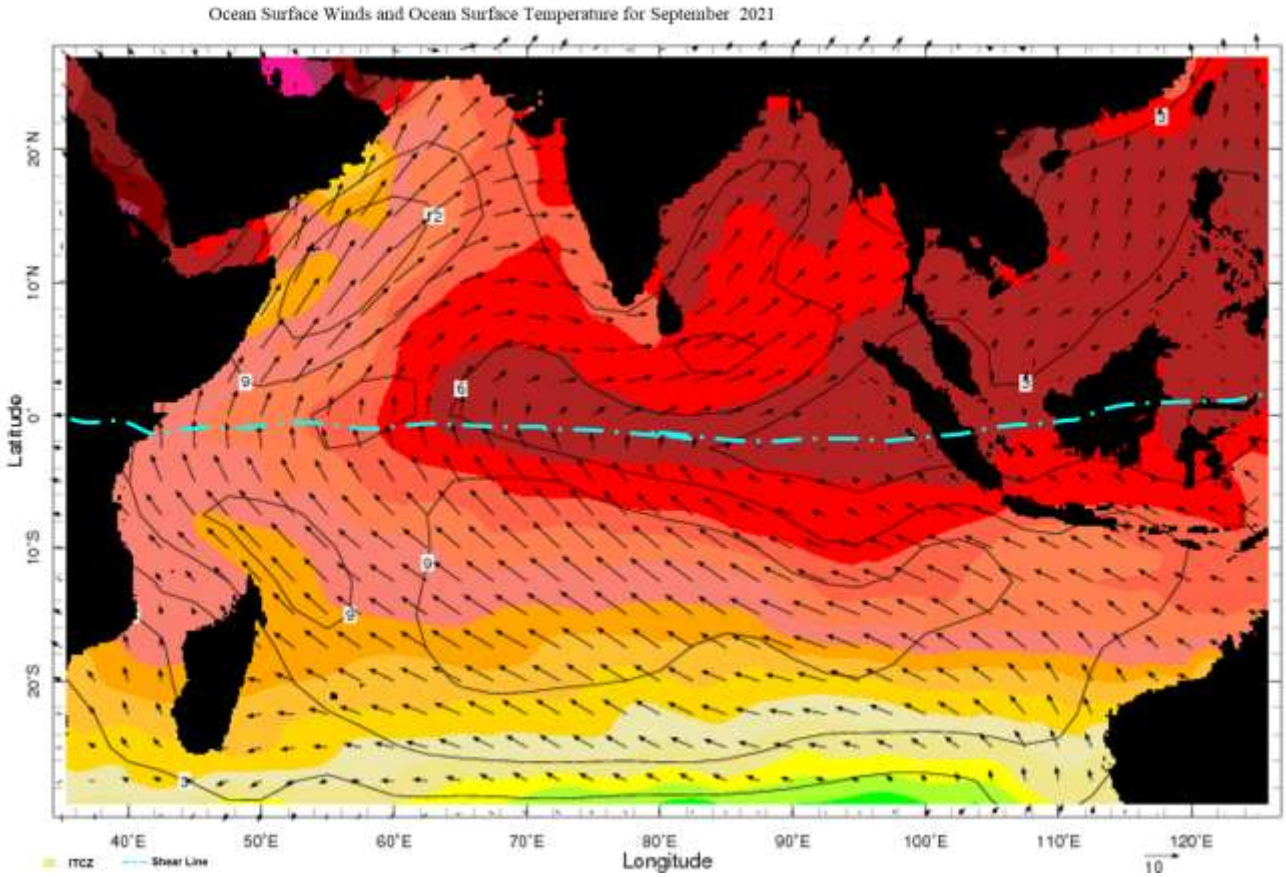

Fig 6: Ocean Surface Winds and Ocean Surface Temperature for September 2021

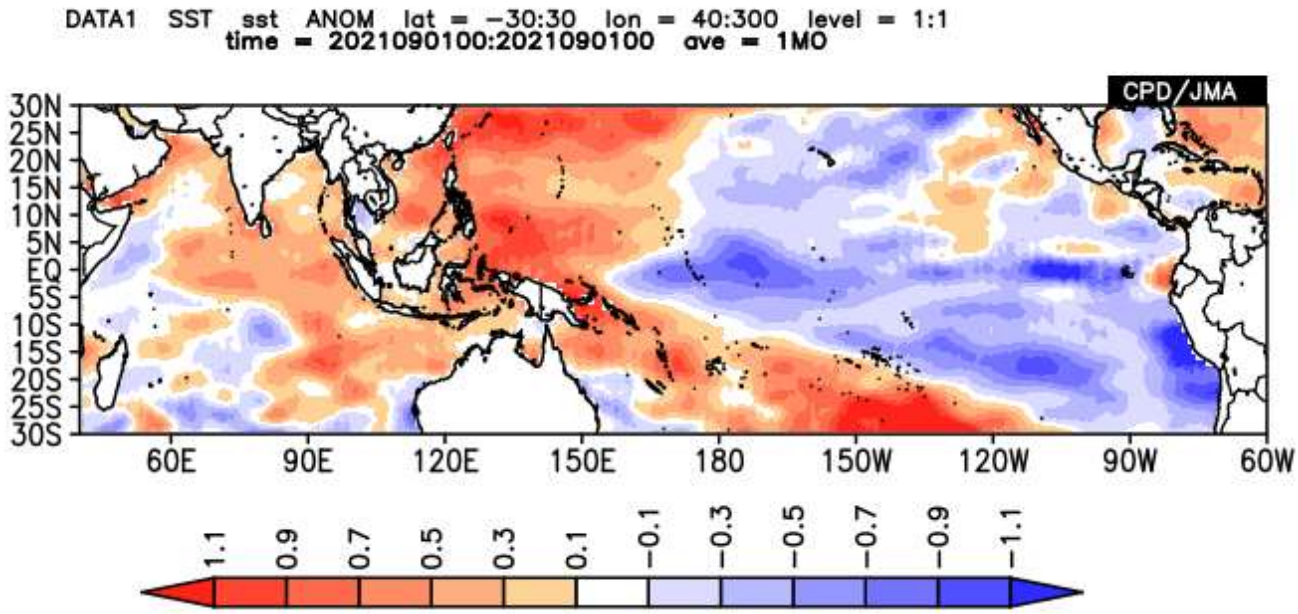

Fig 7: Sea Surface Temperature anomalies forSeptember2021

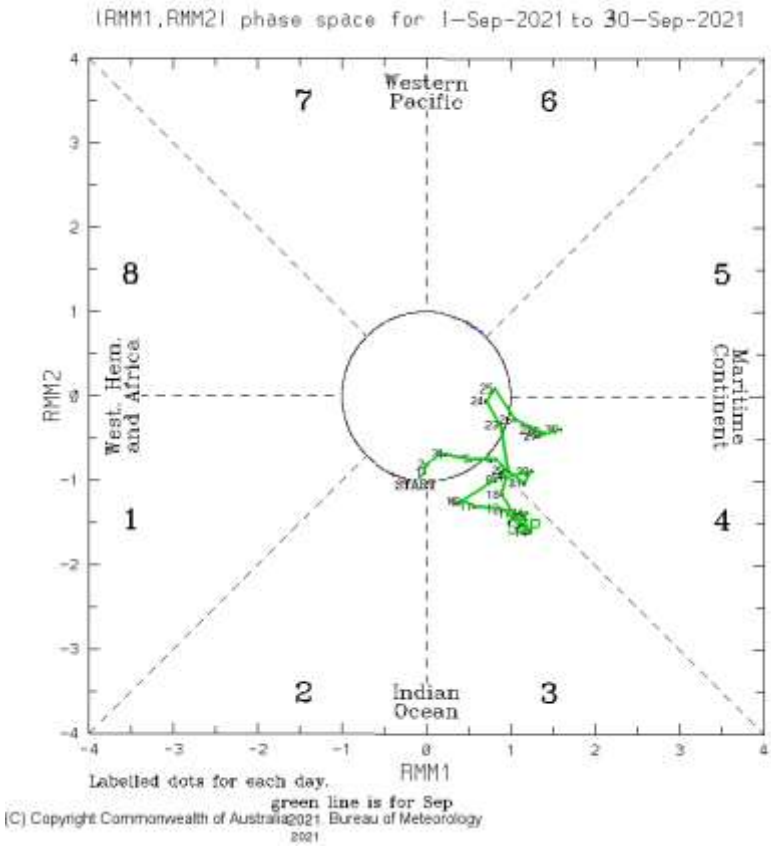

Fig 8: Phase diagram of MJO Index

Surface pressure and winds: The surface pressure was about or below average except from 06th to 11th and from 19th to 21st when it was above average. South-westerly pressure gradient was mild from 03rd , 15th to 16th , on 18th , from 22nd to 23rd , from 29 th to 30th. Moderate south westerly pressure gradient was observed during remaining days except 19th, 20th and 24th when pressure distribution was even or fairly even.

The surface wind was from westerly to southwesterly direction and speed varied within 05-15kts. The surface wind was from westerly to south westerly direction and speed varied within 05-20kts during the 26th and 27th .

Upper winds:

At 850hPa, Westerly wind flow is dominated over the island. Anomalous north south oriented trough appeared to the east of Sri Lanka (Fig 9).

At 700 hPa, Northwesterly to Westerly wind flow is dominated over the island. Anomalous northwest southeast oriented trough appeared over southern part of Sri Lanka (Fig 10).

At 500 hPa, Westerly wind flow is dominated over the island (Fig. 11).

The 200 hpa the upper tropospheric ridge was laid from 27^0N40^0E, 28^0N 90^0E and25^0N 100^0E . Tropical easterly jet was appeared in the vicinity of Sri Lanka.

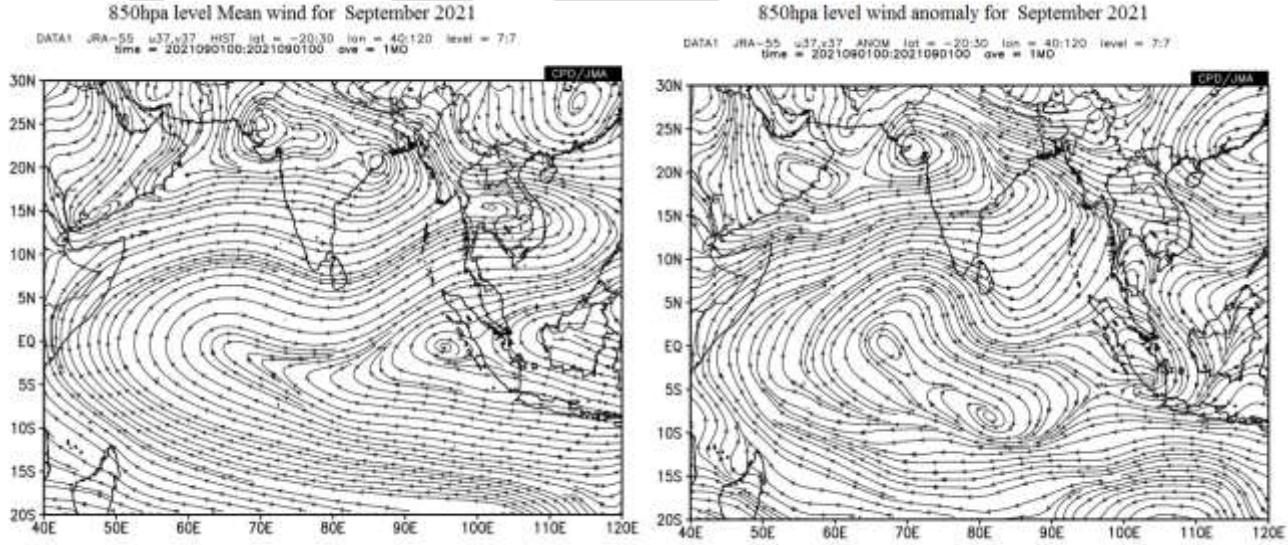

Fig. 9 Monthly average wind pattern at 850hpa level during the month of September2021 (JRA55)

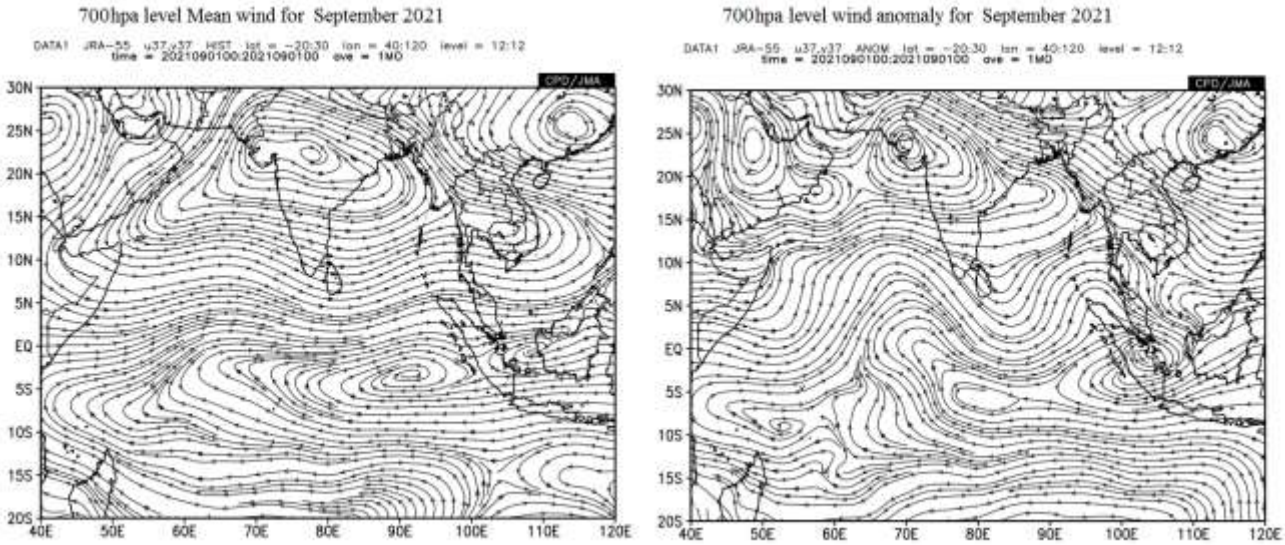

Fig. 10 Monthly average wind pattern at 700hpa level during the month of September 2021 (JRA55)

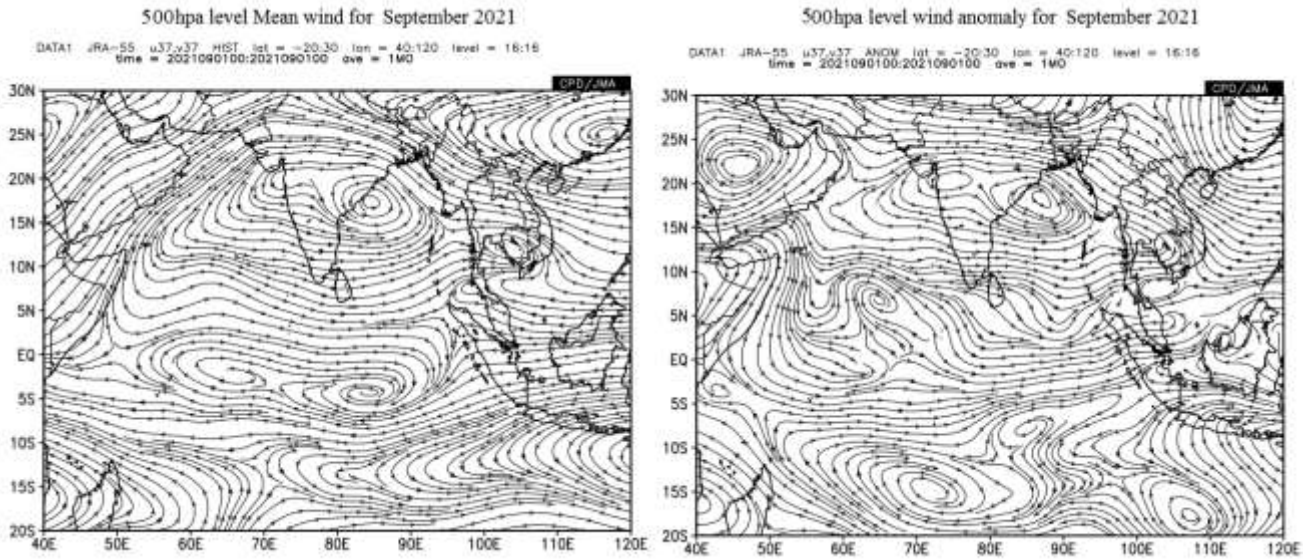

Fig. 11Monthly average wind pattern at 500hPa level during the month of September2021 (JRA55)

Temperature Field:

Generally below normal maximum temperatures were reported from majority of station from 02nd to 05th, , on 16th, on 28th, and on 30th of September. Above normal maximum temperatures were reported from majority of station during rest of the days (Fig.12). Highest recorded maximum temperature for the month of September 2021 was38.2^{0}C at Polonnaruwa on 17th (Table 3a).

Night minimum temperatures over most parts were above normal (Fig 13). However below normal night temperatures were reported from Badulla during most of the days. Lowest recorded minimum temperature for the month of September2021was 10.6^{0}C at NuwaraEliya on 10th (Table 3b).

Maximum and Minimum departures from normal day/night temperature were shown in table 3.

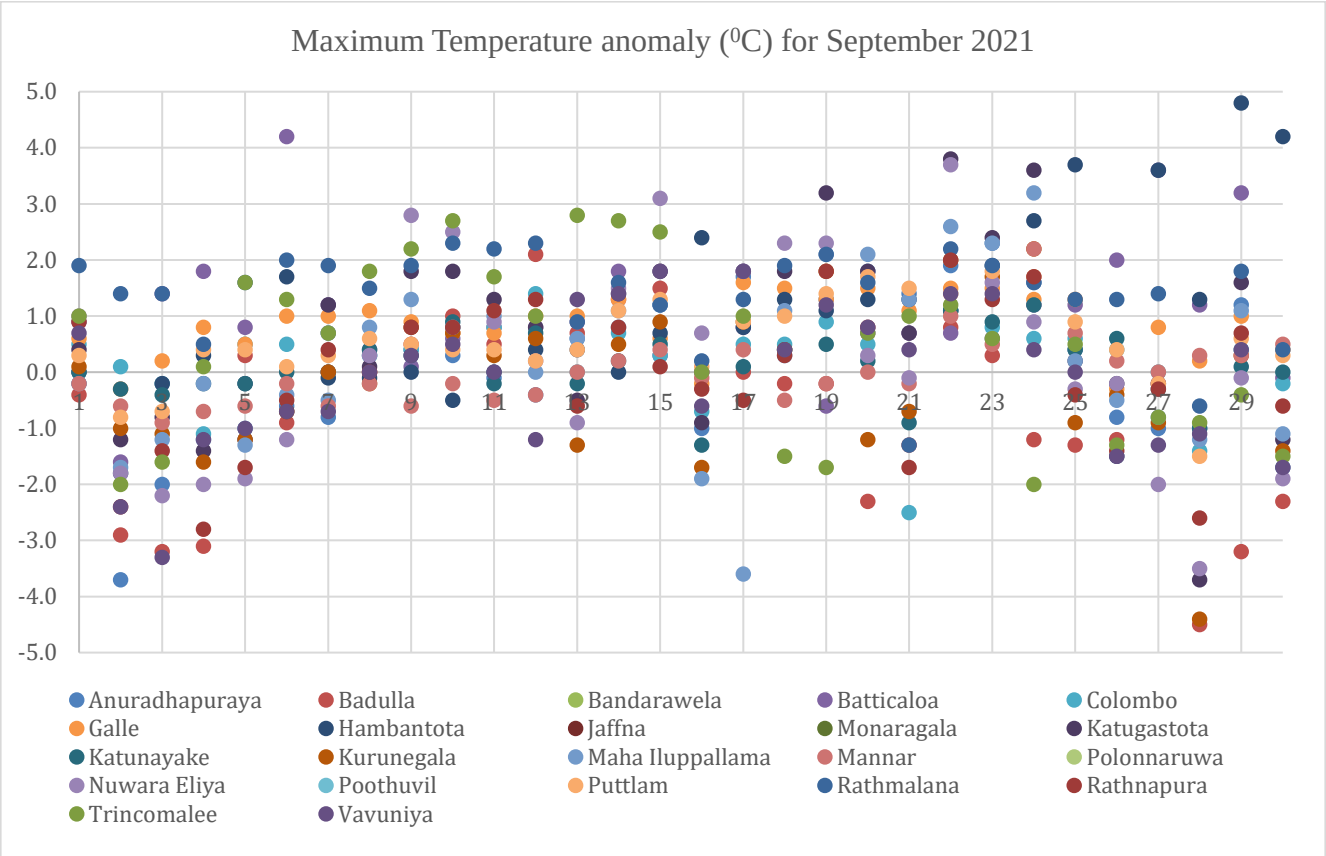

Fig 12 Maximum Temperature anomaly (^{0}C) for September2021

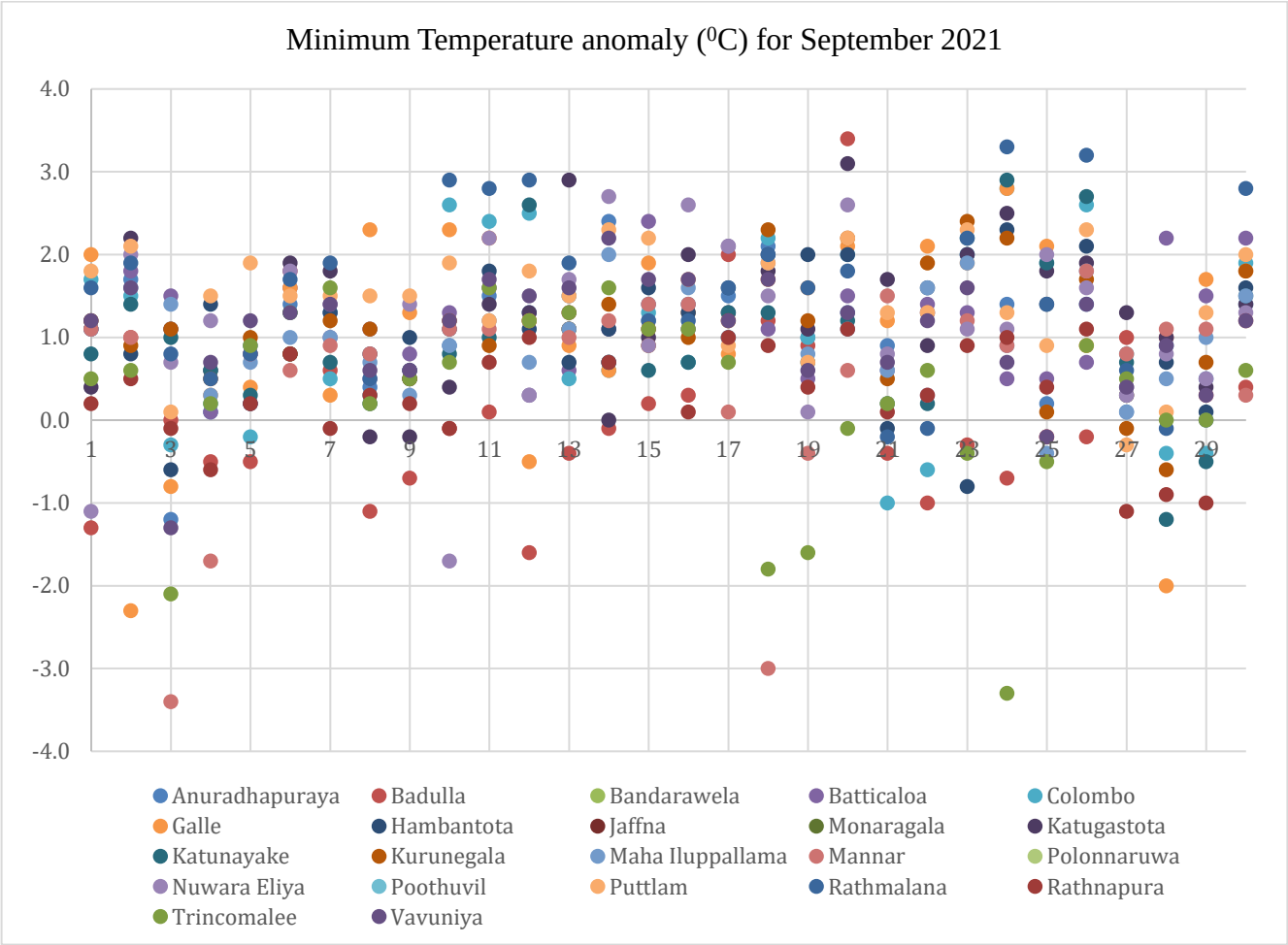

Fig 13 Minimum Temperature anomaly (^{0}C) for September2021

Above normal rainfall was reported at the principal meteorological stations except stations located along north western, western and southwestern coast such as Colombo Katunayake Puttlam Rathmalana and Galle as well as in MahaIluppallama, Jaffna, NuwaraEliya, Badulla and Batticaloa (Fig 1). Number of rainy days was above normal over most of the principal meteorological stations except MahaIluppallama and Puttalum where nearly 80% of rainy days were reported. Maximum percentage was reported from Mannar (333.7%) while minimum from Puttalum station (16.8%)(Table 2).

Hydro catchment stations located along western slopes of the central hills such as Castlereigh Norton Maussakele Canyon Laksapana and Kotmale reported above normal rainfall. However most of the hydro catchment stations located along eastern slopes of the central hills such as Victoria, Randenigala, Bowatenna Ukuwela and Samanalawewa reported below normal rainfall.

Highest cumulative rainfall was **942.4**mm at Wewelthalawa . Highest rainfall received during 24hours, was 210.2 mm at Wewelthalawa on 24th September.

The monthly total rainfall and the number of rain days at the principal meteorological stations, total rainfall at hydro catchment areas, are shown in tables1and 2.

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

Hydro Catchment	September 2021	Average	% (percentage of average)
Castlereigh	404.7	330.5	122.4%
Norton	718.5	521.3	137.8%
Maussakele	321.4	298.0	107.8%
Canyon	546.4	399.6	136.7%
Laksapana	746.4	505.8	147.6%
Kotmale	344.2	329.7	104.4%
Victoriya	20.5	68.4	30.0%
Randenigala	51.6	60.5	85.3%
Bowatenna	84.8	101.2	83.8%
Ukuwela	154.0	171.5	89.8%
SamanalaWewa	45.6	509.9	8.9%
Maskeliya	231.6	260.9	88.8%
Neboda		399.0	

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

Table-02- total rainfall and the number of rain days at the principal meteorological stations recorded in the month against the respective averages (1961-1990).

	Monthly Total rainfall(mm)			Monthly Total No of rainy Days		
Meteorological station	2021-Sept	Average	%	2021-Sept	Average	%
Anuradhapuraya	132.6	74.0	179.2%	7	6	116.7%
Badulla	104.8	119.8	87.5%	13	9	144.4%
Bandarawela	203.1	121.8	166.7%	16	9	177.8%
Batticaloa	61.9	67.0	92.4%	5	5	100.0%
Colombo	179.6	245.4	73.2%	20	15	133.3%
Galle	140.2	255.8	54.8%	22	18	122.2%
Hambantota	74.9	75.2	99.6%	12	8	150.0%
Jaffna	54.7	63.3	86.4%	6	4	150.0%
Monaragala	199.8			9		
Katugastota	162.9	155.2	105.0%	18	13	138.5%
Katunayake	134.5	224.1	60.0%	23	14	164.3%
Kurunegala	194.0	165.3	117.4%	19	13	146.2%
MahaIluppallama	59.1	90.7	65.2%	5	6	83.3%
Mannar	135.5	40.6	333.7%	5	2	250.0%
Polonnaruwa	169.6	112.0	151.4%	6	4	150.0%
NuwaraEliya	158.5	178.8	88.6%	17	15	113.3%
Poothuvil	57.1	44.8	127.5%	4	na	
Puttlam	11.4	67.8	16.8%	4	5	80.0%
Rathmalana	142.0	254.9	55.7%	23	16	143.8%
Rathnapura	407.4	421.4	96.7%	27	20	135.0%
Trincomalee	203.3	99.6	204.1%	7	6	116.7%
Vavuniya	150.4	107.3	140.2%	10	6	166.7%
Mattala	137.5			9		

Table 3(a) - Extremes of Maximum Temperatures September 2021				
	Maximum			Highest Std.Div
	Value	Offsets (-)	Offsets (+)	
Value	38.2^{0}C	4.5	4.8	1.87
Station	Polonnaruwa	Badulla	Hambantota	Mattala
Date	17/09	28/09	29/09	

Table 4(b) -Extremes of Minimum Temperature September 2021				
	Minimum			Highest Std. Div
	Value	Offsets (-)	Offsets (+)	
Value	10.6	3.4	3.4	1.42
Station	NuwaraEliya	Mannar	Badulla	Polonnaruwa
Date	10/09	03/09	20/09	

Prepared by National Meteorological Centre (NMC)

Department of Meteorology