Government of India
Earth System Science Organisation
Ministry of Earth Sciences
India Meteorological Department

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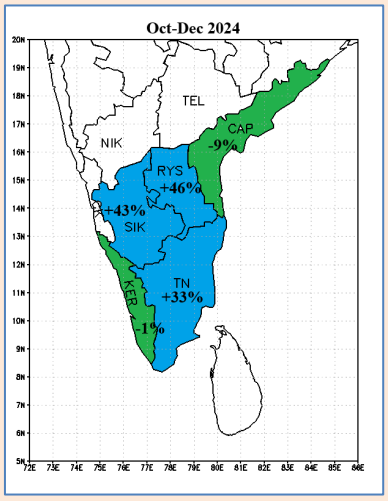
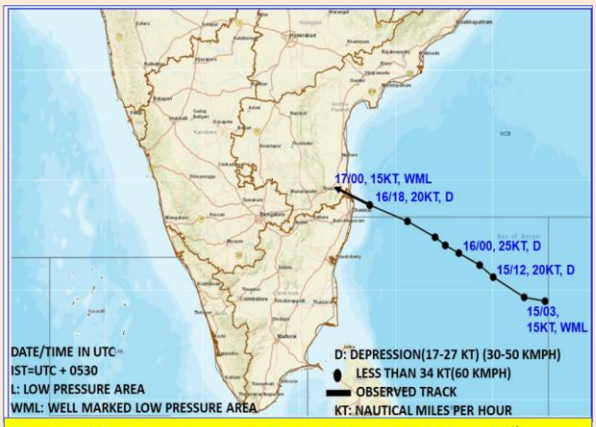
IMD Chennai Scientific Report No. IMDC-SR/18

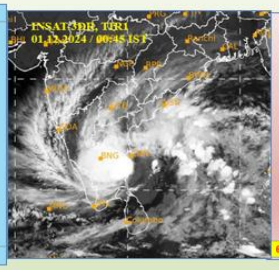
REPORT ON NORTHEAST MONSOON – 2024

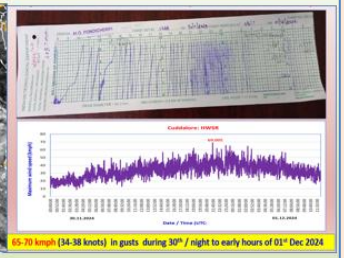




Track of Depression over Bay of Bengal during 15th – 16th Oct, 2024: crossed NTN-SAP coast close to Chennai

Cyclonic Storm FENGAL over Bay of Bengal (25th Nov – 01st Dec 2024)





65-70 kmph (34-38 knots) in gusts during 30th / night to early hours of 01st Dec 2024

Flooding associated with associated heavy rainfall activity and water released from Sathanur dam

Regional Meteorological Centre, Chennai

March 2025

Table of Contents

Executive Summary

1	Document title	Report of Northeast Monsoon – 2024
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Abstract

During the year 2024, the southwest monsoon withdrew from the Indian region on 15th October and the Northeast monsoon (NEM) of 2024 commenced simultaneously over the southeastern parts of peninsular India on **15th October 2024** against the normal date of 20th October. Of the five meteorological sub divisions (Tamilnadu, Puducherry & Karaikal (TN), Coastal Andhra Pradesh & Yanam (CAP), Rayalaseema (RYS), Kerala & Mahe (KER) & South Interior Karnataka (SIK) benefitted by the Northeast Monsoon, three subdivisions (TN, RYS & SIK) received excess rainfall & the other two subdivisions (KER & CAP) received normal rainfall during the NEM season (October-December) 2024. *Active* to *vigorous* monsoon conditions prevailed over TN on **20** days, over SIK on **16** days, over KER & RYS on **13** days each and over CAP on **9** days during the season. There were **61** days of *isolated heavy* rainfall activity with **27** days of *isolated very heavy* rain including **05** days of *isolated extremely heavy rainfall* activity over TN. **Two** *Tropical Cyclones* **–*Severe Cyclonic Storm (SCS)* DANA** and ***Cyclonic Storm (CS)* FENGAL** over the Bay of Bengal (BOB) and **three** *Depressions* (***D***) (one over Arabian Sea & two over the BOB) affected the Indian seas during the season. The ***SCS* DANA** during 22nd-26th Oct 2024 tracked northwestwards and crossed Odisha coast. The ***CS* FENGAL** during 25th Nov – 01st Dec 2024 crossed North Tamilnadu – Puducherry coast close to Puducherry around the mid-night of 30th November 2024 and caused torrential rains and extensive damages over North Tamilnadu & Puducherry during 30th November – 02nd December Dec 2024. One ***Depression*** over BOB during 15th-16th October was associated with the commencement of the NEM rains. The other 2-***D***s, 1-over AS (13th-15th Oct) & the other over BOB (20th-21st Dec) did not contribute significantly towards NEM rainfall. However, a ***Low Pressure area*** (***LOPAR***) over BOB during 11th-12th November, a ***Well Marked Low Pressure Area (WML)*** over BOB during 07th-14th Dec along with frequent upper air cyclonic circulations / troughs in easterlies during the season contributed significantly towards the rainfall of NEM 2024. Further, the season extended into January of 2025. There was *isolated* ***heavy*** rainfall activity on 7 days including three days of *isolated* ***very heavy*** rain and one day of *isolated* ***extremely heavy*** rain (on 20th Jan 2025). Thereafter, with the gradual decrease in rainfall activity, the cessation of NEM **2024** rainfall over the southern peninsular India was declared on **27th January 2025**.

1. Background

The Indian southwest monsoon (SWM) season of June to September is the chief rainy season for India and about 75% of the country's annual rainfall is realised during this season. Subsequent to the withdrawal of SWM, the northeast monsoon (NEM), a small scale monsoon confined to parts of southern peninsular India comprising of the meteorological sub-divisions of Tamil Nadu, Puducherry & Karaikal (TN), Kerala & Mahe (KER), Coastal Andhra Pradesh & Yanam (CAP), Rayalaseema (RYS) and South Interior Karnataka (SIK) occurs. For the subdivision of TN, the normal SWM seasonal rainfall realised is only about 36% (328.5 mm) of its annual rainfall (921.4 mm) as this subdivision comes under the rain-shadow region during the SWM. The northeast monsoon (NEM) season of October to December (OND) is the chief rainy season for this subdivision with 48% (442.8 mm) of its annual rainfall realised during this season and hence its performance is a key factor for this regional agricultural activity.

Further, the NEM season is also the primary cyclone season for the North Indian Ocean (NIO) basin comprising of the Bay of Bengal (BOB) and the Arabian Sea (AS) and cyclonic disturbances (CDs; low pressure systems (LPS) with maximum sustained surface wind speed (MSW) of 17 knots or more) forming over BOB and moving west/northwest-wards affect the coastal areas of southeastern peninsular India and also contribute significantly to NEM rainfall. As such, the NEM season assumes importance from the agricultural as well as cyclone disaster management perspectives.

Prior to the commencement of NEM rains, after the withdrawal of SWM upto 15°N, reversal of low level winds from southwesterly to northeasterly occurs. The normal date of setting in of easterlies over the southeastern peninsular India is 14th October. The normal date of onset of NEM over Coastal TN (CTN) and south CAP is 20th October. The normal rainfall received over the five NEM sub-divisions during OND is TN-442.8 mm, KER-492.0 mm, CAP-322.9 mm, RYS-236.4 mm and SIK-199.0 mm. However, the NEM seasonal rainfall shows a high degree of variability with 27% co-efficient of variation.

The NEM rainfall is influenced by global climate parameters such as ENSO (El Nino/La Nina & Southern Oscillation Index), Indian Ocean Dipole (IOD) and Madden-Julian Oscillation (MJO). El Nino, positive IOD and MJO in phase 2-4 with amplitude greater than one are generally associated with good NEM rainfall.

2. Onset phase

During October 2024, as per the data of various global climate monitoring centres, ENSO (El Nino & Southern Oscillation) continued to be in neutral phase, IOD (Indian Ocean Dipole) became negative and the MJO (Madden Julian Oscillation) index which was in phase-1 at the beginning of the month became insignificant thereafter until 13th, was in phase-4 for a brief period during14th-17th, and then moved to and remained over the western hemisphere from 18th till the end of the month.

Under not very favourable large scale climate settings (neutral ENSO & negative IOD), but favourable MJO conditions, atmospheric flow pattern over the Indian region gradually changed from the SWM to NEM conditions during the second week of October 2024 with the establishment of low level anticyclone over the central India and reversal of low level winds over the southern peninsular India from westerly to easterly flow pattern leading to withdrawal of SWM **from the entire country on 15th October.** Pentad mean wind flow pattern depicting the reversal of wind from westerlies to easterlies during the second week of October 2024 are presented in Fig.1a.

Simultaneously, under the influence of an upper air cyclonic circulation a Low Pressure Area (LOPAR) formed over the Southeast BOB on 14th, became **Well Marked Low Pressure Area** over central part of south Bay of Bengal at 0530 IST and persisted over the same region at 0830 IST on 15th; concentrated into a **Depression** and lay centred at 1730 IST of 15th over Southwest Bay of Bengal near latitude 11.4° N and longitude 84.4° E; lay centered at 0830 IST of 16th over the same region near latitude 12.3° N and longitude 83.0° E on 16th; moved west-northwestwards and **crossed north Tamilnadu - South Andhra Pradesh coasts between Puducherry and Nellore, close to north of Chennai, near latitude 13.5°N and longitude 80.2°E around 0430 IST of 17th October, 2024**. Subsequently, it weakened into a **WML** and lay over South coastal Andhra Pradesh and neighbourhood at 0530 IST / 17th October, 2024.

Under its influence, *fairly widespread-widespread* rainfall occurred over TN during 11th-16th, over Kerala during 12th-18th; & over CAP during 14th-21st; and *scattered to widespread* rainfall occurred over RYS & SIK during 14th-22nd Oct 2024.

*Isolated **heavy -very heavy*** rainfall occurred over TN & CAP during the 24-hr ending 0830 IST of 15th and ***heavy to very heavy*** rain with ***extremely heavy*** rain at *isolated* places occurred over Chennai & Tiruvallur districts of TN; and *heavy to very heavy* rain at *a few* places with ***extremely heavy*** rain at *isolated* places occurred over Tirupati district of RYS during the 24-hr ending 0830 IST of 16th October. *Isolated heavy-very heavy* rain occurred over RYS and *isolated heavy* rain occurred over CAP & SIK on 17th Oct 2024.

Extremely heavy rainfall was reported at **Cholavaram, Red Hills, Avadi areas of Tiruvallur district (30 cm, 28 cm & 25 cm** respectively); and **Zone 01 Kathivakkam & Zone 02 D15 Manali in Chennai district (23 cm & 21 cm** respectively); and **Sullurpeta in Tirupati district** in RYS (22 cm) on 16th October 2024.

Active-Vigorous monsoon conditions prevailed over TN during 11th-16th; over CAP during 15th-17th; over RYS during 15th-19th & over SIK during 15th-18th Oct 2024.

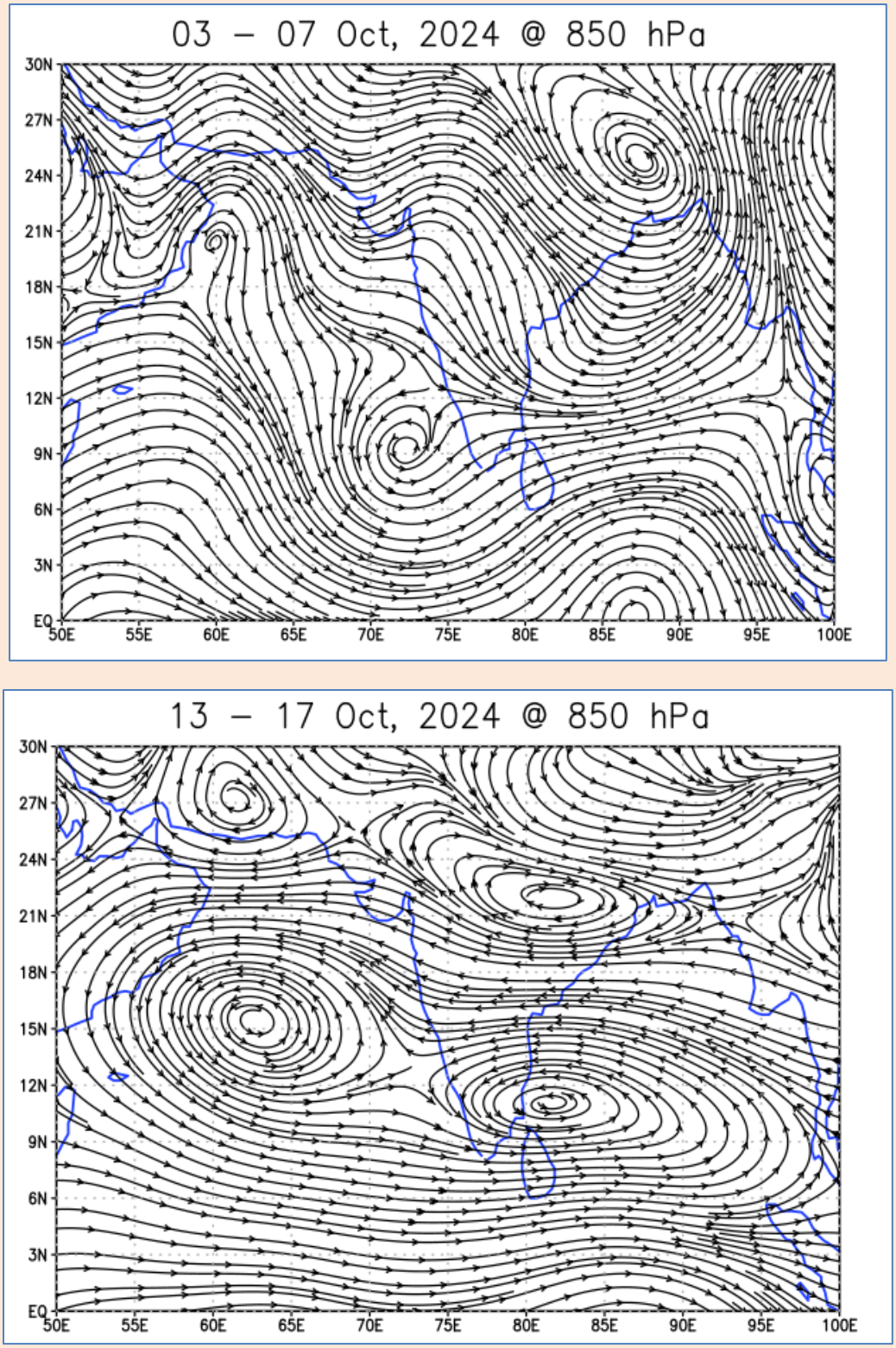


Fig.1a: NCEP reanalysis 850 hPa streamline pattern indicating reversal wind from westerly to easterly over peninsular India during the second week of October 2024

Observed Track of the Depression during 15th-17th October 2024 is presented in Fig.1b. Scatterometer winds depicting the surface wind circulation as on 2130 IST of 15th (NOAA-ASCAT (METOP-B) and 16th/1130 IST (IMD-Oceansat-3) are presented in Fig.1c. IMD-GFS 850 hPa wind analysis depicting the associated upper air circulation in the lower levels as on 0530 IST of 13th, 15th & 17th Oct 2024 are presented in Fig.1d. Relative Vorticity of $100x10^{-6}$/sec at 850 hPa level depicted by CIMSS, METEOSAT based product as on 15th/2330 IST is shown in Fig.1e. INSAT-3D, infra-red imagery depicting the associated cloudiness as on 0830 IST of 16th October is shown in Fig.1f and Doppler Weather Radar, Chennai maximum reflectivity product as on 15th / 0320 IST & 0830 IST are shown in Fig.1g.

GPM satellite-gauge merged rainfall as on 24-hr ending 0830 IST of 14th -17th October 2024 depicting the commencement of NEM rains over TN and neighbouring subdivisions is presented in Fig.1h. Maps of spatial rainfall distribution and rainfall intensity over TN and adjoining areas of RYS & CAP during the 24-hr ending 0830 IST of 15th & 16th October 2024 are presented in Fig.1i.

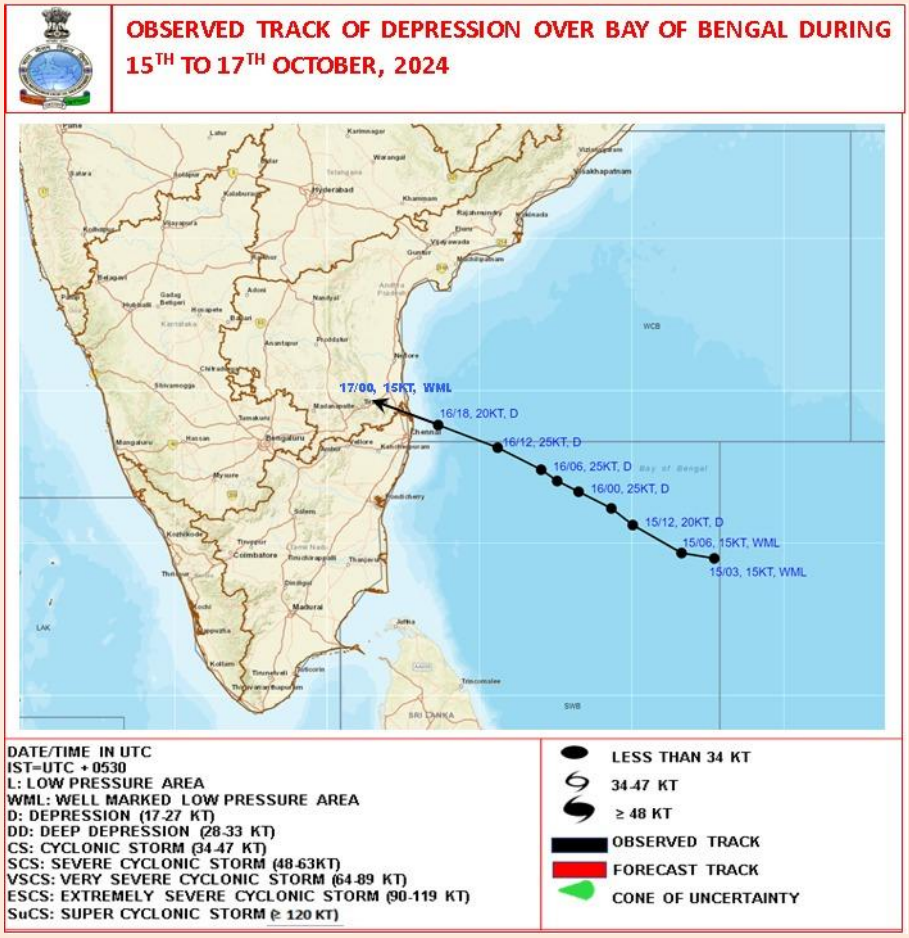
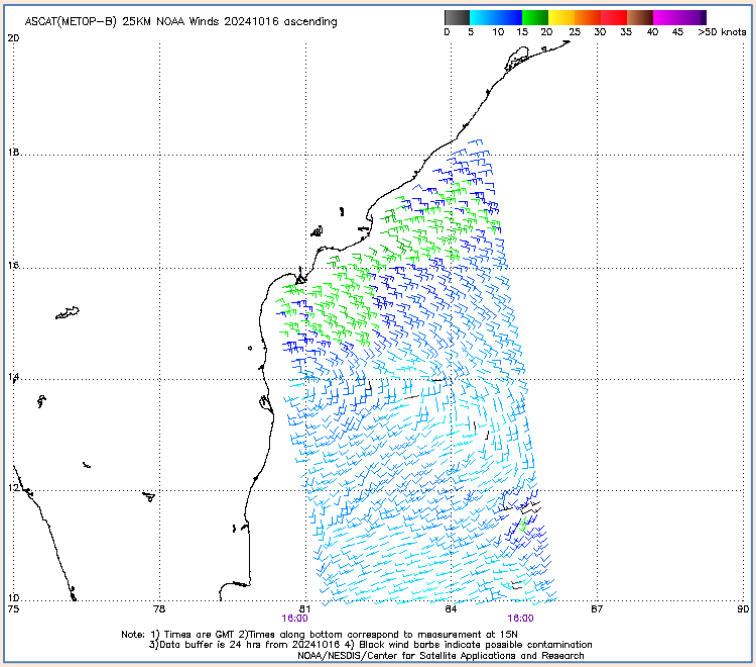


Fig.1b: Observed track of the Depression over Bay of Bengal during 15th-17th Oct 2024



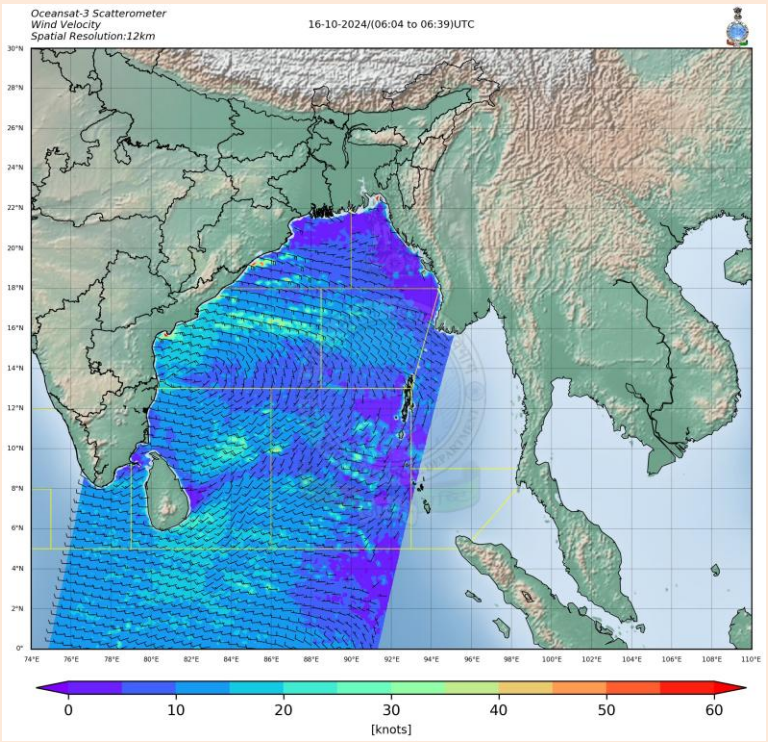
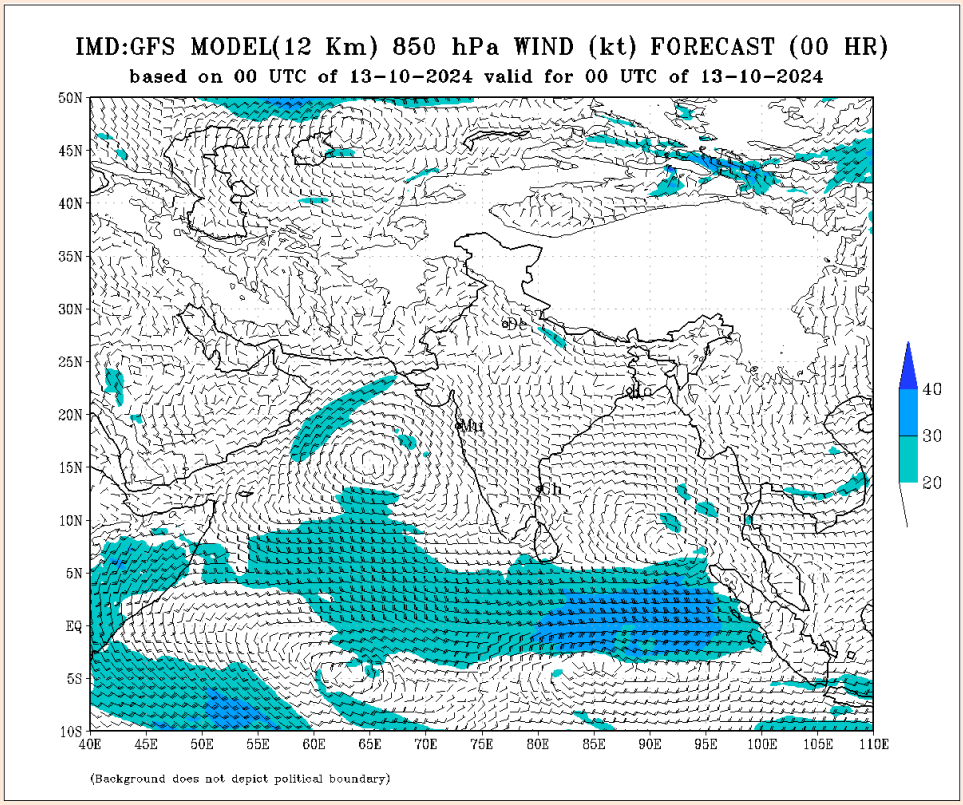


Fig.1c: Scatterometer winds depicted by NOAA-ASCAT(METOP-B) as on 2130 IST of 15th and IMD-Oceansat-3 as on 1130 IST of 16th October 2024



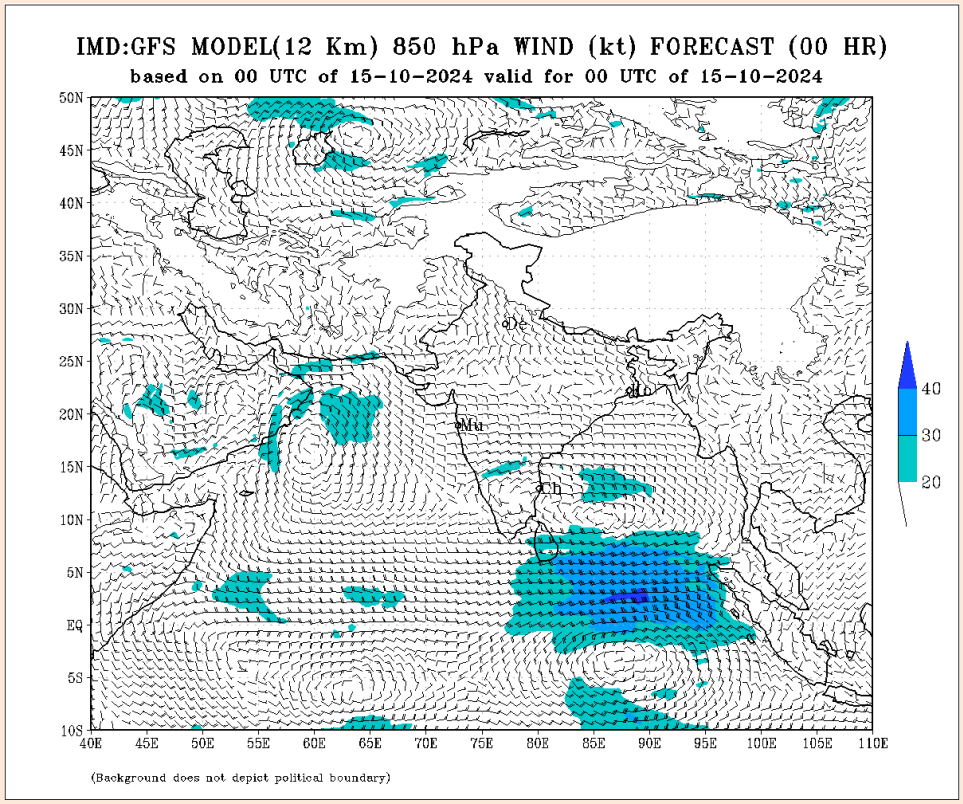


Fig.1d: IMD-GFS, 850 hPa wind analysis as on 0530 IST of 13th, 15th & 17th Oct 2024

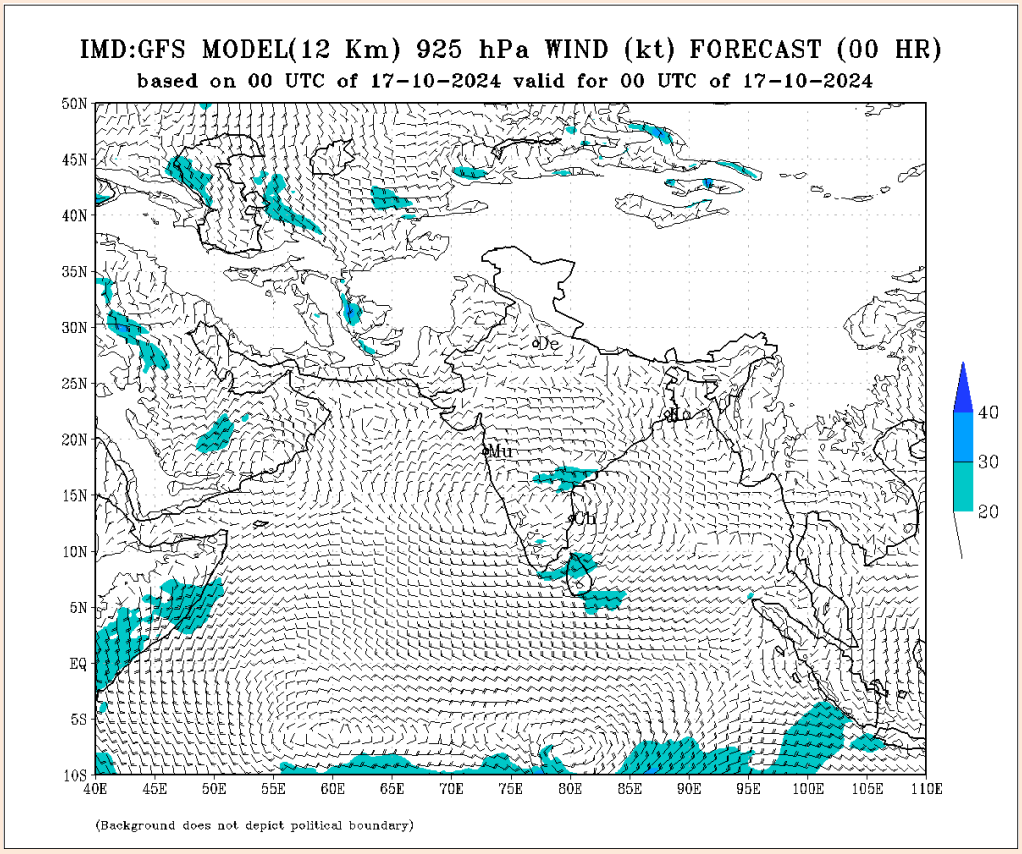


Fig.1d: contd.

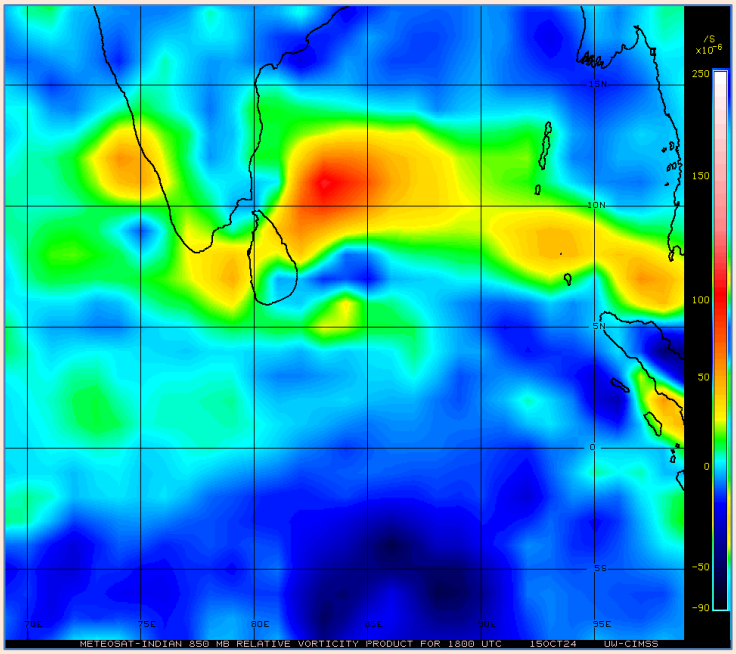


Fig.1e: CIMSS, METEOSAT based 850 hPa, Relative Vorticity product as on 15th/2330 IST

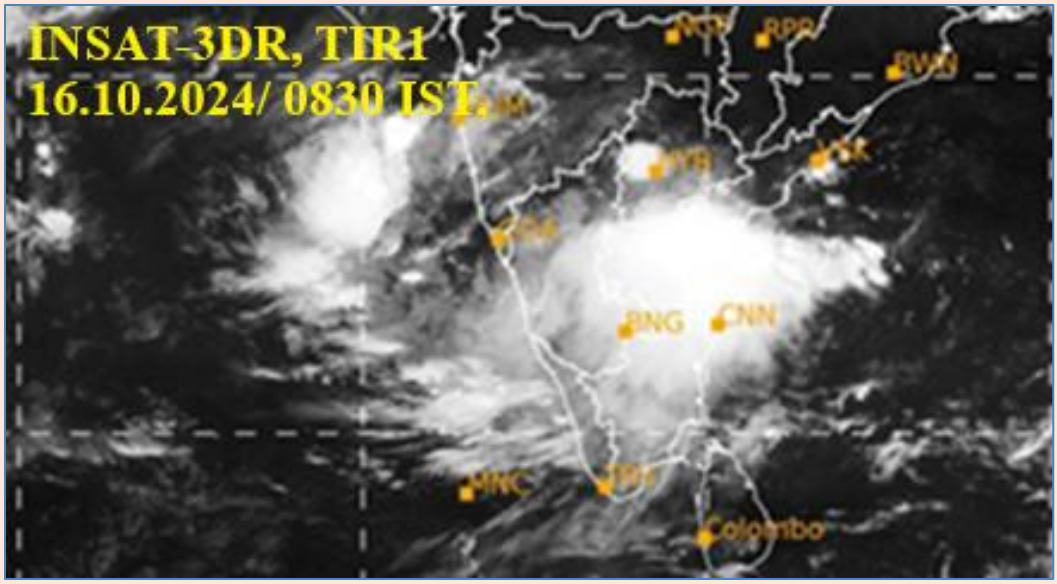


Fig.1f: INSAT-3D / 3DR infra-red imagery as on 16/0830 IST of Oct 2024

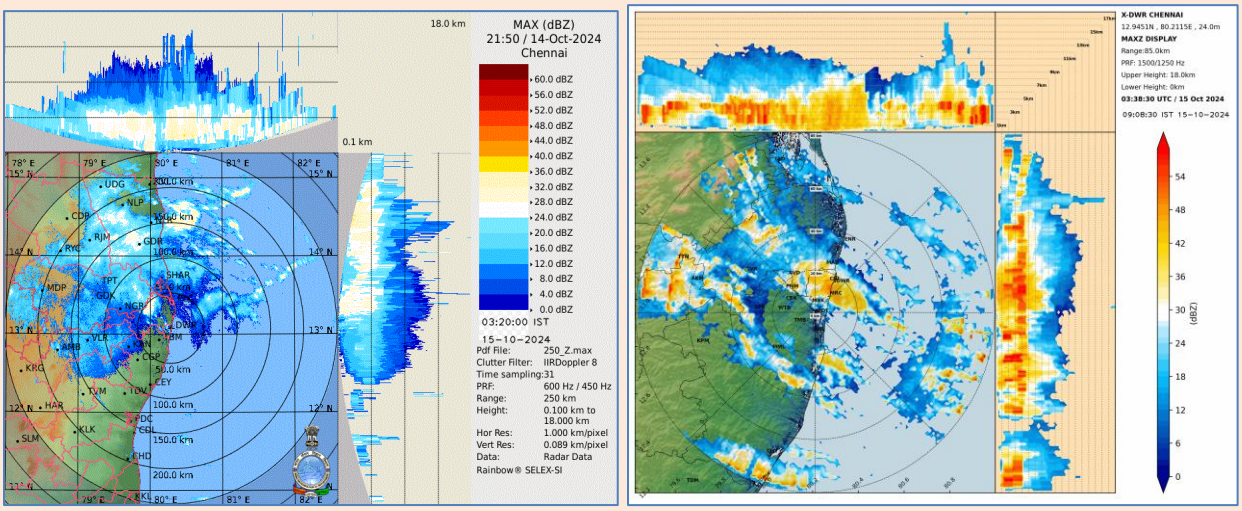


Fig.1g: Doppler Weather Radar Chennai, maximum reflectivity product as on 15th/0320 IST (S-Band) and 15th/0830 IST (X-Band)

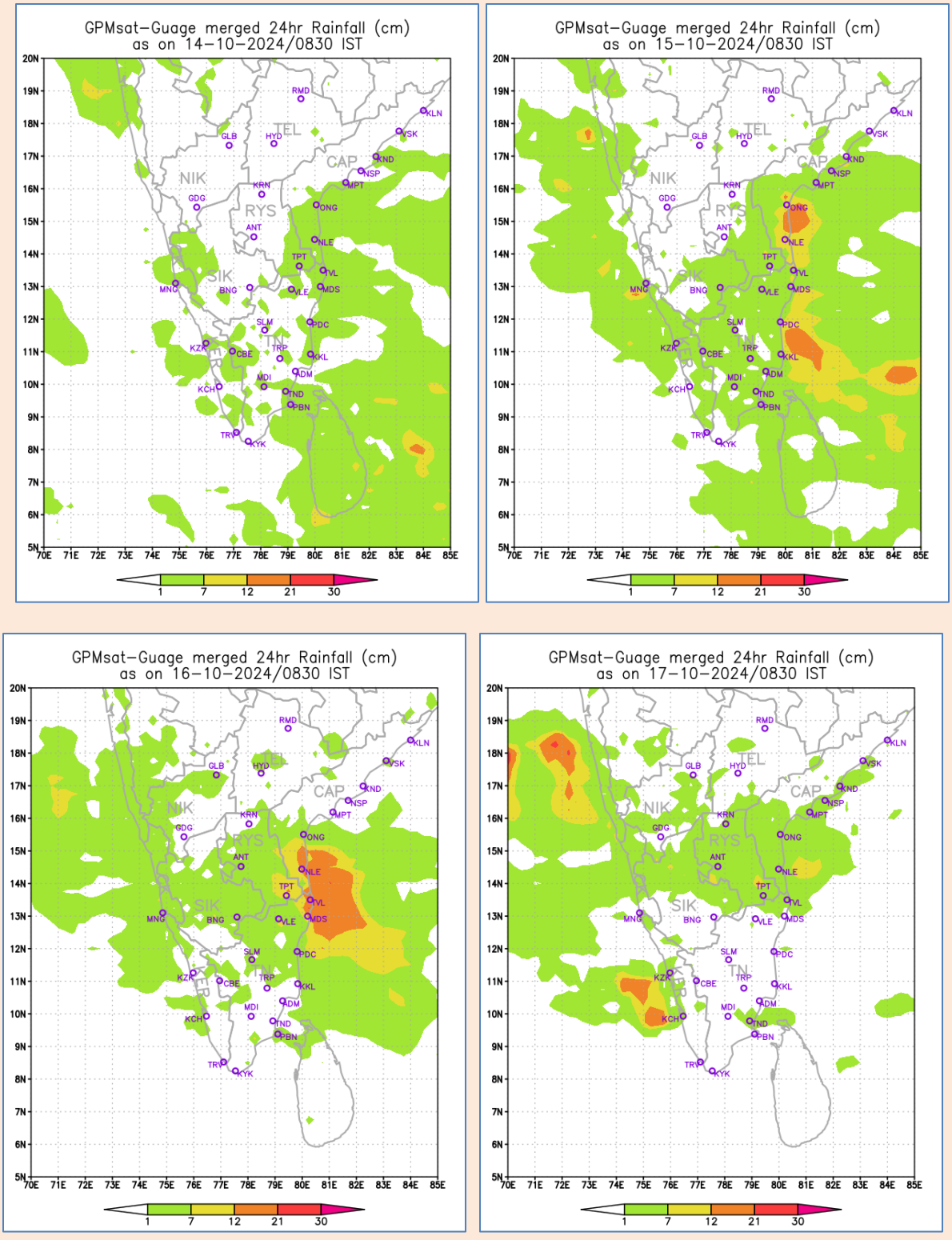


Fig.1h: GPM satellite -gauge merged rainfall as on 24 hr ending 0830 IST of 14-17 Oct 2024

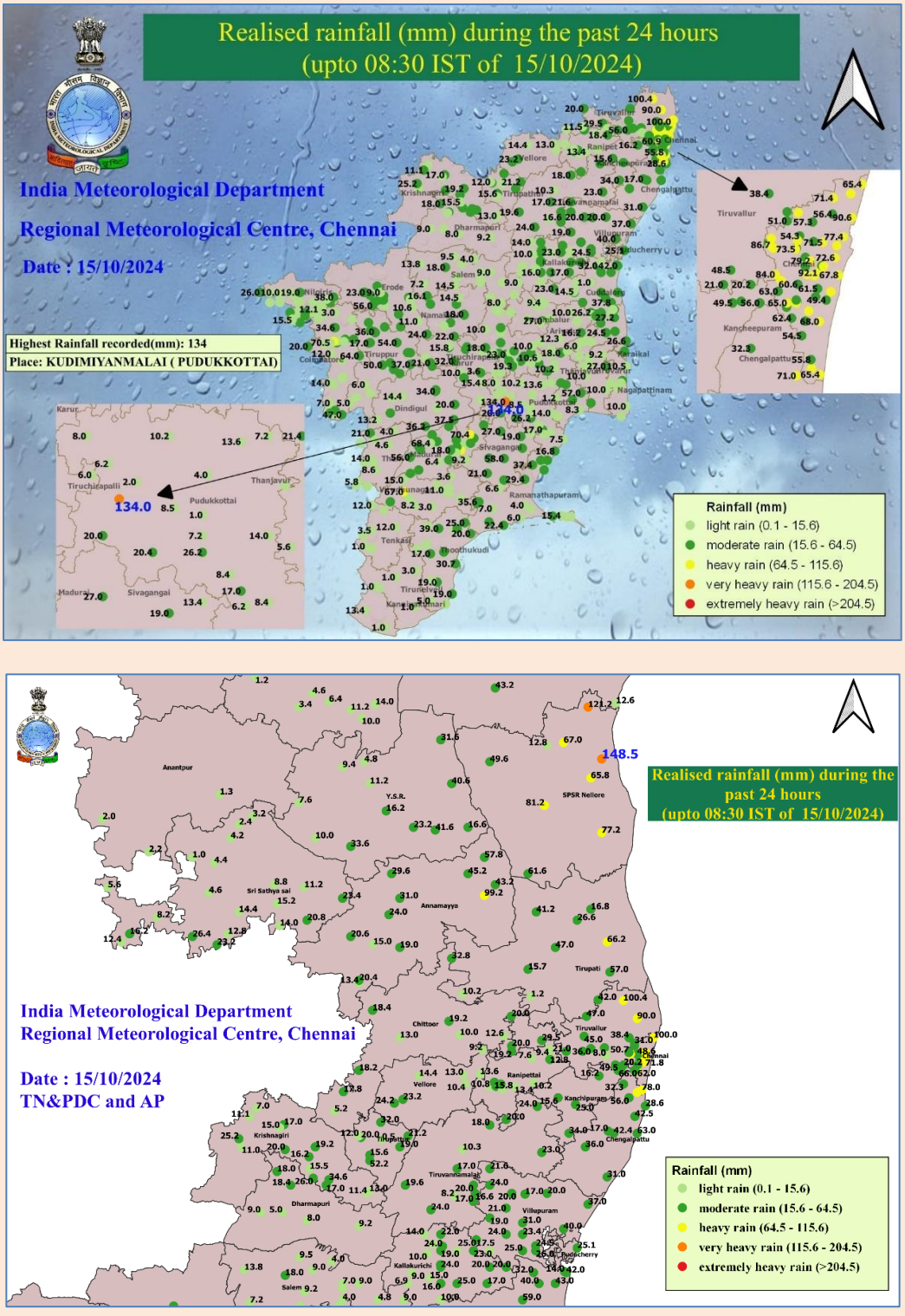
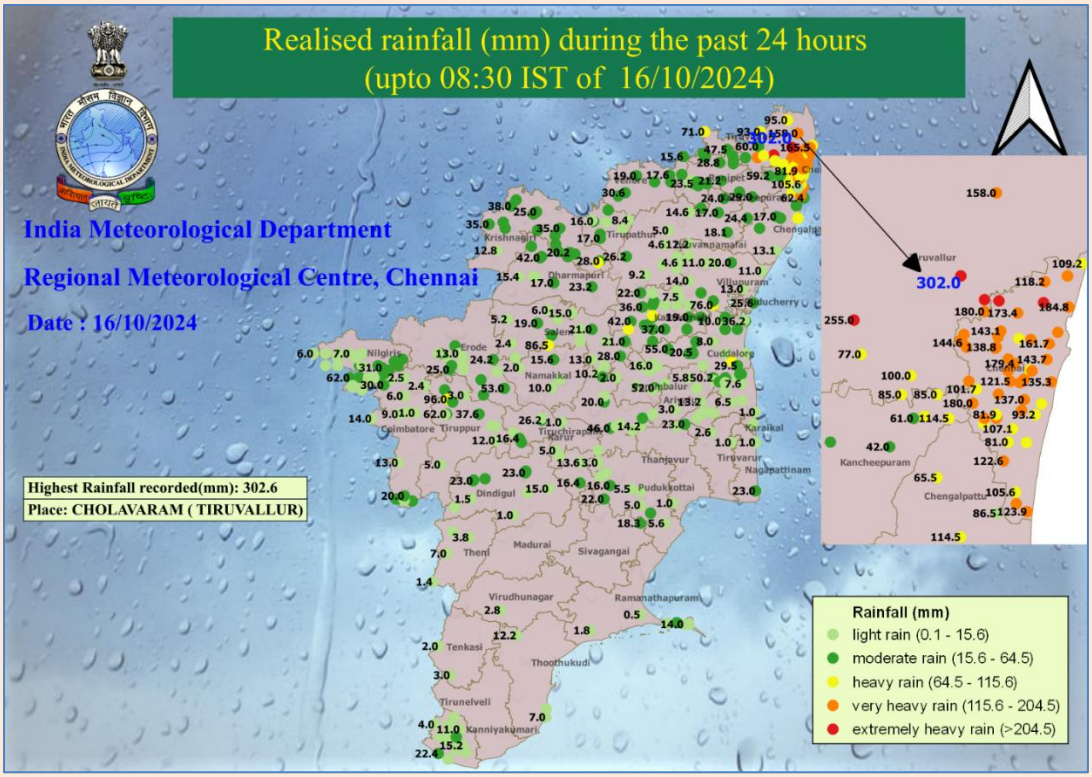


Fig.1i: Spatial rainfall distribution and rainfall intensity over TN and adjoining districts of RYS & CAP as on 24-hr ending 0830 IST of 15th & 16th October 2024


Realised rainfall (mm) during the past 24 hours
(upto 08:30 IST of 16/10/2024)
India Meteorological Department
Regional Meteorological Centre, Chennai
Date : 16/10/2024
Highest Rainfall recorded(mm): 302.6
Place: CHOLAVARAM (TIRUVALLUR)
Rainfall (mm)
light rain (0.1 - 15.6)
moderate rain (15.6 - 64.5)
heavy rain (64.5 - 115.6)
very heavy rain (115.6 - 204.5)
extremely heavy rain (>204.5)

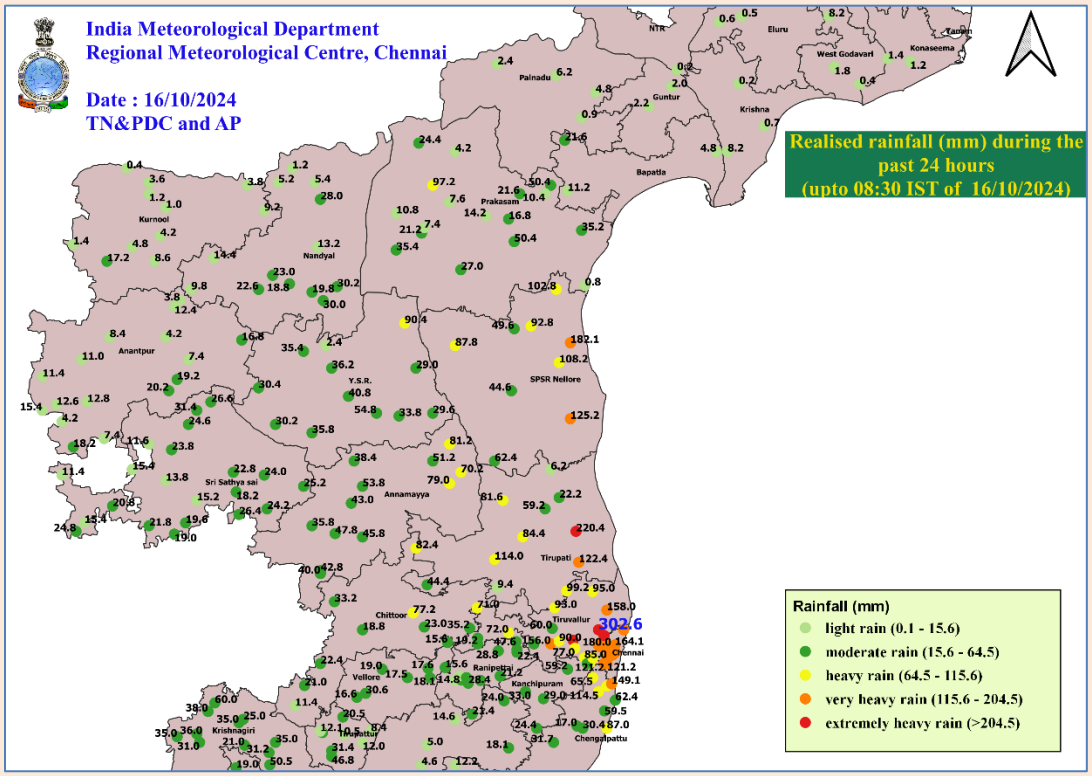

India Meteorological Department
Regional Meteorological Centre, Chennai
Date : 16/10/2024
TN&PDC and AP
Realised rainfall (mm) during the
past 24 hours
(upto 08:30 IST of 16/10/2024)
Rainfall (mm)
light rain (0.1 - 15.6)
moderate rain (15.6 - 64.5)
heavy rain (64.5 - 115.6)
very heavy rain (115.6 - 204.5)
extremely heavy rain (>204.5)

Fig.1i: contd

3a. Major synoptic scale systems during the NEM 2024 season

During the period October-December 2024, 1-***Severe Cyclonic Storm*** (**SCS**), 1-***Cyclonic Storm*** (**CS**) and 2-***Depressions*** (**D**) formed over the **Bay of Bengal** (BOB) and 1-**Depression** formed over the **Arabian Sea** (AS) as follows: (i) Depression over Arabian Sea during 13th-15th October; (ii) Depression over Bay of Bengal during 15th-17th October; (iii) Severe Cyclonic Storm 'DANA' over Bay of Bengal during 22nd-26th October; (iv) Cyclonic Storm 'FENGAL' over Bay of Bengal during 25th November – 01st December; and (v) Depression over Bay of Bengal during 20th-21st Dec 2024. The synoptic situations and weather associated with these systems are discussed below:

(i) Depression over Arabian Sea during 13th-15th October 2024

During the extended Southwest Monsoon (SWM) phase in the first half of October 2024, an upper air cyclonic circulation lay over South Kerala & neighbourhood in the morning of 7th October 2024. Under its influence, a **Low Pressure Area** formed over Lakshadweep and adjoining Southeast & Eastcentral Arabian Sea in the morning of 09th; it lay as a **Well Marked Low Pressure Area** over Eastcentral AS off Karnataka-Goa coasts in the morning of 10th and gradually concentrated into a **Depression** in the evening of 13th over the central parts of AS. Moving northwestwards it **crossed Oman coast** near latitude 19.35°N and longitude 57.7°E, close to Duqm (Oman) on **15th October 2024 during 2230 and 2330 hours IST**. Continuing to move northwestwards, it weakened gradually. The track of the system is presented in Fig.2(i)a.

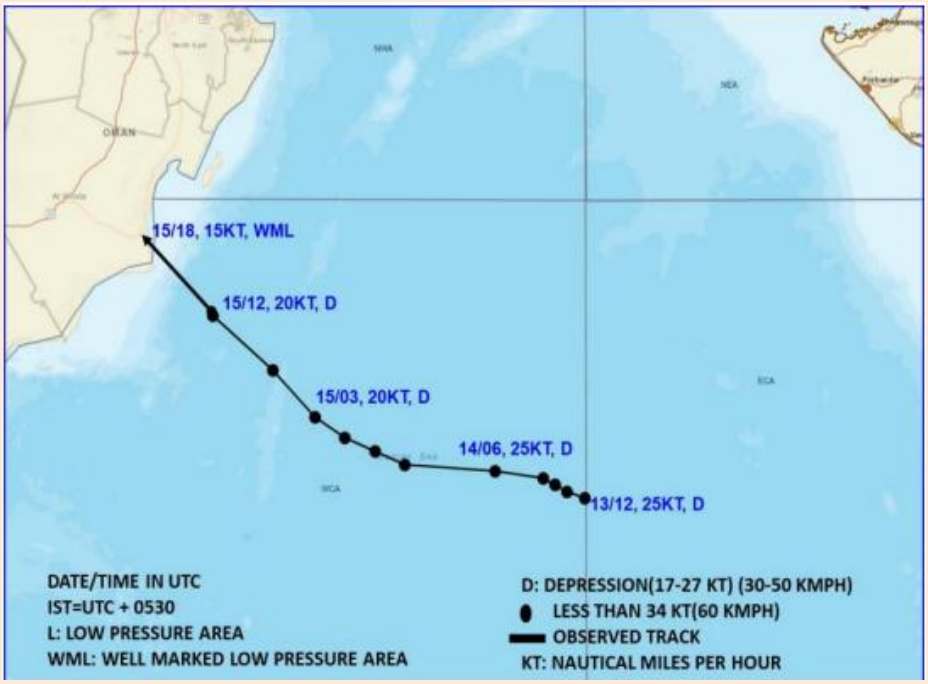


Fig.2(i)a: Track of the Depression over the Arabian Sea during 13-15 Oct 2024

IMD-GFS, 925 hPa wind analysis as on 0530 IST of 08th & 10th depicting the upper air cyclonic circulation in the lower levels with a trough extending from this circulation to Southwest Bay of Bengal across North Tamilnadu and IMD-GFS, mean sea level, isobaric analysis as on 12th October / 0530 IST indicting the centre of the Depression over the central Arabian Sea are shown in Fig.2(i)b.

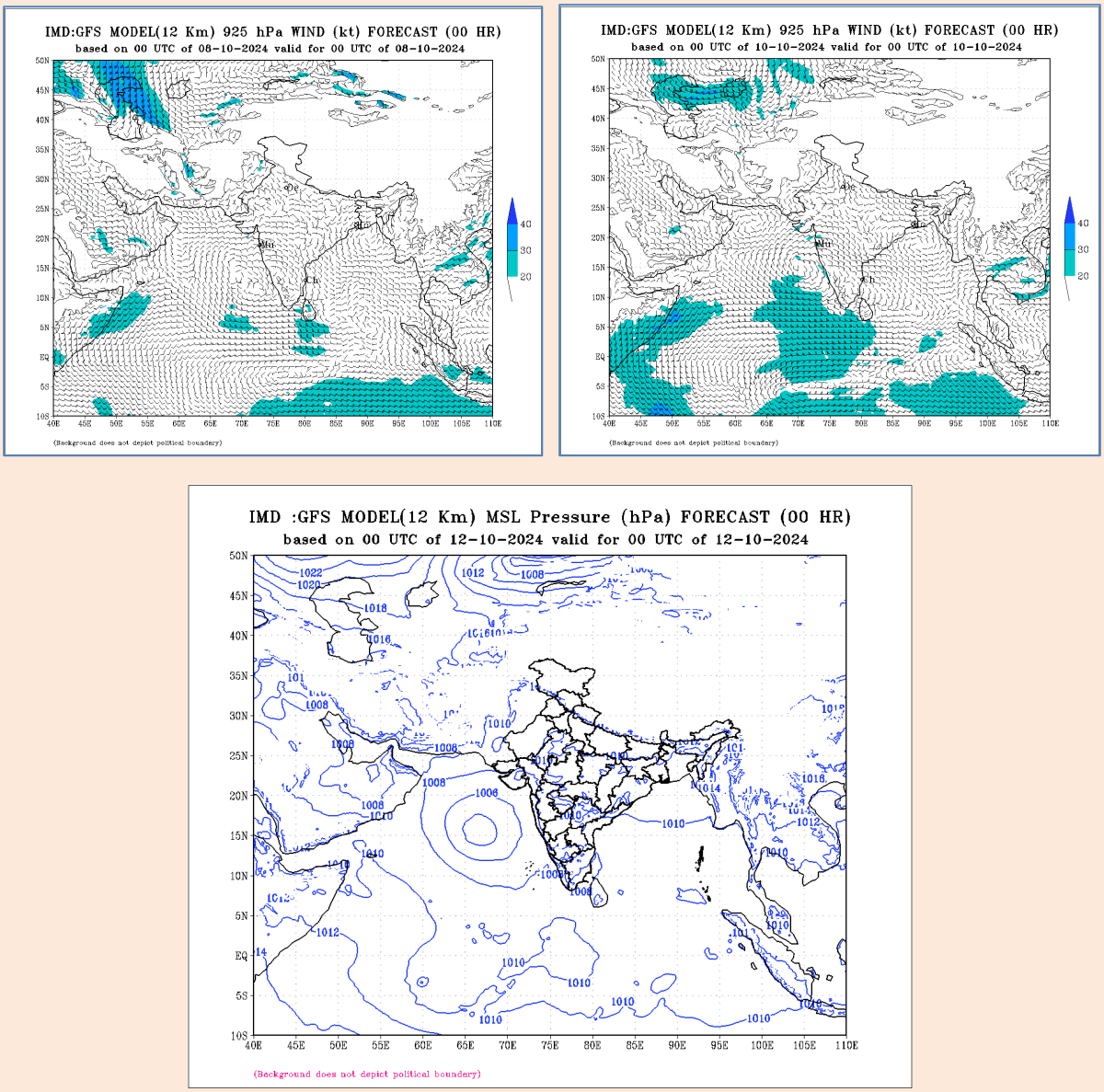


Fig.2(i)b: IMD-GFS, 925 hPa wind analysis as on 08th /0530 IST , 10th /0530 IST & Mean Sea Level Pressure analysis as on 12th / 0530 IST of October 2024

As the system was moving away from the Indian region, it did not contribute much towards rainfall over the peninsular India. However, during the formative stages of this system, *isolated* ***heavy / heavy-very heavy*** rain occurred over **Coastal Karnataka** on 08th & 09th; and over the western ghat areas of Tamilnadu on 08th & 10th; and *isolated* ***heavy*** rain occurred over Kerala on

08th & 09th; and over SIK on 09th October 2024. *Isolated* ***extremely heavy*** rain also occurred over Kerala on 08th October. **Quilandi in Kozhikode district reported 22 cm** on 08th Oct 2024.

(ii) Depression over Bay of Bengal during 15th-17th October 2024

As discussed in Section-2 on onset phase, under the influence of an upper air cyclonic circulation over Southeast Bay of Bengal and adjoining North Equatorial Indian Ocean on 12th /0830 hours IST of October 2024. A **Low Pressure Area** formed over the Southeast BOB in the early morning (0530 hours IST) of 14th October 2024. It lay as a **Well Marked Low Pressure Area** over the central parts of South BOB in the early morning (0530 hours IST) of 15th October and concentrated into a **Depression** over Southwest BOB in the same evening (1730 hours IST). It moved west-northwestwards and crossed North Tamilnadu - South Andhra Pradesh coasts between Puducherry and Nellore, close to north of Chennai, near latitude 13.5°N and longitude 80.2°E around 0430 hrs IST of the 17th October. Subsequently, it weakened into a Well Marked Low Pressure Area and lay over South Coastal Andhra Pradesh and adjoining North Coastal Tamilnadu in the early morning (0530 hrs IST) of the 17th October, 2024. The observed track of the system is presented in Fig.1b.

As discussed in Section-2 on onset phase, under the influence of this system. *fairly widespread-widespread* rainfall occurred over TN during 11th-16th, over Kerala during 12th-18th; & over CAP during 14th-21st; and *scattered to widespread* rainfall occurred over RYS & SIK during 14th-22nd Oct 2024.

Isolated ***heavy -very heavy*** rainfall occurred over TN & CAP during the 24-hr ending 0830 IST of 15th and ***heavy to very heavy*** rain with ***extremely heavy*** rain at *isolated* places occurred over Chennai & Tiruvallur districts of TN; and *heavy to very heavy* rain at *a few* places with ***extremely heavy*** rain at *isolated* places occurred over Tirupati district of RYS during the 24-hr ending 0830 IST of 16th October. *Isolated heavy-very heavy* rain occurred over RYS and *isolated heavy* rain occurred over CAP & SIK on 17th Oct 2024.

Extremely heavy rainfall was reported at **Cholavaram, Red Hills, Avadi areas of Tiruvallur district (30 cm, 28 cm & 25 cm** respectively); and **Zone 01 Kathivakkam & Zone 02 D15 Manali in Chennai district (23 cm & 21 cm** respectively); and **Sullurpeta in Tirupati district** in RYS (22 cm) on 16th October 2024.

Active-Vigorous monsoon conditions prevailed over TN during 11th-16th; over CAP during 15th-17th; over RYS during 15th-19th & over SIK during 15th-18th Oct 2024.

(iii) Severe Cyclonic Storm 'DANA' over Bay of Bengal during 22nd-26th October 2024

Under the influence of a cyclonic circulation Andaman Sea on 19th & 20th October 2024, a **Low Pressure Area** formed over the Eastcentral Bay of Bengal and adjoining North Andaman Sea in the evening (1730 hours IST) of 20th October. Moving west-northwestwards, it became a **Well Marked Low Pressure Area** over Eastcentral BOB in the noon (1130 hours IST) of 21st October. Continuing to move west-northwestwards, it concentrated into a **Depression** over Eastcentral BOB in the early morning (0530 hours IST) of 22nd October. It then moved northwestwards and intensified into a **Deep Depression** over Eastcentral BOB in the same evening (1730 hours IST). Continuing to move further northwestwards, it intensified into a **Cyclonic Storm "DANA**" over Eastcentral BOB in the early morning (0530 hours IST) of 23rd October. It then moved north-northwestwards and intensified into a **Severe Cyclonic Storm** over the Central & adjoining Northwest BOB in the mid-night (2330 hours IST) of 23rd October, 2024. Continuing to move north-northwestwards, it **crossed North Odisha coast close to Habalikhati Nature Camp (Bhitarkanika) and Dhamara during 0130 hrs IST to 0330 hrs IST of 25th October as a SCS with a wind speed of 100-110 kmph gusting to 120 kmph**. Continuing to move further north-northwestwards slowly, it weakened into a **CS** over north coastal Odisha in the forenoon (0830 hours IST) of 25th October and further into a **Deep Depression** in the afternoon (1430 hours IST). Thereafter, it gradually moved westwards, weakened into a **Depression** over interior Odisha in the midnight (2330 hours IST) of 25th October and further into a **WML** over North Odisha in the early morning (0530 hours IST) of 26th October. The track of the system is presented in Fig.2(ii)a.

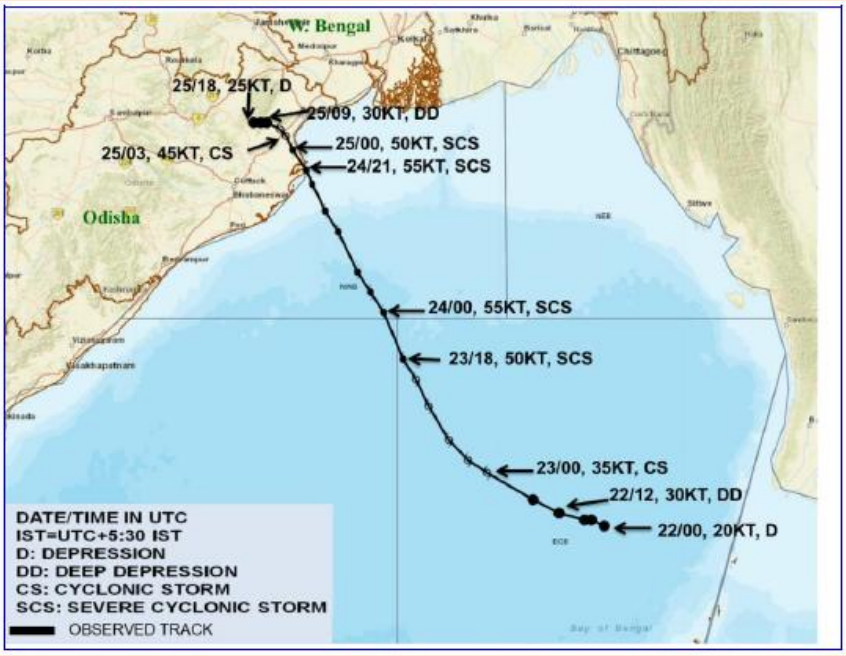


Fig.2(ii)a: Track of Severe Cyclonic Storm 'DANA' over Bay of Bengal during 22-26 Oct 2024

Satellite based cloud imagery as on 23rd October /0400 IST when the system was over the sea and Doppler Weather Radar, maximum reflectivity product when the system centre crossed coast as on 0343 IST of 25th October are presented in Fig.2(ii)b & c respectively.

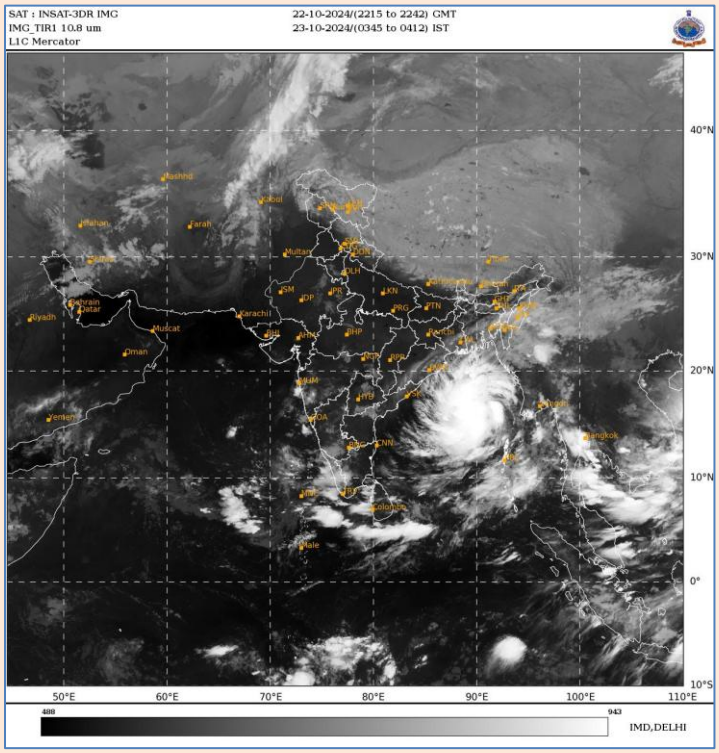


Fig.2(ii)b: INSAT-3DR, TIR1 imagery as on 23 Oct 2024 / 0400 IST

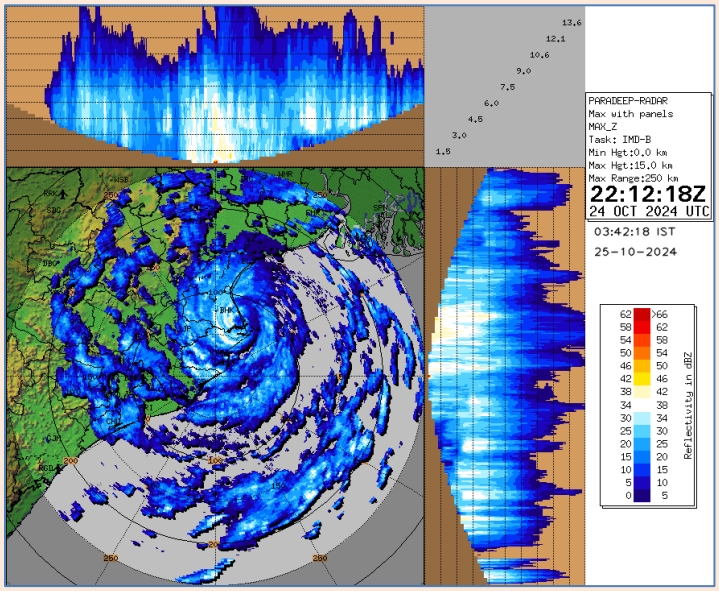


Fig.2(ii)c: Doppler Weather Radar, Paradeep, Maximum Reflectivity product as on 25 Oct 2024 / 0342 IST

As this system towards North Odisha, it did not contribute significantly towards rainfall over the northeast monsoon region. However, due to change in the flow pattern and sweeping away of moisture from the northeast monsoon region, rainfall activity was *subdued* over the northeast monsoon region. TN recorded only *isolated* rainfall activity during 27th-31st October. Further, only *isolated* rainfall occurred over CAP & RYS on most of the days during the last week of October and the first week of November 2024.

(iv) Cyclonic Storm 'FENGAL' over Bay of Bengal during 25th Nov – 02nd Dec 2024

Under the influence of an upper air cyclonic circulation over East Equatorial Indian Ocean (EEIO) and adjoining South Andaman Sea during 21st & 22nd November 2024, a **Low Pressure Area** formed over East Equatorial Indian Ocean (EEIO) and adjoining Southeast Bay of Bengal in the morning (0830 hours IST) of 23rd November. Moving west-northwestwards, it became a **Well Marked Low Pressure Area** in the morning (0830 hours IST) of 24th November over southeast BOB and adjoining EEIO. It moved west-northwestwards, concentrated into a **Depression** in the morning (0830 hours IST) of 25th November over central parts of South BOB and adjoining EEIO. Moving further west-northwestwards, it intensified into a **Deep Depression** in the morning (0830 hours IST /0300 UTC), of 26th November over Southwest BOB. Continuing to move west-northwestwards, it intensified into a **Cyclonic Storm 'FENGAL**' [pronounced as FEINJAL] over Southwest BOB in the afternoon (1430 hours IST) of 29th November. It then moved initially westwards & then west-southwestwards **and crossed North Tamilnadu & Puducherry coasts close to Puducherry between 2230 hours IST and 2330 hours IST of 30th November as a CS with wind speed of 70-80 kmph gusting to 90 kmph.** Thereafter, it remained practically stationary for almost 12 hours and weakened into a **Deep Depression** in the forenoon (1130 hours IST) of 1st December over North Coastal Tamilnadu. Continuing to move further west-northwestwards, it weakened into a **Depression** over the same region in the evening (1730 hours IST) of 1st December. Thereafter, it moved nearly westwards and weakened into a WML over North Interior Tamilnadu in the early morning (0530 hours IST) of 2nd December 2024. The track of the system is presented in Fig.2(iii)a. NOAA-ASCAT, Scatterometer winds as on 30th November / 21:30 IST indicating gale force winds of the order of 70-80 kmph off Cuddalore-Puducherry-Villupuram coasts is shown in Fig.2(iii)b. Surface mean sea level isobaric analysis as on 0830 IST and upper air streamline analysis as on 0530 IST of 30th November are shown in Fig.2(iii)c.

INSAT-3DR, satellite imagery depicting the cloudiness associated with the system as on 1130 IST of 30th November & Doppler Weather Radar, Karaikal, Maximum Reflectivity product as on 01st December 01:00 IST are shown in Fig.2(iii)d&e. Plots of hourly special coastal observations taken at the coastal stations of TN and south CAP from Pamban (TN) to Kavali (CAP) on the day of landfall are presented in Fig.2(iii)f.

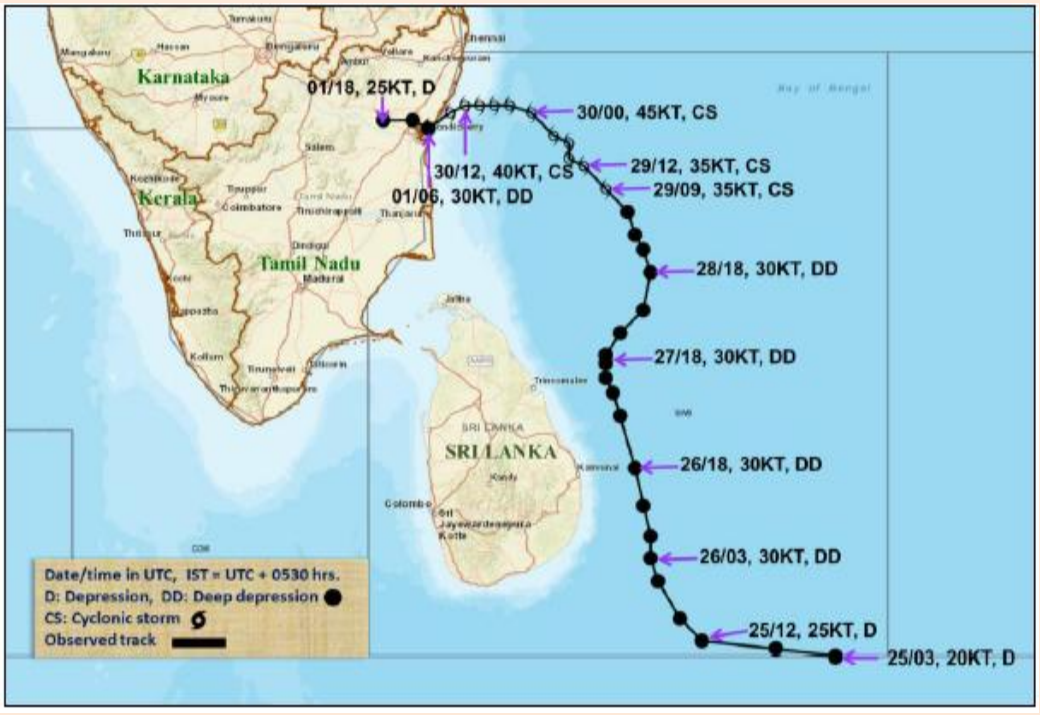


Fig.2(iii)a: Track of the Cyclonic Storm 'FENGAL' over the Bay of Bengal during 25 Nov-02 Dec 2024

Associated with the landfall of the system gale winds with speed 65-70 kmph were recorded at various stations in the coastal areas of Cuddalore, Puducherry, Villupuram, Chengalpattu & Chennai districts [Fig.2(iii)g]. Puducherry AWS recorded mean sea level pressure of 994.7 hPa during the early hours (0315-0330 IST) of 01st December. Also, associated with the passage of the system, northeastern parts of Tamilnadu and Puducherry experienced torrential rains on 01st & 02nd December. ***Extremely heavy*** rainfall occurred over **Puducherry**; ***very heavy to extremely heavy*** rainfall occurred at *most* places over **Villupuram** district; ***very heavy*** rainfall occurred at *most* places with ***extremely heavy*** rainfall at *isolated* places over **Thiruvannamala**i district; *very heavy* rainfall occurred at *most* places over *Tiruvallur & Ranipet* districts; ***heavy to very heavy*** rainfall occurred at *many* places with *extremely heavy* rainfall at *isolated* places over **Cuddalore & Kanchipuram** districts; ***heavy to very heavy*** rainfall at *most* places over **Chennai, Chengalpattu & Kallakurichi** districts; ***isolated heavy to very heavy*** rain occurred over **Salem** district and **isolated heavy** rainfall occurred over **Vellore, Tirupattur, Dharmapuri, Krishnagiri, Namakkal & Mayiladuthurai** districts during the 24-hr ending 08:30 IST of **01st December 2024**. There were extremely heavy rainfall reports from 16 stations in Villupuram district, 6 stations in Puducherry, 3 stations in Thiruvannamalai district, 2 stations in Cuddalore district and 1 station in Kanchipuram district. The highest rainfall amount of **51 cm was recorded at Mailam in Villupuram district followed by Puducherry: 49 cm on 01st December 2024**.

On 02nd December, ***extremely heavy*** rainfall occurred at *many* places over **Villupuram** district; ***very heavy-extremely heavy*** rainfall occurred at *many* places over **Kallakurichi** district and at *a few* places over **Thiruvannamalai** district; ***heavy to extremely heavy*** rainfall occurred at *many* places over **Krishnagiri** district and at *a few* places over **Salem** district; ***heavy-very heavy*** rainfall at *many* places with *isolated* ***extremely heavy*** rainfall occurred over **Dharmapuri** district; ***heavy to very heavy*** rainfall occurred at *a few* places over **Cuddalore** district; ***heav***y rainfall occurred at *many* places over **Tirupattur** district and at *isolated* places over **Namakkal** & **Nilgiris** districts. There were ***extremely heavy*** rainfall reports from **10** stations in **Villupuram** district, **5** stations from **Kallakurichi** district, **3** stations from **Krishnagiri** district and **1** station each from **Dharmapuri, Salem & Thiruvannamalai** districts. **Uthangarai in Krishnagiri** district reported the highest rainfall of **50 cm** followed by **RSCL-2 Kedar in Villupuram** district reporting **42 cm**. Fig.2(iii)h presents the autographic charts of Self Recording Rain Gauges (SRRG) at Puducherry & Cuddalore pertaining to the 24-hr ending 0830 IST of 01st & 02nd December and Fig.2(iii)i presented the spatial rainfall distribution and rainfall intensity over TN during the 24-hr ending 0830 IST of 01st & 02nd December 2024.

Associated with the passage of the system, extensive damages were reported over the north coastal and adjoining interior districts of Tamilnadu and Puducherry. Torrential rains coupled with release of water from Sathanur dam in Thiruvannamalai district caused catastrophic flooding over Thiruvannamalai, Kallaurichi, Villupuram, Cuddalore and adjoining districts and Puducherry area. Some media reports on the damages caused are furnished in Fig.2(iii) j.

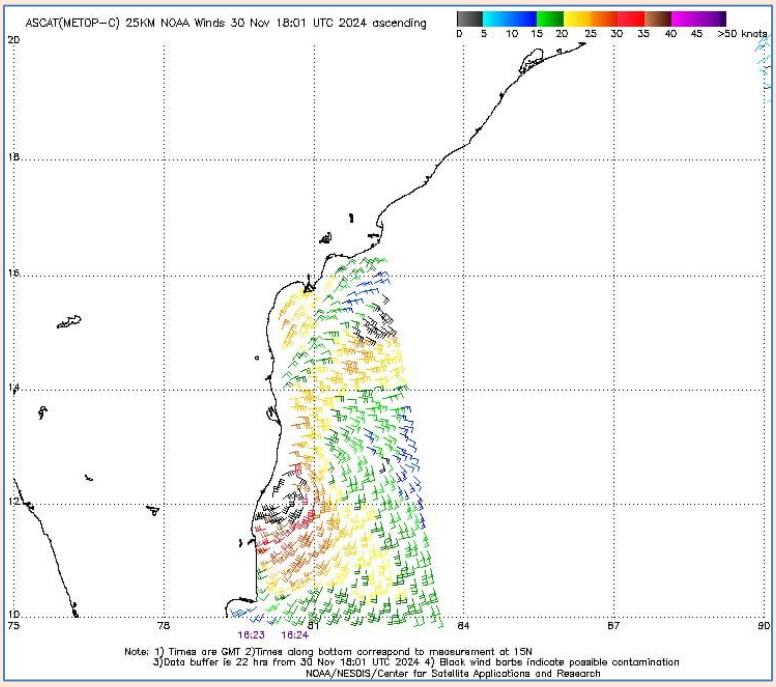
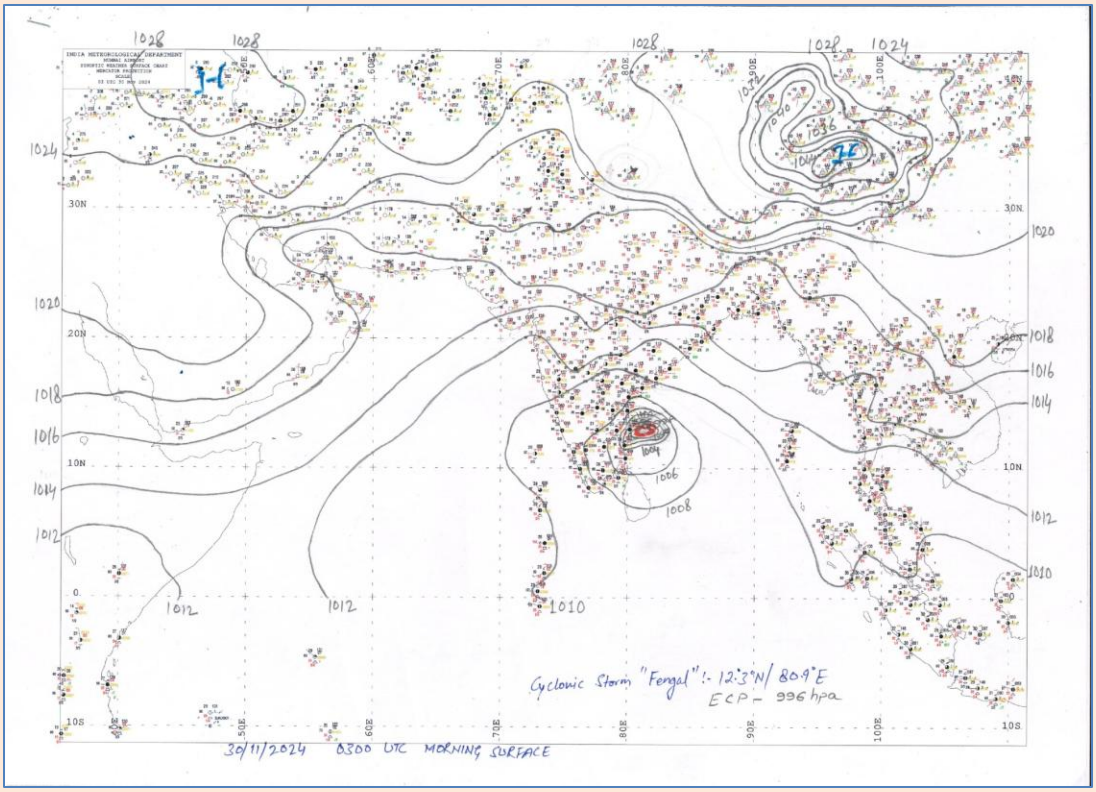


Fig.2(iii)b: NOAA-ASCAT, Scatterometer winds as on 30th November / 21:30 IST



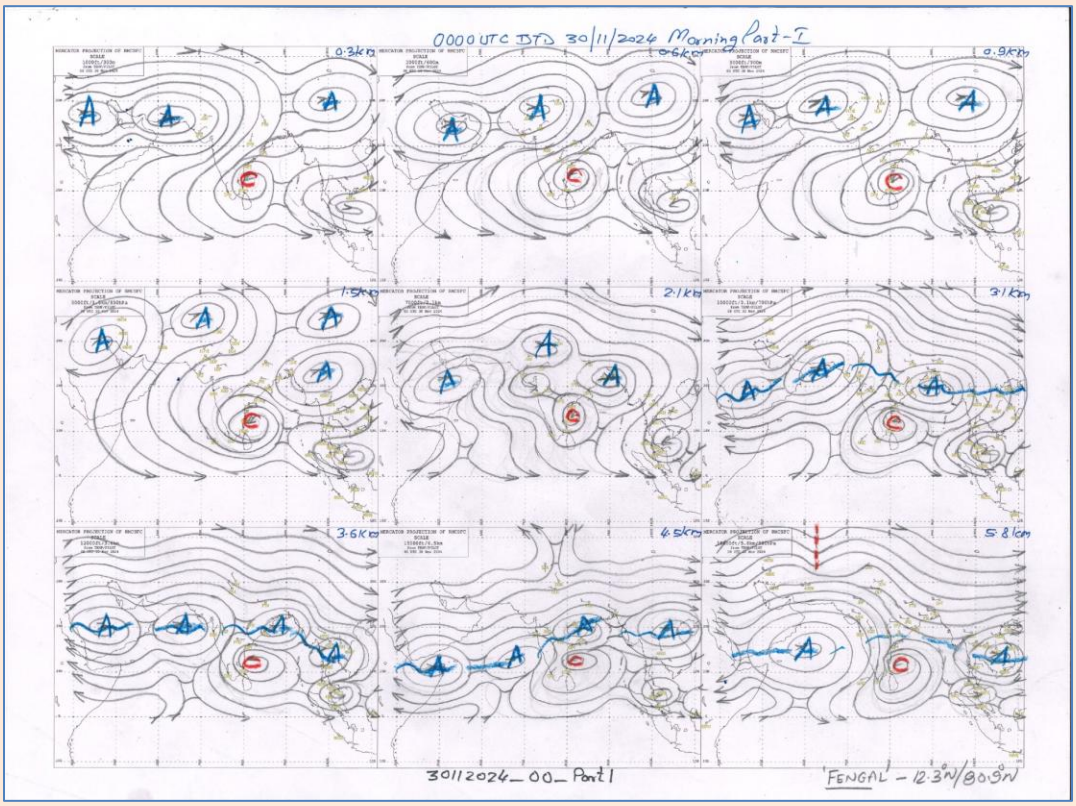
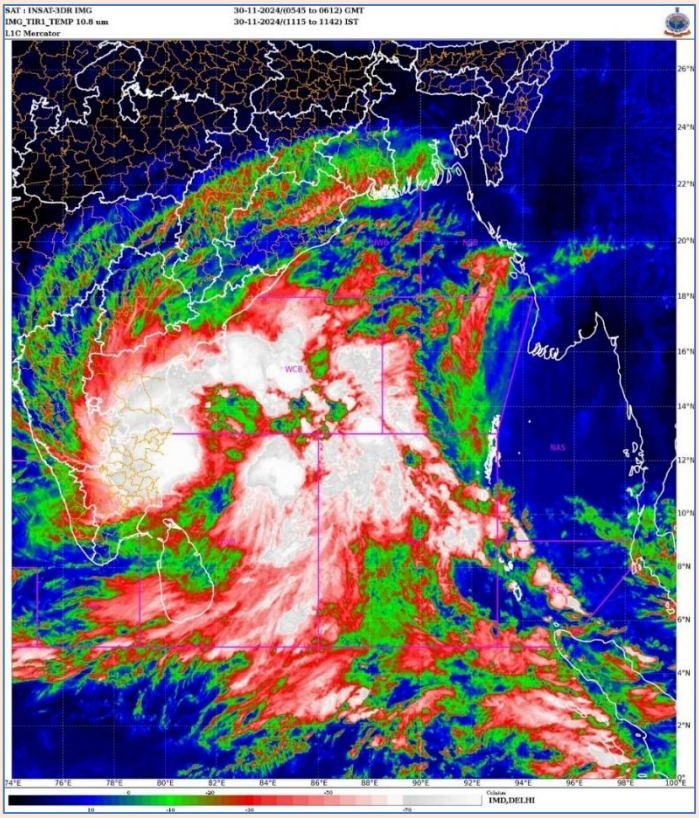
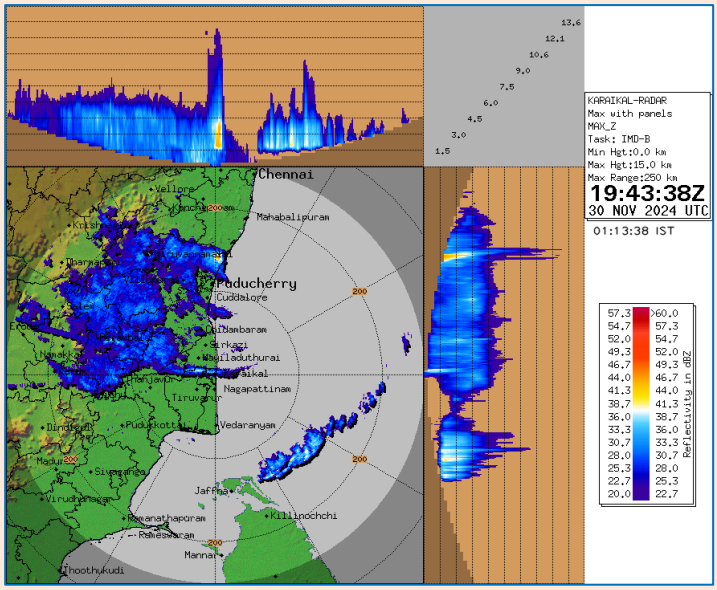


Fig.2(iii)c: Surface mean sea level isobaric analysis as on 0830 IST and upper air streamline analysis as on 0530 IST of 30th Nov 2024

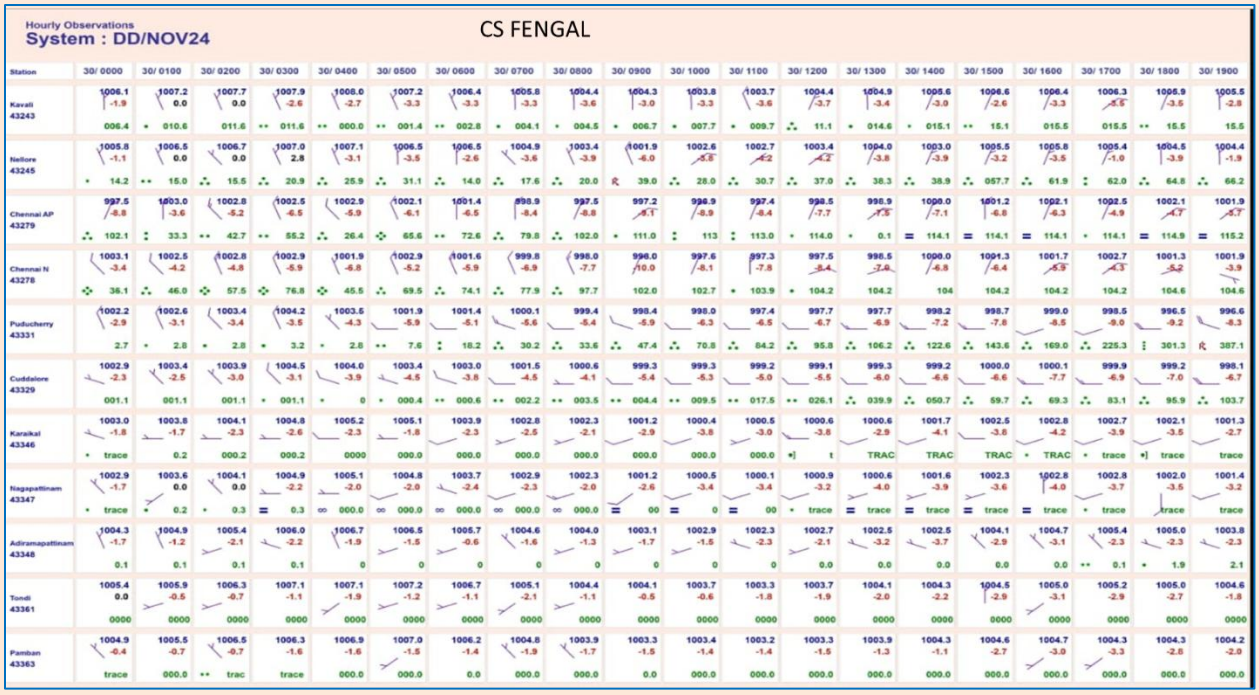


(d)



(e)

Fig.2(iii) d&e: INSAT-3DR, TIR1 imagery as on 1130 IST of 30th November (d) & Doppler Weather Radar, Karaikal, Maximum Reflectivity product as on 01st December 01:00 IST (e).



Flig.2(iii)f: Plots of hourly special coastal observations from Pamban (TN) to Kavali (CAP) on 30 Nov 2024

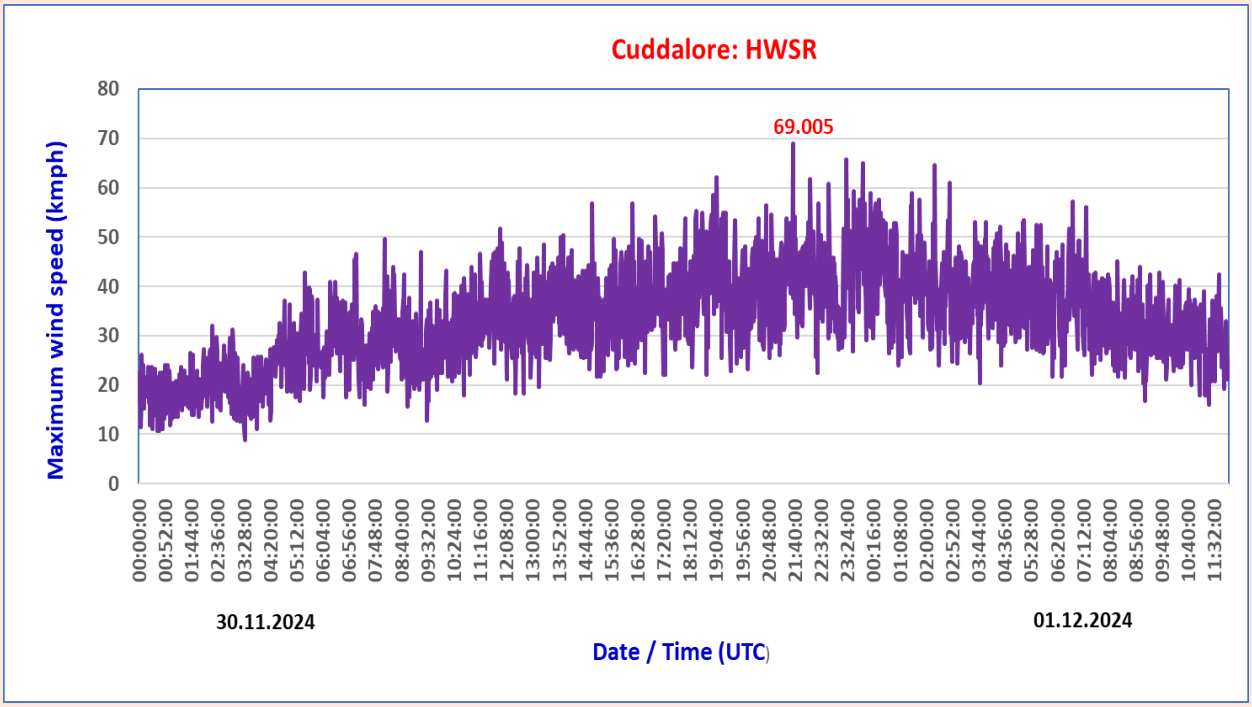
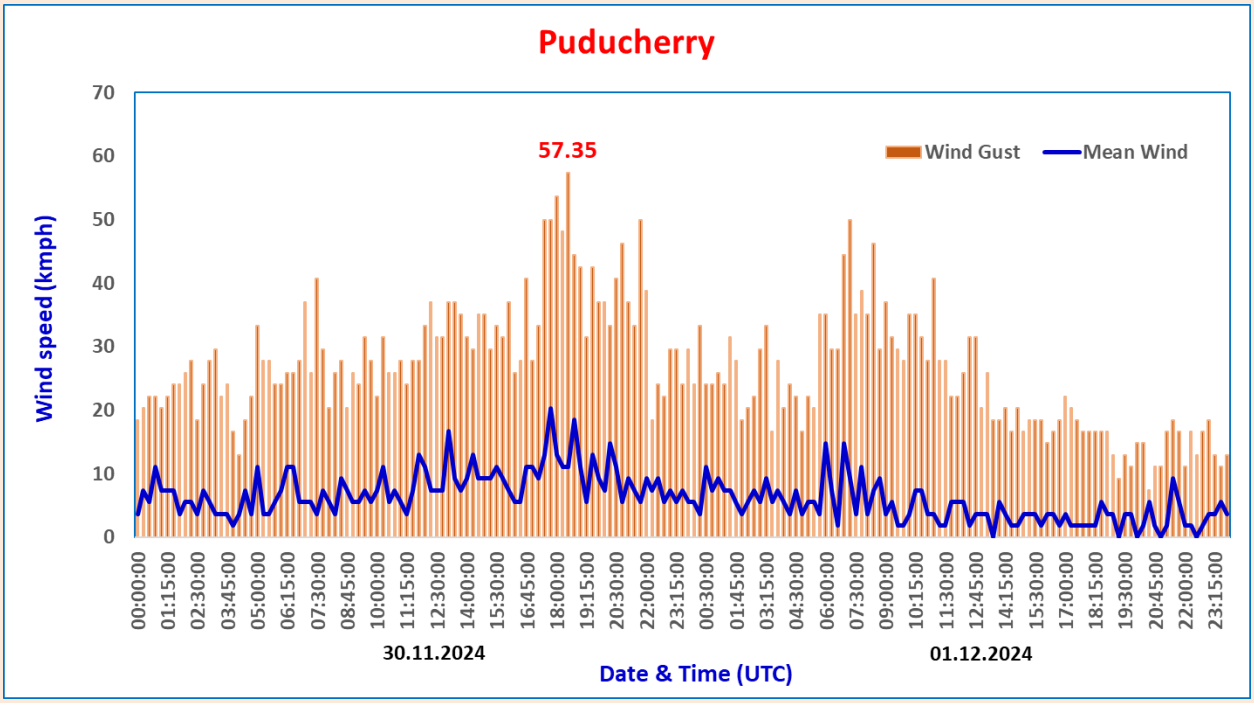


Fig.2(iii)g: Plots of wind speed recorded by High Wind Soeed Recorder (HWSR) / Automatic Weather Stations (AWS) at various coastal stations



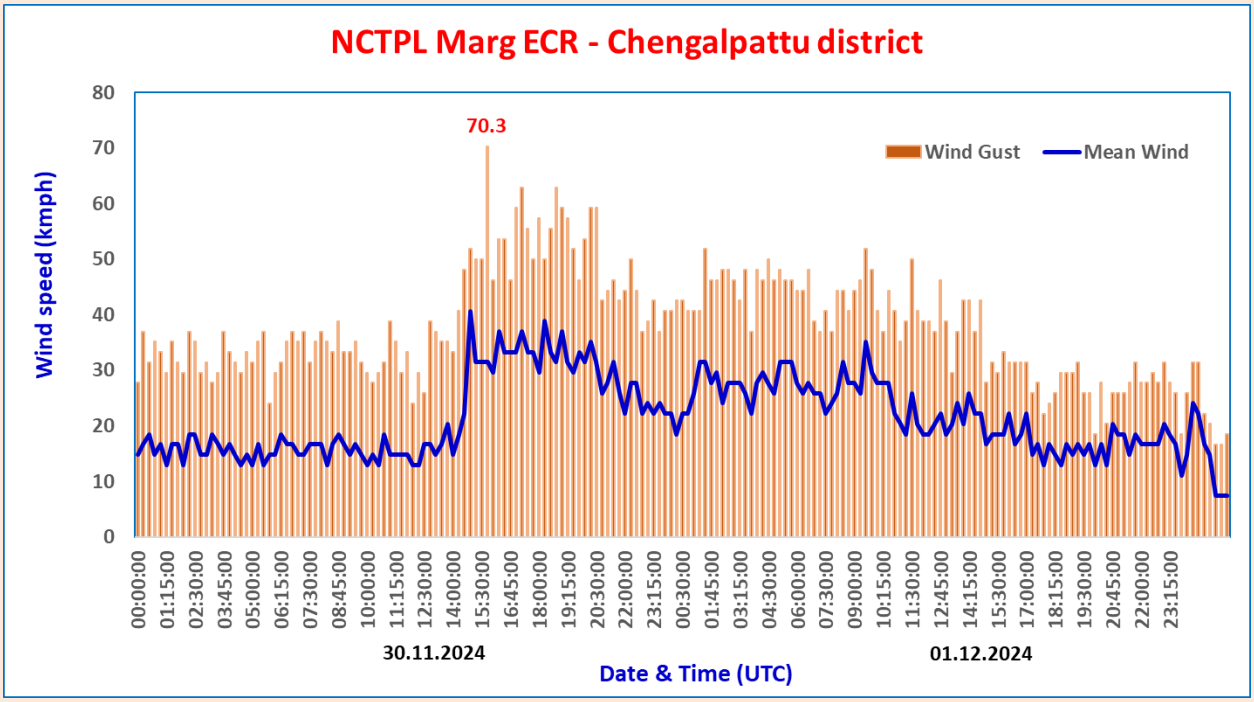
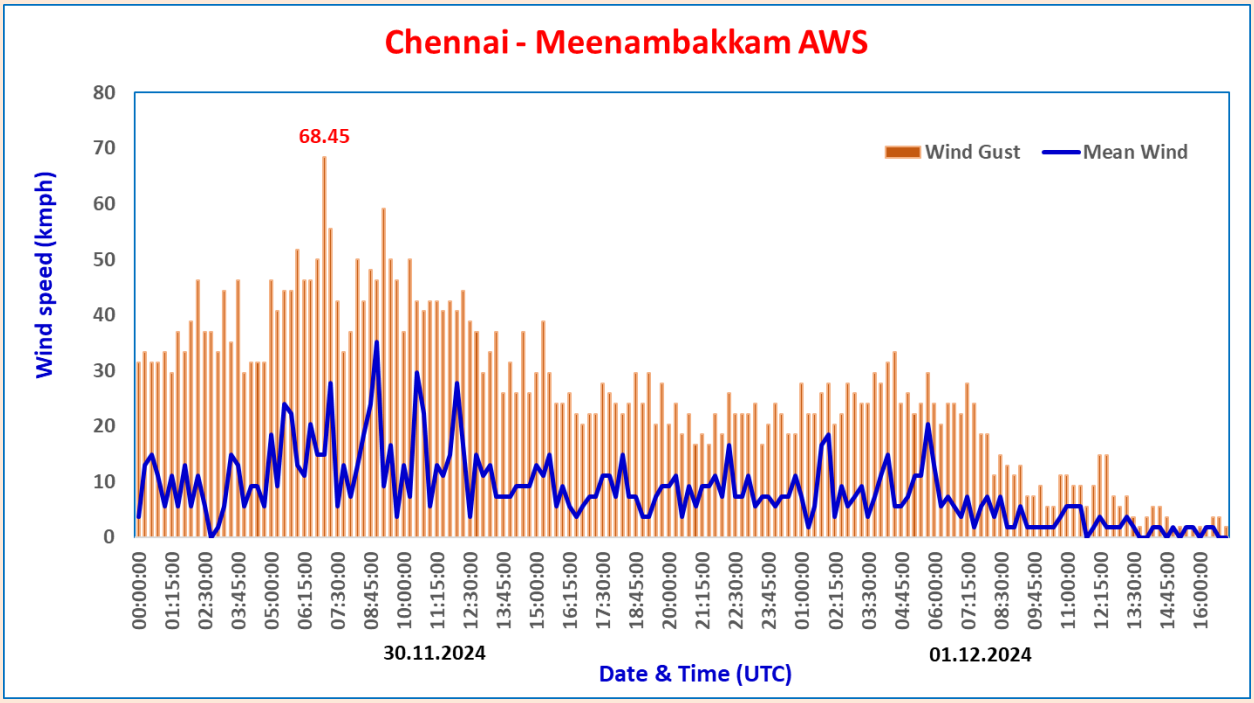


Fig.2(iii)g: contd.



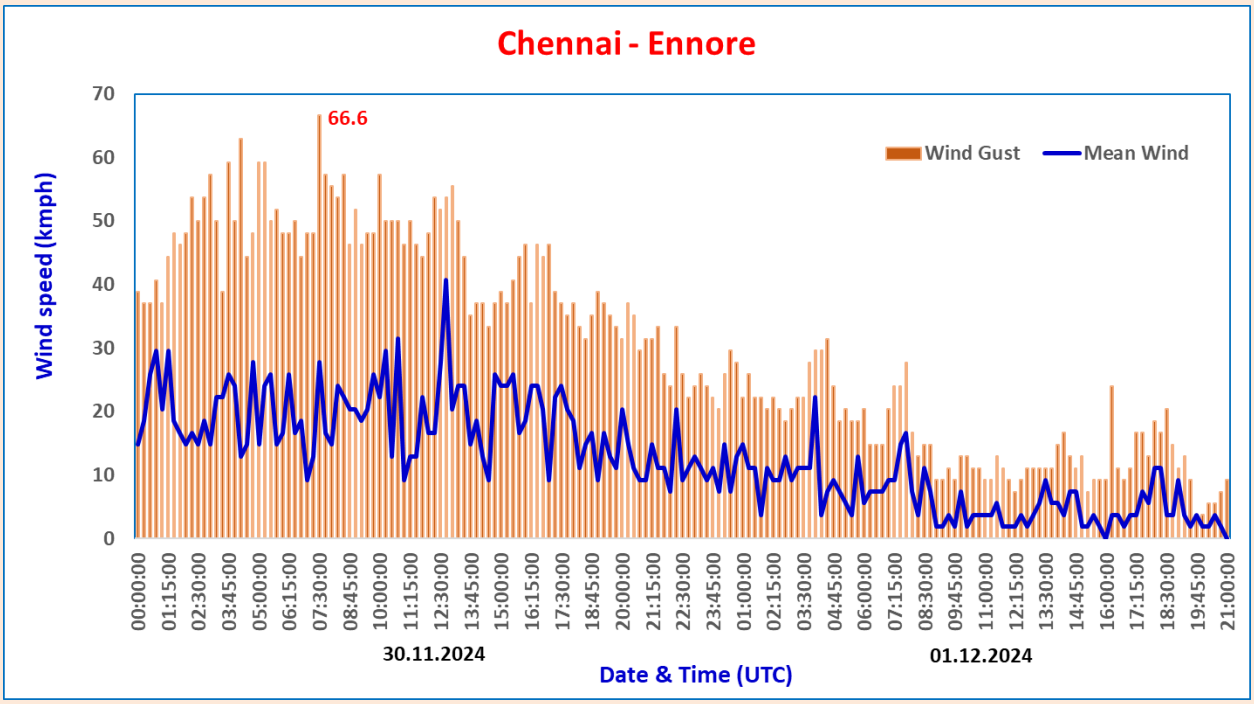
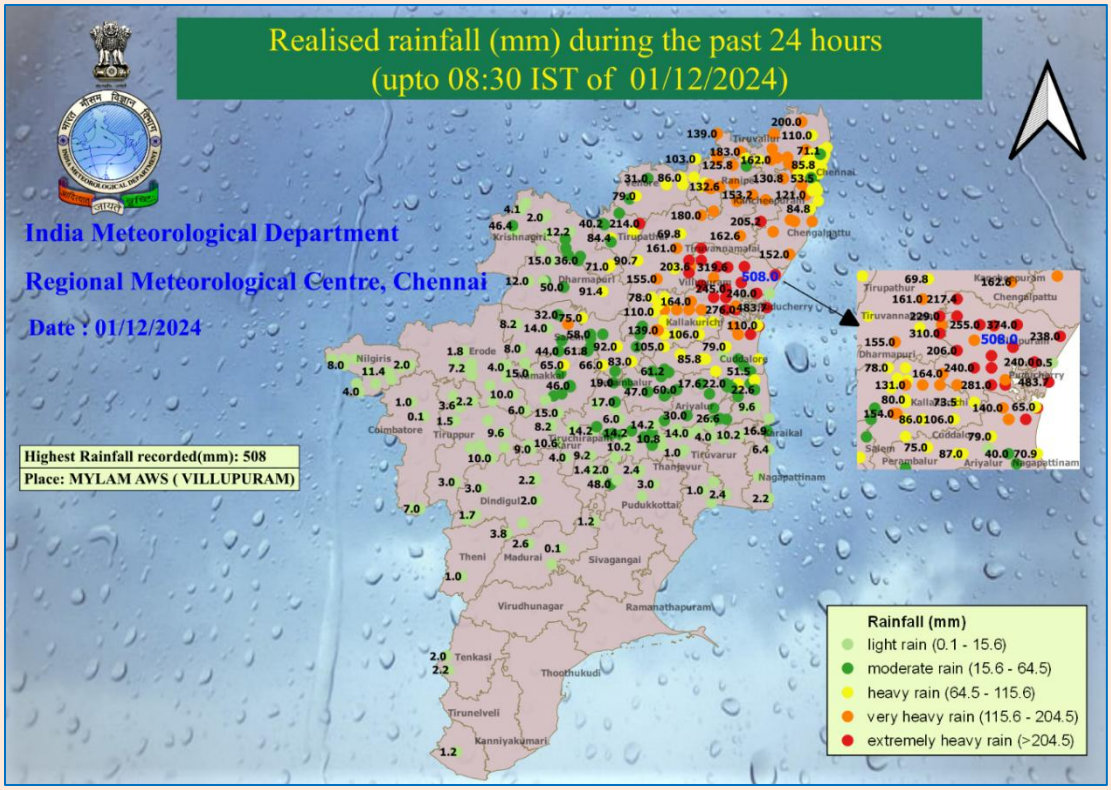


Fig.2(iii)g: contd.

Fig.2(iii)h: Self Recording Rain Gauge charts of Puducherry & Cuddalore as on 24-hr ending 0830 IST of 01st & 02nd December 2024.



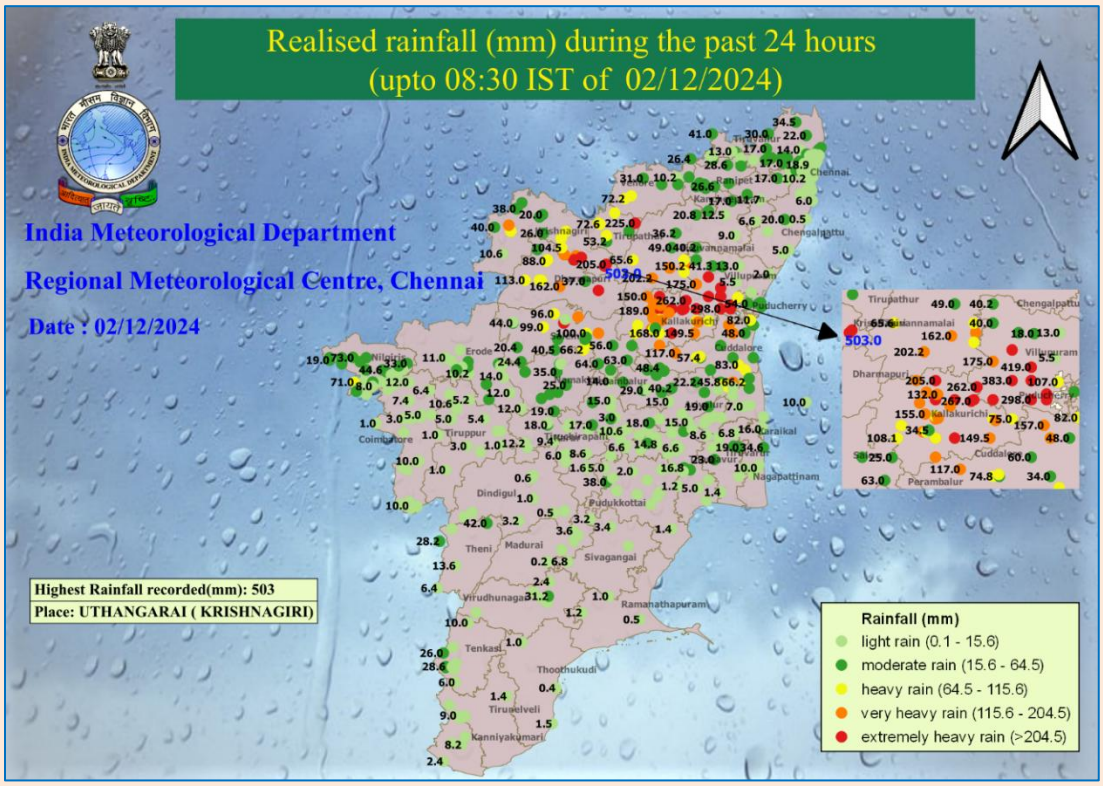


Fig.2(iii)i: Spatial rainfall distribution and rainfall intensity over TN during the 24-hr ending 0830 IST of 01st & 02nd December 2024

A district-wise list of heavy rainfall reports over TN during the 24-hr ending 0830m IST of 01st &02nd Dec 2024 is furnished in Table-1 below:

Table-1: District-wise & Date-wise list of heavy rainfall amounts reported on 01st & 02nd Dec 2024

District	Date-wise list of heavy rainfall (cm) recorded during the 24-hr ending 08:30 hrs IST of 01st & 02nd Dec 2024
Villupuram	**01st Dec:** Mylam AWS **51**; Tindivanam **37**; RSCL-2 Nemoor **35**; RSCL Vallam **32**; RSCL-3 Semmedu **31**; RSCL-2 Valavanur **28**; RSCL-2 Koliyanur **28**; Vilupuram **27**; Gingee **25**; RSCL-2 Kedar **25**; RSCL-3 Valathy **24**; Vanur **24**; RSCL-2 Soorapattu **24**; Marakkanam **24**; RSCL-3 Avalurpettai **23**; RSCL-3 Anandhapuram **21**; BASL Mugaiyur **18**; RSCL-2 Kanjanur **16**; RSCL-2 Mundiyampakkam **15**; BASL Manampoondi **13**; SCS Mill Arasoor **8**; SCS Mill Thiruvennainal **7**; **02nd Dec:** RSCL-2 Kedar **42**; RSCL-2 Soorapattu **38**; Vilupuram **35**; RSCL-2 Mundiyampakkam **32**; RSCL-2 Koliyanur **32**; BASL Mugaiyur **30**; RSCL-2 Valavanur **30**; RSCL-2 Nemoor **29**; RSCL-2 Kanjanur **29**; BASL Manampoondi **29**; RSCL-3 Anandhapuram **17**; RSCL-3 Semmedu **11**; SCS Mill Arasoor **7**; SCS Mill Thiruvennainal **7**; RSCL-3 Avalurpettai **7**;
Puducherry	**01st Dec:** Puducherry AWS **49**; Puducherry **48**; Patthukannu **45**; Thirukkanur **43**; Puducherry Town **40**; Bahour **32**; **02nd Dec:** Thirukkanur **11**; Bahour **8**;
Tiruvannamalai	**01st Dec:** Tiruvannamalai AWS **22**; Chetpet **22**; Jamunamarathur **21**; Keelpennathur **20**; Arani **18**; Cheyyar ARG **17**; Vandavasi **16**; Kalasapakkam **16**; Thandarampettai **15**; Cheyyar **14**; Vembakkam **14**; Chengam **9**; Tiruvannamalai **7**; Polur **7**; **02nd Dec:** Jamunamarathur **23**; Thandarampettai **20**; Tiruvannamalai **16**; Keelpennathur **15**; Chengam **7**;
Cuddalore	**01st Dec:** Cuddalore **23**; Cuddalore Collector Office **21**; Vanamadevi **19**; SRC Kudithangi **17**; Panruti **14**; Kattumayilur **11**; Virdhachalam KVK AWS **9**; Virudachalam **9**; Kuppanatham **9**; Vridhachalam ARG **8**; Me Mathur **8**; Vadakuthu **8**; Vepur **7**; Parangipettai **7**; Srimushnam **7**; Kurinjipadi **7**; **02nd Dec:** Panruti **16**; Vanamadevi **15**; Kattumayilur **14**; Vepur **12**; Me Mathur **12**; SRC Kudithangi **11**; Sethiathope **10**; Pelandurai **9**; Bhuvanagiri **8**; Kuppanatham **7**; Lakkur **7**; Kilacheruvai **7**; Chidambaram **7**; Vridhachalam ARG **7**;
Kancheepuram	**01st Dec:** Uthiramerur **21**; Kancheepuram **15**; Sriperumbudur **13**; Walajabad

	13; Kundrathur 11; ACS Medical College ARG 11;
Kallakurichi	**01st Dec:** Thirukoilur ARG 16; Kallakurichi 15; Kallakurichi ARG 14; DSCL Madampoondi 13; DSCL Thirupalapandal 12; DSCL Kalayanallur 12; Tirukoilur 12; BASL Manalurpet 11; KCS Mill-1 Ariyalur 11; BASL Vengur 11; Sankarapuram 11; Ulundurpet 11; DSCL Virugavoor 11; Ariyalur Camp Area 10; DSCL Sulangurichi 10; DSCL Thiyagadurgam 10; DSCL Keelpadi 10; DSCL Rishivandhiyam 9; DSCL Eraiyur 9; KCS Mill-1 Kadavanur 9; Manimutharu Dam PWD 8; KCS Mill-2 Moorarpalayam 8; KCS Mill-1 Moongilthuraipattu 8; **02nd Dec:** DSCL Thirupalapandal 32; DSCL Madampoondi 31; BASL Vengur 27; Tirukoilur 26; DSCL Eraiyur 23; BASL Manalurpet 21; Sankarapuram 19; Kallakurichi 18; DSCL Kalayanallur 17; KCS Mill-2 Moorarpalayam 15; KCS Mill-1 Moongilthuraipattu 15; Ulundurpet 15; DSCL Sulangurichi 15; DSCL Rishivandhiyam 15; SCS Mill Pillaiyarkuppam 15; DSCL Keelpadi 15; DSCL Virugavoor 14; KCS Mill-1 Ariyalur 13; Ariyalur Camp Area 13; KCS Mill-1 Kadavanur 13; DSCL Thiyagadurgam 11; Manimutharu Dam PWD 11; KCS Mill-2 Kachirayaopalayam 11; Kallakurichi ARG 9; Gomugi Dam PWD 9;
Krishnagiri	**01st Dec:** Pambar Dam 9; Uthangarai 7; **02nd Dec:** Uthangarai 50; Jambukuttapatti 25; Pochampalli ARG 25; Pambar Dam 21; Barur 20; Penucondapuram 19; Nedungal 14; Krishnagiri 11; Paiyur AWS 11; KRP Dam 10;
Dharmapuri	**01st Dec:** Harur 9; Subramania Siva Co.Op Sugar Mill 9; Pappireddipatti 7; **02nd Dec:** Harur 33; Pappireddipatti 20; Dharmapuri PTO 16; Pennagaram 11; Palacode ARG 9; Hogenekal 9; Palacode 8; Dharamapuri 7;
Salem	**01st Dec:** Yercaud 14; Attur 9; Veeraganoor 8; Thammampatty 7; **02nd Dec:** Yercaud 24; Kariyakovil Dam 15; Anaimaduvu Dam 10; Omalur 10; Danishpet 10; TNAU CRI Yethapur 8;
Ranipet	**01st Dec:** Arcot 18; Wallajah 15; Kalavai PWD 15; Arakonam 14; Sholingur 14; Palar Anicut 13; Kaveripakkam 13; Panapakkam 13; Minnal 13; Ranipet AWS 12; Ammoor (Walajah Railway) 11; Ranipet 9;
Tiruvallur	**01st Dec:** Gummidipoondi 20; Avadi 19; Tiruttani 18; Thamaraipakkam 16; Pallipattu 14; Jaya Engg College AWS 14; Koratur 13; Uthukottai 13; Chembarabakkam_REV 13; R.K.Pet ARG 13; Red Hills 13; Poondi 13; R.K.Pet 13; Tiruvallur 13; Cholavaram 12; Tiruttani AWS 12; Tiruttani PTO 11; Ponneri 11; Poonamallee 10; Thiruvalangadu 10; Puzhal ARG 9; Chembarambakkam ARG 9; Ennore AWS 7;

Chengalpattu	**01stDec:** Maduranthagam **20**; Chengalpattu **20**; Thirukalukundram **19**; Tambaram **16**; Cheyyur **15**; Mahabalipuram **14**; LMOIS Kolapakkam ARG **12**; Nctpl Marg ECR AWS **11**; VIT_Chennai AWS **9**; Thirupporur **9**; Mahabalipuram AWS 8; Hindustan_University **7**; Kelambakkam **7**; Satyabama Uty ARG **7**;
Chennai	**01stDec:** MGR Nagar **15**; Ayanavaram Taluk Office **15**; Zone 12 Meenambakkam **12**; Ambathur Rev **12**; Valasaravakkam **12**; Ambattur MW **12**; Zone 07 Ayapakkam **12**; Zone 11 Maduravoyal **12**; Chennai (AP) **11**; Alandur **11**; Meenambakkam AWS **11**; Zone 11 Valasaravakkam **11**; Anna Nagar **11**; Thiru-Vi-Ka Nagar **11**; Chennai Collector Office **11**; Perambur **11**; Chennai(N) AWS **11**; Sholinganallur **11**; Kodambakkam **11**; Chennai (N) **11**; Zone 10 Vadapalani **11**; DGP Office **10**; CD Hospital Tondiarpet **10**; Zone 12 D156 Mugalivakkam **10**; Zone 18 Aminjikarai **10**; Zone 05 Basin bridge **10**; Zone 14 Madipakkam **10**; Anna University **9**; Zone 03 Puzhal **9**; Zone 03 Madhavaram **9**; Zone 04 Tondiarpet **9**; Zone 01 Thiruvottiyur **9**; Madhavaram **9**; YMCA Nandnam ARG **9**; Anna University ARG **9**; Royapuram **9**; Zone 08 Anna Nagar West **9**; Zone 06 Kolathur **9**; Zone 09 Nungambakkam **9**; Tondairpet **8**; NIOT_Pallikaranai ARG **8**; Zone 13 Adyar **8**; Adyar **8**; Zone 12 Alandhur **8**; Perungudi **8**; Zone 05 Chennai central **8**; Thiruvottiyur **7**; Zone 07 Ambattur **7**; Zone 02 D15 Manali **7**; Zone 01 Kathivakkam **7**; Zone 15 Sholinganallur **7**; Zone 09 Ice House **7**; Zone 15 Uthandi **7**; Sholinganallur MW **7**; Zone 13 Raja Annamalaipuram **7**;
Tirupathur	**01st Dec:** Alangayam **10**; Tirupattur AWS **9**; Tirupattur PTO **8**; Vadapudupattu **8**; **02nd Dec:** Vadapudupattu **8**; Vaniyambadi **8**; Tirupattur PTO **7**; Natrampalli **7**; Ambur **7**; Tirupattur AWS **7**; TCS Mill Kethandapatti **7**;
Vellore	**01st Dec:** Vellore **11**; Ponnai Dam **10**; Ammundi **10**; Katpadi **9**; Virinjipuram AWS **8**;
Namakkal	**01st Dec:** Rasipuram **7**; **02nd Dec:** Mangalapuram **7**;
Myladuthurai	**01st Dec:** Kollidam **7.**

EXPRESS POST

INDIA POLITICS BUSINESS SPORTS ENTERTAINMENT INTERNATIONAL SCI-TECH LIFESTYLE OP-

Cyclone Fengal wreaks havoc in Tamil Nadu and Puducherry

EP News Service – Dec 02, 2024

Bus depot at Puducherry flooded due to heavy rainfall triggered by Cyclone Fengal

CHENNAI: Cyclone Fengal, which made landfall over Tamil Nadu's coastal regions on November 30, has wreaked havoc, leaving at least 19 dead and causing widespread damage. The storm intensified into a cyclonic storm as it approached the state, bringing heavy rainfall, gusty winds, and flooding to districts such as Villupuram, Cuddalore, and Puducherry.

The cyclone's trajectory shifted closer to Mahabalipuram, intensifying its impact across Chennai and its surroundings. In the wake of the storm, the Tamil Nadu government declared holidays for schools in several districts and urged residents to stay indoors. As rain and wind continued throughout the weekend, authorities focused on rescue and relief operations.

Thousands were evacuated from affected areas, and disaster management teams worked tirelessly to assist those in need. Reports of severe infrastructure damage, including uprooted trees and collapsed buildings, have emerged, making recovery efforts more challenging. Public transport in several areas was suspended, and power outages were widespread.

The storm's impact has been particularly harsh on agriculture, with crops in several regions reported as damaged. Local farmers are now facing significant losses due to the flooding and destruction of farmland. Efforts are underway to clear roads, restore power lines, and provide aid to affected communities.

Puducherry, which received its highest rainfall in 30 years, remained flooded as the downpour continued. The entire Puducherry town was flooded on Sunday due to a heavy downpour of 46 cm rainfall, the highest since 2004 when it was 21 cm. The Union Territory saw streets submerged, with low-lying residential areas reporting waist-deep water. Trees were uprooted, power lines snapped, and major roads rendered impassable. Relief centres have been set up with voluntary organizations stepping in to supply food to affected residents.

The Indian Army and Coast Guard joined rescue efforts early Sunday morning, evacuating over 100 people stranded in the heavily flooded Krishna Nagar area. In neighbouring Villupuram district in Tamil Nadu, the cyclone's impact was equally severe. Automatic weather stations recorded 504 mm of rainfall in Mailam, while Nemmeli and Vanur reported 46 cm and 41 cm, respectively.

As many as 11 incidents of wall collapse have been reported in Kottakuppam and Marakkanam and about 51 electric poles and 22 trees were uprooted were also reported on Monday. According to the administration over 1,281 residents had been evacuated to 21 relief camps across the district.

Chief Minister M K Stalin described the rain in Villupuram district as "unprecedented," saying that Mailam recorded 49 cm, followed by Nemmeli at 46 cm and Vanur (41 cm) in the past 24 hours. He also said that he would request the Centre to send a team to assess the damage in Villupuram, Cuddalore, and Chengelpet, the other worst-affected areas due to the cyclone.

Stalin has said that he in constant touch with district collectors and Ministers in charge of several districts including that of of Cuddalore, Dharmapuri, Krishnagiri and Tiruvannamalai and instructed them to expedite the relief work and ensure that normalcy returned to the districts at the earliest.

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News / India / Tamil Nadu / Water released from Sathanur dam after multiple warnings: Tamil Nadu Minister

Water released from Sathanur dam after multiple warnings: Tamil Nadu Minister

Rejecting the opposition's claims, the Tamil Nadu minister said that water from the Sathanur dam in Thiruvannamalai district was released after five flood alerts were issued and that the timely action and precautionary steps taken by the state government averted a major catastrophe.

Release of 1.70 lakh cubic feet from Sathanur dam resulted in major flooding

Pramod Madhav
Chennai, UPDATED: Dec 4, 2024 00:35 IST
Edited By: Sudeep Lavania

The Tamil Nadu government on Tuesday rejected the opposition's claim that water was released from the Sathanur dam without warning and said that as many as five warnings were issued before releasing the water.

Several areas in Tamil Nadu's Tiruvannamalai on Monday witnessed flood-like situation gates of the Sathanur dam were opened following the heavy downpour due to Cyclone Fengal.

Pattali Makkal Katchi (PMK) leader Anbumani Ramadoss, after visiting the flood-affected region, alleged that the DMK government released water from the Sathanur dam without prior warning, causing the damage.

"The Chief Minister had tweeted yesterday that the AIADMK government released water from Chembarambakkam reservoir without prior warning, causing havoc, unlike the DMK Government. This morning, around 2 am, 1.7 lakh cusec water was released from Sathanur dam without anyone knowing, due to which 90 per cent of residents on the banks in Cuddalore are underwater," Ramadoss said.

"They have lost their belongings, and we do not know how many have died. The Pennai River has also caused floods on the banks. There is a huge loss as people who did not know about the water release. But he (Chief Minister) is criticising AIADMK," he added.

Rejecting the claims of Ramadoss, Tamil Nadu Water Resources Minister Duraimurugan said in a statement that water from the Sathanur dam in Thiruvannamalai district was released after five flood alerts were issued and that the timely action and also the precautionary steps taken by the state government averted a major catastrophe.

"Due to rain caused by Cyclone Fengal, the water level was almost the maximum capacity of 119 ft. Calculating the water flow, water was released into the Thenpennai River. Some are spreading rumours about the water release for political gain. On December 2, 1.3 lakh cusec water inflow was observed by 2 am which increased to 1.68 lakh cusec by 3 am, forcing the release of flood water from 3 am to 8 am to save the dam. Major disaster and life loss was averted due to immediate action by Water Resources Ministry and Dam Safety officials," Minister Duraimurugan said.

Published By: Sudeep Lavania *Published On: Dec 4, 2024*

Fig.2(iii) j: Media reports on damages due to the cyclone FENGAL

Business Standard dated 03 Dec 2024 (Photo: X@adgpi)

Cyclone Fengal, which struck Tamil Nadu after intensifying from a low-pressure system on November 23, has caused widespread devastation across 14 districts. The storm, which made landfall on December 1, unleashed torrential rains and winds reaching speeds of 90 kmph, severely impacting both coastal and interior regions of the state. The fallout has left more than 15 million individuals and 6.9 million families struggling to cope with the damage, as the state government rushes to provide relief and restoration.

Tamil Nadu Chief Minister MK Stalin has written to Prime Minister Narendra Modi requesting immediate financial assistance of Rs 2,000 crore from the National Disaster Response Fund (NDRF). In his letter, Stalin emphasised the catastrophic nature of the cyclone's impact, describing it as an unprecedented disaster that has overwhelmed the state's resources.

Fig.2(iii) j: contd.

Severe weather warnings

Warnings for ***very heavy to extremely heavy*** rainfall on 30th November 2024 were issued on 29th & 30th November for the north coastal and adjoining districts; and for 01st December, on 30th November & 01st December for the north coastal and interior districts. Extremely heavy rainfall warning was issued for both the days for Puducherry, Villupuram, Kallakurichi & Cuddalore districts (Fig.2(iii)k). Warnings for gale winds during the time of landfall were issued for the north coastal districts on 29th & 30th November 2024 (Fig.2(iii)k). The warnings were issued to the state authorities, other stake holders, press and the public. Frequent updates were posted in the website and social media handles.

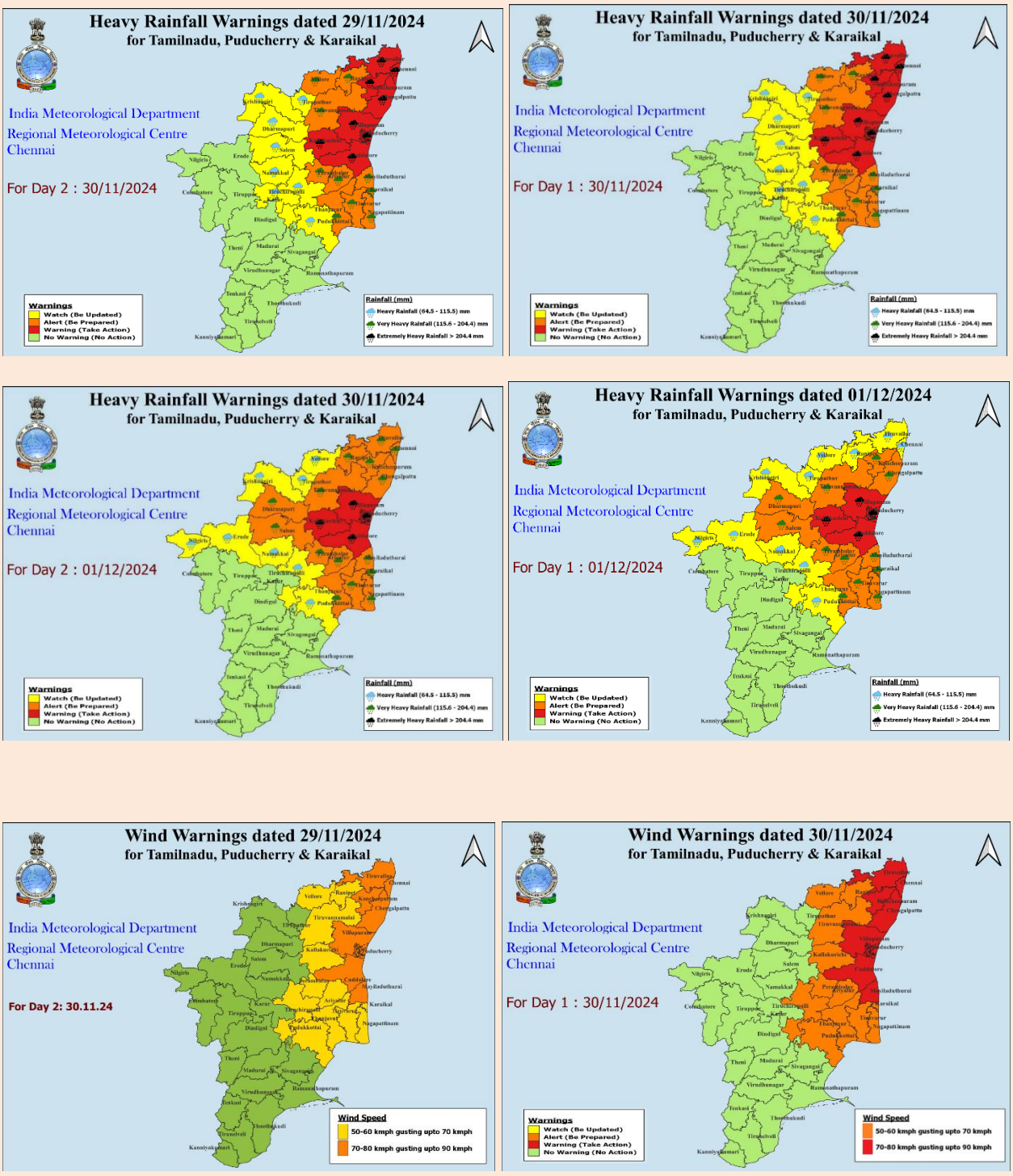


Fig.2(iii)k: Heavy rainfall and wind warnings dated 29-30 Nov & 01 Dec 2024

(v) Depression over Bay of Bengal during 20th-21st Dec 2024

Under the influence of an upper air cyclonic circulation over south Andaman Sea and adjoining southeast Bay of Bengal, a **Low Pressure Area** formed over central parts of south BOB in the morning (0830 hours IST) of the 16th December, 2024. It lay as a **Well Marked Low Pressure Area** over Southwest BOB in the morning (0830 hours IST) of the 18th. Moving southwestwards it lay over Southwest and adjoining Westcentral BOB in the morning (0830 hours IST) of 19th. Thereafter, it moved nearly northwards and lay over Westcentral and adjoining Southwest BOB in the morning (0830 hours IST) of 20th. Moving further northwards, it concentrated into a **Depression** over Westcentral BOB off Andhra Pradesh coast in the evening (1730 hours IST) of 20th. Thereafter, It moved east-northeastwards and lay over Westcentral BOB in the morning (0830 hours IST) of 21st. Moving further east-northeastwards it weakened into a **WML** over the same region in the evening (1730 hours IST) of 21st December, 2024. Thereafter, moving west-southwestwards / westwards, it weakened into a Low Pressure Area over the Westcentral and adjoining Southwest Bay of Bengal off South Andhra Pradesh – North Tamilnadu coast on 26th December 2024. The observed track of the system is depicted in Fig.2(iv)a.

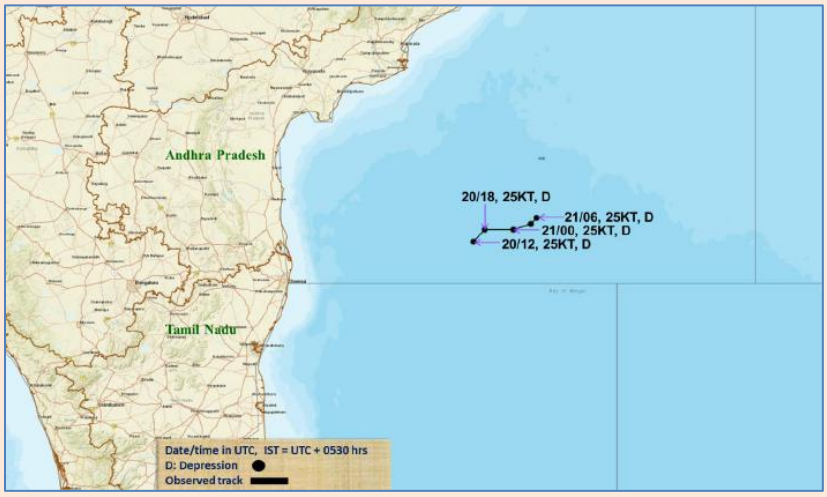


Fig.2(iv)a: Observed track of the Depression over the Bay of Bengal during 20-21 Dec 2024

IMD-GFS, 850 hPa winds as on 19th/0530 IST and NOAA-ASCAT (METOP-C) Scatterometer winds as on 19th/0915 IST depicting the circulation off North TN coast are presented in Fig.2(iv)b. Satellite imageries depicting cloudiness associated with the system (i) along & off north TN & Andhra Pradesh coasts as on 18th/1615 IST and (ii) over the sea away from the coast as on 21st/0515 IST are presented in Fig.2(iv)c.

As the system did not cross coast, but, moved further into the sea, it did not cause extensive rainfall activity over the southern peninsula. However, fairly widespread, light-moderate rainfall was realized over CAP on three days during 19th-21st December 2024 with ***heavy*** rain at *a few* places over **Vizianagaram** district (highest: **9 cm** at **Bondapalle**) and at *isolated* places over

Visakhapatnam district on 21st. *Isolated* rainfall occurred over TN during 18th-21st with *isolated* ***heavy*** rain over Chennai on 19th Dec 2024. Under the influence of the remnant of the system *widespread* rainfall occurred over CAP during the 24-hr ending 0830 IST of 25th & 26th and over RYS on 27th December 2024. *Isolated* ***heavy*** rain also occurred over CAP, RYS & extreme northeastern parts of TN on 27th December 2024.

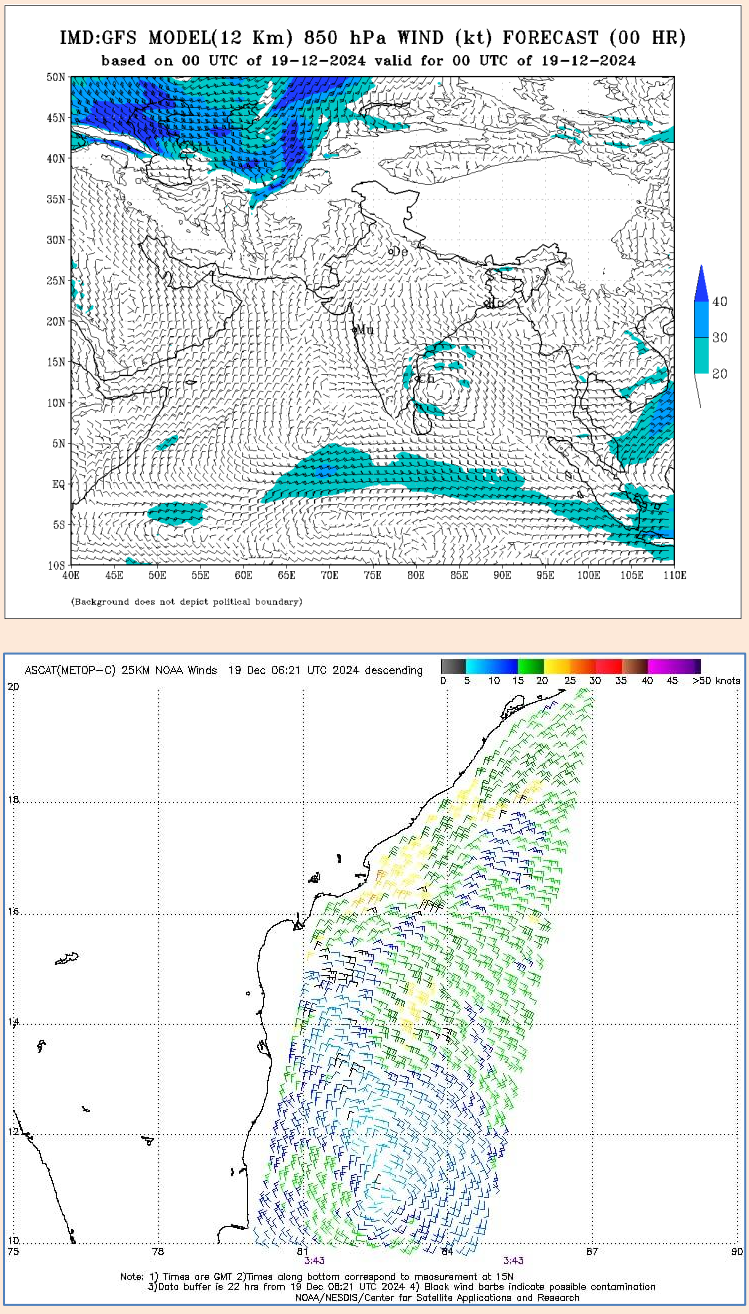


Fig.2(iv)b: IMD-GFS, 850 hPa winds as on 19th/0530 IST and NOAA-ASCAT (METOP-C) Scatterometer winds as on 19th/0915 IST

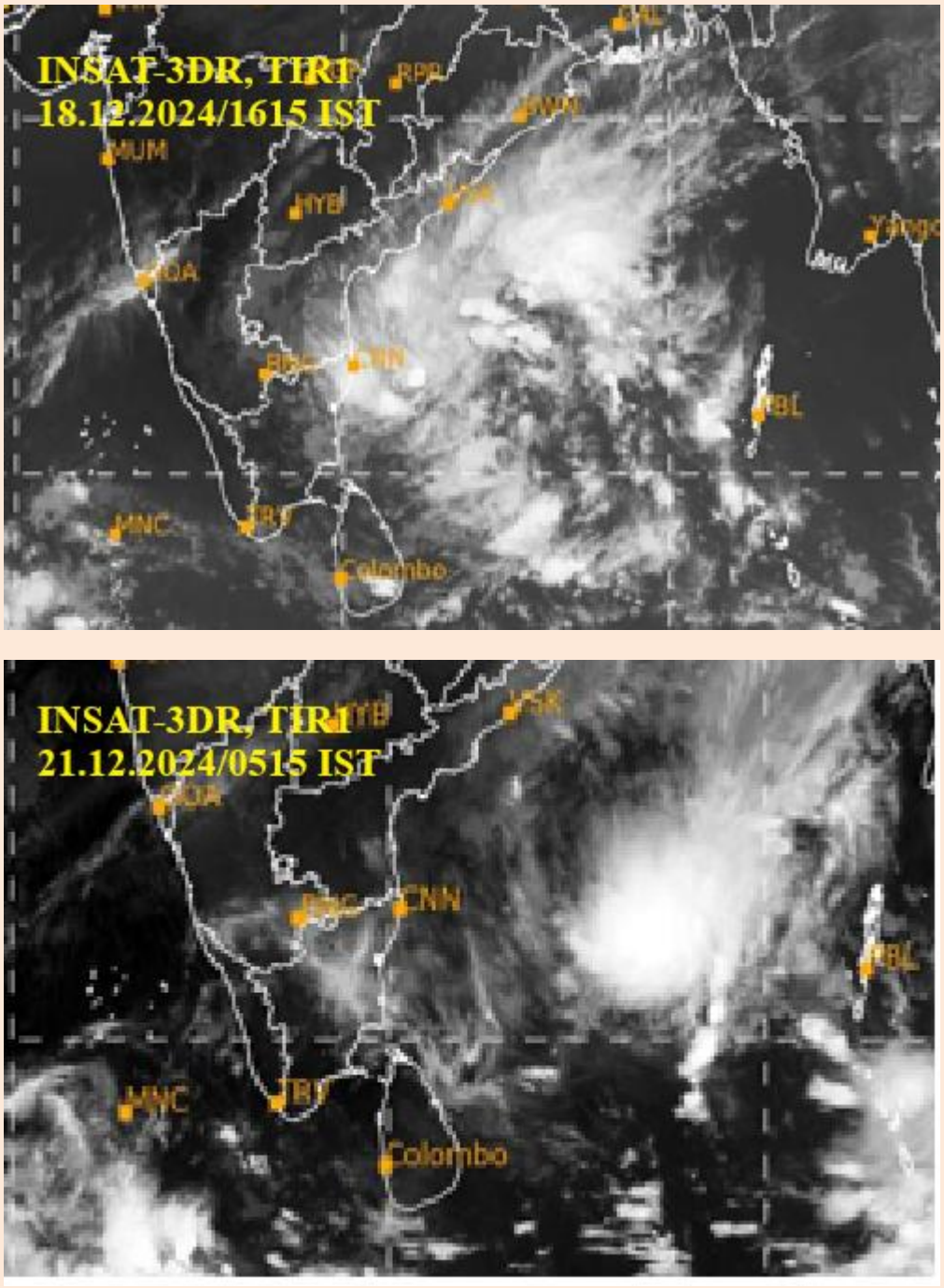


Fig.2(iv)c: INSAT-3DR, TIR1 products as on 18/1615 IST & 21/0515 IST

3b. Other significant synoptic systems

(i) Well Marked Low Pressure Area over Bay of Bengal during 07th-13th December 2024

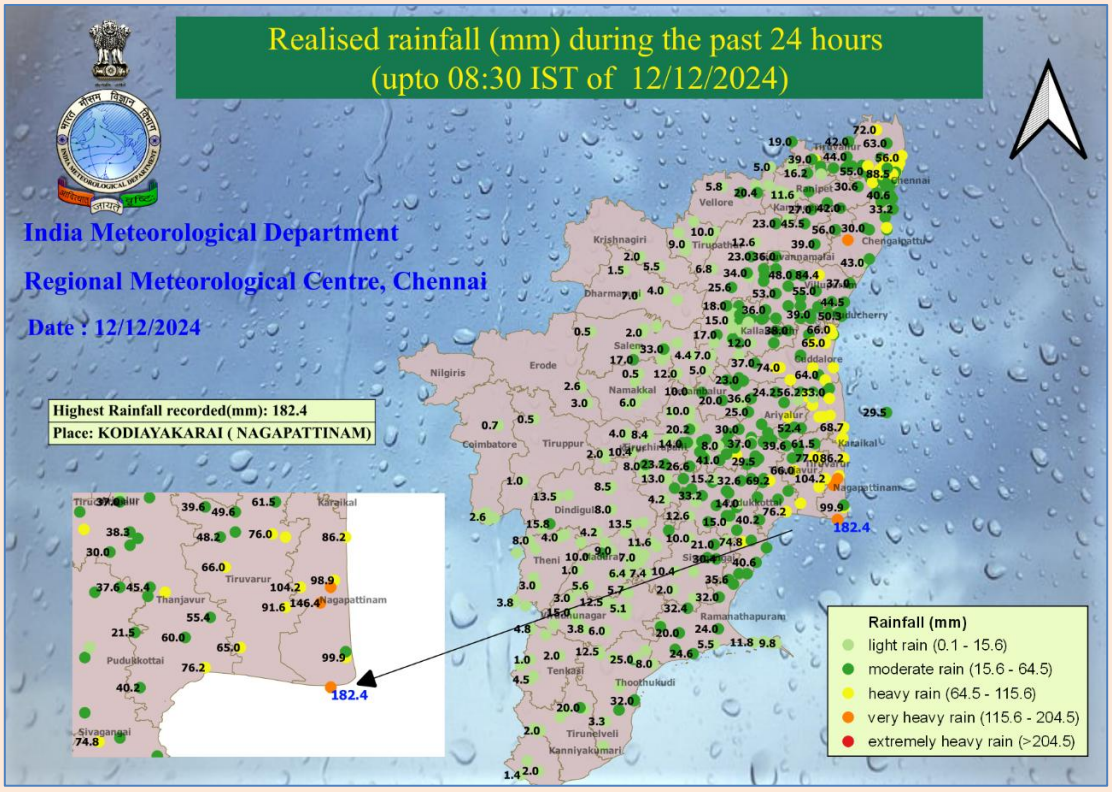
Under the influence of an upper air cyclonic circulation, a **Low Pressure Area** formed over the Southeast Bay of Bengal & adjoining East Equatorial Indian Ocean, 07th December / 0830 IST. It persisted over the same region during the next two days. Thereafter, it lay as a **Well Marked Low Pressure Area** over the Southwest and adjoining Southeast Bay of Bengal at 0830 hrs IST 10th with the associated upper air cyclonic circulation extending up to mid-tropospheric levels. Moving west-northwestwards, it lay over southwest Bay of Bengal off Sri Lanka coast at 0830 IST of 11th with the associated upper air cyclonic circulation extending up to mid-tropospheric levels. Moving further westr-northwestwards, it lay over Gulf of Mannar and neighbourhood at 0830 IST of 12th with the associated upper air cyclonic circulation extending up to mid-tropospheric levels. Moving westwards, it gradually weakened and lay as a **Low Pressure Area** over Lakshadweep-Maldives area at 0830 IST of 13th with the associated upper air cyclonic circulation extending up to mid-tropospheric levels. Moving further westwards, it became less marked during the subsequent 24 hours.

Under its influence, rainfall occurred at many/most places over Tamil, Puducherry & Karaikal during the 24-hr ending 0830 IST of 12th-14th December 2024.

Heavy rain occurred at *isolated* places over the north coastal districts of Tiruvallur, Chennai, Kancheepuram, Chengalpattu, Villupuram, Cuddalore, Mayiladuthurai, Nagapattinam, Tiruvarur and Thanjavur districts and over Puducherry & Karaikal areas during the 24-hr ending 0830 IST of 12th December 2024. *Isolated* ***very heavy*** rain also occurred over Nagapattinam & Chengalpattu districts during the same period.

Heavy to very heavy rain occurred at *a few* places over the North Coastal & neighbouring districts and over the southern districts of Tamilnadu with ***extremely heavy*** **rain** at *a few* places over **Tirunelveli district** and at ***isolated*** places over **Tenkasi, Thoothukudi, Cuddalore, Mayiladuthurai, Thanjavur, Ariyalur & Tiruvallur** districts on 13th. **Oothu in Tirunelveli district** recorded the highest rainfall of **54 cm** during this period.

Heavy to very heavy rain occurred at *isolated* places over the delta and adjoining districts of North Tamilnadu districts and over the southern districts of Tamilnadu with ***extremely heavy*** rain at *isolated* places over **Tirunelveli, Thoothukudi & Tenkasi** districts of South Tamilnadu. Maps of spatial rainfall distribution and rainfall intensity at various stations in Tamilnadu, Puiducherry & Karaikal are presented in Fig.3(i)a. A district-wise list of extremely heavy rainfall events during the 24-hr ending 0830 IST of 13th & 14th Dec 2024 is furnished in Table-2.



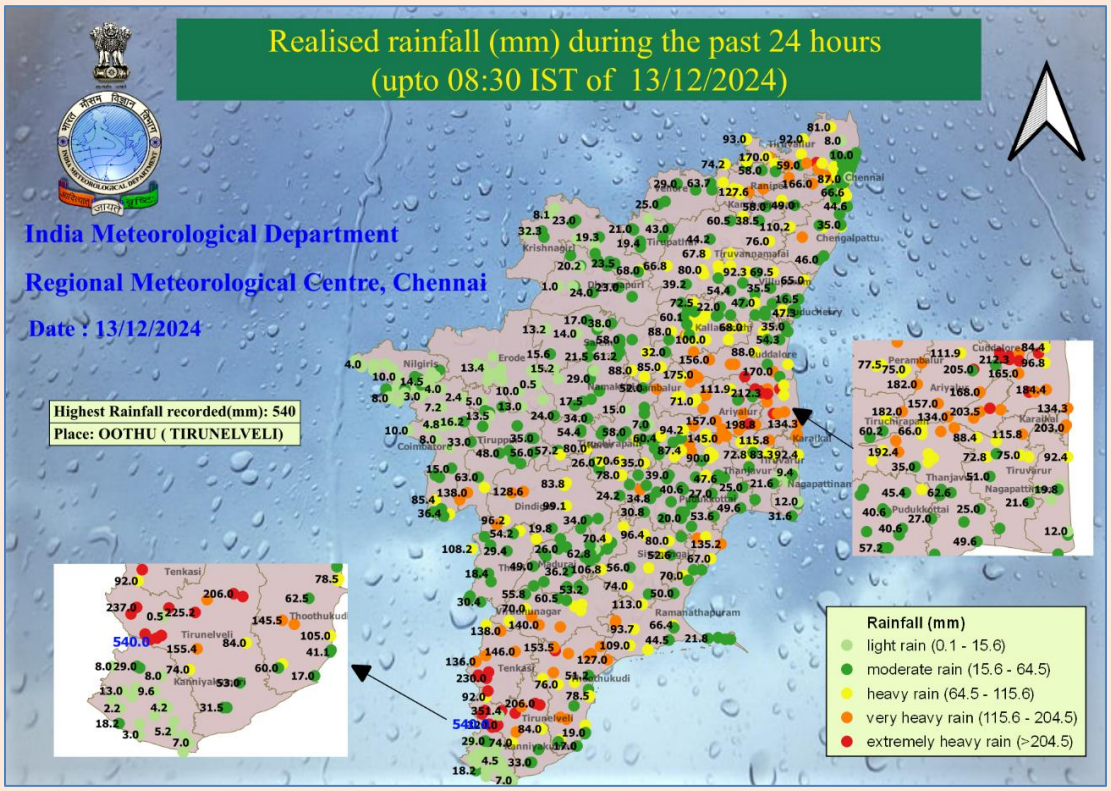


Fig.3(i)a: Rainfall distribution and intensity at various stations in Tamilandu, Puducherry & Karaikal during the 24-hr ending 0830 IST of 12th, 13th & 14th Dec 2024

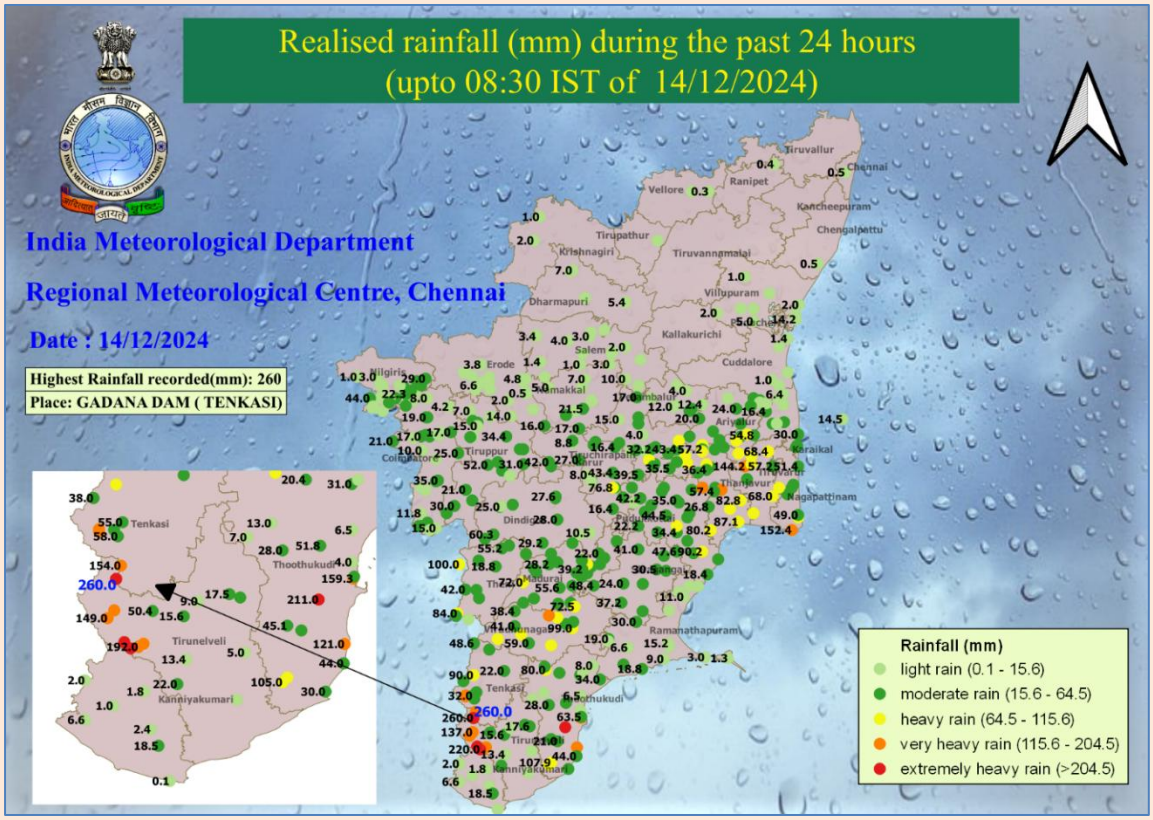


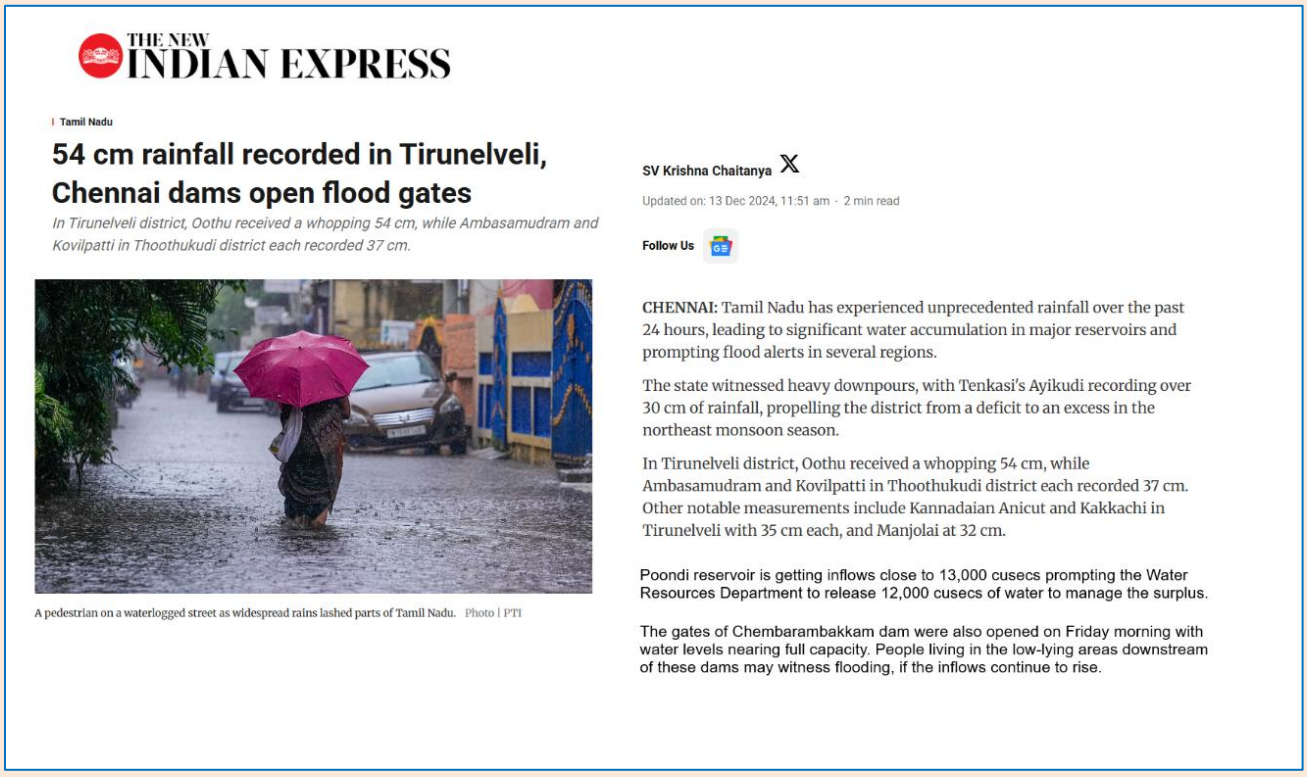
Fig.3(i)a: contd.

Table-2: List of extremely heavy rainfall reports during 13th-14th Dec 2024

District	Station-wise ***extremely heavy*** rainfall amounts (cm) during the 24 hrs ending 08:30 IST of 13.12.2024 & 14.12.2024
Tirunelveli	**13th**: Oothu **54**; Ambasamudram **37**; Kannadaian Anicut **35**; Kakkachi **35**; Manjolai **32**; Nalumukku **31**; Manimutharu **30**; Palayamkottai **26**; Servalar Dam **24**; Cheranmahadevi **23**; Papanasam **22**; Tirunelveli AWS **21**; **14th**: Oothu **23**, Nalumukku **22**;
Thoothukudi	**13th:** Kovilpatti **37**; **14th**: Tuticorin Airport ARG **21**;
Tenkasi	**13th**: Ayikudi **31**; Shencottah **24**; Ramanadhi Dam Section **24**; Thenkasi **23**; Gundar Dam **21**; **14th**: Gadana Dam **26**;

Cuddalore	**13th**: Lalpet 31; Srimushnam 24; K.M koil 24; Kilacheruvai 22; Pelandurari 21; Sethathope 21;
Mayiladuthurai	**13th**: Manalmedu ARG: 26; Mayiladuthurai 22;
Thnajavur	**13th**: Thiruvidaimaruthur 21;
Ariyalur	**13th**:: Jayamkondam 21;
Thiruvallur	**13th**: Avadi 22;

Associated with this intense rainfall activity, inflow to several key water bodies increased substantially leading to overflowing of rivers, release of water from dams etc. causing severe flooding and inundation of low lying areas in South Tamilnadu; the delta & adjoining districts; and Chennai and adjoining districts. Fig.3(i)b presents a sample media report on the extent of flooding and damages caused by this extreme rainfall event.



THE NEW INDIAN EXPRESS

Tamil Nadu

54 cm rainfall recorded in Tirunelveli, Chennai dams open flood gates

In Tirunelveli district, Oothu received a whopping 54 cm, while Ambasamudram and Kovilpatti in Thoothukudi district each recorded 37 cm.

SV Krishna Chaitanya

Updated on: 13 Dec 2024, 11:51 am · 2 min read

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CHENNAI: Tamil Nadu has experienced unprecedented rainfall over the past 24 hours, leading to significant water accumulation in major reservoirs and prompting flood alerts in several regions.

The state witnessed heavy downpours, with Tenkasi's Ayikudi recording over 30 cm of rainfall, propelling the district from a deficit to an excess in the northeast monsoon season.

In Tirunelveli district, Oothu received a whopping 54 cm, while Ambasamudram and Kovilpatti in Thoothukudi district each recorded 37 cm. Other notable measurements include Kannadaian Anicut and Kakkachi in Tirunelveli with 35 cm each, and Manjolai at 32 cm.

Poondi reservoir is getting inflows close to 13,000 cusecs prompting the Water Resources Department to release 12,000 cusecs of water to manage the surplus.

The gates of Chembarambakkam dam were also opened on Friday morning with water levels nearing full capacity. People living in the low-lying areas downstream of these dams may witness flooding, if the inflows continue to rise.

Fig.3(i)b: Sample media report on the flooding due to heavy rainfall

(ii) Low Pressure Area over Southwest Bay of Bengal during 11th-12th November 2024

Under the influence of an upper air cyclonic circulation over Southeast Bay of Bengal that moved gradually westward during 04th – 11th November and lay over the Southwest Bay of Bengal on 11th, a **Low Pressure Area** formed over the same region on 11th at 1430 Hrs IST with associated cyclonic circulation extending upto 5.8 km above mean sea level tilting southwestwards with height. It lay over Southwest and adjoining Westcentral Bay of Bengal off North Tamilnadu & adjoining South Andhra Pradesh coasts on 12th with associated cyclonic circulation extending upto 4.5 km above mean sea level tilting southwestwards with height and became **less marked** on 13th November 2024. Under its influence, *isolated* ***heavy to very heavy*** rain occurred over North Coastal and adjoining districts of TN during the 24-hr ending 0830 IST of 13th with **Sirkali & Mayiladuthurai** (both in Mayiladuthurai district) recording **14 cm** of rain. *Isolated* ***heavy*** rain also occurred over North Coastal TN during the 24-hr ending 0830 IST of 12th & 14th November 2024. As the system did not cross coast and move inland, significant rainfall occurred only over the coastal districts. IMD-GFS, 925 hPa wind analysis depicting the upper air circulation associated with the system as on 12th/0530 IST of Nov 2024 is presented in Fig.3(ii)a. Satellite imageries depicting the cloudiness associated with the rainfall over the North Coastal TN are presented in Fig.3(ii)b&c. Map of 24-hr accumulated precipitation as on 0830 IST of 13th November depicting the isolated heavy-very heavy rainfall over the North Coastal TN is presented in Fig.3(ii)d.

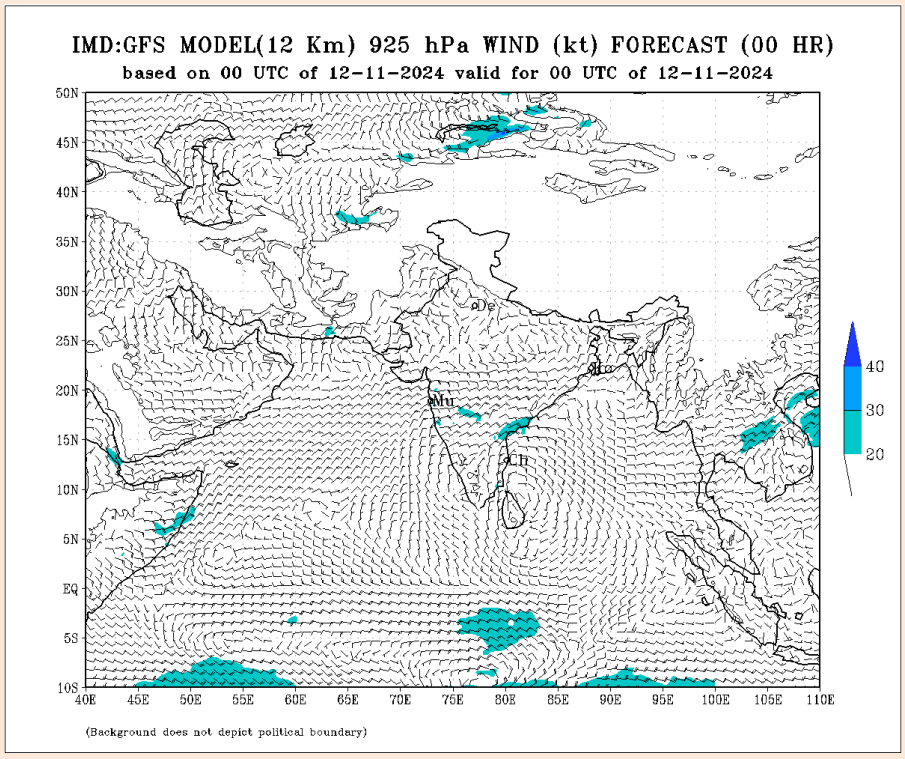


Fig.3(ii)a: IMD-GFS, 925 hPa wind analysis as on 0530 IST of 12th Nov 2024

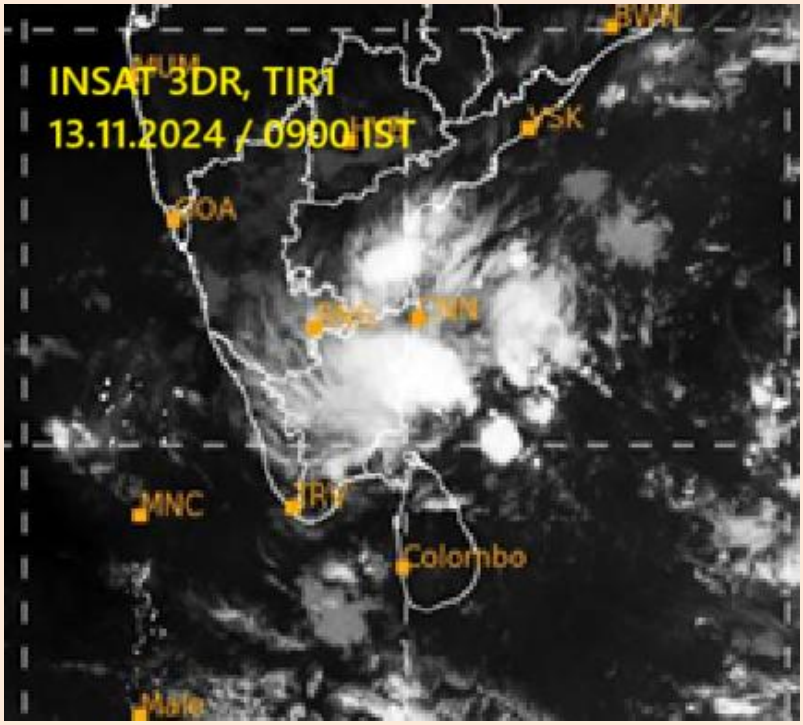


Fig.3(ii)b: INSAT-3DR, TIR1 as on 13/0900 IST of Nov 2024

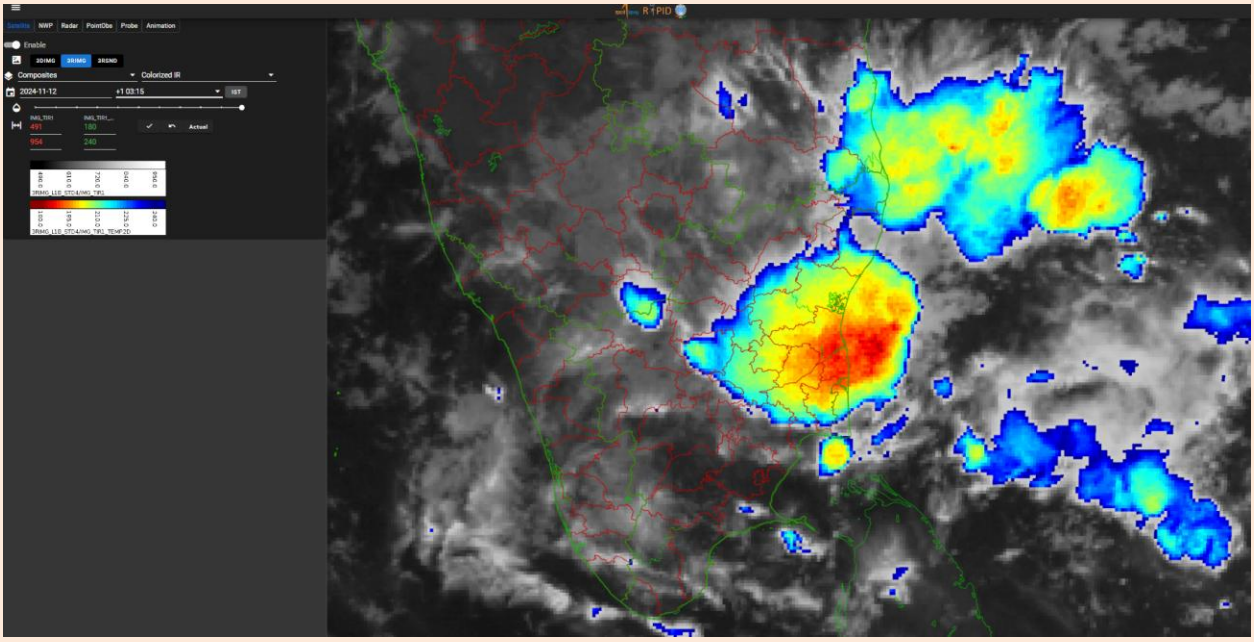


Fig.3(ii)c: INSAT-3DR, brightness temperature product as on 13/0315 IST of Nov 2024

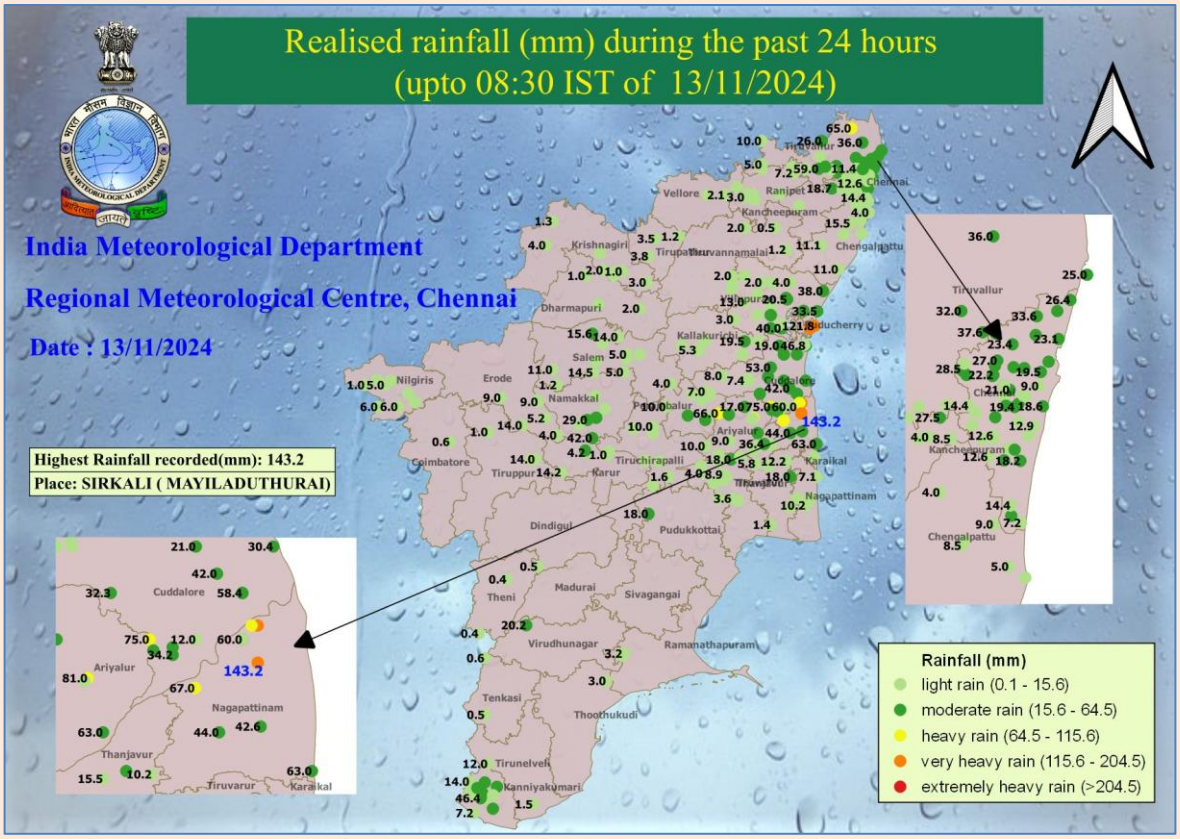


Fig.3(ii)d: 24-hr accumulated precipitation over the TN subdivision as on 0830 IST of 13th Nov 2024

(iii) Upper air cyclonic circulations & trough in easterlies

Aside from the above systems, under the influence of upper air cyclonic circulations and troughs in easterlies, significant rainfall occurred over the NEM region during Oct-Dec 2024. In this regard, it may be mentioned that when the Low Pressure Area over the Southwest Bay of Bengal during the 11th-12th Nov 2024, became less marked on 13th, the associated upper air cyclonic circulation lay over Southwest Bay of Bengal off north Tamilnadu coast and extended upto 0.9 km above mean sea level on 13th; lay over South Tamilnadu & neighbourhood at 0.9 km above mean sea level on 14th; lay over Gulf of Mannar & adjoining Sri Lanka coast and extended upto 1.5 km above mean sea level on 15th November 2024.

Further, a cyclonic circulation lay over Southeast Arabian Sea and adjoining Kerala coast &extended upto 0.9 km above mean sea level on 12th; lay over Southeast Arabian sea off Kerala coast between 1.5 & 3.1 Km above mean sea level on 13th; lay over Lakshadweep and adjoining Southeast Arabian sea and extended upto 3.1 km above mean sea level on 14th Nov 2024.

A cyclonic circulation lay over Maldives & adjoining Equatorial Indian Ocean at 0.9 km above mean sea level on 17th; lay over Comorin area & neighbourhood at 0.9 km above mean sea level on 18th; lay over south Tamilnadu & adjoining Comorin area at 1.5 km above mean sea level on 19th; lay over Comorin area & neighbourhood at 0.9 km above mean sea level on 20th ; persisted over the same region on 21st Nov 2024.

Under the influence of these upper air cyclonic circulations, significant rainfall occurred over the delta and the south coastal districts of TN during 15th-21st Nov 2024. ***Heavy to extremely heavy*** rainfall occurred at *a few* places over the Ramanathapuram district of South Coastal TN during the 24-hr ending 0830 ISGT of 21st with **Rameswaram** reporting **44 cm** followed by **Thangachimadam: 34 cm, Pamban: 28 cm, Mandapam: 27 cm** (all in Ramanathapuram district).

Heavy to very heavy rainfall occurred at *a few* places over the **ghat areas of Tirunelveli** district of TN on 16th & 20th; at isolated places over Nagapattinam district on 18th, 20th & 21st; and at *isolated* places over KER on 16th Nov 2024.

Heavy rain also occurred at *a few* places over the **ghat areas of Tirunelveli** district on 15th, 17th, & 19th; at *isolated* ***heavy*** rain also occurred over Cuddalore & Mayiladuthurai districts on 15th; over Tiruvarur district on 18th; over Nagapattinam & Mayiladuthurai districts on 19th; over Ramanathapuram district on 20th; and over Tiruvarur district & Karaikal area on 21st Nov 2024.

Heavy to very heavy rainfall also occurred at *isolated* places over KER on 16th; and *isolated* ***heavy*** rain occurred over KER on 15th, 18th & 20th Nov 2024.

IMD-GFS, 925 hPa analysis indicating the cyclonic circulation over the Comorin area and neighbourhood on the 20th November 2024, sample satellite imagery depicting the cloudiness associated with the system on 20th forenoon, sample radar imagery showing the maximum reflectivity product on 20th forenoon & map of rainfall distribution and intensity as on 24-hr ending 0830 IST of 21st November 2024 are presented in Fig.3(iii)a-d respectively.

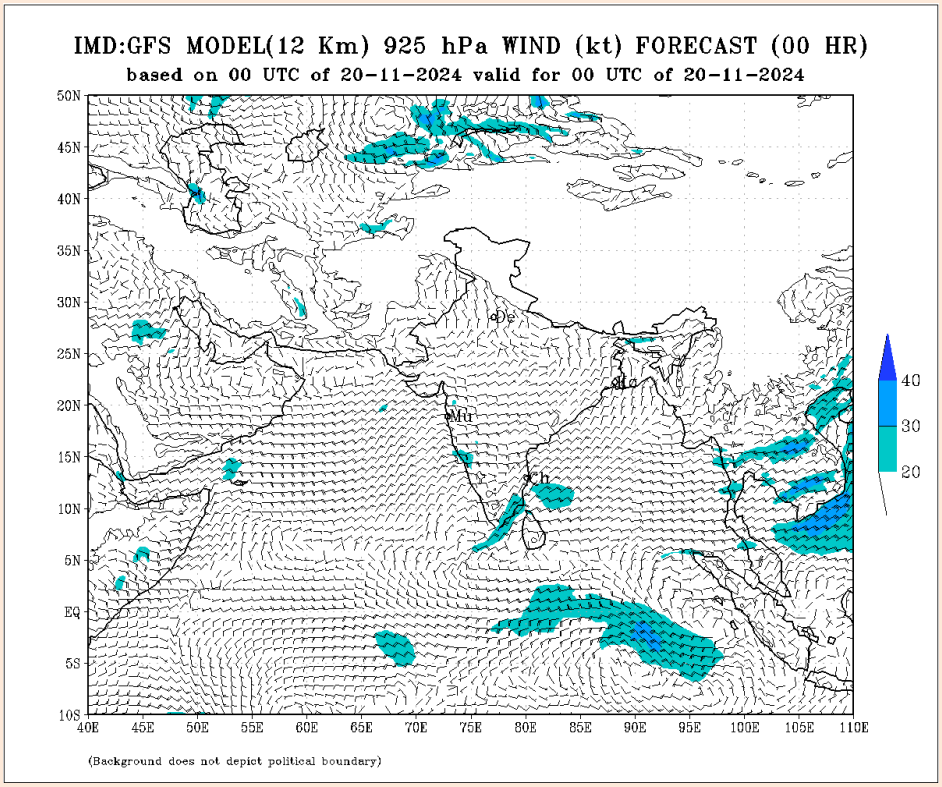


Fig.3(iii)a: IMD-GFS, 925 hPa analysis as on 0530 IST of 20 Nov 2024

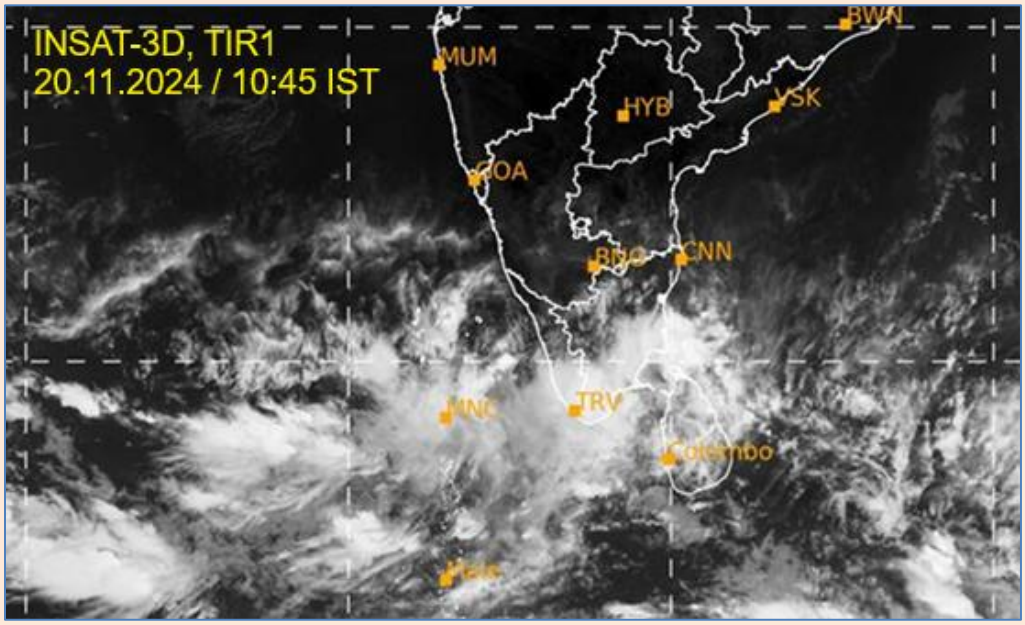


Fig.3(iii)b: INSAT-3DR, infra-red imagery as on 10:45 IST of 20 Nov 2024

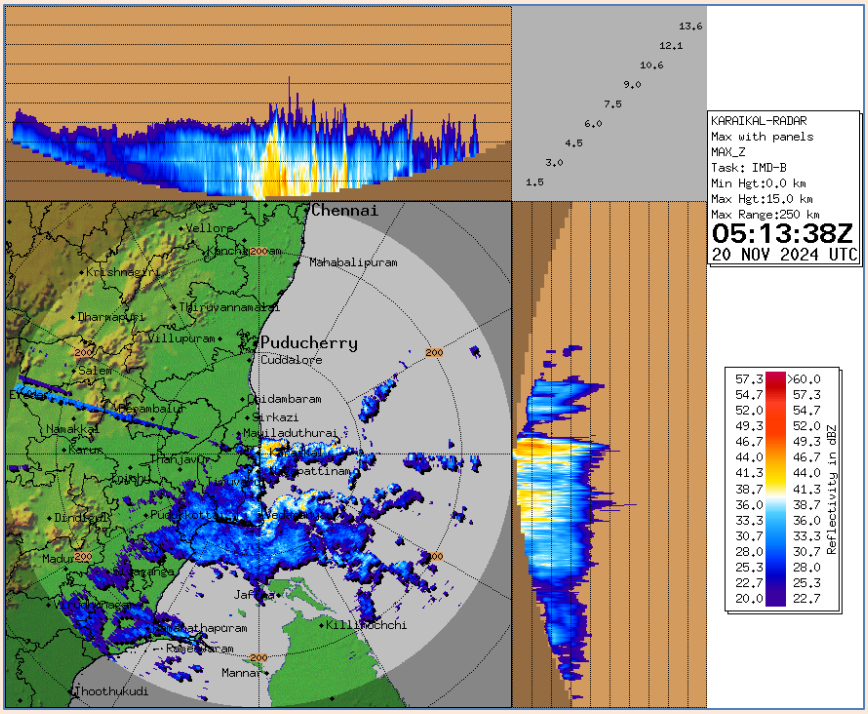


Fig.3(iii) c: Doppler Weather Radar, Karaikal Maximum Reflectivity product as on 10:43 IST of 20 Nov 2024

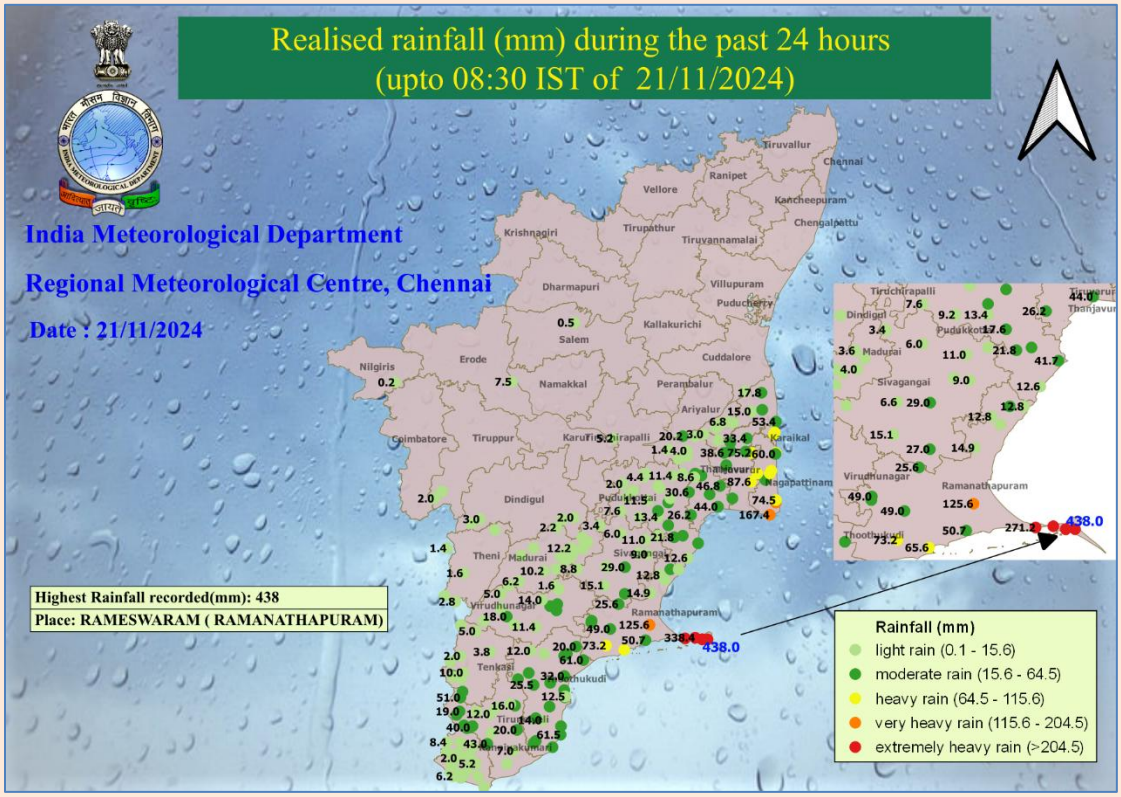


Fig.3(iii)d: 24-hr accumulated rainfall over the TN subdivision as on 0830 IST of 21 Nov 2024

4. Sub divisional rainfall performance during NEM 2024

4.1 Seasonal rainfall

During October-December 2024, the northeast monsoon seasonal rainfall was *normal* (-19% to +19%) to *excess* (+20% to +59%) over all the five meteorological subdivisions benefitted by the NEM viz., TN (+33%, *excess*), RYS (+46%, *excess*), SIK (+43%, *excess*), KER (-1%, *normal*), and CAP (-9%, *normal*). Fig.4a and Table-3 present the season ending (01st Oct-31st December 2024) rainfall figures over these subdivisions.

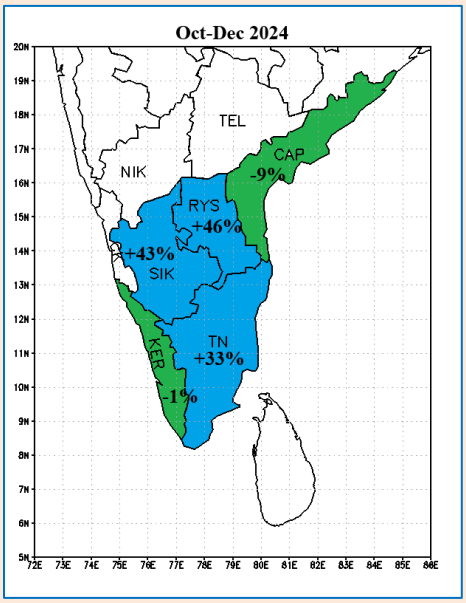


Fig.4a: Seasonal rainfall performance of NEM 2024 over the five meteorological subdivisions benefitted by the NEM

Table-3: Subdivisional seasonal rainfall during October-December 2024

Subdivision	01st October – 31st December 2024		
	Actual (mm)	Normal (mm)	PDN (%)
Coastal Andhra Pradesh & Yanam (CAP)	292.5	322.9	**-9**
Rayalaseema (RYS)	344.4	236.4	**+46**
Tamilnadu, Puducherry & Karaikal (TN)	589.9	442.8	**+33**
South Interior Karnataka (SIK)	285.5	199.0	**+43**
Kerala & Mahe (KER)	487.2	491.9	**-1**

PDN: Percentage Departure from Normal

Legend:

Largely Deficient	*Deficient*	*Normal*	*Excess*	*Large Excess*
≤ -60%	**-20% to -59%**	**-19% to +19%**	**+20% to +59%**	**≥+60%**

4.2 Monthly, Weekly & Daily rainfall scenario

The intra-seasonal rainfall distribution over various sub-divisions during Oct-Dec 2024 is presented in monthly and daily scales. Month-wise rainfall statistics are presented in Table-4 and Fig.4b. Tables-5a&b present the weekly rainfall over the various subdivisions and Tables-6a&b present the daily rainfall scenario in terms of spatial rainfall distribution (*Widespread*: WS, *Fairly widespread*: FWS, *Scattered*: SCT, *Isolated*: ISOL and DRY).

Table-4: Subdivisional monthly rainfall during NEM 2024

2024	OCT			NOV			DEC		
SUB-DIVISION	Actual rainfall (mm)	Normal rainfall (mm)	PDN (%)	Actual rainfall (mm)	Normal rainfall (mm)	PDN (%)	Actual rainfall (mm)	Normal rainfall (mm)	PDN (%)
CAP	170.7	182.2	**-6**	39.0	113.1	**-66**	86.6	27.6	**+214**
RYS	194.2	132.1	**+47**	46.5	78.4	**-41**	103.7	25.9	**+300**
TN	214.2	171.9	**+25**	140.2	181.7	**-23**	235.5	89.2	**+164**
SIK	225.5	137.2	**+64**	28.5	51.2	**-44**	31.6	10.6	**+198**
KER	239.5	306.4	**-22**	116.4	153.1	**-24**	131.4	32.4	**+305**

Largely Deficient	*Deficient*	*Normal*	*Excess*	*Large Excess*
≤ -60%	**-20% to -59%**	**-19% to +19%**	**+20% to +59%**	**≥+60%**

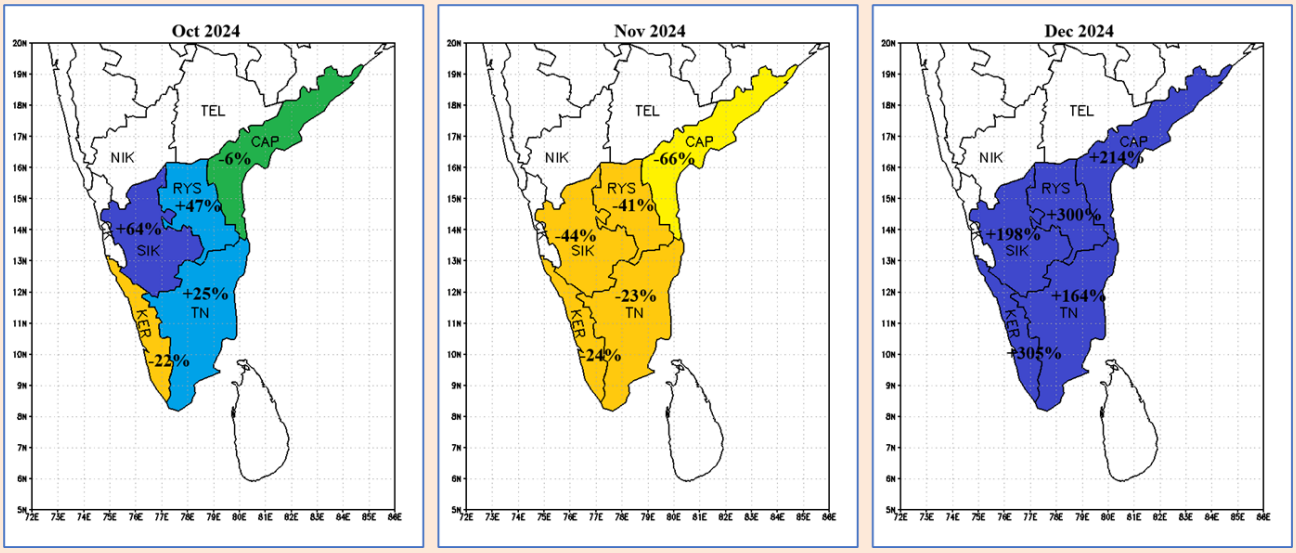


Fig.4b: Subdivisional monthly rainfall performance during October-December 2024

During October 2024, TN, RYS & SIK recorded *excess* to *large excess* rainfall with percentage departures from normal being +25%, +47% & +64% respectively. CAP received *normal* (-6%) rainfall and KER, *deficient* (-22%) rainfall. Till 14th Oct, southwest monsoon contributed

significantly with *active* monsoon conditions prevailing over TN on 07 days, SIK: 05 days, KER: 03 days, RYS: 02 days & CAP: 01 day. Subsequently, under the influence of NEM, due to passage of a **Depression** over North Tamilnadu & South Andhra Pradesh during 15th-16th and its remnant's influence during the subsequent few days, *vigorous* NEM conditions prevailed over TN & CAP on 15th; over RYS: 15th &17th and over SIK: 16th & 17th; and *active* monsoon conditions prevailed over CAP on 16th, 17th, 20th & 21st; RYS: 18th, 19th & 22nd; SIK: 19th, 20th, 22nd-24th October. Thereafter, due to the formation of movement of **SCS DANA** during 22nd-26th October that crossed Odisha coast, NEM activity was subdued over the southern peninsular region till the end of the month with just one day of active monsoon condition over KER on 24th & over TN on 25th October.

In November, but for upper air cyclonic circulations that caused significant rainfall activity over the Cauvery delta districts and extreme south Tamilnadu, in the absence of any major synoptic system that formed over Bay of Bengal, crossing coast and moving across the NEM region, all the five subdivisions ended up on the deficient side with CAP coming under ***largely deficient*** (-66%) and all the other subdivisions, under ***deficient*** category (TN: -23%, KER: -24%, RYS: -41% & SIK: -44%).

In December, due to significant rainfall activity (i) under the influence of the CS FENGAL during the first three of December including the extreme rainfall activity on 01st & 02nd and (ii) under the influence of the Well Marked Low Pressure Area over the Bay of Bengal during 07th-13th December during the 12th-14th including the extreme rainfall activity over the extreme South Tamilnadu on 13th December 2024, all the fivc subdivisions received ***large excess*** rainfall of +160% to +300%.

In the weekly scale (Table-5a), during the week ending 04th December, all the five subdivisions recorded ***large excess*** rainfall (+216% to +736%); during the week ending 16th October, excepting KER that received ***normal*** rainfall, all the other four subdivisions recorded ***large excess*** rainfall (+116% to +164%). During the weeks ending 18th December and 01st Jan, three subdivisions received ***large excess*** rainfall (+260% to +470%) and (+69% to +297%) respectively. During the weeks ending 30th Oct, 13th Nov & 27th Nov, all the five subdivisions became ***deficient- largely deficient***.

Considering the cumulative weekly rainfall performance (Table-5b), it may be noted that TN & RYS were generally under ***normal / excess / large excess*** category through out the season; SIK, on most of the weeks. KER came under ***normal*** category on many weeks during the season. CAP was generally under ***deficient*** category on many weeks till 18th December.

Table 5a: Weekly rainfall performance over various subdivisions during Oct-Dec 2024

SUB-DIVISION	WEEK-BY-WEEK: PDN (%)													
	02-Oct	09-Oct	16-Oct	23-Oct	30-Oct	06-Nov	13-Nov	20-Nov	27-Nov	04-Dec	11-Dec	18-Dec	25-Dec	01-Jan
CAP	-57	-63	+146	+45	-91	-88	-46	-31	-92	+299	-13	-51	+1227	+242
RYS	-53	+22	+164	+178	-86	-84	-32	+27	-82	+431	+42	+422	+53	+297
TN	-29	+67	+164	-9	-34	-36	-69	+53	-21	+216	-78	+468	-36	+69
SIK	-42	+48	+116	+223	-61	-23	-94	+31	-98	+736	+14	-43	-100	-15
KER	-46	-16	+16	-45	-24	+7	-62	+11	-84	+696	-30	+261	-94	-49

Table 5b: Cumulative week ending scenario during Oct-Dec 2024

2024	CUMULATIVE WEEK ENDING : PDN (%)													
	02-Oct	09-Oct	16-Oct	23-Oct	30-Oct	06-Nov	13-Nov	20-Nov	27-Nov	04-Dec	11-Dec	18-Dec	25-Dec	01-Jan
CAP	+26	-69	+11	+20	-4	-22	-25	-25	-29	-19	-19	-20	-12	-9
RYS	+18	-8	+51	+88	+51	+28	+21	+22	+15	+34	+35	+43	+43	+46
TN	+18	+36	+94	+55	+28	+12	-2	+5	+1	+19	+13	+35	+32	+33
SIK	-57	+18	+55	+96	+65	+53	+42	+41	+36	+46	+46	+45	+44	+43
KER	-61	-25	-7	-18	-19	-15	-21	-18	-22	-3	-4	0	-1	-100

In the daily scale (Table-6a&b), ***fairly widespread*** to ***widespread*** rainfall occurred over KER on 35% of the days during the season; over TN, CAP & SIK, on 26%, 22% & 21% of the days respectively and over RYS, on 17% of the days. TN, CAP & KER recorded ***isolated*** *to* ***scattered*** rainfall activity on 60% to 72% of the days during the season. On about 20-30% of the days during the season, RYS & SIK remained ***dry***.

Table-6a: Spatial rainfall distribution during 01st October -31st December 2024

Date as on 08:30 IST	CAP	RYS	TN	SIK	KER
01-10-2024	ISOL	ISOL	ISOL	ISOL	SCT
02-10-2024	ISOL	ISOL	ISOL	SCT	SCT
03-10-2024	SCT	SCT	SCT	FWS	SCT
04-10-2024	ISOL	WS	ISOL	SCT	ISOL
05-10-2024	ISOL	FWS	FWS	WS	FWS
06-10-2024	ISOL	ISOL	FWS	SCT	SCT
07-10-2024	ISOL	ISOL	ISOL	SCT	WS
08-10-2024	SCT	ISOL	FWS	SCT	FWS
09-10-2024	SCT	ISOL	FWS	SCT	SCT
10-10-2024	FWS	SCT	SCT	FWS	WS
11-10-2024	FWS	SCT	FWS	FWS	SCT
12-10-2024	FWS	ISOL	FWS	FWS	WS
13-10-2024	SCT	ISOL	FWS	SCT	FWS
14-10-2024	FWS	SCT	WS	FWS	WS
15-10-2024	FWS	WS	WS	FWS	WS
16-10-2024	FWS	WS	FWS	WS	WS
17-10-2024	FWS	WS	ISOL	WS	WS
18-10-2024	WS	FWS	ISOL	SCT	FWS
19-10-2024	FWS	WS	SCT	FWS	SCT
20-10-2024	FWS	SCT	FWS	WS	FWS
21-10-2024	FWS	SCT	SCT	WS	FWS
22-10-2024	SCT	FWS	ISOL	FWS	SCT
23-10-2024	ISOL	ISOL	SCT	FWS	SCT
24-10-2024	ISOL	SCT	SCT	FWS	WS
25-10-2024	ISOL	ISOL	FWS	ISOL	FWS
26-10-2024	ISOL	ISOL	SCT	ISOL	FWS
27-10-2024	ISOL	ISOL	ISOL	ISOL	SCT
28-10-2024	ISOL	DRY	ISOL	ISOL	ISOL
29-10-2024	ISOL	DRY	ISOL	ISOL	FWS
30-10-2024	ISOL	ISOL	ISOL	ISOL	ISOL
31-10-2024	SCT	ISOL	ISOL	ISOL	ISOL
01-11-2024	ISOL	ISOL	SCT	SCT	FWS
02-11-2024	ISOL	DRY	SCT	SCT	FWS
03-11-2024	ISOL	ISOL	WS	ISOL	WS
04-11-2024	ISOL	ISOL	SCT	ISOL	FWS
05-11-2024	ISOL	ISOL	SCT	ISOL	WS
06-11-2024	ISOL	ISOL	ISOL	ISOL	FWS
07-11-2024	ISOL	ISOL	ISOL	DRY	ISOL
08-11-2024	ISOL	ISOL	SCT	ISOL	SCT
09-11-2024	ISOL	ISOL	SCT	ISOL	SCT
10-11-2024	ISOL	DRY	ISOL	DRY	ISOL
11-11-2024	DRY	ISOL	ISOL	DRY	ISOL
12-11-2024	ISOL	ISOL	ISOL	ISOL	ISOL
13-11-2024	SCT	SCT	SCT	SCT	ISOL
14-11-2024	SCT	SCT	SCT	ISOL	ISOL

Table-6a (contd.)

Date as on 08:30 IST	CAP	RYS	TN	SIK	KER
15-11-2024	SCT	WS	WS	WS	FWS
16-11-2024	ISOL	FWS	WS	FWS	FWS
17-11-2024	ISOL	SCT	WS	SCT	FWS
18-11-2024	ISOL	ISOL	SCT	ISOL	FWS
19-11-2024	ISOL	DRY	SCT	DRY	ISOL
20-11-2024	DRY	DRY	SCT	DRY	SCT
21-11-2024	DRY	DRY	SCT	DRY	ISOL
22-11-2024	DRY	DRY	ISOL	DRY	ISOL
23-11-2024	DRY	DRY	ISOL	DRY	ISOL
24-11-2024	DRY	DRY	ISOL	DRY	ISOL
25-11-2024	DRY	DRY	ISOL	DRY	ISOL
26-11-2024	ISOL	ISOL	ISOL	DRY	ISOL
27-11-2024	ISOL	SCT	WS	ISOL	SCT
28-11-2024	ISOL	ISOL	SCT	DRY	ISOL
29-11-2024	DRY	ISOL	ISOL	DRY	ISOL
30-11-2024	FWS	ISOL	SCT	DRY	ISOL
01-12-2024	WS	SCT	FWS	ISOL	SCT
02-12-2024	WS	FWS	FWS	SCT	WS
03-12-2024	FWS	WS	FWS	WS	WS
04-12-2024	FWS	FWS	ISOL	FWS	FWS
05-12-2024	ISOL	FWS	SCT	ISOL	SCT
06-12-2024	ISOL	ISOL	ISOL	ISOL	SCT
07-12-2024	ISOL	ISOL	ISOL	ISOL	ISOL
08-12-2024	ISOL	ISOL	ISOL	ISOL	SCT
09-12-2024	ISOL	DRY	ISOL	ISOL	ISOL
10-12-2024	DRY	DRY	ISOL	ISOL	ISOL
11-12-2024	ISOL	DRY	ISOL	ISOL	ISOL
12-12-2024	ISOL	ISOL	FWS	DRY	ISOL
13-12-2024	ISOL	SCT	WS	ISOL	FWS
14-12-2024	ISOL	DRY	FWS	ISOL	FWS
15-12-2024	DRY	DRY	SCT	DRY	SCT
16-12-2024	DRY	DRY	ISOL	DRY	ISOL
17-12-2024	DRY	DRY	ISOL	DRY	ISOL
18-12-2024	SCT	ISOL	ISOL	DRY	ISOL
19-12-2024	FWS	ISOL	ISOL	DRY	ISOL
20-12-2024	FWS	ISOL	ISOL	DRY	ISOL
21-12-2024	FWS	ISOL	ISOL	ISOL	ISOL
22-12-2024	SCT	ISOL	ISOL	DRY	ISOL
23-12-2024	DRY	DRY	ISOL	DRY	DRY
24-12-2024	SCT	ISOL	ISOL	DRY	DRY
25-12-2024	WS	ISOL	ISOL	DRY	DRY
26-12-2024	WS	SCT	ISOL	ISOL	ISOL
27-12-2024	ISOL	WS	SCT	SCT	ISOL
28-12-2024	ISOL	SCT	SCT	SCT	ISOL
29-12-2024	DRY	DRY	ISOL	DRY	ISOL
30-12-2024	DRY	DRY	SCT	DRY	DRY
31-12-2024	DRY	ISOL	SCT	DRY	ISOL

Table-6b: Percentage frequency of various categories of daily spatial rainfall distribution

Category	OCT - DEC 2024				
	CAP	RYS	TN	SIK	KER
WS	5	9	9	8	13
FWS	17	8	17	13	22
SCT	13	16	26	16	20
ISOL	47	45	46	33	40
DRY	16	21	0	29	4

WD: ***Widespread*** (76-100% of stations reporting rainfall)

FWD : Fairly widespread (51-75% of stations reporting rainfall)

SCT: Scattered (26-50% of stations reporting rainfall)

ISOL: Isolated (≤25% of stations reporting rainfall)

DRY: No rain

4.3 Monsoon activity & heavy rainfall events

Table-7a&b present the frequency of ***active*** and ***vigorous*** monsoon days and frequency of ***heavy*** rainfall days (***Heavy*** rainfall ≥ 7cm/day***;*** ***Very Heavy*** rainfall ≥ 12cm/day; ***Extremely Heavy*** rainfall ≥ 21 cm/day) during the season.

During Oct-Dec 2024**,** ***Active to Vvigorous*** monsoon conditions prevailed over TN on 22% of the days during the season (20 days out of 92 days); on 13-17% of the days over SIK, KER & RYS,; and on 10% of the days over CAP.

In October, there were 14 days & 10 days of ***active to vigorous*** monsoon conditions over SIK & TN respectively; and 5-8 days over CAP, RYS & KER. In November, 5 days & 4 days of ***active to vigorous*** monsoon conditions prevailed over TN & KER respectively; and 1 day over SIK, & RYS. In December, 5 days of ***active to vigorous*** monsoon activity occurred over TN; and 3-4 days over CAP, RYS & KER.

Table-7a: Frequencies of active and vigorous monsoon days during Oct-Dec 2024

Subdivision	No. of days of active and vigorous monsoon conditions							
	OCT		NOV		DEC		OCT-DEC	
	ACT	VIG	ACT	VIG	ACT	VIG	ACT	VIG
CAP	5	1	0	0	2	1	7	2
RYS	5	3	1	0	1	3	7	6
TN	8	2	4	1	1	4	13	7
SIK	11	3	1	0	0	1	12	4
KER	5	0	4	0	0	4	9	4

Active: Fairly widespread to widespread sub-divisional rainfall with rainfall more than 1½ to 4 times the normal with at least two stations reporting more than or equal to 3 cm in coastal Tamil Nadu, south coastal Andhra Pradesh and 2 cm elsewhere in the NEM region.

Vigorous: Fairly widespread to widespread sub-divisional rainfall with rainfall more than 4 times the normal with at least two stations reporting more than or equal to 5 cm in coastal Tamil Nadu, south coastal Andhra Pradesh and 3 cm elsewhere in the NEM region.

Table-7b: Frequency of heavy rainfall days during Oct-Dec 2024

2024	Oct			Nov			Dec			Oct-Dec 2024		
	>=21	>=12	>=7	>=21	>=12	>=7	>=21	>=12	>=7	>=21	>=12	>=7
Sub div	cm/day	cm/day	cm/day	cm/day	cm/day	cm/day	cm/day	cm/day	cm/day	cm/day	cm/day	cm/day
CAP	0	3	12	0	0	1	0	0	7	0	3	20
RYS	1	3	16	0	0	2	0	3	9	1	6	27
TN	1	11	26	1	9	20	3	7	15	5	27	61
SIK	0	3	21	0	0	1	0	0	1	0	3	23
KER	1	5	16	0	2	12	0	3	3	1	10	31

Heavy: rainfall ≥ 7cm/day; ***Very Heavy:*** rainfall ≥ 12cm/day; ***Extremely Heavy:*** rainfall ≥21 cm/day

Regarding *heavy* rainfall occurrences (≥ 7 cm/day), TN experienced 61 days (66%) of *isolated heavy* rainfall events during the season including 27 days (29%) of *isolated very heavy* rain with *isolated extremely heavy* falls on 5 days (5%). Over Kerala, *isolated heavy* rain occurred on 31 days (34%) including 10 days of *isolated very heavy* rain and 1 day of *isolated extremely heavy* rain. Over RYS, *isolated heavy* rain occurred on 27 days (29%) including 6 days of *isolated very heavy* rainfall & 1 day of *isolated extremely heavy* rain. There were 23 days of *isolated heavy* rainfall activity over SIK including 3 days of *isolated very heavy* rain out of which 21 days were in the month of October. CAP experienced 20 days of *isolated heavy* rain including 3 days of *isolated very heavy* rain. District-wise list of *very heavy* to *extremely heavy* rainfall events over various subdivisions is presented in Table-7c.

Table-7c: List of very heavy to extremely heavy rainfall events during Oct-Dec 2024

DISTRICT	**Date, Station and 24-hr accumulated rainfall (cm; ≥ 12 cm) (ending 0830 IST of the specified date)**
COASTAL ANDHRA PRADESH & YANAM	
BAPATLA	**Oct** : **15th** : Addanki-14
PARVATHIPURAM MANYAM	**Oct** : **28th** : Parvathipuram - 12,
SPSR NELLORE	**Oct** : **15th** : Kavali - 15, Kandukur-12; **16th** : Kavali-18, Nellore-13
RAYALASEEMA	
CHITTOOR	**Dec** : **01st** : Nagari-13
SRI SATYA SAI	**Dec** : **04th** : Gorantla -14,
TIRUPATI	**Oct** : **16th** : Sullurpeta-22, Tada-12; **Dec** : **01st** : Sullurpeta-17, Tada-15; **13th** : Sullurpeta-14, Tada-12

YSR-KADAPA	**Oct** : 17th : Kodur-14; **Dec** : 01st : Kodur-12
TAMILNADU, PUDUCHERRY & KARAIKAL	
ARIYALUR	**Dec**: 13th : Jayamkondam-21, Sendurai-20, Ariyalur TalukOffice-18, Ariyalur PTO-18, Ariyalur AWS-18, Suthamalli Dam-16, Kuruvadi-13
CHENNAI	**Oct** : 16th : Zone 01 Kathivakkam – 23, Zone 02 D15 Manali – 21, Zone 06 T.V.K Nagar – 19, Zone 06 D65 Kolathur -18, Zone 13 U39 Adyar -18, Zone 07 Ambattur-18, Zone 01 Thiruvottiyur -17, Perungudi-17, Zone 02 Manali-17, Ennore AWS -17, Perambur-16, Zone 08 Malar Colony -16, Zone 03 Puzhal -16, Ayanavaram Taluk Office-16, Anna University ARG -16, Ambathur-15, Anna University-15, MGR Nagar-15, Sholinganallur -15, Thiru-Vi-Ka Nagar -15, Tondiarpet -15, Zone 05 Royapuram -15, Adayar-15, Zone 03 Madhavaram -14, Zone 04 Tondiarpet -14, Chennai(N) AWS-14, Chennai (N) -14, CD Hospital Tondaiarpet -14, YMCA Nandnam ARG -14, Kodambakkam -14, Zone 08 Anna Nagar -13, Anna Nagar-13,Zone 07 U18 D81 Vanagaram-13, Chennai Collector Office-13, Zone 10 Kodambakkam -13, DGP Office -13, Royapuram -13, Zone 09 Ice House -12, NIOT_Pallikaranai ARG -12, Zone 09 Teynampet-12 Teynampet -12, Alandur -12, Chennai (AP) -12, Meenambakkam AWS -12, Zone 11 U32 Maduravoyal -12 **Nov** : 27th : Zone 02 D15 Manali-13; 30th : Zone 01 Kathivakkam-12; **Dec** : 01st : MGR Nagar-15, Ayanavaram Taluk Office-15, Zone 12 Meenambakkam-12, Ambathur Rev-12, Valasaravakkam-12, Zone 07Ayapakkam-12,, Zone11 Maduravoyal -12, Ambattur MW-12
CHENGALPATTU	**Dec** 01st : Maduranthagam-20, Chengalpattu-20, Thirukalukundram-19, Tambaram-16, Cheyyur-15, Mahabalipuram-14, LMOIS Kolapakkam ARG-12; 12th : Maduranthagam-12;13th : Maduranthagam-12
CUDDALORE	**Oct** : 05th : Me Mathur-13; 06th : Vadakuthu-13; **Dec** : 01st : Cuddalore -23, Cuddalore Collector Office-21, Vanamadevi-19, SRC Kudithangi-17, Panruti-14; 02nd : Panruti-16, Vanamadevi-15,Kattumayilur-14; 02nd : Vepur-12, Me Mathur-12; 13th : Lalpet-31, Srimushnam-24, K.M.Koil-24, Kilacheruvai-22, Pelandurai -21, Sethiathope-21, Me Mathur-18, Lakkur-18, Tozhudur-17, Bhuvanagiri-17, Kattumayilur-17, Vepur-16, Virudachalam-14, Kuppanatham-14, Virdhachalam KVK AWS-12, Chidambaram-12
COIMBATORE	**Oct** : 10th : PWD Makkinampatti - 12, **Nov** : 04th : Pillur Dam Mettupalayam-12
DHARMAPURI	**Dec** : 02nd : Harur-33,Pappireddipatti-20, Dharmapuri PTO-16
DINDIGUL	**Dec** : 13th :Kodaikannal Boat Club-13, Oddanchatram-13, Palani ARG-12
KALLAKURICHI	**Dec** : 01st : Thirukoilur ARG -16, Kallakurichi-15, Kallakurichi ARG-14, DSCL Madampoondi -13, DSCL Thirupalapandal-12, DSCLKalayanallur-12, Tirukoilur-12; **Dec** : 02nd : DSCL Thirupalapandal-32, DSCL Madampoondi-31, BASL Vengur-27, Tirukoilur-26, , DSCL Eraiyur-23, BASL Manalurpet-21, Sankarapuram-19, Kallakurichi-18, DSCL Kalayanallur-17,KCS Mill-2 Moorarpalayam-15, KCS Mill-1 Moongilthuraipattu-15, Ulundurpet-15, DSCL Sulangurichi-15, DSCL Rishivandhiyam -15, SCS Mill Pillaiyarkuppam-15, DSCL Keelpadi-15, DSCL Virugavoor-14, KCS Mill-1 Ariyalur -13, Ariyalur Camp Area-13, KCS Mill-1 Kadavanur-13; 13th : Kallakurichi -17, DSCL Virugavoor-13

KANCHIPURAM	**Oct** : 16th : Hindustan_University -17; **Dec** : 01st : Uthiramerur -21, Kancheepuram-15, Sriperumbudur-13, Walajabad-13; 13th : Sriperumbudur-17, Kundrathur-14
KANYAKUMARI	**Oct** : 24th : Thuckalay-12 **Nov** : 03rd : Kottaram-16,Kanniyakumari-13,
KARUR	**Dec** : 03rd : Thogamalai - 13
KARAIKAL	**Dec** : 13th : Karaikal-20, Karaikal AWS-18,
KRISHNAGIRI	**Oct** : 24th : Kelavarapalli Dam-12; **Dec** : 02nd : Uthangarai -50, Jambukuttapatti-25, Pochampalli ARG-25, Pambar Dam-21, Barur-20, Penucondapuram-19, Nedungal-14
MADURAI	**Oct** : 13th : Madurai AWS -16, Tallakulam -12, Periyapatti-12
MAYILADUTHURAI	**Nov** : 13th : Sirkali-14, Kollidam-14; **Dec** : 13th : Manalmedu ARG-26, Mayiladuthurai-22, Mayiladuthurai AWS-19, Sembanarkoil PWD-18, Manalmedu-17, Tarangambadi-13
NAMAKKAL	**Oct** : 06th : Rasipuram-12
NAGAPATTINAM	**Nov** : 18th : Vedaranyam-19, Kodiayakarai-15; 20th : Kodiayakarai-15, Tirupoondi-13; 21st : Kodiayakarai-17, Vedaranyam-12; 27th : Nagapattinam AWS-19,Kodiayakarai-18,Nagapattinam-18, Velankanni-18,Tirupoondi-14, Thirukuvalai-13, Vedaranyam-12; **Dec** : 12th : Kodiayakarai-18, Thalaignayer -15, Velankanni -13; 14th : Kodiayakarai-15
NILGIRIS	**Nov** : 03rd : Kil Kotagiri Estate-14,Coonoor PTO-14,Kothagiri-14,Alakarai Estate-14,Adar Estate-13, Burliar-12, Billimalai Estate-12
PERAMBALUR	**Dec** : 13th : Eraiyur-17,Agaram Seegoor-14, Labbaikudikadu-14, Veppanthattai-13, Thaluthalai-12
PUDUKKOTTAI	**Oct** : 05th : Avudayarkoil-12; 15th : Kudimiyanmalai-13; **Dec** : 13th : Avudayarkoil-14, Manamelkudi-13
PUDUCHERRY	**Oct** : 05th : Thirukkanur-12; **Nov** : 13th : Puducherry AWS-12, Puducherry-12; **Dec** : 01st : Puducherry AWS – 49, Puducherry – 48, Patthukannu – 45, Thirukkanur -43,Puducherry Town – 40, Bahour -32,
RAMANATHAPURAM	**Oct** : 05th : Thangachimadam-12; 13th : Rameswaram-12 **Nov** : 21st : Rameswaram -44, Thangachimadam-34, Pamban-28, Mandapam-27, Ramanathapuram-13; **Dec** : 13th : Kamudhi-17, Kamudhi ARG-12
RANIPET	**Dec** : 01st : Arcot-18, Wallajah-15, Kalavai PWD-15, Arakonam -14, Sholingur-14, Palar Anicut-13, Kaveripakkam -13, Panapakkam-13, Minnal-13,Ranipet AWS-12; 13th : Ranipet AWS-14, Arakonam-14, Panapakkam-14, Kaveripakkam-13, Arcot-12
SALEM	**Oct** : 21th : Mettur – 15; 25th : Anaimaduvu-15; **Dec** : 01st : Yercaud -14; 02nd : Yercaud-24; 02nd : Kariyakovil Dam-15
SIVAGANGAI	**Oct** : 06th : Sivagangai PWD TB-13; 12th : Karaikudi -15; 13th : Tirupuvanam - 14
THANJAVUR	**Oct** : 13th : Vettikadu-12; 14th : Budalur-12; 25th : Orthanad-13; **Dec** 13th : Thiruvidaimaruthur-21, Aduthurai AWS-20, Manjalaru-20, Budalur-19, Kumbakonam-19, Tirukattupalli-18, Lower Anaicut-17, Thanjai Papanasam-15, Ayyampettai-15; 14th : Orthanad-12, Kurungulam-13

THENI	**Nov** : 03rd : Sothuparai-12
THENKASI	**Dec** 13th : Ayikudi-31, Shencottah-24,Ramanadhi Dam Section-24, Thenkasi-23, GundarDam-21, Sankarankoil-15, Karuppanadhi Dam-14, Sivagiri-14, Adavinainnarkoil Dam-14; 14th : Gadana Dam-26, Ramanadhi Dam Section-15, Shencottah-14, Gundar Dam-14
THOOTHUKUDI	**Dec** 13th : Kovilpatti-37, Vilathikulam-19, Ettayapuram-17, Vaippar-17, Kalugumalai-17, Kadambur-16, Kovilpatti AWS-15, Old Taluk Office Srivaikuntam-15, Surangudi-13, Kadalkudi-12; 14th : Tuticorin Airport ARG-21, Tuticorin-16, Kayalpattinam-12
TIRUCHIRAPPALLI	**Oct** : 12th : Tiruchirappalli Airport - 13
TIRUNELVELI	**Nov** : 16th : Nalumukku – 12; 20th : Nalumukku-17,Oothu-15; 20th : Kakkachi-14; **Dec** 13th : Oothu-54, Ambasamudram-37, Kannadaian Anicut-35, Kakkachi-35 Manjolai-32, Nalumukku-31, Manimutharu-30, Palayamkottai-26, Servalar Dam-24, Cheranmahadevi-23, Papanasam-22, Tirunelveli AWS-21, Kalakadu-15, Tirunelveli-13; 14th : Oothu-23, Nalumukku-22, Kakkachi-19, Manjolai-18, Papanasam-15, Servalar Dam-14; 15th : Papanasam-13; 31st : Oothu-14, Nalumukku-13, Kakkachi-12
TIRUVANNAMALAI	**Oct** : 19th : Kalasapakkam-17; **Dec** : 01st : Tiruvannamalai AWS -22, Chetpet – 22, Jamunamarathur-21, Keelpennathur-20, Arani-18, Cheyyar ARG-17, Vandavasi -16, Kalasapakkam -16, Thandarampettai -15, Cheyyar -14, Vembakkam -14; 02nd : , Jamunamarathur-23,Thandarampettai-20, Tiruvannamalai-16, Keelpennathur-15; 04th : Kalasapakkam-12
THIRUVARUR	**Nov** : 27th : Tiruvarur-12; **Dec** 13th : Nannilam-12; 14th : Needamangalam-14
THIRUVALLUR	**Oct** : 16th : Cholavaram – 30, Red Hills – 28, Avadi – 25, Puzhal ARG -18, Good Will School VillivakkamARG -16, Ponneri-16, Thamaraipakkam-16 **Nov** : 30th : Ennore AWS-13; **Dec** : 01st : Gummidipoondi-20, Avadi-19, Tiruttani-18, Thamaraipakkam-16, Pallipattu-14, JayaEngg College AWS-14, Koratur-13, Uthukottai-13, Chembarabakkam_REV -13, R.K.Pet ARG -13, Red Hills-13, Poondi-13, R.K.Pet -13, Tiruvallur-13, Cholavaram-12, Tiruttani AWS-12; **Dec** 13th : Avadi-21, Tiruttani-17, Koratur-14, Poonamallee-14, Chembarabakkam_REV-14, Thiruvalangadu-13, Tiruvallur-13, PoonamalleARG-12
TIRUPPUR	**Oct** : 21th : Udumalpet – 12; **Dec** 13th : Thirumoorthy IB-14, Thirumoorthi Dam-13
VILLUPURAM	**Dec** : 01st : Mylam AWS – 51, Tindivanam – 37, RSCL-2 Nemoor- 35, RSCL Vallam – 32, RSCL-3 Semmedu-31, RSCL-2 Valavanur-28, RSCL-2 Koliyanur-28, Vilupuram-27, Gingee -25, RSCL-2 Kedar – 25, RSCL-3 Valathy-24, Vanur-24, RSCL-2 Soorapattu-24,Marakkanam – 24, RSCL-3 Avalurpettai-23 , RSCL-3 Anandhapuram-21, BASL Mugaiyur-18, RSCL-2 Kanjanur-16, RSCL-2 Mundiyampakkam -15, BASL Manampoondi-13, **Dec** : 02nd : RSCL-2 Kedar -42, RSCL-2 Soorapattu – 38, Vilupuram-35, RSCL-2 Mundiyampakkam-32, RSCL-2 Koliyanur-32, BASL Mugaiyur-30, RSCL-2 Valavanur-30, RSCL-2 Nemoor -29, BASL Manampoondi-29, RSCL-2 Kanjanur-29, RSCL-3 Anandhapuram-17,
VIRUDHUNAGAR	**Oct** : 13th : Sivakasi-12; **Dec** : 13th : Vembakottai-14, Sattur-13, Sivakasi-12; 14th : Virudunagar AWS-13
SOUTH INTERIOR KARNATAKA	
CHITRADURGA	**Oct** : 05th : Nayakanahatty-13; 18th : Nayakanahatty-15; 22nd : Nayakanahatty-13

SHIVAMOGGA	**Oct** : **05th** : Agumbe Emo-17,
KERALA & MAHE	
ALAPPUZHA	**Oct** : **12th** : Alapuzha -16; **Nov** : **16th** : Kayamkulam-15; **Dec** : **02nd** : Haripad-15, Cherthala-12, Thycauttussery-12
ERNAKULAM	**Oct** : **24th** : Idamalayar Dam-12; **Dec** : **02nd** : C.I.A.L. Kochi-15, Perumbavur-14, Aluva-13,
IDUKKI	**Oct** : **27th** : Peermade To-13; **Dec** : **02nd** : Peerumedu-15; **13th** : Kovilkadav-12
KASARGOD	**Dec** : **03rd** : Hosdurg – 20, Kudulu -16
KANNUR	**Oct** : **07th** : Irikkur – 13; **Dec** : **03rd** : Irrikur-17, Cheruvanchery - 12
KOTTAYAM	**Dec** : **02nd** : Kottayam -18, Kanjirappally-16,
KOLLAM	**Dec** : **13th** : Aryankavu-15
KOZHIKODE	**Oct** : **08th** : Quilandi – 22; **12th** : Vadakara -18; **Dec** : **03rd** : Vadakara-18, Kozhikode-16, Quilandi – 13, Vadakara -13
MALAPPURAM	**Oct** : **07th** : Perinthalamanna -15; **Dec** : **03rd** : Ponnani – 17, Thennala-17, Angadipuram -15, Perinthalamanna -13, Karipur Ap.-12
THRISSUR	Dec : **02nd** : Kodungallur – 19; **03rd** : Enamakkal -20, Irinjalakuda-17, Chalakudi-15, Kunnamkulam-14, Vellanikkara-13
PATHANAMTHITTA	**Nov** : **03rd** : Laha-12; **Dec** : **02nd** : Kurudamannil – 17, Konni-16, Ranni -16, Laha-13, Kunnathanam-12

4.4 District rainfall scenario

Fig.4c presents the district wise seasonal rainfall during October to December 2024. As seen, in KER, **Kozhikode** district received *excess* rainfall (**+31%**) and most other districts & Mahe of Puducherry received *normal* rainfall. However, **Kollam & Ernakulam** districts became deficient (-21% & -24% respectively) during the season.

In TN, all the districts received *normal to excess* rainfall with many districts coming under *excess* category. **Krishnagiri, Tirupattur, Dharmapuri, Salem, Villupuram & Tirunelveli** districts received *large excess* rainfall (+62% to +86%).

In SIK also, all the districts received normal to excess rainfall with **Chitradurga, Davangere, Vijayanagara, Mandya & Ramanagara** districts receiving *large excess* rainfall (+73% to +135%).

In RYS, excepting **Kurnool** that received *deficient* rainfall (-26%), all other districts received *normal to excess* rainfall with **Sri Satya Sai** district receiving *large excess* rainfall of +**108%**.

In CAP, many districts ended up deficient with **East Godavari** district reporting *largely deficient* rainfall of **-80%**. **SPSR Nellore** district & **Yanam** of Puducherry received *excess* rainfall of **+28% & +25%** respectively. Prakasam, Bapatla, Konaseema, Visakhapatnam, Vizianagaram, Parvatipuram Manyam districts received *normal* rainfall.

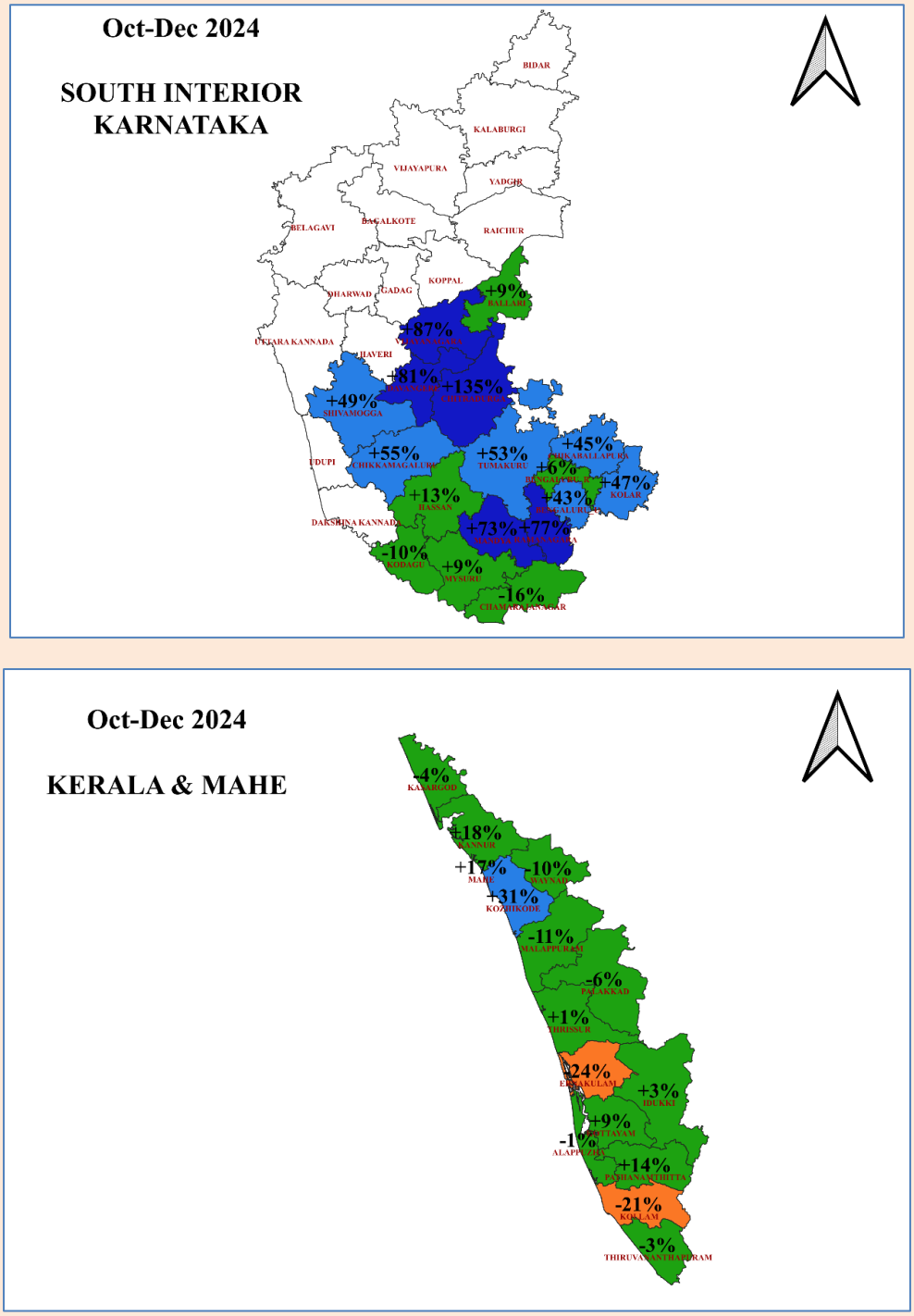
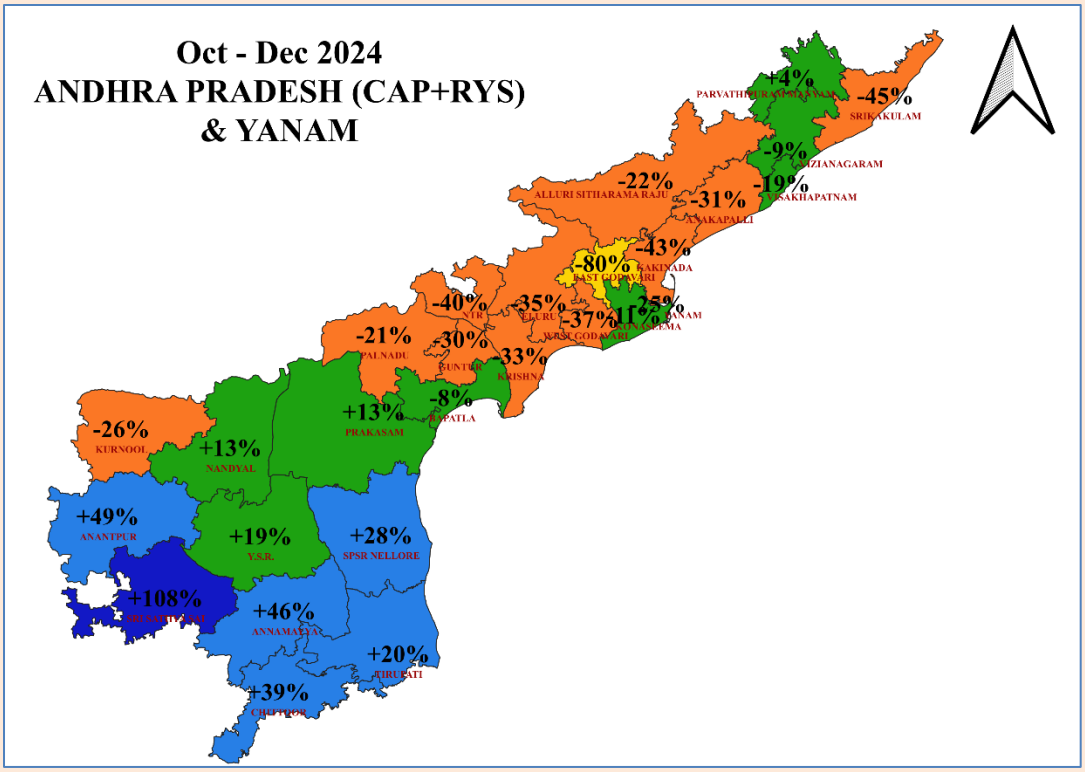


Fig.4c: District-wise rainfall performance in various subdivisions during Oct-Dec 2024


Oct - Dec 2024
ANDHRA PRADESH (CAP+RYS)
& YANAM
+4%
-45%
-9%
-22%
-19%
-31%
-43%
-80%
-40%
-35%
-37%
-11%
-25%
-21%
-30%
-33%
-8%
+13%
-26%
+13%
+49%
+19%
+28%
+108%
+46%
+20%
+39%

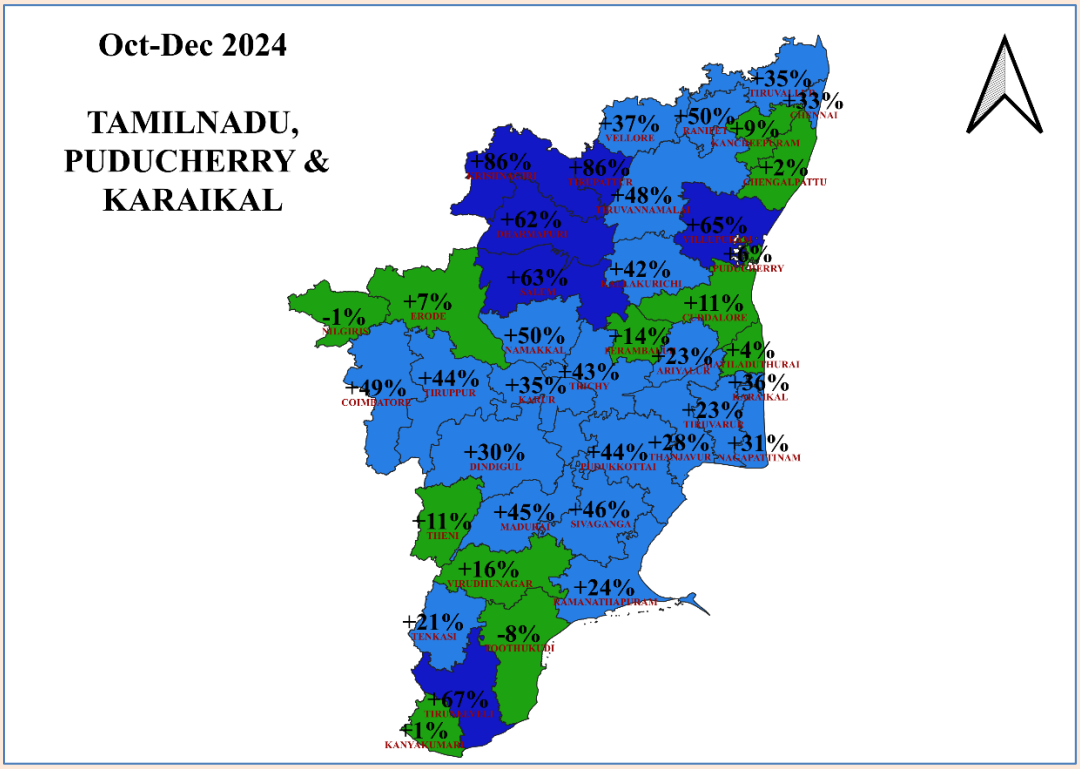

Oct-Dec 2024
TAMILNADU,
PUDUCHERRY &
KARAIKAL
+35%
+33%
+37%
+50%
+9%
+2%
+86%
+86%
+48%
+62%
+65%
+42%
+63%
+7%
-1%
+11%
+50%
+14%
+23%
+4%
+49%
+44%
+43%
+35%
+36%
+23%
+30%
+44%
+28%
+31%
+11%
+45%
+46%
+16%
+24%
+21%
-8%
+67%
+1%

Fig.4c: contd.

5. Rainfall distribution over Tamilnadu and Puducherry

Spatial and temporal distribution of rainfall over the TN subdivision during Oct-Dec 2024 are depicted by the district-wise rainfall distribution and area averaged daily rainfall distribution over TN. Fig.5a presents the daily rainfall distribution over the TN subdivision (including Puducherry and Karaikal) during Oct-Dec 2024. The daily TN subdivisional rainfall was continuously *below normal* during 04th-14th & 22nd-26th November.

State / UT & District-wise seasonal rainfall during Oct-dec 2024 are presented in Tables-8a&b and Fig.4c and district-wise monthly rainfall performance is depicted in Fig.5b. As seen, excepting Kanyakumari, Thoothukudi, Virudunagar, Theni, Nilgiris, Erode, Perambalur, Mayiladuthurai, Cuddalore, Puducherry, Chengalpattu & Kancheepuram districts (**12 districts**) that received ***normal*** rainfall, all the other **28 districts** (including Karaikal) received ***excess to large excess*** rainfall with **Krishnagiri, Tirupattur, Dharmapuri, Salem, Villupuram & Tirunelveli** districts recording ***large excess*** rainfall of **+62% to +86**%. As such, all the 40 districts (including Puducherry & Karaikal), received ***normal to large excess*** rainfall during the Oct-Dec 2024 season.

In the monthly scale, during October 2024, excepting **Tirunelveli, Thoothukudi, Tenkasi & Nagapattinam** districts that became ***deficient***, all the other **36** districts including (Puducherry & Karaikal) received ***normal to excess*** rainfall. During November 2024, **28** out of 40 districts ended up ***deficient to largely deficient*** with **Vellore, Tiruppatur, Dharmapuri, Kallakurichi & Karur** districts reporting ***large deficiency*** (-60% to -75%). Whereas **Nagapattinam, Karaikal, Tiruvarur, Ramanathapuram & Tirunelveli** districts recorded ***excess to large excess*** rainfall with **Nagapattinam** district recording ***large excess*** rainfall of **+78%** and **Chennai, Puducherry, Mayiladuthurai, Thanjavur, Pudukkottai, Sivagangai & Kanyakumari** districts recorded ***normal*** rainfall, all the other 28 districts became *deficient*.

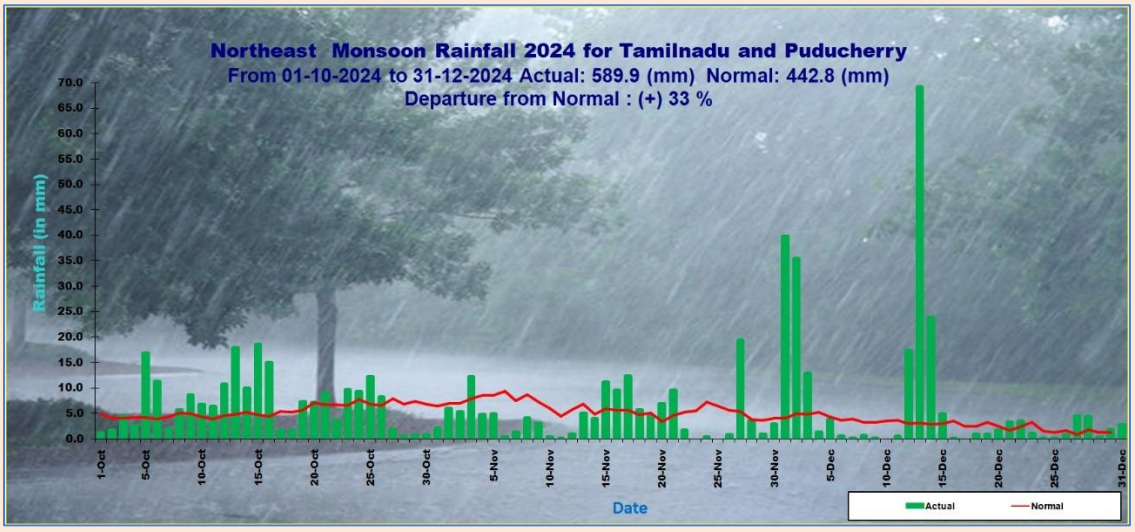


Fig.5a: Area averaged daily rainfall over TN subdivision during Oct-Dec 2024

Table-8a: State /UT wise rainfall figures of Tamilnadu, Puducherry & Karaikal during Oct-Dec 2024

Subdivision / State / UT	Actual rainfall (mm)	Normal rainfall (mm)	Percentage departure from normal (%)
TN subdivision	589.9	442.8	+33
Puducherry& Karaikal (UT)	1056.1	896.1	18
Tamil Nadu State	588.2	441.2	+33

Table-8b: District wise rainfall figures of Tamilnadu, Puducherry & Karaikal during Oct-Dec 2024

District	Oct-Dec 2024		
	Actual (mm)	*Normal (mm)*	*PDN (%)*
ARIYALUR	617.1	501.9	+23
CHENGALPATTU	724.4	707.7	+2
CHENNAI	1077.6	809.6	+33
COIMBATORE	504.1	337.6	+49
CUDDALORE	780.8	701.5	+11
DHARMAPURI	508.1	314.2	+62
DINDIGUL	598.6	460.0	+30
ERODE	328.2	307.1	+7
KALLAKURICHI	645.1	455.5	+42
KANCHEEPURAM	644.5	591.7	+9
KANYAKUMARI	540.0	532.6	+1
KARAIKAL	1380.9	1014.2	+36
KARUR	424.1	313.2	+35
KRISHNAGIRI	518.7	278.7	+86
MADURAI	535.8	370.0	+45
MAYILADUTHURAI	924.6	888.1	+4
NAGAPATTINAM	1224.8	935.3	+31
NAMAKKAL	406.8	270.4	+50
NILGIRIS	496.1	501.3	-1
PERAMBALUR	492.7	432.0	+14
PUDUCHERRY	878.7	831.6	+6
PUDUKKOTTAI	556.5	385.6	+44
RAMANATHAPURAM	657.4	531.4	+24
RANIPET	608.0	406.0	+50
SALEM	540.1	331.7	+63
SIVAGANGA	617.4	422.7	+46
TENKASI	564.1	465.7	+21
THANJAVUR	743.7	579.4	+28
THENI	404.2	364.3	+11
TIRUNELVELI	862.3	514.9	+67
TIRUPATTUR	494.0	266.3	+86
TIRUPPUR	441.6	305.7	+44
TIRUVALLUR	843.6	623.9	+35
TIRUVANNAMALAI	667.8	450.4	+48
TIRUVARUR	894.1	725.4	+23
TOOTHUKUDI	407.8	441.9	-8
TRICHY	541.2	379.4	+43
VELLORE	515.7	375.8	+37
VILLUPURAM	877.5	531.3	+65
VIRUDHUNAGAR	461.6	398.5	+16

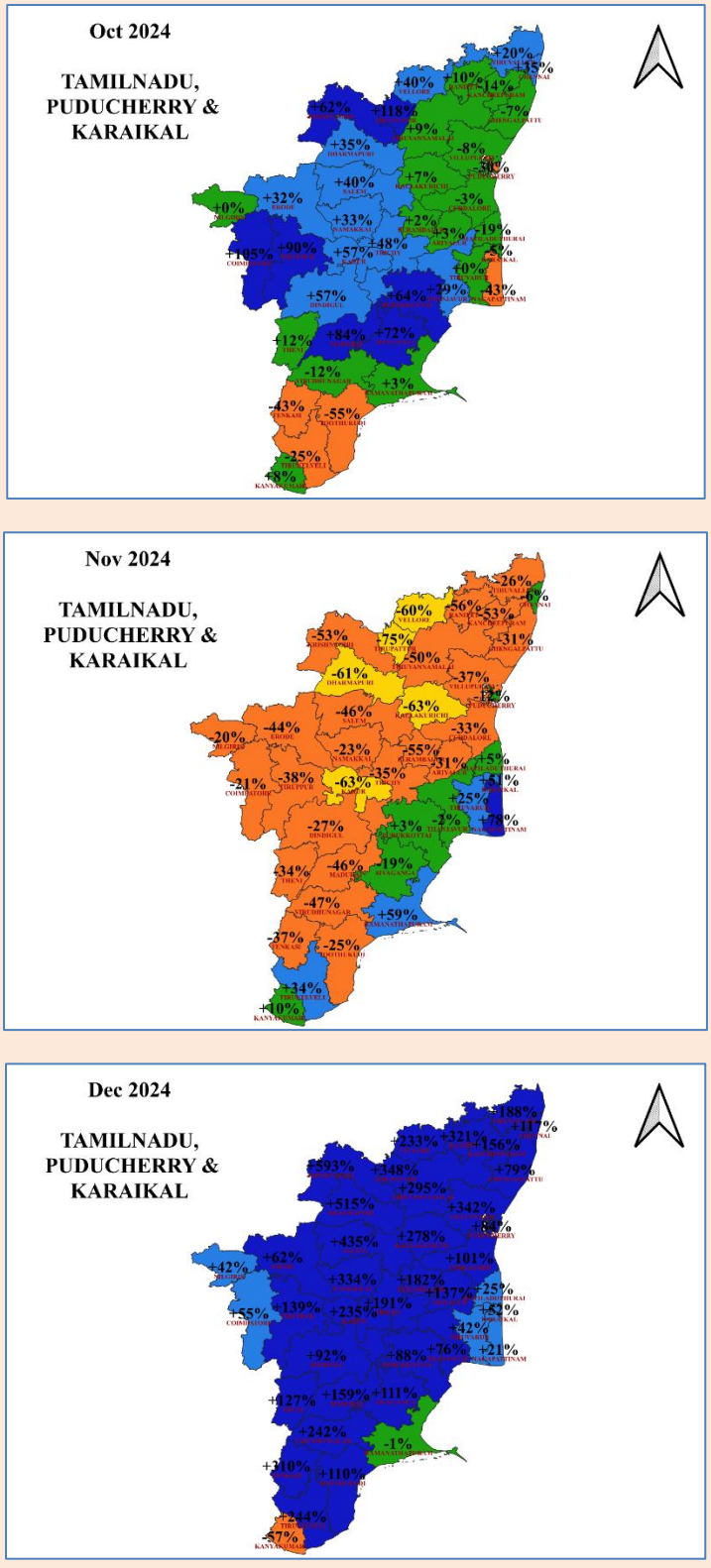


Fig.5b: District-wise rainfall distribution over the TN subdivision during Oct, Nov & Dec 2024

During December 2024, **Kanyakumari** district received ***deficient*** rainfall, **Ramanathapuram** district - ***normal*** rainfall, **Nilgiris, Coimbatore, Tiruvarur, Nagapattinam, Mayiladuthurai** districts and **Karaikal** area - ***excess*** rainfall and all the other **32** districts - ***large excess*** rainfall with **Krishnagiri, Dharmapuri, Tirupattur, Vellore, Ranipet, Thiruvannamalai, Villupuram, Kallakurichi, Salem, Namakkal, Karur, Tirunelveli, Thenkasi & Virudunagar** districts recording rainfall in the range **+200% to +600%.**

6. Standardised Precipitation Index

The Standardized Precipitation Index (SPI) is an index used for monitoring drought and is based on precipitation. This index is negative for dry and positive for wet conditions. As the dry or wet conditions become more severe, the index becomes more negative or positive. For October to December 2024, SPI indicated generally *wet* conditions over TN & SIK and *mildly wet & dry* conditions over CAP, RYS & KER. In TN, *severely wet* conditions prevailed over **Krishnagiri & Dharmapuri** districts and *moderately wet* conditions over **Kallakurichi, Madurai, Namakkal, Ranipet, Salem, Sivagangai, Tenkasi, Tirunelveli, Tirupattur, Tiruppur, Thiruvannamalai, Tiruchirapalli, Vellore & Villupuram district & Puducherry** area. *Mildly wet* conditions prevailed over all the other 22 districts and Karaikal area. In AP, 9 districts in CAP, Yanam area (of Puducherry) & 6 districts in RYS came under *mildly wet* category; and 9 districts in CAP & 2 districts in RYS came under *mildly dry* category. In KER, 9 districts & Mahe area (of Puducherry) came under *mildly wet* category and the other 5 districts came under *mildly dry* category. In SIK, *severely wet* conditions prevailed over **Chitradurga district** and *moderately wet* conditions over **Chikkamagaluru, Davangere, Mandya, Ramanagara & Tumakuru** districts. Of the remaining 11 districts excepting Kodagu district that became *mildly dry*, all the other 10 districts came under *mildly wet* category (Fig.6).

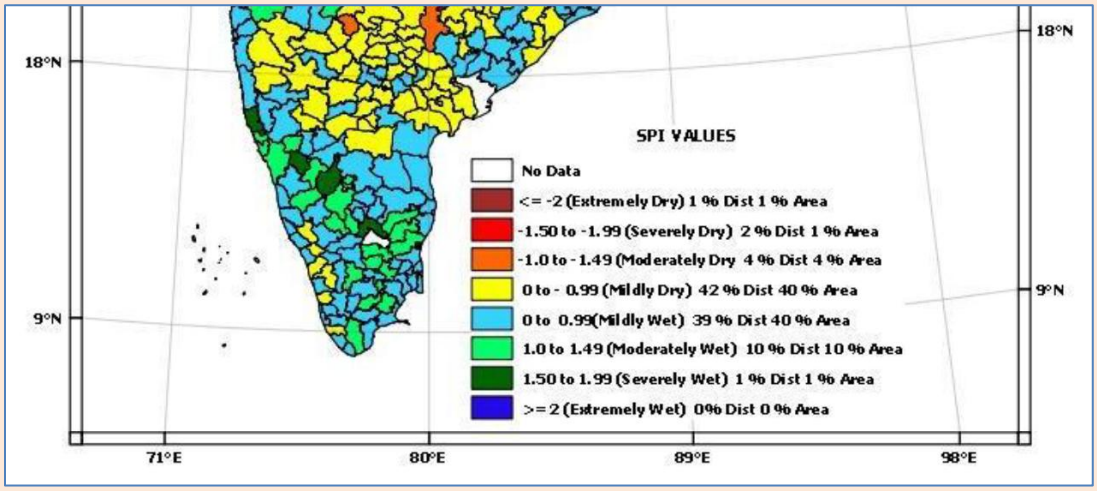


Fig.6: Standardised Precipitation Index for October-December 2024 over the southern peninsular India.

7. Large & Regional scale circulation features

(a) ***Flow pattern:*** The mean and anomalous wind pattern over the Indian region at 850 hPa, 500 hPa and 250 hPa levels during October –December 2024 are presented in Fig.8a(i)-(iii). The 250 hPa velocity potential & 850 hPa stream function over the Indian region during October-December 2024 are presented in Fig.8b & Fig.8c respectively.

In October 2024, anomalous cyclonic circulation was observed in the lower tropospheric levels (850 hPa) over the South and Central Arabian Sea and adjoining southern peninsular region [Fig.7a(i) & Fig.7c] and anomalous anticyclonic circulation was observed over the northwestern parts of India and neighbourhood in the middle and upper tropospheric levels. [Fig.7a(i)]. There was anomalous upper level divergence over the southern peninsular region, adjoining Comorin – Maldives area & equatorial Indian Ocean [Fig.7b].

In November 2024, at 850 hPa level, anticyclonic circulation was present over most parts of India excepting over the extreme southern parts of peninsular region wherein cyclonic circulation prevailed [Fig.7c]. Anomalous anticyclone was present over the Northwestern parts India and neighbourhood led to continental northerlies over the southern peninsular India in the mid levels [Fig.7a(ii)]. Anomalous upper level divergence was present over the equatorial Indian Ocean and Bay of Bengal region and only weak divergence was present over the Indian region at 250 hPa level [Fig.7b].

In December 2024, at 850 hPa level, there was anomalous cyclonic circulation over the Eastcentral Arabian sea and adjoining peninsular India [Fig.7a(iii) &Fig7c]. At 500 hPa level, there were anomalous cyclonic circulations over Northwest India and neighbourhood and over the South Bay of Bengal and adjoining southern peninsular India and anomalous anti cyclonic circulations over the western parts of Arabian Sea and over the northern parts of Bay of Bengal and neighbourhood. The anomalous cyclonic circulation over the Northwest India and neighbourhood extended up to the upper tropospheric levels. There was anomalous upper level divergence over the Southeast Asian region which extended into the Bay of Bengal and adjoining southeastern & eastern Indian region also.

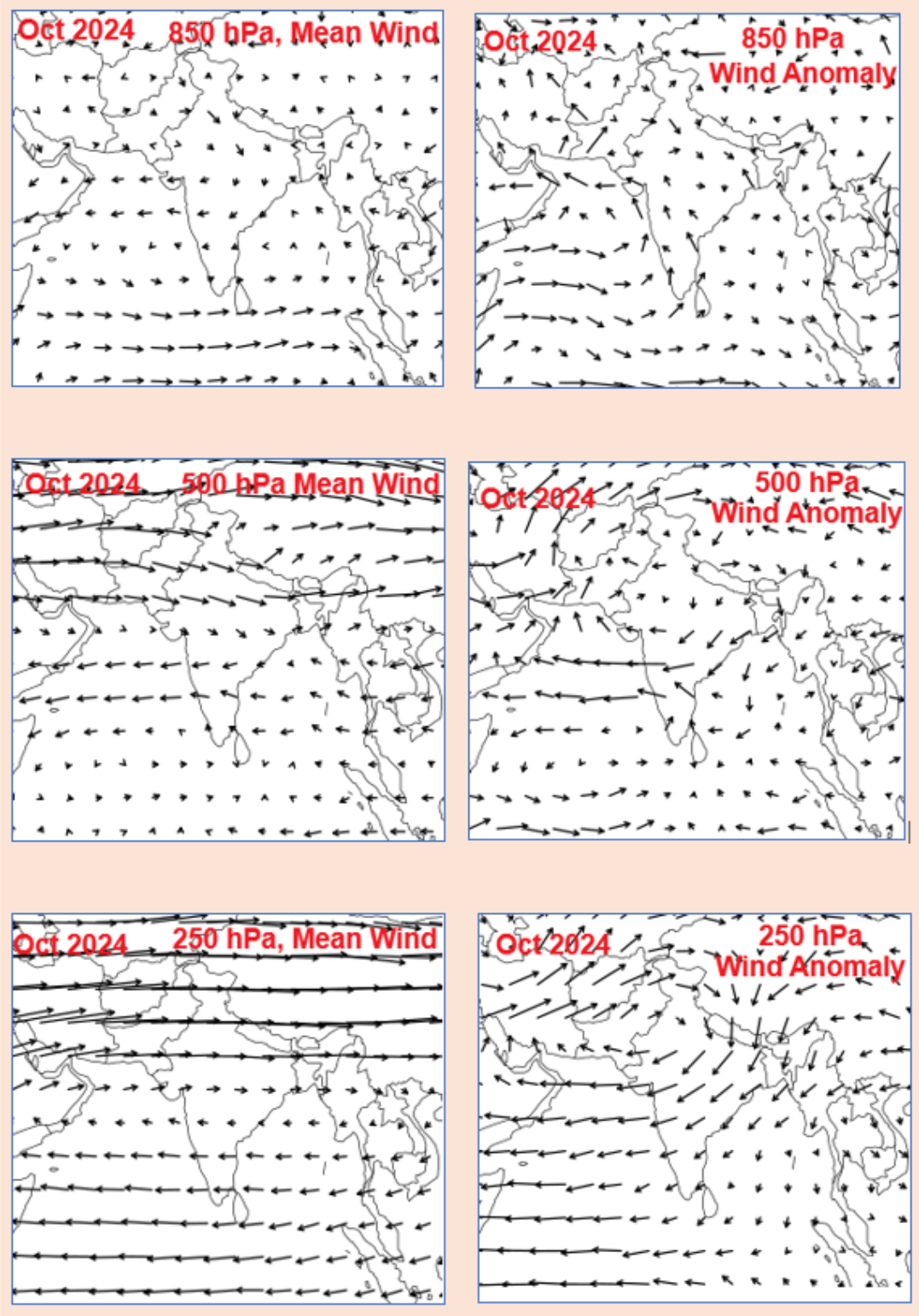


Fig.7a(i): Mean and anomalous wind pattern over the Indian region at 850 hPa, 500 hPa and 250 hPa levels during October 2024 (Source: Climate Diagnostic Bulletin of India, IMD Pune)

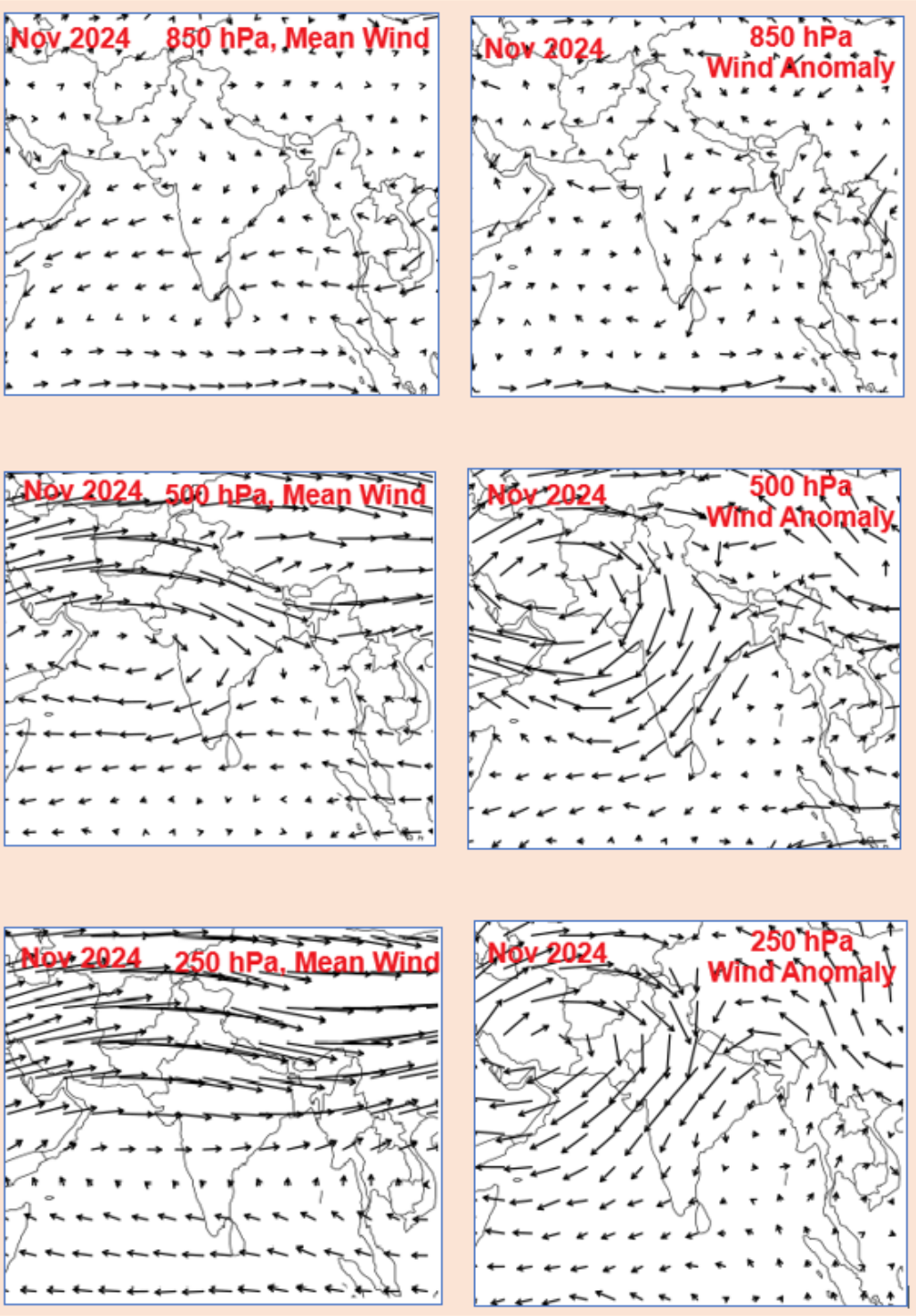


Fig.7a(ii): Mean and anomalous wind pattern over the Indian region at 850 hPa, 500 hPa and 250 hPa levels during Nov 2024 (Source: Climate Diagnostic Bulletin of India, IMD Pune)

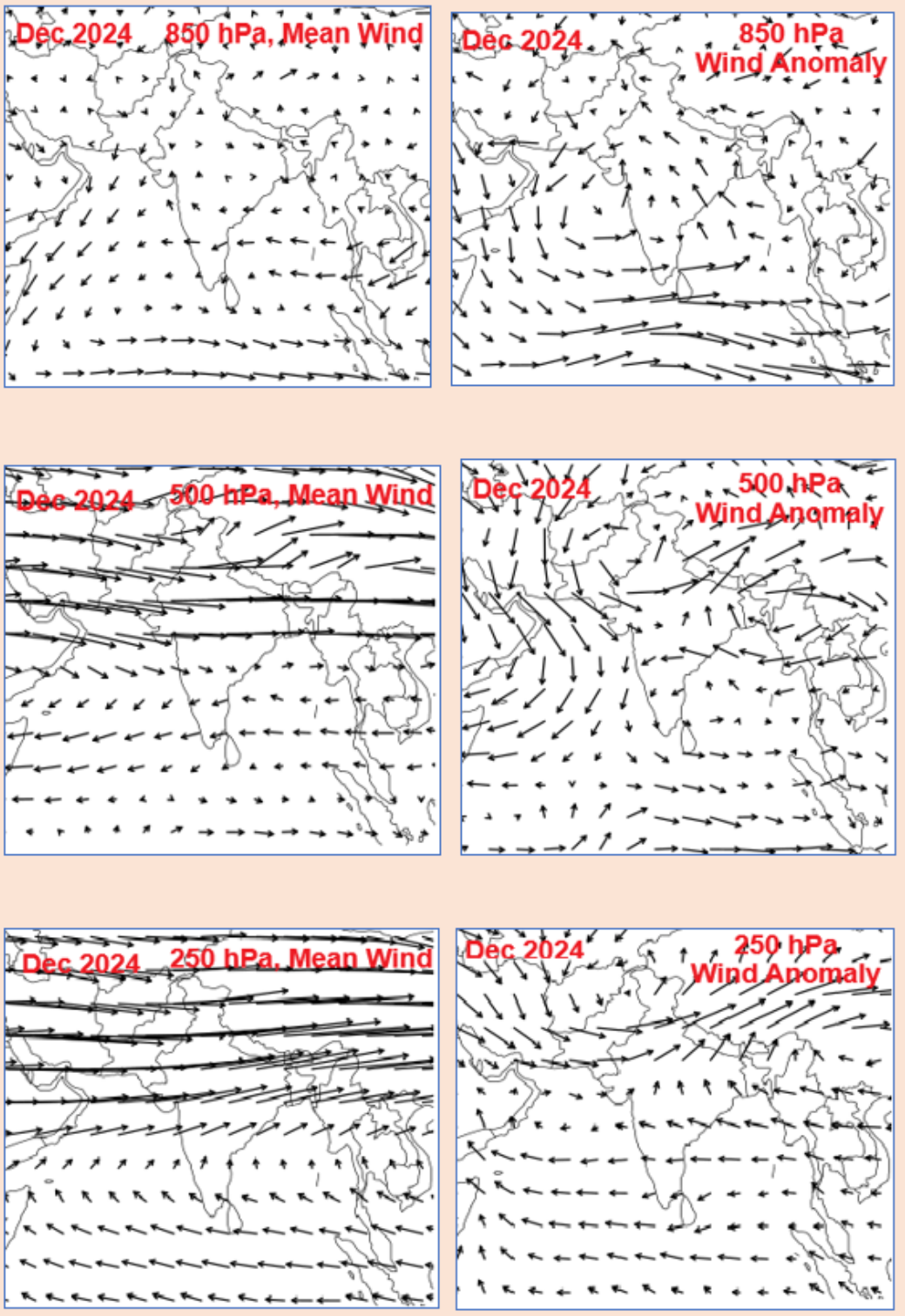


Fig.7a(iii): Mean and anomalous wind pattern over the Indian region at 850 hPa, 500 hPa and 250 hPa levels during December 2024 (Source: Climate Diagnostic Bulletin of India, IMD Pune)

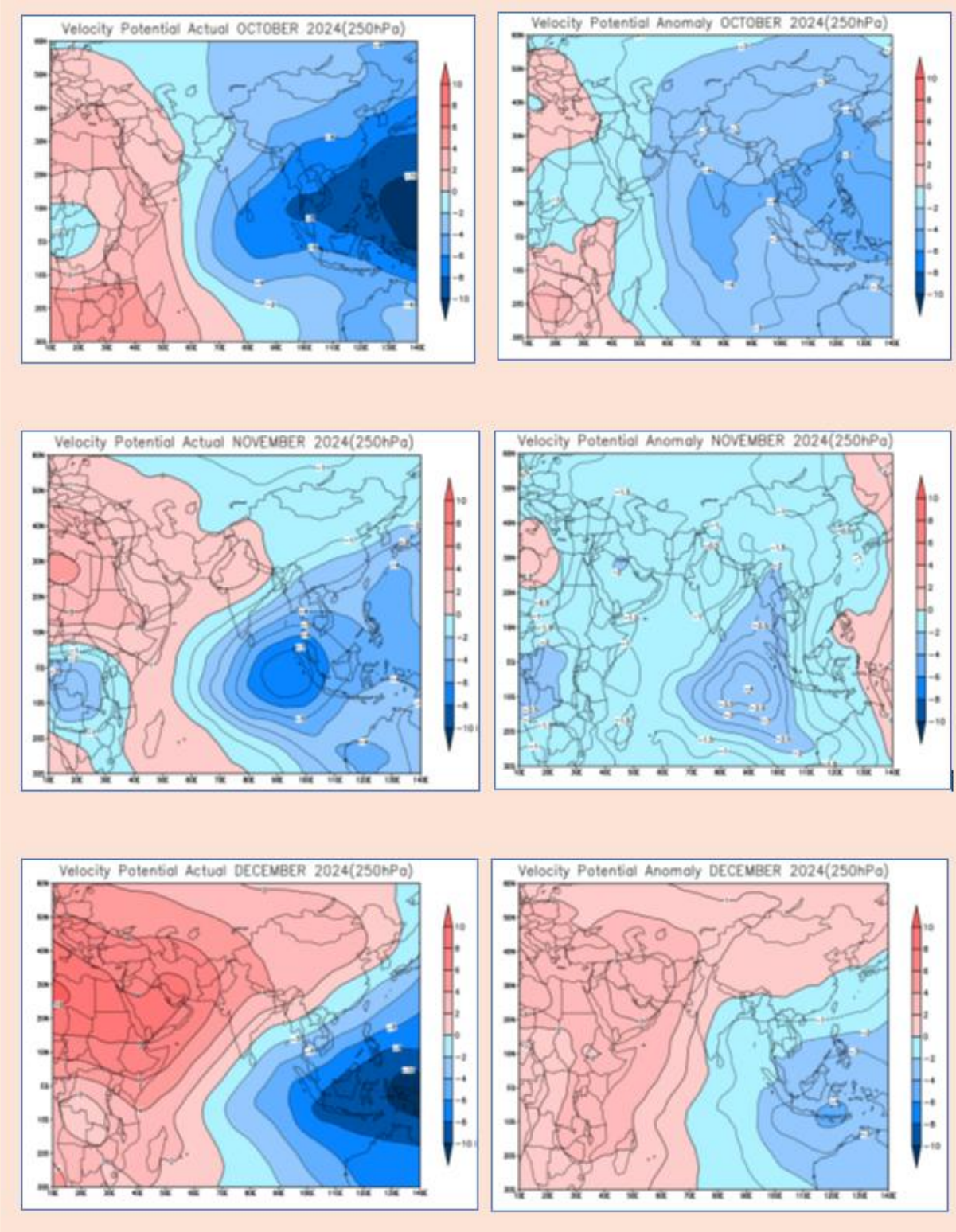


Fig.7b: 250 hPa velocity potential (x 10^6 m^2/s) over the Indian region during Oct, Nov & Dec 2024 (Source: Climate Diagnostic Bulletin of India, IMD Pune)

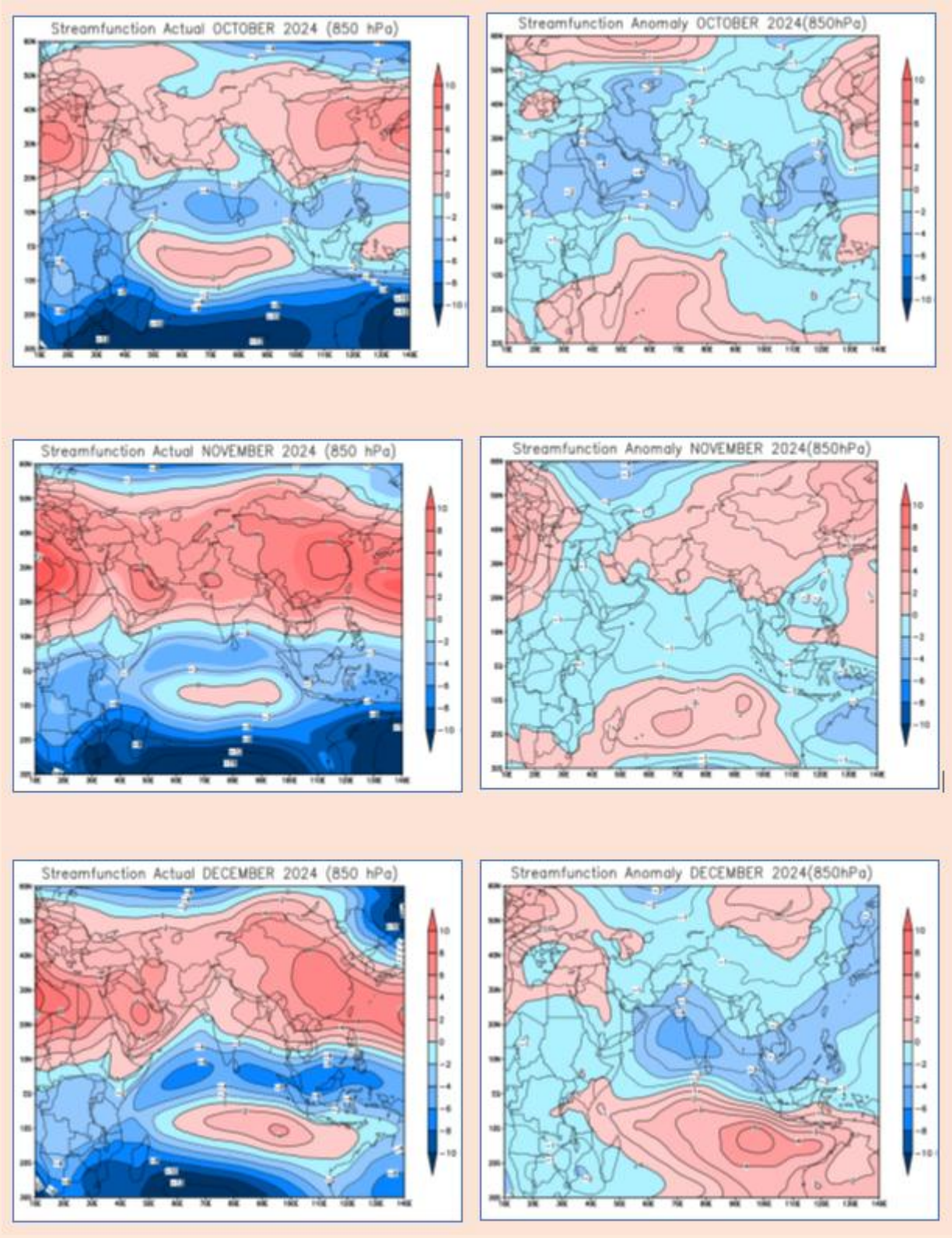


Fig.7c: 850 hPa stream function (x 10^6 m^2/s) over the Indian region during Oct, Nov & Dec 2024 (Source: Climate Diagnostic Bulletin of India, IMD Pune)

(b) Monthly OLR patterns: Monthly OLR anomalies over the Indian region are shown in Fig.7d.

In October 2024, negative OLR anomalies were observed over the southern peninsular region.

In November, positive OLR anomalies were observed over most parts of the NEM region excepting the coastal and adjoining areas of TN.

In December, negative OLR anomalies of about -10 W/m^2 to -30 W/m^2 were observed over most parts of the NEM region.

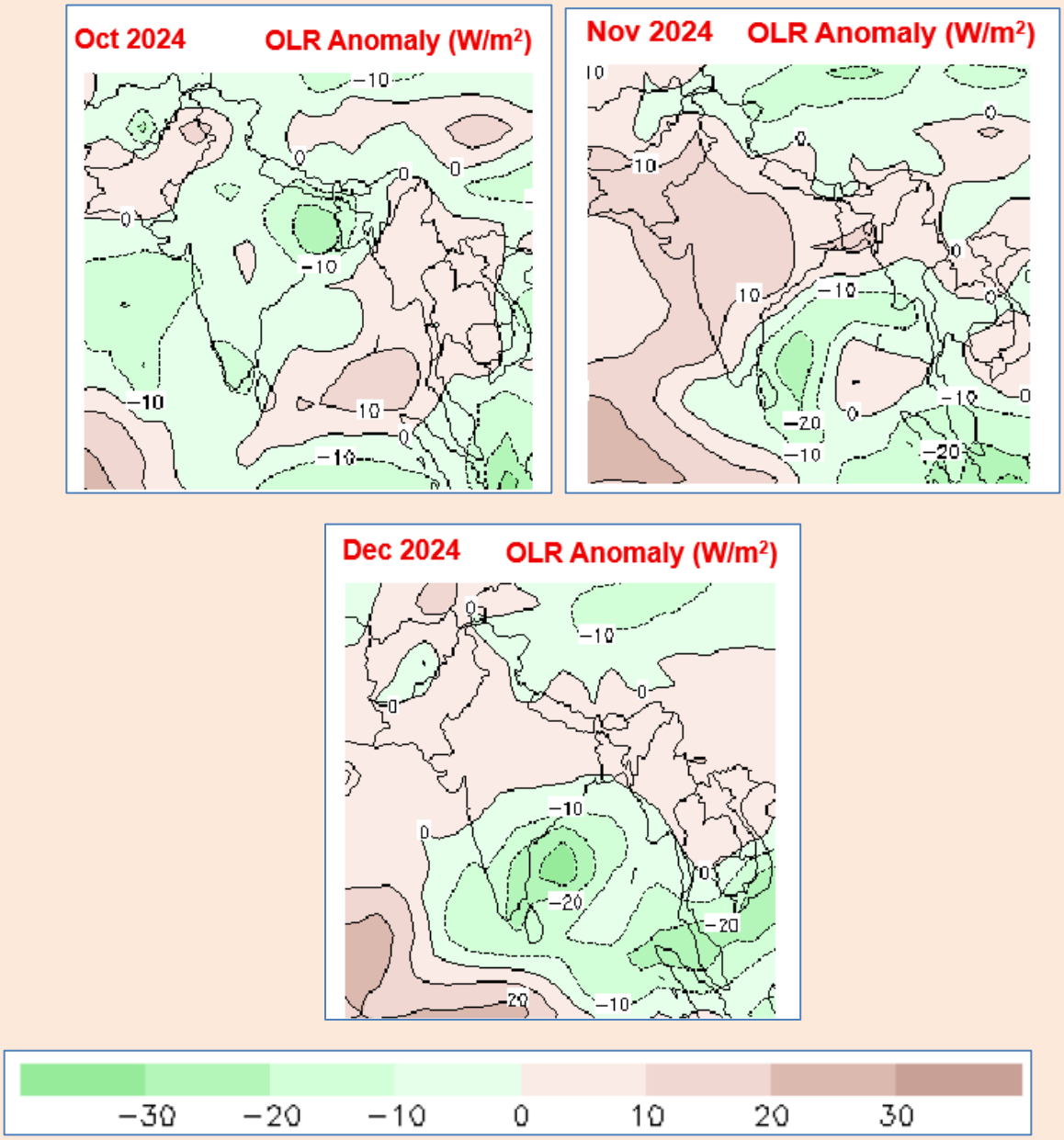


Fig.7d: OLR anomalies over the Indian region during Oct, Nov & Dec 2024 (Source: Climate Diagnostic Bulletin of India, IMD Pune)

c) ***Large scale features****:* Based on analysis and reports of various global climate monitoring centres, the large scale climate parameters during October-December 2024 were as follows:

(i) Neutral ENSO conditions prevailed over the equatorial Pacific region during the season.

(ii) Indian Ocean Dipole was negative during October & November but became neutral in December 2024..

(iii) MJO was insignificant during the first two weeks of October, in Phase-4 during the first half of the third week of October and then over the Pacific during the rest of the month. In November, it was in Phase 8 -1 during the first half of the month and in Phase 2-4 during the rest of the month. In December, it was in Phase-4 during the first five days and then over the Pacific during the rest of the month (Fig.7e (i)-(iii)).

Whereas ENSO was neither favourable nor unfavourable for good northeast monsoon, IOD was not favourable during the first two months and had no influence in the third month. MJO was generally unfavourable during the season excepting during the second half of November. However, all the five subdivisions received deficient rainfall only in November 2024.

Fig.7e(i): Sea surface temperature over the equatorial Pacific Ocean (Source: Bureau of Meteorology, Australia)

Fig.7e(ii): Indian Ocean Dipole mode index (Source: Bureau of Meteorology, Australia)

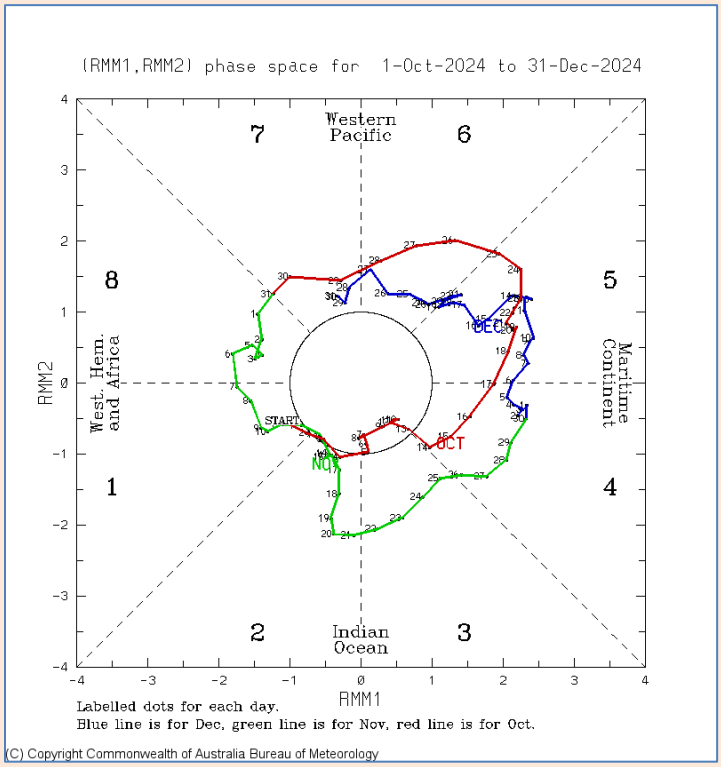


Fig.7e(iii): MJO during Oct-Dec 2024 (Source: Bureau of Meteorology, Australia)

8. Cessation of NEM rains over peninsular India

Subsequent to the Depression over the Bay of Bengal during 20th-21st December 2024 [Section 3a-(v)], NEM rainfall activity continued under the influence of upper air cyclonic circulations over the Southeast Arabian Sea / Equatorial Indian Ocean / South Bay of Bengal during the last week of December and during the second and third weeks of January 2025. ***Active / vigorous*** monsoon conditions prevailed over TN on 28th December 2024 & 19th & 20th Jan 2025; over North TN on 27th Dec 2024, over North Coastal TN on 30th Dec 2024 & over South TN on 31st Dec 2024 & 15th Jan 2025.

Heavy to very heavy rainfall with ***isolated extremely heavy*** rain occurred over Tirunelveli district on 20th Jan 2025. **Oothu, Nalumukku & Kakkachi** in the ghat areas of Tirunelveli district recorded ***extremely heavy*** rainfall of **23 cm, 22 cm & 21 cm** respectively on that day.

Isolated heavy to very heavy rainfall also occurred over *Tirunelveli district on 31st Dec 2024; 01st, 16th and 19th Jan 2025.*

Isolated heavy **rainfall** occurred over *Mayiladuthurai & Nagapattinam districts on 19th; over Ramanathapuram district on 20th; over Tirunelveli district on 11th, 15th and 17th and over Tiruvallur district on 19th Jan 2025.*

Subsequently, with the gradual reduction in rainfall activity, **the Northeast Monsoon rains ceased over Tamilnadu, Puducherry & Karaikal, Rayalaseema, Coastal Andhra Pradesh & Yanam, Kerala & Mahe and South Interior Karnataka from 27th Jan 2025.**

9. Summary

During the year 2024, the southwest monsoon withdrew from the Indian region on 15th October and the Northeast monsoon (NEM) of 2024 commenced simultaneously over the southeastern parts of peninsular India on **15th October 2024** against the normal date of 20th October.

Of the five meteorological sub divisions (Tamilnadu, Puducherry & Karaikal (TN), Coastal Andhra Pradesh & Yanam (CAP), Rayalaseema (RYS), Kerala & Mahe (KER) & South Interior Karnataka (SIK) benefitted by the Northeast Monsoon, three subdivisions (TN, RYS & SIK) received excess rainfall & the other two subdivisions (KER & CAP) received normal rainfall during the NEM season (October-December) 2024.

Active to *vigorous* monsoon conditions prevailed over TN on **20** days, over SIK on **16** days, over KER & RYS on **13** days each and over CAP on **9** days during the season. There were **61** days of *isolated heavy* rainfall activity with **27** days of *isolated very heavy* rain including **05** days of *isolated extremely heavy rainfall* activity over TN.

Two *Tropical Cyclones* ***–Severe Cyclonic Storm (SCS)*** **DANA** and ***Cyclonic Storm (CS)*** **FENGAL** over the Bay of Bengal (BOB) and **three** *Depressions* (***D***) (one over Arabian Sea & two over the BOB) affected the Indian seas during the season. The ***SCS*** **DANA** during 22nd-26th Oct 2024 tracked northwestwards and crossed Odisha coast. The ***CS*** **FENGAL** during 25th Nov – 01st Dec 2024 crossed North Tamilnadu – Puducherry coast close to Puducherry around the mid-night of 30th November 2024 and caused torrential rains and extensive damages over North Tamilnadu & Puducherry during 30th November – 02nd December Dec 2024. One ***Depression*** over BOB during 15th-16th October was associated with the commencement of the NEM rains. The other 2-***D***s, 1-over AS (13th-15th Oct) & the other over BOB (20th-21st Dec) did not contribute significantly towards NEM rainfall.

However, a ***Low Pressure area*** (***LOPAR***) over BOB during 11th-12th November, a ***Well Marked Low Pressure Area (WML)*** over BOB during 07th-14th Dec along with frequent upper air cyclonic circulations / troughs in easterlies during the season contributed significantly towards the rainfall of NEM 2024.

Further, the season extended into January of 2025. There was *isolated* ***heavy*** rainfall activity on 7 days including three days of *isolated* ***very heavy*** rain and one day of *isolated* ***extremely heavy*** rain (on 20th Jan 2025).

Thereafter, with the gradual decrease in rainfall activity, the cessation of NEM **2024** rainfall over the southern peninsular India was declared on **27th January 2025**.

Acknowledgements

This report is a compilation of real-time observational data and analytical products generated by various IMD offices including IMD New Delhi, Pune, Thiruvananthapuram, Hyderabad, Bangalore & Amaravati as well as raingauge networks of state government departments. Contribution from all officials involved in generation of data and analytical products used for preparation of this report is duly acknowledged. Use of US-NCEP reanalysis data, analytical product of Bureau of Meteorology, Australia and local media reports are also duly acknowledged.

APPENDIX-(i): Terminologies for Spatial rainfall distribution

WS - Widespread (Most places): 75 % or more number of stations of a region (sub-division) reporting at least 2.5 mm rainfall.

FWS- Fairly widespread (Many places): 51% to 74 % number of stations of a region (sub-division) reporting at least 2.5 mm rainfall.

SCT- Scattered (at a few places): 26 % to 50% number of stations of a region (sub-division) reporting at least 2.5 mm rainfall.

ISOL- Isolated (At isolated places): 25% or less number of stations of a region (sub-division) reporting at least 2.5 mm rainfall.

DRY: No station of a region reported rainfall

APPENDIX-(ii): Terminologies for description of intensity of rainfall

S No.	Terminology	Rainfall range In mm	Rainfall range In cm	Percentile
1	Very light rainfall	Trace -2.4		
2	Light rainfall	2.5-15.5	Upto 1	Upto 65
3	Moderate rainfall	15.6-64.4	02-06	65-95
4	Heavy Rainfall	64.5- 115.5	07-11	95-99
5	Very Heavy Rainfall	115.6-204.4	12-20	99.0-99.9
6	Extremely heavy rainfall	Greater or equal to 204.5 mm	21 cm or more	>99.9
7	Exceptionally Heavy Rainfall	When the amount is a value near about the highest recorded rainfall at or near the station for the month or season. However, this term will be used only when the actual rainfall amount exceeds 12 cm.		

APPENDIX-(iii): Description of NEM rainfall activity

Active: Fairly widespread to widespread sub-divisional rainfall with rainfall more than 1½ to 4 times the normal with at least two stations reporting more than or equal to 3 cm in coastal Tamil Nadu, south coastal Andhra Pradesh and 2 cm elsewhere in the NEM region.

Vigorous: Fairly widespread to widespread sub-divisional rainfall with rainfall more than 4 times the normal with at least two stations reporting more than or equal to 5 cm in coastal Tamil Nadu, south coastal Andhra Pradesh and 3 cm elsewhere in the NEM region.