

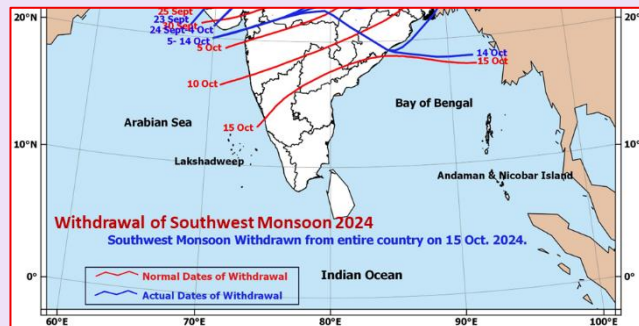
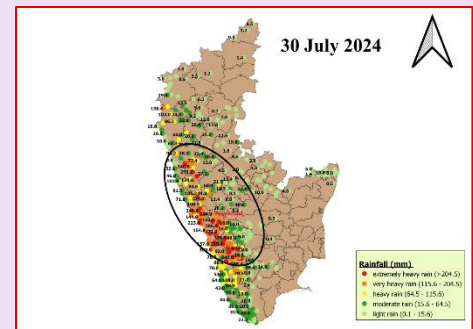
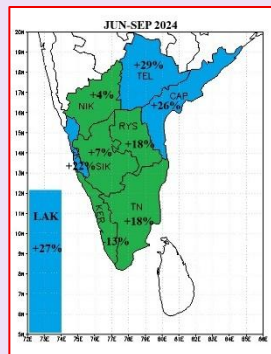
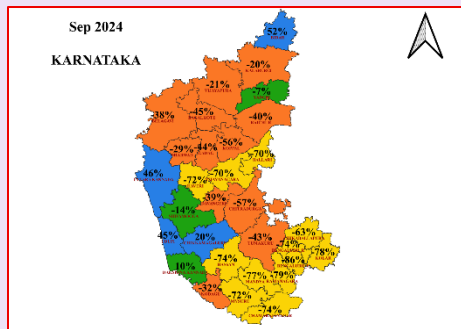
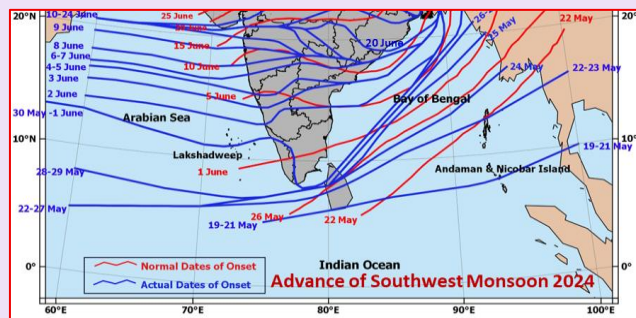


Government of India
Earth System Science Organisation
Ministry of Earth Sciences
India Meteorological Department



IMD Chennai Scientific Report No. IMDC-SR/17

SOUTHERN PENINSULAR INDIA:
SOUTHWEST MONSOON, 2024–REPORT



Regional Meteorological Centre, Chennai
November 2025

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Executive Summary

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HIGHLIGHTS

- ✓ During 2024, southwest monsoon (SWM) advanced over parts of Maldives, Comorin area, south Bay of Bengal, Nicobar islands and South Andaman Sea on 19th May. It set in over Kerala on 30th May, 2 days earlier than the normal date of 1st June and covered the entire southern peninsular (SP) India (comprising of the five states of Andhra Pradesh, Telangana, Karnataka, Kerala and Tamil Nadu and two union territories of Puducherry and Lakshadweep) by 20th June, the normal date being during 11th-15th June. It covered the entire country by 02nd July, six days ahead of its normal date of 08th July.
- ✓ All India southwest monsoon (SWM) seasonal rainfall during Jun-Sep, 2024 was *above normal*. It was 108% (93 cm) of its Long Period Average (LPA) of 87.0 cm. South Peninsular region recorded 114% (81 cm) of its LPA of 72 cm.
- ✓ Seasonal rainfall over the nine meteorological subdivisions covering the five states and two union territories in the SP region was *excess* in 4 sub divisions [Telangana (TEL) Coastal Andhra Pradesh (CAP), Coastal Karnataka (CK) & Lakshadweep (LAK)] and *normal* in the other five subdivisions [Rayalaseema (RYS), Tamilnadu (TN), Kerala (KER), North Interior Karnataka (NIK), & South Interior Karnataka (SIK)]. The seasonal rainfall figures over the nine subdivisions CAP, RYS, TEL, TN, CK, NIK, SIK, KER, LAK) were +26%, +18%, +29%, +18%, +22%, +04%, +07%, -13%, and +27% respectively.
- ✓ During the season, *fairly widespread* to *widespread* rainfall occurred over CK on about 87% of the days, over KER & LAK on 83% & 70% of the days respectively and over TEL, CAP, SIK & NIK, on about 30-50% of the days. *Active* to *Vigorous* monsoon conditions prevailed over CK on 35 days followed by TEL: 34 days & NIK: 30 days.
- ✓ There were *isolated heavy* rainfall activities on 74 days over TN, 60-70 days over SIK, CK & TEL, 40-60 days over KER, CAP & NIK, 27 days over RYS & 4 days over LAK area during the season. The highest 24-hr rainfall recorded during the season in the SP region was over Malyal (Mahabubabad district, Telangana): 40 cm (396 mm) on 01st September.
- ✓ An *extreme* rainfall event over North Kerala, SIK & adjoining western ghat areas of North TN during the 24-hr ending 0830 IST of 30th July triggered devastating landslides over Wayanad district in Kerala on 30th July 2024.
- ✓ The withdrawal of SWM 2024 from the SP region and hence from the entire region took place on 15th October 2024.

1. Onset and Advance

During the year 2024, the Bay of Bengal (BOB) branch of southwest monsoon (SWM) current advanced into some parts of Maldives & Comorin area, some parts of South Bay of Bengal, Nicobar Islands and South Andaman Sea on 19th May with the characteristic strengthening and deepening of cross equatorial flow and enhanced cloudiness and rainfall over the south BOB, Nicobar islands South Andaman Sea three days ahead of the normal date of 22nd May. It further advanced into some more parts of South Arabian sea, Maldives area, Comorin area on 22nd May.

Further, under the influence of an upper air cyclonic circulation that developed in lower tropospheric levels over the southwest Bay of Bengal on 21st, a **Low Pressure Area** formed over the Southwest & the adjoining Westcentral BOB on 22nd May which concentrated into a **Depression** over the central BOB on 24th early morning. Moving nearly northwards, it intensified into a **Deep Depression** (DD) on 25th morning and further into a **Cyclonic Storm** (CS) “**REMAL**” {pronounced as RE-MAL} over the North and adjoining Eastcentral BOB on 25th evening. Continuing to move further northwards, it intensified further into a **Severe Cyclonic Storm** (SCS) over the North BOB on 26th early morning and **crossed Bangladesh and adjoining West Bengal coasts** between Sagar Islands and Khepupara close to southwest of Mongla near latitude 21.7°N and longitude 89.2°E **between 2230 hrs IST of 26th and 0030 hrs IST of 27th May 2024** as an SCS with wind speed of 110 to 120 kmph gusting to 135 kmph. The track of the system is presented in Fig.1a.

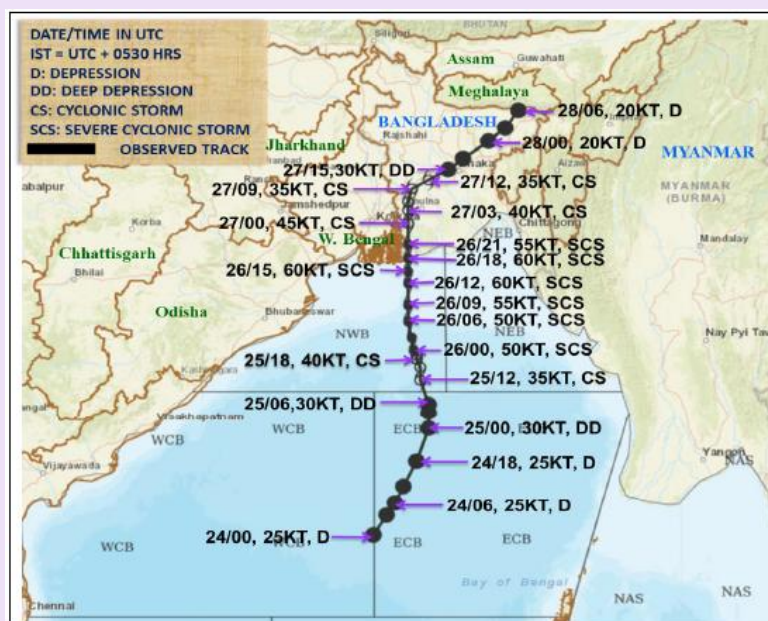


Fig.1a: Observed track of Severe Cyclonic Storm REMAL during 24th-28th May 2024

Formation and movement of the SCS REMAL advanced the monsoon over some more parts of South Bay of Bengal, Andaman & Nicobar Islands and Andaman Sea on 22nd May; some more parts of Southwest Bay of Bengal, remaining parts of Southeast Bay of Bengal, some more parts of central Bay of Bengal and some parts of Northeast Bay of Bengal on 25th; some more parts of Southwest, Central and Northeast Bay of Bengal and some more parts of south Arabian sea and Maldives area on 26th; some more parts of South Arabian sea and Maldives area on 28th; **The monsoon set in over Kerala & Mahe and advanced into some parts of Lakshadweep area and Tamilnadu on 30th May**, two days ahead of the normal date of onset over Kerala on 01st June.

It covered the entire southern peninsular India (SP) comprising of five states (Andhra Pradesh, Telangana, Kerala, Karnataka and Tamil Nadu) and two union territories (Puducherry and Lakshadweep) - divided into nine meteorological subdivisions of Coastal Andhra Pradesh and Yanam (CAP), Telangana (TEL), Rayalaseema (RYS), Tamilnadu, Puducherry and Karaikal (TN), Coastal Karnataka (CK), North Interior Karnataka (NIK), South Interior Karnataka (SIK), Kerala and Mahe (KER) and Lakshadweep (LAK) - by 20th June, delayed by about 5-10 days (normal: 11th-15th June).

The northern limit of monsoon (NLM) passed over Amini (LAK), Kannur (KER), Coimbatore & Kanyakumari (both TN) on 30th May. It advanced into remaining parts of south Arabian sea, some parts of central Arabian sea, remaining parts of Lakshadweep area, Kerala, Tamilnadu, some parts of Karnataka, Rayalaseema and Andhra Pradesh (CAP & RYS), remaining parts of southwest Bay of Bengal on 02nd; some more parts of central Arabian sea, some more parts of Karnataka, Rayalaseema, Coastal Andhra Pradesh, some parts of Telangana and some more parts of Westcentral and Northwest Bay of Bengal on 03rd; some more parts of Karnataka & Telangana and remaining parts of Rayalaseema on 4th; most parts of Karnataka, some more parts of Telangana and Coastal Andhra Pradesh on 06th & 08th; some more parts of Telangana on 11th; remaining parts of Telangana on 12th; and remaining parts of CAP on 20th June and hence, covered the entire SP region by 20th June. It also gradually covered the entire BOB by 26th June. The advance of the monsoon over the SP region, as depicted by the northern limit of the monsoon (NLM) is presented in Fig.1b.

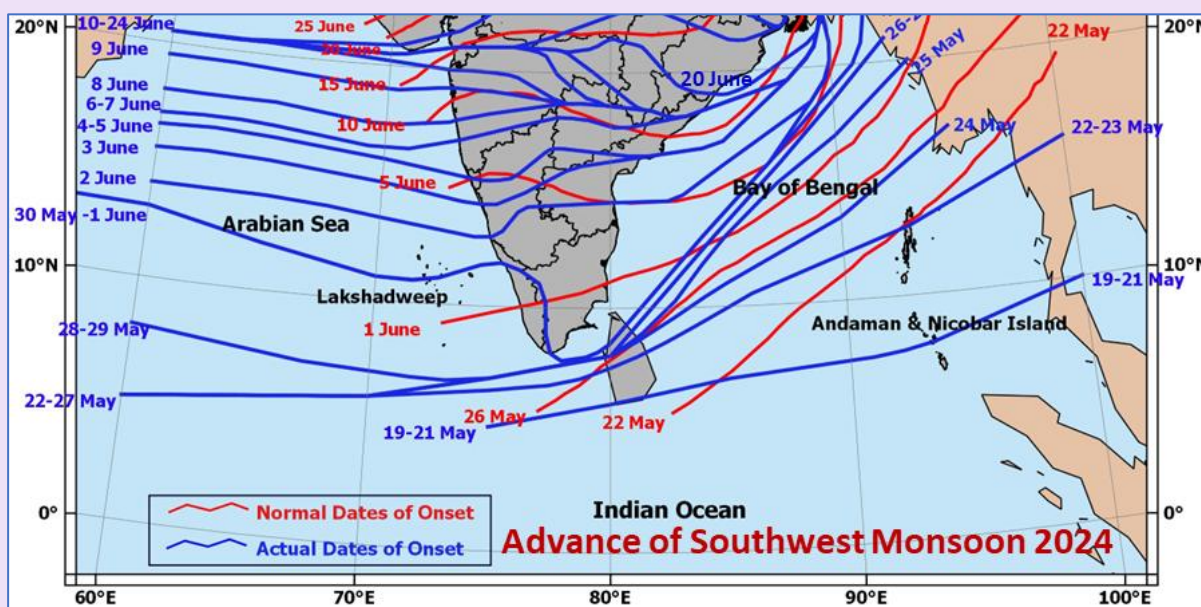


Fig.1b: Advance of southwest monsoon 2024 over southern peninsular India depicted by lines of northern limit of monsoon on various dates

The onset of monsoon over Kerala on 30th May was associated with an east-west shear zone that ran roughly along Lat. 8°N over the extreme south peninsular India in the mid / lower-mid tropospheric levels during 29th -31st May and a cyclonic circulation over Southeast Arabian Sea off south Kerala coast in the mid tropospheric levels during 30th & 31st May 2024 (Fig.1c(i)).

Further advance of the monsoon over the SP region took place under the influence of upper air cyclonic circulations over the Southeast Arabian sea or SP region / east-west trough / east-west shear zone over the SP region / off shore trough at mean sea level off Kerala -Karnataka coasts. Two upper air cyclonic circulation on 05th June – one over Rayalaseema and neighbourhood in the lower tropospheric levels and another over CK and neighbourhood in the mid tropospheric levels, east-west shear zone that ran roughly along 16°N in the mid tropospheric levels on 06th and an east-west trough that ran from Telangana to central parts of Bay of Bengal across Coastal Andhra Pradesh in the lower-mid tropospheric levels on 13th are presented in Fig.1c(ii)-(iii).

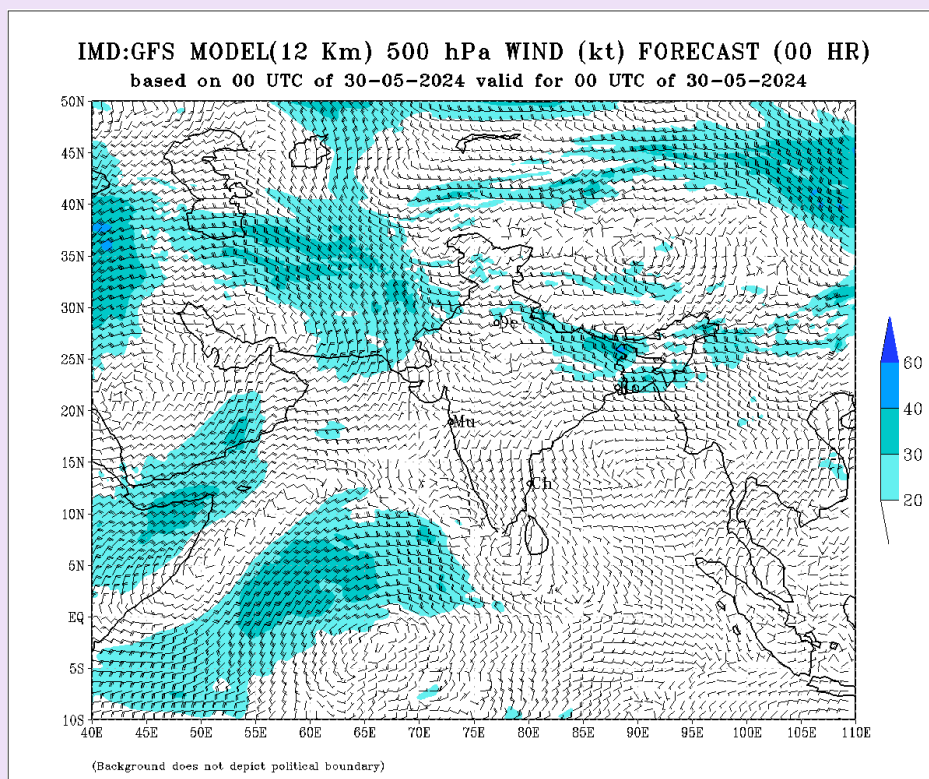
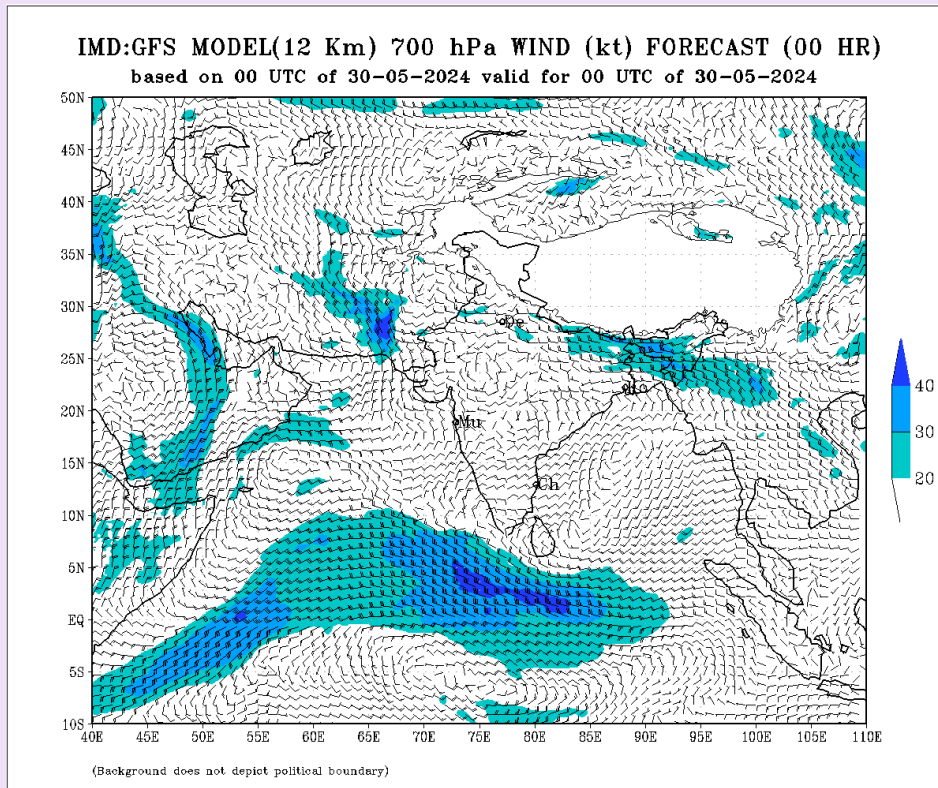


Fig.1c: (i) IMD-GFS, 700 hPa & 500 hPa analysis as on 30.05.2024 / 0530 IST

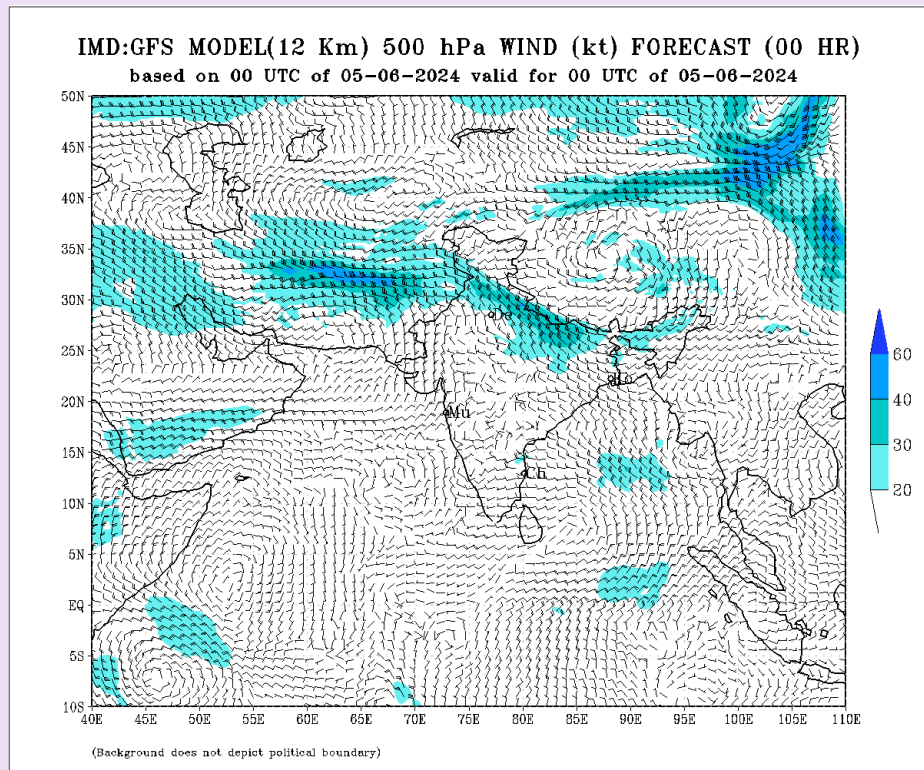
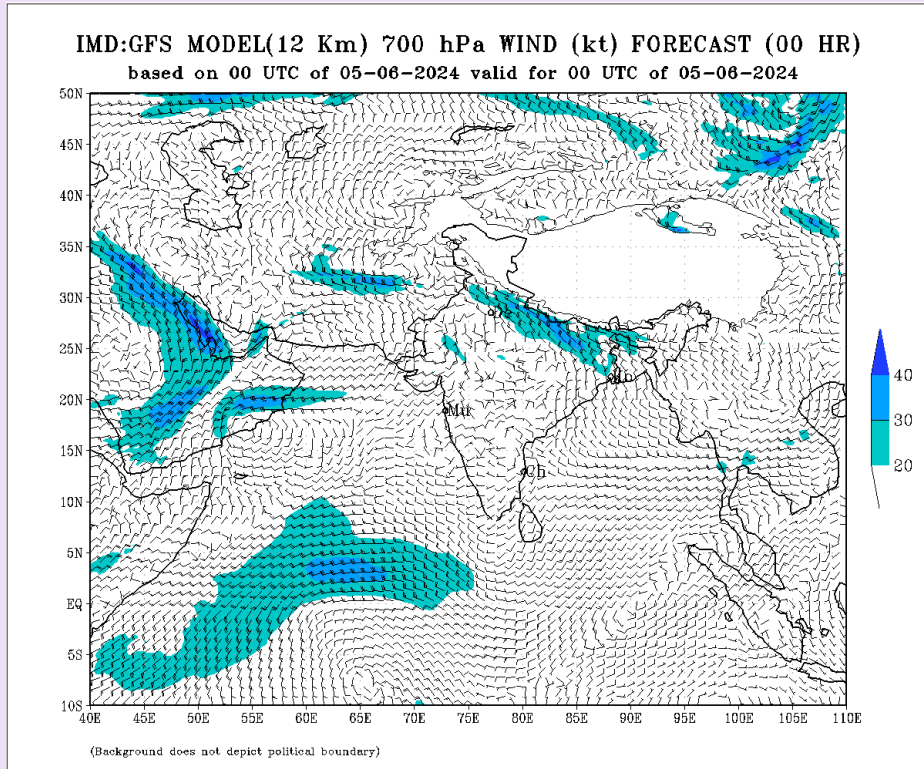


Fig.1c: (ii) IMD-GFS, 700 hPa & 500 hPa analysis as on 05.06.2024 / 0530 IST

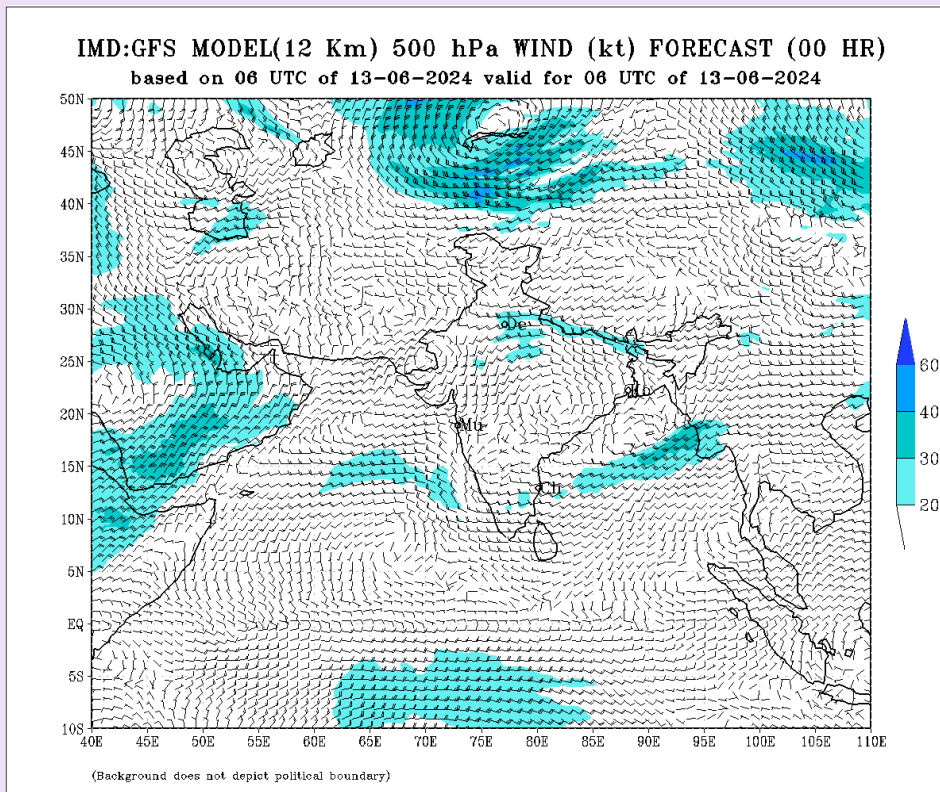
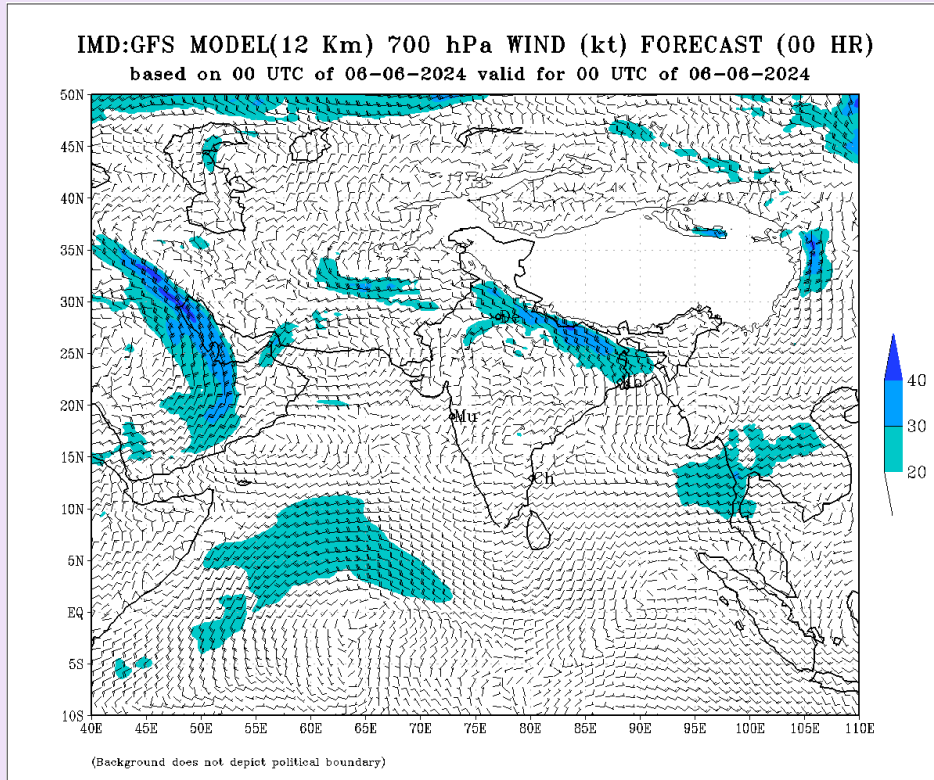


Fig.1c: (iii) IMD-GFS, 700 hPa analysis as on 06/ 0530 IST & 500 hPa analysis as on 13/ 0530 IST of Jun 2024

Fairly widespread to widespread rainfall occurred on *most* days over KER during 30th May – 20th June, over CK during 04th-20th June, over SIK & NIK on *most* days during 07th-14th June; and *scattered to widespread* rainfall occurred over LAK during 30th May – 20th June; over RYS during 02nd-14th June; over TN during 02nd-09th June; *scattered to fairly widespread* rainfall occurred over TEL during 11th-24th June & over CAP during 15th-24th June 2024. On 07th June, excepting CAP, all the other subdivisions in the SP region received *fairly widespread-widespread* rainfall.

Active to vigorous monsoon conditions prevailed over RYS on 06th, 07th, 08th, 12th, 13th, 18th & 19th June; over NIK on 07th, 08th, 09th, 10th, 12th, 13th & 14th; over SIK on 03rd, 07th, 08th & 09th; & over TN on 03rd, 06th, 07th & 08th June; and *Active* monsoon conditions prevailed over CK on 04th, 08th, 09th & 10th; over KER on 09th; and over CAP & TEL on 22nd & 23rd June 2024.

During the period 30th May – 24th June, there were *isolated heavy* rainfall events on 16 days over KER & TN, 15 days over TEL, 11 days over NIK, 10 days over CAP, 09 days over CK & SIK, 07 days over RYS & 02 days over LAK. *Isolated heavy to very heavy* rain with *extremely heavy* rain at *one or two* places occurred over KER on 01st Jun & over CK on 08th Jun. *Isolated heavy to very heavy* rain occurred over KER & TN on five days each (KER: 30th & 31st May, 02nd, 03rd & 07th Jun; TN: 05th, 08th, 18th, 19th & 20th Jun); over TEL on three days (05th, 23rd & 24th Jun); and over CK on two days (09th & 10th Jun) and over RYS, SIK & LAK on one day each - 03rd, 10th & 22nd June respectively. Also, *isolated heavy* rain occurred over TEL on 12 days, over NIK & TN on 11 days; over KER & CAP on 10 days; over SIK on 8 days; and over CK & RYS on 6 days each during the same period.

Extremely heavy rainfall was recorded at Udumbannoor AWS (23 cm) in Idukki district, KER on 01st Jun; and at Manki (23 cm) and Karwar observatory (22 cm), both in Uttara Kannada district of CK on 08th Jun.

The gradual progression of cloudiness associated with the onset and advance of the monsoon over the SP region during 30th May – 20th June 2024 is depicted by the satellite imageries at various instances during this period as presented in Fig.1d.

GPM-gauge merged rainfall as on 0830 IST of 29th & 30th May, 02nd, 06th, 07th, 13th, 19th & 20th June over the various sub divisions of the SP region and gauge observed 24-hr accumulated

rainfall (as on 0830 IST) over KER on 01st & 02nd, KER, KAR & TN on 07th & 08th, Andhra Pradesh (CAP & RYS) on 18th & TEL on 23rd June 2024 are presented in Fig.1e & Fig.1f respectively.

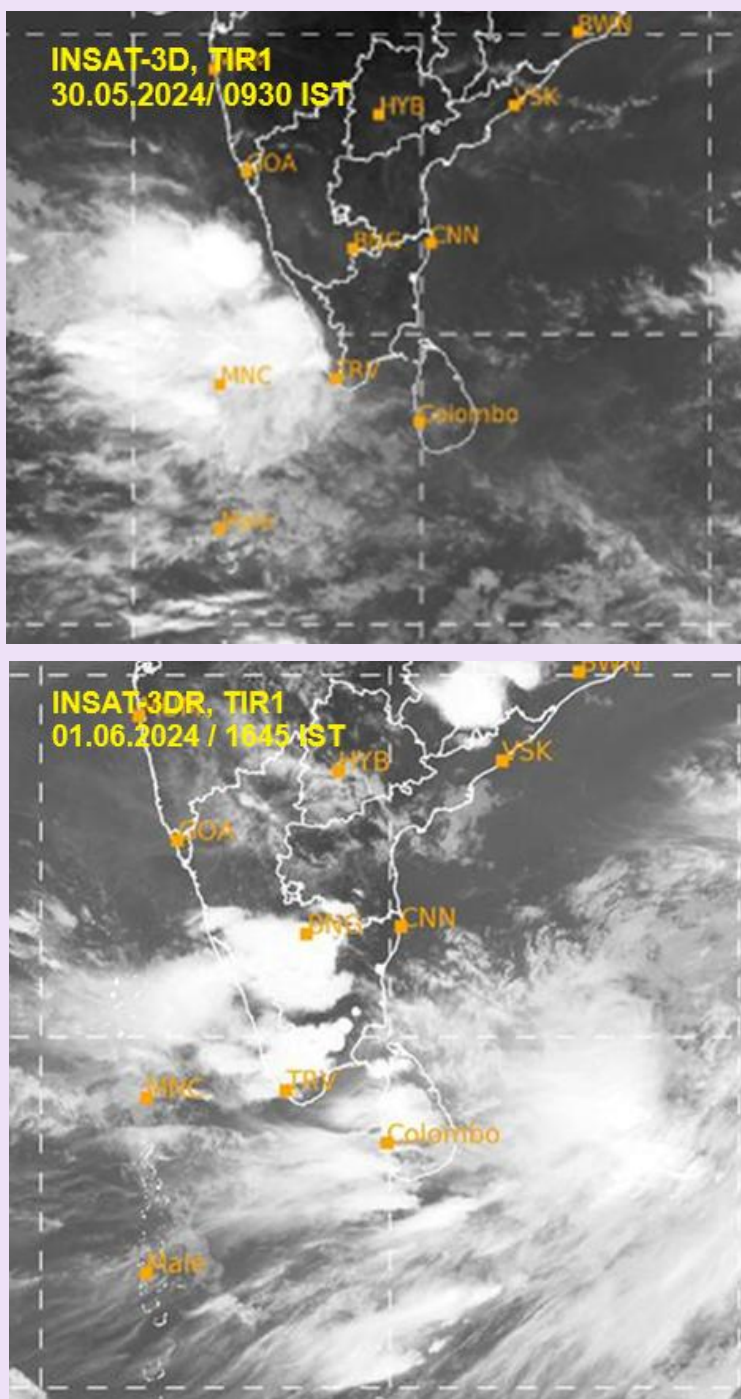


Fig.1d: INSAT-3D/ 3DR, infra-red imageries as on 30/0930 IST of May 2024, 01/1645 IST, 08/1145 IST, 10/2015 IST, 18/1915 IST & 19/0615 IST of Jun 2024

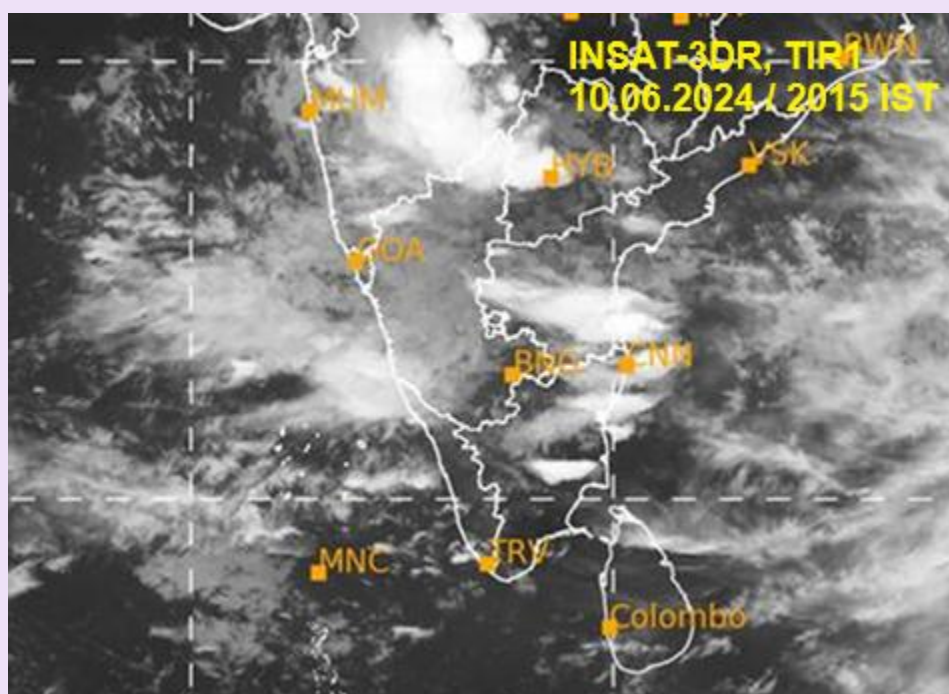
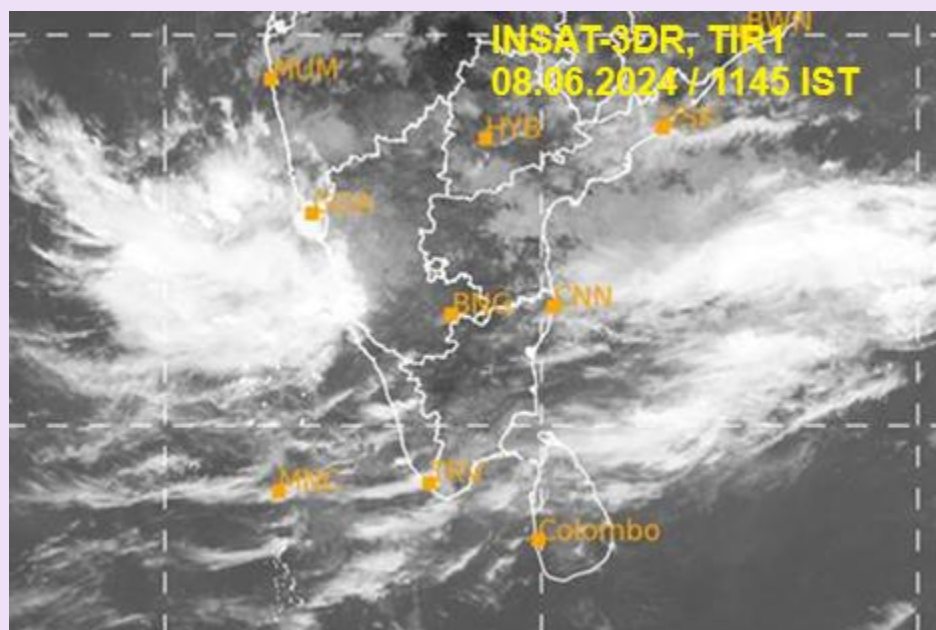


Fig.1d: contd.

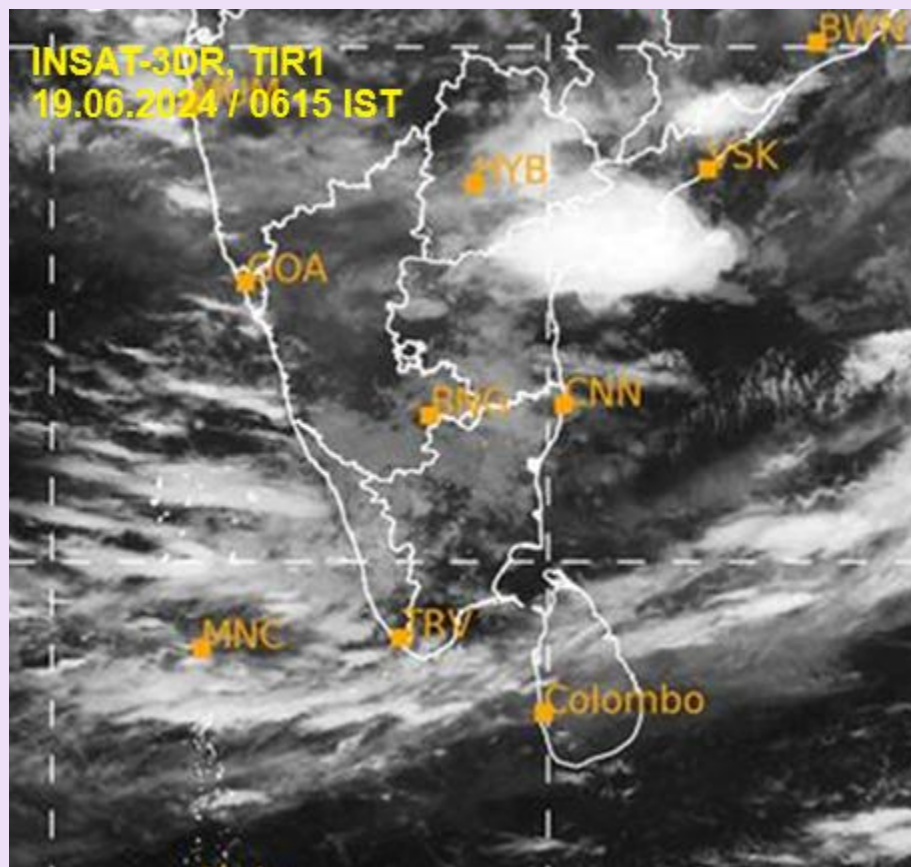
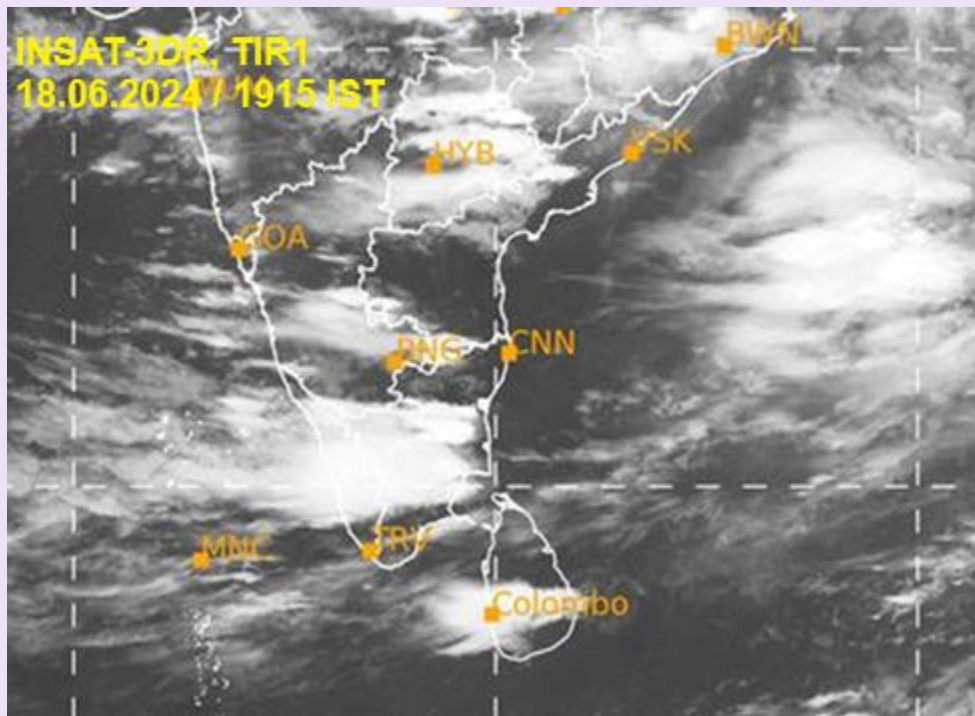


Fig.1d: contd.

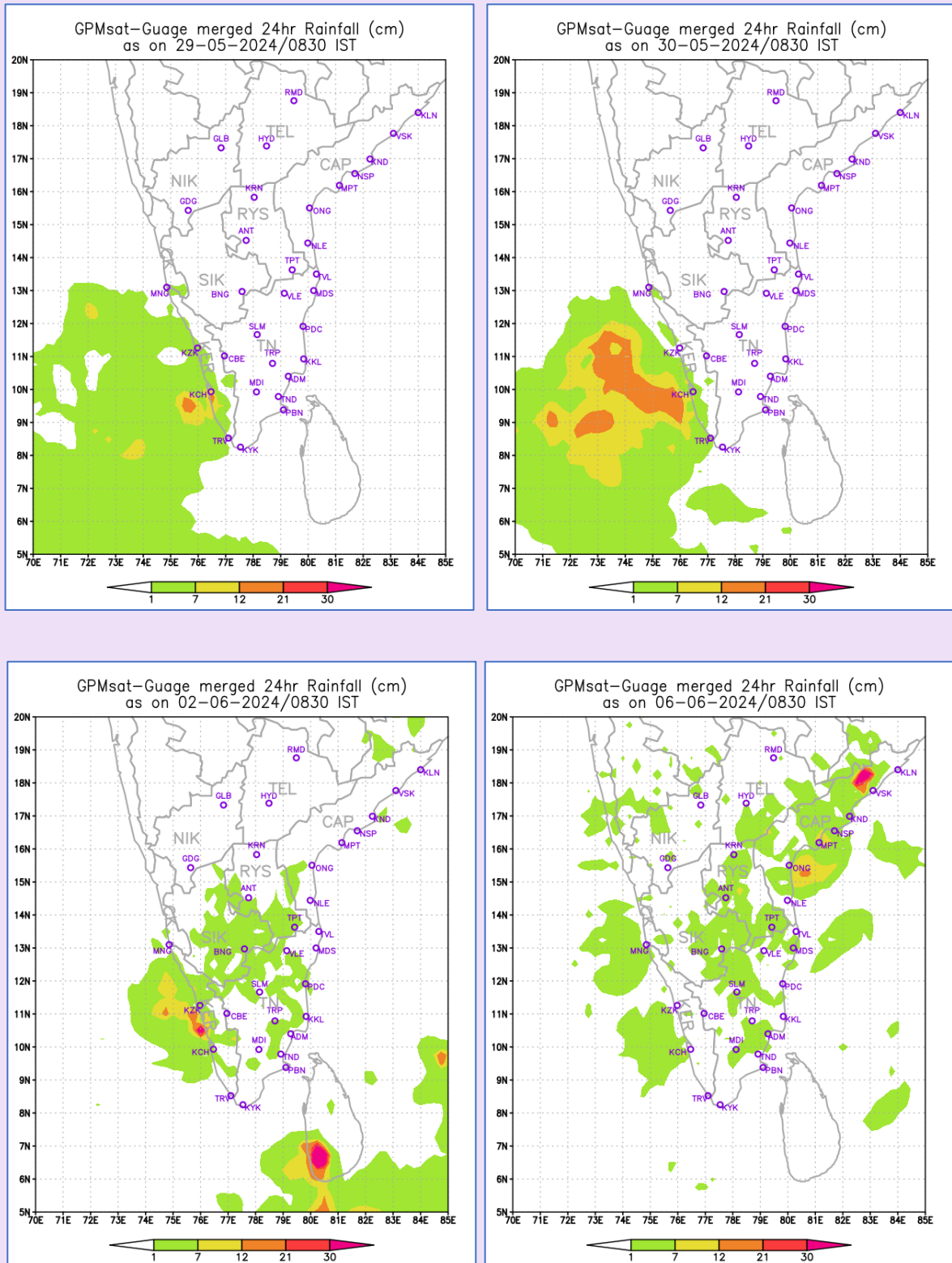


Fig.1e: GPM Sat – Gauge merged rainfall in cm as on 24-hr ending 0830 IST of 29th & 30thMay, 02nd, 06th, 07th, 13th, 19th & 20th June 2024

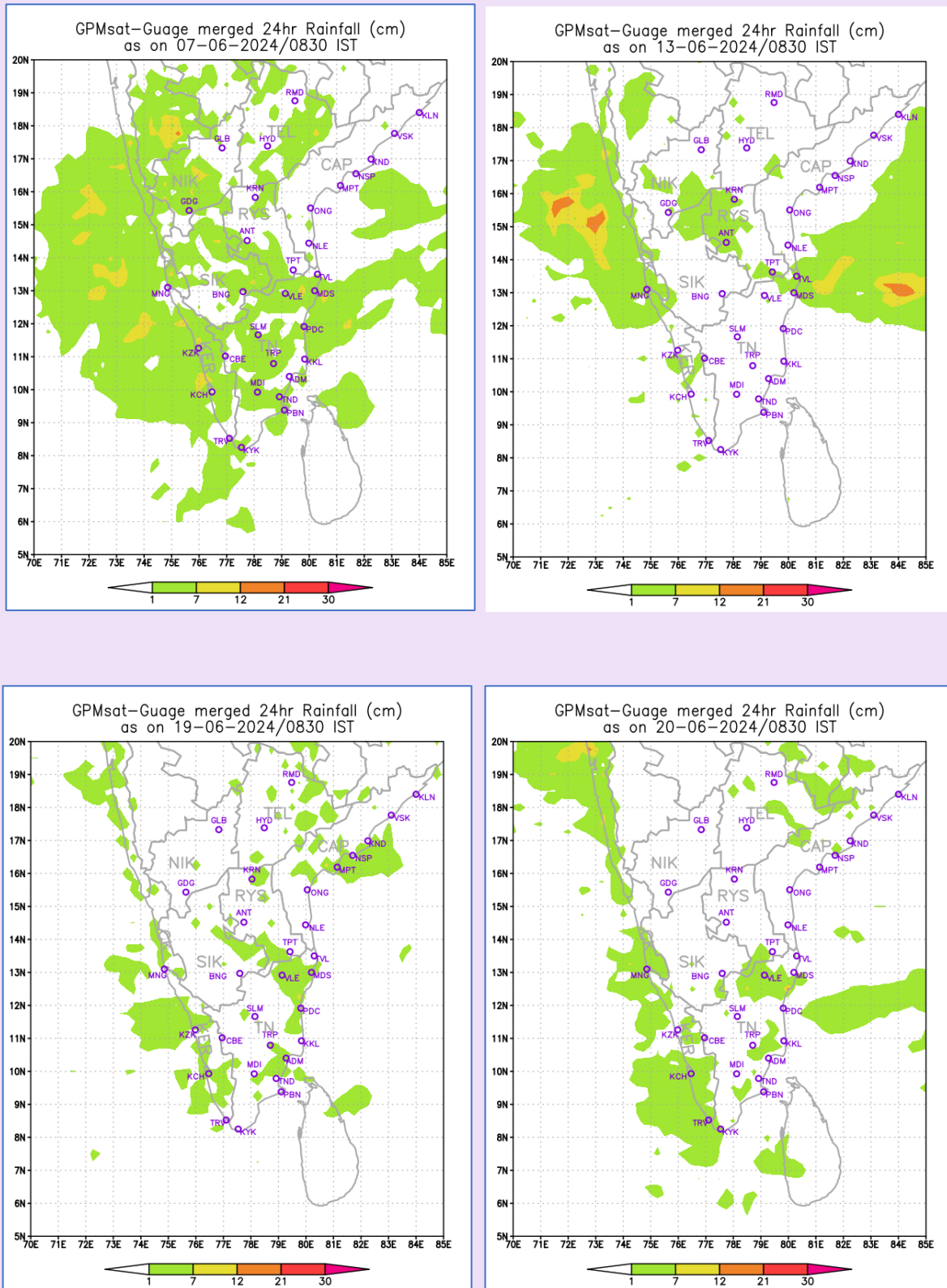


Fig.1e: contd.

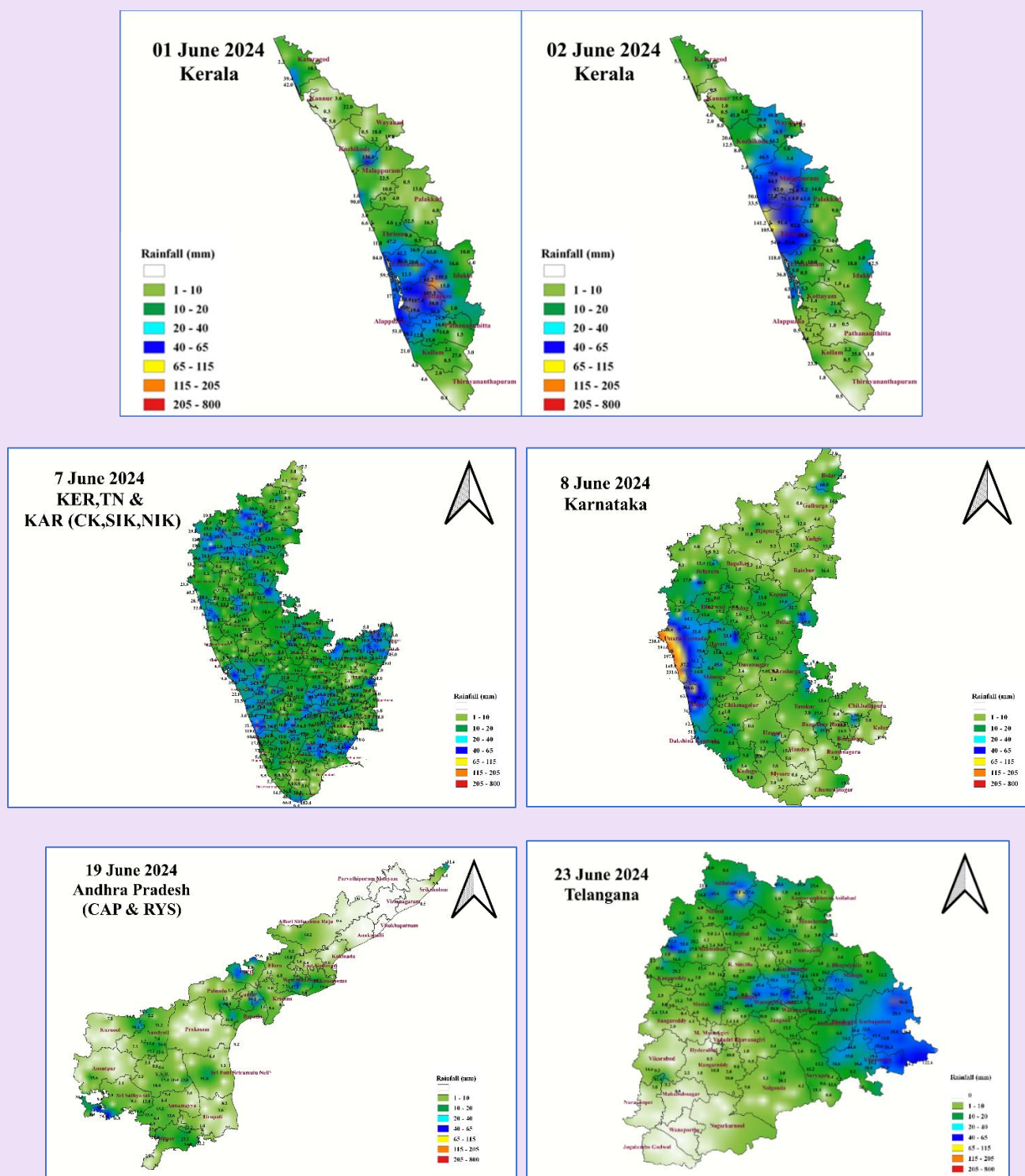


Fig.1f: 24-hr accumulated rainfall (as on 0830 IST) over KER on 01st & 02nd, KER, KAR & TN on 07th, KAR on 08th, Andhra Pradesh (CAP & RYS) on 19th & TEL on 23rd June 2024

2. Chief synoptic features & associated weather

2.1 Significant weather due to major Low Pressure Systems

During June-September 2024, nine major synoptic systems over the Indian region influenced the rainfall activity over the SP region as discussed below.

(i) A **Low Pressure Area (LOPAR)** over Northwest Bay of Bengal and adjoining Odisha coast with the associated cyclonic circulation extending up to mid tropospheric levels tilting southwards with height with an east-west shear zone running roughly along 20° N between 3.1 & 5.8 km above mean sea level tilting southwards during **28th-29th June** caused *fairly widespread-widespread* rainfall over CAP & TEL on most days during 27th June to 01st July with *active* monsoon conditions on four days (27th, 28th & 30th June & 01st July) over both the subdivisions. *Isolated heavy to very heavy* rainfall occurred over TEL on 27th (highest rainfall reported at Chandurthi (Rajanna Sircilla district): **15 cm**) and *isolated heavy* rain occurred over TEL on 28th & 30th and over CAP on 27th, 28th & 30th June 2024.

Mean sea level isobaric analysis as on 28th/0830 IST indicating the LOPAR over the Northwest Bay of Bengal and Upper air streamline analysis as on 28th/ 0530 IST indicating the associated upper air cyclonic circulation are presented in Fig.2(i)a. Satellite imagery depicting the cloudiness as on 29th/1415 IST is shown in Fig.2(i)b and maps of past 24-hr accumulated rainfall over CAP & TEL as on 0830 IST of 27th & 30th June 2024 are furnished in Fig.2(i)c.

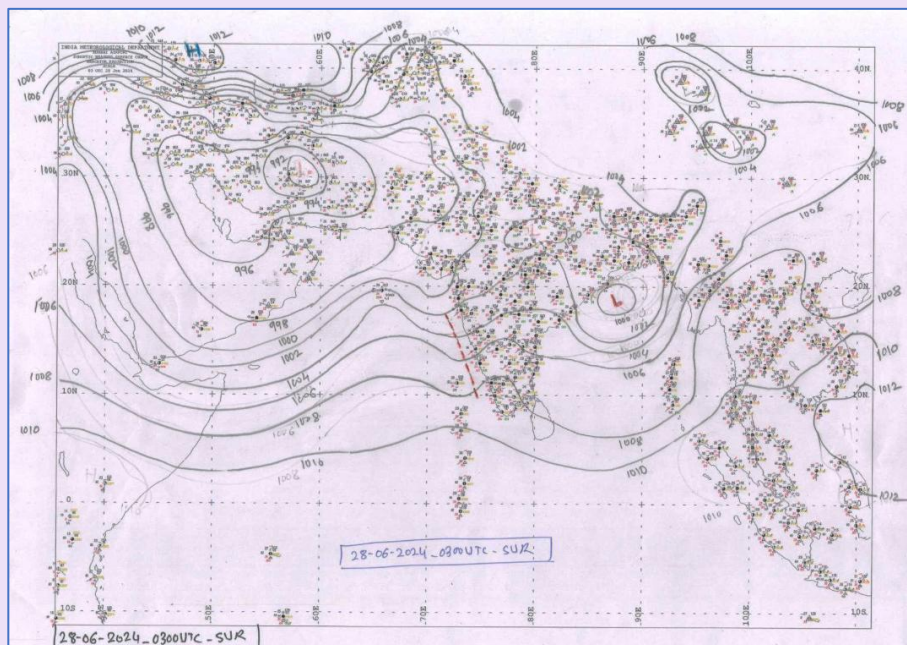


Fig.2(i)a: Mean sea level isobaric analysis as on 28th/0830 IST and Upper air streamline analysis as on 28th/ 0530 IST of June 2024

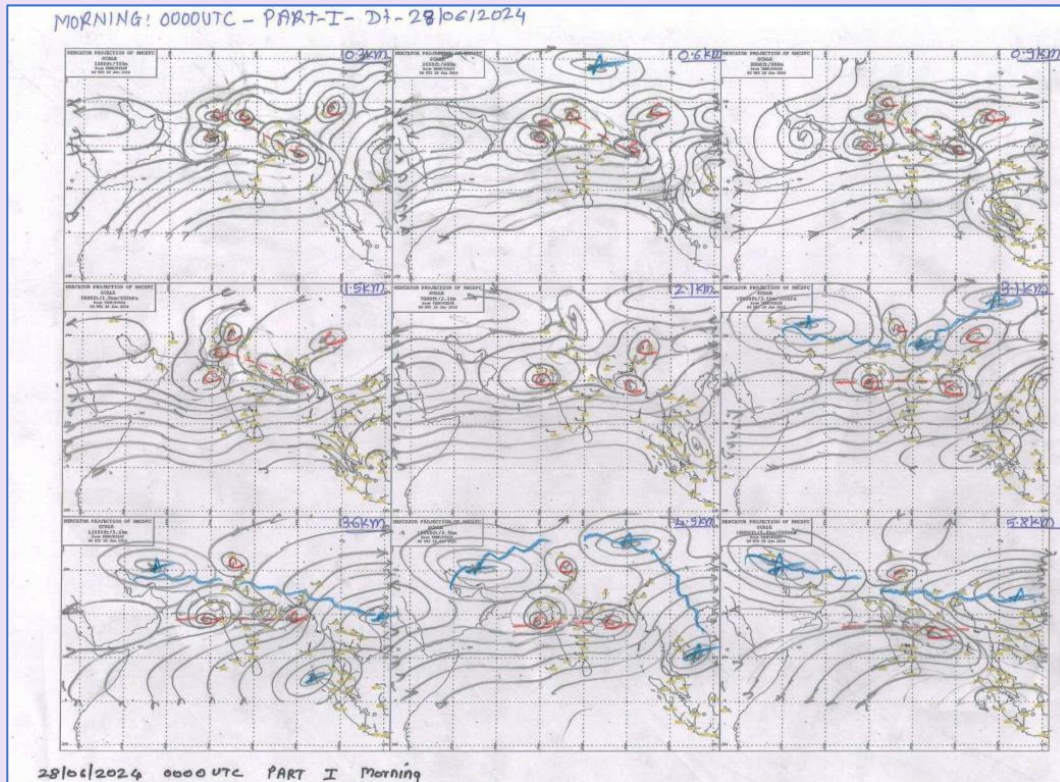


Fig.2(i)a: contd.

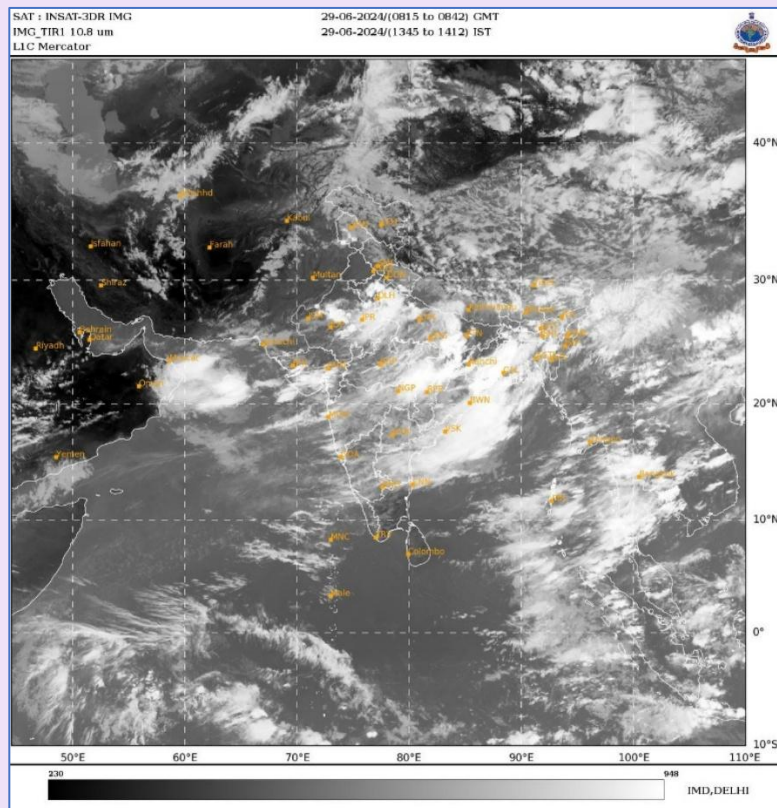


Fig.2(i)b: INSAT-3DR, TIR1 infra red imagery as on 29th / 1415 IST of Jun 2024

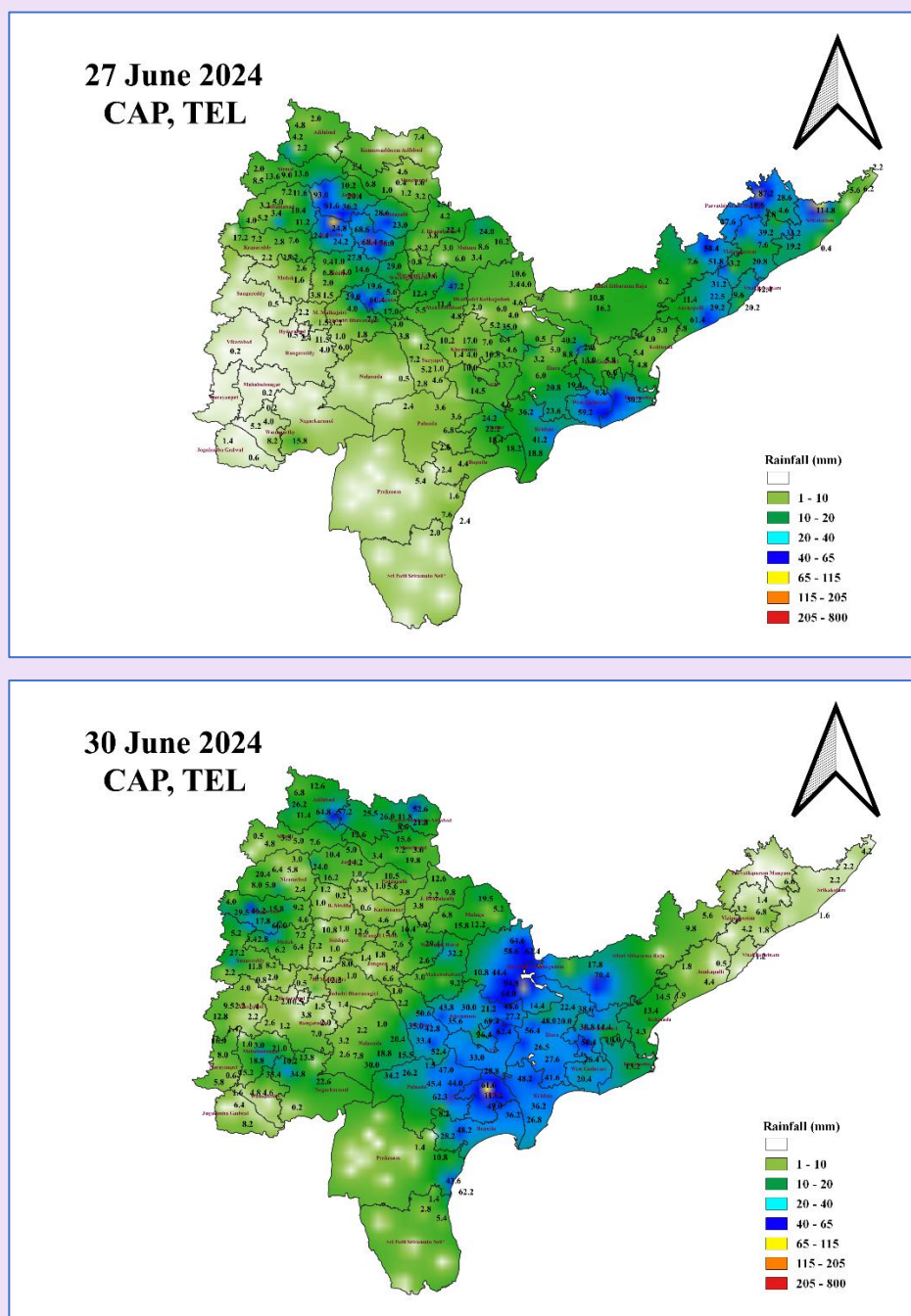


Fig.2(i)c: Maps of spatial rainfall distribution and rainfall intensity over CAP & TEL as on 24-hr ending 0830 IST of 27th & 30th Jun 2024

(ii) & (iii) A **Low Pressure Area** & a **Depression** formed over Northwest & adjoining Westcentral Bay of Bengal in quick succession during the 2nd & 3rd weeks of July as follows:

(ii) Under the influence of an upper air cyclonic circulation over Westcentral Bay of Bengal off CAP during 13th-14th, a LOPAR formed off south Odisha coast on **15th July**. Subsequently, it

moved westward across south Chhattisgarh & Vidarbha with the associated upper air cyclonic circulation extending upto mid tropospheric levels tilting southwestwards with height on **16th July**.

(iii) **A Depression** formed off Odisha-North Andhra Pradesh coasts during **18th-19th July**. It weakened into a Well Marked Low Pressure Area (WML) over coastal Odisha on **20th** evening and subsequently moved across interior Odisha, Chhattisgarh & Jharkhand during **20th-23rd July**. These two systems caused *fairly widespread-widespread* rainfall over CAP & TEL on most days during 13th -24th July with *vigorous* monsoon conditions over CAP on 3 days (13th, 19th & 20th July) and over TEL on 19th and *active* monsoon conditions over CAP on 14th and over TEL on 15th, 16th, 17th, 20th, 21st & 22nd July. *Isolated heavy to very heavy rain* with *extremely heavy* falls at one or two places occurred over CAP during the 24-hr ending 0830 IST of 19th & 20th with **Kukunoor & Polavaram** (both in Eluru district) reporting *extremely heavy* rainfall of **27 cm** on 19th; and **Chintur Chintur** (in Alluri Sitharamaraju district) reporting **21 cm** on 20th July 2024. Also, *isolated heavy to very heavy* rain occurred over CAP & TEL on 1 & 5 days respectively and *isolated heavy* rain occurred over these subdivisions on 2 & 3 days respectively during this period (13th-24th July 2024). The system caused extensive flooding over CAP, especially the Godavari districts. Further the formative stages of the LOPAR, *fairly widespread* rainfall with *vigorous* monsoon conditions prevailed over the TN subdivision on 13th. *Isolated heavy to very heavy* rain with *extremely heavy* rain at *one or two* places occurred over the TN subdivision with **Kilacheruvai** (Cuddalore district) reporting *extremely heavy* rainfall of **23 cm** on 13th July 2024. The mean sea level isobaric analysis as on 15th /0830 IST and upper air streamline analysis as on 15th/0530 IST depicting the LOPAR off Odisha coast and the associated upper air cyclonic circulation are presented in Fig.2(ii)a. Satellite imageries depicting the cloudiness associated with the system as on 13th/0115 IST and 15th/1015 IST are shown in Fig.2(ii)b. Map of spatial rainfall distribution and rainfall intensity over CAP, RYS & TEL and over TN as on 24-hr ending 0830 IST of 13th Jul 2024 are depicted in Fig.2(ii)c.

The track of the Depression off Odisha-North Andhra Pradesh coasts during 18th-19th July is shown in Fig.2(iii)a. The mean sea level isobaric analysis as on 19th /0830 IST and upper air streamline analysis as on 19th/0530 IST of July 2024 depicting the Depression and the associated upper air cyclonic circulation are presented in Fig.2(iii)b. Satellite imagery depicting the cloudiness associated with the system as on 18th/1115 IST is shown in Fig.2(iii)c. Maps of spatial rainfall distribution and rainfall intensity over CAP & TEL as on 24-hr ending 0830 IST of 19th & 20th Jul 2024 are depicted in Fig.2(iii)d. Sample media report indicating flooding over the Godavari

districts is shown in Fig.2(iii)e.

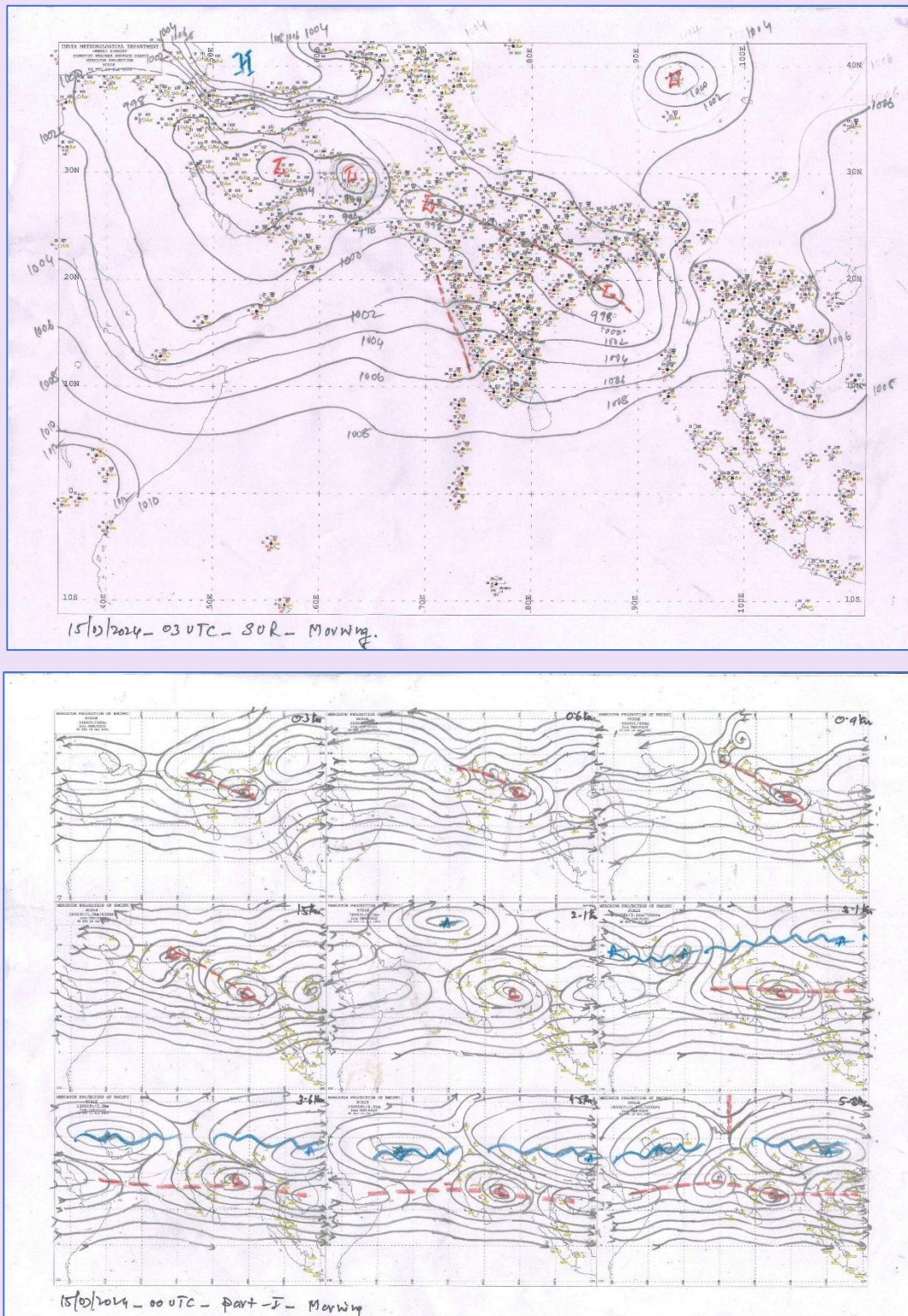


Fig.2(ii)a: Mean sea level isobaric analysis as on 15th/0830 IST and Upper air streamline analysis as on 15th/ 0530 IST of July 2024

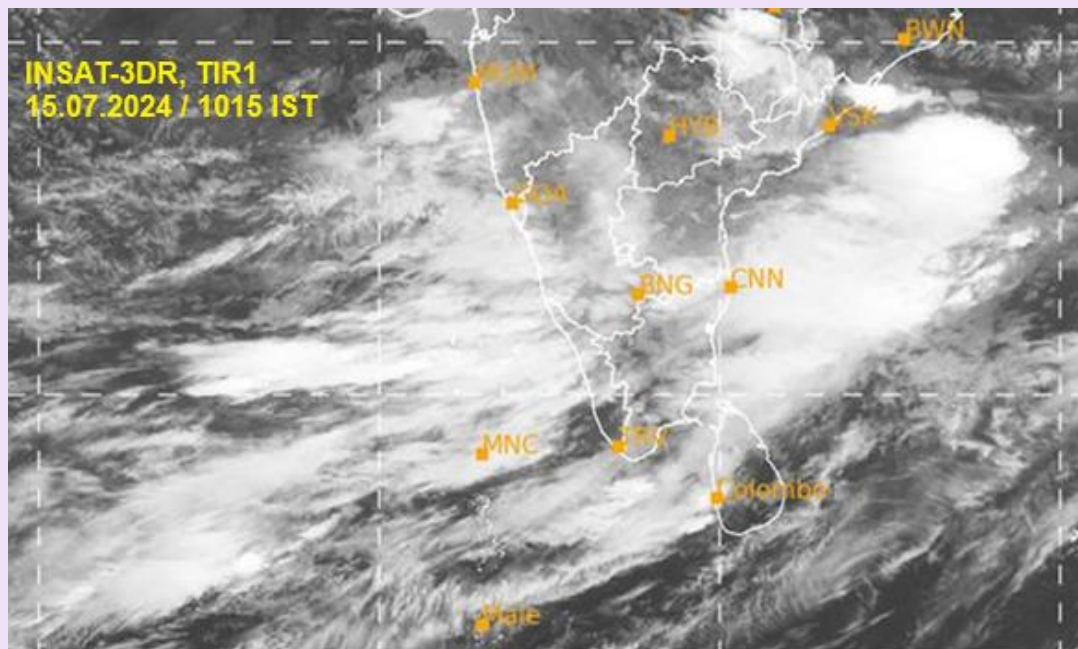
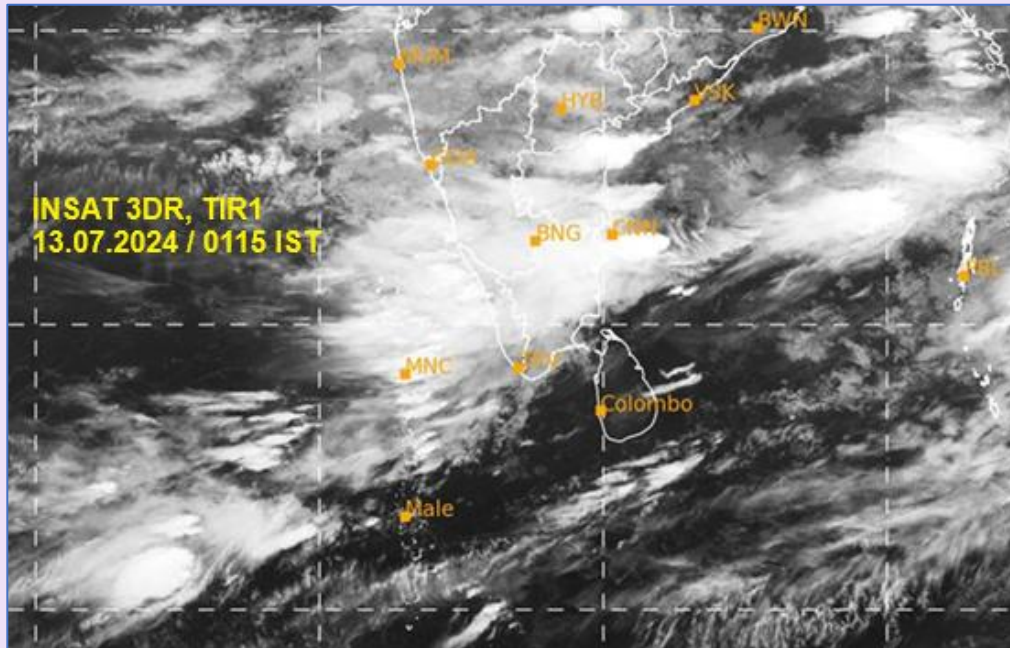
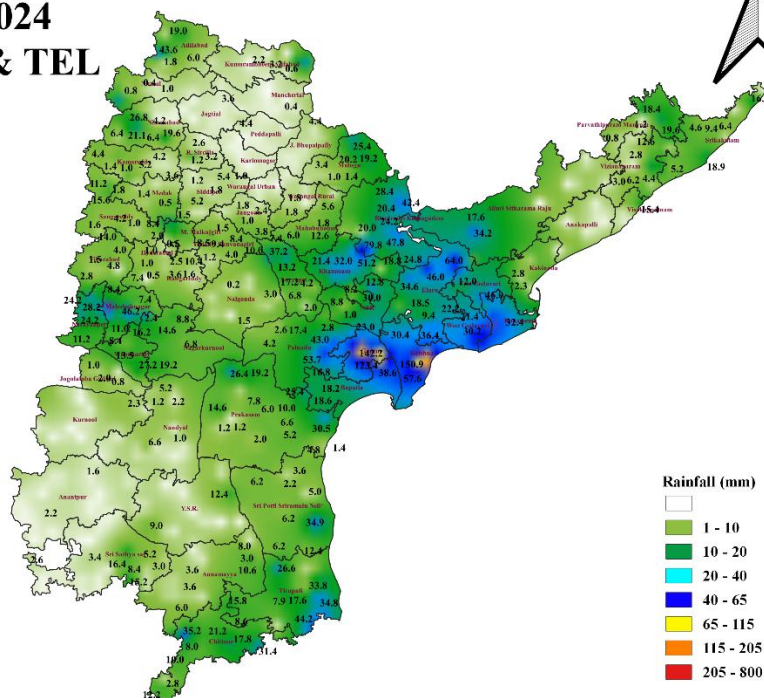


Fig.2(ii)b: INSAT-3DR, TIR1 infra red imagery as on 13th / 0115 IST & 15th/1015 IST of Jul 2024

13 July 2024
CAP, RYS & TEL



13 July 2024
Tamilnadu

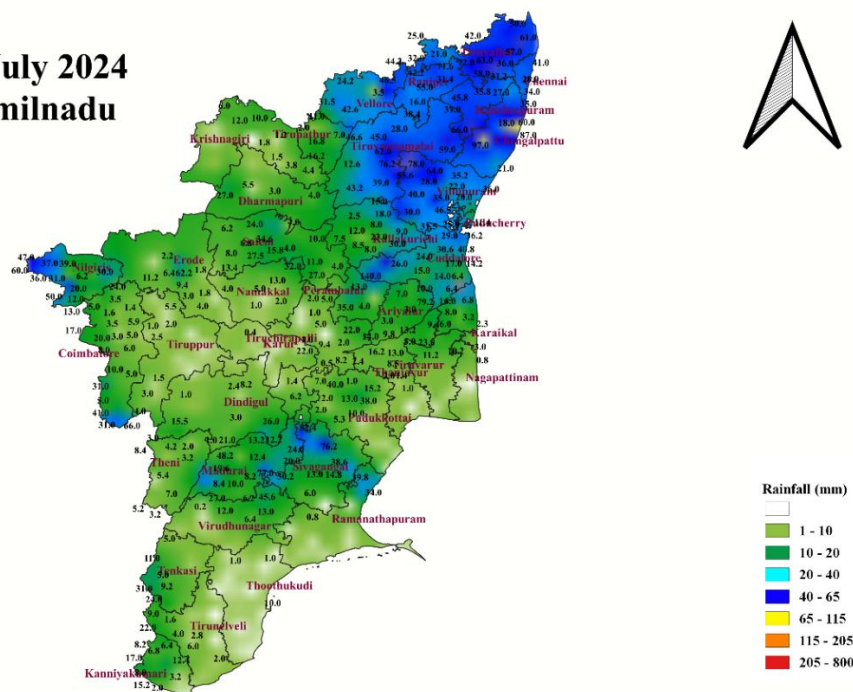


Fig.2(ii)c: Maps of spatial rainfall distribution and rainfall intensity over CAP, RYS & TEL and over TN as on 24-hr ending 0830 IST of 13th Jul 2024



Fig.2(iii)a: Track of Depression over Northwest and adjoining Westcentral Bay of Bengal during 19th -20th July 2024

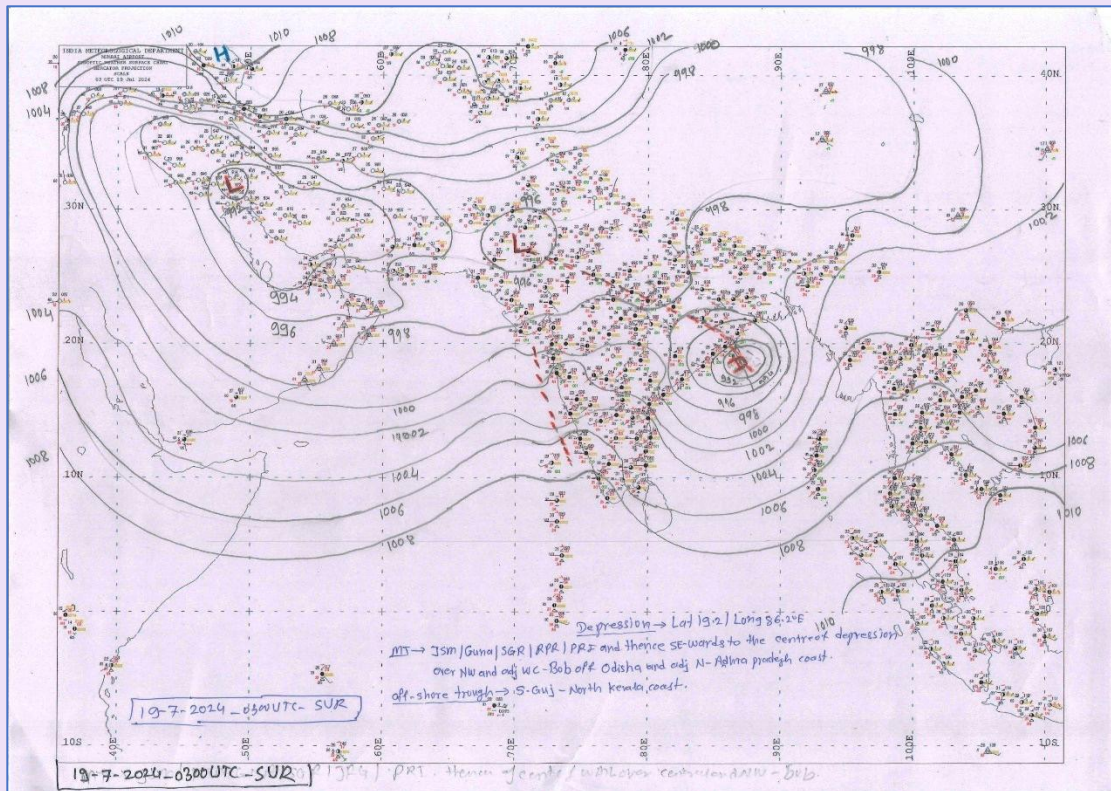


Fig.2(iii)b: Mean sea level isobaric analysis as on 15th/0830 IST and Upper air streamline analysis as on 19th/0530 IST of July 2024

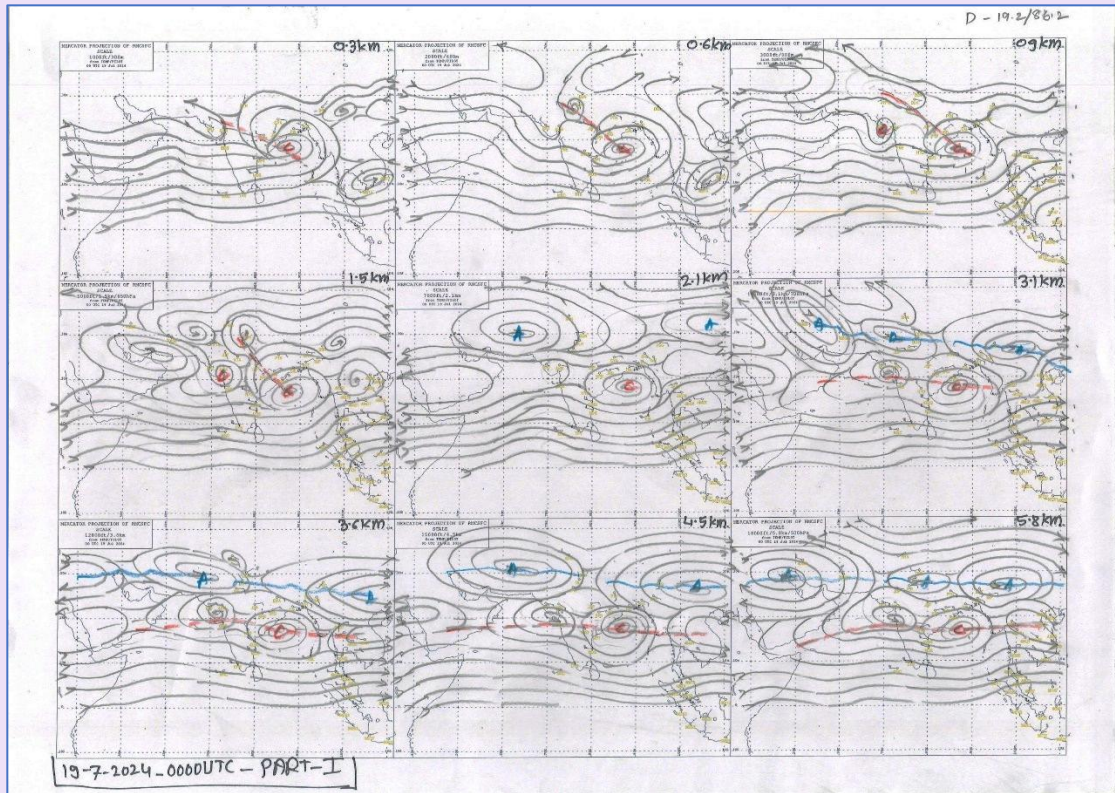


Fig.2(iii)b (contd.)

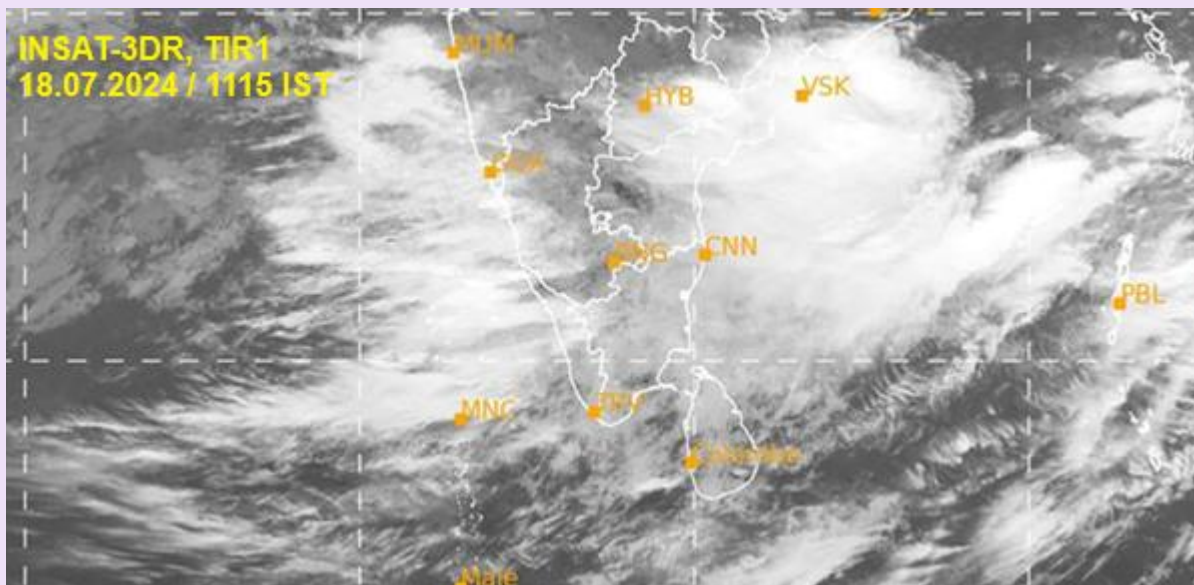


Fig.2(iii)c: INSAT-3DR, TIR1 infra red imagery as on 18th / 1115 IST of Jul 2024

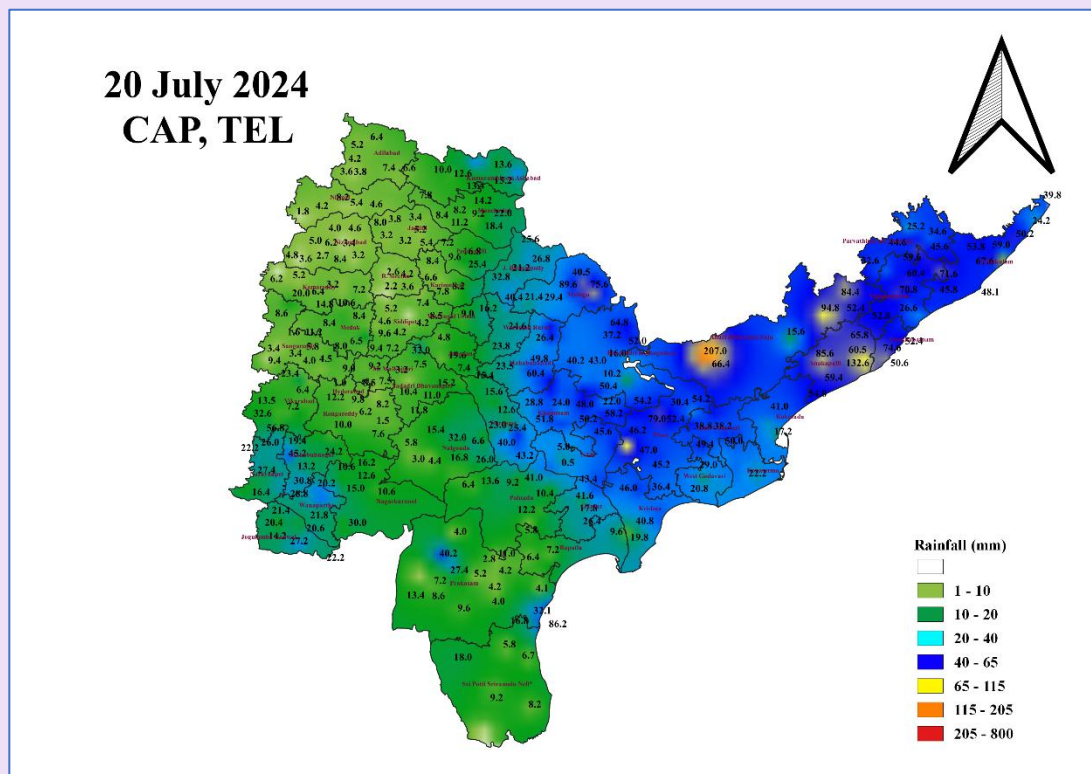
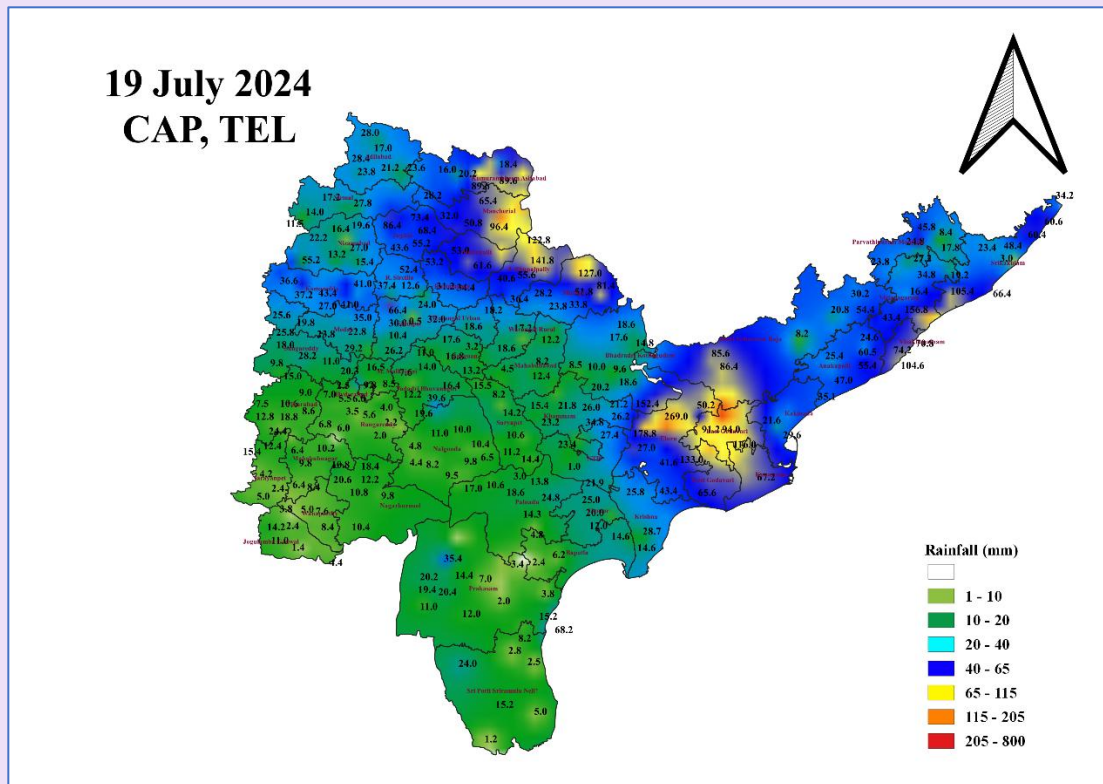


Fig.2(iii)d: Maps of spatial rainfall distribution and rainfall intensity over CAP & TEL as on 24-hr ending 0830 IST of 19th & 20th Jul 2024

Heavy Rains Claim Fisherman's Life, 130 Villages Cut Off in Godavari Districts

Andhra Pradesh

Vadrevu Srinivas

19 July 2024 11:27 PM

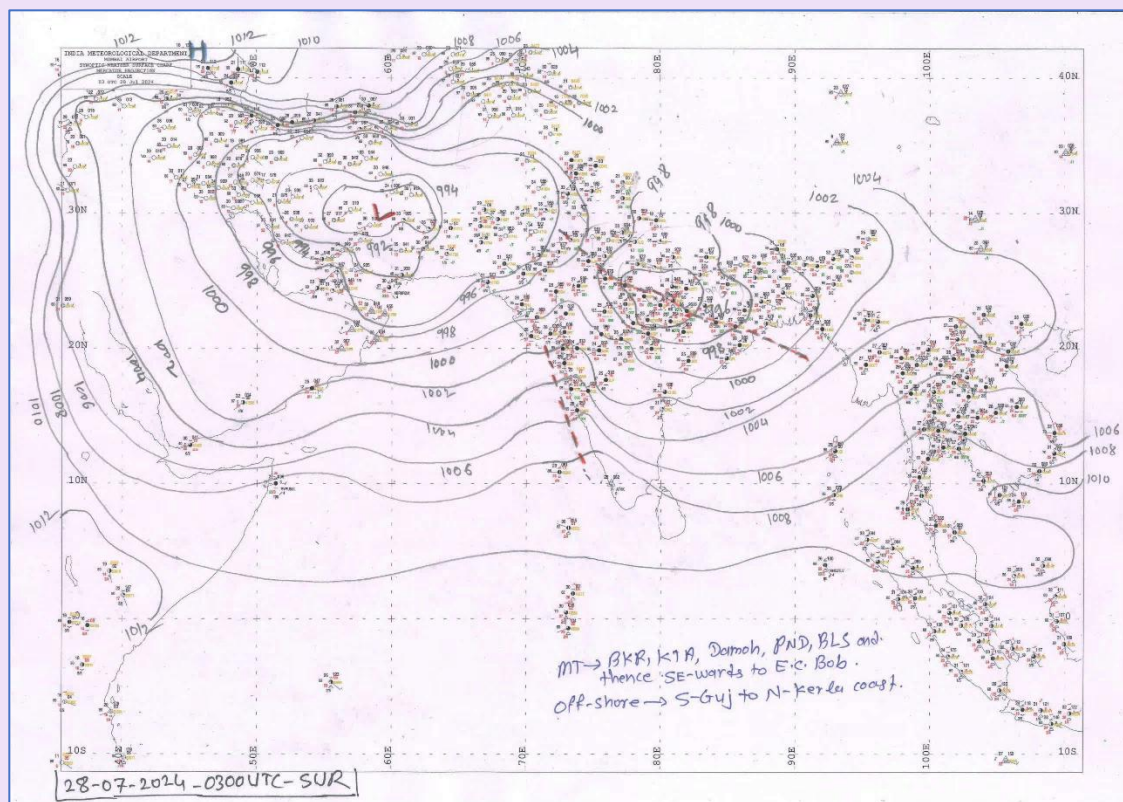


Huts submerged in flood water at Kothapeta in Tanuku Mandal of West Godavari district on Friday. (Image By

Fig.2(iii)e: Extract of Deccan Chronicle report dated 19th July 2024

(iv) A **Low Pressure Area** that formed over North Bay of Bengal and adjoining Coastal areas of Bangladesh and Gangetic West Bengal with associated cyclonic circulation extending upto upper tropospheric levels tilting southwestwards with height on 26th July and became **Well marked Low Pressure Area** on the same day, moved westward further inland on 27th July and weakened gradually and an east-west shear zone in the lower – mid/upper tropospheric levels rough along 18-20°N tilting southwards with height caused *fairly widespread – widespread* rainfall over TEL during 25th July to 03rd Aug with *isolated heavy* rain on 28th, 29th & 30th July 2024.

The mean sea level isobaric analysis as on 28th /0830 IST and upper air streamline analysis as on 28th/0530 IST are presented in Fig.2(iv)a. Satellite imageries depicting the cloudiness associated with the system as on 27th/1515 IST is shown in Fig.2(iv)b. Maps of spatial rainfall distribution and rainfall intensity over CAP & TEL as on 24-hr ending 0830 IST of 28th Jul 2024 are depicted in Fig.2(iv)c.



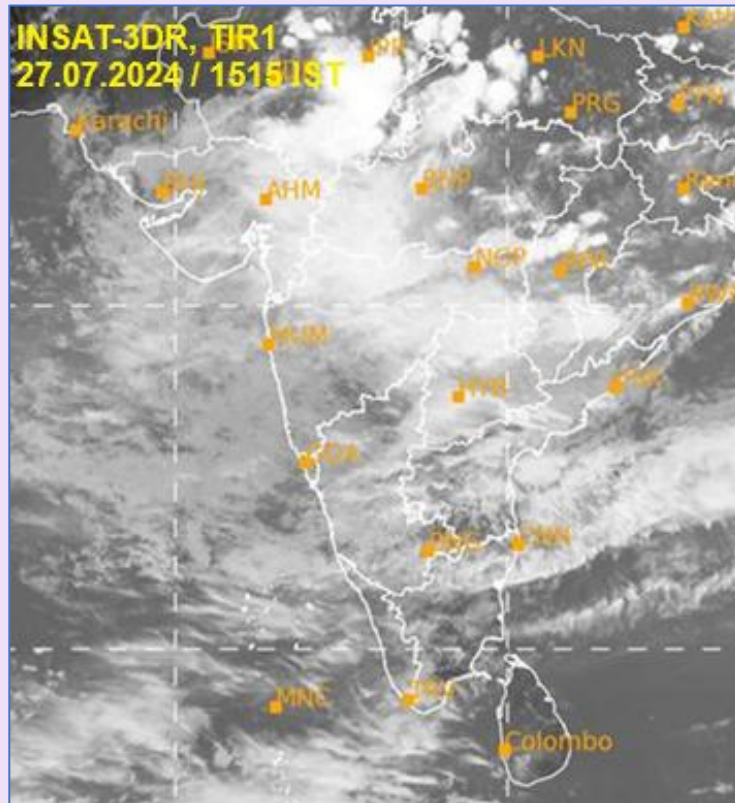


Fig.2(iv)b: INSAT-3DR, TIR1 infra red imagery as on 27th / 1515 IST of Jul 2024

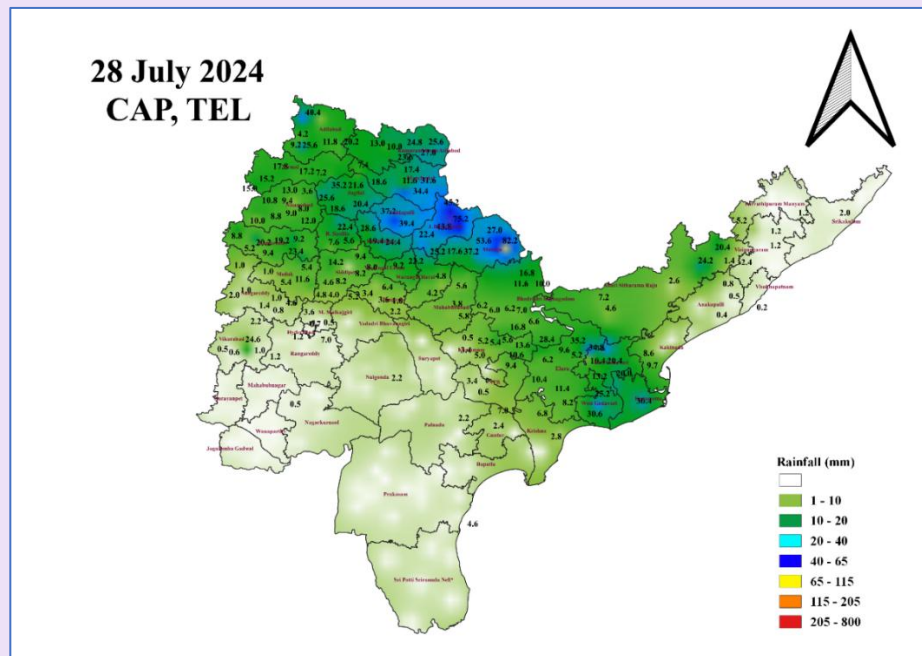


Fig.2(iv)c: Maps of spatial rainfall distribution and rainfall intensity over CAP & TEL as on 24-hr ending 0830 IST of 28th Jul 2024

(v) A **Deep Depression (DD)** formed over Jharkhand and neighbourhood and moved westward during 02nd-06th Aug 2024 caused *fairly widespread-widespread* rainfall over CAP & TEL on 06th, 07th & 08th Aug with *active* monsoon conditions over CAP & TEL on 3 days & 2 days respectively. *Isolated heavy to very heavy* rain occurred over TEL on 06th & 07th [highest: Thollada (Khammam district) **13 cm** on 06th] and *isolated heavy* rain occurred over CAP on 06th, 07th & 08th and over TEL on 08th Aug 2024.

The track of the system is shown in Fig.2(v)a. The upper air streamline analysis as on 06th/0530 IST of August 2024 depicting the upper air cyclonic circulation associated with the system is presented in Fig.2(v)b. Satellite imagery depicting the cloudiness associated with the system as on 06th/1545 IST is shown in Fig.2(v)c. Map of spatial rainfall distribution and rainfall intensity over CAP & TEL as on 24-hr ending 0830 IST of 07th August 2024 are depicted in Fig.2(v)d.

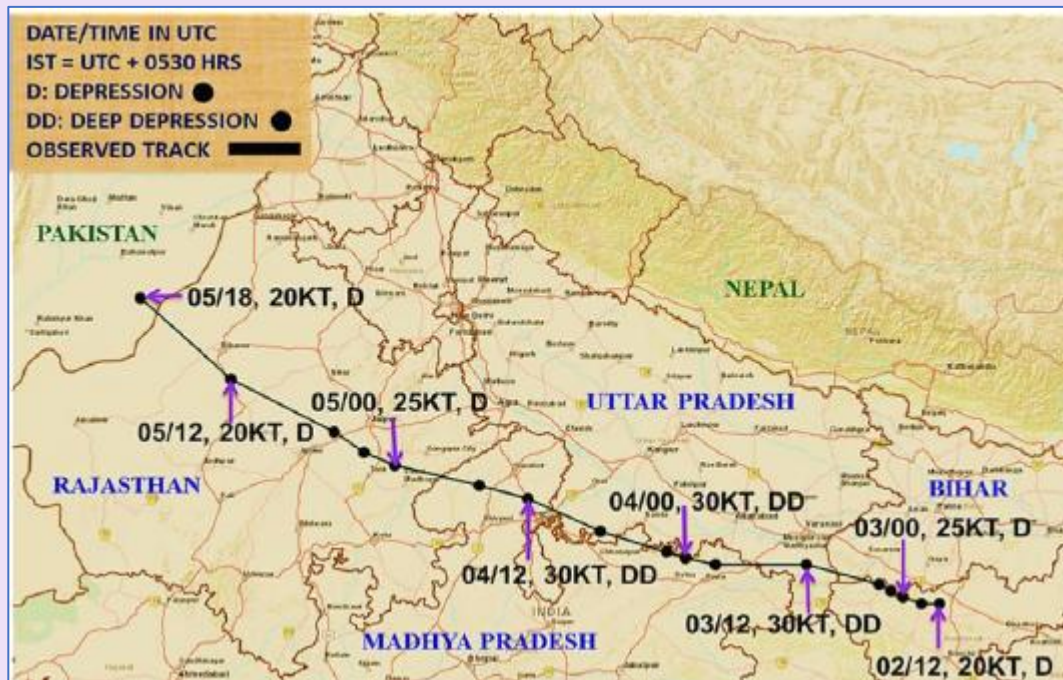


Fig.2(v)a: Track of Deep Depression over Jharkhand & neighbourhood during 02nd-06th Aug 2024

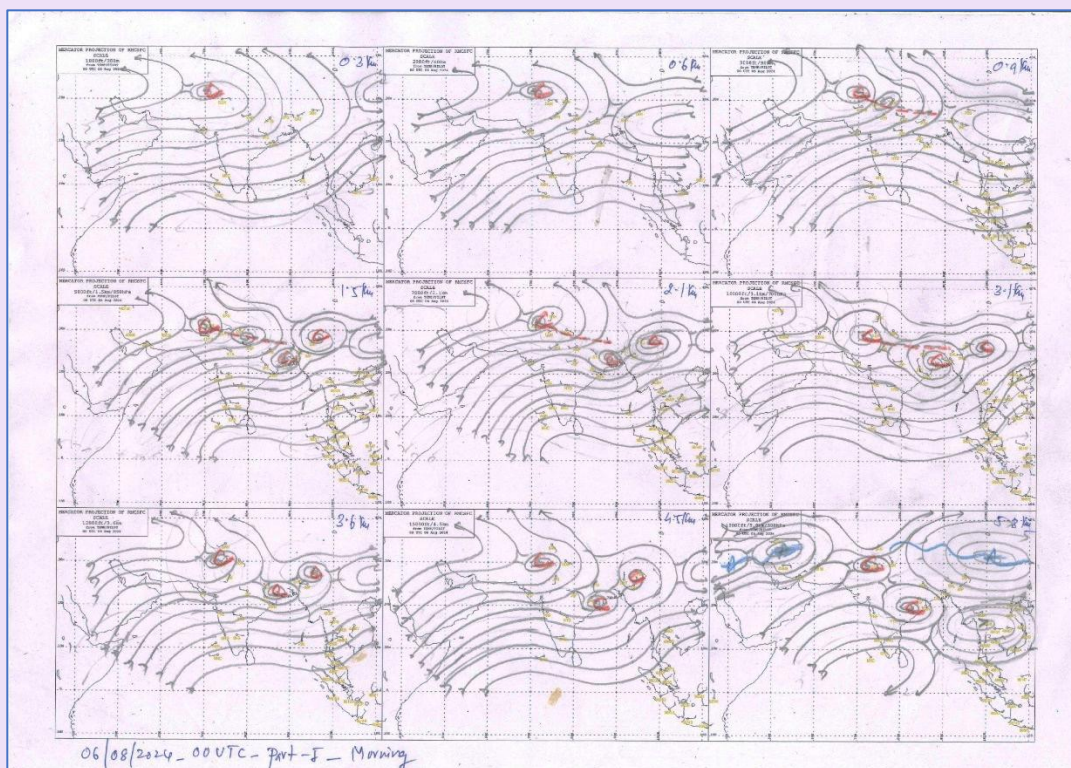


Fig.2(v)b: Upper air streamline analysis as on 06th/ 0530 IST of August 2024

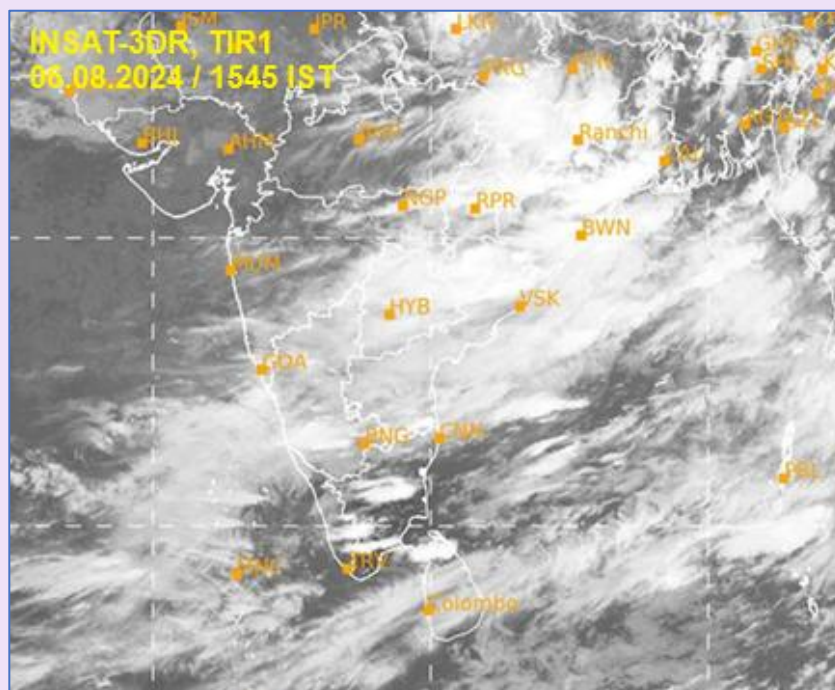


Fig.2(v)c: INSAT-3DR, TIR1 infra red imagery as on 06th / 1545 IST of Jul 2024

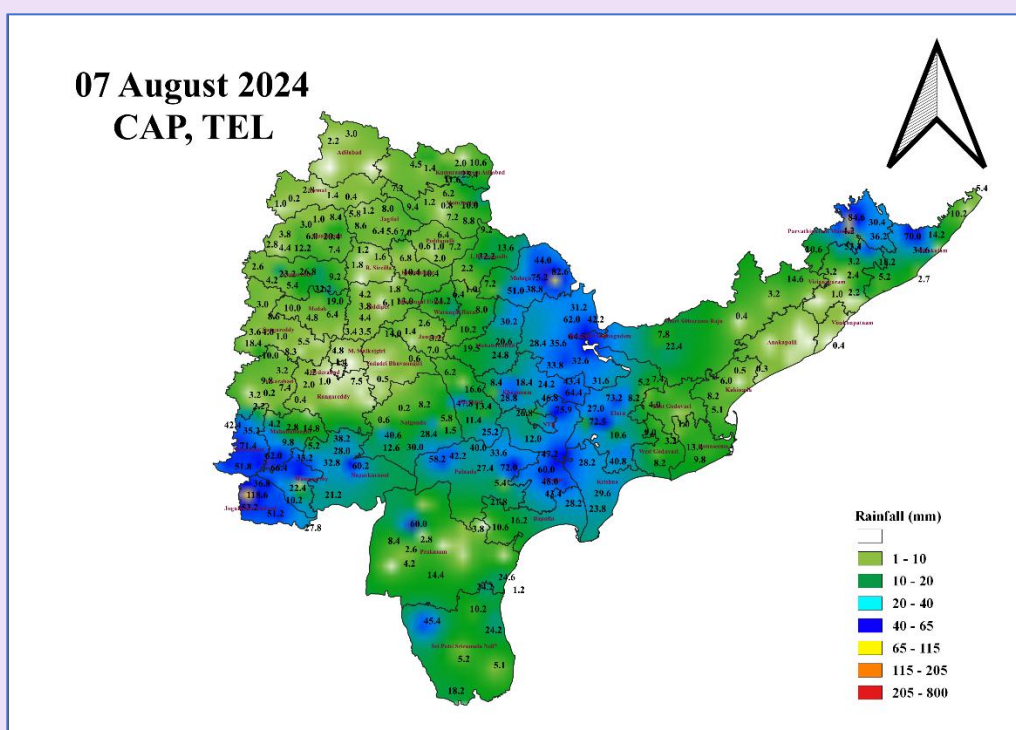


Fig.2(v)d: Map of spatial rainfall distribution and rainfall intensity over CAP & TEL as on 24-hr ending 0830 IST of 07th August 2024

(vi) A **Low Pressure Area** formed over Eastcentral Arabian sea off Karnataka-Goa coasts on 22nd Aug with associated cyclonic circulation extending upto mid tropospheric levels tilting southwestwards with height and lay over Eastcentral Arabian Sea off Maharashtra coast with associated cyclonic circulation extending upto lower tropospheric levels tilting southwestwards with height on 23rd Aug 2024. *Widespread* rainfall over CK and *scattered to fairly widespread* rainfall over NIK during 22nd-24th Aug with *isolated heavy to very heavy* rain over CK on 24th (highest: Castle Rock (Uttara Kannada district) **13 cm**) and *isolated heavy* rain over NIK on 23rd & 24th Aug 2024.

Satellite imagery depicting the cloudiness associated with the system as on 22nd/0345 IST & 24th/0615 IST is shown in Fig.2(vi)a. Map of spatial rainfall distribution and rainfall intensity over KAR as on 24-hr ending 0830 IST of 24th August 2024 is depicted in Fig.2(vi)b.

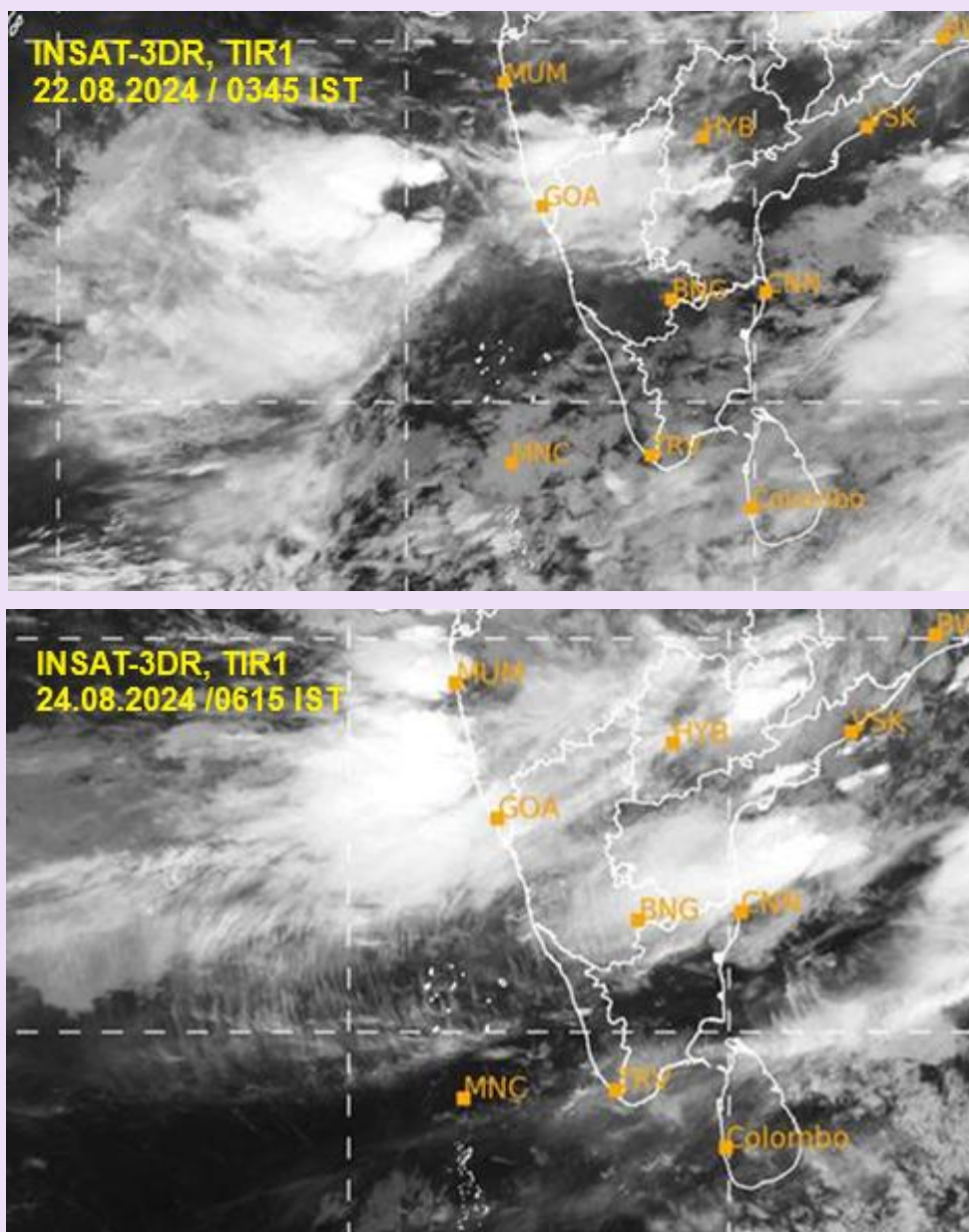


Fig.2(vi)a: INSAT-3DR, TIR1 infra red imagery as on 22nd/0345 IST & 24th / 0615 IST of Aug 2024

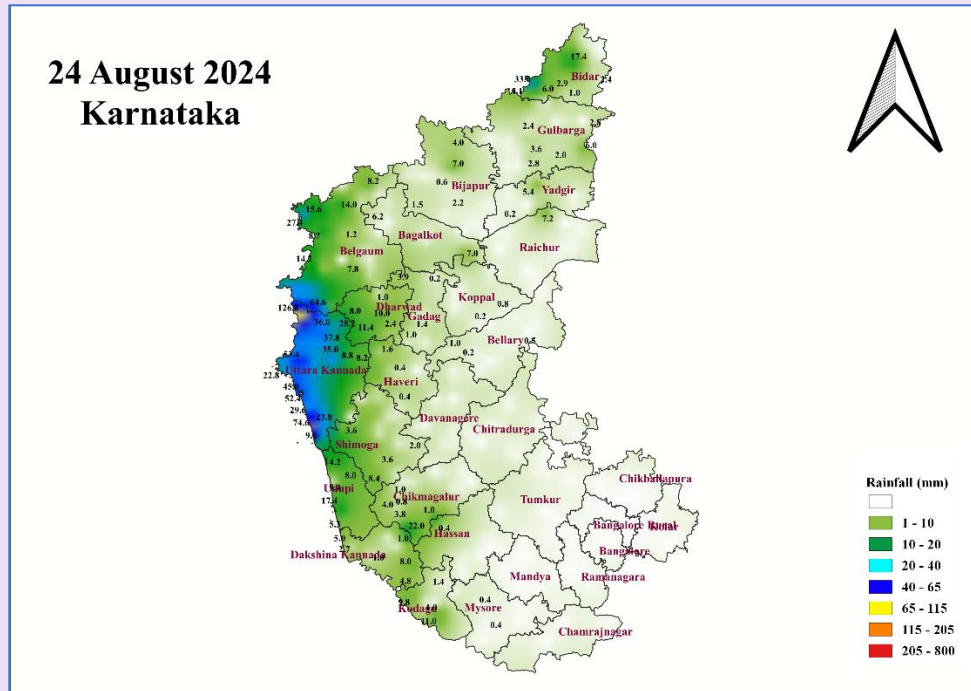


Fig.2(vi)b: Map of spatial rainfall distribution and rainfall intensity over KAR as on 24-hr ending 0830 IST of 24th Aug 2024

(vii) & (viii): A **Depression** formed over Westcentral & adjoining Northwest Bay of Bengal off North Andhra Pradesh & South Odisha coasts during 28th-31st Aug and crossed North Andhra Pradesh and South Odisha coasts near Kalingapatnam (Andhra Pradesh) between 0030 IST and 0230 IST of 01st September 2024. Moving west-northwestwards it weakened into a WML over central parts of Vidarbha and neighbourhood in the evening of 02nd and further into a LOPAR over west Vidarbha & neighbourhood in the morning of 03rd September, 2024. The track of the system is depicted in Fig.2(vii)a. The mean sea level isobaric analysis as on 01st /0830 IST and upper air streamline analysis as on 01st/0530 IST of September 2024 depicting the Depression and the associated upper air cyclonic circulation are presented in Fig.2(vii)b. Satellite imagery depicting the cloudiness associated with the system as on 31st/0815 IST of August 2024 is shown in Fig.2(vii)c.

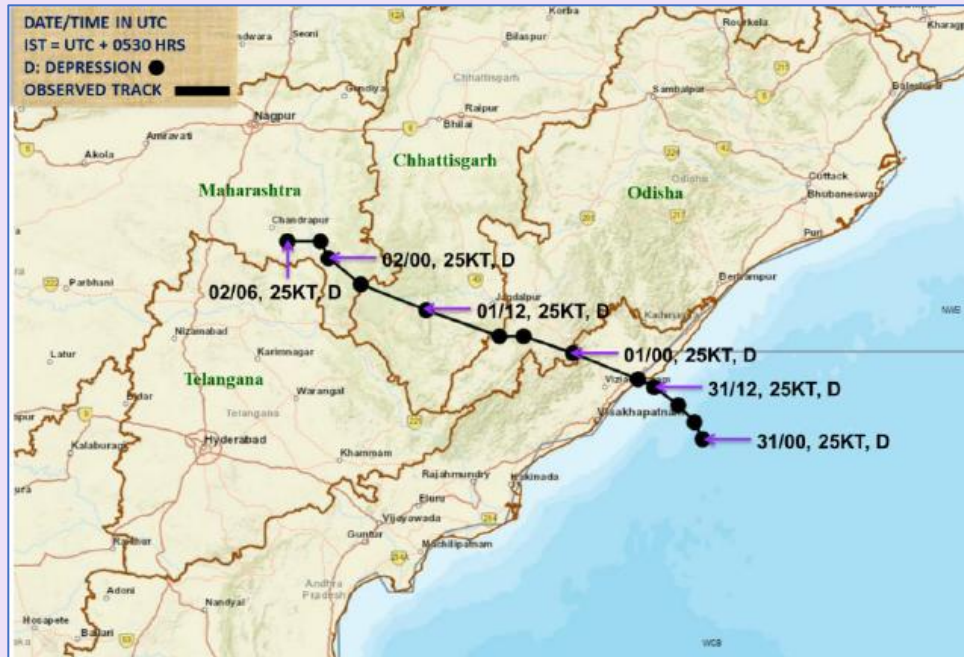


Fig.2(vii)a: Track of Depression over the Westcentral & adjoining Northwest Bay of Bengal during 31st Aug – 02nd Sep 2024

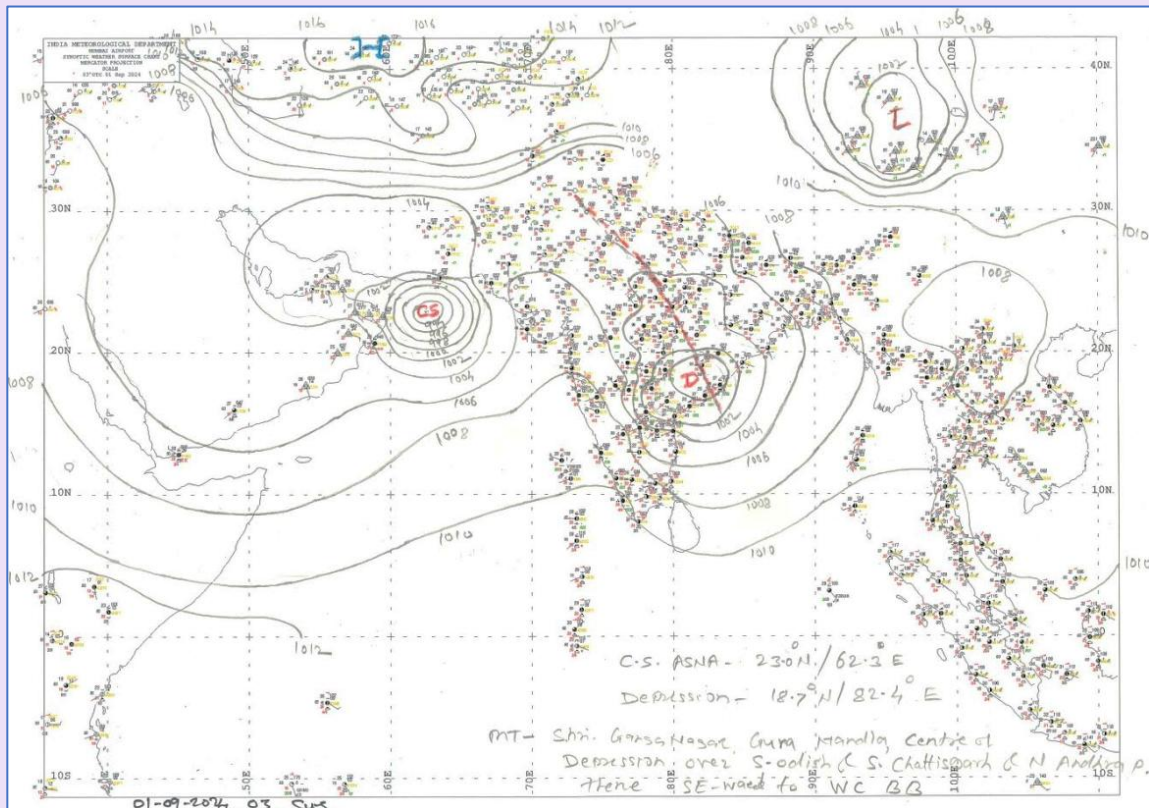


Fig.2(vii)b: Mean sea level isobaric analysis as on 01st/0830 IST and Upper air streamline analysis as on 01st/0530 IST of Sep 2024

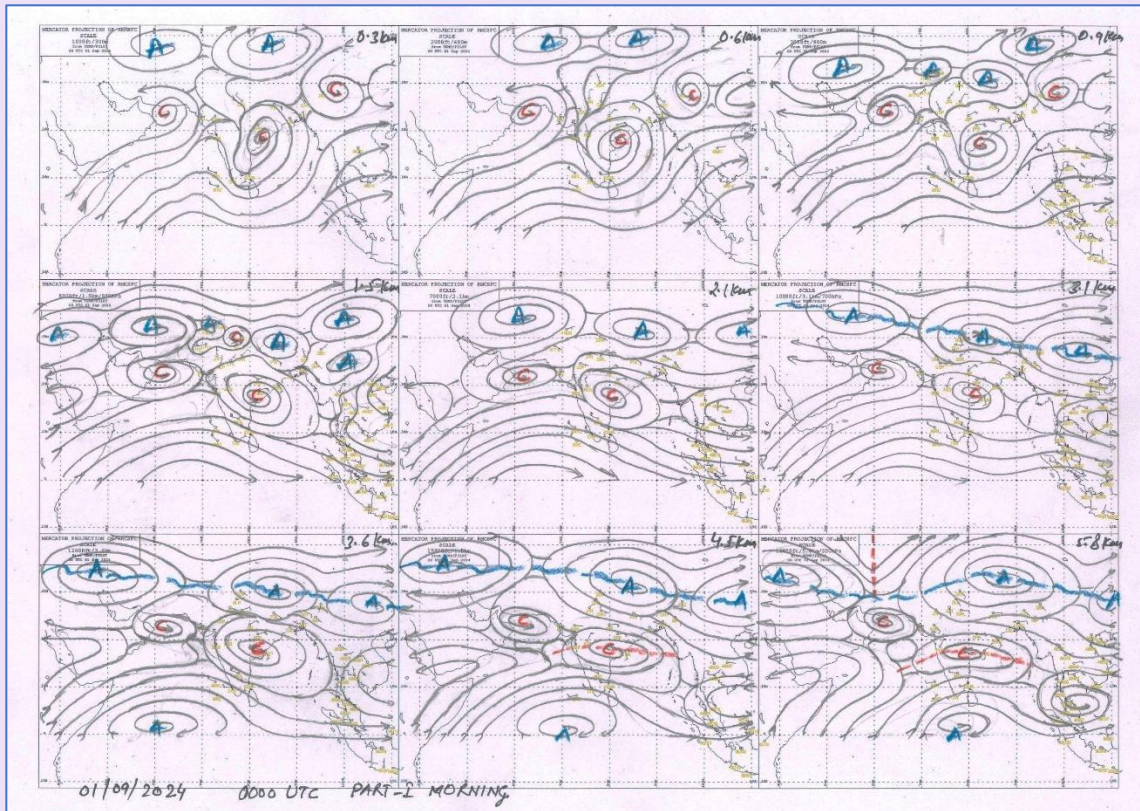


Fig.2(vii)b (contd.)

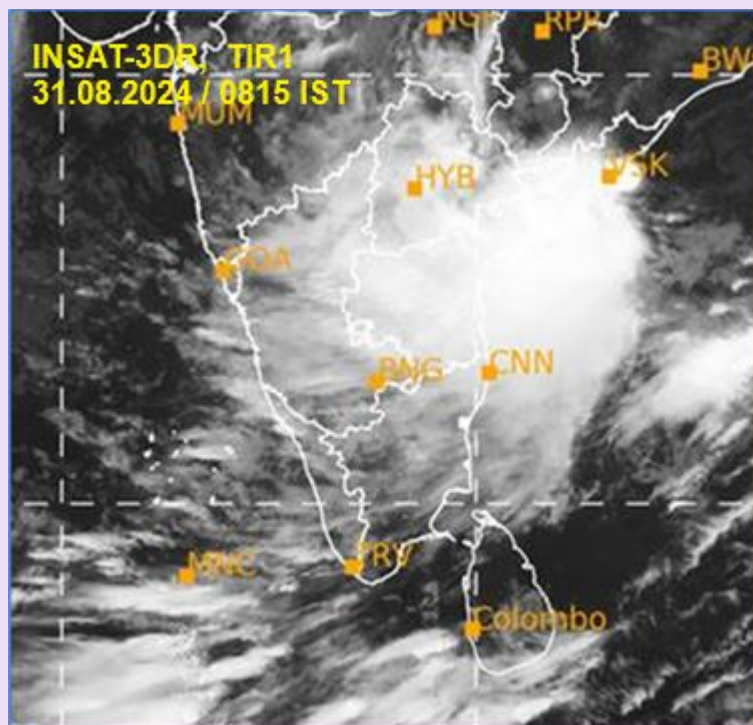


Fig.2(vii)c: INSAT-3DR, TIR1 infra red imagery as on 31st/0815 IST of Aug 2024

Thereafter, another system formed & affected this region in quick succession, a **Deep Depression** over Westcentral and adjoining Northwest Bay of Bengal which moved across Odisha & Chhattisgarh during 5th to 10th September. The system formed as a LOPAR over the Westcentral and adjoining Northwest Bay of Bengal off North Andhra Pradesh-South Odisha coast on 05th morning and became Well Marked Low Pressure Area over the Northwest and adjoining central parts of BOB on 07th morning. It concentrated into a **Depression** in the early morning (0530 hours IST) of 8th over Westcentral and adjoining Northwest BOB, intensified into a **Deep Depression** around the mid-night (2330 hours IST) of 8th over the same region and crossed Odisha coast close to north of Puri on the morning of 9th. Continuing to move northwestwards, it weakened into a **Depression** in the mid-night of 9th over interior Odisha and further into a **Well-Marked Low Pressure Area** over Northeast Madhya Pradesh and neighbourhood in the evening (1730 hours IST) of 10th September 2024. The track of the system is depicted in Fig.2(viii)a. Satellite imagery depicting the cloudiness associated with the system as on 09th/0545 IST of September 2024 is shown in Fig.2(viii)b.

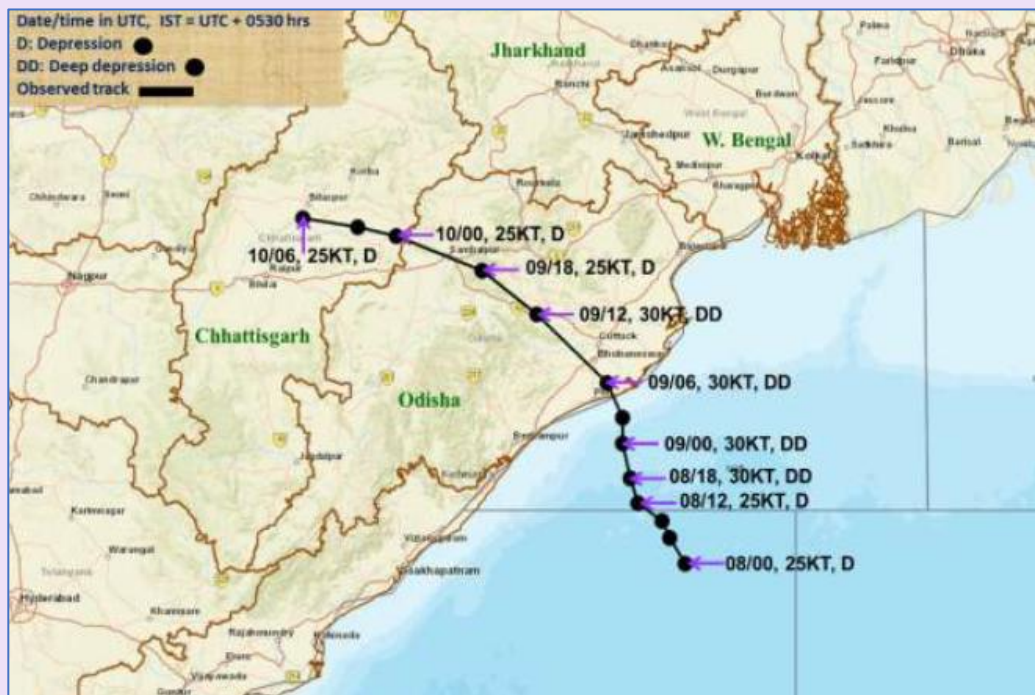


Fig.2(viii)a: Track of Deep Depression over the Westcentral & adjoining Northwest Bay of Bengal during 08th-10th Sep 2024

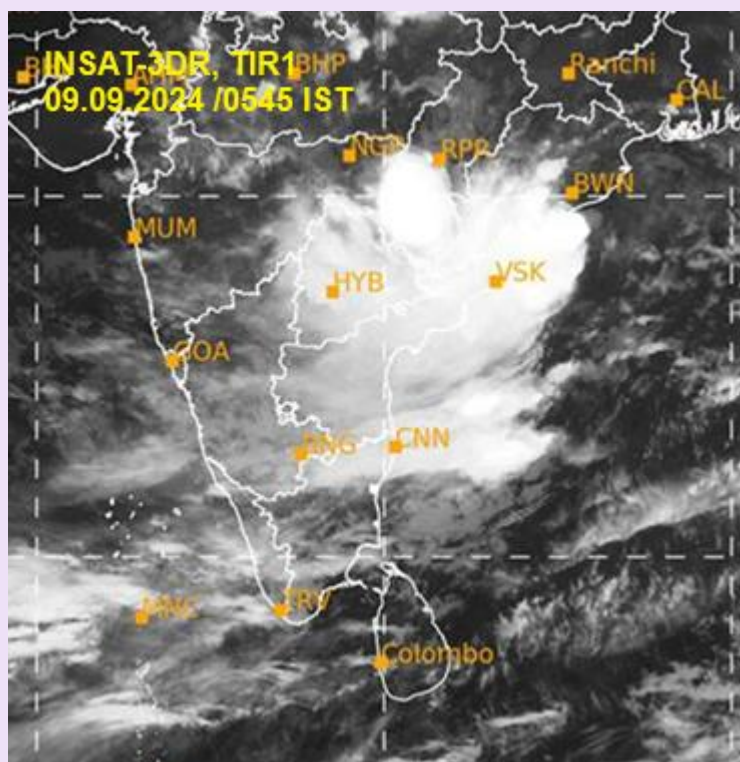


Fig.2(viii)b: INSAT-3DR, TIR1 infra red imagery as on 09th /0545 IST of Sep 2024

Under the influence of formation and movement of these two systems, *fairly widespread – widespread* rainfall occurred over CAP & TEL on most days during 29th Aug to 10th Sep with *vigorous* monsoon conditions prevailing over CAP on 4 days and over TEL on 3 days and *active* monsoon conditions prevailing over CAP on 4 days and over TEL on 08 days during this period. There were heavy rainfall events on 10 days over TEL and 08 days over CAP with *isolated heavy to extremely heavy* rain over CAP on 01st September [Amaravati (Guntur district) **26 cm**, Tiruvuru (NTR district) 26 cm, Guntur (Guntur district) 23 cm] and over TEL on 01st [Malyal (dist Mahabubabad) **40 cm**, Mahabubabad (dist Mahabubabad) 37 cm, Kodada (dist Suryapet) 35 cm, Manuguru (dist B. Kothagudem) 32 cm, Kusumanchi (dist Khammam) 32 cm, Chilkur (dist Suryapet) 31 cm, Mattampally (dist Suryapet) 30 cm, Huzur Nagar (dist Suryapet) 30 cm, Parvathagiri (dist Warangal) 29 cm, Burgampadu (dist B. Kothagudem) 29 cm, Madhira (dist Khammam) 28 cm, Banswada (dist Kamareddy) 28 cm, Kodakandla (dist Jangaon) 27 cm, Dornakal (dist Mahabubabad) 26 cm, Chinthakam (dist Khammam) 26 cm, Tadwai Mlg (dist Mulugu) 26 cm, Noothankal (dist Suryapet) 26 cm, Gudurwrgl (dist Mahabubabad) 25 cm, Palawancha (dist B. Kothagudem) 24 cm, Bhadrachalam (dist B. Kothagudem) 23 cm, Khammam(arg) (dist Khammam) 23 cm, Aswapuram (dist B. Kothagudem) 22 cm, Thollada (dist

Khammam) 22 cm, Sadasivanagar (dist Kamareddy) 21cm, Bonakal (dist Khammam) 21 cm]& 02nd September [Sadasivanagar (dist Kamareddy) 24 cm, Tadwai (dist Kamareddy) 24 cm, Lingampet (dist Kamareddy) 23 cm, Kamareddy (dist Kamareddy) 22 cm].

Maps of spatial rainfall distribution and rainfall intensity over CAP & TEL as on 24-hr ending 0830 IST of 31st Aug, 01st & 02nd Sep are depicted in Fig.2(vii)d and sample media report indicating flooding as on 03rd September is presented in Fig.2(viii)e.

Maps of spatial rainfall distribution and rainfall intensity over CAP & TEL as on 24-hr ending 0830 IST of 08th & 09th Sep 2024 are depicted in Fig.2(viii)c.

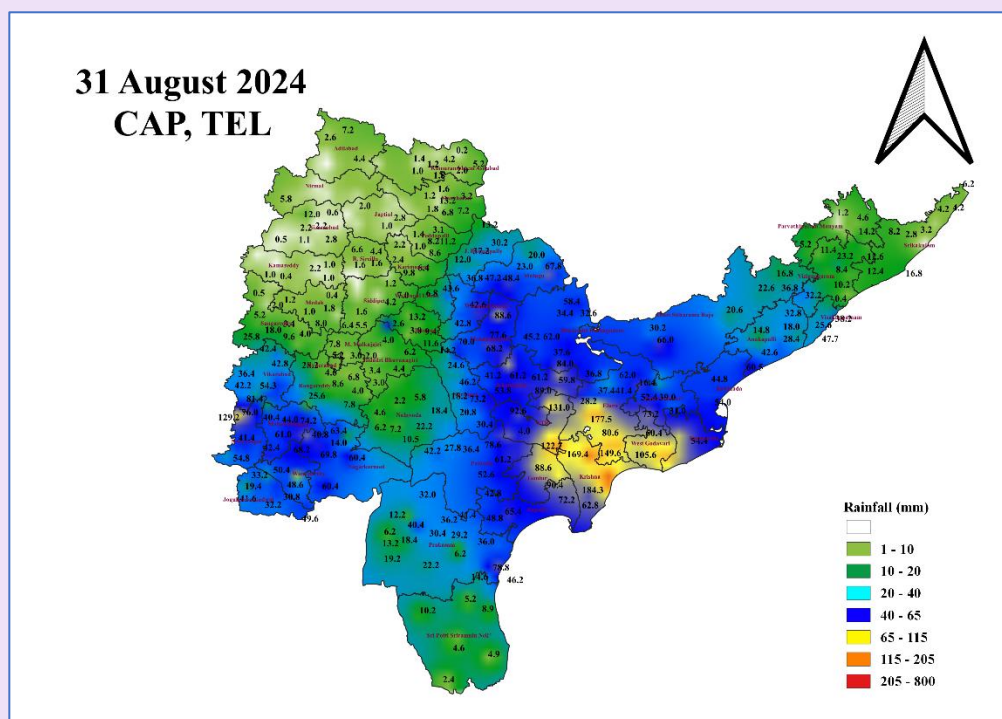


Fig.2(vii)d: Maps of spatial rainfall distribution and rainfall intensity over CAP & TEL as on 24-hr ending 0830 IST of 31st Aug and 01st & 02nd Sep 2024

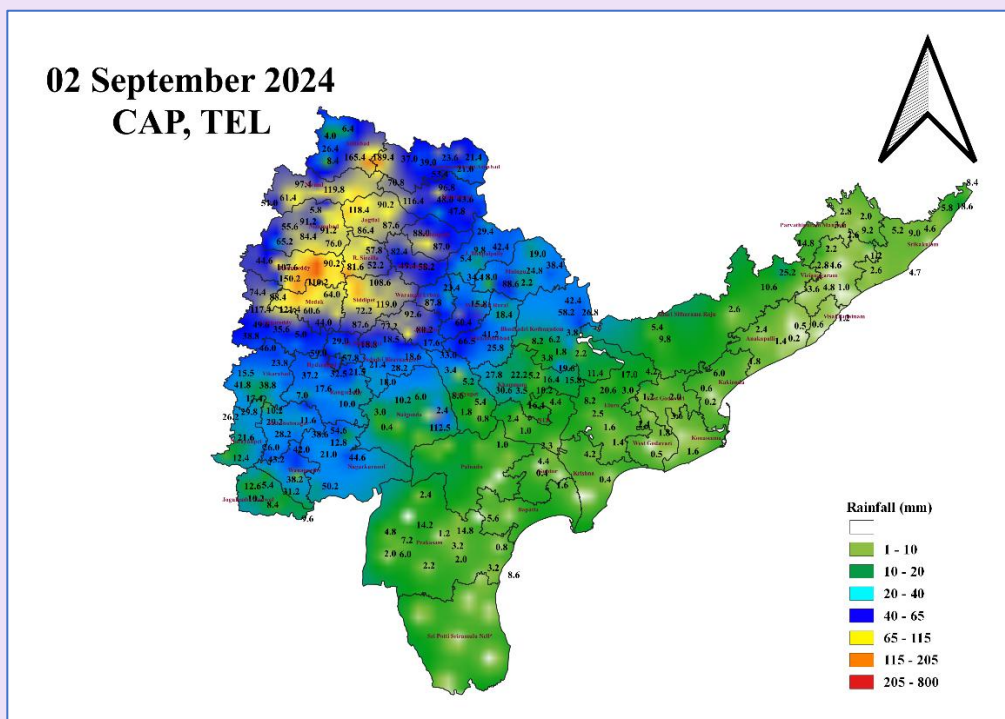
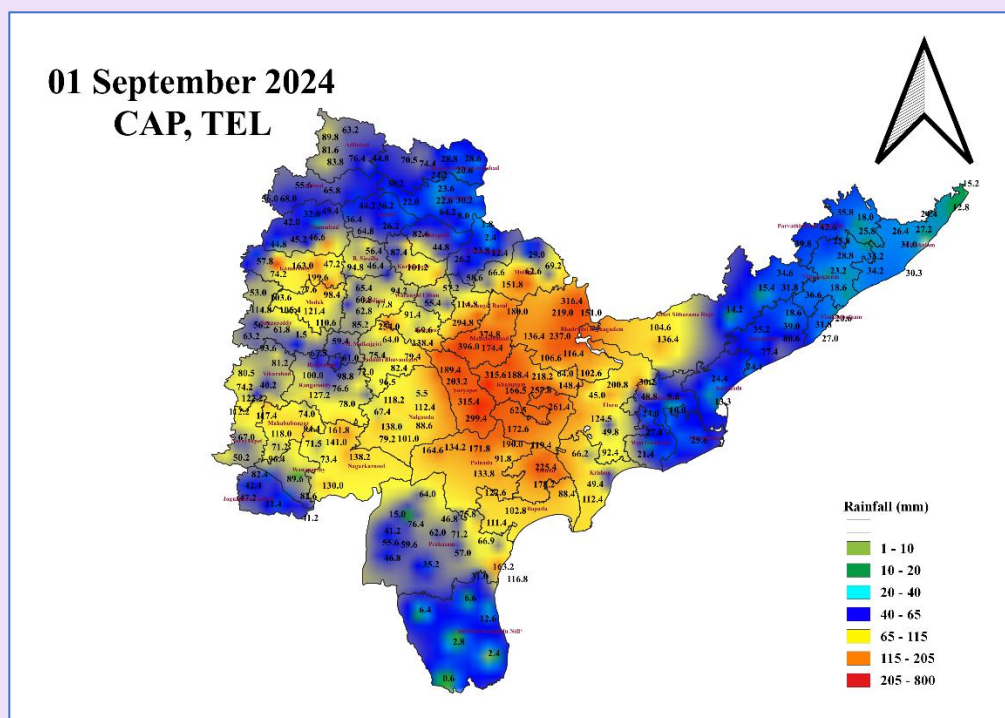


Fig.2(vii)d (contd.)

Hindustan Times dated 03 Sep 2024 35 killed in Telangana, Andhra Pradesh as rains continue to wreak havoc

By [Srinivasa Rao Apparasu](#) X , Hyderabad

Updated on: Sept 03, 2024 08:46 am IST



The India Meteorological Department (IMD) has predicted more rainfall in some parts of both the states on Tuesday.



People wade through waterlogged roads in Vijayawada, Andhra Pradesh, on Monday. (Reuters)

Unprecedented rainfall and floods in Telangana and Andhra Pradesh over the past three days have killed 35 people, battered roads and rail tracks, submerged thousands of acres of crops and left people scrambling for essentials, as agencies engaged in relief and rescue operations and the chief ministers of the two states stepped up efforts to tackle the situation.

Fig.2(vii)e: Extract of Hindustan times report dated 03rd Sep 2024

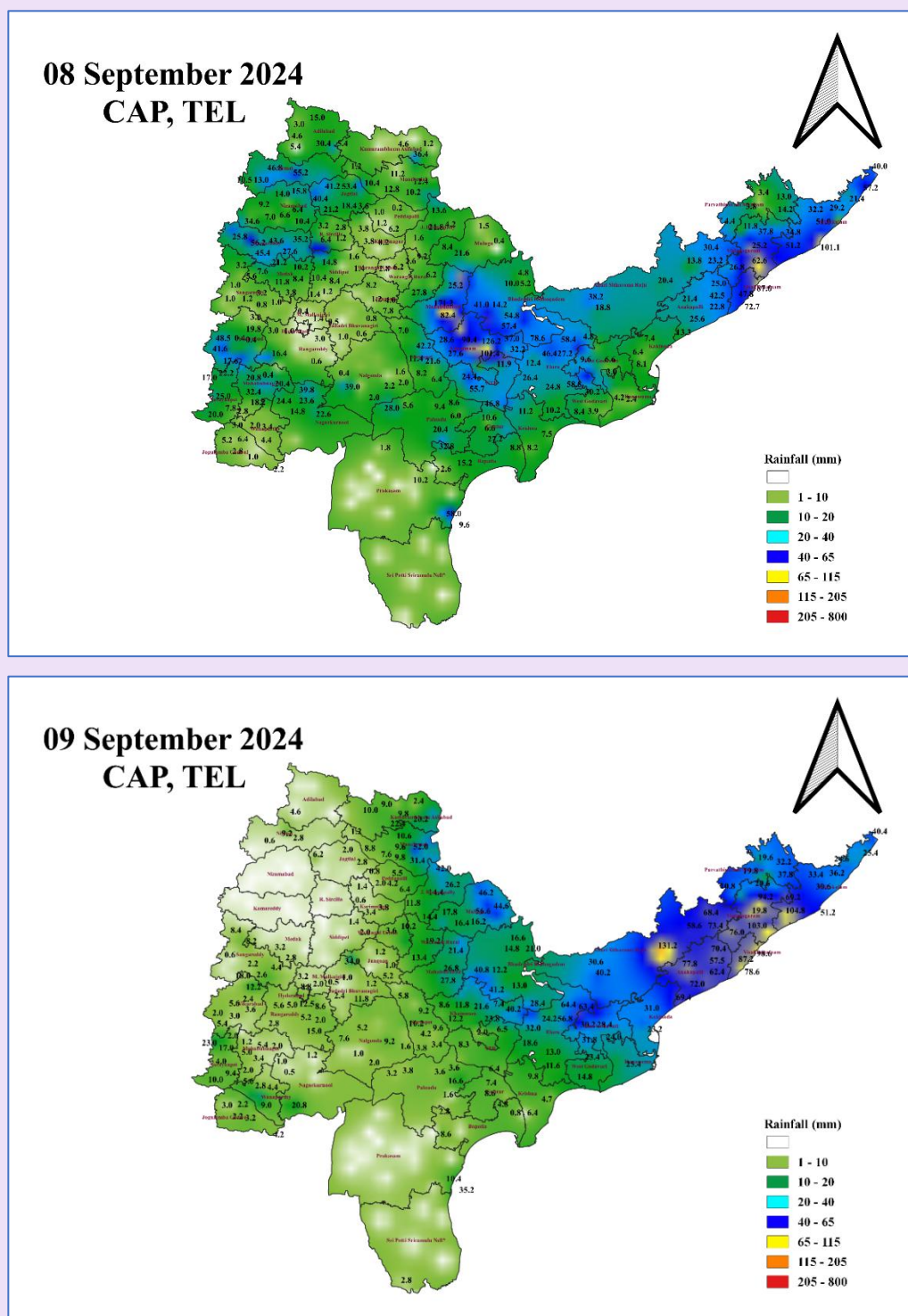


Fig.2(viii)c: Maps of spatial rainfall distribution and rainfall intensity over CAP & TEL as on 24-hr ending 0830 IST of 08th & 09th Sep 2024

(ix) Under the influence of an upper air cyclonic circulation over Westcentral Bay of Bengal and neighbourhood during 20th-23rd September, a **Low Pressure Area** that formed over Westcentral and adjoining North Bay of Bengal off North Andhra Pradesh – South Odisha coasts on 24th and became less marked on 25th September. An east-west shear zone also ran roughly along 16°N over north peninsular India between 3.1 km to 7.6 km above mean sea level tilting southwards with height on 24th & 25th September. Under its influence, *fairly widespread – widespread* rainfall occurred over CAP & TEL on many days during 21st-27th September with *active* monsoon conditions over TEL on 24th, 25th & 26th and over CAP on 24th & 25th September. *Isolated heavy* rain occurred over TEL on five days & over CAP on three days with highest rainfall amount of **11 cm** reported at Podili (dist Prakasam) in CAP and at Devaruppal (dist Jangaon) in TEL on 25th. *Isolated heavy* rain also occurred over RYS on three days (22nd, 24th & 25th) with *active* monsoon conditions on 24th & 25th.

Further, *isolated heavy-very heavy* rain occurred over extreme northeastern parts of Tamilnadu on 21st, 24th & 26th with Chennai Zone 15 Sholinganallur reporting **17 cm** on 21st, Zone 02 D15 Manali reporting **15 cm** on 24th and Zone 07 Ambattur, Avadi (dist Tiruvallur), Zone 07 U18 D81 Vanagaram reporting **13 cm** each on 26th September.

The mean sea level isobaric analysis as on 24th /0830 IST and upper air streamline analysis as on 24th/0530 IST of September 2024 depicting the LOPAR and the associated upper air cyclonic circulation are presented in Fig.2(ix)a. Satellite imagery depicting the cloudiness associated with the system as on 31st/0815 IST of August 2024 is shown in Fig.2(ix)b. Maps of spatial rainfall distribution and rainfall intensity over CAP, RYS & TEL as on 24-hr ending 0830 IST of 24th & 25th Sep 2024 are depicted in Fig.2(ix)c.

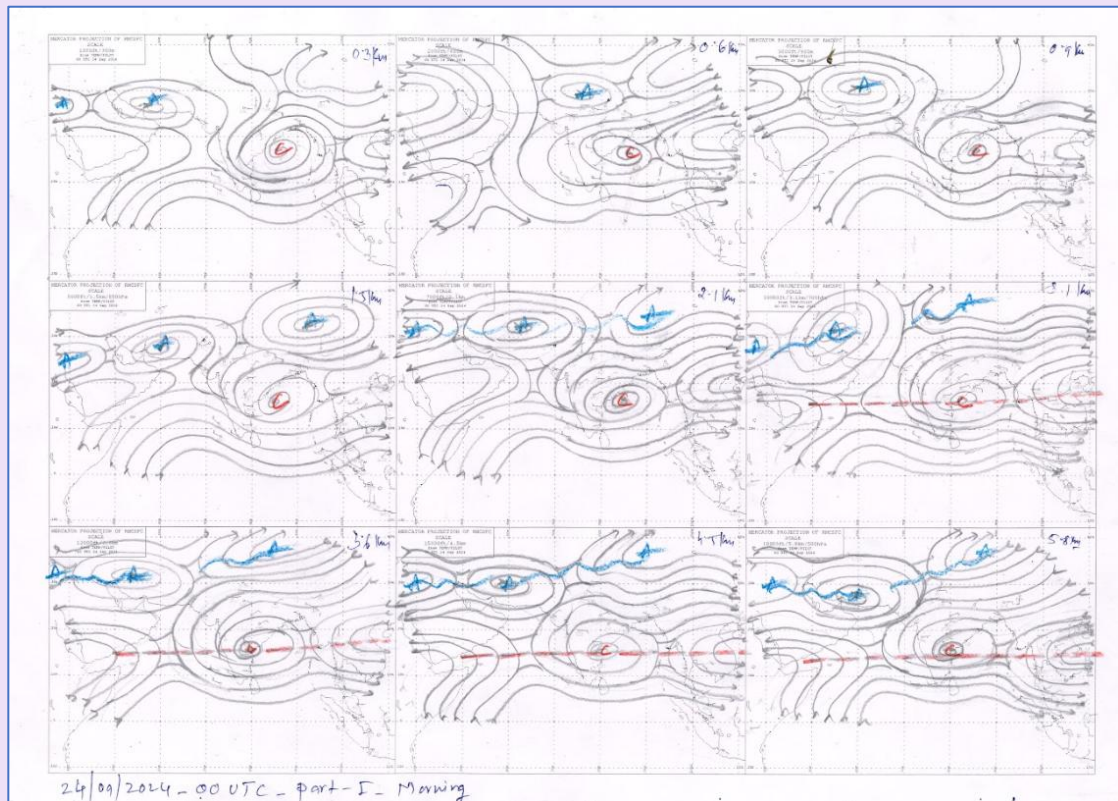
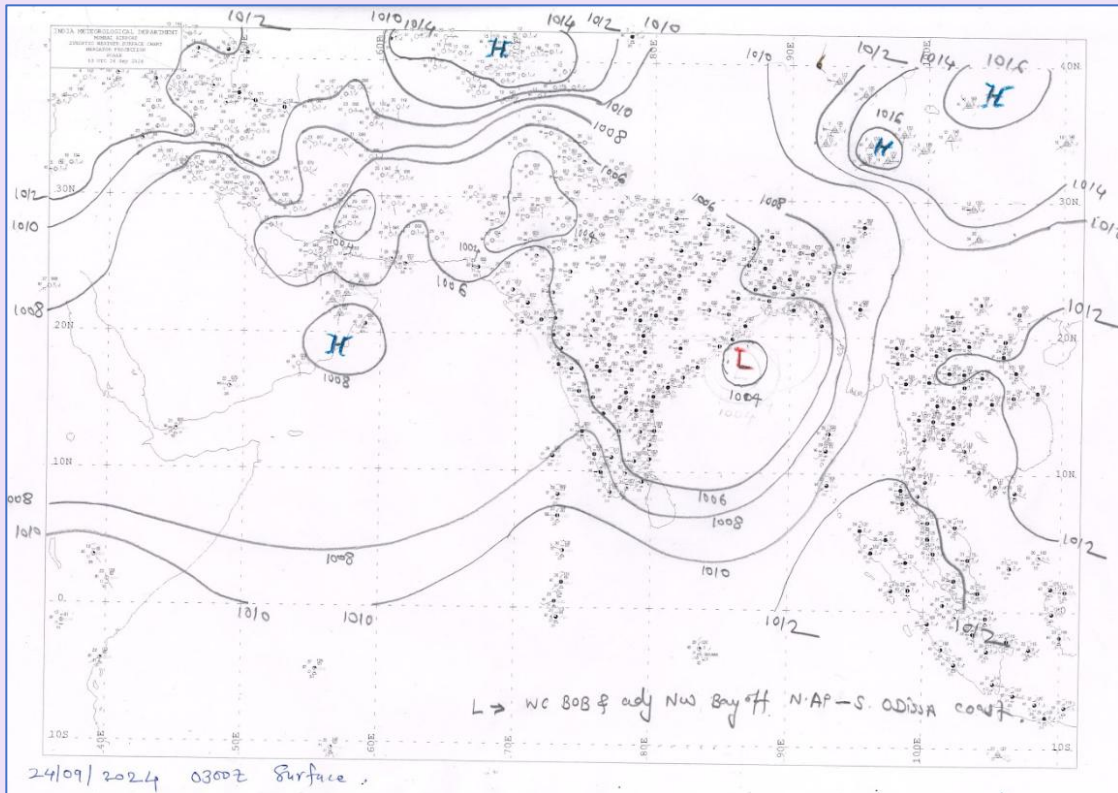


Fig.2(ix)a: Mean sea level isobaric analysis as on 24th /0830 IST and Upper air streamline analysis as on 24th / 0530 IST of Sep 2024

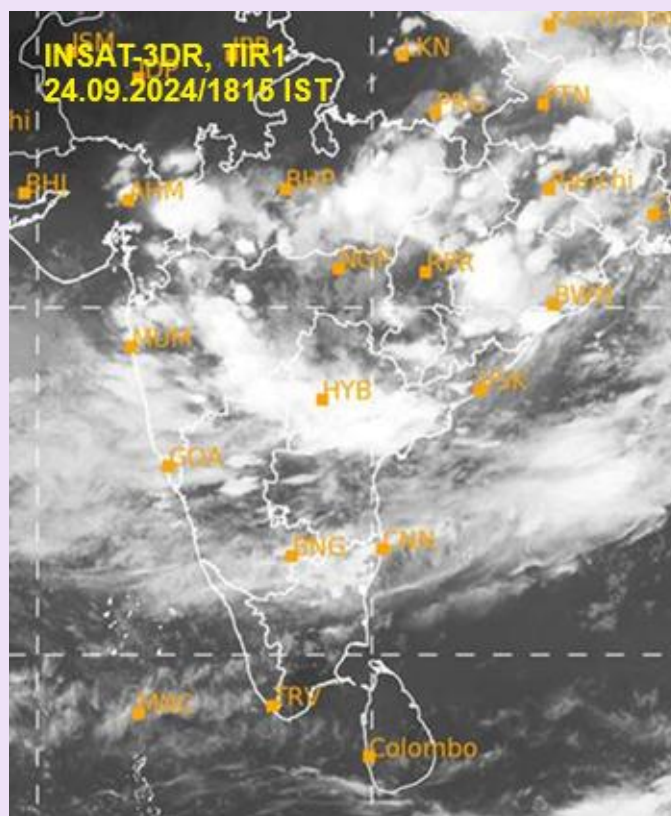


Fig.2(ix)b: INSAT-3DR, TIR1 infra red imagery as on 24th /1815 IST of Sep 2024

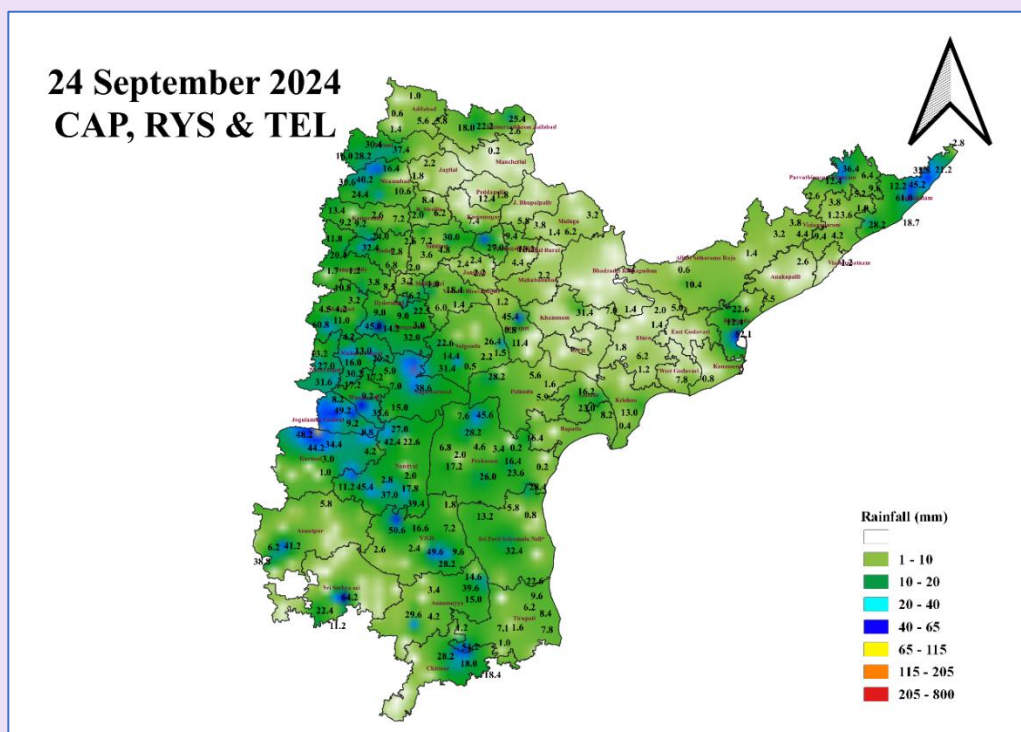


Fig.2(ix)c: Maps of spatial rainfall distribution and rainfall intensity over CAP, RYS & TEL as on 24-hr ending 0830 IST of 24th & 25th Sep 2024

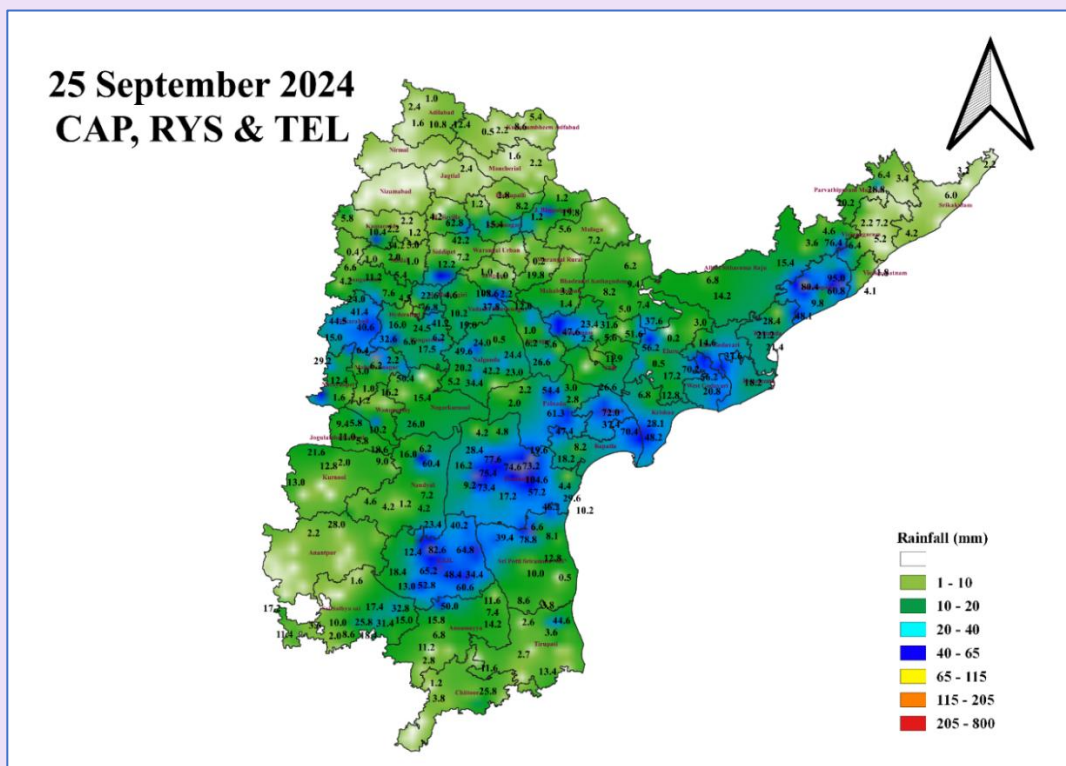


Fig.2(ix)c (contd.)

(x) **Other synoptic systems:** Aside from the above major synoptic systems, there were three other systems as detailed below. However, they did not contribute significantly towards rainfall over the SP region.

A **Cyclonic Storm (ASNA)** that formed as a Low Pressure Area over the Head Bay of Bengal on 16th Aug and moved across Bangladesh, West Bengal, Uttar Pradesh, Madhya Pradesh, Rajasthan & Gujarat during 16th-30th September with gradual intensification up to Deep Depression emerged into the Northeast Arabian Sea off Kachchh and the adjoining Pakistan coast on 30th morning. It then intensified into Cyclonic Storm ‘ASNA’ around 30th noon. Thereafter, moving westwards / south-southwest wards, it gradually weakened over Northwest – Westcentral Arabian sea during 02nd-03rd September. There was not much contribution to rainfall over the SP region due to this system.

Further, a **Depression** that formed over Northeast Madhya Pradesh and moved further northwards during 11th -13th September and a **Deep Depression** that formed over Northeast Bay of Bengal and moved across Bangladesh, West Bengal, Jharkhand, Chhattisgarh and Madhya Pradesh during 13th -18th September did not contribute much to rainfall over the SP region. Tracks of these three

systems are shown in Fig.2(x)(a-c).

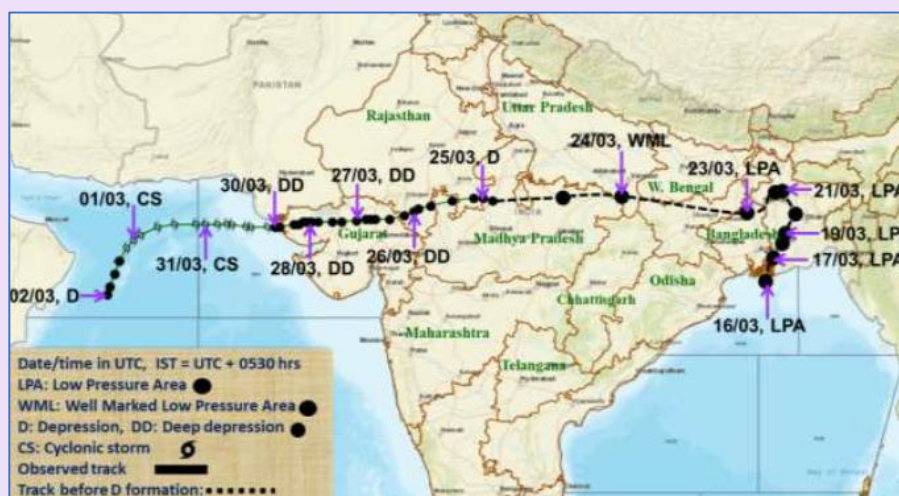


Fig.2(x)a: Track of Cyclonic Storm 'ASNA' over the Arabian Sea from the stage of Low Pressure Area during 16th Aug – 02nd Sep 2024

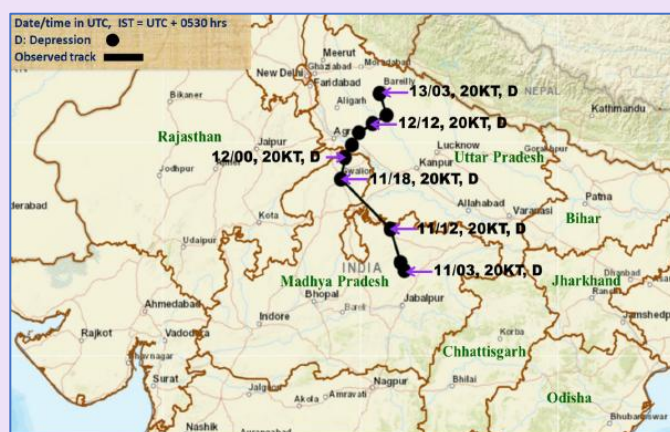


Fig.2(x)b: Track of Depression over Madhya Pradesh & neighbourhood during 11th-13th Sep 2024

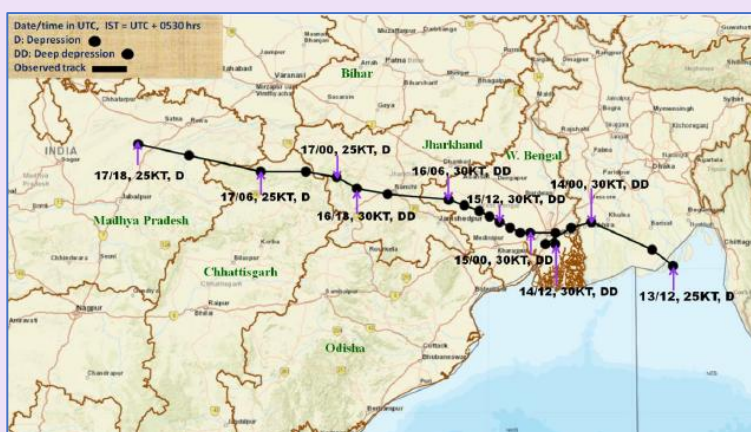


Fig.2(x)c: Track of Deep Depression over Northeast Bay of Bengal and neighbourhood during 13th-18th Sep 2024

2.2 Other major synoptic features and associated significant weather

(xi) **Off shore trough:** Presence of trough at mean sea level off the west coast of peninsular India / cyclonic circulations in the AS with a trough extending over the SP region, *fairly widespread – widespread* rainfall occurred on 87% (106/122) & 83% (101/122) of the days during the season (Jun-Sep 2024) over CK & KER respectively, 70% of the days over LAK, 30-40% of the days over SIK & NIK with *active to vigorous* monsoon conditions on 35 days over CK, 20-30 days over NIK & SIK and 18 days over KER during the season. There were 68, 70 & 58 days of *isolated heavy* rainfall activity including 40, 25 & 22 days of *very heavy* rainfall events with 11, 7 & 2 days of *extremely heavy* rainfall events over CK, SIK & KER respectively during the season. *Isolated extremely heavy* rainfall was reported over CK on 8th & 27th Jun, 04th, 07th, 08th, 14th, 15th, 16th, 18th & 19th July, and 01st Aug 2024; over SIK on 27th Jun, 04th, 16th, 17th, 19th, 30th & 31st July; over KER on 01st Jun & 30th July 2024. There were 4 days of *heavy* rainfall events over LAK with 3 days of *very heavy* rainfall reports and one day of *extremely heavy* rainfall report on 14th Aug 2024.

Over CK, the highest rainfall of **30 cm** was recorded at **Mulki (Dakshin Kannada district)** on 27th Jun; over SIK, **Agumbe (Shivamogga district)** recorded **33 cm** on 16th July and over KER, **Vadakkancherry (Thrissur district)** recorded **34 cm** on 30th July 2024.

Further, the western ghat areas of TN also received *heavy* rainfall on some such occasions. Over the Nilgiris and the western ghat areas of Coimbatore district, there were 31 & 24 days respectively of *isolated heavy* rainfall events including 12 & 4 days respectively of *very heavy* rainfall reports and 5 & 2 days respectively of *extremely heavy* rainfall reports. *Isolated extremely heavy* rainfall occurred over the Nilgiris district on 29th Jun and 16th, 17th, 19th & 30th July; and over the ghat areas of Coimbatore district on 16th & 30th July 2024. **Avalanche (Nilgiris district)** reported the highest rainfall amount of **37 cm** on 16th July. Over the ghat areas of Tirunelveli district, isolated heavy rain occurred on six days including one day of isolated very heavy rainfall event. Dindigul, Theni & Tenkasi districts reported isolated heavy rainfall on 3, 3 & 2 days respectively during the season.

During the later half of July, there were frequent occurrences of *very heavy to extremely heavy* rainfall over CK, SIK, KER & western ghat areas of TN. During the period 13th to 31st July 2024, there were 17, 13, 10 & 9 days of *very heavy to extremely heavy* rainfall events over CK, SIK, KER & western ghat areas of TN respectively. Especially, during the 24-hr ending 0830 IST of 16th July, *extremely heavy* rainfall occurred over three sub divisions - CK, SIK & TN; and again, during the 24-hr ending 0830 IST of 30th July, *extremely heavy* rainfall occurred over three sub divisions - SIK, KER & TN, in the region. Recurrent *heavy* rainfall activity led to devastating landslides over the Wayanad district of KER during the early hours of 30th July 2024.

Mean sea level isobaric analysis depicting the off shore trough off the west coast of peninsular India as on 15th /0830 IST of July 2024 and upper air streamline analysis as on 15th/0530 IST depicting the east-west shear zone between 3.1 & 7.6 km above mean sea level running roughly along 20°N and tilting southwards with height are shown in Fig.2(xi)a and Mean sea level isobaric analysis depicting the off shore trough off the west coast of peninsular India as on 29th /0830 IST & 30th/0830 IST of July 2024 are shown in Fig.2(xi)b. Satellite imageries depicting the cloudiness as as on 16th/0045 IST and 30th/0245 IST & Radar reflectivity as on 29th/1948 IST & 30th /0330 IST of July 2024 are presented in Fig.2(xi)c & d. Fig.2(xi)e presents the 24-hr accumulated rainfall over KER, KAR & TN as on 0830 IST of 16th & 30th July 2024 based on gauge observed and satellite based data. In Fig.2(xi)f, maps of topography of Kerala and adjoining KAR & TN and districts where extremely heavy rainfall was reported on 30th July 2024 are depicted. Fig.2(xi)g presents sample media reports indicating massive landslides and associated damages over Wayanad district of KER.

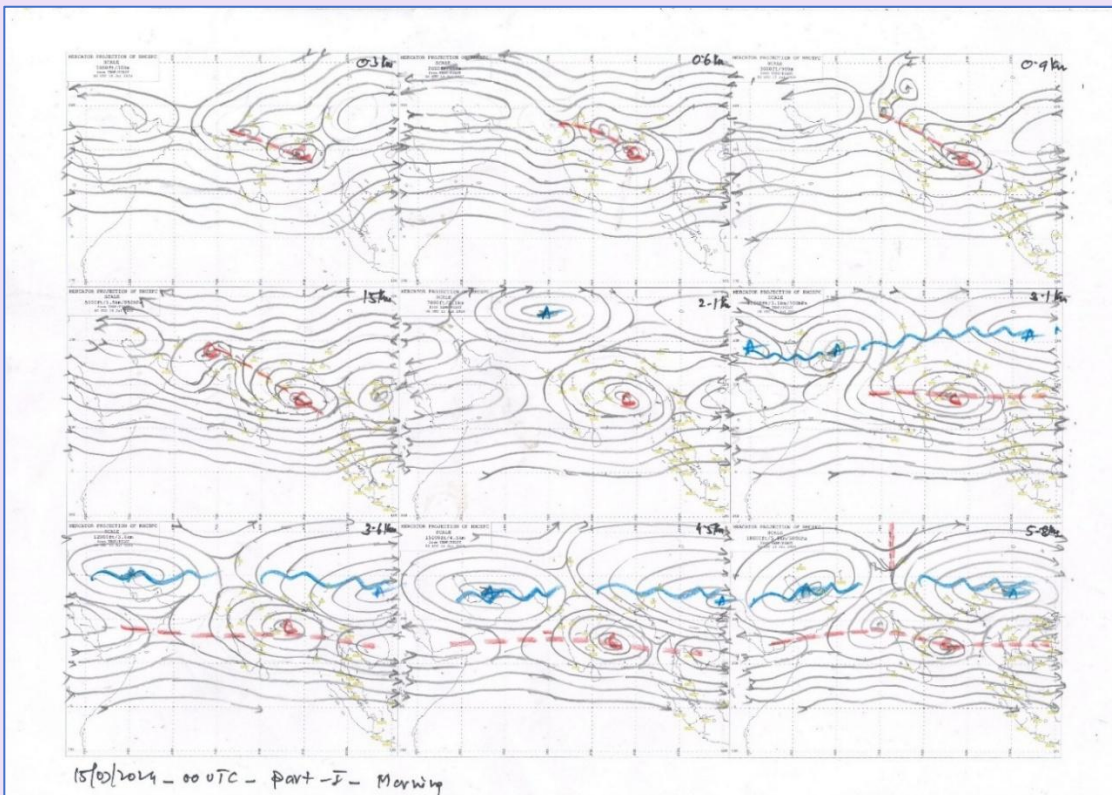
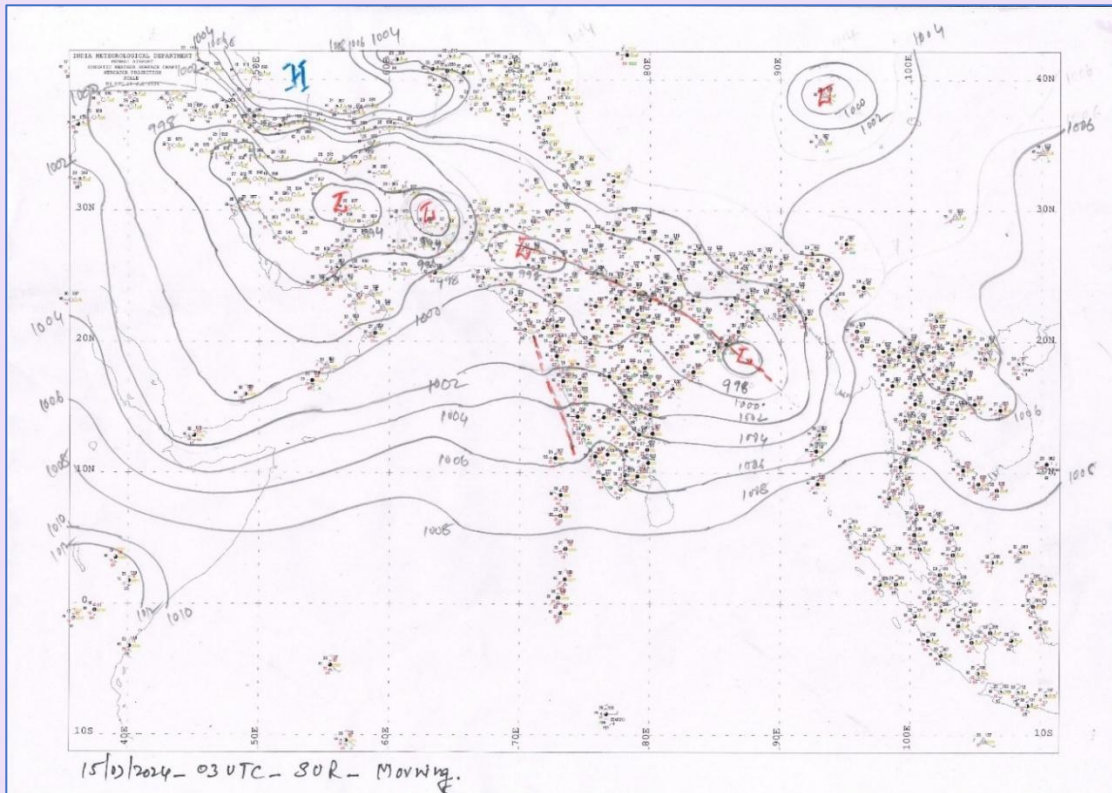


Fig.2(xi)a: Mean sea level isobaric analysis as on 15th /0830 IST and upper air streamline analysis as on 15th/0530 IST of July 2024

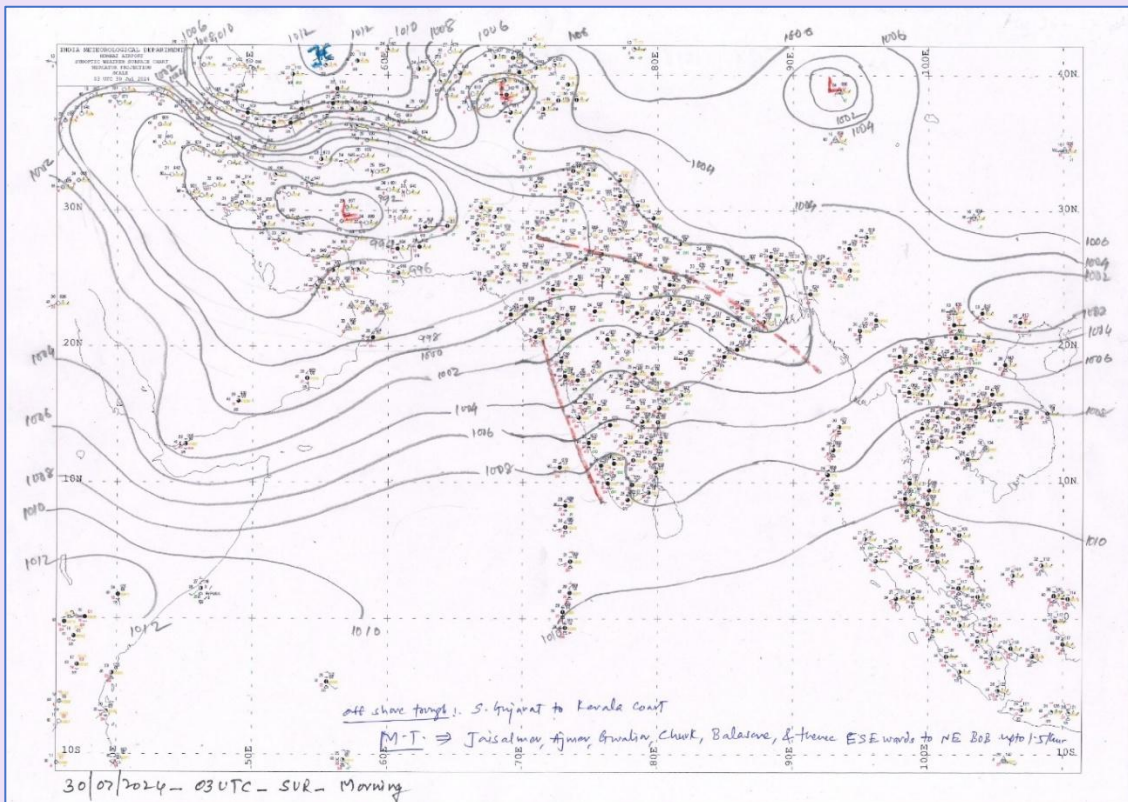
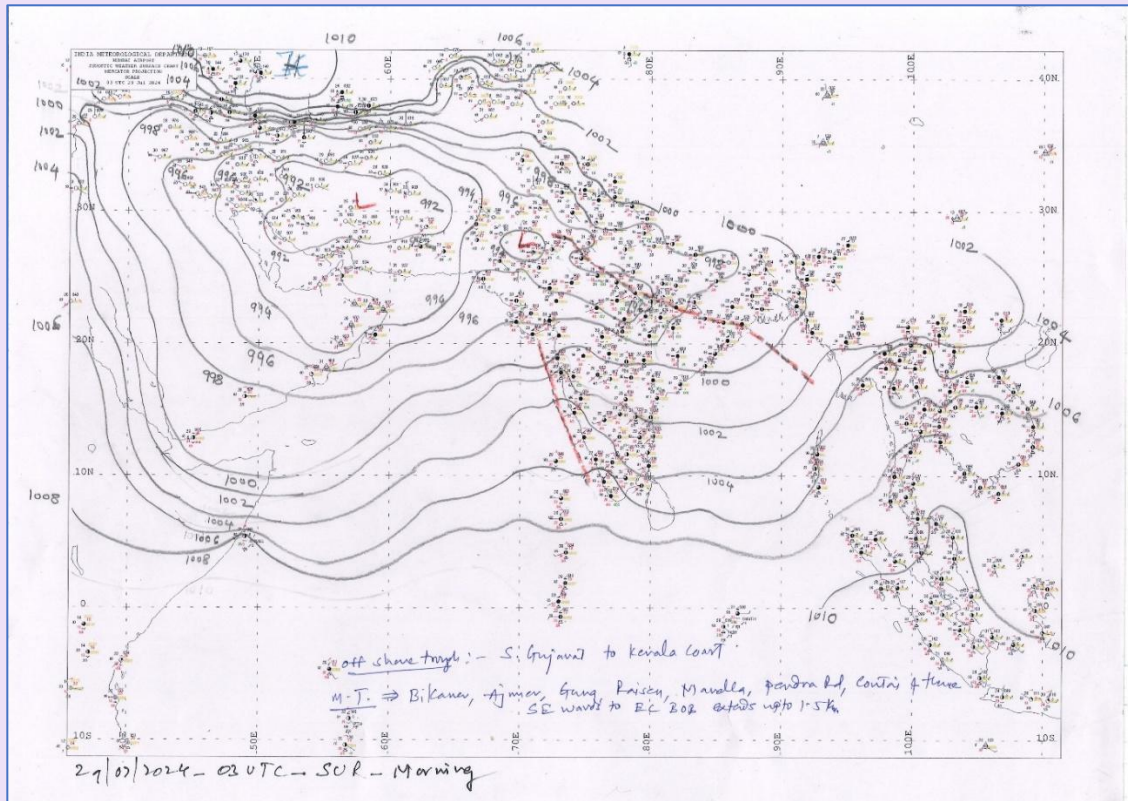


Fig.2(xi)b: Mean sea level isobaric analysis as on 29th /0830 IST and 30th /0830 IST of July 2024

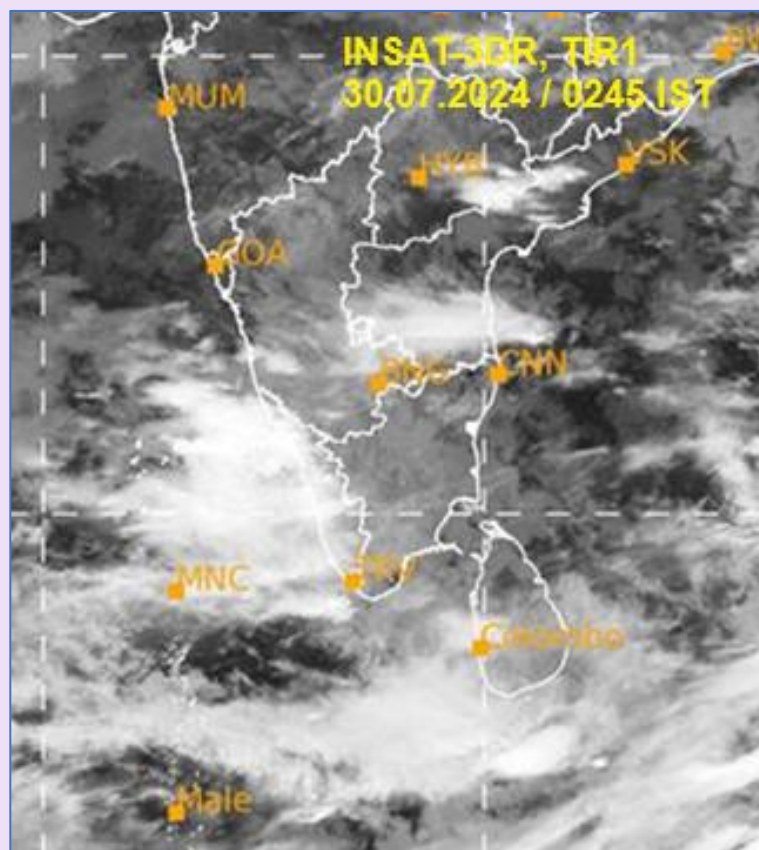
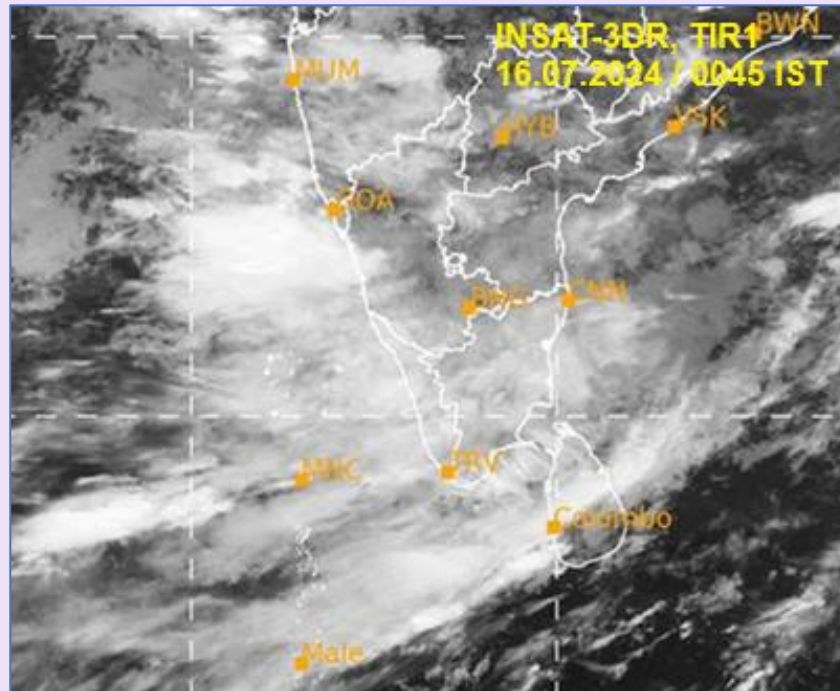


Fig.2(xi)c: INSAT-3DR, TIR1 infra red imagery as on 16th /0045 IST & 30th / 0245 IST of Jul 2024

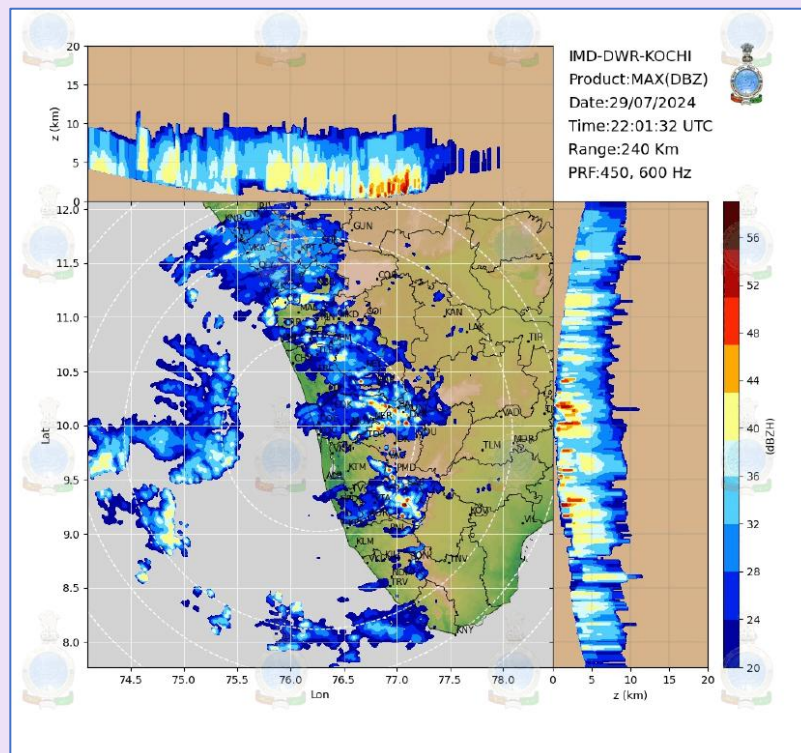
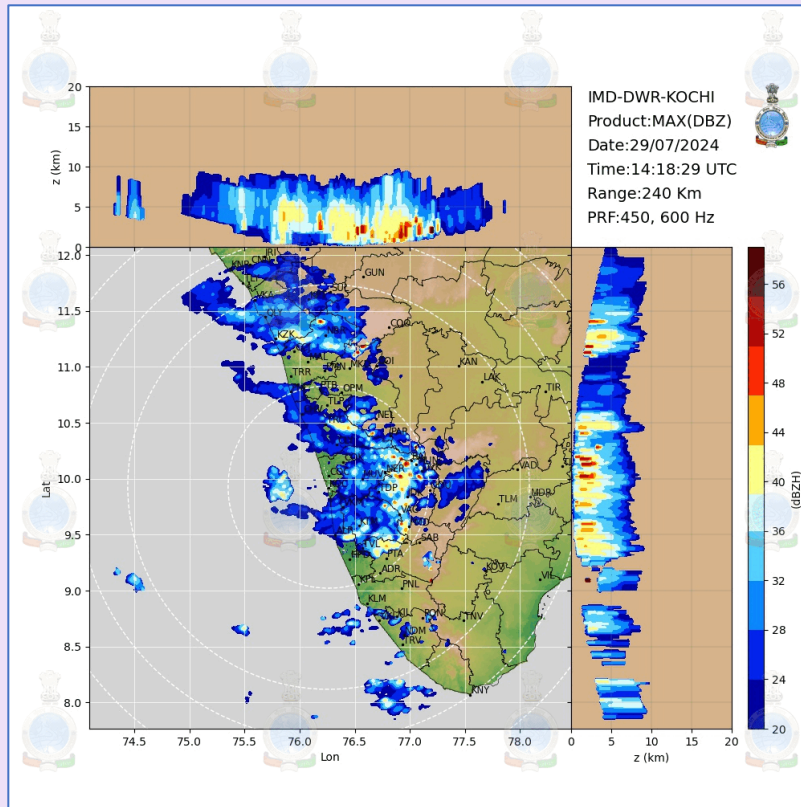


Fig.2(xi)d: DWR Kochi, maximum reflectivity product as on 29th/1948 IST & 30th /0330 IST of Jul 2024

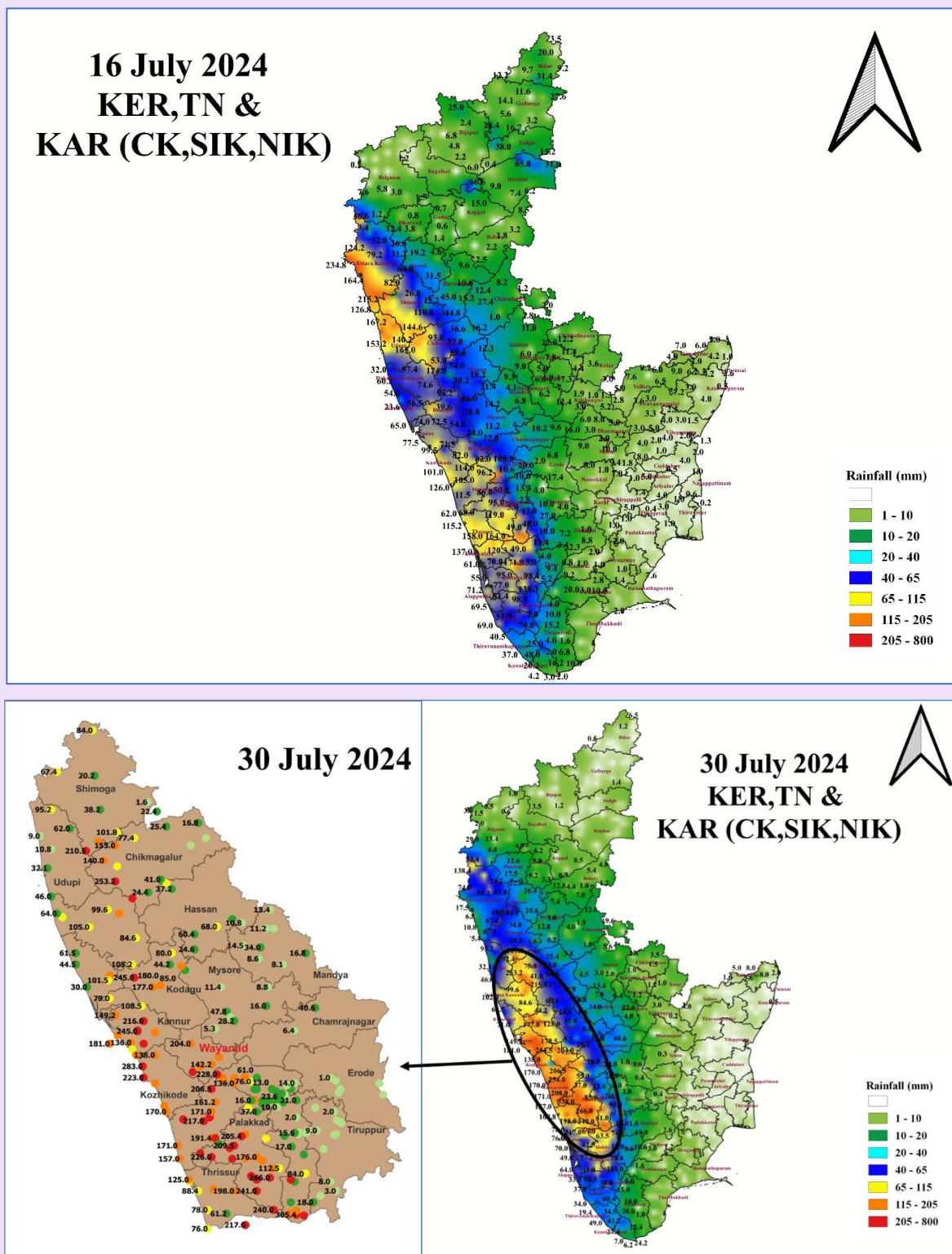


Fig.2(xi)e: 24-hr accumulated rainfall based on raingauge observations and satellite based GPM-Gauge merged rainfall ending 0830 IST of 16th & 30th July 2024 over KER, KAR & TN

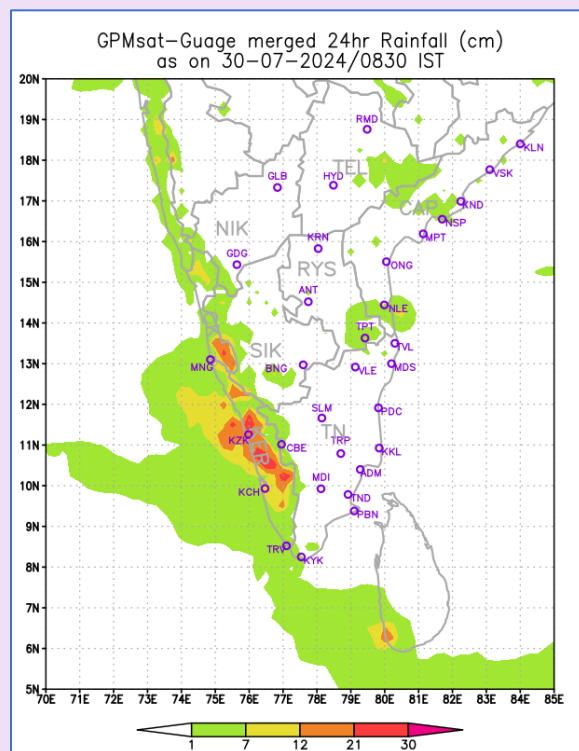
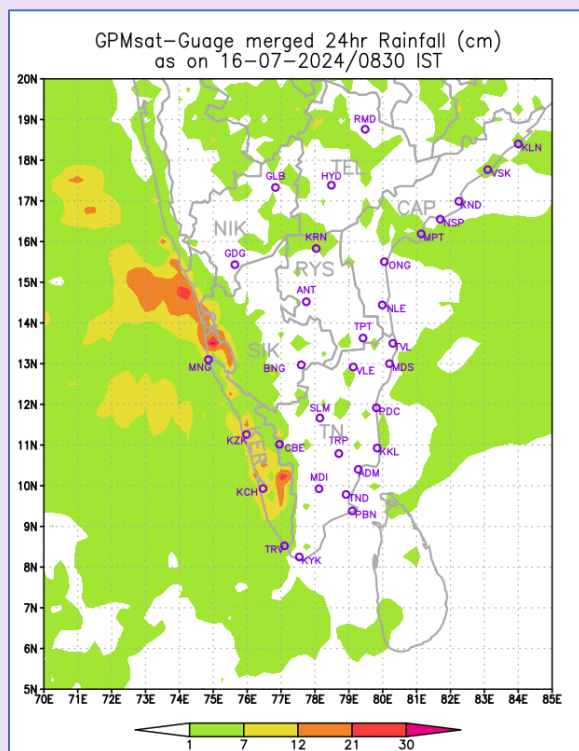


Fig.2(xi)e: (contd.)

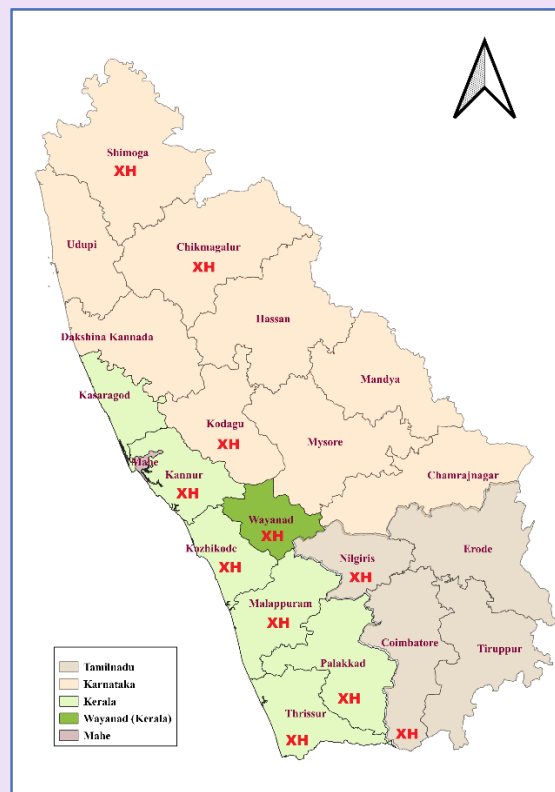
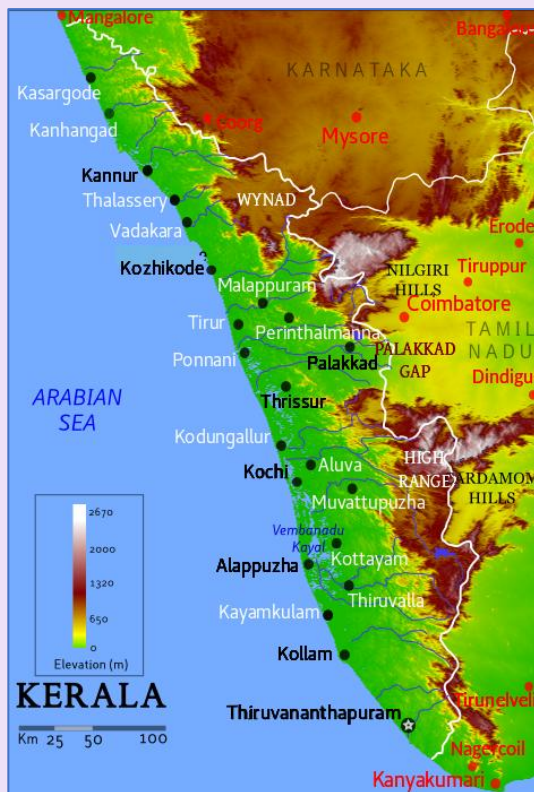


Fig.2(xi)f: Topography of western ghat regions of KER, TN & adjoining KAR (left) and districts where extremely heavy rainfall occurred on 30th July 2024 (right)



Wayanad Landslides Leave Behind A Trail of Death and Destruction -ETV Bharat, 5:24 PM, 30 Jul 2024 (IST)

THE HINDU

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Wayanad landslides updates: Highlights from July 30, 2024

Kerala Government seeks assistance from the Indian Army for rescue operations in the wake of the devastating landslides in Wayanad

Updated - July 31, 2024 11:12 am IST

THE HINDU BUREAU

1 READ LATER

Rescue operation underway after a landslide triggered by heavy monsoon rains, in Wayanad district, on July 30, 2024. | Photo Credit: PTI

Massive landslides hit Kerala's Wayanad district in the early hours of July 30, which buried a large area under debris, killing at least 123 people and leaving scores injured. The death toll is likely to go up further given the number of people missing. Prime Minister Narendra Modi announced an ex-gratia of ₹2 lakh for the next of kin of the deceased in the landslides that hit Kerala's Wayanad.

Wayanad landslides | What we know

- Multiple landslides hit Wayanad on July 30, 2024
- The landslides occurred around 2 am on Tuesday
- Over 106 people killed, several missing
- Hundreds are stranded in the area
- Chooralmala is 4km away from Mundakkai
- Both are small towns surrounded by hills and plantations
- Both locations are tourist attractions
- Several resorts and home stays are located here

Updated at 6.30 pm, July 30, 2024

The Hindu dated 31st July 2024.

Fig.2(xi)g: Sample media reports on the landslide and associated damages

(iii) **East-West shear zone / Upper air cyclonic circulation / North-South trough over the SP region:** East-west shear zone in the lower-mid tropospheric levels tilting southwards with height, upper air cyclonic circulation in the lower-mid tropospheric levels in the SP region, upper air cyclonic circulations in Bay of Bengal / Arabian sea with an east-west trough extending into the SP region and north-south trough in the lower levels in the SP region caused significant rainfall activity over the SP region during the season. A few cases are discussed below.

(a) Aside from the formation of a **Low Pressure Area** over Westcentral and adjoining North Bay of Bengal off North Andhra Pradesh – South Odisha coasts on 24th September as discussed under section 2.1 (ix) above, an east-west shear zone ran roughly along 16°N over the northern parts of the SP region between 3.1 km to 7.6 km above mean sea level tilting southwards with height on 24th Sep 2004. Under their influence, *fairly widespread – widespread* rainfall was reported over KER, KAR, CAP, RYS & TEL on 25th Sep with *isolated heavy to very heavy* rain over CK; and *isolated heavy* rain over SIK, NIK, CAP, RYS & TEL. *Active to vigorous* monsoon conditions prevailed over CK, NIK, CAP, RYS & TEL on that day. Upper air streamline analysis as on 24th/0530 IST indicating the East-West shear zone across the SP region tilting southwards with height is shown in Fig.2(xii)a. Satellite imagery depicting the cloudiness as on 24th/2215 IST is shown in Fig.2(xii)b. The 24-hr rainfall distribution and intensity over the SP region as on 0830 IST of 25th Sep 2024 is depicted in Fig.2(xii)c.

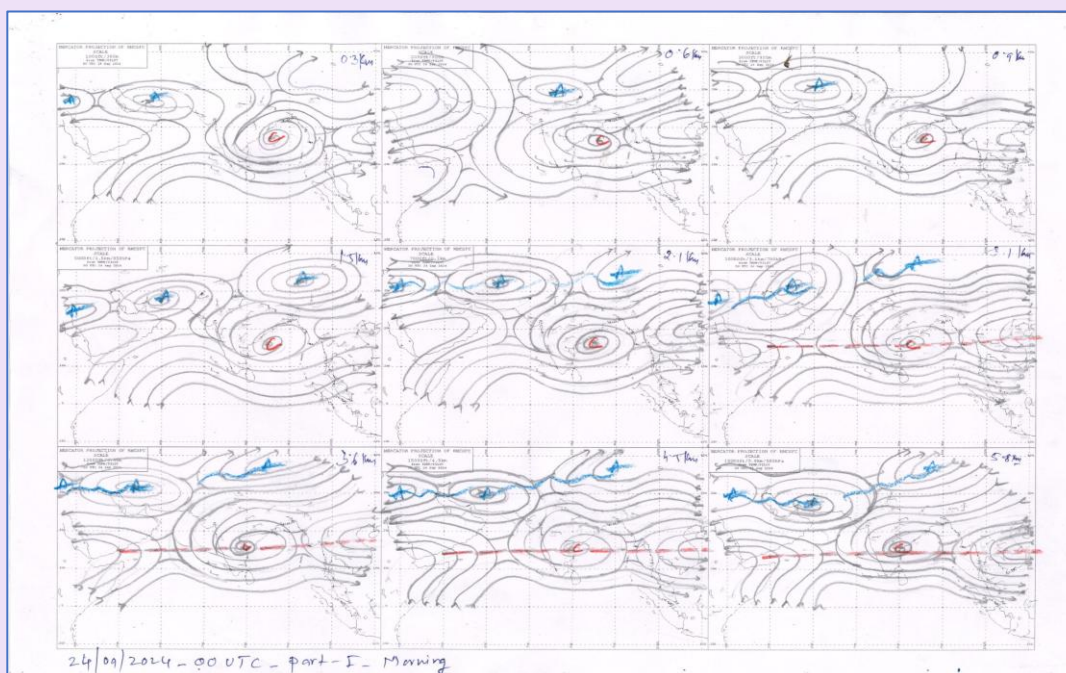


Fig.2(xii)a: Upper air streamline analysis as on 24th/0530 IST of Sep 2024

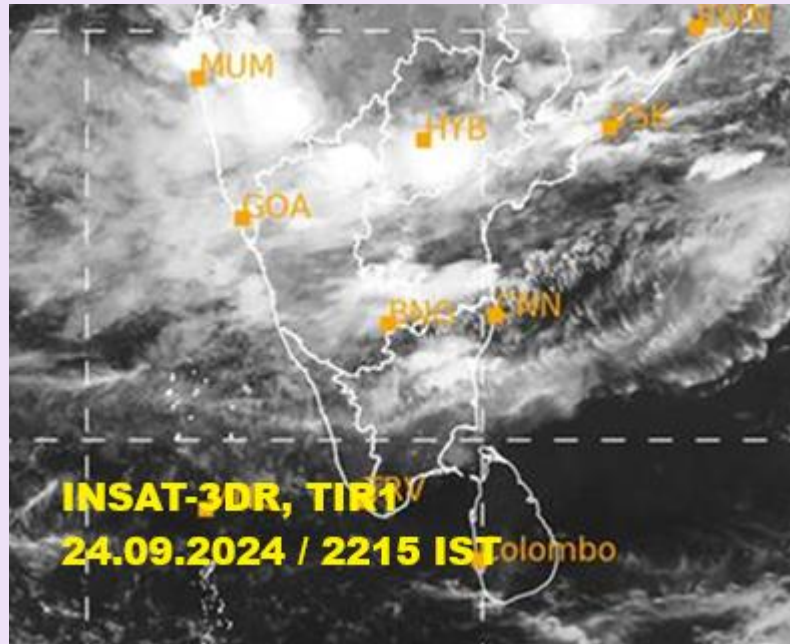


Fig.2(xii)b: INSAT-3DR infrared imagery as on 24th/2215 IST of Sep 2024

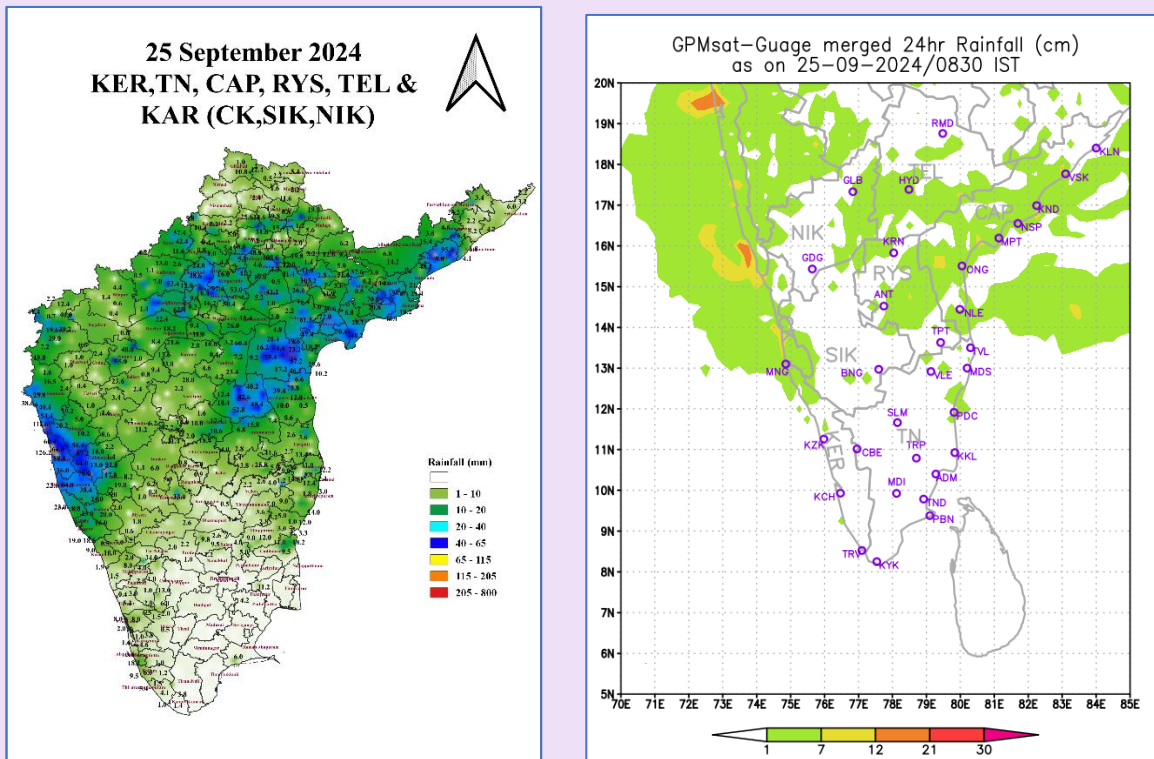


Fig.2(xii)c: 24-hr accumulated rainfall based on raingauge observations and satellite based GPM-Gauge merged rainfall ending 0830 IST of 25th Sep 2024 over the SP region

(b) Under the influence of an upper air cyclonic circulation over Interior Karnataka / Rayalaseema / North TN & neighbourhood extending upto mid tropospheric levels tilting southwestwards with height during 16th-20th Aug and a north-south trough running for NIK/ Rayalaseema to Comorin area / Kerala / Tamilnadu across the above cyclonic circulation in the lower tropospheric levels during 16th-19th Aug, *scattered - fairly widespread* rainfall occurred on *most* days during 17th-21st Aug over SIK, RYS & CAP. *Isolated - fairly widespread / widespread* rainfall occurred over NIK / TEL and *scattered* rainfall occurred over TN on all the days during the same period. *Isolated heavy to very heavy* rain occurred over TEL & RYS on 17th & 20th; and *isolated heavy* rain occurred over TEL on the other three days, over RYS on 21st, over TN on all the five days, over SIK & CAP on 3-4 days and over NIK on two days during this period. Highest rainfall of **17 cm** was reported at Yadagirigutta in Y. Bhuvanagiri district in TEL on 20th. *Active-Vigorous* monsoon conditions prevailed over TEL, NIK & SIK on 17th; over TEL, SIK, RYS, CAP & Interior TN on 20th; and over NIK, SIK, RYS & South TN on 21st August 2024. IMD-GFS analysis of 925 hPa wind as on 18th August, 0530 IST depicting the upper air cyclonic circulation over NIK and neighbourhood and North-South trough from this circulation to Kerala across Interior Tamilnadu is shown in Fig.2(xiii)a. Satellite imagery depicting the cloudiness as on 18th/1745 IST is shown in Fig.2(xiii)b.

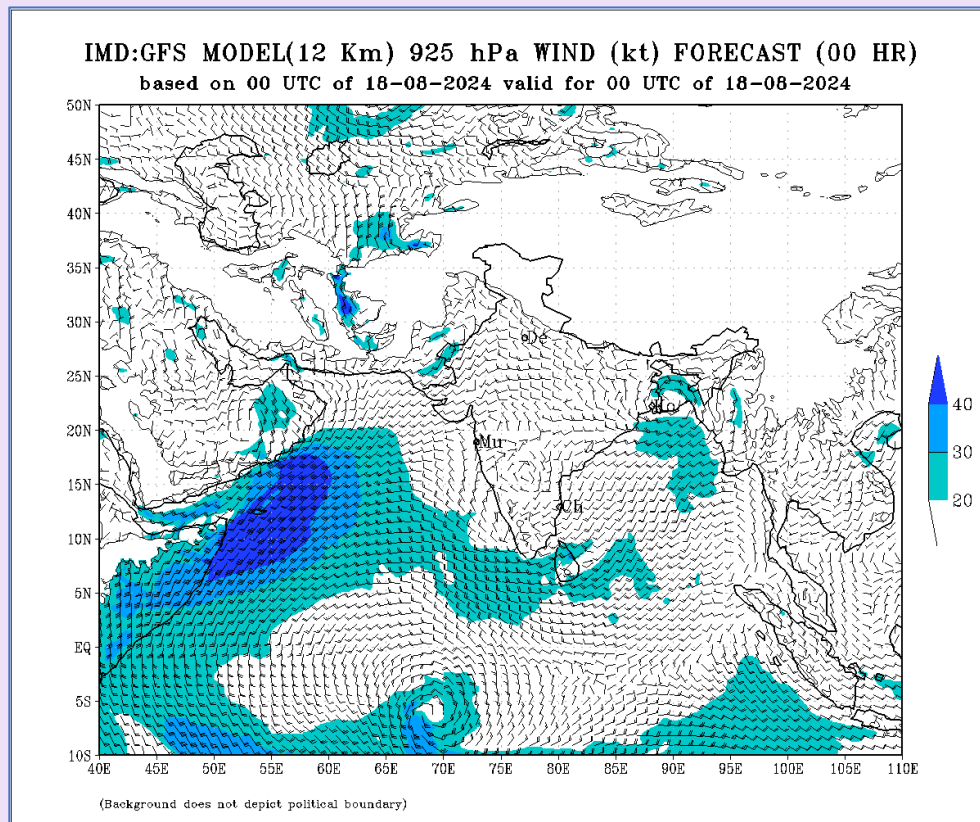


Fig.2(xiii)a: IMD-GFS, 925 hPa wind analysis as on 18th/0530 IST of Aug 2024

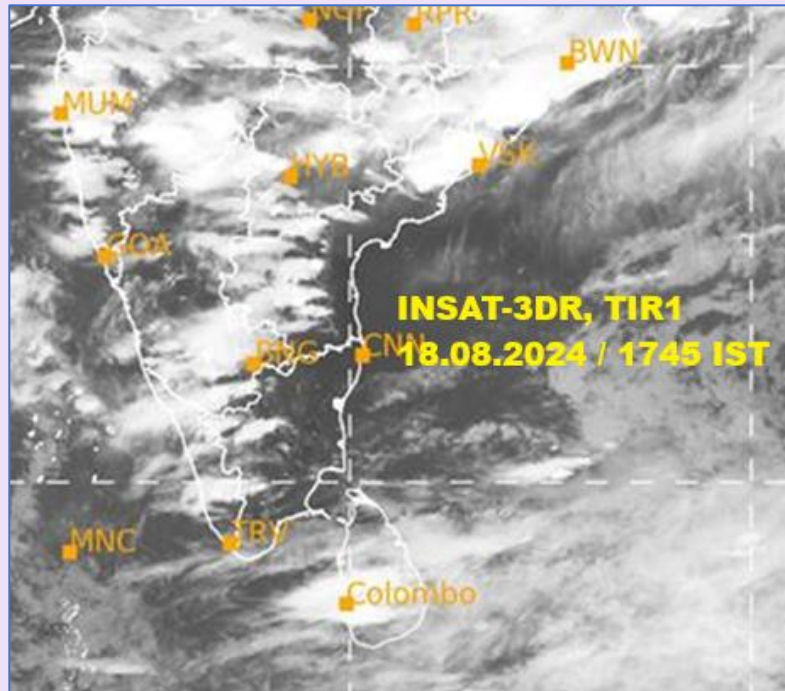


Fig.2(xiii)b: INSAT-3DR infrared imagery as on 18th/1745 IST of Aug 2024

24-hr accumulated rainfall as on 0830 IST of 17th & 20th August based gauge and satellite based data are depicted in Fig.2(xiii)c.

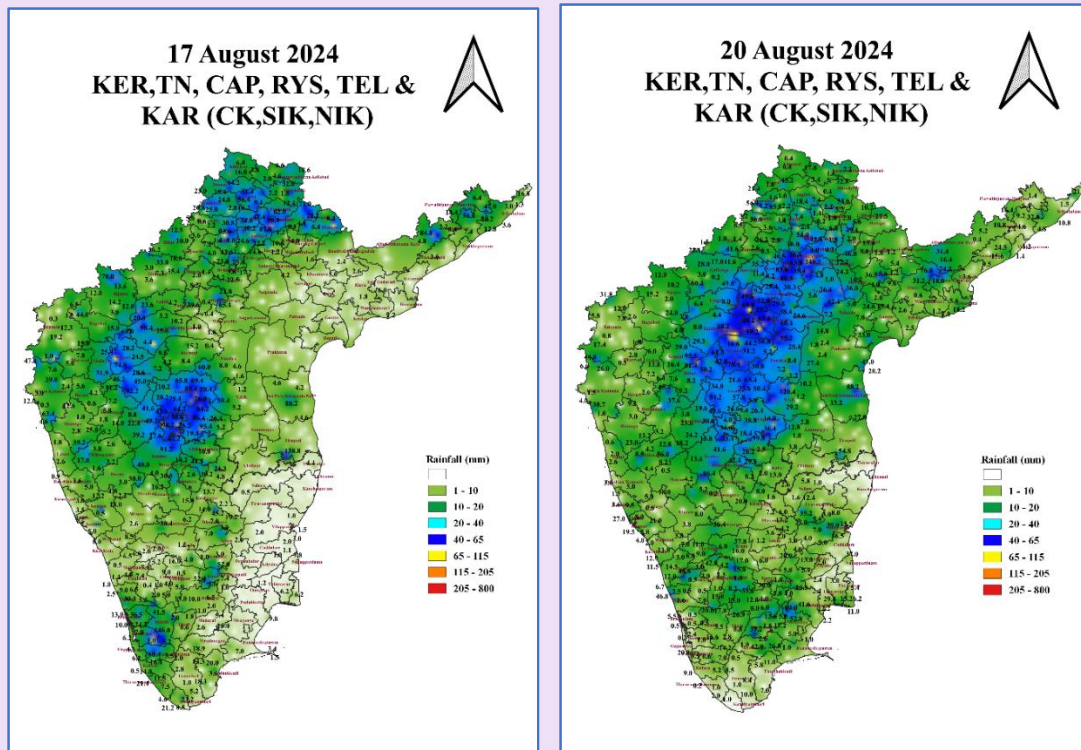


Fig.2(xiii)c: 24-hr accumulated rainfall based on raingauge observations and satellite based GPM-Gauge merged rainfall ending 0830 IST of 17th & 20th Aug 2024 over the SP region

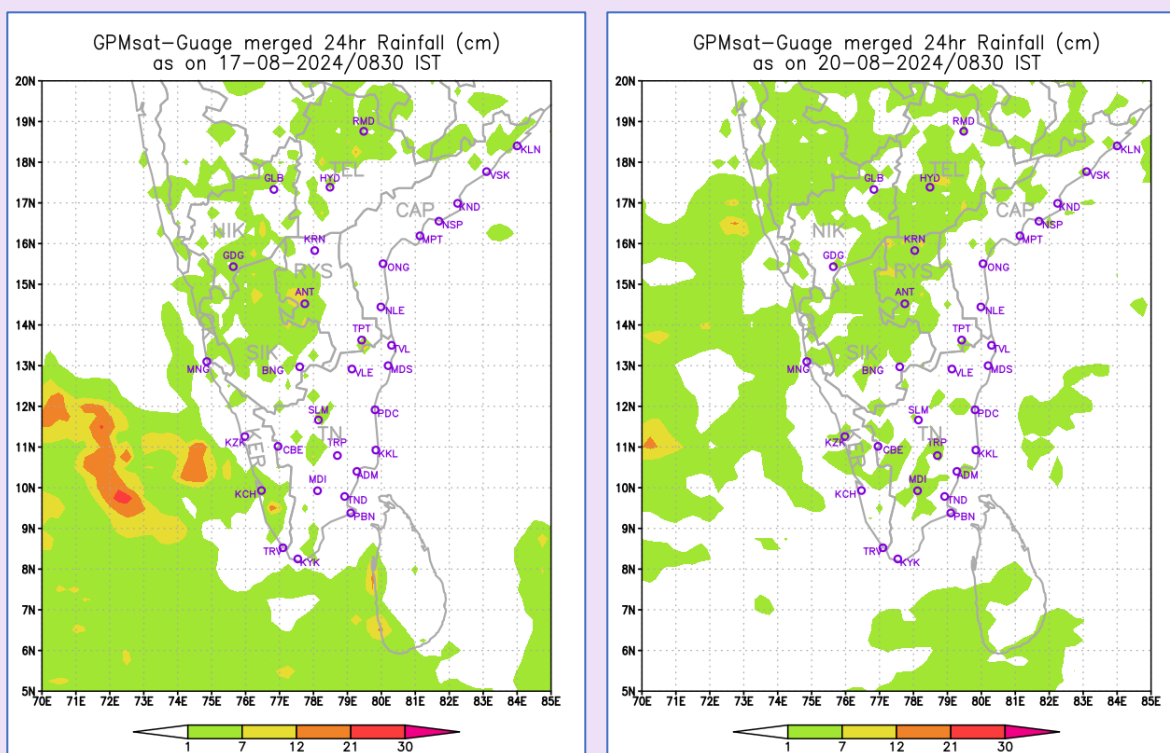


Fig.2(xiii)c: (contd.)

3. Rainfall distribution

3.1 Seasonal sub-divisional rainfall

The SWM seasonal rainfall (June-September) during 2024 over the country as a whole was 108% (93 cm) of its long period average (LPA) of 87 cm and that over the SP region was 114% (81 cm) of its LPA of 72 cm.

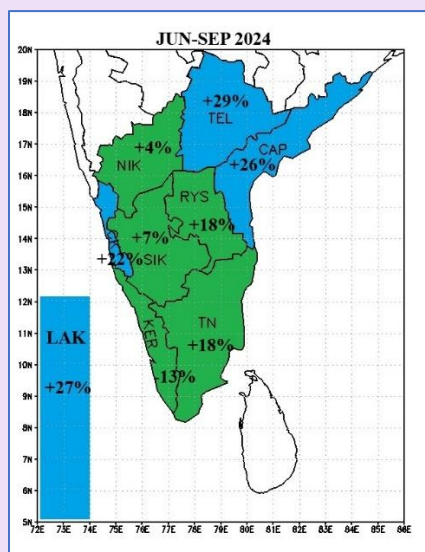
The spatial rainfall distribution is determined in terms of percentage departure from normal (PDN) over 36 meteorological subdivisions in the country. As per IMD's classification of monsoon performance over a meteorological subdivision, if the amount of rainfall received over a region (expressed as PDN) is between -19% and +19%, the monsoon performance is termed as *normal*. If the PDN is between -20% and -59%, the region comes under *deficient* category, if PDN is less than or equal to -60%, the region falls under *scanty* rainfall category, PDN of +20% to +59% indicates *excess* rainfall category and if the PDN is greater than or equal to +60%, it is termed as *large excess*.

During SWM 2024, all the nine subdivisions in the SP region received *normal* to *excess* rainfall. Whereas TEL, CAP, CK & LAK received *excess* rainfall, the other five subdivisions

[KER, SIK, NIK, RYS & TN] came under *normal* category. The seasonal rainfall figures over the nine subdivisions CAP, TEL, RYS, TN, CK, NIK, SIK, KER & LAK were +26%, +29%, +18%, +18%, +22%, +04%, +07%, -13%, and +27% respectively. The cumulative seasonal (01st June to 30th Sep 2024) rainfall figures for the nine meteorological subdivisions of the SP region are presented in Table-3.1 and Fig.3(i).

Table-3.1: Seasonal sub-divisional rainfall distribution over the SP region during the SWM season, 2024 (01st June-30th Sep 2024)

SUB-DIVISION	Actual rainfall (mm)	Normal rainfall (mm)	Percentage departure from normal (%)
COASTAL AP & YANAM (CAP)	755.9	601.4	+26
TELENGANA (TEL)	948.5	734.8	+29
RAYALASEEMA (RYS)	482.5	408.6	+18
TAMILNADU, PUDUCHERRY & KARAIKAL (TN)	389.2	328.5	+18
COASTAL KARNATAKA (CK)	3766.6	3093.9	+22
NORTH INTERIOR KARNATAKA (NIK)	498.4	480.8	+04
SOUTH INTERIOR KARNATAKA (SIK)	726.5	678.4	+07
KERALA & MAHE (KER)	1748.1	2018.6	-13
LAKSHADWEEP (LAK)	1304.2	1026.6	+27



<i>Largely Deficient</i>	<i>Deficient</i>	<i>Normal</i>	<i>Excess</i>	<i>Large Excess</i>
≤-60%	-20%to-59%	-19%to+19%	+20% to+59%	≥+60%

Fig.3(i): Seasonal Sub-divisional rainfall (in percentage departures from normal) during Jun-Sep 2024 over the SP region

3.2 Monthly sub-divisional rainfall

The monthly sub-divisional rainfall scenario during the SWM 2024 season is presented in Table-3.2 and Fig.3(ii). It is noted that CAP, TEL & CK received *normal to excess/large excess* rainfall during all the four months of the season. However, KER became *deficient* (-24% to -31%) during all the three months of the season excepting July when *normal* rainfall (+16%) was recorded over this subdivision.

Whereas eight out of nine subdivisions received *normal / excess / large excess* rainfall during June, July & August, during September, excepting three subdivisions (CAP, TEL & CK) that received *excess/ large excess* rainfall, all the other six subdivisions became *deficient* with TN recording *large deficiency* (-64%).

Large excess rainfall was recorded over RYS (+122%) & TN (+115%) in June, over CK (+67%) & SIK (+60%) in July, over TN (+78%) & LAK (+146%) in August, and over TEL (+85%) in September 2024.

Table-3.2: Monthly sub-divisional rainfall performance during SWM 2024

2024	Jun			Jul			Aug			Sep		
Sub division	Actual rainfall	Normal rainfall	PDN (%)	Actual rainfall	Normal rainfall	PDN (%)	Actual rainfall	Normal rainfall	PDN (%)	Actual rainfall	Normal rainfall	PDN (%)
	(mm)	(mm)		(mm)	(mm)		(mm)	(mm)		(mm)	(mm)	
CAP	144.6	109.5	+32	217.4	158.6	+37	172.9	170.3	+2	221	163	+36
TEL	153.5	131.4	+17	290.8	218.5	+33	209.7	226.1	-7	294.6	158.8	+85
RYS	160.9	72.3	+122	70.3	92.1	-24	160.3	107.3	+49	91.1	136.9	-33
TN	109.2	50.8	+115	77.2	69.0	+12	159.9	90.1	+78	42.8	118.7	-64
CK	743.5	863.6	-14	1814	1088.9	+67	775.1	821.3	-6	433.9	320.1	+36
NIK	132	105.3	+25	138.9	116.5	+19	125.7	119.4	+5	101.8	139.6	-27
SIK	140.4	149.7	-6	321.3	200.6	+60	189.1	179.5	+5	75.7	148.6	-49
KER	490.1	648.2	-24	759.9	653.5	+16	311.1	445.2	-30	187	271.8	-31
LAK	328.3	335.6	-2	312.5	289.3	+8	570.2	232	+146	93.2	169.7	-45

PDN: Percentage Departures from Normal

<i>Largely Deficient</i>	<i>Deficient</i>	<i>Normal</i>	<i>Excess</i>	<i>Large Excess</i>
≤-60%	-20%to-59%	-19%to+19%	+20% to+59%	≥+60%

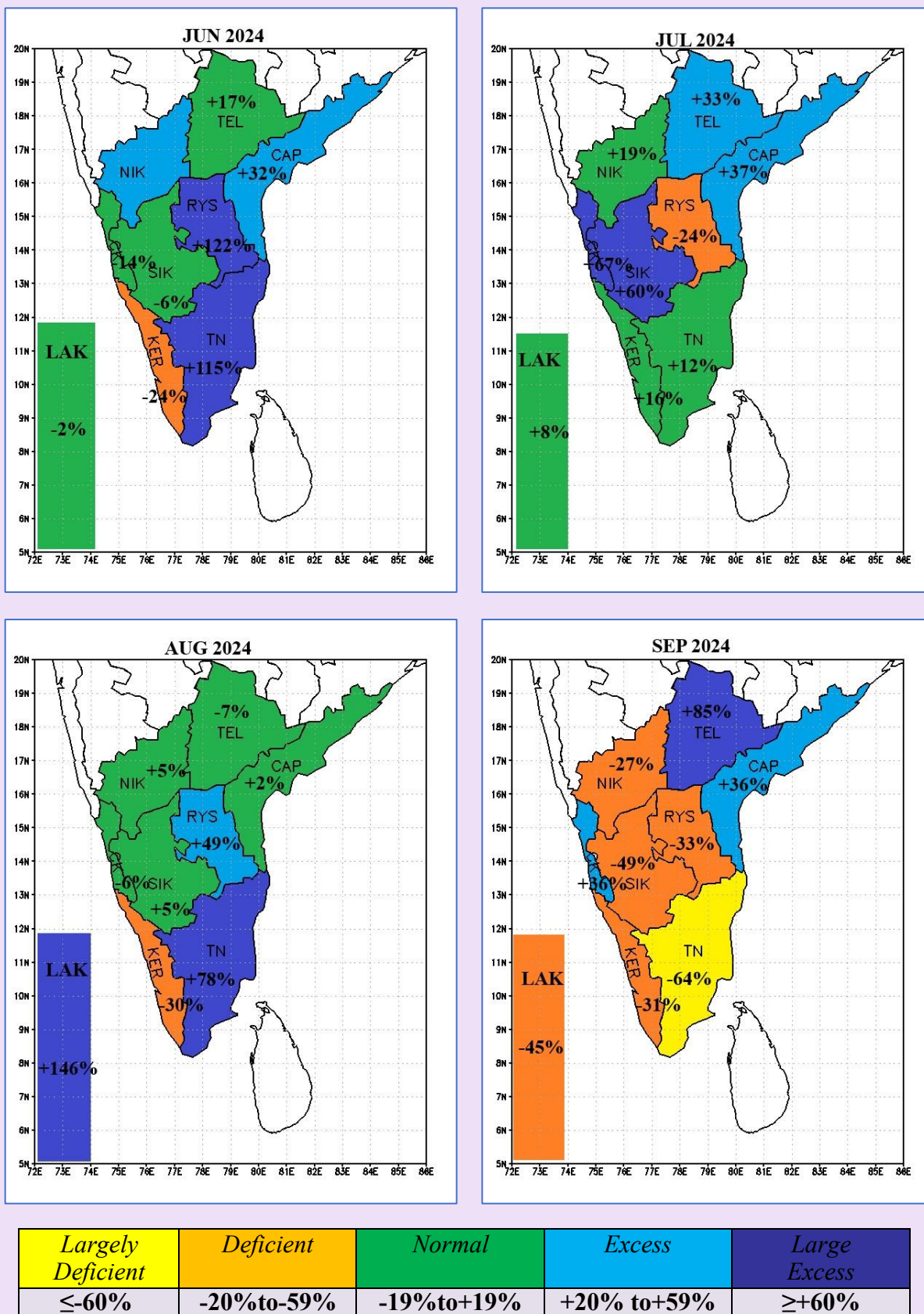


Fig.3(ii): Monthly sub-divisional rainfall distribution during Jun-Sep2024

Kindly refer Appendix-(i)-(iv) in pages 98-99 for description of technical terms

3.3 Weekly sub-divisional rainfall progress

Week by week and cumulative weekly performance of SWM 2024 over the SP region are presented in Table-3.3a and Table-3.3b respectively.

Table-3.3a: Week by week sub-divisional rainfall during June-Sep 2024 over the SP region

SUB-DIVISION	SWM 2024: WEEK-BY-WEEK: PDN (%)																	
	05-Jun	12-Jun	19-Jun	26-Jun	03-Jul	10-Jul	17-Jul	24-Jul	31-Jul	07-Aug	14-Aug	21-Aug	28-Aug	04-Sep	11-Sep	18-Sep	25-Sep	02-Oct
CAP	+158	+21	-42	-11	+80	-12	+46	+143	-32	+4	-31	-49	-28	+278	+119	-97	+15	-57
TEL	+96	+19	-33	+9	+44	-4	+17	+110	+4	-12	-46	+13	-14	+393	+77	-96	+8	-50
RYS	+124	+277	+152	-39	-35	-19	+8	-26	-73	+37	+46	+183	-64	+72	-53	-99	+12	-53
TN	+74	+199	+44	+124	+1	-24	+122	-36	-12	+131	+312	+48	-88	-21	-77	-93	-65	-30
CK	-65	+57	-73	-10	+7	+80	+76	+91	+57	+70	-66	-79	+41	+42	+69	-23	+77	-12
NIK	+26	+163	-10	-58	-30	-16	0	+57	+35	-31	-33	+100	+15	+48	-46	-96	+32	-60
SIK	-1	+73	-52	-42	+4	-1	+54	+90	+110	-9	0	+73	-32	-8	-41	-84	-44	-42
KER	-16	-27	-79	+22	-20	-36	+56	-10	+79	-38	-49	-38	-61	+89	-1	-69	-64	-46
LAK	-85	-47	-77	+194	-18	-30	+77	+16	-3	+70	+117	+416	+49	-8	-37	-50	-69	-31

Table-3.3b: Weekly cumulative sub-divisional rainfall during Jun-Sep 2024

SUB-DIVISION	SWM 2024: CUMULATIVE WEEK ENDING : PDN (%)																	
	05-Jun	12-Jun	19-Jun	26-Jun	03-Jul	10-Jul	17-Jul	24-Jul	31-Jul	07-Aug	14-Aug	21-Aug	28-Aug	04-Sep	11-Sep	18-Sep	25-Sep	02-Oct
CAP	+215	+80	+24	+14	+30	+21	+26	+46	+35	+31	+24	+17	+13	+34	+39	+30	+29	+26
TEL	+28	+48	+8	+8	+18	+12	+13	+31	+27	+22	+13	+13	+11	+38	+40	+33	+31	+29
RYS	+182	+237	+208	+148	+117	+91	+74	+59	+41	+40	+41	+56	+42	+44	+36	+22	+22	+18
TN	+74	+169	+129	+128	+104	+79	+88	+67	+56	+65	+93	+86	+66	+58	+44	+29	+21	+18
CK	-63	+25	-28	-22	-14	+4	+16	+27	+31	+35	+26	+19	+20	+21	+22	+21	+22	+22
NIK	+66	+126	+72	+39	+25	+18	+15	+21	+23	+16	+11	+18	+18	+20	+15	+6	+8	+4
SIK	+33	+57	+8	-6	-4	-4	+7	+20	+32	+27	+24	+28	+23	+21	+18	+12	+9	+7
KER	-16	-23	-47	-27	-25	-27	-15	-14	-4	-4	-10	-12	-14	-10	-9	-11	-13	-13
LAK	-85	-63	-68	-6	-8	-11	+1	+3	+3	+3	+15	+42	+43	+40	+36	+32	+29	+27

<i>Largely Deficient</i>	<i>Deficient</i>	<i>Normal</i>	<i>Excess</i>	<i>Large Excess</i>
≤-60%	-20% to -59%	-19% to +19%	+20% to +59%	≥+60%

As seen, during the SWM season of 2024, during the week ending 17th July, all the nine sub divisions in the region received *normal to large excess* rainfall and during the week ending 04th September, excepting TN that became *deficient*, all the other eight sub divisions received *normal to large excess* rainfall. During the week ending 18th September, all the nine sub divisions and during the week ending 02nd October, eight out of the nine sub divisions in the region became *deficient – largely deficient*.

CK recorded *normal to large excess* rainfall during 13 out of 18 weeks in the season with *excess – large excess* rainfall continuously for five weeks from the week ending 10th July to the week ending 07th August. KER recorded *deficient- largely deficient* rainfall during 11 out of 18 weeks in the season with 7 out 9 weeks during the second half of the season. LAK recorded large excess rainfall of +416% during the week ending 21st Aug and TEL & CAP recorded +393% & +278% respectively during the week ending 04th September 2024.

With regard to the cumulative week ending performance, six of the nine sub divisions (CAP, TEL, RYS, TN, NIK & SIK) were under *normal – large excess* category throughout the season with RYS & TN coming under excess / large excess throughout till the 17th week (week ending 25th September) and then ending up under *normal* category during the last week (week ending 02nd October). The other three sub divisions, CK, KER & LAK, came under *deficient / largely deficient* category only till the week ending 10th July and thereafter, KER came under *normal* category and the other two sub divisions (CK & LAK) came under *normal to excess* category till the end of the season.

3.4 Daily sub-divisional rainfall and monsoon activity

Table-3.4a presents daily spatial rainfall distribution over various subdivisions of the SP region during the SWM 2024 and Table-3.4b, the percentage frequency of various categories of spatial rainfall distribution over each subdivision during the season.

Table-3.4a: Daily sub-divisional rainfall distribution over the SP region during SWM 2024

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

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

Table-3.4b: Percentage frequency of various categories of daily spatial rainfall distribution over the subdivisions of the SP region during SWM season, 2024

Category	Frequency (%)								
	CAP	TEL	RYS	TN	CK	SIK	NIK	KER	LAK
WS	13	20	5	1	76	14	9	58	49
FWS	22	28	16	8	11	26	24	25	21
SCT	35	23	27	30	7	38	38	11	25
ISOL	28	29	45	61	6	22	28	7	0
DRY	2	0	7	0	0	0	2	0	4

WS: Widespread; FWS: Fairly Widespread; SCT: Scattered; ISOL: Isolated; DRY: No rain
(Note: Kindly refer Appendix(i) for explanations on categorisation of spatial rainfall distribution)

As seen, *fairly widespread* to *widespread* rainfall occurred over CK, KER & LAK on 87%, 83% & 70% of the days respectively during the season. *Scattered* to *widespread* rainfall occurred over SIK on 78% of the days and over CAP, TEL & NIK, on 70% of the days. *Isolated* rainfall / *dry* conditions prevailed over TN & RYS on 61% & 52% respectively of the days during the season. On 16th July, all the nine sub-divisions in the region reported *fairly widespread* to *widespread* rainfall.

Table-3.4c presents the monthly and seasonal frequency of *active* and *vigorous* monsoon days over the various subdivisions of the SP region during the SWM season, 2024. *Active* to *vigorous* monsoon conditions prevailed over CK, TEL & NIK on 35 (29%), 34 (28%) & 30 (25%) days respectively during the season. There were 18-26 days (15%-21% of the days) of *active-vigorous* monsoon conditions over CAP, SIK, KER & RYS and 11 days (9%) of *active* to *vigorous* monsoon activity over TN.

Table-3.4c: Subdivision-wise frequency of Vigorous and Active monsoon conditions over the SP region during the SWM season, 2024

Subdivision	Jun		Jul		Aug		Sep		Jun-Sep	
	ACT	VIG	ACT	VIG	ACT	VIG	ACT	VIG	ACT	VIG
CAP	5	0	3	3	5	1	6	3	19	7
TEL	5	0	10	1	6	0	9	3	30	4
RYS	2	5	3	0	1	3	4	0	10	8
TN	3	1	0	2	2	3	0	0	5	6
CK	6	0	17	0	7	0	4	1	34	1
NIK	6	2	12	0	3	1	6	0	27	3
SIK	3	1	11	2	6	0	1	0	21	3
KER	4	0	5	2	4	0	3	0	16	2
LAK	0	0	0	0	0	0	0	0	0	0

ACT: Active monsoon conditions (FWS to WS rainfall over the subdivision with rainfall amount 1½ to 4 times the normal and at least 2 stations reporting 5cm or more along the west coast or 3cm or more elsewhere)

VIG: Vigorous monsoon conditions (FWS to WS rainfall over the subdivision with rainfall amount more than 4 times the normal and at least 2 stations reporting 8cm or more along the west coast or 5cm or more elsewhere).

3.5 Heavy rainfall activity

Table-3.5a presents the number of days of *heavy* rainfall occurrences (≥ 7 cm/day) over the various subdivisions of the SP region during SWM 2024 and the month-wise frequencies are presented in Table-3.5b. List of *very heavy* to *extremely heavy* rainfall events is presented in Table-3.5c. As seen, TN reported 74 days of *isolated heavy* rainfall events (including 27 days of very heavy rainfall events with 7 days of extremely heavy rainfall reports) followed by CK: 69 days, SIK: 68 days & TEL: 66 days. There were 58 days of *isolated heavy* rainfall events over KER, 47 days over CAP & 45 days over NIK. RYS reported 27 days & LAK: 4 days of *isolated heavy rainfall* events during the season. CK & SIK reported 30 days 26 days of *isolated heavy* rainfall events during July 2024. TN reported *isolated heavy* rainfall 22 days during June & 21 days each during July & Aug 2024. RYS reported *isolated heavy* rainfall on 10 days during Aug, 7 days each during Jun & Sep & 3 days during July 2024. Excepting LAK, *isolated heavy* rainfall events over all other subdivisions in the region were in the range 10-19 days /month during the season.

✓ Out of the 69 days of *isolated heavy* rainfall days over CK, there were reports of *very heavy* rain on 40 days

including 11 days of *extremely heavy* rainfall reports. There were 26-27 days of very heavy rainfall reports over TN & SIK with 7 days each of extremely heavy rainfall reports. KER & TEL reported 21-22 days of very heavy rain including 2 days of extremely heavy rainfall reports. The highest 24-hr rainfall recorded during the season in the SP region was over Malyal (Mahabubabad district, Telangana): 40 cm (396 mm) on 01st September.

Table-3.5a: Subdivision-wise frequency of heavy rainfall days over the SP region during 1st June - 30th Sep 2024

Subdivision	No. of days of Heavy rainfall (Rainfall $\geq$ 7cm/day)		
	<i>Extremely Heavy</i> ($\geq$ 21 cm/day)	<i>Very Heavy</i> ($\geq$ 12cm/day)	<i>Heavy</i> ($\geq$ 7cm/day)
COASTAL AP and YANAM	3	8	47
TELANGANA	2	21	66
RAYALASEEMA	0	7	27
TAMILNADU, PDC and KKL	7	27	74
COASTAL KARNATAKA	11	40	69
NORTH INTERIOR KARNATAKA	0	5	45
SOUTH INTERIOR KARNATAKA	7	26	68
KERALA and MAHE	2	22	58
LAKSHADWEEP	1	3	4

Note: Kindly refer Appendix-(ii) for explanations on various terminologies used for description of rainfall intensity.

Table-3.5b: Month-wise frequency of heavy rainfall days during June-Sep 2024

Sub-division	No. of days of Heavy rainfall (Rainfall $\geq$ 7cm/day)											
	June			July			Aug			Sep		
	ExH	VH	H	ExH	VH	H	ExH	VH	H	ExH	VH	H
CAP	0	1	15	2	3	10	0	1	12	1	3	10
TEL	0	4	18	0	6	19	0	5	16	2	6	13
RYS	0	1	7	0	0	3	0	5	10	0	1	7
TN	1	5	22	5	11	21	1	8	21	0	3	10
CK	2	5	16	8	22	30	1	10	15	0	3	8
NIK	0	3	11	0	1	16	0	0	10	0	1	8
SIK	1	4	16	6	17	26	0	4	19	0	1	7
KER	1	6	19	1	11	19	0	5	15	0	0	5
LAK	0	1	0	0	0	2	1	2	2	0	0	0

H: Heavy ($\geq$ 7cm/day); VH: Very Heavy($\geq$ 12cm/day); ExH: Extremely Heavy($\geq$ 21cm/day);

Table-3.5c: List of very to extremely heavy rainfall reports during Jun-Sep 2024

DISTRICT	Date, Station and 24-hr accumulated rainfall (in cm) (ending 0830 IST of the specified date)
COASTAL ANDHRA PRADESH & YANAM	
ALLURI SITHARAMARAJU	Jul : 20th : Chintur Chintur-21; Sep : 01st : Kunavaram-14, Vararamachandrapur-12; 09th : Chintapalle-13;
ANAKAPALLI	Jun : 03rd : Narsipatnam-12; July : 20th : Anakapalle-13;
BAPATLA	Sep : 01st : Bapatla-13, Santhamaguluru-12;
ELURU	Jul : 19th : Kukunoor-27, Polavaram-27, Chintalapudi-18, Koyyalagudem-12; Aug : 31st : Kaikalur-15; Sep : 01st : Kukunoor-20, Velairpad-16, Nuzvid-14;
GUNTUR	Jul : 13th : Guntur-14, Tenali-12; Aug : 31st : Amaravati-13; Sep : 01st : Amaravati-26, Guntur-23, Tenali-18, Mangalagiri-17;
KRISHNA	Jul : 13th : Masulipatnam Cdr-15; Aug : 31st : Masulipatnam Cdr-18, Gudivada-17;
NTR	Aug : 31st : Vijayawada(arg)-18, Prakasam Barrage-18, Vijayawada A.p.-12; Sep : 01st : Tiruvuru-26, Nandigama-17, Vijayawada(arg)-13;
PALNADU	Sep : 01st : Atchampet-19, Piduguralla-17, Macherla-17, Jangamaheswarapuram-13;
PRAKASAM	Sep : 01st : Mundlamuru-14;
WEST GODAVARI	Jul : 19th : Tadepalligudem-13; Aug : 31st : Narsapuram-14;
VIZIANAGARAM	Jul : 19th : Pusapatirega-16;
YANAM	Sep : 25th : Yanam-12;
TELANGANA	
ADILABAD	Jun : 23rd : Utnur-14; Sep : 02nd : Utnur -17;
Y. BHUVANAGIRI	Aug : 20th : Yadagirigutta-17, Yadagirigutta(arg)-15, Bhuvanagiri-12;
BHUPALPALLY	Jul : 19th : Kataram-14, Perur(arg)-13;
KAMAREDDY	Sep : 01st : Banswada-28, Sadasivanagar-21, Bhiknur – 20, Kamareddy – 18, Tadwai- 16, Domakonda – 15; 02nd : Sadasivanagar – 24, Tadwai -24, Lingampet – 23, Kamareddy – 22, Gandhari – 17, Yellareddy-15, Naga Reddipet – 15;
KHAMMAM	Aug : 06th : Thollada-13;

	Sep : 01st : Kusumanchi-32, Madhira-28, Chinthakam -26, Khammam(arg)-23, Thollada-22, Bonakal – 21, Konijerla – 19, Wyra Kvk(agro) – 17, Sathupalle -15, Khammam Urban – 13; 08th : Thollada – 13;
KARIMNAGAR	Jul : 16th : Gangadhara-13; Aug : 17th : Chigurumamidy-16; Sep : 01st : Jammikunta – 14, Huzurabad -13, Thimmapur – 13, Choppadandi – 12, Karimnagar -12;
KUMARAM BHEEM	July : 19th : Kagaznagar-17; Sep : 02nd : Jainoor – 19;
KOTHAGUDEM	Jun : 23rd : Aswaraopeta-12; Jul : 08th : Pinapaka-14; 19 th : Aswaraopeta-15; Sep : 01st : Manuguru-32, Burgampadu-29, Palawancha-24, Bhadrachalam-23, Aswapuram-22, Kothagudem -17, Dummugudem-15, Tekulapalle – 14, Yellandu – 14, Chandrugonda-13, Yellandu(arg) -12, Mulakalapalle-12; 04th : Yellandu – 13; 05 th : Manuguru -13;
JANGAON	Sep : 01st : Kodakandla-27, Zaffergadh – 15, Devaruppal -14;
JAGTIAL	June : 05th : Sarangapur-12; Jul : 21st : Mallapur-13, Metpalle-13; Sep 02nd : Metpalle-12, Mallapur - 12;
JOGULAMBA GADWAL	Aug : 07th : Ghattu-12; 20th : Aiza-12;
MAHABUBABAD	Sep : 01st : Malyal-40, Mahabubabad-37, Dornakal-26, Gudurwrgl – 25, Bayyaram – 18, Garla-17, Kothaguda-16; 08th : Mahabubabad-17, Bayyaram-12;
MAHABUBNAGAR	Sep : 01st : Jadcherla -12, Bhoothpur -12, Gandeed - 12;
MANCHERIAL	Jul : 15th : Kotapalle-12, Vemanapalle-12; 19th : Kotapalle-18, Vemanapalle-15; Sep: 02nd : Dandepalle - 12;
MEDAK	Aug: 17th : Medak-13; Sep : 01st : Medak – 14, Kowdipalle -12; 02nd : Papannapet – 17, Tekmal-12, Alladurg - 12;
MULUGU	Sep : 01st : Tadwai Mlg – 26, Govindaraopet -15;
NALGONDA	Sep : 01st : Miryalaguda -15, Devarakonda-14, Chandur -12;
NARAYANPET	Aug : 20th : Maddur-14; 31st : Damaragidda-13; Sep : 01st : Kosgi - 12;
NAGARKURNOOL	Sep : 01st : Kalwakurthy -16, Vangoor -14, Achampeta -14, Thimmajipeta – 13, Kollapur - 13;
NIRMAL	Jul : 21th : Sarangapurnrl-13, Laxmanchanda -12, Khanpur – 12; Sep : 02nd : Khanpur-14, Laxmanchanda – 13, Nirmal-12;
NIZAMABAD	Jul : 16th : Navipet-12; 17th : Yeda Palle-17, Navipet-15; 21st : Mortad-14, Balkonda-12; Sep : 01st : Dhar Palle -16, Varni – 13; 02nd : Balkonda – 12; 04th : Nandipet – 13, Makloor-13;
PEDDAPALLE	Jun : 24th : Srirampur-14; Jul : 19th : Manthani-12;
RAJANNA SIRCILLA	Jun : 27th : Chandurthi-15; Sep : 02nd : Gambhiraopet – 15, Yellareddypeta - 12;

RANGAREDDY	Sep : 01 st : Shadnagar -13;
SANGAREDDY	Sep : 07 th : Sangareddy-12;
SIDDIPET	Sep : 02 nd : Mirdoddi -15, Dubbak – 13, Kondapak – 12; 04 th : Husnabad(arg) – 17, Nanganur -12;
SURYAPET	Sep : 01 st : Kodada-35, Chilkur-31, Mattampally-30, Huzur Nagar-30, Noothankal-26, Mothey-20, Jajireddigudem – 19, Suryapet – 19, Neredcherla-13;
VIKARABAD	Sep : 01 st : Tandur – 13, Kodangal - 12;
WANAPARTHY	Sep : 01 st : Khila Ghanpur -12;
WARANGAL	Sep : 01 st : Parvathagiri-29, Chennaraopet - 20;
RAYALASEEMA	
ANANTAPURAMU	Aug : 14 th : Gummagatta -13;
CHITTOOR	Aug : 12 th : Nagari -14;
NANDYAL	Jun : 03 rd : Banaganapalle-18;
TIRUPATI	Aug : 17 th : Puttur-14;
YSR	Aug : 20 th : Jammalamadugu-12;
TAMILNADU, PUDUCHERRY & KARAIKAL	
CHENNAI	Jun : 18 th : Zone 15 Sholinganallur-12; Aug : 05 th : Zone 15 Sholinganallur-12; Sep : 21 st : Zone 15 Sholinganallur-17; 24 th : Zone 02 D15 Manali-15; 26 th : Zone 07 Ambattur-13, Zone 07 U18 D81 Vanagaram-13, Zone 08 Malar Colony-12;
CHENGALPATTU	Jun : 20 th : Maduranthagam-15; Jul : 13 th : Thirukalukundram-13;
CUDDALORE	Jul : 13 th : Kilacheruvai – 23, Lakkur-14; Aug : 05 th : Vadakuthu-13, Neyveli AWS-12; 09 th : Sethiyathope-12; 10 th : Tozhudur-14;
COIMBATORE	Jun : 26 th : Chinnakalar-20, Upasi TRF AWS-15, Cincona-15, Valparair PTO-14, Sholayar-12; Jul : 15 th : Chinnakalar-13; 16 th : Valparai PTO-25; Chinnakalar-23; Cincona-17, Valparai PAP-17, Valparai Taluk Office-16, Sholayar-14; 18 th : Chinnakalar-15, Valparai PTO-12; 30 th : Valparai PTO-31, Chinnakalar-24, Upasi TRF AWS-24, Cincona-23, Valparai PAP-19, Valparai Taluk Office-19, Sholayar-19;
DHARMAPURI	Aug : 12 th : Palacode-14;
ERODE	Aug : 15 th : Perundurai-12;
KANYAKUMARI	Aug : 14 th : Adayamadai-13;
KRISHNAGIRI	Jun : 05 th : Nedungal-13; Aug : 12 th : Nedungal-12;
NILGIRIS	Jun : 19 th : Devala-13; 26 th : Devala-19, Gudalur Bazar-15, Upper Gudalur-14, Taluk Office Pandalur-13, Went Worth Estate-12; 27 th : Vint Worth Estate-

	13, Taluk Office Pandalur-12, Avalanche-12; 29th : Taluk Office Pandalur-28, Devala-19; Jul : 01st : Wood Braiyar Estate-13, Harisan Malayalam Ltd-13, Went Worth Estate-13, Cherumulli-13; 16th : Avalanche-37, Upper Bhavani-23, Emeraldad-13; 17th : Avalanche-34, Upper Bhavani-22, Devala-15, Taluk Office Pandalur-14, Emeraldad-13, Vint Worth Estate-13; 18th : Avalanche-20, Emeraldad-12; 19th : Avalanche-22, Vint Worth Estate-13, Upper Bhavani-12; 25th : Avalanche-14; 26th : Avalanche-20; 27th : Avalanche-18; 30th : Vint Worth Estate-23, Taluk Office Pandalur-20, Devala-20, Avalanche-18, Upper Gudalur-17, Gudalur Bazar-17, Barwood-14, Harisan Malayalam Ltd.-12, Wood Braiyar Estate-12;
PUDUCHERRY	Aug : 10 th : Puducherry-15;
RANIPET	Jun : 08th : Wallajah -13; Aug : 06th : Wallajah-13;
SALEM	Aug : 06 th : Attur-13; 10 th : Yercaud-12;
TIRUNELVELI	Jun : 27 th : Nalumukku-12;
TIRUVANNAMALAI	Aug : 11 th : Tiruvannamalai AWS-17;
THIRUVALLUR	Sep : 26 th : Avadi-13;
VELLORE	Aug : 12 th : Katpadi-14;
VILLUPURAM	Aug : 09th : Vilupuram-18; 11th : Vilupuram-22, Gingee-14, Tindivanam-13; 12th : Villupuram-13;
COASTAL KARNATAKA	
DAKSHINA KANNADA	Jun : 26th : Mulki -18, Mani -14, Mangaluru Ap Obsy-13; 27th : Mulki-30, Mangaluru Ap Obsy-17, Mani-17, Panambur Obsy-15, Belthangadi-15, Dharmasthala-15, Uppinangadi-14; Jul : 18th : Belthangadi-12; 19th : Mangaluru Ap Obsy-16, Dharmasthala-12; 30th : Dharmasthala-17; 31st : Mani-19, Uppinangadi-17, Puttur Hms-15, Belthangadi-14, Panambur Obsy-14, Mulki-14, Dharmasthala-13, Mangaluru Ap Obsy-12; Aug : 01st : Mulki-16, Dharmasthala-15, Belthangadi-15; 02nd : Mani-19, Puttur Hms-16, Mangaluru-15, Panambur Obsy-15, Uppinangadi-13, Mangaluru Ap Obsy-12;
UDUPI	Jun : 09th : Kota-16; 26th : Kundapur-13; 27th : Udupi-21, Karkala-17, Kota-14; Jul : 04th : Siddapura-23, Kundapur-13; 06th : Udupi-15; 08th : Udupi-18, Kundapur-16, Siddapura-12, Kollur-12; 13th : Karkala-13; 16th : Kundapur-19, Siddapura-18, Kollur-17, Kota-15; 18th : Kollur-19; 19th : Karkala-18, Udupi-16, Kota-12; 21st : Kollur-12; 25th : Siddapura-17; 31st : Karkala-18, Kollur-13; Aug : 01st : Karkala-23, Siddapura-17, Kundapur-15; 02nd : Karkala-14, Kundapur-12; Sep : 25th : Kundapur - 13;
UTTARA KANNADA	Jun : 08 th : Manki-23, Karwar Obsy-22, Gokarna-20, Kumta-20, Ankola-19,

	HonavarObsy-15; 09th :Gersoppa-18, Karwar Obsy-17, Castle Rock-16, Ankola-12; 10th : Karwar Obsy-12; 26th : Manki-17; 27th : Honavar Obsy-15, Shirali Pto-14; Jul : 04th : Gersoppa-24, Kadra-15, Siddapur-15, Manki-12; 05th : Manki-15; 06th : Castle Rock-17, Honavar Obsy-16, Ankola-13; 07th : Castle Rock-21; 08th : Kadra-23, Kumta-22, Gersoppa-20, Shirali Pto-20, Manki-19, Honavar Obsy-17; 13th : Ankola-13, Kumta-13, Kadra-13, Gersoppa-13; 14th : Castle Rock-22, Kumta-15, Gersoppa-13, Kadra-13, Honavar Obsy-12; 15th : Jagalbet-25; 16th : Ankola-26, Karwar Obsy-23, Gersoppa-21; Manki-19, Honavar Obsy-18, Kumta-16, Siddapur-16, Castle Rock-16, Shirali Pto-13, Kadra-12; 18th : Castle Rock-24, Joida-15, Siddapur-15, Ankola-13, Kadra-13, Kumta-13, Gersoppa-12; 19th : Castle Rock-23, Gersoppa-18, Siddapur-15, Ankola-15, Gokarna-15, Kadra-13, Kumta-12; 20th : Gersoppa-12; 22nd : Castle Rock-20, Gersoppa-13; 23rd : Castle Rock-15; 24th : Manki-15, Gersoppa-13; 26th : Castle Rock-15; 27th : Castle Rock-14; 29th : Castle Rock-15; 30th : Castle Rock-14; 31st : Castle Rock-19, Manki-16, Kadra-13, Gersoppa-12, Ankola-12; Aug : 01st : Ankola-20, Castle Rock-20, Kadra-16, Gokarna-15, Kumta-14, Shirali Pto-13, Gersoppa-13, Manki-13, Karwar Obsy-12; 02nd : Manki-14, Ankola-13, Kadra-13, Gersoppa-12; 03rd : Castle Rock-12; 05th : Manki-13; 07th : Kumta-13, Gokarna-12; 11th : Honavar Obsy-13; 24th : Castle Rock-13; 25th : Castle Rock-13; 26th : Castle Rock-16; 27th : Castle Rock-16; Sep : 03rd : Castle Rock-18; 24th : Manki-12, Shirali Pto-12;
NORTH INTERIOR KARNATAKA	
BELAGAVI	Jul : 18 th : Londa-12;
VIJAYAPURA	Jun : 03 rd : Devarhippargi-13; 10 th : Sindgi-12; Sep : 24 th : Vijayapura Pto-19;
SOUTH INTERIOR KARNATAKA	
CHIKKAMAGALURU	Jun : 27th : Kottigehara-14; Jul : 04th : Kammardi-20, Sringeri Hms-15; 16th : Kottigehara-17, Koppa-17, Sringeri Hms-17, Jayapura-15, Kammardi-14; 17th : Sringeri Hms-14; Kottigehara-14, Kammardi-14, Jayapura-13; 18th : Kottigehara-19; 19th : Kottigehara-17, Kalasa-15, Koppa-13; 25th : Kammardi-14, Kottigehara-13; 27th : Sringeri Hms-14; 30th : Kalasa-25, Kottigehara-21, Kammardi-19, Koppa-15, Sringeri Hms-14; 31st : Kammardi-15, Mudigere-14, Sringeri Hms-12; Aug : 26th : Kottigehara-12;
KODAGU	Jun : 26th : Bhagamandala-15; 27th : Bhagamandala-21, Napoklu-13, Ponnampet Pwd-12; Jul : 13th : Bhagamandala-13; 15th : Bhagamandala-12; 16th : Bhagamandala-17; 17th : Bhagamandala-15; 18th : Bhagamandala-13; 19th : Bhagamandala-22, Murnadu-15, Napoklu-15; 26th : Bhagamandala-18, Napoklu-13, Somwarpet-12; 27th : Somwarpet-15; 30th : Bhagamandala-25, Napoklu-18, Ponnampet Pwd-15, Murnadu-13; 31st : Bhagamandala-14; Aug : 26th : Ponnampet Pwd-14;

SHIVAMOGGA	Jun : 27th : Agumbe Emo-17; Jul : 04th : Agumbe Emo-25, Linganamakki Hms-19; 08th : Linganamakki Hms-14; 14th : Agumbe Emo-17; 16th : Agumbe Emo-33, Linganamakki Hms-19; 17th : Agumbe Emo-21; 18th : Hunchadakatte-14, Agumbe Emo-13, Linganamakki Hms-12; 19th : Agumbe Emo-22, Linganamakki Hms-12; 20th : Agumbe Emo-13; 26th : Agumbe Emo-16; 27th : Agumbe Emo-16; 30th : Agumbe Emo-21; 31st : Agumbe Emo-21; Aug : 01st : Agumbe Emo-17; 02nd : Agumbe Emo-14; 03rd : Agumbe Emo-15;
TUMAKURU	Sep : 30th : Y N Hoskote-15;
RAMANAGARA	Jun : 03rd : Ramanagara-14;
KERALA & MAHE	
ERNAKULAM	Jun : 26th : Idamalayar Dam Aws-13; Jul : 16th : Idamalayar Dam Aws-15, Neeleswaram Arg-13; Kochi C.i.a.l.-12; Perumpavur-12; 30th : Idamalayar Dam Aws-19; Aug : 21st : Idamalayar Dam-13; 30th : Kalamassery-13;
IDUKKI	Jun : 01st : Udumbannoor Aws – 23; 26th : Munnar Kseb-15, Peermade To-14; Jul : 16th : Munnar Kseb-18, Idukki-17, Peermade To-14, Udumbannoor Aws-14; 30th : Munnar Kseb-20, Udumbannoor Aws-16, Peermade To-15, Thodupuzha Arg-13, Idukki-12, Anayirankal Dam Aws-12; Aug : 21st : Peermad-17, Thodupuzha-14;
KASARGOD	Jun : 26th : Padannakkad Aws -12; 27th : Panathur Aws-19, Muliya Aws-18, Vellarikkundu Aws-14; Jul : 18th : Vellarikkundu Aws-13; 30th : Panathur Aws-13; 31st : Panathur Aws-13;
KANNUR	Jun : 26th : Ayyankunnu Aws-12, Tellichery-12; 27th : Ayyankunnu Aws-18 Jul : 13th : Tellichery-14; 14th : Ayyankunnu Aws-12; 17th : Ayyankunnu AWS-14, Aralam AWS-12; 18th : Kannur Icar AWS-14, Irikkur-13, Taliparamba-13 Cheruvanchery AWS-13, AMS KANNUR-12, Kannur-12, Aralam AWS-12 Ayyankunnu AWS-12; 29th : Ayyankunnu Aws-14; 30th : Cheruvanchery Aws-25, AmsKannur-25, Kannur Airport Aws-25, Ayyankunnu Aws-22, Kannur Icar Aws-18, Aralam Aws-18, Kannur-18, Taliparamba-15, Pinarayi Aws-14; Aug : 13th : Ayyankunnu-12;
KOTTAYAM	Jun : 26th : Kottayam-12; Jul : 13th : Poonjar Aws-12; Aug : 17th : Kanjirappally-16, Poonjar-15; 31st : Vaikom-13;
KOZHIKODE	Jun : 01st : Urumi Aws -14; 26th : Vadakara-14, Vadakara Aws-12 Jul : 04th : Vadakara-12; 13th : Vadakara-15, Quilandi-14; 16th : Vadakara-14, Kunnamangalam Aws-13, Kozhikode-12; 30th : Vadakara-28, Vadakara Aws-22, Kunnamangalam Aws-17, Quilandi-17, Kozhikode-15, Vilangad Aws-14; Aug : 30th : Vadakara-12;
MAHE	Jul : 13th : Mahe -12;
MALLAPURAM	Jul : 25th : Thennala Aws-12; 30th : Anakayam Arg-25, Karipur Ap.-24, Manjeri-22, Perinthalamanna-21, Munderi Aws-21, Angadipuram-19, Nilambur Aws-17, Thennala Aws-17, Nilambur-16, Ponnani-16, Palemad Aws-13;

THRISSUR	Jun : 02nd : Kunnankulam -14, Vadakkancherry -14, Kodungallur -12; 03rd : Lower Sholayar Aws-13, Athirappalli Aws-12; 07th : Irinjalakuda-12; 26th : Lower Sholayar Aws-14; Jul : 16th : Lower Sholayar Aws-16,Chalakudi-16, Irinjalakuda-14, Athirappalli Aws-14, Kodungallur-14, Vellanikkara-12; 30th : Vadakkancherry-34, Athirappalli Aws-22, Peechi Aws-20, Vellanikkara-19, Kunnankulam Aws-13; Aug : 30th : Kodungallur-12;
PALAKKAD	Jul : 16th : Alathur-12, Kollengode Aws-12, Kollamkode-12; 30th : Alathur-30, Kollengode Aws-27, Kollamkode-27, Thritle-25, Pothundy Dam Aws-24, Parumbikulam-24, Pattermbi-23, Ottapalam-21, Mannarkkad Aws-21, Mannarkkad-21, Mankara Aws-19, Malampuzha Dam Aws-18, Palakkad-16, Chittur-15;
PATHANAMTHITTA	Jun : 26th : Venkuringi Aws-12;
WAYANAD	Jun : 07th : Pookot-14; 26th : Padinjarathara Dam Aws-17, Vyttiri-14; 27th : Vyttiri-15; Jul : 16th : Vyttiri-13, 17th : Padamala AWS-13; 18th : Kuppady-12; 30th : Vyttiri-28, Manantoddy-20, Ambalavayal-14, Karapuzha Aws-14, Kuppady-12;
LAKSHADWEEP	
LAKSHADWEEP UT	Jun : 22nd : Amini-12; Aug : 14th : Minicoy-22; 17th : Agathi-20; 22nd : Agathi-17;

3.6 District-wise seasonal rainfall distribution

Table -3.6 presents the district rainfall distribution as percentage departures from normal over the nine meteorological subdivisions of the SP region during the period Jun-Sep 2024 and Fig.3(iii), the district-wise seasonal rainfall over the various states and UTs over the SP region.

Of the 147 districts in the SP region [Andhra Pradesh: 27 (CAP & Yanam -19 & RYS-8), Telangana: 33, Tamilnadu, Puducherry and Karaikal: 40, Karnataka: 31 (CK-3, NIK-11 & SIK-17), Kerala & Mahe:15 and Lakshadweep: 1], 134 districts received *normal to large excess* rainfall and 13 districts (6 in TN, 4 in KER, 2 in SIK & 1 in NIK) came under *deficient* category during the season. All the districts in CAP, RYS & TEL recorded *normal to excess / large excess* rainfall.

Table-3.6: District rainfall performance over various sub-divisions of the SP region during June-September 2024

Sub-division	Total No. Of districts	No. of districts under various categories of monsoon performance				
		Large Excess	Excess	Normal	Deficient	Large Deficient
COASTAL AP & YANAM	19	0	15	4	0	0
TELANGANA	33	4	19	10	0	0
RAYALASEEMA	8	0	3	5	0	0
TAMILNADU, PDC & KKL	40	1	17	16	6	0
COASTAL KARNATAKA	3	0	2	1	0	0
NORTH INTERIOR KARNATAKA	11	0	1	9	1	0
SOUTH INTERIOR KARNATAKA	17	0	5	10	2	0
KERALA & MAHE	15	0	0	11	4	0
LAKSHADWEEP	1	0	1	0	0	0

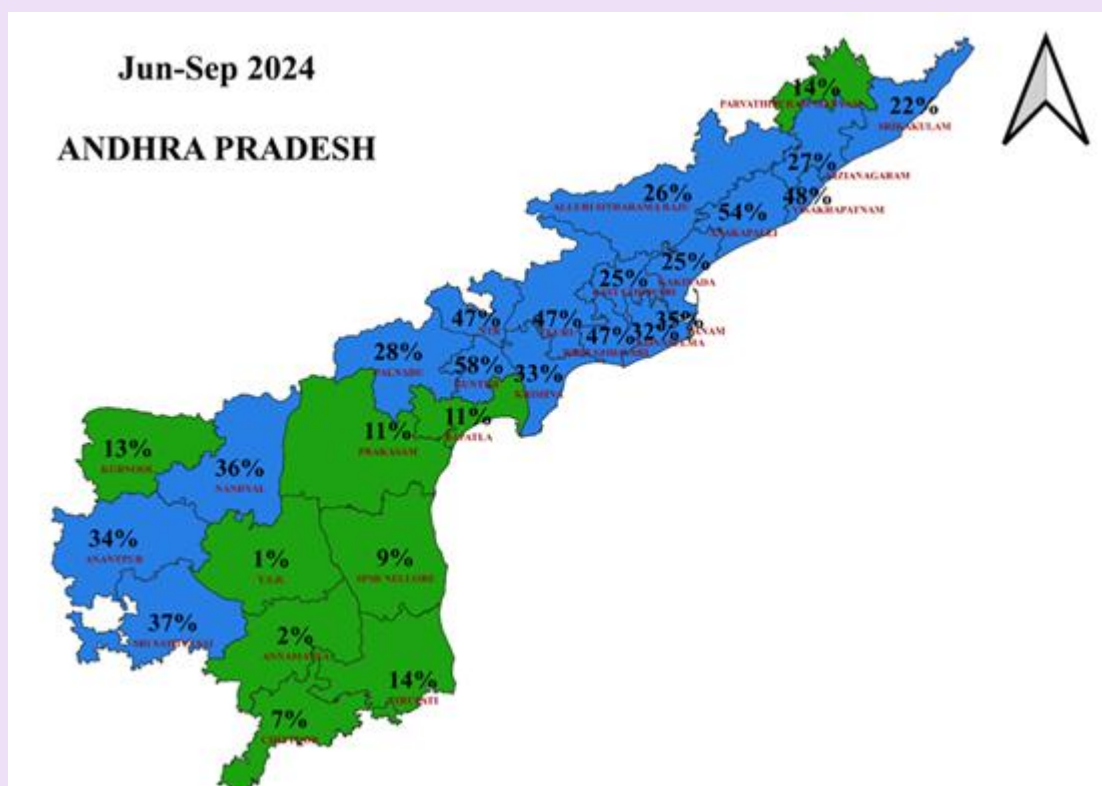


Fig.3(iii): District-wise rainfall (as percentage departure from normal) during Jun-Sep 2024 over various states and UTs in the SP region

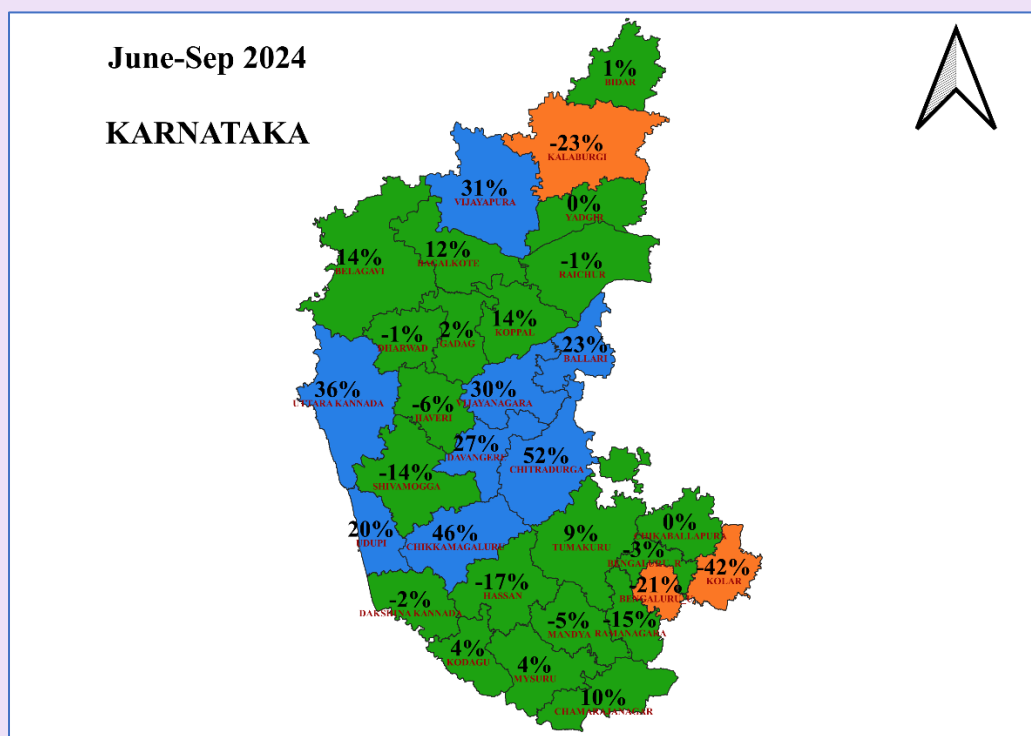
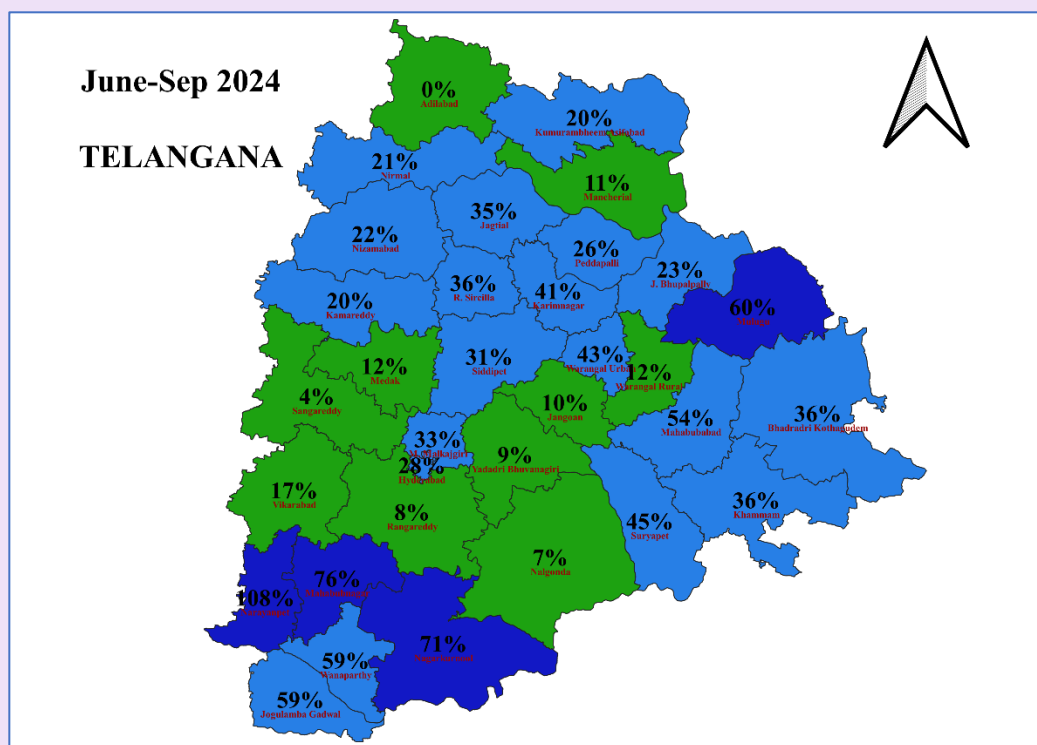
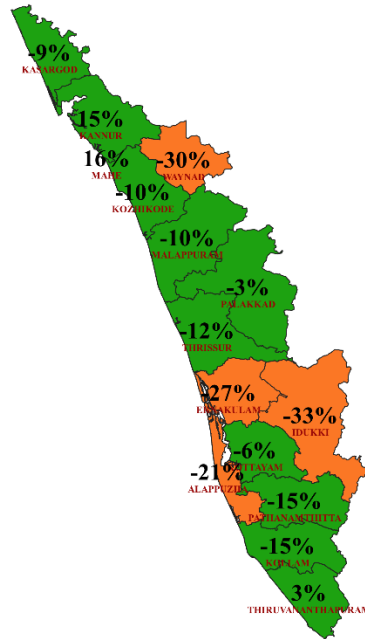
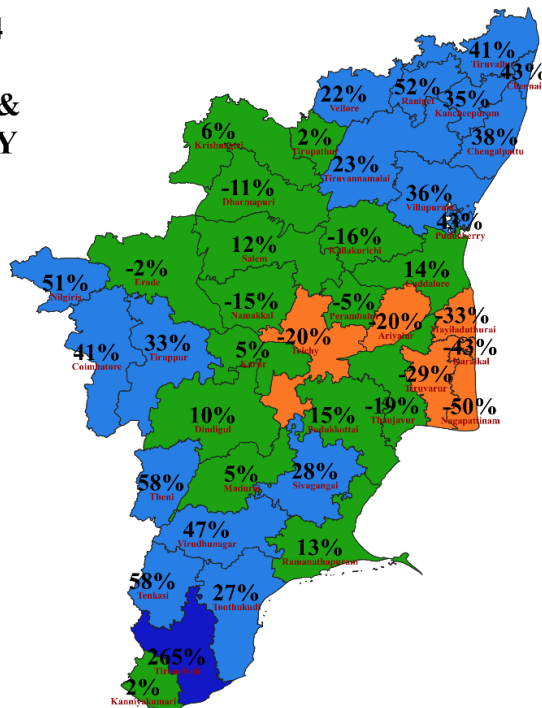


Fig.3(iii): contd.

**KERALA &
LAKSHADWEEP**



**TAMILNADU &
PUDUCHERRY**



Kindly refer Appendix-(i)-(iv) in pages 98-99 for description of technical terms

3.7 Dry and Wet conditions

Based on Standardized Precipitation Index (SPI), a widely accepted index used for drought monitoring world-wide, which is based on rainfall, *mildly/moderately/severely/extremely dry* or *wet* situations over various districts of the region during June-Sep 2024 are depicted in Fig.3(iv). The SPI indicated generally wet conditions (*mildly/moderately/severely/extremely wet* category) over 112 out of 146 districts in the SP region at the end of the season and generally *dry* (*mildly/moderately/severely/extremely dry* category) conditions prevailed over 34 districts in the region.

All the districts in CAP (including Yanam under UT of Puducherry) & RYS came under *wet* categories with Bapatla & Palnadu under *severely wet* and the other 25 districts under *mildly/moderately wet* categories.

In TEL, excepting 2 districts (Adilabad & Rangareddy) that came under *mildly dry* category, all the other 31 districts came under *wet* categories with 4 districts (Jogulamba Gadwal, Mahabubnagar, Nagarkurnool & Narayanpet) under *severely wet* and the other 27 districts under *mildly/moderately wet* categories.

In KAR, 11 districts [(CK: Dakshin Kannada), (NIK: Belagavi, Haveri & Kalburgi) & (SIK: Bengaluru (Urban), Bengaluru (Rural), Hassan, Kolar, Mandya, Ramanagara & Shivamogga)] came under *mildly/moderately dry* categories and the rest of the 20 districts came under *wet* categories with Uttara Kannada in CK & Chikkamagaluru in SIK coming under *extremely wet* category and the others under *mildly/moderately wet* categories.

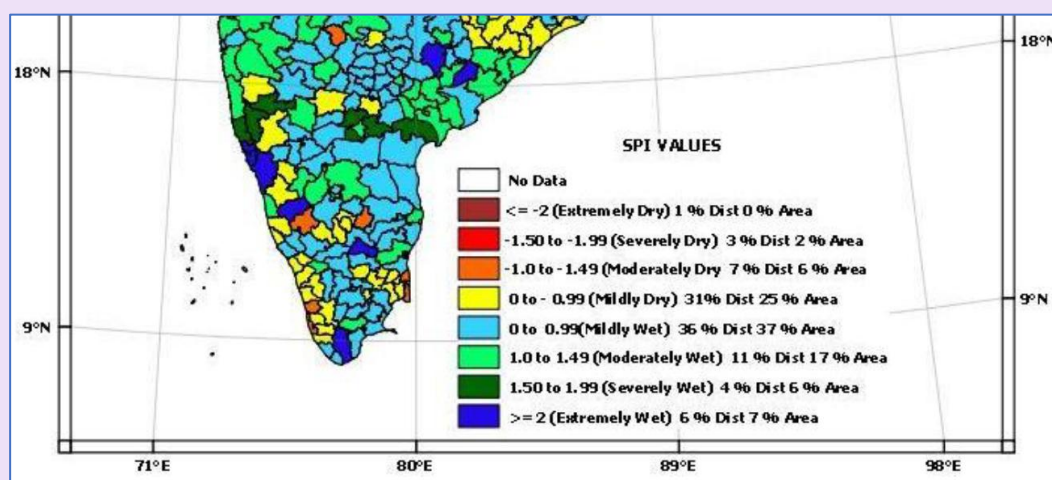


Fig.3(iv): Standardised Precipitation Index (SPI) over the SP region for Jun-Sep 2024
(Source: Climate Diagnostic Bulletin of India, IMD Pune)

Whereas Kannur & Thiruvananthapuram in Kerala & Mahe (UT of Puducherry) came under *mildly wet* category, all other districts in KER came under *mildly / moderately dry* category.

In TN, whereas 09 districts (Ariyalur, Mayiladuthurai, Nagapattinam, Namakkal, Perambalur, Thanjavur, Tirvarur & Thiruchirapalli districts and Karaikal (UT of Puducherry) came under *mildly/moderately dry* categories, all the other 31 districts (including Puducherry area) came under *wet* categories with Dharmapuri & Tirunelveli coming under *extremely wet* category and the rest of the districts under *mildly/moderately wet* categories.

4. Large and Regional scale circulation features

4.1 Large scale features

Climate drivers such as ENSO (that represents *El Nino / La Nina* conditions in the equatorial Pacific region), Indian Ocean Dipole (IOD) and Madden-Julian Oscillation (MJO) influence the SWM performance. During the SWM 2024, generally *neutral* ENSO conditions prevailed over the equatorial Pacific Ocean. *Indian Ocean Dipole (IOD)* was also *neutral*. As such, both these parameters did not contribute much towards the rainfall variability during SWM 2024. *Madden-Julian Oscillation (MJO)* was in insignificant throughout the month of June & most of the days in July; insignificant during the first week of Aug, in phase 1-2 during the 2nd & 03rd weeks, in phase3-4 during the rest of the month of Aug; and in the western hemisphere on many days in September 2024 (Fig.4.1).

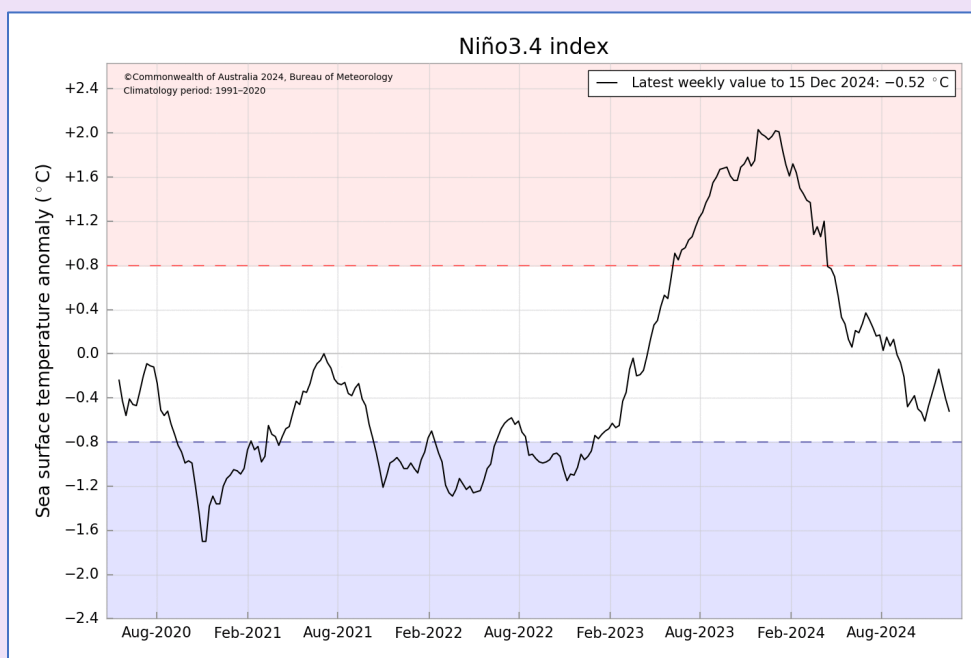


Fig.4.1: Times series of Nino 3.4 SST anomalies, IOD and MJO during the SWM 2024

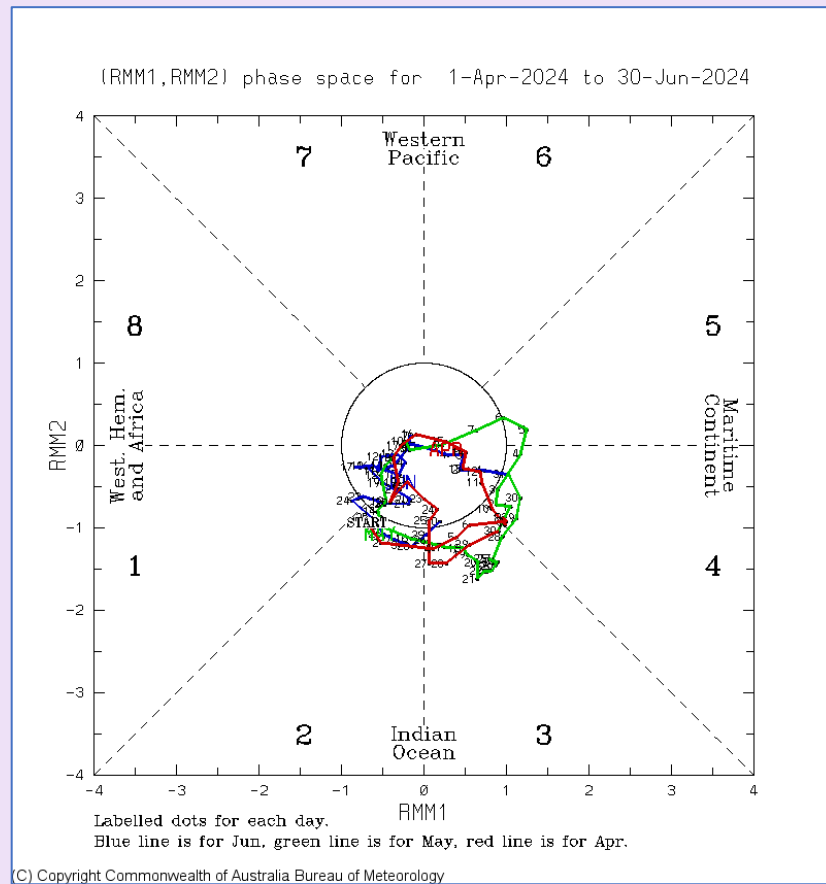
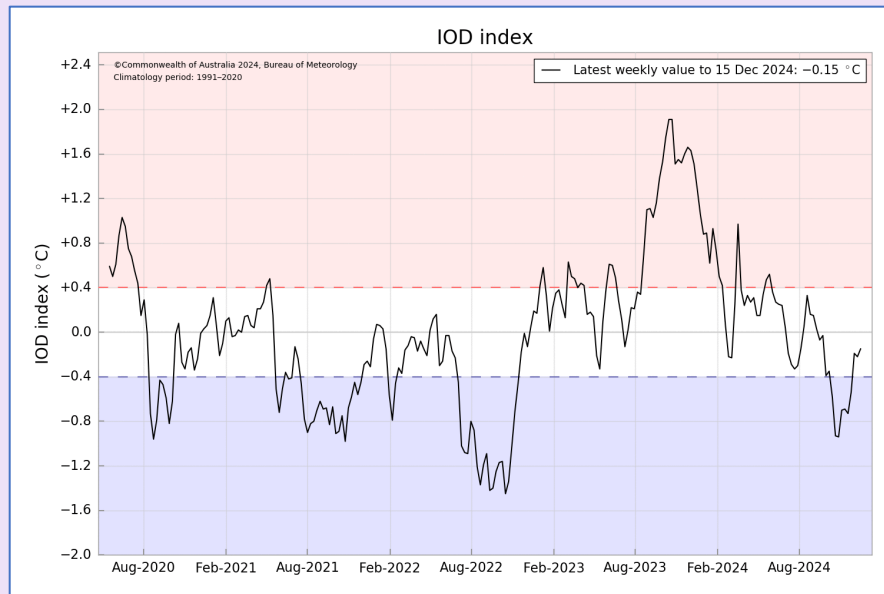


Fig.4.1: contd.

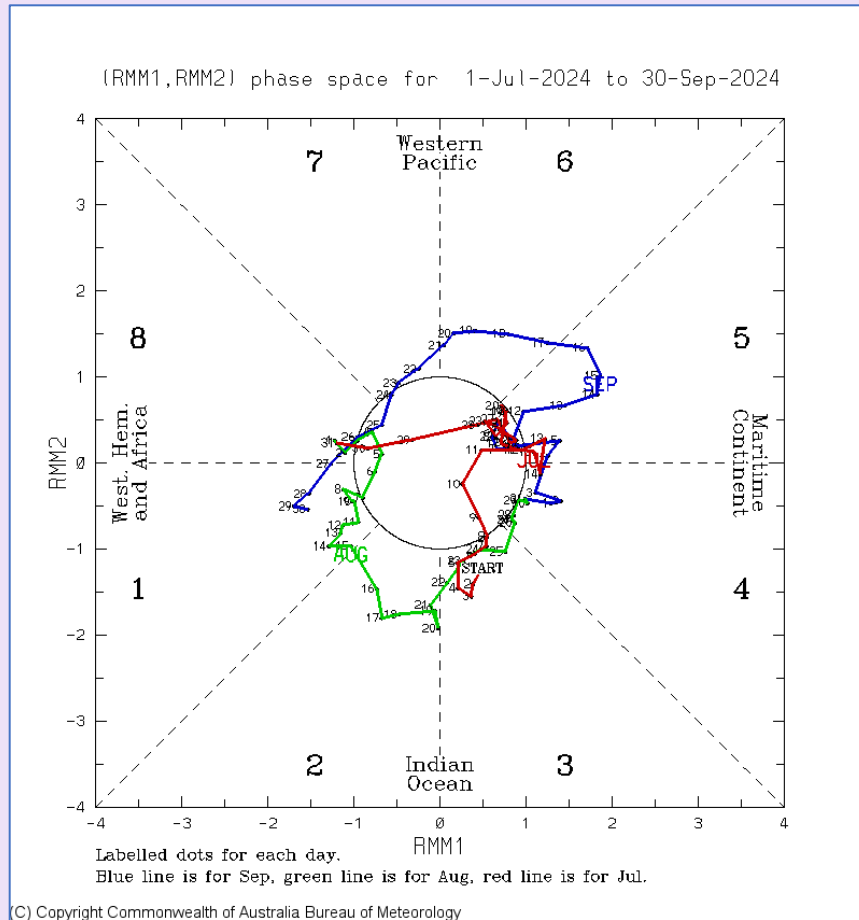


Fig.4.1: contd.

4.2 Regional scale circulation features

Fig.4.2(a-d) depict the 850, 500 and 250 hPa wind anomaly during the months of June, July, August and September 2024.

In June 2024, in the lower tropospheric levels (850 hPa) an anomalous cyclonic circulation was observed over the Comorin- Lakshadweep areas and neighbourhood and anomalous easterlies over the southern peninsula. In the mid levels, an anomalous anti cyclonic circulation was seen over the central and adjoining eastern India. In the upper levels, anomalous cyclonic circulation was seen to the west of the extreme northern parts of India.

In July, in the lower-mid levels, anomalous anti cyclonic circulation over the Comorin area and the adjoining Southeast Arabian Sea and stronger westerlies were present over the southern peninsula.

In August, in the lower-mid levels, easterly-southeasterly anomalies were observed over the southern peninsula, South Bay of Bengal, and Eastcentral Arabian Sea areas and weak

anomalous cyclonic circulation was present over the Southeast Arabian Sea and adjoining Lakshadweep-Comorin areas. In the upper levels, anomalous cyclonic circulation as seen over the Tibetan region and neighbourhood.

In September, northwesterly anomalies were present over the peninsular region in the lower levels. In the upper levels, anomalous westerlies were observed over most parts of the Equatorial Indian Ocean.

4.3 Velocity potential and Streamfunction over the Indian region

Upper tropospheric (250 hPa) velocity potential and lower tropospheric (850 hPa) streamfunction over the Indian region are depicted in Fig.4.3(a-b). It is seen that upper level divergence over the Indian region was generally near normal in June 2024, slightly greater than normal during July 2024 and greater than normal in August 2024. In September 2024, it was normal over the northern parts and lesser than normal over the peninsular India (Fig.4.3a).

Anomalous low level anti cyclonic vorticity was observed over the northern and central Indian region, western and northern parts of Arabian Sea and over the Head Bay of Bengal. Generally low level anomalous cyclonic vorticity was observed over the southern and eastern parts of Arabian Sea, southern parts of Bay of Bengal and southern peninsular region in June; generally anomalous cyclonic vorticity was observed over the central Indian region in July, over the extreme southern parts of peninsula in August and over the eastern Indian region in September 2024.

4.4 Outgoing Longwave Radiation

The Outgoing Longwave Radiation (OLR) anomalies over the southern peninsular region were generally negative in June, July & August and positive in September 2024 (Fig.4.4).

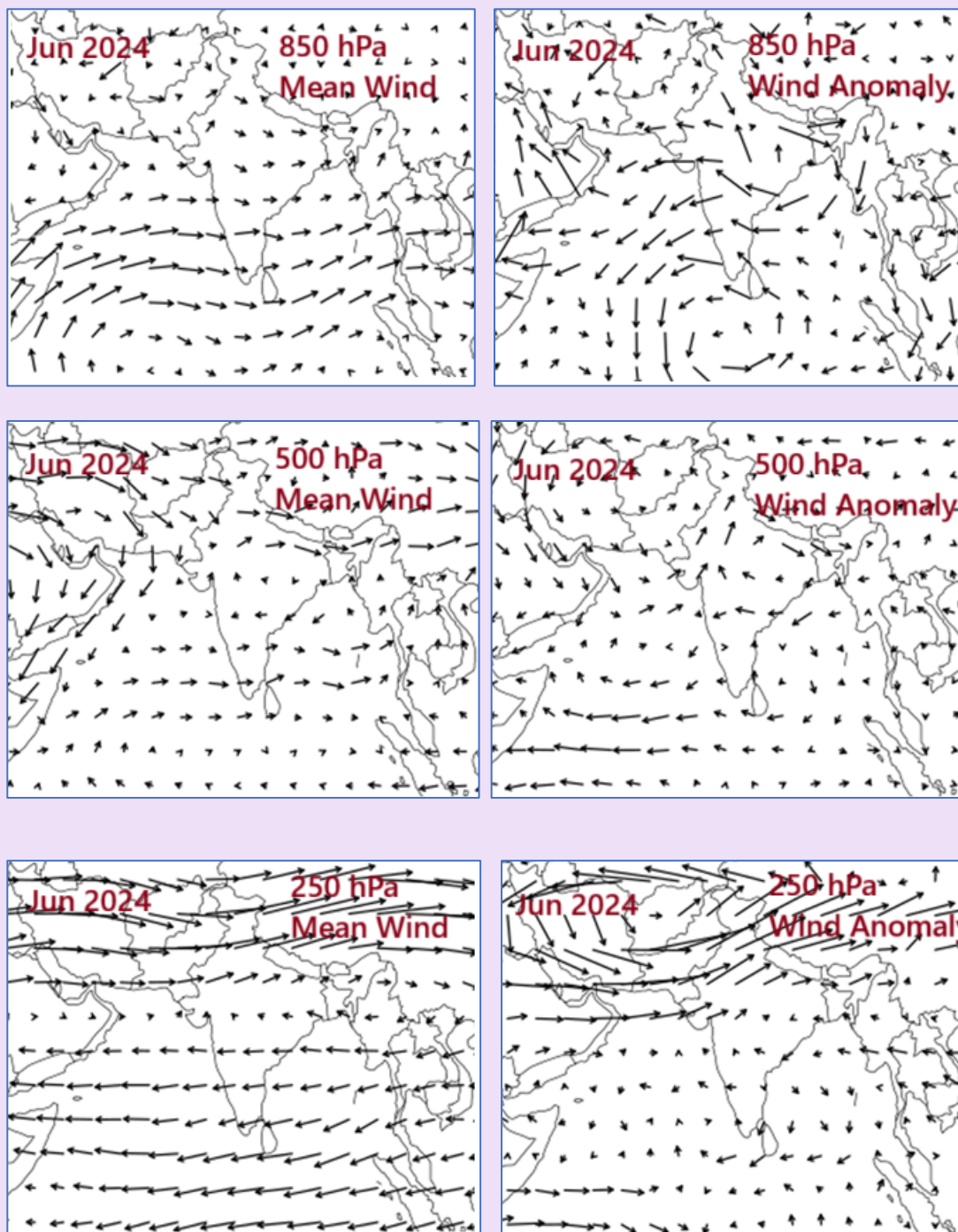


Fig.4.2a: 850hPa, 500hPa & 250hPa wind anomalies over Indian region during June 2024
(Source: Climate Diagnostic Bulletin of India, IMD Pune)

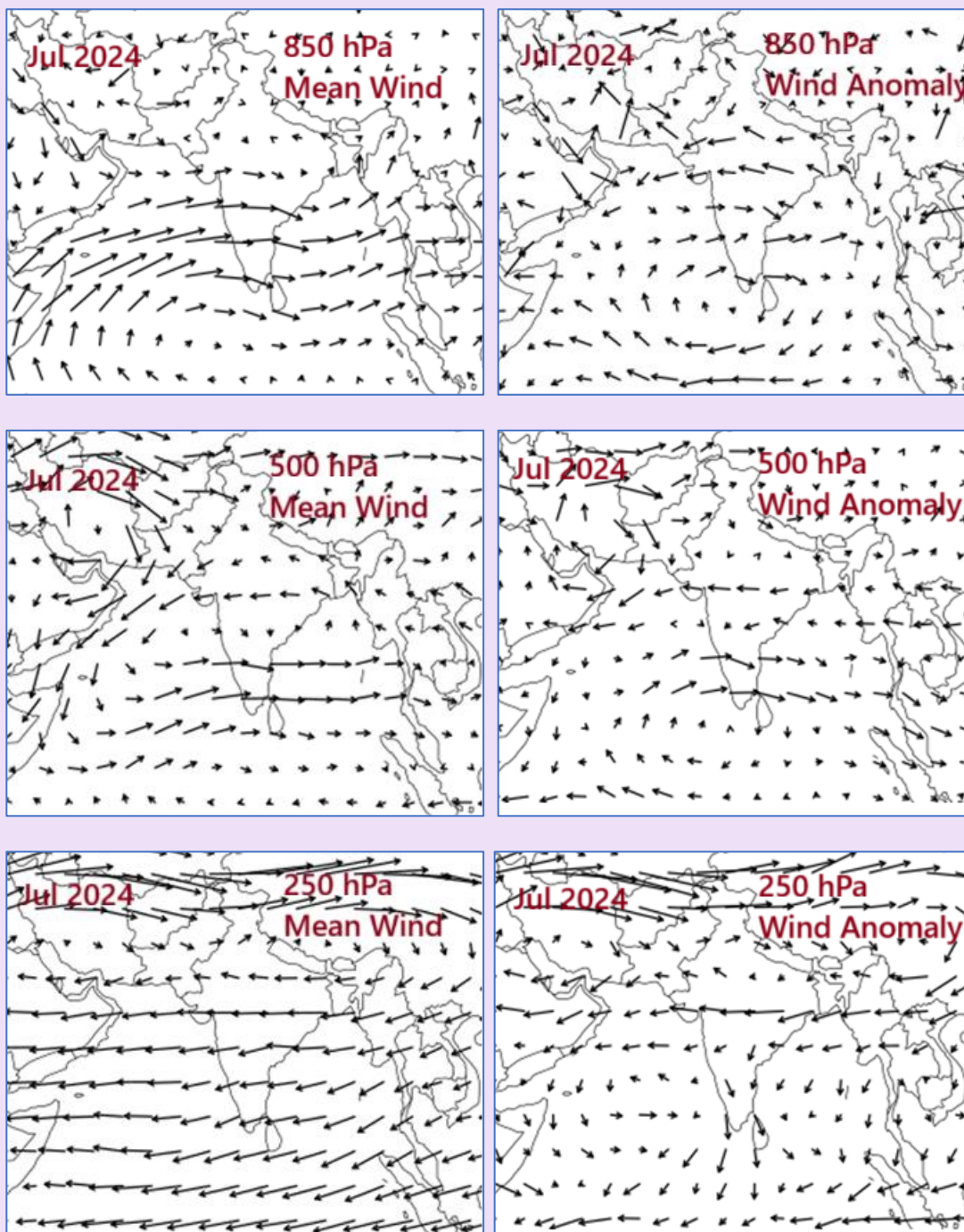


Fig.4.2b: 850hPa, 500hPa & 250hPa wind anomalies over Indian region during July 2024
(Source: Climate Diagnostic Bulletin of India, IMD Pune)

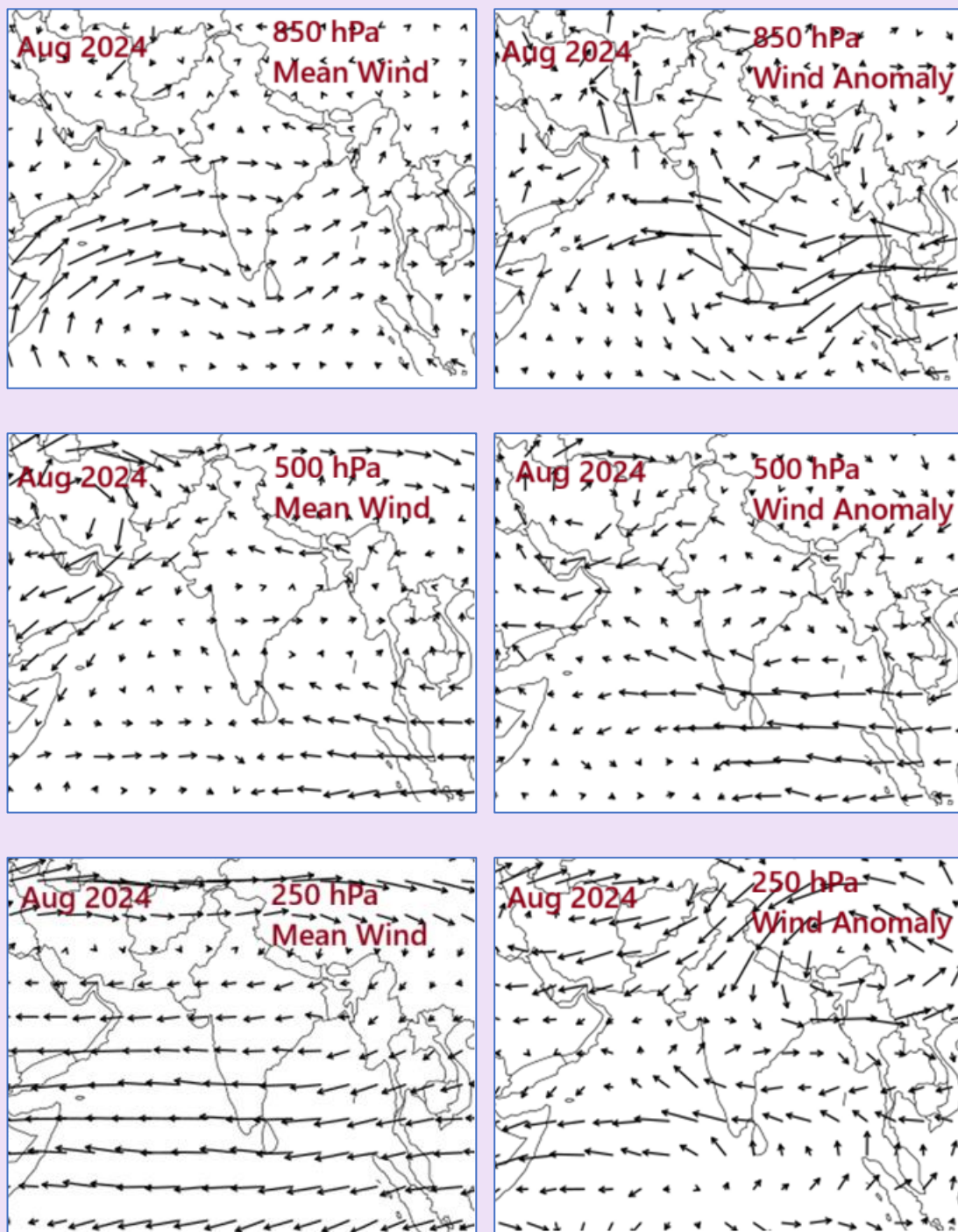


Fig.4.2c: 850hPa, 500hPa & 250hPa wind anomalies over Indian region during Aug 2024
 (Source: Climate Diagnostic Bulletin of India, IMD Pune)

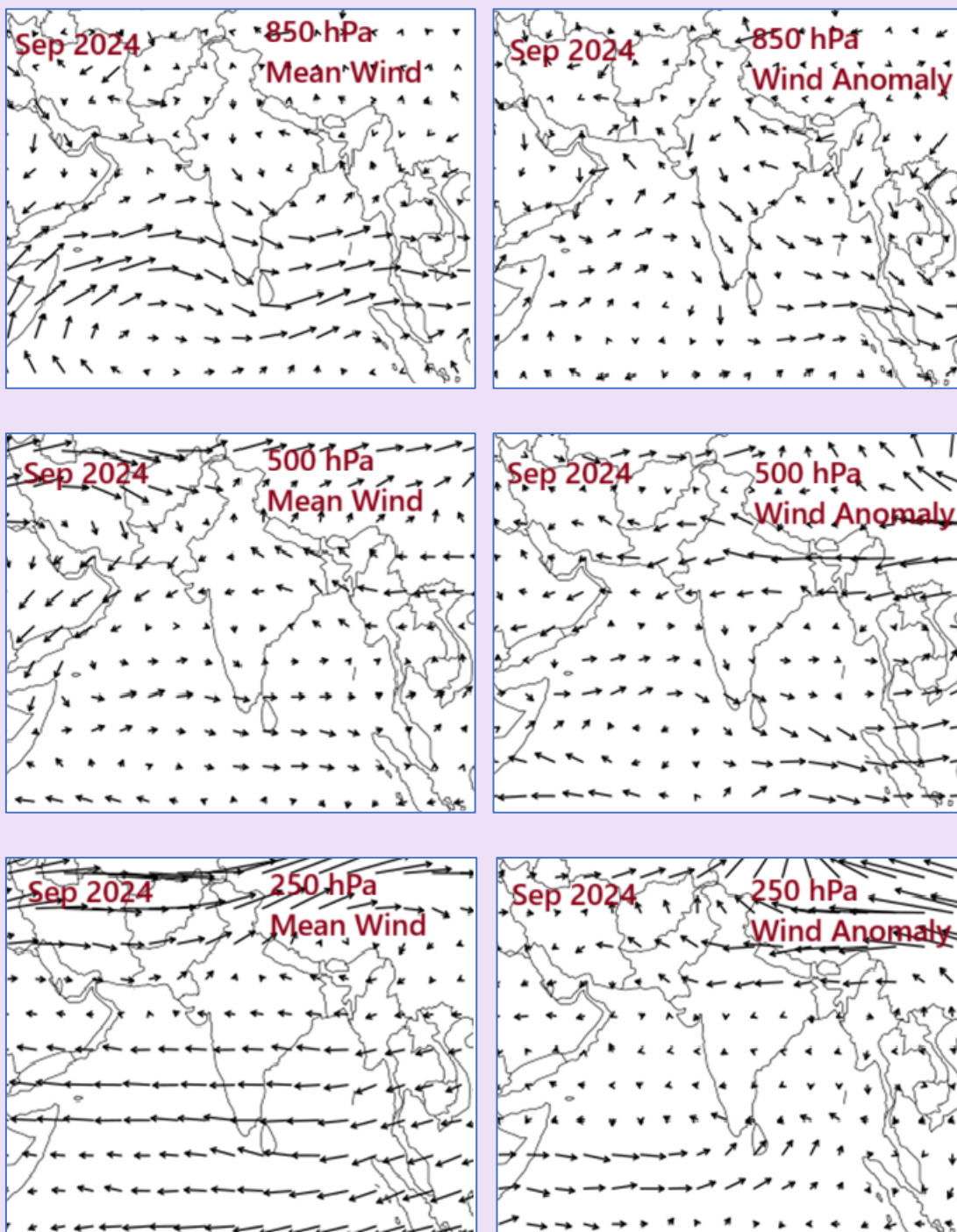


Fig.4.2d: 850hPa, 500hPa & 250hPa wind anomalies over Indian region during Sep 2024
(Source: Climate Diagnostic Bulletin of India, IMD Pune)

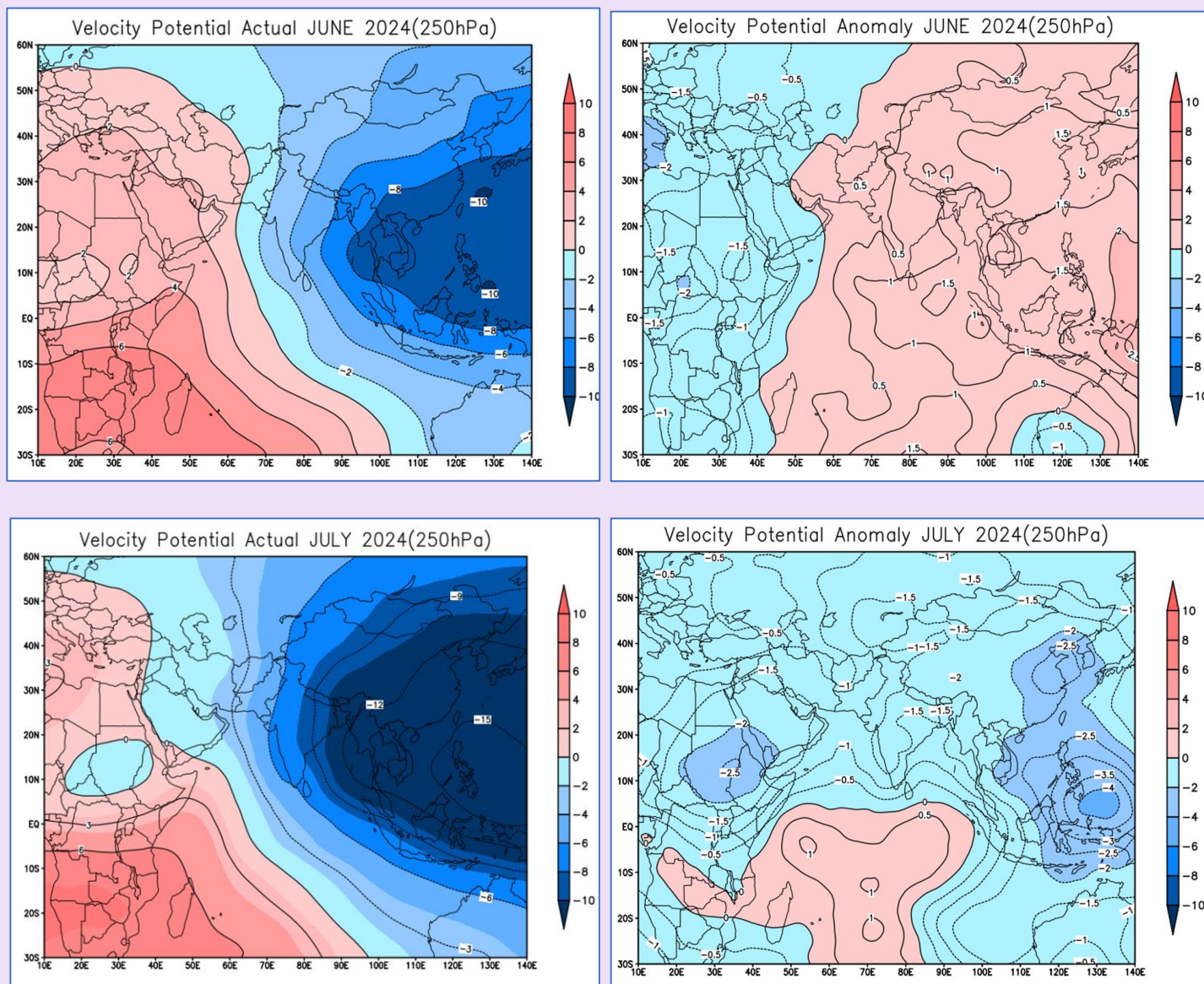


Fig.4.3a: 250 hPa Velocity potential ($\times 10^6 \text{ m}^2/\text{s}$) (actual & anomaly) during Jun, Jul, Aug, Sep 2024
 (Source: Climate Diagnostic Bulletin of India, IMD Pune)

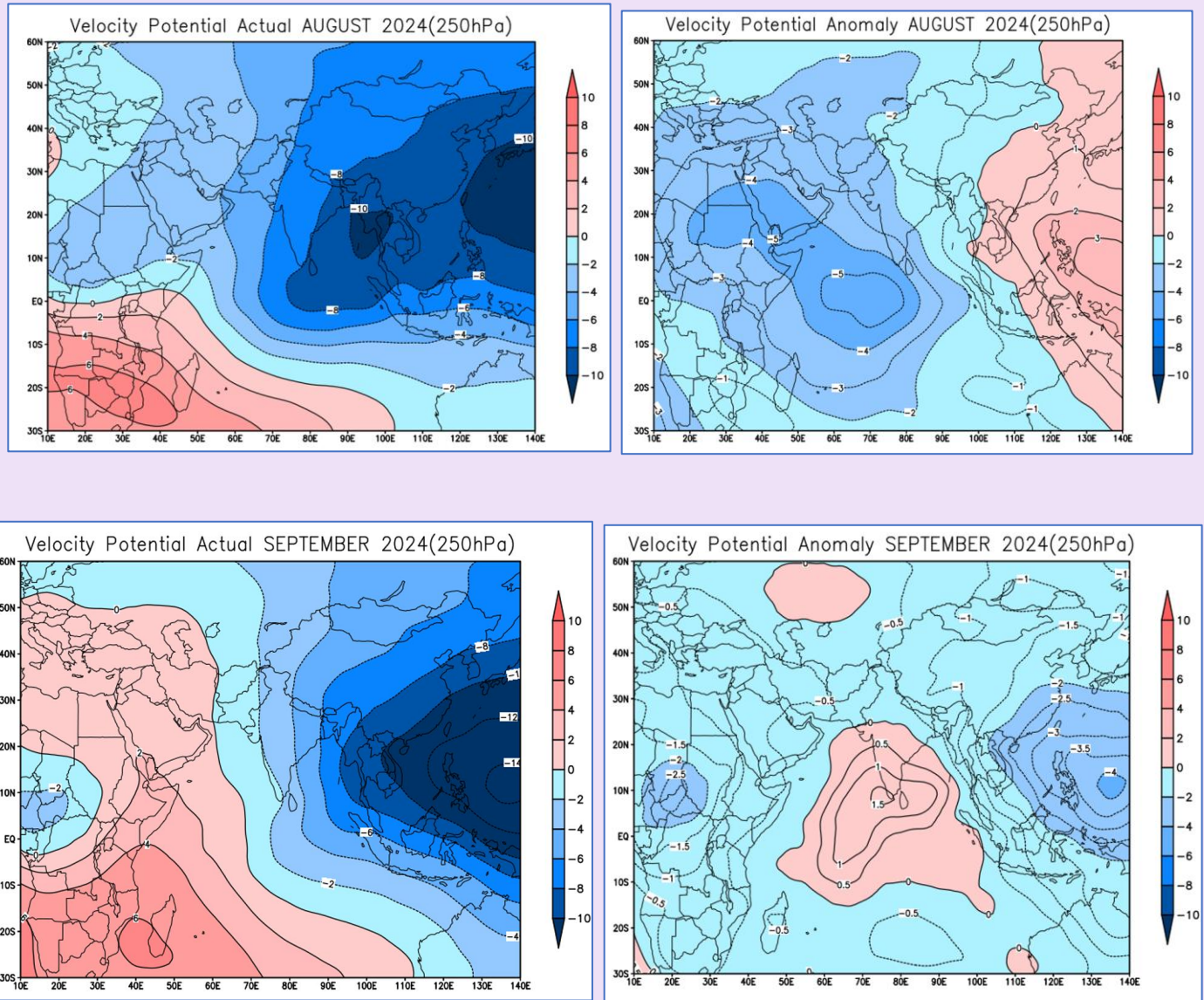


Fig.4.3a: (contd.)

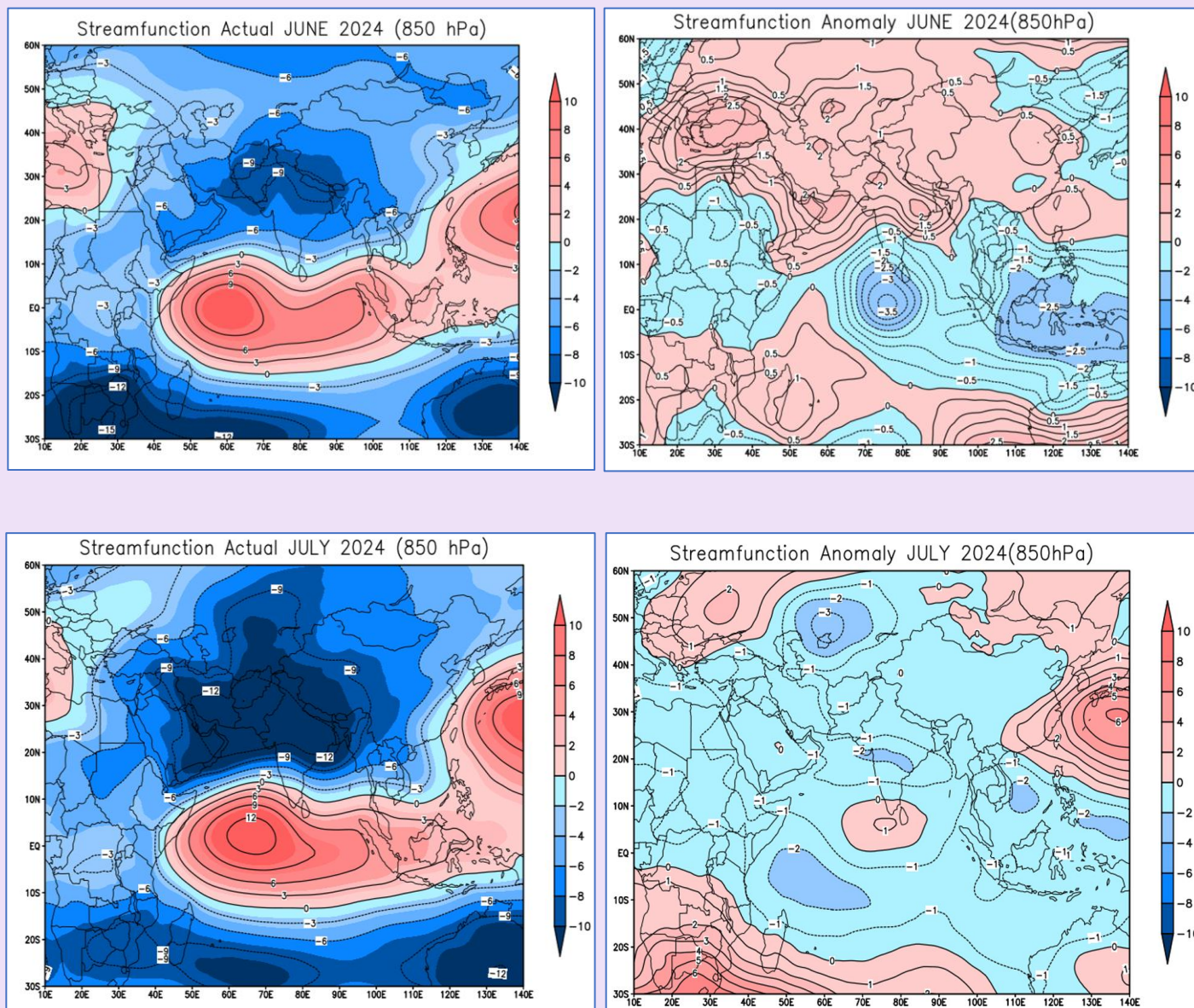


Fig.4.3b: 850 hPa Streamfunction (x 10⁶ m²/s) (actual & anomaly) during Jun, Jul, Aug & Sep 2024
 (Source: Climate Diagnostic Bulletin of India, IMD Pune)

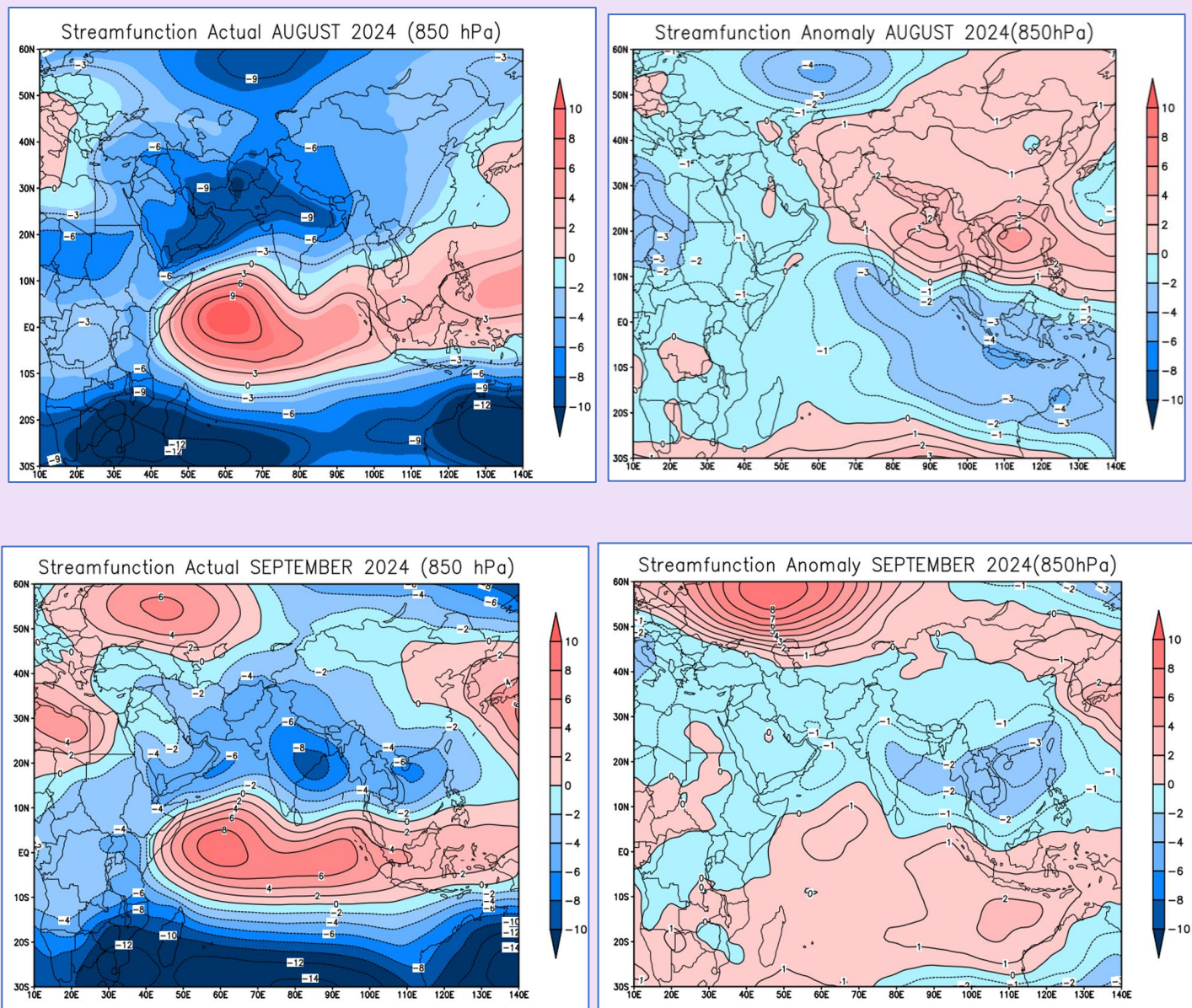


Fig.4.3b: (contd.)

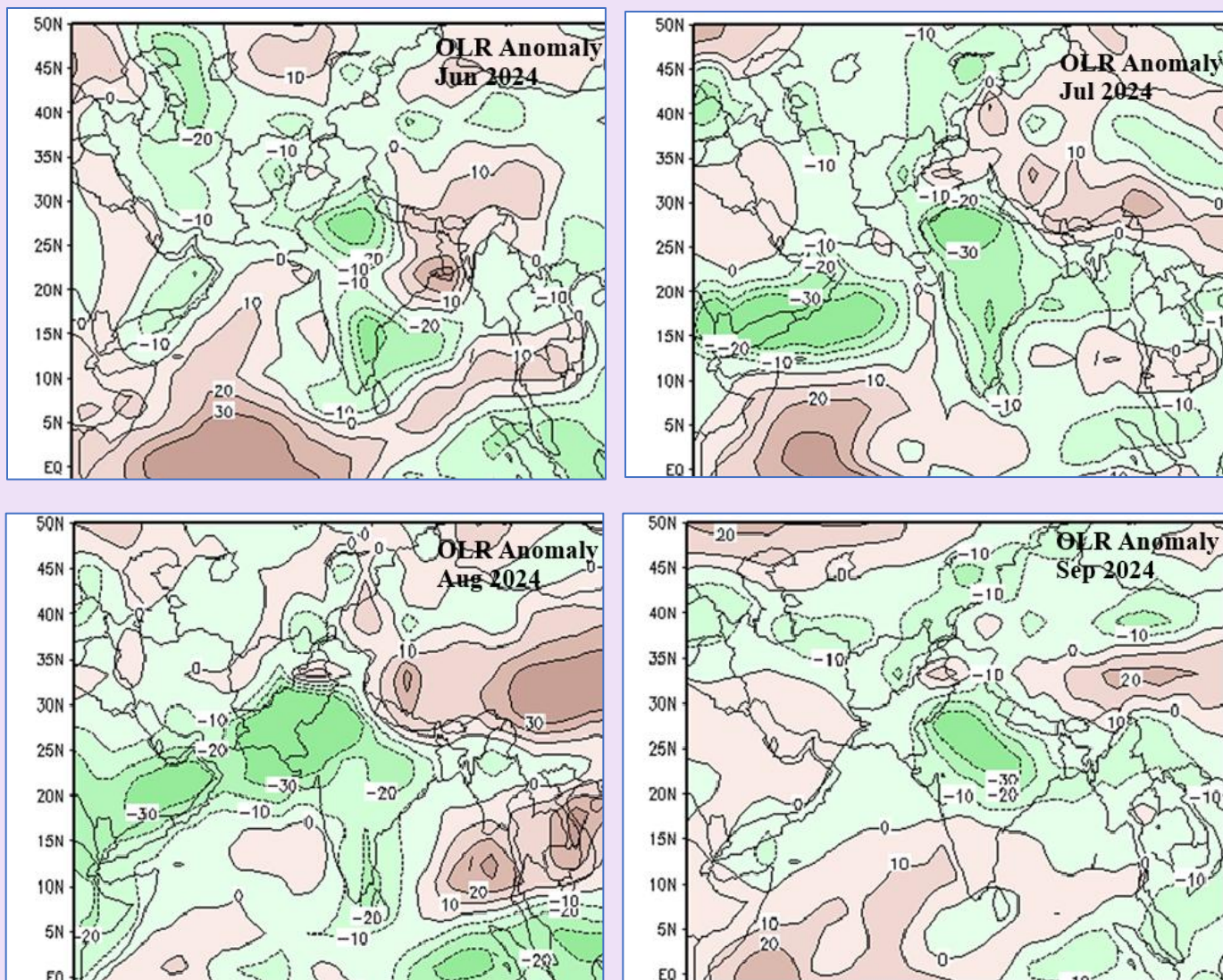


Fig.4.4: OLR anomalies over the Indian region during Jun, Jul, Aug & Sep 2024

5. Withdrawal of SWM 2024 from the SP region

The withdrawal of SWM 2024 commenced from the northwest India on 23rd September, a delay by about 06 days (normal date – 17th September). It withdrew from the SP region and hence from the entire country on 15th October 2024. Fig.5 depicts the isolines of dates of withdrawal of SWM 2025 from the SP region.



Fig.5: Isolines of dates of withdrawal of SWM 2024 over the SP region

6. Summary

During 2024, southwest monsoon (SWM) advanced over parts of Maldives, Comorin area, south Bay of Bengal, Nicobar islands and South Andaman Sea on 19th May. It set in over Kerala on 30th May, 2 days earlier than the normal date of 1st June and covered the entire southern peninsular (SP) India (comprising of the five states of Andhra Pradesh, Telangana, Karnataka, Kerala and Tamil Nadu and two union territories of Puducherry and Lakshadweep) by 20th June, the normal date being during 11th-15th June. It covered the entire country by 02nd July, six days ahead of its normal date of 08th July.

The South Peninsular region received above normal rainfall [114% (81 cm) of its LPA of 72 cm] during the SWM 2024 season.

Seasonal rainfall over the nine meteorological subdivisions covering the five states and two union territories in the SP region was *excess* in 4 sub divisions [Telangana (TEL) Coastal Andhra Pradesh

(CAP), Coastal Karnataka (CK) & Lakshadweep (LAK)] and *normal* in the other five subdivisions [Rayalaseema (RYS), Tamilnadu (TN), Kerala (KER), North Interior Karnataka (NIK), & South Interior Karnataka (SIK)]. The seasonal rainfall figures over the nine subdivisions CAP, RYS, TEL, TN, CK, NIK, SIK, KER, LAK) were +26%, +18%, +29%, +18%, +22%, +04%, +07%, -13%, and +27% respectively.

During the season, *fairly widespread* to *widespread* rainfall occurred over CK on about 87% of the days, over KER & LAK on 83% & 70% of the days respectively and over TEL, CAP, SIK & NIK, on about 30-50% of the days. *Active* to *Vigorous* monsoon conditions prevailed over CK on 35 days followed by TEL: 34 days & NIK: 30 days.

There were *isolated heavy* rainfall activities on 74 days over TN, 60-70 days over SIK, CK & TEL, 40-60 days over KER, CAP & NIK, 27 days over RYS & 4 days over LAK area during the season. The highest 24-hr rainfall recorded during the season in the SP region was over Malyal (Mahabubabad district, Telangana): 40 cm (396 mm) on 01st September.

An *extreme* rainfall event over North Kerala, SIK & adjoining western ghat areas of North TN during the 24-hr ending 0830 IST of 30th July triggered devastating landslides over Wayanad district in Kerala on 30th July 2024.

The withdrawal of SWM 2024 from the SP region and hence from the entire region took place on 15th October 2024.

Acknowledgements

This report is a compilation of real-time observational data and analytical products generated by various IMD offices including IMD New Delhi, Pune, Hyderabad, Bangalore, Amaravati and Thiruvananthapuram as well as raingauge networks of various state governments. Contribution from all officials involved in generation of data and analytical products used for preparation of this report is duly acknowledged.

APPENDIX-(i): Terminologies for Spatial rainfall distribution

Terminology	description
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 (a few places)	26% to 50% number of stations of a region (sub-division) reporting at least 2.5 mm rainfall.
ISOL- Isolated (one or two 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

Sl No.	Terminology	Rainfall range in mm	Rainfall range in cm	Percentile
1	<i>Very Light Rainfall</i>	Trace – 2.4		
2	<i>Light Rainfall</i>	2.5 – 15.5	Up to 1	Up to 65
3	<i>Moderate Rainfall</i>	15.6 – 64.4	02 – 06	65 – 95
4	<i>Heavy Rainfall</i>	64.5 – 115.5	07 – 11	95 – 99
5	<i>Very Heavy Rainfall</i>	115.6 – 204.4	12 – 20	99.0 – 99.9
6	<i>Extremely Heavy Rainfall</i>	Greater than or equal to 204.5 mm	21 cm or more	>99.9
7	<i>Exceptionally Heavy Rainfall</i>	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 Monsoon activity

Active (ACT)	Active monsoon conditions (FWS to WS rainfall over the subdivision with rainfall amount 1½ to 4 times the normal and at least 2 stations reporting 5cm or more along the west coast or 3cm or more elsewhere)
Vigorous (VIG)	Vigorous monsoon conditions (FWS to WS rainfall over the subdivision with rainfall amount more than 4 times the normal and at least 2 stations reporting 8cm or more along the west coast or 5cm or more elsewhere).

Appendix-(iv) Monsoon performance

Terminology	Description
<i>Large Excess</i>	Percentage departure from normal: $\geq +60\%$
<i>Excess</i>	Percentage departure from normal: $+20\%$ to $+59\%$
<i>Normal</i>	Percentage departure from normal: -19% to $+19\%$
<i>Deficient</i>	Percentage departure from normal: -20% to -59%
<i>Largely deficient</i>	Percentage departure from normal: $\leq -60\%$