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

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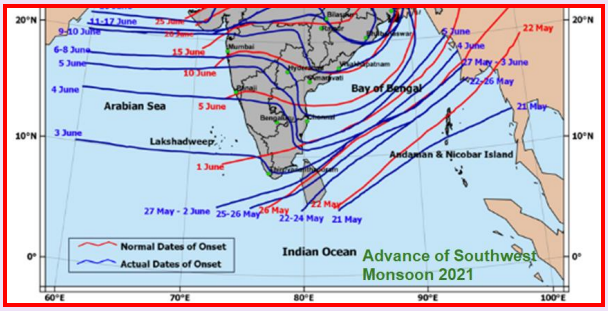
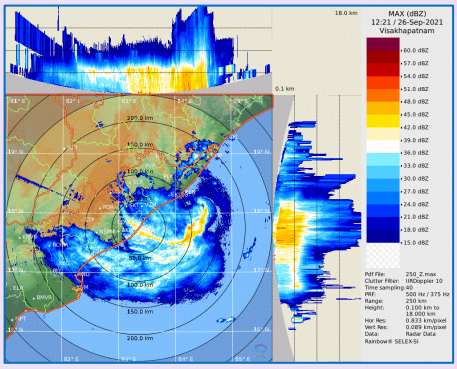
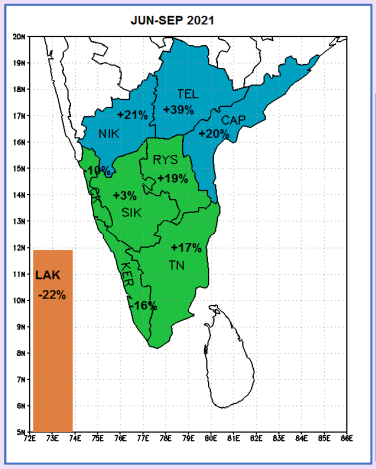
IMD Chennai Scientific Report No. IMDC-SR/11

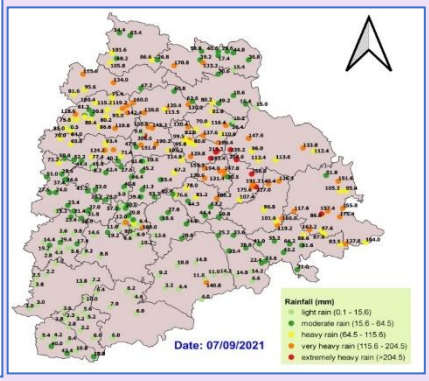
# SOUTHERN PENINSULAR INDIA:

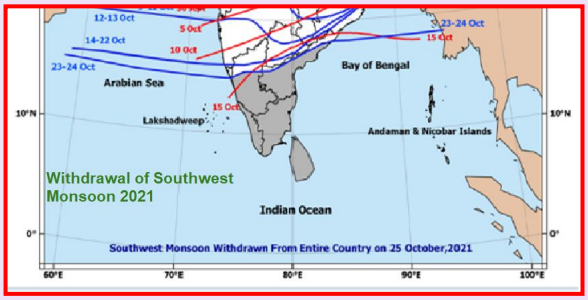
# SOUTHWEST MONSOON, 2021–REPORT






Regional Meteorological Centre, Chennai
December 2021

# Table of Contents





*Kindly refer Appendix-(i)-(iv) in pages 52-53 for description of technical terms*

## Executive Summary

| | | |
|---|---|---|
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*Kindly refer Appendix-(i)-(iv) in pages 52-53 for description of technical terms*

# HIGHLIGHTS

- ✓ During 2021, southwest monsoon (SWM) advanced over Andaman Sea on 21st May, a day ahead of its normal date. It set in over Kerala on 03rd June, a delay by two days from its normal date of onset (i.e.) the 01st June and covered the entire southern peninsular India (SP) by 10th June. It covered the entire country by 13th July, 5 days later than its normal date of 08th July.

- ✓ All India southwest monsoon (SWM) seasonal rainfall during Jun-Sep, 2021 was *normal* (87.0 cm against Long Period Average (LPA) of 88.0 cm)

- ✓ Onset on monsoon over Kerala took place on 03rd June 2021 against the normal date of 01st June.

- ✓ South Peninsular region recorded *above normal* rainfall of 111% of LPA.

- ✓ Excepting Lakshadweep, all other subdivisions in the region received *normal to excess* rainfall during the SWM season - Coastal Andhra Pradesh & Yanam (CAP): +20%, Telangana (TEL): +39%, Rayalaseema (RYS): +19%, Tamilnadu-Puducherry-Karaikal (TN): +17%, Coastal Karnataka (CK): -10%, North Interior Karnataka (NIK): +21%, South Interior Karnataka (SIK): +3%, Kerala & Mahe (KER): -16% and Lakshadweep (LAK): -22%]

- ✓ There were *isolated heavy* rainfall activities on 73 days over TN, 69 days over SIK, 67 days over TEL, 56 days over CK ,53 days over KER, 49 days over CAP, 32 days over NIK, 30 days over RYS & 2 days over LAK area.

- ✓ TEL & SIK experienced 5 & 4 days respectively of *isolated extremely heavy* rainfall during the season.

- ✓ Cyclonic storm '**Gulaab**' formed over Bay of Bengal on 24th September, crossed north Andhra Pradesh coast and caused heavy to very heavy rainfall with isolated extremely heavy falls over north coastal Andhra Pradesh and Telangana on 27th-28th Sep 2021.

- ✓ Wankdi (Kumaram Bheem district) in Telangana recorded the highest rainfall amount of 387.2 mm over the southern region on 23rd July 2021.

- ✓ The SWM withdrew from the entire country on 25th October 2021



*Kindly refer Appendix-(i)-(iv) in pages 52-53 for description of technical terms*

## 1. Onset and Advance

During the year 2021, the Bay of Bengal (BOB) branch of southwest monsoon (SWM) current advanced into the BOB with the characteristic strengthening and deepening of cross equatorial flow and enhanced cloudiness and rainfall over the Andaman Sea on 21st May and covered some more parts of BOB up to 02nd June. It covered Comorin-Maldives area and advanced into some parts of south Arabian Sea (AS), Lakshadweep area, south Kerala, south Tamilnadu and some more parts of southwest BOB on 03rd June. Thus, it set in over Kerala on 03rd June 2021, two days later than the normal date of onset (i.e.) the 01stJune.

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 10th June (normal: 11th June). The northern limit of monsoon (NLM) passed over Kochi (Kerala), Palayamkottai (TN) on 03rd June. It advanced into remaining parts of LAK & KER, most parts of CK & SIK, some parts of NIK, CAP, RYS and some more parts of TN on 04th; some parts of TEL, some more parts of CAP, RYS, TN, entire CK, SIK and most parts NIK on 05th; entire TN, RYS, NIK, some more parts of CAP and TEL on 06th; some more parts of CAP & TEL on 09th; and into remaining parts of CAP & TEL on 10th and thus covered the entire SP region on 10th June 2021. The advance of the monsoon over the SP region, as depicted by the northern limit of the monsoon (NLM) is presented in Fig.1a.

During the onset phase of the monsoon, a cyclonic circulation lay over eastcentral Arabian sea off Karnataka coast extending up to 3.1 km above mean sea level on 3rd June; a trough at mean sea level was seen off Karnataka-Kerala coasts on 03rd, from south Maharashtra coast to south Kerala coast on 04th & 05th, from north Maharashtra coast to north Kerala coast on 06th & 07th; a cyclonic circulation lay over equatorial Indian Ocean and adjoining central parts of south BOB between 3.1 km and 4.5 km above mean sea level on 03rd, over Sri Lanka and adjoining Comorin area between 3.1 km and 4.5 km above mean sea level on 04th & 05t ; an east-west shear zone ran form southwest AS to southeast BOB across extreme southern peninsula along latitude 8°N at 3.1



*Kindly refer Appendix-(i)-(iv) in pages 52-53 for description of technical terms*

km above mean sea level on 03rd; and a north-south trough ran from Telangana to south TN and extending up to 1.5 km above mean sea level on 03rd June.

Subsequently, during 03rd-10th June 2021, under the influence of off shore trough off KER-KAR coasts, upper air cyclonic circulations over AS & BOB and east-west shear zone over the SP region, the monsoon advanced into the entire SP region. Surface isobaric analysis as on 0830 IST and upper air (lower-mid tropospheric levels) streamline analysis as on 0530 IST of 03rd, 06th & 10th June are presented in Fig.1b.

During the period of onset and advance of the monsoon over the SP region (03rd-10th June), *Fairly widespread* (FWS) to *Widespread* (WS) rainfall occurred on 06 out of 08 days over KER and CK; on 05 days of LAK and on 04 days over SIK & NIK. Monsoon was active over KER on 04th, vigorous over RYS and active over TN on 06th and active over TEL on 11th June 2021.

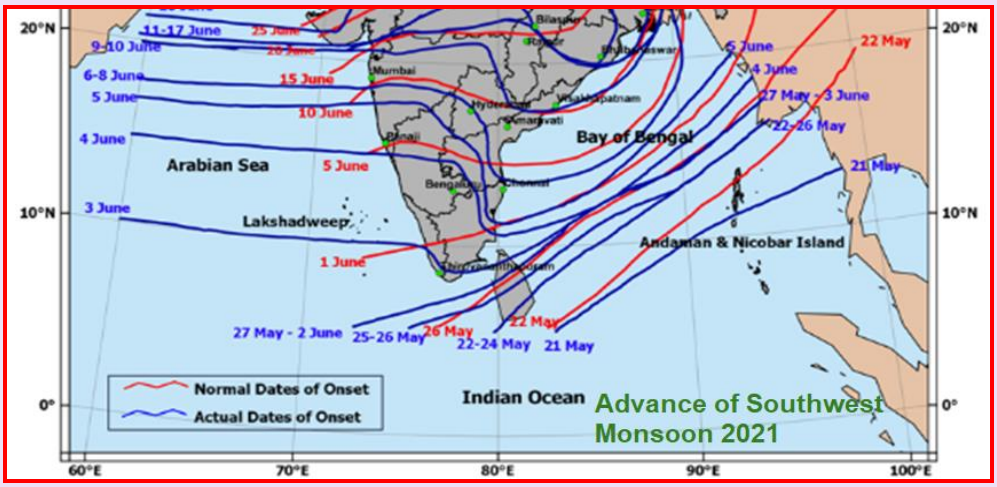
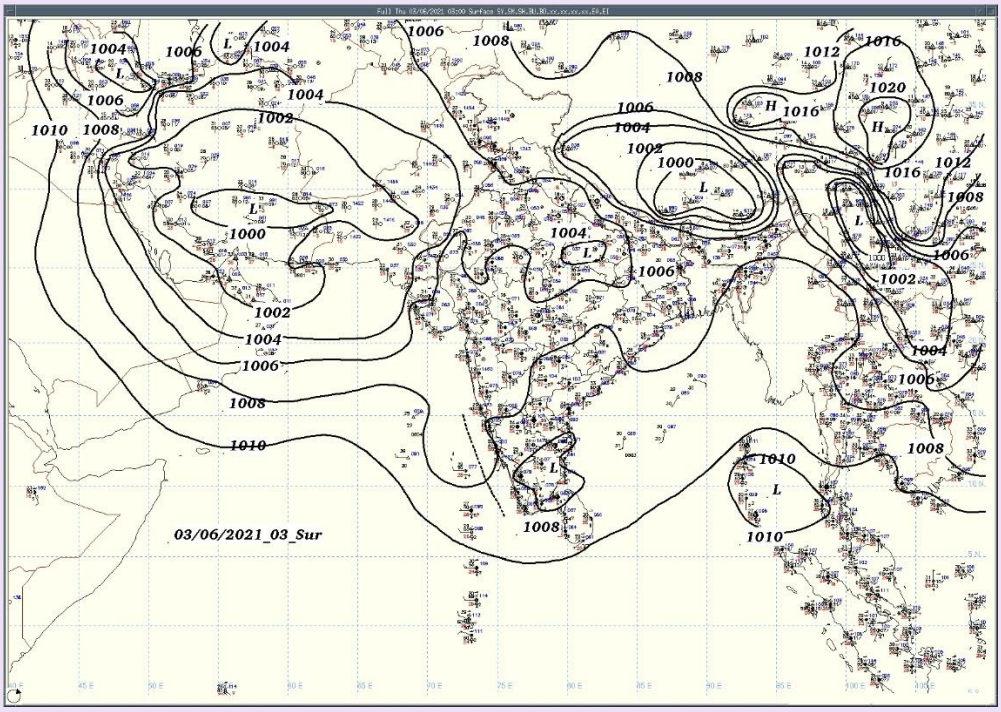



**Fig.1a: Advance of southwest monsoon 2021 over southern peninsular India depicted by lines of northern limit of monsoon on various dates**



*Kindly refer Appendix-(i)-(iv) in pages 52-53 for description of technical terms*



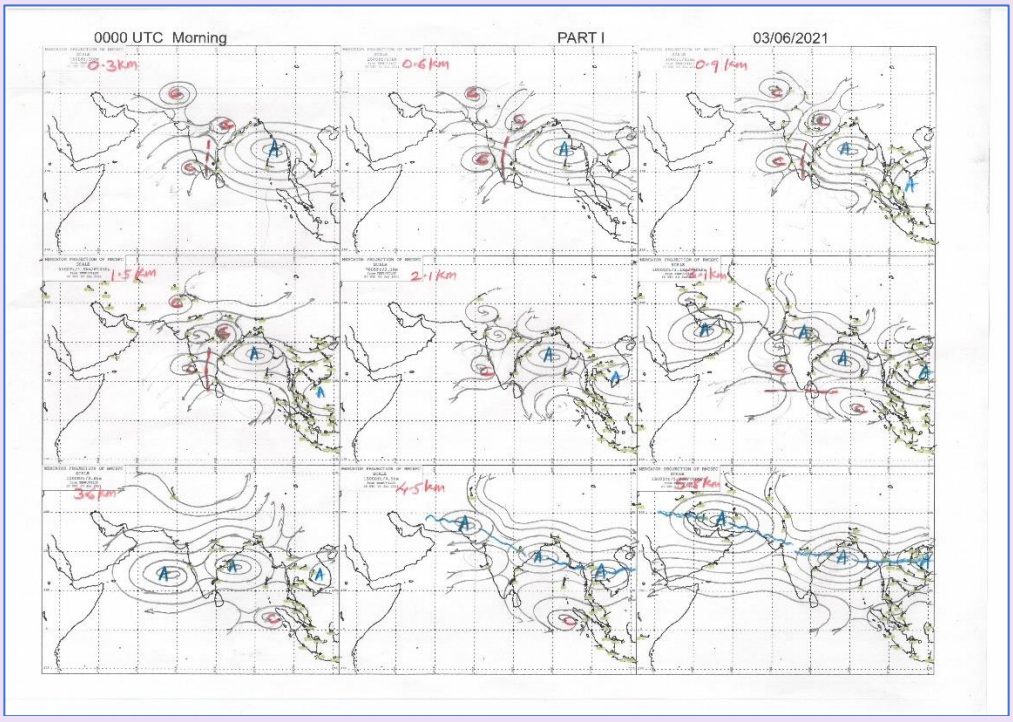
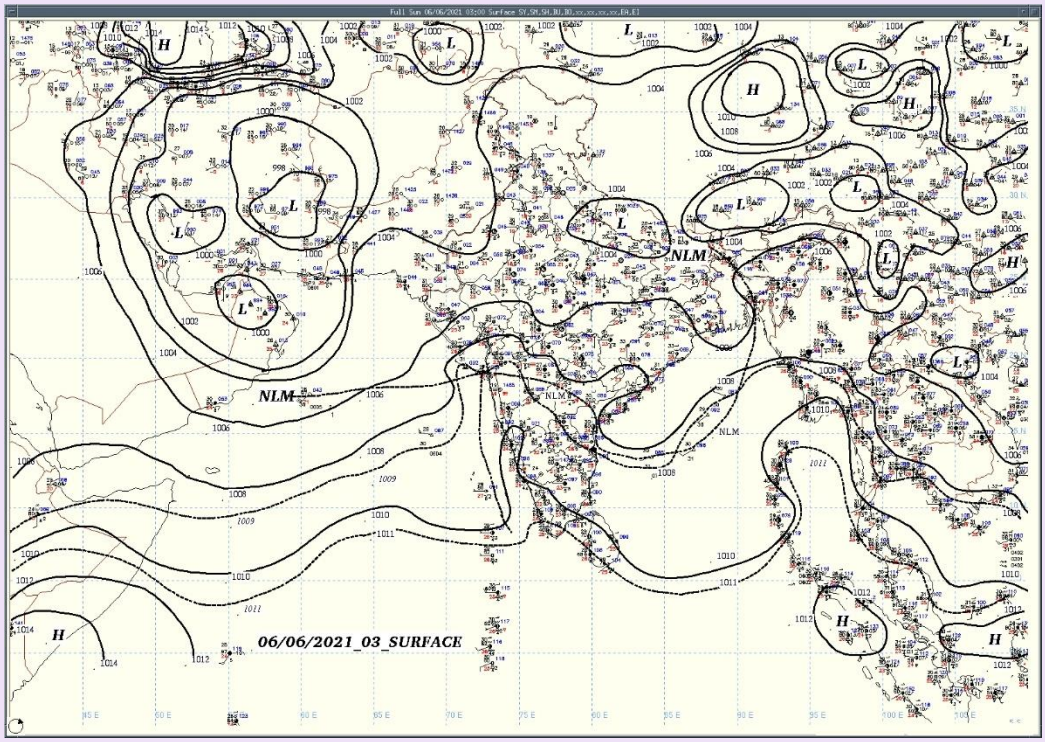




**Fig.1b: Surface Isobaric analysis as on 0830 IST and streamline analysis of lower-mid tropospheric levels as on 0530 IST of 03rd, 06th & 10th June 2021**



*Kindly refer Appendix-(i)-(iv) in pages 52-53 for description of technical terms*



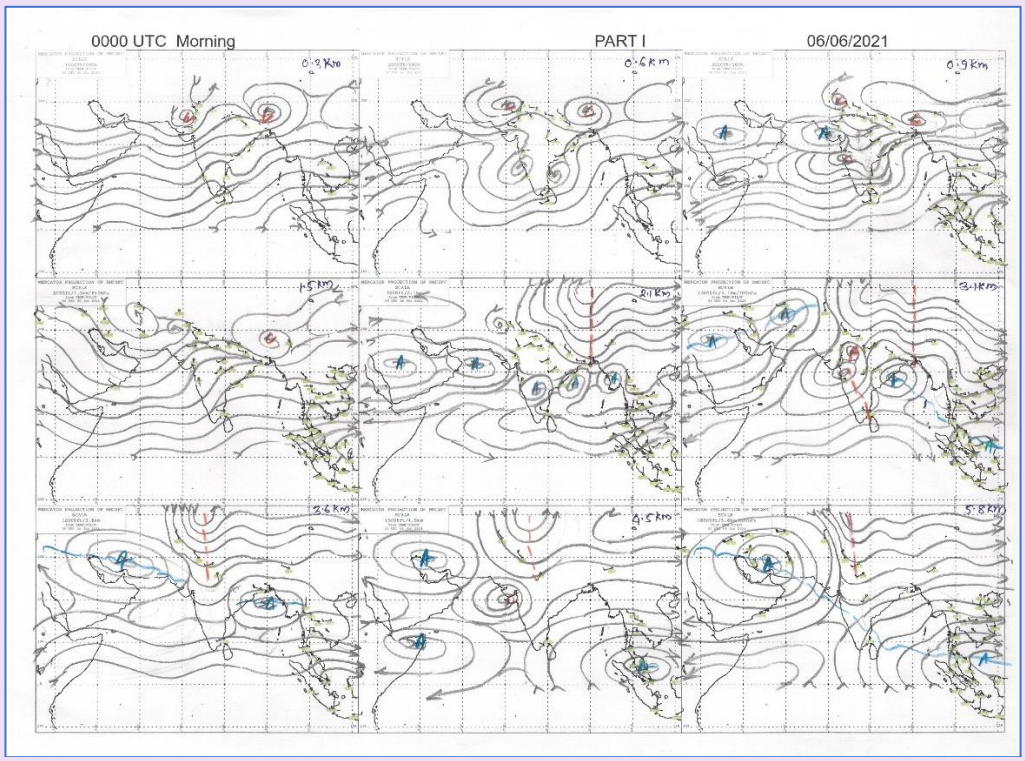
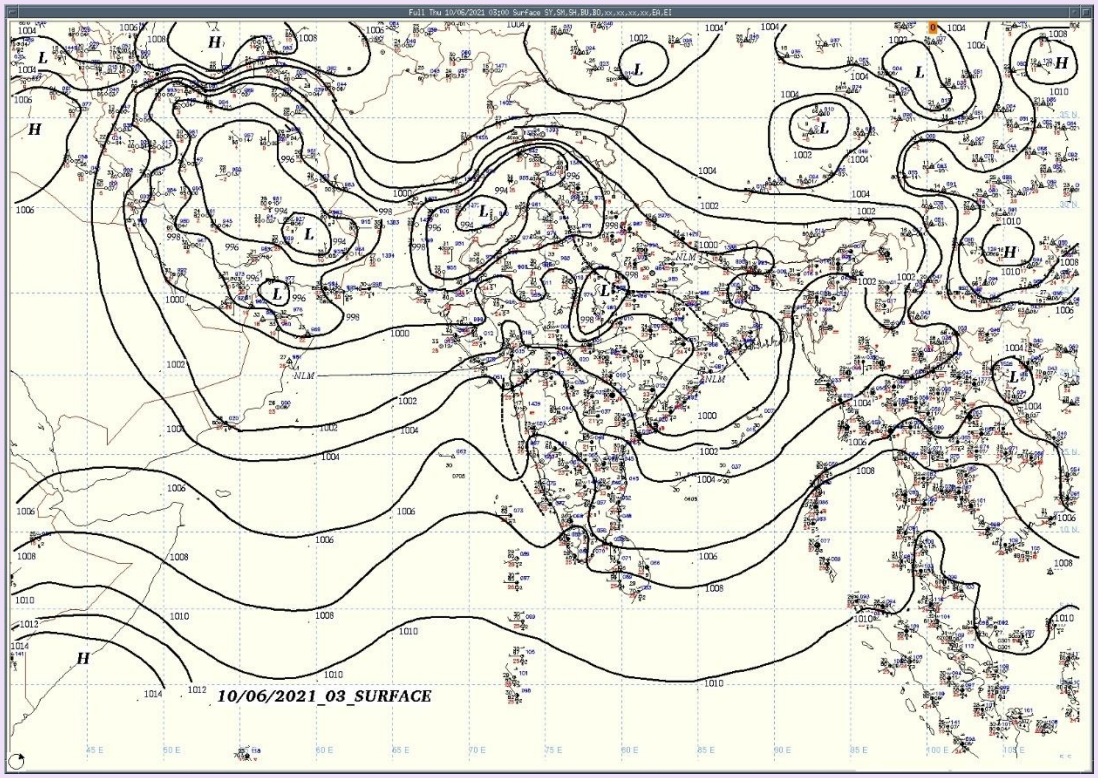




**Fig.1b: (contd.)**



*Kindly refer Appendix-(i)-(iv) in pages 52-53 for description of technical terms*



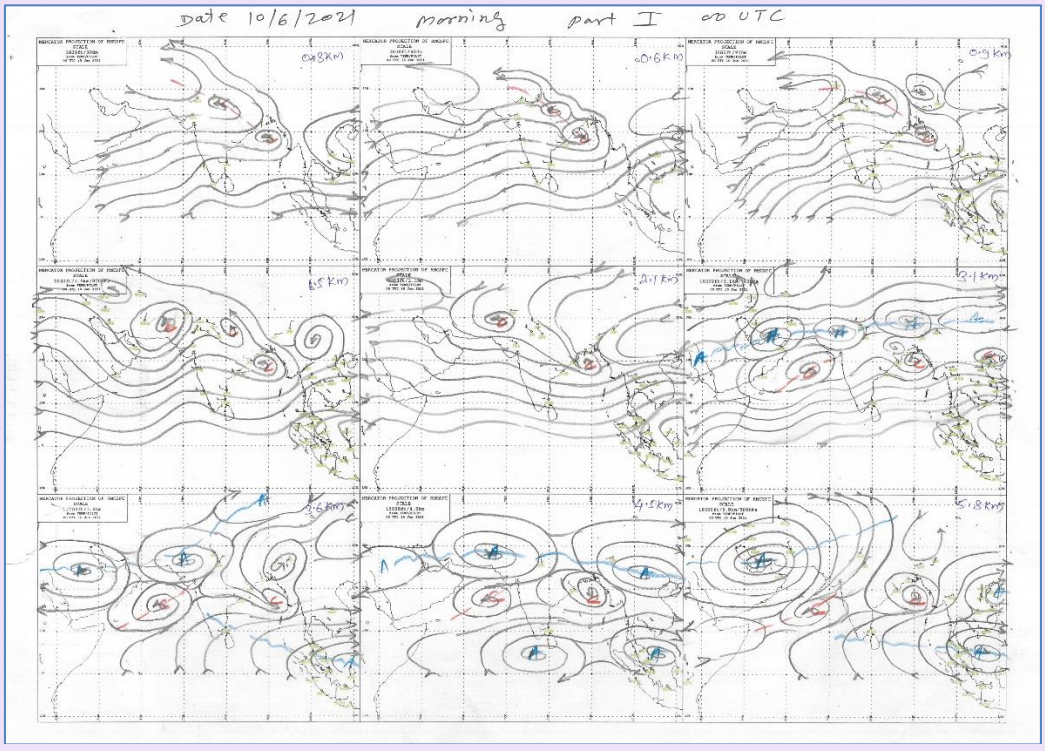




**Fig.1b:(contd.)**



*Kindly refer Appendix-(i)-(iv) in pages 52-53 for description of technical terms*

Fig.1c presents the INSAT-3D satellite infra red imageries depicting the cloudiness associated with the onset of SWM over Kerala on 03rd June and its further advance into the SP region by 10th June. Fig.1d presents the GPM satellite – gauge merged rainfall depicting the advance of SWM 2021 over the SP region and Fig.1e depicts the gauge observed rainfall during the advance of the monsoon over various subdivisions and states over the SP region.

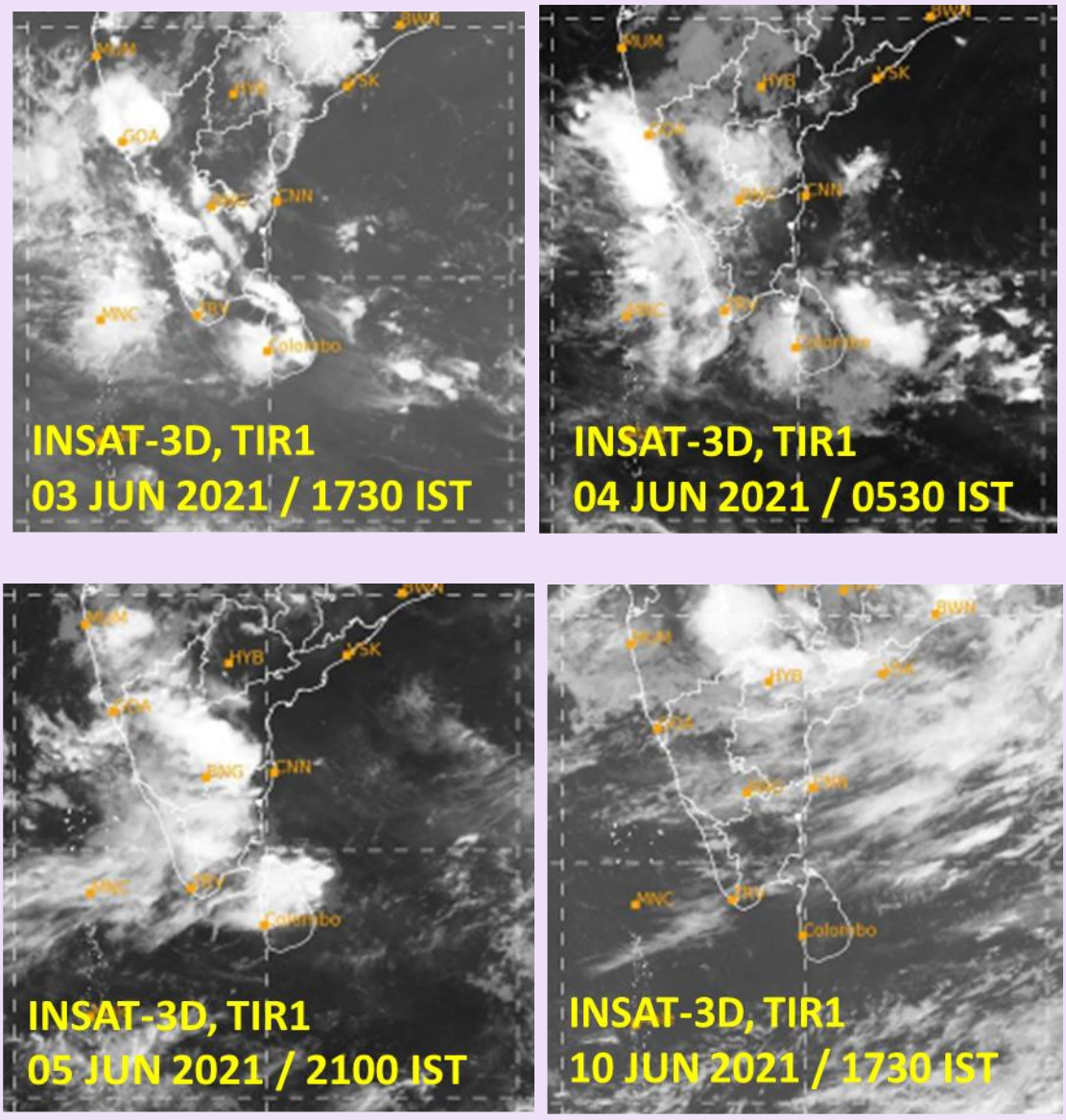



**Fig.1c: INSAT-3D infra-red imageries as on 03/1730, 04/1730, 05/2100, 10/1730 IST of June 2021 depicting the advance of SWM 2021 over the SP region**



*Kindly refer Appendix-(i)-(iv) in pages 52-53 for description of technical terms*

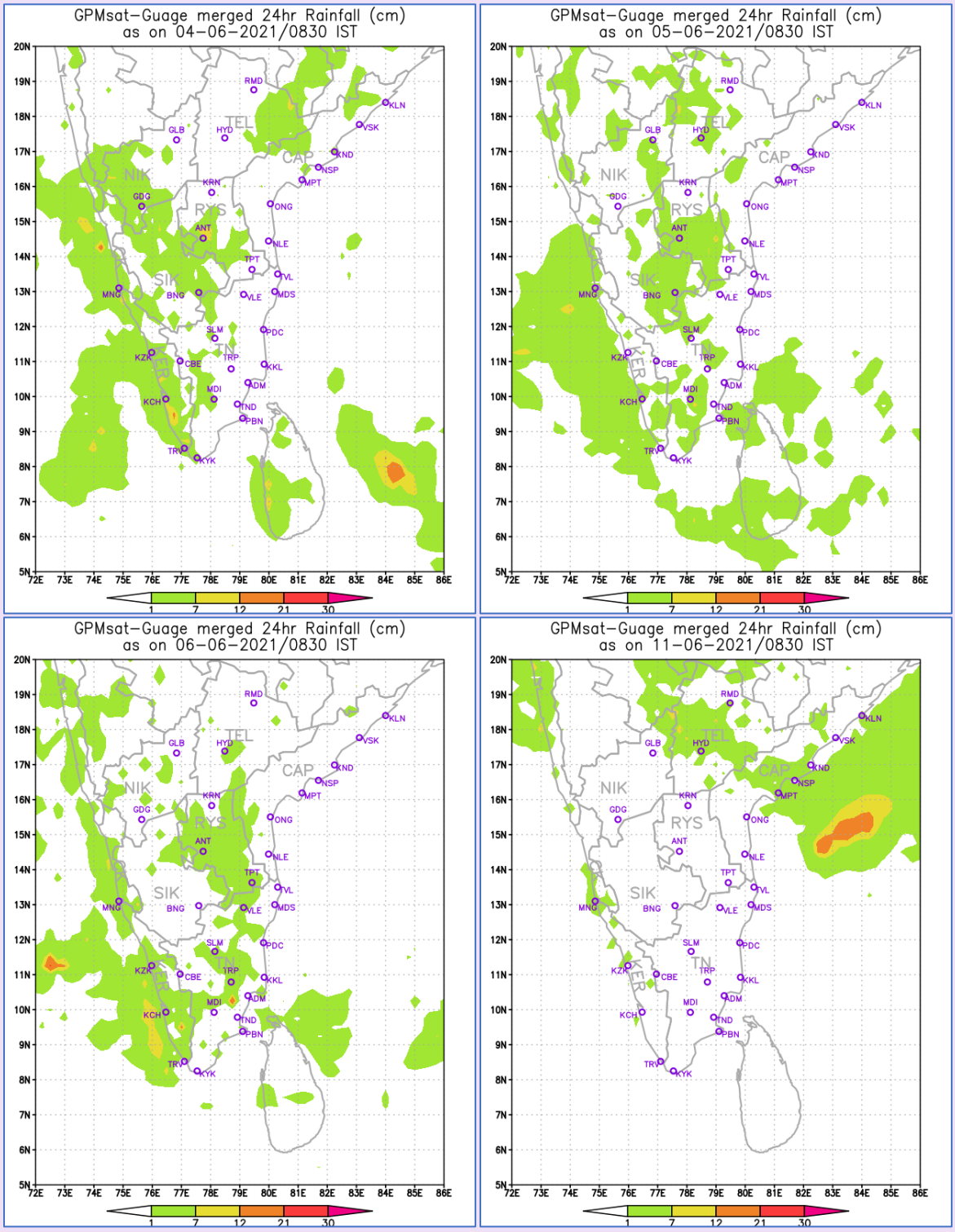



**Fig.1d: GPM Sat – Gauge merged rainfall in cm as on 24-hr ending 0830 IST of 04th, 05th, 06th and 11thJune 2021 depicting the advance of monsoon rains over the SP region during SWM 2021.**



*Kindly refer Appendix-(i)-(iv) in pages 52-53 for description of technical terms*

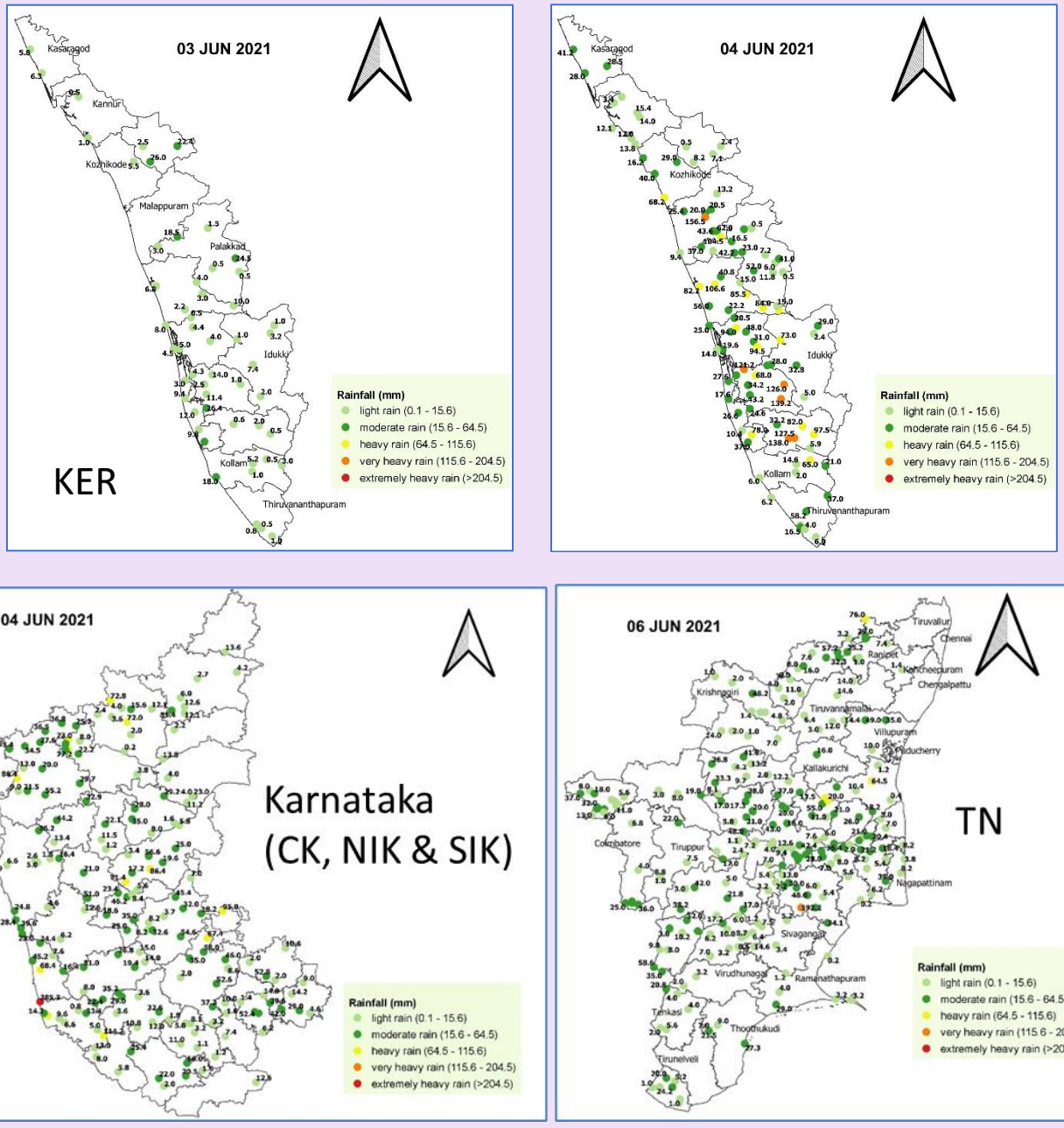
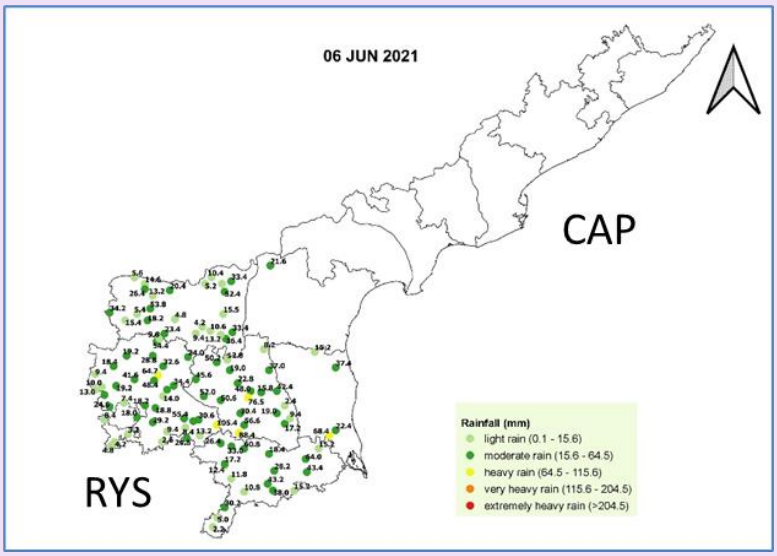



**Fig.1e: Rainfall (distribution and intensity) over Kerala on 03rd & 04th, Karnataka (CK, SIK & NIK) on 04th, TN on 06th, RYS on 06th, CAP ON 11th & TEL on 11th June 2021 (as on 24-hr ending 0830 IST).**



*Kindly refer Appendix-(i)-(iv) in pages 52-53 for description of technical terms*



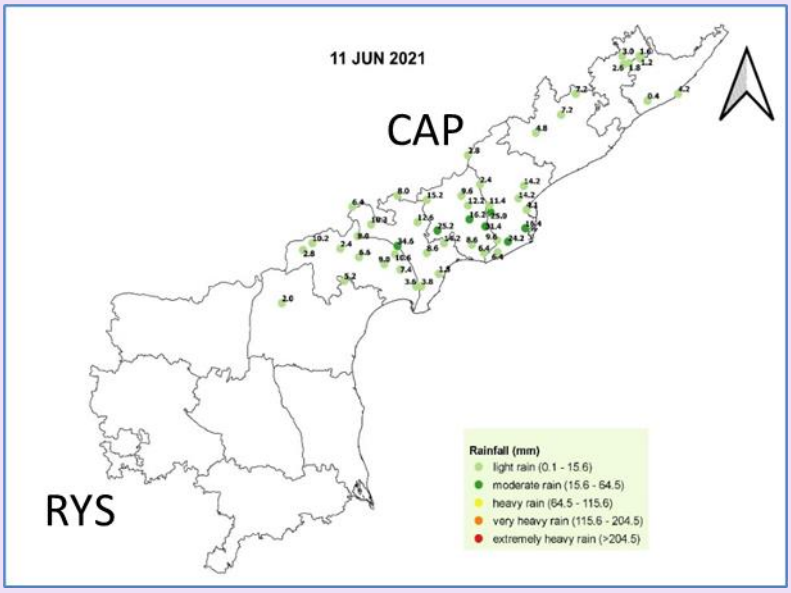




**Fig.1e: (contd.)**



*Kindly refer Appendix-(i)-(iv) in pages 52-53 for description of technical terms*

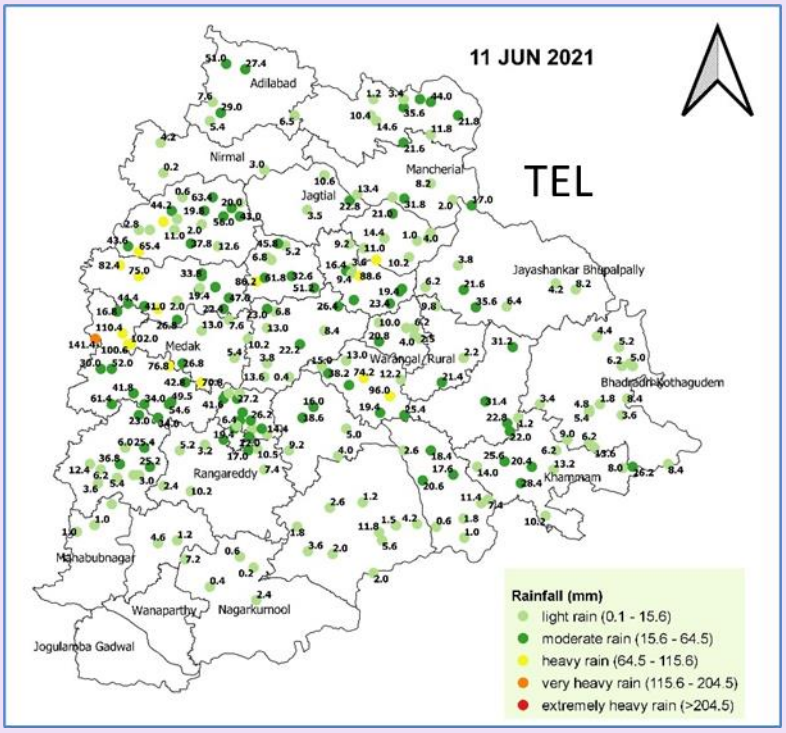



**Fig.1e: (contd.)**

## 2. Chief synoptic features & associated weather

During June-September 2021, 5-low pressure areas (LOPAR), 1-Deep Depression, 1-Cyclonic Storm (Gulaab), presence of off shore trough off the west coast / cyclonic circulations in the lower-mid tropospheric levels over the SP region and neighbourhood /east-west shear zone across peninsular India in the lower-mid tropospheric levels tilting southwards with height / north-south trough across the southern peninsula contributed significantly towards SWM rainfall over the SP region as detailed below:

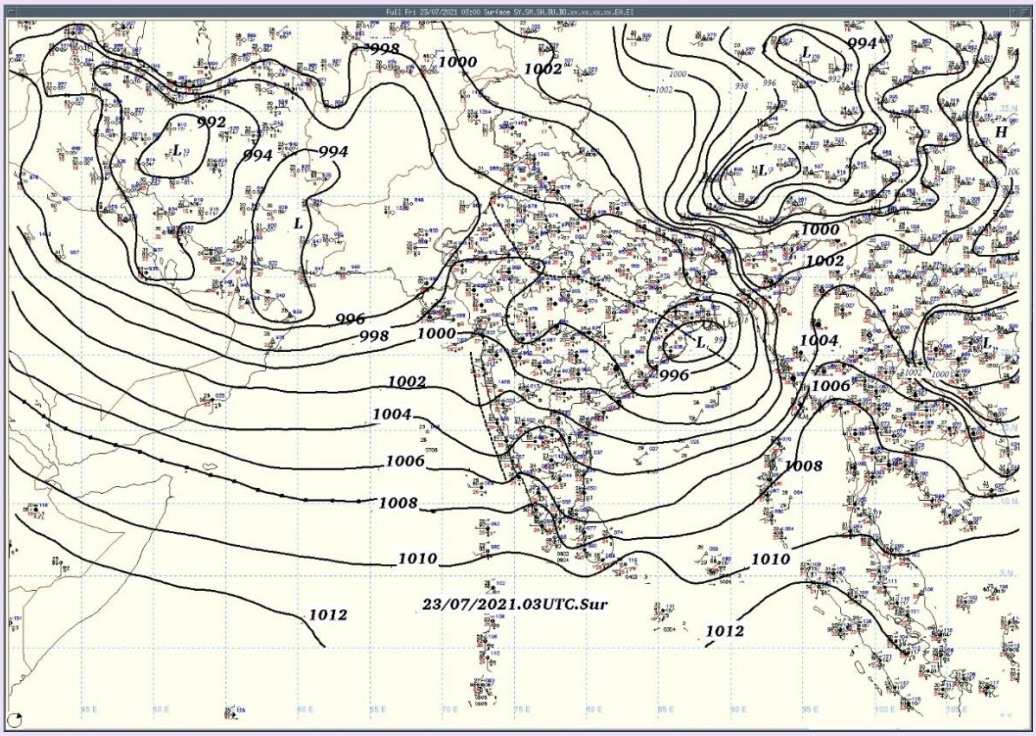
(i) Under the influence of off shore trough / strengthening of low level westerlies / cyclonic circulations in the lower-mid tropospheric levels / east-west shear zone across peninsular India, *fairly widespread – widespread* rainfall occurred over CK on 108 days out of 122 days, 97 days over KER, 89 days over LAK, 65 days over NIK & 58 days over SIK during the season. *Active* to *vigorous* monsoon conditions prevailed over CK on 26 days, over NIK – 34 days, over SIK – 23 days and over KER - 22 days. There were 23, 28, 6 & 16 days of *isolated very heavy* rainfall over CK, SIK, NIK & KER respectively including *isolated extremely heavy* rainfall for 3 days (04$^{th}$ June, 18$^{th}$ & 23$^{rd}$ July) over CK, 4 days (17$^{th}$ & 18$^{th}$ June, 15$^{th}$ & 23$^{rd}$ July) over SIK and 1 day



*Kindly refer Appendix-(i)-(iv) in pages 52-53 for description of technical terms*

(23rd July) over NIK. Surface isobaric analysis as on 0830 IST of 23rd July depicting the off shore trough off Karnataka coast and rainfall distribution and intensity as on 24-hr ending 0830 IST of 23rd July over Karnataka (CK, NIK & SIK) is presented in Fig.2a&b.

(a)




(b)

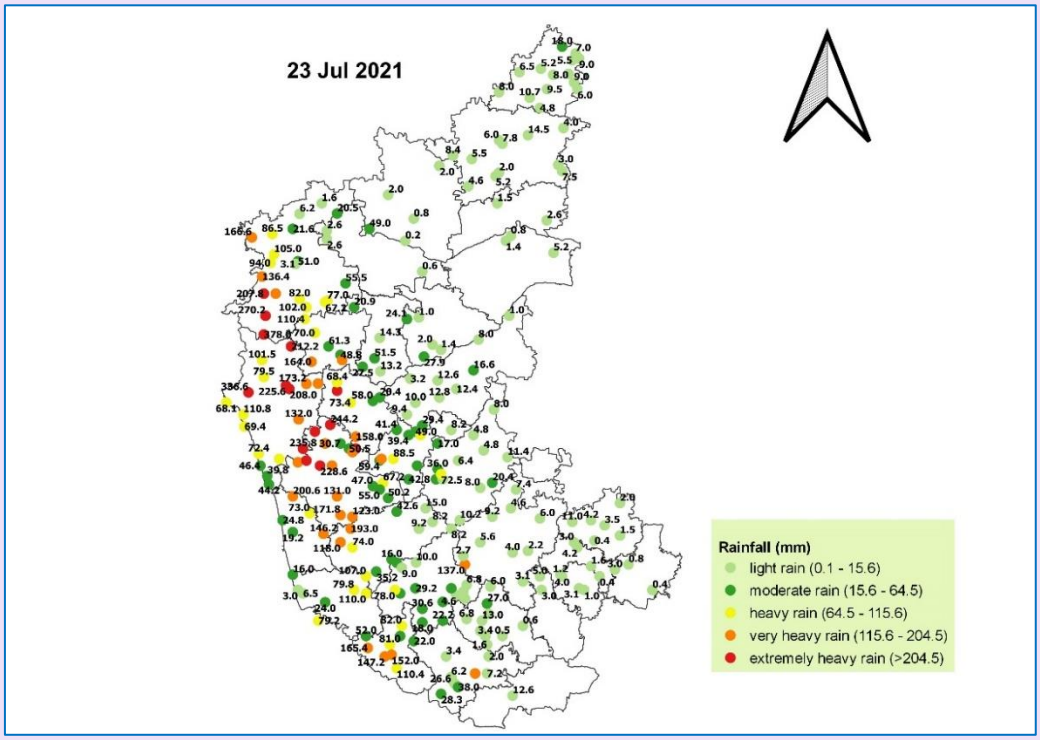



**Fig.2: (a) Surface isobaric analysis as on 08:30 IST of 23rd July and (b) past 24-hr rainfall as on 08:30 IST of 23rd July over Karnataka**



*Kindly refer Appendix-(i)-(iv) in pages 52-53 for description of technical terms*

(ii) Under the influence of a LOPAR that formed on 11th June over northwest BOB and adjoining Odisha-West Bengal coast extending up to to mid-tropospheric levels and tilting southwest wards with height and its subsequent movement inland and an east-west shear zone across the southern peninsula in the lower-mid tropospheric levels, 2 days of *widespread*, 3 days of *fairly widespread* and 3 days of *scattered* rainfall activity occurred over TEL during 11th-18th June with 2 days of *isolated heavy* to *very heavy* rain on 14th & 15th June and *isolated heavy* rain on 13th & 16th June. *Vigorous* monsoon conditions prevailed on 14th & *active* monsoon conditions on 15th in TEL.

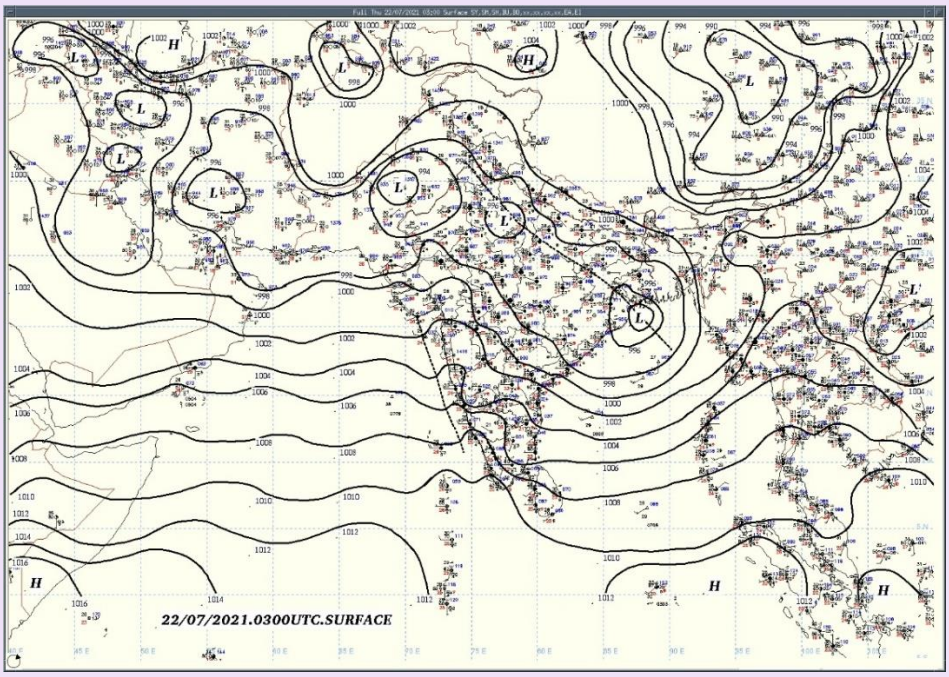
(iii) Under the influence of a LOPAR that formed on 11th July over BOB off North Andhra Pradesh – South Odisha coast with associated cyclonic circulation extending up to mid tropospheric levels tilting southwest-wards with height and its movement inland (including the remnant cyclonic circulation in the lower-mid tropospheric levels), *fairly widespread* to *widespread* rainfall occurred over CAP & TEL during 10th-16th and over RYS on 10th, 15th & 16th July with *vigorous* monsoon conditions over TEL on 14th and *active* monsoon conditions over TEL during 11th-13th & 15th and over CAP during 10th-14th & 16th. *Isolated heavy* to *very heavy* rain occurred over TEL on all days during 11th-17th July with *isolated extremely heavy* rain of 21 cm over Chegunta in Medak district on 15th July.

(iv) Under the influence of a LOPAR that formed on 22nd July over northwest BOB with associated cyclonic circulation extending up to upper tropospheric levels tilting southwest-wards with height and becoming Well Marked LOPAR (WML) over northwest BOB off North Odisha – West Bengal coast and subsequently moving inland, *widespread* rainfall occurred over TEL on all the days during the period 21st-24th July, *fairly widespread* to *widespread* rainfall occurred over CAP during the same period and over RYS during 21st-23rd July with *vigorous* monsoon conditions over TEL on 22nd and 23rd July and *active* monsoon conditions over TEL on 21st and over CAP during 21st-23rd July. *Isolated heavy* to *very heavy* rainfall with *extremely heavy* rainfall at *one or two* places occurred over TEL on 22nd & 23rd (22nd July: Nirmal district – Dilawarpur:23 cm, Sarangapur: 22 cm; Adilabad district – Boath: 21 cm; 23rd July: Kumaram Bheem district – Wankdi: 39 cm (387.2 mm), Asifabad: 30 cm; Nirmal district – Sarangapur: 21 cm). Surface isobaric analysis as on 0830 IST and upper air (lower-mid tropospheric levels) streamline analysis



*Kindly refer Appendix-(i)-(iv) in pages 52-53 for description of technical terms*

as on 0530 IST of 22nd July are presented in Fig.2c and rainfall intensity and distribution over TEL during the 24-hr ending 0830 IST of 22nd & 23rd are depicted in Fig.2d.



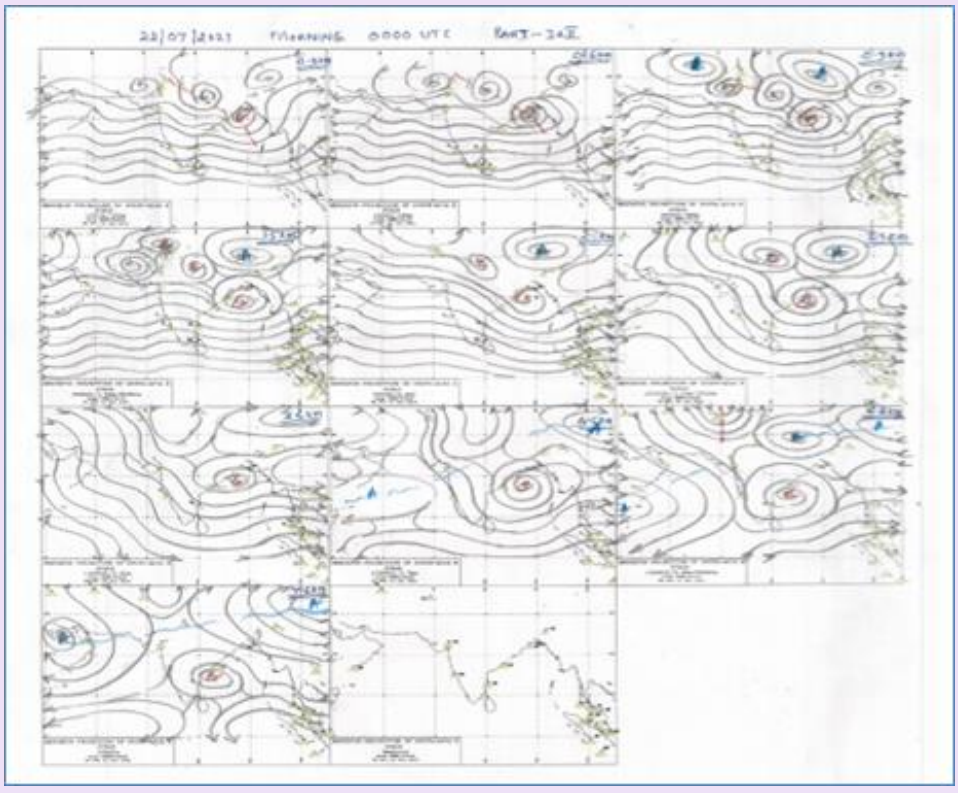
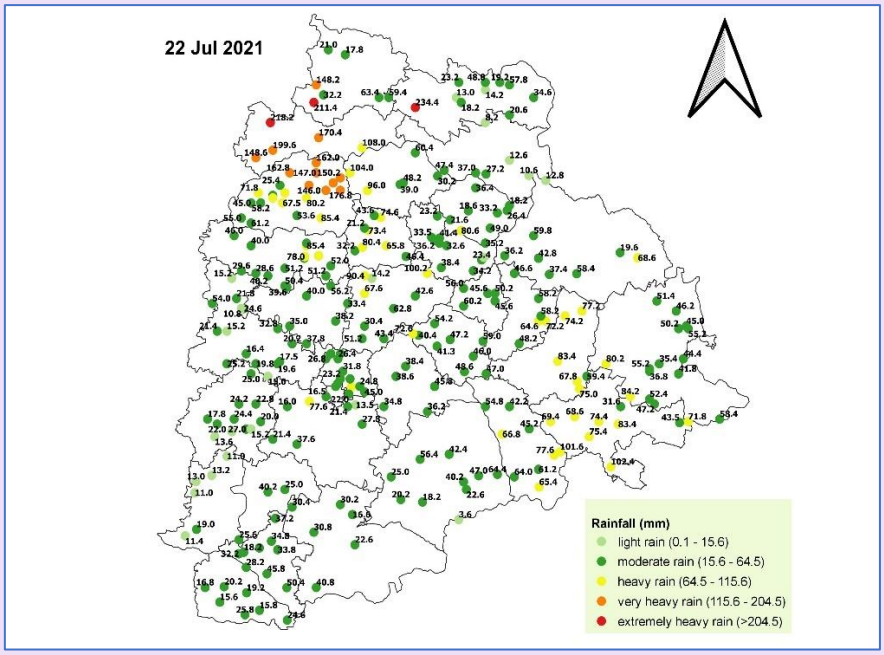



**Fig.2c: Surface Isobaric analysis as on 0830 IST and streamline analysis of lower-mid tropospheric levels as on 0530 IST of 22nd July 2021**



*Kindly refer Appendix-(i)-(iv) in pages 52-53 for description of technical terms*



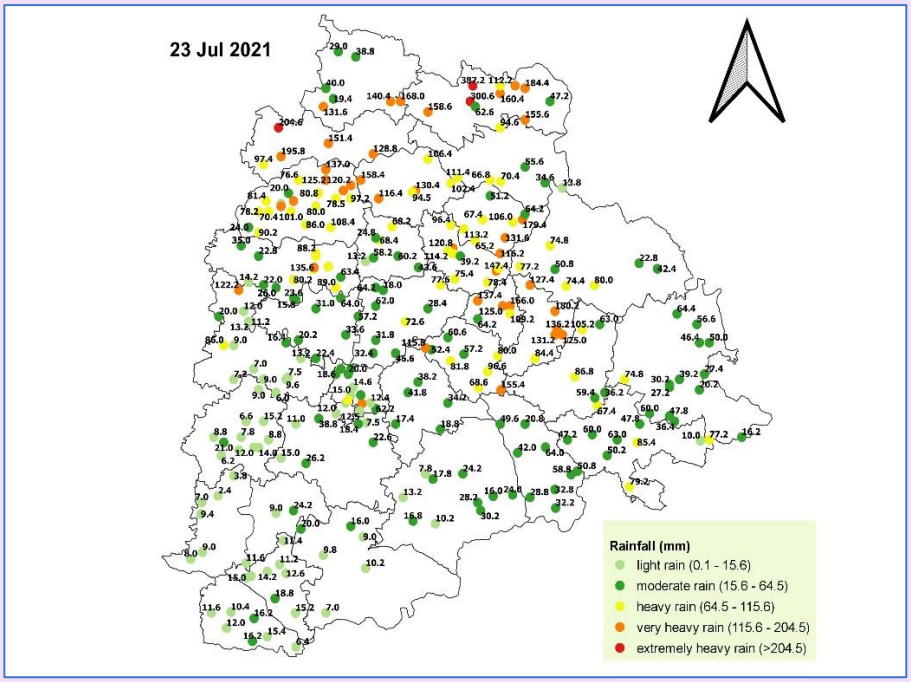




**Fig.2d: Rainfall intensity and distribution over TEL during 22nd & 23rd July 2021**



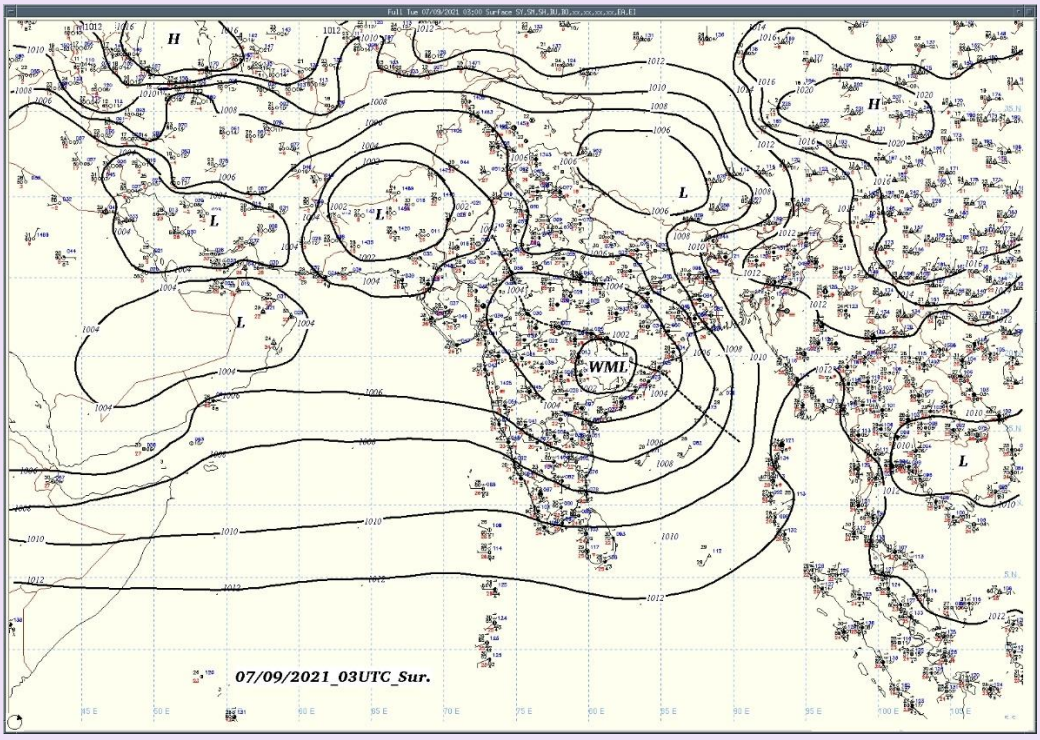
*Kindly refer Appendix-(i)-(iv) in pages 52-53 for description of technical terms*

(v) Under the influence of a LOPAR that formed on 16th August over northwest and adjoining westcentral BOB off south Odisha – north Andhra Pradesh coasts extending up to upper tropospheric levels, titlting southwest-wards with height, *fairly widespread* to *widespread* rainfall occurred over CAP during 13th-17th and over TEL during 16th-19th August with *active* monsoon conditions over CAP during 13th-16th and over TEL during 16th-19th August. *Active* monsoon conditions prevailed over RYS on 17th August. *Isolated heavy* rain occurred over CAP during 13th-17th August and over TEL during 13th-14th and 16th-18th August 2021.

(vi) Under the influence of a LOPAR that formed on 06th September over northwest and adjoining BOB off south Odisha – north Andhra Pradesh coasts extending up to upper tropospheric levels, tilting southwest-wards with height, that became well marked on 07th, *fairly widespread* to *widespread* rainfall occurred over CAP during 05th-07th and over TEL during 05th-08th September 2021 with *vigorous* monsoon conditions over CAP on 06th & 07th and over TEL on 07th September 2021. *Isolated heavy* to *very heavy* rain occurred over CAP on 06th & 07th and over TEL on 07th & 08th. *Isolated extremely heavy* rain occurred over TEL on 07th [Nallabelly (dist Warangal_rural) 26 cm, Huzurabad (dist Karimnagar) 25 cm, Kothagudem (dist B. Kothagudem) 23 cm, Mogullapalle (dist J. Bhupalpally) 23 cm, Khanapur (dist Warangal_rural) 23 cm, Dharmaram (dist Peddapalle) 22 cm, Jammikunta (dist Karimnagar) 21 cm, Konaraopeta (dist Rajanna Sircilla) 21 cm, Parkal (dist Warangal_rural) 21 cm]. Surface isobaric analysis as on 0830 IST and upper air (lower-mid tropospheric levels) streamline analysis as on 0530 IST of 07th September are presented in Fig.2e and rainfall intensity and distribution over TEL during the 24-hr ending 0830 IST of 07th September are depicted in Fig.2f. Water logging and inland flooding due to overflowing of lakes & other water bodies were reported in some areas.



*Kindly refer Appendix-(i)-(iv) in pages 52-53 for description of technical terms*



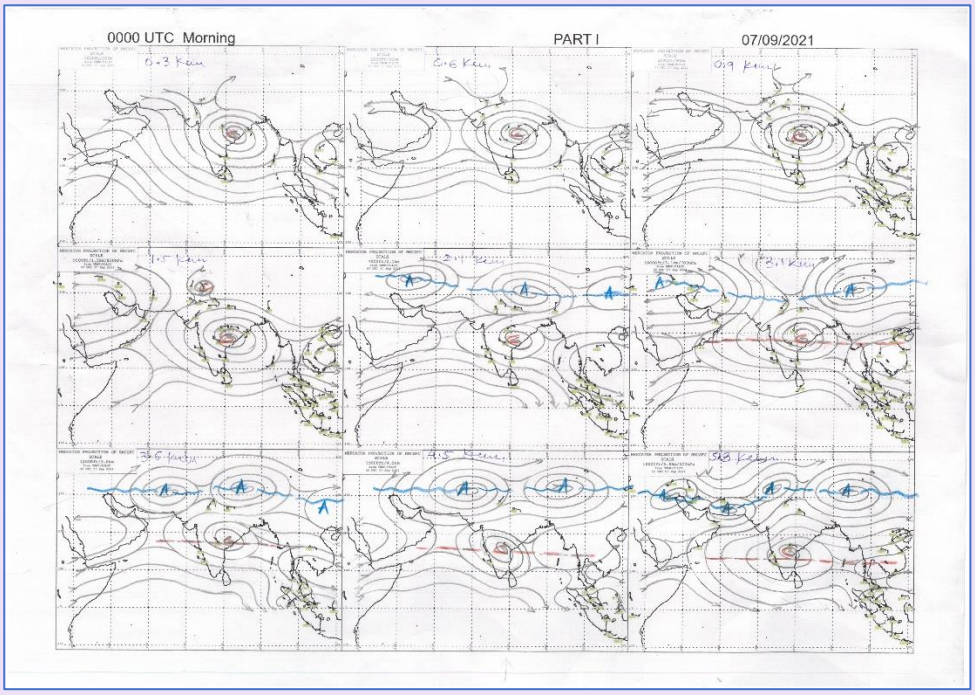




**Fig.2e: Surface Isobaric analysis as on 0830 IST and streamline analysis of lower-mid tropospheric levels as on 0530 IST of 07th September 2021**



*Kindly refer Appendix-(i)-(iv) in pages 52-53 for description of technical terms*

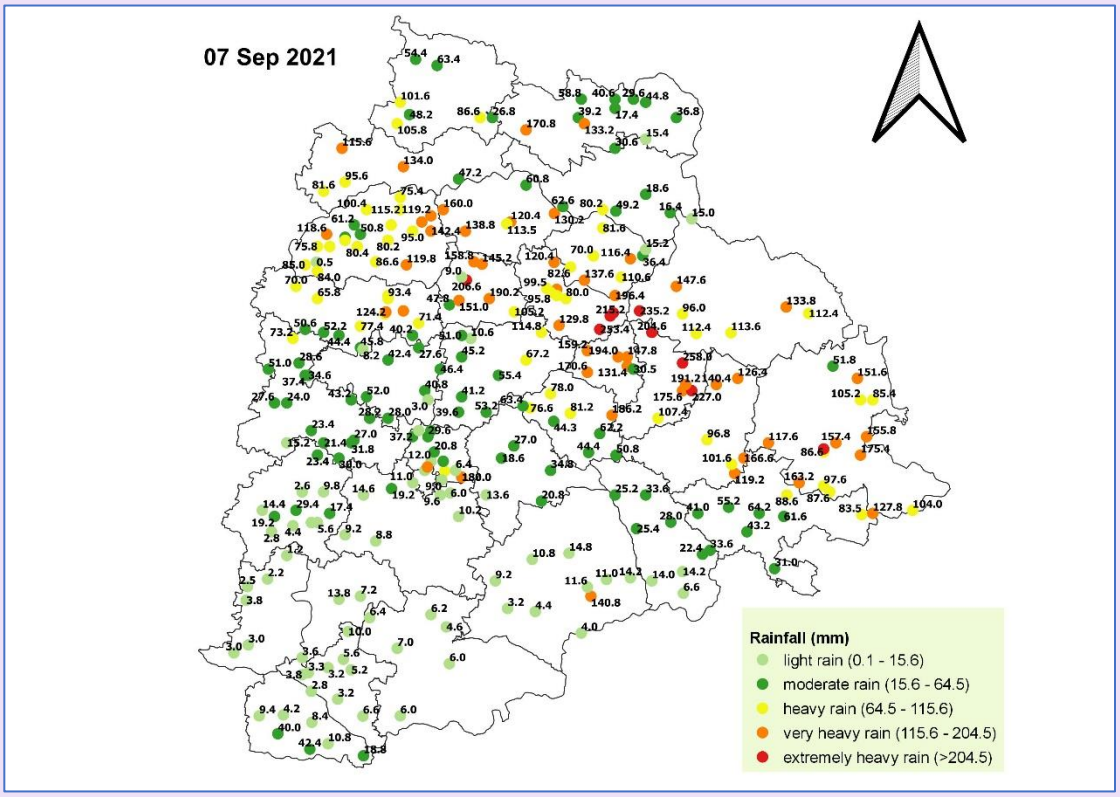



**Fig.2f: Rainfall intensity and distribution over TEL on 07th September 2021**

7/16/22, 4:30 PM Hyderabad: 1,500 homeless as Osman Nagar flooded again - Times of India

Printed from
THE TIMES OF INDIA

## Hyderabad: 1,500 homeless as Osman Nagar flooded again

TNN | Sep 8, 2021, 04.39 AM IST

HYDERABAD: More than 1,500 people in 300 houses adjoining the Osman Nagar Lake were rendered homeless after water overflowed from the lake and swamped homes.

On Tuesday, the residents of Osman Nagar on the city's fringes were seen wading through knee-deep water in an attempt to shift their valuables to a safer place, while some of them were helplessly waiting for the water level to go down.

**Fig.2g: Media report depicting the flood situation due to intense rainfall on 06th-07th September 2021**



*Kindly refer Appendix-(i)-(iv) in pages 52-53 for description of technical terms*

(vii) Under the influence of a LOPAR that formed on 11th September over eastcentral and adjoining northeast BOB with associated cyclonic circulation extending up to upper tropospheric levels, tilting southwards with height and its gradual intensification into a Depression on 12th evening and into a **Deep Depression** on 13th and moving inland, scattered to *fairly widespread* rainfall occurred over CAP & TEL on 13th & 14th September with *isolated heavy* rain over TEL on 14th September.

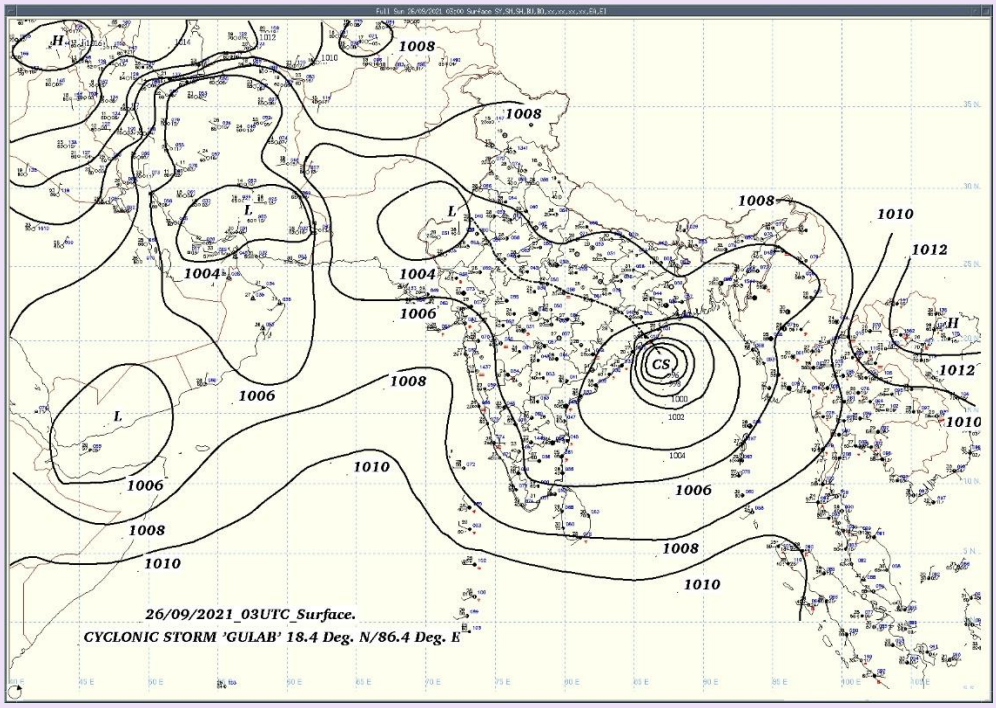
(viii) Under the influence of a LOPAR that formed on 21st September over Gangetic West Bengal and neighbourhood with a trough extending from it up to Telangana, there were 4 days of fairly widespread -widespread rainfall activity over TEL during 21st-24th September with isolated heavy to very heavy rain and active monsoon conditions on 21st. Isolated heavy rain also occurred during 22nd-24th September over TEL.

(ix) A LOPAR that formed over eastcentral BOB on 24th September and gradually intensified into Depression on 24th evening, Deep depression and **Cyclonic Storm - Gulaab** on 25th, crossed north Andhra Pradesh-south Odisha coasts on 26th and its further movement inland. Surface isobaric analysis as on 0830 IST and upper air streamline analysis as on 0530 IST of 26th & 27th September depicting the system are presented in Fig.2h. Sample satellite and Radar imageries depicting the cloudiness and reflectivity associated with the system are shown in Fig.2i and the Track of the cyclone Gulaab is presented in Fig.2j. Rainfall over CAP on 27th & TEL on 28th September are presented in Fig.2k.

Associated with the passage of the system, *fairly widespread* to *widespread* rainfall with *active* to *vigorous* monsoon conditions prevailed over CAP and TEL during 26th-28th September 2021. *Heavy* rainfall occurred at *many* places with *isolated very heavy* to *extremely heavy rain* over north CAP (6 - *extremely heavy* & 17 - *very heavy* rainfall reports) on 27th and heavy rain at *a few* places with *isolated very heavy* to *extremely heavy* rain was reported over TEL (3- *extremely heavy* and 24 -*very heavy* rainfall reports) on 28th. Highest rainfall amount of **28 cm** was reported over Visakhapatnam and Gajapathinagaram, Nellimarla (both Vizianagaram district) on 27th September 2021. Extensive water logging and damages to crops and structures in north CAP and TEL were reported by the media (Fig.2l).



*Kindly refer Appendix-(i)-(iv) in pages 52-53 for description of technical terms*



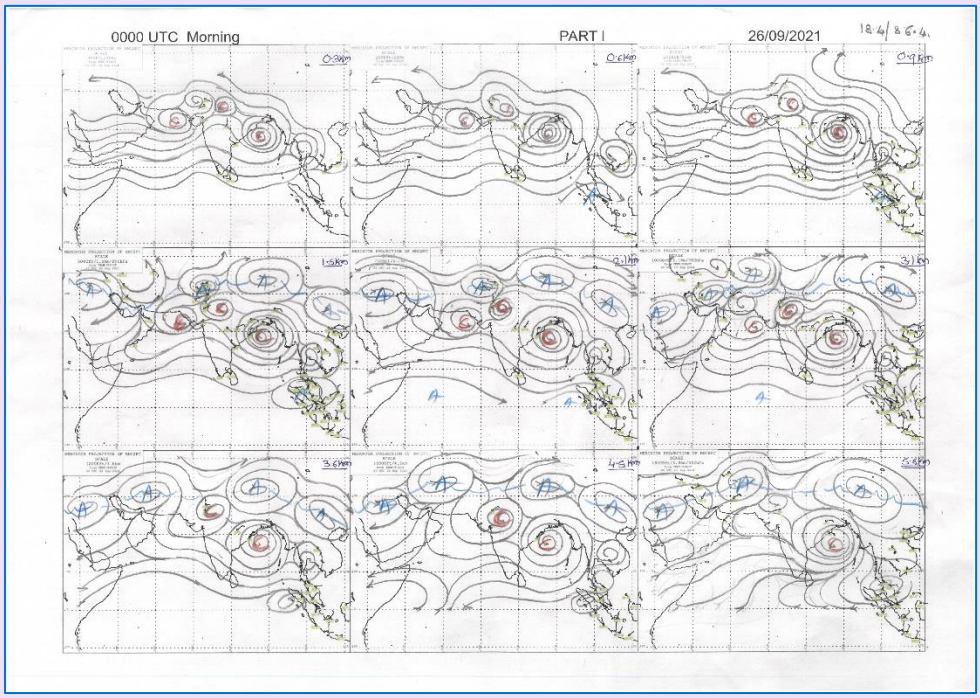
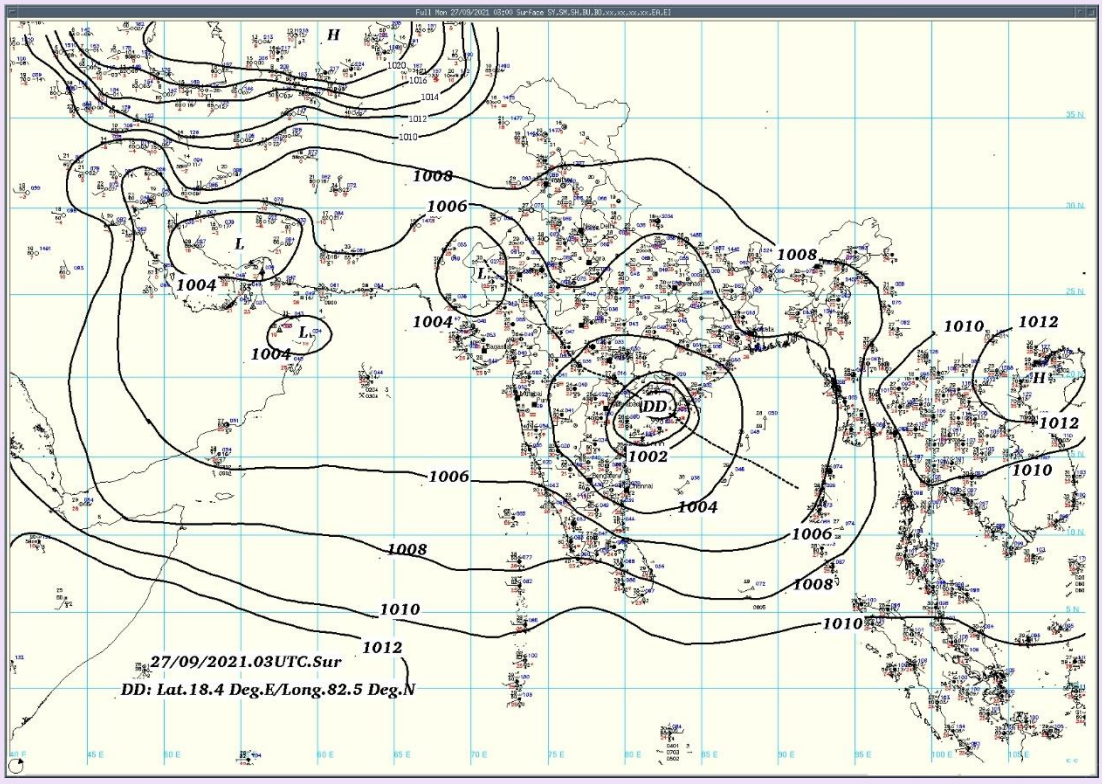




**Fig.2h: Surface Isobaric analysis as on 0830 IST and streamline analysis of lower-mid tropospheric levels as on 0530 IST of 26th & 27th September 2021**



*Kindly refer Appendix-(i)-(iv) in pages 52-53 for description of technical terms*



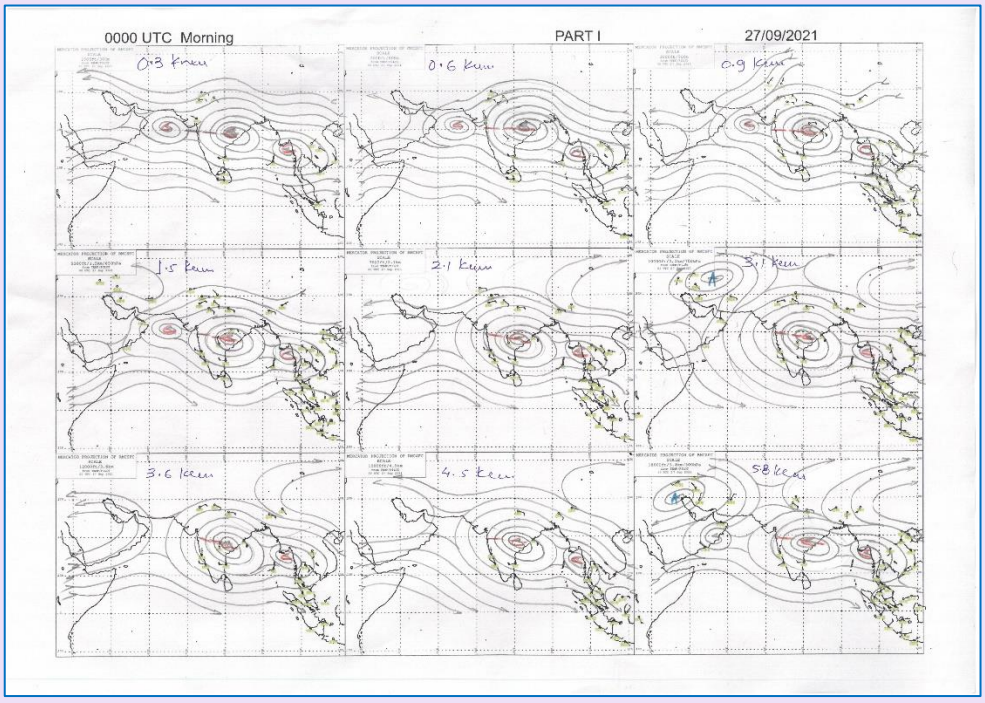
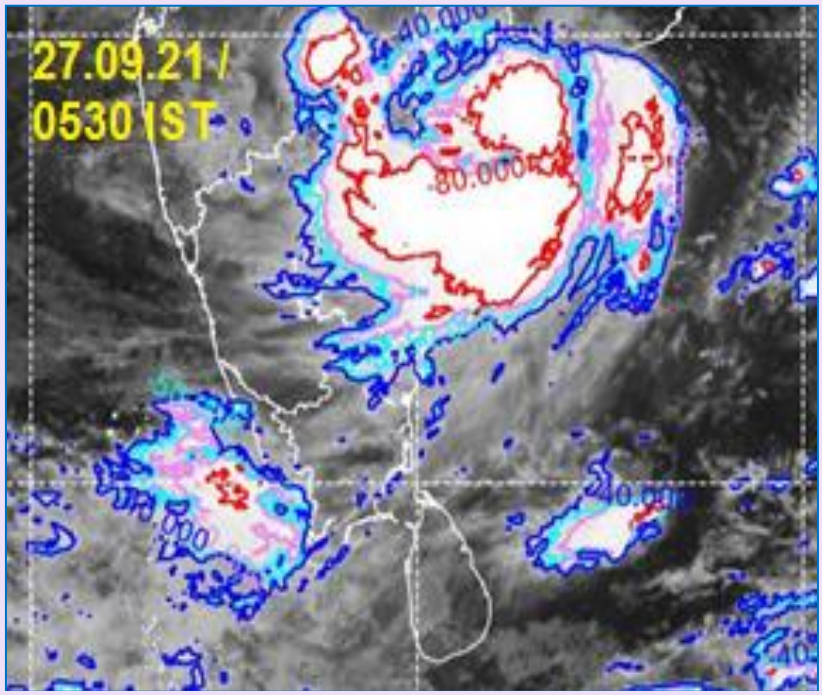




**Fig. 2h (contd)**



*Kindly refer Appendix-(i)-(iv) in pages 52-53 for description of technical terms*



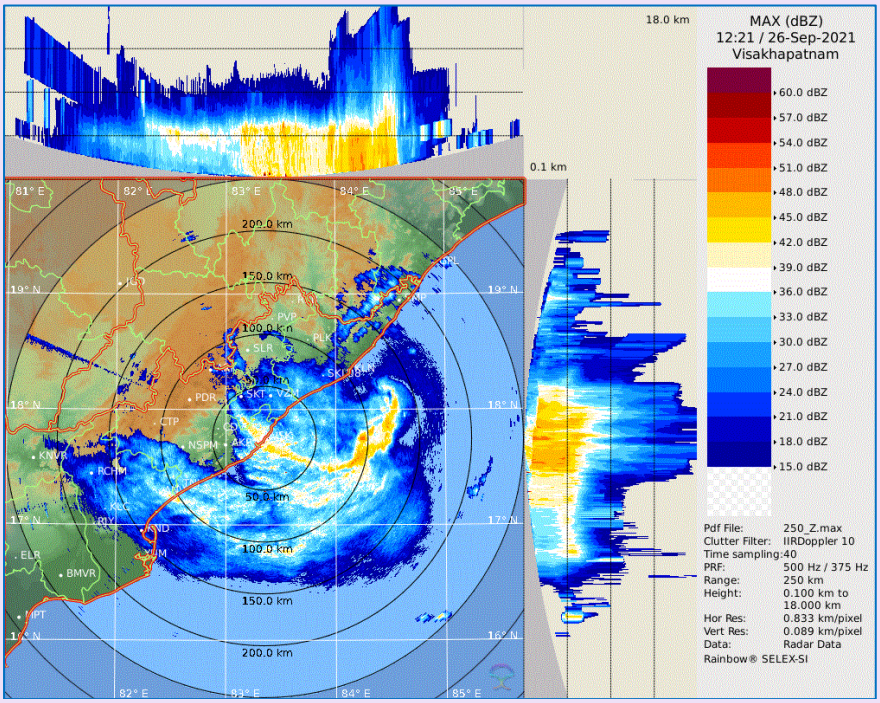




**Fig.2i: INSAT-3D – CTBT (cloud top brightness temperature) product depicting the intense cloudiness associated with the system as on 0530 IST of 27th and Doppler Weather Radar, Visakhapatnam -Maximum Reflectivity product as on 1730 IST of 26th September 2021**



*Kindly refer Appendix-(i)-(iv) in pages 52-53 for description of technical terms*

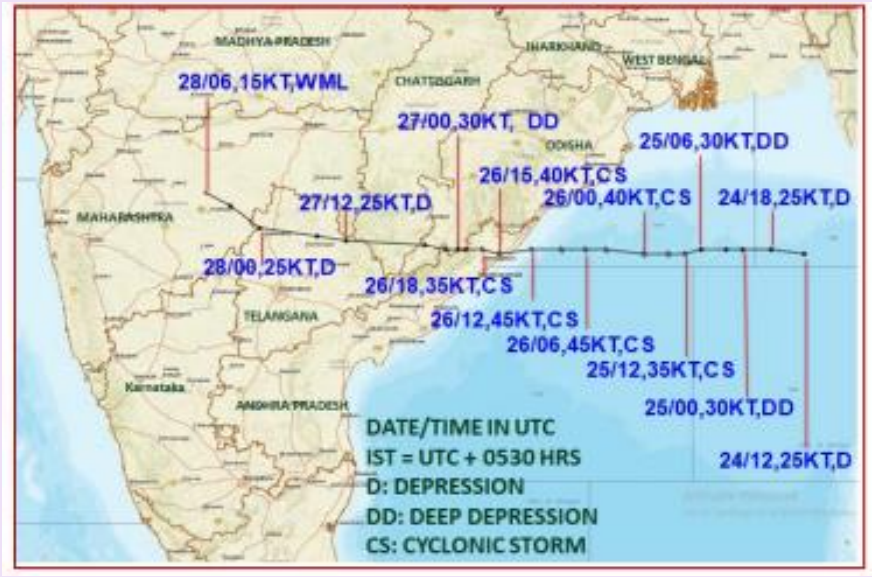



**Fig.2j: Track of the Cyclonic Storm "Gulaab" over the Bay of Bengal**

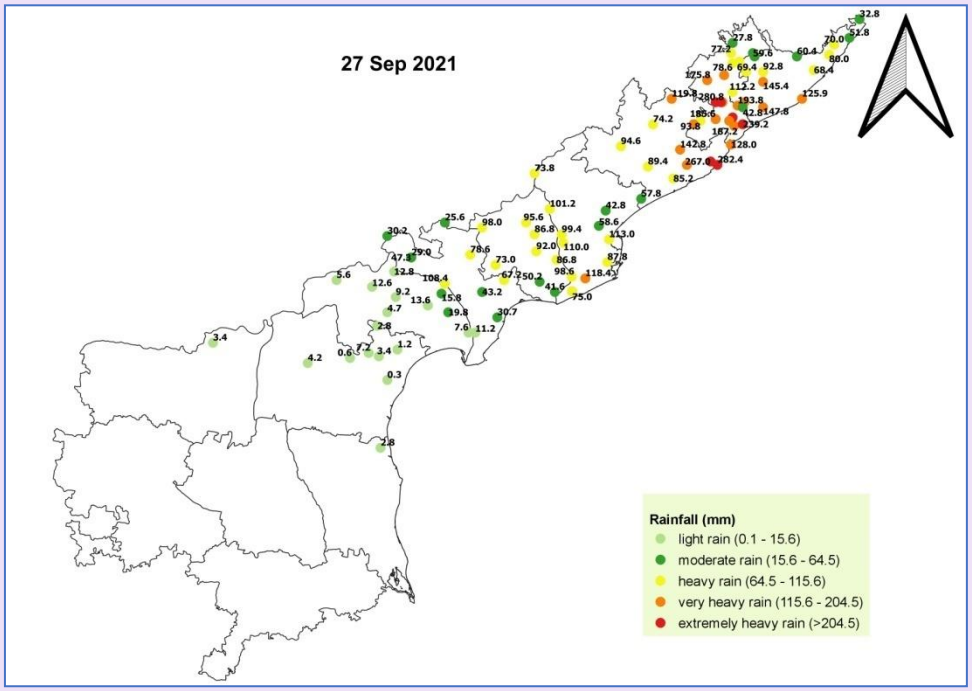



**Fig.2k: Past 24-hr accumulated rainfall over Andhra Pradesh as on 0830 IST of 27th and over Telangana as 0830 IST of 28th September 2021**



*Kindly refer Appendix-(i)-(iv) in pages 52-53 for description of technical terms*

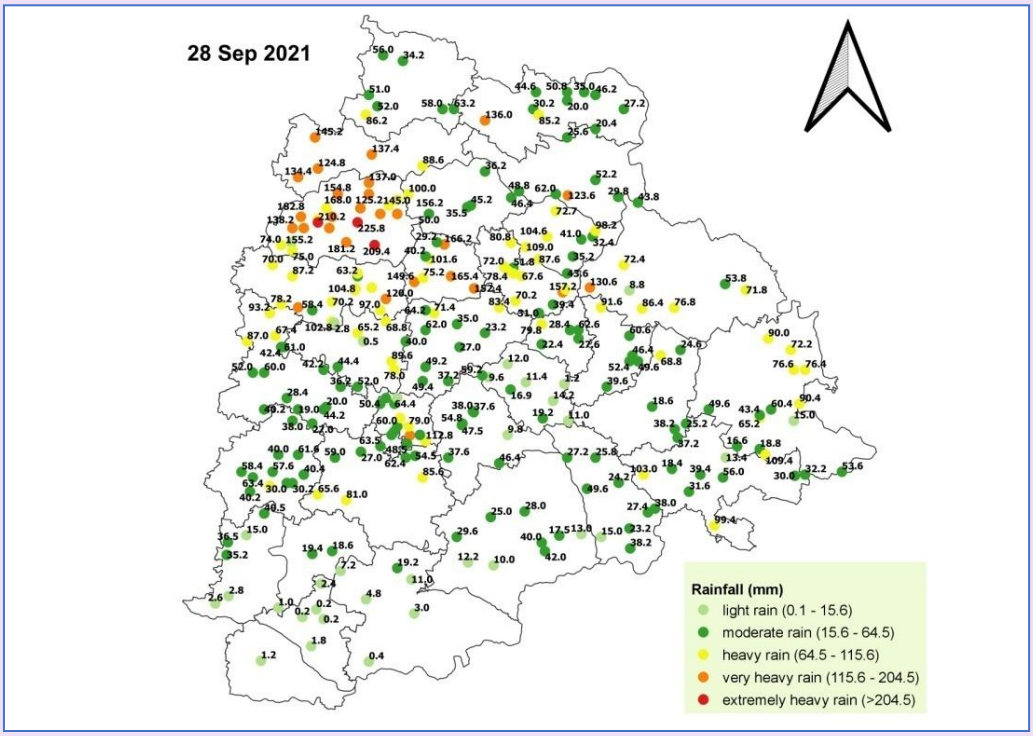
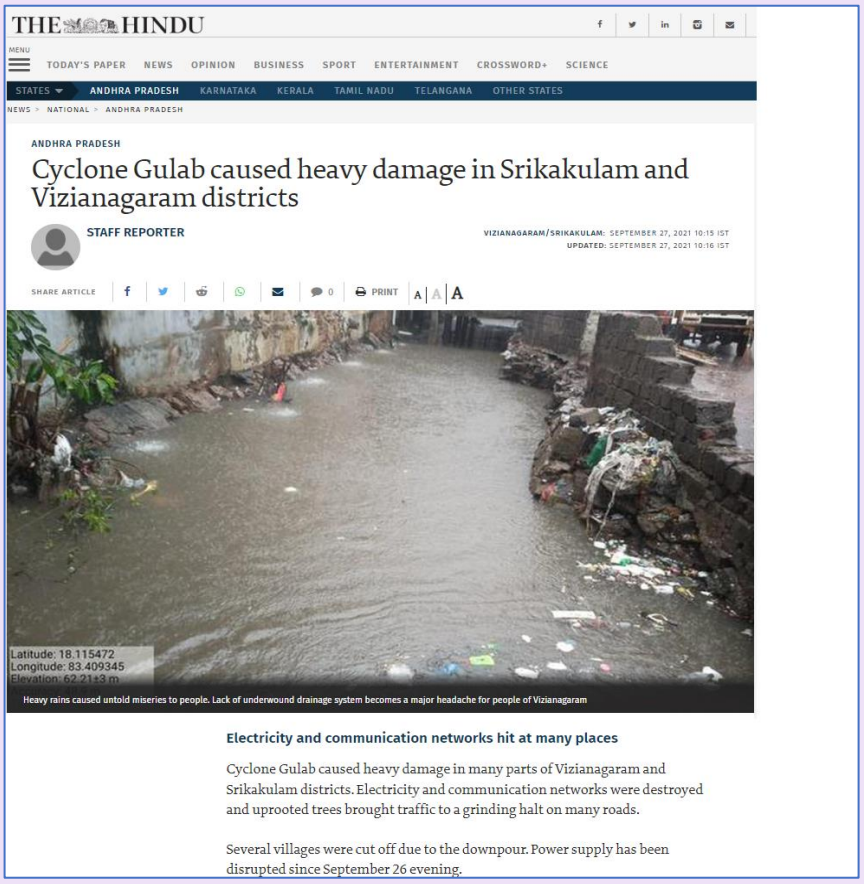



**Fig.2k (contd)**



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ANDHRA PRADESH

## Cyclone Gulab caused heavy damage in Srikakulam and Vizianagaram districts

STAFF REPORTER

VIZIANAGARAM/SRIKAKULAM: SEPTEMBER 27, 2021 10:15 IST
UPDATED: SEPTEMBER 27, 2021 10:16 IST

SHARE ARTICLE | PRINT

Latitude: 18.115472
Longitude: 83.409345
Elevation: 62.21±3 m

Heavy rains caused untold miseries to people. Lack of underwound drainage system becomes a major headache for people of Vizianagaram

### Electricity and communication networks hit at many places

Cyclone Gulab caused heavy damage in many parts of Vizianagaram and Srikakulam districts. Electricity and communication networks were destroyed and uprooted trees brought traffic to a grinding halt on many roads.

Several villages were cut off due to the downpour. Power supply has been disrupted since September 26 evening.



*Kindly refer Appendix-(i)-(iv) in pages 52-53 for description of technical terms*


**Fig.2(l): Media reports on damages due to cyclone Gulaab**

## 3. Rainfall distribution

### 3.1 Seasonal sub-divisional rainfall

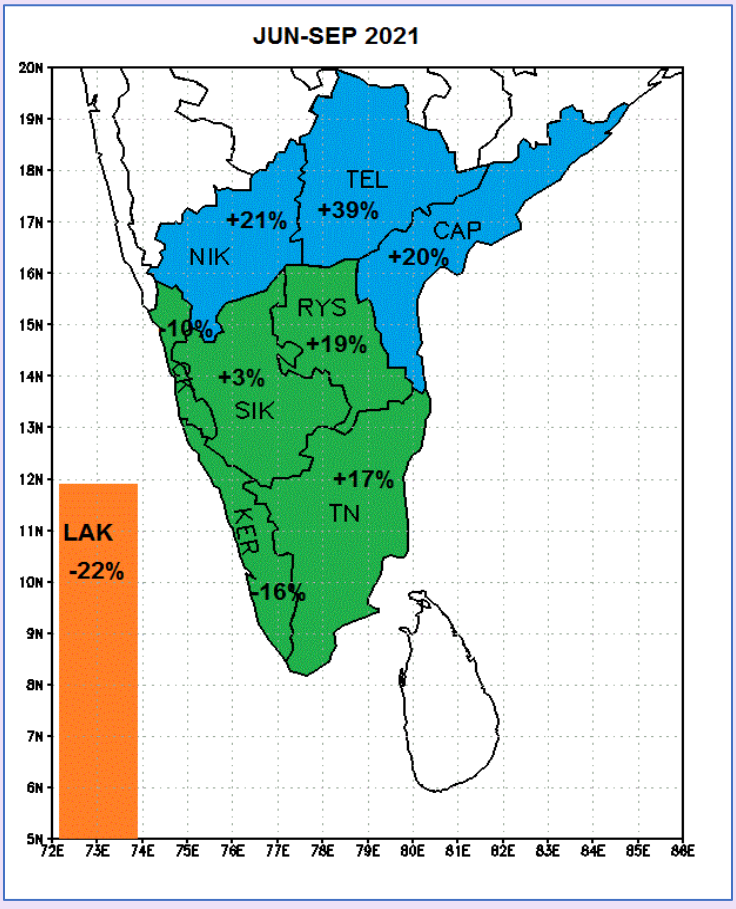
The SWM seasonal rainfall (June-September) during 2021 over the country as a whole was 99 of its long period average (LPA) of 88.0 cm and that over the SP region was 111% of its LPA. The spatial rainfall distribution is determined in terms of percentage departure from normal (PDN) over 36 meteorological 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 2021, excepting LAK that came under *deficient* category (-22%), all the other eight subdivisions in the SP region received *normal* to *excess* rainfall with TEL recording *excess* rainfall of +39%, followed by NIK & CAP, +21% & +20% respectively. KER, CK, SIK, RYS & TN came under *normal* category (-16% to +19%). The cumulative seasonal (01$^{st}$ June to 30$^{th}$ Sep 2021) rainfall figures for the nine meteorological subdivisions of the SP region are presented inTable-1 and Fig.3.



*Kindly refer Appendix-(i)-(iv) in pages 52-53 for description of technical terms*

**Table-1: Seasonal sub-divisional rainfall distribution over the SP region during the SWM season, 2020 (01st June-30th Sep 2021)**

| SUB-DIVISION | Actual rainfall (mm) | Normal rainfall (mm) | Percentage departure from normal (%) |
|---|---|---|---|
| COASTAL AP & YANAM (CAP) | 704.0 | 586.9 | +20 |
| TELENGANA (TEL) | 1044.7 | 751.9 | +39 |
| RAYALASEEMA (RYS) | 488.2 | 411.6 | +19 |
| TAMILNADU, PUDUCHERRY & KARAIKAL (TN) | 393.4 | 336.1 | +17 |
| COASTAL KARNATAKA (CK) | 2795.6 | 3095.1 | -10 |
| NORTH INTERIOR KARNATAKA (NIK) | 603.1 | 497.1 | +21 |
| SOUTH INTERIOR KARNATAKA (SIK) | 701.7 | 681.8 | +03 |
| KERALA & MAHE (KER) | 1718.8 | 2049.2 | -16 |
| LAKSHADWEEP (LAK) | 790.9 | 1013.1 | -22 |




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

**Fig.3: Seasonal Sub-divisional rainfall (in percentage departures from normal) during Jun-Sep 2021 over the SP region**



*Kindly refer Appendix-(i)-(iv) in pages 52-53 for description of technical terms*

### 3.2 Monthly sub-divisional rainfall

The monthly sub-divisional rainfall scenario during the SWM 2021 season is presented inTable-2 and Fig.4. During the first two months of the season, KER & LAK that came under *deficient* category (June: -36% & -52% respectively & July: -20% & -47% respectively) and CAP came under *deficient* category in June (-22%) and all the other subdivisions in the SP region received *normal* to *excess / large excess* rainfall. In August, LAK received *excess* rainfall of +43% & CK came under *deficient* category (-40%); all the other subdivisions received *normal* rainfall during the month. In September, excepting SIK & RYS that came under *deficient* category, all the other subdivisions received *normal - large excess* rainfall with TEL & CK recording large excess rainfall of +78% & +66%. TEL, NIK & TN recorded *normal to excess / large excess* rainfall during all the four months of the season.

**Table-2: Monthly sub-divisional rainfall performance during SWM 2021**

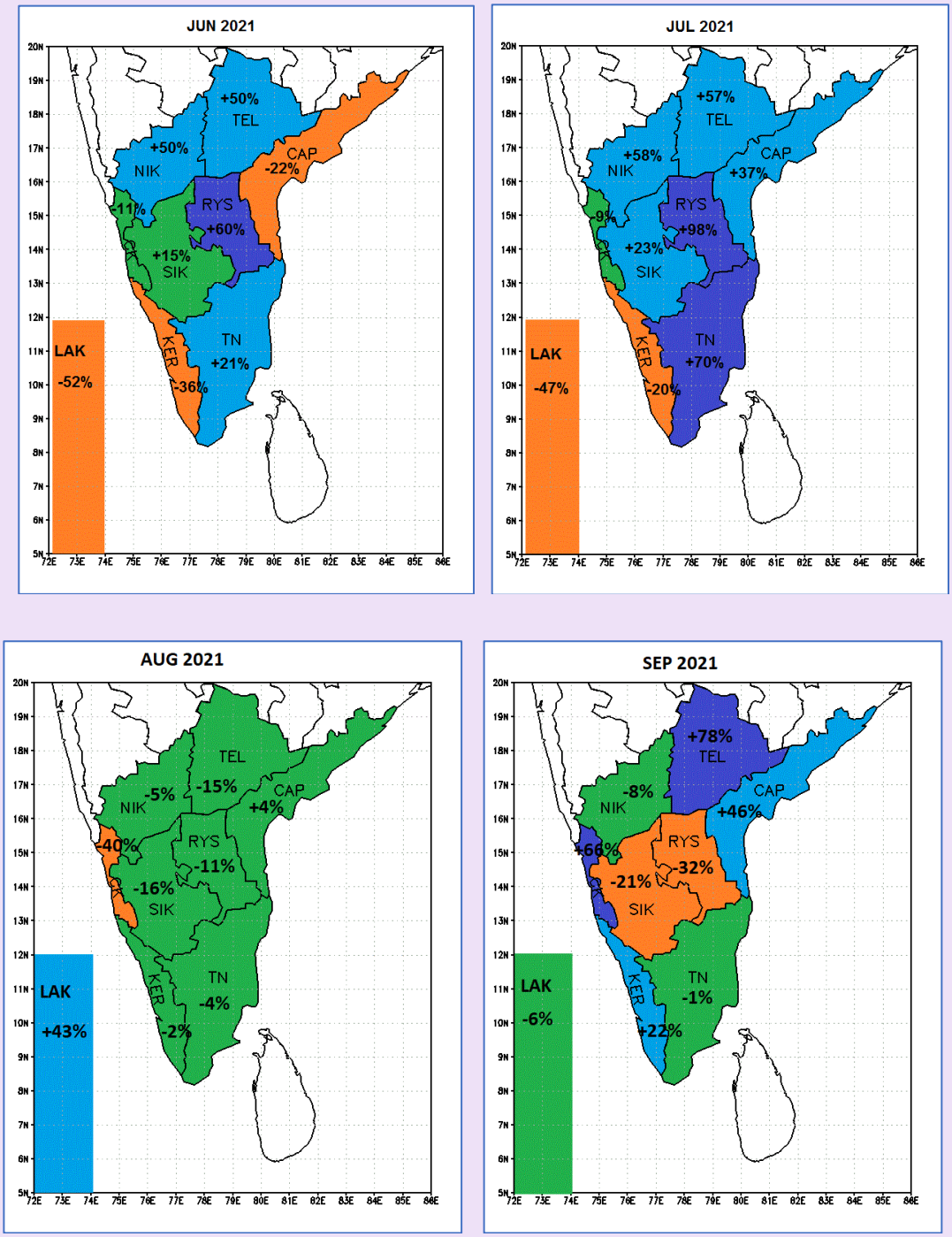
| SUB-DIV | JUN | | | JUL | | | AUG | | | SEP | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | ACL (mm) | NOR (mm) | PDN (%) | ACL (mm) | NOR (mm) | PDN (%) | ACL (mm) | NOR (mm) | PDN (%) | ACL (mm) | NOR (mm) | PDN (%) |
| CAP | 82.5 | 105.2 | -22 | 216.3 | 157.9 | 37 | 169 | 162.1 | 4 | 236.2 | 161.7 | 46 |
| RYS | 113.6 | 70.9 | 60 | 183.4 | 92.6 | 98 | 96.4 | 108.5 | -11 | 94.8 | 139.6 | -32 |
| TEL | 195.7 | 130.4 | 50 | 366.1 | 232.7 | 57 | 192.6 | 225.5 | -15 | 290.3 | 163.3 | 78 |
| TN | 62.3 | 51.7 | 21 | 124.6 | 73.3 | 70 | 88.9 | 92.8 | -4 | 117.6 | 118.3 | -1 |
| CK | 772.3 | 866.7 | -11 | 1015.5 | 1116.3 | -9 | 480.2 | 806.3 | -40 | 508.5 | 305.8 | 66 |
| NIK | 161 | 107.1 | 50 | 194.9 | 123.5 | 58 | 115.6 | 122 | -5 | 132.7 | 144.5 | -8 |
| SIK | 166.4 | 144.1 | 15 | 262.9 | 213.3 | 23 | 149.1 | 178 | -16 | 115.4 | 146.4 | -21 |
| KER | 408.3 | 643 | -36 | 577.4 | 720 | -20 | 416.2 | 426.7 | -2 | 316.9 | 259.5 | 22 |
| LAK | 160 | 330.3 | -52 | 156.5 | 294 | -47 | 319.5 | 223.2 | 43 | 154.9 | 165.6 | -6 |

ACL:Actual; NOR:Normal; PDN: Percentage Departures from Normal

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



*Kindly refer Appendix-(i)-(iv) in pages 52-53 for description of technical terms*




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

**Fig.4: Monthly sub-divisional rainfall distribution during Jun-Sep2021**



*Kindly refer Appendix-(i)-(iv) in pages 52-53 for description of technical terms*

### 3.3 Weekly sub-divisional rainfall progress

Week by week and cumulative weekly performance of SWM 2021 over the SP region are presented in Table-3a and Table-3b respectively.

**Table-3a: Week by week sub-divisional rainfall during June-Sep 2021 over the SP region**

| SUB-DIVISION | 2021: WEEK-BY-WEEK - PDN (%) | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 02-Jun | 09-Jun | 16-Jun | 23-Jun | 30-Jun | 07-Jul | 14-Jul | 21-Jul | 28-Jul | 04-Aug | 11-Aug | 20-Aug | 25-Aug | 01-Sep | 08-Sep | 15-Sep | 22-Sep | 29-Sep |
| CAP | -55 | 30 | -39 | -70 | 3 | 25 | 113 | 49 | 24 | -88 | -39 | 59 | -14 | 69 | 143 | -40 | -39 | 147 |
| TEL | | 121 | 117 | -60 | 33 | -2 | -29 | -31 | 196 | -96 | -78 | 6 | -31 | 129 | 207 | -47 | -15 | 194 |
| RYS | -19 | 314 | -91 | -69 | 90 | 236 | 88 | 226 | -31 | -83 | -9 | -56 | 14 | 34 | 77 | -93 | -55 | -51 |
| TN | -37 | 110 | -33 | -2 | 7 | 253 | 94 | 66 | -8 | -85 | 13 | -10 | 4 | 7 | 84 | -79 | 22 | -6 |
| CK | 24 | -27 | 55 | 8 | -78 | -71 | 14 | 41 | 4 | -46 | -47 | -58 | -64 | 31 | 138 | 130 | -58 | 35 |
| NIK | -38 | 101 | 8 | 98 | 15 | -25 | 94 | 106 | 95 | -76 | -69 | 10 | 17 | 80 | 92 | -45 | -39 | -1 |
| SIK | -70 | 77 | 21 | 49 | -75 | -38 | -9 | 101 | 69 | -47 | -18 | -48 | 12 | 8 | 72 | 9 | -66 | -46 |
| KER | 0 | -42 | 7 | -42 | -75 | -79 | 20 | 6 | 3 | -69 | 16 | -45 | -41 | 143 | 64 | 45 | -39 | 33 |
| LAK | -59 | -6 | -75 | -83 | -45 | -52 | -33 | -93 | 13 | -78 | 113 | -16 | -1 | 135 | -10 | -65 | -33 | 119 |

**Table-3b: Weekly cumulative sub-divisional rainfall during Jun-Sep 2021**

| SUB-DIVISION | 2021: CUMULATIVE WEEK ENDING - PDN (%) | | | | | | | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | 02-Jun | 09-Jun | 16-Jun | 23-Jun | 30-Jun | 07-Jul | 14-Jul | 21-Jul | 28-Jul | 04-Aug | 11-Aug | 20-Aug | 25-Aug | 01-Sep | 08-Sep | 15-Sep | 22-Sep | 29-Sep |
| CAP | -12 | 23 | -12 | -30 | -22 | -11 | 12 | 18 | 19 | 6 | 1 | 7 | 5 | 10 | 20 | 16 | 11 | 21 |
| TEL | | 141 | 127 | 57 | 50 | 37 | 37 | 33 | 40 | 43 | 28 | 26 | 21 | 28 | 40 | 36 | 33 | 40 |
| RYS | 48 | 267 | 94 | 54 | 60 | 92 | 92 | 115 | 91 | 70 | 61 | 49 | 45 | 44 | 47 | 34 | 25 | 19 |
| TN | | 78 | 32 | 24 | 21 | 67 | 72 | 71 | 58 | 40 | 37 | 32 | 28 | 26 | 31 | 20 | 20 | 18 |
| CK | 194 | -25 | 21 | 16 | -11 | -25 | -19 | -9 | -7 | -11 | -14 | -18 | -21 | -19 | -13 | -10 | -11 | -10 |
| NIK | 43 | 82 | 48 | 62 | 50 | 40 | 48 | 58 | 63 | 46 | 34 | 31 | 30 | 34 | 37 | 31 | 25 | 23 |
| SIK | 28 | 44 | 33 | 40 | 15 | 1 | 0 | 18 | 25 | 16 | 13 | 7 | 7 | 8 | 11 | 12 | 7 | 4 |
| KER | -4 | -38 | -15 | -24 | -36 | -46 | -35 | -29 | -25 | -30 | -26 | -28 | -28 | -22 | -19 | -17 | -18 | -16 |
| LAK | -65 | -18 | -41 | -53 | -52 | -52 | -49 | -54 | -48 | -50 | -39 | -38 | -35 | -25 | -25 | -27 | -27 | -22 |

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

During the SWM season of 2021, during the last week of August and first week of September (weeks ending 01st & 08th September), all the subdivisions in the SP region recorded *normal - large excess* rainfall. In the week ending 08th September, excepting LAK that received *normal* rainfall, all subdivisions recorded *large excess* rainfall with TEL, CAP & CK recording more than 100% excess (+207%, +143% & +138% respectively).



*Kindly refer Appendix-(i)-(iv) in pages 52-53 for description of technical terms*

During the weeks ending 09th June, 14th July, 21st July, 28th July & 29th September, but for one or two subdivisions, all the other subdivisions in the region received *normal - large excess* rainfall. During the week ending 04th August, all the subdivisions in the region recorded *deficient* to *largely deficient* rainfall.

Considering the cumulative seasonal rainfall performance at the end of every week, it is noted that TEL, RYS, TN, NIK & SIK came under *normal* to *large excess* category during all the weeks in the season. After the first four weeks of the season, starting from the week ending 07th July, CAP also came under *normal* to *excess* category throughout the season. LAK was generally in *deficient* category throughout and KER, during most of the weeks till the end of August.

### 3.4 Daily sub-divisional rainfall and monsoon activity

Table-4a presents daily spatial rainfall distribution over various subdivisions of the SP region during the SWM 2021 and Table-4b, the percentage frequency of various categories of spatial rainfall distribution over each subdivision during the season.

As seen, *fairly widespread* to w*idespread* rainfall occurred over CK, KER and LAK on more than 70% of the days during the season (89%, 80% & 73% respectively) and over NIK, SIK and TEL on 40%-55% of the days. CAP recorded *scattered* to *fairly widespread* rainfall on 67% of the days. TN reported only *isolated* to *scattered* rainfall on 91% of the days. On 06th September, all the nine Sub-divisions in the region reported *fairly widespread* to *widespread* rainfall.

Table-5 presents the monthly and seasonal frequency of *active* and *vigorous* monsoon days over the various subdivisions of the SP region during the SWM season2021. TEL and NIK experienced 35 & 34 days respectively of *active* to *vigorous* monsoon activity during the season followed by CK & CAP-26 days, SIK- 23 days and KER- 22 days. There were 16 & 8 days of active to vigorous monsoon activity over RYS & TN respectively.



*Kindly refer Appendix-(i)-(iv) in pages 52-53 for description of technical terms*

## Table-4a: Daily sub-divisional rainfall distribution over the SP region during SWM 2021

| Date as on 0830 IST | CAP | TEL | RYS | TN | CK | NIK | SIK | KER | LAK |
|---|---|---|---|---|---|---|---|---|---|
| 01-Jun | SCT | SCT | ISOL | ISOL | WS | ISOL | ISOL | WS | WS |
| 02-Jun | ISOL | FWS | ISOL | ISOL | FWS | SCT | ISOL | FWS | SCT |
| 03-Jun | FWS | FWS | FWS | SCT | FWS | FWS | WS | FWS | WS |
| 04-Jun | SCT | SCT | FWS | SCT | WS | WS | FWS | WS | WS |
| 05-Jun | ISOL | FWS | WS | SCT | WS | FWS | WS | WS | WS |
| 06-Jun | ISOL | SCT | WS | FWS | WS | FWS | FWS | WS | FWS |
| 07-Jun | ISOL | ISOL | ISOL | ISOL | SCT | SCT | ISOL | ISOL | WS |
| 08-Jun | ISOL | ISOL | ISOL | ISOL | ISOL | ISOL | ISOL | SCT | SCT |
| 09-Jun | ISOL | FWS | ISOL | ISOL | WS | ISOL | SCT | FWS | DRY |
| 10-Jun | SCT | SCT | ISOL | ISOL | WS | SCT | SCT | WS | SCT |
| 11-Jun | SCT | WS | DRY | ISOL | WS | ISOL | ISOL | WS | SCT |
| 12-Jun | SCT | FWS | ISOL | ISOL | WS | SCT | ISOL | WS | SCT |
| 13-Jun | SCT | SCT | ISOL | SCT | WS | FWS | FWS | WS | FWS |
| 14-Jun | SCT | WS | ISOL | ISOL | WS | SCT | WS | WS | FWS |
| 15-Jun | ISOL | FWS | ISOL | ISOL | WS | SCT | FWS | WS | WS |
| 16-Jun | ISOL | SCT | ISOL | ISOL | WS | WS | WS | WS | WS |
| 17-Jun | ISOL | SCT | ISOL | ISOL | WS | WS | WS | WS | FWS |
| 18-Jun | SCT | FWS | ISOL | ISOL | WS | WS | FWS | WS | WS |
| 19-Jun | ISOL | ISOL | ISOL | ISOL | WS | WS | SCT | FWS | SCT |
| 20-Jun | ISOL | ISOL | ISOL | ISOL | WS | WS | FWS | WS | WS |
| 21-Jun | ISOL | ISOL | DRY | ISOL | WS | ISOL | SCT | WS | SCT |
| 22-Jun | ISOL | ISOL | ISOL | SCT | WS | ISOL | SCT | SCT | WS |
| 23-Jun | SCT | ISOL | ISOL | ISOL | WS | ISOL | ISOL | SCT | FWS |
| 24-Jun | FWS | SCT | ISOL | SCT | WS | ISOL | SCT | FWS | SCT |
| 25-Jun | SCT | SCT | ISOL | ISOL | FWS | FWS | ISOL | ISOL | FWS |
| 26-Jun | ISOL | ISOL | ISOL | DRY | WS | SCT | ISOL | FWS | FWS |
| 27-Jun | SCT | WS | FWS | ISOL | WS | WS | FWS | WS | SCT |
| 28-Jun | SCT | WS | SCT | ISOL | SCT | WS | SCT | SCT | WS |
| 29-Jun | ISOL | ISOL | ISOL | ISOL | FWS | ISOL | ISOL | SCT | FWS |
| 30-Jun | ISOL | ISOL | ISOL | ISOL | ISOL | ISOL | ISOL | ISOL | WS |
| 01-Jul | SCT | FWS | ISOL | ISOL | SCT | DRY | ISOL | SCT | FWS |
| 02-Jul | SCT | WS | ISOL | SCT | WS | FWS | ISOL | WS | WS |
| 03-Jul | FWS | SCT | SCT | ISOL | FWS | ISOL | ISOL | ISOL | FWS |
| 04-Jul | SCT | ISOL | SCT | ISOL | WS | SCT | ISOL | FWS | DRY |
| 05-Jul | FWS | ISOL | WS | FWS | FWS | SCT | WS | FWS | SCT |
| 06-Jul | SCT | ISOL | SCT | ISOL | FWS | SCT | SCT | SCT | WS |
| 07-Jul | SCT | ISOL | SCT | ISOL | SCT | FWS | SCT | SCT | FWS |
| 08-Jul | FWS | WS | FWS | SCT | FWS | FWS | SCT | SCT | WS |
| 09-Jul | ISOL | ISOL | FWS | FWS | WS | FWS | SCT | WS | WS |
| 10-Jul | FWS | FWS | FWS | SCT | WS | WS | WS | WS | WS |
| 11-Jul | FWS | WS | ISOL | ISOL | WS | FWS | FWS | WS | WS |
| 12-Jul | WS | WS | ISOL | ISOL | WS | FWS | SCT | WS | SCT |
| 13-Jul | FWS | WS | ISOL | ISOL | WS | WS | FWS | WS | SCT |
| 14-Jul | WS | WS | SCT | ISOL | WS | WS | WS | WS | SCT |
| 15-Jul | WS | WS | WS | FWS | WS | WS | WS | WS | SCT |
| 16-Jul | WS | FWS | FWS | SCT | WS | WS | WS | WS | FWS |
| 17-Jul | SCT | SCT | FWS | SCT | WS | WS | FWS | WS | DRY |
| 18-Jul | SCT | SCT | FWS | SCT | WS | WS | WS | WS | DRY |
| 19-Jul | SCT | FWS | FWS | ISOL | WS | WS | WS | WS | SCT |
| 20-Jul | SCT | SCT | SCT | ISOL | WS | FWS | FWS | FWS | FWS |
| 21-Jul | WS | WS | FWS | ISOL | WS | WS | FWS | WS | WS |
| 22-Jul | WS | WS | WS | ISOL | WS | WS | WS | WS | FWS |
| 23-Jul | FWS | WS | WS | ISOL | WS | WS | WS | WS | FWS |
| 24-Jul | FWS | WS | ISOL | ISOL | WS | FWS | FWS | WS | WS |
| 25-Jul | ISOL | SCT | ISOL | ISOL | WS | SCT | FWS | WS | WS |
| 26-Jul | SCT | SCT | ISOL | SCT | WS | SCT | FWS | WS | WS |
| 27-Jul | ISOL | ISOL | ISOL | ISOL | WS | ISOL | SCT | WS | WS |
| 28-Jul | ISOL | ISOL | ISOL | ISOL | WS | SCT | SCT | WS | WS |
| 29-Jul | SCT | ISOL | DRY | ISOL | WS | ISOL | SCT | WS | SCT |
| 30-Jul | ISOL | ISOL | ISOL | ISOL | WS | SCT | SCT | FWS | SCT |
| 31-Jul | ISOL | ISOL | ISOL | ISOL | WS | SCT | SCT | WS | DRY |



*Kindly refer Appendix-(i)-(iv) in pages 52-53 for description of technical terms*

| Date as on 0830 IST | CAP | TEL | RYS | TN | CK | NIK | SIK | KER | LAK |
|---|---|---|---|---|---|---|---|---|---|
| 01-Aug | ISOL | ISOL | ISOL | ISOL | WS | FWS | FWS | FWS | FWS |
| 02-Aug | ISOL | ISOL | ISOL | ISOL | WS | FWS | SCT | SCT | FWS |
| 03-Aug | ISOL | ISOL | ISOL | ISOL | WS | FWS | FWS | WS | FWS |
| 04-Aug | ISOL | ISOL | ISOL | ISOL | WS | FWS | FWS | WS | FWS |
| 05-Aug | ISOL | ISOL | ISOL | ISOL | WS | FWS | FWS | WS | SCT |
| 06-Aug | ISOL | SCT | SCT | ISOL | WS | FWS | FWS | WS | FWS |
| 07-Aug | ISOL | ISOL | ISOL | SCT | WS | SCT | WS | WS | WS |
| 08-Aug | SCT | ISOL | ISOL | SCT | WS | FWS | FWS | WS | WS |
| 09-Aug | SCT | ISOL | ISOL | SCT | FWS | SCT | SCT | WS | WS |
| 10-Aug | SCT | ISOL | SCT | SCT | WS | SCT | SCT | WS | WS |
| 11-Aug | FWS | ISOL | ISOL | ISOL | WS | SCT | SCT | SCT | FWS |
| 12-Aug | SCT | ISOL | ISOL | SCT | WS | SCT | SCT | WS | FWS |
| 13-Aug | FWS | SCT | SCT | ISOL | WS | FWS | FWS | FWS | FWS |
| 14-Aug | WS | ISOL | ISOL | ISOL | WS | FWS | SCT | WS | SCT |
| 15-Aug | FWS | ISOL | ISOL | SCT | WS | ISOL | SCT | WS | FWS |
| 16-Aug | WS | WS | SCT | ISOL | WS | FWS | ISOL | FWS | WS |
| 17-Aug | WS | WS | FWS | ISOL | WS | WS | FWS | FWS | WS |
| 18-Aug | SCT | WS | ISOL | SCT | WS | WS | FWS | WS | WS |
| 19-Aug | FWS | FWS | ISOL | SCT | WS | WS | FWS | WS | WS |
| 20-Aug | SCT | SCT | SCT | ISOL | WS | SCT | FWS | FWS | FWS |
| 21-Aug | FWS | ISOL | ISOL | ISOL | FWS | SCT | SCT | ISOL | SCT |
| 22-Aug | FWS | FWS | SCT | SCT | FWS | WS | WS | ISOL | DRY |
| 23-Aug | ISOL | SCT | SCT | SCT | SCT | FWS | FWS | WS | FWS |
| 24-Aug | ISOL | SCT | SCT | SCT | SCT | ISOL | FWS | FWS | FWS |
| 25-Aug | ISOL | SCT | SCT | ISOL | FWS | SCT | SCT | FWS | FWS |
| 26-Aug | FWS | WS | ISOL | ISOL | FWS | SCT | SCT | WS | WS |
| 27-Aug | SCT | FWS | SCT | SCT | WS | SCT | FWS | WS | WS |
| 28-Aug | FWS | FWS | FWS | SCT | WS | FWS | FWS | WS | WS |
| 29-Aug | FWS | WS | FWS | SCT | WS | WS | WS | WS | WS |
| 30-Aug | WS | WS | SCT | ISOL | WS | FWS | FWS | WS | WS |
| 31-Aug | WS | WS | ISOL | ISOL | WS | SCT | SCT | FWS | WS |
| 01-Sep | FWS | FWS | SCT | SCT | WS | SCT | FWS | FWS | FWS |
| 02-Sep | FWS | FWS | FWS | FWS | WS | FWS | FWS | WS | DRY |
| 03-Sep | FWS | FWS | FWS | FWS | WS | SCT | WS | WS | DRY |
| 04-Sep | SCT | WS | WS | SCT | WS | FWS | FWS | WS | WS |
| 05-Sep | FWS | WS | SCT | SCT | WS | WS | SCT | WS | WS |
| 06-Sep | WS | WS | WS | FWS | WS | WS | FWS | WS | WS |
| 07-Sep | WS | WS | SCT | SCT | WS | WS | WS | WS | WS |
| 08-Sep | SCT | FWS | ISOL | ISOL | WS | FWS | FWS | WS | WS |
| 09-Sep | ISOL | ISOL | ISOL | ISOL | WS | SCT | SCT | FWS | DRY |
| 10-Sep | SCT | ISOL | ISOL | ISOL | WS | SCT | SCT | FWS | FWS |
| 11-Sep | SCT | ISOL | ISOL | ISOL | WS | SCT | SCT | FWS | DRY |
| 12-Sep | ISOL | ISOL | ISOL | ISOL | WS | FWS | FWS | WS | WS |
| 13-Sep | FWS | SCT | ISOL | ISOL | WS | FWS | FWS | WS | FWS |
| 14-Sep | SCT | FWS | ISOL | ISOL | WS | WS | SCT | WS | WS |
| 15-Sep | ISOL | ISOL | ISOL | ISOL | WS | SCT | SCT | FWS | WS |
| 16-Sep | ISOL | ISOL | ISOL | SCT | WS | ISOL | SCT | WS | WS |
| 17-Sep | ISOL | ISOL | DRY | ISOL | WS | ISOL | ISOL | WS | WS |
| 18-Sep | ISOL | ISOL | ISOL | SCT | SCT | ISOL | ISOL | SCT | FWS |
| 19-Sep | SCT | ISOL | ISOL | ISOL | ISOL | ISOL | ISOL | ISOL | DRY |
| 20-Sep | FWS | SCT | ISOL | FWS | ISOL | ISOL | ISOL | ISOL | DRY |
| 21-Sep | SCT | WS | ISOL | FWS | SCT | FWS | SCT | ISOL | FWS |
| 22-Sep | ISOL | WS | SCT | SCT | WS | FWS | WS | FWS | WS |
| 23-Sep | SCT | FWS | ISOL | ISOL | WS | FWS | SCT | SCT | WS |
| 24-Sep | SCT | FWS | SCT | SCT | WS | FWS | SCT | SCT | FWS |
| 25-Sep | SCT | SCT | ISOL | SCT | SCT | SCT | SCT | SCT | SCT |
| 26-Sep | FWS | FWS | SCT | SCT | ISOL | SCT | SCT | SCT | WS |
| 27-Sep | WS | WS | ISOL | ISOL | FWS | FWS | SCT | WS | WS |
| 28-Sep | FWS | WS | ISOL | ISOL | WS | WS | SCT | WS | FWS |
| 29-Sep | FWS | SCT | SCT | ISOL | WS | SCT | SCT | WS | WS |
| 30-Sep | ISOL | ISOL | SCT | ISOL | WS | SCT | SCT | FWS | WS |



*Kindly refer Appendix-(i)-(iv) in pages 52-53 for description of technical terms*

**Table-4b: Percentage frequency of various categories of daily spatial rainfall distribution over the subdivisions of the SP region during SWM season, 2021**

| Category | Frequency (%) | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|
| | CAP | TEL | RYS | TN | CK | NIK | SIK | KER | LAK |
| WS | 11 | 25 | 7 | 0 | 77 | 24 | 16 | 59 | 44 |
| FWS | 23 | 19 | 13 | 7 | 11 | 30 | 31 | 20 | 29 |
| SCT | 33 | 20 | 21 | 30 | 7 | 30 | 36 | 13 | 17 |
| ISOL | 33 | 36 | 56 | 61 | 4 | 16 | 16 | 7 | 0 |
| DRY | 0 | 0 | 3 | 1 | 0 | 1 | 0 | 0 | 10 |

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

**Table-5: Subdivision-wise frequency of Vigorous and Active monsoon conditions over the SP region during the SWM season, 2021**

| Subdivision | JUN | | JUL | | AUG | | SEP | | Jun-Sep | |
|---|---|---|---|---|---|---|---|---|---|---|
| | ACT | VIG | ACT | VIG | ACT | VIG | ACT | VIG | ACT | VIG |
| CAP | 1 | 0 | 11 | 0 | 8 | 0 | 3 | 3 | 23 | 3 |
| TEL | 4 | 1 | 7 | 4 | 9 | 0 | 8 | 2 | 28 | 7 |
| RYS | 0 | 1 | 4 | 5 | 3 | 0 | 2 | 1 | 9 | 7 |
| TN | 1 | 0 | 1 | 2 | 0 | 0 | 3 | 1 | 5 | 3 |
| CK | 5 | 0 | 5 | 0 | 4 | 0 | 11 | 1 | 25 | 1 |
| NIK | 3 | 3 | 11 | 2 | 7 | 1 | 6 | 1 | 27 | 7 |
| SIK | 5 | 0 | 7 | 1 | 3 | 0 | 7 | 0 | 22 | 1 |
| KER | 2 | 0 | 5 | 0 | 5 | 2 | 6 | 2 | 18 | 4 |
| 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).



*Kindly refer Appendix-(i)-(iv) in pages 52-53 for description of technical terms*

### 3.5 Heavy rainfall activity

Table-6a presents the number of days of *heavy* rainfall occurrences (≥ 7 cm/day) over the various subdivisions of the SP region during SWM 2021 and the month-wise frequencies are presented in Table-6b. In the seasonal scale, TN experienced 73 days of *isolated heavy* rainfall activity out of which 20 days were with *isolated very heavy* rainfall events including 2 days of *isolated extremely heavy* rainfall events. Over SIK & TEL, there were 69 and 67 days of *isolated heavy* rainfall activity out of which 28 & 27 days respectively of *isolated very heavy* rainfall events including 4 & 5 days respectively of *isolated extremely heavy* rainfall events. CK & KER experienced 56 & 53 days respectively of *isolated heavy* rainfall activity including 23 and 16 days of *isolated very heavy* rainfall events with 3 days of *isolated extremely heavy* rainfall over CK. CAP, RYS & NIK experienced 30-50 days of *isolated heavy* rainfall activity including 5-9 days of *very heavy* rainfall and 1 day of *extremely heavy* rainfall events. There were only 2 days of *heavy* rainfall events over LAK during the season. In the monthly scale, highest number of *heavy* rainfall days was recorded in July with 22 days each of *heavy* rainfall events over CK, SIK & TN. TEL, TN & SIK reported *heavy* rainfall events on at least 50% of the days (15 days & more) during all the four months of the season.

List of *very heavy* to *extremely heavy* rainfall events is presented in Table-6c.

**Table-6a: Subdivision-wise frequency of heavy rainfall days over the SP region during1st June - 30th Sep 2021**

| Subdivision | No. of days of Heavy rainfall (Rainfall ≥ 7cm/day) | | |
|---|---|---|---|
| | ***Heavy*** **(≥7cm/day)** | ***Very Heavy*** **(≥12cm/day)** | ***Extremely Heavy*** **(≥21cm/day)** |
| COASTAL AP and YANAM | 49 | 9 | 1 |
| TELANGANA | 67 | 27 | 5 |
| RAYALASEEMA | 30 | 5 | 1 |
| TAMILNADU, PDC and KKL | 73 | 20 | 2 |
| COASTAL KARNATAKA | 56 | 23 | 3 |
| NORTHI NTERIOR KARNATAKA | 32 | 6 | 1 |
| SOUTH INTERIOR KARNATAKA | 69 | 28 | 4 |
| KERALA and MAHE | 53 | 16 | 0 |
| LAKSHADWEEP | 2 | 0 | 0 |

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



*Kindly refer Appendix-(i)-(iv) in pages 52-53 for description of technical terms*

**Table-6b: Month-wise frequency of heavy rainfall days during June-Sep 2020**

| Sub-division | No. of days of Heavy rainfall (Rainfall≥7cm/day) | | | | | | | | | | | |
|---|---|---|---|---|---|---|---|---|---|---|---|---|
| | June | | | July | | | Aug | | | Sep | | |
| | *H* | *VH* | *ExH* | *H* | *VH* | *ExH* | *H* | *VH* | *ExH* | *H* | *VH* | *ExH* |
| CAP | 7 | 0 | 0 | 16 | 2 | 0 | 14 | 1 | 0 | 12 | 6 | 1 |
| TEL | 15 | 7 | 0 | 18 | 10 | 3 | 15 | 3 | 0 | 19 | 7 | 2 |
| RYS | 7 | 2 | 0 | 11 | 2 | 1 | 2 | 0 | 0 | 10 | 1 | 0 |
| TN | 15 | 6 | 2 | 22 | 4 | 0 | 16 | 2 | 0 | 20 | 8 | 0 |
| CK | 10 | 1 | 1 | 22 | 15 | 2 | 10 | 4 | 0 | 14 | 3 | 0 |
| NIK | 10 | 3 | 0 | 10 | 2 | 1 | 4 | 0 | 0 | 8 | 1 | 0 |
| SIK | 15 | 7 | 2 | 22 | 10 | 2 | 16 | 5 | 0 | 16 | 6 | 0 |
| KER | 14 | 5 | 0 | 16 | 7 | 0 | 12 | 3 | 0 | 11 | 1 | 0 |
| LAK | 1 | 0 | 0 | 0 | 0 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |

***H*: *Heavy* (≥7cm/day); *VH*: *Very Heavy*(≥12cm/day); *ExH: Extremely Heavy*(≥21cm/day);**

**Table-6c: List of very to extremely heavy rainfall reports during Jun-Sep 2021**

| District | Date, Station and 24-hr accumulated rainfall (in cm) (ending 0830 IST of the specified date) |
|---|---|
| **COASTAL ANDHRA PRADESH & YANAM** | |
| East Godavari | Jul : **08th**:Kakinada-12<br>Sep : **07th** : Kakinada – 17, Vararamachandrapur – 15, Kunavaram – 13;<br>**27th** : Amalapuram-12 |
| Prakasam | Aug :**26th**: Karamchedu – 12 |
| West Godavari | Sep : **03rd** : Eluru – 13; **07th** : Velairpad – 14, Kukunoor – 13; **28th** :Chintalapudi-13 |
| Krishna | Sep : **6th** : Kaikalur – 14; **26th**: Avanigada – 14 |
| Guntur | Sep : **6th**: Macherla -18, Sattenapalle – 15, Mangalagiri – 14 |
| Vizianagaram | Sep: **06th** : Cheepurupalle – 13; **27th** : Gajapathinagaram – 28, Nellimarla – 28, Mentada - 25, Pusapatirega - 24, Garividi -19, Denkada -19, Gantyada -19, Salur -18, Bondapalle -17, Cheepurupalle – 16, Therlam – 15, Vizianagaram -13, Vepada – 13, Bobbili – 12 |
| Vishakhapatnam | Sep: **07th** : Narsipatnam – 12; **27th** :Visakhapatnam – 28, Visakhapatnam Ap – 27, Anakapalle – 18, Chodavaram – 14, Bheemunipatnam – 13, Araku Valley – 12; **28th** :Yelamanchili-13 |
| Srikakulam | Sep : **27th** : Ranastalam – 15, Kalingapatnam – 13 |
| **TELANGANA** | |
| Y.Bhuvanagiri | Jun: **03rd** : Pochampalle-13; **28th**:Ramannapeta-13<br>Jul : **15th**: Bhuvanagiri-15, Yadagirigutta-14 |
| Nalgonda | Jun: **03rd** : Chandur-13<br>Aug **30th**: Chandur – 13; |



*Kindly refer Appendix-(i)-(iv) in pages 52-53 for description of technical terms*

| | |
|---|---|
| Kamareddy | Jun: 5th : Jukkal-12; 09th :Domakond-15, Bhiknu-12; 11th :Madnur-14<br>Jul : 14th:Naga Reddipet-12<br>Aug :31st: Nizam Sagar – 16, Yellareddy – 13<br>Sep : 5th: Naga Reddipet – 17, 07th : Machareddy – 14; 28th : Jukkal – 15, Domakonda – 12 |
| Warangal (Urban) | Jun: 09th :Hanamkond-12<br>Jul : 23rd :Hasanparthy-13<br>Aug: 30th:Hasanparthy – 14<br>Sep: 07th:Hasanparthy – 19, Dharmasagar – 17, Bheemadevarpalle – 16, Hanamkonda – 13 |
| Rajanna Sircilla | Jun :14th:Konaraopeta-12, Chandurthi-12<br>Sep: 05th : Boinpalle – 15; 07th : Konaraopeta – 21, Sirsilla – 19, Boinpalle – 19, Yellareddypeta – 15, Chandurthi – 15, Gambhiraopet – 14;<br>28th : Chandurthi -17, Sirsilla – 17, Ellanthukunta – 15 |
| Peddapalle | Jun : 15th:Peddapalle-13, Dharmaram-12<br>Jul : 23rd:Sultanabad-12<br>Sep: 07th : Dharmaram – 22, Julapalle – 13; 28th : Srirampur – 12 |
| Adilabad | Jul : 08th :Utnur-16, 22nd :Boath-21, Bazarhathnoor-15; 23rd:Utnur-14, Boath-13<br>Aug 19th: Talamadugu – 13, Bazarhathnoor – 12 |
| Nirmal | Jul:08th : Laxmanchanda-12; 11th :Khanpur-13, 14th :Laxmanchanda-13;<br>22nd :Dilawarpur-23, Sarangapurnrl-22, Laxmanchanda-20, Nirmal-17, Shriramsag.pocha-16, Mudhole-15;<br>23rd :Sarangapurnrl-21, Laxmanchanda-20, Dilawarpur-16, Nirmal-15, Khanpur-13<br>Sep: 07th: Dilawarpur – 17, Nirmal – 13, Sarangapurnrl – 12;<br>28th : Sarangapurnrl –15, Nirmal -14, Dilawarpur -14, Mudhole – 13, Laxmanchanda – 13 |
| Nagarkurnool | Jul: 11th : Nagar Kurnool-12 |
| Nizamabad | Jul : 12th:Ranjal-12<br>Jul : 22nd:Bheemgal-18, Nandipet-16, Kammar Palle-15, Mortad-15, Balkonda-15, Armur-15, Velpur-14; 23rd:Navipet-16, Balkonda-13, Mortad-12, Kammar Palle-12, Makloor-12<br>Aug :26th: Kotgiri – 12<br>Sep : 07th : Bheemgal – 14, Mortad – 13, Kammar Palle – 12, Ranjal – 12;<br>08th :Navipet-12; 28th :Jakranpalle-23, Navipet-21, Dhar Palle-21, Ranjal -18, Dich Palle -18, Armur -18, Nandipet -17, Bheemgal -16, Yeda Palle -15, Makloor -15, Velpur -15, Nizamabad -14, Bodhan – 14, Balkonda -13 |
| Warangal (Rural) | Jul : 12th:Khanapur-14; 23rd :Nallabelly-18, Atmakurwrgl-17, Shayampet-14, Narsampet-14, Chennaraopet-13, Parkal-13, Khanapur-13<br>Sep 07th:Nallabelly – 26, Khanapur-23, Parkal-21, Narsampet-19, Chennaraopet-18, Shayampet-16, Atmakurwrgl-15 |
| Kothagudem | Jul : 13th:Aswaraopeta-13<br>Sep: 03rd : Kothagudem – 13; 07th :Kothagudem-23, Mulakalapalle-17, Tekulapalle – 17, Julurpad – 16, Palawancha – 16, Burgampadu – 16, Manuguru – 15,Yellandu – 12 |
| Jagtial | Jul: 14th :Velagatoor-13; 23rd :Mallapur-19, Dharmapuri-18, Metpalle-16, Sarangapur-13, Jagtial-13, Kathlapur-12, Pegadapalle-12<br>Sep: 07th :Pegadapalle – 20, Metpalle – 16, Kathlapur – 14, Velagatoor – 13, Jagtial – 12, Mallial -12; 28th : Mallapur – 13 |
| M. Malkajgiri | Jul: 15th :Uppal(ARG)-16 |
| Medak | Jul : 15th: Chegunta-21 |



*Kindly refer Appendix-(i)-(iv) in pages 52-53 for description of technical terms*

| | |
|---|---|
| | Sep : 21st: Tekmal – 13 |
| Hyderabad | Jul: 15th :Golkonda(ARG)-12 |
| Rangareddy | Jul : 16th:Hayathnagar-16, Hyathnagar(arg)-15, Saroornagar-13 |
| Narayanpet | Jul : 16th:Narayanpet-13 |
| Mahabubnagar | Jul : 17th:Chinta Kunt-12 |
| Karimnagar | Jul : 23rd:Jammikunta-15, Gangadhara-12<br>Sep :07th : Huzurabad-25, Jammikunta-21, Gangadhara-17, Chigurumamidy-13, Choppadandi-12; 28th: Jammikunta – 16 |
| Kumaram Bheem | Jul : 23rd:Wankdi – 39, Asifabad – 30, Kerameri-18, Jainoor-17, Kagaznagar-16, Sirpur (t)-15<br>Aug :30th: Dahegaon – 20<br>Sep: 11th : Dahegaon – 12 |
| Mahabubabad | Jul : 23rd:Gudurwrgl-12<br>Sep 07th : Kothaguda – 14, Bayyaram – 13, Dornakal – 12 |
| Mulugu | Jul : 23rd:Tadwai Mlg-14<br>Sep: 07th : Venkatapur – 18, Perur – 14, Eturnagaram – 13, Tadwai Mlg – 12 |
| Jangaon | Jul : 23rd:Kodakandla-15<br>Aug: 30th:Palakurthi – 19<br>Sep: 07th:Zaffergadh – 19 |
| Siddipet | Aug 30th: Kondapak -13, Nanganur -13, Bejjanki – 13 |
| Bhupalpally | Sep : 07th : Mogullapalle – 23, Bhupalpalle – 15; 28th : Mogullapalle – 13 |
| Khammam | Sep 07th : Sathupalle – 13 |
| **RAYALASEEMA** | |
| Anantapur | Jun: 04th :Anantapur-12<br>Jul: 18th :Kadiri(a)-23, Kadiri-21 |
| Kurnool | Jun :27th:Yemmiganur-12<br>Sep: 01st : Nandyal -13 |
| Cuddapah | Jul: 05th :Utukuru(a) -18, Cuddapah-13 |
| **TAMIL NADU, PUDUCHERRY & KARAIKAL** | |
| Tiruchirapalli | Jun: 03rd :Navalur Kottapattu-12<br>Aug: 10th : Trichy Airport -12 |
| Kanyakumari | Jun: 04th :Chittar-14, Sivalogam-12<br>Sep: 27th: Kalial – 17, Kuzhithurai – 15, Pechiparai -15, Suralacode -14, Thuckalay -13, Kanyakumari -12, Nagercoil -12 |
| Sivaganga | Jun: 05th :Tirupuvanam-12<br>Sep: 25th :Devakottai – 14 |
| Pudukottai | Jun: 06th :Tirumayam-19 |
| Nilgiris | Jun: 16th :Avalanche-14; 17th :Avalanche-21, Upper Bhavani-12<br>18th :Upper Bhavani-22, Avalanche-13, Chamraj Estate-13; 18th :Avalanche-12<br>Jul : 23rd:Avalanche-16, Naduvattam -14, Upper Bhavani-13, Glenmorgan-12;<br>24th:Avalanche-15; 26th:Pandalur Taluk office-16<br>Sep : 09th: Devala-16; 14th : Pandhalur – 12 |
| Madurai | Jul: 02nd :Andipatti-13 |
| Tiruvarur | Jul: 05th :Kodavasal-12 |
| Thiruvannamalai | Jul: 08th :Kalasapakkam-13<br>Aug: 27th: Kalasapakkam – 14<br>Sep: 02nd: Kalasapakkam – 12; 21st: Kalasapakkam – 16; 22nd: Kalasapakkam – 13 |
| Kallakurichi | Jul: 09th :Kalayanallur -14, Sulankurichi-13, Eraiyur-13 |
| Coimbatore | Jul : 23rd:Valparai PTO-12; 24th:Valparai Pto-17, Cincona-17, Sholayar-13, |



*Kindly refer Appendix-(i)-(iv) in pages 52-53 for description of technical terms*

| | |
|---|---|
| | Valparai PAP-13, Taluk Office-13, Chinnakalar-12<br>Sep: 28th :Chinnakalar-13 |
| Tiruvallur | Aug: 10th :Tiruvallur-13 |
| Thanjavur | Aug: 25th: Thanjavur – 14 |
| Krishnagiri | Sep: 02nd: Krishnagiri – 13 |
| Salem | Sep: 03rd : Yethapur – 13; 04th: Yercaud – 13 |
| Ramanathapuram | Sep: 18th: Tiruvadanai – 12 |
| Villupuram | Sep: 21st: Manampoondi – 16; 26th: Marakkanam – 13 |
| Tiruppur | Sep: 24th: Tiruppur Collectrate – 18 |
| **COASTAL KARNATAKA** | |
| Uttar Kannada | Jun :13th:Manki-16, Gokarna-12; 16th:Kadra-14; 17th:Siddapur-13; 18th:Siddapura-14, Siddapura ARG-12<br>Jul: 02nd :Bhatkal-12; 06th : Karwar-12; 11th :Manki-12; 12th :Shirali-12, Bhatkala-12; 14th :Kadra-13; 15th :Karwar Obsy-13, Honavar Obsy-12; 18th:Bhatkal-21, Shirali Pto-18; 22nd :Jagalbet-19; 23rd: Janmane – 34, Kadra – 34, Banavasi – 28, Siddapur – 24, Yellapur – 23, Haliyal – 21, Manchikere – 21, Kiravatti – 17, Sirsi Agro – 13, Mundgod – 12; 24th:Manchikere-15<br>Aug :08th: Gokarna -18<br>Sep: 04th: Gokarna – 13; 05th : Karwar Obsy – 13, Ankola – 12 |
| Udupi | Jun :15th:Kollur-12; 16th :Kollur-15; 18th:Honavar Obsy-12; 19th:Kollur-15; 20th:Karkala-12<br>Jul: 15th:Kollur-12; Kota-17, Kundapur-16, 23rd: Kollur -20<br>Aug: 04th:Siddapura ARG – 15; 28th:Brahmavara AWS – 13 |
| Dakshina Kannada | Jul: 9th :Panambur-15; 15th:Dharmasthala-12, Subramanya-12; 16th:Mulki-20, Panambur Obsy-15, Mani-15, Mangaluru Ap Obsy-13, Puttur Hms-12, Mangaluru-12; 18th:Subramanya-13, Mani-13, Panambur Obsy-12<br>Aug: 04th: Subramanya – 13; 06th: Subramanya – 15<br>Sep :08th:Subramanya-12 |
| **NORTH INTERIOR KARNATAKA** | |
| Koppal | Jun: 3rd : Tavaragera-12<br>Sep 25th: Munirabad – 17 |
| Belagavi | Jun :17th: Nippani-14<br>Jul: 23rd: Londa – 38, Khanapur – 27, Belagavi Pto – 21, Nippani – 17, Belagavi Ap Obsy – 15, Sankeshwar – 14; 24th:Londa-18, Chikodi-12 |
| Raichur | Jun :27th:Maski-14 |
| Haveri | Jul: 23rd: Hirekerur – 16, Akkialur -15 |
| Dharwad | Jul: 23rd: Kalghatgi – 16, Kalghatgi Arg -14 |
| **SOUTH INTERIOR KARNATAKA** | |
| Tumakuru | Jun: 3rd :Gubbi-12 |
| Shivamogga | Jun :13th:Agumbe EMO-18; 16th: Agumbe-20; 17th:Agumbe EMO-18; 18th:Agumbe EMO-15, Thalaguppa-13; 20th:Agumbe EMO-15<br>Jul: 11th : Agumbe Emo-13; 14th :Agumbe-14; 15th :Agumbe-16, Thalaguppa-15; 18th:Agumbe Emo-18; 20th:Hosanagar-12 , 23rd: Thalaguppa – 27, Anavatti – 24, Agarahara Konanduru – 23, Sagar – 23, Tyagarthi – 20, Sorab – 19, Thirthahalli – 17, Agumbe Emo -15, Hunchadakatte – 13, Shikaripur – 12; 24th:Thalaguppa-13<br>Aug: 04th: Agumbe – 15, Tumri – 12; 27th : Agumbe – 13<br>Sep: 12th : Agumbe – 12 |
| Kodagu | Jun :16th:Bhagamandala-13; 17th:Bhagamandala-12; 18th:Bhagamandala-21<br>Jul :15th:Madikeri Pto-15; 23rd: Bhagamandala – 17, Hudakere – 15, Murnadu – 15, Santhahalli – 14; 26th:Bhagamandala-13; 19th: Bhagamandala – 13 |



*Kindly refer Appendix-(i)-(iv) in pages 52-53 for description of technical terms*

| | |
|---|---|
| | Sep: 8th:Bhagamandala-12 |
| Chikkamagaluru | Jun :16th:Kottigehara-14; 17th:Kottigehara-22, Sringeri Hms-13, Kalasa-12; 18th:Kottigehara-18<br>Jul: 15th :Sringeri Hms-13, Jayapura-12 , 23rd: Jayapura – 12, Sringeri Hms – 12; 24th:Koppa-15 |
| Hassan | Jul: 15th :Sakleshpura-12; 24th:Sakleshpura-15 |
| Chikkaballapura | Jul: 18th :Thondebhavi-16<br>Aug 25th: Thondebhavi – 13 |
| Davangere | Jul: 18th :Uchangidurga-20, Davanagere Pto-15 |
| **KERALA & MAHE** | |
| Ernakulam | Jun: 4th :Piravam-12<br>Jul: 22th :Neryamangalam ARG-16 |
| Malappuram | Jun: 4th :Vakkad AWS-16 |
| Kottayam | Jun: 4th :Kanjirappally-14, Poonjar AWS-13; 14th: Vaikom-12<br>Jul: 10th :Kottayam-15, Kanjirappally-14<br>Aug : 07th : Vaikom – 12; 27th: Kozha – 13; 30th: Vaikom – 13 |
| Pathanamthitta | Jun :4th:Konni-14, Konni ARG-13<br>Jul: 2nd :Kurudamannil-12; 10th :Seethathode AWS-13<br>Sep 27th : Seethathode AWS – 13 |
| Idukki | Jun: 6th :Peerumedu-14<br>Jul : 23rd:Munnar-12; 24th :Munnar-19 |
| Wayanad | Jun :17th:Padinjarathara Dam AWS-13; 18th:Padinjarathara Dam AWS-15 |
| Alapuzha | Jul: 2nd :Kayamkulam_agri-12<br>Aug : 27th: Cherthala – 12<br>Sep 27th : Kayamkulam_agri -17, Kayamkulam – 14 |
| Kasargod | Jul: 9th :Kudulu-12, 11th:Hosdurg-16, Vellarikkundu AWS-12 |
| Thiruvananthapuram | Jul: 10th :Neyyattinkara-12<br>Sep 27th: Neyyattinkara – 13, Vellayani AWS – 13 |
| Kollam | Sep: 27th: Aryankavu – 13 |
| **LAKSHADWEEP** | |
| | NIL |



*Kindly refer Appendix-(i)-(iv) in pages 52-53 for description of technical terms*

### 3.6 District-wise seasonal rainfall distribution

Table -7 presents the district rainfall distribution as percentage departures from normal over the nine meteorological subdivisions of the SP region during the period Jun-Sep 2021 and Fig.5, the district-wise seasonal rainfall over the various states and UTs over the SP region.

**Table-7: District rainfall performance over various sub-divisions of the SP region during June-September 2021**

| 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 | 10 | 0 | 5 | 5 | 0 | 0 |
| TELANGANA | 33 | 10 | 15 | 8 | 0 | 0 |
| RAYALASEEMA | 4 | 0 | 2 | 2 | 0 | 0 |
| TAMILNADU, PDC & KKL | 40 | 1 | 15 | 24 | 0 | 0 |
| COASTAL KARNATAKA | 3 | 0 | 0 | 2 | 1 | 0 |
| NORTH INTERIOR KARNATAKA | 11 | 0 | 4 | 7 | 0 | 0 |
| SOUTH INTERIOR KARNATAKA | 16 | 1 | 5 | 8 | 2 | 0 |
| KERALA & MAHE | 15 | 0 | 0 | 10 | 5 | 0 |
| LAKSHADWEEP | 1 | 0 | 0 | 0 | 1 | 0 |

Of the 133 districts in the SP region [Andhra Pradesh: 14 (CAP & Yanam -10 & RYS-4), Telangana: 33, TamilNadu, Puducherry and Karaikal: 40, Karnataka: 30 (CK-3, NIK-11 & SIK-16), Kerala & Mahe:15 and Lakshadweep: 1], 124 districts received *normal to large excess* rainfall and nine districts came under *deficient* category (KER-5, SIK– 2, CK-1 & LAK-1) during the season. Excess - large excess rainfall was realized in about 76% (25/33) of the districts in TEL, 50% of the districts in CAP (5/10) & RYS (2/4), 40% in TN (16/40) and 36%-37% in NIK & SIK. None of the districts in CK, KER & LAK received *excess / large excess* rainfall during the season.



*Kindly refer Appendix-(i)-(iv) in pages 52-53 for description of technical terms*

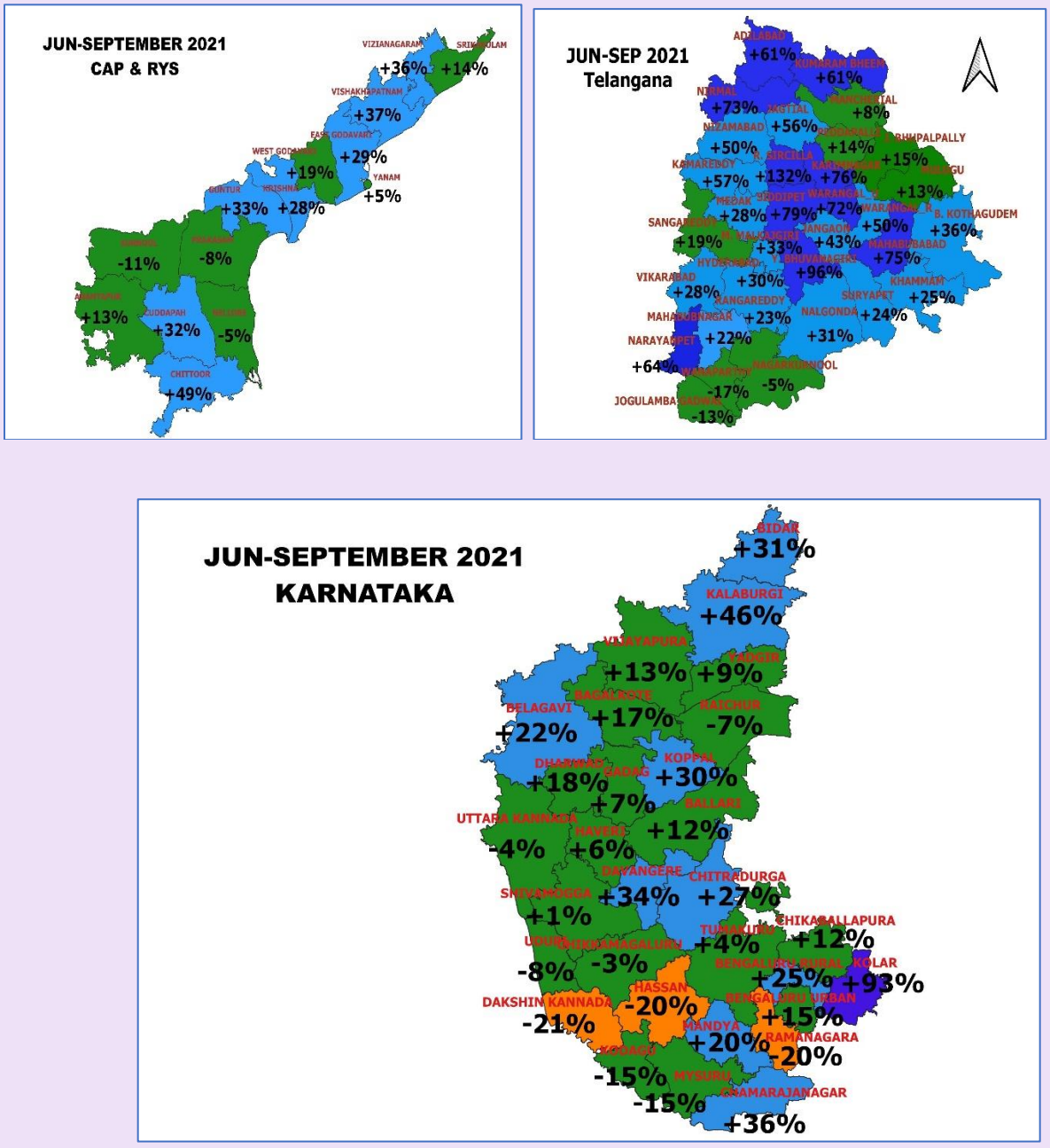
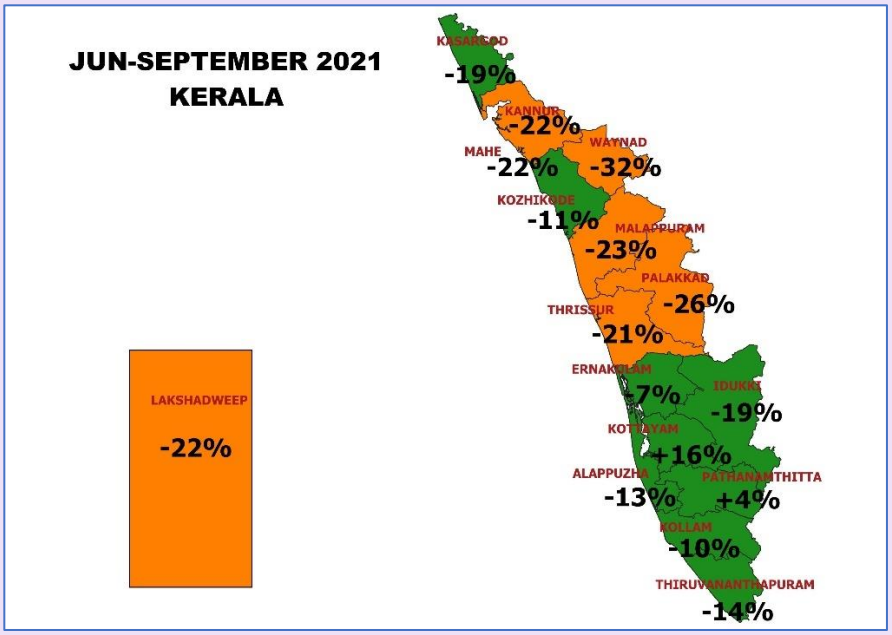



**Fig.5: District-wise rainfall (as percentage departure from normal) during Jun-Sep 2021 over various states and UTs in the SP region**



*Kindly refer Appendix-(i)-(iv) in pages 52-53 for description of technical terms*



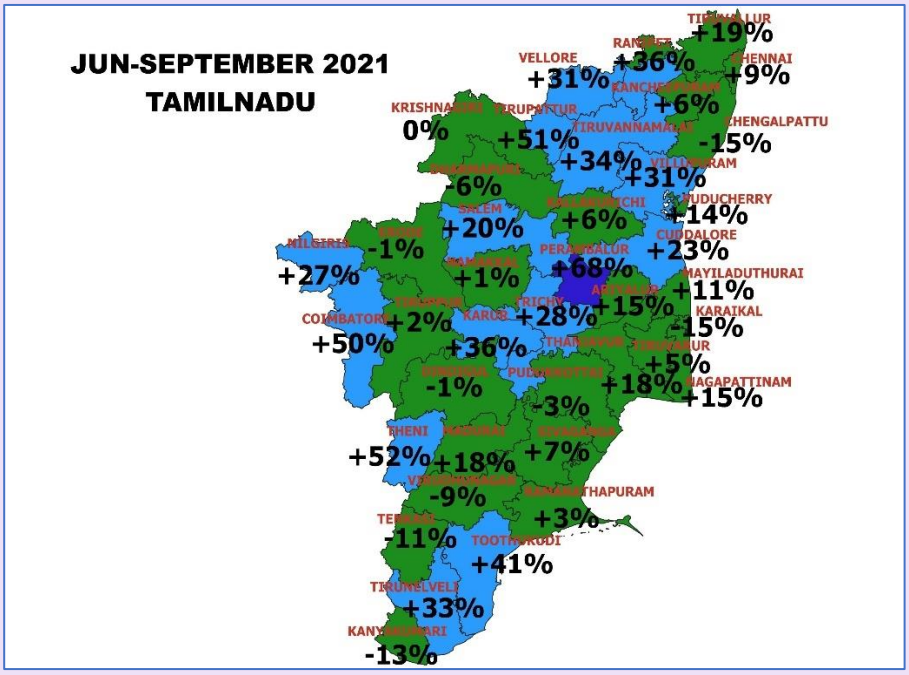




**Fig.5 (contd.)**



*Kindly refer Appendix-(i)-(iv) in pages 52-53 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 2021 are depicted in Fig.6. The SPI indicates generally wet conditions over 106 out of 133 districts in the SP region at the end of the season (*mildly/moderately/severely/extremely wet* category) and generally dry (*mildly/moderately/severely/extremely dry* category) conditions prevailed over 27 districts in the region. *Extremely wet* conditions prevailed over 8 districts [ TEL: 6 (Adilabad, Nirmal, Karimnagar, R.Sircilla, Siddipet & Y.Bhuvanagiri), SIK: 1 (Kolar) and CAP:1 (Vizianagaram)] and Shivamogga in SIK came under *severely dry* category in the region. In CK, all the three districts came under *mildly – moderately* dry category and in Kerala, excepting Kollam, Kottayam & Pathanamthitta districts that came under *mildly wet* category, all the other districts came under *mildly – moderately dry* category. Wet conditions prevailed in all the districts in TEL excepting J.Gadwal, all the districts in TN excepting Kanyamkumari and Virudhunagar, all districts in RYS excepting Kurnool and all districts in CAP excepting Prakasam and all districts in interior Karnataka excepting Belagavi, Hassan, Kodagu, Mysuru, Ramnagara and Shivamogga districts.

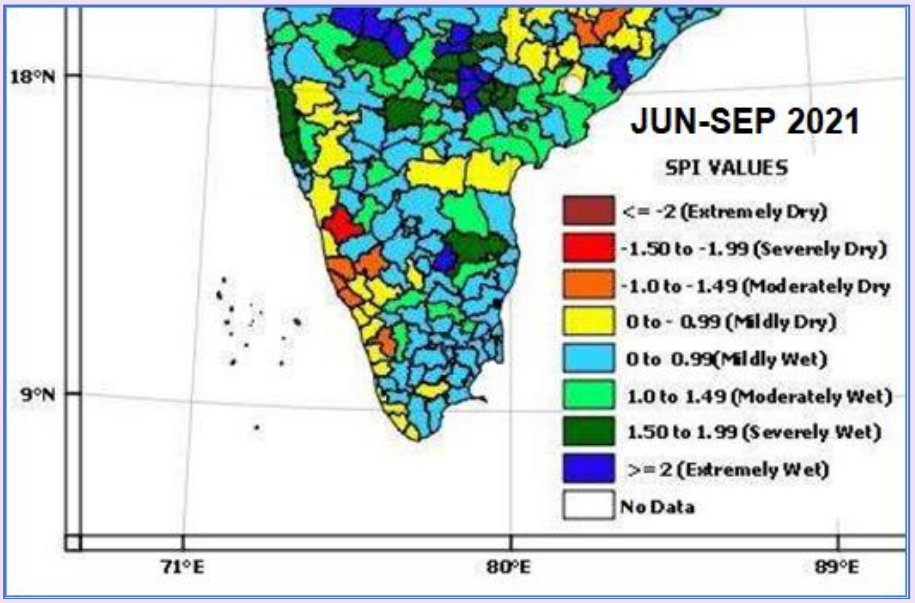



**Fig.6: Standardised Precipitation Index (SPI) over the SP region for Jun-Sep 2021**
**(Source:** Standardised Precipitation Index product, IMD Pune**)**



*Kindly refer Appendix-(i)-(iv) in pages 52-53 for description of technical terms*

## 4. 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 2021, generally *neutral ENSO* to *mild La Nina* conditions prevailed over the equatorial Pacific Ocean which was favourable for good monsoon. *Indian Ocean Dipole (IOD)* was negative and was not favourable for good monsoon activity. *Madden-Julian Oscillation (MJO)* was in phase 3-6 in July and in phase 3-4 in September which was favourable for good monsoon activity. In August, MJO was mainly in phase 8,1 & 2 which was not favourable for the monsoon activity (Fig.7).

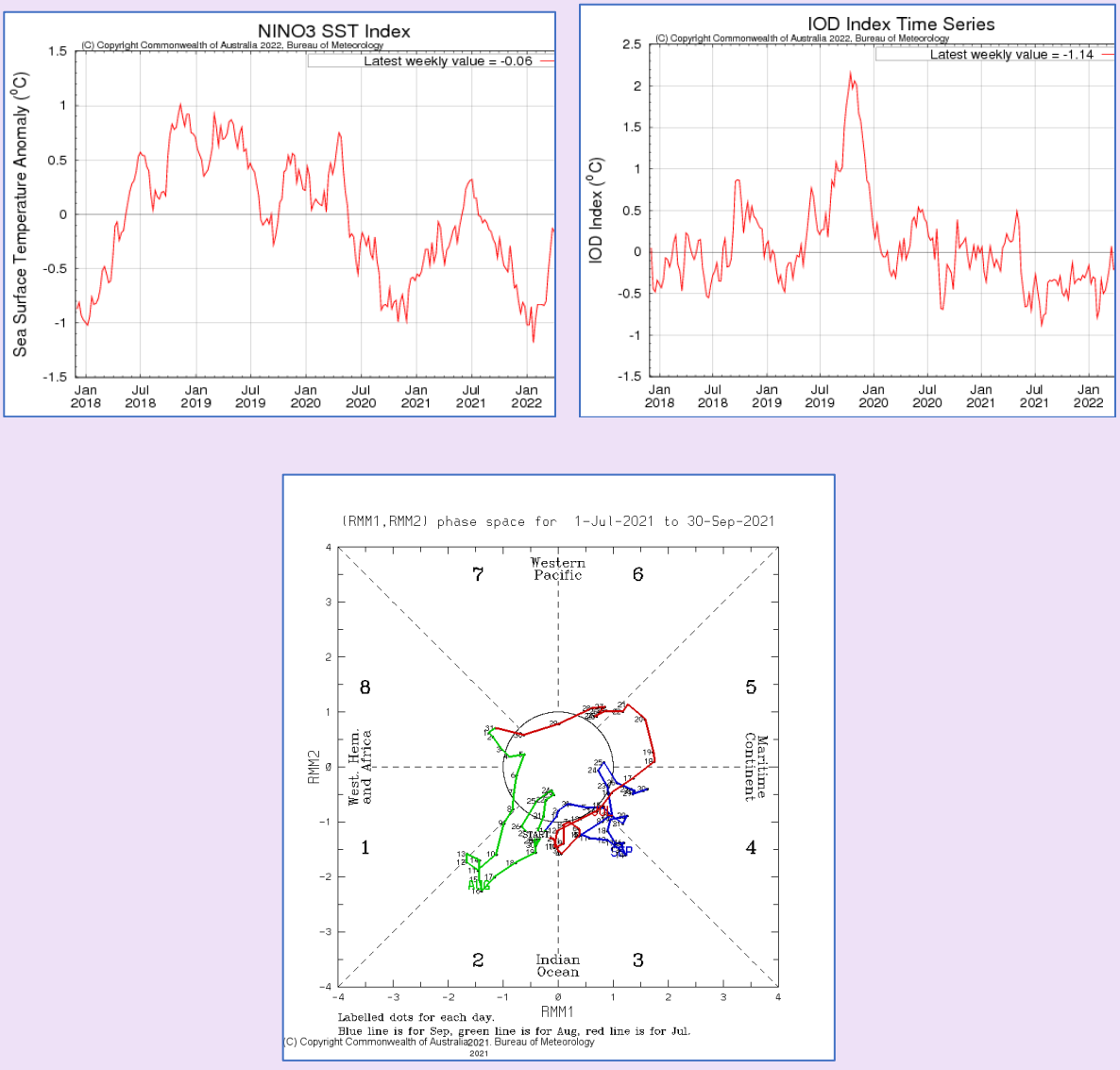



**Fig.7: Times series of Nino 3.4 SST anomalies, IOD and MJO during the SWM 2021**



*Kindly refer Appendix-(i)-(iv) in pages 52-53 for description of technical terms*

**Flow pattern over the Indian region***:* Fig.8 depicts the 850, 500 and 250 hPa wind anomaly during the months of June, July, August and September 2021.

It is observed that in June, at 850 hPa level, anomalous easterlies prevailed over the SP region. In the upper troposphere (250 hPa level) stronger than normal easterlies prevailed over the SP region.

In July, stronger than normal southwesterlies prevailed over the southwest and northeast Arabian sea in the lower (850 hPa) - mid (500 hPa) levels and an anomalous cyclonic circulation was seen over the SP region in the lower levels. Easterly anomalies were observed over the northern parts of India in the upper troposphere.

In August, anomalous anti cyclonic circulation was seen over the northeast Bay of Bengal and adjoining Odisha-West Bengal coasts in the lower levels and anomalous anti-cyclonic circulation was seen over the entire northern parts of India in the upper tropospheric levels.

In September, stronger than normal cross equatorial flow was observed over the Arabian sea and the Indian region in the lower levels. An anomalous anticyclone was observed over the extreme northern parts of India and anomalous easterlies over the extreme southern peninsula were observed in the upper troposphere.



*Kindly refer Appendix-(i)-(iv) in pages 52-53 for description of technical terms*

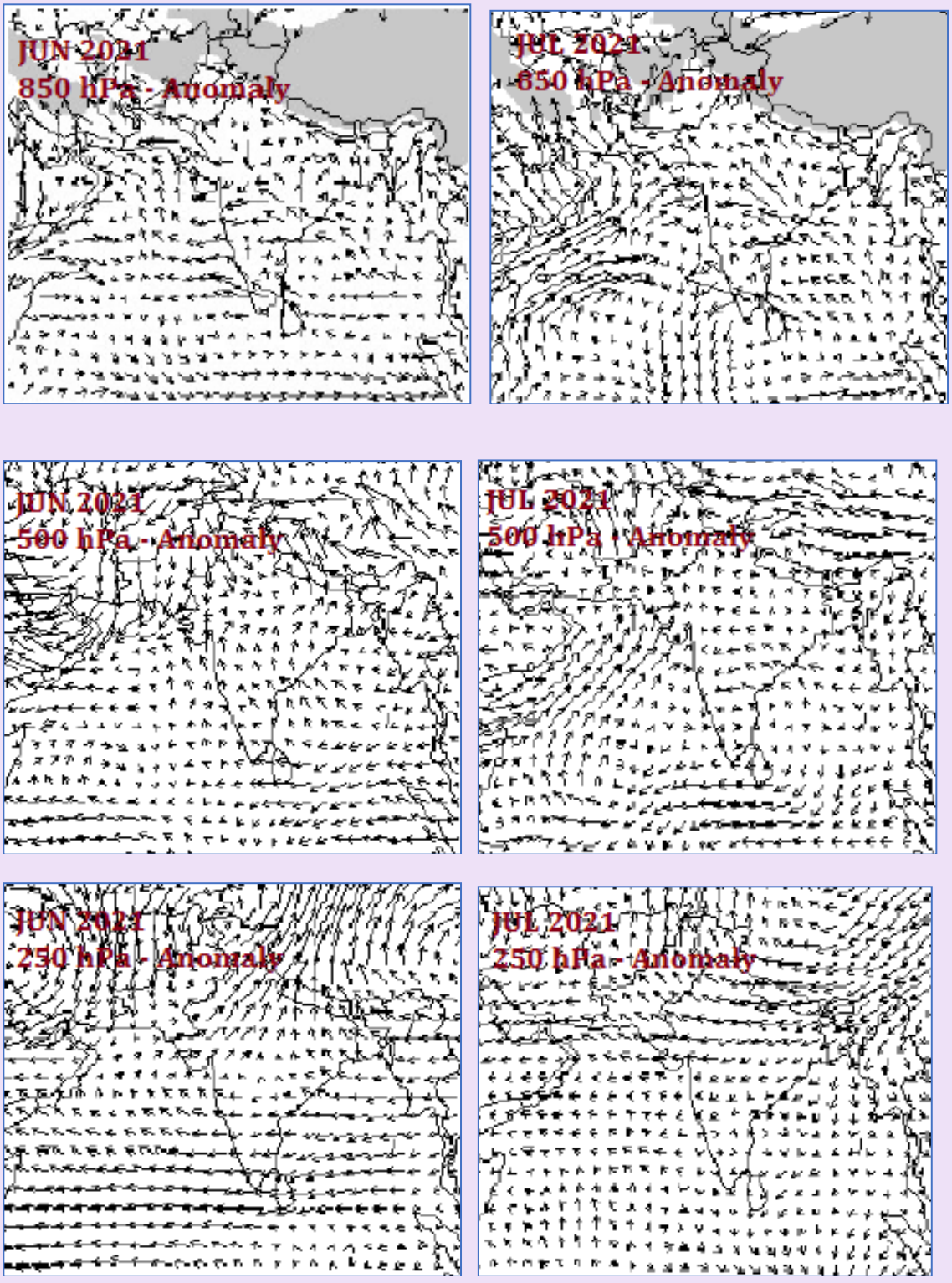



**Fig.8: 850hPa, 500hPa & 250hPa wind anomalies over Indian region during SWM2021**
(Source: Climate Diagnostic Bulletin of India, IMD Pune)



*Kindly refer Appendix-(i)-(iv) in pages 52-53 for description of technical terms*

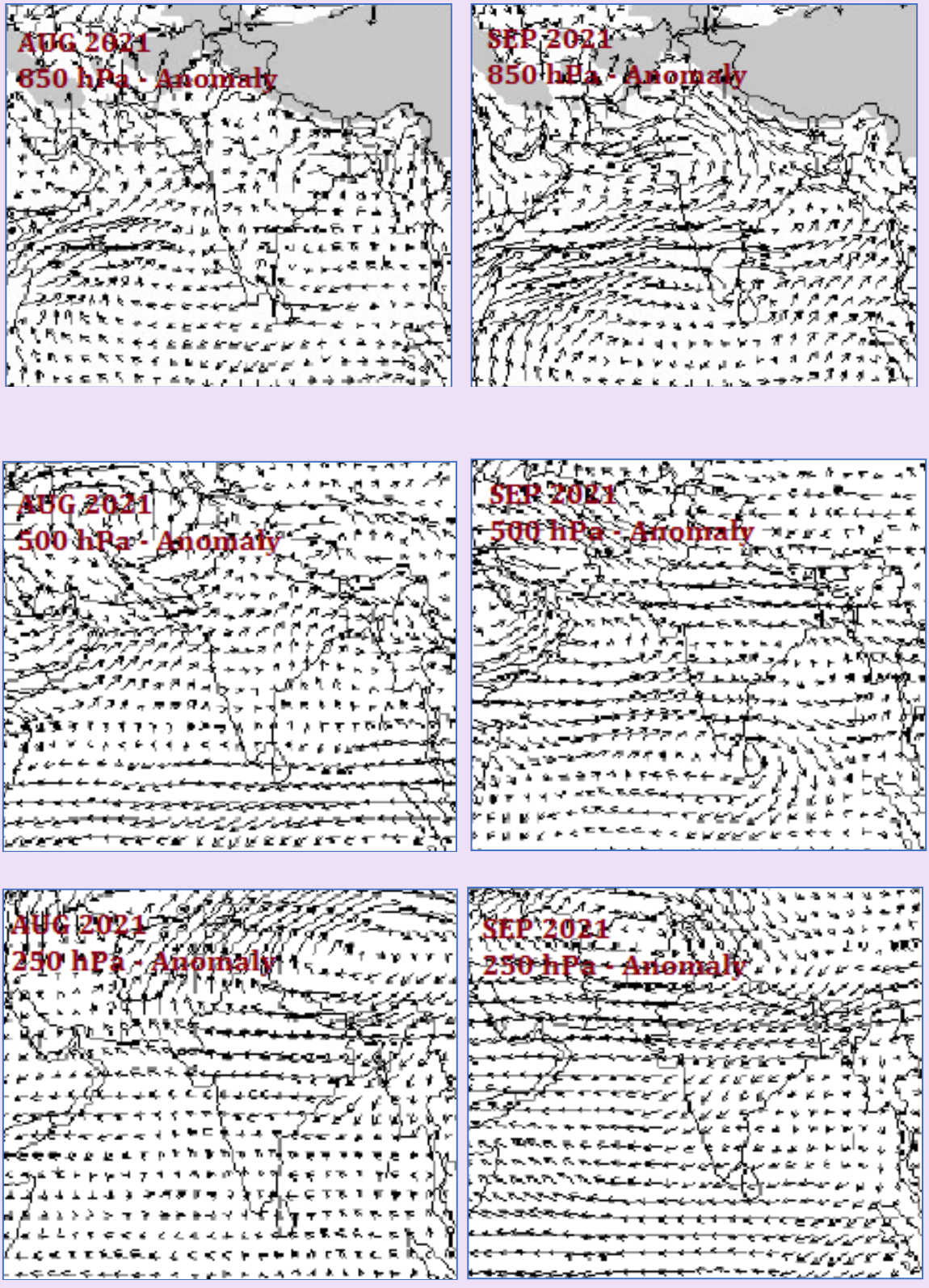



**Fig.8 (contd.)**



*Kindly refer Appendix-(i)-(iv) in pages 52-53 for description of technical terms*

## 5. Withdrawal of SWM 2021 from the SP region

The withdrawal of SWM 2021 commenced from the northwest India on 06th October, a delay by about 20 days (normal date – 17th September). It withdrew from the SP region during 12th – 25th October 2021 and hence from the entire country on 25th October 2021. Fig.8 depicts the isolines of dates of withdrawal of SWM 2021 from the SP region.

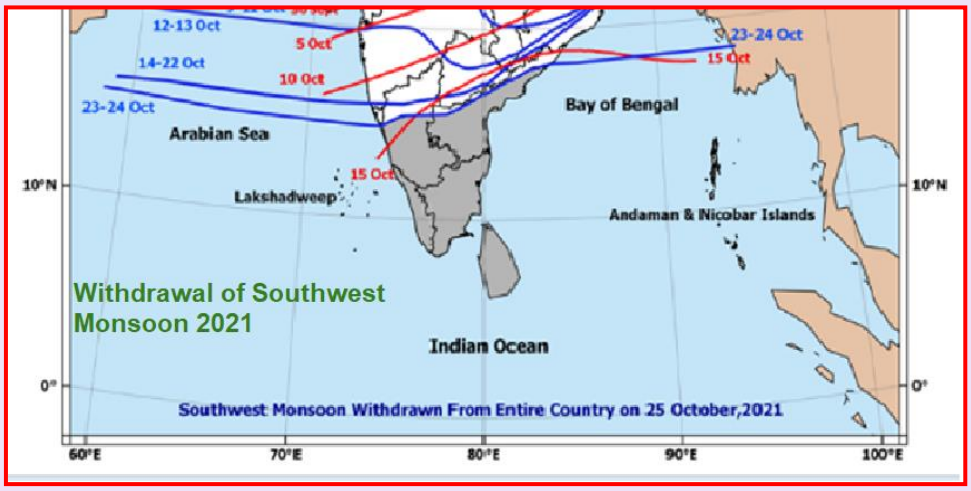



**Fig.8: Isolines of dates of withdrawal of SWM 2020 over the SP region**

## 6. Summary

During 2021, southwest monsoon advanced over Andaman Sea on 21stMay. It set in over Kerala on 03rd June and covered the entire southern peninsular India by 10th June. It covered the entire country by 13th July. South Peninsular region recorded *above normal* rainfall of 111% of LPA during the season. Excepting Lakshadweep, all other subdivisions in the region received *normal to excess* rainfall during the season - Coastal Andhra Pradesh & Yanam (CAP): +20%, Telangana (TEL): +39%, Rayalaseema (RYS): +19%, Tamilnadu-Puducherry-Karaikal (TN): +17%, Coastal Karnataka (CK): -10%, North Interior Karnataka (NIK): +21%, South Interior Karnataka (SIK): +3%, Kerala & Mahe (KER): -16% and Lakshadweep (LAK): -22%]

There were *isolated heavy* rainfall activities on 73 days over TN, 69 days over SIK, 67 days over TEL, 56 days over CK ,53 days over KER, 49 days over CAP, 32 days over NIK, 30 days over RYS & 2 days over LAK area. TEL & SIK experienced 5 & 4 days respectively of *isolated extremely heavy* rainfall during the season.



*Kindly refer Appendix-(i)-(iv) in pages 52-53 for description of technical terms*

Cyclonic storm '**Gulaab**' formed over Bay of Bengal on 24th September, crossed north Andhra Pradesh coast and caused heavy to very heavy rainfall with isolated extremely heavy falls over north coastal Andhra Pradesh and Telangana on 27th-28th Sep 2021. Wankdi (Kumaram Bheem district) in Telangana recorded the highest rainfall amount of 387.2 mm over the southern region on 23rd July 2021. The SWM withdrew from the southern peninsula region during 12th-25th October 2021


## 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.




*Kindly refer Appendix-(i)-(iv) in pages 52-53 for description of technical terms*

## 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 | *Very Light Rainfall* | Trace – 2.4 | | |
| 2 | *Light Rainfall* | 2.5 – 15.5 | Up to 1 | Up to 65 |
| 3 | *Moderate Rainfall* | 15.6 – 64.4 | 02 – 06 | 65 – 95 |
| 4 | *Heavy Rainfall* | 64.5 – 115.5 | 07 – 11 | 95 – 99 |
| 5 | *Very Heavy Rainfall* | 115.6 – 204.4 | 12 – 20 | 99.0 – 99.9 |
| 6 | *Extremely Heavy Rainfall* | Greater than or equal to 204.5 mm | 21 cm or more | >99.9 |
| 7 | *Exceptionally Heavy Rainfall* | When the amount is a value near about the highest recorded rainfall at or near the station for the month or season. However, this term will be used only when the actual rainfall amount exceeds 12 cm. | | |

## APPENDIX – (iii) Description of 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). |



*Kindly refer Appendix-(i)-(iv) in pages 52-53 for description of technical terms*

## Appendix-(iv) Monsoon performance

| Terminology | Description |
|---|---|
| *Large Excess* | Percentage departure from normal: ≥ +60% |
| *Excess* | Percentage departure from normal: +20% to +59% |
| *Normal* | Percentage departure from normal: -19% to +19% |
| *Deficient* | Percentage departure from normal: -20% to -59% |
| *Largely deficient* | Percentage departure from normal: ≤ -60% |



*Kindly refer Appendix-(i)-(iv) in pages 52-53 for description of technical terms*