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Ministry of Earth Sciences
India Meteorological Department

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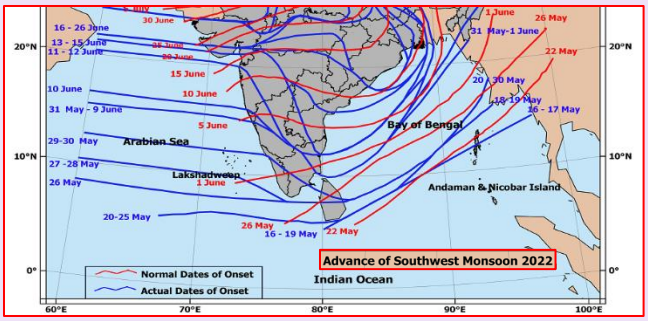
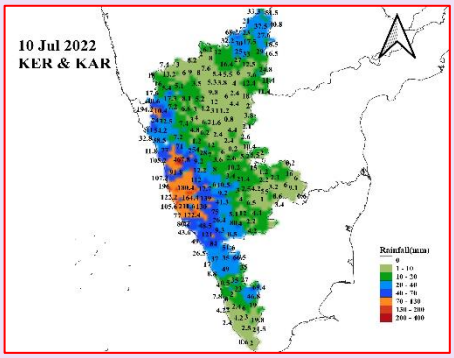
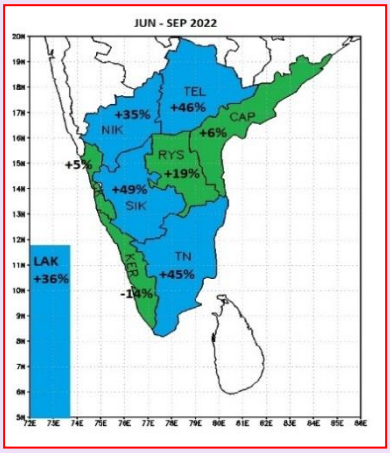
IMD Chennai Scientific Report No. IMDC-SR/13

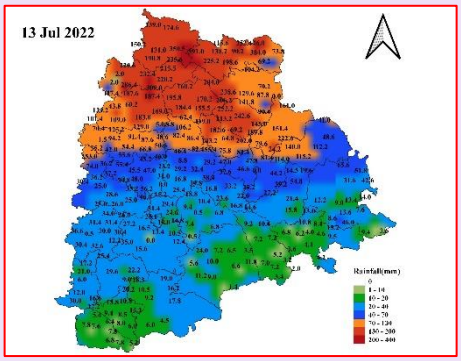
SOUTHERN PENINSULAR INDIA:

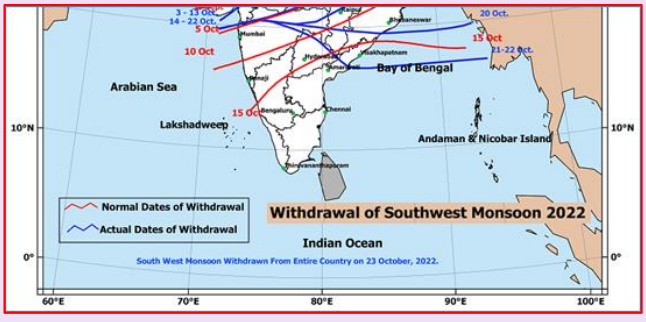
SOUTHWEST MONSOON, 2022–REPORT











Regional Meteorological Centre, Chennai
December 2022

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Executive Summary

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16	Authors' affiliation	India Meteorological Department, Chennai
17	Originating group	Research Section, Regional Meteorological Centre, India Meteorological Department, Chennai
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HIGHLIGHTS

- ✓ During 2022, southwest monsoon (SWM) advanced over Andaman Sea on 16th May, six days ahead of its normal date of 22nd May. It set in over Kerala on 29th May, three days ahead of its normal date of onset (01st June) and covered the entire southern peninsula (SP) by 20th June, delayed by about a week, 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, 2022 was *normal*. It was 93.0 cm and 106% of Long Period Average (LPA) of 87.0 cm.

- ✓ South Peninsular region recorded *above normal* rainfall of 122% of LPA.

- ✓ All the nine subdivisions in the region received *normal to excess* rainfall during the SWM season - Coastal Andhra Pradesh & Yanam (CAP): +6%, Telangana (TEL): +46%, Rayalaseema (RYS): +19%, Tamilnadu-Puducherry-Karaikal (TN): +45%, Coastal Karnataka (CK): +5%, North Interior Karnataka (NIK): +35%, South Interior Karnataka (SIK): +49%, Kerala & Mahe (KER): -14% and Lakshadweep (LAK): +36%].

- ✓ During the season, *Fairly widespread* to *Widespread* rainfall occurred over CK on about 87% of the days, over KER & LAK on about 70-75% of the days and about 40-55% of the days over SIK, NIK & TEL.

- ✓ There were *isolated heavy* rainfall activities on 70 days over SIK, 75 days over TN, 68 days over TEL, 70 days over CK, 56 days over KER, 55 days over CAP, 48 days over NIK, 29 days over RYS & 8 days over LAK area during the season.

- ✓ *Isolated extremely heavy* rainfall occurred over CK on 07 days, TEL & SIK: 06 days each, TN: 05 days, CAP: 02 days & KER: 01 day during the season.

- ✓ During the season, Hosanagar (Shivamogga district) in SIK recorded the highest daily rainfall amount of 467.8 mm over the southern region on 10th July 2022 followed by Jainoor (Kumaram Bheem district) in TEL: 391.0 mm, on 13th July 2022.

- ✓ The SWM withdrew from the SP region during 21st-23rd October and hence from entire country on 23rd October 2022.

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1. Onset and Advance

During the year 2022, 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 and parts of south BOB on 16th May, six days ahead of the normal date of 22nd May. It covered more parts of south BOB and some parts of east central BOB by 18th May and covered the Maldives area, Comorin area, more parts of south Arabian Sea, parts of Lakshadweep areas by 28th May. It advanced into the remaining parts of south AS, Lakshadweep area, most parts of Kerala, most parts of south Tamilnadu, some parts of Gulf of Mannar and some more parts of southwest BOB on 29th May. Thus, it set in over Kerala on 29th May 2022, three days ahead of 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 20th June, delayed by about a week (normal: 11th-15th June). The northern limit of monsoon (NLM) passed over Kannur & Palakkad (KER), 9°N/79°E across TN on 29th May. It advanced over some more parts of central Arabian Sea, some parts of KAR, remaining parts of KER, some more parts of TN, remaining parts of southeast BOB, some more parts of southwest BOB, most parts of Eastcentral BOB, some parts of Westcentral and Northeast BOB by 31st May and further over some parts of northwest and some more parts of northeast BOB by 02nd June. It covered the entire Eastcentral and northeast BOB and advanced further into more parts of Westcentral and northwest BOB on 03rd June ; advanced into some more parts of TN and southwest & Westcentral BOB on 07th June; some more parts of KAR, TN, some parts of RYS & TEL on 12th June; and covered the entire KAR, TN, RYS and advanced into some parts of CAP and some more parts of TEL on 15th June. It covered entire TEL and advanced into most parts of CAP on 16th June. It covered the entire Westcentral BOB & advanced into most parts of Northwest BOB by 18th June and covered the remaining parts of CAP and remaining parts of Northwest BOB on 20th June. Hence, it covered the entire SP region and the BOB by 20th June. The advance of the monsoon over the SP region,

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as depicted by the northern limit of the monsoon (NLM) is presented in Fig.1a.

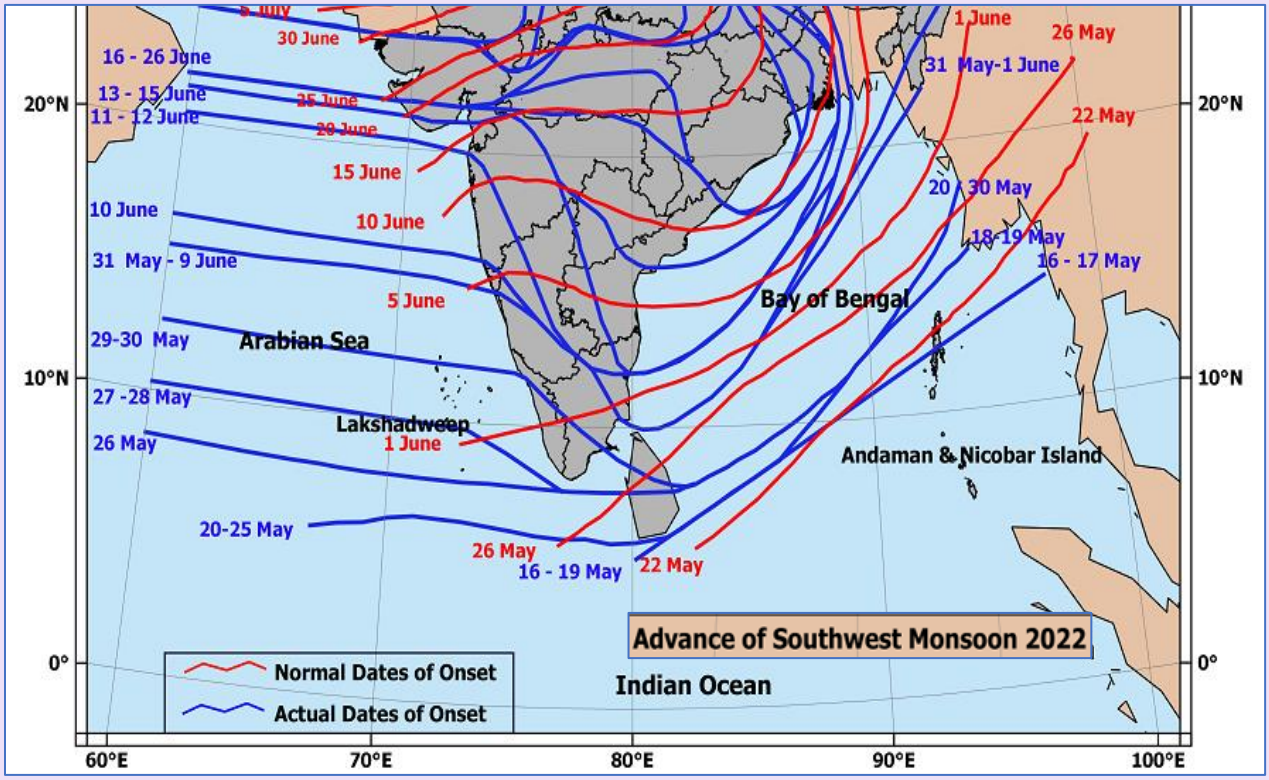

Fig.1a: Advance of southwest monsoon 2022 over southern peninsular India depicted by lines of northern limit of monsoon on various dates

The onset of monsoon over KER was associated with a cyclonic circulation in the mid tropospheric levels over KER & neighbourhood on 29th; and a cyclonic circulation over southeast AS off KER-KAR coasts in the lower-mid tropospheric levels and a trough running from this cyclonic circulation over Southeast AS to Southwest BOB across KER & TN on 30th May. Subsequently, under the influence of east-west shear zone running across peninsular India in the lower-mid tropospheric levels / off shore trough off west coast of India / north-south trough across peninsular India in the lower tropospheric levels / upper air cyclonic circulation over the peninsular India / upper air cyclonic circulation over the BOB and a trough running from this cyclonic circulation to the southern peninsula across the east coast of the southern peninsula / upper air cyclonic circulation over the AS and a trough running from this cyclonic circulation to the southern peninsula across the west coast of the southern peninsula / deep amplitude upper air westerly trough penetrating into southern peninsular region, the monsoon gradually advanced into SP region by 20th June. Surface isobaric analysis as on 0830 IST / 1730 IST and upper air (lower-mid tropospheric levels) streamline analysis as on 0530 IST / 1730 IST

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of 29th May, 05th, 13th & 19th June depicting these synoptic features associated with the onset and advance of the monsoon over the southern peninsula are presented in Fig.1b(i-iv) and satellite imageries depicting the cloudiness associated with the advance of the monsoon over the southern peninsula are presented in Fig.1c.

During the period of onset and advance of monsoon over the SP region, *fairly widespread* to *widespread* rainfall occurred over KER, CK & LAK on *many* days during 29th May to 22nd June; and *scattered* to *widespread* rainfall over SIK, NIK, TEL & CAP on *many* days and over RYS & TN on *a few* days during 11th-22nd June.

Isolated heavy to *very heavy* rain occurred over TEL on three days; over KER, RYS & TN on two days; and over CK & CAP on one day during the period 01st-22nd June. Also, *isolated heavy* rain occurred over TN on 11 days; KER & SIK : 09 days each, CK & CAP: 8 days each; TEL & NIK: 05 days each; and RYS: 03 days during the same period.

Vigorous monsoon conditions prevailed over RYS on 15th, 17th & 19th June and over TN on 16th June. *Active* to *Vigorous* monsoon conditions prevailed over TEL on 16th, 21st & 22nd; and *active* monsoon conditions prevailed over SIK on 15th, 17th & 18th; over NIK on 18th & 19th; over CAP on 21st and over CK on 22nd June 2022.

GPM-gauge merged rainfall as on 0830 IST of 01st, 06th, 15th & 21st 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, TN on 06th, Karnataka (CK, SIK & NIK) on 18th, Andhra Pradesh (CAP & RYS) & TEL on 20th June 2022 are presented in Fig.1d & Fig.1e.

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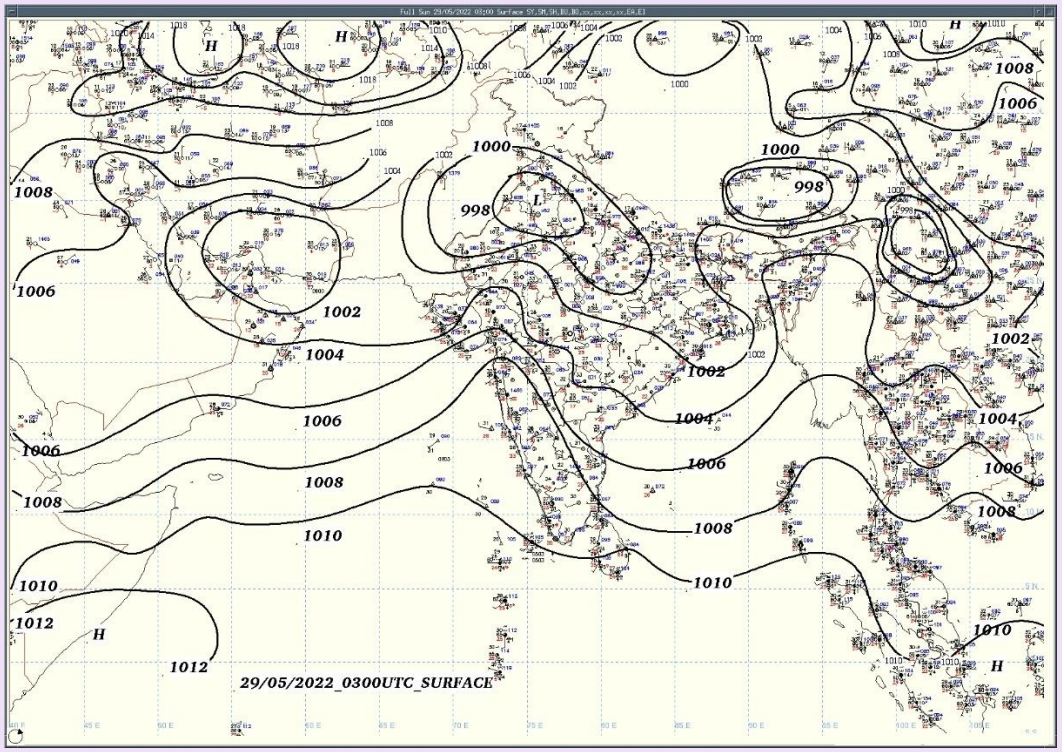

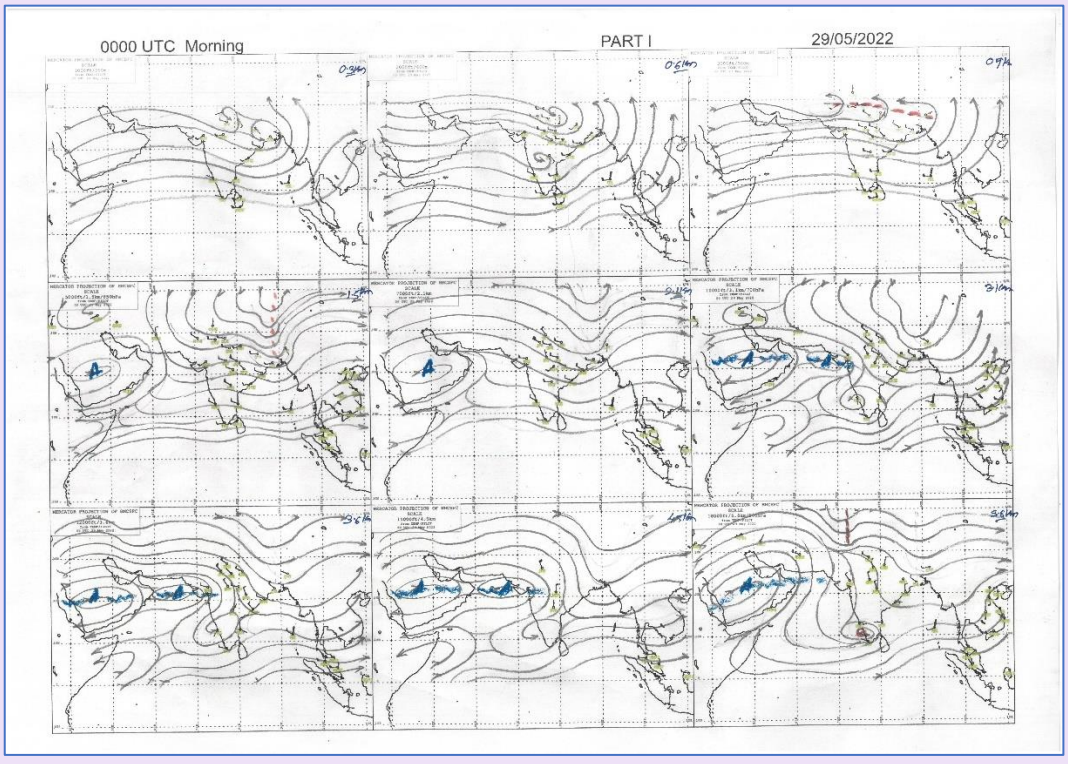

Fig.1b(i): Surface isobaric analysis as on 0830 IST and upper air streamline analysis as on 0530 IST of 29th May 2022

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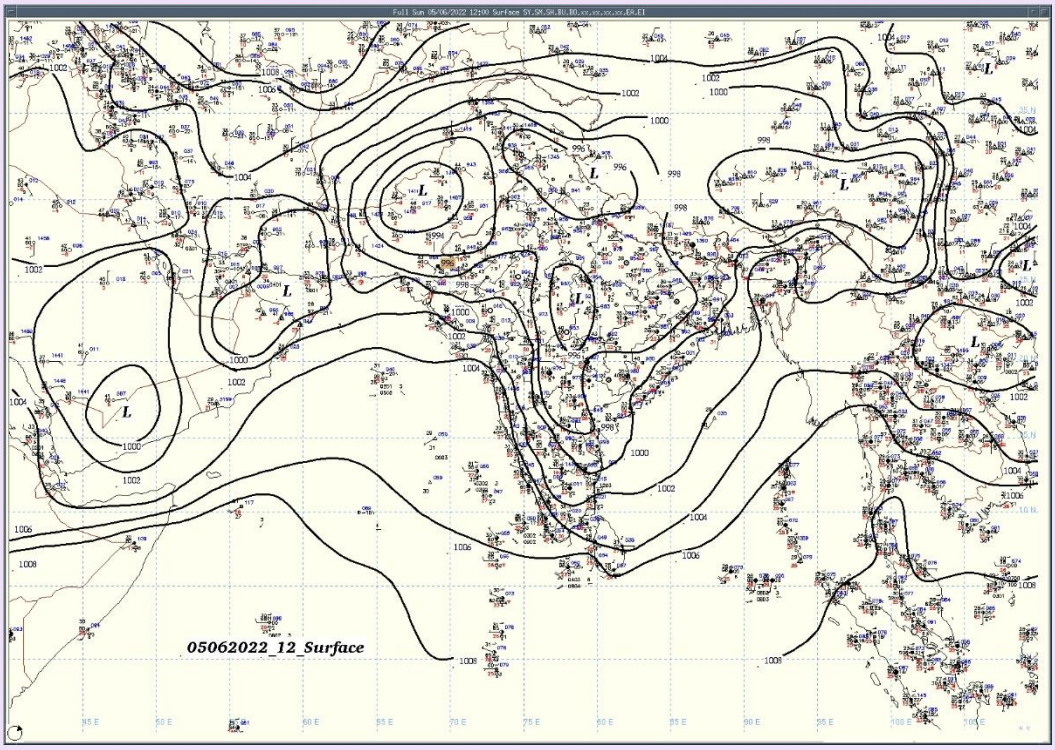

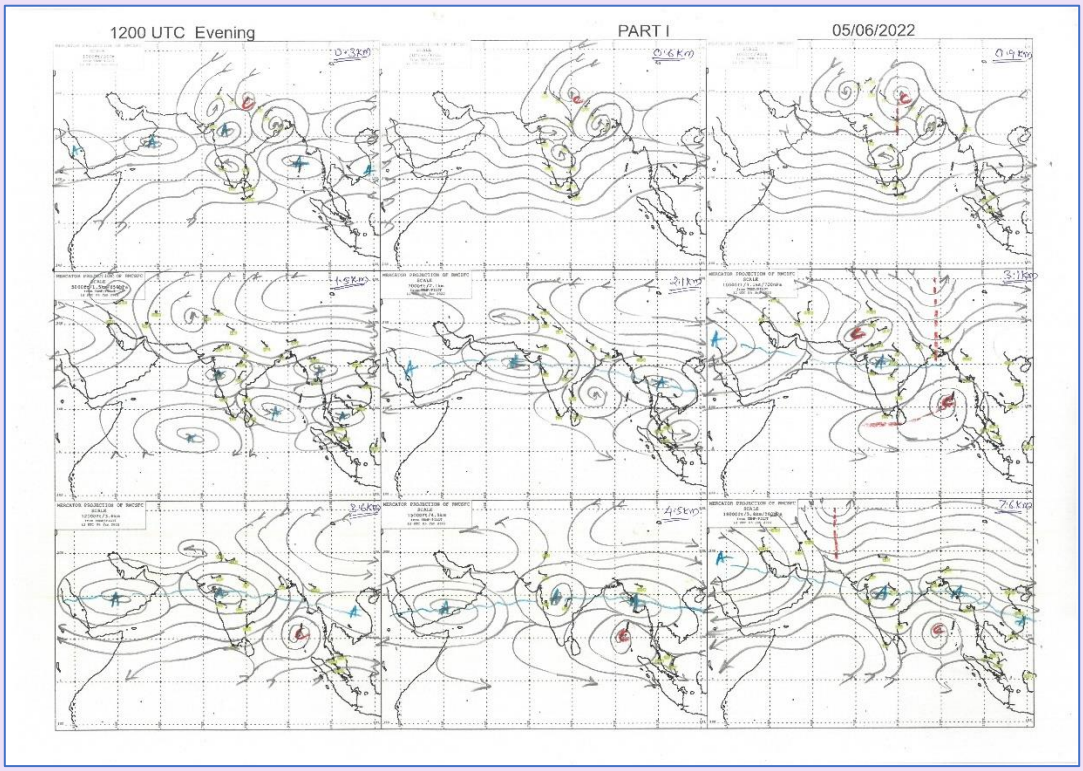

Fig.1b(ii): Surface isobaric analysis and upper air streamline analysis as on 1730 IST of 05th June 2022

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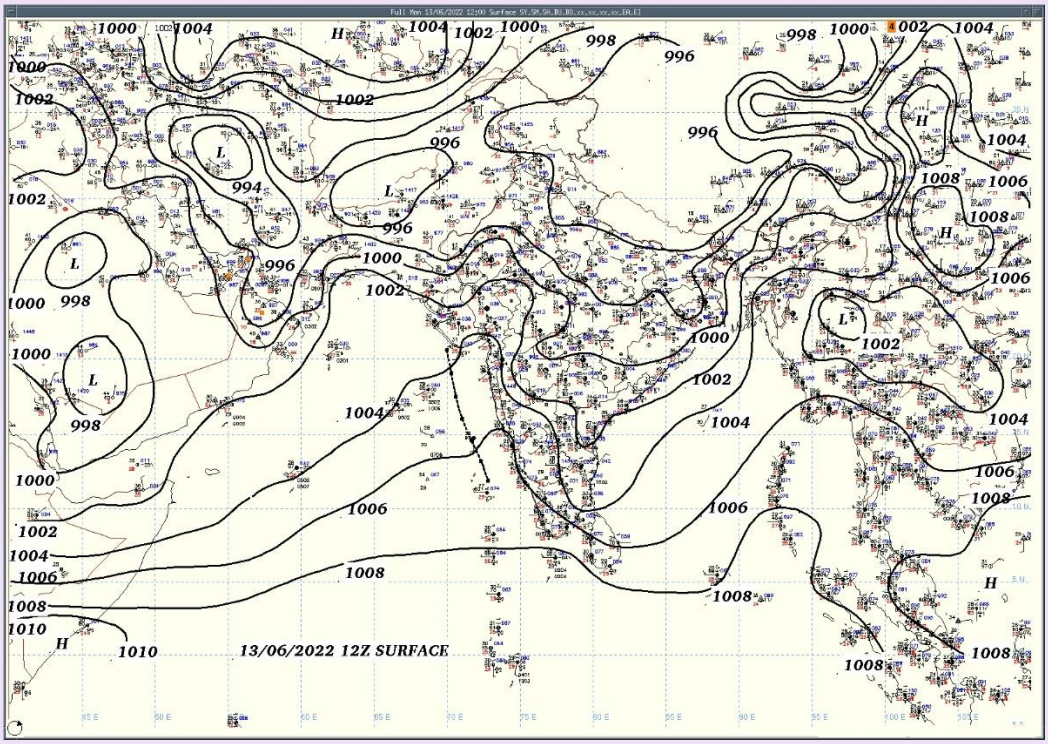

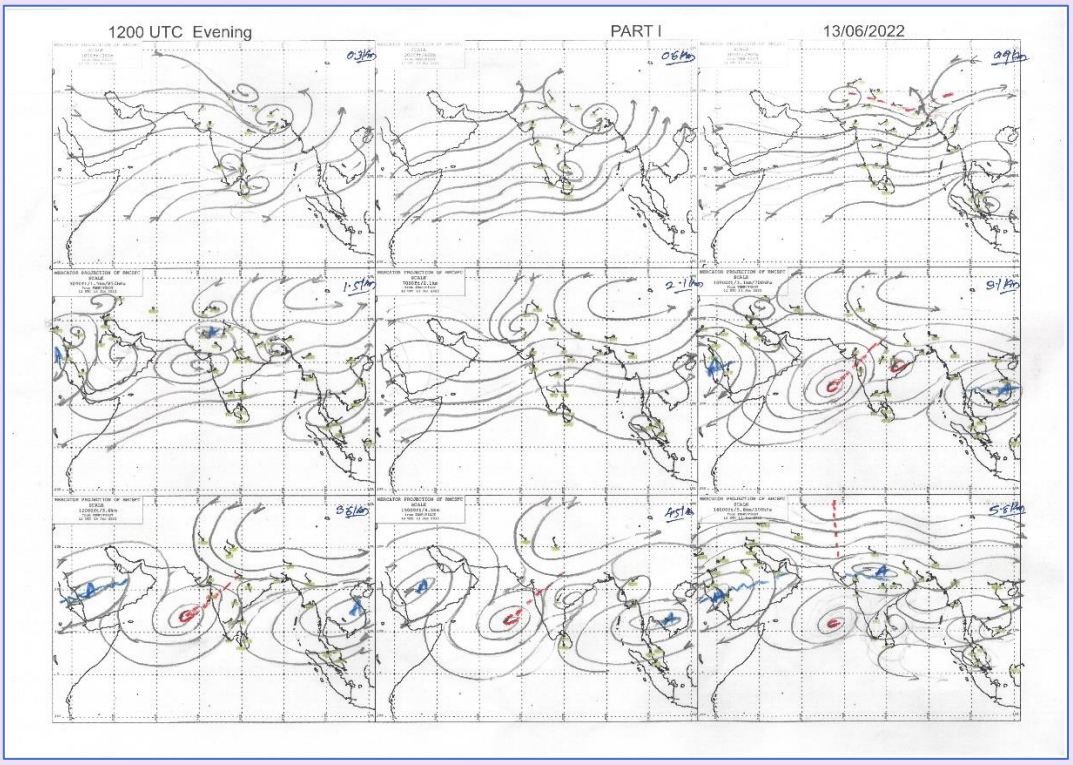

Fig.1b(iii): Surface isobaric analysis and upper air streamline analysis as on 1730 IST of 13th June 2022

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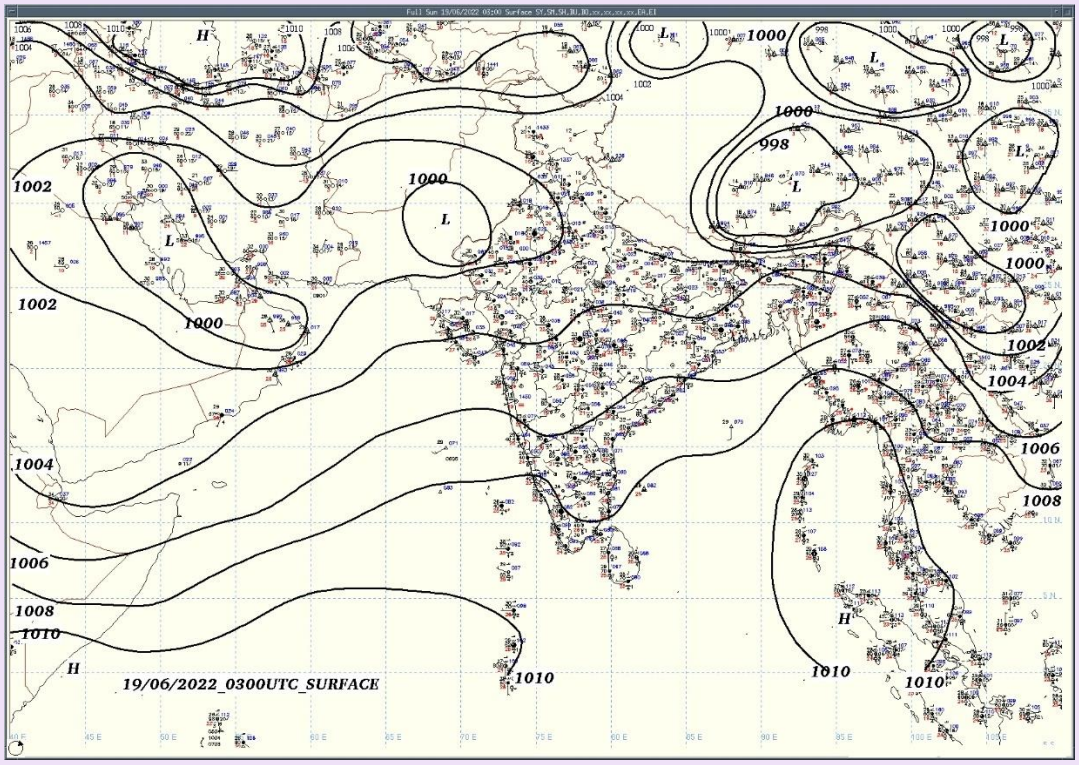

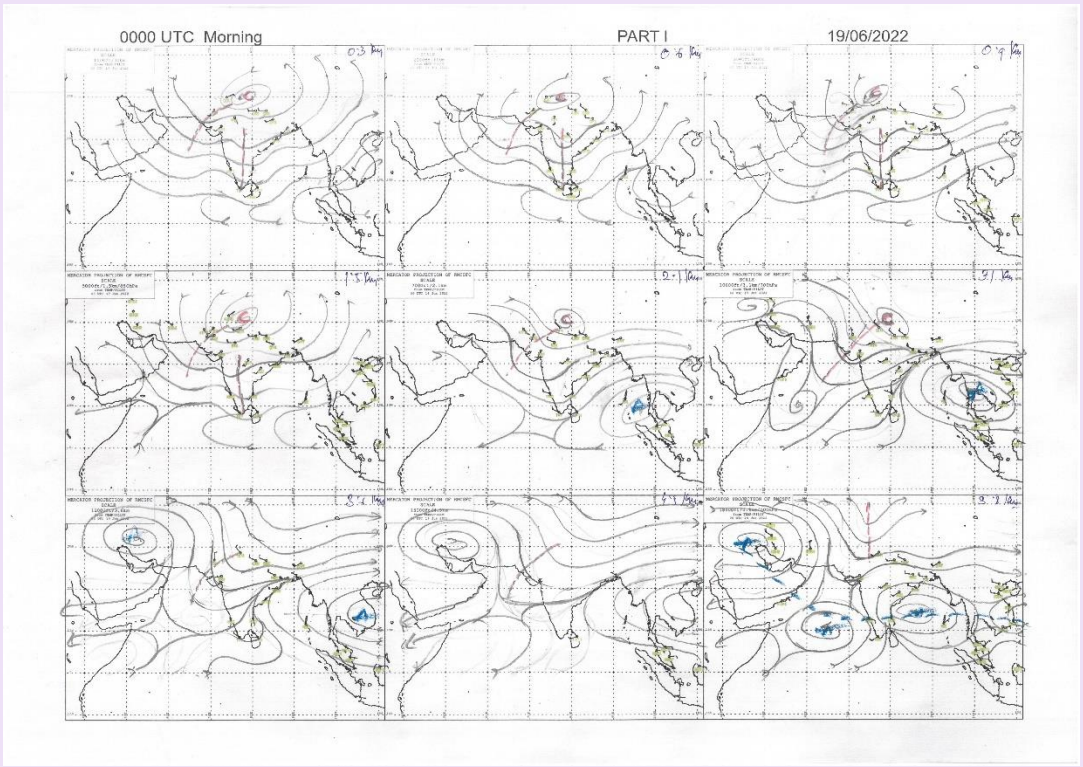

Fig.1b(iv): Surface isobaric analysis and upper air streamline analysis as on 1730 IST of 19th June 2022

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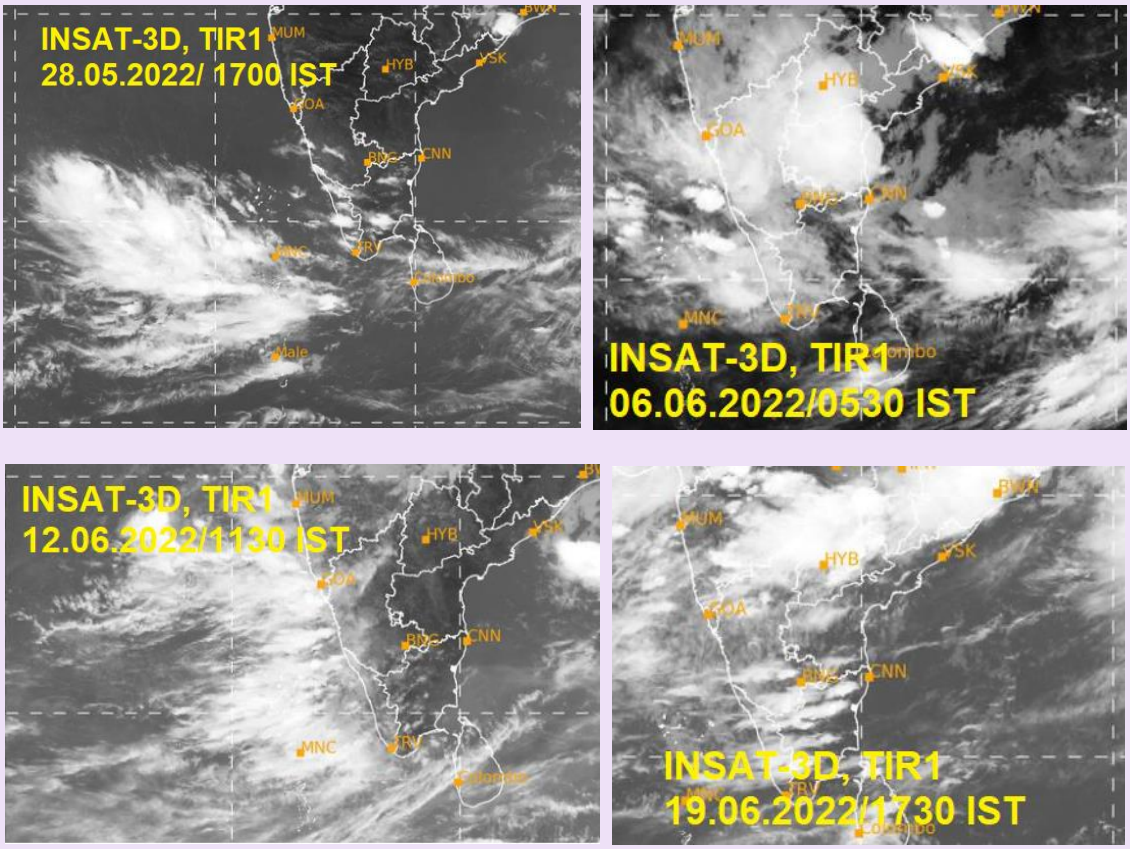

Fig.1c: INSAT-3D infra-red imageries as on 28/1700 IST of May, 06/0530, 12/1130, 19/1730 IST of June 2022

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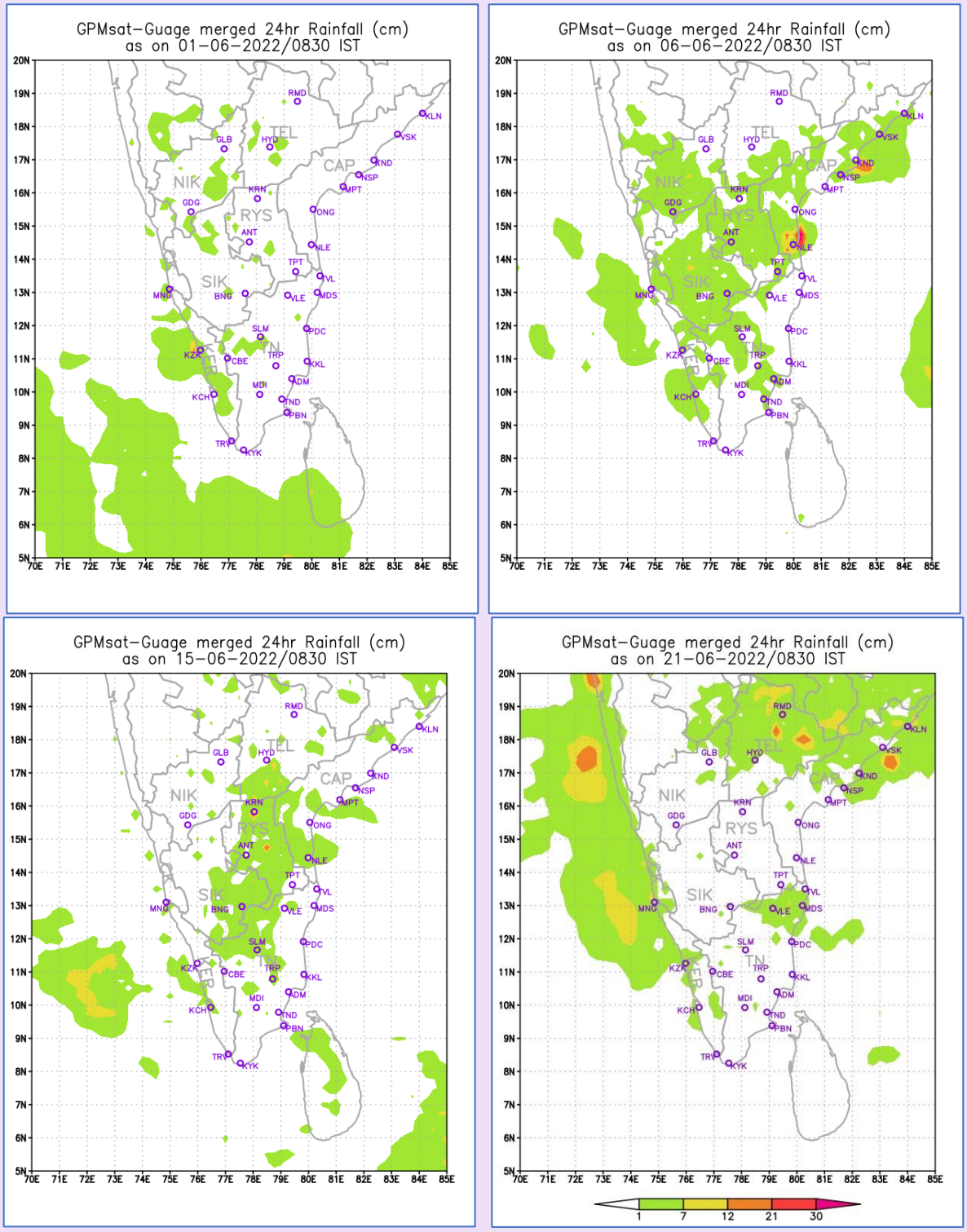

Fig.1d: GPM Sat – Gauge merged rainfall in cm as on 24-hr ending 0830 IST of 01st, 06th, 15th & 21st June 2022

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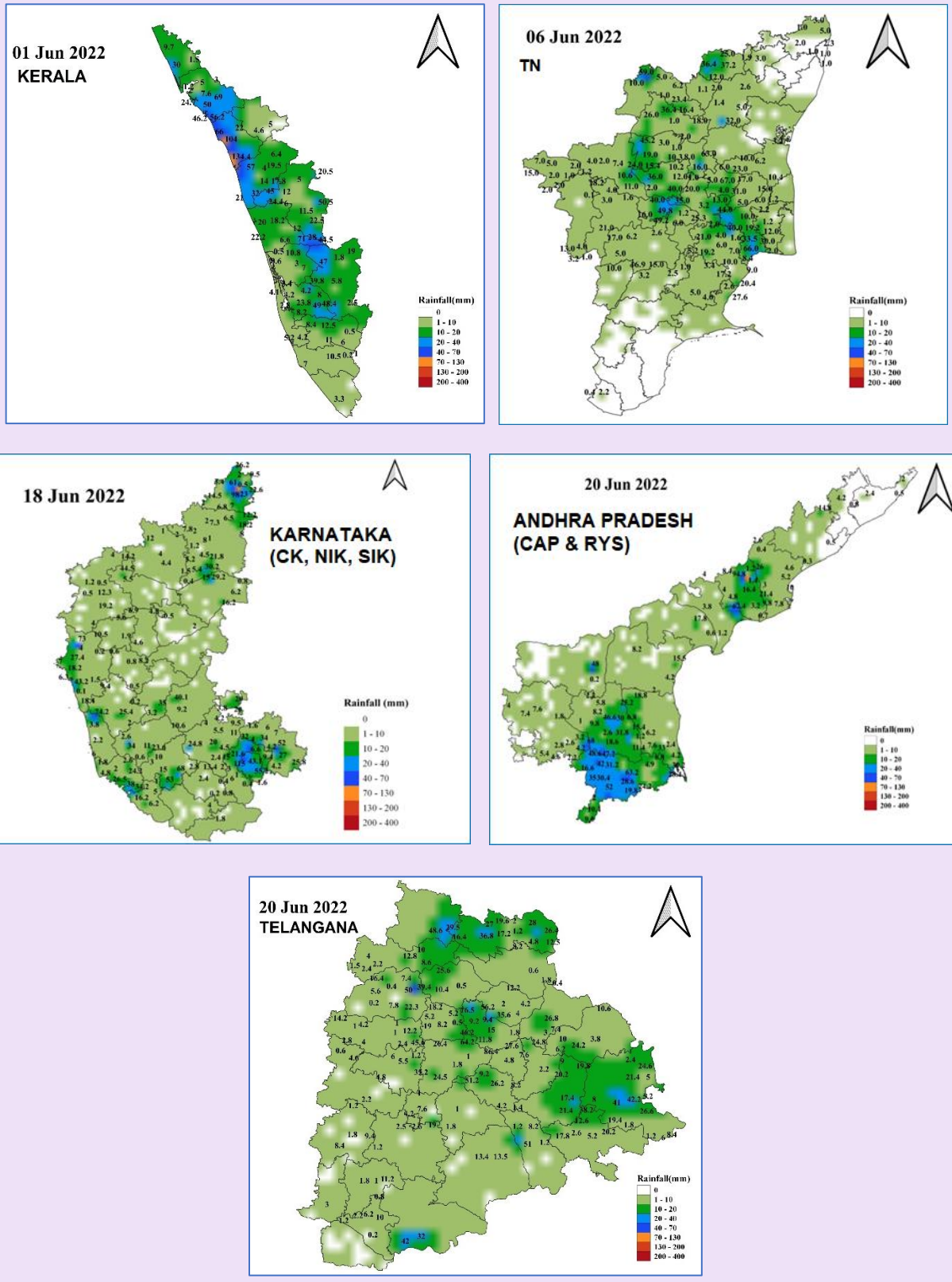

Fig.1e: 24-hr accumulated rainfall (as on 0830 IST) over KER on 01st, TN on 06th, Karnataka (CK, SIK & NIK) on 18th, Andhra Pradesh (CAP & RYS) on 20th & TEL on 20th June 2022.

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2. Chief synoptic features & associated weather

During June-September 2022, the chief synoptic features that contributed significantly towards rainfall activity over the SP region were the following: (i) a low pressure area (LOPAR) over north Odisha & neighbourhood with associated cyclonic circulation extending upto upper tropospheric levels tilting southwestwards with height during 04th-05th July, (ii) a LOPAR-well marked LOPAR (WML) off Odisha coast and neighbourhood with associated upper air cyclonic circulation extending upto upper tropospheric levels tilting southwest-wards with height during 09th to 16th July and its westward movement during 17th-19th July, (iii) strengthening of westerlies during the formation of a Depression over Odisha and neighbourhood on 09th August, (iv) formation of a Depression over northwest BOB on 14th August, (v) formation of a Depression over south coastal Odisha and neighbourhood during 11th-12th September, (vi) presence of off shore trough off the west coast (vii) cyclonic circulations in the lower-mid tropospheric levels over the SP region and neighbourhood (viii) cyclonic circulations in the BOB /AS with a trough extending over the SP region (ix) east-west shear zone across peninsular India in the lower-mid tropospheric levels tilting southwards with height (x) north-south trough across the southern peninsula.

Whereas the cyclonic circulations over the southeast AS and adjoining areas / off shore trough / east-west shear zone in the lower-mid tropospheric levels across peninsular India were associated with rainfall over CK, KER & LAK, rainfall over SIK, RYS & TN were mainly under the influence of north-south trough across peninsular India / strengthening of westerlies / east-west trough across peninsular India and that over CAP, TEL & NIK were under the influence of the westward moving low pressure systems that formed over the BOB / north-south trough across the southern peninsula / east-west shear zone across the southern peninsula. Significant synoptic situations and associated rainfall features over various parts of the SP region are 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 106 days out of 122 days, 87 days over KER, 91 days over LAK, 64 days over SIK, 58 days over NIK during the season. *Active* to *vigorous* monsoon conditions prevailed over CK on 29 days, over NIK – 40 days, over SIK – 48 days and over KER - 26 days. Surface isobaric analysis as on 0830 IST of 10th July & 09th

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August depicting the off shore trough off Kerala-Karnataka coast is presented in Fig. 2(i)a.

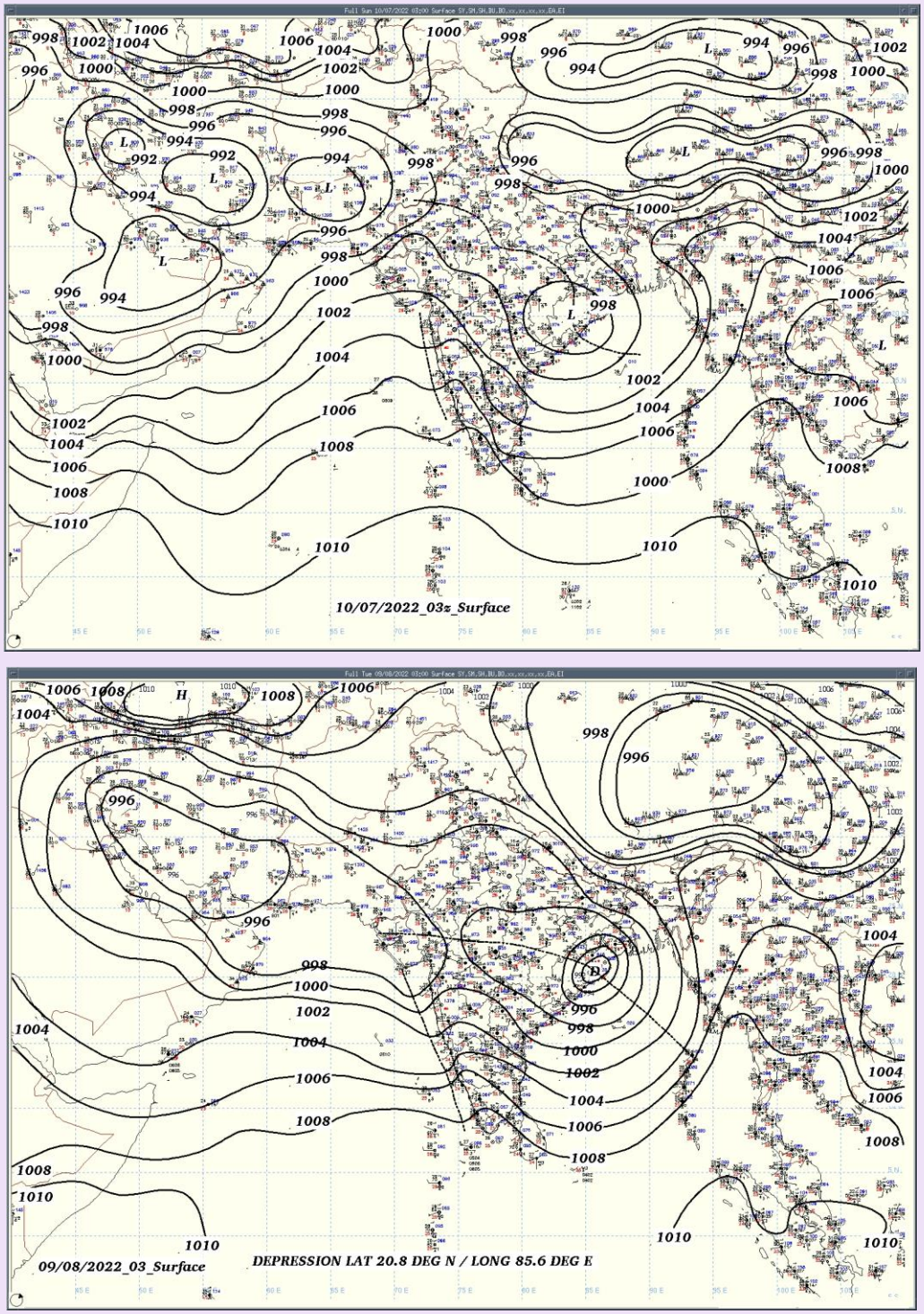

Fig.2(i)a: Surface isobaric analysis as on 0830 IST of 10 July & 09 August 2022

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There were 70 days of *heavy rainfall* activity including 34 days of *isolated very heavy rain* with 07 days of *isolated extremely heavy* rain over CK; 70 days of *isolated heavy rainfall* events including 36 days of *isolated very heavy* rain with 06 days of *isolated extremely heavy* rain over SIK; and 56 days of *isolated heavy rainfall* activity including 24 days of *isolated very heavy* rain with 01 day of *isolated extremely heavy* rainfall over KER during the season. NIK reported *isolated heavy* rainfall events on 48 days including *isolated very heavy* rainfall on 06 days during the season. *Extremely heavy* rainfall (≥21 cm/day) occurred on 07 days over CK (July: 5th- (Castle Rock (Uttara Kannada (UK) district): 26 cm), 06th- (Castle Rock (UK district): 25 cm), 07th- (Kollur (Udupi district): 21 cm), 08th- (Shirali: 23 cm, Karwar: 21 cm & Honavar: 21 cm (all 3 stations in UK district), Mulki (Dakshin Kannada (DK) district: 22 cm), 10th- (Subramanya (DK district): 21 cm) & 17th- (Castle Rock (UK district): 23 cm) and Aug: 02nd - (Shirali PTO (UK district): 29 cm & Subramanya (DK district): 22 cm); on 06 days over SIK (July: 07th- Hosanagar (Shivamogga district): 31 cm, 10th- Hosanagar (Shivamogga district): **47 cm** & 15th- Kottigehara (Chikkamagaluru district): 24 cm); Aug: 06th- Kottigehara (Chikkamagaluru district): 21 cm, 11th- Kottigehara (Chikkamagaluru district): 24 cm & 29th- Bhagamandala (Kodagu district): 21 cm; and over KER, on 02nd August- Enamakkal: 23 cm, Kodungallur: 21 cm & Chalakudy: 21 cm (all 3 stations in Thrissur district).

Fig.2(i)b depicts the cloudiness associated with active off shore trough off Karnataka-Kerala coasts during July 04th-10th & east-west shear zone across southern peninsular India extending from lower to upper tropospheric levels on 02nd August 2022

Rainfall distribution and intensity as on 24-hr ending 0830 IST of 06th & 08th July over Karnataka and on 10th & 14th July and 02nd August 2022 over Kerala and Karnataka (CK, NIK & SIK) are presented in Fig.2(i)c.

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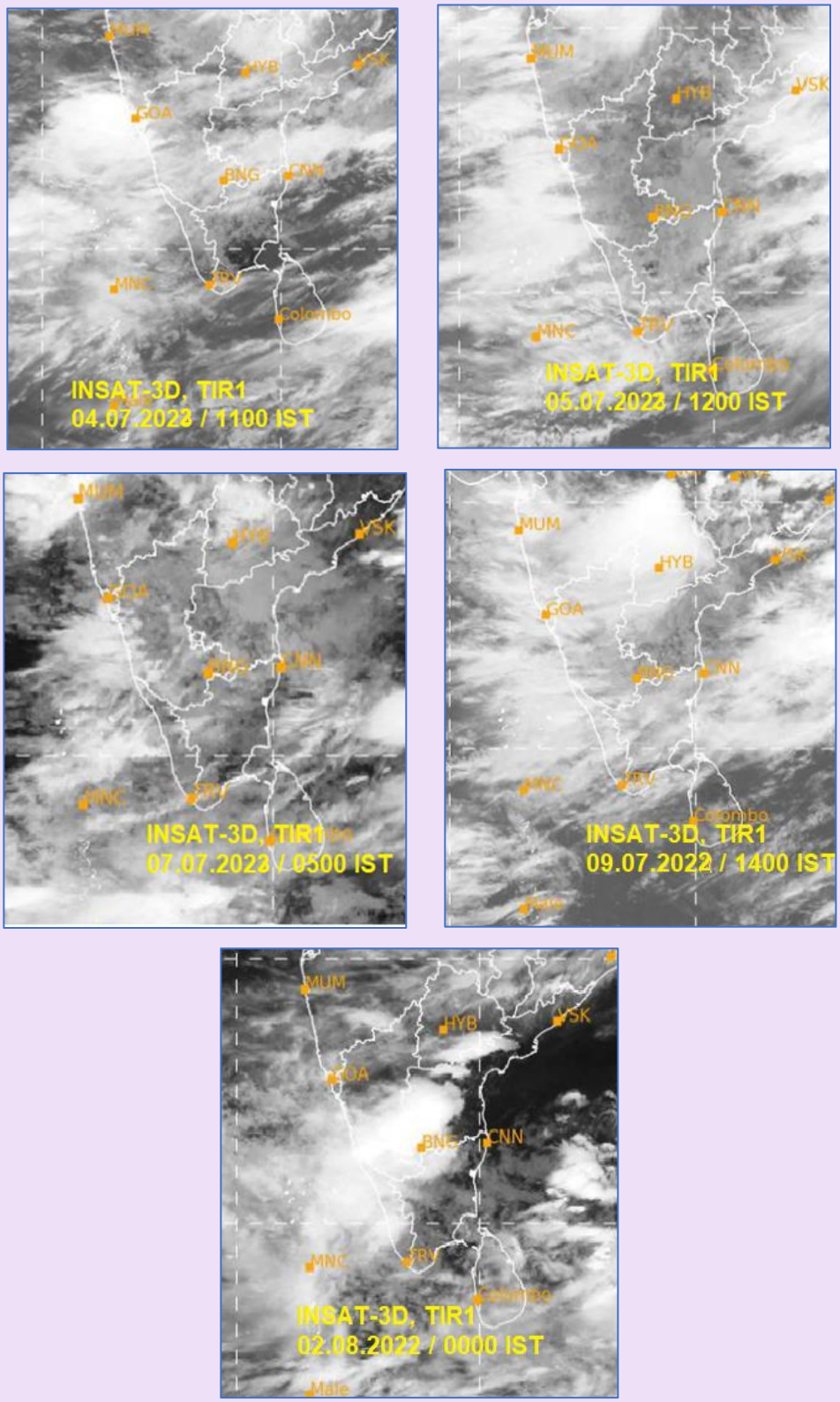

Fig. 2(i)b: INSAT-3D, infra-red imageries as on 04/1100 IST, 05.1200 IST, 07/1500 IST, 09/1400 IST of July & 02/0000 IST of August 2022

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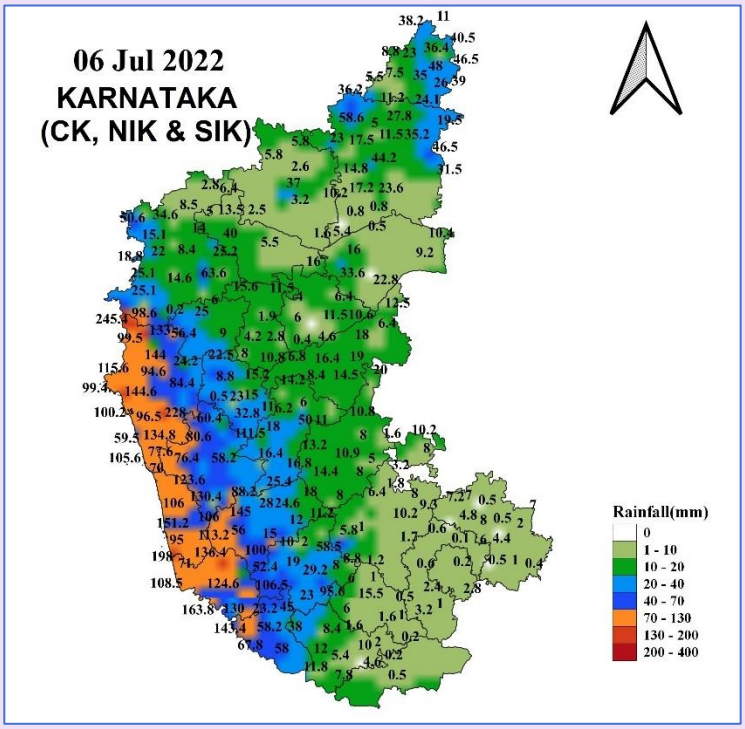

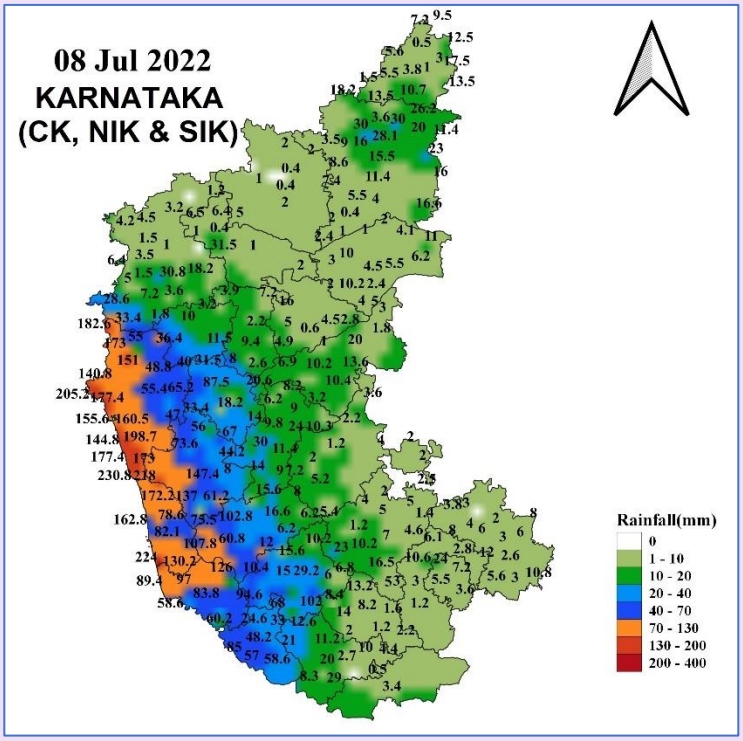

Fig.2(i)c: 24-hr accumulated rainfall ending 0830 IST of 06th, 08th 10th & 14th July & 02nd August 2022 over Kerala & Karnataka

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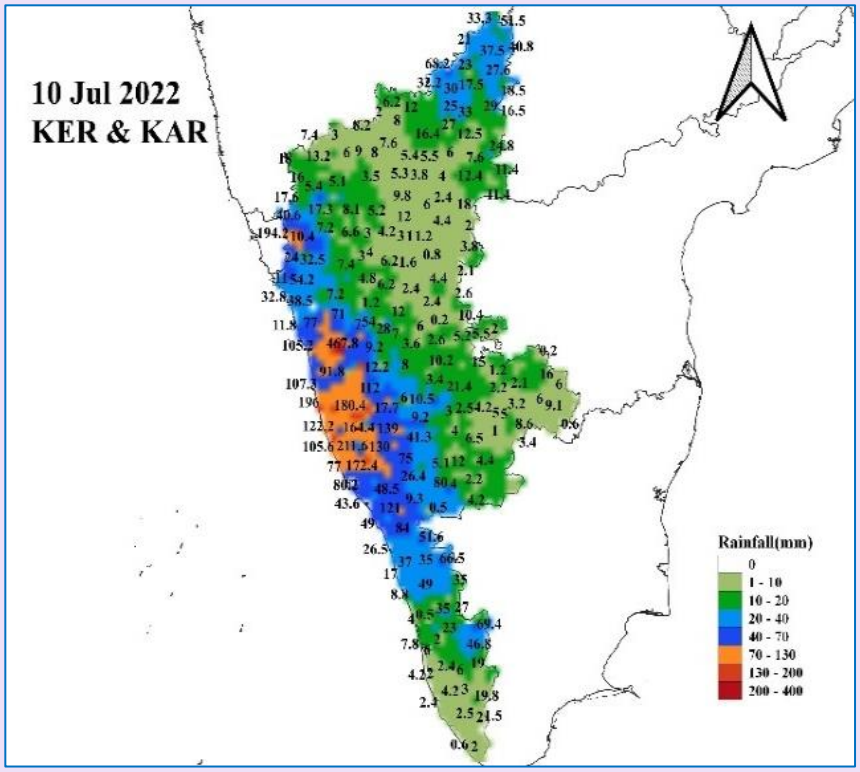

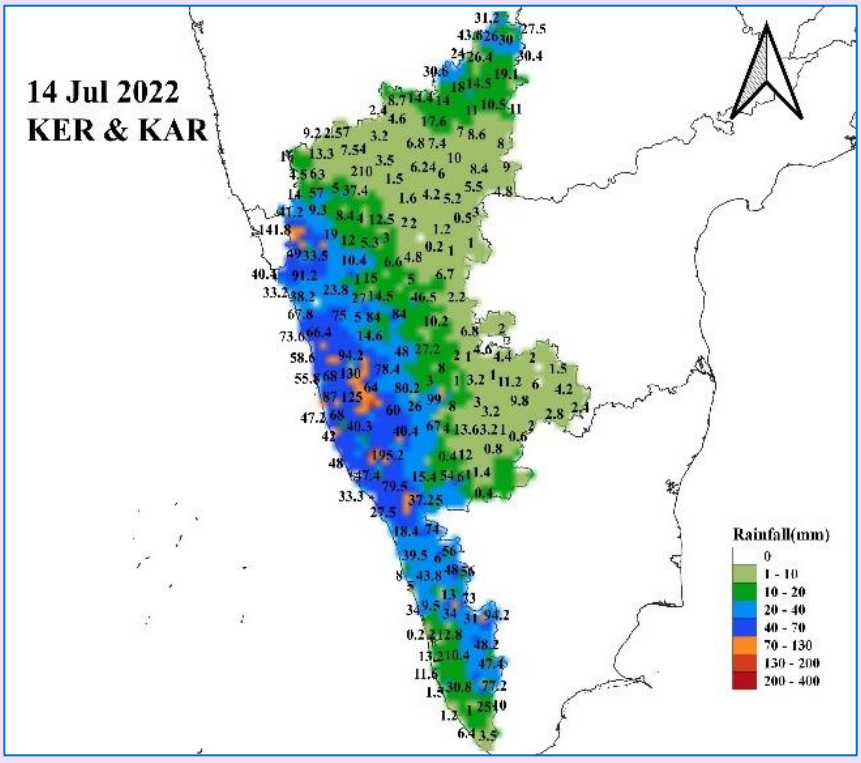

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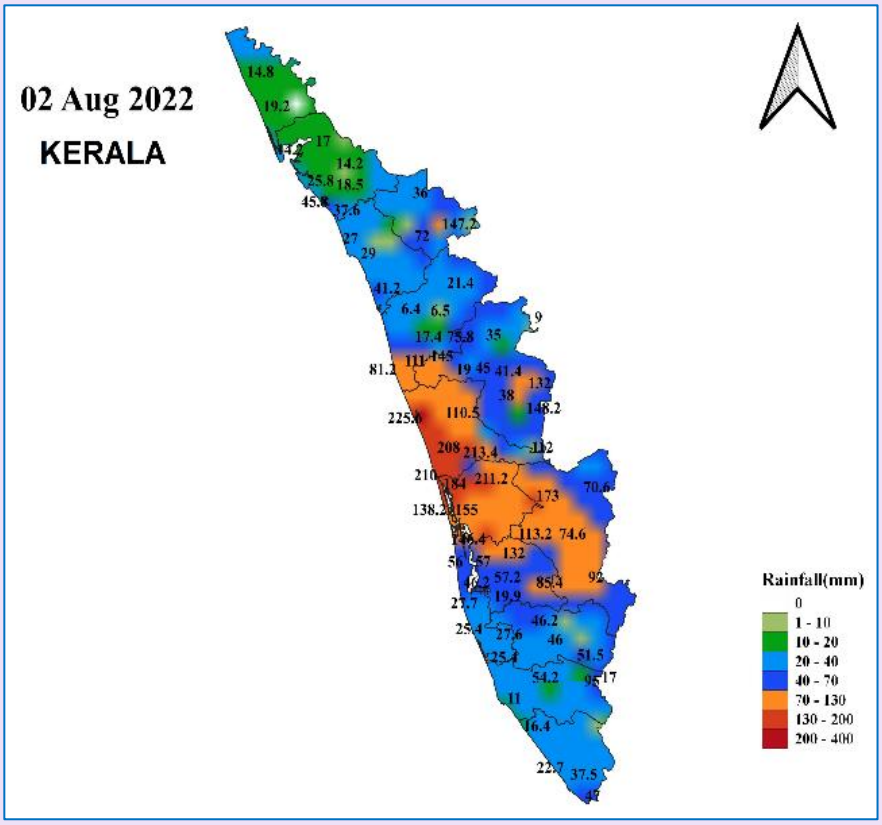


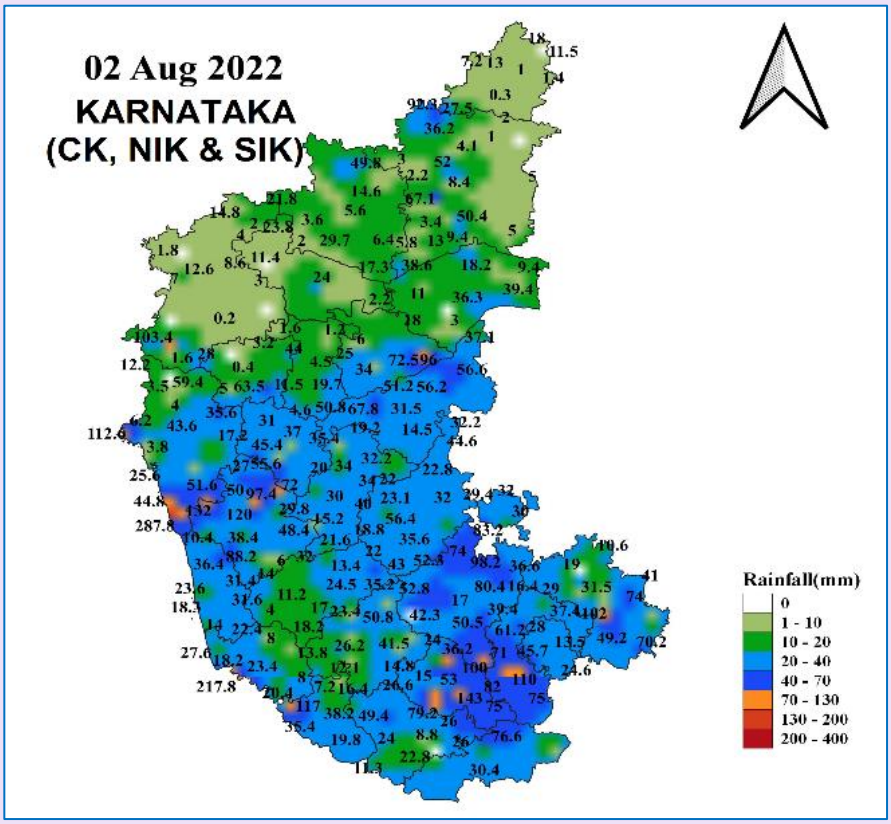


Fig.2(i)c: contd.

Kindly refer Appendix-(i)-(iv) in pages 77-78 for description of technical terms

(ii) Under the influence of the low pressure area (LOPAR) over north Odisha & neighbourhood with associated cyclonic circulation extending upto upper tropospheric levels tilting southwestwards with height during 04th-05th July and its remnant, *fairly widespread* to *widespread* rainfall occurred over TEL and *scattered* to *widespread* rainfall over CAP on all the days during 02nd-08th July. *Isolated heavy* to *very heavy* rain occurred mainly over the northern districts of TEL on all the days during 02nd-08th and *isolated heavy* rain occurred mainly over the northern districts of CAP on all days except 03rd July during this period. In TEL, *vigorous* monsoon conditions prevailed on 04th and *active* monsoon conditions on all the other days during 03rd-08th July. *Active* monsoon conditions prevailed over CAP on 04th, 06th & 08th July 2022. In TEL, rainfall amount of 16 cm/day was recorded at Kalwakurthy in Nagarkurnool district in TEL on 06th July. Fig.2(ii)a presents the surface isobaric analysis as on 05th/0830 IST and upper air streamline analysis as on 05th/0530 IST and Fig.2(ii)b presents the satellite imageries depicting the cloudiness as on 06/0430 IST & 08/0530 IST of July 2022. Fig.2(ii)c depicts the 24-hr rainfall distribution over CAP & TEL as on 0830 IST of 06th & 08th July 2022.

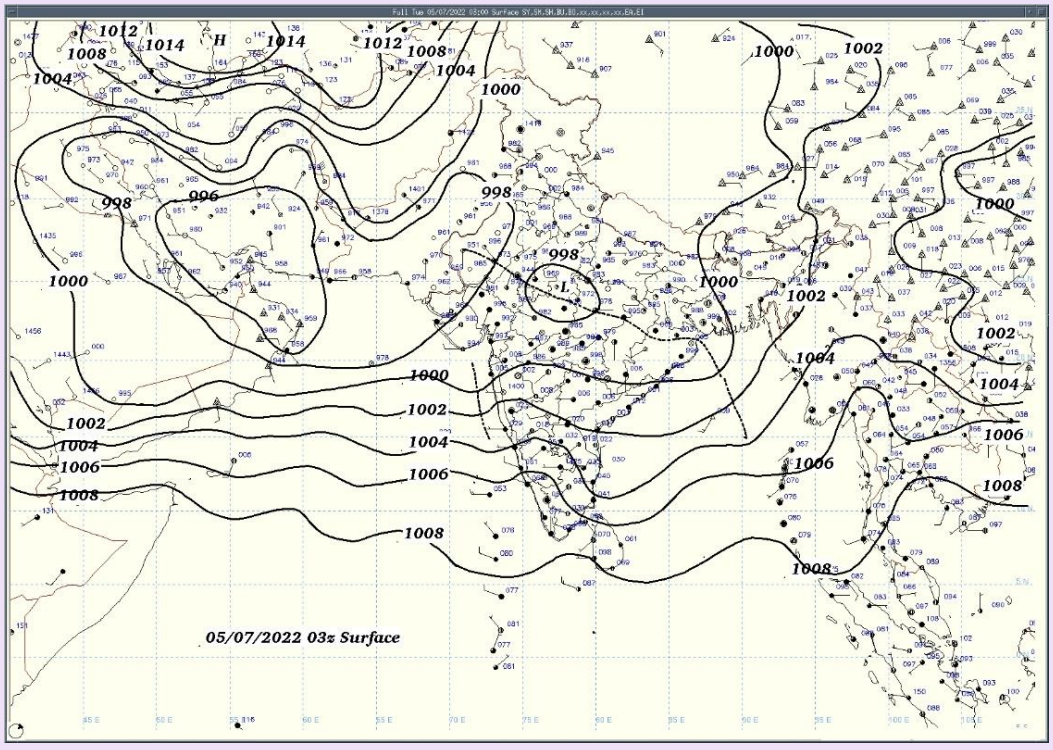


Fig.2(ii)a: Surface isobaric analysis as on 0830 IST and upper air streamline analysis as on 0530 IST of 05th July 2022

Kindly refer Appendix-(i)-(iv) in pages 77-78 for description of technical terms

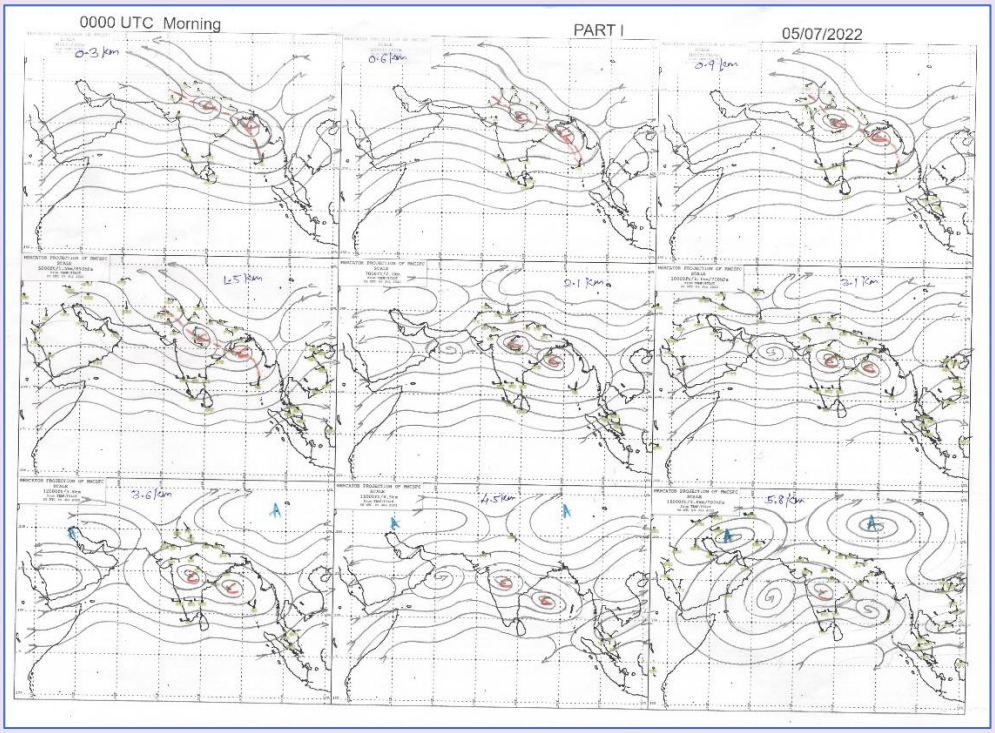


Fig.2(ii)a: contd.

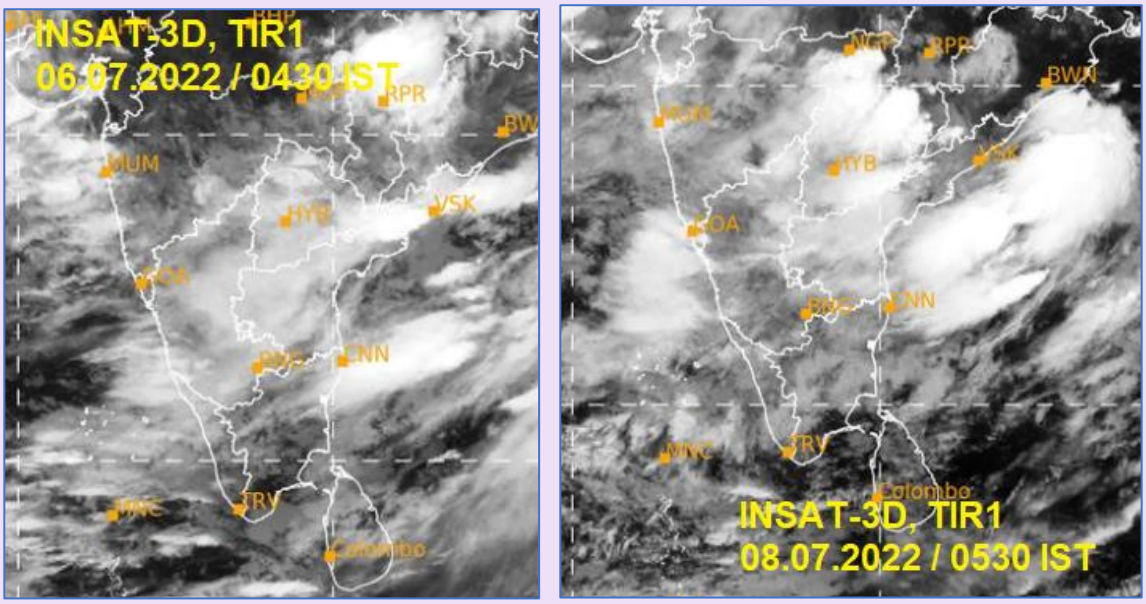


Fig.2(ii)b: INSAT-3D infra-red imageries as on 06/0430 IST & 08/0530 IST of July 2022

Kindly refer Appendix-(i)-(iv) in pages 77-78 for description of technical terms

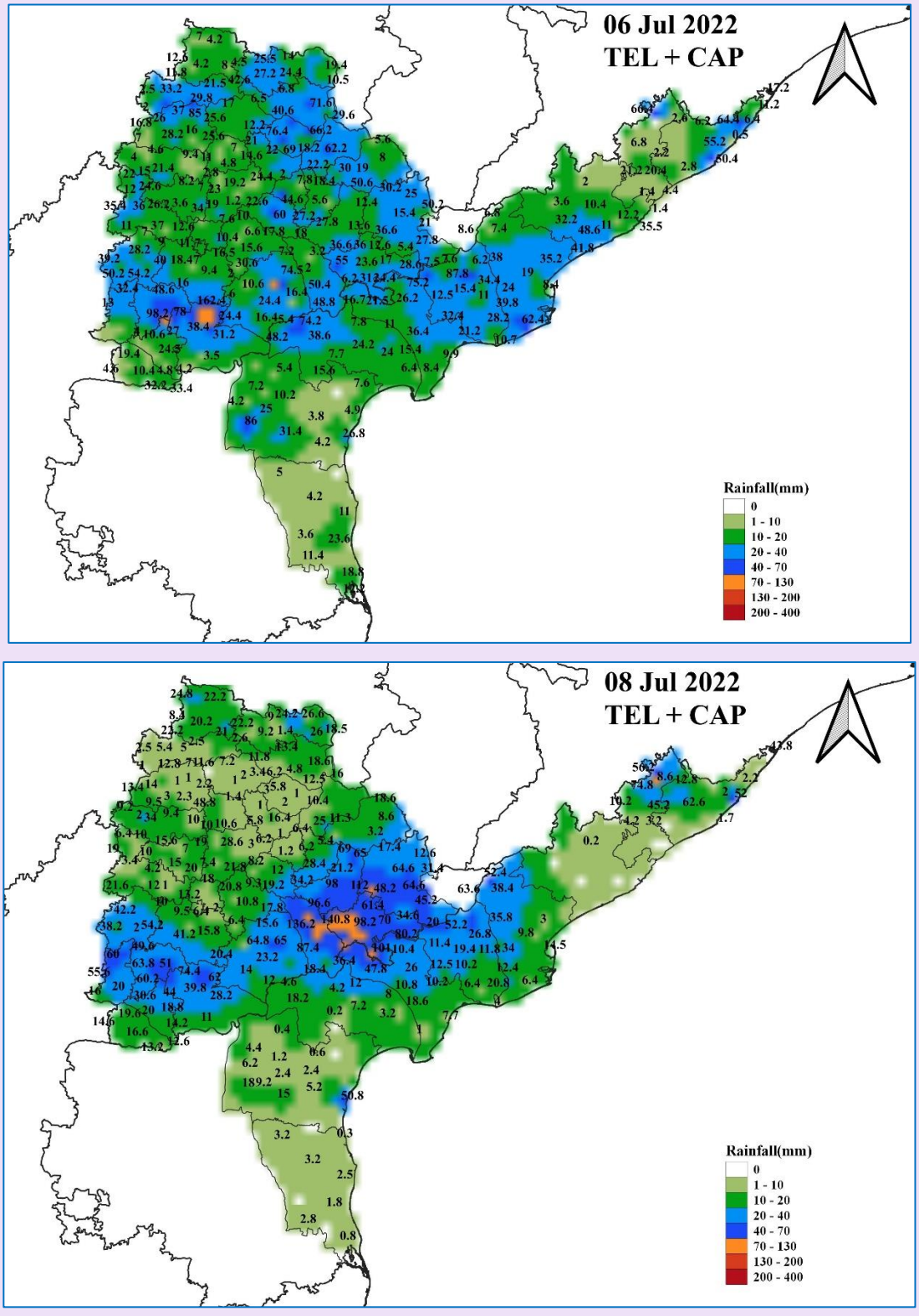


Fig.2(ii)c: 24-hr accumulated rainfall ending 0830 IST of 06th & 08th July over TEL & CAP

Kindly refer Appendix-(i)-(iv) in pages 77-78 for description of technical terms

(iii) Under the influence of a LOPAR - well marked LOPAR (WML) off Odisha coast and neighbourhood with associated upper air cyclonic circulation extending upto upper tropospheric levels tilting southwest-wards with height during 09th to 16th July, its westward movement during 17th-19th *fairly widespread – widespread* rainfall occurred over TEL on all days during 09th-19th excepting 16th and *scattered – widespread* rainfall occurred over CAP during the same period.

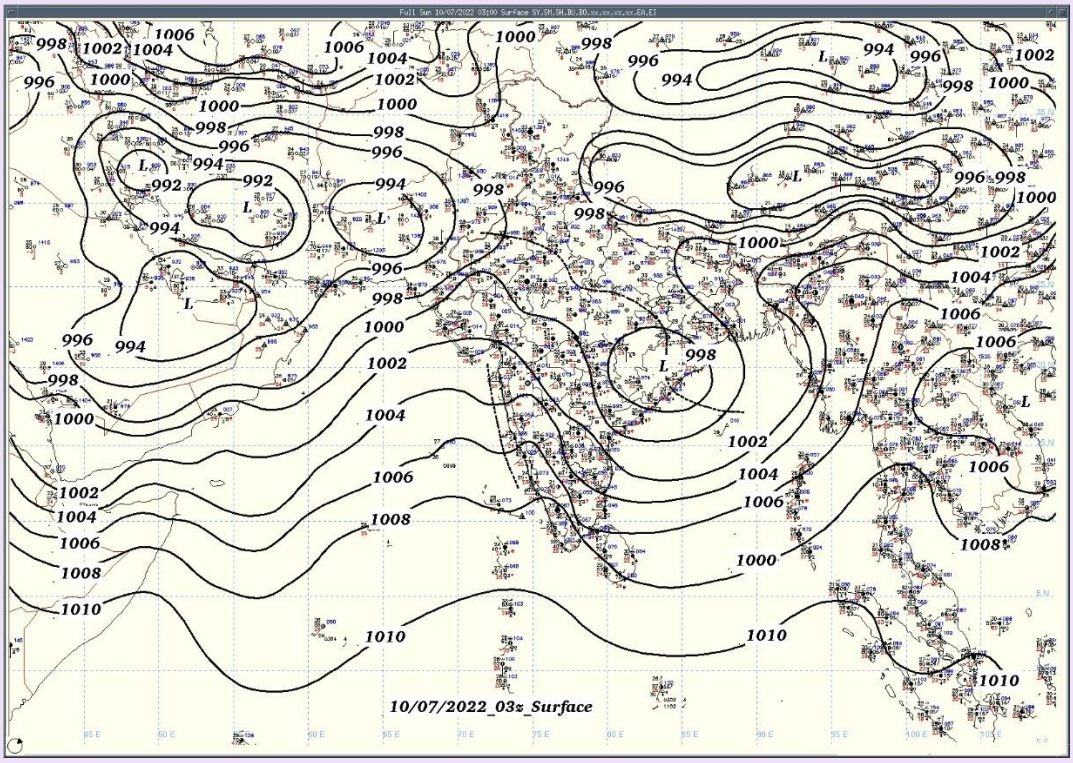
Heavy to very heavy rain occurred at a few places over TEL continuously for six days from 09th to 14th with *isolated extremely heavy* rain on 09th, 10th, 13th & 14th. **Jainoor** (Kumaram Bheem district) in TEL recorded the 39 cm (391.0 mm) amount of rainfall during the 24-hr ending 0830 IST of 13th July. Also, Karameri & Sirpuru, both from Kumaram Bheem district, TEL, recorded 38 cm & 35 cm on the same day. Kaleswaram (J.Bhupalpally district) in TEL recorded 35 cm during the 24-hr ending 0830 IST of 10th July. *Heavy* rain also occurred at isolated places over TEL on 17th & 18th July 2022. Over CAP, *isolated heavy* to *very heavy* rain occurred on 09th &18th with isolated extremely heavy rain on 09th (Merakamudidam, Vizianagaram district: 22 cm). *Isolated heavy* rain also occurred on during 10th-12th July 2022. In TEL, *vigorous* monsoon conditions prevailed on 09th-11th, 13th & 14th and *active* monsoon conditions on 12th, 17th & 18th; and in CAP, *vigorous* monsoon conditions prevailed on 09th and *active* monsoon conditions on 10th, 12th & 18th July 2022.

Subsequently, under the influence of east-west shear zone across the northern parts of peninsular India (about 20°N), fairly widespread to widespread rainfall activity continued over TEL during 21st-25th and scattered to widespread rainfall occurred over CAP during the same period. *Heavy* to *very heavy* rain at *a few* places with *extremely heavy* rain at isolated places occurred over TEL on 23rd; *isolated heavy* rain also occurred over TEL on 21st and over CAP during 21st-23rd July 2022.

Fig.2(iii)a presents the surface isobaric analysis as on 0830 IST of 10th & 18th July 2022 and Fig.2(iii)b presents the upper air streamline analysis as on 0530 IST of 18th July 2022. Fig.2(iii)c presents satellite imageries depicting cloudiness associated with the synoptic situation. Fig.2(iii)d depicts the 24-hr accumulated rainfall over CAP as on 0830 IST of 09th July and Fig.2(iii)e depicts the 24-hr accumulated rainfall over TEL as on 0830 IST of 10th, 13th, 14th & 23rd July 2022.

Associated with recurrent heavy to extremely heavy rainfall events, inland flooding was reported in various parts of TEL. Sample media reports are presented in Fig.2(iii)f.

Kindly refer Appendix-(i)-(iv) in pages 77-78 for description of technical terms



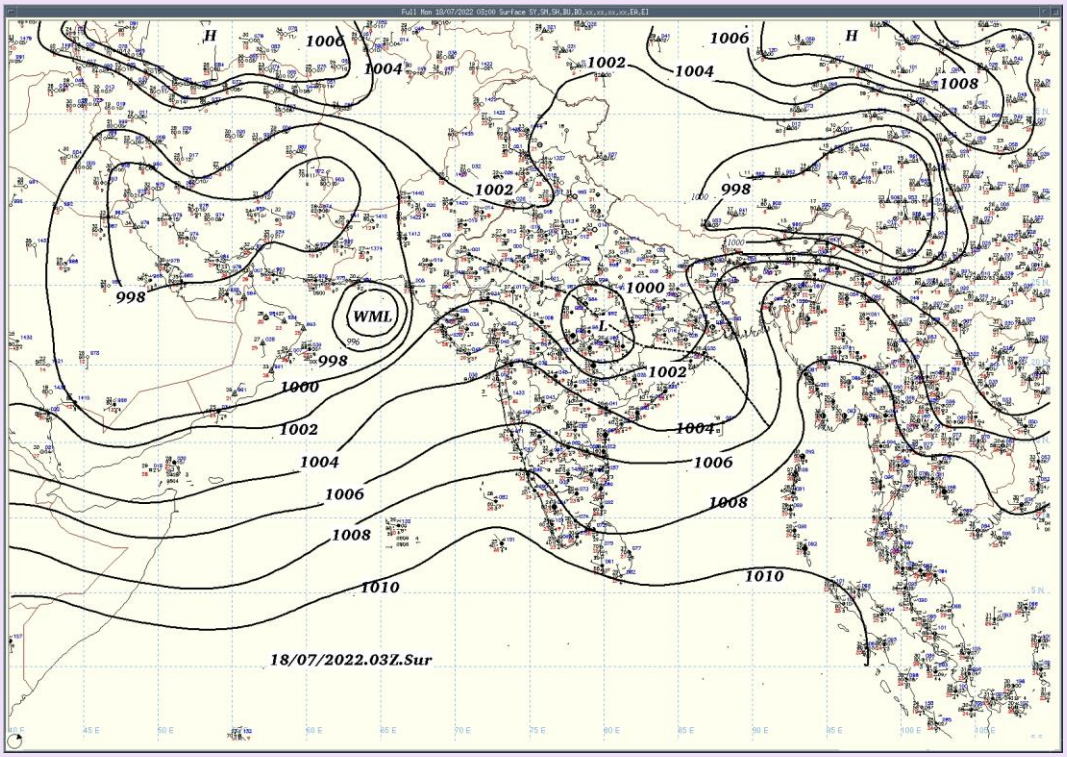


Fig.2(iii)a: Surface isobaric analysis as on 0830 IST of 10th & 18th July 2022

Kindly refer Appendix-(i)-(iv) in pages 77-78 for description of technical terms

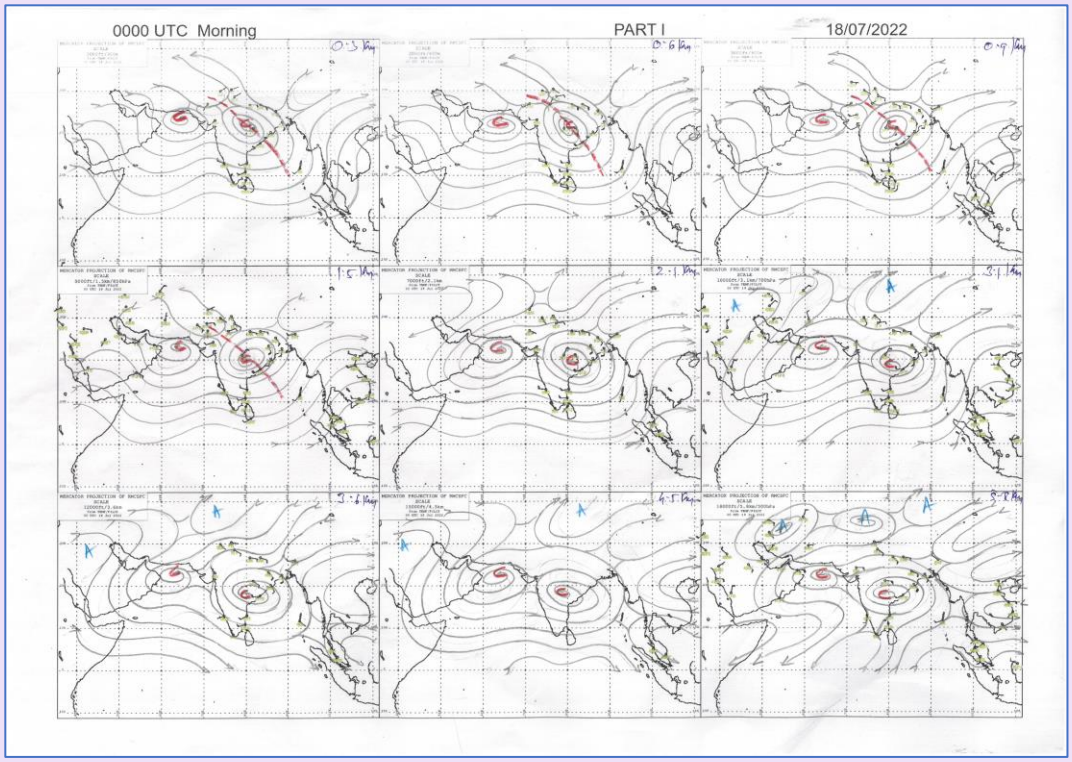


Fig.2(iii)b: Upper air streamline analysis as on 0530 IST of 18th July 2022

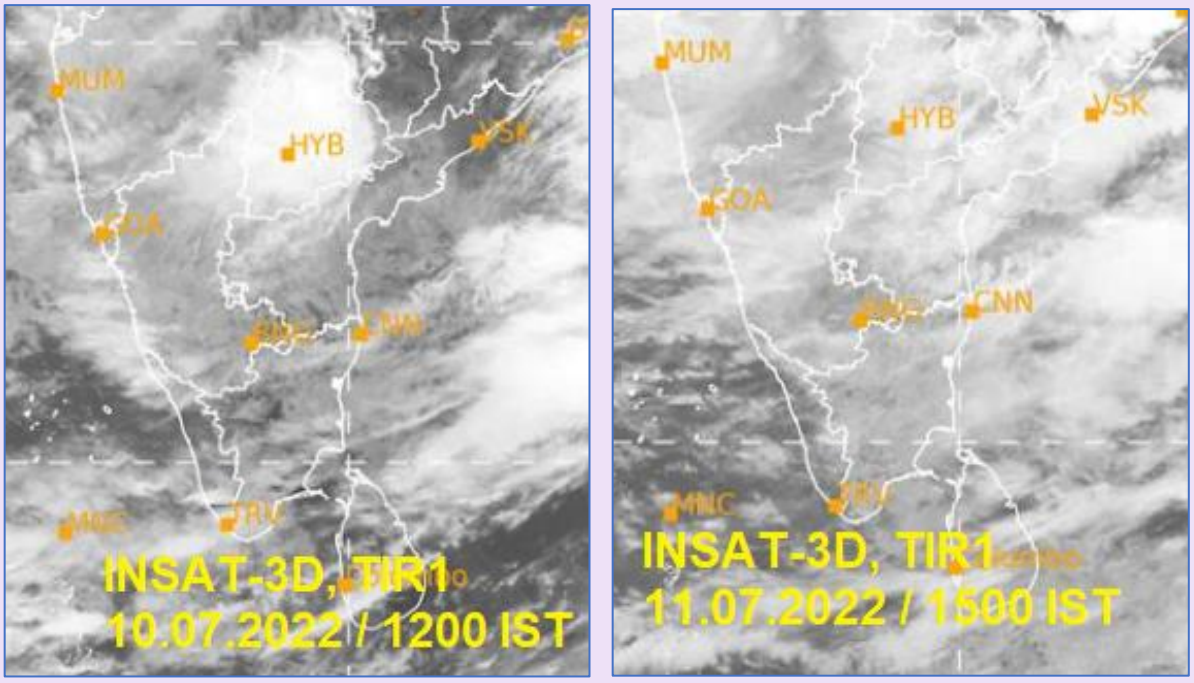


Fig.2(iii)c: INSAT-3D infra-red imageries as on 10/1200 IST, 11/1500 IST, 12/1400 IST, 17/1500 IST, 18/0500 IST & 23/1200 IST of July 2022

Kindly refer Appendix-(i)-(iv) in pages 77-78 for description of technical terms

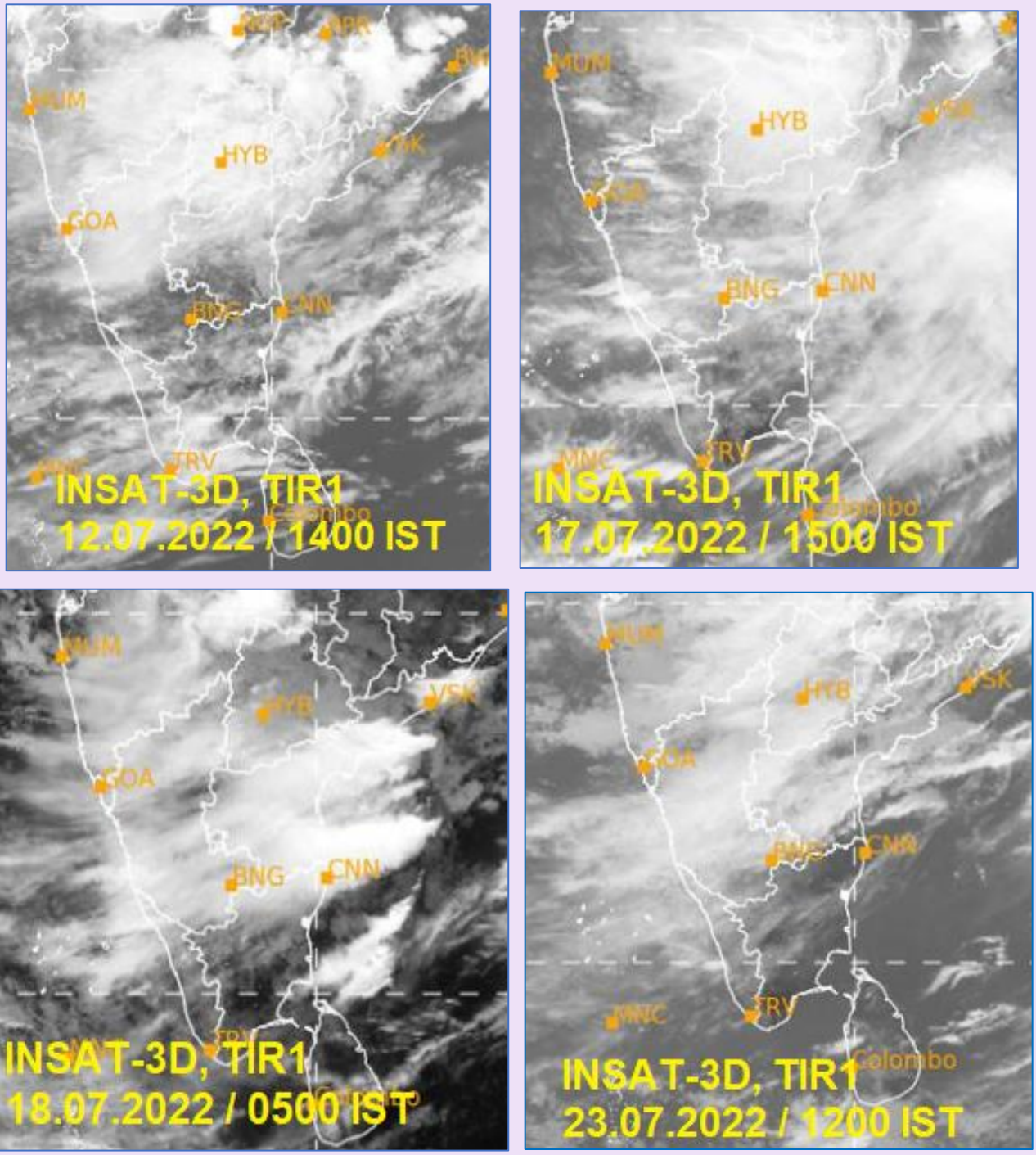


Fig.2(iii)c: contd.

Kindly refer Appendix-(i)-(iv) in pages 77-78 for description of technical terms

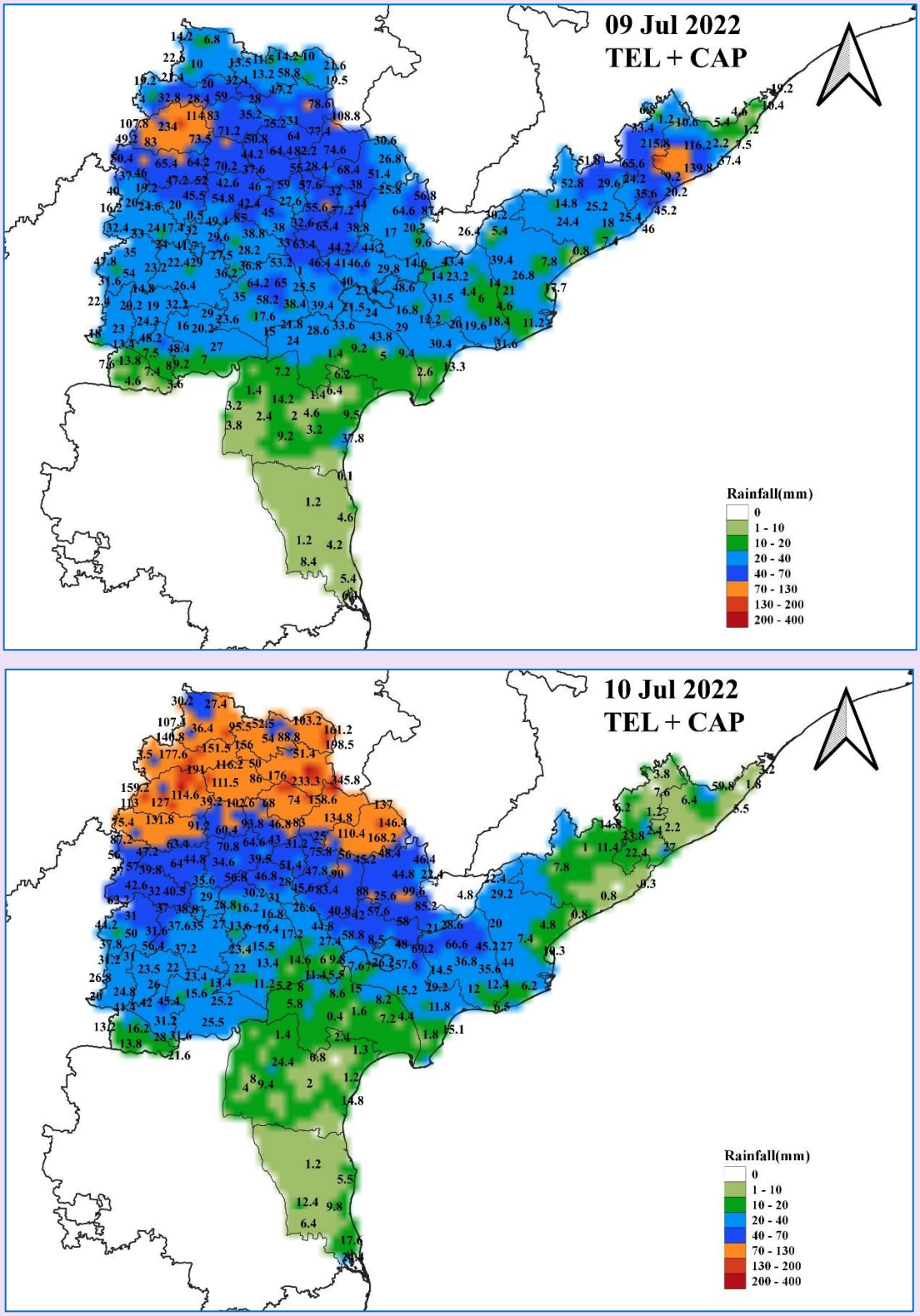


Fig.2(iii)d: 24-hr accumulated rainfall as on 0830 IST of 09th & 10th July over CAP & TEL

Kindly refer Appendix-(i)-(iv) in pages 77-78 for description of technical terms

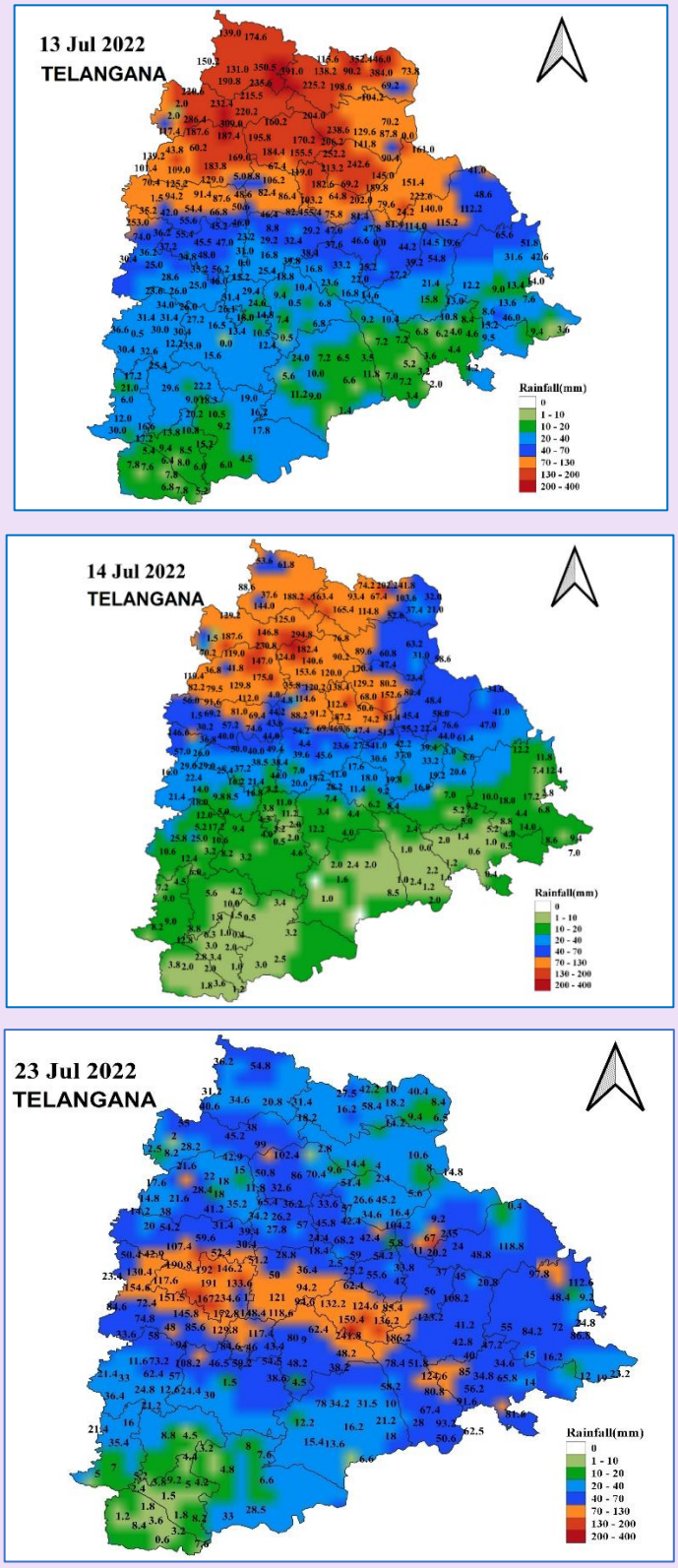


Fig.2(iii)e: 24-hr accumulated rainfall over TEL as on 0830 IST of 13th, 14th & 23rd July 2022

Kindly refer Appendix-(i)-(iv) in pages 77-78 for description of technical terms

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THE TIMES OF INDIA

Extreme rainfall in July in multiple Telangana districts

TNN | Jul 29, 2022, 07.29 AM IST

HYDERABAD: At least four districts in Telangana have seen extreme rainfall events this year with either the highest or second highest rainfall recorded in the span of 24 hours. An analysis of district-wise data available with the Telangana State Development Planning Society (TSDPS) since 2012, shows that five districts - Adilabad, Asifabad, Nirmal, Nizamabad and Bhupalpally - saw one of the rainiest days in July this year.

One of the reasons for clustering of major rainfall events especially in the northern region of state, experts say, is the existence of various irrigation projects here. "The region has undergone a lot of changes in the last few years with various irrigation projects coming up, which would also mean a lot of evaporation of surface water from here and possible formation of rain clouds," said D Narasimha Reddy, environmentalist.

Though Hyderabad and its adjoining districts have not reported any extreme events in 2022, an analysis ascertains a trend of heavier rainfall spells - in the range of 15cm to 24cm - over the last five years. Of the five highest spells in city, three were registered in the last decade - July 2012, October 2020 and September 2016.

Printed from
THE TIMES OF INDIA

Rain returns, pounds districts; Hyderabad drenched

TNN | Jul 23, 2022, 04.41 AM IST

HYDERABAD: After a brief lull, monsoon returned to the city with a vengeance on Friday with several areas receiving heavy rainfall - of over 10 cm -- till 10 pm. Among the localities that recorded maximum rain were Hafeezpet (11.1 cm), Jeedimetla (10.8 cm), Gajularamaram (10.8 cm), even as multiple areas received between 8 cm and 9 cm of rainfall.

The downpour was much more intense in the districts prompting the Indian Meteorological Department (IMD) to sound a yellow alert in the state up to July 26. IMD attributed the Friday's heavy rain to cyclonic circulation over north Odisha and its neighbourhood.

Danthapalle in Mahabubabad district received extremely heavy rainfall of over 21 cm, while Devaruppula in Jangaon recorded 20.5 cm. Many parts of Bhadradri Kothagudem, which is yet to recover from the recent rain mayhem, Suryapet, Yadadri Bhuvanagiri, Khammam among others recorded very heavy rainfall between 12 cm and 17 cm.

In the city, apart from causing severe traffic snarls on several stretches, the incessant rain also led to flooding of roads in multiple areas, including the hi-tech belt. Residents took to social media to highlight how water had gushed into local markets, places of worship and residences.

Fig.2(iii)f: Sample media reports on recurrent heavy rainfall events over TEL in July 2022

Kindly refer Appendix-(i)-(iv) in pages 77-78 for description of technical terms

(iv) Under the influence of a cyclonic circulation off the east coast India and east-west shear zone over the southern peninsula in the lower-mid tropospheric levels which gradually moved northwards during 01st-06th August 2022 prior to the formation of a low pressure area over northwest BOB off Odisha-West Bengal coasts on 6th/1730 IST that concentrated into Depression on 9th/0830 IST over coastal Odisha and neighbourhood, enhanced rainfall activity was observed over the southern peninsula during the period 01st – 10th August 2022.

Fairly widespread rainfall occurred on most of the days over TN during 01st-05th August; *fairly widespread* to *widespread* rainfall occurred on most of the days over RYS during 01st-07th, over CAP & TEL during 03rd-10th and over KER, LAK, CK, NIK & SIK during 01st-09th August 2022. On 05th August, all the nine sub divisions in the SP region reported *fairly widespread* to *widespread* rainfall.

Isolated heavy to *very heavy* rain occurred over TN & SIK on all the days during 01st-10th August excepting 03rd & 07th over TN and 01st & 10th over SIK (when *isolated heavy* rain was reported) with *extremely heavy* falls at one or two places on 01st (Usilampatti (Madurai district): 23 cm), 06th (**Avalanche (**Nilgiris district**): 32 cm**) & 09th (Upper Bavani (Nilgiris district): 22 cm) over TN and on 06th (Kottigehara (Chikkamagaluru district): 22 cm) over SIK; over RYS *Isolated heavy* to *very heavy* rain occurred during 01st-03rd and *isolated heavy* rain on 04th & 05th August. *Isolated heavy / heavy* to *very heavy* rain occurred over KER on all the days and over CK on 02nd, 03rd, 5th-10th August with *extremely heavy* falls over both KER & CK on 02nd August [as detailed under section 2(i)]. *Isolated heavy* rain occurred over NIK on 02nd, 4th, 05th, 09th & 10th with *very heavy* rain at one or two places on 05th August. *Isolated heavy* rain occurred over TEL on all days during 03rd-09th August and over CAP, on all days during 03rd-08th August excepting the 06th August. *Very heavy* to *extremely heavy* rain occurred at one or two places over TEL on 05th August (**Pargi** (Vikarabad district): **22 cm**); and *isolated heavy* to *very heavy* rain occurred over both CAP & TEL on 03rd August.

Active to *Vigorous* monsoon conditions prevailed over RYS on all the days and over TN on most of the days during 01st-05th August; over SIK on all the days & over NIK on many days during 01st-09th August. *Active* monsoon conditions prevailed over KER during 02nd-07th; over CK on 06th & 07th; over CAP on 03rd, 06th & 08th and over TEL on 03rd, 05th, 07th & 08th August 2022.

Fig.2(iv)a presents IMD-GFS analysis of lower tropospheric winds over the Indian region as on 0530 IST of 04th & 09th August 2022 depicting the cyclonic circulation over the Westcentral and adjoining parts of BOB and strengthening of winds over the southern peninsular region.

Kindly refer Appendix-(i)-(iv) in pages 77-78 for description of technical terms

Fig.2(iv)b presents satellite imageries depicting cloudiness associated with the synoptic situations during 03rd-10th August 2022. Fig.2(iv)c depicts the 24-hr accumulated rainfall over the SP region as on 0830 IST of 03rd, 05th & 08th August 2022.

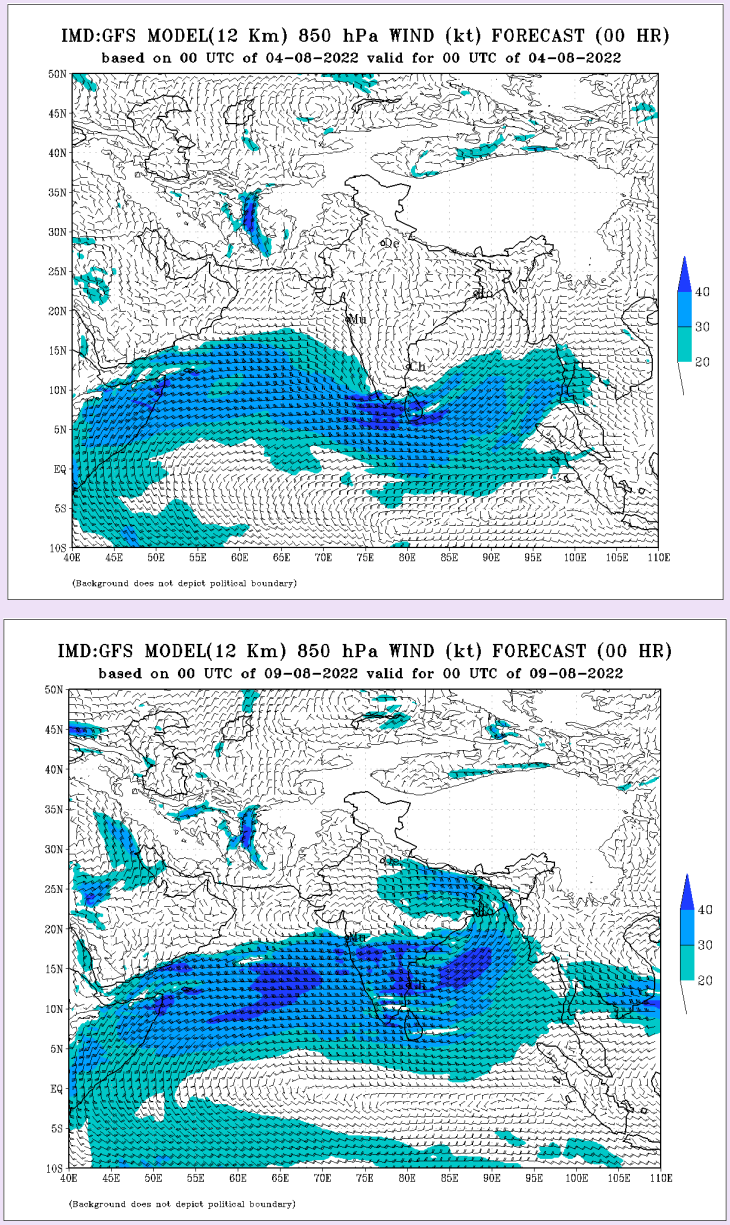


Fig.2(iv)a: IMD-GFS analysis of 850 hPa winds as on 0530 IST of 04th & 09th August 2022

Kindly refer Appendix-(i)-(iv) in pages 77-78 for description of technical terms

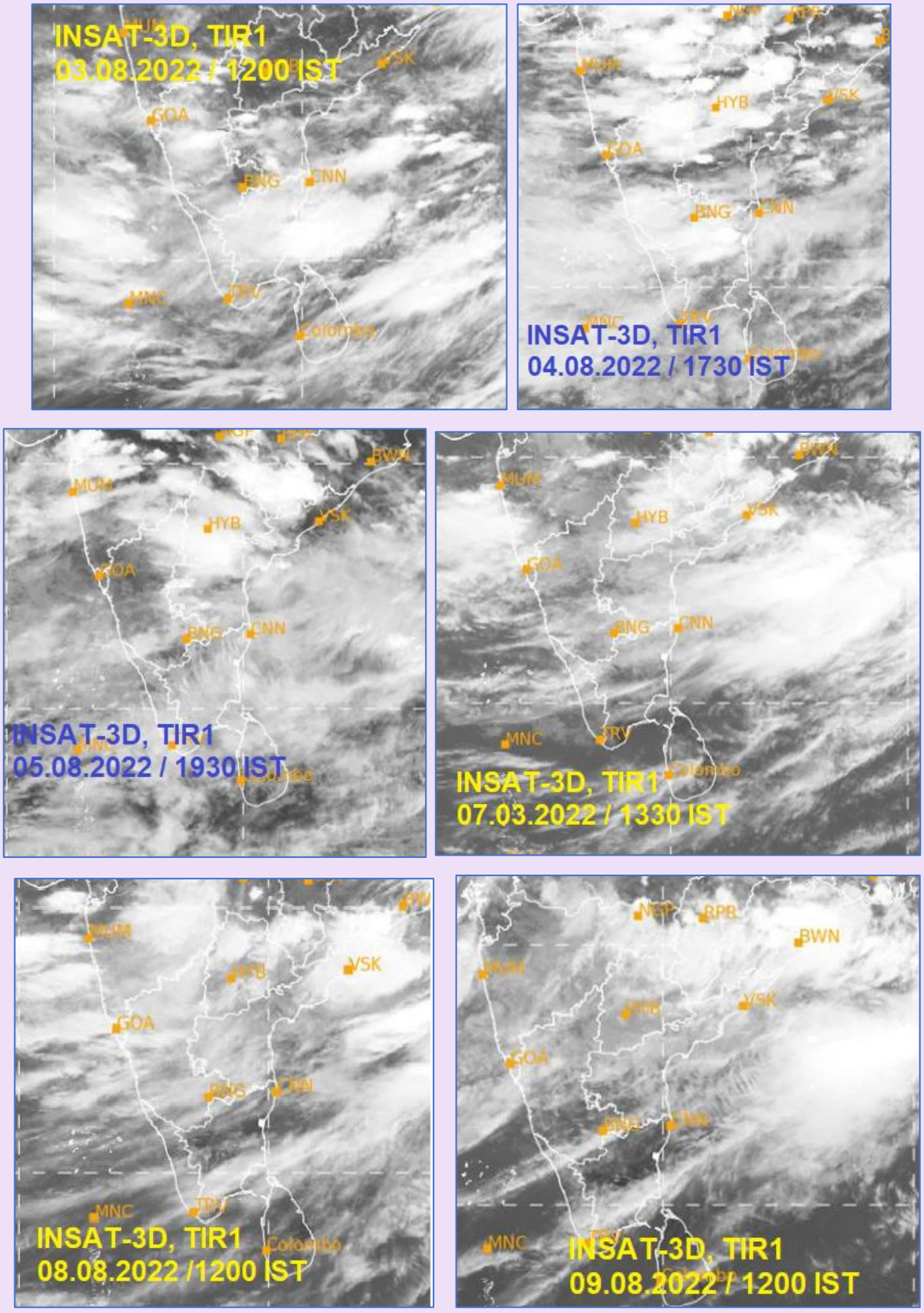
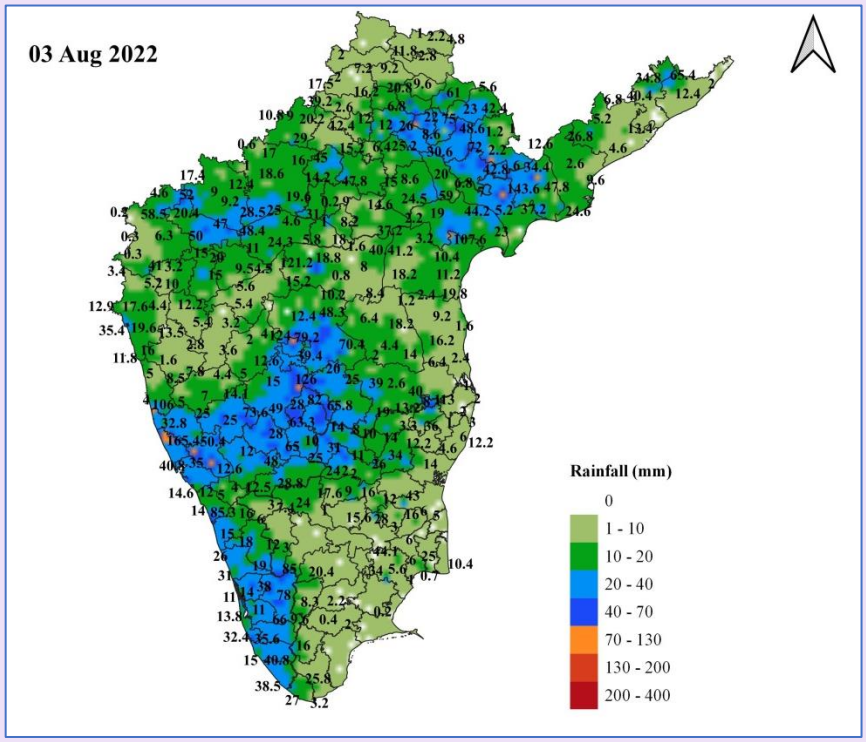


Fig.2(iv)b: INSAT-3D, infra-red imageries as on 03/1200 IST, 04/1730 IST, 05/ 1930 IST, 07/1330 IST, 08/1200 IST & 09/1200 IST of August 2022

Kindly refer Appendix-(i)-(iv) in pages 77-78 for description of technical terms



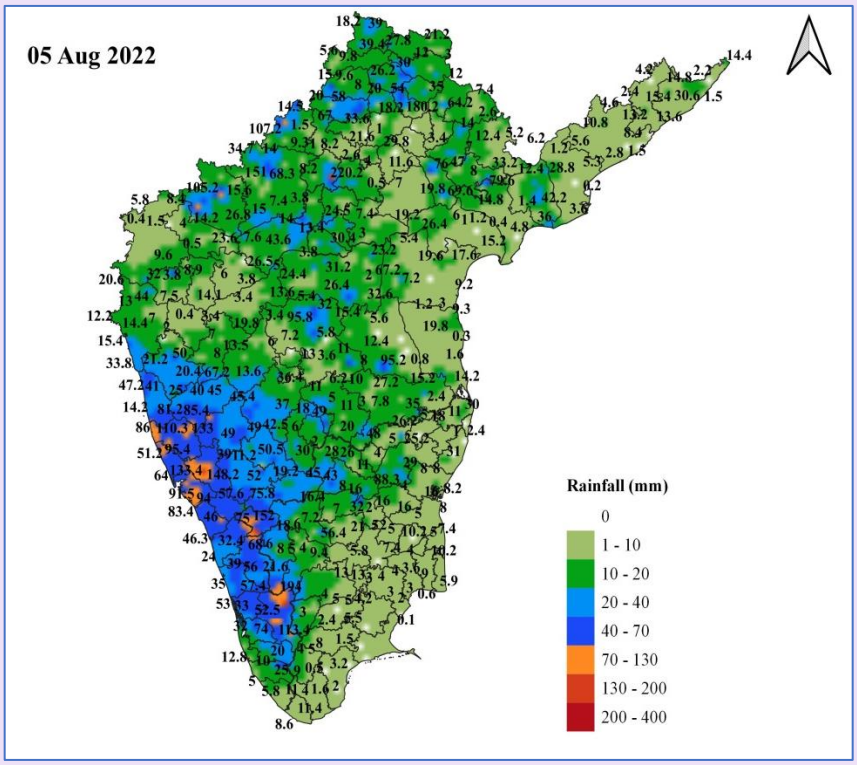


Fig.2(iv)c: 23-hr accumulated rainfall over the southern peninsula as on 0830 IST of 03rd, 05th & 08th August 2022

Kindly refer Appendix-(i)-(iv) in pages 77-78 for description of technical terms

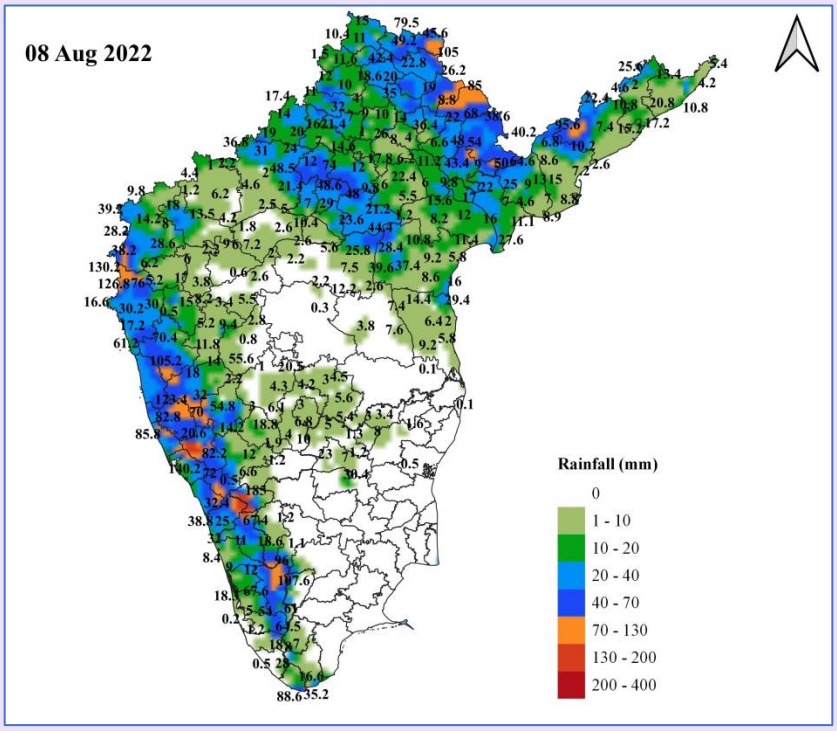


Fig.2(iv)c: contd.

(v) Under the influence of a Depression that formed over northwest BOB on 14th August which crossed West Bengal and north Odisha coasts and moved west-northwestwards during 14th-16th August 2022, *fairly widespread* rainfall to *widespread* rainfall occurred over TEL during 14th-16th and over CAP on 14th & 15th August 2022. *Isolated heavy* rain occurred over TEL on 14th & 15th August. *Active monsoon* conditions prevailed over CAP & TEL on 14thAugust 2022. Surface isobaric analysis and upper air streamline analysis as on 0830 IST & 0530 IST respectively of 14th August 2022 are presented in Fig.2(v)a. Satellite imagery depicting the cloudiness associated with the system is presented in Fig2(v)b. 24-hr accumulated rainfall over AP & TEL as on 0830 IST of 14th August 2022 is depicted in Fig.2(v)c.

Kindly refer Appendix-(i)-(iv) in pages 77-78 for description of technical terms

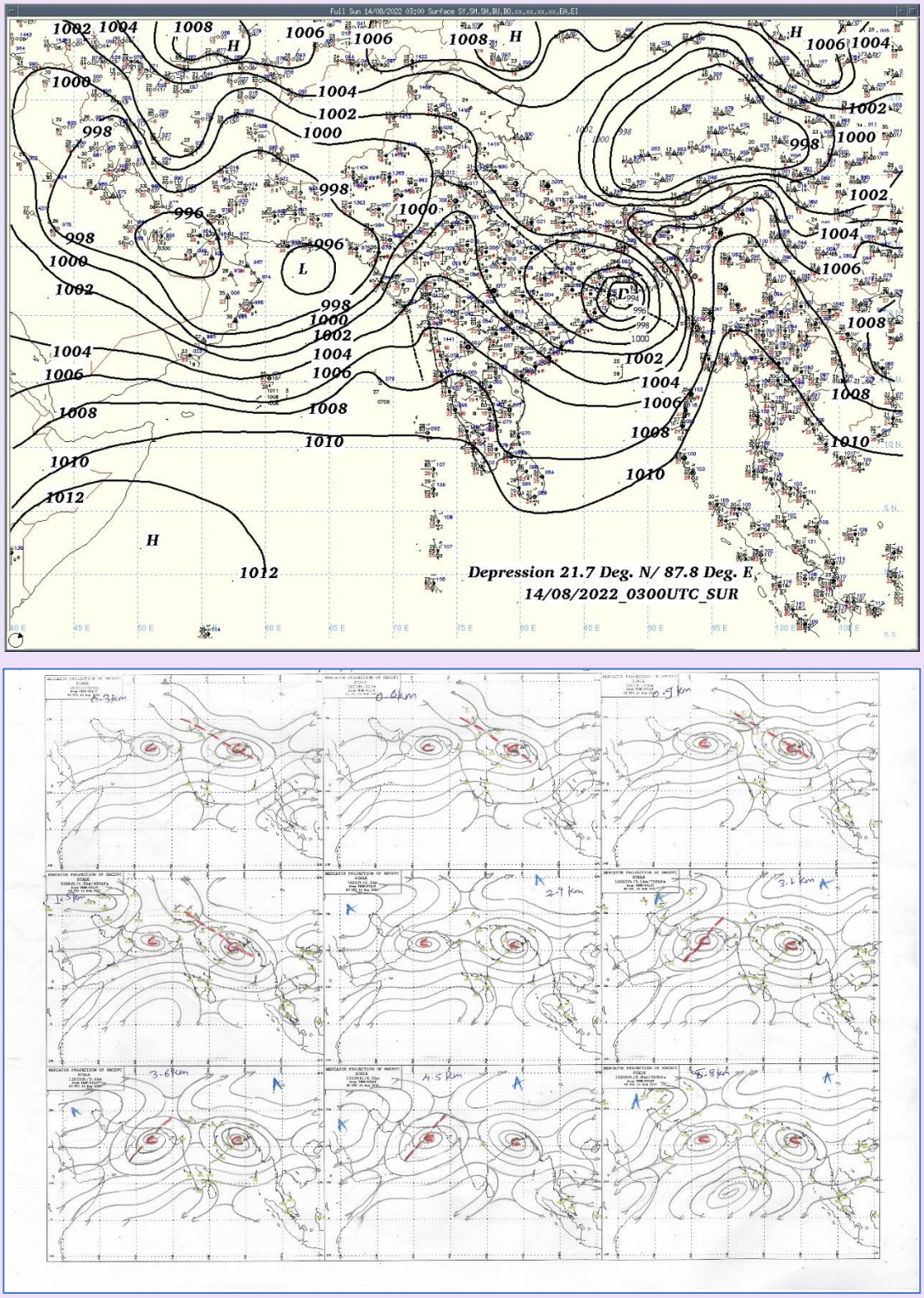


Fig.2(v)a: Surface isobaric analysis as on 0830 IST & upper air streamline analysis as on 0530 IST of 14th August 2022

Kindly refer Appendix-(i)-(iv) in pages 77-78 for description of technical terms

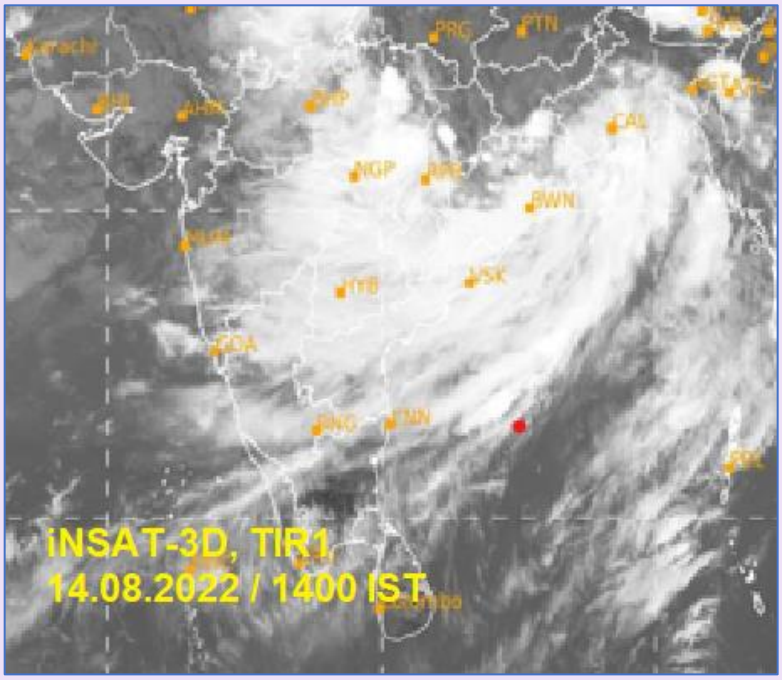


Fig.2(v)b: INSAT-3D, infra-red imagery as on 1400 IST of 14.08.2022

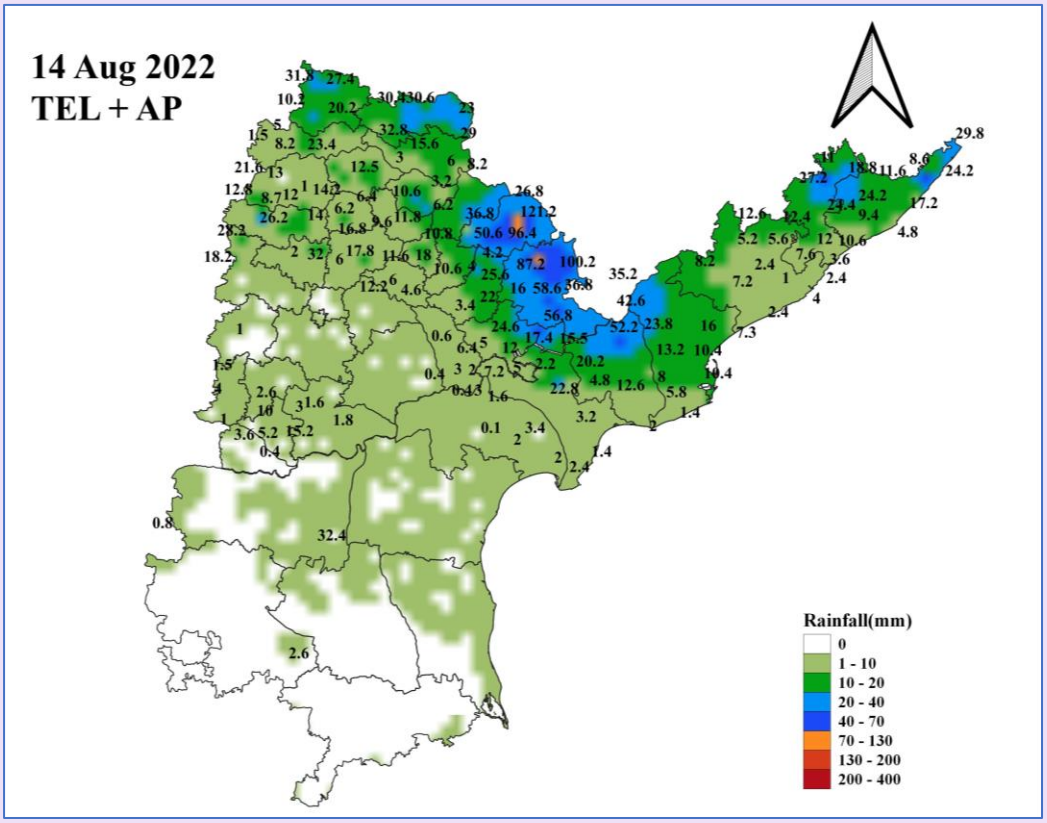


Fig.2(v)c: 24-hr accumulated rainfall over AP & TEL as on 0830 IST of 14.08.2022

Kindly refer Appendix-(i)-(iv) in pages 77-78 for description of technical terms

(vi) Under the influence of a cyclonic circulation over central Bay of Bengal on 07th September, a LOPAR formed over the westcentral & adjoining eastcentral BOB on 08th/0830 IST which became well marked on 09th/0830 IST over the westcentral and adjoining northwest BOB and concentrated into a Depression over south coastal Odisha and neighbourhood on 11th /0530 IST. It then moved west-northwestwards-northwestwards across south Chhattisgarh, southeast Madhya Pradesh and adjoining Vidarbha and weakened into a well marked low pressure area on 12th /0830 IST of September 2022. Fig.2(vi)a presents the surface isobaric analysis as on 0830 IST of 09th & 11th September 2022 & Fig.2(vi)b presents satellite imageries depicting the cloudiness associated with the system as on 10th/1200 IST & 11th/1500 IST of September 2022.

Associated with the formation and movement of the system, *widespread* to *fairly widespread* rainfall occurred over CAP during 08th-12th September and over TEL during 08th-13th September 2022. *Isolated heavy* to *very heavy* rain occurred over CAP on all days during 09th-11th with *extremely heavy* falls at *one or two* places (Bheemunipatnam (Visakhapatnam district): **21 cm**). *Isolated heavy* to *very heavy* rain occurred over TEL on 08th and during 10th-12th. *Isolated heavy* rain also occurred over CAP on 08th and over TEL on 09th September 2022. *Vigorous* monsoon conditions prevailed over CAP on all the days during 08th-11th and *active-vigorous* monsoon conditions prevailed over TEL on all the days during 08th-12th September 2022. Fig.2(vi)c depicts the 24-hr accumulated rainfall over CAP & TEL as on 10th & 11th September 2022.

Kindly refer Appendix-(i)-(iv) in pages 77-78 for description of technical terms

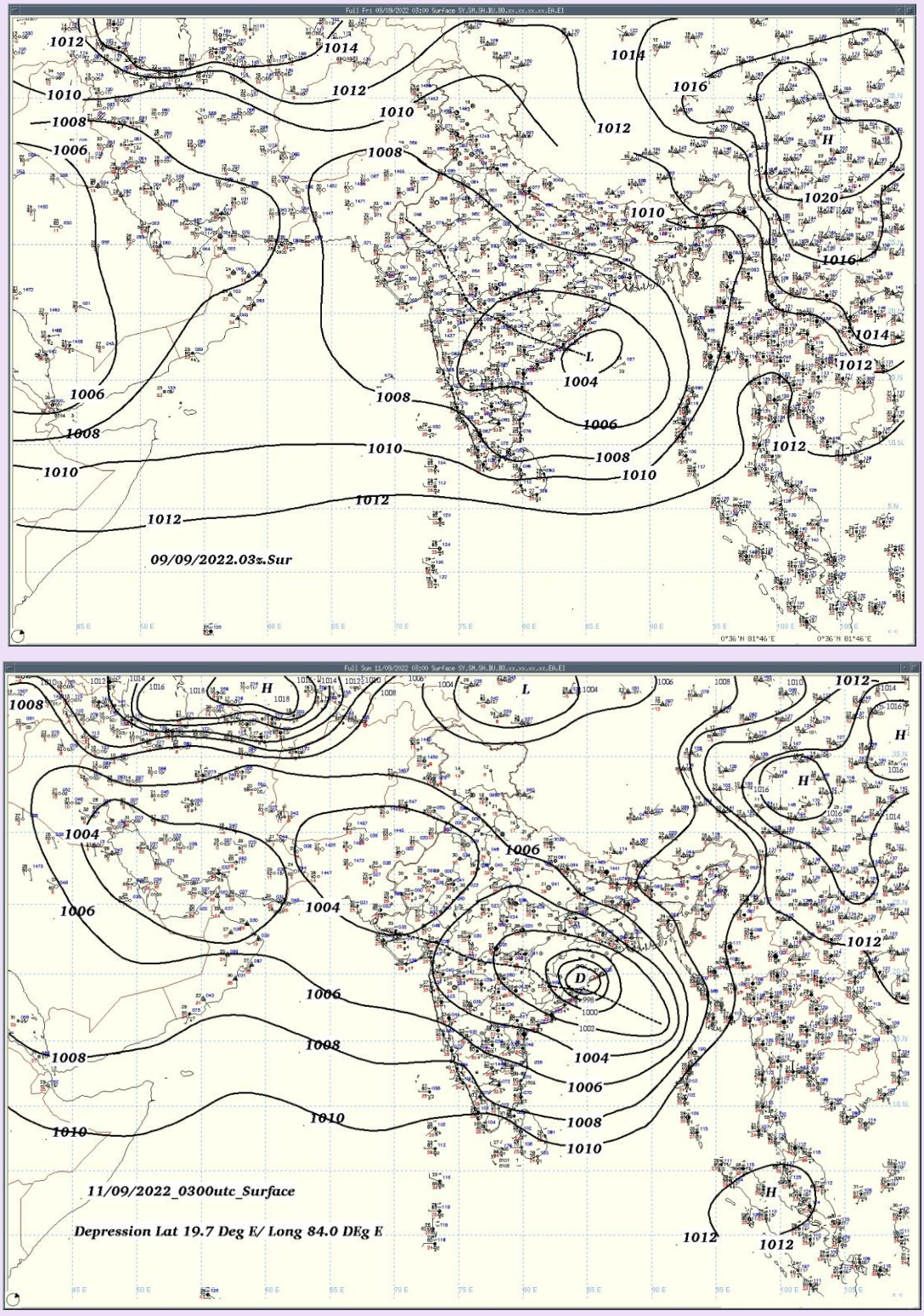


Fig.2(vi)a: Surface isobaric analysis as on 0830 IST of 09th & 11th September 2022

Kindly refer Appendix-(i)-(iv) in pages 77-78 for description of technical terms

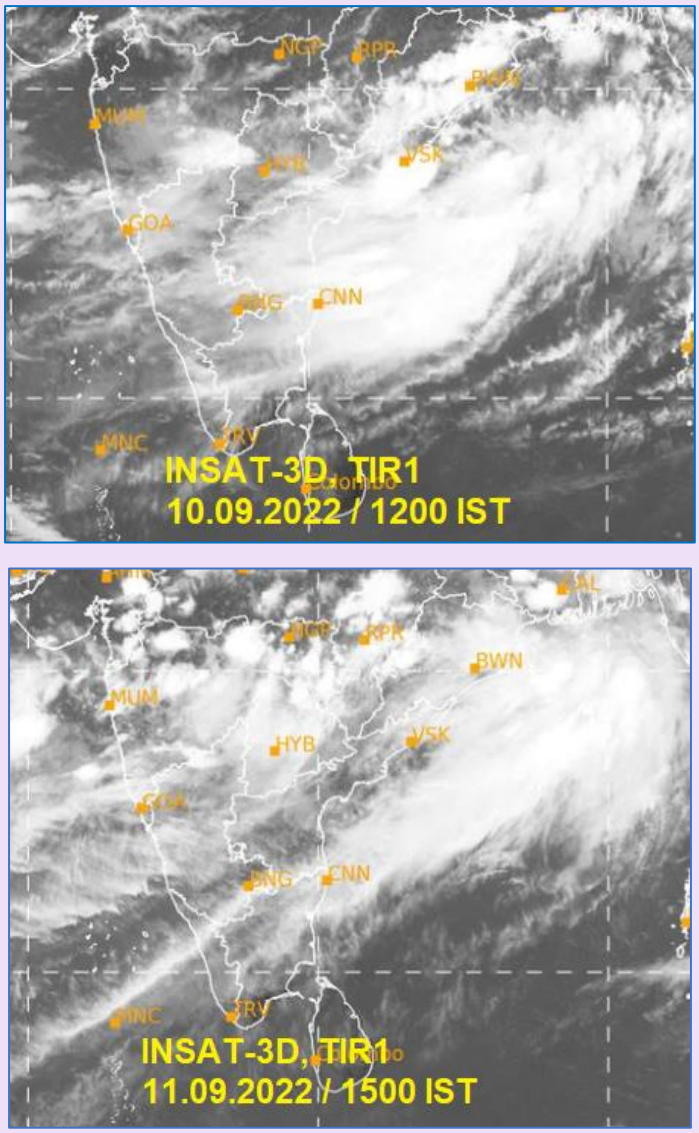


Fig.2(vi)b: INSAT-3D, infra-red imageries as on 10/1200 IST & 11/1500 IST of September 2022

Kindly refer Appendix-(i)-(iv) in pages 77-78 for description of technical terms

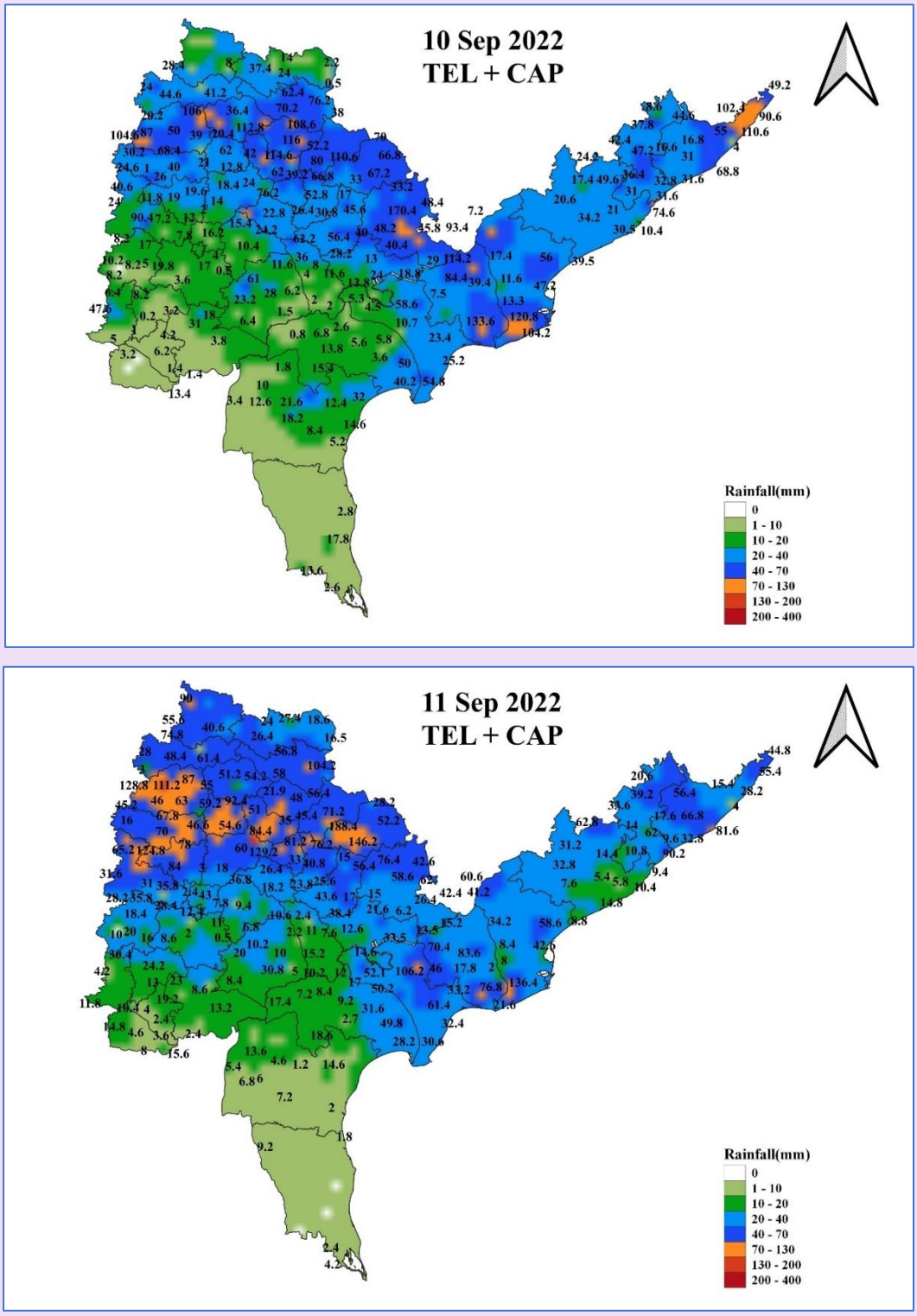


Fig.2(vi)c: 24-hr accumulated rainfall over CAP & TEL as on 0830 IST of 10th & 11th September 2022

Kindly refer Appendix-(i)-(iv) in pages 77-78 for description of technical terms

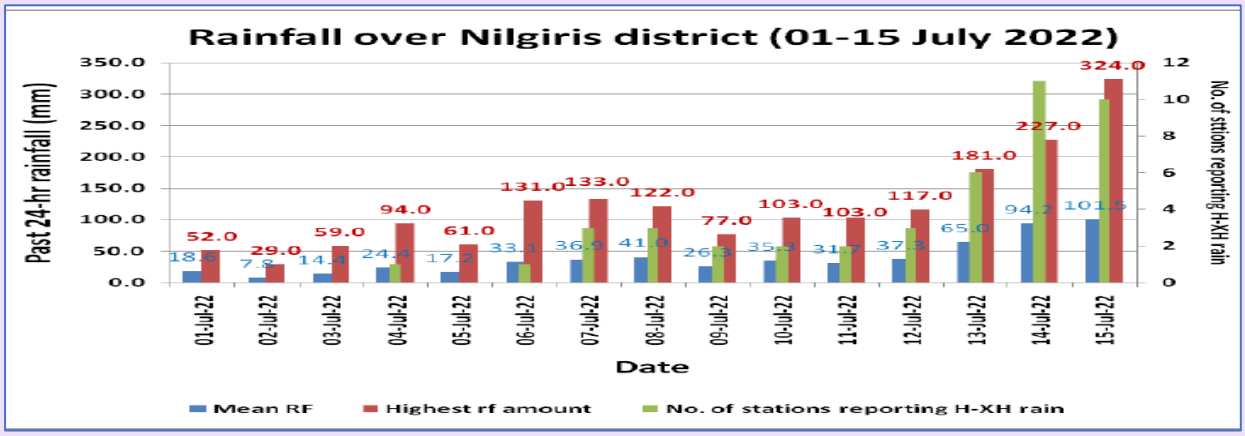
(vii) Under the influence of north-south trough over the southern peninsula in the lower levels / east-west shear zone across the southern peninsula / upper air cyclonic circulations over the extreme southern peninsula, there were 16 days of fairly widespread-widespread rainfall and 31 days of scattered rainfall activity over the TN subdivision. On the rest of the 75 days during the season, mainly *isolated* rainfall activity prevailed over this sub division. However, there were 75 days of *isolated heavy* rainfall due to intense convective activity. There were also 29 days of *isolated very heavy* rain with 5 days of *isolated extremely heavy* rainfall events.

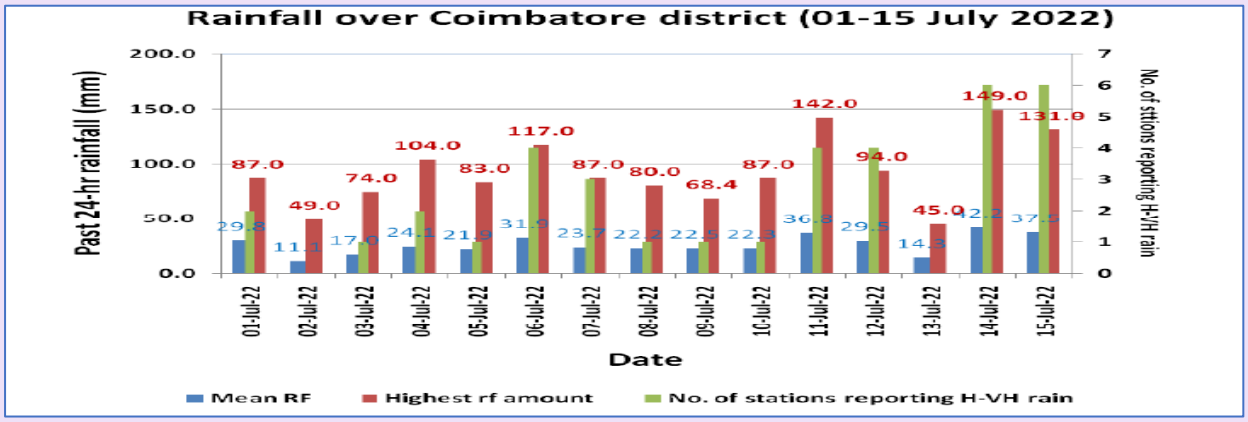
Due to strengthening of westerlies, recurrent *isolated heavy* to *very heavy* rain occurred over the western ghat areas of Nilgiris and Coimbatore districts during 01st-15th July and 02nd-10th August 2022. Daily mean rainfall for the district, highest amount of rainfall reported on the day and the number of stations reporting heavy-extremely heavy rainfall on each day during 01st-15th July and 05th-10th August for Nilgiris district and for the period from 01st-15th July and 02nd-10th August for the Coimbatore district; and the cumulative spatial rainfall distribution for 12 days during 04th-15th July and for 11 days during 31st July-10th August over Nilgiris, Coimbatore and adjoining districts are presented in Fig.2(vii)a&b.

Extremely heavy rainfall occurred at one or two places over Nilgiris district on 14th & 15th July and 06th & 09th August 2022 - 23 cm & 22 cm was recorded at Gudalur bazar & Upper Gudalur respectively on 14th July; on 15th July, Upper Bavani & Avalanche recorded **32 cm** each; on 06th August, Avalanche recorded **32 cm**; and on 09th August, Upper Bavani recorded 22 cm of rain. Over the Nilgiris district, the cumulative rainfall for the 12-day period from 04th-15th July over Avalanche was 141 cm (12 cm/day); over Upper Bavani – 130 cm (11 cm/day); and over Devala – 100 cm (8 cm/day). Further, during the 11-day period from 31st July to 10th August 2022, Avalanche recorded 119 cm (11 cm/day), Upper Bavani – 99 cm (9 cm/day), Gudalur Bazar – 82 cm (7 cm/day) & Devala – 75 cm (7 cm/day). Over the ghat areas of Coimbatore district, during the 12-day period from 03rd-15th July, Chinnakalar recorded 113 cm (9 cm/day), Sholayar-86 cm (7 cm/day) & Valparai- 88 cm (7 cm/day); and during the 11-day period from 31st July-10th August, Chinnakalar recorded 108 cm (11 cm/day), Sholayar – 88 cm (8 cm/day) & Valparai – 81 cm (7 cm/day).

Recurrent heavy rainfall over the ghat areas caused extensive damages over these areas. Sample media reports on the damages due to recurrent heavy rainfall events over Nilgiris district are presented in Fig.2(vii)c.

Kindly refer Appendix-(i)-(iv) in pages 77-78 for description of technical terms





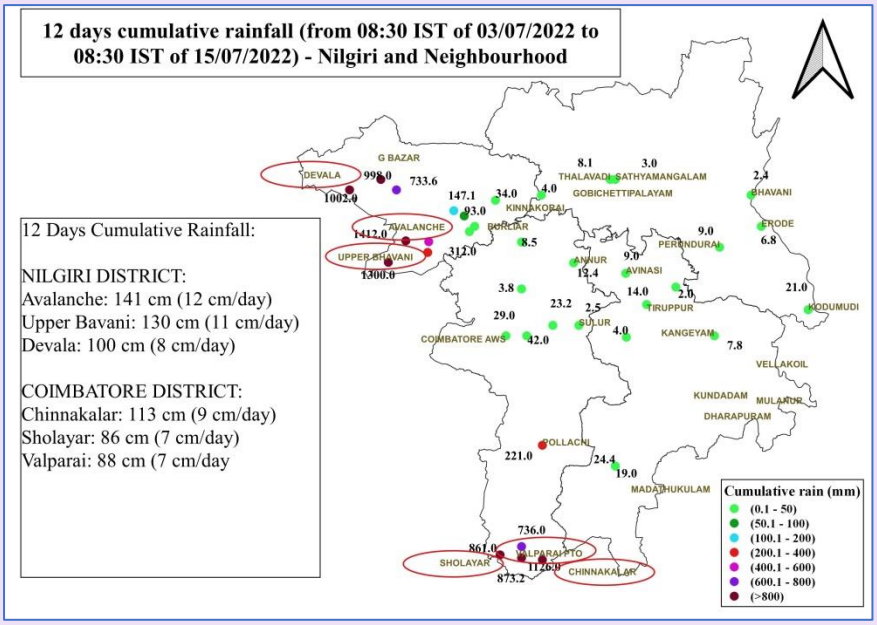
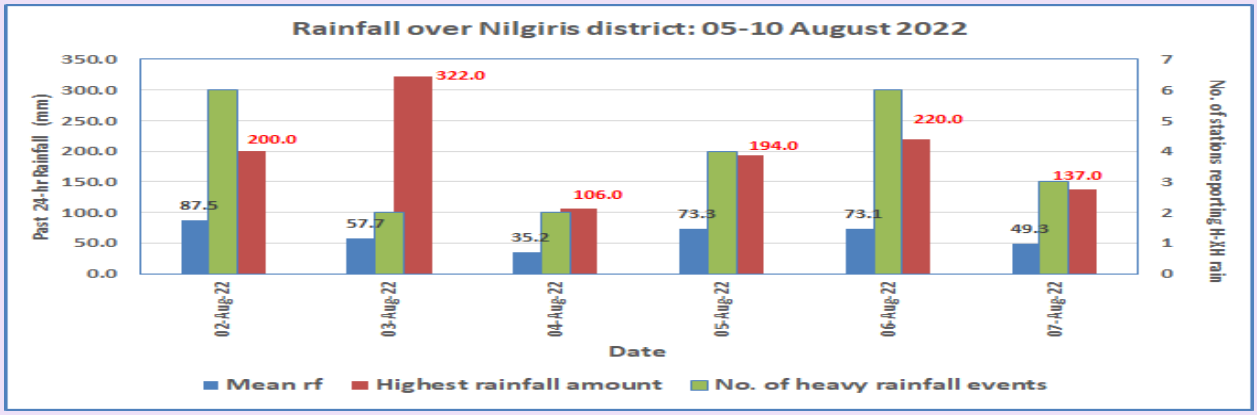
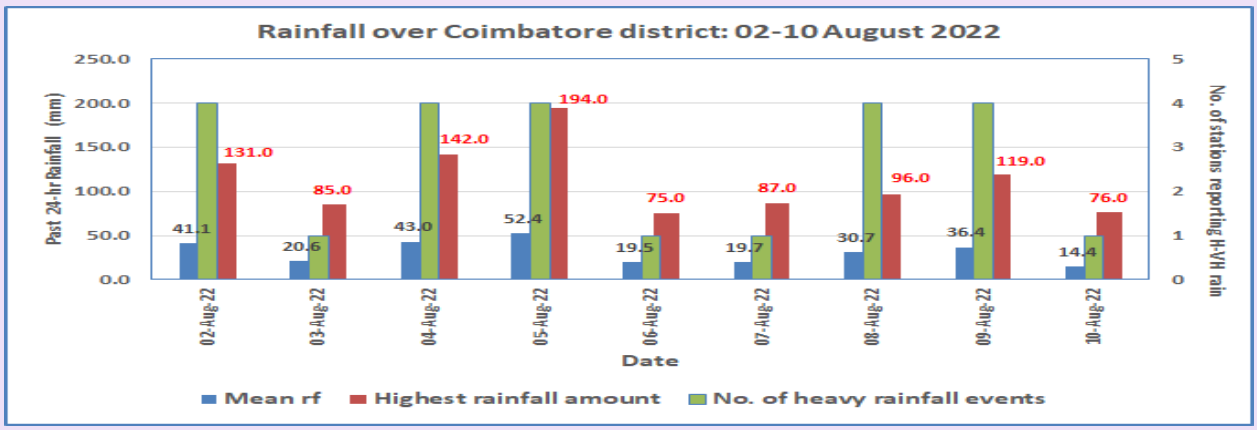


Fig. 2(vii)a: Daily mean district rainfall, highest amount of rainfall reported on the day and the number of stations reporting heavy-extremely heavy rainfall on each day during 01st-15th July and the cumulative spatial rainfall distribution for 12 days during the 24-hr ending 0830 IST of 04th-15th July over Nilgiris & Coimbatore districts

Kindly refer Appendix-(i)-(iv) in pages 77-78 for description of technical terms





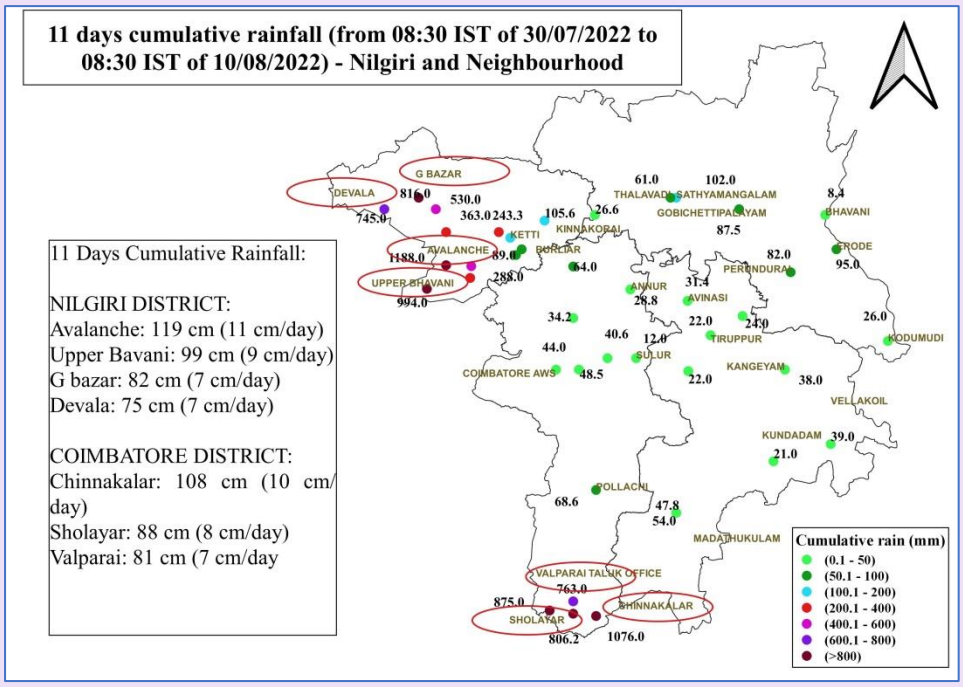


Fig. 2(vii)b: Daily mean district rainfall, highest amount of rainfall reported on the day and the number of stations reporting heavy-extremely heavy rainfall on each day during 02nd-10th August and the cumulative spatial rainfall distribution for 11 days during the 24-hr ending 0830 IST of 31st July-10th August over Nilgiris & Coimbatore districts

Kindly refer Appendix-(i)-(iv) in pages 77-78 for description of technical terms

Rain pounds Tamil Nadu's Nilgiris, 55-yr-old man rescued from flash floods

District Collector SP Amrith declared holiday on Wednesday for schools in Gudalur, Pandalur, Kundah and Ooty taluks as flash floods washed away a bridge in Mankuzhi in Gudalur.

Published: 14th July 2022 02:13 AM | Last Updated: 14th July 2022 02:14 AM | A+ A A-

Locals rescue Manickam by throwing ropes and crawl up the broken bridge in Nilgiris. (Photo| EPS)

By PS Sundar

Express News Service

COONOOR: Rain continued to pound The Nilgiris unabated and the district recorded 1,340 mm of rain for the 24 hours ending 8.30 am on Wednesday, the highest in the last few days.

Rainfall exceeded 100 mm in six rain-gauge stations - Gudalur received the highest rainfall in the district of 181 mm, Upper Gudalur got 161 mm, Devala 149 mm, upper Bhavani 132 mm, Avalanchi 122 mm and Pandalur 102 mm. Naduvattam got 89 mm, Cherangode 79 mm and Glenmorgan 71 mm.

District Collector SP Amrith declared holiday on Wednesday for schools in Gudalur, Pandalur, Kundah and Ooty taluks. Flash floods washed away a bridge in Mankuzhi in Gudalur.

Manickam (55), a resident, was caught in the flooded river under the bridge but locals rescued him by throwing ropes and crawl up the broken bridge. The Collector inspected the area along with Gudalur MLA Pon Jayaseelan.

Due to the rains, a portion of the compound wall of Government Hospital in Ooty crashed and fell on a car. None was injured. Trees fell in many places especially in Ooty, Gudalur, Avalanchi and Naduvattam areas.

The Collector said that 42 teams are on round-the-clock watch in 283 spots identified to be prone for disaster in the district. He said that 456 flood relief centres have been kept ready with adequate stock of food, drinking water and medical facilities. He advised people to move over to their nearby centres if necessary.

Fig.2(vii)c: Media reports dated 14th July & 10th August 2022

Kindly refer Appendix-(i)-(iv) in pages 77-78 for description of technical terms

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THE TIMES OF INDIA

Tamil Nadu: Water released from three dams as rain continues to batter Nilgiris

TNN | Aug 10, 2022, 10.43 AM IST

UDHAGAMANDALAM: Incessant rainfall continued in Ooty, Kundha and Gudalur taluks in the Nilgiris on Tuesday, causing landslips and tree falls.
While Upperbhavani recorded the highest rainfall of 220mm, Gudalur and Pandalur received 166mm and 93mm rain, respectively for the 24 hours that ended at 8.30am on Tuesday. Ooty registered 44.5mm rainfall and Glenmorgan received 76mm rain.

The district administration released water from Avalanche, Pykara and Emerald dams on Tuesday evening, as the water level inched closer to the full storage level.
Before releasing the water from the dams, the district administration shifted people living in the low-lying areas to nearby relief camps as a precautionary measure.

Nilgiris collector S P Amrith and district revenue officer Keerthi Priyadharshini inspected Pykara dam on Tuesday before releasing the water from the dam.
On Monday evening, Sumathi, 58, an estate worker in O'Valley, died after a tree that was uprooted in the heavy rain accompanied by gusty wind fell on her. Another woman worker was injured in the incident. With this, the number of people died in rain-related incidents in the district has gone up to two since the onset of southwest monsoon.

A wall of a government library in Gudalur also collapsed in the rain. Many low-lying areas in Gudalur taluk were flooded.

However, Coonoor and Kotagiri taluks, located at the eastern side of the hills, have been experiencing dry weather for the past three days.

Forest minister K Ramachandran, along with Amrith, inspected the affected areas, including the government library and relief camps in Gudalur. He distributed relief materials such as rice and clothes to the inmates of the camps. He also handed over a cheque for Rs4 lakh from the disaster management fund to the family of Sumathi as a compensation as directed by chief minister M K Stalin.

Speaking to the media, Ramachandran said, "As many as 237 people are housed in five relief camps in Gudalur and one in Ooty. At least 15 houses were damaged and four trees were uprooted in Gudalur taluk, where a few landslips were also reported."

Fig.2(vii)c: contd.

Kindly refer Appendix-(i)-(iv) in pages 77-78 for description of technical terms

3. Rainfall distribution

3.1 Seasonal sub-divisional rainfall

The SWM seasonal rainfall (June-September) during 2022 over the country as a whole was 106% of its long period average (LPA) of 87.0 cm and that over the SP region was 122% of its LPA.

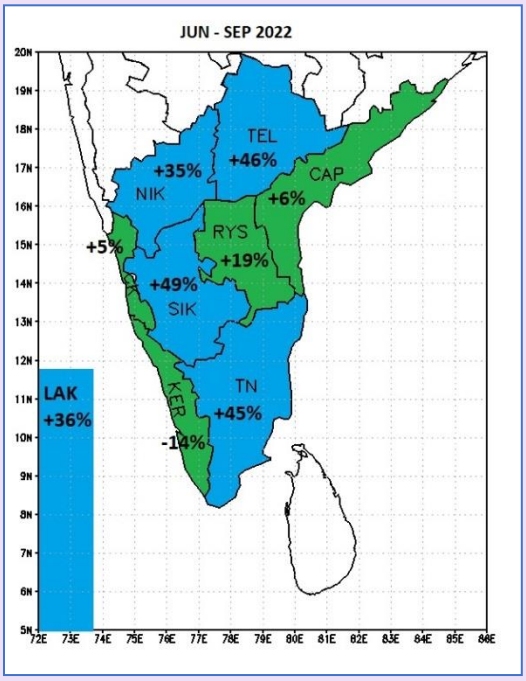
The spatial rainfall distribution is determined in terms of percentage departure from normal (PDN) over 36 meteorological subdivisions in the country. As per IMD's classification of monsoon performance over a meteorological subdivision, if the amount of rainfall received over a region (expressed as PDN) 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 2022, nine sub divisions in the SP region received *normal* to *excess* rainfall with five subdivisions recording excess rainfall - SIK:+49%, TEL:+46%, TN:+45%, LAK:+36% & NIK:+35%. KER, CK, RYS & CAP came under *normal* category (-19% to +19%). The cumulative seasonal (01st June to 30th Sep 2022) rainfall figures for the nine meteorological subdivisions of the SP region are presented inTable-3.1 and Fig.3(i).

Table-3.1: Seasonal sub-divisional rainfall distribution over the SP region during the SWM season, 2020 (01st June-30th Sep 2022)

SUB-DIVISION	Actual rainfall (mm)	Normal rainfall (mm)	Percentage departure from normal (%)
COASTAL AP & YANAM (CAP)	640.2	601.4	6
TELENGANA (TEL)	1073.3	734.8	46
RAYALASEEMA (RYS)	486.5	408.6	19
TAMILNADU, PUDUCHERRY & KARAIKAL (TN)	477.1	328.4	45
COASTAL KARNATAKA (CK)	3235.4	3093.9	5
NORTH INTERIOR KARNATAKA (NIK)	647.3	480.8	35
SOUTH INTERIOR KARNATAKA (SIK)	1008.1	678.4	49
KERALA & MAHE (KER)	1736.6	2018.6	-14
LAKSHADWEEP (LAK)	1391.2	1026.6	36

Kindly refer Appendix-(i)-(iv) in pages 77-78 for description of technical terms



Largely Deficient	*Deficient*	*Normal*	*Excess*	*Large Excess*
≤-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 2022 over the SP region

3.2 Monthly sub-divisional rainfall

The monthly sub-divisional rainfall scenario during the SWM 2022 season is presented inTable-3.2 and Fig.3(ii). It is noted that all the subdivisions received *normal* to *large excess* rainfall during the months of June, July, August & September excepting the west coast sub divisions of CK & KER in June, extreme northern sub division of TEL in August and the extreme southeastern sub division of TN in September. CAP, RYS, NIK, SIK & LAK received *normal* to *large excess* rainfall during all the four months. In July & August, six sub divisions received *excess* to *large excess* rainfall with *more than 100% excess* over TEL & TN in July (TEL: +145%; TN: +101%), SIK (+109%) in August. In September, four sub divisions received *excess* to *large exc*ess rainfall with LAK recording *more than 100% excess* (+115%).

Kindly refer Appendix-(i)-(iv) in pages 77-78 for description of technical terms

Table-3.2: Monthly sub-divisional rainfall performance during SWM 2022

2022	Jun			Jul			Aug			Sep		
Sub division	Actual rainfall (mm)	Normal rainfall (mm)	PDN (%)	Actual rainfall (mm)	Normal rainfall (mm)	PDN (%)	Actual rainfall (mm)	Normal rainfall (mm)	PDN (%)	Actual rainfall (mm)	Normal rainfall (mm)	PDN (%)
CAP	105.1	109.5	-4	210.7	158.6	33	143.1	170.3	-16	181.3	163	11
TEL	142.6	131.4	9	535.5	218.5	145	181.3	226.1	-20	213.8	158.8	35
RYS	106.5	72.3	47	82.7	92.1	-10	182.5	107.3	70	114.6	136.9	-16
TN	79.1	50.7	56	138.5	69	101	173.8	90.1	93	85.6	118.6	-28
CK	609	863.6	-29	1495.7	1088.9	37	744.8	821.3	-9	385.8	320.1	21
NIK	90.9	105.3	-14	211.1	116.5	81	171	119.4	43	174.3	139.6	25
SIK	134	149.7	-10	347.4	200.6	73	374.4	179.5	109	152.3	148.6	3
KER	308.8	648.3	-52	652.6	653.4	0	553.4	445.2	24	221.9	271.7	-18
LAK	366.6	335.6	9	295.2	289.3	2	364.4	232	57	365	169.7	115

PDN: Percentage Departures from Normal

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

3.3 Weekly sub-divisional rainfall progress

Week by week and cumulative weekly performance of SWM 2022 over the SP region are presented in Table-3.3a and Table-3.3b respectively.

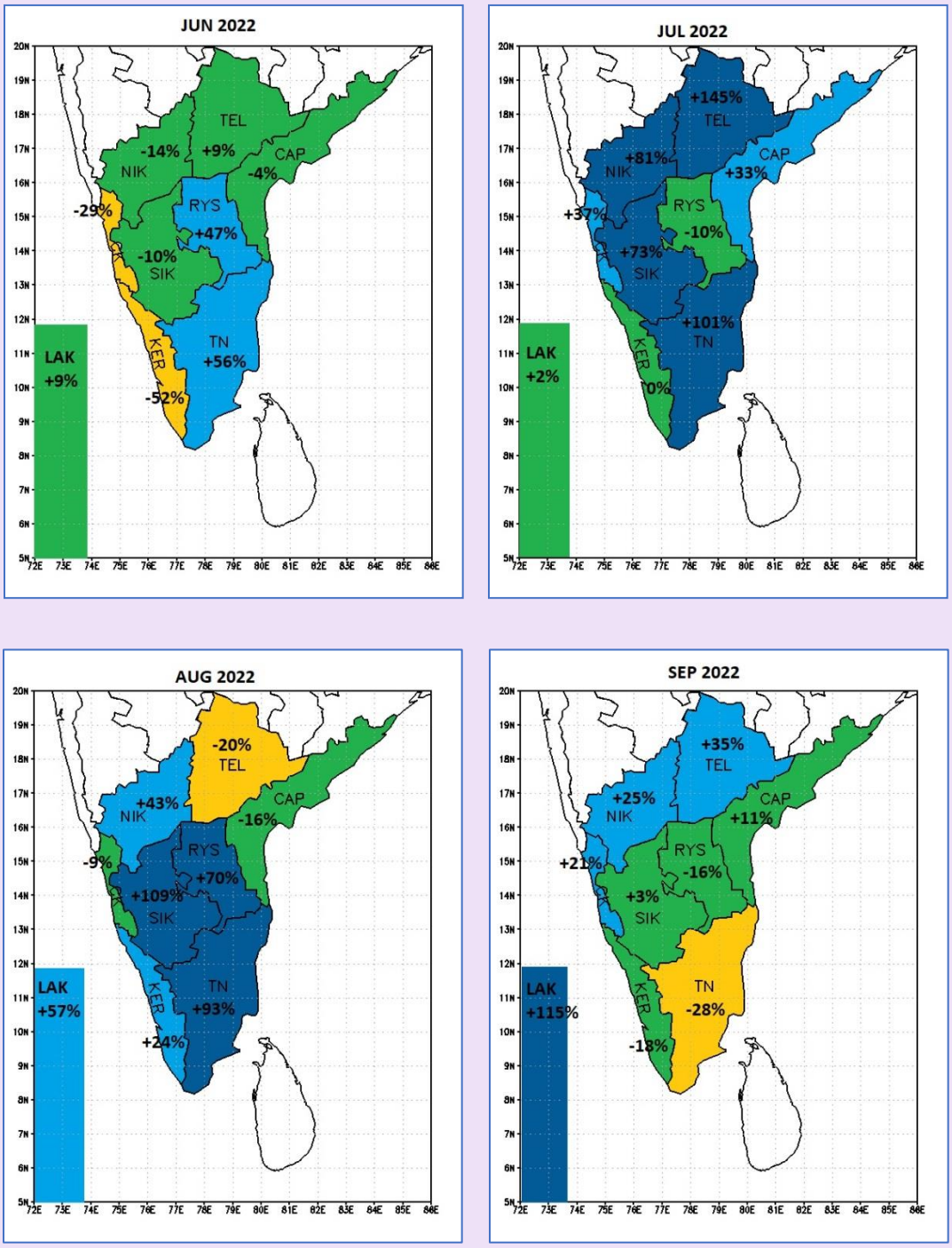
During the SWM season of 2022, during the weeks ending 06th July and 10th August all the nine sub divisions in the SP region received *excess* to *large excess* rainfall. During the weeks ending 13th & 20th July, excepting LAK & RYS that became *deficient*, all the other seven sub divisions received *normal* to *large excess* rainfall. Also, during the week ending 14th September, excepting TN & LAK that became *deficient*, all the other seven sub divisions received *excess* to *large excess* rainfall.

During the weeks ending 10th August and 28th September, all the nine sub divisions became *deficient -largely deficient*. During the weeks ending 15th June & 21st September, but for one or two sub divisions that received *normal / excess* rain, all the other subdivisions became *deficient*.

Considering the cumulative seasonal rainfall performance at the end of every week, it is noted that from the week ending 06th July onwards, all sub divisions except KER came under

Kindly refer Appendix-(i)-(iv) in pages 77-78 for description of technical terms

normal to *large excess* category throughout the season. KER was generally in *deficient* category till the first week of August and then came under *normal* category until the end of the season.



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

Fig.3(ii): Monthly sub-divisional rainfall distribution during Jun-Sep2022

Kindly refer Appendix-(i)-(iv) in pages 77-78 for description of technical terms

Table-3.3a: Week by week sub-divisional rainfall during June-Sep 2022 over the SP region

SUB DIVISION	2022: WEEK-BY-WEEK: PDN (%)																	
	01-Jun	08-Jun	15-Jun	22-Jun	29-Jun	06-Jul	13-Jul	20-Jul	27-Jul	03-Aug	10-Aug	17-Aug	24-Aug	31-Aug	07-Sep	14-Sep	21-Sep	28-Sep
CAP	-35	-21	-67	45	24	76	102	-8	35	-26	31	-58	-51	-4	-25	484	-47	-37
TEL	11	-82	-21	96	10	110	435	80	60	-25	61	-54	-85	-25	-34	236	-44	-24
RYS	-61	8	44	269	-68	28	-11	-57	-15	257	61	-71	-77	194	53	415	-92	-67
TN	22	-2	-11	355	-58	53	7	38	242	234	89	-80	42	255	117	-53	-84	-58
CK	-13	-79	-50	-31	2	115	138	27	-71	-57	44	-45	9	-41	-13	196	-9	-59
NIK	62	-5	-49	11	-23	105	151	37	-10	176	110	-41	-75	107	223	86	-89	-70
SIK	-29	33	-51	23	-36	97	159	55	-53	193	146	-27	-44	310	206	33	-79	-84
KER	44	-63	-65	-55	-37	38	38	17	-80	13	51	-81	29	57	59	54	-85	-95
LAK	-64	-10	-25	75	4	124	-30	-29	-42	187	205	-94	-29	20	666	-32	-90	-86

Table-3.3b: Weekly cumulative sub-divisional rainfall during Jun-Sep 2022

SUB DIVISION	2022: CUMULATIVE WEEK ENDING : PDN (%)																	
	01-Jun	08-Jun	15-Jun	22-Jun	29-Jun	06-Jul	13-Jul	20-Jul	27-Jul	03-Aug	10-Aug	17-Aug	24-Aug	31-Aug	07-Sep	14-Sep	21-Sep	28-Sep
CAP	16	-26	-49	-16	-6	13	30	23	25	18	20	11	6	5	3	14	9	6
TEL		-70	-40	13	12	36	126	118	107	89	85	70	56	49	44	54	48	45
RYS	55	8	26	80	47	44	33	17	12	43	45	34	21	37	38	34	20	13
TN	91	6	-1	89	58	57	46	45	77	97	96	73	69	87	90	76	60	49
CK	-13	-74	-59	-47	-33	1	27	27	14	6	10	5	5	3	2	7	6	5
NIK	62	1	-21	-12	-15	5	32	32	26	44	51	43	33	39	52	54	42	32
SIK	-29	25	-13	0	-10	13	41	45	30	51	61	53	46	62	70	68	60	50
KER	44	-54	-60	-58	-53	-35	-23	-17	-24	-20	-14	-19	-17	-13	-11	-8	-11	-13
LAK	-64	-17	-21	7	7	26	17	11	5	19	32	24	20	20	50	46	41	37

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

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 2022 and Table-3.4b, the percentage frequency of various categories of spatial rainfall distribution over each subdivision during the season.

Kindly refer Appendix-(i)-(iv) in pages 77-78 for description of technical terms

Table-3.4a: Daily sub-divisional rainfall distribution over the SP region during SWM 2022

Date as on 08:30 IST	CAP	TEL	RYS	TN	CK	NIK	SIK	KER	LAK
01-06-2022	DRY	SCT	ISOL	ISOL	FWS	WS	SCT	FWS	FWS
02-06-2022	ISOL	ISOL	ISOL	ISOL	SCT	ISOL	ISOL	FWS	WS
03-06-2022	ISOL	ISOL	SCT	ISOL	FWS	FWS	SCT	FWS	WS
04-06-2022	SCT	ISOL	DRY	ISOL	SCT	ISOL	FWS	SCT	WS
05-06-2022	DRY	ISOL	DRY	ISOL	ISOL	ISOL	SCT	SCT	SCT
06-06-2022	FWS	ISOL	WS	SCT	SCT	FWS	WS	FWS	FWS
07-06-2022	SCT	ISOL	ISOL	SCT	SCT	ISOL	ISOL	FWS	SCT
08-06-2022	DRY	ISOL	ISOL	ISOL	FWS	SCT	ISOL	FWS	FWS
09-06-2022	DRY	ISOL	DRY	ISOL	WS	SCT	ISOL	FWS	FWS
10-06-2022	ISOL	ISOL	DRY	ISOL	WS	ISOL	ISOL	SCT	WS
11-06-2022	ISOL	SCT	DRY	ISOL	WS	ISOL	ISOL	WS	FWS
12-06-2022	ISOL	SCT	ISOL	ISOL	WS	SCT	ISOL	WS	WS
13-06-2022	SCT	SCT	SCT	ISOL	WS	SCT	SCT	WS	WS
14-06-2022	ISOL	SCT	ISOL	ISOL	FWS	ISOL	ISOL	FWS	WS
15-06-2022	SCT	SCT	WS	SCT	FWS	SCT	FWS	FWS	WS
16-06-2022	SCT	WS	ISOL	FWS	WS	ISOL	SCT	WS	WS
17-06-2022	SCT	SCT	FWS	SCT	WS	SCT	WS	WS	WS
18-06-2022	SCT	ISOL	SCT	SCT	WS	FWS	FWS	WS	WS
19-06-2022	ISOL	SCT	FWS	SCT	WS	FWS	FWS	WS	WS
20-06-2022	SCT	FWS	SCT	SCT	WS	SCT	FWS	SCT	WS
21-06-2022	FWS	WS	ISOL	SCT	WS	SCT	FWS	WS	WS
22-06-2022	SCT	FWS	ISOL	SCT	WS	WS	FWS	WS	FWS
23-06-2022	SCT	ISOL	ISOL	ISOL	WS	FWS	SCT	WS	WS
24-06-2022	SCT	ISOL	ISOL	ISOL	WS	FWS	SCT	WS	WS
25-06-2022	FWS	FWS	ISOL	ISOL	WS	SCT	SCT	WS	WS
26-06-2022	SCT	FWS	ISOL	ISOL	WS	SCT	SCT	WS	FWS
27-06-2022	FWS	FWS	ISOL	ISOL	WS	SCT	SCT	FWS	WS
28-06-2022	FWS	SCT	ISOL	ISOL	WS	SCT	SCT	WS	WS
29-06-2022	SCT	SCT	ISOL	ISOL	WS	SCT	SCT	WS	WS
30-06-2022	SCT	ISOL	SCT	ISOL	WS	SCT	SCT	WS	WS
01-07-2022	SCT	SCT	SCT	SCT	WS	FWS	FWS	WS	WS
02-07-2022	FWS	FWS	SCT	SCT	WS	FWS	FWS	WS	WS
03-07-2022	SCT	FWS	ISOL	ISOL	WS	SCT	FWS	WS	WS
04-07-2022	FWS	WS	ISOL	ISOL	WS	SCT	FWS	WS	WS
05-07-2022	SCT	WS	ISOL	ISOL	WS	FWS	WS	WS	WS
06-07-2022	WS	WS	WS	ISOL	WS	WS	WS	WS	WS
07-07-2022	SCT	FWS	FWS	ISOL	WS	WS	WS	WS	WS
08-07-2022	FWS	WS	FWS	ISOL	WS	WS	WS	WS	FWS
09-07-2022	WS	WS	SCT	ISOL	WS	WS	WS	WS	WS
10-07-2022	FWS	WS	FWS	ISOL	WS	WS	WS	WS	WS
11-07-2022	FWS	WS	ISOL	SCT	WS	FWS	FWS	WS	SCT
12-07-2022	WS	WS	SCT	ISOL	WS	WS	WS	WS	WS
13-07-2022	FWS	WS	SCT	ISOL	WS	WS	WS	WS	WS
14-07-2022	SCT	WS	SCT	ISOL	WS	WS	WS	WS	WS
15-07-2022	SCT	FWS	ISOL	ISOL	WS	FWS	WS	WS	WS
16-07-2022	SCT	ISOL	ISOL	ISOL	WS	FWS	FWS	WS	WS
17-07-2022	FWS	FWS	SCT	SCT	WS	WS	WS	WS	WS
18-07-2022	WS	WS	SCT	SCT	WS	WS	WS	WS	WS
19-07-2022	SCT	FWS	SCT	ISOL	WS	SCT	FWS	WS	WS
20-07-2022	SCT	SCT	ISOL	ISOL	WS	SCT	SCT	SCT	WS
21-07-2022	SCT	FWS	ISOL	SCT	WS	SCT	FWS	FWS	WS
22-07-2022	FWS	FWS	SCT	FWS	WS	ISOL	SCT	SCT	FWS
23-07-2022	FWS	WS	ISOL	SCT	WS	FWS	SCT	FWS	SCT
24-07-2022	SCT	FWS	ISOL	SCT	WS	SCT	FWS	WS	SCT
25-07-2022	SCT	FWS	ISOL	ISOL	WS	SCT	SCT	ISOL	DRY
26-07-2022	ISOL	ISOL	SCT	FWS	WS	FWS	WS	WS	WS
27-07-2022	FWS	WS	SCT	FWS	FWS	FWS	SCT	SCT	WS
28-07-2022	ISOL	ISOL	SCT	SCT	WS	FWS	WS	WS	WS
29-07-2022	ISOL	ISOL	ISOL	ISOL	SCT	FWS	FWS	FWS	WS
30-07-2022	ISOL	SCT	SCT	ISOL	FWS	WS	WS	SCT	FWS
31-07-2022	ISOL	ISOL	SCT	SCT	FWS	SCT	FWS	FWS	WS

Kindly refer Appendix-(i)-(iv) in pages 77-78 for description of technical terms

Date as on 08:30 IST	CAP	TEL	RYS	TN	CK	NIK	SIK	KER	LAK
01-08-2022	SCT	ISOL	FWS	FWS	SCT	SCT	WS	WS	FWS
02-08-2022	SCT	SCT	WS	FWS	WS	WS	WS	WS	WS
03-08-2022	FWS	WS	FWS	SCT	WS	WS	WS	WS	WS
04-08-2022	SCT	WS	FWS	FWS	WS	WS	WS	WS	WS
05-08-2022	FWS	WS	FWS	FWS	WS	FWS	WS	WS	WS
06-08-2022	FWS	FWS	SCT	ISOL	WS	FWS	WS	WS	WS
07-08-2022	WS	WS	FWS	ISOL	WS	FWS	WS	WS	WS
08-08-2022	WS	WS	ISOL	ISOL	WS	WS	WS	WS	WS
09-08-2022	WS	WS	SCT	ISOL	WS	WS	WS	WS	SCT
10-08-2022	FWS	WS	ISOL	ISOL	WS	FWS	FWS	FWS	DRY
11-08-2022	ISOL	ISOL	ISOL	ISOL	WS	SCT	SCT	SCT	SCT
12-08-2022	ISOL	ISOL	ISOL	ISOL	WS	FWS	FWS	WS	SCT
13-08-2022	ISOL	ISOL	ISOL	ISOL	WS	SCT	SCT	SCT	SCT
14-08-2022	FWS	FWS	ISOL	ISOL	WS	SCT	SCT	ISOL	SCT
15-08-2022	FWS	WS	SCT	DRY	WS	FWS	SCT	SCT	DRY
16-08-2022	SCT	FWS	ISOL	ISOL	WS	FWS	ISOL	DRY	DRY
17-08-2022	SCT	SCT	ISOL	ISOL	WS	ISOL	ISOL	ISOL	DRY
18-08-2022	ISOL	ISOL	ISOL	SCT	WS	ISOL	ISOL	ISOL	DRY
19-08-2022	SCT	ISOL	DRY	SCT	WS	ISOL	ISOL	SCT	SCT
20-08-2022	SCT	SCT	ISOL	ISOL	WS	SCT	ISOL	ISOL	ISOL
21-08-2022	SCT	ISOL	ISOL	ISOL	WS	SCT	SCT	ISOL	ISOL
22-08-2022	ISOL	ISOL	ISOL	SCT	WS	SCT	FWS	WS	WS
23-08-2022	ISOL	ISOL	ISOL	FWS	WS	SCT	FWS	WS	WS
24-08-2022	SCT	ISOL	ISOL	FWS	WS	ISOL	SCT	WS	WS
25-08-2022	SCT	SCT	SCT	ISOL	WS	SCT	FWS	FWS	WS
26-08-2022	FWS	SCT	FWS	FWS	WS	SCT	WS	FWS	FWS
27-08-2022	SCT	SCT	FWS	FWS	WS	WS	WS	WS	WS
28-08-2022	SCT	SCT	WS	SCT	WS	FWS	WS	WS	WS
29-08-2022	SCT	SCT	FWS	FWS	FWS	FWS	WS	WS	FWS
30-08-2022	FWS	FWS	FWS	SCT	WS	FWS	WS	FWS	FWS
31-08-2022	ISOL	ISOL	ISOL	SCT	WS	FWS	SCT	WS	FWS
01-09-2022	SCT	SCT	ISOL	FWS	WS	WS	FWS	WS	WS
02-09-2022	SCT	ISOL	FWS	WS	WS	FWS	WS	WS	WS
03-09-2022	SCT	ISOL	ISOL	ISOL	FWS	ISOL	SCT	FWS	WS
04-09-2022	SCT	SCT	ISOL	ISOL	ISOL	ISOL	FWS	FWS	WS
05-09-2022	SCT	SCT	FWS	FWS	SCT	SCT	WS	FWS	WS
06-09-2022	SCT	SCT	FWS	SCT	FWS	WS	WS	WS	WS
07-09-2022	SCT	SCT	FWS	SCT	WS	WS	WS	WS	WS
08-09-2022	WS	WS	FWS	SCT	WS	WS	WS	WS	WS
09-09-2022	WS	WS	FWS	ISOL	WS	FWS	FWS	WS	FWS
10-09-2022	WS	WS	SCT	ISOL	WS	FWS	SCT	WS	WS
11-09-2022	WS	WS	SCT	ISOL	WS	WS	FWS	WS	FWS
12-09-2022	FWS	WS	ISOL	ISOL	WS	WS	SCT	FWS	WS
13-09-2022	SCT	FWS	DRY	ISOL	WS	FWS	SCT	WS	FWS
14-09-2022	SCT	ISOL	ISOL	ISOL	WS	SCT	FWS	WS	FWS
15-09-2022	ISOL	ISOL	ISOL	ISOL	WS	SCT	SCT	SCT	DRY
16-09-2022	ISOL	DRY	ISOL	ISOL	WS	SCT	SCT	SCT	SCT
17-09-2022	ISOL	ISOL	ISOL	ISOL	WS	ISOL	SCT	ISOL	WS
18-09-2022	ISOL	SCT	ISOL	ISOL	WS	ISOL	ISOL	SCT	SCT
19-09-2022	FWS	SCT	ISOL	ISOL	WS	ISOL	SCT	SCT	SCT
20-09-2022	FWS	FWS	ISOL	ISOL	SCT	ISOL	ISOL	SCT	FWS
21-09-2022	SCT	SCT	DRY	ISOL	FWS	ISOL	SCT	ISOL	DRY
22-09-2022	ISOL	SCT	ISOL	ISOL	SCT	ISOL	ISOL	ISOL	DRY
23-09-2022	SCT	SCT	ISOL	DRY	SCT	ISOL	ISOL	ISOL	DRY
24-09-2022	SCT	ISOL	DRY	ISOL	WS	ISOL	SCT	ISOL	SCT
25-09-2022	ISOL	ISOL	ISOL	ISOL	WS	ISOL	SCT	ISOL	FWS
26-09-2022	SCT	ISOL	ISOL	SCT	ISOL	SCT	ISOL	ISOL	SCT
27-09-2022	SCT	FWS	SCT	ISOL	ISOL	SCT	ISOL	ISOL	FWS
28-09-2022	SCT	ISOL	ISOL	ISOL	DRY	ISOL	ISOL	ISOL	DRY
29-09-2022	FWS	FWS	FWS	SCT	ISOL	SCT	ISOL	ISOL	SCT
30-09-2022	FWS	FWS	WS	ISOL	FWS	WS	SCT	ISOL	ISOL

Kindly refer Appendix-(i)-(iv) in pages 77-78 for description of technical terms

Table-3.4b: Percentage frequency of various categories of daily spatial rainfall distribution over the subdivisions of the SP region during SWM season, 2022

Category	Frequency (%)								
	CAP	TEL	RYS	TN	CK	NIK	SIK	KER	LAK
WS	9	23	5	1	76	21	30	53	57
FWS	23	20	17	12	11	26	23	18	18
SCT	44	25	22	25	8	32	30	14	14
ISOL	20	31	48	60	4	20	17	14	2
DRY	3	1	7	2	1	0	0	1	9

***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)

As seen, *fairly widespread* to w*idespread* rainfall occurred over CK, LAK and KER on more than 70% of the days during the season (87%, 75% & 71% respectively) and over SIK, NIK and TEL on 40%-55% of the days. CAP recorded *scattered* to *fairly widespread* rainfall on 76% of the days. TN & RYS reported only *isolated* to *scattered* rainfall on 85% & 70% of the days respectively. On 05th August, 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 season2022. SIK and NIK experienced 48 & 40 days respectively of *active* to *vigorous* monsoon activity during the season followed by TEL- 36 days, CK- 29 days, KER- 26 days & CAP- 24 days. There were 19 & 15 days of *active* to *vigorous* monsoon activity over RYS & TN respectively.

Kindly refer Appendix-(i)-(iv) in pages 77-78 for description of technical terms

Table-3.4c: Subdivision-wise frequency of Vigorous and Active monsoon conditions over the SP region during the SWM season, 2022

Subdivison	Jun		Jul		Aug		Sep		Jun-Sep	
	ACT	VIG	ACT	VIG	ACT	VIG	ACT	VIG	ACT	VIG
CAP	4	0	8	1	6	0	1	4	19	5
TEL	5	1	8	7	6	0	7	2	26	10
RYS	0	3	1	0	5	5	4	1	10	9
TN	0	1	0	2	5	5	1	1	6	9
CK	4	0	14	0	4	0	5	2	27	2
NIK	3	0	14	3	9	2	7	2	33	7
SIK	3	0	22	0	15	3	3	2	43	5
KER	0	0	8	0	11	1	6	0	25	1
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 2022 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.

Kindly refer Appendix-(i)-(iv) in pages 77-78 for description of technical terms

Table-3.5a: Subdivision-wise frequency of heavy rainfall days over the SP region during1st June - 30th Sep 2022

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	55	11	2
TELANGANA	68	29	6
RAYALASEEMA	29	6	0
TAMILNADU, PDC and KKL	75	29	5
COASTAL KARNATAKA	70	34	7
NORTHI NTERIOR KARNATAKA	48	6	0
SOUTH INTERIOR KARNATAKA	70	36	6
KERALA and MAHE	56	24	1
LAKSHADWEEP	8	3	0

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 2022

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	14	1	0	17	3	1	10	1	0	14	6	1
TEL	14	4	0	21	12	5	16	5	1	17	8	0
RYS	5	2	0	3	0	0	13	4	0	8	0	0
TN	13	1	0	28	13	2	21	12	3	13	3	0
CK	16	4	0	22	17	6	18	10	1	14	3	0
NIK	9	0	0	16	2	0	13	2	0	10	2	0
SIK	15	1	0	22	17	3	18	13	3	15	5	0
KER	15	2	0	20	12	0	16	8	1	5	2	0
LAK	2	0	0	0	0	0	4	0	0	2	3	0

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

Kindly refer Appendix-(i)-(iv) in pages 77-78 for description of technical terms

Table-3.5c: List of very to extremely heavy rainfall reports during Jun-Sep 2022

DISTRICT	Date, Station and 24-hr accumulated rainfall (in cm) (ending 0830 IST of the specified date)
COASTAL ANDHRA PRADESH & YANAM	
VIZIANAGARAM	**Jun: 20th:** Therlam-12 **Jul: 09th:** Merakamudidam-22, Garividi-17, Cheepurupalle-13, Therlam-12
EAST GODAVARI	**Jul: 01st:** Vararamachandrapur-13 **Sep: 19th:** Vararamachandrapur-13
SRIKAKULAM	**Jul: 09th:** Ranastalam-14
GUNTUR	**Jul: 18th:** Repalle-12 **Sep: 29th:** Macherla-12
KRISHNA	**Aug: 03rd:** Nuzvid-14
VISHAKHAPATNAM	**Sep: 09th:** Bheemunipatnam-21; **13th:** Bheemunipatnam-20
YANAM	**Sep: 09th:** Yanam-12
WEST GODAVARI	**Sep: 10th:** Bheemavaram-13, Palakoderu-12; **11th:** Palakoderu-14
TELANGANA	
KUMARAM BHEEM	**Jun:02nd:** Bejjur-12; **20th:** Kagaznagar-12 **Jul: 10th:** Bijjur(arg)-20, Bejjur-16, Jainoor-13, Dahegaon-12; **11th:** Bejjur-13; **12th:** Kerameri-20, Jainoor-15, Sirpuru-12; **13th:** Jainoor-39, Kerameri-38, Sirpuru-35, Asifabad-14, Wankdi-12; **14th:** Sirpuru-20, Jainoor-16 **Sep: 12th:** Dahegaon-12; **29th:** Kerameri-17
RANGAREDDY	**Jun: 15th:** Ibrahimpatnam-12 ; **Jul: 26th:** Hayathnagar-12
B. KOTHAGUDEM	**Jun: 16th:** Mulakalapalle-12 **Jul: 11th:** Pinapaka-12 **Sep: 08th:** Chandrugonda-12; **10th:** Palawancha-17, Kothagudem-12
MAHABUBABAD	**Jun: 16th:** Mahabubabad-15 **Sep: 10th:** Gudurwrgl-13
NIRMAL	**Jun: 16th:** Mudhole-13 **Jul: 07th:** Khanpur-13; **10th:** Mudhole-21, Shriramsag.pocha-19, Nirmal-18, Dilawarpur-16 Nirmal(arg)-15, Sarangapurnrl-15, Laxmanchanda-12, Khanpur-12; **13th:** Shriramsag.pocha-31, Laxmanchanda-29, Nirmal-23, Dilawarpur-23, Sarangapurnrl-22, Khanpur-22, Mudhole-12; **14th:** Khanpur-29, Shriramsag.pocha-23, Laxmanchanda-19, Dilawarpur-17, Nirmal-15, Sarangapurnrl-13, Nirmal(arg)-

Kindly refer Appendix-(i)-(iv) in pages 77-78 for description of technical terms

	13 **Sep: 12th:** Laxmanchanda-15, Khanpur-13, Sarangapurnrl-12
NAGARKURNOOL	**Jul: 06th:** Kalwakurthy-16
KHAMMAM	**Jul: 08th:** Kusumanchi-14, Bonakal-13; **23rd:** Kusumanchi-13
SURYAPET	**Jul: 08th:** Mothey-14
NIZAMABAD	**Jul: 09th:** Navipet-23, Bheemgal-16, Armur-16, Dich Palle-15, Nandipet-15, Kammar Palle-13, Armoor (arg)-13, Makloor-12; **10th:** Navipet-24, Armur-23, Mortad-19, Dich Palle-18, Ranjal-16, Makloor-15, Bodhan-15, Balkonda-14, Armoor (arg)-14, Varni-14, Nandipet-14, Nizamabad-13, Jakranpalle-12; **13th:** Balkonda-21, Bheemgal-21, Nandipet-19, Kammar Palle-19, Navipet-18, Dich Palle-18, Velpur-17, Mortad-17, Armur-16, Ranjal-16, Makloor-16, Yeda Palle-14, Jakranpalle-14, Bodhan-14, Nizamabad-14, Dhar Palle-13, Varni-13; **14th:** Bheemgal-21, Armur-18, Velpur-17, Ranjal-16, Balkonda-15, Armoor(arg)-15, Navipet-14, Makloor-13, Nizamabad-13, Dich Palle-13, Kammar Palle-12, Nandipet-12 **Sep: 11th:** Navipet-19, Yeda Palle-14, Balkonda-13, Ranjal-13
ADILABAD	**Jul: 10th:** Utnur-14, Boath-14; **12th:** Utnur-17, Utnoor(arg)-15; **13th:** Utnur-24, Boath-19, Adilabad-17, Bazarhathnoor-15, Tamsi-14, Talamadugu-13; **14th:** Utnur-19, Boath-14 **Sep: 12th:** Bazarhathnoor-12
J. BHUPALPALLY	**Jul: 10th:** Kaleswaram-35, Bhupalpalle-13; **11th:** Kaleswaram-19; **13th:** Kaleswaram-16, Bhupalpalle-15
JAGTIAL	**Jul: 10th:** Metpalle-14, Sarangapur-14, Kathlapur-12; **13th:** Dharmapuri-23, Velagatoor-21, Pegadapalle-20, Metpalle-20, Sarangapur-19, Kathlapur-18, Jagtial-17, Mallapur-16, Mallial-15; **14th:** Mallapur-18, Kathlapur-15, Sarangapur-15, Pegadapalle-15, Jagtial-14, Jagtial(a)-12 **Sep: 10th:** Kathlapur-14, Mallial-12
KAMAREDDY	**Jul: 10th:** Banswada-13; **23rd:** Naga Reddipet-19 **Sep: 11th:** Naga Reddipet-13, Kamareddy-12; **20th:** Kamareddy-15
MANCHERIAL	**Jul: 10th:** Kotapalle-25, Chennur-23, Mancherial-18; **11th:** Kotapalle-15; **13th:** Luxettipet-24, Dandepalle-20, Mancherial-13
MULUGU	**Jul: 10th:** Tadwai Mlg-17, Venkatapuram-15, Eturnagaram-15, Perur-14, Govindaraopet-12; **11th:** Venkatapuram-18; **12th:** Venkatapuram-13; **13th:** Venkatapuram-22, Venkatapur-14; **23rd:** Venkatapuram-23, Tadwai Mlg-12 **Sep: 11th:** Venkatapuram-19, Govindaraopet-15
PEDDAPALLE	**Jul: 10th:** Ramgundam-23, Manthani-16, Peddapalle-13; **13th:** Elagaid-25, Sultanabad-25, Dharmaram-25, Peddapalle-24, Srirampur-20, Julapalle-20, Ramgundam-14; **14th:** Elagaid-20, Dharmaram-17, Sultanabad-15, Srirampur-13, Peddapalle-13 **Sep: 11th:** Peddapalle-13
RAJANNA SIRCILLA	**Jul: 10th:** Gambhiraopet-14; **13th:** Chandurthi-14; **14th:** Boinpalle-13, Chandurthi-12 **Sep: 11th:** Yellareddypeta-19, Mustabad-17, Sirsilla-16, Konaraopeta-15, Boinpalle-13

Kindly refer Appendix-(i)-(iv) in pages 77-78 for description of technical terms

KARIMNAGAR	**Jul: 13th:** Choppadandi-21, Gangadhara-18, Karimnagar-14, Jammikunta-13, **14th:** Gangadhara-21, Choppadandi-14 **Aug: 05th:** Gangadhara-18 **Sep: 11th:** Chigurumamidy-12
JANGAON	**Jul: 23rd:** Devaruppal-24, Kodakandla-19, Jangaon-16, Palakurthi-14, Bachhanpet-13, Narmetta-13, Raghunathpalle-13
M. MALKAJGIRI	**Jul: 23rd:** Dindigul-13, Kukatpally Jntu(arg)-12, Hakimpet Iaf-12
MEDAK	**Jul: 23rd:** Chegunta-23, Medak-19, Medak(arg)-19, Narsapur-17, Kowdipalle-17, Regode-15, Tekmal-15, Ramayampet-15, Papannapet-14, Alladurg-12 **Sep: 11th:** Alladurg-19, Tekmal-17, Papannapet-17, Regode-15
SANGAREDDY	**Jul: 23rd:** Jogipet-15, Hathanoora-15, Narayankhed-13
SIDDIPET	**Jul: 23rd:** Wargal-15, Doultabad-13, Jagadevpur-12
VIKARABAD	**Jul: 26th:** Vikarabad-13 **Aug: 05th:** Pargi-22
WARANGAL_URBAN	**Aug: 03rd:** Hanamkonda-13
MAHBUBNAGAR	**Aug: 16th:** Chinna Chintakunt-15 Sep: **30:** Mahbubnagar-13
Y. BHUVANAGIRI	**Aug: 30th:** Bhuvanagiri-17
JOGULAMBA GADWAL	**Sep: 05th:** Itikyal-12
WARANGAL RURAL	**Sep: 11th:** Shayampet-13, Parkal-12
RAYALASEEMA	
KURNOOL	**Jun: 15th:** Kurnool-14 **Aug: 2nd:** Nandikotkur-13, Jupadu Bungalow-12; **03rd:** Devanakonda-12
YSR	**Jun: 15th:** Proddutur-17, Chapad-12 **Aug: 28th:** Sambepalle-13
ANANTAPURAMU	**Jun: 16th:** Nambulipulikunta-13 **Aug: 01st:** Amarapuram-16; **28th:** Dharmavaram-12
TAMILNADU, PUDUCHERRY & KARAIKAL	
CHENGALPATTU	**Jun: 20th:** West Tambaram ARG-13,
COIMBATORE	**Jul: 06th:** Chinnakalar – 12; **11th:** Chinnakalar – 14; **14th:** Sholayar - 15, Valparai PTO – 13; **15th:** Sholayar – 13 **Aug: 02nd:** Chinnakalar-13, Cincona-12, Sholayar-12; **04th:** Chinnakalar-14, Valparai Taluk Office-12, Valparai PTO-12, Valparai PAP-12; **05th:** Chinnakalar-19, Sholayar-13, Valparai PTO-12; **09th:** Sholayar-12
NILGIRIS	**Jul: 06th:** Upper Bhavani-13; **07th:** Avalanche – 13; **08th :** Avalanche – 12; **12th:** Devala – 12; **13th:** Gudalur Bazar - 18, Upper Gudalur - 16, Devala - 15, Upper Bhavani - 13, Avalanche – 12; **14th:** Gudalur Bazar - 23, Upper Gudalur - 22,

Kindly refer Appendix-(i)-(iv) in pages 77-78 for description of technical terms

	Avalanche - 19, Upper Bhavani - 18, Devala - 16, Naduvattam - 15, Pandalur Taluk Office – 12; **15th:** Upper Bhavani - 32, Avalanche - 32, Gudalur Bazar - 17, Upper Gudalur – 16; **16th:** Avalanche – 17; **Aug: 05th:** Avalanche-20, Devala-18, Naduvattam-15, Upper Bhavani-14; **06th:** Avalanche-32, Upper Bhavani-20, Office Pandalur-14; **08th:** Avalanche-19, Upper Bhavani-19, Devala-19, Gudalur Bazar-19, Pandalur Taluk Office-19, Upper Gudalur-18; **09th:** Upper Bhavani-22, Avalanche-19, G Bazar-17; **10th:** Gudalur Bazar-14; **11th:** Naduvattam-13; **12th:** Naduvattam-13; **Sep: 11th:** Pandalur - 14, Devala-13; **12th:** Pandalur -16, **13th:** Pandalur -17, Devala – 12
PUDUKKOTTAI	**Jul: 20th:** Kudimiyanmalai - 14
MADURAI	**Jul: 21st:** Kallandri – 12 **Aug: 01st:** Usilampatti–23
NAMAKKAL	**Jul: 22nd:** Rasipuram-13
SALEM	**Jul: 22nd:** Danishpet – 17, Edapadi – 15, Omalur – 12
THANJAVUR	**Jul: 22nd:** Budalur – 17, Echanviduthi – 16; **26th:** Lower Anaicut – 13 **Sep: 26th:** Budalur – 17; Grand Anaicut-15, Thanjavur-12, Vallam-12, Neivasal Thenpathi-12
CUDDALORE	**Jul: 26th:** Kattumannarkoil – 12
KALLAKURICHI	**Jul: 27th:** Moongilthuraipattu - 13, Ulundurpet – 12
THENI	**Jul: 30th:** Periyakulam - 15
NAGAPATTINAM	**Aug: 23rd:** Velankanni-13 **Sep: 01st:** Thirukuvalai– 13,
RANIPET	**Aug:27th:** Sholingur-14
DINDIGUL	**Aug: 31th:** Kodaikanal DRMS-23, Kodaikanal-17, Boat Club-17
TIRUCHIRAPPALLI	**Sep: 26th:** Trichy Town-17
COASTAL KARNATAKA	
UTTARA KANNADA	**Jun: 22nd:** Karwar-16, Shirali-13, Kumta-13; **24th:** Honavar-15; **29th:** Manki-12; **30th:** Shirali Pto-20, Ankola-12 **Jul: 01st:** Shirali Pto-16, Gokarna-15; **02nd:** Nilkund ARG-17; **04th:** Gersoppa-13; **05th:** Castle Rock-26, Shirali-14, Gerusoppa-14, Kadra-12; **06th:** Castle Rock-25, Siddapur-15, Ankola-15, Basagod-14, Gersoppa-13, Janmane-12; **07th:** Yellapur-12, Shirali-12,, Kumta-12, Manki-12, Honavar-12; **08th:**Shirali-23, Karwar-21, Honavar-21, Castle Rock-18, Manki-18, Ankola-18, Gersoppa-17, Belikeri-17, Nilkund Arg-16, Gokarna-16, Kumta-15, Basagod-15, Kadra-14; **10th:** Castle Rock-19; **11th:** Castle Rock-15; **12th:** Castle Rock-17; **13th:** Castle Rock-13; **14th:** Castle Rock-14; **16th:** Castle Rock-15, Gersoppa-13, Honavar-12; **17th:** Castle Rock-23, Gersoppa-18, Manki-13, Kadra-13, Karwar-12, Ankola-12

Kindly refer Appendix-(i)-(iv) in pages 77-78 for description of technical terms

	Aug: 02nd: Shirali Pto-29; **06th:** Gokarna-16, Ankola-16, Nilkund Arg-15, Karwar-15, Belikeri-13, Honavar-13, Gersoppa-13, Kumta-13; **08th:** Castle Rock-13, Jagalbet-13; **09th:** Castle Rock-19; **10th:** Siddapur-13; **11th:** Siddapur-12; **12th:** Castle Rock-15 **Sep: 10th:** Castle Rock-12; **12th:** Castle Rock-17, Kumta-15; **13th:** Castle Rock-13
UDUPI	**Jun: 29th:** Karkala-15, Kota-13; **30th:** Kundapur-12 **Jul: 01st:** Kota-15; **05th:** Siddapura-19, Kota-15, Karkala-14, Kundapura-13, Kollur-12; **06th:** Karkala-14, Siddapura-13, Kollur-12; **07th:** Kollur-21, Siddapura-18; **08th:** Kollur-17, Kundapur-16, Karkala-15, -14; **09th:** Karkala-15, Kota-14, Siddapura-13; **10th:** Karkala-13; **11th:** Kota-12; **12th:** Siddapura-12; **14th:** Siddapura-12; **16th:** Siddapura Arg-12, Kundapur-12; **17th:** Karkala-12 **Aug: 06th:** Kollur-14, Udupi-13; **07th:** Kollur-16; **09th:** Kollur-19
DAKSHINA KANNADA	**Jun: 30th:** Panambur Obsy-18, Mangaluru Ap Obsy-13 **Jul: 01st:** Mulki-20, Panambur Obsy-14; **02nd:** Sulya-13, Mangaluru Ap Obsy-12, Mani-12; **05th:** Mani-16, Mangalore Airport-15, Puttur-15, Subramanya-15, Mangalore-13, Panambur-13, Mulki-12; **06th:** Mulki-20, Belthangadi-18, Subramanya-16, Dharmasthala-14, Mudubidre-14, Sulya-13, Mani-13; **07th:** Subramanya-14; **08th:** Mulki-22, Belthangadi-13; **09th:** Mulki-19, Mudibidre-13; **10th:** Subramanya-21, Mulki-20, Mudubidre-18, Belthangadi-18, Dharmasthala-17, Mani-16, Sulya-13, Mangaluru Airport-12, Puttur-12; **11th:** Subramanya-16; **12th:** Subramanya-13; **17th:** Mulki-16; **18th:** Subramanya-16; **30th:** Panambur; **Aug: 02nd:** Subramanya-22; **03rd:** Subramanya-17; **23rd:** Mani-16, Mulki-15; **28th:** Panambur-17, Subramanya-14
NORTH INTERIOR KARNATAKA	
BELAGAVI	**Jul: 05th:** Londa-12; **10th:** Londa-13
VIJAYAPURA	**Aug: 05th:** Bableshwar-13
RAICHUR	**Aug: 27th:** Manvi-19
BAGALKOTE	**Sep: 06th:** Lokapur-16, Badami-12
DHARWAD	**Sep: 06th:** Annigere-15
GADAG	**Sep: 06th:** Gadag-12
HAVERI	**Sep: 07th:** Guttal-15
SOUTH INTERIOR KARNATAKA	
KODAGU	**Jul:02nd:** Sampaje-15;**03rd:** Bhagamandala-16; **05th:** Bhagamandala-12; **06th:** Bhagamandala-14; **07th:** Bhagamandala-12; **10th:** Bhagamandala-17; **11th:** Bhagamandala-13; **12th:** Somwarpet-12; **14th:** Bhagamandala-19, Somwarpet-12; **15th:** Bhagamandala-20, Hudakere-12; **17th:** Bhagamandala-14 **Aug: 02nd:** Bhagamandala-12; **04th:** Napoklu-12; **05th:** Bhagamandala, Napoklu-13; **06th:** Bhagamandala-13, Murnadu-12; **07th:** Bhagamandala; **08th:** Bhagamandala-18, Napoklu-14; **12th:** Napoklu-15, Bhagamandala-14; **23rd:** Bhagamandala-12; **29th:**

Kindly refer Appendix-(i)-(iv) in pages 77-78 for description of technical terms

	Bhagamandala-21 **Sep: 02nd:** Harangi-13
CHIKKAMAGALURU	**Jul: 03rd:** Sringeri Hms-14, Jayapura-12; **04th:** Kottigehara-13, Sringeri Hms-13; **05th:** Sringeri-12, Koppa-12; **06th:** Koppa-15; **07th:** Koppa-15, Sringeri Hms-13; **08th:** Sringeri-12; **09th:** Sringeri-14; **10th:** Jayapura-17, Kottigehara-15, Sringeri-12; **12th:** Koppa-17; **13th:** Sringeri Hms-13; **14th:** Kottigehara-15, Sringeri-13, Kalasa-13, Koppa-13; **15th:** Kottigehara-24; **16th:** Kottigehara-14 **Aug: 05th:** Kottigehara-13; **06th:** Kottigehara-21, Sringeri Hms-12; **09th:** Kottigehara-19, Kalasa-12; **11th:** Kottigehara-24; **12th:** Kottigehara-14 **Sep: 07th:** Ajjampura-12; **12th:** Kottigehara-15
SHIVAMOGGA	**Jul: 04th:** Tumri-17; **05th:** Tumri-18; **06th:** Linganamakki Hms-12; **07th:** Hosanagar-31, Tumri-17, Linganamakki Hms-16, Agarahara Konanduru-13; **08th:** Linganamakki Hms-13; **09th:** Tumari-13; **10th:** Hosanagar-47, **11th:** Linganamakki Hms-13; **12th:** Linganamakki Hms-13; **13th:** Agarahara Konanduru-16; **17th:** Linganamakki-12 **Aug: 02nd:** Linganamakki Hms, Tyagarthi-12; **09th:** Hunchadakatte-13; **11th:** Linganamakki Hms-13; **30th:** Bhadravathi-13 **Sep: 01st:** Anavatti-18
HASSAN	**Jul: 15th:** Sakleshpura-13
TUMAKURU	**Jul: 28th:** Kibbanahalli-12 **Aug: 03rd:** Koratagere-13, Y N Hoskote-12; **30th:** Madhugiri-12
MANDYA	**Aug: 02nd:** Basaralu-15, Mandya Pto-14, Pandavapura-13; **30th:** Maddur-14
BENGALURU RURAL	**Aug: 30th:** Devanahalli-12 **Sep: 04th:** Bengaluru city -13, Nelamangala-13; **05th:** Bengaluru HAL Airport-12
CHITRADURGA	**Aug: 30th:** Durga-13
CHAMARAJANAGAR	**Sep: 05th:** Begur-12
KERALA & MAHE	
KOZHIKODE	**Jun: 01st:** Kozhikode-13; **06th:** Kakkayam AWS-13 **Jul: 03rd:** Kakkayam AWS-13; **04th:** Kakkayam AWS-12; **15th:** Peruvannamuzhi ARG-18; **16th:** Peruvannamuzhi ARG-16 **Sep: 01st:** Vadakara-12
PATHANAMTHITTA	**Jun: 06th:** Kurudamannil-13, Kunnamthanam Aws-12, Vazhakunnam Aws-12 **Aug: 29th:** Kurudamannil-15, Vazhakunnam-15, Kunnamthanam-13
KASARAGOD	**Jul: 04th:** Kudulu-13; **04th:** Vellarikkundu AWS-15, Hosdurg-13; **07th:** Vellarikkundu AWS-14; **09th:** Kudulu-12; **10th:** Vellarikkundu AWS-14 **Aug: 23rd:** Hosdurg-16
WAYANAD	**Jul: 10th:** Padinjarathara Dam-12; **12th:** Padinjarathara Dam AWS-12; **14th:** Padinjarathara Dam AWS-16, Mananthavady-14; **15th:** Padinjarathara Dam AWS-13 **Aug: 2nd:** Ambalavayal-15; **09th:** Mananthavady-16
KOTTAYAM	**Aug: 02nd:** Kozha-13; **30th:** Kumarakom-15, KUMARAKOM_AFMU-15

Kindly refer Appendix-(i)-(iv) in pages 77-78 for description of technical terms

THRISSUR	**Aug: 02nd:** Enamakkal-23, Kodungallur-21, Chalakkudy-21, Vilangankunnu ARG-15, Vellanikkara-13 **Sep: 06th:** Chalakkudy-14
ERNAKULAM	**Aug: 2nd:** C.I.A.L. Kochi-21, Aluva-18, Neryamangalam ARG-17, Piravam-15, Ernakulam South, Perumbavur-15, NAS Kochi-14, Muvattupuzha ARG-14; **04th:** Vellanikkara-13, Chalakkudy-13, Enamakkal-13; **30th:** Ernakulam South-14
IDUKKI	**Aug: 2nd:** Peerumedu-15; **04th:** Peerumedu-14; **05th:** Idukki-16, Munnar-15 **Sep: 06th:** Peerumedu-12, Thodupuzha-12
PALAKKAD	**Aug: 02nd:** Kollengode-15, Chittur-13 **Sep: 01st:** Palakkad-17, Palakkad-15, Mannarkkad-13
KOLLAM	**Aug: 04th:** Aryankavu-14
KANNUR	**Aug: 07th:** Mattannur-12; **23rd:** Thalassery-12
ALAPPUZHA	**Aug: 30th:** Mancompu-20
LAKSHADWEEP	
	Sep: 01st: Agathi-12; **02nd:** Minicoy-13; **06th:** Agathi-19

In the seasonal scale, TN experienced 75 days of *isolated heavy* rainfall activity out of which 29 days were with *isolated very heavy* rainfall events including 5 days of *isolated extremely heavy* rainfall events. Over CK, SIK & TEL, there were 70, 70 and 68 days of *isolated heavy* rainfall activity out of which 34, 36 & 29 days respectively of *isolated very heavy* rainfall events including 7, 4 & 6 days respectively of *isolated extremely heavy* rainfall events. KER, CAP & NIK experienced 56, 55 & 48 days respectively of *isolated heavy* rainfall activity including 24, 11 & 6 days respectively of *isolated very heavy* rainfall events with 1 & 2 days of *isolated extremely heavy* rainfall over KER & CAP respectively. RYS &LAK experienced 29 & 8 days respectively of *isolated heavy* rainfall activity including 6 & 3 days of *very 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 28 days of *heavy* rainfall events over TN and 20-22 days over CK, SIK, TEL & KER. CK, SIK & KER reported *heavy* rainfall events on at least 50% of the days (15 days & more) during the first three months of the season.

Kindly refer Appendix-(i)-(iv) in pages 77-78 for description of technical terms

3.6 District-wise seasonal rainfall distribution

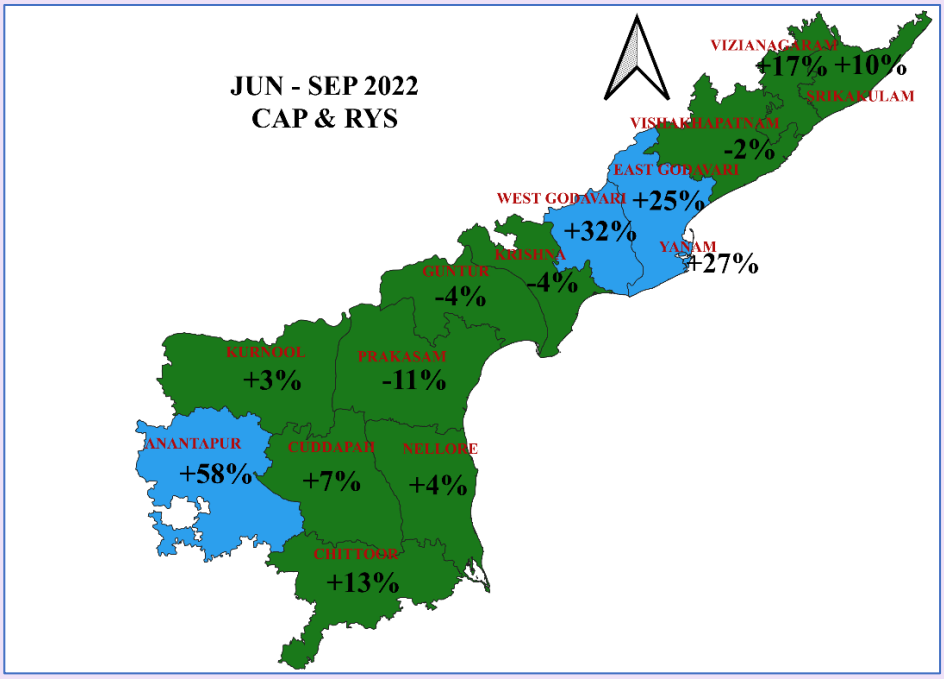
Table -3.6 presents the district rainfall distribution as percentage departures from normal over the nine meteorological subdivisions of the SP region during the period Jun-Sep 2022 and Fig.3(iii), the district-wise seasonal rainfall over the various states and UTs over the SP region.

Table-3.6: District rainfall performance over various sub-divisions of the SP region during June-September 2022

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	3	7	0	0
TELANGANA	33	10	19	4	0	0
RAYALASEEMA	4	0	1	3	0	0
TAMILNADU, PDC & KKL	40	11	16	9	4	0
COASTAL KARNATAKA	3	0	0	0	3	0
NORTH INTERIOR KARNATAKA	11	0	2	5	4	0
SOUTH INTERIOR KARNATAKA	16	7	2	4	1	2
KERALA & MAHE	15	0	0	12	3	0
LAKSHADWEEP	1	0	1	0	0	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], 116 districts received *normal to large excess* rainfall and 17 districts came under *deficient- largely deficient* category (TN & NIK- 4 each & CK, SIK & KER– 3 each) during the season. *Excess - large excess* rainfall was realized in about 88% (29/33) of the districts in TEL, 68% in TN (27/40), 56% in SIK (9/16), 30% & 25% in CAP & RYS respectively. None of the districts in CK & KER received *excess / large excess* rainfall during the season.

Kindly refer Appendix-(i)-(iv) in pages 77-78 for description of technical terms



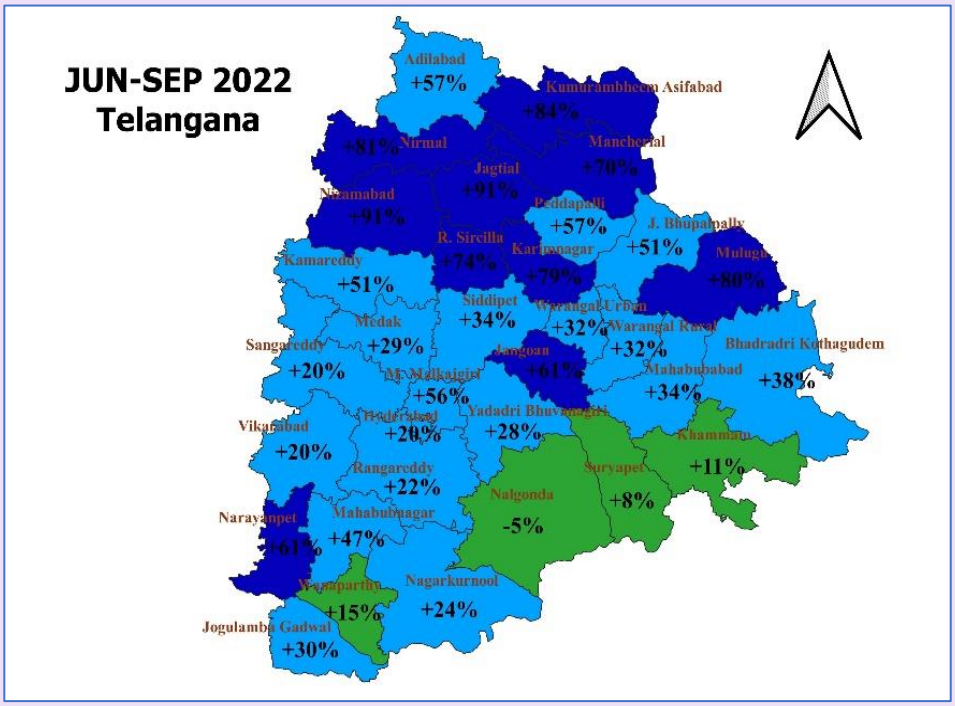


Fig.3(iii): District-wise rainfall (as percentage departure from normal) during Jun-Sep 2022 over various states and UTs in the SP region

Kindly refer Appendix-(i)-(iv) in pages 77-78 for description of technical terms

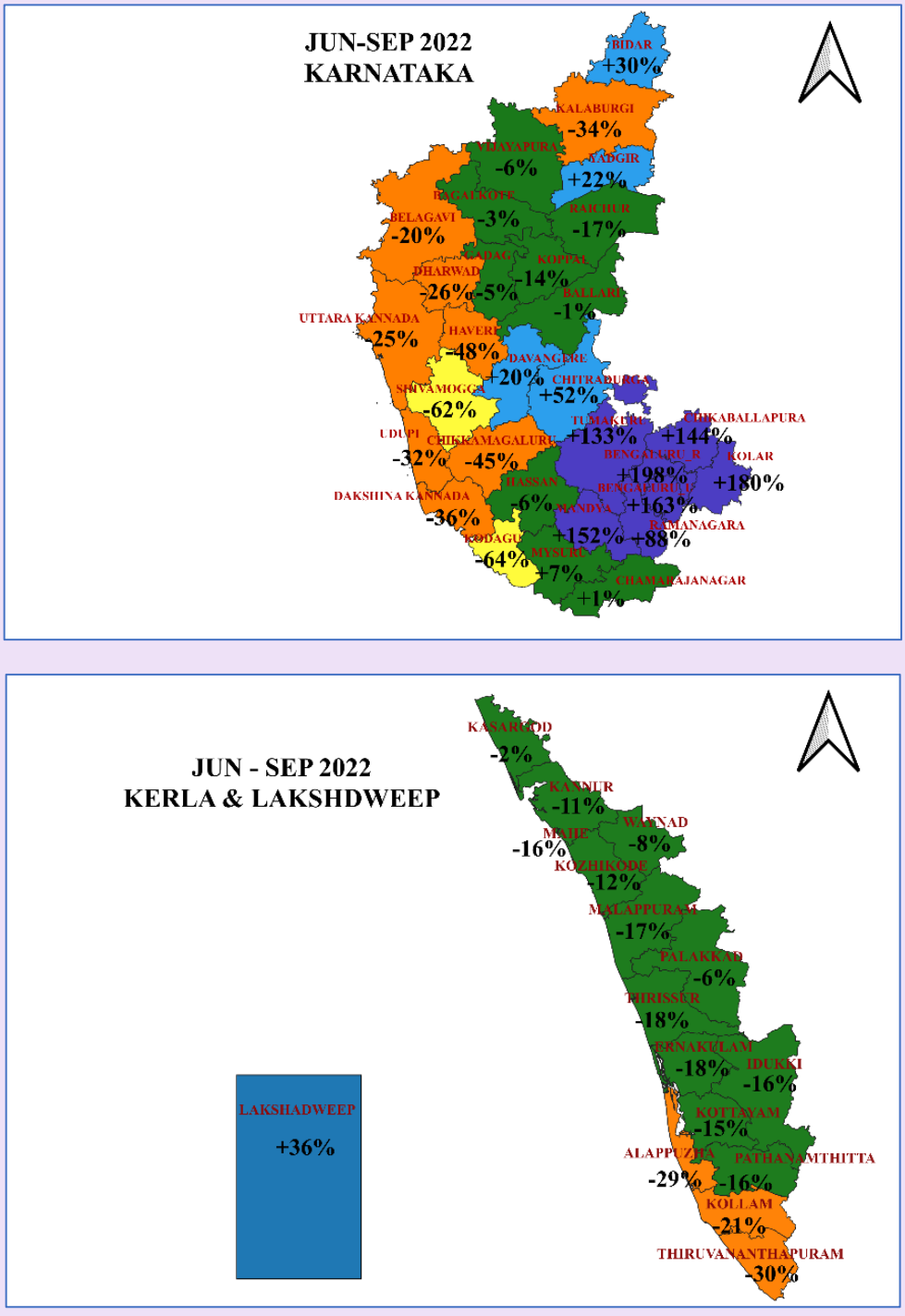


Fig.3(iii): contd.

Kindly refer Appendix-(i)-(iv) in pages 77-78 for description of technical terms

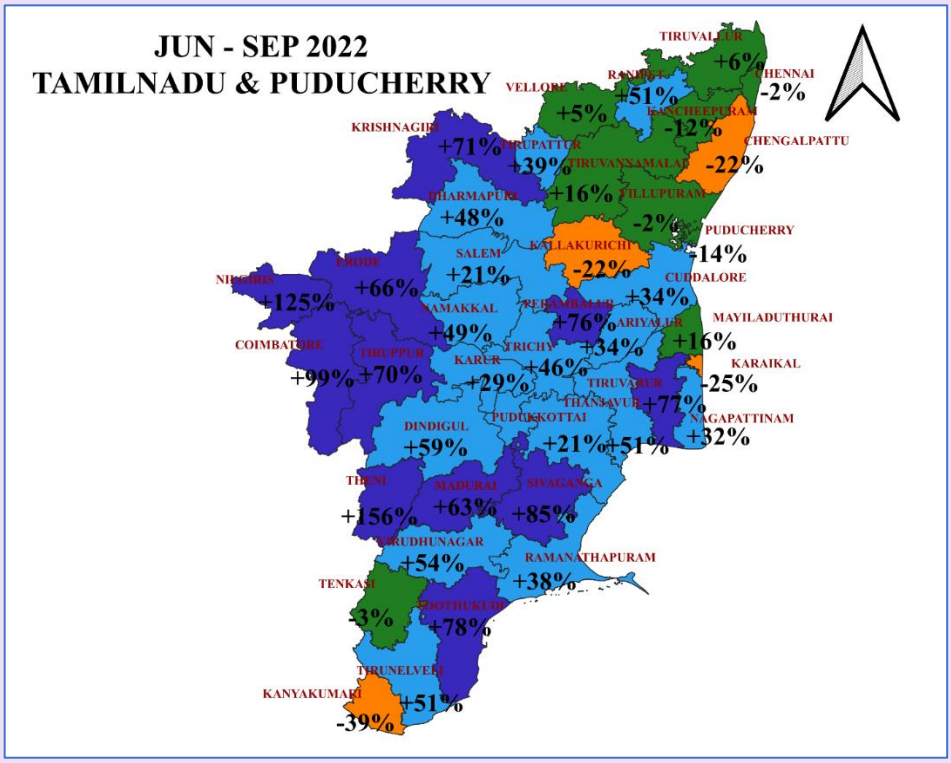


Fig.3(iii): contd.

Kindly refer Appendix-(i)-(iv) in pages 77-78 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 2022 are depicted in Fig.3(iv). The SPI indicated generally wet conditions (*mildly/moderately/severely/extremely wet* category) over 109 out of 133 districts in the SP region at the end of the season and generally dry (*mildly/moderately/severely/extremely dry* category) conditions prevailed over 24 districts in the region.

35 districts came under *severely-extremely wet* category and 74 districts under *mildly-moderately* wet category. *Extremely wet* conditions prevailed over 19 districts [SIK: 12 (Haveri, Davangare, Chitradurga, Chikkamagaluru, Tumakuru, Chikkaballapura, Kolar, Bangalore (Urban & Rural), Chamrajnagar, Mandya, Mysuru), TEL: 5 (Nirmal, Kumaram Bheem, Nizamabad, Jagtial & Mancherial) and TN:2 (Nilgiris & Sivagangai)] and 16 districts came under *severely wet* category [SIK:3 (Ballari, Gadag & Ramanagara), TEL: 6 (Rajanna Sircilla, Karimnagar, Peddapalli, J.Bhupalpally, Jangaon & Mahabubnagar), TN: 6 (Coimbatore, Theni, Madurai, Thootukudi, Tiruvarur & Krishnagiri) and RYS:1 (Anantapur)].

All the 14 districts in Kerala, Mahe, Udupi (DK), Shivamogga (SIK), Belagavi (NIK), Kancheepuram, Chengalpattu & Kanyakumari (TN), Guntur, Prakasam & Visakhapatnam (CAP) became *mildly-severely* dry. Alappuzha (KER) came under *severely dry* category and Kollam (KER), Shivamogga (SIK) and Kanyakumari (TN) districts came under *moderately* dry category.

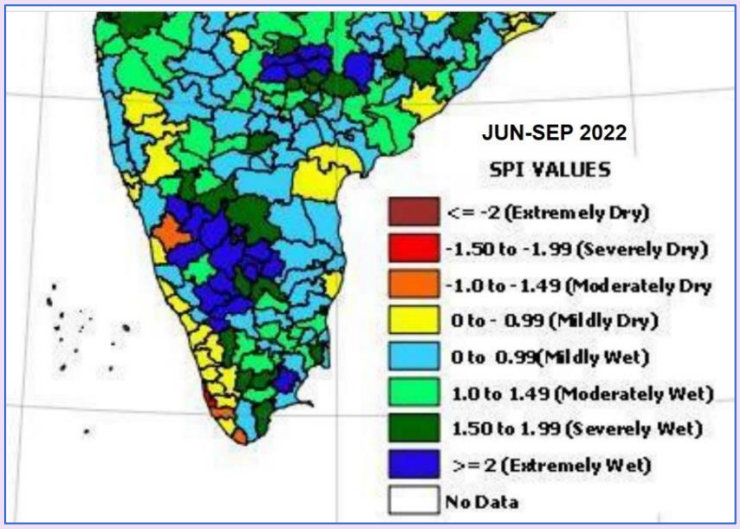


Fig.3(iv): Standardised Precipitation Index (SPI) over the SP region for Jun-Sep 2022
(Source: Climate Diagnostic Bulletin of India, IMD Pune**)**

Kindly refer Appendix-(i)-(iv) in pages 77-78 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 2022, generally *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 the western hemisphere during most part of June and moved to phase -3 during the last week of June only. It moved to phase-4 during the first week of July. Thereafter, but for the third week of July and last ten days of August when it was on Phase-1 & phase-2 respectively, it was insignificant, throughout the season and hence did not contribute much towards the monsoon activity (Fig.4.1).

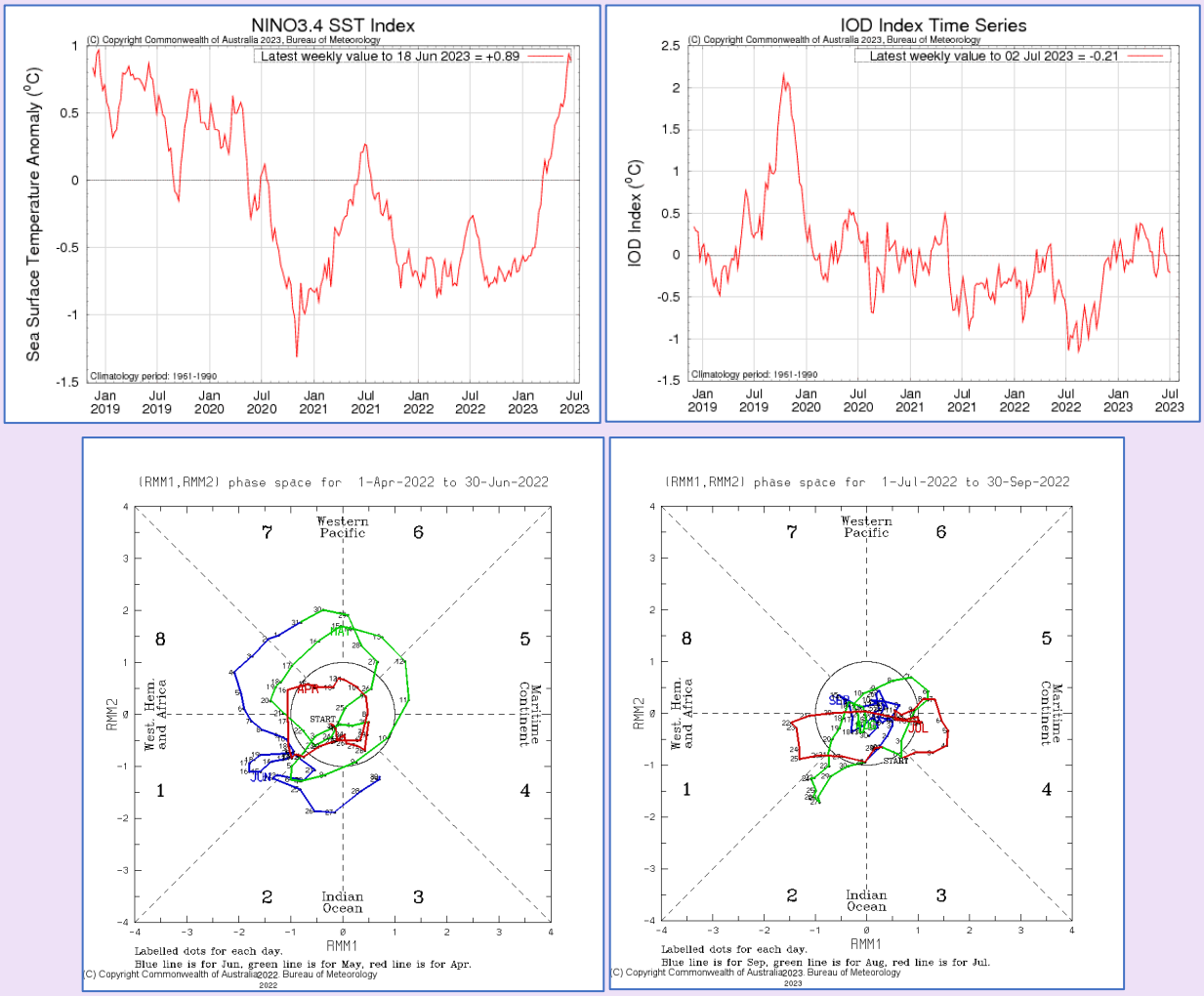


Fig.4.1: Times series of Nino 3.4 SST anomalies, IOD and MJO during the SWM 2022

Kindly refer Appendix-(i)-(iv) in pages 77-78 for description of technical terms

Flow pattern over the Indian region*:* Fig.4.2(a-d) depict the 850, 500 and 250 hPa wind anomaly during the months of June, July, August and September 2022.

It is observed that in June, anomalous easterlies prevailed in the lower -mid tropospheric levels (850–500 hPa levels) over the SP region. Also, at 500 hPa level, anomalous westerly trough was observed over Pakistan and adjoining northwest India and in the upper troposphere (250 hPa level) anomalous cyclonic circulation prevailed over Afghanistan, Pakistan and adjoining northwest India.

In July, anomalous easterlies prevailed over the head Bay of Bengal and most parts of northern India in the lower-mid tropospheric levels. Anomalous cyclonic circulation to the northwest of Indian region leading to anomalous northeasterlies over extreme north and northwest India was observed in the in the upper troposphere.

In August, in the lower tropospheric levels, anomalous easterlies were observed over Bay of Bengal and anomalous easterlies / southeasterlies over the Indian region. Anomalous easterlies were observed upto the mid tropospheric levels over the northern parts of India. Anomalous cyclonic circulation prevailed over the central & north Arabian Sea in the mid tropospheric levels. In the upper levels, stronger than normal anticyclone was observed over the Tibetan and adjoining region.

In September, stronger than normal easterlies continued to prevail over the Bay of Bengal in the lower levels. Anomalous easterlies were observed over the extreme southern peninsula in the upper troposphere.

Kindly refer Appendix-(i)-(iv) in pages 77-78 for description of technical terms

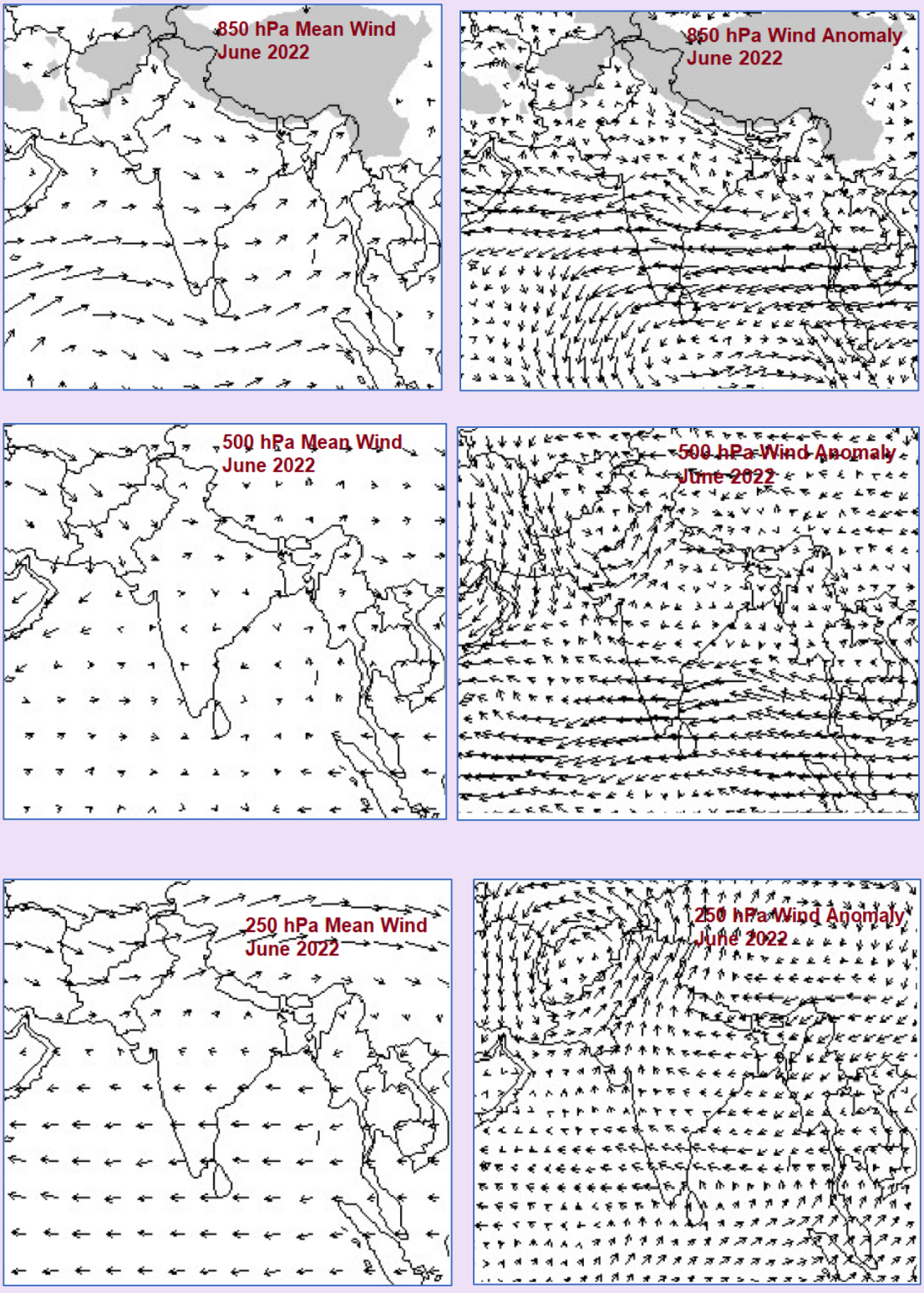


Fig.4.2a: 850hPa, 500hPa & 250hPa wind anomalies over Indian region during June 2022
(Source: Climate Diagnostic Bulletin of India, IMD Pune)

Kindly refer Appendix-(i)-(iv) in pages 77-78 for description of technical terms

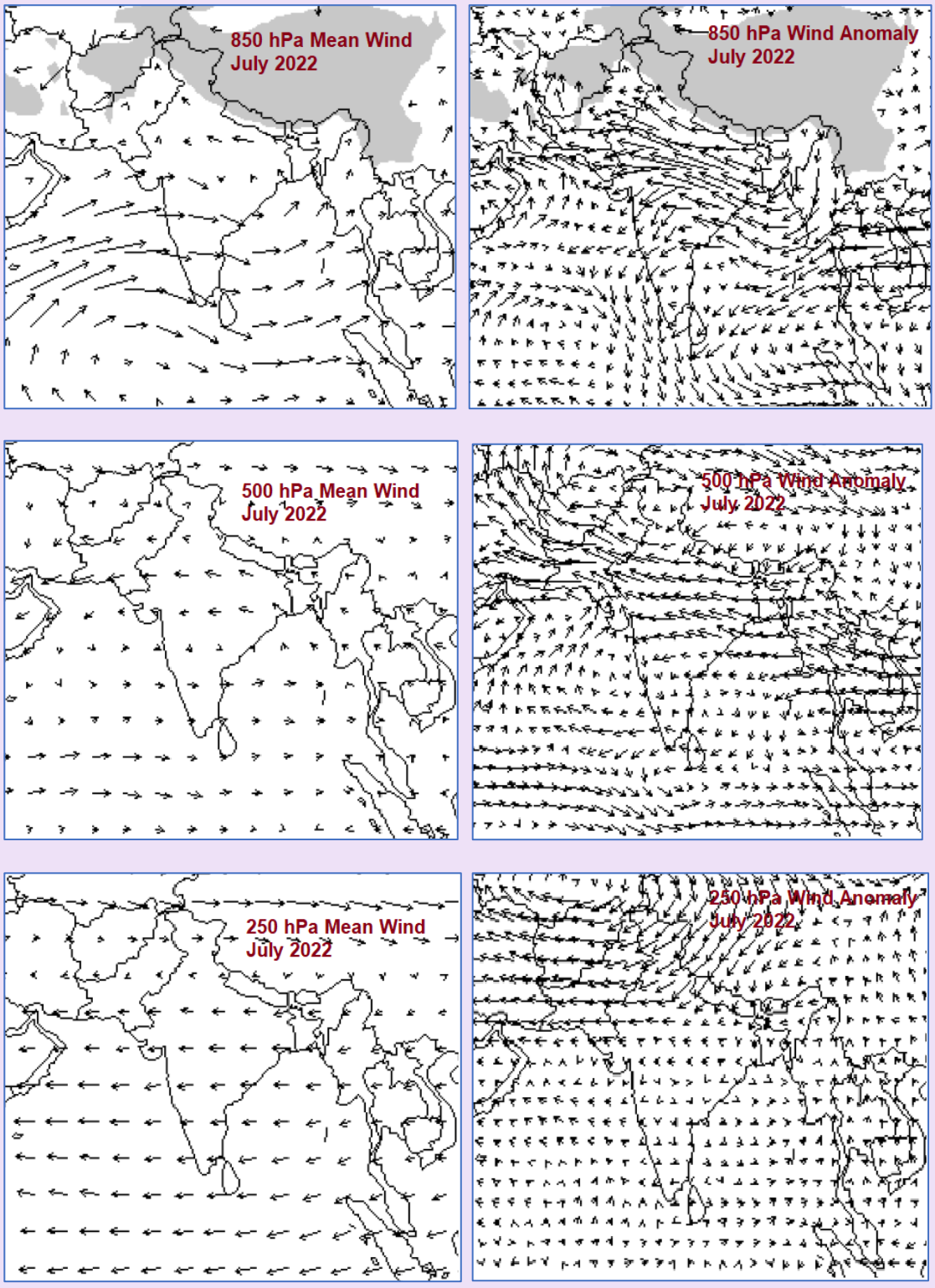


Fig.4.2b: 850hPa, 500hPa & 250hPa wind anomalies over Indian region during July 2022
(Source: Climate Diagnostic Bulletin of India, IMD Pune)

Kindly refer Appendix-(i)-(iv) in pages 77-78 for description of technical terms

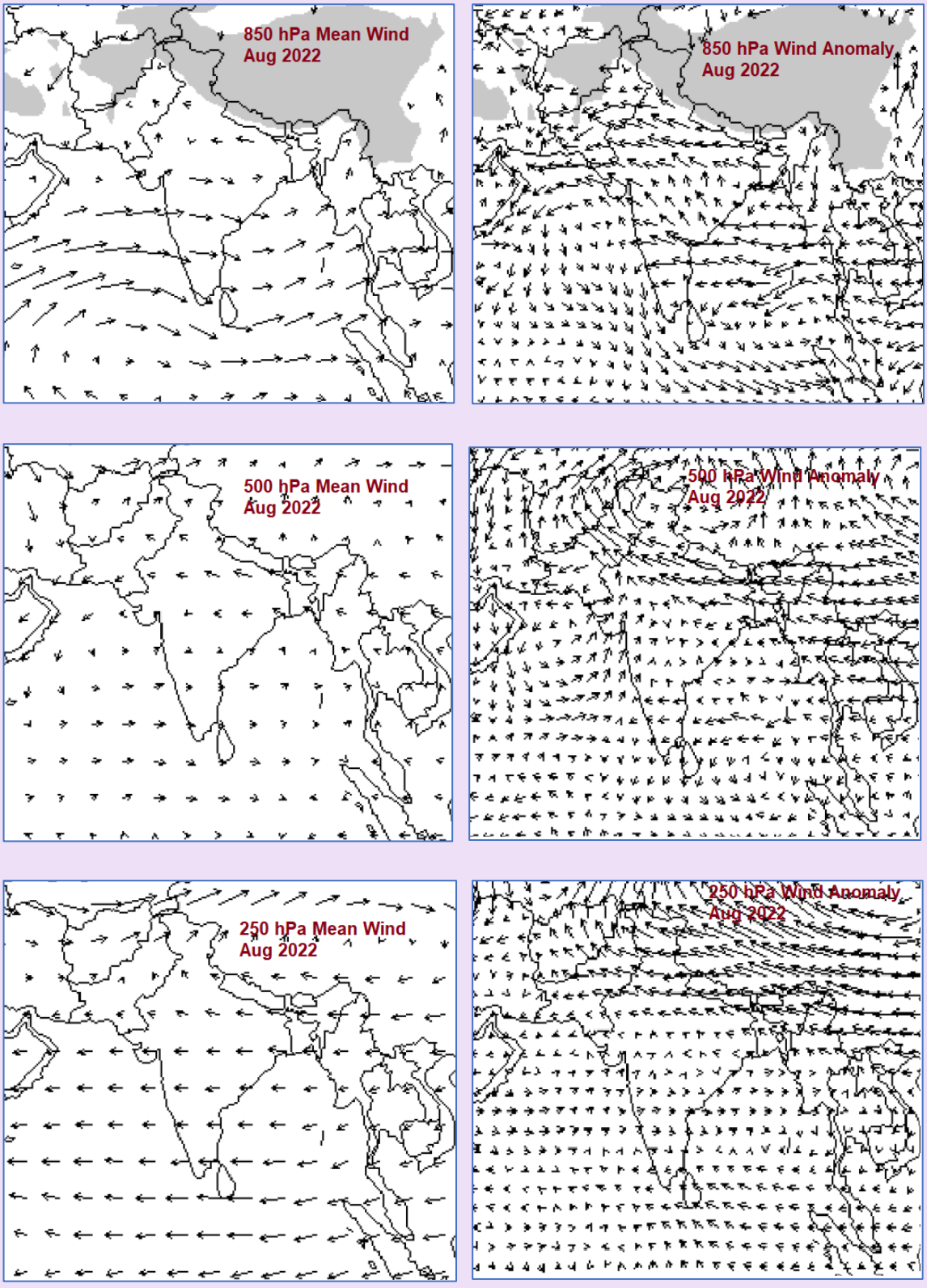


Fig.4.2c: 850hPa, 500hPa & 250hPa wind anomalies over Indian region during Aug 2022
(Source: Climate Diagnostic Bulletin of India, IMD Pune)

Kindly refer Appendix-(i)-(iv) in pages 77-78 for description of technical terms

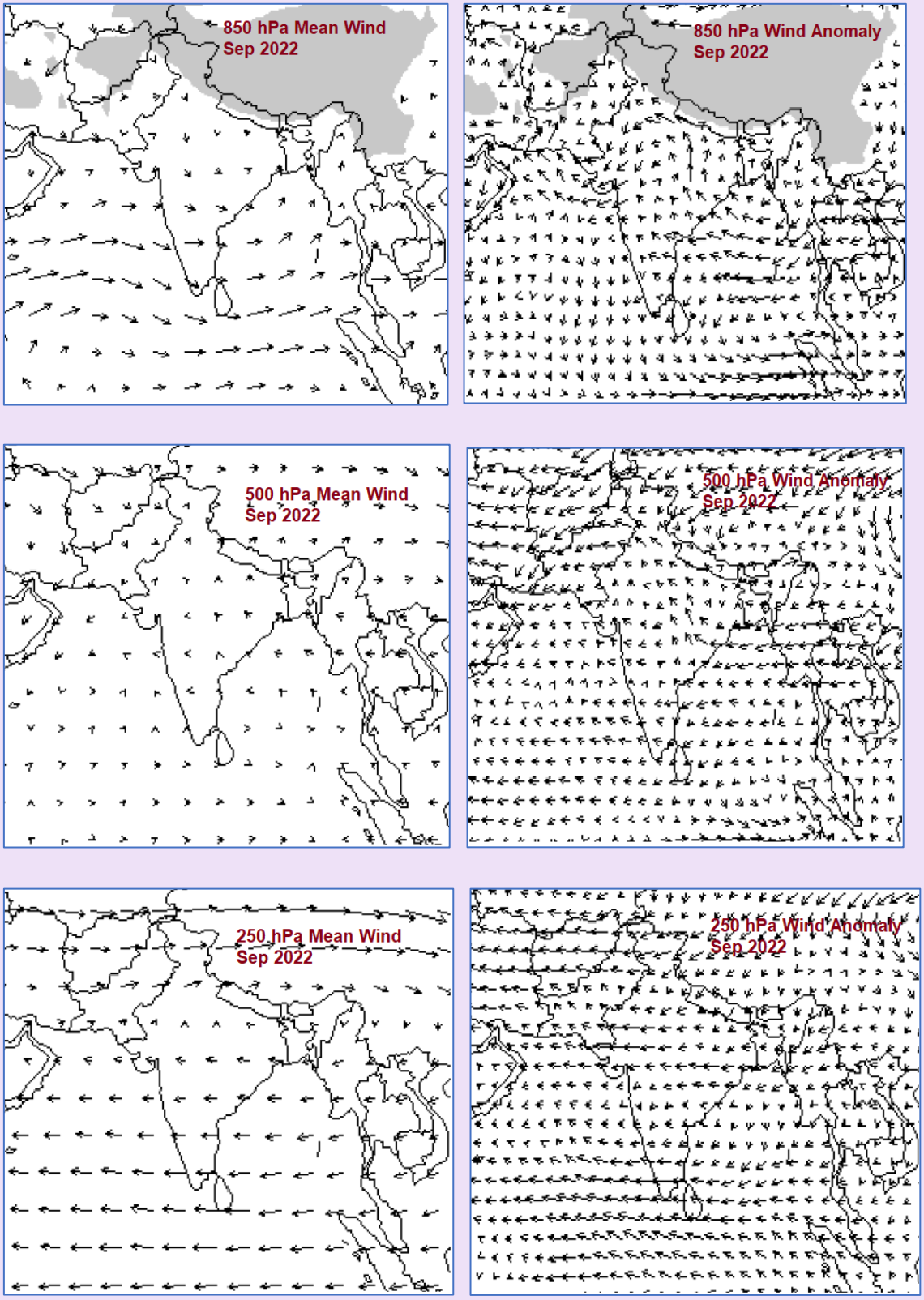


Fig.4.2d: 850hPa, 500hPa & 250hPa wind anomalies over Indian region during Sep 2022
(Source: Climate Diagnostic Bulletin of India, IMD Pune)

Kindly refer Appendix-(i)-(iv) in pages 77-78 for description of technical terms

5. Withdrawal of SWM 2022 from the SP region

The withdrawal of SWM 2022 commenced from the northwest India on 20th September, a delay by about 03 days (normal date – 17th September). It withdrew from the SP region during 21st-23rd October 2022 and hence from the entire country on 23rd October 2022. Fig.5 depicts the isolines of dates of withdrawal of SWM 2022 from the SP region.

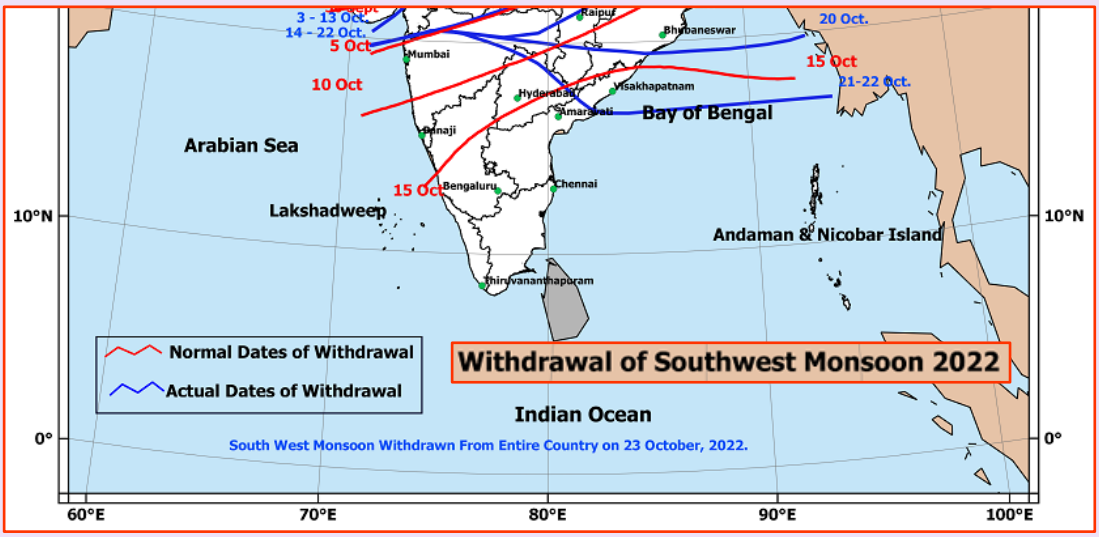


Fig.5: Isolines of dates of withdrawal of SWM 2022 over the SP region

6. Summary

During 2022, southwest monsoon (SWM) advanced over Andaman Sea on 16th May, six days ahead of its normal date of 22nd May. It set in over Kerala on 29th May, covered the entire southern peninsular India (SP) by 20th June and the entire country by 02nd July. All India southwest monsoon seasonal rainfall during Jun-Sep, 2022 was *normal*. It was 93.0 cm and 106% of Long Period Average (LPA) of 87.0 cm.

South Peninsular region recorded *above normal* rainfall of 122% of LPA. All the nine subdivisions in the region received *normal to excess* rainfall during the SWM season - Coastal Andhra Pradesh & Yanam (CAP): +6%, Telangana (TEL): +46%, Rayalaseema (RYS): +19%, Tamilnadu-Puducherry-Karaikal (TN): +45%, Coastal Karnataka (CK): +5%, North Interior Karnataka (NIK): +35%, South Interior Karnataka (SIK): +49%, Kerala & Mahe (KER): -14% and Lakshadweep (LAK): +36%].

Kindly refer Appendix-(i)-(iv) in pages 77-78 for description of technical terms

During the season, under the influence of westward moving low pressure systems that formed over the Bay of Bengal / upper air cyclonic circulations over the southern peninsula / off shore trough / east-west shear zone across peninsular India / north-south trough over the southern peninsula, *fairly widespread* to *widespread* rainfall occurred over CK on about 87% of the days, over KER & LAK on about 70-75% of the days and over SIK, NIK & TEL on about 40-55% of the days. There were *isolated heavy* rainfall activities on 77 days over SIK, 75 days over TN, 69 days over TEL, 68 days over CK, 57 days over KER, 56 days over CAP, 41 days over NIK, 30 days over NIK & 8 days over LAK area during the season. *Isolated extremely heavy* rainfall occurred over CK on 07 days, TEL: 06 days, SIK & TN: 05 days each, CAP: 02 days & KER: 01 day during the season. Hosanagar (Shivamogga district) in Karnataka recorded the highest daily rainfall amount of 467.8 mm over the southern region on 10th July followed by Jainoor (Kumaram Bheem district) in TEL: 391.0 mm, on 13th July 2022 during the season. The SWM withdrew from the SP region during 21st-23rd October and hence from the entire country on 23rd October 2022.

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 77-78 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 77-78 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 77-78 for description of technical terms