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Weather in India

HOT WEATHER SEASON (March-May 2024)†

1. Chief features

(*i*) In the Hot weather season of 2024, only one intense low-pressure system, severe Cyclonic storm, "Remal," formed over the Bay of Bengal during the season from 24-28 May. Along with this severe cyclonic storm, a low-pressure area formed over the Arabian Sea on 23-24 May.

(*ii*) The hot weather season 2024 with reference to severe *heat wave/heat wave** conditions was mild but began in the last week of March continued to first week of April and again appeared during last week of April. In the month of May, the heat wave/severe heat wave conditions were observed over northwest, central India and eastern parts of India.

(*iii*) The seasonal rainfall over homogenous region of central India was excess while the country as a whole and remaining three regions recorded normal rainfall. Rainfall for all the months (March to May) for the country was normal to above normal except some sub-divisions from the south peninsula and northwest India where it was deficient.

(*iv*) Thunderstorms/hailstorms were frequent throughout the season over the country.

(*v*) Monsoon advanced into some parts of the Maldives & Comorin area and some parts of the South Bay of Bengal, Nicobar Islands, and South Andaman Sea on 19 May, 2024. It reached Kerala on 30 May, two days prior to its normal date, *i.e.*, 1 June.

2. Seasonal rainfall

The sub-division wise rainfall and its departure from normal for each month and season as a whole are given in Table 1. The sub-divisional rainfall departures for the season March-May 2024 are also depicted in Fig. 1 and chief amounts of rainfall are given in Table 5.

(* *Definitions of terms in italics (other than subtitles) are given in Appendix*).

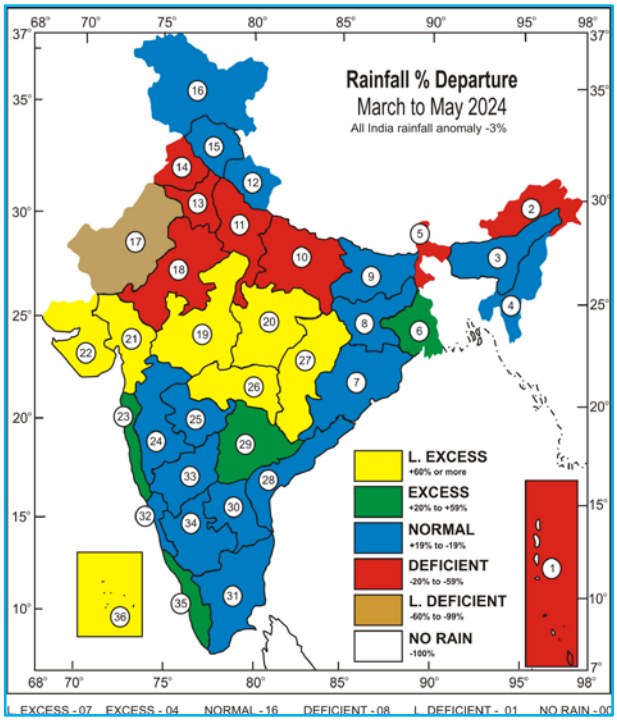

Fig. 1. Sub-divisional rainfall percentage departures (based on Operational data) for the season Mar-May, 2024. Sub-divisions are indicated by number on the map & bold letters in legend. The rainfall anomaly values for these 36 sub-divisions are indicated below :

1	**-29**	7	**6**	13	**-43**	19	**120**	25	**14**	31	**14**
2	**-23**	8	**3**	14	**-39**	20	**124**	26	**234**	32	**18**
3	**-18**	9	**-1**	15	**-8**	21	**93**	27	**122**	33	**16**
4	**-14**	10	**-48**	16	**-9**	22	**352**	28	**-8**	34	**18**
5	**-32**	11	**-21**	17	**-60**	23	**25**	29	**28**	35	**39**
6	**32**	12	**-19**	18	**-45**	24	**8**	30	**13**	36	**81**

Rainfall realized during the Pre-monsoon season was 97% of its Long Period Average (LPA). It was 96% of its LPA, 82% of its LPA and 108% of its LPA during March, April and May respectively. During the Pre-monsoon season, out of 36 meteorological subdivisions, 7 received

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TABLE 1

Sub-division rainfall (mm) for each month and season as a whole (March-May, 2024)

S. No.	Meteorological Sub-divisions	March			April			May			Season		
		Actual (mm)	Normal (mm)	Dep. (%)	Actual (mm)	Normal (mm)	Dep. (%)	Actual (mm)	Normal (mm)	Dep. (%)	Actual (mm)	Normal (mm)	Dep. (%)
1.	A. & N. Islands	1.4	38.2	-96%	1.9	79.3	-98%	319.0	338.4	-6%	322.3	455.9	-29%
2.	Arunachal Pradesh	107.7	171.3	-37%	263.0	301.0	-13%	225.8	285.0	-21%	581.5	757.3	-23%
3.	Assam & Meghalaya	49.1	74.2	-34%	102.2	193.0	-47%	327.2	315.4	4%	478.5	582.6	-18%
4.	Naga., Mani., Mizo. and Tri.	38.5	59.5	-35%	91.9	141.3	-35%	280.5	276.2	2%	409.7	477.0	-14%
5.	S.H.W.B. & Sikkim	87.3	56.7	54%	53.9	124.2	-57%	156.9	257.5	-39%	298.1	438.4	-32%
6.	Gangetic West Bengal	46.9	25.5	84%	3.8	48.8	-92%	197.4	113.6	74%	248.1	187.9	32%
7.	Odisha	50.4	20.1	151%	15.1	36.2	-58%	70.5	72.3	-3%	136.0	128.6	6%
8.	Jharkhand	34.4	14.7	134%	2.9	19.8	-85%	48.3	48.8	-1%	85.7	83.3	3%
9.	Bihar	31.2	8.2	281%	0.7	18.0	-96%	52.3	59.1	-11%	84.2	85.3	-1%
10.	East Uttar Pradesh	13.4	7.5	79%	0.7	6.1	-89%	3.4	20.0	-83%	17.5	33.6	-48%
11.	West Uttar Pradesh	19.0	10.5	81%	3.2	6.2	-49%	3.7	16.0	-77%	25.9	32.7	-21%
12.	Uttarakhand	70.3	54.3	29%	6.2	39.3	-84%	51.0	64.6	-21%	127.5	158.2	-19%
13.	Haryana, Chandigarh & Delhi	16.3	15.1	8%	4.3	9.5	-55%	4.9	20.4	-76%	25.4	45.0	-43%
14.	Punjab	22.1	22.5	-2%	8.6	14.4	-40%	2.5	17.3	-86%	33.2	54.2	-39%
15.	Himachal Pradesh	138.3	113.4	22%	66.0	64.0	3%	16.9	63.3	-73%	221.2	240.7	-8%
16.	Jammu & Kashmir & Ladakh	127.9	152.9	-16%	147.1	99.6	48%	25.5	77.5	-67%	300.5	330.0	-9%
17.	West Rajasthan	1.5	4.3	-65%	4.6	5.9	-22%	3.8	14.5	-73%	10.0	24.7	-60%
18.	East Rajasthan	4.1	4.2	-3%	2.8	4.6	-40%	4.9	12.4	-61%	11.7	21.2	-45%
19.	West Madhya Pradesh	6.7	4.7	43%	14.6	2.4	507%	8.4	6.4	32%	29.7	13.5	120%
20.	East Madhya Pradesh	18.1	10.8	68%	20.1	5.2	287%	14.8	7.7	93%	53.1	23.7	124%
21.	Gujarat Region	3.8	0.3	1175%	0.6	0.9	-34%	6.2	4.3	44%	10.6	5.5	93%
22.	Saurashtra & Kutch & Diu	3.0	0.2	1375%	4.6	0.5	822%	6.4	2.4	168%	14.0	3.1	352%
23.	Konkan & Goa	0.1	2.2	-95%	3.7	1.8	105%	32.9	25.4	30%	36.7	29.4	25%
24.	Madhya Maharashtra	0.5	3.3	-85%	5.0	6.0	-17%	23.1	17.1	35%	28.5	26.4	8%
25.	Marathawada	1.5	6.8	-77%	16.3	5.4	202%	11.2	13.4	-16%	29.1	25.6	14%
26.	Vidarbha	13.9	10.5	33%	53.9	6.7	705%	25.3	9.8	158%	90.1	27.0	234%
27.	Chhattisgarh	29.0	9.1	219%	16.8	11.5	46%	36.4	16.4	122%	82.3	37.0	122%
28.	Coastal A. P. & Yanam	7.8	13.9	-44%	4.4	23.9	-82%	75.9	58.4	30%	88.1	96.2	-8%
29.	Telangana	5.3	15.8	-66%	9.0	18.5	-52%	67.4	29.5	128%	81.6	63.8	28%
30.	Rayalaseema	0.0	9.7	-99%	1.5	19.0	-92%	88.1	50.8	73%	89.6	79.5	13%
31.	Tamil Nadu, Pudcherry & Karaikal	1.2	19.9	-94%	8.6	38.7	-78%	132.2	66.3	99%	141.9	124.9	14%
32.	Coastal Karnataka	2.0	9.3	-79%	26.0	29.1	-11%	154.8	116.8	33%	182.8	155.2	18%
33.	North Interior Karnataka	1.0	8.4	-88%	25.0	23.3	7%	66.3	47.9	38%	92.3	79.6	16%
34.	South Interior Karnataka	0.2	12.6	-98%	13.9	43.1	-68%	154.3	87.1	77%	168.4	142.8	18%
35.	Kerala & Mahe	11.6	34.4	-66%	41.8	105.5	-60%	446.9	219.1	104%	500.4	359.0	39%
36.	Lakshadweep	7.9	16.7	-52%	5.0	29.4	-83%	344.3	150.9	128%	357.2	197.0	81%

Note : Amounts less than 0.1 mm are rounded off to zero

TABLE 2

Details of the weather systems during March 2024

S. No.	System	Duration	Place of initial location	Direction of movement	Place of final location	Remarks
(1)	(2)	(3)	(4)	(5)	(6)	(7)
(**A**)	*Western disturbances / Eastward moving systems*					
(*i*)	*Upper air cyclonic circulation*					
1.	-	-	-	-	-	-
(*ii*)	*As a trough*					
1.	At 5.8 km above m.s.l.	5-9 morning	Roughly Long. 56° E and to the north of Lat. 32° N	East-northeast	Roughly along Long. 78° E to the north of Lat. 32° N	It lay as cyclonic circulation over north Pakistan on 7 and moved away east-northeastwards on 9
2.	Do	9-12	Roughly along Long. 50° E to the north of Lat. 28° N	East	Roughly along Long. 72° E to the north of Lat. 32° N	Became less marked on 12th night
3.	Do	12th mor - 14	Roughly along Long. 50° E to the north of Lat. 28° N	Northeast	Roughly along Long. 73° E to the north of Lat. 32° N	Became less marked on 15th morning. The trough aloft moved away east-north-eastwards on 15
4.	Do	18th mor - 21	Roughly along Long. 68° E to the north of Lat. 30° N	East	Northeast Jharkhand and neighbourhood	It lay as a cyclonic circulation over Jharkhand and neighbourhood on 20and became less marked on 22. However, the trough aloft became less marked on 21
5.	Do	20th mor - 22	Roughly along Long. 50° E to the north of Lat. 20° N	East-northeast	Roughly along Long. 70° E to the north of Lat. 32° N	Moved away east-northeastwards on 23rd morning
6.		24	Roughly along Long. 67° E to the north of Lat. 32° N	Do	-	Moved away east-northeastwards on 25
7.	At 5.8 km above m.s.l.	25 Mar - 2 Apr	Roughly along Long. 45° E to the north of Lat. 25° N	East	Northwest Uttar Pradesh and neighbourhood	It lay as a cyclonic circulation over Iran and neighbourhood on 29 which became less marked on 2nd April morning. The trough aloft which became less marked on 31st March morning
(*iii*)	*As an Induced cyclonic circulation*					
1.	-	-	-	-	-	-
(**B**)	*Other upper air cyclonic circulations*					
1.	Upto 1.5 kms above m.s.l.	1-3	Southwest Rajasthan and neighbourhood	Oscillatory	Northwest Uttar Pradesh and neighbourhood	It lay as an induced low pressure area over west Rajasthan and adjoining Pakistan on 2 morning; over north Pakistan and adjoining Punjab on 2nd & over west Punjab and neighbourhood on 3and became less marked on 4. However, the associated cyclonic circulation over northwest Uttar Pradesh and neighbourhood became less marked on 5
2.	At 3.1 km above m.s.l.	2-3	Meghalaya and neighbourhood	Stationary	*In situ*	It lay as a trough in westerlies roughly along Long. 92°E to the north of Lat. 25°N at 3.1 km above m. s. l. on 3 which became less marked on 4
3.	At 1.5 km Above m.s.l.	4	Northeast Assam and neighbourhood	Do	Do	Became less marked on 5

TABLE 2 (*Contd*.)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
4.	At 0.9 km above m.s.l.	5	South Chhattisgarh and neighbourhood	Stationary	*In situ*	Became less marked on 6
5.	Do	5	Interior Odisha and neighbourhood	Do	*In situ*	Became less marked on 6
6.	Between 1.5 & 3.1 km above m.s.l.	5-6	Punjab and neighbourhood	Southeast	Northwest Uttar Pradesh and adjoining Haryana	Became less marked on 7
7.	At 1.5 km above m.s.l.	6	East Assam and neighbourhood	Stationary	*In situ*	Became less marked on 7
8.	Do	6-7	South Odisha and neighbourhood	Do	*In situ*	Merged with the trough from north Odisha to north coastal Andhra Pradesh and Yanam on 8
9.	Do	8-9	Telangana and neighbourhood	Northeast	South Odisha and neighbourhood	Became less marked on 10
10.	At 3.1 km above m.s.l.	10	Southwest Rajasthan and neighbourhood	Stationary	*In situ*	Became less marked on 11
11.	At 1.5 km above m.s.l.	10-11	South interior Karnataka and neighbourhood	Do	Do	Became less marked on 12
12.	Do	11	North coastal Andhra Pradesh and neighbourhood	Do	Do	Became less marked on 12
13.	At 0.9 km above m.s.l.	13 mor	Induced cyclonic circulation southwest Rajasthan	Do	Do	It lay as a cyclonic circulation over northwest Madhya Pradesh and neighbourhood at 0.9 km above m.s.l. on 14 which became less marked on 15
14.	At 1.5 km above m.s.l.	13-15	East Assam and neighbourhood	Do	Northeast Assam and neighbourhood	Became less marked on 16
15.	Do	14	Southwest Bay of Bengal and neighbourhood	Do	*In situ*	Became less marked on 15
16.	At 0.9 km above m.s.l.	14-15	North interior Karnataka and neighbourhood	Southwards	South interior Karnataka and neighbourhood	Became less marked on 16
17.	Do	15	North Odisha and neighbourhood	Stationary	*In situ*	Do
18.	At 1.5 km above m.s.l.	18	East Assam and neighbourhood	Do	Do	Became less marked on 19
19.	At 3.1 km above m.s.l.	18-19	Northwest Uttar Pradesh and neighbourhood	Do	Do	Became less marked on 20
20.	Upto1.5 km above m.s.l.	18-20	West Vidarbha and neighbourhood	SE then NW	West Vidarbha and neighbourhood	Became less marked on 22
21.	Do	21 -26	North Jharkhand and neighbourhood	Northeast	-	Became less marked on 26. The trough aloft roughly along Long. 92°E moved away east-northeastwards on 24th
22.	Do	22	Northwest Rajasthan and adjoining Pakistan	East	Northeast Rajasthan and neighbourhood at 0.9 km above m.s.l. on 23rd morning	Became less marked on 23

TABLE 2 (*Contd*.)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
23.	Upto 0.9 km above m.s.l.	25	Northeast Bangladesh and neighbourhood	Stationary	*In situ*	Became less marked on 26
24.	Upto 1.5 km above m.s.l.	24	Induced cyclonic circulation lay over northwest Rajasthan and neighbourhood	Do	Do	Became less marked on 25
25.	Upto 0.9 km above m.s.l.	27-31 Mar	Northwest Rajasthan and neighbourhood	Northeast	Haryana and neighbourhood	Became less marked on 1 April
26.	At 1.5 km above m.s.l	27	Kerala and neighbourhood	Stationary	*In situ*	Became less marked on 28
27.	Upto 1.5 km above m.s.l.	28-29	South Assam and neighbourhood	Do	Do	Became less marked on 30
28.	At 0.9 km above m.s.l.	29-30	Southwest Madhya Pradesh and neighbourhood	-	North Chhattisgarh and neighbourhood	Became less marked on 31
29.	Do	28	North Bihar	Do	*In situ*	Became less marked on 29
30.	Do	29	Odisha and neighbourhood	Do	Do	Became less marked on 30
31.	Upto 1.5 km above m.s.l.	30	Sub-Himalayan West Bengal & Sikkim and neighbourhood	Do	Do	Became less marked on 31 March
32.	At 1.5 km above m.s.l.	31 Mar	Northeast Assam	Do	Do	It merged with the trough from the cyclonic circulation over north Bangladesh to southeast Arunachal Pradesh on 2 April
(**C**)	*Other Trough*					
1.	Between 3.1 and 7.6 km above m.s.l.	1-3	From the cyclonic circulation over northwest Afghanistan and neighbourhood to northwest Arabian Sea	East	From the cyclonic circulation over north Pakistan and neighbourhood to northeast Arabian Sea	Became less marked on 4
2.	At 0.9 km above m.s.l.	3-4	From southwest Madhya Pradesh to north interior Karnataka	Oscillatory	From east Madhya Pradesh to north Tamil Nadu across Vidarbha, Telangana and interior Karnataka	Became less marked on 5
3.	Do	5-9	From south Tamil Nadu to north Interior Karnataka across south interior Karnataka	Do	Ran from Vidarbha to south Tamil Nadu across Marathwada and Karnataka	Became less marked on 10
4.	Do	8	From north Odisha to north coastal Andhra Pradesh and Yanam	Stationary	*In situ*	Became less marked on 9
5.	Do	10	From east Vidarbha to interior Odisha	Do	Do	Became less marked on 11

TABLE 2 (*Contd*.)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
6.	At 0.9 km above m.s.l.	11	From west Rajasthan to southeast Madhya Pradesh across east Rajasthan and west Madhya Pradesh	Stationary	*In situ*	Became less marked on 12
7.	Do	12-13	From north Chhattisgarh to north Interior Karnataka across Vidarbha and Telangana	Southeast	From interior Odisha to eastcentral Arabian Sea across south Chhattisgarh, Telangana and Karnataka	Became less marked on 14
8.	Do	14-16	From Gangetic West Bengal to north coastal Andhra Pradesh across Odisha	Oscillatory	From south Odisha to Sub-Himalayan West Bengal and Sikkim across Jharkhand and Gangetic West Bengal	Became less marked on 17
9.	Do	18	From Jharkhand to north coastal Andhra Pradesh across Odisha	Stationary	*In situ*	Became less marked on 19
10.	Do	19-21	From Jharkhand to south Assam	Oscillatory	From the cyclonic circulation over north Jharkhand and neighbourhood to Manipur across Sub Himalayan West Bengal and Meghalaya	Became less marked on 22
11.	Do	24-25	From northwest Bihar to southeast Assam across north Bangladesh	South	Rom northeast Madhya Pradesh to southeast Assam across Chhattisgarh, Jharkhand and Gangetic West Bengal	Became less marked on 26
12.	Upto 0.9 km above m.s.l.	27	From northwest Bihar to southeast Assam	Stationary	*In situ*	Became less marked on 28
	Trough in westerlies					
1.	Between 1.5 & 3.1 km above m.s.l.	5	Roughly along Long. 93° E to the north of Lat. 25° N	East	*In situ*	Moved away eastwards on 6
2.	At 3.1 km above m.s.l.	12	Ran roughly along Long. 92° E to the north of Lat. 25° N	Stationary	Do	Became less marked on 13
3.	Do	8-9	Ran roughly along Long. 92° E to the north of Lat. 25° N	East	Ran roughly along Long. 93° E to the north of Lat. 26° N	Moved away eastwards on 10
4.	Do	19	Roughly along Long. 95° E to the north of Lat. 23° N	Stationary	*In situ*	Became less marked on 20
5.	Do	16-17	Roughly along Long. 93° E to the north of Lat. 24° N	Northeast	Roughly along Long. 94° E to the north of Lat. 24° N	Moved away northeastwards on 18
6.	At 1.5 km above m.s.l.	27	Roughly along Long. 87° E to the north of Lat. 21° N	Stationary	*In situ*	Moved away eastwards on 28

TABLE 2 (*Contd*.)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
7.	At 3.1 km above m.s.l.	26	Roughly along Long. 93° E to the north of Lat. 23° N	Stationary	*In situ*	Became less marked on 26
	Trough/wind discontinuity					
1.	At 0.9 km above m.s.l.	14 Mar-14 Apr	From east Vidarbha to north Tamil Nadu across Telangana and Rayalaseema	Oscillatory	From the cyclonic circulation over Comorin area and neighbourhood to north interior Karnataka across Tamil Nadu and south interior Karnataka	Became less marked on 15 April
	North-South trough					
1.	At 0.9 km above mean sea level	31 Mar	From east Bihar to north Bay of Bengal across Jharkhand and Gangetic West Bengal	Stationary	*In situ*	Became less marked on 1 April

large excess rainfall, 4 received excess rainfall, 16 received normal rainfall, 8 received deficient rainfall and the remaining 1 received largely deficient rainfall.

During the pre-monsoon season, in India, the mean temperature was 28.3 °C with an anomaly of 0.6 °C which is 7th highest since 1901. The minimum temperature was also the 7th highest (21.8 °C with an anomaly of 0.7 °C) since 1901. Among the homogeneous regions over South Peninsular India, the maximum temperature was the 4th highest (36.2 °C with an anomaly of 0.5 °C) after the years 2016 (36.6 °C), 2019 (36.6 °C), 2017 (36.3 °C) and minimum temperature was the 2nd highest (24.8 °C with an anomaly of 0.8 °C) after the year 2016 (25.0 °C) since 1901. The mean temperature over South Peninsular India (30.5 °C with an anomaly of 0.7 °C) was the 3rd highest after the years 2016 (30.8 °C), 2019 (30.7 °C) since 1901. Over East & Northeast India, the minimum temperature was the 2nd highest (21.0 °C with an anomaly of 1.0 °C) after the year 2022 (21.1 °C) since 1901. The mean temperature over East & Northeast India (26.7 °C with an anomaly of 0.9 °C) was the highest since 1901.

3. Significant features during various months

3.1. *March*

3.1.1. *Weather and associated synoptic features*

Details of the weather systems during the month are summarised in Table 2. 7 western disturbances, 32 upper air cyclonic circulations and 21 troughs which affected the weather over the country during the month of March. Out of 7 WDs, 5 WDs were active and caused rain/ thunderstorm and hailstorm over plains of north and central India. East-west trough from Bihar to South Assam and moisture incursion over the region due to anti-cyclone over central and north Bay of Bengal caused wet spell over east and northeast India. No intense low pressure system formed during the month.

During the initial days of the 1st week, an active Western Disturbance (WD) caused severe weather over northwest India. The peak activity of WD was occurred during initial 2-3 days of the week which caused widespread rainfall/snowfall activities over most places in Western Himalayan Region (Jammu-Kashmir-Ladakh-Gilgit-Baltistan-Muzaffarabad, Himachal Pradesh and Uttarakhand). Light to moderate Rainfall reported at many places to most places over adjoining plains of northwest India covering Punjab, Haryana, north Rajasthan, Uttar Pradesh and north Madhya Pradesh and heavy to very heavy rainfall/snowfall reported at isolated places over Western Himalayan Region and Haryana. During this wet spell, most of these areas experienced isolated intense thunderstorm activities accompanied with lightning, gusty winds & Hailstorm also occurred over Punjab, Haryana, Chandigarh, Rajasthan, Delhi- NCR, Uttar Pradesh and north Madhya Pradesh for 1-day on 2nd March while over Madhya Pradesh, Uttar Pradesh and Uttarakhand, it was continued for 2-days consecutively on 2 and 3 March.

During 2nd week of the month, Light/Moderate rainfall/snowfall observed at isolated places over Jammu-

TABLE 3

Details of the weather systems during April 2024

S. No.	System	Duration	Place of initial location	Direction of movement	Place of final location	Remarks
(1)	(2)	(3)	(4)	(5)	(6)	(7)
(**A**)	*Western disturbances/Eastward moving systems*					
(*i*)	*Upper air cyclonic circulation*					
1.	Between 3.1 and 12.6 km above m.s.l.	11-15 mor	West Iran and neighbourhood	Northeast	West Afghanistan and adjoining Iran	Became less marked on 15. However, the trough aloft moved away northeastwards on 17
2.	Between 5.8 & 9.6 km above m.s.l.	17-21	Iran & neighbourhood	East	Jammu - Kashmir and adjoining north Pakistan	Became less marked on 21st evening
3.	At 5.8 km above m.s.l.	21-24	East Iran and neighbourhood	Northeast	Jammu division and neighbourhood	Moved away northeastwards on 25
4.	Between 3.1 and 7.6 km above m.s.l.	24 Apr-1 May	Iran and neighbourhood	Do	Ladakh and neighbourhood	Moved away northeastwards on 2 May
(*ii*)	*As a trough*					
1.	At 5.8 kms above m.s.l.	1 eve - 7	Roughly along Long. 55° E to the north of Lat. 30° N	East-northeast	Roughly along Long. 78° E to the north of Lat. 30° N	It lay as a cyclonic circulation over north Pakistan and neighbourhood with a trough aloft on 5 & and again lay as trough on 8 morning andmoved away east-northeastwards on 8
2.	Do	9 mor -11	Roughly along Long. 60° E to the north of Lat. 32° N	Northeast	Afghanistan and neighbourhood	It lay as a cyclonic circulation on 10 and became less marked on 11. However, trough aloft moved away northeastwards on 12
(*iii*)	*As an Induced cyclonic circulation*					
1.	Upto 1.5 km above m.s.l.	18 eve -20	Pakistan and adjoining Punjab	East	Haryana & neighbourhood	Became less marked on 21
(**B**)	*Other upper air cyclonic circulations*					
1.	At 0.9 km above m.s.l.	1-6	Northeast Bihar	East	North Bangladesh and neighbourhood	Became less marked on 7
2.	Do	3	Odisha & neighbourhood	Stationary	*In situ*	Became less marked on 4
3.	Do	3-4	West Rajasthan and adjoining Pakistan & neighbourhood	Northeast	Northeast Rajasthan and neighbourhood	Became less marked on 5
4.	Do	3-9	East Assam & neighbourhood	*In situ* and surrounding	Northeast Assam and neighbourhood	Became less marked on 10
5.	Upto 1.5 km above m.s.l.	7-10	Southeast Rajasthan and neighbourhood	Oscillatory	Southeast Rajasthan	Became less marked on 11
6.	Do	8-9	Marathwada and neighbourhood	West	Central parts of Madhya Maharashtra	Merged with the trough/wind discontinuity from cyclonic circulation over southeast Rajasthan to northern parts of coastal Karnataka on 10
7.	At 0.9 kms above m.s.l.	9	Sub-Himalayan West Bengal and neighbourhood	Stationary	*In situ*	Merged with the trough from southeast Rajasthan to northeast Bangladesh on 10

TABLE 3 (*Contd*.)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
8.	Upto 1.5 km above m.s.l.	11	Southwest Rajasthan and neighbourhood	*In situ* and surrounding	Southwest Rajasthan	It lay as an induced low pressure area over southwest Rajasthan and neighbourhood on 13th night and became less marked on 14 evening. However, the associated cyclonic circulation became less marked on 16
9.	Do	11	East Bihar and neighbourhood	Stationary	*In situ*	Became les marked-on 12
10.	At 1.5 km above m.s.l.	11	Marathwada and adjoining Madhya Maharashtra	Do	Do	Do
11.	Upto 1.5 km above m.s.l.	12	Comorin area and neighbourhood	Do	Do	Became less marked on 15
12.	At 0.9 km above m.s.l.	12	Southwest Uttar Pradesh	Do	Do	Became less marked on 13
13.	At 1.5 kms above m.s.l.	12	North Odisha	Do	Do	Do
14.	Upto 1.5 kms above m.s.l.	13	Central Assam and neighbourhood	Do	Do	Became less marked on 14
15.	At 3.1 km above m.s.l.	13	Northeast Assam and neighbourhood	Do	Do	Do
16.	At 0.9 kms above m.s.l.	14	Northeast Rajasthan and neighbourhood	Do	Do	Became less marked on 15
17.	Do	14	North Bangladesh and neighbourhood	Do	Do	Do
18.	Do	14-15	Central Madhya Maharashtra and neighbourhood	Northeast	West Vidarbha and neighbourhood	Became less marked on 16
19.	Do	15	Gulf of Mannar	Do	South Tamil Nadu and neighbourhood	Became less marked on 17
20.	Do	15 Apr - 13 May	East Bihar and neighbourhood	Do	Northeast Assam and neighbourhood	Became less marked on 14 May
21.	At 1.5 km above m.s.l.	16-17	Rayalaseema	Southeast	North interior Tamil Nadu	Became less marked on 18
22.	At 3.1 km above m.s.l.	16-18	Northeast Assam	Stationary	*In situ*	Became less marked on 19
23.	At 0.9 km above m.s.l.	19	Marathwada and neighbourhood	Do	Do	Became les marked-on 20
24.	At 3.1 km above m.s.l.	19	Southeast Bay of Bengal	Do	Do	Do
25.	At 0.9 km above m.s.l.	21	Gulf of Mannar and neighbourhood	Do	Do	Became les marked-on 22
26.	Do	21-22	Northeast Bangladesh and neighbourhood	Do	Do	Became les marked-on 23
27.	Upto 1.5 km above m.s.l.	22	Marathwada and adjoining west Vidarbha	Do	Do	Do
28.	Do	22	Southeast Arabian Sea	Do	Do	Do

TABLE 3 (*Contd*.)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
29.	At 0.9 km above m.s.l.	23	Sub-Himalayan West Bengal and neighbourhood	Stationary	*In situ*	Became less marked on 24
30.	At 1.5 km above m.s.l.	23	Over south interior Karnataka and neighbourhood	Do	Do	Became less marked on 24
31.	Do	23	Comorin area	Do	Do	Became less marked on 24
32.	At 0.9 km above m.s.l.	23-24	Northeast Rajasthan and neighbourhood	East	Northwest Uttar Pradesh and neighbourhood	Became less marked on 25
33.	Do	24	Telangana and adjoining coastal Andhra Pradesh	Stationary	*In situ*	Became less marked on 25
34.	Do	24	North interior Karnataka and neighbourhood	-	-	Merged with the trough from cyclonic circulation over central parts of south Madhya Pradesh to south interior Karnataka on 25
35.	Do	24-25	Madhya Maharashtra and neighbourhood	*In situ* and surrounding	Marathwada and adjoining Madhya Maharashtra	Merged with the trough from Marathwada to north Tamil Nadu across interior Karnataka on 26
36.	Upto 1.5 km above m.s.l.	28 Apr-1 May	Central parts of south Arabian Sea	East	Southwest Arabian Sea and adjoining equatorial Indian ocean	Became less marked on 2 May
37.	At 1.5 km above m.s.l.	25	Central parts of south Madhya Pradesh & neighbourhood	Stationary	*In situ*	Became less marked on 26
38.	Induced cy-cirUpto 1.5 km above m.s.l.	26	West Rajasthan	Northeast	North Haryana and neighbourhood	Became less marked on 28
39.	At 0.9 km above m.s.l.	26-28	North Bangladesh	Stationary	*In situ*	Merged with the trough from north Bihar to Manipur on 29
40.	Do	27	South Chhattisgarh and neighbourhood	Do	Do	Became less marked on 27
41.	Do	27	Comorin area and neighbourhood	Do	Do	Became less marked on 27
42.	Do	28-29	Northwest Rajasthan and neighbourhood	Do	Do	Became less marked on 30
43.	Do	28 Apr - 30Ap	Gulf of Mannar and neighbourhood	West	South Tamil Nadu & neighbourhood	Became less marked on 1 May
44.	Upto 1.5 km above m.s.l.	30 Apr - 1 May	Northeast Bangladesh	Stationary	*In situ*	Became less marked on 2 May
(**C**)	*Other troughs*					
1.	At 0.9 km above m.s.l.	10	From southeast Rajasthan to northeast Bangladesh across Uttar Pradesh, Bihar and sub-Himalayan West Bengal	Stationary	*In situ*	Became less marked on 11

TABLE 3 (*Contd*.)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
2.	At 0.9 km above m.s.l.	16	Ran from the cyclonic circulation over east Bihar and neighbourhood to south Chhattisgarh across Jharkhand and Odisha	Stationary	*In situ*	Became less marked on 17
3.	Do	16-17	From Marathwada to north interior Karnataka at 0.9 km above m.s.l.	Oscillatory	From south Vidarbha to south interior Karnataka	Became less marked on 18
4.	At 1.5 km above m.s.l.	17-23	Ran from Gulf of Mannar to south Telangana across interior Tamil Nadu & Rayalaseema	Do	Ran from Madhya Maharashtra to Kerala across Karnataka	Became less marked on 24
5.	At 0.9 km above m.s.l.	19	Ran from northwest Bihar to the cyclonic circulation over central Assam	-	Ran from east Bihar to the cyclonic circulation over northeast Assam	Became less marked on 21
6.	At 5.8 km above m.s.l.	19-22 mor	Ran roughly along Long. 65° E to the north of Lat. 22° N	Northeast	Ran roughly along Long. 73° E to the north of Lat. 30° N	Moved away northeastwards on 22
7.	Upto 1.5 km above m.s.l.	20	Ran from Vidarbha to east central Arabian Sea off Karnataka-Goa coast	Stationary	*In situ*	Became less marked on 21
8.	At 0.9 km above m.s.l.	23	Ran from the cyclonic circulation over Sub-Himalayan West Bengal to north Bay of Bengal	Do	Do	Became less marked on 24
9.	Do	26	Ran from the cyclonic circulation over north Bangladesh to north Odisha across Gangetic West Bengal	Do	Do	Became less marked on 27
10.	Do	28	Ran from northeast Jharkhand to south Chhattisgarh	Do	Do	Became less marked on 29
11.	Do	29 Mar - 1 May	Ran from north Bihar to Manipur across Sub-Himalayan West Bengal and south Assam	Oscillatory	Ran from north Bihar to Nagaland across Sub-Himalayan West Bengal, cyclonic circulation over northeast Bangladesh and south Assam and Meghalaya	Became less marked on 2 May
	North-South troughs					
1.	At 0.9 km above m.s.l.	21	Ran from the cyclonic circulation over northeast Bangladesh to north Bay of Bengal	Stationary	*In situ*	Became less marked on 22

TABLE 3 (*Contd*.)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
	East- west trough					
1.	At 0.9 km above m.s.l.	2	Ran from the cyclonic circulation over north Bangladesh to southeast Arunachal Pradesh across Assam	Stationary	*In situ*	Became less marked on 3
2.	At 1.5 km above m.s.l.	13-14	Ran from the cyclonic circulation over south Rajasthan and adjoining north Gujarat to north Odisha across Madhya Pradesh, Chhattisgarh and south Jharkhand at 1.5 km above m.s.l.	Oscillatory	Ran from the cyclonic circulation over northeast Rajasthan and neighbourhood to Gangetic West Bengal across south Uttar Pradesh, south Bihar and north Jharkhand	Became less marked on 15
3.	At 0.9 km above m.s.l.	17	Ran from Bihar to Manipur across south Assam & Meghalaya	Stationary	*In situ*	Became less marked on 3
	Trough/Wind Discontinuity					
1.	At 0.9 km above m.s.l.	24-30	Ran from the cyclonic circulation over Telangana and adjoining coastal Andhra Pradesh to south Tamil Nadu	Oscillatory	Ran from southeast Madhya Pradesh to south interior Karnataka across Vidarbha, Marathwada and north interior Karnataka	Became less marked on 1st May
2.	At 1.5 km above m.s.l.	25	Ran from the cyclonic circulation over central parts of south Madhya Pradesh to south interior Karnataka across Vidarbha and Marathwada	Stationary	*In situ*	Became less marked on 26

Kashmir, Uttarakhand and Himachal Pradesh due to impact of a fresh WD and Hailstorm over Himachal Pradesh for 2 to 3 days.

Wet spell over eastern parts of central India and east & northeast India was observed with scattered to fairly widespread light to moderate rainfall accompanied with isolated thunderstorms, lightning & gusty winds over East Madhya Pradesh, Jharkhand, Vidarbha, Chhattisgarh, West Bengal & Sikkim, Odisha, Bihar, northeast India and Coastal Andhra Pradesh during end of the third week of the month. Heavy rainfall occurred at isolated places over East Madhya Pradesh and at isolated places over Odisha and Telangana. Hailstorm was reported at isolated places over East Uttar Pradesh, Madhya Pradesh, Vidarbha and Telangana around the end of third week of the month. This persistent wet spell caused the fall in daily maximum temperature over some pockets of Odisha, Chhattisgarh, Jharkhand, Bihar, Gangetic West Bengal and Sikkim and it was appreciable below normal by 6-11 °C in these areas. This 3-4 days wet spell and accompanied severe weather caused by interactions of three systems during 2nd fortnight of the month: (*i*) Rapid Deepening and fast eastward movement of a Western Disturbance (WD) from northwest India towards east and northeast India across eastern parts of central India as a trough in westerly at middle and upper tropospheric levels during the period. (*ii*) An east-west trough ran from Jharkhand to south Assam with embedded cyclonic circulation over east Bangladesh & neighbourhood (*iii*) Wind and moisture convergence over eastern parts of central India and east and northeast India emanating from lower level anti-

TABLE 4

Details of the weather systems during May 2024

S. No.	System	Duration	Place of initial location	Direction of movement	Place of final location	Remarks
(1)	(2)	(3)	(4)	(5)	(6)	(7)
(**A**) *Cyclonic storm / Depression*						
1.	Severe Cyclonic Storm "REMAL"	24 (0530 hours IST) - 28 (0530 hours IST)	Central Bay of Bengal near Lat. 15.0° N / Long. 88.4° E	Northeast then north and again northeast	Northeast Bangladesh and adjoining Meghalaya	Under the influence of cyclonic circulation over southwest Bay of Bengal, a low pressure area formed over southwest and adjoining westcentral Bay of Bengal off north Tamil Nadu-south Andhra Pradesh coasts on 22 May. It concentrated into Well Marked Low Pressure Area on 23 May,Depression on 24 (0530 hours IST), Deep Depression on 25 (0530 hours IST), Cyclonic Storm "Remal" (pronounced as "Re-Mal") on 25 (1730 hours IST), Severe Cyclonic Storm 26 (0530 hours IST and crossed the Bangladesh and adjoining West Bengal coasts between Sagar Islands and Khepupara close to southwest of Mongla near Lat. 21.75° N / Long. 89.2° E between 2230 IST on 26 to 0030 IST on 27 May as a Severe Cyclonic Storm.It weakened into a Cyclonic Storm on 27 (0530 hours IST, Deep Depression on 27 (2030 IST), Depression on 28 (0530 hours IST). Details are given in the article on 'Storms and depression over north Indian ocean 2024'
(**B**) *Low Pressure Area*						
1.	Low Pressure Area	20-23	North Kerala & neighbourhood	West	Southeast Arabian Sea off Kerala coast	Initiallyit lay as a cyclonic circulation over northKerala & neighbourhood on 20.It concentrated into, a Low Pressure Area on 23 and became less marked on 24
(**C**) *Western Disturbances /Eastward moving Systems*						
(*i*) *Upper air cyclonic circulation*						
1.	At 3.1 km above m.s.l.	22	Southeast Iran & neighbourhood	Stationary	*In situ*	Became less marked on 23
2.	At 3.1 km above m.s.l.	31 May - 3 Jun	North Afghanistan & adjoining Pakistan roughly along Long. 69° E to the north of Lat. 32° N	East-northeast	Roughly along Long. 80° E to the north of Lat. 28° N	Moved away northeastwards on 4 June
(*ii*) *As a trough*						
1.	At 5.8 km above m.s.l.	9-14	Roughly along Long. 50° E to the north of Lat. 30° N	East-northeast	Roughly along Long. 82° E to the north of Lat. 25° N	It lay as a cyclonic circulation over Iran with a trough aloft on 10 and again lay as a trough on 11 and again cyclonic circulation over north Pakistan & neighbourhood on 12 and became less marked on 13.However, the trough aloft moved away east-northeastwards on 15
2.	Do	2-6	Roughly along Long. 45° E to the north of Lat. 26° N	Northeast	Roughly along Long. 75° E to the north of Lat. 34° N	It lay as a cyclonic circulation over Iran and neighbourhood with a trough aloft on 3and became less marked on 4 and again lay as a trough on 5 and moved away northeastwards on 7

TABLE 4 (*Contd*.)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
3.	At 5.8 km above m.s.l.	4	Roughly along Long. 52° E to the north of Lat. 25° N	Northeast	-	Moved away northeastwards on 5
4.	Do	17-21	Roughly along Long. 50° E to the north of Lat. 30° N	East-northeast	Roughly along Long. 76° E to the north of Lat. 32° N	It lay as a cyclonic circulation over Afghanistan & north Pakistan on 19 and became less marked 20. However, trough aloft moved away east-northeastwards on 22
5.	At 3.1 km above m.s.l.	29-30	Roughly along Long. 68° E to the north of Lat. 27° N	Northeast	Ran roughly along Long. 73° E to the north of Lat. 30° N	It lay as a cyclonic circulation over Jammu division & neighbourhood with the trough aloft and moved away northeastwards on 31 May
6.	At 3.1 km above m.s.l.	24-28	Roughly along Long. 56° E to the north of Lat. 28° N	Do	Roughly along Long. 76° E to the north of Lat. 33° N	Moved away northeastwards on 29
(**D**)	*Other upper air cyclonic circulations*					
1.	At 0.9 km above m.s.l.	3-6	Sub-Himalayan West Bengal and adjoining west Assam	West	Northeast Bihar and neighbourhood	Became less marked on 7
2.	Upto 1.5 km above m.s.l.	4	Northwest Rajasthan and neighbourhood	Stationary	*In situ*	Became less marked on 5
3.	Between 1.5 km & 3.1 km above m.s.l.	6	Northwest Uttar Pradesh	Do	Do	Became less marked on 7
4.	At 0.9 km above m.s.l.	6	South Jharkhand and neighbourhood	Northwest	-	Merged with the trough from north interior Odisha to southeast Rajasthan on 7
5.	Upto 1.5 km above m.s.l.	6	Marathwada and neighbourhood	Stationary	*In situ*	Became less marked on 7
6.	At 1.5 km above m.s.l.	7	Northeast Madhya Pradesh and neighbourhood	Do	Do	Became less marked on 8
7.	Upto 1.5 km above m.s.l.	7-12	Bangladesh and neighbourhood	East	East Bangladesh and neighbourhood	Became less marked on 13
8.	Do	8	North Haryana & neighbourhood	Stationary	*In situ*	Became less marked on 9
9.	Do	8	Tamil Nadu	Do	Do	Became less marked on 9
10.	Between 1.5 km & 5.8 km above m.s.l.	8-12	Northeast Arabian Sea & adjoining Gujarat coast	North	South Pakistan & adjoining northeast Arabian Sea	Became less marked on 13
11.	Upto 1.5 km above m.s.l.	9	Over Madhya Maharashtra and neighbourhood	Stationary	*In situ*	Became less marked on 10
12.	At 0.9 km above m.s.l.	9-12	Northwest Rajasthan and neighbourhood		West Uttar Pradesh & neighbourhood	Became less marked on 13
13.	At 3.1 km above m.s.l.	10	North Bihar and neighbourhood	Do	*In situ*	Became less marked on 11
14.	At 1.5 km above m.s.l.	10	Central Madhya Pradesh and neighbourhood	Do	Do	Became less marked on 11
15.	Upto 1.5 km above m.s.l.	10-11	South Kerala and neighbourhood	West	Southeast Arabian Sea off Kerala coast	Became less marked on 12

TABLE 4 (*Contd*.)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
16.	At 1.5 km above m.s.l.	11	North Bangladesh & neighbourhood	Stationary	*In situ*	Became less marked on 12
17.	Do	12	Southeast Assam & neighbourhood	Do	Do	Became less marked on 13
18.	At 0.9 km above m.s.l.	12	South Rajasthan & neighbourhood	Do	Do	Became less marked on 13
19.	At 1.5 km above m.s.l.	12-13	South interior Karnataka & neighbourhood	-	South interior Karnataka & neighbourhood	Merged with the trough from the cyclonic circulation over southeast Arabian Sea & adjoining Kerala to Marathwada on 14
20.	Do	12-19	Southeast Bihar & neighbourhood	East	Northeast Assam & neighbourhood	Became less marked on 20
21.	Do	13	Northwest Madhya Pradesh & neighbourhood	Stationary	*In situ*	Became less marked on 14
22.	Between 1.5 & 3.1 km above m.s.l.	13	Comorin Area	-	North Equatorial Indian Ocean & adjoining Comorin area	Became unimportant for Indian region on 15
23.	Upto 1.5 km above m.s.l.	14	Southeast Arabian Sea & adjoining Kerala	-	-	Merged with the trough from the cyclonic circulation over southwest Bay of Bengal & adjoining south Sri Lanka to Lakshadweep on 15
24.	At 0.9 km above m.s.l.	14-16	West Vidarbha & neighbourhood	Northwest	Southwest Madhya Pradesh	Merged with the trough from the cyclonic circulation over northeast Rajasthan to north Madhya Maharashtra on 17
25.	Upto 4.5 km above m.s.l.	14-20	Southwest Bay of Bengal & adjoining south Sri Lanka	West	South coastal Tamil Nadu & neighbourhood	Became less marked on 21
26.	At 0.9 km above m.s.l.	15	South Haryana & neighbourhood	Stationary	*In situ*	Became less marked on 16
27.	Between 1.5 km & 3.1 km above m.s.l.	15	Northwest Uttar Pradesh & neighbourhood	Do	Do	Became less marked on 16
28.	At 1.5 km above m.s.l.	15	Over central parts of Madhya Pradesh & neighbourhood	Do	Do	Became less marked on 16
29.	Upto 4.5 km above m.s.l.	15-20	Southwest Bay of Bengal & adjoining south Sri Lanka	Northwest	South Tamil Nadu and neighbourhood	Became less marked on 21
30.	At 0.9 km above m.s.l.	16	South Bihar & neighbourhood	Stationary	*In situ*	Became less marked on 17
31.	At 1.5 km above m.s.l.	16	South Bangladesh	Do	Do	Became less marked on 17
32.	At 0.9 km above m.s.l.	16-18	Central parts of east Rajasthan & neighbourhood	Northeast	Northeast Rajasthan & neighbourhood	Became less marked on 19
33.	Upto 4.5 km above m.s.l.	16-19	Westcentral Arabian Sea off Yemen coast	Northwest	Over westcentral & adjoining southwest Arabian Sea off south Yemen & Somalia coast	Became less marked on 20

TABLE 4 (*Contd*.)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
34.	At 0.9 km above m.s.l.	16-20	Northwest Rajasthan & neighbourhood	East	Northwest Uttar Pradesh & neighbourhood	Became less marked on 21
35.	Upto 5.8 km above m.s.l.	17	Rayalaseema & adjoining north Tamil Nadu	Stationary	*In situ*	Became less marked on 18
36.	At 0.9 km above m.s.l.	19-20 mor	Madhya Maharashtra & neighbourhood	East	West Vidarbha & neighbourhood	Became less marked 20
37.	At 3.1 km above m.s.l.	19-20	Gangetic West Bengal and neighbiurhood	South	Northwest Bay of Bengal & adjoining north Odisha-West Bengal coasts	Became less marked on 21
38.	Upto 1.5 km above m.s.l.	21	Over Haryana & neighbourhood	Stationary	*In situ*	Became less marked on 22
39.	Between 1.5 km & 5.8 km above m.s.l.	21	Over east Bangladesh & neighbourhood	Northwest	West Bihar and neighbourhood	Became less marked on 22
40.	At 0.9 km above m.s.l.	21	North coastal Andhra Pradesh & neighbourhood	Stationary	*In situ*	Became less marked on 22
41.	Upto 1.5 km above m.s.l.	22-25	Northwest Rajasthan & neighbourhood	Southeast	Southeast Rajasthan	Became less marked on 26
42.	At 1.5 km above m.s.l.	24-25	Northeast Madhya Pradesh & neighbourhood	South	Vidarbha and neighbourhood	Became less marked on 26
43.	Upto 5.8 km above m.s.l.	24-25	South Kerala & neighbourhood	Stationary	*In situ*	Became less marked on 26
44.	At 1.5 km above m.s.l.	26	Southwest Rajasthan & neighbourhood	Do	Do	Became less marked on 27
45.	Do	26	Northeast Assam & neighbourhood	Do	Do	Became less marked on 27
46.	Do	26-27	Northwest Uttar Pradesh & neighbourhood	Do	Do	Became less marked on 28
47.	At 0.9 km above m.s.l.	27-30	Northeast Rajasthan & neighbourhood	East	Northwest Uttar Pradesh & neighbourhood	Became less marked on 31
48.	At 5.8 km above m.s.l.	28	South Tamil Nadu & neighbourhood	Stationary	*In situ*	Merged with the shear zone on 29
49.	Between 1.5 & 5.8 km above m.s.l.	28 May - 2 Jun	Westcentral Arabian Sea off Oman coast	South	Westcentral and adjoining southwest Arabian Sea	Became less marked on 3 Jun
50.	At 5.8 km above m.s.l.	30 May-2 Jun	Southeast Arabian Sea off south Kerala	Stationary	*In situ*	Became less marked on 2 Jun
51.	Between 3.1 & 5.8 km above m.s.l.	31 May - 1 Jun	Central Gujarat & neighbourhood	North	Southwest Rajasthan	Became less marked on 2 Jun
52.	At 1.5 km above m.s.l.	31 May	Northeast Rajasthan & neighbourhood	Stationary	*In situ*	Became less marked on 1 Jun

TABLE 4 (*Contd.*)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
(**E**)	*Other troughs*					
1.	At 0.9 km above m.s.l.	2-3	From south Chhattisgarh to south Tamil Nadu across Telangana and Rayalaseema	Oscillatory	From south Chhattisgarh to Rayalaseema across Telangana	Became less marked on 4
2.	Do	4	From Meghalaya to the cyclonic circulation over Marathwada across the cyclonic circulation over Sub-Himalayan West Bengal, Jharkhand, Odisha, south Chhattisgarh and Vidarbha	Stationary	*In situ*	Became less marked on 5
3.	Do	5	From the cyclonic circulation over northeast Bihar and neighbourhood to north Odisha across Gangetic West Bengal	Do	*In situ*	Became less marked on 6
4.	Do	6	From the cyclonic circulation over south Jharkhand to west Madhya Pradesh	West	From north interior Odisha to southeast Rajasthan across Chhattisgarh and Madhya Pradesh	Became less marked on 8
5.	At 1.5 km above m.s.l.	8	From the cyclonic circulation over northeast Rajasthan to south Assam across Uttar Pradesh, Jharkhand & Gangetic West Bengal	Stationary	*In situ*	Became less marked on 9
6.	At 0.9 km above m.s.l.	9	From the cyclonic circulation over northwest Rajasthan to west Vidarbha across west Madhya Pradesh	Do	Do	Became less marked on 10
7.	Do	9	From east Assam to north Odisha across Gangetic West Bengal	Do	Do	Became less marked on 10
8.	At 3.1 km above m.s.l.	10	From the cyclonic circulation over north Bihar to north Odisha across Jharkhand and Gangetic West Bengal	Do	Do	Became less marked on 11
9.	At 0.9 km above m.s.l.	13-15	South interior Karnataka to northwest Madhya Pradesh across Madhya Maharashtra	Oscillatory	From south interior Karnataka to east Vidarbha	Became less marked on 16
10.	Between 1.5 km & 4.5 km above m.s.l.	15-16	From the cyclonic circulation over southwest Bay of Bengal & adjoining south Sri Lanka to Lakshadweep	Do	From the cyclonic circulation over Comorin area & adjoining south Tamil Nadu to Lakshadweep area	Became less marked on 17

TABLE 4 (*Contd*.)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
11.	At 0.9 km above m.s.l.	17-18	From the cyclonic circulation over northeast Rajasthan to north Madhya Maharashtra across west Madhya Pradesh	Stationary	*In situ*	Became less marked on 19
12.	At 1.5 km above m.s.l.	17-18	South Chhattisgarh to Comorin area across the cyclonic circulation over Rayalaseema & adjoining north Tamil Nadu	Oscillatory	From south Chhattisgarh to south interior Karnataka across Telangana & Rayalaseema	Became less marked on 19
13.	At 0.9 km above m.s.l.	18-20	From northwest Uttar Pradesh to north Bangladesh across Bihar and sub-Himalayan West Bengal & Sikkim	Do	From the cyclonic circulation over northwest Uttar Pradesh to east Bangladesh across east Uttar Pradesh, south Bihar, Jharkhand & Gangetic West Bengal	Became less marked on 21
14.	Do	19	From the cyclonic circulation over Madhya Maharashtra to south Tamil Nadu across interior Karnataka	Stationary	*In situ*	Became less marked on 20
15.	At 1.5 km above m.s.l.	19	From east Uttar Pradesh to Madhya Maharashtra across Madhya Pradesh	Do	Do	Became less marked on 20
16.	At 0.9 km above m.s.l.	20	From the cyclonic circulation over northwest Uttar Pradesh to north Madhya Maharashtra across west Madhya Pradesh	Oscillatory	Ran from the cyclonic circulation over Haryana to Marathwada across west Madhya Pradesh	Became less marked on 22
17.	Do	20	From the cyclonic circulation over south coastal Tamil Nadu to north interior Karnataka across south interior Karnataka	Do	From the cyclonic circulation over southwest Bay of Bengal to north interior Karnataka across Rayalaseema	Became less marked on 22
18.	Do	22-25	From the cyclonic circulation over northwest Rajasthan to Bangladesh across north Madhya Pradesh, south Uttar Pradesh, Jharkhand & W. B.	Do	From the cyclonic circulation over southeast Rajasthan to Telangana across Madhya Pradesh and Vidarbha	Became less marked on 26
19.	Do	27 May-1 Jun	From the cyclonic circulation over northeast Rajasthan to north Chhattisgarh across Madhya Pradesh	Do	West Uttar Pradesh to west Assam across southeast Uttar Pradesh, Jharkhand and Gangetic W.B.	Became less marked on 2 Jun
	North-South troughs					
1.	At 1.5 km above m.s.l.	22-23	From the cyclonic circulation over northwest Rajasthan to north interior Karnataka across southwest Madhya Pradesh & Madhya Maharashtra	Stationary	Cyclonic circulation over southeast Rajasthan to Marathwada	Became less marked on 24

TABLE 4 (*Contd.*)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
2.	At 0.9 km above m.s.l.	18	Ran from Marathwada to the cyclonic circulation over Tamil Nadu across Karnataka	Stationary	*In situ*	It merged with the trough from the cyclonic circulation over Madhya Maharashtra to south Tamil Nadu on 19
	East- west trough					
1.	At 0.9 km above m.s.l.	10-12	From northwest Rajasthan to south Assam across Madhya Pradesh, Jharkhand and Gangetic West Bengal	East-west	From the cyclonic circulation over west Uttar Pradesh to south Assam across east Uttar Pradesh, Bihar and Sub-Himalayan W.B.	Became less marked on 13
2.	At 1.5 km above m.s.l.	21	From the cyclonic circulation over Haryana to the cyclonic circulation over east Bangladesh across U.P., Bihar, Gangetic W.B.	Stationary	*In situ*	Became less marked on 22
	Trough in westerlies					
1.	At 3.1 km above m.s.l.	14-15	Roughly along Long. 88° E to the north of Lat. 21° N	Stationary	*In situ*	Became less marked on 16
2.	At 1.5 km above m.s.l.	29	Roughly along Long. 86° E to the north of Lat. 23° N	Do	Do	Became less marked on 30
	Trough/Wind Discontinuity					
1.	At 0.9 km above m.s.l.	5-7	From Marathwada to south Tamil Nadu across interior Karnataka	Oscillatory	From the cyclonic circulation over Madhya Maharashtra to south interior Karnataka across north interior Karnataka which extended	Became less marked on 8
2.	Upto 1.5 km above m.s.l.	9	From the cyclonic circulation over northeast Rajasthan to south interior Karnataka across north interior Karnataka	Stationary	*In situ*	Became less marked on 10
3	At 0.9 km above m.s.l.	11-12	From Marathwada to Comorin area across interior Karnataka and Kerala	Oscillatory	From east Madhya Pradesh to Comorin area across Vidarbha, Marathwada, interior Karnataka & Tamil Nadu	Became less marked on 13
(**F**)	*Shear zone*					
1.	Between 4.5 & 5.8 km above m.s.l.	29-31 May	Ran roughly along Lat. 8° N over south peninsular India	Stationary	*In situ*	Became less marked on 1 Jun

TABLE 5

Some representative amounts of rainfall in cm for the months March, April and May 2024 (5 cm and above)

Date	Chief amounts of rainfall in cm
1 Mar	Nil
2 Mar	Manali 9, Banjar, Seo Baghand PTO Koksar 8, Bhaderwah ARG, Banihal, Kothiand Udaipur 7 each
3 Mar	Udhampur 13, Chakrata and Jatton Barrage 12 each, Narwana 10, Banihal, Manali, Sangraha, Renuka/Dadhau, Tiuni, Purola and Mori 9 each, Qazi Gund, Nahan, Pachhad, Rajaund, Thanesar, Kothi and Joshimath 8 each, Orchha, Bhaderwah ARG, Rajouri ARG, Ghumarwin, Moorang, Chaupal, Sarahan,Barara,KurukshetraKvkAWS,Bhinga,Batote and Katra 7 each
4 Mar	Nil
5 Mar	Nil
6 Mar	Nil
7 Mar	Nil
8 Mar	Nil
9 Mar	Nil
10 Mar	Nil
11 Mar	Nil
12 Mar	Nil
13 Mar	Nil
14 Mar	Nil
15 Mar	Nil
16 Mar	Nil
17 Mar	Nil
18 Mar	Amraoti 7
19 Mar	Tirodi 7
20 Mar	Cheepurupalle 14, Garividi 13, Bejjur and Mulchera 8 each, Mathabhanga, Athmalik, Talcher, Patnagarh, Kantamal, Bhuban, Gondia, Daringibadi and Komna 7 each
21 Mar	Vaishali and Sikta 13 each, Darjeeling, Sahebpur Kanal and Monghyr 9 each, Bau Kanke 8, Bausi, Benibad and Sangrampur 7 each
22 Mar	Sevoke 10, Bomdila AWS 9, Dhemaji 7
23 Mar	Bagdogra IAF 8, Panambur 7
24 Mar	Nil
25 Mar	Mangan 7
26 Mar	Williamnagar 12, ChanduaKuliana and Cherrapunji (rkm) 10 each, Karimganj 9, Cherrapunji 8, Itanagar 7
27 Mar	Nil
28 Mar	Nil
29 Mar	Nil
30 Mar	Nil
31 Mar	Nil
1 Apr	Cherrapunji (rkm) and Cherrapunji 8 each, Dudhnoi ARG and Jiribam AWS 7 each
2 Apr	Miao 10, Hawai 8
3 Apr	Shella 14
4 Apr	Nil
5 Apr	Nil

TABLE 5 (*Contd*.)

Date	Chief amounts of rainfall in cm
6 Apr	Nil
7 Apr	Cherrapunji 11, Kibithu 7
8 Apr	Bhuban 9
9 Apr	Hut Bay 17, Patiala (new), Mahabaleshwar and Nizamabad 9 each, Hissar and Ramgundam 7 each
10 Apr	Nil
11 Apr	Nil
12 Apr	Coonoor PTO and Coonoor 12 each, Mavelikara 9, Servalar Dam 8, Adar Estate, Kakkachi, Manjolai and Oothu 7 each
13 Apr	Kandhar 8, Sivakasi 7
14 Apr	Shamshabad and Agumbe 8 each, Mahroni and Tavaragera 7 each
15 Apr	Nil
16 Apr	Jammu AWS and Jammu 9 each, Reasi ARG and Udhampur 7 each
17 Apr	Gangtok 9, Mon 8
18 Apr	Gokulpur AWS 9, Zunheboto Nsdma AWS 7
19 Apr	Nachu ARG 8
20 Apr	Kumta and Barpathar 13 each, B P Ghat 12, Gokarna, Mokokchang and Mangkolemba 10 each, Silchar, Cherrapunji and Zunheboto 9 each, Navipet, Manki, Amraghat, Cherrapunji (rkm), Longleng Nsdma AWS and Wokha 8 each, Kammardi, Koppa, APG hat and Ongpangkong Nsdma AWS 7 each
21 Apr	Sarupathar ARG 14, Mokokchang 12, Kotpad 11, Panjim and Khajuri 9 each, Lakhipur ARG 8, Lakhipur, Amraghat, Jiribam AWS, Mangkolembaand Gadag 7 each
22 Apr	Deomali 9, Udaipurand Gharmura 7
23 Apr	Nil
24 Apr	Oyan ARG, Nachu ARG and Halflong 11 each, Tuting 9
25 Apr	Cacher Kvk AWS 13, Roing and Mon 8 each
26 Apr	Nil
27 Apr	Karimganj AWS 7
28 Apr	Kibithuand Shella 7
29 Apr	Hawai 11, Nowgam 10, Lakhipurand Silchar AWS 9, AP Ghat 8, Lakhipur ARG and Silchar 7 each
30 Apr	Manali 8, Verinag 7
1 May	Deomali AWS and Dillighat 12 each, Hawai, Lala ARG, Margherita and Udaipur 9 each, Dholai 8, Amraghat ARG, Moranhat, Naharkatia ARG, Mon, Amraghat, BP Ghat and Karimganj 7 each
2 May	Khliehriat 20, Cherrapunji (rkm) 19, Mawsynram 14, Cherrapunji and Halflong 12 each, Tuting 8
3 May	Anini AWS 21, Gokulpur AWS and Udaipur 11 each, Amarpur ARG 10, Pasighat AP 9, Kamba AWS, Lawngtlai and Saiha 8 each, Lawngtlai ARG and Sonamura ARG 7 each
4 May	Nil
5 May	Gharmura 9
6 May	Mawsynram 14, Williamnagar 12, Cherrapunji (rkm), Cherrapunji and Karimganj 9 each, Mawkyrwat ARG and Kanchanpur 8 each, Dhemaji, Khliehriat, Mawkyrwat, Kamalpur AWS, Khowai, Khowai AWS, Umrangso and Chottabekra 7 each
7 May	MoSaltlake and Padannakkad AWS 9 each, Gosani 8, Gumma, Alipore and Nanjanagud 7 each
8 May	Kakrahi 14, Markapur, Allagadda and Raju Palem 10 each, Krp Dam and Keelpennathur 9 each, Udayagiri, Duvvur, Porumamilla, Lalbegiaghat and Shekpet 8 each, Gudivada, Seetharamapuram, Madanapalle, Jammalamadugu, Vallur, Chengam, Melalathur, Berhampore and Chandur 7 each
9 May	Muzaffarpur, Kollidam, Banki, Aul, Nawana and Narva 7 each

TABLE 5 (*Contd*.)

Date	Chief amounts of rainfall in cm
10 May	Sothuparai 13, Thritla 12, Alur, Peraiyur, Mankara AWS, Ottapalam, Daitari, Rasagovindapur and Kalaikunda (Iaf) 9 each, Watrap, Kollamkode and Harinkhola 8 each, Enamakkal, Vyanthala ARG, Banspal, Ghasipura, Betanati, Karanjia, Muruda, Midnapore, Amfu Kharagpur, Midnapore (CWC), Palawancha, Bengaluru Kial, Periakulum and Kottayam 7 each
11 May	Pennagaram and Rajnagar 10 each, Kailashahar AP, Kailashahar AWS and Srirangapatna 9 each, Hogenekal 8, Gogunda SR, Samayapuram, Aul, Bagli and Kamalpur 7 each
12 May	Gajoldoba 14, Sevoke 13, Murti and Neora 12 each, Banki 11, Nandgaon 10, Gaunaha, Panniyoor ARG, Cuttack and Tangi 9 each, Vadgaon Maval, Kujanga, Naugaon, Bhubaneswar AP, Chengmari/Diana, Chepan, Bankura (CWC) and Hubballi 8 each, - Pamban, Soro, Basudevpur, Reamal, Balikuda, Jagatsinghpur, Jhumpura, Banpur, Chilika, Ranpur, Rama and Thiruvalla AWS 7 each
13 May	Atmakurwrgl 13, Sivagiri and Shayampet 12 each, Kothaguda 11, Puttur HMS 10, Dhone, Rolla, Bhupalpalle and Uppinangadi 9 each, Chittar, Rairakhol, Hanamkonda, Khanapur, Kottigehara and Sira 8 each, C Belagal, Yemmiganur, Elumalai, Mandapam, Ponnani, Angul, Jangaon, Govindaraopet, Gabbur and Belgaum 7 each
14 May	Srirangapatna 16, Udayagiri 12, Thambalapalle and Enadimangalam AWS 11 each, Kunnamangalam AWS 10, Mandya 9, Pwd Makkinampatti and Kozhikode 8 each, Savarkundla, Addanki, Pollachi, Tuticorin, Karipur Ap. and Laha AWS 7 each
15 May	Neryamangalam ARG 9, Aruppukottai Kvk AWS and Kovilankulam 8 each, Tenali, Siddapura, Hukkeri and Bevoor 7 each
16 May	Pattukottai and Sidhi 16 each, Singampunari 14, Mannargudi 13, Manamelkudi, Adirampatnam and Madukkur 11 each, Attur and Urumi AWS 10 each, Vedasandur, Vadipatti, Mohanur, Sothuparai, Majitar and Jowai AWS 9 each, Sembanarkoil PWD 8, Karaikal, Mettupatti, Sathiar, Tirumangalam, Velankanni, Bamra and Khanitar 7 each
17 May	Shillong CSO 13, Mahabubabad and Shillong AWS 12 each, Ghattu, Garla, Kalwakurthy and Malyal 10 each, Yellandu, Shekpet and Bayyaram 9 each, Kudulu, Jajireddigudem and Suryapet 8 each, Canacona, Rajmahal, Mylaudy, Ayyankunnu AWS, Taliparamba, Panniyoor ARG, Poonjar AWS, Atmakurwrgl, Yellandu (ARG), Hasanparthy, Himayatnagar, Hyderabad AP, Palakurthi, Zaffergadh, Dornakal, Addakal, Mothey, Moranhat, Puttur HMS, Kammardi, Konanur and Bhagamandala 7 each
18 May	Pillur Dam Mettupalayam and Coonoor 17 each, Coonoor PTO 14, Enadimangalam AWS and Gubbi 11 each, Mankara AWS and Periakulum 10 each, Usilampatti, Manjalar, Sengulam Dam AWS, Resubelpara and Begur 9 each, Gurramkonda, Burliar, Kil Kotagiri Estate, Sivagiri, Madathukulam, Ottapalam AWS, Manikpur ARG and Shella 8 each, Bapatla, Mylaudy, Alakarai Estate, Taluk Office Pandalur, Neryamangalam ARG, Anakayam ARG, Perinthalamanna, Manash Nh Xing, Srijangram ARG, Bahalpur, Cherrapunji (rkm), Cherrapunji,Yellapur, C R Patna and Sravanabelagola 7 each
19 May	Kollam Rly and Laha AWS 19 each, Airport Chakka ARG 16, Trivandrum AP and Thiruvalla 13 each, Sukma, Jamunamarathur, Thiruvananthapuram, Hosadurga and Channagiri 12 each, Aralam AWS 11, Pechiparai, Irikkur and Konni ARG 10 each, Chhindgarh, Ambur, Vadapudupattu, Poonjar AWS, Konni, Neyyattinkara, Belthangadi, Yellapur and Hesaraghatta 9 each, Parvathipuram, Gooty, Kozhiporvilai, Keerampara ARG, Peermade To, Thodupuzha ARG, Perumkadavila ARG, Gangtok, Ranni AWS and Thrissur 8 each, Chinnamandem, Thirparappu, Pambar Dam, Natrampalli, Paripalli AWS, Quilandi, Anakayam ARG, Ottapalam, Varkala, Chengmari/Diana, Nagarkata, Chikballapura, Kadur, Yagati, Napoklu, Mattannur ARG, Tadang, Chickmagalur and Perumpavur 7 each
20 May	Goalpara PTO and Goalpara AWS 13 each, Kamudhi, Karumadi AWS and Kozhikode 12 each, Tallakulam, Mancompu, Ottapalam, Ottapalam AWS and Chimoni ARG 11 each, Pullambadi, Peechi AWS and Yellapur 10 each, Alapuzha, Keerampara ARG, Thiruvananthapuram and Dudhnoi ARG 9 each, Amarapuram, Suthamalli Dam, Tirumayam, Pattembi, Thritla, Vadakkancherry, Amini, Sevoke, M M Hills and Forbesganj 8 each, Mormugao - Pmo IMD, Chargharia, Vedasandur, Thalavadi, Kumarapalayam, Kariyakovil Dam, Karaikudi, Budalur, Vettikadu, Kayamkulam, Alathur, Vellanikkara, Narsampet, Gersoppa, Kollegal, Yagati, HD Kote, Sira and Urumi AWS 7 each
21 May	Puduchatram 16, Dharmasthala 15, Grand Anaicut 14, Karur, Trp AP and Urumi AWS 13 each, Chinnakalar and Samayapuram 12 each, Sendamangalam and Ambalavayal 11 each, Panchapatti, Rasipuram, Viralimalai, Tondi, Chamarajanagar AWS and Karapuzha AWS 10 each, Chennimalai, Yercaud, Sivaganga and Mavelikara 9 each, Valparai Pap, Hogenekal, Krishnarayapuram, Gandarvakottai, Illuppur, Karaiyur, Theerthandathanam, Salem, Sankaridurg, Lalgudi, Tiruchirappalli Junctio, Nilambur, Chamarajanagar and Santhebennur 8 each, Cincona, Perundurai, Nambiyur, Sankarapuram, Mullanginavillai, Erumapatti, Namakkal, Barwood, Annavasal, Kudimiyanmalai, Danishpet, Manapparai, Trp Town, Vathalai Anaicut, Nilambur AWS, Vakkad AWS, Kuppady, Agathi, Similiguda, Mangaluru AP, Uppinangadi, Lakshmeswar, Koppa, Hunchadakatte and Mangalore/P.bur 7 each
22 May	Aliyar 15, Thirumoorthi Dam and Thirumoorthy Ib 14 each, Amaravathy Dam 12, Maharo and Rajmahal 11 each, Purnea 10, Zrs Dumka, Bausi, Kottaram, Alwaye PWD, Amini and Met Agartala AWS 9 each, Barari, Pwd Vaarappatti, Pwd Makkinampatti, Pilicode AWS, Parumbikulam and Agartala AP 8 each, Jarmindi, Godda, Godda Kvk AWS, Ghurriya, Colachel, Kanyakumari, Tirupathur, Madathukulam, Rscl-3 Semmedu, Varkala, Kunnamkulam AWS,Kunnamkulam and Thiruvalla AWS 7 each
23 May	Cherthala and Kunnamangalam AWS 21 each, Vepur and Kumarakam 20 each, Thycauttussery AWS, Karipur Ap. and Ponnani 19 each, Kattumayilur 18, Vilupuram and Palluruthy ARG 17 each, Port Blair 15, Mylaudy, Enamakkal, Kodungallur, Vilangankunnu ARG and Cochi IAF 14 each, Lakkur, Tozhudur,Choondy AWS and Perumpavur 13 each, Valparai Taluk Office, Kunderipallam, Thammampatty, Alapuzha, North Paravur AWS, Thennala AWS and Ernakulam South 12 each, Kumarkhand,

TABLE 5 (*Contd*.)

Date	Chief amounts of rainfall in cm
	Muzaffarpur, Valparai Pap, Kodanad, Kayamkulam, Keerampara ARG, Kalamassery AWS, Hosdurg, Vaikom and Vaikkom AWS 11 each, Gobichettipalayam, Geddai, Avinasi, Mancompu, Kochi C.i.a.l., Kottayam and Vyanthala ARG 10 each, Vedasandur, Billimalai Estate, K Bridge, Karumadi AWS, Mavelikara, Pinarayi AWS, Neeleswaram ARG,Piravam, Vakkad AWS, Palakkad and M M Hills 9 each, Gurabandha, Chinnakalar, Me Mathur, Anaikedanku, Kottaram, Kurunthancode, Mambzhathuraiyaru,Thuckalay, Thirupathisaram AWS, Chamraj Estate, Harisan Malayalam Ltd., Wood Braiyar Estate, Labbaikudikadu, Kallakudi, Pullambadi, Haripad, Kozhikode and Chalakudi 8 each, Zrs Darisai, Cincona, Mettupalayam, Pillur Dam Mettupalayam, Thondamuthur, Hogenekal, Bhavanisagar, Kodivery, Balamore, Colachel, Pambar Dam, Alakarai Estate, Coonoor PTO, Kil Kotagiri Estate, Agaram Seegoor, Eraiyur, Vaigai Dam, Ams Kannur, Kannur Airport AWS, Neryamangalam ARG, Mahe, Quilandi, Manjeri, Malampuzha Dam AWS, Vellanikkara, Alipore, Sargur, Kabanigiri AWS and Coonoor 7 each
24 May	Kalamassery AWS 15, Alwaye PWD and Ernakulam South 13 each, Kochi C.i.a.l. and Hut Bay 12 each, Pinarayi AWS, Neeleswaram ARG and Perumpavur 11 each, Nalumukku, Kannur, Aluva AWS and Kannur Icar AWS 10 each, Irikkur and Kodungallur 9 each, Pechiparai, Oothu, Ams Kannur, Kannur Airport AWS, Palluruthy ARG, Quilandi and Port Blair 8 each, Kinnakorai, Kakkachi, Taliparamba, Panniyoor ARG, Hosdurg, Sankeshwar, Napoklu, Tellichery, Peringome AWS and Cochi IAF 7 each
25 May	Mulki 19, Palluruthy ARG 14, Alwaye PWD, Hosdurg and Udupi 13 each, Aluva AWS 12, Kakinada, Karumadi AWS, Neeleswaram ARG, Perumpavur, Kurudamannil, Athirappalli AWS and Thiruvalla AWS 11 each, Mylaudy, Haripad, Mavelikara, Kushalnagar, Ernakulam South, Laha AWS and Ranni AWS 10 each, Paderu, Kalyandrug, Mambzhathuraiyaru, Cherthala, Kochi C.i.a.l., Kochi IAF, Konni and Kalasa 9 each, Anaikedanku, Balamore, Thuckalay, Periyar, Choondy AWS, Piravam, Idukki, Peermade To, Vaikkom AWS, Konni ARG, Mangaluru, Panambur, Siddapura, Ulanad AWS and Agumbe 8 each, Kanekal, Madakasira, Kottaram, Nagercoil, Puthan Dam, Perunchani Dam, Nalumukku, Oothu, Alapuzha, Kayamkulam, Nooranad AWS, Kudulu, Pilicode AWS, Poonjar AWS, Vaikom, Kunnathanam AWS, Port Blair, Amarpur ARG, Sringeri HMS, Tarikere, Nayakanahatty and Venkurinji AWS 7 each
26 May	Maya Bandar 13, Tribeni/Balmikinagar 7
27 May	Sagar Island 18, Shella 17, Alipore 15, Durgachack 14, Contai and Uluberia 13 each, Diamond Harbour 12, Mo Saltlake, Canning, Beki Mathungari and N. lakhimpur/Lilabari 10 each, Ranpur, Kalyani Smo, Dum Dum and Amfu Kakdwip 9 each, Rajnagar, Barrackpur (Iaf), Basirhat (pt), Kolasib ARG, Kolasib AWS, Mawsynram and Aizawl 8 each, Alapuzha, Aul, Nawana, Bhapur, Barobhisha, Digha, Bagati, Cherrapunji (rkm), Cherrapunji, Majuli, Tezpur, Chandel AWS and Ukhrul 7 each
28 May	Cherrapunji (rkm) 59, Cherrapunji and Mawphlang 39 each, Mawsynram 36, Jowai AWS 27, Shillong AWS, Shillong CSO, Kvk Dhalai and Umrangso 24 each, Mawkyrwat ARG, Dm Office ARG and Williamnagar 23 each, Karimganj AWS, Mawkyrwat and Kailashahar AP 22 each, Budhjongnagar ARG and Agartala AP 21 each, Amarpur 20, Khowai, Arundhutinagar, Lembuchhera and Hrc Nagicherra ARG 19 each, Khliehriat, Dharmanagar/Panisagar and Ashapara AWS 18 each, Silchar AWS, Barapani, Gandachara AWS, Amarpur ARG, Kadamtala ARG and Sabroom 17 each, Lala ARG, Kamalpur AWS, Matijuri, B P Ghat and Karimganj 16 each, Silchar, Hailakandi AWS, Badarpur ARG, Udalguri AWS,Udaipur and Jowai 15 each, Lengpui, Kvk South, Chavara AWS, A P Ghat and Aizawl 14 each, Paripalli AWS, Kanchanpur and Gharmura 13 each, Mavelikara and Kamalpur 12 each, Kayamkulam, Kollam Rly, Halflong, Resubelpara, Gandecherra, Gokulpur AWS, Bishalgarh, Cti ARG, Belonia and Sabroom AWS 11 each, Cherthala, Kolasib ARG and Mamit ARG 10 each, Nooranad AWS, Vaikom, Lakhipur ARG, Chhamonu, Jiribam AWS, Kolasib AWS, Lunglei, Saiha, Ukhrul and Dholai 9 each, Vaikkom AWS, Basar, Amraghat ARG, Kheronighat, Basar AWS, Amraghat, Lakhipur, Thattathumala AWS and Cochi IAF 8 each, Mancompu, Kayamkulam ARG, Thycauttussery AWS, Trivandrum AP, Palode AWS, Harinagar ARG, Nongpuh, Bishnupur, Chandel AWS and Thoubal 7 each
29 May	Cherrapunji (rkm) 28, Piravam and Mawsynram 20 each, Kumargram, Bomdila AWS and Hasimara 19 each, Poonjar AWS, Cacher Kvk AWS, Khliehriat, Cherrapunji and Lala ARG 18 each, Matijuri 17, Buxaduar 16, Kayamkulam ARG, Silchar, Hailakandi AWS, Lawngtlai ARG, Amraghat and Halflong 15 each, Kayamkulam and Dholai 14 each, Vaikom, Amraghat ARG and Saiha 13 each, Nooranad AWS, Chepan and Lawngtlai 12 each, Mavelikara, Palluruthy ARG,Vaikkom AWS, Vadavathur AWS, Enamakkal, Champasari, Barobhisha, Miao, Kokrajhar, Ukhrul, A P Ghat and Lakhipur 11 each, Haripad, Thycauttussery AWS, Kottayam, Chengmari/Diana, Silchar AWS, Gossaigaon, Harinagar ARG and Tening Nsdma AWS 10 each, Cherthala, Karumadi AWS, Lakhipur ARG, Goalpara PTO, Goalpara AWS, Gossaigaon AWS, Fakiragram ARG, Imphal AP, SaihaARG, Karimganj and Cochi IAF 9 each, Kanjirappally, Thennala AWS, Athirappalli AWS, Bilasipara ARG, Karimganj AWS and Badarpur ARG 8 each, Mattanchery AWS, Peermade To, Kumarakam, Kunnamkulam AWS, Kunnamkulam, Namsai Kvk AWS, Kalaktang, Beki Mathungari, Hazuah, Dhemaji, Jiribam AWS, Ernakulam South and BP Ghat 7 each
30 May	Cherrapunji (rkm) and Mawsynram 66 each, Cherrapunji 63, Khliehriat 33, Jowai AWS 31, Mawphlang 21, Mawkyrwat 20, Mancompu, Mawkyrwat ARG and Jowai 19 each, Karumadi AWS 15, Kodungallur 14, Halflong 13, Aie Nh Xing and Fakiragram ARG 12 each, Jiribam AWS and Lakhipur 11 each, Mavelikara, Choondy AWS, Lakhipur ARG, Tening Nsdma AWS and Ulanad AWS 10 each, Nooranad AWS, Ponnani, Thiruvananthapuram, Manash Nh Xing, Silchar, Silchar AWS and Cheruvanchery AWS 9 each, Piravam, Irinjalakuda,Minicoy,Gossaigaon,Thiruvalla AWS, AP Ghat and Karimganj 8 each, Cherthala, Kayamkulam, Vaikom, Airport Chakka ARG, Trivandrum AP, Enamakkal, Naharlagun AWS, Beky Rly. bridge, Dudhnoi ARG, Harinagar ARG, Kokrajhar, Tamenglong, Ernakulam South and BP Ghat 7 each
31 May	Cherrapunji (rkm) 22, Cherrapunji 19, Mawsynram 18, Williamnagar 15, Tadang 14, Goalpara PTO 13, Bilasipara ARG and Goalpara AWS 12 each, Jorhat 11, Pattembi, Chalakudi and Harinkhola 10 each, Vellarikkundu AWS, Thritla, Dudhnoi ARG, Majuli, Mawkyrwat ARG and Jorhat AWS 9 each, Kishanganj, Ayyankunnu AWS, Thennala AWS, Enamakkal, Gangtok, Srijangram ARG, Resubelpara, Mawkyrwat and Tikrikilla 8 each, Mathabhanga, Buxaduar, Gheropara, Burdwan PTO, Barpeta, Manash Nh Xing, Dhubri IMD, Khliehriat, Sonari ARG, Kamalpur AWS, Kailashahar AP, Tihu ARG and Rangia 7 each

cyclone located over north and adjoining central Bay of Bengal to these areas.

Around the mid of 2nd fortnight of month, light to moderate rainfall accompanied with thunderstorm were recorded at many places over Nagaland, Manipur, Mizoram & Tripura and at a few places over Assam & Meghalaya during most dates in the last week. Light to moderate rainfall/snowfall and thunderstorms were also recorded at most places over Arunachal Pradesh and Sub-Himalayan West Bengal & Sikkim due to (*i*) An east-west trough in the lower levels from Bihar to south Assam (*ii*) cyclonic circulation and associated upper level north-south trough in the region (*iii*) Moisture laden southerly/southwesterly winds at lower levels to these areas from Bay of Bengal due to Anticyclone in lower levels over North Bay of Bengal. Hailstorm was observed at isolated places over East Madhya Pradesh, Vidarbha, Chhattisgarh, Coastal Andhra Pradesh and Telangana, Gangetic West Bengal, Nagaland, Manipur, Mizoram & Tripura, coastal Odisha and Chhattisgarh.

Sea surface temperature was greater than 0.5 °C over all the Nino regions and moderate El Niño conditions are prevailing over equatorial Pacific ocean during the month.

3.1.2. *Monthly rainfall*

During March 2024, rainfall realized over the country as a whole was 96% of its LPA. Except most of the sub divisions from south peninsula, extreme northeast India, West Rajasthan and both the islands, where the remaining sub-divisions received large excess/ excess/normal rainfall. Out of 36 meteorological subdivisions, 10 received large excess, 5 received excess, 4 received normal, 5 received deficient and 12 received large deficient rainfall.

Rainfall over homogeneous region of south peninsula (3.3 mm) was 21st lowest since 1901 and was 2nd lowest since 2001.

Some of the stations recorded highest rainfall, a list of stations is furnished below with their previous record and date.

Station	24 hours record rainfall in march 2024 (mm) #	Date	Previus rainfall record (mm)	Date	State
Itanagar	68.8	26	53.1	24-3-2010	Arunachal Pradesh
Darjeeling	86.2	21	72.9	31-3-1951	West Bengal
Forbesganj	49.2	21	44.4	8-3-2020	Bihar
Muzaffarpur	51.8	21	31.3	20-3-1969	Bihar
Orai	41.0	3	22.1	26-3-1951	Uttar Pradesh
Hissar	43.2	3	42.0	20-3-1997	Haryana
Bilaspur Sadar	50.4	30	25.0	12-3-2020	Himachal Pradesh
Bhind AWS	27.0	3	20.0	27-3-1974	Madya Pradesh
Bilaspur	32.0	19	25.0	12-3-2020	Chhattisgarh

based on real-time available data

3.1.3. *Temperature distribution*

(A) *Maximum temperatures*

Maximum temperature during March 2024 was normal/below normal over most parts of the country, except some parts of Jammu, Kashmir & Ladakh, south peninsular India, northeast India and both the islands. Maximum temperature anomaly was more than 2 °C over parts of Kerala & Mahe. Maximum temperature anomaly was more than 1 °C over parts of Jammu & Kashmir state, Maharashtra state (except Konkan & Goa subdivision), South Interior Karnataka, North Interior Karnataka, Rayalaseema, Tamil Nadu, Puducherry & Karaikal, Kerala & Mahe and Lakshadweep islands. Maximum temperature anomaly was less than -2 °C over parts of Bihar, Jharkhand and West Bengal state. Maximum temperature was the 3rd highest (35.3 °C with an anomaly of 0.7 °C) after the years 2016 (35.7 °C), 2010 (35.5 °C) since 1901. The highest maximum temperature of 42.8 °C had been recorded at Akola (Vidarbha) on 27th March 2024.

(B) *Minimum temperatures*

Minimum temperature was above normal over most parts of the country, except some parts of northwest India, central India, east & northeast India and southern Lakshadweep islands. Minimum temperature anomaly was more than 2 °C over parts of Telangana, Rayalaseema, North Interior Karnataka, Marathawada and Madhya Maharashtra. Minimum temperature anomaly was less than -1 °C over parts of East Madhya Pradesh, Rajasthan state, Punjab, Haryana, Chandigarh & Delhi, Uttar Pradesh state and Gangatic West Bengal. Over South Peninsular India minimum temperature was the 2nd highest (23.3 °C with an anomaly of 1.1 °C) after the year 2016 (23.6 °C) the lowest minimum temperature of 5.0 °C had been recorded at Pilani (East Rajasthan) on 4th March, 2024 and Karnal (Haryana) on 6th March, 2024 over the plains of the country during the month.

Country as a whole the maximum temperature was normal and minimum temperature was above normal during March 2024.

TABLE 6

Dates of occurrence of Heat wave/Severe Heat wave - March 2024

No	Sub-Division Name	Dates (Number of Days) Severe Heat Wave	Heat Wave
2	Arunachal Pradesh	-	-
3	Assam & Meghalaya	-	-
4	Naga, Mani, Mizo and Tri.	-	-
5	S. H. W. B. & Sikkim	-	-
6	Gangetic West Bengal	-	-
7	Odisha	-	-
8	Jharkhand	-	-
9	Bihar	-	-
10	East Uttar Pradesh	-	-
11	West Uttar Pradesh	-	-
12	Uttarakhand	-	-
13	Haryana, Chandigarh & Delhi	-	-
14	Punjab	-	-
15	Himachal Pradesh	-	-
16	JAMMU - KASHMIR and LADAKH	-	-
17	West Rajasthan	-	27, 29 (2)
18	East Rajasthan	-	-
19	West Madhya Pradesh	-	28, 29 (2)
20	East Madhya Pradesh	-	29 (1)
21	Gujarat Region	-	-
22	Saurashtra & Kutch	-	20, 21 (2)
23	Konkan & Goa	-	-
24	Madhya Maharashtra	-	-
25	Marathwada	-	-
26	Vidarbha	-	-
27	Chhattisgarh	-	-
28	Coastal Andhra Pradesh & Yanam	-	-
29	Telangana	-	-
30	Rayalaseema	-	-
31	Tamil Nadu, Puducherry& Karaikal	-	-
32	Coastal Karnataka	-	-
33	North Interior Karnataka	-	-
34	South Interior Karnataka	-	-
35	Kerala	-	-

There was also no significant spell of heat wave conditions developed over any area in the country except isolated pockets over for 2-3 days over parts of West Rajasthan and some sub-division from central India. Dates of occurrence of Heat wave/Severe Heat wave for March 2024 is given in Table 6.

A tornado occurred over Jalpaiguri district of west Bengal around 3:30 pm on 31st March lasting for about 10 minutes.

3.1.4. *Disastrous weather events and damage*

Fig. 2 shows significant weather events during March 2024 (Based on real-time media reports).

Based on real time media reports, during March 2024, a total of 30 persons were reportedly claimed dead & more than 300 persons were injured. Lightning, thunderstorm and heavy Rains & Landslide claimed 12, 6 and 12 persons death respectively.

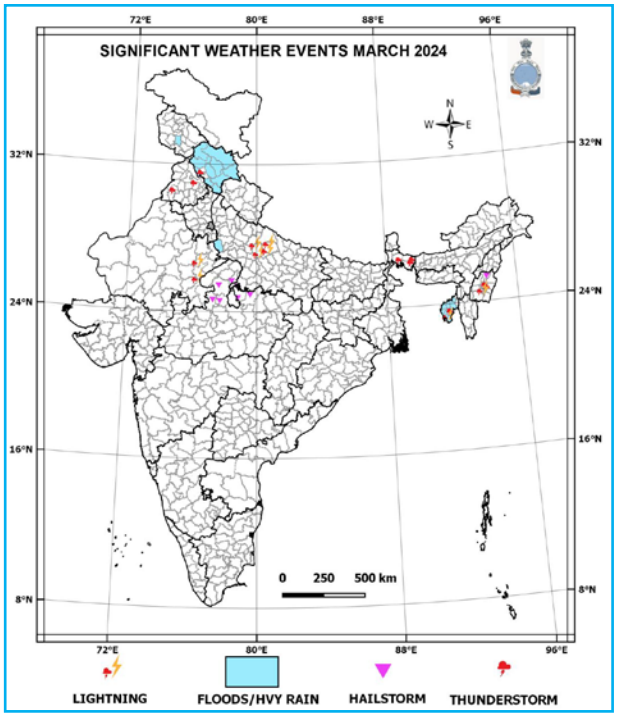

Fig. 2. Significant weather events during March 2024 (*Source* : IMD Climate Summary for the month of Mar 2024)

3.2. *April*

3.2.1. *Weather and associated synoptic features*

The details of the weather systems during the month are given in Table 3.

As given in Table 3, 6 western disturbances with 1 induced cyclonic circulation, 44 upper air cyclonic circulations and 17 troughs which affected the weather over the country during the month of April. No intense low pressure system formed during the month.

An active western disturbance as a cyclonic circulation over Iran & neighbourhood with a trough aloft; formation of an induced cyclonic circulation over northwest Rajasthan & adjoining Pakistan at lower levels and its east ward movement during the week caused light /moderate rainfall /snowfall at most places over Jammu-Kashmir, Uttarakhand; at few places over Himachal Pradesh and at isolated places over parts of eastern parts of central India during first half of the week. Thunderstorms at isolated places were also reported over these areas during the period. Due to mainly dry weather over peninsular India and adjoining western parts of central India during most of the days; maximum temperature was raised in some areas of these regions which led to develop season's first heat wave conditions which observed at isolated places over Madhya Pradesh, west Rajasthan and north interior Karnataka for two days each. East-west trough from Bihar to south Assam, lower level winds with moisture incursion emanating from anti-cyclone over central and north Bay of Bengal caused wet spells over northeast India during the month.

Due to movement of an active western disturbance across north India and formation of an induced low pressure area over Rajasthan during mid of the 3rd week; light to moderate rainfall / snowfall accompanied with thunderstorm and lightning at isolated places was observed at most places over Jammu-Kashmir-Ladakh-Gilgit-Baltistan-Muzaffarabad, Himachal Pradesh, Uttarakhand and adjoining plains of northwest India. Due to wind convergence at lower levels, light to moderate rainfall accompanied with thunderstorm and lightning at isolated places was observed over Madhya Pradesh, north interior Karnataka, Vidarbha and Chhattisgarh during the third week of the month.

Hailstorms were reported at isolated places over Telangana, Himachal Pradesh, Madhya Pradesh, Vidarbha, Jammu - Kashmir for two days and over Madhya Maharashtra, northwest Rajasthan, Uttarakhand, Punjab, Haryana, Odisha, east Uttar Pradesh and Jharkhand on a day in last week.

3.2.2. *Monthly rainfall*

During April 2024, rainfall realized over the country as a whole was 82% of its LPA. Over the homogeneous region, 171% of its LPA over central India, 121% of its LPA over northwest India, 37% of its LPA over south peninsular India, and 63% of its LPA over east & northeast India. Most of the subdivisions received large deficient/deficient rainfall, except most subdivisions from Central India, Jammu & Kashmir & Ladakh, Arunachal Pradesh, Himachal Pradesh, North Interior Karnataka and Coastal Karnataka which received large excess/ excess/normal rainfall. Out of 36 meteorological subdivisions, 6 received large excess, 2 received excess, 5 received normal, 11 received deficient and 12 received large deficient rainfall.

Rainfall over the homogeneous region of south peninsular India (12.6 mm) was 4th lowest since 1901. Prior lowest rainfall years were 1983 (4.6 mm), 1906 and 2016 (7.3 mm), 1950 (10.7 mm). Rainfall over homogeneous region of Central India (15.1 mm) was 22 highest since 1901 but 5th highest since 2001 after the years 2023 (30.0 mm), 2015 (25.7 mm), 2020 (23.9 mm), 2013 and 2018 (17.1 mm).

3.2.3. *Temperature distribution*

Over the country as a whole both the maximum and minimum temperatures were above normal during April 2024. In the month of April, over the country the mean temperature was 29.1 °C with an anomaly of 0.8 °C and 8th highest since 1901. Among the four homogeneous regions, over South Peninsular India maximum temperature was the 2nd highest (37.3 °C with an anomaly of 1.5 °C) after the year 2016 (37.6 °C) and minimum temperature was also the 2nd highest (25.5 °C with an anomaly of 1.1 °C) after the year 2016 (25.8 °C) since 1901. The mean temperature over South Peninsular India was the 2nd highest (31.4 °C with an anomaly of 1.2 °C) after the year 2016 (31.7 °C) since 1901. Over East & Northeast India minimum temperature was the highest (22.2 °C with an anomaly of 1.78 °C) since 1901. The mean temperature over East & Northeast India was the highest (28.1 °C with an anomaly of 2.0 °C) since 1901.

(a) *Minimum temperatures*

Minimum temperature was above normal over most parts of the country, except some parts of northwest India and central India. Minimum temperature anomaly was more than 3 °C over parts of Bihar and northern Madhya Maharashtra. Minimum temperature anomaly was more than 2 °C over parts of East Uttar Pradesh, Bihar, Jharkhand, West Bengal state, Sikkim state, Mizoram, Tripura, Madhya Maharashtra, North Interior Karnataka, Telangana and Kerala & Mahe. Minimum temperature anomaly was less than -2 °C over parts of East Madhya Pradesh and Vidarbha.

TABLE 7

Dates of occurrence of Heat wave/Severe Heat wave - April 2024

Sub-Division		Dates (Number of Days)	
No	Name	Severe Heat Wave	Heat Wave
2	Arunachal Pradesh	-	-
3	Assam & Meghalaya	-	-
4	Naga, Mani, Mizo and Tri.	-	-
5	S. H. W. B. & Sikkim	23, 24, 29, 30 (4)	22, 25,26, 28 (4)
6	Gangetic West Bengal	19, 20, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30 (12)	5, 6, 16, 17,18, 19, 20, 21, 25, 26, 27 (11)
7	Odisha	5, 23,27, 28, 29, 30 (6)	6, 15, 16, 17, 18, 19, 20, 21, 22, 24, 25, 26, 27 (13)
8	Jharkhand	30 (1)	5, 6, 21, 25, 26, 29 (6)
9	Bihar	28, 29, 30 (3)	20, 21, 24,25, 26 (5)
10	East Uttar Pradesh	-	-
11	West Uttar Pradesh	-	-
12	Uttarakhand	-	-
13	Haryana, Chandigarh & Delhi	-	-
14	Punjab	-	-
15	Himachal Pradesh	-	-
16	Jammu - kashmir and ladakh	-	-
17	West Rajasthan	-	-
18	East Rajasthan	-	-
19	West Madhya Pradesh	-	-
20	East Madhya Pradesh	-	-
21	Gujarat Region	-	30 (1)
22	Saurashtra & Kutch	16, 17, 29 (3)	18, 30 (2)
23	Konkan & Goa	-	16, 28, 29, 30 (4)
24	Madhya Maharashtra	-	-
25	Marathwada	-	-
26	Vidarbha	-	-
27	Chhattisgarh	-	20 (1)
28	Coastal Andhra Pradesh & Yanam	7 (1)	4,6, 24, 25 (4)
29	Telangana	-	6, 7, 18, 19, 28 (5)
30	Rayalaseema	-	4,6, 7, 18, 23, 24, 26, 28, 29, 30 (10)
31	Tamil Nadu, Puducherry & Karaikal	-	6, 7, 8, 19 (4)
32	Coastal Karnataka	-	22(1)
33	North Interior Karnataka	-	1,2,3, 4, 6, 7, 22, 23, 24, 25, 26 (11)
34	South Interior Karnataka	-	22, 23, 24, 25, 26 (5)
35	Kerala	-	26, 27, 29 (3)

(b) *Maximum temperatures*

Maximum temperature was above normal over most parts of the country, except some parts of northwest India and central India. Maximum temperature anomaly was more than 3 °C over parts of West Bengal state and western parts of Assam state. Maximum temperature anomaly was more than 2 °C over parts of East Uttar Pradesh, Bihar, West Bengal state, Assam & Meghalaya, Nagaland, Manipur, Mizoram, Tripura, Jharkhand, Odisha, Andhra Pradesh state, Tamil Nadu, Puducherry & Karaikal, South Interior Karnataka and Kerala & Mahe. Maximum temperature anomaly was less than -2 °C over parts of East Madhya Pradesh and Vidarbha.

The highest maximum temperature of 47.2 °C was reported at Bahargora of east Singhbhum district (Jharkhand) on 30th April over the plains of the country.

In the month of April, the heat wave/severe heat wave conditions were observed mainly over east coast and South Interior Karnataka. In April there were two spells of heat wave during the month. The first spell was from 5-7 April; during this period, heat wave / severe heatwave conditions were observed mainly over eastern India and the southeast Peninsula. The second spell of the heat wave was from 15-30 April, mainly over Odisha and WB, which later intensified and expanded to Bihar, Jharkhand, Southeast Peninsular India and interior Karnataka from 24 April. Heat wave conditions (2nd spell of heat wave during this season) with day maximum temperature within the range of 40-44 °C were observed at isolated places over Odisha, Gangetic West Bengal, Saurashtra, Kutch, north Konkan for two days. Many parts of Gujarat state, Maharashtra state, states over eastern coast of India and parts of southeast peninsular India also experienced higher maximum temperature (within the range of 40-43 °C which were above normal by 1-4 °C) during first fortnight.

Heat wave to severe heat wave conditions further intensified over the eastern parts of India and southeast peninsula during the 4th week. Heat wave to severe heat wave conditions observed over Odisha and West Bengal throughout the week, while heat wave conditions were observed over Chhattisgarh, Bihar, Telangana, Tamil Nadu, Saurashtra, Kutch.

Dates of occurrence of Heat wave/Severe Heat wave for April 2024 is given in Table 7.

3.2.4. *Disastrous weather events and damage*

Fig. 3 shows significant weather events during April 2024 (Based on real-time media reports).

During April 2024, based on real time media reports, total 32 persons were reportedly claimed dead & 30 livestock were perished. Heat wave, Lightning, thunderstorm and heavy Rains & Landslide claimed 9, 17, 4 and 2 persons death respectively.

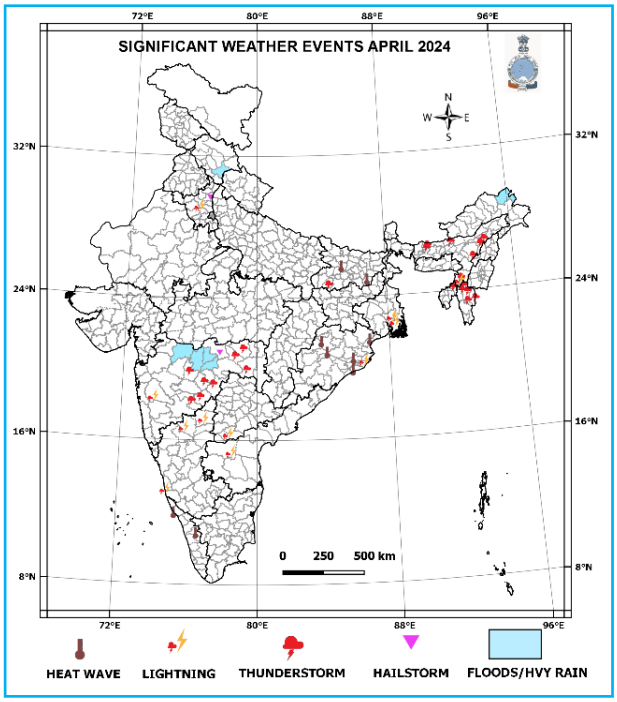

Fig. 3. Significant weather events during April 2024 (*Source* : IMD Climate Summary for the month of Apr 2024)

3.3. *May*

3.3.1. *Weather and associated synoptic features*

(a) *Advance of southwest monsoon*

In view of strengthening of south westerlies in the lower tropospheric levels, fairly widespread to widespread rainfall activity and persistent cloudiness over the area, Southwest Monsoon advanced into some parts of the Maldives & Comorin area and some parts of the South Bay of Bengal, Nicobar Islands and South Andaman Sea on 19th May, 2024. It further advanced into some more parts of the Maldives & Comorin area, the south Bay of Bengal, the remaining parts of Andaman & Nicobar Islands, the Andaman Sea and some parts of the east-central Bay of Bengal on 24th May and advanced gradually over the Bay and over the Arabian Sea and Maldives area on 28th May. Continuing its advance, the monsoon covered remaining parts of southwest Arabian Sea, some parts of west-central Arabian Sea, most parts of southeast Arabian Sea and Lakshadweep area, most parts of Kerala, Mahe, some parts of south Tamil Nadu, remaining parts of Maldives and Comorin area; some more parts northeast Bay of Bengal, most parts of northeast India including entire Nagaland, Manipur, Mizoram, Arunachal Pradesh and most parts of Tripura, Meghalaya and Assam on 30th May. Thus, the Southwest Monsoon was set in over Kerala on the 30th of May, two days prior to its normal date, *i.e.*, 1 June.

(b) *Other synoptic features and rainfall*

The details of the weather systems during the month are given in Table 4.

As given in Table 4, 1 severe cyclonic storm, 1 low pressure area, 8 western disturbances, 52 upper air cyclonic circulations, 28 troughs and 1 shear zone which affected the weather over the country during the month of May.

The occurrence of rainfall accompanied with thunderstorm activities and gusty winds reported over many parts of India with eastern India, Southeast Peninsular India and over northwest India, central India and western parts of India including Maharashtra and Gujarat during first fortnight of the month. The rainfall over northwest India on 10 May was mainly due to active WD impacted the region and over eastern and central India were due to easterly wind with moisture incursion from Bay of Bengal while over Southeast Peninsular India, it was north-south trough/wind discontinuity over the same area.

Formation and persistence of a cyclonic circulation at lower and middle tropospheric levels over Kerala & neighbourhood and very slow Movement of cyclonic circulation from southwest Bay of Bengal & adjoining south Sri Lanka towards south coastal Tamil Nadu & neighbourhood caused almost a week, long wet spell with heavy to very heavy rainfall spell observed in most dates during the third week over extreme southern parts of India covering Kerala and Tamil Nadu.

A Low Pressure Area formed over Southwest adjoining Westcentral Bay of Bengal off north Tamil Nadu-south Andhra Pradesh coasts formed during 20-23 May, caused heavy to very heavy rainfall at isolated places over Kerala and Tamil Nadu. Heavy rainfall also observed at isolated places over east/northeast India and peninsular India.

(c) *Severe Cyclonic Storm "REMAL" formed over the Bay of Bengal during 24th - 28th May, 2024*

Under the influence of cyclonic circulation over southwest Bay of Bengal, a low pressure area formed over

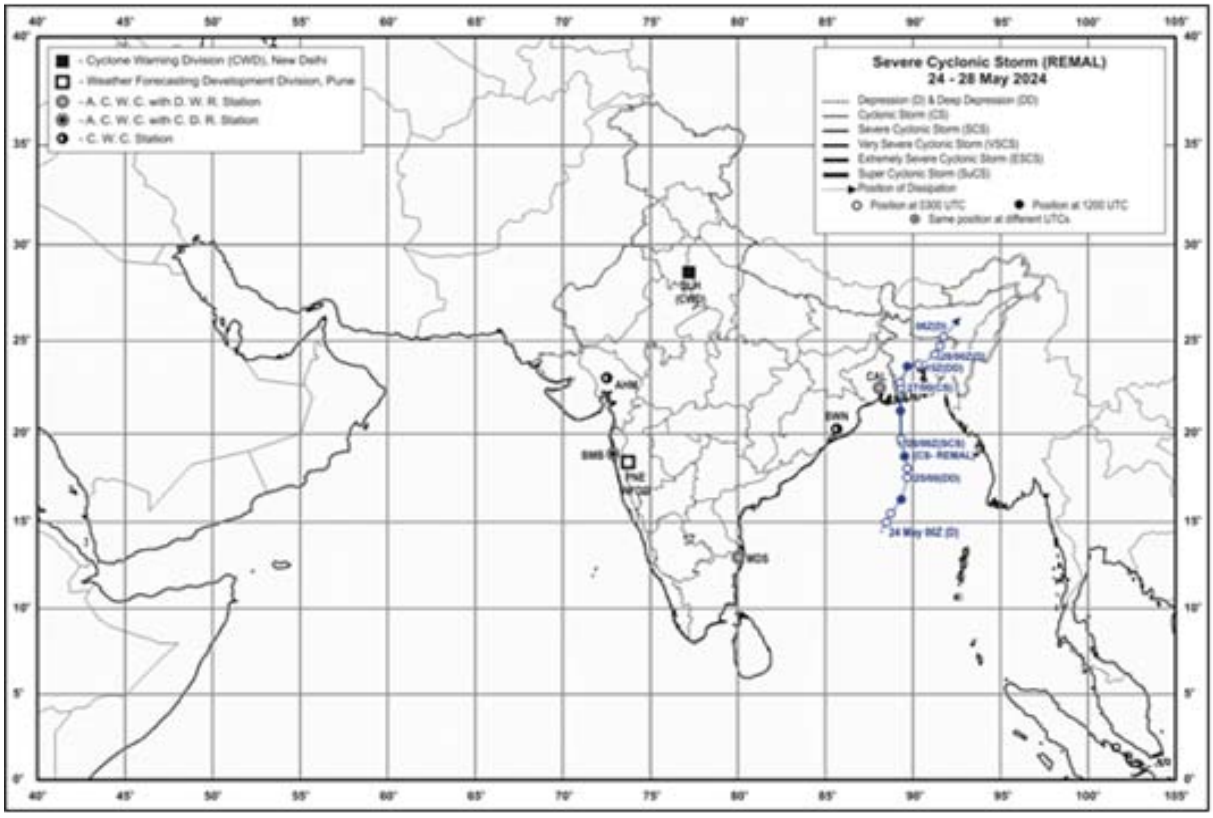

Fig. 4. Severe Cyclonic Storm "REMAL" over the Bay of Bengal

southwest and adjoining westcentral Bay of Bengal off north Tamil Nadu-south Andhra Pradesh coasts on 22nd morning. It moved northeastwards and lay as a Well Marked Low Pressure Area over the same region on 23rd. It continued to move northeastwards and concentrated into a **Depression** and lay centered over central Bay of Bengal near Lat.15.0° N/Long. 88.4° E, at 0530 IST on 24th. It moved north-northeastwards and intensified into a **Deep Depression** and lay centered over eastcentral Bay of Bengal near Lat.17.6° N/Long. 89.7° E at 0530 IST on 25th. It further moved nearly northward and intensified into a **Cyclonic Storm "Remal" (pronounced as "Re-Mal")** and lay centered over north & adjoining eastcentral Bay of Bengal near Lat. 18.8° N/Long. 89.5° E at 1730 IST on 25th and further intensified into a **Severe Cyclonic Storm** and lay centered over north Bay of Bengal near Lat. 19.5° N/Long. 89.3° E at 0530 IST of on 26th. It crossed the Bangladesh and adjoining West Bengal coasts between Sagar Islands and Khepupara close to southwest of Mongla near Lat. 21.75° N/Long. 89.2° E between 2230 IST on 26th to 0030 IST on 27th May as a **Severe Cyclonic Storm** with wind speed of 110 to 120 kmph gusting to 135 kmph. It continued to move nearly northwards and weakened into a **Cyclonic Storm** and lay centered over the same region, near Lat. 22.5° N/Long. 89.3° E at 0530 IST on 27th. It moved east-northeastwards and weakened into a **Deep Depression** which lay centered over the same region, near Lat. 23.7° N/Long. 90.2° E at 2030 IST on 27th and further weakened into a **Depression** and lay centered over east Bangladesh, near Lat. 24.4° N/Long. 91.1° E at 0530 IST on 28th. It moved nearly northeastwards and weakened into a Well Marked Low Pressure Area over northeast Assam & neighbourhood on 28th evening. It further weakened into a Low Pressure Area over the same region on 29th morning and became less marked thereafter. However, the associated cyclonic circulation persisted over the same region and extended upto 5.8 km above m.s.l. on 29th.

The cyclone "REMAL" caused, torrential rains (heavy to extremely heavy rainfall) and gale-force winds over coastal districts of Bangladesh and West Bengal on 26th and 27th May. While moving northeastwards, outer rainbands reached the northeastern states and caused squally wind and heavy to extremely heavy rainfall activity over Assam, Meghalaya, Nagaland, Manipur, Mizoram and Tripura on 27th and 28th May.

Due to impact of Severe Cyclonic Storm Remal extremely Heavy rainfall occurred over North Eastern states. Fig. 4 shows Severe Cyclonic Storm "REMAL" over the Bay of Bengal.

3.3.2. *Monthly rainfall*

Most of the country's sub-divisions received large excess/excess/normal rainfall, except a few subdivisions from north India and extreme northeast India. Out of 36 meteorological subdivisions, 11 received large excess rainfall, 7 received excess rainfall, 7 received normal rainfall, 3 received deficient rainfall, and 8 received largely deficient rainfall

The rainfall realized during the month was 34% of its LPA over northwest India, 132 % of its LPA over central India, 174% of its LPA over south peninsular India, and 99% of its LPA over east & northeast India. Rainfall over the homogeneous region of Northwest India (11.8 mm) was the 11th lowest since 1901 and lowest since 2001.

3.3.3. *Temperature distribution*

In May, over the country, the mean temperature was 31.08 °C with an anomaly of 0.7 °C and the 4th highest after the years 1921 (31.9 °C), 1906 (31.2 °C), 1978 (31.1 °C) since 1901. Among the four homogeneous regions over Northwest India, the maximum temperature was the 3rd highest (38.4 °C with an anomaly of 1.8 °C) after the years 1921 (39.9 °C) and 1978 (38.6 °C) since 1901. Over East & Northeast India minimum temperature was the 4th highest (23.6 °C with an anomaly of 0.8 °C) after the years 1956 (23.8 °C), 1960 (23.7 °C), 1921 (23.6 °C) and the mean temperature was the 3rd highest (28. 7 °C with an anomaly of 1.0 °C) after the years 1960 (28.9 °C), 1966 (28.8 °C) since 1901.

(a) *Maximum temperatures*

The maximum temperature was above normal over most parts of the country, except some parts of south peninsular India, eastern parts central India, and east India. Maximum temperature anomaly was more than 2 °C over parts of Jammu & Kashmir state, Himachal Pradesh, Uttarakhand, Punjab, West Rajasthan, Assam & Meghalaya and Sub Himalayan West Bengal & Sikkim where it was less than -2 °C over parts of East Madhya Pradesh, Vidarbha, Telangana, and Coastal Andhra Pradesh & Yanam. The highest maximum temperature of **50.5°C** had been recorded at **Churu (West Rajasthan)** on **28th May, 2024** during the month.

(b) *Minimum temperatures*

The minimum temperature was above normal over most parts of the country, except some parts of central India, south peninsular India, and Lakshadweep. The minimum temperature anomaly was more than 2 °C

TABLE 8

Dates of occurrence of Heat wave/Severe Heat wave - May 2024

Sub-Division No	Name	Dates (Number of Days) Severe Heat Wave	Heat Wave
2	Arunachal Pradesh	-	-
3	Assam & Meghalaya	25 (1)	25(1)
4	Naga, Mani, Mizo and Tri.	-	-
5	S. H. W. B. & Sikkim	1 (1)	1, 2, 4(3)
6	Gangetic West Bengal	1, 2, 3, 4, 5 (5)	1 (1)
7	Odisha	29, 30 (2)	1, 2, 3, 4, 5, 6, 31 (7)
8	Jharkhand	29, 30 (2)	1, 31 (2)
9	Bihar	1, 19, 29 (3)	1, 2, 4, 17, 30, 31 (6)
10	East Uttar Pradesh	18, 27, 28, 29, 30, 31 (6)	17, 19, 20, 26 (4)
11	West Uttar Pradesh	18, 19, 27, 28, 29, 30, 31 (7)	17, 20, 21, 26 (4)
12	Uttarakhand	31 (1)	
13	Haryana, Chandigarh & Delhi	19, 20, 26, 27, 28, 29, 30, 31 (8)	17, 18, 21, 22, 24, 25, 26 (7)
14	Punjab	19, 27, 28, 29, 31 (5)	17, 18, 20, 21, 26, 30 (6)
15	Himachal Pradesh	28 (1)	19, 21, 25, 26, 27, 29, 30, 31 (9)
16	Jammu - Kashmir and Ladakh	-	24, 25, 27, 28 (4)
17	West Rajasthan	18, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31 (12)	8, 9, 10, 17, 19, 20 (6)
18	East Rajasthan	18, 21, 22, 23, 24, 25, 26, 27, 28, 29, 30, 31 (12)	17, 19, 20 (3)
19	West Madhya Pradesh	19, 21, 24, 27, 28, 31 (6)	18, 19, 20, 22, 23, 25, 26, 29, 30 (9)
20	East Madhya Pradesh	19, 27, 28, 29, 30, 31 (6)	18, 19, 20, 25, 26 (5)
21	Gujarat Region	18, 19, 21 (3)	15, 16, 17, 20, 22, 23, 24, 27, 30 (9)
22	Saurashtra & Kutch	18, 19 (2)	16, 17, 20, 22, 23, 27, 30 (7)
23	Konkan & Goa	-	
24	Madhya Maharashtra	-	24 (1)
25	Marathwada	-	-
26	Vidarbha	-	24, 25, 27, 28, 29, 30, 31(7)
27	Chhattisgarh	-	28, 29, 30, 31 (4)
28	Coastal Andhra Pradesh	2 (1)	1, 3, 31 (3)
29	Telangana	-	1, 2, 3, 4, 5, 6, 7 (7)
30	Rayalaseema	-	1, 2, 3,4,5 ,6 (6)
31	Tamil Nadu, Puducherry &Karaikal	1, 2, 4, 5, 6 (5)	1, 3, 7 (3)
32	Coastal Karnataka	-	-
33	North Interior Karnataka	-	1, 2,4, 5, 6 (5)
34	South Interior Karnataka	-	1, 2, 4, 5, 6 (5)
35	Kerala	-	-

over parts of Bihar, Sikkim state, Gangatic West Bengal, Rajasthan state, and Punjab. The minimum temperature anomaly was less than -3 °C over parts of Vidarbha. The minimum temperature anomaly was less than -2 °C over parts of East Madhya Pradesh, Vidarbha, Chhattisgarh, Telangana and Coastal Andhra Pradesh & Yanam.

In the month of May, the heat wave/severe heat wave conditions were observed mainly over northwest and central India.

During the first week of May, severe heat waves were observed mainly over eastern parts of India, southeast Peninsular India, and interior parts of Karnataka. During the second week, no heat wave conditions developed over parts of India except at isolated pockets over the Gujarat region on 15th May. During the third week, most parts of northwest and adjoining central India, Gujarat state, and Delhi NCR experienced persistent spells of Heatwave to severe heatwave conditions from 17-22 May. During last week, Heatwave to severe heatwave conditions, which already prevailed over northwest and adjoining central India and Gujarat state, continued to prevail on almost all dates during this week till 29 May 2024 and also intensified and further extended to more parts of central, north and eastern parts of India.

Dates of occurrence of Heat wave/Severe Heat wave for May 2024 is given in Table 8.

3.3.4. *Disastrous weather events and damage*

Fig. 5 shows significant weather events during May (based on real-time media reports).

Based on real-time media reports, during May, a total of 356 persons reportedly died, more than 680 persons were reportedly injured, nine persons were reportedly missing & more than 200 livestock perished. Heat wave, Lightning, thunderstorm and heavy Rains, floods & Landslide claimed 150, 68, 41 and 43 persons death respectively.

Cyclonic Storms caused death of 51 persons and more than 500 persons were reportedly injured & 7 persons were reportedly missing due to the Severe Cyclonic Storm REMAL (24 May to 28 May), in the districts of west Bengal and north-eastern region.

Gale claimed death of 3 persons & one person was reported injured. In the districts of Vidarbha.

The inputs from the Offices of India Meteorological Department, *viz.*, (*i*) Director General of Meteorology (Hydromet), New Delhi and (*ii*) Climate Research and Services, Pune are gratefully acknowledged. Thanks are due to Shri Abhinav Arora S.A. for his assistance in preparation of map.

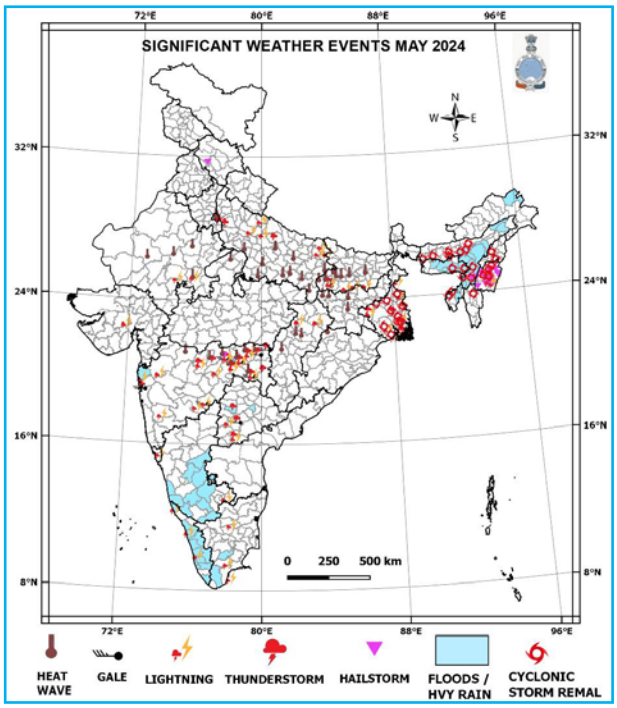

Fig. 3. Significant weather events during May 2024 (*Source* : IMD Climate Summary for the month of May 2024)

Appendix

Definitions of the terms given in '*Italics*'

Temperatures	
Heat Wave	Heat wave is considered if maximum temperature of a station reaches at least 40 °C or more for Plains and at least 30 °C or more for Hilly regions.
(a) *Based on Departure from Normal*	
Heat Wave	- Departure from normal is 4.5 °C to 6.4 °C
Severe Heat Wave	- Departure from normal is >6.4 °C
(b) *Based on Actual Maximum Temperature (for plain stations only)*	
Heat Wave	- When actual maximum temperature ≥ 45 °C
Severe Heat Wave	- When actual maximum temperature ≥47 °C

(d) *Criteria for describing Heat Wave for coastal stations*

When maximum temperature departure is 4.5 °C or more from normal, Heat Wave may be described provided actual maximum temperature is 37 °C or more.

Temperature

(a) *Maximum/day temperatures*

Markedly above normal	- 5.0 °C or more
Appreciably above normal	- 3.1 °C to 5.0 °C
Above normal	- 1.6 °C to 3.0 °C
Normal	- 1.5 °C to –1.5 °C

(b) Minimum / Night temperature

Markedly below normal	- when the departure from normal is –5 °C to or less
Appreciably below normal	- when the departure from normal is between –3.1 °C to –5.0 °C
Below normal	- when the departure from normal is –1.6 °C to +3.0 °C
Normal	- departure from normal is –1.5 °C to +1.5 °C.

Rainfall

Very light	- 0.1 to 2.4 mm
Light	- 2.5 to 15.5 mm
Moderate	- 15.6 to 64.4 mm
Heavy	- 64.5 to 115.5 mm
Very heavy	- 115.6 to 204.4 mm
Extremely Heavy	- ≥ 204.5 mm
Large Excess	- Percentage departure from normal rainfall is + 60% or more
Excess	- Percentage departure from normal rainfall is + 20% to +59%
Normal	- Percentage departure from normal rainfall is +19% to –19%
Deficient	- Percentage departure from normal rainfall is –20% to –59%
Large Deficient	- Percentage departure from normal rainfall is –60% or less
No rain	- –100%