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Weather in India

HOT WEATHER SEASON (March-May 2023)†

1. Chief features

(*i*) In the hot weather season of 2023, only one intense low-pressure system, Extremely Severe Cyclonic Storm (ESCS), "MOCHA" formed over the Bay of Bengal (9th - 15th May, 2023).

(*ii*) The hot weather season 2023 with reference to severe heat wave/heat wave conditions was mild but began early, *i.e.*, in the first week of March but soon abated with the severe wet condition over the country. They reoccurred in the third week of April for a few days and again in May, but lacked the intensity and spatial extension.

(*iii*) Rainfall in the season and all the months (March to May) for the country was above normal. The seasonal rainfall over the homogenous region of East and Northeast India was below normal while the remaining three regions recorded more than normal rainfall.

(*iv*) Thunderstorms/hailstorms were frequent throughout the season over the country and aided in keeping the heat waves at bay.

(*v*) Southwest Monsoon advanced into some parts of south Bay of Bengal, Nicobar Islands and Andaman Sea on 19th May, 2023. It reached Kerala on 8th June, eight days delayed than its normal date, *i.e.*, 1st 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 2023 are also depicted in Fig. 1.

The rainfall over the country, for the season and for all the three months from March to May were more than normal. The seasonal precipitation was 113% of the long period average (LPA), while the monthly rainfall for March was 126% of LPA, for April (108% of LPA) and May was 111% of LPA. The seasonal rainfall over 17 sub-divisions (58% of the country), recorded large excess rainfall, 4 sub-divisions recorded excess rainfall, 7 normal, 6 deficient rainfall and 2 sub-divisions received large deficient precipitation and no sub-division observed zero/no rainfall. Rainfall over homogeneous region of Central India (85.2 mm) was 3rd highest since 1901 after the years 1933 (106.1 mm) and 1990 (101.6 mm). Rainfall

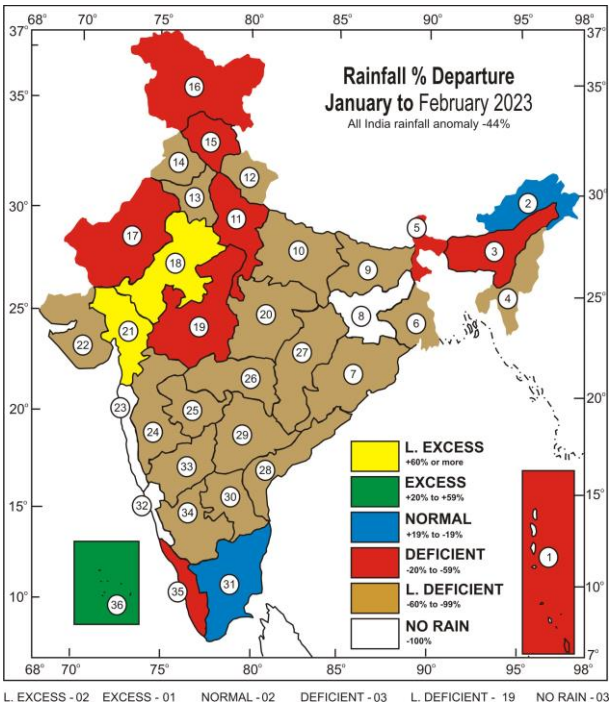

Fig. 1. Sub-divisional rainfall percentage departures (based on Operational data) for the season Mar-May, 2023. Sub-divisions are indicated by number on the map & bold letters in legend. The rainfall anomaly values for these 36 sub-divisions are indicated below :

1	-65	**7**	39	**13**	145	**19**	405	**25**	77	**31**	62
2	-41	**8**	15	**14**	135	**20**	291	**26**	380	**32**	-62
3	-40	**9**	-12	**15**	20	**21**	425	**27**	197	**33**	31
4	-52	**10**	90	**16**	-6	**22**	1378	**28**	95	**34**	9
5	-16	**11**	172	**17**	308	**23**	-39	**29**	149	**35**	-34
6	2	**12**	43	**18**	320	**24**	16	**30**	83	**36**	-49

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

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TABLE 1

Sub-division rainfall (mm) for each month and season as a whole (March-May, 2023)

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	11.2	38.2	-71%	15.7	79.3	-80%	134.4	338.4	-60%	161.3	455.9	-65%
2.	Arunachal Pradesh	114.4	171.3	-33%	110.6	301.0	-63%	222.0	285.0	-22%	446.9	757.3	-41%
3.	Assam & Meghalaya	98.9	74.2	33%	102.2	193.0	-47%	145.9	315.4	-54%	347.0	582.6	-40%
4.	Naga., Mani., Mizo. and Tri.	50.6	59.5	-15%	75.4	141.3	-47%	102.1	276.2	-63%	228.0	477.0	-52%
5.	S.H.W.B. & Sikkim	112.7	56.7	99%	96.3	124.2	-22%	160.0	257.5	-38%	369.0	438.4	-16%
6.	Gangetic West Bengal	55.3	25.5	117%	34.2	48.8	-30%	102.1	113.6	-10%	191.6	187.9	2%
7.	Orissa	58.9	20.1	193%	63.4	36.2	75%	56.0	72.3	-23%	178.2	128.6	39%
8.	Jharkhand	34.5	14.7	135%	26.2	19.8	32%	35.3	48.8	-28%	96.0	83.3	15%
9.	Bihar	19.7	8.2	141%	14.8	18.0	-18%	40.1	59.1	-32%	74.6	85.3	-12%
10.	East Uttar Pradesh	19.1	7.5	155%	12.1	6.1	99%	32.6	20.0	63%	63.8	33.6	90%
11.	West Uttar Pradesh	33.1	10.5	215%	11.7	6.2	88%	44.1	16.0	176%	88.9	32.7	172%
12.	Uttarakhand	63.5	54.3	17%	64.0	39.3	63%	98.4	64.6	52%	225.8	158.2	43%
13.	Haryana, Chandigarh & Delhi	42.2	15.1	180%	14.6	9.5	53%	53.5	20.4	162%	110.3	45.0	145%
14.	Punjab	56.6	22.5	152%	26.0	14.4	80%	45.0	17.3	160%	127.6	54.2	135%
15.	Himachal Pradesh	66.7	113.4	-41%	103.5	64.0	62%	118.2	63.3	87%	288.3	240.7	20%
16.	Jammu & Kashmir and Ladakh	80.3	152.9	-47%	129.1	99.6	30%	100.5	77.5	30%	310.0	330.0	-6%
17.	West Rajasthan	15.0	4.3	249%	16.0	5.9	171%	69.7	14.5	381%	100.7	24.7	308%
18.	East Rajasthan	23.2	4.2	452%	12.7	4.6	175%	53.1	12.4	328%	89.0	21.2	320%
19.	West Madhya Pradesh	19.5	4.7	316%	17.5	2.4	630%	31.1	6.4	386%	68.2	13.5	405%
20.	East Madhya Pradesh	25.5	10.8	136%	30.4	5.2	484%	36.8	7.7	377%	92.7	23.7	291%
21.	Gujarat Region	11.5	0.3	3722%	3.1	0.9	245%	14.3	4.3	233%	28.9	5.5	425%
22.	Saurashtra & Kutch & Diu	15.9	0.2	7845%	9.2	0.5	1736%	20.7	2.4	764%	45.8	3.1	1378%
23.	Konkan & Goa	6.9	2.2	213%	1.5	1.8	-18%	9.6	25.4	-62%	18.0	29.4	-39%
24.	Madhya Maharashtra	5.7	3.3	73%	14.0	6.0	133%	10.8	17.1	-37%	30.6	26.4	16%
25.	Marathawada	6.0	6.8	-11%	28.3	5.4	424%	11.1	13.4	-17%	45.4	25.6	77%
26.	Vidarbha	17.0	10.5	62%	59.5	6.7	788%	53.2	9.8	443%	129.7	27.0	380%
27.	Chhattisgarh	35.3	9.1	288%	40.6	11.5	253%	33.9	16.4	107%	109.8	37.0	197%
28.	Coastal A.P. & Yanan	60.0	13.9	331%	31.6	23.9	32%	96.0	58.4	64%	187.6	96.2	95%
29.	Telangana	42.9	15.8	172%	48.0	18.5	160%	67.7	29.5	129%	158.6	63.8	149%
30.	Rayalaseema	36.6	9.7	277%	25.0	19.0	32%	83.8	50.8	65%	145.4	79.5	83%
31.	Tamil Nadu, Pudcherry & Karaikal	34.3	19.9	72%	45.5	38.7	18%	122.7	66.3	85%	202.5	124.9	62%
32.	Coastal Karnataka	1.6	9.3	-83%	5.0	29.1	-83%	53.0	116.8	-55%	59.6	155.2	-62%
33.	North Interior Karnataka	8.2	8.4	-2%	39.6	23.3	70%	56.6	47.9	18%	104.4	79.6	31%
34.	South Interior Karnataka	10.3	12.6	-18%	27.5	43.1	-36%	118.1	87.1	36%	155.9	142.8	9%
35.	Kerala & Mahe	31.6	34.4	-8%	76.5	105.5	-27%	128.9	219.1	-41%	236.9	359.0	-34%
36.	Lakshadweep	3.4	16.7	-80%	16.0	29.4	-46%	80.9	150.9	-46%	100.3	197.0	-49%

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

TABLE 2

Details of the weather systems during March 2023

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 5.8 km above m.s.l.	22-27	Iran and neighbourhood	Northeast	Jammu and neighbourhood	Initially it lay as a trough with its axis at 5.8 km above m.s.l. ran roughly along Long. 52°E to the north of Lat. 30°N on 22 morning. It lay as a trough and ran roughly along Long. 80°E to the north of Lat. 30°N on 28 morning and then ran roughly along Long. 85°E to the north of Lat. 25°N which moved away northeastwards on 29
2.	At 3.1 km above m.s.l.	29 Mar - 1 Apr	Afghanistan and neighbourhood	East	Jammu-Kashmir and Ladakh	Initially it lay as a trough in mid tropospheric westerlies with its axis at 5.8 km above m.s.l. roughly along Long. 52°E to the north of Lat. 30°N on 28th morning. The trough aloft moved away east northeastwards on 4.The cycir became less marked on 5
(*ii*) *As a trough*						
1.	At 3.1 kms above m.s.l.	6	Long. 90°E and to the north of Lat. 23°N	Stationary	*In situ*	Became less marked on 7
2.	Do	2-9	Roughly along Long. 50°E to the north of Lat. 20°N	East northeast	Roughly along Long. 76°E to the north of Lat. 23°N	Merged with the trough in westerlies from northeast Uttar Pradesh to Madhya Maharashtra on 10
3.	At 5.8 kms above m.s.l.	11-15	Roughly along Long. 53°E to the north of Lat. 25°N	East	Roughly along Long. 82°E to the north of Lat. 25°N	Moved away northeastwards on 16
4.	Do	17-20	Roughly along Long. 68°E to the north of Lat. 25°N	Do	Roughly along Long. 78°E to the north of Lat. 22°N	Initially it lay as a cycir over east Iran on 15.Moved away northeastwards on 20 evening
5.	Do	20-22	Roughly along Long. 72°E to the north of Lat. 25°N	Do	Roughly along Long. 87°E to the north of Lat. 25°N	Initially it lay as a cycir over Iran and neighbourhood on 19. The trough moved away northeastwards on 23
(*iii*) *As an Inducedcyclonic circulation*						
1.	At 1.5 km above m.s.l.	4-8	North Gujarat and neighbourhood	Northeast	East Rajasthan and neighbourhood	Became less marked on 9
2.	Up to 1.5 km above m.s.l.	12-17	South Pakistan and neighbourhood	Do	Northeast Rajasthan and neighbourhood	Merged with the trough from northeast Arabian sea to northeast Rajasthan on 18
3.	Up to 3.1 kms above m.s.l.	16-21	Southwest Rajasthan and adjoining Kutch	Do	Haryana and neighbourhood	Became less marked on 22 morning
(**B**) *Other upper air cyclonic circulations*						
1.	At 0.9 kms above m.s.l.	1	South Assam and neighbourhood	Stationary	*In situ*	Became less marked on 2
2.	Upto 1.5 km above m.s.l.	8	Interior Odisha and adjoining parts of Chhattisgarh	Do	Do	Became less marked on 9
3.	At 3.1 km above m.s.l.	9	Northwest Madhya Pradesh and neighbourhood	Do	Do	Merged with the trough in westerlies from northeast Uttar Pradesh to Madhya Maharashtra on 10

TABLE 2 (*Contd*.)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
4.	Upto3.1 km above m.s.l.	13	South Assam and neighbourhood	Stationary	*In situ*	Became less marked on 14
5.	At 0.9 km above m.s.l.	16-18	Bangladesh and neighbourhood	Northeast	Assam and neighbourhood	Became less marked on 19
6.	At 1.5 km above m.s.l.	18-20	Northwest Rajasthan and neighbourhood	South	Southwest Rajasthan and neighbourhood	Became less marked on 21
7.	At 1.5 km above m.s.l.	21	Northeast Assam and neighbourhood	Stationary	*In situ*	Became less marked on 22 morning
8.	Upto 3.1 kms above m.s.l.	22-25	Southwest Rajasthan and neighbourhood	Northeast	Northeast Rajasthan and adjoining Haryana	Became less marked on 26 morning
9.	At 1.5 km above m.s.l.	26	East Bangladesh and neighbourhood	Stationary	*In situ*	Became less marked on 27
10.	At 1.5 km above m.s.l.	27	Northwest Madhya Pradesh and neighbourhood	Do	Do	Became less marked on 28
11.	At 1.5 km above m.s.l.	24	Rayalaseema and neighbourhood	Do	Do	Became less marked on 25
12.	Upto 1.5 km above m.s.l.	28 Mar - 1 Apr	Southwest Rajasthan and neighbourhood	Northeast	Northeast Rajasthan and adjoining Haryana	Became less marked on 2 April
13.	Upto 1.5 km above m.s.l.	31 Mar - 1 Apr	South Assam and neighbourhood	Stationary	*In situ*	Became less marked on 2 April
14.	Upto 1.5 km above m.s.l.	31 Mar - 1 Apr	Central Uttar Pradesh & neighbourhood	West	Uttar Pradesh & adjoining Madhya Pradesh	Became less marked on 2 April
(**C**)	*East West Trough*					
1.	Between 3.1 and 7.6 km	10-12	From northeast Uttar Pradesh to Madhya Maharashtra	Oscillatory	Roughly along Long. 88°E to the north of 22°N	Became less marked on 13
2.	At 1.5 km above m.s.l.	17-18	From cyclonic circulation over southwest Rajasthan and adjoining Kutch to Bangladesh	Do	From cyclonic circulation over northwest Rajasthan and neighbourhood to north Bihar	Became less marked on 19
3.	At 1.5 km above m.s.l.	19	From north Punjab to the cyclonic circulation over west Rajasthan	Stationary	*In situ*	Became less marked on 20
4.	At 0.9 km above m.s.l.	19-21	From the cyclonic circulation over east Rajasthan and adjoining west Madhya Pradesh to northwest Bay of Bengal a	Oscillatory	From the cyclonic circulation over Haryana and neighbourhood to Bangladesh	Became less marked on 22 morning
5.	At 1.5 km above m.s.l.	25	From the cyclonic circulation over northeast Rajasthan to south Assam	Stationary	*In situ*	Became less marked on 26
(**D**)	*Trough in easterlies / Trough of Low*					
1.	At 0.9 km above m.s.l.	17-18	From northeast Arabian Sea to cyclonic circulation over northeast Rajasthan	Stationary	*In situ*	Became less marked on 19

TABLE 2 (*Contd.*)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
(E)	*North-South troughs / Wind Discontinuity/other troughs*					
1.	At 1.5 km above m.s.l.	5-7	From south Konkan to north Madhya Maharashtra	Oscillatory	From Goa to north Chhattisgarh	Became less marked on 8
2.	At 0.9 km above m.s.l.	14-16	From Jharkhand to Telangana	Do	From Bangladesh and neighbourhood to north coastal Andhra Pradesh	Became less marked on 17
3.	Upto 1.5 km above m.s.l.	14-31 Mar	From south interior Karnataka to Konkan	Do	From cycir over central Uttar Pradesh to Telangana	Itbecame less marked on 1 April
4.	At 0.9 kms above m.s.l.	27-31	From Bihar to north Odisha	Do	From Sub Himalayan West Bengal to north Odisha	Became less marked on 1 April

over homogeneous region of Northwest India (157.0 mm) was 8th highest since 1901 after the years 1983 (236. 6 mm), 2015 (216.0 mm), 1982 (213.8 mm), 1987 (176.2 mm), 1926 (163.7 mm), 1986 (159.8 mm) and 1957 (157.3 mm). Rainfall over the homogeneous region of East & Northeast India (241.4 mm) was 6th lowest since 1901. Prior lowest rainfall years were 1903 (220.3 mm), 1979 (236.2 mm), 1908 (239.3 mm), 1901 (240.3 mm) and 1960 (240.7 mm).

3. Significant features during various months

3.1. *March*

3.1.1 *Weather and associated synoptic features*

The details of the weather systems during the month are summarised in Table 2 and the chief amounts of rainfall are given in Table 5.

The passage of western disturbances caused rainfall/snowfall over western Himalayan region and Northwest India and isolated rainfall along with thunderstorms over Rajasthan, Madhya Pradesh and Gujarat during the first half of the month. In the second week of the month, a trough from south Konkan to north Madhya Maharashtra at lower tropospheric level caused isolated rainfall along with thunderstorms over Maharashtra. The weather during the period 14-22 March was most severe with thunderstorms supported by enhanced moisture accompanied with hail and squally winds over most parts of the country. Passage of consecutive active western disturbances, with very slow movement of their induced cyclonic circulations, an east-west trough in the lower tropospheric level which extended from Northwest India to East / Northeast India across Central India throughout the week. A trough in lower tropospheric level extending from extreme southern peninsula to Jharkhand/Chhattisgarh across peninsular India and cyclonic circulations in the lower tropospheric levels over East and Northeast India, all these systems together supported by enhanced moisture incursion caused fairly widespread to widespread rainfall / thunderstorms / hailstorms causing huge damage to life and property. During second half of the month, persistence of trough/wind discontinuity from southern parts of the peninsular India to east central India on many days, active western disturbances which moved across North and Central India, strong westerly jet stream (with wind speed exceeding 120 kmph to 200 kmph sometimes at the height of about 12 km) which provided upper level divergence and hence lower level convergence of air mass and uplifting of air leading to formation of deep clouds, occurrence of lower level cyclonic circulations leading to development of thundery clouds. Lowering of the freezing level in atmosphere helped in formation of hail. All these systems were further enhanced by feeding of moisture from Bay of Bengal and Arabian Sea in association with the anti-cyclonic circulation over the north Bay of Bengal and central Arabian Sea. All these factors culminated in the monthly rainfall of March exceeding its long period normal, when 23 sub-divisions (73% of the country) recorded large excess rainfall, 1 sub-division received excess rainfall, 6 normal, 3 deficient, 3 large deficient and no sub-division recorded zero rainfall (no rainfall). The monthly rainfall over the homogenous region of South Peninsular India of 31.7 mm, which was 7th highest record since 1901 after the years 2008 (122.2 mm), 1944 (69.7 mm), 1915 (46.9 mm), 1984 (43.3 mm), 2006 (40.9 mm) and 1967 (33.5 mm). Similarly, rainfall over Central India (24.0 mm) in March 2023 was 11th highest since 1901 after the years 1944 (48.9 mm), 1967 (48.4 mm), 1951 (35.8 mm), 1926 (33.6mm), 1915 (31.8 mm), 2015 (31.8 mm), 2006 (28.7 mm), 1957 (27.7 mm), 2020 (26.3mm) and 1950 (24.8 mm). Out of the 10 sub-divisions of Central India 9 sub-divisions recorded large excess rainfall while Marathwada sub-division recorded normal rainfall.

TABLE 3

Details of the weather systems during April 2023

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 7.6 kms above m.s.l	25 Apr - 4 May	Southeast Iran	East	South Haryana and neighbourhood	Became less marked on 5 May
2.	Upto 7.6 kms above m. s. l	28	North Pakistan and neighbourhood	Do	Haryana and neighbourhood	It merged with the western disturbance as a cyclonic circulation over central Pakistan and neighbourhood on 29
(*ii*) *As a trough*						
1.	At 5.8 kms above m.s.l.	4-6	Roughly along Long. of 60°E to Lat. of 32°N	East	Roughly along Long. of 71°E to Lat. of 28°N	Initially it las as a trough in mid and upper tropospheric westerlies with its axis at 5.8 km above m.s.l., roughly along Long. 52°E to the north of Lat. 30°N on 2nd morning and then lay as a cyclonic circulation over west Iran and neighbourhood at 5.8 km above m.s.l. The trough moved away east northeastwards on 7.
2.	At 5.8 kms above m.s.l.	9	Roughly along Long. 63°E to the north of Lat. 30°N	Stationary	*In situ*	Became less marked on 10
3.	At 5.8 kms above m.s.l.	14-18	Roughly along Long. 54°E to the north of Lat. 28°N	East	Roughly along Long. 64°E to the north of Lat. 21°N	It lay as a cyclonic circulation over Afghanistan at 3.1 km above m. s. l. with trough aloft with its axis at 5.8 km above m.s.l. roughly along Long. 65°E to the north of Lat. 25°N on 19th. It lay as a trough in middle tropospheric levels with its axis at 5.8 km above m.s.l. roughly along Long. 68°E to the north of Lat. 25°N on 20. It lay as a cyclonic circulation over north Pakistan and adjoining Punjab on 23morning. It lay as a trough in mid tropospheric levels roughly along Long. 76°E to the north of Lat 28° on 25 morning and became less marked on 26
4.	Upto 7.6 km above m.s.l.	27	Central Pakistan and neighbourhood	Stationary	*In situ*	It merged with the western disturbance as a cyclonic circulation over north Pakistan and neighbourhood on 28
(*iii*) *As an Induced cyclonic circulation*						
1.	Up to 1.5 km above m.s.l.	18-20	North Pakistan and adjoining Punjab	Stationary	*In situ*	Became less marked on 21
2.	Up to 1.5 km above m.s.l.	30th Apr - 1st May	South Pakistan and adjoining west Rajasthan	Northeast	Northwest Rajasthan and neighbourhood	Merged with the western disturbance over Haryana and neighbourhood on 2 May
(**B**) *Other upper air cyclonic circulations*						
1.	Upto 1.5 km above m.s.l.	1-3	West Rajasthan and neighbourhood	Stationary	*In situ*	Became less marked on 4
2.	At 0.9 km above m.s.l.	3-5	Northeast Bangladesh and neighbourhood	Oscillatory	Northeast Bangladesh and neighbourhood	Became less marked on 6

TABLE 3 (*Contd.*)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
3.	At 0.9 km above m.s.l.	5	Northern parts of central Madhya Pradesh	Stationary	*In situ*	Became less marked on 6
4.	Upto 1.5 km above m.s.l.	5-7	Southwest Rajasthan and adjoining Pakistan	Northeast	Central parts of Rajasthan	Became less marked on 8
5.	Upto 1.5 km above m.s.l.	6	North interior Karnataka and neighbourhood	Stationary	*In situ*	Became less marked on 7
6.	At 5.8 km above m.s.l.	8	West Rajasthan and neighbourhood	Do	Do	Became less marked on 9
7.	Upto 1.5 km above m.s.l.	9-10	Southeast Rajasthan and neighbourhood	West	South Rajasthan and neighbourhood	Became less marked on 11
8.	At 0.9 kms above m.s.l.	8-10	Northeast Bangladesh and neighbourhood	North	East Assam and neighbourhood	Became less marked on 11
9.	At 0.9 kms above m.s.l.	10	Gangetic west Bengal and neighbourhood	Stationary	*In situ*	Became less marked on 11
10.	Between 1.5 and 3.1 kms above m.s.l.	10-18	Northeast Arabian sea and adjoining Pakistan	West	Southwest Rajasthan and neighbourhood	Became less marked on 19
11.	At 0.9 km above m.s.l.	13-15	North Bangladesh and neighbourhood	East	Northeast Bangladesh and neighbourhood	Became less marked on 16
12.	Upto 1.5 km above m.s.l.	16	North Pakistan and adjoining Punjab	Stationary	*In situ*	Became less marked on 17
13.	At 0.9 kms above m.s.l.	15-16	Northwest Madhya Pradesh and neighbourhood	Do	Do	Became less marked on 17
14.	At 0.9 kms above m.s.l.	20	North Bangladesh & neighbourhood	Do	Do	Became less marked on 21
15.	At 0.9 kms above m.s.l.	21	Central Uttar Pradesh and neighbourhood	Do	Do	Became less marked on 22
16.	At 1.5 kms above m.s.l.	22	Interior Tamil Nadu and neighbourhood	Do	Do	Became less marked on 23
17.	Upto 0.9 kms above m.s.l.	24	South Tamil Nadu and neighbourhood	Do	Do	Became less marked on 25
18.	Upto 0.9 kms above m.s.l.	22-26	Northwest Madhya Pradesh and adjoining northeast Rajasthan	Southeast	West Vidarbha	Merged with the trough from west Vidarbha to north Tamil Nadu on 27
19.	Between 1.5 and 3.1 kms above m.s.l.	26	Southwest Rajasthan and neighbourhood	Stationary	*In situ*	Became less marked on 27
20.	Upto 3.1 kms above m.s.l.	27	East Bangladesh and neighbourhood	Do	Do	Became less marked on 28
21.	Upto 1.5 kms above m.s.l.	27	Central Pakistan and neighbourhood	Do	Do	Merged with the western disturbance as a cyclonic circulation over north Pakistan and neighbourhood on 28
22.	At 0.9 km above m.s.l.	30 Apr	South Chhattisgarh and neighbourhood	Do	Do	Became les marked-on 1 May
23.	Upto 3.1 km above m.s.l.	30 Apr	Southwest Uttar Pradesh and neighbourhood	Do	Do	Became les marked-on 1 May
24.	Up to 1.5 km above m.s.l.	30th Apr - 1st May	Southeast Arabian Sea and adjoining Lakshadweep area	South	Maldives area	Became less marked on 2 May

TABLE 3 (*Contd.*)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
25.	At 1.5 km above m.s.l.	24	South Tamil Nadu and neighbourhood	Stationary	*In situ*	Became less marked on 25
(**C**)	*North-South troughs / Wind Discontinuity/other troughs*					
1.	At 0.9 km above m.s.l.	1-7	From south Odisha to north interior Tamil Nadu	Oscillatory	From central Madhya Pradesh to south Tamil Nadu	Became less marked on 8
2.	Upto 1.5 km above m.s.l.	4 eve - 5	From Sikkim to south Bangladesh	Do	From the cyclonic circulation over northeast Bangladesh and neighbourhood to north Odisha	Became less marked on 6
3.	At 1.5 km above m.s.l.	12-29	From east Vidarbha to coastal Karnataka	Do	From the cyclonic circulation over southeast Arabian sea and adjoining Lakshadweep area to south Chhattisgarh	Initially it lay as a trough in easterlies from 8 to 10. Became less marked on 30
4.	Between 0.9 and 3.1 km above m.s.l.	18 mor	From the cyclonic circulation over southwest Rajasthan and neighbourhood to Himachal Pradesh	Stationary	*In situ*	Became less marked on 18
5.	At 3.1 km above m.s.l.	23	From Sub Himalayan West Bengal and Sikkim to Chhattisgarh	Do	Do	Became less marked on 24
6.	At 1.5 km above m.s.l.	20-23	From east Bangladesh to northwest Bay of Bengal	Oscillatory	Along Long 90°E to the north of Lat 20°N	It lay as a cyclonic circulation over northeast Bangladesh and neighbourhood extending upto 1.5 km above m.s.l. on 24 and persisted at 1.5 km above m.s.l. on 25 which became less marked on 26
7.	At 1.5 km above m.s.l.	30 Apr - 3 May	From east Vidarbha to north interior Tamil Nadu	Do	From southwest Madhya Pradesh to south Tamil Nadu	Became less marked on 4 May

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

Station	*24 hour record rainfall (mm)*	*Date*	*Previous rainfall record (mm)*	*Date*
Goalpara	81.0	20/3/2023	68.0	19/3/2011
Jalpaiguri	75.0	21/3/2023	68.6	7/3/1926
Koraput	122.0	19/3/2023	47.0	12/3/2006

3.1.2. *Temperature distribution*

(*a*) *Minimum temperatures*

No Cold day or Cold wave conditions were observed in this month.

The minimum temperatures in the first half of the month were generally above normal over the country except the homogenous region of South Peninsula, where they were normal to below normal. In the later half of the month the night temperatures were generally normal or below normal over most parts of the country. The months and the season's lowest minimum temperature over the plains was 9.7°C, reported at Sikar (east Rajasthan) on 10th March.

(*b*) *Maximum temperatures*

Heat wave conditions were recorded in the first fortnight of the month over the western coastal areas of Central India and South Peninsular region, *i.e.*, over the sub-divisions of Saurashtra & Kutch, Konkan & Goa and coastal Karnataka. An anticyclone over the Arabian Sea, lead to subsidence of air resulting in clear sky conditions and warming over the west coast, the anticyclone strengthened the easterly winds blowing from the interior parts of the country affecting the sea breeze bringing no respite from the heat. In the second half of the month, there was abatement of heat waves, which may be attributed to the exceptionally high precipitation over most parts of the country during that period.

TABLE 4

Details of the weather systems during May 2023

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.	Extremely Severe Cyclonic Storm 'Mocha'	9 (1730 hours IST) - 15 (0830 hours IST)	Southeast Bay of Bengal	Northwest	Myanmar	Under the influence of cyclonic circulation oversoutheast Bay of Bengal and adjoining south Andaman Sea a low pressure area formed on 8 May, it concentrated to a WML on 9 (0530 hours IST), a Depression (1730 hours IST) of 9, Deep Depression (0530 hours IST) of 10, Cyclonic Storm (0530 hours IST) of 11, Severe CS (1730 hours IST) of 11, VSCS (0530 hours IST) of 12, ESCS (2330 hours IST) crossed north Myanmar-southeast Bangladesh coasts between Kyaukpyu (Myanmar) and Cox's Bazar (Bangladesh) close to north of Sittwe (Myanmar) near latitude 20.3°N and longitude 92.8°E as an ESCS during 1230 to 1430 hours IST of 14 May. It weakened into a VSCS of 14 (1730 hours IST), SCS (2030 hours IST) of 14, CS (0230 hours IST) and D (0530 hours IST) of 15 morning. Details are given in the article on 'Storms and depression over north Indian ocean 2023'
(**B**) *Western Disturbances/Eastward moving Systems*						
(*i*) *Upper air cyclonic circulation*						
1.	At 5.8 kms above m.s.l.	4-8	West Iran and neighbourhood	East	Jammu and adjoining Pakistan	It then lay as a trough between 3.1 and 5.8 km above m.s.l. with its axis at 5.8 km above m.s.l. which ran roughly along Long. 75°E to the north of Lat.30°N on 9, roughly along Long. 85°E to the north of Lat.26°N on 12 and became less marked on 13
2.	At 5.8 kms above m.s.l.	28	Himachal Pradesh and neighbourhood	Northeast	-	Initially it lay as a trough in mid and upper tropospheric levels with its axis at 5.8 km above m.s.l. roughly along Long. 72°E to the north of Lat. 35°N on 27. The cyclonic circulation moved away northeastwards on 29
3.	Between 3.1 km and 7.6 km above m.s.l.	30 May - 2 Jun	North Pakistan and neighbourhood	East	Jammu region and neighbourhood	Initially it lay as a northwest-southeast trough in mid and upper tropospheric westerlies with its axis at 5.8 km above m.s.l. and ran roughly along Long. 61°E to the north of Lat. 30°N on 29th morning. It again lay as a trough in mid-tropospheric westerlies with its axis at 5.8 km above m.s.l. and ran roughly along Long. 76°E and to the north of Lat. 30°N on 3rd and moved away northeastwards on 7th June
4.	At 5.8 km above m.s.l.	31 May	Northeast Afghanistan and neighbourhood	Do	-	Merged with the cyclonic circulation over north Pakistan and neighbourhood on 1st June

TABLE 4 (*Contd.*)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
(*ii*) *As a trough*						
1.	At 5.8 kms above m.s.l.	2-4	Along Long. 68°E to the north of Lat. 22°N	Northeast	Along Long.84° E to the north of Lat. 25° N	It lay as a cyclonic circulation over south Pakistan and neighbourhood on 1. The trough moved away northeastward on 5
2.	Do	11-16	Roughly along Long. 57°E to the north of Lat. 28°N	East	Roughly along Long. 90°E to the north of Lat. 25°N	Became less marked on 17
3.	Do	15-16	Roughly along Long. 55°E to the north of Lat. 28°N	Do	Roughly along Long. 62°E to the north of Lat. 30°N	It then lay as a cycir over North Pakistan and Jammu & Kashmir. Moved away northeastward on 18
4.	Do	17-22	Roughly along Long. 53°E to the north of Lat. 28°N	Do	Roughly along Long. 90°E to the north of Lat. 25°N	Moved away northeastward on 23
5.	Do	23-28	Roughly along Long. 55°E to the north of Lat. 28	Do	Roughly along Long. 85°E to the north of Lat. 28°N	It became less marked on 29
(*iii*) *As an Induced cyclonic circulation*						
1.	Upto 1.5 kms above m.s.l.	30 May - 2 Jun	North Pakistan and adjoining Punjab	East	Punjab and neighbourhood	It became less marked on 3 June morning
(**C**) *Other upper air cyclonic circulations*						
1.	At 0.9 kms above m.s.l.	1	East Bangladesh and neighbourhood	Stationary	*In situ*	It became less marked on 2
2.	Upto 0.9 kms above m.s.l.	2-3	South Chhattisgarh and neighbourhood	Do	Do	It became less marked on 4
3.	Between 1.5 km and 3.1 km above m.s.l.	2-7	South interior Karnataka and adjoining Tamil Nadu	Oscillatory	Southwest Bay of Bengal off north Tamil Nadu coast	It merged with the trough from southwest Bay of Bengal to cyclonic circulation associated with low pressure area over southeast Bay of Bengal and adjoining south Andaman sea on 8
4.	At 0.9 kms above m.s.l.	5	North interior Karnataka and neighbourhood	Stationary	*In situ*	The cycir became less marked on 6
5.	Do	8-9	East Bangladesh and neighbourhood	Do	Do	It became less marked on 10
6.	Upto 1.5 kms above m.s.l.	5-9	Southeast Rajasthan and neighbourhood	Northeast	West Uttar Pradesh and neighbourhood	It became less marked on 10 morning
7.	At 3.1 kms above m.s.l.	12	Gujarat region and neighbourhood	Stationary	*In situ*	It became less marked on 13
8.	At 1.5 kms above m.s.l.	12	Southwest Rajasthan and neighbourhood	Do	Do	It became less marked on 13
9.	Do	11-12	Jharkhand and neighborhood	Do	Do	It became less marked on 13
10.	Upto 1.5 kms above m.s.l.	13	East Uttar Pradesh and neighborhood	Do	Do	It became less marked on 14
11.	At 0.9 kms above m.s.l.	13-14	North Rajasthan and neighbourhood	East	South Haryana and neighbourhood	It became less marked on 15
12.	Do	15	South Bangladesh and neighbourhood	Stationary	*In situ*	It became less marked on 16
13.	Upto 1.5 kms above m.s.l.	17-18	Central Pakistan	East	Punjab and adjoining central Pakistan	It became less marked on 19

TABLE 4 (*Contd.*)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
14.	At 0.9 kms above m.s.l.	18-19	East Uttar Pradesh	East	-	Merged with the trough from west Bihar to north Telangana on 20
15.	Upto 1.5 kms above m.s.l.	22	South Tamil Nadu and neighbourhood	Stationary	*In situ*	Became less marked on 23
16.	Between 1.5 and 3.1 kms above m.s.l.	23-26	Central Pakistan and neighbourhood	Northeast	North Pakistan and adjoining Jammu and Kashmir	Became less marked on 27
17.	Upto 1.5 kms above m.s.l.	22-24	East Uttar Pradesh	Southeast	Jharkhand and neighbourhood	Became less marked on 25
18.	Between 1.5 and 5.8 kms above m.s.l.	24	East Bangladesh and neighbourhood	Stationary	*In situ*	Do
19.	At 0.9 kms above m.s.l	26 mor	Gangetic West Bengal	Do	Do	Became less marked on 26
20.	Upto 1.5 kms above m.s.l.	27	Northwest Rajasthan and adjoining Pakistan	Do	Do	It became less marked on 28
21.	Do	28	Northeast Bangladesh and adjoining Meghalaya	Do	Do	It became less marked on 29
22.	At 0.9 kms above m.s.l.	29	Southeast Gangetic West Bengal and neighbourhood	Do	Do	Became less marked on 30 morning
23.	Do	29	South Chhattisgarh and neighbourhood	Do	Do	Became less marked on 30
24.	Do	28-29	Telangana and neighbourhood	South	South Telangana and neighbourhood	Became less marked on 30
25.	At 1.5 kms above m.s.l.	30	Southeast Arabian sea and adjoining Kerala	Stationary	*In situ*	Became less marked on 31
26.	At 0.9 kms above m.s.l.	30	East Madhya Pradesh	Do	Do	Do
27.	At 0.9 kms above m.s. l.	28-30	Southwest Rajasthan and adjoining Pakistan	Do	Do	Do
28.	Between 3.1 and 5.8 kms above m.s.l.	30-31 May	East Bangladesh and neighbourhood	Do	Do	Became less marked on 1 June
29.	At 3.1 kms above m.s.l.	31 May	South Sri Lanka	Do	Do	Do
(**D**)	*East-West trough/shear zone*					
1.	At 1.5 kms above m.s.l.	18	Along Long. 90° E to the north of Lat. 22° N	Stationary	*In situ*	Became less marked on 19
(**E**)	*Other troughs / Wind Discontinuity*					
1.	Between 1.5 and 3.1 kms above m.s.l.	2	From the cyclonic circulation over south interior Karnataka and adjoining Tamil Nadu to southwest Bay of Bengal	Stationary	*In situ*	It became less marked on 3
2.	Upto 1.5 kms above m.s.l.	3	From the cyclonic circulation over northeast Rajasthan to west Bihar	Do	Do	Became less marked on 4 morning

TABLE 4 (*Contd.*)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
3.	At 0.9 kms above m.s.l.	5-6	Roughly along Long. 86°E to the north of Lat. 21°N	Northeast	Roughly along Long. 88°E to the north of Lat. 23°N	It became less marked on 7 morning
4.	At 1.5 km above m.s.l	9	From Telangana to south Tamil Nadu	Stationary	*In situ*	It became less marked on 10
5.	Between 1.5 km and 5.8 km above m.s.l.	8-11	From southwest Bay of Bengal off north Tamil Nadu coast to cyclonic circulation associated with low pressure area over southeast Bay of Bengal and adjoining south Andaman Sea	Northwest	From cyclonic circulation associated with the cyclonic storm "Mocha" over southeast Bay of Bengal to south Andhra Pradesh coast	It became less marked on 12
6.	At 1.5 kms above m.s.l.	10	Roughly along Long. 89°E to the north of Lat. 22°N	Stationary	*In situ*	Became less marked on 11
7.	Upto 1.5 kms above m.s.l.	16-17	From north Bihar to central Chhattisgarh	Do	Do	Became less marked on 18
8.	At 0.9 kms above m.s.l.	17	From Andhra Pradesh to south Tamil Nadu	Do	Do	Do
9.	Do	18-20	From the cyclonic circulation over east Uttar Pradesh to Telangana	Oscillatory	From west Bihar to north Telangana	Became less marked on 21
10.	Do	23	From Bihar to north Chhattisgarh	Stationary	*In situ*	Became less marked on 24
11.	Do	20-26	From north Interior Karnataka to south Tamil Nadu	Oscillatory	From southeast Madhya Pradesh to south Interior Karnataka	Became less marked on 27
12.	Do	24-29	From northwest Uttar Pradesh to West Bengal coast	Do	From the cyclonic circulation over southwest Rajasthan to northwest Madhya Pradesh	Became less marked on 30
13.	At 1.5 kms above m.s.l.	26-27	From north Bihar to north Odisha	East	From Sub Himalayan West Bengal and Sikkim to interior Odisha	Became less marked on 28
14.	At 0.9 kms above m.s.l.	28-29	From southeast Madhya Pradesh to south Tamil Nadu	Do	from cyclonic circulation over south Chhattisgarh to interior Tamil Nadu with embedded cyclonic circulation over Telangana and Rayalaseema	Became less marked on 30
15.	Do	30	From west Vidarbha to south Tamil Nadu a	Stationary	*In situ*	Became less marked on 31
16.	Do	30	From the cyclonic circulation over east Madhya Pradesh to east Bihar	Do	Do	Became less marked on 31
17.	At 1.5 kms above m.s.l.	31 May	From coastal Andhra Pradesh to Gulf of Mannar	Do	Do	Became less marked on 1 June

TABLE 5

Some representative amounts of rainfall in cm for the months March, April and May 2023 (7 cm and above)

Date	Some representative amounts of rainfall in cm for March 2023 (7 cm and above)
1 Mar	Nil
2 Mar	Nil
3 Mar	Nil
4 Mar	Nil
5 Mar	Nil
6 Mar	Nil
7 Mar	Nil
8 Mar	Nil
9 Mar	Nil
10 Mar	Nil
11 Mar	Lohardaga Kvk AWS 9
12 Mar	Nil
13 Mar	Nil
14 Mar	Nil
15 Mar	Nil
16 Mar	Nil
17 Mar	Enkuru 9, Koilkuntla 8, Garla, Lamataput and Burnpur 7 each
18 Mar	Repalle, Alandur, Chennai AP, Bidar PTO and Nirna 7 each
19 Mar	Jeypore 15, Mathili 13, Koraput 12, Tihidi 11, Garla, Venkatapuram and Yanam 10 each, Aswapuram, Aswaraopeta, Mahabubabad, Bagdogra IAF, Basudevpur, Remuna, Phulberia and Chegunta 9 each, Padia, Similiguda, Yadagirigutta, Garugubilli, Tadwai Mlg, Amalapuram, Sathupalle, Shankarapatnam, Jammikunta, Baitunthpur and Manuguru 8 each, Malyal, Palawancha, Gidam, Dantewara, Hodal, Rapur, Rajampet, Kaptipada, Kothagudem, Mulakalapalle, Soro, Atmakurwrgl, Ghanpur, Gudurwrgl, Huzurabad, Nh5 Gobindpur, Balasore, Lower Anaicut, Bhuvanagiri, Khanapur, Mominpet, Dharmaram, Govindaraopet and Malkangiri 7 each
20 Mar	Kaiserganj and Mandira Dam 13 each, Mangawan and Pelandurai 9 each, Annamalai Nagar, Goalpara PTO, Hazaribagh Dvc, Messenjor, Rajgarh, Tozhudur and Chidambaram AWS 8 each, Jarmindi, Vepur, Mawkyrwat, Mawkyrwat ARG, Bara and Hazaribagh 7 each
21 Mar	Guhla 10, Cherrapunji, Mawkyrwat ARG, Mawana, Pachhad, Mirganj, Khliehriat, Mawsynram and Mawkyrwat 9 each, Rai REV and Cherrapunji (rkm) 8 each, Dhampur, Jalpaiguri, Nautan, Polur, Williamnagar, Kharkoda, Sattur and Derabassi (basi) 7 each
22 Mar	Pennagaram, Shella and Palliakalan 9 each, Vepada and Mawsynram 7 each
23 Mar	Nil
24 Mar	Lakkur 8
25 Mar	Bhatinda IAF 11, Kanjirappally 9, Valparai Pap, Valparai Taluk Office, Vellakoil, Dalhousi Alha AWS and Kapurthala 8 each, Nkl Collectorate, Sankaridurg, Avinasi and Khanna 7 each
26 Mar	Matheran 36
27 Mar	Mannargudi 8, Alakarai Estate, Punalur and Korei 7 each
28 Mar	Tuting 10, Kashinagar 7
29 Mar	Alakarai Estate 14, AdarEstate and Burliar 7 each
30 Mar	Bhuban 8, Ambalavayal 7
31 Mar	Danagadi, Lakhipur and Kalaikunda (Iaf) 7 each

TABLE 5 (*Contd.*)

Date	Some representative amounts of rainfall in cm for April 2023 (7cm and above)
1 Apr	Banda 9, Nawabganj 8, Kashipur, Kaiserganj, Fatehpur Tehsil, Rayalpadu, Naraj and Daringibadi 7 each
2 Apr	Palacode and Vedasandur 12 each, Gopalpur and Williamnagar 11 each, Kamatchipuram 10, Dscl Thiyagadurgam 9, Berhampur, Rangeilunda and Chikiti 8 each, Ichchapuram, Dhubri IMD and Dharmanagar/Panisagar 7 each
3 Apr	ValparaiPap and Valparai PTO 8 each, Valparai Taluk Office and D/Mohanbari AP 7 each
4 Apr	Gobichettipalayam, Billimalai Estate and Kollegal 9 each, Ayikudi 7
5 Apr	Kurudamannil 8, Cherrapunji, Matijuri and Karimganj AWS 7 each
6 Apr	Nil
7 Apr	Manthala and Lamataput 7 each
8 Apr	Bodhan 8
9 Apr	Nil
10 Apr	Nil
11 Apr	Nil
12 Apr	Nil
13 Apr	Nil
14 Apr	Nil
15 Apr	Bramhapuri 27
16 Apr	Nil
17 Apr	Nil
18 Apr	Nirna 7
19 Apr	Nowgam, Deomali and Deomali AWS 7 each
20 Apr	QaziGund, Cherrapunji, Mawsynram and Kothi 7 each
21 Apr	Nil
22 Apr	Khowai 10, Nalbari/Pagladia 9
23 Apr	Huzurabad 8, Koksara 7
24 Apr	Dharmanagar/Panisagar and Karimganj 10 each, Dscl Kalayanallur 9, Ketti, Kinnakorai and Ponnaniyar Dam 8 each, Pollachi, Kattumayilur, Jamunamarathur, Manapparai, Kavali and Dhemaji 7 each
25 Apr	Banaigarh 9, Anchal ARG and Mallial 8 each, Chinnakalar, Billimalai Estate, Thimmapur, Ghasipura and Lahunipara 7 each
26 Apr	Yemmiganur 11, Mirdoddi and Jeypore 10 each, Mominpet, Banaganapalle, Bhuvanagiri and Kottayam 9 each, R.udaigiri, Narayanpet, Madhira, Hakimpet IAF, Bhongir (ARG), Midjil and Cherthala 8 each, Saidapur, Nallabelly, Marpalle, Narsapur, Kondapak, Damaragidda, Makthal, Kanjirappally, Bhoothpur, Kukatpally Jntu (ARG), Lingampet, Narmetta, Gonegandla, Jiyyamma Valasa and Barapani 7 each
27 Apr	Nanguneri and Neyyattinkara 7 each
28 Apr	Kodaikannal Boat Club 11, Nittur 10, Udgir-IMD Parttime and Bidar 9 each, Kodaikanal and Bhalki 8 each, Kohir, Hulsoor, Saigaon, Midnapore, Midnapore (CWC), Nilanga, Baripada and Kalaburagi 7 each
29 Apr	Kodungallur, Vellanikkara and Neora 9 each, Kodanad, Irinjalakuda and Sankheimundi 8 each, North Paravur AWS, Pamidi, Raichur PTO, Gangtok, Murti, Digapahandi and Dhule 7 each
30 Apr	Peraiyur and Patan 11 each, Radhapuram 9, Periyanaickenpalayam, Mettupalayam, Vijayawada AP, Konanur, Bhainsdehi and Gannavaram AP 8 each, Kodanad, Manamelkudi, Wallajah, Kovilpatti AWS, Gudurwrgl and Kakkeri 7 each

TABLE 5 (*Contd.*)

Date	Some representative amounts of rainfall in cm for May 2023 (7 cm and above)
1 May	Darsi 17, Palakurthi 13, Devaruppal 12, Macherla and Proddutur 10 each, Zaffergadh, Dharmasagar, Karimnagar, Velagatoor and Ottapalam 9 each, Datia-aws, Podili, Jupadu Bungalow, Nambulipulikunta, Naga Reddipet, Bhongir (ARG), Raghunathpalle, Gudivada, Shekpet, Amberpet and Khajuripada 8 each, Kurudamannil, Sankalan, Nandikotkur, Baheri, Kurnool, Chandausi, Konakanamitla, Adaki, Coonoor, Shahpura, Chandurthi, Koyyalagudem, Jangaon, Sausar, Coonoor PTO, Chamraj Estate, Parkal, Shayampet, Hyderabad AP, Bhupalpalle, Pitlam, Amalapuram, Konijerla, Belampalle, Kollapur, Makloor, Sultanabad, Saroornagar, Atmakur Wnp, Bhuvanagiri and Valparai 7 each
2 May	Vanamadevi 19, Sankaridurg 17, Adirampatnam 15, Sattur 14, Tirukattupalli, Tiruchengode and Nandhiyar Head 13 each, Kamatchipuram, Mahabalipuram, Edapadi and Cincona 12 each, Ennore AWS, Budalur, Kancheepuram, Cuddalore, Thirukalukundram and Hindusthan University 11 each, Sankarapuram, Pwd, Perumpavur, Collectorate, Thaluthalai and Kumarapalayam 10 each, Alathur, Madukkur, Thammampatty, Karaikudi, Supaul, Madavaram AWS, Gaya Aerodrome, Pullambadi, Forbesganj, Motihari, Paradip Cwr, Sullurpeta, Chandbali, Diamond Harbour, Rithi, Uluberia, Malur, Balurghat, Dhubri, Rameswaram, Goalpara, Chennimalai, Kozhiporvilai, Silchar, Valparai PTO, Kodiayakarai, Kcs Mill1 Moongilthura, Kuppanatham, Panruti, Perundurai and Vadakuthu 9 each, Adilabad, Ramgundam, Daltonganj, Hanamkonda, Tikamgarh, Khammam, Kurnool, Bagati, Cuddapah, Vedaranniyam, Anantapur, Yeotmal, Rentachintala, Nanded, Khandwa, Seoni, Jalgaon, Sholapur, Hoshangabad, Parbhani, Guna, Durg, Washim, Jaipur AP, Dharmsala, Amraoti, Gorakhpur, Chindwara, Narsinghpur, Agati, Bhoothapandy, Glenmorgan, Pattukottai, Puducherry, SrcKudithangi, Therlam, Vepur, Atmakur Wnp, Thalavadi, Virdhachalam Kvk AWS and Kalasapakkam 8 each, Kolhapur, Penucondapuram, Satara, Nasik, Beed, Thalaignayer, Mormugao, Panjim, Ratnagiri, Harnai, Sangli, Sargur, Nedungal, Thirparappu, Thuckalay, Veraval, Kcs Mill-1 Kadavanur, Basl Manalurpet, Vedasandur, Virudachalam, Srimushnam, Cd Hospital Tondaipet, Satyabama Uty ARG, Honavar, Belgaum/Sambra A, Diu, Surendranagar, Bhaunagar AP, Jorhat, Neyyattinkara, Kumarakam, Canning, Idukki, Gudur, Puri, Pebbair, Thuraiyur, Chetpet, Uthukuli, Sriganganagar, Bikaner (pbo), Jodhpur IAF, Vettikadu, Mahuva, Ratlam, Dhar, Grand Anaicut, Khargone, Omalur, Mandapam, Eraiyur, Deesa, Baroda AP, Surat, Kandla New, Kodungallur, Keshod AP and Bijuri 7 each
3 May	Ponnani 16, Cincona and Tumakuru 11 each, Kalugumalai, Angadipuram and Kadambur 10 each, Arjuni Morgaon, Chimur, Maniyachi, Moolaikaraipatti, Pavagada, Elanthakuttai Medu and Thalavadi 9 each, Palayamkottai, Bhavanisagar, Dalhousi Alha AWS, Punalur, Ralegaon, Piduguralla and Bhiwapur 8 each, Kalamb, Chandpur, Bramhapuri, Tuting, Samudrapur, Manora, Channapatna, Vaikom, Hinganghat, Warora, Pwd Makkinampatti, Neryamangalam ARG, Mulakalapalle, Satankulam, Taluk Office Pandalur, Kuzhithurai, Sathyamangalam, Kodivery and Madurai/T.south 7 each
4 May	Shoolagiri 15, Kamba AWS and Cheyyar 12 each, Tindivanam 11, Manamelkudi, Perungalur and Mimisal 10 each, Kilacheruvai, Nandhiyar Head and Tirupathur 9 each, Veligandla and Joshipur 8 each, Sivaganga, Rameswaram, Tiruvaiyaru, Vamban Kvk AWS, Kadaladi, Adanakkotai, Peddapuram, Roorkee, Dhupdhara ARG, Karanjia and SuthamalliDam 7 each
5 May	Lakkur 16, Vepur and Modakkurichi 11 each, Sankarapuram and Kalyandrug 10 each, Perungalur, Thiruchuzhi, Paramathivelur, Labbaikudikadu, Khategaon and Chengam 9 each, Kattumayilur, Erode, Tondi, Tuting and Kalasapakkam 8 each, Nakhatrana, Guntakal, Thiruthuraipoondi, Thalaivasal and GUdayagiri 7 each
6 May	Wallajah 14, Kancheepuram 13, Ammundi 12, Tirupathur PTO 11, Tirupattur 10, Kalasapakkam 9, Ammoor (walajah Railway, Karamchedu and Repalle 8 each, Ranipet, Palamaner, Venkatagiri Kota and Kosagumda 7 each
7 May	Nagar Kurnool 12, Rscl Vallam and Viralimalai 9 each, Tallakulam and Basl Mugaiyur 8 each, Periyanaickenpalayam, Sankarapuram, Krishnarayapuram, Denkanikottai, Ketti, Manjalaru, Valangaiman, Rscl-2 Kanjanur, Rscl-2 Nemoor, Chandur and Tadimarri 7 each
8 May	Krishnagiri, Arcot and Panapakkam 9 each, Kattumayilur, Vepur, Kalavai PWD, Kalasapakkam, Ponnai Dam and Nuagada 7 each
9 May	Mettupalayam 9, Virudhunagar, Virudunagar AWS, Myladumpara ARG, Sakleshpura, Tuting and Lamataput 7 each
10 May	Suralacode 8, Nidige 7
11 May	Iaf Carnicobar 8
12 May	Mattannur ARG 7
13 May	Long Island 8, Honnali 7
14 May	Bayar AWS and Karumadi AWS 9 each
15 May	Nil
16 May	Nil
17 May	Neamatighat 8, Mathabhanga, Barpeta, BekyRly. bridge and Kamakhyanagar 7 each
18 May	Bausi 10
19 May	-
20 May	BPGhat 14, APGhat 9, Tuting 8, Silchar 7

TABLE 5 (*Contd.*)

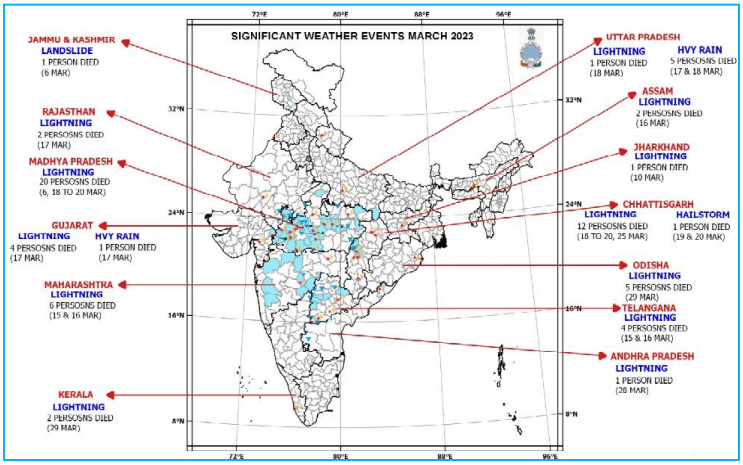
Date	Some representative amounts of rainfall in cm for May 2023 (7 cm and above)
21 May	Naharlagun 15, Itanagar and Ranganadi Nt Xing 13 each, T Narasipur 12, Cherrapunji 10, Lakhimpur ARG 9, Cherrapunji (rkm) and N. lakhimpur/Lilabari 8 each, Majuli and Periakulum 7 each
22 May	Hassan 9, Pulivendla 8, Tyagarthi 7
23 May	Quepem 12, Chittar and Konni 9 each, Valparai Pap, Valparai Taluk Office,Vaikom and Kurudamannil 8 each, Anchal ARG 7
24 May	Ayyankunnu AWS 11, Rajmahal, Basua, Rongo and Kvk South 7 each
25 May	Wokha Sadar Nsdma AWS 11, Sujangarh 10, Ladnoo 9, Ballowal Saunkri 8, Danta Ramgarh, Dharampur, Balachaur AWS and B Durga 7 each
26 May	Cherrapunji 11, Burnpur, Badatighat and Venkurinji AWS 9 each, Makrana SR, Nandadih, Chengmari/Diana, Chhamonu and Mundali 8 each, Kolayat Magra, Shoolagiri, Murti, Luchipur, Itanagar and Khowang 7 each
27 May	Nkl Collectorate 12, Mandal SR 11, Buxaduar 10, Jalpaiguri 9, Kodanad, Pwd Travellers Bungalow and Jamshedpur AP 8 each, Domohani 7
28 May	Kailashahar AP 10, Williamnagar 9, Valparai PTO 8, Valparai Pap, Valparai Taluk Office and Pendra Road 7 each
29 May	Kumbhalgarh SR, Patharia and Erinpura/Jawai 8 each, Becharaji and Bikaner (pbo) 7 each
30 May	Tehri (CWC) 10, Jaisalmer, Hirekerur and Hadagali 8, Ater, Illayangudi, Thanesar, Fatehgarh Sahib, Sirhind, Yelburga and Hassan PTO 7 each
31 May	Vepur 9, Kattumayilur and Magadi 8 each, Suratgarh, Pechiparai, Palakoderu, Bengaluru City, Kil Kotagiri Estate and Venkurinji AWS 7 each

The maximum temperatures in the first fortnight of the month were generally above normal to appreciably above normal over the country outside the South Peninsular region. They were markedly above normal over sub-divisions, *viz.*, Jammu- Kashmir & Ladakh, Punjab and Arunachal Pradesh. In the last half of the month with the unusually frequent thunderstorms / hailstorms and cloudiness, sharp drop in day temperatures were observed over most parts of the country. The month's highest maximum temperature over the plains was 39.8°C was reported at Mangalore (coastal Karnataka) over the country on 10th March.

3.1.3. *Disastrous weather events and damage*

The figure below shows significant weather events and associated deaths during March 2023 based on real time media reports.

During March, total 68 persons reportedly died 70 persons got injured and more than 550 livestock perished due to various weather events.



Source : IMD Climate Summary for the month of March 2023

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 and the principal amounts of rainfall are given in Table 5.

The monthly rainfall over the country was 108% of LPA with 18 sub-divisions (61% area of the country) recorded large excess rainfall, 5 sub-divisions recorded excess, 3 sub-divisions recorded normal, 7 sub divisions were deficient, 3 sub-divisions observed large deficient rainfall while no sub-divisions received zero or no rainfall.

The homogenous regions of Northwest India (148% of LPA), Central India (326% of LPA) and South Peninsular region (114% of LPA) recorded above normal rainfall while East and Northeast India (52% of LPA) received below normal precipitation.

3.2.2. *Chief Synoptic weather features observed during April 2023*

During April, active western disturbances impacted Northwest and Central parts of the country, trough/wind discontinuity were also seen in the lower levels from extreme southern parts of the Peninsular India to Vidarbha/east central India. As a result of these synoptic systems, there was large-scale thunderstorm activity and rainfall, accompanied with lightning and gusty winds over India, mainly during the first and last week of the month. Isolated hail storms also occurred over many areas during this period. Due to such extensive rain/thunderstorm activities and cloudy conditions over most parts of India, large parts of the country experienced lower than normal maximum temperatures. There was subdued rainfall and thunderstorm activities over Northeast India and it was mainly due to absence of any favorable synoptic weather systems and absence of southwesterly or southerly wind and moisture convergence from north Bay of Bengal to the region.

The country as a whole for the month of April 2023 recorded 42.3 mm of rainfall, which is 8% more than its LPA of 39.3 mm based on data of 1971-2020. Rainfall over homogeneous region of central India (30.0 mm) was 4th highest since 1901 after the years 1909 (52.8 mm), 1937 (44.7 mm) and 1907 (40.6 mm). Among the four homogeneous regions, East & Northeast India received 63.8 mm (52% of L.P.A.) of rainfall which is the 5th lowest since 1901. Prior lowest rainfall years were 1960 (36.9 mm), 2014 (41.1 mm), 1940 (47.3 mm) and 1903 (53.0 mm).

3.2.3. *Temperature distribution*

(*a*) *Minimum temperatures*

The minimum temperatures over India were generally normal over the country. They were appreciably below normal or markedly below normal over sub-divisions of Northwest India and Central India in the last fortnight of the month.

(*b*) *Maximum temperatures*

Over South Peninsular India during April, the average maximum temperature was the seventh highest (35.03 ºC with an anomaly of 0.77 °C) after the years 2016 (35.86 °C), 2010 (35.27 °C), 2019 (35.25 °C), 2014 (35.21 °C), 2017(35.13 °C) and 2013 (35.11 °C) since 1901.

In April the severe heat waves were observed for few days over the eastern sub-divisions of India, *viz*., Gangetic West Bengal, Sub Himalayan West Bengal and Bihar. Heat waves were recorded over parts of Bihar, Gangetic West Bengal, Sub Himalayan West Bengal & Sikkim, Coastal Andhra Pradesh, Konkan & Goa, Odisha, Punjab, Haryana, Chandigarh & Delhi, Jharkhand and Uttar Pradesh during 12 - 20 April corresponding with the period when these sub-divisions recorded subdued rainfall activity.

The day temperatures were generally below normal over the country outside the homogenous regions of East & Northeast India and coastal parts of South Peninsular India. It rose to appreciably above normal for some days and markedly above normal for 1-4 days in the second and third week especially over Northwest India. In the last few days of the month, with the increase in cloudiness and precipitation, the maximum temperatures dropped to appreciably below normal to markedly below normal over most parts of the country except for sub-divisions of Northeast India where they were normal/above normal. The highest maximum temperature recorded during the month was 44.5°C reported at Prayagraj (East Uttar Pradesh) and Khajuraho (east Madhya Pradesh) on 19th April.

3.2.4. *Disastrous weather events*

According to media reports during this month,100 persons died, more than 84 people were injured. 140 livestock perished due to various weather events. The details of causalities are given below in the figure, which are based on real time media reports.

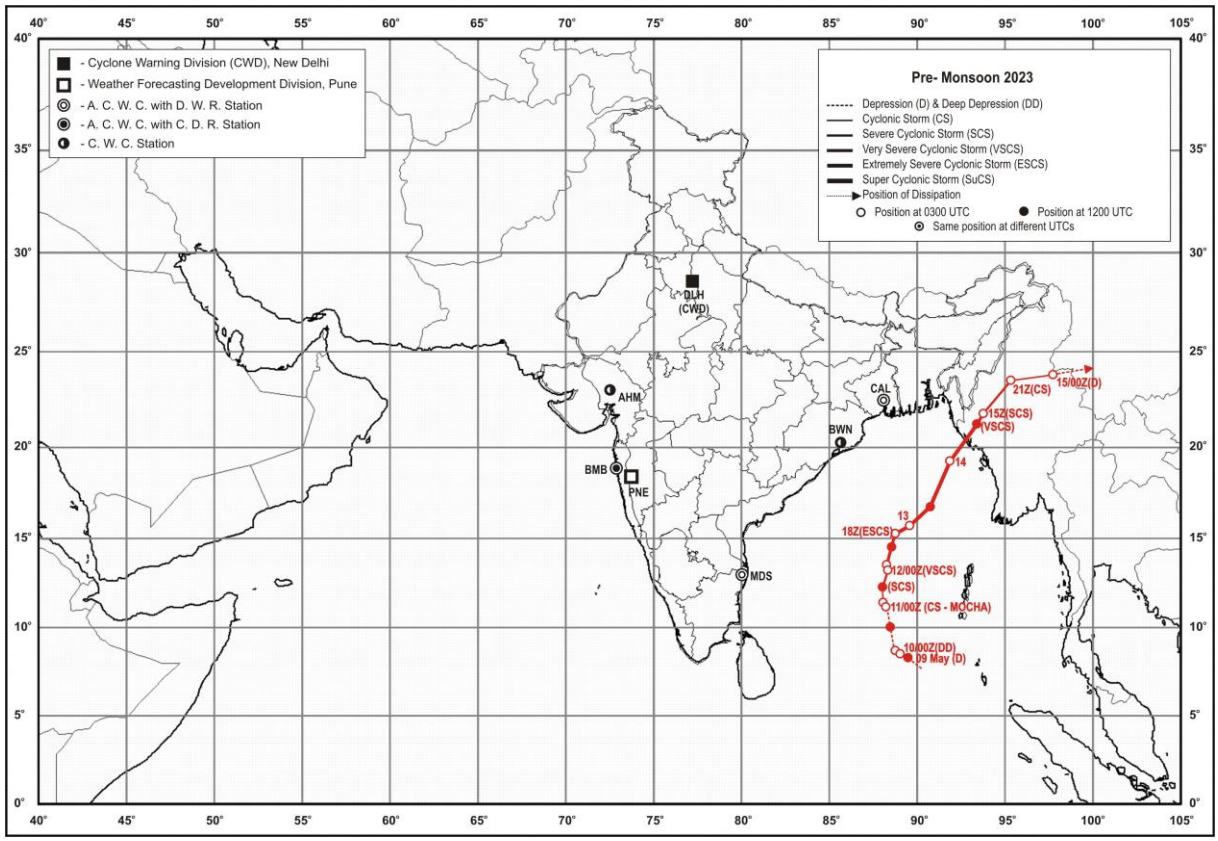
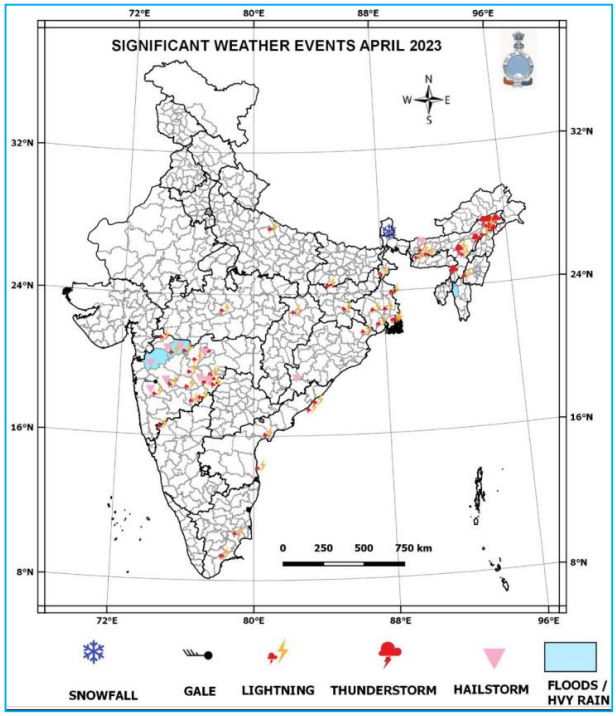


Fig. 2. Track of cyclonic storm, deep depression and depression during pre-monsoon season 2023



Source : IMD Climate Summary for the month of April 2023

3.3. *May*

3.3.1. *Weather and associated synoptic features*

(*a*) *Advance of southwest monsoon*

In view of strengthening of southwesterlies in the lower tropospheric levels, fairly widespread to widespread rainfall activity and persistent cloudiness over the area, Southwest Monsoon advanced into some parts of southeast Bay of Bengal, Andaman, Nicobar Islands and Andaman Sea on 19th May, 2023, it further advanced into some more parts of southwest Bay of Bengal, more parts of the southeast Bay of Bengal, the Andaman Sea, Andaman and Nicobar Islands, and portions of the east-central Bay of Bengal on 30th May. Continuing its advance, the monsoon covered areas such as the south Arabian sea, Maldives and the Comorin region on 1st June, followed by additional parts of the south Bay of Bengal and east-central Bay of Bengal on 2nd June, 2023. It reached Kerala on 8th June, seven days late than its normal date, *i.e.*, 1 June.

(*b*) *Other synoptic features and rainfall*

The details of weather systems and its track during the month are given in Table 4 and Fig. 2. The principal amounts of rainfall are given in Table 5.

During May 2023, one extremely severe cyclonic storm "MOCHA" formed over Bay of Bengal during 9 - 15 May.

A Cyclonic Circulation formed over the Southeast Bay of Bengal and neighbourhood in the morning (0830 hours IST/0300 UTC) of 6th May, 2023, it lay over southeast Bay of Bengal and adjoining south Andaman sea on 7th May. Under its influence a Low Pressure Area formed over southeast Bay of Bengal and adjoining south Andaman Sea in the morning (0830 hours IST/0300 UTC) of 8th May. It lay as a Well Marked Low Pressure Area (WML) over the same region in the early morning (0530 hours IST/0000 UTC) of 9th May. It concentrated into a Depression in the same evening (1730 hours IST/1200 UTC) over Southeast Bay of Bengal. It initially moved west-northwestwards and intensified into a Deep Depression (DD) in the early morning (0530 hours IST/0000 UTC) of 10th May over southeast Bay of Bengal. Thereafter, it moved north-northwestwards and intensified into a Cyclonic Storm (CS) "Mocha" pronounced as "Mokha" in the early morning (0530 hours IST/0000 UTC) of 11th May, 2023 over the same region. From 11th morning (0830 hours IST/0300 UTC), it started moving northwards and intensified into a Severe Cyclonic Storm (SCS) in the evening (1730 hours IST/ 1200 UTC) of 11th May over the same region. Thereafter, it gradually started recurving north-northeastwards and intensified into a Very Severe Cyclonic Storm (VSCS) in the early morning (0530 hours IST/0000 UTC) of 12th May over central Bay of Bengal. Moving further north-northeastwards, it intensified into an Extremely Severe Cyclonic Storm (ESCS) in the midnight (230 hours IST/ 1800 UTC of 12th May) over eastcentral Bay of Bengal. Continuing to move north-northeastwards, it intensified further till early morning of 14th May. The peak intensity was 210-220 kmph gusting to 240 kmph over the eastcentral Bay of Bengal from 13th midnight to 14th early morning. It then slightly weakened and crossed north Myanmar-southeast Bangladesh coasts between Kyaukpyu (Myanmar) and Cox's Bazar (Bangladesh) close to north of Sittwe (Myanmar) near latitude 20.3°N and longitude 92.8°E as an ESCS with maximum sustained wind speed (MSW) of 180-190 kmph gusting. Under the influence of this system, fairly widespread to widespread rainfall/thunderstorm activity occurred over Andaman & Nicobar Islands on two days during 9th - 11th May with isolated heavy rainfall on 10th May, 2023.

A total of 8 number of western disturbances and one induced cycir affected the weather over the country during this month. These western disturbances were active and helped in triggering large-scale thunderstorms and rainfall activities accompanied with lightning, hail storms, squalls and gusty winds in many parts of Northwest India and Central India and were main reasons for below normal maximum temperatures over these regions. Rainfall over the homogeneous region of Northwest India (68.4 mm) was second highest since 1901 after the year 1987 (95.0 mm), while East & Northeast India received 111.5 mm of rainfall, which is 3rd lowest since 1901, the prior lowest rainfall years were 1907 (108.1 mm) and 2012 (109.6 mm).

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

Station	*24 hour record rainfall In may 2023(mm)*	*Date*	*Previous rainfall record (mm)*	*Date*
Koraput	57.5	10/5/2023	50.4	12-05-2019
Hamirpur obsy	35.0	2/5/2023	28.9	07-05-2016
Roorkee	72.2	4/5/2023	57.7	30-05-1910
Phalodi	40.2	29/5/2023	38.1	22-05-1920
Erinpura/ Jawai dam	77.0	29/5/2023	44.2	07-05-2008
Bhind-aws	40.0	31/5/2023	18.1	17-05-1973
Datia-aws	76.2	1/5/2023	23.2	06-05-1981
Wardha	32.5	3/5/2023	30.0	17-05-1999
Washim	59.2	3/5/2023	7.0	11-05-2014
Adilabad	47.6	1/5/2023	32	09-05-1981

Source : IMD Climate Diagnostics Bulletin of India May 2023

3.3.2. *Temperature distribution*

There were no heat waves in the first and last week of the month. Severe heat wave to heat wave conditions occurred at isolated places over west Bengal on 10th and Gujarat on 11th May. The heat wave conditions were observed mainly over Northwest India, East & Northeast India and Central India over subdivisions of Bihar, East Madhya Pradesh, East Uttar Pradesh, West Uttar Pradesh Gangetic West Bengal, Gujarat Region, Haryana, Chandigarh & Delhi, Saurashtra & Kutch, Vidarbha, West Madhya Pradesh, West Rajasthan, Sub Himalayan West Bengal & Sikkim, Coastal Andhra Pradesh, Madhya Maharashtra and Jharkhand. These spells were recorded for a few days in the middle of the month and were absent in the last week of the month.

TABLE 6

Dates of occurrence of Heat wave/Severe Heat wave and various categories of maximum temperatures - March 2023

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	-	-
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	-	-
18.	East Rajasthan	-	-
19.	West Madhya Pradesh	-	-
20.	East Madhya Pradesh	-	-
21.	Gujarat Region	-	-
22.	Saurashtra & Kutch	-	-
23.	Konkan & Goa		11 & 14(2)
24.	Madhya Maharashtra		8, 9, 10, 11 & 12(5)
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		3 & 9(2)
34.	South Interior Karnataka	-	-
35.	Kerala	-	-

TABLE 7

Dates of occurrence of Heat wave/Severe Heat wave and various categories of maximum temperatures - April 2023

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	17, 18 & 19(3)	20(1)
6.	Gangetic West Bengal	17, 18, 19 & 20(4)	12, 13, 14, 15 & 16(5)
7.	Odisha	-	14, 17, 18, 19 & 20(5)
8.	Jharkhand	-	18(1)
9.	Bihar	17, 18 & 20(3)	14, 15, 16 & 19(4)
10.	East Uttar Pradesh	-	18 & 19(2)
11.	West Uttar Pradesh	-	18(1)
12.	Uttarakhand	-	-
13.	Haryana, Chandigarh & Delhi	-	16, 17 & 18 (3)
14.	Punjab	-	16, 17 & 18 (3)
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	-	-
22.	Saurashtra & Kutch	-	-
23.	Konkan & Goa	-	19(1)
24.	Madhya Maharashtra	-	-
25.	Marathwada	-	-
26.	Vidarbha	-	-
27.	Chhattisgarh	-	-
28.	Coastal Andhra Pradesh & Yanam	-	14, 15, 16 & 17(4)
29.	Telangana	-	-
30.	Rayalaseema	-	-
31.	Tamil Nadu, Puducherry & Karaikal	-	-
32.	Coastal Karnataka	-	-
33.	North Interior Karnataka	-	-
34.	South Interior Karnataka	-	-
35.	Kerala	-	-

TABLE 8

Dates of occurrence of Heat wave/Severe Heat wave and various categories of maximum temperatures - May 2023

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	10(1)	10 & 11(2)
6.	Gangetic West Bengal	10(1)	9, 10, 11, 17 & 21(5)
7.	Odisha	-	-
8.	Jharkhand	-	17, 21 & 22(3)
9.	Bihar	-	10, 11 & 21(3)
10.	East Uttar Pradesh	-	21(1)
11.	West Uttar Pradesh	-	21, 22 & 23(3)
12.	Uttarakhand	-	-
13.	Haryana, Chandigarh & Delhi	-	22 & 23(2)
14.	Punjab	-	-
15.	Himachal Pradesh	-	-
16.	Jammu - Kashmir and Ladakh	-	-
17.	West Rajasthan	-	12, 13 & 21(3)
18.	East Rajasthan	-	
19.	West Madhya Pradesh	-	13 & 22(2)
20.	East Madhya Pradesh	-	21, 22, 23 & 24(4)
21.	Gujarat Region	11(1)	-
22.	Saurashtra & Kutch	11(1)	12(1)
23.	Konkan & Goa	-	-
24.	Madhya Maharashtra	-	13(1)
25.	Marathwada	-	-
26.	Vidarbha	-	13 & 14(2)
27.	Chhattisgarh	-	-
28.	Coastal Andhra Pradesh	-	15, 16 & 17(3)
29.	Telangana	-	-
30.	Rayalaseema	-	-
31.	Tamil Nadu, Pudcherry & Karaikal	-	-
32.	Coastal Karnataka	-	-
33.	North Interior Karnataka	-	-
34.	South Interior Karnataka	-	-
35.	Kerala	-	-

The maximum temperatures were generally below normal over most parts of the country outside East and Northeast India and South Peninsula. The month's as well as the season's highest maximum temperature 46.5°C was reported at Jhansi (west Uttar Pradesh) on 22nd May over the plains of the country.

The minimum temperatures were below normal over most parts of the country, except some parts of East & Northeast India, western Central India and South Peninsular India. Over Central India during May 2023, the average minimum temperature was the sixth lowest (25.20 °C with an anomaly of - 0.74 °C) after the years 1917(23.51 °C), 1907(24.84 °C), 1920(24.96 °C), 1968(25.06 °C), 1987(25.15 °C) since 1901.

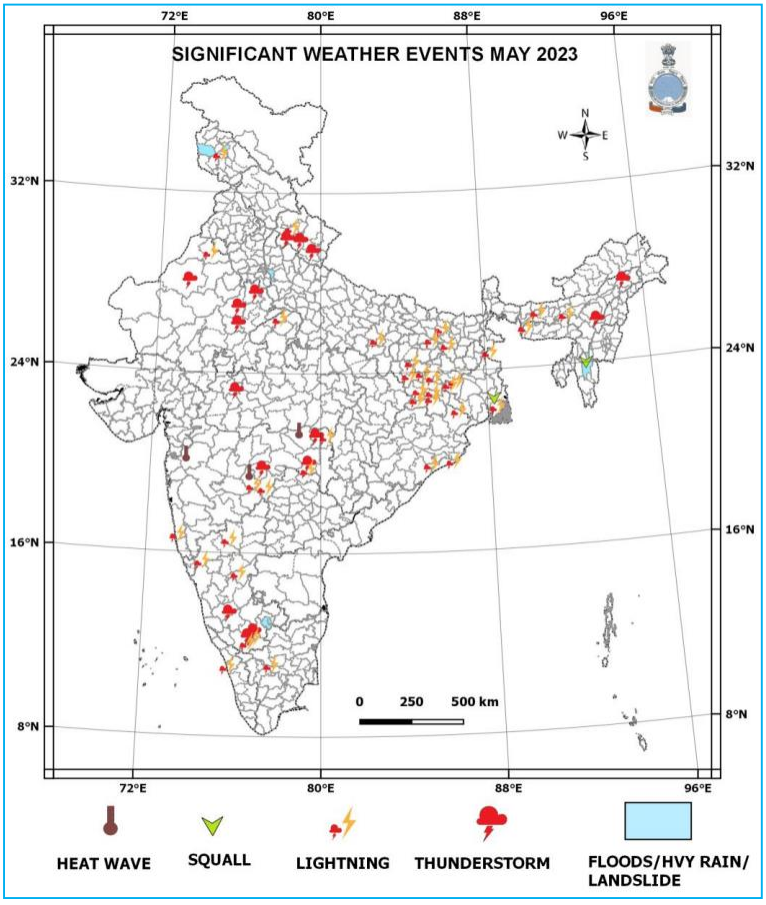
Some stations even recorded lowest minimum temperature for the month. A list of stations is given below with their previous record and date.

Station name	*New Record. (°C)*	*Date (may 23)*	*Previous Record (°C)*	*Dd-mm-yyyy*
Dharamsala*	8.4	1/5/2023	8.8	6-5-2009
Kota (ap)	19.4	1/5/2023	20.0	17-5-1971
Guna	16.0	1/5/2023	16.7	8-5-1960
Sagar	16.2	1/5/2023	16.3	5-5-1969
Nagpur (ap)	19.3	1/5/2023	19.4	4-5-1917
Yeotmal	16.0	1/5/2023	18.2	1-5-2011
Ramgundam	20.5 @	12/5/2023	20.5	6-5-2016
Honavar	18.6	23/5/2023	20.5	6-5-1987

* Indicates hill station @ means equals previous record

Disastrous weather events and damage

According to media reports, during May 2023, 96 persons died, more than 115 people were injured, more than 10 persons missing and more than 45 livestock perished due to various weather events. The details of causalities are given below, which are based on real time media reports.



Source : IMD Climate Summary for the month of May 2023

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*	
Heat Wave	- When actual maximum temperature ≥ 45 °C
Severe Heat Wave	- When actual maximum temperature ≥ 47 °C
(c) *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
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
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%