MAUSAM, **69**, 2 (April 2018), 335-358

Weather in India

HOT WEATHER SEASON (March-May 2017)†

1. Chief features

(*i*) A cyclonic storm 'Maarutha' and a severe Cyclonic storm 'Mora' formed over the Bay of Bengal in the month of April and May respectively. The first cyclonic storm 'Maarutha' formed over the east central Bay of Bengal on 15th April. The severe cyclonic storm 'Mora' formed over the Bay of Bengal on 28th May.

(ii). In the westerly wind regime a short lived western depression formed over Pubjab and adjoining Haryana on 6th April.

(*iii*) *Heat wave conditions** manifested from the last week of March over central and adjoining west/northwestern parts of India and as the season progressed, it extended to parts of Northern India and adjoining eastern India. Its severity and extent increased by the end of April. However in the second week of May, the heat wave conditions abated from northern plains but heat wave conditions prevailed over Northwest, central, east, southeast India during the period

(*iv*) There were convective rains over south peninsula with Tamil Nadu getting exceptionally heavy rainfall in March. Convective rainfall occurred over major parts of India in April and May. Systems in westerlies and Western Disturbances caused widespread precipitation over Northwest and Northeast India in March and over western Himalayan region and adjoining plains in March and April. There was widespread precipitation over north eastern regions in April that continued in May as well.

(*v*) There were occurrences of Thunder squalls and hailstorms over east and North eastern states, Rajasthan, Maharashtra, Telangana and somemore parts of some south peninsular India during the months of March, April and May.

(*vi*) Rainfall activity over the country during the season as a whole was normal (97.7% of Long Period Average (LPA) value). It was normal during March (92.5% of LPA), above normal during April (116.4% of LPA) and slightly below normal during May (89.2 % of LPA).

**Definitions of terms in italics other 5 than sub-titles are given in Appendix*

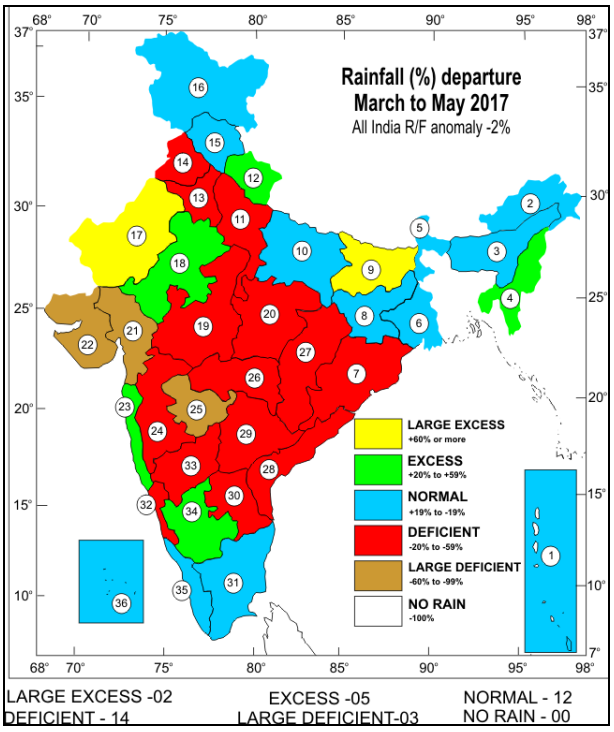

Fig. 1. Sub-divisional rainfall percentage departures (based on Operational data) for the season March-May, 2017. Sub-divisions are indicated by number on the map & bold letters in legend. The rainfall anomaly values for these 36 sub-divisions are indicated below :

1	-10	**7**	-30	**13**	-36	**19**	-37	**25**	-73	**31**	-02
2	10	**8**	-16	**14**	-27	**20**	-46	**26**	-57	**32**	-21
3	18	**9**	60	**15**	-15	**21**	-97	**27**	-58	**33**	-23
4	21	**10**	2	**16**	-14	**22**	-96	**28**	-46	**34**	32
5	00	**11**	-20	**17**	76	**23**	26	**29**	-40	**35**	-07
6	2	**12**	32	**18**	23	**24**	-49	**30**	-25	**36**	07

(*vii*) Southwest Monsoon (SWM) advanced over parts of southeast Bay of Bengal and Andaman Sea & NicobarIslands during 14th - 17th May. SWM set in over Kerala on 30th May.

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 2017 are also depicted in Fig. 1.

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TABLE 1

Sub-division wise rainfall (mm) for each month and season as a whole (March-May 2017) (based on operational data)

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.	Andaman & Nicobar Islands	33	25.0	32	108.3	81.5	33	275.8	358.5	-23	417.1	465.0	-10
2.	Arunachal Pradesh	221.8	179.7	23	348.2	278.8	25	257.1	291.9	-12	827.0	750.4	10
3.	Assam & Meghalaya	116.7	77.7	50	310.9	181.2	72	268.4	331.3	-19	695.9	590.2	18
4.	Naga., Mani., Mizo. and Tri.	125.3	76.8	63	277.6	149.4	86	196.7	267.9	-27	599.7	494.1	21
5.	Sub-Himalayan West Bengal & Sikkim	84.6	63.6	33	146.8	123.7	19	226.8	269.8	-16	458.2	457.1	0
6.	Gangetic West Bengal	35.2	28.0	26	25.8	42.1	-39	106.3	94.7	12	167.3	164.8	2
7.	Orissa	29.8	27.0	10	8.7	37.5	-77	55.2	70.2	-21	93.8	134.7	-30
8.	Jharkhand	4.5	17.1	-73	6.1	18.4	-67	55.9	43.9	27	66.6	79.4	-16
9.	Bihar	22.8	10.1	126	21.8	16.3	34	79.7	51.1	56	124.3	77.5	60
10.	East Uttar Pradesh	4.3	9.1	-52	2.0	5.6	-64	25.8	17.0	52	32.2	31.7	2
11.	West Uttar Pradesh	8.5	11.3	-25	1.4	4.6	-69	13.5	13.2	2	23.4	29.1	-20
12.	Uttaranchal	44.5	57.6	-23	52.8	33.3	59	108.2	65.1	66	205.6	156.0	32
13.	Haryana, Chandigarh & Delhi	7.2	12.7	-43	4.3	7.5	-43	10.3	14.0	-27	21.8	34.2	-36
14.	Punjab	14.5	25.3	-43	12.3	12.5	-1	12.3	15.7	-22	39.1	53.5	-27
15.	Himachal Pradesh	57.4	114.2	-50	88.0	65.4	34	62.0	65.3	-5	207.3	244.9	-15
16.	Jammu & Kashmir	85	151.9	-44	156.7	97.5	61	38.5	76.6	-50	280.1	326.0	-14
17.	West Rajasthan	4.2	3.8	10	3.3	4.2	-20	26.1	11.1	135	33.6	19.1	76
18.	East Rajasthan	5.5	3.7	49	0.7	2.9	-74	15.1	10.8	40	21.3	17.4	23
19.	West Madhya Pradesh	1.5	4.6	-68	0.2	2.0	-92	6.9	6.9	0	8.5	13.5	-37
20.	East Madhya Pradesh	2.0	12.5	-84	0.0	5.5	-100	11.4	7.1	61	13.4	25.1	-46
21.	Gujarat region	0.0	1.1	-100	0.0	0.3	-94	0.2	5.3	-96	0.2	6.7	-97
22.	Saurashtra & Kutch	0.0	1.2	-100	0.0	0.2	-79	0.1	2.6	-96	0.1	4.0	-96
23.	Konkan & Goa	0.0	0.0	-100	0.0	2.8	-100	47.0	34.4	37	47.0	37.2	26
24.	Madhya Maharashtra	0.4	2.7	-84	0.8	8.9	-92	18.0	26.2	-31	19.2	37.8	-49
25.	Marathawada	4.7	5.7	-17	0.0	6.5	-100	3.3	18.1	-82	8.1	30.3	-73
26.	Vidarbha	6.1	12.0	-49	0.0	7.7	-100	7.3	11.2	-35	13.4	30.9	-57
27.	Chattisgarh	3.5	12.7	-73	0.8	14.4	-95	15.6	19.7	-21	19.8	46.8	-58
28.	Coastal Andhra Pradesh	12.4	11.1	12	8.8	21.8	-60	30.8	64.1	-52	52	97.0	-46
29.	Telangana	8.7	9.4	-8	3.2	16.5	-80	22.4	30.9	-27	34.3	56.8	-40
30.	Rayalaseema	12.8	6.5	96	8.8	19.9	-56	39.9	55.6	-28	61.5	82.0	-25
31.	Tamil Nadu	35.4	18.3	94	17.3	42.3	-59	73.5	67.5	9	126.1	128.1	-2
32.	Coastal Karnataka	2.5	4.1	-39	9.5	28.1	-66	129.0	146.6	-12	141.0	178.8	-21
33.	North interior Karnataka	10.7	5.2	106	9.9	25.6	-61	44.8	54.3	-17	65.5	85.1	-23
34.	South interior Karnataka	16.8	8.5	98	34.1	43.8	-22	140.9	92.9	52	191.8	145.2	32
35.	Kerala	87.8	30.4	189	52.8	109.5	-52	213.3	239.8	-11	353.9	379.7	-7
36.	Lakshadweep	100.2	11.8	749	1.8	48.9	-96	145.7	171.7	-15	247.8	232.4	7

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

TABLE 2

Details of the weather systems during March 2017

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.	Upto mid tropospheric levels	5-9	Eastern parts of Iran and adjoining Afghanistan	East northeast	Northern parts of Jammu & Kashmir and neighbourhood	Moved away northeastwards on 10
2.	Do	7-11	Southern parts of Iran and neighbourhood	Do	North Pakistan and adjoining Jammu & Kashmir.	It moved away east northeastwards on 12
3.	Do	13-14	Jammu & Kashmir and neighbourhood	Do	Eastern parts of Jammu & Kashmir	It moved away east-northeastwards on 15. Initially, it lay as a trough in mid-tropospheric westerlies with its axis at 5.8 kms a.s.l. extended along Long. 73° E to the north of Lat. 35° N on 12
4.	Do	15-18	Central parts of Afghanistan	Northeast	Northeastern parts of Jammu & Kashmir and neighbourhood	It moved away east-northeastwards across Jammu & Kashmir on 18 evening. Initially, it lay as a trough in mid-tropospheric westerlies with its axis at 3.1 kms a.s.l. extended along Long. 52° E to the north of Lat. 30° N on 14
5.	Between 3.1 & 4.5 kms a.s.l.	29-30	North Pakistan and neighbourhood	Do	Eastern parts of Jammu & Kashmir	It moved away east-northeastwards on 31
6.	Upto 3.1 kms a.s.l.	31 Mar-2 Apr	Do	Do	Jammu & Kashmir and neighbourhood	It moved away east-northeastwards on 3 April
(*ii*) *As a trough*						
1.	Mid tropospheric levels	8 - 11	Along Long. 65° E to the north of Lat. 32° N (axis at 5.8 kms a.s.l.)	Northeast	Along Long. 73° E to the north of Lat. 30° N (axis at 5.8 kms a.s.l.)	It lay aloft the system (1 a (2)) during 10 - 11. It moved away east-northeastwards on 12
2.	At lower levels	11	From northwest Rajasthan to southwest Madhya Pradesh	Stationary	*In-situ*	Became less marked on 12
3.	Do	11 - 12	Extended from the cyclonic circulation over eastern parts of Bihar and adjoining Sub- Himalayan West Bengal to Telangana across Gangetic West Bengal	Oscillatory	Extended from the cyclonic circulation over eastern parts of Bihar and adjoining Sub-Himalayan West Bengal to south Chhattisgarh to across Gangetic West Bengal and interior Odisha	Became less marked on 13
4.	At lower levels	16 - 17	From Sub- Himalayan West Bengal to south Odisha across Gangetic West Bengal	Quasi-Stationary	From Sub - Himalayan West Bengal to Gangetic West Bengal	Became less marked on 18
5.	Upto lower tropospheric levels	16 - 20	From northeast Rajasthan to Gujarat Region	East	From the cyclonic circulation over northern parts of West Bengal and neighbourhood to interior Karnataka across Odisha, Telangana and Rayalaseema	Became less marked on 21
6.	Mid & upper tropospheric levels	18	Along Long. 90° E to the north of Lat. 20° N (axis at 5.8 kms a.s.l.)	Stationary	*In-situ*	It moved away eastwards on 19

TABLE 2 (*Contd.*)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
7.	Mid tropospheric levels	20	Along Long. 86° E to the north of Lat. 22° N (axis at 5.8 kms a.s.l.)	Stationary	*In-situ*	It moved away eastwards on 21
8.	Mid & upper tropospheric levels	21 - 23	Along Long. 45° E to the north of Lat. 20° N (axis at 5.8 kms a.s.l.)	East	Along Long. 70° E to the north of Lat. 35° N (axis at 5.8 kms a.s.l.)	It moved away east-northeastwards on 24
9.	Do	26 Mar - 4 Apr	Along Long. 48° E to the north of Lat. 25° N (axis at 5.8 kms a.s.l.)	Do	Along Long. 85° E to the north of Lat. 32° N (axis at 7.6 kms a.s.l.)	It moved away east-northeastwards on 4
(*iii*)	*As an induced cyclonic circulation*					
1.	Upto lower tropospheric levels	7 - 11	West Rajasthan and adjoining central Pakistan	East	West Uttar Pradesh and neighbourhood	Became less marked on 12
2.	Do	15	Central Pakistan and adjoining west Rajasthan	Stationary	*In-situ*	Became less marked on 16
3.	Do	22 - 23	Central Pakistan and adjoining west Rajasthan	Do	Do	Became less marked on 24
(B)	*Other upper air cyclonic circulations*					
1.	At lower levels	2 - 3	Sub- Himalayan West Bengal and neighbourhood	Stationary	*In-situ*	Became less marked on 4
2.	Upto lower tropospheric levels	3 - 5	Southwest Madhya Pradesh and neighbourhood	Northeast	Northeast Madhya Pradesh and adjoining Chhattisgarh	It became less marked on 6
3.	Do	3 - 8	Comorin area and neighbourhood	West	Lakshadweep area and neighbourhood	It lay embedded in the trough of low at mean sea level during 5-7 and became less marked on 9
4.	Upto lower tropospheric levels	8 - 9	Bangla Desh and adjoining Sub- Himalayan West Bengal	East	Assam & Neighbourhood	Became less marked on 10
5.	At lower levels	8	Jharkhand and adjoining areas of Odisha & Gangetic West Bengal	Stationary	*In-situ*	Became less marked on 9
6.	Upto lower tropospheric levels	7 - 10	North interior Karnataka and neighbourhood	East	Telangana and adjoining north interior Karnataka	Became less marked on 11
7.	At lower levels	9 - 10	North Chhattisgarh and neighbourhood	Stationary	*In-situ*	Became less marked on 11
8.	Do	10	Southwest Rajasthan	Do	Do	Became less marked on 11
9.	Do	13 - 16	Telangana and neighbourhood	West	North interior Karnataka and adjoining areas of Marathwada and south Madhya Maharashtra	It lay embedded in the trough IV (4) at lower level and merged in it on 17
10.	Do	11 - 12	Eastern parts of Bihar and adjoining Sub- Himalayan West Bengal	Stationary	*In-situ*	Became less marked on 13
11.	Do	18 - 19	Southeast Rajasthan and adjoining west Madhya Pradesh	Do	Do	Became un-important on 20
12.	Upto lower tropospheric levels	20 - 23	Northern parts of West Bengal and neighbourhood	Northeast	Northern parts of Bangla Desh and adjoining Sub- Himalayan West Bengal	It lay embedded in the trough at lower levels from northeast Madhya Pradesh to Assam across Bihar and West Bengal on 23 and became less marked on 24

TABLE 2 (*Contd.*)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
13.	Upto lower tropospheric levels	22 - 23	Western parts of south interior Karnataka and neighbourhood	West	Coastal Karnataka and neighbourhood	It lay embedded in the trough in easterlies at lower level extended from south east Arabian Sea to north interior Karnataka on 23 and became less marked on 24
14.	Do	24 - 25	Eastern parts of Bihar and neighbourhood	East	West Assam and neighbourhood	Became less marked on 26
15.	Do	25 - 31	North interior Karnataka and neighbourhood	Do	North interior Karnataka and adjoining Telangana	It lay embedded in the trough [4(8)] and became less marked on 1 April
16.	Do	27	Comorin area and neighbourhood	Stationary	*In-situ*	Became less marked on 28
17.	At lower levels	27 - 28	South Chhattisgarh and neighbourhood	East	South Chhattisgarh and adjoining Odisha	Became less marked on 29
18.	Upto lower tropospheric levels	27 Mar - 2 Apr	Eastern parts of Bihar and neighbourhood	Do	North Bangla Desh and neighbourhood	It lay embedded in the east-west trough from Bihar to eastern parts of Nagaland on 30 & 31 and became less marked on 3 April
19.	Do	31 Mar - 2 Apr	South Pakistan and adjoining west Rajasthan	Stationary	*In-situ*	It became less marked on 3 April
(**C**)	*Trough in easterlies/trough of low*					
1.	At mean sea level	1-5	From Comorin area to south Konkan across Kerala Karnataka coasts	Oscillatory	Maldives area to north Maharashtra coast across west coast on 2 from southeast Arabian Sea and adjoining Maldives area to north Maharashtra coast across Lakshadweep area and east central Arabian Sea on 3 and from southeast Arabian Sea to east central Arabian sea off south Gujarat coast on 4	The trough of low became less marked on 5
2.	Do	5 - 6	Equatorial Indian Ocean and adjoining southeast Bay of Bengal	Stationary	*In-situ*	Became less marked on 7
3.	Upto lower tropospheric levels	15	From Maldives to coastal Karnataka across Lakshadweep area	Do	Do	Became less marked on 16
4.	Do	21 - 23	Lakshadweep area to north coastal Andhra Pradesh across interior Karnataka and Telangana	Oscillatory	Southeast Arabian Sea to north interior Karnataka	Became less marked on 24
5.	Do	24	From north Kerala to Telangana across south interior Karnataka and Rayalaseema	Stationary	*In-situ*	Became less marked on 25
6.	At lower levels	26 - 27	Southeast Sri Lanka to south Tamil Nadu across Comorin area	East	From the cyclonic circulation over Comorin area and neighbourhood to interior Tamil Nadu	Became less marked on 28
(**D**)	*North-South troughs/Wind discontinuity*					
1.	At lower levels	6 - 7	From Sub-Himalayan west Bengal & Sikkim to south Odisha across Gangetic West Bengal	East	West Assam to north coastal Andhra Pradesh across Gangetic West Bengal and Odisha	Became less marked on 8

TABLE 2 (*Contd.*)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
2.	At lower levels	4 - 5	From the cyclonic circulation over northeast Madhya Pradesh and adjoining Chhattisgarh to north interior Karnataka across Vidarbha and Marathwada	Stationary	*In-situ*	Became less marked on 6
3.	Do	10 - 11	Extended from cyclonic circulation over Telangana and adjoining north interior Karnataka to south Tamil Nadu	Quasi stationary	Extended from Telangana to south Tamil Nadu across Rayalaseema	Became less marked on 12
4.	Do	13 - 14	From north coastal Andhra Pradesh to interior Tamil Nadu	Do	From cyclonic circulation over north interior Karnataka and neighbourhood to south Tamil Nadu across south interior Karnataka	It became less marked on 15
5.	Upto lower tropospheric levels	16	Extended from Lakshadweep area to western parts of Vidarbha across interior Karnataka and Marathwada	Stationary	*In-situ*	Became less marked on 17
6.	At lower levels	23	From northeast Madhya Pradesh to Assam across Bihar and West Bengal	Do	Do	Became less marked on 24
7.	Do	26	West Assam to south Chhattisgarh across Gangetic West Bengal, Jharkhand and interior Odisha	Do	Do	Became less marked on 27
8.	Do	24 - 25	From northeast Madhya Pradesh to south Madhya Maharashtra across Vidarbha and Marathwada	Oscillatory	From northeast Madhya Pradesh to north interior Karnataka across Vidarbha and Marathwada	Became less marked on 26
9.	Between 1.5 & 3.1 kms a.s.l.	28 - 29	From Sub-Himalayan West Bengal to north Odisha across Gangetic West Bengal	Do	From Sub-Himalayan West Bengal to northwest Bay of West Bengal	Became less marked on 30
10.	Upto 0.9 km a.s.l.	30 - 31	From Comorin area to south interior Karnataka across interior Tamil Nadu	Do	From Comorin area to interior Tamil Nadu	It became less marked on 1 April
(**D**)	*East-West troughs*					
1.	Upto 1.5 kms a.s.l.	30 - 31	From Bihar to eastern parts of Nagaland across Bangla Desh and Assam	Oscillatory	From Bihar to Manipur across Bangla Desh and Assam.	It became less marked on 1 April

The consecutive passage of western disturbances (WDs) and their induced systems caused widespread rainfall over western Himalayan region while the systems in westerlies caused widespread precipitation over NW and NE India. The favourable conditions for intense convective activity generated by lower tropospheric instability, upper level velocity divergence, moisture incursion in the lower tropospheric levels and presence of feeble wind discontinuity over parts of south peninsula caused excess/normal* rainfall almost over most parts of

the country. Organized convection caused rainfall over major parts of India and isolated to scattered thunderstorms and hailstorms over east, central and south east peninsula. Along with this a low pressure zone developed at mean sea level over south Pakistan and adjoining west Rajasthan. It drew moisture from the Arabian Sea and caused sporadic rainfall activity over Rajasthan. The cyclonic storm 'Maarutha' formed in mid-April. It did not cause much weather but it did change the flow pattern over most parts of the country. The severe cyclonic storm 'Mora' that formed by the end of May caused widespread to fairly widespread rainfall over the North eastern regions. The advance of South west Monsoon over South Bay of Bengal and Nicobar Islands in mid-May and Kerala by end of May also contributed to the seasonal rainfall.

Sub divisions of north, northeast and south peninsular India in general received large excess/excess/normal rainfall while, sub divisions of central and adjoining north peninsular India received deficient/large deficient rainfall. Bihar and West Rajasthan received about one and half times of their respective normal rainfall. During the season, out of 36 meteorological subdivisions, 2 subdivisions received large excess rainfall, 5 subdivisions received excess rainfall while 12 received normal rainfall. 14 subdivisions received deficient rainfall and 3 received large deficient rainfall.

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 principal amounts of rainfall are given in Table 5.

In the first week, the Indian landmass in general remained under a lower than normal pressure regime while the anticyclones over the Bay of Bengal and Arabian Sea started building up gradually. Moisture incursion from the Bay of Bengal and feeble wind discontinuities developed over various parts of the country and caused moderate to intense convection over parts of south peninsula and east and northeast India. Convective activity over south Peninsular India resulted in some exceptionally heavy rainfall events over Tamil Nadu. Karaikal (Tamil Nadu) reported 172.6 mm rainfall on 5th March, 2017, breaking the past record for the month of March, which had been 137.8 mm on 3rd March 2004. Systems in westerlies in quick succession caused scattered to widespread precipitation over northwest and northeast India and western Himalayan region. Under the influence of troughs in the lower tropospheric levels that formed as a result of heating of the land surface, isolated rainfall and hailstorms occurred over parts of south Peninsula and central India. A low pressure zone developed at mean sea level over south Pakistan and adjoining west Rajasthan and moisture incursion occurred from the Arabian Sea. This caused sporadic rainfall activity over Rajasthan during mid-March. Due to the presence of an anomalous anticyclone and strong ridge that prevailed over the northwestern parts of India there was a rise in day temperatures and night temperatures. This led to heat wave conditions over west Rajasthan and west Madhya Pradesh on 26th March. This became severe and also spread to more areas of northwest, west and central India during 27-29 March.

3.1.2. *Temperature distribution*

(a) *Minimum temperatures*

Cold wave conditions prevailed at isolated places over west Madhya Pradesh on 13th & 15th over Rajasthan and Madhya Pradesh on 14th during the month.

The minimum temperatures remained normal to above normal in the first week of March. In the second week the minimum temperatures were below normal to appreciably below normal over all the subdivisions except peninsular India where it was normal. In the third week the minimum temperatures were normal over the country except over North east and northern sub divisions where they were below normal to appreciably below normal. The last week of march saw a rise in minimum temperatures due to the presence of an anomalous anticyclone and a strong ridge that prevailed over the Northwestern parts of India extending all through the troposphere and tilting southwards with height. Therefore, the minimum temperatures were above normal to appreciably above normal over all the subdivisions except parts of Northeast regions and parts of southern peninsula where the minimum temperatures were normal to above normal during the last week of March.

The month's and the season's lowest minimum temperature over the plains was 5.0 ºC, recorded at Bhilwara (east Rajasthan) on 12th March, 2017.

(b) *Maximum temperatures*

Severe Heat wave conditions prevailed on 1 to 3 days over Rajasthan.

Heat wave conditions prevailed on 1 or 2 days over Madhya Pradesh, Gujarat, west Rajasthan, Vidarbha,

TABLE 3

Details of the weather systems during April 2017

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*					
1.	Cyclonic storm 'Maarutha'	15 (0000 UTC) - 17	Southeast Bay of Bengal centred near Lat. 12° N / Long. 88° E. about 540 kms west-southwest of Maya Bandar	North-northeast	Myanmar centred near Lat. 19.5° N / Long. 95.5° E.	Details are given in the article on Storms & Depressions over the north Indian Ocean - 2017
(**B**)	*Western disturbances/eastward moving systems*					
(*i*)	*Western disturbances*					
1.	Depression	6	Punjab and adjoining areas of north Rajasthan & Haryana	Stationary	*In-situ*	It became less marked on 7. It formed under the influence of an induced cyclonic circulation over Punjab and adjoining areas of north Rajasthan & Haryana. The associated cyclonic circulation extending upto 1.5 kms a.s.l. lay over Punjab and adjoining Haryana on 7 and became less marked on 8
(*ii*)	Upper air cyclonic circulation					
1.	Upto Mid tropospheric levels	4 - 8	Northern parts of Iran and neighbourhood	East	Jammu & Kashmir and adjoining north Pakistan	A trough lay aloft with its axis at 5.8 kms a.s.l. during 5 - 8. The WD and the trough aloft moved away east-northeastwards on 9
2.	Do	12 - 13	Northeast Afghanistan and adjoining north Pakistan	Do	North Pakistan and adjoining Jammu & Kashmir	Moved away east-northeastwards on 11. It lay as a trough with its axis at 5.8 kms a.s.l. along Long. 88° E to the north of Lat. 22° N on 14 and became les marked on 15
3.	Upto 3.1 kms a.s.l.	19 - 22	North Pakistan and neighbourhood	Do	Eastern parts of Jammu & Kashmir and neighbourhood	It moved away northeastwards on 23
4.	Do	22 - 28	Afghanistan and neighbourhood	Do	Eastern parts of Jammu & Kashmir	Initially it lay as a trough with its axis at 5.8 kms a.s.l. on 20 & 21. A trough lay aloft with its axis at 5.8 kms a.s.l. during 22 to 25 and merged with the system on 26
5.	Upto 3.6 kms a.s.l.	27 - 30	West Afghanistan and neighbourhood	Do	Jammu & Kashmir and neighbourhood	It moved away east-northeastwards on 1 May
(*iii*)	*As a trough*					
1.	Mid & upper tropospheric levels	3 - 4	Along Long. 65° E to the north of Lat. 32° N (axis at 3.1 kms a.s.l.)	East	Along Long. 68° E to the north of Lat. 32° N (axis at 3.1 kms a.s.l.)	It moved away northeastwards on 5
2.	Do	29 - 30	Along Long. 68° E to the north of Lat. 32° N (axis at 5.8 kms a.s.l.)	Do	Along Long. 72° E to the north of Lat. 30° N (axis at 5.8 kms a.s.l.)	It moved away east-northeastwards on 1 May. It lay aloft the system II b (5)
(**C**)	*Other upper air cyclonic circulations*					
1.	Upto 2.1 kms a.s.l.	3	South Tamil Nadu and adjoining Comorin area	Stationary	*In-situ*	Became less marked on 4

TABLE 3 (*Contd.*)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
2.	Upto 3.1 kms a.s.l.	6 - 14	Gulf of Siam and neighbourhood	West	Southeast Bay of Bengal and neighbourhood	It lay embedded in the trough of low at mean sea level during on 12 & 13 and then associated with the system I(1)
3.	Upto 2.1 kms a.s.l.	7 - 8	Assam and neighbourhood	Do	Do	Became less marked on 9
4.	At 1.5 kms a.s.l.	7	North interior Karnataka and neighbourhood	Do	Do	Became less marked on 8
5.	Upto 0.9 km a.s.l.	8	North Chhattisgarh and adjoining areas of Jharkhand	Do	Do	Became less marked on 9
6.	Do	10 - 11	Assam and neighbourhood	East	Eastern parts of Assam and neighbourhood	Became less marked on 12
7.	Do	11 - 13	South Konkan and neighbourhood	North	Madhya Maharashtra and neighbourhood	Became less marked on 14
8.	Upto 1.5 kms a.s.l.	12 - 14	Northern parts of West Bengal and neighbourhood	West	Jharkhand and neighbourhood	It lay embedded in the trough at 0.9 km a.s.l. extended from northwest Rajasthan and neighbourhood to Nagaland across Madhya Pradesh on 14. Became less marked on 15
9.	Do	14 - 15	Northwest Rajasthan and neighbourhood	East	Northeast Rajasthan and neighbourhood	Became less marked on 16
10.	At 1.5 kms a.s.l.	15 - 16	East Bihar and neighbourhood	South	Southeast Bihar and neighbourhood	Became less marked on 17
11.	Between 1.5 & 5.8 kms a.s.l.	16	Southwest Bay of Bengal and adjoining Sri- Lanka	Stationary	*In-situ*	Became less marked on 17
12.	Upto 0.9 km a.s.l.	16	Southeast Uttar Pradesh and adjoining north Madhya Pradesh	Do	Do	Became less marked on 17
13.	Between 1.5 & 5.8 kms a.s.l.	18 - 22	South Pakistan and adjoining southwest Rajasthan & Saurashtra & Kutch	South	Northeast Arabian Sea and adjoining Saurashtra & Kutch	Became less marked on 23
14.	Upto 1.5 kms a.s.l.	17	North interior Odisha and adjoining Chhattisgarh and Jharkhand	Stationary	*In-situ*	Became less marked on 18
15.	Do	20 - 24	East Bangla Desh and neighbourhood	East	Nagaland- Manipur-Mizoram-Tripura and neighbourhood	Became less marked on 25
16.	Upto lower tropospheric levels	21 - 23	Haryana and neighbourhood	Do	Southwest Uttar Pradesh and neighbourhood	Became less marked on 24
17.	Upto mid tropospheric levels	24 Apr - 1 May	Southwest Rajasthan and neighbourhood	North and then east	Northwest Uttar Pradesh and neighbourhood	Became less marked on 2 May
18.	Do	20 - 23	Western parts of Jharkhand and neighbourhood	West and then east	Jharkhand and neighbourhood	Became less marked on 24
19.	At 1.5 kms a.s.l.	27	Interior Karnataka and neighbourhood	Stationary	*In-situ*	Became less marked on 28. It was embedded in the system IV (22)
20.	Do	27	Comorin area and neighbourhood	Do	Do	Became less marked on 28. It was embedded in the system IV (22)
21.	Upto 0.9 km a.s.l.	25 Apr - 3 May	East Assam and neighbourhood	Do	Do	Became les marked on 4 May

TABLE 3 (*Contd.*)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
22.	Upto 1.5 kms a.s.l.	27	Northwest Uttar Pradesh and neighbourhood	Stationary	*In-situ*	Became less marked on 28
23.	Upto 0.9 km a.s.l.	29 - 30	East Bihar	Do	Do	Became less marked on 1 May. It was embedded in the system IV (24)
24.	Upto 0.9 km a.s.l.	29 - 30	North Chhattisgarh	Southeast	Coastal Andhra Pradesh and neighbourhood	Became less marked on 1 May. It was embedded in the system IV (24)
(**D**)	*North-south trough /wind discontinuity /other troughs*					
1.	Upto lower tropospheric levels	1 - 3	From the cyclonic circulation over north Bangla Desh and neighbourhood to south Odisha across Gangetic West Bengal.	Oscillatory	From eastern parts of Bihar to north coastal Odisha	It lay as a cyclonic circulation extending upto 2.1 kms a.s.l. over eastern parts of Bihar and adjoining West Bengal on 4 & 5 and became less marked on 6
2.	At lower levels	4 - 8	From north interior to south Tamil Nadu across south interior Karnataka	Do	From Marathwada to south Tamil Nadu across interior Karnataka	Became less marked on 9
3.	Upto 0.9 km a.s.l.	1 - 3	From western parts of Vidarbha to south Konkan across Marathwada and south Madhya Maharashtra	Do	From south Chhattisgarh to south Madhya Maharashtra across Vidarbha and Marathwada	Became less marked on 4
4.	Do	9 - 11	Northwest Bengal to south Chhattisgarh across Jharkhand	South	North coastal Andhra Pradesh to Telangana	Became less marked on 12
5.	Do	10	Marathwada to north interior Karnataka	Stationary	*In-situ*	A cyclonic circulation extending upto 0.9 km a.s.l. lay embedded over north interior Karnataka on 10. Became less marked on 11
6.	Do	10 - 11	Interior Tamil Nadu to Comorin area	Do	Do	Became less marked on 12
7.	Do	12	From the cyclonic circulation over northern parts of Bengal and neighbourhood to south interior Odisha	Do	Do	Became less marked on 13
8.	Do	12 - 15	From cyclonic circulation over south Madhya Maharashtra and adjoining interior Karnataka to south Tamil Nadu across south interior Karnataka	Oscillatory	From Marathwada to Lakshadweep area across coastal Karnataka	Became less marked on 16
9.	Do	15	From cyclonic circulation over northeast Rajasthan and neighbourhood to Marathwada across west Madhya Pradesh and west Vidarbha	Stationary	*In-situ*	Became less marked on 16
10.	At 1.5 kms a.s.l.	16	From cyclonic circulation over southeast Bihar and neighbourhood to coastal Odisha across Jharkhand	Do	Do	Became less marked on 17
11.	Do	16 - 19	From north Telangana to east central Arabian Sea across north interior & coastal Karnataka	Oscillatory	From north Telangana to Konkan	A cyclonic circulation extending upto 0.9 km a.s.l. lay embedded over north Telangana and neighbourhood on 17. It The trough lay as a cyclonic circulation extending upto 0.9 km a.s.l. over north interior Karnataka on 18, 19 and became less marked on 20

TABLE 3 (*Contd.*)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
12.	Upto 0.9 km a.s.l.	16	From the cyclonic circulation over southeast Uttar Pradesh and adjoining north Madhya Pradesh to Marathwada across Vidarbha	Stationary	*In-situ*	Became less marked on 17
13.	Do	18	From the cyclonic circulation over north interior Karnataka and neighbourhood to Lakshadweep area	Do	Do	Became less marked on 19
14.	At 1.5 kms a.s.l.	18 - 19	From Odisha to Comorin area	North	From north coastal Andhra Pradesh to coastal Karnataka	Two cyclonic circulations lay embedded on 18 one over south Odisha and the other over coastal Andhra Pradesh and adjoining Rayalaseema and became less marked on 19. The trough became less marked on 20
15.	Upto 0.9 km a.s.l.	18 - 19	From north Haryana to Vidarbha	Oscillatory	From Uttarakhand to Vidarbha across east Madhya Pradesh	Two cyclonic circulations lay embedded on 18 one over north Haryana and the other over Vidarbha and neighbourhood and became less marked on 19. The trough became less marked on 20
16.	Do	17	From south interior Karnataka to south Tamil Nadu	Stationary	*In-situ*	Became less marked on 18
17.	Upto 3.1 kms a.s.l.	19 - 20	From east Bihar to north Odisha	Do	Do	Became less marked on 21. A cyclonic circulation extending at 1.5 kms a.s.l. lay embedded on 19 and became less marked on 20
18.	Upto 0.9 km a.s.l.	19	From south interior Karnataka to Comorin area	Do	Do	Became less marked on 20
19.	At mean sea level	24 - 25	From south Jharkhand to south Tamil Nadu across south Chhattisgarh and coastal Andhra Pradesh	South	From Telangana to Comorin area across Rayalaseema and Tamil Nadu	A cyclonic circulation extending upto 0.9 km a.s.l. lay aloft on 25. The trough with the embedded cyclonic circulation became less marked on 26
20.	Upto 0.9 km a.s.l.	20 - 21	From Marathwada to Lakshadweep area across north interior Karnataka	Oscillatory	From Marathwada to east central Arabian Sea across north interior & coastal Karnataka	Became less marked on 22
21.	Upto 1.5 kms a.s.l.	24 - 26	From east Bihar to north Bay of Bengal across Jharkhand and Gangetic West Bengal	Stationary	*In-situ*	It lay as a cyclonic circulation extending upto 0.9 km a.s.l. over east Bihar and neighbourhood on 27 and became less marked on 28
22.	Upto lower tropospheric levels	26 - 29	From north Telangana to Comorin area across south interior Karnataka and Tamil Nadu	West	From south Konkan to Comorin area across interior Karnataka and neighbourhood	It became less marked on 30
23.	At 3.1 kms a.s.l.	28	From southeast Rajasthan to northeast Arabian Sea	Stationary	*In-situ*	Became less marked on 29
24.	Upto lower tropospheric levels	27 - 30	From cyclonic circulation over east Bihar and neighbourhood to southeast Odisha across Jharkhand	Oscillatory	From east Bihar to Telangana across Jharkhand and Chhattisgarh	Became less marked on 1 May

TABLE 3 (*Contd.*)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
(E)	*Trough In Easterlies*					
1.	Upto 1.5 kms a.s.l.	9	Lakshadweep area to Telangana across Kerala, interior Karnataka and Rayalaseema	Stationary	*In-situ*	A couple of cyclonic circulations lay embedded over Telangana and Interior Karnataka & neighbourhood on 9.Became less marked on 10
2.	Between 1.5 & 2.1 kms a.s.l.	7	From southeast Sri- Lanka to south coastal Tamil Nadu	Do	Do	Became less marked on 8
3.	At 1.5 kms a.s.l.	30 Apr	From Maldives to coastal Karnataka	Do	Do	Became less marked on 1 May
(F)	*East-Weast Trough*					
1.	At lower levels	3 - 5	From east Uttar Pradesh to Manipur across Bihar and northern parts of West Bengal and Bangla Desh	South	Southeast Uttar Pradesh to Manipur across south Jharkhand and Gangetic West Bengal	It merged with the trough at mean sea level extended from Western Depression to northwest Bay of Bengal on 6
2.	At mean Sea level	6 - 7	From centre of Western Depression to northwest Bay of Bengal across Rajasthan, south Uttar Pradesh, Jharkhand and West Bengal	Quasi-stationary	From the associated cyclonic circulation of Western Depression to north coastal Odisha across Uttar Pradesh and Jharkhand	It became less marked on 8
3.	Upto 0.9 km a.s.l.	14 - 15	From the cyclonic circulation over northwest Rajasthan and neighbourhood to Nagaland across Madhya Pradesh	Oscillatory	From the cyclonic circulation over northeast Rajasthan and neighbourhood to northeast Jharkhand across north Madhya Pradesh	Became less marked on 16
4.	Do	19	From west Uttar Pradesh to east Assam across Bihar	Stationary	*In-situ*	A cyclonic circulation lay embedded over Assam on 19. The trough with the cyclonic circulation became less marked on 20
5.	At mean Sea level	20 - 26	From south Punjab to north coastal Odisha across Haryana, south Uttar Pradesh and Jharkhand	Oscillatory	From north Uttar Pradesh to northern parts of West Bengal across Bihar	Became less marked on 27
6.	Do	30Apr - 3 May	From west Rajasthan to south Gangetic West Bengal across west Uttar Pradesh, Madhya Pradesh and Jharkhand	Do	Northwest Rajasthan to southeast Uttar Pradesh across southwest Uttar Pradesh	Became less marked on 4 May

remaining places of Rajasthan, interior Odisha and north Madhya Maharashtra.

Maximum temperatures were normal to above normal over most parts of the country except in the second week when the temperatures were below normal to appreciably below normal. This was due to the active Western disturbances and its induced systems that caused heavy precipitation over northwest and northeast India. Parts of south peninsula, central and east India experienced convective rainfall all through the week. In the last week, above normal day temperatures and resultant heat wave warm night conditions prevailed over Rajasthan, Gujarat, Madhya Pradesh and parts of Maharashtra due to the anomalous anticyclone and a strong ridge that prevailed over the northwestern parts of India extending all through the troposphere and tilting southwards with height. A few stations broke their past records of highest day maximum temperatures.

The month's highest maximum temperature over the plains was 44.4 °C, recorded at Barmer (West Rajasthan)

TABLE 4

Details of the weather systems during May 2017

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 / severe cyclonic storm*					
1.	Severe cyclonic Storm 'Mora'	28 - 31	East central Bay of Bengal centred near Lat. 14° N / Long. 88.5° E. 950, kms south of Kolkata	Northeast-north-northeast	South Meghalaya and neighbourhood centred near Lat. 25.3° N / Long. 93.2° E. 50 kms north-northwest of Silchar	Details are given in the article on Storms & Depressions over the north Indian Ocean - 2017
(**B**)	*Western disturbances/eastward moving systems*					
(*i*)	*Upper air cyclonic circulation*					
1.	At 3.1 kms a.s.l.	8 - 9	Jammu & Kashmir and adjoining north Pakistan	East	Eastern parts of Jammu & Kashmir and neighbourhood	Initially it lay as a trough in mid & upper tropospheric levels with its axis at 5.8 kms a.s.l. on 7. The feeble WD moved away east-northeastwards on 10
2.	Upto 3.1 kms a.s.l.	13 - 17	North Pakistan and adjoining Jammu & Kashmir	Do	Northeast Jammu & Kashmir and neighbourhood	Initially it lay as a trough in mid tropospheric levels with its axis at 5.8 kms a.s.l. during 10-12. It moved away east-northeastwards on 18
3.	Between 3.6 & 5.8 kms a.s.l.	21 - 25	North Pakistan and neighbourhood	Do	Eastern parts of Jammu & Kashmir	It moved away east-northeastwards on 26
(*ii*)	*As a trough*					
1.	Mid & upper tropospheric levels	3 - 5	Along Long. 64° E to the north of Lat. 30° N (axis at 5.8 kms a.s.l.)	East	Along Long. 74° E to the north of Lat. 35° N (axis at 5.8 kms a.s.l.)	It lay as a cyclonic circulation extending upto 3.1 kms a.s.l. over north Pakistan and neighbourhood with a trough aloft on 4. Moved away east northeastwards on 6
2.	Mid tropospheric levels	4 - 5	Along Long. 80° E to the north of Lat. 15° N (axis at 5.8 kms a.s.l.)	Do	Along Long. 90° E to the north of Lat. 25° N (axis at 5.8 kms a.s.l.)	Moved away northeastwards on 17
3.	Do	8 - 9	Along Long. 65° E to the north of Lat. 32° N (axis at 5.8 kms a.s.l.)	Do	Along Long. 70° E to the north of Lat. 32° N (axis at 5.8 kms a.s.l.)	It moved away east-northeastwards on 10
4.	Do	14 - 18	Along Long. 54° E to the north of Lat. 30° N (axis at 5.8 kms a.s.l.)	Do	Along Long. 75° E to the north of Lat. 30° N (axis at 5.8 kms a.s.l.)	It moved away northeastwards on 19
5.	Between 2.1 & 3.6 kms a.s.l.	20 - 21	Along Long. 92° E to the north of Lat. 23° N (axis at 5.8 kms a.s.l.)	Do	Along Long. 93° E to the north of Lat. 23° N (axis at 5.8 kms a.s.l.)	It moved away eastwards on 22
6.	Mid & upper tropospheric levels	22 - 24	Along Long. 72° E to the north of Lat. 25° N (axis at 7.6 kms a.s.l.)	Do	Along Long. 77° E to the north of Lat. 35° N (axis at 7.6 kms a.s.l.)	It moved away northeastwards on 25
7.	Between 3.1 & 5.8 kms a.s.l.	31 May - 2 June	Along Long. 82° E to the north of Lat. 22° N	North	Along Long. 82° E to the north of Lat. 26° N	It became less marked on 3 June
8.	Do	27 - 30	Along Long. 85° E to the north of Lat. 22° N (axis at 5.8 kms a.s.l.)	East	Along Long. 87° E to the north of Lat. 25° N (axis at 5.8 kms a.s.l.)	It became less marked on 31
(*iii*)	*As an Induced cyclonic circulation*					
1.	Between 1.5 & 2.1 kms a.s.l.	22 - 24	Punjab and neighbourhood	East	Haryana and neighbourhood	It became less marked on 25
2.	Upto 3.1 kms a.s.l.	25 - 29	Southeast Uttar Pradesh and neighbourhood	Do	Eastern parts of Bihar and adjoining areas of Sub - Himalayan West Bengal	It became less marked on 30

TABLE 4 (*Contd.*)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
(C)	*Other upper air cyclonic circulations*					
1.	Upto 1.5 kms a.s.l.	1 - 2	East Uttar Pradesh and neighbourhood	East	East Bihar and neighbourhood	It became less marked on 3
2.	Upto 2.1 kms a.s.l.	1 - 9	Southwest Rajasthan and neighbourhood	Northeast-east	Bihar and adjoining east Uttar Pradesh	It became less marked on 10
3.	Upto 1.5 kms a.s.l.	2	South Madhya Pradesh and adjoining Vidarbha	Stationary	*In-situ*	It became less marked on 3
4.	Upto 0.9 km a.s.l.	3	South Chhattisgarh and neighbourhood	Do	Do	It became less marked on 4
5.	Do	4	Bihar and neighbourhood	Do	Do	It became less marked on 5
6.	Do	4 - 5	South Rajasthan and neighbourhood	East	Southeast Rajasthan and neighbourhood	It lay embedded in the trough at IV (5) and became less marked on 6
7.	Upto 3.1 kms a.s.l.	6 - 10	Bihar and neighbourhood	Do	Sub-Himalayan West Bengal & Sikkim	It became less marked on 11
8.	Upto 1.5 kms a.s.l.	7 - 10	Northwest Rajasthan and neighbourhood	Do	Haryana and neighbourhood	It lay embedded in the east-west trough on 10 and became less marked on 11
9.	Do	7 - 8	Assam and neighbourhood	Do	Do	It became less marked on 9
10.	Between 1.5 & 2.1 kms a.s.l.	8	South coastal Andhra Pradesh and neighbourhood	Stationary	*In-situ*	Became less marked on 9
11.	Upto 2.1 kms a.s.l.	10 - 12	Assam and neighbourhood	Do	East Assam and neighbourhood	It lay embedded in the east-west trough and became less marked on 13
12.	Between 1.5 & 3.6 kms a.s.l.	10	South coastal Andhra Pradesh and neighbourhood	Do	*In-situ*	Became less marked on 11
13.	Upto 1.5 kms a.s.l.	11 - 13	Central parts of south Uttar Pradesh and adjoining north Madhya Pradesh	East	Bihar and adjoining Jharkhand	It lay embedded in the east-west trough on 11 and became less marked on 14
14.	Do	11 - 21	Central parts of Rajasthan and neighbourhood	Do	South Chhattisgarh and adjoining Odisha	It lay embedded in the east-west trough on11 and in the north-south trough on 18 and during 20-21. It became less marked on 22
15.	Between 1.5 & 5.8 kms a.s.l.	12 - 18	Eastern parts of Bihar and adjoining Sub- Himalayan West Bengal	Do	Tripura and neighbourhood	It lay embedded in the trough IV (13) on 14 & 15 and became less marked on 19
16.	Upto 1.5 kms a.s.l.	11 - 14	North interior Karnataka and adjoining Telangana	Quasi stationary	North interior Karnataka and neighbourhood	It became less marked on 15
17.	Upto 3.6 kms a.s.l.	12 - 18	South Andaman Sea and adjoining Malay peninsula	North	Gulf of Martaban and neighbourhood	It became less marked on 19
18.	Between 1.5 & 2.1 kms a.s.l.	12 - 13	Maldives and adjoining Lakshadweep area	Do	Lakshadweep area and neighbourhood	It became less marked on 14
19.	Upto mid tropospheric levels	18 - 21	Punjab and neighbourhood	East	Northwest Uttar Pradesh and neighbourhood	It became less marked on 22
20.	Upto 2.1 kms a.s.l.	20 - 23	Southwest Rajasthan and neighbourhood	Quasi-stationary	Southwest Rajasthan and adjoining south Pakistan	It became less marked on 24
21.	Upto 0.9 km a.s.l.	20	Central parts of Uttar Pradesh and neighbourhood	Stationary	*In-situ*	It became less marked on 21
22.	At 1.5 kms a.s.l.	21 - 22	Rayalaseema and neighbourhood	Do	Do	It became less marked on 23
23.	Upto 1.5 kms a.s.l.	22 - 26	Southwest and adjoining west central Arabian Sea	West	Western parts of west central Arabian Sea and neighbourhood	It moved away westwards on 27

TABLE 4 (*Contd.*)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
24.	Upto 0.9 km a.s.l.	22 - 23	Southeast Uttar Pradesh and neighbourhood	East	North Chhattisgarh and neighbourhood	It became less marked on 24
25.	Do	24	South Chhattisgarh and neighbourhood	Stationary	*In-situ*	It became less marked on 25
26.	Do	25	Eastern parts of Assam and neighbourhood	Do	Do	It became less marked on 26
27.	Upto 2.1 kms a.s.l.	27 May - 1 June	Central Pakistan and neighbourhood	East	Southwest Rajasthan and neighbourhood	It became less marked on 2 June
28.	Between 3.6 & 4.5 kms a.s.l.	30 - 31	Southwest Bay of Bengal off Sri-Lanka coast	West	South Tamil Nadu and neighbourhood	It became less marked on 1 June
29.	Upto 1.5 kms a.s.l.	30	East Uttar Pradesh and neighbourhood	Stationary	*In-situ*	It became less marked on 31
(D)	*East-West trough/shear zone*					
1.	Upto 0.9 km a.s.l.	10 - 11	From Haryana to west Assam across Uttar Pradesh, Bihar and Sub-Himalayan West Bengal	South	Central parts of Rajasthan to south Assam across north Madhya Pradesh, southeast Uttar Pradesh, Bihar and Sub-Himalayan West Bengal	It became less marked on 12
2.	Between 1.5 & 3.1 kms a.s.l.	24	Along Lat. 10° N	Do	Along Lat. 8° N	It became less marked on 25
3.	Upto 1.5 kms a.s.l.	31 May - 1 June	From west Rajasthan to Nagaland across north Madhya Pradesh, Jharkhand, West Bengal and Bangla Desh	Quasi-stationary	From west Rajasthan to Bihar across north Madhya Pradesh and south Uttar Pradesh	It became less marked on 2 June
4.	Between 3.6 & 4.5 kms a.s.l.	29	Along Lat. 8° N	Stationary	*In-situ*	It became less marked on 30
(E)	*Other troughs / wind discontinuity*					
1.	Upto 1.5 kms a.s.l.	1	From cyclonic circulation over east Uttar Pradesh and neighbourhood to west Vidarbha	Stationary	*In-situ*	It became less marked on 2
2.	Upto mid tropospheric levels	1	From east Madhya Pradesh to Maldives area across coastal Karnataka across Telangana, south interior Karnataka and Kerala	Do	Do	It became less marked on 2
3.	Upto 0.9 km a.s.l.	1	From north Telangana to Maldives area across Rayalaseema, south interior Karnataka and Kerala	Do	Do	It became less marked on 2
4.	Upto 1.5 kms a.s.l.	2	From the cyclonic circulation over south Madhya Pradesh and adjoining Vidarbha to north interior Karnataka across Marathwada	Do	Do	It merged with the trough at IV (4) on 3
5.	At 5.8 kms a.s.l.	2	From Interior Odisha to Lakshadweep area across Telangana, south interior Karnataka & coastal Karnataka	Do	Do	It became less marked on 3
6.	Upto 1.5 kms a.s.l.	2	From Comorin area to south interior Karnataka across Tamil Nadu & Kerala	Do	Do	It became less marked on 3

TABLE 4 (*Contd.*)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
7.	At 1.5 kms a.s.l.	3	From east Bihar to northwest Bay of Bengal	stationary	*In-situ*	It became less marked on 4
8.	Upto 0.9 km a.s.l.	3 - 7	From the cyclonic circulation over Haryana and neighbourhood to Comorin area across west Madhya Pradesh, Madhya Maharashtra, interior Karnataka and interior Tamil Nadu	Oscillatory	From the cyclonic circulation over central parts of Uttar Pradesh and neighbourhood to north interior Karnataka across interior Madhya Pradesh, Vidarbha and Marathwada	It became less marked on 8
9.	Upto 1.5 kms a.s.l.	5 - 7	From east Bihar to Gangetic West Bengal across Jharkhand	East	From the cyclonic circulation over Sub-Himalayan West Bengal and adjoining Bihar to northeast Bay of Bengal across Gangetic West Bengal	It became less marked on 8
10.	Upto 0.9 km a.s.l.	8	From the cyclonic circulation over central parts of Uttar Pradesh and neighbourhood to east Assam across Bihar & Sub-Himalayan West Bengal	Stationary	*In-situ*	Became less marked on 9
11.	Upto 1.5 kms a.s.l.	8 - 13	From Telangana to south Tamil Nadu across Rayalaseema	Oscillatory	From the cyclonic circulation over north interior Karnataka and adjoining Telangana to Comorin area across south interior Karnataka and interior Tamil Nadu	It became less marked on 14
12.	Upto 0.9 km a.s.l.	9	From the cyclonic circulation over Bihar and adjoining east Uttar Pradesh to south Chhattisgarh across Jharkhand	Stationary	*In-situ*	Became less marked on 10
13.	Do	8 - 17	From the cyclonic circulation over east Uttar Pradesh and neighbourhood to Mizoram across Bihar, Sub- Himalayan West Bengal and Assam	Oscillatory	From the cyclonic circulation over north Chhattisgarh and neighbourhood to north coastal Andhra Pradesh across interior Odisha	It became less marked on 18
14.	Do	14	From northwest Madhya Pradesh to north Madhya Maharashtra	Stationary	*In-situ*	It became less marked on 15
15.	Do	14	From Marathwada to south Tamil Nadu across Telangana and Rayalaseema	Do	Do	It became less marked on 15
16.	At mean sea level	16 - 20	North coastal Andhra Pradesh to south coastal Tamil Nadu	Oscillatory	South coastal Andhra Pradesh to Comorin area off Tamil Nadu coast	It became less marked on 21
17.	Upto 1.5 kms a.s.l.	18 - 19	From western parts of Bihar to west central Bay of Bengal across Jharkhand and Odisha	Do	From Bihar to west central Bay of Bengal off north Andhra Pradesh coast across Jharkhand and Odisha	It became less marked on 20
18.	Upto 0.9 km a.s.l.	19	From the cyclonic circulation over Punjab and neighbourhood to southeast Madhya Pradesh across northeast Rajasthan	Stationary	*In-situ*	It became less marked on 20

TABLE 4 (*Contd.*)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
19.	Upto 1.5 kms a.s.l.	20 - 21	From south Chhattisgarh to south coastal Andhra Pradesh	Oscillatory	From south Chhattisgarh to Rayalaseema	It became less marked on 22
20.	Upto 0.9 km a.s.l.	21	From western parts of Bihar to north Chhattisgarh	Stationary	*In-situ*	It became less marked on 22
21.	Do	22 - 23	From the cyclonic circulation over southeast Uttar Pradesh and neighbourhood to interior Odisha across north Chhattisgarh	South	From the cyclonic circulation over north Chhattisgarh and neighbourhood to north coastal Andhra Pradesh across Odisha	It became less marked on 24
22.	At 1.5 kms a.s.l.	24	From eastern parts of Bihar to north coastal Andhra Pradesh across Jharkhand, Chhattisgarh and Odisha	Stationary	*In-situ*	It became less marked on 25
23.	Upto 0.9 km a.s.l.	26	From northwest Rajasthan to Vidarbha across Madhya Pradesh	Do	Do	I t merged with the trough at IV(23) on 27
24.	At mean sea level	27 - 31	From west Rajasthan to east central Bay of Bengal and adjoining areas of southeast and west central Bay of Bengal	Oscillatory	From west Rajasthan to west central Bay of Bengal off north Andhra coast across	It became less marked on 1 June.
25.	Upto 0.9 km a.s.l.	25	From the cyclonic circulation over southeast Uttar Pradesh and neighbourhood to north interior Karnataka across Chhattisgarh, Vidarbha and Telangana	Stationary	*In-situ*	It became less marked on 26
26.	Do	27	From south Madhya Maharashtra to south interior Karnataka across north interior Karnataka	Do	Do	Initially it lay as a cyclonic circulation extending upto 0.9 km a.s.l. over north interior Karnataka on 26. The trough became less marked on 28
(F)	*Trough in easterlies*					
1.	Between 1.5 & 2.1 kms a.s.l.	3	From Maldives - Lakshadweep area to southwest Madhya Pradesh across north Kerala, interior Karnataka, Marathwada & Madhya Maharashtra	Stationary	*In-situ*	It became less marked on 4

on 27th March, 2017. It was found that tht the temperatures reported by Bhira is unrepresentative and thus misleading. Thus, the change is made.

3.1.3. *Disastrous weather events and damage*

According to media and other disaster reports, the Srinagar-Jammu national highway remained closed for traffic for seven days due to landslide caused by snowfall and rains. Six people were killed in Maharashtra due to lightning. Crops and thatched huts were damaged due to hailstorms in parts of Srikakulam, Vizianagaram and Vishakhapatnam districts of north coastal Andhra Pradesh. Two lives were lost due to sunstroke in Nanded and Beed, Maharashtra.

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.

During the first week, the anomalous lower tropospheric southerlies provided moisture convergence

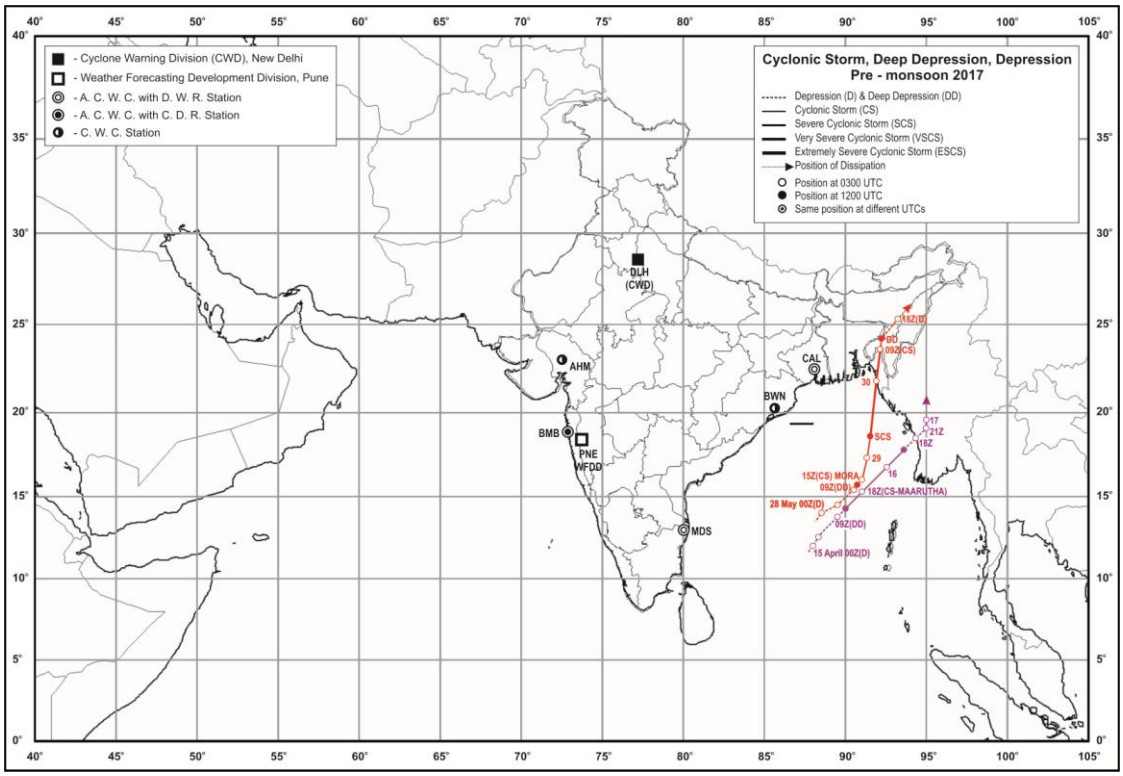

Fig. 2. Track of cyclonic storm during pre-monsoon season 2017

over northeast India. Orographic features along with the upper level divergence due to the sub-tropical westerly jet stream over the region caused widespread precipitation. This widespread precipitation with isolated very heavy and extremely heavy falls occurred over Northeastern states during 29th March to 4th April. In association with upper level divergence, the anomalous moisture convergence caused widespread rain/thunderstorm activity over the Northeastern regions in the last week of April too. The Western Himalayan region also received widespread precipitation while the adjoining plains received scattered rainfall due to the passage of the WDs. A Western Depression formed over Punjab and Haryana (6th - 8th) under the influence of induced cyclonic circulation over the same region. The hilly regions of north India received rainfall at most places with heavy amount of rain/snow at isolated places causing avalanches due to the Western depression The cyclonic storm 'Maarutha' formed over east central Bay of Bengal on 15th April, 2017. The system did not cause any significant weather over mainland but it changed the flow pattern over most parts of the country. A trough in the lower tropospheric levels from north Telangana to Comorin area across south interior Karnataka and Tamil Nadu caused isolated rainfall over Andhra Pradesh, Tamil Nadu and Karnataka and Kerala during the last week of April.

3.2.2. *Temperature distribution*

(a) *Minimum temperatures*

The minimum temperatures over most parts of India were normal to above normal throughout the month except over North and Northwestern regions where they were below normal in the second week of April.

(b) *Maximum temperatures*

Severe Heat wave conditions prevailed for 4 to 8 days over Punjab, west Rajasthan and Saurashtra and Kutch and for 1 to 3 days over Haryana, Chandigarh and Delhi, Himachal Pradesh and Tamil Nadu.

Heat wave conditions prevailed for 1 to 3 days over Odisha, Jharkhand, Punjab Himachal Pradesh, Chhattisgarh coastal Andhra Pradesh and 4-7 days over Haryana Chandigarh and Delhi, Gujarat, Saurashtra and Kutch and Tamil Nadu and for 8 to 11 days over Uttar Pradesh and Vidarbha. Heat wave conditions prevailed for 15 to 20 days over Rajasthan and Madhya Pradesh.

The maximum temperatures remained normal to above normal over most subdivisions throughout the

TABLE 5

Some representative amounts of rainfall in cm for the months March, April and May 2017 (5 cm and above)

Date	Some representative amounts of rainfall in cm for March, April and May 2017 (5 cm and above)
1 Mar	Nil
2 Mar	Nil
3 Mar	Hut Bay 7
4 Mar	Nanguneri 6,Vedaranniyam and Tuting 5 each
5 Mar	Karaikal 17, Kurudamannil and Nagapattnam 9 each, Vedaranniyam 8, Anini AWS and Tuting 7 each, Perumpavur 6, Tezu and Idukki 5 each
6 Mar	Varkala 13, Belonia 10, Kollam Rly 8, Sonamura, Shoolagiri, Ottapalam and Anini AWS 7 each, Bishalgarh, Denkanikottai and Ramanagara 6 each, Basar 5
7 Mar	Sholavandan 16, Sathyamangalam and Vadipatti 7 each, Chintamani PTO and Usilampatti 6 each, Mayanur, Hosur, Andipatti, Valparai and Minicoy 5 each
8 Mar	Krishnagiri 9, Derabis and Anjatti 8 each, Pattamundai 7, Konni, Kuppam, Bari, Marandahalli and Kayamkulam Agri 6 each, Royachoti, Chinnakalar, Rayalpadu, Thambalapalle, Dongargaon, Kendrapara, Manali, Mannarkad, Binjharpur, Ballarpur and Parumbikulam 5 each
9 Mar	Berhampur 12, Batote 8, Chhatrapur 7, Udhampur IAF and Vizianagaram 6 each, Srungavarapukota, Cherrapunji, Nellimarla, Gopalpur, Kanjirappally and Konni 5 each
10 Mar	Karur 8, Panchapatti 6, Gopalpur, Valparai, Batote, Mandasa, Roing, Dharapuram and Punalur 5 each
11 Mar	11 - Ramnagar; 8 - Pullambadi, Gudari and Contai each; 7 - Kishanganj, Paikmal, Joshipur, Perambalur, Vazhapadi, Kanjirappally, Bishalgarh and Chargharia each; 6 - Bhograi and Panagarh AP each; 5 - Gaunaha, Kalingpong, Dharmanagar / Panisagar, Chhatrapur, Remuna, Balimundali, Toofanganj ARG, Trichy town, Chettikulam, Amraghat, Murliganj, Akhuapada, Tigiria, Jagadhari, Kailashahar and Udai Kishanganj each
12 Mar	Mettupatti 10, Bishalgarh and Amarpur 9 each, Gandarvakottai 8, Anini AWS and Konni 7 each, Tuting 6, Punalur, Lengpui, Belonia, Chittampatti and Manamadurai 5 each
13 Mar	Dholla Bazar 6, Tuting and Anini AWS 5 each
14 Mar	Paiyur AWS 7
15 Mar	Kothagiri 17, Coonoor PTO 11, Coonoor 10, Sivagiri 9, K Bridge 7, Hesaraghatta 6
16 Mar	Gonegandla 11, Amini Divi 10, Coonoor and Coonoor PTO 9 each, Ottapalam, Papanasam, Koppal PTO and Koppal R 7 each, Nandavaram and Chengannur 6 each, Vaikom, Haripad, Honakere, Atmakur, Umarga and Tirupathur 5 each
17 Mar	Nil
18 Mar	Mudigere and Ranastalam 5 each
19 Mar	Shergarh and Anini AWS 5 each
20 Mar	Jaleswar 6, Gudivada and Remuna 5 each
21 Mar	Kodumudi 7
22 Mar	Kottigehara 5
23 Mar	Nil
24 Mar	Nil
25 Mar	Goalparacwc and Malbazar ARG 5 each
26 Mar	Bishalgarh 6
27 Mar	Nahar Katia 8, Miao 7, Deomali 5
28 Mar	Cherrapunji 8
29 Mar	Mawsynram 11, Car Nicobar IAF and Baghmara AWS 9 each, Cherrapunji (Rkm) 6, Cherrapunji 5
30 Mar	B P Ghat, Cherrapunji and Mawsynram 15 each, Kamalpur, Matijuri and Khowai 13 each, Annapurnaghat and Cherrapunji (Rkm) 12 each, Karimganj 10, Silchar 8, Imphal, Barpathar, Haflong and Lakhipur each 7, Dholai, Kailashahar and Arundhutinagar each 6, Bishalgarh, Shella, Baghmara AWS and Lumding 5 each
31 Mar	Lakhipur 30, Silchar 24, B P Ghat and Karimganj 23 each, Cherrapunji 17, Annapurnaghat 16, Mawsynram 15, Dholai 14, Chottabekra and Williamnagar 13 each, Amraghat and Imphal 10 each, Cherrapunji (Rkm) and Williamnagar AWS 9 each, Matijuri, Gharmura, Thoubal AWS and Kamalpur 7 each, Dharmanagar / Panisagar 6, Baghmara AWS, Jorhat and Dhubri Cwc 5 each
1 Apr	Cherrapunji 28, Mawsynram 23, Karimganj 18, Cherrapunji (Rkm) and Shella 11 each, Haflong 10, Tinsukia 9, Gangtok, Itanagar and Tadong 5 each

TABLE 5 (*Contd.*)

Date	Some representative amounts of rainfall in cm for March, April and May 2017 (5 cm and above)
2 Apr	Cherrapunji 24, Mawsynram, Cherrapunji (Rkm) and Williamnagar 13 each, Williamnagar AWS 9, Karimganj 8, Dholla Bazar, Shella and Bhalukpong 7 each, Jia Bharali N T Xing, Wokha AWS, Kiphire AWS, Haflong and Tezu 6 each, Tadong, Majbhat, Dhemaji AWS, Along AWS, Roing, Guwahati AP, Basar, Jorhat, Barpathar and Tinsukia 5 each
3 Apr	Kokrajhar 19, Cherrapunji 16, Roing 15, Cherrapunji (Rkm) and Mawsynram 14 each, Haflong 13, Manash Nh Xing 12, Bahalpur and Karimganj 10 each, Passighat, Aie Nh Xing and B P Ghat 9 each, Beky Rly.Bridge, Barpeta, Dillighat, Silchar, Nahar Katia, Tezu and Goalparacwc 7 each, Chottabekra, Deomali, Changlang, Williamnagar, Gossaigaon and Goalpara 6 each, 5 - Along AWS, Gharmura, Namsai, Nalbari / Pagladia, Matijuri, Miao, Hazuah and Sompeta 5 each
4 Apr	Cherrapunji 14, Mawsynram 13, Serchip (Hydro) 11, Cherrapunji (Rkm) and Karimganj 9 each, Mathabhanga 8, Bishalgarh, Lakhipur and Shella 7 each, Goibargaon, Goalparacwc, B P Ghat, Lengpui, Neora, Silchar, Chhamonu and Chottabekra 6 each, Aizawal, Nagarkata, Kokrajhar, Guwahati AP, Murti, Sabroom, Matijuri, Bahalpur, Kamalpur, Dharamtul, Williamnagar and Dharmanagar / Panisagar 5 each
5 Apr	Khowai 13, Kamalpur 10, Dholai and Aya Nagar 8 each, Kailashahar 6, Chottabekra, Kupwara, Pahalgam AWS and Gulmarg 5 each
6 Apr	Kailashahar 10, Shalimar AGRO and Banihal 9 each, Srinagar and Anantnag 8 each, Dharmanagar / Panisagar, Kukernag, Joshimath, Rambagh AWS, Sonamura, Bishalgarh and Jakholi 7 each, Pahalgam, Kalpa, Srinagar IAF, Ukhimath, Kupwara, Awantipur IAF, Kumarsain and Quazigund 6 each, Rajouri, Barkot, Konibal, Shimla, Manali, Banjar, Bhuntar AP, Batote, Tehri, Rampur Bushar, Bajaura AGRO, Bajura AWS, Uttar Kashi and Chhamonu 5 each
7 Apr	Kushalnagar 9, Saloni and Kukernag 8 each, Hardwar 7, Tissa, Bantwal, Naina Davi and Banihal 6 each, Napoklu, Baderwah, Kurudamannil, Anantnag, Punalur, Kanjirappally and Kozha 5 each
8 Apr	B P Ghat 7, Puthimari and Dillighat 6 each, Dhubri Cwc, Dhubri and Barpeta 5 each
9 Apr	Tuting 7, Punalur and Kashipur 5 each
10 Apr	Roing 8
11 Apr	Nil
12 Apr	Nil
13 Apr	Nil
14 Apr	Nil
15 Apr	Mangan 5
16 Apr	Kaliaganj 9, Long Islands 5
17 Apr	Anandpur and Nanjanagud 5 each
18 Apr	Aizawal and Dudda 6 each, Car Nicobar IAF 5
19 Apr	Cherrapunji 10, Kokrajhar 9, Tamulpur and Haldibari 7 each, Nalbari / Pagladia 6, Panbari and Rampurhat (Drms) 5 each
20 Apr	Agartala AP and Bishalgarh 12 each, Khowai 11, Williamnagar 10, Sabroom and Arundhutinagar 9 each, Sonamura 8, Matijuri, Jakholi, Gaunaha, Tikrikilla and Belonia 7 each, Amarpur, Sapaul, Kokrajhar, Kamalpur, Dhengbridge and Udaipur 5 each
21 Apr	Kailashahar 13, Kamalpur 11, Dharmanagar / Panisagar 9, Chhamonu, Matijuri, Williamnagar, Shalimar AGRO, Sabroom, Coonoor and Coonoor PTO 5 each
22 Apr	Dhubri Cwc 18, Williamnagar 17, Dhubri 16, Gharmura 15, Thodupuzha 11, Kaliaganj 10, Mawsynram, Cherrapunji and Gossaigaon 9 each, Goalparacwc 8, Tikrikilla, Raiganj, Panbari, Cherrapunji (Rkm) and Gangarampur 7 each, Nalbari / Pagladia, Bishalgarh, Bahalpur, Malda, Chanchal, Dinhata and Munsyari 6 each, Harur, Kaliachak, Nh31 Bridge, Barobhisha, Tapan, Kokrajhar and Puthimari 5 each
23 Apr	Khowai 12, Chhamonu 11, Itanagar 10, Arundhutinagar, Aizawal and Agartala AP 8 each, Lengpui 7, Car Nicobar IAF and Tezpur 6 each, Sabroom, Dharmanagar / Panisagar, Amarpur, Chauldhowaghat, Mawsynram, Belonia, Purnea, Serchip (Hydro), Kailashahar, Sonamura, Gobichettipalayam and Bhavani 5 each
24 Apr	Udaipur 9, Bishalgarh, Hazuah and Sagar 8 each, Bharwain, Amarpur, Badatighat and Maheshi 7 each, Gharmura and Gokulpur AWS 6 each, Kamalpur, Hayaghat and Lunglei AWS 5 each
25 Apr	Karimganj and Sabroom 10 each, Tadong and Khowai 9 each, Gangtok 8, Beki Mathungari, Belonia and Chauldhowaghat 7 each, Passighat and Anini AWS 6 each, Melabazar / Matunga, Kamalpur, Chengmari / Diana, Lunglei, Dholai, Virudhunagar, Hazuah, Sonamura, Amarpur, Tuting, Serchip (Hydro), Bhavani and Drf 5 each
26 Apr	Passighat 16, Roing 15, Lakhipur 12, Karimganj and Silchar 11 each, B P Ghat 10, Tezu 9, Matijuri, Tawang AWS and Naharlagun 8 each, Anini AWS, Dholai, Badatighat and Chottabekra 7 each, Tuting, Cherrapunji and Itanagar 6 each, Goibargaon, Dholla Bazar, Drf, Dibrugarh AP, Khowang, Chauldhowaghat, Majbhat, Annapurnaghat, Jia Bharali N T Xing and Along AWS 5 each
27 Apr	Cherrapunji 33, Mawsynram 25, Cherrapunji (Rkm) and Roing 17 each, Tuting and Karimganj 9 each, Chauldhowaghat 7, N. Lakhimpur and Anini AWS 6 each, Chottabekra, Passighat and Beki Mathungari 5 each
28 Apr	Panbari 13, Haflong 10, Tuting and Anini AWS 9 each, Aie Nh Xing, Sankalan and Roing 6 each, Dhemaji AWS, Shimoga and Shivamogga PTO 5 each

TABLE 5 (*Contd.*)

Date	Some representative amounts of rainfall in cm for March, April and May 2017 (5 cm and above)
29 Apr	12 - Hangal; 7 - Aizawal; 6 - N. Lakhimpur and Cooch Behar each; 5 - Ranebennur (Hos), Roing and Mathabhanga each
30 Apr	Cherrapunji 19, Kukernag 8, Cherrapunji (Rkm), Pahalgam AWS and Mawsynram 6 each, Anantnag, Pahalgam and Periyapatna 5 each
1 May	Roing 9, Mysore and Mysuru PTO 8 each, Panagarh AP and Durgapur 7 each, Aryankavu 6, Obuladevaracheruvu, Goalparacwc, Magadi, Deomali, Jia Bharali N T Xing, Puthimari and Tezu 5 each
2 May	Bishalgarh 11, Mandasa 9, Chintalapudi, Arundhutinagar and Hassan 7 each, Uthagamandalam, Sattenapalle, Agartala AP and Ambalavayal 6 each, Pinapaka, Kovai / Koyamutthur AP, AP Peelamedu, Gudurwrgl, Digapahandi ARG, Panagarh AP, Dharmanagar / Panisagar, Nuagada ARG, Mohana and Tuting 5 each
3 May	Shencottah, Pechiparai and Kochi AP 6 each, Melabazar / Matunga, Ayikudi, Aryankavu and Beki Mathungari 5 each
4 May	Shencottah 6, Anandpur and Nuagada ARG 5 each
5 May	Anini AWS 7, Dibrugarh AP 6, Tinsukia and Tuting 5 each
6 May	Manash Nh Xing 9, Kokrajhar 8, Aie Nh Xing 7, Miao 6, Roing, Beky Rly.Bridge, Barobhisha, Bahalpur, Nalbari / Pagladia and Panbari 5 each
7 May	Hosanagar 12, Mahendragarh 6, Chengmari / Diana, Nagarkata, Hassan, Hunchadakatte, Haveri PTO, Devihosur AGRO, Honnali, Kanjirappally, Matijuri and Nellimarla 5 each
8 May	9 - Tirupathur PTO and Kannur each; 8 - Uthangarai, Nanjanagud and Sravanabelagola each; 7 - Bailhongal and Tirupattur each; 6 - Udayagiri, Penucondapuram, M Hills, Dharmapuri PTO, Thuckalay, Eraniel and Virinjipuram AWS each; 5 - Harur, Koppa, Pollachi, Kunigal, Tenali, Hosur, Pallipattu, Car Nicobar IAF, H D Kote, Kalghatgi, CIAL Kochi and Nancowry each.
9 May	Dhengraghat and Jhanjharpur 9 each, Mathabhanga 8, Agathi 7, Neora and Basua 6 each, Bhimnagar, Gajoldoba, Siliguri ARG, Ghatagaon, Malbazar ARG, Darbhanga, Harichandanpur ARG and Toofanganj ARG 5 each
10 May	Thakurganj 9, Khammam Urban, Chevella, Pullambadi, Tezu, Bhagamandala, Mahbubabad and Chargharia 7 each, Pinapaka, Bahadurganj, Poondi, Bahalpur, Enkuru, Hyderabad, Udala, Thimmajipeta, Kapkot, Baripada, Samayapuram and Lakshmeswar 6 each, Sendamangalam, Tirukoilur, Puri, Thammampatty, Perambalur, Addanki, Samakhunta AWS, Julurpad, Namakkal, Tentulikhunti ARG, Kalyani Smo, Hesaraghatta, Manchal and Hosadurga 5 each
11 May	Sivakasi 13, Papanasam 12, Quilandi 10, Aryankavu, Kannur and Srivilliputhur 9 each, Sankarankoil and Varkala 8 each, Shencottah and Thenkasi 7 each, Malavalli ARG, Kollam Rly, Kottayam, Thalavadi and Periyar 6 each, Bellur, Mancompu, Kheri, Watrap, Peermade To, Ayikudi, Konni, Srirangapatna, Hosur, Chamarajanagar PTO, Mananthavady and Chamarajanagar AWS 5 each
12 May	Toofanganj ARG 11, Andipatti 7, Honnali and Belur 6 each, Jagalur, N. Lakhimpur, Rattihalli ARG and Sevoke 5 each
13 May	CIAL Kochi 12, Gangtok and Thodupuzha 11 each, Kamudhi 10, Tadong and Kodaikanal 9 each, Idukki, Alathur, Hosanagar and Chengannur 8 each, Thrithala 7, Nancowry and Kayamkulam Agri 6 each, R.Udaigiri, Konni, Pattambi, Chalakudi, Mahad, Bhanjnagar, Solan, Aska, Kayamkulam and Nanguneri 5 each
14 May	Murti and Domohani 8 each, Balasore, Jalpaiguri, Deomali, Karimganj, Car Nicobar and Kankadahad ARG 7 each, Jia Bharali N T Xing and Champasari 6 each, Kumargram, Madurai AP, Numaligarh, Velhe, Purnea, Gajoldoba, Golaghat Cwc and Similiguda AWS 5 each
15 May	Dharmanagar / Panisagar 11, Dholai 10, Sevoke 9, Bishalgarh 8, Dharmasthala, Lakshmeswar, Uchangidurga and Savanur 7 each, Yelandur, Shirahatti, Khanapur, Mawsynram, Bagrakote, Yedwad and Muddebihal 6 each, Kamalpur, Hut Bay, Kailashahar, Badami, Pedong, Alamatti HMS, Varkala, Belur, Bellatti, Jagalur, Matijuri, Nargund, Bellur, Holagunda, Dharwad PTO, Cherrapunji, Kumta, Sargur, Jagalbet, Tadong, Karimganj, Lengpui and Udaipur 5 each
16 May	Bishalgarh 11, Rajapur and Tinsukia 9 each, Hut Bay 8, Melur 7, Williamnagar, Jangipur, Remuna ARG and Naharlagun 6 each, Sirmari B.Pur, Murarai and Golaghat 5 each
17 May	Maddur and Dhaurahara 7 each, Kanakapura, Hut Bay and Haldwani 6 each, Belonia, Nainital and Nanpara 5 each
18 May	7 - Chamoli and Kozha each; 5 - Mudigere, Sono, Khalilabad and Basti each.
19 May	Siddapura 13, Kollam Rly 11, Gowribidanur, Kanakapura and Agumbe 10 each, Dindigul, Matijuri and Haripad 9 each, Mawsynram, B P Ghat, Dharmanagar / Panisagar, Annapurnaghat, Kailashahar and Hosanagar 8 each, Kokrajhar, Channapatna, Gopal Nagar ARG, Thondebhavi, Huliyurdurga, Nelamangala, Pachhad, Banaigarh AWS, Alathur and Pattambi 7 each, Thuckalay, Thalavadi, Pochampalli, Mulki, Thuvakudi Imti, Yelandur, Jaleswar, Damthang, Digha, Mandya, Cherrapunji, Malavalli & Punalur 6 each, Kankadahad ARG, Thrithala, Srirangapatna, Begur, Passighat, Gajoldoba, Nagarkata, Denkanikottai, Malavalli ARG, Mangalooru AP, Mangaluru AP, Lepakshi, Dibrugarh AP, Penucondapuram, Kundapur, Shoolagiri, Halli Mysore, Amraghat, Baghdogra AP, Tumakuru, Kurudamannil, Bengaluru Kial, Belthangadi and Kolabira ARG 5 each
20 May	Haldwani 15, Car Nicobar IAF 10, Dhemaji AWS 9, Mathabhanga and N. Lakhimpur 8 each, Nh31 Bridge, Naharlagun, Dibrugarh AP and Itanagar 7 each, Badatighat, Car Nicobar, Toofanganj ARG, Rairangpur, Cooch Behar and Nainital 6 each, Venkatagiri Kota 5

TABLE 5 (*Contd.*)

Date	Some representative amounts of rainfall in cm for March, April and May 2017 (5 cm and above)
21 May	Nilgiri and B P Ghat 9 each, Badatighat 8, Aizawal and Mattanur 7 each, Roing, Lengpui, Chengannur, Gangtok and Ambalavayal 6 each, Taliparamba, Madurai City, Madurai South, Tadong, Naduvattam, Dibrugarh AP, G Bazar, Balasore, Sukinda, Cherrapunji, Yercaud, Jalpaiguri, Uthagamandalam, Dharmapuri PTO, Dindigul ARG, Alappuzha and Munsyari 5 each
22 May	Nayanagar / Beawar 8, Karimganj 7, Pisagan and Raipur 6 each, Pali, N. Lakhimpur, Bilara, Roing, Naraingarh, Matijuri and Raipur 5 each
23 May	Jamshedpur 13, Chepan and Irikkur 8 each, Palacode, Karimganj, Coonoor PTO and Pedong 7 each, Mawsynram, Taliparamba, Baripada, Hoskote, Kancheepuram, Hazuah, Karur and Tirukoilur 6 each, Panbari, Kumarakom, Coonoor, Jamshedpur AP, Cherrapunji, Kumarapalayam and Grand Anaicut 5 each
24 May	Mawsynram 11, Hosanagar 8, Vadakara, Krishnarajpet and Mudigere 7 each, Beki Mathungari and Sheikhpura 6 each, Honakere, Dharmasthala, Namsai, Krishnarajasagara, Chepan, Basaralu and Kottigehara 5 each
25 May	Williamnagar 17, Tezpur 10, Cherrapunji, Cherrapunji (Rkm) and Passighat 9 each, Mawsynram and Nuagada ARG 8 each, Mathabhanga, Kollegal, Tuting, Yelandur and N. Lakhimpur 7 each, Tikarpara 6, Srivilliputhur, Bihubar, R.Udaigiri, Bhalukpong, Dibrugarh AP, Dhubri Cwc and Chandikhol ARG 5 each
26 May	Williamnagar 22, Mawsynram 11, Karimganj 10, Dholai 9, Cherrapunji 8, Cherrapunji (Rkm), Sapaul and Barobhisha 7 each, Kokrajhar, Rayakottah and Birpur 6 each, Similiguda AWS, Madhwapur, Kollam Rly, Kessariah, Jhanjharpur, Jangipur, Kochi AP, Guwahati AP, Khachrod, Pollachi and Port Blair 5 each
27 May	Jamshedpur AP, Hoskote and Mankar 10 each, Khammam, Khammam Urban, Jamshedpur and Bengaluru Kial 9 each, Bengaluru CO, Bengaluru City, Dudda, Naktideul, Thalavadi, Sriniketan, Sathupalle and Midnapore Cwc 8 each, Proddutur, Midnapore, Rajghat, Thondebhavi, Purihansa, Anekal, Chintalapudi, Krishnanagar and Uttar Kashi 7 each, Gopal Nagar ARG, Krishnagiri, Begur, Uttar Kashi Cwc, K G F AWS, Denkanikottai, Thali, Madhugiri, Jammalamadugu, Kirmira ARG, Aswapuram, Kuppam, Bobbili and Virinjipuram AWS 6 each, Chinthakam, Yelandur, Pauri, Kunigal, Palawancha, Malavalli, Hosur, Nanjanagud, Jharsuguda AP, Kheri, Rasra, Veeraghattam, Bargur, Jaleswar, Malavalli ARG, T Narasipur, Bahadurganj, Keertinagar, Bagaha, Mangalapuram, Sira, Madhabarida, Allagadda, Maddur, Manjeri, Kotraguda, Sargur, Omalur, Bonakal, Agali, Mohanpur, Halli Mysore, Mannarkad, Atlur, Kolabira ARG, Muzaffarpur, Vaniaymbadi and Hesaraghatta each
28 May	Gopal Nagar ARG 9, Minicoy and Derabis ARG 7 each, Wokha AWS and Sabroom 6 each, Kodaikanal, Maya Bandar and Basaralu 5 each
29 May	Rampurhat (Drms) 12, Rajgarh / Sadulpur 10, Motihari 9, Sheohar 7, Nahan, Vaikom, Mavelikara and Nalhati 6 each, Narnaul, Hayaghat, Darbhanga, Kochi AP, Champua, Samastipur, Maheshi, Wokha AWS, Mahedi / Mehshi, Port Blair, Almora, Pandoh, Mahendragarh AWS, Mandawar, Bindki and Mahendragarh 5 each
30 May	Mavelikara 13, Alappuzha, Kayamkulam and Haripad 9 each, Kayamkulam Agri, Ghumarwin, Cherthala, Konni and Vadakara 7 each, Sivaganga, Enamakkal, Ajmer, Irinjalakuda, Kollam Rly, Mungaoli, Colachel, Kuzhithurai and Punalur 6 each, Vaikom, Chalakudi, Tajewala, Sallopat, Kurudamannil, Agumbe, Bijahi, Chengannur, Kota, Mylaudy, Neyyattinkara, Eraniel, Kottayam, Varkala, Arki, Vellanikkara, Ajmer Tehsil, Kochi AP and Thuckalay 5 each
31 May	Vaibhavwadi 21, Lanja 20, Kankavli 16, Kadra 13, Jakholi 12, Haflong, B P Ghat and Sangameshwar Devrukh 11 each, Radhanagari, Lumding, Chandgad, Lunglei and Serchip (Hydro) 10 each, Sono, Shillong and Gaganbawada 9 each, Lakhipur, Passighat, Basar, Chiplun, Jagalbet and Mahabaleshwar 8 each, Kapurtala, Vaikom, Irikkur, Rajapur, Karimganj, Minicoy, Kohima, Chauldhowaghat, Matijuri, Barpathar, Jia Bharali N T Xing, N. Lakhimpur and Asansol Cwc 7 each, Daparijo, Sanguem, Piravam, Hussainganj, Kochi AP, Silchar, Asansol, Naina Davi, Labpur, CIAL Kochi, Roing and Dharmanagar / Panisagar 6 each, Darauli, Maharajganj, Naharlagun, Aluva Pwd, Dharampur, Numaligarh, Bokajan, Shirali PTO, Baltara, Itanagar, Sabroom, Tuting, Chhamonu, Ukhimath, Cherrapunji, Golaghat, Tinsukia, Kailashahar, Banjar, Mandi, Gargoti / Bhudargad, Vadakara, Khadrala, Golaghat Cwc, Neamatighat, Bijahi, Neyyattinkara, Dharmasthala and Quepem 5 each

month except north and northwest, central India and peninsular India where they were markedly above normal in the first and third week of April. West and northwest India experienced *severe heat wave* to *heat wave conditions* due to dry northerly winds. Absence of anti-cyclones in the sea areas also resulted in no moisture incursion which led to dry conditions in most parts of peninsular India. Over the north eastern regions the maximum temperatures remained *below normal, appreciably below normal and markedly below normal* in the first and last week of April because of widespread precipitation, thunder squalls and hailstorms over parts of Northeast India.

The month's highest maximum temperature recorded over the plains was 46.8 °C at Ganganagar (west Rajasthan) on 17th April, 2017.

3.2.3. *Disastrous weather events*

According to media and other disaster reports, total ten lives were lost due to sunstroke in Maharashtra. Norwesters and Hailstorms claimed two lives, damaged more than 1200 houses, disrupted power supply and transport in parts of Tripura, Nagaland and south Assam on 2nd and 3rd April. Two persons were killed due to Rain/snow in Shimla while cherry blossoms and power

supply were damaged in Kashmir. Five people died and eight injured after being hit by lightning in Himachal Pradesh. Heavy snowfall triggered multiple avalanches, buried one post in the Batalik sector, and killed three soldiers in Kashmir.

3.3. *May*

3.3.1. *Weather and associated synoptic features*

(a) *Advance of southwest monsoon*

The southwest monsoon advanced into some parts of southeast Bay of Bengal, Andaman Sea and Andaman and Nicobar Islands during 14-17 May. It further advanced into some more parts of Bay of Bengal and remaining parts of Andaman Sea on 18th. However with the pre-dominance of the mid latitude westerlies and sub-tropical ridge no further advance took place and a hiatus of six days occurred in the further advance of Monsoon. The advance of Southwest Monsoon resumed and it set in over Kerala on 30th May. It also advanced over parts of northeastern states on the same day.

(b) *Other synoptic features and rainfall*

The details of weather systems and track of the severe cyclonic storm (Mora) form over the Bay of Bengal during the month are given in Table 4 & Fig 2. The principal amounts of rainfall are given in Table 5.

During the first week, the presence of anomalous anticyclone over the Bay of Bengal aided moisture incursion over peninsular India. Heating of the land masses and moisture availability in the lower troposphere led to organized convection causing rainfall over major parts of India and isolated to scattered thunderstorms and hailstorms over east, central and southeast peninsula during 6-9 May.

The formation of the cyclonic circulation over Andaman Sea strengthened the cross equatorial flow over southern parts of Bay of Bengal and Andaman Sea. The active phase of Madden Julian Oscillation (MJO) during the mid of May and its eastward propagation towards the Indian Ocean led to persistent cloudiness and rainfall over the region. The conditions became conducive for the advance of Southwest Monsoon. The Southwest monsoon advanced into some parts of Southeast Bay of Bengal 14-17 May and into some more parts of Bay of Bengal and remaining parts of Andaman Sea on 18th. This was followed by a hiatus of 6 days that occurred due to the predominance of the mid latitude westerlies and the sub-tropical ridge. The convective phase of the Madden Julian Oscillation (MJO) entered the western Indian Ocean around 26th May, strengthening further and moving eastwards from 27th May onwards. This generated conducive conditions for the genesis of Severe Cyclonic Storm (SCS) 'MORA' over the Bay of Bengal during 28-31May. It made landfall over Bangladesh coast, close to Kutubdia Island on 30th May and caused fairly widespread to widespread rainfall over the North eastern region. In association with this development southwest monsoon further advanced over Kerala and northeastern states on 30th May.

3.3.2. *Temperature distribution*

The first half of the month saw *normal to above normal* temperatures over most subdivisions except the Northern, Northwest subdivisions along with Chhattisgarh, coastal Andhra Pradesh and Arunachal Pradesh where it remained *appreciably above normal*.

With the advance of monsoon over Kerala and Northeast India simultaneously and the formation of Severe cyclonic storm 'Mora' in the last week, the maximum temperatures which remained to be normal to above normal over most subdivisions with then, became *normal* over most divisions. Over Northeast, North, Northwest and Central India where the maximum temperatures were below normal during this period.

Severe heat wave conditions prevailed on 2 days over coastal Andhra Pradesh. Heat wave conditions prevailed on 1 to 3 days over Jharkhand, Uttar Pradesh, Haryana, Chandigarh and Delhi, coastal Andhra Pradesh, Telangana and Tamil Nadu, on 4 to 7 days over west Rajasthan and Madhya Pradesh and on 8 to 11 days over Odisha and Vidarbha.

The month's as well as the season's highest maximum temperature of 49.0 °C was recorded at Churu (west Rajasthan) on 26th May, 2017.

3.3.3. *Disastrous weather events and damage*

According to media and other disaster reports, one person was killed due to gusty wind/lightning and two people were injured, 20 cattle were dead and roofs of houses collapsed, trees uprooted and snapped electric supply at few districts in Maharashtra. Two persons were killed due to sunstroke in Maharashtra and 46 people in Odisha. Four persons were killed due to lightning in Assam and one in Maharashtra, two in Dhumka, Jharkhand and Thane, Maharashtra. Rainstorms killed 15 lives and standing crops and properties were destroyed in at least eleven districts of Bihar and one in Assam. Hailstorm damaged fruit crops and snapped electric

supply in Pune, Maharashtra. Lightning claimed 5 lives and damaged horticulture crops in thousands of acres in a few districts of Andhra Pradesh. Property was destroyed by hailstorm in Kohima. Twenty five lives were lost and 40 injured as a wall collapsed during a wedding due to a thunder squall in Bharatpur, Rajasthan. Lightning claimed five lives and injured two in Maharashtra. One life in Mysuru, Karnataka, five lives and two injured in Bihar, seven lives and injured three in Ananthapuram and Kurnool, Andhra Pradesh. Lightning/squall claimed eight lives and injured three others in Kolkata, south Bengal. Landslide in Uttarakhand claimed the lives of 13 pilgrims. Three people lost their lives and trekkers were injured at Chanshal pass, Shimla, Himachal Pradesh. Two people lost their lives and eight injured in Bihar. Four more lives were lost in weather related incidents in Madhya Pradesh. Heavy rains/lightning disrupted normal life, number of roads submerged and communications channels were also affected in Srinagar and adjoining areas in Kashmir. According to the State Disaster Management Authority, due to lightning there were 25 reported incidents of death from different parts of Bihar.

Appendix

Definitions of the terms given in '*Italics':*

Temperatures

Markedly below normal	-	–5 °C or less
Appreciably below normal	-	–3.1 °C to -5 °C
Below normal	-	–1.6 °C to -3 °C
Normal	-	-1.5 °C to 1.5 °C
above normal	-	1.6 °C to 3 °C
Appreciably above normal	-	3.1 °C to 5 °C
Markedly above normal		5 °C or more

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

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

Heat Wave : 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.

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%