MAUSAM, **67**, 2 (April 2016), 513-528

Weather in India

HOT WEATHER SEASON (March-May 2015)†

1. Chief features

(*i*) The hot weather season of 2015 was devoid of intense low pressure systems over the Indian Seas. However, 2 induced low pressure areas formed in the westerly wind regime during the month of March.

(*ii*) *Heat wave conditions** manifested from the last week of March over central parts of India and remained confined to the region upto first half of May.

(*iii*) Rainfall during March and April had been above normal while May received below normal rainfall. Hence, the all India rainfall with respect to Long Period Average (LPA) for the season had been 140%.

(*iv*) Southwest Monsoon advanced over parts of Andaman Sea and southeast Bay of Bengal on 16th May.

(*v*) Frequent and widespread hailstorm activity with moderate to severe intensity occurred over Bihar during March and April. Hailstorm activity was also reported from Uttar Pradesh, Himachal Pradesh and Karnataka during April. It claimed 54 lives and damaged around 75000 of dwellings in Bihar.

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 2015 are also depicted in Fig. 1.

Consecutive passage of western disturbances (WDs) and their induced systems, favourable conditions for intense convective activity generated by lower tropospheric instability and upper level velocity divergence, moisture incursion in the lower tropospheric levels and presence of north-south\wind discontinuity caused *excess** rainfall almost over the entire country outside the sub-divisions along the coast, extreme northeastern region and the islands.

The seasonal rainfall over the meteorological sub-divisions was *excess/normal** over major parts of the country except Coastal Andhra Pradesh and where it was *deficient**.

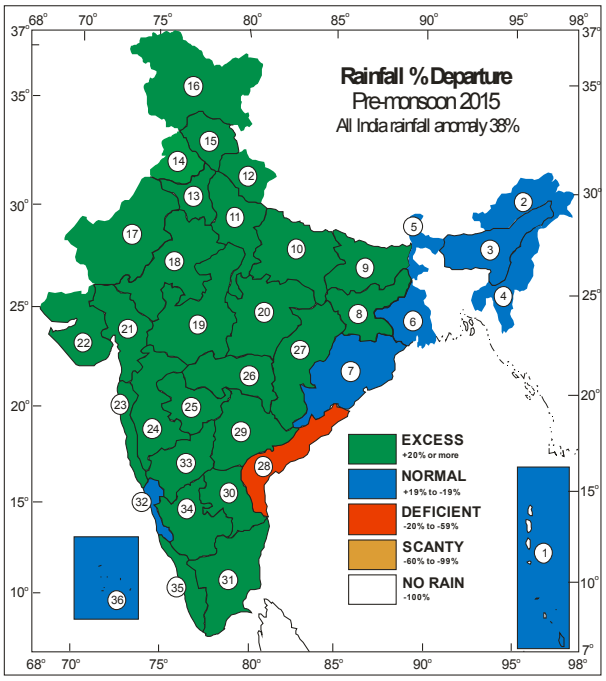

Fig. 1. Sub-divisionwise rainfall percentage departures for the season March-May, 2015. Sub-divisions are indicated by number on the map & bold letters in legend. The rainfall anomaly values for these 36 sub-divisions are indicated below :

1	2	**7**	-18	**13**	236	**19**	410	**25**	176	**31**	90
2	-17	**8**	29	**14**	115	**20**	320	**26**	247	**32**	14
3	4	**9**	37	**15**	23	**21**	114	**27**	57	**33**	45
4	-4	**10**	152	**16**	78	**22**	109	**28**	-32	**34**	58
5	13	**11**	230	**17**	272	**23**	41	**29**	92	**35**	23
6	0	**12**	43	**18**	333	**24**	99	**30**	54	**36**	-4

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.

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

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TABLE 1

Sub–division wise rainfall (mm) for each month and season as a whole (March-May, 2015) (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	3.1	25.0	-88%	138.2	81.5	70%	331.9	358.5	-7%	473.2	465.0	2%
2.	Arunachal Pradesh	97.5	179.7	-46%	287.1	278.8	3%	238.9	291.9	-18%	623.5	750.4	-17%
3.	Assam & Meghalaya	36.8	77.7	-53%	248.4	181.2	37%	327.4	331.3	-1%	612.7	590.2	4%
4.	Naga., Mani., Mizo. and Tri.	21.6	76.8	-72%	253.5	149.4	70%	198.3	267.9	-26%	473.4	494.1	-4%
5.	Sub-Himalayan West Bengal & Sikkim	64.8	63.6	2%	149.0	123.7	20%	304.6	269.8	13%	518.4	457.1	13%
6.	Gangetic West Bengal	18.2	28.0	-35%	88.4	42.1	110%	57.5	94.7	-39%	164.1	164.8	0%
7.	Orissa	10.4	27.0	-61%	67.6	37.5	80%	32.6	70.2	-54%	110.7	134.7	-18%
8.	Jharkhand	21.6	17.1	26%	55.5	18.4	201%	25.5	43.9	-42%	102.6	79.4	29%
9.	Bihar	27.2	10.1	169%	38.7	16.3	137%	39.5	51.1	-23%	105.4	77.5	36%
10.	East Uttar Pradesh	48.3	9.1	430%	23.2	5.6	314%	8.5	17.0	-50%	80.0	31.7	152%
11.	West Uttar Pradesh	66.4	11.3	488%	21.4	4.6	365%	8.3	13.2	-37%	96.1	29.1	230%
12.	Uttaranchal	127.3	57.6	121%	57.3	33.3	72%	38.0	65.1	-42%	222.6	156.0	43%
13.	Haryana, Chandigarh & Delhi	71.6	12.7	464%	34.7	7.5	363%	8.4	14.0	-40%	114.8	34.2	236%
14.	Punjab	68.5	25.3	171%	29.8	12.5	139%	16.7	15.7	6%	115.0	53.5	115%
15.	Himachal Pradesh	191.0	114.2	67%	81.8	65.4	25%	42.4	65.3	-35%	315.3	244.9	29%
16.	Jammu & Kashmir	341.4	151.9	125%	173.3	97.5	78%	64.6	76.6	-16%	579.3	326.0	78%
17.	West Rajasthan	30.3	3.8	697%	25.2	4.2	501%	15.5	11.1	39%	71.0	19.1	272%
18.	East Rajasthan	56.0	3.7	1414%	15.9	2.9	449%	3.5	10.8	-68%	75.4	17.4	333%
19.	West Madhya Pradesh	53.5	4.6	1064%	13.3	2.0	566%	2.0	6.9	-71%	68.9	13.5	410%
20.	East Madhya Pradesh	73.4	12.5	488%	25.8	5.5	369%	6.3	7.1	-12%	105.5	25.1	320%
21.	Gujarat region	6.7	1.0	572%	5.9	0.3	1879%	1.0	5.1	-80%	13.7	6.4	114%
22.	Saurashtra & Kutch	4.9	1.2	312%	2.4	0.2	1078%	0.9	2.5	-66%	8.2	3.9	109%
23.	Konkan & Goa	36.7	0.0	366645 %	1.9	2.7	-29%	13.5	34.3	-61%	52.1	37.0	41%
24.	Madhya Maharashtra	41.2	2.7	1427%	9.6	8.9	8%	24.4	26.2	-7%	75.3	37.8	99%
25.	Marathawada	32.0	5.7	461%	39.6	6.5	509%	12.3	18.1	-32%	83.8	30.3	176%
26.	Vidarbha	66.3	12.0	452%	28.1	7.7	265%	12.8	11.2	15%	107.2	30.9	247%
27.	Chattisgarh	20.5	13.3	54%	36.7	13.8	166%	13.6	18.1	-25%	70.8	45.2	57%
28.	Coastal Andhra Pradesh	5.2	11.1	-54%	33.9	21.8	56%	26.7	64.1	-58%	65.8	97.0	-32%
29.	Telangana	30.0	9.4	220%	56.4	16.5	242%	22.6	30.9	-27%	109.0	56.8	92%
30.	Rayalaseema	10.7	6.5	65%	70.2	19.9	253%	45.3	55.6	-19%	126.2	82.0	54%
31.	Tamil Nadu	21.7	18.3	18%	108.8	42.3	157%	112.4	67.5	66%	242.8	128.1	90%
32.	Coastal Karnataka	30.5	4.1	644%	50.8	28.1	81%	122.8	146.6	-16%	204.1	178.8	14%
33.	North interior Karnataka	27.6	5.2	430%	50.8	25.6	98%	45.3	54.3	-17%	123.6	85.1	45%
34.	South interior Karnataka	24.3	8.5	186%	80.5	43.8	84%	125.3	92.9	35%	230.1	145.2	58%
35.	Kerala	50.1	30.4	65%	214.0	109.5	95%	201.8	239.8	-16%	465.9	379.7	23%
36.	Lakshadweep	3.7	11.8	-69%	87.1	48.9	78%	133.1	171.7	-22%	223.9	232.4	-4%

TABLE 2

Details of the weather systems during March 2015

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	19-20	Afghanistan and adjoining Pakistan	Northeast	North Pakistan and neighbourhood	Moved away northeastwards on 21
2.	Do	22-25	Iran and neighbourhood	Do	Afghanistan and neighbourhood	The feeble WD moved away northeastwards on 26. A trough aloft with its axis at 5.8 kms a.s.l. on 24. It lay as a trough with its axis at 5.8 kms a.s.l. extended along Long. 74°E to the north of Lat. 32° N on 25
3.	Do	26-31	Afghanistan and neighbourhood		North Pakistan and neighbourhood	Moved away northeastwards on 1 April. The cyclonic circulation lay as a trough with its axis at 5.8 kms a.s.l. extended along Long. 82° E to the north of Lat. 30° N on 31
(*ii*) *As a trough*						
1.	Mid & Upper tropospheric levels	4-6	Along Long. 63° E to the north of Lat. 30° N (axis at 5.8 kms a.s.l.)	Northeast	Along Long. 74° E to the north of Lat. 30° N (axis at 5.8 kms a.s.l.)	The WD moved away northeastwards on 7
2.	Do	6-9	Along Long. 52° E to the north of Lat. 30° N (axis at 5.8 kms a.s.l.)	Do	Along Long. 72° E to the north of Lat. 25° N (axis at 5.8 kms a.s.l.)	Moved away northeastwards on 10. It was seen as an upper air cyclonic circulation with a trough aloft with its axis at 7.6 kms a.s.l. extended along Long. 64° E to the north of Lat. 20° N on 8
3.	Do	9-17	Along Long. 55° E to the north of Lat. 35° 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.)	Moved away east-northeastwards on 18. It lay as an upper air cyclonic circulation extending upto mid & upper tropospheric levels during 12-16
4.	Do	27-28	Along Long. 50° E to the north of Lat. 25° N (axis at 5.8 kms a.s.l.)	East	Along Long. 60° E to the north of Lat. 25° N (axis at 5.8 kms a.s.l.)	Merged with the cyclonic circulation over northeast Afghanistan and adjoining Pakistan and seen as a trough aloft extended along Long. 73° E to the north of Lat. 23° N with its axis at 5.8 kms a.s.l. on 30
(*iii*) *As an induced cyclonic circulation*						
1.	Upto lower tropospheric levels	5-10	Central Pakistan and adjoining west Rajasthan	East	West Uttar Pradesh and adjoining Haryana	Became less marked in the evening of 10
2.	Do	13	Central Pakistan and adjoining a Punjab	Stationary	*In situ*	Became less marked on 14
3.	Do	19-21	West Rajasthan and adjoining central Pakistan	East	North Rajasthan and neighbourhood	Became less marked on 22
4.	Do	24-25	Central Pakistan and adjoining west Rajasthan	Do	Do	Became less marked on 26
(*iv*) *As an induced low pressure area*						
1.	Low pressure area	14-15	West Rajasthan and neighbourhood	Stationary	*In situ*	It formed under the influence of a WD as an upper air cyclonic circulation over Pakistan and neighbourhood. It became less marked on 16. However, the associated cyclonic circulation persisted on 16 and became less marked on 17
2.	Low pressure area	29-30	Central Pakistan and adjoining west Rajasthan	East	East Rajasthan and neighbourhood	Became less marked on 31. Associated cyclonic circulation extending upto mid tropospheric levels persisted upto 31 and became less marked on 1 April

TABLE 2 (*Contd.*)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
(**B**)	*Other upper air cyclonic circulations*					
1.	Upto lower tropospheric levels	1	North Chhattisgarh and adjoining east Madhya Pradesh	Stationary	*In situ*	Less marked on 2
2.	Do	2-7	Comorin area and adjoining Sri Lanka	West	Maldives-Lakshadweep areas	Became less marked on 8
3.	Do	7-9	Assam & Meghalaya and neighbourhood	Stationary	*In situ*	Became less marked on 10
4.	At lower levels	15-18	Chhattisgarh and neighbourhood	East	Odisha and adjoining Chhattisgarh	Became less marked on 19
5.	Upto lower tropospheric levels	18	Extreme south Peninsula	Stationary	*In situ*	Became less marked on 19
6.	Between Lower & mid tropospheric levels	21-25	Bangla Desh and neighbourhood	East	Bangla Desh and adjoining areas of Assam	Moved away eastwards on 26
7.	At lower levels	25	Comorin area and neighbourhood	Stationary	*In situ*	Became less marked on 26
8.	Upto lower tropospheric levels	26 Mar – 6 Apr	Jharkhand and neighbourhood	East	Gangetic West Bengal and neighbourhood	Became less marked on 7 April. It lay as a trough during 28- 31 March with embedded cyclonic circulation over Jharkhand and neighbourhood
9.	Do	28 Mar – 1 Apr	Tamil Nadu and adjoining Comorin area	West	Lakshadweep area and neighbourhood	Became less marked on 2 April
10.	Do	26-28	South Rajasthan and adjoining Gujarat	Northwest	Southwest Rajasthan and neighbourhood	Merged with the induced low pressure area over central Pakistan and adjoining west Rajasthan
(**C**)	*Trough in easterlies/Trough of Low*					
1.	At mean sea level	10-14	Lakshadweep area to south Madhya Maharashtra across coastal & north interior Karnataka	Oscillatory	Lakshadweep area to north Madhya Maharashtra across coastal areas of Karnataka and Maharashtra	Became less marked on 15
2.	Do	10-17	Southwest and adjoining southeast Bay of Bengal	West	Southeast Arabian Sea and adjoining Lakshadweep area	Moved away westwards on 18
3.	Do	22-29	South Andaman Sea and neighbourhood		Equatorial Indian Ocean and adjoining southwest Bay of Bengal	Became un-important on 30
(**D**)	*Other troughs/Wind discontinuity*					
1.	At lower levels	4-5	Bihar to south Odisha	East	Western parts of Assam to north Bay of Bengal	Became less marked on 6
2.	At lower levels	8-9	Lakshadweep area to west Madhya Pradesh across coastal & north interior Karnataka and interior Maharashtra	Oscillatory	Lakshadweep area to east Madhya Pradesh across coastal & north interior Karnataka and interior Maharashtra	Became less marked on 10
3.	Upto lower tropospheric levels	24-25	Extended from cyclonic circulation over Bangla Desh and adjoining areas of Assam to south Chhattisgarh	Stationary	*In situ*	Became less marked on 26
4.	At lower levels	19	Comorin area to south Madhya Maharashtra across Kerala and interior Karnataka	Stationary	*In situ*	Became less marked on 20
5.	Do	24-28	Chhattisgarh to Tamil Nadu	Oscillatory	Extended from cyclonic circulation over south Tamil Nadu and adjoining Comorin area to south Madhya Maharashtra across interior Karnataka	Became less marked on 29
6.	Do	31 Mar	Extended from the cyclonic circulation over Lakshadweep area and neighbourhood to south Madhya Maharashtra	Stationary	*In situ*	Became less marked on 1 April

TABLE 3

Details of the weather systems during April 2015

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.	Mid & Upper tropospheric levels	1	Afghanistan and neighbourhood	Stationary	*In situ*	Moved away northeastwards on 2. It was seen as a trough in mid & upper tropospheric levels with its axis at 5.8 kms a.s.l. extended along Long. 50° E to the north of Lat. 30° N on 31 March
2.	Upto Mid tropospheric levels	2-4	Iran and neighbourhood	Northeast	Eastern parts of Jammu & Kashmir and neighbourhood	Moved away northeastwards on 5. A trough aloft with its axis at 5.8 kms a.s.l. during 2 to 5 and became un- important on 6
3.	Do	6-8	North Pakistan and neighbourhood	Do	Jammu & Kashmir and neighbourhood	It lay as a trough in mid & upper tropospheric levels with its axis at 5.8 kms a.s.l. extended along Long. 86° E to the north of Lat. 28° N on 9 and moved away northeastwards on 10
4.	Do	16	North Pakistan and adjoining Jammu & Kashmir	Stationary	*In situ*	Moved away northeastwards on 17. It lay as a trough in mid tropospheric westerlies extended along Long. 65° E to the north of Lat. 25° N on 15
5.	Do	18-21	North Afghanistan and adjoining Pakistan	Northeast	Jammu & Kashmir and neighbourhood	Moved away northeastwards on 22
6.	Do	29 Apr – 2 May	Iran and neighbourhood	Do	Jammu & Kashmir and neighbourhood	It lay as a trough in mid tropospheric westerlies on 2 and moved northeastwards on 3 May
(*ii*)	*As a trough*					
1.	Mid & Upper tropospheric levels	9-14	Along Long. 56° E to the north of Lat. 25° N (axis at 5.8 kms a.s.l.)	East	Along Long. 81° E to the north of Lat. 15° N (axis at 5.8 kms a.s.l.)	Became less marked on 15. It lay as an upper air cyclonic circulation extending upto 5.8 kms a.s.l. during 11 & 12 with a trough aloft in upper tropospheric westerlies with its axis at 7.6 kms a.s.l.
2.	Upto Mid tropospheric levels	20-22	Along Long. 68° E to the north of Lat. 30° N (axis at 5.8 kms a.s.l.)	Northeast	Along Long. 74° E to the north of Lat. 35° N (axis at 5.8 kms a.s.l.)	Became un-important on 23
3.	Mid & Upper tropospheric levels	25-26	Along Long. 72° E to the north of Lat. 30° N (axis at 5.8 kms a.s.l.)	Do	Along Long. 77° E to the north of Lat. 32° N (axis at 5.8 kms a.s.l.)	Moved away northeastwards on 27
4.	Do	25Apr – 3 May	Along Long. 58° E to the north of Lat. 30° N (axis at 5.8 kms a.s.l.)	Do	Along Long. 92° E to the north of Lat. 20° N (axis at 5.8 kms a.s.l.)	Became un-important on 4 May. It lay as an upper air cyclonic circulation extending upto mid tropospheric levels with a trough aloft during 27 & 28 and with an embedded cyclonic circulation on 29
(*iii*)	*As an induced cyclonic circulation*					
1.	Upto lower tropospheric levels	1	South Pakistan and adjoining west Rajasthan	Stationary	*In situ*	Became less marked on 2
2.	Upto Mid tropospheric levels	2 (E) - 4	Northwest Rajasthan and neighbourhood	East	Northeast Rajasthan and neighbourhood	Became less marked on 4 evening
3.	Upto lower tropospheric levels	7	Punjab and adjoining central Pakistan	Stationary	*In situ*	Became less marked on 8
4.	Between lower & mid tropospheric levels	11-16	West Rajasthan and adjoining Pakistan	East	Central Parts of Madhya Pradesh and neighbourhood	Became less marked on 17. It lay as an upper air cyclonic circulation embedded in the trough in mid & upper tropospheric westerlies from 14
5.	Upto lower tropospheric levels	16	Punjab and neighbourhood	Stationary	*In situ*	Became less marked on 17

TABLE 3 (*Contd.*)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
6.	Upto lower tropospheric levels	18-20	West Rajasthan and adjoining central Pakistan	East	Punjab and neighbourhood	Became less marked on 21
7.	Upto Mid tropospheric levels	30 Apr - 1 May	Central Pakistan and adjoining west Rajasthan	Do	Southwest Uttar Pradesh and adjoining Haryana and east Rajasthan	Became less marked on 2 May
(**B**)	*Other upper air cyclonic circulations*					
1.	Upto lower tropospheric levels	5-7	South Rajasthan and neighbourhood	Quasi Stationary	South Rajasthan and adjoining Gujarat	became less marked on 8
2.	Do	8	East Assam and adjoining Arunachal Pradesh	Stationary	*In situ*	Became less marked on 9
3.	Upto Mid tropospheric levels	9-14	North Konkan and adjoining Gujarat Region	North	Gujarat Region and neighbourhood	Became less marked on 15
4.	At lower levels	12-16	Comorin area and neigbourhood	West	Lakshadweep area and neighbourhood	Moved away westwards on 17. It was embedded in the trough VI (6) during 12-14
5.	Upto lower tropospheric levels	10-16	Assam & Meghalaya and adjoining Bangla Desh	East	Assam & Meghalaya and neighbourhood	Became less marked on 17
6.	Do	10	Southwest Madhya Pradesh and adjoining Maharashtra	Stationary	*In situ*	Became less marked on 11
7.	Between 2.1 & 5.8 kms a.s.l.	10	Comorin area and neighbourhood	Do	Do	Less marked on 11
8.	Upto lower tropospheric levels	18-27	Sub-Himalayan West Bengal & Sikkim and neighbourhood	Oscillatory	Odisha and neighbourhood	Became less marked on 28
9.	Upto mid tropospheric levels	19-22	Do	West	Lakshadweep and neighbourhood	Moved away westwards on 23
10.	Upto lower tropospheric levels	19-20	Central Parts of south Arabian Sea	Stationary	*In situ*	Became less marked on 21
11.	At lower levels	20	South Konkan and neighbourhood	Do	Do	Became less marked on 21
12.	Do	22	North Konkan and south Gujarat	Do	Do	Became less marked on 23
13.	Upto mid tropospheric levels	23-29	East Rajasthan and neighbourhood	East	Northwest Madhya Pradesh and neighbourhood	Became less marked on 30
14.	Do	24-25	Assam & Meghalaya and neighbourhood	Do	Assam & Meghalaya and adjoining Nagaland-Manipur-Mizoram-Tripura	Became less marked on 26
15.	Upto lower tropospheric levels	26-29	Northwest Rajasthan and neighbourhood	North	Northwest Rajasthan and adjoining Haryana and neighbourhood	Became less marked on 30
16.	At lower levels	28-29	Assam & Meghalaya and neighbourhood	East	East Assam & neighbourhood	Became less marked on 30
17.	Upto Lower tropospheric levels	29-30	East Uttar Pradesh and neighbourhood	South	Southeast Uttar Pradesh and neighbourhood	Became less marked on 1 May
18.	At lower levels	25-28	Comorin area and neighbourhood	West	Lakshadweep area and neighbourhood	Became less marked on 29
(**C**)	*Other troughs/wind discontinuity*					
1.	At lower levels	2-6	From Sub-Himalayan West Bengal & Sikkim to north Bay of Bengal	Oscillatory	From Assam to Vidarbha across Gangetic West Bengal, Jharkhand and Chhattisgarh	Became less marked on 7
2.	Upto lower tropospheric levels	3-9	From Rayalaseema to Comorin area	Do	From Telangana to Kerala across interior Karnataka	Became less marked on 10
3.	Upto mid tropospheric levels	7	From west Madhya Pradesh to Nagaland-Manipur-Mizoram-Tripura across east Uttar Pradesh, Bihar and Bangla Desh and adjoining Tripura	Stationary	*In situ*	Became less marked on 8. A cyclonic circulation extending upto 3.1 kms a.s.l. lay embedded over Bangla Desh and adjoining Tripura
4.	Upto lower tropospheric levels	8-9	Sub-Himalayan West Bengal & Sikkim to Chhattisgarh across Bihar	Quasi Stationary	Sub-Himalayan West Bengal & Sikkim to north Odisha across Gangetic West Bengal	Became less marked on 10

TABLE 3 (*Contd.*)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
5.	At lower levels	11	From Cyclonic circulation over south Gujarat and neighbourhood to Lakshadweep area	Stationary	*In situ*	Became less marked on 12
6.	Do	12-14	From cyclonic circulation over south Gujarat and neighbourhood to Comorin area across Madhya Maharashtra, interior Karnataka and Kerala	Oscillatory	From cyclonic circulation over Gujarat and neighbourhood to Comorin area	Became less marked on 15
7.	Do	12-13	From the cyclonic circulation over Assam & Meghalaya and adjoining areas to south Chhattisgarh across Gangetic West Bengal and Odisha	-	Sub-Himalayan West Bengal & Sikkim to west Madhya Pradesh across Bihar and east Uttar Pradesh	Became less marked on 14
8.	Upto lower tropospheric levels	15-16	From cyclonic circulation over central parts of Madhya Pradesh and neighbourhood across interior Karnataka and Madhya Maharashtra to the cyclonic circulation over Lakshadweep area	Stationary	*In situ*	Became un-important on 17
9.	Between Lower & upper tropospheric levels	15-26	From central parts of Madhya Pradesh to Lakshadweep area	Oscillatory	From cyclonic circulation over Jharkhand and neighbourhood to interior Tamil Nadu across Chhattisgarh and coastal Andhra Pradesh	Became less marked on 27
10.	Upto lower levels	21-22	From east Madhya Pradesh to south Konkan across Vidarbha and Madhya Maharashtra	Quasi Stationary	From east Madhya Pradesh to Marathwada across Vidarbha	Became less marked on 23
11.	Upto lower tropospheric levels	23	From Telangana to extreme south Peninsular India across Rayalaseema and south interior Karnataka	Stationary	*In situ*	Merged with the trough from Gangetic West Bengal and adjoining Jharkhand to Comorin area on 24
12.	Between 3.1 & 5.8 kms a.s.l.	26-28	From east Bihar to west central Bay of Bengal	Oscillatory	Assam to northwest Bay of Bengal	Became less marked on 29
13.	Do	29 Apr - 4 May	From Marathwada to south Tamil Nadu across interior Karnataka	Do	From the cyclonic circulation over Chhattisgarh and adjoining Odisha to south Tamil Nadu across coastal Andhra Pradesh and Rayalaseema	Became less marked on 5 May
14.	Upto lower tropospheric levels	30 Apr - 1 May	From southeast Madhya Pradesh to Assam across Jharkhand and Gangetic West Bengal	Do	From southeast Uttar Pradesh to Assam across Bihar	Became less marked on 2 May
(**D**)	*Trough in easterlies*					
1.	At lower levels	10	From Lakshadweep area to north interior Karnataka	Stationary	*In situ*	Became less marked on 11
2.	At mean sea level	14-18	South Andaman Sea and neighbourhood	West	Southwest Bay of Bengal	Became less marked on 19
3.	Do	16-18	South Andaman Sea	Stationary	*In situ*	Became un-important on 19
4.	Do	24-25	Equatorial Indian Ocean and adjoining south Andaman Sea	Northwest	South Andaman Sea and adjoining southeast Bay of Bengal	Became less marked on 26
5.	At lower levels	28	From the cyclonic circulation over Lakshadweep area and neighbourhood to coastal Karnataka	Stationary	*In situ*	Became less marked on 29

TABLE 4

Details of the weather systems during May 2015

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	5-6	North Pakistan and neighbourhood	Northeast	Northern parts of Jammu & Kashmir and neighbourhood	A feeble WD. Moved away northeastwards on 6 evening. Initially it lay as trough with its axis at 5.8 kms a.s.l. extended along Long.55° E to the north of Lat. 25° N (axis at 5.8 kms a.s.l.) on 4
2.	Do	7-10	Northeast Afghanistan and adjoining Pakistan	Do	Jammu & Kashmir and neighbourhood	Moved away northeastwards on 11
3.	Do	10-15	Eastern parts of Iran and neighbourhood	Do	Eastern parts of Jammu & Kashmir and neighbourhood	Moved away northeastwards on 16
4.	Do	16-20	Northeast Afghanistan and neighbourhood	Do	Jammu & Kashmir and neighbourhood	Moved away northeastwards on 21
5.	Do	27-31	Iran and adjoining western parts of Afghanistan	East	Eastern parts of Jammu & Kashmir and neighbourhood	Moved away northeastwards on 31 evening
6.	Do	31 May - 6 Jun	North Pakistan and adjoining Afghanistan	Do	Jammu & Kashmir and neighbourhood	Moved away northeastwards on 7 June
(*ii*)	*As a trough*					
1.	Upto Mid tropospheric levels	4-7	Along Long. 82° E to the north of Lat. 25° N (axis at 5.8 kms a.s.l.)	East	Along Long. 92° E to the north of Lat. 28° N (axis at 5.8 kms a.s.l.)	Moved away eastwards on 8
2.	Do	11-19	Along Long. 65° E to the north of Lat. 22° N (axis at 4.5 kms a.s.l.)	Do	Along Long. 88° E to the north of Lat. 25° N (axis at 5.8 kms a.s.l.)	Moved away eastnortheastwards on 20
3.	Do	22-26	Along Long. 65° E to the north of Lat. 25° N (axis at 4.5 kms a.s.l.)	Do	Along Long.73° E to the north of Lat. 30° N (axis at 4.5 kms a.s.l.)	Moved away northeastwards on 27
4.	Do	28-31	Along Long. 55° E to the north of Lat. 28° N (axis at 4.5 kms a.s.l.)	Do	Along Long.77° E to the north of Lat. 30° N (axis at 4.5 kms a.s.l.)	Moved away northeastwards on 31 evening
(*iii*)	*As an Induced cyclonic circulation*					
1.	Upto Mid tropospheric levels	8-10	Central Pakistan and adjoining west Rajasthan	East	Haryana and neighbourhood	Became less marked on 11
2.	Upto lower tropospheric levels	11-12	Central Pakistan and adjoining areas of Punjab	Do	Punjab and neighbourhood	Became less marked on 13
3.	Upto Mid tropospheric levels	23-26	Northwest Rajasthan and neighbourhood	Do	Haryana and neighbourhood	Became less marked on 27
4.	Upto Lower tropospheric levels	28-30	Central Pakistan and adjoining west Rajasthan	Do	Do	Became less marked on 31
(**B**)	*Other upper air cyclonic circulations*					
1.	Upto mid tropospheric levels	1-8	Southeast Bay of Bengal and adjoining south Andaman Sea	West	South coastal Tamil Nadu and neighbourhood	Became less marked on 9. Initially it lay as trough of low at m.s.l. over south Andaman Sea and adjoining equatorial Ocean on 30 April
2.	Upto Lower tropospheric levels	1-4	East Uttar Pradesh and neighbourhood	South	Chhattisgarh and adjoining Odisha	Became less marked on 5
3.	Between lower & mid tropospheric levels	1	Southwest Bay of Bengal and neighbourhood	Stationary	*In situ*	Became less marked on 2

TABLE 4 (*Contd.*)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
4.	At lower levels	2	Northwest Madhya Pradesh and neighbourhood	Stationary	*In situ*	Became less marked on 3
5.	Upto mid tropospheric levels	3-6	South Rajasthan and neighbourhood	East	Southeast Rajasthan and neighbourhood	Became less marked on 7
6.	Upto Lower tropospheric levels	5-6	South Andaman Sea and adjoining southeast Bay of Bengal	Stationary	*In situ*	Became less marked on 7
7.	Do	7-10	Gangetic West Bengal and neighbourhood	Do	Do	Less marked on 11
8.	Upto mid tropospheric levels	7-14	Malay Peninsula and neighbourhood	West	South Andaman Sea and adjoining southeast Bay of Bengal	Became un-important on 15
9.	Do	11-16	Southwest Bay of Bengal and adjoining Sri Lanka	Do	Lakshadweep area and adjoining Kerala coast	It merged with the east-west shear zone across south peninsula on 17
10.	Upto lower tropospheric levels	12-14	East Uttar Pradesh and neighbourhood	East	Bihar and neighbourhood	Became less marked on 15
11.	Do	13	Northeast Rajasthan and neighbourhood	Stationary	*In situ*	Became less marked on 14
12.	Do	17-19	North Rajasthan and neighbourhood	East	North Rajasthan and adjoining Haryana	Became less marked on 20
13.	Between lower & mid tropospheric levels	17-23	West central Bay of Bengal off Andhra Pradesh coast	Do	East central and adjoining northeast Bay of Bengal	Became less marked on 24
14.	Upto mid tropospheric levels	20-24	Eastern parts of Bihar and adjoining Sub-Himalayan West Bengal & Sikkim	Quasi Stationary	Sub-Himalayan West Bengal & Sikkim and adjoining eastern parts of Bihar	Became less marked on 25
15.	At lower levels	22-23	Assam & Meghalaya and neighbourhood	Stationary	*In situ*	Became less marked on 24
16.	Upto mid tropospheric levels	24-26	North Andaman Sea and neighbourhood	West	East central Bay of Bengal and neighbourhood	Became less marked on 27
17.	At lower levels	26-31	North Chhattisgarh and neighbourhood	South	Chhattisgarh and neighbourhood	Became less marked on 1 June. It lay embedded in the trough from east Uttar Pradesh to coastal Andhra Pradesh on 29
18.	Upto lower tropospheric levels	28	East Bihar and adjoining Sub-Himalayan West Bengal & Sikkim	Stationary	*In situ*	Became less marked on 29
19.	Between lower & mid tropospheric levels	30 May – 3 Jun	Southwest Bay of Bengal off north Tamil Nadu coast	Northwest	West central Bay of Bengal off Andhra Pradesh coast	Became less marked on 4 June
20.	Do	31 May – 2 Jun	Lakshadweep area and neighbourhood	Stationary	*In situ*	Became less marked on 3 June
(**C**)	*East-West trough/shear zone*					
1.	At mean sea level	19	From west Rajasthan to northeast Bay of Bengal across Uttar Pradesh, Jharkhand and Gangetic West Bengal	Stationary	*In situ*	Became less marked on 20
2.	Between 2.1 & 4.5 kms a.s.l.	16-17	Along Lat. 10° N	Oscillatory	Along Lat. 12° N	Became less marked on 18
3.	Between 2.1 & 4.5 kms a.s.l.	19-20	Along Lat. 10° N	North	Along Lat. 11° N	Became less marked on 21

TABLE 4 (*Contd.*)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
4.	Between 3.1 & 5.8 kms a.s.l.	27 May - 4 Jun	Along Lat. 8° N	North	Along Lat. 11° N	It was disorganized on 1 June and re-appeared along Lat. 10° N on 2 June. Became less marked on 5
(**D**)	*Other troughs / wind discontinuity*					
1.	At lower levels	6	From the cyclonic circulation over south Tamil Nadu and adjoining Comorin area to north Madhya Maharashtra across interior Karnataka	Stationary	*In situ*	Became less marked on 7
2.	Do	8	From the cyclonic circulation over Gangetic West Bengal and neighborhood to northeast Madhya Pradesh across Jharkhand and north Chhattisgarh	Do	Do	Became less marked on 9
3.	Upto lower tropospheric levels	9-11	From Telangana to south Tamil Nadu across interior Karnataka	Oscillatory	From north Madhya Pradesh to Marathwada across Vidarbha	Became less marked on 12
4.	Do	13-14	From the cyclonic circulation over Bihar and adjoining east Uttar Pradesh to northeast Bay of Bengal	Stationary	*In situ*	Became less marked on 15
5.	Do	13	From central parts of Madhya Pradesh to Marathwada across Vidarbha	Do	Do	Became less marked on 14
6.	Do	20 – 24	From the cyclonic circulation over eastern parts of Bihar and adjoining Sub-Himalayan West Bengal & Sikkim to south Odisha across Jharkhand	Oscillatory	from the cyclonic circulation over eastern parts of Bihar and adjoining Sub-Himalayan West Bengal & Sikkim to south Odisha across Jharkhand	Became less marked on 25
7.	Do	25	From Sub-Himalayan West Bengal & Sikkim to north Bay of Bengal	Stationary	*In situ*	Became less marked on 26
8.	Between lower & mid tropospheric levels	26 – 27	From Bihar to coastal Odisha across Gangetic West Bengal	Do	Do	Became less marked on 28
9.	Upto lower tropospheric levels	29	East Uttar Pradesh to coastal Andhra Pradesh across Chhattisgarh and Odisha	Do	Do	Became less marked on 30
(**E**)	*Trough in easterlies*					
1.	At lower levels	12	From the cyclonic circulation over Comorin area and neighbourhood	Stationary	*In situ*	Became less marked on 13

Passage of active WDs and their induced systems caused widespread precipitation over western Himalayan region and adjoining plains. Their interaction with the troughs in tropical easterlies in the mid & upper tropospheric levels and wind discontinuity in the lower tropospheric levels, aided with the moisture influx from the tropical Seas, led to well distributed rainfall/hailstorms over west, northwest, north, central and adjoining peninsular India during the first fortnight.

The third week witnessed a suppressed easterly wave activity on account of the convectively suppressed phase of Madden Julian Oscillation (MJO) over the Indian Seas. This along with clear skies, caused a sharp rise in the day temperatures leading to heat wave conditions over western parts of central India. The weather almost remained dry outside northeast and south peninsula. Thereafter, the passage of a series of WDs and perturbations in mid-latitude westerlies, and trough/wind discontinuity in the

lower levels caused precipitation over north, northeast, central and Peninsular India.

3.1.2. *Temperature distribution*

(a) *Minimum temperatures*

Severe cold wave conditions prevailed for one day over Madhya Maharashtra.

Night temperatures generally remained near normal over most parts of India during first fortnight except over subdivisions in the east, northeast and Gangetic Plains where appreciably to markedly above normal minimum temperatures, appreciably to markedly below normal minimum temperatures prevailed over Western Himalayan region and parts of central India during initial days of first week & second week respectively.

The month's and the season's lowest minimum temperature over the plains was 5.2° C, recorded at Amritsar (Punjab) on 9 March 2015.

(b) *Maximum temperatures*

Severe heat wave conditions prevailed on one day over Saurashtra & Kutch and *heat wave* conditions prevailed on 4 to 6 days over Gujarat State and west Rajasthan and on 1 to 2 days over Konkan & Goa and west Madhya Pradesh.

The favourable atmospheric conditions which led to increase in rainfall activity over most parts of the country kept the day temperatures *normal to below normal* for most of the days of the month over most parts of the country with a*ppreciably to markedly below normal* temperatures over parts of Indo-Gangetic Plains, central and western Himalayan Region outside, extreme northeastern parts where temperatures were well *above normal* during the first fortnight. Thereafter, due to suppressed easterly wave troughs, the rainfall activity reduced causing rise in day temperatures and resultant heat wave conditions over central India.

The month's highest maximum temperature over the plains was 43.5 °C, recorded at Bhira (Konkan & Goa) on 25 March, 2015.

3.1.3. *Disastrous weather events and damage*

According to media and other disaster reports, avalanche/Landslide and snowfall related incidents claimed 22 people in Jammu & Kashmir and 10 each in Uttarakhand and Himachal Pradesh. Thunderstorm/ lightning/Hailstorm and rain related incidents claimed 12 lives in Rajasthan, 6 in Odisha, 5 in Bihar, 4 in Tamil Nadu, 3 in Telangana, 2 each in Madhya Pradesh and Maharashtra and one each in Karnataka and Kerala. Apart from loss of lives, the heavy rain which triggered landslides in Jammu & Kashmir caused damage to about 50 structures including houses and closure of Jammu-Srinagar National Highway and overflowing of Jhelum river.

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.

Passage of active WDs and cyclonic circulations induced by them once again caused *isolated to scattered* precipitation over north and northeast India almost all through the month. The presence of north-south troughs/wind discontinuity in the lower levels led to *isolated to scattered* thundershowers over south Peninsular India and central India during the month.

3.2.2. *Temperature distribution*

Heat wave conditions prevailed on 1 to 4 days over Punjab, Rajasthan, Saurashtra & Kutch and Vidarbha.

Occurrence of *isolated to scattered* precipitation during the first two weeks, kept the day temperatures *below normal* over most parts of the country outside Peninsular India and parts of subdivisions in the east and parts of west coast, where the day temperatures were *normal/above normal*. Parts of western Himalayan Region also exhibited *above normal* temperatures during the second week. With the rainfall activity getting reduced in the latter half of the month kept the day temperatures *normal/above normal* over most parts outside north, northeast and parts of south Peninsular India which exhibited *below normal* temperatures.

The month's highest maximum temperature over the plains was 45.5 °C recorded at Jaisalmer (West Rajasthan) on 27 April, 2015.

3.2.3. *Disastrous weather events*

According to media and other disaster reports, Thunderstorms/lightning related incidents claimed 33 lives in Uttar Pradesh, 25 in Karnataka, 6 in Tamil Nadu, 5 in Andhra Pradesh, 4 each in Jammu & Kashmir and Tamil Nadu, 3 in west Bengal and 2 in Madhya Pradesh. Rain related incidents claimed 10 lives in Andhra Pradesh,

TABLE 5

Some representative amounts of rainfall in cm for the months March, April and May 2015 (7 cm and above)

Date	March	April	May
1.	Murtajapur 17, Akot 11, Telhara and Barshitakli 9 each, Mangaon 7	Coonoor and Coonoor PTO 13 each, Sulya and Sulya ARG 7 each	Matijuri 7
2.	Kotkasim 17, Renuka / Dadhau and Jhahhar 15 each, Katra 13, Kandaghat, Naraingarh, Sirmaur Nicra, Dharampur, Balaghat - AWS, Kasauli, Bilaspur, Nahan AWS and Nahan 12 each, Sangraha and Tirora 11 each, Bhandara, Udhampur IAF and Karnal 10 each, Arki, Bichhia, R L Bbmb, Anandpur Sahib, Dhundi, Solan, Kishngarhwas, Nilokheri, Chandigarh AWS, Ramgarh, Mohadi and Amb 9 each, Chhachhrauli, Rajgarh, Ganaur ARG, Una, Palampur, Ganaur, Kahu, Banihal, Mehre (Barsar), Chhachrauli ARG, Tajewala, Nawanshahr, Dadupur, Amritsar IAF, Una Rampur AWS, Delhi Ridge and Radaur 8 each, Rajpura, Narayangarh ARG, Bawal AWS, Nangal, Karnal AWS, Ambala, Sakoli, Deoprayag, Kathua, Bawal, Sadhaura, Dehra Gopipur, Jammu City, Dehra Dun, Baghpat, Nuh, Bhiwapur, Karnal Rev, Morni, Sonipat ARG, Derabassi (Basi), BanganaF, Barthin, Mandawar, Rewari, Gohar, Mauda, Nakur, Bopani AWS, Nabha, Shimla AP, Batote, Jhandutta, Chandigarh Sase AWS, ChathaAgro AWS, Lodi Road, Berthin AGRO, Paonta, Govindpura AWS, Todaraisingh, Shadnagar, Ellenabad, Jagadhari and Kalpa 7 each	Banihal, Batote and Tissa 7 each	Chhamonu 9, Matijuri, Barapani, Rongo and Goalpara AWS 7 each
3.	Arki 11, Nainital, Khanna, Champawat and Morni 8 each, Nangal, Haldwani, Sangraha, Dehra Dun, Bilaspur, Hardwar, Baheri, Dhundi, Jhandutta, Puranpur, Nawanshahr and Manjhanpur 7 each	Kalanaur 16, Sampla 8, Silchar 7	Cherrapunji 11, Mathabhanga 7
4.	Mavelikara 9, Thodupuzha 8	Cherrapunji and Malsisar 7 each	Pakuria 9
5.	Tuting 9	Udhampur IAF 7	Muniguda ARG 10, Sindewahi 9, Andipatti 8, Komarada 7
6.	Coonoor and Coonoor PTO 11 each, Khanapur 10, Huzurabad and Kothagiri 9 each, Dharmasagar, Bheemadevarpalle and K Bridge 7 each	Agartala AP 10, Jaleswar 7	Nil
7.	Siddipet (Arg) 10	Nayagarh 7	Uttamapalayam 10, Rongo and Jhorigam ARG each 9, Thali 8, Thollada 7
8.	Coonoor PTO 13, Coonoor 9, Morni 7	Udaipur 8, Karimnagar and Mathabhanga 7 each	Rongo 11
9.	Shalimar AGRO 10, Dharwad (Hos) 9, Sirpur T, Koppa and Srinagar IAF 8 each, Banihal, Vicarabad, Govindpura AWS, Dhundi, Bidar, Marpalle, Dharmasthala, Jubbal, Batote and Agumbe 7 each	Nil	Sattur 7
10.	Manora and Shahpur 8 each, Mahbubabad and Kayamkulam Agri 7 each	Nil	Nil
11.	Nil	Nil	Bagrakote 9, Domohani and Rongo 8 each, Radaur, Hosdurg and Williamnagar 7 each

TABLE 5 (*Contd.*)

Date	March	April	May
12.	Nil	Nil	Bhadrak AWS 9, Neamatighat 8, Manamelkudi 7
13.	Nil	Nil	Kunnamkulam and Coonoor PTO 11 each, Coonoor and Kottayam 10 each, Enamakkal 9, Kothagiri and Aranmanaipudur 8 each, Kozhikode, Kodungallur, Rongo, Vellanikkara, Chittur, Quilandi, Palakkad, Haliyal, Aluva PWD, Paonta, Mudubidre and Mani 7 each
14.	Nil	Nil	Illayangudi 12, Chittur, Hosanagar and Kollamkode 11 each, Pune, Karwar and Pollachi 10 each, Rajapalayam, Pune (Pashan) and Vythiri 9 each, Alathur 8, Williamnagar, Mathabhanga, Honavar, Jhahhar and Kumarapalayam 7 each
15.	Ayikudi, Sabalgarh, Kamudhi and Arai 8 each, Bijoliya, Indergarh, Hindoli, Sawai Madhopur, Sarwar, Papanasam, Banera and Nayanagar / Beawar 7 each	Nil	Tirumangalam 14, Puthimari 12, Kokrajhar 10, Moranhat 9, Jorhat, Mahua Tea Estate ARG, Puducherry, Puducherry, Mushalpur AWS and Bihubar 8 each, Sivasagar, Buxaduar, Beki Mathungari, Neamatighat, Cheyyar, Mettupalayam and Peraiyur 7 each
16.	Coonoor, Coonoor PTO and Kanpur The 12 each, Kothagiri 11, Banihal and Faridkot 10 each, Govindpura AWS, Muthupet and Quazigund 9 each, Kanpur AP, Kanpur city, Ketti, Udhampur IAF, Akbarpur Knp Dht, Batote, Anantnag, Akbarpur and Kozha 8 each, Morni, Shahpur Kandi, Baderwah and Kheri 7 each	Nil	Kamatchipuram 22, Rongo 18, Mulanur 17, Chatrapatti (Odanchatra) 16, Kankadahad ARG 12, Tenali 10, Thiruthuraipoondi, Sulur, Kovai / Koyamutthur AP, AP Peelamedu, Maheshpur and Vedasandur 9 each, Kamalpur, Tezu and Santhebennur 8 each, Kovai / Koyamutthur, Sirkali, Gadchiroli, Chennaraopet, Mangan, Mettupalayam, Nuggehalli, Chengalpattu, Anaikaranchatram (Kollid), Khanapur and Aravakurichi 7 each
17.	Kathua 9, Madhopur, Shahpur Kandi, Malakpur, Vaikom, Shalimar AGRO and Banihal 7 each	Nil	Thiruvananthapuram AP 14, Rongo, Danagadi ARG and Dhamnagar ARG 13 each, Nagercoil, Falakata, Jajpur and Bhadrak AWS 11 each, Malur, Amalapuram and Thiruvananthapuram 10 each, Akhuapada, Ponneri and Krishnanagar 9 each, Keeranur, Mylaudy, Hosanagar, Vedaranniyam and Tiruvuru 8 each, Panbari, Chengmari / Diana, Trichy town, Narsapur, Therlam, Polavaram, Karkala, Mayiladuthurai, Nagarkata, Daspalla, Dharmagarh ARG, Bengaluru CO, Bengaluru City, Nannilam and Avanigada 7 each
18.	Nil	Nil	Mannarkad, Manjeri and Sankarapuram 12 each, Nh31 Bridge and Colachel 11 each, Pechiparai, Thiruvananthapuram and Varkala 10 each, Nagercoil, Thiruvananthapuram AP, Pochampalli, Ambasamudram, Barur, Dharmanagar / Panisagar and Kuzhithurai 9 each, Eraniel, Champasari, Alipurduar CWC and Tirupathur PTO 8 each, Chhamonu, Tirupattur, Neyyattinkara, Yercaud, Tezpur, Dharmapuri, Dharmapuri PTO, Bhoothapandy, Panbari, Paiyur AWS and Nanjanagud 7 each
19.	Nil	Nil	Rongo 17, Domohani and Chopra ARG 11 each, Panbari, Alipurduar CWC and Chepan 10 each, Barobhisha, Nh31 Bridge and Jalpaiguri 9 each, Kishanganj and Kavaratti 8 each, Tenughat, Purulia, Thakurganj, Taibpur and Thiruchuzhi 7 each.
20.	Nil	Nil	Kayamkulam Agri 11, Damthang 10, Thakurganj 9, Bhoothapandy, Thuckalay and Araria 8 each, Punalur, Chopra ARG, Colachel, Kishanganj and Bahadurganj 7 each

TABLE 5 (*Contd.*)

Date	March	April	May
21.	Nil	Nil	Long Islands 13, Maya Bandar 10, Thakurganj 9, Williamnagar and Taibpur 7 each
22.	Nil	Nil	Dhubri CWC 10, Dhubri 9, Bhalukpong 8, Port Blair, Tuting, Melabazar / Matunga and Khowai 7 each
23.	Nil	Nil	Itanagar 10, Maya Bandar and Chungthang 9 each, Passighat and N. Lakhimpur 8 each, Naharlagun and Tinsukia 7 each
24.	Nil	Nil	Cherrapunji (Rkm) and Panbari 15 each, Port Blair 12, Cherrapunji 11, Passighat 8, Long Islands 7
25.	Nil	Nil	Thuckalay and Kuzhithurai 8 each
26.	Nil	Nil	Cherrapunji 15, Cherrapunji (Rkm) 12, Panbari 11, Williamnagar 9, Williamnagar AWS 8, Tikrikilla 7
27.	Golaghat CWC 7	Nil	Panbari 11, Cherrapunji 9, Williamnagar 7
28.	Gurundia ARG 8, Moharo, Dhubri and Toofanganj ARG 7 each	Nil	Pochampalli 13, Illuppur 11, Gorantla 10 Sethiathope 9, Kozha, Nallamada, Papanasam, Matijuri and Tiruppur 7 each
29.	Nil	Nil	Cherrapunji (Rkm) 19, Cherrapunji 15, Mushalpur AWS 12, Sevoke 11, Numaligarh 10, Nalbari / Pagladia 9, Manash Nh Xing, Jorhat and Neora 8 each, Malbazar ARG, Beky Rly.Bridge, Barpeta and Falakata 7 each
30.	Katra 14, Batote and Govindpura AWS 12 each, Udhampur IAF and Jammu City 10 each, Kukernag 9, Banihal, Jammu IAF, Quazigund, Anantnag, ChathaAgro AWS and Baderwah 7 each	Nil	Sonamura 14, Cherrapunji, Katihar and Goalpara Cwc 11 each, Shivani and Santhebennur 10 each, Gobichettipalayam, Cherrapunji (Rkm) and Bahalpur 9 each, Sedbal, Manash Nh Xing, Gajoldoba, Kuppam and Belonia 8 each, Tikrikilla, Venkatagiri Kota, Bhatkal, Gossaigaon, Panbari, Ranebennur (Hos), Karimganj, Chitradurga, Mangan, Gossaigaon AWS, Nongstain AWS, Shivamogga and Purnea 7 each
31.	Muthupet 10, Amrapara 8, Siddapura, Godda, Mahua Tea Estate ARG and Chakia 7 each	-	Sankalan and Nalbari / Pagladia 14 each, Cherrapunji (Rkm) 13, Cherrapunji 12, Rongo 11, Barobhisha 9, Barpeta, Beky Rly.Bridge, Chepan, Puthimari and Aie Nh Xing 8 each, Gangtok, Goalpara Cwc, Bahalpur, Gossaigaon and Manash Nh Xing 7 each

5 in Uttar Pradesh, 4 in Telangana and 3 in Karnataka. Strong winds/Squall claimed 6 lives in Bihar. Severe Hailstorm affected 8 northern districts of Bihar. It claimed 54 lives. Uprooting of telephone poles, trees took place and over 75000 houses were partially/totally damaged. Around 71000 families were affected. Maize and wheat crops in several districts were destroyed. Purnea district was one among the worst affected. Similarly hailstorm claimed 2 lives and destruction to wheat crops in around 1000 hectares of land in Mathura district of Uttar Pradesh. Himachal Pradesh and Karnataka state were also affected where Apple orchards and Banana plantations were destroyed in hailstorm. Avalanche claimed 4 lives in Jammu & Kashmir.

3.3. *May*

3.3.1. *Weather and associated synoptic features*

(a) *Advance of southwest monsoon*

During the third week of May, cross equatorial flow in the lower troposphere strengthened and cyclonic shear vorticity increased over southern parts of the Bay of Bengal and Andaman & Nicobar Islands. This enhanced the convective activity over the region. The resultant increase in rainfall indicated the arrival of southwest monsoon over this region on 16th May. It advanced over entire south Andaman Sea and Nicobar Islands and some parts of southeast Bay of Bengal, north Andaman Sea and Andaman Islands on 16th May and remaining parts of Andaman Sea, some parts of southeast Bay of Bengal and some parts of southwest and east central Bay of Bengal on 21st May. Thus the southwest monsoon current reached over south Andaman Sea, 4 days before the normal date of 20th May. It further advanced into entire Andaman Sea and some parts of southeast Bay of Bengal and some parts of southwest and east central Bay of Bengal on 21st May and into southern parts of south Arabian Sea & Maldives-Comorin areas and some parts of southwest Bay of Bengal on 28th May.

(b) *Other synoptic features and rainfall*

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

Reduced rainfall activity and corresponding increase in day temperatures over northwest and central India did show signs of temporary setting in of monsoon circulation pattern in the lower tropospheric levels during the first week. Presence of a couple of troughs in lower tropospheric levels and embedded cyclonic circulations over the sub-divisions in the east gave scattered convective rainfall over northeast and south peninsular India throughout the week which continued upto first half of second week.

Thereafter, the active WDs delayed the development of the 'Heat Low' over northwestern parts of India. Presence of cold and dry mid latitude air in the wake of slow moving deep amplitude westerly trough inhibited the vortices over Indian Seas to organize further. However, this cold and dry air and moisture incursion from the Sea due to low level cyclonic vorticity led to convective activity over most parts of India towards the later part of the second week. With the appearance of northeasterly return flow at upper tropospheric levels gave the indications of monsoonal weather over Andaman Sea. During the month no intense low pressure system formed over the Indian region.

3.3.2. *Temperature distribution*

Towards the later half of the month, convective rainfall activity reduced gradually over major parts of India, outside the northeastern states, leading to the development and spreading of heat wave conditions both in spatial extent and severity.

Severe heat wave conditions prevailed on 5 days over Coastal Andhra Pradesh and on 2 days over Odisha. *Heat wave* conditions prevailed on 14 days over west Madhya Pradesh and Vidarbha; on 8 to 12 days over Odisha, Uttar Pradesh, Rajasthan, east Madhya Pradesh, Chhattisgarh and Telangana; on 4 to 7 days over Haryana, Chandigarh & Delhi and Coastal Andhra Pradesh and on 1 to 3 days over Gangetic West Bengal, Jharkhand, Bihar, Uttarakhand, Punjab, Gujarat State, Madhya Maharashtra, Marathwada and north interior Karnataka.

The day and night temperatures were normal to above normal over most parts of the country except during mid-May when day temperatures were below normal over north and Peninsular India.

The month's as well as the season's highest maximum temperature of 47.6 °C was recorded at Titlagarh (Odisha) on 26 May and Wardha & Chandrapur (Vidarbha) on 22 & 29 May, 2015.

3.3.3. *Disastrous weather events and damage*

According to media and other disaster reports, Thunderstorm/lightning/ rain related incidents claimed 7 lives in Kerala, 6 each in Karnataka and Tamil Nadu, 5 in Bihar, 3 in Uttar Pradesh and 1 each in West Bengal and Telangana. Flash floods in Tamil Nadu claimed 8 lives. Severe dust storm in Bikaner region of Rajasthan damaged 50 houses, uprooted trees & poles and claimed 20 lives. Heatwave claimed 1722 lives in Andhra Pradesh, 585 in Telangana, 41 in Odisha, 7 in Gujarat State and 2 in Haryana.

Appendix

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

Temperatures

(a) *Maximum/ day temperatures*

According to the criteria being followed since 1st March 2002, Heat Wave will be declared only when the maximum temperature of a station reaches at least 40 °C for plains and at least 30 °C for Hilly regions.

Severe heat wave - Departure of maximum temperature from normal is + 6 °C or more for the regions where the normal maximum temperature is more than 40 °C and departure of maximum temperature from normal is + 7 °C or more for the regions where the normal maximum temperature is 40 °C or less.

Heat wave conditions - Departure of maximum temperature from normal is between + 4 °C to + 5 °C or more for the regions where the normal maximum temperature is more than 40 °C and departure of maximum temperature from normal is +5° to + 6 °C for the regions where the normal maximum temperature is 40 °C or less.

Hot day conditions - Whenever the maximum temperature remains 40 °C or more and minimum remains 5 °C or more above normal, provided, it is not satisfying the heat wave criteria.

(b) *Minimum/night temperatures*

Severe cold wave conditions Departure of WCTn from normal minimum temperature is –7 °C or less for the regions where normal minimum temperature is > 10 °C and –6 °C or less elsewhere.

Cold wave conditions - Departure of WCTn from normal minimum temperature is from –5 °C to –6 °C where normal minimum temperature is ≥10 °C and from –4 °C to –5 °C elsewhere.

Also cold wave is declared when WCTn is ≤0 °C irrespective of the normal minimum temperature for those stations.

Rainfall

Excess - Percentage departure from normal is + 20% or more.

Normal - Percentage departure from normal is +19% to –19%.

Deficient - Percentage departure from normal is –20% to –59%.

Scanty - Percentage departure from normal is –60% to –99%.