MAUSAM, **69**, 1 (January 2018), 161-176

Weather in India

WINTER SEASON (January-February 2017)†

1. Introduction

The winter season comprising January and February of 2017, in general had been mild in terms of temperature realized over major parts of India. Except for a brief spell of *severe cold wave / cold wave & cold day** occurrence over parts of northwest, central and Northern India, major part of the season witnessed *above normal* night and day temperatures.

The shifting of the Inter Tropical Convergence Zone towards the equator weakened the circulation features in the tropical belt. This together with the prevailing dry weather over southern peninsula India indicated the cessation of NE Monsoon rains over the region from 4th January. The anomalous easterly flow in the peninsula resulted in the *above normal* temperatures in West and North West India. The dry and warm easterlies along the west coast caused *Heat wave* conditions over coastal Gujarat, Karnataka and Kerala.

The high index phase of mid-latitude circulation regime and subdued tropical easterly wave activity over the Indian seas caused the remaining parts of mainland outside western Himalayan region and NE India to be less humid and devoid of clouds. Thus leading to significant rise in day max temperature over NW India and interior parts of south Peninsula. The frequency of Western Disturbances (WDs) affecting the northern latitudes remained high. (as is evident from Tables 2 & 3), the precipitation realized from these systems affected the northern, northwest regions and the western Himalayan regions. A series of avalanches occurred over northern Himalayan region due to active western disturbances in the last week of January (from 25-27 January). The western disturbances also caused *fairly widespread to widespread* rains/ snowfall activity over western Himalayan region along with *isolated heavy* falls over Jammu and Kashmir and *isolated to scattered* rain/ thundershower activity over adjoining plains of Northwest India from 5-7 February.

The cumulative area weighted All India rainfall Anomaly was -5%. The northernmost sub-division (J&K) received *large excess* rainfall during the season while the southernmost peninsular India sub-division with the exception of Kerala received *excess* rainfall during the season. North West India and parts of NE India received *normal* rainfall.

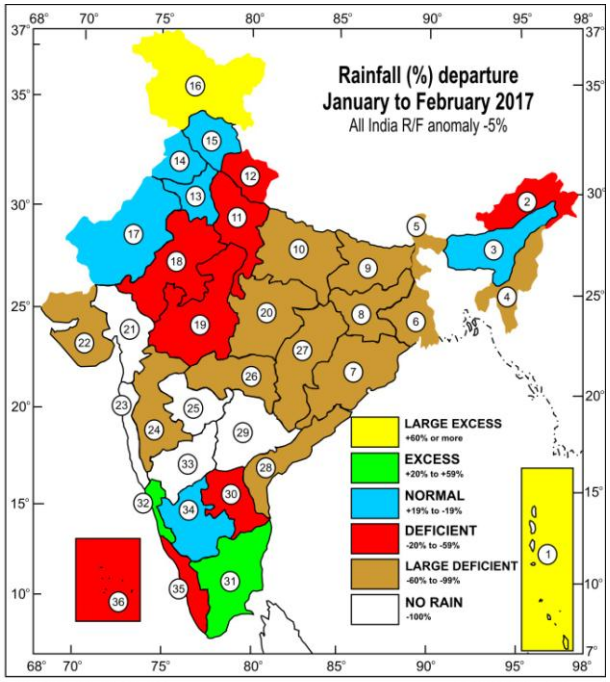

Fig. 1. Sub-divisionwise rainfall percentage departures for the season Jan-Feb 2016. Sub-divisions are indicated by number on the map & bold letters in legend. The rainfall anomaly values for these 36 sub-divisions are indicated below :

1	183	**7**	-95	**13**	5	**19**	-52	**25**	-100	**31**	24
2	-36	**8**	-84	**14**	-8	**20**	-68	**26**	-99	**32**	20
3	-16	**9**	-97	**15**	4	**21**	-100	**27**	-92	**33**	-100
4	-71	**10**	-66	**16**	70	**22**	-68	**28**	-95	**34**	13
5	-87	**11**	-31	**17**	-15	**23**	-100	**29**	-100	**35**	-46
6	-96	**12**	-53	**18**	-20	**24**	-98	**30**	-41	**36**	-38

This winter, the core of Sub-Tropical Westerly Jet (STWJ) was seen oscillating between wide ranges of Latitudes *viz*., 15° N & 34° N. The wind speed was above 60 kts around 200 hPa throughout the season.

There was a prevalence of *dense to very dense* Fog over parts of northern plains, parts of northeastern region, North West region and parts of central India nearly all

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

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TABLE 1

Sub-divisionwise rainfall (mm) for each month and season as a whole (January-February, 2017)

S. No.	Meteorological Sub-divisions	January			February			Season		
		Actual (mm)	Normal (mm)	Dep. (%)	Actual (mm)	Normal (mm)	Dep. (%)	Actual (mm)	Normal (mm)	Dep. (%)
1.	A. & N. Islands	228.7	53.7	326	5.6	29.2	-81	234.2	82.9	183
2.	Arunachal Pradesh	8.2	50.1	-84	86.2	98.0	-12	94.4	148.1	-36
3.	Assam & Meghalaya	1.7	16.4	-90	37.8	30.5	24	39.5	46.9	-16
4.	Naga., Mani., Mizo. and Tri.	0.8	13.7	-94	11.9	30.3	-61	12.7	44.0	-71
5.	Sub-Himalayan West Bengal & Sikkim	3.0	26.6	-89	5.1	33.7	-85	8.1	60.3	-87
6.	Gangetic West Bengal	1.4	13.5	-90	0.0	20.9	-99	1.4	34.4	-96
7.	Orissa	1.7	10.8	-84	0.0	21.0	-100	1.7	31.8	-95
8.	Jharkhand	5.1	16.1	-68	0.1	17.3	-99	5.2	33.4	-84
9.	Bihar	0.7	13.3	-95	0.0	9.7	-100	0.7	23.0	-97
10.	East Uttar Pradesh	9.7	16.8	-42	0.1	12.1	-99	9.8	28.9	-66
11.	West Uttar Pradesh	22.0	18.2	21	1.1	15.1	-92	23.1	33.3	-31
12.	Uttaranchal	36.6	52.1	-30	13.5	54.1	-75	50.1	106.2	-53
13.	Haryana, Chandigarh & Delhi	34.2	17.8	92	0.3	15.1	-98	34.5	32.9	5
14.	Punjab	42.4	25.2	68	3.0	24.3	-87	45.5	49.5	-8
15.	Himachal Pradesh	157.6	97.5	62	46.3	98.0	-53	204.0	195.5	4
16.	Jammu & Kashmir	255.5	95.7	167	106.4	117.2	-9	361.8	212.9	70
17.	West Rajasthan	6.0	2.9	106	0.3	4.5	-93	6.3	7.4	-15
18.	East Rajasthan	8.4	5.6	50	0.0	4.9	-100	8.4	10.5	-20
19.	West Madhya Pradesh	4.6	8.5	-45	1.9	5.1	-63	6.5	13.6	-52
20.	East Madhya Pradesh	4.6	20.0	-77	6.7	15.3	-56	11.3	35.3	-68
21.	Gujarat region	0.0	0.8	-100	0.0	0.2	-100	0.0	1.0	-100
22.	Saurashtra & Kutch	0.1	0.1	-47	0.0	0.2	-78	0.1	0.3	-68
23.	Konkan & Goa	0.0	0.1	-100	0.0	0.0	-100	0.0	0.1	-100
24.	Madhya Maharashtra	0.0	1.1	-96	0.0	0.8	-100	0.0	1.9	-98
25.	Marathawada	0.0	3.8	-100	0.0	3.0	-100	0.0	6.8	-100
26.	Vidarbha	0.2	10.2	-98	0.0	7.0	-99	0.2	17.2	-99
27.	Chattisgarh	0.9	10.5	-91	0.7	10.3	-93	1.6	20.8	-92
28.	Coastal Andhra Pradesh	1.0	8.3	-88	0.0	10.4	-100	1.0	18.7	-95
29.	Telangana	0.0	5.8	-100	0.0	5.5	-100	0.0	11.3	-100
30.	Rayalaseema	3.9	3.0	30	0.0	3.6	-100	3.9	6.6	-41
31.	Tamil Nadu	37.3	17.5	113	1.1	13.4	-92	38.4	30.9	24
32.	Coastal Karnataka	1.1	0.7	55	0.0	0.2	-100	1.1	0.9	20
33.	North interior Karnataka	0.0	2.2	-100	0.0	1.7	-100	0.0	3.9	-100
34.	South interior Karnataka	5.0	1.4	255	0.0	3.0	-100	5.0	4.4	13
35.	Kerala	12.7	8.7	46	0.3	15.6	-98	13.0	24.3	-46
36.	Lakshadweep	21.3	20.8	2	0.9	14.7	-94	22.2	-35.5	-38

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

TABLE 2

Details of the weather systems during January 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**)	*Low pressure area*					
1.	Low pressure area	5 - 11	South Andaman Sea and neighbourhood	North	Tenasserim coast and adjoining north Andaman sea.	It lay initially as a trough of low at mean sea level over northern Sumatra and adjoining south Andaman sea on the 4. The associated cyclonic circulation extended upto upper tropospheric levels
(**B**)	*Western disturbances /eastward moving systems*					
(*i*)	*Upper air cyclonic circulation*					
1.	Upto Mid tropospheric levels	2 - 8	North Afghanistan and neighbourhood	Northeast	Jammu & Kashmir and adjoin north Pakistan.	Moved away on 9. A trough lay aloft with its axis at 5.8 kms a.s.l. during 6-8
2.	Upto Mid tropospheric levels	5	North east Afghanistan and neighbourhood	Do	North Pakistan and neighbourhood	The cyclonic circulation with a trough aloft merged with the cyclonic circulation over North Pakistan and neighbourhood on 6
3.	Do	9 - 10	North Pakistan and neighbourhood	East-northeast	Jammu & Kashmir and neighbourhood	The feeble WD moved away on 11. It lay initially as a trough in lower and mid tropospheric westerlies with its axis at 3.1 kms a.s.l. and lay aloft with its axis at 5.8 kms a.s.l. on 9 and became less marked on 10
4.	Do	11 - 13	North Pakistan and adjoining northeast Afghanistan	Northeast	Do	Moved away on 14
5.	Do	15 - 16	North Pakistan and neighbourhood	Do	North Pakistan and adjoining Jammu & Kashmir	It moved east northeastwards on 17
6.	Do	17 - 19	Do	Do	Jammu & Kashmir and neighbourhood	The WD lay initially as a trough in mid and upper tropospheric levels with axis at 5.8 kms a.s.l. during 14-16 and lay aloft the cyclonic circulation during 17-20. The cyclonic circulation became less marked on 20 and the trough aloft moved northeastwards on 21
7.	Do	21 - 22	North Pakistan and adjoining Afghanistan	Do	North Pakistan and adjoining Jammu & Kashmir	It move away northeastwards on 23
8.	Do	22 - 27	Northeast Afghanistan and neighbourhood	Do	Do	It moved away east-northeastwards on 28. A trough with its axis at 5.8 kms a.s.l. lay aloft during 23 - 28 and moved away east-northeastwards on 29
(*ii*)	*As a trough*					
1.	Mid & upper tropospheric levels	1 - 4	Along Long. 80° E to the north of Lat. 25° N (axis at 7.6 kms a.s.l.)	East	Along Long. 90° E to the north of Lat. 23° N (axis at 5.8 kms a.s.l.)	It became un important on 5

TABLE 2 (*Contd.*)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
2.	Mid tropospheric levels	20 - 21	Along Long. 55° E to the north of Lat. 28° N (axis at 5.8 kms a.s.l.)	East	Along Long.67° E to the north of Lat. 22° N (axis at 7.6 kms a.s.l.)	The WD initially lay as an upper air cyclonic circulation extending upto 3.1 kms a.s.l. over central parts of Iran and neighbourhood. It moved away northeastwards on 22
3.	Mid tropospheric levels	29 Jan - 2 Feb	Along Long.66° E to the north of Lat. 30° N (axis at 3.1 kms a.s.l.)	Do	Along Long. 90° E to the north of Lat. 25° N (axis at 3.1 kms a.s.l.)	It moved away northeastwards on 3 February
(*iii*)	*As an Induced cyclonic circulation*					
1.	Upto lower tropospheric level	5 - 8	Central Pakistan and adjoining west Rajasthan	-	Northwest Madhya Pradesh and neighbourhood	It became less marked on 9
2.	Upto Mid tropospheric levels upto	14 - 16	Central Pakistan and neighbourhood	East	North west Rajasthan and adjoining areas of Haryana and Punjab	It became less marked on 17
3.	Upto lower tropospheric level	17 - 19	Punjab and neighbourhood	-	West Uttar Pradesh and neighbourhood	It became less marked on 20
4.	Do	24 - 27	Central Pakistan and neighbourhood	East	Northwest Uttar Pradesh and neighbourhood	Became less marked on 28
5.	At lower levels	31 Jan	Rajasthan and neighbourhood	Stationary	*In-situ*	It became less marked on 1 February
(**C**)	*Other upper air cyclonic circulations*					
1.	Upto lower tropospheric levels	8	Mizoram and neighbourhood	Stationary	*In-situ*	It became less marked on 9. A trough lay aloft with its axis at 3.1 kms a.s.l. on 8 and 9 before it moved away east northeastwards on 10
2.	Upto Lower tropospheric levels	9 - 11	North Madhya Pradesh and neighbourhood	East	South Odisha and neighbourhood	It became less marked on 12
3.	Upto lower tropospheric levels	10 - 11	Sub-Himalayan West Bengal and Sikkim and adjoining Bihar	Do	West Assam and neighbourhood	It became less marked on 12
4.	Between lower and mid tropospheric levels	12 - 13	East Uttar Pradesh and neighbourhood	Do	East Uttar Pradesh and adjoining Bihar	Became less marked on 14
5.	Upto lower tropospheric levels	12 - 16	Interior Tamil Nadu and neighbourhood	West	Maldives-Lakshadweep areas	Became less marked on 17
6.	At lower levels	14	South Madhya Maharashtra and neighbourhood	Stationary	*In-situ*	Became less marked on 15
7.	Upto lower tropospheric levels	21 - 23	North Gujarat and adjoining south Rajasthan	East	Southwest Rajasthan and neighbourhood	Became less marked on 24
8.	Upto mid tropospheric levels	23 - 27	Meghalaya and Nagaland-Manipur-Mizoram-Tripura and east Bangla Desh	West	Bangla Desh and neighbourhood	It became less marked on 28
9.	Upto lower tropospheric levels	26	Southeast Rajasthan and neighbourhood	Stationary	*In-situ*	It became less marked on 27
10.	Do	29 Jan - 4 Feb	North Bangla Desh and neighbourhood	Quasi-stationery	Southeast Bangla Desh and neighbourhood	It became less marked on 5 February
11.	Do	27 Jan - 2 Feb	Comorin area and adjoining south Tamil Nadu and south Kerala	West	Maldives and neighbourhood	It became less marked on 3 February

TABLE 2 (*Contd.*)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
(D)	*Trough in easterlies*					
1.	At mean sea level	17 - 27	Gulf of Siam and neighbourhood	-	Southeast Arabian sea and adjoining Equatorial Indian Ocean.	A cyclonic circulation lay aloft extending upto mid tropospheric levels. The trough merged with the trough extended from Comorin area to north Konkan coast on 28
2.	At lower levels	15	south interior Karnataka to north Madhya Maharashtra	stationary	*In-situ*	Became less marked on 16
3.	At mean Sea level	26 -30	Southwest Bay of Bengal and neighbourhood	West	From southeast Arabian Sea to east central Arabian Sea off Konkan coast	It became feeble and moved away westwards on 31
(E)	*Other troughs*					
1.	At Lower levels	6	North Madhya Maharashtra across Gujarat	-	*In-situ*	It became unimportant on 5
2.	Upto lower tropospheric levels	27 - 28	From the cyclonic circulation over northwest Uttar Pradesh and neighbourhood to north Madhya Maharashtra across west Madhya Pradesh	East	Northern parts of Jharkhand to Vidarbha	It became less marked on 29

through the month of January but was absent in February. *Cold wave* and *severe cold wave* conditions prevailed in some parts of northern India, northwestern India and parts of central India in the month of January but were absent in February except for two days when *cold wave* conditions were present in parts of Madhya Pradesh.

No intense low pressure system formed over the Indian region in this season.

2. Seasonal Rainfall (January-February)

The monthly and seasonal sub-division wise rainfall (actual, normal and percentage departure) are given in Table 1. Also representative amounts of rainfall on a day-to-day basis are given in Table 4. Out of the 36 met-subdivisions of India, the seasonal rainfall was *large excess* in 2, *excess* in 2, *normal* in 6, *large deficient* in 13, *deficient* in 8 and *no rain* in 5 sub-divisions. The percentage departures falling under various categories *viz*. *large excess*, *excess*, *normal*, *deficient*, *large deficient* and *no rain* are shown in Fig. 1.

Climatologically, the WDs moving from west to east move to northeast India after traveling across the northern states *viz*., Jammu & Kashmir, Punjab, Haryana, Himachal Pradesh and Uttarakhand. On interacting with the regional synoptic situations and topography of the region, these systems give rise to precipitation over northwest and northeastern parts of the country during winter season. The rainfall during the season was *normal*.

3. Monthly features

3.1. *January*

3.1.1. *Storms and Depressions*

No intense low pressure system formed over the Indian Seas during the month. However, a low pressure system formed over south Andaman Sea on the 5th of January. This low pressure remained over the Tenasserim coast and adjoining Andaman Sea from 5 -12 January. It cause *widespread*, *fairly widespread* and *isolated* rains over Andaman and Nicobar Islands.

3.1.2. *Weather and associated synoptic features*

As given in Table 2, 10 WDs (including 7 upper air cyclonic circulations, and 3 troughs in westerlies), 10 upper air cyclonic circulations, 5 troughs of low, 2 troughs in westerlies, 5 induced cyclonic circulations and 2 troughs in easterlies formed which affected the weather over the country during the month of January.

3.1.3. *Monthly rainfall*

Out of the 36 met-subdivisions of India, the month's rainfall was *large excess* in 8, *excess* in 5, *normal* in 1, *deficient* in 4, *large deficient* in 13 sub-divisions and *no rain* in 5 sub-divisions. The rainfall received in the month of January for the whole country as a whole was *above normal*.

TABLE 3

Details of the weather systems during February 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	1 - 7	West Iran and neighbourhood	Northeast	North Pakistan and adjoining Jammu & Kashmir	A trough lay aloft with its axis at 5.8 kms a.s.l. during 2 - 7. It moved away east-northeastwards on 8
2.	Do	7 - 11	Afghanistan and neighbourhood	Do	Eastern parts of Jammu & Kashmir and neighbourhood	It moved away east-northeastwards on 12. A trough lay aloft with its axis at 5.89 kms a.s.l. on 8
3.	Do	12 - 14	North Pakistan and adjoining Jammu & Kashmir	Do	Do	The Feeble WD moved away northeast wards on 15
4.	Do	20 - 23	North Pakistan and neighbourhood	Do	Northern parts of Jammu & Kashmir and neighbourhood	The WD moved away across Jammu & Kashmir on 24. It lay as a trough in mid tropospheric westerlies with its axis at 5.8 kms a.s.l. on 18 & 19 and then aloft during 20 - 22 and moved away east-northeastwards on 23
5.	Do	28 Feb - 4 Mar	Do	Do	Northeastern parts of Jammu & Kashmir	Initially it lay as a trough in mid & upper tropospheric westerlies with its axis at 5.8 kms a.s.l. during 25-27 and then aloft during 28 February - 4 March. It moved away east-northeastwards on 5 March
(*ii*) *As trough in westerlies*						
1.	Mid tropospheric levels	15 - 17	Along Long. 70° E to the north of Lat. 32° N (axis at 5.8 kms a.s.l.)	Northeast	Along Long. 81° E to the north of Lat. 35° N (axis at 3.1 kms a.s.l.)	It moved away east-northeastwards on 17 evening. Initially it lay as an upper air cyclonic circulation extending between 3.1 & 5.8 kms a.s.l. over Afghanistan and neighbourhood on 8
2.	Mid & upper tropospheric levels	24 - 25	Along Long.57° E to the north of Lat. 35° 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.)	Moved away east-northeastwards on 26
(*iii*) *As an Induced cyclonic circulation*						
1.	Upto lower tropospheric levels	3 - 5	Pakistan and neighbourhood	East	Central Pakistan and adjoining west Rajasthan	It became less marked on 6
2.	Do	8	West Rajasthan and adjoining central Pakistan	Stationary	*In-situ*	Became less marked on 9
3.	Upto lower tropospheric levels	27 Feb - 2 Mar	South Pakistan and neighbourhood	East	East Rajasthan and adjoining northwest Madhya Pradesh	It became less marked on 3 March

TABLE 3 (*Contd.*)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
(**B**) *Other upper air cyclonic circulations*						
1.	At lower level	1 - 7	North interior Karnataka and neighbourhood	Oscillatory	North interior Karnataka and neighbourhood	Became less marked on 8. It lay as a trough at 0.9 km a.s.l. extending from south interior Karnataka to north Madhya Maharashtra across north interior Karnataka on 3 and from coastal Karnataka to north Madhya Maharashtra on 5
2.	Do	3	Saurashtra & Kutch and neighbourhood	Stationary	*In-situ*	It merged with the induced cyclonic circulation over Pakistan and neighbourhood on 4
3.	Upto lower tropospheric levels	5 - 7	Bangla Desh and neighbourhood	Quasi-stationary	Southeast Bangla Desh and neighbourhood	It became less marked on 8
4.	Do	5 - 8	Comorin area and neighbourhood	Stationary	*In-situ*	It lay as a trough from Equatorial Indian Ocean to Comorin extending upto lower tropospheric levels on 8 and became less marked on 9
5.	Do	8 - 9	Sub- Himalayan West Bengal & Sikkim and neighbourhood	East	Meghalaya and neighbourhood	It became less marked on 10
6.	At lower level	10 - 12	Comorin area and neighbourhood	Stationary	*In-situ*	It became less marked on 13
7.	Upto lower tropospheric levels	10 - 11	North interior Odisha and adjoining Chhattisgarh	South	South Chhattisgarh and adjoining Odisha	It became less marked on 12
8.	Do	12	East Bihar and adjoining Sub-Himalayan West Bengal & Sikkim	Stationary	*In-situ*	It became less marked on 13
9.	Do	13	East Bangla Desh and neighbourhood	Do	Do	It became less marked on 14
10.	At lower levels	14 - 15	Saurashtra & Kutch	East	Gujarat region and neighbourhood	It became less marked on 16
11.	Upto mid tropospheric levels	17 - 19	Southeast Bangla Desh and neighbourhood	Quasi-stationary	Bangla Desh and neighbourhood	It became less marked on 20. It lay initially as a trough in lower levels extended from east Bihar to northeast Bay of Bengal on 16
12.	At lower level	22	North Rajasthan and neighbourhood	Stationary	*In-situ*	It became less marked on 23
13.	Do	24	North coastal Andhra Pradesh and adjoining south coastal Odisha	Do	Do	It became less marked on 25
14.	Do	20	North Madhya Maharashtra and neighbourhood	Do	Do	It became less marked on 21
15.	Upto mid tropospheric levels	25 - 28	Southeastern parts of Bangla Desh and neighbourhood	North	Sub-Himalayan West Bengal and adjoining Bangla Desh	It became less marked on 1 March
(**C**) *Trough in easterlies*						
1.	At lower levels	9 - 13	North interior Karnataka to central parts of Madhya Pradesh across Marathwada and Vidarbha	West	Maldives area to north Konkan	It moved away westwards and became un-important on 14

TABLE 3 (*Contd.*)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
2.	At mean Sea level	16 - 21	southeast Andaman Sea and neighbourhood	West	Comorin area and adjoining Equatorial Indian Ocean	A cyclonic circulation lay aloft extending upto 0.9 km a.s.l. on 21. It became less marked on 22
3.	At lower levels	19	Southeast Arabian Sea to east central Arabian Sea off Konkan coast	Stationary	*In-situ*	It became less marked on 20
4.	Upto lower tropospheric levels	24 - 28	Equatorial Indian Ocean and adjoining Malay peninsula	West	Southwest Bay of Bengal off Sri-Lanka coast and adjoining Equatorial Indian Ocean	It lay as a trough of low at mean sea level on 27 & 28. It merged with the trough of low at mean sea level extended from Comorin area to south Konkan across Kerala - Karnataka coast on 1 March
5.	At lower levels	25 - 27	From Maldives area to coastal Karnataka	Oscillatory	From Lakshadweep area to Karnataka coast	It became un-important on 28. It was seen as a cyclonic circulation over coastal Karnataka and adjoining areas of southeast Arabian Sea on 26
6.	At mean Sea level	28 Feb - 6 Mar	South Andaman Sea and adjoining Equatorial Indian Ocean	West	From Lakshadweep area to north interior Karnataka across Kerala and south interior Karnataka	It extended at lower level on 6 and became less marked on 7 March
(**D**)	*Other troughs/Wind discontinuity*					
1.	Upto mid tropospheric levels	19 - 20	From the cyclonic circulation over Bangla Desh and neighbourhood to north Andhra Pradesh across Odisha	-	From Sub-Himalayan West Bengal & Sikkim to west central bay of Bengal off north Andhra Pradesh coast	It became less marked on 21. Initially as a cyclonic circulation extending upto 1.5 km a.s.l. over Jharkhand and adjoining Odisha and Gangetic West Bengal on 18
2.	At lower levels	22 - 23	Sub-Himalayan West Bengal & Sikkim to north Odisha across Gangetic West Bengal	Stationary	*In-situ*	It became less marked on 24
3.	Upto lower tropospheric levels	21 - 22	From Comorin area to north interior Karnataka across Tamil Nadu and south interior Karnataka	Oscillatory	From Lakshadweep area to Telangana across Kerala and interior Karnataka	It lay as a trough at lower levels on 23 and became less marked on 24

In the first week of January the prolonged dry spell was broken towards the end of the week as *fairly widespread* rain/ snowfall occurred over Jammu & Kashmir from 3rd January. Due to active Western Disturbances precipitation started over the western Himalayan region towards the end of the week. There had been *isolated* occurrences of Hailstorms over parts of east and northeast India during 2nd to 4th January due to the high amplitude trough in the mid and upper tropospheric westerlies. The southward shift of the ITCZ and the weakening of the circulation features over the tropical belt led to the cessation of the NE monsoon from the 4th January. The wet spell over northwest India due to Western disturbances continued in the second week too. *Heavy* snowfall in the higher reaches affected normal life. The low pressure area over south Andaman Sea and neighborhood from 5th to 12th January caused *widespread* to *fairly widespread* rains over Andaman & Nicobar Islands. The NE regions also received *isolated* rainfall due to cyclonic circulations during the second week. The Western Disturbances caused *fairly widespread to widespread* precipitation over western Himalayas and adjoining plains all throughout the month. The trough of low over the Andaman Seas for most part of the month caused *widespread to fairly widespread* rains over the Andaman throughout the month.

3.1.4. *Temperature*

The gradual change of the prevailing high index phase to low index phase of the mid latitude circulation led to the development of *cold waves* in the first week of the month. The frequent passages of the Western Disturbances also facilitated the formation of *severe cold wave* over the North western region and the adjoining central parts. Subsequent to the passage of this, UP and Vidarbha temperatures dropped sharply over the region owing to the cold and dry air advection from the north. This situation led to the development of *severe cold wave* conditions over parts of northwest India, in which a few places over the plains as well, reported sub-zero temperatures.

Severe cold wave conditions prevailed on 1 to 2 days over east UP, at a few places over Punjab and Rajasthan and many places over Madhya Pradesh and Vidarbha. *Cold wave* conditions prevailed for 1 to 4 days over Odisha. *Cold wave* conditions prevailed on 1 to 3 days over Gangetic West Bengal, west UP and Haryana, Chandigarh & Delhi at a few places over Punjab and Rajasthan, Madhya Pradesh, Saurashtra & Kutch, Vidarbha and Chhattisgarh. *Cold day* conditions prevailed for one day over Uttar Pradesh, Haryana, Chandigarh & Delhi and west Rajasthan.

The maximum temperatures were *above normal* to *appreciably above normal* over most of the subdivisions. It was *markedly above normal* for one or two days in the beginning of the month over Himachal Pradesh, Kashmir and west Rajasthan. The temperatures over Bihar and Uttar Pradesh showed *markedly below* temperatures. During the second week onwards, the maximum temperatures were *normal* or *above normal* all through the month over most parts except Northern and Northwest regions where the temperatures were *below normal* and *appreciably below normal* due to the passage of Western disturbances and the resultant precipitation over the regions. A series of avalanches that took place over the western Himalayan region were also responsible for the *below normal* temperatures.

Minimum temperature was *normal* to *above normal* over most parts of India in the first week. In the second week the minimum temperature was *below normal* to *appreciably below normal* over NE, NW, North, upper north peninsula sub-divisions. East Madhya Pradesh, east Uttar Pradesh and Vidarbha recorded markedly below minimum temperatures for a few days.

The month's and the season's lowest minimum temperature over the plains of the country was *minus* 0.5 °C recorded at Narnaul (Haryana) on 11th January 2017.

3.1.5. *Disastrous weather events and damage*

According to press and media reports, at least 26 people were killed, including 20 soldiers in a series of avalanches in north western Kashmir. Over 150 people were moved to safety because of looming avalanches in Srinagar. Connectivity affected over both the Srinagar airport and the Srinagar-Jammu highway (25-27 January). Due to *dense* fog two persons were killed in UP and one in MP in different road mishaps. Eighty trains were delayed and 49 trains were rescheduled due to foggy weather in national capital New Delhi and neighboring states. (23rd January). Due to *severe cold wave* nine deaths were reported from UP and two from Himachal Pradesh (12 - 14 January) died, trees and power poles got uprooted, blocked most of the roads in Himachal Pradesh, the Hindustan Tibet road (NH-22) besides Manali-Rohtang road was blocked more than 1000 tourists were stranded in many parts of Shimla (8 January). The Jammu Srinagar highway and Jammu-Batote Kishtwar roads were closed due to landslide, 1000 vehicles were stranded and all flights from Jammu and Delhi to Srinagar were cancelled due to *heavy* snow at Srinagar airport (7th January). Three people died two in UP and one in MP in different road accidents due to *dense* fog that hit road and rail traffic in the northern states. Trains were rescheduled due to foggy weather in the national capital Delhi and neighboring states (3rd January).

3.2. *February*

3.2.1. *Storms and depressions*

No intense low pressure system formed over the Indian Seas during the month.

3.2.2. *Other synoptic features and associated weather*

As given in Table 3 and 5 WDs (including1 upper air cyclonic circulation and 4 troughs in westerlies), 13 upper air cyclonic circulations and 3 troughs in the easterlies, 3 induced cyclonic circulations, 3 troughs in westerlies, 3 troughs of low, formed which affected the weather over the country during the month of February.

3.2.3. *Monthly rainfall*

Out of the 36 met-subdivisions, the month's rainfall was *large excess* in 0, *excess* in 1, *normal* in 2, *deficient* in 2 and *large deficient* in 18 sub-divisions. There was *no rain* in 13 sub-divisions. The rainfall departure for the month of February was -44%.

TABLE 4

Some representative amounts of rainfall in cm for January and February 2017 (1 cm and above)

Date	Some representative amounts of rainfall in cm for January and February 2017 (1 cm and above)
1 Jan	Vedaranniyam 2
2 Jan	Car Nicobar IAF 9, Nancowry 6, Latehar, Hut Bay and Car Nicobar 3 each, Daltonganj, Dudhi, Dehra Dun, Kotkhai, Manatu, Tehri, Khadrala, Kumarsain and Rohru 1 each
3 Jan	Nancowry 7, Rajkishorenagar 4, Jujumura and Naktideul 3 each, Atabira, Deogaon, Athmalik, Midnapore, Burla, Barmul, Hirakud, Sambalpur and Korba 2 each, Batli, Lakhanpur, Car Nicobar, Car Nicobar IAF, Champua, Hemgiri, Ambabhona, Haldwani, Sundargarh, Papanasam, Rairakhol, Midnapore CWC and Balumath 1 each
4 Jan	Car Nicobar 10, Nancowry 6, Kupwara 2, Gulmarg, Hut Bay, Shalimar AGRO and Banihal 2 each, Pahalgam, Srinagar, Maya Bandar, Gund, Port Blair, Srinagar AGRO AWS, Long Islands, Tissa and Rambagh AWS 1 each
5 Jan	Port Blair 5, Long Islands 4, Car Nicobar IAF 3, Kupwara, Nancowry, Car Nicobar, Barapani, Gulmarg and Pahalgam AWS 2 each, Banihal, Srinagar IAF and Maya Bandar 1 each
6 Jan	Car Nicobar IAF 16, Car Nicobar 13, Nancowry 10, Long Islands 4, Gulmarg 3, Hut Bay and Srinagar IAF 2 each, Maya Bandar, Kupwara, Baramulla AWS, Rajouri, Banihal, Majitar and Port Blair 1 each
7 Jan	Arki 21, Kandaghat 19, Mawana and Shalimar AGRO 9 each, Awantipur IAF and Srinagar IAF 8 each, Banjar, Sunibhajji, Gohar, Nangal, Barthin, Kasauli, Ghumarwin and Mashobra AGRO 7 each, Banihal, Shimla AP, Jhandutta, Chandigarh, Karsog, Kahu, Rajgarh, Sangraha, Sujanpur Tira and Nadaun 6 each, Bhoranj, Palampur, Aghar, Sundernagar, Chamba AWS, Shimla, Khadrala, Mehre (Barsar), Gulmarg and Theog 5 each, Dharmasala , Balachaur AWS, Hamirpur, Dharampur, Ropar, Baldwara, Pachhad, Chhachhrauli, Naraingarh, Anandpur Sahib, Derabassi (Basi), Naina Davi, Bhuntar AP, Mandi, Solan, Paonta, Saharanpur, Srinagar, Jagadhari, BanganaF, Nilokheri, Seo Bagh, Kukernag, Balachaur and Kumarsain 4 each, Nahan, BanganaR, Renuka / Dadhau, Baderwah, Pandoh, Bijnor, Manali, Una, Gurudaspur, Dhampur, Kotkhai, Baijnath, Bajaura AGRO, R L Bbmb, Srinagar AGRO AWS, Katra, Dadupur, Panchkula, Tajewala, Fatehgarh Sahib, Sirhind, Bharmaur, Dharmshala AWS, Rajouri, Morni, Dehra Gopipur, Jammu City, Narwana, Batote, Nagina, Barwala, Bajura AWS, Patiala Rev, Kheri, Malakpur, Raipur Rani, Bijahi, Amb, Jind, Rampur Bushar, Tehri CWC and Kangra AP 3 each, Rajpura, Anantnag, Mustafabad, Sarkaghat, Kotdwar, Barara ARG, Kathua, Shahpur Kandi, Tissa, Phangota, Ganaur, Kharkoda, Madhopur, Samrala, Pahalgam, Kupwara, Kalka, Sadhaura, Udhampur IAF, Ranjit Sagar Dam Site, Radaur, Uchana, Nancowry, Deoprayag, Ambala, Car Nicobar, Bilaspur, Mukerian, Car Nicobar IAF, Udaipur, Kaithal, Mansa, Nagrota Surian, Patiala, Saloni, Rohru, Pilukhera, Guler, Berthin AGRO, Dehra Dun, Tehri, Jammu IAF, Roorkee, Nakur, Ambala AWS, Patiala AWS, Tibri, Nurpur / Jassur and Gund 2 each, Quazigund, Ambala Rev, Baghpat, Nawanshahr, Budhana, Mussoorie, Assandh, Barkot, Laksar, Barara, Garhshankar, Baramulla AWS, Nazibabad, Long Islands, Sarahan, Anupshahr, Deoband, Hissar, Indri, Kalayat, Kurukshetra, Sangrur, Jubbal, Meerath, Mungeshpur AWS, Sonepat, Muzaffarnagar, Hardwar, Sambhal, Samba, Karnal, Hassanpur, Barnala, Kalpa and Ramnagar 1 each
8 Jan	Berthin AGRO 7, Arki and Naina Davi 6 each, Gohar, Sangraha and Bijahi 5 each, Banjar, Naraingarh, Shimla AP and Pachhad 4 each, Dharampur, Munsyari, Manali, Shimla, Udhampur IAF, Nahan, Jagadhari, Tehri CWC, Batote, Kasauli, Jhandutta, Solan, Rajgarh, Renuka / Dadhau, Dharmasala, Seo Bagh, Sundernagar, Mandi, Nazibabad, Ranikhet (G), Sunibhajji, Karnal, Champawat, Srinagar, Ambala, Sarahan, Barara ARG, Bilaspur, Mashobra AGRO and Tehri 3 each, Baheri, Sadhaura, Tajewala, Deoprayag, Kahu, Nilokheri, Jogindarnagar, Bisauli, Baldwara, Nainital, Nagrota Surian, Ranjit Sagar Dam Site, Kalka, Karnal Rev, Derabassi (Basi), Dharmshala AWS, Dharchula, Laksar, Assandh, Mukteswar, Nawabganj, Ukhimath, Chandigarh, Indri, Panchkula AWS, Janjehli, Phangota, Pandoh, Baramulla AWS, Katra, Bhuntar AP, Karsog, Haldwani, Gairsain, Kaithal, Radaur, Paonta, Kangra AP, Bhatwari, Ambala Rev, Barara, Saloni, Khadrala, Jakholi, Bajaura AGRO, Shahpur Kandi, Ghansali, Kotkhai, Palampur, Banihal and Jammu City 2 each, Madhopur, Dunda, Ambala AWS, Chhachhrauli, Mustafabad, Panipat, Baijnath, Bharmaur, Jubbal, Theog, Kumarsain, Dehra Gopipur, Rohru, Dwarhat, Gunnaur, Uttar Kashi, Pehowa, Didihat, Barthin, Pawayan, Pithoragarh, Purola, Morni, Raipur Rani, Kalpa, Chamba AWS, R L Bbmb, Malakpur, Phoolbagh, Pauri, Aghar, Almora, Una, Bhoranj, Kathua, Roorkee, Barwala, Dadupur, Gharaunda, Ujha Panipat AWS, Guler, Nurpur / Jassur, Karnaprayag, Uttar Kashi CWC, Keertinagar, Bareilly, Gund, Aonla, Banbasa, Shahbad, Sujanpur Tira, Jammu IAF, Nancowry, Bareilly Tehsil, Nadaun, Ghamroor, Garud, Lansdown, Panchkula, BanganaF, Ghumarwin, Joshimath, BanganaR, Nagina, Rampur Bushar, Kheri, Nawanshahr, Mehre (Barsar), Tissa, Baderwah, Car Nicobar, Safipur, Sahaswan, Barkot, Bapouli, Kalayat, Samalkha, Anandpur Sahib and Kukernag 1 each
9 Jan	Nancowry and Naina Davi 3 each, Bharmaur, Berthin AGRO and Bijahi 1 each
10 Jan	Katangi, Tilpara Barrage, Nancowry, Seoni and Seoni - AWS 2 each, Tundi, Patan, Manatu, Dumka, Daltonganj, Dumri, Chatra, Hunterganj, Jarmindi, Umaria, Umaria - AWS, Baderwah, Balaghat - AWS, Baramulla AWS, Chindwara, Chindwara - AWS, Goregaon, Latehar and Suri CWC 1 each
11 Jan	Minicoy 3, Anini AWS 2, Gohar, N. Lakhimpur, Bharmaur, Khadrala, Roing and Bhatwari 1 each

TABLE 4 (*Contd.*)

Date	Some representative amounts of rainfall in cm for January and February 2017 (1 cm and above)
12 Jan	Nancowry 1
13 Jan	Nil
14 Jan	Nil
15 Jan	Nil
16 Jan	Naina Davi 7, Banihal, Batote and Bharmaur 5 each, Kandaghat 4, Katra, Baderwah, Jhandutta, Ghumarwin and Jammu City 3 each, Quazigund, Sarkaghat, Manali, Dharmasala, Phangota, Kukernag, Chamba AWS, Palampur, Bhoranj, Banjar, Malakpur, Kotkhai, Kathua, Shalimar AGRO, Srinagar AGRO AWS, Udhampur IAF, Berthin AGRO, Jammu IAF, Udaipur, Pathankot, Gohar, Kheri, Khadrala, Samba, Baldwara, Nurpur / Jassur and Chhatrari 2 each, Aghar, Sundernagar, Saloni, Seo Bagh, Theog, Mandi, Sangraha, Awantipur IAF, Anantnag, Kapurtala, Madhopur, Kahu, Barthin, Mashobra AGRO, Jogindarnagar, Ranjit Sagar Dam Site, Dharampur, Sujanpur Tira, Kangra AP, Rohru, Bijahi, Taran Taran, Baijnath, Nagrota Surian, Mehre (Barsar), Anandpur Sahib, Nangal, Arki, Hamirpur, Keylong, Nadaun, Pachhad, Shimla, Kalpa, BanganaF, Kasauli, Sarahan, Amritsar IAF, Rajouri, BanganaR, Jallundur, Phillaur, Jubbal, Karsog, Kupwara, Mukerian and Srinagar 1 each
17 Jan	Naina Davi 4, Manali and Kheri 3 each, Kalpa and Udhampur IAF 2 each, Jogindarnagar, Ranjit Sagar Dam Site, Gohar, Awantipur IAF, Phangota, Purola, Tiuni, Baderwah, Khadrala, Shahpur Kandi, Bijahi, Bharmaur, Rohru, Pandoh, Madhopur, Ukhimath, Kotkhai, Kupwara, Malangpura AWS and Bhuntar AP 1 each
18 Jan	Nancowry 9, Quazigund 5, Awantipur IAF, Udhampur IAF, Baderwah and Banihal 3 each, Kukernag, Shalimar AGRO, Phangota, Anantnag, Batote, Pahalgam and Kheri 2 each, Car Nicobar, Srinagar, Srinagar IAF, Srinagar AGRO AWS, Bharmaur, Chamba AWS, Khadrala, Gulmarg, Keylong, Gund, Reckong Peo AWS and Rohru 1 each
19 Jan	Car Nicobar IAF 4, Car Nicobar 3, Hut Bay 2, Srinagar AGRO AWS and Gund 1 each
20 Jan	Nancowry and Car Nicobar IAF 9 each, Car Nicobar 8, Hut Bay 5
21 Jan	Sirkali 11, Puducherry 8, Nancowry and Anaikaranchatram (Kollid)) 6 each, Thiruthuraipoondi, Parangipettai, Pattukottai and Chidambaram AWS 5 each, K.M.Koil, Nagapattnam and Chidambaram 4 each, Madukkur, Vedaranniyam, Nannilam, Kodavasal, Kkl Surakudi Kvk, Sethiathope and Jayamkondam 3 each, Tiruvarur, Pandavaiyar Head, Adirampattinam, Karambakudi, Needamangalam, Kumbakonam, Mayiladuthurai, Valangaiman, Aduthurai AWS, Pamban, Mannargudi and Papanasam 2 each, Thiruvidaimaruthur, Vanur, Orthanad, Rameswaram, Alangudi, Arimalam, Neyveli AWS, Tiruvaiyaru, Panruti, Peravurani, Muthupet, Thanjavur, Thanjavur PTO, Trangambadi (Or)Tranqueb, Thirumanur, Papanasam, Arantangi, Srimushnam, Ulundurpet and Vallam 1 each
22 Jan	Papanasam and Kodavasal 11 each, Manamelkudi and Nannilam 10 each, Tirupuvanam, Karaikal and Adirampattinam 8 each, Jayamkondam, Devakottai, Kkl Surakudi Kvk and Muthupet 6 each, Pattukottai, Vedaranniyam, Thiruvidaimaruthur, Tiruvaiyaru, Madukkur, Madurai AP, Thirumanur, Aduthurai AWS, Pullambadi, Manimutharu u u, Kumbakonam, Arantangi and Pandavaiyar Head 5 each, Valangaiman, Tirumangalam, Karaikudi, Illayangudi, Tirukattupalli, Kodaikanal, Thiruthuraipoondi, Needamangalam, Tirupathur and Grand Anaicut 4 each, Tiruvadanai, Paramakudi, Ambasamudram, Sholavandan, Papanasam, R.S.Mangalam, Nagapattnam, Lalgudi, Tiruvarur, Samayapuram, MyladumparaAgri, Tondi, Orthanad, Thanjavur, Thanjavur PTO, Tirumayam, Karambakudi, Mayiladuthurai, Ariyalur, Mannargudi and Peraiyur 3 each, Trichy town, Pudukottai, Alangudi, Aruppukottai, Peravurani, Melur, Manamadurai, Sivaganga, Chatrapatti (Odanchatra), Keeranur, Cheranmahadevi, Trangambadi (Or)Tranqueb, Arimalam, Vedasandur, Usilampatti, Panchapatti, Mudukulatur, Chittampatti, Mettupatti, K.M.Koil, Rameswaram, Thiruchuzhi, Uthagamandalam AWS, Aryankavu, Pamban, Coonoor, Coonoor PTO, Kamudhi, Vallam, Illuppur, Anaikaranchatram (Kollid)) and Watrap 2 each, Kovilankulam, Madurai City, Madurai South, Vadipatti, Kamatchipuram, Ramanathapuram, Uttamapalayam, Chettikulam, Natham, Kadavur, Palani, Nanguneri, Perungalur, Dindigul, Tiruchirapalli AP, K Bridge, Karur, Sattur, Thuvakudi Imti, Dindigul ARG, Periyar, Sivakasi, Rasipuram, Car Nicobar, Fatehabad AWS, Kalugumalai, Kulithalai, Periyakulam, Kamudhi ARG, Pahalgam, Ayikudi, Marungapuri, Jubbal, Andipatti, Sirkali, Gund, Gudalur, Thenkasi, Car Nicobar IAF, Viralimalai, Gandarvakottai, Kodumudi, Kothagiri, Mayanur, Haripad, Erode, Kangeyam, Kovilpatti, Periyakulam AWS, Tiruchengode and Tiruppur 1 each
23 Jan	Car Nicobar IAF 5, Minicoy, Car Nicobar and Nancowry 2 each, Papanasam and Piravam 1 each
24 Jan	Nancowry, Hut Bay, Tissa and Gulmarg 3 each, Car Nicobar and Gund 2 each, Car Nicobar IAF, Pahalgam and Kupwara 1 each
25 Jan	Tissa and Gulmarg 9 each, Manali 6, Banihal 5, Quazigund, Batote and Kupwara 4 each, Keylong, Udaipur, Rajouri, Kukernag and Shalimar AGRO 3 each, Kalpa, Saloni, Baderwah, Pahalgam, Bharmaur and Srinagar 2 each, Srinagar IAF, Katra, Anantnag, Chhatrari, Gund, Reckong Peo AWS, Seo Bagh, Car Nicobar, Pathankot, Udhampur IAF, Dalhousi Alha AWS and Papanasam 1 each

TABLE 4 (*Contd.*)

Date	Some representative amounts of rainfall in cm for January and February 2017 (1 cm and above)
26 Jan	Banihal 14, Batote 13, Udaipur AP 12, Pahalgam, Udhampur IAF and Kukernag 11 each, Quazigund 9, Baderwah 8, Jammu IAF, Anantnag and Gulmarg 7 each, Naina Davi, Saloni, Mehre (Barsar) and Katra 6 each, Manali, Dharmasala, Samba, Jhandutta, Batala, Jammu City, Keylong and Shalimar AGRO 5 each, Baldwara, Kheri, Baijnath, Hamirpur, Srinagar IAF, Awantipur IAF, Banjar, Jogindarnagar, Aghar, Arki, Barthin, Berthin AGRO, Gohar, Dalhousi Alha AWS, Nadaun, R L Bbmb, Udaipur, Kathua, Bhuntar AP and Seo Bagh 4 each, Taran Taran, Kalpa, Pathankot, Anandpur Sahib, Sundernagar, Ropar, Palampur, Nangal, Bijahi, Rajouri, Kangra AP, Mashobra AGRO, Bharmaur, Sujanpur Tira, Kahu, Shimla, Bajaura AGRO, Dharampur, Bhoranj, Naraingarh, Madhopur, Patiala Rev, Kotkhai, Bawal, Mukerian, Balachaur AWS, Shahpur Kandi, Nurpur / Jassur, Sunibhajji, Shimla AP, Sangrur, Tissa, Ranjit Sagar Dam Site, Mandi, Kandaghat, Guler and Malakpur 3 each, Renuka / Dadhau, Sangraha, Sarkaghat, Kupwara, BanganaF, Gund, Kasauli, Rampur Bushar, Tiruvarur, Balachaur, Ajmer, Tohana, Fatehgarh Sahib, Raya, Sirhind, Pandoh, Solan, Bilaspur, Nagrota Surian, Chhatrari, Safidon, Samana, Tibri, Janjehli, Rajgarh, Srinagar, Samrala, Nahan, BanganaR, Bawal AWS, Hissar Rev, Reckong Peo AWS, Sarahan, Ambala, Ghamroor, Nabha, Nagapattnam, Ludhiana and Dharmshala AWS 2 each, Churu, Guhla, Morni, Raipur Rani, Amritsar IAF, Karsog, Tiuni, Barwala, Kaithal, Sadhaura, Amloh, Dasuya, Derabassi (Basi), Una, Hissar, Tajewala, Jodhpur AP, Ambala AWS, Mungeshpur AWS, Sports Complex AWS, Khadrala, Karnal, Patiala, Kumarsain, Moga, Dadupur, Kapurtala, Jubbal, Pachhad, Pilani, Udaipur, Phangota, Nilokheri, Radaur, Patiala AWS, Paonta, Narnaul, Ambala Rev, Kosli, Kurukshetra, Panchkula, Panipat, Rewari, Khanna, Theog, Farukhnagar, Fatehabad AWS, Kharkoda, Malerkotla, Chandigarh, Rajpura, Faridkot, Cheeka ARG, Mahendragarh, Mustafabad, Nangal Chaudhary, Tosham and Papanasam 1 each
27 Jan	Arki 15, Neyveli AWS and Guhla 10 each, Parangipettai and Ghumarwin 9 each, Naraingarh and Sethiathope 8 each, Thiruvidaimaruthur, Naina Davi, Kumbakonam, Udhampur IAF and Dharampur 7 each, Batote, Anaikaranchatram (Kollid)), Jhandutta, Virudachalam, Kheri, Kasauli, Berthin AGRO, Banihal and Rajouri 6 each, Budhana, Kahu, Aduthurai AWS, Kkl Surakudi Kvk, Baghpat, Radaur, Panipat, Chidambaram, Nilokheri, Sirkali, Chidambaram AWS, Samalkha, Assandh, Baderwah, Nakur, Farukhnagar, Ganaur, Kharkoda, Bharmaur, Pachhad and Palampur 5 each, Tibri, Katra, Kodavasal, Nannilam, Sonepat, Derabassi (Basi), Aghar, Ambala, Barthin, Datia, Datia - AWS, Gulmarg, Fatehgarh Sahib, Sirhind, Sujanpur Tira, Manali , Nuh, Balachaur AWS, Haldwani, Dabra, Pahalgam, Bhoranj, Delhi Ridge, Safipur, Sangrur, Jammu IAF and Gohad 4 each, Mayiladuthurai, N. Delhi (PLM), Ambala Rev, Jagadhari, Mustafabad, Najafgarh AWS, Madhopur, Nangal, Samana, Amb, Jafarpur AWS, Karera, Aya Nagar, Ayanagar AWS, Phangota, Patiala, Bahadurgarh, Bawal, Bawal AWS, Mungeshpur AWS, Sundernagar, Gohar, Kandaghat, Alipur (Jaura), Una, Dehra Gopipur, R L Bbmb, Nawanshahr, Nadaun, Kathua, Anupshahr, Ambala AWS, Bilaspur, Dalhousi Alha AWS, Quazigund, Lodi Road, Panchkula, Pitampura AWS, Narela, Patiala Rev, Ropar, Shimla AP, N.Delhi (SFD), Israna, Kaithal, Taoru, Balachaur, Karaikal, Jogindarnagar, Patiala AWS, Samrala, Jammu City, Malakpur, Akshardham AWS, Jatusana, Rohtak AWS, Guler, Nurpur / Jassur, Sarkaghat, Srimushnam, Sidhauli, Bisauli, Kairana, Julana, Kurukshetra, Morni, Narwana, Rewari, Saloni, Lahar, Tiruvaiyaru, Shahpur Kandi, Mehgaon, Raipur Rani, Adampur IAF, Phoolbagh, Bijahi, Mukerian, Ranjit Sagar Dam Site, Kangra AP, Nabha, Seo Bagh, Morena - AWS, Bukkapatna, Barwala, Kalka, Pehowa, Batala, Dharmshala AWS, Awantipur IAF, K.M.Koil, Shahabad, Kanpur AP, Ghamroor and Hoshiarpur 3 each, Mehre (Barsar), Chhibramau, Jalesar, Dadri, Pataudi, Uchana, Pathankot, Seodha (Seondha), Papanasam, Nighasan, Jalalabad, Baheri, BanganaR, Pattukottai, Agra, Bhuntar AP, Gwalior, Valangaiman, Hardoi Teh, Sikandarabad, Gurgaon AWS, Lodi Road AWS, Kapurtala, BanganaF, Papanasam, Peravurani, Dharmasala, Bajaura AGRO, Deoband, Jalaun, Siwani, Shivpuri, Bhind - AWS, Shivpuri - AWS, Kukernag, Kalpi Tehsil, Hissar, Gund, Harpur, Kasganj, Keylong, Solan, Jaipur AP, Amritsar IAF, Nagapattnam, Akbarpur Knp Dht, Bilgram, Bilari, Iglas, Barkot, Loharu, Punhana, Rohtak Rev, Jallundur, Nakodar, Nagrota Surian, Chittorgarh, Jayamkondam, Cheranmahadevi, Muhammadi, Sathanur Dam, Biswan, Dataganj, Mawana, Hissar AWS, Palwal, Sadhaura, Anandpur Sahib, Phillaur, Kalpa, Alwar, Ludhiana, Kupwara, Nainital, Sunam, Pilibhit Tehsil, Ghansali, Chhachhrauli, Gohana, Hassanpur, Sampla, Mandi, Baijnath, Hamirpur, Karhal, Etah, Gunnaur, Sahaswan, Mahendragarh, Tohana, Halwara, Karambakudi, Atrauli, Khair, Gairsain, Ballabgarh, Beri, Bhawanikhera, Dujana, Jhirka, Jind, Pilukhera, Pusa AWS, Shahbad, Sports Complex AWS, Amloh, Malerkotla, Sangraha, Shalimar AGRO, Sawai Madhopur and Udaipur 2 each, Bareilly Tehsil, Chhatrari, Amroha, Bharthana, Mukteswar, Tehri, Narnaul, Barara, Gurgaon Rev, Jhahhar, Kosli, Meham, Nilokheri ARG, Safidon, Bhainder, Sunibhajji, Pawayan, Shimla, Shikohabad, Kanpur Teh, Chhansa, Kanina, Raya, Ambah, Tozhudur, Uttar Kashi CWC, Dhuri, Jasrana, Ramnagar, Madukkur, Nahan, Uttar Kashi, Deoprayag, Bhiwani Rev, Nangal Chaudhary, Tehri CWC, Samba, Jakholi, Garud, Tiruvarur, Devakottai, Shahjahanpur T, Anantnag, Nawabganj, Dunda, Pauri, Dwarhat, Banbasa, Lansdown, Ellenabad, Faridabad, Khol, Narnaul Rev, Sahlawas, Sohana, Dasuya, Garhshankar, Khanna, Janjehli, Jubbal, Ketti, Shahjahapur, Srinagar, Pandavaiyar Head, Ariyalur, Muthupet, Kirawali, Purola, Gangolihat, Kalayat, Karsog, Rajgarh, Sarahan, Vedaranniyam, Dharmapuri, Thanjavur, Dharmapuri PTO, Thanjavur PTO, Thirumanur, Punganur, Srinagar, Tirukattupalli, Sargur, Churu, Bara Banki, Chamoli, Bhatwari, Ukhimath, Delhi University AWS, Hathin, Hodal, Kalanaur, Rania, Sirsa, Barnala, Mashobra AGRO, Reckong Peo AWS, G Bazar, Vallam, Ghaziabad, Ranikhet (G), Unnao Tehsil, Aonla, Champawat, Dadupur, Gharaunda, Jagraon, Sabalgarh, Sendurai, Uthagamandalam AWS, Basaralu, K G F AWS, Nawabganj Tehsil, Thiruthuraipoondi, Karnaprayag, C R Patna, Bhatinda, Ghatampur, Budaun, Dhampur, Khairagar, Munsyari, Dubwali, Talwandi Sabo, Theog, Naduvattam, Rudraprayag, Pilani and Bindki 1 each
28 Jan	Pamban 13, Rameswaram 11, Kancheepuram 10, Coonoor and Coonoor PTO 8 each, Kaveripakkam, Somwarpet, Virudachalam, Madapura, Jayamkondam, Kushalnagar and Sendurai 7 each, Ponnampet PWD, Thottambedu and Kozha 6 each, Arani, Cuddalore, Piravam, Kallakkurichchi, Ulundurpet, Devakottai, Thirukoilur ARG, R.K.Pet, Bhagamandala and Srikalahasti 5 each, Muhammadi, Napoklu, Tirukoilur, Ramanathapuram, Sethiathope, Vanur, Wallajah, Polur, Neyveli AWS, Tindivanam, Tiruttani, Irikkur, Nighasan and Vellore 4 each, Cheyyar, Panruti, Sankarapuram, Sathanur Dam, Arakonam, Medikeri, Srimushnam, Vandavasi, Vilupuram, Kurudamannil, Mudukulatur, Arkalgud, Karaikal, Ambalavayal, Sargur, Kumarakom, Tirupuvanam, Baheri, Kumbakonam, Maduranthagam, Tozhudur, Gingee, Palasamudram, Kodavasal, Puttur HMS, Punganur, Kothagiri, Rayalpadu, Venkatagiri, Anaikaranchatram (Kollid)), Sivagiri and Hosdurg 3 each, Paramakudi, Sathyamangalam, Sholingur, Kadavur, Kaiserganj, Parangipettai,

TABLE 4 (*Contd.*)

Date	Some representative amounts of rainfall in cm for January and February 2017 (1 cm and above)
	Thiruchuzhi, Haraiya, Mettupalayam, Peravurani, Phoolbagh, Gyanpur, Papanasam, R.S.Mangalam, Thiruvidaimaruthur, Ariyalur, Sivakasi, Tiruvarur, Virajpet, Karaikudi, Puducherry, Sandila, Aduthurai AWS, Sirkali, Pilibhit Tehsil, Valangaiman, Pandavaiyar Head, Bahraich, Mandapalle, K.M.Koil, Needamangalam, Virudhunagar, Palani, Vilathikulam, Kamudhi, Nagapattnam, Cheyyur, Mayiladuthurai, Illayangudi, Nannilam, Gairsain, Virinjipuram AWS and Mavelikara 2 each, Thirumanur, Kottayam, Mawana, Haldwani, Dalhousi Alha AWS, Illuppur, Manamadurai, Kamudhi ARG, Sultanpur, Sultanpur, Vythiri, Basti, Chidambaram, K Bridge, Karambakudi, Vallam, Kadaladi, Deogaon Lalganj, Muthupet, Tirupathur, Mariahu, Perambalur, Sivaganga, Tiruvaiyaru, Konanur, Tiptur, Sabour, Pattukottai, Bikapur, Palayamkottai, Nilakottai, Konni, Mankapur, Harpur, Andipatti, Ketti, Papanasam, Satankulam, Thiruvalangadu, Faizabad, Arantangi, Palamaner, Vedaranniyam, Ghosi, Tarabganj, Angadipuram, Kodungallur, Chengam, Fursatganj, Atmakur, Tiruvannamalai, Alappuzha, Melabazar / Matunga, Gudur, Tondi, Melalathur, Thanjavur, Srivaikuntam, Thanjavur PTO, Tiruchendur, Venbavur, Kollam Rly, Mattanur, Rapur, Satyavedu, Chittampatti, Madukkur, Drf, Sambhal, Chittoor, Kodur, Ayikudi, Marungapuri, Bansgaon, Maharajganj, Salempur, Pullampeta, Thiruthuraipoondi, Adirampattinam and Sulya 1 each
29 Jan	Papanasam 9, Mavelikara 5, Arani 4, Kayamkulam, Dindigul ARG, Periyakulam, Vilathikulam, Aryankavu and Harur 3 each, Satankulam, Ambasamudram, Alangayam, Coonoor, Coonoor PTO, Manimutharu u u, Omalur, Alappuzha, Mayiladuthurai, Ayikudi, Periyanaickenpalayam, Sivagiri, Kovai / Koyamutthur AWS, Kayamkulam Agri, Sendurai, Kottayam, Shalimar AGRO, Thenkasi, Kovai / Koyamutthur AP, AP Peelamedu, K Bridge, Kurudamannil, Srivaikuntam, Vythiri, Attur and Sathanur Dam 2 each, Wallajah, Kodur, Vedasandur, Viralimalai, Natham, Mancompu, Vadakara, Kodaikanal, Srinagar, Kadavur, Aduthurai AWS, Tiruppur, Trangambadi (Or)Tranqueb, Srinagar IAF, Dindigul, Mettur, Sirkali, Thiruvananthapuram AP, Radhapuram , Sankarankoil, Kodavasal, Manapparai, Yercaud, Illuppur, Kudulu, Kalugumalai, Mayanur, Periyakulam AWS, Tiruvannamalai, Gulmarg, Kupwara, Awantipur IAF, Perundurai, Thuraiyur, Thuvakudi Imti, Thalasserry, Watrap, Ketti, Perambalur, Shencottah, Quilandi, Polur, Kamatchipuram, Tirupattur, Bodinaickanur, Melalathur, Kumarakom, Tinsukia, Annur, Kothagiri, Palani, Sankarapuram, Uttamapalayam, Pookot, Pahalgam, Madapura, Thiruvananthapuram and Chengam 1 each
30 Jan	Tirumayam and Papanasam 3 each, Tiruchendur 2, Mayiladuthurai, Pudukottai, Thenkasi, Arimalam, Kayamkulam Agri, Vaikom, Kayamkulam, Gandarvakottai, Pahalgam, Nannilam, Tirupuvanam, Tirupathur, Shalimar AGRO and Manimutharu u u 1 each
31 Jan	Saloni 3, Manali and Dalhousi Alha AWS 2 each, Keylong, Baderwah, Chamba AWS, Kathua, Kheri, Jammu IAF and Kupwara 1each
1 Feb	Nil
2 Feb	Nil
3 Feb	Nil
4 Feb	Nil
5 Feb	Quazigund 8, Katra 7, Srinagar and Banihal 6 each, Udhampur IAF, Batote and Pahalgam 5 each, Kukernag and Baderwah 4 each, Jammu City, Jammu IAF, Kupwara and Gulmarg 3 each, Srinagar IAF and Nahan 2 each, Manali, Kalpa, Dharmasala and Tehri 1 each
6 Feb	Udhampur IAF 8, Batote 7, Banihal 5, Kukernag and Quazigund 4 each, Baderwah, Pahalgam and Kathua 3 each, Manali, Chamoli, Kalpa, Munsyari, Bhuntar AP and Hoshiarpur 2 each, Tehri, Katra, Joshimath, Srinagar IAF, Dharmasala, Kupwara and Sundernagar 1 each
7 Feb	Nil
8 Feb	Nil
9 Feb	Nil
10 Feb	Nil
11 Feb	Nil
12 Feb	Pachmarhi 2, Jabalpur, Sagar, Narsingpur, Umaria, Damoh and Ambikapur 1 each
13 Feb	Nil
14 Feb	Vedaranniyam and Adirampattinam 4 each

TABLE 4 (*Contd.*)

Date	Some representative amounts of rainfall in cm for January and February 2017 (1 cm and above)
15 Feb	Nil
16 Feb	Nancowry 2, Kupwara 1
17 Feb	Nil
18 Feb	Kupwara 2
19 Feb	Kupwara 4, Banihal 2, Srinagar, Pahalgam, Gulmarg and Batote 1 each
20 Feb	Banihal 4, Pahalgam 3, Batote, Kukernag, Kupwara, Manali, Gulmarg and Baderwah 1 each
21 Feb	Majbhat 7, Cherrapunji, Tezpur, Baderwah and Manali 5 each, Golaghat, Kukernag and Pahalgam 4 each, Banihal, N. Lakhimpur and Dibrugarh AP 3 each, Quazigund, Silchar, Tangla, Batote, Passighat, Udhampur IAF, Bhuntar AP, Jammu City and Dharchula 2 each, Haflong, Dharmasala, Imphal, Tezu, Chamoli, Pathankot, Sundernagar, Shimla, Joshimath and Kalpa 1each
22 Feb	Cherrapunji 18, Tezu and Silchar 4 each, Tangla and Dibrugarh AP 3 each, Sundernagar, Goalpara, Mandi, Dharmasala, Bhuntar AP and Majbhat 2 each, Baderwah, Nainital, N. Lakhimpur, Golaghat, Manali, Passighat, Tezpur, Haflong, Guwahati AP, Kupwara, Gulmarg and Munsyari 1 each
23 Feb	Cherrapunji 25, Dibrugarh AP 6, Haflong 5, Agartala AP, Lumding and Tezu 3 each, Majbhat 2, Tezpur, Passighat, Baghdogra AP and N. Lakhimpur 1 each
24 Feb	Aizawal 2, Passighat 1
25 Feb	Nil
26 Feb	Nil
27 Feb	Gangtok 1
28 Feb	Nancowry 1

During the month, rainfall activity over the country as a whole was very subdued. Except for some subdivisions of eastern/ northeastern region, northern regions and central India which received *excess*/ *normal* rainfall, most parts of the country received *deficient*/ *large deficient*/ *no rainfall*.

The passage of active WDs caused widespread to fairly widespread rain/ snowfall activity over western Himalayan region, with *isolated heavy* rainfall over J&K and *isolated* to *scattered* rain/ thundershower activity over adjoining plains of NW from 5-7 February in the first week of February. The wind confluence that took place over Madhya Pradesh in the second week caused *widespread* rainfall over east Madhya Pradesh and *isolated* rainfall over west Madhya Pradesh. The upper level divergence in the zonal flow pattern over NE India along with moisture incursion in the lower levels from Bay of Bengal caused *widespread* rainfall with *isolated* hailstorms over NE states from 20-22 February. The NE and northern regions of J & K and HP region continued to get *isolated* and *scattered* rainfall in the last week of February too.

3.2.4. *Temperature*

The maximum temperature for the month of February for most sub-divisions was *normal* to *above normal* for most part of the month. Jammu & Kashmir experienced *below normal* maximum temperatures in the first week. In the third week the high Index phase of mid latitude circulation regime and subdued tropical easterly waves over the Indian seas caused the remaining parts of the mainland, outside western Himalayan region and northeast India to be less humid and devoid of clouds so the maximum temperatures showed significant rise over

the northern regions, plains of North west India and interior parts of south peninsula that also showed *markedly above normal* temperatures.

The minimum temperature was also *normal* to *above normal* over most of the sub-divisions except in the third week when *appreciably* to *markedly above normal* temperatures were experienced in the northern, north western and Central India.

The lowest minimum temperature reported during the week over the plains had been 3.3° C at Ganganagar (West Rajasthan) on 11 February.

Cold wave conditions prevailed at isolated places over east Madhya Pradesh on 25th February. *Heat wave* conditions prevailed at a few places over Konkan on 25th and at *isolated* places over coastal areas of Saurashtra and Konkan on 26th, over coastal areas of south Gujarat on 27th and over coastal areas of Saurashtra and Konkan on 28th February.

3.2.5. *Disastrous weather events and damage*

Due to *dense* fog, six persons died and a dozen were critically hurt in different road accidents in Jewar and Dankaur areas, Uttar Pradesh (2nd February). Due to multiple landslides/ snowfall Jammu Srinagar National highway closed for the fourth consecutive day.

Appendix

Definitions of the terms given in '*Italics*'

Snowfall

Light Snowfall - 10.4 cm or less

Moderate Snowfall - 10.5 to 64.4 cm

Heavy - 64.5 cm to 115.5 cm

Very heavy - 115.6 to 204.4 cm.

Extremely Heavy - ≥ 204.5 cm

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 cm

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 from – 60 % or less

No rain (NR) - –100%

Temperatures

Cold Wave - [As per the criteria with effect from 1st January, 2016]

It should be based on the actual minimum temperature of a station.

Cold Wave is considered when minimum temperature of a station is 10 °C or less for plains and 0 °C or less for Hilly regions.

Based on Departure

Cold Wave - Negative Departure from normal is 4.5 °C to 6.4 °C

Severe Cold Wave - Negative Departure from normal is more than 6.4 °C

(a) *Based on Actual Minimum Temperature (For plain stations only)*

Cold Wave - When minimum temperature is ≤ 04 °C

Severe Cold Wave - When minimum temperature is ≤ 02 °C

(b) *Cold Day*

It is considered when minimum temperature is 10 °C or less for plains and 0 °C or less for Hilly regions

Cold day - Maximum Temperature Departure is -4.5 °C to -6.4 °C

Severe Cold day - Maximum Temperature Departure is < -6.4 °C

Cold Wave conditions for coastal stations

When minimum temperature departure is -4.5 °C or less over a station, "Cold Wave" may be described if the minimum temperature is 15 °C or less.

Cold day/cold wave or heat wave/warm night should be described, if conditions are satisfied simultaneously.

Markedly below normal	-	departure of minimum temperature from normal is from –5 °C or less.
Appreciably below normal	-	departure of minimum temperature from normal is from –3.1 °C to –5 °C.
Below normal	-	departure from normal is –1.6 °C to –3.0 °C.
Normal	-	departure from normal is -1.5 °C to +1.5 °C.
Markedly above normal	-	departure of minimum temperature from normal is + 5 °C or more.
Appreciably above normal	-	departure of minimum temperature from normal is from +3.1 °C to +5 °C.
Above normal	-	departure of minimum temperature from normal is + 1.6 °C to 3.0° C.

Fog

Moderate Fog	-	When the visibility is between 200 – 500 m
Fog	-	When the visibility is between 50 – 200 m
Very Dense Fog	-	When the visibility is between < 50 m