

Weather

WINTER SEASON (JANUARY & FEBRUARY 1987)*

1. Introduction

During the winter season the meteorological sub-divisions in India, which receive more than 10 cm of rainfall are Andaman & Nicobar Islands, Arunachal Pradesh, hills of west Uttar Pradesh, Himachal Pradesh and Jammu & Kashmir. The normal rainfall during the season for the plains of the north India, east Madhya Pradesh, Vidarbha, Tamil Nadu and Kerala ranges between 3 and 6 cm. The other parts of the country receive even smaller amount of rainfall.

For classification of rainfall two norms have been adopted, one for describing the seasonal and the other for describing the monthly rainfall. This is because the limits for describing normal rainfall are generally decided on the basis of the variability or standard deviation of the rainfall. As the period increases, the standard deviation decreases and *vice-versa*. Thus, in the case of seasonal rainfall, where the period is larger, the limits of ± 10 per cent departure from normal has been adopted for defining normal rainfall, where as in describing monthly rainfall the limits of ± 19 per cent departure from normal has been adopted for defining the same. The other norms adopted for the monthly rainfall are, excess, +20 per cent and above; deficient, -20 to -59 per cent and scanty -60 per cent or less.

2. Chief features

(i) Development of a severe cyclonic storm with core of hurricane winds in the Bay of Bengal.

(ii) Cold wave conditions in Jammu & Kashmir.

(iii) Snowfall over Jammu & Kashmir and Himachal Pradesh.

(iv) The seasonal rainfall (Fig. 1) was excess, largely over east Rajasthan, west Madhya Pradesh and Marathwada; moderately over Assam & Meghalaya, Madhya Maharashtra and Vidarbha and slightly over Haryana, Punjab, east Madhya Pradesh and Telangana. It was normal over Jammu & Kashmir and coastal Andhra Pradesh. It was deficient, slightly over hills of west Uttar Pradesh, Himachal Pradesh and west Rajasthan; moderately over Andaman & Nicobar Islands, Nagaland, Manipur, Mizoram & Tripura, Sub-Himalayan West Bengal & Sikkim, plains of Uttar Pradesh and north interior Karnataka and largely over the

rest of the country outside Saurashtra & Kutch and coastal Karnataka, where there was no rain during the season.

3. January

3.1. Weather and associated synoptic features

The western disturbance, which lay over Himachal Pradesh and adjoining Jammu & Kashmir on the last day of the previous month, moved away eastwards across Western Himalayas by 1st of this month. Eight more western disturbances moved away across Western Himalayas and neighbourhood during the course of this month. The ninth western disturbance of the month lay over Jammu & Kashmir and neighbourhood on 31st.

Besides those western disturbances, which primarily affected extreme north of India, several other synoptic features developed over the Indian sub-continent and the adjoining sea areas, one of them a cyclonic storm (track is given in Fig. 2) during this month. They are listed in Table 1.

The western disturbance caused two spells of snowfall over Himachal Pradesh and Jammu & Kashmir. The first spell of snowfall over those sub-divisions occurred between 5th and 7th. The second spell of snowfall occurred over Jammu & Kashmir on 13th and 14th and over Himachal Pradesh on 17th and 18th. Besides the snowfall, rain or thundershowers were generally widespread on 1 day each and scattered or isolated on 2 days each over these sub-divisions between 5th and 18th. During the period from 5th to 20th rain or thundershowers were generally widespread on 1 to 2 days and scattered or isolated on 5 to 9 days in west Uttar Pradesh, Punjab, Rajasthan and Madhya Pradesh. They were generally widespread in Vidarbha on 11th, in Marathwada on 23rd and in Andaman & Nicobar Islands on 29th. They were also scattered or isolated on 13 days in Andaman & Nicobar Islands during the month and were so on 4 to 7 days in Madhya Maharashtra, Vidarbha, coastal Andhra Pradesh and Tamil Nadu and on 1 to 3 days in Marathwada, Telangana, Rayalaseema, interior Karnataka and Kerala between 9th and 24th. Assam & adjacent States, West Bengal & Sikkim, Orissa, Bihar plains and east Uttar Pradesh, experienced thundershower activities on 1 to 3 days during the first fortnight of the month.

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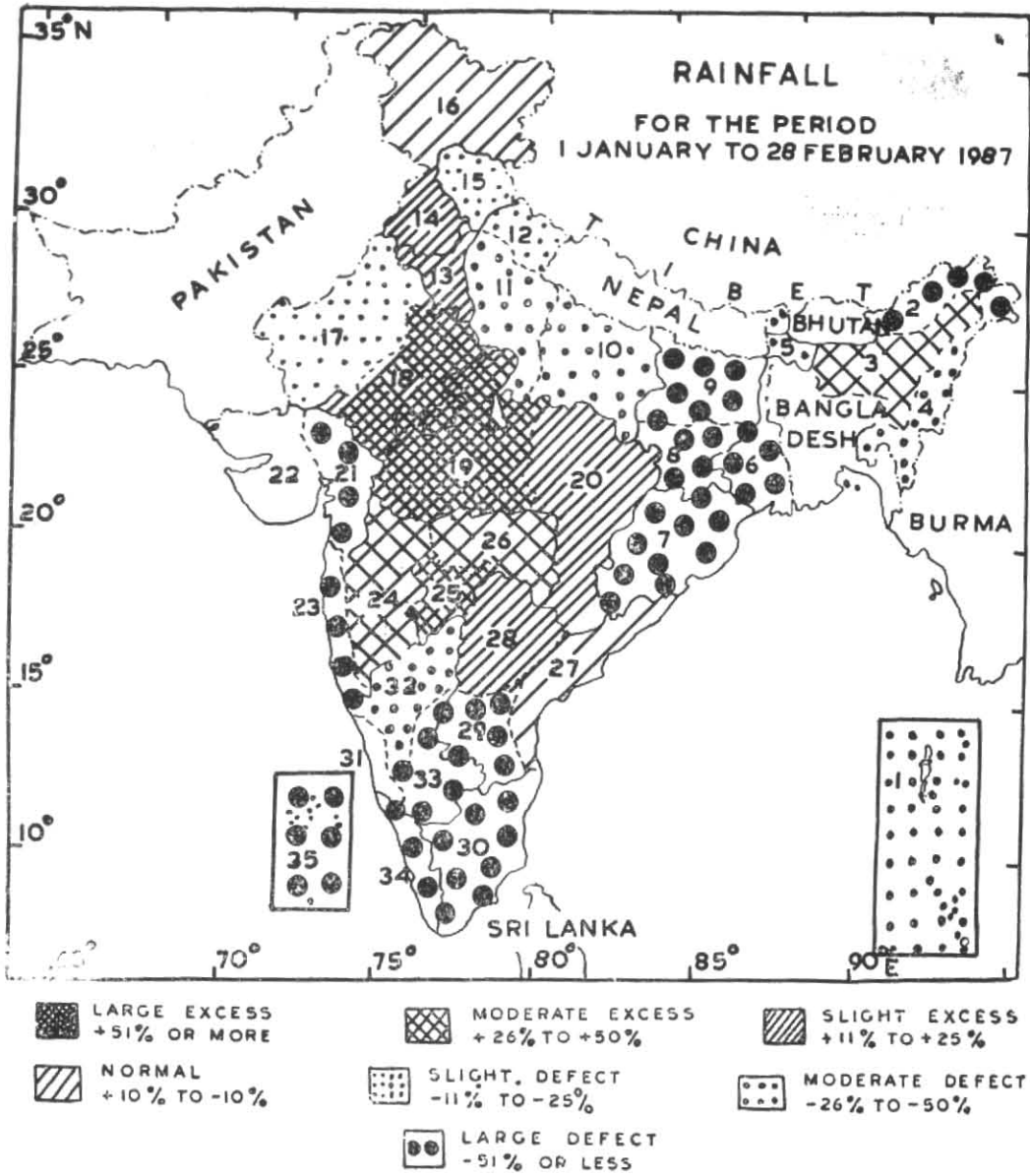


Fig. 1. Rainfall and its departure from normal for the period 1 January to 28 February 1987

TABLE 1
Details of synoptic features during January, 1987

Period	Place of first location	Track followed	Place of dissipation	Remarks	Period	Place of first location	Track followed	Place of dissipation	Remarks
(1) Cyclonic storm					(5) Cyclonic circulation in lower levels				
30th-31st*	SE Bay	Northwest-erly	—	*Lay as a cyclonic storm on 31st evening near 7.5°N, 86.5°E	(i) 12th-16th	Konkan & Goa and neighbourhood	Easterly	North Madhya Maharashtra and neighbourhood	
(2) Cyclonic circulations in lower tropospheric levels					(ii) 15th-17th	Northeast Arabian Sea off Gujarat coast	North-easterly	Merged with the western disturbance over Punjab and adjoining Himachal Pradesh	
(i) 2nd-5th	Sri Lanka and neighbourhood	Westerly	Maldives		(6) Troughs in westerlies in lower levels				
(ii) 6th-8th	Southwest Bay off Sri Lanka	Do.	Sri Lanka and neighbourhood		18th-20th	Uttar Pradesh/northwest Madhya Pradesh to Saurashtra	Quasi-stationary	<i>in situ</i>	
(3) Cyclonic circulation in lower & mid Trop. levels					(7) Troughs in mid and upper trop. westerlies				
7th-13th	South Pakistan and adjoining west Rajasthan	Easterly	Northeast Madhya Pradesh and adjoining Bihar and east Uttar Pradesh		26th-29th	Tibet to southeast Madhya Pradesh	Easterly	Moved away eastwards	
(4) Cyclonic circulation in lower trop. levels					(8) Troughs in easterlies in lower levels				
(i) 8th-10th	Bihar and neighbourhood	Easterly	Moved away eastwards across Nagaland, Manipur, Mizoram & Tripura		(i) 1st-5th	Andaman Sea	Westerly	Southwest Bay off Sri Lanka coast	
(ii) 8th-10th	North Madhya Maharashtra and neighbourhood	Do.	Marathwada and neighbourhood		(ii) 12th-15th	Southwest and adjoining west central Bay off south Andhra-Tamil Nadu coast	Do.	Southeast Arabian Sea off Kerala coast	
(iii) 9th-12th	South Gujarat and neighbourhood	Do.	Vidarbha and neighbourhood		(9) Troughs in easterlies in lower trop. levels				
					20th-23rd	Southeast Arabian Sea to Andaman Sea	Quasi-stationary	<i>in situ</i>	

3.2. Rainfall

It was excess in Rajasthan, west Madhya Pradesh, Marathwada, Vidarbha, coastal Andhra Pradesh, Telangana and north interior Karnataka; normal in Haryana, Punjab, Himachal Pradesh, east Madhya Pradesh and Madhya Maharashtra; deficient in Andaman & Nicobar Islands, Assam & Meghalaya, Nagaland, Manipur, Mizoram & Tripura, Orissa, Uttar Pradesh, Jammu & Kashmir and Rayalseema; scanty in Arunachal Pradesh, West Bengal & Sikkim, Bihar, Gujarat region, Tamil Nadu, south interior Karnataka, Kerala and Lakshadweep. There was no rain in Saurashtra & Kutch, Konkan & Goa and coastal Karnataka.

The significant amounts (cm) of rainfall were :

- 11th: Rajgarh 6, Tikamgarh 4, Adilabad, Banda, Bhopal, Chandrapur, Damoh, Mahoroni and Ujjain 3 each
- 12th: Parvathipuram 10, Eluru & Kondumur 7 each, Palakonda 6, Nagapattinam 5, Gopalpur, Karimnagar, Puri & Sironcha 4 each
- 13th: Mukteshwar & Ongole 3 each
- 14th: Dharmsala 9, Bhadarwah 6, Barnala, Betul, Coonoor, Kandaghat & Sundernagar 4 each
- 15th; Pendra 3

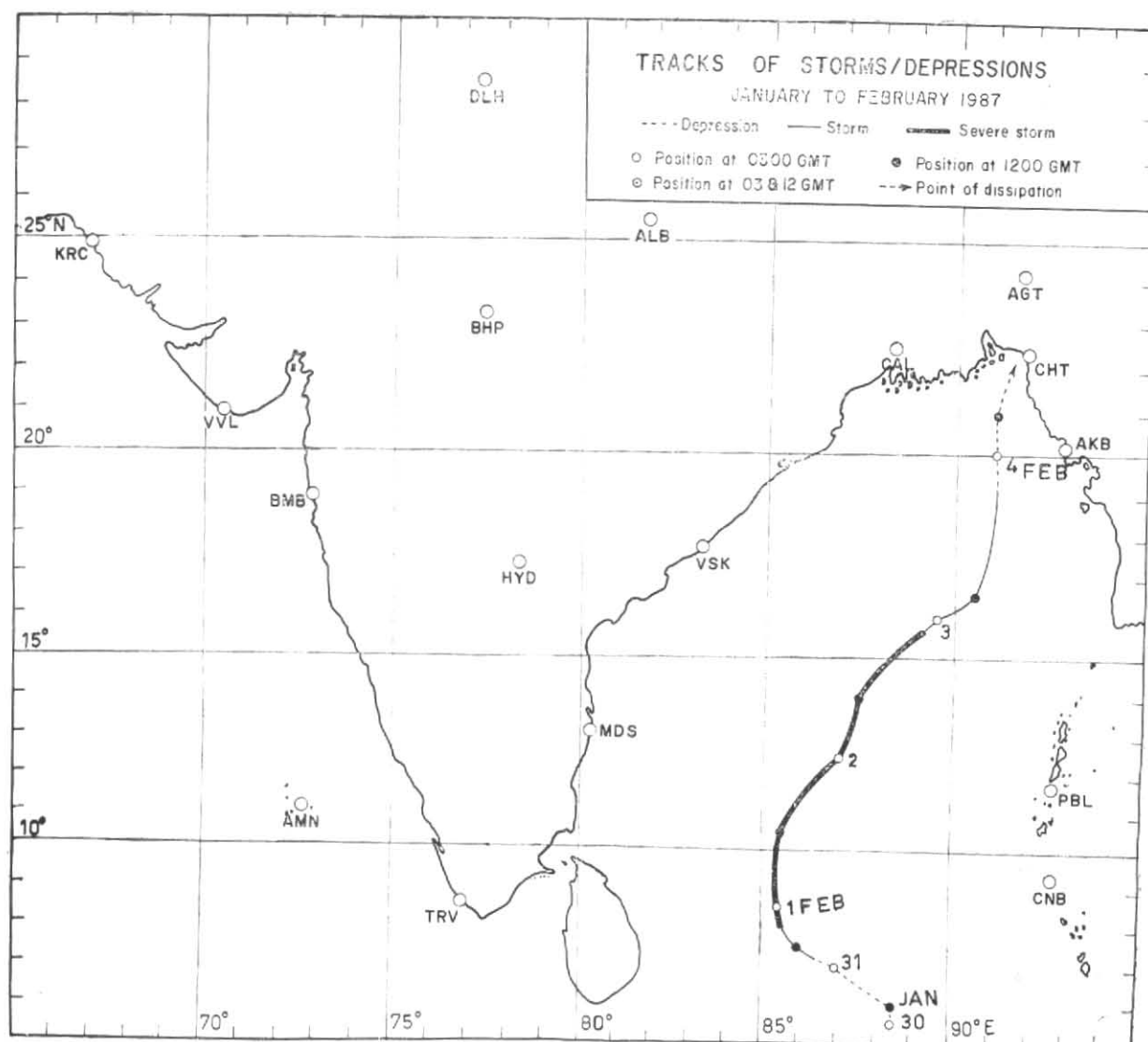


Fig. 2. Tracks of storms/depressions during January and February 1987

17th: Bijnore 8, Jogindernagar & Mana, 7 each, Bhiwani, Dalhousie & Joshimath 5 each, Una 4, Fazilka, Hissar, Kasauli, Ludhiana, Munsyari & Muzaffarnagar 3 each

18th: Kasauli 6, Dharmpur, Ghumarwin, Kandaghat & Solan 5 each, Bilaspur, Mandi, & Sundernagar 4 each, Bareilly & Malari 3 each

23rd: Jintoor 8, Parbhani 3

3.3. Disastrous weather events and damages

According to press reports 20 people died in Uttar Pradesh due to cold. Air traffic in Kashmir valley was disrupted on a couple of days due to snowfall during the first week of the month. Hailstorms on 10th and 11th of the month affected several villages in Sehore, Ujjain, Ratlam, Shajapur and Dewas districts of Madhya Pradesh damaging considerable amount of rabi crops.

3.4. Temperature

Moderate cold wave conditions prevailed over Kashmir on 2nd and 3rd. The night temperatures

were mostly below normal in Arunachal Pradesh Assam & Maghalaya, Gangetic West Bengal, Orissa, Bihar, Punjab, Madhya Pradesh, Vidarbha, Telangana and north Interior Karnataka being appreciably so on a couple of days in Orissa, Bihar, Plateau, Madhya Pradesh, Telangana in the first week. During the last 10 days of the month the night temperatures were also mostly below normal in Orissa, Bihar, plains of Uttar Pradesh, Punjab, Jammu & Kashmir, east Rajasthan Madhya Pradesh and Marathwada being appreciably below normal on a couple of days in Bihar, east Uttar Pradesh, Jammu & Kashmir, Madhya Pradesh and Marathwada. Night temperatures were -7°C to -10°C below normal in Dhanbad and Gwalior on 1st, in Dhanbad and Ramagundam on 3rd, in Varanasi and Raichur, on 5th, Shimla on 17th, Abu on 18th and 19th and Gangtok on 22nd. The night temperature was generally above to appreciably above normal in Gangetic West Bengal, Orissa, Bihar plains, Haryana & Punjab, Rajasthan and Madhya Pradesh between 8th and 20th and was so in Maharashtra and Andhra Pradesh between 9th and 25th.

TABLE 2
Details of synoptic features during February 1987

Period	Place of first location	Track followed	Place of dissipation	Remarks	Period	Place of first location	Track followed	Place of dissipation	Remarks
(1) Severe cyclonic storm with core of hurricane winds					(8) Lower trop. levels				
1st-5th evening	Last month's C.S. became S.C.S. on 1st morning centred near 9°N, 85°5'E	North/north-easterly	North Bay†	†The remnant became unimportant over Bangladesh on 6th	13th-19th evening	Southwest Rajasthan adjoining Pakistan	Easterly	Sub-Himalayan West Bengal & Sikkim and neighbourhood	
(2) Cyclonic circulation in lower trop. levels					(9) Lower levels				
31-Jan-4 Feb	West Uttar Pradesh and neighbourhood	Easterly	Bihar plains		18th-21st evening	West Rajasthan	Southeast-erly	Southeast Rajasthan and neighbourhood	
(3) Cyclonic circulation lower and mid trop levels					(10) Lower trop. levels				
1st-4th	Punjab and neighbourhood	Easterly	Haryana and adjoining west Uttar Pradesh		21st-22nd	Tamil Nadu and neighbourhood		<i>in situ</i>	
(4) Cyclonic circulation in lower trop. levels					(11) Lower trop. levels¹				
(i) 4th-8th	Southwest Bay	Westerly	Southeast Arabian Sea and adjoining north Kerala		(i) 23rd-25th evening	West Rajasthan and neighbourhood	Northerly	Merged with the western disturbance Jammu & Kashmir, Punjab and neighbourhood	
(ii) 4th-6th	Southeast Arabian Sea	Do.	Southeast Arabian Sea, west of Lakshadweep		(ii) 25th-26th evening	Haryana and neighbourhood	Easterly	West Uttar Pradesh and neighbourhood	
(5) Cyclonic circulation in mid trop. levels					(12) Troughs in mid and upper trop. westerlies				
5th-7th evening	East central Arabian Sea off Maharashtra coast	Easterly	South Madhya Maharashtra		(i) 7th-12th	Roughly along Long. 60°E north of Lat. 20°N	Easterly	Moved away eastwards across north India	
(6) Cyclonic circulation in lower trop. levels					(ii) 13th-17th evening	Russian-Turkistan to south Pakistan	Quasi-stationary	<i>in situ</i> }	
11th-17th	Southwest Bay off Sri Lanka coast	Northerly	Southwest and adjoining west central Bay off north Tamil Nadu-south Andhra coast		(iii) 27th-28th	North Rajasthan and neighbourhood	Quasi-stationary	Punjab and neighbourhood	
(7) Lower and mid trop. levels									
12th-15th	Lakshadweep and adjoining southeast Arabian Sea	Northerly	East central Arabian Sea off Karnataka-Goa-south Maharashtra coast						

4. February

4.1. Weather and associated synoptic features

The last western disturbance of the previous month moved away eastwards across Western Himalayas on 2nd. Besides that eight more western disturbances affected Western Himalayas and neighbourhood during the month. Also over the Peninsula wind discontinuity/trough at 0.9 km a.s.l. was observed in the second fortnight of the month.

The other synoptic features, which were over the Indian sub-continent and neighbouring seas during February, are listed above in Table 2.

The western disturbances caused three spells of snowfall over the extreme north India. In the first spell, it was fairly widespread over Jammu & Kashmir on 9th. The second spell occurred between 15th and 18th when both Himachal Pradesh and Jammu & Kashmir experienced generally widespread snowfall for three days each. During the third spell, the snowfall

was widespread over Jammu & Kashmir on 24th and 25th and over Himachal Pradesh on 25th. Rain or thundershowers were generally widespread over Andaman & Nicobar Islands, Assam, Meghalaya & Nagaland, Manipur, Mizoram & Tripura on 5th and in Arunachal Pradesh on 6th. They were so on 1 to 2 days in Arunachal Pradesh, hills of west Uttar Pradesh, Haryana and Punjab between 16th and 18th. Another spells of thundershowers activity took place between 21st and 25th causing generally widespread rain on 1 to 2 days over Haryana, Punjab, east Madhya Pradesh Marathwada and Vidarbha. The thundershower activity, thereafter, shifted over Arunachal Pradesh, Sub-Himalayan West Bengal & Sikkim, Bihar Plateau and Jammu & Kashmir during the last three days of the month causing generally widespread rain for 1 or 2 days over those sub-divisions. Besides that, scattered or isolated rain or thundershowers occurred on 8 to 13 days in Assam & Meghalaya, Haryana, Himachal Pradesh and Madhya Pradesh and on 1 to 7 days over the rest of the country during the month outside Gujarat, Konkan & Goa, coastal Andhra Pradesh, Rayalaseema, coastal and south interior Karnataka, where weather was mainly dry.

4.2. Rainfall during February

It was excess in Assam & Meghalaya, Haryana Punjab, Jammu & Kashmir, Madhya Pradesh, Madhya Maharashtra, Marathwada and Vidarbha; normal in Andaman & Nicobar Islands, hills of west Uttar Pradesh and east Rajasthan, deficient in Arunachal Pradesh, Nagaland, Manipur Mizoram, & Tripura, Sub-Himalayan West Bengal & Sikkim, Bihar Plateau, plain of Uttar Pradesh and Himachal Pradesh and scanty in Gangetic West Bengal, Orissa, Bihar Plains, west Rajasthan, Gujarat region, Konkan & Goa, Telangana, Tamil Nadu, Kerala and Lakshadweep. There was no rain over Saurashtra & Kutch, coastal Andhra Pradesh, Rayalaseema and Karnataka.

The significant amounts (cm) of rainfall were :

- 2nd: Long Island 3, Hut Bay 2
- 4th: Sandheads 3
- 5th: Imphal AP 3, Aijal, Chaparmukh, Chunnar, Gauhati AP, Port Blair & Tezpur 2 each,
- 9th: Tirsa 3, Banihal, Bhadarwah, Chamba & Kupwara 2 each
- 15th: Bhadarwah 2
- 16th: Mana 10, Bhuntar AP, Jagadhari & Malari 5 each, Ambala AP, Batote, Bhadarwah, Joshimath & Roorkee 4 each, Banihal, Bilaspur,

Dalhousie, Manali, Suni & Una 3 each, Damoh 2

- 17th: Gulha 8, Mandla 6, Dalhousie 5, Dharmpur & Kasauli 4 each, Ambala, Jogindernagar & Satna 3 each, Chandigarh AP, Shimla & Sherthala 2 each
- 18th: Banihal & Gulmarg 6 each, Batote 5, Kukernag, Poonch & Sunam 3 each, Bhuntar AP, Chamba, Jabalpur, Jammu AP and Joshimath 2 each
- 19th: Canning Town & Hoshangabad 2 each
- 20th: Gangapur & Nevasa 2 each
- 21st: Amraoti 2
- 22nd: Betul, Datia & Satna 2 each
- 23rd: Gangtok 4, Ahmadpur, Bidar AP, Seoni & Umaria 2 each
- 24th: Dalhousie 4, Bhatinda, Gulmarg & Taran Taran 3 each, Guna, Poonch & Sagar 2 each
- 25th: Kukernag 14, Banihal 12, Batote 10, Bhadarwah 8, Chamba, Srinagar, Udampur AP & Katra 7 each, Batala & Raya 5 each, Bijnore, Jammu & Mussoorie 4 each, Manali & Sonapat 3 each, Gwalior & Murtizapur 2 each
- 26th: Banihal 6, Kathua & Quazigund 3 each, Sundernagar 2
- 27th: Kondul 6, Batote 4, Jabalpur, Kathua & Malari 3 each, Dalhousie, Narsinghpur, Pendra, Rewa, Satna & Tangla 2 each
- 28th: Pasighat 3, Baghdogra AP & Dibrugarh AP 2 each.

4.3. Temperature

Night temperatures were generally below normal being appreciably so on a couple of days in south Interior Karnataka between 1st and 16th; in east Madhya Pradesh between 5th and 9th and in Marathwada and Vidarbha between 5th and 12th. They were generally below normal in north Interior Karnataka between 4th and 9th; in Nagaland, Manipur, Mizoram and Tripura between 6th and 17th; in Orissa and Bihar Plateau between 6th and 12th; in Rayalaseema and Tamil Nadu between 11th and 16th and in hills of west Uttar Pradesh between 17th and 20th. They were generally above or appreciably above normal in Haryana and Jammu & Kashmir during the month and were so in Bihar plains, plains of Uttar Pradesh, east Rajasthan, Madhya Pradesh and Gujarat between 14th and 28th and in Konkan & Goa, Madhya Maharashtra and Marathwada between 18th and 24th.