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Weather

WINTER SEASON (JANUARY-FEBRUARY 1990)*

1. Introduction

During winter season the precipitation mainly occurs in the hilly regions of north India and in Andaman & Nicobar Islands. The normal rainfall for the season in Andaman & Nicobar Islands, Arunachal Pradesh, hills of west Uttar Pradesh, Himachal Pradesh and Jammu & Kashmir is more than 10 cm and amongst these areas it is the highest in Jammu & Kashmir, which exceeds 20 cm. The normal rainfall in Assam & Meghalaya, Sub-Himalayan West Bengal & Sikkim, Punjab and Tamil Nadu is around 5 cm and in the remaining parts of the country it is even smaller.

For describing both the short term and long term rainfall distributions, the following norms, in vogue in India Meteorological Department, have been adopted.

Norm	*Percentage departure from normal*
Excess :	+20 per cent and above.
Normal :	±19 per cent.
Deficient :	—20 to —59 per cent and
Scanty :	—60 per cent or less.

2. Chief features

(*i*) Heavy snowfall over Himachal Pradesh and Jammu & Kashmir.

(*ii*) Cold wave conditions in several parts of north India and Maharashtra.

(*iii*) Good thundershower activity over Tamil Nadu in the second week of January and in central Andhra Pradesh in February.

3. Seasonal rainfall

The monthly and seasonal rainfall distribution for the 35 meteorological sub-divisions of India are shown in Table 1.

During the season rainfall was in excess in 15 sub-divisions and normal in 6 sub-divisions. It was deficient in 6 and scanty in 7 sub-divisions. There was no rainfall over coastal Karnataka.

The sub-divisions, where the rainfall was in excess were : Arunachal Pradesh, Assam & Meghalaya, West Bengal & Sikkim, Orissa, east Uttar Pradesh, Haryana, Jammu & Kashmir, Rajasthan, Gujarat, coastal Andhra Pradesh, Telangana, and Tamil Nadu. It was normal in Nagaland, Manipur, Mizoram & Tripura, Bihar plains, Punjab, Himachal Pradesh and Madhya Pradesh; deficient in Bihar plateau; west Uttar Pradesh, north interior Karnataka, Kerala and Lakshadweep and was scanty over Andaman & Nicobar Islands, Maharashtra, Rayalaseema and south interior Karnataka.

4. January

4.1. *Weather and associated synoptic features*

The details of synoptic features of the month are given in Table 2.

Northwest India was affected by six western disturbances and two induced systems, while the extreme south Peninsula had a good spell of rain due to the passage of a well marked low pressure area.

Besides, the systems listed in Table 2, a trough of low pressure area was observed over south Andaman Sea and neighbourhood from 14th to 18th of this month. Also a trough in the low level easterlies affected south Peninsula during 1 to 3 January.

In the Peninsular India and Lakshadweep area, the rainfall activity occurred from 1st to 10th. During the remaining period of the month the weather remained mainly dry.

During the first ten days of the month rain or thundershowers occurred almost at all the places on 2 days in Tamil Nadu and Lakshadweep and on one day in coastal Andhra Pradesh. Both Tamil Nadu and coastal Andhra Pradesh experienced heavy falls. Rainfall also occurred at a few places or at one or two places on 5 to 7 days in Tamil Nadu and Kerala and on 1 to 3 days in Madhya Maharashtra, Marathwada, Vidarbha, Telangana, Rayalaseema, interior Karnataka and Lakshadweep. Andaman & Nicobar Islands experienced rainfall for 9 days during the month. In the north India rain occurred almost at all the places on 2 days in Jammu & Kashmir and at many places on one day

*Prepared by : S/Shri G. R. Gupta, D. S. Desai and N. C. Bsiwas, Meteorological Office, Pune.

TABLE 1

Monthly and seasonal rainfall figures for winter season (January and February 1990)

Sub-divisions	Jan		Feb		Season (Jan & Feb)		
	Actual (mm)	% Dep.	Actual (mm)	% Dep.	Actual (mm)	Normal (mm)	% Dep.
1. Andaman & Nicobar Islands	26.2	—73	0.1	—99	26.3	144.1	—82
2 Arunachal Pradesh	142.4	169	102.5	38	173.7	127.7	36
3. Assam & Meghalaya	27.6	46	51.4	86	79.0	46.5	70
4. Naga., Mani., Mizo. & Tripura	0	—100	42.9	55	42.9	43.9	—2
5. S.H.W.B. & Sikkim	1.5	—93	63.8	135	65.3	47.5	37
6. Gangetic West Bengal	0	—100	75.4	256	75.4	33.4	126
7. Orissa	0	—100	62.0	164	62.0	38.2	62
8. Bihar Plateau	0	—100	36.0	41	30.9	45.6	—32
9. Bihar Plains	0	—100	26 5	89	26.5	30.2	—12
10. East Uttar Pradesh	0	—100	43.8	211	43.8	35.8	22
11. Plains of west Uttar Pradesh	0	—100	31.9	62	31.9	43.8	—27
12. Hills of west Uttar Pradesh	2.6	—96	56.1	—14	58.7	126.6	—54
13. Haryana, Chandigarh and Delhi	0.1	—99	78.2	327	78.3	38.5	103
14. Punjab	1.9	—94	64.4	144	66.3	55.9	19
15. Himachal Pradesh	18.1	—78	150.6	109	168.7	152.4	11
16. Jammu & Kashmir	165.3	72	107.7	—14	273.0	221.5	23
17. West Rajasthan	0.2	—95	27.8	456	25.2	9.2	174
18. East Rajasthan	0	—100	29.3	486	29.3	12.0	144
19. West Madhya Pradesh	1.2	—91	16.7	120	18.0	20.7	—13
20. East Madhya Pradesh	0.3	—99	34.7	63	35.0	41.9	—16
21. Gujarat Reg. Daman, Dadra & Nagar Haveli	0	—100	5.2	333	5.2	3.1	68
22. Saurashtra, Kutch and Diu	0	—100	16.4	811	16.4	3.2	413
23. Konkan & Goa	0	—100	0.1	—83	0.1	1.6	—94
24. Madhya Maharashtra	1.4	—59	0.4	—71	1.8	4.8	—63
25. Marathwada	0.9	—87	0	—100	0.9	10.5	—91
26. Vidarbha	0.1	—99	7.9	—16	7.3	21.0	—65
27. Coastal Andhra Pradesh	14.0	40	101.5	1094	115.6	18.5	525
28. Telangana	8.3	41	8.9	19	17.3	13.4	29
29. Rayalaseema	0	—99	0	—99	0	9.8	—99
30. Tamil Nadu and Pondicherry	94.2	161	3.9	—69	98.1	48.7	101
31. Coastal Karnataka	0	—100	0	—100	0	1.5	—100
32. North Interior Karnataka	3.7	0	0	—100	3.7	7.5	—51
33. South Interior Karnataka	3.0	—30	0	—100	3.0	10.7	—72
34. Kerala	17.8	—7	9.1	—61	26.8	42.6	—37
35. Lakshadweep	26.0	3	0.2	—99	26.1	41.5	—37

TABLE 2

Details of weather systems during January 1990

Weather system	Period	Place of first location	Direction of movement	Place of dissipation	Remarks
(A) *Low pressure area*					
(1) Well marked low pressure area	5th-11th	Southwest Bay off Sri Lanka coast	West/northwestwards	East central & adjoining west central Arabian Sea	
(B) *Cyclonic circulation*					
(1) Lower tropospheric levels	21st-23rd	Bangladesh & neighbourhood	—	*In situ*	
(C) *Weather disturbance*					
(1) Upper air system*	1st-2nd	Jammu & Kashmir and neighbourhood	Eastnortheastwards	Moved away eastwards across Jammu & Kashmir & neighbourhood	*Brought forward from December 1989
(2) Do.	3rd-8th	Northeast Afghanistan & adjoining north Pakistan	Eastwards	Do.	
(3) Do.	8th-12th]	North Afghanistan	Eastwards	Do.	
(4) Do.	16th-18th eve.	North Pakistan & adjoining Jammu & Kashmir	Do.	Do.	
(5) Do.	20th-23rd eve.	North Afghanistan & neighbourhood	Do.	Do.	
(6) Do.	25th-29th	North Afghanistan & adjoining Jammu & Kashmir	Eastnortheastwards	Do.	
(7)† Do.	31st	North Pakistan & adjoining Jammu & Kashmir	—	—	†Carried over to Feb '90
(D) *Induced cyclonic circulation*					
(1) Lower tropospheric levels	3rd-5th	Central Pakistan	Eastwards]	Punjab and adjoining Haryana & neighbourhood	
(E) *Induced low pressure area*	27th-29th	Northwest Rajasthan & adjoining Pakistan and north Pakistan	Eastsoutheastwards	Central parts of Uttar Pradesh	Initially observed as a cyclonic circulation in the lower levels over northwest Rajasthan & neighbourhood on 26th

in the hills of west Uttar Pradesh and Himachal Pradesh. However, it occurred at a few places or at one or two places on 10 days in the hills of west Uttar Pradesh, on 4 to 6 days in Assam & Meghalaya, Punjab, Himachal Pradesh and Jammu & Kashmir and on 1 to 2 days in Sub-Himalayan West Bengal & Sikkim, Haryana and Madhya Pradesh.

Jammu & Kashmir experienced snowfall almost at all the places on 28th and at one or two places on 30th.

4.2. *January rainfall*

Rainfall during the month was in excess in 6 and normal in 3 sub-divisions. It was deficient in two and scanty in 12 sub-divisions. Over the remaining 12 subdivisions the weather was mainly dry.

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

4.3. *Temperature during January*

During the first fortnight of the month nights were comparatively cooler over northeast India and plains of Uttar Pradesh, while they were so during the second fortnight over Madhya Maharashtra, Marathwada, Andhra Pradesh, Tamil Nadu, Karnataka and Kerala.

Cold wave conditions prevailed on 4 to 7 days over Bihar plains, east Uttar Pradesh and Jammu and on 1 day each over Gangetic West Bengal, west Uttar Pradesh and Rajasthan during the first half of the month. It was severe on 2 days each in Bihar plains and Jammu. Night temperatures were appreciably to marked below normal on most days over Telangana, Rayalaseema, Tamil Nadu and south interior Karnataka between 12th and 23rd of the month.

The lowest minimum temperature during the month in the hills of India was recorded at Banihal on 3rd, which was —4°C. In the plains of India it was —1°C, which was recorded at Amritsar on 9th.

TABLE 3

Details of weather systems during February 1990

	Weather system	Period	Place of first location	Direction of movement	Place of dissipation	Remarks
(A)	*Cyclonic circulation*					
(1)	Lower levels	16th-17th	South Andhra Pradesh & neighbourhood	—	*In situ*	
(2)	Do.	19th-21st	East Madhya Pradesh	—	Do.	
(B)	*Western disturbance*					
(1)	*Upper air system	1st-3rd	Jammu & Kashmir	Eastwards	Moved away across Jammu & Kashmir and neighbourhood	*Brought forward from Jan 1990
(2)	Do.	3rd-5th	North Pakistan & neighbourhood	Do.	Do.	
(3)	Do.	6th-9th eve.	North Pakistan & neighbourhood	Do.	Do.	
(4)	Do.	10th-16th	North Pakistan & neighbourhood	Do.	Do.	
(5)	Do.	17th-19th	North Pakistan & adjoining Afghanistan	Do.	Do.	
(6)	Do.	23rd-26th	North Pakistan & adjoining Jammu & Kashmir	Do.	Do.	
(7)†	Do.	26th	North Pakistan & neighbourhood	Do.	—	Lay over north Pakistan & adjoining Jammu & Kashmir on 28th †Carried on to March '90
(C)	*Induced cyclonic circulation*					
(1)	Lower levels	9th-11th	Southeast Rajasthan & neighbourhood	North eastwards	Northeast Rajasthan and neighbourhood	
(2)	Lower tropospheric levels	12th-13th eve.	Punjab and neighbourhood	—	*In situ*. However it moved eastwards as a trough across Uttar Pradesh and Madhya Pradesh and became less marked over east Uttar Pradesh and east Madhya Pradesh on 14th evening	
(3)	Lower tropospheric levels	23rd-26th	Northwest Rajasthan & neighbourhood	Eastwards	Haryana & neighbourhood	
(4)	Do.	26th eve.	Northwest Rajasthan & Pakistan	Eastwards	—	Lay on 28th over northeast Rajasthan and adjoining Haryana and west Uttar Pradesh
(D)	*Induced low pressure area*					
(1)	Low pressure area	31st Jan-1st eve. eve.	West Rajasthan & neighbourhood	Eastnortheastwards	North Rajasthan	First seen as a cyclonic circulation in the lower levels over Rajasthan and adjoining Pakistan on 31st morning
(2)	Do.	7th-8th	Northwest Rajasthan & neighbourhood	—	*In situ*. However, the associated cyclonic circulation in the lower tropospheric levels became less marked over Punjab & neighbourhood on 9th	Seen as a cyclonic circulation in the lower levels over north & west Rajasthan and neighbourhood on 6th evening
(3)	Well marked low pressure area	17th-19th	South Pakistan and adjoining west Rajasthan	Eastwards	Southwest Uttar Pradesh & neighbourhood. The associated cyclonic circulation in the lower tropospheric levels became less marked there on 21st	

Night temperatures were appreciably to markedly above normal on most days in Assam & adjacent States, West Bengal & Sikkim, hills of west Uttar Pradesh, Haryana, Punjab, Himachal Pradesh, Jammu & Kashmir and Rajasthan during the second half of the month.

During the first five days of the month, one characteristic feature was the occurrence of very chilly day in Bihar plains, plains of Uttar Pradesh, Haryana, Punjab and Jammu, where day temperatures were as much as —7°C to —13°C below normal. Some of the unusually low day temperatures recorded at various statons during the above period are listed below.

Date (Jan 1990)	*Station*	*Max. temp recorded (°C)*	*Dep. from normal (°C)*
1	Bahraich	10	—13
1	Hissar	12	—10
1	Motihari	13	—10
2	Patiala	11	—10
	Karnal	11	—9
	Bareilly	13	—9
3	Jammu	9	—10
	Karnal	10	—10
	Patna	12	—11
4	Ludhiana	12	—9
	Patna	15	—8

4.4. *Disastrous weather events and damages*

As per the newspaper reports cold wave and chilly weather in the northern plains claimed 178 lives in Bihar, 17 in Uttar Pradesh and 5 in Gujarat during the first week of the month. The Suraj Tal lake in the Spiti valley of Himachal Pradesh froze due to sub-zero temperatures and heavy snowfall during this period. Heavy rain on 6th and 7th in several parts of Tamil Nadu claimed 8 lives left 11 other injured.

5. February

5.1. *Weather and associated synoptic features*

The details of the synoptic features of the month are given in Table 3.

Seven western disturbances affected the extreme northern parts of the country besides the last western disturbance of the previous month, which moved away eastwards across western Himalayas by 3 February.

Apart from the weather systems listed in Table 2, a trough in lower tropospheric westerlies affected central and Peninsular India during the second half of the month.

In the western Himalayas, Himachal Pradesh experienced four spells of snowfall while Jammu & Kashmir experienced only one spell. Snowfall occurred almost at all the places in Himachal Pradesh on 9th, 13th and 25th and in Jammu & Kashmir on 27th. It occurred at many places on 26th and at a few places or at one or two places on 19th and 24th over Himachal Pradesh.

Rainfall or thundershowers occurred almost at all the places or at many places on 12 days in Arunachal Pradesh, on 4 to 7 days in Assam & Meghalaya, Nagaland, Manipur, Mizoram & Tripura, West Bengal & Sikkim, Plains of west Uttar Pradesh, Haryana, Punjab, Himachal Pradesh and Jammu & Kashmir and on 1 to 3 days in Orissa, Bihar, east Uttar Pradesh hills of west Uttar Pradesh, Rajasthan, Saurashtra & Kutch and coastal Andhra Pradesh during the month. It occurred at a few places or at one or two places on 8 to 15 days in Assam, West Bengal & Sikkim, Orissa, Uttar Pradesh, Haryana, Punjab, Himachal Pradesh, Rajasthan, Madhya Pradesh and coastal Andhra Pradesh and on 3 to 6 days in Nagaland, Manipur, Mizoram & Tripura, Bihar, Jammu & Kashmir, Telangana and Kerala and on 1 to 2 days in Arunachal Pradesh, Gujarat, Konkan & Goa, Vidarbha and Rayalaseema. Heavy rainfall occurred at one or two places in Himachal Pradesh on 8th and 14th and in coastal Andhra Pradesh on 18th, 24th and 26th. The weather was mainly dry over Madhya Maharashtra, Marathwada, Karnataka and Andaman & Nicobar Islands and Lakshadweep.

5.2. *February rainfall*

During this month the normal precipitation is about 13 cm in Jammu & Kashmir and about 7 cm in Arunachal Pradesh, hills of west Uttar Pradesh and Himachal Pradesh. It is 2 to 3 cm in Assam, Nagaland, Manipur, Mizoram & Tripura, West Bengal & Sikkim, Orissa, Bihar Plateau, Plains of west Uttar Pradesh, Haryana, Punjab in northern India and Kerala & Lakshadweep in southern India. The normal for Andaman & Nicobar Islands is about 5 cm. It is less than 2 cm elsewhere.

Rainfall during this month was excess in 20 and normal in 4 sub-divisions. It was scanty over 7 sub-divisions, while the remaining 4 sub-divisions there was no rainfall.

Rainfall was excess in Arunachal Pradesh, Assam, & Meghalaya, Nagaland, Manipur, Mizoram & Tripura, West Bengal & Sikkim, Orissa, Bihar, Plains of Uttar Pradesh, Haryana, Punjab, Himachal Pradesh, Rajasthan Madhya Pradesh, Gujarat and coastal Andhra Pradesh and normal in hills of west Uttar Pradesh, Jammu and Kashmir, Vidarbha and Telangana.

It was scanty in Andaman & Nicobar Islands, Konkan & Goa, Madhya Maharashtra, Rayalaseema, Tamil Nadu, Kerala and Lakshadweep. There was no rain in Marathwada and Karnataka.

5.3. *Temperature during February*

During this month the nights were generally warmer in the plains of north India. They were on most of the days appreciably to markedly above normal in Nagaland, Manipur, Mizoram and Tripura, Gangetic West Bengal, Orissa, Haryana, Jammu and Rajasthan during the first half of the month and were so in Madhya Pradesh,

Gujarat, Madhya Maharashtra and Marathwada between 7th and 14th and in coastal Andhra Pradesh and Tamil Nadu between 16th and 20th of this month.

Severe cold wave conditions (Dep.—8°C and above) prevailed over hills of west Uttar Pradesh from 18th to 28th and in Jammu on 2nd. Cold wave conditions also prevailed on a day or two in Punjab, Himachal Pradesh, Madhya Maharashtra, Marathwada and in north interior Karnataka during the second-half of the month. In the hilly region the coldest night was at Gulmarg on 22nd, when the minimum temperature was recorded as —7°C. In the northern plains of India the lowest minimum temperature was 2°C at Amritsar on 2nd. The next lowest night temperature was 3°C recorded at Darbhanga on 4th morning.

During the second-half of the month chilly weather occurred on a number of days in Haryana, Punjab, Jammu, Himachal Pradesh, Rajasthan and in some parts of Uttar Pradesh when the day temperatures were as much as —6°C to —10°C below normal in those regions. Low day temperatures were recorded at a few other stations over northwest India. These were Dharmsala 10°C on 25th, at Amritsar 14°C and Dehra Dun 14°C each on 25th and at Ajmer and Ludhiana 15°C each on 18th.

The lowest day maximum temperature during the month was 2°C at Dalhousie on 27th, which was 13°C below the normal.

5.4. *Disastrous weather events and damages*

Hailstorms lashed some parts of Dibrugarh and north Lakhimpur, districts of Assam on 17th and 18th causing extensive damage to rabi crops. Thundersqualls accompanied with hail also affected north 24-Paraganas of West Bengal on 20th. One person was killed and a number of houses were damaged. From 17th to 19th thundersqualls occurred in Koreput, Puri and Cuttack districts of Orissa, causing considerable damage to property there.

As per the media reports, Lahoul, Spiti, Kinnaur, Bharmour and Shimla and its surroundings areas experienced heavy snowfall during the last week of the month. Traffic to upper Shimla areas was disrupted. The lakes in the entire tribal belt of Lahoul, Spiti, Kinnaur and Bharmour were frozen and temperatures at some places reached —17°C to —28°C.