

Weather

WINTER SEASON (JANUARY-FEBRUARY 1993)*

1. Introduction

The period January and February constitutes winter season for India. During the winter season the main precipitation belt comprises the hilly regions of North India and parts of north Indian plains. Andaman and Nicobar Islands also receive winter rains.

Tables 1 and 2 give monthwise synoptic features for January and February respectively while Table 3 gives the monthly and seasonal rainfall figures.

2. Chief features

(i) Cold wave conditions in several parts of north India.

(ii) Unusual hot spell of weather over northern parts of India during first half of February.

(iii) Hail storms in Meghalaya and Nagaland, Manipur, Mizoram and Tripura during the season.

3. Seasons rainfall

The season's rainfall was in excess in Arunachal Pradesh, Assam & Meghalaya, Nagaland, Manipur, Mizoram and Tripura and Sub-Himalayan West Bengal & Sikkim and Saurashtra & Kutch and Diu. It was normal in Himachal Pradesh, Jammu & Kashmir, west Rajasthan and Gujarat region (Daman, Dadra & Nagar Haveli), and was either deficient or scanty over the rest of the country outside Konkan & Goa and coastal Karnataka. Pictorial representation of the above features is given in Fig. 1.

4. January

4.1. Weather and associated synoptic features

There were 6 western disturbances and 5 induced systems which affected north India during the month. In general, systems in the first fortnight caused good rainfall in Arunachal Pradesh, Assam & Meghalaya, Sub-Himalayan West Bengal & Sikkim, hills of west Uttar Pradesh, Himachal Pradesh and Jammu & Kashmir. Except for a brief spell during 22-24 January, rainfall activity over Andaman & Nicobar Islands was below normal.

Rain or thundershowers have occurred almost at all places or at many places over Arunachal Pradesh, Assam & Meghalaya, Sub-Himalayan West Bengal &

Sikkim, hills of west Uttar Pradesh, Himachal Pradesh and Jammu & Kashmir on 2 to 10 days and have occurred at a few places or at one or two places in Andaman & Nicobar islands, Arunachal Pradesh, Assam & Meghalaya, Nagaland, Manipur, Mizoram & Tripura, West Bengal & Sikkim, Orissa, Bihar, Uttar Pradesh, Haryana, Punjab, Himachal Pradesh, Jammu & Kashmir, Rajasthan, Saurashtra & Kutch, coastal Andhra Pradesh, Tamil Nadu and Lakshadweep on 1 to 8 days. Mainly dry weather prevailed over the rest of the country.

4.2. Month's rainfall

Accumulated monthly rainfall was in excess in 4, normal in 3, deficient in 4 and scanty in 12 meteorological sub-divisions while there was no rainfall in 12 sub-divisions. Rainfall was in excess in Arunachal Pradesh, Assam & Meghalaya, Sub-Himalayan West Bengal & Sikkim and Jammu & Kashmir, normal in hills of west Uttar Pradesh, Himachal Pradesh and west Rajasthan, deficient in Bihar plains, Haryana, Punjab and Saurashtra & Kutch and scanty in Andaman & Nicobar islands, Nagaland, Manipur, Mizoram & Tripura, Gangetic West Bengal, Orissa, Bihar plateau, plains of Uttar Pradesh, east Rajasthan, Gujarat region, coastal Andhra Pradesh, Tamil Nadu and Lakshadweep. Significant amounts of rainfall (cm) are given in Table 4.

4.3. Temperature

Severe cold wave conditions prevailed over Bihar plains, west Uttar Pradesh, Punjab, Himachal Pradesh and Jammu & Kashmir on 1 to 11 days. Cold wave conditions also prevailed over Nagaland, Manipur, Mizoram & Tripura, Bihar plains, Uttar Pradesh, Punjab, Himachal Pradesh, Jammu & Kashmir and Rajasthan on 1 to 10 days. The lowest minimum temperature in the plains was -3°C recorded at Adampur on 14, 23, 24 and 27 January 1993 and at Amritsar on 14 January 1993 and that in the hills was -8°C (dep. -6°C) recorded at Srinagar on 23 January 1993.

4.4. Disastrous weather events and damages

On 22 January 1993 hailstorm caused damage to dwelling houses and school buildings in Rajbala constituency of Meghalaya and a few persons were reported to have received serious injuries. Several deaths were also reported from rural areas of Meghalaya due to cold wave conditions in the last week of January.

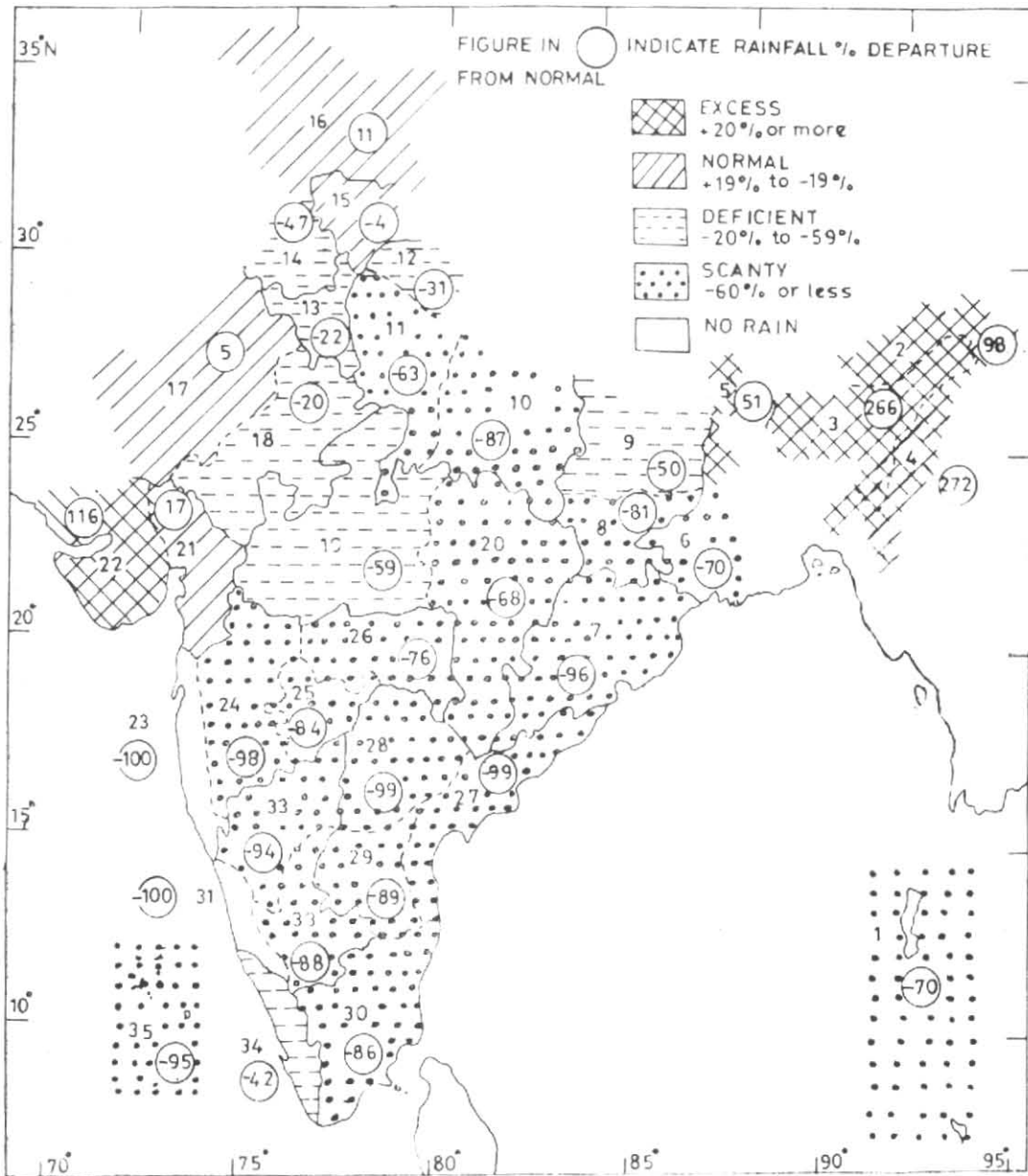


Fig. 1. Rainfall for the period 1 January to 28 February 1993

1. 100%
 2. 95%
 3. 90%
 4. 85%
 5. 80%
 6. 75%
 7. 70%
 8. 65%
 9. 60%
 10. 55%
 11. 50%
 12. 45%
 13. 40%
 14. 35%
 15. 30%
 16. 25%
 17. 20%
 18. 15%
 19. 10%
 20. 5%
 21. 0%
 22. -5%
 23. -10%
 24. -15%
 25. -20%
 26. -25%
 27. -30%
 28. -35%
 29. -40%
 30. -45%
 31. -50%
 32. -55%
 33. -60%
 34. -65%
 35. -70%
 36. -75%
 37. -80%
 38. -85%
 39. -90%
 40. -95%
 41. -100%

TABLE 1
Details of weather systems during January 1993

S. No.	Weather system	Period	Place of first location	Direction of movement	Place of dissipation	Remarks
(1)	(2)	(3)	(4)	(5)	(6)	(7)
(A)	Nil	—	—	—	—	—
	(B) <i>Cyclonic circulation</i>					
(1)	Lower tropospheric level	2-5 Eve	Assam & Meghalaya & neighbourhood	Stationary	<i>In situ</i>	—
(2)	Do.	8-10	Haryana, Punjab & neighbourhood	Do.	Do.	—
(3)	Do.	9-10	Bihar plains and neighbourhood	Do.	Do.	—
(4)	Do.	24-29	Assam and neighbourhood	Do.	Do.	—
	(C) <i>Western disturbance</i>					
(1)	Upper air	3-5	North Pakistan and neighbourhood	Eastwards	Moved away across Jammu & Kashmir	Induced low pressure area 6-9
(2)	Do.	5-9	Do.	Northeast	Do.	—
(3)	Do.	9-12	Afghanistan and adjoining north Pakistan	Do.	Do.	Induced cyclonic circulation 15-17
(4)	Do.	15-18	Northwest Afghanistan and neighbourhood	Eastwards	Do.	—
(5)	Do.	21-22	North Pakistan and neighbourhood	Northeastwards	Do.	—
(6)	Do.	25-26	North Pakistan and adjoining Afghanistan	Do.	Do.	Induced low pressure area 28 Jan-1 Feb
	(D) <i>Induced systems</i>					
(1)	Cyclonic circulation (lower level)	31 Dec-2 Jan	Northwest Rajasthan & neighbourhood	Stationary	<i>In situ</i>	—
(2)	Low pressure area	6 Eve-9	Northwest Madhya Pradesh & neighbourhood	Southeasterly	Central Madhya Pradesh	Associated cyclonic circulation extended upto lower tropospheric levels induced by western disturbance (5-9)
(3)	Cyclonic circulation (lower tropos. level)	11-13	North Pakistan and adjoining Punjab	Stationary	<i>In situ</i>	Induced by western disturbance (9-12)
(4)	Low pressure area (lower tropos. level)	15-17	Central Pakistan	Northeastwards	Moved across Himachal Pradesh	Associated cyclonic circulation extending to 2.1 km asl. A trough from this extended upto south Gujarat. Induced by western disturbance (15-18)
(5)	Low pressure area (lower tropos. level)	28-30	Northwest Rajasthan & adjoining Pakistan	Eastwards	Bihar plateau and neighbourhood on 1 March	Induced by western disturbance (25-26). Associated cyclonic circulation extend upto lower tropospheric levels. A trough from this extended upto Madhya Pradesh in lower levels which moved over Bihar plateau

TABLE 1 (Contd.)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
<i>(E) Upper air westerly troughs</i>						
(1)	Mid & upper tropospheric level	25-27	Lat. 49° E N, Long. of 25° N	Northeastwards	Moved away	Axis at 9.5 km asl
<i>(F) Other troughs</i>						
(1)	Lower level	Dec-6 Eve	Andaman Sea & neighbourhood	Stationary	<i>In situ</i>	—
(2)	Do.	Do.	Southwest Bay and neighbourhood	Do.	Do.	—
(3)	Do.	12-16	Sub Himalayan West Bengal and neighbourhood	Do.	Do.	—
(4)	Do.	18-25	Andaman Sea	—	Andaman Sea and adjoining southeast Bay	—
(5)	Do.	20-21	Orissa to south interior Karnataka	Stationary	<i>In situ</i>	—
(6)	Do.	26-29	Andaman Sea	Do.	Do.	—
(7)	Do.	26-31	Southwest Bay off Tamil Nadu coast	Westwards	Southeast Arabian Sea	—

TABLE 2

Details of weather systems during February 1993

S. No.	Weather system	Period	Place of first location	Direction of movement	Place of dissipation	Remarks
(1)	(2)	(3)	(4)	(5)	(6)	(7)
<i>(A) Nil</i>						
<i>(B) Cyclonic circulation</i>						
(1)	Cyclonic circulation (Mid-tropospheric level)	1-7	Assam and adjoining Bangladesh, Tripura and neighbourhood	Northeastwards	South Assam and adjoining Meghalaya	—
(2)	Cyclonic circulation (Lower level)	12-16	Assam and neighbourhood	—	—	After 16 seen as a trough from Bihar plains to Arunachal Pradesh till 20
(3)	Cyclonic circulation (Lower tropospheric level)	22-23	North Bay and neighbourhood	Stationary	<i>In situ</i>	—
(4)	Cyclonic circulation (Lower tropospheric level)	22-23	Lakshadweep area and neighbourhood	Westwards	Moved away	—
<i>(C) Western disturbance</i>						
(1)	Western disturbance (Upper air system)	1-3	North Afghanistan & neighbourhood	Eastwards	Moved away across Jammu & Kashmir	—
(2)	Do.	4-9	Afghanistan	Do.	Do.	—
(3)	Do.	15-18	North Pakistan and adjoining Afghanistan	Northeastwards	Do.	—
(4)	Do.	18-20	North Pakistan and neighbourhood	Eastnortheastwards	Do.	—
(5)	Do.	20-22	Afghanistan and neighbourhood	Do.	Do.	—

TABLE 2 (Contd.)

(1)	(2)	(3)	(4)	(5)	(6)	(7)
(6)	Western disturbance (Upper air system)	22-27	North Afghanistan and neighbourhood	Eastnortheastwards	Moved away across Jammu & Kashmir	—
(7)	Do.	26-1 Mar	Central Pakistan and adjoining Jammu & Kashmir	Do.	Western Himalayas	—
<i>(D) Induced systems</i>						
(1)	Induced low pressure area (upto 1.5 km asl)	16-18	Northwest Rajasthan and adjoining Pakistan	Northeastwards	Moved away across Himachal Pradesh	—
(2)	Induced cyclonic circulation (upto 1.5 km asl)	18-19	Northwest Rajasthan and neighbourhood	Do.	Punjab & neighbourhood	—
(3)	Induced cyclonic circulation (upto 1.5 km asl)	23-24	Northwest Rajasthan & adjoining parts of Haryana & Punjab	Stationary	<i>In situ</i>	—
(4)	Induced cyclonic circulation (upto 3.1 km asl)	24-27	Southwest Rajasthan & adjoining Pakistan	Northeastwards	—	Merged with the western disturbance (26-1 March)
(5)	Induced cyclonic circulation (0.6 to 1.5 km asl)	28-1 Mar	Southwest Madhya Pradesh and adjoining Gujarat region	Do.	Bihar plains and adjoining east Uttar Pradesh	—
<i>(E) Upper air westerly troughs</i>						
(1)	Upper air westerly troughs	4-7	At 9.5 km asl from northwest China to central Bay through Bangladesh	Eastwards	Moved away across northeast India	—
(2)	Do.	13-14	At 9.5 km asl from Bihar plains to south Telangana	Do.	Moved away across west Assam to north coastal Orissa	—
(3)	Do.	20-24	At 9.5 km asl along Long. 78°E north of Lat. 15° N	Northeastwards	Moved away across the country	On 21 seen at 9.5 km asl along Long. 80°E North of 12°N
(4)	Do.	24-2 Mar	At 9.5 km asl along Long. 58°E north of Lat. 25° N	Eastwards	East Uttar Pradesh & adjoining east Madhya Pradesh	—
<i>(F) Other troughs</i>						
(1)	Trough (lower level)	8-10	Bihar plains to north coastal Andhra Pradesh	Stationary	—	—
(2)	Do.	7-12	Andaman Sea	Do.	—	—
(3)	Trough in the easterlies (upper tropos. levels)	13-15	Rayalaseema to Maldives across Kerala coast	Westwards	South Maharashtra coast to Maldives	—
(4)	Trough (lower level)	11-17	Southwest Bay off Sri-Lanka coast	Do.	Southern parts of Lakshadweep area	—
(5)	Do.	23-1 Mar	Off Tamil Nadu coast	Do.	Moved away across south peninsular region	—

TABLE 3
Monthly and seasonal rainfall figures (mm) for winter season (January and February 1993)

S. No.	Sub-divisions	January			February			Season		
		Actual (mm)	Normal (mm)	% Dep.	Actual (mm)	Normal (mm)	% Dep.	Actual (mm)	Normal (mm)	% Dep.
1	A. & N. Islands	16	70	-77	19	47	-61	35	117	-70
2	Arunachal Pradesh	112	44	156	105	66	59	217	109	98
3	Assam & Meghalaya	55	18	203	123	31	303	177	49	266
4	Naga., Mani., Mizc. & Trip	4	15	-71	155	28	458	159	43	272
5	S.H.W.B. & Sikkim	36	18	103	24	22	9	61	40	51
6	Gangetic West Bengal	3	13	-75		20	-66	10	33	-70
7	Orissa	0	13	-99	1	25	-94	2	37	-96
8	Bihar Plateau	6	19	-71	3	25	-89	8	45	-81
9	Bihar Plains	9	15	-39	6	16	-62	15	31	-50
10	East Uttar Pradesh	1	18	-96	3	16	-78	4	34	-87
11	Plains of West U.P.	4	22	-81	11	19	-40	15	41	-63
12	Hills of West U.P.	55	66	-16	34	63	-46	89	129	-31
13	Har., Chandī. & Delhi	10	22	-53	22	19	13	32	41	-22
14	Punjab	15	29	-47	14	26	-47	29	55	-47
15	Himachal Pradesh	94	80	18	53	74	-28	147	153	-4
16	Jammu & Kashmir	99	80	24	95	94	1	193	174	11
17	West Rajasthan	4	4	-12	6	5	19	10	9	-5
18	East Rajasthan	1	7	-92	10	5	81	10	13	-20
19	West Madhya Pradesh	0	13	-100	9	7	15	9	21	-59
20	East Madhya Pradesh	0	20	-100	13	22	-38	13	41	-68
21	Gujarat Reg., Daman, Dadra & Nagar Haveli	0	2	-94	3	1	200	3	3	17
22	Saurashtra, Kutch & Diu	1	1	-27	3	1	313	4	2	116
23	Konkan & Goa	0	1	-100	0	1	-100	0	2	-100
24	Madhya Maharashtra	0	4	-100	0	1	93	0	6	-98
25	Marathwada	0	3	-100	1	3	-71	1	6	-84
26	Vidarbha	0	12	-100	5	10	-47	5	21	-76
27	Coastal Andhra Pradesh	0	10	-97	0	11	-99	0	21	-99
28	Telangana	0	4	-100	0	7	-99	0	11	-99
29	Rayalaseema	0	8	-100	1	5	-70	1	13	-89
30	Tamil Nadu & Pondi.	0	33	-99	6	15	-58	7	48	-86
31	Coastal Karnataka	0	2	-100	0	1	-100	0	3	-100
32	N.I. Karnataka	0	2	-100	0	3	-90	0	5	-94
33	S.I. Karnataka	0	3	-100	1	4	-80	1	7	-88
34	Kerala	0	15	-100	18	17	8	18	31	-42
35	Lakshadweep	1	25	-95	1	9	-95	2	34	-95

TABLE 4

Principal amounts of rainfall (cm) during January-February 1993

Date	January	February
1	Eatote 6, Banihal 5, Katra 3	—
2	Manali 5	Kohima 3
3	—	—
4	Banihal 3	—
5	—	—
6	Katra 4, Banihal & Batote 3 each	—
7	Dharamsala 5, Kalpa 4, Mandi 3	—
8	Balughat 7, Nalagarh 6, Malakpur & Shimla 5 each, Satour 4, Dehradun, Cuwahati & Shillong 3 each	—
9	Cherrapunji 6, Guwahati 5	—
10	Karimnagar 6, Passighat 3	—
11	—	Kondul 5
12	—	Kondul 6, Cuddalore 4
13	Calcutta, Itanagar & north Lakhimpur 3 each	—
14	—	Itanagar 6, Passighat 4
15	—	—
16	Jogindernagar 5	Cherrapunji & Karimganj 4 each, Ammathy 3
17	Ranikhet 13, Jogindernagar 10, Batote 5, Dharamsala 3	Arki & Imphal 5 each, Banihal & Guwahati 4 each, Srinagar 3
18	—	Cherrapunji 38, Sikhar 11, Imphal 8, Thenmala 5
19	—	Agartala 14, Imphal 6
20	—	Passighat 6, Agartala 3
21	—	Tada 8, Sriperumbudur 5, Tirupati 3
22	—	Agartala 4, Kailashahar 3
23	Nancowry 9	Idukki & Vedaranyam 4 each
24	—	Alapuzha, Kochi & Watrap 5 each
25	—	Konni 6, Batote & Jogindernagar 5 each, Jaipur 4, Deoprayag & Jammu 3 each
26	—	Bhuntar 9, Banihal 7, Mandvi 4, Chamba 3
27	—	Jammu 5, Dehra Dun, Jagadhari & Lansdown 3 each
28	—	Enmakal 5, Alapuzha, Ambikapur & Panposh 3 each
29	—	—
30	—	—
31	—	—

5. February

5.1. Weather and associated synoptic features

7 western disturbances and 5 induced systems affected the country during this month. Details of synoptic systems are given in Table 2. In general, systems in the second fortnight of the month were active and caused precipitation.

Rain or thundershowers occurred almost at all places or at many places in Assam & Meghalaya, Nagaland, Manipur, Mizoram & Tripura, Sub-Himalayan West Bengal & Sikkim, Uttar Pradesh, Haryana, Punjab, Himachal Pradesh, Jammu & Kashmir, Rajasthan, east Madhya Pradesh and Kerala on 1 to 7 days. They occurred at a few places or at one or two places in Andaman & Nicobar islands, Arunachal Pradesh, Assam & Meghalaya, Nagaland, Manipur, Mizoram & Tripura, West Bengal & Sikkim, Orissa, Bihar, Uttar Pradesh, Haryana, Punjab, Himachal Pradesh, Jammu & Kashmir, Rajasthan, Madhya Pradesh, Gujarat State, Madhya Maharashtra, Marathwada, Vidarbha, Rayalaseema, Tamil Nadu, interior Karnataka and Kerala on 1 to 11 days. Mainly dry weather prevailed over the rest of the country.

5.2. Months rainfall

Accumulated monthly rainfall was in excess in 6, normal in 5, deficient in 8 and scanty in 14 meteorological sub-divisions while 2 sub-divisions recorded no rain. Rainfall was in excess in Arunachal Pradesh, Assam & Meghalaya, Nagaland, Manipur, Mizoram & Tripura, east Rajasthan and Gujarat State (including Daman, Dadra, Nagar Haveli and Diu), normal in Sub-Himalayan West Bengal & Sikkim, Haryana, Jammu & Kashmir, west Rajasthan and west Madhya Pradesh, deficient in west Uttar Pradesh, Punjab, Himachal Pradesh, east Madhya Pradesh, Vidarbha, Tamil Nadu and Kerala and scanty in And-

man & Nicobar islands, Gangetic West Bengal, Orissa, Bihar, east Uttar Pradesh, Madhya Maharashtra, Marathwada, Andhra Pradesh, interior Karnataka and Lakshadweep. Konkan & Goa and coastal Karnataka remained dry during the period. The significant amounts of rainfall (in cm) are given in Table 4.

5.3. Temperature

During the first half of February, most parts of north-west India and Gujarat State experienced abnormally high day and night temperature. The day temperature recorded by many stations in these areas were above normal by 8 to 9°C. On 16 February 1993, New Delhi experienced the highest maximum temperature of 33.9°C which was the highest ever recorded temperature in February.

With the passage of three western disturbances across northwest India during second half of February, the temperatures fell significantly.

Severe cold wave conditions and cold wave conditions prevailed in Bihar Plateau, hills of west Uttar Pradesh, Punjab, Himachal Pradesh, Jammu & Kashmir, west Madhya Pradesh, Madhya Maharashtra, Marathwada, Vidarbha and Telangana on 1 to 8 days and on 1 to 2 days respectively.

Lowest minimum temperature of 2°C (dep. -3°C) in the plains was recorded at Amritsar and Pathankot on 1 February and in the hills -5°C (dep. -9°C) was recorded at Mukteswar on 21 February 1993.

5.4. Disastrous weather events and damages

Thundersquall over Guwahati and neighbourhood disrupted normal life on 17. Hailstorm (hail diameter 1 cm) on 17 over Imphal caused partial damage to Rabi crops.