

## Weather in India

### WINTER SEASON (JANUARY-FEBRUARY 1997)\*

#### 1. Introduction

During the winter season, the main rainfall belt lies over hilly regions of north India and Andaman & Nicobar Islands. However, this year Andaman & Nicobar Islands and hills of west Uttar Pradesh, Jammu & Kashmir received scanty rainfall, whereas Himachal Pradesh received deficient rainfall.

Monthwise synoptic features for the season are given in Tables 1, 2 & 3 contains the monthly and seasonal rainfall figures.

#### 2. Chief features

(i) Good spells of rain occurred during the period from 8 to 22 January over Gujarat, Maharashtra & Goa states and peninsular India outside Tamil Nadu, Kerala and coastal Karnataka.

(ii) Cold wave conditions prevailed in northern parts of India.

#### 3. Season's rainfall

The season's rainfall was excess in Gangetic West Bengal, Gujarat State, Konkan & Goa, Madhya Maharashtra, Marathwada, coastal Andhra Pradesh, Telangana & north interior Karnataka; normal in Arunachal Pradesh, Assam & Meghalaya, Sub-Himalayan West Bengal & Sikkim, Vidarbha, Rayalaseema and south interior Karnataka and deficient in Nagaland, Manipur, Mizoram & Tripura, Orissa, Bihar Plains, Punjab, Himachal Pradesh, west Rajasthan, east Madhya Pradesh and coastal Karnataka. It was scanty over the rest of the country.

The seasonal rainfall departures are given in Fig. 1.

#### 4. January

##### 4.1. Weather and associated synoptic features

There were 7 western disturbances and 4 induced cyclonic circulations which affected north India during the month. Out of these, only one western disturbance (17-18) and one induced cyclonic circulation (27-28) were active and caused weather over northern parts of India. There were 3 easterly troughs, 2 westerly troughs and 4 troughs in low levels formed during the month. Many troughs were active and caused weather over many parts of Peninsular India during 8 to 22 January.

Rain or snow occurred either almost at all the places or at many places on two days in Jammu & Kashmir and at a few places on 1 to 2 days in Himachal Pradesh and Jammu & Kashmir.

Rain or thundershowers occurred either almost at all the places or at many places on 1 to 2 days in Arunachal Pradesh, Assam & Meghalaya, Sub-Himalayan West Bengal & Sikkim, Orissa, Bihar, Haryana, Punjab, Himachal Pradesh, east Madhya Pradesh, Maharashtra & Goa States and Telangana. Rain or thundershowers occurred either at a few places or at one or two places on 10 to 14 days in Orissa, coastal Andhra Pradesh, Tamil Nadu and south interior Karnataka; on 5 to 9 days in Andaman & Nicobar Islands, Himachal Pradesh, Madhya Pradesh, Gujarat region, Konkan &

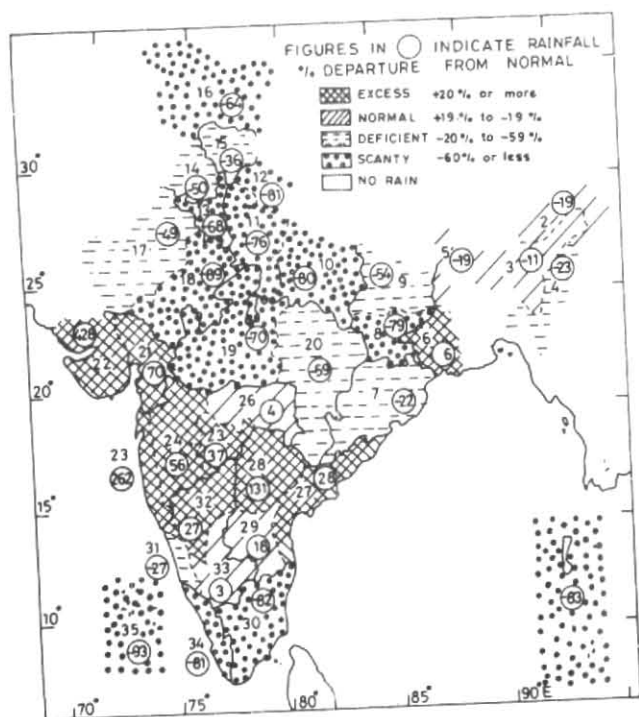


Fig. 1. Rainfall for the period January February 1997

\*Compiled by: S.K., Dikshit, D.S. Desai, V. Krishnan and M.V. Mande, Meteorological Office, Pune-411005, India.

TABLE 1  
Details of the weather systems during January 1997

S.No.	System	Duration	Place of first location	Direction of movement	Place of dissipation	Remarks
(1)	(2)	(3)	(4)	(5)	(6)	(7)
<b>(A) Western disturbances</b>						
1.	Upper air system	2 - 4	North Pakistan and neighbourhood	Northeasterly	Jammu & Kashmir (moved away across Western Himalayas)	
2.	Do	3 - 7	North Pakistan and adjoining Afghanistan	Do	Do	
3.	Do	10 - 14	North Pakistan and neighbourhood	Eastnortheasterly	Do	
4.	Do	17 - 18	North Afghanistan	Do	Do	It lay as a low pressure area over north Pakistan and neighbourhood on 18
5.	Do	23 - 25	Afghanistan and neighbourhood	Do	Do	
6.	Do	26 - 29	Southwest Pakistan and neighbourhood	Do	Do	
7.	Do	29 Jan-11 Feb	North Pakistan and adjoining parts of Afghanistan	Do	Do	
<b>(B) Low Pressure Area (LOPAR)</b>						
1.	Low pressure area	13 - 16	Southern parts of south Andaman Sea and adjoining southeast Bay	easterly	Southern parts of southeast Bay	
2.	Do	20 - 22	East Madhya Pradesh and adjoining Bihar	Do	Bangladesh and adjoining Gangetic West Bengal	It was seen as an upper air cyclonic circulation (cycir) from 21
<b>(C) Induced cyclonic circulations</b>						
1.	Lower levels	12 - 14	South Rajasthan and neighbourhood	Stationary	<i>In situ</i>	
2.	Lower tropospheric levels	18 - 21	Do	Northeasterly	North Rajasthan and adjoining Punjab & Haryana	With a trough aloft on 19
3.	Do	27 - 28	Southeast Rajasthan and neighbourhood	Stationary	<i>In situ</i>	
4.	Do	30 - 31	Punjab and adjoining Pakistan	Do	Do	
<b>(D) Other cyclonic circulations</b>						
1.	Lower levels	8 - 12	West Uttar Pradesh, Haryana and neighbourhood	Quasi-stationary	West Uttar Pradesh and neighbourhood	
2.	Do	17 - 18	Meghalaya and neighbourhood	Stationary	<i>In situ</i>	
3.	Do	19-20	North interior Karnataka, South Madhya Maharashtra and neighbourhood	Do	Do	
4.	Lower tropospheric levels	22	Northeast Bay and adjoining Myanmar	Do	Do	
5.	Do	29 - 30	South Tamil Nadu and neighbourhood	Do	Do	

TABLE 1 (Contd.)

(1)	(3)	(4)	(5)	(6)	(7)
<b>(E) Troughs of low</b>					
1.	Sea level chart	7 - 13	West-central and adjoining Bay	Quasi-stationary	Southwest and west-central Bay of Tamil Nadu, Andhra Pradesh coast
2.	Lower level	11-13	Lakshadweep-Maldiv area and adjoining southeast Arabian Sea	Stationary	<i>In situ</i>
3.	Sea level chart	23 - 25	Lakshadweep-Maldiv area and adjoining southeast Arabian Sea	Do	Do
4.	Lower tropospheric levels	23 - 24	Southwest and adjoining southeast Bay	Do	Do
<b>(F) Troughs in the easterlies</b>					
1.	Lower tropospheric levels	13 - 17	Kerala coast to south Maharashtra coast	Easterly	Telangana to adjoining south Tamil Nadu
2.	Lower levels	18 - 21	Southwest and adjoining west-central Bay off Tamil Nadu coast	Stationary	<i>In situ</i>
3.	Do	25 - 29	South Tamil Nadu to north interior Karnataka	Northeasterly	North interior Karnataka to west Madhya Pradesh
<b>(G) Troughs in the westerlies</b>					
1.	Lower tropospheric levels	14 - 15	Southwest Rajasthan to south interior Karnataka	Southeasterly	South Madhya Pradesh to south interior Karnataka
2.	Upper tropospheric level	19 - 21	Long. 72°E, north of Lat. 28°N	Stationary	<i>In situ</i>
<b>(H) Other troughs</b>					
1.	Lower levels	29 Dec - 3 Jan	Southwest Bay and neighbourhood	Do	Do
2.	Lower tropospheric levels	7 - 9	Lakshadweep to south Gujarat coast	Do	Do
3.	East-West trough (Lower levels)	20 - 22	Bihar Plateau to Nagaland, Manipur, Mizoram & Tripura	Easterly	Gangetic West Bengal to Nagaland, Manipur, Mizoram & Tripura
4.	Sea level chart	25 - 27	Kerala coast to south Maharashtra coast	Quasi-stationary	Kerala to Maharashtra coast

It was seen with an embedded cycir extending upto 3.01 km as l over east-central Arabian Sea and adjoining south Gujarat and Maharashtra-Goa coast on 8

Goa, Madhya Maharashtra, Marathwada, Telangana, Rayalaseema, north interior Karnataka and Kerala and on 1 to 4 days in Arunachal Pradesh, Assam & Meghalaya, Na-

galand, Manipur, Nizoram & Tripura, West Bengal and Sikkim, Bihar, Rajasthan, Saurashtra & Kutch, Vidarbha, coastal Karnataka and Lakshadweep.

TABLE 2  
Details of the weather systems during February 1997

S.No.	System	Duration	Place of first duration	Direction of movement	Place of dissipation	Remarks
(1)	(2)	(3)	(4)	(5)	(6)	(7)
<b>(A) Western disturbances</b>						
1.	Upper air system	1 - 5	North Pakistan and neighbourhood	Eastnortheasterly	Jammu & Kashmir (moved away across Western Himalayas)	
2.	Do	8 - 11	North Pakistan	Do	Do	
3.	Do	13 - 17	North Pakistan and neighbourhood	Do	Do	
4.	Do	18 - 22	Do	Do	Do	
5.	Do	24 - 28	North Pakistan and adjoining Jammu & Kashmir	Do	Do	
6.	Do	28 Feb - 1 Mar	North Pakistan and neighbourhood	Do	Do	
<b>(B) Induced low pressure area</b>						
1.	Lower levels	2 - 4	Northwest Rajasthan and neighbourhood	Eastnortheasterly	Associated cyclonic circulation (cycir) extended upto 3.1 km asl. It lay as an extended low over south Uttar Pradesh & adjoining Madhya Pradesh on 3 and less marked on 4. Associated cycir persisted upto 6 and less marked over north Assam on 7	
2.	Lower levels	8 - 10	Northwest Rajasthan and neighbourhood	Eastnortheasterly	Haryana & adjoining parts of east Uttar Pradesh	Associated cycir extended upto 1.5 km asl. It lay over west Uttar Pradesh and extended upto 0.9 km asl on 9. It became less marked on 11
<b>(C) Induced cyclonic circulations</b>						
1.	Lower level	15 - 19	West Rajasthan and adjoining Pakistan	Eastnortheasterly	East Madhya Pradesh and neighbourhood	
2.	Do	24 - 26	Central Pakistan and adjoining west Rajasthan	Northeasterly	West Rajasthan and adjoining Punjab & Haryana	It lay as a low pressure area over west Rajasthan and adjoining Punjab & Haryana with associated cyclonic circulation extended upto 1.5 km asl on 25 and became less marked on 26
3.	Do	28 Feb - 3 Mar	Southeast Pakistan and adjoining west Rajasthan	Do	Punjab and adjoining Himachal Pradesh	
<b>(D) Other cyclonic circulations</b>						
1.	Lower levels	31 Jan - 2 Feb	North Assam & neighbourhood	Stationary	<i>In situ</i>	
2.	Lower tropospheric levels	11 - 12	Punjab and neighbourhood	Do	Do	
3.	Do	21 - 25	Bangladesh & neighbourhood	Northeasterly	Nagaland, Manipur, Mizoram & Tripura	Moved away across western Himalayas
4.	Do	24 - 26	Bihar Plateau & neighbourhood	Stationary	<i>In situ</i>	
5.	Do	26 Feb - 9 Mar	Southern parts of plains of west Uttar Pradesh and adjoining north Madhya Pradesh and Bihar	Northeasterly	Gangetic West Bengal and neighbourhood	An East-West trough from the system to 25°N, east of 75° E to Nagaland, Manipur, Mizoram & Tripura on 28. It becomes less marked over Assam and neighbourhood on 7 March

TABLE 2 (Contd.)

(1)	(3)	(4)	(5)	(6)	(7)	
<b>(E) Troughs in the easterlies</b>						
1.	Lower tropospheric levels	3 - 6	East Madhya Pradesh to north Tamil Nadu	Quasi-stationary	South Tamil Nadu to south Madhya Maharashtra	
2.	Lower levels	17 - 19	Southwest Bay off Tamil Nadu-Sri Lanka coast	Stationary	<i>In situ</i>	
<b>(F) East-West trough</b>						
1.	Lower levels	11 - 14	Bihar Plains to Nagaland	Quasi-stationary	Bihar Plains to Mizoram	
2.	Do	18 - 23	West Madhya Pradesh to north interior Karnataka	Southeasterly	Southeast Madhya Pradesh and adjoining Orissa	
3.	Do	20 - 21	Sub-Himalayan West Bengal and Sikkim to south Tamil Nadu through southeast Madhya Pradesh	Stationary	<i>In situ</i>	
<b>(G) Other troughs</b>						
1.	Lower levels	15 - 19	Assam & Meghalaya and Nagaland Manipur, Mizoram & Tripura	Stationary	<i>In situ</i>	It lay as an upper air cycir over the same area on 16 and became less marked on 19

#### 4.2. Month's rainfall

Accumulated monthly rainfall was excess in 13, normal in 4, deficient in 7 and scanty in the remaining 11 sub-divisions of India.

Rainfall was excess in Gangetic West Bengal, Orissa, Gujarat state, Maharashtra & Goa states, Andhra Pradesh and interior Karnataka and normal over Bihar Plains, west Rajasthan, east Madhya Pradesh and coastal Karnataka. Rainfall was deficient or scanty over the rest of the country. Principal amounts of rainfall are given in Table 4.

#### 4.3. Temperature

Several cold wave conditions prevailed on 3 days in Punjab and Himachal Pradesh and on one day in Kashmir. Cold wave conditions also prevailed on 15 days in Punjab, on 8 days in Nagaland, Manipur, Mizoram and Tripura and Haryana and on 1 to 3 days in Bihar Plains, plains of Uttar Pradesh, Himachal Pradesh, Kashmir, Rajasthan, Marathwada and Vidarbha.

Day temperatures were generally below normal over Maharashtra, Telangana and Rayalaseema from 21st to 25th of the month and also in the last week of the month over Bihar.

Lowest minimum temperature of  $-2^{\circ}\text{C}$  was recorded at Amritsar on 13 January. In the hills, lowest temperature of  $-11^{\circ}\text{C}$  was recorded at Quazigund on 25 January.

#### 4.4. Disastrous weather events and damages

According to the press reports, 24 persons died due to cold wave in Bihar. Squally winds with rain took lives of 3

persons in Nagpur. Crops over 500 acres of land damaged due to hailstorm in Madhya Pradesh.

### 5. February

#### 5.1. Weather and associated synoptic features

6 western disturbances, 2 induced low pressures and 3 induced cyclonic circulations at lower tropospheric levels affected northwest India. As none of the systems was active, rainfall activity was subdued in the month. Details of the weather systems are given in Table 2.

Rain or thundershowers occurred almost at all the places or at many places on 3 to 4 days in Assam & Meghalaya, Himachal Pradesh and Jammu & Kashmir and on 1 to 2 days in Arunachal Pradesh, Nagaland, Manipur, Mizoram & Tripura, Gangetic West Bengal and Punjab. Rain or thundershowers occurred either at a few places or at one or two places on 10 to 15 days in Assam & Meghalaya, Sub-Himalayan West Bengal & Sikkim, Himachal Pradesh and Kerala; on 4 to 7 days in Andaman & Nicobar Islands, Nagaland, Manipur, Mizoram & Tripura, Gangetic West Bengal, Orissa, hills of west Uttar Pradesh, Haryana, Punjab and Jammu & Kashmir and on 1 to 3 days in Arunachal Pradesh, Bihar, plains of Uttar Pradesh, Rajasthan, coastal Andhra Pradesh and Tamil Nadu.

#### 5.2. Month's rainfall

Accumulated monthly rainfall was excess in Arunachal Pradesh and Gangetic West Bengal; normal in Assam & Meghalaya, Nagaland, Manipur, Mizoram & Tripura and Sub-Himalayan West Bengal and Sikkim and deficient in Himachal Pradesh. It was scanty over

TABLE 3  
Rainfall figures (mm) for each month and season as a whole (January-February 1997)

S. No.	Meteorological sub-division	January			February			Winter Season		
		Actual (mm)	Normal (mm)	Dep (%)	Actual (mm)	Normal (mm)	Dep (%)	Actual (mm)	Normal (mm)	Dep (%)
1.	Bay Islands	8	73	-89	12	47	-74	20	120	-83
2.	Arunachal Pradesh	7	44	-85	84	68	23	91	113	-19
3.	Assam & Meghalaya	11	17	-34	31	30	1	42	47	-11
4.	Naga.,Mani.,Mizo. & Tripura	9	13	-32	19	24	-18	28	37	-23
5.	SHWB & Sikkim	10	18	-41	23	24	-2	33	41	-19
6.	Gangetic West Bengal	18	13	34	28	20	37	46	34	36
7.	Orissa	25	12	105	4	25	-83	29	37	-22
8.	Bihar Plateau	7	20	-66	3	25	-89	9	45	-79
9.	Bihar Plains	14	16	-10	0	16	-98	15	32	-54
10.	East Uttar Pradesh	6	18	-64	0	16	-98	7	34	-80
11.	Plains of west Uttar Pradesh	8	22	-63	2	18	-91	10	40	-76
12.	Hills of west Uttar Pradesh	19	67	-72	6	63	-91	25	131	-81
13.	Har., Chandni. & Delhi	9	22	-56	4	19	-82	13	41	-68
14.	Punjab	18	29	-37	9	26	-64	28	55	-50
15.	Himachal Pradesh	58	80	-28	41	74	-45	98	154	-36
16.	Jammu & Kashmir	32	82	-61	28	86	-68	60	168	-64
17.	West Rajasthan	4	4	0	1	5	-89	4	9	-49
18.	East Rajasthan	1	7	-88	0	4	-90	1	11	-89
19.	West Madhya Pradesh	6	13	-52	0	8	-100	6	21	-70
20.	East Madhya Pradesh	17	20	-14	0	22	-100	17	41	-59
21.	Gujarat Region	5	2	165	0	1	-100	5	3	70
22.	Saurashtra, Kutch & Diu	9	1	741	0	1	-100	9	2	428
23.	Konkan & Goa	7	1	468	0	1	-100	7	2	262
24.	Madhya Maharashtra	9	4	113	0	1	-100	9	6	56
25.	Marathwada	9	3	204	0	4	-100	9	7	37
26.	Vidarbha	25	11	120	0	13	-100	25	24	4
27.	Coastal Andhra Pradesh	22	9	138	4	11	-66	26	20	28
28.	Telangana	25	4	486	0	6	-100	25	11	131
29.	Rayalaseema	14	7	90	0	5	-100	14	12	18
30.	Tamil Nadu & Pondy.	9	34	-74	0	15	-99	9	49	-82
31.	Coastal Karnataka	3	2	14	0	1	-100	3	3	-27
32.	N.I. Karnataka	6	2	206	0	3	-99	6	5	27
33.	S.I. Karnataka	7	3	146	0	4	-100	7	7	3
34.	Kerala	2	15	-85	4	17	-77	6	31	-81
35.	Lakshadweep	2	25	-91	0	9	-99	2	34	-93

TABLE 4  
Principal amounts of rainfall (cm) for the month of January and February 1997

Date	January	February
1	Nil	Calcutta 2, Krishnanagar 1
2	Nil	Tezpur & Gangtok 2 each, Rewari & Bhuntar 1 each
3	Nil	Kangra & Banihal 3 each, Hasimara & Amritsar 1 each
4	Nil	Nancowry 5, Magra-Bagati 4, Kahu 1
5	Nil	Gangtok 1
6	Nil	North Lakhimpur & Gangtok 1 each
7	Maya Bandar 4	Nil
8	Karaikal 3, Verawal 2, Ahmedabad 1	Hasimara 1
9	Tirupathi 6	Gangtok, Manali & Anantnag 1 each
10	Kothagudam 3, Ongole 2	Joginder Nagar 6, Puri & Basihal 2 each, Guhla & Malkapur 1 each
11	Ongole 7, Tripathi & Pondicherry 1 each	Joginder Nagar 3, Magra-Bagati 2, Gangtok & DehraDun 1 each
12	Tiruchirapalli 4, Malegaon 2	Nil
13	Karjat 3, Akola 2, Vaijapur 1	Nil
14	Akola, Nizamabad & Kurnool 3, each, Manjeri 2, Parola, Hingoli, Panambur, Raichur & Bellary 1 each	Nil
15	Hyderabad 6, Jabalpur 2, Jamshedpur, Chandrapur & Nandyal 1 each	Dibrugarh 1
16	Bhubaneswar 5, Uthagamandalam 1	North Lakhimpur 1
17	Agartala 1	Dibrugarh 1
18	Nil	Agartala 1
19	Banihal 4, Kangra 2, Hissar & Nagapattimam 1 each	Nil
20	Jogindernagar 15, Katra 8, Malkapur 7, Mukteswar 4, Jagadhari 3, Patna, Lucknow, Mainpuri, Pendra, Surat, Veraval & Bhira 1 each	Jamshedpur 2, Krishnagar 1
21	Calcutta 3, Gangtok, Balasore 2 each, Dehra Dun 1	Imphal & Bhubaneswar 1 each
22	Nil	Krishnanagar 1
23	Nil	Nil
24	Nil	Nil
25	Nil	Bhuntar 1
26	Nil	Bhuntar 2, Mukteswar 1
27	Bhuntar 1	Shillong & Malda 1 each
28	Nil	Gangtok 2
29	Nil	Nil
30	Nil	-
31	North Lakhimpur 2	-

the rest of the country outside Madhya Pradesh, Gujarat State, Maharashtra & Goa States, Telangana, Rayalaseema and coastal & south interior Karnataka where there was no rain. Principal amounts of rainfall are given in Table 4.

### 5.3. Temperature

Severe cold wave conditions prevailed on one day in Arunachal Pradesh and Nagaland, Manipur, Mizoram & Tripura. Cold wave conditions also prevailed on 15 days in

Punjab; on 4 to 5 days in Himachal Pradesh and Jammu & Kashmir and on 1 to 2 days in Nagaland, Manipur, Mizoram & Tripura and east Rajasthan.

Lowest temperature of  $1^{\circ}\text{C}$  was recorded at Amritsar on 7th & Churu on 11th. In the hills, lowest temperature of  $-8^{\circ}\text{C}$  was recorded at Quazigund on 12th.

#### 5.4. *Disastrous weather events and damages*

According to press reports, hundreds of domestic animals died, road's telecommunication and water supply were disrupted at several places in Arunachal Pradesh due to heavy snowfall on 5 February.

In Bihar 3 persons died due to cold wave on 4 February.

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