

# Weather

## HOT WEATHER SEASON (MARCH-MAY 1991)\*

### 1. Introduction

The normal seasonal rainfall in Andaman & Nicobar Islands, Arunachal Pradesh, Assam & Meghalaya, Nagaland, Manipur, Mizoram & Tripura, Sub-Himalayan West Bengal & Sikkim and Kerala is of the order of 45 cm to 56 cm. In association with the western disturbances over northwest India, rainfall/snowfall occurs over hills of west Uttar Pradesh, Himachal Pradesh and Jammu & Kashmir whose normal ranges from 18 cm to 33 cm. The normal pre-monsoon rainfall ranges from 10 cm to 19 cm in Gangetic West Bengal, Orissa, Bihar Plateau, Tamil Nadu, Coastal and South Interior Karnataka, and Lakshadweep. It is least in Gujarat (<1 cm).

The spatial distribution of rainfall over different meteorological sub-divisions of the country is described using following criteria:

Classification	Percentage departure from normal rainfall
(i) Excess	+20 or more
(ii) Normal	+19 to -19
(iii) Deficient	-20 to -59
(iv) Scanty	-60 or less

Monthwise synoptic features are given in Table 2-4 and the monthly and seasonal rainfall figures in Table 1. Seasonal rainfall departures for the 35 meteorological sub-divisions are shown in Fig. 1.

### 2. Chief synoptic features

(i) Formation of a severe cyclonic storm with core of hurricane winds [SCS(H)] and another cyclonic storm (CS) in the Bay of Bengal. Both the storms crossed Bangladesh coast. Tracks of these storms are shown in Fig. 1.

(ii) Floods in Brahmaputra and Barak valleys of Assam during May.

(iii) Hailstorms lashed several parts of Assam and Gangetic West Bengal, Orissa, Himachal Pradesh, Rajasthan and in Bombay and its suburbs.

(iv) In northeast India, days were cooler in April and May and also over northwest India in April.

(v) Advance of southwest monsoon in the south Bay of Bengal and south Arabian Sea during the last week of May.

### 3. Season's rainfall

It was excess or normal in 19, deficient in 11, and scanty in 4 sub-divisions (Data from Jammu & Kashmir were absent).

Rainfall was excess in Nagaland, Manipur, Mizoram & Tripura, Punjab, Madhya Maharashtra and Interior Karnataka; normal in Andaman & Nicobar Islands, Arunachal Pradesh, Assam & Meghalaya, Gangetic West Bengal, Orissa, Bihar, Haryana, Himachal Pradesh, Rajasthan, East Madhya Pradesh, Telangana and Coastal Karnataka; deficient in Sub-Himalayan West Bengal & Sikkim, Uttar Pradesh, West Madhya Pradesh, Marathwada, Coastal Andhra Pradesh, Rayalaseema, Tamil Nadu, Kerala and Lakshadweep and was scanty over the rest of the meteorological sub-divisions.

### 4. March

#### 4.1. Weather and associated synoptic features

Trough/wind discontinuity in the lower levels over the peninsular India was observed throughout the month, Northwest India was affected by five western disturbances and three Induced Cyclonic Circulations. Details of the synoptic systems of the month are given in Table 2.

Thundershowers, well distributed in time and space occurred over northeast India, Punjab, Himachal Pradesh, Jammu & Kashmir, East Madhya Pradesh, South Interior Karnataka and Kerala. Rain or thundershowers occurred either almost at all the places or at many places on 4 to 6 days in Arunachal Pradesh, Gangetic West Bengal, Bihar Plateau, Himachal Pradesh, Jammu & Kashmir and on 1 to 2 days in Assam & Meghalaya, Nagaland, Manipur, Mizoram & Tripura, Sub-Himalayan West Bengal & Sikkim, Hills of West Uttar Pradesh, Punjab and East Madhya Pradesh. They occurred at a few places or at one or two places on 23 days each in Orissa and Kerala, on 17 to 18 days in Assam & Meghalaya, Sub-Himalayan West Bengal & Sikkim and East Madhya Pradesh, on 5 to 12 days in Andaman & Nicobar Islands, Arunachal Pradesh, Gangetic West Bengal, Bihar, West Uttar Pradesh, Haryana, Punjab, Himachal Pradesh, West Madhya Pradesh, Vidarbha, Coastal Andhra Pradesh,

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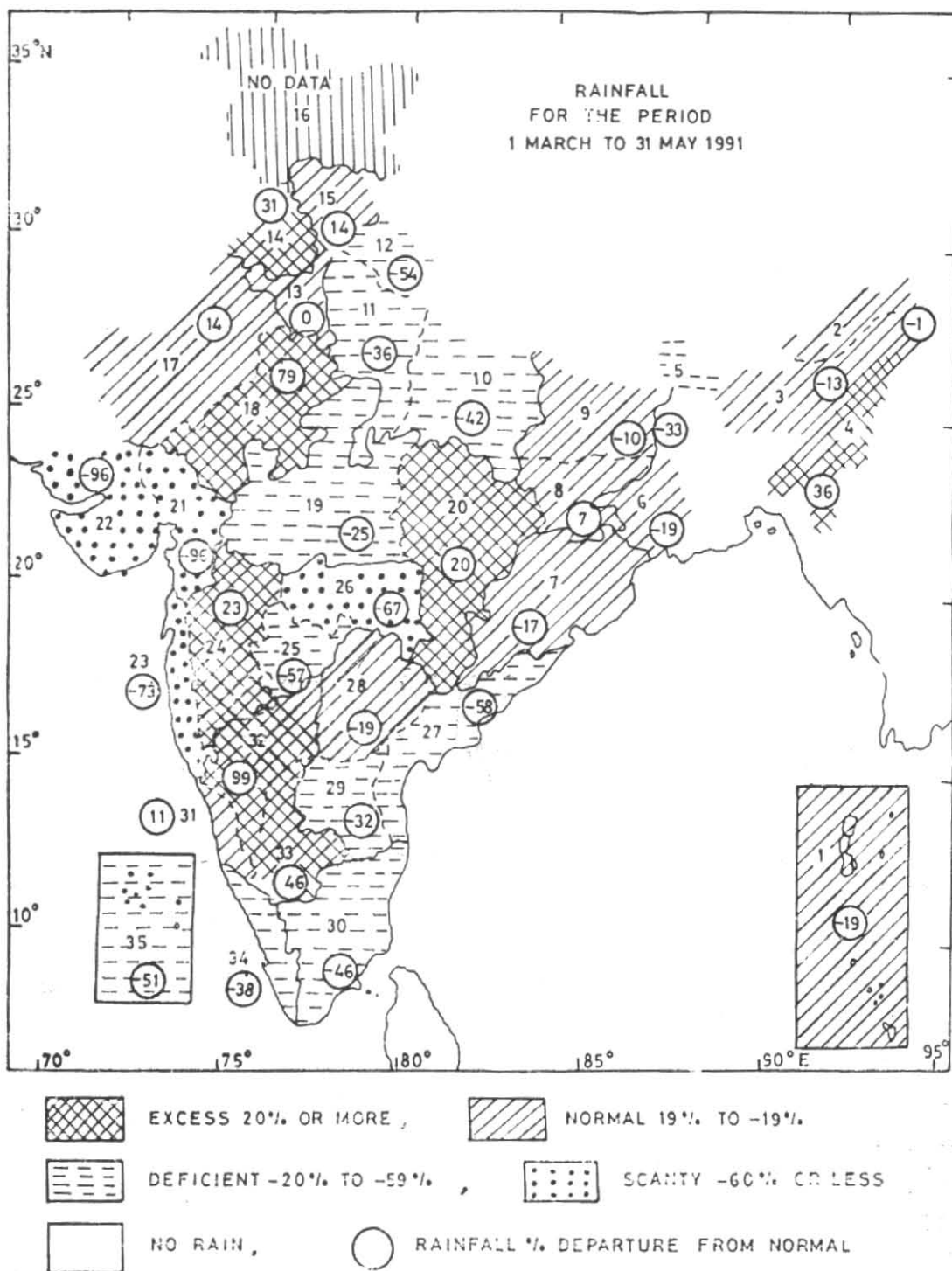


Fig. 1. Rainfall for the period 1 March to 31 May 1991 (Percentage departure from normal)

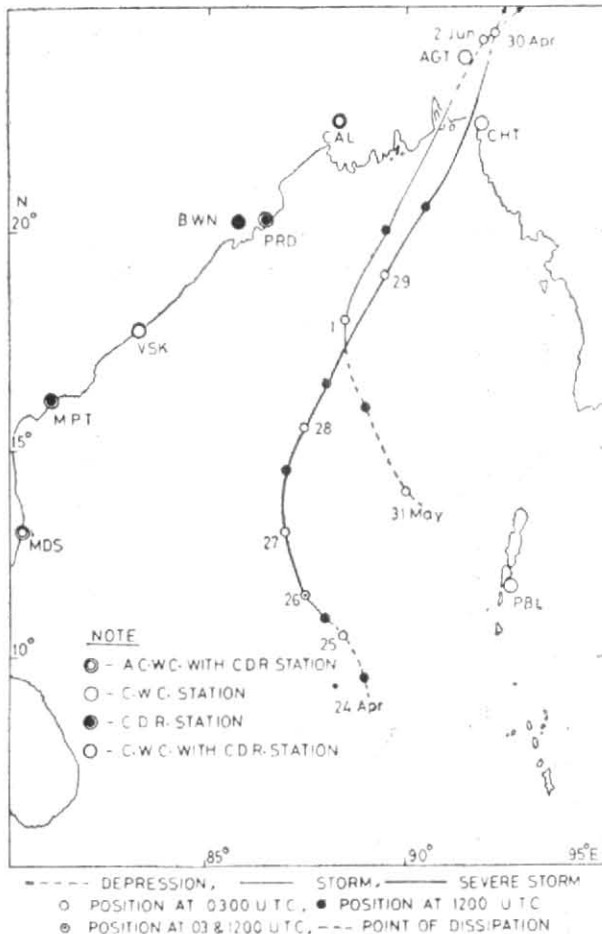


Fig. 2. Tracks of storms/depressions, March to May 1991

Tamil Nadu and South Interior Karnataka and on 1 to 4 days over the rest of the country outside Gujarat, Konkan & Goa, Rayalaseema and coastal Karnataka, where the weather was mainly dry.

#### 4.2. Month's rainfall

Rainfall during the month was in excess in 5, normal in 10, deficient in 5 and scanty in 10 sub-divisions. Weather was dry over 4 sub-divisions namely Gujarat, Konkan & Goa and Coastal Karnataka.

Rainfall was excess in Gangetic West Bengal, Orissa, Bihar Plateau, East Madhya Pradesh and Lakshadweep; normal in Andaman & Nicobar Islands, Arunachal Pradesh, Assam & Meghalaya, Nagaland, Manipur, Mizoram & Tripura, Bihar Plains, East Uttar Pradesh, Punjab, Himachal Pradesh, West Madhya Pradesh and Kerala; deficient in Sub-Himalayan West Bengal & Sikkim, West Uttar Pradesh, Tamil Nadu and South Interior Karnataka and was scanty in Haryana, Rajasthan, Madhya Maharashtra, Marathwada, Vidarbha, Andhra Pradesh and North Interior Karnataka. Data from Jammu & Kashmir were absent.

The significant amounts (cm) of rainfall during March are given below :

1st : Jamsolaghat 8, Konni 6, Ghumarwin 5, Kalaikunda 4.

2nd : Chowari & Seoni 6 each, Balaghat & Ghumarwin 5 each, Tondi 4.

5th : Chamba & Tissa 7 each, Rajghat 5, Bhuntar AP & Samrala 4 each.

6th : Kallam 8, Kalpa & Thodupuza 6 each.

7th : Punalur 6, Konni 4.

8th : Pollachi 6, Katraguda 4.

10th : Konni & Thodupuza 4 each.

11th : Silchar 5, Baripada 4.

14th : Dehragopipur & Jogindernagar 7 each, Bankura 4.

15th : Bankura 6, Jamshedpur 5.

21st : Car Nicobar 6.

22nd : Dasua 4.

23rd : Car Nicobar 9, Chowari 5.

25th : Chaparmukh 7, Calcutta & Cooch Behar 3 each.

27th : Tezu 4.

29th : Tondi 5, Minicoy & Tadong 4 each.

30th : Nangunari 9, Sattankulam 5, Kanyakumari 4.

31st : Arundhatinagar 6, Agartala 3.

#### 4.3. Temperature

Day temperatures were below or appreciably below normal in Bihar, Uttar Pradesh, Haryana, Punjab, Jammu & Kashmir, West Rajasthan and Gujarat Region from 1st to 10th and were so over Haryana, Punjab, Jammu & Kashmir and Gujarat between 20th & 26th. They were above or appreciably above normal on most days of the month in Tamil Nadu and Interior Karnataka and were so in Sub-Himalayan West Bengal & Sikkim, Bihar, East Uttar Pradesh, Madhya Pradesh, Vidarbha and Rayalaseema between 11th & 20th and in Himachal Pradesh, Rajasthan, Madhya Pradesh and Gujarat from 27th to 31st. During the last week at several places in Gujarat temperatures were 43°C which were 6°C to 10°C above normal values. Bhuj, Naliya, Porbandar and Rajkot recorded day's maximum temperature 43°C on 28th and Ahmedabad, Bhuj, Naliya, Kandla and Rajkot on 29th and at Ahmedabad, Dohad, Naliya, Rajkot on 30th. The lowest day temperatures in the plains was 16°C recorded at Amritsar on 3rd and 3°C in the high altitude stations recorded at Srinagar on 4th.

Night temperatures were 5°C to 7°C below normal in Hills of West Uttar Pradesh on 1st, from 14th to 17th on 23rd, 24th and 29th, in Himachal Pradesh on 23rd and 24th and in Jammu on 6th, 14th, 19th and 24th. They were 3°C to 4°C below normal in Hills of West Uttar Pradesh between 2nd and 5th, in Punjab and West Rajasthan on 15th and 16th in, Bihar Plains between 25th and 27th, in East Uttar Pradesh between 24th and 26th and in Punjab, Himachal Pradesh and Jammu on 25th and 26th. They were generally above or appreciably above normal (dep. +2°C to +4°C) in Nagaland, Manipur, Mizoram & Tripura, Gangetic West Bengal, Orissa, Rajasthan, Madhya Pradesh and Gujarat Region during the month and were so in Marathwada, Vidarbha, Telangana, Rayalaseema and Tamil Nadu between 1st and 13th.

## WEATHER

TABLE 1

Monthly and seasonal rainfall, March to May 1991

Sub-divisions	March 1991			April 1991			May 1991			Season Mar+Apr+May 1991		
	Actual (mm)	Normal (mm)	% Dep.	Actual (mm)	Normal (mm)	% Dep.	Actual (mm)	Normal (mm)	% Dep.	Actual (mm)	Normal (mm)	% Dep.
(1) A. & N. Islands	36	40	-9	134	88	52	241	378	-36	411	506	-19
(2) Arunachal Pradesh	80	99	-19	157	168	-7	364	339	7	600	607	-1
(3) Assam & Meghalaya	65	79	-17	215	224	-4	301	365	-17	581	667	-13
(4) Naga., Mani., Mizo.	63	63	0	194	210	-8	433	234	85	690	507	36
(5) S.H.W.B. & Sikkim	28	53	-48	51	109	-53	214	278	-23	293	440	-33
(6) G. West Bengal	41	26	60	29	39	-27	62	99	-37	132	163	-19
(7) Orissa	29	22	33	31	31	0	36	63	-43	97	117	-17
(8) Bihar Plateau	34	20	73	13	19	-32	50	52	-4	98	91	7
(9) Bihar Plains	10	11	-9	14	15	-7	42	48	-13	66	74	-10
(10) East Uttar Pradesh	10	9	6	4	6	-39	13	31	-57	27	47	-42
(11) Plains — West U.P.	8	13	-37	6	7	-10	18	31	-41	33	51	-36
(12) Hills — West U.P.	41	59	-31	19	37	-49	53	151	-65	113	247	-54
(13) Har. Chandī, & Delhi	5	15	-68	19	7	153	12	13	-7	35	35	0
(14) Punjab	23	26	-14	36	11	210	10	15	-29	69	52	31
(15) Himachal Pradesh	90	70	14	70	57	38	41	49	-16	211	186	14
(16) Jammu & Kashmir												
(17) West Rajasthan	0	7	-95	12	2	467	0	1	-100	12	11	14
(18) East Rajasthan	2	6	-71	15	2	546	0	1	-100	17	10	79
(19) West Madhya Pradesh	7	8	-8	11	10	12	2	9	-78	20	27	-25
(20) East Madhya Pradesh	28	18	60	42	31	35	7	15	-57	77	64	20
(21) Gujarat Reg., Daman, Dadra & Nagar Hav.	0	2	-100	0	1	-73	0	7	-100	0	10	-96
(22) Sau., Kutch & Diu	0	3	-100	0	1	-70	0	4	-100	0	8	-96
(23) Konkan & Goa	0	1	-100	6	5	20	8	45	-83	14	50	-73
(24) Madhya Maharashtra	0	4	-92	15	12	23	40	29	38	55	44	23
(25) Marathwada	1	7	-90	8	11	-24	7	20	-63	16	37	-57
(26) Vidarbha	6	18	-68	6	12	-49	2	13	-84	14	44	-67
(27) Coastal A. P.	3	13	-75	12	25	-52	24	56	-57	39	94	-58
(28) Telangana	2	11	-84	20	20	2	25	27	-9	47	58	-19
(29) Rayalaseema	0	6	-98	18	21	-16	37	54	-31	55	81	-32
(30) T. Nadu & Pondi.	12	21	-43	40	51	-21	26	72	-64	78	144	-46
(31) Coastal Karnataka	0	5	-100	61	31	93	134	140	-4	195	176	11
(32) N. I. Karnataka	2	7	-77	66	26	155	95	48	98	163	82	99
(33) S. I. Karnataka	4	9	-58	88	46	90	141	105	35	232	159	46
(34) Kerala	34	39	-13	99	112	-11	119	256	-54	252	407	-38
(35) Lakshadweep	10	8	134	12	35	-65	61	144	-58	92	187	-51

TABLE 2  
Details of weather systems during March 1991

S. No.	Weather system	Period	Place of first location	Direction of movement	Place of dissipation	Remarks
<i>(A) Western disturbances</i>						
(1)	Upper air system	1st-5th eve.	North Pakistan and neighbourhood	Easterly	Moved away across Jammu & Kashmir and neighbourhood	
(2)	Do.	8th-13th	Northeast Afghanistan and adjoining north Pakistan	Do.	Do.	
(3)	Do.	16th-18th	North Pakistan	Do.	Do.	
(4)	Do.	17th-20th eve.	Central Pakistan and neighbourhood	ENE'ly	Moved away across Himachal Pradesh and neighbourhood	
(5)	Do.	20th-25th eve.	North Pakistan and neighbourhood	Easterly	Moved away across Jammu & Kashmir and neighbourhood	
<i>(B) Induced cyclonic circulation</i>						
(1)	Lower levels	4th-6th eve.	North Rajasthan and neighbourhood	Easterly	Plains of West Uttar Pradesh	
(2)	Do.	13th-15th	Northwest Rajasthan and neighbourhood	Do.	Southern parts of Uttar Pradesh	
(3)	Do.	21st-25th	North Rajasthan and neighbourhood	Quasi-stationary	Punjab and neighbourhood	
<i>(C) Trough in westerlies</i>						
(1)	Middle upper tropospheric levels	4th-6th	Extended from northwest Afghanistan to north Arabian Sea	ENE'ly	Moved away across northwest India and neighbourhood	
(2)	Do.	17th-20th	Extended from northeast Iran to northeast Arabian Sea	Easterly	Pakistan and adjoining west Rajasthan and Saurashtra & Kutch	Dissipated with its axis roughly along Long. 71°E
(3)	Do.	21st-26th	Extended from northeast Iran to west central Arabian Sea	Do.	Moved away across north India and adjoining northern Peninsula	
<i>(D) Other cyclonic circulations</i>						
(1)	Lower levels	25th-27th	Extreme south Tamil Nadu and neighbourhood	Westerly	Lakshadweep area	
(2)	Do.	27th-30th eve.	East central Arabian Sea off Maharashtra coast	Quasi-stationary	<i>In situ</i>	
(3)	Lower tropospheric levels	30th-31st	Gangetic West Bengal and adjoining Bangladesh	—	<i>In situ</i>	

The lowest night temperature of the month at high altitude stations was  $-1^{\circ}\text{C}$  recorded at Mukteswar and Srinagar on 1st, while in the plains that was  $7^{\circ}\text{C}$  (dep.  $-6^{\circ}\text{C}$ ) recorded at Amritsar on 24th. The highest night temperature of the month was  $29^{\circ}\text{C}$  (dep.  $+9^{\circ}\text{C}$ ) recorded at Ahmedabad on 31st.

#### 4.4. Disastrous weather events and damages

As per media reports severe local storms accompanied with hailstorms occurred on several days in Assam and on one or two occasions in Manipur. Hailstorms also lashed some areas of Orissa and Rajasthan during the month. Hailstorm on 8th in some areas of Tinsukia district (Assam) damaged vast areas of tea garden and vegetables. Between 12th and 17th several parts of

Nowgong, Kamrup and Karbi. Along districts of Assam experienced heavy rains accompanied with severe hailstorms, which damaged crops and houses and up-rooted trees, electric and telephone poles in the affected areas. Squall accompanied with hailstorms on 24th damaged considerable properties in Guwahati and neighbourhood. Incessant rain on 30th/31st submerged several parts of Guwahati town. Severe local storm in Churachandpur and Bishanpur of Manipur in the last week of March destroyed 300 houses and rendered 2000 people homeless. In Orissa severe hailstorms lashed some parts of Mayurbhanj district on 2nd and Puri district on 7th damaging standing crops and blowing off roof-tops of large number of houses. Bharatpur in Rajasthan experienced hailstorm in the morning of 23rd, which caused damages to crops. Heavy rain

TABLE 3

Details of weather systems during April 1991

S. No	Weather system	Period	Place of first location	Direction of movement	Place of dissipation	Remarks
<b>(A) Cyclonic storm/Depression/Low pressure area</b>						
(1)	Severe cyclonic storm with core of hurricane winds	24th-30th eve.	Southeast Bay of Bengal	NNW'ly to NNE'ly	South Assam and adjoining Meghalaya, Tripura and Bangladesh. The remnant dissipated over northeast Assam on 1st May	Appeared as a low pressure area over southeast Bay on 23rd
<b>(B) Western disturbances</b>						
(1)	Upper air system	3rd-6th eve.	North Pakistan and neighbourhood	Easterly	Moved away across Jammu and Kashmir and neighbourhood	
(2)	Do.	6th-8th	Northeast Afghanistan and neighbourhood	Do.	Do.	
(3)	Do.	8th-10th	North Pakistan and neighbourhood	Do.	Do.	
(4)	Do.	12th-15th	Do.	Do.	Do.	
(5)	Do.	15th-17th	North Pakistan and adjoining Afghanistan	Do.	Do.	
(6)	Do.	21st-24th	North Pakistan and neighbourhood	Do.	Do.	
<b>(C) Induced cyclonic circulation/ Low pressure area</b>						
(1)	Lower tropospheric levels	1st-4th	Northwest Rajasthan and neighbourhood	Easterly	Himachal Pradesh and neighbourhood	
(2)	Do.	8th-10th	Do.	Do.	Do.	
(3)	Low pressure area	13th-15th eve.	West Rajasthan and neighbourhood	Do.	Southwest Uttar Pradesh and adjoining north Madhya Pradesh	Appeared as a cyclonic circulation in the lower levels over west Rajasthan on 12th
<b>(D) Trough in westerlies</b>						
(1)	Lower tropospheric levels	1st-3rd	Extended from west Assam to northwest Bay	—	<i>In situ</i>	
(2)	Middle and upper tropospheric level	5th-9th	Axis along Long. 65°E to north of Lat. 15°N	NE'ly	Moved away across northwest India and Uttar Pradesh	
(3)	Do.	8th-11th	Axis along Long. 62°E to north of Lat. 25°N	Easterly	Northwest India and neighbourhood	
<b>(E) Trough in easterlies</b>						
(1)	Lower levels	30th-4th Mar. Apr.	North Sri Lanka and neighbourhood	Westerly	Lakshadweep area	
(2)	Do.	3rd-6th	Off and along south Maharashtra-Karnataka coasts	—	<i>In situ</i>	
(3)	Do.	6th-10th	Extended from North Sri Lanka to Interior Karnataka	—	<i>In situ</i>	
<b>(F) Cyclonic circulation</b>						
(1)	Lower levels	15th-17th eve.	North Sri Lanka and neighbourhood	Westerly	South Tamil Nadu and Comorin area	



accompanied with strong winds on 9th caused extensive damages to rubber trees and houses in Kollam district of Kerala.

## 5. April

### 5.1. Storms and depressions

A severe cyclonic storm with core of hurricane winds, developed over the Bay of Bengal on 27th April. It crossed Bangladesh coast around midnight of 29th near Sandwip Island. The storm caused havoc in coastal Bangladesh and in the off-shore islands.

### 5.2. Weather and associated synoptic features

Trough/wind discontinuity in the lower levels was observed over the Peninsular India between 11th and 24th. Northwest India was affected by six western disturbances and three induced circulations. Details of the synoptic features are given in Table 3.

Thundershower activities occurred almost all the days in Assam & Meghalaya, Nagaland, Manipur, Mizoram & Tripura, Sub-Himalayan West Bengal & Sikkim, Orissa, Andhra Pradesh, Tamil Nadu, Interior Karnataka and Kerala during the month, while over the rest of the country thundershower activities were during the first fortnight of the month. Rain/thundershowers occurred either almost at all the places or at many places on 7 to 10 days in Assam & Meghalaya, Nagaland, Manipur, Mizoram & Tripura, Sub-Himalayan West Bengal & Sikkim and Jammu & Kashmir, on 3 to 5 days in Andaman & Nicobar Islands, Himachal Pradesh, Marathwada and North Interior Karnataka and on 1 to 2 days in Arunachal Pradesh, Haryana, Punjab, Madhya Maharashtra, Telangana, Coastal and South Interior Karnataka and Kerala during the month. They occurred at a few places or at one or two places on 25 to 28 days in Tamil Nadu, South Interior Karnataka and Kerala, on 15 to 19 days in Orissa, East Madhya Pradesh and Telangana on 10 to 14 days in Assam and adjacent States, West Bengal & Sikkim, Himachal Pradesh, Rajasthan, West Madhya Pradesh, Coastal Andhra Pradesh, Rayalaseema and Coastal Karnataka and on 5 to 10 days in Bihar, Hills of West Uttar Pradesh, Haryana, Punjab, Jammu & Kashmir, Konkan & Goa, Marathwada and Vidarbha. They occurred on 2 to 4 days over the rest of the country.

### 5.3. Month's rainfall

Rainfall during the month was in excess in 12, normal in 10, deficient in 9 and scanty in 3 meteorological subdivisions. Data from Jammu & Kashmir were absent.

It was excess in Andaman & Nicobar Islands, Haryana, Punjab, Himachal Pradesh, Rajasthan, West Madhya Pradesh, Konkan & Goa, Madhya Maharashtra and Karnataka; normal in Arunachal Pradesh, Assam & Meghalaya, Nagaland, Manipur, Mizoram & Tripura, Orissa, Bihar Plains, Plains of West Uttar Pradesh, East Madhya Pradesh, Telangana, Rayalaseema and Kerala; deficient in West Bengal & Sikkim, Bihar Plateau, East Uttar Pradesh, Hills of West Uttar Pradesh, Marathwada, Vidarbha, Coastal Andhra Pradesh and Tamil Nadu and was scanty in Gujarat and Lakshadweep.

The significant amounts of rainfall (cm) during April are given below :

1st : Supaul 15, Kamtaul 12, Chaparmukh & Usilampatti 7 each.

2nd : Silchar & Tondi 6 each, Karimganj 5, Tezpur 4.  
 3rd : Aizawl 8, Karimganj 5, Belgaum AP 4.  
 4th : Mangalore AP 11, Bantwal & Karkala 9 each, Sultanabad 7, Panamubur 6.  
 5th : Dharmnagar, Holenarsipur 6 each, Karimganj, Latur & Silchar 5 each.  
 6th : Aizawl & Silchar 6 each.  
 7th : Rapur 9, Omalur 8, Periapatna 7.  
 8th : Ramakkal 10, Tehnmala 7, Karimganj 6.  
 9th : Yelahanka 10, Aryankavu 7, Rajampat 4.  
 10th : Nilambur 7, Patiala 5, Kota AP 4.  
 12th : Jhargram 7, K. Patan 4.  
 13th : Mavelikara 5, Ajmer & Coimbatore 4 each.  
 14th : Chamba & Jammu 7 each, Bhuntar AP 6, Taran Taran 5, Bhatinda 4.  
 15th : Thumba 6, Hamirpur & Nanguneri 5 each.  
 16th : Vadakara 5, Belgaum 4.  
 18th : Rengali 4.  
 20th : Shahapur 7, Channagiri 6, Chalakudy 4.  
 22nd : Arshikere 7.  
 23rd : Periyakulam 7, Port Blair 5, Chamba 4.  
 24th : Car Nicobar 14, Kunnankulam 7, Sri Niketan 6.  
 25th : Port Blair 5, Chandbali & Karimganj 4 each.  
 26th : Gangtok & Nancowry 7 each, Hut Bay 6.  
 27th : Natham 7, Varkala 6, Pattambi 5.  
 28th : Domohani 4.  
 29th : Mysore 6, Thirumangalam 5, Maheshi 4.  
 30th : Aizawl 7, Imphal 5, Silchar, Shillong & Yercand 4 each.

### 5.4. Temperature

Day temperatures were above or appreciably above normal on most of the days of the month over Rayalaseema and Tamil Nadu. In north India, the day temperatures were 5°C to 9°C below normal on several days in Assam and adjacent States, Hills of West Uttar Pradesh, Haryana, Punjab, Himachal Pradesh, Jammu & Kashmir and in West Rajasthan and from 6th to 8th in Maharashtra. However, the highest day temperature of 47°C of the month was recorded at Phalodi (West Rajasthan) on 27th. Lowest day temperature over the plains was 19°C (dep. -9°C), recorded at Pasighat on 1st and in the hill station was 10°C (dep. -10°C) on 12th at Mukteswar. Day's maximum temperature was less than 25°C in Assam and adjacent States during the 1st week of the month.

The lowest night temperature in the plains was 10°C (dep. -6°C) at Amritsar on 19th and in the hills was 1°C (dep. -7°C) on 1st and 2nd.

### 5.5. Disastrous weather events and damages

Squalls accompanied with hailstorms affected several parts of Assam, Gangetic West Bengal, Orissa, Rajasthan and western Maharashtra. As per reports squall accompanied with hailstorms affected Bombay and its

TABLE 4

Details of weather systems during May, 1991

S. No.	Weather system	Period	Place of first location	Direction of movement	Place of dissipation	Remarks
(A) <i>Cyclonic storm/Depression/Low pressure area</i>						
(1)	Cyclonic storm	31st May-2 Jun	East central and southeast Bay	NNW'ly to NNE'ly	South Assam and neighbourhood. The remnant became unimportant over Assam & Meghalaya on 3rd June	First located as a low pressure area over east central & adjoining southeast Bay on 30th May
(B) <i>Cyclonic circulation</i>						
(1)	Lower tropospheric levels	11th-16th	Bihar Plateau and adjoining Orissa and Gangetic West Bengal	Quasi-stationary	Bihar and neighbourhood	
(2)	Lower levels	14th-15th eve.	South Tamil Nadu and neighbourhood	Do.	Comorin area and neighbourhood	
(3)	Do.	20th-24th	Bihar Plateau and adjoining Orissa	Westerly	West Madhya Pradesh adjoining and Vidarbha	
(4)	Do.	25th-27th	North Madhya Pradesh	—	<i>In situ</i>	
(C) <i>Western disturbances</i>						
(1)	Upper air system	1st-4th	Northeast Afghanistan and adjoining Pakistan	Easterly	Moved away across Jammu & Kashmir and neighbourhood	
(2)	Do.	5th-8th eve.	North Pakistan and neighbourhood	Do.	Do.	
(3)	Do.	9th-11th	Northeast Afghanistan and neighbourhood	Do.	Do.	
(4)	Do.	20th-22nd	North Pakistan and adjoining Jammu & Kashmir and Punjab	Do.	Do.	
(5)	Do.	25th-28th	North Pakistan and neighbourhood	Do.	Do.	
(6)	Do.	27th-31st eve.	Jammu & Kashmir and neighbourhood	Do.	Do.	
(D) <i>Induced cyclonic circulation</i>						
(1)	Lower tropospheric levels	2nd-4th	Northwest Rajasthan and neighbourhood	Easterly	West Uttar Pradesh and adjoining Haryana	
(2)	Do.	5th-7th	Southwest Rajasthan	NE'ly	North Rajasthan and neighbourhood	
(3)	Do.	10th-12th	Northwest Rajasthan	Do.	Hills of Himachal Pradesh and neighbourhood	
(4)	Lower levels	24th-26th	Northwest Rajasthan and neighbourhood	Easterly	West Uttar Pradesh	
(5)	Lower Tropospheric levels	26th-27th	Do.	—	<i>In situ</i>	
(E) <i>Trough in westerlies</i>						
	Middle and upper-tropospheric westerlies	16th-19th	Axis 9.5 km. a.s.l. roughly along Long. 60°E to the north of Lat. 25°N	Easterly	Over East Uttar Pradesh, Madhya Pradesh and western Maharashtra	Axis extended on 18th from east Uttar Pradesh to Konkan



suburbs on 5th morning. Nine moored Motorboats capsized at Gorai due to squally winds. Between 6th and 14th of April hailstorms occurred in several parts of Rajasthan, namely in Bhilwara district on 6th, in Dholpur, Chittorgarh and Udaipur districts between 8th and 10th and in Ganganagar district on 14th. Consequently standing crops in these districts were damaged. Severe local storm accompanied with hail occurred in several parts of Kamrup, Nalbari, Barpeta, Lakhimpur and Darrang districts of Assam between 5th and 15th April causing considerable damages to houses and public utility services. Squalls in Midnapore district (West Bengal) on 9th damaged vegetables worth Rs. 50 Lakhs. Severe hailstorm/thunderstorms between 2nd and 12th April affected parts of Puri, Balasore, Cuttack and Keonjhar districts of Orissa, which claimed 5 lives and injured 28 persons and caused extensive damages to vegetable crops. Power supply and telephones were also disrupted in some areas.

In the last week of the month, the storm in the Bay caused saline inundation in the coastal areas of Cuttack district damaging standing rabi crops. The storm also caused considerable damages in Mizoram & Tripura. The storm reported to have caused the death of large number of lives in Bangladesh.

## 6. May

### 6.1. Storms and depressions

A depression developed over east central Bay on the last day of the month. Intensifying into a cyclonic storm, it crossed Bangladesh coast. It did not cause much damage in Bangladesh.

### 6.2. Weather and associated synoptic features

Trough/wind discontinuity in the lower levels over Peninsular India was observed almost throughout the month. Besides, an east-west trough in the lower level was observed across Madhya Pradesh, Bihar, Gangetic West Bengal and Assam during the last four days. Northwest India was affected by six western disturbances and five induced circulations during the month. Details of the synoptic features are given in Table 4.

Pre-monsoon thundershower activities occurred almost on all the days of the month over Northeastern States, West Bengal, Orissa, Andhra Pradesh, Karnataka, Tamil Nadu, Kerala and in Andaman & Nicobar Islands, while they were pre-dominant over Maharashtra during the second half of the month. Rain/thundershowers occurred either almost at all the places or at many places on 21 to 22 days in Assam & Meghalaya and Nagaland, Manipur, Mizoram & Tripura on 11 days in Sub-Himalayan West Bengal & Sikkim, on 4 to 6 days in Andaman & Nicobar Islands, Jammu & Kashmir, Karnataka, Kerala and Lakshadweep and on 1 to 2 days in Gangetic West Bengal, Orissa, Bihar, Himachal Pradesh, Madhya Maharashtra, Marathwada, Telangana and Rayalaseema. They occurred at a few places or at one or two places on 30 days in Tamil Nadu, on 20 to 24 days in Sub-Himalayan West Bengal & Sikkim, Orissa, Rayalaseema, Interior Karnataka and Kerala, on 10 to 19 days in Andaman & Nicobar Islands, Assam & Meghalaya, Gangetic West Bengal, Haryana, Punjab, Himachal Pradesh, East Madhya Pradesh, Konkan & Goa, Madhya Maharashtra, Coastal Andhra Pradesh,

Telangana and Coastal Karnataka, on 4 to 9 days over the rest of the country outside Gujarat, where the weather was mainly dry during the month. Heavy rainfall occurred on 1 to 3 days in Arunachal Pradesh, Assam & Meghalaya, Nagaland, Manipur, Mizoram & Tripura, Sub-Himalayan West Bengal & Sikkim, Telangana and Kerala.

### 6.3. Month's rainfall

Rainfall during the month was in excess in 4, normal in 8, deficient in 13 and scanty in 7 meteorological sub-divisions. The weather was dry over 2 sub-divisions namely Gujarat and data from Jammu & Kashmir were absent.

It was excess in Nagaland, Manipur, Mizoram & Tripura, Madhya Maharashtra and Interior Karnataka; normal in Arunachal Pradesh, Assam & Meghalaya, Bihar, Haryana, Himachal Pradesh, Telangana and Coastal Karnataka; deficient in Andaman & Nicobar Islands, West Bengal & Sikkim, Orissa, Plains of Uttar Pradesh, Punjab, West Rajasthan, East Madhya Pradesh, Coastal Andhra Pradesh, Rayalaseema, Kerala and Lakshadweep and was scanty in Hills of West Uttar Pradesh, East Rajasthan, West Madhya Pradesh, Konkan & Goa, Marathwada, Vidarbha and Tamil Nadu.

The significant amounts of rainfall (cm) during May are given below :

- 1st : Agartala & Hasimara 4 each.
- 2nd : Chaparmukh 7, Aizawl & Gangtok 4 each.
- 3rd : Cherrapunji 29, Silchar 15, Chaparmukh & Imphal 10 each, Guwahati AP 9, Tezu 7.
- 4th : Agartala 9, Munnar 6, Mysore 5, Tadong 4.
- 5th : Cherrapunji 16, Gangtok 9, Udumapet 8, Karimganj & Alapuzha 5 each.
- 6th : Nancowry 8, North Lakhimpur 7, Calcutta & Cooch Behar 5 each.
- 7th : Silchar 17, Hassan 7, Aizawl 6, Agartala AP 3.
- 8th : Dibrugarh AP & Guwahati AP 7 each, Car Nicobar 4.
- 9th : Gangtok 7, Aizawl 6.
- 10th : Bangalore 9, Mazbat 8, Bellary 5.
- 11th : Karimganj 11, Nalgonda & Polavaram 7 each, Paderu 5, Berhampur 4.
- 12th : Ranibennur 8, Cuddapah & Varkala 7 each, Aizawl 6, Kanekal 5, Guntur 4.
- 13th : Mazbat 8, Tezu 6, Dibrugarh AP & Kondul 4 each.
- 14th : Rangiyā 6, Jalpaiguri & Nurgund 5 each.
- 15th : Varkala 9, Thodupuza 8, Punalur 5.
- 16th : Jagdalpur 5, Dharmnagar 3.
- 17th : Gunupur 5.
- 18th : Hubli 18, Chitradurga, Jalpaiguri & Kokrajhar 5 each.
- 19th : Agartala AP 7, Dumka 5, Jamshedpur 4.
- 20th : Agumbe 7, Aizawl & Chauldghat 5 each.

- 21st : Kumarakom 9, Dharmnagar 7, Balurghat, & Thiruvananthapuram 5 each.
- 22nd : Bikaner 8, Karkala 5.
- 23rd : Gharmura 10, North Lakhimpur & Pasighat 8 each, Bantwal 6, Port Blair 5.
- 24th : Car Nicobar & Pasighat 8 each, Harur, North Lakhimpur & Ottapalam 6 each, Gharmura 5.
- 25th : Hosdurg 13, Kannur 12, Alur, Dindigul & Nancowry 5 each.
- 26th : Digha 5, Sangamner 4.
- 27th : Ankola 12, Perumbavur 8, Sulerpet 7, Vadakara 6, Balurghat, Digha & Sangli 5 each.
- 28th : Guwahati AP 8, Long Island 6, Tadong 4.
- 29th : Port Blair 7, Pambani 6, Balasore, Bhagamandala, Midnapore & Sangli 4 each.
- 30th : Baki Road Bridge & Hut Bay 9 each, Port Blair 7, Kalingapatnam 6, Dudari & Kasargode 5 each.
- 31st : Hut Bay 9, Berhampore & Ranchi 8 each, Goalpara & Tangle 7 each, Amini Divi 5.

#### 6.4. Advance of southwest monsoon

Southwest monsoon advanced over southeast Bay, Nicobar group of Islands and south Andaman Sea on 24 May. It advanced over southern parts of southwest Bay and north Andaman Sea and adjoining parts of southeast Bay on 25th. Monsoon further advanced into south Arabian Sea on 29th May and over Maldives & Comorin area on 30 May. On 30 May, the Bay Branch of the monsoon covered the entire Andaman Sea and the Andaman group of Islands. The monsoon did not set in over the mainland of India during the month.

#### 6.5. Temperature

Good thundershower activities throughout the month over Assam & Meghalaya, Nagaland, Manipur, Mizoram & Tripura and Sub-Himalayan West Bengal & Sikkim moderated the days temperatures in these subdivisions. They were 5°C to 7°C below normal on many days. Day's maximum temperature was 19°C (dep.

—10°C) at Imphal on 8th and 10th. Day temperatures were also appreciably to markedly below normal in Bihar Plains between 16th and 23rd, in Punjab from 10th to 12th and from 21st to 23rd, in Jammu & Kashmir from 3rd to 12th and from 21st to 27th and in Gujarat region between 2nd and 11th. Day's maximum temperature was 17°C (dep. —5°C to —9°C) at Srinagar on 10th and 21st.

Heat wave conditions prevailed in Arunachal Pradesh on 16th and 17th and on 1 to 2 days during the first week in Vidarbha, Coastal Andhra Pradesh and Telangana and on 6 days during the second fortnight in West Madhya Pradesh on 2 to 3 days in East Rajasthan, East Madhya Pradesh, Gujarat Region and Telangana. Day temperatures in Tamil Nadu, Coastal and North Interior Karnataka and in Kerala were mostly above or appreciably above normal during the month.

#### 6.6. Disastrous weather events and damages

Torrential rain during the first week of May caused floods in Brahmaputra and Barak valleys in Assam. As the incessant rain continued, the flood waters engulfed more areas in Barak valley during the second week. In Cachar, Karimganj and Hailakand districts of Barak valley floods affected more than one million population in 1650 villages and claimed 30 lives. Rail and road transport services remained suspended in the valley for several days. Flash floods on 3 May claimed 10 lives in Arunachal Pradesh and injured 25 others. Breach in the embankment of *Noa-Dihing* river in Lohit districts (Arunachal Pradesh) in the second week caused floods in 40 villages of the district. Incessant rain also inundated large parts of Imphal town and neighbourhood in the first week.

Hailstorms were reported from West Bengal and Sikkim, Orissa, Himachal Pradesh and Rajasthan. Hailstorms occurred at Shimla and neighbourhood on 6th and from 25th to 28th, at Alwar (Rajasthan) on 6th in Sikkim on 8th and 13th in Asansol on 15th and in Midnapore and neighbourhood and in Purulia (Gangetic West Bengal) on 16th. Hailstorm also occurred at Ranaghat and neighbourhood (Nadia district of Gangetic West Bengal) on 24th, which claimed 4 lives and injured 21 persons. In Shimla it disrupted telecommunication links and water supply in the last week. These storms damaged considerable amounts of crops in the affected areas.