Mausam, (1991), 42, 2, 219-226

Weather

HOT WEATHER SUMMARY (MARCH-MAY 1990)*

1. Introduction

Pre-monsoon thundershower activities in the country are prominent in Andaman & Nicobar Islands, Arunachal Pradesh, Assam & Meghalaya, Nagaland, Manipur, Mizoram & Tripura, Sub-Himalayan West Bengal & Sikkim and Kerala, where the season's normal rainfall is of the order of 45 cm to 56 cm. In Gangetic West Bengal, Orissa, Bihar plateau, Tamil Nadu, Karnataka and Kerala also, the normal rainfall, which ranges between 10 cm and 19 cm is quite significance though not as high as in the aforesaid meteorological sub-divisions. Western disturbance activities in north India produce considerable amount of precipitation in the hills of west Uttar Pradesh, Himachal Pradesh and Jammu & Kashmir. The season's normal rainfall is around 20 cm in the hills of west Uttar Pradesh and Himachal Pradesh while it is about 33 cm over Jammu & Kashmir.

The spatial distribution of rainfall over the country is usually described in terms of following criteria:

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

2. Chief features

The most prominent weather events are as followes :

(*i*) Formation of a severe cyclonic storm with a core of hurricane wind in the Bay of Bengal during May, which hit Andhra coast and caused devastation in the State.

(*ii*) Occurrence of local severe storms and hailstorms in Assam & Meghalaya.

(*iii*) Flash flood in Kashmir during March.

(*iv*) Heavy snowfall in the upper reaches of Himachal Pradesh during the month of March.

(*v*) Below normal western disturbance activity in extreme north India during April and May.

(*vi*) Normal to above normal thundershower activity during the season in northeast India and Andhra Pradesh.

(*vii*) Comparatively cool weather during March and April in Assam & Meghalaya, Nagaland, Manipur, Mizoram & Tripura, West Bengal & Sikkim, and during the month of March and May, in Orissa, Bihar and in Uttar Pradesh.

3. Season's (March-May) rainfall

Seasonal rainfall was excess over 20 meteorological subdivisions and normal over 8 sub-divisions. It was deficient over 6 and scanty over one sub-division. Rainfall as excess in Nagaland, Manipur, Mizoram & Tripura, Gangetic West Bengal, Orissa, Bihar plateau, Haryana, Punjab, Himachal Pradesh, Madhya Pradesh, Gujarat region, Konkan & Goa, Marathwada, Vidarbha, Andhra Pradesh, Tamil Nadu, coastal and north interior Karnataka and Kerala and was normal in Andaman & Nicobar Islands, Assam & Meghalaya, Sub-Himalayan West Bengal & Sikkim, Bihar plains, east Uttar Pradesh, West Rajasthan, Madhya Maharashtra and south interior Karnataka. It was deficient in Arunchal Pradesh, plains of west Uttar Pradesh, Jammu & Kashmir, east Rajasthan, Saurashtra & Kutch and Lakshadweep and was scanty over the hills of west Uttar Pradesh.

Actual, normal and percentage departures of the seasonal rainfall are given in Table 1.

4. March

4.1. *Weather and associated synoptic features*

Trough wind discontinuity in the lower levels over Peninsular India was observed throughout the month. Also two troughs in the middle and upper tropospheric westerlies moved across north India, the first one between 11th and 14th and the second one between 22nd and 27th of this month. Besides these synoptic systems, north India was affected by three western disturbances and nine upper air circulations. The details of the synoptic systems are given in Table 2.

During this month major precipitation spells occurred in Assam and adjacent States, Sub-Himalayan West Bengal & Sikkim, hills of west Uttar Pradesh, Himachal Pradesh, Jammu & Kashmir and Kerala, where the normal is 5 cm or more. In fact, the normal value of precipitation over western Himalayas during the month is between 8 and 15 cm. Rain or thundershowers occurred in almost all the meteorological sub-divisions

*Compiled by : S/shri G. R. Gupta, D. S. Desai and N. C. Biswas, Office of the Dy. Director General of Meteorology (WF), Pune.

TABLE 1

Rainfall

S. No.	Sub-divisions	Mar' 90		Apr' 90		May' 90		Season		
		Actual (mm)	% Dep.	Actual (mm)	% Dep.	Actual (mm)	% Dep.	Actual (mm)	Normal (mm)	% Dep.
1	A. & N.Islands	32.6	—9	124.5	64	389.4	—4	525.7	518.2	1
2	Arunachal Pradesh	74.5	40	144.8	—47	175.5	—58	234.7	447.3	—48
3	Assam & Meghalaya	90.0	11	274.9	84	205.6	—37	464.8	558.3	—17
4	Naga. Mani., Mizo. & Trip.	124.5	65	292.6	105	267.6	14	611.5	452.7	35
5	S.H.W.B. & Sikkim	72.3	12	153.2	16	290.1	—14	515.6	534.3	—3
6	G. West Bengal	247.6	890	83.0	113	158.6	64	489.3	161.0	204
7	Orissa	120.2	420	72.9	176	162.0	198	347.0	103.8	234
8	Bihar Plateau	32.0	43	12.7	—43	92.9	75	137.6	97.6	41
9	Bihar Plains	9.5	—19	6.3	—63	84.7	64	81.0	80.2	1
10	East Uttar Pradesh	10.9	11	2.9	—45	28.9	75	33.8	31.7	7
11	Plains of west U.P.	9.6	—35	0.6	—91	20.3	41	20.3	36.0	—44
12	Hills of west U.P.	61.1	—23	18.3	—57	42.4	—24	69.4	178.2	—61
13	Har. Chandi & Delhi	6.0	—64	6.1	—30	41.5	201	53.6	39.4	36
14	Punjab	54.3	107	10.8	3	11.1	—18	76.2	50.2	52
15	Himachal Pradesh	194.8	107	28.4	—47	148.9	163	273.5	203.9	34
16	Jammu & Kashmir	187.3	29	37.3	—67	7.6	—90	232.1	333.0	—30
17	West Rajasthan	0.3	—96	1.5	—48	15.0	44	16.6	20.6	—19
18	East Rajasthan	1.4	—75	1.2	—50	9.0	—20	10.1	19.1	—47
19	West Madhya Pradesh	1.0	—89	0.3	—93	30.8	221	28.8	23.1	25
20	East Madhya Pradesh	9.6	—54	8.3	—42	97.7	404	95.4	54.5	75
21	Gujarat Reg., Daman, Dadra & Nag. Haveli	0	—100	0	—100	19.1	282	19.1	9.7	97
22	Sau., Kutch & Diu	1.3	—70	0	—99	3.9	56	5.2	7.5	—31
23	Konkan & Goa	0.7	133	0	—100	230.7	447	205.8	46.8	340
24	Madhya Maharashtra	0	—100	0	—100	77.5	128	56.4	50.8	11
25	Marathwada	0.1	—99	0	—100	146.9	580	110.2	48.9	125
26	Vidarbha	9.7	—45	1.6	—88	79.6	431	83.0	45.8	81
27	Coastal Andhra Pradesh	76.9	709	33.4	118	332.6	590	457.9	73.0	527
28	Telangana	33.8	194	0.8	—96	190.4	473	224.9	67.4	234
29	Rayalaseema	4.8	—20	5.7	—70	127.8	173	138.3	71.9	92
30	T. Nadu & Pondi.	42.3	102	29.9	—34	93.9	61	166.2	124.7	33
31	Coastal Karnataka	0	—100	1.8	—90	584.3	238	586.2	193.0	204
32	N.I. Karnataka	0	—100	4.6	—84	131.7	148	136.3	88.7	54
33	S.I. Karnataka	1.9	—79	12.8	—70	128.7	22	143.7	157.2	—9
34	Kerala	27.7	—42	55.7	—59	507.0	73	590.4	474.7	24
35	Lakshadweep	19.7	137	0	—100	191.3	36	147.2	183.2	—20

except Gujarat region, Madhya Maharashtra, Marathwada and coastal and north interior Karnataka during the month. Himachal Pradesh experienced four spells of snowfall. The first spell of snowfall occurred at a few places over Himachal Pradesh on 1st. The second spell was of one day duration and it occurred on 12th. During this spell snowfall was experienced at many places in the State. The third spell of snowfall was a prolonged one and it occurred almost at all the places of Himachal Pradesh from 19th to 24th. The fourth spell occurred almost at all the places in the State on 30th of the month. Jammu & Kashmir experienced snowfall almost at all the places on 23rd.

Rain/thundershowers occurred almost at all the places or at many places on 5 to 8 days in Arunachal Pradesh, Nagaland, Manipur, Mizoram & Tripura, Gangetic West Bengal and Jammu & Kashmir and on 1 to 4 days in Andaman & Nicobar Islands, Assam & Meghalaya, Sub-Himalayan West Bengal & Sikkim, Orissa, Bihar plateau, hills of west Uttar Pradesh, Haryana, Punjab, Himachal Pradesh and coastal Andhra Pradesh. They occurred at a few places or at one or two places on 10 to 17 days in Assam & Meghalaya, West Bengal & Sikkim, Orissa, plains of west Uttar Pradesh, Punjab, east Madhya Pradesh, coastal Andhra Pradesh, Tamil Nadu and Kerala; on 4 to 10 days in Andaman & Nicobar Islands, Nagaland, Manipur, Mizoram & Tripura, Bihar, east Uttar Pradesh, Haryana, Himachal Pradesh, Jammu & Kashmir, Madhya Pradesh, Vidarbha, Telangana, Rayalaseema and south interior Karnataka and on 1 or 2 days in Arunachal Pradesh, Rajasthan, Saurashtra & Kutch, Konkan & Goa and Lakshadweep.

TABLE 2

Details of weather system During March 1990

S. No.	Weather system	Period (Dates)	Place of first location	Direction of movement	Place of disssipation	Remarks
	(A) Cyclonic circulation					
(1)	Lower levels	4-5	Orissa & neighbourhood	—	*In situ*	
(2)	Lower Tropsheric levels	7-9	Konkan & neighbourhood	—	Do.	
(3)	Do.	7-11 eve.	Southeast Madhya Pradesh & adjoining Orissa	WNW'ly	Southwest Madhya Pradesh	
(4)	Do.	9-14 eve.	South Konkan & Goa	Northerly	North Konkan & neighbourhood*	*Moved there on 11th evening
(5)	Do.	14-16 eve. eve.	Assam & Meghalaya	Quasi-stationary	Arunachal Pradesh & adjoining Assam	
(6)	Lower levels	18-20	Tamil Nadu & neighbourhood	Westerly	Lakshadweep & neighbourhood	
(7)	Do.	21-22	Assam & Meghlaya	—	*In situ*	
(8)	Lower tropospheric levels	22-26 eve.	Bihar and adjoining Gangetic West Bengal & north Orissa	Quasi-stationary	North Orissa & adjoining Gangetic West Bengal	
(9)	Lower levels	26-31	SE Madhya Pradesh and neighbourhood	ENE'ly	—	Lay on 31st over Bihar plateau & neighbourhood
	(B) Western disturbances					
(1)*	Upper air system	28 Feb-3 Mar	North Pakistan and adjoining Jammu & Kashmir	Easterly	Moved away across Jammu & Kashmir and neighbourhood	*First located on 26 Feb over north Pakistan & neighbourhood
(2)	Do.	20-24	Punjab and adjoining northwest Rajasthan	ENE'ly	Do.	Observed as low pressure area over Punjab and neighbourhood between 21st evening and 22nd evening
(3)	Do.	28 Mar-1 Apr	North Pakistan & neighbourhood	Easterly	Do.	
	(C) Included cyclonic circulation					
(1)*	Lower tropospheric levels	28 Feb-2 Mar	Northeast Rajasthan and adjoining Haryana and west Uttar Pradesh	ESE'ly	Southern parts of Uttar Pradesh and adjoining Madhya Pradesh*	*First located over north west Rajasthan and adjoining Pakistan in the evening of 26 Feb
(2)	Lower levels	9-12	North Pakistan	Easterly	Haryana and adjoining plains of west Uttar Pradesh	
(3)	Lower tropospheric levels	15-20	Northwest Rajasthan and neighbrouhood	Do.	Hills of west Uttar Pradesh and neighbourhood	
(4)	Lower tropospheric levels	25-29	South Pakistan	Do.	Southeast Rajasthan and adjoining west Madhya Pradesh	
(5)	Do.	28-29	Northwest Rajasthan and neighbourhood	—	*In situ*	
(6)	Do.	29-31	Northwest Rajasthan & adjoining Pakistan	Easterly	Hills of west Uttar Pradesh & neighbourhood	

4.2. *Month's rainfall*

During the month rainfall was in excess in 13, normal in 5, deficient in 6 and scanty in 7 meteorological sub-divisions. No rainfall occurred in 4 sub-divisions.

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

4.3. *Temperature*

Nights were quite cold over the hills of west Uttar Pradesh, Himachal Pradesh and west Uttar Pradesh and Jammu & Kashmir during the first 14 days and the last 10 days of the month. During this period mostly cold-wave conditions, at times being severe, prevailed over these regions. Also during the first half of the month, night temperatures were, in general, below normal over

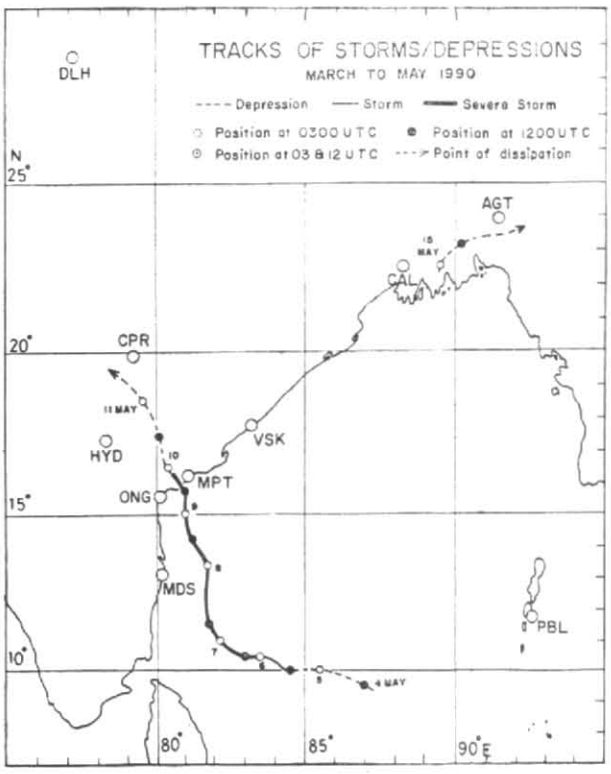

Fig. 1

Assam and adjacent States, Gangetic West Bengal, Bihar, plains of Uttar Pradesh, Haryana, Punjab and Saurashtra & Kutch. Night temperatures were appreciably to markedly below normal on several days in these sub-divisions during this period. Appreciably to markedly below normal night temperatures prevailed on a few days over Gujarat, Madhya Maharashtra, Marathwada during the first week and between 24th and 26th of this month. In general, they were above normal over Andhra Pradesh and Tamil Nadu.

Over the hills region the lowest night temperature of the month, —2°C on 2nd, was recorded at Mukteswar which was —7°C below normal. Over the plains the lowest night temperature of the month was recorded at Amritsar and Roorkee. It was 5°C at Amritsar on 1st, 3rd and 4th and at Roorkee on 2nd.

During the month days were comparatively cooler in the country. However, appreciably above normal day temperatures prevailed on a few days in Rajasthan and west Madhya Pradesh between 14th and 19th March. Appreciably to markedly below normal day temperatures prevailed for many days over north India.

The highest day temperature during the month over the hills was 32°C at Mahabaleshwar on 21st March, while over the plains it was 42°C at Bellary recorded on 29th March. Lowest day temperature during the month in the hills was 2°C recorded at Srinagar on 22nd March and was 8°C in the plains, recorded at Jammu on 17th March.

4.4. *Disastrous weather events*

As per reports heavy rains between 17th and 23rd caused flash floods, landslides and avalanches in Jammu & Kashmir, which took a toll of 35 lives in the State. Two truck drivers were burried alive in a landslide near Batote on 23rd and eleven people lost their lives in an avalanches in Kargil on 22nd. Flash floods in Billol nuhla washed away a bus drowning 13 persons. Seven members of a family were killed in an avalanche in Khalsi area of Ladakh region in the early morning of 24th. The water level in the river *Chenab* rose alarmingly on 24th after a huge glacier stuck in the stream forcing evacuation of thousands of people living in Coda and Ramban. Floods affected crops in as many as 50 villages. Jammu-Srinagar National Highway remained closed for about a week.

Heavy snowfall in Himachal Pradesh between 19th and 24th cut off the entire tribal belt of the State from the country.

Thundershower and squall in Calcutta and neighbourhood on 24th disrupted road communication and train services for quite sometime. Hailstorm at Jorhat and neighbourhood on 26th evening damaged houses, properties and crops. On 29th hailstorm affected about 400 villages in Vaishali districts of Bihar. It damaged standing crops extensively. The worth of the damage was estimated at Rs. one crore.

5. April

5.1. *Weather and associated synoptic features*

The details of the synoptic features of the month over the Indian sub-continent and neighbourhood are given in Table 3. Besides these systems a trough in the lower level (up to 0.9 km a.s.l.) westerlies extending from Bihar to south Tamil Nadu through southeast Madhya Pradesh was observed almost throughout the month.

Rain/thundershowers predominantly occur during this month in the meteorological sub-divisions of Andaman & Nicobar Islands, Assam and adjacent States, West Bengal & Sikkim, hills of West Uttar Pradesh, Himachal Pradesh, Jammu & Kashmir, Tamil Nadu, south interior Karnataka and Kerala. However, the activities remained sub-dued over western Himalayas Tamil Nadu, interior Karnataka and Kerala during the month. Rain/thundershowers occurred almost at all the places or at many places on 17 days in Assam & Meghalaya and on 12 days in Nagaland, Manipur, Mizoram & Tripura, They occurred on 4 to 7 days in Andaman & Nicobar Islands, Arunachal Pradesh, West Bengal & Sikkim, Orissa and on 1 to 2 days in hills of west Uttar Pradesh, Himachal Pradesh and Jammu & Kashmir. They occurred at a few places or at one or two places on 10 to 15 days in Andaman & Nicobar Islands, Assam & Meghalaya, Nagaland, Manipur, Mizoram & Tripura, Sub-Himalayan West Bengal, Himachal Pradesh, Tamil Nadu and Kerala and on 4 to 9 days in Arunachal Pradesh, Gangetic West Bengal, Orissa, Bihar, Haryana, Jammu & Kashmir, east Madhya Pradesh, coastal Andhra Pradesh, Rayalaseema and interior Karnataka and on 1 to 3 days over the rest of the country outside Gujarat, Konkan & Goa, Madhya Maharashtra, Marathwada and Lakshadweep, where the weather was mainly dry. Heavy rainfall occurred at one or two places on 2 days in Assam & Meghalaya.

TABLE 3

Details of weather systems during April 1990

S. No.	Weather system	Period (Dates)	Place of first location	Direction of movement	Place of dissipation	Remarks
	(A) Low pressure area					
(1)	Low pressure area	17-19	West central & adjoining south Bay	Easterly	East central & adjoining north Andaman sea. Remnant became unimportant there on 23rd	Associated cyclonic circulation extended up to mid tropospheric levels
	(B) Cyclonic circulation					
(1)*	Lower levels	1-5	Bihar plateau & adjoining Gangetic West Bengal	Easterly	Bangladesh & neighbourhood	*Continuation of the system under S. No. 9 of March 1990
(2)	Lower tropospheric levels	3-6	Southeast Madhya Pradesh & neighbourhood	—	*In situ*	
(3)	Do.	25-26	Over east central Arabian Sea off coastal Karnataka	—	*In Situ*	
(4)	Lower levels	26-29 eve.	Bihar & adjoining east Uttar Pradesh & northeast Madhya Pradesh	ESE'ly	Bihar plateau & adjoining Gangetic West Bengal & north Orissa	
	(C) Western disturbance					
(1)	Upper air cyclonic circulation	4-8 eve.	Central Pakistan	Easterly	Moved away across H. P. and neighbourhood	
(2)	Upper air system	11-14	North Pakistan and neighbourhood	Do.	Moved away across J. & K. and neighbourhood	
(3)	Do.	16-19	North Pakistan and adjoining northeast Afghanistan	Do.	Do.	
(4)	Do.	26-27	Punjab & adjoining Pakistan	Do.	Punjab and adjoining Himachal Pradesh and Haryana	
	(D) Induced cyclonic circulation					
(1)	Lower trop. levels	11-13	Northwest Rajasthan & adjoining Pakistan	ENE'ly	Himachal Pradesh	
(2)	Do.	16-18	Central Pakistan and adjoining west Rajasthan	Easterly	Northwest Rajasthan & adjoining Haryana and Punjab	
(3)	Do.	21-23	Northwest Rajasthan & adjoining ning Pakistan	ENE'ly	Punjab & adjoining Haryana	

5.2. *Month's rainfall*

Month's normal rainfall is around 27 cm in Arunachal Pradesh and between 11 cm and 15 cm in Assam & Meghalaya, Nagaland, Manipur, Mizoram & Tripura, Sub-Himalayan West Bengal & Sikkim, Jammu & Kashmir and Kerala. The normal rainfall ranges between 4 cm and 8 cm in Andaman & Nicobar Islands, Gangetic West Bengal, hills of west Uttar Pradesh, Himachal Pradesh, Tamil Nadu and Lakshadweep and is less than 3 cm elsewhere.

Rainfall during the month was excess in 6 and normal in 2 sub-divisions. It was deficient in 11 and scanty in 11 sub-divisions and there was no rainfall over the five sub-divisions namely Gujarat region, Konkan & Goa, Madhya Maharashtra, Marathwada and Lakshadweep. It was excess in Andaman & Nicobar Islands, Assam & Meghalaya, Nagaland, Manipur, Mizoram & Tripurra Gangetic West Bengal, Orissa and coastal Andhra Pradesh; normal in Sub-Himalayan West Bengal & Sikkim and Punjab; deficient in Arunachal Pradesh, Bihar plateau, east Uttar Pradesh, hills of west Uttar Pradesh, Haryana, Himachal Pradesh, Rajasthan, east Madhya Pradesh, Tamil Nadu and Kerala and was scanty in Bihar plains, plains of west Uttar Pradesh, Jammu & Kashmir, west Madhya Pradesh, Saurashtra & Kutch, Vidarbha, Telangana, Rayalaseema and Karnataka.

5.3. *Temperature*

Heat wave conditions prevailed over west Madhya Pradesh on 17th. Day temperatures were generally above or appreciably above normal in Bihar, Uttar Pradesh, Haryana, Punjab, Jammu, Rajasthan, Madhya Pradesh, Marathwada, Vidarbha, Andhra Pradesh and interior Karnataka during the second-half of the month.

TABLE 4

Details of weather systems during May 1990

S. No.	Weather system	Period (Dates)	Place of first location	Direction of movement	Place of dissipation	Remarks
	(A) Cyclonic storm/low pressure area etc.					
(1)	Severe cyclonic storm with a core of hurricane winds	5-10 eve.	Southwest & adjoining southeast Bay	WNW'ly to N'ly	Telangana & neighbourhood. The remnant dissipated over northwest Madhya Pradesh & neighbourhood on 13th.	Seen as a low pressure area over southeast & adjoining southwest Bay on 4th.
(2)	Depression	15-16	Bangladesh & neighbourhood	NE'ly	Northeast Assam and nighbourhood. Remnant became less marked thereby 16th evening.	Seen as a low pressure area over Bihar plateau & neighbourhood on 14th.
(3)	Low pressure area	16-19	Northwest Bay & neighbourhood	ESE'ly	East central Bay & neighbourhood.	
(4)	Do.	21-24	East central Bay	NE'ly	Arakan coast and adjoining coastal Burma.	
	(B) Cyclonic circulation					
(1)	Lower trop. levels	19-23 eve.	Bihar plains & neighbourhood	Easterly	Sub-Himalayan West Bengal & Sikkim and neighbourhood.	
(2)	Lower and middle troposnheric levels	24-27	West central & adjoining southwest Bay off south Andhra-north Tamil Nadu coasts	—	*In situ*	
	(C) Western disturbance					
(1)	Upper air system	18-20	North Pakistan & neighbourhood	Easterly	Moved away across Jammu & Kashmir and neighbourhood	
	(D) Induced cyclonic circulation					
(1)	Lower tropospheric levels	4-8	Northwest Rajasthan and neighbourhood	ESE'ly	East Rajasthan and adjoining northwest Madhya Pradesh	
(2)	Lower levels	16-18	Central Pakistan and adjoining northwest Rajasthan	NE'ly	Punjab & neighbourhood	

Days were comparatively cooler in Assam and adjacent States throughout the month and was so in Gangetic West Bengal, Bihar, Uttar Pradesh, Haryana and Punjab during the first 10 days of the month. Day temperatures were as such as 7°C to 11°C below normal in some places of north India.

Highest recorded day temperature of the month was 45°C. It was recorded at Fatehpur on 16th and at Chandrapur on 18th and 19th.

5.4. *Disastrous weather events and damages*

According to press reports a local severe storm in Meghalaya's, east Khasi hills district and Manipur's, Imphal district claimed the lives of 6 persons in the evening of 20th. Water supply in greater Shillong remained suspended on 21st as uprooted trees fall over high tension wires and cut off electric supply. Severe squall accompanied with hail lashed Mawpat near Shillong on 28th afternoon. Seven persons were killed due to house collapse and 15 others were injured.

6. May

6.1. *Onset of southwest monsoon*

Southwest monsoon set in over Kerala and coastal Karnataka on 28th. It advanced northwards along the west coast up to Dahanu on 31st and covered on that day south Madhya Maharashtra, south Andhra Pradesh and most parts of interior Karnataka.

6.2. *Weather and associated synoptic features*

During this month a severe cyclonic storm with a core of hurricane winds developed over the southwest Bay of

Bengal and struck Andhra coast near Machilipatnam causing severe damages in the State. Also a depression developed in mid-May over Bangladesh and neighbourhood. The tracks of these systems are given in Fig. 1.

The details of the weather systems during the month of May are given in Table 4.

Besides those synoptic features a trough on the sea level chart off and along Maharashtra-Karnataka-Kerala coasts was observed on most days in the second half of the month.

Like April, maximum precipitation occurs during this month also in Andaman & Nicobar Islands, in the subdivisions of northeast India western Himalayas and south Peninsula.

Thundershower activities during this month were adequate over the most of the sub-divisions causing normal or excess rainfall. Rain/thundershowers occurred almost at all the places or at many places on 13 to 17 days in Andaman & Nicobar Islands, Sub-Himalayan West Bengal & Sikkim and Kerala, on 5 to 10 days in Assam & Meghalaya, Nagaland, Manipur, Mizoram & Tripura, Gangetic West Bengal, Bihar plateau, Marathwada, Andhra Pradesh, coastal and north interior Karnataka and Lakshadweep and on 1 to 4 days in Orissa, Bihar plains, hills of west Uttar Pradesh, Haryana, Himachal Pradesh, Jammu & Kashmir, west Rajasthan, east Madhya Pradesh, Gujarat region, Maharashtra, outside Konkan & Goa, Tamil Nadu and north interior Karnataka.

Heavy to very heavy rainfall occurred at one or two places on 3 to 5 days in coastal Andhra Pradesh, Tamil Nadu, coastal Karnataka and Kerala and on 1 to 2 days in Assam & Meghalaya, Nagaland, Manipur, Mizoram & Tripura, Gangetic West Bengal, Orissa and Konkan & Goa.

Rain or thundershowers also occurred at a few places on 5 to 10 days over the country outisde Punjab, Jammu & Kashmir, Rajasthan, Gujarat and Konkan & Goa.

6.3. *Month's rainfall*

The normal rainfall for the month ranges between 30 cm and 42 cm in Andaman & Nicobar Islands, Arunachal Pradesh, Assam & Meghalaya, Sub-Himalayan West Bengal & Sikkim and Kerala and between 14 cm and 24 cm in Nagaland, Manipur, Mizoram & Tripura, Tamil Nadu and Lakshadweep. It ranges between 5 cm and 10 cm in Gangetic West Bengal, Orissa, Bihar, western Himalayas, coastal Andhra Pradesh, Rayalaseema, Tamil Nadu and north interior Karnataka and is below 5 cm elsewhere.

During the month rainfall was excess in 26 and normal in 4 sub-divisions. It was deficient or scanty over the rest of the country.

Rainfall was excess in Gangetic West Bengal, Orissa, Bihar, plains of Uttar Pradesh, Haryana, Himachal Pradesh, west Rajasthan Madhya Pradesh, Gujarat, Maharashtra, Andhra Pradesh, Tamil Nadu, Karnataka Kerala and Lakshadweep and was normal in Andaman & Nicobar Islands, Nagaland, Manipur, Mizoram & Tripura, Sub-Himalayan West Bengal & Sikkim and Punjab. It was deficient in Arunachal Pradesh, Assam & Meghalaya, hills of west Uttar Pradesh, east Rajasthan and was scanty in Jammu & Kashmir.

6.4. *Temperature*

During the month the days were comparatively cooler over the country outside Assam and adjacent States, Jammu & Kashmir and Rajasthan where they were generally warmer. Day temperatures were as much as 6°C to 13°C below normal on a number of days in Orissa, Bihar, Uttar Pradesh, east Madhya Pradesh, Marathwada, Vidarbha and Andhra Pradesh.

The highest day temperature during the month was 46°C, recorded in west Rajasthan. On 11th, the mercury at Barmer, Jaisalmer and Phalodi touched 46°C mark, which was 4°C to 5°C above the normal. The next 3 days, *i.e.*, from 12th to 14th the day temperatures at Phalodi continued to rise to 46°C mark.

6.5. *Disastrous weather events and damages*

The Bay hurricane, which struck Andhra coast in the evening of 9th caused devastation in coastal Andhra Pradesh and adjoining Telangana. It took a toll of 967 human lives and affected about 7.8 million population in 5160 villages. Krishna and Guntur districts were worst affected. The cost of the damages to crops and properties was estimated at about Rs. 2248 crores.

Between 2nd and 5th moderate to severe hailstorm affected Shimla and its surroundings causing damage to horticulture crops. In the early morning of 7th a loca severe storm affected Tinsukia and neighbourhood. It uprooted many trees, blew off roof tops of the houses

huts & claimed three lives. On 18th & 19th seven hail-storms/squalls affected Malerkota and surroundings in Punjab. It disrupted power supply and telecommunication and damaged crops in the area.

Heavy rains between 28th and 31st of the month claimed eight lives in Maharashtra and one life in Gujarat. Railway services in Bombay was also affected due to heavy downpour.