

# Weather

551.553 : 21 "1988"

## POST MONSOON SEASON (OCTOBER—DECEMBER 1988)\*

### 1. Introduction

During the post monsoon season of 1988, three cyclonic storms and three depressions developed over the Bay of Bengal. Of these six systems, one depression and two cyclonic storms caused weather over the country.

The northeast monsoon rainfall over south Peninsular India was largely deficient during the season. Except for Assam & adjacent States, Himachal Pradesh and Vidarbha, the seasonal rainfall over the country was deficient.

For classification of rainfall distribution two norms have been used, one for describing the seasonal and the other for describing the monthly rainfall distribution. This has been done because the limits for describing normal rainfall are generally decided on the basis of the variability or the standard deviation of the rainfall. As the period increases the standard deviation tends to decrease and *vice versa*. Thus, for seasonal rainfall distribution, where the period is larger  $\pm 10$  per cent departures from the normal has been taken for defining the normal rainfall, whereas for the monthly rainfall distribution  $\pm 19$  per cent departures from the normal has been adopted as normal rainfall.

### 2. Chief features

(i) Withdrawal of southwest monsoon from the country by 12 October.

(ii) Commencement of northeast monsoon rainfall over Tamil Nadu and adjoining coastal Andhra Pradesh on 2 November.

(iii) Development of three cyclonic storms and three depressions over the Bay of Bengal. Tracks of these storms and depressions are given in Fig. 1.

(iv) Heavy rainfall claimed 12 lives and disrupted rail, road and air traffic in Bombay on 3 October.

(v) Considerable loss of lives and properties in coastal West Bengal due to the severe cyclonic storms with a core of hurricane winds during November.

(vi) Heavy snowfall in several parts of Kashmir valley in the third week of December.

(vii) Rainfall during the season was excess, largely (+51% or more) in Arunachal Pradesh, Assam & Meghalaya and Vidarbha and moderately (+26% to +50%) in Andaman & Nicobar islands, Nagaland, Manipur, Mizoram & Tripura and Himachal Pradesh. It was normal in Gangetic West Bengal and deficient slightly (-11% to -25%) in east Uttar Pradesh, Punjab, west Madhya Pradesh and coastal Karnataka, moderately (-26% to -50%) in Bihar plains, plains of west Uttar Pradesh, Jammu & Kashmir, east Rajasthan, east Madhya Pradesh, Konkan & Goa and Tamil Nadu. It was largely deficient (-51% or less) over the rest of the country. Details of seasonal rainfall are given in Fig. 2.

### 3. October

#### 3.1. Withdrawal of southwest monsoon

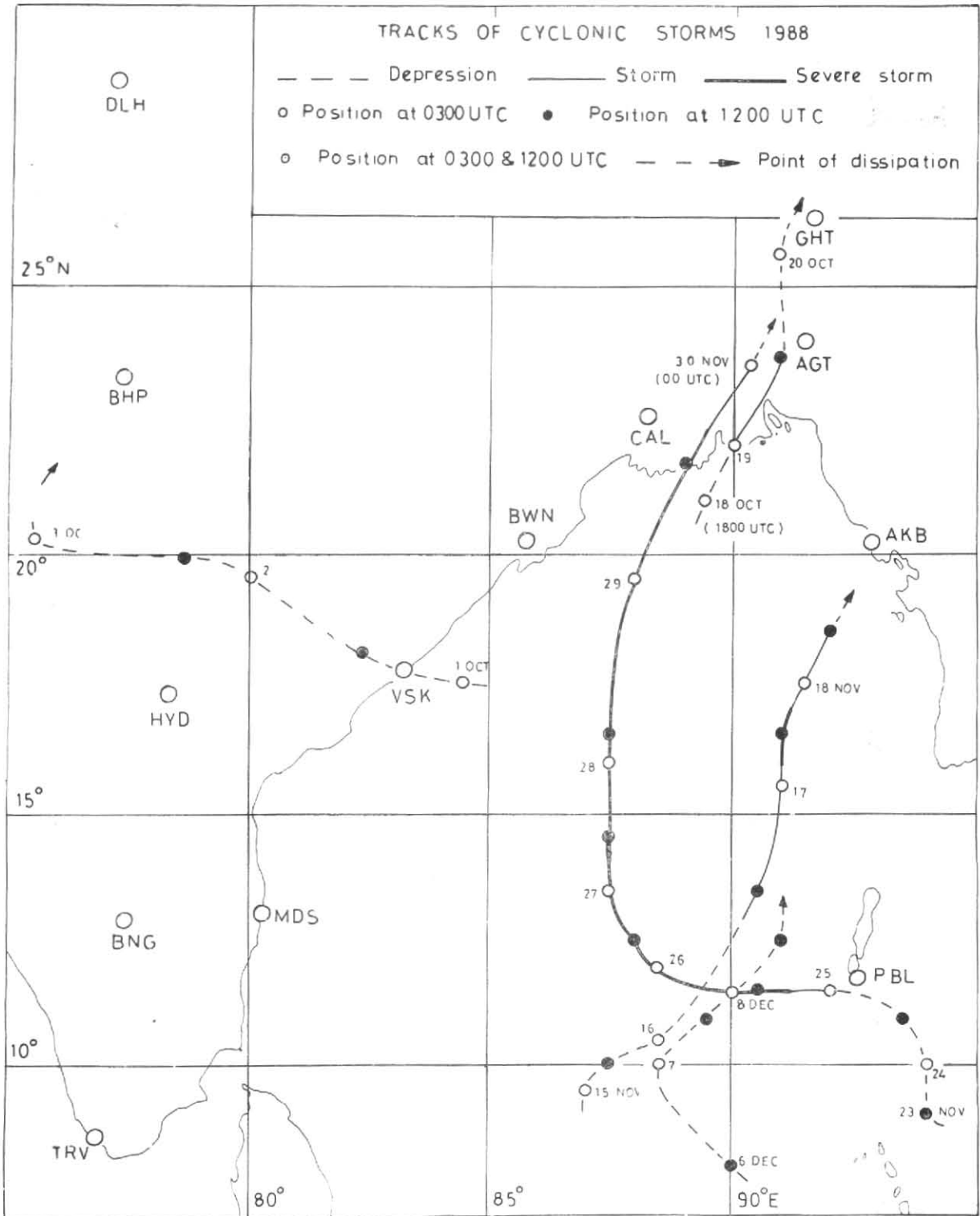
By the end of September, southwest monsoon withdrew from northwest India and from major parts of west Uttar Pradesh. On 6 October, it withdrew from Gujarat, west Madhya Pradesh, Maharashtra, Goa and the remaining parts of west Uttar Pradesh. Next day, *i.e.*, on 7 October it withdrew from east Uttar Pradesh. On 8 October, it withdrew from northeast Madhya Pradesh. On 10 October, it further withdrew from Telangana, north interior Karnataka, major parts of Rayalaseema, southeast Madhya Pradesh and from northeast India outside coastal Orissa. The withdrawal of the southwest monsoon was complete from the country outside Tamil Nadu and Kerala on 12 October.

#### 3.2. Weather and associated synoptic features

During the month two systems, *i.e.*, one cyclonic storm and one depression developed over the Bay of Bengal. Also a trough in mid and upper tropospheric levels affected northwest India on the last three days of the month. Details of the synoptic features are given in Table 1.

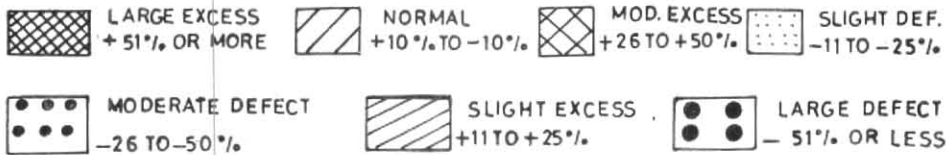
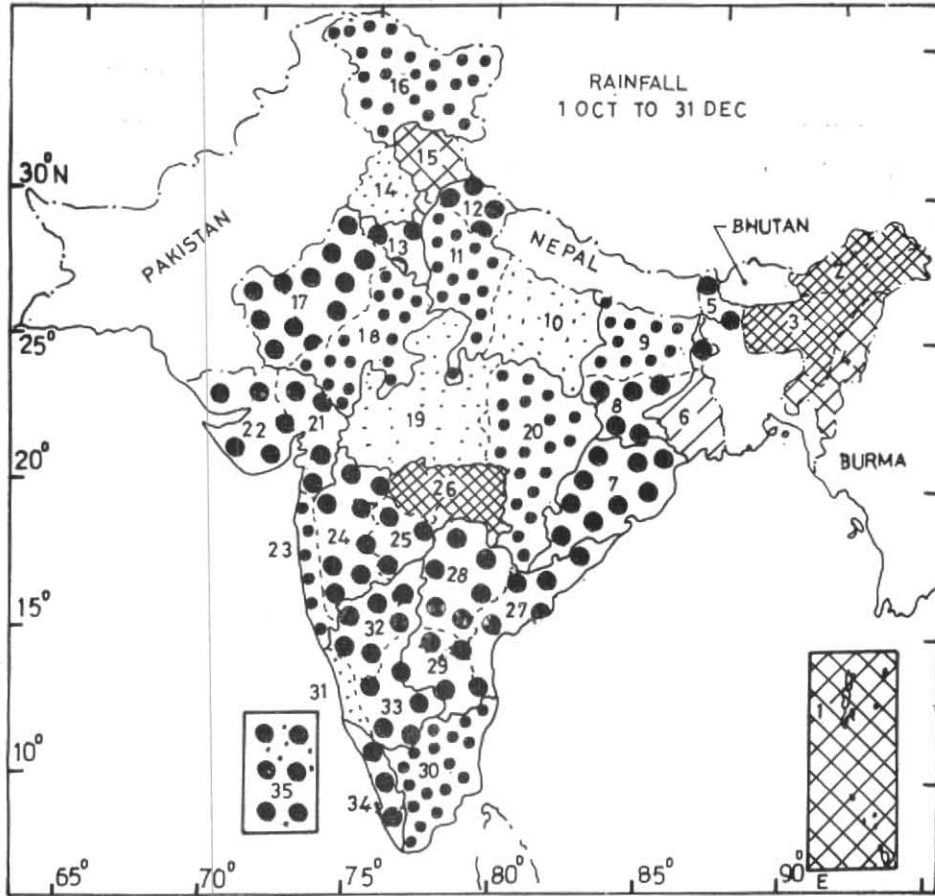
During the first week of the month southwest monsoon was active to vigorous on 1 to 3 days in Arunachal Pradesh, Assam & Meghalaya, Orissa, west Madhya Pradesh, Konkan & Goa, Madhya Maharashtra, Vidarbha, coastal Andhra Pradesh and coastal

\*Prepared by S/Shri Nootan Das, D. S. Desai and N. C Biswas, Meteorological Office, Pune



Note : (i) 16 Nov 09 UTC C.S., 17 Nov 06 UTC S.C.S., 18 Nov 06 UTC C.S., (ii) 25 Nov 02 UTC C.S., 25 Nov 06 UTC S.C.S., 06 UTC S.C.S. (core of hurricane wind), 29 Nov 14 UTC C.S.

Fig. 1. Tracks of storms and depressions during October-December 1988



<i>Sub-divisions</i>	<i>Dep. from normal</i>	<i>Sub-divisions</i>	<i>Dep. from normal</i>	<i>Sub-divisions</i>	<i>Dep. from normal</i>
1. A. & N. Islands	29	13. Haryana	-58	25. Marathwada	-78
2. Arunachal Pradesh	282	14. Punjab	-17	26. Vidarbha	91
3. Assam & Megha.	54	15. Himachal Pradesh	33	27. Coastal A.P.	-55
4. N.M.M. & T.	30	16. Jammu & Kashmir	-47	28. Telangana	-64
5. S.H.W.B. & Sikkim	-57	17. West Rajasthan	-69	29. Rayalaseema	-62
6. G. West Bengal	-1	18. East Rajasthan	-37	30. Tamil Nadu	-47
7. Orissa	-67	19. West M.P.	-13	31. Cot. Karnataka	-18
8. Bihar Plateau	-61	20. East M.P.	-47	32. N.I. Karnataka	-77
9. Bihar Plains	-44	21. Gujarat Region	-78	33. S.I. Karnataka	-74
10. East U.P.	-24	22. Saurashtra & Kutch	-88	34. Kerala	-59
11. Plains of W. U.P.	-39	23. Konkan & Goa	-45	35. Lakshadweep	-64
12. Hills of W. U.P.	-62	24. Madhya Maha.	-70		

Fig. 2. Rainfall (Percentage departure from normal) for the period 1 October to 31 December 1988

TABLE 1

Details of weather systems during October 1988

S. N.	Weather system	Period	Place of first location	Direction of movement	Place of dissipation	Special remarks
<i>(A) Cyclonic storm/depression/low pressure area, etc</i>						
(1)	Depression	1st-3rd	West central Bay off Andhra coast	Westnorthwest/northerly	Madhya Pradesh and adjoining east Rajasthan. The remnant became unimportant over south Uttar Pradesh adjoining northwest Madhya Pradesh on 5th evening	Observed as a cyclonic circulation in the lower and mid-tropospheric levels over west central Bay on 28 Sep
(2)	Cyclonic storm	19th-21st	North Bay	Northnortheasterly	Meghalaya	Observed as a low pressure area over northeast Bay on 15th
(3)	Low pressure area	17th-19th	North Andaman Sea	—	<i>In situ</i>	Moved over north Andaman Sea from the east
(4)	Low pressure area	30th evening	Southeast Bay & neighbourhood where persisted on the last day of the month	Westerly	—	Observed as a cyclonic circulation extending up to mid-tropospheric levels over north Andaman Sea on 23rd where it persisted upto the 29th
<i>(B) Cyclonic circulation</i>						
(1)	Lower tropospheric levels	9th evening-12th	East central Arabian Sea off Maharashtra coast	Quasi-stationary	South Konkan & Goa and adjoining sea areas	
(2)	Lower levels	10th-12th	North Tamil Nadu & neighbourhood	Do.	<i>In situ</i>	
(3)	Lower & middle tropospheric levels	11th-19th	Do.	Do.	Tamil Nadu & neighbourhood	
(4)	Lower tropospheric levels	20th evening-22nd	West central Bay off Andhra coast	Do.	West central and adjoining southwest Bay off south Andhra-north Tamil Nadu coast	
(5)	Lower & mid-tropospheric levels	22nd evening-26th	Southwest Bay off south Tamil Nadu coast	Westerly	South Kerala & adjoining sea areas	
(6)	Lower tropospheric levels	24th-28th	North Bay & neighbourhood	Quasi-stationary	Northwest Bay off Orissa coast	
(7)	Do.	27th-30th	Southwest Bay off north Tamil Nadu coast	Southerly	South Tamil Nadu coast & neighbourhood	
(8)	Lower & mid-tropospheric levels	29th-30th	Coastal Karnataka and neighbourhood	—	<i>In situ</i>	
<i>(C) Western disturbance</i>						
(1)	Upper air system	4th-6th	North Pakistan & adjoining Jammu & Kashmir	Easterly	Moved away across Western Himalayas	
(2)	Do.	18th evening-21st	North Pakistan & adjoining northwest Rajasthan & neighbourhood	Easterly	Do.	

Karnataka. Andaman & Nicobar Islands, Tamil Nadu and Kerala experienced rain/thundershowers throughout the month. They were generally widespread over Andaman & Nicobar Islands between 5th and 11th with isolated heavy falls on 8th. Over Tamil Nadu rainfall was of scattered or isolated nature. Kerala had received generally widespread rainfall on 2 days only between 7th and 17th. Rains continued over Assam & adjacent States and Sub-Himalayan West Bengal & Sikkim up to 23rd of the month, but they were generally widespread on 9 days in Arunachal Pradesh and so on 4 to 6 days in Assam & Meghalaya and Nagaland, Manipur, Mizoram & Tripura. Bihar and Uttar Pradesh experienced rains during the first week and that extended up to 16th over east Madhya Pradesh, Andhra Pradesh and Karnataka. There was a second spell of rain over West Bengal & Sikkim, Orissa, Bihar plateau, coastal Andhra Pradesh and coastal Karnataka between 19th and 26th but the spatial distribution was mainly of scattered or isolated nature except for Gangetic West Bengal, where it was widespread with isolated heavy falls on 19th. Lahskadweep had experienced rains only for 5 days during the month; over northwest India isolated rainfall occurred on 1 to 3 days outside Haryana, where dry weather prevailed throughout the month.

### 3.3. Rainfall

It was excess in Arunachal Pradesh, Assam & Meghalaya, Nagaland, Manipur, Mizoram & Tripura, west Madhya Pradesh and Vidarbha, normal in Gangetic West Bengal, east Rajasthan and coastal Karnataka and deficient in Andaman & Nicobar Islands, Bihar, plains of Uttar Pradesh, west Rajasthan, east Madhya Pradesh and Konkan & Goa. It was scanty over the rest of the country outside Haryana, where there was no rain.

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

- 1st : Sandheads 21, Sompeta 15, Kalingapatnam 11, Gadchiroli 10, Berhampur & Visakhapatnam 9 each, Satna 7, Paradip 6, Port Blair 5, Bhubaneswar AP & Kakinada 4 each, Bikaner & Gondia 3 each.
- 2nd : Bhatkal 21, Rajur 17, Shirali 16, Asifabad 15, Chandrapur 13, Sandheads 12, Honavar 10, Ramagundam & Wardha 9 each, Sironcha 8, Cuttack & Visakhapatnam AP 6 each, Contai 4.
- 3rd : Amravati 22, Rajapur 20, Honavar 19, Akola & Tezu 12 each, Bombay 11, Yeotmal 10, Pasighat 9, Indore & Madras AP 8 each, Shajapur 7, Nandurbar 6, Ratnagiri 5.
- 4th : Bombay AP 14, Ratlam 10, Tezu & Yelhanka AP 9 each, Dibrugarh AP & Ujjain 7 each, Alibag & Kargaon 6 each, Aijal & Pasighat 5 each.
- 5th : Pasighat 15, Gorakhpur AP 13, Lucknow AP 9, Kargaon 8, Tezu 7, Agartala AP, Berhampore & North Lakhimpur 6 each, Bagati (Magra) 5, Agra, Gangtok, Port Blair & Sabaur 4 each.
- 6th : Hungund & Sultanpur 6 each, Banpur & Chickmagalur 5 each, Bhagalpur, Tezu & Tiruchirappalli AP 4 each.
- 7th : Kailashahar 9, Vellore 6, Madras AP & Port Blair 4 each.
- 8th : Madurai AP 9, Hut Bay 8, Mancompu 7, Port Blair 6.
- 9th : Car Nicobar 24, Mayabandar 6.
- 10th : Namakkal 11, Salem 6, Peermade 5, Madurai AP 4.
- 11th : Paramathi 4, Devikulam, Malavalli, Nancowry & Tuticorin 3 each.
- 13th : Dibrugarh AP 5, Chaparmukh 4.
- 14th : Mayiladuthurai 6, Imphal 3.
- 15th : Imphal 3.
- 16th : Nancowry 4, Cooch Behar 3.
- 17th : Thenmala 9, Cochin AP & Kottayam 5 each, Aijal 3.
- 18th : Ponnani & Tezu 6 each.
- 19th : Durgachak 11, Calcutta 10, Diamond Harbour & Sagar Island 8 each, Chaparmukh 6, Kailashahar 5, Agartala AP, Imphal & Tezu 4 each.
- 20th : Shillong 13, Daitari 7, Kailashahar & Majbat 6 each, Adirampattinam, Agartala AP & Tondi 5 each, Chaibasa, Gauhati AP & Pasighat 4 each.
- 21st : Rengali 8, Naraj 6, Dibrugarh AP 4, Tezu 3.
- 22nd : Purushottampur 6, Belthangady 3.
- 23rd : Narsipatnam 4, Chintapalli & Madurai 3 each.
- 24th : Camrajnagar 6, Shivganga 4, Malavalli 3.
- 25th : Ottapalam 4, Kanniyakumari & Minicoy 3 each.
- 26th : Mettupalayam 10, Tuticorin 6, Bhagamandala 4, Adirampattinam, Mannaghat & Pamban 3 each.
- 27th : Sankarankoil 6, Chalakudi 4, Paramathi 3.
- 28th : Thuckalay 4.
- 29th : Kunnankulam 3.
- 30th : Punalur 7, Tuticorin 6, Car Nicobar 3.
- 31st : Chalakudi, Idikki & Siddapur 3 each.

### 3.4 Temperature

Day temperatures were above normal in coastal Andhra Pradesh and Tamil Nadu almost throughout the month and was so in Gangetic West Bengal, Orissa, Bihar, plains of Uttar Pradesh, Rajasthan, Madhya Pradesh, Madhya Maharashtra, Vidarbha, Telangana, Rayalaseema, Karnataka and Kerala during the second half of the month being appreciably above normal on a couple of days in west Madhya Pradesh, coastal Andhra

TABLE 2  
Details of weather systems during November 1988

S. N.	Weather system	Period	Place of first location	Direction of movement	Place of dissipation	Remarks
<i>(A) C.S./Depression etc</i>						
(1)	Low pressure area	1st-7th	Southeast Bay and neighbourhood*	Quasi-stationary	Central parts of south Bay	*Developed there on 30 Oct evening.
(2)	Severe cyclonic storm	15th evening-19th	Southeast Bay	Northwesterly/northerly	Central Burma	Developed under the influence of a cyclonic circulation in lower & mid-tropospheric levels which moved from the east to south Andaman Sea & neighbourhood on 12th
(3)	Severe cyclonic storm with core of hurricane winds	23rd evening-30th	Andaman Sea & neighbourhood	Westnorthwesterly/northerly	Assam & Meghalaya. The remnant became less marked there on 1 Dec	Observed as a low pressure area over Andaman Sea on 22nd evening
<i>(B) Cyclonic circulation</i>						
(1)	Lower & mid-tropospheric levels	7th-9th	South Tamil Nadu & neighbourhood	Westerly	Moved away across Lakshadweep area	
(2)	Do.	9th-12th	Coastal Tamil Nadu & adjoining southwest Bay	Do.	South Kerala & neighbourhood	
(3)	Lower tropospheric levels	18th-23rd	Lakshadweep and neighbourhood	--	<i>In situ</i>	
(4)	Low tropospheric levels	19th-24th	Southeast Bay	Westerly	Southwest Bay off Tamil Nadu coast	
(5)	Do.	23rd-27th	South Gujarat	Quasi-stationary	Off south Gujarat north Maharashtra coast	
<i>(C) Western disturbance</i>						
(1)	Upper air system	20th-23rd	North Afghanistan & adjoining Pakistan	Eastwards	Moved away across Western Himalayas	
(2)	Do.	23rd-26th	Northeast Afghanistan & adjoining Pakistan	Do.	Do.	
(3)	Do.	26th-28th	North Pakistan & adjoining J & K	Northeastwards	Do.	
<i>(D) Induced cyclonic circulation</i>						
(1)	Lower tropospheric levels	22nd-26th	West Rajasthan & neighbourhood	Eastnortheasterly	Moved away across Himachal Pradesh	
(2)	Do.	27th-30th	Northwest Rajasthan & adjoining central Pakistan	Do.	Do.	

Pradesh and Tamil Nadu. They were generally below normal in Jammu & Kashmir during the first half of the month.

Nights were comparatively cooler in Orissa, Bihar, Uttar Pradesh, Haryana, Punjab, Himachal Pradesh, east Madhya Pradesh, Konkan & Goa, Madhya Maharashtra, Vidarbha and Andhra Pradesh during the month. Night temperatures were generally below normal in those areas from 6th onwards being appreciably below normal on 2 to 4 days in Orissa, Bihar, east Uttar Pradesh, Punjab, east Madhya Pradesh and

Madhya Maharashtra. They were above or appreciably above normal on most days during 1st to 5th in Nagaland, Manipur, Mizoram & Tripura, Gangetic West Bengal, Bihar, Madhya Pradesh, Gujarat, Madhya Maharashtra, Marathwada, Vidarbha and Telangana.

### 3.5. Disastrous weather events and damages

As per reports heavy rain claimed a toll of 12 lives in Bombay on 3rd and 2 lives in Yeotmal on 4th. It also disrupted rail, road and air traffic in Bombay on 3rd. The impact of the cyclonic storm of 19 October

was in Bangladesh. According to reports nearly 300 people were missing or feared drowned and 430 persons were injured in Bangladesh. Torrential rains submerged the low lying areas of the capital city, Dhaka. 20 fishing boats in Chittagong and 15 boats and trawlers in Patnakhali were sunk by the storm.

#### 4. November

##### 4.1. Northeast monsoon

Northeast monsoon rainfall commenced over Tamil Nadu and adjoining coastal Andhra Pradesh on 2 November. However, the activity of northeast monsoon over the south Peninsula was rather weak during the month resulting in large deficiency in rainfall over large areas of south Peninsula.

##### 4.2. Weather and associated synoptic features

During the month two severe cyclonic storms developed over the Bay of Bengal. Of these, two storms one attained hurricane intensity and struck West Bengal, Bangladesh coast on 29th of the month. Details of the synoptic features are given in Table 2. Besides these synoptic features, two troughs in the middle and upper tropospheric westerlies moved across northern India during the first week. A third trough affected central and northeast India between 10th and 15th.

The rainfall activity over the country as a whole during November was quite subdued. The number of western disturbances which affected the northern parts of the country were also few.

Andaman & Nicobar islands received generally widespread rains on 17 days during the month with isolated heavy to very heavy falls on four days. Thunder-shower activity over northeast India was very much subdued except in the last three days of the month when it was generally widespread over Assam & Meghalaya, Nagaland, Manipur, Mizoram & Tripura and West Bengal & Sikkim. Practically dry weather prevailed over central and northwest India, except fairly widespread rain over Jammu & Kashmir on 24th. Hills of west Uttar Pradesh experienced generally isolated snowfall on 25th. In the Peninsular India, Marathwada, Vidarbha, Telangana, north interior Karnataka and coastal Karnataka received isolated rainfall on 1 to 3 days during the first week of the month. Number of rainy days varied from 7 to 11 days over Rayalaseema, south interior Karnataka and Lakshadweep and these were 12 to 19 days over coastal Andhra Pradesh, Tamil Nadu and Kerala. However, northeast monsoon was active to vigorous on 6 days over Tamil Nadu and generally widespread rainfall occurred on 1 to 4 days in Rayalaseema, south interior Karnataka, Kerala and Lakshadweep.

##### 4.3. Rainfall

It was excess in Andaman & Nicobar islands, Assam & Meghalaya, Nagaland, Manipur, Mizoram & Tripura, Gangetic West Bengal and Vidarbha and was normal in Sub-Himalayan West Bengal & Sikkim, Tamil Nadu and Lakshadweep. It was scanty over the rest of the

country outside Arunachal Pradesh, east Uttar Pradesh, Punjab, east Rajasthan, Gujarat, Telangana and north interior Karnataka, where there was no rain.

The significant amounts (cm) of rainfall during the month were :

- 1st : Tuticorin 5, Minicoy, Nedumangad & Palayankottai 3 each.
- 2nd : Kolar Gold Field, Konni, Madurai AP & Vridunagar 5 each, Visakhapatnam AP 4.
- 3rd : Sulurpeta 10, Madras AP 7, Tambaram 6, Pondicherry 5, Trivandrum 4, Nancowry 3.
- 4th : Pusad 5, Karaikal 4, Buldhana, Cuddalore, Jalna & Madras AP 3 each.
- 5th : Ponneri 11, Karaikal 7, Tambaram 6, Cuddalore 5, Gudur & Pusad 4 each.
- 6th : Parangipettai 21, Cuddalore 18, Pondicherry 12, Karaikal 11, Madras AP 7, Sulurpeta 6, Tirupati AP & Verkala 5 each.
- 7th : Tambaram 17, Vedaranyam 16, Madras 14, Nellore 12, Tirupati AP 6, Kottayam 3.
- 8th : Ambasundaram 18, Vedaranyam 11, Karaikal 8, Sulurpeta 7, Mancompu 4.
- 9th : Mancompu 11, Haripad 8, Tiruvalla 6, Nagipattinam 3.
- 10th : Adirampattinam 4, Tiruthuraipondi 3.
- 11th : Nagapattinam 16, Vedaranyam 12, Karaikal & Minicoy 7 each, Cochin AP & Kozhikode 3 each.
- 12th : Kayamkulam 9, Nagapattinam 5, Kottayam 4.
- 13th : Thuckalay 8, Madras 7, Thodupuzha 4.
- 14th : Car Nicobar 11, Karaikal 8, Vedaranyam 6, Pondicherry 4, Kondul 3.
- 15th : Port Blair 6, Kondul, Madras AP & Thodupuzha 4 each.
- 16th : Maya Bandar 13, Port Blair 11, Adur & Madras AP 3 each.
- 17th : Car Nicobar 16, Hut Bay 13, Port Blair 12, Long Island 10, Punalur 3.
- 18th : Long Island 15, Hut Bay 14, Peermade 6, Quilon 5.
- 19th : Car Nicobar 4, Idikki 3.
- 20th : Long Island 6, Maya Bandar & Trivandrum 3 each.
- 21st : Idikki 3.
- 23rd : Kondul & Nancowry 6 each, Car Nicobar 5.
- 24th : Kondul 6, Car Nicobar & Nancowry 5 each, Taran Taran 4, Port Blair 3.
- 25th : Hut Bay 41, Port Blair 9, Maya Bandar 8.
- 26th : Long Island 7, Nancowry & Port Blair 5 each.

TABLE 3

Details of weather systems during December 1988

S. N.	Weather system	Period	Place of first location	Direction of movement	Place of dissipation	Remarks
<i>(A) Depression/Low pressure area etc</i>						
(1)	Depression	7th-8th	Southeast Bay	Northwesterly to northeasterly	Southeast and adjoining east central Bay	Observed as a low pressure area over southeast Bay & adjoining south Andaman Sea on 6th. The remnant became less marked on 10th
(2)	Low pressure area	11th-14th	West central & adjoining south Bay	Westerly	Coastal Karnataka & neighbourhood	
<i>(B) Cyclonic circulation</i>						
(1)	Lower tropospheric levels	30 Nov-2nd evening	Off south coastal Andhra Pradesh-north Tamil Nadu coast	—	<i>In situ</i>	
(2)	Do.	8th-11th	North Kerala & neighbourhood	Westerly	Moved away	
(3)	Lower & mid-tropospheric levels	17th-21st	South Andaman Sea & neighbourhood	Do.	Southeast Bay & neighbourhood	
<i>(C) Western disturbance</i>						
(1)	Upper air system	1st-2nd	North Pakistan & neighbourhood	Easterly	Moved away across Jammu & Kashmir & neighbourhood	
(2)	Do.	5th-8th	Do.	Do.	Do.	
(3)	Do.	14th evening-15th evening	North Pakistan	Do.	Do.	
(4)	Do.	17th-21st	North Pakistan & neighbourhood	Do.	Do.	
(5)	Do.	21st evening-27th	Do.	Do.	Moved away across Himachal Pradesh	Seen as a low pressure area between 22nd & 23rd
(6)	Do.	24th evening-27th	North Pakistan	Eastnortheasterly	Moved away across Jammu & Kashmir	
(7)	Do.	31st-	North Pakistan & adjoining Jammu & Kashmir	—	—	
<i>(D) Induced cyclonic circulations etc</i>						
(1)	Lower tropospheric levels	17th evening-22nd	Northwest Rajasthan & neighbourhood	Easterly	Haryana & adjoining Himachal Pradesh & west Uttar Pradesh	
(2)	Do.	24th-27th	South Rajasthan & adjoining Gujarat	Do.	North Madhya Pradesh & adjoining southeast U.P.	Developed into a low pressure area on 25th



- 27th : Maya Bandar & Nancowry 5 each, Long Island 3.  
 28th : Silchar 8, Shillong 3.  
 29th : Cherrapunji 13, Canning town & Gauhati AP 4 each, Car Nicobar & Calcutta AP 3 each.  
 30th : Cherrapunji 14, Shillong 12, Baghdogra AP & Canning town 10 each, Agartala AP & Calcutta AP 6 each, Gangtok, Krishnanagar & Tangla 4 each, Majbat & Tezpur 3 each.

#### 4.4. Temperature

During the month night temperatures were generally below normal being appreciably so on 1 to 5 days in Saurashtra & Kutch, Konkan & Goa, Madhya Maharashtra, Telangana and north interior Karnataka. They were also below normal on most of the days in in Orissa between 6th and 19th, in Gujarat region and Marathwada between 7th & 21st, in coastal and south interior Karnataka between 18th and 28th and in Punjab, Himachal Pradesh and Rajasthan in the last week of the month. They were generally above or appreciably above normal in plains of Uttar Pradesh and Haryana during the month and were so in Punjab between 3rd & 17th on west Rajasthan between 9th and 23rd and in Madhya Pradesh and Vidarbha during the first week of the month.

#### 4.5. Disastrous weather events and damages

Heavy rains in Madras claimed 3 lives on 6th. The hurricane, which struck West Bengal-Bangladesh coast in the evening of 29 November, took a heavy toll of lives and properties in the districts of Midnapore and 24-Parganas of West Bengal. According to reports 532 lives were lost and 57,600 cattle heads were perished. It also damaged partially or completely about 4,45,500 houses in West Bengal.

#### 5. December

##### 5.1. Weather and associated synoptic features

In the month of December one depression developed over the Bay of Bengal but it did not affect the weather over the mainland of India. A trough in the middle and upper tropospheric westerlies moved away across the northern India during last week of this month. Details of synoptic features are given in Table 3.

Northwest India and Uttar Pradesh received precipitation during the period from 18th to 27th while Western Himalayas experienced two spells of snowfall. In the first spell generally widespread rain or snow occurred in Himachal Pradesh and Jammu & Kashmir on 20th and during the second spell, which commenced on 22nd and ended on 26th it was generally widespread on 3 days in Himachal Pradesh and on 1 to 2 days in hills of west Uttar Pradesh and Jammu & Kashmir. Plains of Uttar Pradesh, Haryana and Punjab experienced mainly scattered or isolated nature of rain or thundershowers on 3 to 5 days during this period. In northeast India rain or thundershowers were generally widespread in Assam & Meghalaya and in Nagaland, Manipur, Mizoram & Tripura on 1st. They were scattered or isolated on 1 to 3 days in Assam & Meghalaya, Sub-Himalayan West

Bengal & Sikkim, Orissa and Bihar plains. In central India, east Madhya Pradesh experienced isolated thundershowers on 3 days during the period from 21st to 27th of this month. In the Peninsular India rain or thundershowers were generally widespread on 1 to 3 days in coastal Andhra Pradesh, Telangana, Tamil Nadu, interior Karnataka and Kerala and were of scattered or isolated nature on 10 to 15 days in coastal Andhra Pradesh, Rayalaseema and Tamil Nadu, on 2 to 5 days in Madhya Maharashtra, Vidarbha, Telangana, coastal and south interior Karnataka and Kerala and were one day each in Marathwada and north interior Karnataka. The number of rainy days were 12 over Andaman & Nicobar Islands and 5 over Lakshadweep area but the rainfall was widespread only on one day over Andaman & Nicobar Islands.

##### 5.2. Rainfall during December

It was excess in Nagaland, Manipur, Mizoram & Tripura, Bihar, Uttar Pradesh, Haryana, Punjab, Himachal Pradesh, Madhya Maharashtra, coastal Andhra Pradesh and interior Karnataka, normal in Assam & Meghalaya, Sub-Himalayan West Bengal & Sikkim, Jammu & Kashmir, Telangana, Rayalaseema and Kerala and deficient in Andaman & Nicobar Islands, Arunachal Pradesh and east Madhya Pradesh. It was scanty over the rest of the country outside Gujarat and Konkan & Goa, where there was no rain.

The significant amounts (cm) of rainfall were :

- 1st : Cherrapunji 11, Shillong 4.  
 2nd : Kondul 3.  
 3rd : Parangipettai 10, Madras 7, Nagapattinam & Sulerpeta 3 each.  
 4th : Coonoor, Atmakur & Tirupati AP 3 each.  
 5th : Ambasamundram 4, Pamban 3.  
 6th : Kozhikode 7, Car Nicobar 5.  
 7th : Idikki 7, Nedumangad 6, Cochin AP 5, Vridhunagar 4, Kottayam 3.  
 8th : Long Island 4.  
 9th : Long Island 7.  
 12th : Kavali & Sholingar 7 each, Machillipatnam 6, Nellore & Vellore 5 each, Tirupati AP 3.  
 13th : Kavali & Ongole 12 each, Bapatla 7, Chalakudi, Chennagiri & Manjeri 6 each, Shimoga 5, Madras AP 4, Arogyavaram 3.  
 14th : Udayagiri 12, Coonoor 5, Bellary, Kodaikanal & Ongole 4 each, Bapatla, Bijapur & Tondi 3 each.  
 15th : Balehonnur 5, Madikeri, Pondicherry & Sivaganga 4 each, Coonoor 3.  
 16th : Allepey & Sulya 4 each, Coonoor, Kasargode & Puttere 3 each.  
 19th : Kondul 3.  
 20th : Jogindernagar 10, Buntar AP 6, Batote & Muzaffarnagar 5 each, Shimla & Udampur AP 3 each.

22nd : Poonch 3.

23rd : Bharai 15, Sundernagar 13, Mandi 12, Bhuntar AP 10, Batote Shimla & Udhampur AP 8 each, Chandigarh AP 5, Sarsawa AP 4, Amritsar AP & Joshimath 3 each.

24th : Bilaspur 3.

25th : Gurgaon 9, Chandigarh AP & Una 3 each.

26th : Rajnandgaon 8, Bahraich, Bellary, Gorakhpur AP, Hardoi, Joshimath & Shimla 3 each.

27th : Patna AP 3.

### 5.3. Temperature

During the first fortnight of the month night temperatures were below normal on 10 days each in Punjab and Jammu & Kashmir and on 3 to 6 days in Haryana, Himachal Pradesh, Rajasthan, Madhya Pradesh,

Saurashtra & Kutch, Madhya Maharashtra, Marathwada, Vidarbha and Telangana. They were below or appreciably below normal on 3 to 4 days in hills of west Uttar Pradesh, Himachal Pradesh, west Madhya Pradesh, Konkan & Goa, Marathwada, coastal and south interior Karnataka during the last 10 days of the month. Night temperatures were generally above normal during the month in Arunachal Pradesh, Assam & Meghalaya, Nagaland, Manipur, Mizoram & Tripura, West Bengal & Sikkim being appreciably to markedly so on a couple of days. They were generally above normal in Rajasthan, Madhya Pradesh and Gujarat being appreciably to markedly so on 1 to 7 days during the period from 11th to 27th. Above to appreciably above normal night temperatures were also observed in Andhra Pradesh and Karnataka between 11th and 15th.

### 5.4. Disastrous weather events and damages

On account of heavy snowfall in several parts of Kashmir valley during 20th to 26th several roads were blocked.