

# Weather

## POST MONSOON SEASON (OCTOBER-DECEMBER 1987)\*

### 1. Introduction

For classification of rainfall distribution two norms have been used, one for describing the seasonal and the other for describing the monthly rainfall distribution. The dual norms have been adopted 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 decreases and *vice-versa*. Thus in the case of seasonal rainfall distribution where the period is larger, the limit of  $\pm 10$  per cent departure from the normal has been taken for defining normal rainfall, whereas in describing the monthly rainfall distribution limits of  $\pm 19$  per cent departure from the normal has been adopted for defining the normal rainfall.

### 2. Chief features

- (i) Withdrawal of southwest monsoon from the country was complete on 24 October.
- (ii) Northeast monsoon rains commenced over Tamil Nadu on 30 Oct.
- (iii) Three cyclonic storms developed in the Bay of Bengal, two of which attained severe intensity. All the three storms struck south Andhra coast. Tracks of storms and depressions of the season is given in Fig. 1.
- (iv) Appreciably above normal ( $+4^{\circ}\text{C}$  to  $5^{\circ}\text{C}$ ) day temperatures prevailed in west Uttar Pradesh, Rajasthan and west Madhya Pradesh in October.
- (v) Moderate cold wave condition in Jammu and west Rajasthan in the first week of December.
- (vi) Rainfall during the season was excess; largely ( $+51\%$  or more) in Madhya Pradesh, Maharashtra, Andhra Pradesh and north interior Karnataka; moderately ( $+26\%$  to  $50\%$ ) in coastal and south interior Karnataka and Kerala; slightly ( $+11\%$  to  $25\%$ ) in Andaman & Nicobar Islands, Sub-Himalayan West Bengal & Sikkim, Orissa, Himachal Pradesh and east Rajasthan and normal in east

Uttar Pradesh, Jammu & Kashmir Gujarat region and Tamil Nadu. It was deficient; slightly ( $-11\%$  to  $-25\%$ ) in Assam & Meghalaya and Lakshadweep; moderately ( $-26\%$  to  $-50\%$ ) in Arunachal Pradesh, Nagaland, Manipur, Mizoram & Tripura, Gangetic West Bengal, Bihar Plateau, hills of west Uttar Pradesh, Punjab and west Rajasthan and largely ( $-51\%$  or less) in the rest of the country. Details of seasonal rainfall is given in Fig. 2.

### 3. October

#### 3.1. Withdrawal of southwest monsoon and commencement of northeast monsoon rains

During the month of September southwest monsoon withdrew from northwest India, Uttar Pradesh, Gujarat and west & adjoining east Madhya Pradesh. Thereafter, it withdrew on 9 October from most parts of Bihar, east Madhya Pradesh and Maharashtra. Next, it withdrew on 13 October from the remaining parts of north-east India and east Madhya Pradesh, north Andhra Pradesh and north interior Karnataka. The withdrawal was complete from the country outside Tamil Nadu and Kerala on 24 October.

Northeast monsoon rains ushered in Tamil Nadu on 30 October.

#### 3.2. Weather and associated synoptic features

During the month two intense systems developed over Bay of Bengal, one of which affected south Andhra coast during the month. Extreme north India was affected by seven western disturbances, which moved away eastwards across the Western Himalayas. Besides those western disturbances, Uttar Pradesh and Madhya Pradesh were affected by a trough in mid and upper tropospheric westerlies between 3rd evening and 5th. Another trough in those levels moved eastwards across Vidarbha, east Madhya Pradesh and northeast India between 25th and 29th of this month.

Details of the synoptic features other than the western disturbances and the trough in mid and upper tropospheric westerlies are given in Table 1.

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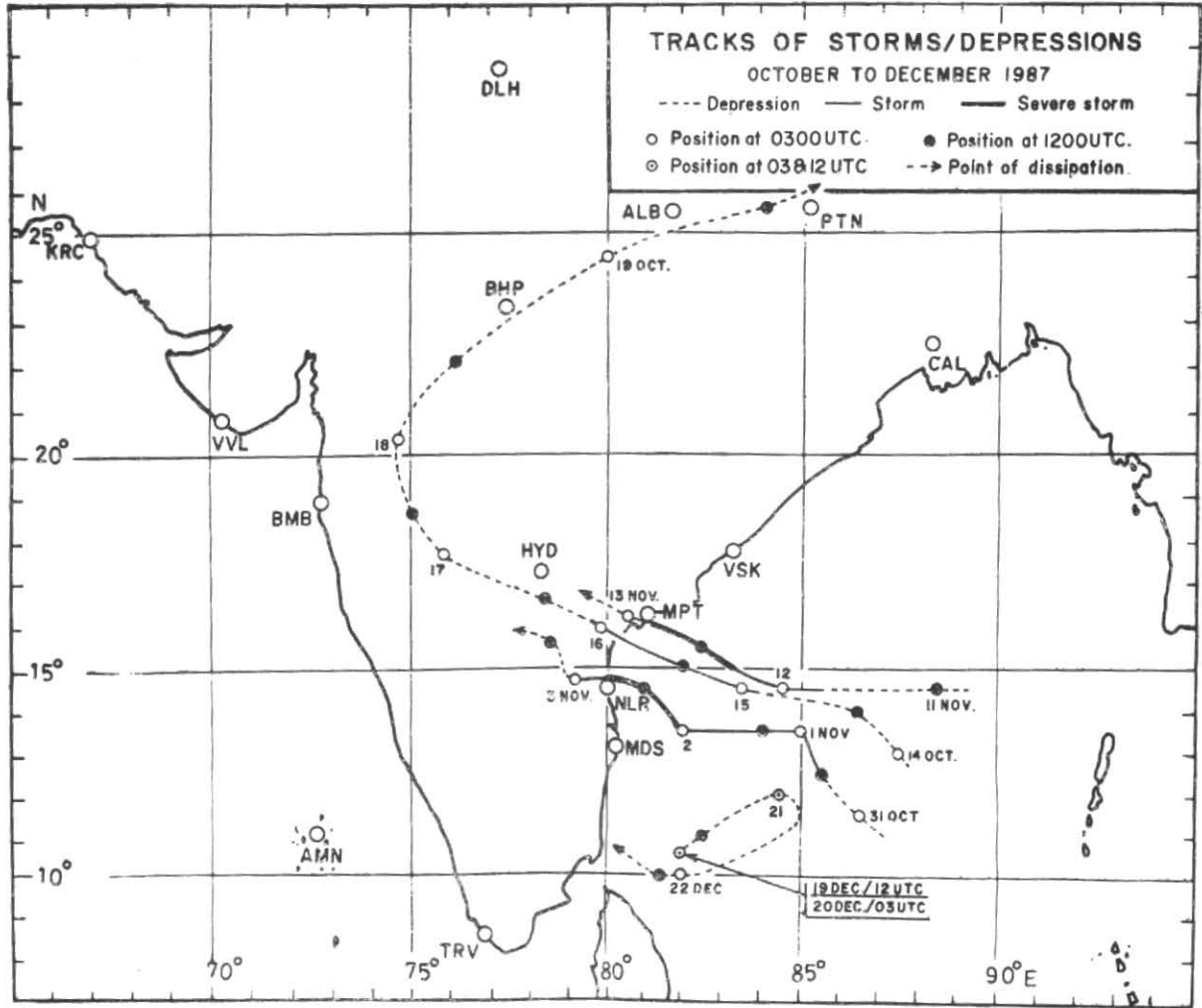
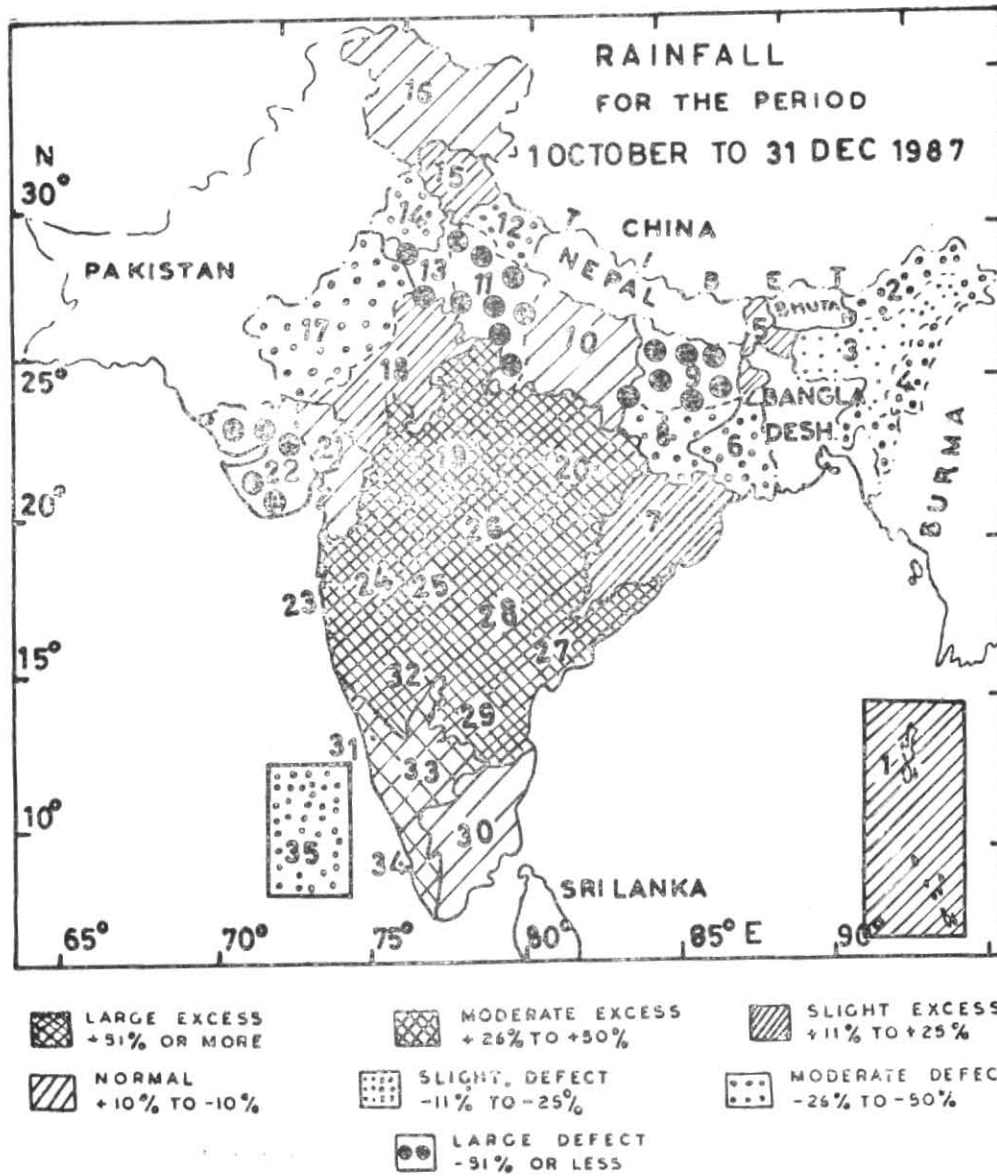


Fig. 1. Tracks of storms/depressions, 1 October to 31 December 1987



Sub-divisions	Dep. from normal	Sub-divisions	Dep. from normal	Sub-divisions	Dep. from normal
1. A. & N. Islands	14	13. Haryana	-70	25. Marathwada	152
2. Arunachal Pradesh	-33	14. Punjab	-38	26. Vidarbha	76
3. Assam and Megha.	-20	15. Himachal Pradesh	24	27. Cot. A.P.	94
4. N.M.M. & T.	-29	16. Jammu & Kashmir	6	28. Telangana	146
5. S. H. W. B. Sikkim	19	17. West Rajasthan	-32	29. Rayalaseema	85
6. G. West Bengal	-34	18. East Rajasthan	19	30. Tamil Nadu	4
7. Orissa	17	19. West M.P.	56	31. Cot. Karnataka	49
8. Bihar Plateau	-44	20. East M.P.	55	32. N. I. Karnataka	83
9. Bihar Plains	-60	21. Gujarat Region	3	33. S. I. Karnataka	45
10. East U. P.	0	22. Saurashtra & Kutch	-59	34. Kerala	38
11. Plains of W. U.P.	-62	23. Konkan and Goa	88	35. Lakshadweep	-21
12. Hills of W. U.P.	-41	24. Madhya Maharashtra	75		

Fig. 2. Rainfall for the period, 1 October to 31 December 1987

## WEATHER

TABLE 1  
Details of weather systems during October 1987

S. No.	Weather system	Period	Place of first location	Direction of movement	Place of dissipation	Special remarks
(1)	Low pressure area*	3rd-6th evening	East central Arabian Sea off Karnataka Goa-south Maharashtra coast	—	<i>In situ</i> * However, associated cyclonic circulation in the lower levels became unimportant over northeast Arabian Sea off north Maharashtra, south Gujarat coast on 7th evening	First observed as a cyclonic circulation in the lower & mid-tropospheric levels over the same area on 1st evening
(2)	Low pressure area	6th-7th	West Bengal and neighbourhood	—	<i>In situ</i>	First appeared as a cyclonic circulation in the lower levels over the same area on 5th
(3)	Cyclonic storm	14th-20th	Central & adjoining south Bay	Northwesterly to northeasterly	Weakened into a low pressure area over Sub-Himalayan West Bengal and neighbourhood where it dissipated by 20th evening	Crossed south Andhra coast between Ongole & Bapatla on 16th morning
(4)	Severe cyclonic storm*	31st	Southeast and adjoining south-west Bay	—	Please see Nov 87* (Table 2. S. No. 1)	Seen as a low pressure area over southeast and adjoining southwest Bay on 30th
<i>Cyclonic Circulations</i>						
(1)	Lower levels	1st-2nd	Bihar plains & neighbourhood	—	<i>In situ</i>	Remnant of the low pressure area which weakened on 25 Sep over Bihar Plateau and adjoining Gangetic West Bengal
(2)	Lower levels	1st-2nd	Southeast Arabian Sea west of Lakshadweep	Westerly	Moved away westwards	First located over Lakshadweep on 30 Sep
(3)	Lower tropospheric levels	2nd evening-11th	North Andaman Sea and neighbourhood.	Westnorthwesterly	West central and northwest Bay off north Andhra, south Orissa coast.	—
(4)	Lower tropospheric levels	7th-8th	Telangana and neighbourhood	Easterly	—	Merged with the cyclonic circulation under S.No. 3
(5)	Lower tropospheric levels	8th evening-10th	Kerala and neighbourhood	Westerly	—	Moved away westwards across Lakshadweep area
(6)	Lower and mid-tropospheric levels	10th evening-15th evening	Southeast Arabian Sea off Kerala coast	—	<i>In situ</i>	—
(7)	Lower tropospheric levels	10th-14th	North Tamil Nadu and neighbourhood	Southwesterly	South Tamil Nadu and neighbourhood	—
(8)	Lower tropospheric levels	10th-12th	Bangladesh and neighbourhood	—	<i>In situ</i>	—
(9)	Lower tropospheric levels	15th-16th	West Rajasthan	—	<i>In situ</i>	—
(10)	Lower and mid-tropospheric levels	19th-23rd	South Tamil Nadu and neighbourhood	Westerly/northnorthwesterly	East central Arabian Sea off Karnataka-Goa-south Maharashtra coast	—
(11)	Lower levels	22nd-27th evening	Southwest Bay and adjoining Sri Lanka and south Tamil Nadu	—	Maldives-Lakshadweep area	—
(12)	Lower tropospheric levels	26th-30th	Southwest Bay off Sri Lanka coast	—	—	Merged with cyclonic circulation of the low pressure area over southeast and adjoining southwest Bay on 30th
(13)	Lower levels	28th-29th	Lakshadweep and neighbourhood	—	<i>In situ</i>	—
(14)	Lower tropospheric levels	29th-30th evening	Maldives-Lakshadweep area	Quasi-stationary	Lakshadweep and neighbourhood	—
(15)	Lower levels (Induced)	29th-31st	Northwest Rajasthan & neighbourhood	—	<i>In situ</i>	—

Rainfall occurred on almost all days in Andaman & Nicobar Islands, Andhra Pradesh, Tamil Nadu, Karnataka Kerala and Lakshadweep during October. Prior to withdrawal of monsoon active to vigorous monsoon conditions prevailed on 8 days in Rayalaseema and on 2 to 4 days in coastal Andhra Pradesh, Telangana and Kerala. Rain or thundershowers were generally widespread on 15 to 18 days in Andaman & Nicobar Islands, coastal & south interior Karnataka and Kerala and on 2 to 9 days in coastal Andhra Pradesh, Telangana, Tamil Nadu, north interior Karnataka and Lakshadweep with isolated heavy to very heavy falls on a couple of days in some of those sub-divisions. Rain or thundershowers occurred on 6 to 18 days over northeast India outside Bihar, east Uttar Pradesh, Punjab, Himachal Pradesh, Jammu & Kashmir, Madhya Pradesh and Maharashtra and on 1 to 5 days over the remaining sub-divisions outside Saurashtra & Kutch. The distribution was generally widespread on 4 to 6 days in Arunachal Pradesh, Nagaland, Manipur, Mizoram & Tripura, Sub-Himalayan West Bengal & Sikkim, Orissa, Jammu & Kashmir, east Madhya Pradesh and Maharashtra and on 1 to 2 days in Assam & Meghalaya, Bihar plains, Uttar Pradesh, Punjab, Himachal Pradesh and west Madhya Pradesh. Isolated heavy to very heavy rainfall occurred on 2nd and 20th in Sub-Himalayan West Bengal & Sikkim, on 5th in Marathwada, on 18th in Madhya Maharashtra, on 19th in east Uttar Pradesh and west Madhya Pradesh, on 20th in Assam & Meghalaya and on 21st in Arunachal Pradesh. Weather was mainly dry over Saurashtra & Kutch during the month.

### 3.3. Rainfall

It was excess (+20% and more) in Sub-Himalayan West Bengal & Sikkim, east Uttar Pradesh, Himachal Pradesh, Jammu & Kashmir, Madhya Pradesh, Maharashtra, Andhra Pradesh, Tamil Nadu and coastal & north interior Karnataka; normal (+19% to -19%) in Andaman & Nicobar Islands, Assam & Meghalaya, Punjab, south interior Karnataka, Kerala and Lakshadweep; deficient (-20% to -59%) in Arunachal Pradesh, Nagaland, Manipur, Mizoram & Tripura, Orissa, hills of west Uttar Pradesh and Rajasthan and was scanty (-60% or less) over the rest of the country.

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

- 1st : Ongole 13, Ponneri 8, Magadi 6, Chalakudi, Honavar, Malda & Taibpur 4 each
- 2nd : Gangtok 10, Aryankavu, Khanapur & Tiruthuraiyandi 9 each, Rajapur 8, Vengurla 7
- 3rd : Sidlaghatta 10, Vedaraniyam 8, Harnai & Jalgaon 7 each, Aland, Bhira & Bhor 6 each, Bapatla, Cooch Behar, Hut Bay & Ratnagiri 5 each
- 4th : Madikeri 14, Hingoli, Peermade & Vengurla 11 each, Idikki, Kankavali, Lumding, Machilipatnam & Pamai 9 each, Shevgaon 8, Car Nicobar 6
- 5th : Jalna 18, Mehkar 12, Aurangabad AP & Kanyakumari 9 each, Bhira & Car Nicobar 8 each, Kakinada, Kerwar & Paud 7 each, Pune 6
- 6th : Paithon 12, Nalgonda & Vedaraniyam 11 each, Ramnathpuram 9, Ahmadnagar, Arogyavaram & Partur 8 each, Nandyal 7, Karwar 6
- 7th : Dhenkanikottai 10, Karimnagar 10, Hannamkonda 8, Vedaraniyam 7, Tiptur 6, Solapur 4
- 8th : Hannamkonda 13, Cuttack 11, Agartala AP 10, Madikeri 9, Hyderabad AP, Perinthalmanna, Paikmal, Rajampet & Sakti 7 each, Kalingapatnam 5
- 9th : Konni 14, Pakala 13, Kozhikode & Malavalli 12 each, Mavelikara 11, Gobichettipalayam 9, Bolangir & Vellore 7 each, Bangalore & Sambalpur 6 each
- 10th : Madikeri 11, Karaikudi 8, Balasore 7, Phulbani & Tiruvur 6 each, Dalhousie 4
- 11th : Madikeri 10, Car Nicobar 9, Chittoor, Udaygiri, Vedaraniyam & Verinag 7 each, Pahalgam 6
- 12th : Kozhikode, Malavalli & Nancowry 9 each, Salem 8, Peermade, Rapur & Verinag 7 each
- 13th : Nilakottai 12, Nancowry 9, Cochin AP & Kolar Gold Fields 7 each
- 14th : Ponneri 11, Car Nicobar, Holenarsipur & Thenmala 8 each, Magadi & Punalur 6 each
- 15th : Krishnarajsagar Dam 7, Talguppa 6
- 16th : Atchanta 22, Viakhapatnam 18, Mohana & Ongole 17 each, Thenmala 14, Amalapuram 12
- 17th : Pandharpur 17, Mancompu 12, Mohana 9, Talegaon 8, Madras, Mundali & Peermade 7 each
- 18th : Koyna 29, Satara 15, Ashti 14, Jeur 13, Patoda 10, Kailashahar, Mohaba, Mehkar, Quilon & Seoni 8 each
- 19th : Tikamgarh 15, Guna 13, Bhor 12, Mahoba 11, Bahraich, Jogindernagar, Rewa, Satyanganagam & Ziro 10 each, Sundernagar 9, Banda, Bhopal & Kanpur AP 8 each, Dalhousie 7
- 20th : Belur 20, Cooch Behar & Gangtok 15 each, Sivaganga 12, Holenarsipur 10, Gorakhpur, Gauhati AP & Melur 9 each, Alathur 8
- 21st : Nidadavole 11, Coimbatore & Tezu 10 each, Aryankavu 9, Chipurapalli 7, Madras & Rajampet 5 each
- 22nd : Yemmiganur 13, Mudhol 9, Kudhigi 8, Atchanta & Tondi 7 each, Coonoor & Dhone 6 each



- 23rd : Nagapattinam 10, Kayamkulam 8, Belgaum 7, Ootnur 6, Byadgi & Kavali 4 each
- 24th : Rajamundry & Rajapur 5 each
- 25th : Karaikal 15, Pondicherry 12, Piravam 7
- 26th : Piravam, Ramanathapuram & Thukalay 7 each, Alleppey & Lingadahalli 6 each
- 27th : Nanguneri 9, Kayamkulam & Quilandy 8 each, Kanyakumari & Punalur 7 each, Mangalore AP 4
- 28th : Thenmala 8, Punalur 7, Kangayam 4
- 29th : Idikki 7, Madras 5
- 30th : Kunnankulam 16, Pamban 10, Trivandrum 9, Car Nicobar, Madras AP & Nagapattinam 8 each
- 31st : Tiruvallur 13, Mayiladuthurai & Sulurpeta 7 each, Car Nicobar & Tirupati AP 6 each

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

As per reports, river *Vedavati* in Chitradurga district of Karnataka experienced flash floods on 2nd. A private bus carrying 50 passengers fell into the swollen river in the early morning of 2nd and was swept away. 20 persons reported to have met with water grave and 16 others were injured. Heavy snowstorm on 18th in Baralacha passes in Himachal Pradesh took a toll of 4 human lives and blocked vehicular traffic. Also due to heavy snowfall from 17th to 19th of this month in the upper reaches of Jammu & Kashmir, traffic on National Highway between Srinagar and Leh was blocked. The cyclonic storm, which struck south Andhra coast, took a toll of 17 human lives and affected about 6.2 lakhs population in Andhra Pradesh. The damage to crops and properties was estimated to about Rupees 34 crores. Severe local storms were reported from several places of Bihar plains on 19th and 20th, which claimed about 31 human lives.

### 3.5. *Temperature*

Day temperatures were 6° to 7°C above normal in Gujarat on 2nd, in hills of west Uttar Pradesh on 16th and in east Rajasthan on 29th. During the first fortnight of the month 4°C to 5°C above normal day temperatures were reported on most days in west Uttar Pradesh, Rajasthan, west Madhya Pradesh and Gujarat. During the last week such high day temperatures prevailed on most days in east Rajasthan, Saurashtra & Kutch and Konkan & Goa. Day temperatures in Jammu & Kashmir were 6° to 7°C below normal on most of the days between 11th and 21st.

Night temperatures were 4° to 5°C above normal on most days in Haryana, Rajasthan and Gujarat between 15th and 19th. They were below normal by 6° to 7°C in Kashmir on 20th and 21st, by 4°C to 5°C on 2 to 3 days in Nagaland, Manipur, Mizoram & Tripura, Bihar plains, plains of west Uttar Pradesh and Punjab between 20th and 24th.

## 4. November

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

During this month two severe cyclonic storms hit south Andhra coast causing considerable damage in coastal Andhra Pradesh. The western disturbance activities in the extreme north were below normal in this month. Only three western disturbances affected extreme north India. Also a trough in mid and upper tropospheric westerlies affected Uttar Pradesh, Bihar, and east Madhya Pradesh on 15th and another trough in those levels affected north India and northern parts of Peninsular India between 18th and 25th of the month.

Details of the synoptic features, other than the western disturbances and troughs are given in Table 2.

Rain or thundershowers occurred on most days of the month in Andaman & Nicobar Islands, coastal Andhra Pradesh, Rayalaseema, Tamil Nadu, coastal and south interior Karnataka and Kerala of which the spatial distribution of rainfall was generally widespread on 11 days in Andaman & Nicobar Islands and on 5 to 9 days in the above sub-divisions. There were two spells of rain over northeast India, Madhya Pradesh, Maharashtra, Telangana and north interior Karnataka. During the first spell, which commenced on 1st and ended on 6th, those sub-divisions received rainfall on 1 to 4 days out of which the spatial distribution was generally widespread on 1 to 3 days. During the second spell, which was from 13th to 22nd the rainfall was generally widespread on 1 to 6 days in Nagaland, Manipur, Mizoram & Tripura, Gangetic West Bengal, Orissa, Bihar Plateau, east Madhya Pradesh, Maharashtra, Telangana and north interior Karnataka, Himachal Pradesh, west Madhya Pradesh and Gujarat received only scattered or isolated rainfall on 1 to 3 days. Lakshadweep received fairly widespread rainfall on 20th. Isolated heavy to very heavy rainfall occurred on 1 to 4 days in Orissa, coastal Andhra Pradesh, Telangana, Tamil Nadu, south interior Karnataka and Kerala during the month. The weather over Uttar Pradesh, Haryana, Punjab, Jammu & Kashmir and Rajasthan was mainly dry.

### 4.2. *Rainfall*

It was excess in Gangetic West Bengal, Orissa, Bihar Plateau, east Madhya Pradesh, Gujarat region, Maharashtra, Andhra Pradesh, Karnataka and Kerala; normal in Andaman & Nicobar Islands, Nagaland, Manipur, Mizoram & Tripura and Saurashtra & Kutch; deficient in Arunachal Pradesh, Assam & Meghalaya, Sub-Himalayan West Bengal & Sikkim, west Madhya Pradesh, Tamil Nadu and Lakshadweep and scanty in Bihar plains, plains of west Uttar Pradesh, and Himachal Pradesh. There was no rain over the rest of the country.

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

- 1st : Peermade 5
- 2nd : Kottayam 4
- 3rd : Nellore 52, Ponneri 24, Udayagiri 22, Kalinapatnam 18, Sompeta 12, Gopalpur & Kakina 11 each, Madras & Neyyatinkara 9 each

TABLE 2

Details of weather systems during November 1987

S. No.	Weather system	Period	Place of first location	Direction of movement	Place of dissipation	Special remarks
(1)	Severe cyclonic storm*	1st-4th	*Developed over southeast and adjoining south-west Bay on 31 Oct	Westnorthwesterly	Became well marked low pressure area over north interior Karnataka and neighbourhood on 4th morning. Emerged into east central Arabian Sea on 5th and moved away westwards by 6th	Crossed south Andhra coast near Nellore around 0530 IST on 3rd
(2)	Severe cyclonic storm	11th A.N.-14th	Central and adjoining south Bay	Westnorthwesterly	South Andhra Pradesh. The remnant emerged into east central Arabian Sea on 16th and became less marked over east central and adjoining northeast Arabian Sea off north Maharashtra south Gujarat coasts on 20th	Seen as a low pressure area over north Andaman Sea and neighbourhood on 9th. The severe cyclonic storm crossed south Andhra coast near Machilipatnam on 13th morning
(3)	Low pressure area	29th*	Andaman Sea and neighbourhood lay over southeast and adjoining east central Bay on 30th	Westerly	Contd. in Dec* (S. No. 1 of Table 3)	First located over Gulf of Siam and neighbourhood on 26th where it persisted upto 28th
<i>Cyclonic Circulations</i>						
(1)	Lower and mid-tropospheric levels	4th-9th	Kerala and adjoining south Tamil Nadu	Westnorthwesterly	Off Kerala-Karnataka coast	
(2)	Lower tropospheric levels*	5th evening-12th	Southwest Bay off Tamil Nadu-Sri Lanka coast	Northerly	Merged with the circulation of the severe cyclonic storm under S.N. 2 on 12th	*Extended upto 7 mid-tropospheric levels from 9th
(3)	Lower tropospheric levels	10th evening-12th	East central Arabian Sea & coastal Karnataka	—	<i>In situ</i>	
(4)	Lower tropospheric levels	14th-15th	East central Arabian Sea off Karnataka coast	—	<i>In situ</i>	
(5)	Lower tropospheric levels	20th-28th	South Bay	Westerly	Southeast Arabian Sea west of Lakshadweep area	
(6)	Lower tropospheric levels	20th-21st	Lakshadweep and neighbourhood	—	<i>In situ</i>	
(7)	Lower tropospheric levels	25th-28th evening	Southwest Bay and adjoining south Tamil Nadu and Sri Lanka	Quasi-stationary	Southwest Bay & adjoining Sri Lanka	

- 4th : Huzurabad 18, Tenali 17, Kalingapatnam & Nalgonda 16 each, Mahabubnagar & Sompetta 15 each, Rentachintala 13, Hyderabad AP 11
- 5th : Visakhapatnam 14, Parangipettai, Ponneri, Siddipet, Shahapur & Yellamanchilli 6 each
- 6th : Sriperumbudur 8, Atmakur & Cuddalore 7 each, Pondicherry 6, Alleppey & Huzurnagar 4 each
- 7th : Ramanathapuram 8, Devanahalli & Trivandrum AP 6 each, Alathur, Atirampattinam & Vedaranyam 5 each
- 8th : Pondicherry 12, Perumbavur & Cuddalore 8 each, Kozhikode & Parangipettai 7 each
- 9th : Thenmala 10, Alleppey 8, Srivilliputtur 7, Long Island & Vridhunagar 6 each
- 10th : Perumbavur 8, Karaikal 6, Madras AP 4
- 11th : Nellore 18, Long Island 11, Port Blair 9
- 12th : Atchanta 11, Chipurupalli 10, Nandyal 5
- 13th : Bapatla 21, Tenali 15, Visakhapatnam 13, Machilipatnam 12, Gopalpur 10, Nalgonda 9, Ramannapet 8, Bankura & Hosdurg 6 each
- 14th : Agumbe 8, Badagar 7, Balasore & Bankura 6 each
- 15th : Digha 9, Balasore 5
- 16th : Car Nicobar 10, Angul & Pakala 7 each, Aijal 6, Venguria 5, Imphal AP 4
- 17th : Shahapur 7, Bolangir 6, Port Blair 5
- 18th : Kurnool 15, Chidambaram 7, Tondi 6, Sirsilla 5
- 19th : Thuckalay 12, Dohad 9, Bramhapuri & Pattambi 7 each, Coimbatore, Malegaon & Wardha 6 each
- 20th : Alwaye & Honsur 16 each, Cochin AP 15, Krishnarajapet 13, Mandya 12, Mancompu & Trichur 11 each, Mysore & Periyakulam 9 each
- 21st : Aryankavu & Bhira 7 each, Thenmala 6, Namakkal & Udumalpet 5 each, Be'gaum & Ramdurg 4 each
- 22nd : Thuckalay 8, Badvel, Sankaridurg 6 each, Holenarsipur 5, Rajmundry & Thodupuza 4 each
- 23rd : Nagapattinam & Usilampatti 6 each
- 24th : Sulurpetta 12, Vellore 6, Chidambaram 5, Kumarakom, Madras AP & Nagamandala 4 each
- 25th : Irinja'akuda & Kayamkulam 5 each, Tuticorin 4
- 26th : Madurai AP & Tumkur 5 each, Konni 4

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

The severe cyclonic storm, which hit south Andhra coast near Nellore on 2nd midnight affected a population of 6.8 lakhs and took a toll of 50 human lives. 23,200 livestock in Andhra Pradesh were perished. The second storm of the month also hit south Andhra coast on 13th near Machilipatnam. It took a toll of 28 human lives in coastal Andhra Pradesh.

#### 4.4. *Temperature*

Night temperatures were above normal by 6°C to 9°C on 6 to 9 days in Madhya Maharashtra and Marathwada and on 3 to 5 days in Nagaland, Manipur, Mizoram & Tripura, east Madhya Pradesh and Vidarbha and by 4°C to 5°C on 3 to 8 days in Orissa, Bihar, east Uttar Pradesh, Saurashtra & Kutch, Konkan & Goa, Vidarbha and Andhra Pradesh between 13th and 22nd. Moderate cold wave conditions prevailed in Jammu on 1st. They were below normal by 4° to 5°C on 2 to 4 days in Punjab and Jammu & Kashmir in the first week of the month.

#### 5. *December*

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

In the third week of the month a deep depression developed over Bay of Bengal, which weakened over the sea area off Tamil Nadu-north Sri Lanka coast. Four western disturbances moved away eastwards across extreme north India during the month. The fifth western disturbance of the month was observed over north Pakistan and adjoining Jammu & Kashmir on 31st. Also a trough in mid and upper tropospheric westerlies affected northwest India between 12th and 13th.

Details of synoptic features other than the western disturbances and trough are given below in Table 3.

Coastal Andhra Pradesh, Rayalaseema, Tamil Nadu, south interior Karnataka and Kerala experienced rain or thundershowers almost throughout the month while they occurred over Andaman & Nicobar Islands upto 19th of the month. There was a spell of rainfall over Himachal Pradesh and Jammu & Kashmir between 2nd and 3rd. Coastal and north interior Karnataka received rainfall on 9 and 6 days respectively between 8th and 16th. There was rainfall on 1 to 5 days in north-east India. Uttar Pradesh, northwest India outside Jammu & Kashmir, Gujarat and rest of Peninsular India between 10th and 15th Lakshadweep experienced the first spell of rain between 7th and 12th and the second one between 20th and 21st and on 25th. Rain or thundershowers were generally widespread on 4 to 7 days in Andaman & Nicobar Islands, Rayalaseema, Tamil Nadu, south interior Karnataka, Kerala & Lakshadweep and on 1 to 3 days in Assam & Meghalaya, Nagaland, Manipur, Mizoram & Tripura, Gangetic West Bengal, Bihar, hills of west Uttar Pradesh, Haryana, Punjab, Himachal Pradesh, Jammu & Kashmir, east Rajasthan, west Madhya Pradesh, Gujarat region, Konkan & Goa, Madhya Maharashtra, Vidarbha, coastal and north interior Karnataka. Isolated heavy to very heavy falls occurred on 5 to 7 days in Tamil Nadu and Kerala during the month.



TABLE 3

Details of weather systems during December 1987

S. No.	Weather system	Period	Place of first location	Direction of movement	Place of dissipation	Special remarks
(1)	Low pressure area*	1st-14th evening	South & adjoining central Bay	Westerly	East central and west central Arabian Sea	*Developed in December. The system moved across south Peninsula between 6th and 7th
(2)	Low pressure area	7th-9th	Southwest Bay off Tamil Nadu coast	Westerly	Merged with the system under S. No. 1 west of Lakshadweep	
(3)	Low pressure area	9th-12th	Southwest Bay	Quasi-stationary	Southwest Bay off south Tamil Nadu-Sri Lanka coasts	
(4)	Deep depression	19th evening-22nd	Southwest Bay	Northeasterly and then southwesterly	Southwest Bay off south Tamil Nadu-north Sri Lanka coast. The remnant moving across south Peninsula emerged into southeast Arabian Sea on 24th and moved away westwards by 27th	First appeared as a low pressure area over south-east and adjoining southwest Bay on 13th evening
<i>Cyclonic Circulation</i>						
(1)	Lower tropospheric levels	13th-16th	Southwest Bay off south Tamil Nadu-Sri Lanka coasts	—	<i>In situ</i>	
(2)	Lower tropospheric levels	10th-12th	Southwest Rajasthan	Northeasterly	Northwest Rajasthan	
(3)	Lower levels	15th-20th	Southeast Arabian Sea off Kerala coast	Westerly	Lakshadweep and neighbourhood	
(4)	Lower tropospheric levels	28th-29th	Lakshadweep area and neighbourhood	—	<i>In situ</i>	

## 5.2. Rainfall

It was excess in Andaman & Nicobar Islands, Gange-tic West Bengal, Bihar Plateau, Rajasthan, west Madhya Pradesh, Gujarat, Konkan & Goa, Madhya Maharashtra, coastal Andhra Pradesh, Rayalaseema, Tamil Nadu, interior Karnataka, Kerala & Lakshadweep; normal in Arunachal Pradesh, Bihar Plains, plains of west Uttar Pradesh, east Madhya Pradesh and coastal Karnataka and was deficient over the rest of the country outside Himachal Pradesh, Jammu & Kashmir and Telangana, where the rainfall was scanty.

The significant amounts of rainfall during the months are given below :

2nd : Port Blair 4

3rd : Hut Bay & Nancowry 4 each

4th : Trivandrum 13, Madras AP 7, Nellore 4

5th : Karaikal 12, Madras 10, Parangipettai 9, Cuddalore 8, Varkala 7, Chamrajnagar, Quilon & Sulpurpeta 5 each, Nellore 4

6th : Mayiladuthurai 21, Ariyalur 20, Kumbakonam 18, Cuddalore 12, Trichirapalli AP 8, Long Island 7, Kottayam & Tirupati AP 4 each

7th : Mayiladuthurai 21, Ambasamudram 16, Parangipettai 14, Pondicherry 13, Cai Nicobar 10, Punalur 8

8th : Madras, Minicoy & Nancowry 6 each, Pamban 5

9th : Ponneri 8, Chalakudi 6, Kanakpura 5, Madras AP & Machilipatnam 4 each

10th : Kodaikanal 9, Chalakudy 8, Ponneri & Tellicherry 7 each, Madras AP & Parangipettai 5 each

- 11th : Ongole 7, Ahmadnagar, Chittoor, Coonoor & Satara 4 each
- 12th : Satara 7, Chittorgarh 6, Agumbe, Bhira, Malegoan, Pune, Sawai Madhopur & Telli-cherry 5 each
- 13th : Car Nicobar, Chittoor & Gokak 7 each, Bhagamandala, Jeur, Karaikal & Talaguppa 6 each
- 14th : Thenmala 9, Car Nicobar & Trivandrum 8 each, Koppal 7, Alur & Raichur 5 each
- 15th : Mettupalayam 11, Alatur 10, Palghat & Port Blair 8 each, Chennapatna & Yemmi-ganur 7 each
- 16th : Car Nicobar 9, Port Blair 4
- 19th : Quilon & Trivandrum AP 15 each, Varkala 9, Thenmala 8, Palghat 5
- 21st : Ponneri 5, Minicoy 4
- 22nd : Ponneri, Tiruvellur & Venkatagiri 4 each
- 23rd : Adirampattinam 12, Vedaranyam 8, Chidam-baram 7, Nagapattinam 5
- 24th : Chittoor 15, Coonoor 13, Periyakulam 9, Atmakur 8
- 26th : Coonoor 4

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

As per reports heavy rains in the first week of the month claimed 3 lives and submerged 10,000 acres of paddy crops in Tamil Nadu.

### 5.4. *Temperature*

Moderate cold wave condition prevailed in Jammu on 4th and 5th and in west Rajasthan on 5th and 6th. Night temperatures were below normal by 4° to 5°C on 5 days in Punjab and on 1 to 2 days in Nagaland, Manipur Mizoram & Tripura, plains of Uttar Pradesh and east Rajasthan and by 2° to 3°C on 2 to 6 days in Nagaland, Manipur, Mizoram & Tripura, Orissa, Bihar, plains of west Uttar Pradesh, Haryana, Punjab, Kashmir and Rajasthan during the period from 1st to 9th of the month. They were also below normal by 2° to 3°C on 3 to 8 days in plains of west Uttar Pradesh, Punjab, west Madhya Pradesh, Maharashtra, Telangana, Rayalaseema during the period from 14th to 22nd. 6°C to 8°C above normal night temperatures were observed on 2 to 4 days in Orissa, Haryana, Madhya Maharashtra, Marathwada, Vidarbha and Telangana between 10th and 14th.