

## Weather

### MONSOON SEASON (JUNE-SEPTEMBER 1982)\*

#### 1. Chief features

##### *Advance of the monsoon*

The southwest monsoon, during 1982, advanced over Kerala on 28 May and over Andaman and Nicobar Islands on 27 May, *i.e.*, two days earlier than normal over Kerala and 7 days behind the scheduled date over the Bay Islands. It covered coastal Karnataka and parts of south interior Karnataka by 1 June. Subsequently its northward progress was arrested for 10 days. Thereafter it progressed rather rapidly and covered the whole Peninsular India and northeast India by 17 June which was 5-7 days behind the normal date. Its advance into Uttar Pradesh was delayed by about a month. It covered the entire country by 22 July.

##### *Activity of monsoon*

The delayed onset over some parts of the country initially resulted in rainfall deficiency. But the performance of monsoon was generally good from last week of July to the 4th week of August over central and northwest India outside Jammu and Kashmir, Himachal Pradesh and Punjab. The rainfall deficiency by the end of August was wiped out over most of these areas. There were only few spells of good rainfall activity interspersed with periods of low rainfall during the monsoon period over the Peninsula and in September over northwest and central parts.

Floods occurred in Uttar Pradesh and Bihar, the worst affected being Uttar Pradesh. Other flood affected areas during this season were Assam, Manipur, Gangetic West Bengal, Orissa, Rajasthan, Gujarat and north Kanara. The seasonal rainfall was normal in 24 and deficient in 11 meteorological sub-divisions. Progress of the monsoon week by week expressed as percentage departure of rainfall is given in Table 1.

##### *Withdrawal of the monsoon*

The monsoon withdrew from Jammu and Kashmir and west Rajasthan on 3 September, 10-12 days earlier than normal. The withdrawal from rest Northwest India, Uttar Pradesh and Madhya Pradesh was earlier by about one to two weeks. It withdrew from the country outside Tamil Nadu and Kerala by 11 October.

#### 2. Depressions and cyclones

9 depressions and 1 severe cyclonic storm developed in the Indian seas during this season out of which 3 were land depressions. Tracks of these systems are given in Fig. 1.

#### 3. Significant monthly features

##### 3.1. June

##### 3.1.1. Hurricane

A depression formed over east central and adjoining southeast Bay centred on the evening of 31 May near  $14.5^{\circ}$  N/ $91.5^{\circ}$  E. It intensified into a severe cyclonic storm with core of hurricane winds by 3rd evening and crossed Orissa coast north of Paradip around midnight of 3rd. Moving northwestwards it gradually weakened into a low over east Uttar Pradesh by 5th evening. This hurricane caused heavy damage in the coastal districts of Puri, Cuttack and Balasore. Considerable number of persons were reported to have lost their lives and a large number of cattle were perished. Heavy damage to crops and property also reported. The noteworthy amount of rainfall (cm) in association with this system was: Paradip, Kendrapara 26 each, Bhubaneswar 25, Kakatpur 24, Jagatsinghpur 22, Jenapur 20 on 4th.

##### 3.1.2. Features heralding the advance of monsoon during June

The advance of the monsoon and its activity during the month were associated mainly with

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TABLE 1  
Progress of the monsoon week by week (1 June to 30 September 1982)

WEEK ENDING ON (WEEK COMMENCES FROM THURSDAY)

SUB-DIVISIONS	JUNE				JULY				AUGUST				SEPTEMBER				
	9	16	23	30	7	14	21	28	4	11	18	25	1	8	15	22	29
1 ANDAMAN AND NICOBAR ISLANDS	○	■	■	■	■	■	■	○	●	○	■	■	■	■	■	ND	ND
2 ARUNACHAL PRADESH	■	○	●	○	■	●	●	■	○	●	●	●	●	■	■	■	●
3 ASSAM AND MEGHALAYA	■	○	■	■	○	○	■	■	○	■	○	○	■	■	■	■	■
4 NAGALAND, MANIPUR, MIZORAM AND TRIPURA	○	○	○	■	○	●	○	■	■	○	○	○	■	■	■	○	■
5 SUB-HIMALAYAN WEST BENGAL AND SIKKIM	■	○	○	■	■	■	■	■	○	○	●	■	■	■	■	○	●
6 GANGETIC WEST BENGAL	■	○	■	○	●	○	○	■	■	■	○	■	○	○	■	●	●
7 ORISSA	■	■	■	●	●	●	○	○	■	○	■	■	■	○	■	●	●
8 BIHAR PLATEAU	○	■	○	●	●	○	■	■	■	■	■	■	○	■	●	●	●
9 BIHAR PLAINS	■	■	○	●	●	○	■	○	●	●	○	■	■	■	■	■	●
10 EAST UTTAR PRADESH	■	■	■	■	■	○	■	■	○	●	■	■	■	■	■	■	■
11 PLAINS OF WEST UTTAR PRADESH	■	■	■	■	■	■	■	■	○	■	■	■	○	○	■	■	■
12 HILLS OF WEST UTTAR PRADESH	○	■	○	○	●	■	■	■	■	■	■	■	■	■	■	■	■
13 HARYANA, CHANDIGARH AND DELHI	■	■	■	■	■	■	■	■	○	■	■	■	■	■	■	■	■
14 PUNJAB	○	■	■	■	■	■	■	■	○	○	○	○	○	○	○	○	○
15 HIMACHAL PRADESH	●	■	■	■	■	○	○	■	○	○	○	○	●	●	●	○	○
16 JAMMU AND KASHMIR	○	○	○	■	○	○	○	○	■	○	○	○	○	○	○	○	○
17 WEST RAJASTHAN	●	■	■	■	■	■	■	○	○	■	■	■	■	■	■	○	○
18 EAST RAJASTHAN	○	■	■	■	○	■	■	■	■	■	■	■	■	■	■	■	■
19 WEST MADHYA PRADESH	■	■	■	■	■	■	■	■	○	○	○	○	○	○	○	○	○
20 EAST MADHYA PRADESH	■	■	○	●	○	○	■	■	■	■	■	■	○	○	○	○	○
21 GUJARAT REGION, DAMAN DADRA & NAGAR HAVELI	■	■	■	■	○	○	■	■	■	■	■	■	■	■	■	■	■
22 SAURASHTRA, KUTCH AND DIU	○	■	■	■	○	○	■	■	■	■	○	○	○	○	○	○	○
23 KONKAN AND GOA	●	■	■	○	○	■	■	○	○	■	■	○	○	○	○	○	○
24 MADHYA MAHARASHTRA	●	■	■	■	○	○	■	■	○	○	■	■	■	○	○	○	○
25 MARATHWADA	○	○	●	■	○	○	○	○	○	○	○	○	○	○	○	○	○
26 VIDARBHA	■	○	○	●	■	■	■	○	○	○	○	○	○	○	○	○	○
27 COASTAL ANDHRA PRADESH	●	■	○	○	○	○	■	■	■	■	■	■	○	○	○	○	○
28 TELANGANA	●	■	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
29 RAYALASEEMA	●	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
30 TAMIL NADU AND PONDICHERRY	■	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
31 COASTAL KARNATAKA	●	■	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○
32 NORTH INT. KARNATAKA	○	○	■	○	○	○	○	○	○	○	○	○	○	○	○	○	○
33 SOUTH INT. KARNATAKA	■	■	■	■	■	■	■	○	○	○	○	○	○	○	○	○	○
34 KERALA	■	■	■	○	○	○	○	○	○	○	○	○	○	○	○	○	○
35 LAKSHADWEEP	■	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○	○

■ EXCESS +20% OR MORE      ○ DEFICIENT -20% TO -59%      □ NO RAIN  
 ▨ NORMAL +19% TO -19%      ● SCANTY -60% OR LESS      ND NO DATA

TABLE 2

Statement showing sub-divisional means of rainfall in each month and during the season as a whole (June to September 1982)

Sub-divisions	June		July		August		September		June to September			
	Actual	Percentage departure from normal	Actual	Percentage departure from normal	Actual	Percentage departure from normal	Actual	Percentage departure from normal	Actual	Normal	Departure from normal	Percentage departure from normal
	(mm)		(mm)		(mm)		(mm)		(mm)	(mm)	(mm)	
1. Andaman and Nicobar Islands	405	-14	363	-7	351	-5	357	-12	1476	1639	-163	-10
2. Arunachal Pradesh	410	-39	1126	33	219	-65	852	129	2607	2523	85	3
3. Assam and Meghalaya	461	-4	416	5	347	2	289	15	1513	1471	42	3
4. Nagaland, Manipur, Mizoram and Tripura	326	-25	252	-24	334	15	205	2	1117	1256	-139	-11
5. Sub-Himalayan West Bengal and Sikkim	469	-24	935	37	321	-38	319	-32	2044	2278	-234	-10
6. Gangetic West Bengal	187	-26	245	-22	385	21	103	-55	919	1115	-196	-17
7. Orissa	269	32	182	-47	518	55	137	-46	1105	1133	-28	-2
8. Bihar Plateau	142	-22	148	-58	377	8	132	-40	800	1103	-303	-27
9. Bihar Plains	234	25	235	-25	143	-52	126	-46	739	1035	-296	-29
10. East Uttar Pradesh	120	12	189	-39	351	12	290	52	950	918	33	3
11. Plains of West Uttar Pradesh	87	4	209	-19	357	37	65	-59	717	761	-43	-6
12. Hills of West Uttar Pradesh	54	-29	403	-34	796	40	70	-78	1323	1711	-387	-23
13. Haryana, Chandigarh and Delhi	48	-13	179	2	225	36	6	-95	458	518	-59	-11
14. Punjab	24	-37	111	-32	198	38	4	-96	337	449	-112	-25
15. Himachal Pradesh	105	-5	249	-51	278	-41	32	-86	664	1316	-652	-49
16. Jammu and Kashmir	35	-36	81	-39	94	-19	29	-62	239	380	-141	-37
17. West Rajasthan	25	-5	80	-18	84	-20	6	-89	194	283	-89	-31
18. East Rajasthan	46	-23	173	-25	296	26	11	-91	525	644	-119	-19
19. West Madhya Pradesh	65	-47	287	-17	466	60	115	-39	933	950	-17	-2
20. East Madhya Pradesh	123	-23	281	-32	564	38	153	-33	1120	1209	-88	-7
21. Gujarat Region, Daman, Dadra and Nagar Haveli	21	-78	314	-5	227	4	11	-92	573	789	-215	-27
22. Saurashtra, Kutch and Diu	4	-96	181	-33	118	-11	15	-84	317	589	-270	-46
23. Konkan and Goa	699	6	870	-11	613	9	182	-44	2364	2522	-138	-6
24. Madhya Maharashtra	97	-7	108	-39	110	-13	131	-4	446	543	-97	-18
25. Marathwada	62	-57	190	7	87	-41	177	-7	516	661	-147	-22
26. Vidarbha	108	-40	263	-23	212	-24	140	-29	723	996	-273	-27
27. Coastal Andhra Pradesh	67	-34	146	-7	116	-19	126	-17	455	553	-98	-18
28. Telangana	128	-9	302	26	178	-17	172	-9	779	783	-4	0
29. Rayalaseema	102	46	65	-33	47	-56	138	-4	353	419	-66	-16
30. Tamil Nadu and Pondicherry	47	17	38	-34	24	-70	68	-24	178	270	-91	-34
31. Coastal Karnataka	929	-7	755	-27	1433	133	109	-64	3226	2945	281	9
32. North Interior Karnataka	115	4	170	-1	90	-33	153	-5	528	580	-52	-9
33. South Interior Karnataka	71	3	63	-39	71	-27	115	-3	320	390	-69	-18
34. Kerala	635	2	448	-20	391	18	67	-71	1542	1743	-201	-11
35. Lakshadweep	269	-16	238	-12	308	53	97	-39	912	950	-39	-4

In calculation of excess, defect and their percentages, rainfall figures are taken correct to 0.1 mm.

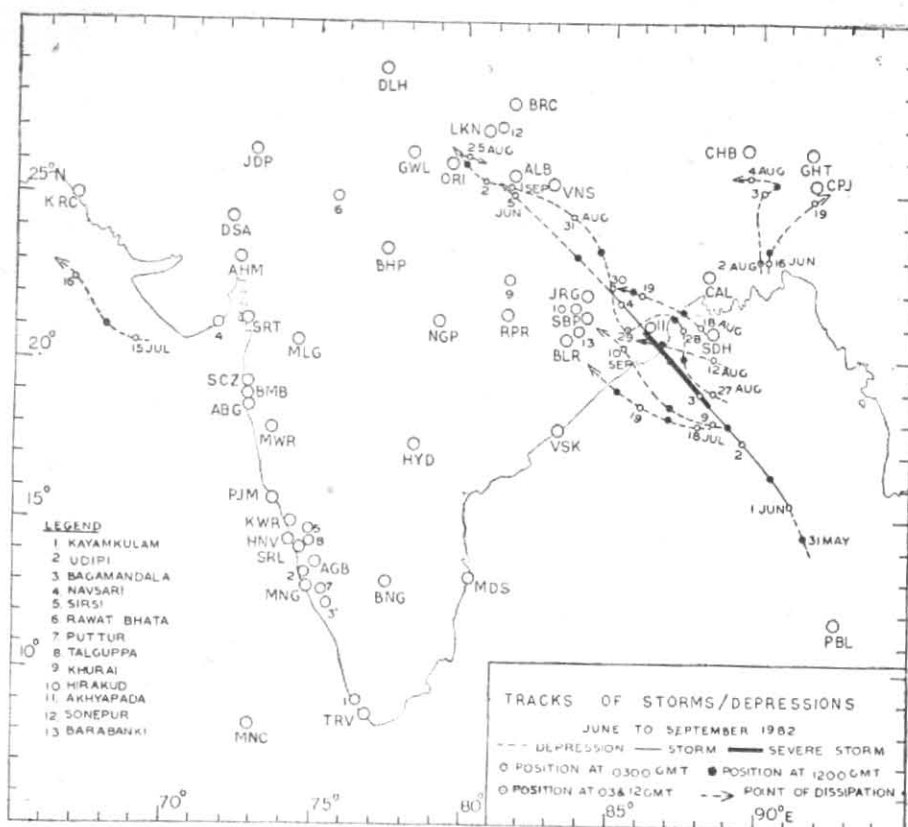


Fig. 1

the following systems:

(i) From the last week of May a trough of low persisted off Kerala-Karnataka coasts till 9 June. Under its influence southwest monsoon set in over Kerala on 28 May and advanced into southern parts of Karnataka by 1 June.

(ii) The trough of low, persisted off Maharashtra and Kerala coasts between 10th and 24th. A cyclonic circulation between 3.1 and 7.6 km a.s.l. developed along and off Maharashtra coast on 15th. It progressively moved eastnortheastwards to Bihar State by 22nd. Due to these systems the monsoon advanced further northwards along the west coast covering the whole Maharashtra coast by 17th.

(iii) A trough/cyclonic circulation extending to middle troposphere moved from southeast Bay to north interior Karnataka and adjoining Maharashtra between 6th and 12th. A cyclonic circulation extending to middle troposphere developed over Gangetic West Bengal on 10th and slowly moved away across Assam by 14th. Another circulation in the lower troposphere lay over Bihar plains and adjoining Sub-Himalayan West Bengal between 13th, and 16th. Under the influence of these systems southwest monsoon advanced into the rest of Peninsula, northeast India and most parts of east Madhya Pradesh by 15th.

The other synoptic features during the month were:

(i) A low formed over northwest Bay on 16th which concentrated into a depression on 18th, moved northeastwards and weakened into a low over Assam by 19th evening.

(ii) A cyclonic circulation in the lower troposphere developed over east Madhya Pradesh on 22nd, moved to West Bengal and neighbourhood on 23rd and persisted there as a trough/circulation on most days till 30th.

(iii) Five western disturbances moved across Western Himalayas during the month. Two induced cyclonic circulation in the lower troposphere moved from south Pakistan and neighbourhood to west Rajasthan.

These systems caused generally widespread rainfall in Assam and Meghalaya and Nagaland, Manipur, Mizoram and Tripura on 4 to 5 days with isolated heavy to very heavy falls and scattered or isolated rain/thundershowers over northwest India, Uttar Pradesh and west Madhya Pradesh on a few days.

The monsoon was active on 9 days in Kerala and Konkan and Goa on 5 to 6 days in Assam and Meghalaya and coastal Karnataka during the month and active or vigorous on 1 to 3 days in interior Maharashtra, Andhra Pradesh, Bihar plains, Orissa and West Bengal in the second half of the month.

### 3.1.3. Rainfall during June 1982

The principal rainfall amounts (cm) associated with synoptic systems described above were:

2nd	: Kayamkulam 22
10th	: Udipi 43, Mangalore 20
16th	: Cherrapunji 32
20th	: Cherrapunji 29, Malegaon 24
22nd	: Alibag 22
23rd	: Karwar 32, Goa (Dabolim) 27, Panjim 23, Honavar 21

According to press reports some persons died and a number of houses were damaged due to very heavy rain in Udipi town coastal Karnataka on 10th and 11th. A part of national highway No. 17 was washed away. Floods in the Brahmaputra and its tributaries affected many villages in north Lakhimpur, Sibsagar, Majuli, Golaghat and Nowgong sub-divisions in Assam.

Rainfall for the month was normal or excess in Assam and Meghalaya, Orissa, Bihar plains, plains of Uttar Pradesh, Haryana, Himachal Pradesh, west Rajasthan, Konkan and Goa, Madhya Maharashtra, Telangana, Rayalaseema, Tamil Nadu, Karnataka, Kerala and Lakshadweep and Andaman and Nicobar Islands. It was deficient over the rest of the country outside Gujarat State where it was scanty.

### 3.2.1. Advance of monsoon over north India

3.2. July — The southwest monsoon did not advance further after 17 June till 11 July. Its further advance commenced by 12th and it covered the entire country by 22nd. The reason for the delay in the advance of the monsoon into central and northwest India is due to the absence of systems moving westwards into these areas from the east. The activity and the advance of the monsoon were associated mainly with the following systems:

(i) A north-south trough in lower troposphere lay over West Bengal and Sikkim from 1st to 4th and a cyclonic circulation over west central and adjoining northwest Bay from 5th to 7th.

(ii) A low moved from off north Andhra-south Orissa coasts to east Madhya Pradesh between 8th and 12th and weakened but the associated upper air circulation moved to Rajasthan by 17th and weakened on 18th.

(iii) A cyclonic circulation in the lower troposphere lay over Gujarat State from 10th to 12th.

(iv) A low formed off north Maharashtra coast on 13th, moved to Saurashtra and Kutch on 14th and emerged into northeast Arabian Sea as a depression on 15th. The depression dissipated over northeast Arabian Sea on 17th. A deep

depression formed over northwest Bay on 18th, crossed Orissa coast on 19th night, weakened and moved as a low to northwest Madhya Pradesh and adjoining southwest Uttar Pradesh by 21st. It merged with the monsoon trough on 22nd but the upper air cyclonic circulation moved to north Rajasthan and neighbourhood and dissipated by 26th.

A western disturbance persisted over Jammu and Kashmir between 19th and 22nd. A cyclonic circulation in the lower troposphere lay over south Gujarat and north Maharashtra coast from 18th to 21st, moved to north Gujarat and adjoining south Rajasthan on 22nd and weakened on 24th. Under its influence monsoon advanced into rest Gujarat State, Madhya Pradesh, Uttar Pradesh, east Rajasthan and Delhi and adjoining Haryana by 14th, in the remaining parts of Haryana, Punjab and Himachal Pradesh by 20th and in west Rajasthan and Jammu and Kashmir by 22nd.

### 3.2.2. The other important features during the month were:

(i) A low moved from Gangetic West Bengal and adjoining north Bay to south Uttar Pradesh between 27th and 29th and merged with the monsoon trough on 31st.

(ii) A western disturbance affected Western Himalayas between 24th and 26th.

(iii) Consequent on the delay in the advance of the monsoon and scanty rainfall in the first week, moderate heat wave conditions prevailed in Bihar Plateau, Uttar Pradesh, Madhya Pradesh and some parts of Vidarbha on many days and on a few days in Gangetic West Bengal, Orissa, Bihar plains, Haryana and east Rajasthan from 1st to 11th being severe in some parts of Orissa, Madhya Pradesh and Uttar Pradesh on a few days.

In the first week, monsoon was active on 1 or 2 days in Assam and adjacent States. Sub-Himalayan West Bengal and Sikkim, Marathwada and north interior Karnataka. In the second week it was active to vigorous on 4 days in interior Maharashtra, Telangana and north interior Karnataka, on 3 days in south Gujarat State and on 14th in east Rajasthan. During the second half of the month it was so on 5 to 7 days in Sub-Himalayan West Bengal and Sikkim, Bihar plains, east Uttar Pradesh, Gujarat State, Konkan and Goa, coastal Andhra Pradesh, Telangana and coastal Karnataka and on 2 to 4 days in Assam and adjacent States, Gangetic West Bengal, west Uttar Pradesh, Haryana, Himachal Pradesh, Rajasthan, Madhya Pradesh, Vidarbha, north interior Karnataka and Kerala.

### 3.2.3. Rainfall during July 1982

The significant amounts of rainfall (cm) were:

4th	: Cherrapunji 20
10th	: Cooch Behar 26

19th	: Santacruz 28
20th	: Bagamandala 26
21st	: Bagamandala 35, Santacruz 21
23rd	: Surat 22
24th	: Cooch Behar 22
25th	: Deesa 29, Navsari (Gujarat) 23, Cherapunji 21
28th	: Sandheads 25
29th	: Orai 24, Sirsi 23
30th	: Rawat Bhata (Rajasthan) 30

According to press reports, the *Brahmaputra* and its tributaries were in spate in the first half of the month and affected some parts of Sibsagar, Lakhimpur and Nowgong districts and inundated some villages in Mongaldoi sub-division of Darrang district. Flood also affected parts of Cooch Behar district in north Bengal in second week. In the last week floods again affected Sibsagar and Dibrugarh districts in Assam submerging 26 villages in Sibsagar district. In Bihar the flooded Gandak inundated many villages in Champaran district near Uttar Pradesh-Bihar border. Heavy rain in Gujarat between 23rd and 25th caused house collapses and damage to railway tracks and took toll of some human lives.

The rainfall for July was excess or normal in Arunachal Pradesh, Assam and Meghalaya, Sub-Himalayan West Bengal and Sikkim, plains of west Uttar Pradesh, Haryana, west Rajasthan, west Madhya Pradesh, Gujarat region, Konkan and Goa, Marathwada, coastal Andhra Pradesh, Telangana, north interior Karnataka, Lakshadweep and Andaman and Nicobar Islands. It was deficient over the rest of the country.

3.3. August — Five depressions including two land depressions formed during this month. The monsoon was active to vigorous on 16 days in coastal Karnataka, 7 to 11 days in Uttar Pradesh, east Rajasthan, Madhya Pradesh, Gujarat region, Konkan and Goa and Kerala and on a few days in Assam and Meghalaya, West Bengal and Sikkim, Bihar State, Orissa, Haryana, Punjab, Himachal Pradesh, Jammu and Kashmir, Saurashtra and Kutch, interior Maharashtra, coastal Andhra Pradesh and Telangana.

The activity of the monsoon was generally associated with the following systems :

(i) A land depression formed over Bangla Desh on 2nd near 23.0°N, 90.0°E. It weakened over north Bangla Desh and adjoining Meghalaya by 6th.

(ii) A depression formed over northwest Bay on 12th with its centre about 250 km east of Paradip. It crossed north Orissa coast near Chandbali on 13th morning and weakened into

a low. It merged with the seasonal trough over north Madhya Pradesh on 16th.

(iii) The third depression of the month formed on 18th morning about 150 km southeast of Contai. It crossed West Bengal, north Orissa coasts on 18th night and weakened into a low pressure area over east Madhya Pradesh and adjoining Bihar Plateau on 22nd. The low pressure area slowly moved westnorthwestwards and again concentrated into a depression over land about 100 km west of Kanpur on 24th. It weakened over east Uttar Pradesh by 25th evening and became less marked by 30th.

(iv) Another depression developed about 250 km southeast of Paradip on 27th. It crossed Orissa coast near Balasore on 28th night. Moving northwestwards it weakened over central Uttar Pradesh on 3rd September.

(v) A well marked low pressure area formed over northwest Bay and neighbourhood on 7th. It moved across northeast Madhya Pradesh and Bihar and weakened over south Uttar Pradesh and adjoining northwest Madhya Pradesh by 11th.

(vi) A cyclonic circulation upto 4.5 km a sl lay over Gangetic West Bengal and adjoining north Orissa on 14th. It was seen as a low pressure area over east Madhya Pradesh and neighbourhood on 16th. It merged with the seasonal trough over south Uttar Pradesh on 19th.

(vii) A cyclonic circulation developed on 22nd over north Bay extending upto middle tropospheric levels. It lay over Gangetic West Bengal and neighbourhood for next 2 days and was seen as a low over the same area on 25th.

(viii) The west coast trough was generally extending from Gujarat to Lakshadweep and was well marked off south Maharashtra, Goa, Karnataka, Kerala coasts on four to five days.

(ix) Extreme northwest India was affected by two western disturbances between 10th and 12th and by two troughs in mid-tropospheric westerlies between 21st and 23rd and from 26th to 31st respectively.

#### 3.3.1. Rainfall during August 1982

The significant amounts of rainfall (cm) in association with these systems were :

1st	: Agumbe 31
2nd	: Agumbe 36, Puttur 22, Mangalore 21, Sandheads 20
3rd	: Agumbe 27, Honavar 26, Karwar, Shirali 24 each, Talguppa 23
16th	: Khurai (Madhya Pradesh) 31
18th	: Mahabaleshwar 20
19th	: Sambalpur 58, Hirakud 41, Jharsuguda 20

- 24th : Gwalior 22  
 25th : Agumbe 27  
 29th : Akhuapada (Orissa) 25, Bolangir 23  
       Sonepur 22, Phulbani 21  
 30th : Phulbani 48, Bolangir 40

Consequent on the movement of about 6 systems across Orissa, Bihar, east Madhya Pradesh and Uttar Pradesh there were large scale floods in these areas. According to press reports the worst flood affected States were Uttar Pradesh and Orissa in the 2nd fortnight of the month. Mogalsarai and Varanasi were cut off by the flood waters of *Ganga*. In Uttar Pradesh floods have taken toll of some lives. Unprecedented rain in Sambalpur and adjoining areas from 18th to 19th August caused severe damage to Hirakud irrigation system. Breaches also occurred in *Mahanadi* protective embankment of Sambalpur town submerging half of it. Torrential rain in Assam during early part of August caused floods there affecting many villages. River *Tunga* inundated a number of houses and huts in Shimoga district of Karnataka. A major landslide in Western Ghat in early August washed away more than 100 m of railway track between Dudhsagar and Sonaulin cutting off Goa from the rest of the country.

Rainfall during the month was normal or excess in Assam and Meghalaya, Nagaland, Manipur, Mizoram and Tripura, Gangetic West Bengal, Orissa, Bihar Plateau, Uttar Pradesh, Haryana, Punjab, Jammu and Kashmir, east Rajasthan, Madhya Pradesh, Gujarat, Konkan and Goa, Madhya Maharashtra, Coastal Andhra Pradesh, Telangana, coastal Karnataka, Kerala, Lakshadweep and Andaman and Nicobar Islands, deficient over the rest of the country outside Arunachal Pradesh and Tamil Nadu where it was scanty. The rainfall was in excess in coastal Karnataka (+133%), west Madhya Pradesh (+60%) and Orissa (+55%).

3.4 September — The monsoon started its withdrawal from northwest India earlier. By 3 September, it withdrew from northwest India outside most parts of east Rajasthan and Gujarat State. By 16th the withdrawal was complete from

Uttar Pradesh, rest of east Rajasthan, north Madhya Pradesh and most parts of Gujarat State. As a whole the withdrawal from these parts was 10 to 15 days earlier than the normal dates. By 30 September it further withdrew from Bihar interior Orissa, south Madhya Pradesh and Maharashtra State outside south Konkan and Goa and south Madhya Maharashtra. Withdrawal was complete from the rest of northeast India by 9 October and from the country outside Tamil Nadu and Kerala by 11 October, which was nearly normal.

There was good monsoon activity in Arunachal Pradesh, Assam and Meghalaya during the second and third week of the month. It was active to vigorous on 8 to 9 days in these areas. During the first half of the month it was active to vigorous on 2 to 5 days in West Bengal, Orissa, Bihar, east Uttar Pradesh, Madhya Pradesh, Marathwada, Vidarbha, coastal Andhra Pradesh, Telangana and south interior Karnataka and being so on 5 to 7 days during the second half of the month in Madhya Maharashtra, Marathwada and interior Karnataka. The activity was in association with the following systems :

(i) Last month's depression over east Uttar Pradesh weakened by 3 September.

(ii) A low pressure lay over northwest and adjoining west central Bay on 8th. It intensified into a deep depression on 9th crossed Orissa coast on 10th and weakened into a depression. Moving northwestward it merged with the seasonal trough over east Uttar Pradesh and neighbourhood on 14th.

(iii) Three troughs in low level westerlies moved from Bihar plains to Assam and adjacent States between 14th and 22nd.

(iv) A low pressure area with associated cyclonic circulation upto 1.5 km a.s.l. lay over east central and adjoining southeast Arabian Sea off Goa-Karnataka coasts between 19th and 22nd.

(v) The trough off west coast generally extended from south Gujarat to Lakshadweep during the month and was well marked off south Maharashtra-Karnataka coasts on a few days,

(vi) A low level cyclonic circulation lay over central parts of the Peninsula on 25th, emerged into east central Arabian Sea off south Maharashtra-Karnataka coasts on 28th and persisted there where a low pressure area formed on 30th.

#### 3.4.1. Rainfall during September 1982

The significant amounts of rainfall (cm) were :

1st	: Allahabad 20
12th	: Bahraich 34, Elginbridge (Uttar Pradesh) 33, Barabanki 24, Unnao 21, Cherrapunji 20
13th	: Bahraich 46, Cherrapunji 33, Elginbridge 25
14th	: Pasighat 31
16th	: Cherrapunji 28.

During this month the fury of floods in Orissa, Uttar Pradesh and Bihar were unabating. According to press reports the floods, during the first week, in the rivers *Mahanadi* and *Kathjuri* of Orissa caused widespread loss of property. Flood situation in Orissa worsened in the second week

due to incessant rains. Floods in Uttar Pradesh and Bihar started receding in the last week of the month. The death toll due to floods in Uttar Pradesh alone in this season was considerable. A large number of villages were affected involving millions of population in 40 districts. Damages to crops and houses were huge. Assam and Arunachal Pradesh were also under the reel of flood during second week by the swollen *Brahmaputra*.

Extreme northwest India was affected by four western disturbances during the second half of the month.

Rainfall was excess or normal in Andaman and Nicobar Islands, Assam and adjacent States, east Uttar Pradesh, Madhya Maharashtra, Marathwada, Andhra Pradesh, interior Karnataka, deficient in West Bengal and Sikkim, Orissa, Bihar, plains of west Uttar Pradesh, Madhya Pradesh, Konkan and Goa, Vidarbha, Tamil Nadu, Lakshadweep and scanty over the rest of the country.