

# Weather

## MONSOON SEASON (JUNE-SEPTEMBER 1985)\*

### 1. Introduction

The monsoon rainfall of 1985 was normal or excess in 22 meteorological sub-divisions and was deficient in remaining 11 sub-divisions. Sub-divisionwise percentage departure of monthly and seasonal rainfall is shown in Table 1. Seasonal rainfall departure computed from individual station rainfall data is shown in Fig. 1.

The seasonal trough at 0.9 km a.s.l. appeared in the fourth week of June and became well established over the country by the second week of July. In August, the trough at this level was mainly seen to the east of Long. 80° E. During the first week of September it became indistinct but reappeared in the second week and remained active during the second fortnight. During September, it lay mostly south of its normal position.

Several upper air cyclonic circulations developed during the season in the Bay of Bengal. A few of them resulted in the formation of low pressure areas or of higher intensity systems.

### 2. Chief features of the season

#### 2.1. Advance of monsoon

Southwest monsoon advanced over Kerala on 28 May. The Arabian Sea branch of the monsoon advanced northwards with normal pace and covered upto Maharashtra coast and south Peninsula by 8 June. The Bay branch of the monsoon advanced into eastern Assam and adjacent States on 4 June. Till 8th the progress of monsoon over these areas was earlier by two to four days. During June the Arabian Sea branch did not further advance northward. However, the monsoon covered rest parts of northeast India, east Uttar Pradesh, east and southwest Madhya Pradesh, interior Maharashtra and north Andhra Pradesh by 28 June. The advance of monsoon over these areas was delayed by 1 to 2 weeks. Further westward marching of monsoon commenced on 8 July, when it covered west Uttar Pradesh and adjoining Haryana, northwest Madhya Pradesh and adjoining east Rajasthan. It covered the entire

country on 14 July. Its advance was delayed by a month over Gujarat State and about one to two weeks over west Uttar Pradesh, northwest Madhya Pradesh and northwest India. Fig. 2 shows the dates of onset of monsoon over the country, and Fig. 5 the progress of it week by week prepared from the weekly rainfall data available at the time of its preparation.

#### 2.2. Activity of the monsoon

Due to much delayed advance (14 July) of monsoon over Gujarat State the rainfall over it was largely deficient (—51% or less) during June. The other sub-divisions, which had largely deficient during the month, were plains of west Uttar Pradesh and east Rajasthan. The rainfall was moderately deficient (—26% to —50%) over Bihar Plateau, hills of west Uttar Pradesh, Jammu & Kashmir, west Rajasthan, west Madhya Pradesh, Rayalaseema and south interior Karnataka. The monsoon activity in July wiped out the rainfall deficiency from west Uttar Pradesh, Jammu & Kashmir, west Rajasthan and Rayalaseema and reduced the deficiency from Bihar Plateau, east Rajasthan and west Madhya Pradesh. But it did not significantly improve the rainfall deficiency in Gujarat State and south interior Karnataka. In August, the monsoon activity over Gujarat region was better but it was again very much subdued in September resulting in large deficiency in the seasonal rainfall in the State. The subdued monsoon activity over interior Maharashtra during August and September led to moderate deficiency in seasonal rainfall over the area. In the end of the monsoon seasonal rainfall was excess or normal (—19% and above) over the country outside Rajasthan, Gujarat State, interior Maharashtra, Telangana, Rayalaseema and interior Karnataka where it was deficient.

#### 2.3. Withdrawal of monsoon

The withdrawal phase of monsoon commenced on 11 September, when it withdrew from northwest India outside east Rajasthan and eastern parts of Haryana and Himachal Pradesh. The withdrawal from rest of northwest India, Gujarat State and extreme western

\*Prepared by : A.A. Ramasastry, M.R.M. Rao, N.C. Biswas, Meteorological Office, Pune

TABLE 1  
Statement showing sub-divisional means of rainfall in each month and during the season as a whole  
(June-September 1985)

Sub-divisions	June		July		August		September		June-September			
	Actual (mm)	% dep.*	Actual (mm)	% dep.*	Actual (mm)	% dep.*	Actual (mm)	% dep.*	Actual (mm)	Normal (mm)	Dep.†	% dep.
1. Andaman & Nicobar Islands	482	5	192	-51	342	-3	346	-15	1362	1609	-247	-15
2. Arunachal Pradesh	689	2	952	13	475	-25	—	—	—	—	—	—
3. Assam and Meghalaya	444	-7	504	28	297	-19	394	56	1639	1491	148	10
4. Nagaland, Manipur, Mizoram & Tripura	409	-6	267	-19	144	-50	300	49	1121	1256	-135	-11
5. Sub-Himalayan West Bengal & Sikkim	458	-11	831	59	341	-32	447	-1	2078	1993	85	4
6. Gangetic West Bengal	258	5	341	13	443	45	195	-17	1236	1085	151	14
7. Orissa	185	-9	262	-26	519	59	363	44	1329	1134	195	17
8. Bihar Plateau	139	-27	234	-19	309	-10	268	21	950	1105	-155	-14
9. Bihar Plains	158	-16	502	61	231	-25	211	-8	1103	1039	64	6
10. East Uttar Pradesh	86	-21	355	18	230	-26	374	94	1045	915	131	14
11. Plains of west Uttar Pradesh	39	-53	382	40	297	14	170	5	888	779	109	14
12. Hills of west Uttar Pradesh	194	-26	592	3	512	-14	352	21	1650	1723	-73	-4
13. Haryana, Chandigarh & Delhi	57	4	337	92	179	2	43	-64	617	527	90	17
14. Punjab	47	26	233	36	194	31	49	-51	523	455	68	15
15. Himachal Pradesh	124	3	467	-12	487	-3	177	-20	1255	1374	-119	-9
16. Jammu & Kashmir	31	-32	154	16	73	27	26	-67	284	314	-29	-9
17. West Rajasthan	13	-44	124	16	65	-41	8	-86	210	299	-89	-30
18. East Rajasthan	31	-52	189	-20	226	3	36	-69	483	639	-156	-24
19. West Madhya Pradesh	80	-34	278	-20	325	13	151	-24	835	958	-123	-13
20. East Madhya Pradesh	130	-21	445	7	377	-6	229	0	1181	1208	-27	—
21. Gujarat Region, Daman, Dadra & Nagar Haveli	1	-98	189	-47	170	-22	8	-95	368	815	-447	-5
22. Saurashtra, Kutch & Diu	33	-52	79	-71	128	-6	19	-80	259	575	-315	-55
23. Konkan & Goa	1176	72	875	-17	621	10	133	-62	2804	2650	155	6
24. Madhya Maharashtra	99	-2	128	-26	64	-49	73	-47	365	539	-174	-32
25. Marathwada	127	-8	221	25	46	-69	60	-68	454	653	-198	-30
26. Vidarbha	196	10	253	-24	192	-31	75	-62	717	986	-269	-27
27. Coastal Andhra Pradesh	113	11	149	-7	160	11	83	-45	504	555	-51	-9
28. Telangana	151	8	199	-17	167	-22	45	-76	562	783	-221	-28
29. Rayalaseema	49	-28	125	27	73	-31	48	-68	294	420	-126	-30
30. Tamil Nadu & Pondicherry	73	81	69	20	116	37	139	56	397	271	126	46
31. Coastal Karnataka	1095	10	589	-43	753	22	127	-58	2564	2945	-381	-13
32. North Interior Karnataka	108	-3	137	-21	123	-9	85	-47	453	582	-129	-22
33. South Interior Karnataka	52	-32	52	-59	61	-39	119	2	284	420	-136	-32
34. Kerala	774	25	335	-40	235	-29	146	-37	1489	1743	-254	-15
35. Lakshadweep	280	-12	141	-48	159	-21	159	0	740	950	-210	-22

\*Percentage departure from normal.

†Departure from normal.

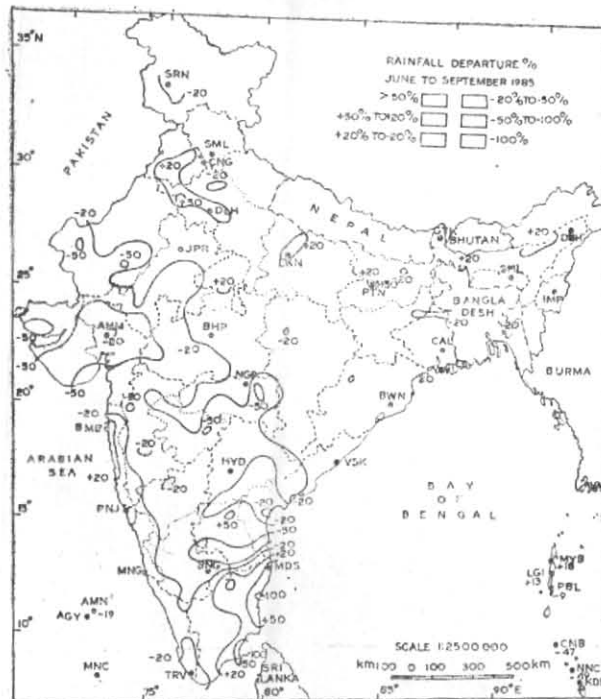


Fig. 1. Seasonal rainfall departure (June-September 1985)

parts of west Madhya Pradesh took place on 19 September. The withdrawal from northwest India and Gujarat State was around the normal dates except from west Rajasthan where it was delayed by about one week. By 27 September it further withdrew from Uttar Pradesh, rest of west Madhya Pradesh and northwest Madhya Pradesh. Thereafter the retreat of southwest monsoon from the country was rather slow. On 17 October it withdrew from Maharashtra State. The withdrawal from northeast India, Andhra Pradesh, north interior Karnataka and remaining parts of east Madhya Pradesh was complete on 21 October and from over the country outside Tamil Nadu and Kerala on 24 October. The withdrawal from northeast India, Andhra Pradesh and north interior Karnataka was delayed by about ten to fourteen days. This year the withdrawal from the country was complete in about one and half months, which is the normal period for withdrawal phase. Fig. 3 shows the dates of withdrawal of the southwest monsoon from the Indian sub-continent.

#### 2.4. Storms and depressions

During 1985 monsoon season six depressions/storm developed over the Indian seas and the sub-continent, of which four had developed over Bay of Bengal and two over the land. The first fortnight of August was quite active, which accounts for the development of four depressions. Likewise in the second fortnight of September there was a storm and a depression. The tracks of these depressions and the storm have been shown in Fig. 4.

### 3. Significant monthly features

#### 3.1. June

During the month no intense system like cyclonic storm or depression formed over the Indian seas.

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

The following synoptic features were responsible for the advance of monsoon over the country during June.

Three mid-tropospheric cyclonic circulations developed over Arabian Sea off west coast.

(i) The first one developed over east central Arabian Sea off Karnataka-Goa-south Maharashtra coasts on 2nd. It became less marked off Goa-south Maharashtra coast on 3rd evening.

(ii) The second one was observed over east central and adjoining northeast Arabian Sea off Maharashtra-south Gujarat coasts on 6th. It became less marked there on 8th.

(iii) The third one was observed over east central Arabian Sea off Maharashtra coast from 13th to 16th. Thereafter it moved eastwards and became less marked over interior Maharashtra on 19th.

(iv) A cyclonic circulation in the lower tropospheric levels was observed over Bihar and adjoining West Bengal on 11th. It became less marked there on 12th

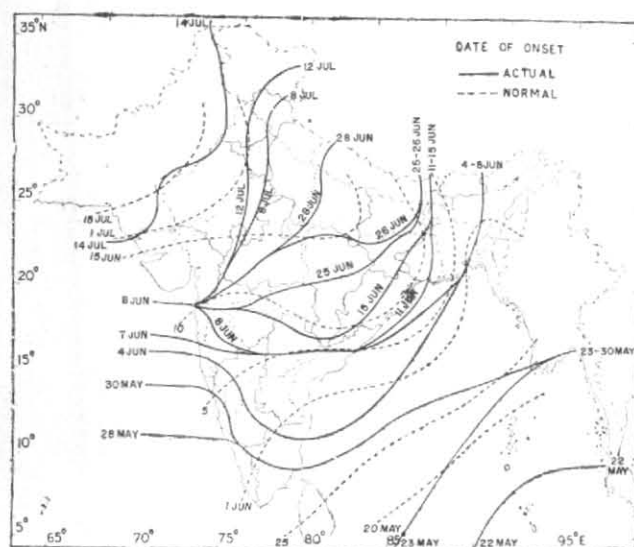


Fig. 2. Advance of southwest monsoon, 1985

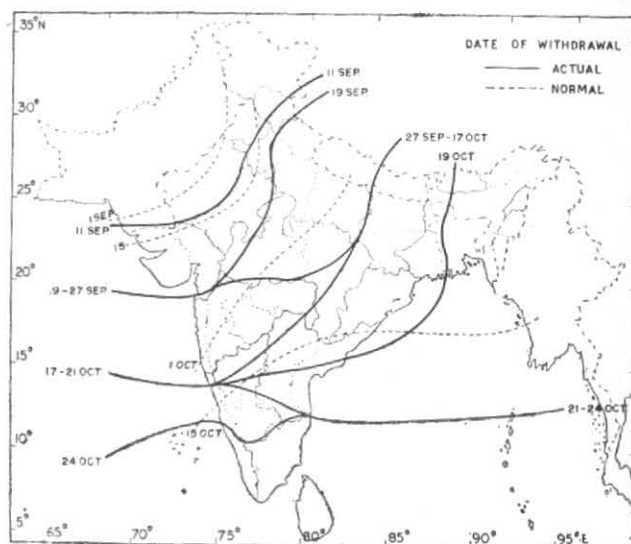


Fig. 3. Withdrawal of southwest monsoon, 1985

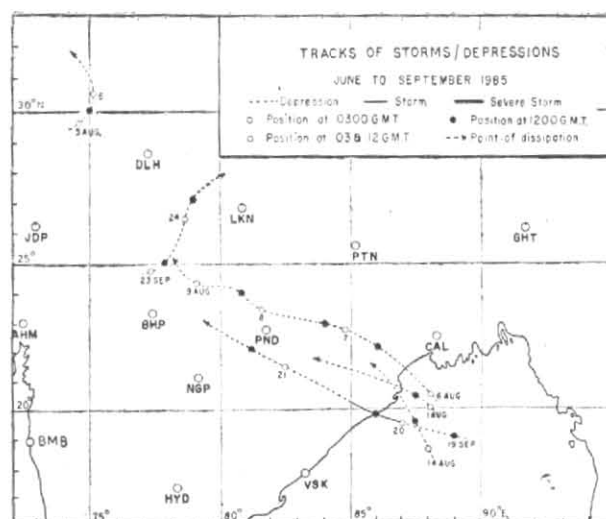


Fig. 4. Tracks of storm/depressions, June-September 1985



(v) A mid-tropospheric cyclonic circulation was observed over west central Bay on 17th. Slowly moving northwards it developed into a low pressure area over northwest and adjoining west central Bay on 24th. It crossed Orissa coast on 25th and became less marked over northeast Madhya Pradesh and neighbourhood on 29th evening.

### 3.1.2. Other synoptic features

Several lower and mid-tropospheric cyclonic circulations developed during the month. A few of these circulations developed into low pressure areas. These systems as listed below, caused rainfall over the country during the month.

#### (a) Lower tropospheric cyclonic circulations

(i) One was observed over Bihar plains from 2nd to 5th and another, which was seen on 14th, became less marked over Sub-Himalayan West Bengal & Sikkim on 16th.

(ii) One was observed over Gangetic West Bengal and neighbourhood from 5th to 7th.

(iii) Another developed over Uttar Pradesh and neighbourhood on 7th. It became less marked over Sub-Himalayan West Bengal & Sikkim on 9th evening.

(iv) One, which was seen over Bangla Desh and adjoining Tripura on 16th evening, became less marked over Bihar and neighbourhood on 24th.

(v) A circulation, which developed over central Pakistan on 8th, became less marked over northwest Rajasthan on 10th. Another was seen over north Pakistan and adjoining Punjab and Jammu & Kashmir on 27th. It became less marked over Himachal Pradesh and neighbourhood on 30th.

#### (b) Mid-tropospheric cyclonic circulation

(i) One was observed over west central Bay off Andhra coast from 13th to 14th evening.

(ii) Another was observed over Gujarat State and neighbourhood from 20th to 24th evening.

#### (c) Low pressure area

(i) A cyclonic circulation in the lower tropospheric levels, which was observed over north Bay and adjoining land areas on 11th evening, developed into a low pressure area over Gangetic West Bengal and neighbourhood on 15th. It became less marked over Sub-Himalayan West Bengal & Sikkim on 17th.

(ii) A low pressure area with associated cyclonic circulation extending upto mid-tropospheric levels formed over Bangla Desh on 29th. It lay over Gangetic West Bengal and adjoining Bihar on 30th. Another mid-tropospheric cyclonic circulation, which was observed over west central Bay off north Andhra coast on 28th, merged with the above system on 29th.

(d) Apart from the above systems, western disturbances and mid and upper tropospheric troughs also affected the country as given below :

(i) Nine western disturbances moved away eastwards across Western Himalayas and neighbourhood during the month.

(ii) A mid and upper tropospheric trough in westerlies affected northeast India between 10th and 12th and another affected northwest India and neighbourhood between 21st and 30th.

After the advance of monsoon, it was vigorous on 5 days in Konkan & Goa and one day each in Gangetic West Bengal and interior Maharashtra. It was active on 4 to 8 days in Assam & Meghalaya, Gangetic West Bengal, Konkan & Goa, coastal Karnataka and Kerala; so on 1 to 3 days in Arunachal Pradesh, Sub-Himalayan West Bengal & Sikkim, Orissa, Bihar, interior Maharashtra, coastal Andhra Pradesh and Telangana. Generally widespread rain or thundershowers occurred on most days in Andaman & Nicobar Islands, Nagaland, Manipur, Mizoram & Tripura, coastal Karnataka, Kerala and Lakshadweep with isolated heavy to very heavy falls on a couple of days. There were also generally widespread rain on 7 to 12 days in Arunachal Pradesh, Assam & Meghalaya, Sub-Himalayan West Bengal & Sikkim, Bihar Plateau, Konkan & Goa, Telangana and south interior Karnataka and so on one to five days over the rest of the country.

### 3.1.3. Rainfall during the month

It was excess in Punjab, Konkan & Goa, Tamil Nadu and Kerala; normal in Andaman & Nicobar Islands, Assam & adjacent States, West Bengal & Sikkim, Orissa, Bihar plains, Haryana, Himachal Pradesh, interior Maharashtra, coastal Andhra Pradesh, Telangana, coastal & north interior Karnataka and Lakshadweep; deficient over the rest of the country outside Gujarat region, where it was scanty.

Significant amounts (cm) of rainfall were :

- 1st Cherrapunji 62, Pasighat 25, Kayamkulam 11, Ramannapets & Atting 10 each, Cannanore 9
- 2nd Cooch Behar 16, Agartala AP 13, Pasighat, Dhubri, Kumakulam & Alwaye 9 each
- 3rd Irinjalakuda 11, Kayamkulam 10, Mavelikara & Junagarh 8 each, Jind & Quilon 7 each
- 4th Koderu 24, Hanamkonda 7
- 5th Pondicherry, & Kandukur 11 each, Asthi 10, Kalimpong 9, Peermedu & Ahmedpur 7 each
- 6th Silchar, Shirali & Kundapur 13 each, Vedaranyam, Cannanore & Arantangi 11 each, Panambur & Car Nicobar 9 each
- 7th Panagarh & Goa (Dabolim) 15 each, Devgarh 13, Bhaunagar & Vengurla 10 each
- 8th Santacruz & Harnai 14 each, Mahbubnagar 10 Peint & Arvi 9 each
- 10th Sangli 10, Arvi 9, Harnai 8, Cooch Behar 7
- 11th Santacruz 13, Alibag 11, Siddapur 10, Purnea 9, Askot, Ratnagiri & Vengurla 8 each

## WEATHER

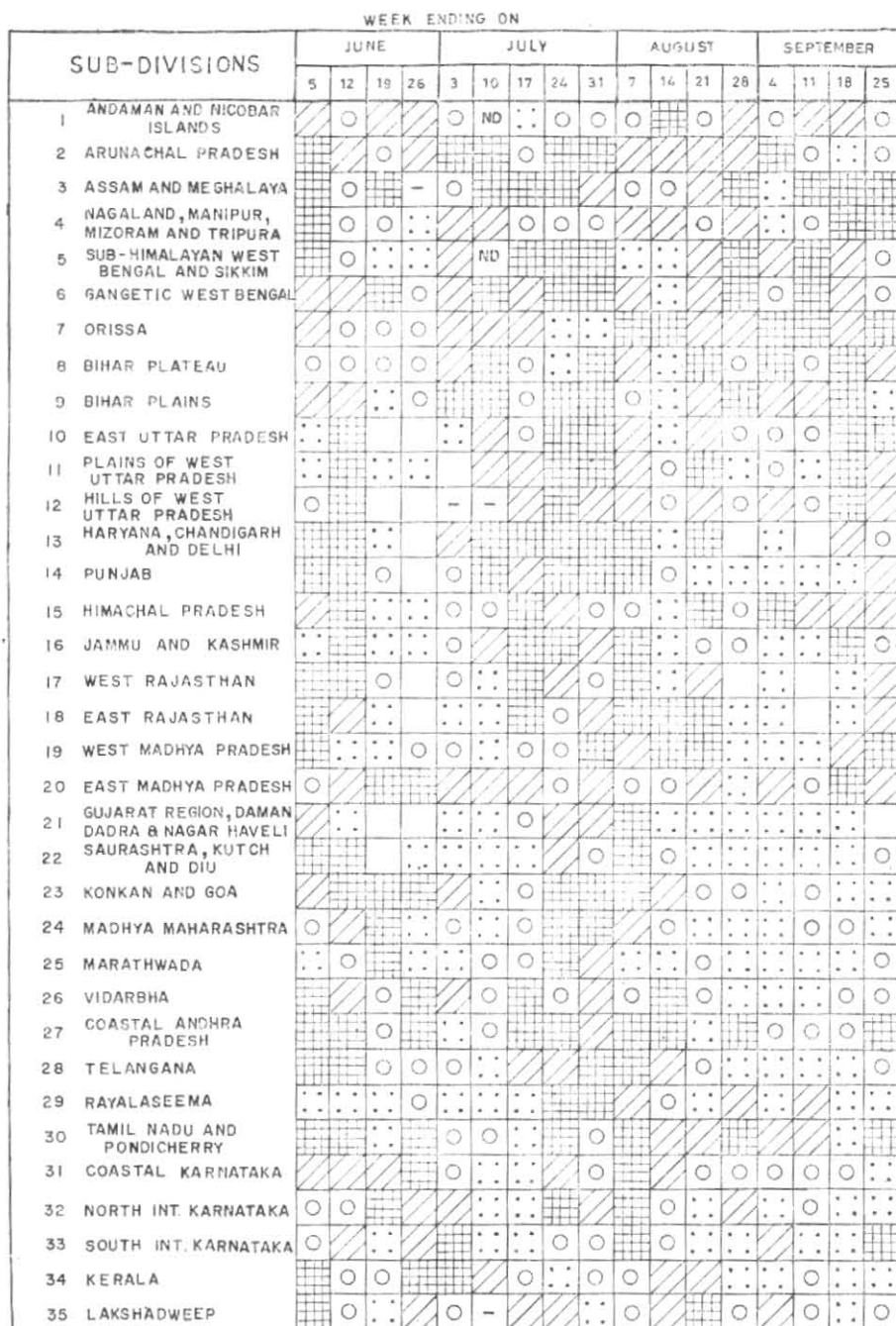


Fig. 5. Progress of the monsoon week by week, 1 June-30 September 1985

- 12th Bombay & Devgarh 12 each, Vengurla 11, Kalimpong 9, Shirali 8, Kayamkulam 7
- 13th Khandala 20, Maya Bandar 19, Devgarh 15, Aurangabad 9, Kozhikode 8, Honavar 7
- 14th Shirali 10, Kayamkulam 9, Silchar & Baramati 8 each
- 15th Bonth 22, Champua 17, Sandheads 14, Kamakhyanagar 13, Nizam Sagar 12, Shahapur 11, Kallam 10
- 16th Sandheads 22, Alibag 18, Goa (Dabolim) 17, Kumta & Vengurla 10 each, Kalimpong & Ratnagiri 9 each
- 17th Bombay 35, Alibag 29, Cherrapunji 26, Harnai 25, Ratnagiri 15, Mangaon & Gaganbavda 14 each
- 18th Silchar 19, Gaganbavda 15, Akola, Alibag & Chandigarh 14 each, Hingoli 12, Khanapur & Kankavali 11 each
- 19th Agumbe 21, Balehonnur 11, Kundapur 10, Port Blair, Thiruthahali & Karkala 8 each
- 20th Agumbe 13, Siddapur & Vengurla 10 each, Panagarh, Mercara & Panjim 8 each
- 21st Kalimpong 11, Nawranpur 9, Junagarh 7
- 22nd Bemetara 9, Gangtok, Berhampur & Kalinapatnam 8 each
- 23rd Mancompu 10, Kottayam, Bemetara & Agumbe 9 each, Gangtok, Kalingapatnam, Sherthala & Quilon 8 each
- 24th Panambur 29, Mangalore AP 25, Karkala 19, Shirali & Alibag 17 each, Udipi 16, Bagmandala & Vayittiri 14 each, Kasargode & Puttur 13 each
- 25th Harnai 44, Alibag 34, Vengurla 33, Bombay 31, Agumbe 23, Jagdalpur & Shirali 20 each, Vayittiri, 15, Kundapur & Bagmandala 14 each
- 26th Vengurla 30, Panjim 28, Agumbe 27, Bagmandala 26, Honavar & Nilambur 21 each, Murtizapur 20
- 27th Bagmandala 26, Cherrapunji 22, Yeotmal & Mahabaleshwar 16 each, Pasighat, Santacruz, Harnai, Kolhapur & Agumbe 14 each, Panjim 13
- 28th Bhira 28, Mominabad, Khandala & Ambejogai 19 each, Mahabaleshwar 18, Cherrapunji 16, Jalna & Bagmandala 14 each
- 29th Kalimpong 13, Kozhikode 12, Durgachak & Purnea 11 each, Sandheads & Tensa 10 each, Sironcha 9
- 30th Bankura 12, Hyderabad AP 11, Kamakhyanagar 10, Calcutta AP 9, Cherrapunji, Goalpara & Mercara 8 each, Dalhousie, Raigarh, Kozhikode & Kottayam 7 each

#### 3.1.4. Floods and damages during June

As per "Weekly Flood News Letter" from Central Water Commission (CWC) river *Brahmaputra* in Assam was in floods throughout the month barring the second

week. Flash floods were reported from Manipur during the second week. There was report of landslides due to heavy rain in Bombay on 17 June. Also heavy rain in the last week of June in Kerala caused severe damage to houses, highways, bridges, sea walls, irrigation structures and crops. As per Kerala State Govt. report total number of deaths was 102. Damages to crops was estimated at about Rs. 161.5 crores and that to property, roads, irrigation works, sea walls etc about Rs. 355 crores. Cattle and poultry worth Rs. 3.35 crores were lost. Number of human lives lost during the month were 44 in Assam, 58 in Bombay and 3 in Manipur.

#### 3.1.5. Temperature

During 3rd and 4th week day temperatures were generally above normal in Bihar plains, Uttar Pradesh, northwest India and Madhya Pradesh. They were appreciably to markedly below normal on three to four days in Haryana, Punjab, Himachal Pradesh, Andhra Pradesh and Tamil Nadu between 6th and 12th. Temperatures as low as 9° to 11° C below normal were recorded at a few places in Punjab and Haryana on 12th.

#### 3.2. July

##### 3.2.1. Advance of monsoon

After a respite of about 9 days from 28 June, monsoon started advancing westwards over west Uttar Pradesh and adjoining northwest Madhya Pradesh and north-west India on 8th. It covered the entire country on 14th (Fig. 2). The following features were responsible for advance of monsoon in July :

(i) A cyclonic circulation in the lower tropospheric levels was observed over plains of west Uttar Pradesh and neighbourhood on 4th. It became less marked there on 8th.

(ii) A cyclonic circulation between 2.1 and 5.8 km a.s.l. developed over southwest Rajasthan and adjoining Gujarat State and Pakistan on 4th and another between 2.1 and 3.6 km a.s.l. over Saurashtra & Kutch and neighbourhood on 12th. The former one became less marked over Gujarat State and neighbourhood on 8th and the latter one *in situ* on 14th.

##### 3.2.2. Monsoon activity and associated synoptic features

Several cyclonic circulations developed in the seasonal trough during the month. Most of these circulations moved north or northwestwards before becoming insignificant. These systems, as listed below, maintained the monsoon rainfall over the country during the month.

##### (a) Lower and mid-tropospheric cyclonic circulations

(i) One was observed over plains of west Uttar Pradesh and neighbourhood between 4th and 8th.

(ii) A circulation which was observed over Orissa and neighbourhood between 11th and 14th, became less marked over Bihar Plateau and Gangetic West Bengal on 18th. Another was observed over Bihar plains between 19th and 22nd.



(iii) A circulation developed over northwest Madhya Pradesh and adjoining areas on 11th. Slowly it moved across Haryana and north Rajasthan and merged with the seasonal trough over south Pakistan on 22nd. Another circulation, which developed over east Madhya Pradesh and adjoining Orissa on 21st, became less marked over Madhya Pradesh on 23rd.

(iv) A circulation was seen over Punjab and adjoining Jammu & Kashmir between 18th and 23rd evening.

(v) One was observed over west central and adjoining northwest Bay off north Andhra coast on 20th. It became less marked over north interior Karnataka and adjoining Maharashtra on 25th. Another was seen over north coastal Andhra Pradesh and neighbourhood between 26th evening and 28th.

(vi) A circulation, which developed over east Rajasthan and adjoining Madhya Pradesh on 25th, became less marked over east Uttar Pradesh and neighbourhood on 27th.

(b) *Low pressure area*

(i) Last month's low pressure area over Gangetic West Bengal and adjoining Bihar became unimportant over Sub-Himalayan West Bengal & Sikkim and adjoining Bihar on 10th evening.

(ii) A cyclonic circulation in the lower tropospheric levels developed over northeast Madhya Pradesh and neighbourhood on 29th. Under its influence formed a low pressure area on 30th, which lay over northwest Madhya Pradesh and adjoining Rajasthan on 31st.

(iii) Under the influence of a mid-tropospheric cyclonic circulation over west central Bay off north Andhra coast a low pressure area developed over northwest and adjoining west central Bay off south Orissa-north Andhra coasts on the last day of the month.

Besides the above mentioned synoptic features several other systems in westerlies invaded northwest India. The worth mentioning are those listed below :

(c) *Systems in westerlies*

(i) A cyclonic circulation in the lower and mid-tropospheric levels, which lay over central Pakistan and neighbourhood on 6th, moved away northeastwards across Punjab and Western Himalayas on 7th evening.

(ii) Three cyclonic circulations in the lower tropospheric levels developed over north Pakistan and neighbourhood; first one on 7th, which moved away across Punjab and Western Himalayas on 10th; the second one on 8th, which became less marked over Punjab and neighbourhood on 10th evening and the third one developed on 25th, which also became less marked over Punjab and neighbourhood on 29th evening.

(iii) A trough in mid and upper tropospheric westerlies moved across northwest India between 2nd and 8th and another across Uttar Pradesh and central and northeast India between 9th and 12th.

Monsoon was vigorous on one to three days in Arunachal Pradesh, Assam & Meghalaya, Gangetic West Bengal, Bihar plains, hills of west Uttar Pradesh,

Haryana, Punjab, Jammu & Kashmir, west Rajasthan and Rayalaseema. It was active on seven to eleven days in West Bengal & Sikkim, Bihar plains, Punjab, east Madhya Pradesh, Konkan & Goa, Telangana; so three to six days in Arunachal Pradesh, Orissa, Bihar Plateau, plains of Uttar Pradesh, Haryana, Himachal Pradesh, Jammu & Kashmir, east Rajasthan, west Madhya Pradesh, Gujarat region, Madhya Maharashtra, Vidarbha, coastal Andhra Pradesh and on one to two days in Nagaland, Manipur, Mizoram & Tripura, Saurashtra & Kutch, Marathwada, Rayalaseema, coastal and north interior Karnataka and Kerala. Though the monsoon activity was quite low in coastal Karnataka and Kerala it had received generally widespread rainfall during the month with isolated heavy falls on 2 to 5 days. Rainfall over south interior Karnataka was mostly of scattered or isolated nature.

3.2.3. *Rainfall during the month*

It was excess in Assam & Meghalaya, Sub-Himalayan West Bengal & Sikkim, Bihar plains, plains of west Uttar Pradesh, Haryana, Punjab, Marathwada, Rayalaseema and Tamil Nadu; normal in Arunachal Pradesh, Nagaland, Manipur, Mizoram & Tripura, Gangetic West Bengal, Bihar Plateau, east & hills of west Uttar Pradesh, Himachal Pradesh, Jammu & Kashmir, west Rajasthan, east Madhya Pradesh, Konkan & Goa, coastal Andhra Pradesh and Telangana; deficient over the rest of the country outside Saurashtra & Kutch, where rainfall was scanty.

Significant amounts (cm) of rainfall were :

- 1st Parli 11, Bankura 9, Darjeeling & Kayamkulam 8 each, Maya Bandar, Cherrapunji & Sherthala 7 each
- 2nd Trichur & Chipun 9 each, Muzaffarpur 7
- 3rd Udala 10, Vengurla & Panposh 7 each
- 4th Pasighat 30, Puri, Tenza & Jamshedpur AP 14 each, Ottapalam 13, Beltangadi 12
- 5th Ottapalam 17, Jagdalpur 12, Sakti 11, Raigarh, Mana AP & Agumbe 8 each
- 6th Pasighat 30, North Lakhimpur & Cherrapunji 18 each, Balod 14, Pathalgaon 11, Panagarh 10
- 7th Motihari 21, Cherrapunji 18, Katra 12, Muzaffarpur & Katghora 11 each, Kandaghat & Ambikapur 10 each
- 8th Dhubri 15, Hapur 10, Kanpur 8, Pasighat & Motihari 7 each
- 9th Cherrapunji 44, Daltonganj 16, Cooch Behar 13, Gorakhpur & Kozhikode 12 each, Puri 11
- 10th Gauhati 18, Kayamkulam 11, Nahan, Chamba & Cannanore 9 each, Dumka 8
- 11th Nayapara 15, Paikmat 14, Dhubri 13, Beltangadi 12, Chaparmukh & Mana AP 11 each
- 12th Dharamsala 17, Mussoorie 13, Gwalior & Alathur 9 each, Baijnath & Agumbe 8 each
- 13th Cooch Behar 16, Bira & Mahadi 11 each, Bagati & Jabalpur 7 each



- 14th Chaparmukh 14, Cooch Behar 10, Minicoy & Tirvallor 9 each, Sarsawa AP & Makrana 8 each
- 15th Agumbe 17, Kakatpur 15, Gondia & Igatpuri 13 each, Mahan 12, Pamie & Bharatpur 11 each, Majbat, Sarsawa AP & Tarantaran 9 each
- 16th Trimbak 20, Paumi 14, Manali, Mandi, Nagaur, Mokhada & Kalyan 11 each, Tezu, Baijnath & Dalhousie 10 each
- 17th Bhira 30, Ahwa 22, Narsinghpur 17, Dharampur & Mangaon 16 each, Kathua & Nagpur AP 15 each, Mahabaleshwar 14, Bombay & Kalyan 13 each
- 18th Gaganbavda & Vaibhawadi 22 each, Talasari 20, Mahabaleshwar, Bhira & Dahanu 17 each, Santacruz 16, Kudal 15, Mangaon 13
- 19th Kudal 26, Ganganbavda 22, Vaibhawadi 20, Cooch Behar & Vengurla 16 each, Agumbe 15, Tarantaran & Batala 14 each, Poladpur 12
- 20th Savantwadi 25, Mandi 20, Ongole 18, Hoshiarpur 16, Devgarh 15, Una 14, Vengurla 13, Kapurthala 12
- 21st Sandheads 14, Pargi 13, Cooch Behar 12, Suratgarh & Jammalamadugu 9 each, Paradip & Jogindernagar 8 each
- 22nd Sandheads 28, Chaparmukh 15, Pasighat & Alibag 12 each, Jaggayyapeta & Panambur 11 each, Satna 10, Cooch Behar 9
- 23rd Forbesganj 24, Cooch Behar 14, Pasighat, Karwar, Agumbe, Panambur & Tangla 11 each, Tezu & Khargone 10 each
- 24th North Lakhimpur 13, Cooch Behar & Shirali 11 each, Katra 10, Gangtok 9, Gauhati, Mandi & Aurangabad 8 each
- 25th Khajuraho, Satna, Mangaon & Chiplun 12 each, Ludhiana & Katra 11 each, Nowgong, Tikamgarh, Ganganbavda & Veda 10 each
- 26th Harnai 19, Vengurla & Chalisgaon 16 each, Santacruz & Mahad 14 each, Sheopur & Bhira 13 each, Sheopurkalam 12, Raigarh 11
- 27th Cherrapunji 36, Goalpara 28, Dholpur, Harnai & Mangaon 13 each, Fazilka 11, Ahwa 10
- 28th Goalpara 17, Cooch Behar 12, Baroda, Kudal & Narsinpatnam 8 each, Pasighat, Bhira & Veda 7 each
- 29th Jalpaiguri 15, Cherrapunji & Ludhiana 11 each, Chapra 8, Dhubri, Dhanbad, Supaul, Ambala, Dharamsala & Joshpurnagar 7 each
- 30th Rewa 21, Nurpur 15, Calcutta & Mahabaleshwar 13 each, Bhira & Sandheads 12 each, Raigarh & Satna 11 each, Gaya AP & Morena 10 each
- 31st Bhopal & Mahabaleshwar 18 each, Bhira 17, Hosangabad 16, Shajapur & Mangaon 14 each, Navsari & Vaibhawadi 13 each, Kathua, Shivpuri & Yellapur 11 each

### 3.2.4. Floods and damages

As per CWC report, Brahmaputra valley continued to be in the grip of floods throughout this month affecting many habitations. Damages to crops and properties estimated at about Rs. 10.4 crores. Due to incessant rain there were landslides in Tura town in Meghalaya on 28 July. Also flash floods washed away roads at many places cutting off the communication with the town. Six people lost their lives and eight were missing. In the last week of July, rivers *Burhi Gandak*, *Kamla*, *Balan*, *Bagmati*, *Kosi*, *Mahananda* and *Adhawara* group in north Bihar and river *Punpun* in south Bihar were in floods affecting 341 villages in 10 districts. Number of lives lost were reported to be 17 and damages to crops and properties estimated about Rs. 98 lakhs in the State. Rivers *Dwarkeshwar* and *Gandheswari* in West Bengal were in floods on 10th of this month. River *Kaljani* eroded lands at Balabhat in Cooch Behar affecting roads and habitation. During second and third weeks, vast areas of forest and habitation on the right bank of river *Pana* was devastated due to its diversion of course through a new channel in Bhutri forest in Jalpaiguri district. Rivers *Mahuri* and *Gomti* in Tripura were in floods on 9th and 10th. Local heavy rains and flash floods in Jammu & Kashmir claimed 21 human lives during 3rd week. The deaths were due to house collapse and drowning. Heavy rains on 18th and 19th caused flash floods in river *Swan* in Punjab which affected crops in 10 villages of Rupar district. Number of lives lost were 55 and damages to crops and properties estimated at about 5.63 crores.

### 3.3. August

August was characterised by the formation of the first depression of the season. During this month the monsoon over the Bay of Bengal was quite active, where three depressions and several cyclonic circulations developed. A land depressoin had also developed over northwest Rajasthan and neighbourhood in the first week of the month.

#### 3.3.1. Depressions

(i) The low pressure area, which lay over northwest and adjoining west central Bay on the last day of the previous month, concentrated into a depression on 1st centred at 0830 IST near 20.0° N, 88.0° E. It crossed north Orissa coast near Chandbali in the early hours of 2nd and weakened into a well marked low pressure area over Orissa and adjoining east Madhya Pradesh. Moving northwestwards it lay over north Rajasthan and adjoining Haryana on 4th evening.

(ii) Under the influence of a mid and upper tropospheric trough in westerlies the remnant of the aforesaid Bay depression reconcentrated into a depression over north Rajasthan and neighbourhood on 5th and lay centred at 0830 IST about 50 km southeast of Ganganagar. Moving in a northerly direction it became less marked over Jammu & Kashmir and neighbourhood on 7th evening.

(iii) The second Bay depression formed on 6th when the low pressure area, which lay over northeast and adjoining northwest Bay and Bangla Desh on 4th, intensified. It lay centred at 0830 IST of 6th near

21.0° N, 88.0° E. Crossing north Orissa coast near Contai around the noon of the same day it moved westnorthwestwards and weakened into a low pressure area over northwest Madhya Pradesh and adjoining west Uttar Pradesh on 9th evening. It gradually dissipated over the same area by 12th.

(iv) A cyclonic circulation in the lower and mid-tropospheric levels was observed over northwest and adjoining west central Bay on 9th evening. Under its influence a low pressure area developed there on 13th, which concentrated into a depression on 14th and lay centred at 0830 IST near 18.5° N, 88.0° E. It crossed north Orissa coast between Paradip and Balasore in the morning of 15th and lay as a well marked low pressure area over north Orissa. It merged with the seasonal trough over central Uttar Pradesh on 19th.

### 3.3.2. Other synoptic features

Besides those depressions three more cyclonic circulations formed over Bay of Bengal, which did not develop into intense systems. They are described below :

(i) A lower and mid-tropospheric cyclonic circulation developed over north Bay and neighbourhood on 18th. Moving northwestwards it lay over Bihar plains and neighbourhood on 20th, where a low pressure area developed on that day. It became less marked over Bihar plains and adjoining east Uttar Pradesh on 23rd.

(ii) Another lower and mid-tropospheric cyclonic circulation developed over Andaman Sea and adjoining southeast Bay on 20th evening. It became less marked there on 22nd.

(iii) A cyclonic circulation extending upto mid-tropospheric levels developed over north Bay and neighbourhood on 26th, where a low pressure area formed by next day. Moving northwestwards it lay over Bihar Plateau and adjoining east Madhya Pradesh on 31st evening.

Besides the above systems the following synoptic features were observed during the month :

(i) Last month's low pressure area over northwest Madhya Pradesh and adjoining east Rajasthan became well marked over southwest Rajasthan and neighbourhood on 1st. It became less marked over north Arabian Sea on 3rd.

(ii) A cyclonic circulation in the lower troposphere developed over northwest Rajasthan and adjoining Pakistan on 7th evening. It became less marked there on 9th.

(iii) Another cyclonic circulation in the lower and mid-tropospheric levels was observed over south Rajasthan from 26th to 28th. It lay over Saurashtra & Kutch and adjoining Pakistan and neighbourhood on 31st evening.

(iv) A cyclonic circulation in the lower and mid-tropospheric levels was observed over Gujarat State on 9th evening, where it persisted till 14th and then moved over Saurashtra & Kutch and adjoining north-east Arabian Sea by 15th evening. It became less marked there on 19th evening.

(v) A cyclonic circulation in the lower levels developed over Haryana and adjoining north Rajasthan on 16th. It became less marked over northwest Uttar Pradesh and neighbourhood on 18th.

(vi) Several cyclonic circulations were observed over Pakistan during the month of which the worth mentioning one was the cyclonic circulation extending upto mid-tropospheric levels, which lay over Jammu & Kashmir on 8th and became less marked over Jammu & Kashmir on 10th evening.

(vii) Two cyclonic circulations in the mid-tropospheric levels moved westwards across extreme south Peninsula one between 23rd and 25th and the other between 25th and 27th.

During the month, monsoon was active to vigorous on 5 to 10 days in Gangetic West Bengal, Orissa, Bihar plains, plains of west Uttar Pradesh, Haryana, Punjab, Himachal Pradesh, east Rajasthan, Vidarbha, coastal Andhra Pradesh and Kerala; and on 2 to 4 days in Arunachal Pradesh, hills of west Uttar Pradesh, east Madhya Pradesh and Jammu & Kashmir. Monsoon was active to vigorous in the first fortnight of the month on four to six days in west Madhya Pradesh, Konkan & Goa, Telangana and coastal Karnataka and on one to two days in west Rajasthan, Gujarat State, Madhya Maharashtra and south interior Karnataka. It was so during the second fortnight on four to five days in Assam & Meghalaya and east Uttar Pradesh and on one to two days in Nagaland, Manipur, Mizoram & Tripura, Sub-Himalayan West Bengal & Sikkim, Bihar Plateau and north interior Karnataka. Rainfall over Marathwada, Rayalaseema and Tamil Nadu was mainly of isolated or scattered nature.

### 3.3.3. Rainfall during the month

It was excess in Gangetic West Bengal, Orissa, Punjab, Jammu & Kashmir, Tamil Nadu and coastal Karnataka; normal in Andaman & Nicobar Islands, Assam & Meghalaya, Bihar Plateau, west Uttar Pradesh, Haryana, Himachal Pradesh, east Rajasthan, Madhya Pradesh, Saurashtra & Kutch, Konkan & Goa, coastal Andhra Pradesh and north interior Karnataka. It was deficient over the rest of the country outside Marathwada where it was scanty.

Significant amounts of rainfall (cm) were :

1st	Ahwa 37, Navsari 27, Dharmpur 24, Shirali & Mahabaleshwar 20 each, Mangaon 19, Surat & Koragaon 18 each, Bhira 17, Igatpuri & Kasargode 14 each
2nd	Bhira 32, Harnai 22, Mahabaleshwar & Vaibhavwadi 21 each, Sambalpur & Mahad 18 each, Yellapur 14
3rd	Agumbe 22, Shirpur 17, Ahmedabad & Amroli 13 each, Tikamgarh 12, Igatpuri 11, Mahabaleshwar & Hellapur 10 each
4th	Malpura 23, Alwar 19, Khetri 14, Trimbak & Navsari 13 each, Silchar & Bardoli 11 each, Umaria & Dwarka 10 each

- 5th Sirsa 30, Paradip 23, Hissar 22, Abu 14, Chandbali 13, Bhatinda 11, Keonjargarh 10
- 6th Phulbani 22, Malerkotla 19, Chhatarpur 15, Zira 13, Jamshedpur AP & Bolangir 10 each
- 7th Kathua 16, Sambalpur 15, Agumbe 12, Bolangir & Dasuya 11 each, Tezu, Batote & Titlagarh 10 each
- 8th Sagar 17, Khurai & Agumbe 15 each, Astha 14, Datia 13, Sironj 12, Narsinghpur, Jabalpur, Patan & Mahabaleshwar 11 each
- 9th Shajapur 27, Vidisha 26, Vaibhavwadi 22, Agumbe 21, Rajgarh 20, Raisen 19, Bhopal 17, Khanpur 14
- 10th Mahabaleshwar 16, Agumbe 9, Rawat Bhata, B'hira, Iगतपुरी & Gaganbavda 7 each
- 11th Sangod 16, Kangra 15, Agumbe 14, Maya Bandar & Bivapur 8 each
- 12th Agumbe 13, Seoni & Gondpipri 10 each, Shillong & Adilabad 9 each, Pathankot & Chandrapur 8 each
- 13th Bijnore 17, Nawrangpur 12, Jaggayyapeta & Sahabad 9 each, Agumbe, Narsapur & Una 8 each
- 14th Sompeta 20, Hata 16, Agumbe 10, Dharm-sala, Kankavali, Ratnagiri, Gaganbavda & Deobad 9 each
- 15th Vaibhavwadi 13, Agumbe 12, Ratnagiri 11, Jalwar, Porbandar & Parbhani 10 each, Chittorgarh 9
- 16th Vaibhavwadi 9, Raipur, Puttur, Koyana, Saharanpur, Bijnore & Rajgarh 8 each
- 17th Dharmsala 14, Badaun & Baihar 9 each, Bagmandala 8, Durg, Balaghat & Kasargode 7 each
- 18th Vidisha 17, Mathura & Raisen 15 each, Baijnath 13, Dholpur 11, Rawat Bhata, Bhopal & Ghasi 9 each
- 19th Jamshedpur AP 20, Forbesganj 14, Midnapore 13, Una 10, Karaikudi & Sepotra 9 each, Jhalwar, Gorakhpur & Cooch Behar 8 each
- 20th Mirzapur & Baijnath 15 each, Haldwani 14, Jamshedpur AP & Kondaghat 12 each, Dehra Dun, Datia, Dharmsala & Kasauli 11 each
- 21st Nahan 25, Nizamabad 24, Hardwar 14, Korba & Katerniaghat 11 each, Jamshedpur AP & Gorakhpur 9 each
- 22nd Cherrapunji 17, Pasighat & Ghosi 15 each, Dehri 11, Bahraich & Sundernagar 8 each
- 23rd Cherrapunji 30, Tenali 18, Tirupattur 14, Pennagaram 13, Gorakhpur & Kolar Gold Fields 10 each
- 24th Tirupattur 17, Cherrapunji 14, Mannargudi 9, Thanjavur & Kallakurichi 8 each, Patna AP & Hoshiarpur 7 each
- 25th Kalimpong 24, Koyana 7
- 26th Baripada 8, Malda 7
- 27th Darbhanga 11, Chintalapudi 10, Balasore & Lonavala 8 each, Kuchinda & Koyana 7 each
- 28th Bijapur 11, Maya Bandar 9, Ratnagiri & Agumbe 8 each, Sambalpur 7
- 29th Mussoorie 8, Titlagarh & Bolangir 7 each
- 30th Mana AP 10, Shimla 9, Raipur 8
- 31st Dharmsala 7

#### 3.3.4. Floods and damages during August

Floods were reported from Assam, West Bengal, Orissa, Bihar, Uttar Pradesh, Rajasthan and Gujarat State during the month. In Assam river *Dhansiri* was in floods during 9th and 10th and 17th and 21st. River *Brahmaputra* and its tributaries were in spate in the last week of August. In Bihar floods in rivers *Burhi Gandak*, *Adhwara* group, *Bagmati*, *Kosi*, *Mahananda* and *Punpun* affected about 1930 villages during the month. It took a toll of 18 lives and damaged crops and properties estimated at about Rs. 12.86 crores. Floods in rivers *Ganga*, *Buri Rapti*, *Rapti*, *Gherghara*, *Gola*, *Khoh* and *Malin* and their tributaries affected 4481 villages in 36 districts of Uttar Pradesh. 48 human lives had been reported to have lost. Rivers *Baitarani* and *Mahanadi* were in floods in Orissa. Several breaches in Hirakund canal systems were reported. About 1216 villages were marooned in six districts of Orissa. Continuous rain from 3 to 7 August in Bharatpur and Mahuva caused floods in *Banganga* and *Ghambiri* rivers affecting 76 villages of which 46 were marooned. Rivers *Ambica*, *Purna*, *Kaveri* were in floods in Gujarat affecting 36 villages in the first week of the month. In Mizoram landslides in the second week damaged roads in all parts of the union territory. River *Ganga* was in floods in West Bengal during the second fortnight of the month.

#### 3.4. September

##### 3.4.1. Withdrawal of southwest monsoon

Southwest monsoon started withdrawing from north-west India on 11 September. The withdrawal from the country was complete on 24 October. The withdrawal is shown in Fig. 3.

##### 3.4.2. Storms and depressions

A cyclonic storm in the Bay of Bengal and a depression over the land developed during September.



(i) A cyclonic circulation extending upto mid-tropospheric levels emerged into north Andaman Sea and adjoining east central Bay across Tenasserim coast on 18th. Under its influence a well marked low pressure area developed over east central and adjoining north Bay on 19th, which concentrated into a depression over northwest and adjoining central Bay by evening and lay centred at 1200 GMT near  $19.0^{\circ}\text{N}$ ,  $89.0^{\circ}\text{E}$ . It further intensified into a cyclonic storm over northwest Bay on 20th and lay centred at 0300 GMT near  $19.5^{\circ}\text{N}$ ,  $87.0^{\circ}\text{E}$ . Moving westnorthwestwards it crossed Orissa coast near Puri in the evening of 20th and weakened into a depression. Continuing to move westnorthwestwards across Orissa and east Madhya Pradesh it further weakened into a low pressure area over west and adjoining east Madhya Pradesh on 22nd.

(ii) The remnant of the aforesaid storm again concentrated into a depression over northwest Madhya Pradesh and neighbourhood on 23rd and lay centred at 0300 GMT near Guna. It recurved northeastwards and became unimportant over northeast Uttar Pradesh on 26th.

### 3.4.3. Other synoptic features

#### (a) Bay systems

(i) A cyclonic circulation in the lower and mid-tropospheric levels developed over north Bay and neighbourhood on 3rd. Under its influence a low pressure area formed over north and adjoining central Bay on 8th, which became well marked on 9th evening over north Bay. Crossing Orissa coast it lay as a low pressure area over north Madhya Pradesh and adjoining south Uttar Pradesh on 13th. A low pressure area with associated cyclonic circulation upto 3.1 km a.s.l. was seen over northeast Madhya Pradesh and adjoining east Uttar Pradesh on 12th evening. It merged with the above system on 13th. The combined system became less marked over Haryana and adjoining northeast Rajasthan on 16th evening.

(ii) A cyclonic circulation upto mid-tropospheric levels developed over northwest Bay off Orissa coast on 13th. It moved over to east Uttar Pradesh and adjoining plains of west Uttar Pradesh on 17th, where it became less marked on 21st.

(iii) A cyclonic circulation in the lower and mid-tropospheric levels developed over southwest Bay off Tamil Nadu coast on 22nd. It crossed Peninsula and lay over east central and adjoining southeast Arabian Sea on 27th, where a low pressure area formed on that day. It became less marked over east central Arabian Sea on 29th.

(iv) A cyclonic circulation extending upto mid-tropospheric levels was seen over Gulf of Siam and neighbourhood on 26th. Moving westwards it developed into a well marked low pressure area over southeast and adjoining southwest Bay on 29th evening. It lay over west central and adjoining southwest Bay on the last day of the month.

#### (b) Arabian Sea system

(i) A cyclonic circulation in the lower tropospheric levels developed over east central and adjoining north-east Arabian Sea off Maharashtra-Gujarat coasts on 9th evening. It became less marked over northeast Arabian Sea and adjoining land areas on 11th.

(ii) A cyclonic circulation in the lower and mid-tropospheric levels was seen meandering over east central and adjoining northeast Arabian Sea off west coast from 14th to 23rd.

#### (c) Other systems

(i) The low pressure area, which lay over Bihar Plateau and neighbourhood on the last day of August became less marked there on 2nd evening. However, the associated cyclonic circulation/trough extending to lower tropospheric levels became less marked on 6th over Bihar plains and adjoining Sub-Himalayan West Bengal & Sikkim.

(ii) A cyclonic circulation in the lower tropospheric levels, which developed over northwest Madhya Pradesh and adjoining Uttar Pradesh on the last day of August, became less marked there on 2nd.

(iii) Two cyclonic circulations in the lower tropospheric levels were seen over Pakistan. One was seen over north Pakistan on 4th, which became less marked over Punjab and adjoining Himachal Pradesh on 6th evening. Another which was over central Pakistan & adjoining west Rajasthan on 6th, became less marked over north Pakistan and adjoining Punjab on 10th.

(iv) A cyclonic circulation/trough in the lower and mid-tropospheric levels was observed over Jammu & Kashmir and neighbourhood between 8th and 11th.

(v) A cyclonic circulation/trough in the lower tropospheric levels was seen over Bihar and neighbourhood on 27th. It moved over Sub-Himalayan West Bengal & Sikkim and neighbourhood on 28th where it became less marked on 30th.

(vi) A western disturbance moved away eastwards across north Pakistan and Jammu & Kashmir between 12th and 15th. These synoptic features caused active to vigorous monsoon condition on nine to twelve days in Assam & Meghalaya, Orissa and east Uttar Pradesh; on four to six days in West Bengal & Sikkim, Bihar, plains of west Uttar Pradesh, Madhya Pradesh and south interior Karnataka during the month. Monsoon was active to vigorous on one to three days in hills of west Uttar Pradesh, Himachal Pradesh, Konkan & Goa, coastal Andhra Pradesh and coastal Karnataka during the first fortnight and that on one to two days in Arunachal Pradesh, Nagaland, Manipur, Mizoram & Tripura, Madhya Maharashtra, Marathwada, Telangana and Kerala during the second fortnight of the month. It was also active to vigorous in Haryana on 16th and in north interior Karnataka on 10th and 29th. Rainfall was generally widespread on six to twelve days in Andaman & Nicobar Islands, Tamil Nadu and Lakshadweep with isolated heavy falls on a couple of days. Haryana, Punjab, Jammu & Kashmir, Rajasthan,



Gujarat State and Vidarbha received rainfall mainly of scattered or of isolated nature during the month.

#### 3.4.4. Rainfall during the month

The monthly rainfall was excess in Assam & Meghalaya, Nagaland, Manipur, Mizoram & Tripura, Orissa, Bihar Plateau & Tamil Nadu; normal in Andaman & Nicobar Islands, West Bengal & Sikkim, Bihar plains, east Madhya Pradesh, south interior Karnataka and Lakshadweep; deficient in Punjab, Himachal Pradesh, west Madhya Pradesh, Madhya Maharashtra, coastal Andhra Pradesh, coastal and north interior Karnataka and Kerala. It was scanty over the rest of the country outside Arunachal Pradesh and Uttar Pradesh, from where rainfall data were not available.

Significant amounts (cm) of rainfall were :

- |      |   |
|------|---|
| 1st  | Madras AP 13, Angul 10, Pasighat, Sidhi, Hoshiarpur & Rupar 8 each, Panna 7   |
| 2nd  | Dharmasala 12, Pasighat & Muzaffarpur 8 each  |
| 3rd  | Pendra 12, Dalhousie 11, Cherrapunji & Cooch Behar 8 each, Puri & Darjeeling 7 each                                       |
| 4th  | Sonepur 13, Cherrapunji & Hirakund 12 each, Sambalpur 11, Long Island 10, Darbhanga 9, Contai, Mandya & Jharsuguda 8 each |
| 5th  | Sambalpur 22, Sandheads 15, Keonjhar 14, Cooch Behar 10, North Lakhimpur, Patna AP & Dehra Dun 9 each                     |
| 6th  | Sambalpur 12, Gorakhpur 11, Jogindernagar & Mahadi 9 each, Sandheads, Mandi & Naraj 8 each                                |
| 7th  | Alibag 14, Shivpuri 10, Wangaon 9, Hut Bay & Thakurwadi 8 each, Bhira & Kalyan 7 each                                     |
| 8th  | Hut Bay 8, Goa (Dabolim) & Karwar 7 each  |
| 9th  | Chaparmukh 12, Gopalpur 10, Harapanahalli 7   |
| 10th | Titlagarh 20, Paikmal 17, Phulbani 11   |
| 11th | Mana AP 16, Rajghat 13, Raipur & Durg 12 each, Phulbani 9, Bolangir & Shajahanpur 7 each                                  |
| 12th | Raipur 16, Maihar 14, Bhawanipatna & Gondia 8 each, Ahmednagar 7  |
| 13th | Jhansi 14, Kailashahar 12, Banda 11, Morena 10, Sagar 8, Gwalior AP & Shivpuri 7 each                                     |
| 14th | Lucknow AP 18, Kheri Lakhimpur 12, Badaun 11, Chhatarpur 9, Tezpur, Dibru-  |

garh AP & Mussoorie 8 each, Rewa, Bareilly AP & Chandbali 7 each

- |      |  |
|------|--|
| 15th | Jamshedpur & Bahraich 13 each, Lucknow AP, Gauhati AP & Chandbali 11 each, Bareilly 10, Durgachak 8  |
| 16th | Hindon AP 9, Majbat & Askot 8 each, Lucknow AP & Hazaribagh 7 each   |
| 17th | Gorakhpur 14, Kolar Gold Fields 10, Patna AP & Port Blair 8 each, Fatehpur & Tiruchirapalli 7 each   |
| 18th | Chipurupalli 13, Guntur 9  |
| 19th | Tirupattur & Dharamapuri 7 each  |
| 20th | Konta 22, Parangipettai 14, Parenda 13, Paradip & Chidambaram 8 each, Puri 7   |
| 21st | Rajnandgaon & Bolangir 15 each, Bametara 10, Raipur & Phulbani 9 each, Cuttack 7   |
| 22nd | Kawardha 28, Raisen 13, Vidisha 10, Pasighat & North Lakhimpur 7 each  |
| 23rd | Lateri 21, Shajapur 18, Kakinada 14, Raisen 13, Tarana, Chaparmukh & Bhopal 12 each, Salem 9, Tondi 8  |
| 24th | Guna 23, Lateri & Tarana 12 each, Omalur 11, Shajapur & Sivaganga 10 each, Bahraich & Dindigul 9 each, Gauhati AP, Kheri Lakhimpur, Tondi, Tirupathi & Chamaraj-nagar 8 each |
| 25th | Dharapuram 17, Lucknow AP 14, Zaheerabad 11, Gorakhpur AP 8, Baghdogra AP, Raigad & Beed 7 each  |
| 26th | Kayamkulam & Alleppey 10 each, Chapra & Amini Divi 9 each, Kottayam 8  |
| 27th | Pasighat 13, Tezu, Phalton & Salem 7 each  |
| 28th | Pasighat 12, Madhugari 9, Satara 8, Trimbak 7  |
| 29th | Calcutta AP & Alleppey 7 each  |
| 30th | Narsapur 11, Tiptur 10, Trivandrum AP & Silchar 7 each   |

#### 3.4.5. Floods and damages

As per the C.W.C. reports, in Assam river *Brahmaputra* and its tributaries were in floods throughout the month and river *Barak* and its tributaries during 14-17 September. Rivers *Mahanadi*, *Baitarani*, *Subarnarekha*, *Burhabalang* and *Rushikulya* in Orissa were in spate during the second fortnight affecting Bolangir, Phulbani, Sambalpur, Balasore, Kalahandi, Puri and Ganjam districts.

Most of the rivers in north Bihar continued to be in floods during the month while rivers *Punpun* and *Sone* in south Bihar were in spate during the first week. In Uttar Pradesh rivers *Ganga*, *Gomti* and *Ghaghara* were in floods. Also heavy rain flooded Lucknow town in the middle of September. Rivers *Mahananda*, *Bhairab*, *Rupnarayan*, *Jalingi*, *Ajoy* and several other rivers were in floods in West Bengal during the first week. Floods in *Ganga* at Farakka were reported in the first week and in the second fortnight. Floods/

heavy rain during the month affected about 794 villages in 19 districts of Bihar and 12,708 villages in 46 districts of Uttar Pradesh. As per the State Govt. report the loss of lives due to floods/heavy rain was 10 in Assam, 15 in Bihar, 50 in Orissa and 332 in Uttar Pradesh and total damage to crops and properties was estimated at about Rs. 5.60 crores, Rs. 13.65 crores and Rs. 1.81 crores in Assam, Bihar and Orissa respectively during the month.

---