

Weather

MONSOON SEASON (JUNE-SEPTEMBER 1983)*

1. Introduction

The southwest monsoon rainfall this year was well distributed over the country. There was no break in the monsoon. From the agricultural point of view it was one among the best in the recent past. By the end of the season about 95 per cent area of the country received excess or normal rainfall and only 5 per cent area had deficient rainfall.

2. Chief features of the season

2.1. Advance of monsoon

Southwest monsoon advanced over Andaman and Nicobar Islands on 27 May and over Kerala on 12 June. Its advance over Andaman and Nicobar Islands was delayed by 7 days and that over Kerala by 11 days than the normal date. It further advanced northwards along the west coast upto south Gujarat State by 21st. Its advance over the west coast and parts of Karnataka and south Madhya Maharashtra was late by about 7 to 10 days. It advanced into Assam and adjacent States on 18 June and thereafter stalled for about a week. By 24 June it covered the remaining parts of Peninsula. Its further westwards advance was rather fast. It covered whole of India outside the western most parts of Rajasthan by 4 July and the whole country by 18 July. The advance of monsoon over interior Maharashtra outside south Madhya Maharashtra, Andhra Pradesh, northeast and central India was late by about 2 to 3 weeks. However, its arrival was nearly normal over northwest India. Fig. 1 gives the dates of onset of the monsoon.

2.2. Activity of monsoon

The delayed onset and late advance of the southwest monsoon over the sub-continent, outside northwest India caused large deficiency (—51% or less) of rainfall over Orissa, Uttar Pradesh, east Madhya Pradesh, Konkan & Goa, Marathwada, Vidarbha, Telangana and coastal Karnataka and moderate deficiency (—26% to —58%) in Nagaland, Manipur, Mizoram & Tripura, Gangatic West Bengal, Bihar State, west Madhya Pradesh, Madhya Maharashtra and Kerala upto 22 June. However, with further rapid advance the

large deficiency was wiped out from all the meteorological sub-divisions except from coastal Karnataka. But the moderate deficiency continued to persist in Nagaland, Manipur, Mizoram & Tripura, Orissa, Bihar plains, hills of west Uttar Pradesh, east Madhya Pradesh and Marathwada by 29 June. By the end of July the rainfall over all the sub-divisions became normal or excess outside Nagaland, Manipur, Mizoram & Tripura, Bihar plateau, hills of west Uttar Pradesh, Himachal Pradesh and Kerala, where it remained deficient. The activity of monsoon during August, as a whole was quite satisfactory outside Bihar plains and east Uttar Pradesh and so it was in the month of September. The seasonal rainfall was excess in 15, normal in 17 and deficient in 3 meteorological sub-divisions. Progress of the monsoon week by week as observed on an operational basis expressed as percentage departure of rainfall is given in Table 1. The monthly and seasonal rainfall and departures from normal over 35 meteorological sub-divisions are shown in Table 2.

2.3. Withdrawal of monsoon

The monsoon started its withdrawal on 13 September from west Rajasthan — two weeks later than normal. The withdrawal from the north and central India was late by about 4 to 7 days. It withdrew from the country (outside Tamil Nadu and Kerala) by 19 October which was also delayed, though slightly from the normal. Withdrawal dates are shown in Fig. 2.

2.4. Depressions

4 depressions developed during the season, one in the Arabian Sea, two in the Bay of Bengal and one over the land. Tracks of these systems are given in Fig. 3.

3. Significant monthly features

3.1. June

By the second week of June the near equatorial east-west trough in the lower troposphere was found to extend from Lakshadweep to southwest Bay. Several feeble cyclonic circulations within the trough zone moved westwards from southwest Bay to Lakshadweep areas across the extreme south Peninsula and Sri Lanka. The cyclonic circulation which lay over Lakshadweep







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WEATHER

TABLE 1
Progress of the monsoon week by week (12 June to 30 September 1983)

| SUB-DIVISIONS | WEEK ENDING ON | | | | | | | | | | | | | | | |
|---|----------------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|---------|-----------|---------|---------|---------|
| | JUNE | | | JULY | | | | AUGUST | | | | | SEPTEMBER | | | |
| | 15 | 22 | 29 | 6 | 13 | 20 | 27 | 3 | 10 | 17 | 24 | 31 | 7 | 14 | 21 | 28 |
| 1 ANDAMAN AND NICOBAR ISLANDS | EXCESS | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN |
| 2 ARUNACHAL PRADESH | SCANTY | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN |
| 3 ASSAM AND MEGHALAYA | SCANTY | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN |
| 4 NAGALAND, MANIPUR, MIZORAM AND TRIPURA | SCANTY | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN |
| 5 SUB-HIMALAYAN WEST BENGAL AND SIKKIM | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN |
| 6 GANGETIC WEST BENGAL | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN |
| 7 ORISSA | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN |
| 8 BIHAR PLATEAU | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN |
| 9 BIHAR PLAINS | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN |
| 10 EAST UTTAR PRADESH | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN |
| 11 PLAINS OF WEST UTTAR PRADESH | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN |
| 12 HILLS OF WEST UTTAR PRADESH | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN |
| 13 HARYANA, CHANDIGARH AND DELHI | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN |
| 14 PUNJAB | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN |
| 15 HIMACHAL PRADESH | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN |
| 16 JAMMU AND KASHMIR | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN |
| 17 WEST RAJASTHAN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN |
| 18 EAST RAJASTHAN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN |
| 19 WEST MADHYA PRADESH | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN |
| 20 EAST MADHYA PRADESH | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN |
| 21 GUJARAT REGION, DAMAN DADRA & NAGAR HAVELI | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN |
| 22 SAURASHTRA, KUTCH AND DIU | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN |
| 23 KONKAN AND GOA | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN |
| 24 MADHYA MAHARASHTRA | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN |
| 25 MARATHWADA | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN |
| 26 VIDARBHA | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN |
| 27 COASTAL ANDHRA PRADESH | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN |
| 28 TELANGANA | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN |
| 29 RAYALASEEMA | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN |
| 30 TAMIL NADU AND PONDICHERRY | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN |
| 31 COASTAL KARNATAKA | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN |
| 32 NORTH INT. KARNATAKA | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN |
| 33 SOUTH INT. KARNATAKA | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN |
| 34 KERALA | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN |
| 35 LAKSHADEEP | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN | NO RAIN |

LEGEND: —

| | | |
|---|--|--|
|  EXCESS +20% OR MORE |  DEFICIENT -20% TO -59% |  NO RAIN |
|  NORMAL +19% TO -19% |  SCANTY -60% OR LESS |  ND NO DATA |

and adjoining Kerala and coastal Karnataka and extending up to 5.8 km a.s.l. on 15th, moved north-northwestwards to east central Arabian Sea and adjoining Maharashtra coast by 16th leading to the *in situ* development a low pressure area. Thereafter the system moved northwards and concentrated into a depression over Saurashtra by 19th evening and lay close to Veraval. It lay centred at 0300 GMT of 20th about 100 km north-northwest of Veraval. It further intensified into a deep depression by the morning of 21st. The system continued to persist over Saurashtra and Kutch till it weakened and became unimportant by 24th. The system during its development stage ushered the southwest monsoon over Kerala on 12th. With its intensification and northward movement it further drew the monsoon current northwards along the west coast upto Gujarat State. The monsoon penetrated into coastal and south interior Karnataka, Goa and extreme southern parts of north interior Karnataka by 16th; south Konkan and south Madhya Maharashtra by 18th; north Konkan, most parts of north interior Karnataka, south Saurashtra and extreme south Gujarat region by 28th and the rest of Saurashtra, parts of Kutch and Gujarat region on 21st.

Under the influence of a trough in low level westerlies over Sub-Himalayan West Bengal and adjoining Bihar plains the Bay branch of southwest monsoon advanced into Assam and adjacent States on 18th.

A low pressure area developed over northwest and adjoining west central Bay on 22nd. It concentrated into a depression by 23rd evening and was centred near 18.5 deg. N and 86.0 deg. E. Moving west-northwestwards, it became a deep depression and crossed south Orissa coast near Gopalpur in the forenoon of 25th. As a depression it continued to move west-northwestwards upto southeast Madhya Pradesh and then northwards before weakening into a well marked low over south Uttar Pradesh and adjoining north Madhya Pradesh on 28th. An independent cyclonic circulation extending upto 5.8 km a.s.l. developed over northwest Madhya Pradesh and adjoining southwest Uttar Pradesh on 27th. However, it merged with the circulation of the earlier well marked low pressure area on 28th. The combined system still located as a well marked low moving west-northwestwards, merged with the seasonal low by 1 July. Under the influence of these synoptic features the southwest monsoon advanced in Orissa, southeast Madhya Pradesh, coastal Andhra Pradesh, Telangana, Rayalaseema and the rest north interior Karnataka on 24th. It further advanced in West Bengal & Sikkim, southern parts of Bihar plateau, southwest Madhya Pradesh, Vidarbha, Marathwada and north Madhya Maharashtra on 26th. It covered whole of Bihar State, Uttar Pradesh, Himachal Pradesh, parts of Haryana and east Rajasthan and the remaining parts of Madhya Pradesh by 29th.

Other synoptic features during the month were :

(i) A low pressure area which developed over west central and adjoining southwest Bay off south Andhra-north Tamil Nadu coasts on 31 May with associated cyclonic circulation in the lower troposphere moved

inland and was seen as a cyclonic circulation upto 1.5 km a.s.l. over Telangana and neighbourhood on 1st. It weakened by 4th.

(ii) A cyclonic circulation in the lower troposphere which lay over northwest and adjoining west central Bay on 3rd evening, moved into southeast Madhya Pradesh and adjoining Orissa by next day and became less marked there by 6th evening.

(iii) A trough of low extended from coastal Orissa to north Andaman Sea between 6th and 8th.

(iv) A cyclonic circulation in the lower troposphere developed over southeast Madhya Pradesh on 10th, persisted there till 13th and then moving westwards, it dissipated over Vidarbha and neighbourhood by 14th.

(v) The last western disturbance of May and seven other moved across the Western Himalayas and neighbourhood during the month.

(vi) A cyclonic circulation in the lower troposphere moved from central Pakistan and adjoining west Rajasthan to hills of west Uttar Pradesh between 8th and 13th.

(vii) An induced cyclonic circulation upto 1.5 km a.s.l. developed over south Pakistan on 18th. It moved over west Rajasthan where it became less marked by 21st.

These systems caused generally widespread rain or thundershowers in Sub-Himalayan West Bengal and Sikkim on 15 days and on 4 to 6 days in Assam & adjacent States, Western Himalayas and south interior Karnataka and on 1 to 3 days in Gangetic West Bengal, plains of Uttar Pradesh, Punjab, west Madhya Pradesh, Gujarat region, Andhra Pradesh, Tamil Nadu, north interior Karnataka and Kerala. Isolated heavy to very heavy falls occurred on 11 days in Sub-Himalayan West Bengal & Sikkim, on 6 days in Assam & Meghalaya and on 1 to 3 days in Arunachal Pradesh, Nagaland, Manipur, Mizoram & Tripura, Gangetic West Bengal, Orissa, Bihar plateau, west Madhya Pradesh, coastal Andhra Pradesh, Tamil Nadu and south interior Karnataka. After the advance of monsoon, it was active or normal on all days in Konkan & Goa and Gangetic West Bengal during the month. It was vigorous on 1 to 3 days in Saurashtra & Kutch, Konkan & Goa, coastal Andhra Pradesh & Telangana and was active on 4 days in Assam & Meghalaya and Konkan & Goa, on 2 to 3 days in Arunachal Pradesh, Sub-Himalayan West Bengal & Sikkim, Orissa, Bihar, east Uttar Pradesh, Madhya Pradesh, Saurashtra & Kutch, Marathwada, Vidarbha, coastal & north interior Karnataka and Kerala and one day each in Gangetic West Bengal, hills of west Uttar Pradesh, east Rajasthan, coastal Andhra Pradesh, Telangana and south interior Karnataka.

3.1.1. Rainfall during the month

Rainfall during June was excess in west Rajasthan, Gujarat State, coastal Andhra Pradesh and interior Karnataka, normal in Arunachal Pradesh, Assam &

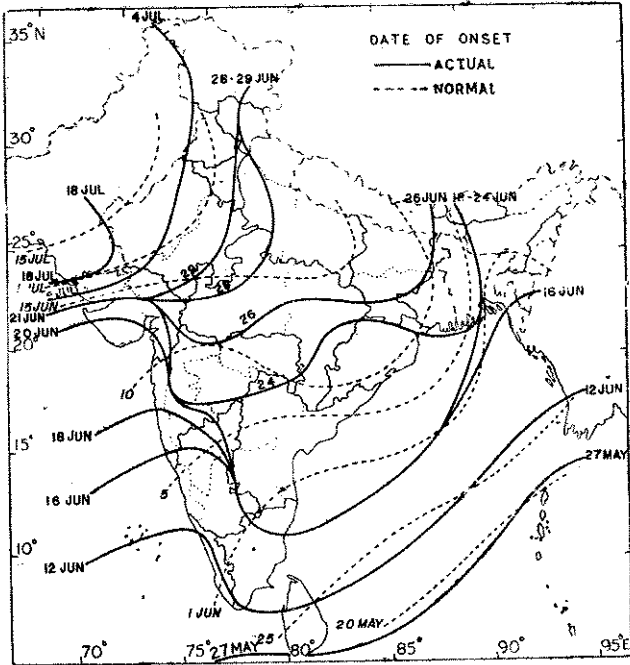


Fig. 1. Advance of southwest monsoon 1983

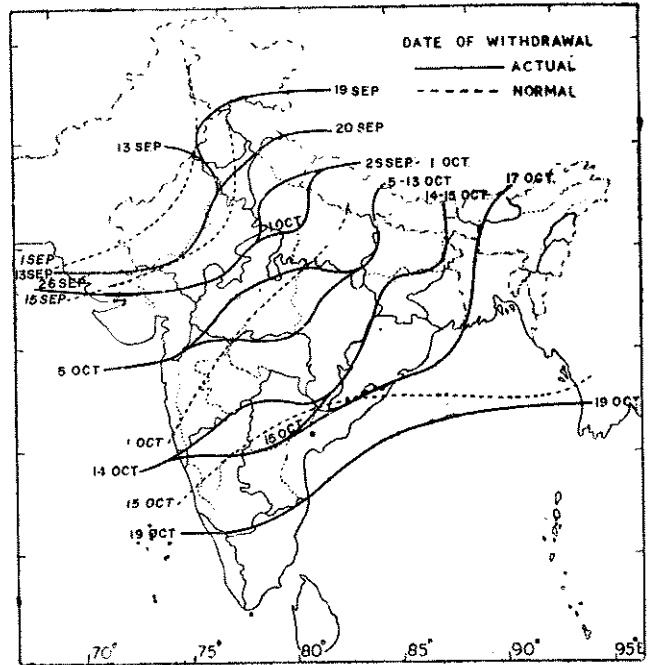


Fig. 2. Withdrawal of southwest monsoon 1983

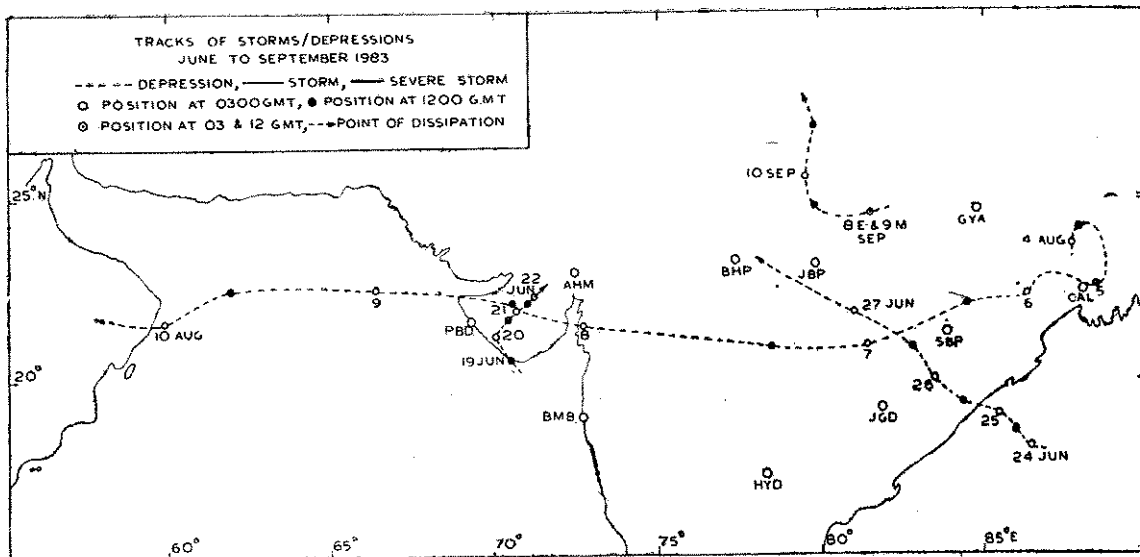


Fig. 3. Tracks of storms/depressions during June-September 1983

Meghalaya, West Bengal & Sikkim, plains of Uttar Pradesh, Haryana, Punjab, Jammu & Kashmir, east Rajasthan, Konkan & Goa, Madhya Maharashtra, Vidarbha, Telangana, Rayalaseema and Tamil Nadu and deficient over the rest parts of the country.

The significant amounts (cm) of rainfall were :

| | |
|------|---|
| 5th | Cherrapunji 13 |
| 6th | Malavalli (SIK) 14 |
| 15th | Chaibasa 15 |
| 16th | Mangalore AP 16, Peermedu 14, Trivandrum 13 |
| 19th | Pasighat 14 |
| 20th | Mahuva 36, Veraval 25, Mahabaleshwar 13 |
| 21st | Porbandar 39, Cherrapunji 23, Surat 17, Navasari 13 |
| 22nd | Navasari 22, Veraval 16, Cherrapunji 15 |
| 23rd | Veraval and Porbandar 21 each |
| 24th | Bhira 36, Baghdogra 28, Bombay (Colaba) 15, Veraval 14 |
| 26th | Kalingapatnam 22, Jagdalpur 20, Berhampore 19, Nowrangpur 18, Jaipatna 16, Pottangi 15 |
| 27th | Alibag 29, Devgarh 23, Ratnagiri & Telguppa 20 each, Belgaum 18, Darjeeling 16, Sirsi 14, Vangurla 13 |
| 28th | Raebareili, Belgaum & Yellapur 20 each, Thakurdwara 15, Darjeeling 13 |
| 29th | Vengural 16, Belgaum 13 |
| 30th | Udaipur 18, Nilambur & Vayittiri 17 each, Dabolim 13 |

3.1.2. Floods and damages

The deep depression which persisted over Saurashtra & Kutch during 19th to 22nd caused unprecedented heavy rainfall resulting in devastating floods over Saurashtra. Veraval got 25 cm of rainfall on 20th, the highest ever recorded for the month of June. According to the reports of Central Water Commission Munjiasar Dam in Amreli district and Moj dam in Rajkot district received a rainfall of 50 cm and 46 cm respectively in 24 hours. 24 major/medium dams overflowed upto the depth ranging from 2 ft to 27 ft. Heavy rain and floods affected 52 towns and 2977 villages. 594 human lives were reported to have been lost and considerable number missing. 77884 heads of cattle were dead.

Following heavy rain in the catchment areas the *Brahmaputra* and its tributary *Pagladiya* were in floods in the fourth week of the month. Following rainfall on 27th Sangameshwar town in Ratnagiri district was flooded. Landslides blocked Bombay-Goa highway.

Due to incessant showers in the last week of June, several houses were completely destroyed by the landslides in Darjeeling district of West Bengal.

3.1.3. Temperature

Delayed arrival of monsoon resulted in appreciably to markedly above normal day temperature in most parts of the Peninsula, east Madhya Pradesh, east Uttar Pradesh, Bihar and northeast India during the first fortnight.

3.2. July

The march of monsoon over northwest India continued progressively and it covered the whole area outside the western parts of west Rajasthan by 4 July. Thereafter it did not advance further for the next two weeks. The monsoon was fully established over the country only by 18th.

The advance of monsoon and its activity during July were associated with the following systems :

(i) A low level cyclonic circulation developed over east Uttar Pradesh and adjoining northeast Madhya Pradesh on 1st, which extended upto mid-tropospheric levels on 2nd. Moving northwards it became less marked over east Uttar Pradesh and adjoining Bihar plains on 3rd from which date the system could be located as a low pressure area over the same region till 6th.

(ii) A cyclonic circulation extending upto mid-tropospheric levels developed over northwest and adjoining west central Bay on 8th. A low pressure area developed off south Orissa-north Andhra coast by the same evening. Moving westnorthwestwards the low pressure area became well marked on 10th over coastal Orissa and adjoining north coastal Andhra Pradesh. Continuing to move westnorthwestwards across central India it merged with the seasonal low over west Rajasthan on 15th. However, the associated cyclonic circulation became unimportant by next day.

(iii) Another cyclonic circulation developed in the lower and middle tropospheric levels over northwest Bay and adjoining north Orissa on 18th where a low pressure area formed on 19th. Moving westnorthwestwards it became unimportant over northeast Madhya Pradesh on 22nd.

(iv) A low pressure area developed over southwest Madhya Pradesh and adjoining north Madhya Maharashtra on 21st with associated cyclonic circulation extending upto middle troposphere. Moving westnorthwest to northwestwards it merged with the seasonal low over southeast Pakistan and adjoining northeast Arabian Sea by 24th.

(v) A cyclonic circulation developed in the lower troposphere over north Pakistan and adjoining Punjab on 24th. Under the influence of a trough in mid and upper tropospheric westerlies it moved eastwards and lay on 27th over northwest Rajasthan and adjoining Haryana and Punjab extending upto middle troposphere. It lay over Punjab on the last day of the month.

TABLE 2

Statement showing sub-divisional means of rainfall in each month and during the season as a whole
(June to September 1983)

| 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. † (mm) | % dep.* (mm) |
| 1. Andaman and Nicobar Islands | 390 | -15 | 490 | 23 | 491 | 35 | 498 | 23 | 1869 | 1622 | 247 | 15 |
| 2. Arunachal Pradesh | 582 | -14 | 924 | 9 | 490 | -22 | 653 | 76 | 2650 | 2523 | 127 | 5 |
| 3. Assam and Meghalaya | 396 | -12 | 505 | 20 | 391 | 6 | 456 | 90 | 1747 | 1476 | 271 | 18 |
| 4. Nagaland, Manipur, Mizoram and Tripura | 327 | -25 | 225 | -32 | 334 | 15 | 177 | -12 | 1064 | 1256 | -193 | -15 |
| 5. Sub-Himalayan West Bengal and Sikkim | 567 | -7 | 899 | 20 | 367 | -33 | 704 | 29 | 2538 | 2457 | 80 | 3 |
| 6. Gangetic West Bengal | 183 | -25 | 333 | 11 | 353 | 13 | 224 | -5 | 1094 | 1093 | 1 | 0 |
| 7. Orissa | 149 | -27 | 224 | -32 | 529 | 60 | 297 | 17 | 1219 | 1149 | 70 | 6 |
| 8. Bihar Plateau | 128 | -29 | 244 | -30 | 225 | -29 | 282 | 29 | 900 | 1096 | -196 | -18 |
| 9. Bihar Plains | 82 | -51 | 296 | -7 | 183 | -41 | 222 | -5 | 782 | 1027 | -245 | -24 |
| 10. East Uttar Pradesh | 100 | -7 | 271 | -11 | 232 | -25 | 330 | 72 | 933 | 916 | 18 | 2 |
| 11. Plains of West Uttar Pradesh | 79 | -8 | 292 | 3 | 357 | 30 | 284 | 75 | 1013 | 806 | 207 | 26 |
| 12. Hills of West Uttar Pradesh | 164 | -16 | 311 | -41 | 488 | -14 | 422 | 51 | 1386 | 1575 | -189 | -12 |
| 13. Haryana, Delhi and Chandigarh | 47 | -15 | 315 | 79 | 298 | 80 | 107 | -12 | 766 | 518 | 248 | 48 |
| 14. Punjab | 37 | -2 | 173 | -6 | 198 | 27 | 60 | -46 | 468 | 490 | -22 | -4 |
| 15. Himachal Pradesh | 86 | -26 | 269 | -47 | 331 | -27 | 206 | -7 | 991 | 1300 | -309 | -24 |
| 16. Jammu and Kashmir | 47 | 2 | 137 | 3 | 103 | -12 | 83 | 7 | 370 | 372 | -2 | -1 |
| 17. West Rajasthan | 38 | 56 | 188 | 77 | 118 | 12 | 40 | -27 | 384 | 291 | 94 | 32 |
| 18. East Rajasthan | 64 | 9 | 229 | -4 | 249 | 3 | 125 | 8 | 667 | 656 | 11 | 2 |
| 19. West Madhya Pradesh | 98 | -21 | 286 | -70 | 360 | 24 | 315 | 67 | 1059 | 950 | 109 | 11 |
| 20. East Madhya Pradesh | 139 | -13 | 362 | -11 | 413 | 2 | 317 | 40 | 1231 | 1198 | 33 | 3 |
| 21. Gujarat region, Daman, Dadra & Nagar Haveli | 198 | 60 | 355 | 7 | 309 | 51 | 161 | 13 | 1024 | 802 | 222 | 28 |
| 22. Saurashtra, Kutch and Diu | 321 | 370 | 229 | -8 | 264 | 105 | 54 | -36 | 867 | 529 | 339 | 64 |
| 23. Konkan and Goa | 582 | -13 | 1040 | 4 | 1376 | 144 | 636 | 84 | 3634 | 2576 | 1058 | 41 |
| 24. Madhya Maharashtra | 98 | -6 | 174 | -1 | 164 | 30 | 233 | 70 | 669 | 543 | 126 | 23 |
| 25. Marathwada | 63 | -55 | 263 | 34 | 382 | 159 | 423 | 122 | 1130 | 671 | 459 | 68 |
| 26. Vidarbha | 153 | -13 | 345 | 1 | 355 | 27 | 317 | 61 | 1169 | 994 | 175 | 18 |
| 27. Coastal Andhra Pradesh | 151 | 49 | 202 | 27 | 241 | 68 | 259 | 72 | 854 | 555 | 299 | 54 |
| 28. Telangana | 166 | 19 | 282 | 18 | 445 | 114 | 307 | 62 | 1200 | 776 | 424 | 55 |
| 29. Rayalaseema | 79 | 17 | 123 | 40 | 231 | 104 | 295 | 105 | 727 | 412 | 315 | 76 |
| 30. Tamil Nadu and Pondicherry | 39 | -4 | 69 | 19 | 108 | 28 | 143 | 61 | 359 | 271 | 87 | 32 |
| 31. Coastal Karnataka | 504 | -49 | 1150 | 11 | 1257 | 104 | 779 | 158 | 3689 | 2945 | 745 | 25 |
| 32. North Interior Karnataka | 197 | 78 | 155 | -10 | 209 | 54 | 240 | 49 | 802 | 580 | 221 | 38 |
| 33. South Interior Karnataka | 158 | 104 | 89 | -29 | 149 | 54 | 135 | 16 | 531 | 417 | 114 | 27 |
| 34. Kerala | 302 | -51 | 462 | -17 | 494 | 49 | 429 | 87 | 1687 | 1743 | -56 | -3 |
| 35. Lakshadweep | 182 | -43 | 273 | 1 | 409 | 104 | 248 | -55 | 1112 | 950 | 162 | 17 |

*Percentage departure from normal

† Departure from normal

(vi) A low level cyclonic circulation lay over south Uttar Pradesh and adjoining northeast Madhya Pradesh between 14th and 17th.

(vii) The west coast trough on sea level chart extending from south Gujarat coast to Lakshadweep areas was present on most days from the second week of the month.

(viii) Three western disturbances affected extreme north of the country between 1st and 20th. During the first fortnight four low level cyclonic circulations developed over northwest India.

Under the influence of the above systems monsoon was active on 6 to 10 days in Arunachal Pradesh, Assam & Meghalaya, Bihar plains, Madhya Pradesh, Gujarat State, Konkan & Goa, Vidarbha, Telangana, coastal Karnataka and Kerala, on 3 to 5 days in west Bengal & Sikkim, Bihar plateau, Uttar Pradesh, Haryana, Punjab, west Rajasthan, Marathwada and coastal Andhra Pradesh and on 1 to 2 days in the rest parts of the country outside Nagaland, Manipur, Mizoram & Tripura and Rayalaseema. The monsoon was vigorous on 2 to 4 days in Sub-Himalayan West Bengal & Sikkim, Haryana and Gujarat region and on one day each in plains of west Uttar Pradesh, east Rajasthan, Madhya Maharashtra, Marathwada, Telangana and Rayalaseema.

The monsoon was generally weak upto 10th in Maharashtra State, coastal Andhra Pradesh, Telangana, Karnataka and Kerala and so on most days in Arunachal Pradesh, Nagaland, Manipur, Mizoram & Tripura, Gangetic West Bengal, Orissa, Uttar Pradesh, Haryana, Punjab, Jammu & Kashmir, Madhya Pradesh and Saurashtra & Kutch between 6th and 19th.

3.2.1. Rainfall during the month

Rainfall during July was excess in Assam & Meghalaya, Haryana, Punjab, Rajasthan, Marathwada, coastal Andhra Pradesh and Tamil Nadu; normal in Andaman & Nicobar Islands, Arunachal Pradesh, West Bengal & Sikkim, Orissa, Bihar plains, plains of Uttar Pradesh, Jammu & Kashmir, Madhya Pradesh, Gujarat State, Konkan & Goa, Madhya Maharashtra, Vidarbha, Telangana, Rayalaseema, coastal & north interior Karnataka, Kerala and Lakshadweep. It was deficient over the rest of the country.

The notable amounts of rainfall in cm were :

| | |
|------|---|
| 1st | Abu 16 |
| 4th | Shillong 17 |
| 5th | Baghdogra 21, Jalpaiguri & Baroda 18 each |
| 6th | Cherrapunji 16 |
| 12th | Vengurla 17 |
| 14th | Cannanore 26, Dahanu 16 |
| 16th | Chaibasa 28, Jalpaiguri 22, Baghdogra 21 |
| 17th | Santacruz 25, Alibag 19, Harnai 15 |
| 20th | Surat 18, Mahabaleshwar 17 |

| | |
|------|---|
| 21st | Bagmandala 25, Bulsar, & Agumbe 22 each, Daman 20, Trichur 18 |
| 22nd | Bagmandala 33, Yellapur 22, Beitangadi 19, Cannanore 17 |
| 23rd | Agumbe 19, Cannanore 17 |
| 24th | Agumbe 18, Panambur & Mangalore AP 15 each |
| 25th | Agumbe 15 |
| 26th | Cherrapunji 18 |
| 27th | Cherrapunji 22, Motihari 20, Ajmer 19 |
| 28th | Muzaffarnagar 28, Cherrapunji 22, Sarsawa AP & Ambala 19 each |
| 29th | Cherrapunji 18 |

3.2.2. Floods and damages

During this month, floods were reported from Assam, north Bengal, Bihar, Rajasthan, Maharashtra and north interior Karnataka. In Assam *Brahmaputra* and its tributaries were in spate throughout the month. National highway Nos. 31, 36 and 37 in Assam breached at some places. It was reported that a population of 2.35 lakhs living in 879 villages in north Lakhimpur, Dhemaji, Darrang, Jorhat, Nowgong, Goalpara, Sibsagar and Dibrugarh districts was affected. Extensive damage covering an area of 14,000 hectares was also reported. In north Bengal river *Jaidhaka* and *Torsa* were in flood during the second week. Due to heavy rain on 5th Jalpaiguri town was under water ranging from 1 ft to 4 ft. Floods and landslides affected a population of 1.07 lakh in the districts of Jalpaiguri, Cooch Behar and Darjeeling upto 24th. 7 human lives were reported to have been lost. Floods in Bihar in the first fortnight affected 461 villages in the districts of Darbhanga, Madhubani, Motihari, Saharsa, Sitamari and Khagaria and a total of 941 villages in the nine districts during this month. Floods and landslides that occurred in the 1st week in Ratnagiri, Sindhudurg and Kolhapur districts of Maharashtra had claimed the lives of 30 people and 1890 cattle. Belgaum district of Karnataka was reeling under floods in the 4th week. Breach of some embankments had also been reported. Following heavy rain between 29 June and 1 July and from 23 July to 1 August several villages in Rajasthan got water logged, 29 human lives were reported to have been lost due to floods and house collapse.

3.3. August

During this month, northwest Bay of Bengal was quite active. As many as five cyclonic systems developed in this area, one of which developed into a deep depression. In the easterly monsoon current, a few lower tropospheric cyclonic circulations were found to have developed over northwest India *in situ*.

The activity of monsoon during the month was associated with the following systems :

3.3.1. (i) A cyclonic circulation extending upto 5.8 km a.s.l. developed over north Bay and adjoining land

areas on 1st morning where a low pressure area formed by the same evening. It persisted there and became well marked on 3rd. Then moving northwards it concentrated into a depression on 4th and into a deep depression on 5th over Bangla Desh. It made a loop over Bangla Desh and lay close to Balasore on 6th. Thereafter, it moved westwards across south Madhya Pradesh and Gujarat State and emerged into northeast Arabian Sea on 9th and moved away towards Arabian coast by next day. The system caused active to vigorous monsoon on 1 to 3 days in Gangetic West Bengal, east Madhya Pradesh, Gujarat & Maharashtra States, coastal Andhra Pradesh and coastal & north interior Karnataka. The significant amounts of rainfall in cm were : Diamond Harbour 13, Cherrapunji 12, Chandbali 10 on 3rd; Agartala & Kailashahar 10 each on 4th; Cherrapunji 37, Siddhi 34 on 5th; Balod 13, Gudhyari 11 on 7th; Mahabaleshwar 21, Khandwa 16, Surat 15 on 8th; Mahabaleshwar 17, Ratnagiri & Devgarh 12 each, Cochin 10 on 9th; Devgarh, Alibag & Santacruz 10 each on 10th.

According to press reports the flood situation in Gujarat took a serious turn as several dams started overflowing their embankments following heavy rains.

(ii) The cyclonic circulation in the lower and middle troposphere, which lay over Gangetic West Bengal and adjoining coastal Orissa on the last day of July, moved westwards across Madhya Pradesh and emerged into northeast Arabian Sea on 4th and then moved away towards gulf of Oman.

(iii) A well marked low pressure area with cyclonic circulation upto mid-tropospheric levels which developed over west central Bay off north Andhra coast on 7th, moved westwards into southeast Madhya Pradesh and adjoining Vidarbha on 10th and persisted there till 12th. Thereafter, it moved slowly northwest/west-northwestwards and merged with the seasonal low over south Pakistan by 17th.

(iv) A cyclonic circulation in the middle troposphere developed over northwest Bay on 15th evening, which later became a low pressure area *in situ*. The low pressure area persisted there till 17th. By 18th evening it became well marked and lay over north Orissa. Moving westnorthwest/northwestwards it lay over northwest Madhya Pradesh and adjoining east Rajasthan on 21st. From there, it recurved initially northnortheastwards and then eastwards and weakened over northeast Uttar Pradesh by 24th.

(v) On 22nd an east-west trough in the middle tropospheric levels ran along 12 deg. N across the Peninsula. In this trough a cyclonic circulation developed over south coastal Andhra Pradesh, north Tamil Nadu and adjoining Bay areas by next day. It moved over west central and adjoining northwest Bay by 25th and developed into a low pressure area there by 27th evening. By next day it moved over north Orissa and adjoining Bihar plateau as a well marked low. Moving northwestwards it lay over northeast Madhya Pradesh and adjoining southeast Uttar Pradesh on 31st.

(vi) The cyclonic circulation which lay over north-west Rajasthan, Haryana and Punjab on 31 July persisted there till 2nd.

(vii) Low level cyclonic circulation was seen over Punjab, Haryana, Jammu & Kashmir and adjoining north Pakistan on most days between 3rd and 12th.

(viii) A cyclonic circulation in the lower troposphere developed over Punjab and adjoining northwest Rajasthan and Haryana on 14th. It became less marked over Jammu & Kashmir and adjoining Himachal Pradesh by 16th evening.

(ix) A low pressure area formed over south Rajasthan and neighbourhood on 18th evening with cyclonic circulation upto 3.1 km a.s.l. Moving westwards it became well marked over south Pakistan and neighbourhood on 19th evening. Subsequently it became less marked there by 22nd. A trough from the system extended to east central Arabian Sea off north Maharashtra coast on the first three days.

(x) The trough extending from south Gujarat to Lakshadweep areas was seen on most days upto 17th.

(xi) Two western disturbances moved away eastwards across Western Himalayas one between 13th and 15th and the other between 25th and 27th.

(xii) A cyclonic circulation developed in the lower troposphere over Punjab and adjoining Haryana on 27th. It moved over Himachal Pradesh, Haryana and adjoining northwest Uttar Pradesh on 29th and persisted there till 30th. Then it moved westwards and lay over Punjab and adjoining Jammu & Kashmir on 31st.

(xiii) The east-west trough at 3.1 km a.s.l. extended from northwest Bay to north Gujarat State on most days between 1st and 17th and thence to south Rajasthan till 20th.

Under the influence of these systems monsoon was vigorous on as many as 8 days in Konkan & Goa, 6 days in Marathwada and on 3 to 4 days in Bihar plains; Gujarat State and coastal Karnataka. It was active on 10 days in coastal Karnataka and on 3 to 5 days in Konkan & Goa, Marathwada and Gujarat State. Monsoon was not active on a single day in Bihar plains, during the month. Vigorous monsoon conditions also prevailed on 1 to 2 days in Assam & Meghalaya, Nagaland, Manipur, Mizoram & Tripura, Gangetic West Bengal, plains of Uttar Pradesh, Haryana, Punjab, Rajasthan, Vidarbha, coastal Andhra Pradesh, Telangana and Kerala. Monsoon was active on 7 to 9 days in Assam & Meghalaya, Orissa, Bihar plateau, plains of west Uttar Pradesh, east Rajasthan, Madhya Pradesh and Vidarbha, on 3 to 5 days in Arunachal Pradesh, West Bengal & Sikkim, hills of west Uttar Pradesh, Haryana, Madhya Maharashtra and south interior Karnataka and on 1 to 2 days in east Uttar Pradesh, Punjab, Himachal Pradesh, Jammu & Kashmir, west Rajasthan, coastal Andhra Pradesh, Rayalaseema and north interior Karnataka. Weak monsoon or dry spell prevailed on most days in Arunachal Pradesh, Bihar plain and east Uttar Pradesh between 1st and 20th and in the last week of the

month in Rajasthan, west Madhya Pradesh, Gujarat State and between 11th and 18th in Marathwada.

3.3.2. Rainfall during the month

Rainfall during August was excess in Andaman & Nicobar Islands, Orissa, plains of west Uttar Pradesh, Haryana, Punjab, Madhya Pradesh, Gujarat & Maharashtra States, Andhra Pradesh, Karnataka, Kerala & Lakshadweep, normal in Assam & Meghalaya, Nagaland, Manipur, Mizoram & Tripura, Gangetic West Bengal, Jammu & Kashmir, Rajasthan and Tamil Nadu and deficient over the rest of the country.

The significant amounts (cm) of rainfall were :

| | |
|------|--|
| 2nd | Raipur 16 |
| 5th | Gonda 20 |
| 6th | Roorkee 20 |
| 7th | Ratnagiri 30, Santacruz 17 |
| 8th | Devgarh 19, Panjim 18, Vengurla 15 |
| 9th | Agumbe 22, Karwar 16 |
| 10th | Karimnagar 18 |
| 11th | Nizamabad 33, Alibag 28, Pusad 22, Nander 20, Harnai 16 |
| 12th | Nander 25, Devgarh 23, Vengurla 22, Nazimabad 21, Dabolim 19 |
| 13th | Mahabaleshwar 21, Colaba 17 |
| 14th | Alibag 22, Mahabaleshwar 21, Agumbe 19 |
| 15th | Mahabaleshwar 30, Agumbe 17, Bulsar 16, Colaba 15 |
| 16th | Mahabaleshwar 29, Sikandra Rao 23, Sambhal 15 |
| 19th | Igatpuri 15 |
| 20th | Raisen 33, Hoshangabad 32, Bagmandala 24, Beltangdi 17 |
| 21st | Jamalmadugu 40 |
| 22nd | Pasighat 15 |
| 23rd | Chapra 20, Devarkonda (Telangana) 16 |
| 24th | Dumka 22, Maheshi (Bihar plateau) 15 |
| 29th | Cannanore 18. |

3.3.3. Floods and damages

During this month floods were reported from Assam, Tripura, Bihar, Uttar Pradesh, Gujarat, Maharashtra and Andhra Pradesh. During the first week *Brahmaputra* was in floods affecting 411 villages in the 8 subdivisions of upper Assam. All the rivers in Tripura were in floods during 4th and 5th. Floods in *Gomti* river made the Gomti Hydel Power House inoperative on 4th. Floods in the river *Kosi* continued in Bihar during the first fortnight, affecting a total 1152 villages in 9 districts. Heavy rains caused floods in parts of

many districts in western Maharashtra. Nanded district was the most affected, which recorded 345 mm of rainfall in 3 days. Flooded *Godavari* affected 70 villages in Nanded district and about 300 villages in nine districts of Andhra Pradesh, East and West Godavari districts being worst hit. Also swollen *Bhima* river flooded Pandharpur, a pilgrimage centre, in Sholapur district on 17th. The death toll in western Maharashtra was reported to be 112 and that in Andhra Pradesh to be 30. River *Yamuna* was in floods at Mathura on 22nd.

3.4. September

Withdrawal phase of southwest monsoon from northwest India started late. It withdrew from west Rajasthan on 13 September and from the rest of northwest India by 20 September. Withdrawal was complete from Uttar Pradesh, northwest Madhya Pradesh and Gujarat State by 5 October. It withdrew from Bihar plains, rest of Madhya Pradesh, Maharashtra State by 15 October and from remaining parts of the country by 19 October.

During this month a land depression formed over northeast Madhya Pradesh and adjoining southeast Uttar Pradesh.

The activity of monsoon during the month was associated with the following systems :

(i) A cyclonic circulation in the lower and middle troposphere formed over northwest and adjoining west central Bay on the last day of August. Moving across Orissa it became less marked over northeast Madhya Pradesh and adjoining southeast Uttar Pradesh on 5th.

(ii) A cyclonic circulation in the lower levels formed over north Bay on 3rd. Under its influence a low pressure area developed over northwest Bay on 4th. It moved across Bihar plateau and concentrated into a depression over northwest Madhya Pradesh and adjoining southeast Uttar Pradesh on 8th. Moving north-northwestwards the depression broke up over hills of west Uttar Pradesh and adjoining Nepal hills on 12th.

(iii) A cyclonic circulation between 3.1 and 7.6 km a.s.l. developed over west central Bay off south Andhra coast on 10th. Under its influence a low pressure area formed there on 11th. The system moved inland across coastal Andhra Pradesh and became less marked over Telangana and adjoining Marathwada by 15th.

(iv) A cyclonic circulation in the lower and middle troposphere was located over north Bay on 13th. Under its influence a low pressure area formed over northwest Bay on 14th. The system moved across Bihar plateau, northeast Madhya Pradesh and Uttar Pradesh and broke up over Nepal hills on 21st.

(v) Another cyclonic circulation in the lower and middle troposphere developed over west central and adjoining southwest Bay on 21st. It moved to west central Bay off Andhra coast on 22nd where a low pressure area formed by the same evening. It moved into Andhra Pradesh and gradually weakened over west Telangana and adjoining Marathwada by 27th.

(vi) A lower and middle tropospheric cyclonic circulation developed over north Andaman Sea on 27th. Under its influence a low pressure area formed over north Andaman Sea and adjoining areas of east central and southeast Bay on 29th evening. The system lay over west central and adjoining northwest Bay on 30th.

(vii) The trough off and along the west coast was present throughout this month being well marked on a couple of days in the 1st, 3rd and 4th weeks.

(viii) A cyclonic circulation between 2.1 and 5.8 km a.s.l. lay over Gujarat State on 2nd and 3rd.

(ix) A cyclonic circulation in the lower and middle troposphere developed over south Maharashtra-Goa and adjoining east central Arabian Sea on 13th. It moved over north Madhya Maharashtra-south Gujarat State and adjoining east central Arabian Sea on 16th and persisted there till 27th.

(x) A cyclonic circulation in the lower troposphere moved across north Pakistan and Western Himalayas between 5th and 8th and another across Punjab, Haryana and adjoining Western Himalayas between 12th and 14th.

(xi) Two western disturbances moved away eastwards across Western Himalayas and adjoining areas, one between 15th and 18th and the other between 22nd and 26th.

(xii) An induced cyclonic circulation in the lower levels, formed over west Uttar Pradesh and adjoining Haryana on 24th. It became less marked over east Uttar Pradesh on 27th.

Monsoon was vigorous on 3 days and active on 13 days in Marathwada during the month. It was active on 5 to 9 days in Assam & Meghalaya, West Bengal & Sikkim, Orissa, Bihar, Uttar Pradesh, Himachal Pradesh, Madhya Pradesh, rest of Maharashtra State Andhra Pradesh and coastal Karnataka and so on 1 to 4 days in Arunachal Pradesh, Nagaland, Manipur, Mizoram & Tripura, Haryana, Punjab, east Rajasthan, Gujarat region, interior Karnataka and Kerala. It was vigorous on 3 to 4 days in east Uttar Pradesh Vidarbha, Telangana and Kerala and on 1 to 2 days in Assam & Meghalaya, Bihar plateau, plains of west Uttar Pradesh, Jammu & Kashmir, east Rajasthan Madhya Pradesh, Konkan & Goa, coastal Andhra Pradesh and south interior Karnataka. Monsoon was generally weak over Punjab and was weak in Saurashtra & Kutch in the first fortnight, in Madhya Maharashtra upto 11th, in Gangetic West Bengal, Orissa and Bihar plateau in the 2nd week and in Nagaland, Manipur, Mizoram and Tripura in the second fortnight of the month.

3.4.1. Rainfall during the month

Rainfall during September was excess in Arunachal Pradesh, Assam & Meghalaya, Sub-Himalayan West Bengal & Sikkim, Bihar plateau, plains of Uttar Pradesh, Madhya Pradesh, Gujarat region, Maharashtra, Andhra Pradesh, Tamil Nadu, coastal & north interior Karnataka, Kerala and Lakshadweep. It was

normal over the rest of the country outside Nagaland, Manipur, Mizoram & Tripura, Punjab, west Rajasthan and Saurashtra & Kutch where it was deficient.

Notable amounts (in cm) of rainfall were :

| | |
|------|--|
| 2nd | Mulug (A.P.) 17, Nandigam 15 |
| 3rd | Deolgaon Mahi 18 |
| 5th | Patan (MP) 18 |
| 6th | Hardwar 21, Sambalpur 16 |
| 7th | Sambalpur 21 |
| 8th | Cherrapunji 25 |
| 9th | Sagar 26, Mahroni 21, Umaria 18, Mungaoli 17 |
| 10th | Mahroni 27, Penukonda 18, Khurai 17, Malpura 15 |
| 11th | Amroha (Plains of west U.P.) 41, Katerniaghat 18, Krishnagar 15 |
| 12th | Cannanore 18, Dharmpur 17 |
| 13th | Chaibasa 32, Jalpaiguri 16, Lalitpur 15 |
| 14th | Polavaram 22 |
| 15th | Jamkhed 19 |
| 16th | Cannanore 25, Devgarh 19, Jamkhed 16 |
| 17th | Kuchinda (Orissa) 16 |
| 18th | Jhaspurnagar 19 |
| 22nd | Ambejogai 19, Telani 17, Pandharpur & Chikhali 16 each |
| 23rd | Pandharpur 19, Varanasi 18 |
| 24th | Billoli 23, Bisauli (Plains of west U.P.) 18, Deglur (Marathwada) 16 |
| 26th | Patoda 41, Parthur (Marathwada) 32 |
| 27th | Poladpur 18, Kopergaon, Jamkhed & Bhivpuri 17 each |
| 28th | Dawdi 16 |
| 29th | Long Island 15. |

3.4.2. Floods and damages

During this month floods were reported from Arunachal Pradesh, Assam, Sikkim, Orissa, Bihar, Uttar Pradesh, Delhi, Madhya Pradesh, Marathwada and Andhra Pradesh. There was no let up in flood situation in Uttar Pradesh throughout the month. From the first week of August till the end of September about 18126 villages in 49 districts of Uttar Pradesh were affected by floods and 118 lives were lost. Floods in Bihar continued till 3rd week affecting a total of 2420 villages in 16 districts. The entire northeastern region of Assam remained cut-off by rail from the rest of the country for a few days in the second week as the flood waters of river Aie washed away a vast portion of the railway track and breached several places between Bijni and Chaparmukh Railway station. It was reported that landslides in northern Sikkim on 11th caused by heavy rain, killed 105 people and cut-off Mangaon town from the rest of the State. Heavy rains/floods in Marathwada, in the third week, claimed 59 lives in Nanded district.