

## Rainfall and Floods during 1965 Southwest Monsoon period\*

### 1. Introduction

During the period under review, five depressions from the Bay of Bengal crossed inland, but these did not cause well distributed rain in the country nor did they cause any major floods. The southwest monsoon seasonal rainfall distribution in the country was reminiscent of the deficit rainfall conditions of the monsoon season of 1920.

### 2. Onset and withdrawal of Monsoon

The onset of SW monsoon in 1965 was delayed by 10 to 15 days over the country outside Kerala, Mysore, Konkan, West Bengal and Assam where it was more or less on schedule, though as a feeble current.

The Arabian Sea branch of the monsoon advanced into south Kerala on 26 May about 5 days in advance. The Bay of Bengal branch was also ushered into the south Bay by about the same date under the influence of a depression which lay on 26 May near Lat.  $15^{\circ}0'N$  and Long.  $89^{\circ}0'E$ . As this depression intensified into a severe cyclonic storm and moved in a northerly direction crossing East Pakistan coast on 1 June, the monsoon advanced into the eastern parts of Assam by 3 June. Further advance of both the branches of the monsoon was slow. The Arabian Sea branch set in over coastal Mysore by 6 June and advanced into Konkan by 16 June. Moderate to severe heat wave conditions prevailed over Bihar State, Orissa, Gangetic West Bengal and Uttar Pradesh during second and third weeks of June causing a number of deaths.

The monsoon extended to the central parts of the country and northeast India by 23 June. Under the influence of a low pressure area that formed over East Pakistan and adjoining West Bengal on 1 July and moved to Rajasthan by 4th, the monsoon extended further into Rajasthan and Gujarat and some parts of Madhya Pradesh and Uttar Pradesh. The monsoon current covered the rest of the country by 17 July in association with a depression that originated in the northwest Bay on 13 July, crossed the Orissa coast on 14th and

moved across Madhya Pradesh finally merging with the seasonal trough of low pressure on 17 July.

During the period June to September 1965, five depressions crossed the coast from the Bay of Bengal; the distribution being two near Balasore (on 27 July and 24 August), two near Gopalpur (on 14 July and 1 September) and one between Ongole and Masulipatnam (during the night of 19—20 September). These depressions became unimportant after causing a few heavy falls of rain over the areas affected by them. In addition to these, one cyclonic storm crossed the East Pakistan coast near Chittagong on 1 June.

The withdrawal of the monsoon from northwest India outside east Rajasthan took place by about 15 September, the normal date of withdrawal. By 29 September, the monsoon withdrew completely from northwest India, Gujarat State and Central India; it finally withdrew from the country outside the Peninsula by about 13 October.

### 3. Weekly and Seasonal rainfall

Rainfall week-by-week for the period 27 May to 6 October 1965 in each of the 30 meteorological sub-divisions of the country is shown in Table 1 as percentage departures from the normal rainfall. The main inferences from this table are —

- (a) Rainfall was more than 25 per cent in defect during most of the weeks in all the sub-divisions barring south Assam, Sub-Himalayan West Bengal and north Interior Mysore.
- (b) During the period June—September 1965 the rainfall was more than 25 per cent deficit, for a continuous spell of 6 weeks or longer, in the meteorological sub-divisions of Orissa, Bihar Plains, Uttar Pradesh, Punjab, Himachal Pradesh, Jammu and Kashmir, Rajasthan, Madhya Pradesh and Gujarat State.
- (c) Himachal Pradesh, Jammu and Kashmir, west Rajasthan, west Madhya Pradesh

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Note — Flood accounts and damage reports given in the Article are as obtained from the Flood News Letters issued by the Central Water and Power Commission, New Delhi

TABLE 1  
Southwest Monsoon 1965  
Percentage departures from normal rainfall for week ending

METEOROLOGICAL SUB-DIVISIONS	JUNE					JULY				AUGUST				SEPTEMBER				OCT	
	2	9	16	23	30	7	14	21	28	4	11	18	25	1	8	15	22	29	6
NORTH ASSAM INCLUDING NEFA	-62	-39	-70	-42	-18	-49	-25	-59	-45	-11	-1	-35	-55	+2	-50	-32	-38	-24	-82
S-ASSAM (INCLUDING NAGALAND, MANIPUR AND TRIPURA)	-63	-47	-67	+6	-15	+15	-14	-27	-65	-28	+72	-2	-82	-43	-32	-37	+9	-70	-61
SUB-HIMALAYAN WEST BENGAL	-91	-11	-81	+4	+9	+16	-12	+86	-31	+98	+90	-131	-7	+14	-79	-18	-14	-56	-100
GANGETIC WEST BENGAL	-84	-97	-79	-45	+108	+68	-23	-61	-11	+66	-47	-41	-45	-87	-54	-82	-13	+4	-70
ORISSA	-95	-71	-96	-51	-32	-60	-13	-11	+58	-56	-55	-71	-38	-21	-48	-80	-28	-20	-83
BIHAR PLATEAU	-86	-97	-98	-57	-28	-9	-60	-57	+23	+55	-89	-65	-24	-48	+65	-88	-64	-79	-79
BIHAR PLAINS	-100	-100	-72	-45	-31	-36	-2	-80	-49	+134	-84	-51	-55	-25	-70	-25	-90	+55	-99
U.P., EAST	-92	-98	-100	-71	-78	-53	-78	-64	-28	+9	-96	-74	-73	+129	-50	+104	-100	-32	-99
U.P., WEST	-100	-98	-100	-97	-99	-66	-58	+20	-265	-13	-91	-92	+9	-21	+89	+19	-91	-98	-99
PUNJAB (INCLUDING DELHI)	-100	-65	-100	-98	-99	-64	-17	-65	+13	-14	-83	-85	-3	-79	-6	-99	-99	-99	-100
HIMACHAL PRADESH	-100	-97	-100	-82	-8	-83	-39	-5	-53	-73	-94	-108	-47	-30	-52	-100	-87	-80	-100
JAMMU & KASHMIR	-100	-9	-91	-99	-89	-39	-59	-93	-58	-58	-39	-97	+10	-30	-90	-97	-91	-46	-56
RAJASTHAN, WEST	-97	+20	-98	-82	-100	-69	-87	-53	-23	+175	-98	-99	-38	-40	-75	-100	-70	-93	-100
RAJASTHAN, EAST	-100	-55	-98	-54	-100	-90	-98	0	-31	+59	-100	-97	-29	-14	+67	-99	-99	-61	-100
MADHYA PRADESH, WEST	-96	-91	-65	-29	-67	-37	-74	-62	+15	-42	-99	-45	-30	-20	-33	-67	-74	-90	-98
MADHYA PRADESH, EAST	-99	-44	-84	-39	-26	-58	-69	-38	+6	-75	-81	-83	-18	-40	-33	-81	-30	+87	-100
GUJARAT REGION INCLUDING DAMAN DADRA & NAGAR HAVELI	-100	-60	-100	-99	-99	-64	-92	-81	-30	-74	-98	-69	+135	+24	-89	-81	-95	-77	-100
SAURASHTRA AND KUTCH (INCLUDING DIU)	-100	-100	-95	-99	-99	-73	-98	+39	-3	+14	-99	-85	-44	-27	-100	-99	-98	-66	-100
KONKAN (INCLUDING GOA)	-100	-70	+22	-67	+9	+16	-60	-87	-38	-29	-59	-72	+101	-11	-51	-88	-60	-98	-99
MADHYA MAHARASHTRA	-97	-56	-22	-51	-42	-59	-26	-237	-38	-17	-53	+125	+146	-41	-80	-92	-68	-89	-69
MARATHWADA	-100	-63	-44	0	+21	+69	-39	+76	-63	-73	-77	-6	+298	+2	-88	-82	-23	-100	-99
VIDARSHA	-96	-88	-15	-93	-82	-41	-57	+14	-44	-75	-92	-17	-83	-18	-2	-93	+73	-94	-100
COASTAL ANDHRA PRADESH	-100	-1	-17	-62	-67	-58	+8	+85	-16	-74	-58	-69	+191	+20	-82	+12	+115	-74	-78
TELANGANA	-100	-3	-82	-21	-20	-6	+69	+193	-47	-86	-70	-59	-54	-32	-42	-68	+196	-88	-100
RAYALASEEMA	-100	+149	-61	-90	+22	-46	+80	-44	-71	-80	+73	+15	-56	0	-97	-47	+91	-92	-96
MADRAS STATE INCLUDING PONDICHERRY	-95	-3	+15	-85	-62	-26	-48	-15	-46	-90	+115	+119	-49	-25	-79	+3	+2	+19	-48
COASTAL MYSORE	-75	-22	+8	-92	-30	-28	-88	-28	-68	+20	-65	-9	-75	-50	-27	-54	-12	-85	-100
INTERIOR MYSORE, NORTH	-86	+5	-5	+31	-2	-45	-12	+257	-49	-24	+10	-29	+15	-66	-97	-86	+250	-51	-72
INTERIOR MYSORE, SOUTH	-100	-36	-37	-26	-18	-56	-81	-39	-69	-43	+107	-14	+16	-80	-91	-37	-81	-80	-77
KERALA	-51	-12	-45	-71	-43	-31	-82	-19	-55	+20	-55	-25	+10	-32	-39	-60	-21	-81	-53

LESS THAN -50%  
 -50% TO -25%  
 -24% TO +24%  
 +25% TO +50%  
 >50%

THICK LINES BELOW THE WEEKLY FIGURES INDICATE CONTINUOUS SPELLS OF 6 WEEKS OR LONGER WITH MORE THAN 25% DEFICIT RAINFALL EACH WEEK

Percentage departures from normal rainfall for the period 1 June to week ending

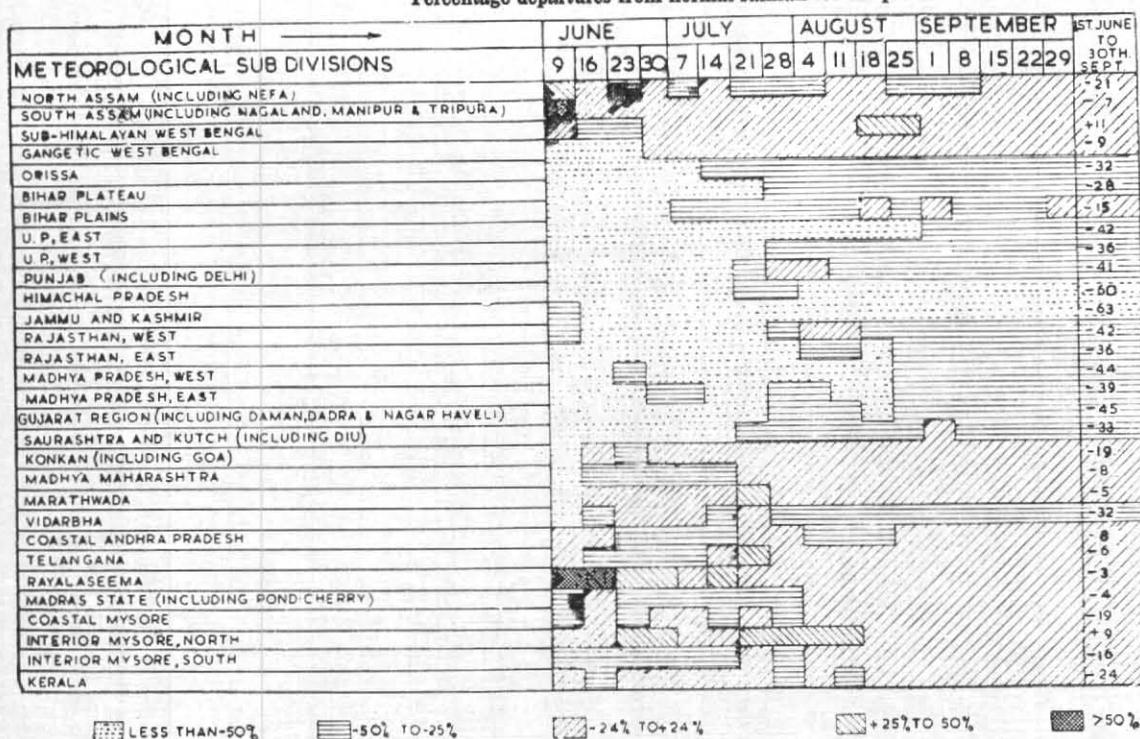


Fig. 1

and Gujarat Region did not get excess rainfall in any individual week during the entire monsoon period.

- (d) The rainfall in northwest India, Madhya Pradesh and Gujarat State was characterised by severe drought conditions (*i.e.*, more than 50 per cent in deficit) in all individual weeks till after mid-July. Only a few heavy spells of rain were observed during 3rd and 4th weeks of July and first week of August in these areas.

Fig. 1 shows the departures, from normal, of the cumulative rainfall from 1 June till the end of each successive week of the period. Percentage departures of the total seasonal rainfall for all the subdivisions are shown in the last column of this figure.

- (i) The monsoon season started with large deficit of rainfall in Orissa, Bihar State, Uttar Pradesh, northwest India, Madhya Pradesh and Gujarat and Maharashtra States. The deficit of rainfall in Maharashtra was temporarily made up by the middle of June; the accumulated rainfall was characteristic of severe drought conditions till mid-July in Orissa, Bihar,

west Uttar Pradesh and Gujarat States; till the end of August in east Uttar Pradesh and throughout the period in Himachal Pradesh and Jammu and Kashmir.

- (ii) Rainfall at the end of the season was more than 50 per cent deficit in Himachal Pradesh and Jammu and Kashmir, 25 to 50 per cent deficit in Orissa, Bihar Plateau, Uttar Pradesh, Punjab, Rajasthan, Madhya Pradesh, Gujarat State and Vidarbha. Rainfall was less than 25 per cent deficit in the rest of the country outside Sub-Himalayan West Bengal and north Interior Mysore where it was about 10 per cent above normal.

A comparative study of the June-September rainfall in various meteorological sub-divisions, over the last decade has revealed that the deficit of rainfall recorded this year had not been reached at any time during this decade. A comparison of the current year's rainfall with the earlier years shows that only twice since the year 1901, *viz.*, in 1918 and 1920, the rainfall deficit situation was worse than in the current year. In the year 1941 the rainfall deficit was considerable but less extensive than in the current year.

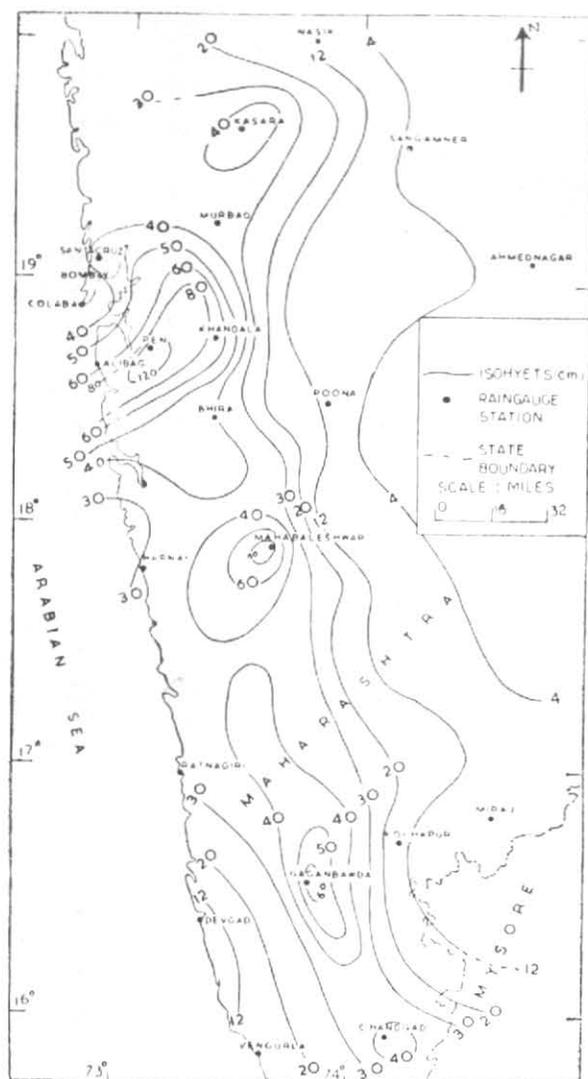


Fig. 2. Isohyetal map of 19-22 July 1965 storm over Maharashtra

#### 4. Chief Floods of 1965

In northeast India, the river Brahmaputra was in floods during this season as usual. Although the total rainfall was much below normal in central India, there were spells of heavy rain causing floods of short duration in Madhya Pradesh. The Bihar rivers were in floods for about a week in the beginning of July.

##### 4.1. Floods in the rivers of northeast India during the first half of July 1965

During the last week of June an upper air cyclonic circulation persisted over Gangetic West Bengal and neighbourhood in association with which a low pressure area developed by about 1 July over East Pakistan and adjoining Gangetic West Bengal. It moved in a westnorthwesterly direction and lay over Rajasthan on 4 July. On

6 July, the axis of the monsoon trough shifted to the foot of the Himalayas and remained there till about 10 July. Under the influence of these developments, northeast India received well distributed rainfall during the last few days of June and first and second weeks of July. The rivers in this region were in floods during this period. The noteworthy amounts of rainfall in northeast India during this period are—Darjeeling 8 cm on 24 June, Mohanbari 13 cm on 26th, Pasighat 9 cm on 27th, Cooch Behar 10 cm on 28th, Pasighat and Malda 13 cm each on 1 July, Pasighat 13 cm on 4th, Tezpur 11 cm on 5th, Bagdogra 11 cm on 8th, Purnea 11 cm on 9th and Dhubri and Gauhati 18 cm and 10 cm respectively on 10th.

##### 4.1.1. Brahmaputra Floods of 30 June to 12 July 1965

Because of the widespread rain in Assam and Sub-Himalayan West Bengal the water level in Brahmaputra and its tributaries rose considerably causing floods by 30 June and the situation remained unchanged in the Assam State till 12 July.

Jorhat sub-division was the worst affected. About 50 villages were submerged and standing crops over a large area were damaged.

##### 4.1.2. Bihar Floods of 6-14 July 1965

In association with the break-monsoon conditions obtaining between 6 to 10 July, the catchment areas of Bihar rivers received heavy rains. Rivers Bhagmati and Kamla rose in spate and were responsible for the major floods in the Bihar State. River Bhagmati crossed the danger level on 7 July at Dheng Bridge. River Kamla recorded the highest ever gauge level of 234.10 ft at Jaynagar (danger level 227.0 ft) on 9 July as against the previous highest of 230.60 ft recorded on 29 July 1964.

Floods of Bhagmati river affected 4 Panchayats of Dhaka Block in Champaran district. Sitamarhi sub-division of Muzaffarpur district was also affected. Dheng Baigania rail line was breached on 7th night and railway traffic was temporarily suspended on this line. Crops were damaged over wide areas in the Champaran and Muzaffarpur districts.

High floods of 9 July in Kamla river caused breaches at 16 places on either side of embankments of the river endangering large areas of Jhanjarpur, Madhopur, Anchanthari, Rajnagar, Khajauli, Bahabhari and Basopatti blocks where railway traffic and postal telecommunications were paralysed. A number of villages in Darbhanga district were also affected.

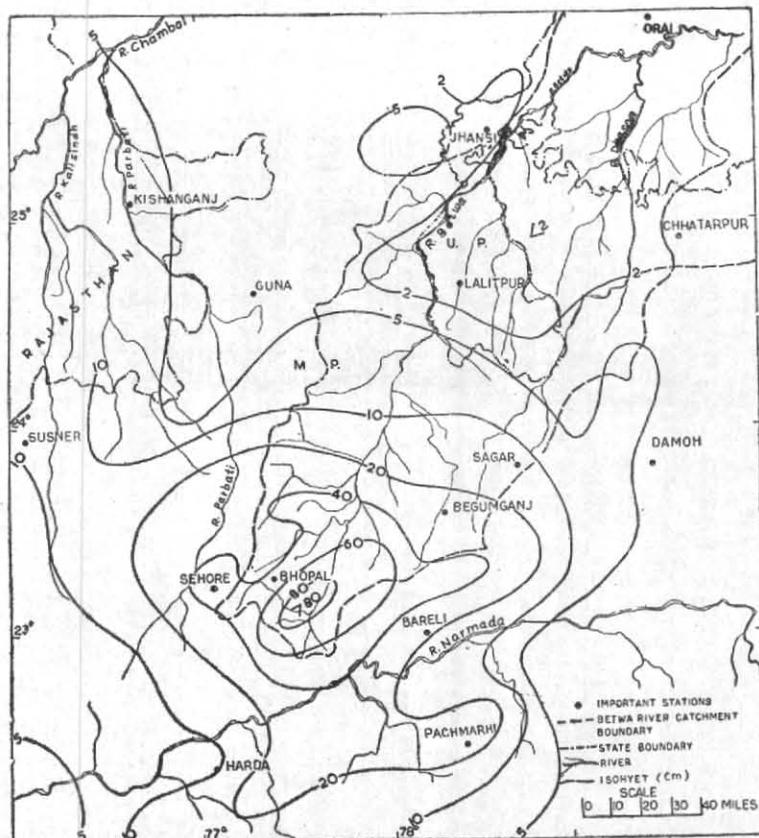


Fig. 3. Madhya Pradesh storm of 27-29 July 1965

4.2. Heavy rains in Maharashtra during 19-22 July 1965

A low pressure area formed over Orissa on 19 July and moved westwards through the central parts of Madhya Pradesh. It lay over Gujarat State as a well marked low on 21 July from where it moved northwards and merged into the seasonal low on 23rd. Associated with this situation, there were heavy rains in Maharashtra State particularly over Konkan and adjoining Western Ghats from 19 to 22 July. Some of the noteworthy amounts of rain are — Panjim 19 cm, Bhira 28 cm, Mahabaleshwar 26 cm, Santacruz 15 cm on 20th; Santacruz 20 cm, Mahabaleshwar 18 cm and Kolhapur 14 cm on 21st; Mahabaleshwar 22 cm, Bhira 17 cm and Santacruz 11 cm on 22 July.

The low lying areas of Bombay and suburbs were flooded. Air, rail and road traffic were disrupted. About a lakh of people were rendered homeless. In Ratnagiri district, road traffic was held up for several hours on 20th. Bhansala and some other rivers in the district were in floods. Roads in rural areas were submerged and telecommunications were disrupted.

The isohyetal map of Maharashtra for the period 19-22 July 1965 is given at Fig. 2 and the depth-area values for standard areas are given below.

Area (sq. km)	4-day depth value (cm) (19-22 July 1965)
2000	94.0
5000	71.8
10000	59.2
20000	49.7
50000	33.7

4.3. Betwa floods of 27-30 July 1965

Heavy rains occurred in the Betwa catchment (Madhya Pradesh) during 27 to 29 July 1965. The synoptic situation responsible for this heavy rain spell is as follows — A low pressure area developed over the north Bay of Bengal on 25th and intensified into a depression on 26th morning with centre near Lat. 21°N and Long. 89.5°E. Moving slowly westnorthwestwards, it further intensified into a deep depression by 27th morning. It crossed coast near Balasore the same evening

and lay about 50 km eastsoutheast of Jamshedpur on the morning of 28th. Simultaneously, another low pressure area developed over west Madhya Pradesh on 27-28th. While the deep depression moved northwestwards to east Uttar Pradesh where it weakened and became unimportant by 30 July, the latter moved slightly northwards and intensified into a depression centred near Gwalior on the morning of 31st. Thereafter, it moved northeastwards and weakened into a low pressure area before it merged into the seasonal trough on 2 August.

Under the influence of these developments, there was good monsoon activity over Madhya Pradesh during the last week of July, particularly during 27-29 July when Raisen, Bhilsa and Sehore districts, which comprise the head water of the Betwa catchment, received very heavy rains. As a result, river Betwa was in floods and caused dislocation in rail and road traffic. A number of villages in Raisen and Sehore districts were badly affected by floods. Bhopal and Raisen were completely cut off from the rest of the country. Sehore district suffered the maximum loss during these floods. Six persons and more than a thousand heads of cattle perished. Kharif crops were damaged over a large area.

The isohyetal map of the Betwa catchment and adjoining areas for the period 27-29 July is given in Fig. 3.

The maximum 1 to 3-day depths of rainfall in

the Betwa catchment over standard areas are given below —

Area (sq. km)	Depth values (cm)		
	Max. 1-day 28 Jul 1965	Max. 2-day 28-29 Jul 1965	3-day 27-29 Jul 1965
2000	37.9	64.0	73.8
5000	27.6	49.0	60.2
10000	18.7	32.4	42.7
20000	10.7	18.5	25.5
30000	7.1	13.0	17.3

#### 5. Summary

1. The rainfall during southwest monsoon season was generally below normal over the whole country being appreciably so in northwest India comprising of Uttar Pradesh, Punjab, Himachal Pradesh, Jammu and Kashmir, Rajasthan, central parts of the country comprising of Madhya Pradesh and Gujarat State and part of eastern India comprising of Orissa and Bihar. This year's seasonal rainfall distribution over the country was of drought conditions, last experienced during the monsoon season of 1920.

2. Except for the normal seasonal floods in the Assam rivers and two minor ones in the States of Madhya Pradesh and Bihar, no major floods occurred in the other rivers.

3. There were two periods of break monsoon conditions, the first from 7 to 11 July and the other from 5 to 11 August.