

Rainfall and floods/droughts in India during the 1972 southwest monsoon period

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(Received 13 April 1973)

1. Introduction

The 1972 monsoon was characterised by its late onset over most of the country outside northwest India, an unusually long three weeks of break in its activity from about the middle of July upto the first week of August and its rather early withdrawal from north India and the north Peninsula. As a result the rainfall of the season was deficient over most of the country outside Jammu & Kashmir, where it was in excess and over Bay Islands, Arunachal Pradesh, Assam & Meghalaya, Gangetic West Bengal, Orissa, Bihar Plateau, hills of west Uttar Pradesh, Haryana, Punjab, east Madhya Pradesh, Rayalaseema, Tamil Nadu, south Interior Mysore, Kerala and the Arabian Sea Islands where it was normal. The intensity of drought was particularly severe in the Maharashtra and Gujarat States. The failure of monsoon over large areas affected agricultural production to some extent but the storage of water in reservoirs to a great extent. This seriously affected power generation leading to power cuts in several States. The only large scale floods reported in an otherwise drought year were in the Bharatpur and Sawai Madhopur districts of east Rajasthan and the Agra district of west Uttar Pradesh during the second week of August, in parts of west Uttar Pradesh and adjoining Rajasthan during the last week of August and in south Orissa and adjoining Andhra Pradesh in September due to two cyclonic storms in September.*

2. Statewise distribution of monsoon rainfall

In order to examine the progress of monsoon over the various parts of the country, tables have been prepared showing the percentage departures from normal of the rainfall week by week as well as the cumulative seasonal departure from normal

during the successive weeks over the various meteorological sub-divisions of the country. These are shown in Figs. 1 and 2 respectively.

2.1. Assam and adjacent States

The Bay branch of the monsoon advanced into Assam and adjacent States by 13 June, about 10 days later than the normal date. It became active during the next week and the rainfall during the week ending on 21 June was in excess in Assam & Meghalaya and in Nagaland, Manipur, Mizoram and Tripura. It continued to remain active over Assam & Meghalaya during the subsequent week also resulting in floods in the *Brahmaputra* and *Barak* river basins. It weakened thereafter. The rainfall during June was normal in Assam & Meghalaya and deficient in Arunachal Pradesh, Nagaland, Manipur, Mizoram and Tripura.

Monsoon was rather weak during the first half of July but became active during the second half. During the weeks ending on 26 July and 2 August Arunachal Pradesh recorded 100 per cent and 84 per cent excess rainfall respectively during these two weeks and Assam 68 per cent excess rainfall during the week ending on 2 August. These resulted in floods in the *Brahmaputra* which crossed the warning stage of 104.24 m at Dibrugarh on 23 July. The season's rainfall upto 2 August was normal except in Nagaland, Manipur, Mizoram and Tripura where it was in defect by 36 per cent. During the rest of the season, rainfall in this region was in deficit except during the week ending on 6 September when Arunachal Pradesh recorded a weekly rainfall which was in excess of the normal by 293 per cent. The monsoon withdrew from the region by 3 October. The season's rainfall was normal in Arunachal Pradesh, Assam

* In the *Indian Journal of Meteorology & Geophysics*, Vol. 24 No. 1, the chief synoptic features including cyclones and depressions associated with the performance of the 1972 southwest monsoon period have been described in detail.

SOUTHWEST MONSOON 1972

PERCENTAGE DEPARTURES FROM NORMAL RAINFALL FOR THE WEEK ENDING

MONTH	JUNE					JULY					AUGUST					SEPTEMBER				OCT			
	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	
METEOROLOGICAL SUB-DIVISIONS																							
BAY ISLANDS	57	+35	-56	25	+59	-86	-16	+17	-31	14	+117	-68	-87	-18	+56	+27	+5	-40					
ARUNACHAL PRADESH	-73	-99	+18	-15	-47	-88	+5	+100	+84	-92	-29	-90	-24	+298	-65	-95	+28	-87					
ASSAM AND MEGHALAYA	-56	-73	+39	+38	-33	-98	-21	+1	+68	-55	-55	-36	+19	+4	-74	-61	-32	-76					
NAGALAND MANIPUR MIZORAM & TRIPURA	-56	-92	+54	-46	+38	-72	-53	-27	+9	+5	-50	-77	-66	+2	-60	-99	-72	-69					
SUB-HIMALAYAN WEST BENGAL	-41	-70	-46	-20	-74	-21	-63	+14	+22	-40	-77	-80	-45	+41	-69	-69	+51	-99					
GANGETIC WEST BENGAL	-72	-87	-84	+40	-41	+3	+34	-40	-96	-18	+121	-45	+56	-38	17	-96	-11	-65					
ORISSA	-69	-67	-74	-3	-5	-22	+34	-70	-85	-18	+29	-43	-61	-75	+49	-87	+78	-63					
BIHAR PLATEAU	-71	-88	-89	-4	-63	-23	+44	-92	-99	+23	+53	-60	+46	-79	+71	-68	-40	-89					
BIHAR PLAINS	-81	-100	-76	-45	-78	-53	-13	-78	-79	-59	-3	-67	-28	-18	-11	-78	+43	-99					
UTTAR PRADESH EAST	-96	-100	-95	+20	-74	-5	-41	-97	-93	-3	-39	-78	-12	-67	-20	+55	+27	-99					
PLAINS OF WEST UTTAR PRADESH	-99	-100	-100	+19	-58	+102	-92	-98	-99	-32	-13	-64	+155	-94	+4	+130	-97	-100					
HILLS OF WEST UTTAR PRADESH	-52	-96	-78	-30	+4	+99	-37	-59	-58	-21	-21	-61	-9	-1	+73	+155	-94	-96					
HARYANA	-77	-99	-98	+136	-21	+386	-89	-97	-98	-40	+37	+44	+176	-93	-91	-73	-100	-100					
PUNJAB	-46	-100	-36	+59	-13	+319	-99	-95	-99	-99	+38	+41	+127	-65	-89	-47	-99	-100					
HIMACHAL PRADESH	-29	-87	+24	+18	-22	+55	-40	-50	-77	-59	-47	-65	+5	-49	+47	-7	-92	-100					
JAMMU & KASHMIR	+81	-89	-99	-81	-22	+214	-83	-87	-91	+187	-76	-1	+193	+35	-46	+206	-98	-95					
RAJASTHAN, WEST	+233	-95	-100	-31	+3	+42	-90	-100	-100	-84	-33	+140	-3	-83	-98	-65	-100	-99					
RAJASTHAN, EAST	-83	-11	-100	+17	-18	-25	-96	-99	-93	-50	+39	-24	-31	-55	-99	-68	-100	-100					
MADHYA PRADESH, WEST	-83	-48	-91	+4	+24	+11	-96	-97	-99	-42	+18	+87	+92	-57	-33	-78	-95	-100					
MADHYA PRADESH, EAST	-84	-99	-76	-34	+37	+8	-18	-91	-98	-4	+58	-48	+77	-88	+41	-60	+16	-75					
GUJARAT REGION (INCLUDING DAMAN, DADRÁ AND NAGAR HAVELI)	-100	-39	-98	-9	+30	+27	-97	-92	-97	-86	-89	+234	-81	-94	-72	-92	-100	-100					
SAURASHTRA & KUTCH (Including DIU)	-99	-100	-99	+33	+62	-17	-99	-94	-99	-81	-96	-42	-99	-99	-81	-100	-100	-100					
KONKAN (Including GOA)	-99	-99	-17	+68	+55	-2	-78	-71	-87	-65	-68	-28	-71	-74	+7	-63	-96	-96					
MADHYA MAHARASHTRA	-91	-52	-56	+8	-19	+19	-85	-89	-92	-75	-91	+47	-73	-82	+109	-46	-86	-90					
MARATHWADA	-100	-83	+24	+48	-39	-36	-93	-97	-98	-90	-18	+14	-75	-86	-30	-91	-100	-100					
VIDARBHA	-99	+84	-54	+1	-5	-7	-87	-96	-97	-47	-32	+113	-21	-79	-17	-96	-99	-100					
COASTAL ANDHRA PRADESH	-93	-96	-12	+30	+67	-39	-78	-45	-97	-74	-34	-45	-68	-53	+6	-31	-72	+21					
TELANGANA	-79	-68	+6	+11	+90	+23	-92	-95	-97	-46	-61	+5	-78	-96	+44	-58	-100	-67					
RAYALASEEMA	-88	+28	+124	+203	+45	-29	-86	-96	-87	-98	-82	-79	-98	-100	+138	+143	-86	+41					
TAMILNADU (Including PONDICHERRY)	-86	-37	+91	+144	+27	+13	-67	-45	-87	-84	-2	-53	-85	-75	+107	+98	+1	+27					
COASTAL MYSORE	-95	-100	-60	+122	+47	+19	-39	-63	-46	-29	-7	-17	-44	-93	-44	-98	-99	-48					
INTERIOR MYSORE, NORTH	-92	-27	+54	-3	+47	+33	-74	-97	-79	-50	-66	-64	-70	-92	+62	+35	-86	-57					
INTERIOR MYSORE, SOUTH	-19	-84	+122	-1	+34	+79	-66	-75	-79	-78	-46	-35	-66	-99	+86	+92	-38	+74					
KERALA	-82	-96	-64	+2	+77	+64	+73	-74	-61	-14	-69	+4	-59	-87	-33	-48	+49	+1					
ARABIAN SEA ISLANDS	-100	-85	+35	+212	+82	-12	-53	-27	-97	-17	+38	-58	-76	-79	-50	+118	-51	-9					

Fig. 1

and Meghalaya and deficient over Nagaland, Manipur, Mizoram and Tripura.

2.2. West Bengal

The onset of monsoon over West Bengal was delayed and it advanced into Sub-Himalayan West Bengal on 13 June as a weak current and into Gangetic West Bengal on 22 June as a strong current. However, rainfall during June was deficient over the whole State. In July the monsoon was weak except for a spell of activity in the second half of the month when moderate floods were reported in the *Teesta* river due to some heavy rains in the sub-montane regions. The monsoon continued to be weak during the rest of the season in Sub-Himalayan West Bengal except for two

weeks of moderate activity. The seasonal rainfall was 28 per cent in defect over Sub-Himalayan West Bengal. However, in Gangetic West Bengal the seasonal deficiency was made up primarily due to active or vigorous monsoon condition from 12th to 16th, on the 23rd and from 26 to 29 August. The monsoon withdrew from the State by 3 October 1972.

2.3. Orissa

The monsoon set in Orissa on 23 June, about a fortnight late. It became active in association with a severe cyclonic storm over the north Bay of Bengal on 14th, moving westnorthwestwards and rapidly weakening into a low on 15th over the Bihar Plateau. The rivers *Mahanadi*, *Brahmani*, *Baita*-

SOUTHWEST MONSOON 1972

PERCENTAGE DEPARTURES FROM NORMAL RAINFALL FOR THE PERIOD 1ST JUNE TO WEEK ENDING

MONTH	JUNE				JULY				AUGUST				SEPTEMBER				No. Days with rain	
	7	14	21	28	5	12	19	26	2	9	16	23	30	6	13	20		27
METEOROLOGICAL SUB-DIVISIONS	-57	-20	-33	-29	-15	+1	+1	+4	+1	0	+9	+2	-5	-5	0	+3	+3	+1
BAY ISLANDS	-57	-20	-33	-29	-15	+1	+1	+4	+1	0	+9	+2	-5	-5	0	+3	+3	+1
ARUNACHAL PRADESH	-73	-88	-23	-21	-26	-41	-35	-19	-7	-15	-16	-23	-23	-14	-15	-20	-18	-19
ASSAM AND MEGHALAYA	-56	-64	-21	-3	-8	0	-2	-2	+5	+3	-2	-3	-1	-1	-1	-4	-5	-5
NAGALAND MANIPUR MIZORAM & TRIPURA	-56	-77	-37	-39	-27	-38	-41	-40	-36	-34	-35	-39	-40	-37	-34	-37	-38	-39
SUB-HIMALAYAN WEST BENGAL	-41	-58	-53	-21	-32	-30	-34	-29	-25	-22	-27	-30	-31	-26	-29	-31	-27	-28
GANGETIC WEST BENGAL	-72	-80	-82	-47	-45	-35	-23	-26	-35	-25	-40	-13	+1	-1	0	-4	-4	-4
ORISSA	-69	-69	-71	-47	-32	-23	-10	-20	-29	-19	-14	-16	-19	-20	-13	-15	-11	-11
BIHAR PLATEAU	-71	-82	-85	-57	-58	-45	-26	-36	-45	-33	-23	-26	-20	-24	-14	-15	-16	-16
BIHAR PLAINS	-81	-92	-85	-68	-71	-64	-53	-59	-62	-57	-51	-52	-50	-46	-43	-43	-40	-40
UTTAR PRADESH EAST	-96	-98	-96	-45	-55	-43	-38	-50	-56	-42	-41	-43	-42	-44	-40	-34	-32	-32
PLAINS OF WEST UTTAR PRADESH	-99	-98	-99	-41	-36	-4	-28	-44	-54	-49	-45	-47	-30	-34	-30	-19	-22	-24
HILLS OF WEST UTTAR PRADESH	-52	-60	-75	-58	-37	+4	-3	-11	-19	-11	-13	-17	-17	-16	-9	-2	-4	-5
HARYANA	-77	-88	-92	0	-9	+135	+76	+37	+15	+13	+16	+19	+32	+24	+17	+11	+5	+2
PUNJAB	-46	-71	-57	-14	-13	+125	+51	+24	0	-16	-9	-6	+3	-3	-6	-8	-12	-14
HIMACHAL PRADESH	-29	-58	-28	-9	-14	+12	-3	-16	-29	-28	-29	-32	-29	-30	-26	-25	-27	-28
JAMMU & KASHMIR	+81	-13	-48	-56	-49	+9	-3	-25	-37	+23	+16	+15	+27	+27	+22	+31	+24	+21
RAJASTHAN, WEST	+233	+71	+2	-3	+4	+21	-11	-32	-45	-51	-49	-27	-24	-29	-25	-26	-28	-28
RAJASTHAN, EAST	-83	-42	-65	-36	-26	-25	-40	-65	-62	-66	-47	-44	-43	-42	-40	-41	-43	-43
MADHYA PRADESH, WEST	-83	-60	-76	-39	-15	-8	-27	-42	-52	-50	-40	-26	-17	-20	-17	-19	-21	-22
MADHYA PRADESH, EAST	-84	-94	-85	-63	-27	-9	-11	-24	-35	-32	-21	-23	-15	-19	-14	-15	-14	-14
GUJARAT REGION (INCLUDING DAMAN, DADRA & NAGAR HAVELI)	-100	-62	-82	-45	-11	+3	-18	-31	-42	-46	-48	-29	-32	-36	-35	-38	-40	-41
SAURASHTRA & KUTCH (INCLUDING DIV)	-99	-99	-99	-22	+24	+14	-14	-25	-37	-41	-45	-45	-47	-51	-53	-53	-54	-55
KONKAN INCLUDING GOA	-99	-99	-99	-15	+5	+8	-7	-15	-24	-23	-26	-26	-28	-30	-28	-29	-31	-32
MADHYA MAHARASHTRA	-91	-68	-63	-41	-34	-21	-31	-39	-46	-48	-51	-44	-46	-49	-38	-39	-42	-44
MARATHWADA	-100	-90	-38	-4	-13	-12	-28	-40	-48	-50	-47	-42	-45	-49	-48	-52	-54	-55
VIDARBHA	-99	-90	-69	-37	-22	-13	-24	-38	-48	-43	-43	-31	-29	-33	-31	-33	-34	-37
COASTAL ANDHRA PRADESH	-95	-95	-87	-25	+14	+7	-7	-13	-29	-27	-29	-31	-35	-35	-31	-25	-23	-27
TELANGANA	-79	-73	-35	-16	+31	+30	+10	-6	-21	-25	-28	-25	-29	-35	-28	-36	-34	-34
RAYALASEEMA	-88	-40	+2	+47	+47	+45	+22	+2	-9	-27	-32	-38	-44	-49	-35	-15	-21	-19
TAMIL NADU (INCLUDING PONDICHERY)	-84	-64	-11	+23	+29	+27	+10	+1	-10	-22	-19	-24	-32	-35	-22	-11	-9	+9
COASTAL MYSORE	-95	-98	-84	-33	-11	-1	-7	-13	-17	-20	-19	-19	-20	-23	-23	-25	-26	-26
INTERIOR MYSORE, NORTH	-92	-59	-20	-15	+4	+13	-2	-17	-25	-28	-32	-34	-36	-40	-33	-27	-31	-31
INTERIOR MYSORE, SOUTH	-19	-46	0	-1	+10	+28	+11	-9	-11	-17	-19	-21	-23	-28	-23	-14	-16	-10
KERALA	-82	-69	-82	-59	-28	-15	-2	-9	-13	-12	-15	-14	-16	-18	-19	-19	-17	-15
ARABIAN SEA ISLANDS	-104	-92	-58	-6	+15	+3	-2	-5	-9	-11	-7	-9	-12	-15	-17	-12	-13	-11

Fig. 2

rani and Salandi were in floods. Thereafter, break monsoon conditions prevailed and the monsoon activity was revived only on 5 August. It was vigorous from 13th to 14th and 22 to 23 August in association with a deep depression that moved in from the north Bay on 12th and a low pressure area that moved from northwest Bay and adjoining coastal Orissa to south Uttar Pradesh. The monsoon was again active or vigorous from 10 to 12 September and 22 to 24 September in association with two severe cyclonic storms that formed in the Bay of Bengal and crossed the south Orissa coast during the weeks ending on 13 September and 27 September resulting in 49 per cent and 78 per cent excess rainfall during these two weeks. In the coastal districts of Orissa thousands of houses were reported damaged and loss due to the cyclone is estimated to be of several crores of rupees. 75 people are reported to have lost their

lives. The monsoon withdrew from the State by 3 October 1972. The total rainfall during the season was normal.

2.4. Bihar

The monsoon advanced into Bihar Plains on 22 June and in the Plateau on the next day as a weak current. This was about 10 days later than the normal date. It became active over Bihar Plateau under the influence of a severe cyclonic storm from the north Bay of Bengal which weakened into a low over this region on 15 July. In August monsoon was weak over Bihar Plains and somewhat better over the Plateau where fairly widespread rainfall occurred on 6th, 7th, 12th and 16th, 27th and 28th. In September also, the monsoon was weak except during the week ending on 13th when it became active on the Bihar Plateau and the week ending on 27th when it strengthened over

the Bihar Plains. The monsoon withdrew from the State on 30 September 1972. The season's rainfall was deficient over the Plains and normal over the Plateau.

2.5. Uttar Pradesh

The monsoon advanced into Uttar Pradesh by 25 June about a week later than the normal date as a rather feeble current. It strengthened during the week ending on 12 July but thereafter it was weak except during the weeks ending on 30 August and 20 September when it was active particularly over west Uttar Pradesh. The monsoon withdrew from west Uttar Pradesh on 18 September and from east Uttar Pradesh on 27 September. The season's rainfall was deficient over the plains and normal over the hills.

2.6. Haryana

The monsoon advanced into Haryana as a strong current on 27 June almost on the normal date of onset. It became vigorous during the week ending on 12 July. Thereafter, there was a lull in its activity till about the first week of August. The monsoon was very active since then till the end of August. It weakened thereafter and withdrew from the State on 6 September. The total rainfall during the season was normal.

2.7. Punjab

The monsoon advanced into the Punjab by 29 June almost on the normal date. It was vigorous between 6 and 12 July. Thereafter, its activity decreased until it revived again on 10 August under the influence of two Bay depressions that moved upto Rajasthan. It continued to be active till the end of August. Thereafter it weakened and the monsoon withdrew on 6 September. The total rainfall of the season was more or less normal.

2.8. Himachal Pradesh

The monsoon set in Himachal Pradesh on 27 June, more or less on time. It was active in the State during the week ending on 12 July, otherwise it was weak during the most of the season. The monsoon withdrew from the State on 6 September. There was, however, some rain during the second week of September in association with a western disturbance. The total rainfall of the season was below normal.

2.9. Jammu & Kashmir

The monsoon advanced into Jammu & Kashmir on 9 July as a strong current and remained active for a few days. Thereafter, it weakened and re-

mained so for about three weeks. Active monsoon conditions prevailed during the weeks ending on 9 and 30 August. Good rain fell during the week ending on 20 September also. The total rainfall of the season was slightly above normal.

2.10. Rajasthan

Unseasonal showers occurred in west Rajasthan during the first week of June. The monsoon advanced into southeast Rajasthan on 24 June, into southwest Rajasthan on 27th and the rest of the State by 30 June. It was active in west Rajasthan during the weeks ending on 12 July and 23 August and in east Rajasthan during the week ending on 16 August. Under the influence of a deep depression that moved from Bangla Desh and adjoining Gangetic West Bengal to east Rajasthan between 5 and 13 August, active or vigorous monsoon conditions prevailed in east Rajasthan between 9 and 11 August, resulting in floods in *Gambhir* and *Banganga* rivers on 9 and 10 August. According to reports, the flood waters overtopped the Ajan Bund in Bharatpur district and subsequently the bund breached at many places on 12 August and the flood waters flowed down to Chicksana Bund, which also breached on 13 August. The Baretta dam was also reported to have overtopped and damaged on 12 August. As a result of these breaches flood waters entered Agra district of Uttar Pradesh. According to the preliminary estimates the floods in Bharatpur and Sawai Madhopur area affected 3.7 lakh people and an area of 5.7 lakh hectares. 38,350 houses were also damaged. Rail and road communications were affected. The rainstorm of 9-12 August 1972 has been analysed by isohyetal method. The pattern of the 4-day rainstorm is shown in Fig. 3. The weighted rainfall depths for various standard areas are given in Table 1. The monsoon withdrew from the State on 6 September. The total rainfall of the season was deficient throughout the State and in east Rajasthan by as much as 43 per cent.

2.11. Madhya Pradesh

The monsoon advanced into southwest Madhya Pradesh on 22 June and the rest of the State by 24 June. It was active over the entire State during the fortnight ending on 12 July. Thereafter, break monsoon condition set in till the beginning of August. The monsoon became active again from 8 to 10, 13 to 19 and 22 to 30 August. The rivers *Tapi* and *Narmada* were in floods on 17 and 18 August. Monsoon became active over east Madhya Pradesh in the second week of September under the influence of a severe cyclonic storm from the Bay of Bengal which

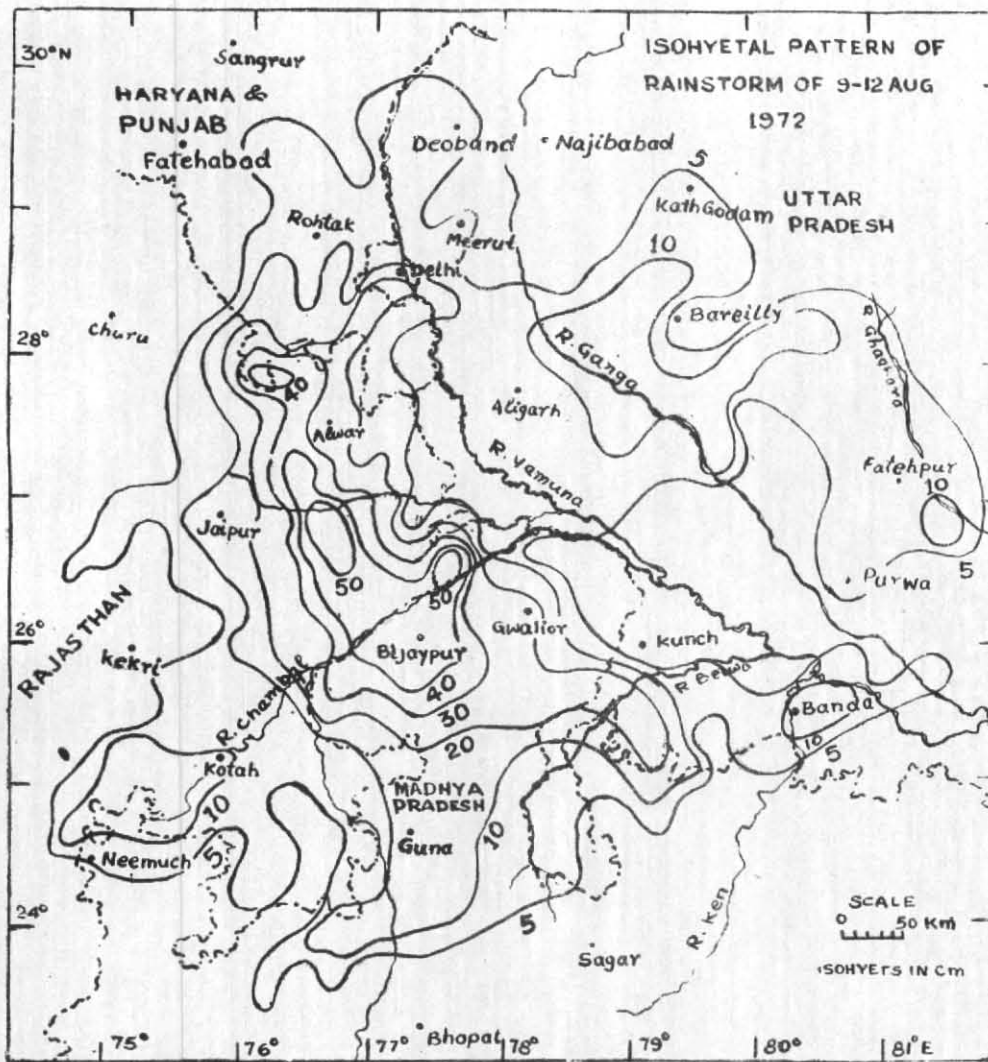


Fig. 3

TABLE 1

Area (sq. km)	Weighted rainfall depths (cm)	Area (sq. km)	Weighted rainfall depths (cm)
1,000	55.7	20,000	41.7
2,000	54.0	50,000	32.0
5,000	50.7	75,000	26.7
10,000	47.0	100,000	23.0

crossed the coast and dissipated over the hills of Uttar Pradesh. The river *Indravati* was in floods on

13 September disrupting road communications. The monsoon withdrew from west Madhya Pradesh on 18 September and from the east Madhya Pradesh during the last week of September. The total rainfall of the season was deficient over west Madhya Pradesh and more or less normal over east Madhya Pradesh.

2.12. Gujarat State

The monsoon advanced into the Gujarat State on 22 June as a weak current. It strengthened towards the end of June and remained active till the week ending on 12 July. Thereafter, except during the week ending on 23 August when vigo-

rous monsoon conditions prevailed over the Gujarat Region, the monsoon was very weak throughout the State. It withdrew from the State on 18 September. The total rainfall of the season was deficient by 41 per cent in the Gujarat Region and as much as 55 per cent in Saurashtra & Kutch.

2.13. Maharashtra

The onset of the monsoon over Konkan was delayed by about 10 days and it set in there on 20 June. It advanced over the rest of Maharashtra during the subsequent two days. It was very active over the Konkan during the fortnight ending on 5 July. It was fairly active over the rest of the State also during this period and normal activity continued during the next week also except in Marathwada where it was deficient. Then came a five-week long break in the monsoon activity over the State. There was a revival of the monsoon activity in the State during the third week of August, particularly over Vidarbha but it was far too inadequate to wipe out the deficiencies caused by the long break. Except during the week ending on 13th, rainfall in September also was highly deficient thus aggravating the earlier drought conditions. The monsoon withdrew from Maharashtra on 26 September. The total rainfall during the season was deficient throughout the State, the deficits being 32 per cent in Konkan, 44 per cent in Madhya Maharashtra, 55 per cent in Marathwada and 37 per cent in Vidarbha.

2.14. Andhra Pradesh

The monsoon advanced into the State as a fairly strong current during the week ending on 28 June under the influence of a low that moved from the west central Bay of Bengal to north coastal Andhra Pradesh on 27th. It continued to be active during the week ending on 5 July also. Thereafter, it weakened and except for a spurt in activity during the week ending on 13 September, and again to some extent during last week of September, the monsoon was very weak throughout the season. The total rainfall of the season was deficient in coastal Andhra Pradesh and Telangana and nearly normal over drought prone Rayalaseema.

2.15. Tamil Nadu (including Pondicherry)

There was good rainfall in the State during the second fortnight of June and normal rains occurred during the first fortnight of July also. Thereafter there was a long spell of deficient rainfall lasting till the first week of September. Rainfall during the rest of September was much

above normal. As a result the total rainfall for the season as a whole became normal.

2.16. Mysore

The monsoon which made a temporary advance into coastal Mysore on 16 May receded by 24 May. It revived only on 19 June and extended to the other parts of the State in the course of the next week. Thus the onset of the monsoon was delayed by about a fortnight. The monsoon was active over Mysore during the fortnight ending on 12 July. It weakened thereafter and remained weak throughout the season except during the fortnight ending on 20 September when Interior Mysore received good rains. The monsoon withdrew from north Interior Mysore on 9 October and from the rest of the State by 12 October. The season's rainfall was deficient in coastal and north Interior Mysore and normal in south Interior Mysore.

2.17. Kerala

The Arabian Sea branch of monsoon which temporarily advanced into Kerala on 16 May retreated from the State by 24 May. During the week ending on 17 May floods were reported from many parts of the State. Rainfall during the week was in excess by 559 per cent. The regular onset of the monsoon took place over the State only on 18 June, the latest onset during the past fifty years. Active monsoon conditions prevailed over the State upto 19 July. Thereafter the monsoon activity weakened and continued generally weak throughout the season except during the last week of September when active monsoon conditions prevailed. The total rainfall of the season was, however, more or less normal.

3. Floods

The number of major floods was comparatively small during the 1972 monsoon. The more important ones are detailed below.

(1) Floods were reported in Orissa during the middle of July as the result of a cyclonic storm from the Bay of Bengal which crossed the Orissa coast. The *Mahanadi*, *Brahmani*, *Baitarni* and *Salandi* crossed the warning stage. The floods are reported to have caused some loss of life and property in the Balasore and Keonjhar districts.

(2) Heavy rains occurred in the Assam region and Sub-Himalayan West Bengal during the second half of July when the eastern end of the monsoon trough moved to the foot of the Eastern Himalayas. The *Brahmaputra* crossed the warning stage on 20 July. Due to floods in the northern

districts of Assam and north Bengal extensive damage was reported to have occurred including the loss of ninety human lives.

(3) Heavy rains in east Rajasthan and adjoining areas occurred during the week ending on 16 August resulting in floods in the *Gambhir* and *Banganga* rivers. These floods caused breaches in several bunds and overflow of some lakes, inundating many villages. In Bharatpur and Sawai Madhopur districts of Rajasthan 3.7 lakh people are reported to have been affected and 38,350 houses damaged. A detailed account of this has already been stated in the Statewise discussion under Rajasthan.

(4) During the last week of August heavy rains occurred in the plains of west Uttar Pradesh, Haryana, Punjab and Madhya Pradesh. The river *Ghagra* in Uttar Pradesh crossed the warning stage. The river *Narmada* also crossed the warning stage at several points. Some districts of Madhya Pradesh and Broach and Baroda districts of Gujarat are reported to have been affected.

(5) The rivers of Orissa were in spate in the month of September when a severe cyclonic storm struck south Orissa and adjoining north Andhra coast on 10 September. In the coastal districts of Orissa and Andhra Pradesh many villages were inundated and thousands of houses destroyed. About 75 people are reported to have lost their lives. Damage due to this cyclone is estimated to be about 30 crores of rupees.

4. Droughts

As already mentioned earlier the 1972 monsoon season was characterised by severe drought conditions over many parts of India, particularly so in Maharashtra and Gujarat. Table 2 gives the meteorological sub-divisions of India where the total rainfall during the monsoon season was 20 per cent or more in deficit. The corresponding figures for these sub-divisions during the recent drought years of 1965 and 1966 are also given for comparison.

It is seen from Table 2 that drought conditions were more severe in 1972 than those in 1965 and 1966 in many of the sub-divisions, such as Maharashtra State, Gujarat State, east Rajasthan, Nagaland Manipur, Mizoram & Tripura, Andhra Pradesh, Coastal Mysore, north Interior Mysore, Sub-Himalayan West Bengal and Bihar Plains.

The past records show that in almost every year one part or the other of the country has

TABLE 2

Meteorological Sub-Division	Percentage departure from normal		
	1972	1965	1966
Marathwada	-55	-5	-6
Saurashtra & Kutch	-55	-33	-43
Madhya Maharashtra	-44	-8	-14
East Rajasthan	-43	-39	-38
Gujarat Region	-41	-45	-32
Bihar Plains	-40	-17	-49
Nagaland, Manipur, Mizoram & Tripura	-39	-7	+13
Vidarbha	-37	-32	-10
Telangana	-34	-7	-3
East Uttar Pradesh	-32	-41	-41
Konkan	-32	-20	-31
North Interior Mysore	-31	+9	-1
Sub-Himalayan West Bengal	-28	+10	-4
Himachal Pradesh	-28	-61	-7
West Rajasthan	-28	-42	-22
Coastal Andhra Pradesh	-27	-10	-3
Coastal Mysore	-26	-19	-23
Plains of West Uttar Pradesh	-24	-32	+4
West Madhya Pradesh	-22	-46	-30

been subject to droughts or floods owing to failure of monsoon or excessive monsoon activity. The years 1877, 1899 and 1918 are remembered as famine years due to failure of monsoon over a major portion of the country. Drought and scarcity conditions affected a number of States in 1905, 1915 and 1920 apart from the years 1965 and 1966. Again in 1972 the monsoon failed over a major portion of the country leading to widespread and acute drought conditions particularly in Maharashtra and Gujarat States.

5. Unusual meteorological situations that contributed to the deficient monsoon rains during 1972

The situations that were responsible for the deficient monsoon rains during 1972 are summarised below—

(i) The onset of monsoon over south Peninsula and northeast India was delayed by about a fortnight, over north Peninsula by about 10 days and over east Uttar Pradesh and central parts of the country by about a week. During the

last 50 years, the monsoon has not established itself in Kerala as late as it did during 1972.

(ii) There was a long break in the monsoon from the middle of July to the first week of August. Such long breaks in the monsoon and that too in the month of July are extremely rare.

(iii) The Arabian Sea branch of monsoon was generally weak almost throughout the season, primarily due to the absence of the normal mid-tropospheric vortex over Gujarat thus resulting in weak monsoon conditions over Maharashtra and Gujarat.

(iv) Though the number of monsoon depressions was more or less normal during the season, their tracks were a little more to the north than normal. Also, their activity was of a shorter duration and many of them filled up over the central parts of the country. This deprived Maharashtra, Gujarat and Rajasthan of a good portion of their normal rainfall which is received in association with the passage of these depressions over or near these States.

(v) The withdrawal of the monsoon was also one to two weeks earlier than normal over many parts of the country.