Weather

MONSOON SEASON (JUNE — SFPTEMBER 1969)

INTRODUCTION

The southwest monsoon which set in over south Kerala in the middle of May about a fortnight earlier than the normal date, in association with a cyclonic storm in the Bay which crossed Andhra coast on 17 May, advanced into the rest of the Peninsula and northeast India near about the normal date. Its advance into Madhya Pradesh and Uttar Pradesh was delayed by one to two weeks. However, the entire country was covered by the normal date — 15 July.

The activity of the southwest monsoon this year was good and sustained over most parts of the country. Of the various low pressure systems which maintained the activity of the monsoon, one developed into a cyclonic storm in the Bay of Bengal and six into depressions — five in the Bay of Bengal and one in the Arabian Sea. The tracks of these disturbances are shown in Fig. 1. It was mostly in association with these systems that the heaviest monsoon rainfall occurred resulting in floods in practically all the States of north India and in Maharashtra State, particularly in August and September. Heavy rain in Kerala in the last week of July caused floods in that State. As most of the depressions in the Bay did not reach sufficiently west, the monsoon rainfall in Jammu and Kashmir, west Rajasthan and Gujarat State was deficient. Although during the last 10 days of August the monson was generally weak in northwest India, Gujarat State and central parts of the country, the lack of break in the monsoon this year contributed to the deficient rainfall in Tamil Nadu.

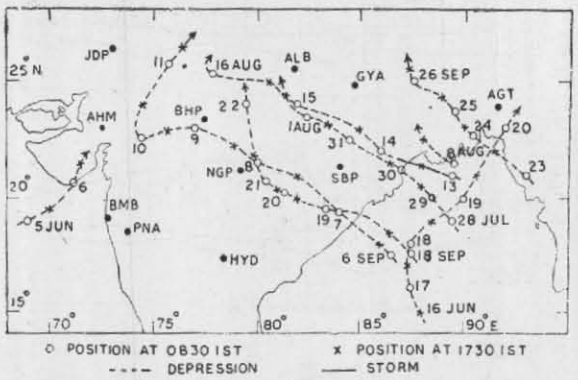

Fig. 1. Tracks of storms/depressions during June-September 1969

The withdrawal of the monsoon from northwest India commenced in the middle of September and by 1 October 1969, it had withdrawn from northwest India, Uttar Pradesh, Madhya Pradesh, Gujarat and Maharashtra States, which is nearly the normal date of withdrawal of the monsoon from these areas.

The total rainfall for the period from 1 June to 30 September 1969 in terms of departures from normal is shown in Figs. 2(a) and 2(b). The progress of the monsoon over the various subdivisions in India month by month, is given in Fig. 3. The important features of the weather are given below month by month.

JUNE

Under the influence of a cyclonic storm that formed in the central Bay and crossed Andhra coast in the middle of May, the southwest monsoon advanced as a feeble current into south Kerala on 17 May, about a fortnight earlier than the normal date. The monsoon did not advance further for about a week. It strengthened over south Kerala on 25 May and advanced into north Kerala on 26 May. On 1 June the northern limit of the monsoon was passing through Karwar, Nellore and Cox's Bazar.

A well marked trough of low pressure was lying off the west coast in the beginning of June. A depression formed in this trough off north Maharashtra–south Gujarat coasts on 5 June, moved northeastwards and weakened over Gujarat region by 7th. These caused the advance of the monsoon into Maharashtra State and south Gujarat State in the first week. A low pressure area which formed over northwest Bay and adjoining Orissa on 3rd moved to Gangetic West Bengal and adjoining Bihar State and later moved away

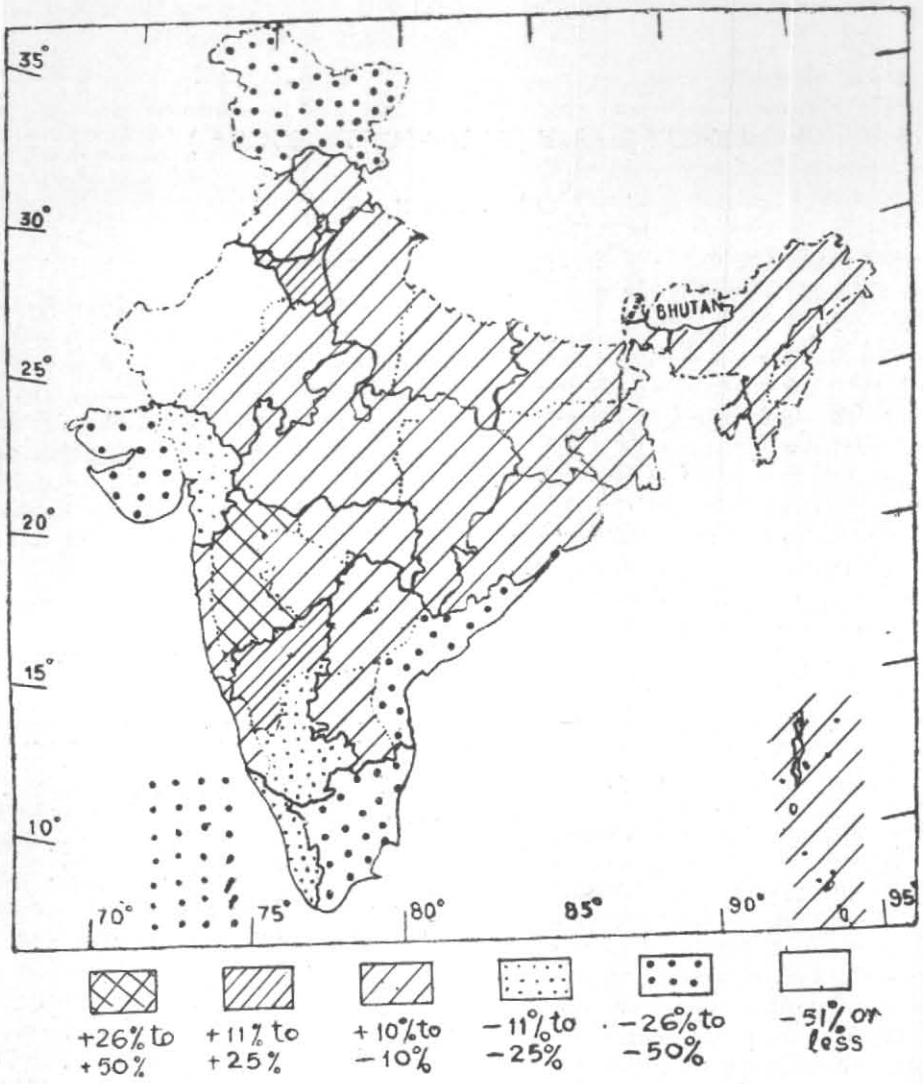

Fig. 2(a). Rainfall for the period 1 June to 30 September 1969
(Percentage departure from normal)

northeastwards across Assam by 8th evening causing the advance of the monsoon into entire northeast India. On 7 June, the northern limit of the monsoon was passing through Porbandar, Baroda, Nagpur, Jharsuguda and Motihari. The monsoon did not make any further advance till the end of the month and its advance into Madhya Pradesh and Uttar Pradesh was consequently delayed by 10 to 15 days.

Over the sea area, the monsoon advanced into Andaman Sea, south and east central Bay and southeast Arabian Sea between 13 and 31 May and covered the central Arabian Sea and rest of the Bay of Bengal in the first week of June.

The monsoon trough over northeast India was lying close to the foot of the Himalayas from 8 to 14 June causing heavy rains in Assam and sub-Himalayan West Bengal and resulting in floods in those areas during this period. A depression which formed in the central Bay on 16th evening moved initially north and then northeast towards south Assam by 20th, weakened and merged with the seasonal trough over Assam the next day, which in turn became well marked from 21st to 23rd and caused heavy rain and another spell of floods in Assam and sub-Himalayan West Bengal during that period. The floods in Assam are reported to have caused

serious damage to standing crops and other property.

The monsoon was generally weak on most of the days along the west coast, Gujarat State, Orissa , Gangetic West Bengal and Bihar Plateau from 8th to 18th. However the monsoon was active along the west coast and in Madhya Maharashtra on a few days during the last 10 days of the month in association with troughs of low pressure which formed in the east central Arabian Sea off the west coast during that period.

Three western disturbances moved across northwest India during the periods 2nd to 6th, 10th to 12th and 28 to 30 June causing scattered precipitation in northwest India and Uttar Pradesh. The seasonal low pressure area over West Pakistan was marked from 20th to 22nd causing scattered duststorms in Haryana, Punjab and Rajasthan on those days. According to press reports, the duststorms in Barmer district dislocated rail traffic betweer Barmer and Jodhpur with sand covering the rail track at some places upto a depth of 3 ft.

Some of the noteworthy amounts of very heavy rainfall during this month were 21 cm at Long Island and 19 cm at Maya Bandar on 1st; 16 cm at Balasore on 6th; 16 cm at Cooch Behar on 14th; 18 cm at Dahanu on 20th; 16 cm at Haflong on 22nd ; 15 cm at Calicut on 23rd, 18 cm at Panjim (Goa) on 23rd ; and 19 cm at Dabolim (Goa) and 15 cm at Santacruz on 29th.

The daily maximum temperatures were 4-5°C above normal (1) in north Assam and sub-Himalayan West Bengal on the first two days ; (2) in many parts of Madhya Pradesh and Uttar Pradesh, between 7th and 19th ; (3) in Madhya Pradesh, Uttar Pradesh, east Rajasthan and Vidarbha during the last 10 days, being 6–8°C above normal in most parts of Madhya Pradesh and the adjoining parts of east Rajasthan and Vidarbha; and (4) in Bihar Plateau, Orissa and the interior part of Gujarat and Maharashtra States on some days in the last week.

JULY

Three troughs of low pressure which formed off the west coast in the first fortnight kept the monsoon geenerally active along the west coast during this period. The trough of low pressure which formed in the east central Arabian Sea off Kerala coast on 11th, shifted gradually northwards, became well-marked off north Maharashtra–south Gujarat coasts on 15th, shifted further northwards across Saurashtra–Kutch and merged with the seasonal low over West Pakistan on 18th. This caused the advance of the monsoon into the rest of the Arabian Sea and into north Gujarat State by 15th.

Under the influence of an upper air cyclonic circulation in the lower troposphere lying over northeast Madhya Pradesh and adjoining east Uttar Pradesh, the monsoon advanced into east Madhya Pradesh and east Uttar Pradesh on 1st. It advanced into west Uttar Pradesh and west Madhya Pradesh by 8th and into northwest India by 15th in association with a low pressure area which formed in northwest Bay on 2nd, moved to south Uttar Pradesh and adjoining north Madhya Pradesh by 7th, persisted there till 13th and moved further northwest into Haryana by 14th. The monsoon thus covered the entire country by 15 July.

A trough of low pressure lying in southwest Bay off Tamil Nadu–Ceylon coasts from 9th to 11th caused good rainfall in Tamil Nadu between 10th and 12th.

There was heavy rain in Assam between 8th and 11th and in Bihar Plains, sub-Himalayan West Bengal and Assam between 14th and 17th. These two spells of heavy rain are reported to have caused floods in north Assam including NEFA resulting in heavy damage to standing crops and houses. The rivers in north Bengal and north Bihar also were in spate and affected Champaran, Purnea and Jalpaiguri districts.

The monsoon was fairly active in many parts of north India in the second fortnight in association with the formation and movement of (1) a low pressure area from west central Bay to east Madhya Pradesh between 13th–16th; (2) a low pressure area from central Uttar Pradesh and adjoining north Madhya Pradesh to the southern divisions of West Pakistan and adjoining north Arabian Sea across south Rajasthan and Gujarat State between 17th–23rd; (3) two low pressure areas in quick succession from head Bay of Bengal to Bihar Plateau and adjoining Madhya Pradesh between 18th–22nd ; and (4) a depression from northwest Bay to north Orissa from 28th to 31st. The heavy rains associated with the good monsoon activity casued floods in some part of Punjab, Uttar Pradesh and Rajasthan, in many districts of Orissa and in Jagdalpur during

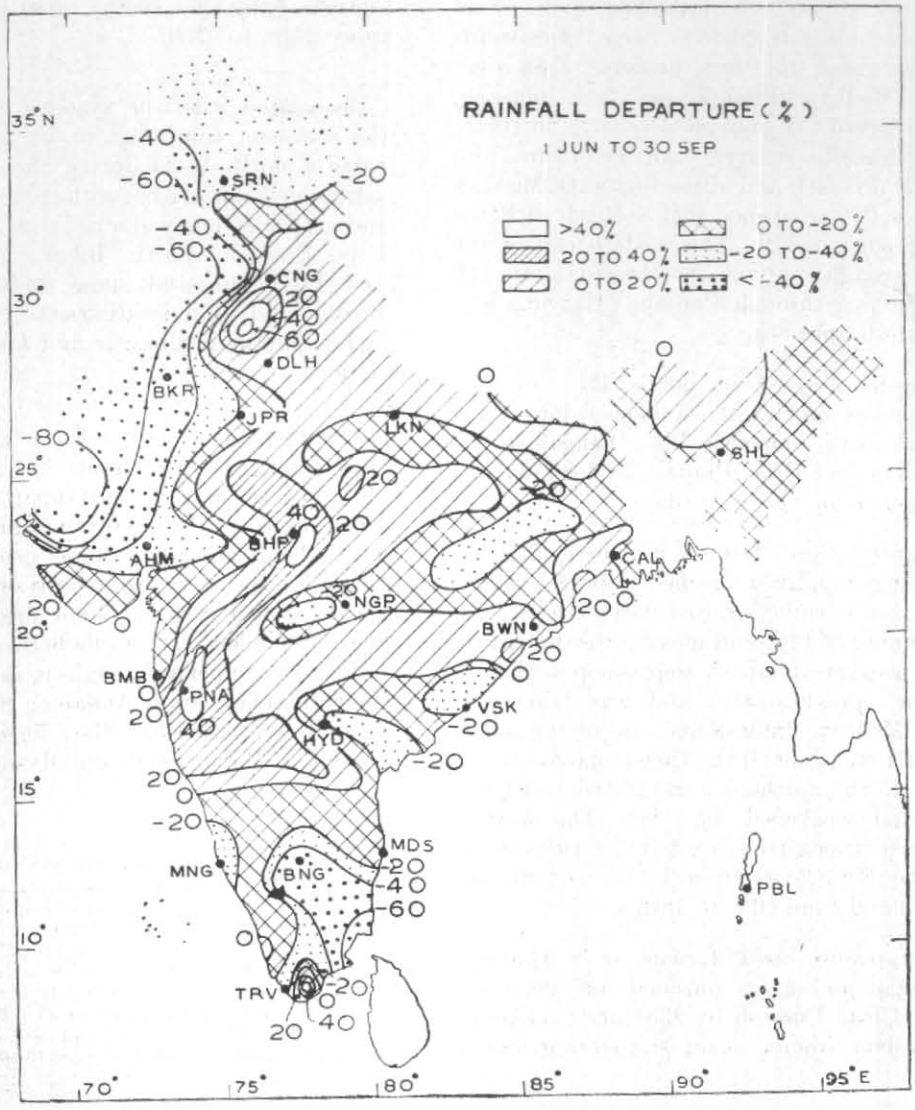

Fig. 2(b). Percentage departure from normal of rainfall occurred during the period 1 June to 30 September 1969

the second fortnight.

Active to vigorous monsoon conditions prevailed in Maharashtra and Mysore States and in Kerala in the last week of July 1969. According to press reports, the heavy rains and strong winds in Kerala caused many house collapses and floods in the local rivers. Malappuram and Kottayam were the worst affacted districts. The heavy rains in Maysore State caused floods in the *Netravathi* and other rivers and landslides in the Ghats. South Kanara was the worst affected district.

The noteworthy amounts of very heavy rainfall during the month were 19 cm at Ratnagiri and 17 cm at Harnai on 2nd ; 20 cm at Santacruz on 3rd ; 16 cm at Azamgarh on 10th ; 19 cm at Panjim (Goa) on 12th ; 16 cm at Honavar and 15 cm at Ratnagiri on 12th ; 20 cm at Mangalore (AP) and 17 cm at Ratnagiri on 14th ; 25 cm at Porbandar and 17 cm at Pasighat on 16th ; 17 cm at Azamgarh, 16 cm at Gorakhpur and 15 cm at Cooch Behar on 17th ; 16 cm at Dehri ond 15 cm at Kota (AP) on 18th ; 18 cm at Mahabaleshwar on 21st ; 22 cm at Mahabaleswhar, 19 cm at Dwarka and 16 cm at Okha on 22nd ; 16 cm at Mercara on 23rd and 25 cm on 24th ; 17 cm at Fort Cochin and 15 cm at Alleppey on 24th ; 16 cm at Ferozepore on 26th ; 17 cm at Puri on 29th ; 28 cm at Bhubaneshwar on 30th ; 15 cm at Puri and 15 cm at Bhira on 30th ; and 31 cm at Mahabaleshwar and 16 cm at Bhira on 31st.

AUGUST

The depression which was lying in north Orissa on 31 July moved northwestwards and weakened into a low pressure area on the morning of 2 August over northeast Madhya Pradesh and adjoining southeast Uttar Pradesh. On the same morning a cyclonic circulation in the lower

and middle troposphere developed over East Pakistan and neighbourhood, moved westwards and accentuated the low pressure area over northeast Madhya Pradesh on 3rd morning. This well-marked low pressure area over northeast Madhya Pradesh moved northwestwards to south Uttar Pradesh and adjoining north Madhya Pradesh on 4th, weakened and merged with the monsoon trough on 5th. The western end of the monsoon trough shifted northwards on 5th and was passing through Punjab, Haryana and Uttar Pradesh upto 8th.

A depression formed in north Bay on 8th morning, moved northwest , weakened into a low pressure area over Gangetic West Bengal on 9th and moved to west Uttar Pradesh by 12th evening and weakened on the next day.

Another depression formed in north Bay on 13th morning, rapidly intensified intto a cyclonic storm by that evening, crossed north Orissa coast on the morning of 14th and moving westnorthwest gradually weakened into a depression and then into a low pressure area and was lying over northwest Madhya Pradesh and adjoining southwest Uttar Pradesh on 16th. Then it moved northeastwards to the northern parts of central Uttar Pradesh and weakened on 18th. The western end of the monsoon trough was lying close to the foot of the Himalayas from 17th to 20th and the eastern end from 16th to 18th.

A low pressure area formed over Gangetic West Bengal and neighbourhood on 20th and moved to Uttar Pradesh by 23rd and weakened. The monsoon trough again shifted northwards and was lying close to the foot of the Himalayas from 25th to 27th.

Associated with the systems mentioned abve, the monsoon continued to be active over most parts of north India during the first 3 weeks resulting in floods in most of the rivers in north India and affecting many districts in Madhya Pradesh, Uttar Pradesh, north Bihar, north Bengal and east Rajasthan and some districts of Punjab, Broach and Baroda districts of Gujarat State and Lakhimpur, Sibsagar and Cachar districts of Assam.

During the last 10 days of the month, the monsoon was generally weak in northwest India, Gujarat State and the central parts of the country. However, there was good rainfall in the Peninsula, Bay Islands and the Arabian Sea Islands during this period, mainly in association with the westward movement of (1) a low pressure area across the extreme south Peninsula between 16th and 21st and (2) two upper air troughs in the lower and middle troposphere from Andaman Sea to the Peninsula between 21st and 31st. There was also good rainfall in Maharashtra and Mysore States in the first week.

Some of the noteworthy amounts of very heavy rainfall were—22 cm at Jabalpur on 1st ; 19 cm at Dharmsala on 3rd; 21 cm at Mussoorie on 5th; 21 cm at Najibabad on 6th; 23 cm at Chandbali and 19 cm at Jharsuguda on 14th; 35 cm at Jhalawar on 17th; 15cm at Agartala on 18th;15cm at Dharmsala on 19th; 39 cm at Bahraich and 23 cm at Kheri on 20th; and 16 cm at Lucknow (Amausi) on 23rd. In the Peninsula, Mahabaleshwar recorded 28 cm of rain on 1st, 20 cm on 4th, 19 cm on 5th; Bhira 23 cm on 1st and Coonoor 19 cm on 18th. In the Bay Islands, Kondul recorded 16 cm of rain on 23rd.

SEPTEMBER

The monsoon revived in northwest India, central parts of the country and Gujarat State in the course of the first fortnight in association with the formation of a depression in the Bay on 6th about 400 km east of Visakhapatnam and its movement to Gujarat Region by 10th and recurvature to east Rajasthan by 12th. In association with this depression and an east–west trough in the lower and middle troposphere that was lying over north Peninsula roughly along 17°N from 1st to 6th, there was good monsoon activity in north Peninsula during the first 10 days. According to press reports, the heavy rains in Maharashtra State caused floods in the *Godavari* and three other rivers inundating vast areas in Nander, Parbhani and Aurangabad districts of Marathwada. The flood waters of the *Narmada* and the *Tapti* and other rivers in south Gujarat inundated vast areas in Dhulia and Jalgaon districts and many districts in south Gujarat; the worst affected districts being Surat, Baroda and Broach. There were also floods in Alwar district of east Rajasthan caused by breaches in many dams and irrigation tanks.

A trough in the middle and lower troposphere was extending from east central Bay to north Andaman Sea from 11th to 14th causing widespread rain with scattered heavy falls in the Bay Islands during this period. Another depression formed in the Bay on the morning of 18th about 450 km east of Visakhapatnam, crossed south Orissa coast on that night and moved to north Madhya Pradesh by 22nd, weakened into a low pressure

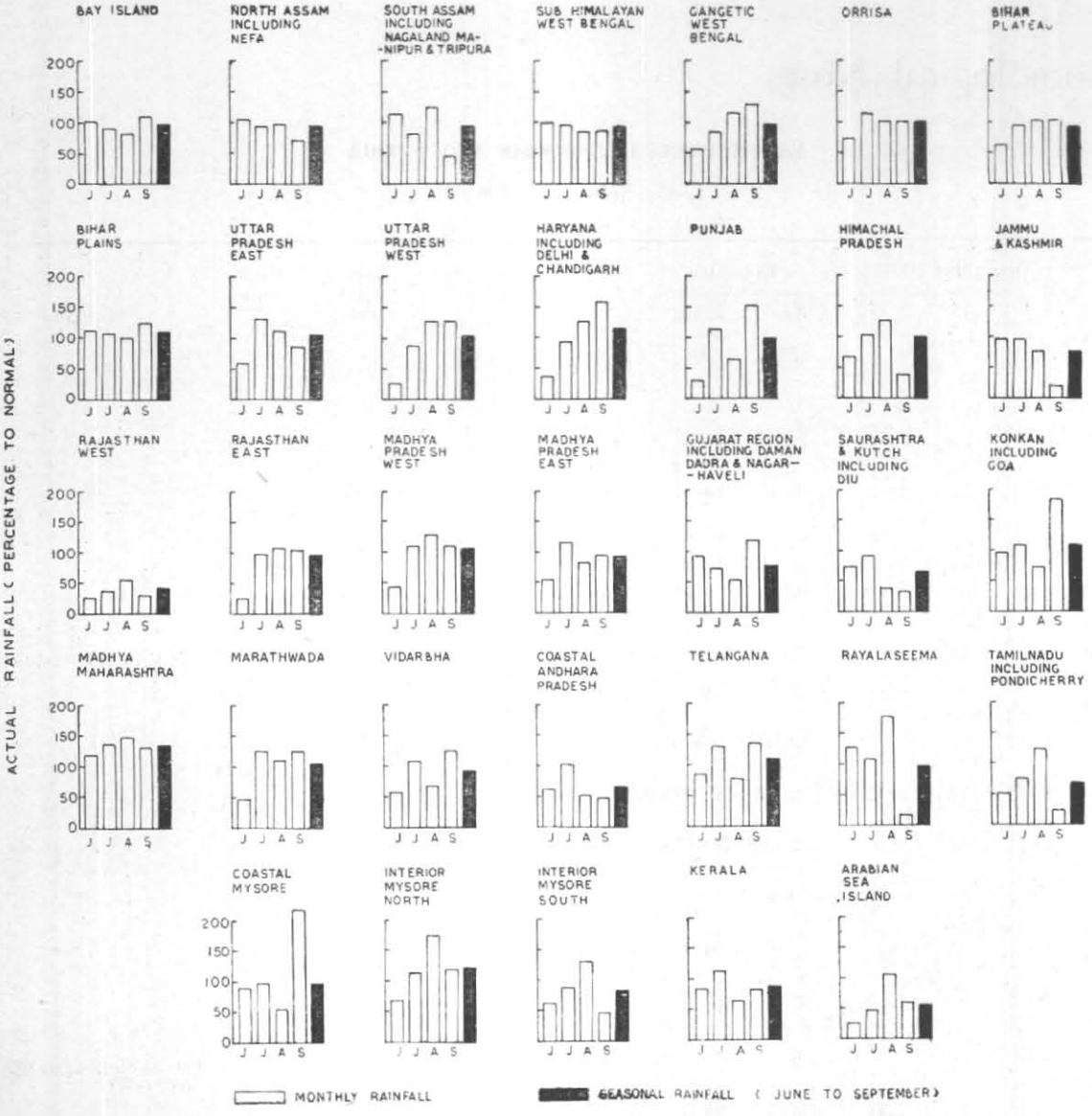

Fig. 3. Progress of monsoon month by month, June to September 1969

area and moved further north to Uttar Pradesh by 24th and became less marked by 26th. This system caused good monsoon activity on some days in northeast India, Madhya Pradesh, Uttar Pradesh and north Peninsula during the period 18th to 23rd. The heavy rain in Telangana was reported to have caused floods in the *Godavari* which inundated low lying areas in Bhadrachalam. Floods were also reported in the *Wainganga* and other rivers in Vidarbha. Northeast India had another spell of good rain from 25th to 27th when a deep depression which formed near Akyab on 23rd morning moved northwestwards across East Pakistan to sub-Himalayan West Bengal and adjoining Bihar Plains by 26th and weakened into a low pressure area on 27th.

The noteworthy amounts of very heavy rainfall during this month were 15 cm at Mahabaleshwar on 1st; 26 cm at Ratnagiri on 2nd; 17 cm at Dhanu on 5th; 18 cm at Gulbarga on 6th; 17 cm at Harnai and 15 cm at Devgarh on 7th; 22 cm at Alwar and 15 cm at Surat on 10th; 20cm at Patiala and 17 cm at Baroda on 11th; 16 cm at Maya Bandar on 12th; 20 cm at Hut Bay on 13th; 15 cm each at Jagdalpur and Gopalpur on 19th; and 18 cm at Bareilly and 17 cm at Nainital on 23rd.

The southwest monsoon withdrew from west Rajasthan and Punjab from 17th, from the rest of northwest India by 25th, from west Uttar Pradesh, west Madhya Pradesh and Gujarat State by 27th and from Maharashtra State and the rest of Madhya Pradesh and Uttar Pradesh by the end of the month which is nearly the normal date of withdrawal from these areas.