Indian J. Met. Geophys. (1974), 25, 2, 317-323

Weather

POST MONSOON PERIOD (OCTOBER—DECEMBER 1973)

CHIEF FEATURES

Cyclonic storms/depressions

Four cyclonic storms and two depressions formed in the Bay of Bengal and one depression in the Arabian Sea during the post-monsoon period. Their tracks are shown in Fig. 1. Of the four cyclones, two attained severe intensity. The cyclones during this period took generally a northerly course and did not cause any serious damage to life or property in the country except the Chandbali cyclone of 6-12 October. The rain storm associated with this cyclone caused very heavy rain and floods in Orissa leading to some loss of life and damage to standing crops and houses. In the wake of the Barisal cyclone of 5-9 December, M.V. *Sonavati* sank in the Bay of Bengal. Damage to crops was also reported from the coastal districts of West Bengal.

Withdrawal of southwest monsoon

The southwest monsoon withdrew from east Uttar Pradesh, most parts of Madhya Pradesh, Gujarat and Maharashtra States by 10 October and from northeast India and the rest of the north Peninsula by the middle of October.

Western disturbances

Eighteen western disturbances moved eastwards across northwest India during this period; 5 in October, 6 in November and 7 in December. The western disturbances which affected northwest India in December, caused normal to excess rainfall in the plains of northwest India.

Rainfall

The rainfall during this season was normal to excess generally over the Peninsula, northeast India, east Uttar Pradesh, east Madhya Pradesh, west Rajasthan, Punjab, Haryana, the hill of west Uttar Pradesh, Lakshadweep and Bay Islands. It was deficient or scanty over the rest of the country. The total rainfall over the country for the period 1 October 1973 to 31 December 1973 in terms of percentage departure from normal is shown in Figs. 2(a) and 2(b).

Temperature

A severe and prolonged cold spell prevailed in north India in the second half of December. A few stations in Rajasthan recorded night temperature below freezing point in the last week of December. Day temperatures were also 8 to 11°C below normal in Punjab, Haryana and the adjoining parts of Rajasthan and west Uttar Pradesh on many days in the last two weeks of December. About 250 persons were reported to have died on account of this cold spell, mostly from Uttar Pradesh and Bihar. Some damage to standing crops was also reported from these areas.

The important features of weather during each month were as follows.

OCTOBER

The southwest monsoon withdrew from Gujarat State and northwest Madhya Pradesh by 3 October, from east Uttar Pradesh, southwest and northeast Madhya Pradesh and Maharashtra State by 10th, from southeast Madhya Pradesh, Bihar State and Sub-Himalayan West Bengal by 15th and from the rest of the country outside south Peninsula by 16 October.

A cyclonic storm developed in the central Bay of Bengal in the second week. Moving initially northwards and later northnorthwestwards, it crossed Orissa coast close to and north of Chandbali around midnight of 11th. Continuing to move northnorthwest, it weakened into a trough over north Bihar and neighbourhood by the morning of 13th. This system caused generally widespread rain with scattered heavy to very heavy falls in Orissa, West Bengal and Bihar State between 11th and 13th. Fairly widespread rain also occurred in Bay Islands from 4th to 11th and in Assam and adjacent States on 11th and 12th. This storm caused very heavy rain in Orissa. Four stations in Orissa

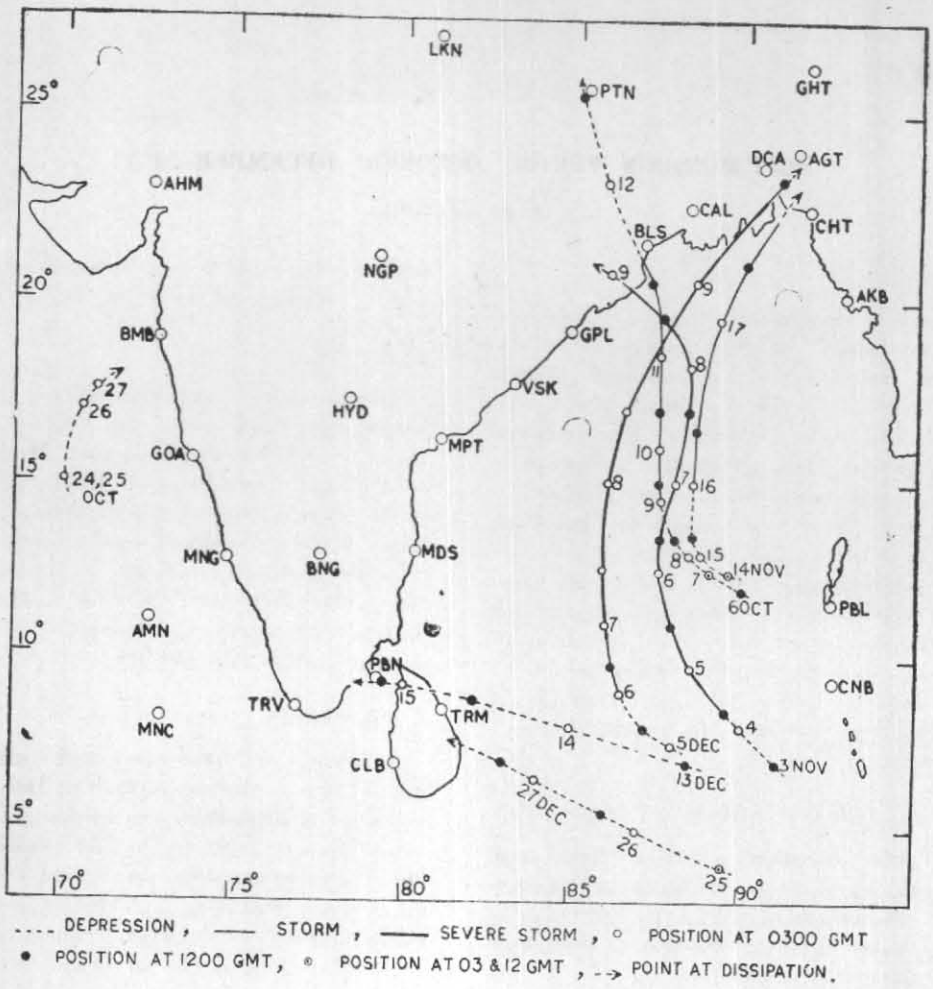

Fig. 1
Tracks of storms/depressions during October-December 1973

recorded more than 40 cm of rain each on 12th. According to press reports, about 1·5 million people were affected by floods in Orissa. More than 60,000 houses were damaged in north Orissa. Road, rail and telecommunication links were disrupted and a number of bridges were damaged. Floods due to heavy rain and saline water inundation due to mild tidal waves in the coastal areas, affected vast areas of agricultural land in Orissa. Less than a hundred persons were reported to have lost their lives, while the toll of cattle was reported to be rather heavy in that State. Heavy rain in Bihar was also reported to have damaged flowering paddy crops over some areas of the State. The coastal areas of West Bengal were also reported to have been affected by saline water inundation and floods in rivulets.

A low which lay off Kerala-Mysore coasts on 22nd, moved northwest and concentrated into a depression in east central Arabian Sea on 25th. Recurving northnortheast later, it weakened into a low off Maharashtra coast by 27th evening. From this system, a trough extended northeastwards in the lower troposphere to northeast India across Maharashtra State and Madhya Pradesh during the above period. In association with these systems, fairly widespread rain occurred in the Peninsula, Madhya Pradesh and many parts of northeast India between 23rd and 29th.

An east-west trough between 0·5 and 4·5 km a.s.l. lay over Maharashtra State from 1-3 October and a sea level trough off Mysore-Maharashtra coasts from 4th to 7th. A well marked low moved from central Bay to west Madhya Pradesh between 1st and 5th. The low weakened on 6th but the associated cyclonic circulation extending upto 4·5 km a.s.l. moved to east Rajasthan on that day. On 7th, the circulation weakened into a trough

extending from Punjab to Maharashtra State. Subsequently this trough moved eastwards and extended from central Uttar Pradesh to north Maharashtra on 8th and became unimportant on 9th. In association with these systems, there was scattered to fairly widespread rain with isolated heavy falls in north Peninsula and many parts of north India from 1st to 9th. Heavy rain in Uttar Pradesh and Bihar was reported to have caused floods, resulting in some damage to standing crops in those States.

In association with a few troughs in the low level easterlies moving across the Peninsula, there was good rainfall in many parts of the Peninsula during the second and third weeks. Scattered or isolated heavy falls occurred in Kerala on many days between 13th and 21st and in Tamil Nadu and Andhra Pradesh between 20th and 22nd.

Bay Islands had another spell of rainfall in the last week in association with low level troughs lying over the Andaman Sea. Orissa, West Bengal, Bihar, Uttar Pradesh, east Madhya Pradesh and the Peninsula had normal to excess rainfall during the month.

Five western disturbances moved eastwards across northwest India during the month causing generally scattered rain or thundershowers in the Western Himalayas and the adjoining plains. The rainfall was normal to excess in Punjab, Haryana and the hills of west Uttar Pradesh and deficient or scanty over the rest of northwest India for the month.

The principal amounts of heavy rainfall during the month were :

Date	*Station*	*Rainfall* (cm)
1	Ramgundam	12
	Balasore	10
2	Narasapur (Andhra)	13
	Bhimavaram (Andhra)	11
3	Darjeeling	13
4	Gonda	21
	Ramgundam	10
7	Tezu	12
9	Car Nicobar	12
11	Nilagiri (Orissa)	35
12	Baripada	47
	Chandbali	44
	Rajkanika (Orissa)	42
	Bhadrak (Orissa)	41
	Balasore	26
	Ranchi	18
	Hazaribagh, Dhanbad	14 each
	Monghyr, Jamui, Paradeep	12 each
	Kalimpong, Darjeeling	11 each
	Bankura, Purulia	10 each
13	Coochbehar	25
	Raxaul	23
	Darjeeling, Chapra	21 each
	Patna, Jalpaiguri	16 each
	Purnea	14
	Mannarghat (Kerala)	13
14	Coimbatore	13
20	Kanchipuram (T. Nadu)	10
21	Vedaranniyam	16
	Thumba	12
22	Avaniguda (Andhra)	17
	Woolapalem, Agumbe, Masulipatam	13 each
	Ongole	10
24	Contai	10
26	Mannarghat (Kerala)	12
27	Rapur (Andhra)	10
30	Kumbhakonam (T. Nadu)	13
	Mannargudi (T. Nadu)	11
31	Punalur	10

Day temperatures were appreciably to markedly below normal in Uttar Pradesh and Haryana from 4th to 7th. Night temperatures were appreciably below normal in many parts of Gujarat State and Rajasthan on many days between 3rd and 10th, being markedly so in Rajasthan on 4th.

NOVEMBER

A depression formed over southeast Bay on 3rd evening. Moving northwest, it intensified into a severe cyclone by 5th. Then moving practically northwards upto 7th and later northwestwards, it crossed Orissa coast near Paradeep on the early morning of 9th. It weakened rapidly and lay as a trough over Orissa the same evening. This system caused widespread rain with isolated heavy falls in Bay Islands from 4th to 6th and scattered to fairly widespread rain in many parts of northeast India from 8th to 10th. This cyclone was reported to have caused some damage to standing crops in the coastal districts of Orissa between Paradeep and Chandbali. There was saline water inundation in Uttar Sumiti and Jamboo area of Mahakalpara Block, but the saline water receded quickly.

Another depression developed in southeast Bay on 14th. Taking practically a northerly course, it

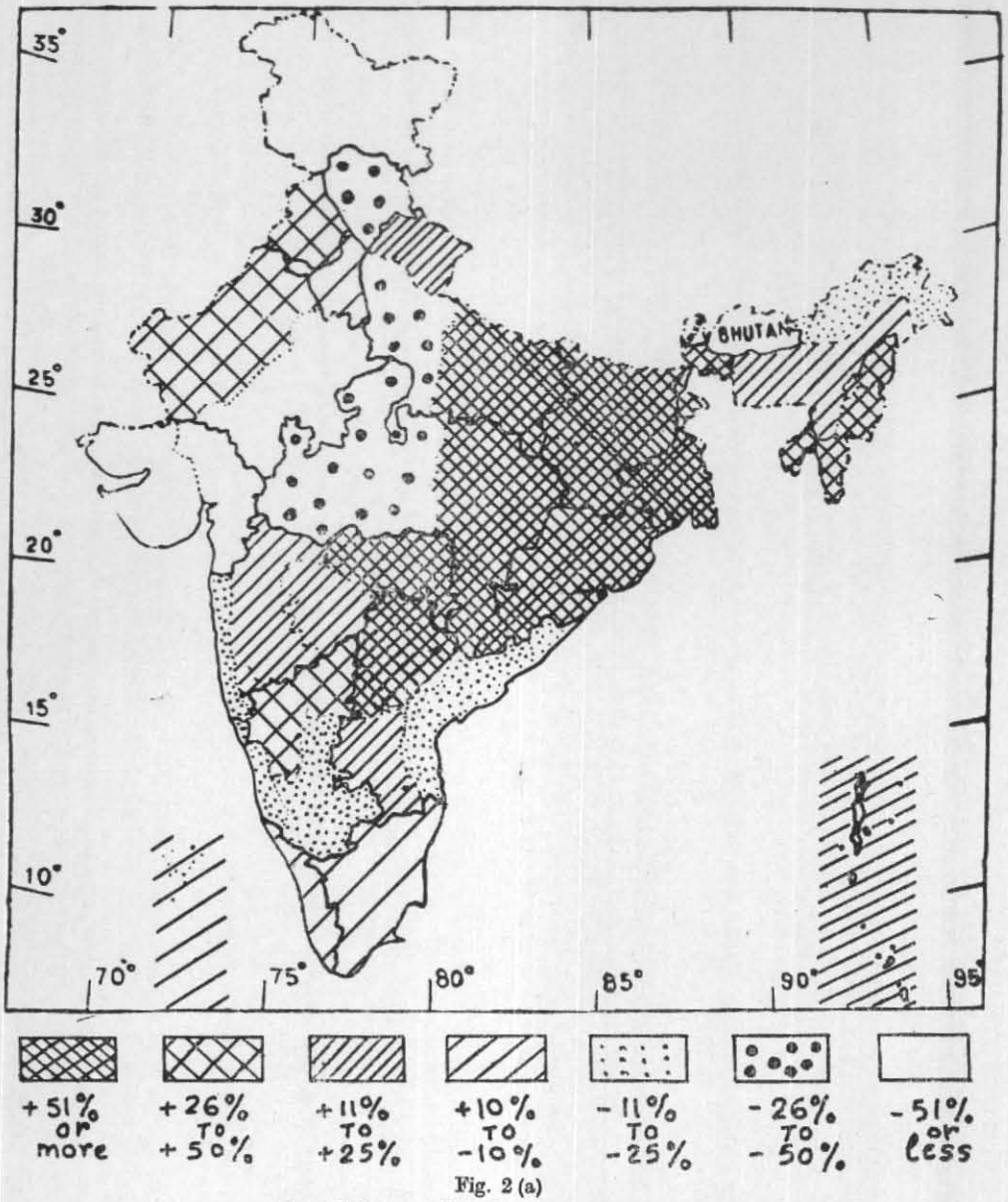

Fig. 2 (a)

Rainfall for period 1 October to 31 December 1973

(Percentage departure from normal)

became a cyclonic storm on 16th. Subsequently recurving northnortheastwards, it crossed Bangla Desh coast near Hatia as a depression on the early morning of 18th and became unimportant on 19th. A trough in the middle tropospheric westerlies moved eastwards across northeast India between 17th and 20th. Under the influence of these systems, there was fairly widespread rain or thundershowers in Assam and adjacent States on 18th and 19th. Scattered rain or thundershowers occurred in Orissa, West Bengal and Bihar State on 17th and 18th. Bay Islands also had fairly widespread rain from 12th to 18th with isolated heavy falls on 14th.

The seasonal trough extending from Tamil Nadu to Andaman Sea was well marked from the 1st to 4th. Another trough in the lower troposphere extended from Lakshadweep to coastal Maharashtra during the same period. Under the influence of these systems, there was a spell of good rainfall in Bay Islands, south Peninsula and Lakshadweep during this period.

Two troughs in the lower tropospheric easterlies moved westwards across the Peninsula between 10th and 17th, causing scattered rain or thundershowers in south Peninsula and isolated thundershowers in north Peninsula on some days between 12th and 19th.

A trough of low lay off Tamil Nadu-Sri Lanka coasts from 24th to 29th and another over Lakshadweep from 26th to 28th. These caused scattered or isolated rainfall in the south Peninsula from 24th to 29th, the rainfall being fairly widespread in Tamil Nadu on 26th. The rainfall in the Peninsula was deficient or scanty for the month.

A cyclonic circulation in the lower troposphere lay over northeast India from 1st to 6th. A trough in the westerlies in the middle and upper troposphere lay over Bihar and neighbourhood upto 5th and moved eastwards across northeast India by 6th evening. These systems caused a spell of good rainfall in Assam and adjacent States on many days and in the rest of northeast India on a few days in the first week.

In association with six western disturbances which moved across northwest India, there was only scanty precipitation in the Western Himalayas. The plains of northwest India had no rainfall during the month.

The principal amounts of heavy rainfall during the month were :

Date	*Station*	*Rainfall* (cm)
1	Nellore	15
	Nagapattinam	1
	Cochin	11
	Nedumangad	9
	Woolapalem	8
2	Tuticorin	10
	Rapur (Andhra Pradesh)	7
4	Car Nicobar, Kakinada	10 each
	Tiruvur	8
	Ziro	7
5	Maya Bandar	13
	Port Blair	8
6	Maya Bandar	7
8	Cherrapunji	13
9	Cherrapunji	13
14	Hut Bay	9
	Maya Bandar	7
15	Cuddalore	10
16	Kunnamkulam (Kerala)	14
	Thumba	10
18	Haflong	11
	Agartala, Kailashahar	8 each
19	Srivalliputtur, Tuticorin	8 each
25	Pondicherry	9
26	Nagapattinam	7
27	Pamban	9
29	Vedaranniyam	11

Night temperatures were appreciably below normal in interior Maharashtra from 5th to 10th and again on 18th and 19th, in Interior Karnataka from 7th to 10th, again on 19th and 20th and in Rajasthan from 11th to 20th. They were appreciably to markedly above normal in many parts of northeast India on many days in the second and third weeks and in east Madhya Pradesh, Telangana and interior Maharashtra between 11th and 16th.

DECEMBER

The outstanding feature of the month was the prevalence of a severe and prolonged cold spell in many parts of north India in the second half of the month. A few stations in Rajasthan recorded night temperatures below freezing point in the last week. Day temperatures were also markedly below normal in the plains of northwest India and Uttar Pradesh during the second fortnight, being as much as 8° to 11°C below normal in Punjab, Haryana and the adjoining parts of Rajasthan and west Uttar Pradesh. This prolonged cold spell is reported to have taken a toll of about 250 human lives, mostly from Uttar Pradesh and Bihar. Extensive fog which persisted day after day over north India during the above period, is reported to have disrupted air services and caused road accidents and some damage to standing crops.

Seven western disturbances moved eastwards across northwest India during the month. The rainfall associated with these was deficient in the Western Himalayas but normal to excess in the plains of northwest India. Simla and its surrounding areas were reported to have been lashed by a hail storm on 9th. The western disturbance which moved across the Western Himalayas between 15th and 17th, induced a low over Rajasthan on 15th. The low became well marked on 16th over north Rajasthan-but it weakened into a low over Haryana the same evening and moved away eastwards across west Uttar Pradesh by 18th as a cyclonic circulation in the lower troposphere. This western disturbance and the induced low caused good precipitation in northwest India and west Uttar Pradesh between 16th and 18th. Landslides caused by heavy precipitation in Jammu & Kashmir

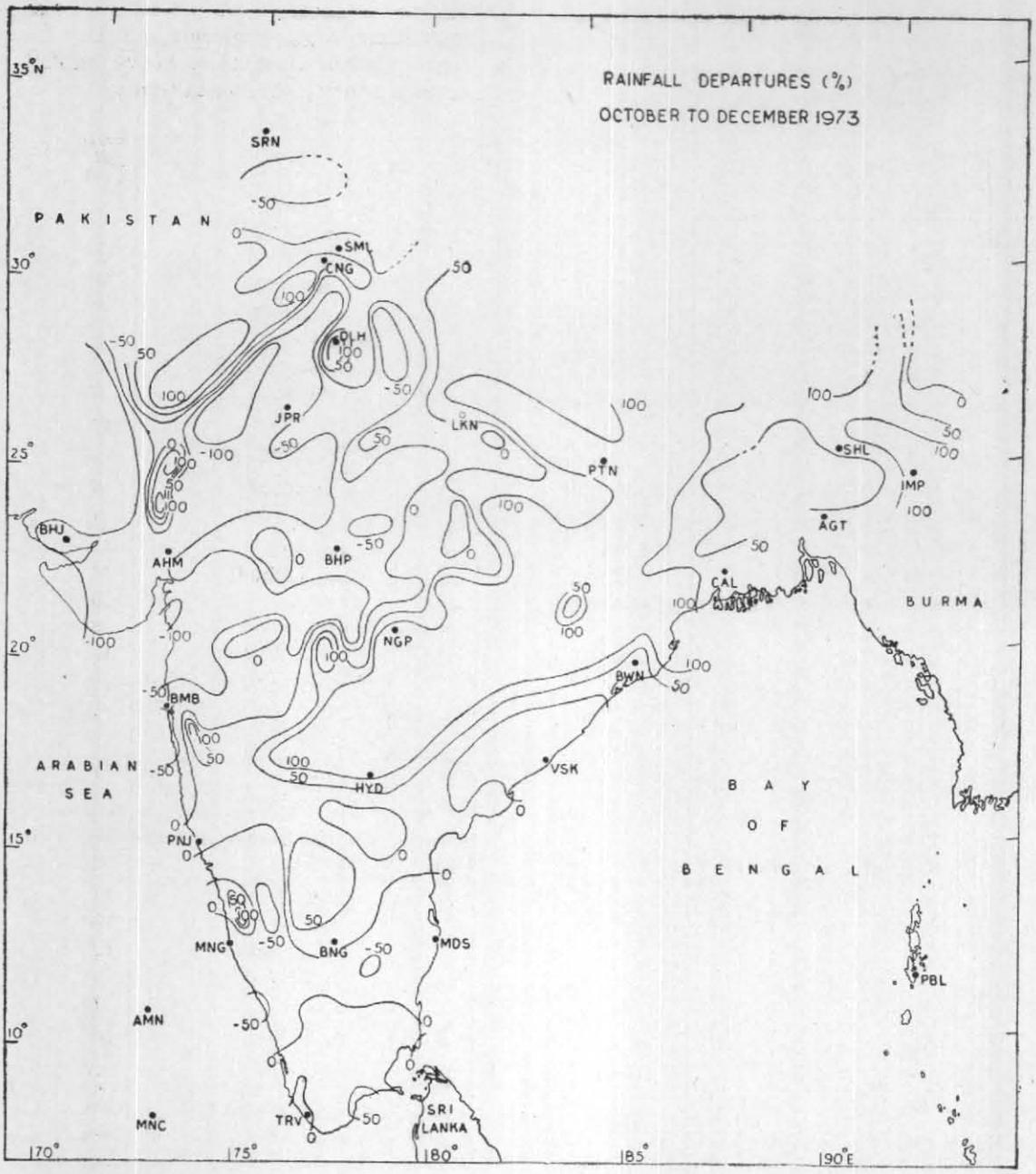

Fig. 2 (b)

Percentage departure from normal of rainfall occurred during the period 1 October to 31 December 1973

were reported to have disrupted road traffic on Jammu-Srinagar Highway.

A low which developed over south Bay on 3rd moved northwestwards and became a depression on 5th. In intensified into a severe cyclone on 7th near 10·5°N, 85·5°E. Subsequently moving northwards and later recurving northeastwards, it crossed Bangla Desh coast near Barisal on the afternoon of 9th and weakened into a low over northeast Bangla Desh and adjoining parts of Assam on 10th. This system caused fairly widespread rain in Bay Islands from 3rd to 9th, with isolated heavy falls from 4th to 6th. Northeast India also had a spell of good rainfall between 9th and 11th. M.V. *Sonavati* was caught in the cyclone and sank about 250 km southeast of Visakhapatnam. About 10 members of the crew lost their lives. Heavy rain in Gangetic West Bengal was reported to

have caused some damage to crops in the coastal districts, particularly in Midnapore district and in Sagar Island. A tidal wave of about 4·5 m was reported to have affected the coastal areas of Bangla Desh, with considerable damage to cattle life and property.

A deep depression moved from southwest Bay to south Peninsula across Pamban in the second week and emerged into Lakshadweep-Maldive area on 16th as a low. This low moved away westwards to southwest Arabian Sea by 20th. In association with this system, there was fairly widespread rain or thundershowers in south Peninsula between 15th and 18th, with isolated heavy to very heavy falls in Tamil Nadu. Isolated very light rain occurred in Madhya Maharashtra on 17th and 18th.

Another depression moved from southeast Bay to Sri Lanka between 25th and 27th and lay as well marked low over Comorin on 28th. Subsequently it moved away westwards to south Arabian Sea across Maldive-Lakshadweep area by 31st. This system also caused another spell of good rainfall in south Peninsula between 28th and 31st, with scattered or isolated heavy falls in Tamil Nadu on 28th and 29th. Bay Islands also had good rainfall between 22nd and 26th.

A trough of low which lay over southwest Bay from 1st to 3rd, caused scattered rain in Tamil Nadu, coastal Andhra Pradesh and Rayalaseema from 1st to 4th, with isolated heavy falls in coastal Andhra Pradesh and Tamil Nadu.

Troughs in the easterlies lay along and off the west coast in the first week and again between 19th and 23rd. They extended northwards into west Madhya Pradesh and Rajasthan on some days during the above periods. Under the influence of these systems, there was scattered or isolated rainfall in Kerala and Lakshadweep on many days and in Madhya Maharashtra, Gujarat State, Madhya Pradesh and Rajasthan on a few days.

A trough of low which lay over Andaman Sea from 16th to 18th caused a spell of good rainfall in the Bay Islands from 16th to 19th, with isolated heavy falls on 18th.

The rainfall for the month was normal to excess in northeast India, south Peninsula and Bay Islands. The principal amounts of heavy rainfall over the country during the month were:

Date	*Station*	*Rainfall (cm)*
1	Woolapalem	8
	Pamban	7
2	Woolapalem	11
	Car Nicobar	8
3	Srivalliputtur	9
	Tuticorin	8
	Coimbatore	7
4	Hut Bay	10
5	Port Blair	12
6	Car Nicobar	9
	Long Island	7
9	Paradeep	11
	Sagar Island	10
	Contai	9
	Puri	8
10	Haflong	14
	Cherrapunji	11
	Ziro	11
	Silchar	8
14	Pamban	7
15	Pondicherry	9
16	Kanchipuram	10
	Madras	9
18	Tenkasi	16
	Pamban	13
	Palayankottai	12
	Car Nicobar	8
	Kondul	7
23	Car Nicobar	14
26	Kondul	11
28	Vedaranniyam	14
	Arantangi	9
	Pudukottai	8
	Thanjavur	8
	Karwar	8
29	Kodaikanal	9

ANNOUNCEMENTS

Spectral Classification and Multicolour Photometry

Edited by C. Fahrenbach and B.E. Westerlund
Published by D. Reidel Publishing Co., Dordrecht-Holland/Boston-U.S.A., 1973, pp. I-XIV+314.

The contents of the book follow closely the programme of the individual sessions of the International Astronomical Union Symposium on Spectral Classification and Multicolour Photometry No. 50 held in Villa Carlos Paz near Cordoba between 18 and 24 October 1971. The book is divided into four parts dealing with (i) Classification of Slit Spectra (14 papers), (ii) Classification of Objective-Prism Spectra (13 papers), (iii) Photometry Classification (18 papers) and (iv) Catalogues and Documentation (8 papers).

Wolf-Rayet and High-Temperature Stars

Edited by M.K.V. Bappu and J. Sahade

Published by D. Reidel Publishing Company, Dordrecht-Holland/Boston-U.S.A., 1973, pp. I-XIV+263.

The proceedings of the I.A.U. Symposium on Wolf Rayet and High Temperature Stars No. 49 held at Buenos Aires, Argentina between 9 and 14 August 1971 have been compiled in this volume giving a connected account of the proceedings. This volume is dedicated to C.S. Beals, B. Edlen, Cecilia Payne-Gaposchkin and P. Swings for their contributions to the present degree of comprehension of Wolf-Rayet Spectra.

The book contains eight sections in accordance with the different sessions of the Symposium. Each section contains two or three papers followed by edited versions of the discussions.

Problems of Calibration of Absolute Magnitudes and Temperatures of Stars

Edited by B. Hauck and B.E. Westerlund

Published by D. Reidel Publishing Company, Dordrecht-Holland/Boston-U.S.A., 1973, pp. I-x+304.

The book contains the Proceedings of the I.A.U. Symposium No. 54 held at Geneva (Switzerland) between 12 and 15 September 1971, dealing with the fundamental problems of the calibration of absolute magnitudes and temperature of stars.

There are eight parts in the book following closely the programme of the individual sessions of the Symposium. Each part starts with a review paper by an invited speaker and this is followed by a general discussion including a few contributed papers.

Variable stars in Globular Clusters and in related Systems

(Astrophysics and Space Science Library Vol. 36)
Edited by J.D. Fernie

Published by D. Reidel Publishing Company, Dordrecht-Holland/Boston-U.S.A., 1973, pp. I-x+234.

The volume contains the papers presented and discussions made at the IAU Colloquium No. 21 on Variable Stars in Globular Clusters and Related System held at Toronto (Canada) between 29 and 31 August 1972. The intention of the organisers of this Colloquium was to honour the life-long work done in this field by Prof. Helen Sawyer Hogg, as they are of fundamental importance to all research workers.

The book is divided into four parts, each part containing a review paper and then followed by other research papers in the related topics. Discussion follows at the end of each paper.

Monthly and Annual Rainfall and Number of Rainy Days for the period 1901-1950, Part IV-A

Published by India Meteorological Department, New Delhi.

The India Meteorological Department is publishing the monthly and annual rainfall and number of rainy days for about 2700 raingauge stations in India for the years 1901 to 1950 in five parts. The first three parts have already been issued. Part I covers the States of Assam (prior to reorganisation), West Bengal, Orissa and Bihar; Part II Jammu & Kashmir, Punjab (and Delhi), Himachal Pradesh and Rajasthan and Parts III A and B Uttar Pradesh and Madhya Pradesh. Part IV A is the latest publication in the series and covers the States of Gujarat and Karnataka. The remaining parts are under print.

The above publications are intended to be of service to Agriculture and Hydrology and other users of the water resources of the country. They are available for sale with the *Assistant Controller (Business), Department of Publications, Civil Lines, Delhi-110006, India.*