Notes and News

FIRST SESSION OF THE COMMISSION FOR HYDROLOGICAL METEOROLOGY OF THE WORLD METEOROLOGICAL ORGANISATION

As reported in January 1961 issue of this journal, the First Session of the Commission for Hydrological Meteorology of the World Meteorological Organisation was held at Washington, U.S.A. from 12 to 26 April 1961. India was represented at the Session by a delegation consisting of Shri S.K. Ghose, Meteorologist (Leader) and Shri R.C. Shenoy of Central Water and Power Commission. Among the subjects discussed, the most important were the purview and scope of the Commission, quantitative precipitation forecasts for hydrological use, Hydrometeorological networks, and methods of measurements and estimation of evaporation.

WORKING GROUP ON METEOROLOGICAL TELECOMMUNICATION OF THE WMO COMMISSION FOR SYNOPTIC METEOROLOGY

The meeting of the Working Group on Meteorological Telecommunication of the WMO Commission for Synoptic Meteorology was held in Paris from 11 to 26 April 1961. Shri C. Ramaswamy, Deputy Director General of Observatories attended the meeting in his capacity as Chairman of the Working Group on Meteorological Telecommunication, RA II, of the World Meteorological Organisation. He was elected Vice-Chairman of the meeting for the duration of the Session.

ECONOMIC COMMISSION FOR ASIA AND THE FAR EAST (ECAFE)

The Seventeenth Session of ECAFE was held at New Delhi from 8 to 20 March 1961. Shri P.R. Krishna Rao, Director General of Observatories, attended the Session as representative of the World Meteorological Organisation.

UNESCO'S PANEL — HUMID TROPICS RESEARCH PROGRAMME

Shri P.R. Krishna Rao, Director General of Observatories has been nominated by the Indian National Commission to UNESCO's International Panel of honorary consultants for humid tropics research programme.

INTERNATIONAL METEOROLOGICAL ORGANISATION PRIZE

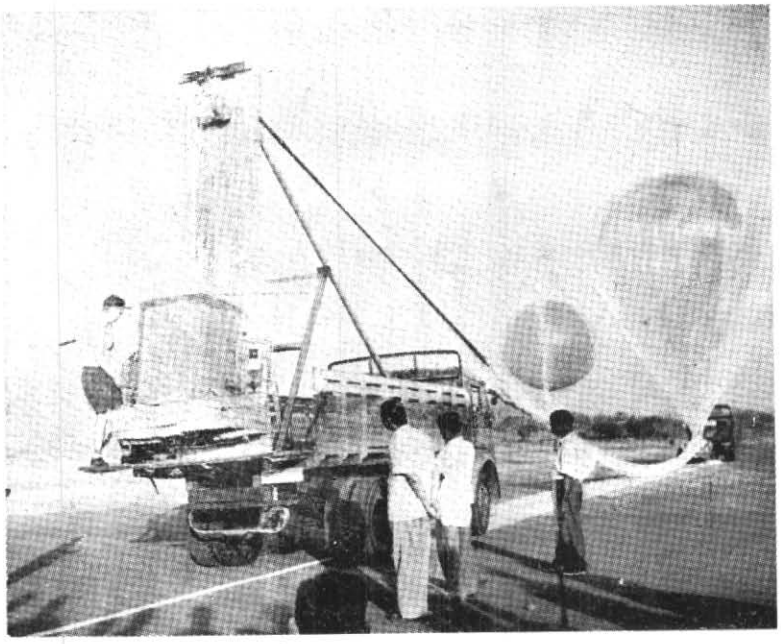
Prof. K.R. Ramanathan, Director of the Physical Research Laboratory, Ahmedabad, has been awarded by the WMO the "IMO Prize" for 1961 in recognition of his outstanding work in meteorology and international collaboration in the subject. An article on Dr. Ramanathan's career and work appears elsewhere in this issue.

JOINT INDO-US BALLOON FLIGHT PROGRAMME—1961

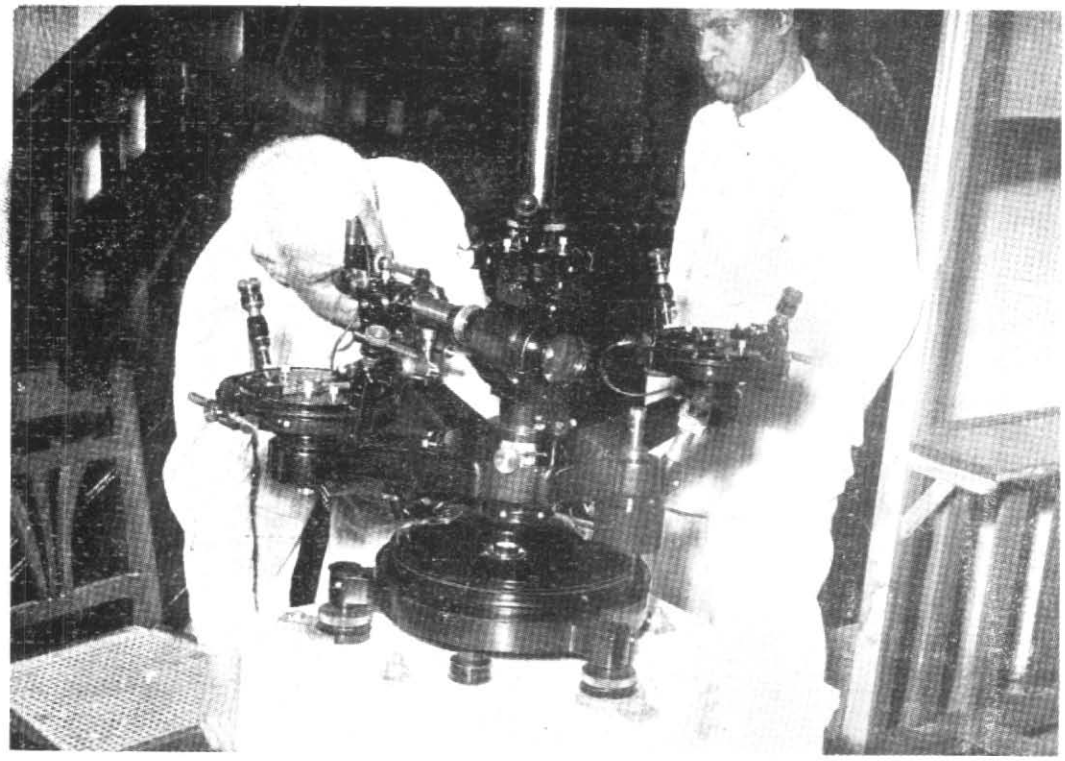
As reported in the previous issue, the Indo-US high altitude equatorial balloon flight programme jointly sponsored by the U.S. Air Force Cambridge Research Centre and the Govt. of India was conducted at Hyderabad from 2 February to 25 April 1961. Over 50 scientists from the U.S. Air Force Combridge Research Laboratories, Bedford, Mass.; the Naval Research Laboratories, Washington D.C.; the University of Bristol, Bristol; the Tata Institute of Fundamental Research, Bombay; the Physical Research Laboratory, Ahmedabad; and the India Meteorological Department took part in the programme, which was characterised throughout by an atmosphere of extreme cordiality and enthusiasm.

The purpose of the high altitude flights was (1) the collection of stratospheric particulate material for the study of (*a*) stratospheric distribution of particulate aerosols and environmental radioactivities of natural and artificial origin, and (*b*) inter-hemispherical

JOINT INDO-US BALLOON FLIGHT PROGRAMME AT HYDERABAD—1961



VISIT OF THE DEPUTY MINISTER FOR CIVIL AVIATION TO COLABA AND ALIBAG OBSERVATORIES



and troposphere-stratosphere mixing and circulations, (2) the observation of primary cosmic rays by means of photographic emulsions and electronic counters to study their origin and energies, and (3) the determination of other meteorological parameters simultaneously with the above observations, namely, stratospheric wind velocities and patterns, pressure-altitude, temperature, humidity, ozone concentration and atmospheric electricity.

A total of 39 high altitude ascents with plastic balloons were made during the three months from February to April, 20 by the U.S. personnel from the Begumpet airport, for the study of stratospheric aerosols and 16 by the TIFR personnel from the Osmania University campus for the study of cosmic rays. Three special flights with American balloons were also made from Begumpet to carry Indian and British emulsion stacks—two, to carry heavy loads of 1000 kg to 85,000 ft and one to carry a smaller 70 kg load to 1,30,000 ft.

The India Meteorological Department team from Poona attached the F-type radiosonde and the newly developed motorsonde in TIFR-U.S. flights and also instruments for determination of potential gradient and conductivity. This team also took about 50 independent rubber or neoprene balloon flights for the determination of temperature, pressure, potential gradient or conductivity in the upper air.

The India Meteorological Department team from Delhi installed radio-theodolite at Gulbarg and Hyderabad. Besides determining wind data, this team was responsible for tracking all the balloons carrying TIFR equipment for the entire duration of the flights which varied from 3 to 30 hours and guide its recovery. This was successfully done in all the cases. Recovery could not be made only once when the payload fell in jungle near Jagdalpur. This team also attached improved C-type Radiosonde instrument in 12 TIFR-U.S. flights and got high altitude temperature and pressure data which was transmitted by rawin transmitter itself using a system specially developed for the purpose.

Sri Jawaharlal Nehru, Prime Minister of India, visited the Osmania University campus at the time of the launching of the balloon on 5 February 1961.

A detailed report of the programme will be published in July by the Air Force Cambridge Research Laboratories as the principal sponsor of the joint Indo-US Balloon flight Programme-1961.

VISIT OF THE DEPUTY MINISTER FOR CIVIL AVIATION TO COLABA AND ALIBAG OBSERVATORIES

Shri Ahmed Mohiuddin, Deputy Minister for Civil Aviation, Government of India, visited the Magnetic Observatory at Alibag (Bombay) on 11 March 1961. He showed keen interest in the scientific work done by the Observatory and the contributions it has made to Geomagnetism. This observatory is one of the oldest magnetic observatories in the world; it has been functioning since 1841, at Colaba upto 1904 and at Alibag for the last 57 years.

The observatory records geomagnetic data useful for the study of cosmic rays, ionosphere and related solar phenomena and serves as a reference station for the magnetic survey so essential for navigations over land, sea and air. It may be recalled that the USSR non-magnetic ship 'Zarya' and the U.S. Naval Aeromagnetic Plane 'Kiwi' had their instruments compared with those at Alibag in October 1959 and February 1960 respectively.

The observatory records and studies data relating to "magnetic storms", *i.e.*, any violent fluctuations in the normal values of the magnetic content. The data collected at this observatory are exchanged with the data of other similar observatories of the world on an international exchange basis and have also formed the basis of numerous scientific papers published in India and elsewhere. It is proposed to augment the scientific

equipment of the observatory in the Third Five Year Plan and also to make a thorough analysis and study of the accumulated valuable geomagnetic data.

METEOROLOGICAL REQUIREMENTS FOR JET AIRCRAFT OPERATIONS SECOND CONSULTATIVE CONFERENCE

Since the first meteorological Consultative Conference with Airline Operators convened by the India Meteorological Department in December 1957, high speed high altitude Jet aircraft have been introduced for commercial operations on most of the international routes through India. The present day Jet movements at the three International Airports Palam (New Delhi), Dum Dum (Calcutta) and Santacruz (Bombay) total 95 flights per week. With a view to assessing the growing requirements of operators and evolving a uniform pattern of meteorological service within the framework of ICAO recommendations, a second Consultative Conference on meteorological requirements for Jet operations was convened at Dum Dum Airport, Calcutta on 6 and 7 April 1961.

The response to this conference from the Airline operators was quite encouraging in spite of the very short notice given to them. Twelve representatives from the various Airlines, representative from the ICAO Regional Office, Bangkok, and the regional representative of the IATA at Bangkok attended the meeting; besides representatives from the Indian Air Force (Met. Branch), the Civil Aviation Department of India and the India Meteorological Department. Shri P. R. Krishna Rao, Director General of Observatories (India) was the Chairman and Dr. P. Koteswaram, Director, Aviation Services, India Meteorological Department acted as the Secretary of the Conference.

The Agenda of the Conference covered the meteorological requirements in the various stages of Jet flights. Requirements for take-off, approach and landing, the inflight requirements as well as the pre-flight planning requirements were discussed in detail. The need for *routine* availability of the trend type landing forecasts appended to all hourly aerodrome and selected special reports at the various communication units was stressed by the operators and was accepted. The memorandum on Area Met. Watch procedures and issue of Sigmet information prepared by the India Meteorological Department and distributed at the Conference was greatly appreciated by the operators. The India Meteorological Department's plans for preparation of charts extending from Europe to Asia were explained. The need for prognostic significant weather charts for flight documentation purposes was discussed at great length and the Conference recommended a combination of fixed time and composite method of preparation of prognostic significant weather charts to be issued four times a day, the validity period being 12 hours. As regards upper air charts, fixed time prognostic charts of 18 hours validity for 500, 300 and 200-mb levels, supplemented by a maximum wind level chart were recommended.

The Conference also discussed the communication difficuties in the exchange of operational meteorological data especially with the Middle East countries. It was however, noted that steps were being taken for improving these vital links.

Amongst other items discussed were, Review of upper air networks along Jet routes, Contents of Volmet broadcasts at Calcutta, Aircraft weather reports and supply of debrief information, High level turbulence reporting programme and Aviation climatological requirements.

Actions based on the recommendations of the Conference have already been initiated by the India Meteorological Department.

INTERNATIONAL CONFERENCE ON CLOUD PHYSICS

An International Conference on Cloud Physics will be held in Australia from 11—20 September 1961, under the joint sponsorship

of the Australian Academy of Science and the Commonwealth Scientific and Industrial Research Organisations. The Conference will be devoted to the presentation and review of papers concerned with the physical processes which enter into the formation of cloud and precipitation in its various forms; there will also be informal seminars which will provide opportunities for critical discussion on the methods, instruments and techniques used in cloud physics research. The Conference will also include flight and laboratory demonstrations of the techniques used in cloud physics and cloud seeding investigations in Australia.

INDIAN NATIONAL COMMITTEE FOR OCEANIC RESEARCH

A meeting of the Indian National Committee for Oceanic Research was held on 24 and 25 May 1961 at the Central Secretariat, New Delhi. Shri C. Ramaswamy, Deputy Director General of Observatories, represented the India Meteorological Department at the meeting. The meeting was convened to formulate the programme for the forthcoming Indian Ocean Expedition.

CENTRAL BOARD OF GEOPHYSICS

The Central Board of Geophysics with its two research wings, *viz.*, the Geophysical Research Wing and the Oceanographic Research Wing has been transferred to the Control of the Council of Scientific and Industrial Research from April 1961.

MEETING OF THE CENTRAL INDIA RIVERS COMMISSION

The eighth meeting of the Central India Rivers Commission was held at Bhubaneshwar on 15 and 16 April 1961. The flood problem of Orissa State was one of the important subjects discussed at the meeting.

Shri S. Banerji, Meteorologist, represented the India Meteorological Department at the meeting.

ARID ZONE RESEARCH

A meeting of the Technical Sub-Committee for Agronomy, Silviculture, Irrigation and Agricultural Chemistry of the National Co-operating Committee for Arid Zone Research at Jodhpur was held on 14 and 15 April 1961. The programme of work on Climatology along with the programme of work in other allied fields were discussed and finalised at this meeting. Shri S. K. Das, Meteorologist, represented the India Meteorological Department.

ADVISORY COMMITTEE OF THE SCIENTISTS' POOL

Shri P. R. Krishna Rao, Director General of Observatories, has been nominated by the Government of India as a Member of the Advisory Committee of the "Scientists' Pool" to represent the Ministry of Transport and Communications. Shri P.R. Krishna Rao attended the Second Meeting of the Advisory Committee for the "Scientists' Pool" held on 14 March 1961.

SYMPOSIUM ON UNDER WATER ACOUSTICS AND OCEANOGRAPHY

Under the auspices of the Indian Naval Physical Laboratory, a Symposium on Underwater Acoustics and Oceanography was held at Cochin from 17-19 February 1961. Dr. A. A. Rama Sastry, Meteorologist, and Shri C. Poornachandra Rao, Assistant Meteorologist, represented the India Meteorological Department at the Symposium.

BEHAVIOUR OF THE GROUND WATER-TABLE IN INDIA

Shri P.R. Krishna Rao, Director General of Observatories, attended on 28 February 1961 a meeting convened by the Ministry of Irrigation and Power for a preliminary discussion on organisation of observations of the behaviour of the ground water-table in the country. As a result of the discussions, an inter-ministerial committee to co-ordinate and review the work to be done in connection

with the observations of the ground water-table in the country has been set up. Shri S. Banerji, Meteorologist, Hydrology Section, has been nominated to represent the department on this Committee.

MESO-SCALE STUDY OF THUNDERSTORMS

In connection with the meso-scale study of thunderstorms six meteorological observatories with self-recording instruments have been set up around Delhi during the current season.

SEMINAR ON AERONAUTICAL SCIENCES, BANGALORE, 1961

Under the auspices of National Aeronautical Laboratory of Council of Scientific and Industrial Research, a Seminar on Aeronautical Sciences is being held at Bangalore in November 1961 dealing with the following subjects—(1) Fluid mechanics, (2) Aerodynamics, (3) Wind Tunnel design, (4) Aircraft structures and Materials, (5) Aircraft propulsion, (6) Aviation Electronics and (7) Aviation Meteorology.

VISIT OF DIRECTOR GENERAL AND DEPUTY DIRECTOR GENERAL OF OBSERVATORIES TO NAIROBI

Shri P. R. Krishna Rao, Director General of Observatories and Dr. R. Ananthakrishnan, Deputy Director General of Observatories (Forecasting) accompanied the proving flight of Air India International Boeing-707, *Nanda Devi*, to Nairobi on 26 April 1961. While at Nairobi they visited the Headquarters of the East African Meteorological Service on 27 April 1961 and had discussions on matters of common interest with Dr. B. W. Thompson, Deputy Director of the East African Meteorological Service and his colleagues. They also visited and saw the working of the Meteorological Office at Nairobi airport. Among the points discussed were—(*i*) the need for an Institute of Tropical Meteorology in this part of the world, (*ii*) participation in the meteorological programmes of the forthcoming International Indian Ocean Expedition, (*iii*) work done by the East African Meteorological Service on artificial rain-making, (*iv*) exchange of meteorological information in connection with Jet air services between Nairobi and Bombay.

The return flight left Nairobi on the forenoon of 28 April 1961 and landed at Bombay on the evening of the same day. Enroute, the two officials were met at Aden airport by Dr. Bushby who showed them round the RAF Meteorological Office and the Wind-finding Radar Station at Aden.

Dr. Hugh W. Sansom, Regional Representative of the East African Meteorological Service came to India on the return proving flight and visited the Meteorological Offices at Bombay and Poona.

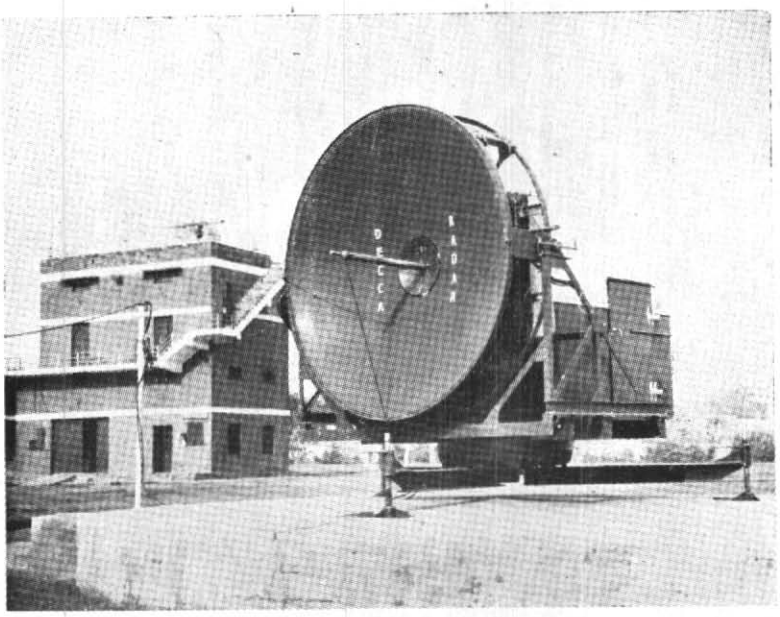
The personal contacts established during these visits have been mutually beneficial and have contributed to fruitful exchanges of ideas on the organisational and research aspects of the two Meteorological Services. Some transmissions of meteorological reports between Nairobi and Bombay have been brought into effect following these visits.

VISIT OF FOREIGN METEOROLOGISTS TO INDIA

Dr. H.W. Sansom, Regional Meteorological Representative, Kenya of the East African Meteorological Service who came to India from Nairobi with Air India International's return proving flight visited the Meteorological Offices at Bombay and Poona.

Dr. Erich Höller, Meteorologist, Hamburg, who has been deputed to take measurements of temperature and humidity in the ships holds in connection with the studies on damage to cargo—visited the Regional Meteorological Centre, Madras on 15 May 1961. Dr. Höller who has come to India by sea is expected to visit also the Regional Meteorological Centre, Calcutta.

Professor V.V. Beloussov, President of the International Union of Geodesy and Geophysics visited the Meteorological Office, New Delhi, on 15 and 16 May 1961 and met the Director General of Observatories. He also



Decca Wind Finding Radar at New Delhi

visited the Seismological Observatory at the Ridge near the Delhi University. The Seismological Organisation under the department and the development plans in Seismology in the Third Five Year Plan were explained to him by Dr. A. N. Tandon, Director of Seismology.

Dr. E. V. Karous of U.S.S.R. also visited the Office and the Seismological Observatory on 29 May 1961.

INDIAN METEOROLOGIST INVITED TO UNIVERSITY OF HAWAII

Dr. P. Koteswaram, Director, Aviation Services Division of the India Meteorological Department, left India on 14 May 1961 to join the Department of Meteorology of the University of Hawaii for a period of five months. He has been invited by the East-West Center, Institute of Advanced Projects, University of Hawaii, one of the aims of which is to bring together distinguished scholars for an exchange of ideas. Dr. Koteswaram is the fifth East-West Senior Scholar at the University and the first in Meteorology. During his stay at Hawaii, Dr. Koteswaram plans to collaborate with Prof. C. S. Ramage in the scientific organization of the Indian Ocean Expedition, examine satellite photographs over the Indian Ocean and continue his studies of the Indian Monsoon and the general circulation. He will also attend the Pacific Science Congress to be held in August 1961 at Honolulu as an invited participant of the Symposium on Monsoons.

DECCA WIND FINDING RADAR AT NEW DELHI

A Decca Wind Finding radar type WF-2 was installed in the Observatory, Lodi Road, New Delhi during the first week of July 1960. Since that time it has been tested periodically under (*i*) varying weather conditions, (*ii*) different upper wind velocities and (*iii*) different seasons for an assessment of its performance. The results have been satisfactory. In the winter months, for example when jet streams are encountered aloft and tracking becomes difficult due to low elevation angles, balloons were followed up to slant ranges extending beyond 140 km. The equipment will shortly be put into regular use for routine flights.

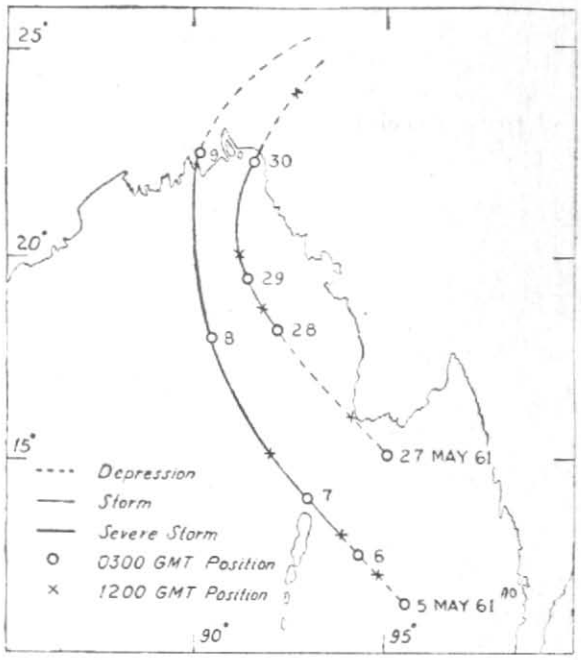


Fig.1. Track of Severe Cyclonic Storm, May 1961

SEVERE CYCLONES IN THE BAY OF BENGAL IN MAY 1961

Two severe cyclonic storms from the Bay of Bengal struck the East Pakistan coast in May 1961 within a period of 3 weeks and caused considerable damage to life and property. The tracks followed by the cyclones are shown in Fig. 1.

An easterly wave entered the Andaman Sea on 3 May and developed into a depression by the morning of 5th, with centre about 350 km eastsoutheast of Port Blair. Moving in a northwesterly direction, the depression intensified into a cyclonic storm on the evening of 6th which became severe by the evening of 7th. On the morning of 8th, S.S. *Fausta*, which was sailing about 170 km westsouthwest of the centre of the storm reported an atmospheric pressure of 982 mb, northerly wind of speed 96 km/hr, mountainous swell and poor visibility. The storm moved northward and crossed the Sundarbans coast near Barisal on the early morning of 9th. Thereafter it weakened rapidly and moved away as a low pressure wave across Assam on 10 May.

On the morning of 9th, Comilla which lay about 170 km northeast of the centre of the cyclone reported a wind speed of 30 knots, and a pressure of 994·5 mb (13 mb less than the normal).

According to press reports, when the storm struck the East Pakistan coast, the wind velocity was more than 100 mph and a tidal bore 16 feet high "roared menacingly over three offshore islands of Ramgati, Hatia and Sonedwip". Several thousand houses were destroyed and scores of vessels laden with valuable cargo were sunk; over one thousand deaths were reported from ten districts of East Pakistan, which were hit by the storm.

The severity of the storm was also felt in lower Assam and in Gangetic West Bengal.

At Agartala airport extensive damage was caused by winds of hurricane force which reached 90 knots. The Indian Airlines Corporation's scheduled services to Agartala, Silchar and Imphal had to be cancelled on 10 May. The Bay Islands and Assam area reeeived heavy rain due to the storm.

The second cyclonic storm developed in the Bay of Bengal in the last week of May 1961 and struck East Pakistan coast near Chittagong on the morning of the 30th. This was the fourth cyclonic storm to have struck East Pakistan coast since October 1960.

In association with a low pressure wave which moved across Tennaserim coast, a depression developed over the north Andaman Sea with centre near Lat. 15°N and Long. 95°E on the morning of 27th. Moving northwestwards, it concentrated into a cyclonic storm by 28th morning and became severe during the next 24 hours. Later, it recurved and crossed the East Pakistan coast near Chittagong on the morning of 30th. Thereafter, it weakened rapidly and lay as a shallow low over central Assam on the 31st. It became unimportant by 1 June.

Under the influence of this severe cyclonic storm, the Bay branch of the monsoon strengthened and advanced into Assam on 31 May. A few very heavy falls of rain were reported from the Bay Islands and Assam, noteworthy amounts being Port Blair 13 cm on 25th and 18 cm on 27th, Cherrapunji 22 cm and Agartala 15 cm on 31 May.

In association with this cyclone, heavy rains accompanied by gales and squalls occurred in the coastal districts of East Pakistan. According to newspaper reports, winds reaching 100 mph accompanied by a tidal wave were experienced at some places in the coastal districts along and near the track of the storm.

HEAT WAVE IN BIHAR STATE DURING MAY 1961

There was a prolonged spell of hot weather in Bihar State and neighbourhood during the month of May. According to press reports, this hot spell was responsible for about 75 deaths in Bihar State and for a few deaths in the adjoining states.

Day temperatures were generally above normal in Bihar State and neighbourhood from 11 May to 3 June, being appreciably so at a number of places from 13 to 22 May and again from 26 May to 2 June. The temperatures were markedly (6° to 7°C) above normal at a few places from 19 to 21 May and from 26 to 28 May. During this spell of hot weather, the highest maximum temperature of 45°C was recorded by Gaya on 5 days and by Jamshedpur and Daltonganj on 2 days each.

It may, however, be mentioned that this hot spell was less severe than the spell of hot weather which Bihar experienced in 1958 both in respect of the length of duration as also in respect of the highest values of maximum temperature recorded at individual stations. The heat wave of 1958 was the severest during the last ten years and caused 450 deaths in Bihar State. It lasted for over a month from 20 May to 22 June. The highest maximum temperature recorded during this spell was 46°C at Gaya, Dumka, Dhanbad and Daltonganj.

UNUSUAL WARMING AND DECREASE OF HUMIDITY AT VISAKHAPATNAM ON 27 MARCH 1961

The autographic instruments at Visakhapatnam Aerodrome recorded interesting temperature, humidity and wind changes on 27 March 1961 at about 1755 IST. The dry bulb temperature rapidly increased by 5·3°C and equally suddenly dropped to the original value, these changes taking place within only seven minutes. The simultaneous wet bulb decrease was 1·8°C. The hair

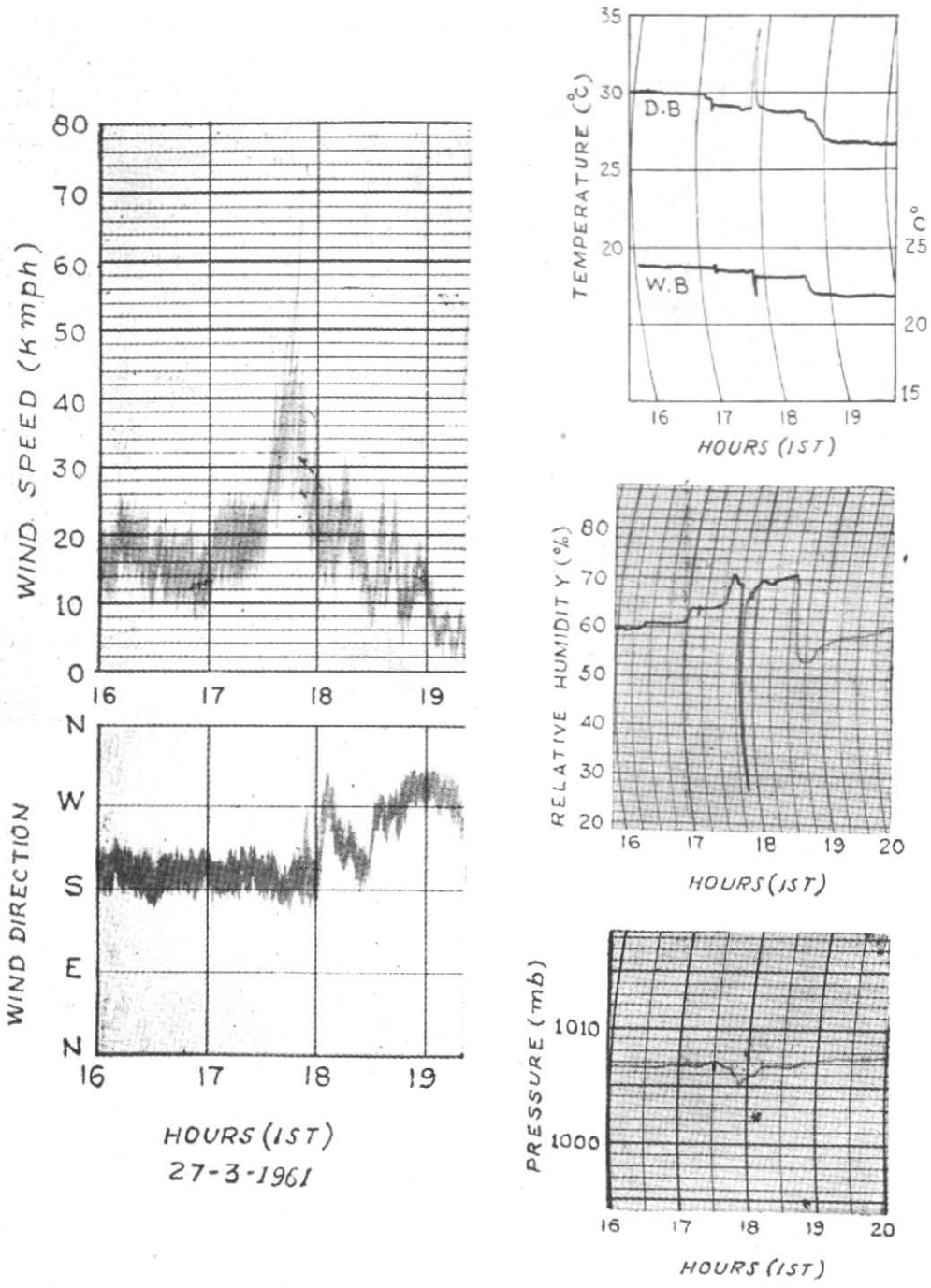


Fig. 1. Relevant portions of autographic records of Visakhapatnam on 27 March 1961

hygrograph registered a fall of 42 % while the value from the thermograph worked to 37 per cent. At the time of these changes 3/8 *Cb* was observed though thunder was not heard. Other clouds were 4/8 *St*. The anemograph showed a squall with wind speed rising from 38 to 72 kmph. There was no marked change in wind direction. There was a pressure minimum about the time, though the decrease and subsequent increase were spread over a longer period. Relevant portions of the autographic records are reproduced in Fig. 1. The synoptic situation at 1730 IST was as follows—

> At 1730 IST a wind discontinuity was running at 0·9 km from Jagdalpur to Gopalpur but synoptic stations along north Circars coast did not record any rainfall.

Attention to this phenomenon was drawn by Sri G.V.S.N. Murthy, Scientific Assistant-in-charge of the station.

UNUSUAL HAILSTORM ACTIVITY OVER ASSAM, MANIPUR AND TRIPURA STATES BETWEEN 17 AND 20 MARCH 1961

Between 17 and 20 March 1961, there was extensive hailstorm activity over Manipur and Tripura States, Cachar and NW Assam which caused considerable damage to tea plantation and properties over a large area. The maximum hailstorm activity occurred on the 18th and 19th. Almost all the stations in Manipur and Tripura States, Cachar, Dhubri and Kamrup districts of Assam reported hailstorms on these two days.

At Gauhati Airport, there were 4 thundershowers with hail at 0020, 0155, 1232 and 1625 IST on the 18th and all of them were accompanied with hail. Such a recurrence of hailstorm on one day is rather uncommon. Large hailstones fell on the two occasions at 0155 and 1625 IST. The latter occasion is described below—

On the afternoon of 17th, the sky was partly covered with *Ci* clouds. At 1800 IST

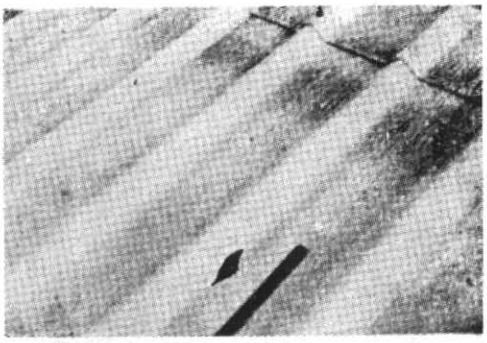


FIG. 1. 0155 IST

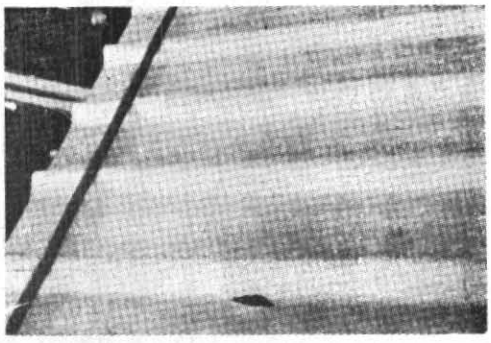


FIG. 2. 1625 IST

DAMAGES CAUSED BY HAILSTORM ON 18-3-1961

1/8 *Ac* was seen and *Cb* heads were seen to develop over the hills on the southern side of the airport. At 2225 IST thunder was heard and *Cb* was seen all round the sky. There was a thundershower with moderate hail at 0020 IST of 18th which came from WSW with a wind speed of about 20 knots. Hail continued for about 7-8 minutes after which the wind veered to WNW/NW and the speed dropped to about 10 knots. Thunderstorm with rain, however, continued and at 0155 IST there was a spell of heavy hailstorm for 10 minutes, some of the hailstones being as large as 5 cm in diameter. In the morning, clouds became less thick and decreased in amount but

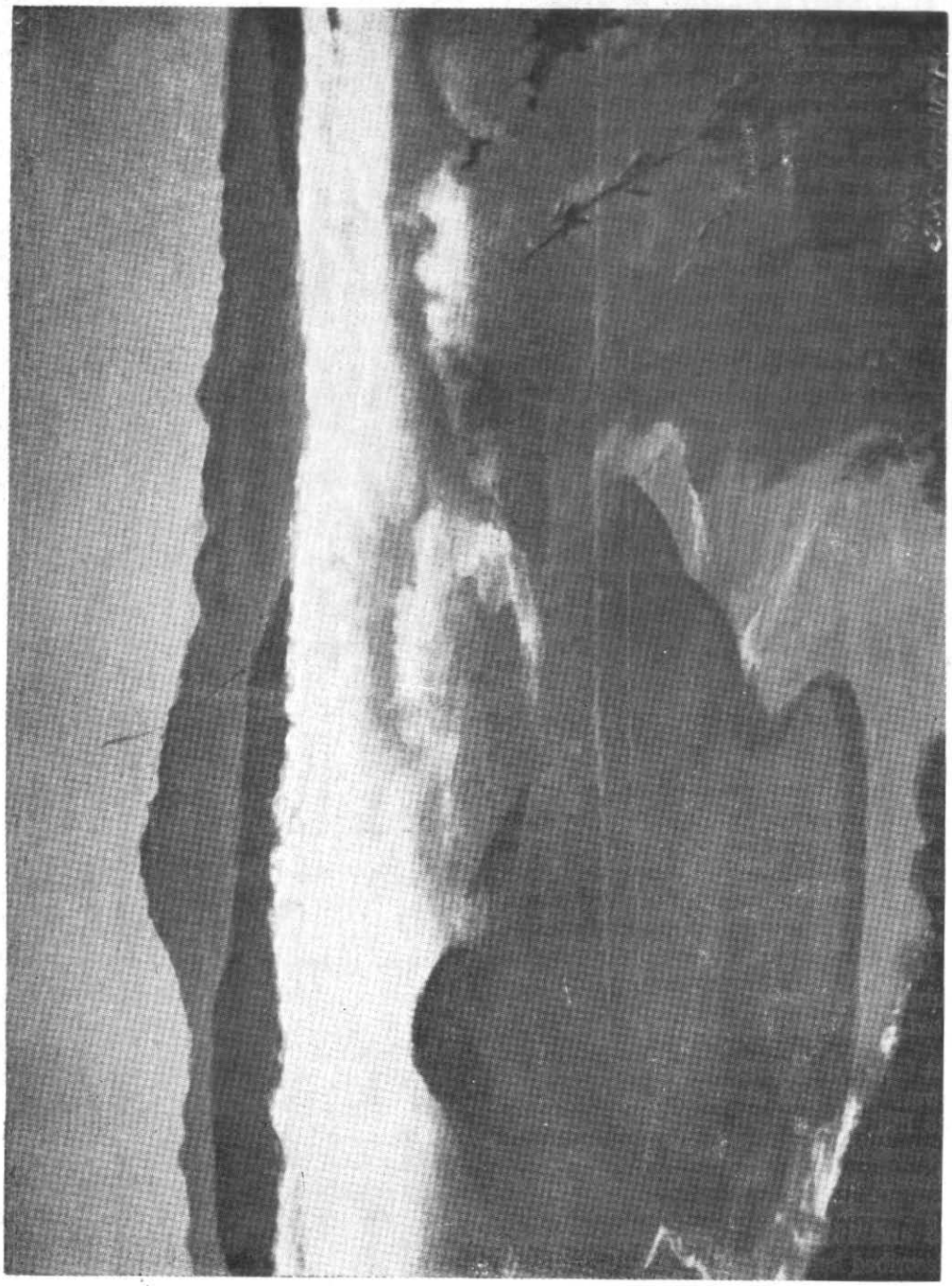


Fig. 1. Low stratus clouds over river Bheri Karnali (Photo by Shri J. N. Choudhuri)

by midday *Cb* clouds were seen to develop rapidly and a fresh storm approached the station from a westerly direction. At 1210 IST there was another moderate thundershower when soft hail fell for about 1 minute. Rain stopped shortly after 1300 IST. Thunder, however, continued to be heard, cloud base came down to 1500 ft and the surface wind further veered to NE. *Cb* clouds moved rapidly towards N/NW direction and covered the whole sky by 1625 IST, with base at 1000 ft, when a squall with an average speed of 45 knots accompanied by severe hailstorm passed over the station from WNW direction. This hailstorm lasted for 19 minutes. The hailstones were spherical in shape with jagged outer surface. The maximum size of hailstones that fell on the 18th was of diameter 5·2 cm and weighed 50 gm. All of them were found to contain opaque cores with alternate layers of transparent and opaque ice. The hailstones were found to bounce considerably after hitting hard ground like cement floor or metalled road.

The impact of these hailstones was so great that they damaged the fabric of a parked Dakota aircraft and some asbestos roofs of newly built quarters. In one case, the hailstones pierced a hole clean through the roof. Many glass panes of windows facing north and west were shattered in the residential area. Even some thick glass shutters of the control tower were broken to pieces by the impact of hailstones. Two photographs of a damaged roof are reproduced in Figs. 1 and 2.

LOW STRATUS CLOUD OVER RIVER BHERI KARNALI

A network of 166 hydrometeorological stations has been set up to study the hydrological and hydrometeorological aspects of the river catchments of the north Indian rivers lying in the Himalayas. For installation, inspection and upkeep of these observatories, on an average 4 parties from the Hydrometeorological Branch of the India Meteorological Department tour these out-lying regions every year. The tours extend from the Terai across the Siwaliks to the Central Himalayas, extending in some cases to even beyond the Central Himalayas reaching the edge of Tibetan tableland. The parties have to climb snow-covered passes, cross hazardous mountain rivulets on rope bridges to reach these remote and inaccessible places under trying weather conditions.

During a recent tour (December 1960—January 1961) in the upper reaches of Bheri Karnali in the Central Himalayas, a member of the Inspecting Party, Shri J.N. Choudhuri, took a photograph (Fig.1) of low stratus cloud over the Bheri Karnali valley. The river Bheri Karnali can be seen at a level of 500 m below the Jajarkot (Lat. 28°42′ N, Long. 82° 12′ E; altitude 1150 m a.s.l.) hydrometeorological observatory. At this point Karnali approaches from eastnortheast encircling a small hill (left foreground) and gushes away to the southwest. The valley further south, locally known as Tatagaon Tar (plain), is about 700 m a.s.l.

The sky at the station was mainly overcast with *St* from early morning reducing visibility to nil. With sunrise the low stratus lifted up and the visibility improved. However the Tatagaon valley was covered with low stratus even at the time of taking the photograph, *i.e.* at about 1100 IST on 5 January 1961.

PHOSPHORESCENCE

Vessel : M. V. *Daressa*

Captain : T. Woodward

Voyage : Bombay to Persian Gulf

Observer : P. L. Miller and S.F. Oliver

On 19 November 1960 between the hours of 1530 and 1700 GMT phosphorescence was observed to be so extensive (in patches, very approximately 1 sq. mile per patch) that the sea took an appearance as if a force 5-6 wind existed. The whole effect was a

slight glare enough to reduce the visibility by at least 3 miles. (It should also be noted that the whales, in both small and large schools, have been observed around this area on various occasions).

Position—Approx. 10 miles SW of C. Monze (Karachi)
Course—270° (T), Speed—14 knots.
Variable winds, speed 01 knot. Clear sky.
Air temp. 26·1°C and Sea temp. 26·7°C.

LUNAR HALO

Vessel : S. S. *Jalaprakash*

Captain : V.P. Sharma

Voyage : Kandla to Calcutta

Observer : Capt. V.P. Sharma and S.K. Singh, 3rd Officer

On 30 March 1961, at 1830 GMT observed Halo of the Moon. Sextant diameter of the halo 36°50′. Visible upto 1705 GMT when it faded.

Position—Lat. 10°06′N, Long. 82°43′E.
Course —005°(T). Speed—9 kts.
Wind : ENE, 4/5 kts. Sky covered 7 oktas.

WATERSPOUT*

Vessel : S.S. *Mahadevi*

Captain : H.C. Cutts

Voyage : Anchorage at Madras

Observer : Capt. H. C. Cutts and Mr. Kelsey, 2nd Officer

A waterspout passed through the Madras outer anchorage at about 1730 IST on 2 October 1960.

There were about 14 ships anchored there awaiting berths, and even though this phenomenon passed amongst the ship—within a few feet of one particular vessel—it did not appear to cause alarm or even any harm. It is the first time I have had the opportunity to view one of these at such close range, and it was quite interesting experience as the photographs (p. 509) show the sea surface was considerably churned up and there appeared to be a definite gyratory motion, not dissimilar in character to the whirl winds as experienced in parts of northern India during the hot summer months.

COLOURED WATER

Vessel : S. S. *Jalaprakash*

Captain : V. P. Sharma

Voyage : Kandla to Calcutta

Observer : Capt. V.P. Sharma and S. K. Singh, 3rd Officer

I

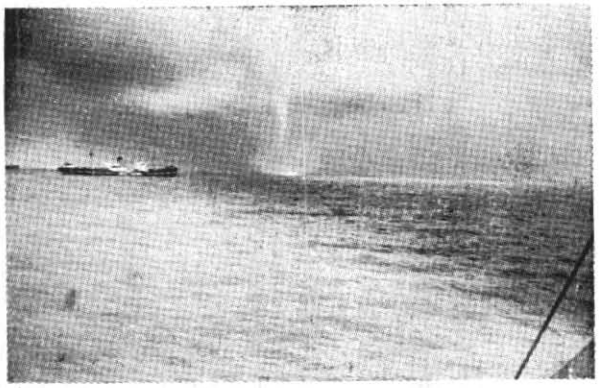
On 26 March 1961 at 1100 IST the vessel passed through light brown patches on surface of water; elongated in line with the wind. From close appearance like sand particles suspended in water. Probably fish eggs. No sample of water was taken.

Position at noon : Lat. 11°28·5′N, Long. 75° 16·5′E
Course : 156° (T) at 1205 IST
Wind : W by N, 4 kts. Slight sea and low swell
D.B. 28·6°C, W.B. 24·4°C

*The Port Officer, Madras has sent the following remarks on the report—

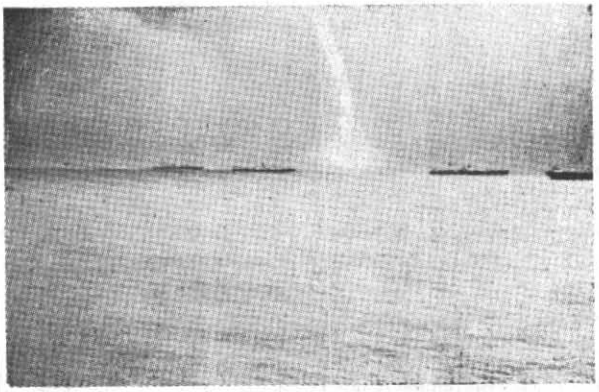
"A waterspout was observed at about 1730 hours on 2 October 1960. The phenomenon was like a mushroom with the sea and sky meeting in a column of water and was about five miles off the coast. This was observed to travel in a SE to NE-ly direction. The sea in the line of this waterspout was like a fountain and the line of travel was clearly demarcated."

There was thunderstorm at Meenambakkam aerodrome at 1730 IST. The state of sea at 1730 IST reported from the harbour shows that there were waves of one foot height and period 2 seconds from the southeast. The surface wind was southerly 14 knots —*Editor*



STAGE I

STAGE II



STAGE III

WATERSPOUT IN MADRAS HARBOUR
ON 2-10-1960

II

On 27 March 1961, from 1600 to 1800 IST. Passed thick streaks of light brown scum lying in SW—NE direction. Individual streaks 1-2 cable apart. Light patches appeared like suspended particles of sand in water, while the thicker patches appeared like muddy water. Schools of fish and a few whales were also observed at that time.

D.R. Position—Lat. 7°40'N, Long. 77° 43'E

Course : 125°(T)

Wind : SW, 2 kts. Sky : Clear

D.B. 29·4°C, W.B. 24·7°C

AWARDS TO VOLUNTARY OBSERVING SHIPS

The following ships of the voluntary observing fleet of the India Meteorological Department were selected for "Excellent Awards" for outstanding meteorological work during the year 1959-60. The awards, which were in the form of books, were sent to Captains, Observing Officers and Radio Officers who had been on the ships concerned for six months or more during the award year. Details of the recipients are given below.

S. S. *State of Bombay* (Eastern Shipping Corporation Ltd.)—S. K. Kaikobad (Captain), M. S. Naik and N. Krishnamachari (Observing Officers), C. D. Joshi and S. M. Villait (Radio Officers).

S. S. *Rajula* (British India Steam Navigation Co. Ltd.)—G. A. Brignall (Captain), D. H. Cain and R. Mortlock (Observing Officers), I. Jaffery and W. Hall (Radio Officers).

S. S. *Amra* (British India Steam Navigation Co. Ltd.)—A. G. Smythe (Captain), P. C. S. Jackson and B. J. B. Biddick (Observing Officers), K. J. Bourke and W. Martin (Radio Officers).

S. S. *Karanja* (British India Steam Navigation Co. Ltd.)—H. W. Harwood (Captain), C. S. Robinson (Observing Officer), E. Mc Ginty and P. Chapman (Radio Officers).

S. S. *Mozaffari* (The Mougal Line Ltd.)—A. Shirrefs (Captain), I. H. Glen and B. Nazareth (Observing Officers), S. D. Warke and G. B. Bhagat (Radio Officers).

The useful work put in by the other officers who served on the ships listed above for lesser periods than six months is also very much appreciated.

M. V. DARA

M. V. *Dara* of the British India Steam Navigation Co. Ltd., which was lost in the sea by fire on 8 April 1961, was one of the first ships recruited by India Meteorological Department as a 'Selected' ship. She was enlisted as a "Selected" ship in November 1948, and had ever since been extending her unstinted cooperation to India Meteorological Department by sending regular meteorological reports. She earned the "Excellent Award" once for outstanding meteorological work. India Meteorological Department would like to convey sincere sympathies to the officers and crew of the vessel who were on the ship during her last voyage in their misfortune and also congratulate them on their courage and devotion to duty in the face of danger.