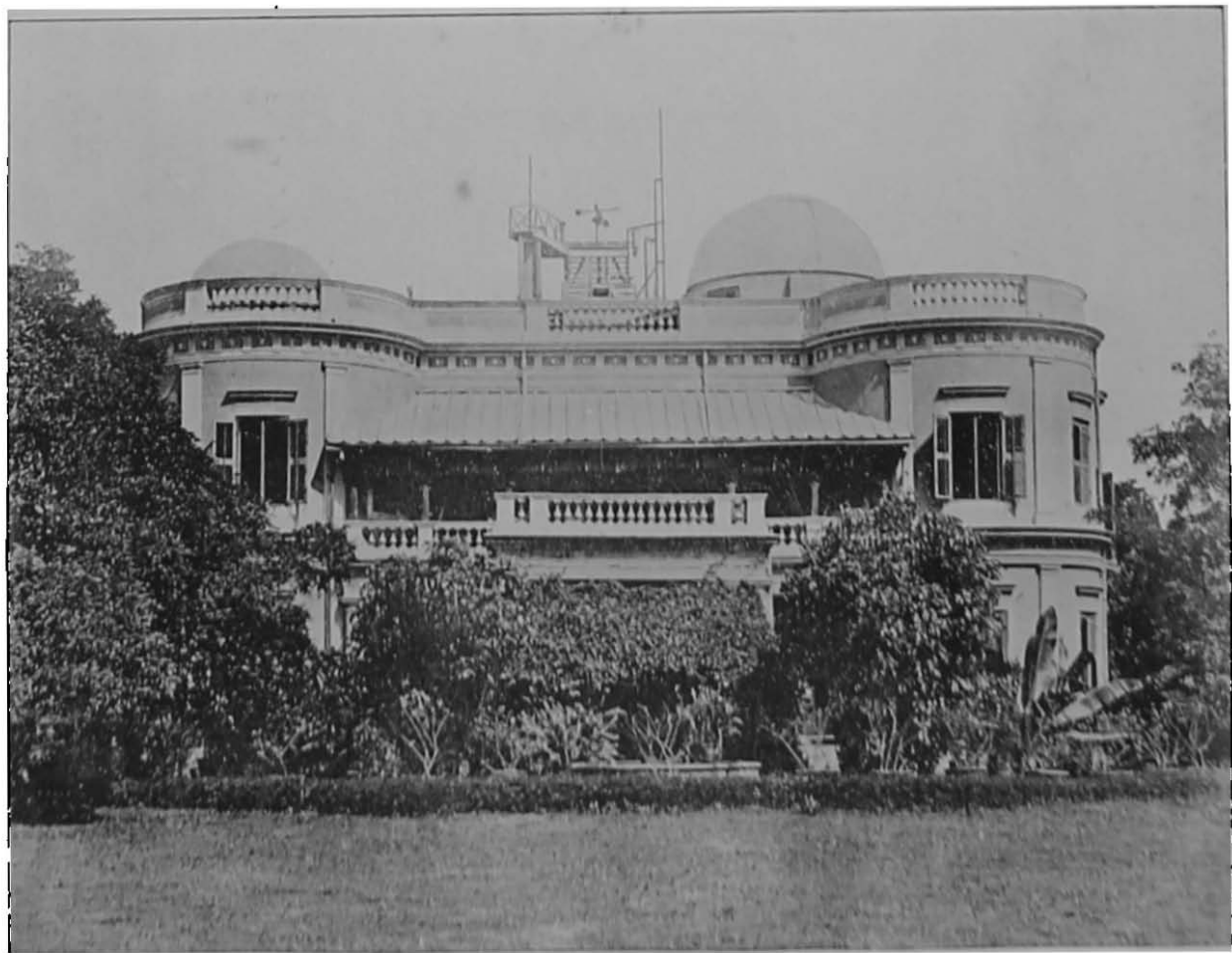




**Report on the Administration of the  
Meteorological Department of the  
Government of India in 1925-26,  
and a Note on the Long-  
Established Observatories  
of Madras and  
Bombay.**

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SIMLA  
GOVERNMENT OF INDIA PRESS  
1926



OBSERVATORY MADRAS  
Founded 1788  
(Newer part)

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**Report on the Administration of the Meteorological Department of the Government of India in 1925-26, and a Note on the Long-Established Observatories of Madras and Bombay.**

CONTENTS.

	PAGE.
Note on the Madras Observatory .. .. .	1
Note on the Colaba Observatory .. .. .	3
<i>Administration Report for 1925-26—</i>	
Chief Features of the year .. .. .	6
Leave and appointments .. .. .	8
The system of storm warnings .. .. .	9
Flood warnings .. .. .	11
Military and aviation weather warnings .. .. .	12
New weather service for R. A. F. .. .. .	12
Supply of meteorological information .. .. .	13
Observatories .. .. .	13
Inspection of Observatories .. .. .	15
Marine meteorology .. .. .	15
Rainfall registration .. .. .	16
Seismology .. .. .	19
Time signals .. .. .	19
Publications and library .. .. .	19
Concluding remarks .. .. .	20

Last year saw the completion of the first half-century's history of the Department as an organised unit for India ; and the present year completes a whole century of history in the case of Bombay Observatory. But both these records are eclipsed by that of Madras, for the observatory there was established in 1792,

Madras Observatory (see Plate). 134 years ago, by the Hon. East India Company "for Promoting the Knowledge of Astronomy, Geography and Navigation in India". Sir Charles Oakeley was then Governor of Madras ; he had been Assistant Secretary at 16,\* an age when most present-day English boys have barely forgotten the feel of their knickers ; had graduated Secretary at 22, and proceeded Governor (with a baronetcy attached) at 39. In an age when the mental horizons of the Hon. East India Company's officers were heavily clouded by the pursuit of gain, and their hands busy in shaking the pagoda tree, he rose above his contemporaries in taking a keen interest in astronomy. So keen, indeed, was he, that without awaiting from the Court of Governors in London the approval for which he had asked, he established the observatory *ultra vires*, and when the actual sanction arrived in 1792, the building was complete and partly equipped.

In those happy days valuable initiative had free scope, for by the time objection could be raised an act had become a matter of history, and its author

\*Lawson : "Memories of Madras", page 117.

was probably entitled to claim *De mortuis exemption from censure*. Such means of progress cannot be adopted nowadays, for Standing Finance Committees, cables, Secretaries of State, and other inventions of a later age place restrictive limits on peculiar action.

Oakeley's scheme was largely helped forward by the liberality of a member of the Madras Government—Mr. William Petrie—who some 5 years earlier had built an observatory at his private expense, the first ever instituted for astronomical purposes by a European in the East. The original building, (the transit-room of the present observatory) was erected with great care, every precaution being taken to secure the utmost possible stability for the instruments and durability for the structure. The pier which carried the original small transit instrument is a granite pillar weighing 2½ tons resting on a base of solid brickwork and separated from the foundations of the walls. On the top of this pier there is cut :—

Michael Topping Arch.

A. D. MDCCXCII.

Michael Topping was captain of E. I. C. Ship "Walpole" and was engaged in 1792 in taking observations of the currents in the Bay of Bengal. He became Chief Surveyor in Madras in 1794, and with the versatility which so conspicuously marked the Company's Officers in those days turned his hand to architecture when the need arose. On the south wall of the observatory is a slab bearing the following inscription :—

Astronomiæ Consecratum

Sumptibus Societatis Anglicanæ

In India Mercaturæ Faciendæ

Favente CAROLO OAKELEY Bar<sup>o</sup>

Præfecto Præsidiî Sancti Georgiî

A. D. MDCCXCII.

and somewhat corresponding inscriptions in Tamil, Telugu and Hindustani are carved on the granite pier in order that "Posterity may be informed a thousand years hence of the period when the Mathematical Sciences were first planted by British liberality in Asia".

2. The first Astronomer was Mr. J. Goldingham, F.R.S., who also held the appointment of Government Architect. His earliest observations made in 1793 are recorded in a manuscript volume, now preserved in Kodaikanal Observatory, prefaced by an account of the building of the observatory, from which quotation has been made above. Two volumes contain his observations between 1812 and 1825, and another contains an account of his very valuable pendulum observations made near the equator and at Madras. He also made longitude determinations of a number of stations in India and elsewhere, a long series of observations on the velocity of sound by means of the Fort and Mount time guns, and he began a meteorological register in 1796.

He was followed by Mr. Thomas Glanville Taylor, F.R.S., who had been trained at Greenwich Observatory and held charge of Madras observatory from September 1830 till early 1848. He equipped his observatory with new and more powerful instruments and began the compilation of his Star Catalogue which, in its final form, was published in 1844, and contains the places of 11,000 stars. This catalogue is still asked for, and was reprinted some 20 years back. Hourly meteorological and magnetic observations were begun in 1840 by Captain S. O. E. Ludlow, and transferred to the observatory in 1845, when the buildings were considerably enlarged.



COLABA OBSERVATORY BOMBAY.

Founded 1801. Photographed 1877.

From 1849 to 1861 the appointment of Astronomer was held successively by Captain W. S. Jacob, Major W. K. Worster and General J. F. Tennant, R.E., and then for 30 years by Mr. N. R. Pogson, who was joined in his work by his wife and daughter, the latter of whom held also for many years the appointment of Meteorological Reporter to the Government of Madras.

After 1861 the observatory was again furnished with modern instruments of a high class, the chief being a transit circle and an 8-inch equatorial; and during Mr. Pogson's tenure the transit circle was employed for the preparation of a catalogue of 5,000 stars, each of which was observed at least five times. With the equatorial Mr. Pogson discovered six minor planets and seven variable stars, and continued his work on an atlas of variable stars. Mr. Pogson died in 1891 before the observations for the catalogue had been completely reduced or published, but that work was completed by his successor, Mr. Michie Smith, who remained Government Astronomer at Madras until 1899.

3. For some years before this it had been recognised that the equipment of the observatory had again become inadequate, and that Madras was unable to undertake any work in the newer fields of spectroscopic and photographic astronomy. The question then arose of what the future work should be, and where the new equipment should be located—at Madras or at one of the hill stations where a clearer and steadier atmosphere and better observing conditions would be obtainable. It was eventually decided (1893) to locate this part of the Madras Observatory at Kodaikanal, and to furnish it with new instruments for the spectroscopic study of solar phenomena and changes, and for detection of any solar influences on terrestrial phenomena—more particularly their influence on monsoon strength and its distribution, with their corollary, the incidence of famine. The present observatory at Kodaikanal, started by Mr. Michie Smith, continued by Mr. Evershed, F.R.S., and now directed by Dr. Royds, is the result of that decision, and a systematic study is now being made there by daily observations of the sun's surface; the work is done in co-operation with other observatories similarly equipped in other parts of the world.

4. In 1899 Mr. R. Ll. Jones, Professor of Physics, Presidency College, Madras, was appointed Meteorologist, Madras, and did valuable work in that capacity. He published three important papers in the departmental memoirs, Professor Jones retired in 1919 and in 1921 was followed by Dr. S. R. U. Savoor, also of Presidency College.

5. It was in the year 1823 that the present site of the Colaba Observatory was selected and the ground enclosed under the direction of the East India Company. The main building was erected in 1826 under the supervision of Mr. Curnin, the first Astronomer at Bombay, and during the year now under review completed a century of its existence. The first fifteen years of the observatory's operations were marked by a period of inactivity, for the instruments supplied to Mr. Curnin were found to be defective and had to be shipped back to England. In 1835, the Observatory was assigned as a dwelling house to Mr. Orlebar, Professor of Astronomy in the Elphinstone College, and although a few instruments were placed at his disposal, no meteorological or magnetical observations taken before 1841 are on record. On the recommendation of the Royal Society systematic observations began in that year, and the Observatory was associated in research on meteorology and magnetism (besides continuing its astronomical work) with the colonial observatories of Toronto, Hobarton, St. Helena, Singapore, the Cape of Good Hope, and with the Indian Observatories at Simla and Madras. From this year the active life of the Observatory may be said to have begun. In 1842, Mr. Orlebar was succeeded by Dr. Buist, but the appointment of Astronomer at the Observatory was subsequently held by officers of Her Majesty's Navy stationed at Bombay. This arrangement continued till 1864,

during which period continuous records of astronomical, magnetic and meteorological observations were secured. But the work was not wholly satisfactory ; the generally defective condition of the equipment of the Observatory resulted in the appointment by Government of a committee of enquiry which, after a full investigation, recommended that (a) a full equipment comprising the latest type of recording instruments should be procured, and (b) a full-time and fully qualified officer should be appointed as Director. These recommendations were at once acted upon, and Mr. C. Chambers, F.R.S., was appointed in 1865 as the first Director. The change then made has more than fulfilled the expectations of usefulness for the Observatory, which now ranks as a first class Institution with a well-established reputation in the scientific world. Both the magnetic and meteorological branches were, as recommended, fully equipped with photographic and mechanically self-recording instruments and with other auxiliary instruments for eye observations. The activity of the Observatory under Mr. Chambers' régime is apparent from the papers published by him in scientific journals, and by the volumes issued from the Observatory during the years 1865 to 1894, which contain valuable contributions to science. On the death of Mr. Chambers in February 1896, Dr. N. A. F. Moos was appointed to fill the vacancy.

6. Later in 1896, Sir John Eliot recommended to the Government of India that Colaba Observatory, till then under the Government of Bombay, should be transferred to the jurisdiction of the Imperial Department with the Government of India ; that the Director should reside in Kodaikanal and there do his work of analysis and memoir-writing on the Colaba records, and that the officer in charge on the spot should be a half-time Superintendent holding professorial duties at some Bombay College.

In 1898 Sir Norman Lockyer was deputed by the Secretary of State to visit India and report upon various observatories and their work. Subsequently the imperialisation was effected, but the division of duties between a non-resident Director and a resident superintendent was not adopted, and the Director remained on the spot.

In 1898 a seismograph was obtained and set up, to take part in the programme of observations started by the Seismological Committee of the British Association.

7. Early in 1900 the city of Bombay decided to electrify its street tram service, and it became necessary to remove the magnetic work from Colaba to a place free from artificial disturbance. A new Magnetic Observatory was consequently built at Alibag some 18 miles to the south-east of Bombay, a distance which was considered sufficient to secure the needed immunity, but still small enough to retain generally similar magnetic conditions and so to continue the record of Bombay measurements. The site was secured in 1902, the buildings were completed in 1903, the observatory was equipped with a full set of new magnetic instruments, and comparative observations began in April, 1904.

During the next two years, and before the electric tramways were put into actual commission, undisturbed duplicate records were obtained at Colaba and Alibag for comparison purposes, and the magnetic work at Colaba was then permanently closed in March 1906. By that time Colaba had the creditable record of more than 60 years of continuous magnetic records, and in 1910 Dr. Moos, the Director, published a comprehensive study of the whole, for the period 1846 to 1905, under the title " Colaba Magnetic Data ".

Dr. Moos retired in 1919, and the Directorate was assumed in 1920 by Mr. T. K. Chinmayanandam and in 1922 by Dr. S. K. Banerji.

8. A few years after the appointment of Mr. C. Chambers as Director of the Observatory, the Government of Bombay created the post of Meteorological

Reporter to the Government of Bombay, and located this officer and his staff at the Observatory. Mr. Frederick Chambers became the first Reporter, and associated himself with Mr. C. Chambers in meteorological and magnetic investigations. In 1888 the post of meteorological reporter was reduced to a half-time appointment and placed under the control of the Imperial Meteorological Reporter. The local Superintendent of Telegraphs was appointed in this post, the meteorological office being transferred to the Telegraph buildings. This arrangement remained in force till April 1923 when the weather duties were returned to Colaba Observatory, the half-time post of the Meteorologist was abolished, and the weather office amalgamated with that of the Director, Bombay and Alibag Observatories, who was thereafter designated as 'Meteorologist, Bombay'.

9. The operations of the observatories at Colaba and Alibag are directed first to enquiry into the sciences of terrestrial magnetism, meteorology, and seismology; secondly, to the publication of recorded facts and observations, their reduction and discussion, and to the distribution of publications amongst learned societies and men of science in all parts of the world; and thirdly, to astronomical observations for the purposes of timekeeping, the signalling of time for the purposes of navigation and the rating of marine chronometers. With these objects in view, the observatories are equipped with various magnetic, meteorological, astronomical and seismological instruments installed in separate buildings, suitably constructed for their accommodation.

The routine operations of the Observatory and Meteorological Office consist in maintaining in continuous action the autographic instruments (magnetic, meteorological and seismographic); taking eye observations five times a day of the absolute instruments; taking a regular series of observations to determine the absolute values of the various magnetic elements; reducing the data thus secured and putting them into the proper form for publication and investigations; publishing a daily weather report; collecting data for marine meteorology; supplying climatological, magnetic and seismic data and reports to several officers and men of science, and furnishing the requisite information on magnetic, meteorological, seismological and other allied questions to Government Officers and others. In the astronomical section the observations of stars and sun are made with sufficient frequency for the correct rating of the large number of chronometers kept in store for issue to ships of the Royal Indian Marine and the Royal Navy, and for directing the falls of the time-signal balls on the towers at the Castle and Prince's Dock. Wireless time-signals from the various time transmitting stations, particularly Eiffel Tower and Nauen, are regularly received in the observatory and used as a check on the determination of local time.

The principal publications which have been issued by the Observatory are :—

- (1) Bombay Magnetical, Meteorological and Seismographic Observations ; 42 volumes.
- (2) Meteorology of the Bombay Presidency.
- (3) Colaba Magnetic Data ; 2 volumes.
- (4) Magnetic Disturbance Charts, 1905-1915.
- (5) Rainfall in the Bombay Presidency ; 6 volumes.
- (6) Numerous papers published in the Proceedings of the Royal Society, Philosophical Transactions of Royal Society, Philosophical Magazine, Terrestrial Magnetism and Atmospheric Electricity, Nature, etc.



# REPORT ON THE ADMINISTRATION OF THE METEOROLOGICAL DEPARTMENT OF THE GOVERNMENT OF INDIA IN 1925-26.

## CHIEF FEATURES OF THE YEAR.

10. In the year under review, the first of the Department's new half century, it became necessary to propose to Government various internal changes bearing on further development with utilitarian objects. That changes to allow of extended practical activity were called for, had been independently evidenced by the critical interest in the department shown during the year by Chambers of Commerce and the responsible Press of the country. A resolution of the Associated Chambers, at their meeting in December, outlined the Chambers' views as to present meteorological needs, and their views coincided closely with those of the department itself: while with regard to the Press, it was very noticeable throughout the year how frequently was voiced the public realisation that the time had come to provide adequately for essential advance. It has come, in fact, to be generally recognized that if the Meteorological Department cannot claim to be a revenue-producing body, it is incontestably revenue-saving, and that with suitable official support it would rapidly justify the allotment of a greatly increased budget.

In regard to this support it is gratifying to be able to record that Government have recently approved in principle the proposals put forward for early extension, and the department wishes to express the greatest appreciation of the helpful interest now shown officially in the desired new developments. As first fruits of the approval referred to, sanction has been received for an immediate small increase of staff, with a promise of early consideration for action on the remainder of the programme in view. The staff increase will admit of a first step towards provision for adequate treatment of marine meteorology, improvements in daily forecasting, analysis of accumulated upper-air data, and the better care of departmental instruments.

11. Shortly before his retirement Sir Gilbert Walker pointed out to Government that statistical methods of forecasting, using ground level data, had been developed, and given a full chance, in the course of 48 years of work in Simla; and that as such methods had shown limitations, the time had come to use in addition all other available means of improvement. The processes at work in the atmosphere being essentially physical it was necessary to take actively in hand the measurement of characters of air currents throughout their depths by means of balloons and recording instruments; and as for such physical work generally the location of the headquarters office in Simla was unsuitable, removal to the plains had become advisable.

Sir Gilbert Walker agreed, in fact, with his officers in regarding an active experimental programme as essential at the present stage, and Government have now given their emphatic approval to this view. They have promptly granted an initial monetary allotment in the budget for 1926-27, and a start is to be made at once by acquisition of land at Poona, and preparation of building plans and material.

12. Three several schemes in connection with the supply of weather information to aviators received attention during the year. One concerned the Royal Air Force squadrons on the frontier, for whom the R. A. F. appointed two British meteorologists to start local forecasting centres at Quetta and Peshawar respectively. In view of the advantage of concentrating all meteorological arrangements as far as possible under one authority, and in return for the useful information which these officers will be able to supply, this department placed at their disposal the necessary equipment, as well as telegraphic information from observatories in Persia and north-west India.



The two other schemes, still in the stage of examination, concern the share which India will take in the supply of meteorological information to airships and aeroplanes on the Egypt-Karachi route. Airships may follow alternatively the Persian Gulf and Red Sea routes, according to the prevailing or seasonal flow of the upper winds; and for the airship service India has been asked to undertake the cost and responsibility of providing weather information in the area roughly represented by the triangle Karachi-Aden-Basrah, a region singularly poor at present in communications, and in conveniences for starting and maintaining upper-air observatories. It will be recollected that a disastrous storm occurred in October last in the Persian Gulf, and did great damage to pearling boats and date plantations: such a storm might well spell destruction to an unwarned airship, but so open is the present meteorological network in those regions that the indications afforded on weather maps of what was to take place there were practically *nil*. Forecasting for airships from a centre at Karachi will therefore involve considerable expenditure, and call for a very knowledgeable choice of programme.

13. The upper-air researches of the department, which centre round the observatory at Agra, (see Plate), were carried on throughout the year by measurements of high level winds at Agra and eight outstations. The expedition to Jask at the entrance of the Persian Gulf completed its year's useful observations of upper winds there; and a new station was opened at Karachi, partly to provide needed information to aviators of the R. A. F., and partly in preparation for the Airship and Aeroplane services which are expected to be operating within two or three years.

The Agra results have already been found to bear close application in daily weather forecasting; and they promise now to be of practical use for seasonal forecasts, possibly a still more important purpose. During the 12 years for which data are available a close relationship has existed between the strength of westerly winds in the air-stream between 4 and 8 km. above Agra in September and October, and the subsequent winter precipitation in north-west India. The relationship has a physical basis, for the high-level winds in Agra first begin in September to assume their winter characters, and it is in these winds that the rain-bearing storm-centres of the cold weather travel eastward from the Mediterranean. There have further been found hopeful indications in the hot-weather upper-winds at Agra and Bangalore for forecasting monsoon rainfall. Many further years' test-data will be required before these tentative conclusions can be accepted, but meanwhile the department believes that the opening of several more upper-air stations over India and Burma, as well as at Port Blair, Aden and Seychelles, would bring results thoroughly justifying the expenditure involved.

Quite apart from potential use in seasonal forecasting, an extension of this work is needed. Improvement in the practice of warning for cyclones calls now for much more knowledge of upper-air currents than exists to-day in Indian regions, and it is further essential not to be found materially wanting in preparedness when the safety of aircraft in a few years' time shall draw attention to any lack of present foresight.

14. During the year the services of storm-warning to ports and shipping and of flood warning to officers in the Irrigation, Railway and other departments, were carried out from Simla, and were as satisfactory as circumstances allowed. Warnings for the Arabian Sea were issued on 21 occasions, one for a storm and the others mainly for depressions or for squally weather due to advances of monsoon. For the Bay of Bengal warnings were issued for 31 periods of disturbed weather, of which four developed into moderate storms and one into a severe cyclone.

On the general question whether storm-warning for the Bay of Bengal should continue to be dealt with in Simla or should revert to Calcutta (under adequate staff for the first time), Government decided in favour of the latter, and two officers, one of whom had been under intensive training to prepare him for the work, were transferred to Calcutta in March, and are to be followed by a third officer newly to be appointed. Apart from this work of storm-warning, it is expected that very solid advantages in the efficiency of Alipore Observatory will be gained from the change, which replaces a single part-time officer, necessarily absent on college duties for the greater part of each day, by trained personnel with their whole-time available for the work of the observatory.

It was mentioned last year that an attempt to secure "touch" with ship-captains in the Bay had been made by supplying on personal loan reliable instruments for shipboard use, and that two barographs were in that way in operation on the Madras-Rangoon run. The intention is to extend this practice considerably, and it will now be possible for the new storm-warning officers in Calcutta to give attention to the matter. Fully effective action must, however, await the appointment of the Marine Meteorologist, for there is much work attached to the system of loan of such instruments: its purpose is not gained unless prompt and critical attention is given to the instrumental records, and unless appreciation is shown of the services of commanders in working the instruments efficiently. The appointment of this officer is under consideration by Government.

15. Allusion had to be made in the report for 1924-25 to the enforced cancellation of some of the points of retrenchment which had been impressed upon the department in an earlier year. Public opinion, and the insistent demands of such well-informed bodies as the Bengal Chamber of Commerce, had shown that, in the attempt loyally to meet the call for retrenchment, more had been undertaken than had been advisable. In the year just past this reaction had to go further; the Madras Daily Weather Report has returned to its original practice of issue throughout the year, and the Bombay report has resumed an additional month, so that it now appears from May to November inclusive.

16. In matters of publication a paper on the storms of the cold-weather, by Sir Gilbert Walker and Dr. Kumeshtar Ray, was issued during the year, and there were under preparation or in the press an issue of revised normals of meteorological elements at departmental observatories, and a set of tables of monthly rainfall in geographical divisions and sub-divisions covering the last 50 years. An Atlas of Storm Tracks in the Bay of Bengal, based on the history of the last 33 years, was published by Dr. Normand and a volume giving the magnetic, meteorological and seismographic observations made at Bombay during 1916-20 was published by the Bombay observatory in January.

#### LEAVE AND APPOINTMENTS.

17. Mr. S. Sitaramayya, B.A., Assistant Meteorologist, was transferred from Agra to Simla, and Mr. Barkat Ali, M.Sc., from Simla to Agra. The former made over charge of his office to Mr. Barkat Ali on the 21st April 1925, and joined the Simla headquarters three days later.

Mr. S. Sitaramayya, was granted leave on average pay for one month and 8 days from the 22nd June 1925, and in continuation leave on half average pay for 26 months and 22 days. Mr. Mukand V. Unakar, B.A., was appointed to act as Assistant Meteorologist during his absence.

Mr. M. V. Unakar reverted to his post of Superintendent in the Simla Meteorological Office from the 17th August 1925 and Mr. Hans Raj Puri, M.Sc., an Assistant in the Simla Meteorological Office, was appointed to act as Assistant Meteorologist with effect from the same date, *vice* Mr. Sitaramayya, on leave.

Mr. Hans Raj Puri reverted to his post of Assistant in the Simla Meteorological Office from the 21st September 1925. Mr. F. M. Shuja, M.Sc., an Assistant in the Simla Meteorological Office was appointed to act as Assistant Meteorologist with effect from the same date, *vice* Mr. Sitaramayya on leave.

Mr. F. M. Shuja reverted to his post of Assistant in the Simla Meteorological Office from 1st October 1925, and Mr. M. V. Unakar was appointed as Offg. Assistant Meteorologist from the same date, *vice* Mr. Sitaramayya.

Mr. V. V. Sohoni, B.A., B.Sc., Meteorologist, Simla, after return from leave for 30 days, resumed charge of his duties at Simla from the 20th April 1925.

Mr. V. Doraiswamy Iyer, B.A., Assistant Meteorologist, on return from leave for 3 months and 12 days reported himself for duty at the Madras Office from the 8th June 1925.

Dr. S. N. Sen, Ph.D., M.Sc., was appointed on probation to be a Meteorologist in the Indian Meteorological Department with effect from the 14th September 1925.

Dr. K. R. Ramanathan Iyer, M.A., D.Sc., Lecturer, at University College, Rangoon, was appointed to be a temporary Meteorologist in the Indian Meteorological Department and posted to Simla Office with effect from the 2nd October 1925.

Dr. B. N. Banerji, M.Sc., Ph.D., was granted leave on average pay from the 11th September, 1925 to 7th October, 1925.

Mr. G. Chatterjee, M.Sc., Meteorologist, Upper Air Observatory, Agra, was granted leave on average pay for two months with effect from the 12th October 1925.

Dr. S. K. Banerji, D.Sc., Meteorologist, Bombay, was granted leave on average pay for 3½ months with effect from the 16th December 1925.

Dr. T. Royds, D.Sc., Director, Kodaikanal Observatory, returned to duty, after leave for 13 months, on the 18th December 1925.

Mr. Barkat Ali who had been appointed on probation to the post of Assistant Meteorologist with effect from the 16th April 1924, was confirmed in his post from the 21st December 1925.

Dr. S. N. Sen was granted leave on average pay for 6 days with effect from the 28th December 1925.

Dr. B. N. Banerji was posted to Agra from 8th October to 2nd December 1925 and to Bombay from 14th December 1925 to 8th March 1926. He returned to Simla on the 15th March 1926.

Dr. K. R. Ramanathan was posted to Bombay with effect from the 4th March 1926.

Dr. C. W. B. Normand, M.A., D.Sc., Meteorologist, Simla, went on leave on average pay for eight months with effect from the 29th March 1926.

#### THE SYSTEM OF STORM WARNING FOR PORTS AND SHIPPING.

18. The work of warning ports and shipping in the Arabian Sea and the Bay of Bengal of the approach of cyclonic storms, or of bad weather, was done throughout the year from Simla. Thirty-two ports are on the warning list for storms in the Arabian Sea, and thirty-eight ports, fourteen River Police Stations and thirty-nine District Police stations for storms in the Bay ; of the Bay ports, twelve get additional information regarding the particular areas in which weather is disturbed, a special system of 'locality signals' being in use for this purpose. Shipping at sea is also supplied with the latest weather information by means of wireless bulletins, which are broadcasted twice daily, or more frequently if the occasion demand it, from the radio stations at Bombay, Karachi, Calcutta, Rangoon, Madras, Matara (Ceylon) and Aden. An account of the warning system as it stood in 1918 may be found in the "Code of Storm Warning Signals for use at Indian Ports," obtainable at Calcutta from the Superintendent of Government Printing India ; but additions to the extent of the warnings have been made since.

*Warnings for storms or disturbed weather issued to ports and shipping in the Bay of Bengal.*

19. During the year warnings were issued for 31 periods of disturbed weather ; the disturbances developed into moderate storms during four of these periods, and into a cyclone once. This last storm was generated in the neighbourhood of the Nicobars on the 10th May. The 8 hrs. observations of the 11th showed a marked fall of pressure at Port Blair and a fairly definite circulation of wind round an area of low pressure south or south-east of Port Blair. By the morning of the next day a definite depression had formed with centre near Lat.  $11^{\circ}$  N., Long.  $19^{\circ}$  E.; it continued to intensify and by the morning of the 14th had become a severe storm of small extent with centre near  $13^{\circ}$  N.,  $85^{\circ}$  E., the area of stormy winds being of diameter about 150 miles. The storm developed still further, and, after passing through  $14^{\circ}$  N.,  $82^{\circ}$  E., at 20 hrs. on the 15th altered its course towards the north and crossed the coast a little north of Masulipatam shortly after noon on the 16th. Thereafter it weakened to a depression and advanced north-eastwards parallel with the coast line without further weakening until it reached Assam, where it disappeared on the 20th. The storm was of the very violent type which has a calm centre, and the deficiency of pressure in the central area was at least  $1.5''$ . It was noteworthy for the circumstance that although its point of crossing the coast did not lie actually in south Madras it was the first storm since 1888 to have in May a track across the Bay towards that coast. In the Godavary and Kistna districts it caused extensive damage to buildings with some loss of life and a dislocation of railway and telegraphic traffic ; hundreds of cattle also were reported to have been drowned.

*Warnings for storms or disturbed weather to ports and shipping in the Arabian Sea.*

20. The west coast ports are warned not only for storms but also for squally weather, especially at the beginning of the monsoon. There were 21 periods of disturbed weather for which warnings were issued : during 15 of these the warnings were for squally weather or strong winds connected with the monsoon, during 5 for rough weather off the Mekran coast due to the passage of western depressions through Baluchistan, and during the remaining one for a storm which struck the Malabar coast in November. This storm had its origin in the south-east of the Bay of Bengal. Unsettled conditions appeared in this region on the 3rd November and, advancing westwards, developed into a depression off the east coast of Ceylon by the morning of the 6th. The depression was over Ceylon on the morning of the 7th, and later passed into the Arabian Sea : at 8 hrs. on the 9th it was a storm of small extent with centre about  $2^{\circ}$  west of Cape Comorin. Its track then became practically northerly and it crossed the coast near Tellicherry on the night of the 10th-11th. The warnings to ports other than Calicut and Tellicherry were satisfactory. There was only one ship's message on the 10th from the sea area, and that one was some considerable distance from the storm and afforded little help ; but the log of the S. S. "Japan", subsequently obtained, showed clearly that if a message had been received from that ship to give any one of the three sets of observations logged at 10 h., 12 h. or 16 h. on the 10th ~~September~~ in the immediate vicinity of the storm, the sharp change of storm track would have come to light, and the probability would have been clear of the storm striking the coast. In that case the "distant warning" signals which had been hoisted along that coast could have been changed to "local danger" signals in good time.

21. The number of warning messages for ports and the two sea areas issued by the department during the year was 5,149. These messages consist of radio weather broadcasts from the wireless stations at Rangoon, Calcutta, Madras,



Tornado destruction: train blown off bridge.

Matara, Bombay, Karachi and Aden, and of warning messages during storms or periods of disturbed weather to coastal ports on the Bay of Bengal and the Arabian Sea.

22. Reports on the working of this marine warning system were received from 33 officers on the warning lists ; of these, 31 stated that the warnings were satisfactory or gave no remarks, and the remaining 2 offered criticisms which received prompt consideration. Of the criticisms offered, the one from the Deputy Conservator of the Port, Rangoon, complained that local warnings were not issued in respect of the storm experienced at Rangoon on the 15|16th October. At the time of this storm another and greater disturbance was developing off Masulipatam, to last several days and traverse the Bay to the Burma coast near Cox's Bazar. The smaller storm was, on the evidence available, a mere depression on the 15th and unlikely to develop seriously : of this notice was given to Rangoon. By the next morning it had passed inland and shown that its winds were stronger than the evidence had indicated. It may be remarked that subsequent examination of the logs of S. S. " Jalvihar " and " Tilawa " showed that if those ships had telegraphed their logged data on wind direction and strength the true state of the case would have been known, and warnings would have obviated the damage that actually occurred in Rangoon river.

The second criticism was from the Port Officer, Tellicherry, who objected that the " distant warning " and not the " danger " signal was hoisted during the cyclonic storm which passed over the port between 4 A.M. and 7 A.M., on the 11th November 1925. The reason for this has been shown above to have been the complete lack of observations from the sea area near the storm.

#### FLOOD AND STORM WARNINGS, AND WEATHER FORECASTS TO DISTRICT, IRRIGATION, RAILWAY AND OTHER OFFICERS.

23. This work was done wholly by the Simla Meteorological Office. The organisation for warnings is a development of many years' practice, and its details differ considerably in character, according to the nature and extent of the flood or weather warnings required by those concerned. In most cases the officers require telegrams either warning them of advancing storms likely to give heavy rain or informing them of the actual occurrence of heavy rainfall likely to cause severe floods which may injure railways or canal works ; in other cases they require warnings or forecasts of the weather for as long a period beforehand as is practicable.

At the end of the year there were 199 addresses in the listed number of district officers and officers in the irrigation, railway and other departments to whom flood warnings, weather forecasts, and intimations of the likelihood of rain during the dry season were to be sent by this department. There were also 19 officers of the Telegraph Department requiring warnings, mostly for strong winds.

In order to provide against serious loss of life and property in inland Bengal when a cyclone from the Bay crosses the coast, 461 officers were added in 1921 to the warning list ; of these officers 40 hoist the signals shown in Appendix D of the " Code of Storm Warning Signals " whenever instructed to do so.

The number of special inland forecasts and warning messages issued by the Department during the year was 1,555, and in addition 850 telegrams of actual heavy rainfall were sent by meteorological observers direct to various officers.

Reports on the working of this system of inland warnings were received from 26 of the officers on the warning lists. Of these, 22 stated that the warnings were satisfactory or gave no remarks, and the remaining 4 offered suggestions or minor criticism, which have received consideration.



On the whole a comparison of the inland warnings with the actual subsequent rainfall, or the tracks of storms across country, show that the system is working satisfactorily and that most of the warnings issued were of value to the recipients. Examples of damage by storm and flood are shown by two plates of illustrations herein.

*Warnings of disturbed weather to military authorities and aviators.*

24. Telegraphic forecasts of the likelihood of bad weather, required by the Military Headquarters, Waziristan, in the first two months of the year were stated to have proved accurate and of utmost value for military operations. Special warnings were several times issued to the General Officers Commanding-in-Chief, Northern Command, Rawalpindi, and Eastern Command, Roorkee, and also to the G. O. C., Peshawar District.

From time to time telegraphic weather warnings were supplied to various aviators, and it is satisfactory to note that almost invariably the forecast were reported to have been correct and useful.

The following appreciation, dated 27th May 1925, of the department's warnings, received from Headquarters, Royal Air Force, Peshawar, is of interest :—

"I should like to record the fact that the weather reports issued from the office of the Director-General of Observatories, Simla, during the recent operations in Waziristan and since, especially those issued in connection with the flight of aeroplanes from Risalpur to Srinagar during the past week, have been of the utmost value.

The success of the flight to Srinagar rested to a great extent on the accuracy of the weather reports received ; that issued from your office enabled the flight to be carried through without interference from inclement weather, and in spite of local adverse reports."

The Chief of the Air Service, War Department, Washington, wrote with regard to the American world flyers :—

"The flight of the United States Army Airplanes which set out to encircle the world on April 6, 1924, succeeded in completing its undertaking September 28, 1924. It is realised that only through the aid and co-operation given these airmen along the route were they able to make the expedition a success. The reports of the members of the flight and the officer who made the advance preparations speak highly of your aid.

I wish to express to you my sincere thanks and appreciation for your assistance which has played such a large part in making the first airplane flights around the world a reality".

**ORGANISATION FOR IMPROVED WEATHER SERVICE TO ROYAL AIR FORCE.**

25. Opinions had for some time been agreed that the available supply of meteorological information to the R. A. F. on the frontier was inadequate, and that the minimum requirement was the posting of a competent meteorologist at Peshawar and another at Quetta, with necessary staff, instruments, stores and daily telegrams to enable them to make detailed forecasts ; and it was judged that their daily telegrams should include pilot balloon observations from the R. A. F. stations at Karachi, Quetta, Dardoni, Peshawar, Lahore and Ambala.

With a view to give effect to these proposals, F./Lt. R. G. Vervard and F./Lt. R. P. Batty were appointed with *pro forma* R. A. F. commissions as Meteorologists for the Royal Air Force, and in November 1925 were stationed at Peshawar and Quetta respectively. These two officers are under their respective commanders for disciplinary purposes, but their technical work is supervised by the Director General of Observatories. They issue general accounts and forecasts of weather over the area Delhi-Peshawar-Quetta-Karachi.



Flood destruction; line breached.

and detailed local forecasts and warnings, each for his own immediate neighbourhood. The organization to accomplish these aims provides for :—

- (i) A daily composite message from Simla at about noon to each of these officers, embodying in code all the morning observations received from observatories in the Punjab, Sind, the Frontier Province and Baluchistan.
- (ii) Afternoon observations from selected stations in Baluchistan.
- (iii) Afternoon observations from stations in Persia and Arabia.
- (iv) Upper air observations from Karachi, Lahore, Peshawar, and Quetta : with Ambala and Miranshah as soon as arrangements can be completed.
- (v) Such other weather information as can be arranged for from other aerodromes and military stations in N.-W. India.

#### SUPPLY OF METEOROLOGICAL INFORMATION.

26. From time to time special information is supplied to the meteorological departments of England, Australia and Egypt. Climatological and other data, at times involving special calculations, are also provided for sanitary and other officers of Government as well as for those private firms who are willing to pay for the service. The extent to which the department was utilized in this manner during the last year will be seen from the curves B and C in the graph at the end of this report.

#### OBSERVATORIES.

27. *Agra : Upper-air.*—Exploration of the free atmosphere in India has been recognised as indispensable in the interest of aviation, general meteorology, and both daily and seasonal forecasting. The recognition found its expression in the orders issued by Government in April, 1924, placing Agra Observatory on a permanent footing, and also in recent orders sanctioning a second meteorologist for the observatory and some increase in the staff. The principal routine work of the year at the observatory consisted, as before, of—

- (a) supplying material and equipment to the upper-air stations at Quetta, Peshawar, Karachi, Lahore, Simla, Diamond Harbour, Akyab, Poona, Bangalore and Port Blair,
- (b) exercising close supervision over work at out-stations,
- (c) tabulation of pilot balloon results and of cloud observations,
- (d) flight of instrument-balloons ; 50 were sent up and 28 recovered,
- (e) repairs to barometers and anemometers,
- (f) construction of Stevenson screens, 50 of which were made and sent to various observatories and private institutions.

A new 30-B.H.P. paraffin engine, a hydrogen compressor, a new battery of 600 ampere-hour capacity, and a new electrolyser capable of producing 100 cubic feet hydrogen per hour, were installed in the new engine house, the construction of which was completed in February 1925.

The temporary station at Jask, which was opened on the 4th June 1924 to collect upper-air data in an unsurveyed part of the Imperial air route, and also to throw some light on the physical causes of breaks in the monsoon, was continued to secure a whole year's history, the observations made in the previous year having been found to be of considerable importance. Towards the end of the year, on March 14th, an upper-air station was started at Port Blair. A

knowledge of the upper winds at this station, apart from its usefulness for storm warning purposes, is expected to give valuable indications of the oncoming Bay monsoon.

To arrange for a supply of more adequate information to the two R. A. F. Meteorologists, stationed at Quetta and Peshawar, it was decided to transfer the upper-air station at Simla to Ambala and to open a new station at Dardoni, but this could not be given effect to during the year. A new station was opened at Karachi, in August 1925.

28. At the request of the Air Ministry, arrangements were made to expose different samples of airship fabrics, supplied from the airship works at Cardington, to Indian climatic conditions, and Agra was selected as a suitable station for carrying out this test. A report on this exposure was drawn up and sent to the Director of Airship Development, Cardington, and this appears to have met with great appreciation there.

The Agra Observatory, as usual, supplied equipment for pilot balloon work at 8 artillery practice camps during the winter.

29. *Bombay*.—The routine activities of the observatory and the Meteorological Office consisted of registering continuous records of meteorological, magnetic and seismograph instruments, taking numerous eye-observations of meteorological and magnetical elements, reduction and tabulation of the data so obtained, the publication of a Daily Weather Report (for 7 months—May to November—under the revised arrangement), taking star or sun observations for time determination, receiving, rating and issuing a large number of chronometers belonging to the Royal Indian Marine and Royal Navy, directing the local time-ball service at the harbour and collecting extracts from weather logs of ships. All these were satisfactorily carried out during the year; about 81 chronometers were rated and issued and 953 weather logs from ships were collected. The preparation of hourly normals of meteorological elements based on data for 1846 to 1920 was completed during the year and sent for publication.

30. *Calcutta, Alipore*.—In addition to the issue of the Daily Weather Report for northeast India, the Calcutta Office and Observatory have the important duties of supplying all Indian observatories with instruments and stores, keeping a stock of the tested instruments, checking and computing a portion of the data accumulated from observatories, supplying mean local time to the Port of Calcutta and by wireless to shipping at sea, distributing the departmental publications through the agency of the Central Publication Branch and attending to some of the routine correspondence of the department as a whole. The Calcutta Daily Weather Report was published throughout the year in its pre-retrenchment form. The arrangement made last year, in connection with cyclone warning for the Bay, of providing Calcutta with duplicates of telegrams of all special observations from coast stations continued throughout the year. Wireless time-signals were sent out from Calcutta at 14 hrs. and 22 hrs. (Indian Standard Time), and the electric diffuser was regularly used for this transmission. The Meteorologist, as a member of the North Bengal Flood Enquiry Committee, added another part to the report under "North Bengal Floods", which he submitted last year to the Government of Bengal. This part contains a general discussion of variabilities of rainfall and inter-class correlations for different periods and of fluctuations of rainfall in north Bengal.

31. *Madras Observatory*.—The most important routine work, the supply of time to the local shipping, and throughout the Indian telegraph system to the whole country generally, was carried out satisfactorily. The yearly period of publication of the Madras Daily Weather Report, which was shortened by three months in the year as a measure of retrenchment, by the omission of January, February and March, was revised on 1st January 1926 and the

Report will in future continue to be published throughout the year, until the next retrenchment, or perhaps some adequate cause, dictates a change.

32. *Kodaikanal*.—The collection and measurement of spectroheliograms from foreign observatories have been continued as a part of the programme of the International Astronomical Union. At the instance of Lord Rayleigh, the observatory is taking part in his scheme of observations for determining the luminosity of the night sky. A report on the astronomical work of the observatory during the calendar year 1925 was published in March 1926. Orders were received during the year from the Government of India retaining the Assistant Director's quarters for the use of the observatory as its library and store house.

33. *Other Observatories*.—A number of observatories keep continuous instrumental records of certain meteorological elements ; 6 stations record wind by Beckley anemographs, 4 by Dines' anemograph, 6 record hours of sunshine, 15 deal with air pressure and 7 with air temperature.

Of the purely meteorological observatories under the department's care 44 were non-departmental and 216 were maintained by the Government of India ; these include stations as far afield as Tehran, Kashgar, Aden and Seychelles. According to the classification given in the report for 1918-19, the departmental observatories consisted this year of 6 of the first class, 178 of the third class, 7 of the fourth class and 25 of the fifth class. The maintenance of these observatories, the supply to them of tested instruments, and the careful scrutiny of their observations naturally entail much work of a routine character at headquarters. The correctness of observations depends upon the continuance of good exposure and good condition of instruments at observatories, and upon the accuracy of reading by observers. The former point can only be ensured by visits of inspection by trained officers. The latter point can to some extent be estimated at headquarters from the number of mistakes detected in the data for the Indian Daily Weather Report. The stations of great reliability, in which no mistake or at most one has been detected, numbered 30, and the number at which more than 50 mistakes were made was 2. The average number of mistakes during the year at the remaining stations was 10.

34. *Inspection of Observatories*.—One of the essentials for continued accuracy of meteorological observations is frequent inspection of observatories. This feature had been neglected for many years owing either to want of funds or to inadequate staff ; but a marked improvement took place after 1922-23 with more liberal inspection in the following year, chiefly of those stations on the coast lines between Rangoon and Karachi. During 1924-25, eighty-eight observatories and during 1925-26, 63 were inspected by Meteorologists and others. The Director-General visited the principal observatories at Bombay, Agra, Alipore (Calcutta), Kodaikanal, Madras and Bangalore.

Inspection of Upper Air stations at intervals is very necessary, but only three such stations, Diamond Harbour, Karachi and Poona were visited during the year, as staff for the purpose was scanty.

#### MARINE METEOROLOGY.

35. Wireless weather messages from ships at sea, and extracts from weather logs of ships calling at the principal ports on the Indian seaboard, are the chief sources of marine data collected by the department.

The object of the system of radio-messages from ships is mainly to supplement the coast observations in cyclone-warning work. In the absence of observations from sea areas it is not always easy to draw correct conclusions about the position, movement and intensity of storms ; this is the case particularly with disturbances in the Arabian Sea for which inferences have had in the past to be drawn from very insufficient observations from the west coast

line of India. The system of wireless weather messages which was started in 1914, but which was necessarily suspended during the war, was resumed in 1921. It showed improvement over preceding years during the year under report ; thus the number of ships' messages from the Bay and the Arabian Sea totalled 3,689, in comparison with 3,633 in the previous year and 956 in 1921-22. The department gratefully acknowledges the assistance given by commanders of ships who took part in this service, and would especially mention the following steamers from whom more than 40 weather messages were received during the year :—

S.S. "Arankola" ..	56	S.S. "Ekma" ..	67	S.S. "Manipur" ..	47
"Aronda" ..	64	"Erinpura" ..	84	"Narkunda" ..	56
"Aungban" ..	104	"Havildar" ..	51	"Norjahan" ..	51
"Badarper" ..	119	"Jaladuta" ..	71	"Ormara" ..	54
"Chanta's" ..	45	"Kangola" ..	47	"Shah'shan" ..	48
"Chindwara" ..	64	"Koh'nur" ..	54	"Shahzade" ..	68
"Domala" ..	49	"Maharaja" ..	107	"Takhwa" ..	112
"Edavana" ..	55				

This is a gratifying increase, but even yet the department's warning officers frequently lack, at critical times, ships' observations from the vicinity of a storm at sea and find themselves compelled to draw their inferences and base their broadcast messages on coast observations alone. It is hoped that as more ships come to co-operate with the warning service the number of such occasions will steadily diminish. It would be most helpful if co-operating captains would induce others to take a share in this service of information from sea. A message which may appear colourless to a ship captain when despatching it is frequently of great use.

The Madras-Rangoon mail boats were provided with two good barographs, in accordance with the policy of issuing instruments on loan to ships' commanders. The results have been satisfactory and this policy, when extended, will certainly be fruitful in increasing a knowledge of the meteorology of the Indian Seas ; but lack of sufficient gazetted staff prevents at present an extension in this direction.

Apart from ships' wireless messages, an important source of data is the log extracts taken by clerks in Calcutta and Bombay. In this connection the new opening which was created in Rangoon earlier, through the helpfulness of the Port authorities, allowing the observers of the Time-Ball and Tidal observatory of the Port Commissioners to collect ships' data, continued to give valuable service. Occasionally, in special cases, logs of steamers with experience of disturbed weather are collected at Madras ; and the Colombo Port authorities also help similarly whenever requested. A total of over 2,000 logs recorded at the end of the year.

The data thus obtained are entered on charts of disturbances in the Bay of Bengal and the Arabian Sea, and kept for reference in the storm-warning work of the department, and in drawing up an account of the storms of the year for publication in the India Weather Review (Annual Summary).

#### RAINFALL REGISTRATION.

36. The registration of rainfall in India has always been carried out under the control of provincial authorities. In 1889 a uniform system was introduced by the Government of India, and the Director-General of Observatories was made consulting officer in connection with this work. His advice is sought

regarding the starting of new rain gauge stations, and he receives annual reports upon the efficiency of the work from the local controlling officers, who are in most of the provinces the Directors of Agriculture or of Land Records.

The following is a statement giving number of rain gauge stations in India totalling 3,313 as they stood in January 1926 :—

Province.	No. of stations.	Province.	No. of stations.
Burma .. .. .	243	Rajputana .. .. .	338
Assam .. .. .	126	Bombay .. .. .	274
Bengal .. .. .	253	Central India .. .. .	151
Bihar and Orissa .. .. .	317	Central Provinces and Berar (including Irrigation Department.)	168
United Provinces .. .. .	284	Hyderabad .. .. .	18
Punjab .. .. .	191	Mysore (including Taluks) .. .. .	227
Kashmir .. .. .	41	Coorg .. .. .	10
North-West Frontier Province .. .. .	34	Madras (including Feudatory States).	494
Baluchistan .. .. .	80		
Sind .. .. .	64		

In 1920 the necessity of frequent inspections of rain gauges was brought to the notice of the officers in charge of rainfall registration, and subsequent reports have shown a decided improvement in this subject.

The following notes are based on the reports for 1925-26 of these officers :—

**Burma.**—The total number of stations during the year under report was 243 against 241 last year ; of these 18 are meteorological observatories, 30 are in charge of P. W. D. ; 2 under the control of the Director of Agriculture, and the rest under the supervision of Civil Officers. 218 rain gauges were inspected, against 217 in the previous year. The inspections were satisfactory. The main defect was, as usual, nearness to buildings and trees. Steps were taken to remove these defects and to improve the number and quality of the instruments in use.

**Assam.**—There were 126 stations at the end of the year. One new station was opened at Sylhet. The number of rain gauges inspected was 101 against 114 last year. Of these there are 8 rain gauges belonging to the meteorological department. The districts are generally well equipped with rain gauges and their accessories.

**Bengal.**—The number of rain gauges at the end of the year was 253. Two stations, one Henria (Midnapore) and the other at Jalapahar (Darjiling), were abolished, while four new stations were opened, two in Murshidabad, one in Rajshahi and one in Bogra. The number of stations inspected was 229 against 197 in the preceding year. The condition of the rain gauges in the province is reported to have been good on the whole, defects pointed out by the inspecting officer having been promptly remedied.

**Bihar and Orissa.**—There were 317 rain gauges (including 30 in the Feudatory States of Orissa and Chota Nagpur). A new station was started at Gudri in the district of Singhbhum. The number of stations inspected was 270 against 255 of the last year. The condition of rain gauges was generally well maintained.

**United Provinces.**—There were 284 rain reporting stations including 16 meteorological observatories, as against 286 last year. Of the 268 stations under District and Canal-Officers 88 per cent. were inspected during the year as compared with 79 per cent. in the previous year. Two new stations were opened (Dasna in Meerut and Buland

Shahr in Buland Shahr). Four stations were abolished, namely (1) Mohaban in District Muttra, (2) Mirganj in District Bareilly, (3) Ghazipur in District Fathpur and (4) Bara in District Allahabad.

*Punjab.*—There has been no change in the number of raingauges during the year. 119 stations were inspected during the year by Civil Officers.

*North-West Frontier Province.*—There were 34 raingauges : of these 31 were inspected and reported to be in good order, except the one at Chitral, where some repair to the masonry pillar was needed.

*Baluchistan.*—There were 80 raingauge stations and 10 meteorological observatories including a new observatory opened during the year at Sibi. 23 raingauges in charge of the Civil Department were inspected by District Officers as against 18 in the preceding year. The raingauges at Sunri railway station and at Chagazi were removed, as the railway station at the former place was closed and the retention of the gauge at the latter was considered unnecessary. A new station was established at Sorab in the Kalat State on the 8th June, 1925 and the recording of rainfall was commenced at Yak Mach and Nok Kundi railway stations in April 1925 and January 1926 respectively.

*Bombay.*—There were 338 raingauge stations including those in Sind and the Native States : out of these 224 were inspected. In the Presidency proper there were 277 stations, of which 207 were inspected as against 242 in the previous year ; while out of 61 raingauges in the Indian States 17 were inspected as against 40 in the last year. The report of the Director of Agriculture, Bombay Presidency, Poona shows :—

“ The progress made in the direction of raingauge inspection in the last year has not been maintained during this year but inspection work has, nevertheless, been generally satisfactory in the Presidency proper and in Sind. In the case of native states, however, it must be admitted that the inspection work has not been very satisfactory. The attention of the officers concerned in the native states, as well as those in the British Districts, is being invited to the importance of this piece of work and they are being requested to give more attention to the work of raingauge inspection in future.”

*Rajputana.*—Reports on the rainfall registration were received from all the states. In all there were 338 raingauge stations, out of which 301 were inspected as against 311 last year.

*Central India.*—Reports on the rainfall registration were received from almost all the states in the Central India Agency with the exception of Indore. 151 raingauges were inspected against 153 of the previous year. The raingauges were reported to be in good and satisfactory condition.

*Jammu and Kashmir State.*—There were 41 stations altogether, of which 8 are meteorological observatories. The number of raingauge stations inspected during the year was 18 against 21 last year.

*Central Provinces.*—The number of raingauges in the Central Provinces and Berar remained unchanged at 125 and 43 respectively. This figure excludes the raingauges maintained by the Irrigation Department. The opening of a new raingauge at Dhamangan in Berar has been sanctioned, but the work has not yet been done. The number of inspections of raingauge stations was slightly reduced in the Central Provinces and slightly increased in Berar. It was 307 against 309 in Central Provinces and 122 against 115 in Berar the previous year. Of the 168 raingauges, 13 are maintained by the meteorological department and the remaining 155 are managed by medical, police and agricultural departments and by Feudatory States.

*Hyderabad.*—There were 18 raingauges in direct charge of the P. W. D. under the supervision of observers who are the officials of the Public Works Department. All these gauges were inspected by the Divisional Officers, and were reported to be in good working order.

*Mysore.*—There were 227 raingauge stations as against 226 in the previous year. Of these, 77 are at district and taluk headquarters and the rest in villages. 214 stations were inspected in 1925-26 as compared with 203 stations in the previous year.

*Coorg.*—The number of raingauges was 10. Seven stations were inspected during the year and found to be in good order.



**Madras.**—There were 504 raingauge stations (excluding meteorological observatories) in the Madras Presidency and feudatory states, against 492 last year. The number of stations inspected during the year was 469. The condition of the raingauges was generally good.

**Baroda.**—No report has been received, and it is understood that none can be sent for this season's work.

A general review of the report reveals the satisfactory fact that in almost all the divisions a high proportion of the raingauges was inspected.

**37. Heavy Rainfall Reports.**—Heavy rainfall is occasionally so very local that small areas can have as much as 10" of rain without the Daily Weather Report conveying the least suggestion of it. With a view to have such useful data promptly available for the Daily Weather Report it was arranged in 1921, with the approval of the Government of India, that reports of 5 inches or more of rainfall should be telegraphed to Simla from raingauge stations at district headquarters throughout the country. The number of such telegrams received during 1925-26 was 134 as compared with 180 in the previous year.

*Snowfall Registration in the Mountain Districts to the North and West of India.*

**38.** Information as to the amount, distribution and time of occurrence of snowfall in the Himalayan and Afghan mountain areas was on the whole tolerably complete, and the thanks of the department are due to the various officers who collected and forwarded it.

#### SEISMOLOGICAL OBSERVATIONS.

**39.** Seismological observations were recorded throughout the year by two Omori-Ewing seismographs at Simla, two at Calcutta and one at Bombay, and by a Milne seismograph at Kodaikanal. At Bombay (Colaba) the new Milne-Shaw machine has worked excellently since its installation in 1922-23. All the seismic data collected at these places are sent to the Seismological Committee of the British Association.

#### TIME SIGNALS.

**40.** The observatories at Madras, Calcutta and Bombay determine time from star and sun observations, and communicate it to the local ports by time-ball signals. The distribution of time over the country generally is made from the Madras Observatory by a signal transmitted daily at 16 hrs. (Indian Standard Time) over the Indian telegraph system; considerable errors are inevitably introduced into the signal at stations where retransmission is affected by hand. A wireless time signal for the use of ships was broadcasted automatically twice daily from the Alipore Observatory at 2 P.M. and 10 P.M. I. S. T. through the Calcutta radio station.

The wireless receiver put up at the Bombay Observatory was used regularly from November 1924 for a comparison of the local time determination with the time signals transmitted from Calcutta, Eiffel Tower and Nauen.

The time work was satisfactory throughout the year.

#### PUBLICATIONS AND LIBRARY.

**41.** The routine publications of the Department are shown at length in the Administration Report for 1922-23.

The Daily Weather Telegram was despatched to subscribers daily about noon, and the weekly rainfall summary was supplied to the *Gazette of India*. The Weekly Weather Report, containing matter similar to the Weekly Summary published in the *Gazette of India*, was published during the monsoon period, and supplied to about 42 subscribers and also to the Press.

The quinquennial volume for 1916-20 of the Bombay observatory was published in January. The printing of the first Bombay Annual Volume, that of 1921, was nearing completion at the end of the year and is expected to come out shortly. The manuscript of the Annual Volume, 1922, was sent to the press and considerable progress has been made in its printing.

The number of institutions, etc., on the distribution lists of the department was 335 at the end of the year.

The following publications were issued during the year :—

1. Indian Meteorological Memoirs, Volume XXIV, Part XI—"Rainfall types in India in the cold weather, period, December 1 to March 15", by Sir Gilbert Walker and J. C. Kamesvara Rav.
2. "Storm tracks in the Bay of Bengal, 1891-1923", by C. W. B. Normand.

A publication entitled "Storm Tracks in the Arabian Sea" was sent to the press and will be out shortly.

Books, periodicals and pamphlets either purchased or received as presentation copies in the department's libraries at Simla and Calcutta during the year numbered 1019. In regard to classification of current literature 358 current books and pamphlets were catalogued and indexed.

#### CONCLUDING REMARKS.

42. The Meteorological Department owes a large part of its usefulness to the sympathetic assistance it receives from other departments. Civil Surgeons and other officers of Government departments, as honorary superintendents of observatories and in other capacities, help in the meteorological work; the Posts and Telegraphs Department assists in the rapid transmission of meteorological information; at the same time they allow their employees to act as observers. The Indo-European Telegraph Department, also, by giving free transit to the daily messages from the Persian observatories, places a large amount of most useful information at the disposal of the Meteorological Department. Weekly telegrams are received from April to September from the Director, Royal Alfred Observatory, Mauritius, and from April to October from the departmental observatories at Zanzibar and Seychelles. These telegrams give valuable information of the weather conditions in the Indian Ocean, and the department is indebted to the officers indicated for the punctual transmission of the information. Thanks are further due to the Director of the Royal Alfred Observatory for his courtesy in placing the meteorological data of that observatory at our disposal.

The department is greatly indebted for important information on meteorological conditions prevailing before and during the southwest monsoon to the Controller, Physical Department, Cairo; the Directors of the observatories at Buenos Ayres, Santiago and Batavia; the Astronomer Royal, Cape Town; Director, L'Observatoire Physique Central, Leningrad; the Secretary, Friends' Industrial Mission, Banani Pemba, Zanzibar; the Principal Medical Officer, Tanganyika Territory, Dar-es-Salaam; the Commonwealth Meteorologist,

Melbourne ; Director of Agriculture, Salisbury, Rhodesia ; Chief of the Weather Bureau, Washington ; and to the various officers around the Indian frontiers who have collected and supplied valuable snowfall information.

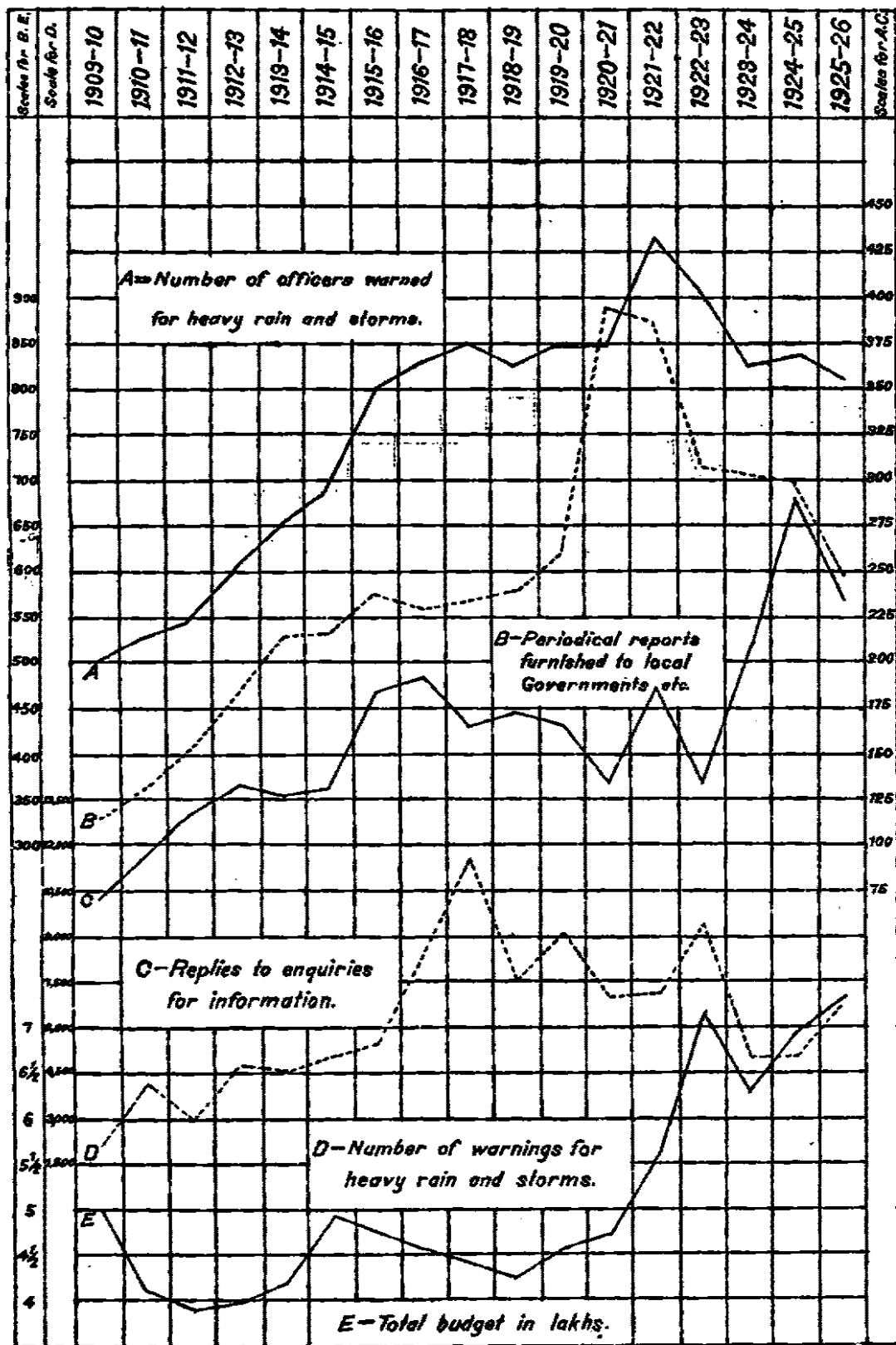
The thanks of the Department are due to the Superintendent of Colombo Observatory, for the very useful help he has rendered from time to time in connection with storm warning work. The department is also grateful to the Director, Koninklijk Magnetisch en Meteorologisch Observatorium, Batavia, Java who has arranged for taking and telegraphing to Simla daily observations from Sabang in Sumatra during the cyclone months April, May and October to December.

J. H. FIELD,

*Director-General of Observatories.*

SIMLA ;

*The 13th September 1926.*



***With the Compliments of  
The Director-General of Commercial Intelligence***