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Annual Report of the Meteorological Committee to the Air Council

For the Year ended 31st March 1926

The Seventy-first Year of the Meteorological Office

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1926

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1925-6

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	E. Gold, D.S.O., F.R.S.
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Clerks, Grades II & III ..	10

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Junior Professional Assistant	——

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Clerk, Grade I	E. Boxall.
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Clerks, Grade III	2

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Junior Professional Assistant	J. F. B. Wardale, B.A.
Clerks, Grades II & III ..	12

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Clerks, Grades II & III ..	5

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BIGGIN HILL

Clerks, Grades II & III ..	3

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Clerks, Grades II & III ..	4

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Telephone-Typists	2

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Clerks, Grades II & III ..	2

HOLYHEAD

Clerks, Grades II & III ..	3

LEUCHARS

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Clerks, Grade III	2

LYMPNE

Senior Professional Assistant	R. M. Stanhope, B.A.
Clerks, Grades II & III ..	6 (one vacancy).

RENFREW

Senior Professional Assistant	J. J. Somerville, B.A., B.L.
Clerks, Grade III	2

SEALAND

Senior Professional Assistant	H. F. Jackson, M.S.E.
Clerks, Grades II & III ..	3

SOUTH FARNBOROUGH

Senior Professional Assistant	E. Taylor, M.A., B.Sc.
Clerks, Grades II & III ..	3

AIRSHIP METEOROLOGY STATIONS

CARDINGTON

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Clerks, Grade III	1

PULHAM

(Staff transferred as required.)

SECONDED FOR DUTY WITH OTHER BODIES

Senior Professional Assistants	R. P. Batty, B.A. (R.A.F., India). E. L. Davies, B.Sc. (War Office, Porton Experimental Station). L. G. Hemens, B.Sc., (War Office, Porton Experimental Station). N. K. Johnson, M.Sc., A.R.C.S. (War Office, Porton Experimental Station). F. J. Scrase, M.A., B.Sc. (War Office, Porton Experimental Station). R. G. Veryard, B.Sc. (R.A.F., India).

ANNUAL REPORT

OF THE

METEOROLOGICAL COMMITTEE

TO

THE AIR COUNCIL,

For the year ended 31st March, 1926 (the seventy-first year of the Meteorological Office).

The Meteorological Committee met three times during the year, on July 29th, 1925, November 11th, 1925, and March 10th, 1926. Captain R. C. Warden, who had represented the Board of Trade on the Committee since October, 1922, died on August 15th, 1925. Captain Warden also served on the Marine Sub-Committee, and his valuable assistance was at all times most readily given. He was succeeded by Captain W. Ellery.

Lieutenant-Colonel Clapham, D.S.O., was succeeded by Lieutenant-Colonel J. U. Hope, D.S.O. at the beginning of year. Lieutenant-Colonel Clapham had been a member since 1921.

Reorganization.—The outstanding feature of the work of the Meteorological Office during the year under review has been a large re-distribution of the work amongst the Divisions of the Office. Although primarily of domestic interest there can be little doubt that the changes will materially affect the efficiency of the work and so react on the usefulness of the Office to those who need its services.

Four of the old Divisions are primarily concerned, namely the Forecast Division, the Climatology Division, the Local Centres Division and the British Rainfall Division. In place of these, four new Divisions have been created with the following duties :—

(a) *Forecast Division.*—This division is responsible for all forecasts except those dealing with aviation. It organizes the interchange of data between the British Isles and foreign countries and publishes the *Daily Weather Report.* It is the largest Division at Headquarters, employing 11 professional assistants and 29 other assistants.

(b) *The Aviation Services Division.*—This division deals with all questions relating to aviation except those dealing with airships. Its primary duty is to inform pilots and others concerned in aviation, of the existing weather conditions and of the changes which are likely to take place in the course of the next few hours. In addition it prepares reports, on request, of the meteorolgical conditions along any proposed air route or at the proposed site of any new aerodrome.

At headquarters it prepares a constant succession of weather charts on the basis of which information can be given at any time,

day or night, of the weather conditions affecting aviation in any part of the British Isles and along the chief continental air routes. It maintains small meteorological stations on twelve aerodromes at ten of which there are professional assistants in a position to give immediate meteorological information to those requiring it.

(c) *British Climatology Division.*—Before the change there were two divisions dealing with climatology: the old Climatology Division which collected climatological data from all parts of the world including the British Isles, and the British Rainfall Division which was a continuation of the old British Rainfall Organization and dealt only with questions of the rainfall of the British Isles. In addition the the Library, which is the storehouse of climatological data of all kinds, was not attached to any Division. It was felt that a better distribution of the work would be effected by concentrating all the British Climatology in one Division. The British Climatology Division was therefore established to deal with all questions relating to the climatology (including rainfall) of the British Isles and to publish the *Weekly Weather Report*, the *Monthly Weather Report*, the *Observatories' Year Book*, and the annual volume entitled *British Rainfall.*

(d) *The General Climatology Division.*—On the formation of the British Climatology Division the remaining duties of the old Climatology Division were combined with the supervision of the Library to form the subjects of the new General Climatology Division. The duties of the new division may conveniently be classified as :—

The preparation of the *Réseau Mondial.*

The supervision of the Meteorological Office Library.

The editing of the *Meteorological Magazine* and of all other Meteorological Office publications not specially assigned to other Divisions.

The issue of climatological information not derived primarily from the MS. records held by the British Climatology Division.

Further particulars regarding the details of the work of these new divisions will be found in the reports of their work which appear later in this Report.

Wireless Weather Bulletin for Shipping.—Two years ago, on 1st January, 1924, the Meteorological Office commenced to broadcast twice a day from the Air Ministry's high power wireless station special messages prepared for the use of shipping approaching Great Britain and in Home waters. The "Weather Shipping Bulletins" are divided into five parts :—

(*a*) A "general inference" of the weather conditions existing, and of changes likely to take place.

(*b*) Data in code of pressure, wind, weather, visibility and barometric tendency at ten stations around the British coast.

(*c*) Forecasts for the next twelve hours for three sea areas adjacent to our coasts—Eastern, Western and Channel—subdivided into smaller districts if necessary.

(*d*) A "further outlook" respecting possible changes in the weather after the twelve hours to which the forecasts refer.

These bulletins are much appreciated and used by the ships which can receive them, but as they are issued on continuous wave, 4,100 metres wave-length, they cannot be intercepted by the smaller ships which are fitted only with wireless apparatus capable of taking in signals issued on " spark " transmission. As stated in the *Annual Report* for 1923–4 the various shipping organizations pressed very strongly for similar messages to be issued from wireless stations which the " spark " ships could hear. As no single " spark " station capable of being heard over the whole of the British sea area exists in this country it was not possible to arrange for the transmission desired, but during the course of the present year a satisfactory solution of the problem has been effected. Instead of issuing the whole of the Weather Shipping Bulletin on spark from one station, four coastal stations were chosen and each receives and issues the forecasts contained in the Weather Shipping Bulletin which are appropriate to the area it serves. The four stations are :—

West Coast—Valencia and Seaforth.
South Coast—Niton.
East Coast—Cullercoats.

This new service came into operation on the 1st June, 1925, on which date the previous Western Seaboard forecasts issued from Valencia and Malin Head were discontinued.

The new service met the needs of ships which carry wireless operators, but there still remained a large amount of small coasting shipping which do not carry wireless operators and are therefore incapable of receiving messages in the Morse code. On the other hand many of these small vessels have the wireless apparatus used for listening to the programmes issued by the British Broadcasting Company. In the interests of these small craft, which need the forecasts even more than the larger shipping, the Board of Trade approached the Meteorological Office and the British Broadcasting Company to see if arrangements could be made for the latter to broadcast the Weather Shipping Bulletin. The result will be described in the next paragraph.

Weather Messages issued by the British Broadcasting Company.—At the time that the Board of Trade asked for broadcast messages for small craft the Ministry of Agriculture made a similar request for harvest forecasts for farmers. A conference was held and the British Broadcasting Company expressed their willingness to help and offered to open their highpower station at Daventry at 10.30 a.m. each morning for the issue of a special weather message for farmers and shipping. Unfortunately this time is too late for farmers, but as there were insuperable difficulties both in the Meteorological Office and at the Broadcasting Station to providing an earlier issue, it was decided to accept the offer of the British Broadcasting Company. On July 1st, 1925, the new issue commenced and it consists of three parts (1) forecasts for land areas with special reference to the requirements of farmers, (2) a " general inference " and (3) the forecasts for the sea areas taken from the Weather Shipping Bulletin.

The question of the issue of a similar message in the evening raised many difficulties. The evening message was only required for shipping as the general forecasts which the British Broadcasting Company

publish as part of their ordinary programme meet the needs of the farmer. The difficulty was temporarily met by three local stations, Liverpool, Bournemouth and Newcastle issuing the parts of the Weather Shipping Bulletin which referred to their areas with their "local news." A much more satisfactory solution was found in January when the British Broadcasting Company arranged to issue each evening from the Daventry Station a special shipping bulletin similar to the one issued in the morning.

All those who find these special weather bulletins useful in their daily work have reason to be grateful to the British Broadcasting Company not only for issuing them, but also for the clear way in which they are announced.

Daily Weather Reports from Greenland.—Those responsible for the British weather forecasts have long felt the need for information of the conditions in the neighbourhood of Greenland. Here take place those outflows of cold polar air on which the formation and maintenance of the cyclonic depressions of the North Atlantic so largely depend. Realizing the importance of this information for European meteorology the Danish Government have decided to establish and equip with wireless telegraphy a network of meteorological stations along the west coast of Greenland. The first of these stations to be established is Julianehaab and on February 7th, 1926, the first wireless report from this station was received in Europe. All European meteorological services owe a great debt to the public spirit of the Danish Government for the undertaking.

Gale Warning Board.—One of the earliest duties of the Government meteorological service which was established in 1855 was the issue of gale warnings to the shipping around the British coast. The information was supplied by the exhibition of cones on the masts of signal stations. The arrangements then made and which have continued in force ever since, were for the Meteorological Office to issue the warnings by telegram and to provide the cones. The provision and maintenance of the signal mast and of the personnel for hoisting and lowering the cones was a charge on the local authority to which the warnings were sent. The majority of the gale warning stations were under the Coast Guards but other authorities such as the Northern Lighthouse Commissioners, Trinity House and Harbour Boards also maintained gale warning stations. Unless some local authority asked the Meteorological Office to supply gale warning telegrams there was no machinery to exhibit the signals at important points. The recent change in the organization of the Coast Guards and the establishment of the Coast Watching Force under the Board of Trade raised several questions affecting the gale signal stations. The Superintendent of the Navy Services Division of the Meteorological Office made a tour of inspection of the gale warning stations and submitted a report. This report was considered by an inter-departmental committee which recommended the establishment of a permanent Gale Warning Board the function of which should be to make recommendations to the competent authorities on the following subjects :—

(*a*) The number and location of gale warning stations.
(*b*) The organization of the distribution of gale warning telegrams.
(*c*) The method of displaying the warnings.

This recommendation having been approved the Board was established and met for the first time on October 30th, 1925. The Board consists of the following :—

The Director of the Meteorological Office (*Chairman*).

Representatives of :—

The Admiralty.
The Board of Trade.
The Ministry of Agriculture and Fisheries.
The Scottish Fishery Board.
Trinity House.
The Northern Lighthouse Board.

The Board has already done very useful work in revising the method of distributing the gale warning telegrams and initiating action towards a better distribution of gale warning stations around the coast.

Increase in the Number of Inquiries.—Every Division reports a marked increase in the number of inquiries received and dealt with. In spite of the greater diffusion of the forecasts by wireless telegraphy and the broadcasts of the British Broadcasting Company the number of demands for forecasts received in the Forecast Division is increasing very rapidly. From the table printed on page 30 it will be seen that during the five years **1921**–2 to **1925**–6 the inquiries for special forecasts has doubled, increasing from 1,914 in the former year to 3,845 in the year under review. Less surprising, but nevertheless remarkable, is the increase in the inquiries associated with forecasts and data for aviation. The Aviation Services Division dealt, at its headquarters and out-stations, with 14,579 inquiries as compared with 12,442 during the previous year. During the year 2,983 inquiries were received from aeroplanes by wireless telephony while in flight.

While this increase is very gratifying as indicating the increasing use made of the facilities afforded by the meteorological service it is embarrassing in that it absorbs more and more of the time of the staff.

International Commission for Air Navigation.—Meetings of this Commission were held in London in April, 1925, and in Brussels at the time of the Air Congress in October, 1925. Lieut.-Col. E. Gold was re-elected Chairman of the Meteorological Sub-Commission.

The revised draft of the Meteorological Annex to the Convention was approved at the meeting of the Commission at Brussels and it is now being printed in three languages, British, French and Italian. The revised Annex gives an outline of the most important meteorological arrangements which are necessary in connexion with Civil Aviation, but there are still many questions which require further study before the solution of them can be incorporated in the Annex. The Commission, therefore, decided that the Meteorological Sub-Commission should continue its study of these questions. The principal ones are :—

(*a*) The special observations of cloud and visibility from stations situated on the summits of, or in proximity to, mountains.
(*b*) The observation of sudden variations of fog and of the height of low clouds, as well as the transmission of this information.
(*c*) The preparation of a Code for the international exchange of short period forecasts for aviation.
(*d*) The preparation of codes for the optional figures xxz of the Code for hourly and other frequent reports for aviation.

Civil Aviation Conferences.—Conferences between England, France, Belgium and Holland on points arising in connexion with the working of the meteorological arrangements on the air lines from London to the Continent were held at Paris in June, 1925, and at Brussels in October, 1925.

At the meeting in Paris it was agreed that certain special reports of sudden changes in the amount and height of low cloud and of the commencement or cessation of precipitation which had been in operation internally in England, should be exchanged internationally between stations on either side of a frontier: the question of their inclusion in the general collective issues of reports from Paris, Brussels, Amsterdam and London, was postponed until further experience had been gained.

At the meeting at Brussels the forecast code, which had been brought into use experimentally at the beginning of 1925, was discussed in the light of the experience gained and certain modifications were introduced. The modified code came into force on November 1st, 1925.

It was also agreed at Brussels that the display of meteorological information at terminal aerodromes should be made in the manner described in the revised Annex G of the International Convention for Aerial Navigation from May 1st 1926, and that from the same date at latest, the system of ground signals of Annex G should also be put into operation.

In the course of the year the question had arisen as to the application of the decisions of the Civil Aviation Conferences. The matter was discussed at Paris and the following resolution adopted by the main Conference:

> "The decisions of the plenary conference will be applied by the participating States concerned in the decision in question, unless within the three months following the receipt of the final reports the said States have raised any objection. In such case the question will automatically be submitted at the next meeting. The decisions will take effect within a period of three months, unless a different period is laid down on the occasion of some particular decision."

In connexion with this resolution Holland did not agree to put into operation the decisions of the conference at Brussels regarding the forecast code and the display of meteorological information and the installation of new ground signals.

Air Congress.—An Air Congress was held at Brussels in October, 1925, during the week in which the meetings of the International Commission for Air Navigation and the Civil Aviation Conference were held. Lieut.-Col. E. Gold and Capt. F. Entwistle, who were attending these meetings, were also present at some of the meetings of the Air Congress and they each read papers at meetings of the Congress as follows:—

"A Numerical Index of Meteorological Conditions on an Aerodrome or on an Air Route for Comparison with Flying Statistics." By Lieut-Col. E. Gold.

"Meteorological Conditions in relation to the Choice of Aerodrome Sites on Civil Air Routes." By Capt. F. Entwistle.

These papers were subsequently printed in the report of the Congress.

New Hygrometric Tables.—New hygrometric tables were brought into use at all stations connected with the office on the 1st of January, 1926. The tables hitherto in use have been those prepared by the late James Glaisher, F.R.S., in which vapour pressure is expressed in inches of mercury. The adoption of the millibar as the unit for atmospheric pressure and vapour pressure rendered necessary some modification of the tables, and advantage was taken of the need for a reprint to re-compute them on the basis of Regnault's formula, thus bringing the practice of this country into harmony with that followed in most other meteorological services.

Visit of Dr. J. Bjerknes.—The investigations of the Bergen School of Meteorology which have led to the well-known Bjerknes' theory of cyclones has introduced new and important methods into forecasting. In order to profit by this work the Air Ministry invited Dr. J. Bjerknes, of the Bergen Meteorological Office, to spend six months in the Meteorological Office and to demonstrate his methods to the staff. Dr. Bjerknes kindly accepted the invitation and joined the Office on 1st October and stayed until the end of March. During this period every member of the staff, whose work it is to make forecasts, both at Headquarters and Outstations, went through a course with Dr. Bjerknes. Dr. Bjerknes' visit was very successful and the staff appreciated the way in which he explained his ideas to them. There can be no doubt that the forecasting work of the Office has benefited by the visit.

Staff.—A serious loss was suffered in May through the retirement of Dr. Charles Chree, F.R.S. on attaining the age limit of the public service. Dr. Chree was appointed to the superintendentship of Kew Observatory in 1893 by the Kew Committee of the Royal Society and on the transference of the observatory to the Meteorological Office in 1910 he accepted service under the Office with the title of Assistant Director of Observatories. Throughout the 32 years during which Dr. Chree has guided the work of the observatory he has maintained a very high standard both as to quality and quantity in its scientific work, Dr. Chree has made himself the foremost authority in this country on Terrestrial Magnetism and the unique position he has acquired among magneticians is witnessed by the fact that he has been elected President both of the International Magnetic Commission appointed by the International Conference of Directors and of the Magnetic Section of the International Union of Geodesy and Geophysics. The Committee desire to place on record their high appreciation of the services which Dr. Chree has rendered to the Office and to the cause of British Science.

The Committee record with great regret the death at the early age of 28 years of Mr. George Marwood Watson, who has been engaged as chemist on the work of the Advisory Committee for Atmospheric Pollution. Mr. Watson had shown great ability and perseverance in carrying out the work entrusted to him and his early death has cut short prematurely a very promising career. The Committee also record with regret the deaths of Mr. G. F. Golding, Grade III clerk at Lympne and of Mr. W. R. Chillman, office keeper at South Kensington, the former as the result of a motor accident.

On the retirement of Dr. Chree, Mr. F. J. W. Whipple, Superintendent of the British Rainfall Organization was appointed to take charge of the work at Kew Observatory, with the rank of Assistant Director in the Meteorological Office. At the same time the work of the British Rainfall Organization and of the Climatology Division was re-organized, as already stated, Mr. R. Corless taking charge of the British Climatology Division and Mr. C. E. P. Brooks of the General Climatology Division, the latter appointment involving promotion to the grade of Superintendent. The resultant vacancy in the grade of Assistant-Superintendent has been filled by the promotion of Mr. M. T. Spence, while the new post of Assistant-Superintendent at Croydon, to which reference is made elsewhere, has been filled by the promotion of Mr. G. R. Hay. The following promotions to the grade of Senior Professional Assistant have been made: Mr. J. M. Stagg, Mr. M. J. Thomas, Mr. R. G. Veryard, Mr. C. V. Ockenden, Mr. L. G. Hemens. There have been three resignations from the professional staff, and the following new appointments to the grade of Junior Professional Assistant have to be chronicled:—Mr. F. H. Dight, B.Sc. (Bristol), Mr. G. Manley, B.A., B.Sc. (Cambridge), Mr. R. F. Budden, M.A. (London), Mr. T. W. H. Vernon-Jones, B.Sc. (London), Mr. G. A. Bull, B.Sc. (London) and Mr. J. S. Farquharson, M.A. (Aberdeen).

Messrs. C. V. Starr and H. T. Smith have been promoted to Grade II. clerkships, the former promotion arising from the promotion of Mr. L. G. Hemens to the professional staff and the latter from the upgrading of a post in the Marine Division. There have been three resignations from the established clerical staff, one of these by reason of marriage. As it has not yet been possible to reach a decision as to the methods to be followed for the future recruitment of the clerical staff all vacancies have had to be filled by making appointments on a temporary basis.

Finance.—The year under review, **1925**–6, is the sixth in which the cost of the Meteorological Office has been borne on Air Ministry Votes. The accounts are not yet closed, it is therefore impossible to give the exact amounts for the expenses and receipts of the Meteorological Office, but the following tables give the approximate figures :—

APPROXIMATE STATEMENT OF EXPENDITURE AND RECEIPTS IN RESPECT OF METEOROLOGICAL SERVICES DURING THE YEAR **1925**–6

Expenditure	*Amount* £	£
Salaries and Wages—H. Q. Establishments	47,054	
„ „ —Out-station Establishments ..	41,780	
		88,834
Fuel and Light		582
Transport of Personnel and Equipment		2,965
Instruments, Equipment and Stores		6,471
Minor Works Services, Rents, Repairs and Maintenance of Buildings		2,292
Research		741
Telegrams, Cables and Telephones		7,690
Subventions and Reporting Stations		1,493
Miscellaneous		580
Superannuation		2,221
Total ..		£113,869

Receipts

Receipts from Royal Society	606
,, ,, National Debt Commissioners (Annuities)	400
Sale of Instruments, Carriage, etc.	2,362
Daily Weather Reports, Forecasts, etc.	1,737
Receipts from War Office	5,955
Total ..	£11,060

Divisional Reports.—The following reports have been prepared in the Divisions. As certain subjects are dealt with by more than one Division there is some repetition, but it has been thought best to make no change as the report of each Division is then complete in itself and reference to other parts of the Report is avoided.

MARINE DIVISION

The improvement in observation at sea during the past year has been maintained, and a higher standard of classification of meteorological logs is now necessary. The corps of marine observers, has therefore been notified that from April 1st, 1926, about 40 per cent only of the best logs received will be classed "Excellent," thus introducing a more competitive standard.

Voluntary Observing Fleet and Observers.—The number of ships regularly making returns has been limited to a maximum of 500, but the number of ships equipped with tested instruments for keeping the meteorological log has been still further slightly reduced (with the exception of H.M. Surveying Ships, the number of which has been maintained); at the same time steps have been taken materially to improve the geographical distribution of observational activity.

The comparative table on page 24 shows the numbers of ships engaged in the various branches of work, the disposal of sets of instruments on loan, and the returns made, for the past eleven years. No ship now on the list has failed to make the prescribed returns during the past year, and all sets of instruments on loan are in full use.

Obituary.—The following deaths of marine observers and former marine observers are noted with regret:—

Captain A. Carpenter, D.S.O., R.N., late of H.M. Ships, *Challenger, Nassau, Magpie, and Myrmidon.*

Captain A. H. Clews, s.s. *Melita.*

Captain T. A. Hill, s.s. *Demerara.*

Captain W. J. Jenks, formerly of the Orient Line.

Commander C. F. Preston, R.N.R., late Commodore of the P. & O. Company.

Excellent Observers.—A list of Captains and Officers who have been granted awards for "Excellent" meteorological logs or wireless telegraphy weather report registers is given in the June, 1926, number of the *Marine Observer.*

Marine Agents.—Captain J. J. McEwan of the Marine School, South Shields, took over the marine agency for the Tyne, *vice* Commander E. S. MacLeod, R.D., R.N.R., Board of Trade Surveyor, resigned on account of press of official duties.

The Meteorological Office is indebted to the Marine Agents in Great Britain, Ireland, Australia, Hong Kong and Vancouver, who form a valuable link with the corps of voluntary marine observers, and to many other master mariners resident at ports of the British Empire for their valuable support and interest in the work.

Port Meteorological Office, Liverpool.—This branch of the Marine Division continues to increase its value to the Service.

Collection of Data.—*Meteorological Logs (4-hourly) used with Instruments lent by the Meteorological Office.*—The improvement of routine observations recorded in logs during the year has been very marked, the percentage classed excellent being 43·6 whereas last year it was 33·6 and the year before 31·3.

The following table shows the classifications of logs received this year and during the three previous years :—

Classification	1925–6	1924–5	1923–4	1922–3
Excellent	115	92	80	83
Very Good ..	145	178	169	170
Good	3	3	6	11
Not classed ..	1	1	1	8
Total Received ..	264	274	256	272

Ships' Meteorological Reports, Form 911 *(twice daily) used with Ships' Instruments.*—The following table shows the classifications of Ships' Meteorological Reports received this year and last. Last year was the first when a definite classification was used for this form.

	1925–6	1924–5
Excellent	416	393
Very Good	1,641	1,721
Good	32	75
Not classed	2	0
Total .. .	2,091	2,189

The decrease in the total number received may be accounted for by the delays in port which a number of ships were subject to, during the Seamen's dispute, and to a greater proportion of long voyage ships being engaged in this form of observation.

During the year the practice of indicating in the fleet list in the *Marine Observer* those ships which have a mercurial barometer in their outfit has been introduced.

North Atlantic Wireless Telegraphy Weather Report Registers, used with instruments lent by the Meteorological Office. Ships' coded reports.—The high standard of these registers has been maintained.

Classification	1925–6	1924–5	1923–4	1922–3
Excellent	157	162	155	73
Very Good ..	143	100	90	150
Good	0	0	5	3
Not Classed ..	0	2	0	2
Total Received ..	300	264	250	228

Sea Water Samples.—Ships in the South American, West Indian, and North Atlantic trades, additional to the Meteorological Office fleet list, have collected water samples for the Fisheries Laboratory, Lowestoft. This work is arranged by the Port Meteorological Officer, Liverpool, to ensure that there shall not be duplication of effort.

Miscellaneous Contributions.—Many interesting and valuable papers, manuscripts, weather charts, sketches, and photographs have been received with the logs, forms, and registers, and independently of them, and have been of the great assistance in the production of the *Marine Observer*.

Useful information from the Remark Books of H.M. Ships and data of ocean currents have been received from the Hydrographer of the Navy.

General.—The corps of marine observers have taken much trouble in setting down their observations in the manner prescribed, so that the observations being recorded in a uniform manner, can be handled with ease and quickness by the computers.

The Use made of the Data Collected.—A thorough examination has been made of the data now available and a scheme worked out for the construction of meteorological charts upon a uniform scale. This examination has led to renewed efforts to obtain a more suitable geographical distribution by an increase of observing ships in Pacific trades, with a reduction in eastern trades. The revision of the Admiralty Wind Charts of the World for the use of H.M. Fleet has meanwhile been commenced.

Data extraction, compilation, and research.—During the year 75,852 sets of observations were extracted from logs and punched on Hollerith cards, and 8,210 sets of additional current observations dating back to 1910 for the North Atlantic routes have been extracted. The rate of extraction has averaged the very creditable figure of 81 observations per man per day.

Sixty-nine per cent. of the logs received during the year which reached the standard "Very Good" or above, have been prepared for extraction. Hence the number of ships keeping full logs was more than sufficient and that number, about 120, is now reduced to 115. In addition there are nine of H.M. Surveying vessels which provide observations. As the logs are required for many purposes, this number is considered the minimum compatible with efficiency. The distribution and number of sets of observations extracted from logs during the past twelve months, and for the whole period from April, 1920, are shown on Marsden's Charts in the June, 1926 number of the *Marine Observer*, in which number will also be found results of researches and compilations made in the Marine Division.

Further proofs of the utility of the Hollerith System are given in the wind, fog, and mist roses for the south-west approaches to the British Isles and in the charts of cloud frequencies along the Trans-North Atlantic tracks published in the *Marine Observer*. As time advances and the number of observations punched on cards increases, so the value of this system is enhanced and the effort of producing results is lessened.

The great need for logs received prior to 1920 to be indexed and extracted, referred to in the last three *Annual Reports*, was made more than ever apparent by the examination referred to above.

The comparative table below shows the data extracted during the last four years from logs received :—

	1925–6	1924–5	1923–4	1922–3
Percentage of Logs reaching the required standard, extracted and indexed.	64	55	66	73
Sets of observations extracted and punched on cards, with currents entered in data books and phenomena indexed.	75,852	65,060	74,749	97,533
Current observations prior to April, 1920, extracted and entered in data books.	8,210	5,746	4,259	1,826

Marine Inquiries, Exchange of Data with other Services and General Co-operation.—Inquiries continue to increase in number and scope. The work has been very heavy in this connexion. The majority of inquiries refer to the weather at sea at the time of shipping casualties; special mention may be made of a request from Lloyd's Register of Shipping for observations of weather at sea at the times of the loss of 36 ships reported missing between the years 1921 and 1925.

The adoption of the Hollerith system of data extraction by Great Britain and Holland has proved itself of mutual benefit. No less than 15,429 observations of current for the Trans-North Atlantic tracks for the years 1910 to 1924 have been received from the Royal Meteorological Institute of the Netherlands, and are being incorporated, with British observations, in the Quarterly Charts of Currents published in this year's *Marine Observer*. 1,241 sets of observations for 1924 for selected squares in the Atlantic, Indian and Pacific Oceans, punched on Hollerith cards were sent to Holland, without involving appreciable additional work for the staff of the Marine Division.

The Dutch Institute also desired observations for the same squares in the years 1917 to 1920 before the Hollerith system was introduced. 1,979 observations were supplied but the task of extracting them occupied 85 man hours, which by comparison with the new system worked since 1921 will give some idea of the great advantage which may be derived from the Hollerith system amongst maritime countries co-operating.

The Geophysical Institute, Bergen, has been supplied with 1,197 sets of observations made in the North Sea, North Atlantic, and Mediterranean, between January 26th and February 5th, 1922, on Hollerith cards.

To the Central International Bureau of Vulcanology, Naples, have been sent copies of all observations of submarine earthquake phenomena received for the years 1922 to 1924.

The International Commission for the Investigation of the Upper Air was supplied with observations from ships in all parts of the Southern Hemisphere on January 4th, February 12th to 17th, and March 8th, 1923, for making World synoptic charts for those special dates.

The Hydrographer of the Navy has been supplied with certain meteorological information concerning different parts of the oceans.

The Scottish Fishery Board was provided with observations of currents for the year 1924 in the North Atlantic between the parallels of 40° and 60° N. Latitude and the meridians of 10° W. and 50° W.

Publication of Information for Mariners.—In the *Marine Observer* have been published concise descriptions, of all the most useful weather signals in use in all parts of the world.

A list of the other important contributions to the *Marine Observer* will be found on page 71.

The appropriate parts of the Weather Shipping Bulletin are now available to shipping fitted with spark wireless telegraphy only, and to small vessels with wireless telephony, as well as to ships capable of receiving it at long range on continuous wave.

Sweden has adopted a weather shipping bulletin, framed on the same plan, which greatly simplifies the application of weather intelligence broadcast by both countries for seamen.

The invitation to the Commanders of ships at sea, in all parts of the world, to broadcast a routine standard form of weather report, addressed to "all ships," based on observations synchronizing with those of the nearest coast, has been extended to all ships on the Fleet List having a mercurial barometer, the index error of which is known. Though this practice received a temporary check during the wireless dispute it is steadily growing, notwithstanding the difficulties occasioned by the diversity of observation times and codes in different countries, and the fact that present watches for single-operator ships are not favourable for reception in some zones, with existing times of observation.

There is evidence that the making of weather charts at sea is slowly but steadily growing in favour and examples of this work have been published in the *Marine Observer.*

Wireless Telegraphy Coded Reports from North Atlantic Liners.—During the year 4,467 weather reports were received by Wireless Telegraphy for the use of the daily weather service. Of these 1,193 reports were received within one hour of observation, 1,217 within two hours, 981 within four hours; while 1,076 were over four hours in transmission from the time of observation. 2,090 reports were sent by ships to the west of longitude 40° W. through Bar Harbour and other American Coast Stations direct to the United States Weather Bureau at Washington, D.C. 510 errors in transmission were corrected by the check system the registers proving that the check had only failed in 32 cases.

Instrumental Observation.—There are now 56 barometers fitted with the Gold correction scale in use at sea, and these are proving of great assistance; more are being fitted. With a view to facilitating and reducing the cost of maintenance, standardization of the parts of marine mercurial barometers has been recommended.

A new type of portable thermometer screen was issued on trial to several ships with satisfactory results and was subsequently compared with the old pattern screen at Kew Observatory. It has been decided to put into use a limited number of the new type of screen, before making any general change in the type usually lent to ships.

Mahogany adapters for protecting thermometers have been tried at sea and favourable reports have been received on them.

DETAILS OF VOLUNTARY OBSERVING FLEET AND COAST STATIONS

	At 31st March										
	1926	1925	1924	1923	1922	1921	1920	1919	1918	1917	1916
Ships equipped with instruments keeping full logs ...	115	117	122	123	125	133	104	—	—	—	—
H.M. Ships keeping full logs	9	8	8	9	9	9	2	2	—	—	1
Ships contributing reports from ship's instruments...	325	321	322	332	341	216	117	7	—	—	—
Ships equipped especially for W/T Weather Reports ...	31	32	21	24	17	1	—	—	—	—	—
Coast Stations equipped with instruments for Form 914.	34	34	35	38	40	42	53	52	49	49	58
Ships equipped with instruments for Home Waters Telegraphic Reports ...	10	10	10	8	8	24	—	—	—	—	—
Ships with logs overdue...	0	0	0	0	0	2	19	—	—	—	—
No. of Barometer Errors	1560	1474	1368	1355	1025	365	—	—	—	—	—

	Receipts for the year ended 31st March										
	1926	1925	1924	1923	1922	1921	1920	1919	1918	1917	1916
Meteorological Logs... ...	264	274	256	272	264	204	67	22	59	115	147
Ships' Meteorological Rpts. Forms 911 ...	2091	2189	1785	1741	1717	1668	503	21	144	670	882
Forms 914 (Coast Observations) ...	406	402	404	423	460	437	381	334	324	340	351
Lighthouse Registers ...	13	14	14	13	16	16	12	16	15	14	15
Ocean W/T Report Registers	300	264	250	228	98	—	—	—	—	—	—
Home Waters Telegraphic Reports ...	767	802	820	752	1066	1808	—	—	—	—	—
Cadets Meteorological Log...	9	9	9	9	9	6	—	—	—	—	—
New Data Extraction. Logs extracted	170	142	165	204	155	169	—	—	—	—	—

FORECAST DIVISION

General.—Important changes have been made during the year in connexion with the weather reports broadcast both by wireless telegraphy and telephony. The regular issues for shipping on spark transmission were formerly confined to the Western Seaboard reports issued from Valencia and Malin Head each morning and evening. In response to a demand for forecasts issued on spark for all the waters around the British Isles the appropriate sections of the Weather Shipping Bulletin are now issued twice daily from Post Office Wireless Stations on the west, south and east coasts as follows :—

On the west coast from Valencia and Seaforth;
on the south coast from Niton; and
on the east coast from Cullercoats.

A new morning weather bulletin is now prepared for the British Broadcasting Company for issue from the high power station at Daventry; and an evening shipping bulletin is also issued from that station. These matters are dealt with more fully below.

A comprehensive exhibit was again maintained at the British Empire Exhibition at Wembley from May to September. A large blackboard chart was prepared twice each day, the necessary observations being received by wireless telegraphy by an operator in the room in which the chart was exhibited. Maps and instruments were also on view, one of the features being a set of cloud pictures in oil colour which formed a frieze round the room. Three members of the staff of the forecast division attended each day to answer inquiries, prepare the maps and deal with the observations received.

In June the work of the Forecast and Local Centres Divisions was re-organized, all forecasts for aviation being transferred to the latter, which has also become responsible for all forecast work during the night.

A Gazetteer of telegraphic reporting stations has been almost completed. The following items have been prepared for each station :—

A contour map, scale $\frac{1}{2}$ inch to 1 mile, for a radius of ten miles around the station; a chart on the scale of 25 inches to 1 mile for the immediate surroundings; photographs of the site; a general description of the station and its surroundings, and a list of instrumental equipment and of the "visibility objects" in use.

Fifteen supplements to the 3rd edition of M.O. 252 "Particulars of Meteorological Reports issued by Wireless Telegraphy in Great Britain and the countries of Europe and North Africa" were issued and the manuscript for a new (4th) edition was complete at the end of March.

The manuscript of a supplement to the " Meteorological Observer's Handbook," containing " Instructions for Meteorological Telegraphy," has been prepared and passed forward for press.

The instructions for observations of upper air temperature and humidity by aeroplane have been revised.

An inquiry is in progress into the relation between upper air temperature and the occurrence of thunderstorms.

A report has been prepared on the conditions associated with heavy snowfalls in Scotland, and other scientific inquiries into matters bearing on the work of the Division have been carried out.

In the course of the year many visitors have been shown the work of the Division, including a number of officials from foreign services.

Observations received. (*a*) *British Reports.*—Several changes at telegraphic reporting stations have occurred during the year and others are anticipated in the near future.

On the 1st July the observing work at St. Ann's Head was transferred from the Lightkeepers to the Coastguard.

Arrangements are well advanced for the establishment of a telegraphic reporting station in the island of Tiree and it is hoped that the station will be opened shortly. The need of an anemograph station in the west of Scotland has long been felt and it is proposed that an anemograph shall form part of the equipment at Tiree, the site being a very suitable one for this purpose.

Observations at 1 a.m. have been contributed by the State Meteorological Service of Guernsey since 8th March.

From August additional reports have been received from Cranwell at 4 p.m. and from Felixstowe both at 10 a.m. and 4 p.m.

Some interruption was caused in reports from the Hebrides on several occasions owing to breakdown of cable communication. The messages were transmitted temporarily in each case by wireless telegraphy until the cable could be restored so that the interruptions were of short duration.

The service of weather reports from ships of the British Mercantile Marine by wireless telegraphy has been well maintained, and a considerable number of reports from foreign ships has also been received.

Reports of upper air temperature and humidity have been received regularly throughout the year from the Meteorological Flight, R.A.F., at Duxford and have proved of great value. A revised code for reporting upper air temperature records from aerodromes was brought into use in October.

Information about vertical velocities greater than 200 feet per minute has been included in the reports of pilot balloon ascents received from observing stations since 1st January.

During the year the following additional Health Resorts have contributed observations for issue to the newspaper press :—
Bognor, Cleethorpes, and Guernsey.

A new and simplified code for the reports from Health Resorts came into operation on 1st January.

(*b*) *Foreign Reports.*—An event of great importance in synoptic meteorology was the receipt on February 7th of the first wireless report from Julianehaab in the South of Greenland. Since that date regular reports have been received twice daily and have given very useful information for a part of the map from which data have previously been lacking.

The exchange of information by wireless between all the principal European Countries is now well established and few changes have been made during the year.

Observations from N. America have continued to be received regularly viâ the Eiffel Tower.

Reports of Upper Air Temperature have been received frequently from Malta since September.

The International Code was adopted in the reports from the Azores in June.

Distribution of Information.—The regular British Synoptic Reports have continued to be broadcast by wireless telegraphy at the normal hours.

In October the list of stations in the international collective report issued from the Air Ministry was revised and new station numbers allocated. From 15th September, Cranwell, Felixstowe and Guernsey were added to the stations included in the 1050 issue ; and Cranwell and Felixstowe to those in the 1650 issue.

As previously noted, on 31st May the Western Seaboard forecasts issued by wireless telegraphy were discontinued, and instead appropriate sections of the Weather Shipping Bulletin have been issued on spark transmission from Valencia and Seaforth for the western area ; from Niton for the southern area ; and from Cullercoats for the eastern area. The morning forecasts to the Board of Trade Offices at Southampton and Glasgow were also discontinued after 31st May, these new spark issues having rendered their continuance unnecessary.

From July 1st the British Broadcasting Company have been supplied with a morning weather bulletin for issue at 10.30 a.m. from the high power station at Daventry. This consists of three parts—(1) forecasts for land areas with special reference to the requirements of farmers, (2) a general inference, and (3) forecasts for shipping. The evening broadcast shipping report which was issued from three low

power stations has also been issued from Daventry since January. Since November a forecast for farmers has been supplied for issue each afternoon from the Glasgow station of the British Broadcasting Company.

The usual Harvest Forecast Service was maintained during the summer months, but the number of subscribers showed a very marked decrease as compared with previous years. Many former recipients are finding the normal service of forecasts issued by radio telephony sufficient for their needs.

From January 1st, an evening weather forecast for the whole of Ireland has been telegraphed to the Department of Posts and Telegraphs, Dublin for broadcasting.

In addition to the regular issues, numerous forecasts have been supplied in response to special inquiries and there have been a number of applications for weather reports and forecasts from ships at sea. Among these special forecasts mention may be made of those sent to His Majesty the King during Cowes week.

Arrangements have been made to supply the International Ice Patrol, Washington, with mean pressures for each month from October to March for a selected number of European stations.

Lithographed and Duplicated reports.—A summary of the weather for the past month has been issued on the first day of each month and a short summary of the weather of the year 1925 was issued to the press on the last evening of the year.

From the 1st of January day maximum and night minimum temperatures for the London stations have been published in the *Daily Weather Report*, thus bringing these into line with the other contributing stations. From the same date revised values have been used in the table for times of sunrise, noon and sunset. The values now adopted are correct for each year and are no longer the average figures for a four year period.

The normal distribution of the daily duplicated reports and charts has been maintained together with the usual reports and forecasts for the press. A morning Health Resort Report giving data for 9 a.m. at a certain number of Health Resorts was prepared for the use of the newspapers during the summer months.

Gale Warnings.—In conjunction with the Board of Trade some modification was made in the distribution of gale warning messages on 1st March. A certain number of the signal stations were linked up with the local coastguard stations, reducing the number of addresses warned by direct telegraphy by about 37. At the same time seventeen new stations were opened and four stations closed.

The result of the checking of the gale warnings issued during 1925, is given in the following table.

DISTRICTS	Summary of occasions of gales		Summary of warnings issued			
	Total number of occasions upon which warnings were necessary	Percentage of occasions of gales effectively warned	Total number issued	Issues justified by gales (force 8 or above)	Issues justified by strong winds (force 6 and 7)	Percentage justified by gales and strong winds
I. Scotland N.E. A	5	80	28	4	16	71
I. Scotland N.E. B	5	60	22	3	11	64
II. Scotland E.	6	100	24	6	10	67
III. Scotland N.W.	7	86	30	6	13	63
IV. Scotland W. and North Channel.	12	92	31	11	13	78
V. Ireland N.	7	100	34	7	17	71
VI. Ireland S.	11	82	33	9	13	67
VII. Irish Sea.	13	92	32	12	16	87
VIII. St. George's Channel.	10	90	31	9	14	74
IX. Bristol Channel.	14	86	33	12	14	79
X. England S.W.	13	85	41	11	19	73
XI. England S.	9	100	34	9	15	71
XII. England S.E.	20	90	34	18	9	79
XIII. England N.E.	6	82	28	5	13	64
XIV. England E.	18	78	31	14	9	74
Totals	156	87	466	136	202	73

Inquiries.—The number of inquiries for special forecasts and reports has again shown an increase over former years. Details are shown in the subjoined table. No less than 50 such inquiries were dealt with on the 3rd of December, a day of much fog and of low temperature.

The number of inquiries received during the past five years is given in the subjoined table.

Month	1925–6	1924–5	1923–4	1922–3	1921–2
April	190	265	182	126	97
May	313	329	271	190	75
June	455	329	340	200	121
July	415	356	306	375	262
August ..	352	265	280	158	162
September ..	298	214	205	143	142
October ..	283	229	282	138	205
November ..	358	207	285	177	175
December ..	346	341	203	178	122
January ..	322	330	271	244	214
February ..	247	283	182	206	117
March	266	206	177	202	222
Total ..	3,845	3,354	2,984	2,337	1,914

GENERAL CLIMATOLOGY DIVISION

The General Climatology Division was constituted on May 18th 1925, to carry out the duties specified on page 11.

Climatology of the Globe.—Manuscript returns from eight foreign stations and 98 colonial stations have been received. In addition manuscript returns are regularly received from 10 meteorological stations under the control of the Royal Air Force in the Middle East Area, Iraq and Palestine.

An Introduction has been prepared to accompany the reprints of the meteorological tables contained in Colonial Blue Books which are circulated to meteorological institutions on the Exchange Lists of the Office under an arrangement made with the Colonial Office some years ago. It gives particulars of equipment and exposure at the contributing stations which have been received in response to a questionnaire circulated through the Colonial Office. The Introduction is now in the press and copies of it will be distributed with the reprints for 1923.

The bibliographies of climatological publications and of upper air data have been kept up to date.

The work on the preparation of the *Réseau Mondial* is progressing steadily. The volume for 1919 is in the press, and the preparation of that for 1920 is well advanced.

Library. *General.*—The preparation of the monthly "List of Meteorological Papers" has been continued.

A list of papers bearing on agricultural meteorology received in the Library has been forwarded monthly to the Ministry of Agriculture and Fisheries for incorporation in that Ministry's monthly report ("Crop-weather" Scheme).

Abstracts of the more important meteorological papers received in the Library have been prepared by members of the professional staff. These abstracts have been manifolded and circulated in sets to the Branches and Establishments of the Office.

Bibliographies.—Bibliographies of the following subjects have been compiled :—

Anemometry, Marine Meteorology, Arctic Meteorology, Data of Vapour Pressure, and Old Weather Records. In addition various shorter lists of references have been compiled and all these are being put together and kept up to date as a comprehensive subject bibliography.

Exchange of Publications.—New exchanges of publications have been arranged with :—

Meteorological Service of Siam.
Lands and Survey Department, New Zealand.
Meteorological Service, Vera Cruz, Mexico.
National Research Council of Japan, Tokyo.
Meteorological Service of Tunis.
Hydrological Institute, Leningrad.
Geographical Association, Aberystwyth.

Additions.—The additions to the Library during the past year include 391 new books and pamphlets and 12,460 daily weather reports. The number of periodicals received was about 800.

Loan of Books.—4,410 books were issued on loan during the year.

Catalogues.—The author and subject card catalogues have been kept up to date.

Binding.—240 volumes have been bound during the year.

Lantern Slides.—69 new slides were received into the collection. Sets of slides were borrowed on 28 occasions.

Books Presented.—The following important works have been presented to the library during the year :—

Weickmann, L. Wellen im Luftmeer: neuere Untersuchungen über Gesetzmässigkeiten im Gange und in der Verteilung des Luftdruckes.

Toussoun, Omar. Mémoire sur l'histoire du Nil. Tomes I–III.

Australasian Antarctic Expedition, 1911–14. Scientific reports. Ser. B. Terrestrial magnetism and related observations. Vol. 1. Pts. 1 and 2, Vol. II. Pt.1.

Covert, R. N. Meteorological instruments and apparatus employed by the U. S. Weather Bureau.

Exner, F. M. Monatliche Luftdruck- und Temperaturanomalien auf der Erde. Korrelationen des Luftdrucks auf Island mit dem anderer Orte.

Vegard, L. The origin of the auroral spectrum, and other papers.

Tokyo, Imperial University, Physical Institute. Anniversary volume dedicated to Professor Hantaro Nagaoka.

Antevs, E. Quaternary climates. The big tree as a climatic measure.

Fontseré, E. Atlas elemental de núvols. Presented by La Fundació Concepció Rabell i Cibils.

Greenberg, L. Studies on the industrial dust problem. Nos. I and II.

Merz, A. Die Deutsche Atlantische Expedition auf dem Vermessungs- und Forschungsschiff "Meteor."

Books Purchased.—Among those acquired by purchase are :—

London, Royal Society. Catalogue of scientific papers. Vols. XVII and XVIII.

Thomson, J. J. Elements of the mathematical theory of electricity and magnetism.

Planck, Max. Treatise on thermodynamics. Translated by Alexander Ogg.

Aristotle. The works of Aristotle—Meteorologica. Translated into English by E. W. Webster.

Lodge, Oliver. Atoms and rays. An introduction to modern views on atomic structure and radiation.

Strutt, John William, Lord Rayleigh. Scientific papers. Vols. I–VI.

Wegener, Alfred. The origin of continents and oceans. Translated from the 3rd Ed. by J. G. A. Skerl.

Chauveau, B. Electricité atmosphérique. Fasc. 2 and 3.

Köppen, W. und A. Wegener. Die Klimate der geologischen Vorzeit.

Kähler, K. Die Elektrizität der Gewitter.

Barton, Edwin H. A text-book on Sound.

Göttingen, Aerodynamischen Versuchsanstalt. Ergebnisse. Lief. I u. II.

Langenbeck, R. Physische Erdkunde. II. Die Lufthülle und Wasserhülle der Erde.

Exner, F.M. Dynamische Meteorologie. 2e Ed.

Weber, G. A. The Weather Bureau. Its history, activities and organisation.

Huntington, Ellsworth. Civilization and climate. 3rd Ed.

Long-Series Climatological Data.—The International Meteorological Committee at their meeting at Utrecht, September, 1923, decided to make a collection of serial monthly mean values of pressure, temperature and rainfall for a long period of time for a number of stations distributed as uniformly as possible all over the globe. In making the collection, care was to be taken to exclude data for periods which were known not to be comparable with those for the remainder of the period, either by reason of change of site or exposure, or because of faulty instruments. The periods to which the data for each station refer are to be as long as possible, and except in certain special cases no series is to be included in which the period does not exceed 20 years.

Under this scheme the London Meteorological Office was entrusted with the collection of data for Africa, Australia and the Oceanic Islands. Data for 56 stations in this area have been collected from other British or from Foreign Meteorological Services and data for 22 stations have been prepared in the Office.

The Smithsonian Institution has taken charge of the publication of the data, and some specimen sheets have already been printed. The result will form a valuable body of data for the student of world-weather and of meteorological periodicities, and for the preparation of long-period forecasts of the character of the seasons.

Meteorology of Air Routes.—Numerous inquiries have been received as to the flying conditions in various regions. In order to provide the material for ready answers to such inquiries in future, systematic descriptions, accompanied by tables, dealing with the meteorology of

the air routes in all parts of the world are being prepared on a uniform plan. The description of the Eastern Mediterranean area with special tables for 20 stations has been completed.

Publications.—The General Climatology Division has prepared for press the publications enumerated on p. 70, as issued during the year, with the exception of those specifically allocated to other divisions.

The Meteorological Magazine has been published regularly.

Admiralty Pilots.—These handbooks, issued by the Admiralty for the use of navigators, contain notes on weather and climatological tables prepared in the Meteorological Office. The text of the meteorological portion of five pilots was revised during the year. The revision of tables for five pilots was carried out, involving the the preparation in the division of data for 11 stations. In addition Meteorological Services abroad were good enough to contribute revised tables for 26 stations.

Special Investigations.—The investigation into the causes of the variations of pressure distribution over the North Atlantic and Western Europe has been continued. A paper on "The Variation of Pressure from Month to Month in the Region of the British Isles" has been submitted to the Royal Meteorological Society. A detailed discussion of the influence of the Gulf Stream on the subsequent pressure distribution is nearly complete.

Commander E. H. Smith, U.S. Coast Guard, was given facilities for work in the division during September and October in connexion with the work of the International Ice Patrol, a special object of study being methods of forecasting ice conditions off the Banks of Newfoundland.

Inquiries.—During the year 135 general or scientific inquiries and 269 personal inquiries were dealt with.

Among the inquiries may be mentioned as illustrating the wide range covered.

A request from the Entomological Department, Cairo, for upper wind data in connexion with the migrations of insects.

An inquiry from the National Radiator Company for mean temperatures and absolute minimum temperatures at 120 stations in all parts of the world.

A request for revised rainfall maps of Europe for January and July from Messrs. W. & A. K. Johnston.

INSTRUMENTS DIVISION.

General.—The work of the Instruments Division was continued on the general lines of the preceding year. Some improvements have been made in the details of store accounting procedure with a view to reducing delays in supplying equipment to Observatories. As a result, some economies of time have been effected, both at head-quarters and at out-stations. Nevertheless, the pressure of increasing work has been felt in all sections of the Division.

Progress has been made in various investigations. As in previous years, the Division has kept in close touch with the National Physical Laboratory, with gratifying results in various directions. The test work undertaken at South Kensington has been extended to include the certification of sunshine spheres.

Supply of equipment to Official Stations.—The equipment at official stations at home and abroad, including meteorological stations in the Middle East Area and Iraq Commands, has been maintained in serviceable condition. Special mention may be made of the following transactions :—

The pressure tube anemometer at Eskdalemuir was replaced by a more modern type of instrument with double pen direction recorder and new head and vane. Towards the end of the year, arrangements were made to supply a pressure tube anemograph and Baxendell direction recorder, both fitted with quick run clocks, to Cardington for use in experiments on the details of wind structure. A new anemometer fitted with connecting pipes one inch in diameter was prepared for issue to a new station on the Island of Tiree.

Equipment for use in the tail method of balloon observation was issued to all pilot balloon stations.

Arrangements were made whereby a sufficient number of aeroplane aneroids could be issued to the Meteorological Flight, Duxford and to the Meteorological Office, Malta, to enable two instruments to be returned for test periodically and for one to be kept as a spare.

Supply of Instruments on Repayment.—No change was made in the conditions under which stores are issued on repayment. The total value of stores issued in this way was £2,957 17*s.* 6*d.*

Reference may be made to the following issues :—

(*a*) Bent stem and self-recording earth thermometers to Crop Weather Stations on behalf of the Ministry of Agriculture.

(*b*) Hydrogen and balloons to Iraq for aerial gunnery practice on behalf of Director of Training, Air Ministry.

(*c*) 254 thermometers, 58 aneroids, 27 barographs and 59 barometers to the Admiralty.

(*d*) A non-liquid type wind velocity and direction recorder to H.M.S. *Furious.*

Instruments and equipment of various types have also been issued to the Dominion Governments and to the Crown Agents for the Colonies.

The sunshine recorder lent in 1922 to the Carnegie Institute, Washington, for Amundsen's Polar Expedition was returned to the Office.

Store-keeping and Accounting.—During the year, the store accounts for equipment on charge to wireless stations and civil aviation departments of the Air Ministry which had been kept in the Instruments Division of the Meteorological Office under an arrangement made some years ago, were transferred to the Civil Aviation Transport Officer at Croydon.

A number of changes of procedure were made with a view to simplifying store accounting both at headquarters and out-stations. These

included a new system of classification of equipment in inventories which it is proposed to introduce gradually as circumstances permit. The method of dealing with demands of equipment from Observatories was also reviewed and a new procedure put into practice. Towards the end of the year a simplified scheme for accounting for certain workshop stores was introduced.

The number of store accounts now kept, each of which details the equipment on charge and accounted for by the Office at a single station is 727. Each account has been checked by inspection or by correspondence with the custodian during the year. All discrepancies revealed have been investigated and cleared in consultation with the relative branches of the Air Ministry when necessary.

Air Ministry auditors visited the division from 27th July to 7th August, 1925, from 15th to 19th February, 1926 and on 21st October, 1925.

Boards of Survey for conditioning surplus and unserviceable stores were held on 1st September, 1925 and 10th March, 1926. The recommendations of the Board were approved and carried into effect.

Stock was taken of the instruments and equipment held at the central stores at South Kensington as on 31st March, 1926, and compared with the ledgers.

The total number of demands dealt with during the year was 2,490 an increase of 105 on last year.

Two amendments to the "Priced Vocabulary of Meteorological Stores" were issued during the year.

The establishment of stores for Middle East Area was revised and some additions authorized.

Special Investigations—Specifications.—The amount of time which could be devoted to research work was considerably affected by the absence of one professional assistant for half the year. Nevertheless, fair progress has been made with the investigations mentioned in the last Report and a number of other problems.

Mention may be made of the following :—

(*a*) *Barometers.*—Trials were made with barometers with cisterns of cast iron, polished cast iron and stainless steel. These were issued to H.M.S. *Endeavour* and read regularly during a long voyage. A report by the National Physical Laboratory on the results so far obtained, indicates that stainless steel is preferable to other materials for the construction of barometer cisterns.

With a view to preventing the entry of air into the tubes of portable barometers, a shielding device was designed and fitted to two barometers which will subsequently be issued to inspectors for use as travelling standards.

A device for securing a marine barometer in its box while in port was designed at the request of the Marine Division.*

Progress was made in the design of a standard Kew pattern barometer with interchangeable fittings and the working drawings were nearing completion by the end of the year.

(*b*) *Spirit Thermometers.*—In connexion with the investigation into the change of zero in spirit thermometers, the National Physical

* See *Marine Observer*, Vol. II, No. 24, 1925.

Laboratory found that exposure to sunlight is the predominating factor in the change of zero and that the addition of 1% acetone to pure alcohol affects the zero by as much as 1°F. per month. With carefully purified ethyl or methyl alcohol no change of zero occurred. A paper on the effect of acetone as an impurity in spirit thermometers was prepared by the National Physical Laboratory. The alcohol used for these investigations was supplied by the Government Chemist. As a result of this investigation pure ethyl alcohol is being issued to manufacturers for filling spirit thermometers and it is hoped in this way to prevent further difficulties arising from the use of unsuitable spirit.

(*c*) *Sunshine Cards.*—Further progress was made in the provision of board of standard colour for sunshine cards. Brass templates for all sunshine cards were made and sent to H.M. Stationery Office for issue to the contractor. A duplicate set is retained at South Kensington. For the purpose of testing proofs and supplies of sunshine cards special gauges and apparatus have been provided by means of which the necessary measurements can be made rapidly and accurately.

(*d*) *Sunshine Spheres.*—Considerable time was given to the problem of optically testing sunshine spheres. An apparatus was designed for the determination of focal length and the detection of striae in the glass. This apparatus was found to be very satisfactory in use. A comparison carried out at Kew Observatory between a clear sphere and a striated one of similar focal length indicated that the striations may not seriously affect the records. On the other hand shortness in the focal length appreciably reduces the burning power. Work was was also done on the relation between the visual focal length and the best burning position.*

The specification for sunshine spheres was amended in accordance with the results of these investigations and towards the end of the year a service for testing and certifying spheres was inaugurated.

(*e*) *Anemometers.*—Various aspects of both cup and pressure tube anemometers have received attention during the year. In order to simplify the auxiliary apparatus employed with the cup anemometer provided with electrical contacts, a compact receiver incorporating the battery, switch and buzzer was designed and brought into use.†

The pressure tube anemometer has been the subject of much consideration during the year. At Kew Observatory a series of experiments was made with the object of testing a new type of head designed at the National Physical Laboratory. This investigation was extended to include tests on connecting pipes of varying length and diameter. Subsequently a laboratory investigation on the latter subject was begun at the National Physical Laboratory and important results had been obtained by the end of the year. As a result of these investigations it was decided, provisionally, to employ one inch gas piping for the pressure and suction tubes in future anemometers. Three new anemometers so provided were ordered towards the end of the year.

The Division has been in touch with the firm of R. W. Munro, Ltd., in connexion with the development of the diaphragm anemograph.

*See *Meteorological Magazine*, February, 1926, p. 1.

†See *Meteorological Magazine*, February, 1926, p. 14.

An instrument of this type was installed on H.M.S. *Furious* in May and gave satisfactory results.

The investigation of wind structure has been facilitated by the use of clock drums whereby the paper is made to travel past the recording pens at the rate of about 1·5 inch per minute. Three clocks of this type were designed and made at South Kensington during the year.

The principles involved in the calibration of the tube anemograph were dealt with in a note submitted to the Royal Meteorological Society.*

(*f*) *Thermometer Screens.*—With a view to reducing the cost of Stevenson Screens, a screen similar to the present standard instrument but with zinc louvres and an iron stand was made at Kew Observatory. This screen is at present under test at the Observatory.

The normal type of marine screen is made with a solid back ; an experimental portable screen of the same size but with the back louvred has been designed.

In order to minimize the breakage of thermometers used at sea, a protecting frame was designed and found to be satisfactory in use. It has been decided to introduce these for use generally. Two forms of the frame, designed for use with air and sea temperature thermometers respectively will be available. In each case the replaceable element is an ordinary mercurial thermometer on a porcelain mount.

(*g*) *Thermographs.*—The question of the corrosion of thermographs was considered and a " non-corrosive " instrument is now undergoing test.

(*h*) *Meteorographs.*—An illustrated memorandum was prepared in conjunction with the Upper Air Section on the calibration of the Dines balloon meteorograph. Copies were forwarded to two firms of instrument makers as well as to a number of foreign meteorological services.

(*i*) *Inspection Equipment.*—Consideration was given to the question of providing specially graduated thermometers for use by inspectors and these were brought into use by the end of the year. The general question of inspector's equipment for testing rain measures was also reviewed. Three inspectors' boxes without barometers were made at Kew Observatory and fitted in the workshop at South Kensington.

(*j*) *Balloons.*—The investigation on the leakage of hydrogen from balloons was continued as time permitted.

Consideration was given to the modification of the pilot balloon slide rule in order to make it more convenient for use with the " tail " method.

(*k*) *Hut Nephoscopes.*—A design for a hut nephoscope and accessories, suitable for installation at observatories or local centres, was prepared.

(*l*) *Photography of electrical discharges.*—In connexion with an investigation by the Director, the photographic assistant took a large number of photographs of electrical discharges under varying conditions.

Testing and Inspection of Instruments.—The usual test work has been carried on during the year. Some slight modifications in testing barometers and anemometers were introduced and a regular service

Q. J. R. Meteor. Soc., October, 1925.

of testing sunshine spheres was inaugurated. 10 spheres were tested for manufacturers on repayment.

It has become evident that the conditions under which rain-gauges and measures will be certified should be set forth in detail for the guidance of manufacturers. A memorandum on this subject was prepared. It is proposed to ascertain the views of manufacturers before the proposed conditions are finally adopted. The total number of rain-gauges of all types tested on repayment was 79, while 152 measures were certified.

Drawing and Photographic Work.—The statement given below summarizes the work carried on during the year :—

Drawings	109
Blue Prints	232
Negatives	248
Contact Prints	889
Lantern Slides	211

Workshop.—A considerable amount of both constructional and repair work was carried out during the year in the workshops both at South Kensington and Kew Observatory. Mention may be made of the following items made at South Kensington :—

(*a*) 6 Charging rods of new design.
(*b*) Strut thermometer for use as wet bulb, and strut psychrometer, incorporating wet and dry bulb thermometers.
(*c*) Three quick run clocks for use on pressure tube anemometers.
(*d*) Pocket nephoscope.
(*e*) Modification of friction drive of non-magnetic clock drums at observatories.
(*f*) A new type of barograph.
(*g*) Gauges for testing sunshine cards.
(*h*) Gauge for testing adjustment of sunshine recorder.
(*i*) Apparatus for testing sunshine spheres.
(*j*) Portable anemometer.

Exhibitions.—Instruments were exhibited at the British Empire Exhibition, Wembley; the British Association Meeting at Southampton and the Highland and Agricultural Show at Glasgow.

Inquiries.—The advice of the Division with regard to the design and supply of instruments was sought on numerous occasions by Foreign and Colonial Governments, firms of instrument makers, local corporations and private individuals.

ARMY SERVICES DIVISION

The work of the Division has continued on the lines of the preceding years. Meteorological stations have been maintained at Shoeburyness and Larkhill for supplying meteorological information, as required, to artillery units. With the concurrence of the Ordnance Committee, the Kite Balloon station at Shoeburyness has been dismantled, and only the winch and such items of stores as would be difficult to replace, have been retained. It was found that upper air temperatures obtained from aeroplanes at Duxford could be applied with sufficient accuracy at Shoeburyness, so making it possible to dispense with the Kite Balloon.

The Meteorological Station at the Chemical Warfare Station, Porton, has been maintained as before, the professional staff required being seconded from the Meteorological Office, and the clerical staff being lent.

At Shoeburyness the two-theodolite method of observing pilot balloons remains the standard method of measuring upper winds, but on occasions when two theodolites are not used, a tail is attached to the balloon.

During the year lectures on the application of meteorology to gunnery have been delivered from time to time by the meteorologists-in-charge at Shoeburyness and Larkhill to classes of officers and non-commissioned officers.

During the summer of 1925, one observer (Grade III clerk) was posted to each of five Artillery Practice Camps at Buddon Ness, Okehampton, Trawsfynydd, Redesdale, and Wahn (Cologne), for the purpose of supplying upper air data to the artillery units posted at these camps. Arrangements were also made for the supply of meteorological information to the Anti-Aircraft Artillery Practice camp at Weston Zoyland during July and August.

The computation of a number of trajectories, and of weighting factors for wind and temperature appropriate to special trajectories, has been carried out at Shoeburyness. The mean weighting factors for wind and temperature for use in the field have been revised.

A pamphlet entitled "The Supply of Meteorological Reports to Artillery Units" has been prepared in draft form by Messrs. Brunt, Britton and Batty. This pamphlet aims at giving all instructions necessary to enable the meteorologist to supply information in the form required by artillery units, giving some hints as to the procedure to follow when no observations are available. It has been submitted to the Ordnance Committee for their remarks, and will be printed when approved by them.

The Superintendent has attended a number of meetings of the Chemical Warfare Committee and certain of its sub-committees, and has continued to act as Chairman of the Meteorological Sub-Committee.

A number of inquiries for data of weather and climatology have been received from the War Office, and have been answered with the assistance of other divisions of the office.

The periodogram analysis of twelve sets of meteorological observations, each covering a period of 100 years, was completed early in the year, and was published by the Royal Society in its *Philosophical Transactions*, under the title, "Periodicities in European Weather"—(D. Brunt).

AVIATION SERVICES DIVISION

General.—The decision to re-organize the meteorological services for the Royal Air Force, to which reference was made in the last *Annual Report*, led to a considerable expansion, during the period under review, of the work of this Division at Headquarters. Responsibility was assumed as from the 27th June, for the issue of all weather reports and forecasts for aviation during both day and night. In order to meet the demands of the increased service, it was necessary to augment the staff of the Division by four senior professional assistants, one of whom was stationed at Croydon, and three Grade III clerks. As, however, it was arranged that the forecaster on night duty should meet any requests for forecasts during that period, whether required for aviation or for other purposes, the increase of professional staff was made largely by a redistribution of the staff of this Division and of the Forecast Division. An economy was also effected by an arrangement in which the forecaster at Headquarters supplied by telephone any meteorological information required for occasional flying at Croydon in the early morning or at night. Duties were arranged so that the professional assistants at Headquarters and at Croydon work to a combined duty roster, each forecaster having in turn a period of duty at the out-station, and thus keeping in personal touch with the meteorological requirements of air pilots.

Services for Civil Aviation. (*a*) *London-Continent routes.*—The general arrangements for the supply of meteorological information for flying on these routes have continued on the lines of previous years. Regular forecasts have been issued daily to meet the needs of the various services, and these, together with the hourly reports of actual weather on the routes, have been exhibited at the aerodromes at Croydon and Lympne. In addition, advice has been given as required to the officials and pilots of the operating companies by the meteorologists-in-charge at both stations and weather reports have been passed by radio-telephony to aircraft in flight. During the year 3,725 requests for reports or forecasts were received either personally or by telephone at the terminal aerodrome at Croydon while 2,983 reports were passed by radio-telephony from Croydon and Lympne to aircraft in flight.

The meteorological arrangements on the air routes have been improved in detail from time to time as a result of civil aviation conferences held between representatives of the meteorological services of the countries concerned. At a conference held in Brussels in October a code for the transmission of short-period forecasts by W/T which had been tried experimentally by Great Britain and France, was adopted with slight modifications. The modified code was brought into use for forecasts on hourly route reports on 1st November. An improved code for reporting line-squalls and thunderstorms was adopted at the same conference and brought into use on 1st January.

Special arrangements were made during January and February in connexion with a series of night flights between Croydon and Le Bourget.

In consequence of the increasing importance of the meteorological work for civil aviation at Croydon, the grade of the meteorologist-in-charge was raised to Assistant Superintendent in June.

(*b*) *Southampton-Guernsey route.*—This route was re-opened on the 11th November, since which date a weekly service has operated in both directions. The general arrangements for the supply of meteorological information are those which were in force prior to the closing of the route on 1st March, 1925, reports and forecasts being issued to the operating company by the meteorologist-in-charge at Calshot.

(*c*) *Stranraer–Belfast route.*—The meteorological arrangements for this route detailed in last year's report were maintained until the 8th of June when the service was suspended. The station at Belfast was closed on the 4th of December.

(*d*) *Forecasts for special flights.*—Mention may be made of the following flights for which special forecasts were issued:—

April	..	Croydon to Lisbon.
		London to Zurich and back.
October	..	Croydon to Prague.
December	..	A light aeroplane flight from London to Dublin, returning *viâ* Northern Ireland to London.

(*e*) *Special data for civil aviation.*—During the year reports have been prepared on the meteorological conditions affecting civil aviation over the following routes.

(1) Cairo to Karachi.
(2) Frederikshavn to Stockholm.
(3) Cairo to Cape Town (special flight).

(*f*) *Aeroplane races and competitions.*—A system of special reports and forecasts was organized in connexion with the King's Cup Race in July. Reports and forecasts were also supplied to the officials and competitors at the Light Aeroplane Meeting at Lympne in August.

A statement of the average weather conditions at Baltimore, U.S.A., was prepared for the Royal Aero Club in connexion with the Schneider Cup Race.

(*g*) *Pilots licences.*—Examinations in meteorology were conducted as in previous years for pilots taking "Class B" licences. 28 pilots were examined during the year.

(*h*) *Miscellaneous.*—There has been little civil flying at Renfrew (Glasgow) but the meteorological station at that aerodrome has continued to do useful work in distributing over 40 copies of the *Local Daily Weather Report* and in answering inquiries received from a wide area. Assistance was given to the Public Health department of the University of Glasgow in the establishment of a climatological station.

The station at Castle Bromwich was closed on the 31st March. In view of the cessation of reports from this station, arrangements were made with Sir W. G. Armstrong Whitworth Aircraft, Limited, for weather reports to be supplied from the aerodrome at Whitley Abbey, Coventry, in connexion with flying in the Midlands.

In addition to the normal routine at Croydon, special observations of horizontal visibility on foggy nights were made during November

and December in connexion with experimental tests on the visibility of certain lights from a captive balloon.

Forecasts were supplied by the meteorologist-in-charge at Lympne for night flying operations which were carried out at that aerodrome from June to August in connexion with the work of the R.E. Acoustical Section at Hythe. Special observations of upper wind, cloud and visibility were made for the Acoustical Section and upper air temperatures obtained by a member of the Meteorological Office staff.

Services for the Royal Air Force.—(*a*) *Supply of meteorological information for Service aviation.*—Following on the expansion of the work of the Division at Headquarters in June, to which reference has already been made, the arrangements for the supply of meteorological information to Royal Air Force Units were completely reorganized. The first step in this direction was the issue of an Air Ministry Weekly Order in November setting out the arrangements by which units could obtain weather reports and forecasts from the aviation forecast service at the Air Ministry at short notice, for any route or area in the British Isles. The extent to which use has been made of this arrangement is indicated by the fact that 176 such requests have been received and dealt with between the date of issue of the Order and the 31st March.

As the result of a discussion between representatives of the Meteorological Office and Service Branches of the Air Ministry, a procedure was laid down in September by which pilots of aircraft in flight could obtain meteorological reports by wireless telegraphy.

A second conference was held during November between representatives of the Meteorological Office and the Service Branches of the Air Ministry to consider the arrangements for the supply of routine forecasts to aerodromes. As a result of the conference the existing arrangements were completely revised and the new system that was evolved was set out in a further Order issued in February. The new scheme involved the issue of forecasts by W/T from the Air Ministry four times daily as follows :—

(i) A collective message giving forecasts for different areas, covering daylight hours, is broadcast approximately one hour before sunrise.

(ii) Subsidiary forecasts for daylight flying are sent to all units at 0900 G.M.T.

(iii) Forecasts for night flying covering the period from sunset to sunrise are issued to the units concerned about an hour before sunset.

(iv) Forecasts covering the period from the time of issue to dusk on the following day are sent to all units at 1500 G.M.T.

In addition to the routine forecasts, warnings of line squalls and thunderstorms are issued at any time to aerodromes likely to be affected. No change was made in the system of issuing gale warnings to aerodromes which has remained as part of the gale warning service of the Forecast Division.

Forecasts have been supplied daily from Headquarters to the Superintendent of Reserve, Northolt. Among special forecasts may be mentioned forecasts issued to the Swedish Naval Attaché in June for flights from Malmö to Felixstowe and from Malmö to Kenley,

forecasts for a flight from Felixstowe to Sweden in June, and forecasts for a flight from Felixstowe to Gothenburg in October.

(*b*) *Meteorological instruction to Royal Air Force Officers.*—The question of meteorological instruction to flying personnel of the Royal Air Force was also re-considered. The future policy was decided as the result of a conference held between representatives of the Meteorological Office, and the Directorate of Training in January. A syllabus of instruction was subsequently drawn up and approved for each course, and arrangements made for the lectures to be given by the meteorologists-in-charge of the appropriate out-stations.

(*c*) *Supply of information from Distributive Stations.*—The work of the different meteorological stations attached to Royal Air Force units has continued on the lines of preceding years.

A temporary meteorological station was in operation at Weston Zoyland in Somerset from July to September in connexion with night flying operations. The meteorologist-in-charge also supplied meteorological information to the anti-aircraft practice camp at Watchet.

(*d*) *Supply of data other than forecasts.*—Statements of weather conditions in different parts of the country were prepared on various occasions for the Inspector of Accidents.

Reports on the probable meteorological conditions affecting various aerodrome sites were prepared on several occasions for the President of the Aerodromes Board. A statement of the probability of fog at different aerodromes was also prepared for a Royal Air Force Command.

Data regarding air densities over various parts of the world have been supplied to branches of the Air Ministry.

Reports were prepared on the meteorological conditions likely to be experienced during the periods selected for the Royal Air Force flights between Cairo and Nigeria and between Cairo and Cape Town, the periods having been selected on data previously supplied. In the case of the latter flight, the conditions were discussed with the Officer Commanding, Cairo—Cape Flight prior to his departure from England. A memorandum was also prepared discussing the best period, from the point of view of weather conditions, for a flight over the Mediterranean. In addition 13 statements of weather conditions in various parts of the world were prepared as required for other branches in the Air Ministry. Special problems relating to the application of meteorology to aerial navigation were also dealt with.

(*e*) *Training of Royal Air Force personnel for meteorological duty overseas.*—One officer received a preliminary course of training in meteorology at Calshot before proceeding to the School of Meteorology, Imperial College of Science and Technology.

Seven airmen were trained in meteorology at Calshot and Cranwell for three months. At the end of the Course, examination papers for the "trade-testing" of the airmen were prepared and supplied to the Central Trade Test Board. The papers were subsequently marked and reports forwarded to the Board in January. An examination paper was also set for the "trade-testing" in meteorology of an airman in Iraq and a report forwarded to the Central Trade Test Board.

Special Work at Distributive Stations.—At the experimental anemometrical station, Holyhead, comparison of the old and new sites, in respect of observations of temperature and rainfall, was

continued until the end of March when most of the observations at the old site were discontinued. Reports on the comparisons of temperature and of rainfall readings were prepared. A comparison was made of the readings of a Richard fan anemometer and those of a Dines pressure-tube anemometer.

Meteorological reports for Artillery practice have been supplied at various times from Lympne, Felixstowe, Calshot, Cattewater, Renfrew and Cranwell.

Warnings of the occurrence of line-squalls and thunderstorms were issued from Sealand, Cranwell and Castle Bromwich to the station at Pulham in connexion with airship operations during April, October, November and December.

Summaries of current upper wind observations according to the scheme recommended by the International Commission for Air Navigation have been prepared at Croydon, Cranwell and Leuchars. Frequency summaries of visibility and low cloud were brought up to date at all stations.

Since 1st January, index figures of fitness for flying have been computed at Croydon for each hour at which observations were taken.

Work on the checking of rainfall returns and the copying of long period data was carried out by the clerical staff at certain stations during the winter months on behalf of the British Rainfall Organization and the General Climatology Division.

Diagrams and charts were prepared at Calshot for a meteorological exhibit held in connexion with the meeting of the British Association in August. The meteorological officer at Calshot took charge of the exhibit and gave daily demonstrations of weather forecasting. Similar assistance was rendered by the meteorologist-in-charge at Renfrew in connexion with the Highland Agricultural Show at Glasgow in July. The meteorologist-in-charge at Sealand arranged an exhibit and demonstration of weather forecasting at the Annual Conversazione of the Chester Scientific Society in October.

Upper Air Observations.—The total number of pilot balloon ascents made at out-stations during the year, either by the single theodolite method or by the "tail" method was 10,729. In addition, 4,114 nephoscope observations of the movements of upper clouds have been made. As from 1st January, reports of the magnitude of large vertical currents as obtained by pilot balloon ascents with the "tail" method have been added to reports of upper winds sent to Headquarters.

Registering balloons have been sent up from Sealand in connexion with the Upper Air Section at Kew Observatory.

A meteorograph designed by Commandant Jaumotte of the Royal Meteorological Institute of Belgium, and a new type of barothermograph for upper air observations were tested at South Farnborough.

A report on the suitability of an accelerometer for the measurement of bumpiness was prepared at South Farnborough.

209 observations of upper air temperatures taken from aeroplanes have been received from South Farnborough, Andover, Felixstowe and Lympne.

Investigations.—The following papers were completed during the year and circulated among the staff :—

"A note on the occurrence and persistence of fog at Calshot," by J. Durward.

A series of papers dealing with various aspects of the meteorology of Cranwell, by W. H. Pick, assisted by the staff of the meteorological station at Cranwell.

A paper on "Meteorology in relation to the Selection of Aerodrome Sites" was read by Captain F. Entwistle before the Third International Air Congress at Brussels in October.

Observations at night of the visibility of a 1 candle-power light at a distance of 1 kilometre were continued at Lympne and Cranwell.

Further measurements of sea-disturbance by observation of the movement of an anchored buoy were made at Calshot and Felixstowe.

Experiments have been continued at Lympne in order to investigate the effect of a paddle vane connected with a barometric chamber in securing the barometer record free from the effects of wind pressure on the inside of a building.

Inquiries.—The number of inquiries has again shown an increase, the total number received at out-stations during the year being 13,754. In particular, an increasing number of inquiries has been received at Cranwell from the Royal Air Force units at Digby and Spittlegate and at Andover from the units at Netheravon, Old Sarum and Worthy Down.

At Headquarters, 752 inquiries were received for forecasts and 73 inquiries for data regarding weather conditions affecting flying. The total number of inquiries was thus 14,579, as against the corresponding figure of 12,442 for the previous year.

Works and Buildings.—Plans of the offices allocated to the Meteorological Office in the proposed building at the London Terminal Aerodrome, Croydon, were approved.

Work has been commenced on the new office at Cranwell and on the alterations to an existing office which has been allotted for the accommodation of a proposed meteorological station at Worthy Down.

Minor alterations and redecorations were carried out in the offices at Castle Bromwich, Sealand, Leuchars, Cattewater, Holyhead, Renfrew, Lympne, Biggin Hill, South Farnborough and Felixstowe.

The erection of screens round the pilot balloon pillars has been sanctioned for all stations and work is proceeding.

Repairs were carried out to Pyestock Chimney, South Farnborough, and a new screen to accommodate a thermograph and hygrograph was fixed at the top of the tower.

BRITISH CLIMATOLOGY DIVISION

Organization.—In May, 1925, the former Climatology Division of the Office was divided into two parts and the part dealing with the *Réseau Mondial* and the climate of the British Colonies was separated from the part dealing with the Climatology of the British Isles. The latter portion was combined with the British Rainfall Organization

to form a "British Climatology Division" which is responsible for all questions dealing with the climate and rainfall of the British Isles. Further particulars of the change are given on p. 10. The organization of stations reporting full climatological observations is now co-ordinated closely with that of the large number of stations reporting rainfall only. The re-constituted division is responsible for the preparation of the annual volumes of *British Rainfall* as well as the serial issues of the *Weekly* and *Monthly Weather Reports.*

The division collects and indexes climatological and rainfall records from all stations in the British Isles and prepares summaries and discussions of the observations for publication. It also prepares replies to inquiries regarding the climate of the British Isles and detailed reports regarding the rainfall of specified areas in connexion with questions of water supply and for other purposes.

Climatology of the British Isles—Distribution of Stations.—The following table gives the distribution by districts of the stations of different types; it also shows the distribution of the stations from which autographic records are received. The classification under "autographic records" is independent of that under "stations" and a single station may be counted more than once under "autographic records." The classification now takes account of more than 4,500 stations from which eye-measurements of rainfall made daily, weekly or monthly are received and published in *British Rainfall.*

Districts	Stations						Autographic Records					
	Observatories	Distributive	Telegraphic	Climatological	Crop Weather	Rainfall only	Sunshine	Rainfall	Wind	Pressure	Temperature	Humidity
0. Scotland, N...	1	0	4	8	0	116	8	2	2	9	0	0
1. ,, E...	1	1	2	26	2	341	16	3	3	2	2	2
6*a*. ,, W...	1	1	0	21	0	299	11	4	1	3	1	1
6*b*. Isle of Man ..	0	0	0	1	0	8	1	0	0	0	0	0
2. England, N.E.	0	1	2	18	2	272	16	3	3	3	1	1
3. ,, E...	0	2	2	21	4	456	23	4	3	3	1	1
4. ,, Midlands	0	0	4	41	3	974	29	9	1	4	1	1
5. ,, S.E.	0	7	1	37	4	779	35	10	8	8	7	6
London District	2	0	1	7	0	54	7	1	1	1	3	0
7*a*. England, N.W.	0	0	1	22	1	412	21	5	2	1	0	0
7*b*. N. Wales ..	0	2	0	6	1	154	6	2	2	2	2	2
8*a*. S. ,, ..	0	0	1	6	1	216	8	2	0	1	0	0
8*b*. England, S.W.	0	1	2	29	3	524	25	4	2	3	1	0
9. Ireland, N. ..	0	0	3	5	0	107	4	2	1	3	0	0
10. ,, S. ..	1	0	2	16	0	141	5	2	3	6	0	0
11. Scilly and Channel Isles	0	0	2	3	0	27	3	0	2	0	0	0
Total	6	15	27	267	20	4,880	218	53	34	49	19	14
Corresponding number for last year	6	16	26	263	19	4,864	214	51	33	51	18	16

The observatories and distributive stations are operated by the staff of the Office. The telegraphic stations are, as a rule, maintained at coastguard stations or lighthouses by arrangement with the authorities concerned. The observing work done at these stations forms part of the regular work of the station staff, for which payment is made from the Office. The numerous climatological and rainfall stations are maintained by private observers or by municipal or other local authorities without payment by the Office. The Committee wish to express their appreciation of the public spirit shown by those who maintain these stations and forward their records and observations for incorporation in the official weather reports for the benefit of the community.

Only such autographic records as are regularly received at the Office are included in the above table. It should be noted that the records from other municipal or private observatories or stations are usually available on loan if required. The records from distributive* stations at aerodromes are examined at South Kensington month by month and returned for preservation locally.

Changes of stations associated with the British Climatology Division.—Stations have been started at Huddersfield (Oakes) (July, 1925), Mansfield (March, 1926), Petersfield (June, 1925), Pontefract (February, 1926) and West Kirby (February, 1926).

In addition, two new stations forwarded returns under the "Crop-weather" Scheme of the Ministry of Agriculture and Fisheries, viz., Chelmsford (Good Easter) (January, 1926), and Worcester (Perdiswell).

Summaries for two new Scottish stations were received from January, 1926, viz., Glenbranter and Glasgow (University).

The following climatological stations have ceased, for various reasons, to send in observations :—Bushfield (January, 1926), Hildenborough (February, 1926), Kirton (April, 1926), Dunrobin (April, 1926).

As usual, numerous changes have occurred in the list of rainfall stations. On the average about 300 rainfall observers drop out of the list every year and are replaced by others. In many cases the sites of the gauges remain unchanged. Considerable simplification in the handling of the returns from these stations was affected at the commencement of the year 1926 by a revision of the forms used.

Health Resort Stations.—Certain simplifications were made as from 1st January, 1926, in the form of the daily telegrams which are despatched to the Office from Health Resort Stations at 17h G.M.T. (5 p.m. in winter, 6 p.m. in summer) and also in the form of the monthly return of observations received from these stations.

Inspections.—During the year, 167 climatological stations and 87 rainfall stations were inspected. Among the latter were a number of isolated stations in Central Wales and in the Lake District, including the historic gauges at Seathwaite and the Stye, Cumberland, in the wettest part of England. A new observer has been appointed to read the Seathwaite gauges and it is hoped that continuity of this interesting record has been assured. Thanks are due to Mr. F. Hudleston of Penrith for the valuable assistance which he rendered

* The stations of the Army Meteorological Service, Shoeburyness and Larkhill, are counted with the distributive stations in the table.

in connexion with this appointment. A number of the rain-gauges maintained by the Metropolitan Water Board were also inspected.

Courses of Training for Observers.—Two courses were arranged at Kew Observatory, each lasting about a week. One was held at the end of April, principally for observers at health resort stations; eight persons attended this course. The second course, which was held in September, was for the benefit of observers at the agricultural meteorological stations; 23 persons attended this course. It was followed by meetings at the Meteorological Office, South Kensington, to read and discuss papers of interest to the student of agriculture and meteorology; Sir Napier Shaw took the chair at these meetings and Sir Thomas Middleton, Professor Blackman, Dr. B. H. Keen and others contributed to the discussions.

Publications.—*The Weekly and Monthly Weather Reports* have been published regularly throughout the year, and the issues are up to date. No important change of form has been made in either of these publications. Since January, 1926, the stations reporting sunshine of which the exposures are such that more than 5 per cent of the total possible sunshine for the month is liable to be cut off by obstructions, are suitably marked in the columns of the *Monthly Weather Report* devoted to the sunshine data.

British Rainfall, 1924, was published on November 12th, 1925, The volume was on the same lines as its predecessors. It contains a report on the heavy rainfall at Cannington near Bridgwater in the early morning of August 19th, 1924, when at least 8 inches of rain fell in 5 hours. The volume also contains an article on "General Monthly Rainfall over the British Isles for the years 1881 to 1924," in which serial values of the monthly and annual general rainfall are given for each month and year in the series.

The first number of the *Observatories' Year Book*, viz., that for 1922, was issued. The volume for 1923 is now in the press and it will contain a section devoted to data for the new Geophysical Observatory at Lerwick, Shetland Islands. The printing of copies of *Hourly Values for Autographic Records*, 1921, the concluding volume of the former series of publications containing hourly values from observatories, was completed at the end of the year, so that the combined series is now complete to the end of 1922.

The Meteorological Observer's Handbook, 1926 edition, has been issued. It contains instructions for observing, both instrumental and non-instrumental, but the instructions for compiling weekly and monthly returns of observations and those dealing with the daily programmes of observations will be issued as supplements to the Handbook, one supplement being prepared for each important class of station.

A new edition of *Rules for Rainfall Observers* was issued.

Returns for Registrars-General.—A weekly summary of the weather at certain large towns is prepared for the Registrar-General for England and Wales. Quarterly and annual summaries are also supplied. Similar information is supplied quarterly to the Governments of Northern Ireland and the Irish Free State. The report for Scotland, published by the Registrar-General for Scotland, is prepared at the Edinburgh Office.

Weekly Climatological Values for the British Isles.—The preparation of a homogeneous series of weekly values, by districts, of temperature, rainfall and sunshine for the British Isles, from 1878 to the present time, which was referred to last year, has proceeded but the results are not yet ready for publication.

Rainfall Survey of the British Isles.—Some progress was made with the preparation of maps showing, on a scale of 2 miles to 1 inch, the isohyetal lines of average annual rainfall. Maps covering Wales and Shropshire were completed, and additional averages were computed for stations in the eastern counties of England.

Inquiries.—During the year 614 general or scientific inquiries including 85 legal inquiries were dealt with. They were of many different kinds, but the following may be specially mentioned :—

Reports on the rainfall of the Thames Valley for each month and for the year ending March 31st, 1924, were supplied to the Metropolitan Water Board. Statistics were also sent monthly to the Thames Conservancy.

A report was supplied to the Electricity Commission in connexion with questions of storage of available rainfall for the purpose of supplying electricity to the town of Barmouth.

Rainfall statistics and a map of annual average rainfall were supplied to the Commission of the Ministry of Agriculture and Fisheries on the Ouse Drainage.

The average annual and monthly rainfall over an area north of Carmarthen was evaluated.

The average annual rainfall over a portion of the River Swincombe on Dartmoor was estimated for the Ministry of Agriculture and Fisheries in connexion with a Parliamentary Bill promoted by the Paignton Urban District Council.

A rainfall map of the British Isles was supplied to Messrs. W. and A. K. Johnston, Ltd., Edinburgh, and published as a wall map on a scale of 16 miles to 1 inch.

Maps of average annual and monthly rainfall and of the wettest and driest years were supplied to the Royal Meteorological Society for incorporation in a Rainfall Atlas.

Particulars of the atmospheric conditions as regards visibility and freedom from smoky fogs in respect of various places in the Home Counties were supplied in response to inquiries as to the places near London which would be most suitable for cinema studios for the production of British films.

Staff.—Following on a decision to replace two Grade III Clerks by two " Writing Assistants " with a view to their employment principally on the operation of comptometers, two typists from the Air Ministry typing-pool of " Writing Assistant " grade, were trained in the use of the comptometer.

General.—A large quantity of original records of rainfall and sunshine was transferred from South Kensington to Gwydyr House, Whitehall, where more commodious storage space was available.

ADVISORY COMMITTEE ON ATMOSPHERIC POLLUTION

The investigation into atmospheric pollution has been continued during the year ending March 31st, 1926. The office of Chairman was filled by the Director of the Meteorological Office ; Dr. J. S. Owens acted as Honorary Secretary. A list of members of the Committee during the year referred to is given on p. 5.

The work of collecting and examining the monthly deposits of rain and impurity from 64 gauges has been continued. The number of stations operating deposit gauges during the current year was 30. Of these 9 commenced work during 1925, while 3 stations which were already making observations started additional gauges. Since January, 1926, 26 public authorities have asked for instructions relative to setting up observation stations for measuring atmospheric impurity.

The *Eleventh Report* of the Committee has been issued.

The special researches in hand during the current year have been as follows :—

(1) The examination of the relation between atmospheric impurity and public health, carried out in conjunction with the Ministry of Health.

(2) Investigation into the relation between the deposit of tar in different places and the total deposit of impurity as bearing upon the relative proportions of domestic and industrial smoke, the domestic smoke being much richer in tar.

(3) The relation between the suspended impurity in the air and the amount deposited from the air. These being to some extent complementary it was expected that a relation should appear when sufficient figures were available.

(4) Investigation into the deposit of sulphur and its relation to total deposit. A marked tendency was evident for the percentage of sulphur in the deposit to diminish as the amount of total deposit increased, the highest percentages of sulphur being found in those places of lowest total impurity.

(5) The examination of London fogs.

(6) Photomicrography of dust records as bearing upon identification of the source of dust.

(7) The development of methods of examination of the crystalline matter found in the air, with special reference to the conditions of humidity required to initiate condensation upon hygroscopic nuclei. This investigation showed that many of the nuclei found in air brought about condensation of water to form liquid drops at humidities of about 70%, while a comparison of the vapour pressures and temperatures of deliquescence with those of pure salts gave a possible means of identification of the nature of the salt found in the air.

As during the current year the Committee has not had the use of a laboratory or the services of an assistant, the amount of research work has been strictly limited.

NAVY SERVICES DIVISION

General.—The work of the Division has progressed steadily during the past year and the increasing interest shown by Naval Officers in meteorology remarked on last year is continued. A close liaison is maintained with the Admiralty and frequent visits made to the Hydrographer to whom all meteorological matters concerning the Fleet are referred.

The number of inquiries, some of a confidential nature, show a marked increase from former years and the amount of correspondence has almost doubled.

The supply of special forecasts for specified operations has been an important advance and it is understood that they have been of much value to those concerned. A close liaison has been developed with the Dockyard Authorities at Portsmouth and arrangements have been made by which the Daily Weather Chart is received at that Port on the same day as issued. When important operations are in progress the weather probabilities are frequently discussed by telephone with the Captain of the Dockyard.

Arrangements have also been made for the supply of the Daily Weather Chart and forecast to the King's Harbour Master, Plymouth. In this case the chart is supplied by the Meteorological Station at Cattewater. In view of the great advantage of these charts being received on the same day of issue, it is hoped that similar arrangements may be extended to other Naval Ports in the near future.

The Naval establishments at Chatham, Devonport, Pembroke and Portsmouth have been visited and the meteorological requirements of these areas discussed. Several of H.M. Ships have been visited including the Aircraft Carriers *Eagle* and *Furious*.

Pilot Balloon Observations at Sea.—The Superintendent by permission of the Hydrographer went afloat in H.M.S. *Fitzroy* for 6 days in June and carried out pilot and sounding balloon experiments. Three of H.M. Ships continue to co-operate in obtaining pilot balloon observations over the sea and some interesting results have been received from H.M.S. *Repulse*, obtained during her recent cruise with H.R.H. the Prince of Wales. A further development of this scheme of obtaining pilot balloon observations over the sea is probable in the near future.

Visit to Malta.—The Superintendent visited Malta in December in order to confer with the Commander-in-Chief, Mediterranean, on meteorological matters concerning the Fleet. The Superintendent in company with the Superintendent of the Airship Meteorology Division, took passage to Malta in H.M.S. *Barham* which afforded an oportunity of demonstrating the drawing of synoptic charts and forecasting at sea. Weather reports were also despatched twice daily from the ship to Headquarters and to the Meteorological Office, Malta.

In Malta conferences were held on board H.M.S. *Queen Elizabeth* (Flagship) and arrangements made for :—

(1) the transmission of weather reports from H.M. Ships at sea to the Meteorological Office, Malta, thus giving assistance in forecasting the weather for sections of the Mediterranean which will be of great importance to the meteorological side of the Airship Development scheme.

(2) a Fleet synoptic message to be issued at a routine time for the information of H.M. Ships in order that the practice of constructing synoptic charts and forecasting at sea may be developed, and

(3) the issue of gale and " Gregale " warnings for the Malta area.

All the above arrangements have been approved by the Commander in-Chief, Mediterranean, and (1) and (2) were brought into force on the 20th February (3) having commenced in January. With regard to (1) and (2) special forms and pamphlets of instructions have been compiled, printed and distributed to the Fleet.

As a result of this visit it is anticipated that the foundation of a close liaison between the Fleet in the Mediterranean and the Meteorological Office at Malta has been laid to the mutual benefit of both.

Gale Warning Stations.—The report by the Superintendent on the gale warning stations of the British Isles, mentioned in last year's report, was considered by a Committee of representatives of Government Departments concerned, and as a result, a Gale Warning Board was held, the Superintendent being nominated Secretary. The Board met on October 30th, 1925, and on their recommendation the method of distributing gale warning telegrams has been revised thus making it possible to reduce the number of telegrams and allowing a large number of additional stations being added to the list of gale warning stations without additional expense.

Gale warning stations were visited during the year and where necessary the positions fixed for insertion in the Admiralty Charts. Gale warning stations have been established at the following places :—

Collieston	Holy Isle	Landguard
Johnshaven	Amble	Margate
Arbroath	Scarborough	Mousehole
Fifeness	Aldbrough	Fishguard
North Berwick	Maplethorpe	Helmsdale

The gale warning stations at Amlwch, Anvil Point, New Brighton and St. Andrews have been closed.

Fishery Barometer Stations.—Fishery barometer stations have been established at St. Abb's and the Island of Gigha (west coast of Scotland) and a barograph supplied to each place. A Fishery barometer has been supplied to the existing station at Burntisland and a barograph to Gardenstown.

AIRSHIP METEOROLOGY DIVISION

The year under review has shown steady progress along the lines indicated in the report for last year.

Airship Route Working Chart.—It was found at the outset that there did not exist a contoured outline map embracing the routes from England to India together with a sufficient area on either side, on a suitable projection and of suitable scale. A special "England—Egypt—India Airship Route Working Chart" (Form 2206), measuring 40″ by 30″ as described more fully in the last *Annual Report*, was accordingly produced, and a stock became available in October, 1925.

Investigational Work. *Conditions along Airship Routes.*—Good progress has been made with :—

(1) The investigation of the average distribution of thunderstorms by months, the results being plotted on the Airship Route Working Charts.

(2) The statistical analysis of upper wind data. Daily observations for several years at 31 stations in Italy, Malta, Middle East Area and Iraq have been treated, summaries being made for each month for the heights, 1,500 feet, 3,000 feet, 6,000 feet and 10,000 feet, the form of summary being in accordance with recommendations of the International Commission for Air Navigation. The results are also being charted on the Airship Route Working Charts by means of "wind roses," there being a separate chart for each month for each height.

(3) The preparation of a series of synoptic weather charts covering the whole area of the Airship Route Working Chart, using data extracted from all available sources. It is proposed to prepare daily charts for a whole year, the period chosen being the year April, 1924, to March, 1925. Much preliminary work has been necessary in collecting data, but actual charting is now proceeding. The maps when complete will serve primarily for the study of the day to day weather changes along the routes in relation to Airship Navigation and as a basis on which to work when forecasting for the airship routes commences. Their scientific value is also expected to be considerable.

Conditions at Airship Bases.—CARDINGTON. The most important investigation under this heading is that of wind structure in relation to airship design and mooring, a question which has been considered by a Sub-Committee of the Aeronautical Research Commmittee. There is a demand for records of the short period fluctuations of wind strength and direction on a much more open time-scale than have been made hitherto, and for knowledge of the horizontal extent of eddies, particularly during gales. It is proposed to experiment at Cardington with a network of anemometers, the records being synchronized with an electrically controlled time marking system. A good deal of the necessary preliminary work, instrumental and otherwise, has already been done.

ISMAILIA.—A complete analysis is in progress of the autographic records of wind, temperature, etc., obtained since 1922, at the Royal Air Force Meteorological Station at Abu Sueir, with a view to determining the diurnal and seasonal variation of these elements, and the characteristics of individual days.

Special attention is being devoted to upper air conditions in this area. A programme of special pilot balloon ascents to determine the diurnal variation of upper wind was commenced at the Royal Air Force Station, at Abu Sueir in June, 1925, and will continue until a year's records have been obtained. These are being worked up in the Division.

The co-operation of the Royal Air Force has enabled the diurnal variation of upper air temperature and humidity to be investigated by aeroplane ascents. On selected days in August, September and October five ascents a day were made, and a further series was commenced in March, 1926. The results which have been worked up have proved of great value to the Airship Staff.

The most important investigation which is being planned to be undertaken at Ismailia is concerned with obtaining a continuous record of the temperature and the lapse-rate of temperature, by day and night in the first few hundred feet above the surface. This information is of fundamental inportance in connexion with the problem of mooring airships in a sub-tropical climate. It will be necessary to erect electrically recording thermometers at various points on a mast extending at least 250 feet above the surface of the ground.

KARACHI.—A good deal has already been published on the subject of the ordinary meteorological elements at Karachi. This has been collected and is being co-ordinated for airship use.

It is anticipated that certian special questions relating to conditions there will require attention.

Special Investigations.—In addition to the main lines of investigation already indicated, a number of special investigations have been completed or are in progress. Among them may be mentioned :—

(*a*) Specially detailed examination of average thunderstorm conditions in the Rhone Valley compared with those on other possible routes across southern France.

(*b*) The Mistral.

(*c*) The destructive Persian Gulf ' cyclone " of October, 1925.

(*d*) An intense Mediterranean depression in November, 1925, during the visit of the Superintendent referred to below, resembling the one in which the French Airship *Dixmude* was lost in the same region.

(*e*) A " line squall " at Malta in December, 1925, accompanied by waterspout phenomena observed by the Superintendent during his visit.

(*f*) Sea breeze effects on North African Coast (with the co-operation of the Royal Air Force Meteorological Section in making special pilot balloon ascents at Aboukir near Alexandria).

Inquiries.—Numerous inquiries, not covered by the above, have been answered. Among them may be mentioned :—

(*a*) A report on existing knowledge of small scale wind structure, prior to taking up the special research at Cardington referred to already.

(*b*) A report prepared in collaboration with Wing Commander T. R. Cave-Browne-Cave, C.B.E. (Airship Engines),

on "selected records of Upper Air Temperature and Humidity in different localities with special reference to the maximum water recoverable from the exhaust gas of an airship in flight." The results were incorporated in a paper read by Wing Commander Cave-Browne-Cave at a joint meeting of the Royal Aeronautical Society and Institute of Automobile Engineers in November, 1925.

(*c*) Evidence on the magnitude of intense vertical atmospheric currents and of the winds in tornadoes and waterspouts.

(*d*) Estimate of the extremes of temperature occurring up to heights of 5,000 feet along probable airship routes to India.

(*e*) Humidity data for driest known climate of the earth.

(*f*) Extreme temperatures likely to be attained by various materials exposed to tropical insolation.

General Organization.—Attention has been directed to the question of the provision of a meteorological organization along the entire airship routes from England to India. The proposed general organization has been drawn up and a memorandum on the subject has been forwarded to the Government of India through the India Office. Discussion of details is proceeding.

The Superintendent of the Division was absent from November, 18th, 1925, to January 22nd, 1926, on a tour of duty to Malta, Egypt, Italy and France, in order to investigate the existing resources on which to draw for the airship meteorological organization as far as Egypt, and to look into the additions which will be necessary. The visit served the purpose also of providing an opportunity for the study of Mediterranean weather conditions by personal experience and by discussions with members of the various meteorological services. It further resulted in obtaining certain unpublished data for some of the investigations detailed previously.

The Superintendent was present in Malta in December with the Superintendent, Navy Services Division, and participated in the arrangements made for a system of weather reports by W/T to Malta from H.M. Ships of the Mediterranean Fleet when at sea. This organization should prove of great assistance when airship flights commence.

Operations.—The station at Pulham was opened on two occasions. A meteorological organization was provided for the operations of H.M. Airship R.33 in April, 1925, and the Station was open again in October, November and December, 1925, for the same purpose.

In March, 1926, a complete organization was drawn up and arrangements were made for the further opening of the Pulham Station in anticipation of the arrival of the Amundsen-Ellsworth Polar Airship *Norge* I from Rome in April.

Forecasts were provided from the Air Ministry as required, in connexion with kite balloon operations at Pulham.

Miscellaneous.—The Superintendent organized the Meteorological Office Exhibit and Forecasting Demonstration at the meeting of the British Association for the Advancement of Science held at Southamption, August, 1925, and attended the meeting in his capacity as a Secretary of Section A (Mathematics and Physics).

METEOROLOGICAL OFFICE, EDINBURGH

General.—The organization of the work of this Office has been described in earlier reports. It was continued unaltered during the year now under review.

Reduction of Data from Observatories.—The reduction of the Eskdalemuir magnetic data has been carried on as usual. The sections on the three Scottish Observatories for the 1923 *Observatories' Year Book* were completed, including proof reading of tabular matter. This volume contains for the first time a section relating to the Lerwick Observatory. The year closes with the greater part of the computing completed for the Eskdalemuir and Lerwick sections of the 1924 *Observatories' Year Book*, but copy has not yet been prepared for the press. As noted below and particularly in respect of the Eskdalemuir Section of the *Year Book* the position in regard to arrears is being slowly retrieved.

Climatological, Telegraphic and Rainfall Stations.—The number of climatological stations in Scotland is now 58. New stations have been started at Glenbranter, near Strachur, under the control of the Forestry Commission (Scotland) and at Glasgow University under the direction of the Professor of Public Health. Observations are no longer received from Dunrobin. The total number of rainfall stations is about 760. Work in these sections has been kept well forward. The number of observing stations in Scotland (other than rainfall stations) at work during the year is shown below.

	Observatories.	Telegraphic Reporting Stations.	Climatological Stations.
Number at beginning of year.	3	8	57
,, closed during year	—	—	1
,, opened during year.	—	—	2
,, at end of year ..	3	8	58

The opening of a new telegraphic reporting station at Cornaigmore on the Island of Tiree is still being delayed pending the settlement of questions relating to the provision of telephonic communication between Cornaigmore and the Post Office at Scarinish.

Inquiries.—The number of inquiries dealt with by correspondence was 59.

Evidence was given in one case in the Court of Session.

Forecasts, etc.—In general, inquiries for forecasts have been dealt with by reference to the information received by W/T and by telegram from London or by referring the inquirers to the Forecast Division.

In connexion with the possible usefulness of special warnings of snowstorms, an examination was made of the losses of sheep and lambs

in Scotland arising from snowstorms. Statistics provided by the Board of Agriculture suggested that the losses which could be related to snowstorms in spring were of considerable magnitude. With regard to lambs alone the deficiency in the numbers living at 4th June ranged up to 280,000 in an extremely bad year, whereas the excess (above the normal expectation) in good years might reach 140,000. Even accepting part of the losses as due to other causes and a considerable proportion as absolutely unavoidable, it appeared that early warning of storms or renewals of wintry conditions could still enable much loss to be averted.

The purely meteorological aspects of the problem were examined in conjunction with the Forecast Division. The chief difficulty was that in the past virtually no telegraphic information had been received in London from the inland and upland districts where snow is of more general occurrence, but only from the coastal reporting stations where snow occurs much less frequently and cannot lie for any length of time. It was decided therefore that for the winter of 1925–26 the Edinburgh Office, which is in receipt of very complete daily information regarding weather over Scotland, should report all occurrences of snow to the Forecast Division and that the latter should regard the first winter as one for study of the problem and for experiment.

Advisory Committee.—This Committee met on 26th June and on 21st December, 1925, the Director being present as Chairman. The questions relating to new premises for the Office and to the negotiations with the Town Council regarding the Calton Hill Observatory occupied a considerable part of the time of the Committee. These matters are referred to again below.

Office Premises.—The lease of the house at 10 Rothesay Place expired in May, 1925. New accommodation was eventually found in the shape of two upper floors of the building at 6 Drumsheugh Gardens which had recently been purchased by the British Medical Association. A five-years lease (with the option of termination at two years) of these premises was arranged. The removal to the new premises was effected at the end of April.

Calton Hill Observatory.—In March, 1925, the Town Council of Edinburgh approved in principle of the Observatory Buildings at the Calton Hill being made available for the Meteorological Office at a rent not exceeding £150 per annum, and a remit was made to a Committee with powers to adjust the terms of a lease and to make any further arrangements necessary. Examination of the situation disclosed considerable difficulties. The amount of useful office accommodation at the Observatory was extremely small and every proposal for adaptation or extension had to face the initial difficulties that on the one hand the existing buildings had been erected in a style which was now impossibly expensive of reproduction and on the other hand that all considerations of architectural taste, not to mention certain Acts of Parliament, forbade spoiling the architectural features of the Calton Hill as a whole. At the same time scientific opinion and local opinion generally realized that a great opportunity was presented, if only it could be used. Whilst negotiations were in progress the Royal Society of Edinburgh passed the following

resolution and communicated copies to the Town Council and to the Scottish Meteorological Committee :—

" The Royal Society of Edinburgh recognizing that the present occasion is suitable for a reconsideration of the position of the Calton Hill Observatory, welcome the suggestion that it should be permanently attached to the Meteorological Service, and trust that the Air Ministry on the one hand, and the Town Council on the other, may find a satisfactory basis for arrangement. In such an arrangement they trust that an improved forecast service for Scotland would result ; and further that the astronomical services to the citizens of Edinburgh, so long associated with the Calton Hill, might be continued in some effective form."

The Scottish Committee after consideration of the position up to date passed the following resolution at the meeting on 26th June, 1925 :

" The Advisory Committee of the Meteorological Office, Edinburgh, having heard and considered the offer by the Town Council to lease the Observatory on the Calton Hill to the Meteorological Office (Air Ministry) at a rent of £150 per annum, after first spending the sum of £1,500–£2,000 in adapting the premises to the purpose and in putting them into suitable repair, is of the opinion that this offer furnishes a basis for negotiation that should be pursued by the Meteorological Office with the intention of making an agreement.

The grounds for this opinion are the following and are in some respects of a general character bearing upon the influence of the Meteorological service in Scotland, and its future. The Calton Hill Observatory has been associated with scientific interests in Edinburgh for upwards of a century—first as a private establishment owned and erected by the Edinburgh Astronomical Institution, later under H.M. Office of Works as the Observatory of the Astronomer Royal for Scotland, and since 1889 maintained by the Town Council as the City Observatory. If it now passes to the Meteorological Office, the value of this tradition, which in Scotland is substantial, would pass over unimpaired. But the Committee do not advocate the acceptance of the Town Council's offer merely because it would continue a tradition. They can point to a wide and increasing range of usefulness, in which such an establishment could and should be employed for the purposes of agriculture, weather, forecasts, gale warnings and aviation, all of which in their application to Scotland can be more adequately served by arrangements less highly centralized than at present.

Further, though observational work in Meteorology may not be contemplated immediately, such a development may be required in the early future, for the Flying Service, or for the Town's local meteorological needs, or for other purposes and the area would be suitable for such developments.

The Committee desires to record an emphatic opinion that it is undesirable to treat the Meteorological Service in Scotland as a detail of the service for the whole Island which might be discharged equally in a London Office or elsewhere. It considers this view compatible with the equally important scientific absence of demarcation between England and Scotland. For this reason it is to be wished that the Meteorological Office, Edinburgh should be housed in fitting quarters such as are offered by the Calton Hill.

In expressing general approval of the idea, the Committee records its view that the actual details would require careful arrangement. The requirements of the Edinburgh establishment in respect to the number of rooms, etc., being known, it would remain to see that the changes agreed to by the Town Council would supply sufficient and suitable accommodation. It is assumed that it is the intention of the Town Council in making the offer to render it possible of acceptance by meeting actual reasonable requirements."

Negotiations were pursued further with the Town Council and somewhat improved proposals were later on submitted by them.

But the accommodation offered was still, from the point of view of housing the entire Edinburgh Office, library, etc., unsatisfactory, and the Scottish Committee at their meeting in December, 1925, agreed that a communication in the following terms should be sent to the Town Clerk:—

"The Committee were in agreement that the proposed accommodation would not be satisfactory. Also in view of the great cost that would apparently be involved either in altering existing buildings or in erecting accommodation of a suitable nature, the Committee did not feel justified in asking the Lord Provost's Committee to proceed further."

Library.—447 volumes, mostly of serials and in the main arrears for the war period or earlier years, were bound during the year. Increased shelving was also provided.

Inspections, etc.—In the course of the year 24 stations in Scotland were inspected.

Observatories :—

ESKDALEMUIR OBSERVATORY

Terrestrial Magnetism.—Continuous photographic registration of the three geographical components of terrestrial magnetic force was maintained, the curves being standardized by means of the results of absolute observations, made twice weekly, of horizontal force, declination and inclination. The tabulation, from the curves, of hourly values, hourly ranges, daily maxima and minima, and the assigning of the curve base line and scale values were done at the Observatory, while most of the ensuing work of computation and reduction was performed at the Edinburgh Office. Estimates of the daily magnetic character figures, according to the international scheme, and the values of the squares of the daily range were forwarded quarterly to the Royal Netherlands Meteorological Institute at De Bilt.

By means of the coil and galvanometer method mentioned in earlier reports records of the finer details of the changes in vertical magnetic force were obtained from time to time during the earlier part of the year and practically without interruption during February and March, 1926. Some phenomena of considerable interest appear in the records and it is hoped that time will permit of a closer study of these and allied matters.

Two direct-reading magnetometers, for horizontal force and declination were constructed from a design supplied by Dr. A. Crichton Mitchell and forwarded to Lerwick Observatory.

The magnetographs formerly in use for many years at Kew Observatory were received in October, 1925. It is expected that the west room of the underground magnet house will be available in the very near future and then these instruments will be installed.

Meteorology.—The routine work of a first order station was maintained and in addition observations were made daily at 7h, 13h, and 18h, G.M.T. for the purpose of telegraphic reports to Headquarters. Pilot balloon ascents were made on "International days," when weather permitted, and on other days as opportunity offered; the "tail method" was employed in the majority of ascents.

Solar radiation observations with the Ångström pyrheliometer were made on a few days. Eder photometer records, which give a measure of ultra-violet radiation, were obtained throughout the year and were forwarded to the National Institute of Medical Research. The special monthly returns of sunshine in connexion with the Eder records were continued.

In August, 1925, the pressure tube anemograph was provided with a new vane and head, a stouter sectional direction rod and a twin-pen direction recorder. A marked improvement in the character of the direction record resulted.

In May, 1925, the Fuess recording snow-gauge, mentioned in the last report, was removed to a position nearer the standard rain-gauges. A comparison of the Fuess and standard gauges in respect of amounts of precipitation received in various conditions is in progress.

Electric light has been substituted for acetylene gas as illuminant for the photographic thermograph.

The tabulation of these autographic records (controlled and standardized by eye observations where necessary) and the work of computation and reduction were carried out at the Observatory. The usual data were supplied for publication in the *Weekly* and *Monthly Weather Reports.* During the year the preparation of the greater part of the current tables in meteorology for the *Observatories' Year Book* was kept practically up to date.

The harmonic analysis of the mean diurnal variation of temperature for the years 1911–23 was commenced.

Atmospheric Electricity.—The photographic records from a Dolezalek quadrant electrometer connected to a water dropper were maintained; and the behaviour of the installation was generally satisfactory. Combined leakage and scale value determinations were carried out almost daily and in nearly all months at least six absolute observations of potential gradient in the open were made for the purpose of obtaining values of the factor for converting the indications of the photographic records into potential gradient in volts per metre above ground level in the open. Since May, 1925, the scale value of the photographic records has been about one half of that in previous years. Some preliminary arrangements have been made for maintaining an additional and much less sensitive record in order that the large changes associated with precipitation, etc., may be recorded without loss. Calibrations of the Wulf electrometer, used in the potential gradient work, were carried out by means of a battery of dry cells and a potentiometer.

Values of the potential gradient at 3h, 9h, 15h, 21h, G.M.T. on each day and at each hour on certain selected electrically quiet days were tabulated.

The preparation of summaries of some of the potential gradient results for the period 1911–23 was in progress intermittently throughout the year.

Seismology.—The Galitzin seismographs, three pendulums with galvanometric registration, which had been in operation at the Observatory since 1910–11 were removed to Kew Observatory on October 9th, 1925. No seismological records were maintained after that date.

During the portion of the year in which the Galitzin instruments were available only horizontal component records were obtained, owing to lack of a second efficient recording drum. Partial determination of the instrumental constants was carried out. Earthquake bulletins were prepared and copies issued to about twenty institutions, and the measurements of amplitude and period of the microseisms of the north component were made as in previous years.

Prior to the removal of the Galitzin instruments the details of their manipulation and of the normal seismological routine work were demonstrated to two members of the professional staff of Kew Observatory.

Publication of Results.—The meteorological and atmospheric electrical tabular matter for the *Observatories' Year Books* for 1923 and 1924 and the seismological matter for the former were prepared, as were also the texts for the 1921 and 1923 publications. The position in regard to preparation of Year Book material is therefore being retrieved and it is anticipated that everything will be brought up to date during the coming year.

Miscellaneous.—The observations with Mr. Reeves's "true north" apparatus, to which reference was made in the last report, were discontinued in June, 1925.

Records of atmospheric pollution from Dr. Owen's automatic air filter have been obtained from September, 1925.

Visitors to the Observatory included :—Dr. G. C. Simpson, Dr. D. La Cour, Prof. C. G. Darwin, Dr. A. C. Mitchell, Commander L. Garbett, Mr. J. S. Dines, Mr. J. M. Stagg, Mr. R. E. Watson, Mr. A. W. Lee, and Dr. J. Bartels.

Buildings, etc.—Shortage of water was experienced (*a*) in June–July, as a result of unusually prolonged dry weather and (*b*) in early December, as a result of a period of frost.

Early in the year arrangements were made, by the Works and Buildings departments, for the leading away of the water which enters through the floor near the north-west corner of the underground magnet house. Since October the cement rendering of the walls of the corridors and of the west room of the magnet house has been in progress and is now nearing completion. The ventilation system has been modified.

The Works and Buildings department has also attended to bad leaks in certain of the buildings.

The provision of accomodation for certain married members of the staff has been under consideration.

Aberdeen Observatory

Routine.—In the course of the year only minor alterations occurred in the ordinary routine. The employment of the "trial group" for reporting the character of the weather (S.C.N.I. of the International Commission for Synoptic Weather Information) was continued in the 13h. and 18h. telegrams. From 1st January, 1926, the new *Hygrometric Tables* were brought into use.

Reduction of Data.—The stage reached in the preparation of data for the *Observatories' Year Books* is that the work for the 1924 volume

has not yet been completed, though considerable progress has been made on it.

Instruments.—The Beckley rain-gauge was entirely dismantled in December and some minor repairs were executed on the clockwork. The Campbell Stokes Sunshine Recorder which had required to be re-adjusted last year in consequence of the deterioration of some of its fittings was finally fixed and cemented in position in March. In the same month a Robin Hill " whole-sky " camera was received for use as occasion permits.

Inquiries.—Several inquiries were dealt with either locally or after reference to Edinburgh. On two occasions evidence was given in courts of law.

Two climatological observers (from Berwick-on-Tweed and Boghall respectively) were given some preliminary training in observing.

Lerwick Observatory

Terrestrial Magnetism.—The magnetographs have been in operation throughout the year, but the success attending some of the adjustments to the instruments, mentioned in the last report, was only of a temporary nature :—

1. After six months or so a further drift set in on the horizontal force instrument, and, despite many efforts to eliminate it, persisted until the end of the year. Possible causes of the drift are still being investigated.

2. The Watson multiple-magnet vertical force magnetograph, after behaving fairly well for about six months, again showed signs of sticking and the scale value varied very erratically from test to test. As these defects could not be obviated by cleaning or by renewing the drier enclosed in the case, it was decided to replace this instrument by the vertical force magnetograph formerly in use at Falmouth. The Falmouth instrument, although inferior to the Watson in some points of design, is giving much better records than any previously obtained at Lerwick.

3. An unlooked for improvement has accompanied the increased damping of the declination instruments in that a small drift, which had been apparent on the declination records up to December, 1924, has stopped since the alteration to the damping box. (This drift is mentioned in the "Review of Results of Lerwick Magnetic Observations," *Observatories' Year Book*, 1923.)

Two Krogness portable magnetographs were received from Kew in January, 1926, and have been installed in the concrete house for emergency use.

Absolute observations of declination, dip, and horizontal force, have been made twice weekly when possible, and scale tests carried out frequently.

Two eye-reading magnetometers, constructed at Eskdalemuir have been received for obtaining direct readings of declination and horizontal force during auroral displays.

A number of trial records of vertical magnetic force were obtained in the summer of 1925 from the horizontal coil apparatus. Tests of the insulation of the cable were made, and the reduction of the circuit to aperiodicity had been carried out, when the galvanometer suspension

was broken. The galvanometer was returned from repair early in 1926, but no time was available for further work with this instrument during the remainder of the year under review.

Miscellaneous additions associated with the magnetic equipment of the station include :—

1. The Jones unifilar magnetometer, No 101, which arrived from Eskdalemuir on January 18th.
2. A thermograph with a very open temperature scale for use in the magnetograph house.
3. A bank of new accumulators for use in the magnetograph lighting.

The magnetic tabulations have fallen slightly in arrears, chiefly owing to illness of staff.

Estimates of the daily magnetic character figures according to the international scheme were made and forwarded to Edinburgh quarterly, together with absolute daily ranges of declination and horizontal force.

Aurora.—The regular auroral watch from 19h. to 23h. has been maintained except during the four summer months, and the details of displays have been forwarded to Edinburgh monthly. Although the regular logging of meteorological conditions ceases at 23h., the members of the staff show a very active interest in the work and have taken numerous voluntary observations after that time.

Eye readings of declination were taken every half minute during a few displays observed towards the end of the year.

A series of observations of the luminosity of the night sky has been taken in connexion with a scheme inaugurated by Lord Rayleigh for obtaining co-operative observations of this nature from various parts of the world.

Meteorology.—The work in this section has proceeded along the lines set out in previous reports.

The calibration of the anemometer was tested in April 1925, and the orientation has been checked on several occasions. Considerable sticking of the velocity pen has been experienced throughout the year. A number of quick run anemograms have been obtained from a special clock which rotates at approximately 144 times the normal rate. These records have been forwarded to London and Edinburgh for further investigations.

An annual summary of the weather at Lerwick has again been supplied to the County Medical Officer of Health for inclusion in his report to the County Committee and the Board of Health.

Atmospheric Electricity.—The Benndorf electrometer has been maintained throughout the year, and behaved well during the summer months. During the autumn and winter there have been many breaks in the records owing to failures of the insulation and of the clock. These difficulties, which were caused, partly by the dampness of the atmosphere, and partly by fumes from a stove in the hut, have been minimised by enclosing the electrograph in a large wooden case.

Insulation tests have been made daily and scale tests carried out weekly.

An Elster and Geitel electroscope for measuring potential gradient in the open has been lent by the Director. No reduction factors have yet been obtained.

Radio Research and W/T Station.—The Atmospheric Recorder, belonging to the Radio Research Board, has been maintained throughout the year by the W/T Charge Hand. During his absence on leave, this work, together with the management of the Pelapone charging set, was undertaken by the Meteorological Office Staff.

On several occasions, when the W/T aerial has been damaged during gales, new aerials have been erected by the W/T Charge Hand with the assistance of the Observatory staff.

Buildings, etc.—The Works and Buildings Section Officer from Leuchars visited the station in May, 1925, in order to investigate maintenance work and certain new works which were under consideration at that time.

The installation of a new electrical plant was carried out in November, 1925, under the supervision of the Station Engineer from Leuchars. The new generator is driven by a single cylinder Ruston Hornsby oil engine and forms an immense improvement over the Pelapone charging set.

New paths have been constructed to outlying huts, and repairs have been carried out to existing paths; the cutting of open drains, to prevent flooding of the Observatory grounds by water from adjacent higher ground, was carried out at the same time, the material excavated from drains being used in the construction of paths. The whole of the work was carried out by two labourers working under the supervision of the Officer-in-Charge.

The barbed wire entanglements, surrounding the station, were removed in March, 1926.

The wind pump has twice needed repair owing to damage during gales, and on one occasion the water supply failed owing to chokage of the filters. No trouble has been experienced with the drainage throughout the year.

General.—Telephonic communication has been established between the hut containing the direct reading magnetometers and the auroral hut.

Outstanding discrepancies relating to stores have been cleared up and an inventory received from London has been accepted.

A scheme for furnishing one of the cottages as staff quarters has been approved.

KEW OBSERVATORY

Staff.—Mr. F. J. W. Whipple, Superintendent of the British Rainfall Organization, succeeded Dr. Charles Chree, F.R.S., as Superintendent, on May 5th.

Equipment.—The principal event of the year was the installation of the three Galitzin seismographs from Eskdalemuir in place of the magnetographs.

The magnetographs, which had been in operation since 1857 when they were designed and set up by John Welsh, and were the models for the "Kew pattern" magnetographs set up at numerous observatories, have been transferred to Eskdalemuir Observatory.

Practically all the serviceable magnetic instruments have also been transferred to other stations. It having been arranged that tests of magnetic apparatus are to be conducted at the Magnetic Station of the Royal Observatory, Greenwich at Abinger, the records of tests have been made over to the Astronomer Royal. The inertia bar apparatus designed by the late Professor W. Watson has also gone to the Royal Observatory. The Jones magnetometer, which has been the standard for magnetic observations since 1857, is to be retained in the Observatory museum.

The pendulums of the Galitzin seismographs have been accommodated on a large concrete pillar in the old magnetograph room and the galvanometers and recording drums have been installed on slate slabs in the old seismograph room, which housed the Milne seismograph until it was put out of action on June 17th, 1925. For the control of the timing of the seismographs, a half-second clock, Morrison 8587 was adapted by the maker. Electric lighting from the Company's mains was arranged for the seismographs, special lamp-holders, etc., being designed. To ensure uniform temperature, the windows of the pendulum room have been provided with triple glass and also shielded by louvred screens from the direct sunshine which might fall on them morning and evening. The seismographs have been in continuous operation since January 1st., 1926.

The photo-barograph was moved from the old magnetograph room to the photographic dark-room on June 16th, 1925.

Since December 1st, 1925, electric light has been utilized for the photo-thermograph in place of gas.

New equipment received includes a divided megohm, a 600-volt dry battery, a Gorczynski pyrheliograph, and a Hill cloud camera.

Special Investigations.—A comparison of thermometer screens has been in progress since 1923. In addition to the north-wall screen, in which the bulbs of the photographic thermograph are exposed, and a Stevenson screen at the normal height, an elevated Stevenson screen 17 feet above ground and a Glaisher stand formerly in use at Camden Square have been utilized. The results are under discussion.

A dry and wet-bulb thermograph with forced ventilation has been on trial throughout the year.

Three thermometer screens designed for use at sea were under observation for four months.

A Stevenson screen with metal louvres was set up in March. Comparisons with the normal Stevenson screen are being made.

A series of comparisons of anemometer heads was concluded. The primary purpose of the investigation was to test a "static" head designed at the National Physical Laboratory.

On behalf of the Instruments Division, three sunshine recorders have been in operation on the Observatory roof. The records have served for a comparison between the sunshine duration given by the normal type in use in this country and in Switzerland, and also for an investigation of the effects of using spherical lenses of different specifications.

A comparison of earth thermometers of different types is proceeding.

Voltameters devised by Mr. R. E. Watson for measuring very small currents having proved satisfactory in the laboratory, a test plate for

the determination of the air-earth current has been constructed. Experiments are proceeding.

Routine Work.—The normal routine of the Observatory has been maintained. Tables for the *Observatories' Year Book* for 1924 were completed and much progress made with those for 1925.

Instructional Classes.—An instructional class for observers at health resorts was held in April, 1925, under Captain Barlow, and one for observers at "Crop-weather stations" connected with the Ministry of Agriculture was held in October under Captain Spence. Both instructors were provided by the British Climatology Division.

Visitors.—In connexion with the celebration of the 75th anniversary of the foundation of the Royal Meteorological Society, the Fellows of the Society were invited to visit the Observatory on April 21st, 1925. The party included most of the members of the International Commission for the Investigation of the Upper Air.

The members of the Seismological Committee of the British Association were invited to visit the Observatory on November 20th, 1925, to inspect the Galitzin installation.

In June, 1925, a set of pendulum observations was made at the Observatory by Col. Cowie, R.E., with the assistance of Mr. G. Manley. The pendulums used were the ones which served in 1903 for the comparison between the values of g at Kew and Greenwich.* They have been in use by the Indian Survey since that date. News of the death of Col. Cowie on his return voyage to India was subsequently received with great regret.

Pendulum observations were also made in October by Sir Gerald Lenox-Conyngham and Mr. Manley, the immediate object being the comparison of the values of g at Cambridge and Kew.

In July, Professor W. F. G. Swann of Yale University spent two days at the Observatory making observations with apparatus designed to detect penetrating radiation of a type which he had reason to think might exist. Only negative results were obtained, however†.

Kew Observatory—Upper Air Section

The work of the Upper Air Section and workshop at Kew Observatory has been continued on lines similar to those followed in the previous year.

The mechanical staff have been engaged on design, maintenance and experimental work connected with the upper air observations, and with similar work for the Observatory and other departments of the Meteorological Office. A good deal of installation and repair work has been executed for the Observatory, and as the work done for it and other departments has increased as compared with former years, the workshop has been very fully occupied.

The total number of sounding balloons sent up during the year was 56. Of these, the instrument failed in one case, in another the

* G. P. Lenox-Conyngham, *Proc. R. Soc.* A 78 (1906) 241.

† *Journal of the Franklin Institute*, Feb. 1926.

attachment to the balloon broke at a very small height, and in 12 others the instrument was not returned. The remaining 42 gave good records, which have all been worked up and tabulated. Heights up to 22·6 kilometres were reached, with a mean of 15·4, a result decidedly better than that of the previous year. One of the balloons released from Sealand fell in Alsace.

Fourteen of the successful soundings were made from Kew Observatory, the remaining 28 from Sealand Aerodrome ; the Kew soundings reached heights slightly less than the others, but yielded a smaller percentage of lost instruments. Three simultaneous soundings were made from Sealand on December 14th, and provide interesting data regarding casual errors of measurement of pressure and temperature. Improved means have been adopted, both of sending calibrated meteorographs to Sealand, and of transit through the post of those returned by the finders, and damage or derangement of the returned instrument is now rare.

Some slight modifications were made in the Dines meteorograph with a view to stiffening a part of the barograph formerly rather weak. The practice of partially calibrating the instrument again after return and before the record has been disturbed, has been adopted as part of the regular routine. This puts a check on the reliability of the instrument and its ability to stand the shocks incidental to transit and the actual ascent. The methods and apparatus employed in calibrating the meteorographs at very low temperatures are gradually being improved, the casual error has been reduced and the measurement of the temperature of the calibrating bath made more precise. The existing stock of balloon meteorographs has been almost entirely rebuilt with new aneroid boxes, of which the pressure lag is appreciably less than that of the old ones.

The policy of making working drawings and complete specifications of all the major pieces of apparatus made in the Upper Air Section has been continued, and few arrears now remain.

Observations were made through the winter with the small captive balloon on the temperature gradient in fogs, and the information obtained supplied at once to the Aviation Services Division.

The tables for the Upper Air Section of the *Observatories' Year Book* for 1924 and 1925 were completed.

A paper is in preparation on errors in measurement of upper air temperatures by means of registering balloons.

Current information as to upper air conditions was supplied regularly to Dr. G. M. B. Dobson in connexion with his investigations into the ozone content of the atmosphere.

VALENCIA OBSERVATORY, CAHIRCIVEEN, CO. KERRY

Meteorological Routine.—The Observatory has been maintained as a first order meteorological station. The standard self-recording instruments have been kept in continuous operation without loss of record during the twelve months and the tabulation and reduction of the records have been kept well up to date. Eye observations of the various instruments have been made at the usual hours without intermission throughout the year and in addition to the usual telegraphic reports to the Air Ministry the special reports at 10h. and 16h. have been continued. The principal alteration in routine was the discontinuance of the tabulation of the records of the Robinson cup anemometer from the 1st January, 1926, and the substitution for these in the normal work of the Observatory of the records from the pressure tube anemograph.

The rain-gauge at the Cahirciveen reservoir continues in action and is read on the first day of each month. The readings are supplied to the British Rainfall Organization and to Mr. E. W. M. Murphy of the Irish Rainfall Association who receives also the monthly totals from the Observatory gauge.

Nephoscope and pilot balloon observations have been made fairly regularly but a full programme has not been possible owing to the smallness of the staff.

Magnetic Observations.—Absolute observations of magnetic declination, horizontal force and inclination were made weekly throughout the year. A revised method of computing the distribution constant for the magnets of the Dover unifilar was introduced as standard procedure from the 1st week in January, 1926.

Miscellaneous.—An extended analysis of the records of the variously exposed rain-gauges at the Observatory was completed and a paper dealing with the effects of difference in exposure and the screening properties of the Nipher Shield and two types of pit protection, was prepared and read to the Royal Meteorological Society.

The evaporation tank and the Piché evaporimeter continue to be read twice daily. The analysis of the results is in hand but has been retarded by the pressure of routine work. Maximum and minimum thermometers had been fixed a little way below the water surface in the tank but the readings were not found to be of great use for the study of the evaporation records and in July, 1925, these thermometers were replaced by ordinary thermometers on a floating frame, so arranged that the temperatures in the surface of the water and at a level 10 inches below could be read off. These readings have been taken every three hours from 9h. to 21h. inclusive for some months and should provide interesting information quite apart from their possible usefulness in connexion with the evaporation records.

The Eder photometer supplied by the National Institute for Medical Research continues in use and specially prepared sunshine totals have been supplied monthly. The instrument was lost in a storm and records were missing for an interval of some weeks.

METEOROLOGICAL OFFICE, MALTA

Reports.—The routine morning and evening reports issued last year to the Navy, Artillery, and Royal Air Force were continued, with slight modifications made to economise time. The international broadcasts at 0735, 1335, and 1835 were carried on unchanged except for the addition of morning observations of upper air temperature. The relay to Cairo of observations in north Africa and Spain became a broadcast in February, 1926, at the request of the Meteorological Officer, Royal Air Force, in Egypt.

Synoptic reports for the Navy in the Mediterranean were started in May, 1925. At first these were used by Aircraft Carriers only, but in February, 1926, other ships of the Fleet began to use them.

A considerably increased number of " meteor " messages involving special pilot balloon ascents were issued to the Artillery during practice camps.

Owing to the increased demands on the office during the year, a hectographed Daily Weather Report, started in May, 1925, was discontinued.

Information received.—W/T reception was improved during the year by the use of a frame aerial instead of a mast, and the information available was increased considerably.

In March, 1926, certain ships of the Mediterranean Fleet began to make observations at sea and to transmit them to the office.

Gale Warnings.—As a result of a visit by the Superintendent, Navy Services Division, a system of warnings for gales, and for the north-east wind, locally known as "gregale" was started at Malta in January, 1926. This formed part of a scheme including the synoptic issued to the Fleet and the supply of observations by the Fleet to the office.

Investigations.—Two papers on cloud observations, and observations of upper winds at Malta, were written by Mr. J. Wadsworth during the year, and work on the variation of upper winds, in connexion with flying over the sea, was continued when time was available. For the purpose of the latter work the Royal Air Force began to make upper air observations in June, 1925.

Efforts were renewed to apply the polar front method of forecasting, and the method proved very useful in cases when the fronts could be located with certainty. In many situations however the fronts proved difficult to detect.

General.—In December the Superintendents of the Navy Services Division and the Airship Services Division visited Malta. During their visit conferences took place with representatives of the Navy. Various new arrangements were made in connexion with the issue and receipt of reports, and the Naval Chief of Staff visited the office. In addition, the state of forecasting at Malta and the facilities for issuing reports in connexion with airships were discussed and, following on these discussions, the Superintendent (Malta) visited Headquarters in January and worked for some time with Dr. J. Bjerknes on the application of " fronts " to forecasting in the Mediterranean.

In the course of the year inquiries were again made with a view to transferring the office from Pieta to Valletta, but without success. The rent of the existing premises was increased during the year.

Co-operation with the University Observatory was maintained, and Professor Agius courteously lent records on several occasions.

PUBLICATIONS

The first volume of the *Observatories' Year Book*, containing data for the year 1922 has been issued. This publication records the meteorological and geophysical observations made at the observatories of the Office formerly contained in Parts III and IV of the *British Meteorological and Magnetic Year Book*. The manuscript for the several sections has been prepared at the individual observatories, but the general editing of the volume has been carried out in the British Climatology Division of the Office. The *British Meteorological and Magnetic Year Book* terminates with the issue for 1921, and the appearance during the year of *Hourly Values from Autographic Records* for 1921, completes the issue of the earlier publication, with the exception of Part V (*Réseau Mondial*) for which the volumes for 1919-1921 are still outstanding.

A new edition of the "Meteorological Observer's Handbook" has also been passed through the press, but the issue was not completed before the termination of the year under review. The work of its preparation has fallen mainly on the British Climatology Division, but it has necessitated the co-operation of all Divisions of the Office. The edition differs from its predecessors in some important respects. It confines itself to giving instructions for setting up of meteorological stations and the taking of observations. The detailed instructions of procedure and for the completion of monthly returns are omitted. These will be dealt with in special supplements prepared to meet the special requirements of different types of station.

The official publications issued or signed for press during the year are as follows :—

PERIODICAL.—**The Daily Weather Report** issued in three sections (to date) :—
1. The British Section.
2. The International Section.
3. The Upper Air Section.

The Weekly Weather Report (to date).

The Monthly Weather Report with a summary for the year (to January, 1926).

The Marine Observer (to date).

The Meteorological Magazine (to date).

The British Meteorological and Magnetic Year Book: —
Part IV. (2) **Hourly Values from Autographic Records.** Geophysical Section. Vol. for 1921.
Part V. **Réseau Mondial.** Monthly and annual summaries of pressure, temperature and precipitation at land stations, generally two for each 10 degree square of latitude and longitude. Vols. for 1917 and 1918.

The Observatories' Year Book, 1922. Comprising the results obtained from autographic records and eye observations at Meteorological Office Observatories. (In continuation of Parts III (2) and IV of the British Meteorological and Magnetic Year Book.)

British Rainfall, 1924. A report on the distribution of rain in space and time over the British Isles as recorded by more than 5,000 observers.

Report of the Committee for the Investigation of Atmospheric Pollution. Reports on observations for the years ending 31st March, 1924, and 31st March, 1925.

Southport Auxiliary Observatory. Annual Report and results of meteorological observations. By J. Baxendell. Report for the year 1924.

OCCASIONAL.—**International Meteorological Commission for the Exploration of the Upper Air.** Report of the meeting in London, April 16–22, 1925.

Geophysical Memoirs :—

Vol. III.

No. 23. Climatology of Glasgow. By Prof. L. Becker, Ph.D., F.R.S.E.

No. 24. Distribution of Thunderstorms over the Globe. By C. E. P. Brooks, M.Sc.

No. 25. Surface and Geostrophic Wind Components at Deerness, Holyhead, Great Yarmouth and Scilly. By S. N. Sen, M.Sc.

No. 26. Classification of Synoptic Charts for the North Atlantic, 1896 to 1910. By E. V. Newnham, B.Sc.

No. 27. On the design of the Kew Pattern Barometer. By S. N. Sen, Ph.D.

No. 28. The Doldrums of the Atlantic. By C. S. Durst, B.A.

No. 29. Absolute Daily Range of Magnetic Declination at Kew Observatory, Richmond, 1901 to 1910. By J. M. Stagg, M.A., B.Sc.

No. 30. Comparison of Magnetic Standards at British Observatories with a discussion of various instrumental questions involved. By C. Chree, Sc.D., LL.D., F.R.S.

Professional Notes :—

Vol. III :—

No. 40. Ground Day Visibility at Cranwell, Lincolnshire, during the period April 1, 1920, to December 31, 1923. By W. H. Pick, B.Sc.

Vol. IV :—

No. 41. Upper Air Temperatures in Egypt. By E. V. Newnham, B.Sc.

No. 42. Investigation of Winds in the Upper Air from information regarding the place of fall of Pilot Balloons, and the distribution of Pressure. By J. Durward, M.A.

No. 43. Some effects produced by Protective Shields on the readings of Grass Minimum Thermometers. By J. M. Stagg, M.A., B.Sc.

Barometer Manual for the use of Seamen. A text-book of Marine Meteorology. 10th edition, 1925.

Meteorological Observer's Handbook. 1926 edition.

Weather Map. An introduction to modern meteorology. By Sir Napier Shaw, F.R.S. 6th issue, 1925.

The Committee desire to express their appreciation of the following articles by contributors not on the staff of the Meteorological Office :—

In the *Marine Observer*

Weather Reports and Forecasts, and their Aid in Ship Salvage Operations.	Captain C. G. Bonner, V.C., D.S.C., Salvage Officer, Leith Salvage and Towage Company.
Wireless as an Aid to Navigation.	Commander J. A. Slee, C.B.E., R.N.
How a Great Port meets the Needs of Navigation.	Captain F. W. Mace, O.B.E., R.N.R., Marine Surveyor and Water Bailiff, Port of Liverpool.
Ocean Fish	Captain Sir David Wilson Barker, Kt., R.D., R.N.R., F.R.S.E.
Wireless and Weather as an Aid to Navigation.	C. B. Roche, Chief Officer, P. & O. S. N. Co.
Commodore Sir Bertram Hayes, K.C.M.G., D.S.O., R.D., R.N.R.	Lieut. A. F. Butcher, R.N.R.

Meteorology and Cable Work ...	Lieut. W. E. Allen, R.N.R., and F. Bolingbroke.
Airship Navigation	E. L. Johnston, Master Mariner, Aerial Master Navigator.
Set and Drift, and the New D. R. Instruments.	F. S. Clifford, Master Mariner.
A Singular Mistake	Lieut.-Commr. P. M. van Riel, R.H.M., Netherlands Meteorological Institute.
The Ocean regarded as a Pasture ...	W. R. G. Atkins, O.B.E., Sc.D., Marine Biological Laboratory, Plymouth.
Typhoons and Statics	Rev. Father E. Gherzi, S. J., Zi-ka-wei Observatory.

In the *Meteorological Magazine*

Pilot Balloon Ascents at Colombo Ceylon.	H. Jameson, Colombo Observatory, Ceylon.
The Border Line between Meteorology and Soil Physics.	Dr. B. A. Keen, Assistant Director and Head of the Soil Physics Department, Rothamsted Experimental Station.
The International Ice Patrol ...	Lt. Comdr. Edward H. Smith, U.S. Coast Guard.
Some recent Papers by W. Wiese ...	Sir Gilbert Walker, Professor of Meteorology.
The Structure of Fronts	Dr. J. Bjerknes, Geofysisk Institutt, Bergen.

Among the articles contributed to the publications of the Office by members of the staff may be mentioned :—

In the *Marine Observer*

Ocean Currents, Notes on Observation and Use of Published Information. Work of the Year. Note to Marine Observers. Wireless Telegraphy and Tropical Revolving Storms. West Indian Hurricanes, August and September, 1924. Current Charts. Developments in Wireless and Weather, an Aid to Navigation. Quarterly Charts of Currents for the Tracks from the British Isles to North America. Some Common Interests of Seamen and Airmen.	Captain L. A. Brooke Smith, R.D., R.N.R.
Upper Air Observations over the Sea	Commander L. G. Garbett, R.N.
Currents on the Track from the Latitude of Cape Blanco to the Brazils.	Mr. C. S. Durst, B.A.

Notes on Average Conditions in the Indian Ocean, north of Latitude 35°S. Typhoons of the North Pacific and China Seas. Wind and Fog Charts for Great Britain and Ireland and the South Western Approaches. Wireless and Weather in the North Pacific.	Commander J. Hennessy, R.D., R.N.R.
Sea and Swell ... ... Notes on Frequency of Gales: All Oceans. Local Winds.	Mr. H. Keeton.
Marine Meteorology, History and Progress.	Mr. H. T. Smith.

In *British Rainfall*, 192'.

The Unprecedented Rainfall at Cannington.	J. Glasspoole, M.Sc., Ph.D.
General Monthly Rainfall, 1868–1921	do.

In the *Meteorological Magazine*

The International Commission for the Investigation of the Upper Air.	E. Gold, F.R.S.
Long Period Variations in the Rainfall of Great Britain.	C. E. P. Brooks, M.Sc.
The King's Cup Air Race—Meteorological Conditions.	F. Entwistle, B.Sc.
An Outstanding Problem of Meteorology.	D. Brunt, M.A., B.Sc.
The Cierva Autogyro	E. Taylor, M.A., B.Sc.
The Optics of the Sunshine Sphere	E. G. Bilham, B.Sc., D.I.C.
"A Red Sky at Night . . . . . "	Spencer Russell.

The publication of the following papers by members of the staff, etc., may also be mentioned:—

By G. C. Simpson, C.B.E., D.Sc., F.R.S.—

The new ideas in meteorology. Presidential Address to section A of the British Association. *Rep. Brit. Ass.*, Southampton, 1925, pp. 15–29.

By C. Chree, Sc.D., F.R.S.—

The times of "sudden commencements" (S.C's) of magnetic storms; observation and theory. London, *Proc. Physic. Soc.*, 38, pp. 35–46. Analysis and discussion of magnetograph curves. In: Australian Antarctic Expedition 1911–1914. Scientific Reports, Ser. B, Vol. 1, Pt. 2, pp. 199–286.

The relationship between the "solar constant" and terrestrial magnetism. London, *Proc. R. Soc.*, 109, pp. 1–6.

By F. J. W. Whipple, M.A., F. Inst.P.—

Radiation and the atmosphere. In:—Phases of Modern Science, published in connexion with the.....British Empire Exhibition, 1925, pp. 97–9.

On well-poised series, generalised hypergeometric series having parameters in pairs, each pair with the same sum. London, *Proc. Math. Soc.*, (2), 24 (1924), pp. 247–63.

On the best linear relation connecting three variables. *Phil. Mag.*, London, 1, pp. 378–84.

By C. E. P. Brooks, M.Sc.—
The Norwegian Fiords—climatic history. *Geogr. Teacher*, 13, pp. 34–41.
The problem of warm polar climates. *Q. J. R. Meteor. Soc.*, 51, pp. 83–91.
From the Ice Age to the Iron Age. *Discovery*, VI, 1925, pp. 470–4.

By David Brunt, M.A., B.Sc.—
Periodicities in European weather. *Phil. Trans. R. Soc.*, A, 225, pp. 247–302.
Energy in the earth's atmosphere. *Phil. Mag.*, 1, pp. 523–32.

By M. A. Giblett, M.Sc.—
Notes from a log held in the North Sea, August, 1921. *Q. J. R. Meteor. Soc.*, 51, pp. 46–8.

By A. H. R. Goldie, M.A., F.R.S.E.—
Gustiness of wind in particular cases. *Q. J. R. Meteor. Soc.*, 51, pp. 357–62.
Waves at an approximately horizontal surface of discontinuity in the atmosphere. *Q. J. R. Meteor. Soc.*, 51, pp. 239–46.
Discontinuities in the atmosphere. Edinburgh, *Proc. R. Soc.*, XLV, 1924–25, pp. 213–24.

By H. W. L. Absalom, B.Sc., A.R.C.S., D.I.C.—
Magnetic storm of February 23–5, 1926. *Nature*, 117, pp. 416–7.

By C. K. M. Douglas, B.A.—
On the relation between the source of the air and the upper air temperature up to the base of the stratosphere. *Q. J. R. Meteor. Soc.*, 51, pp. 229–38.

By W. H. Pick, B.Sc.—
A note on isobaric distribution and sunshine at Cranwell, Lincolnshire. *Q. J. R. Meteor. Soc.*, 51, pp. 282–3.

By R. S. Read, M.A., B.Sc., A.R.C.S.—
The thunderstorms of July 22nd, 1925. *Q. J. R. Meteor. Soc.*, 51, pp. 396–9.
Cold front: September 1st, 1925. *idem*, pp. 416–21.

By C. D. Stewart, B.Sc.—
Experiments in the shielding of rain-gauges. *Q. J. R. Meteor. Soc.*, 52, pp. 55–72.

By C. S. Durst, B.A.—
Formation of waterspouts. *Nature*, 115, pp. 676–7.

By J. Glasspoole, Ph.D., M.Sc.—
Fluctuations of annual rainfall. Three driest consecutive years. *Trans. Inst. Water Engineers*, 29, 1924, pp. 83–110.
Months of greatest and least rainfall at stations in Europe. *Q. J. R. Meteor. Soc.*, 51, pp. 275–7.

By N. K. Johnson, B.Sc. and O. F. T. Roberts, B.A.—
The measurement of the lapse rate of temperature by an optical method. *Q. J. R. Meteor. Soc.*, 51, pp. 131–8.

By Spencer C. Russell, LL.B.—
Well-water temperatures. *Q. J. R. Meteor. Soc.*, 51, pp. 400-2.

By L. Doris Sawyer, B.A.—
The effect of pressure distribution upon London's sunshine in winter. *Q. J. R. Meteor. Soc.*, 51, pp. 121–30.

By R. G. Veryard, B.Sc.—
On the calibration of pressure-tube anemometers. *Q. J. R. Meteor. Soc.*, 51, pp. 413–6.

The paper by Dr. J. Glasspoole on "Fluctuations of Annual Rainfall" was awarded the Institution Premium of the Institution of Water Engineers.

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