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METEOROLOGICAL
OFFICE
EDINBURGH
28 FEB. 1925
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ANNUAL REPORT

OF THE

METEOROLOGICAL COMMITTEE

TO

THE AIR COUNCIL

For the Year ended 31st March, 1924

(The Sixty-ninth Year of the Meteorological Office).



LONDON:

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METEOROLOGICAL COMMITTEE,

1923-24.

Appointed by the Air Council.

Chairman :—The Under Secretary of State for Air.

Vice-Chairman :—Sir ARTHUR SCHUSTER, F.R.S. Nominated by the Royal Society.

Lieut.-Colonel D. CLAPHAM, D.S.O., O.B.E. Superintendent of Experiments, Shoeburyness. Nominated by the War Office.

Mr. J. E. W. FLOOD. Nominated by the Colonial Office.

Vice-Admiral F. LEARMONTH, C.B., C.B.E. Hydrographer of the Navy. Nominated by the Admiralty.

Colonel H. G. LYONS, D.Sc., F.R.S. Nominated by the Royal Society.

Mr. H. W. W. McANALLY, C.B. Principal Assistant Secretary, Air Ministry. Nominated by the Air Ministry.

Mr. L. V. MEADOWCROFT, Assistant Secretary, Air Ministry. Nominated by the Air Ministry.

Sir THOMAS MIDDLETON, K.B.E., C.B., LL.D., Development Commission. Nominated by the Ministry of Agriculture and Fisheries.

Mr. P. J. ROSE. Assistant Under-Secretary for Scotland. Nominated by the Scottish Office.

Professor R. A. SAMPSON, M.A., D.Sc., F.R.S.,* Astronomer Royal for Scotland. Nominated by the Royal Society of Edinburgh.

Dr. G. C. SIMPSON, C.B.E., F.R.S., Director, Meteorological Office.

Captain R. C. WARDEN, C.B.E. Nominated by the Board of Trade.

Professor E. M. WEDDERBURN, M.A., D.Sc., W.S.† Nominated by the Royal Society of Edinburgh.

Secretary :—Captain D. BRUNT, M.A.

* From November, 1923. † Up to November, 1923.

COMMITTEE OF THE METEOROLOGICAL OFFICE, EDINBURGH.

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

Professor T. HUDSON BEARE, B.A., B.Sc., M.I.C.E. Nominated by the University of Edinburgh.

Dr. J. E. CROMBIE, Nominated by the University of Aberdeen.

Commander LESLIE FISHER, R.N. Nominated by the Fishery Board for Scotland.

Sir W. L. MACKENZIE, M.D., LL.D. Nominated by the Scottish Board of Health.

Professor W. PEDDIE, D.Sc. Nominated by the Royal Society of Edinburgh.

Mr. J. M. RAMSAY, O.B.E. Nominated by the Board of Agriculture for Scotland.

Professor R. A. SAMPSON, F.R.S. Nominated by the Royal Society.

Professor E. M. WEDDERBURN, M.A., D.Sc., W.S. Nominated by the Royal Meteorological Society.

THE GASSIOT COMMITTEE, 1924

Appointed by the Royal Society in accordance with Treasury Letter of 26th February, 1910, to administer the Gassiot Trust, and to promote the scientific study of the branches of science to which the Trust relates, viz :—Meteorology, Terrestrial Magnetism, Atmospheric Electricity, Seismology and the cognate subjects.

Sir CHARLES SCOTT SHERRINGTON, G.B.E. (*President of the Royal Society*).

Colonel H. G. LYONS (*Chairman*).

The Astronomer Royal.

Professor S. CHAPMAN.

Dr. C. CHREE.

Sir G. LENOX-CONYNGHAM.

Dr. J. H. JEANS.

Sir ARTHUR SCHUSTER.

Sir NAPIER SHAW.

Dr. G. C. SIMPSON.

Mr. G. I. TAYLOR.

ADVISORY COMMITTEE ON ATMOSPHERIC
POLLUTION, 1923-24.

Sir NAPIER SHAW, F.R.S. (*Chairman*).

Dr. J. S. OWENS (*Honorary Secretary*).

Dr. T. L. BAILEY (*Chief Alkali Inspector, Ministry of Health*).

Professor H. B. BAKER, C.B.E., F.R.S. (*Royal College of Science*).

Dr. JOSEPH CATES, (*Medical Officer of Health to the Surrey County Council*).

Captain C. J. P. CAVE (*Past President of the Royal Meteorological Society*).

MR. J. G. CLARK, F.I.C. (*Chemist, Gas, Light & Coke Co.*)

Professor J. B. COHEN, B.Sc., Ph.D., F.R.S. (*Professor of Organic Chemistry, Leeds University*).

Dr. H. A. DES VOEUX (*Hon. Treasurer, Coal Smoke Abatement Society*).

Lieut.-Colonel E. GOLD (*Assistant Director, Meteorological Office*).

Sir JOHN RUSSELL (*Director of the Rothamsted Experimental Station, Harpenden*).

MR. W. B. SMITH (*Member of Departmental Committee on Smoke Abatement*).

Mr. F. J. W. WHIPPLE (*Superintendent Climatology Division, Meteorological Office*).

Dr. JOHN ROBERTSON, nominated by the Corporation
of Birmingham.

MR. A. R. TANKARD, nominated by the Corporation of Hull.

Dr. W. HANNA, nominated by the Corporation of
Liverpool.

Dr. W. T. HOWARTH, nominated by the Corporation
of the City of London.

Mr. HENRY MILLS, J.P., nominated by the London County Council.

Mr. W. OSBORN THORP, nominated by the Corporation
of Malvern.

Professor W. HALDANE GEE, nominated by the Corporation of Manchester.

Dr. R. W. SIMPSON, nominated by the Corporation of Newcastle-on-Tyne.

Dr. J. B. WILKINSON, nominated by the Corporation of Oldham.

Dr. J. R. ASHWORTH, nominated by the Corporation of Rochdale.

DR. FRANK HAUXWELL, nominated by the Corporation
of St. Helens.

Mr. J. BAXENDELL, nominated by the Corporation of Southport.

Mr. JOHN FYFE, nominated by the Corporation of Stirling.

Dr. MARGARET FISHENDEN, nominated by the Department of Scientific and Industrial Research.

Nominated by the
Meteorological
Committee.

Nominated
by the Municipal
Authorities
contributing
observations.

THE STAFF OF THE METEOROLOGICAL OFFICE, ITS OBSERVATORIES AND BRANCHES, MARCH, 1924.

THE STAFF AT HEADQUARTERS

DIRECTOR :

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

DIRECTORATE AND GENERAL SERVICES DIVISION

<i>Assistant Directors</i>	..	R. G. K. Lempfert, C.B.E., M.A. E. Gold, D.S.O., F.R.S.
<i>Chief Clerk</i>	..	H. L. B. Tarrant.
<i>Clerk, Grade I</i>	..	R. Pyser.
<i>Clerks, Grades II & III</i>	..	10
<i>Officekeeper</i>	..	1

LIBRARY

<i>Senior Professional Assistant</i>	M. T. Spence, B.Sc.
<i>Clerks, Grade III</i>	.. 3

MARINE DIVISION

<i>Superintendent</i>	.. L. A. Brooke-Smith, Captain, R.D., R.N.R.
<i>Senior Professional Assistants</i>	C. S. Durst, B.A., J. Hennessey, Lt. Cdr., R.N.R.
<i>Clerk, Grade I</i>	.. H. Keeton.
<i>Clerks, Grades II & III</i>	.. 10

FORECAST DIVISION

<i>Superintendent</i>	.. J. S. Dines, M.A.
<i>Assistant Superintendents</i>	.. E. G. Bilham, B.Sc., A.R.C.S., D.I.C., M. A. Giblett, M.Sc., E. V. Newnham, B.Sc.
<i>Senior Professional Assistants</i>	W. C. Kaye, B.Sc., Miss L. F. Lewis, B.Sc., S. C. Russell, LL.B., Miss L. D. Sawyer, B.A., A. Walters, R. A. Watson, B.A., S. F. Witcombe, B.Sc.
<i>Junior Professional Assistants</i>	J. E. Belasco, B.Sc., H. St. G. Dyke-Marsh B.A., W. J. Grassick, M.A.
<i>Clerk, Grade I</i>	.. W. Hayes.
<i>Clerks, Grades II & III</i>	.. 20
<i>Telephone-Typists</i>	.. 8

CLIMATOLOGY DIVISION

<i>Superintendent</i>	.. R. Corless, O.B.E., M.A.
<i>Assistant Superintendent</i>	.. C. E. P. Brooks, M.Sc.
<i>Senior Professional Assistants</i>	E. W. Barlow, B.Sc., Miss E. H. Geake, M.Sc., P. I. Mulholland, B.Sc.
<i>Junior Professional Assistant</i>	Miss G. L. Thorman, B.Sc.
<i>Clerk, Grade I</i>	.. A. G. W. Howard
<i>Clerks, Grades II & III</i>	.. 16

INSTRUMENTS DIVISION

<i>Superintendent</i>	..	..	F. Entwistle, B.Sc.
<i>Senior Professional Assistant</i>	..	..	S. N. Sen, M.Sc., A.Inst.P.
<i>Junior Professional Assistant</i>	..	..	R. G. Veryard, B.Sc.
<i>Clerk, Grade I</i>	..	..	P. N. Skelton.
<i>Clerks, Grade III</i>	..	..	7
<i>Instrument Designer</i>	..	..	1
<i>Storemen, Packer and Porter</i>	3

ARMY SERVICES DIVISION

<i>Superintendent</i>	D. Brunt, M.A., B.Sc.
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LOCAL CENTRES DIVISION

<i>Superintendent</i>	A. H. R. Goldie, M.A.
<i>Assistant Superintendent</i>	R. S. Read, M.A., B.Sc., A.R.C.S.
<i>Senior Professional Assistant</i>	..	..	R. H. Mathews, B.A.
<i>Clerks, Grades II and III</i>	..	..	2

BRITISH RAINFALL ORGANIZATION

<i>Superintendent</i>	..	..	F. J. W. Whipple, M.A., F.Inst.P.
<i>Senior Professional Assistant</i>	..	..	J. Glasspoole, M.Sc., A.I.C.
<i>Clerk, Grade I</i>	..	..	A. T. Bench.
<i>Clerks, Grades II and III</i>	..	..	4

ADVISORY COMMITTEE ON ATMOSPHERIC POLLUTION, 47, Victoria St., S.W.1.

<i>Superintendent</i>	J. S. Owens, M.D., A.M.I.C.E., F.G.S., F.R.S.I.
<i>Junior Professional Assistant</i>	G. M. Watson, B.Sc., A.R.C.S., A.I.C.

NAVY SERVICES DIVISION

<i>Superintendent</i>	L. G. Garbett, Commander, R.N. (ret.).
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THE STAFF AT OBSERVATORIES AND BRANCH ESTABLISHMENTS

METEOROLOGICAL OFFICE, 10, Rothesay Place, EDINBURGH.

<i>Superintendent</i>	..	..	A. Crichton Mitchell, D.Sc., F.R.S.E.
<i>Assistant Superintendent</i>	..	..	A. Watt, M.A., F.R.S.E.
<i>Senior Professional Assistant</i>	..	..	E. Taylor, M.A., B.Sc.
<i>Clerks, Grade III</i>	..	..	5
<i>Housekeeper</i>	..	..	1

KEW OBSERVATORY, Old Deer Park, Richmond, Surrey.

<i>Assistant Director</i>	..	..	C. Chree, Sc.D., LL.D., F.R.S.
<i>Senior Professional Assistants</i>	..	..	S. T. A. Mirrlees, M.A., R. E. Watson, B.Sc.
<i>Junior Professional Assistant</i>	..	..	J. M. Stagg, M.A., B.Sc.
<i>Clerk, Grade I</i>	..	..	E. Boxall.
<i>Clerks, Grades II and III</i>	..	..	5
<i>Caretaker, Mechanic and Handyman</i>	..	..	3

KEW OBSERVATORY (Upper Air Section), Richmond, Surrey.

<i>Assistant Superintendent</i>	..	..	L. H. G. Dines, M.A., A.M.I.C.E.
<i>Instrument Maker</i>	..	..	1
<i>Mechanic</i>	..	..	1

THE OBSERVATORY, ESKDALEMUIR, Langholm, Dumfries-shire.

<i>Assistant Superintendent</i>	..	..	H. W. L. Absalom, B.Sc., A.R.C.S., D.I.C.
<i>Senior Professional Assistant</i>	..	..	C. H. Kellett, B.Sc.
<i>Clerks, Grade III</i>	..	..	3
<i>Housekeeper, Mechanic and Handyman</i>	..	..	3

VALENCIA OBSERVATORY, Cahirciveen, Co. Kerry.

<i>Assistant Superintendent</i>	..	..	C. D. Stewart, B.Sc.
<i>Senior Professional Assistant</i>	..	..	One vacancy.
<i>Clerks, Grade III</i>	..	..	3
<i>Messenger</i>	..	..	1

THE OBSERVATORY, King's College, ABERDEEN.

Clerk, Grade I G. A. Clarke.
Clerks, Grade III 2

THE OBSERVATORY, LERWICK, Shetlands.

Senior Professional Assistant J. Crichton, M.A., B.Sc.
Clerks, Grade III 2
Caretaker 1

PORT METEOROLOGICAL OFFICE, Liverpool.

Senior Professional Assistant G. ff. H. Lloyd, Commander R.D., R.N.R.
Clerk, Grade III 1

METEOROLOGICAL OFFICE, MALTA.

Superintendent W. A. Harwood, D.Sc.
Senior Professional Assistant J. Wadsworth, M.A.
Clerks, Grades II & III .. 4

ARMY SERVICES STATIONS

METEOROLOGICAL OFFICE, SHOEBURYNESSE.

Senior Professional Assistant C. E. Britton, B.Sc.
Junior Professional Assistant T. H. Fallows, B.A.
Clerks Grades II & III .. 12

METEOROLOGICAL OFFICE, LARKHILL.

Senior Professional Assistant R. P. Batty, B.A.
Clerks Grades II & III .. 4

METEOROLOGICAL OFFICE, PORTON.

Clerks Grade III 3

DISTRIBUTIVE STATIONS

ANDOVER

Senior Professional Assistant G. L. H. Douglas-Lane, M.A.
Clerks, Grades II & III .. 2

BIGGIN HILL

Clerks, Grades II & III .. 3

CALSHOT

Assistant Superintendent .. J. Durward, M.A.
Junior Professional Assistant A. W. Lee, M.Sc., A.R.C.S., D.I.C., A.Inst.P.
Clerks, Grade II & III .. 4

CASTLE BROMWICH

Clerks, Grade III 1

CATTEWATER

Clerks, Grade II & III .. 2

CRANWELL

Assistant Superintendent .. W. H. Pick, B.Sc.
Junior Professional Assistant S. P. Peters, B.Sc.
Clerks, Grades II & III .. 4

CROYDON

Senior Professional Assistants G. R. Hay, M.A., N. H. Smith, B.Sc.
Clerks, Grades II & III .. 7
Telephone Typists 2

FELIXSTOWE

Senior Professional Assistant C. W. Lamb, B.Sc.
Clerks, Grade II & III .. 2

HOLYHEAD

Clerks, Grades II & III .. 3

LEUCHARS

Senior Professional Assistant W. Gillon, M.A., B.Sc.
Clerks, Grade III 2

LYMPNE

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

MANCHESTER

Clerks, Grade II & III .. 2

RENFREW

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

SHOTWICK

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

SOUTH FARNBOROUGH

Senior Professional Assistant C. K. M. Douglas, B.A.
Clerks, Grade II & III .. 3

SECONDED FOR DUTY WITH OTHER BODIES

Assistant Superintendent .. R. A. W. Watt, B.Sc., A.M.I.C.E. (Department of Scientific and Industrial Research).

Senior Professional Assistants Miss E. E. Austin, (Imperial College of Science).

F. J. Herd, A.M.I., Radio E. (Department of Scientific and Industrial Research).

N. K. Johnson, B.Sc., A.R.C.S. (War Office, Porton Experimental Station).

Junior Professional Assistants O. F. T. Roberts, B.A. (War Office, Porton Experimental Station).

F. J. Scrase, B.Sc. (War Office, Porton Experimental Station).

ANNUAL REPORT
OF THE
METEOROLOGICAL COMMITTEE
TO
THE AIR COUNCIL,

For the Year ended 31st March, 1924 (the sixty-ninth year of the
Meteorological Office).

The Meteorological Committee met three times during the year : on 18th July and 21st November, 1923, and 12th March, 1924.

Professor Wedderburn, who had served as a member of the Committee for over four years as representative of the Royal Society of Edinburgh, was forced by the pressure of academic duties to resign as from November, 1923, and was replaced by Professor R. A. Sampson, F.R.S., Astronomer Royal for Scotland. The Committee desire to take this opportunity of recording their gratitude to Professor Wedderburn for his assistance during the last four years.

Administration.—The Office has now settled down to what is likely to be its normal state for some years to come and only minor changes have taken place during the year. The chief of these has been the transfer of the upper air work from Benson to Kew. By this change the policy of making Kew Observatory a centre of meteorological investigation and research has been advanced, and incidentally administration has been facilitated by closing the somewhat inaccessible station at Benson.

“The Marine Observer.”—In April, 1901, the Meteorological Office commenced the publication of the Monthly Pilot Charts of the North Atlantic, copies of which were supplied to all ships keeping meteorological logs for the Office, and five years later similar monthly charts of the Indian Ocean and Red Sea were added. These charts served a very useful purpose for while on the face of the charts valuable information regarding meteorological conditions was given, the backs were used for conveying information to the marine observers. As time went on the tendency was to add more and more detail to the charts so that they became confused and difficult to use, while the backs provided too little space for all the articles, instructions and

information which it was desired to communicate to the observers. It was therefore decided to cease issuing charts each month, and to publish in place of them a magazine specially written for marine observers. The first number of the new magazine, which has been called *The Marine Observer*, was dated January, 1924, and was issued early in December so as to give time to reach co-operating ships before the beginning of the month. The Superintendent of the Marine Division is the editor and it is his policy to make the magazine appeal to the marine observer in such a way as to stimulate his interest in meteorological matters and also to let him see that the observations he makes are put to good use after they reach the Meteorological Office. Information regarding wind, weather, climate, currents, derelicts and ice are provided. Articles dealing with wireless weather reports and how they may be used by ships at sea have already appeared, and the magazine is being used for explaining in non-technical language the results of meteorological researches, especially those carried out in the Marine Division.

The Marine Observer is issued free to every voluntary observing ship, to the owners of observing ships and generally to those institutions particularly interested in marine meteorology. Copies may be purchased by the general public at two shillings each.

Wireless Weather Bulletin for Shipping.—In last year's *Annual Report* the history was given of the arrangements made to broadcast weather information for the use of ships approaching our western coasts. Owing to the non-existence of a high-power spark station in the British Isles use had to be made of the two low power stations at Malin Head and Land's End (later transferred to Valencia). These messages refer only to the western seaboard and many requests have been received at the Meteorological Office for similar information regarding the whole coastal area of the British Isles. In the absence of a high power wireless station capable of reaching all the coastal areas and using spark transmission—the only transmission which the majority of ships can pick up—the only way to meet the demands would be to telegraph the weather messages to a number of low power wireless stations for local issue. The cost of a number of such issues proved on investigation to be prohibitive. The number of ships, however, which are fitted with wireless installations capable of receiving wireless messages on continuous wave is steadily increasing and as the Air Ministry possesses a wireless station capable of reaching distances up to 2,000 miles on continuous wave, it was decided to issue from this station a weather bulletin for ships as a partial solution of the difficulty. The new issue commenced on the 1st of January, 1924. It consists of five parts :—

- (a) A general inference of the weather conditions existing and of changes likely to take place.
- (b) Observations 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 areas—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 issued twice daily at 9 a.m. and 8 p.m., G.M.T.

This issue has been very much appreciated by shipping, but it has not really solved the problem, for the demands for spark issues which the smaller ships—who need meteorological information even more than large ships—can pick up is increasing and great pressure is being brought to bear on the Meteorological Office especially by shipping organisations, to provide such information.

West Indian Hurricanes.—In 1917 and 1918 correspondence passed between the Meteorological Office and the Colonial Office regarding the necessity for a closer study of hurricanes, especially those of the West Indies, in view of the great economic damage caused by these storms in our colonies. It was decided that the matter should be taken up and as a first step a paper should be prepared summarising our knowledge regarding tropical storms. This proved to be a very large undertaking and it was not until the second half of 1922 that a *Geophysical Memoir* entitled “Hurricanes and Tropical Revolving Storms” was published. On the appearance of this Memoir the matter was again taken up with the Colonial Office and it was agreed that the next step should be to invite the Governments of the British Colonies in the West Indies to co-operate with the Meteorological Office in an investigation of the upper air currents by means of pilot balloons, the Meteorological Office undertaking to arrange for the issue of apparatus and instructions if the local authorities would bear the cost. A despatch was accordingly sent to the Colonial Governors in the West Indies explaining the position and Mr. J. F. Brennan, the Government Meteorologist, Jamaica, brought the question before the West Indian Agricultural Conference which met in Jamaica during February, 1924. From the replies received it would appear that the financial conditions in the West Indies are unpropitious for the undertaking; it is therefore very gratifying that one Government at least, namely Jamaica, has voted the funds necessary for establishing a pilot balloon station.

International Meteorological Conference.—On the invitation of Professor van Everdingen, Director of the De Bilt Observatory, the International Meteorological Conference met in Utrecht from September 7th to 14th. Sir Napier Shaw was elected President of the Conference and the Meteorological Office was represented by the Director. The Conference was preceded by meetings of several Commissions, Lieut.-Colonel Gold presiding over the Commission for Weather Telegraphy and Dr. Chree being elected President of the Commission for Terrestrial Magnetism and Atmospheric Electricity on the retirement of Professor van Everdingen. Extremely useful work was done by the Conference, which adopted 70 resolutions, many of them of great importance for the future of international meteorology.

To mark their great appreciation of his work in the cause of international co-operation in meteorology, the Conference unanimously elected Sir Napier Shaw an Honorary Member of the International Meteorological Committee, an honour which had never previously been bestowed.

The following is a list of the members of the staff of the Meteorological Office who are members of the International Meteorological Committee and its Commissions :—

International Meteorological Committee	The Director.
Commission for Agricultural Meteorology	Mr. F. J. W. Whipple.
Commission for Synoptic Weather Information	Lt.-Col. E. Gold (President).
Commission for Maritime Meteorology	{ Captain Brooke-Smith. Commander Garbett (Secretary).
Commission for the Application of Meteorology to Aerial Navigation ..	Lt.-Col. Gold.
Commission for the Réseau Mondial and Polar Meteorology	{ The Director (President). Mr. R. G. K. Lempfert.
Commission for the Investigation of the Upper Air	Lt.-Col. Gold.
Commission for Terrestrial Magnetism and Atmospheric Electricity ..	{ Dr. Chree (President). The Director. Dr. Crichton Mitchell.
Commission for the Study of Clouds ..	{ Mr. G. A. Clarke. Captain C. K. M. Douglas.
Commission for the Investigation on the Sound of Explosions	Mr. F. J. W. Whipple.

International Commission for Air Navigation.—Meetings of this Commission were held in London in June, 1923; in Rome in October, 1923; and in Paris in February, 1924.

After further discussion in the Meteorological Sub-Commission of the draft of the revised Annex G, the draft has been circulated to various States which have ratified the Convention; in particular, copies of the draft were sent to the self-governing Dominions of the British Empire and the replies received indicate that the experts of the Dominions are in general agreement with the revision, although the different conditions prevailing in the various Dominions will not permit of the adoption of all the codes set forth in the Annex.

The Sub-Commission is also endeavouring to secure agreement upon the specification of the temperature, pressure and humidity of the atmosphere at all heights to be used as the basis of graduation of altimeters and generally as a standard of reference for the purposes of aviation.

It is also dealing with the problem of securing a uniform method of presentation of meteorological statistics for air routes for rapid comparison with flying statistics on these routes.

The conditions under which it should be compulsory for a meteorologist to be carried on aircraft, have also been referred to the meteorological sub-commission for consideration and report and, in the absence of any international agreement on the necessary qualifications of a meteorologist, the sub-commission has been asked to draw up a specification of the qualifications to be required.

Civil Aviation Conferences.—At the periodical conferences on questions relating to civil aviation between England, France and Belgium (A-F-B Conferences) various points in connection with the organization of the meteorological arrangements have been discussed.

During the year under review, representatives of Holland have also attended the conferences and the reports from Holland are issued in accordance with the time-table originally drawn up for the reports from London, Paris and Brussels.

At the Conference in Paris in February, 1924, a meteorological representative from Switzerland attended and arrangements were made for the issue from a Swiss W/T station of hourly meteorological reports on the same lines as those adopted by the other four countries.

Meetings have also been held at the Hague between representatives of Holland, Denmark, Germany and Sweden with reference to aviation between London, Amsterdam, Berlin, Copenhagen, and Göteborg, and meteorological arrangements were made for the exchange of reports on these routes on the same lines as those adopted for the routes dealt with at the A-F-B conferences. Thus, agreement is gradually being reached between the different countries of Europe on a common system of meteorological reports for aviation, and the practical difficulties which arise in extending a system originally devised to meet the requirements of the comparatively short routes between London and Paris, and London and Brussels, are being surmounted.

Staff.—The death on May 31st, 1923, of Mr. Mortyn de C. S. Salter, Superintendent of the British Rainfall Organization, after a brief illness, deprived the Office of the services of a valued member of the staff. Mr. Salter had been on the staff of the British Rainfall Organization, since 1897 and had acted as Joint-Director with Dr. H. R. Mill from 1913. Upon the transfer of the Organization to the Meteorological Office in July, 1919, he accepted service under the Office and continued to devote himself whole-heartedly to the work of the Organization. His long experience of rainfall work in its varying aspects was of great value to the Office and his early death represents a serious loss.

A re-allocation of the work among the senior officers became necessary in consequence of Mr. Salter's death. Mr. F. J. W. Whipple, Superintendent of the Climatology Division, was appointed to take charge of the British Rainfall Organization and Mr. R. Corless, Superintendent of the Instruments Division, was transferred to the vacancy so caused. Captain F. Entwistle, Assistant Superintendent of the Local Centres Division, was promoted to be Superintendent of Instruments, his former post being filled by the promotion of Mr. R. S. Read, Senior Professional Assistant, in charge at Lympne.

Messrs. S. P. Peters, B.Sc., T. H. Fallows, B.A., A. W. Lee, M.Sc., A.R.C.S., D.I.C., and J. M. Stagg, M.A., B.Sc., have joined the staff in the grade of Junior Professional Assistant. There have been six resignations from the Clerical Staff, two of them by reason of marriage. The resulting vacancies, in so far as it has been necessary to fill them, have been filled on a temporary basis pending a decision upon the channels through which clerical staff shall be recruited in the future. Towards the end of the year the experiment of appointing Air Service Clerks to vacancies on the clerical establishment of the Office after a period of probation was tried. One officer in that category has been confirmed.

Finance.—The year under review, 1923-24, is the fourth 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 1923-24

<i>Expenditure</i>		<i>Amount</i>	
		£	£
Salaries and Wages—H. Q. Establishments .. ..	..	44,760	
„ „ —Out-station Establishments .. ..	..	35,760	
			80,520
Fuel and Light .. ..	..		590
Transport of Personnel and Equipment .. ..	..		2,050
Instruments, Equipment and Stores .. ..	..		4,230
Minor Works Services, Rents, Repairs and Maintenance of Buildings .. ..	..		2,350
Research .. ..	..		—
Telegrams, Cables and Telephones .. ..	..	6,620	
Subventions and Reporting Stations .. ..	..	1,350	
Miscellaneous .. ..	..	1,420	
			9,390
Superannuation .. ..	..		3,930
	Total ..		£103,060

<i>Receipts</i>			
Receipts from Royal Society .. ..	..	595	
„ „ National Debt Commissioners (Annuities) .. ..	..	512	
Sale of Instruments, Carriage, etc. .. ..	..	1,620	
Daily Weather Reports, Forecasts, etc. .. ..	..	2,440	
Receipts from War Office .. ..	..	5,280	
	Total ..		£10,447

MARINE DIVISION

Several important results have been achieved during the year under review, including the establishment of the “Marine Observer,” and the “Weather Shipping” wireless bulletin. There are indications that these innovations are already obtaining the response which was anticipated in last year’s report, for observations at sea continue to improve.

Voluntary Observing Fleet and Observers.—The number of ships who regularly make returns has been steadily maintained at about 500, which is the limiting maximum, in order that the work may be efficiently dealt with. The proportionate numbers of ships undertaking the various functions has throughout the year remained practically the same as that given at the end of last year. A tabular statement for the past 11 years is given on page 21.

The senior cadets of H.M.S. *Conway*, H.M.S. *Worcester* and Pangbourne have continued the cadets' meteorological log, and all three establishments have now attained the "Excellent" standard in this work. The Marine Superintendent has visited the three establishments during the year, examining the senior cadets of the two first named training ships at the end of the summer term. Progress in synoptic meteorology was noted.

The collection of water samples on behalf of the Ministry of Agriculture and Fisheries by steamers on the Liverpool to West Indies and Liverpool to South America routes has been continued.

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

Captain H. V. Rigby, D.S.C., S.S. *City of London*.

Commander A. H. H. G. Douglas, R.D., R.N.R., late Commodore of the Aberdeen Line.

Captain B. H. Haddy, S.S. *City of Baroda*.

Captain W. Thompson, S.S. *Songster*.

Commander W. C. Crutchley, R.N.R., formerly of New Zealand Shipping Company and Union Company.

Captain Horatio McKay, formerly Commodore of the Cunard Line.

Excellent Observers.—A list is appended on pages 22 and 23 of Captains and Officers who have been granted awards for "Excellent" meteorological logs and wireless telegraphy weather report registers.

The spirit of ready co-operation generally existing in the Corps of Voluntary Marine Observers is most commendable.

Classification of Meteorological Logs.—Generally the standard of the logs continues to improve. The percentage of logs classed excellent is 31·3 ; last year it was 31 per cent.

256 logs have been received which have been classed as follows :—

Excellent	80
Very Good	169
Good	6
Not classed	1

Classification of Wireless Telegraphy Weather Report Registers.—

There has been a marked improvement in this work, as the following comparison shows :—

	1923-24	1922-23
Excellent	155	73
Very good	90	150
Good	5	3
Not classed	—	2
Total received	250	228

Ships' Meteorological Reports, Form 911, Using Ships' Instruments.—

1785 of these reports have been received from ships on all routes, and much useful information has been collected by this means.

The reduction of correspondence, brought about by using the list of voluntary observing ships published monthly in *The Marine Observer* to acknowledge work done, has made it possible to classify these forms

since November, 1923, and the encouragement thus given is expected to bring about still further improvement in this useful branch of observational activity.

Of 722 Forms 911 received since 1st November, 1923,

116 were classed Excellent.

530 „ „ Very Good.

72 „ „ Good.

4 were not classed.

All forms received have been indexed.

Port Meteorological Office and Marine Agencies.—The Port Meteorological Office, Liverpool, continues to be a valuable means of collecting data, maintaining touch with Liverpool marine observers, and distributing information.

The marine agency at Sunderland was closed down upon the transference of Commander A. H. Raymer, R.D., R.N.R., of the Board of Trade, to Southampton.

A marine agency has been established at Dublin, Captain M. H. Clarke, Chief Surveyor of the Department of Trade and Shipping, Ministry of Industry and Commerce, being appointed agent.

Captain T. Johnston, Head of the Navigation Department, Technical College, Cardiff, has been appointed marine agent *vice* Captains J. Weir and W. H. Hunter, of the Board of Trade, resigned.

The marine agency at Dundee, established for many years, had obtained valuable data through whalers from the Arctic and ships trading to the East; but the port is now comparatively little used by foreign going ships. The greatest entry of tonnage on the east coast of Scotland is now to the Firth of Forth. The agency at Dundee has, in these circumstances, been transferred to Leith, Captains G. Black and C. G. Bonner, V.C., D.S.C., of the Leith Salvage and Towage Company, being appointed joint agents.

The Meteorological Office is indebted to Marine Agents for much useful work. These gentlemen spend a considerable amount of time in obtaining the interest of marine observers, shipowners and others, necessary for the success of a voluntary system of co-operation.

Data Extraction and Research.—The system of extracting and indexing data from logs from all parts of the world as received, established in April, 1920, has been continued.

Due to the heavy work in publishing the monthly charts, at the same time preparing the early numbers of *The Marine Observer* and answering marine inquiries also due to transfers necessitating the training of computers new to the work and also to sickness, the number of computers detailed for data extraction has been reduced from time to time during the year. Consequently the number of sets of observations extracted and punched on cards is reduced. Last year the total number of sets of observations so dealt with was 97,533. This year the total number of sets of observations extracted and punched on cards was 74,749. In 1922 to 1923, 55 sets of observations per man per day, including Sundays and holidays were indexed and prepared for mechanical extraction. This year the average was 56.

Sixty-six per cent. of meteorological logs received during the year, which reached the high standard required, have been prepared for extraction.

The great need for logs received prior to April, 1920, to be indexed and extracted, referred to in last year's report, is felt more as general progress in marine meteorology is made. 4259 current observations in logs received prior to April, 1920, have been extracted.

Researches have been continued with regard to :—

Tropical revolving storms.

Weather in Middle Latitudes.

Ocean Currents.

The Doldrums of the Atlantic.

Exchange of Data and International Co-operation.—Information regarding ice and derelicts in the North Atlantic, together with a summary of Atlantic wireless telegraphy weather reports have been forwarded regularly to Lloyd's. All information received regarding ice in the North was forwarded monthly to the Danish Meteorological Institute until November, 1923, when this service was discontinued at their request.

458 sets of observations for selected squares in the North Atlantic for the period January 10th to 26th, 1923, extracted on to Hollerith cards were sent to the Geophysical Institute, Bergen. Similarly 425 sets of observations, in the same area, for the period February 1st to 9th, 1922, were sent to the Royal Meteorological Institute, Brussels. Mean pressure, wind, air and sea temperature, and cloud amount, for all months of the year 1922, in selected areas in all oceans, have been calculated and sent to the Dutch Meteorological Institute, De Bilt.

Observations of current, with generalised direction and force of the wind, for all months of 1921 and 1922, for the area Latitude 40° to 50° N., Longitude 10° to 50° W., were sent to the Fishery Board for Scotland.

At the International Meteorological Conference held in London in September, 1921, representatives of Marine Divisions of foreign services were interested in the Hollerith system. Last year the Dutch Office sent Lieut.-Commander P. M. van Riel, R.H.M., to obtain detailed information with a view to its adoption in Holland; and the Hydrographer of the United States Navy has made inquiries as to its suitability for dealing with observations of currents. Interest has also been shown in this matter by Japan, Brazil and Portugal.

Publication of Information for Mariners.—Following the recommendation of the Sub-Committee of Marine Meteorology, mentioned in last year's report, the monthly publication of Meteorological Charts of the North Atlantic Ocean and East Indian Seas has been discontinued as from December, 1923. A number of these charts, less the blue colouring and information of a non-permanent character, has been printed in order to supply information of normals and frequencies until such time as new charts can be made.

To replace and extend the information previously given on the backs of the monthly charts, a monthly review published in co-operation with Marine Observers, entitled *The Marine Observer* has been established. The functions of this magazine are to provide information

useful to navigation concerning winds, weather, climate, currents, derelicts and ice, to stimulate interest in observation and the practice of meteorology at sea; to promote the use of wireless weather reporting for shipping; to provide a means whereby mariners may give their experiences to others and to foster the traditions of Marine Meteorology upon international lines.

In it is published a complete list of voluntary observing ships, with the names of their captains and observing officers, with date of last log, register or report contributed up to the time of going to press each month.

The articles on applied marine meteorology formerly published on the backs of the charts, and now in *The Marine Observer* have been continued. Amongst them were:—

Fore-word, introducing the Marine Observer,

—Dr. G. C. Simpson, C.B.E., F.R.S.

Work of the Year. Note to Marine Observers.

West India Hurricane, September, 1922.

Steamship Route from Colombo and the East to Perim during the South West Monsoon.

Wireless and Weather, an Aid to Navigation. Serial, Chapters I to V).

—Commander L. A. Brooke Smith, R.D., R.N.R. (retd.)

Ocean Currents.

Currents on Direct Route, Cape Blanco to Table Bay,

—Mr. C. S. Durst, B.A.

North Atlantic Gale, December 27th to 30th 1922.

Tropical Storms in Eastern Waters reported by ships during latter half of 1922,

—Lieut.-Commander J. Hennessy, R.D., R.N.R.

Investigation of the Upper Air.

—Commander L. G. Garbett, R.N. (ret.)

Study of Currents in the North Atlantic.

—Lieut. J. R. Lumby, R.N. (retd.) of the Ministry of Agriculture and Fisheries.

Fog.

Ocean Waves.

South Pacific Hurricanes.

—Mr. H. Keeton.

Biographical Notes of some Leaders of Marine Meteorology.

—Mr. H. T. Smith.

In *The Marine Observer* pages are reserved monthly, entitled "The Marine Observer's Log," in which numerous contributions are published, which have included:

"Weather and Currents in South African Waters," by Captain H. Strong of S.S. *Armada Castle*.

"Atmospheric Disturbance" by Captain H. P. Douglas, C.M.G., R.N., H.M.S. *Mutine*.

Board of Trade Load Line (Zones) Committee.—A memorandum and charts were prepared for this Committee, giving the frequency of gales in five degree squares over all the oceans; and the areas where tropical revolving storms occur.

Information Required in Connection with the Investigation of Missing Ships and other Maritime Casualties.—This work has been very heavy. All regular forms of returns by ships and coast stations have been used for providing the necessary information.

Wireless Telegraphy Reports from North Atlantic Liners.—The efficiency of this service has still further improved. During the year 3,603 weather reports have been received and checked in the Marine Division on the receipt of the registers. Of these 839 were received within 1 hour of observation, 1,057 were received within 1 to 2 hours of observation, 810 were received in from 2 to 4 hours of observation. The remainder, 897, were over 4 hours in transmission. 715 errors, corrected by the check system, were substantiated on receipt of registers, while the check failed in 38 cases.

The code having been revised according to the latest International agreement, a reprint of the register and code tables has been made, embodying improved instructions found necessary by the experience gained since March 27th, 1921, when the first post-war report was received; and it is proposed to bring this into force on June 1st, 1924.

A number of marine observers having expressed the desire that these reports should be made directly available to ships at sea, consultations with Marine Superintendents and Commanders interested have been held, as a preliminary to the formulation of a scheme to extend the utility of these reports, which is now under consideration.

The Application of Wireless Telegraphy to Weather Work at Sea.—From 1st January, 1924, the Forecast Service commenced a weather bulletin, entitled "Weather Shipping," specially designed to give information in a suitable form for mariners. This bulletin contains reports from stations on all coasts of the British Isles, together with a general inference, and forecasts for the seas and coasts eastward of the 100 fathom line to the coasts of France, Holland, Denmark, and Norway.

The Air Ministry station broadcasts the information on continuous wave, twice daily, and it has been received by ships at a distance of 2,400 miles to the westward, and 2,000 miles to the southward.

A number of officers have forwarded synoptic weather charts made at sea, together with forecasts. Reciprocation of weather report between ships at sea is slowly but surely growing, but there is ample evidence that without a popular organization, no great progress can be made. Hence the endeavours to formulate the scheme above mentioned for the North Atlantic trade, with a view to its possible extension to other trades.

Further Improvement of Instrumental Observation.—Improvement in barometric observation has been continued and in the reprint of the meteorological log, a space has now been provided in which the observers can insert the *corrected* reading.

A number of ships have used barometers fitted with a sliding correction scale, which has proved of assistance to the observers, and has contributed to accuracy in reporting absolute pressure by wireless.

Experiments have been made with a number of portable thermometer screens by commanders of ships in the Atlantic, Pacific and Indian Oceans; and it is found that more accurate temperatures are obtained with a portable single louvered screen of handy dimensions, than with the old regulation ship's fixed screen.

DETAILS OF VOLUNTARY OBSERVING FLEET AND COAST STATIONS

	At 31st March										
	1924	1923	1922	1921	1920	1919	1918	1917	1916	1915	1914
No. of Ships equipped with sets of instruments keeping full Logs ...	122	123	125	133	104	—	—	—	—	192	209
No. of H.M. Ships keeping full Logs ...	8	9	9	9	2	2	—	—	1	3	4
No. of Ships contributing ship's Meteorological Reports, using ship's own Instruments ...	322	332	341	216	117	7	—	—	—	—	—
No. of Ships equipped especially for W/T Weather Reports ...	21	24	17	1	—	—	—	—	—	9	11
No. of Coast Stations equipped with Instruments for Form 129A....	35	38	40	42	53	52	49	49	58	59	62
No. of Ships equipped with Instruments for Home Waters Telegraphic Reports ...	10	8	8	24	—	—	—	—	—	—	—
No. of Ships with Instruments on board, logs overdue	0	0	0	2	19	—	—	—	—	—	—
No. of Barometer Errors ascertained or checked ...	1368	1355	1025	365	—	—	—	—	—	—	—

	Receipts for the year ended 31st March										
	1924	1923	1922	1921	1920	1919	1918	1917	1916	1915	1914
Meteorological Logs... ..	256	272	264	204	67	22	59	115	147	224	279
Ships' Meteorological Rpts. Forms 129A...	1785	1741	1717	1668	503	21	144	670	882	1064	1597
Lighthouse Registers ...	404	423	460	437	381	334	324	340	351	510	682
Ocean W/T Report Registers ...	14	13	16	16	12	16	15	14	15	14	15
Home Waters Telegraphic Reports ...	250	228	98	—	—	—	—	—	20	410	858
Cadets Meteorological Log ...	820	752	1066	1808	—	—	—	—	—	—	—
New Data extraction. Logs extracted	9	9	9	6	—	—	—	—	—	—	—
	165	204	155	169	—	—	—	—	—	—	—

LIST OF CAPTAINS AND PRINCIPAL OBSERVING OFFICERS TO WHOM
THE METEOROLOGICAL COMMITTEE HAVE MADE EXCELLENT AWARDS

Captain	Principal Observing Officer	Ship
*Adamson, B. W.	(Bulsteel, C. V. S.	<i>Oxfordshire.</i>
Ashley, H.	(Whiteside, W. L.	<i>Hypatia.</i>
*Barter, H. O., Commr., R.N.R., R.D.	Maddrell, G. D.	
Beadnell, F. E., Capt., R.N.R.	Hammond, S. M.	<i>C.S. Norseman</i>
*Berry, G.	Thompson, L.	<i>Adriatic.</i>
Black, J.	Day, H. J. C.	<i>Megantic</i>
Byers, G.	Ure, T.	<i>Saturnia</i>
Campos, V., O.B.E., Lt.-Commr., R.N.R.	Hunter,	<i>Changchow</i>
Carlton, G. F., O.B.E., Commr., R.N.R.	Muir, A. S.	<i>C.S. Colonia</i>
*Carpendale, F. W. J.	Hegarty, L. J.	<i>C.S. Stephan</i>
Cartmer, G. E., O.B.E.	Hand, C. H.	<i>Nyanza</i>
Chambers, F. W., D.S.C.	Clowser, S. E.	<i>Kurmark</i>
Charles, Sir J. T. W., K.B.E., C.B., Commodore, R.N.R., R.D.	Pascoe, J.	<i>Digby</i>
Coad, A. J., Commr., R.N.R.	Croasdaile, J.	<i>Aquitania</i>
Cornish, N. P.	Goodman, F. S.	<i>Osterley</i>
Cottell, S. C.	Barker, G. W.	<i>Matheran</i>
David, H. F., Capt., R.N.R., R.D.	Johnston, W. R.	<i>Port Hunter</i>
Davies, J. Burton.	Boyce, J. C. M.	<i>Olympic</i>
Diggle, E. G., Capt., R.N.R., R.D.	Carpenter, J.	<i>Hurunui</i>
*Douglas, H. P., C.M.G., Capt., R.N.	Wood, J. H.	<i>Caronia</i>
Evans, T. R.	(Tennent, H. P. L.	<i>H.M.S. Mutine</i>
Fitzroy, F. H., Capt., R.N.R., R.D.	(Stephens, R. A.	<i>Elpenor</i>
Geary Hill, S. A., D.S.O., Commr., R.N.	Houghton, C.	
Griffiths, E., Lt.-Commr., R.N.R.	Holland, S. J.	<i>Nyanza</i>
Griffiths, J. N.	Exton Turner, H.	<i>H.M.S. Endeavour</i>
*Haddy, B. H. (the late).	Everett, R. V.	<i>Empress of France</i>
Hayes, Sir B. F., K.C.M.G., D.S.O., Commodore, R.N.R., [R.D.]	Piggott, A. H.	<i>Brecon</i>
Hearne, G. W.	Radcliffe, A. V.	<i>City of Baroda</i>
Henderson, W.	Butcher, A. F.	<i>Majestic</i>
*Hester, C., Commr., R.N.R., R.D.	Coate, C. F.	<i>Port Augusta</i>
Higgins, C. J.	MacCullum, H. A.	<i>Metagama</i>
Higgs, W. G.	Snow, B. W.	<i>Peshawur</i>
Hoad, A. C.	Young, T. G.	<i>Clan Malcolm</i>
Howarth, F. B., Commr., R.N.R.	Stannard, R. S.	<i>Port Pirie</i>
Howell, T.	Townshend, C. R.	<i>Port Nicholson</i>
*Irvine, W. R. D., Commr., R.N.R., R.D.	Patchett, F.	<i>Homeric</i>
*Kearney, F. J.	Grace, H. H.	<i>Lapland</i>
	Myles, J. A.	<i>Berengaria</i>
	(Post, C. F.	
	(Linklater, R. B.	<i>Port Melbourne</i>

* Those marked with an asterisk appear in the list of "Excellent" observers for the first time.

LIST OF CAPTAINS AND PRINCIPAL OBSERVING OFFICERS TO WHOM
THE METEOROLOGICAL COMMITTEE HAVE MADE EXCELLENT AWARDS

Captain	Principal Observing Officer	Ship
Kettlewell, C. R.	Allard, G. W.	<i>Surrey</i>
*Latta, R. G.	Davies, H. H.	<i>Empress of Britain</i>
Lea, W. H.	{ Lovegrove, F. A.	<i>Port Sydney</i>
*Learmont, H. P., Capt., R.N.R., R.D.	{ Martin, A. R.	
*Marshall, W., D.S.O., Capt., R.N.R., R.D.	Rawlingson, W. G.	<i>Waipara</i>
Matheson, C. G., D.S.O., Commr., R.N.R., R.D.	Kavanagh, G.	<i>Celtic</i>
Metcalf, G. R. Lt.-Commr., R.N.R.	Whinfield, N.	<i>Orsova</i>
*Nares, J. D., D.S.O., Capt., R.N.	Hughes, E. F.	<i>Cedric</i>
*O'Connor, E. W., D.S.C.	Exton Turner, H.	<i>H.M.S. Endeavour</i>
*Owens, A. L., Lt.-Com., R.N.R. R.D.	Stumbles, A. M.	<i>Wangaratta</i>
Parker, W. H., C.B.E., Capt., R.N.R., R.D.	Lester, M. C.	<i>Orviato</i>
Peterson, H.	Lee, D. R.	<i>Orbita</i>
Prothero, W.	Walmsley, W. T.	<i>Warwickshire</i>
Randall, H. W., Capt., R.N.R., R.D.	Kite, D. S.	<i>Scythia</i>
Reilly, J. V.	Ablewhite, J. C.	<i>Nore</i>
Renaut, F. A.	Graham, L. D.	<i>Woodarra</i>
*Rennie, A., O.B.E.	Fullick, E. G.	<i>Port Caroline</i>
*Riley, J. E.	Williams, F. E.	<i>Montcalm</i>
	Stocker, C. E.	<i>Manchester</i>
		<i>Mariner</i>
Roberts, J., C.B.E., D.S.O., Capt., R.N.R., R.D.	Bell, E. S.	<i>Baltic</i>
Robinson, C. A.	{ Beardshaw, J. S.	<i>Port Albany</i>
Rostron, A. H., C.B.E., Capt., R.N.R., A.d.C., R.D.	{ Craig, W. B.	
*Rowe, J. P.	Howson Jones, G.	<i>Mauretania</i>
*Sawbridge, I. K.	Robertson, L.	<i>Maihar</i>
Shelford, W. S., Lt.-Commr., R.N.R., R.D.	Pinkney, H. G. B.	<i>Port Stephens</i>
Sibbons, H.	Lester, M. C.	<i>Orviato</i>
Simner, G. L., Commr., R.N.R., R.D.	Fegan, R.	<i>Minnedosa</i>
Stanley, W.	{ Savage, N.	<i>Omar</i>
*Warner, G. E., Commr., R.N.R., R.D.	{ Dodgson, C. V.	<i>Herefordshire</i>
*Waterhouse, J.	Hawkins, P.	
Webster, G. S., Lt.-Commr., R.N.R., R.D.	Carr, J. W.	<i>Orduna</i>
*Wightman, H. G. E., D.S.C.	Forster, J. A.	<i>Clan Mackay</i>
Willis, M.	Jones, E. J.	<i>Montclare</i>
Wyles, W. S.	Lawrence, H.	<i>C.S. Britannia</i>
	Canner, H. E.	<i>Arracan</i>
	Norris, H. W.	<i>Bambra</i>

* Those marked with an asterisk appear in the list of "Excellent" observers for the first time.

FORECAST DIVISION

General.—The working charts used in the Forecast Division were revised on 1st July. The area for the 7h. and 18h. charts has been increased to include Russia as far east as the Ural Mountains, wireless reports being now received from this area. Provision has also been made on the backs of the charts for plotting observations of cloud, visibility, etc., for the neighbouring Continental countries as well as for the British Isles.

A sunshine recorder and self-registering rain-gauge were installed on the roof of Adastral House in April, and continuous records have been maintained. An additional sunshine recorder was placed on the roof in February in order that the effect on the record of the accumulation of dirt upon the ball may be tested. The ball of one recorder is cleaned each evening and that of the second instrument on the first day of each month only. Comparison of the records from the two instruments indicates that a deposit of dirt may, under certain conditions in a town exposure, have a striking effect on the sunshine measurements.

The examination of the postcards attached to pilot balloons and returned by post was transferred to the local centre at Calshot, in July.

The preparation and issue of six supplements to the first edition of *Particulars of Meteorological Reports issued by Wireless Telegraphy in Great Britain and the Countries of Europe and North Africa* (M.O. 252) was carried out. A new edition of the publication was prepared and published in November. Three supplements to the second edition have also been issued.

The reading over of the British Section of the *Daily Weather Report* against the monthly returns from the telegraphic reporting stations was transferred from the Climatology to the Forecast Division in October, the reports for September being the first dealt with in the Forecast Division. By this arrangement all responsibility for checking the readings at telegraphic reporting stations rests with the Forecast Division.

Detailed meteorological information from some 60 lighthouses and 15 lightvessels round the coasts of Great Britain was extracted for certain days in February, 1922, and forwarded to Mr. Bergeron, of the Norwegian Meteorological Service, for use in connection with an investigation which he is carrying out.

A comprehensive classification of the pressure types shown on the daily North Atlantic charts issued by the Danish Meteorological Service and the Deutsche Seewarte for the 15 years' period 1896—1910 has been completed.

Meteorological exhibits were organized at the Royal Agricultural Society's show at Newcastle, July 3rd–7th and at the British Association Meeting at Liverpool in September. Arrangements were also made for a forecast exhibit at the British Empire Exhibition at Wembley.

Observations received.—(a) *British Reports.* The transfer of certain coastguard stations to the Board of Trade from the Admiralty caused a slight dislocation of the observing work at these stations during the first few days of April, but subsequently the work has been carried on without any departure from the usual standard. Reports from Irish stations which suffered much disturbance during the previous year have gradually returned to the normal state. By May, all

stations except Roches Point were operating regularly. On 22nd June telegraphic communication was restored to that station, and with the recommencement of 0100 observations at Blacksod Point in July all Irish Stations were once more contributing full reports.

The meteorological station at Birmingham became a telegraphic reporting station in May, and observations at 0700, 1300 and 1800 have been published in the *Daily Weather Report* since the 10th of that month.

After the closing of the Coastguard station at Guernsey, at the end of March, some dislocation was caused in the telegraphic reporting work in the island until June, when arrangements were completed for the resumption of the work by the staff of the Air Ministry Wireless Station. At present reports are taken at 0700, 1300 and 1800. It has not yet been found possible to make satisfactory arrangements for the forwarding of reports at 0100. Such reports are greatly needed in the Forecast Work.

The arrangement whereby two stations had been operative in the Channel Islands, certain reports being received from Jersey and others from Guernsey, was terminated in October in accordance with a decision to concentrate the work at one station. The station in Jersey was accordingly closed on October 9th and thereafter all reports were obtained from Guernsey.

With the closing of Benson Observatory in October the telegraphic reporting work was transferred to the Post Office Wireless station at Leafeld.

Reports from Grain ceased in February, the station being transferred to Felixstowe, from which reports have been received since 1st March.

The station at Tynemouth was transferred from Tynemouth Castle back to its pre-war position at Spanish Battery on 28th September.

The closing of the Air Station at Howden at the end of 1921 left a gap in the network of stations in the North Midlands which it has proved difficult to fill. Arrangements have now been practically completed for obtaining telegraphic reports from Harrogate in place of Howden.

Reports from British ships by wireless telegraphy have continued and have been of great value. In addition there has been a welcome increase in the number of such reports received from foreign ships.

Upper wind observations have been received from Local Centres and Observatories. Upper air temperatures have been taken by means of aeroplanes when conditions permitted at Lympne and Cranwell in addition to the reports received from Leuchars, Andover and Farnborough.

During the year changes have taken place in the list of health resorts from which observations are received for issue to the press. The following stations have been added :—

Banff	Cowes	Jersey
Berwick-on-Tweed	Dover	Sheerness.
Bexhill	Harwich (Dovercourt)	

Publication of readings from the following has ceased :—

Guernsey	Montrose	Penzance.
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The number of Health Resorts reporting daily continues to increase steadily. For previous years the numbers were 41 in 1919, 48 in 1920, 49 in 1921, 53 in 1922, while for the current year the total is 60.

(b) *Foreign Reports.* The new International code for weather reports has been adopted during the year by Italy and Germany for synoptic issues.

The exchange of information with Foreign Countries is now almost entirely effected by wireless telegraphy, but certain reports are still cabled daily from Norway, Italy, Portugal, the Azores and Madeira.

A second meteorological reporting station has been established by Norway in Spitzbergen, at Quade Hook, somewhat further north than Green Harbour, and reports from this station have been received occasionally.

Reports from the Danish Ship *Islands Falk* cruising along the south and west coasts of Greenland were received during the summer months.

Reports from Mygbugten, in the east of Greenland, ceased in September.

Cable reports from Cairo and Limassol (Cyprus) were discontinued at the end of 1923, the wireless transmission from Abu Zabal (Egypt) being received satisfactorily in London.

Since January a new wireless issue from Leningrad has been received containing observations from Siberia, and occasionally from as far east as Vladivostock.

Distribution of Information.—During April a system of distribution of forecasts to rural telephone exchanges was worked out in conjunction with the General Post Office. For this purpose Great Britain has been divided into 42 forecast districts, and each afternoon appropriate forecasts are telephoned to the Post Office for distribution to the local exchanges. Telephone subscribers can obtain the forecast for their own district by asking the exchange for it at any time between 5 p.m. and midnight, the fee for the local call only being charged. The same facilities are available to the general public through public call offices. The service was well used during the summer months but the demand decreased during the winter.

Forecasts have been prepared each evening throughout the year for the British Broadcasting Company, and with the opening of new broadcasting stations additional forecasts have been supplied for the particular districts.

In connection with the experimental aeroplane service between Plymouth and Belfast, special early morning weather forecasts were prepared daily between 17th September and 19th October and forwarded for use by the pilots at Plymouth, Manchester and Belfast.

Since 5th December, forecasts for the Southampton-Guernsey aerial route have been despatched each day to Calshot at 2 a.m.

In connection with experiments being carried out at Biggin Hill a special upper wind report is prepared each Monday, Tuesday and Thursday evening and telephoned soon after 1800 G.M.T. The report gives the wind prevailing up to 15,000 feet as deduced from pilot balloon observations.

Synoptic reports containing data from selected stations in the British Isles have continued to be issued by wireless five times each day, that for 0100 being issued at 0200 and repeated at 0600. From 1st December four additional stations, Wick, Donaghadee, Roches Point and Plymouth have been added to these reports. The foreign synoptic report which gives observations from about 30 European stations has been issued daily at 0850 and 1450 G.M.T., while additional reports are now sent out at 0840 and 1940 giving ships' observations.

The number of daily synoptic reports sent by cable has been reduced to a minimum. Messages consisting of a report from a single station are sent each morning to Utrecht and Lisbon. Reports for seven stations are despatched to Rome morning and evening, and reports for four stations to Christiania three times each day.

A new wireless issue came into operation on 1st January consisting of a weather report for shipping. This is issued at 0900 and 2000 G.M.T. each day and consists of a General Inference, coded reports from 10 British coastal stations and forecasts for the sea districts around the British Isles.

The western seaboard report has been transmitted by wireless from the Valencia station in place of Land's End since the 10th December.

From the 8th February the special Admiralty service of "Fleet Weather" reports has been discontinued, requirements being met by the new wireless reports for shipping referred to above.

Special reports and forecasts have been issued during the year to a number of applicants. Forecasts were supplied to His Majesty the King on certain occasions in July and August.

Lithographed and Duplicated Reports.—*The Daily Weather Report*, in three sections, has been published throughout the year, and apart from a slight modification in the Upper Air Section in January no change has been made. Correction and addition sheets to the British and Upper Air Sections were issued up to December. The *Monthly Supplement* to the *Daily Weather Report* has been issued regularly and, with the July issue, monthly mean temperature and pressure and wind roses for certain stations were incorporated. This information was included in response to a wish expressed by the International Meteorological Committee for the early publication of monthly climatological means for a few stations in every country.

The regular daily duplicated charts have been issued as usual.

Since the reception in January of the wireless synoptic report issued from Leningrad, the area of information given in the chart of weather for the northern hemisphere (N. Report) has extended over Siberia, and sometimes as far east as Vladivostock.

The normal issue of reports and forecasts to the press has been maintained. A morning report giving data from certain health resorts for 0900 G.M.T. was issued during the summer months.

Gale Warnings.—The number of gale warning stations at the end of the year was 179. During the year four were closed and ten new stations were established. The Irish stations still remain few, those closed in 1922 not having yet been re-opened.

Examination of the returns from the signal stations showed that delivery of the telegrams continued to be carried out expeditiously: 90 per cent. of the whole of those despatched during the day time were delivered within two hours of the time of issue.

The result of the checking of the gale warnings for 1923 is given in the table on the following page. The percentage of the warnings issued which were followed by subsequent gales or strong winds was 84 for the whole country. The district values ranged from 95 per cent. in Ireland South, the Irish Sea and England South to 72 per cent. in Scotland North and West. The results also show that warnings were issued effectively for 95 per cent. of the gales experienced in the British Isles. These figures show an improvement over those obtained in previous years.

GALE WARNINGS ISSUED DURING THE YEAR, 1923

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 subsequent gales (forces 8 and above)	Issues justified by subsequent strong winds (forces 6 and 7)	Percentage justified by gales and strong winds
1. Scotland N.E. { A B	18	100	47	18	17	74
2. Scotland E.	9	100	40	9	21	75
3. Scotland N.W.	6	100	34	6	21	79
4. Scotland W. and North Channel.	14	93	46	13	20	72
5. Ireland N.	11	91	46	10	23	72
6. Ireland S.	18	94	51	17	22	76
7. Irish Sea.	10	100	41	10	29	95
8. St. George's Channel.	16	94	41	15	24	95
9. Bristol Channel.	19	84	39	17	17	87
10. England S.W.	29	93	39	27	8	90
11. England S.	11	100	37	11	22	89
12. England S.E.	9	100	38	9	27	95
13. England N.E.	15	93	39	14	21	90
14. England E.	8	88	32	7	22	91
	10	100	37	10	20	81
All districts	203	95	607	193	314	84

Inquiries.—The number of inquiries received in the Forecast Division continues to show a steady increase. The figures of the past three years are given in the subjoined table.

Month	1921-22		1922-23		1923-24	
	By Tele- phone or Telegram	Per- sonal	By Tele- phone or Telegram	Per- sonal	By Tele- phone or Telegram	Per- sonal
April	76	21	94	32	131	51
May	54	21	131	59	203	68
June	82	39	150	50	272	68
July	197	65	303	72	241	65
Aug.	124	38	111	47	198	82
Sept.	110	32	103	40	163	42
Oct.	145	60	102	36	211	71
Nov.	119	56	136	41	239	46
Dec.	82	40	125	53	153	50
Jan.	147	67	193	51	224	47
Feb.	86	31	147	59	162	20
Mar.	163	59	158	44	140	37
TOTAL ..	1,385	529	1,753	584	2,337	647
GRAND TOTAL	1,914		2,337		2,984	

CLIMATOLOGY DIVISION

Organization.—The normal work of the Climatology Division is the collection of meteorological observations and of autographic records, the preparation of summaries of the observations for publication, and the discussion of all information bearing on climate.

Climatology of the British Isles. Distribution of Stations.—The following table gives the distribution by districts of the stations of different types, and also indicates where autographic records are being kept. The list refers to March, 1924.

	Stations				Autographic Records					
	Observatories	Distributive	Telegraphic	Climatological	Sunshine	Rainfall	Wind	Pressure	Temperature	Humidity
0. Scotland, N...	1	0	4	9	8	0	2	13	0	0
1. " E...	1	1	2	28	6	1	4	2	2	2
6a. " W...	1	1	0	19	13	1	1	2	1	1
6b. Isle of Man ..	0	0	0	1	1	0	0	0	0	0
2. England, N.E.	0	1	2	17	12	1	3	3	1	1
3. " E...	0	2	2	21	20	2	3	4	2	1
4. " Midlands	1	0	4	37	24	1	0	5	1	1
5. " S.E.	0	8	1	39	33	5	6	7	6	4
London District	2	0	0	7	6	3	1	1	1	1
7a. England, N.W.	0	0	1	20	17	1	2	1	0	0
7b. N. Wales ..	0	2	0	5	5	2	1	3	2	2
8a. S. " ..	0	0	1	6	7	0	0	1	0	0
8b. England, S.W.	0	1	2	29	21	2	4	4	3	3
9. Ireland, N. ..	0	0	3	5	3	0	1	3	0	0
10. " S. ..	1	0	2	15	6	0	3	6	0	0
11. Scilly and Channel Isles	0	0	1	1	2	0	1	2	0	0
	7	16	25	259	194	19	32	57	19	16

The observatories and distributive stations are operated by staff provided from 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 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 observatories such as those at Oxford, Paisley and Southport and from numerous private observers 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.

The records of rainfall in the possession of the British Rainfall Organization are not shown in the table.

Changes of Stations Associated with the Climatology Division.—Stations have been started or resumed at Ascot (Bushfield) (September, 1923), Berwick-on-Tweed (May, 1923), Bexhill (August, 1923), Cork (January, 1924), Comondale (February, 1924), Dover (September, 1923), Harwich and Dovercourt (March, 1924), Hellingly (from Bexley Heath) (November, 1923), Hunstanton (January, 1924), Long Sutton (December, 1923), Morwenstow (October, 1923), Roade (January, 1924), Sheerness (August, 1923), Sutton Bonnington (from Kingston-on-Soar (January, 1924), Usk (Mon.) (March, 1924).

The following stations have for various reasons ceased to forward observations during the year:—Aberdovey (June, 1923), Alfriston (moved to Morwenstow) (September, 1923), Bexley Heath (moved to Hellingly) (August, 1923), Kingston-on-Soar (moved to Sutton Bonnington) (December, 1923), Malmesbury (November, 1923), Raunds (October, 1923).

Climatology of the Globe.—Manuscript returns from 17 foreign stations and 108 colonial stations have been received. Returns have been received for the first time during the year under review from Mien-Chow (W. China), Smyrna (Turkey) and Port Stanley (Falklands) and from six new stations in Uganda. In addition manuscript returns are now regularly received month by month from 10 meteorological stations under the control of the Royal Air Force in Iraq and Palestine.

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

Publications.—This division is responsible for the preparation of the climatological publications of the Office.

As from 1922 the serial statistical publications will be the following:—

Weekly Weather Report.

Monthly Weather Report.

British Observatories' Year Book.

Réseau Mondial.

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

The *Weekly* and *Monthly Weather Reports* have been published regularly throughout the year and the issues are up-to-date. A slight change in the arrangement of the tables of the *Weekly Weather Report* was made from January, 1924.

The *Observatories' Year Book* will replace the following publications, which cease with the issues for 1921 :—

Geophysical Journal,

Hourly Values from Autographic Records, meteorological and geophysical sections.

Daily Readings at meteorological stations of the first and second order also ceased with the issue for 1921 and will not be represented in the new publication.

The *Observatories' Year Book* for 1922 is in preparation for printing. The issues of *Daily Readings* and of the *Geophysical Journal* have been completed. *Hourly Values from Autographic Records* for 1920 has been issued, but the volume for 1921 has not yet been printed.

The whole of *Réseau Mondial* for 1915 and part of 1916 were sent to press. The tables for 1916 were completed and those for 1917 are in hand.

The *Observer's Handbook* has been revised for publication in a new edition.

A list of the occasional publications passed through the press during the year is given on p. 59.

Returns for Registrars-General.—A weekly summary of the weather at certain large towns has been 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.

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 ten *Pilots* was revised during the year. The revision of tables for sixteen *Pilots* was carried out; this involved the preparation in the division of data for 59 stations. In addition, Meteorological Services abroad were good enough to contribute revised tables for 46 stations.

British Empire Exhibition.—A number of climatological diagrams and maps has been prepared for this Exhibition.

Special Investigations.—A paper on Seasonal Forecasting was prepared. This is now being considerably amplified. A note on the distribution of vapour pressure over the British Isles has been prepared. Means for 88 stations are given together with 12 monthly charts and an annual chart.

A comparison of various methods of computing accumulated temperature have been examined and a note prepared.

New humidity tables have been prepared for printing and issue.

An inquiry has been made into the effect on monthly means of extreme temperature of the hour of reading and setting maximum and minimum thermometers, and a memoir on the subject is completed.

A systematic investigation into the exposure of sunshine recorders at all stations has been commenced.

Some work has been done on the determination of the true monthly mean temperature from daily observation at fixed hours.

The preparation of "long series" data for a number of stations is being undertaken at the request of the International Meteorological Committee.

The following papers have been prepared by the Assistant-Superintendent.

A note on the Sea Temperature, Pressure Distribution and Weather of May, 1923.

East-West Oscillation of the Iceland Minimum as shown by monthly pressure charts.

A note on the Rainfall over Uganda.

Inquiries.—During the year 376 inquiries were dealt with in the Climatology Division, comparing with 559 for the previous year. Inquiries for information for legal purposes numbered 97 as against 98 in 1922-3.

Various reports on meteorological conditions to be anticipated on air-routes in different parts of the world have been prepared.

INSTRUMENTS DIVISION

General.—The work of the division has been continued on the general lines of the preceding year. A re-arrangement of accommodation which was made during the year has resulted in a room being set apart and fitted for test work, the existing laboratory being reserved for investigation and research. The appointment of a mechanical assistant in July to fill the vacancy caused by the death of Mr. J. H. James last year permitted a resumption of experimental work in the workshop.

The work of the division falls naturally, and may be dealt with under the following heads:—

- (a) Store-keeping and Accounting.
- (b) Supply of Instruments and Equipment to Official Stations.
- (c) Supply of Instruments on Repayment.
- (d) Investigations and Research.
- (e) Testing and Inspection of Instruments.
- (f) Drawing and Photographic Work.
- (g) Other Work.

Store-keeping and Accounting.—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 or on board ship is 750. Each store account has been verified on inspection or by correspondence with the custodian during the course of the year, and all discrepancies revealed have been investigated and disposed of in consultation with the relative accounts branch of the Air Ministry when necessary.

In addition to accounting for the equipment on charge to stations and establishments of the Meteorological Office, the arrangements by which the store accounts are kept by this division for stations under the Directorate of Signals and for certain other branches of the Air Ministry have been continued during the year.

Air Ministry auditors visited the Division in September, 1923, and in February, 1924, to audit the store accounts from 1st January, 1923, to 31st December, 1923. Stock was taken of the instruments and stores held at the central store at South Kensington as on 30th September, 1923, and 31st March, 1924, and compared with the ledgers.

Boards of Survey for the purpose of conditioning surplus and unserviceable stock were held on the 18th July, 1923, and 22nd February, 1924; the recommendations of the Boards were approved and carried into effect.

Surplus stores at Benson Observatory, Andover and Grain were disposed of by tender.

The total number of demands dealt with during the year was 2061.

Supply of equipment to Official Stations.—The equipment at official stations maintained by the Meteorological Office at home and abroad and also at R.A.F. meteorological stations in the Middle East and Iraq Commands has been maintained in serviceable condition.

Supply of Hydrogen for Balloon Ascents.—Owing to the length of time that had elapsed since the hydrogen cylinders in use at Meteorological Office stations were obtained, instructions were issued for pressure to be reduced in all cylinders that had not been re-annealed and tested for two years. Towards the end of the year arrangements for new supplies were completed.

Establishments.—Standard maximum rates of supply were arranged in respect of consumable stores (Observatories only), hydrogen and paper lanterns and candles for balloon ascents. Establishments of instruments and stores for official stations of different types were also laid down.

Supply of Instruments on Repayment.—Instruments are issued on repayment to voluntary observers who send in regular returns to the Office, to the Crown Agents for the Colonies, to Admiralty Dockyards and to other Government Departments. Among issues so made during the year may be mentioned the following :—

Instruments were issued to Samoa on behalf of the High Commissioner for New Zealand and to Ceara, Brazil.

Instruments were issued to new climatological stations at Dover, Harwich, Jersey and Usk (Monmouth).

A number of instruments were issued to different stations participating in the crop-weather scheme of the Ministry of Agriculture.

Investigations and Research.—Experiments have been made with a view to determining the cause of the sticking of the velocity pens of pressure tube anemometers at low velocities; the difficulty was finally overcome by fitting the velocity recorder with a collar of new design.

Attention has been given to the design of a portable anemometer for use at telegraphic reporting stations and at temporary meteorological stations.

After prolonged investigation an improved metallic paper for Robinson anemograph charts has been obtained and is now in use.

Work has been continued on the specification of the Kew Pattern Barometer. A memorandum on the subject has been drawn up and a specimen marine barometer, made according to a new specification obtained.

A specification of a modified form of the Gold correction slide for the reduction of barometer readings to Mean Sea Level was drawn up and a number of the slides obtained for use on marine barometers.

Apparatus has been made and installed at a station near the coast for the investigation of the conditions affecting the readings of barometers exposed in windy localities.

A memorandum has been drawn up on a new type of Surveying Aneroid for the Tropics.

Comparisons between different types of recording rain-gauges have been made and a report drawn up.

A shield has been designed in conjunction with the Natural History Museum in order to prevent the entry of earwigs into recording rain-gauges. An experimental shield was installed at a station during the summer and proved effective; issues are now being made to all official stations.

A new type of rain measure was evolved having a tapered end, designed to facilitate the accurate measurement of small quantities of rain. Specifications were drawn up and the measures are being obtained for general use.

An experimental rain measure for insurance purposes was designed and obtained.

In connection with the question of the effect of eddies on the catch of a standard rain-gauge, a new pattern gauge has been designed, the outer surface of which is stream-lined. An experimental gauge is being made.

A specification of a modified Campbell-Stokes Sunshine Recorder was prepared for use in tropical countries.

As a result of experiments which were continued from last year two improved specimens of cardboard for the manufacture of sunshine cards have been selected and cards made from the new boards are to be tried at Observatories and out-stations during the summer of 1924 with a view to a final selection being made.

Experiments were made, in conjunction with the National Physical Laboratory, with a view to determining the cause of the contraction of the liquid in spirit thermometers. In order to continue the investigation a further programme of experimental work has been drawn up.

Attention is being paid to the design of earth thermometers. Two recording mercury-in-steel thermometers of a transmitting type have been obtained and also a number of mercury-in-glass thermometers of special pattern.

A new type of recording psychrometer with a ventilated wet bulb has been obtained for comparison with the photographic wet and dry bulb thermometer at Kew Observatory.

A revised specification of a Stevenson Thermometer Screen has been prepared, embodying some slight alterations in design.

Considerable attention has been given to the question of obtaining suitable balloons and meteorographs of prescribed pattern for registering balloon ascents.

Trials have been made with a new pilot balloon theodolite designed for use on board ship.

An attempt was made to improve the design of the light filters used with pilot balloon theodolites in order to minimize the diminution of

the field of view which occurs with the ordinary pattern. Three sets of a new type of filter were obtained and are being tried at out-stations.

Testing and Inspection of Instruments.—At the beginning of the year arrangements were made whereby the Superintendent of Instruments, acting for the Deputy Director of Aeronautical Inspection, carries out the inspection of all meteorological stores received under Air Ministry Contracts.

A pressure-tube anemometer, purchased from the makers by the Ministry of Agriculture and Fisheries, was inspected before delivery. A second instrument, purchased in connection with the tests on the Menai Bridge, was inspected on behalf of the Ministry of Transport.

A number of instruments were tested on behalf of the Australian Government.

During the year 65 rain-gauges and 130 rain measures, received in the Office for test on repayment, were approved.

Burettes of special design for testing rain measures and a Chattock micro-manometer were obtained for the test laboratory. A pressure chamber for test work is also being obtained.

Drawing and Photographic Work.—During the year 114 drawings were made, chiefly in connection with the specifications of new instruments. The number of blue prints made was 265.

In the photographic section 102 lantern slides were prepared for lectures and discussions and 220 negatives were made.

Other Work.—Exhibitions. Exhibits of instruments were arranged for the Royal Agricultural Show at Newcastle in June and also in connection with the British Association meeting at Liverpool in August. An exhibit of instruments was also prepared to be incorporated in the Meteorological Office Exhibit at the British Empire Exhibition at Wembley.

Inquiries. Inquiries relating to various matters connected with the design and supply of instruments and emanating from private and official sources at home and abroad have been received and dealt with during the year.

ARMY SERVICES DIVISION

The work of the stations at Shoeburyness and Larkhill has been maintained on the lines of preceding years. At Shoeburyness the computations of weighing factors for wind and temperature have been continued, and applied in the computation of corrections to the results of range and accuracy trials. Observations of upper winds have been made wherever possible by following pilot balloons with two theodolites. An extended trial of large pilot balloons and large theodolites has been carried out and has shown that the instruments are well adapted for high ascents into the stratosphere on occasions when weather conditions are favourable.

At Larkhill suitable bases have been surveyed, and telephone lines erected, for pilot balloon observations with two theodolites. Further, a long series of observations of pilot balloons provided with tails has shown that the tail method provides a useful check on the assumed rate of ascent of the balloons, and gives a valuable indication of the

existence of ascending or descending currents. Synoptic charts are now drawn twice daily at Larkhill, and forecasts issued to the School of Artillery. During the past year the synoptic data have been passed by telephone from Porton to Larkhill, but arrangements are being made to provide W/T receiving apparatus at Larkhill, so that the station there may be independent of Porton.

During the summer of 1923, lectures were delivered by the Superintendent to each course at the School of Anti-Aircraft Defence, Biggin Hill. Lectures have been delivered to Artillery officers at Shoeburyness and Larkhill by the Meteorologists-in-charge at those stations.

During the summer of 1923, one 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 there. Also arrangements were made to meet the needs of an Anti-Aircraft practice camp at Hunstanton during July and August, 1923.

The periodogram analysis of twelve sets of meteorological observations of 100 years has been continued at Shoeburyness. Considerable progress has been made and valuable results have been obtained.

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

A scheme to meet the meteorological requirements of the Army in time of war has been drawn up, and after discussion with the departments of the Air Ministry concerned, has been submitted to the War Office.

LOCAL CENTRES DIVISION

General.—Stations have been in operation at the following places :—

Civil Aviation Aerodromes

Croydon	throughout the year.
Lympne	" " "
Renfrew	" " "
Manchester	" " "
Castle Bromwich	" " "

Royal Air Force Establishments

Cadet College, Cranwell	throughout the year.
Royal Air Force Base, Calshot	" " "
Royal Aircraft Establishment, South Farnborough	" " "
No. 56 Squadron, Biggin Hill	" " "
Seaplane Station, Cattewater	" " "
Marine and Armament Experimental Establishment, Isle of Grain (later Felixstowe)	" " "
No. 5 Flying Training School, Shotwick	" " "
Royal Air Force Base, Leuchars	" " "
Royal Air Force, Andover	" " "

<i>Unattached</i>	
Experimental Anemometrical Station, Holyhead .. .. .	.. .. .

<i>Auxiliary Reporting Stations</i>	
Beachy Head Coastguard Station ..	throughout the year.
Hythe Coast Watching Force Station ..	.. .. .
Dungeness Lighthouse .. .. .	.. .. .
North Foreland Post Office Wireless Station .. .. .	.. .. .
Deal Coastguard Station.. .. .	.. .. .

St. Catherine's Point Coastguard Station	From 4th Sept., 1923.
St. Bee's Head Lighthouse	From 23rd Sept., to 20th Oct., 1923.
Portpatrick Coast Watching Station ..	From 25th Sept., to 20th Oct., 1923.

Ten of these stations were in charge of a professional assistant, with clerical staff. The stations at Manchester, Castle Bromwich, Biggin Hill and Cattewater, being reporting rather than distributive stations, were in charge of a clerical assistant. The auxiliary stations have no Meteorological Office Staff, arrangements having been made with the Departments responsible for abbreviated weather reports to be supplied either as a regular routine or on demand. The stations at St. Bee's Head and Portpatrick were opened temporarily during the experimental flights between Plymouth and Belfast.

Services for Civil Aviation.—An Assistant Superintendent stationed at Headquarters has been responsible for these services and for regular forecasts issued twice daily for the different routes. The forecasts, together with the hourly reports of actual weather on the routes, have been set out as usual at Croydon, Lympne, Manchester and Castle Bromwich for the benefit of the pilots and officials of the air lines, and any additional advice required has been supplied by the staff at these stations. At all stations on aerodromes situated on definite routes, forecasts and weather reports have been exhibited as received.

The general system of reports remains similar to that described in the last *Annual Report*, but the following changes have taken place during the year.

- (a) *London-Berlin Service.*—A service between Croydon and Berlin was commenced by Daimler Airways on 30th April, 1923. The report issued from Lindenberg at 0635, giving meteorological data for various German stations, was received regularly and supplied to pilots of this company. Weather reports were thus available for the whole route.
- (b) *London-Manchester Service.*—This service has been worked at intervals during the year but the meteorological arrangements at Castle Bromwich and Manchester were in the main kept up throughout, details being varied from time to time according to the requirements of the service. By the kindness of the De Havilland Aircraft Company, reports of the weather at Stag Lane Aerodrome have been supplied as required.

- (c) *London-Zurich Service*.—Arrangements were made for Messrs. Handley-Page, Limited, to obtain information on the Paris-Zurich section of the route at the Meteorological Office at Le Bourget.
- (d) *Southampton-Guernsey Service*.—This service commenced during September, 1923; the Assistant Superintendent at Calshot is in charge of the meteorological arrangements, including the issue of forecasts. All reports are collected at Calshot and are either telephoned to the British Marine Air Navigation Company at Woolston, the terminus of the service in Southampton, or are transmitted by wireless to the Air Ministry Wireless Station at Guernsey. An auxiliary reporting station was opened at St. Catherine's Point Coast-guard Station on 4th September, 1923, and reports were also received as from that date from the Wireless Station at Guernsey. The hours of reports have varied during the past six months owing to the alterations in the time-table of the service.
- (e) *Plymouth-Belfast Service*.—An experimental aerial mail service was operated by the Ministry on the route Plymouth-Castle Bromwich-Manchester-Belfast from 15th September to 19th October, 1923. Observations as required were supplied by the stations at Cattewater, Ross-on-Wye, Castle Bromwich, Manchester and Donaghadee. In addition, auxiliary reporting stations were opened at St. Bee's Head and Portpatrick for the duration of the service. Forecasts were sent from Headquarters to the meteorological assistants at Cattewater, Castle Bromwich and Manchester and to the Postmaster at Belfast.
- (f) *Weather Reports on Alternative Route*.—After the transference of the station from the Isle of Grain to Felixstowe, arrangements were made for a daily message at 0900 from Shoeburyness from 14th February, 1924, this report to be sent for the period 1st October to 28th February each winter, and additional reports being called for on days when bad weather conditions render impossible the normal route between Croydon and Lympne.

With a view to achieving some acceleration in cases where air services are held up by bad weather conditions, a trial was commenced on 24th January, 1924, of the interchange between stations on the aerial routes of special reports when visibility, height of low cloud and wind force crossed certain limits.

Special arrangements were made on certain days during March, 1924, for reports on the Croydon to Lympne route in connection with experimental night flights carried out by the Royal Aircraft Establishment, Farnborough.

No regular aerial service yet operates from Renfrew; the distribution of about 40 copies of the *Local Daily Weather Report* (Form 2375) to the public libraries, University, railway stations and engineering departments, Harbour authorities, etc., has been continued. The Meteorologist-in-Charge is to deliver lectures in meteorology to the officers of the Royal Air Force Reserve in training at Renfrew.

A further course of lectures to civilian pilots, who would have to undergo an examination in meteorology for their Class "B" Licence, was given at Croydon by the Meteorologist-in-Charge during December.

Special information and forecasts were supplied to the competitors and officials during the Royal Aero Club Competition for light-planes at Lympne from 8th to 13th October.

Services for the Royal Air Force.—Regular courses of lectures were continued at the Cadet College, Cranwell, and the Aerial Navigation School, Calshot, by the Meteorologists-in-Charge, who also acted as examiners. The Meteorologist-in-Charge at Shotwick has also conducted courses of lectures to the pilots in training at that station.

The station at Isle of Grain was transferred to Felixstowe on 16th February in consequence of the removal of the Marine Aircraft Experimental Establishment to the latter place.

There has been little change in the work of the stations at Andover, Leuchars and Cattewater.

Experiments in the release of pilot balloons from aeroplanes were continued at Farnborough, but the results are not yet very satisfactory. Experiments have also been conducted with a new baro-thermograph and a portable anemometer of the pitot-tube type.

Meteorological information was supplied to the Officer Commanding Royal Air Force Unit, H.M.S. *Pegasus*, and one officer of this unit was instructed in meteorological observational work at Cattewater. This officer will take surface observations and upper air temperatures during the cruise of the ship.

Summaries were prepared of the statistics of the past three years of fog, mist and height and amount of low cloud for all Local Centres. These summaries have been of value for various purposes, including that of preparing reports on the meteorological values of various aerodrome sites.

Inquiries on a variety of other subjects called for the making of various investigations.

In connection with the delivery of machines, special reports and forecasts for various routes were supplied as required to the Director of Equipment and to the manufacturing firms. Statements of weather conditions were prepared on various occasions for the Inspector of Accidents.

From 16th November, reports and forecasts have been telephoned to the Superintendent of Reserve, Northolt, for flying to Edgware, Filton, Coventry and Renfrew.

Experimental Anemometrical Station—Holyhead.—Comparison of the old and new sites (in respect of observations of pressure, temperature and rainfall) was continued throughout the year. A comparison between the readings of the pressure-tube anemometer and the anemobiograph was carried out for the month of November, 1923. The pressure-plate anemometer was dismantled and an experimental test carried out during March, 1923. The test indicated that the instrument was not very reliable.

Upper Air Observations.—The total number of single theodolite pilot balloon ascents made at the stations during the year was 8,360. Several ascents by the "tail-method" were made at Calshot during the summer, and a report on the vertical currents during sea breezes was prepared from the data obtained by these ascents.

The number of aeroplane ascents made by pilots of the Royal Air Force to determine upper air temperatures and humidities totalled 236.

Investigations.—The following papers and investigations were completed during the year :—

A note upon the relation between night visibility, wind and pressure type at Cranwell during the period April 1st, 1920, to March 31st, 1923.—W. H. Pick.

A note upon the effect of surface convection currents upon day ground visibility in summer.—W. H. Pick.

A note on the vertical visibility at Cranwell, February, 1922, to June, 1923.—W. H. Pick and S. P. Peters.

The relationship between the origin of air and ground horizontal visibility and relative humidity.—W. H. Pick.

A paper on the structure of cyclones as deduced from data published in the *Daily Weather Report* for the two previous years.

—W. Gillon.

Further researches into European Upper Air Data.—C. K. M. Douglas.

The ground day visibility at Cranwell during the period 1st April, 1920, to 31st December, 1923.—W. H. Pick.

A report on the vertical motion of the atmosphere during sea breezes.

—J. Durward.

Data regarding the periods of barometric recurrences at Kew and Aberdeen during 1921 were abstracted at Cranwell for comparison with a paper submitted to the Director by Mr. L. F. Richardson.

Statistical comparisons between the theoretically computed heights of the bases of clouds and the measured or estimated height for the months of April and May, 1923, were made at Croydon and Lympne.

In 1920, a considerable amount of material on the question of the variation with time and space of the wind at given heights was collected at headquarters and partially discussed; the manuscript data have been sorted out and a connected summary of the results has been prepared from the notes made in 1920.

Frequency summaries of mist, fog and low cloud were prepared for all stations; for Croydon and Lympne tables showing the diurnal range of these elements were also prepared.

Summaries of winds at great heights over Southern England and Northern France for a period of 6 years were prepared at Calshot.

Investigations into local conditions of relative humidity have been conducted at Croydon, Lympne, Andover, Calshot, Cranwell, Grain, Leuchars, Renfrew and Shotwick.

Upper air temperature data as computed from ballon-sonde ascents made in Great Britain from 1906 were entered on a card index at Farnborough.

The following investigations are in hand :—

The upper air circulation as deduced from the drift of pilot balloons with post-cards attached—at Calshot.

The structure of cyclones—at Leuchars.

A further investigation into upper air temperatures and humidities—at Farnborough.

Inquiries.—On 1st November, 1923, this division became primarily responsible for dealing with meteorological inquiries from the Royal Air Force or connected with aviation. Several of such have been received and dealt with.

Amongst major inquiries from outside the Ministry or the Royal Air Force may be mentioned a report on the meteorological facilities

between India and Australia and the additional organization likely to be required in connection with the Imperial Airship Route,—prepared for the Prime Minister of Australia.

A large number of minor inquiries by telephone or in person was received, the total for headquarters and the out-stations exceeding 9,000. Most of these inquiries dealt with forecasts and advice required in connection with flying. In addition, 1,550 replies were passed by radio-telephony to machines in flight.

Buildings.—The new office at Shotwick is nearing completion. Minor structural improvements or redecorations have been effected at the Offices at Lympne, Leuchars, Biggin Hill, Renfrew, Holyhead, Andover and Felixstowe.

Arrangements are in hand for an addition to the office at Croydon and the construction of paths and a storage shed for fuel at Felixstowe.

Staff.—A few changes took place in the staff consequent upon the re-organization scheme for the clerical grades. The total staff increased from 61 to 64 during the year.

BRITISH RAINFALL ORGANIZATION

Administration.—The death of Mr. Salter, referred to elsewhere in this Report (*vide* p. 14), was a severe loss to the Division on account of his unique knowledge of the history of the Organization, his cordial personal relations with the observers and his grasp of the problems of rainfall distribution. Mr. Salter's place was filled by the transfer of Mr. F. J. W. Whipple, Superintendent of the Climatology Division.

Rainfall Stations.—The number of stations from which rainfall records are being received continues to increase. The most convenient "index number" is the number of entries in the "General Table" of *British Rainfall*. As will be seen from the following table the number of records in this table in the 1922 volume exceeded the number in the previous volume by 48.

	England	Wales	I. of Channel		Scotland	Ireland	British Isles
1922	3601	432	8	30	785	270	5126
Increase from 1921	+24	+18	—1	+6	+1	—1	+48

In England the more important gains include a group of records from the Corporations of Bolton and of Rotherham. More than 40 records from gauges maintained by the Great Central Railway Company were discontinued on the incorporation of that Company in the new London and North Eastern Railway Company. In Wales records were received for the first time from a group of gauges in Glyn Ceiriog, in Denbighshire. The Channel Isles show an increase of six records, which must be attributed to Mr. Salter's inspection of the gauges in Guernsey in 1921. The decrease in the number of gauges in Ireland is explained by the disturbed political conditions. There was a further

decrease in the year 1923. In three cases the records came to an end owing to houses being burned down by incendiaries.

The Royal Meteorological Society is now responsible for the climatological station at Camden Square, the old headquarters of the British Rainfall Organization. Observations have been made for the Society by pupils of the North London Collegiate School and (since May 7th, 1923) by officials of the Public Health Department of St. Pancras.

Inspections.—During the year ending March 31st, 1924, 131 stations and 19 sites were inspected by the staff of the British Rainfall Organization. These included :—

- (a) A large number of stations in Yorkshire, most of which are maintained by the corporations of Harrogate, Leeds and Bradford.
- (b) The gauges in the Lune and Balder Valleys (tributary to the Tees) where sites were selected for 5 new gauges.
- (c) The gauges in the Northern and Kent districts of the Metropolitan Water Board.
- (d) All gauges maintained by the London County Council.

Reports were drawn up and submitted to the responsible authorities.

Publications.—*British Rainfall*, 1922, was published on December, 22nd.

The statistical tables included :—

Records of Percolation	..	..	..	at	11 stations
Records of Evaporation	..	..	..	„	14 „
Detailed Analysis of daily rainfall..	..	..	..	„	100 „
Duration of rainfall	..	..	..	„	60 „
Records of monthly rainfall	..	..	..	„	390 „
Records of annual	„	..	..	„	5,126 „

Two papers by Mr. J. Glasspoole were included in the volume, the one dealing with “The Fluctuations of Monthly Rainfall” and the other being a “Comparison of the Fluctuations of Annual Rainfall over the British Isles.”

The Obituary list contained the names of 80 observers, and included 13 who had reported observations for 30 years and upwards.

The Meteorological Magazine has been published regularly during the year. On Mr. Salter's death Mr. Whipple, who had previously shared the editorial duties, became sole editor.

Book of Normals for the British Isles.—Tables giving average monthly rainfall for the period 1881 to 1915 were prepared under the superintendence of Mr. Salter. Tables for 578 stations are being published as a section of the *Book of Normals*. This section was ready for the printer in March, 1924.

The Rainfall Map of the British Isles.—Work was resumed on the rainfall survey of the British Isles and progress was made in the preparation of average annual rainfall maps on the scale of 2 miles to the inch. The areas dealt with included the counties of Carmarthen, Pembroke, Cardigan, Carnarvon and Anglesey. All available records

in these counties were worked up ; about 350 of these had not been utilised previously. The areas which have now been mapped on the scale 2 miles to an inch are shown by shading in the attached diagram.

Sketch Map showing area of British Isles for which Large Scale Rainfall Maps are available - March, 1924.



Professional Work.—Mr. Salter attended the hearing in the House of Lords of Water Bills promoted by the Oldham and Rochdale Corporations and by the Wakefield and Moseley Corporations ; in the latter case he also gave evidence in Committee.

An evaluation was made of the probable monthly rainfall over the Lune and Balder watersheds for the years 1887, 1905, 1915 and 1921 for the Tees Valley Water Board. A scheme for placing new rain-gauges in these valleys was drawn up, and Mr. Whipple visited the areas and selected sites for the gauges.

A map was prepared and an evaluation made of the rainfall over the basin of the Clyde above the Falls of Clyde.

Under the arrangement with the Metropolitan Water Board reports on the rainfall of the Thames Valley were prepared each month and an annual report for the year ending March 31st, 1923, was also supplied.

Inquiries.—The number of inquiries dealt with during the year was 309. Data were supplied in connection with questions of water supply and rainfall insurance and in connection with various actions at law.

Information was supplied to :—

The Ministry of Agriculture and Fisheries (for the Standing Committee on Rivers Pollutions).

Leeds University, Inland Revenue Office, Ordnance Survey (map for inclusion in Agricultural Atlas of England and Wales), Thames Conservancy (regular monthly rainfall tables), Middlesex County Council, Perthshire Natural History Museum, Manchester High School for Girls, London Press Exchange, Rothamsted Experimental Station, Tyne Salmon Conservancy, Manchester Ship Canal Co., London and North Eastern Railway, London General Omnibus Co., English Electric Co., Ltd. (a hydro-electric scheme), Messrs. Johnston & Co. (map for publication as a wall-map).

Miscellaneous.—A paper by the late Mr. Salter on "The Volumetric Determination of Rainfall" was discussed at the International Navigation Congress on July 5th.

ADVISORY COMMITTEE ON ATMOSPHERIC POLLUTION

The work of investigation into atmospheric pollution has continued under the direction of the Advisory Committee on Atmospheric Pollution, of which Sir Napier Shaw is Chairman and Dr. J. S. Owens the Honorary Secretary. A list of the members of the Committee at the end of the year is given on page 5. There are 46 standard deposit gauges in operation, 8 new ones having been started during the year. The routine work of collection and classification of the monthly deposits has been carried out as usual and the results embodied in the *Annual Report*. The tabulated results of six automatic recorders are included in this report. There are twelve of these automatic recorders in operation, five of them being in Glasgow and four in London.

Research work in the laboratory has been carried out upon various problems connected with atmospheric pollution, including the effect of suspended matter upon visibility, the results of which research have shown a direct relationship between the obstruction of light and the amount of suspended matter. This research also has demonstrated that the estimation of dust by the automatic recorder and by means of the jet dust counter give identical results within the limits of error of the experiments.

Further tests have been made with the vapour pressure hygrometer, referred to in the last *Annual Report* and an instrument has been constructed in the Office workshop which is giving promising results.

NAVAL SERVICES DIVISION

The work of the division has progressed steadily during the past year and close co-operation has been maintained with the Admiralty and H.M. Fleet, resulting in an increasing number of inquiries from Naval sources.

In addition to those which keep logs for the Office, seventeen of H.M. Ships on home and foreign stations have sent in reports of meteorological interest.

With reference to the co-operation of the Navy in upper air work referred to in last year's report, Captain H. P. Douglas, C.M.G., R.N., commanding H.M.S. *Mutine* on the North American and West Indian Station, has sent in some interesting records of pilot balloon ascents made at Bermuda and Jamaica. These observations are being continued by the officers of H.M.S. *Ormonde*, which ship has relieved H.M.S. *Mutine* on that station.

The Naval Establishments at Portsmouth and Devonport have been visited and the meteorological requirements of the Fleet discussed with the authorities. Arrangements have been made for a series of lectures on Meteorology to be given at Portsmouth; these will commence in May next.

The "Fleet Weather Forecast" was discontinued on the introduction of the "Weather Shipping Bulletin." The Admiralty W/T Stations at Rosyth, Sheerness, Culven Cliff, Rame Head, Portland and Pembroke take in this message and pass it to their respective Senior Naval Officers.

Forty-three Gale Warning Stations were visited during the year and, where necessary, their positions fixed for insertion on the Admiralty Charts.

LIBRARY

General.—The work of the library has been continued on the lines of the preceding year.

Exchange of Publications.—Exchanges of publications have been established with:—

Hydrographic Office, Tokyo.

Aeronautical Research Institute, Tokyo.

L'Institut Physico-Mathématique de l'Académie des Sciences de Russie.

Oficina Meteorologica, Cordoba.

Lu-kia-pang Observatory (near Shanghai).

Freeman Observatory, Canton Christian College, China.

Section Météorologique de Loggildingarstefan, Iceland.

Additions.—The additions to the library during the past year include 645 new books and pamphlets, and 11,500 Daily Weather Reports. The number of periodicals received was about 700.

Loan of Books.—3,869 books were issued on loan during the year.

Catalogues.—The author-card catalogue has been kept up-to-date. The subject card catalogue has been kept up-to-date so far as books added to the library during the year are concerned. The preparation of the shelf catalogue has been continued, the books on 226 shelves having been numbered and catalogued.

Binding.—552 volumes have been bound during the year.

Books Presented.—The following important works have been presented to the library during the year. The names of the donors are given as well as the titles of the publications.

British Science Guild. *A Catalogue of British Scientific and Technical Books.*

Committee of the Captain Scott Antarctic Fund, British Antarctic Expedition, 1910–13. *Glaciology*, by C. S. Wright and R. E. Priestley.

Exner, F. M. *Zum Klima von Palästina.*

Kidson, E. *Cloud Heights from Melbourne Observatory. Photographs.*

London, Admiralty. *Ocean Passages of the World. Winds and Currents.*

London Medical Research Council. *The Kata-Thermometer in Studies of Body Heat and Efficiency.*

Paschinger, V. *Die Eiszeit; ein meteorologischer Zyklus.*

Rouch, J. *Notice météorologique sur les cotes de France et d'Algerie.*

Weickmann, L. *Zum Klima Türkei. Heft I.*

Wiedemann, Eilhard. *Zuwachsrückgang und Wuchsstockungen der Fichte in den mittleren und unteren Höhenlagen der sächsischen Staatsforsten.*

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

Balduf, A. *Etudes élémentaires de météorologie pratique.* 2e. edition.

Brooks, C. E. P. *The Evolution of Climate.*

Glazebrook, Sir Richard. *Dictionary of Applied Physics.*

Guilbert, G. *La prévision scientifique du temps.*

Hann-Süring. *Lehrbuch der Meteorologie.* 4. Aufl.

Huntington, E., and S. S. Visser. *Climatic Changes: Their Nature and Causes.*

Kähler, K. *Luftelektrizität.*

Kassner, C. *Gerichtliche und Verwaltungs-Meteorologie.*

Kendrew, W. G. *The Climates of the Continents.*

Rouch, J. *Manuel d'oceanographie physique.*

Shaw, Sir Napier. *The Air and Its Ways.*

„ „ *Forecasting Weather*, 2nd edition.

Minor Personal Inquiries.—252 minor personal inquiries were dealt with.

Lantern Slides.—101 new slides were received into the collection. Sets of slides were borrowed on 24 occasions.

Investigations.—The Librarian prepared a paper summarising the results obtained on examination of the Dyce anemograph records and has contributed articles to the *Meteorological Magazine*.

METEOROLOGICAL OFFICE, EDINBURGH.

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

The reduction of the Eskdalemuir magnetic data was carried on as usual and was kept well forward.

The climatological work of the Office comprises the examination and tabulation of returns from 56 stations throughout Scotland, and the preparation of tables and summaries for the *Monthly Weather Report* and for the Registrar-General for Scotland.

The number of inquiries dealt with by correspondence was 73, a slight increase over the previous year's figure. In addition, a number of verbal inquiries were made and answered. It would appear that the existence of the Office as an agency for information with regard to Scottish meteorology is becoming better and more widely known. The nature of the inquiries made shows this clearly. One special inquiry of importance related to the weather in the Hebrides and north-west of Scotland during the summer of 1923, and formed the subject of a memorandum to the Board of Agriculture for Scotland, the Fishery Board for Scotland, and the Scottish Board of Health. Another inquiry involved the calculation of the hourly values of magnetic "activity" at Eskdalemuir for the first six months of 1923.

During the year a wireless receiving set was installed in the Office, and from reports received the 7 a.m. weather map has been drawn and a forecast issued to the local press.

The collection and tabulation of rainfall statistics for Scotland has been carried on as usual. Reference was made in last year's Report to the necessity for obtaining these statistics monthly instead of annually from the observers. During the year this change was made in the case of 40 stations, and all new rainfall stations send in monthly returns. It is hoped that the current year will see an extension of the monthly report system.

The number of observing stations in Scotland at work during the year is shown below.

	Observa- tories.	Climato- logical Stations	Telegraphic Reporting Stations
No. at beginning of year	3	55	8
No. closed during year	—	1	—
No. opened during year	—	2	—
No. at end of year	3	56	8

Advisory Committee.—This Committee met on 4th December, 1923, the Director being present as Chairman.

Observatories:—

ESKDALEMUIR OBSERVATORY

Terrestrial Magnetism.—The Observatory was established primarily for the prosecution of work in this branch of Geophysics. In all essential details the scope and character of the activities were as in recent years. Continuous photographic registration of the three geographical components of terrestrial magnetic force was maintained. Absolute determinations of horizontal intensity, declination and inclination were carried out twice weekly, and the absolute values of the

elements thus obtained were employed for the standardization of the records obtained photographically. From the curve readings so corrected hourly values, diurnal inequalities, mean values, absolute daily ranges and hourly ranges are derived. As in recent years, the reading of the curves and the assigning of base and scale values was done at the Observatory, while the bulk of the ensuing work of computation and reduction was carried out in the Edinburgh Office.

In the summer and autumn of 1923 continuous records of magnetic declination were obtained in connection with similar records obtained during the same period at a coal mine near Birmingham. The declination records are being continued at the Observatory.

A number of simultaneous observations of inclination with the Schulze Dip Inductor and the Dover Dip Circle were made. The Dover Dip Circle was also sent to Kew for comparison with the Kew and Greenwich Dip Instruments.

Some time was devoted to an examination of the fluctuations of the "P and Q" correction, which is involved in the determination of horizontal intensity, but although there is some evidence of an annual variation in the correction as derived the results of the examination were mainly inconclusive.

In connection with the investigation of short period pulsations of the vertical component of the magnetic field a new four-core lead sheathed and armoured cable, rather more than a mile in length, was placed in position in loop form on the moor west of the Observatory in November. A number of interesting records have been obtained.

The tabulation of hourly ranges of the three components of magnetic force for the years prior to 1918 has been continued and the work is now nearing completion. Magnetic character figures and the values of the square of daily range were forwarded quarterly to De Bilt.

Meteorology.—As a first order meteorological station of the International Classification the Observatory is responsible for (a) the maintenance of autographic records of atmospheric pressure, dry and wet bulb temperature, relative humidity, wind speed and direction, rainfall and sunshine; (b) eye observations at 9h, 15h, 21h, G.M.T., for control purposes; (c) general attention to weather phenomena. In addition to the routine eye observations at the hours named, observations are made at 7h, 13h, and 18h, G.M.T., for the purposes of telegraphic reports to Headquarters. These various activities were fully maintained throughout the year. Pilot balloon ascents were made on International and Amundsen days, when weather permitted, and on other occasions as opportunity occurred.

For the first nine months of the year the standard photographic barograph was under repair and during this period the records from the Dines float barograph (pen recording) were used in obtaining hourly values of atmospheric pressure.

The work of tabulation of the autographic records (controlled and standardized by eye observations where necessary) and the work of computation and reduction were carried out at the Observatory. This, involving as it does the entire preparation of data for publication in the *Year Book*, has increased very considerably the amount of purely clerical work.

Solar radiation observations with the Ångström pyrheliometer were made on very few days.

The usual data were supplied for publication in the *Weekly* and *Monthly Weather Reports*.

During the first half of the year a record was maintained of the amounts of rain received by two gauges (one unshielded, the other provided with Nipher Shield) situated in an exposed position to the north of the Observatory enclosure.

Atmospheric Electricity.—The photographic records from a Dolezalek electrometer connected to a water-dropper were maintained, but with rather more interruptions than during last year. There were occasions during the early part of the year when the action of the electrometer was unsatisfactory but the defects were finally remedied in August. Early in 1924 further improvement was effected by introducing a new suspension to the electrometer needle. To convert the curve readings into potential gradient in volts per metre above ground level in the open, factors based upon the results of absolute observations, usually made at least four times per month, were employed. Values of the potential gradient at 3h, 9h, 15h and 21h, G.M.T., on each day and at each hour on certain selected electrically quiet days were tabulated.

Seismology.—The Galitzin instruments, with galvanometric registration, recording disturbance in north, east and vertical directions continued in operation. There were several interruptions due to failure of the clockwork mechanisms of the recording drums, but it was generally possible to maintain records of the two horizontal components of disturbance. Steps have been taken to secure the repair of the original recording drum combinations, and it is hoped that in the very near future loss of record will be a rare occurrence.

Earthquake bulletins have been prepared and issued at intervals of three or four months to the British Association Seismological Committee, to the International Bureau at Strasbourg, and to various Observatories at home and abroad. An extension of this branch of the work is contemplated. Details of individual earthquakes have been communicated to the B. A. Committee from time to time and the number of communications with various individuals and institutions interested in seismology has increased. The measurement of micro-seismal amplitudes and periods was continued as in previous years.

ABERDEEN OBSERVATORY

The work at this Observatory is confined wholly to meteorology, and in equipment it ranks as a First Order Station. Continuous autographic records of pressure, temperature, humidity, rainfall, sunshine, wind direction and speed, are obtained, and are controlled by eye observations taken at 9h, 15h, and 21h. The Observatory also acts as a telegraphic reporting station.

During the year, a redetermination was made of the heights above M.S.L. of the "station level" and of the barometer cistern. The new determination differs from that formerly used by about 3 feet.

The vane of the Robinson-Beckley anemograph was removed and a vane of 3-ply wood was substituted. The cause of the sticking of the pen-rod of the pressure tube anemometer was investigated and cured by the application of a thin film of oil over rod and gland.

The observer at the Onich climatological station attended for training.

Owing to lack of time, the number of pilot balloon ascents was small, viz., 12. All were followed to at least the 2,000 feet level.

LERWICK OBSERVATORY

As stated in last year's Report, the regular recording work at this Observatory began on 1st January, 1923. The programme has been slightly altered since in order to concentrate attention on the magnetic work of the Observatory. During this first year's work, considerable difficulties have been encountered in the management of the magnetic recording instruments. To a considerable extent, if not wholly, these are due to damp in the magnetograph house. The concrete walls of this house are 3 feet thick, and having been thoroughly cooled down during winter, condense moisture on their inner surfaces during spring and summer. The damp has affected the vertical force instrument more than the others; this has been partially cured by the use of a drying agent in the instrument case, although discontinuities occur when the drying agent is renewed. In the case of the horizontal force instrument, damp appears to be the cause of a steady drift, which has been in progress for some months. The question of protecting the instruments from these influences is being carefully considered.

Absolute observations of declination, horizontal force, and dip have been made twice weekly throughout the year. Observations of auroral phenomena have been made whenever opportunity offered.

Under an arrangement with the Radio Research Board, facilities were given for a series of observations on W/T direction finding.

Climatological Stations.—The climatological station at Fort William came to an end on 31st May, 1923, and the Town Council found it impossible to continue the work which had been carried out for twenty years by a voluntary observer. To secure adequate representation of the area a new station, under the Forestry Commission (Scotland), was established near Onich. New municipal stations of the Health Resort class were organized at Banff, and at Berwick-on-Tweed, though for administrative purposes the latter was assigned to England. In the case of each of the three new stations the observer received a preliminary course of training at Aberdeen Observatory.

During the year the island of Tiree was visited in order to ascertain whether it would be possible to establish a climatological and telegraphic reporting station on the island. The subsequent action taken does not fall within the year under report.

The number of stations inspected during the year was 23.

Rainfall Stations.—Complete rainfall returns for 1922 were published for 785 stations, and about the same number will be available for 1923 as the gains about balance the inevitable losses. Very considerable correspondence has taken place with observers in order to clear up doubtful points, and there is on the whole an improvement in the quality of the observations. The general distribution still leaves much to be desired, but there has been some improvement in securing more adequate representation of thickly populated areas.

Library.—220 volumes, mostly of serials, were bound during the year.

CENTRAL OBSERVATORY, KEW OBSERVATORY, RICHMOND, SURREY.

Buildings.—As a preliminary to the transfer of the upper air work from Benson, an extension was made to the workshop building by H.M. Office of Works. Electricity, for power and illumination, was introduced into the building, a cable being laid across the Park.

Instruments and Instrumental Comparisons.—New equipment includes glass-blowing tools, a 150 volt dry battery for the new Benndorf electrograph (still remaining at the Observatory), two self-recording earth thermometers recording at depths of 4 and 12 inches, four bent mercury earth thermometers recording at 4, 6, 8 and 12 inches.

The following inter-comparisons of instruments have been continued :—

- (a) *Thermometer Screens.* Glaisher, North Wall, and Stevenson screens (at two levels).
- (b) *Grass Minimum Thermometers*, protected and unprotected.
- (c) *Anemometer Heads*, ordinary Dines, and two others.
- (d) *Sunshine recorders*, Swiss, modern English and Kew instrument.
- (e) *Earth Thermometers*, different kinds.

One of Mr. Reeve's azimuth reading instruments has been read regularly during most of the year.

Regular daily observations have been made with ventilated thermometers of Assmann's form, for comparison with the thermometers in the screens.

Another comparison with the coil magnetometer at the National Physical Laboratory was made in July, 1923.

At the end of October and beginning of November a comparison was made with the Greenwich magnetic instruments. Unifilar Dover 140 and dip circle Dover 74 (belonging to Eskdalemuir Observatory) were taken to Greenwich. At a subsequent date a more satisfactory declination comparison was made at Greenwich by the Greenwich staff by means of the unifilar magnetometer Casella No. 181, which had previously been carefully compared with the Kew standard at Kew.

In March, 1924, Mr. C. D. Stewart brought the magnetometer and dip circle, belonging to Valencia Observatory, to Kew, and a number of comparative observations with the Kew instruments were made by Mr. Stewart, Mr. Francis and the Superintendent.

Eye Observations and Observational Data.—The ordinary eye readings of the meteorological instruments have been made daily as usual at the statutory hours.

Fifty pilot balloon ascents were made on 21 days in connection with the international scheme, and on 33 days in connection with the Amundsen programme.

On days of bright sunshine pyrheliometric observations have been taken within half an hour of noon. Observations have been regularly made on the visibility of distant objects.

Absolute observations of potential gradient have been made in the garden on most fine days, and have been used to standardize the electrograph. Observations have also been made between 14½h and 15½h, G.M.T., of the air-earth electrical current with the Wilson apparatus, and of the ionic charges with the Ebert apparatus.

The magnetic elements, horizontal force, declination and inclination have been observed regularly, usually once a week, with the Jones magnetometer and the Barrow dip circle. On most occasions simultaneous observations of the horizontal force have been taken with the Dover Magnetometer No. 140.

Publication of the Results.—The results of the ordinary meteorological and magnetic observations have been published as usual.

A paper by Mr. R. E. Watson on the comparison of pyrheliometers, and one by the Superintendent on the daily range of magnetic declination, have appeared as *Geophysical Memoirs*. A paper by the Superintendent on the alleged 11-year period in atmospheric electricity has appeared in the *Proceedings of the Physical Society*, and he has also contributed an article on magnetic instruments and methods of observation to the *Dictionary of Applied Physics*, edited by Sir R. T. Glazebrook. A joint paper by Mr. R. E. Watson and the Superintendent on the relations between atmospheric pollution and potential gradient has been read to the Royal Society.

Verification Work.—In addition to various instruments intended for use in the Meteorological Office there have been tested 4 unifilar magnetometers with their magnets, one dip circle, 19 dip needles and an azimuth needle.

Instruction to Observers.—A class for observers at health resorts was conducted in April, 1923.

Miscellaneous.—In September the Superintendent attended the meeting in Utrecht of the International Meteorological Committee's Commission for Terrestrial Magnetism, and was elected president, in succession to Professor E. Van Everdingen.

The magnetic observations below and above ground at the Sandwell Park Colliery, near Birmingham, referred to in last year's report, have been concluded, and the apparatus has been brought back to Kew.

KEW OBSERVATORY. UPPER AIR SECTION.

Benson Observatory was closed on September 30th and the whole of the upper air work transferred as an independent unit to Kew Observatory.

The workshop buildings at the latter were enlarged in anticipation during the summer of 1923, and electric power and light laid on. A number of machine tools were installed by the Works and Buildings Department after the transfer, and for the first two months the greater part of the activities of the workshop staff were directed to fitting up the new workshop in a convenient manner.

A separate laboratory and office has been fitted up in another existing building, and the apparatus for the calibration of balloon meteorographs installed therein. The necessary vacuum has been provided by means of a pipe laid underground from a power driven pump in the workshop.

The normal work of the station at Benson was carried on until the transfer, but an unusually large number of balloons were lost during the summer. During the autumn comparatively few ascents were made, but of these many were lost also.

In December a course of instruction in the technique of ballon-sonde work was given to Capt. Jackson, of Shotwick, and since that time the Upper Air Section at Kew Observatory and the Distributive station at Shotwick have both held themselves in readiness to make ascents at short notice on the prescribed days. The choice of station has been made at as late an hour beforehand as possible (in general after consultation with the Forecast Division), with a view to reducing the risk of losing the instrument through falling into the sea. There have been a few failures in this method of working, but on the whole it has been very satisfactory.

The total number of balloons sent up during the year was 53, of which only 31 instruments were returned. Two records, though received back, were almost useless from various accidental causes, making a total of 29 successful ascents. A few of the soundings reached as high as 18 kms., but owing to trouble with bad balloons a number of very poor heights were also recorded. During the latter part of the year some larger balloons have been employed and better average heights obtained with them.

Several meteorographs have been supplied by outside firms to the designs prepared by the Upper Air Section. So far there has been a good deal of difficulty in getting really first class instruments made other than in the official workshop.

A great deal of time has been devoted to experimental work on the question of the accuracy of the pressure record of the balloon meteorograph. Many difficulties were encountered and had to be overcome before reliable data could be obtained. Finally it was found that if the instruments are well seasoned by repeated pressure reductions before being used, the pressure record on the up trace is reasonably reliable, but that on the down trace there is considerably more lag than had before been suspected.

Many attempts have been made to produce an aneroid box not subject to this defect, but so far without success. As a result of the work, however, precise methods of testing have been evolved, by which the fitness of any particular meteorograph for its intended purpose can be much more quickly and certainly determined than was formerly the case. In other ways also several small improvements have been effected in the design.

Designs of several pieces of apparatus have been prepared, and several instruments have been made or repaired for other departments of the Meteorological Office.

Very little statistical work has been done during the year, other than the normal routine.

VALENCIA OBSERVATORY, CAHIRCIVEEN, CO. KERRY.

At the commencement of the period covered by the present report the southern portion of Kerry was still suffering to a large extent from the consequences of the disturbances which had occupied such a prominent place in Irish affairs in 1922. The hilly districts around Cahirciveen were still the resting place of armed irregular forces in

considerable numbers, and the town was still isolated except for the calling of an occasional coasting steamer. The Observatory was able to send its usual telegraphic reports to the Air Ministry but only through the wireless station at Valencia, some delay in transmission frequently arising in consequence. It had already become evident, however, that a return to conditions more nearly normal would not long be delayed; in fact, from the middle of April, when postal communications were first restored by a road service working three times a week, a steady improvement was effected, the resumption of a daily post, though still by road, and later the restoration of land telegraphic communication, being followed at the end of May by the re-opening of the railway after a suspension of trains which had lasted for close upon ten months. The arrangement by which the Observatory receives the Greenwich time signal at 10h daily was not revived until the end of September, but with this exception it may be said that the Observatory has been working under normal conditions since June, 1923.

It is a matter for satisfaction that during the whole of the time in which these considerable difficulties were experienced no observation was missed and no record was lost from an autographic instrument except through failure of the instrument. There was some anxiety on several occasions with regard to the renewal of the stocks of charts for the self-recording instruments; in the case of the sunshine recorder it became necessary to postpone the seasonal change of cards, and charts for the float barograph had each to be used for two days for a time, but with these exceptions the necessary supplies were obtained in time although the margin was uncomfortably small.

The work of the Observatory, including that of telegraphic reporting, continued uninterrupted throughout the year. In March the inspection of Irish telegraphic reporting stations by the Superintendent was resumed, this being a branch of the work which it had not been possible to carry out for some years.

Meteorological Routine.—The Observatory has been maintained as a first order meteorological station, keeping as far as possible a continuous record of the weather. Regular eye observations, including weather and sky, have been made eight times daily between 7h and 21h. Telegraphic reports have been made five times daily to the Forecast Division on weekdays and four times on Sundays. Cloud observations with the Besson-Comb Nephoscope have been made regularly throughout the year.

The records of the mountain raingauge at the Cahirciveen Waterworks have been obtained without interruption.

The self-recording equipment has been maintained in full operation save for a few unimportant stoppages which did not affect the work of making out the usual returns and summaries. The Robinson Cup Anemometer, which had lost two cups in a gale in February, 1923, was repaired on the 7th May, 1923, and has since been maintained in good working order.

Tabulation has been kept up to date and the hourly values of temperature, humidity, pressure, wind (two anemometers), rain and sunshine have been computed and checked. The hourly values for 1922, together with other meteorological and magnetic information and a short discussion, have been prepared for *The Observatories' Year*

Book. Information as to rainfall, both at the Observatory and the waterworks, has been supplied monthly to the Irish Rainfall Organization.

Instruments and Instrumental Investigations.—Measurements of rainfall with differently exposed raingauges continue. A considerable amount of information is now available and an examination of the records is being made, with the object of obtaining experimental evidence of the effect of exposure on the amount of rain measured. The evaporation tank and the Piché evaporimeter continue in use, the former without appreciable leak. During the time when no time signals were being received, approximate measurements of the rate of the Observatory chronometer were obtained from meridian observations of the sun.

Pilot Balloons.—Pilot balloon observations were made less frequently than in previous years, only 102 ascents being carried out. In present conditions, with a semi-permanent vacancy on the staff of the Observatory, these observations are confined to days of international co-operation and days on which the weather is such as to give a reasonable expectation of a fairly long ascent.

Terrestrial Magnetism.—Absolute observations of magnetic declination, horizontal force and inclination have been made weekly throughout the year. During March an inter-comparison between the Valencia and Kew magnetic instruments was made at Kew.

METEOROLOGICAL OFFICE, MALTA.

The second year's work consisted mainly of issuing reports and forecasts for the Malta area to the Navy and the Air Force, broadcasting observations thrice daily for international information, and testing methods of improving the forecasts. Special reports also were supplied on various occasions, chiefly to the Navy. The routine of the office ran smoothly and the progress of the forecast work which formed the principal part of the routine was satisfactory. The present position in regard to forecasts is indicated by the following figures which, give the percentage success obtained.

			Summer, 1923.	Winter, 1923-4	
				Morning	Evening
Wind direction	..	..	86	83	79
Wind velocity	..	..	79	79	74
Cloud amount	..	..	82	62	64
Visibility	..	..	85	87	78
Sea disturbance	..	..	79	85	80
Averages	..	..	82	79	75

Some active interest was taken in the work towards the end of the year by officers of the Navy.

The greatest progress to be recorded for the year occurred in connection with meteorological communications in the Mediterranean. The amount of information normally available for the daily working charts showed a very marked increase, and the extent of the blank areas on the charts was reduced by about half. The officer in charge of the Air Force W/T stations co-operated in the work very cordially, and the office is greatly indebted to him for the flexibility of the W/T arrangements, which made it possible to receive new issues promptly and to follow the modifications of existing ones, which were frequently made without notice.

Working arrangements with the University Observatory operated with perfect smoothness, thanks to the unfailing courtesy of Professor Agius. The freedom of access to the observatory records and to continental publications not available in the office library was of great assistance in investigational work.

Facilities for investigational work in the office itself increased considerably, chiefly through the presentation of past issues of their daily reports by continental meteorological offices. There were encouraging and very useful increases also in the meteorological literature received by the library.

The work was carried on during the year in the quarters which were acquired at short notice on the arrival of the staff at Malta last year. The comparative inaccessibility of the situation for persons wishing to make inquiries or to see the work, was, however, increasingly felt, and efforts are now being made to obtain in Valletta accommodation which will be satisfactory as permanent quarters.

Reception of Information.—In April, 1923, the office was provided with its own receiving W/T aerial. This was a very great advance and saved the delays and errors involved in forwarding by telephone the messages received by the Air Force Station at Calafra. It became possible also, except when special work was in progress at Calafra, to receive messages which overlapped each other.

The year was one of numerous changes in W/T issues, chiefly in the direction of increases, and the office was able to benefit by about half of these. The information available for the daily charts was much improved by the development of the W/T issues of Egypt, Greece, Italy and Syria. These, particularly that of Italy, had been greatly needed on many occasions.

Towards the end of the year weather signals began to be received from French ships by retransmission through Bizerta and Toulon, but on the whole the information from the sea area, Tripoli and the Balkans was scanty. It is hoped that the year 1924-5 will see some improvement in this respect, as each of these areas, according to the prevailing type of weather, is from time to time of great importance.

Considerable changes occurred in the French arrangements for broadcasting from North Africa, and these affected the reception of the information at Malta somewhat adversely.

Distribution of Information.—The broadcasting of the meteorological reports for international use was transferred from the Navy station at Rinella to the new Air Force station at Calafra in May. The chief change during the year in the information issued was the introduction in July of an additional broadcast of the observations made at 1300, G.M.T. The routine reports and forecasts sent morning and evening

to the Navy and the Air Force were continued with little alteration. Requests for special reports on the part of the Navy showed an increase over last year, while those of the Air Force diminished. The issue of forecasts to the Navy for sections of the Mediterranean other than that immediately surrounding Malta, which was mentioned in last year's report, proved on testing to be not justified by the success to be anticipated, and the issue of a printed Daily Weather Report was also postponed, pending further developments.

Investigations.—Two experimental sets of forecasts were made and analysed. The first aimed at providing the Navy with forecasts for various sections of the Mediterranean, and the second at increasing the period of the forecasts to 24 hours. The forecasts actually issued during the year referred only to the Malta area and covered a period of 12 hours. The results of these experiments were not satisfactory, and show that the time has not yet come for the issue of such extended forecasts.

In addition to these experiments, which were brought to a conclusion, several other pieces of work were taken in hand. The examination of the relations of cloud and rainfall to wind direction made considerable progress. These relations introduce modifications into the weather accompanying given distributions of pressure, and the work is therefore of direct importance in connection with the forecasting. Some progress was made with the discussion of the upper winds at Malta, and also, towards the end of the year, with work on the nature of the north-east gales known locally as "gregale." An examination of the applicability to the Mediterranean of the method of forecasting employed by the French Meteorological Office was in hand at the close of the year.

Library.—The number of publications added during the year was approximately 100. They included papers on various meteorological investigations from the meteorological services of:—

Algeria	France	Italy	Spain
Austria	Germany	Norway	Switzerland,
Egypt	Greece	Roumania	

and private gifts from Lieut.-Commander Francis Crowther, D.S.C., R.N., M.E.G. Mariolopoulos, and Lieut.-Colonel Gold, D.S.O.

In addition, past and current copies of weather reports were sent by:—

Algeria	Egypt	Hungary	Switzerland
Cyprus	France	Italy	Syria.
Czecho-Slovakia	Germany	Roumania	

The following periodicals were received from 1st January, 1924, after circulation through several stations in Great Britain:—

Nature.

Philosophical Magazine.

Meteorologische Zeitschrift.

and the *Marine Observer* was supplied direct.

The shortage of works of reference and the distance of the office from the Headquarters library in London was felt from time to time as somewhat of a handicap on investigational work.

Staff.—The two airmen attached for training in the early part of the year rejoined their unit in May.

In the last month of the year the staff was brought up to its full sanctioned strength by the appointment of a second Technical Assistant recruited locally. As the hours of work (0645 to 1930) involve dividing the staff, in order to provide for morning and evening reports, this appointment enabled the duties to be made more regular. It also enabled increasing progress to be made with those investigations involving much tabulation.

PUBLICATIONS

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, 1924).

Monthly Meteorological Charts of the North Atlantic Ocean (publication ceased with the issue for December, 1923).

Monthly Meteorological Charts of the East Indian Seas (publication ceased with the issue for December, 1923).

The Marine Observer (to date). (Commenced with the issue for January, 1924.)

The Meteorological Magazine (to date).

The British Meteorological and Magnetic Year Book :—

Part III. (2) **Geophysical Journal**. Daily Readings in meteorology and terrestrial magnetism and the results of observations in the upper air. Volume for 1921 issued.

Part IV. **Hourly Values from Autographic Records**. Hourly Values for terrestrial magnetism, atmospheric electricity and meteorology for five observatories. Volume for 1920 issued.

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. 1915 volume (in the press).

British Rainfall, 1922. A report on the distribution of rain in space and time over the British Isles during the year 1922, as recorded by more than 5,000 observers.

Ninth Report of the Committee for the Investigation of Atmospheric Pollution. Report on observations for the year ending 31st March, 1923 (in the press).

Southport Auxiliary Observatory. Annual Report and results of meteorological observations for the year 1922. By Joseph Baxendell.

OCCASIONAL.—**Particulars of Meteorological Reports issued by Wireless Telegraphy in Great Britain and the countries of Europe and North Africa**. Second Edition, 1923 (also Supplements 1 to 3).

Professional Notes :—

No. 31. **The Relation between the Height reached by a Pilot Balloon and its Ascending Velocity**. By J. Wadsworth, M.A.

No. 32. **A note on the Upper Air Observations taken in North Russia in 1919**. By W. H. Pick, B.Sc.

No. 33. **The Diurnal and Seasonal Variations of Fog at certain stations in England**. By F. Entwistle, B.Sc.

Geophysical Memoirs :—

No. 20. **Variations in the Levels of the Central African Lakes, Victoria and Albert**. By C. E. P. Brooks, M.Sc.

No. 21. **Pyrheliometer Comparisons at Kew Observatory, Richmond, and their bearing on data published in the Geophysical Journal**. By R. E. Watson, B.Sc.

No. 22. **Absolute Daily Range of Magnetic Declination at Kew Observatory, 1858–1900**. By C. Chree, Sc.D., LL.D., F.R.S.

The Book of Normals of Meteorological Elements for the British Isles.

Section IV (a). **The Range of Variation of Temperature and Rainfall**. (b) **Frequency Tables for Hail, Thunder, Snow, Snow Lying and Ground Frost**.

Other publications for which authority has been given and which are in preparation, or in the press, are as follows :—

The British Observatories Meteorological and Geophysical Year Book from 1922 (in continuation of the Geophysical Journal and Hourly Values at Meteorological Stations).

Professional Notes :—

No. 34. How to observe the Wind by Shooting Spheres Upward. By L. F. Richardson, B.A., F.Inst.P.

No. 35. Report on Observations of 'Atmospheric Electricity and Terrestrial Magnetism made at Kew, Stonyhurst and Eskdalemuir Observatories on the occasion of the Solar Eclipse, April 8th, 1921. By C. Chree, Sc.D., LL.D., F.R.S., and A. Crichton Mitchell, D.Sc.

No. 36. On the Inter-Relation of Wind Direction with Cloud Amount and Visibility at Cahirciveen, Co. Kerry. By L. H. G. Dines, M.A., A.M.I.C.E., and P. I. Mulholland, B.Sc.

No. 37. Pressure Type in Relation to Fog Frequency at Scilly during the Summer Months. By E. G. Bilham, B.Sc., D.I.C.

Geophysical Memoirs :—

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

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

The Book of Normals of Meteorological Elements for the British Isles.

Section V. Monthly Normals for Rainfall Stations.
Hygrometric Tables.

The publication of the following papers, etc., may also be mentioned :

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

Problems of hydron and water: the origin of electricity in thunderstorms. *Nature* 112, p. 620.

Thunderstorms and globular lightning. *Nature* 112, pp. 727-728.

Thunderstorms, mammato clouds, and globular lightning. *Nature* 113, p. 82.

By Charles Chree, Sc.D., F.R.S.—

Aurora and allied phenomena. *Q. J. R. Met. Soc.* 49, pp. 67-74.

Magnetic phenomena in the region of the South Magnetic Pole. *Proc. R. Soc.* 104, pp. 165-191.

Solar activity and atmospheric electricity. *Nature* 112, pp. 361-362.

By C. Chree, Sc.D., F.R.S., and R. E. Watson, B.Sc.—

Atmospheric pollution and potential gradient at Kew Observatory, 1921 and 1922. *Proc. R. Soc.*, 105, pp. 311-333.

By E. Gold, D.S.O., F.R.S.

Reform of the Calendar. *Q. J. R. Met. Soc.*, 49, pp. 147-151.

Formation of mammato-cloud. *Nature* 113, pp. 235-236.

By David Brunt, M.A., B.Sc.—

Physics of the atmosphere. *Dict. App. Phys.* Vol. III, pp. 22-44.

The dynamics of cyclones and anti-cyclones regarded as atmospheric vortices. *Proc. R. Soc.*, 105, pp. 70-80.

By Richard Corless, O.B.E., M.A.—

Meteorological instruments. *Dict. App. Phys.* Vol. III, p. 487-517.

By A. Crichton Mitchell, D.Sc., F.R.S.E.—

Seismometry (in collaboration with J. J. Shaw). *Dict. App. Phys.* Vol. III, pp. 735-741.

By M. de Carle S. Salter and J. Glasspoole. M.Sc.

The fluctuations of the annual rainfall in the British Isles considered cartographically. *Q. J. R. Met. Soc.* 49, pp. 225-229.

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

The disturbance of the uniform temperature of the stratosphere by the vertical displacement associated with horizontal motion governed by the "Geostrophic Law." *Phil. Mag.* 45, pp. 778-782.

Meteorological optics. *Dict. App. Phys.* Vol. III, pp. 518-533.

Determination of the temperature of the upper atmosphere by meteor. observations. *Nature* 112, p. 759.

A limit gauge for rainfall. *Q. J. R. Met. Soc.* 50, pp. 23-24.

By C. E. P. Brooks, M.Sc.—

Weather influences in the British Isles. *Nature* 112, pp. 834-836.

The difference-periodogram—a method for the rapid determination of short periodicities. *Proc. R. Soc.* 105, pp. 346-359.

By L. H. G. Dines, M.A.—

An examination of British upper air data in the light of the Norwegian theory of the structure of the cyclone (in collaboration with W. H. Dines, F.R.S.). *Q. J. R. Met. Soc.* 49, pp. 167-176.

Can a geostrophic term account for the angular momentum of a cyclone. *Nature* 112, p. 473.

By M. A. Giblett, M.Sc.—

The thunderstorm of July 9-10 over Southern England. *Nature* 111, pp. 113-114.

The effect of the rolling of a ship on the readings of a marine mercury barometer. *Phil. Mag.* 46, pp. 707-716.

Upper air conditions after a line squall. *Nature* 112, pp. 863-864.

By W. H. Pick, B.Sc., and S. P. Peters, B.Sc.—

A note on the vertical visibility (estimated looking downwards) at Cranwell during the period February, 1922, to June 1923. *Q. J. R. Met. Soc.* 50, pp. 53-56.

By C. K. M. Douglas, B.A.—

Formation of mammato-cloud. *Nature* 113, p. 462.

By Sachindra Nath Sen, M.Sc., A.Inst.P.—

On the distribution of air density over the globe. *Q. J. R. Met. Soc.* 50, pp. 29-51.

By A. W. Lee, M.Sc., A.Inst.P.—

The relation of the circulation in the upper air to a circumpolar vortex. *Q. J. R. Met. Soc.* 50, pp. 69-74.

By O. F. T. Roberts, B.A.—

The theoretical scattering of smoke in a turbulent atmosphere. *Proc. R. Soc.* 104, pp. 640-654.