

M.O. 274.

FOR OFFICIAL USE.

ANNUAL REPORT
OF THE
METEOROLOGICAL COMMITTEE

TO
THE AIR COUNCIL
For the Year ended 31st March, 1925

(The Seventieth Year of the Meteorological Office).



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METEOROLOGICAL COMMITTEE,

1924-25

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.

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† Captain H. P. DOUGLAS, C.M.G., R.N. Hydrographer of the Navy. Nominated by the Admiralty.

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.

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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.

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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.

Secretary :—Mr. D. BRUNT, M.A.

* Up to October, 1924. † From October, 1924.

COMMITTEE OF THE METEOROLOGICAL OFFICE, EDINBURGH

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

Professor H. S. ALLEN, M.A., D.Sc., F.Inst.P. Nominated by the University of St. Andrews.

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

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, 1925

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-CONYNTHAM.

Dr. J. H. JEANS.

Sir ARTHUR SCHUSTER.

Sir NAPIER SHAW.

Dr. G. C. SIMPSON.

Professor G. I. TAYLOR.

ADVISORY COMMITTEE ON ATMOSPHERIC POLLUTION

| | | | | |
|--|----|----|----|---|
| Dr. G. C. SIMPSON, C.B.E., F.R.S. (<i>Chairman</i> , 1925). | | | | |
| Dr. T. L. BAILEY (<i>Chief Alkali Inspector</i>). | | | | |
| Professor H. B. BAKER, F.R.S., C.B.E. (<i>Royal College of Science</i>). | | | | |
| Captain C. J. P. CAVE. | | | | |
| Mr. J. G. CLARK, F.I.C. | | | | |
| Professor J. B. COHEN, F.R.S., Ph.D., B.Sc. (<i>Professor of Organic Chemistry, Leeds University</i>). | | | | |
| Dr. H. A. DES VOEUX (<i>Chairman, Coal Smoke Abatement Society</i>). | | | | |
| Dr. MARGARET FISHENDEN (<i>Fuel Research Board</i>). | | | | |
| Dr. J. S. OWENS (<i>Hon. Secretary</i>). | | | | |
| Sir JOHN RUSSELL (<i>Director of Rothamsted Experimental Station, Harpenden</i>). | | | | |
| Sir NAPIER SHAW, F.R.S. (<i>Chairman to Jan., 1925</i>). | | | | |
| Mr. W. B. SMITH (<i>Member of Departmental Committee on Smoke Abatement</i>). | | | | |
| Mr. F. J. W. WHIPPLE (<i>Superintendent British Rainfall Organization, Meteorological Office</i>). | | | | |
| Dr. JOHN ROBERTSON | .. | .. | .. | Nominated by Corporation of Birmingham. |
| Mr. G. P. MITCHELL | .. | .. | .. | Corporation of Blackburn. |
| Mr. J. K. BEST | .. | .. | .. | Messrs. Cadbury Bros. |
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| Professor W. HALDANE GEE | .. | .. | .. | Corporation of Manchester. |
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| Dr. J. B. WILKINSON | .. | .. | .. | Corporation of Oldham. |
| Dr. J. R. ASHWORTH | .. | .. | .. | Corporation of Rochdale. |
| Dr. F. HAUXWELL | .. | .. | .. | Corporation of St. Helens. |
| Mr. J. BAXENDELL | .. | .. | .. | Corporation of Southport. |
| Mr. J. FYFE | .. | .. | .. | Corporation of Stirling. |

THE STAFF OF THE METEOROLOGICAL OFFICE, ITS OBSERVATORIES AND BRANCHES, MARCH, 1925

THE STAFF AT HEADQUARTERS

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

Assistant Directors .. R. G. K. Lempfert, C.B.E., M.A.
E. Gold, D.S.O., F.R.S.
Senior Professional Assistant Miss E. E. Austin.

GENERAL SERVICES DIVISION

Chief Clerk H. L. B. Tarrant.
Clerk, Grade I R. Pyser.
Clerks, Grades II & III .. 9
Officekeeper 1

LIBRARY

Senior Professional Assistant M. T. Spence, B.Sc.
Clerks, Grade III 3

MARINE DIVISION

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Senior Professional Assistants C. S. Durst, B.A.; J. Hennessey, Lt.-Cdr.,
R.N.R., R.D.
Clerk, Grade I H. Keeton.
Clerks, Grades II & III .. 10

FORECAST DIVISION

Superintendent J. S. Dines, M.A.
Assistant Superintendents.. J. Crichton, M.A., B.Sc.; C. K. M. Douglas,
B.A.; E. V. Newnham, B.Sc.
Senior Professional Assistants 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.
Junior Professional Assistants J. E. Belasco, B.Sc.; W. J. Grassick, M.A.;
W. H. Pearce, B.Sc.
Clerk, Grade I W. Hayes.
Clerks, Grades II & III .. 20
Telephone-Typists 8

CLIMATOLOGY DIVISION

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

| INSTRUMENTS DIVISION | | |
|---|-------|---|
| <i>Superintendent</i> | .. .. | E. G. Bilham, B.Sc., A.R.C.S., D.I.C. |
| <i>Senior Professional Assistant</i> | .. .. | S. N. Sen, Ph.D., 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>Storeman, Packer and Porter</i> | .. .. | 3 |
| ARMY SERVICES DIVISION | | |
| <i>Superintendent</i> | .. .. | D. Brunt, M.A., B.Sc. |
| LOCAL CENTRES DIVISION | | |
| <i>Superintendent</i> | .. .. | F. Entwistle, B.Sc. |
| <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 & 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, Ph.D., A.I.C. |
| <i>Clerk, Grade I</i> | .. .. | A. T. Bench. |
| <i>Clerks, Grades II & 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. (retd.). |
| AIRSHIPS DIVISION (see also Pulham). | | |
| <i>Superintendent</i> | .. .. | M. A. Giblett, M.Sc. |

THE STAFF AT OBSERVATORIES AND BRANCH ESTABLISHMENTS

| METEOROLOGICAL OFFICE, 10, Rothesay Place, EDINBURGH | | |
|--|-------|--|
| <i>Superintendent</i> | .. .. | A. H. R. Goldie, M.A. |
| <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. Murreles, 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 & III</i> | .. .. | 5 |
| <i>Caretaker and Handyman</i> | .. .. | 2 |
| 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 and Carpenter</i> | .. .. | 2 |
| 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 A. W. Lee, M.Sc., A.R.C.S., D.I.C., A.Inst.P.
Clerks, Grade III 2
Caretaker 1

PORT METEOROLOGICAL OFFICE, Liverpool

Senior Professional Assistant M. Cresswell, Lt.-Cdr., 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, SHOEBOURNE

Senior Professional Assistant C. E. Britton, B.Sc.
Junior Professional Assistant M. J. Thomas, B.Sc.
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, Grades II & III .. 5

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 C. V. Ockenden, B.Sc.
Clerks, Grades II & III .. 4

CASTLE BROMWICH

Clerks, Grade III 1

CATTEWATER

Clerks, Grades II & III .. 2

CRANWELL

Assistant Superintendent .. W. H. Pick, B.Sc.
Junior Professional Assistant One vacancy.
Clerks, Grades II & III .. 4 (one vacancy).

CROYDON

| | |
|---------------------------------------|--------------------------------------|
| <i>Senior Professional Assistants</i> | G. R. Hay, M.A. ; N. H. Smith, B.Sc. |
| <i>Clerks, Grades II & III ..</i> | 7 |
| <i>Telephone-Typists</i> | 2 |

FELIXSTOWE

| | |
|---------------------------------------|-------------------|
| <i>Senior Professional Assistant</i> | C. W. Lamb, B.Sc. |
| <i>Clerks, Grades II & III ..</i> | 2 |

HOLYHEAD

| | |
|---------------------------------------|---|
| <i>Clerks, Grades II & III ..</i> | 3 |
|---------------------------------------|---|

LEUCHARS

| | |
|--------------------------------------|------------------------|
| <i>Senior Professional Assistant</i> | W. Gillon, M.A., B.Sc. |
| <i>Clerks, Grade III</i> | 2 |

LYMPNE

| | |
|---------------------------------------|----------------------|
| <i>Senior Professional Assistant</i> | R. M. Stanhope, B.A. |
| <i>Clerks, Grades II & III ..</i> | 6 |

PULHAM

| | |
|--------------------------------------|---------------------|
| <i>Senior Professional Assistant</i> | S. P. Peters, B.Sc. |
| <i>Clerks, Grade III</i> | 2 (one vacancy). |

RENFREW

| | |
|--------------------------------------|------------------------------|
| <i>Senior Professional Assistant</i> | J. J. Somerville, B.A., B.L. |
| <i>Clerks, Grade III</i> | 2 |

SEALAND

| | |
|---------------------------------------|-----------------------|
| <i>Senior Professional Assistant</i> | H. F. Jackson, M.S.E. |
| <i>Clerks, Grades II & III ..</i> | 3 |

SOUTH FARNBOROUGH

| | |
|---------------------------------------|----------------------------|
| <i>Senior Professional Assistant</i> | H. St. G. Dyke-Marsh, B.A. |
| <i>Clerks, Grades II & III ..</i> | 3 |

SECONDED FOR DUTY WITH OTHER BODIES

| | |
|---------------------------------------|--|
| <i>Assistant Superintendent ..</i> | R. A. W. Watt, B.Sc., A.M.I.C.E. (Department of Scientific and Industrial Research). |
| <i>Senior Professional Assistants</i> | F. J. Herd, A.M.I. Radio E. (Department of Scientific and Industrial Research). |
| | N. K. Johnson, M.Sc., A.R.C.S. (War Office, Porton Experimental Station). |
| | E. L. Davies, M.Sc. (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, 1925 (the seventieth year of the Meteorological Office).

The Meteorological Committee met three times during the year: on July 9th, November 12th, 1924, and March 11th, 1925. On 1st October, 1924, Rear-Admiral Learmonth severed his connexion with the Meteorological Committee on his retirement from the office of Hydrographer of the Navy. He has been a member of the Committee since October, 1919, and has taken great interest in the work. The Meteorological Office owes a great deal to Admiral Learmonth's cordial co-operation and the Committee wish to record their appreciation of his services. The new Hydrographer, Captain Douglas, joined the Committee as Admiral Learmonth's successor.

"The Marine Observer."—It is now possible to estimate the value of this new magazine which was commenced during the previous year. There is no doubt that it has been much appreciated by seamen and has stimulated the interest of the observer at sea. A gratifying number of contributions have been received from the observers and one of its most popular features is "The Marine Observer's Log" which is composed entirely of such contributions and extracts from reports received. Each month the *Marine Observer* contains a list of the observing ships, their commanders and observing officers, with acknowledgments of logs and registers and reports received and this has simplified the administrative work in the Marine Division and reduced correspondence.

Co-operation with the United States of America.—There has always been a cordial relationship between the American and British Meteorological Services, but it is only in recent years that it has been possible to co-operate in the daily weather work. In the *Annual Report* for 1922-23 (pp. 11 and 27) the arrangements by which the Washington Weather Bureau sends to Europe daily by wireless telegraphy a message giving meteorological data from a number of stations in North America, were described. This message made it possible to publish daily in London a chart of weather covering North America,

the North Atlantic and Europe. During the year under review another important step forward was taken. The information received from ships in the North Atlantic ceased as each ship got out of range of the British wireless stations. Under the new arrangements, which came into operation on August 15th, 1924, the observing ships, when west of longitude 40° W., send their messages to the coast wireless station of the U.S. Navy which forwards them to Washington where they are added to the next message to Europe. Here they are received at Lyons and broadcast from the Eiffel Tower with the other data from America. By this means information becomes available from another large blank area on our charts. Great Britain, with all other European nations, is much indebted to the United States for supplying this important information at their own expense.

Upper Air Temperatures—the Meteorological Flight.—Meteorological research points more and more to the importance of knowing the conditions in the upper atmosphere. This information has been gained in the past mainly from the ascents of small free balloons carrying meteorological instruments. This method, which is relatively cheap, has the disadvantage that the information does not become available until the instrument has been found, returned to the station from which the ascent was made and the record reduced. As this generally takes several days, the observations are of little value for day to day forecast work. The only quick way of getting the information required is by aeroplanes. The Meteorological Office has been indebted to the R.A.F. and to the Royal Aircraft Establishment in the past for many records of upper air temperatures taken when opportunity offered, but this did not give the regular series of observations which is so necessary. To meet this need a special R.A.F. Meteorological Flight of two aeroplanes with the necessary personnel was established on November 1st, 1924. At first it was stationed at Eastchurch at the mouth of the Thames, but later was transferred to Duxford in Cambridgeshire. Whenever the weather permits ascents are made, generally once a day but sometimes twice a day, heights of 15,000 feet being reached frequently and of 17,000 feet occasionally. The results obtained are not only valuable for the forecast work but in addition they provide information of the greatest importance for the artillery work at Shoeburyness, which had previously been obtained at great expense by means of a kite balloon.

Meteorology for the R.A.F.—The rapid growth of the R.A.F., especially in connexion with the Home Defence Force, has made it necessary to re-consider the needs of service aviation for meteorological information. The problem is not a simple one and is different from the corresponding problem connected with civil aviation which has been solved so far as the continental routes are concerned. The Chief of the Air Staff therefore asked the Director and Group Captain C. L. N. Newall, to prepare a report after visiting a number of aerodromes and consulting the officers concerned. Visits were made to the service aerodromes at Andover, Cranwell, Sealand and Calshot, and a number of R.A.F. Officers interviewed; a visit was also paid to Croydon where the arrangements for civil aviation were examined and the use made of the facilities discussed with the civil pilots.

Meteorologists with experience in the late war were also consulted. As a result a report was prepared which was subsequently approved by the Chief of the Air Staff and sanctioned by the Treasury. The chief proposals are the following :—

- (a) The establishment at the Air Ministry of a Division of the Meteorological Office which will be prepared at any time during day or night to give on demand information regarding the weather, from the point of view of flying, for any route within the British Isles.
- (b) The establishment of Distributive Stations with the necessary personnel for giving meteorological advice at or near all aerodromes where the following types of units are stationed :
 - (1) Night Bombing Squadrons.
 - (2) Flying Training Schools.
 - (3) Flying Boat Flights.

The first of these (a) is to be carried through during the year 1925–26 and the second (b) is to be spread over three years and will entail the establishment of three new Distributive Stations, and the removal of others.

Airship Meteorology.—The decision to proceed with the development of airships and ultimately to establish a regular airship service between England and India, made new demands on the Meteorological Office. Several entirely new problems had to be solved, chief amongst which may be mentioned : the best method to supply the navigating officers with meteorological information before and during flight ; the effect of meteorological factors on airships ; the meteorological conditions likely to be met with between England and India ; the best route to be followed from a meteorological point of view. To meet these needs a new Division of the Meteorological Office was established in January, 1925. At present the personnel consists of a Superintendent, a Senior Professional Assistant and two Grade III clerks. As the service develops it is anticipated that it will be necessary to increase this staff, especially if it is found necessary to establish permanent meteorological stations along the route. Further particulars regarding the work of the Division will be found on page 47.

Magnetic Work at Kew Observatory.—In view of the increasing disturbance due to electric railways, the approaching retirement of Dr. Chree, and the development of other branches of scientific work, it was decided to terminate the work on terrestrial magnetism at Kew Observatory on 31st December, 1924. Magnetic work commenced at Kew in 1850, the effects of the electric trains commenced to be serious in 1901 and in 1907, the Eskdalemuir Observatory was built in Scotland to carry on the magnetic record at a site likely to remain free from interference in the future. The magnetic observatory associated with Greenwich Observatory will continue to provide magnetic data for south-east England and the Astronomer Royal has kindly undertaken to carry on at that Observatory certain parts of the magnetic work formerly performed at Kew.

International Commission for Air Navigation.—A meeting of this Commission was held in Paris in October, 1924, while the Meteorological Sub-Commission, of which Lieut.-Colonel E. Gold is chairman, met in Paris in June and December, 1924.

The Sub-Commission decided at its meeting in December, that those States which had not yet submitted their observations on the revised draft of the Meteorological Annex of the Convention (Annex G) should be invited to do so before the end of February, 1925, and that the final draft of the Annex should then be prepared with a view to its approval by the Commission itself in October, 1925.

The Sub-Commission also, in conjunction with the Operational and Materials Sub-Commission, reached agreement on the value of temperature at different heights and of pressure and density at sea level which should be taken as the basis for the graduation of altimeters and generally as the standard to which measurements made in aircraft should be reduced for International inter-comparisons. The standard values adopted are briefly :—

| | | | | |
|-------------|----|----|----|---|
| Temperature | .. | .. | .. | 15°C. |
| Pressure | .. | .. | .. | 1013·2 mbs. |
| Density | .. | .. | .. | 1225·7 grammes per cubic metre at Mean Sea Level. |

| | | | |
|---------------------------|----|--------|---|
| Lapse rate of temperature | .. | 6·5°C. | per kilometre from Sea Level up to 11 kms. ; above 11 kms. tem- perature is assumed to be constant. |
|---------------------------|----|--------|---|

The atmosphere is assumed to be dry and of the same chemical composition at all altitudes.

The value of gravity, *g*, is taken to be constant and equal to 980·62 in c.g.s. units.

The Meteorological Sub-Commission considered also the question of the computation of an index figure of fitness for flying for purely statistical purposes, but it was not possible to reach agreement and it was decided that, in the meantime, the meteorological information contained in tables of frequency of occurrence of the different meteorological elements, furnished the best basis for comparison with flying statistics.

The Sub-Commission also reported on the conditions under which it should be obligatory on aircraft to carry a meteorologist, a question which had been referred to the Sub-Commission by the main Commission. The Meteorological Sub-Commission was of opinion that the obligation to carry a meteorologist should be restricted to lighter-than-air craft when making voyages of more than 1,200 kms. and that in this case the meteorologist carried should have both theoretical knowledge and practical experience in the actual work of forecasting in the meteorological service of one of the States signatory to the Convention. The decision of the Commission on this question has not yet been taken.

Civil Aviation Conferences.—At the periodical conferences on questions between England, France, Belgium and Holland, various points arising in connexion with the working of the meteorological arrangements on the air lines from London to the Continent, have been discussed and a satisfactory solution achieved.

At the meeting at the Hague in July, 1924, arrangements were made for reporting changes in the horizontal visibility occurring between the hours of regular reports. A report is sent immediately to all concerned whenever horizontal visibility :—

- (a) is decreasing and becomes less than 1000 metres ;
- (b) decreases still further and becomes less than 200 metres ;
- (c) after having been less than 200 metres, has improved and become greater than 500 metres during a period of 10 minutes at least.

The arrangement has worked well and the results have proved of great value. The extension of the system to reports of changes in height of cloud and of weather, is under consideration.

At the meeting in Paris in December a figure code for the issue of forecasts on air routes was discussed and agreement arrived at. The code is now in operation. It enables the length of the forecast messages to be reduced to about one-fifth of the length of the forecasts in plain language and it also makes the messages easily understood as difficulties of language or difficulties arising from the special meaning of national terms for meteorological phenomena, are avoided.

International Union of Geodesy and Geophysics.—A meeting of the International Union of Geodesy and Geophysics was held in Madrid at the beginning of October, 1924, and was attended by Dr. C. Chree and Mr. R. G. K. Lempfert, as representatives of the Office. Dr. Chree acted as President of the Section of Terrestrial Magnetism. Sir Napier Shaw, late Director of the Office, was President of the Section of Meteorology and at his suggestion Mr. Lempfert was invited to act as English Secretary of the Section, the General Secretary being Professor Eredia of the Italian Meteorological Service. Dr. Crichton-Mitchell and Dr. J. S. Owens, also attended the meeting of the Union, the former in the section of Terrestrial Magnetism, the latter in that of Meteorology.

Meteorology and Agriculture.—There has been a marked increase in recent years in the interest taken in the study of the influence of meteorological conditions on agriculture. A report on the subject was prepared by a Committee of the Agricultural Research Council in April, 1922, and in order to give effect to the recommendations made therein the Ministry of Agriculture summoned a conference of the Heads of Agricultural Colleges and others interested in the subject. Several meetings of this conference were held at the Ministry of Agriculture during 1923 under the presidency of Sir Daniel Hall, K.C.B., LL.D., F.R.S., Chief Scientific Adviser and Director-General, Intelligence Department, Ministry of Agriculture and Fisheries, and were attended by the Director or other representatives of the office. A definite scheme of work has been evolved as the result of these Conferences and on December 27th, 1924, the Ministry of Agriculture

and Fisheries nominated a Permanent Committee on Agricultural Meteorology to advise the Minister of Agriculture on all questions involved. Sir Napier Shaw has been appointed Chairman of this Committee, which includes among its members two representatives of the Meteorological Office, Mr. R. G. K. Lempfert and Mr. R. Corless. This Committee has appointed a meteorological sub-committee consisting of Mr. R. G. K. Lempfert (Chairman), Mr. R. Corless, Dr. B. A. Keen, Assistant Director of the Rothamsted Experimental Station and Mr. C. S. Leaf of the School of Agriculture, Cambridge University, to deal with specifically meteorological questions.

The object of the scheme may be described as the collection and co-ordination according to a fixed plan of meteorological, agricultural and phenological data from a network of observing stations. A complete outfit of meteorological instruments has been issued to a selection of agricultural colleges and arrangements have been made for regular observations. A complete list of these stations, for which the name "crop weather station" has been suggested, will be found on page 32. The scheme of observation is essentially that of a normal climatological station with certain minor modifications, principal among which may be mentioned observations of soil temperature at depths of 4 inches and 8 inches. The monthly schedules of observations, duly summarised in an agreed form, are sent to the Meteorological Office where they are available for reference. Summaries of the observations of certain elements are published in Table III of the *Monthly Weather Report*. Apart from the advice which has been given from time to time by its representatives at the Conferences and on the Committee, the only services which the Meteorological Office has been called upon to render in connexion with the scheme, have been those which it has always rendered to voluntary climatological stations from which it receives returns, viz.: the supply of approved instruments, upon repayment, the "inspection" of the stations and advice upon the selection of sites, facilities for instructing observers and the scrutiny of the returns.

Very complete arrangements have been made by the Ministry of Agriculture for the collection of agricultural, horticultural and phenological data. No arrangements have as yet been made for printing the observations but very full monthly summaries are prepared at the Ministry of Agriculture and circulated in type-script to all the co-operating institutions. For the purposes of these summaries the Meteorological Office supplies to the Ministry of Agriculture copies of the summaries received from the stations. Advance copies of the meteorological summaries by districts which appear in the *Weekly Weather Report* are also supplied to the Ministry for publication in its Journal. The scheme is thus providing in convenient form, exceedingly useful material for the investigation of the effects of varying meteorological conditions on agriculture.

Staff.—On September 30th, 1924, Dr. A. Crichton Mitchell retired, at the age limit, from the Superintendship of the Meteorological Office, Edinburgh. Dr. Mitchell, who had previously held the position of Director of Instruction, Travancore, India, joined the staff of the Office on 16th May, 1916, as Superintendent of Eskdalemuir Observatory in succession to Mr. L. F. Richardson. In 1922, upon the

re-organization of the meteorological work in Scotland, he took up his residence in Edinburgh. The Committee wish to place on record their high appreciation of the services rendered by Dr. Mitchell and of the manner in which he has placed his scientific knowledge and organizing ability at their disposal for the advancement of meteorological and geophysical work in Scotland.

Dr. Mitchell's retirement has caused a number of changes in the distribution of staff. Major A. H. R. Goldie, formerly in charge of the Local Centres Division at Headquarters, has been transferred to the Edinburgh Office as successor to Dr. Mitchell and Captain F. Entwistle has taken charge of the Local Centres Division. The vacancy thus arising in the Superintendentship of the Instruments Division, has been filled by the transfer, on promotion, of Mr. E. G. Bilham from the Forecast Division and Mr. J. Crichton, formerly Senior Professional Assistant in charge of the Observatory at Lerwick, has succeeded Mr. Bilham as one of the Assistant Superintendents in the Forecast Division. Mr. A. W. Lee has taken charge of Lerwick, on promotion to the grade of Senior Professional Assistant.

Further movements and promotions of staff became necessary as a result of the establishment of the new division in the Office to deal with Airship Meteorology, to which reference has already been made. Mr. M. A. Giblett and Mr. S. P. Peters have been nominated respectively to the posts of Superintendent and Senior Professional Assistant in the Division. The vacancy in the Assistant Superintendentship in the Forecast Division arising from Mr. Giblett's promotion, was filled by the promotion of Captain C.K.M. Douglas, formerly in charge at South Farnborough and the post at South Farnborough has been assigned to Mr. H. St. G. Dyke-Marsh, also on promotion.

In the course of the year the Committee have lost the services of Mr. O. F. T. Roberts, Commander G.f.f. H. Lloyd, R.D., R.N.R., Port Meteorological Officer at Liverpool, and Mr. T. H. Fallows. Mr. Roberts relinquished his work at Porton in order to take up the newly-founded Cruickshanks Lectureship in Astronomy and Meteorology in the University of Aberdeen. Commander Lloyd has accepted an appointment as Assistant Marine Superintendent under the Coast Lines, Ltd. He has been succeeded as Port Meteorological Officer at Liverpool by Lieutenant-Commander M. Cresswell, R.N.R. Mr. Fallows has joined the Survey Department of H.M. Colonial Service. The remaining vacancies on the professional staff arising from the resignations and creation of new posts enumerated above, have been filled by the following promotions and new appointments :—

Promotion to Senior Professional Assistantship :—Mr. F. J. Scrase.

New appointment to Senior Professional Assistantship :—Lieut-Commander M. Cresswell, R.N.R.

New appointments to Junior Professional Assistantships :—Messrs. C. V. Ockenden, B.Sc. ; E. L. Davies, M.Sc. ; M. J. Thomas, B.Sc. ; and W. H. Pearce, B.Sc.

As regards the clerical staff, the retirement at the age limit of Mr. J. T. Williams after 44 years of service in the Meteorological Office, has to be chronicled. The Committee desire to place on record their high appreciation of Mr. Williams' long service. Mr. L. G. Hemens has been promoted to a newly created Grade II clerkship at Porton and Mr. W. Andrews has been given acting rank as a Grade II Clerk while

in charge of the temporary station established at Belfast in connexion with the aerial route to Northern Ireland. There has been one resignation from the clerical staff and appointments of temporary clerical officers have been made to fill vacancies or new posts.

Schemes of payment for night duty and for attendance at abnormal hours have been approved both for the professional and clerical grades. Under these schemes payments are made to the holders of certain posts which involve regular attendance at night or at abnormal hours.

Arrangements were made during the year for some of the senior staff to visit foreign meteorological institutions in order to study the methods of work adopted there. Mr. E. G. Bilham spent some weeks in Paris at the Office National Météorologique, the Headquarters of the French Meteorological Service, to study the methods of dealing with observations of clouds which have been developed by that service. Mr. M. A. Giblett, after attending the meeting of the British Association for the Advancement of Science at Toronto, where he acted as Secretary of Section A, paid a visit to Washington and gained much valuable experience by studying at first hand the organization of the Weather Bureau of the United States. He also visited the Meteorological Offices at Toronto (Headquarters of the Canadian Service) and New York. The Committee wish to express their thanks to the Directors of these Services for the facilities extended to these members of the staff and for the courtesy with which they were received. Mr. F. J. W. Whipple also attended the meeting of the British Association at Toronto and made three contributions to the proceedings of Section A.

The Committee note with satisfaction that the degrees of Ph.D. have been conferred by the University of London upon Messrs. J. Glasspoole and S. N. Sen in connexion with work in meteorology.

Finance.—The year under review, 1924–25, is the fifth 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 1924–25

| <i>Expenditure</i> | <i>Amount</i> | |
|---|---------------|--------|
| | £ | £ |
| Salaries and Wages—H. Q. Establishments | 46,800 | |
| „ „ —Out-station Establishments | 37,805 | |
| | | 84,605 |
| Fuel and Light | | 500 |
| Transport of Personnel and Equipment | | 1,920 |
| Instruments, Equipment and Stores | | 3,545 |
| Minor Works Services, Rents, Repairs and Maintenance of Buildings | | 2,795 |
| Telegrams, Cables and Telephones | | 6,990 |
| Subventions and Reporting Stations | | 1,420 |
| Miscellaneous | | 365 |
| Superannuation | | 3,630 |
| Total .. | £105,770 | |

Receipts

| | |
|--|----------------|
| Receipts from Royal Society | 605 |
| „ „ National Debt Commissioners (Annuities) | 400 |
| Sale of Instruments, Carriage, etc. | 3,270 |
| Daily Weather Reports, Forecasts, etc. | 2,065 |
| Receipts from War Office | 5,600 |
| Total .. | <u>£11,940</u> |

MARINE DIVISION

Voluntary Observing Fleet and Observers.—The number of ships regularly making returns has been strictly limited to a maximum of 500, but the number of ships equipped with tested instruments for keeping the meteorological log has been slightly further reduced (the number of H.M. Surveying Ships keeping these logs has been maintained) as is shown by the comparative table on page 24. A 14

During the winter months it has been necessary temporarily to increase the number of ships equipped with official instruments for making wireless weather reports to the Office, in view of fewer sailings in the North Atlantic service. Thus the number shown in the table does not represent the number of ships participating in this service throughout the year, which is usually 28.

The service for reporting weather from their mid-positions by cross-Channel steamers has been maintained, and recently through the courtesy of the owners of the Newhaven and Weymouth packets the time of transit of the messages has been considerably reduced by use of wireless telegraphy.

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.

The senior Cadets of H.M.S. *Conway*, H.M.S. *Worcester* and *Pangbourne* have continued the cadets' meteorological log. The Marine Superintendent has visited the three establishments during the year.

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

Captain T. H. Tizard, C.B., R.N., F.R.S., late Assistant Hydrographer of the Navy.

Captain William Ellery, Senr., formerly of Messrs. T. and J. Brocklebank.

Captain C. W. Hodder, s.s. *Marloch*.

Lieut. G. H. P. Muhlhauser, R.N.R., Yacht *Amaryllis*.

Captain A. E. Stickland, s.s. *Port Hacking*.

Captain J. J. Symons, s.s. *Ceramic*.

Captain L. D. Pinckney, s.s. *Mantua*.

Commander C. H. Greame, R.D., R.N.R., s.s. *Celtic*.

Captain E. G. Hughes, s.s. *Crawford Castle*.

Not only is the spirit of ready co-operation generally existing in the corps of marine observers commendable ; but latent *esprit de corps* has made itself evident with the establishment of the *Marine Observer*, to the mutual advantage of voluntary marine observers and the Office.

A card index with records of marine observers introduced in 1920 has proved of great value.

Collection of Data.—*Classification of Meteorological Logs (4-hourly) used with instruments lent by the Meteorological Office.*—Generally the standard of the routine observations recorded in the logs has maintained a steady improvement; this year 33·6 per cent. were classed excellent as against 31·3 per cent. last year.

The classifications of logs received this year and in the previous years were as follows :—

| Classification | 1924-1925 | 1923-1924 | 1922-1923 |
|-------------------|-----------|-----------|-----------|
| Excellent .. | 92 | 80 | 83 |
| Very Good | 178 | 169 | 170 |
| Good | 3 | 6 | 11 |
| Not classed | 1 | 1 | 8 |
| Total received .. | 274 | 256 | 272 |

A list of Captains and Principal Observing Officers to whom Excellent Awards have been made will be found in the *Marine Observer*, June, 1925, page 89.

An increasing number of marine observers have responded to the invitation given last year to correct the barometer reading and enter the absolute pressure in the new column provided. When Gold scales are provided it is expected that all will do so, this will reduce the work of the computers.

As these logs are the backbone of the work the steady improvement in them is perhaps the best gauge of the state of progressive efficiency of British Marine Meteorology.

Ships' Meteorological Reports, Form 911 (twice daily), used with Ships' Instruments.—Generally the same remarks with regard to meteorological logs apply to ships' meteorological reports, but the improvement is even more marked, probably owing to the knowledge that these are now classified upon receipt. It has been noted that observations of currents by many ships keeping these forms are of a high order. As this is the first complete year that a definite classification has been used, it is not possible to provide numerical comparison. Forms 911 received during the year were classed as follows :—

| Classification | Year 1924-1925 |
|-------------------|----------------|
| Excellent | 393 |
| Very Good | 1721 |
| Good | 75 |
| Not classed | 0 |
| Total received .. | 2,189 |

These forms are most useful in completing a network of observations over all the oceans which would be too expensive with the meteorological log.

Ice Report, Form 912.—These forms are supplied to ships whose trades take them through regions where ice may be encountered in both Northern and Southern Hemispheres. The information provided has been good. The compilation of ice limits remains an important need for navigation as well as for meteorology.

Report of Tropical Revolving Storms, Form 905.—A number of these forms have been completed by regular observing ships and ships not upon our list; they are welcomed and valued from all. Many are needed before hurricanes can be adequately charted and investigated.

North Atlantic Wireless Telegraphy Weather Report Registers, used with instruments lent by the Meteorological Office.—Last year the registers showed a marked improvement in this work; this year the standard has been maintained, as the comparative table below shows, notwithstanding changes which generally tend to make work difficult at first. These will be mentioned later.

| Classification | 1924-1925 | 1923-1924 | 1922-1923 |
|--------------------|-----------|-----------|-----------|
| Excellent . . . | 162 | 155 | 73 |
| Very Good . . . | 100 | 90 | 150 |
| Good . . . | 0 | 5 | 3 |
| Not classed . . | 2 | 0 | 2 |
| Total received . . | 264 | 250 | 228 |

Miscellaneous Contributions.—In addition to the prescribed forms for observations, a large number of interesting manuscripts, sketches, photographs and weather charts have been received from commanders and officers, including regular members of the corps of marine observers as well as others.

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

Marine Agents, and Voluntary Co-operators at the Ports.—Lieut.-Commander C. R. H. Harvey, R.N. took over the Marine Agency on his appointment as Superintendent of the Admiralty Chart and Chronometer Dépôt at Hong Kong *vice* Lieut.-Commander P. W. S. Henderson, R.N.

All marine agencies in Great Britain and Ireland have been inspected by the Marine Superintendent during the year, and much useful work has been done at the ports, where in addition to the marine agents, we have a number of voluntary co-operators interested in furthering the work.

The Meteorological Office is indebted to the marine agents for forming a useful link, without which the Marine Division would have

great difficulty in maintaining touch with the corps of marine observers, and it would be impossible to control the issues of instruments on loan. Where work is generally well and willingly done, it is difficult to make distinction, but this is well deserved by Captain D. Forbes at Southampton, the oldest agent, who was first appointed under Captain Toynbee in 1883; notwithstanding his advanced age he is helping very materially towards efficiency by his unceasing care of Office instruments and his advice and assistance to his brother seamen.

The influence of the British Empire Exhibition upon voluntary marine co-operation with Colonial and Dominion Services has been apparent; for nautical officers have taken the opportunity, when at home for the exhibition, to obtain closer touch with the Marine Division. Among them may be mentioned Captain E. W. G. Twentyman, Harbour Master of Suva, Fiji, who is in charge of the hurricane warning service in that part of the Pacific.

Such co-operation undoubtedly tends towards the uniformity of methods within the Empire, which is so desirable.

Use made of Data.—*Data Extraction and Research.*—The new system of data extraction established on the 1st April, 1920, by which as far as possible meteorological logs reaching the classification of "Very Good" or above are extracted and indexed as received from all oceans, has been vigorously continued. During the year 65,060 sets of observations were extracted and punched on cards, 5,746 sets of additional observations of currents dating back to 1910 for Atlantic routes have been extracted. In all since April 1st, 1920, 384,537 sets of observations have been extracted. During the last 12 months 53 per cent. of logs received reaching the required standard have been prepared for extraction on to Hollerith cards.

The great need for logs, received prior to April, 1920, to be indexed and extracted, referred to in the last two *Annual Reports*, is becoming more and more acute; but increased demands on the time of the Marine Division have been the cause of the reduction of the volume of data extracted from logs currently received. The comparative table below shows the reduction:—

| | 1924-25 | 1923-24 | 1922-23 |
|--|---------|---------|---------|
| Percentage of Logs received, reaching the required standard, completely extracted and phenomena indexed. } | 55% | 66% | 73% |
| Number of complete sets of observations extracted and punched on cards, with currents entered in data books and phenomena indexed. } | 65,060 | 74,749 | 97,533 |
| Current observations, prior to April, 1920, extracted and entered in data books. } | 5,746 | 4,259 | 1,826 |

The charting of currents along Ocean Routes is proceeding satisfactorily.

Exchange of Data with other Services, International Co-operation, and Marine Inquiries.—The importance of the interchange of marine data with foreign countries has been stressed in previous reports.

During the year 5,511 sets of weather observations made in 1923 in selected regions in all oceans were sent to the Marine Division of the Dutch Meteorological Service on Hollerith cards, also 2,315 observations for June, July and August for certain areas in the Atlantic, for incorporation in new charts which that service is publishing. The Réseau Mondial was provided with means of pressure, sea, and air temperature for the year 1922 incorporated with foreign data for the Marsden Squares 182 and 218; also with observations made by the Lighthouse Keepers at Cape Pembroke (Falkland Islands) and Watling Island (West Indies) for the year 1918.

The Dutch Meteorological Service was supplied with 5,457 current observations on the route Cape Blanco to Table Bay and the Fishery Board for Scotland with 244 observations of current for the year 1923 in the middle latitudes of the North Atlantic.

Monthly means of air temperature at Cape Pembroke, Falkland Islands, based on 25 years' observations were supplied to the International Meteorological Conference, 1923.

Meteorological observations in connexion with the lunar eclipse, August 1924, were extracted and forwarded to the Blue Hill Observatory, Mass., U.S.A.

Regulations for the supply on loan of marine data by means of Hollerith cards to Dominion and foreign weather institutions have been drawn up and adopted.

Many inquiries have been received from shipowners, underwriters, lawyers and others regarding weather for the purpose of investigating maritime casualties and claims, answers to which have been given very largely from the meteorological logs, ships' meteorological reports, and coast station reports, kept by the Corps of Voluntary Marine Observers. Indeed this service, for which a charge is made to cover the cost of transcription, has become a very important part of the work of the Marine Division.

The Dutch Meteorological Office has undertaken to supply current observations on the Trans-North-Atlantic routes, which are scheduled to be charted next. They will have available in the course of a few years, data for a great number of years for the North and South Atlantic Oceans punched on Hollerith cards, so that we may now look forward with confidence to regular exchange of marine data between Great Britain and Holland.

Publication of Information for Mariners.—In the *Marine Observer* which was established to supersede all publications issued in return for voluntary observational work at sea, it has been possible to amplify very considerably the production of information and charts suitable to aid navigation, to stimulate accurate observation, and to further the science of marine meteorology.

A list of the more important contributions to the *Marine Observer* will be found on page 62.

Wireless Telegraphy Coded Reports from North Atlantic Liners.—On June 1st, 1924, the new International Code, the outcome of the provisional code used since 27th March, 1921, was brought into force, and on August 15th, 1924, the service was extended across the North Atlantic, ships westward of longitude 40° W. sending their reports to America.

During the year 4,018 weather reports were received at the Meteorological Office and used in the Forecast Division while approximately 996 reports were sent, by ships on our list to America.

Of the 4,018 reports received at the Meteorological Office, 1,014 were received within one hour of observation, 1,304 within two hours, 852 within four hours, while 848 were over four hours in transmission from the hour of observation.

Seven hundred and fifty errors in transmission were corrected by the check system; when the registers were received we found that in only 33 cases had the check failed.

As soon as all material changes in code and instructions required by the land service that could be foreseen were made, instructions for decoding the messages were published in the *Marine Observer*, so that ships intercepting the messages could make use of them.

Results.—*Advantages accruing from Central Forecasting.*—The Weather Shipping Bulletin has been steadily proving its value throughout the year and many reports of its practical use have been received in the Marine Division.

Captain M. H. Clarke, Chief Surveyor, Ministry of Industry and Commerce, our Marine Agent at Dublin, is to be congratulated upon being the first to make successful arrangements for the local interception and dissemination of the Weather Shipping Bulletin at his port. The Port of Liverpool and the Meteorological Office are indebted to the Cunard Line for their courtesy in permitting one of their ships in port to intercept this message and send it to the Port Meteorological Office whence it is distributed for the information of ships about to proceed to sea. Approval has been given for the repetition of the respective parts of this Bulletin through spark stations which will make it generally available to all ships fitted with wireless telegraphy.

Instrumental Observation.—The scale devised by Lt.-Col. Gold for attachment to a barometer so that the total correction to be applied to the reading can be read at once from the attached thermometer has been thoroughly tried and tested, and Mark III has been adopted as a standard method for correcting barometer readings at sea. Full supply of these is awaited by observers in ships equipped with Office instruments.

With regard to the experiments referred to in last year's report with portable thermometer screens, these have demonstrated so clearly the need for improved means of obtaining temperatures, that comparisons are now being made at Kew Observatory, to prove which screen gives the best results.

DETAILS OF VOLUNTARY OBSERVING FLEET AND COAST STATIONS

| | On 31st March | | | | | | | | | | |
|---|--|------|------|------|------|------|------|------|------|------|------|
| | 1925 | 1924 | 1923 | 1922 | 1921 | 1920 | 1919 | 1918 | 1917 | 1916 | 1915 |
| No. of Ships equipped with sets of instruments keeping full Logs ... | 117 | 122 | 123 | 125 | 133 | 104 | — | — | — | — | 192 |
| No. of H.M. Ships keeping full Logs ... | 8 | 8 | 9 | 9 | 9 | 2 | 2 | — | — | 1 | 3 |
| No. of Ships contributing ship's Meteorological Reports, using ship's own Instruments ... | 321 | 322 | 332 | 341 | 216 | 117 | 7 | — | — | — | — |
| No. of Ships equipped especially for W/T Weather Reports ... | 32 | 21 | 24 | 17 | 1 | — | — | — | — | — | 9 |
| No. of Coast Stations equipped with Instruments for Form 129A.... | 34 | 35 | 38 | 40 | 42 | 53 | 52 | 49 | 49 | 58 | 59 |
| No. of Ships equipped with Instruments for Home Waters Telegraphic Reports ... | 10 | 10 | 8 | 8 | 24 | — | — | — | — | — | — |
| No. of Ships with Instruments on board, logs overdue... | 0 | 0 | 0 | 0 | 2 | 19 | — | — | — | — | — |
| No. of Barometer Errors ascertained or checked ... | 1474 | 1368 | 1355 | 1025 | 365 | — | — | — | — | — | — |
| | Receipts for the year ended 31st March | | | | | | | | | | |
| | 1925 | 1924 | 1923 | 1922 | 1921 | 1920 | 1919 | 1918 | 1917 | 1916 | 1915 |
| Meteorological Logs... .. | 274 | 256 | 272 | 264 | 204 | 67 | 22 | 59 | 115 | 147 | 224 |
| Ships' Meteorological Rpts. Forms 129A... | 2189 | 1785 | 1741 | 1717 | 1668 | 503 | 21 | 144 | 670 | 882 | 1064 |
| Lighthouse Registers ... | 402 | 404 | 423 | 460 | 437 | 381 | 334 | 324 | 340 | 351 | 510 |
| Ocean W/T Report Registers ... | 14 | 14 | 13 | 16 | 16 | 12 | 16 | 15 | 14 | 15 | 14 |
| Home Waters Telegraphic Reports ... | 264 | 250 | 228 | 98 | — | — | — | — | — | 20 | 410 |
| Cadets Meteorological Log ... | 802 | 820 | 752 | 1066 | 1808 | — | — | — | — | — | — |
| New Data extraction. | 9 | 9 | 9 | 9 | 6 | — | — | — | — | — | — |
| Logs extracted | 142 | 165 | 204 | 155 | 169 | — | — | — | — | — | — |

FORECAST DIVISION

General.—An important feature of the year's work was the maintenance of a comprehensive exhibit at the British Empire Exhibition at Wembley from April to October. Two large blackboard charts were exhibited each day in the Government Building, one showing the distribution of pressure, wind, temperature and weather over north-west Europe, and the other the distribution of pressure and wind over a considerable part of the Northern Hemisphere. The exhibit also included diagrams and charts showing the weather conditions on occasions of special interest. Two members of the staff of the Forecast Division attended daily to answer inquiries, prepare the blackboard charts, and deal with the reception of synoptic weather reports which were intercepted in the building by a wireless operator from the Signals Branch of the Air Ministry. On the occasion of the Royal visit to the Exhibition on the 14th May the construction of weather charts and preparation of forecasts was demonstrated to Their Majesties the King and the Queen, the King and Queen of Roumania and other members of the Royal Party.

Other important features of the year's work were (1) the establishment by the Royal Air Force of a Meteorological Flight to obtain regular observations of upper air temperature by means of aeroplane flights, and (2) the commencement of the reception by W/T of reports from British ships on the further side of the Atlantic.

A supplement to the *Wireless Weather Manual* (M.O. 255) was prepared and issued in June, 1924, in order to bring the information contained in the manual up to date. Thirteen supplements to the 2nd Edition of M.O. 252, *Particulars of Meteorological Reports issued by Wireless Telegraphy in Great Britain and the Countries of Europe and North Africa* were issued and a revised 3rd edition was prepared and copies received at the end of March.

Considerable progress has been made in collecting particulars of telegraphic reporting stations and preparing contour maps of the country surrounding each station. It is proposed later to publish these particulars for stations included in the W/T Synoptic issues as desired by the International Meteorological Committee.

The large exhibition chart at the front of Adastral House, Kingsway, was closed after the 18th of March for complete reconditioning.

At the request of the Director of the Medical Research Council measurements of ultra violet light have been made on the roof of the Adastral House, Kingsway, since the 14th July, and an Eder Photometer was also installed during August and records commenced on the 1st September.

Comparative tests of sunshine recorders have been carried out on the roof of Adastral House throughout the year.

Reports on the probability of fog at numerous aerodrome sites were prepared in collaboration with the Local Centres Division during the year.

Observations received.—(a) *British Reports.*—Few changes have taken place in the course of the year in connexion with the telegraphic

reporting stations. Reports from Nottingham ceased on May 1st, and reports from Harrogate commenced on June 1st. The latter station replaced Howden which closed at the end of 1921, and thus filled a gap which had existed for $2\frac{1}{2}$ years in the network of stations over the northern Midlands.

Cable communication with the Hebrides broke down on the 15th January, but communication by wireless telegraphy was established on the 27th and was maintained to the end of March. Owing to the difficulty of obtaining wireless communication during the night, reports were not received from Stornoway at 0100* after the breakdown of the cable. Communication by cable with the Scilly Isles broke down on the 25th February, and in this case also communication by wireless telegraphy has replaced that by cable until repairs can be effected.

Particulars of a new trial group for reporting present and past weather were received from the President of the Commission for Synoptic Weather Information early in January. Arrangements were made for Aberdeen, Valencia, Cranwell and Cattewater, to use this group from 1st February at 0700, 1300 and 1800 and the group has been added to the wireless synoptic messages issued at 0800, 1400 and 1900.

The code for reports from ships at sea was altered on the 1st June in accordance with a recommendation of the International Meteorological Committee at its meeting at Utrecht in 1923.

A meteorological flight was established at Eastchurch Aerodrome on 1st November for obtaining upper air temperatures and humidities, and the first reports were received on the 19th of the month. The flight was later transferred to Duxford, Cambridgeshire. 89 reports of upper air temperature and humidity were received up to March 31st.

These reports form a most valuable addition to the data received in the Forecast Division.

Upper wind observations have been received regularly from Local Centres and Observatories and upper air temperatures have been taken by means of aeroplanes when conditions permitted at Eastchurch (later Duxford), and Farnborough and occasionally at Andover, Lympne, Felixstowe, Cranwell and Leuchars.

Owing to the drifting of sand at Spurn Head it has been necessary to instal a new raingauge in a less exposed position and readings from the two instruments are being taken for a time for purposes of comparison.

From the 2nd of February additional observations at 1000 and 1600 have been received from Stornoway, observations at 1600 have also been received since 12th January from Cattewater, and since 11th March from Calshot.

The service of weather reports from British ships by wireless telegraphy has been well maintained. In the early part of the year arrangements were made, in co-operation with the United States Weather Service, for the re-transmission of reports from British ships in the Western Atlantic to Europe *via* a high power wireless station

* Times written 0100, 0700, etc., are Greenwich Mean Time.

in the United States. A few reports were received during September and since that date the number has increased to from 60 to 80 per month.

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 :—

| | | | |
|-------------|------------|----------|----------|
| Bridlington | Exmouth | Penzance | Wallasey |
| Cheltenham | Hunstanton | Swansea | |

The issue of readings from Cowes and Sheerness has ceased.

The number of Health Resorts reporting daily during the summer months of the year was 68.

(b) *Foreign Reports*.—The reception of foreign reports has undergone little change during the year.

Additional observations from Thorshavn at 1000 and 1600 G.M.T. have been received since 1st March.

The daily synoptic reports from America have been received *via* the Eiffel Tower in a very satisfactory manner.

Distribution of Information.—The principal British Synoptic Reports have continued to be broadcasted by wireless telegraphy at the same hours as formerly.

The following alterations and additions to the service of wireless reports have been made during the year :—

From the 1st of April, 1924, a new wireless synoptic issue has been made at 0840 each day giving those ship reports received since 0600 which have not been already issued. This is complementary to the similar issue already made at 1940.

From 1st March, 1925, additional W/T issues have been made from the Air Ministry at 1050 and 1650 daily. Observations taken at 1000 and 1600 at four British stations and at Thorshavn are issued in these messages.

Observations from Reykjavik and Thorshavn have been added to the ten British reports included in the "Weather Shipping" message since 1st October.

The supply of "Rural Weather Forecasts" to the telephone exchanges mentioned in the previous report was discontinued after the 14th June, it having been found that the needs of most people were sufficiently met by other existing methods of distribution of forecasts.

From the 13th April a general weather forecast covering all districts has been sent to the British Broadcasting Company in place of the separate district forecasts previously supplied. Arrangements have also been made to send to the Company for broadcasting with the evening report, any notifications of spells of settled weather that may be issued. From August, Ireland was included in the area covered by the general forecast and from October a separate forecast for the south of England, primarily for agricultural purposes, has been prepared for issue from Bournemouth.

From the 25th March special data reports with warnings of gales and thunderstorms were sent to the Airship station at Pulham.

During the summer months the Harvest Forecast service was carried on as in previous years.

Special reports and forecasts have as usual been issued during the year to a number of applicants. Among these were included (1) forecasts to His Majesty the King on certain dates in July and August ; (2) forecasts to H.M.S. ships on numerous occasions ; (3) forecasts for both the U.S.A. and the Italian World Flights in July and August and (4) forecasts required in connexion with special events at the British Empire Exhibition at Wembley.

Lithographed and Duplicated Reports.—The *Daily Weather Report*, in three sections has been published throughout the year. In April the list of stations in the International Section was revised and in the British Section the publication of records of atmospherics obtained at Croydon ceased at the end of November. On the 1st January the Upper Air Supplement was recast, all diagrams being collected on one side of the sheet and other alterations made.

A summary of the weather of the past month has been issued as in the past on the 1st day of each month. Reports from 21 stations are included in this issue.

A short summary of the weather of the year 1924 was issued to the press on the evening of the last day of the year.

The normal daily duplicated reports and charts have been issued throughout as also the reports and forecasts for the press. A morning "Health Resort Report" giving data for 0900 G.M.T. for a limited number of health resorts was prepared during the summer months. Owing to the increase in the number of health resorts reporting in the evening at 1700 it has become necessary to issue the evening report in two sections.

At the request of the Press Association a forecast of the weather for the coming evening for communication to the evening press has been issued each day since 26th July at 4.15 p.m. in the summer and 3.30 p.m. in the winter.

Gale Warnings.—During the year, ten new gale warning stations were established, nine of these being at coast-guard stations in response to a request from the Board of Trade. One station was closed during the year.

Arrangements were made in September for the addition of a note of the movement of pressure systems to the gale warnings issued by wireless telegraphy.

The result of the checking of the gale warnings issued during the twelve months January–December, 1924, is given on the attached table.

GALE WARNINGS ISSUED DURING THE YEAR, 1924

| DISTRICTS | Summary of occasions of gales | | Summary of Warnings issued | | | |
|-----------------------------------|--|---|----------------------------|---|---|---|
| | Total number of occasions upon which warnings were necessary | Percentage of occasions of gales effectively warned | Total number issued | Issues justified by gales (force 8 and above) | Issues justified by strong winds (forces 6 and 7) | Percentage justified by gales or strong winds |
| 1. Scotland N.E. (A | 7 | 100 | 26 | 7 | 13 | 77 |
| 2. Scotland E. | 4 | 100 | 23 | 4 | 5 | 39 |
| 3. Scotland N.W. | 2 | 100 | 19 | 2 | 10 | 63 |
| 4. Scotland W. and North Channel. | 7 | 100 | 27 | 7 | 10 | 63 |
| 5. Ireland N. | 10 | 80 | 29 | 8 | 15 | 79 |
| 6. Ireland S. | 6 | 100 | 29 | 8 | 11 | 66 |
| 7. Irish Sea. | 8 | 83 | 32 | 5 | 21 | 81 |
| 8. St. George's Channel. | 13 | 100 | 26 | 8 | 15 | 89 |
| 9. Bristol Channel. | 17 | 92 | 27 | 12 | 11 | 85 |
| 10. England S.W. | 13 | 94 | 29 | 16 | 11 | 93 |
| 11. England S. | 9 | 85 | 33 | 11 | 13 | 73 |
| 12. England S.E. | 15 | 77 | 27 | 7 | 15 | 82 |
| 13. England N.E. | 3 | 67 | 24 | 10 | 11 | 88 |
| 14. England E. | 12 | 67 | 17 | 2 | 15 | 100 |
| | | 83 | 20 | 10 | 7 | 85 |
| Totals | 134 | 87 | 388 | 117 | 183 | 77 |

Inquiries.—The number of inquiries for forecasts or involving the extraction of data has again shown an increase over former years.

An exceptional number of such inquiries were received during December owing to the spells of foggy weather and of stormy weather which prevailed respectively about the middle and during the latter part of the month.

Data from coast stations were supplied for inclusion in the replies to numerous inquiries concerning the weather at the time of shipping casualties.

The number of inquiries received during the past four years is given in the subjoined table:—

| Month. | 1921-22 | 1922-23 | 1923-24 | 1924-25 |
|---------------|---------|---------|---------|---------|
| April | 97 | 126 | 182 | 265 |
| May | 75 | 190 | 271 | 329 |
| June | 121 | 200 | 340 | 329 |
| July | 262 | 375 | 306 | 356 |
| August | 162 | 158 | 280 | 265 |
| September .. | 142 | 143 | 205 | 214 |
| October | 205 | 138 | 282 | 229 |
| November .. | 175 | 177 | 285 | 207 |
| December .. | 122 | 178 | 203 | 341 |
| January | 214 | 244 | 271 | 330 |
| February .. | 117 | 206 | 182 | 283 |
| March | 222 | 202 | 177 | 206 |
| Total | 1,914 | 2,337 | 2,984 | 3,354 |

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; it also shows the distribution of the stations from which autographic records are received. The classification under “autographic records” is independent of that under “stations,” and a single station may be counted more than once under “autographic records.”

| Districts | Stations | | | | | Autographic Records | | | | | |
|------------------------------|---------------|--------------|-------------|----------------|--------------|---------------------|----------|------|----------|-------------|----------|
| | Observatories | Distributive | Telegraphic | Climatological | Crop Weather | Sunshine | Rainfall | Wind | Pressure | Temperature | Humidity |
| 0. Scotland, N... | 1 | 0 | 4 | 9 | 0 | 8 | 0 | 2 | 9 | 0 | 0 |
| 1. " E... | 1 | 1 | 2 | 26 | 2 | 16 | 1 | 3 | 2 | 2 | 2 |
| 6a. " W... | 1 | 1 | 0 | 19 | 0 | 11 | 1 | 1 | 3 | 1 | 1 |
| 6b. Isle of Man .. | 0 | 0 | 0 | 1 | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| 2. England, N.E. | 0 | 1 | 2 | 17 | 2 | 14 | 1 | 3 | 3 | 1 | 1 |
| 3. " E... | 0 | 2 | 2 | 21 | 3 | 21 | 1 | 3 | 3 | 1 | 1 |
| 4. " Midlands | 0 | 1 | 3 | 39 | 3 | 30 | 1 | 1 | 4 | 1 | 1 |
| 5. " S.E. | 0 | 7 | 1 | 42 | 4 | 36 | 6 | 8 | 8 | 7 | 6 |
| London District | 2 | 0 | 1 | 7 | 0 | 6 | 3 | 1 | 1 | 1 | 0 |
| 7a. England, N.W. | 0 | 0 | 1 | 21 | 1 | 19 | 0 | 2 | 1 | 0 | 0 |
| 7b. N. Wales .. | 0 | 2 | 0 | 7 | 1 | 6 | 2 | 2 | 2 | 2 | 2 |
| 8a. S. " .. | 0 | 0 | 1 | 6 | 1 | 9 | 0 | 0 | 1 | 0 | 0 |
| 8b. England, S.W. | 0 | 1 | 3 | 30 | 3 | 25 | 1 | 2 | 3 | 2 | 2 |
| 9. Ireland, N. .. | 0 | 0 | 3 | 5 | 0 | 4 | 1 | 1 | 3 | 0 | 0 |
| 10. " S. .. | 1 | 0 | 2 | 16 | 0 | 5 | 0 | 3 | 6 | 0 | 0 |
| 11. Scilly and Channel Isles | 0 | 0 | 1 | 2 | 0 | 3 | 0 | 1 | 2 | 0 | 0 |
| | 6 | 16 | 26 | 268 | 20 | 214 | 18 | 33 | 51 | 18 | 16 |

The observatories and distributive stations are operated by the staff of the Office. The telegraphic stations are, as a rule, maintained at coast-guard 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 other municipal or private observatories or stations are usually available on loan if required. The records from distributive* stations at aerodromes are examined at South Kensington month by month and returned for preservation locally.

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 Balbriggan (November, 1924); Cleethorpes (August, 1924); Cowes (April, 1924); Dyfryn August, 1924); Jersey (April, 1924); Nottingham Castle (in lieu

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

of Nottingham, Trent Lane) (May, 1924); Raunds (May, 1924); Wallasey (July, 1924); Hildenborough (January, 1925); Swinton (January, 1925); Stroud Green (January, 1925).

In addition the following new stations forwarded returns under the agricultural-meteorological scheme of the Ministry of Agriculture and Fisheries :—

Aberystwyth (Plant Breeding Station) (September, 1924); Cambridge (University Farm) (October, 1924); Gulval (October, 1924); Newton Abbot (July, 1924); Sprowston (October, 1924); Wellington (October, 1924); Wye (September, 1924); Aber (Bangor) (January, 1925); East Malling (January, 1925); Houghall (March, 1925); Kirton (January, 1925). The following stations which had previously forwarded regular climatological observations have also supplied special returns under the agricultural-meteorological scheme :—Cockle Park, Rothamsted, Sutton Bonington, Wisley, Long Sutton, Newton Rigg, Long Ashton.

The following climatological stations have ceased, for various reasons, to send in observations during the year :—

Crathes (December, 1924); Seaford (May, 1924); Sheerness (November, 1924); Whitby (April, 1924); Cowes (November, 1924). Harrogate became a telegraphic reporting station from the 1st June, 1925.

Weekly Values for the British Isles.—A considerable amount of time has been devoted to the prosecution of an enterprise which was initiated many years ago; namely, the preparation and discussion of a homogeneous series of weekly values of temperature, rainfall and sunshine for each of the twelve districts, into which the British Isles are divided for climatological purposes. The period of the data is from 1878 to the present time. The material for the data is published in the *Weekly Weather Report*, but owing to various changes which have taken place in the list of stations from which the district values were computed, corrections to the published values have in some cases been applied to bring the whole of the material into a homogeneous series.

Book of Normals.—Two further sections of this book are in preparation: one will deal with the distribution of atmospheric pressure, the other with the distribution of wind over the British Isles.

Courses of Training for Observers.—Two courses were held at Kew Observatory, each lasting about a week. One was arranged principally for observers at health resort stations, the other for observers at the agricultural-meteorological stations. The attendance at the former course was ten and at the latter 21.

Climatology of the Globe.—Manuscript returns from 7 foreign stations and 114 colonial stations have been received. Returns have been received for the first time during the year under review from Kamaran Island, Red Sea. In addition, manuscript returns are regularly received from ten meteorological stations under the control of the Royal Air Force in the Middle East area, Iraq and Palestine.

With the assistance of the Colonial Office, full particulars have been obtained of the equipment and exposure at each of the stations in the Colonies which contribute meteorological summaries to Colonial Blue Books.

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

Long-Series Climatological data.—In accordance with a resolution of the International Meteorological Committee at their meeting at Utrecht, September, 1923, a collection is being made of serial monthly mean values of pressure, temperature and rainfall for a long period of time, for a limited number of stations, distributed as uniformly as possible all over the globe. In making the collection, care is taken to exclude data for any period which are known not to be comparable with those for the remainder of the period, either by reason of change of site or exposure, or because of faulty instruments. If, however, corrections can be applied to such data which will make them comparable with the remainder, and so render the whole a homogeneous series, the corrected values are included with a suitable explanatory note. The periods to which the data for each station refer are chosen to be as long as possible, and, except in certain special cases no series is included if the period does not exceed 20 years.

Under the scheme which was arranged at Utrecht, the Office is responsible for the collection of data for Africa, Australia and the Oceanic Islands. Data for 46 stations from this area have been received from other British or Foreign meteorological services: data for 5 stations have been prepared in the Office, and data for 15 stations are in course of preparation.

It is understood that the Smithsonian Institution will undertake the publication of the data. The result should be the production of a very valuable body of data for the student of world-weather and of meteorological periodicities, and for the preparation of long-period forecasts of the character of seasons.

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

The Serial statistical publications are the following :—

Weekly Weather Report.

Monthly Weather Report.

Observatories' Year Book.

Réseau Mondial.

The *Weekly* and *Monthly Weather Reports* have been published regularly throughout the year and the issues are up-to-date. No important change in the form of these has been made.

The *Observatories' Year Book* takes the place of the *Geophysical Journal* and *Hourly Values from Autographic Records*. The volume for 1922, which will be the first of the series, is in the press.

The volumes of *Réseau Mondial* for 1916 and 1917 were issued. The volume for 1918 is in the press, and that for 1919 is in preparation.

The *Observer's Handbook* has been revised for publication in a new edition which is now in the press.

A new set of *Hygrometrical Tables* has been published and will be brought into use on 1st January, 1926.

An *Observer's Primer* containing the rules for the observation of temperature, rainfall, wind and weather has been published for the use of observers in the Colonies.

A list of the occasional publications passed through the press during the year is given on p. 61.

Returns for Registrars-General.—A weekly summary of the weather at certain large towns is prepared for the Registrar-General for England and Wales. Quarterly and annual summaries are also supplied.

Similar information is supplied quarterly to the Governments of Northern Ireland and the Irish Free State. The report for Scotland, published by the Registrar-General for Scotland, is prepared at the Edinburgh Office.

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 three Pilots was revised during the year. The revision of tables for four Pilots was carried out; this involved the preparation in the division of data for 9 stations. In addition, Meteorological Services abroad were good enough to contribute revised tables for 20 stations.

Special Investigations.—The investigation into the causes of the variations of pressure distribution over the North Atlantic and Western Europe has been continued.

A memoir on "Charts of Monthly Distribution of Pressure (deviation from normal) over the Northern Hemisphere" has been prepared for publication.

Inquiries.—During the year 359 general or scientific inquiries, including 41 legal inquiries were dealt with in the Climatology Division. The corresponding figures for the previous year were 376 and 97 respectively. The figures for 1924-25 do not include a number of inquiries referred to this Division by other divisions of the Office.

A considerable amount of climatological information for various parts of the world has been supplied to research students of the University of Liverpool.

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

INSTRUMENTS DIVISION

General.—There has been no important change in the general work of the division. With regard to the arrangement of accommodation, the changes made in the preceding year have proved advantageous and no further re-arrangement has been attempted.

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

A recording aspirated psychrometer was installed at Kew. This instrument has given a certain amount of trouble arising from unsatisfactory running of the motor.

Instruments for use in the auroral hut and also for use in the determination of atmospheric electric potential gradient have been supplied to Lerwick.

The anemometers at Biggin Hill and Croydon have been dismantled and the latter re-erected at another site. The mechanical assistant also visited Scilly on two occasions to erect the new pressure tube anemometer and later to overhaul the Robinson anemometer. The anemometer tower in a small enclosure near Kew Observatory has been dismantled and returned to store. It is intended to re-erect this instrument on the roof of the new Science Museum as soon as building operations permit, probably in September next.

Microbaroscopes were constructed and issued to 6 stations for use during observations in connexion with the explosions at La Courtine Main y, 1924.

Supplies of Dines balloon meteorographs were purchased from two firms, both consignments proving satisfactory.

The contractors for the supply of tapered measures for rain-gauges found great difficulty in supplying satisfactory glasses and the position called for serious consideration towards the end of the year. It was decided to purchase blank glassware direct from glassworkers and issue the measures in small quantities for graduation as occasion demanded.

24 Gold* barometer scales were purchased during the year for attachment to marine barometers. In November it was decided that all barometers in use at sea whose certificates were dated 1916 or earlier should be replaced by recently tested barometers, fitted, when available, with Gold scales. By the end of the year 16 such barometers had been replaced.

Supply of Instruments on Repayment.—No change was made in the conditions under which stores are issued on repayment. The total value of the stores issued in this way was £2,680.

Among the more important issues the following may be mentioned:—

- (a) Equipment for crop-weather stations under the Ministry of Agriculture and Fisheries. The instruments issued included 9 anemobiographs, the sites for which were selected in most cases by the Superintendent, and in the remaining cases, by meteorologists at out-stations.
- (b) 45 barometers, 31 barographs and 140 thermometers to the Admiralty.
- (c) 12 Hill mirrors to the Equipment Branch of the Air Ministry.

Storekeeping and Accounting.—The number of store accounts now kept, each of which details the equipment on charge and accounted

* See p. 23 under "Instrumental Observation."

for by the Office at a single station or on board ship, is 845. Each store account has been checked by inspection or by correspondence with the custodian during the course of the year. All discrepancies revealed have been investigated and cleared in consultation with the relevant branches of the Air Ministry when necessary.

The arrangements whereby this division keeps the store accounts for stations under the Signals Branch and other branches of the Air Ministry have been continued.

Air Ministry auditors visited the division from 27th–31st October, 1924 and from 2nd–6th March, 1925.

Stock was taken of the instruments and stores held at the central stores at South Kensington as on 30th September, 1924 and 31st March, 1925, and compared with the ledgers.

Boards of Survey for conditioning surplus and unserviceable stores were held on 15th August, 1924 and 10th March, 1925. The recommendations of the Boards were approved and carried into effect.

The stocks of old 375 cubic feet hydrogen cylinders held on charge at various stations throughout the country were disposed of by tender. The total number of cylinders disposed of in this way was 1,341.

The transfer to the respective Governments of the fishery barometers held on charge at stations in the Irish Free State and in Northern Ireland was completed. All remaining instruments missing or destroyed were written off and the store accounts for Ireland are now clear.

A simplification of procedure in the supply of small stores to Observatories and to the office in Malta was made by arranging for such stores to be purchased locally up to the value of £5 per quarter.

The total number of demands dealt with during the year was 2,385, an increase of 324 on last year.

Investigations and Research.—Apart from special work connected with the drafting and discussion of new specifications, work has been done in connexion with a number of problems. The following call for individual mention :—

(a) *New Pattern Kew Barometer.*—The barometers made to Dr. Sen's specification were kept under observation. From the information gained, it has now become possible to prepare a detailed specification.

(b) *Autographic Recording.*—Investigations were carried out with various pens, ink and papers, with the result that the best type of paper was found to be Hollingsworth, cut with the time axis in the downboard direction. Arrangements were made to ensure that all forms are correctly cut in future. Further work on the ink is in hand.

(c) *Zero Changes in Spirit Thermometers.*—This investigation (using various combinations of alcohols, etc.), which was undertaken in conjunction with the National Physical Laboratory, has already yielded important results.

(d) *Losses in Rainfall Measurements.*—Experiments were made to determine the magnitude of losses due to wetting and evaporation in an ordinary gauge.

(e) *Radiation in High Fogs.*—Some observations were made with a Crookes Radiometer and a report prepared.

(f) *Earth Thermometry*.—A report was prepared on the results obtained with thermometers of different types at Kew Observatory.

(g) *Comparison of Sunshine Recorders*.—A report was prepared on the results obtained at Kew with the old recorder, a standard Hicks instrument and an instrument formerly in use in Switzerland.

Preliminary consideration was given to the problem of the optical testing of sunshine spheres.

(h) *Sunshine Cards, Standardization of Colour*.—Work on this question has been delayed by the difficulty of obtaining suitable cards in graduated shades of blue on standard board.

(i) *Leakage of Hydrogen from Pilot Balloons*.—Work has been carried on in connexion with this investigation, as time permitted.

Specifications.—The following new or revised specifications were approved during the year. In each case new working drawings were prepared for issue with the specifications :—

- (a) Storm Warning Cone.
- (b) Balloon Fillers, Mark III.
- (c) “ Gold ” Correction Scale, Mark III.
- (d) Tapered rain measures.
- (e) Blank glasses for tapered rain measures.
- (f) Symons's type earth thermometers and 1 foot and 4 feet tubes.

In addition to the above a detailed specification of the cardboard used for sunshine records was adopted after careful preliminary tests.

Testing and Inspection of Instruments.—The installation of a pressure chamber has much facilitated the testing of barographs and aneroids. The special burettes used for testing rain measures have resulted in a considerable economy in the time expended on this work.

After discussion with the National Physical Laboratory, it was arranged in November, 1924, that the Office should, in future, be the sole testing department for raingauges and measures.

The amount of test work carried out during the year has been unusually large. The total number of rain-gauges tested on repayment was 289 while 634 measures were certified. The corresponding figures for last year were 65 and 130 respectively.

Drawing and Photographic Work.—The following tabular statement summarises the year's work in these departments :—

| | |
|------------------------|-----|
| Drawings | 197 |
| Blue Prints | 361 |
| Negatives | 301 |
| Contact Prints | 262 |
| Lantern Slides | 93 |

Workshop.—During the year full use has been made of the workshop facilities at Kew and South Kensington for experimental and

repair work. Amongst other items mention may be made of the following work done at South Kensington :—

- (a) Specimen Inspector's box, Mark IV.
- (b) Specimen compact receiver for use with electric cup anemometer.
- (c) Steel limit gauges for testing sunshine spheres.
- (d) Re-conditioning a Masing clock and drum for Galitzin seismograph.
- (e) Templates for sunshine recorder cards.
- (f) Pilot balloon releases.
- (g) Vapour pressure hygrometer for the Advisory Committee on Atmospheric Pollution.

ARMY SERVICES DIVISION

The work of the Division has continued on the lines of the preceding years. Observations of pilot balloons with two theodolites have been continued at Shoeburyness, and at both Shoeburyness and Larkhill, the method of observing pilot balloons with tails is adopted in cases where only one theodolite is employed.

The establishing of a "meteor flight" at Duxford has made it possible to discontinue the use of Kite Balloons at Shoeburyness. It is proposed to dismantle the Kite Balloon Station but to retain such stores as would be difficult or costly to replace.

A certain number of computations of trajectories and of weighting factors for wind and temperature appropriate to special trajectories, have been carried out at Shoeburyness.

A wireless receiving set has been installed at Larkhill, for the reception of synoptic messages, and daily weather charts are now drawn and supplied to the School of Artillery.

The Meteorologists in Charge at Shoeburyness and Larkhill have delivered lectures on the application of meteorology to Gunnery to classes of officers and N.C.Os. from time to time during the year.

During the summer of 1924 one observer was posted to each of five Artillery Practice Camps at Buddon Ness, Okehampton, Trawsfynydd, Redesdale, and Wahn (Cologne) for the purpose of supplying upper air data to the Artillery Units posted at these camps. Arrangements were made for the supply of meteorological information to the anti-Aircraft Practice Camps at Hunstanton during July and August, 1924.

The periodogram analysis of twelve sets of meteorological observations, each covering at least 100 years, has been continued, and is nearing completion.

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

The scheme to meet the meteorological requirements of the Army in time of war has been approved by the War Office, and regulations for enrolment of meteorologists in the Reserve of the Royal Air Force are being drawn up.

LOCAL CENTRES DIVISION (Aviation Services)

General.—The work of the Division, both at Headquarters and at the various out-stations has been continued on the general lines of the preceding year. An outstanding feature has been a marked increase in requests for data and reports on the meteorological conditions affecting aviation in various parts of the world.

Services for Civil Aviation.—(a) *London-Continent routes.*—Regular forecasts have been issued daily to meet the needs of the various services and these, together with the hourly reports of actual weather on the routes, have been exhibited at the aerodromes at Croydon and Lympne. In addition, advice has been given as required to the officials and pilots of the operating companies by the Meteorologists-in-Charge at both stations and weather reports have been passed by radio-telephony to aircraft in flight. During the year, 3,507 requests for reports or forecasts were received either personally or by telephone at Croydon and 1,472 reports were passed by radio-telephony from that station to aircraft in flight.

The hourly reports of weather from stations on the route commenced at 0300 G.M.T. in the summer and from 0500 during the winter. At various times during the year additional observations were made after normal hours in connexion with night flying tests. During November and December special visibility observations were made at Croydon and Biggin Hill during foggy evenings in connexion with observations of the visibility of lights from a captive balloon.

As from September, arrangements have been in force whereby important changes in visibility at stations on the route are immediately communicated to the pilots of aircraft in flight and also transmitted by W/T to the continental terminal aerodromes. The arrangements were extended as from 1st January to include important changes in cloud height, weather and wind force. The latter reports are communicated by radio-telephony to aircraft in flight but are not transmitted to continental aerodromes.

A gazetteer of stations in south-east England was prepared and forwarded to the Meteorological Offices at Paris, Brussels and Utrecht.

(b) *Southampton-Guernsey route.*—This service which was maintained on the lines indicated in last year's report was suspended on the 1st March when the route was closed temporarily.

(c) *London-Manchester route.*—This route was closed on 1st April, 1924, and the meteorological services were suspended. On the closing of Manchester Aerodrome on 28th August, the meteorological station there was also closed. The Station at Castle Bromwich has been retained, chiefly as a reporting station in connexion with cross-country flying.

(d) *Liverpool-Belfast route.*—Between the 22nd May and 5th June, a meteorological service was provided in connexion with this route. A station was opened at Belfast with a Grade II clerk in charge and reports were received regularly from Little Ross Lighthouse, Portpatrick Coast Watching Force Station and Donaghadee Coastguard Station. Forecasts were supplied to the terminal aerodromes at Liverpool and Belfast by the Meteorologist-in-Charge at Sealand Aerodrome.

(e) *Carlisle-Belfast route*.—The station at Belfast and the system of reports from auxiliary stations as organized for the Liverpool-Belfast route were maintained during the operation of this route from 29th August to the 3rd November. In view of the shortness of this route, no forecasts were issued, the meteorological arrangements being supervised by the assistant-in-charge at Belfast. The observations at Carlisle were made by the operating staff of the Northern Air Lines Ltd.

(f) *Stranraer-Belfast route*.—This route was opened on March 14th. The station at Belfast was re-established on that date and reports have been obtained from the auxiliary reporting station at Donaghadee. The observations at Stranraer were made by the staff of Northern Air Lines Ltd.

(g) *Aeroplane races and competitions*.—A system of special reports and forecasts was organized in connexion with the King's Cup Race in August.

Reports and forecasts were also supplied to the officials and competitors at the "Light Aeroplane Meeting" at Lympne in September.

(h) *Special data for civil aviation*.—Special information and forecasts were supplied during September in connexion with a flight from London to Tangier.

During the year reports have been prepared on the meteorological conditions affecting civil aviation over the following routes and areas:—

- (1) Croydon to Cologne.
- (2) Cologne to Prague.
- (3) Zurich to Vienna.
- (4) Coasts of the Adriatic Sea.
- (5) England to India *via* Constantinople.
- (6) West Indies and Northern Coast of South America.
- (7) Singapore to Batavia.
- (8) Hong-Kong to Shanghai.
- (9) Berlin to Bucharest.
- (10) Cairo to Karachi.
- (11) Cape Town to Durban.
- (12) Cape Town to Pretoria.
- (13) Paris to Madrid *via* Marseilles.

Services for the Royal Air Force.—Regular courses of lectures have been continued at the Cadet College at Cranwell, the Aerial Navigation School at Calshot and the Flying Training School at Sealand by the Meteorologists-in-Charge, who have also acted as examiners. In addition, throughout the year the Meteorologist-in-Charge at Calshot has supervised the meteorological instruction of the Naval Observers' Course at Lee-on-Solent. Lectures to officers of the Royal Air Force Reserve have been given by the Meteorologist-in-Charge at Renfrew.

The work of the stations at Leuchars, Felixstowe and Cattewater has been maintained on the general lines of the previous year.

Reports and forecasts have been supplied daily from Headquarters to the Superintendent of Reserve, Northolt, for flying to Edgware, Filton, Coventry and Bristol. Occasional forecasts have been supplied to the Director of Equipment in connexion with the delivery of machines. Statements of weather conditions were prepared on various occasions for the Inspector of Accidents.

Reports on the meteorological conditions of proposed aerodrome sites have been prepared on several occasions for the President of the Aerodromes Board.

Data regarding air densities over various parts of the world have been supplied to the Director of Technical Development.

A note on the meteorological conditions on the Cairo to Cape Town and Cairo to Nigeria routes was prepared in connexion with the projected flights over Africa. In addition 16 statements of weather conditions in various parts of the world have been prepared as required for other branches in the Air Ministry.

Experimental Anemometrical Station—Holyhead.—Comparison of the old and new sites (in respect of observations of pressure, temperature and rainfall) was continued during the year. A further comparison between the readings of the pressure-tube anemometer and the anemobiograph was carried out for the month of February, 1924. An investigation into the velocity of the wind at high and low tides was also conducted; no appreciable difference was found.

Upper Air Observations.—The total number of single theodolite pilot balloon ascents made at distributive stations during the year was 9,354. In addition 3,355 nephoscope observations of the movements of upper clouds have been made. As from the 1st October, the "tail method" has been in general use for pilot balloon ascents at all stations.

Registering balloons have been sent up from Sealand at times decided upon by the Superintendent of the Upper Air Section at Kew Observatory. An investigation was continued into the structure of the atmosphere as disclosed by the trajectories of pilot balloons released from Sealand to float at a known height.

Summaries of upper winds during the period 1st January, 1920, to 31st July, 1924, in accordance with a scheme recommended by a Sub-commission of the International Commission for Aerial Navigation have been prepared at Croydon, Cranwell and Leuchars.

A card-index of registering balloon ascents made in England from 1907 to 1923 has been prepared at South Farnborough.

Reports were received from South Farnborough on the suitability of a Marvin meteorograph for observations by aircraft and also on the readings of thermometers placed in different positions on aircraft.

Attempts to obtain records of atmospheric pollution in the upper air by means of observations from aircraft have been made at South Farnborough since September but these observations have been few in number.

Investigations.—The following investigations were completed during the year and reports thereon circulated among the staff:—

The relation between surface relative humidity and cloud height at Cranwell.—S. P. PETERS.

A memorandum on visibility.—W. H. PICK.

The relation between upper air temperatures and pressure type over south-east England during the period 1st January, 1920, and 30th November, 1924.—W. H. PICK and S. P. PETERS.

Night frosts at Cranwell during late autumn, winter and early spring.—W. H. PICK.

The meteorological characteristics associated with the north-easterly type at Cranwell.—W. H. PICK and G. A. WRIGHT.

A note on warm and cold anticyclones.—W. H. PICK and S. P. PETERS.

A note on pressure type and sunshine at Cranwell.—W. H. PICK.

A note on "Bumps and bumpiness" by three Royal Air Force officers at Cranwell was received during July.

A paper was prepared containing, together with a note on the subject written by Major A. H. R. Goldie, frequency summaries of visibility and low cloud at all stations.

Reports of the audibility of the explosions at La Courtine, which took place in May in connexion with an investigation on the propagation of sound in the atmosphere were collected, 150 reports being received from all parts of the country. The reports were tabulated and summarised and the results forwarded to the Institute of Physics at Paris.

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

To determine the effect of the accumulation of dust on the glass ball of a sunshine recorder, two recorders have been installed at South Farnborough, the ball of one instrument being cleaned daily while the other is not cleaned. Records are still being obtained from both instruments.

A report on the readings of thermometers in a large and small screen differently situated has been prepared at South Farnborough.

A comparison of the readings of a new pressure tube anemometer and an old instrument at Scilly was made by the staff at Cattewater.

The following investigations are in hand :—

The occurrence and persistence of fog—at Calshot.

The visibility of a 1 candle-power light at a distance of 1 kilometre at night—at Cranwell and Lympe.

The values of sea disturbances as computed by readings measured by a theodolite of the movement of a buoy—at Calshot and Felixstowe.

Inquiries.—The number of inquiries has increased during the year and an increasing number of telephonic inquiries has been received at stations from Royal Air Force units and aircraft firms at places where no meteorological stations exist. In particular, A. V. Roe & Co., Ltd., have frequently obtained reports and forecasts from Sealand, the Blackburne Aircraft Co., Ltd., Brough, from Cranwell and the De Havilland Aircraft Co., Ltd., from Headquarters.

The total number of inquiries received at stations during the year exceeded 12,000 whereas the corresponding figure for last year was 9,000.

Buildings.—The new office at Sealand was completed and occupied by the staff in November.

Owing to the danger to aircraft, the office at Croydon was condemned and an aerodrome building was converted into a meteorological office and occupied on March 21st.

The office at Biggin Hill was also condemned owing to the extension of War Office buildings in the vicinity. An office on the aerodrome was allotted for meteorological work and occupied on the 9th February.

Plans have been prepared for a new office at Cranwell. Minor structural alterations were made to the offices at Calshot and Felixstowe.

BRITISH RAINFALL ORGANIZATION

Changes in Rainfall Stations.—The arrangements for the collection and distribution of information with regard to rainfall have continued on the same lines as in previous years. From the majority of rainfall stations, reports are received annually. The total number of gauges in the British Isles for which reports are available for the year 1924 is approximately 5,000. The number of stations from which information is received monthly is now about 1,000. There are 19 observers who receive small honoraria for observations in remote parts of the country, mostly in Wales.

In the collection of records great assistance is rendered by the officials of local rainfall associations, especially by Mr. E. W. M. Murphy of the Irish Rainfall Association. The retirement of three of these officials whose work has been highly appreciated has to be recorded: Mr. F. Campbell Bayard prepared a series of reports on behalf of the Croydon Natural History and Scientific Society. These reports are to lapse, but the rainfall returns which were used in their compilation will be sent direct to the Meteorological Office. The Rev. H. A. Boys has given up the collection of records for the Mid-Wessex Rainfall Association owing to advanced age but the work is being continued by the Rev. F. P. Synge. Major C. A. Markham, Secretary of the Northamptonshire Rainfall Association is succeeded by Mr. R. H. Primavesi who carried out the duties during the war.

The obituary list contained the names of 115 observers and included 21 who had reported observations for 30 years and upwards.

Inspections.—During the year 138 rainfall stations and 34 sites for proposed gauges were inspected by the staff of the British Rainfall Organization. More than half were in South Wales, these include the gauges maintained by the Cardiff Waterworks, the Taff Fechan Water Supply Board, the Llanelly Waterworks and the Llanelly Rural District Council. The inspection of the gauges in the County of London was completed.

Publications.—*British Rainfall*, 1923, was published on January 24th, 1925. Considerable modifications were made in the arrangement of the tables but otherwise the volume was on the same

lines as its predecessors. Of special interest are the photographs of the damage done by a remarkable storm at Carrbridge on July 8th, 1923, and the records of the great all night thunderstorm which began in the south of England, late on July 9th.

The Meteorological Magazine has been published regularly during the year. In a letter addressed by Mr. Sampaio Ferraz of Brazil to the directors of meteorological services of all countries on July 10th, 1924, an appeal was made for the inclusion in a single monthly publication of particulars of anomalous weather in all parts of the world and the hope expressed that the *Meteorological Magazine* would be used for this purpose. In a leading article printed in the December number of the *Magazine*, reports of such anomalies were asked for with a view to their inclusion in the monthly articles on "Weather Abroad." The general adoption of this suggestion will add to the value of the *Meteorological Magazine*.

Book of Normals for the British Isles.—The tables giving average monthly rainfall for the period 1881 to 1915 for 578 stations were published in September as Section V of the *Book of Normals*. These tables, which represent in the main information collected by the British Rainfall Organization before incorporation with the Meteorological Office, were prepared under the superintendence of the late M. de Carle S. Salter.

The Rainfall Map of the British Isles.—Work was continued on the rainfall survey of the British Isles. The map of Wales on the scale 2 miles to an inch was nearly completed and the computation of averages for the eastern counties of England was commenced.

In response to an application from the Tynwald averages for the stations in the Isle of Man were worked up and mapped.

Thames Valley Rainfall.—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, 1924 was also supplied. Statistics were also sent monthly to the Thames Conservancy.

Professional Work.—In connexion with schemes for the utilization of hydraulic power, reports were prepared on the rainfall of the basin of the River Leven in the Lake District and of two areas in Wales, the Ystwyth Valley and the basins of the Artro and Nantcol. A memorandum on the average rainfall of the Upper Churnet Valley in Staffordshire was also prepared.

Inquiries.—The number of other inquiries for which fees were charged was 108 as compared with 70 in the preceding twelve months. Several of the inquiries had reference to proposals for the utilization of hydraulic power. A point of legal interest was involved in one inquiry which referred to the heavy rainfall in London on July 26th and 29th, the question at issue being whether a landlord was bound to provide drains capable of carrying away rain of very exceptional intensity.

General.—*British Empire Exhibition.* A relief map showing the rainfall in London in the great thunderstorm of June 16th, 1917, was modelled by Mr. A. T. Bench. The amount of rain is shown on the natural scale. Maps showing the average rainfall for each month of the year on the scale 19 miles to the inch were also sent to the Exhibition.

Exceptionally heavy Rainfall. The outstanding event of the year was the occurrence of rainfall in some respects without precedent at Cannington near Bridgwater in the early morning of August 19th. At least 8 inches of rain fell in 5 hours. Subsequently, Dr. J. Glasspoole visited Cannington, inspected the rain-gauges in the district and prepared a report which will be published in *British Rainfall*, 1924.

ADVISORY COMMITTEE ON ATMOSPHERIC POLLUTION

The work of investigating atmospheric pollution has been continued under the direction of the Advisory Committee of which Sir Napier Shaw acted as Chairman until the meeting of January 16th, 1925, when the duties of Chairman were taken over by the Director of the Meteorological Office in accordance with the recommendations of the Meteorological Committee's minute of November 12th, 1924. Dr. J. S. Owens acted as Honorary Secretary. Certain new members have been elected to the Committee and the complete list at the end of the year was as shown on page 5. The routine work of collecting and classifying the monthly analysis of rain and impurities from 48 standard gauges in different parts of the country was continued. Three new gauges have been put into operation during the year.

The results of six automatic recorders have been available at different stations giving continuous records of the suspended impurity in the air.

The *Tenth Annual Report* of the Committee has been prepared for publication.

The researches which the Committee have in hand include the following :—

1. The effect of suspended matter in obstructing light ; observations by lumeter and cube method and by contrast photometer.
2. Experiments aimed at the correction of the lumeter and cube method for colour of light.
3. The selective absorption of light by suspended impurity.
4. Loss of daylight due to impurity as distinct from loss of sunshine.
5. The development of methods for measuring sulphur pollution, especially in country districts, in collaboration with H.M. Office of Works and aimed particularly at elucidating the causes of stone decay in country districts.
6. Examination of London fogs :—
 - (a) Dust counter observations.
 - (b) The collection of solid impurity for examination and analysis.

- (c) The estimation of tar and its relation to domestic and factory smoke.
- (d) The spectrographic analysis of the solid matter from London fogs.
- 7. The development of micro-chemical methods of analysis of suspended impurity, with particular reference to dust counter records.
- 8. The development of crystallographic methods of analysis of atmospheric dust.
- 9. Photomicrography of dust records.
- 10. The measurement of water in fog and the relative amount of suspended water in country and city fog.
- 11. Observations on the horizontal distribution of impurity.
- 12. The analysis of the effect of wind velocity upon the concentration of suspended matter in city air.

An investigation into the effect of suspended impurity upon the incidence of bronchial diseases has been arranged in collaboration with the Ministry of Health and data have been collected for the six months November, 1924 to March, 1925, in the hope of throwing light upon the problem.

The problem of measurement of smoke from chimneys has been under investigation in collaboration with the Fuel Research Board, and this is progressing satisfactorily.

While the above researches are in hand little progress has been possible with most of them during the past winter owing to the illness of Mr. G. M. Watson, the Committee's research chemist and work in the laboratory at South Kensington has been suspended since November 1st, 1924, as it has not been possible to obtain a substitute for Mr. Watson.

A large number of records of atmospheric dust have been taken in England, also in other countries and over the open sea, and valuable information has been obtained.

The experiments in connexion with the new instrument for the measurement of water in fog, referred to in last year's Report, have been suspended since November 1st. Two metal instruments have been made but the final tests of these have not yet been completed owing to the absence of assistance.

Exhibits were shown at Wembley Exhibition at the request of the Ministry of Health illustrating the methods of measuring atmospheric impurity and the results obtained. A similar exhibit was given at Manchester in November, 1924, for the Smoke Abatement League of Great Britain. A paper was read by Dr. Owens at the Toronto meeting of the British Association upon atmospheric pollution and a demonstration given of atmospheric dust obtained in mid-Atlantic and on Lake Ontario. A paper dealing with the same subject was read before the Royal Society of Arts.

NAVY SERVICES DIVISION

The work of the Division has expanded considerably during the past year and it would appear that increasing interest is being shown by Naval Officers in the subject of Meteorology. Several Naval

Officers have visited the Office and have been shown the work of the Forecast Division. Numerous inquiries have been received from Naval sources including the Gunnery and Navigation Schools and Submarine Depot.

A series of lectures in synoptic meteorology was given at the Port Library, Portsmouth to Officers undergoing courses at the Navigation School and other Officers of H.M. Fleet; the lectures in May were delivered by the Director and those in October by the Naval Superintendent.

The number of ships sending reports of meteorological interest has been well maintained. The Naval establishment at Portsmouth, Devonport, Chatham and Pembroke has been visited and the meteorological requirements of these respective areas discussed with the Commander in Chief and other officers: several of H.M. Ships have also been visited including H.M.S. *Emperor of India* of the Mediterranean Fleet. The co-operation of the Navy in upper air work is maintained. The Superintendent with the permission of the Hydrographer went afloat in H.M.S. *Kellett* for 6 days during the month of June, and carried out pilot balloon and registering balloon experiments and trials with the mirror theodolite.

H.M.S. *Ormonde* continues to carry out pilot balloon observations in the West Indies and in addition H.M.S. *Repulse*, during her cruise to the Cape and Argentine and H.M.S. *Emperor of India* in the Mediterranean, have also undertaken to carry out such observations.

Twenty-three Gale Warning Stations have been inspected during the year and where necessary their positions fixed for insertion on the Admiralty Charts. New Gale Warning Stations have been established at eight ports.

A full detailed report of the Gale Warning Stations of England and Wales has been prepared.

AIRSHIP METEOROLOGY DIVISION

The new division (*see* page 12) works in the closest possible touch with the Directorate of Airship Development, Air Ministry, and a programme of work for the investigation of meteorological conditions along proposed airship routes to Egypt and India has been drawn up. This provides for the investigation, not only of average conditions along the routes and the special characteristics of the bases, but also of the general distribution of weather and wind on individual days and of the day to day changes. The last has for its object not only the safeguarding of the airships by showing the conditions in which undesirable phenomena occur, but also of looking into the question of the extent to which the route followed on a particular occasion can be chosen according to the wind distribution prevailing at the time in order to secure economical flying. The base map for this investigation is a specially prepared one on a conical orthomorphic projection with two standard parallels (50°N and 20°N) where the scale is 9/10 of 1 : 10,000,000. The map measures 40" × 30" and embraces Iceland, Jan Mayen and Bear Is. in the north, the Azores, Madeira and Canaries

in the west, the Sudan, Abyssinia and Ceylon in the south, Rangoon and the Andaman Is. in the east. On copies of this daily synoptic charts may be drawn covering the whole route to India from England, utilising data derivable from all sources including the logs of ships.

During the period under review some progress was made with the investigation of conditions along the routes, especially the summarising of upper wind observations in the Mediterranean area in a form suggested by the International Commission for Air Navigation. The full specification of the base map described above was also drawn up and arrangements made for the map to be drawn for printing.

Another phase of the work of the Airship Meteorology Division is that connected with the meteorological organization for the supply of data and forecasts during operations with airships.

The meteorological hut at Pulham Airship Station was opened on February 23rd with the Senior Professional Assistant in charge and a routine for observing, charting and forecasting was laid down in anticipation of the arrival of R.33 from the Royal Airship Works, Cardington, for experimental flights at Pulham.

The Superintendent also devoted some time to preliminary work in connexion with the meteorological organization for the flights which are to be made later to the East.

LIBRARY

General.—Commencing with January, 1925 a monthly list of the papers bearing on agricultural meteorology received in the library has been prepared and forwarded to the Ministry of Agriculture and Fisheries for incorporation in the Monthly Report (Agricultural Meteorological Scheme).

Abstracts of the more important meteorological papers received in the library have been prepared by members of the professional staff. These abstracts have been manifolded and circulated in sets to the Branches and Establishments of the Office. The Council of the Royal Meteorological Society has been good enough to arrange to print a selection of these abstracts in the Society's Quarterly Journal.

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

Union Office of Census and Statistics, Pretoria.

Chief of the Central Management of Russian Maritime Transport, Moscow.

Observatorio Centrale della Libia, Tripoli.

Hydro-Meteorological Office, Theodosia.

Tsingtao Observatory, China.

Astrophysical Institute of Russia, Moscow.

The scope of the exchange of publications with the Department of Terrestrial Magnetism, Washington, has been extended to include the Observatories of the Department established in Western Australia and Peru.

An exchange of publications has been re-established with the Bureau of Standards, Washington.

Additions.—The additions to the library during the past year include 444 new books and pamphlets and 10,728 daily weather reports. The number of periodicals received was about 800.

Loan of Books.—4,432 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 and the numbering and listing of all books contained on the shelves has been completed. The books on 69 shelves were numbered and listed during the year under review.

Binding.—257 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 publications.

London Royal Society. *British Empire Exhibition, 1924, Handbook to the Exhibition of Pure Science* arranged by the Royal Society.

Mathias, E. *La régime de la pluie dans le comté de Kent et la région française du Pas-de-Calais.*

Gregory, Sir Richard. *British Climate in Historic Times.*

Hellmann, G. *Untersuchungen über die jährliche Periode der Niederschläge in Europa.*

Dorno, C. 1. *General remarks on Meteorology and Climatology.*
2. *Radiation.*

3. *Medical Climatology and High Altitude Climate.*

Committee of the Captain Scott Antarctic Fund. *Meteorology.*
III. *Tables* by G. C. Simpson. *Miscellaneous Data*, by H. G. Lyons.

Cape Town Drought Investigation Commission. *Final Report.*

Georgii, Walter. *Wettervorhersage.*

Georgii, Walter. *Die meteorologischen Messmethoden.*

Rouch, J. *L'atmosphère et la prévision du temps.*

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

Jeans, J. H. *The Mathematical Theory of Electricity and Magnetism*, 4th Edition.

Huntington, Ellsworth. *Earth and Sun.*

Herdman, William, A. *Founders of Oceanography and Their Work. An Introduction to the Science of the Sea.*

Hawkins, Edgar. *Medical Climatology of England and Wales.*

Cherry Garrard, Apsley. *The Worst Journey in the World. Antarctic, 1910-1913.* Vols. I and II.

Hill, Leonard. *Sunshine and Open Air, Their Influence on Health, with special reference to Alpine Climates.*

Gibbs, William, E. *Clouds and Smokes.*

Johnstone, James. *An Introduction to Oceanography with special reference to Geography and Geophysics.*

Clayton, H. H. *World Weather.*

- de Quervain, Alfred and P. L. Mercanton. *Ergebnisse des Schweizerischen Grönlandexpedition, 1912-13. Teil I-IV.*
- Koppen, W. *Die Klimate der Erde.*
- Eckardt, W. R. *Die Palao-klimatologie, ihre Methoden und ihre Anwendung auf die Paläobiologie.*
- Brand, Walter. *Der Kugelblitz.*
- Filchner, Wilhelm. *Zum sechsten Erdteil.*
- Defant, A. u.E. Obst. *Lufthülle und Klima.*
- Talman, C. F. *Meteorology. The Science of the Atmosphere.*
- Wild, Frank. *Shackleton's Last Voyage. The Story of the Quest.*
- Ponting, Herbert, G. *The Great White South.*
- Davison, Charles. *The History of British Earthquakes.*
- Jeffreys, Harold. *The Earth, Its History, Origin and Physical Constitution.*
- Howarth, O. J. R. *The British Association for the Advancement of Science: a Retrospect, 1831-1921.*

Minor Personal Inquiries.—249 minor personal inquiries were dealt with.

Lantern Slides.—75 new slides were received into the collection. Sets of slides were borrowed on 32 occasions.

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.

Reduction of Data from Observatories.—The reduction of the Eskdalemuir magnetic data has been carried on as usual.

The preparation of the last volume of the series of *Hourly Values from Autographic Records, i.e.*, that for 1921, is still outstanding, but all computing work on it has been completed and the year closes with the tables, text, etc., almost ready for the press. At the same time the first volume of the new *Observatories' Year Book, i.e.*, that for 1922 is going through the press and part of the computing required in connexion with the 1923 *Year Book* has been accomplished.

Climatological, Telegraphic and Rainfall Stations.—The climatological work has been kept well forward. The number of climatological stations in Scotland is now 67. Two of these are research stations established in connexion with a scheme promoted by the Board of Agriculture for the study of the correlation between crops and weather; these stations are situated at Craibstone, near Aberdeen, and at Boghall, near Edinburgh. The Office co-operated in connexion with the training of observers and the supply of equipment.

Certain simplifications of routine in connexion with the collection and tabulation of rainfall statistics for Scotland have enabled the work to be kept month by month well up to date, an advantage which

became more fully apparent in preparing the records for 1924 for publication. The total number of rainfall stations stands as formerly, about 760.

The number of observing stations in Scotland (other than rainfall stations) at work during the year is shown below.

| | Observa- tories. | Telegraphic Reporting Stations. | Climato- logical Stations. |
|---------------------------------|---------------------|---------------------------------------|----------------------------------|
| Number at beginning of year. | 3 | 8 | 56 |
| „ closed during year | — | — | 1 |
| „ opened during year. | — | — | 2 |
| „ at end of year .. | 3 | 8 | 57 |

The number of inquiries dealt with by correspondence was 46.

Advisory Committee.—This Committee met on 17th December, 1924, the Director being present as Chairman.

Library.—253 volumes, mostly of serials, were bound during the year.

Observatories :—

ESKDALEMUIR OBSERVATORY

Terrestrial Magnetism.—As in former years continuous photographic registration of the three geographical components of terrestrial magnetic force was maintained, absolute determinations of horizontal intensity, declination and inclination being carried out twice weekly. The reading of the curves and the assigning of base and scale values were done at the Observatory, while most of the ensuing work of computing and reduction was carried out in the Edinburgh Office. In compliance with the request of the International Meteorological Committee estimates of the daily magnetic character figures and values of the square of the daily range were forwarded quarterly, as in previous years, to the Royal Netherlands Meteorological Institute at De Bilt. Tabulation of the hourly ranges of the magnetic components for the years prior to 1918 was completed.

With a view to obtaining material for an inquiry into the possibility of improving the horizontal force determinations by using deflexion distances other than 25, 30 and 35 cms., additional deflexion observations at 40 cms. were made during several months of the year.

Further comparisons between the Schulze Dip Inductor and the Dover Dip Circle were carried out and towards the end of July, 1924, a comparison between the Observatory unifilar magnetometer (Elliott No. 60) and the Dover No. 140 unifilar, from Kew, was made.

At the end of 1924 it was discovered that the azimuth of the west magnetograph magnet had been rather seriously in error since the end

of August, 1923. The necessary readjustment was made and the work of correcting the tabulation of the records is in hand.

From time to time during the year records were obtained from the "vertical force coil" referred to in the last report.

Meteorology.—The routine work as a first order station was carried on as in former years. Pilot balloon ascents were made on International and Amundsen days, when weather permitted, and on other occasions as circumstances dictated and opportunity offered. Most of the ascents in the latter part of the year were by the "Tail" method.

Solar radiation observations with the Angström pyrheliometer were made on a few days. During the greater part of the year Eder Photometer records, giving a measure of ultra-violet radiation, were obtained and forwarded to the National Institute of Medical Research. In connexion with these special records monthly returns of sunshine were made.

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

In February, 1925 a Fuess recording snow-gauge was brought into use.

Atmospheric Electricity.—The photographic records from a Dolezalek quadrant electrometer connected to a water-dropper were maintained, the behaviour of the installation being more satisfactory than during the preceding year. Combined leakage and scale tests were made almost daily and in each month at least six absolute observations of potential gradient in the open were made for the purpose of obtaining values of the factor employed for converting the curve readings of the photographic records into potential gradient in volts per metre above ground level in the open. Values of the potential gradient at 3h, 9h, 15h, 21h, G.M.T. on each day and at each hour in certain selected electrically quiet days were tabulated.

Later in the year a battery of dry cells (0-440 volts) was received for use in standardizing the Wulf-electrometers employed in potential gradient work.

Seismology.—As in recent years the instruments in use were Galitzin seismographs, with galvanometric registration, recording disturbance in the north, east and vertical directions. Owing to failures of the clockwork mechanisms of the recording drums complete records of all three components were obtained during only a small portion of the year, and during the latter months of the year horizontal component records only were obtained, owing to two drums being under repair. One determination of instrumental constants was carried out.

Earthquake bulletins were prepared and issued as described in the last report and the measurement of the amplitude and periods of microseisms was continued as in previous years.

Publication of Results.—The volume for 1922 being the first of the new series of the *Observatories' Year Book* it was considered desirable

to re-write completely the introductory matter, notes on instruments, etc., relating to the Observatory. This and the discussion of results were done by the Assistant Superintendent. The meteorological tables for the 1923 *Year Book* were brought nearly to completion.

Buildings, etc.—The principal buildings were re-painted externally during the summer and autumn of 1924. The white paint of the interior of both magnetic huts was extended to floor level. The damp condition of the underground magnet house received much consideration from the Works and Buildings Department of the Air Ministry. Various schemes of improvement were proposed but it was finally decided to concentrate upon dealing with the water which enters from below floor level and work in this direction was put in hand towards the end of the year.

A small generating set to supply electric lighting for certain of the photographically recording instruments was installed in November, 1924.

Miscellaneous.—Readings of Mr. E. A. Reeves's† "true-north" apparatus were taken twice daily, apart from times of rain, from July, 1924.

The meteorological observer at the experimental farm of the Edinburgh College of Agriculture attended the Observatory for a period of three weeks to familiarise himself with the methods and practice of meteorological observation.

ABERDEEN OBSERVATORY

Routine work as a first order station proceeded as usual. Most of the autographic instruments were dismantled, cleaned and adjusted during the year. The platform supporting the screen of the photo-thermograph 41 feet above the ground and attached to the north wall of the Observatory tower, was repaired and partially rebuilt; the mounting of the sunshine recorder was also repaired.

A series of observations of humidity was made with the Assmann Aspirated Psychrometer and results were compared with the values deduced from the dry and wet bulb standards in the photo-thermograph screen. Extremely good agreement was found.

The Observer for Craibstone Experimental Station was trained in observational and instrumental work.

In order to establish a relation between the records of the newly installed Dines pressure tube anemograph and the old Robinson cup anemograph, an elaborate comparison of recorded values was carried out. The observed differences were found to be related almost entirely to exposure.

LERWICK OBSERVATORY

Terrestrial Magnetism.—The magnetographs have been in operation throughout the year, though many difficulties have, as in the previous

† *Vice* The *Geographical Journal*. Vol. LX, p. 268.

year, been experienced. The following adjustments and slight alterations were carried out towards the end of 1924 :—

- (1) Copper strips were fitted inside the original damping box of the declination instrument and gave a considerable improvement in the damping of the magnet.
- (2) Alterations to the torsion head and suspension of the horizontal force instrument appear to have eliminated the drift formerly experienced and mentioned in earlier reports.
- (3) The vertical force instrument was thoroughly cleaned, placed inside an airtight box and arrangements made to trap dust ; the subsequent records have so far been free from discontinuities.

Absolute observations have been carried out twice weekly when possible and scale tests made frequently.

Progress has been made with the magnetic tabulations ; the reading and checking of curves for 1925 are being kept up to date and most of the arrears from 1923 and 1924 have been made up. The magnetic records for 1923 were despatched to Kew and will be worked up there.

Atmospheric Electricity.—A Benndorf Electrograph was received from Kew on the 8th August, and after preliminary trials in one of the offices was removed to the electrograph hut. The insulation of the system requires continual attention for satisfactory results to be obtained, as, despite the fact that a stove is burning continually in the hut, it is usually in a very damp condition.

The electrostatic voltmeter required for use in connexion with the absolute observations of potential gradient in the open was received on March 30th, 1925.

Aurora.—An auroral watch has been kept regularly except during the summer months and notes of any displays have been forwarded to Edinburgh. A number of exposures have been made with Lord Rayleigh's spectrograph. There have been very few auroral displays during the year.

Meteorology.—The curtailed programme set out in the last *Annual Report* has been continued and the autographic records have been maintained without serious breaks. Minor repairs to the instruments have been carried out when necessary.

A summary of the weather at Lerwick during 1924 was prepared for the County Medical Officer of Health for inclusion in his annual report to the County Committee and the Board of Health.

Buildings, etc.—A new and improved wind pump for raising water was installed in March, 1925.

A considerable amount of maintenance work was carried out ; a new hut for use when obtaining direct readings of the "horizontal force" and the "declination" during auroral displays was erected.

Radio Research and W/T Station.—The atmospheric recorder belonging to the Radio Research Board was fitted up early in July, the assemblage of the instrument being carried out by Mr. Airy of the Research Board. Repairs to the two huts belonging to the Radio Research Board were carried out in December, 1924.

The wireless station was taken over by the Post Office from 10th to 22nd March, 1925, during a breakdown of cable communication with the mainland. Communication was maintained with the P.O. station at Wick and approximately 6,000 messages were dealt with.

KEW OBSERVATORY

Instruments and Instrumental Comparisons.—New equipment includes a self-recording psychrometer with forced ventilation, an Eder photometer, a rain-gauge (for evaporation experiments), a Mark II head for a pressure-tube anemometer, a dial wind indicator, two quick-run clocks, two marine screens, an air condenser, an induction coil, a Wheatstone wire bridge and a travelling microscope.

The following comparisons of instruments have been in progress :—

- (a) *Thermometer Screens.* Glaisher, North Wall, Stevenson (two levels) and two marine screens of different patterns.
- (b) *Grass Minimum Thermometers*, protected and unprotected.*
- (c) *Anemometer Heads*, ordinary Dines and a new pattern designed to give static pressure instead of suction.
- (d) *Sunshine Recorders*, Swiss, modern English and Kew instrument.
- (e) *Earth Thermometers*, different kinds.

One of Mr. Reeves's azimuth instruments† has been read regularly during the last part of the year.

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

During July observations were taken with the unifilar magnetometer, Dover No. 140, at Stonyhurst and Eskdalemuir, in order to effect a comparison between the magnetic standards at these observatories and at Kew. Subsequently a re-determination was made at Kew of the moment of inertia of the Stonyhurst collimator magnet with a view to arriving at the causes of the difference between the observatory standards.

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

Forty pilot balloon ascents were made on 15 days in connexion with the international scheme and on 23 days in connexion with the Amundsen programme.

On days of bright sunshine pyr heliometric 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

* *Vide The Meteorological Magazine.* Vol. 59 (Mar., 1924), p. 40, and *Professional Notes*, No. 43.

† *Loc.cit.* p. 53.

in order to standardize the electrograph. Observations have also been made between 14h. 30m. and 15h. 30m. G.M.T., of the air-earth electric current with the Wilson apparatus, and of the ionic charges with the Ebert apparatus.

Up to the end of 1924, the magnetic elements, horizontal force, declination and inclination were observed regularly, usually once a week, with the Jones magnetometer and the dip circle. On most occasions simultaneous observations of the horizontal force were taken with the Dover magnetometer No. 140.

Magnetic observations stopped at the end of 1924 when the magnetographs ceased to record.* On the cessation of the magnetic work the magnetographs were dismantled to make room for the Galitzin seismographs which are to be transferred from Eskdalemuir to Kew.

Publication of the Results.—Meteorological data have been supplied regularly for publication as usual in the *Daily, Weekly and Monthly Weather Reports*; until the end of 1924 magnetic declination data appeared week by week in the *Colliery Guardian*. Tables for the new *Observatories' Year Book* for 1922 were completed and progress was made with the tables for 1923 and 1924.

Verification Work.—In addition to various instruments intended for the Meteorological Office there have been tested one unifilar magnetometer and two collimator magnets. With the stoppage of the magnetograph magnetic testing work will naturally cease.

Instructional Work.—In April and September classes for observers at health resorts were conducted at the Observatory by Capt. E. W. Barlow of the Climatology Division.

Miscellaneous.—In the course of the year the Observatory was visited by two successive Under-Secretaries of State for Air, Mr. W. Leach and Sir Philip Sassoon.

A large contribution was made to the exhibits in terrestrial magnetism and atmospheric electricity in the Government Pavilion in the British Empire Exhibition at Wembley.

On December 28th the Observatory grounds and the vaults were flooded to a larger extent than had happened during the last thirty years by an overflow of the Thames over the Old Deer Park. The vaults remained flooded for over a week.

KEW OBSERVATORY. UPPER AIR SECTION

The Upper Air Section has continued its work at Kew Observatory. Its activities have been in two distinct directions; firstly in the prosecution of upper air investigations proper, secondly in the manufacture, repair, and design in the workshop of instruments and apparatus for other departments.

The total number of registering balloon ascents made during the year was 54, from which 38 good records were obtained. Heights up to 20·7 km. were reached, the mean being 14·5 km., a result appreciably better in every way than that of the previous year.

* *Vide The Meteorological Magazine.* Vol. 59 (Nov., 1924), p. 242.

The system of making ascents from the distributive station of the Meteorological Office at Sealand aerodrome has been continued, and has worked well. The only trouble experienced has been that of damage in the post to meteorographs in transit to Sealand from Kew Observatory, ready calibrated for an ascent.

Full and complete data, both in tabular and graphical form, of all the British registering balloon ascents made in 1923 and 1924 have been supplied to the President of the International Commission for the Exploration of the Upper Air.

Instrumental investigation was chiefly concerned with hysteresis in response to changes of pressure of the aneroid box of the Dines pattern balloon meteorograph. A very definite result in the shape of an improved box has to be recorded, though it has not yet been found possible to eliminate more than a few of the older and less satisfactory aneroid boxes still in general use.

An effort has been made to overhaul or renew the auxiliary apparatus connected with the upper air observations, and to this end both the old automatic calibrating apparatus and the revolving stage of the reading microscope have been largely replaced by new apparatus, in which various minor improvements have been incorporated. The increased accuracy and greater ease of manipulation now possible tend to lighten the necessary routine work.

A small instrument intended to release the spider and instrument from the balloon at a predetermined height has been in experimental use for some time. It has lately been re-designed and rendered much more reliable, and has several times allowed of an ascent being made to a moderate height, when without it the balloon and instrument would certainly have fallen into the sea.

Meteorographs of the Dines type have been supplied by two firms during the year, of better quality than any previously purchased. They are, however, still not as good as those made in the official workshop.

Observations were continued in the winter on the determination of the upper limits of fogs, using for the purpose a small captive balloon and an open scale meteorograph specially designed by the Upper Air Section. The results have proved reasonably accurate and the method of observation convenient and cheap.

The workshop has been fully employed throughout the year.

The mechanical staff have been chiefly engaged on work connected with upper air observations:—maintenance, renewals, experimental apparatus, and occasional manufacture of standard instruments.

A model of Mr. W. H. Dines's radiometer was made for exhibition in the British Empire Exhibition at Wembley.

The policy has been followed of making working drawings of all standard and occasional instruments used by the Upper Air Section. Heretofore the details of many useful pieces of apparatus have not been available in a convenient permanent form, a defect which has largely now been remedied.

VALENCIA OBSERVATORY, CAHIRCIVEEN, CO. KERRY

After the troubled and somewhat difficult times of the last few years, the twelve months ended March, 1925 show a welcome return to normal conditions.

Meteorological Routine.—The Observatory has been maintained as a first order meteorological station. The standard self-recording instruments have been kept in efficient working order during the twelve months and the tabulations for the various returns and summaries have been kept well up-to-date. Telegraphic reports have been supplied to the Forecast Service at the usual hours and the special telegraphic service at 10h. and 16h. has been continued. There was no interruption in telegraphy during the year.

Monthly observations continue to be made with the rain-gauge at the Cahirciveen reservoir and the information so obtained has been supplied regularly to the British Rainfall Organization. This information together with the monthly rainfall observed at the Observatory has also been supplied to the Irish Rainfall Association each month as in previous years.

Pilot balloon observations have been made regularly but weather conditions during the whole period have been most unsuitable for this branch of the work.

Magnetic Observations.—Absolute observations of magnetic declination, horizontal force and inclination were made weekly throughout the year.

Miscellaneous.—Measurements of rainfall with rain-gauges having various exposures continue to be made. From the fairly extensive records now available information has been extracted bearing upon the general question of rain-gauge exposure.

Observations with the evaporation tank and the Piché evaporimeter are made daily. A paper is in preparation embodying some of the results obtained up to the present. Maximum and minimum thermometers are now in position a little way below the surface of the water in the tank in an attempt to gain some knowledge of the temperature changes in the surface water and their possible bearing on the evaporation figures obtained.

An Eder photometer, supplied from the National Institute for Medical Research, has been in operation in a position close by the sunshine recorder since July. In connexion with this, information with regard to sunshine is supplied to the Institute monthly.

METEOROLOGICAL OFFICE, MALTA

General.—Various new arrangements have been introduced during the year. Chief among these are the reduction of the interval between the issue of the routine reports and the receipt of the observations on which they are based, and a similar acceleration of the issue of charts. Also, in compliance with requests received, additions have

been made to the routine reports, and the office has supplied special reports not formerly prepared. Owing to the ready assistance of the Royal Air Force W/T Officer, by extending the reception of local reports from individual stations instead of depending on central W/T issues, it has been possible to increase somewhat the information for the Mediterranean available for the charts, and to obtain at an earlier hour some of the information previously received. Several investigations have been completed, but those of a scientific nature have had to be put back to make way for others connected with the more immediate reporting work. Cordial co-operation has been maintained with the University Observatory, and Professor Agius has at various times lent to the office apparatus and records which have been very useful. It has not been possible during the year to find more accessible office quarters, and there is no immediate prospect of doing so.

Reports.—On the reporting and forecasting side the most notable improvements in information available have been the regular reception of Russian synoptic data which have been found important in connexion with certain winter types of disturbed weather in the Mediterranean and, recently, the frequent reception of information from Tripoli and Benghazi. The reports from Tripoli and Benghazi indicate the approach of depressions, otherwise unannounced, from the interior of North Africa, and, could they be obtained regularly, would be extremely useful. The reception of information relating to the sea area still leaves much to be desired, and such information is becoming much needed not only to provide data on which to base reports and forecasts for ships, but also to enable the office to check forecasts for the sea areas, with a view to their improvement.

The routine reports issued have been increased, firstly, by special W/T messages to Egypt notifying the existence of depressions, likely to affect that area but possibly not indicated on the Egyptian charts owing to disturbances of W/T reception, and, secondly, by local "meteor" messages to the Royal Artillery. Arrangements are in hand also for the regular signalling of weather charts to ships of the Navy, and for relaying to Egypt Spanish and North African W/T signals which are not so well received in Egypt as at Malta.

The number of special reports asked for has shown considerable increase. These reports have included "meteor" messages used in gun practice by H.M. Ships and by the Royal Artillery, reports and forecasts for ships of the Navy and of private owners covering the passages to France, Italy, Egypt and North Africa, and a few miscellaneous inquiries. Information for some of these reports has been somewhat scanty, notably that of upper air temperatures for the "meteor" messages and that of actual conditions over sea areas. Estimates of the conditions have been given however, when this was judged to be justified for the purpose in view by the data available.

The routine reports have been improved in several ways. The morning forecasts, formerly made on the basis of the charts for 1800 G.M.T. of the previous day and issued at 0800 G.M.T. (0900 Malta time), have been replaced by forecasts based on the charts of 0700 G.M.T. of the same day and issued at 0940 G.M.T. (1040 Malta time). This is inconveniently late for most purposes, and reports which were

specially required at the earlier hour, have been continued, while forecasts based on the 1800 G.M.T. charts have been issued when asked for. The most satisfactory way of providing for early morning forecasts would be to issue a report at 2200 Malta time, based on the observations at 1800 G.M.T., in place of the existing report at 1930 Malta time, based on the more restricted data for 1300 G.M.T. This question has accordingly been gone into; but the demand for the 2200 reports has been found not to justify at present the extra work involved.

The daily weather chart sent to the Officer Commanding, Royal Air Force Base, which formerly referred to 0700 G.M.T. of the previous day has been replaced by a chart for 0700 G.M.T. of the same day, without any delay in the time of its receipt, and arrangements are in hand for issuing this chart to such ships in harbour as require it in connexion with the scheme for signalling the weather chart to ships at sea.

Investigations.—Attempts have been made to apply the French and Norwegian methods of forecasting, but the density of observations in the Mediterranean area has been found to be too small in both cases. Local variations of wind and temperature have been examined by comparing records made at the Office with those of the University Observatory. A comparison has also been made between estimates of sea visibility made at the University and measurements based on observations of the sea horizon from shore stations at different altitudes. This has been rendered possible by the co-operation of the Royal Artillery who have made the observations. The Superintendent attended the meetings of a Naval Committee for the study of upper winds in connexion with aerial navigation in the Mediterranean, and two reports on examination of the Malta pilot balloon observations have been sent to the Committee.

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, 1925).

The **Marine Observer** (to date).

The **Meteorological Magazine** (to date).

The **British Meteorological and Magnetic Year Book** :—
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. Volumes for 1916 and 1917 issued.

British Rainfall, 1923. A report on the distribution of rain in space and time over the British Isles during the year 1923, 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.

Southport Auxiliary Observatory. Annual Report and results of meteorological observations for the year 1923. By Joseph Baxendell.

OCCASIONAL.—**Particulars of Meteorological Reports issued by Wireless Telegraphy in Great Britain and the countries of Europe and North Africa**. Third edition, 1925 (also Supplement No. 1).

Geophysical Memoirs :—None issued.

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.; H. W. L. Absalom, B.Sc. and E. Taylor, M.A., B.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. 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.

No. 38. **Measurement of Upper Wind Velocities by Observations of Artificial Clouds**. By C. D. Stewart, B.Sc.

No. 39. **Upper Air Circulation of the Atlantic Ocean**. By E. W. Barlow, B.Sc.

The **Book of Normals of Meteorological Elements for the British Isles** :—

Section V. **Monthly Normals of Rainfall**.

The **Observer's Primer**, being short instructions in the method of taking and reporting readings of temperature and rainfall, specially prepared for meteorological observers in the British Colonies.

Priced Vocabulary of Meteorological Stores. September, 1924.

Hygrometric Tables for the Computation of Relative Humidity, Vapour Pressure and Dew Point from Readings of Dry and Wet Bulb Thermometers exposed in Stevenson Screens.

Among the articles appearing in these publications by members of the staff may be mentioned :—

In the Marine Observer.

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| Sir Napier Shaw | R. G. K. Lempfert, C.B.E., M.A., Assistant Director. |
| Wireless and Weather, an Aid to Navigation, Chapters VI to XII, completing this serial. | Captain L. A. Brooke-Smith, R.D., R.N.R. (Retired). |
| Work of the Year. Note to Marine Observers. | Do. |
| Steamship Route from Colombo and the East to Perim during the South West Monsoon. | Do. |
| Currents on the direct Route, Cape Blanco to Table Bay. | C. S. Durst, B.A. |
| Currents on the Route, Latitude of Cape Blanco to the Brazils. | Do. |
| The Doldrums of the North Atlantic. | Do. |
| Hong Kong Typhoon, August 18th, 1923. | Lt.-Cdr. J. Hennessey, R.D., R.N.R. |
| Notes upon Average Conditions in the Indian Ocean, North of Lati- tude 35°S. | Do. |
| Ice in the Western North Atlantic. | Do. |
| Fog. | H. Keeton. |
| South Pacific Hurricanes. | Do. |
| Biographical Notes of some Leaders of Marine Meteorology. | H. T. Smith. |
| Marine Meteorology, History and Progress. | Do. |

In British Rainfall, 1923.

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| Fluctuations of Annual Rainfall: a comparison of 35 year rainfall aver- ages over the British Isles for different groups of 35 years falling in the period 1868 to 1921. | J. Glasspoole, M.Sc. |
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The Committee also desire to express their appreciation of the following articles which have appeared in the *Marine Observer* by contributors not on the staff of the Office :—

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| A Meteorologist at Sea, August, 21–28, 1924. | Sir Napier Shaw, LL.D., Sc.D., F.R.S. |
| “ Hotspur ” Captain Henry Toynbee's last command. | Basil Lubbock. |
| Wireless Direction Finders in Merchant Ships. | Commander J. A. Slee, C.B.E., R.N. (Retired). |
| Temperature and Salinity. | Lieut. J. R. Lumby, R.N. (Retired) of Ministry of Agriculture and Fisheries. |

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

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

Thunderstorms and aviation. *J. R. Aero. Soc.*, Vol. XXIX, 1925, pp. 24–46.

By C. Chree, Sc.D., F.R.S.—

Atmospheric electricity. *Handbook to the Exhibition of Pure Science, British Empire Exhibition, 1924*, arranged by the Royal Society.

Periodicities, solar and meteorological. *Q. J. R. Meteor. Soc.*, 50, pp. 87–97.

On the diurnal variation of atmospheric pressure at Eskdalemuir and Castle O'er, Dumfriesshire. *Q. J. R. Meteor. Soc.*, 50, pp. 245–247.

Atmospheric ionisation and its variations. *London, Proc. Physic Soc.*, 37, pp. 5D–15D.

By E. Gold, D.S.O., F.R.S.—

Weather forecasting. *Handbook to the Exhibition of Pure Science, British Empire Exhibition, 1924*, arranged by the Royal Society.

By David Brunt, M.A., B.Sc.—

Climatic continentality and oceanity. *Geog. J.*, Vol. LXXV, pp. 43–56.

By M.A. Giblett, M.Sc.—

The International free-balloon race for the Gordon Bennett Cup. *Q. J. R. Meteor. Soc.*, 50, pp. 260–267.

An analysis of a retrograde depression in the Eastern United States of America (in collaboration with J. Bjerknes), *Washington Monthly Weather Rev.*, 52, pp. 521–527.

By M. A. Giblett, M.Sc., and R. A. Watson, B.Sc.—

May 1924, a month of thunderstorms. *Q. J. R. Meteor. Soc.*, 50, pp. 268–270.

By W. A. Harwood, D.Sc.—

The free atmosphere in India. Observations with kites and sounding balloons up to 1918. *Indian Meteor. Memoirs*, Vol. XXIV, Part VI, pp. 167–216.

The free atmosphere in India. Heights of clouds and directions of free air movements. Upper air movement in the Indian monsoons and its relation to the general circulation of the atmosphere. *Indian Meteor. Memoirs*, Vol. XXIV, Parts VII and VIII, pp. 217–273.

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

On the diurnal variation of atmospheric pressure at Eskdalemuir and Castle O'er, Dumfriesshire. *Q. J. R. Meteor. Soc.*, 50, pp. 127–135.

By F. J. W. Whipple, M.A., F.Inst.P.—

Comments on the law of pressure ratios, *Washington Monthly Weather Rev.*, 52, pp. 94–95.

The significance of regression equations in the analysis of upper air observations. *Q. J. R. Meteor. Soc.*, 50, pp. 237–243.

A group of generalized hypergeometric series. *London, Proc. Math. Soc.* (2), 23 (1924).

By C. E. P. Brooks, M.Sc.—

The distribution of rainfall over Uganda with a note on Kenya Colony. *Q. J. R. Meteor. Soc.*, 50, pp. 325–336.

The Evolution of Climate, 2nd edition (Benn Brothers).

By L. H. G. Dines, M.A., A.M.I.C.E.—

A simple electrical time marking system for use with self-recording meteorological instruments. *Q. J. R. Meteor. Soc.*, 50, pp. 373–380.

By C. K. M. Douglas, B.A.—

Further researches into the European upper air data with special reference to the life history of cyclones. *Q. J. R. Meteor. Soc.*, 50, pp. 339-361.

By C. S. Durst, B.A.—

The relationship between current and wind. *Q. J. R. Meteor. Soc.*, 50, pp. 113-119.

By J. Glasspoole, M.Sc., Ph.D.—

Fluctuations of annual rainfall: three driest consecutive years. *London, Water and Water Engineering*, Vol. XXVII, 1924, pp. 469-474.

By Lilian F. Lewis, B.Sc.—

The effect of the source of air on its temperature at 4,000 ft. and 10,000 ft. *Q. J. R. Meteor. Soc.*, 50, pp. 365-371.

By Spencer C. Russell, LL.B.—

Daily well measurements during 1923 at Chilgrove, Sussex and Detling, Kent. *Q. J. R. Meteor. Soc.*, 50, pp. 248-249.

By S. F. Witcombe, B.Sc.—

The heavy floods of May 31st and June 1st, 1924. *Q. J. R. Meteor. Soc.*, 50, pp. 254-257.

By A. H. R. Goldie, M.A., F.R.S.E.—

The cause of cyclones. *Nature* 114, pp. 783-787.

Waves at an approximately horizontal surface of discontinuity in the atmosphere. *Q. J. R. Meteor. Soc.*, 51, pp.

Discontinuities in the atmosphere. *Edinburgh Proc. R. Soc.*