M.O. 388.

ANNUAL REPORT

of the Director of the

METEOROLOGICAL OFFICE

presented by the Meteorological Committee
to the Air Council

For the Year ended
March 31
1935

The Eightieth Year of the Meteorological Office

LONDON
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METEOROLOGICAL COMMITTEE

1934–5.

Appointed by the Air Council.

Chairman :—The Under-Secretary of State for Air.

Vice-Chairman :—Colonel Sir HENRY LYONS, F.R.S. Nominated by the Royal Society.

Professor S. CHAPMAN, F.R.S. Nominated by the Royal Society.

Rear-Admiral J. A. EDGELL, O.B.E., R.N. Hydrographer of the Navy. Nominated by the Admiralty.

Captain W. ELLERY. Nominated by the Board of Trade.

Mr. J. E. W. FLOOD, C.M.G. Nominated by the Colonial Office.

Mr. C. N. KNIGHT, O.B.E. Assistant Secretary, Air Ministry. Nominated by the Air Ministry.

Bt. Colonel A. H. LOUGHBOROUGH, O.B.E., R.A. Superintendent of Experiments, Shoeburyness. Nominated by the War Office. (To September 2, 1934.)

Bt. Colonel A. E. MACRAE, O.B.E., R.A. Superintendent of Experiments, Shoeburyness. Nominated by the War Office. (From September 3, 1934.)

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

Mr. P. J. G. ROSE, C.B. Assistant Under-Secretary of State for Scotland. Nominated by the Scottish Office.

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

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

Mr. J. A. WEBSTER, C.B., D.S.O. Principal Assistant Secretary, Air Ministry. Nominated by the Air Ministry.

Secretary :—Mr. D. BRUNT, M.A. (To September 30, 1934.)
Mr. F. ENTWISTLE, B.Sc. (From October 1, 1934.)

The Committee met on July 25 and November 14, 1934, and January 23, 1935.

COMMITTEE OF THE METEOROLOGICAL OFFICE EDINBURGH, 1934–5

Chairman :—The Director of the Meteorological Office.

Vice-Chairman :—Professor R. A. SAMPSON, F.R.S. Nominated by the Royal Society.

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

Mr. DAVID RONALD, M.Inst.C.E., F.R.S.E. Nominated by the Department of Health for Scotland.

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

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

Dr. A. CRICHTON MITCHELL, F.R.S.E. Nominated by the Royal Meteorological Society.

Professor H. M. MACDONALD, O.B.E., M.A., F.R.S. Nominated by the University of Aberdeen.

Professor J. R. CURRIE, M.A., M.D., D.P.H. Nominated by the University of Glasgow.

Secretary : Mr. A. H. R. GOLDIE, M.A., F.R.S.E.

The Committee met on May 8 and June 12, 1934. Professor H. M. MACDONALD was nominated as representative of the University of Aberdeen as from April 1, 1934.

THE GASSIOT COMMITTEE, 1934

Appointed by the Royal Society in accordance with Treasury Letter of February 26, 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.*

The President of the Royal Society (Sir F. G. HOPKINS).

Sir HENRY LYONS (*Chairman*).

The President of the Royal Astronomical Society (Professor F. J. M. STRATTON).

The Director of the Meteorological Office (Dr. G. C. SIMPSON).

Professor A. FOWLER.

Sir GERALD LENOX-CONYNGHAM.

Sir GILBERT WALKER.

Professor S. CHAPMAN.

Dr. G. M. B. DOBSON.

Professor G. I. TAYLOR.

Sir FRANK DYSON.

The Committee met on July 19, 1934, at Kew Observatory.

A list of the staff and of the divisions and establishments of the Office will be found on pp. 38 to 43.

ANNUAL REPORT of the Director of the Meteorological Office presented by the Meteorological Committee to the Air Council for the year ending March 31, 1935 (the eightieth year of the Meteorological Office).

In the Annual Report for 1933-4 a detailed account was given of the organisation and work of the Meteorological Office, and as there have been no major changes from the conditions there described, it has been thought best to give this year short accounts of the work carried out in the various divisions at Headquarters and the other establishments of the Office.

MARINE DIVISION.

There has been no change during the course of the year in the scope of the work in the Marine Division. Beyond the routine organisation of the observing ships and scrutiny of the records received, the chief work has been the extraction of data from old meteorological logs in the care of the Division with the object of the ultimate preparation of a new set of climatological charts of the oceans. As a full account of the work performed in the Marine Division is published each year in the January number of *The Marine Observer* it is unnecessary to enter into further detail here.

FORECAST AND AVIATION DIVISION.

Since the reorganisation of the Office after the war there have been separate divisions for forecasts and aviation, each in charge of a Superintendent. Owing to the fact that the Forecast Division used very largely observations made at aviation stations and to the fact that aviation depended so largely on weather forecasts, it was impossible to draw a line between the work to be allotted to the two Divisions, and in the course of the fifteen years there have been several reorganisations and adjustments. As the result of experience, it has been decided that the most harmonious and efficient method of work would be to combine the two Divisions under one head with two senior officers as deputies who would be respectively in charge of the two branches of the work. On October 1, 1934, the initial step in the reorganisation was made, the two Divisions were combined and Mr. Corless, the previous Superintendent of the Forecast Division was placed in charge of the combined Division with Mr. H. W. L. Absalom as his first deputy.

Another change of importance was that the combined division was moved from the 5th floor of Adastral House to the 8th floor on January 3, 1935. This change has facilitated the co-ordination of the work, since sufficient experience had previously been obtained

to enable the planning of the accommodation in the new quarters to be successfully carried out. The accommodation for the forecasting work and for the services ancillary thereto was considerably improved.

Aviation Services Stations.—On July 1, 1934, a new aviation services station was opened at Abingdon to meet the needs of Central Area Headquarters of the Royal Air Force, and on January 1, 1935, a similar station was opened at the new Royal Air Force Station at Mildenhall. In other respects the work at the aviation services stations has continued unchanged in principle, but greatly increased in activity. An index of the activity is given by the numbers of inquiries received and dealt with at outstations during the year compared with the numbers of the previous year, as follows :—

	1933–4.	1934–5.
Inquiries by telephone, in person, or by post	43,760	62,507
Weather reports passed to aircraft in flight from Croydon, Lympne and Manchester	8,020	10,424

Internal Air Lines.—Arrangements for the supply of weather reports and forecasts for the various internal air lines were made as required during the year. Proposals for new weather reporting stations on the more difficult portions of the routes were considered, and arrangements for the establishment of many additional stations are in hand. Forecasts for the routes were supplied by Headquarters and Aviation Services Stations as follows :—

Route.	*Forecasting Centres.*
London-Liverpool-Belfast-Glasgow	Croydon, Manchester, Aldergrove and Abbotsinch.
Croydon-Southampton-Plymouth	Croydon, Calshot and Mount Batten.
Plymouth-Cardiff-Birmingham ...	Mount Batten.
Southampton-Jersey	Calshot.
Croydon-Southampton-Cowes ...	Croydon and Calshot.
Sherburn-Nottingham-Heston ...	Croydon.
Aberdeen-Renfrew	Abbotsinch.
Newcastle-Isle of Man	Catterick.
Renfrew-Islay	Abbotsinch.
Hull-Leicester-Southampton ...	Calshot and Air Ministry.
Norwich-Leicester	Air Ministry.

Special arrangements were made for the supply of weather reports and forecasts for the Amsterdam-Hull-Liverpool route during the period of operation. The linking of the aerodromes at Manchester and Liverpool by teletypewriter has enabled the Meteorological Office at Manchester to supply information for all services operating from Speke Aerodrome.

Reports from Cross-Channel Steamers.—Since 1920 cross-channel steamer packets on the Guernsey-Weymouth, Kingstown-Holyhead, and Dieppe-Newhaven runs have made observations in mid-channel and reported them, either by land wire on arrival, or by W/T to Weather, London. This service has now been extended to the Guernsey-Southampton, Belfast-Heysham, and Hook of Holland-Harwich routes; and has been improved by the general use of wireless telegraphy.

The information of weather, sea and air temperature thus quickly received from ships in home waters is of valuable assistance for forecasting visibility for the "Weather Shipping Bulletin," and for the preparation of forecasts for cross-channel air services.

Royal Air Force.—In addition to the normal supply of routine weather forecasts for the Royal Air Force as a whole and special forecasts for cross-country flights, meteorological services were supplied to the Royal Air Force on many occasions, the chief of which may be mentioned: the provision of extra staff to certain stations to provide a twenty-four hour forecast service during tactical exercises in April; the establishment of a forecasting station at Hendon in connexion with the Royal Air Force Display on June 30; the provision of a twenty-four hour service at a number of stations during the A.D.G.B. Command Exercises and, in addition, the attachment of meteorologists to Command and Air Headquarters to act as advisers to the Air Officers Commanding.

In connexion with all long distance flights or cruises undertaken by the Royal Air Force, it is now the routine procedure to include the meteorological arrangements made for different parts of the route, in the Operational Orders. During the year special meteorological arrangements were made for cruises and flying boats from the British Isles to the Mediterranean, the Far East, Iceland and Greenland.

The normal courses of instruction in meteorology have continued at Cranwell, Calshot, Sealand, Leuchars, Andover and other out-stations. A further course of lectures on the meteorological aspects of cloud flying was given to units in Fighting Area during the Individual Training Season.

Civil Aviation.—The work at Croydon, the chief aerodrome for Continental Air Lines, has followed the same routine as in previous years, but has been considerably intensified consequent upon the general development of civil aviation. The number of inquiries for meteorological information at that station during the year was 12,264, an increase of 63 per cent over the corresponding figure for the previous year.

Consequent upon the increased practice of following direct compass courses on continental flights, it was necessary to alter the position of auxiliary weather reporting stations which had been established to serve the old air routes. For this reason the auxiliary reporting stations at Farningham, Deal, North Foreland and Sandgate were closed in August and replaced by stations at Leatherhead,

Crowborough and Bexhill. In addition, the personnel of the meteorological station at Manston aerodrome was increased so as to allow for reports throughout the 24 hours.

A " ceiling projector " (i.e., a searchlight arranged to project a powerful beam of light vertically upwards) was installed at Croydon Aerodrome for the exact measurement of the height of low cloud over that aerodrome at night. The instrument has been installed so that measurements may be made from the meteorological station itself and cloud heights supplied immediately in response to requests from pilots of aircraft in flight. Arrangements are in hand for the supply of ceiling projectors to the meteorological stations at Biggin Hill, Lympne and Manston.

Special arrangements were made for the supply of meteorological information during the King's Cup Air Race and the England-Australia Air Race for the MacRobertson Trophy. In the latter case, a pamphlet on the climatology of the route was prepared and supplied to the Royal Aero Club for the use of the competitors. Arrangements were made for weather reports and forecasts to be available at all control aerodromes and a temporary meteorological station was established at Mildenhall aerodrome for the supply of forecasts and reports for the first section of the route to Baghdad.

To meet the needs of pilots proposing to undertake long-distance flights, arrangements were made for the preparation of a series of *Aviation Meteorological Reports* dealing with the climatology of certain routes or areas. The first two reports, dealing with the climatology of the Karachi to Singapore route and of the Singapore to Melbourne route, were issued during the year whilst further reports are in course of preparation.

The number of requests for climatological data in connexion with aviation has also shown a marked increase, particularly in the case of reports on meteorological conditions affecting proposed aerodrome sites.

Forecasts issued through the British Broadcasting Corporation.—Some changes were made in the form of the " Weather Shipping Bulletin " issued in the evening and, on weekdays, it is now issued with few exceptions after the forecast announced at 9.30 p.m.; on Sundays the bulletin is broadcast at 11 p.m. The usual daily weather forecasts were prepared for broadcasting for the Scottish Herring Fishing Fleet between July and September and for the East Anglian Fishing Fleet between October and December.

Press Reports.—The form of the bulletin containing meteorological observations from certain health resorts was changed in April 1934, so that the amount of sunshine given in the bulletin now refers to the 24 hours ending at 5 p.m. G.M.T. (or 6 p.m. Summer Time). Previously the sunshine between 5 p.m. G.M.T. and sunset was not accounted for at all in the bulletin. The new arrangement has the incidental advantage that the form of the heading is much simplified. From January 1, 1935, the rainfall measurements published in all press reports have been given in inches instead of millimetres.

Film showing the working of the Meteorological Service.—During the summer the Post Office Film Unit visited Headquarters and the station at Croydon Aerodrome as well as the telegraphic station maintained by the courtesy of the Board of Trade at Gorleston, and took a number of motion pictures of operations connected with the preparation of weather reports and forecasts. Subsequently the pictures were incorporated in a film entitled " Weather Forecast" which has been shown to the public in many parts of the country.

Researches.—Several members of the Staff of the Division have contributed papers containing the results of their own researches into particular problems of meteorological interest. The titles and authors of these papers will be found on p. 46.

Owing to the expanding nature of the work, and the fact that difficulty has arisen from time to time in providing sufficient staff, it has not been possible to devote much time to organised research. Some progress has however been made in the following problems :—

(*a*) Ice accretion on aircraft. Reports of these occurrences have been collected and investigated.

(*b*) Occurrence of sudden fogs at Bircham Newton. A preliminary report was prepared by the Meteorological Officer at that station.

(*c*) Weather conditions over north-east England. An investigation is being conducted by the Meteorological Officer at Catterick.

(*d*) Wind pressure on a building. This investigation is being carried out by the National Physical Laboratory; and in connexion therewith the Meteorological Officer at Manston is conducting certain wind measurements on suitable occasions.

(*e*) Water content of the upper air. Apparatus for this investigation was carried on the aircraft of the Meteorological Flight, Duxford, during several ascents.

BRITISH CLIMATOLOGY DIVISION.

The collection and publication of climatological data for the British Isles has continued along the customary lines. Information is received from a large number of stations in all parts of the country. These stations vary greatly in equipment and personnel and may be roughly divided into six classes :

(*a*) Observatories (see pp. 21-6) where continuous records of all meteorological elements are obtained.

(*b*) Distributive stations, which are established to distribute information for civil aviation, the Royal Air Force and the Army, at which—with but few exceptions—synoptic charts are prepared daily.

(*c*) Telegraphic reporting stations. These stations have been established to take observations and report them immediately by telegraph. The observers are not members of the Meteorological

Office staff, being frequently coastguards, lighthouse keepers or others with permanent posts giving them facilities for taking meteorological observations at all hours.

(*d*) Crop Weather Stations are maintained at certain agricultural colleges and research institutions in connexion with the study of the relations between the weather and growing crops. They report partly to the Meteorological Office and partly to the Ministry of Agriculture and the Department of Agriculture for Scotland, and the arrangements for the observations are under the general control of a committee on which the Office is represented.

(*e*) and (*f*). Climatological and Rainfall Stations. These are maintained by private observers, or by municipal or other local authorities without payment by the Office. Great public spirit is shown by those who maintain these stations and send their records and observations, for incorporation in the official weather reports and for preservation in the Office, where they are available for the benefit of the community.

The number of stations of each of the above types in each of the 16 divisions into which the British Isles is divided for meteorological purposes is shown in Appendix I (p. 35). In that table also is given the number of stations which maintain instruments for the continuous record of certain specified meteorological elements. Only such autographic records as are regularly received in the office are included in the table.

Publications.—*The Monthly Weather Report* has appeared regularly in the same form as in recent years. As from the January 1934 issue, unweighted averages for temperature and sunshine for periods up to 30 years ending 1930 were used, in place of the weighted averages for the period 1881-1915 formerly in use. Two new tables appeared in the Wind Section of the Annual Summary. One of these numbered XIIA gives the number of hours in each month with gusts exceeding (*a*) 38 m.p.h., (*b*) 54 m.p.h, at stations with 1 inch connecting pipe, and the other, numbered XVII gives weekly means of wind components at Yarmouth, Holyhead, Scilly and Kingstown.

The Weekly Weather Report, 1933-4, was published on September 20, 1934.

British Rainfall, 1933.—The volume was issued on December 19, 1934.

Returns for Registrar-General.—Weekly summaries of the weather at certain large towns are prepared for the Registrar-General for England and Wales. Quarterly and annual summaries are also prepared. Similar information is supplied quarterly to the Governments of Northern Ireland and the Irish Free State. The returns were in the same form as in recent years.

Observatories' Year Book.—Requests for supply of the data for the 1932 volume were sent out in May, 1933 and the whole of the

copy had been forwarded to the printer by September 19, 1933. The volume was reproduced by the "Replika" process which caused considerable delay, and copies were not received until September 11, 1934.

In view of the need for early publication of data to complete the Polar Year, special arrangements were made with H.M. Stationery Office to expedite the publication of the 1933 volume, and the whole of the copy was passed forward to the printer on September 19, 1934. Printing had not, however, been completed by the end of March, 1935.

Inquiries.—During the year, 2,348 general or scientific inquiries for particulars of past weather, including 178 legal inquiries, were dealt with in the Division. A comparison with the year 1924-5 shows that the volume of inquiries has increased nearly six-fold in ten years, and is nearly twice as great as in 1929-30.

Numerous inquiries for rainfall data from Catchment Boards set up under the provisions of the Land Drainage Act, 1930, have again been received. The usual number of inquiries from commercial firms and from Government Departments have been received.

Investigations and Special Work.—*Exposure of Rain-gauges.*—Mr. F. Hudleston, M.Inst.C.E., continued his work at Hutton John. The observational work having been completed, Mr. Hudleston prepared a summary of his results which was published in the 1933 volume of *British Rainfall.*

Inland Water Survey.—The Superintendent continued to serve on the Research Committee of the British Association. In February 1935, he was appointed Assessor for the Meteorological Office on the Committee set up by H.M. Government under the auspices of the Minister of Health and the Secretary of State for Scotland.

Agricultural Meteorology.—Following upon a decision by the Agricultural-Meteorological Committee to adopt a scheme of weeks with fixed dates of commencement, advocated by Sir Napier Shaw, the crop-weather return form (Form 3204) was revised and the change was made as from January 1, 1934.

Sunshine Averages for the British Isles.—The new (unweighted) averages for periods of at least ten years and not more than 30 years during the epoch 1901-1930 were published in May 1934, under the above title.

Courses of Training for Observers.—A course of training for the Observers at Health Resorts was held in the Library at South Kensington on November 27 and 28. Twenty Observers attended the course.

Agricultural-Meteorological Conference and Course of Instruction.—A conference of workers in Agricultural-Meteorology was held in the Library at South Kensington on October 5. The Superintendent read a paper on "Evaporation—A brief review of

methods and results". The conference was preceded by a short course of instruction which was attended by 22 Observers.

Meteorological Observer's Handbook (1934 *Edition*).—The new edition was published in September and a distribution was made to all official stations and voluntary climatological stations.

Fortnightly Rainfall Bulletin.—In June, in view of the difficulties occasioned by the drought, the Ministry of Health asked to be supplied with a fortnightly statement on the rainfall. Later in the year the fortnightly report was superseded by a monthly report.

GENERAL CLIMATOLOGY DIVISION.

The General Climatology Division deals with the climate of the world excluding the British Isles. It collects data from many sources, the chief being the publications of the various meteorological services of the world. In addition manuscript copies of data are obtained from a number of stations which do not normally publish their data.

Réseau Mondial.—The publication of the Reséau Mondial, 1926, by the photographic process from typewritten sheets having proved satisfactory, the volume for 1927 has also been produced by this method and that for 1928 is now in the press. Several new stations on land areas have been included but owing to the decrease in the number of reports from ships, it has been found necessary to omit some of the "marine squares" which have been included since 1922.

Admiralty Pilots.—These handbooks, issued by the Admiralty for the use of navigators, contain sections on winds, weather and climate and climatological tables supplied by the Meteorological Office. The text of the meteorological portions of 6 Pilots was revised in two of which the Meteorological Service of Canada co-operated. The tables were revised for 6 Pilots, involving the compilation in the Office of data for 4 stations. In addition, Meteorological Services abroad were good enough to contribute revised tables for 37 stations.

The Second International Polar Year.—As a contribution by the meteorological service of this country to the Polar Year Investigation it is proposed to publish a special volume containing detailed observations and reproductions of autographic records made at six selected Colonial stations during the Polar Year period. The work of preparation, involving a considerable amount of tabulation of records, has been in progress throughout the year.

Assistance was also rendered to the Colony of Bermuda in the preparation of daily observations during the Polar Year for publication in a special volume.

Special Investigations.—Memoranda on "Recent work on the Relations between Solar Variations and Meteorology" and on the

literature of solar and meteorological relationships since 1924 were prepared for the International Commission on Solar and Terrestrial Relationships.

The International Locust Conference.—At this Conference, held at the House of Lords in September, the Office was represented and also supplied meteorological data in connexion with the discussions. Following on the Conference, correspondence took place with the Imperial Institute of Entomology, with the result that the Office has agreed to co-operate in the investigations of the Institute by supplying data in cartographical form for locust infested areas.

Inquiries.—During the year, 193 general or scientific inquiries and 163 personal inquiries, covering a wide range of subjects, were dealt with in the Division. These included the supply of a long series of Bermuda data to the Ministry of Health, and the extraction of temperature and humidity figures for those cities throughout the world which have more than 500,000 inhabitants for an investigation on the effects of humidity on the trade and efficiency of various peoples.

Library.—The preparation of the monthly *List of Meteorological Papers*, and the brief abstracts calling attention to those of special interest, has been continued. A list of papers bearing on agricultural meteorology has been forwarded monthly to the Ministry of Agriculture and Fisheries for incorporation in that Ministry's monthly report ("Crop-Weather" scheme). The collection of "Abstracts" of meteorological papers has been carried on, and continues to prove of value for reference purposes. The arrangement by which the meteorological authorities of the Dominions and Colonies furnish twice yearly lists of the papers published during the preceding six months has continued to operate successfully, and acknowledgments are due in many cases to the respective Authorities for presenting copies of the papers thus brought to notice.

The library is now collaborating with the Office National Météorologique, Paris in a plan for an International Meteorological Bibliography, and lists of titles (with abstracts where available) of meteorological papers published in Great Britain and the other parts of the Empire during the year 1933 were compiled and supplied to Paris for this purpose.

During the year relations have been entered into with the National Central Library and the Meteorological Office library has agreed to co-operate as an "outlier" library for the supply of meteorological works on request. On a few occasions books or papers not otherwise obtainable have been lent to the Meteorological Office through the National Central Library, and our Library has also lent several books to approved borrowers through the National Central Library.

The additions to the Library during the past year included 468 new books and pamphlets and 11,573 daily weather reports. The number of periodicals received was 3,932. 1,478 books, etc., were issued on loan during the year, and 439 volumes were bound.

Catalogues.—The author catalogue has been kept up to date. The classified subject bibliography has also been maintained as it is always consulted in preference to the subject card catalogue. The latter includes part only of the same material, and has been discontinued. The index of climatological literature classified geographically and the classified catalogue of bibliographies of special subjects have been maintained.

Lantern Slides.—77 new slides were received into the collection. Sets of slides were borrowed on 43 occasions. The usefulness of this section of the library to those giving instructional lectures has been well maintained. A considerable number of negatives of the original slides having become available, prints are being made for the purpose of forming an album to facilitate the selection of appropriate slides for specific purposes.

Books Presented.—Valuable gifts of publications to the library or for use in the branches of the Office were made by :

C. J. P. Cave, Esq.
Dr. C. Davison.
Royal Astronomical Society.
Astronomer Royal, Greenwich.
Radcliffe Observatory, Oxford. (Old Weather Diaries.)

Classification of Meteorological Literature.—During the year the preparation of a revised classification of meteorological literature on the decimal system, based on that employed by the International Institute for Documentation, The Hague, was carried a stage further. Alternative drafts had been prepared by the Meteorological Office, and by Dr. Th. Hesselberg, Director of the Norwegian Meteorological Institute. In September a conference was held at The Hague, between Prof. E. van Everdingen, President of the International Meteorological Organisation, who presided, Dr. Hesselberg, Heer Donker Duyvis, Secretary of the International Institute for Documentation, and Dr. C. E. P. Brooks, representing the Meteorological Office. The differences of opinion were successfully overcome and a revised classification was agreed upon. Copies of this have been circulated to the members of the International Sub-Commission on the Classification of Meteorological Literature, and a copy has also been sent to Berlin for incorporation in a German edition of the Universal Decimal Classification which is now in the press. The revision will be considered by the International Meteorological Conference at a meeting at Warsaw in September 1935.

ARMY SERVICES DIVISION.

Close liaison has been maintained with the War Office Departments interested in meteorology, particularly the Chemical Defence Research Department, the Royal Engineer Board and the Chemical Defence Experimental Station at Porton.

Outstations.—The Army Services outstations at Shoeburyness and at the School of Artillery, Larkhill, have been maintained. At

the former station the work consists mainly of computations for artillery experiments, acoustical forecasts of conditions for firing, and the supply of routine reports for the artillery and data for sound ranging. In addition, lectures and demonstrations are arranged in connexion with courses for Artillery officers. At Larkhill ballistic winds and temperatures are supplied regularly to artillery units in training, and reports of upper winds and temperatures to the local sound ranging section. Synoptic charts are drawn daily and forecasts and warnings issued as required.

Practice Camps.—During the summer staff was provided to supply meteorological information at three Artillery Practice Camps.

Special Work.—Experiments were carried out at Orfordness for one month in February and March to determine the comparative accuracies of measuring upper winds by the following methods :—

(*a*) Double Theodolite.
(*b*) Single Theodolite.
(*c*) Tail Method.
(*d*) Orfordness standard camera method.

Meteorological Section, R.A.F. Reserve.—This Section was called up for a fortnight's training at Cranwell in May.

NAVAL DIVISION.

Organisation of Fleet Meteorology.—In the Annual Report for 1933-4 reference was made to the recommendations of the Fleet Meteorological Committee regarding future policy in Fleet meteorology. The recommendations, which were based upon proposals submitted by the Naval Division, embraced internal organisation of meteorological work in the Fleet, selection and training of personnel for meteorological duties, meteorological equipment of H.M. ships, and meteorological publications for use in the Fleet. These recommendations were approved by the Board of Admiralty during the year under review, and when carried out will result in the establishment of a self-contained, fully equipped and adequately staffed forecasting service within the Fleet itself in the course of the next twelve months.

After qualifying in meteorology, Instructor Officers will be appointed to certain ships other than aircraft carriers, for instructional and meteorological duties. In each aircraft carrier, one Instructor Officer qualified in meteorology will be borne for meteorological duties and one Naval Observer qualified in meteorology will be appointed for observer and meteorological duties. The meteorological equipment supplied to these ships is designed to ensure that the meteorological officer in the ship has instrumental assistance similar to that available at a Meteorological Office outstation, although the type of instrument supplied is usually specially designed for use in a ship.

The daily meteorological routine in ships carrying officers appointed for meteorological duties comprises the preparation of

synoptic charts and charts of upper air conditions (according to the issues available), surface observations at the usual hours, and observations of upper winds and upper air temperatures. From these data forecasts are prepared for operations of the Fleet and the Fleet Air Arm, weather reports are made to shore meteorological services, and a meteorological log is compiled. A trained rating is detailed in each ship to assist the meteorological officers in the more routine duties. In ships not carrying qualified observers or instructor officers, the meteorological duties, which will be considerably less comprehensive, will continue to be performed by the Navigating Officer.

The Fleet Navigating Officer is to be responsible to the Commander-in-Chief for the meteorological organisation of the Fleet on the station, and Squadron Navigating Officers are to be responsible for the organisation in squadrons other than aircraft-carrier squadrons. In aircraft-carrier squadrons the senior meteorological officer will be responsible for the meteorological work in the squadron. The King's Harbour Master at each naval base is responsible for liaison with the local shore meteorological service.

It is anticipated that the scheme described above will be in full operation by the end of 1936, the total number of ships with officers appointed for meteorological duties then amounting to about 25.

The work of the Division during the year has been largely concerned with detailed discussion of the scheme outlined above, and has necessitated visits by the Superintendent to the Commander-in-Chief, Home Ports, the Director of Admiralty Departments, and the Commanding Officers of H.M. Ships and Naval Shore Establishments. The Fleet Meteorological Committee met on April 24 and December 13, 1934, and its work also has centred mainly around the development of the organisation.

From the foregoing it will be appreciated that the year under review has been an important one in the history of the Naval Division, since it has seen the attainment of the objective towards which the Division in close co-operation with the Admiralty has been working for many years—the creation of a forecasting service within the Fleet which shall be self-contained yet, in virtue of the fact that the Naval Division is so closely connected with its control and development, not independent of the State Meteorological Service. The active interest in Fleet Meteorology taken by successive Hydrographers has been an essential factor in the successful development of this service.

The close liaison established between the Fleet on foreign stations has been maintained, and the Fleet synoptic messages issued by the British shore meteorological services on the Mediterranean, Africa and China Stations have proved to be of considerable benefit to the Fleet. It is satisfactory to note that as a result of discussions between the local authorities and the Commodore, New Zealand Squadron, a collective message in the Fleet synoptic form has been instituted jointly by Suva and Apia, while on the America and West Indies station a trial Fleet synoptic message has been instituted by the

Canadian Meteorological Service, the message being issued from Halifax. A collective message for H.M. ships, in the Fleet synoptic form has also been instituted on the Australian station, and there is reason to believe that, in the near future, the abridged Fleet synoptic message now issued by Matara (East Indies Station) will be expanded to the full message recommended by the Fleet meteorological conference at Colombo in 1930.

In view of the fact that the meteorological organisation of the Fleet on the Mediterranean Station was established in 1925 and that considerable developments had taken place on other stations since that date, a conference on Fleet meteorology was convened by the Commander-in-Chief, at the request of the Admiralty in November, 1934, the Superintendent attending as a representative of the Meteorological Office. This Conference recommended, *inter alia* :—

(*a*) The substitution of the system of three figure station index numbers for the grid system now used in the Fleet synoptic message;

(*b*) The addition of a cloud group to the Fleet synoptic message;

(*c*) The establishment of a 24-hour forecasting service during the winter months at the Meteorological Office, Malta.

(*d*) The establishment of a forecasting service at Gibraltar.

While in Malta the Superintendent presided over a conference between representatives of the Italian Air Ministry and of the Meteorological Office, Air Ministry upon the provision of meteorological information for civil air routes in the Mediterranean, and on his homeward passage visited Gibraltar to discuss with the naval, military and civil authorities proposed changes in the arrangements for obtaining meteorological observations at Gibraltar. As a result of the last mentioned discussions, it has been agreed that the meteorological station at Gibraltar shall be transferred from the Alameda Gardens to Windmill Hill Flats, where the meteorological work will be undertaken by naval personnel.

Meteorological work in H.M. Ships.—During the year H.M. ships made 697 weather reports to the Meteorological Office, London, and a considerable number to the meteorological services of the Dominions and British possessions overseas. In addition, 998 pilot balloon observations and 66 observations of upper air temperature were received from H.M. ships, and 65 meteorological logs were forwarded for retention in the Division. The total number of pilot balloon ascents is approximately 45 per cent. higher than that for 1933-4.

Training of Officers.—During the year, 30 officers received courses of training in the Meteorological Office, eight of whom took the twelve weeks' course and qualified in meteorology. One of these officers (a Navigating Officer) has been attached to the Navigation School, Portsmouth, to undertake the meteorological instruction of officers at the School.

Meteorological Equipment of H.M. Ships.—The Division has continued to advise the Admiralty regarding the installation of meteorological instruments in H.M. ships and representatives of the Division have visited a number of ships in the course of the year, in connexion with the fitting of instruments, the provision of space for meteorological officers and pilot balloon shelters, etc. Supervision of the meteorological equipment of H.M. ships now forms an important branch of the work of the Division. Considerable attention was given by the Division during the year to problems connected with the design of a true wind recorder and a suitable pilot balloon sight for use in H.M. ships. A fairly suitable dry battery has now been devised for use in electric torches attached to pilot balloons at night and supplies have been issued to aircraft carriers. A specimen calculator for computing pilot balloon results has been constructed to the design of Lieut.-Commander J. V. Findlay, and arrangements are now being made for trials of this instrument at sea.

Handbooks of Local Meteorology on Naval Stations.—Considerable progress has been made with the preparation of the handbooks of local meteorology by Dr. W. A. Harwood, and Lieut.-Commander A. E. M. Dodington, R.N., Hydrographic Department, Admiralty, who has been attached to the Division for the purpose.

INSTRUMENTS DIVISION.

During the past year there have been increasing demands for meteorological instruments from all sources. In addition to the activity which has thus occurred in the normal work of meeting current demands, continuous attention has been given to improving the design of instruments and several special problems have come up for solution. One of the most important of these is the provision of distant reading anemometers. The pressure tube anemometer, which has satisfactorily met the needs of the Meteorological Office for many years past, is not adapted for recording wind speed and direction at a spot remote from the vane. The need is becoming urgently felt at R.A.F. aerodromes for a continuous record of the wind to be available in the administrative building at a spot which may be quite unsuited for the erection of an anemometer mast. A satisfactory solution can only be reached by the provision of an anemometer in which the recording part may be as much as half a mile distant from the vane. An instrument to record wind velocity by electrical means has been on the market for some years past, but no suitable means of recording wind direction has been available and it was therefore necessary to tackle the problem *ab initio*. The co-operation of the Admiralty Research Laboratory was sought and a design for an electrical wind direction recorder has now been evolved, which it is believed will satisfactorily meet the requirements of the Air Force. An instrument to this design, together with an electrical velocity recorder, has been ordered for installation at Cranwell and if this installation proves successful it is intended to standardize the design for use at all aerodromes where conditions do not permit of the

anemometer mast being erected directly above the meteorological station.

During the past few years the Meteorological Office has been directly represented on a Committee of the British Standards Institution which is engaged in preparing British standard specifications for thermometers. During the year, this Committee has had under consideration the drafting of a standard specification for meteorological thermometers and a good deal of experimental work has been carried out in the Instruments Division to assist the Committee in its work. It is anticipated that when the specification has been issued by the Institution, thermometers required by the Meteorological Office will be ordered to this specification instead of to a Meteorological Office specification as in the past. This change of procedure will mark a step forward which should be advantageous both to the Office and to British makers of meteorological thermometers. During the year tests of minimum thermometers filled with glycol ether instead of ethyl alcohol have been continued with promising results. It appears probable that this spirit will form a suitable filling for minimum thermometers and that the evaporation from the column and condensation up the tube, which has been such a frequent cause of inaccurate readings in minimum thermometers in the past, will be overcome by its use.

In the Annual Report for 1933-4, reference was made to experimental work which was being carried out on two types of self-recording rain-gauges. After prolonged test it was decided to standardize the pattern of tilting syphon gauge originally devised by the late Mr. W. H. Dines. Certain modifications have been introduced into the design, full working drawings prepared and the first batch of instruments are due for delivery early in the coming financial year.

A comprehensive inquiry which has been conducted by the National Physical Laboratory and the Meteorological Office over a period of ten years on the relative advantages of stainless steel and cast iron for the cisterns of marine barometers was brought to a satisfactory conclusion during the year. Three barometers with different types of cistern were given alternating periods of service at sea and test at the National Physical Laboratory. The final conclusion reached was that although the cast iron cisterns are slightly liable to corrosion whereas the stainless steel cisterns are not liable, yet this corrosion has no appreciable effect upon the accuracy of the readings of the barometer.

Work on the design of a standard clock adaptable for use on all the recording instruments in common use has continued and such modifications as have been found necessary in the original design have been incorporated in it. No further clocks of non-standard design will be purchased for these instruments in future and the specifications of all instruments are being modified where necessary to ensure that they will take the standard clock.

The trial of pilot balloons to test their keeping qualities when stored in hot climates was continued during the year. Final reports

have now been received and these reports show that the balloons have stood up to the test satisfactorily. It appears that British makers are now able to supply balloons which will remain serviceable for an adequate period even when shipped to a hot climate.

An investigation made with a view to improving the quality of sunshine cards was continued and special attention was directed to the spreading of the burn, a fault, the cause of which is not easy to elucidate.

Among instruments the design of which received attention during the year may be mentioned, in addition to those already specifically referred to, the following : The Aitken Nucleus Counter, the Besson Nephoscope, the Pilot Balloon Slide Rule and Balloon Fillers. The design of suitable pens for use with recording instruments has also been the subject of a good deal of experimental work.

OBSERVATORIES.

KEW.

Buildings.—The Observatory is an old building, and it had been noticed for a long while that the floors of the north and south upper rooms were very irregular, In September, part of the floor of the south room was lifted and it was soon found that both floors were in a very dangerous state. Eventually new floors were provided, these being supported by steel girders. Unfortunately the beautiful moulding round the ceilings in the Superintendent's Room and the hall had to be sacrificed. The curious discovery was made that the building which has now a flat roof was constructed originally with gables. It is even doubtful whether the characteristic octagonal rooms were included in the first plan.

The unsightly staging which was erected on the roof of the Observatory in 1913 was removed on July 17, 1934.

The electric light supply was changed from direct current to alternating current on April 8, 1934.

Atmospheric Electricity.—The principal addition to the equipment for observations in atmospheric electricity has been an electrograph for recording the charge on rain. This apparatus, which is installed at the underground laboratory, has been in regular operation since the beginning of 1935.

The desirability of obtaining numerous records of potential gradient in the upper atmosphere, especially during thunderstorms, has been manifest for a long while. As the sign of the potential gradient is of more significance than the strength of the gradient, it should suffice to utilise pole-finding paper instead of an electrometer. Apparatus based on this principle has been developed and a few trial ascents have been made. A number of instruments are now kept in readiness and it is proposed to release these at short intervals during thunderstorms. All of these instruments incorporate barographs and some are provided with hydrographs so that it will be possible to ascertain the sign of the gradient within and above the clouds.

The point-discharge recorder has been in continuous operation since the middle of 1932. Comparable records of point-discharge and of potential gradient were obtained during 11 thunderstorms in the summer months of 1934. A point-discharge recorder is now in operation at the Royal Observatory, Greenwich, and it is anticipated that similar apparatus will be working at the National Physical Laboratory stations at Teddington and Slough before long.

On several occasions during the winter of 1933-4 there were spells of negative potential gradient at Kew in dry weather. These occurred mostly at night and always with a NE. wind. In the hope of detecting the cause of this anomaly, arrangements were made for Benndorf electrographs to be set up and operated at Kingsway and South Kensington.

Atmospheric Pollution.—It is a well-known result of the analysis of the matter collected by a deposit gauge that the amount of soluble matter varies with the rainfall whilst the amount of insoluble matter has a negative correlation with the rainfall. To throw some light on this generalization, Mr. Coste, the Chief Chemist to the London County Council, has undertaken the analysis of small samples of rain-water collected at Kew. The samples are being taken when possible at different times during the same spell of rain.

Meteorology.—*Colour of the Sky.*—A series of observations of the colour of the sky was begun on May 1, 1934. Cards painted in shades of blue are used for comparison. The observations are made on suitable days at 13h and are confined to the sky in the meridian and at 90° from the sun. It is found that there is some correlation between the depth of the blue and the " visibility " of distant objects.

Radiation.—As from the beginning of 1935 results obtained with the Gorczynski pyrheliograph at Kew are being printed in the *Monthly Weather Report*, viz. the average for a month of the total radiation received during a day and the maximum daily value. Data from the same records are to be published in the *Observatories' Year Book* for 1934. Hourly values will be published as they have been since June, 1930 in the *Bulletin Actinométrique International.*

Two pyrheliometers, the Ångstrøm Pyrheliometer No. 100 and the Abbott Silver Disk Pyrheliometer No. 28 were lent to the National Physical Laboratory for a comparison of standards. The comparison has confirmed the accepted relation between the scales introduced by Ångstrøm and by the Smithsonian Institution which differ by about $3\frac{1}{5}$ per cent. The N.P.L. scale, depending on the radio balance, is intermediate.

Rainfall.—To determine whether the effect of the splashing of rain falling on gravel or concrete would affect appreciably the quantity of rain caught by a rain-gauge embedded in either of those materials, a comparison was made during the year ending August, 1934. It was found that the amount caught in the gauge standing in concrete exceeded that caught in a gauge with the

normal exposure in grass, but only by 4 mm. in 400. The excess for the gauge in gravel was insignificant. Details are to be found in an article in the *Meteorological Magazine*, March, 1935, p. 32.

Exceptionally heavy rain occurred at the Observatory on July 18, 1934. The highest rate recorded by the "minute-by-minute" gauge was 5 mm. (0·2 in.) in a minute. There is no other authentic record of such a high rate of fall in this country.*

Underground Water.—Owing to the persistent drought the underground water level recorder was out of action from August 17 to December 18, 1934, when the water rose after widespread rains in the Thames Valley. During the greater part of this period the level of the water at a site just outside the Observatory was observed.

Seismology.—The Galitzin seismographs have been maintained in operation, and the records have been supplemented by those of the Wood-Anderson instrument mentioned in the report for 1933-4. During the calendar year 1934 the number of earthquakes recorded was 259; of these 9 were large enough to give waves with an amplitude exceeding 0·1 mm. Details of 18 of the records were broadcast in the International Seismological Code. In 10 cases the azimuth could be determined from the Kew records alone.

A synchronome clock was installed on July 14, 1934 in the south-east room in the basement. This clock transmits not only the normal synchronome signals (short signals at half minute intervals) but also the drawn out minute and hour signals required for seismological records.

Much attention has been given at Kew to the study of microseisms but hitherto there has been no certain method of determining the origin of microseismic storms. A method developed by Mr. A. W. Lee for ascertaining the direction from which the microseismic waves approach an observatory puts the subject on a new basis. The method is explained in a paper in the *Proceedings of the Royal Society* (*see* Appendix V, p. 47). This paper provides a definite answer to the controversial question whether microseisms are generated on the coasts of the ocean or under deep water. The latter hypothesis is found to be correct.

Progress has been made in the study of the records collected from all over the world, of the Baffin Bay earthquake of November 20, 1933.

Airwaves from Gunfire.—The most important development in the investigation of the transmission of air waves through the upper atmosphere was the reorganisation of the station for the reception of the waves at North Walsham in Norfolk. Mr. R. H. Angus was successful in recording at that station waves from Woolwich in October, December, January and February during the season when the waves are not received at the other stations, which are all to the

* See *Meteorological Magazine*, **69**, 1934, p. 157.

west of the Woolwich meridian. On March 28 waves were recorded at Birmingham and Nottingham as well as at North Walsham.

In two trials in July 1934, good results were obtained at Exeter where success had not been achieved before though microphones have been installed there since 1928. Prof. F. H. Newman is to be congratulated on his perseverance and ultimate success.

During the twelve months to March, 1935 there were 13 occasions of firing at Woolwich, on 10 of which waves were recorded at one or more stations. Thanks are due to the War Office as well as to the B.B.C. for their continued co-operation in the investigation and also to the observers at the receiving stations Birmingham, Bristol, Cardiff, Nottingham, Exeter and North Walsham.

Investigation of the Upper Atmosphere.—Forty-five balloons were released carrying the ordinary Dines meteorograph for the determination of temperature and humidity at all heights. Thirty-five instruments were recovered, all yielding records. The maximum height reached was 22·9 Km; the maximum effective heights were distributed as follows:

Above 20 Km.	...	...	3
from 15-20 Km.	...	...	17
from 10-15 Km.	...	...	12
below 10 Km.	...	...	3

Eight special balloons were sent up carrying special apparatus designed by Professor Paneth for obtaining samples of air from the upper atmosphere in order that the distribution of helium in the atmosphere might be determined. Unfortunately, through a series of accidents and the loss of balloons, no success was attained until after the date of this Report.

Three balloons carrying special meteorographs for recording vertical air currents were sent up during thunderstorms. So far the instruments sent up in this investigation have not revealed any abnormal vertical currents. It is realised, however, that it is largely a matter of chance whether a balloon gets caught in the active part of a thunderstorm and the only method of obtaining results is to send up a large number of balloons in the hope that one or more will produce interesting results.

Seven balloons were released carrying the new apparatus for determining the sign of the potential gradient in thunderstorms described on p. 21. Interesting records have been obtained but they are not sufficiently numerous yet to allow conclusions to be drawn.

Eskdalemuir.

Terrestrial Magnetism.—The standard magnetographs recording declination D, the horizontal component H and the vertical component V, of the earth's magnetic field, have recorded, apart from a few hours lost through clock stoppage, continuously throughout the year. They have been supplemented by an auxiliary set of instruments recording the same elements, but less sensitive than

the standard set, so that values might be obtained when the records from the standard magnetographs exceeded the limits of the photographic paper, or were otherwise defective. The records have been standardized by almost daily observations of declination and horizontal force, and by dip made twice weekly. The daily horizontal force determinations have been made with the Schuster Smith Coil; determinations of H, with the Kew Magnetometer continued to be made regularly.

The la Cour quick-run recorder, installed to record rapid changes in D, H and V, has been in operation throughout the year. During December, a new suspension was fitted to H, and in January the set was rearranged, both changes being made to increase the sensitivity of the instruments.

Hourly values of magnetic declination continue to be tabulated and supplied for publication weekly in *The Colliery Guardian* and *The Iron and Coal Trades Review* alongside simultaneous data for Abinger. Arising out of this publication of data, copies of original records and other information have been supplied on request to various engineers. A party of engineers from the Institute of Mine Surveyors, Lancashire and Cheshire Branch visited the Observatory on June 30.

The large coil of cable laid out on the moor several years ago was reconditioned and brought into use in order to provide information regarding rapid changes of the vertical magnetic force during the period of emission of specially standardized wireless waves in connexion with an investigation organised by the International Union of Scientific Radio Telegraphy.

Meteorology.—The routine meteorological work was carried out as in previous years.

Atmospheric Electricity.—A continuous record of potential gradient was maintained.

Aberdeen.

As stated in last year's Report, the new meteorological enclosure, though excellent in most respects, has not proved entirely satisfactory as an anemograph site. Some investigations of the nature of the air flow over the enclosure have been carried out by means of small no-lift balloons and by streamers with the object of determining whether it is desirable that the height of the anemograph mast should be increased. The matter is still under investigation.

The establishment of air lines in the north of Scotland has led to a number of inquiries for meteorological information.

During the meeting of the British Association at Aberdeen in September, 1934, the Observatory was visited by a large number of members. At the same time Mr. Clarke exhibited a series of 60 enlarged photographs of cloud forms in the University Library.

LERWICK.

Terrestrial Magnetism.—The la Cour magnetograph set, which had been used by the British Polar Year Expedition at Fort Rae, was installed in the concrete hut and operated as the standard set from April 20, 1934. The former standard set (Munro H and D and Watson quartz fibre V recorders) were transferred to the supplementary hut. The la Cour set has performed very satisfactorily. The short periods when the trace has been lost owing to adjustments to the instruments have all been bridged by the supplementary set. Base-line values are very steady, apart from a small residual temperature-variation in the H instrument which has not yet been compensated. During the year the lighting of the supplementary instruments has been improved; lamps of the la Cour type have been fitted to all three, and new mirrors to the H and D.

Considerable difficulty has been experienced during the year in connexion with the absolute observations. The Schuster-Smith portable magnetometer, which it is hoped to make the ultimate standard, was found to be seriously affected by the temperature at the time of observations in an unexpected manner. The instrument is under investigation but in the meantime it has been necessary to continue to use the Kew magnetometer for making the absolute observations. Difficulty has also been experienced with the dip circle and a second dip circle had to be brought into use.

The usual observations of aurora, atmospheric electricity and meteorology described in previous reports were continued without change.

VALENTIA.

There has been no change during the year in the work of the Valentia Observatory. Regular telegrams have been sent to Headquarters in connexion with the forecast work and observations of magnetic declination, horizontal force and dip have been made weekly.

BRANCH METEOROLOGICAL OFFICES.

EDINBURGH.

The Edinburgh Meteorological Office acts as a local centre for the organisation of climatological and rainfall stations in Scotland, and for the administration of the three observatories at Eskdalemuir, Lerwick and Aberdeen. The number of climatological stations in Scotland is now 84 and the number of rainfall stations about 900. The Edinburgh Office also receives the monthly registers and autographic records from 8 telegraphic stations in Scotland before they are forwarded to London.

New climatological stations have been started during the year at Thornhill, Dumfriesshire and Law, Lanarkshire. A new station of the " Health Resort " Class was set up at Dunoon. The station at Linlithgow came to an end during the year.

A monthly summary of the weather in Scotland, together with statistics for certain large towns, has been prepared, as well as the annual report, as usual for the Registrar-General. Two years ago some changes were made in the tabular matter included in the annual report, the effect of these changes being to bring the general form of the report more closely into accord with that followed by the Registrar-General for England and Wales; some further minor changes in the same direction have been introduced during the present year.

Reports on rainfall were prepared for the public health authorities of Argyll and Wigtown and for the Department of Agriculture. Meteorological data were also supplied to the Macaulay Institute for Soil Research. A large number of inquiries of a smaller nature were dealt with in connexion with losses or damage sustained by fishing vessels.

In connexion with the Highland and Agricultural Society's Show at Glasgow from June 19 to 22, a meteorological exhibit, with demonstration, was given.

Malta.

The routine work of the office continued to develop along normal lines.

Work for the Services again occupied most of the time of the staff and interest in reports, forecasts and general climatology was maintained. A good deal of work was done in connexion with inquiries from the Port Authorities and other local institutions.

Work for the Italian civil air line operating the Syracuse-Malta-Tripoli air route continued to increase. An interesting feature in connexion with this service was a large increase in the number of weather reports received from aircraft in flight.

Synoptic reports continued to improve both as regards volume and quality, and reception of broadcasts from Europe and the north African coast was on the whole satisfactory. Reports from the eastern Mediterranean showed a decided improvement, but the lack of regular information from the Sahara was again badly felt at times although some improvement was noticeable. The absence of 0100 reports from Mediterranean countries continued to be felt in connexion with the demands of the Air Force for early morning forecasts. Reports of 0100 and 0400 observations from Italian stations have proved of great value.

The number of reports received from H.M. ships again increased and there was a remarkable improvement in the number of reports from merchant ships. Many reports were picked up from foreign ships, chiefly Italian.

Two conferences were held at Malta during the year, one in connexion with the organisation of meteorology for aviation. A representative of the Italian Air Ministry attended the latter conference, while both were attended by the Superintendents of the Naval Division, Malta and Middle East.

Information was supplied from time to time for the benefit of ships from foreign fleets. This included reports and forecasts for ships of the French and Japanese Fleets visiting Malta, and for a Yugoslavian destroyer on passage.

W/T reception of synoptic broadcasts was on the whole very good. Occasional jamming by atmospherics and by Italian stations, particularly in the evenings, interrupted the reception of the central European messages, and portions of the Berlin collective issues were affected at times by interference from Rinella.

Middle East Area and Iraq.

Middle East.—Normal surface and upper wind observations have been continued throughout the year at Heliopolis, Aboukir, Ismailia, Ramleh and Amman. In addition, observations at 0900 G.M.T. have been made during the winter months and sent by W/T to Heliopolis. Routine forecasts have been issued twice daily and international collective broadcasts once daily from Heliopolis.

Pilot balloon stations were established at Mirabello (Crete) and Wadi Halfa (Upper Egypt) in August 1934. The observations at the former station are taken by the staff on Imperial Airways Motor Yacht " Imperia " and at the latter by the ground staff of Imperial Airways.

The Officer Commanding, Arab Legion, Transjordan has offered to supply regular surface observations from various posts in Transjordan. Personnel of the Arab Legion are being trained at the meteorological station, Amman.

Reports have been received regularly from ships in the Mediterranean and Red Sea and also from aircraft whilst flying over selected positions on the Imperial Airway routes, Cairo to Kisumu, Cairo to Athens, Cairo to Karachi.

Additional services inaugurated by Imperial Airways to and from Egypt have necessitated a large increase in the forecasting and upper wind observational work of the meteorological offices in Middle East Area.

Copies of the routine forecasts issued from Heliopolis together with the latest weather and upper wind reports from all Middle East Stations are supplied daily to the Egyptian Army Air Force, and additional reports and forecasts are issued on request.

Discussions have taken place with the Director of the Physical Department, Egyptian Government, with the object of improving the supply of meteorological information for civil aviation in Upper Egypt and the Sudan.

Iraq.—*The Royal Air Force.*—Close liaison was maintained with Air Headquarters and all Royal Air Force units in Iraq, and much special work was performed in co-operation with the Air Staff.

Lectures on Meteorology were given as part of the ground training of the Royal Air Force.

Routine forecasts for Iraq and the western end of the Persian Gulf, upper wind and weather reports, etc., were issued daily to all stations.

In addition to the normal routine 869 forecasts and 1,993 weather and/or upper wind reports were supplied to the Royal Air Force: these figures showed an increase of 112 per cent and 62 per cent respectively on last year's.

Civil Aviation.—Weather forecasts and reports were issued to Imperial Airways, Air France, K.L.M., Iraq Petroleum Company, and other civil aircraft. During the year 709 special forecasts and 1,308 weather and/or upper wind reports were issued from Hinaidi or Shaibah to civil aircraft: the former figure showed an increase of 37 per cent and the latter a decrease of 10 per cent on last year's figures.

GALE WARNING SERVICE.

In order to facilitate the administration of the gale warning service it has been decided that the Meteorological Office will be responsible in the future only for the preparation and issue of the necessary warning telegrams. The Board of Trade has undertaken to organise and administer the exhibition of the warnings. There are about 230 points around the coasts where cones are hoisted on suitable masts to warn shipping, and the Board of Trade will, in future, be responsible for the choice of sites and the supply of the necessary cones. That Department will also undertake the cost of distributing the warning messages. The new scheme has the great advantage over the old arrangement that the Board of Trade has local agents closely connected with the craft which make most use of these signals, and in many cases the signals are actually hoisted at stations under the control of the Board of Trade. The transfer was effected on September 1, 1934. The usual table setting out the results of checking the gale warnings issued will be found in Appendix II, p. 36.

FISHERY BAROMETER AND BAROGRAPH SERVICE.

New regulations governing the Fishery Barometer and Barograph Service were introduced on January 1, 1935. In accordance with these regulations the service is administered by the Meteorological Office (Instruments Division) through the local Fishery Officers of the Ministry of Agriculture and Fisheries and the Fishery Board for Scotland, each Fishery Officer being responsible for the supervision of the stations in his area.

INTERNATIONAL POLAR YEAR 1932–3.

Work has continued on the reduction and discussion of the observations taken at Fort Rae but as it was necessary to recall Mr. J. M. Stagg to the Office on November 1, 1934, on account of shortage of staff, progress has been slower during the latter half of the year. In addition to spending as much official time as their duties will allow

on the Polar Year results, Mr. Stagg and Mr. Morgans have devoted a large part of their private time to the work.

INTERNATIONAL CO-OPERATION.

Executive Council of the International Meteorological Committee.—The annual meeting was held on May 17, 1935; the Director attended.

International Climatological Commission.—A meeting of this Commission under the Presidency of Prof. Dr. H. von Ficker, Director of the Prussian Meteorological Institute, was held in Wiesbaden from May 22–26, 1934. The Superintendent of the General Climatology Division attended. The Commission discussed climatic fluctuations; the period 1901 to 1930 was proposed as a standard, and it was recommended that each country should maintain perfect stability of the conditions of observation in future at one or two selected stations. It was also recommended that the hours of observation at climatological stations should be brought where possible into accord with synoptic hours. Five resolutions were passed concerning the broadcasting of monthly meteorological values. Units and symbols in climatology and synoptic meteorology and proposals for a uniform international form of publication of monthly and annual climatological tables were discussed in detail and a number of resolutions were agreed to.

International Commission for the Exploration of the Upper Atmosphere.—A meeting of this Commission was held under the presidency of Geheimrat H. Hergesell, formerly Director of the Lindenberg Observatory, at Friedrichshafen from August 30 to September 4, 1934. Mr. R. G. K. Lempfert attended as representative of the Office. The business was concerned mainly with the arrangements for the publication by the Commission of the observations made on the international days for the intensive study of the upper air. The form of the publication was reviewed and some modifications suggested and approved. The financial arrangements for securing the continuation of the publication were also discussed. It was decided that as soon as the volume dealing with the observations for 1928 has been issued, the Commission should concentrate on the results for the Polar Years 1932 and 1933 and endeavour to secure the publication of the voluminous material available for these years as soon as funds permit. The President was asked to prepare a close estimate of the cost involved and then to approach the Institutes with a view to ascertaining to what extent they would be prepared to support the enterprise.

A number of resolutions were also passed directed to secure more extensive co-operation in the work of the Commission, more particularly by endeavouring to utilise the facilities that exist in most countries for making high ascents with aeroplanes for securing meteorological observations in the free air.

International Commission for Synoptic Weather Information.—The Ninth Meeting of the International Commission for Synoptic

Weather Information, of which Lieut.-Colonel E. Gold is President, was held at De Bilt from May 12 to 18, 1934.

The principal matters dealt with at the Meeting were :—

(*a*) The consideration of a *Scheme for Broadcasting by Radio-telegraphy* at the end of each month the mean values for the month of pressure, temperature and rainfall. The scheme is intended to enable any country to obtain a world picture of the distribution of these elements as soon after the end of the month as practicable. The Commission proposed to achieve this object by utilising as far as possible the organisation for the international exchange of synoptic information : the mean values would be collected in each continental region at a single centre from which they would be broadcast, for the information of the Services both in the continent concerned and in other continents.

(*b*) The preparation of a *Code for use in the Transmission of Weather Forecasts for Ships at Sea.* A code for this purpose is especially required in countries like Iceland from which weather forecasts are issued for use by ships of all nations, and the Commission prepared an experimental code which it is understood is to be put into operation in Iceland during 1935. This code is based on the code which has been used by the Meteorological Service of Norway.

(*c*) *Symbols.*—Reports have been received by the Commission on the trial of the symbols prepared by the Sub-Commission in the preceding year, which were referred to in the last Annual Report. These reports indicated substantial divergencies of view. In particular it was urged that insufficient attention had been given in preparing the set of symbols, to the system of symbols used by the Meteorological Office, especially the symbols for the amount of cloud. A revised set of symbols was prepared in which the method of showing cloud amount was modified in the direction of the British system. The revised set of symbols will be considered at the General Meteorological Conference at Warsaw in 1935. In the interval this revised set of symbols is being subjected to trial in different services. The purpose of this set of symbols is primarily to ensure uniformity in the preparation of charts for the information of aviators for whom a uniform method of presentation on the charts used in different countries would clearly be of substantial value.

(*d*) *Beaufort Scale of Wind Force.* The Commission agreed at Zurich in 1926 upon a specification for the conversion of the records of anemometers to the Beaufort Scale. Hitherto there had been no international agreement upon the method of estimating the force of the wind when no anemometer is available. At the meeting at De Bilt in May, 1934, the Commission agreed that the descriptions of the effects of the wind given in the British instructions for land and for sailing ships and the instructions of the Deutsche Seewarte for the effect on the sea should be recommended for approval for international use. This recommendation will also be considered at the Conference at Warsaw.

(*e*) *Reports of Polar Ice.* In order to secure uniformity in the method of reporting ice, the Commission recommended the adoption for international purposes of an Ice Atlas presented by Dr. Hesselberg of the Norwegian Meteorological Institute and they appointed a Sub-Commission to prepare a code for use in international reports of polar ice.

(*f*) In the *Standard Code for the International Exchange of Meteorological Reports* each station is represented by a three-figure index number. Owing to the increase in the number of stations required for aviation reports there are not enough numbers to provide for a separate index number for each station in Europe. Consequently there are different stations with the same index number, which gives rise to difficulty. A plan was prepared and approved by the Commission for meeting this difficulty.

These were the main points dealt with at the meeting of the Commission; agreement was also reached on a number of additions and alterations to the existing codes and to the existing arrangements for the international exchange of reports by radio-telegraphy.

International Commission for Air Navigation.—There has been no meeting of the Meteorological Sub-Commission of the International Commission for Air Navigation during the past year. Questions relating to the work of the Sub-Commission and to the interpretation of the Meteorological Annex to the International Air Convention, have been dealt with by correspondence. Proposals have also been circulated by the different Services represented on the Sub-Commission for consideration and discussion by correspondence before the next meeting which will probably be held in the winter of 1935–6.

PUBLICATIONS.

The serial publications of the Office have been issued without change in their form. A new edition of the "Meteorological Observer's Handbook" which contains the standard instructions for meteorological observing and the care and manipulation of instruments appeared in the course of the year. It replaces the 1926 edition which is now exhausted. As eleven years had elapsed since the publication of the previous editions, a good deal of amendment and amplification has had to be made. The principal change has been in the section dealing with cloud forms in which the revised classification recently approved by the International Meteorological Organisation has been introduced. This section has also been issued as a separate pamphlet.

Four *Geophysical Memoirs* were issued and two were in the press at the close of the year under review. Memoir No. 61 deals with the meteorological observations of the British Arctic Air-Route Expedition 1930–1, which carried out a large programme of work in Greenland under the direction of the late H. G. Watkins mainly directed to the investigation of the possibility of an air route from England to America via Greenland. The meteorological results are discussed at length by S. T. A. Mirrlees.

In Memoir No. 62, Mr. A. W. Lee contributes a special study of the microseisms experienced during January 1930 with the aid of records kindly supplied by about 50 seismological observatories. With the help of this material it was possible for the first time to discuss these minute earth tremors on a world-wide basis. As a result of the investigation the effect of the sub-soil upon the amplitude of the microseisms has been put on a rational basis, and the suggestion that the earth disturbances may be of meteorological origin receives some support, but on the other hand cases were noted in which the microseisms over Europe were not always large when deep depressions were located over the eastern Atlantic.

Memoir No. 63, which is contributed by Mr. A. H. R. Goldie, deals with the wind records from the Bell Rock Lighthouse. The exposure of this anemometer is unique as the lighthouse on which it is placed rises to a height of about 100 feet out of the North Sea. The Scottish coast is about 12 miles distant and at high tide the rocks round the lighthouse are submerged. The records thus afford an opportunity for the study of wind structure freed from the complications introduced by the flow of air over the obstacles that are inevitable at a land station. In Memoir No. 64, Mr. F. J. Scrase discusses work done at Kew Observatory on the part played by charged and uncharged nuclei in the atmospheric ionisation.

Contributions by members of the Office staff again figure largely in the *Quarterly Journal of the Royal Meteorological Society*. The July number contains an account of the work of the British Polar Year Expedition to Fort Rae by its leader Mr. J. M. Stagg, contributed as the Symons' Memorial Lecture delivered on March 21, 1934. Lieut.-Colonel Gold's presidential address, delivered at the January meeting of the Society, was entitled " Fronts and Occlusions " and gives a summary of the development of synoptic meteorology since the beginning of the twentieth century. In the " Problems of Meteorology " series there are articles by C. K. M. Douglas on " Rainfall " and by C. E. P. Brooks on " Post-glacial Climates and the Forests of Europe." The Journal also includes nine papers by members of the Office staff read at the Society's meetings and a number of notes and reviews. The titles are given in the list of papers published by members of the staff on pp. 45-7. The list also contains two papers contributed to the *Proceedings of the Royal Society* (*see* Appendix V, p. 47): one by A. W. Lee on the " Direction of Approach of Microseismic Waves," the other by O. G. Sutton on " Wind Structure and Evaporation in a Turbulent Atmosphere."

STAFF.

During the year the Office has lost the services of Mr. D. Brunt who resigned on appointment to the Professorship of Meteorology at the Imperial College of Science and Technology which had become vacant owing to the retirement of Sir Gilbert Walker. Mr. Brunt joined the staff of the Office in 1916 and subsequently accepted a Commission in the Meteorological Section of the Royal Engineers,

taking an important part in the supply of meteorological information to the Services during the war. On the termination of hostilities he became the Superintendent of the newly-formed Army Services Division of the Office. In that capacity he rendered valuable service and also found time to make many important contributions to meteorological science. His retirement is a great loss to the Office but his new work is likely to offer many opportunities for co-operation with his former colleagues in the advancement of Meteorology and its applications.

The Office has also lost the services of Mr. M. G. Bennett who joined the staff of Kew Observatory as Research Officer for problems connected with visibility in June, 1930. Mr. Bennett's investigations during the period of his connexion with the Office have covered a wide range. A report on the latest, a comparison between the range of visibility of objects by day and lights at night, is about to appear in the *Quarterly Journal of the Royal Meteorological Society.* Mr. Bennett has resigned his appointment in the Office in order to take a post on the staff of the London, Midland & Scottish Railway.

As the employment of officers recruited from the general clerical examination for the Civil Service on meteorological work has not proved entirely satisfactory it has been decided to replace the meteorological clerks at most of the out-stations by a new category of employee specially recruited for the service of the Office. The new Observer class will be divided into two grades. A first batch of 10 Observers, Grade II, was recruited early in the year under review for training in meteorological work, and further appointments have been made from time to time. At the end of the year to which this report refers, 52 Observers had entered the service of the Office. In the autumn of 1934, 16 clerks, Grade III, were released from service with the Office in order that they might take up offers of transfer to the Department of Customs and Excise. The remaining Observers have been absorbed in vacancies which would otherwise have been filled by the appointment of clerks. No appointments have as yet been made as Observer, Grade I. These posts will in due course be filled by promotion from the lower grade as the Grade II clerks now holding them are absorbed in other posts.

The Hood Medal of the Royal Photographic Society for the most meritorious performance in any branch of photography has been awarded to Mr. G. A. Clarke, The Observatory, Aberdeen, for a cloud photograph exhibited in the scientific section of the Society's Exhibition in 1934. A prize has been awarded to Mr. L. C. Burridge, Kew Observatory, by the Jury of the Exhibition organised by the International Commission for the Study of Clouds (Paris, 1934), in recognition of his contribution to the exhibition.

Details of the staff and its present distribution will be found on pp. 38-43.

APPENDIX I

CLASSIFICATION OF STATIONS WHICH REPORT TO THE BRITISH CLIMATOLOGY DIVISION

	Districts	Stations						Autographic Records					
		Observatories	Distributive	Telegraphic	Crop Weather	Climatological	Rainfall only	Sunshine	Rainfall	Wind	Pressure	Temperature	Humidity
0	Scotland, N. ...	1	0	3	0	11	132	13	1	3	6	0	0
1	„ E. ...	1	1	2	2	30	351	19	6	3	2	2	2
6A	„ W. ...	1	1	1	1	21	395	21	7	3	2	2	1
2	England, N.E. ...	0	2	2	2	13	280	18	6	6	6	3	1
3	„ E. ...	0	2	1	8	17	412	22	5	6	6	2	2
4	„ Midlands	0	1	4	5	40	1060	32	17	1	5	3	2
5	„ S.E. ...	0	7	3	6	32	927	39	26	9	9	8	8
	London District ...	2	0	0	0	11	53	8	8	1	1	2	0
8B	England, S.W. ...	0	1	2	5	33	608	31	6	3	6	3	3
7A	„ N.W. ...	0	2	1	1	22	485	25	9	3	2	0	0
7B	N. Wales ...	0	2	0	1	5	180	7	3	5	5	2	2
8A	S. „	0	0	1	2	8	229	11	3	2	2	2	1
9	Ireland, N. ...	0	1	3	0	5	127	6	2	3	6	1	1
10	„ S. ...	1	0	2	0	14	123	11	2	3	6	0	0
6B	Isle of Man ...	0	0	0	0	1	7	2	0	0	0	0	0
11	Scilly and Channel Isles	0	0	2	0	1	26	4	0	1	2	1	1
	Total	6	20	27	33	264	5395	269	101	52	66	31	24
	Corresponding number for last year ...	6	19	27	31	261	5383	260	94	51	65	30	23

APPENDIX II

GALE WARNINGS ISSUED DURING THE YEAR 1934.

Districts	Summary of occasions of gales		Summary of warnings issued			
	Total number of occasions when 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 and strong winds
1. Scotland, N.E. ...	22	82	46	18	21	85
2. Scotland, E. ...	8	63	27	5	16	78
3. Scotland, N.W. ...	14	79	51	11	28	76
4. Scotland, W. and North Channel ...	11	100	36	11	17	78
5. Ireland, N.	8	100	51	8	29	73
6. Ireland, S. ...	15	100	44	15	18	75
7. Irish Sea	12	92	34	11	20	91
8. St. George's Channel	16	94	33	15	12	82
9. Bristol Channel ...	17	100	42	17	14	74
10. England, S.W. ...	22	95	43	21	15	84
11. England, S.	11	91	33	10	20	91
12. England, S.E. ...	4	50	24	2	16	75
13. England, N.E. ...	4	100	20	4	13	85
14. England, E. ...	8	88	25	7	13	80
Totals	172	90	509	155	252	80

APPENDIX III

FINANCIAL STATEMENT

The year under review, 1934–5, is the fourteenth in which the cost of the Meteorological Office has been borne on Air Ministry Votes. The accounts are not yet closed, but the following tables give the approximate figures for the expenses and receipts of the Meteorological Office :—

APPROXIMATE STATEMENT OF EXPENDITURE AND RECEIPTS IN RESPECT OF METEOROLOGICAL SERVICES DURING THE YEAR 1934–5.

Expenditure.	*Amount.* £	£
Salaries and Wages—H.Q. Establishments	49,664	
,, ,, —Out-station Establishments ...	68,456	
		118,120
Fuel and Light		373
Transport of Personnel and Equipment		4,378
Instruments, Equipment and Stores		7,810
Research (including Polar-Year Work)		2,426
Minor Works Services, Rents, Repairs and Maintenance of Buildings		3,219
Telegrams, Telephones ... ... Subventions to reporting Stations and miscellaneous charges		15,567
Superannuation		831
Total ...		£152,724

Receipts	
Receipts from Royal Society	812
,, ,, National Debt Commissioners(Annuities)	28
Sale of Instruments, Carriage, etc.	4,240
Daily Weather Reports, Forecasts, etc.	3,521
Receipts from War Office and Admiralty	6,323
Total ...	£14,924

APPENDIX IV

THE STAFF OF THE METEOROLOGICAL OFFICE, ITS OBSERVATORIES AND BRANCHES, MARCH 31, 1935

THE STAFF AT HEADQUARTERS

DIRECTOR:

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

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

GENERAL SERVICES DIVISION.

Chief Clerk	H. L. B. Tarrant, M.B.E.
Clerk, Grade I	R. M. Poulter.
Clerks, Grades II & III ...	7 (one vacancy).

MARINE DIVISION.

Superintendent	L. A. Brooke Smith, Captain R.N.R. (retd.), R.D.
Senior Professional Assistants	E. W. Barlow, B.Sc.; J. Hennessy, Cdr. R.N.R. (retd.), R.D.
Clerk, Grade I	H. Keeton.
Clerks, Grades II & III ...	11

BRITISH CLIMATOLOGY DIVISION.

Superintendent	E. G. Bilham, B.Sc., A.R.C.S., D.I.C.
Assistant Superintendent ...	E. V. Newnham, B.Sc.
Senior Professional Assistants	J. Glasspoole, M.Sc., Ph.D.; Miss L. F. Lewis, B.Sc.
Clerk, Grade I	A. G. W. Howard.
Clerks, Grades II & III ...	14
Draughtsman	1

GENERAL CLIMATOLOGY DIVISION.

Superintendent	C. E. P. Brooks, D.Sc.
Senior Professional Assistants	Miss E. H. Geake, M.Sc.; Miss L. D. Sawyer, B.A.; Miss G. L. Thorman, B.Sc., A.K.C.
Clerk, Grade I	A. T. Bench.
Clerks, Grades II & III ...	9 (one vacancy).

FORECAST AND AVIATION SERVICES DIVISION.

Superintendents	R. Corless, O.B.E., M.A. H. W. L. Absalom, B.Sc., A.R.C.S., D.I.C.
Assistant Superintendents ...	C. K. M. Douglas, B.A.; C. S. Durst, B.A.; W. C. Kaye, B.Sc.; R. S. Read, M.A., B.Sc., A.R.C.S., F.Inst.P.
Senior Professional Assistants	A. C. Best, B.Sc.; C. J. Boyden, B.A.; G. A. Bull, B.Sc.; E. A. Cope, B.Sc.; L. G. Hemens, B.Sc.; D. W. Johnston, B.Sc.; T. W. V. Jones, B.Sc.; A. L. Maidens, B.Sc.; P. I. Mulholland, B.Sc.; B. C. V. Oddie, B.Sc.; J. Pepper, Ph.D., M.A., B.Sc.
Clerks, Grade I	W. Hayes; F. M. Dean.
Clerks, Grades II & III ...	29 (four vacancies).
Telephone-Typists	8

APPENDIX IV—*continued*

NAVAL DIVISION.

Superintendent	... ...	L. G. Garbett, Cdr., R.N. (retd.).
Assistant Superintendent	...	W. A. Harwood, D.Sc.
Senior Professional Assistants		A. H. Nagle, B.Sc., A.R.C.S., D.I.C.; A. G. Forsdyke, Ph.D., A.R.C.S., D.I.C.
Clerk, Grade III	... ...	1 (one vacancy).

ARMY SERVICES DIVISION.

Superintendent	... ...	F. Entwistle, B.Sc.

INSTRUMENTS DIVISION.

Superintendent	... ...	J. S. Dines, M.A.
Senior Professional Assistant		J. E. Belasco, B.Sc.
Clerk, Grade I	... ...	P. N. Skelton.
Clerks, Grades II & III	...	8
Draughtsman ...	... ...	1
Instrument Designer ...	...	1
Storeman, Packer and Porter		3

THE STAFF AT OBSERVATORIES AND BRANCH ESTABLISHMENTS

METEOROLOGICAL OFFICE, 6, Drumsheugh Gardens, EDINBURGH, 3.

Superintendent	... ...	A. H. R. Goldie, M.A., F.R.S.E.
Assistant Superintendent	...	M. T. Spence, B.Sc.
Senior Professional Assistant		J. M. Stagg, M.A., B.Sc.
Clerks, Grade III	... ...	5

METEOROLOGICAL OFFICE, MALTA.

Superintendent	... ...	G. R. Hay, M.A.
Senior Professional Assistants		N. H. Smith, B.Sc.; A. Walters.
Clerk, Grade II	... ...	1
Clerks (locally entered)	...	4

METEOROLOGICAL OFFICE, MIDDLE EAST.

HELIOPOLIS.

Superintendent	... ...	J. Durward, M.A.
Senior Professional Assistants		C. V. Ockenden, B.Sc.; G. J. W. Oddie, B.Sc.
Clerk, Grade I	... ...	R. Pyser.
Clerk, Grade II	... ...	1
Clerks (locally entered)	...	4

ABOUKIR, AMMAN, ISMAILIA AND RAMLEH.

Clerks, Grade II	... ...	4
Clerks (locally entered)	...	4

METEOROLOGICAL OFFICE, IRAQ.

HINAIDI.

Assistant Superintendent	...	R. H. Mathews, B.A.
Senior Professional Assistants		R. F. Budden, M.A.; F. E. Coles, B.Sc., A.R.C.S., D.I.C.
Clerk, Grade II	... ...	1
Clerks (locally entered)	...	7

DIWANIYAH, MOSUL, RAMADI, SHAIBAH.

Clerks, Grade II	... ...	2
Clerks (locally entered)	...	4

APPENDIX IV—*continued*

KEW OBSERVATORY, Old Deer Park, Richmond, Surrey.

Assistant Director	F. J. W. Whipple, Sc.D., F.Inst.P.
Senior Professional Assistants	A. W. Lee, M.Sc., A.R.C.S., D.I.C.; F. J. Scrase, M.A., B.Sc.
Junior Professional Assistant	1 (vacancy).
Clerk, Grade I	E. Boxall.
Clerks, Grades II & III ...	5
Observer, Grade II	1
Caretaker and Handyman ...	2

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

Assistant Superintendent ...	L. H. G. Dines, M.A.
Instrument Maker	1
Mechanic and Carpenter ...	2

VALENTIA OBSERVATORY, Cahirciveen, Co. Kerry.

Assistant Superintendent ...	H. F. Jackson, M.S.E.
Clerks, Grade III	4
Messenger	1

THE OBSERVATORY, ESKDALEMUIR, Langholm, Dumfriesshire.

Assistant Superintendent ...	J. Crichton, M.A., B.Sc., F.R.S.E.
Senior Professional Assistant	L. Dods, B.Sc.
Clerks, Grade III	3
Housekeeper, Mechanic and Handyman	3

THE OBSERVATORY, King's College, ABERDEEN.

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

THE OBSERVATORY, LERWICK, Shetlands.

Senior Professional Assistant	D. N. Harrison, D.Ph.
Clerks, Grade III	3
Caretaker	1

PORT METEOROLOGICAL OFFICE, LIVERPOOL.

Senior Professional Assistant	M. Cresswell, Cdr. R.N.R.
Clerk, Grade III	1

PORT METEOROLOGICAL OFFICE, LONDON.

Senior Professional Assistant	C. H. Williams, Cdr. R.N.R. (retd.).
Clerk, Grade III	1

AVIATION SERVICES STATIONS

ABBOTSINCH.

Senior Professional Assistant	W. J. Grassick, M.A., B.Sc.
Clerk, Grade II	1
Observers, Grade II	2

ABINGDON.

Assistant Superintendent ...	R. E. Watson, B.Sc., Ph.D.
Observer, Grade II	1

ALDERGROVE.

Senior Professional Assistant	D. Dewar, B.Sc.
Clerks, Grades II & III ...	2
Observers, Grade II	2

APPENDIX IV—*continued*

ANDOVER.

Assistant Superintendent ...	W. H. Pick, B.Sc., F.Inst.P., F.C.P.
Clerk, Grade III	1

BICESTER.

Senior Professional Assistant	J. S. Farquharson, M.A.
Clerk, Grade III	1

BIGGIN HILL.

Clerk, Grade II	1
Observers, Grade II	4

BIRCHAM NEWTON.

Senior Professional Assistant	W. H. Bigg, B.Sc.
Clerk, Grade III	1

BOSCOMBE DOWN.

Senior Professional ssistant ...	C. W. Lamb, M.C., B.Sc.
Clerks, Grades II & III ...	2
Observers, Grade II	3

CALSHOT.

Assistant Superintendent ...	R. A. Watson, B.A.
Junior Professional Assistant	1 (vacancy).
Clerks, Grades II & III ...	3
Observers, Grade II	2

CATTERICK.

Senior Professional Assistant	W. R. Morgans, M.Sc.
Clerks, Grades II & III ...	2
Observers, Grade II	2

CRANWELL.

Assistant Superintendent ...	R. P. Batty, B.A.
Senior Professional Assistant	R. M. Stanhope, B.A.
Clerks, Grades II & III ...	2
Observers, Grade II	3

CROYDON.

Assistant Superintendent ...	S. F. Witcombe, B.Sc.
Clerks, Grades II & III ...	4
Observers, Grade II	5
Telephone-Typists	2

FELIXSTOWE.

Senior Professional Assistant	R. C. Sutcliffe, Ph.D.
Clerks, Grades II & III ...	2
Observer, Grade II	1

HOLYHEAD.

Clerks, Grades II & III ...	3

LEUCHARS.

Senior Professional Assistant	S. T. A. Mirrlees, M.A.
Clerk, Grade II	1
Observers, Grade II	2

APPENDIX IV—*continued*

LYMPNE.

Senior Professional Assistant	1 (vacancy).
Clerks, Grades II & III ...	3
Observers, Grade II	4

MANCHESTER.

Senior Professional Assistant	C. W. G. Daking, B.Sc.
Clerks, Grades II & III ...	2
Observer, Grade II	1

MANSTON.

Senior Professional Assistant	A. F. Crossley, M.A.
Clerks, Grades II & III ...	3
Observers, Grade II	3

MILDENHALL.

Senior Professional Assistant	R. Frost, B.A.
Clerks, Grades II & III ...	2
Observers, Grade II	2

MOUNT BATTEN.

Senior Professional Assistant	M. J. Thomas, B.Sc.
Clerks, Grades II & III ...	2
Observers, Grade II	2

PEMBROKE DOCK.

Senior Professional Assistant	L. H. Starr, M.Sc.
Clerk, Grade III	1

SEALAND.

Senior Professional Assistant	W. D. Flower, B.Sc., A.Inst.P.
Clerk, Grade II	1
Observers, Grade II	2

SOUTH FARNBOROUGH.

Senior Professional Assistant	F. H. Dight, B.Sc.
Clerk, Grade II	1
Observers, Grade II	2

UPPER HEYFORD.

Senior Professional Assistant	J. C. Cumming, M.A.
Clerk, Grade II	1
Observers, Grade II	2

WORTHY DOWN.

Senior Professional Assistant	S. P. Peters, B.Sc., A.Inst.P.
Clerk, Grade III	1

ARMY SERVICES STATIONS

METEOROLOGICAL OFFICE, SHOEBURYNESS.

Assistant Superintendent ...	C. E. Britton, B.Sc.
Junior Professional Assistant	1 (vacancy).
Clerks, Grades II & III ...	7 (one vacancy).
Observers, Grade II	3

APPENDIX IV—*continued*

METEOROLOGICAL OFFICE, LARKHILL.

Senior Professional Assistant	H. L. Wright, M.A.	
Clerks, Grades II & III	...	2
Observers, Grade II ...	...	2

METEOROLOGICAL OFFICE, PORTON.

Clerks, Grades II & III	...	5
Observer, Grade II ...	...	1

SECONDED FOR DUTY WITH OTHER BODIES

Senior Professional Assistants	R. G. Veryard, B.Sc. (R.A.F., India).	
	E. L. Davies, M.Sc. A. E. Mayers, B.Sc. P. A. Sheppard, B.Sc. O. G. Sutton, B.Sc.	(War Office, Porton Experimental Station).
	H. Garnett, M.Sc. (Indian Government).	

APPENDIX V

PUBLICATIONS

The publications prepared by the Office are generally issued by His Majesty's Stationery Office as official publications. A complete list, with the prices at which they can be purchased through any of the Sale Offices or usual agents of the Stationery Office is sent free to any applicant.

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 Monthly Weather Report with a summary for the year (to February, 1935).

The Marine Observer (to date).

The Meteorological Magazine (to date).

Monthly Frequency Tables, being summaries of observations of horizontal visibility, height of base of low cloud and speed and direction of surface and upper winds in the form approved by the International Commission for Air Navigation (to January, 1935). *Not on sale.*

Seismological Bulletin. A diary of seismological disturbances recorded on the Galitzin Aperiodic Seismographs at Kew Observatory, Richmond (to February, 1935). *Not on sale.*

Observatories' Year Book, 1932. Comprising the meteorological and geophysical results obtained from autographic records and eye observations at the observatories at Lerwick, Aberdeen, Eskdalemuir, Cahirciveen (Valentia Observatory) and Richmond (Kew Observatory), and the results of soundings of the upper atmosphere by means of registering balloons. *42s.*

Réseau Mondial, 1926, 1927. Monthly and annual summaries of pressure, temperature, and precipitation based on a world-wide network of observing stations, 1926, *12s. 6d.*; 1927, *15s.*

British Rainfall, 1933. A report on the distribution of rain in space and time over the British Isles as recorded by over 5,000 observers. 15*s.*

Southport Auxiliary Observatory. Annual Report and results of meteorological observations, 1933. By J. Baxendell. *Not on sale.*

OCCASIONAL :—

Meteorological Observers' Handbook. Instructions in the care and manipulation of meteorological instruments, and in the making of observations both instrumental and non-instrumental. 1934 edition. 5*s.*

Averages of Bright Sunshine for the British Isles, for periods ending 1930. 1*s.*

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