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ANNUAL REPORT

of the Director of the

REPLACEMENT COPY

METEOROLOGICAL OFFICE

presented by the Meteorological Committee
to the Air Council

For the Year ended
March 31
1936

The Eighty-first Year of the Meteorological Office

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METEOROLOGICAL COMMITTEE

1935-6.

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. 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.

Colonel A. E. MACRAE, O.B.E., R.A. Superintendent of Experiments,
Shoeburyness. Nominated by the War Office.

Sir THOMAS MIDDLETON, K.C.I.E., K.B.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.

Sir GEORGE C. SIMPSON, K.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. F. ENTWISTLE, B.Sc.

The Committee met on July 17 and November 13, 1935, and
March 11, 1936.

COMMITTEE OF THE METEOROLOGICAL OFFICE
EDINBURGH, 1935-6

Chairman :—The Director of the Meteorological Office.

Vice-Chairman :—Professor R. A. SAMPSON, D.Sc., 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.

Dr. E. M. WEDDERBURN, M.A., Deputy Keeper of the Signet. 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. (Died May 16, 1935.)

Professor J. A. CARROLL, M.A., Ph.D. Nominated by the University of Aberdeen. (From December, 1935.)

Professor A. G. OGILVIE, O.B.E., M.A., B.Sc. Nominated by the University of Edinburgh.

Secretary : Dr. A. H. R. GOLDIE, F.R.S.E.

The Committee met on June 5, 1935.

THE GASSIOT COMMITTEE, 1935

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 Astronomer Royal (Dr. H. SPENCER JONES).

The President of the Royal Astronomical Society (Mr. J. H. REYNOLDS).

The Director of the Meteorological Office (Sir GEORGE C. SIMPSON).

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 24, 1935.

A list of the staff and of the divisions and establishments of the Office will be found on pp. 58 to 64.

ANNUAL REPORT of the Director of the Meteorological Office presented by the Meteorological Committee to the Air Council for the year ending March 31, 1936 (the eighty-first year of the Meteorological Office).

The year under review has been one of the most difficult since the war for the Meteorological Office. The demands on the Office were greatly increased due to the rapid development of civil aviation, the great expansion of the Royal Air Force and the international situation which developed in the autumn of 1935. Each of these developments demanded the establishment of more meteorological stations, not only in this country but overseas. To man these stations, additional trained staff was required and as none was available it was impossible to meet all the needs adequately. In consequence, it was necessary to reduce the staff at several existing stations and even to close completely four stations on R.A.F. aerodromes. At Headquarters and the Observatories, it was necessary to carry on with depleted staff in spite of the general increase of work.

The position was still further complicated by the fact that on April 1, 1935, a general regrading of the staff became necessary following upon the decision to apply to the Meteorological Office the scheme of grading and pay recommended by the Committee on the Staffs of Government Scientific Establishments presided over by Sir Harold Carpenter, as described on p. 48 below. This regrading necessitated a considerable number of transfers of staff and added to the difficulty of meeting the additional demands which were being made upon the office.

As the needs became clear, additional Officers were recruited, and a number of the existing Assistants were selected for training in forecasting. As, however, it takes a considerable time to train a forecaster no immediate relief of the situation could be effected in this way. Circumstances have changed so frequently and so rapidly during the year under review that it has only been possible to meet the demands by temporary expedients. Further rapid developments, both in connexion with the expansion of the Royal Air Force and the development of civil aviation are expected during the present year; it will then be necessary to review the whole organization of the Meteorological Office to meet the changed conditions.

The year has also been a memorable one on account of the important Empire and International Conferences held in London and Warsaw respectively.

Meteorology became an organized science between 1850 and 1860, when national meteorological services were established in several countries. From the first the need for uniform methods of observing, tabulating and publishing was recognized and in 1872 the first International Conference was held at Leipzig. Since that date a large number of International Conferences have been held and the existing International Meteorological Organization has been evolved. The Organization consists of :

- (a) The Conference of Directors which meets every six years ;
- (b) The International Meteorological Committee elected at the end of each Conference of Directors to carry on the business of the Organization in the interval between the Conferences ;
- (c) Commissions which are appointed to study and report on special aspects of the work of the Organization.

A very large change has come over the work and responsibilities of the Organization during the last few years. Whereas previously, so long as the main decisions of the International Organization in regard to methods of observation were adopted, national meteorological services were largely independent, now the growth of aviation with the consequent international air traffic has made it necessary that the exchange of information should be organized on a world-wide plan. Thus the existence of completely different methods of synoptic meteorology in America, Europe, India and Australasia has become undesirable and the need is felt for the adoption of uniform methods of observations, the use of the same code for weather messages and the observance of a fixed programme of times of observation and of broadcasting the information. All these matters are regulated by the International Meteorological Organization and the decisions of the Organization have become of great importance in the work of every meteorological service in the world. The meetings of the Conference at six-yearly intervals, to which every director of a state meteorological service is invited, are of especial importance. In connexion with the last International Conference in 1929, a preliminary Conference of Empire Meteorologists was held in London and it proved so useful and successful that it was decided to hold a similar Empire Conference before the International Conference which was to be held in Warsaw in September, 1935. Both Conferences proved a great success and an account of each will be found later in this report.

MARINE DIVISION.

The work of the Marine Division may be divided into two main classes : (a) the organization of the work by voluntary observers at sea, and (b) the collating and discussion of the observations taken.

The work at sea is carried out by three classes of ships :—(1) log-keeping ships which take observations at the end of each watch, and forward their logs to the Marine Division at the end of the voyage ;

(2) selected ships which take observations at two or more of the standard hours 0000, 0600, 1200 and 1800 G.M.T., the observations when taken being coded and issued by wireless telegraphy for the use of land meteorological services and surrounding ships; and (3) ships which do not take regular observations except in regions where there are very few selected ships, in these regions British ships are asked to take observations and issue them by wireless telegraphy as though they were selected ships. At the end of the year under review, there were 41 log-keeping ships and 285 selected ships. The work of visiting these ships in order to solicit the help of the ships' officers and to provide instruments and collect the records is carried out by the Port Meteorological Officers of London and Liverpool, who are on the staff of the Meteorological Office, and by agents, who are retired Captains of the Merchant Navy, giving part time to the work, at Cardiff, Glasgow, Leith, Hull, South Shields, Southampton, Hong Kong and Sydney (N.S.W.).

The work of collating the results at Headquarters is carried out mainly with the help of the Hollerith calculating machine. The observations entered in the meteorological logs are carefully scrutinized and a Hollerith card punched for each set of observations, and notes on weather phenomena are recorded in special registers. During the year under consideration, rather fewer observations than usual were extracted in this way, owing to the press of other work and staff changes, but in the circumstances the number of observations extracted was satisfactory.

The need for the publication of atlases of the meteorological conditions over the oceans has been felt for a long time and has recently been stressed by the Honourable Company of Master Mariners in correspondence with the Air Ministry. Arrangements are in hand to prepare such atlases, using the large mass of data accumulated in the ships' meteorological logs preserved in the Office.

The Meteorological Office receives many requests for information regarding weather at sea. Due to the large number of inquiries into the loss of British ships at sea, the amount of information supplied to the Board of Trade has exceeded the normal. On the other hand, the work as a result of ordinary inquiries arising from damage to ships and cargoes, and also provision of information to the public, has been rather less than in previous years.

For further details regarding the work performed by the Marine Division, reference should be made to the full account given in the *Marine Observer* for July, 1936.

BRITISH CLIMATOLOGY DIVISION.

Organization.—The division collects and indexes climatological and rainfall records from all stations in the British Isles which report to the Office. Summaries of the results of the observations at the stations are published in one or more of the publications entitled

Weekly Weather Report, Monthly Weather Report and British Rainfall. The division is also responsible for the passage through the press of the annual volumes of the *Observatories' Year Book*, of which the "copy" is prepared at the several observatories.

Other activities of the Division include the preparation of replies to inquiries relating to past weather or British Climatology, including the assessment of mean rainfall on specified areas in connexion with water schemes, and the computation of climatological averages for publication and official use.

Distribution of Stations.—The stations vary greatly in equipment and personnel and may be roughly divided into six classes—

(a) Observatories (*see pp. 32–8*) 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 forward 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. 51). 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.

The Weekly Weather Report, 1934-5, was published on March 4, 1936.

British Rainfall, 1934.—The volume was signed for press on November 26, 1935, and issued on January 29, 1936. This late date of issue was due to an exceptional incidence of sickness among the staff.

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. The report for Scotland published by the Registrar-General for Scotland is prepared at the Meteorological Office, Edinburgh.

Observatories' Year Book.—The volume for 1933 was published on June 3, 1935.

Inquiries.—During the year 2,598 general inquiries have been received and dealt with, including 214 legal inquiries. These figures represent an increase of 11 per cent. and 20 per cent. respectively over last year's figures. The majority of the inquiries refer to rainfall data or general climatological data for specified places; it is gratifying to note, however, that the number of inquiries of a more specialized character, for data required in connexion with industry or research, continues to increase.

Investigations and Special Work.—*Inland Water Survey*.—The Superintendent served as Assessor on the Committee set up by the Ministry of Health. Dr. J. Glasspoole contributed a memorandum on "Rainfall data in relation to Inland Water Survey" in which the general lines of participation by the British Rainfall Organization were discussed, with special reference to the survey of the River Nene catchment area.

London Fog.—Visibility observations at street level, using a Bennett-Casella visibility meter, were commenced at South Kensington, at 0900 and 1500. On occasion of fog, hourly observations were made. Similar observations are being made at Kingsway and it is hoped in this way to obtain useful data in regard to fog conditions in typical London streets.

Humidity Slide Rule.—Specimens of a slide-rule designed by the Head of the Division as an alternative to the use of hygrometric tables were tested at headquarters and certain outstations with satisfactory results.

Conference on Frost Damage.—Following upon the severe frost of May, 1935, conferences were held at East Malling Research Station which were attended either by the Head of the Division or his deputy. Subsequently a new Horticultural Meteorological Scheme was submitted to a committee on which the Air Ministry was

represented by the Head of the Division and Mr. C. S. Durst (M.O. 2). The scheme provides for an investigation of the origin and movements of katabatic winds, and for a long-term investigation of the general relationship between weather conditions and the growth of horticultural crops.

Instruction.—A conference of workers in agricultural-meteorology was held in the Library at South Kensington on November 22. The conference was preceded by a short course of instruction which was attended by 16 observers.

Rainfall Survey of Great Britain.—Survey of the Nene Catchment area was completed for the Nene Catchment Board and of parts of Radnor, Cardigan and Brecon for the Wye Catchment Board.

Rainfall Bulletin.—In connexion with the drought two rainfall bulletins were prepared for the Ministry of Health, one for the period January-March, 1935, and a second for the period January-August, 1935.

List of British Climatological Stations for the International Secretariat.—A list of existing and defunct climatological stations in the British Isles was prepared for the International Climatology Commission.

Road Accidents.—An investigation was carried out to ascertain the relationship between the incidence of road accidents and the general weather conditions. It was found that accidents tended to be more frequent in fine weather during summer months and in wet weather during winter months.

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.

Meteorological Returns from British Colonies.—Under an arrangement made with the Colonial Office in 1910, reprints of the summaries of meteorological observations published in the Annual Reports of the Colonial Governments are circulated to institutions on the exchange lists of the Office. Thirty-five Colonies and Protectorates have supplied reprints for 1934, containing data for 655 stations.

Réseau Mondial.—The volume for 1928 was published and that for 1929 was in the press at the end of the year.

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 portion of 5 Pilots was revised, in one of which the Meteorological Service of Australia co-operated. The tables were revised for 6 Pilots, involving the compilation in the Office of data for 21 stations. In addition, Meteorological Services abroad were good enough to contribute revised tables for 26 stations.

Special Investigations.—The British Trans-Greenland Expedition 1934, under the leadership of Mr. Martin Lindsay, obtained a number of aneroid readings. From these readings the heights of the camps were calculated in the Meteorological Office, and some interesting results were obtained. A report on the calculations was supplied to Mr. Lindsay for incorporation in his report on the expedition.

Total Eclipse of the Sun, June 19, 1936.—Information as to the climate and weather of Japan, Siberia and Chios was given to members of the British astronomical expeditions preparing to visit these regions for the purpose of witnessing the eclipse.

Inquiries.—During the year 179 general or scientific inquiries and 248 personal inquiries were dealt with, covering a wide range of subjects.

Library.—The additions to the Library during the past year include 506 new books and pamphlets and 11,164 daily weather reports. The number of periodicals received was 4,165. 1,428 books, etc., were issued on loan during the year.

Catalogues.—The author catalogue has been kept up to date. In the early days of the Library no card catalogue was kept, the only register being in book form, which was very inconvenient to consult. The author card catalogue has now been extended to include these early accessions, and forms a complete record of all the separate publications in the Library. The classified subject bibliography has also been maintained, and the early accessions are also being classified under subjects. When this work is completed, a uniform subject index of the separate publications in the library will be available from the earliest works to the end of 1935. The index of climatological literature classified geographically and the classified catalogue of bibliographies of special subjects have been maintained.

Classification of Meteorological Literature.—For several years a revised classification of meteorological literature has been in preparation, based on that employed by the International Institute for Documentation, The Hague. A revised classification was finally agreed upon by the International Commission for Bibliography and was adopted by the International Meteorological Conference at Warsaw in September, 1935. An article on the subject was contributed to the *Quarterly Journal of the Royal Meteorological Society* for January, 1936.

The new classification was taken into use in the Library on January 1, 1936. This involved a complete break with the classification formerly employed, which was that of the International Catalogue of Scientific Literature. It was not possible to recatalogue the whole of the Library, but tables of equivalents between the two classifications have been prepared to facilitate cross-references. The opportunity was taken to examine and re-organize the system of cataloguing in the Library. A new subject catalogue has been commenced in loose-leaf form, designed to give the maximum of information about the nature and contents of each book or article. The Meteorological Office Library is one of the largest meteorological libraries in the world and its organization has now reached a high degree of efficiency.

FORECAST AND AVIATION DIVISION.

The reorganization of this Division described in last year's report (p. 6) has proved satisfactory in spite of the fact that it was found impossible to provide the second deputy to the Head of the Division necessary to complete the staff. The establishment of the Overseas Division described on p. 21 has relieved this Division of some of its responsibilities in connexion with aviation overseas.

Observations and Reports.—The 0400 G.M.T. synoptic reports, which have been received during "summer-time" during the past few years were continued throughout the winter with a break during October of only 5 days, and were broadcast, at the urgent request of the National Meteorological Office of Paris for the service of international air lines.

The need for observations at 2200 G.M.T. has been felt for some time and arrangements were made for a few stations in the south of England to report at this hour from July 1. Additional observations at 1000 G.M.T. were reported from Malin Head, Blacksod Point and Tiree.

There is now a service of reports for each of the hours 0100, 0400, 0700, 1000, 1300, 1600, 1800 and 2200, G.M.T., so that reports are available every three or four hours throughout the day.

Synoptic Weather Charts at Headquarters.—Three synoptic charts are now drawn at Headquarters for each of the observational hours of 0100 and 1300 G.M.T.

(a) A Northern Hemisphere chart on the scale of 1 : 30 million (recently increased from 1 : 40 million). These charts cover a large part of the northern hemisphere, but the chart for 1300 is more complete than that for 0100.

(b) A chart of Europe, north Africa, eastern Newfoundland, Greenland and the eastern North Atlantic on the scale of 1 : 10 million.

(c) A detailed chart for aviation covering only a part of Europe, Iceland and the neighbouring parts of the North Atlantic on the scale of 1 : 5 million. Nearly all the station observations within its area are now plotted on this chart in accordance with a scheme approved by the International Meteorological Conference, which met at Warsaw in September. This scheme of charting was brought fully into operation on January 1, 1936.

For the 0700 and 1800 observational hours, charts as described at (b) and (c) are prepared, while at the intermediate hours (0400, 1000, 1600 and 2200) only the aviation charts, as described at (c) above, are drawn. The charts for intermediate hours cover a smaller area than those for other hours, and the number of reports for the area is fewer.

Synoptic Charts at Outstations.—The normal arrangement is to prepare charts for 0700, 1000 and 1300, but where night flying takes place, additional charts for 1600, 1800 and even 2200 are also prepared as necessary. All charts at outstations are similar to those described under (c) above, and show full information according to the international scheme.

Aviation Service Stations.—No new stations were established during the year.

To ensure the rapid and accurate determination of cloud height at night, "ceiling projectors," or searchlights with a vertical beam, similar to that previously erected at Croydon, are now in regular use at Biggin Hill, Manston and Lympne for the international civil air routes, and also at the Royal Air Force stations, Boscombe Down and Worthy Down. In use, the searchlight which is situated some two or three hundred yards from the office, is switched on from the office, and the angular elevation of the bright patch which is observed on the under surface of a cloud not exceeding 5,000 feet high, is measured from the office by a fixed alidade, whence the height of the cloud is easily determined.

Owing to the removal of staff for duty elsewhere, the following stations were temporarily closed in September and October: Bircham Newton, Pembroke Dock and Bicester. At a later date the office at Felixstowe was also closed. The meteorological officers at Worthy Down and Mount Batten were temporarily transferred for other duties, the stations being carried on by the ancillary staff.

Telegraphic Reporting Stations.—Former telegraphic stations at Liverpool, Donaghadee and Harrogate ceased to forward regular reports on June 30, but the last two continue as auxiliary reporting stations.

Anemographs with good exposures have been erected at Stornoway and Point of Ayre.

Reports from Cross-Channel Steamers.—This service has been extended so that reports of weather are now received by W/T from

steamers in mid-channel between the Channel Islands and Weymouth and Southampton; and from steamers in the Irish Sea. The reports are of special value for the preparation of advice for internal air lines crossing these waters.

The Home Station Fleet Synoptic Message.—This message, which was initiated on September 9, is prepared in the Forecast Division, and telephoned to the Admiralty for issue by W/T from the Admiralty W/T Station, (Cleethorpes) at 1000 and from Gibraltar. It consists of four parts :—

(1) Observations in code from land stations (0700) from Greenland, Iceland, British Isles, France, Spain, Portugal, north-west Africa and Azores.

(2) Observations for 0600 from ships in the eastern North Atlantic.

(3) A brief coded statement of the position and movement of high and low pressure systems.

(4) A statement in words describing the movements of important fronts.

This message extends to the Atlantic, in a more general and technical form, the "Weather Shipping Bulletin" which is issued by W/T from Rugby and Air Ministry and from Post Office coast stations twice a day.

Meteorological Broadcasts by Radiotelephony from the Air Ministry.—In 1932 the Automobile Association in collaboration with the Meteorological Office commenced a service of weather reports issued by wireless telephony from the aerodrome at Heston for the benefit of civil aviation. An extension of this service to reach the whole country has been under consideration for a number of years. On July 10, 1935, the Meteorological Office took over the service from the Automobile Association. From that date the messages have been announced from a special "studio" built in the division and transmitted from the wireless station at Borough Hill, Northamptonshire. The wave-length of the transmission remains the same as at Heston (1,186 metres, 253 kc/s) but the power of the transmitter has been considerably increased. The transmissions are heard on a good selective broadcast receiver over most of the British Isles. Reports from certain continental stations were added on September 2, 1935, at the request of private pilots who wish to fly across the Channel. On February 15, 1936, the whole scheme was reorganized so as to provide full information for both service and civil aviation. Weather reports, weather forecasts, air navigational warnings and weather warnings are now broadcast according to a fixed programme which commences soon after 0700 each morning and continues until 2000 in the winter and 2100 in the summer. The service operates on every day including Saturdays and Sundays. The full programme is printed for convenience of reference as Appendix II to this report.

Meteorological Flights.—The meteorological flight for obtaining observations from the upper atmosphere, established at Duxford, has continued to supply invaluable information throughout the year. Flights are made normally twice on Mondays, Tuesdays, Thursdays and Fridays and once on Wednesdays and Saturdays; no flights are made on Sundays. The aeroplanes penetrate through great thicknesses of cloud and have in the past been much handicapped by bad weather, especially low cloud. It is evidence of the keenness of the pilots and their increasing skill in cloud-flying that no scheduled flight has been omitted since November, 1934. The flight supplies values of the temperature at stated pressures in the atmosphere, whence values of the temperature at stated heights can be deduced. From all the values obtained from Duxford for the 10-year period 1925 to 1934 mean monthly values of temperature have been worked for each 50 mb. pressure level from 950 mb. to 450 mb. (roughly from 1,500 ft. to 16,000 ft. of height). Tables of the frequencies of different temperature readings at the various levels for each month of the year have been constructed.

With increasing knowledge of the structure of the atmosphere the value of the upper air observations has been greatly enhanced and the reports from Duxford are invaluable in the forecast work. It is hoped that another meteorological flight will be established in the coming year, probably in the north of Ireland.

Civil Aviation.—The work at Croydon, the chief aerodrome for continental air lines, has continued as in previous years, but it has been considerably increased because meteorological forecasts for Heston Airport have been added to the duties performed at Croydon. Heston Airport in Middlesex now acts regularly as an airport for services to the continent, and also as the London terminus of civil internal air lines. Heston and Croydon have been connected by teleprinter so that weather reports and forecasts can be passed without delay.

The work at Manchester, which is the chief meteorological centre for civil aviation in the north of England, has also greatly increased. There is considerable activity throughout a large part of the year in tourist traffic by air between Manchester, Liverpool, Isle of Man, Carlisle, Blackpool and Ireland. The Royal Air Mail route from London to Glasgow passes through Manchester and Liverpool, thence to Northern Ireland, and to Renfrew. The meteorological work required in connexion with this route in Northern Ireland and in Scotland is performed respectively by the meteorological officers at Aldergrove, County Antrim, and at Abbotsinch, near Paisley.

Some further development of the meteorological services for internal air lines has to be recorded. A regular aeroplane service was established between Aberdeen and Edinburgh, and meteorological reports were occasionally issued to this service from Leuchars. Another regular service runs on two days a week between Renfrew,

Islay, Isle of Skye and South Uist. For this service the meteorological officer at Abbotsinch is responsible, and auxiliary reporting stations in connexion with the service have been established at Campbeltown in Islay and at Glen Brittle in Skye.

Aviation Meteorological Reports.—In continuation of the two reports on weather conditions over long distance air-routes which were issued last year, two further reports have been issued this year. They deal respectively with the air-routes Aleppo–Baghdad–Karachi, and Cairo–Cape Town.

Special meteorological arrangements were made for the King's Cup Air Race on September 6.

Royal Air Force.—Special meteorological staff were provided in connexion with the Tactical Exercises of the Western and Central Commands; at Weston Zoyland in connexion with Army Exercises; for Coastal Defence Exercises; and for the Exercises of the Air Defence of Great Britain Command both in summer and in winter.

Instruction in meteorology has continued to be given to the Flying Training Schools, the Central Flying School, Upavon, the Air Navigation School at Manston, and lectures were also given to pilots at eight Fighter Stations.

The duration of meteorological instruction courses at Flying Training Schools has had to be curtailed, and the syllabus of the lectures has been adjusted accordingly.

For the Royal Air Force display at Hendon a temporary station was opened on the aerodrome.

Special meteorological assistance was provided on June 30 for the occasion of the Royal Review at Mildenhall and Duxford in connexion with the Jubilee celebrations of His Late Majesty King George.

Meteorological Advice to Selectors of Aerodrome Sites.—Reports on 57 sites were prepared during the year for various authorities.

Investigation into the Distribution of Fog and Mist in Winter.—Rainfall observers were invited in December to make daily observations on the visibility of objects at distances of 220, 1,100 and 2,200 yards. More than 800 observers have responded, and as a result, it is hoped that a much more detailed survey of the country in respect of visibility variations during the winter months will become available.

Issues to the Press.—The issues of reports from Health Resorts have been continued unchanged in form. During last summer 96 different places contributed reports.

At the request of the Editors, the weather charts prepared for *The Times* and *Glasgow Herald* have been considerably extended to include information for the North Atlantic as well as for western Europe and Greenland.

Issues to the British Broadcasting Corporation.—No change has been made in the form of the “ Weather Shipping Bulletins ” which are issued to the corporation for broadcasting.

The weather forecasts issued at 6 p.m., 9.30 p.m., 10 p.m. and about 11.30 p.m. have however been changed from the “ narrative ” form to a form similar to that used for forecasts which are issued for publication in the daily press. Any listener in any part of the British Isles may now identify with certainty the particular forecast which has been prepared for that locality.

Gale Warnings.—A table setting out the results of checking the gale warnings issued will be found in Appendix III, p. 56.

ARMY SERVICES DIVISION.

The work of the Army Services Division has been continued on the same lines as in previous years, stations being maintained at Shoeburyness for the supply of data to the War Office Experimental Establishment and at Larkhill where a small staff is posted for the supply of reports to the School of Artillery and the Sound Ranging Section.

The work at Shoeburyness entails the employment of a fairly large staff who are responsible not only for meeting the needs of the Experimental Establishment but also for manning stations at Artillery Practice Camps during the summer months. Four such camps in different parts of the country were staffed in 1935 while reports were furnished to other camps in the neighbourhood of Salisbury Plain from the station at Larkhill.

The Meteorological Section of the R.A.F. Reserve was called up for the customary fortnight's training at Cranwell from May 13 to May 25.

NAVAL DIVISION.

Organization of Fleet Meteorology.—During the year under review, the Division has been actively engaged in establishing in the Fleet the meteorological organization approved by the Board of Admiralty in 1934-5 and outlined in the annual report for that year. In spite of difficulties arising out of the international situation, considerable progress has been made and the completion of the establishment of a self-contained, fully equipped and adequately staffed meteorological service in the Fleet is now within sight. The number of ships (in commission or in reserve) so far equipped is 24, but, owing to developments in naval policy, the total number that will be equipped eventually is likely to be considerably in excess of this number.

Synoptic Information for the Fleet.—The close liaison established between the Fleet on foreign stations and local British Meteorological Services has been maintained and the Fleet synoptic messages issued

by these services have continued to be of considerable benefit to the Fleet. It is satisfactory to be able to report a further extension of these messages. With effect from April 1, 1935, the New Zealand Meteorological Service issued a message in the Fleet synoptic form and the trial Fleet synoptic message issued from Halifax, N.S., by the Canadian Meteorological Service was permanently established on and from July 22, 1935. A Home Station Fleet synoptic message was instituted on September 9, 1935 (see p. 15) and on June 1, 1936, the Indian Meteorological Service commenced the issue of an extensive Fleet synoptic message for the East Indies Station. As a consequence of these innovations it is now possible for H.M. ships on any station to receive meteorological information in the same standard form and the work of the meteorological officers in these ships is thus considerably facilitated.

Mediterranean Station.—Reference was made in the annual report for 1934–5 to the naval meteorological conference held at Malta in November, 1934. In accordance with the recommendations of this conference, the grid system of identifying stations in the Malta Fleet synoptic messages was replaced by the system of international station index numbers and a cloud group was added to each station report, on and from October 15, 1935. Circumstances have not yet permitted the establishment of a 24-hour service at Malta during the winter months, as recommended by the conference, but arrangements were made during the course of the year under review for the service to commence at 0400 G.M.T. The naval requirement of a forecasting service at Gibraltar, to which attention was drawn by the conference, has also been partially met by the establishment of a temporary forecasting station staffed by Meteorological Office personnel. The meteorological observing work at Gibraltar was transferred from officials of the Colonial Government to naval personnel on and from December 1, 1935, in accordance with the arrangements referred to in the annual report for 1934–5.

Meteorological Work in H.M. Ships.—During the year H.M. ships made 635 weather reports to the Meteorological Office, London, and a considerable number to the meteorological services of the Dominions and British possessions overseas. In addition, 943 pilot balloon observations and 62 observations of upper air temperatures were received from H.M. ships and 43 meteorological logs were forwarded for retention in the Division. The total number of pilot balloon observations was about the same as that for 1934–5, but approximately 45 per cent greater than that for 1933–4.

Training of Naval Personnel.—The meteorological training of naval officers was continued during the year, the total number of officers attending being 26, 14 of whom took the full 12 weeks' course and qualified in meteorology. This brings the total number of officers who have qualified in meteorology since the inception of

the scheme up to 54, of whom 47 are actually available to undertake ships' meteorological duties if required.

Two extensions of the present arrangement for the meteorological training of personnel were authorized during the year. Approval was given for selected R.N.V.R. officers to attend the 12 weeks' course with a view to qualifying in meteorology and, at the request of the Admiralty, a 3 weeks' course of training in the preparation of reports for artillery, etc., for N.C.O.s and men of the Royal Marines, was established, the first of these courses to be held at Calshot during the training year 1936-7.

Meteorological Equipment for 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 fittings of instruments, the provision of space for meteorological offices and pilot balloon shelters, etc.

With regard to the design of new instruments suitable for use in H.M. ships, further progress has been made with the development of a true-wind recorder and it is anticipated that instruments will be available for trial during 1936-7. Pending the production of this true-wind recorder, H.M. ships are being equipped with distant-reading relative wind recorders (speed and direction), operated from the gunnery anemometer, in lieu of the Munro wind speed recorders and Baxendell wind direction recorders now fitted. The new arrangement represents a considerable advance, as the selection of suitable positions for two separate anemometers, (one for gunnery and one for meteorological purposes) has proved to be very difficult.

The strut psychrometer, Mark V, graduated in degrees Centigrade and suitable for all latitudes, has been introduced in the Fleet Air Arm, for use both in air navigation and in obtaining upper air temperatures. This renders unnecessary the supply of psychrometers purely for meteorological purposes.

The trials of the specimen pilot balloon calculator, referred to in the annual report for 1934-5, were carried out during the year. As a result of these trials it was decided that a modification of the form (Misc. 70) used in the graphical method of computation, would meet requirements and that provision of a special calculator was not essential.

Attention has been given also to the provision of meteorological working charts for H.M. ships. A scheme for a series of charts of a uniform type, covering all parts of the world, was prepared in the Division and production of these charts has been commenced by the Hydrographic Department, Admiralty.

Handbooks of Local Meteorology on Naval Stations.—In co-operation with the General Climatology Division considerable progress has been made in the Handbook on the local meteorology of the Mediterranean Station.

Progress has also been made with the China Handbook.

Charting of the Upper Air over the Sea.—Owing to shortage of staff it was not possible to make any further progress in the preparation for publication of the upper air data obtained by H.M. ships. During the year, however, Chart No. 5075, showing the distribution of upper air observations over the sea was revised to include all data published or filed in the Meteorological Office on or before December 31, 1935. The revised chart will be published by the Hydrographer of the Navy in 1936-7.

Investigations.—The investigation of single-observer forecasting has been continued by Lt.-Cmdr. T. R. Beatty, R.N., special attention being given to the application of the method on foreign stations. The revision of the first report on single-observer forecasting was also taken in hand during the year.

OVERSEAS DIVISION.

The Overseas Division was formed early in October to deal with meteorological questions connected with Empire Air Routes, including the projected trans-Atlantic routes. The Division is also responsible for the administration of Meteorological Office establishments and stations overseas and for matters connected with Empire and Foreign meteorological services which are not assigned specifically to other divisions. Actually the present Head of the Division was engaged mainly on work connected with Empire Air Routes from March 25, 1935, and the Division may therefore be regarded as having been in existence, in all but name, throughout the period under review. From January 1, 1936, responsibility was assumed for the preparation of replies to inquiries for meteorological data affecting aviation overseas, a branch of work which had hitherto been performed by the Forecast Division. The latter division, however, remains responsible for all matters connected with European air lines ending in Great Britain.

Empire Air Routes.—In the House of Commons, on December 20, 1934, the Under-Secretary of State for Air announced the Government's proposals regarding the carriage by air, without surcharge, of all first-class mail from the United Kingdom for delivery within the British Empire. He stated that these proposals contemplated four or five services a week to India, three to Malaya and east Africa and two each to South Africa and to Australia. This programme, which is known as the "Empire Air Mail Scheme" will involve regular flying by day and by night and its success will depend very largely on an efficient ground organization—that is, lighting, radio and meteorological services—along the routes.

On May 7 an Air Ministry Mission left England to visit Iraq, Palestine, Egypt, the Sudan and British East Africa in connexion with the development of the Empire Air Mail Scheme. Mr. Entwistle was attached to the Mission as Meteorological Adviser. During the

visit, after discussions with the appropriate authorities, definite proposals were submitted for improving the meteorological service along the various sections of the routes. Negotiations have since been opened with the Governments concerned with a view to putting the proposals into effect.

It may be recalled that the meteorological work for aviation in Egypt, Palestine and Iraq has been carried out for a number of years by Meteorological Office staffs attached to the Royal Air Force. As civil aviation has developed the Air Ministry meteorological sections have undertaken the work of providing the meteorological information required for the civil air services in addition to their normal duties. With the developments in civil aviation which are now in contemplation, it has been felt that the time is approaching when the countries concerned would desire in accordance with normal international practice to assume full responsibility for the provision of the necessary meteorological organisations in their own territories. The development of this principle in the conversations which took place during the tour of the Air Ministry Mission in May and June resulted in the following proposals.

Iraq.—The Iraq Government to establish a meteorological service in 1936 with an adequate network of pilot balloon and reporting stations, the headquarters and main forecast centre to be located at Baghdad, and a subsidiary forecast centre at Basrah; the Basrah station to be responsible for collating reports from the Persian Gulf and issuing forecasts for that area.

Palestine.—The Government of Palestine to establish a meteorological service with headquarters at the main airport at Lydda.

Egypt.—The Government of Egypt to establish an Aviation Section of the existing Meteorological Service of the Egyptian Physical Department with the main aviation forecast centre at Dakheila Airport, a secondary centre at Almaza and subsidiary forecast centres at Mersa Matruh, El Arish and Luxor.

Sudan.—The Sudan Government to establish a meteorological service with headquarters and main forecast centre at Khartoum.

British East Africa.—The existing meteorological service to be expanded in order to provide an adequate network of pilot balloon and reporting stations and the necessary information along the air route.

At the Conference of Empire Meteorologists held in London in August one session was devoted to the Empire Air Mail Scheme and projected meteorological developments. In the course of the Conference it was found possible to pursue certain of the discussions

which had taken place overseas earlier in the year. Three sub-committees were appointed in connexion with special organizations. The first dealt with the organization which would be required for an interim air service between Khartoum and west Africa to be established by Imperial Airways Ltd. early in 1936; the second referred to the meteorological arrangements that would be necessary for a series of experimental flights to be undertaken by the same company between Penang and Hong Kong in the autumn of 1935; while the third took the form of a discussion with the Director-General of Observatories, India Meteorological Department, on the fuller organization that would be required for aviation purposes along the Persian Gulf.

During September a detailed meteorological organization was drawn up for the experimental flights which took place in October between Penang and Hong Kong and copies distributed to Imperial Airways Ltd. and to interested services.

In connexion with the Khartoum—west Africa service it is with gratification that it is possible to record that, following the Conference of Empire Meteorologists, immediate steps were taken in Nigeria to establish a synoptic weather service under the Department of the Surveyor-General and that, by February, when the air service was due to commence, an organization was in existence sufficient to meet aviation requirements. During the previous summer discussions had taken place with the French authorities regarding the information which would be required along that section of the route passing through French Equatorial Africa and, following correspondence with the Sudan Government, it was possible to draw up a complete meteorological organization for the air service. Reports which have since been received from the operating company indicate that the meteorological arrangements throughout the route are reasonably satisfactory. The present interim air service terminates at Kano, Nigeria, but it is intended that the service should extend, eventually, to the Gold Coast via Lagos. Active steps are also being taken in the Gold Coast to organise adequate meteorological observations and Mr. W. Cutland, Government Surveyor, took a course of training in the Meteorological Office in December preparatory to commencing meteorological work in the Colony.

Reverting to the main Empire Air Routes it is also gratifying to be able to record substantial developments in meteorology since the visit of the Air Ministry Mission early in the year. In the two main territories in which the Air Ministry maintains meteorological staffs attached to the Royal Air Force, that is Iraq and Egypt, memoranda were submitted to the respective Governments regarding the transfer of civil aviation meteorology to the national meteorological services. It is understood that the Iraq Government have under their active consideration the early establishment of a meteorological service on the lines suggested in May. The Governments of Palestine and

of the Sudan have taken preliminary steps to appoint the senior officers for the new meteorological services. Following discussions in London with Mr. A. Walter, Director of the British East Africa Meteorological Service, a memorandum was submitted to the Colonial Office regarding the minimum requirements of a meteorological service in that territory to meet the needs of aviation and other services. It may be stated, therefore, that along the main Empire air routes, active consideration is being given to the improvement of meteorological services.

Trans-Atlantic Air Route.—During the summer detailed proposals were submitted to the Air Ministry regarding the meteorological organization which would be required for the operation of a regular air service between Great Britain and North America. These proposals included a detailed preliminary survey of the meteorology of Newfoundland and the establishment of forecasting organizations at the terminal bases in Newfoundland and Ireland. During the Conference of Empire Meteorologists in London the opportunity was taken to discuss with Mr. J. Patterson, Director of the Meteorological Service of Canada, the existing distribution of meteorological stations in Newfoundland and proposals for future development. It was afterwards decided that Mr. Entwistle should visit Newfoundland in October in order to obtain further information regarding the meteorological facilities available in that Dominion. This programme was duly carried out, Mr. Entwistle leaving England on October 10. After a preliminary survey tour of Newfoundland he spent some time at the headquarters of the Meteorological Service of Canada at Toronto, and on November 22 joined the United Kingdom Air Mission which arrived in Ottawa on that date, afterwards participating in discussions in Ottawa and Washington regarding projected trans-Atlantic air routes. At Ottawa definite proposals were submitted for the establishment of a close network of meteorological stations in Newfoundland, for the collection of preliminary data, and also for the establishment of a forecasting organization at the terminal base before actual flying commenced. It was agreed that these services should be undertaken on behalf of the Newfoundland Government by the Meteorological Service of Canada. Discussions also took place, both in Canada and at Washington, regarding the additional data which would be required to provide adequate meteorological information for a trans-Atlantic air service and on questions concerning route organization.

The Conference in Ottawa was attended by delegates from the United Kingdom, the Irish Free State, Newfoundland and Canada, who afterwards proceeded to Washington to confer with representatives of the Government of the United States. The participation of the Irish Free State raised, among other questions, that of the meteorological organization in that territory, and in February, further discussions took place in Dublin regarding the control of the meteorological service at the eastern terminus of the trans-Atlantic

air route and other questions connected with meteorology in the Irish Free State.

Investigation and Training Section.—This section was established on February 1, primarily for the investigation of specific meteorological problems associated with the operation of aircraft over the North Atlantic and for the training of personnel destined for forecasting duties at trans-Atlantic air bases. The replies to major inquiries for meteorological data overseas are also prepared in the section. The number of trainees at the beginning of February included six new technical officer entrants and two assistants I; this number has since been increased by one technical officer. Training has been given in observational work, in plotting synoptic charts and in general meteorology.

A preliminary investigation, based on data extending over ten years, to determine average and maximum values of the head-wind component on an east to west course along the direct route between Ireland and Newfoundland, was completed early in March and a report submitted to the Department of Civil Aviation. A commencement has been made in plotting a series of special weather charts for the North Atlantic for the purpose of further investigation.

Mr. L. Starbuck, who was appointed by the Colonial Office as Professional Assistant at the Royal Observatory, Hong Kong, received a short course of training in February before proceeding overseas.

Inquiries.—During the period January 1 to March 31, 1936, 30 inquiries for data affecting aviation overseas were received and dealt with. The inquiries included a number of requests for meteorological data affecting the operation of aircraft along existing Empire air routes and projected extensions of the same, while others related to the operation of trans-Atlantic aircraft in Newfoundland and eastern Canada.

Overseas Stations.—Towards the end of September a decision was reached to proceed with the establishment of a meteorological distributive station at Gibraltar, which had been under consideration for some time previously. The station was opened in November, the staff consisting of one technical officer, one assistant II and one observer II. During the same month similar stations were established at Aden with an officer in charge, one assistant II and two observers II, and at Khartoum, where the staff consists of one technical officer, one assistant II and three observers II. As in the case of existing stations in the Middle East and Iraq, the staff are attached to Royal Air Force Commands or Units and their primary duty is to supply meteorological information to the Royal Air Force and to other Service units. A brief account of the work of the different overseas stations during the period under review is given below.

Malta.—The routine work of the office continued along normal lines of development but the increase in responsibilities, particularly in regard to work for the Services, has necessitated an increase in staff. Two assistants I and an additional locally entered clerk joined the office during the year.

Full synoptic observations were made and broadcast three times daily and pilot balloon ascents twice daily. A duplicated daily weather report, containing 0700 G.M.T. observations and a forecast for the Malta area, was issued daily for the use of Service units and local authorities. The system of warnings of gregales*, gales and squalls continued in force, and has been found useful by the units concerned. In response to a demand for an extension of the system, and for earlier forecasts for aviation, arrangements are being made to have professional officers available for advice from 0400 to 2100 G.M.T. daily.

Work for the Services formed the major part of the office routine, and the general interest in reports, forecasts and general climatology was maintained. Liaison has been maintained with the civil departments of H.M. Dockyard, the Victualling Yard, and the Armament Depot, and with the Port Authorities and other local institutions. Forecasts and summaries of local conditions were issued as usual for publication in the local press.

Reports for the Italian civil air line operating the Syracuse—Malta—Tripoli air route continued, and a further increase in the number of reports required is noted. The number of weather reports received from Italian aircraft in flight showed a further increase.

Synoptic reports again showed an improvement as regards quantity, and reception of broadcast messages from Europe and north Africa was generally satisfactory. The scheme for obtaining reports by cable from certain key stations in the Mediterranean has now practically fallen into disuse owing to the continued reliability of wireless reception.

The absence of 0100 G.M.T. reports from Mediterranean countries continued to be felt when early forecasts were required in connexion with long-distance flights by Royal Air Force and civil aircraft. On the other hand the marked improvement in 0400 G.M.T. reports from the western half of the Mediterranean has been of great benefit.

The number of reports received direct from H.M. ships and from merchant ships decreased, but this was balanced to a certain extent by a definite increase in the number of ships' reports received in the normal collective messages issued by Italy.

Middle East Area.—Normal surface and upper wind observations have been carried out throughout the year at Heliopolis, Aboukir, Ismailia, Ramleh and Amman. A new station was opened

* "Gregale" is the name given in the central and western Mediterranean to NE. gales. At Malta and on the east coast of Sicily they are of special importance owing to the orientation of the harbours towards the north-east.

at Mersa Matruh and commenced full observations and reports on March 16, 1936. Observations at 0900 G.M.T. have been made at all stations during the months October–May and sent by W/T to Heliopolis.

Routine forecasts, primarily for the Royal Air Force, have been issued twice daily and international collective broadcasts once daily from Heliopolis.

Co-operation has been maintained with various authorities who supply observations from stations not manned by Air Ministry Staff. For example, the Arab Legion (Trans-Jordan) supply daily observations from Bair, Mudawara and Akaba, the Iraq Petroleum Company from Landing Ground H.4, Imperial Airways from Gaza, Wadi Halfa and M/Y Imperia, the Director of Public Works, Cyprus from Nicosia and the Royal Air Force from Ma'an. The British Resident, Amman, supplied details of rain-gauges from which rainfall statistics for Trans-Jordan are being collected; a representative of the Suez Canal Company was given advice on the modernization of their meteorological stations.

The reception of meteorological data from other countries continued satisfactory; notable improvements being the direct reception of reports from Sollum and Matruh and also a collective report from Tripoli ("Meteo Libie").

Five-yearly summaries of wind frequency and mean wind speed for all stations in Middle East and Iraq were completed and tables produced and distributed showing average wind speed and direction on all Imperial Air Routes through Egypt, Palestine and Iraq.

Analyses of upper wind records from Wadi Halfa, Mirabella and Nicosia were completed. Memoranda on the results from the first two stations were submitted.

Instruction in meteorology has been given regularly at No. 4 Flying Training School, Abu-Sueir, and assistance given to officers and airmen in connexion with 2nd Class Navigators' and B Class Pilots' Licence examinations.

Heliopolis has continued to supply meteorological information to all civil aviation authorities in Egypt to the utmost limit of its resources. A direct telephone line to Almaza Airport was installed to facilitate the sending of forecasts and reception of reports from civil aerodromes.

Wind data were supplied to the Director of Civil Aviation, Palestine, in connexion with the construction of runways at Lydda Airport, and to Imperial Airways for a flying boat base near Sherjah.

The considerable increase in reports required by Imperial Airways necessitated an increase of staff at Aboukir of one observer II.

Copies of the routine forecasts issued from Heliopolis, together with the latest weather and upper wind reports from all Middle East stations, were supplied daily to the Egyptian Army Air Force and additional reports and forecasts issued as requested.

Iraq.—Surface and upper wind observations were made throughout the year at Hinaidi, Mosul, Shaibah, Rutbah, Ramadi and Diwaniyah, and surface observations from Kirkuk. Routine forecasts for Iraq and the western end of the Persian Gulf and collective synoptic reports were broadcast daily. Steps were taken to augment the supply of information from the Persian Gulf by reports from H.M. ships.

Close liaison was maintained with Air Headquarters and all Royal Air Force units in Iraq.

Lectures on meteorology were given as part of the ground training of the Royal Air Force and in connexion with Airmen's Higher Education Tests.

In addition to the normal routine, 1,293 special forecasts and 2,337 weather and/or upper wind reports were supplied to the Royal Air Force at Hinaidi, Mosul, Shaibah and Basrah; these figures showed an increase on the previous year of 49 and 17 per cent respectively.

Weather forecasts and reports were issued to Imperial Airways, Air France, K.L.M., Iraq Petroleum Company and other civil aircraft operating in Iraq. During the year 1,061 special forecasts and 1,698 weather and/or upper wind reports were issued from Hinaidi or Shaibah to civil aircraft; these figures showed an increase on the previous year of 50 and 30 per cent respectively.

Information was supplied to various Iraq Government Departments, including those of Defence, Economics and Communications, Health, Irrigation, Public Works and Railways, and also to the Royal Iraq Air Force.

Gibraltar.—The meteorological station was opened on November 5, 1935. Routine meteorological observations continued to be made by naval personnel at the existing meteorological station, but regular pilot balloon ascents have been made since the establishment of the distributive station.

Regular forecasts have been issued twice daily to the Royal Navy and the Royal Air Force. Special route forecasts have been issued in connexion with long distance cruises by Royal Air Force aircraft.

Since the establishment of the station to the close of the period under review 856 inquiries for information have been received and dealt with.

Aden.—The meteorological station at Khormaksar, Aden, was opened for observations on November 27, 1935.

Since December 1, routine observations have been made and transmitted to Middle East and Weather London at 0500 and 1100 G.M.T. Pilot balloon ascents have been made twice daily. By arrangement with the Royal Air Force, upper air temperatures have been taken whenever other flying work permitted.

Synoptic charts were commenced on March 1, when observations from Perim Island became available. Previously, owing to the

inability of the local Wireless Section to receive the Middle East or Iraq broadcasts, the only outside information received was from Khartoum (from January 31, 1936) and Port Sudan (from February 8, 1936).

An exchange of 0400 G.M.T. reports with Jibuti, in French Somaliland, commenced on March 30. Arrangements have been made for observations to be taken at Kamaran Island.

Owing to the small day-to-day variations in the local weather conditions, routine forecasts have not been issued but arrangements have been made for the issue of special warnings when applicable and for the supply of forecasts and other information on request.

Khartoum.—A distributive station was established at Khartoum on November 11, 1935. Although the primary duty of the Meteorological Office in Khartoum was to meet the meteorological needs of the Royal Air Force in the Sudan, the meteorological requirements of civil aviation were also met as far as possible. Pending the establishment of a meteorological service under the Sudan Government, all questions which would normally have been referred to the Director of the proposed new service were referred to, and dealt with by, the Meteorological Office, Khartoum. This side of the work has involved a considerable amount of correspondence and has taken up much of the time of the office.

To meet the requirements of Units at Port Sudan a subsidiary meteorological station was established there on January 1.

Regular surface observations were commenced at Khartoum on November 19 and at Port Sudan on January 8, observations being made at Khartoum at 0400, 0600, 0700, 1000, 1200 and 1800 G.M.T. and at Port Sudan at 0600, 1200 and 1800 G.M.T. Pilot balloon observations have been made daily from November 24 at Khartoum and from January 8 at Port Sudan. In addition, special upper wind observations were made when required by the Royal Air Force or by Imperial Airways.

By arrangement with the Royal Air Force, upper air temperature observations were made by pilots, whenever possible, at both Khartoum and Port Sudan.

In collaboration with Sudan Government Officials, a reporting station on the new air-route from Khartoum to Kano was established in February. Upper wind observations were made daily from February 13 to March 18, at El Fasher. On the transfer of the observers from their temporary station at El Fasher to their permanent station at Geneina, surface and upper wind observations were made daily at the latter station from March 20 onwards.

Arrangements were made with the appropriate authorities so that the telegraph systems of both the Sudan Railways and Sudan Posts and Telegraphs were made available for the transmission to the Meteorological Office, Khartoum, of synoptic weather reports from all observing stations in the Sudan. This included reports from all the meteorological stations in the Sudan under the control

of the Egyptian Meteorological Service. In addition, synoptic wireless issues from Ismailia and Abu Zabal were picked up by local R.A.F. staff daily, and occasionally from February 26 onwards a meteorological transmission from Fort Lamy was received. With the information thus available synoptic charts based on the observations at 0800, 1400 and 2000, local time, were constructed daily.

All Royal Air Force Units in the Sudan were supplied daily, as a matter of routine, with upper wind observations from Khartoum and Port Sudan.

All reports were also sent to the Meteorological Office, Heliopolis, and, after January 30, to the meteorological station at Aden.

Imperial Airways were supplied with all necessary meteorological information. All forecasts required for civil aviation in the Sudan were supplied from Khartoum as from March 14.

In connexion with the establishment of the Sudan Meteorological Service arrangements were made to train the observing staff required. Four observers commenced training on February 17 and one had already taken up duty at Geneina before the end of March.

INSTRUMENTS DIVISION.

Abnormal demands were received for the supply of instruments during the year under review. These are reflected in the figure for expenditure on instruments, equipment and stores given in the financial statement which forms Appendix IV to the report. This figure of £14,215 shows a rise of £6,405 over the figure for the preceding 12 months. The increase is to be attributed largely to the expansion of the Royal Air Force and the increased expenditure on other Defence Services of the country. Apart from expansion at home, new stations have been equipped overseas at Gibraltar, Aden, Khartoum and Mersa Matruh and, in addition, much additional equipment has been required for H.M. ships.

Notwithstanding the abnormal activity on the supply side, it has been possible, during the year, to devote a good deal of attention to improving the design of instruments and developing new equipment. Reference was made in the previous report to experimental work which is being carried out on a distant-reading anemometer to enable accurate records of wind speed and direction to be obtained at a considerable distance from the anemometer head. An instrument has now been in operation at Cranwell for a sufficient period to judge of its suitability for the work. The problem of recording wind direction at a distance appears to be satisfactorily solved but, as regards velocity, the position is less satisfactory as the record obtained does not give the same detailed measure of the gustiness of the wind as that given by a pressure tube anemometer. While the instrument will meet immediate needs it is not considered

to afford a final solution to the problem and work is being continued with a view to developing an alternative method.

Another problem which has engaged attention is the development of Radio Sonde instruments. These instruments are sent up with small free balloons and are designed to send out radio signals continuously throughout the ascent from which the pressure, temperature and humidity of the air through which the balloon is passing can be read on the ground. Considerable attention has been devoted to this matter on the continent for some years past and it is felt that the time is ripe for the development of similar apparatus in this country. The problems presented for solution are as numerous on the radio side as on the meteorological side and the collaboration of the Director of the National Physical Laboratory has been sought in the work. It is proposed that a joint attack on this problem shall be carried out during the coming 12 months.

At stations where the expense of a pressure tube anemometer is not justified, small anemometers of the Robinson cup type are frequently employed. These suffer from the serious defect that the speed of the cups is not directly proportional to the speed of the wind, the number of turns of the cup system per mile run of the wind being materially different at high speeds from that at low speeds. Recent work in the United States of America suggested that if the edge of the cup were turned over to form a small circular beading a more constant relation between the speed of the wind and the speed of the cups would be obtained. A three-cup system with this beading was made up and tested in a wind tunnel at the National Physical Laboratory. The result was extremely satisfactory and it has been decided to adopt this type of cup system in the cup anemometers used by the Meteorological Office in the future.

The increasing speeds at which aeroplanes are flown has brought into prominence the need for a reconsideration of the design of the strut psychrometers which have been used in the past for obtaining upper air temperatures. It is well known that a thermometer bulb moving at high speed through the air gives a reading which may be considerably in excess of the true air temperature. With an aeroplane speed in the neighbourhood of 100 m.p.h. the error was not of great importance. At a speed of 200 m.p.h. it may be serious. In collaboration with the Royal Aircraft Establishment this point has been considered and a modified design of psychrometer evolved which it is hoped will give errors, the magnitude of which is a known function of the wind speed, so that a correction can readily be applied. Tests on this psychrometer will be undertaken as soon as possible.

Among other instruments, the design of which has received attention, may be mentioned the following :—barometers, sheathed thermometers, thermographs, rain-gauges, aeroplane aneroids, pilot balloon theodolites and slide rules.

The question of protecting anemometers against damage by lightning is one which has been under consideration for some time

past. During the year, detailed instructions for earthing the masts were drawn up and issued in collaboration with the Director of Works and Buildings.

A detailed specification and drawing of a slide rule designed by Mr. E. G. Bilham for humidity calculations have been prepared and, after trial of a number of rules made to this specification, it has been decided to adopt the slide rule for the work of the Meteorological Office.

Searchlights for the determination of cloud heights at night were issued for use on five aerodromes.

Equipment has been issued to several expeditions to distant countries either on repayment or on loan. Among these may be mentioned the Oxford University Arctic Expedition, an expedition organized by the Royal Society to Montserrat, and the Public Schools Exploring Society's Expedition to Newfoundland.

OBSERVATORIES.

Kew.

Buildings.—The Galitzin seismographs were installed during 1925 in the cellars under the main Observatory building. Although the pillars on which the instruments are erected have their foundations in the undisturbed gravel, it has been found that the records are much affected by the wind. The cause has been traced to the fact that the Observatory building is fully exposed and in high winds the building and the ground on which it stands are rocked appreciably. To obviate this trouble it has been decided that the seismographs should be removed to an underground house in the grounds of the Observatory and at a considerable distance from the building itself. The construction of such a house was authorised in January, 1936, and at the same time the expansion of the workshop and the erection of a new greenhouse and a house for the motor-mower were sanctioned. The work was commenced in March.

Atmospheric Electricity.—It was mentioned in last year's report that an electrograph had been installed for recording the charge on rain. This apparatus has been in regular operation since the beginning of 1935. The records obtained during one year have been analysed. It is found that whereas at other places where observations have been made the positive charge brought down by rain exceeds the negative, at Kew the charges are nearly equal. It is found that showers are responsible for most of the negative electricity brought down during the year, whilst continuous rain and thunder-storm rain are associated with a slight excess of positive electricity.

The point discharge at the Observatory has remained in operation. Arrangements have been made to set up a second point discharge recorder; the mast is to be about $\frac{1}{2}$ mile from the Observatory and the Post Office telephone cable will be used to convey the current

between the discharge point and the recorder in the Observatory. It is anticipated that the comparison between the variations of point discharge at two points at this distance apart will yield useful information about the electric field below thunderstorms.

The development of an electrograph for recording the sign of potential gradient in balloon soundings was mentioned in the last annual report. Up to the end of March, 1936, 42 soundings had been attempted. The electrographs were recovered on 32 occasions and 20 yielded legible records. In one violent thunderstorm nine balloons were released, and six records were obtained. Twelve electrographs are now kept ready for use. For determining the sign of moderate potential gradient it is found necessary to use a very long trailing wire. A wire about 100 metres long is used. At the start this is wound on a spool, as the balloon rises the wire runs off the spool, which soon drops to the ground.

The diurnal variation of atmospheric pollution and of potential gradient during the first and last weeks of summer time and during the first and last weeks of winter time has been computed for the years 1921–34. The result confirms previous indications that the times of maxima and minima of the potential gradient, shift in Greenwich time on the adoption of summer time. This is doubtless due to the fact that potential gradient is affected by atmospheric pollution, the hours of increase of which are governed by clock time and not by Greenwich time.

Atmospheric Pollution.—At the request of the Atmospheric Pollution Research Committee arrangements have been made for the analysis of the dust collected in a receiving vessel kept under shelter. The principal question to be investigated is how much the ratio of the quantities of soluble and insoluble matter in the deposit will differ from the corresponding ratio for the gauges out-of-doors.

Samples of rain collected at Kew in the course of continuous rain are being analysed by Mr. Coste of the London County Council. The object of the investigation is to determine whether there is excess of solid matter at the beginning of a period of rain.

Radiation.—A Gorczynski pyrliograph belonging to Rothamsted Agricultural Station was compared in September and October with the Kew instruments. The agreement was satisfactory.

Meteorology.—*Microthermograph.*—Experiments with a sensitive thermocouple have been initiated. The most interesting results have been obtained with the thermocouple used as a psychrometer during fog in freezing weather, one junction being covered with ice. It was found that this junction was generally the warmer, the difference of temperature between the ice-covered junction and the other ranging up to 0.1° F. The experiment demonstrates that the "depression of the wet bulb" is reversed when the air in fog is nearly saturated with respect to water and is therefore super-saturated with respect to ice.

Evaporation.—An evaporimeter designed by Dr. J. S. Owens was installed in August in a Stevenson screen and remained in operation until the first frosts. The instrument was returned to Dr. Owens who proposes to modify the design so as to minimise the risk of breakage when the water in the container freezes.

Grass-minimum Thermometer.—A grass-minimum thermometer filled with glycol-ether was observed during the two years 1934 and 1935. This thermometer was left exposed during the day, whereas the normal grass-minimum thermometer is kept in the shade between 9h and 18h. It was found that the glycol-ether thermometer was less liable to the development of bubbles and to the condensation of spirit at the end of the tube than the normal instrument.

Seismology.—The Galitzin seismographs have been maintained in operation. A Wood-Anderson seismograph has been in use for more than two years. A second instrument of the same type was installed in January, 1936; the N-S and E-W components of earth movements are now recorded on a single drum rotated by a synchronous motor. The instruments have been adjusted with a free period of 1 second.

Much attention was given to the problems presented by the seismic disturbances in Montserrat. The National Committee for Geodesy and Geophysics recommended the provision of Jagger shock-recorders, simple seismographs designed by the Director of the Volcanic Observatory, Hawaii. Four of the instruments were built in the workshop at Kew Observatory, certain improvements such as the introduction of oil-damping and of electrical time-markers being made. In addition a vertical seismograph of similar type was designed and built. The instruments have a low magnification, about 10, and a period of 1 second. These instruments form part of the equipment taken to Montserrat by Dr. C. F. Powell, of Bristol University, who has been sent out by the Royal Society to make observations of the conditions in that island where considerable anxiety has been caused by numerous earthquakes and active production of noxious gases. Dr. Powell is working in conjunction with Mr. A. G. MacGregor of the Geological Survey.

During the calendar year 1935 the number of earthquakes recorded at Kew was 231; of these 13 were large enough to give waves with an amplitude exceeding 0.1 mm. Details of 16 of the records were broadcast in the International Seismological code. In 10 cases the azimuth could be determined from the Kew records alone.

The earthquake of May 30, 1935, which overwhelmed Quetta produced at Kew waves with amplitude nearly $\frac{1}{2}$ mm. Waves with slightly greater amplitude were produced by earthquakes near New Guinea in September and near northern Sumatra in December. Another large earthquake (yielding at Kew waves with the amplitude 0.3 mm.) occurred on Good Friday, April 19, 1935, with an epicentre under the Mediterranean close to the coast of Tripoli. It is remark-

able that no news of this shock appeared in the English newspapers ; it may be presumed that no damage was done on shore.

Airwaves from Gunfire.—The investigation of the transmission of airwaves through the upper atmosphere was continued through the year. The stations at Cefn Mably (near Cardiff), Bristol, Birmingham, Nottingham and North Walsham, all provided with sound-ranging equipment by the War Office, were in operation throughout the period. During the 12 months to March, 1936, there were 16 occasions of firing at Woolwich, when signals were broadcast by the B.B.C. from Droitwich. On 12 of these occasions waves were recorded at one or more stations. The well-known alternation in the propagation of the waves to west and east persisted. From May to August waves were recorded at stations in the west. In two trials in the critical month of September the station at Cefn Mably was not in operation and none of the other stations was successful. From October 4 onwards to March 27 the airwaves were recorded with few exceptions at North Walsham but not at the other stations.

During the firing practice which took place in the Channel on July 17 in connexion with the Jubilee celebrations, microphones were in operation at five stations. Good results were obtained at Cardiff, Bristol and Birmingham. These are the first satisfactory records of such intensive firing. The request, published (by courtesy of the Admiralty) in the newspapers, for reports of the audibility of the firing, produced very few letters. There was a small area of normal audibility near Eastbourne and a narrow belt of abnormal audibility in the west from Paignton to Ledbury, but there was no region where the sounds attracted general attention as they have on other similar occasions.

Thanks are due to the War Office as well as to the B.B.C. for their continued co-operation in the investigation as well as to the observers at all the receiving stations.

Observations are being suspended but it is hoped that equipment will be kept at most of the stations for use if further experiments are required.

Investigation of the Upper Atmosphere.—An unusually large number of soundings of the upper air of various kinds have been made during the year. Ordinary soundings were made on International days in 1935 as usual ; a special additional series of six was made at six-hourly intervals in October in collaboration with the Geophysical Institute at Bergen, and another similar series of five at the end of February, 1936, at the request of the International Aerological Commission. A number of soundings were made, as in former years, in connexion with the work on sound ranging.

Thirteen ascents were made with the Paneth-Glückauf apparatus to obtain samples of air for analysis of the helium content. Since these involve a meteorograph as an auxiliary fitting, and usually

reach good heights, they add considerably to the total number of effective temperature records. Unfortunately the main object of the investigation has not been so successfully achieved, only four samples of air having been obtained, of which three were analysed by Dr. Glückauf.

The total number of temperature soundings made was 65, and the heights are set out in the following table :—

Above 20 Km.	...	...	...	15
Between 15 and 20 Km.	...	...	...	30
Between 10 and 15 Km.	...	...	...	8
Less than 10 Km.	...	...	...	2
Not found (to date)	...	...	...	10

The maximum height for a normal sounding was 27.5 Km., which constitutes a record for the British Isles, and 21.1 Km. for an effective sounding with the helium apparatus.

With the assistance of Dr. Glückauf a new form of apparatus for obtaining samples of air from great heights for analysis of water vapour has been designed, and partly made.

Mean monthly tables of temperature and pressure in the upper air in England up to 20½ Km. have been prepared, based on about 400 soundings spread over 15 years.

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 almost without interruption throughout the year. They have been supplemented by an auxiliary set of instruments recording the same elements, but with less sensitivity 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. In December, 1935, the auxiliary set was dismantled and replaced by a set of la Cour instruments, recording the same elements. From January, 1936, the newly installed set has replaced the standard variometers, the latter becoming the auxiliary set. The magnetograph records have been standardised by almost daily observations of both declination and horizontal force and by dip made twice weekly, declination observations being made with the Kew magnetometer, horizontal force with the Schuster Smith Coil and dip with the Schulze dip inductor. Determinations of *H*, with the Kew magnetometer, continue to be made regularly.

In addition to the above instruments, the la Cour quick run recorder, installed to record rapid changes in *D*, *H* and *V*, has been in operation, apart from minor interruptions, throughout the year. Difficulty at times has been experienced in maintaining the time operating relay system used in time-marking the la Cour records, this being due largely to faulty contacts operating the relay. Towards

the end of the year the Adie clock from the dismantled set of variometers was adjusted to operate the relay mechanism and has so far proved satisfactory.

The underground magnetograph chambers and corridors have been redecorated during the year and it was so arranged that interference with the records was a minimum.

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 similar data for Abinger. Arising out of this publication of data, copies of original records and other information have been supplied to various engineers and mining authorities.

The field coil apparatus, used for measuring changes in the earth's vertical magnetic field of force, has not been in operation during the year but has been maintained in working condition.

Comparison tests have been made, as circumstances permitted, with Fort Rae and Lerwick portable Smith Coils. Dover Dip circle, No. 238, was received from Lerwick and is undergoing test.

Dr. Laursen, Copenhagen, brought for comparison of absolute standards two recently designed instruments, one (QHM) for H determination, and the other (BM) for V. The values from these instruments were compared with the observatory standards and the records, although provisional, point to good agreement.

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

Observations of solar radiation have been carried out with an Ångström pyrheliometer, whenever conditions were favourable.

Atmospheric Electricity.—As in recent years, the work has been confined to maintaining autographic records and making absolute observations of atmospheric electrical potential gradient. The water dropper was replaced at the end of January, 1936, by a polonium collector.

ABERDEEN.

There have been no changes of importance in the general work of the Observatory during the past year. It is, however, worthy of note that meteorological information is becoming increasingly valuable to the general public, as is evidenced by the increased number of inquiries as compared with earlier years; particularly is this the case with information supplied to the various departments of the municipality.

The tests of wind flow in the neighbourhood of the anemometer site were continued and, as a result of the report on the investigations, a height of only 8 ft. has been derived as the "equivalent height" of the vane throughout the sector 40°–110°.

During the winter the Hellmann-Fuess snow-gauge has proved of the greatest service in recording the durations and amounts of snowfall.

A meteorological exhibit was arranged in connexion with the Highland and Agricultural Society's Show, held at Aberdeen from June 18-20.

LERWICK.

Terrestrial Magnetism.—Recording Instruments.—Apart from minor adjustments, no change has been made in the standard set. The la Cour quick-run set, which was used by the British Polar Year Expedition at Fort Rae, was installed in July, 1935, and has worked since that date, with interruptions due mainly to the recording apparatus. The supplementary set has worked satisfactorily. New pillars were made for the H and V variometers in November, 1935, the old pillars having been found to be insecure. The records from this set have been available to fill all breaks in the standard records.

Absolute Observations.—Dip observations were made with a Dip Circle up to the end of June, 1935, and with an Inductor, on loan from the Astronomer Royal, from the beginning of June onwards. The inductor observations are a great improvement on those made with the Dip Circle, although they show a scatter much greater than can be accounted for by errors of setting.

Aurora.—The usual watch has been kept. Conditions have been quiet, and there have been no displays suitable for photography.

Atmospheric Electricity.—No change has been made in the Benndorf electrograph nor in the routine of scale and insulation tests and absolute observations.

Meteorology.—The usual 9h. observations have been made.

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 OFFICE, 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.

Climatological, Rainfall and Telegraphic Stations.—The number of climatological stations in Scotland is now 85 and the number of rainfall stations about 900. The Edinburgh Office also receives the

monthly registers and autographic records from eight telegraphic stations in Scotland before they are forwarded to London. The systematic examination and checking of all returns and the extraction of data in form ready for publication have been carried out in the usual way.

A new station was arranged during the year at Lassintullich near Loch Rannoch; and a station at Dunoon (arranged in the previous year) has commenced sending in reports.

The municipal authorities have now accepted responsibility for the maintenance of the climatological stations at Kilmarnock and Fortrose, hitherto maintained by private voluntary observers.

The pressure tube anemograph was transferred from the Butt of Lewis to Stornoway in November and the remaining recording instruments were withdrawn from Butt of Lewis.

Reports for the Registrar-General for Scotland.—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. Three years ago some changes were made in the tabular matter included in the annual report, and from the beginning of the year 1936 some revision has been made also in the monthly reports. Hitherto these have included climatological data for seven principal towns, viz. Edinburgh, Glasgow, Dundee, Aberdeen, Greenock, Paisley and Perth. By request of the Registrar-General, Dunfermline, Kirkcaldy, Kilmarnock and Ayr have now been added. Sunshine data will also be included in future.

Inquiries.—A memorandum was prepared for the Secretary of State for Scotland dealing with the occurrence of fog in the Kelvin Valley and the extent to which fog might be reduced if an extensive drainage scheme under consideration were carried through.

The number of inquiries, other than those received daily from the newspapers, was 235, many of which were legal inquiries, a few involving expert opinion.

Services for Aviation.—During the year visits were made to a number of stations in the north of Scotland with the object of selecting suitable sites for auxiliary reporting stations in connexion with the proposed establishment of new civil air lines in that part of the country.

Special reports as to the meteorological suitability of sites for aerodromes were prepared for various authorities in regard to sites at or near Prestwick, Buckie, Sumburgh, Ayrshire generally, Fauldhouse, Grangemouth and Selvielands.

Research.—The special research scheme initiated in 1929 on the recommendation of the Advisory Committee for the Meteorological Office, Edinburgh, has now been brought to a conclusion.

VISIT OF DR. J. BJERKNES.

During the war, important studies were made in Norway in connexion with weather forecasting in which Professor V. Bjerknes and his son, Dr. J. Bjerknes, took the lead. The method consisted in recognizing the existence of large masses of air in the atmosphere, which have travelled from widely separated parts of the earth's surface, two main kinds of air masses, polar and equatorial, being recognized. It was found that, when air masses of different origin came into contact, there was a surface of separation which could be traced for many miles on the weather maps; and that it was at these surfaces of discontinuity, called "fronts," that the chief weather phenomena, such as squalls, rain, rapid change of temperature, &c., generally existed.

In 1925, the Air Ministry invited Dr. J. Bjerknes to visit the Meteorological Office to demonstrate his methods to the staff. The visit was highly successful and has had a marked influence on the forecasting since that date.

In the 10 years since his visit to London, Dr. J. Bjerknes, now Professor at the Geophysical Institute, Bergen, has continued his investigations and still further progress has been made in the Norwegian method of forecasting. In order that the staff of the Meteorological Office should be made familiar with these recent advances, Dr. Bjerknes was invited, in 1935, to pay a second visit to the Office. He arrived on December 14 for a five months' visit. During his stay he has given particular attention to the frontal analysis of the northern hemisphere charts, more especially to the development and progress of fronts over the Atlantic Ocean. While he carried out the work of analysis, Dr. Bjerknes was, as a rule, accompanied by a member of the forecasting staff to whom he explained his methods. In this way, practically all the members of the Meteorological Officer staff connected with forecasting were brought into personal touch with Dr. Bjerknes and received first-hand information regarding his methods. In addition, daily discussions of Dr. Bjerknes's charts were held in the forecast room.

On three afternoons in March, Dr. Bjerknes lectured, to as many of the staff as could attend, on the subjects :—

1. Synoptic aerology with special reference to balloon soundings on February 15-17, 1935.
2. Convection—saturated air ascending through a descending dry environment.
3. The general circulation of the atmosphere.

Although at the end of the year under review, Dr. Bjerknes had not yet completed his visit, it is quite clear that the staff of the Office has greatly benefited from the highly stimulating and practical methods which he had to demonstrate.

CONFERENCE OF EMPIRE METEOROLOGISTS.

The third Conference of Empire Meteorologists was held in London from August 12 to 21, 1935.

The directors of ten fully organized meteorological services* and representatives of meteorological interests from fourteen other British territories† attended. Sir Henry Lyons, Vice-Chairman of the Meteorological Committee welcomed the delegates on behalf of the Air Ministry at the Meteorological Office, South Kensington, on Monday, August 12. Mr. J. Patterson, the Director of the Canadian Meteorological Office, was unanimously elected President of the Conference and his energetic and able conduct of the business of the Conference contributed in no small measure to its success.

The subjects for discussion had been prepared in 68 memoranda which were circulated to the delegates before the meetings—it is noteworthy that 42 of these memoranda had been contributed by Empire Services outside Great Britain.

It was not the purpose of the Conference to come to decisions and pass resolutions. The subjects for discussion were introduced either by an address or by taking the memorandum dealing with the subject as read and then proceeding to a discussion.

At the first business meeting Mr. Self, Assistant Secretary, Air Ministry, gave an account of the British Government's policy with regard to the Empire Air Mail Scheme. This address was welcomed by the delegates as it gave them a clear idea of the proposed extension and development of the Empire air routes and the responsibilities which would fall on them in connexion with the associated meteorological services. Mr. Self's address was followed by the consideration of a number of problems dealing with aviation meteorology, chief amongst which was the ice accretion on aircraft and the meteorological aid required for blind flying.

Two meetings were devoted to synoptic meteorology. In recent years the method of forecasting developed by the Norwegian meteorologists and depending on air mass analysis has been largely adopted in Europe. It was interesting to learn that air mass analysis has an application in tropical regions although the methods which have to be employed are different from those in temperate regions. A useful discussion took place on methods of plotting data on synoptic charts and the form of codes used for the exchange of synoptic information. It became clear that the International Codes were not satisfactory in tropical countries and proposals for modification were formulated. These proposals were subsequently

* Australia, Canada, East Africa, Great Britain, Hong Kong, India, Malaya, New Zealand, South Africa and Southern Rhodesia.

† Gold Coast, Cyprus, Nigeria, Zanzibar, Tanganyika, A.E.Sudan, Palestine, Gambia, Mauritius, Uganda, Bermuda, Seychelles, Trinidad and Ceylon.

presented at the International Conference in Warsaw and in the main adopted.

The meteorological aid required by the Military Services both in peace and war was fully discussed and valuable information given and received.

A whole day was devoted to marine meteorology. The Superintendent of the Marine Division explained the policy adopted for the organization of weather reporting by British ships. Several directors, especial those from India, Hong Kong and New Zealand, expressed the wish for more observations from ships to be transmitted to them. The difficulties of meeting these wishes with the scheme of "selected ships" adopted by international agreement were discussed and proposals made for meeting them. In the past there had been a certain amount of misunderstanding regarding the meteorological work in British ships in certain parts of the Empire and the discussion did a great deal to remove these misunderstandings and to promote closer co-operation in the future.

Two days were given to climatology and agricultural meteorology. A very large range of subjects was discussed as these problems affected all the territories represented. The chief items discussed were:—uniformity in climatological observations, broadcasting climatological data, computation of averages, measurement of evaporation, construction of rainfall maps, methods of measuring snowfall, soil-temperatures and seasonal forecasting.

A complete report of the meetings, with reprints of the memoranda, is in the press.

The delegates were entertained to dinner by the Government. The Secretary of State for Air presided and made a speech which gave much pleasure to the guests as showing that the importance of their work and the difficulties under which they served were clearly understood. The Air Ministry entertained the delegates to tea at Kew Observatory to meet the staff of the Meteorological Office and Sir George and Lady Simpson gave an evening reception on the first day of the Conference in order that the delegates and their wives might become acquainted with their colleagues and others connected with the Conference.

INTERNATIONAL CO-OPERATION.

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

International Conference of Directors of Meteorological Services.—The Eighth International Conference of Directors of Official Meteorological Services in all parts of the world was held at Warsaw in September, 1935. The Conference was held under the Presidency of Professor E. van Everdingen, Director of the Meteorological Service of Holland, who succeeded Sir Napier Shaw in 1923 as

President of the International Meteorological Committee. This was the last year of Professor van Everdingen's term of office, and he has been succeeded in the Presidency by Dr. Th. Hesselberg, Director of the Meteorological Service of Norway.

The Conference was preceded by meetings of the Commissions for Climatology and for Agricultural Meteorology at Zoppot, near Danzig, and by meetings at Warsaw itself of the Commissions for the Réseau Mondial and Polar Meteorology, for Synoptic Weather Information, for Aerology, for Maritime Meteorology and for Terrestrial Magnetism.

The Report of the Conference shows that 109 Resolutions were passed during the meetings, many of them of first importance in the organization of international co-operation which is vital to progress in meteorology.

Before describing the technical resolutions, with which the Conferences of Directors are primarily concerned, it is necessary to refer to a matter affecting the Statutes of the International Meteorological Organisation. Before the Conference met the President of the Committee received from the Italian Air Ministry proposals for a modification of the statutes of the Organization, designed to make the Conference a Conference of Representatives of Governments instead of a Technical Conference of the Directors of Meteorological Services. The principal purpose of the Italian proposals was to secure greater efficiency and uniformity in the internationally organised service of meteorological reports for aviation. A similar request for a greater degree of officialization of the Conference was also received from the Director of the Meteorological Service of the French Colonies. In the ordinary course, these proposals would have been considered before the meeting of the Conference by the International Meteorological Committee and the Conference would have had the advantage of the Committee's advice before dealing with the proposals. The proposals had, however, been received too late for this course to be followed and the Conference had to decide between deferring their consideration or adopting a procedure differing from the normal. The former course would have necessitated in practice deferring action on the Italian proposals for another six years. The Conference therefore decided to refer the Italian proposals to a Commission appointed at the Conference itself and sitting simultaneously with the meeting of the Conference. This Commission was placed under the Chairmanship of Sir George Simpson.

The Commission recommended to the Conference an addition to the existing Statutes of a new Article constituting a Commission for Aeronautical Meteorology whose main object should be to secure the fuller co-ordination of the international meteorological arrangements for aviation, which had prompted the Italian proposals. They further recommended some slight changes in the existing

Statutes designed to ensure that future Conferences should be brought to the notice of the Government Departments concerned in each country a year before the Conferences were due to assemble. These recommendations were approved by the Conference and accepted by the Italian Delegation as satisfying their desires.

Another important decision of a general character which was taken at the Conference was designed to meet the difficulty arising from the fact that the Conferences and meetings of the Commissions were normally held in Europe and—in addition to dealing with problems universal in character and applicable to meteorological services all over the world—dealt with problems of a purely European character. There existed no organization appropriate to deal with similar problems arising in other continental regions and the Conference therefore decided to appoint Regional Commissions whose members should be representatives of the meteorological services of the continents or regions concerned, and whose objects should be to deal, within the framework of the International Meteorological Organization, with problems regional in character. Two of these Regional Commissions were instituted by the Conference at Warsaw, namely:—the Regional Commission for Africa under the Presidency of Mr. A. Walter, Director of the East African Meteorological Service, and the Regional Commission for the Far East, under the Presidency of M. Bruzon, Director of the Meteorological Service of French Indo-China.

The principal technical matters on which agreement was reached at the Conference were:—

Collective Issues.—The Conference at Copenhagen in 1929 approved the arrangements for the distribution of meteorological reports in the European area by means of collective wireless issues from Paris, Hamburg and Moscow. The arrangement is described on page 38 of the *Annual Report by the Meteorological Committee for the year ending March 31, 1930*. At that time the arrangements for the issue of reports from the countries of south-east Europe and the meteorologically connected areas of the eastern Mediterranean were not sufficiently complete to enable the institution of a similar collective issue for that area to be effected. Advances have been made in the intervening period and the Conference at Warsaw approved the institution of a further collective issue from Rome in which the reports from meteorological stations in Italy, Yugoslavia, Greece, Turkey, Rhodes, the Dodecanese, Lybia, Syria, Palestine, Iraq, Egypt and ships' reports in the eastern Mediterranean would be included.

Uniformity in Weather Maps.—The development of civil aviation and the increased use which the pilots and navigators of aircraft make of synoptic meteorological charts, had made evident the necessity for a uniform method of entering meteorological information on these charts. The charts are designed primarily for use in the preparation of forecasts and for the guidance of expert meteoro-

logists, and different methods were naturally in use in different countries. The differences related both to the amount of information which was entered on the charts and to the manner in which it was shown.

In the earlier years of the last decade the meteorological requirements of aviators on international air routes in the matter of charts were met by a simple system, promulgated in the meteorological annex of the International Convention for Air Navigation, according to which the wind, weather, height of cloud and visibility were indicated in a uniform manner, pictorial in character. It was not anticipated that this would be permanently sufficient and it soon appeared that pilots and navigators wanted to see complete charts with full meteorological information entered upon them, and that the best practical method of meeting this requirement was to permit the pilots to consult the charts which the expert meteorologists used.

The charts are necessarily complicated; the information from a single station consists of the direction and force of the wind, barometric pressure and the rate of change of barometric pressure, temperature, weather, amount of cloud, forms of cloud and height of the cloud base, visibility and humidity. A complete chart contains this information for a hundred or more stations. It is only by experience that a pilot can become sufficiently familiar with the charts for the meteorologist to be able to explain to him the interpretation of the chart from the point of view of the pilot's forthcoming flight. It presents an almost insurmountable problem if the pilot has to become familiar with a number of different types of chart. It became therefore a matter of first importance for the different meteorological services to devise a common method which could be used by all the services in the preparation of these charts. Broadly speaking that problem has now been solved and the Conference at Warsaw approved of the solution. The solution is not quite complete because there are still two points on which differences exist. The first is in regard to the method of showing the amount of cloud; in this it has been impossible to agree upon a uniform method, but the differences of method have been reduced to two. The second is in regard to temperature: the countries using Fahrenheit degrees have continued to enter temperature on their charts in degrees F. and the countries using centigrade degrees continue to make their entries in degrees C.

Distribution by Radio Telegraphy of Monthly Values of Pressure, Temperature and Rainfall.—The scheme, referred to in last year's annual report (p. 30), prepared by the Commission for Synoptic Weather Information, was considered at a joint meeting of the Commission for Synoptic Weather Information and the Climatological Commission. Minor amendments were made and the scheme was subsequently approved by the Conference.

A number of countries have already commenced to issue their reports in accordance with the scheme, the issue of the values being made not later than the 5th of the month following that to which they refer, *i.e.*, the monthly values for January are issued not later than February 5.

The collection of the reports from the national issues and their issue in collective broadcasts for the information of other continents has not yet been commenced.

Meteorological Reports from Iceland.—In the past the meteorological reports from Iceland and the Faroes have been transmitted by cable to London. They have then been included, along with the reports from British stations, in the messages broadcast from Air Ministry wireless stations. During the past two years efforts have been made to establish a satisfactory system of direct broadcasts of these reports by wireless telegraphy from Iceland. Owing to unexpected difficulties the first efforts in this direction failed, but during 1935 fresh efforts were made and were successful. The International Conference at its meeting at Copenhagen in 1929 expressed the view that if a satisfactory system of broadcast reports were arranged it would be appropriate if the payments hitherto made for the transmission by cable were diverted to meet the cost of the broadcast issues. As the result of the trials which were made during 1935 advantage was taken of the presence of the Director of the Meteorological Service of Iceland at Warsaw to make the necessary arrangements for the change-over from the cable messages to the wireless issues. The arrangements with the cable company and the collection of the contributions towards the cost have been made in the past by the Director of the Danish Meteorological Institute. The arrangements for the broadcast issues have been made between the International Meteorological Organization and the Government of Iceland and the contributions will in future be collected by the Secretariat of the Organization.

Observations of Ozone—Possible application to Weather Forecasts.—Investigations of the distribution of ozone by methods developed by Dr. G. M. B. Dobson, F.R.S., have shown that there is a connexion between the ozone in the atmosphere and the distribution of barometric pressure. The investigations are comparatively costly and sufficient observations are not yet available to determine whether this connexion may have importance in forecasting the development and decay of weather systems.

The Conference considered that it was a promising line of investigation and recommended the establishment of a réseau of 20 stations in Europe making daily observations of ozone, and of other stations in North America and the U.S.S.R. The establishment of these stations depends upon the directors of the meteorological services in the countries of Europe. Already arrangements have been made for the establishment of more than half of the stations in Europe and there will be two in the British Isles : one, Dr. Dobson's

own station at Oxford and another at one of the observatories of the Meteorological Office.

International Commission for Air Navigation.—A meeting of the Meteorological Sub-Commission of the International Commission for Air Navigation was held in Paris on January 6, 1936, under the presidency of Lt.-Col. E. Gold, Assistant Director of the Meteorological Office, London.

The questions considered at the meeting related mainly to the modification of the Meteorological Annex to the International Air Convention, taking into account the developments since the last meeting of the Sub-Commission in January, 1933, and the modifications necessitated by the decisions of the International Meteorological Conference at Warsaw (September, 1935) in regard to synoptic meteorological reports.

The Sub-Commission also decided to recommend to the Commission that in regions where aerial activities extend over most of the hours of the day the system of synoptic observations should be based on reports every 3 hours, and that in regions where aerial activity is suspended during the night the first synoptic reports should be sufficiently early to enable the information derived from them to be available at terminal aerodromes before the first regular departures for the day.

PUBLICATIONS.

A list of the publications issued in the course of the year is given in Appendix VI. No change of form has been made in any of the serials but in consequence of the staff changes referred to elsewhere, some difficulty was experienced in keeping them up to date.

Contributions by members of the staff to non-official publications have again been numerous. The *Quarterly Journal of the Royal Meteorological Society* has contained Lt.-Col. Gold's presidential address on "Fronts and Occlusions" to which reference was made in the report for last year and also the Symons' Memorial Lecture, delivered by Dr. F. J. W. Whipple. Dr. Whipple chose for his subject "The Propagation of Sound to great Distances" and took the opportunity to review the meteorological results derived from specially organised experiments during the years that have passed since the war. In this country special arrangements have been made for collecting observations on occasions of firing of heavy guns, partly by inviting the co-operation of the public by broadcasting in advance the times when firing would take place, and partly by obtaining records from suitably placed sound-reading machines. On the continent, special explosions have been arranged and the International Meteorological Organization has invited international co-operation in recording the results. The waves that carry sound to abnormally great distances travel through the upper atmosphere

and from the distribution of the zones of abnormal audibility interesting deductions can be made regarding the distribution of temperature in the upper atmosphere. In addition to these two addresses the journal has contained 20 papers or notes contributed by members of the staff.

Two papers by J. M. Stagg on magnetic matters, appeared in the *Proceedings of the Royal Society*, in which use is made of the observations at Fort Rae during the second Polar Year. Contributions by members of the staff have also appeared in *Nature*, the *Monthly Notices of the Royal Astronomical Society*, the *Journal of Scientific Instruments*, the *Philosophical Magazine*, *Water and Water Engineering*, and other journals.

STAFF.

The year has been a memorable one in the history of the Office as it has seen the introduction of revised scales of pay on the lines recommended by the Committee on the Staffs of Government Scientific Establishments presided over by Sir Harold Carpenter. The new scales were introduced as from April 1, 1935.

It has been decided to employ in the Meteorological Office the various grades of Technical Officer and Assistant proposed by that Committee. Recruitment for the Officer class will normally be from University graduates holding Honours Degrees in Mathematics and Physics, while for the Assistant class the standard of education required is that of the Intermediate Bachelor of Science Degree. One of the main recommendations of the Carpenter Committee was that before the improved rates of pay were applied in any establishment the work should be carefully scrutinised with a view to relieving the Officer grades of work which could be satisfactorily performed by the lower grades.

In this connexion careful consideration was given to the forecasting work of the Office. Under the system which has been in operation for the past 15 years the issue of forecasts has been entirely in the hands of the professional staff recruited from University graduates. While it is generally agreed that weather forecasting research is a branch of meteorological science that demands the high scientific training associated with an Honours Degree, it has to be recognised that the element of experience plays a very important part in the more routine aspects of forecasting, and it was felt that Assistants acquire in the course of long service in the Office experience which should be utilised to the full in this connexion. After very careful consideration by the Meteorological Committee, therefore, it has been decided that Assistants who have this experience may be employed on forecasting duties provided that steps are taken to give them adequate training in the scientific principles on which the practice of forecasting is based. Assistants II who have been thus trained may be assigned to forecast posts

under the supervision of higher grades, while suitably qualified Assistants I who have been similarly trained will be allowed to carry out forecasting without such supervision.

Another problem to which careful consideration had to be given arose from the large volume of low-grade routine work performed by certain of the Meteorological Office grade III clerks. As stated in the report for last year, this situation has been met at the outstations by the introduction of the grade of Observer in substitution for such Clerks. At Headquarters Writing Assistants have been introduced to do the simple routine work, and in the Forecast Division draughtswomen have taken over some of the work connected with the production of the *Daily Weather Report*.

The establishment of the Office has in the past been adjusted strictly to meet the requirements of the work which could definitely be foreseen. Each sanctioned post had a specific piece of work assigned to it and there was no margin for carrying out any additional work which the Office might be required to undertake. On this basis the possibilities of undertaking research work, which is one of the recognised functions of the Office, were very limited in view of the ever increasing demands made on the time of the staff by the regular work. The close correspondence between posts and work also made it exceedingly difficult to give appropriate training to new entrants and to give officers on transfer from one branch to another the opportunity of acquiring familiarity with their new duties before they were called upon to undertake the full responsibilities attaching to them. To improve matters in this respect the staff which would otherwise be necessary in each grade has been increased by approximately 10 per cent. Normally this would provide a pool of staff from which to meet special requirements, but in the exceptional circumstances which have prevailed during the year under review, the pool has had to be used up to the present mainly for training purposes. A special course of training in the theory of forecasting, under the direction of a Technical Officer who was relieved from his ordinary duties was arranged for six Assistants II who had had long practical experience in the Forecast Division. The course lasted for approximately four months and at its conclusion the Assistants were absorbed in posts in which the preparation of forecasts is part of their regular duty. At the close of the year seven newly recruited Technical Officers were under training, and four more were about to be appointed.

The introduction of the new grades has brought with it some changes in the internal organization of the Office, details of which are given in the sections of the report describing the work of the divisions. The assimilations to the new grades may be summarised as follows :

- 5 Superintendents to Principal Technical Officers.
- 3 Superintendents to Senior Technical Officers.
- 6 Asst. Superintendents to Senior Technical Officers.

- 11 Asst. Superintendents to Technical Officers on the extended scale of salary.
- 49 Senior Professional Assistants to Technical Officers.
- 10 M.O. Clerks Grade I to Assistants I.
- 27 M.O. Clerks Grade II to Assistants II.
- 62 M.O. Clerks Grade III to Assistants III.

Concurrently with the assimilations 19 promotions were made from Clerk Grade III to Clerk Grade II to fill posts at outstations which will eventually be staffed by Observers I. Subsequently 5 promotions from Assistant II to Assistant I have been made against vacancies in the higher grade.

The carrying through of the staff reorganization outlined above at a time when the demands made on the office were exceptionally heavy presented many difficulties; a considerable number of transfers had to be made, and the regular routine of the work was temporarily interrupted in consequence. At times there was a serious shortage of staff in some divisions.

Details of the Staff and its present distribution will be found on pp. 58-64.

APPENDIX I

CLASSIFICATION OF STATIONS WHICH REPORT TO THE BRITISH CLIMATOLOGY DIVISION (see p. 9 for explanation).

DISTRICTS	STATIONS						AUTOGRAPHIC RECORDS					
	Observatories	Distributive	Telegraphic	Crop Weather	Climatological	Rainfall only	Sunshine	Rainfall	Wind	Pressure	Temperature	Humidity
0 Scotland, N. ...	1	0	4	0	11	131	14	1	3	5	0	0
1 " E. ...	1	1	1	2	34	348	22	6	3	3	2	2
6A " W. ...	1	1	1	1	26	395	21	7	3	3	3	1
2 England, N.E. ...	0	2	2	2	14	281	21	4	5	4	2	2
3 " E. ...	0	3	1	8	18	480	22	12	6	8	5	1
4 " Midlands	0	1	2	6	40	1083	31	18	1	3	2	1
5 " S.E. ...	0	7	3	4	38	882	41	16	10	10	11	9
London District...	2	0	0	0	11	51	10	4	2	2	2	2
8B England, S.W. ...	0	1	2	5	32	610	30	6	4	5	5	3
7A " N.W. ...	0	1	0	1	22	489	21	8	3	3	0	0
7B N. Wales ...	0	2	0	1	6	195	6	3	4	1	2	2
8A S. " ...	0	0	1	2	9	229	12	3	2	2	1	0
9 Ireland, N. ...	0	1	2	0	7	134	7	2	3	5	1	1
10 " S. ...	1	0	2	0	13	118	9	2	3	6	0	0
6B Isle of Man ...	0	0	1	0	1	7	2	0	1	1	1	1
11 Scilly and Channel Isles ...	0	0	2	0	1	28	3	0	1	2	1	0
TOTAL ...	6	20	24	32	283	5461	272	92	54	63	38	25
Corresponding number for last year ...	6	20	27	33	264	5395	269	101	52	66	31	24

APPENDIX II

SPECIAL

AIR MINISTRY
NOTICE TO AIRMEN*No. 14 of the year 1936*RADIOTELEPHONIC BROADCASTS OF
WEATHER REPORTS, FORECASTS AND WARNINGS,
AND AIR NAVIGATIONAL WARNINGS.*(Amendment to "The Air Pilot")*

1. As from 15th February, 1936, the present service of radiotelephonic broadcasts of weather reports, weather forecasts and air navigational warnings, from the Air Ministry meteorological radio station at Borough Hill, Northamptonshire, on a frequency of 254 kc/s (1,181 m.) will be replaced by a more comprehensive and more frequent service of broadcasts, comprising weather, weather forecasts, weather warnings and air navigational warnings, from the same station and on the same frequency.
2. The service will be in operation on every day of the year and the daily time-table will be as set out in the Appendix hereto.
3. Messages will be announced firstly at dictation speed; they will then be repeated at reading speed.
4. Pads entitled "Broadcasts of Weather Reports, Forecasts and Navigational Warnings from the Air Ministry Radio-Meteorological Station (Form 2352)", each containing 100 forms for the entry of the weather reports, can be purchased, price 2s. 6d. post free, from H.M. Stationery Office at the following addresses:—Aadastral House, Kingsway, London, W.C.2; 120, George Street, Edinburgh 2; 26, York Street, Manchester 1; 1, St. Andrew's Crescent, Cardiff; 80, Chichester Street, Belfast; or through any bookseller. A map (Form 2350), showing the positions of the stations, can also be obtained from H.M. Stationery Office or through any bookseller, price 6d. net (7d. post free).
5. Attention is drawn to the necessity for persons intending to receive the broadcasts to receive a copy of the map referred to in para. 4 above, in order that certain stations which will be given a revised nomenclature under the new programme may be identified.
6. On the forms referred to in para. 4 above, the stations for which weather reports are received are arranged according to the main United Kingdom air routes. The names of the stations are printed in three kinds of type:—(a) *Black capitals* for key stations, reports from which are announced 15 minutes after the principal hours of observations, viz. 0700, 1000, 1300, 1600 and 1800 hours G.M.T. (0800, 1100, 1400, 1700 and 1900 hours, British Summer Time); (b) *Small black Clarendon type* for main stations, reports from which are announced 30 minutes past the principal hours of observation; and (c) *Small red type* for auxiliary stations which usually report at times other than the principal hours of observations. (*Note.*—The number of auxiliary stations is being increased.)

7. In connection with entering the reports on the forms, it should be noted that the stations will be announced in accordance with the time-table and in the order:—(a) stations printed in capitals, (b) stations printed in small black Clarendon type and (c) stations printed in small red type. For observation hours 1000 and 1600 hours G.M.T. (1100 and 1700 B.S.T.) certain of the stations will be omitted.

8. Reports for 0700 and 1300 hours G.M.T. for certain main stations on the Continent, *viz.*: St. Inglevert, Dieppe, Paris, Amsterdam, Ostend and Brussels, which are not at present shown on Form 2352, will be broadcast at 0730 and 1330 hours (winter) and 0830 and 1430 hours (summer) after the report for Lerwick. For the time being, reports from the six Continental stations should be entered on Form 2352 in the available space below Lerwick at the bottom of the third column of station names; reprints of Form 2352 will show these stations in their proper place in the "London-Continent Route" section.

9. The following remarks should be noted in connection with the several kinds of observation:—

(a) *Visibility*, being determined by observations of objects at standard distances, is always given with reference to the furthest of such objects which can be seen; i.e. the actual distance of visibility lies between the distance announced and the next *greater* value in the list: 0, 50, 200, 500, 1,000, 2,000, 4,000 yards, 6, 12, 31 miles. *Example*: "visibility 2,000 yards", means visibility between 2,000 and 4,000 yards.

(b) *Height of low cloud*, which is expressed in feet above ground level has, similarly, a value between the height announced and the next higher value in the list: 0, 150, 300, 600, 1,000, 2,000, 3,000, 5,000, 6,500 feet.

(c) *Amount of low cloud* is expressed in terms of the number of tenths of the whole sky which are covered with low cloud. If there is no low cloud, the words "no low cloud" will be announced, and should be written across columns 5 and 6.

(d) *Wind speed at "Surface"* refers to the wind at about 40 feet above the ground in an open situation, and is given in miles per hour. At many stations the value is estimated.

(e) *Wind at 2,000 feet*, when given, is derived from observations of a small rubber balloon, inflated with hydrogen so that it rises at a known rate. The direction is given in degrees from true North and the speed in miles per hour.

10. *Weather forecasts* are given in general terms and are applicable to broadly specified areas of the country. They cannot take account of local but important variations, especially when these variations are due to local topography, or to land and sea breeze effects. Local forecasts can be obtained between 0900 and 1700 hours from the nearest of the meteorological offices in the following list:—

<i>Office.</i>	<i>Telephone.</i>
Abbotsinch	Paisley 4181 and 4182.
Aldergrove	Antrim 20.
Boscombe Down	Amesbury 321, Ext. 36.
Calshot (Southampton)	Fawley 46.
Catterick, Yorks, N. Riding	Old Catterick 53.
Cranwell	Sleaford 64, Ext. 85.
South Farnborough	Aldershot 361, Ext. 44.
Leuchars	Leuchars 16.
Manchester	Eccles 1124.

<i>Office.</i>	<i>Telephone.</i>
Manston	Ramsgate 196, Ext. 52.
Mildenhall	Newmarket 591.
Mount Batten (Plymouth)	Plymstock 2224.
Sealand (Chester)	Connahs Quay 190, Ext. 4.
Upper Heyford	Bicester 105.
Croydon	Croydon 2721.

11. *The Air Pilot*.—“The Air Pilot: Great Britain and Ireland”, Part I, §10 (5), is affected by the above, and will be amended in due course.

12. *Cancellations*.—Notices to Airmen Nos. 63 and 84 of 1935, are hereby cancelled.

By direction of the Secretary of State,
C. LL. BULLOCK.

Air Ministry,
London, W.C.2.

7th February, 1936.

(401656/35)

ANNEX.

TIME TABLE OF BROADCASTS OF WEATHER REPORTS, FORECASTS AND AIR NAVIGATIONAL WARNINGS FROM THE AIR MINISTRY METEOROLOGICAL RADIO STATION.

The reports, etc., are issued by radio-telephony in accordance with the following time table:—

Hours of Broadcast
(Clock Time).

<i>Winter.</i>	<i>Summer†.</i>	
—	0745	(<i>Not Sundays—not in winter.</i>) Preliminary general forecast for day; navigational warnings.
0715	0815	Reports from key stations (observation hour 0700 G.M.T.).
0730	0830	Reports from main stations (observation hour 0700 G.M.T.).
—	0900	(<i>Summer only.</i>) Reports from auxiliary stations (observation hour 0800 clock time).
0815	0915	*Reports from key and main stations (either repetitions of 0700 G.M.T. observations, or later reports if sudden changes have occurred); meteorological warnings.
0845	0945	General forecast for day; navigational warnings.
0900	—	(<i>Winter only.</i>) Reports from auxiliary stations (observation hour 0800 clock time).
—	1000	(<i>Summer only.</i>) *Repetition of reports from auxiliary stations (observation hour 0800 clock time or later).
0915	1015	*Reports from key and main stations (either repetitions of 0700 G.M.T. observations or later reports if sudden changes have occurred); meteorological warnings.
1015	1115	Reports from key stations (observation hour 1000 G.M.T.).

* The hour of observation will be that stated, unless a report of a sudden change of weather has been received since that hour, in which case the hour of observation will be announced as the time just following the change of weather.

† “Summer” is the period during which British Summer Time is in force.

*Hours of Broadcast
(Clock Time).*

<i>Winter.</i>	<i>Summer†.</i>	
1030	1130	Reports from main stations (observation hour 1000 G.M.T.).
1115	1215	*Reports from key and main stations (either repetitions of 1000 G.M.T. observations or later reports if sudden changes have occurred); meteorological warnings.
1145	1245	General forecast for remainder of day; navigational warnings.
1215	1315	*Reports from key and main stations (either repetitions of 1000 G.M.T. observations or later reports if sudden changes have occurred); meteorological warnings.
1315	1415	Reports from key stations (observation hour 1300 G.M.T.).
1330	1430	Reports from main stations (observation hour 1300 G.M.T.); reports from auxiliary stations (if any).
1415	1515	*Reports from key and main stations (either repetitions of 1300 G.M.T. observations or later reports if sudden changes have occurred); meteorological warnings.
1445	1545	Preliminary general forecast for night flying; navigational warnings.
1515	1615	*Reports from key and main stations (either repetitions of 1300 G.M.T. observations or later reports if sudden changes have occurred); meteorological warnings.
1545	1645	Preliminary general forecast for next day; navigational warnings.
1615	1715	Reports from key stations (observation hour 1600 G.M.T.).
1630	1730	Reports from main stations (observation hour 1600 G.M.T.).
1715	1815	*Reports from key and main stations (either repetitions of 1600 G.M.T. observations or later reports if sudden changes have occurred); meteorological warnings.
1815	1915	Reports from key stations (observation hour 1800 G.M.T.).
1830	1930	Reports from main stations (observation hour 1800 G.M.T.).
1915	2015	*Reports from key and main stations (either repetitions of 1800 G.M.T. observations or later reports if sudden changes have occurred); meteorological warnings.
1945	2045	Final general forecast for night flying; final forecast for next day; navigational warnings.

NOTE.—When hours of observation are given in G.M.T., add one hour to get Summer Time.

* The hour of observation will be that stated, unless a report of a sudden change of weather has been received since that hour, in which case the hour of observation will be announced as the time just following the change of weather,

† "Summer" is the period during which British Summer Time is in force.

APPENDIX III

GALE WARNINGS ISSUED DURING THE YEAR 1935.

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
Scotland, N.E.	15	93	38	14	13	71
Scotland, E.	9	89	22	8	8	73
Scotland, N.W.	12	100	34	12	13	73
Scotland, W. and North Channel	15	66	24	10	6	66
Ireland, N.	13	100	36	13	15	78
Ireland, S.	13	85	39	11	17	72
Irish Sea	12	100	27	12	12	89
St. George's Channel	13	92	31	12	14	84
Bristol Channel	26	92	39	24	8	82
England, S.W.	24	92	39	22	14	92
England, S.	18	94	37	17	13	81
England, S.E.	15	93	34	14	12	76
England, N.E.	6	83	26	5	14	73
England, E.	17	100	33	17	12	88
TOTALS	208	91	459	191	171	79

APPENDIX IV

FINANCIAL STATEMENT.

The year under review, 1935-6, is the fifteenth 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 1935-6.

<i>Expenditure.</i>		<i>Amount.</i>	
		£	£
Salaries and Wages—H.Q. Establishments	... ..	55,436	
" " —Out-station Establishments	... ..	74,949	
		<hr/>	130,385
Fuel and Light	... ..		418
Transport of Personnel and Equipment	... ..		5,619
Instruments, Equipment and Stores	... ..		14,215
Research	... ..		614
Minor Works Services, Rents, Repairs and Maintenance of Buildings	... ..		3,380
Telegrams, Telephones	... ..	
Subventions to reporting Stations and miscellaneous charges	}		16,790
Superannuation	... ..		776
	Total	...	<hr/> <u>£172,197</u>
 <i>Receipts</i>			
Receipts from Royal Society	... ..		571
Sale of Instruments, Carriage, etc.	... ..		5,378
Daily Weather Reports, Forecasts, etc.	... ..		3,042
Receipts from War Office and Admiralty	... ..		1,011
	Total	...	<hr/> <u>£10,002</u>

APPENDIX V

 THE STAFF OF THE METEOROLOGICAL OFFICE, ITS
 OBSERVATORIES AND BRANCHES, MARCH 31, 1936.

THE STAFF AT HEADQUARTERS.

DIRECTOR :

Sir George C. Simpson, K.C.B., D.Sc., F.R.S.

<i>Assistant Directors</i>	...	...	R. G. K. Lempfert, C.B.E., M.A., F.Inst.P. E. Gold, D.S.O., F.R.S.
<i>Technical Officer</i>	...	...	1 (vacancy).

GENERAL SERVICES DIVISION.

<i>Chief Clerk</i>	...	...	H. L. B. Tarrant, M.B.E.
<i>Assistant I</i>	...	...	R. Pyser.
<i>Assistants & Clerks</i>	...	...	7 (one vacancy).

MARINE DIVISION.

<i>Superintendent</i>	...	...	L. A. Brooke Smith, Captain, R.N.R. (retd.), R.D.
<i>Technical Officer</i>	...	...	J. Hennessy, Cdr., R.N.R., (retd.), R.D.
<i>Senior Professional Assistant</i>			E. W. Barlow, B.Sc.
<i>Assistant I</i>	...	...	H. Keeton.
<i>Assistants and Clerks</i>	...	...	21 (nine vacancies).

BRITISH CLIMATOLOGY DIVISION.

<i>Principal Technical Officer</i>	...	...	E. G. Bilham, B.Sc., A.R.C.S., D.I.C.
<i>Technical Officers</i>	...	...	W. C. Kaye, B.Sc.; J. Glasspoole, M.Sc., Ph.D.
<i>Senior Professional Assistant</i>			Miss L. F. Lewis, B.Sc.
<i>Assistant I</i>	...	...	A. G. W. Howard.
<i>Assistants & Clerks</i>	...	...	20
<i>Draughtsmen</i>	...	...	2 (one vacancy).

GENERAL CLIMATOLOGY DIVISION.

<i>Superintendent</i>	...	...	C. E. P. Brooks, D.Sc.
<i>Technical Officer</i>	...	...	Miss E. E. Austin, M.A.
<i>Senior Professional Assistants</i>			Miss E. H. Geake, M.Sc.; Miss L. D. Sawyer, B.A.; Miss G. L. Thorman, B.Sc., A.K.C.
<i>Assistant I</i>	...	...	A. T. Bench.
<i>Assistants & Clerks</i>	...	...	6
<i>Draughtsman</i>	...	...	1

APPENDIX V—continued

FORECAST AND AVIATION SERVICES DIVISION.

<i>Principal Technical Officer</i> ...	R. Corless, O.B.E., M.A.
<i>Senior Technical Officers</i> ...	H. W. L. Absalom, B.Sc., A.R.C.S., D.I.C.; R. S. Read, M.A., B.Sc., A.R.C.S., F.Inst.P.
<i>Technical Officers</i> ...	C. S. Durst, B.A., M. T. Spence, B.Sc.; C. J. Boyden, B.A.; E. A. Cope, B.Sc.; F. H. Dight, B.Sc.; L. Dods, B.Sc.; D. W. Johnston, B.Sc.; T. W. V. Jones, B.Sc.; B. C. V. Oddie, B.Sc.; J. Pepper, Ph.D., M.A., B.Sc.
<i>Senior Professional Assistants</i>	P. I. Mulholland, B.Sc.; R. M. Stanhope, B.A.
<i>Assistants I</i> ...	W. Hayes; F. M. Dean.
<i>Assistants and Clerks</i> ...	30
<i>Draughtswomen</i> ...	5
<i>Telephone Typists</i> ...	8

NAVAL DIVISION.

<i>Superintendent</i> ...	L. G. Garbett, Captain, R.N. (retd.).
<i>Senior Technical Officer</i> ...	W. A. Harwood, D.Sc.
<i>Technical Officers</i> ...	A. H. Nagle, B.Sc., A.R.C.S., D.I.C.; A. G. Forsdyke, Ph.D., A.R.C.S., D.I.C.
<i>Assistants & Clerks</i> ...	5 (one vacancy).

ARMY AND INSTRUMENTS DIVISION.

<i>Principal Technical Officer</i> ...	J. S. Dines, M.A.
<i>Senior Technical Officer</i> ...	E. V. Newnham, B.Sc.
<i>Technical Officer</i> ...	R. Cranna, M.A., B.Sc.
<i>Senior Professional Assistant</i>	J. E. Belasco, B.Sc.
<i>Assistant I</i> ...	P. N. Skelton.
<i>Assistants & Clerks</i> ...	8
<i>Draughtsman</i> ...	1
<i>Instrument Designer</i> ...	1
<i>Storeman, Packer and Porter</i>	3
<i>Photographic Assistant</i> ...	1

OVERSEAS DIVISION.

<i>Principal Technical Officer</i> ...	F. Entwistle, B.Sc.
<i>Assistant II</i> ...	1

POOL FOR TRAINING AND SPECIAL INVESTIGATIONS.

<i>Senior Technical Officer</i> ...	C. K. M. Douglas, B.A.
<i>Technical Officers</i> ...	J. H. Brazell, M.Sc.; G. A. Bull, B.Sc.; D. A. Davies, B.Sc.; F. E. Dixon, B.A.; J. Harding, B.A., B.Sc.; G. W. Hurst, B.Sc., A.R.C.S., D.I.C.; F. E. Lumb, B.Sc.; S. P. Peters, B.Sc.; A.Inst.P.; S. Proud, M.A.
<i>Assistants I</i> ...	D. F. Bowering; E. S. Tunstall.

APPENDIX V—continued

THE STAFF AT OBSERVATORIES AND BRANCH ESTABLISHMENTS.

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

<i>Principal Technical Officer</i> ...	A. H. R. Goldie, M.A., F.R.S.E.
<i>Technical Officer</i> ...	J. M. Stagg, M.A., B.Sc.
<i>Assistant I</i> ...	1 (vacancy).
<i>Assistants & Clerks</i> ...	6

KEW OBSERVATORY, Old Deer Park, Richmond, Surrey.

<i>Assistant Director</i> ...	F. J. W. Whipple, Sc.D., F.Inst.P.
<i>Technical Officers</i> ...	A. W. Lee, D.Sc., A.R.C.S., D.I.C.; F. J. Scrase, M.A., B.Sc.
<i>Assistant I</i> ...	E. Boxall.
<i>Assistants & Clerks</i> ...	5
<i>Observer II</i> ...	1
<i>Caretaker and Handyman</i> ...	2

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

<i>Technical Officer</i> ...	L. H. G. Dines, M.A.
<i>Instrument Maker</i> ...	1
<i>Mechanics and Carpenters</i> ...	3

VALENTIA OBSERVATORY, Cahirciveen, Co. Kerry.

<i>Technical Officer</i> ...	H. F. Jackson, M.S.E.
<i>Assistants & Clerks</i> ...	2
<i>Observers II</i> ...	2
<i>Messenger</i> ...	1

THE OBSERVATORY, ESKDALEMUIR, Langholm, Dumfriesshire.

<i>Technical Officers</i> ...	J. Crichton, M.A., B.Sc., F.R.S.E.; R. F. M. Hay, B.A.
<i>Assistants & Clerks</i> ...	3
<i>Housekeeper, Mechanic and Handyman</i> ...	3

THE OBSERVATORY, King's College, ABERDEEN.

<i>Assistant I</i> ...	G. A. Clarke.
<i>Assistant</i> ...	1
<i>Observer II</i> ...	1

THE OBSERVATORY, LERWICK, Shetlands.

<i>Technical Officer</i> ...	D. N. Harrison, D.Ph.
<i>Assistant</i> ...	1
<i>Observers II</i> ...	2
<i>Caretaker</i> ...	1

PORT METEOROLOGICAL OFFICE, LIVERPOOL.

<i>Senior Professional Assistant</i>	M. Cresswell, Cmdr., R.N.R.
<i>Clerk</i> ...	1

PORT METEOROLOGICAL OFFICE, LONDON.

<i>Senior Professional Assistant</i>	C. H. Williams, Cmdr., R.N.R. (retd.).
<i>Clerk</i> ...	1

APPENDIX V—continued

AVIATION SERVICES STATIONS.

ABBOTSINCH.

<i>Technical Officer</i>	...	...	W. J. Grassick, M.A., B.Sc.
<i>Assistants & Clerks</i>	...	...	2
<i>Observers II</i>	...	...	2

ABINGDON.

<i>Technical Officer</i>	...	...	R. E. Watson, B.Sc., Ph.D.
<i>Observers II</i>	...	...	2

ALDERGROVE.

<i>Technical Officer</i>	...	...	D. Dewar, B.Sc.
<i>Clerk</i>	...	...	1
<i>Observers II</i>	...	...	2

ANDOVER.

<i>Assistant Superintendent</i>	...	...	W. H. Pick, B.Sc., F.Inst.P., F.C.P.
<i>Clerk</i>	...	...	1

BIGGIN HILL.

<i>Clerk</i>	...	...	1
<i>Observers II</i>	...	...	4

BIRCHAM NEWTON.

<i>Technical Officer</i>	...	...	W. H. Bigg, B.Sc.
<i>Observer II</i>	...	...	1 (vacancy).

BOSCOMBE DOWN.

<i>Technical Officer</i>	...	...	C. V. Ockenden, B.Sc.
<i>Clerk</i>	...	...	1
<i>Observers II</i>	...	...	2

CALSHOT.

<i>Technical Officer</i>	...	...	R. A. Watson, B.A.
<i>Assistants & Clerks</i>	...	...	2
<i>Observers II</i>	...	...	2

CATTERICK.

<i>Technical Officer</i>	...	...	W. R. Morgans, M.Sc.
<i>Clerk</i>	...	...	1
<i>Observers II</i>	...	...	2

CRANWELL.

<i>Technical Officers</i>	...	...	R. P. Batty, B.A.; F. E. Coles, B.Sc., A.R.C.S., D.I.C.
<i>Clerk</i>	...	...	1
<i>Observers II</i>	...	...	3

CROYDON.

<i>Technical Officers</i>	...	...	S. F. Witcombe, B.Sc.; A. L. Maidens, B.Sc.
<i>Assistants & Clerks</i>	...	...	2
<i>Observers II</i>	...	...	7
<i>Telephone-Typists</i>	...	...	2

APPENDIX V—continued

HOLYHEAD.

<i>Clerks</i> ... ..	...	2
<i>Observer II (part time)</i> ...	...	1

LEUCHARS.

<i>Technical Officer</i> ... ..	...	S. T. A. Mirtlees, M.A.
<i>Clerk</i> ... ..	...	1
<i>Observers</i> ... ..	...	1

LYMPNE.

<i>Technical Officer</i> ... ..	...	1 (vacancy).
<i>Clerk</i> ... ..	...	1
<i>Observers II</i> ... ..	...	4

MANCHESTER.

<i>Technical Officer</i> ... ..	...	C. W. G. Daking, B.Sc.
<i>Assistants & Clerks</i> ... ..	...	2
<i>Observers II</i> ... ..	...	2

MANSTON.

<i>Technical Officer</i> ... ..	...	A. F. Crossley, M.A.
<i>Assistants & Clerks</i> ... ..	...	2
<i>Observers II</i> ... ..	...	3

MILDENHALL.

<i>Technical Officer</i> ... ..	...	R. F. Budden, M.A.
<i>Observers II</i> ... ..	...	2

MOUNT BATTEN.

<i>Technical Officer</i> ... ..	...	A. Walters.
<i>Clerks</i> ... ..	...	2
<i>Observers II</i> ... ..	...	2

SEALAND.

<i>Technical Officer</i> ... ..	...	W. D. Flower, B.Sc., A.Inst.P.
<i>Assistant</i> ... ..	...	1
<i>Observers II</i> ... ..	...	2

SOUTH FARNBOROUGH.

<i>Assistant I</i> ... ..	...	R. M. Poulter.
<i>Observers II</i> ... ..	...	2

UPPER HEYFORD.

<i>Technical Officer</i> ... ..	...	J. C. Cumming, M.A.
<i>Clerk</i> ... ..	...	1
<i>Observers II</i> ... ..	...	2

WORTHY DOWN

<i>Technical Officer</i> ... ..	...	1 (vacancy).
<i>Clerk</i> ... ..	...	1
<i>Observer II</i> ... ..	...	1

APPENDIX V—continued

ARMY SERVICES STATIONS.

SHOEBURYNESS.

<i>Technical Officer</i>	...	...	C. E. Britton, B.Sc.
<i>Assistants & Clerks</i>	...	...	7 (one vacancy).
<i>Observers II</i>	...	...	5

LARKHILL.

<i>Technical Officer</i>	...	...	L. G. Hemens, B.Sc.
<i>Clerks</i>	...	...	1
<i>Observers II</i>	...	...	3

PORTON.

<i>Assistants & Clerks</i>	...	...	4
<i>Observer II</i>	...	...	1

OVERSEAS STATIONS.

MALTA.

<i>Superintendent</i>	...	...	G. R. Hay, M.A.
<i>Technical Officers</i>	...	...	A. C. Best, B.Sc.; N. H. Smith, B.Sc.
<i>Assistants I</i>	...	...	E. L. Clinch; C. C. Newman.
<i>Assistant</i>	...	...	1
<i>Clerks (locally entered)</i>	...	...	5

MIDDLE EAST.

HELIOPOLIS.

<i>Superintendent</i>	...	...	J. Durward, M.A.
<i>Technical Officers</i>	...	...	C. W. Lamb, M.C., B.Sc.; G. J. W. Oddie, B.Sc.
<i>Assistants</i>	...	...	2
<i>Observers II</i>	...	...	4

ABOUKIR, AMMAN, ISMAILIA, MERSA MATRUH AND RAMLEH.

<i>Assistants & Clerks</i>	...	...	5
<i>Observers II</i>	...	...	4
<i>Clerks (locally entered)</i>	...	...	2

KHARTOUM.

<i>Technical Officer</i>	...	...	J. S. Farquharson, M.A.
<i>Assistant</i>	...	...	1
<i>Observers II</i>	...	...	3

IRAQ, HINAIDI.

<i>Senior Technical Officer</i>	...	...	R. H. Mathews, B.A.
<i>Technical Officers</i>	...	...	M. J. Thomas, B.Sc.; H. L. Wright, M.A.
<i>Assistant</i>	...	...	1
<i>Clerks (locally entered)</i>	...	...	7

DIWANIYAH, MOSUL, RAMADI, SHAIBAH.

<i>Clerks</i>	...	...	2
<i>Clerks (locally entered)</i>	...	...	4

APPENDIX V—continued

GIBRALTAR.

<i>Technical Officer</i>	...	...	R. Frost, B.A.
<i>Clerk</i>	...	...	1
<i>Observer II</i>	...	...	1

ADEN.

<i>Civilian Assistant</i>	...	...	Flight-Lieut. R. C. Bryant.
<i>Clerk</i>	...	...	1
<i>Observer II</i>	...	...	1

SECONDED FOR DUTY WITH OTHER BODIES.

<i>Technical Officers</i>	L. H. Starr, M.Sc. (R.A.F., India).	
			E. L. Davies, M.Sc.	} (War Office, Porton Experimental Station.)
			A. E. Mayers, B.Sc.	
			P. A. Sheppard, B.Sc.	
			O. G. Sutton, B.Sc.	
			H. Garnett, M.Sc. (Indian Government).	
			R. C. Sutcliffe, Ph.D.	

APPENDIX VI

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, 1936).

Weekly Weather Report for the period March 4, 1934, to March 2, 1935. Particulars of temperature, rainfall and bright sunshine for each week. *7s. 6d.*

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, 1936). *Not on sale.*

Seismological Bulletin. A diary of seismological disturbances recorded on the Galitzin Aperiodic Seismographs at Kew Observatory, Richmond (to February, 1936). *Not on sale.*

Observatories' Year Book, 1933. 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, 1928. Monthly and annual summaries of pressure, temperature, and precipitation based on a world-wide network of observing stations. *15s.*

British Rainfall, 1934. A report on the distribution of rain in space and time over the British Isles as recorded by over 5,000 observers. *15s.*

Southport Auxiliary Observatory. Annual Report and results of meteorological observations, 1934. By J. Baxendell. *Not on sale.*

OCCASIONAL :—

Fishery Barograph. A note on the use of the barograph in anticipating gales and instructions for the care and maintenance of barographs lent to fishing communities. 2nd edition, 1935, *2d.*

Indian Ocean Currents. Atlas of. (*In the Press.*)

APPENDIX VI—continued

Geophysical Memoirs :—

Vol. VII :—

67. Some measurements of the variation of potential gradient with height near the ground at Kew Observatory. By F. J. Scrase, M.A., B.Sc. *1s.*

Professional Notes :—

Vol. V :—

67. The rates of ascent and descent of free balloons and the effects of radiation on records of temperature in the upper air. By L. H. G. Dines, M.A. *6d.*
68. Some notes on the readings at Kew Observatory of the Gorczynski Pyrheliometer, the Sunshine Recorder and the Black Bulb Thermometer. By H. L. Wright, M.A. *2d.*
69. The frequency of days with specified duration of sunshine. By E. G. Bilham, B.Sc., D.I.C., and Lilian F. Lewis, B.Sc. *3d.*

The publication of the following books or papers by members of the Staff may also be mentioned :—

By SIR GEORGE C. SIMPSON, K.C.B., D.Sc., F.R.S.—

- Weather forecasting. *Nature, London, 135, 1935, pp. 703-5.*
- Obituary notice of Axel Wallén. *London, Quart. J. R. met. Soc., 61, 1935, pp. 394-5.*
- Lightning risks. *London, Quart. J. R. met. Soc., 61, 1935, pp. 445-8.*
- Obituary notice of Sir Arthur Schuster, 1851-1934. *London, Proc. roy. Soc., A, 153, 1935, pp. 409-23.*

By E. GOLD, D.S.O., F.R.S.—

- Fronts and occlusions. (Presidential address delivered before the Royal Meteorological Society, January 16, 1935.) *London, Quart. J. R. met. Soc., 61, 1935, pp. 107-57.*
- The effect of wind, temperature, humidity and sunshine on the loss of heat of a body at temperature 98° F. *London, Quart. J. R. met. Soc., 61, 1935, pp. 316-31, disc., pp. 331-43.*
- Change of potential energy of a layer of air with change of lapse rate. *London, Quart. J. R. met. Soc., 62, 1936, pp. 129-31.*

By F. J. W. WHIPPLE, M.A., Sc.D., F.Inst.P.—

- Progress in knowledge of the upper air. *Nature, London, 135, 1935, pp. 698-702.*
- On the relation between the mean velocity of the stars, the mean radial velocity and the mean transverse velocity. *London, Mon. Not. R. astr. Soc., 95, 1935, pp. 442-4.*
- The propagation of sound to great distances. *London, Quart. J. R. met. Soc., 61, 1935, pp. 285-308.*
- Sunshine records with convex mirrors. *London, Quart. J. R. met. Soc., 61, 1935, pp. 388-9.*
- Recent advances in seismology. *Nature, London, 136, 1935, pp. 782-4.*

By F. J. W. WHIPPLE, M.A., Sc.D., F.Inst.P., and A. W. LEE, M.Sc., D.I.C.—

- Notes on the theory of microseisms. *London, Mon. Not. R. astr. Soc. Geophys. Suppl., 3, No. 8, 1935, pp. 287-97.*

APPENDIX VI—continued

By E. G. BILHAM, B.Sc., A.R.C.S., D.I.C.—

On the interpretation of some measurements by A. C. Best of horizontal temperature differences over small distances. *London, Quart. J. R. met. Soc.*, **61**, 1935, pp. 159–64, disc., pp. 164–6.

Conference of Empire Meteorologists. *Nature, London*, **136**, 1935, pp. 404–5.

A humidity slide rule. *London, J. Sci. Instrum.*, **12**, 1935, pp. 318–22.

The incidence of intense rainfall as shown by autographic records. *Wat. and Wat. Engng., London*, **37**, 1935, pp. 622–6.

By A. H. R. GOLDIE, M.A., F.R.S.E.—

Some characteristics of the mean annual circulation over the British Isles. *London, Quart. J. R. met. Soc.*, **62**, 1936, pp. 81–98, disc., pp. 98–102.

By C. E. P. BROOKS, D.Sc.—

Review of: The pleistocene climate of Bermuda, by K. Bryan and P. C. Cady in *Amer. J. Sci., New Haven, Conn.* (Ser. 5), **27**, 1934, pp. 241–64. *Geogr. Rev., New York*, **25**, 1935, pp. 340–2.

Calculation of altitudes from aneroid readings. (App. II to The British Trans-Greenland Expedition, by M. Lindsay.) *London, Geogr. J.*, **86**, 1935, pp. 238–41.

The classification of meteorological literature. *London, Quart. J. R. met. Soc.*, **62**, 1936, pp. 134–44.

By C. E. P. BROOKS, D.Sc., and C. S. DURST, B.A.—

The circulation of air by day and night during the south-west monsoon near Berbera, Somaliland. *London, Quart. J. R. met. Soc.*, **61**, 1935, pp. 167–76, disc., pp. 176–7.

By C. E. BRITTON, B.Sc.—

Forgotten English meteorological societies. *London, Quart. J. R. met. Soc.*, **61**, 1935, pp. 343–6.

The cold winter of 1676–1677. *London, Quart. J. R. met. Soc.*, **61**, 1935, pp. 390–1.

Dubious frosts. *London, Quart. J. R. met. Soc.*, **62**, 1936, pp. 17–8.

By C. S. DURST, B.A.—

Smoke and visibility. Conference on Smoke and Aviation, London, May 30, 1935, pp. 3–18.

The structure of wind near the surface. *London, Quart. J. R. met. Soc.*, **62**, 1936, pp. 116–9.

By C. S. DURST, B.A., and W. H. BIGG, B.Sc.—

The diurnal variation of the maximum gusts occurring in each hour at Worthy Down (Winchester). *London, Quart. J. R. met. Soc.*, **61**, 1935, pp. 401–5, disc., p. 405.

By R. FROST, B.A.—

Note on eddy diffusion. *London, Quart. J. R. met. Soc.*, **62**, 1936, pp. 131–4.

By J. GLASSPOOLE, M.Sc., Ph.D.—

The drought over England and Wales during the years 1932 to 1935. *Wat. and Wat. Engng., London*, **37**, 1935, pp. 669–77, and *London, Trans. Instn. Wat. Engrs.*, **40**, 1935, pp. 190–226.

APPENDIX VI—continued

By F. J. SCRASE, M.A., B.Sc.—

The sampling errors of the Aitken nucleus counter. *London, Quart. J. R. met. Soc.*, **61**, 1935, pp. 367-78, disc., pp. 378-9.

By M. T. SPENCE, B.Sc.—

Temperature changes over short distances as shown by records in the Edinburgh district. *London, Quart. J. R. met. Soc.*, **62**, 1936, pp. 25-30, disc., pp. 30-1.

By J. M. STAGG, M.A., B.Sc.—

The diurnal variation of magnetic disturbance in high latitudes. *London, Proc. roy. Soc., A*, **149**, 1935, pp. 298-311.

Aspects of the current system producing magnetic disturbance. *London, Proc. roy. Soc., A*, **152**, 1935, pp. 277-98.

Numerical character-figures of magnetic disturbance in relation to geomagnetic latitude. *Terr. Magn. atmos. Elect., Washington, D.C.*, **40**, 1935, pp. 255-62.

Some general characteristics of aurora at Fort Rae, 1932-33. *London, British National Polar Year Committee*, 1935, pp. 1-6.

By R. C. SUTCLIFFE, Ph.D.—

Surface resistance in atmospheric flow. *London, Quart. J. R. met. Soc.*, **62**, 1936, pp. 3-12, disc., pp. 12-4.

By O. G. SUTTON, B.Sc.—

The logarithmic law of wind structure near the ground. *London, Quart. J. R. met. Soc.*, **62**, 1936, pp. 124-7.

By R. G. VERYARD, B.Sc.—

Scent and the weather. (Published by the Masters of Foxhounds Association of India, No. 1935/3.) Peshawar, 1935, pp. ii+33.

By H. L. WRIGHT, M.A., with J. H. COSTE—

The nature of the nucleus in hygroscopic droplets. *Phil. Mag., London* (7. Ser.), **20**, 1935, pp. 209-34.

By Miss L. F. LEWIS, B.Sc.—

Weather forecasting. *Wom. Engr., London*, **4**, 1936, pp. 88-91.

By R. M. POULTER—

Configuration, air mass and rainfall. *London, Quart. J. R. met. Soc.*, **62**, 1936, pp. 49-76, disc., pp. 76-9.