

Duplicate

M.O. 3

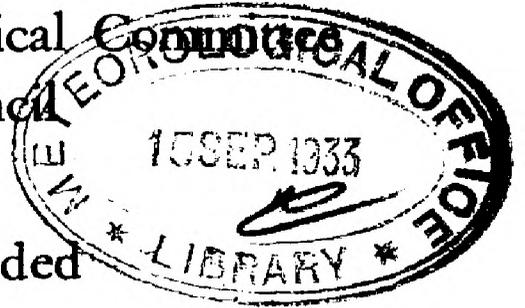
Lending Library

M.O. 358

FOR OFFICIAL USE

ANNUAL REPORT of the Director of the METEOROLOGICAL OFFICE

presented by the Meteorological Committee
to the Air Council



For the Year ended
March 31
1933

*The Seventy-eighth Year of the
Meteorological Office*

Crown Copyright Reserved



LONDON

AND PUBLISHED BY HIS MAJESTY'S STATIONERY OFFICE
and directly from H.M. STATIONERY OFFICE at the following addresses
House, Kingsway, London, W.C.2 ; 120, George Street, Edinburgh 2
York Street, Manchester 1 ; 1, St. Andrew's Crescent, Cardiff
15, Donegall Square West, Belfast
or through any Bookseller

1933

Price 1s. od. Net

A
ORGS UKMO Duplicate

National Meteorological Library
FitzRoy Road, Exeter, Devon. EX1 3PB



3 8078 0002 8542 1

CONTENTS

| | PAGE |
|--|------|
| LIST OF MEMBERS OF THE METEOROLOGICAL COMMITTEE | 3 |
| LIST OF MEMBERS OF THE COMMITTEE OF THE METEOROLOGICAL OFFICE, EDINBURGH | 4 |

REPORT

| | |
|--|----|
| GENERAL | 5 |
| MARINE DIVISION | 5 |
| FORECAST DIVISION | 6 |
| AVIATION DIVISION | 10 |
| BRITISH CLIMATOLOGY DIVISION | 14 |
| GENERAL CLIMATOLOGY DIVISION | 16 |
| ARMY SERVICES DIVISION | 17 |
| NAVAL DIVISION | 17 |
| INSTRUMENTS DIVISION | 19 |
| OBSERVATORIES | 19 |
| BRANCH METEOROLOGICAL OFFICES | 28 |
| THE INTERNATIONAL POLAR YEAR 1932-3 | 33 |
| INTERNATIONAL CO-OPERATION | 36 |
| PUBLICATIONS | 41 |
| STAFF | 42 |

APPENDICES

| | |
|---|----|
| I. CLASSIFICATION OF STATIONS WHICH REPORT TO THE BRITISH CLIMATOLOGY DIVISION | 43 |
| II. GALE WARNINGS ISSUED DURING THE YEAR 1932 | 44 |
| III. FINANCIAL STATEMENT | 45 |
| IV. THE GASSIOT COMMITTEE, 1932 | 46 |
| V. THE STAFF OF THE METEOROLOGICAL OFFICE, ITS OBSERVATORIES AND BRANCHES, MARCH 31, 1933 | 47 |
| VI. PUBLICATIONS | 52 |

METEOROLOGICAL COMMITTEE
1932-3

Appointed by the Air Council.

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

Vice-Chairman :—Sir ARTHUR SCHUSTER, F.R.S. Nominated by the Royal Society. (Till November, 1932) Colonel Sir HENRY LYONS, F.R.S. (From November, 1932).

Professor S. CHAPMAN, F.R.S. Nominated by the Royal Society. (From November, 1932).

Vice-Admiral H. P. DOUGLAS, C.B., C.M.G., R.N. Hydrographer of the Navy. Nominated by the Admiralty. (Till October, 1932).

Captain J. A. EDGELL, O.B.E., R.N. Hydrographer of the Navy. Nominated by the Admiralty. (From October, 1932).

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

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

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

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

Colonel Sir HENRY LYONS, F.R.S. Nominated by the Royal Society.

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

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

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

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

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

Secretary :—Mr. D. BRUNT, M.A.

Sir ARTHUR SCHUSTER, who had served as a member of the Committee since its inception, and as Vice-Chairman since 1920,

retired during the course of the year. The Committee recorded in their minutes their warm appreciation of the valuable services Sir Arthur had rendered to geophysical science generally, to the Meteorological Office, and to the Meteorological Committee, during a period of over 30 years.

Professor S. CHAPMAN succeeded Sir ARTHUR SCHUSTER as representative of the Royal Society on the Committee, and Sir HENRY LYONS was appointed Vice-Chairman.

From October, 1932, Captain EDGELL succeeded Vice-Admiral DOUGLAS as representative of the Admiralty on the Committee.

**COMMITTEE OF THE METEOROLOGICAL OFFICE
EDINBURGH, 1932-3**

Chairman :—The Director of the Meteorological Office.

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

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

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

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

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

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

Professor W. PEDDIE, D.Sc. Nominated by the University of St. Andrews.

Professor A. G. OGILVIE, M.A. Nominated by the University of Edinburgh.

The Edinburgh Meteorological Committee met on June 7, and October 31, 1932. Professor W. PEDDIE was nominated as representative of the University of St. Andrews.

A list of the staff and of the divisions and establishments of the Office will be found on pp. 47 to 51.

ANNUAL REPORT of the Director of the Meteorological Office presented by the Meteorological Committee to the Air Council for the year ending March 31, 1933 (the seventy-eighth year of the Meteorological Office).

There have been no major changes in the organization of the Meteorological Office during the year ending March 31, 1933. It has been a year of consolidation and the numerous changes and developments which have been recorded in the *Annual Reports* since the end of the War have now been assimilated, but the demands made on the Office continue to show a steady increase. The greater facilities for providing meteorological information, both on the climatological and forecasting sides, are being appreciated more and more by Government departments, commerce and the general public, as reflected in the number of inquiries and increasing demand for services. Naturally demands for aviation are increasing with the steady development of civil and private flying.

The chief matter of interest during the past year has been the despatch of the party to Fort Rae, North West Territories, Canada, to take part in the Second International Polar Year, a full account of which is given later in the Report (p. 33). With the exception of the preparation for this expedition the work of the Office has progressed with little incident. In the following pages are given short reports of the work in the various divisions of the Office.

MARINE DIVISION

The Merchant Shipping (Safety and Load-Line Conventions) Act 1932 became operative on January 1, 1933. Articles 34 and 35 of this Act deal with marine meteorology and impose on the master of a ship at sea the duty of reporting by all the means of communication at his disposal to the ships in his vicinity and also to the nearest land stations the presence of dangerous ice or dangerous tropical storms; while the Government undertakes to encourage the collection of meteorological data by ships at sea and to arrange for their examination, dissemination and exchange in the manner most suitable for the purpose of aiding navigation. The Act also particularizes certain ways in which the Government is to provide meteorological help for ships at sea, particularly in giving information of prevailing weather conditions, forecasts of anticipated changes and warnings of gales and storms. Thus the work commenced by Admiral Fitzroy when he was put in charge of the new Meteorological Department of the Board of Trade in 1855 has now become a legal international obligation.

It was decided last year to re-organize the work of the Marine Division with the object of extracting and making available for practical use the information contained in the thousands of meteorological logs which are in store in the archives of the Division, the plan being to reduce the number of new observations and to use the staff so released—with a certain amount of additional help—in working up the old records. In furtherance of this plan the number of ships which compile complete meteorological logs has been reduced to 50 and the voluntary observing fleet has been reduced to the total number necessary to provide the British quota of the so-called "Selected Ships", i.e. ships which take observations at specified times and immediately broadcast them for the use of other ships and shore stations. At the end of the year the voluntary observing fleet numbered 389 ships.

All meteorological logs received have been examined and the information required extracted so that the current observations are being completely dealt with as they arrive. A good start has also been made in the extraction of the old records.

The Marine Observer, which was commenced in January 1924 as a monthly journal to contain articles of scientific and practical interest to seamen and to form a vehicle for communication of instructions and information regarding the marine meteorological service, has been a great success, but in view of the need for economy and in order to set free more help for the extraction of old records, it has been converted from a monthly to a quarterly journal.

FORECAST DIVISION

The re-organization of the work of the Forecast Division set out in detail in last year's *Annual Report*, by which the whole of the weather forecasting, whether for aviation, shipping or the general public, was transferred to this Division, has been a success. As expected, it has been necessary to retain two types of working charts, one, which is mainly used for general forecasts, taking in a large area, and one of a smaller area on a larger scale on which more detailed information can be entered for aviation. The former of the two working charts has been increased in size so that the area of the map now includes a portion of Labrador and of Newfoundland, and extends from the American coast in the west to beyond the Ural Mountains in the east. The observations from both sea and land are sufficiently numerous to make it possible to draw a synoptic chart in considerable detail. The area of the chart used for aviation forecasting is much smaller, being mainly occupied by the British Isles and including only a small portion of the Atlantic on the west and the adjacent parts of the Continent on the east. Both working charts are prepared in the same room at the same time and forecasts are drawn up after consideration of the particulars contained on both of the maps.

In view of the ever-increasing dependence of one meteorological service on another and of the visits which pilots of aircraft pay to the meteorological stations of the various countries on their routes, it is highly desirable that the symbols entered on meteorological charts to indicate the data received—for example, the symbols to indicate rain, snow, hail, etc.—should be the same in all countries. The International Commission for Synoptic Weather Information has appointed a “ Sub-Commission on Symbols ” to formulate a set of symbols for international adoption. The preliminary proposals of this sub-commission vary in several material respects from the method in use in the British meteorological service and much consideration has been given during the present year to these proposals, and modifications based on experience have been formulated and communicated to the Commission.

The amount of meteorological information broadcast from all countries continues to increase rapidly and new sources of information are therefore constantly becoming available. During the latter part of the year messages transmitted from Horta in the Azores, three times a day have been received fairly regularly. These messages contain a number of observations from ships in the Atlantic which have frequently proved to be of considerable importance and utility.

During the year it was learnt that Russia was broadcasting a synoptic message each morning containing observations made at 0100 local mean time. These reports are now regularly received and plotted on the weather map containing 0100 G.M.T. observations. Reception of the international synoptic of messages issued from Paris, Hamburg and Moscow, which were referred to in detail last year, has continued to be on the whole satisfactory. Reception from America has been less good, but considering the long range of transmission it was quite as satisfactory as could be fairly expected.

Almost immediately after the end of the War, the Norwegian meteorologists developed the idea of the interaction of air masses of different origin, and showed how most of the outstanding features of weather occur along the boundary between two such air masses. These boundaries are frequently well marked at the surface and they can be shown on the synoptic chart; such lines marking the discontinuity between two air masses are called “ fronts ” and they play an increasingly important part in weather forecasting. From March 1, 1933 well-defined “ fronts ” have been indicated on the charts of the International Section of the *Daily Weather Report*. It is hoped that this will prove useful to schools and to those who are interested in the scientific study of daily weather.

Meteorologists have always felt the need for more information regarding the conditions in the upper atmosphere and during recent years scientific developments have been mainly along lines which have increased the importance of upper-air data. For instance, the fronts described in the last paragraph can be traced along

the earth's surface from the surface observations but the position of these fronts in the upper atmosphere—as they are by no means vertical—is of great importance, and only by observations of temperature from aircraft is this information obtainable. To meet this need most countries now have small meteorological flights of aeroplanes which take regular upper-air observations. The observations so obtained are immediately broadcast for the information of all countries. The great increase of upper-air data now available made it necessary to revise the form of the Upper-Air Section of the *Daily Weather Report* in which the data are published, and on January 1, 1933, the Section was published in a new form which provides room for details of 16 aeroplane ascents each day. Another important change in the Upper-Air Section was introduced at the same time. The increased information of upper air temperature and also of upper winds has at last made it possible to draw isobaric charts at levels of 1 km. and 2 km. above the surface for western Europe. Synoptic charts for these levels are therefore prepared whenever the information is sufficient and published in the "Upper-Air Section."

Weather reports broadcast by the British Broadcasting Corporation—During the year a special effort has been made to improve the wording of the forecasts which are broadcast by the B.B.C. so as to make it easier for the listener to obtain the information he requires, which is generally that of the anticipated weather in his own region. It is not easy to condense into a few words a description of the weather to be expected over the whole of such an area as the British Isles. For a number of years the practice has been to describe each of the weather elements for the different parts of the country, for example the anticipated distribution of the wind would be described, then that of the rain, then that of fog, temperature, etc. After a number of trials it has been decided to replace this method by one in which the British Isles is divided into several parts as required by the prevailing meteorological situation and to give as clearly as possible the anticipated weather for each of these parts, using of course as far as possible the main political divisions. Although the new method may involve a certain amount of repetition, experience has shown that it is now easier for a listener to obtain the forecast for that part of the country in which he is interested. It may be mentioned that the word "depression" has practically ceased to be used in the broadcast weather reports.

Aviation forecasts.—The increasing use of the aeroplane as a means of rapid transport by Royalty, members of the Cabinet and high officials, is reflected in the increasing demands for special forecasts before such flights are undertaken. In spite of the numerous broadcasts of information on flying conditions which are now made in code from the Air Ministry and by wireless telephony from the Heston Air Port, the number of inquiries from

civilian and Royal Air Force pilots for information for individual flights continues to grow. The number of general inquiries also shows a large increase, the total number of inquiries dealt with by the Forecast Division during the year being as follows :—

| | |
|---------------------------------------|-------|
| Inquiries from civilian pilots | 2,717 |
| Inquiries from R.A.F. pilots | 4,407 |
| Press inquiries | 4,477 |
| General inquiries | 4,228 |

Gale warnings.—The method of transmitting instructions to the gale-warning stations to hoist and lower the cones has been completely revised during the year. It has always been the practice to group the stations in districts and the districts were chosen so that generally one message would apply to all the stations in the district. It was found desirable to revise the districts in order to bring them more nearly into relation with the practical requirements of shipping. At the same time advantage was taken of the offer of the Board of Trade to undertake a great deal of the final distribution of the gale-warning messages after they had been received at certain selected stations. This was possible because a considerable number of gale-warning stations are coastguard stations which are connected by telephone. The Board of Trade consider the gale warnings a useful adjunct to their coast-watching and life-saving service. The whole method of distribution of the telegrams was discussed with the General Post Office and the Board of Trade and as a result the new system was devised and brought into operation at the beginning of January, 1933. The effect of the change has been to accelerate the delivery of gale-warning telegrams, especially those issued during the night. During October, 1932, only 55 per cent of the telegrams issued at night were delivered within two hours, while during January, 1933, after the change had been made, over 71 per cent of the night telegrams were delivered within this period.

Whenever gale warnings are issued, information is broadcast to ships at sea from the coastal wireless stations at Wick, Humber, Niton (Isle of Wight), Fishguard, Valentia and Malin Head. A ship which is approaching the British Isles from any direction will therefore receive from one of these stations notice of any gale warning which has been issued.

The usual table giving in summary form the results of the checking of the gale warnings issued during 1932–3 is printed as Appendix II. The number of warnings issued which were followed by gales or strong winds reached the gratifying total of 80 per cent while effective warnings of 92 per cent of the gales experienced were issued.

AVIATION DIVISION

As a result of the changes made during 1931-2, and described in last year's *Annual Report*, the Aviation Division is no longer responsible for the forecasts made at Headquarters for aviation; but it retains the responsibility for meeting all the other meteorological needs of aviation, including the forecasts made at distributive stations. This division is also responsible for the organization of all distributive and telegraphic reporting stations in the British Isles.

SERVICES FOR CIVIL AVIATION

(a) **Organization on regular air routes.**—A regular night air service between Croydon and Berlin was in operation until October; this service necessitated the meteorological stations at Croydon, Biggin Hill and Lympne remaining open day and night.

Reports of visibility and state of the sea at Dover have been included once daily in the "meteor" reports for civil air routes in connexion with the operation of a seaplane service between Dover and Calais by a French company.

In accordance with a resolution of the 34th International Aeronautical Conference held at Berlin in January, arrangements were made for special messages to be issued between 2205 and 2300, 0005 and 0100 and 0405 and 0500 commencing March 15, during which the three transmitting stations, Croydon, Cologne and Le Bourget transmit collective messages containing synoptic observations from the whole area covered by the air routes of western Europe. This arrangement enables full synoptic information for the night period to be picked up at any station on a single receiver by one operator, together with the normal half-hourly reports.

A captive balloon with a meteorograph attached for the purpose of measuring the height of the upper boundary of a fog was transferred from Kew to Croydon and was in operation at the latter station in September.

(b) **Supply of meteorological information for special flights.**—The routine for the supply of information in connexion with the carrying of mails by seaplanes catapulted from s.s. *Bremen* and *Europa* was operated as required during the summer months.

Special arrangements were made for the supply of meteorological information in connexion with the visit of the *Graf Zeppelin* to this country on July 2 and 3. A temporary meteorological station was opened at Hanworth and forecasts and landing data were supplied to the airship in flight between north-east France and Hanworth on the 2nd. Copies of the two most recent synoptic charts and a forecast for the 24-hour cruise round England were supplied to the Commander of the airship before leaving Hanworth on the evening of the 2nd and during the night of the 2nd and 3rd forecasts were supplied every six hours by W/T to the airship in flight. Charts and a forecast were supplied to the Commander of the airship on the 3rd for the return from Hanworth to Friedrichshafen.

As in previous years special arrangements were made for the King's Cup Air Race which took place in July. Meteorological Office staff were on duty at the controls at Brooklands, Bristol and Leicester, and arrangements were made for special weather reports and forecasts to be available at these controls.

The regular service of weather reports and forecasts from the Automobile Association radio station at Heston has been continued throughout the year. Considerable use of this service is made by private civil aerodromes within a radius of 200 miles of Heston.

Information was supplied to members of the Houston Mount Everest Expedition regarding the best period of the year for a flight over Mount Everest and the meteorological conditions likely to be encountered.

(c) Supply of special data for Civil aviation.—There has again been a large number of personal inquiries from pilots requiring meteorological information for projected long-distance flights.

A considerable amount of data has been supplied to the Directorate of Civil Aviation, including reports of projected new air routes by Imperial Airways on the southern side of the Persian Gulf and between Calcutta and Australia. Several reports on the meteorological conditions affecting sites for proposed municipal aerodromes have also been prepared.

(d) Navigators' and pilots' licences.—Examinations in meteorology were conducted for 2nd class navigators' licences in October and March and for 1st class navigators' licences in March; 120 viva voce examinations in meteorology were conducted for class B pilots' licences during the year, an increase of 30 on the previous year.

SERVICES FOR THE ROYAL AIR FORCE

(a) Supply of meteorological information for Service aviation.—The Royal Air Force Meteorological Committee met on two occasions during the year. As a result of these meetings the organization for the supply of meteorological information was improved in detail. The section of King's Regulations and Air Council Instructions dealing with meteorological organization was revised and a revised Air Ministry Order was published setting out the arrangements for the supply of meteorological information in this country.

The Committee devoted considerable time to examining the question of the transmission of station weather reports between different aerodromes for the cross-country flights and are examining means whereby the number of such reports will be decreased materially without depriving Service aerodromes of essential meteorological information.

A member of the professional staff of the Division was posted to Hendon to advise the Air Officer Commanding flying on meteorological questions during rehearsal and display days of the Royal Air Force Display in June.

Auxiliary reporting stations for the supply of weather reports for Service aircraft flying between Aldergrove and Catterick were opened in April at Portpatrick, Little Ross, Silloth and Appleby. Reports from these stations are transmitted daily at 8 a.m. to the Air Ministry, whence they are broadcast for the information of the meteorological staff at Sealand, Aldergrove and Catterick. Additional special reports are obtained on request.

(b) **Air Exercises.**—As in previous years special arrangements were made for the Air Defence Command Exercises which took place in July. Meteorological staff were attached to Command Headquarters to act as advisers on meteorological questions to Air Officers Commanding and temporary meteorological stations were opened as required.

Special arrangements have also been made during the year for exercises carried out by units in Wessex Bombing Area.

(c) **Supply of special data for Service aviation.**—Statements of weather conditions in various parts of the country were supplied during the year to the Inspector of Accidents. Memoranda on weather conditions in various parts of the world were supplied as required to other branches of the Air Ministry.

(d) **Meteorological arrangements for long-distance flights.**—A special meteorological organization was brought into operation for the non-stop flight of the Fairey-Napier monoplane from England to South Africa. In order that the pilots might be in possession of the latest and most detailed information before commencing the flight special meteorological arrangements were made at Cranwell. Special charts covering the Atlantic, Europe, the Mediterranean and North Africa were prepared four times daily. In addition, by the courtesy of the Director of the Meteorological Office, Pretoria, and the Surveyor General, Lagos, special data messages, including upper-wind information, from the coasts of the Union of South Africa and of South-West Africa and from Nigeria were received daily. All this information was collated by the meteorological staff at Cranwell and detailed information regarding conditions along the route supplied to the pilots. As everything was in readiness for the flight the decision as to whether the flight should be postponed or commenced on any particular day was governed mainly by the prevailing meteorological conditions. It was not an easy matter to ensure that the requisite conditions would be obtained, for the pilots required (a) a full moon, (b) a westerly wind at Cranwell for the take-off, (c) a following wind component along a large portion of the route and (d) reasonable weather conditions. The flight was postponed in November and December owing to bad weather conditions and in January owing to the death of one of the pilots, but it was successfully completed in February, when the machine flew non-stop from Cranwell to Walvis Bay.

Special meteorological organizations have been drawn up for several long-distance flights and cruises by Royal Air Force flying boats, both at home and abroad.

(e) **Meteorological instruction to Royal Air Force officers.**—Regular courses of instruction in meteorology have been continued during the year at the Cadet College at Cranwell, the flying training schools at Digby, Grantham and Sealand, the Royal Air Force base at Calshot, the School of Naval Co-operation at Lee-on-the-Solent, the Royal Air Force training base at Leuchars and the Air Pilotage School at Andover.

A weekly lecture in meteorology was given to a course for flight-commanders in Fighting Area during the individual training season. Occasional lectures have also been given at the Central Flying School, Wittering.

In addition to the above courses individual tuition and occasional lectures have been given by the local meteorological officers at the various stations.

Meteorological Flight, Duxford.—The work of this flight has been continued on the lines of preceding years, two ascents being made daily, excluding Sundays, for the purpose of obtaining upper air temperatures and humidities. The results obtained are of the greatest value in the forecast work and the Office is grateful to the pilots for the keenness they show in securing records from great heights and frequently in bad weather.

Upper-air observations.—The total number of pilot-balloon ascents made at outstations during the year either by the single-theodolite method or by the tail method, was 13,807. In addition, 6,474 nephoscope observations of medium and high clouds were made.

Registering balloon ascents have been made at Sealand during the year in conjunction with the Upper-Air Section at Kew Observatory.

Two hundred and seventy-nine observations of upper air temperatures by aeroplanes were received from Felixstowe, South Farnborough, Worthy Down and Leuchars, in addition to the observations made at Duxford.

Inquiries.—The total number of inquiries received at outstations during the year was 37,419, while 6,873 weather reports were passed from Croydon or Lympne to aircraft in flight on the civil air route. At Headquarters, 48 inquiries for data regarding weather conditions for aviation were dealt with. The total number of inquiries, excluding weather reports passed to aircraft in flight, was 37,467, an increase of over 8,500 on the corresponding figure for last year.

BRITISH CLIMATOLOGY DIVISION

The collection and publication of climatological data for the British Isles has continued along the customary lines. Observations are taken at a large number of stations in all parts of the country. These stations vary greatly in equipment and personnel. On the one hand there are the observatories maintained by the Meteorological Office where continuous records of all meteorological elements are obtained, and on the other hand the 5,000 rainfall stations, where the equipment is restricted to a rain-gauge which is read once a day. In Appendix I the particulars are given of the number of stations of the various types in each district into which the British Isles are divided. From this table it will be seen that 344 stations provide climatological data, while rainfall records are received from 5,329 rainfall stations. It is important to notice that practically all the rainfall stations and the stations classified as climatological stations in Appendix I are maintained by local authorities or private persons, who supply information without charge to the Meteorological Office. The observers at these stations carry out at considerable personal inconvenience a real public service.

The data collected are published for general use in the following publications :—

The Weekly Weather Report.—This publication which is issued annually, contains data from a certain number of selected stations, arranged according to weeks ; it is designed for special use in agricultural problems for which the week is a useful unit of time.

The Monthly Weather Report contains data from nearly all stations at which observations are taken, arranged according to months. The numbers are issued monthly.

British Rainfall.—This annual publication contains data supplied by the large number of rainfall stations with a description of the distribution of rainfall, and articles on interesting features connected with the rainfall of the year.

The Observatories' Year Book contains data from the five observatories, hourly values being given for most of the elements. The data are not confined to those of climatology, but data of terrestrial magnetism, atmospheric electricity and seismology are also contained in the *Year Book*. A section is devoted to observations made in the upper air.

All these publications have been kept up to date throughout the year.

Inquiries.—During the year, 2,097 general or scientific inquiries for particulars of past weather, including 190 legal inquiries, were dealt with ; these figures represent an increase of 16·6 per cent on those of last year.

Numerous inquiries for rainfall data were received from catchment boards set up under the provision of the Land Drainage Act, 1930.

A large increase in the number of inquiries from commercial firms affords evidence of a growing perception of the importance of climatic conditions in relation to manufacturing processes and to the sales of certain products. In particular, inquiries for humidity data have shown a definite increase.

Inquiries from other Government departments have shown a 50-per-cent increase; they include requests for information in connexion with investigations into fuel and light consumption and the relation between weather and the incidence of certain diseases.

Velocity equivalents of the Beaufort scale.—As from April 1, 1932, an important change has been made in regard to the determination of wind force on the Beaufort scales from the indications of an anemometer. Hitherto the scale of equivalents given in the "Meteorological Observer's Handbook" has been used at all stations although it was regarded as strictly applicable only to instruments with vanes or cups at 10m. (33 feet) above ground in an open situation free from obstruction, or when the "effective height" is 10m., allowance being made for the effects of existing obstacles. From April 1, special scales of equivalents have been brought into use at stations with anemometers at abnormal effective heights. Details of the new procedure are given in the *Meteorological Magazine* for January 1933.

Temperature averages.—The question of revising the averages of temperature used for the *Monthly* and *Weekly Weather Reports* has been the subject of close study in recent years. The matter became particularly urgent during the year under review owing to the running out of print of the "Book of Normals", Section I. In considering the policy to be adopted in preparing new tables of averages, account had to be taken of the fact that a serious discontinuity had been introduced into the statistics for telegraphic stations and health-resort stations by the adoption in 1921 of "day maximum" and "night minimum" instead of extremes for periods of 24 hours. Additional complexity was given to the problem by the fact that health resorts reverted to 24-hour extremes in 1926. It was decided, having regard to these and other considerations, that the most appropriate course was to work, *ab initio*, new averages of maximum and minimum temperature for all stations having at least 10 years of readings to December 1930 under the regime of either (a) extremes for 24-hours or (b) day maximum and night minimum. It was decided, further, that the averages should be straightforward arithmetic means for the number of years available up to a maximum of 30, no attempt being made to weight or adjust the means for shorter periods. The new averages will be published shortly under the title "Averages of Temperature for the British Isles for periods ending 1930".

GENERAL CLIMATOLOGY DIVISION

World Climatology.—The collection of meteorological data from all parts of the world outside the British Isles, especially from British Colonies and Protectorates, has continued throughout the year. The data are mainly collected from the publications of the various official meteorological services. Where no such publication takes place an endeavour is made to obtain copies of the observations in manuscript form. Such manuscript returns have been received from six foreign stations, from 69 stations in British Colonies and from ten Air Ministry stations in the Middle East, Iraq and Palestine.

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-four Colonies and Protectorates supplied reprints for 1931 containing data for 590 stations, an increase of 6 on the preceding year. An introduction entitled "Notes on Meteorological Observations made in British Colonies and Protectorates, 1931" is being prepared for issue with these reprints.

The work on the preparation of the *Réseau Mondial* has progressed steadily. The volume for 1925 has been issued, the manuscript of that for 1926 is complete, and the preparation of the tables for 1927 is well advanced.

For some years the *Réseau Mondial* has contained data for a number of five-degree ocean "squares". Unfortunately in the last year or two the number of observations taken on board ship which were available for compiling these means has shown a great decrease, and it will be necessary to omit many of these squares from the *Réseau Mondial* for 1926 and subsequent years.

Library.—The additions to the library during the past year included 487 new books and pamphlets and 12,683 daily weather reports. The number of periodicals received was 3,700. Books issued on loan during the year numbered 1,330.

Author and subject catalogues have been kept up to date and the preparation of the monthly list of meteorological papers, and the brief abstracts calling attention to those of special interest have been continued. A list of papers bearing on agricultural meteorology has been forwarded monthly to the Ministry of Agriculture and Fisheries, for incorporation in that Ministry's monthly report on the "crop weather" scheme.

Preparation of a new system of classification.—As described in last year's *Annual Report*, a draft classification of meteorological literature on the decimal system based on that employed at the International Institute of Bibliography, Brussels, was constructed in collaboration with the Science Library, and now awaits approval by the International Meteorological Committee. The proposals

have been received with interest in bibliographical circles, and a paper on "The decimal classification as applied to meteorology" was presented to the International Bibliographical Conference in August, 1932.

Lantern slides.—The lantern-slide collection was critically examined and a large number of obsolete slides were removed from it. The remainder were re-arranged and a descriptive card catalogue with references was compiled for the use of the curator. For more general use a "dictionary" catalogue was made, the use of which does not require a knowledge of the library classification. This new catalogue has proved very helpful to borrowers.

ARMY SERVICES DIVISION

The stations at Shoeburyness and Larkhill have been maintained, and temporary stations were opened at three summer artillery practice camps.

Lectures have been delivered from time to time to officers and men of different units by the officers-in-charge at Shoeburyness and Larkhill. An artillery officer was trained in pilot-balloon observational methods at Shoeburyness.

The Meteorological Section of the Royal Air Force Reserve was called up for a fortnight's training at Cranwell during October.

NAVAL DIVISION

Organization of Fleet meteorology.—Although the continued existence of a state of financial stringency both at home and in the Dominions and Colonies has had unfortunate repercussions upon the development of Fleet meteorology, some progress has been made in spite of the obvious difficulties.

With regard to naval stations abroad, attention has been concentrated mainly on implementing the recommendations of the various conferences on Fleet meteorology and co-ordination of organization generally. The issue of a Fleet synoptic message for H.M. ships on the Africa station was commenced by the meteorological service of the Union of South Africa in January, 1933, and the issue of routine forecasts for H.M. ships has been commenced by the Meteorological Office, Bermuda, although Fleet synoptic messages have not yet been instituted on the America and West Indies station. Action in regard to such messages is, however, being taken by the meteorological services of Canada and Bermuda, and it is anticipated that synoptic messages will shortly be instituted.

On the East Indies station, no change in the position described in the *Annual Report* for 1931-2 has occurred: the short synoptic message and forecasts issued from Colombo have proved of distinct assistance to H.M. ships, but the Indian Government is still precluded by the financial situation from giving effect to the main recommendations of the Colombo Conference on Fleet meteorology.

With regard to the China station, the issue of the Hong Kong Fleet synoptic message has been continued, but in June, 1932, the Singapore Fleet synoptic message included only two stations, on account of the cessation of telegraphic reporting for reasons of economy. With the resumption of telegraphic reporting the synoptic messages have returned to the original form.

Considerable difficulty has been experienced in maintaining complete uniformity in the times of weather reporting by H.M. ships on stations abroad. Dominion and Colonial services appear to be unable, on account of local conditions, to adopt the times of observation recommended by the Copenhagen Conference, and it has been necessary to agree in a number of cases to weather reporting by H.M. ships at times additional to those laid down by the Copenhagen Conference. In each case, however, every endeavour has been made to conform as closely as possible to the spirit of the resolution of the Conference and to emphasize in correspondence with Dominion and Colonial meteorological services the importance of conformity to international agreements.

Meteorological work in H.M. ships.—During the year H.M. ships made 740 weather reports to the Meteorological Office, London, and a considerable number to the meteorological services at Malta, Colombo, Hong Kong, Pretoria and Bermuda. 583 pilot-balloon ascents and 75 observations of upper-air temperatures were received from H.M. ships and 28 meteorological logs were forwarded.

In June, 1932, Mr. A. H. Nagle, Senior Professional Assistant in the Division, was appointed to H.M.S. *Challenger* for meteorological work during the 1932 survey of the Labrador coast. In addition to routine observations conforming as far as possible to the Polar-Year programme, special experimental work was undertaken and a number of upper-air observations made.

Training of officers.—The meteorological training of naval officers was continued during the year, the total number of officers attending courses being 47.

Attention has also been given to meteorological instruction at the Navigation School, Portsmouth; a complete meteorological equipment is being supplied to the School, the Division assisting in the installation of instruments, the provision of instructional diagrams, etc., and advising generally upon the syllabus.

Charting of the upper air over the sea.—Some progress has been made in the working up of the upper-air data already obtained, the preliminary tabulation of the first 2,000 pilot-balloon ascents, in 10° squares, having been completed.

Investigations.—Work in connexion with the development of single-observer forecasting has been continued.

Action has been initiated in the investigation of visibility at sea and Mr. Bennett (see p. 23) spent a period in H.M.S. *Courageous* in order to become acquainted at first hand with the practical problems in visibility confronting the naval forecaster.

INSTRUMENTS DIVISION

The arrangements for maintaining the equipment at stations both at home and abroad were continued, the outstanding feature of the year under review being the work carried out in connexion with anemometers. The pressure-tube instruments of the old pattern at Holyhead, Aberdeen and Gorleston and one of the anemobiographs in Iraq were replaced by modern pressure-tube anemometers with twin-pen direction recorders. Similar instruments were supplied to the new stations opened at the Lizard and Abbotsinch Aerodrome. Pressure-tube anemometers with Baxendell direction recorders were issued to Boscombe Down, Catterick and to the R.A.F. aerodrome at Abingdon.

The equipment for the Polar Year station at Fort Rae was completed, and arrangements made with the Customs authorities for its transit without delay due to Customs formalities on its despatch to, and subsequent return from, Canada.

Much time was given to the question of improving the quality of balloons for pilot-balloon work, especially those for use in hot climates. This work was carried out in conjunction with the Research Association of British Rubber Manufacturers and tests are now being carried out in Egypt, Malay, Samoa and some of H.M. ships on a type of balloon which it is hoped will prove more satisfactory than previous supplies. Arrangements were also made for balloons held in stock at headquarters to be stored in paraffin vapour, tests having shown that this method of storage preserves the balloons from deterioration.

OBSERVATORIES

The Meteorological Office maintains five first-order observatories, namely Kew, Eskdalemuir, Aberdeen, Lerwick and Valentia, at which meteorological and geophysical observations are made. These observatories are well spread over the country, being situated in south-east England, southern Scotland, northern Scotland, the Shetland Islands and south-west Ireland, respectively.

At all these observatories self-recording instruments are installed which give continuous records of all meteorological elements which it is possible to record automatically; eye observations are taken at regular intervals to control the recording instruments and to keep a record of such elements as cannot be automatically recorded. All observatories except Lerwick send observations by telegram to London at the standard hours of 7h., 13h. and 18h.

In addition to meteorological observations, self-recording instruments are installed at Eskdalemuir and Lerwick for giving a continuous record of terrestrial magnetism; atmospheric electricity is recorded at Kew, Eskdalemuir and Lerwick; while the seismographs at Kew give a complete record of earthquake activity.

Since 1922 the results obtained at the observatories have been published in a special publication entitled the *Observatories' Year Book*, of which the volume for 1930 was issued during the year under review.

KEW

Meteorology.—Air temperature.—During the spring and summer tests were carried out with a minimum thermometer provided with a copper shield, the use of such an arrangement for obtaining the lowest temperature at night at different heights without the complication of Stevenson screens having been proposed. It was found that the shielded thermometer frequently gave lower readings than the minimum thermometer in the Stevenson screen at the same height, the difference exceeding 1° F. five times in one month.

Earth temperature. Inspector's earth thermometers.—For the use of inspectors visiting stations where there are soil thermometers at depths of a few inches special sheathed thermometers are provided. The inspector makes a hole with a suitable tool and inserts his thermometer. It is found that reliable comparisons are made in wet weather but not in dry. A series of readings carried out in August and September led to the conclusion that wetting the ground was an effective way of securing a good comparison between the inspector's thermometer and the observer's thermometer but that the wetting of the ground might invalidate the observer's readings for the next few days.

Four-ft. earth thermometers.—The investigation of the results of different arrangements for obtaining the temperature at a depth of 4 ft. has been continued. A sensitive thermometer mounted on a rod which almost plugs the iron tube (which is of the ordinary Symons type) is being compared with another thermometer suspended in a second tube at the same depth. The test indicates that any error in the earth temperature at 4 ft. due to convection in the Symons tube is not more than 0.2° F.

Vapour pressure.—Apparatus for recording vapour pressure by using a hair hygograph in a thermostat through which air from outside is circulated was originally installed in 1931. The original thermostat was built of materials which proved to be hygroscopic. In July, 1932, a new thermostat was set up in the north room of the clinical house, and interesting records showing directly the changes in vapour pressure are being obtained.

Jardi raingauge.—A Jardi raingauge was set up on brick piers in front of the Observatory on October 7, 1932. The apparatus is designed to record the rate at which rain is falling. The scale is linear up to the maximum, 150 mm./hr., represented by 75 mm. The merit of the instrument is that it gives a more vivid picture of the weather sequence than is provided by the ordinary integrating rainfall recorder. (*Note:* Similar raingauges have been set up at Valentia and Aberdeen. An older pattern of Jardi recorder has been in use at Eskdalemuir since April, 1929).

Air waves.—The investigation of the propagation of air waves to great distances by recording the waves from the firing at Woolwich Arsenal was supplemented during the year by two experiments in which the help of the general public could be obtained.

On July 14, during a review of the Fleet in West Bay near Portland by H.M. the King, three battleships fired eight simultaneous broadsides. The public had been warned and numerous reports were collected. The firing was heard very distinctly in an outer zone of audibility in the north-west quadrant, i.e. in Cornwall and in South Wales.

On December 15, 1932, there was a series of explosions at Oldebroek in Holland. In addition to those at the four University stations special microphones were in operation at Hythe and at Foulness. The results were negative. On the other hand there is fairly satisfactory evidence that infra-sonic waves caused vibration of windows and doors over a considerable area in the middle of England*. Good records of the air waves were obtained in Germany in accordance with the usual rule that abnormal audibility occurs in winter to the east of the source.

The Woolwich trials took place on 5 days during the summer and on December 16. On the last occasion a new station, North Walsham, came into operation for the first time but was not successful in obtaining any record of the firing. An unexpected feature of the year's results was the non-receipt of air waves at the stations in the west on August 25. Previously there have been successful reception of waves at Cardiff as late as September. On August 25, 1932, the only receptions were at Nottingham.

Atmospheric electricity.—Potential gradient.—In recent years there have been numerous comparisons of potential gradient measured in different ways in different parts of the Observatory grounds. The site in the garden which had been used for the standard observations suffered from the drawback that there were various obstructions near by. The site was obviously not the best available approximation to part of an infinite plane. Moreover it was desirable to have the fundamental observations of potential gradient and of air-earth current on the same spot. It was known that the potential gradient over the test-plate of the underground laboratory was (within about one per cent) the same as the mean gradient in the first metre over the grass of the paddock. Accordingly the observations with the test-plate have been adopted for the standardization of the potential-gradient records as from the beginning of 1932. Frequent comparisons are made between the potential gradient immediately over the test-plate and the mean gradient for a metre either over the roof of the laboratory or over grass.

**Nature*, 130, 1932, p. 1008 & 131, 1933, p. 138.

The electrical data published during the period 1898 to 1931 are being revised. In the case of potential gradient the amended figures will correspond with the open site in the paddock.

The variation of potential gradient with height has not been studied extensively hitherto. Poles were erected in August, 1932 to carry the apparatus intended for use in an investigation of this subject. The apparatus is designed so that two radio-active collectors a metre apart can be raised to any height up to 10 metres from the ground. The collectors are connected to an electrometer. The principal difficulty in using such apparatus is to obtain sufficiently good insulation, the potential at 10 metres being so high that sparks can be obtained from the electrometer. Observations have to be restricted to days on which humidity is low. The preliminary work indicates that information of great interest will be obtained with this apparatus.

Portable Wilson apparatus.—To facilitate the measurement of air-earth current at observatories without an underground laboratory a system by which a Wilson electrometer can be used in a small pit has been devised. Experiments with this arrangement indicate that the differences between the conductivities of the air near the ground at different points are larger than had been anticipated.

Ionization recorder.—The apparatus designed for giving continuous records, from which the total conductivity of the air, the number and mobility of the small ions can be found, has been improved and brought into regular operation. It is proposed to tabulate all satisfactory records for the year 1933. To facilitate discussion of the records the air-earth current recorder will be maintained in regular use during the same period.

Records of point discharge.—For the study of the electric current which passes through exposed points during thunderstorms and other times when potential gradient is high the plan of using a needle point at a height of 10m. with a cable leading the current to a galvanometer and so to earth has been adopted. In June, 1932, a suitable recording drum was provided for this apparatus so that it can operate throughout the 24 hours but yield a record on an open time scale, each minute being represented by about 1 cm. It is found that by this arrangement eloquent records of the electrical conditions in disturbed weather are obtained.

Aitken nuclei : charged and uncharged.—A cylindrical condenser has been attached to the Aitken nucleus counter so that the numbers of nuclei charged and uncharged can be counted. Between 45 and 73 per cent of the nuclei are uncharged.

Atmospheric pollution.—On behalf of the Atmospheric Pollution Research Committee comparisons of the amount of rainfall and of pollution obtained with various gauges have been made at the

Observatory since 1927. The results obtained up to March, 1932, have been summarized and published in a paper printed in the *Eighteenth Report on the Investigation of Atmospheric Pollution* issued by the Department of Scientific and Industrial Research.

Two gauges of the same pattern are being kept in operation so that the order of consistency in records covering a period of several years may be investigated.

Seismology.—During the calendar year 1932 the number of earthquakes recorded was 244, of these 8 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 8 cases the azimuth of the epicentre could be determined.

The principal work in seismology during the year has been a world survey of microseismic disturbances during a selected month, January 1930. The characteristics of the disturbance at British stations during that month had already been studied and a letter was sent in June 1932 to seismological stations in other parts of the world asking for the magnitude of the microseisms recorded during the month in question to be tabulated. There has been a generous response to this application. Up to the end of March 1933 sets of tabulations had been received from 38 observatories, whilst records had been lent from 12 other observatories for tabulation at Kew. The investigation has produced results of considerable interest.

Dr. H. M. Tickell, who has very kindly been acting as an honorary assistant since June 1932, has given much time to the re-arrangement of the seismological records.

When the Galitzin seismographs were installed at the Observatory it was found that the pillar on which the pendulums were placed was subject to comparatively large oscillations whenever there was appreciable wind. It was not known whether the oscillations of the ground were confined to the immediate neighbourhood of the Observatory or whether they would be appreciable at any place in the Observatory grounds. To investigate this question a Milne-Shaw seismograph was obtained on loan from the Science Museum in May 1932. This seismograph was set up first in the pendulum room and then in the underground laboratory. It was found that in the latter position the instrument was not affected by wind disturbance. It is accordingly proposed to make an underground room for seismology as soon as funds are available.

Visibility.—Mr. M. G. Bennett has continued to carry out researches on behalf of the Inter-Departmental Visibility Committee. Among the subjects investigated by him may be mentioned the effect of the varying transmission of the atmosphere, for light of different wave-lengths, upon the visibility of white and coloured lights and of objects illuminated by a beam of light such as a motor head-light.

Mr. Bennett has co-operated with the Gas Light & Coke Company in initiating measurements of the light transmission factor of the atmosphere in London. The results should form a useful addition to the data already available for country air.

The question of the effect of the optical properties of the atmosphere upon the visibility of lights at night and the relation of the visibility, as thus measured, to the visibility of ordinary objects by day, has been further considered, with a view to drawing up a satisfactory scheme of visibility observations at night.

The measurements of fog height by the method suggested by Mr. Brunt, referred to in the last *Annual Report*, have been continued. They showed that the method reveals very clearly and accurately the position of the top of a fog. The matter has now been referred to the Instruments Division of the Office, where a light recording instrument which can be sent up through a fog on a small balloon is being developed.

A service of special fog forecasts has been arranged for certain stations on the L.M.S. railway line. The service is so far only in a preliminary stage of development, but it is understood that it has already proved of value to the Company.

Mr. Bennett is studying the processes of evaporation and condensation in the atmosphere over soils of different types and with different coverings, with the object of explaining the occurrence of fog patches in otherwise uniform areas.

Many visibility problems arising in other Government departments have also been studied by Mr. Bennett during the past year.

Investigation of the upper atmosphere.—Soundings of the upper air were made on 46 occasions, mostly on the "international days of the first order." In 13 cases the meteorograph was never found, but the remaining 33 provided good records. The mean height reached was $16\frac{1}{2}$ km. distributed as follows :—

| | | | | |
|-------------------|-----|-----|-----|----|
| Above 20 km. | ... | ... | ... | 7 |
| From 15 to 20 km. | ... | ... | ... | 17 |
| From 10 to 15 km. | ... | ... | ... | 4 |
| Below 10 km. | ... | ... | ... | 5 |

Soundings with balloons carrying special instruments (see last year's *Annual Report*, p. 28) have been made on a few occasions from Kew Observatory to measure the magnitude of vertical currents in thunderstorms. A number of these instruments have now been distributed to the meteorological stations at Calshot, Upper Heyford and South Farnborough for use as occasion may offer. The records are as yet too few for discussion.

In conjunction with the Government Chemist a piece of apparatus has been devised with which it is intended to obtain samples of the atmosphere from great heights for the estimation of water content. It is hoped to make use of it shortly.

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 continuously throughout the year. They have been supplemented by an auxiliary set of instruments recording the same elements, but at about half the sensitiveness of the standard set, so that values might be obtained when the record from the more sensitive standard magnetographs exceeded the limits of the photographic paper. The records have been standardized by absolute observations of declination, horizontal force and dip made twice weekly; in addition declination has been observed on all days except Sunday.

The new Schuster-Smith coil magnetometer installed last year for the rapid absolute determination of horizontal force has been in continuous operation. Results from it were slightly lower than those from the standard Kew magnetometer. A re-determination of some of the constants of the Kew magnetometer has practically accounted for the difference between the two magnetometers.

In January, 1933, a series of observations of horizontal force was made by Mr. Witchell of Greenwich, using Kew magnetometer Casella 181 from Abinger, with a view to comparing the standard absolute magnetic instruments at Eskdalemuir and Abinger.

One of the objects of the International Commission for the Polar Year is to study in detail the small oscillations associated with certain magnetic disturbances. In order to co-operate in this study a modern, "quick-run" recorder by Dr. la Cour was installed in August to record rapid changes in H , D and V , with an extended time-scale, all on a single sheet.

Hourly values of magnetic declination have been supplied weekly for publication in *The Colliery Guardian* and *The Iron and Coal Trades Review*, alongside simultaneous data for Abinger. Arising out of this arrangement, in connexion with colliery survey work, copies of declination records and other information have been supplied to several firms of mining engineers and surveyors.

Whenever auroræ have been seen at night, a continuous watch has been maintained and a diary of changes compiled. For measuring altitudes and elevations of the auroræ a simple theodolite with open sights has been erected on the roof of the tower.

Meteorology.—The routine work of a first-order station, the despatch of telegraphic reports at 7h., 13h. and 18h. G.M.T. to Headquarters, and the supply of data for the *Weekly* and *Monthly Weather Reports* were maintained as in previous years.

In connexion with the investigation into upper air conditions during the Polar Year, pilot-balloon ascents have been made on all the selected days of the first order.

The standard Fortin barometer was returned after repair by the makers in August. The subsequent comparison with the standard Kew pattern barometer showed that the readings of the two barometers were in agreement and the Fortin instrument was re-installed as the standard on January 1, 1933.

Observations of solar radiation have been carried out with an Ångström pyrheliometer whenever conditions were favourable, the total number for the year being 19.

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 electrometers in use have been regularly standardized by means of a high-tension dry battery, calibrated with a standard cell and potentiometer.

ABERDEEN

In the *Annual Report* of two years ago a detailed account was given of the interference caused to the Aberdeen wind records through the development of building in the neighbourhood of the anemometer. The investigation of the wind records in order to obtain a continuous record or at least to estimate the differences between different periods has necessitated a large amount of computing work at the Observatory in recent years. During the year under review preparations have been made for the removal of the outdoor instruments to a new site and the erection of a new pressure-tube anemograph thereon. The new site lies on University land to the westward of the High Street of Old Aberdeen, and about 300 yards distant to the north-west from the Observatory Tower. This land is higher generally than its immediate surroundings, and the exposures both for the anemograph and for the other instruments are much better than were the previous exposures of these instruments. Furthermore, whereas previously the pressure-tube anemograph was situated over 400 yards east of the Observatory, and the screen and raingauges at another site to the north-east, there is now the great advantage that all the outdoor instruments are within the one enclosure. The enclosure fence is 150 feet square and within it there is ample room for the instruments to be well spaced and subject to no shielding effects from each other. The removal and re-erection of the instruments is only just completed and there still remains some work to be done before everything is in thorough order.

An additional instrument, the Jardi rate-of-rainfall recorder, is being installed at the new site.

LERWICK

The Lerwick Observatory was established mainly for observations of terrestrial magnetism, atmospheric electricity and the aurora. Meteorological observations are taken only in so far as they are necessary for the main purpose of the Observatory, but self-recording instruments for wind, pressure and sunshine are maintained.

During the year now under view no alterations beyond a few small adjustments were made to the standard magnetographs. The daily range of temperature in the subsidiary magnetograph house has been considerably reduced by painting the outside of the hut white.

In October a new magnetometer of the Schuster-Smith portable type was taken into use, the hut for absolute observations having previously been enlarged sufficiently to house the additional instrument. Comparative observations show that the measurements of magnetic horizontal force obtained by the new instrument are fairly consistently about 18γ below those obtained by the Kew magnetometer. The difference is similar to that found at Eskdalemuir and the matter is under investigation.

In the matter of auroral observations the usual watch has been maintained and photographs have been taken on suitable occasions. In addition, as part of the contribution of the Observatory to the Polar Year scheme, a second auroral station has been established at Urafirth, about 26 miles north of the Observatory, and on suitable occasions simultaneous photographs of aurora have been taken from the two stations, which were connected by telephone. The cameras at both stations were new ones of much greater sensitivity than the one formerly in use. The results have been somewhat disappointing, as only 34 pairs of photographs have been taken up to date. This is chiefly because aurora, especially active aurora, has been very rare; but partly, also, because suitable auroræ have often persisted for a few minutes only, and have disappeared before the installation could be brought into action. Moreover, occasions when both stations are free from cloud are by no means frequent.

In atmospheric electricity and in meteorology the usual routine has been maintained, with some additional thermograph and hygrograph records required in connexion with the Polar-Year scheme.

The two 200-foot wireless masts which formerly stood within the grounds were dismantled during the summer.

VALENTIA

Valentia Observatory was established chiefly with the object of obtaining complete meteorological records for south-west Ireland. This work has been continued without a break since 1867, but during recent years the work of the Observatory has developed largely as a reporting station for the Forecast Division. The geographical position of Valentia makes it the most important reporting station in Europe, and all meteorological services depend on the accuracy of its observations for the success of their forecasts. In addition to the meteorological work, absolute observations of magnetic declination, horizontal force and dip are made weekly.

The Director visited the Observatory in June, 1932.

BRANCH METEOROLOGICAL OFFICES

EDINBURGH

The Edinburgh Meteorological Office acts as a local centre for the organization of climatological and rainfall stations in Scotland, and for the administration of the three observatories at Eskdalemuir, Lerwick and Aberdeen. The number of climatological stations in Scotland is now 83 and the number of rainfall stations about 900. The Edinburgh Office also receives the monthly registers and autographic records from 8 telegraphic stations in Scotland before they are forwarded to London.

New climatological stations have been started during the year at Dunoon, Forres and Peebles ; the station at Dunoon was set up by the Forestry Commission, while those at Forres and Peebles are of the health-resort class. During the year the stations at Dunfermline and Turnberry became health-resort stations. Three long-established stations lapsed during the year, namely Smeaton, Dundee (Eastern Necropolis) and Bangour. The first mentioned was a voluntary station, first a rainfall station and afterwards a climatological station, and was maintained by one family for about a century, though there had been occasional breaks in the record.

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. Some changes were made in the tabular matter included in the annual report, the effect of these changes being to bring the general form of the report more closely into accord with that followed by the Registrar-General for England and Wales.

The total number of inquiries received was 184, of which 86 were dealt with by correspondence and 98 by interview or by telephone. As in the previous year meteorological data were supplied on several occasions in connexion with investigations of the incidence of crop or animal diseases, also in connexion with flooding. One inquiry was in connexion with a water-power scheme in the Galashiels area. A number of inquiries were in connexion with losses or damage sustained by fishing vessels.

The Scottish Command was supplied with weather forecasts in connexion with transport experiments under certain conditions.

For use in connexion with the field survey work of the Ordnance Survey Department, Southampton, comparative magnetic data were extracted from the records of Eskdalemuir and Lerwick observatories.

MALTA

The routine observation work of the Office continued unchanged, full surface observations being made three times daily, and pilot-balloon ascents twice daily. As in previous years the most important side of the Office routine was work for the Services and in this respect

the development has been progressive. Requests for information by local institutions, in particular by the port authorities, also continued to increase.

The Royal Navy again made the greatest demands on the Office in respect of reports and forecasts, but the requirements of the Army, the Royal Air Force and civil aviation continued to increase. An interesting feature was a marked increase in requests for reports and forecasts for local Service sports events. As sports play an important part in Service training this has been encouraged.

The Italian civil air line operating the mail and passenger service from Malta to Syracuse and Tripoli increased its routine runs during the year with a consequent marked increase in the number of weather reports required.

The volume and accuracy of synoptic reports continued to show an improvement, the collective issues from France and Germany in particular having been found very useful. For local forecasting, however, it was still necessary to take many of the national issues from Mediterranean countries. Reports from the eastern Mediterranean and from the Sahara continued unsatisfactory. The improvement noted last year, in the number of reports received from merchant ships, was maintained. The absence of 0100 (1h. G.M.T.) reports from Mediterranean countries continued to be felt, particularly for the gale-warning service, and when early forecasts were required for aviation.

Increased interest in the work of the Office, in co-operation with the Services and local authorities was shown by an increase in the number of visitors to 138 from 105 in the previous year.

METEOROLOGICAL SECTION—MIDDLE EAST

No change has taken place in the normal observation work of the Section. Full observations have been made regularly four times daily and pilot-balloon ascents twice daily at each of the stations Heliopolis, Aboukir, Ismailia, Ramleh and Amman. In addition, regular observations of surface conditions have been made by Imperial Airways staff at Gaza and Mirabello (Crete) and by Royal Air Force personnel at Limassol (Cyprus) to suit air-mail services or special flights. Routine forecasts broadcast twice daily from Heliopolis have, since July, 1932, been issued in the international code for aviation weather forecasts instead of in plain language as hitherto.

W/T reception of meteorological reports has not been altogether satisfactory and on occasions difficulty has been experienced in obtaining sufficient and reliable information to enable forecasts to be prepared. The central European broadcasts were for a time received at very poor strength, the direct issues from Italy and Syria have been seldom heard and the issues from Greece and Asia Minor which are so important for forecasting for trans-Mediterranean air routes have at times not been received for periods of several weeks.

Meteorological reports issued by W/T by merchant ships in the Mediterranean and Red Sea have been received at Heliopolis and plotted on the synoptic charts.

On completion of the experimental work in connexion with the vertical temperature-gradient recorder at Ismailia, the installation was dismantled in October, 1932.

Royal Air Force.—The routine forecasts issued from Heliopolis satisfied to a large extent the requirements of units in Middle East area. For cross-country flights surface observations and upper-wind reports were supplied by stations on request and special reports and forecasts have been supplied for reconnaissance flights to and from Cairo. Requests for meteorological data have been received from various branches at Headquarters, Royal Air Force, Middle East.

Meteorological lectures have been given regularly to pupils at No. 4 Flying Training School, Abu-Sueir, and candidates have been examined in meteorology for the 2nd class navigators' and class "B" licences.

In connexion with the International Polar Year, observations of upper-air temperature have been made on 1st-order days by selected Royal Air Force units in Egypt, Palestine, Trans-Jordan and the Sudan.

The Army.—At the request of the War Office, meteorological co-operation was provided for an investigation into the strength of atmospheres at different times of the day carried out by the Royal Corps of Signals.

A summary of the general weather conditions (with special reference to the rainy seasons) from Cairo to Cape Town was supplied to the Officer Commanding, W.D. Experimental Convoy, Royal Army Service Corps. The information was required in order to decide as to the best time of the year for a road convoy to make the journey from Cairo to Cape Town.

Rainfall data for Palestine, extracted from observations of the past 10 years were supplied to General Staff, Headquarters, British Troops in Egypt.

Civil aviation.—Increasing demands have been made by Imperial Airways, the K.L.M. Dutch Air-Mail Service, the Misr Airwork Co., Egypt, and private owners. For Imperial Airways, regular reports and coded forecasts have been supplied to meet the requirements of the air-mail services en route from England to India and England to Cape Town. Close co-operation has been maintained with the Operations Division of Imperial Airways at Heliopolis and with the captains of aircraft on the various routes. A system of reporting weather conditions by W/T at selected intervals whilst flying over the Mediterranean routes has proved of great assistance in forecasting and in checking the forecasts issued.

Egyptian Army Air Force.—Headquarters and the main aerodrome are at Almaza, about 1½ miles to the north-east of Heliopolis, and a considerable number of telephonic inquiries have been received

and dealt with since the first aircraft arrived from England in June, 1932. Most of these inquiries have been for forecasts from Cairo to various places in Egypt and Sinai (Alexandria, Metruh, Siwa, Luxor, Aswan, El Arish, etc.).

Physical Department, Cairo.—Liaison has been maintained with the Director, Meteorological Service, Physical Department, Cairo, and a daily exchange of meteorological information has been made by telephone. Hydrogen has been issued on repayment to the Department and shipped by them to Sollum (Western Desert coast station) where pilot-balloon ascents have been made regularly.

METEOROLOGICAL SERVICE, IRAQ

The meteorological service in Iraq was completely civilianized and all meteorological duties were taken over from the Royal Air Force from April 1, 1932.

The meteorological service in Iraq now comprises :—

- (a) a headquarters at Hinaidi, staffed by one assistant superintendent, one senior professional assistant, one M.O. clerk, Grade II, and five native clerks ;
- (b) distributive stations at Mosul and Shaibah, each staffed by one M.O. clerk, Grade II, and one native clerk ;
- (c) reporting stations at Ramadi and Diwaniyah, each staffed by one native clerk, and
- (d) a reporting station at Rutbah, the observations being made by an employee of the Iraq Posts and Telegraph Department.

At all stations routine observations have been made thrice daily and pilot-balloon ascents about dawn daily. At Hinaidi, Mosul and Shaibah an afternoon ascent has also been made daily throughout the winter half of the year, while all stations have made additional ascents on request.

The procedure for " warning " and " improvement " messages has been revised and the abbreviated plain-language messages are now in general use.

Efforts have been made to improve the reception of the Syrian broadcasts, and the reports from Persian Gulf stations, but the former are still received irregularly and most of the reports are unreliable.

The Royal Air Force.—Close liaison has been maintained with Air Headquarters, Iraq Command, and with all R.A.F. units in Iraq. The British meteorological officers are accommodated at the Air Headquarters mess and at the messes of flying units, and this has considerably facilitated mutual co-operation. Personal talks with pilots have resulted in a number of observations of upper air temperatures being made at Hinaidi, Mosul and Shaibah, but the majority have been for heights up to 6,000 feet only.

Routine forecasts for Iraq areas and the Persian Gulf area, upper wind and weather reports, have been issued daily to all stations. In addition to the normal routine, 509 forecasts and 925 weather and/or upper-wind reports were supplied to R.A.F. pilots.

Amongst the special flights for which additional information was supplied were :—

- (a) the transportation of an infantry battalion from Egypt to Iraq and return ;
- (b) air operations in Kurdistan ;
- (c) flights of Rangoon flying boats between Alexandretta and Basra ;
- (d) periodical flights between Iraq and Egypt, and
- (e) flights of H.E. the High Commissioner between Baghdad and Teheran.

Much time has been devoted to the preparation and supply of climatological information, including :—

- (a) data for landing grounds in Iraq ;
- (b) a preliminary report on meteorological conditions on the Basra-Aden route ;
- (c) meteorological data for the " Military Report of Iraq " ;
- (d) data for investigations made by the medical, supplies, engineering, W/T repair, and transport branches of the Royal Air Force.

Royal Iraq Air Force.—An increasing interest in meteorology has been taken by the Royal Iraq Air Force and, in addition to the daily forecasts, special forecasts and reports have been supplied for operations, manoeuvres and demonstration flights.

Civil aviation.—The distance of the Meteorological Office, Hinaidi, from the civil airport at Baghdad militates against close liaison with the civil aviation companies operating over Iraq ; and it is impossible to discuss meteorological matters with pilots or representatives of the companies, except on few occasions, unless additional British staff are authorised at Hinaidi.

Weather forecasts and reports have been issued to Imperial Airways, French Air Orient, Royal Dutch K.L.M. and other civilian aircraft. During the year 560 forecasts and 860 weather and/or upper-wind reports have been issued from Hinaidi to civil aircraft.

Upper-wind reports from Hinaidi and Ramadi and all " warning " and " improvement " messages are telephoned daily to the Civil Airport, Baghdad, for transmission to aircraft in flight and to Rutbah. The Iraq forecasts, broadcast at 1600 G.M.T. are received daily at Rutbah, so that all aircraft entering Iraq from the west and landing at Rutbah can obtain adequate meteorological information.

Local Government departments.—Meteorological data have been supplied, on request, to local Government departments ; amongst others, to the Department of Health ; to the Director of Civil Aviation, in connexion with the inauguration of the new civil airport at Baghdad ; to the Irrigation Department for the investigation of floods ; to the Iraq Railways for a study of the effects of rainfall ; and to the Baghdad Water Board for the investigation of the effects of frost.

Details of temperatures and humidities at Hinaidi, Mosul and Shaibah have been supplied daily to the *Iraq Times*.

General.—Establishments of instruments and equipment, domestic stores, furniture and tools, for the meteorological service in Iraq were authorized in December, 1932. The replacement of obsolete equipment in Iraq is gradually being effected.

The training of the native staff, involving the numerous replacements of unsuitable clerks after some months of training, has involved the expenditure of much time by the British staff at Hinaidi and, with the existing authorized establishment of staff in Iraq, it is exceedingly difficult to maintain routine work and returns up to date.

THE INTERNATIONAL POLAR YEAR 1932-3

In spite of the serious economic crisis which has affected the whole world since it was decided to celebrate the jubilee of the First International Polar Year 1882-3 by organizing a Second International Polar Year, the scheme is being carried through with remarkable completeness, no less than fourteen countries sending special parties to occupy one or more stations in polar regions, namely :—

| | | | |
|--------------------------|-----|-----|---|
| Austria | ... | ... | Jan Mayen. |
| Canada | ... | ... | Chesterfield Inlet, Canada. Cape Hope's Advance, Canada. Coppermine, Canada. |
| Denmark | ... | ... | Thule, Greenland. Julianehaab, Greenland. Angmagssalik, Greenland. Snaefellsjökull, Iceland. (Jointly with Switzerland). |
| Finland | ... | ... | Petsamo, Finland. |
| France | ... | ... | Scoresby Sound, Greenland. |
| Germany | ... | ... | Arsuk, Greenland. |
| Great Britain | ... | ... | Fort Rae, Canada. Tromsø, Norway. |
| Holland | ... | ... | Reykjavik, Iceland. |
| Norway | ... | ... | Tromsø, Norway. |
| Poland | ... | ... | Bear Island. |
| Sweden | ... | ... | Spitsbergen. |
| Switzerland | ... | ... | Snaefellsjökull, Iceland. (Jointly with Denmark). |
| United States of America | | | Fairbanks, Alaska. Point Barrow, Alaska. |
| U.S.S.R. | ... | ... | Franz Josef Land Cape Chelyuskin, U.S.S.R. Lena Mouth, U.S.S.R. Kolymsk, U.S.S.R. St. Laurence Bay, U.S.S.R. |

News has been received that all these expeditions have safely arrived and at the time of writing are in the middle of a successful year's observational work.

The programme drawn up by the International Commission for the Polar Year 1932-3 includes observations at existing stations in all parts of the world, and also from ships at sea. Special instructions and advice have been given by the London Meteorological Office to the stations which provide observations for the annual volumes of the *Réseau Mondial*, and it is hoped that the countries concerned will publish their own data in the form prescribed.

Fort Rae.—The British party left for Canada in May, 1932, the instruments and stores—of which there were 16 tons—having been despatched a month earlier. The party consisted of Mr. J. M. Stagg (Leader), Mr. W. R. Morgans, Mr. P. A. Sheppard, Mr. W. A. Grinsted, Mr. A. Stephenson and Mr. J. L. Kennedy. Messrs. Stagg, Morgans, Sheppard and Grinsted are all members of the staff of the Meteorological Office, while Mr. Stephenson—who is in charge of transport—has had previous experience of similar conditions with the British Arctic Air Route Expedition in Greenland. Mr. Kennedy is an experienced mechanic and is acting as cook in addition to his mechanical work.

The party arrived safely at Fort Rae, Great Slave Lake, on June 15, 1932, and immediately commenced the erection of the instruments and the necessary huts to house them. Reports have been received indicating that the work is proceeding with great success. All the meteorological instruments, in spite of natural difficulties, are functioning and giving complete records. The magnetic instruments, many of which were of a new pattern, have been successfully installed and are giving good records, while absolute magnetic observations are being made regularly. Comparative observations are being made at the site of the Old Fort Rae occupied by the British party during the First Polar Year, as well as at the new base station which is 16 miles further north. Upper-air observations are being made, both with pilot balloons and self-registering balloons. Great difficulty was anticipated in retrieving the instruments carried by the latter and a complete failure of this part of the work was feared. Information has, however, been received that two instruments with records reaching well into the stratosphere have already been recovered and it is hoped that in the course of time other instruments will be found. The atmospheric electrical work includes observations of air-earth current, ion content and conductivity; continuous records of potential gradient have also been obtained. An ambitious programme of auroral observation is being carried out. Two auroral cameras of the Störmer-Krogness pattern were taken to Canada and the Old Fort has been used as a sub-station from which to obtain simultaneous photographs for the purposes of measurement. More than 4,500 double photographs have been secured. In addition to these, many single photographs have been obtained at the base station and during the periods of shorter nights and less brilliant displays visual observations

have been made and minute-to-minute records kept. During the time when the Great Slave Lake was free of ice a double transmitting and receiving wireless set was used for passing instructions from the base station to the Old Fort. This method has certain drawbacks, but it was employed successfully for the first part of the auroral work. As soon as the Lake was frozen over, a telephone line was erected between the two stations and this has proved the ideal method of communication.

The party will continue observations at Fort Rae until after the completion of the Polar Year on August 31, 1933, probably leaving the station by the Hudson's Bay Company's last boat of the season.

Tromsø.—The party organized by Professor E. V. Appleton left London in July, 1932; it consisted of Professor Appleton himself, Messrs. R. Naismith and W. C. Brown from the Radio Research Station, Slough, and Mr. C. Builder, a research student at King's College. When the apparatus had been erected and the station at Tromsø was in working order Professor Appleton and Mr. Naismith returned to England. The main work at Tromsø is the investigation of the ionized layers of the atmosphere and a continuous watch on conditions is being kept. From the results obtained it is hoped to discover the correlation between magnetic effects and ionization and to solve many problems connected with wireless, the aurora and ultra-violet light.

The continuation of the work at Tromsø until the close of August 1933 has been made possible by a generous contribution of £250 to Polar-Year funds by the Institute of Electrical Engineers.

Synoptic charts of the Northern Hemisphere.—During the First Polar Year a series of charts covering the North Atlantic Ocean and the greater part of North America and Europe was published by the London Meteorological Office. These charts were followed in 1873 by the Hoffmeyer charts of the North Atlantic published in the first place by the Danish Meteorological Office and later as a joint undertaking of the Danish Meteorological Office and the German Hydrographic Office. These charts were based on reports from ships at sea as well as from land stations and they were published several years in arrear. The series was interrupted by the War and since the War nothing more has been done than to publish charts for those years for which data had already been collected prior to the War.

The matter has, however, been under constant consideration and in 1929 the International Meteorological Conference at Copenhagen accepted the proposals of Dr. la Cour, Director of the Danish Meteorological Office, and Admiral Dominik, President of the German Hydrographic Office, for the preparation of two separate sets of charts in continuation of the former series. The Danish Meteorological Office is to be responsible for continuing the Hoffmeyer charts of the Atlantic Ocean, and the German Hydrographic Office

for the preparation of synoptic charts of the Northern Hemisphere, the cost of the preparation to be met by the different countries purchasing copies of the charts. (Conference of Directors, Copenhagen, 1929, Resolution 94).

Sample charts on various different lines were prepared by the German Hydrographic Office, Hamburg, at the expense of the funds of the International Meteorological Organization and the final form has been chosen. A scheme for the purchase of the charts by the various countries has been drawn up and it is hoped that sufficient promises of purchase will be forthcoming to enable the charts to be published. All countries in the Northern Hemisphere are collaborating by sending copies of their observations to Hamburg: for convenience of handling they are sent in the international code. British Colonies have been invited to send their observations in the first place to London where they are coded and sent on to Hamburg.

Though these charts of the Northern Hemisphere are being prepared in the first instance for the Polar Year, it is hoped that the series may be continued in future years since for successful investigation of the motions of the atmosphere such synoptic charts are essential.

INTERNATIONAL CO-OPERATION

International Commission for Maritime Meteorology.—A meeting of this Commission was held in Hamburg from April 5-7, 1932. The Director attended. Resolutions were passed dealing with meteorological work at sea, particular attention being given to the co-operation of ships in the work of the Polar Year. Much consideration was given to the offer of the Deutsche Seewarte, Hamburg, to prepare synoptic charts of the Northern Hemisphere, in the first place for the period of the Polar Year and, if possible, thereafter. Specimen charts had been prepared according to different schemes. (*See also page 35*).

International Commission for the Polar Year, 1932-3.—The Director has been in close touch with Dr. la Cour, President of this Commission throughout the year. In April 1932 he attended a meeting in Copenhagen of a small sub-commission appointed to administer a grant which the Rockefeller Foundation had made for the purpose of assisting in the training of observers and for the purchase of instruments for use during the Polar Year.

Executive Council of the International Meteorological Committee.—Reference was made in last year's *Annual Report* to the formation of this Council (p. 37). The annual meeting was held on May 26, 1932, the Director attending.

International Commission for the Exploration of the Upper Air.—This Commission has not met during the year. In accordance with a resolution which the Commission passed when it met in Leipzig in 1927, the volume of results of ascents made on the "international

days' of the year 1924 was to be produced in this country in similar form to that for 1923 which was prepared as a specimen at the suggestion of the International Union of Geodesy and Geophysics. The execution of this task has been delayed for various reasons, but it has now been completed. The work was done under the supervision of Sir Napier Shaw, the Commission's Honorary President, Mr. R. G. K. Lempfert, who is the Commission's Secretary, and Miss E. E. Austin, the cost of production being defrayed by the Commission.

International Commission for Air Navigation.—A meeting of the Meteorological Sub-Commission of the International Commission for Air Navigation was held in Paris under the Chairmanship of Lieut.-Col. Gold in January, 1933. At this meeting the Sub-Commission revised the section of Annex G which deals with the communication of meteorological information to pilots in the air. The revised arrangements provide for the transmission by radiotelephony both of surface observations and of upper wind observations.

The Sub-Commission also decided to make provision, in the section of the Annex which deals with the preparation of climatological summaries of the height of the base of cloud above the ground, for summaries of those occasions when the total amount of low cloud is nine or ten tenths, i.e. when the sky is nearly overcast.

The extension of the use of the international code for short-period forecasts for aviation has necessitated further provision of index numbers for the routes or regions covered by the forecasts, and the Sub-Commission, at its meeting in January, 1933, decided to allocate a series of 600 figures for eastern Europe and a series of 600 figures for the Mediterranean region, in addition to the original series of 600 figures reserved under the new plan for use in north-west Europe.

International Commission for Synoptic Weather Information.—There has been no meeting of the International Commission for Synoptic Weather Information during the year, but further progress has been made in the discussion of the important question of the symbols to be used in the representation of synoptic weather information on charts. The proposals of the sub-commission appointed to deal with this matter did not prove acceptable for use in the meteorological offices in London, Hamburg and Lisbon, and they are being reconsidered in the light of memoranda submitted by these offices.

The main work of the Commission during the year has been to secure more satisfactory arrangements in regard to meteorology in the International Radiotelegraph and Telegraph Conventions. The Commission appointed a delegation consisting of:—

Lt.-Col. E. Gold, Dr. Th. Hesselberg, and Commandant R. Bureau,
to represent it at the International Radiotelegraphic and Telegraphic Conferences at Madrid. Dr. Hesselberg was prevented, through

illness, from going to Madrid. The meteorological delegation received great assistance from Dr. N. Sama, Director of the Spanish Meteorological Service and a member of the Spanish delegation to the Conferences.

The Telegraphic Conference and the Radiotelegraphic Conference were two distinct and separate conferences, which have previously met at separate times and in separate places. The meeting at Madrid this year was the first at which both Conferences had been held simultaneously in the same place. Meteorological questions which affected both Conferences had to be approved (either explicitly or implicitly) separately by each Conference.

The Conferences lasted from September 3 until December 10, but owing to the courtesy of the presidents of the commissions and sub-commissions which were primarily concerned with meteorological questions, the consideration of these questions by the commissions and sub-commissions was completed by the end of September, with the exception of the questions concerning the allocation of wave-lengths. Commandant Bureau had to leave Madrid in the middle of September to attend another conference at Munich. Lt.-Col. Gold left Madrid on September 29, after the discussions in the sub-commissions and commissions had been completed, leaving it to Dr. Sama to see that the decisions taken in the sub-commissions and commissions were duly approved by the commissions and Conferences.

The principal results obtained are as follows :—

I.—TELEGRAPH CONVENTION AND REGULATIONS

Article 20, §1 (2).—In meteorological telegrams the letter *x* is counted as a figure in the group of figures where it occurs. (In broadcast wireless messages, the practice had grown up of using the letter *x* in a group of figures to indicate that the corresponding figure was missing. This had led to difficulties because the use of the letter *x* in groups of figures in telegrams was only permitted if the group of figures in which it occurred counted as three words instead of one.)

Article 36.—Order of transmission.—(a) Telegrams relating to the safety of human life in maritime or aerial navigation.

(b) Government telegrams.

(c) Meteorological telegrams.

(d) to (i) Other telegrams.

(Meteorological telegrams now have priority over urgent service telegrams).

Article 73.—Meteorological telegrams.—§1. (1) The term "meteorological telegram" denotes a telegram sent by an official meteorological service or by a station in official relation with such a service, and addressed to such a service or to such a station, which consists solely of meteorological observations or meteorological forecasts.

(2) Such telegrams must bear the paid-service indication = O B S = before the address.

§2. The terminal and transit rates applicable to the meteorological telegrams contemplated in the previous paragraph are reduced by at least 50 per cent in all relations.

§3. On request by the counter officer, the sender must affirm that the text of his telegram fulfils the conditions set out in §1, (1).

II.—RADIOTELEGRAPH CONVENTION AND REGULATIONS

Article 7, §15.—In order to facilitate the exchange of synoptic meteorological messages in the European area, the frequencies 41·6 kc./sec. and 89·5 kc./sec. (7,200 m. and 3,350 m.) are allocated for this service. (These wave-lengths are used for the western European and central European collective reports transmitted from the Eiffel Tower and Königswüsterhausen respectively. The allocation of wave-lengths required for the exchange of meteorological reports for civil aviation on international air routes in Europe, in the region between 255 and 290 kc./sec. was referred to a European conference to meet at Lucerne in May, 1933.)

Article 30.—Special services :—

A.—Meteorology

§1. Meteorological messages comprise :—

- (a) messages addressed to meteorological services officially entrusted with the forecasting of weather and the protection of maritime and air navigation ;
- (b) messages from these services intended specially for :—
 - (1) mobile stations of the maritime service ;
 - (2) the protection of the aircraft service ;
 - (3) the public.

The information contained in these messages may be :—

- (1) observations taken at fixed times ;
- (2) warnings of dangerous phenomena ;
- (3) forecasts and warnings.
- (4) statements of the general meteorological situation.

§2. (1) The different national meteorological services agree together concerning the establishment of common programmes of emission so as to use the transmitters best situated for the benefit of the wide areas they are intended to serve.

(2) The meteorological observations contained in classes (a) and (b) 1 and 2 above (§1) are, in principle, drawn up in an international meteorological code whether they are transmitted by, or intended for, mobile stations.

§3. Observation messages intended for an official meteorological service have the use of the facilities resulting from the allocation of exclusive waves to the synoptic meteorological service and the aeronautical meteorological service, in conformity with regional agreements for the use of these waves concluded by the services concerned.

§4. (1) Meteorological messages intended specially for the whole of the stations of the maritime mobile service are sent, in principle, in conformity with a fixed time-table, and, so far as possible, at times when they can be received by stations having only one operator, the speed of transmission being such that an operator possessing only a 2nd-class certificate may be able to read the signals.

(2) During the transmission "to all stations" of meteorological messages intended for stations of the mobile service, all stations in that service whose transmissions might interfere with the reception of the messages in question, must keep silence in order to permit all stations which desire to do so to receive these messages.

(3) Meteorological warning messages are transmitted immediately and must be repeated after the end of the first silence period which follows. These messages must be sent on the waves assigned to the maritime mobile service. Their transmission is preceded by the safety signal.

(4) In addition to the regular services contemplated in the preceding sub-paragraphs, administrations take the necessary measures to ensure that certain stations shall, upon request, communicate meteorological messages to stations in the mobile service.

(5) The preceding rules are applicable to the aircraft service, in so far as they are not contrary to more detailed regional arrangements ensuring at least an equal measure of protection to air navigation.

§5. (1) Messages originating in mobile stations and containing information concerning the presence of tropical cyclones must be transmitted, with the least delay possible, to other mobile stations in the vicinity and to the competent authorities at the first point of the coast with which contact can be established. Their transmission is preceded by the safety signal.

(2) Every mobile station may intercept, for its own use, meteorological observations sent out by other mobile stations even when they are addressed to a national meteorological service. Stations in the mobile service which transmit meteorological observations addressed to a national meteorological service, are not required to repeat these observations; but the exchange between mobile stations, on request, of information relating to the state of the weather is authorised.

ADDITIONAL RADIOTELEGRAPH REGULATIONS

Article 2, §11.—Charges for meteorological radiotelegrams.—(1) (a) Land station and ship or aircraft charges applicable to meteorological radiotelegrams are reduced by at least 50 per cent in all relations.

(b) For land stations, the date on which this provision shall be put into force will be fixed by agreement between the administrations and operating companies on the one hand, and the official meteorological services concerned on the other hand.

(2) (a) The term "meteorological radiotelegram" means a radiotelegram, sent by an official meteorological service or by a station having official relations with such a service, and addressed to such a service or station, containing exclusively meteorological observations or meteorological forecasts.

(b) These radiotelegrams must bear at the beginning of the address, the paid-service indication =OBS=.

(3) If requested, the sender must declare that the text of his radiotelegram complies with the above conditions.

III.

Proposals had been made to the Radiotelegraphic Conference, in particular by the Dutch and Italian delegations, in regard to the meteorological information published in the "List of stations performing special services" (The Berne List). As a result of the discussions at the Conference, the Conference adopted the following resolution:—

"The International Meteorological Organization is requested:—

1. To draw up, and have printed and bound as soon as possible a handbook containing all the international information necessary for the decoding and use of the meteorological messages transmitted by the stations mentioned in the "List of stations performing special services" issued by the Bureau of the Union.

This handbook, published in French and, if necessary, in other languages, should consist of two separate parts, one for the use of the maritime radio service and the other for the use of the air radio service.

2. To inform the Bureau of the Union of the date on which this handbook will be on sale and the approximate cost price.

The purchase of this handbook will not be obligatory. The Bureau of the Union will ask the administrations and operating companies how many copies of each part they wish to purchase. The Bureau of the Union will communicate this number to the International Meteorological Organization.

The cost of publication and despatch of the parts will in no case be borne by the Bureau of the Union and such costs must be wholly covered by the receipts from sales.

In addition, on the publication of the handbook, the Bureau of the Union will omit from the "List of stations performing special services" the meteorological information mentioned in section 1 above, and will limit itself to giving in that list references to the parts of the meteorological handbook in question."

PUBLICATIONS

A list of the publications issued by the Office or contributed by members of the staff to outside publications is given on pp. 52-5. The number of official publications is again small for the reason given in the *Annual Report* for last year. Only four *Memoirs* have appeared. The first of these is a discussion of the atmospheric circulation over central Africa by Dr. C. E. P. Brooks and Mr. S. T. A. Mirrlees on the basis mainly of the observations appearing in official Blue Books under a scheme of publication adopted at the suggestion of the Office in 1909. The records of many years are thus made the subject of a comprehensive discussion. In the second *Memoir*, "Some upper-air observations over Lower Egypt," Mr. S. P. Peters discusses the observations of upper air temperatures made by officers of the Royal Air Force during aeroplane ascents in the area named. The two remaining *Memoirs* are devoted to accounts of major researches carried out at Kew Observatory. Mr. H. L. Wright describes the results of observations on smoke particles and condensation nuclei, and Mr. F. J. Scrase the records of the air-earth electric currents obtained with a specially designed automatic recorder.

The contributions of members of the staff to scientific journals have again been numerous. In the *Quarterly Journal of the Royal Meteorological Society* the interesting series of articles entitled "Problems in modern meteorology" has been continued, and of the four articles appearing, no fewer than three are by members of the Office staff. In the April number Mr. D. Brunt dealt with the problems of radiation and absorption. In October Dr. C. E. P. Brooks followed with an article on the origin of anticyclones, and in the January number Major A. H. R. Goldie with magnetic variations of short duration. Original papers and short notes by members of the staff also take a prominent place in the Society's *Quarterly Journal*.

In the *Philosophical Transactions of the Royal Society* there is an important paper by Mr. F. J. Scrase, "The characteristics of a deep-focus earthquake." In this the seismological disturbance of February 20, 1931, of which the epicentre was located near Vladivostock, was

studied with the help of records collected from nearly 100 observatories distributed all over the world. A preliminary examination of the records of the Kew seismograph had suggested that this disturbance originated at a great focal depth. In such circumstances phases additional to those associated with normal earthquakes are produced by reflexions at points comparatively near the epicentre. A close study of the large number of records collected made it possible to trace out the details of these reflexions in a most interesting and arresting manner.

The list of publications also includes a number of articles which members of the staff contributed by invitation. The Director delivered a lecture on "Physics in meteorology" before the Institute of Physics, the 18th lecture of the series which the Institute has arranged under the general heading *Physics in Industry*. At the request of the French Société de Géographie Dr. Brooks prepared a monograph on "Le climat du Sahara et de l'Arabie" for inclusion in a compilation entitled "Le Sahara," which the Society is publishing, in which the geography of the French African possessions is discussed in its many different aspects. A preliminary account of the results of the British Arctic Expedition to Greenland was prepared by Mr. S. T. A. Mirrlees for the Royal Geographical Society for publication in the July number of that Society's journal.

STAFF

Details of the staff and its distribution will be found on pp. 47-51. The only change in the authorised establishment made during the year is that which arises from the reorganization of the forecast service to which reference is made elsewhere. The concentration of all forecast work at Headquarters in a single division has made it possible to dispense with three posts of junior professional assistant at the expense of a slight increase in the clerical establishment.

APPENDIX I

CLASSIFICATION OF STATIONS WHICH REPORT TO THE BRITISH CLIMATOLOGY DIVISION

| DISTRICTS | STATIONS | | | | | | AUTOGRAPHIC RECORDS | | | | | |
|--|---------------|--------------|-------------|--------------|----------------|---------------|---------------------|-----------|-----------|-----------|-------------|-----------|
| | Observatories | Distributive | Telegraphic | Crop Weather | Climatological | Rainfall only | Sunshine | Rainfall | Wind | Pressure | Temperature | Humidity |
| 0 Scotland, N. ... | 1 | 0 | 3 | 0 | 8 | 136 | 13 | 1 | 3 | 6 | 0 | 0 |
| 1 " E. ... | 1 | 1 | 2 | 2 | 30 | 353 | 19 | 5 | 3 | 2 | 2 | 2 |
| 6A " W. ... | 1 | 1 | 1 | 1 | 22 | 361 | 19 | 5 | 3 | 2 | 2 | 1 |
| 2 England, N.E. ... | 0 | 2 | 2 | 3 | 13 | 276 | 18 | 4 | 6 | 6 | 3 | 1 |
| 3 " E. ... | 0 | 2 | 1 | 7 | 18 | 416 | 23 | 6 | 6 | 6 | 2 | 2 |
| 4 " Midlands | 0 | 1 | 4 | 5 | 39 | 1048 | 30 | 14 | 1 | 5 | 3 | 2 |
| 5 " S.E. ... | 0 | 8 | 3 | 4 | 32 | 917 | 41 | 16 | 9 | 9 | 8 | 8 |
| London District ... | 2 | 0 | 0 | 0 | 12 | 54 | 7 | 10 | 1 | 1 | 2 | 0 |
| 8B England, S.W. ... | 0 | 1 | 2 | 5 | 31 | 610 | 28 | 3 | 3 | 6 | 3 | 3 |
| 7A " N.W. ... | 0 | 0 | 1 | 1 | 20 | 473 | 22 | 8 | 3 | 2 | 0 | 0 |
| 7B N. Wales ... | 0 | 2 | 0 | 1 | 5 | 170 | 7 | 3 | 5 | 5 | 2 | 2 |
| 8A S. " ... | 0 | 0 | 1 | 2 | 7 | 216 | 10 | 2 | 1 | 1 | 1 | 0 |
| 9 Ireland, N. ... | 0 | 1 | 3 | 0 | 6 | 129 | 6 | 3 | 3 | 6 | 1 | 1 |
| 10 " S. ... | 1 | 0 | 2 | 0 | 17 | 133 | 9 | 2 | 3 | 6 | 0 | 0 |
| 6B Isle of Man ... | 0 | 0 | 0 | 0 | 1 | 10 | 1 | 0 | 0 | 0 | 0 | 0 |
| 11 Scilly and Channel Isles ... | 0 | 0 | 2 | 0 | 1 | 27 | 4 | 0 | 1 | 2 | 1 | 1 |
| TOTAL ... | 6 | 18 | 27 | 31 | 262 | 5329 | 257 | 82 | 48 | 65 | 30 | 23 |
| Corresponding number for last year ... | 6 | 17 | 27 | 30 | 262 | 5316 | 255 | 81 | 46 | 64 | 28 | 21 |

APPENDIX III

FINANCIAL STATEMENT

The year under review, 1932-3, is the twelfth 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 1932-3.

| <i>Expenditure.</i> | | <i>Amount.</i> | |
|---|--------|----------------|-------------|
| | | £ | £ |
| Salaries and Wages—H.Q. Establishments | ... .. | 50,240 | |
| " " —Out-station Establishments | ... .. | 60,951 | |
| | | <hr/> | 111,191 |
| Fuel and Light | ... .. |  | 418 |
| Transport of Personnel and Equipment | ... .. |  | 3,210 |
| Instruments, Equipment and Stores | ... .. |  | 7,337 |
| Research (including Polar-Year Work) | ... .. |  | 4,517 |
| Minor Works Services, Rents, Repairs and Maintenance of Buildings | ... .. |  | 4,722 |
| Telegrams, Telephones | ... .. |  |  |
| Subventions to Reporting Stations | ... .. |  | 14,982 |
| and miscellaneous charges | ... .. |  |  |
| Superannuation | ... .. |  | 1,625 |
| | Total | | <hr/> <hr/> |
| | | | £148,002 |
| <i>Receipts.</i> | | | |
| Receipts from Royal Society | ... .. |  | 452 |
| " " National Debt Commissioners (Annuities) | ... .. |  | 113 |
| Sale of Instruments, Carriage, etc. | ... .. |  | 2,904 |
| Daily Weather Reports, Forecasts, etc. | ... .. |  | 2,704 |
| Receipts from War Office and Admiralty | ... .. |  | 6,208 |
| | Total | | <hr/> <hr/> |
| | | | £12,381 |

APPENDIX IV

THE GASSIOT COMMITTEE, 1932

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.

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

The Astronomer Royal (*Chairman*).

The President of the Royal Astronomical Society.

Sir NAPIER SHAW.

Sir JAMES JEANS.

Dr. G. C. SIMPSON.

Professor A. FOWLER.

Sir GERALD LENOX-CONYNGHAM.

Sir GILBERT WALKER.

Professor S. CHAPMAN.

Mr. J. EVERSHEED.

APPENDIX V

THE STAFF OF THE METEOROLOGICAL OFFICE, ITS
OBSERVATORIES AND BRANCHES, MARCH 31, 1933

THE STAFF AT HEADQUARTERS

DIRECTOR :

G. C. Simpson, 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>Senior Professional Assistants</i> | Miss E. E. Austin, M.A.; W. J. Grassick, M.A., B.Sc. |
| <i>Junior Professional Assistants</i> | C. J. Boyden, B.A.; J. C. Cumming, M.A.; A. L. Maidens, B.Sc.; A. E. Mayers, B.Sc.; (one vacancy). |

GENERAL SERVICES DIVISION.

| | |
|--|--------------------------|
| <i>Chief Clerk</i> | H. L. B. Tarrant, M.B.E. |
| <i>Clerk, Grade I</i> | R. M. Poulter. |
| <i>Clerks, Grades II & III</i> ... | 9 |
| <i>Officekeeper</i> | 1 |

MARINE DIVISION.

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

BRITISH CLIMATOLOGY DIVISION.

| | |
|--|---|
| <i>Superintendent</i> | E. G. Bilham, B.Sc., A.R.C.S., D.I.C. |
| <i>Assistant Superintendent</i> ... | E. V. Newnham, B.Sc. |
| <i>Senior Professional Assistants</i> | J. Glasspoole, M.Sc., Ph.D.; Miss L. F. Lewis, B.Sc. |
| <i>Clerk, Grade I</i> | A. G. W. Howard. |
| <i>Clerks, Grades II & III</i> ... | 16 |
| <i>Draughtsman</i> | 1 |

GENERAL CLIMATOLOGY DIVISION.

| | |
|--|--|
| <i>Superintendent</i> | C. E. P. Brooks, D.Sc. |
| <i>Senior Professional Assistants</i> | Miss E. H. Geake, M.Sc.; S. T. A. Mirrlees, M.A.; Miss L. D. Sawyer, B.A. |
| <i>Junior Professional Assistant</i> | Miss G. L. Thorman, B.Sc., A.K.C. |
| <i>Clerk, Grade I</i> | A. T. Bench. |
| <i>Clerks, Grades II & III</i> ... | 7 |

APPENDIX V—continued

FORECAST DIVISION.

| | | | |
|---------------------------------------|-----|-----|---|
| <i>Superintendent</i> | ... | ... | R. Corless, O.B.E., M.A. |
| <i>Assistant Superintendents</i> | ... | ... | H. W. L. Absalom, B.Sc., A.R.C.S., D.I.C. ; C. K. M. Douglas, B.A. ; W. C. Kaye, B.Sc. |
| <i>Senior Professional Assistants</i> | | | R. F. Budden, M.A. ; G. A. Bull, B.Sc. ; A. F. Crossley, B.A. ; F. H. Dight, B.Sc. ; J. S. Farquharson, M.A. ; W. D. Flower, B.Sc., A.Inst.P. ; A. G. Forsdyke, Ph.D., A.R.C.S., D.I.C. ; C. H. Kellett, B.Sc. ; P. I. Mulholland, B.Sc. |
| <i>Clerk, Grade I</i> | ... | ... | W. Hayes. |
| <i>Clerks, Grades II & III</i> | ... | ... | 22 (one vacancy) |
| <i>Telephone-Typists</i> | ... | ... | 8 |

AVIATION SERVICES DIVISION.

| | | | |
|--------------------------------------|-----|-----|--|
| <i>Superintendent</i> | ... | ... | F. Entwistle, B.Sc. |
| <i>Assistant Superintendent</i> | ... | ... | R. S. Read, M.A., B.Sc., A.R.C.S., F.Inst.P. |
| <i>Senior Professional Assistant</i> | | | C. S. Durst, B.A. |
| <i>Clerk, Grade I</i> | ... | ... | F. M. Dean. |
| <i>Clerks, Grade III</i> | ... | ... | 3 |

NAVAL DIVISION.

| | | | |
|---------------------------------------|-----|-----|---|
| <i>Superintendent</i> | ... | ... | L. G. Garbett, Commander, R.N. (retd.). |
| <i>Senior Professional Assistants</i> | | | A. H. Nagle, B.Sc., A.R.C.S., D.I.C. ; E. Taylor, M.A. |
| <i>Clerk, Grade III</i> | ... | ... | 1 |

ARMY SERVICES DIVISION.

| | | | |
|-----------------------|-----|-----|-----------------------|
| <i>Superintendent</i> | ... | ... | D. Brunt, M.A., B.Sc. |
|-----------------------|-----|-----|-----------------------|

INSTRUMENTS DIVISION.

| | | | |
|--------------------------------------|-----|-----|----------------------|
| <i>Superintendent</i> | ... | ... | J. S. Dines, M.A. |
| <i>Senior Professional Assistant</i> | | | J. E. Belasco, B.Sc. |
| <i>Junior Professional Assistant</i> | | | R. Frost, B.A. |
| <i>Clerk, Grade I</i> | ... | ... | P. N. Skelton. |
| <i>Clerks, Grade III</i> | ... | ... | 7 |
| <i>Draughtsman</i> | ... | ... | 1 |
| <i>Instrument Designer</i> | ... | ... | 1 |
| <i>Storeman, Packer and Porter</i> | | | 3 |

THE STAFF AT OBSERVATORIES AND BRANCH
ESTABLISHMENTS

METEOROLOGICAL OFFICE, 6, Drumsheugh Gardens, EDINBURGH.

| | | | |
|--------------------------------------|-----|-----|------------------------------------|
| <i>Superintendent</i> | ... | ... | A. H. R. Goldie, M.A., F.R.S.E. |
| <i>Assistant Superintendent</i> | ... | ... | J. Crichton, M.A., B.Sc., F.R.S.E. |
| <i>Senior Professional Assistant</i> | | | D. N. Harrison, D.Ph. |
| <i>Clerks, Grade III</i> | ... | ... | 5 (and one research post). |

METEOROLOGICAL OFFICE, MALTA.

| | | | |
|---------------------------------------|-----|-----|-------------------------------------|
| <i>Superintendent</i> | ... | ... | G. R. Hay, M.A. |
| <i>Senior Professional Assistants</i> | | | D. W. Johnston, B.Sc. ; A. Walters. |
| <i>Clerk, Grade II</i> | ... | ... | 1 |
| <i>Clerks (locally entered)</i> | ... | ... | 4 |

APPENDIX V—continued

METEOROLOGICAL OFFICE, MIDDLE EAST.

HELIOPOLIS.

| | | | |
|---------------------------------------|-----|-----|---|
| <i>Superintendent</i> | ... | ... | J. Durward, M.A. |
| <i>Senior Professional Assistants</i> | | | C. V. Ockenden, B.Sc. ; G. J. W. Oddie, B.Sc. |
| <i>Clerk, Grade I</i> | ... | ... | R. Pyser. |
| <i>Clerks (locally entered)</i> | ... | ... | 4 |

ABOUKIR, AMMAN, ISMAILIA AND RAMLEH.

| | | | |
|---------------------------------|-----|-----|---|
| <i>Clerks, Grade II</i> | ... | ... | 4 |
| <i>Clerks (locally entered)</i> | ... | ... | 4 |

METEOROLOGICAL OFFICE, IRAQ.

HINAIDI.

| | | | |
|--------------------------------------|-----|-----|-----------------------|
| <i>Assistant Superintendent</i> | ... | ... | R. P. Batty, B.A. |
| <i>Senior Professional Assistant</i> | | | T. W. V. Jones, B.Sc. |
| <i>Clerk, Grade II</i> | ... | ... | 1 |
| <i>Clerks (locally entered)</i> | ... | ... | 5 |

DIWANIYAH, MOSUL, RAMADI, SHAIBAH.

| | | | |
|---------------------------------|-----|-----|---|
| <i>Clerks, Grade II</i> | ... | ... | 2 |
| <i>Clerks (locally entered)</i> | ... | ... | 4 |

KEW OBSERVATORY, Old Deer Park, Richmond, Surrey.

| | | | |
|---------------------------------------|-----|-----|--|
| <i>Assistant Director</i> | ... | ... | F. J. W. Whipple, Sc.D., F.Inst.P. |
| <i>Senior Professional Assistants</i> | | | A. W. Lee, M.Sc., A.R.C.S., D.I.C., A.Inst.P. ; F. J. Scrase, M.A., B.Sc. |
| <i>Junior Professional Assistant</i> | | | L. H. Starr, M.Sc. |
| <i>Clerk, Grade I</i> | ... | ... | E. Boxall. |
| <i>Clerks, Grades II & III</i> | ... | ... | 5 |
| <i>Caretaker and Handyman</i> | ... | ... | 2 |

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

| | | | |
|---------------------------------|-----|-----|----------------------|
| <i>Assistant Superintendent</i> | ... | ... | L. H. G. Dines, M.A. |
| <i>Instrument Maker</i> | ... | ... | 1 |
| <i>Mechanic and Carpenter</i> | ... | ... | 2 |

VALENTIA OBSERVATORY, Cahirciveen, Co. Kerry.

| | | | |
|---------------------------------|-----|-----|---------------------|
| <i>Assistant Superintendent</i> | ... | ... | M. T. Spence, B.Sc. |
| <i>Clerks, Grade III</i> | ... | ... | 4 |
| <i>Messenger</i> | ... | ... | 1 |

THE OBSERVATORY, ESKDALEMUIR, Langholm, Dumfriesshire.

| | | | |
|---|-----|-----|----------------------------|
| <i>Assistant Superintendent</i> | ... | ... | R. E. Watson, B.Sc., Ph.D. |
| <i>Senior Professional Assistant</i> | | | L. Dods, B.Sc. |
| <i>Clerks, Grade III</i> | ... | ... | 3 |
| <i>Housekeeper, Mechanic and Handyman</i> | ... | ... | 3 |

THE OBSERVATORY, King's College, ABERDEEN.

| | | | |
|--------------------------|-----|-----|---------------|
| <i>Clerk, Grade I</i> | ... | ... | G. A. Clarke. |
| <i>Clerks, Grade III</i> | ... | ... | 2 |

THE OBSERVATORY, LERWICK, Shetlands.

| | | | |
|--------------------------------------|-----|-----|-----------------------|
| <i>Senior Professional Assistant</i> | | | B. C. V. Oddie, B.Sc. |
| <i>Clerks, Grade III</i> | ... | ... | 3 |
| <i>Caretaker</i> | ... | ... | 1 |

APPENDIX V—continued

PORT METEOROLOGICAL OFFICE, LIVERPOOL.

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

PORT METEOROLOGICAL OFFICE, LONDON.

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

AVIATION SERVICES STATIONS

ABBOTSINCH.

*Junior Professional Assistant** E. A. Cope, B.Sc., A.R.C.S.
Clerks, Grade III 2

ALDERGROVE.

Junior Professional Assistant F. E. Coles, B.Sc., A.R.C.S., D.I.C.
Clerks, Grades II & III ... 3

ANDOVER.

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

BIGGIN HILL.

Clerks, Grades II & III ... 5

BOSCOMBE DOWN.

Senior Professional Assistant C. W. Lamb, M.C., B.Sc.
Clerks, Grades II & III ... 3

CALSHOT.

Assistant Superintendent ... H. F. Jackson, M.S.E.
Junior Professional Assistant D. Dewar, B.Sc.
Clerks, Grades II & III ... 4

CATTERICK.

Senior Professional Assistant (vacancy).
Clerks, Grades II & III ... 3

CRANWELL.

Assistant Superintendent ... W. A. Harwood, D.Sc.
Senior Professional Assistant R. M. Stanhope, B.A.
Clerks, Grades II & III ... (one vacancy).

CROYDON.

Assistant Superintendent ... S. F. Witcombe, B.Sc.
Senior Professional Assistant C. W. G. Daking, B.Sc.
Clerks, Grades II & III ... 9
Telephone-Typists 2

FELIXSTOWE.

Senior Professional Assistant R. C. Sutcliffe, Ph.D.
Clerks, Grades II & III ... 3

HOLYHEAD.

Clerks, Grades II & III ... 3

LEUCHARS.

Senior Professional Assistant R. H. Mathews, B.A.
Clerks, Grades II & III ... 3

APPENDIX V—continued

LYMPNE.

*Assistant Superintendent** ... R. A. Watson, B.A.
Clerks, Grades II & III ... 6

MOUNT BATTEN.

Senior Professional Assistant M. J. Thomas, B.Sc.
Clerks, Grades II & III ... 3

SEALAND.

Senior Professional Assistant J. J. Somerville, B.A., B.L.
Clerks, Grades II & III ... 3

SOUTH FARNBOROUGH.

Senior Professional Assistant W. H. Bigg, B.Sc.
Clerks, Grades II & III ... 3

UPPER HEYFORD.

Senior Professional Assistant N. H. Smith, B.Sc.
Clerks, Grades II & III ... 3

WORTHY DOWN.

Senior Professional Assistant S. P. Peters, B.Sc., A.Inst.P.
Clerks, Grades II & III ... 3

ARMY SERVICES STATIONS

METEOROLOGICAL OFFICE, SHOEBUEYNESS.

Assistant Superintendent ... C. E. Britton, B.Sc.
Junior Professional Assistant J. Pepper, M.A., B.Sc., Ph.D.
Clerks, Grades II & III ... 9 (one vacancy).

METEOROLOGICAL OFFICE, LARKHILL.

Senior Professional Assistant H. L. Wright, M.A.
Clerks, Grades II & III ... 4

METEOROLOGICAL OFFICE, PORTON.

Clerks, Grades II & III ... 5

SECONDED FOR DUTY WITH OTHER BODIES

Senior Professional Assistants R. G. Veryard, B.Sc. (R.A.F., India).
 A. C. Best, B.Sc. }
 E. L. Davies, M.Sc. } (War Office, Porton
 H. Garnett, M.Sc. } Experimental Station).
 O. G. Sutton, B.Sc. }
 L. G. Hemens, B.Sc. (Indian Government).
 J. M. Stagg, M.A., B.Sc. }
 P. A. Sheppard, B.Sc. } (Polar Year
 W. R. Morgans, M.Sc. } Expedition.)
Clerk, Grade III ... W. A. Grinsted.

* Held against vacancy for Senior Professional Assistant.

APPENDIX VI

PUBLICATIONS

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

PERIODICAL :—

The Daily Weather Report issued in three sections (to date) :—

1. The British Section.
2. The International Section.
3. The Upper Air Section.

The Monthly Weather Report with a summary for the year (to February, 1933).

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 December, 1932).

Seismological Bulletin. A diary of seismological disturbances recorded on the Galitzin Aperiodic Seismographs at Kew Observatory, Richmond (to February, 1933).

British Rainfall, 1931. A report on the distribution of rain in space and time over the British Isles as recorded by over 5,000 observers.

Observatories' Year Book, 1931. 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.

Réseau Mondial, 1925. Monthly and annual summaries of pressure, temperature and precipitation based on a world-wide network of observing stations.

Southport Auxiliary Observatory. Annual Report and results of meteorological observations, 1931. By J. Baxendell.

Weekly Weather Report for the period March 1, 1931 to February 27, 1932. Particulars of temperature, rainfall and bright sunshine for each week.

OCCASIONAL :—

Barometer Manual for the use of seamen : a text book of marine meteorology. 11th edition, 1932.

Examples of Weather Maps showing Typical Distributions of Pressure. 2nd edition, 1932.

Wireless Weather Messages. Particulars of meteorological reports issued by wireless telegraphy and wireless telephony in Great Britain, Gibraltar, Malta, Middle East and Iraq. 9th edition, 1933.

APPENDIX VI—continued

OCCASIONAL—continued.

Geophysical Memoirs :—

Vol. VI :—

55. A study of the atmospheric circulation over tropical Africa. By C. E. P. Brooks, D.Sc. and S. T. A. Mirrlees, M.A.
56. Some upper-air observations over lower Egypt, with special reference to the diurnal variation of temperature and humidity. By S. P. Peters, B.Sc., A.Inst.P.
57. Observations of smoke particles and condensation nuclei at Kew Observatory. By H. L. Wright, M.A.

Vol. VII :—

58. The air-earth current at Kew Observatory. Some results obtained with a new automatic recorder. By F. J. Scrase, M.A., B.Sc.

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

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

Types of iridescent clouds. *Nature*, **129**, 1932, pp. 689–690.

W. H. Dines's scientific papers. (Review of : Collected Scientific Papers of W. H. Dines, B.A., F.R.S.) *Nature*, **129**, 1932, pp. 811–812.

Physics in meteorology. (*Physics in Industry*, lecture No. 18.) London, Inst. Physics, 1932. 8°. Pp. 22.

Low auroras. *London, Q. J. R. Meteor. Soc.*, **59**, 1932, pp. 185–190.

By R. G. K. LEMPFERT, C.B.E., M.A., F.Inst.P.—

The presentation of meteorological data. Presidential address delivered before the Royal Meteorological Society. *London, Q. J. R. Meteor. Soc.*, **58**, 1932, pp. 91–102.

By E. GOLD, D.S.O., F.R.S.—

Notes on currents and temperature in the higher stratosphere. *London, Q. J. R. Meteor. Soc.*, **58**, 1932, pp. 199–202.

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

The propagation to great distances of airwaves from gunfire. Progress of the investigation during 1931. *London, Q. J. R. Meteor. Soc.*, **58**, 1932, pp. 471–478.

Air waves from experimental explosions. *Nature*, **130**, 1932, p. 1008 ; **131**, 1933, pp. 138–139.

On potential gradient and the air-earth current. *Terr. Mag.*, **37**, 1932, pp. 355–359.

The wet-and-dry-bulb hygrometer : the relation to theory of the experimental work of Awbery and Griffiths. *London, Proc. Physic. Soc.*, **45**, 1933, pp. 307–317, disc., pp. 317–319.

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

Recent progress in meteorological measurements and data. *London, Min. Agric., Rep. Agric. Meteor. Conf.*, 1931, pp. 1–4.

A rapid method of checking measurements of rainfall duration. *London, Q. J. R. Meteor. Soc.*, **59**, 1933, p. 38.

The British Rainfall Organization. *Water and Water Engin.*, London, **35**, 1933, pp. 61–64

Variations in the climate of York during the sixty years 1871–1930 and comparison with Oxford. *London, Q. J. R. Meteor. Soc.*, **59**, 1933, pp. 137–149, disc., pp. 149–150.

APPENDIX VI—continued

By C. E. P. Brooks, D.Sc.—

Le climat du Sahara et de l'Arabie. ("Le Sahara," Tome I, Partie 1). Paris (Société d'Éditions Géographiques, Maritimes et Coloniales), 1932. 4°. Pp. 81.

Some problems of modern meteorology, No. 9. The origin of anti-cyclones. *London, Q. J. R. Meteor. Soc.*, **58**, 1932, pp. 379-387.

By D. BRUNT, M.A., B.Sc.—

Some problems of modern meteorology, No. 7. Radiation and absorption in the atmosphere. *London, Q. J. R. Meteor. Soc.*, **58**, 1932, pp. 103-113.

Notes on radiation in the atmosphere. I. *London, Q. J. R. Meteor. Soc.*, **58**, 1932, pp. 389-420.

By R. CORLESS, O.B.E., M.A.—

The weather of January, 1932. *London, Q. J. R. Meteor. Soc.*, **58**, 1932, pp. 297-299.

By L. G. Garbett, Commander, R.N. (retd.) with Sir NAPIER SHAW, F.R.S.—

A new sort of wind rose. *London, Q. J. R. Meteor. Soc.*, **59**, 1933, pp. 39-43, disc., pp. 43-44.

By A. H. R. GOLDIE, M.A., F.R.S.E.—

Some problems of modern meteorology, No. 10. Terrestrial magnetism—the magnetic variations of short duration. *London, Q. J. R. Meteor. Soc.*, **59**, 1933, pp. 3-15.

By H. W. L. ABSALOM, B.Sc., A.R.C.S., D.I.C.—

A diagram for evaluating heights from readings of pressure and temperature. *London, Q. J. R. Meteor. Soc.*, **59**, 1933, pp. 82-85.

By L. H. G. DINES, M.A.—

Mean values of the relative humidity at different heights in the atmosphere over England. *London, Q. J. R. Meteor. Soc.*, **59**, 1933, pp. 157-162, disc., p. 162.

By C. K. M. DOUGLAS, B.A.—

Pressure changes on the charts of the Northern Hemisphere during a downward surge over Europe. *London, Q. J. R. Meteor. Soc.*, **58**, 1932, pp. 198-199.

The origin of anticyclones and associated problems. *London, Q. J. R. Meteor. Soc.*, **59**, 1933, pp. 62-65.

By W. C. KAYE, B.Sc., with C. S. DURST, B.A.—

Some examples of the development of depressions which affect the Atlantic. *London, Q. J. R. Meteor. Soc.*, **58**, 1932, pp. 151-163.

By E. V. NEWNHAM, B.Sc.—

Sunset glows and the Andean eruptions. *Nature*, **130**, 1932, pp. 139-140.

By W. H. PICK, B.Sc., F.Inst.P., F.C.P.—

The age of a fog in relation to its relative humidity. *London, Q. J. R. Meteor. Soc.*, **58**, 1932, pp. 149-150.

Visibility with saturated air. *London, Q. J. R. Meteor. Soc.*, **58**, 1932, pp. 165-168.

Visibility at sea. *London, Q. J. R. Meteor. Soc.*, **58**, 1932, pp. 251-255, disc., pp. 255-257.

Visibility with saturated air at Felixstowe, Suffolk, with special reference to on-shore and off-shore winds. *London, Q. J. R. Meteor. Soc.*, **58**, 1932, pp. 387-388.

A problem of visibility in "tropical" air over the open sea. *London, Q. J. R. Meteor. Soc.*, **59**, 1933, pp. 66-67.

APPENDIX VI—continued

By S. F. WITCOMBE, B.Sc.—

Humidity and the age of fog. *London, Q. J. R. Meteor. Soc.*, **59**, 1933, pp. 44–46.

By M. G. BENNETT, M.Sc.—

The visual range of lights at night, and its relation to the visual range of ordinary objects by day. *London, Q. J. R. Meteor. Soc.*, **58**, 1932, pp. 259–267, disc., pp. 267–270.

By C. W. G. DAKING, B.Sc.—

The meteorology of Kamaran Island (Red Sea). *London, Q. J. R. Meteor. Soc.*, **58**, 1932, pp. 441–447.

By C. S. DURST, B.A.—

The thermal balance of a water drop or ice particle suspended in the atmosphere, and the effect of radiation on the upper layers of the atmosphere. *London, Q. J. R. Meteor. Soc.*, **59**, 1933, pp. 125–127, disc., pp. 127–129.

The breakdown of steep wind gradients in inversions. *London, Q. J. R. Meteor. Soc.*, **59**, 1933, pp. 131–135, disc., pp. 135–136.

By A. W. LEE, M.Sc., A.R.C.S., D.I.C., A.Inst.P.—

The effect of geological structure upon microseismic disturbance. *London, Mon. Not. R. Astr. Soc., Geoph. Supp.*, **3**, 1932, pp. 83–105.

Microseismic disturbance in Great Britain during 1930 January; a comparison of the records of seven observatories. *London, Mon. Not. R. Astr. Soc., Geoph. Supp.*, **3**, 1932, pp. 105–116.

By S. T. A. MIRRLEES, M.A.—

The weather on a Greenland air route. *London, Geog. J.*, **80**, 1932, pp. 15–30.

By F. J. SORASE, M.A., B.Sc.—

The characteristics of a deep focus earthquake: a study of the disturbance of February, 20, 1931. *London, Phil. Trans. R. Soc.*, **[231 (A)**, 1933, pp. 207–234.

By N. H. SMITH, B.Sc.—

Smoke and visibility. *London, Q. J. R. Meteor. Soc.*, **58**, 1932, pp. 113–114.

By O. G. SUTTON, B.Sc.—

Note on the relationship between wind gradient and wind velocity. *London, Q. J. R. Meteor. Soc.*, **58**, 1932, pp. 288–292.

By R. G. VERYARD, B.Sc.—

Note on local line-squall at Peshawar on March 10, 1932. *London, Q. J. R. Meteor. Soc.*, **58**, 1932, pp. 478–480.

By H. L. WRIGHT, M.A.—

The influence of atmospheric suspensoids upon the earth's electric field as indicated by observations at Kew Observatory. *London, Proc. Physic. Soc.*, **45**, 1933, pp. 152–170, disc., pp. 170–171.

By W. R. MORGANS, M.Sc.—

A memorandum giving a summary of present knowledge on the relation between ground contours, atmospheric turbulence, wind speed and direction. *London, Aeron. Res. Council, Rep. Mem.*, No. 1456 (T.3198), 1932. Pp. 39, pls.

By P. A. SHEPPARD, B.Sc.—

Some atmospheric electrical instruments for use on the British Polar Year Expedition, 1932–33. *London, Inst. Physics, J. Sci. Instr.*, **9**, 1932, pp. 246–250.

