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METEOROLOGICAL  
OFFICE,  
EDINBURGH.  
29 SEP 1928

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  
31st March  
1928

*The Seventy-third Year of the  
Meteorological Office*



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1928

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# METEOROLOGICAL COMMITTEE

1927-8

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Appointed by the Air Council.

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

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

Lieut.-Colonel E. L. BOND, D.S.O., R.A. Superintendent of Experiments, Shoeburyness. Nominated by the War Office.

Rear-Admiral H. P. DOUGLAS, C.M.G., R.N. Hydrographer of the Navy. Nominated by the Admiralty.

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

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

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

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

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

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

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

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

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

*Secretary* :—Mr. D. BRUNT, M.A.

COMMITTEE OF THE METEOROLOGICAL OFFICE,  
EDINBURGH

*Chairman* :--The Director of the Meteorological Office.

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

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

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

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

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

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

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

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

**ANNUAL REPORT of the Director of the Meteorological Office presented by the Meteorological Committee to the Air Council for the year ending 31st March, 1928 (the seventy-third year of the Meteorological Office).**

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**The Meteorological Committee** met three times during the year, on the 13th July, 1927, the 9th November, 1927, and on the 7th March, 1928. There were no changes in the membership of the Committee during the year.

**The Edinburgh Meteorological Committee** met on the 12th May, 1927, the 10th October, 1927, the 16th January, 1928, and the 12th March, 1928. The Meteorological Committee, at the meeting held on the 9th May, 1927, nominated Professor R. A. Sampson, F.R.S., as Vice-Chairman of the Edinburgh Meteorological Committee. Several changes in the membership of the Edinburgh Committee occurred during the year. Dr. A. Crichton-Mitchell was appointed as representative of the Royal Meteorological Society in place of Professor E. M. Wedderburn, who was later appointed as representative of the University of Edinburgh. Dr. J. E. Crombie ceased to be a member of the Committee on 31st March, 1927, at the termination of a period of two years representation of the University of Aberdeen. 8

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### CLIMATOLOGY

**British Climatology.**—The collection of meteorological records for the British Isles has continued along the customary lines. Regular observations have been taken at 343 stations varying from the private climatological station at which observations are taken only once a day, to the fully-equipped observatories of the Meteorological Office which maintain continuous records of all meteorological elements so far as this is possible. In addition nearly 5,000 stations have supplied information about rainfall. Particulars of the number of stations of each type in the various districts into which the British Isles are divided will be found in Appendix I. The mass of data received from these stations has been examined and published for general use in the following publications :—

- (a) Weekly Weather Report ;
- (b) Monthly Weather Report ;
- (c) British Rainfall, 1926 ;
- (d) Observatories' Year Book.

The chief change in the climatological work has been connected with the form in which the information is published in the *Weekly* and *Monthly Weather Reports*. Until the present year the *Weekly Weather Report* has been published each week. For many investigations the average values of the meteorological elements for intervals of a week are essential but it is not necessary that they should be published immediately. For many purposes it is much more convenient to collect the weekly values for a station and publish them together at the end of each year; while the preparation of an annual volume entails much less work and expense than the preparation and publication of the same information in weekly numbers. For these and other reasons it has been decided to replace the *Weekly Weather Report* by an annual volume. The weekly issues terminated with that for the week ending February 25th, 1928, and the preparation of the first annual volume, which will refer to the seasonal year spring 1928 to winter 1929, was commenced. The volume will contain meteorological data by calendar weeks which will be presented both for stations and for districts of the British Isles as heretofore, but the number of stations will be reduced to five for each district.

Small changes were also made in the *Monthly Weather Report* commencing in January, 1928. The number of health resorts supplying meteorological observations has grown so rapidly that the work of checking and preparing the data for publication had become a strain on the staff. At the same time the stations were so near together that they were largely duplicating one another's observations. The stations were therefore carefully scrutinised and the records from a large number omitted from the tables in the *Monthly Weather Report*. The result has been not only a reduction in work and expense but a more uniform representation of the meteorological conditions of the country.

Since 1914, it has been the practice to use both the inch and the millimetre as a measure of rainfall in the publication entitled *British Rainfall*. The use of the millimetre was discontinued in the volume of *British Rainfall* 1926, which was published during the year under review. The column of the table which contained the millimetre values was replaced by a column giving the average annual rainfall in inches for the stations so far as the average values are available. These changes have been welcomed by the rainfall observers and have reduced materially the work of preparation of *British Rainfall*.

It would be impossible for the Meteorological Office to collect the large amount of observations necessary to give a complete and accurate description of the climate of the British Isles if it did not receive the voluntary help of a large number of private and municipal observers. The Office is greatly indebted to the public spirit shown by those who maintain voluntary climatological stations in all parts

of the country and forward their records for incorporation in the official weather reports. All records received from climatological stations are carefully preserved in the Office where they are available for the benefit of the whole community.

During the discussion in Parliament on the Bill for stabilising Easter, suggestions were made that the weather at Easter as fixed by the Bill would be less good for holiday makers than the weather of the present movable Easter. At the request of the Home Secretary the question was investigated by the Meteorological Office. The weather of the Easter week-ends during the past 100 years was compared with that of the week-ends on which Easter would have fallen if the Bill had been in operation. The result of the investigation was that as regards rainfall in London nothing would be gained or lost by stabilising the date of Easter. On the other hand as regards sunshine and temperature, the fact that Easter would never fall after stabilisation so early in the year as it may at present would be an advantage, for at this time of the year sunshine and temperature are undergoing a rapid seasonal change for the better.

A number of inquiries have been received during the year regarding the maximum pressure of wind likely to be experienced in various parts of the country, the information being required in connexion with the design of electric overhead transmission wires and their supporting towers.

From September 19th to 23rd, a course of instruction for observers at stations maintained by the authorities at health resorts and at agricultural meteorological stations was held at Kew Observatory. The object of these courses is to familiarise the observers with the approved methods of making their observations and preparing their returns. Seventeen persons attended the course at which much useful work was done. At the end of the course an interesting conference was held during two days for the discussion of subjects connected with agricultural meteorology. The conference which was held in the Meteorological Office, South Kensington, was presided over by Sir Napier Shaw and was attended by a large number of agriculturists and meteorologists. Papers on the following subjects were read and the discussions were extremely valuable.

The week as a phenological unit	...	...	...	Sir Napier Shaw, F.R.S.
Rothamsted temperature records	...	...	...	Mr. T. B. Hoblyn.
The effects of temperature and humidity on the changes in weight of crops in storage.				Mr. G. V. Jacks.
Changes during storage in the stack	...	...	...	Mr. W. S. Gibson and Dr. W. Goodwin.
The effect of temperature on the keeping quality and bacterial content of milk.				Captain H. Barkworth.
The effect of meteorological conditions on the amount and nutritive value of pasture and hay.				Prof. R. G. Stapledon.
Temperature and the food requirements of animals				Prof. T. B. Wood.
The effect of ultra-violet light on animal nutrition				Dr. H. E. Magee.
The meteorological factors affecting sheep	...	...	...	Mr. J. E. Nichols

**World Climatology.**—The Meteorological Office collects meteorological information from all parts of the world, chiefly from the official publications of the meteorological services of other countries. Owing to the world-wide distribution of the British Empire, a large proportion of the statistics of world weather is prepared in the British Empire. The London Meteorological Office is not responsible for the meteorology of the Empire as a whole and in the larger Dominions there are excellent meteorological services, but the Office gives considerable help to the Colonies and Protectorates which have no organised meteorological services. It advises on methods of observation, and under an arrangement made with the Colonial Office it collects reprints of the summaries of the meteorological observations which are published in the Annual Reports of the Colonial Governments. The reprints collected in this way are then circulated to the chief meteorological services of the world. Thus in the year under review observations taken at 319 stations in 34 Colonies and Protectorates were made available for scientific and industrial investigations.

An important contribution to climatological knowledge of the world is made by the Office in the publication of an annual volume entitled *Réseau Mondial*. This volume contains monthly data from about 440 stations systematically distributed over the earth. During the year the volume for 1920 was issued, and that for 1921 was in the press. The preparation of the tables for 1922 was well advanced. As the data for this publication are extracted from the official publications of other countries, it is inevitable that it should be in arrears. Until the volume for 1921 the *Réseau Mondial* has contained information from land stations only; in that volume, however, data are included for certain regions of the ocean based on observations taken on board ship.

Practically no climatological investigations can be made until data for a number of years are available. Meteorological observations have been taken to a greater or less extent in all inhabited parts of the world, but it is often difficult to obtain the information when required. At their meeting in Utrecht in 1923 the International Meteorological Committee decided to collect the existing information from a representative number of stations distributed all over the globe. As a result of this resolution and the generosity of an American citizen, a volume entitled "World Weather Records" has been published by the Smithsonian Institution of Washington. The volume contains all the monthly values of pressure, temperature and rainfall available for 385 stations in all latitudes from Upernivik in 72° 45' N. to Laurie Island in 60° 44' S. The volume consists of 1,197 pages and is one of the most valuable climatological publications ever compiled. The London Meteorological Office was responsible for collecting the data for stations in Africa, Australia and Oceanic Islands.



Many inquiries are received and investigations undertaken which necessitate the use of climatological information collected from all parts of the world. The Admiralty issues a series of handbooks entitled "Admiralty Pilots," which contain notes on weather and climatology for the regions with which the Pilot deals. The text of the meteorological portion of the Admiralty Pilots is prepared in the Meteorological Office and during the year four Pilots were revised and a long chapter on Antarctic meteorology was prepared for inclusion in a new Pilot for the Antarctic regions which is in course of preparation.

As examples of the numerous inquiries received from private and public bodies regarding world weather the following may be mentioned. The Empire Marketing Board required the regular supply of rainfall data for a number of places in the Mediterranean. A large amount of information has been supplied to the Colonial Office regarding a number of places in the South Atlantic and Southern South America for use in connexion with an investigation into the whale fishery. A firm of publishers was supplied with information for the preparation of rainfall and temperature maps of South America. An entomologist in Tanganyika desired information as to the structure of wind gusts in connexion with the flight of birds and insects.

A library is an essential part of any meteorological service and the library attached to the London Meteorological Office is one of the most complete of its kind in the world. It is maintained largely by exchange of the publications of the Office for similar publications issued by other meteorological services, relatively few books being bought. During the year the additions to the library included 582 new books, about 4,300 periodicals and over 12,500 daily weather reports. Between 9,000 and 10,000 books were issued on loan during the year.

Abstracts of the more important meteorological papers received in the library are prepared by members of the professional staff and these have been manifolded and circulated in sets to the branches and establishments of the Office. During the year this part of the work has been extended and systematised and sets No. 8 and 9 were issued.

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## OCEAN METEOROLOGY

The collection of meteorological information from the ocean has continued as in the past. The voluntary observing fleet consists of 500 ships, this number being fixed by the capacity of the Marine Division to deal with the observations made. The Office equips 118 of these ships with a complete outfit of meteorological instruments and observations are taken every four hours and entered into meteorological logs which are forwarded to the Office at the end of

each voyage ; 350 ships use their own instruments and provide a less elaborate record. The information collected is thoroughly examined and recorded in the Marine Division where the most important data are punched on cards for use in the Hollerith mechanical calculating machine. During the year 279 full logs were received from the ships equipped by the Office and 2,261 meteorological reports from the ships using their own instruments. 73,745 sets of observations were punched on Hollerith cards. The quality of the observations was maintained at a high level and reflects great credit on the officers of the Merchant Navy who undertake this onerous work without any reward beyond the knowledge that they are providing information which is of the utmost value regarding the weather in all parts of the ocean. The information collected is not only of value for meteorological purposes but it is used in replying to frequent inquiries regarding the weather in different parts of the world at specified times, mainly in connexion with marine casualties.

*The Marine Observer* has been published regularly throughout the year. This monthly magazine has continued to serve successfully the purpose for which it was established, namely, to be the channel of communication between the Meteorological Office and the voluntary marine observers. The magazine contains a series of articles on meteorological subjects and gives the latest information regarding meteorological signals in all parts of the world. A great deal of space has been devoted in the *Marine Observer* to instructing ships' officers in the practice of preparing meteorological charts so that they may use synoptic meteorology as an aid to navigation.

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### FORECASTING

The possibility of forecasting the weather by modern methods depends on the rapid collection of information from as large an area as possible. As the result of close international co-operation, observations are taken in all parts of Europe at specified hours and then the results are immediately broadcast by powerful wireless stations so that within less than two hours from the time of observation all the meteorological services in Europe have already received information extending from well within the Polar Circle on the north to North Africa on the south, from Russia on the east to the Azores on the west. Since the beginning of February a synoptic report containing 7 h. readings has been issued each morning by Lithuania, which was the only remaining European country without a synoptic issue. The international organisation is based on observations taken four times a day, at 1 h., 7 h., 13 h. and 18 h. G.M.T. and synoptic charts are prepared for each of these hours. Nearly all countries provide information at 7 h., 13 h., and 18 h. but readings at 1 h. are not taken over such a wide area so that a complete synoptic chart for the whole of Europe cannot yet be prepared for that hour.

Besides the reports received from Europe, a report is received each day from the U.S.A. giving observations from 75 stations in North America, including a number of stations in Canada. The messages are issued on short wave length by the Arlington, Va. wireless station and are received in France whence they are re-transmitted by wireless from the Eiffel Tower. It has, however, been possible to receive these messages direct in this country and there have been very few occasions of complete failure in reception. The whole of Europe is greatly indebted to the U.S.A. Weather Bureau for providing this valuable information free of charge.

For forecasting purposes information from the Atlantic is of vital importance and a special system of reports from ships has been organised for the North Atlantic. A number of the large Atlantic liners co-operate in this work and a constant supply of information is received daily from these ships. The ships co-operating in this work are supplied with instruments by the Meteorological Office but the work is entirely voluntary on the part of the officers, and the wireless messages are issued free of charge. During the course of the year, 4,292 weather reports were received from 32 North Atlantic liners, the number being limited only by the cost of the transmission when the wireless messages reach the land stations. The observations from the Atlantic taken by the liners are confined to a narrow track between England and North America. During the course of the year arrangements were made for ships of H.M. Navy, when they are in regions of the Atlantic south of the liner track, to forward meteorological reports to the Office. The reports received in this way form a valuable addition to the observations made by the liners. By combining the observations received from America, from ships at sea, and from Europe, it is possible to draw each day a synoptic chart for the greater part of the Northern Hemisphere, which is of great assistance in preparing accurate forecasts.

There are two main methods of disseminating the forecasts to the public as soon as they are made, namely, through the Press and by the British Broadcasting Corporation. Arrangements are made for the newspapers to receive the latest forecasts available up to the moment of going to press, but with the exception of a few evening papers an interval of something like 12 hours elapses between the preparation of the forecasts and the time the newspapers reach their readers. Wireless broadcasting makes it possible to reduce this interval very appreciably and the forecasts are issued by the B.B.C. within half an hour of the time they are prepared. For example, during summer time observations are taken all over Europe at 7 p.m., these are collected, plotted and discussed by the Meteorological Office in time for the forecasts to be broadcast at 9 p.m. Thus the forecasts are received by the public in all parts of the country within two hours of the time the observations are taken, an obvious triumph for wireless and international co-operation.

Reference has been made above to the reception of information from foreign meteorological services. This, of course, implies a similar service on the part of the London Meteorological Office, and four times a day the powerful Air Ministry wireless station at Kidbrooke issues a synoptic message which can be picked up over the whole of Europe, giving information of the observations made at the British stations. In addition, twice a day, messages are broadcast from the same station giving special information to ships at sea regarding the conditions in coastal waters. These messages are also repeated in a modified form by the B.B.C. for use of small coasting craft.

The demand for special forecasts and reports has undergone a very rapid increase during the last few years, indicating that the general public is beginning to realise the value of the information now available for them. During the last five years the number of inquiries for special forecasts has been 2,984, 3,354, 3,845, 3,167, and 4,005; these are independent of inquiries for aviation purposes, to which reference will be made later.

**Thames Floods.**—On January 7th, 1928, there was a high tide in the Thames which caused serious flooding with the loss of several lives. The subsequent inquiry showed that the phenomenal rise of the tide was mainly due to a northerly gale over the North Sea. At the request of a committee appointed by the Minister of Health it was decided that the Meteorological Office in collaboration with the Hydrographer of the Navy and the Tidal Institute of Liverpool, should investigate the causes of abnormally high tides and this work has been commenced. In the meantime the Office has undertaken to warn the public and a number of authorities—after consultation with the Port of London Authority—when weather conditions appear likely to cause high tides in the Thames.

**Gale Warnings.**—The service of gale warnings has been carried on throughout the year, new stations having been established at Galway, Ballywalter, Bangor, Ballycastle, Kilkeel, Killough, Calshot, Baltasound and Whalsay. The gale warning station at Rathmullen was closed during the year. A slight change has been made in the procedure in connection with the lowering of the gale warning cones. Until December it was the practice not to lower the cone unless the forecaster considered that there would be at least 24 hours free from gale. The consequence of this rule was that in periods of very unsettled weather when it was probable that after a gale the wind would rise again to gale force within 24 hours, the cone was left flying. Thus shipping remaining in port on account of the weather was not informed of short comparatively calm periods. Owing to the greater confidence of the forecasters it is now possible to alter the rule and the cone is now lowered if a period of not less than 12 hours free from gales is anticipated. The gale warnings issued have, as usual, been checked against the actual occurrences

of high winds and the results are shown in Appendix II, from which it will be seen that effective warnings were issued for 91 per cent. of the gales which occurred, while 75 per cent. of the warnings issued were justified by the occurrence of either gales or strong winds.

## AVIATION

The arrangements for the supply of meteorological information to the Royal Air Force and for civil aviation have continued with little modification, except as regards detail, on the lines described in the *Annual Reports* for 1925 and 1926.

There has been, however, further expansion of the work of the Aviation Division of the Meteorological Office in practically all branches. This expansion is reflected in the number of inquiries received at headquarters and at the various outstations for forecasts and for other information, the increase on the previous year being more than the increase during the two years 1925 and 1926.

In January the weather-reporting organisation for aviation was improved by the addition of a weather report each morning from six Air Force stations, from Newcastle-upon-Tyne Aero Club at Cramlington, and from the Blackburn Aeroplane Company at Brough. The stations were selected to cover areas from which little information was available previously, and the reports are extremely useful in the preparation of information for cross-country flying, particularly from the south of England to Scotland. The arrangements made include the possibility of supplementing the routine reports by special reports at other times of the day when weather conditions or aviation requirements render such reports desirable.

During the period under review, 4,910 requests for reports or forecasts were received at the Terminal Aerodrome at Croydon, an increase of 1,068 on the previous year, while 3,964 reports were passed by radio-telephony from Croydon and Lympne to pilots of aircraft in flight.

International aeronautical conferences for the discussion of questions affecting civil aviation between Great Britain, France, Belgium, Holland, and Switzerland, were held in London in April, in Paris in November, 1927 and in Berlin in March, 1928. Representatives from Germany attended the Conference for the first time in April, and from Czecho-Slovakia in November. As a result of discussions at these conferences, various changes have been made in the direction of the improvement as to detail of the weather reporting organisation on regular air routes.

Among these changes may be mentioned the alteration of the order of the meteorological ground signals at Lympne from the 1st October, to conform to a recent recommendation of the International Commission for Air Navigation, which ensures that all meteorological

reports furnished to aircraft in flight are transmitted in the same order ; and the display at terminal aerodromes of tables showing the times of sunset at various European aerodromes, for the guidance of pilots flying in the afternoon.

The main improvement, as far as the organisation in England is concerned, was the establishment in January of additional auxiliary reporting stations lying on alternative air routes between Croydon and the Channel, which can be followed by aircraft when bad weather prevails on the normal route. At the same time, reports already received from the stations at North Foreland and Deal, lying on the alternative route along the north coast of Kent, have been increased.

A new wireless station was opened at Cologne in July, since which month hourly reports giving observations at stations in the neighbourhood have been received by the Air Ministry. This arrangement has resulted in a considerable speeding up in the reception of information relating to the route Brussels-Cologne.

During the year 805 requests for weather reports and forecasts for cross-country or special cross-Channel flights in connexion with civil aviation, have been dealt with by the Aviation Forecast Service at Headquarters.

**Meteorological Arrangements for Trans-Atlantic Flights.**—An outstanding feature of the year has been the supply of meteorological information for trans-Atlantic flights. The work involved in this connexion may be classified under the following heads :—

- (i) Preliminary discussion of the meteorological conditions over the route, including the frequencies of different wind speeds and directions during the different months of the year.
- (ii) The supply to pilots of route weather information, including forecasts, prior to the commencement of the flight.
- (iii) In the case of west to east flights, the preparation and transmission to America of forecasts of the meteorological conditions over the eastern Atlantic and western Europe.

In connexion with (ii) the synoptic weather charts normally prepared for forecasting were supplemented by special charts prepared twice daily, covering North America, the North Atlantic and Europe. During certain periods a daily message was received by wireless from the United States Weather Bureau giving conditions and forecasts for the area extending from longitude 40° W. to New York.

Information as under (i) was supplied to Captain F. T. Courtney, to Colonel Minchin and Mr. Hamilton, to Captain McIntosh, and to Captain Hinchliffe.

Data regarding the prevailing weather conditions in western Ireland and the English Channel during June, July and August, were also supplied to the American Air Attaché.

Information as under (ii) was supplied daily to Captain Courtney from the 20th July to 3rd September ; to Colonel Minchin from 23rd to the 31st August ; to Captain McIntosh from the 29th August to the 16th September ; and to Captain Hinchliffe from the 4th to the 13th September, and from the 27th February to the 13th March.

With regard to (iii) special forecasts were sent to America on the 19th and 20th May for Colonel Lindbergh's flight, and throughout the month of June in connection with Commander Byrd's flight, and from the 10th August to the 9th October for the " Old Glory " and Ruth Elder flights. During the course of Commander Byrd's flight on the 29th and 30th June, special weather information was added to the " Weather Shipping " messages broadcast from the Air Ministry and Valentia, with a request to ships to pass the information to Commander Byrd if in touch with him.

Special forecasts were also sent to Newfoundland on the 27th August for the " Pride of Detroit " flight ; on the 6th and 7th September for Mr. Tully's projected flight from Newfoundland to England ; and on the 8th September for a similar flight by Mr. Wood.

**Meteorological Arrangements for Long Distance Flights.**—Special arrangements were made for the supply of meteorological information in connexion with the projected non-stop flights by Royal Air Force officers from England to India in May, June and July. Special messages were received daily by wireless from the Meteorological Office, Heliopolis, giving information regarding the existing conditions between Asia Minor and the Persian Gulf, and also a forecast of probable changes. Similar messages were received from India relating to conditions at the eastern end of the route.

From these reports and the synoptic charts of Europe, prepared in the Meteorological Office, a statement of the present and probable future conditions along the entire route was telephoned to Cranwell, from where the start was made.

The arrangements were complicated by the fact that for the start of the flight a wind from due west or due east at Cranwell was necessary for the take-off of the machine.

Forecasts were supplied to Captain Hinchliffe from the 14th to the 23rd September, in connexion with a projected non-stop flight to India, and to Captain McIntosh and Mr. Hinkler from the 8th to the 15th November, for a similar projected flight. The organisation in these cases was similar to that described above for the Royal Air Force flights over this route, which took place earlier in the year.

**Meteorological Instruction to Royal Air Force Officers.**—Regular courses of instruction have been given during the year to officers under training at the Flying Training Schools at Netheravon, Digby and Sealand, the lectures having been given by the meteorological officers at Worthy Down, Cranwell and Sealand respectively.

Courses of lectures to naval flying officers were also given at Leuchars by the meteorological officer at that station.

Instruction in connexion with special courses in air pilotage at Calshot and courses for naval observers at Lee-on-Solent has been given by the meteorological officer at Calshot, who has also given special instruction to naval officers destined for meteorological duties on aircraft carriers.

**Observations of Upper Winds.**—The total number of pilot balloon ascents made at outstations during the year to determine the velocity and direction of the upper winds, was 10,231. In addition 4,766 nephoscope observations of the movement of upper cloud have been made.

**Airships.**—In connexion with the erection of mooring towers for airships in different parts of the British Empire, the Air Ministry despatched an Airship Mission led by Group Captain P. F. M. Fellowes, D.S.O., A.D.C., R.A.F., Director of Airship Development, to visit South Africa, Australia, New Zealand and Ceylon. Mr. M. A. Giblett, Superintendent of the Airship Service Division of the Meteorological Office was a member of this Mission. The tour commenced from England on 5th May, 1927, and the following places were visited :—

St. Helena.

Union of South Africa (Cape Province, Transvaal and Natal).

Australia (West Australia, South Australia, Victoria, New South Wales and Tasmania).

New Zealand (North and South Islands).

Ceylon.

As the choice of a suitable site for a mooring tower depends very largely on suitable meteorological conditions, Mr. Giblett's duties mainly consisted of giving advice on this subject, but he took every opportunity of discussing with the local authorities what meteorological ground organisation would be required for the operation of airships and what additional meteorological information it would be necessary to collect before the establishment of regular airship services.

After leaving Ceylon Mr. Giblett visited India and Egypt before returning to England. In India visits were paid to the airship base at Karachi, to Delhi and to the Aerological Observatory at Agra, and opportunity was taken of discussing in considerable detail the co-operation of the Indian Meteorological Department in the ground organisation for the airship route England-Egypt-India. In Egypt the airship base at Ismailia was inspected and preliminary arrangements made for the meteorological organisation which will be required on the airship route from England to India.

During the absence of the Superintendent the investigation staff of the Airship Services Division continued their work of charting and studying the meteorological conditions along the England-Egypt-India route.



During the whole of the year a special investigation has been in progress at Cardington in connexion with wind structure. The investigation is being made on behalf of the Aeronautical Research Committee, who have appointed a Wind Structure Sub-Committee to advise on the investigation. Special anemometers which record the velocity and direction of the wind at a height of 50 feet above the ground have been installed at the corners of an equilateral triangle, the length of the side of the triangle being 700 feet, which is the approximate length of an airship. An additional similar anemometer is placed in the middle of the side of the triangle which lies along the prevailing wind. The instruments record on clock-driven charts which move so rapidly that changes of wind which only last two or three seconds can be clearly separated. Special arrangements are made to synchronise the clocks so that simultaneous values can be read off from all four instruments. From the records it is therefore possible to determine the variations of wind to which an airship would be subjected along its own length. The results which have been obtained are extremely interesting and valuable, but they have not yet been completely discussed.

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### METEOROLOGY FOR THE ARMY

The chief service rendered by the Meteorological Office to the Army during peace times is to provide the information of atmospheric conditions which is necessary for artillery work.

At Shoeburyness a meteorological station is maintained which provides data for correcting the trajectories of the shell fired on the experimental range. This requires complete knowledge of the temperature, density and direction of motion of the air in all layers traversed by the projectile, which in certain cases extend to great altitudes. At Larkhill similar information is given for ordinary artillery work.

The firing of certain heavy guns at Shoeburyness is liable to cause damage in the surrounding towns, chiefly in Southend. An investigation showed, however, that the intensity of the sound is dependent on atmospheric conditions. In certain conditions of the atmosphere firing can take place with little disturbance at Southend, while on other occasions the disturbance is intensified to the point of danger. The Meteorologist-in-Charge at Shoeburyness now informs the Superintendent of Experiments when the conditions are suitable for firing, and since this procedure has been adopted cause for complaint has almost entirely ceased.

The firing of these heavy guns has been used for investigating an extremely interesting problem in the structure of the atmosphere. It has long been known that when great sounds have been made, generally accidental explosions, the intensity of the sound decreases

in a normal way with distance from the seat of the explosion, until it has entirely disappeared. At still greater distances, however, the sound is heard again and in certain cases a second zone of audibility can clearly be defined outside a region in which nothing is heard. The physical cause of this has given rise to considerable speculation, and Dr. Whipple, Superintendent of Kew Observatory, has done valuable scientific work on this problem. In 1926 it occurred to him that it might be possible to make use of the firing at Shoeburyness in his investigations and he was successful in timing the passage of sound from the Shoeburyness range to Grantham. In 1927, with the co-operation of the military authorities and the British Broadcasting Corporation, arrangements were made for broadcasting signals when gun trials were taking place on the Shoeburyness range. In the first instance the co-operation of the public in listening to the sound of gunfire was invited. At the same time apparatus for recording the sound of gunfire was installed at Birmingham, Bristol and Southampton. Experience obtained with the trials of July 9th and August 3rd showed that the apparatus could be made more sensitive than the human ear in detecting the passage of the longer air waves associated with the gunfire. In later trials, therefore, instruments alone were used for making the observations. At the first trials reception was so good at Birmingham and Bristol that it has been decided to extend the network of stations. There is little doubt that valuable results will be obtained. The work so far lends considerable support to the suggestion, made on other evidence, that the temperature of the upper air in the neighbourhood of 40 or 50 kilometres above the ground is almost the same as at sea level.

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## METEOROLOGY FOR THE ROYAL NAVY

The Navy has to face many new problems which necessitate a more scientific study of meteorology in the Fleet. The importance now attached to meteorology by the Navy is emphasised by the appointment by the Admiralty of a Fleet Meteorological Committee to direct and supervise the development of meteorology in the Navy. The Superintendent of the Navy Services Division of the Meteorological Office has been appointed a member of this Committee.

The direct need for meteorological information by the Navy when at sea is chiefly felt in connexion with the Fleet Air Arm, and an officer on board each of the aircraft carriers has been charged with meteorological duties. Special accommodation for meteorological work has been allotted in H.M.S. *Courageous* and H.M.S. *Hermes*, and it is anticipated that similar accommodation will be provided in other carriers. Special meteorological instruments have been designed and fitted in all aircraft carriers, thereby facilitating the work of the officer charged with meteorological duties. The two lieutenants appointed to meteorological duties in H.M.S. *Courageous*

and H.M.S. *Hermes* underwent a month's special course in meteorology in the London Meteorological Office before taking up their duties. These officers are not only called upon to issue forecasts in connexion with aviation but they issue general forecasts to the Fleet also. This is an interesting development and the experience so far gained indicates that the forecasts are of considerable use in connexion with operations of the Fleet.

It is interesting to note that the practice of drawing synoptic charts by navigators of the Fleet is still increasing. The large amount of meteorological information broadcast from land stations and from a number of ships at sea facilitates the preparation of such charts.

The need for accurate knowledge of the prevailing winds in the upper air is becoming as important to the Navy in connexion with the Fleet Air Arm as a knowledge of the conditions at the surface is for ordinary navigation. The Admiralty and the Air Ministry are therefore co-operating to obtain this information by pilot balloon observations made from H.M. Ships. It was agreed to equip 40 ships with the necessary apparatus. Some unavoidable delay occurred in the supply of pilot balloon outfits to ships on foreign stations ; but at the end of the year 35 ships had been equipped.

In addition to the observations of the upper winds made by means of pilot balloons, shell bursts are employed for the same purpose and occasionally observations of upper air temperatures are made from aeroplanes operating from fleet carriers. All the upper air data obtained by H.M. Ships are plotted and summarised in the Meteorological Office.

A number of special meteorological investigations have been carried out by H.M. Ships, amongst which may be mentioned an investigation to determine whether a small portable thermometer screen fitted with dry and wet bulb thermometers exposed on the windward side of the ship gave satisfactory readings of temperature and humidity. Work on this investigation has been carried out by H.M.S. *Beaufort*, H.M.S. *Fitzroy*, H.M.S. *Flinders*, and H.M.S. *Kellett*. H.M.S. *Endeavour* has carried, during an extended voyage, three special experimental barometers, in one of which the cistern was made of stainless steel in order to determine whether barometers made of this material have any advantages for observations at sea. A knowledge of the correct rate at which pilot balloons ascend is essential if accurate determinations of upper wind are to be obtained by their use, and experiments were carried out from H.M.S. *Furious* to check the rate of ascent by observing the balloon from aeroplanes.

The question whether the wide-spread belief that a change of wind accompanies a change of the tide has been investigated by observations made in H.M.S. *Flinders*. The investigation is, however, not yet completed.

The decision of the Admiralty to adopt the millibar as the unit of pressure for general use in the Navy is of much importance as it brings the meteorological observations made by the Navy into line with those made at the official stations of the Meteorological Office. It also brings us one step nearer to the universal adoption of one unit of barometric pressure throughout the world.

## 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; and 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 1925 was issued during the year under review.

**Kew.**—No major change was made during the course of the year in the work of Kew Observatory. The chief work undertaken at the Observatory in addition to the meteorological work has been in connexion with seismology and atmospheric electricity. The Galitzin seismographs have recorded satisfactorily throughout the year and monthly seismological bulletins have been issued regularly. On 15 occasions earthquake shocks of sufficient severity to justify communicating the information to the Press were recorded; while on 18 occasions technical details regarding the records were broadcast as part of the synoptic meteorological reports for the information of other seismological observatories on the Continent.

Considerable work of an experimental kind has been carried out in connexion with measurements of atmospheric electricity, the endeavour being to investigate the relationship between the potential gradient and the conductivity of the air in order to throw light on the mechanism of the current of electricity which is always passing

between the ground and the upper atmosphere. During the year an electrograph was constructed for Mauritius by the Cambridge Instrument Company to the design of the Meteorological Office. The instrument after manufacture was tested at the Observatory before despatch to Mauritius. The trial proved very satisfactory.

At the request of the Research Committee for Atmospheric Pollution appointed by the Department of Scientific and Industrial Research, an investigation is being carried out at Kew on the standard gauge used for measuring the quantity of impurity deposited from the atmosphere. The questions to be answered are the following :—

- (a) Do two gauges placed side by side give comparable results ?
- (b) How is the amount of deposit received by the gauge affected by the position in which it is exposed with relation to surrounding buildings ?
- (c) What is the relationship between the impurities brought down by rain and those deposited in the absence of rain ?

For the purpose of this investigation five similar gauges have been erected at Kew in positions chosen to answer these questions and observations are taken regularly of the deposit collected by each of the five gauges.

A systematic investigation is also being made of the so-called nuclei of condensation which are counted by the well-known Aitken apparatus and the large material particles of dust which are collected by the Owens jet dust-counter. The investigation should throw considerable light on the mechanism of condensation of water vapour in the atmosphere.

A number of minor investigations have also been undertaken of which the following may be mentioned. A special raingauge has been designed to record accurately the rate of rainfall, minute by minute, during very heavy rain, and a complementary instrument for recording periods during which very light rain occurs. The ordinary apparatus fails when the rain is very heavy and when it is very light, while information regarding the rate of heavy rainfall and the period of light rainfall is of very great importance both for scientific and practical purposes.

It has long been known that the amount of rain collected in a raingauge is greatly affected by the strength of the wind to which the gauge is exposed. A gauge surrounded by a wind-break of such a form that it reduced the wind velocity at the mouth of the gauge without sheltering the gauge itself from the rain, records more rain than a similar gauge without protection. To investigate this effect two small anemometers have been set up on the lawn near the raingauges to record the strength of the wind at the height of the gauges. It was found that in the comparatively sheltered position of the raingauges at Kew the wind speed was only about one-third of that recorded at 60 feet above the ground.

With the object of improving the ordinary Stevenson screen, a number of screens of different pattern have been made and comparative observations taken in them.

During the remarkable floods on December 26th, 1927, and January 7th, 1928, the Old Deer Park surrounding Kew Observatory was seriously flooded, on the latter occasion the floods were the highest of which there is any record in the neighbourhood. The observation lawn was submerged and inside the building the water rose round the seismograph pillars until it was nearly level with the floor of the room. Fortunately no material damage resulted.

**Eskdalemuir.**—The continuous photographic registration of the three geographical components of terrestrial magnetic force was satisfactorily continued throughout the year. The curves have been standardised and hourly values with other data tabulated from them.

In response to a request from mining surveyors, tables have been prepared each week and published since early in August, 1927, in the *Colliery Guardian* and the *Iron and Coal Trades Review*, giving hourly values of magnetic declination together with indications of the magnetic character of the day. Similar information for the magnetic station at Abinger is supplied by the Astronomer Royal. As an outcome of the publication of these data a number of mining surveyors have asked for and received copies of the magnetograph records and further information regarding the conditions at certain times, thus showing that the information supplied is being used by the surveyors.

A number of investigations recently carried out by the Radio Research Board have suggested that the transmission of wireless signals is liable to be affected by magnetic storms. In order that those working on these problems should have as early intimation as possible of any magnetic disturbances, arrangements have been made with the observatories at Abinger and Eskdalemuir to report by telegram or telephone the occurrence of each magnetic disturbance observed to be in progress.

At the end of the third week of December the records which had been obtained continuously for the last 12 months of the changes of vertical magnetic force recorded by means of the large horizontal coil were discontinued. The mass of records obtained is very large and will need considerable time for adequate discussion.

In order to commemorate the connexion of four eminent physicists with the Eskdalemuir Observatory it was decided by the Meteorological Committee to give the four residential houses the following names :—

Superintendent's House—Rayleigh House,

Assistants' House—Schuster House,

and the two houses recently erected for members of the staff—

Glazebrook House and Shaw House.

**Aberdeen.**—The observatory at Aberdeen records only meteorological data. It has maintained a continuous record of barometric pressure, temperature, wind and rainfall for 60 years, and other meteorological observations at specified hours have been made without interruption. The work has continued throughout the year as usual. In view of the impending extension of the university buildings which will encroach seriously on the site where the instruments for recording temperature and rainfall have been exposed, steps have been taken to choose a new site to which the instruments can be transferred when necessary. The university authorities have generously offered a new site a little to the north-east of the present one and comparative observations have been initiated.

**Lerwick.**—The Lerwick Observatory was established mainly for observations on 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, temperature and sunshine are maintained. The magnetographs continued in operation throughout the year and the records are the most satisfactory yet obtained, many of the difficulties associated with observational work in this exposed position having been satisfactorily overcome.

As the staff available does not allow of a continuous watch being kept on the aurora all night, it is necessary to terminate regular hours of observation at 11 p.m. daily, but when exceptional displays are observed the staff voluntarily continue their observations which occasionally have extended to the following morning.

Owing to its high northerly latitude, Lerwick is a valuable observing station for a number of geophysical factors which vary with latitude, and help is willingly extended to investigators who wish observations taken in high latitudes. Two such investigations have been carried out during the year. Regular observations have been made for Lord Rayleigh, who is making a survey of the light of the night sky in different parts of the world, and observations have been made for Dr. Dobson in connexion with his determination of the amount of ozone in the upper atmosphere.

The instrument installed at Lerwick by the Radio Research Board for recording continuously the direction from which "atmospherics" are received, has been maintained in action and the records forwarded regularly to the Radio Research Board.

**Valentia.**—Valentia Observatory was established chiefly with the object of obtaining complete meteorological records for south-west Ireland. This work has been continued uninterrupted 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 and vertical force, are made weekly, and regular observations were made with Dr. Dobson's ozone spectrograph during the summer months, the instrument being returned to Dr. Dobson at the end of October.

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### BRANCH METEOROLOGICAL OFFICES

**Edinburgh.**—The Edinburgh Meteorological Office acts as a local centre for the organisation of climatological and rainfall stations in Scotland, and for the administration of the three observatories at Eskdalemuir, Aberdeen and Lerwick. The number of climatological stations in Scotland is now 61 and the number of rainfall stations about 800. The Edinburgh Office also receives the monthly registers and autographic records from Scottish telegraphic stations before they are forwarded to London.

A monthly summary of the weather in Scotland together with the statistics for certain large towns has been prepared as usual for the Registrar-General. An annual report has also been prepared. In connexion with the latter certain suggestions have been made to the Registrar-General with a view to reducing the tabular matter which has to be prepared, but on further inquiry it appeared that reduction would impair the usefulness of the report and the complete tabular matter was retained. The text of the annual report was however differently arranged and a considerable reduction in length thereby attained.

The Edinburgh Office deals with local inquiries and supplies assistance to teachers or students engaged in special meteorological studies. One inquiry arising out of a lawsuit, in which entomologists and other expert witnesses were called, related to the possible occurrence in Scotland of temperature sufficiently high and lasting for sufficiently long periods to permit the development of the malaria germ in mosquitoes and its communication in active form to the population.

The Edinburgh Office does not regularly prepare synoptic charts though facilities for wireless reception are maintained and inquiries regarding forecasts are dealt with so far as the information is available. Other inquiries are referred to the Forecast Division in London. Special forecasts are, however, prepared each morning for the evening newspapers.

Besides the general supervision of the work of the observatories a considerable amount of the computation and reduction of the magnetic data obtained at Eskdalemuir and Lerwick falls to the Edinburgh Office. Improvements in computing, rendered possible largely by the increased use of adding machines, have enabled



a considerable saving to be effected in the amount of tabular matter to be copied and checked and the bulk of manuscript material to be subsequently stored.

In addition to the ordinary work of the Office the professional staff undertake so far as time is available special scientific investigations, and during the year the Superintendent was engaged on an investigation dealing with the diurnal variation of meteorological factors from the point of view of polar and equatorial air currents.

Following on the discovery in November, 1927, that the larger magnetic storms could be separated into well-marked groups according to their features as recorded at Eskdalemuir and Lerwick Observatories, computations were made of the disturbing electric field in a number of cases. The general deductions made from inspection of magnetograms lead to results of a very definite and encouraging nature in respect of the initial stages of the storms. The investigation was, however, incomplete at the end of the year under review.

During the summer of 1927 meteorological instruments were lent by the Office to Mr. Donald Mathieson who was engaged on a survey of the island of St. Kilda. An excellent record of the four summer months was provided by Mr. Mathieson and a summary of the climatic features of St. Kilda as compared with other stations in the west of Scotland was prepared and published in the *Meteorological Magazine* for February, 1928.

**Malta.**—The Meteorological Office, Malta, was established primarily to provide meteorological information for the Fleet when in the Mediterranean and for aeroplanes crossing from Europe to North Africa. The increasing development of the Fleet Air Arm has made meteorological information of vital importance to the Fleet, and work for H.M. Navy continued to form the major part of the duties of the office. The office collects the meteorological reports issued by wireless telegraphy from the various meteorological services surrounding the Mediterranean, and, in addition, collects a certain number of reports by cable. The cable is used, however, mainly to supplement the wireless information which is frequently incomplete owing to the large interference in the Mediterranean by "atmospherics" with the transmission of wireless messages. In 1925 the office commenced to issue each morning a message giving in code observations taken at a selected number of stations. These messages were received by H.M. Ships when away from Malta and formed the basis for the preparation of synoptic charts on the Flag Ship and aircraft carriers. At the request of the Naval Authorities, after several periods of trial, a similar message was prepared and issued each evening commencing on the 16th January, 1928. In order to do this it was necessary to augment the staff at the Malta Meteorological Office, when it became possible to arrange for the morning and evening issues to be continued during week-ends and holidays as well as on ordinary days. In order to increase the

amount of information available, the ships of the Fleet, when outside 50 miles radius from Malta, take observations twice a day and forward them through the Naval W/T station to the Meteorological Office. This additional information is extremely valuable.

During the year a beginning was also made with the collection of weather reports from British merchant ships in the Mediterranean. The London Meteorological Office arranged for a certain number of ships when passing through the Mediterranean to make observations and forward them through the Naval W/T station to the office. The amount of information obtainable in this way is limited and from December onwards only 2 to 4 reports were received from merchant ships each month, but it is hoped that the service will be materially extended in the future.

Each year there is an increase in the number of British aeroplanes flying across the Mediterranean, most of which cross via Malta. The pilots of these machines depend entirely on the Malta Meteorological Office for information regarding the conditions to be expected on the long sea flight. During the year under review the number of civilian aeroplanes passing through Malta on long distance flights was seven. This included one in May flying to Australia, one in September to the Cape, one in October to Australia, two in November to the Cape, one in February to Australia, and one in March to the Cape. In addition the Royal Air Force asked for and were supplied with special reports from time to time for extended flights.

The Royal Air Force aeroplanes continued to make observations of upper air temperatures which they communicated to the office. From December to February the number of these was reduced to two per week ; but during March special efforts were made to obtain as nearly as possible daily observations in connexion with the special observations called for by the International Commission for the Exploration of the Upper Air.

During the year preparations were made to remove the office from the temporary quarters which had been rented at Pietà, to Valletta, where the office will be much more conveniently situated for supplying meteorological reports to those who require them.

The office has continued to supply meteorological information to the Royal Artillery for use during firing practice.

**Meteorological Section, Middle East.**—During the year all Air Force personnel have been withdrawn from meteorological work in the Middle East Area and civilian staff have taken their place.

The meteorological organisation for the Middle East now consists of the following stations :—

Heliopolis	Headquarters and fully equipped meteorological station.
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Aboukir	} Fully equipped meteorological stations.
Abu Sueir	
Ramleh	
Amman	

The staff at the headquarters at Heliopolis consists of the superintendent, one professional assistant, and four clerk observers, while at each of the other four stations there is a chief observer sent out from the clerical staff of the home office, assisted by a locally recruited British observer. In addition to the five stations mentioned above, there are auxiliary reporting stations at Gaza and Rutbah. At the former station the meteorological work is undertaken by the W/T operator employed by Imperial Airways, while at the latter the observations are temporarily made by the R.A.F. Iraq ; but arrangements are in hand to train at Heliopolis a member of the Iraq Posts and Telegraph Department who will later be posted to this station.

Meteorological reports broadcast by the countries of Europe, North Africa and Iraq are collected at headquarters and synoptic charts are prepared from which a forecast is made daily for Egypt and Palestine and broadcast to all stations, Middle East. Additional reports are made on flying days for the information of the pilots of the Imperial Airways machines on the Cairo-Baghdad air route, and warnings of dangerous phenomena are issued in accordance with the recommendations of the International Commission for Air Navigation.

Meteorological summaries for Gaza, Ramleh and Amman are supplied to the Director of Agriculture and Forests, Jerusalem, for the monthly and annual reports issued by that Department.

On December 3rd and 7th, a conference was held in Cairo to discuss a large number of questions affecting the meteorological services in Egypt, Middle East, Iraq and Malta, chief amongst which was the improvement of the supply of information from the Middle East to the meteorological services of Europe and the meteorological organisation which would be necessary in connexion with the airship route between England and India. The Conference met under the Chairmanship of Dr. H. E. Hurst, Director-General, Physical Department, Cairo, and was attended by representatives of the meteorological services of Egypt, Iraq, Middle East and Malta ; and by representatives of the Airship Division of the Meteorological Office ; the Air Ministry Superintendent, Cairo-Karachi Civil Air Service ; and a Signals Officer, Air Staff, Middle East. The conference which was the most important meteorological conference which has ever met in Egypt, was very successful and its recommendations are being put into force as far as possible.

**Iraq.**—The arrangements have continued in Iraq by which the meteorological work is undertaken by R.A.F. personnel. The headquarters are in Baghdad in charge of a flight-lieutenant, who has received special training in meteorology and who is assisted by a number of airmen who act as clerks and observers.

## SPECIAL INVESTIGATIONS

**Upper Air Observations.**—At all the observing stations at which Meteorological Office staff is employed small pilot balloons are sent up as part of the ordinary observations in order to determine the direction of motion of the upper air currents. In Great Britain alone more than 12,000 balloon ascents were made for this purpose. These observations, however, give no information regarding the temperature of the upper air. Temperature observations are of great importance both for the theoretical study of the upper atmosphere and for the preparation of forecasts. For the scientific study of the upper air, temperature and humidity at great heights are required and this investigation is undertaken by the Upper Air Section at Kew Observatory. Special light instruments are attached to balloons considerably larger than those used for pilot balloon work and these are released on suitable occasions. The balloon rises until it bursts, when the instrument falls. Each instrument has attached to it a label instructing the finder to return it to the Meteorological Office when a reward of 5s. is paid. These balloons are sent up either from Kew or some other station according to the direction of the wind at the time of observation, that station being chosen which will give the greatest probability of the balloons falling on land. The total number of sounding balloons sent up during the year was 54, and the number of records obtained 46. Heights up to 21·9 kilometres were reached and 6 exceeded 20 kilometres; the mean height was 14·3 kilometres. Of the successful soundings 28 were made from Sealand, 15 from Kew, 2 from Calshot Aerodrome, and 1 from H.M.S. *Fitzroy* in the North Sea. The latter was of special interest as the instrument lay at the bottom of the sea for 10 days and was accidentally dredged up by a trawler. A good record was obtained in spite of the long immersion.

For several years efforts have been made to fit a simple form of hair hygrometer to the Dines meteorographs used with balloons. The problem proved to be one of some difficulty but during the previous year a fairly satisfactory hair hygrometer was designed. During the present year 80 per cent. of the instruments sent up were provided with the new hygrometer. The instrument has proved satisfactory so far as mechanical questions are concerned but the accuracy of hair hygrometers is limited by the uncertain behaviour of hairs in response to changes in relative humidity.

The balloon method of obtaining temperatures of the upper air has the disadvantage that it is always several days before the instrument is returned and the record can be worked up. The data obtained by this method are therefore useless for forecasting. In order to provide the observations required for forecast work a small meteorological flight has been established at Duxford, and aeroplane ascents are made twice a day when conditions are suitable. On these flights observations of temperature and humidity are made

by eye-reading instruments. Immediately the aeroplane lands the results are telegraphed to the Forecast Division. The observations made by the meteorological flight at Duxford have maintained a high level due entirely to the enthusiasm of the pilots employed on the work. A considerable amount of attention has been given to the possibility of improving the instruments used on these aeroplanes during the year under review. Similar observations are taken on suitable opportunities at other aerodromes chiefly at the Royal Aircraft Establishment at Farnborough. It is impossible to over-estimate the importance and value of the upper air observations made in this way.

**Investigation of Atmospheric Pollution.**—In 1915 the Department of Scientific and Industrial Research made a grant from public funds to the Advisory Committee on Atmospheric Pollution, which was an unofficial body. As a condition of the grant the work of the Committee was placed under the control of the Meteorological Office, the Director of which was appointed *ex-officio* Chairman of the Committee. The work of the Committee has continued along the lines originally laid down and very valuable work has been accomplished. Reports summarising the observations made and the scientific work carried out have been published annually. In 1926 it was decided, for administrative and financial reasons, that the control of the investigation of atmospheric pollution should be transferred from the Meteorological Office to the Department of Scientific and Industrial Research, and the change was carried out on the 1st April, 1927. Advantage was taken of the transfer to effect changes in the organisation of the investigation. In the future the organisation will consist of a standing Conference to which representatives of municipal and other bodies interested in the work on atmospheric pollution will be invited ; and a research committee which will advise the Council of the Department of Scientific and Industrial Research on the scientific work of the investigation. Except that the Director of the Meteorological Office has been appointed Chairman of the Research Committee and that observations according to the standard method will be continued at one or more of the Meteorological Office observatories, the Meteorological Office no longer has any responsibility for the conduct of the investigation.

**Eclipse.**—A total eclipse of the sun occurred at 5 h. 24 m. on June 29th, 1927. As the eclipse occurred just after sunrise the conditions were unfavourable for purely meteorological investigations, but special observations of atmospheric electricity and terrestrial magnetism were undertaken at Kew, Eskdalemuir and Lerwick. The weather conditions, however, at the time of the eclipse were so bad that the observations obtained were of little value.

**Insulation Troubles.**—One of the worst gales which has occurred in this country for many years commenced soon after midday on Friday, October 28th, 1927. It reached its maximum at midnight and was practically over by 7 a.m. on Saturday morning. After the gale a number of communications were received in the Meteorological Office from electrical engineers in many parts of the country asking whether there had been any abnormal magnetic or atmospheric electricity conditions during the gale as they had experienced considerable trouble with the overhead transmission lines, both during and after the gale. In all cases the trouble had been the same, the automatic switches which are set to break the current when it exceeds a definite amount were constantly in action, indicating an excess current in the lines. One of the most puzzling features of these inquiries was the fact that whereas in South Wales the troubles on the transmission lines had occurred on the Friday evening during the gale, no trouble was experienced at other places until the afternoon and evening of the following day when the gale had ceased for something like twelve hours. An investigation was undertaken in the Meteorological Office and it was soon obvious that the trouble had not been caused by any electrical or magnetic effect but the following explanation was obtained. During the gale, which was from the south-west, great quantities of sea-spray were blown up by the wind all along the west coast. The spray was carried inland by the wind and coated the insulators of the power lines in South Wales with a layer of salt water which practically short-circuited them so that the safety switches came into action. As the spray-laden wind passed inland the water was evaporated owing to the low humidity of the air and by the time the air had reached the Midlands the spray had been reduced to salt crystals. Sea salt is hygroscopic, therefore the crystals remained sufficiently damp to stick on the insulators of the power lines in the Midlands but the coating of salt was too dry to destroy the insulation completely. When the air became damp on Saturday evening, the insulation failed here also just 24 hours after the failures in South Wales. In the early morning of Sunday rain became general; this washed the insulators clean and the trouble was over.

**Scientific Work.**—Owing to the large amount of routine work, the opportunities for doing original research are very limited, but in all departments of the Office more or less purely scientific work is undertaken. The greater part of this work, however, is done out of office hours by the staff purely from the interest they have in the work. In Appendix VI. is given a list of the scientific papers and articles which have been published during the year by the members of the staff. From this it will be seen that in the aggregate the scientific work produced is of considerable magnitude. More original work would be undertaken if the staff of the Office were larger. At present there is no special provision for pure research, every post in the Office carrying with it a definite amount of fixed work.

## STAFF

Details of the staff and its distribution will be found on pp. 38–42. The numbers show an increase of 9 professional and 15 clerical officers as compared with the previous year, owing mainly to the calls of aviation in its various aspects. The most important increase is due to the development of the Airship Division mentioned on p. 16. The rapid development of this part of the work of the Office has made it difficult to provide sufficient trained personnel for all sections of the work. In addition to its own internal development the Office has been invited to second a senior officer, Mr. R. A. Watson, to take charge of the Royal Alfred Observatory, Mauritius.

The arrangements for the recruitment of established officers to the clerical staff of the Office to which reference was made in the report for last year have still not been completed and all new clerical appointments have therefore again been on a temporary basis.

The Committee have heard with deep regret of the death of Mr. W. H. Dines which occurred on December 24th, 1927. Mr. Dines had been closely associated with the office for many years and held the position of Honorary Assistant Director in charge of Upper Air Research until June, 1922 when advancing years and failing health compelled him sever the official connexion. Mr. Dines's many valuable contributions to the advancement of meteorology, more particularly to the investigation of the upper air, have secured for him for all time a foremost place among the meteorologists of the world.

**Training of Attached Officers.**—During the year a number of officers have been attached to the Meteorological Office to be trained in meteorology. Amongst these were three officers from the colonies—St. Helena, Sierra Leone and Uganda—who received special training in observations of the upper air and in taking normal climatological observations.

Four officers who will be engaged in the navigation of airships and three naval officers from aircraft carriers received instruction in synoptic meteorology and the special aspects of meteorology which have a bearing on their normal duties.

In addition various representatives of foreign meteorological services have attended at the Office for short periods in order to see the methods of work in Great Britain.

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## INTERNATIONAL MEETINGS

**International Commission for the Exploration of the Upper Air; International Union of Geodesy and Geophysics.**—Meetings of these two bodies were held respectively at Leipzig and Prague at the end of August and the early part of September, and were attended

by Mr. R. G. K. Lempfert as representative of the Office. At both meetings the position of President was filled by Sir Napier Shaw, a former Director of the Office.

The International Commission for the Exploration of the Upper Air was nominated in 1896 and exists for the object of co-ordinating observations made in the upper air by means of kites, balloons, aeroplanes, etc., in different countries. As one of the means of fostering co-operation the Commission has agreed on the periods during which countries should be asked to concentrate their ascents, and before the war it had also succeeded in making arrangements for the collective publication of the material so collected. The arrangement, however, lapsed during the war and the main business before the meeting at Leipzig was the consideration of a volume setting out the data for 1923 which had been prepared in the Meteorological Office by Sir Napier Shaw, President and Mr. Lempfert, Secretary of the Commission as a specimen of what should be aimed at for the future. The cost of preparing and printing the specimen has been defrayed largely from a grant of £500 made to the Commission by the International Union of Geodesy and Geophysics. The specimen volume embodies several new features, and whereas the volumes produced before the war may be described as more or less fortuitous collections of data for all countries, we now have an attempt to present the facts upon an organised plan, the adoption of which cannot fail to prove of the utmost assistance to those engaged in the scientific study of the upper air. The specimen was cordially received by the Commission which decided to issue an appeal to the Meteorological Offices of all countries to induce their Governments to provide international funds for the regular publication by the bureau of the Commission of similar volumes for future years. Before the close of the meeting Sir Napier Shaw announced his intention of resigning the Presidency of the Commission, and upon the motion of the French representative present, Professor Dr. Hergesell, the Director of the Prussian Aerological Observatory at Lindenberg, was unanimously elected to the vacant office. Dr. Hergesell had filled the position of President with great distinction from the founding of the Commission up to the outbreak of war. An official report of the proceedings has been prepared in the Meteorological Office and issued as a publication of H.M. Stationery Office.

The work of the meteorological section of the International Union of Geodesy and Geophysics at Prague ranged over a much wider field. Much useful work was accomplished in such directions as the co-ordination of observations of solar and terrestrial radiation, the preparation of specimen synoptic charts of the whole of the Northern Hemisphere upon a more extended basis than has been possible in the past, the important task of providing similar charts for the Southern Hemisphere, the comparison of methods of forecasting used in different countries and many other subjects.



**International Radio-Telegraphic Convention.**—A meeting of this Convention was held in Washington in October, 1927, and was attended by a delegation of the International Commission for Synoptic Weather Information of which Lieutenant-Colonel E. Gold is President. The exchange of meteorological reports between forecast services, the organisation of which is one of the principal functions of the Commission, is now-a-days effected in great measure by radio-telegraphy and hence the Commission's desire, formulated at its Meeting at Zürich in 1926, to be represented at the Conference. The delegation consisted of

Lieut.-Col. E. Gold (Great Britain).

Captain R. Bureau (France).

Dr. Th. Hesselberg (Norway).

The principal objects which the Commission had in view in asking to be heard were to urge on the Convention that no regulations should be made which would hamper the exchange of the meteorological messages now being issued according to a fixed time-table from the wireless stations of the principal countries, and that, as far as practicable, provision should be made to reduce the difficulties which arise through "interference" or delay.

The delegation was able to secure recognition of the degrees of priority to be assigned to meteorological messages of varying types. It was agreed that those meteorological messages of which particulars are published in the "Berne List," shall be issued exactly at the times published. Further the principle was conceded that meteorological warning messages should be transmitted without any delay, and that they should be preceded by the safety signal TTT. Other meteorological messages were placed in the second category as regards priority, i.e. they are placed immediately after Messages of State, and receive the same degree of priority as messages relating to the navigation movements and needs of ships, and to the security and regulation of air services. With regard to the prevention of interference it was found that the only practical steps that could be taken were by the reservation of wave lengths, but the details of such reservation were found to present great difficulties. Ultimately, upon the intervention of the French delegation to the Convention who were prepared to give up for meteorological purposes one of the wave lengths already allocated to France and to obtain in exchange another wave length from the European organisation of commercial wireless stations, the following resolution was agreed upon :—

"To facilitate the exchange of meteorological synoptic messages in the European region, two wave lengths between 3,000 and 8,000 metres shall be allotted for this (the meteorological) service by regional agreement."

The delegation also sought to obtain from the convention recognition of the principle that meteorological reports from ships at sea should be transmitted free of radio-telegraphic charges,

on the understanding that the number of messages would be confined within well defined limits, but in that they were unsuccessful and the utmost that could be attained was a resolution that freedom within certain limits might be arranged between the meteorological organisations and the companies and administrations concerned.

**Meteorological Sub-Commission of the I.C.A.N.**—The International Commission for Air Navigation has a meteorological sub-commission on which the representative of the office is Lieutenant-Colonel E. Gold. Meetings of the sub-commission were held in the course of the year under review in London, April 25th-27th, Rome, October 24th and following days and Paris, February 14th-15th. The meetings in London and Rome were in conjunction with the 12th and 13th sessions of the Commission, that in Paris, was a special meeting of the sub-commission. Lieut.-Col. Gold was present on behalf of the Office at the meetings in London and Paris.

The sub-commission has been concerned especially with the question of an international code for the exchange of short-period weather forecasts for aviation. The subject is one of great difficulty, but agreement has been reached on the main questions involved.

Modifications have been made in the regulations in regard to meteorological ground signals exhibited at aerodromes for the information of machines in flight and many other minor questions of organisation have been satisfactorily arranged.

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## 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	5	0	8	130	10	1	2	4	0	0
1 " E. ...	1	1	2	2	27	338	16	4	2	2	2	2
6A " W. ...	1	1	0	0	20	307	13	3	3	2	2	1
2 England, N.E. ...	0	1	2	3	20	258	13	3	2	1	0	0
3 " E. ...	0	2	2	3	20	450	22	4	5	5	3	2
4 " Midlands ...	0	2	3	4	40	961	29	10	1	3	2	2
5 " S.E. ...	0	7	3	5	42	749	39	8	8	7	6	5
London District ...	2	0	0	0	6	60	7	8	0	0	2	0
8B England, S.W. ...	0	1	2	3	29	531	20	5	3	2	4	2
7A " N.W. ...	0	0	1	1	21	448	22	7	2	1	0	0
7B N. Wales ...	0	1	0	1	6	161	5	3	3	2	2	2
8A S. " ...	0	0	1	1	6	213	9	3	1	1	1	0
9 Ireland, N. ...	0	1	3	0	6	105	5	3	4	4	1	1
10 " S. ...	1	0	2	0	15	133	5	2	2	6	0	0
6B Isle of Man ...	0	0	0	0	1	8	1	0	0	0	0	0
11 Scilly and Channel Isles ...	0	0	2	0	2	25	3	0	2	2	1	0
TOTAL ...	6	17	28	23	267	4877	219	64	40	42	26	17
Corresponding number for last year ...	6	15	27	22	262	4886	223	53	34	58	21	18

The observatories and distributive stations which are classified in the table are operated by the staff of the Office. Reports on the work of the observatories will be found on pages 20-4. The distributive stations are administered by the Aviation Services Division. The telegraphic stations are, as a rule, maintained at coastguard stations or lighthouses by arrangement with the respective authorities. The meteorological observations at these stations are made expressly for the purposes of the daily weather service and form part of the regular work of the station staff, for which payment is made from the Office. The "crop-weather stations" are maintained at certain agricultural colleges and research institutions, in connexion with the study of the relations between the weather and growing crops. They report partly to the Meteorological Office and partly to the Ministry of Agriculture and the Board of Agriculture for Scotland, and the arrangements for the observations are under the general control of a committee on which the Office is represented.

## APPENDIX II

## GALE WARNINGS ISSUED DURING THE YEAR 1927

DISTRICTS	Summary of occasions of gales		Summary of warnings issued			
	Total number of occasions when warnings were necessary	Percentage of occasions of gales effectively warned	Total number issued	Issues justified by gales, force 8 and above	Issues justified by strong winds, forces 6 and 7	Percentage justified by gales and strong winds
1. Scotland N.E. { A	14	86	35	12	15	74
B	12	100	30	12	8	67
2. Scotland, E. ...	6	100	31	6	15	68
3. Scotland, N.W. ...	7	86	41	6	21	66
4. Scotland W. and North Channel ...	9	100	47	9	23	68
5. Ireland, N. ...	11	91	51	10	27	74
6. Ireland, S. ...	7	100	44	7	30	84
7. Irish Sea ...	14	93	39	13	15	72
8. St. George's Channel	12	75	39	9	19	72
9. Bristol Channel ...	23	78	40	18	16	85
10. England, S.W. ...	21	86	47	18	23	87
11. England, S....	12	100	39	12	21	85
12. England, S.E. ...	15	100	38	15	16	82
13. England, N.E. ...	5	100	29	5	10	52
14. England, E....	16	94	32	15	13	86
TOTALS ...	184	91	582	167	272	75

## APPENDIX III

## FINANCIAL STATEMENT

The year under review, 1927-8, is the eighth in which the cost of the Meteorological Office has been borne on Air Ministry Votes. The accounts are not yet closed, it is therefore impossible to give the exact amounts for the expenses and receipts of the Meteorological Office, but the following tables give the approximate figures :—

APPROXIMATE STATEMENT OF EXPENDITURE AND RECEIPTS IN RESPECT  
OF METEOROLOGICAL SERVICES DURING THE YEAR 1927-8.

<i>Expenditure.</i>				<i>Amount.</i>	
				£	£
Salaries and Wages—H.Q. Establishments	...	...	...	49,217	
„ „ —Out-station Establishments	...	...	...	49,772	
					98,989
Fuel and Light	...	...	...		553
Transport of Personnel and Equipment	...	...	...		3,512
Instruments, Equipment and Stores	...	...	...		7,443
Minor Works Services, Rents, Repairs and Maintenance of Buildings	...	...	...		5,913
Research	...	...	...		645
Telegrams, Cables and Telephones	...	...	...		9,572
Subventions and Reporting Stations	...	...	...		2,200
Miscellaneous	...	...	...		374
Superannuation	...	...	...		1,947
			Total	...	£131,148
<i>Receipts.</i>					
Receipts from Royal Society	...	...	...		655
„ „ National Debt Commissioners (Annuities)	...	...	...		260
Sale of Instruments, Carriage, etc.	...	...	...		3,387
Daily Weather Reports, Forecasts, etc.	...	...	...		1,670
Receipts from War Office	...	...	...		6,622
			Total	...	£12,594

## APPENDIX IV

## THE GASSIOT COMMITTEE, 1927

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

SIR ERNEST RUTHERFORD, O.M., D.Sc., G.B.E. (*President of the Royal Society*).

Colonel Sir HENRY LYONS (*Chairman*).

The Astronomer Royal.

Professor S. CHAPMAN.

Dr. C. CHREE.

Dr. J. H. JEANS.

SIR NAPIER SHAW.

Dr. G. C. SIMPSON.

Professor G. I. TAYLOR.

## APPENDIX V

THE STAFF OF THE METEOROLOGICAL OFFICE, ITS  
OBSERVATORIES AND BRANCHES, 31st MARCH, 1928

## THE STAFF AT HEADQUARTERS

## DIRECTOR :

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

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

*Senior Professional Assistant* Miss E. E. Austin, M.A.

## GENERAL SERVICES DIVISION.

*Chief Clerk* ... .. H. L. B. Tarrant.

*Clerk, Grade I* ... .. F. M. Dean.

*Clerks, Grades II & III* ... 9

*Officekeeper* ... .. 1

## MARINE DIVISION.

*Superintendent* ... .. L. A. Brooke Smith, Captain R.N.R., R.D.

*Senior Professional Assistants* E. W. Barlow, B.Sc. ; J. Hennessy, Cdr.  
R.N.R., R.D.

*Clerk, Grade I* ... .. H. Keeton.

*Clerks, Grades II & III* ... 10

## BRITISH CLIMATOLOGY DIVISION.

*Superintendent* ... .. R. Corless, O.B.E., M.A.

*Assistant Superintendent* ... M. T. Spence, B.Sc.

*Senior Professional Assistants* J. Glasspoole, M.Sc., Ph.D., P. I. Mulholland,  
B.Sc.

*Clerk, Grade I* ... .. A. G. W. Howard.

*Clerks, Grades II & III* ... 15

*Draughtsman* ... .. 1

## APPENDIX V—continued.

## 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.
<i>Clerk, Grade I</i>	...	...	A. T. Bench.
<i>Clerks, Grades II &amp; III</i>	...	...	7

## FORECAST DIVISION.

<i>Superintendent</i>	...	...	J. S. Dines, M.A.
<i>Assistant Superintendents</i>	...	...	J. Crichton, M.A., B.Sc.; C. K. M. Douglas, B.A.; E. V. Newnham, B.Sc.
<i>Senior Professional Assistants</i>			F. H. Dight, B.Sc.; Miss L. F. Lewis, B.Sc.; S. C. Russell, LL.B.
<i>Junior Professional Assistants</i>			L. Dods, B.Sc.*; W. D. Flower, B.Sc.; J. Paton, M.A., B.Sc.; R. C. Sutcliffe, Ph.D.
<i>Clerk, Grade I</i>	...	...	W. Hayes.
<i>Clerks, Grades II &amp; III</i>	...	...	20
<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.
<i>Senior Professional Assistants</i>			C. W. Lamb, M.C., B.Sc.; R. H. Mathews, B.A.; E. Taylor, M.A., B.Sc.; M. J. Thomas, B.Sc.; S. F. Witcombe, B.Sc.;
<i>Clerks, Grades II &amp; III</i>	...	...	5

## AIRSHIP SERVICES DIVISION.

<i>Superintendent</i>	...	...	M. A. Giblett, M.Sc.
<i>Senior Professional Assistant</i>			C. S. Durst, B.A.
<i>Clerks, Grade III</i>	...	...	2

## NAVY SERVICES DIVISION.

<i>Superintendent</i>	...	...	L. G. Garbett, Commander, R.N. (retd.).
<i>Senior Professional Assistant</i>			A. H. Nagle, B.Sc., A.R.C.S., D.I.C.

## ARMY SERVICES DIVISION.

<i>Superintendent</i>	...	...	D. Brunt, M.A., B.Sc.
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## INSTRUMENTS DIVISION.

<i>Superintendent</i>	...	...	E. G. Bilham, B.Sc., A.R.C.S., D.I.C.
<i>Senior Professional Assistant</i>			J. E. Belasco, B.Sc.
<i>Junior Professional Assistant</i>			D. W. Johnston, B.Sc.
<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

\* Held against vacancy for Senior Professional Assistant.

APPENDIX V—*continued*.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>	...	...	A. Watt, M.A., F.R.S.E.
<i>Senior Professional Assistant</i>	...	...	D. N. Harrison, D.Ph.
<i>Clerks, Grade III</i>	...	...	5

## METEOROLOGICAL OFFICE, MALTA.

<i>Superintendent</i>	...	...	W. A. Harwood, D.Sc.
<i>Senior Professional Assistants</i>	...	...	G. A. Bull, B.Sc.; H. St. G. Dyke-Marsh, B.A.
<i>Clerk, Grade II</i>	...	...	1
<i>Clerks (locally entered)</i>	...	...	4

## METEOROLOGICAL OFFICE, MIDDLE EAST.

## HELIOPOLIS.

<i>Superintendent</i>	...	...	J. Durward, M.A.
<i>Senior Professional Assistant</i>	...	...	J. Wadsworth, M.A.
<i>Clerk, Grade I</i>	...	...	R. Pyser.
<i>Clerks (locally entered)</i>	...	...	4

## ABOUKIR, ABU SUEIR, AMMAN AND RAMLEH.

<i>Clerks, Grade II</i>	...	...	3 (and one vacancy)
<i>Clerks (locally entered)</i>	...	...	3 (and one vacancy)

## 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>	...	...	F. J. Scrase, M.A., B.Sc., A.I.C.; R. E. Watson, Ph.D.
<i>Junior Professional Assistant</i>	...	...	H. L. Wright, M.A.
<i>Clerk, Grade I</i>	...	...	E. Boxall.
<i>Clerks, Grades II &amp; III</i>	...	...	5
<i>Caretaker and Handyman</i>	...	...	2

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

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

## VALENTIA OBSERVATORY, Cahirciveen, Co. Kerry.

<i>Assistant Superintendent</i>	...	...	C. D. Stewart, B.Sc.
<i>Clerks, Grade III</i>	...	...	4
<i>Messenger</i>	...	...	1

## THE OBSERVATORY, ESKDALEMUIR, Langholm, Dumfriesshire.

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

## THE OBSERVATORY, King's College, ABERDEEN.

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



## APPENDIX V—continued.

## THE OBSERVATORY, LERWICK, Shetlands.

<i>Senior Professional Assistant</i>	A. W. Lee, M.Sc., A.R.C.S., D.I.C., A.Inst.P.	
<i>Clerks, Grade III</i> ... ..	3	
<i>Caretaker</i> ... ..	1	

## PORT METEOROLOGICAL OFFICE, Liverpool.

<i>Senior Professional Assistant</i>	M. Cresswell, Lt.-Cdr. R.N.R.	
<i>Clerk, Grade II (Temp.)</i> ...	1	

## AVIATION SERVICES STATIONS

## ALDERGROVE.

<i>Senior Professional Assistant</i>	W. Gillon, M.A., B.Sc.	
<i>Clerks, Grades II &amp; III</i> ...	3	

## BIGGIN HILL.

<i>Clerks, Grades II &amp; III</i> ...	3	
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## CALSHOT.

<i>Assistant Superintendent</i> ...	H. F. Jackson, M.S.E.	
<i>Junior Professional Assistant</i>	H. Garnett, M.Sc.	
<i>Clerks, Grades II &amp; III</i> ...	4	

## CATTEWATER.

<i>Clerks, Grades II &amp; III</i> ...	2	
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## CRANWELL.

<i>Assistant Superintendent</i> ...	W. H. Pick, B.Sc.	
<i>Junior Professional Assistant</i>	G. J. W. Oddie, B.Sc.	
<i>Clerks, Grades II &amp; III</i> ...	4	

## CROYDON.

<i>Assistant Superintendent</i> ...	G. R. Hay, M.A.	
<i>Senior Professional Assistants</i>	J. S. Farquharson, M.A.; A. Walters.	
<i>Clerks, Grades II &amp; III</i> ...	7	
<i>Telephone-Typists</i> ... ..	2	

## FELIXSTOWE.

<i>Senior Professional Assistant</i>	T. W. V. Jones, B.Sc.	
<i>Clerks, Grades II &amp; III</i> ...	2	

## HOLYHEAD.

<i>Clerks, Grades II &amp; III</i> ...	3	
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## LEUCHARS.

<i>Senior Professional Assistant</i>	J. M. Stagg, M.A., B.Sc.	
<i>Clerks, Grade III</i> ... ..	2	

## LYMPNE.

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

## RENFREW.

<i>Senior Professional Assistant</i>	W. J. Grassick, M.A.	
<i>Clerks, Grade III</i> ... ..	2	

## APPENDIX V—continued.

## 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

## WORTHY DOWN.

*Senior Professional Assistant* C. V. Ockenden, B.Sc.  
*Clerks, Grades II & III* ... 3

## AIRSHIP SERVICES STATIONS

## CARDINGTON.

*Assistant Superintendent* ... W. C. Kaye, B.Sc.  
*Senior Professional Assistants* B. C. V. Oddie, B.Sc., S. P. Peters, B.Sc.,  
 A.Inst.P.  
*Junior Professional Assistants\** A. F. Crossley, B.A. ; D. E. Smith, M.A.  
*Clerks, Grades II & III* ... 5  
*Draughtsman* ... 1  
*Telephone-Typist* ... 1 Vacancy

## ARMY SERVICES STATIONS

## METEOROLOGICAL OFFICE, SHOEBOURNE.

*Assistant Superintendent* ... C. E. Britton, B.Sc.  
*Junior Professional Assistant* O. G. Sutton, B.Sc.  
*Clerks, Grades II & III* ... 12

## METEOROLOGICAL OFFICE, LARKHILL.

*Senior Professional Assistant* A. C. Best, B.Sc.  
*Clerks, Grades II & III* ... 4

## METEOROLOGICAL OFFICE, PORTON.

*Clerks, Grades II & III* ... 5

## SECONDED FOR DUTY WITH OTHER BODIES

*Assistant Superintendent* ... N. K. Johnson, M.Sc., A.R.C.S. (War Office,  
 Porton Experimental Station).  
*Senior Professional Assistants* R. P. Batty, B.A. (R.A.F., India).  
 E. L. Davies, M.Sc. (War Office, Porton  
 Experimental Station).  
 L. G. Hemens, B.Sc. (War Office, Porton  
 Experimental Station).  
 R. F. Budden, M.A. (War Office, Porton  
 Experimental Station).  
 R. G. Veryard, B.Sc. (R.A.F., India).

\* Held against vacancies for Senior Professional Assistants.

## 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 Weekly Weather Report** (to week ending February 25th, 1928).

**The Monthly Weather Report** with a summary for the year (to January, 1928).

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

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

**The British Meteorological and Magnetic Year Book :—**

Part V. **Réseau Mondial.** Monthly and annual summaries of pressure, temperature and precipitation at land stations, generally two for each 10-degree square of latitude and longitude. Volume for 1920.

**The Observatories' Year Book.** Comprising the results obtained from autographic records and observations at Meteorological Office Observatories. (In continuation of Parts III (2) and IV of the British Meteorological and Magnetic Year Book.) Volumes for 1924 and 1925.

**British Rainfall, 1926.** A report on the distribution of rain in space and time over the British Isles as recorded by more than 5,000 observers.

**Southport Auxiliary Observatory. Annual Report** and results of meteorological observations. By J. Baxendell. Report for the year 1926.

**OCCASIONAL :—**

**Meteorological Observer's Handbook, 1926.**

**Supplement No. 2.** Instructions to Observers at Auxiliary Climatological Stations.

**Supplement No. 3.** Instructions to Observers at Normal Climatological Stations.

**Supplement No. 4.** Instructions to Observers at Climatological Stations at Health Resorts.

**Meteorological Reports issued by Wireless Telegraphy** in Great Britain and by the countries of Europe and North. 5th edition, 1926.

**Notes on Meteorological Observations made in British Colonies and Protectorates in 1926** and summarized in the Annual Reports.

**Geophysical Memoirs :—**

Vol. IV :—

35. Comparison of the Records from British Magnetic Stations Underground and Surface. By C. Chree, Sc.D., LL.D., F.R.S., and R. E. Watson, B.Sc.
36. On Magnetic Fluctuations and Sunspot Frequency. A discussion based primarily on the daily ranges of declination as recorded at Kew Observatory, Richmond, during the 67 years 1858–1924. By J. M. Stagg, M.A., B.Sc.
37. Studies of Wind and Cloud at Malta. By J. Wadsworth, M.A.
38. Electric Potential Gradient Measurements at Eskdalemuir 1913–23. By R. A. Watson, B.A.
39. Results of Observations on the Direction and Velocity of the Upper Air Current over the South Indian Ocean. By A. Walter, F.R.A.S., Statistician East African Governors' Conference, formerly Director, Royal Alfred Observatory, Mauritius.
40. The 27-Day Recurrence Interval in Magnetic Disturbance. An examination made with the aid of hourly character figures. By J. M. Stagg, M.A., B.Sc.

## APPENDIX VI—continued.

## OCCASIONAL—continued.

## Professional Notes :—

## Vol. IV :—

47. Regression Equations with many Variates. By C. E. P. Brooks, D.Sc.  
 48. Falling Time of Marine Barometers. Historical note and some recent observations. By E. Gold, F.R.S.

## Reports of International Meteorological Meetings :—

- Report of Sixth Meeting of Commission for Synoptic Weather Information. Zürich, 1926.  
 Reports of Meetings of Commissions for Terrestrial Magnetism and Atmospheric Electricity and for the Réseau Mondial. Zürich, 1926.  
 Report of Meeting of Commission for the Exploration of the Upper Air. Leipzig, 1927.

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.—

The mechanism of a thunderstorm. London, Proc. R. Soc., 114 (A), 1927, pp. 376-401.

The development of weather forecasting. XIX Century, London, 101, 1927, pp. 557-573.

Past climates. London, Q. J. R. Meteor. Soc., 53, 1927, pp. 213-225.

Thunderstorms. Broadcast talk No. 4. London, Q. J. R. Meteor. Soc., 53, 1927, pp. 172-176.

Past climates. Nature, 120, 1927, pp. 192-194.

Some studies in terrestrial radiation. London, R. Meteor. Soc., Mem., 2, No. 16, 1928, pp. 69-95.

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

Leipzig meeting of the International Commission for the Exploration of the Upper Air. Nature, 120, 1927, pp. 566-567.

By R. G. K. Lempfert, C.B.E., M.A., F.Inst.P. with Sir Napier Shaw, Sc.D., F.R.S. and Elaine Austin, M.A.—

Report of the international days of 1923. London, Q. J. R. Meteor. Soc., 54, 1928, pp. 43-58.

By E. Gold, D.S.O., F.R.S.—

Water vapour in the atmosphere. The constitution of fog and cloud. [Review of: Untersuchungen über die Elemente des Nebels und der Wolken, by Hilding Köhler.] Nature, 119, 1927, pp. 654-655.

Weather and weather forecasting. [Review of: Wetter und Wettervorhersage, by Albert Defant. 2nd Ed.] Nature, 119, 1927, pp. 843-845.

An atlas of rainfall. [Review of: Rainfall atlas of the British Isles, published by the Royal Meteorological Society.] Nature, 120, 1927, pp. 291-292.

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

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Some transformations of generalized hypergeometric series. London, Proc. J. Math. Soc., 26 (Ser. 2), 1926, pp. 257-272.

Units of energy. Nature, 121, 1928, pp. 355-356.

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

Descriptions of exhibits at the exhibition of the Physical and Optical Societies. Meteorological instruments. J. Sci. Instr., London, 4, 1927, pp. 200-202.

APPENDIX VI—*continued*.

- By E. G. Bilham, B.Sc., A.R.C.S., D.I.C.—*continued*.  
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 Descriptions of the exhibits at the 18th annual exhibition of the Physical and Optical Societies. Meteorological instruments. **J. Sci. Instr.**, **London**, 5, 1928, pp. 74–75.
- By C. E. P. Brooks, D.Sc.—  
 The influence of forests on rainfall. **Water and Water Engineering**, **London**, 29, 1927, pp. 368–371 and **Empire Forestry Journal**, 6, 1927, pp. 210–8.  
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 The weather: an introduction to climatology. **London (E. Benn)**, 1927, 8°, pp. 79.  
 Periodicities in the Nile floods. **London, R. Meteor. Soc., Mem.**, 2, No. 12, 1928, pp. 9–26.  
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 The problem of the varves. **London, Q. J. R. Meteor. Soc.**, 54, 1928, pp. 64–70.
- By D. Brunt, M.A., B.Sc.—  
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 Harmonic analysis and the interpretation of the results of periodogram investigations. **London, R. Meteor. Soc., Mem.**, 2, No. 13, 1928, pp. 29–37.
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 The relation between rainfall and flow-off. **Nature**, 121, 1927, pp. 37–38.
- By J. S. Dines, M.A.—  
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- By M. A. Giblett, M.Sc.—  
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- By A. H. R. Goldie, M.A., F.R.S.E.—  
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- By H. W. L. Absalom, B.Sc., A.R.C.S., D.I.C.—  
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- By L. H. G. Dines, M.A., A.M.I.C.E.—  
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- By L. H. G. Dines, M.A., A.M.I.C.E., with W. H. Dines, B.A., F.R.S.—  
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## APPENDIX VI—continued.

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By J. Glasspoole, M.Sc., Ph.D.—

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By J. M. Stagg, M.A., B.Sc. with C. Chree, Sc.D., F.R.S.—

Recurrence phenomena in terrestrial magnetism. *London, Phil. Trans. R. Soc.*, 227 (A), 1927, pp. 21-62.

By R. A. Watson, B.A.—

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Nephoscope observations at Mauritius. *London, Q. J. R. Meteor. Soc.*, 53, 1927, pp. 446-448.

By G. A. Clarke.—

How clouds indicate the weather. The significance of the sky's appearance. *Motor Boat*, (London), 1927, pp. 26-28.