

**EIGHTH ANNUAL REPORT**  
**OF THE**  
**METEOROLOGICAL COMMITTEE**

**TO THE**  
**LORDS COMMISSIONERS OF HIS MAJESTY'S**  
**TREASURY.**

**For the Year ended 31st March, 1913**  
*(the Fifty-eighth Year of the Meteorological Office).*

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**Presented to both Houses of Parliament by Command of His Majesty.**

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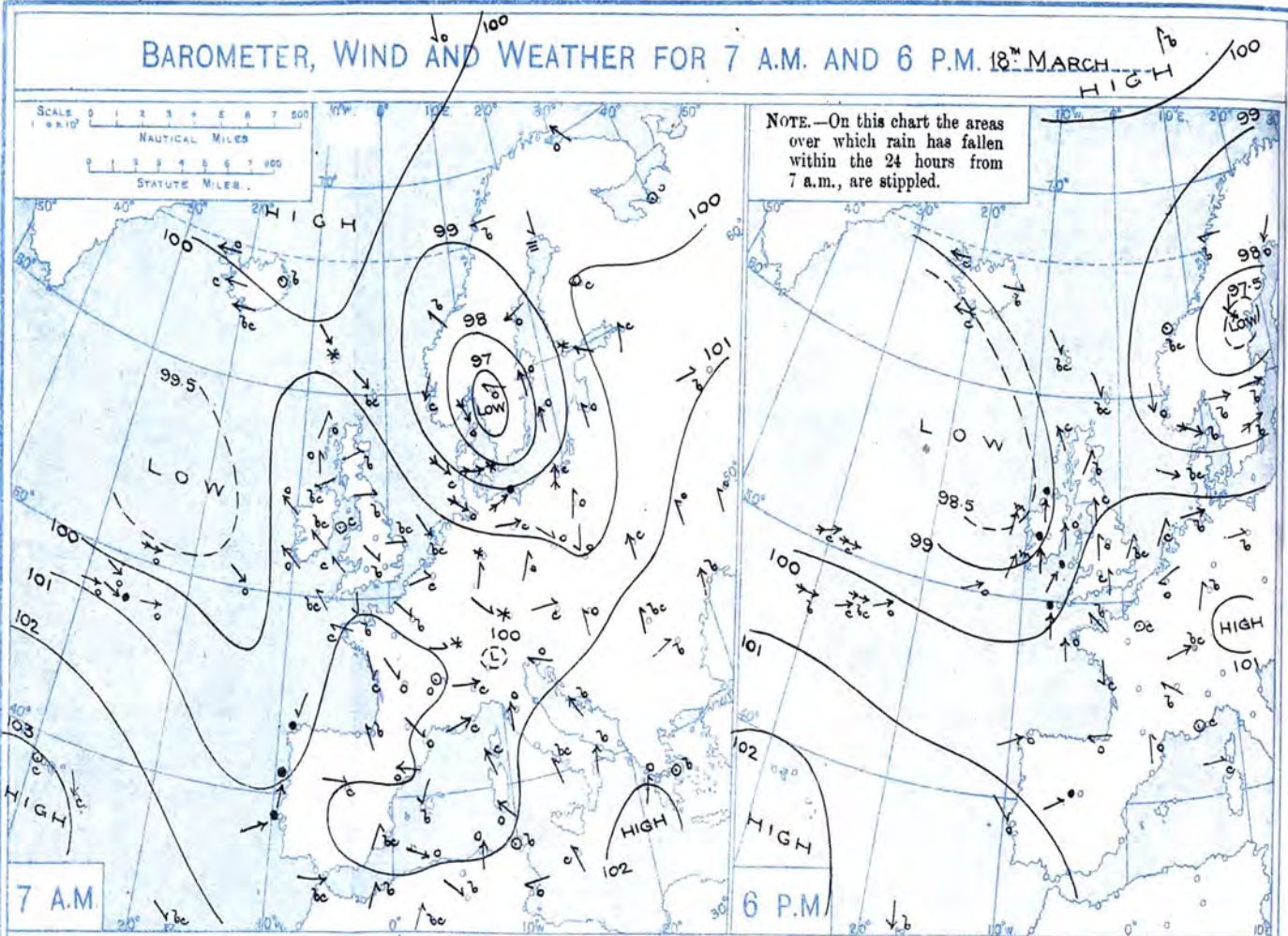
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**1913.**

[Cd. 6999.] *Price 1s. 0d.*

BAROMETER, WIND AND WEATHER FOR 7 A.M. AND 6 P.M. 18<sup>th</sup> MARCH

## GENERAL INFERENCE

A very deep cyclone over western Scotland will move eastward or north-eastward

## WEATHER PROSPECTS.

and a stormy day will be general throughout the Kingdom, moderating later.

0 { Easterly strong winds and gales, backing later, very squally, some rain or snow, then fairer, cold, night frost.

1 { Wind between South and West and North-West, gales or strong winds, moderating and backing again later; very squally, some rain, fairer later; very mild during day, colder to-night.

2 {

3 {

4 {

5 {

## THE FURTHER OUTLOOK.

## FORECAST DISTRICTS.



## STORM WARNINGS.

The Coasts upon which the Warning Signals are at present displayed are indicated thus:—

Signals hoisted yesterday.	Signals hoisted this morning.
South Cone.	South Cone.
North Cone.	North Cone.

## SOUTH CONE HOISTED

Districts 6-11 at 8.20 a.m. yesterday.  
do. 0-6-11 at 2.25 p.m. "  
do. 0-6-11 at 7.10 "  
do. 0-6-11 at 7.50 a.m. to-day.

WEDNESDAY

TO NOON THURSDAY.

6 {

7 {

8 {

9 {

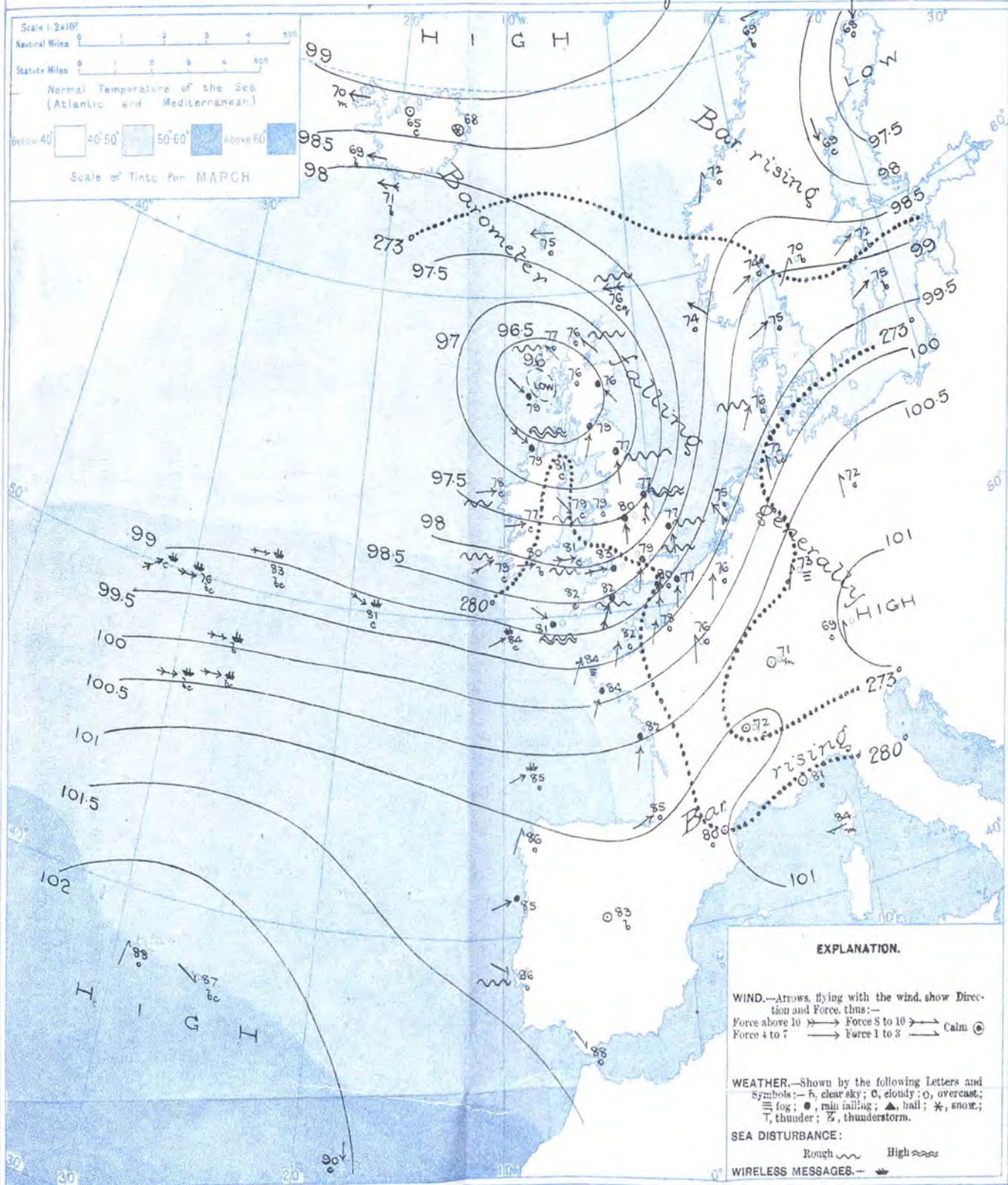
10 {

11 WESTERN CHANNEL AND BAY.

Southerly, Westerly and North-Westerly gales, moderating later; high sea and North-Westerly swell; very squally, some rain, mist or fog; fairer later; mild.



SYNOPSIS CHART FOR 7 A.M. Wednesday, 19<sup>th</sup> MARCH 1913.



NOTES ON THE GENERAL SITUATION AT 7 A.M.

Isobars are shown for Centibars.

97	centibars	=	28.64 in.	=	727.5 mm.
98	"	=	28.93 "	=	734.8 "
99	"	=	29.22 "	=	742.2 "
100	"	=	29.52 "	=	749.8 "
101	"	=	29.82 "	=	757.4 "
102	"	=	30.12 "	=	765.0 "
103	"	=	30.41 "	=	772.4 "
104	"	=	30.71 "	=	780.0 "
105	"	=	31.01 "	=	787.6 "

Temperatures are shown in degrees Absolute, the first figure being omitted.

Dotted lines show Isotherms for

$$\begin{aligned}
 280^{\circ} \text{ A} &= 7^{\circ} \text{ C} = 45^{\circ} \text{ F.} \\
 273^{\circ} \text{ A} &= 0^{\circ} \text{ C} = 32^{\circ} \text{ F.}
 \end{aligned}$$

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Plate 1. Maps of the Daily Weather Report for March 19, 1913, with isobars drawn for every half centibar, and isotherms shown in degrees absolute ... .. *Frontispiece.*

Plate 2. Maps of the Weekly Weather Report for the week ending February 15, 1913, with isobars drawn for every whole centibar, and air temperature shown in absolute measure *between pp. 14 and 15.*

## THE METEOROLOGICAL COMMITTEE, 1911-12.

*Constituted by Minutes of the Lords Commissioners of H.M.  
Treasury, dated 20th May, 1905, and 31st March, 1910.*

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Appointed till

- March 31, 1915 ... Mr. W. N. SHAW, Sc.D., F.R.S., Director,  
*Chairman.*
- Sept. 2, 1914 ... Rear-Admiral H. E. PUREY CUST, R.N.,  
Hydrographer to the Navy.
- March 31, 1915 ... Captain J. M. HARVEY, Principal Examiner  
of Masters and Mates, Board of Trade,  
Nominated by the Board of Trade.
- Dec. 2 [1916] ... T. H. MIDDLETON, C.B., M.A., M.Sc., Assis-  
tant Secretary of the Board of Agriculture  
and Fisheries. Nominated by the Board  
of Agriculture.
- ... Sir GEORGE H. DARWIN, K.C.B., F.R.S.,  
University of Cambridge. Nominated by the  
Royal Society. Deceased December 7, 1912.
- March 31, 1915 ... Professor ARTHUR SCHUSTER, F.R.S. Nomi-  
nated by the Royal Society.
- Feb. 25, 1917 ... Captain H. G. LYONS, R.E., D.Sc., F.R.S.  
Nominated by the Royal Society.
- March 31, 1915 ... Mr. G. L. BARSTOW, C.B. Nominated by the  
Treasury.
- 

Subject to the discretion of the authorities by which they were  
respectively nominated, the members of the Committee hold  
office for a period not exceeding five years, but are eligible for  
reappointment.

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## THE GASSIOT COMMITTEE, 1912-13.

*Appointed in accordance with Treasury Letter of 26th February. 1910, by the Royal Society on 17th March, 1910, to administer the Gassiot Trust, and to promote the scientific study of the branches of science to which the Trust relates, viz., Meteorology, Terrestrial Magnetism, Atmospheric Electricity, Seismology, and the cognate subjects.*

---

### The Officers of the Royal Society :—

<i>President</i>	...	...	Sir Archibald Geikie, K.C.B.
<i>Treasurer</i>	...	...	Sir A. B. Kempe.
<i>Secretaries</i>	...	...	Sir J. Rose Bradford. Prof. Arthur Schuster.
<i>Foreign Secretary</i>	...		Dr. D. H. Scott.

Dr. C. Chree.

Sir George Darwin, K.C.B. [*dec.* December 7th, 1912].

Mr. W. H. Dines.

Mr. F. W. Dyson (*Astronomer Royal*).

Dr. R. T. Glazebrook, C.B.

Sir Joseph Larmor, M.P.

Captain H. G. Lyons.

Prof. H. F. Newall.

Prof. J. H. Poynting.

Sir Arthur Rücker.

Prof. E. Rutherford.

Dr. W. N. Shaw.

Dr. G. T. Walker.

Mr. G. W. Walker.

Mr. C. T. R. Wilson.

*Secretaries :* Dr. C. Chree.

Mr. R. W. F. Harrison.

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# THE STAFF OF THE METEOROLOGICAL OFFICE AND OF THE OBSERVATORIES OF THE METEOROLOGICAL COMMITTEE, 1912-13.

## DIRECTOR.

William Napier Shaw, LL.D., Sc.D., F.R.S.

## METEOROLOGICAL OFFICE.

### SECRETARIAL STAFF.

<i>Secretary to the Director and Clerk of Publications.</i>	}	R. Corless,* M.A.
<i>Clerk Assistants ...</i>	...	E. L. Ardley, H. L. B. Tarrant.
<i>Typist ...</i>	...	Miss A. Turney.

### ACCOUNTS.

<i>Chief Clerk and Cashier...</i>	John A. Curtis.
<i>Clerk ...</i>	E. J. Hood.
<i>Boy Clerk ...</i>	N. C. Bradnock.
<i>Office Keepers ...</i>	W. H. Parsons, A. G. Goad.

4 Messengers, 3 Office Boys.

### MARINE DIVISION.

<i>Marine Superintendent ...</i>	M. W. Campbell Hepworth,* C.B., R.D., Commander, R.N.R.
<i>Principal Assistant ...</i>	W. Allingham.
<i>Assistants ...</i>	W. G. James, C. H. Thompson.
<i>Clerks ...</i>	J. T. Williams, H. Keeton, A. Lovie.† Misses E. D. Anderson, D. Buckeridge, R. E. Smith.
<i>Probationer ...</i>	W. B. Greening.†
<i>Boy Clerk ...</i>	A. J. Tabor.†

### FORECAST DIVISION.

<i>Superintendent ...</i>	R. G. K. Lempfert,* M.A.
<i>Principal Assistant ...</i>	F. J. Brodie.*
<i>Forecast Assistants ...</i>	H. Harries,* R. Sargeant.*
<i>Clerks ...</i>	A. R. Simpkins, F. W. Snell; A. T. Bench, W. Hayes,† A. G. W. Howard.†
<i>Probationer ...</i>	C. F. J. Jestico.†
<i>Boy Clerk ...</i>	R. Pyser.†

\* Inspectors of Meteorological Stations.

† Members of the corps of observers for the instruments installed at the office.



## STATISTICS AND LIBRARY DIVISION.

<i>Superintendent</i>	...	...	E. Gold,* M.A.
<i>Principal Assistant</i>	...	...	T. Duncan Bell.
<i>Graduate Assistant</i>	...	...	H. W. Braby,† B.A.
<i>Assistants</i>	...	...	A. H. Bell, A. J. Rigby, J. Sheerman.
<i>Clerks</i>	...	...	C. A. Bracey, C. W. Heinemann, L. H. Powers.
<i>Clerk Assistants</i>	...	...	C. E. P. Brooks,† P. N. Skelton,† M. T. Spence.†
<i>Supernumerary Clerks</i>	...	...	A. E. Pycock, W. J. Tomkins.†
<i>Boy Clerk</i>	...	...	M. H. Megrah.†

## INSTRUMENTS DIVISION.

<i>Superintendent</i>	...	...	F. J. W. Whipple,* M.A.
<i>Assistant</i>	...	...	R. F. Wallace.
<i>Boy Clerk</i>	...	...	

*Laboratory, Workshop, and Drawing Office.*

<i>Mechanical Assistant</i>	...	...	J. H. James.†
<i>Photographic Assistants</i>	...	...	Miss E. C. Humphreys, Miss E. V. Turney.
<i>Attendant</i>	...	...	B. G. Brame.†

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<i>Additional Inspector</i>	...	...	A. Watt, M.A., Secretary Scottish Meteorological Society.
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*Lithographers*—Messrs. Wyman & Sons, Ltd. (A. G. King, *Artist*).

## BRANCH OFFICE AT SOUTH FARNBOROUGH.

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<i>Meteorologist</i>	...	...	J. S. Dines*, M.A.
<i>Mechanic Computer</i>	...	...	H. Wise.

---

\* Inspectors of Meteorological Stations.

† Member of the corps of observers for the instruments installed at the Office.

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## OBSERVATORIES.

### CENTRAL OBSERVATORY.

Kew Observatory, Old Deer Park, Richmond, Surrey.

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<i>Superintendent</i>	...	...	<div style="display: inline-block; vertical-align: middle;"> <div style="font-size: 3em; vertical-align: middle; margin-right: 5px;">{</div> <div style="display: inline-block; vertical-align: middle;"> C. Chree, Sc.D., LL.D.,  F.R.S., <i>Assistant-Director</i>  <i>of Observatories.</i> </div> </div>
<i>Clerk Assistants</i>	...	...	E. Boxall, B. Francis.
<i>Clerk Computer</i>	...	...	G. Harris.
<i>Boy Clerk</i>	...	...	F. Levin.
<i>Observer and Caretaker</i>	...	...	W. R. Corrin.

### MAGNETIC OBSERVATORY.

Eskdale Observatory, Langholm, Dumfries-shire, N.B.

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<i>Superintendent</i>	...	...	<div style="display: inline-block; vertical-align: middle;"> <div style="font-size: 3em; vertical-align: middle; margin-right: 5px;">{</div> <div style="display: inline-block; vertical-align: middle;"> G. W. Walker, M.A.,  A.R.C.Sc., till December  31st, 1912. </div> </div>
<i>Professional Assistant for</i>	...	...	L. H. G. Dines, M.A.
<i>Seismology.</i>	...	...	
<i>Clerk Assistant</i>	...	...	A. E. Gendle.
<i>Clerk Computer</i>	...	...	W. C. Parkinson.
<i>Mechanic</i>	...	...	A. Stonier.
1 handyman.			

### WESTERN OBSERVATORY.

Valencia Observatory, Cahirciveen, co. Kerry.

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<i>Superintendent</i>	...	...	J. E. Cullum.
<i>Assistant</i>	...	...	M. Sugrue.
1 handyman.			

### AEROLOGICAL OBSERVATORY.

Pyrton Hill, Watlington, Oxon.

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<i>Director of Experiments in connexion with the Investigation of the Upper Air.</i>	{	W. H. Dines, F.R.S.
<i>Mechanical Assistant</i>	...	H. W. Baker.

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EIGHTH ANNUAL REPORT  
OF THE  
METEOROLOGICAL COMMITTEE

TO  
THE LORDS COMMISSIONERS OF HIS  
MAJESTY'S TREASURY.

For the Year ended 31st March, 1913 (the Fifty-eighth  
year of the Meteorological Office).

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MAY IT PLEASE YOUR LORDSHIPS,

Meetings of the Committee have been held on 1st May, 3rd July, 2nd October, 6th November, 4th December, 1912, and 12th March, 1913.

**Obituary.**—The Committee record, with deep regret, the death of Sir George Howard Darwin, K.C.B., F.R.S., on Saturday, 7th December, 1912, at his home, Newnham Grange, Cambridge. He had been a member of the Committee on the nomination of the Royal Society from the time of its appointment under Treasury Minute of 20th May, 1905; and previously to that he had been for 20 years a member of the Meteorological Council, which was in charge of the Office from 1877 till 1905. He was appointed on that body by the Royal Society to take the place of the late Mr. Warren De la Rue, F.R.S., who retired in February, 1885. His wide knowledge and experience, the variety and reach of his interests, his ready appreciation and imperturbable courage combined to distinguish the large part which he took in the organisation of the meteorological service of the country.

**New Member.**—By Your Lordships' minute, dated 26th February, 1913, on the nomination of the Royal Society, Captain H. G. Lyons, R.E., F.R.S., was appointed for a period not exceeding five years, to the seat on the Committee which had become vacant by the lamented death of Sir George Darwin.

**Information for The King.**—The Committee have much pleasure in reporting the receipt of the following letter :—

Buckingham Palace,  
April 25th, 1913.

SIR,

I BEG to acknowledge the receipt of your letter of the 21st inst., and to thank you for your kind offer to supply me with information regarding the prospects of the weather on Monday next, the 28th. I will communicate with you by telephone about 9 a.m.

Regarding the suggestion contained in the latter part of your letter, I am commanded by The King to tell you that His Majesty would be very glad to

have a copy of the Daily Weather Report sent to him regularly. His Majesty has always taken a great interest in the chart and details concerning the barometer ever since he was on board H.M.S. "Thrush." The King would therefore be pleased to receive your Daily Report, and desires me to ask you to be good enough to address it direct to him every day.

Yours truly,

F. E. G. PONSONBY.

**Meteorology for Airmen.**—At the request of the War Office, arrangements have been made for a course of instruction in Meteorology at the Royal Flying School at Upavon, and for the supply of forecasts to the Naval Flying Schools at Eastchurch and Montrose.

**Ice Scout.**—The Office has been called upon to co-operate with the Board of Trade in the organisation of the expedition of the "Scotia" to investigate the condition of the Atlantic Ocean as regards ice between Newfoundland and Greenland, and the Committee have lent the services of Mr. G. I. Taylor, Schuster Reader in Meteorology at Cambridge, for the time being for the meteorological work of the Expedition.

**Award of the German Meteorological Society.**—Mr. E. Gold, M.A., Superintendent of the Statistics and Library division of the Office has obtained the first prize of 2,000 marks in an international competition arranged by the German Meteorological Society in 1908 for the best essay on "The International Kite and Balloon Ascents." The essay comprises a discussion of the observations of the upper air which have appeared in the publications of the International Commission for Scientific Aeronautics or of the various Meteorological Institutes mainly in the past ten years. The essay is being printed by authority of the Committee as No. 5 of the series of "Geophysical Memoirs," and, at the request of the German Meteorological Society, a special issue of copies will be made to the Society on repayment.

**Office and Observatory Staff.**—A list of the members of the Staff at the close of the year is given on pp. 6 to 8.

In the course of the year there has been an unusual amount of absence on sick leave, both at the office and the observatories.

**Office and Observatory Premises and Fittings.**—Through the care of the Director, a set of bookcases for housing the collection of weather maps of all countries, commencing with the Bulletin International, issued from the Paris Observatory in 1858, has been provided in the Forecast Room at a cost of £200.

To the list of private contributors to the cost of the bronze memorial tablets for the show cases in the hall of the first floor of the Office, given in last year's report, p. 12, should be added the following: Mr. Francis Druce, Mr. W. L. Fox, Dr. H. R. Mill.

Structural alterations have been arranged for Kew Observatory, as indicated on the next page.

The Magnet House at Eskdalemuir has been receiving the attention of the Office of Works in consequence of signs of damp having appeared.



Mrs. C. Theodore Williams has presented to the Office for the Library at Eskdalemuir a set of the Reports of the British Association from 1860 up to date, and a set of Reports of Magnetic and Meteorological Observations at the Royal Observatory, Greenwich.

**M. O. Press.**—The Press has been in regular operation throughout the year, and the Daily Report has been produced without fail, as well as the charts for the Weekly Report and the Monthly Report, and the various issues of charts of the North Atlantic Ocean and the Indian Ocean.

Printing orders for 25 requisitions have been executed, in addition to about 292,000 copies of the Daily Weather Report, 23,400 copies of the maps for the Weekly Weather Report, 20,000 copies of the maps for the Monthly Weather Report, with Annual Summary; 9,000 copies of the Monthly Meteorological Charts of the North Atlantic and Mediterranean, and 6,600 copies of the Monthly Meteorological Charts of the Indian Ocean.

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Besides questions of ordinary administration various important matters have occupied the attention of the Committee during the year; many of these relate to the observatories in connexion with the office.

**Observatories.**—A number of questions have arisen with regard to the organisation, staff and buildings of Eskdale Observatory, upon which the Committee have had the assistance of the Gassiot Committee of the Royal Society (p. 56). Arrangements have been in progress for the transference of the work of testing optical and meteorological instruments from Kew Observatory to the National Physical Laboratory at Teddington, and the reconstruction of the interior of the Observatory in accordance with the special requirements of the work of observing. They have been subject to prolonged delay. The removal has been successively postponed from October to January, and again from January for two or three months longer, but it will be complete by May 13, 1913 (p. 53). The question of the discontinuance of the magnetic and meteorological work at Falmouth Observatory has come up for consideration on various occasions, as the Royal Cornwall Polytechnic Society were encouraged by resolutions passed by the British Association at Dundee to hope that, notwithstanding the intimation that the Society could not continue the observations after the close of 1912, an effort would be made to obtain a special grant from Government for the continuance of the Observatory while a repetition of a detailed magnetic survey of the British Isles was in progress. A grant was made by the Royal Society out of the Government Grant Fund for Scientific Research to keep the work going while the appeal was under consideration. No information is available as to further action on the part of the British Association. In the meantime notice has been given to terminate the appointments of the staff and the tenancy of certain neighbouring lands held by the Society for the benefit of the Observatory; and, on the other hand, Dr. L. A. Bauer, director of the magnetic department of the

Carnegie Institution of Washington, has asked for the continuance of the magnetic work until the present cruise of the magnetic surveying ship "Carnegie" is concluded, and has offered to make a contribution for the maintenance of the observations till the end of the year.

In these circumstances, the Meteorological Committee recognise that the magnetic work at Falmouth, and the regular meteorological work there on the lines laid down in 1868, must come to an end in a few months' time, and they are considering whether, with the funds thus set free, they can provide for the co-ordination of meteorological work in the extreme South-West of England, and initiate experimental work on modern lines.

The grants for the self-recording observatories of the Kew type at Glasgow and Stonyhurst have been withdrawn, and with the funds thus set free provision has been made for daily telegraphic reports from Glasgow and Eskdalemuir; thus the wish for additional stations in Scotland in connexion with the Daily Weather Service has been met.

**Scottish Meteorological Society.**—At the close of the year, at Your Lordships' request, the Committee have entered into negotiations with the Scottish Meteorological Society with the object of placing the finances of the Society upon a satisfactory footing as regards the supply of information to the public, and securing closer co-operation between the work of the Office and of the Society in respect of climatological stations in Scotland. A scheme has been drawn up for a meteorological office in Edinburgh, which is intended to "occupy the same relation towards the supply of information for the use of His Majesty's courts, public departments, and the public generally in Scotland, as the Office in London does in regard to the same objects in England, and to a certain extent also in Ireland." The matter is in a fair way towards a satisfactory conclusion. If that should fortunately prove to be the case, the organisation of the supply of meteorological information to the public will, for the first time, be placed upon a comprehensive footing.

In this connexion it is desirable to take into consideration the sources from which the greater part of the information has hitherto been derived. It is largely the work of voluntary observers, who maintain the observations, either for their own immediate information or for their interest in meteorology, and are good enough to transmit copies to a central organisation for the benefit of the public. The central organisation not only enables the observers to compare their results with those of their colleagues all over the country, but it also fulfils the useful function of a record office or guardian of the public memory, so that an answer may be forthcoming to any question as to what has happened, as regards weather, in times past. As time goes on the interest of the private landowner and voluntary observer becomes impaired, and at the same time the interest of the local authority from the point of view of the municipal surveyor and engineer, the medical officer, the education authority, and, indeed, the general interest of the community becomes increased, especially as the organisation becomes

more and more effective, and the answers to the questions put are more and more to the point. Moreover, the local authorities have the best means of securing continuity in the maintenance of the observations.

The Committee therefore view with satisfaction the increasing tendency of local authorities in many parts of the country to keep their own records of the weather for their own immediate purposes, and to contribute them to a central organisation for the purpose of comparison and record. They look forward to some such distribution as a rain-gauge in each parish, a thermometer screen in each district, and a full climatological station in each county and county borough, as a rational basis for a trustworthy memory of events which are of interest to everybody, and of economic importance to large numbers.

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The Office has been represented at a number of international meetings.

**Scientific Aeronautics.**—The first was a meeting of the International Commission for Scientific Aeronautics, which was held at Vienna on May 27th, 1912, and following days. The subjects treated had a wide range, and included the establishment, for the purposes of aerological research, of observatories at Rostock, by Herr Hildebrandt, through the generosity of Mr. Patrick Y. Alexander, of London; at Tenerife, by the Spanish Government, to replace ultimately the temporary observatory established there for the International Commission by the German Emperor; at Montevideo, by the Government of Uruguay; in the Argentine, by Mr. W. G. Davis, Director of the Argentine Weather Bureau; at Spitzbergen, by the German Government; at Victoria Nyanza by His Excellency the German Secretary of State for the Colonies; at Guadalajara, by Colonel Vives y Vich, for the Spanish War Office; at Pawlowsk, Tiflis, Ekaterinburg, Irkutsk, and Nijni-Ussurissky, near Vladivostock, by the Russian Government.

The problems to which the Commission directed special attention were, first, the investigation of typical weather conditions by means of simultaneous soundings of the air; secondly, the collection of samples of air from very high levels, with a view to chemical analysis; thirdly, the investigation of the physical condition of air at very low pressures, and of water vapour at low pressures and temperatures; and, fourthly, the organisation of an international network of stations for pilot-balloon soundings. With regard to this last, a resolution of the Commission, urging participation on the part of this country in the international scheme, has been received from the War Office, to which it had been forwarded by the Foreign Office, which had received it from the German Chargé d'Affaires. In forwarding the resolution the Army Council expressed their willingness to co-operate as far as they find it possible.

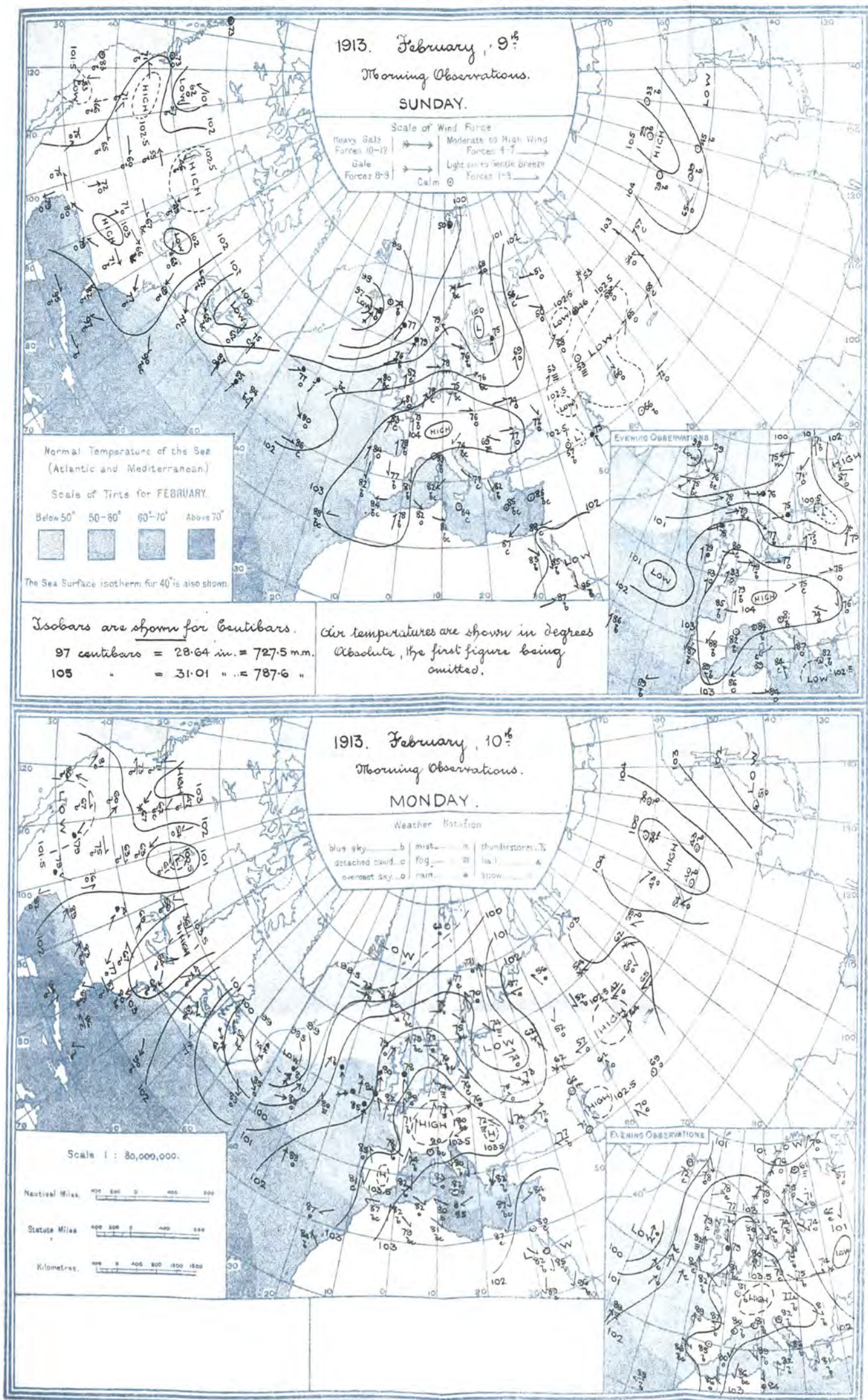
At the conclusion of the meeting in Vienna the Commission expressed their willingness to hold the next meeting in England in 1915.



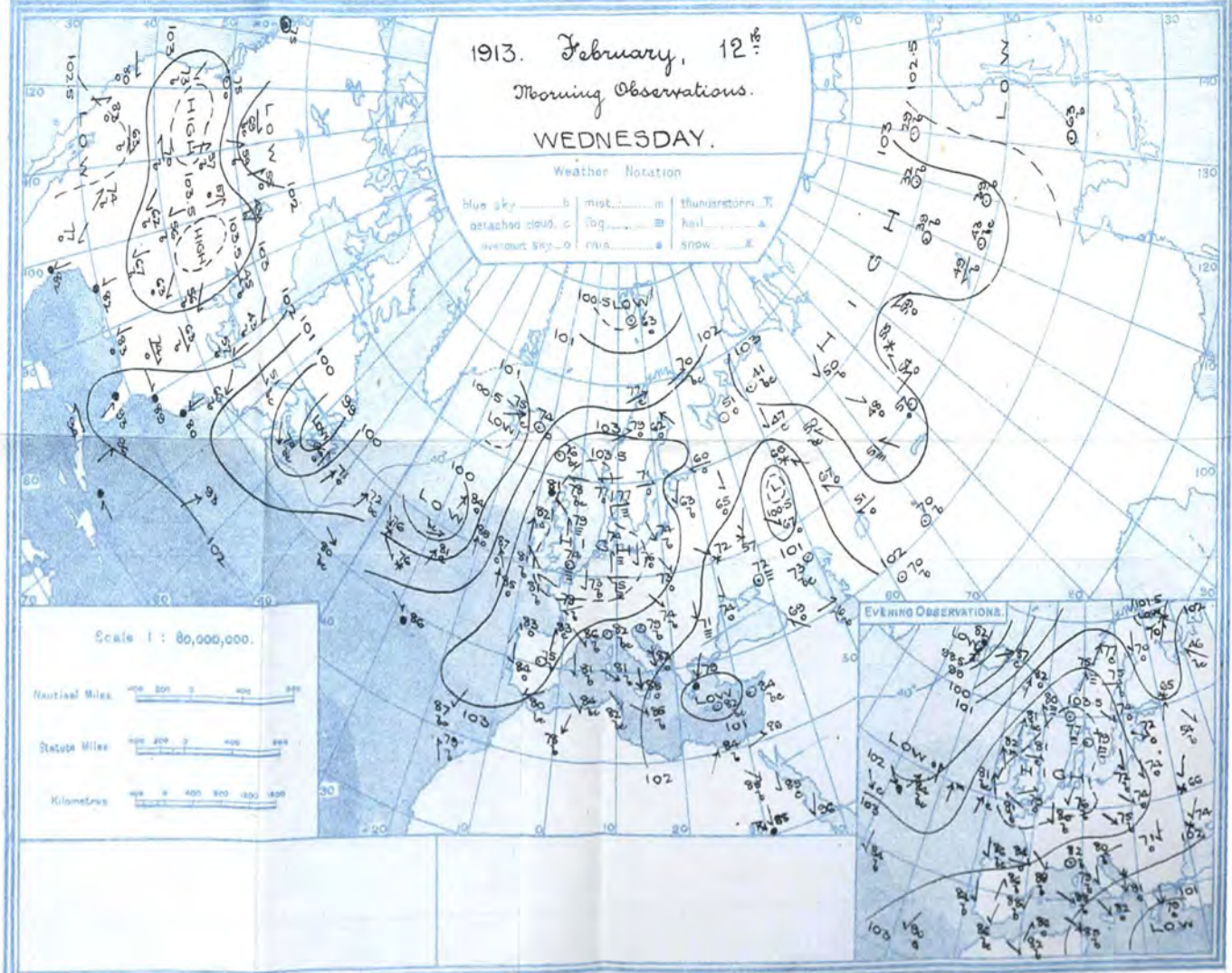
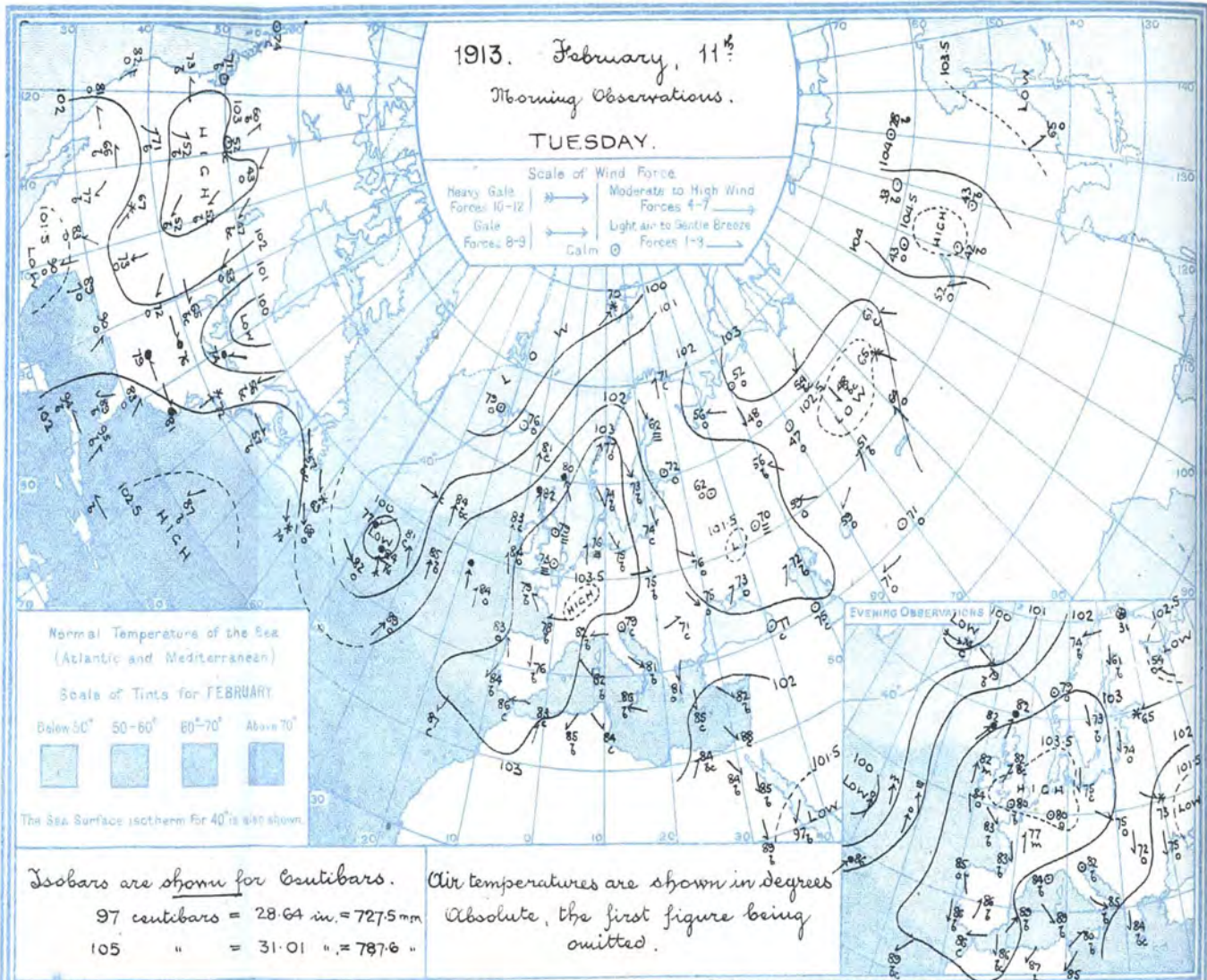
**Central Aerological Observatory for the British Isles.**—While remarkable activity in the investigation of the upper air is thus displayed abroad, our own share in the investigation is liable to a serious set-back. The estate known as Pyrton Hill, near Watlington, Oxon, which has been in Mr. Dines's occupation since 1906, and at which he has carried on investigations for the Office with remarkable success, was offered for sale to the Committee by the owners. As the Committee did not see their way to buying it, it was disposed of otherwise, and it is understood that Mr. Dines must give up possession by 31st March, 1914. The main objection to the estate as a site for an aerological observatory is that it is too near the South Coast; on that account apparently many registering balloons are lost at sea. If the Committee are free to seek another site, they would regard some point near the centre of England as being the most suitable.

**International Units.**—Among the subjects discussed by the International Commission for Scientific Aeronautics was the question of the units to be adopted in the publication of the results of the international investigation of the upper air—a publication to which the Meteorological Committee contribute £50 per annum. The question was brought forward by Professor Bjerknes, of Christiania, who has now been called to Leipzig by the Government of Saxony. He proposed among other things that pressures should be given in units based upon the C.G.S. (Centimetre, Gramme, Second) System, which is universally adopted for electrical and magnetic measurements, instead of the popular continental unit, the millimetre. This proposal is of great interest to the Committee, because they have already adopted units based on the C.G.S. System for all measurements at their observatories, and, more recently, for the publication of daily observations from their stations of the second order. The question is particularly important to the Committee at the present time, because, if it is decided to go forward with what they consider an important reform, they must now take steps to alter the graduation of their instruments, whereas if, sooner or later, they should have to retrace their steps, it is better to do so now. Since the units of the C.G.S. System are to be included in the international publications of the results of the upper air, they have decided to go forward, and, in future, to use the centibar or millibar instead of the inch as far as possible for all barometric measurements in connexion with the Office. The reasons for adopting this course are set out in the preface to the 1913 edition of the *Observer's Handbook*. One circumstance in favour of the change may be mentioned here. We have been accustomed for a long time to a barometer-dial originally used for wheel barometers, in which the barometric pressure 29·5 inches at the top of the dial is marked "change," while "rain," "much rain," and "stormy," mark half-inch intervals on the one side, and "fair," "set fair," and "very dry," similar intervals on the other side. The same legends appear opposite to different barometric pressures in continental barometers. For at least sixty years these inscriptions have been known to be incorrect and misleading, and yet they persist. The time has certainly arrived when something ought to be done to induce the instrument-makers to place something better on the market. Now it happens that the

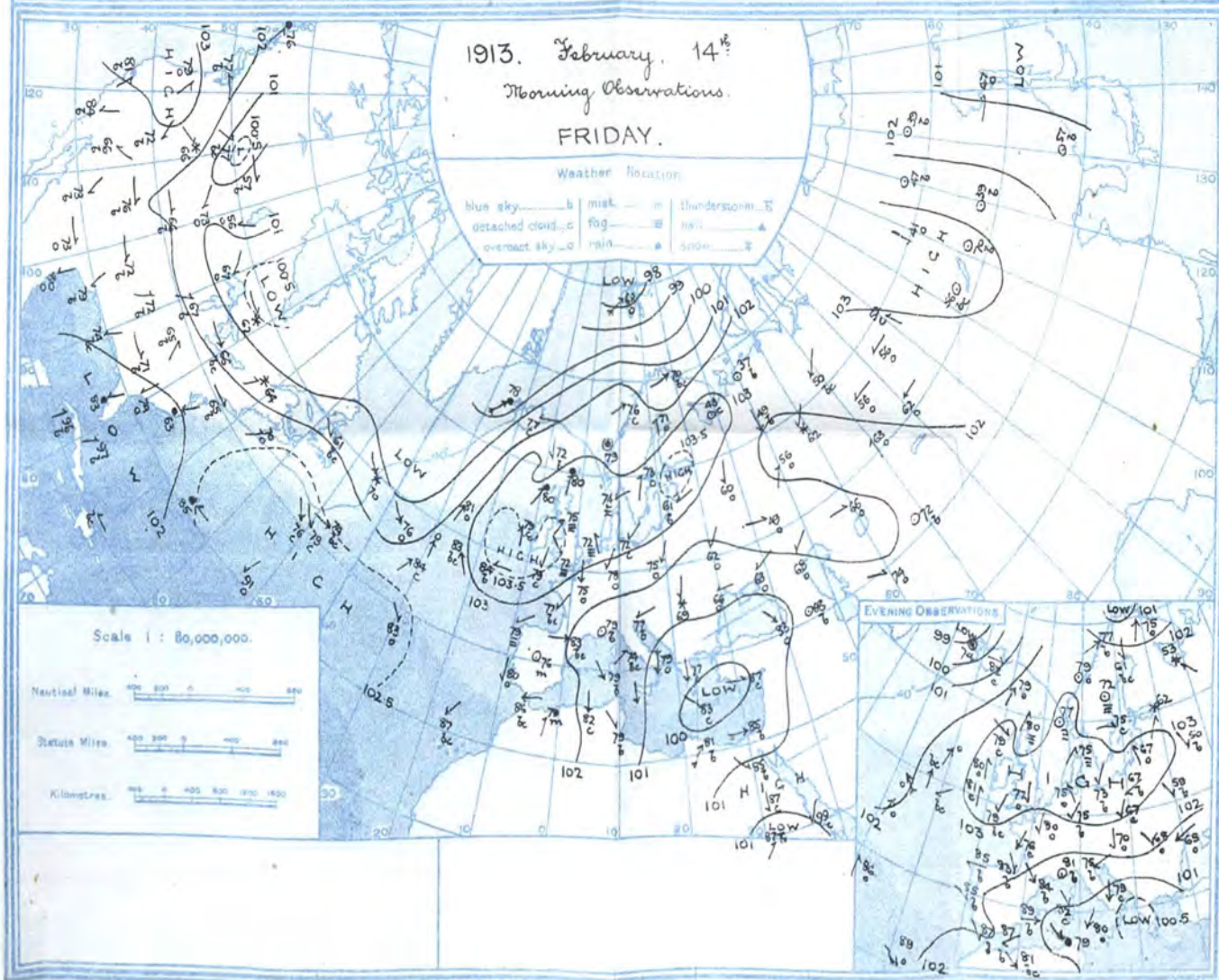
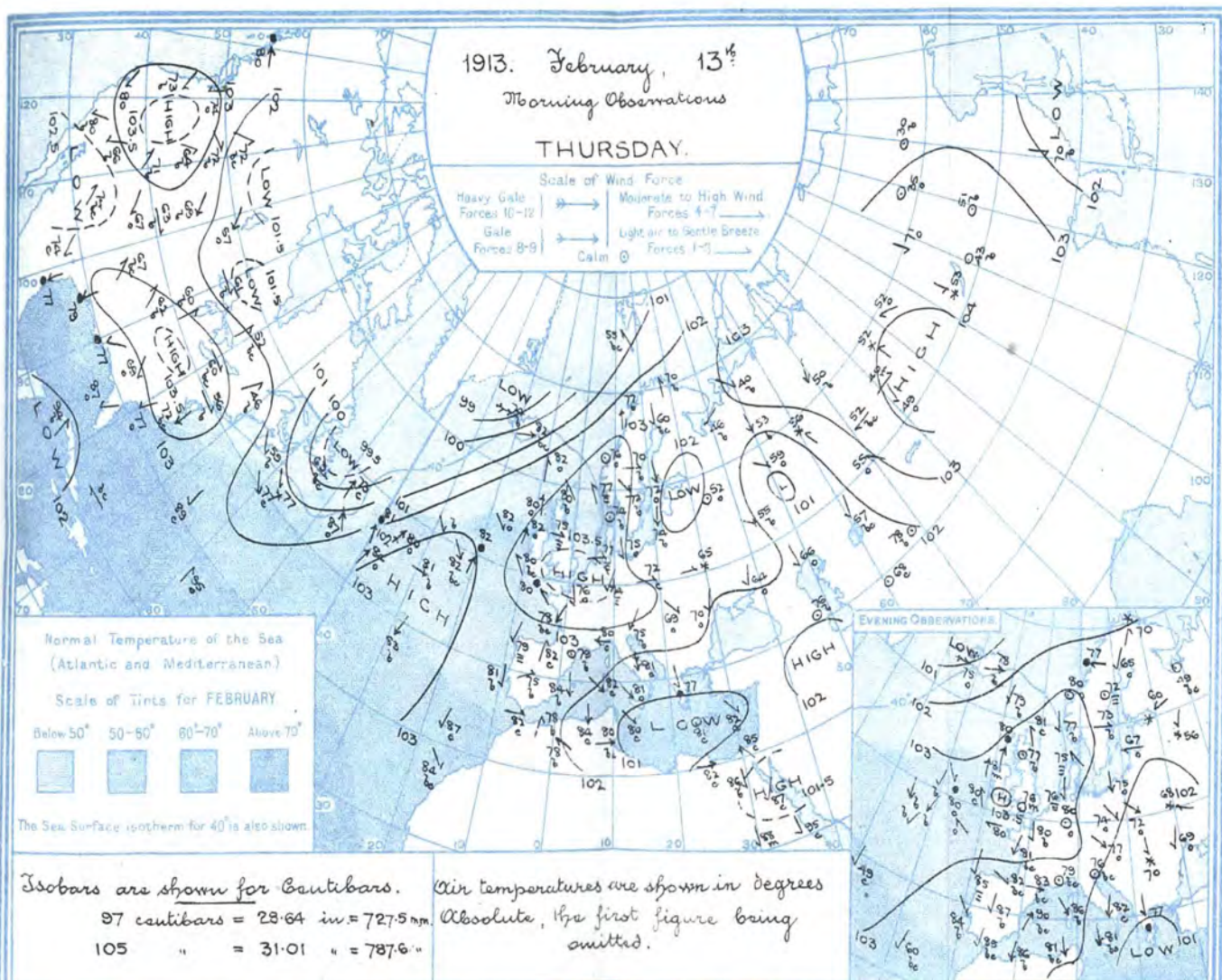




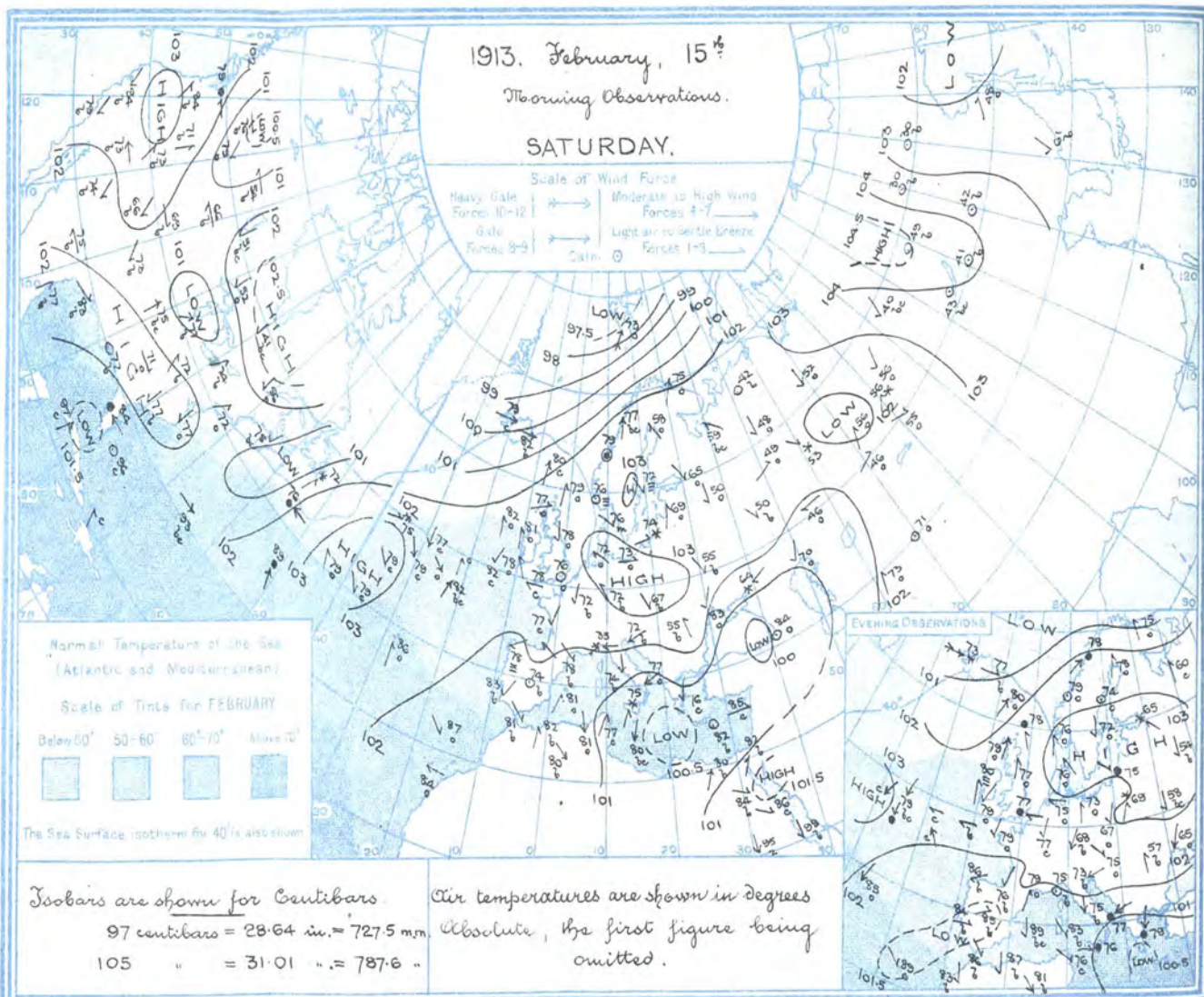




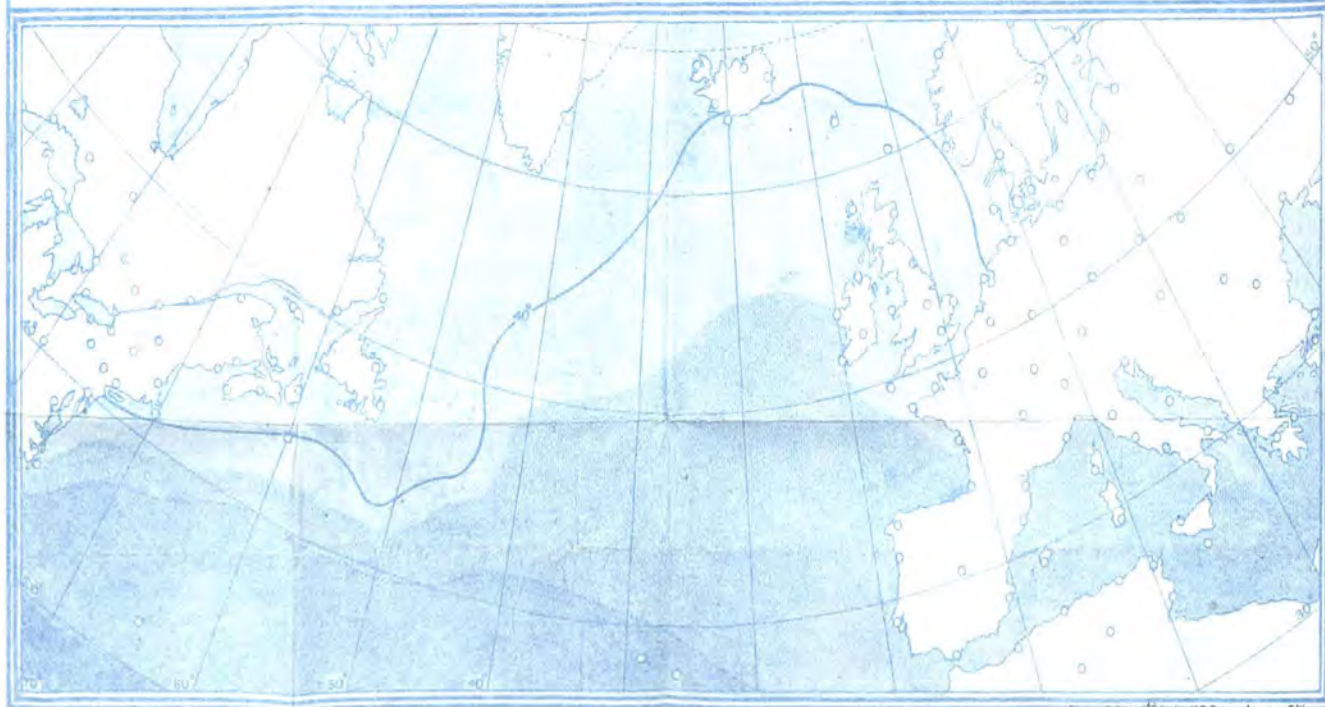








**SURFACE TEMPERATURE of the SEA during the week ended Saturday,** \_\_\_\_\_





top of the dial marked 29.5 inches corresponds with 100 on the new scale of pressure in centibars, and that the ordinary range of the barometer at sea-level in these islands is from 95 to 105, so that the scale is specially useful for the practical purposes of a commercial barometer.

The Committee propose to introduce the new units for the expression of pressure in the Daily Weather Report on 1st May, 1914. A specimen copy of the maps of the Daily Weather Report, with isobars drawn for each half-centibar, and isotherms shown on the absolute temperature scale, is given in Plate 1, while corresponding specimens of maps for the Weekly Weather Report are given in Plate 2.

**International Commission for the Study of Solar Radiation.**—A meeting of the Commission for the study of solar radiation, at which, unfortunately, no representative of the Office was able to be present, was held at Rapperswyl, near Zürich, on 2nd and 3rd September, 1912. The proceedings were mostly concerned with technical matters concerning solar radiation, but one conclusion is of public interest, namely, that the Commission proposes to undertake an investigation, with a view to precise specification, of the sunshine recorder which was originally introduced by Mr. J. Campbell, of Islay, and reduced to scientific shape by Sir G. G. Stokes while he was a member of the Meteorological Council. So far as this country is concerned, the process proposed by the Commission has already been gone through, and the specification is given in detail in the Observer's Handbook. The Committee will watch with interest the result of the proposed investigation.

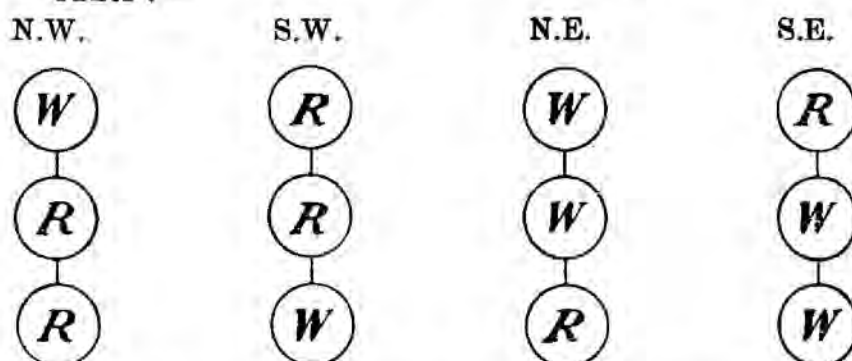
**Commission for Maritime Meteorology and Storm Warnings.**—This International Commission met in London, by invitation of the Director, in September, 1912. The Board of Education kindly lent the Committee Room of the Science Museum for the meetings. H.H. the Raj Rana of Jhalawar, who was in London at the time, expressed a wish to attend the meetings. The business of the meeting consisted mainly in arriving at a conclusion with regard to an international system of signals for storm warnings at night, in completion of the system of one or two cones adopted for storm-warnings in daylight by the International Meteorological Committee, at the meeting at Berlin in 1910. Two proposals were chiefly under consideration; one using combinations of two lanterns in the vertical, red and white, about 12 to 15 feet apart, and the other using combinations of three lanterns, in the vertical, red and white, extending over about 15 feet over all. The use of two lanterns was objected to by the Board of Trade, the French Ministry of Marine, and other bodies, on the ground of liability to confusion with other signals specified in the international rules for avoiding collisions at sea; and, on the other hand, the use of three lanterns was objected to by the United States and Germany as being unworkable. International agreement on a single system being, therefore, impossible, it was agreed to make separate recommendations for the countries using two lanterns, and for the countries using three lanterns. The recommendations have already been circulated for comments to the meteorological institutes of the world. Since the close of the year they have been reported, with



the comments made, to a meeting of International Meteorological Committee held at Rome, April 7th to 12th, 1913, and approved by that Committee in the following form :—

(i) For countries using three lanterns :—

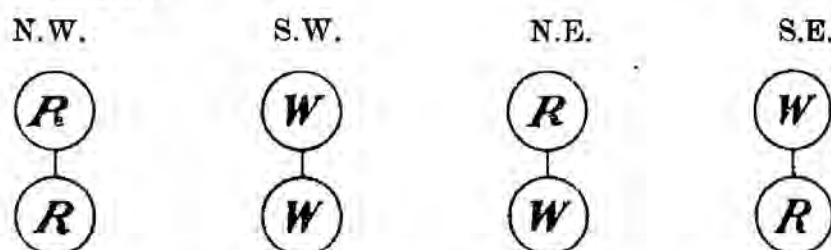
For a gale commencing with wind in the following quadrants :—



The lanterns should be not less than 2 metres apart, 4 metres covering the whole signal.

(ii) For countries using two lanterns :—

For a gale commencing with wind in the following quadrants :—



The lanterns should be not less than 2 metres apart (generally 4 metres or 15 feet).

Note.— (R) = Red light. (W) = White light.

The Committee have adopted the system of signals consisting of two cones for day signals and three lanterns for night signals. In the course of the current year they propose to introduce the day signals, and to proceed, as far as funds allow, with the introduction of the night signals.

The Commission requested the London Office to publish an annual edition of a summary of the signals for storm warnings employed by different countries, which had been prepared for the information of the meeting, and the Committee propose to comply with that request. Various resolutions were passed, inviting the several countries to contribute information for the publication.

The signals agreed upon are what are technically known as local storm warnings; that is to say, they are intended to indicate the probability of bad weather which may not necessarily be in evidence at the port where the signal is exhibited, but may be expected in exposed situations in the immediate neighbourhood. Various

schemes are in vogue in different countries for what are called "non-local" signals—that is to say, signals which indicate the state of the weather, generally the existence of a tropical revolving storm in countries where such occur, or the existence of gales at some distance in more temperate regions—were under the consideration of the Commission, but the views of those interested were not sufficiently in accord to justify any final conclusion on the subject. The most recent method of distribution of non-local weather information is by means of radio-telegraphy, as from the Eiffel Tower, Norddeich, and the Admiralty Wireless Stations. The best form of message for these purposes has yet to be ascertained.

With reference to maritime meteorology in general, the Commission decided to ask the various meteorological institutes which collect observations from ocean-going ships to send copies of the observations for certain ocean squares to the Meteorological Institute of the Netherlands at De Bilt, in order that the information may be summarised as a contribution to the meteorology of the Globe. The Committee propose to comply with this request.

**International Commission for Weather Telegraphy.**—Concurrently with the meetings of the Commission for Maritime Meteorology and Storm Warnings, meetings were held in London of the Commission for Weather Telegraphy, which resolved to recommend various alterations in the international code for the exchange of weather reports in Europe. The alterations are mostly of a technical character, and it is unnecessary to give the details; but it may be mentioned that one of the proposals is that, in future, only two figures shall be assigned for information as to rainfall in the British reports, instead of three as heretofore, and only one figure for wind force, instead of two. These changes will bring the code for the British reports into complete parallelism with that for the Continental reports, but the resolution as to rainfall involves giving the rainfall in millimetres, and it is a question whether the change should be introduced in the measuring of the rain or in the coding of the message. It is proposed that the changes shall come into operation on 1st May, 1914.

**Meteorological Telegrams.**—The discussion with the Post Office as to the charges due to the Postmaster-General for delivering telegrams at the new Office has, with Your Lordships' sanction, resulted in a compromise whereby the Office will pay a commuted sum of £100 a year, in addition to £67 10s., the special charge for the attendance of clerks to deal with telegraphic business for the Office between 7 a.m. and 8 a.m.

With regard to the service of meteorological telegrams, it may be of interest to mention that, at the beginning of 1913, Mr. R. F. Stupart, Director of the Meteorological Service of Canada, brought to the notice of the Committee specimens of the charts of barometric distribution over practically the whole of the Northern Hemisphere, which are prepared daily in Toronto by co-operation with the Weather Bureau of Washington. The charts in question differ from those now prepared in this Office ten days after date for issue with the Weekly Weather Report, by including observations from Alaska. These are not charted on the Canadian Daily Chart,

which is used for the compilation of the charts in the Weekly Report, but it is pointed out that they are of exceptional importance in relation to the general distribution of weather conditions.

The question was brought up in relation to the reduced prices now charged for "deferred" telegrams across the Atlantic, which eases the financial side of the question of preparing a comprehensive daily chart. But, even so, the expense of getting a telegraphic report of observations from the other side of the Atlantic would amount to not less than £300 a year, and the information would have to be supplemented by observations from the Far East, hardly less expensive. It is, however, important to notice that a daily weather chart for the Northern Hemisphere is even now practicable. Moreover, the Committee are informed that the Russian Imperial Government is raising the sum devoted to meteorology to £50,000 a year, with the object, among others, of initiating in the year 1915 a service of strictly simultaneous observations at 6 a.m. and 6 p.m. (Greenwich time) over the whole of the Russian Empire, which extends over nearly 180° of Longitude. The extension of the ordinary daily working chart to include practically the whole of the Northern Hemisphere will then be easily realisable, and it is evident that the *réseau mondial* proposed by M. Teisserenc de Bort in 1905 is much nearer realisation than was generally supposed. At this moment the cable and wireless companies of the world could exchange information which would give a very fair representation of the weather conditions of the globe to those who are familiar with the average features. The realisation of the project of a *réseau mondial* for the daily weather services is now only a question of international organisation and of money.

**Application of Meteorology to Agriculture.**—On the initiative of the International Institute for Agriculture, which has its seat in Rome, the International Meteorological Committee has taken up the question of the practical application of meteorology for the use of agriculturists. The question was referred to a small Commission of experts, MM. Angot, Börnstein, Brounoff, Louis Dop, Palazzo, which has recommended the appointment of a permanent Commission, to further the study. Certain aspects of the study have been treated by the Director in a lecture before the meeting of teachers of agriculture in Cambridge, in July, 1912, which has been printed in the Journal of the Scottish Meteorological Society.

**Publications.**—During the past year the first volume of *Hourly Values from Autographic Records, Geophysical Section*, has been published. The volume forms Section 2 of Part IV. of the *British Meteorological and Magnetic Year Book* for 1911. It is in continuation of the volumes of results published up to 1909 by the National Physical Laboratory, but it contains much information of a new type. In particular, hourly readings of terrestrial magnetic force as recorded at Eskdalemuir—the observatory which was erected by Government to continue the work of magnetic recording, which had been impaired at Kew owing to the disturbance caused by electric traction—are given *in extenso*, and for the first time. The publication of the volume has been noted with considerable satisfaction by some of the principal magnetic observatories on the Continent.



The *Geophysical Journal* has been published regularly every month, and, from the beginning of 1912, the results of observations of the upper air by means of kites and balloons, also daily results from the Callendar Radiation Recorder installed in the Office have been printed therein. The information for the upper air had hitherto appeared in the Weekly Weather Report.

The series of *Geophysical Memoirs* has been continued. A fourth memoir has been published, and several further memoirs are in the press.

A *Calendar, with Notes and Diary of Operations for the Use of Observers*, was prepared at the end of 1912, in 8vo form, to replace the former foolscap *Diary of Operations* which was issued to observatories and anemograph stations. The Calendar contains information of a climatic character which was not previously included, as well as notes of historical interest in connexion with the sciences of Meteorology, Terrestrial Magnetism, &c. The issue of the Calendar is based upon the conclusion that the time has now arrived when some of the principal results of the meteorological organisation of the last half-century may, with advantage, be put before the public in calendar form.

The *Barometer Manual for the Use of Seamen*, of which the sixth edition, consisting of 7,500 copies, was issued in 1909, was notified as being out of print in 1911, and a seventh edition of 10,000 copies was published in November, 1912.

Exchanges of publications have been arranged with the following:—

University College of North Wales, Bangor; Mungret College, Limerick; Editor of "Civil Engineering"; University College, Reading; Royal Society of Canada, Montreal; Hydrographic Institute, Genoa; Hydrographic Office of the Po, Parma; University Library, Christiania; Weather Bureau Local Office, New York; Observatory of the College of Montserrat, Cienfuegos; Mount Tsukuban Observatory, Tokio.

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

PERIODICAL.—The Daily Weather Report.

Monthly Meteorological Charts of the Atlantic Ocean and the Mediterranean.

Monthly Meteorological Charts of the Indian Ocean and Red Sea.

The British Meteorological and Magnetic Year Book for 1912, comprising:—

Part I.—The Weekly Weather Report with Quarterly and Annual Summaries, and a wind-force Supplement.

Part II.—The Monthly Weather Report, with a summary for the year.

Part III. (1).—Daily Readings at Meteorological Stations of the First and Second Order.

Part III. (2).—*Geophysical Journal*. Daily readings in Meteorology, Solar Radiation, Seismology, Atmospheric Electricity and Terrestrial Magnetism, with the results of Soundings of the upper Air by means of kites and balloons. [Partially completed.]

**Part IV. (1).—Hourly Values from Autographic Records: Meteorological Section.** Hourly values for pressure, temperature, humidity, rainfall, and sunshine for Kew, Eskdalemuir, and Valencia. [Partially completed.]

**Part IV. (2).—Hourly Values from Autographic Records: Geophysical Section.** Hourly values for terrestrial magnetism, atmospheric electricity and meteorology, for five observatories. [Partially prepared.]

**Calendar**, with notes and diary of operations for the use of observers.

**Provisional Summary of the Maritime Weather Signals** at present in use in the various countries of the globe. 1912 edition.

**OCCASIONAL.**—**Report of the Meeting of the Commission for Maritime Meteorology and Storm Warnings**, held in London in September, 1912.

**Report of the Meeting of the Commission for Weather Telegraphy**, held in London in September, 1912.

**Barometer Manual for the use of Seamen.** Seventh edition.

**GEOPHYSICAL MEMOIRS.**—Vol. I., Part II. for 1912:—

No. 4. On the Radiation Records obtained in 1911 at South Kensington, together with a comparison between them and the corresponding absolute observations of radiation made at Kew Observatory, by R. Corless, M.A., Secretary to the Director.

The Second Volume of Meteorological Results of the National Antarctic Expedition, 1901–4, with the title **Meteorology, Part II**, comprising daily synchronous charts, 1st October, 1901 to 31st March, 1904, prepared in the Meteorological Office under the superintendence of M. W. Campbell Hepworth, C.B., R.D., Commander R.N.R., Marine Superintendent, was made ready for issue by the Royal Society, before the close of the year.

Other publications for which authority has been given and which are in preparation, but have not yet been issued, are as follows:—

Climatological Report for certain British Stations overseas.

The Observer's Handbook (1913 edition).

The Computer's Handbook.

The Tabulator's Handbook.

The Seaman's Handbook.

The Marine Observer's Handbook: a reprint of instructions for keeping the meteorological log.

Gales on the British Coasts. A revised edition of the Fishery Barometer Manual.

The Seasons in the British Isles, with normals for four observatories, and tables for their application in climatology.

Atlas of Tropical Hurricanes.

Report of the tenth meeting of the International Meteorological Committee, Rome, 1913.

Monthly Meteorological Charts of the South Atlantic Ocean.

GEOPHYSICAL MEMOIRS.—*Vol. I., Part II., for 1912 :—*

No. 5. The International Kite and Balloon Ascents, by Ernest Gold, M.A., Superintendent of Statistics.

No. 6. The Free Atmosphere in the Region of the British Isles (Third Report).—The calibration of the balloon meteorograph and the reading of the traces, by W. H. Dines, F.R.S.

No. 7. A Comparison of the Electrical Condition of the Atmosphere at Kew and Eskdalemuir, by Gordon Dobson, B.A., Graduate Assistant.

No. 8. Lag in the Readings of Marine Barometers on Land and Sea, by Charles Chree, Sc.D., LL.D., F.R.S., Superintendent of Kew Observatory.

*Vol. I., Part III., for 1913.*

No. 9. On the Relation between the Velocity of the Gradient Wind and that of the Observed Wind, by J. Fairgrieve.

A book entitled *The Structure of the Atmosphere in Clear Weather*, by Mr. C. J. P. Cave, M.A., of Ditcham Park, Petersfield, embodying the conclusions arrived at from a study of the results of a number of pilot balloon ascents made by him in co-operation with the Investigation of the Upper air, was published in 1912 by the Cambridge University Press.

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

By Dr. Charles Chree, F.R.S., Superintendent of Kew Observatory—

*Some phenomena of Sunspots and of Terrestrial Magnetism at Kew Observatory.* Phil. Trans. A. vol. 212, pp. 75-116.

By Mr. R. G. K. Lempfert, M.A., Superintendent of the Forecast Division—

*A lecture on "British Weather Forecasts, past and present," delivered before the Royal Meteorological Society, March, 1913.*

By Mr. W. H. Dines, F.R.S.—

*The vertical distribution of temperature in the atmosphere and the work required to alter it.* Q.J. Roy. Met. Soc., vol. 39, April 1913.

By Mr. J. S. Dines, M.A.—

*Rate of Ascent of Pilot Balloons.* Q.J. Roy. Met. Soc., vol. 39, p. 101, 1913.

*Note on the Mean Observed Rate of Ascent of Pilot Balloons.* Beiträge für Physik der freien Atmosphäre, Band V., Heft 2.

*Fourth Report on Wind Structure.* To be printed in the Technical Report of the Advisory Committee for Aeronautics for 1912-13.

By Mr. R. Corless, M.A., Mr. Gordon Dobson, B.A., and Dr. Charles Chree, F.R.S.—

*Meteorological, Electrical, and Magnetic Observations made during the Solar Eclipse of April 17th, 1912.* Q.J. Roy. Met. Soc., vol. 39, April, 1913.

By Mr. G. W. Walker, F.R.S.—

*On a New Analytical Expression for the Representation of the Components of the Diurnal Variation of Terrestrial Magnetism.* Proc. Roy. Soc., vol. 88A, p. 191, 1913.



## FINANCE.

A statement of the receipts and payments during the year ended 31st March 1913 is given on p. 23. The amount of the parliamentary vote for meteorology, which was paid to the Committee direct from the Treasury, was £17,000. In addition to this, monies from grants voted by Parliament to the Royal Society and the Advisory Committee for Aeronautics were paid by those bodies to the Committee on account of Eskdale observatory and the Branch Office at Farnborough respectively, while a payment from the National Physical Laboratory on account of the joint occupation of Kew observatory by the office and the laboratory, a grant from the Royal Society for seismology at Eskdale observatory and proceeds of the Gassiot and Rosse Trust funds administered by the Royal Society in respect of Kew and Valencia observatories have been added to observatory revenues. The sum total of these items was £2,716 6s. 11d., which together with the grant of £17,000, provided £19,716 6s. 11d. as the amount of revenue available for the work of the year. The miscellaneous receipts and repayments have amounted to £6,473 11s. 5d., and a sum of £308 8s. 7d. (as compared with £553 estimated to be required) has therefore been expended out of balance in order to meet the cost of special instruments, furniture and fittings of the office and to meet certain items of ordinary expenditure, making up a total expenditure of £26,498 6s. 11d.

The following abstract shows approximately the net payments for this and the preceding years, together with the increase or decrease in 1912-13, as compared with the previous year :—

NET EXPENDITURE.	1911-12.	1912-13.	Increase.	Decrease.
<b>SALARIES :</b>	£	£	£	£
Director ... ..	1,000	1,000	—	—
Office and Observatories ...	10,722	11,186	464	—
<b>GENERAL ADMINISTRATION</b> of the Central Office :				
Rent, Fuel, and Lighting...	684	700	16	—
Furniture, fittings and incidental expenses.	688	422	—	266
Postage ... ..	391	371	—	20
TELEGRAMS, &c. ... ..	2,168	1,997	—	171
TRAVELLING EXPENSES ...	281	152	—	129
INSTRUMENTS ... ..	515	633	118	—
<b>OBSERVATORIES (Expenses other than Salaries) :—</b>				
Kew ... ..	246	268	22	—
Eskdale ... ..	319	338	19	—
Valencia ... ..	57	84	27	—
Farnborough ... ..	60	142	82	—
Allowances to auxiliary Observatories, Observers, &c.	2,020	2,141	121	—
<b>SUPERANNUATION ACCOUNT</b>	677	591	—	86
Total ... .. £	19,828	20,025	197	—

# ACCOUNT of RECEIPTS and PAYMENTS for the year ended 31st March, 1913 :—

RECEIPTS.				PAYMENTS.			
	£	s.	d.		£	s.	d.
Balance from year 1911-12				Director .. ..	1,000	0	0
Parliamentary vote ..			17,000	0	0		
M.O. OBSERVATORIES :				OFFICE SALARIES :			
Kew .. ..	1,032	7	4	Monthly .. ..	7,743	13	11
Eskdalemuir .. ..	1,348	7	5	Weekly .. ..	909	11	3
Valencia .. ..	65	2	11		8,653	5	2
Farnborough .. ..	400	0	0	Less refunds .. ..	8	4	5
			2,845				8,645
			17				0
			8	M.O. OBSERVATORIES :			
DEPARTMENTAL EXPENSES REPAID :				Kew .. ..	1,625	16	9
Forecasts, &c. .. ..	163	2	3	Eskdalemuir .. ..	1,406	5	1
Marine, Statistics, and Observatories .. ..	104	19	1	Valencia .. ..	539	11	0
Instruments .. ..	168	2	2	Farnborough .. ..	366	13	1
			436				3,938
			3				5
			6	OFFICE EXPENSES :			
INCIDENTAL EXPENSES REPAID :				Rent, Fuel, &c. .. ..	700	0	11
Daily Weather Reports	445	0	6	Furniture, Fittings, &c. ..	319	11	11
Other Divisions .. ..	76	4	10	Incidental .. ..	377	8	3
Stationery Office Account .. ..	50	11	2				1,397
			571				1
			16				1
			6	POSTAGE AND TELEGRAMS :			
TELEGRAPH CHANGES REPAID :				General Postage .. ..	297	8	11
Home .. ..	216	3	2	Postage of Daily Weather Reports .. ..	369	14	11
Telegrams sent abroad	388	19	3	Telegrams, &c. .. ..	2,602	10	10
			605				3,269
			2				14
			5				8
INSTRUMENTS :				TRAVELLING EXPENSES AND INSPECTIONS ..			308
Royal Navy .. ..	742	2	10				17
Mercantile Marine, Stations, &c. .. ..	2,600	0	9				6
			3,342				
			3	SUPERANNUATION .. ..			1,367
			7				8
OBSERVATORY FORMS, &c. ..			109				3
			9	COSTS OF INSTRUMENTS :			
			6	Royal Navy .. ..	738	12	6
INSPECTIONS .. ..			156	Mercantile Marine, Stations, &c. .. ..	3,236	11	7
			12				3,975
			5				4
SUPERANNUATION ACCOUNT :							1
Annuities .. ..	715	0	0	AUXILIARY OBSERVATORIES, &c. .. ..			2,246
Interest on Investment	52	19	4				14
Income Tax—Returned	8	15	0				8
			776	LECTURES AND EXPERIMENTS .. ..			350
			14				0
			4	BALANCE :			
LECTURES AND EXPERIMENTS .. ..			345	Cash at Bank .. ..	47	16	8
			18	" at Office .. ..	48	1	1
			5				95
							17
							9
			£26,594				£26,594
			4				4
			8				8

Note.—On 31st March, 1913, the amount of 2½ per cent. Annuities held for the provision of Superannuation Annuities was £2,119 5s. 11d.

# ACCOUNT of RECEIPTS and PAYMENTS for the year ended 31st March, 1913:—

RECEIPTS.			PAYMENTS.		
	£	s. d.		£	s. d.
Balance from year 1911-12	—	—	Director .. ..	—	1,000 0 0
Parliamentary vote ..	—	17,000 0 0	OFFICE SALARIES:		
M.O. OBSERVATORIES:			Monthly .. ..	7,743 13 11	
Kew .. ..	1,032	7 4	Weekly .. ..	909 11 3	
Eskdalemuir .. ..	1,348	7 5		8,653 5 2	
Valencia .. ..	65	2 11	Less refunds .. ..	8 4 5	8,645 0 9
Farnborough .. ..	400	0 0			
		2,845 17 8	M.O. OBSERVATORIES:		
DEPARTMENTAL EXPENSES REPAID:			Kew .. ..	1,625 16 9	
Forecasts, &c. ..	163	2 3	Eskdalemuir .. ..	1,406 5 1	
Marine, Statistics, and			Valencia .. ..	539 11 0	
Observatories .. ..	104	19 1	Farnborough .. ..	366 13 1	3,938 5 11
Instruments .. ..	168	2 2			
		436 3 6	OFFICE EXPENSES:		
INCIDENTAL EXPENSES REPAID:			Rent, Fuel, &c. ..	700 0 11	
Daily Weather Reports	445	0 6	Furniture, Fittings, &c.	319 11 11	
Other Divisions .. ..	76	4 10	Incidental .. ..	377 8 3	1,397 1 1
Stationery Office Account .. ..	50	11 2			
		571 16 6	POSTAGE AND TELEGRAMS:		
TELEGRAPH CHARGES REPAID:			General Postage ..	297 8 11	
Home .. ..	216	3 2	Postage of Daily		
Telegrams sent abroad	388	19 3	Weather Reports ..	369 14 11	
		605 2 5	Telegrams, &c. ..	2,602 10 10	3,269 14 8
INSTRUMENTS:			TRAVELLING EXPENSES AND INSPECTIONS ..	—	308 17 6
Royal Navy .. ..	742	2 10			
Mercantile Marine, Stations, &c. ..	2,800	0 9	SUPERANNUATION ..	—	1,367 8 3
		3,342 3 7	COSTS OF INSTRUMENTS:		
OBSERVATORY FORMS, &c. ..	—	109 9 6	Royal Navy .. ..	738 12 6	
INSPECTIONS .. ..	—	156 12 5	Mercantile Marine, Stations, &c. ..	3,236 11 7	3,975 4 1
SUPERANNUATION ACCOUNT:			AUXILIARY OBSERVATORIES, &c. ..	—	2,246 14 8
Annuities .. ..	715	0 0	LECTURES AND EXPERIMENTS .. ..	—	350 0 0
Interest on Investment	52	19 4			
Income Tax—Returned	8	15 0	BALANCE:		
		776 14 4	Cash at Bank .. ..	47 16 8	
LECTURES AND EXPERIMENTS .. ..	—	345 18 5	“ at Office .. ..	48 1 1	95 17 9
		£26,594 4 8			£26,594 4 8

Note.—On 31st March, 1913, the amount of 2½ per cent. Annuities held for the provision of Superannuation Annuities was £2,119 5s. 11d.



The Reports by the superintendents of the four divisions of the Office and of the several Observatories are given below.

The most important event of the year is the completion of the daily synoptic charts of the southern hemisphere south of  $80^{\circ}$  S. for publication by the Royal Society in connexion with the National Antarctic Expedition under Captain R. F. Scott in 1901-1904. Special efforts were made to collect data from observatories and ships in the region referred to in order that daily synoptic charts of pressure and temperature might be made. The Marine Division has been engaged upon this work since the return of the expedition in 1904. The area to which the charts refer is one-quarter of the surface of the globe, and it is the first time that anything of the kind has been attempted for the southern hemisphere. The data obtained are not adequate for filling up the details, but a general idea of the behaviour of the pressure systems of the southern hemisphere can be got from the charts.

Other events that may be mentioned are the large extension of the Monthly Weather Report, and the publication for the first time of hourly readings of the magnetic elements.

#### I.—MARINE DIVISION.

*Report by M. W. Campbell Hepworth, C.B., R.D.,  
Commander, R.N.R., Superintendent.*

**Collection of Information.**—The number of vessels entered in the Office books as having been equipped with the full set of meteorological instruments which are requisite for keeping a four-hourly meteorological log was 192, as compared with 181 during the previous financial year. In addition, there were 12 Atlantic liners among those from which reports are received by radio-telegraphy that are provided with mercury barometers lent by the Office. The allocation of full sets of instruments has been studied with a view to acquiring the largest possible number of reliable observations from oceanic regions for which information is most needed; bearing in mind the fact that the number of meteorological instruments available for marine purposes is restricted.

Meteorological four-hourly logs, registers, and similar documents, to the number of 2,710 were received during the year, as compared with 2,791 in 1911-1912. Of the meteorological log books which contain four-hourly observations, 188 have been classed as "excellent," or "very good," after careful examination of the data they contain, as compared with 206 for the previous financial year.

**Supplementary Information.**—The arrangements for obtaining meteorological observations from the captains and officers of ocean-going ships who offer their co-operation, but who for various reasons are unable to keep the full log, or to whom the instruments requisite for that purpose cannot conveniently be lent, have been continued. Under these circumstances the observers have used their own instruments or those supplied by the owners of the ships; the corrections for which are ascertained from time to time by comparison

with standards at home and abroad. By this means a large amount of information, which is noted on registers supplied by the Office, has been collected, and many of these data are immediately utilised in connexion with the preparation of the Monthly Meteorological Charts of the North Atlantic and Mediterranean, and of the Indian Ocean. Co-operation in this form is not confined to the personnel of British ships; the registers are kept by a number of captains and officers under foreign flags also.

As in previous years, a number of barograms have been received from ships of H.M. Navy and the Mercantile Marine which give a continuous record of pressure in various parts of the world.

The number of contributions received, classified according to the different lines of route, is shown in the following lists :—

*Four-hourly Logs.*

Cable Ships	...	{ United Kingdom	1
		{ North Atlantic ...	2
		{ Canada ...	8
North Atlantic...		{ United States ...	15
		{ Gulf of Mexico...	27
		{ West Indies ...	3
		{ Tenerife ...	2
Mediterranean	...	...	4
Black Sea	...	...	2
Africa, S.E. and E. Coasts	...	...	9
China, coasting	...	...	4
East Indies, coasting	...	...	2
East Indies	...	{ viâ Cape	2
		{ viâ Suez ...	12
China and Japan		{ viâ Cape	3
		{ viâ Suez ...	22
Australia	...	{ viâ Cape	24
		{ viâ Suez ...	34
Trans-Pacific	...	...	3
New Zealand	...	{ viâ Capes	27
		{ viâ Suez ...	1
South America...		{ East Coast	27
		{ West Coast	4
United States, West Coast	...	...	3
Surveying	...	{ Australia	2
		{ W. C. Africa	2
River Thames	...	...	2

*"Short" Logs.*

China, viâ Suez	...	...	1
East Indies, viâ Suez	...	...	5
Mediterranean	...	...	2
Black Sea	...	...	1



*North Atlantic Registers (Form No. 121), Indian Ocean Registers (Form No. 122), and Radio-telegraphy Registers (Form No. 138).*

Routes.		North Atlantic Registers. Form No. 121.	Indian Ocean Registers. Form No. 122.	Radio- telegraphy Registers. Form No. 138.
North Atlantic...	{ Canada ... ..	416	—	360
	{ United States ...	604	—	423
	{ Gulf of Mexico...	92	—	—
	{ West Indies ...	43	—	—
	{ Bermuda ... ..	31	—	—
Mediterranean...	... ..	160	—	—
Africa ... ..	{ West Coast ...	15	—	—
	{ S.E. and E. Coasts	21	4	—
East Indies ...	{ viâ Cape ... ..	—	3	—
	{ viâ Suez ... ..	—	176	—
China and Japan,	viâ Suez ... ..	—	27	—
Australia ... ..	{ viâ Cape ... ..	—	5	—
	{ viâ Suez ... ..	—	4	—
	{ Coasting ... ..	—	1	—
South America...	{ East Coast ... ..	22	—	—
	{ West Coast ... ..	4	—	—
Totals ... ..		1,408	220	783

“Excellent” observers.—A list of the 22 captains who, during the past year, have contributed logs classed as “excellent” is given in a special Circular, 001. Several of these observers have co-operated with the Office for many years; some have to their credit a number of logs that are “excellent,” and among these should be mentioned Captain F. C. Mullan, F.R.G.S., who has kept 33; Captain G. H. Harris, Lieut. R.N.R., and Commander C. D. Bennett, R.D., R.N.R., who have kept 19 and 17 respectively, and Captain W. G. Lingham, F.R.A.S., F.R.Met.Soc., who has kept 10 of that class. Those whose names appear in the “excellent” list for the first time are, Captain R. Bidwell, S.S. *Narrung*; Captain A. J. Charman, S.S. *Waiwera*; Captain F. Chrimes, S.S. *Tydeus*; Captain T. E. Cuffley, S.S. *Julia Park*; Captain S. G. Dale, S.S. *Boyne*; and Captain H. W. Potter, R.D., R.N.R., S.S. *Bangor*.

As a mark of recognition of valuable co-operation, various publications of the Office have been presented to observers who have returned well-kept meteorological log books. The publications which have been chiefly used for this purpose are:—Monthly Wind Charts of the South Atlantic; Monthly Wind Charts for the Coastal Regions of South America; Meteorological Charts of the Southern Ocean, between the Cape of Good Hope and New Zealand; Meteorological Charts of the Red Sea; Charts showing the Surface Temperature of the Atlantic, Indian and Pacific Oceans; Monthly Current Charts for the Atlantic Ocean; Monthly Current Charts for the Indian Ocean; Quarterly Current Charts for the Pacific Ocean; Bound Copies of the Monthly Meteorological Charts of the North Atlantic and Mediterranean, also of the Meteorological Charts of the Indian Ocean.

**Obituary.**—The Committee have noted with regret the deaths of eleven of their old observers during the year ended 31st March last :—Captain R. F. Scott, R.N., C.V.O., D.Sc., the heroic leader of two Antarctic Expeditions, who met his death, under tragic circumstances, on his return from the South Pole at the beginning of last year; Admiral L. F. Jones, H.M.S. *Valorous*, June; Captain D. Andersen, Ship *Edith Byrne*, August; Admiral Sir R. Vesey Hamilton, G.C.B., H.M.S. *Sphinx*, September; Captain I. Wylic, S.S. *Sarmatian*, October; Captain W. H. Hood, Lieut. R.N.R., Ship *County of Edinburgh*, November; Captain R. Pattman, Ship *Loch Torridon*, November; Captain N. McCallum, S.S. *Bohemian*, December; Captain J. P. Forsdick, S.S. *Orari*, December; Captain J. Horne, Ship *Loch Garry*, February, 1913; Captain J. Tyson, S.S. *Balmoral Castle*, February, 1913.

**Use of Information received.**—The information collected has been used, as already mentioned, as much as possible, on receipt, in the preparation of the Monthly Charts. The Monthly Charts of the Atlantic Ocean and the Mediterranean Sea and of the Indian Ocean and Red Sea have not been altered, except in detail during the year. The weekly instalment of these charts with daily maps on the back, showing the distribution of pressure, winds, &c., over the Atlantic Ocean, prepared by the incorporation of the reports by radio-telegraphy from the ocean, with information received by telegraph from the other side has been continued. On these weekly issues five weekly maps are shown exhibiting the results of recent sea surface and air temperature observations, recent reports of ice, and of derelicts, and of fog.

Observations from the logs of ships navigated in the Indian Ocean between the parallels of  $10^{\circ}$  N. and  $20^{\circ}$  S and the meridians of  $40^{\circ}$  E. and  $80^{\circ}$  E. have been supplied to the Director General of Observatories, Simla, as in past years. Information relating to drifting ice in the North Atlantic has been forwarded to the *Shipping and Mercantile Gazette* and *Lloyds List* regularly upon receipt of the reports.

The Admiralty have been furnished at the request of the Hydrographer to the Navy with the tabulated results of observations taken at various places on the coasts of China, Japan, and British Columbia; and on the shores of the Baltic, the Eastern Archipelago, and the Mediterranean. Several hydrographical reports from captains of ships have also been forwarded to the Hydrographer.

Information is given to seamen, upon application, either in person or by letter, regarding the meteorological conditions that are likely to prevail along a proposed route, either for sailing vessels or steamships.

## II.—FORECAST AND STORM WARNING DIVISION.

*Report by R. G. K. Lempfert, M.A., Superintendent.*

**Daily Weather Report.**—The arrangements for the issue of the Daily Weather Report and Forecasts have remained generally the same as those which were in operation last year. The Report has



been issued each day at about 12.30 p.m. The area included in the Report has undergone a noteworthy extension by the addition of information from Spitzbergen since the beginning of 1913.

There has been a steady increase in the number of subscribers to the Daily Weather Report during the last ten years, and at the end of the year under review the issue was 827 copies a day, of which 451 are for subscribers. In 1900 the numbers were 415 and 165 respectively. The increase is largely due to the subscriptions from schools. It will be remembered that the subscription of £1 per annum is only intended to cover the cost of postage and wrappers.

**Reports from Health Resorts.**—The re-arrangement of the work of the staff of the division, consequent upon the removal of the Office to South Kensington, has made it possible for the staff on evening duty to deal more fully than was formerly the case with the reports received each evening from health resorts. Instead of issuing to the newspaper press only a statement of the duration of bright sunshine at these stations, arrangements have now been made to compile the information for all elements, and to place it at the disposal of the newspapers shortly after 7.15 p.m. The information is also published in the next issue of the Daily Weather Report. Data are only accepted for publication in the reports from stations which arrange for annual inspection by a representative of the Office. About 40 health resorts have availed themselves of this arrangement.

**Wireless Telegrams.**—During the year ended March 31st, 81 wireless telegrams were received from the ships of His Majesty's Navy. The arrangements for the receipt of wireless messages from H.M. ships have been revised. In order to avoid the unnecessary dispatch of reports by ships in close proximity to the telegraphic reporting stations on the coast, arrangements have been made to restrict the reports to ships South of Latitude  $48^{\circ}$ . These reports are often of great value, as they are generally received from the Bay of Biscay, and the Office does not receive reports from ships of the mercantile marine crossing the Bay.

In the course of the twelve months ending with March, 1913, 5,385 wireless reports were received from Atlantic liners. The numbers in the several months ranged from 500 in September to 377 in February. The number of messages is greater by nearly 450 than the corresponding figure for the twelve months ending with March, 1912.

Only 272 out of the total of nearly 5,400 messages reached the Office in time to be included in "to-day's" map in the Daily Weather Report, *i.e.*, within about four hours of the time of taking the morning observations; 2,544 messages, or rather less than half the total, reached the Office in time to be included in one of the two maps for "yesterday" shown in the Daily Weather Report.

**Weekly Weather Report.**—The form of the daily synoptic charts included in this publication was modified at the beginning of the year 1913. The scale of the chart has been reduced from  $1 : 4 \times 10^7$  to  $1 : 8 \times 10^7$ . This reduction of scale has made it possible to include a much larger area. The charts now extend from the Pacific coast

of Siberia in longitude  $140^{\circ}$  E. to the Pacific coast of America in longitude  $120^{\circ}$  W., and thus include practically the whole of the Northern hemisphere with the exception of Alaska and the North Pacific Ocean. The charts show the information derived from the morning observation of all countries but synoptic charts for Europe and the North Atlantic Ocean based on the evening observations are shown on inset-maps. The information shown on the chart is derived from the Daily Weather Reports of the United States of America, Canada, France, Russia and Egypt, as well as from the telegraphic reports received by the Office. The information for the Atlantic Ocean is derived from wireless reports supplemented by reports received by post from Atlantic liners. The maps are published in weekly instalments within 11 days of the taking of the observations. Plate 2 (p. 14) shows a specimen of the maps with pressures and temperatures expressed in absolute units.

**Inquiries for Forecasts.**—The inquiries for forecasts of various kinds dealt with during the year again showed an increase. The numbers were as follows:—Telegraphic prepaid replies 330, other inquiries answered by telegram 123, telephonic inquiries 106, personal inquiries 19; a total increase of 73. In addition regular forecasts have been telegraphed to subscribers for varying periods. The arrangements for the supply of forecasts to the dockyards and by wireless ships of H.M. Navy remained the same as in the previous year.

**Weather Information for Aviators.**—Telegraphic reports and forecasts have been sent daily for the Royal Flying Corps to the Naval wing at Eastchurch, to the Military wing at South Farnborough, to the Central Flying School at Upavon, and to the Officers in command of the establishments at Salisbury Camp, and at Montrose. Arrangements have been made for telegraphing once a day to Upavon, the data for the construction of the day's map, during the terms of the Central Flying School.

**Harvest Forecasts.**—During the summer months, June to September, the usual arrangements for the supply of telegraphic forecasts for agriculturists were carried out. The service takes the form of the supply either of a daily forecast of the weather anticipated for the following day and extended, whenever conditions appear sufficiently definite to justify it, to cover two or more days, or of special notifications of occasions on which spells of several consecutive days of fine weather are anticipated. Notice of the impending break up of settled conditions is also issued in connexion with these spell forecasts. The number of subscribers for both services was greater than in 1911.

The summer of 1912 was unusually disturbed, and there were only four occasions on which spell notifications of fine weather could be issued.

The first was on June 23rd, when notifications were sent to the South Eastern districts of England, after the weather had been fine for two or three days, although the conditions could not be defined as "settled" from the point of view of synoptic forecasting. On the following day a fresh disturbance appeared unexpectedly and the notification had to be cancelled.



The second notification was issued on July 4th to the greater part of England and was extended on the following day to the South of Scotland. Notification of the impending break up of spell had to be sent to the Southern districts on the evening of July 5th, and to the remainder of the country on the evening of the following day. Conditions actually became unsettled in the South during the night from the 5th to the 6th, and by the morning of July 8th unsettled weather was again general. Over the greater part of the country three days of fair weather were experienced after the issue of the notification.

The third spell notification was issued on July 15th to practically the whole country. During the following days there were a few local showers, but for the most part too light to interfere with harvest operations. Conditions became unsettled in the East of the Kingdom on the evening of July 18th, and in the course of the next three days unsettled weather became general. Over the greater part of the country this spell notification was thus also successful.

No further notifications of settled conditions could be issued until September 9th, which marked the commencement of a dry anti-cyclonic period which lasted until September 25th, when its approaching break-up was duly announced.

In order to obtain an independent check on the accuracy of the daily forecasts during the harvest season, the Office invites subscribers to supply records of the weather during the period covered by their subscriptions on special forms; 29 subscribers complied with this request. These records have been examined and compared with the forecasts issued. The results show that 54 per cent. of the predictions were correct in all particulars, while in 39 per cent. of the cases more than half the details included in the forecast were justified by the day's experience. Thus 93 per cent. of the forecasts may be regarded as successful.

For the "further outlook" the comparison shows that 68 per cent. of the forecasts were completely justified by the weather experienced on the day following the expiration of the ordinary 24 hours, while 11 per cent. were correct in more than half the particulars specified, making the total percentage of successful issues 79.

**Results of Forecasts:**—A comparison of the forecasts for the United Kingdom issued at 8.30 p.m., with the subsequent weather is given on p. 31. In checking the forecasts the weather is considered under the aspects (1) Wind, its direction and force and the sequence of its changes within the period of the forecast; (2) Weather, state of the sky in respect of cloud, together with precipitation in its various forms; (3) Temperature of the day and night and its sequence, as represented mainly by the maximum and minimum temperatures; and (4) Fog.

A forecast has been regarded as successful if it has given a fair representation of the actual facts for a majority of the aspects, and unsuccessful if the aspects which were correctly anticipated were less than half. If all aspects of the facts are adequately indicated in the forecast the mark of complete success is assigned to it. On

this understanding the evening forecasts for 1912 have given the following percentage successes :—

January ...	90	per cent., of which 47 were completely successful.
February	91	" " 56 " "
March ...	97	" " 62 " "
April ...	98	" " 73 " "
May ...	91	" " 60 " "
June ...	96	" " 69 " "
July ...	92	" " 64 " "
August ...	90	" " 59 " "
September	94	" " 67 " "
October ...	85	" " 45 " "
November	86	" " 55 " "
December	87	" " 59 " "

In October, 1912, a new method was introduced for setting out the data used for checking the accuracy of the forecasts. Outline maps of the British Isles were printed on the backs of the working charts used for the primary plotting of the observations received from the telegraphic reporting stations, and on these outlines the observations of maximum and minimum temperature, rainfall and sunshine were plotted for the full number of over 100 stations which contribute to the Weekly Weather Report. These charts set out the information collected by the Office about each day's weather in a convenient form for checking the accuracy of the forecasts. They are intended ultimately to provide material for the study of the local distribution of weather over the forecast districts under varying meteorological conditions, a point on which our information at the present time is very vague. Other outline maps on the backs of the working charts were used for setting out for selected places the general sequence of weather, in order that information might be available on such points as the distribution of fog or the character of the precipitation and its distribution in time as well as of its total amount. On occasions of severe and widespread thunderstorms maps were also used for setting out the information received so as to show the distribution of the storm and the time of its occurrence over different regions.

The plotting of the data from all parts of the Kingdom has placed the study of the daily weather upon a much more effective basis. Hitherto the maps upon which the forecasts were based were bound together in one book, while the information as to the temperature, rainfall, and weather experienced, &c., was not collected in any summarised form; the summaries for checking forecasts had therefore to be improvised for each occasion. As now arranged the series of maps showing the position of affairs at 7 a.m., 1 p.m. and 6 p.m. with the maps showing the subsequent distribution of temperature, rainfall, sunshine and weather opposite, form a most instructive record of weather.

The plotting of the data in the manner described and the consequent precision in the representation of the actual course of events, have led to increased stringency in the checking of the forecasts. This is apparent in the percentage of successes attained during the last three months of the year, and the results for these are, therefore, not strictly comparable with those for the earlier months. The change of practice must also be borne in mind in comparing



the mean for the whole year with the corresponding means for earlier years, which were as follows:—

Year.	Percentage Number of Successes.		Percentage of Complete Successes.	
1903-04	...	86	...	56
1904-05	...	88	...	57
1905	...	88	...	56
1906	...	91	...	61
1907	...	91	...	54
1908	...	92	...	58
1909	...	93	...	58
1910	...	93	...	60
1911	...	94	...	62
1912	...	91	...	59

A "Further Outlook" extending the period covered by the forecast to two or more days was appended to the ordinary daily forecasts for the ensuing 24 hours on 236 occasions. Of these notifications 130 were issued in connexion with the morning forecasts, and 105 in connexion with the evening forecasts. In a large majority of cases the notification indicated the probability of a continuance of the existing conditions, but in eight instances it referred to a change or partial change in the type of weather. 91 per cent. of the notifications were justified by subsequent events, of which 79 received the mark of complete success.

#### STORM WARNING SERVICE.

The arrangements made with the Post Office for the introduction of a new system for the distribution of the telegrams sent out from the Office containing instructions to hoist or lower storm cones, foreshadowed in last year's Report, came into operation on October 1st. It has reduced the time required for the circulation of the messages, especially in the case of remote stations with which telegraphic communication involves the frequent re-transmission of the messages. Apart from cases of interruption of telegraphic communication, the cones are now generally displayed within  $1\frac{1}{2}$  to 2 hours of the despatch from the Office of the instruction to hoist.

The year 1912 was again disturbed, particularly in the second half. The average number of warnings per district was 60 as compared with 63 in 1911, 59 in 1910, but only 33 in 1907. The stormy character of the year was particularly marked in the South and South-West. There were 51 occasions on which warnings were required in the Bristol Channel as compared with only 30 in the N.E. and 27 in the North-West of Scotland.

A modification has been introduced into the method of checking the accuracy of the warnings. Hitherto the warning has been regarded as dating from the time of issue from the Meteorological Office of the instruction to hoist the cone. As particulars are now sent in from the stations of the time of receipt of the telegrams, it has become possible to date the warnings from the time of receipt of the instruction at the signal station. The returns show that, as

a general rule, the telegrams reach their destinations in less than two hours, and thus, in practice, the warnings have been regarded as dating from two hours after the time of issue. With this increased stringency in the checking, a certain number of warnings which, under the old system, would have been classed as successful, have now to be omitted. The results given in the table below are thus not comparable with those issued in the reports for previous years.

## STORM WARNING CHECKING.

District.	Summary of Occasions for Warning.		Summary of Warnings Issued.			
	Total Number of Occasions on which Warnings were necessary.	Percentage of Occasions of Gale effectively Warned.	Total Number of Issues.	Issues justified by subsequent Gales. Force 8 and upwards.	Issues justified by subsequent Strong Winds. Forces 6 and 7.	Percentage of Issues justified either by Gales or Strong Winds.
1A. Scotland, N.E. (Northern Part)	{ 12 } { 18 }	83	{ 23 } { 40 }	7 18	{ 9 } { 12 }	73
1B. Scotland, N.E. (Southern Part)	{ 10 } { 16 }	92	{ 22 } { 36 }	8 16	{ 6 } { 15 }	78
2. Scotland, E. ...	{ 8 } { 11 }	95	{ 16 } { 34 }	8 10	{ 4 } { 13 }	70
3. " N.W. ...	{ 9 } { 18 }	82	{ 25 } { 39 }	7 15	{ 9 } { 13 }	69
4. " W. and North Channel ...	{ 11 } { 13 }	92	{ 28 } { 42 }	10 12	{ 11 } { 17 }	71
5. Ireland, N. ...	{ 14 } { 25 }	77	{ 30 } { 41 }	8 22	{ 11 } { 11 }	73
6. " S. ...	{ 18 } { 21 }	85	{ 28 } { 37 }	14 19	{ 8 } { 12 }	82
7. Irish Sea ...	{ 16 } { 22 }	89	{ 27 } { 37 }	13 21	{ 10 } { 12 }	88
8. St. George's Channel	{ 15 } { 16 }	90	{ 26 } { 36 }	12 16	{ 11 } { 14 }	85
9. Bristol Channel ...	{ 23 } { 28 }	92	{ 30 } { 43 }	21 26	{ 6 } { 13 }	90
10. England, S.W. ...	{ 18 } { 24 }	86	{ 29 } { 35 }	17 19	{ 8 } { 12 }	87
11. " S. ...	{ 9 } { 20 }	86	{ 26 } { 32 }	8 17	{ 13 } { 13 }	88
12. " S.E. ...	{ 8 } { 22 }	87	{ 24 } { 32 }	7 19	{ 11 } { 9 }	82
13. " N.E. ...	{ 11 } { 12 }	91	{ 17 } { 30 }	9 11	{ 5 } { 14 }	83
14. " E. ...	{ 6 } { 4 }	80	{ 16 } { 27 }	3 9	{ 8 } { 15 }	81
Average per District	{ 12.5 } { 18.3 }	87	{ 24.4 } { 36.0 }	10.0 16.7	{ 8.7 } { 13.0 }	80

NOTE.—In order to facilitate comparison with the statistical tables of the Board of Trade which are made up for the year ending June 30, the figures for the two halves of the year 1911—January 1 to June 30, and July 1 to December 31—are given separately for each district. The upper line of figures in each case gives the particulars for the first half of the year.



The table is divided into two sections. The first deals with "occasions for warning," *i.e.*, occasions on which the wind reached gale force at at least two stations in a district, and failure to hoist a cone in good time would therefore count as a gale missed. On the average, adequate warning was given of 87 per cent. of all gales experienced. The second part of the table deals with the number of warnings issued to each district, and those "justified" by subsequent increase of wind. The percentage of success attained was rather lower, as there were a number of occasions on which the issue of warnings was not followed by appreciable increase of wind.

As usual, there were in each district a number of occasions when the wind attained the force of a gale, on which warnings were either not issued at all or issued too late. There were, however, no occasions of gales over a wide area for which no cones were hoisted on any part of our coasts. The failures consisted generally in the omission to issue warnings in adequate time to the outlying districts. Occasionally, also, gales for which adequate warning had been issued to the outlying districts extended over a wider area than was anticipated, with the result that a gale nearer home was missed. The most conspicuous failure occurred on January 17th, 1912, on the East Coast. Cones had been hoisted on January 15th, and these warnings expired on the evening of January 16th. Though a gale was still blowing at that time the cones were not rehoisted, as it appeared probable that the force of the wind would moderate. By the morning of January 17th, a high-pressure system over Finland, where barometer readings were above 31 inches, had spread westward and caused a decided increase of the barometric gradient, and severe south-easterly gales were felt along our East Coast. Warning of this gale was issued to the Western and South-Eastern districts on the morning of January 17th, and were in time to be effective.

### III.—STATISTICS AND LIBRARY DIVISION.

*Report by E. Gold, M.A., Superintendent.*

#### CLIMATOLOGY OF THE BRITISH ISLES.

**Distribution of Stations.**—A list of stations in connexion with the Office, in which particulars are given of the orders of the stations and of the Official publications for which the returns have been prepared is issued separately as an Appendix to this Report.

The distribution of the stations in the various districts may be summarised as follows :—

	Observatories.	Normal Climatological.	Auxiliary Climatological.	Telegraphic Reporting.	Sunshine (including Observatories).	Additional Rainfall.	Additional Anemograph.	Additional Barograph.
0. Scotland, N. ... ..	0	8	2	4	7	3	1	7
1. " E. ... ..	1	5	7	3	10	2	2	4
2. England, N.E. ... ..	0	9	10	2	12	8	2	3
3. " E. ... ..	0	9	11	2	15	14	3	2
4. " Midlands ... ..	0	12	29	3	23	21	2	5
5. " S.E. ... ..	0	7	34	2	31	17	3	4
London District ... ..	1	3	9	1	10	8	1	2
6. Scotland, W., and Isle Man.	2	7	4	0	8	3	0	2
7. England, N.W., and N. Wales.	1	11	22	2	22	8	5	5
8. England, S.W., and S. Wales.	1	5	28	3	26	25	2	2
9. Ireland, N. ... ..	0	4	2	3	2	4	1	4
10. " S. ... ..	1	7	10	3	8	7	4	4
11. Western Channel ... ..	0	1	1	2	4	0	1	1
Total ... ..	7	88	169	30*	178	120	27	45

\* Of these, 16 observe at 7 a.m., 1 p.m., and 9 p.m., and thus come under the international definition of a station of the second order. These stations have not been included in the 94 normal climatological stations. Aberdeen, Kew, and Valencia are given under Observatories and also under Telegraphic Reporting Stations.

Records have also been received from 6 additional thermograph stations, 12 additional autographic raingauge stations, 62 sea temperature stations. An autographic record of the intensity of radiation received on a horizontal surface is obtained at South Kensington, and the results from it are published in the Daily Weather Report and the Geophysical Journal. Daily reports are received by telegraph from 42 foreign stations.

Observatories are also maintained at Greenwich (The Royal Observatory), Oxford (Radcliffe Observatory), Bidston (Mersey Docks and Harbour Board), Southport (the Corporation), and Berkhamsted (E. Mawley, Esq.), and from these, records for occasions of special interest are courteously supplied from time to time.

#### NORMAL METEOROLOGICAL OBSERVATORIES, ANEMOGRAPH AND SUNSHINE STATIONS.

**Observatories.**—The work of the three normal observatories of the office is reported upon separately, pp. 53 to 57.

The work of the normal observatories at Aberdeen and Falmouth has been carried on as usual. At Aberdeen theodolite observations of pilot balloons are made regularly to determine the velocity and direction of the upper wind currents, and the results have been published in the Geophysical Journal.

In connexion with the publication of the records from the observatories in absolute units it has been necessary to convert the



tabulated values from degrees Fahrenheit, inches of mercury and miles per hour into degrees absolute, millibars and metres per second. Arrangements are being made for the direct measurement of the original records in absolute units. For pressure the arrangements have been completed. Before direct tabulation of the dry and wet bulb thermograms in degrees absolute can be undertaken, it will be necessary to prepare hygrometric tables in the new units.

**Anemograph Stations.**—The number of anemograph stations which are maintained by the Office, or from which records are regularly received at the Office, is now 32. The autographic records are tabulated or analysed week by week, so that the information they contain may become available for public use without delay. Information from four of them is published monthly in the *Geophysical Journal* (British Meteorological Year Book, Part III. (2)), and an annual summary of gales is published as an appendix to the Weekly Report (Year Book, Part I.).

From the beginning of January, 1912, the anemograms from pressure-tube instruments belonging to the Office have been summarised under the general headings: gales, strong winds, fresh or moderate breezes, and light winds or calms, with special notes of exceptional gusts, the range of variation and the character of the trace. For four other stations, for which the anemograms are returned to the observers, hourly tabulations are still made. The summaries have been utilized in the preparation of the Annual Summary of Gales, to which new tables giving additional information have been added. The strongest wind recorded in 1912 was in a gust of 43·8 metres per second at Pendennis Castle, Falmouth, on March 4th and again on December 26th.

**Records of Sunshine.**—The number of stations from which returns of "bright sunshine" are received is 181. With three exceptions they are all situated in the British Isles, the exceptions being Georgetown, British Guiana; the Falkland Islands; and Chin-kiang, China. The original records from 121 stations are retained in the Office, whilst those from the remainder are sent to the Office monthly for examination and are then returned.

**Changes in Stations.**—The normal climatological station at Prestwich which had been used in the preparation of District Values in the Weekly Weather Report since 1878 was discontinued at the beginning of 1912. Its place in the Weekly Report has been taken by Whitworth Park, a station maintained by the University of Manchester, for which a summary has been included in the Monthly Weather Report since 1904.

Among the stations which have been started or have come into connexion with the Office during the year, must be mentioned a normal climatological station at Little Massingham which has been used as a "District" Value Station in place of Hillington. The following auxiliary climatological stations have been added to the list: St. Andrews, Ridgewell (near Halstead), Leamington, Rugeley (Beaudesert), South Wimbledon, Blundellsands, and Hutton (Leicestershire County Council Horticultural Station).

**Obituary.**—The Committee record with regret the death of the following observers :—

Dr. John Knight, M.D., D.P.H., Medical Officer of Health for Scarborough. The observations are continued under the direction of his successor, Dr. Stanley F. Linton.

Thomas Newbitt, Esq., Secretary of the Whitby Literary and Philosophical Society and Curator of the Society's Museum. The observations are being continued.

G. H. Aird, Esq., Seaham, who had contributed observations for nearly 40 years from a station in that town which was discontinued in 1911.

Dr. J. Butler Hogan, Medical Officer of Health for Tottenham. F. G. Smart, Esq., M.B., Tunbridge Wells. The Corporation of Tunbridge Wells are making arrangements for continuing the observations.

**Inspections.**—A list of stations inspected during the year by representatives of the Office is given on pp. 59 to 61.

**Publications.**—The statistical publications of the Office have been grouped together under the general title "The British Meteorological and Magnetic Year Book."

**Part I., Weekly Weather Report, Part II., Monthly Weather Report.**—Several important changes, referred to briefly in last year's report, were made in the Weekly Report for 1912, and the present appears a favourable opportunity for putting on record the following short history of the development of the Report both to facilitate a survey of the publication of summaries of observations in connexion with future developments, and to provide a readily accessible reference to the different stages of the report in connexion with investigations or inquiries for information.

### WEEKLY WEATHER REPORT.

The preparation and publication of the "Weekly Weather Report" was begun in order to fulfil a recommendation of the Treasury Committee of 1875-6, that the Office should endeavour to make the information which it collected available in a form suitable for agricultural and sanitary purposes.

In 1877 the new Council appointed a Committee on Land Meteorology consisting of Professor Smith, Mr. Galton and Professor Stokes, and during the latter half of 1877 the Committee arranged the details of a weekly publication, consulting the Agricultural Society, Professor Voelker, and others, with reference to the form to be adopted. The first issue of the publication, for the week ending February 11th, 1878, was published along with the issues for succeeding weeks in the following April, but a summary of the information given in the first Report was communicated on February 14th to the "Times," and subsequently similar summaries were inserted in a number of newspapers.

For the purposes of the Report, the country was divided into ten districts, which correspond approximately with the present districts 1-10. Scotland N. and the English Channel were not included.



The Report consisted of a summary of temperature and rainfall for different districts, shown on a map, with very brief general remarks, and a corresponding summary for each of the 46 stations used in the compilation of the district values, and for six other stations. Differences from the average of mean temperature and rainfall were included. Provision was also made for the inclusion of a summary of the weather over Western Europe during the week, which had been issued since 1873 as a supplement to the Daily Weather Report. The summary was, however, not actually included until the 22nd issue, that for the first week in July; it was then accompanied by charts of wind and pressure and of temperature at 8 a.m. for each day of the week.

The Report was a 4-page octavo sheet, price 2*d.*, although the Committee had intended originally that it should be issued at 1*d.* per number.

It referred to data for the week ending on Monday, the seven days for which observations were made being Tuesday to Monday.

At the end of 1879 a summary for each quarter of the year and for the whole year was prepared and issued as an Appendix to the Report. The corresponding values for preceding years from 1866 were calculated from the data available, and included in the summary. A new district, Scotland N., was included in this summary but not in the weekly issues, although data from three stations in it were given.

The first material change in the Report itself was the inclusion of values of bright sunshine from the beginning of April, 1880. The table of data for individual stations was transferred at the same time from the second to the fourth page of the Report.

The number of stations, had now increased to 57 for the ten districts.

In 1884 the matter included in the Report was increased, and the Report was enlarged to quarto size. The separate issues still consisted of four pages, but the price was increased to 4*d.*

The principal changes were the inclusion of a chart of wind and pressure at 6 p.m. for each day, and in the district summary the inclusion of: Values of (1) accumulated temperature above or below 42° F.; (2) the duration of bright sunshine, and the percentage of the possible duration; (3) accumulated temperature, rainfall, and duration of sunshine for the period from Jan. 1st of the current year.

The values of the mean temperature, which had previously been the arithmetical means of the values of the maximum and minimum temperatures, were computed in accordance with the practice, which still obtains, of multiplying the difference between the maximum and minimum readings by a factor (usually not 0.5) to obtain the difference between the mean and the minimum.

Scotland N. was added to the districts from which summaries were given, as district 0, and the Channel Islands as a district without a number, a position in which it remained until 1906, when it was named district 11.

The summaries for the different districts of the rainfall and temperature of each quarter for the current and preceding years were collected into an Appendix which included also the monthly

values from 1878 of rainfall, number of rain-days, and accumulated temperature in day-degrees above and below 42° F. The monthly values of the duration of sunshine and the percentage of the possible duration from 1880 were also included. Small additional tables for each quarter contained the dates of the driest and wettest and coldest and warmest corresponding quarters for the 19 preceding years. This constituted Appendix I.

Appendix II. contained the weekly and progressive values for the year of the number of rain-days, rainfall, day-degrees above and below 42° F., duration and percentage of bright sunshine. The values for each year from 1878 (1880 for sunshine) were also included.

A preface was also added to the Report giving explanations of the methods of preparation of the summaries published, and a supplementary table gave for each year the number of hours during which the sun was above the horizon for each degree of latitude from 49° to 58°.

In 1886 a third Appendix was added, giving the mean values deduced from the years 1878-1885 (1880-1885 for sunshine) of the weekly and progressive values published for the individual years in Appendix II. This Appendix was continued in succeeding years, the values of the preceding year being included to bring the mean up to date.

In the district summary the differences from the average of the progressive values of rainfall, accumulated temperature, and sunshine were included, and in 1887 the differences from the averages for the current week, in the case of accumulated temperature, were also added to the summary.

A fourth Appendix was added in 1887, giving for each district the average values deduced from the values for the eight years 1878-1885 of the mean temperature of the air for each week of the year. This Appendix also was issued in succeeding years with averages calculated afresh for each year, to include the values of the year before that of issue. The total number of stations was increased to nearly eighty and their distribution among the different districts became more uniform, principally by the inclusion of additional stations in Scotland North and East, and the omission of some stations in the Midland Counties.

In 1888 a monthly summary of the observations included in the Daily and Weekly Reports was issued as a supplement to the Weekly Weather Report, the publication of the Monthly Weather Report as a separate series having ceased with the volume for 1887. The Monthly Summary Supplement is essentially a continuation of the Monthly Weather Report, and a note on the latter publication is appropriate here. It was itself a continuation of a section of the Quarterly Weather Report, which had contained a discussion of the weather of each month, and a table for each month of the climatological summaries of observations made at telegraphic reporting stations, which was first included, with a corresponding summary for climatological stations, in the year 1876. This form of publication lapsed during the years 1881-1883, after the cessation of the Quarterly Weather Report.



The new issue of the Monthly Weather Report began in 1884, at the time of the increase in the Weekly Weather Report. It contained for each month (1) a short summary of the weather for each of the periods into which the month could be conveniently divided according to the type of pressure distribution which prevailed; (2) a tabular statement of the form, motion, and characteristics of each cyclonic and anticyclonic system which appeared in the area covered by the daily and weekly charts; (3) remarks under the headings Pressure, Movement of Depressions, Anticyclones, Winds, Temperature, Vapour, Rainfall, and Bright Sunshine. But more important than these was (4): the table giving a summary of the observations of pressure, temperature, rainfall, wind, and weather at the telegraphic reporting stations, and a shorter summary of rainfall, temperature, and bright sunshine, for Weekly Weather Report stations. A large chart giving the wind roses at twelve stations, and four small charts giving the distribution of pressure, temperature, and rainfall, and the movements of depressions completed the presentation, although for the first month, January 1884, a chart giving storm tracks for that month across the Atlantic, and remarks upon it, were also included. The wind roses were of the cart-wheel type, the thickness of the felly at any point being proportional to the frequency of wind from that quarter. No isohyets were drawn on the rainfall chart.

In the Monthly Summary Supplement for 1888 the principal features of the Monthly Report were continued: the general summary according to periods, and the tabular statement of cyclones and anticyclones were omitted, but the remarks under the different headings were continued as before. The two tables of summaries of observations were published in the same form as previously. The large wind chart was omitted, and the wind was inserted on the small pressure map, which appeared with the other three mentioned above on one page of the Supplement. The price of the separate monthly issues of the Supplement was 6*d.* No summary for the whole year was given.

In 1889 the area covered by the daily charts of the Weekly Report was increased to embrace nearly the whole of Europe and the greater part of the Mediterranean: the area covered extended from lat. 35° to lat. 70° and from long. 10° W. to 30° E. in the south, and from 30° W. to 45° E. in the north. The remarks which had previously separated the temperature and weather charts from the pressure charts were put beneath a block which included the three charts for each day. The size of the Report was increased to six pages to accommodate the charts in their extended form, and the price became 6*d.* instead of 4*d.* The departure from the original intention of a penny weekly is not without significance as indicating a change in the views of the Council as to the class to whom the Report might make its appeal. It had become a climatological report, for the presentation of the course of the weather during the year in a form that might be convenient to the meteorologist, rather than an "Intelligence Bulletin" for the agriculturist and the sanitary official.

In 1890 the week was altered, and the values from the beginning of the year referred to the 7 days Sunday to Saturday, as at

present, instead of the 7 days Tuesday to Monday, which had previously been used. The charts were lithographed in two colours, the outline being printed in blue and the sea shaded in the same colour, while the current information inserted was given in black. At the same time the table of data from stations was transferred from the last page to the second, so that the statistical summaries preceded the charts instead of embracing them. A table was added to the preface, giving a list of stations used, with their altitudes and the names of the observers.

The monthly supplement was unaltered and the charts in it continued to be printed in black.

In 1891 the regular issues of the Report were unaltered except for the introduction of columns giving differences from the average of the sunshine values, both in the summary for each week and in the table of station values. A small additional table was included to give the sunshine values at 7 stations not included in the general table. Two of the former appendices were omitted, *viz.*, Appendix III., which gave the averages of the progressive values from January 1st for the different elements; and Appendix IV., which gave the weekly averages for the temperature of each district. These two Appendices were subsequently issued at the end of each five yearly lustrum.

At the end of the Preface for this year were given tables of monthly averages for individual stations of maximum, minimum, and mean temperature (20 years, 1871-1890), rainfall (25 years, 1866-1890), and duration and percentage of bright sunshine (10 years, 1881-1890).

In the Monthly Supplement, columns were introduced into the table of summaries for telegraphic reporting stations, giving the differences from the average of pressure, temperature, and rainfall, and in the table for climatological stations the corresponding differences for temperature, rainfall, and sunshine were inserted.

In the fifteen following years no alterations were made in the form of the regular issues of the Weekly Report. In 1895 a new table of monthly averages for individual stations was published; the periods were for temperature (1871-1895), rainfall (1866-1895), sunshine (1881-1895).

Appendix III. gave for each district the mean values for each of the three lustra 1881-5, 1886-90, 1891-5, and for the whole period of 15 years of the progressive values, week by week, of the rainfall, number of rain-days, accumulated temperature, and sunshine. Appendix IV. gave the weekly mean temperatures for each district for the same three lustra and for the whole period.

The number of additional sunshine stations had increased to 14 in 1895, and to 28 in 1900.

Appendices III. and IV. were again published in 1900, the values for the new lustrum and for the whole period only being given.

In the Monthly Supplement a table of sunshine at 23 additional stations was included in 1898.

The table of monthly averages for individual stations included in the prefaces for 1891, 1895 was given as Appendix III. to the Report for 1901. The monthly averages of the number of rain-days were included in addition to those of the elements previously



treated. The mean monthly temperatures were computed from the mean maximum and minimum values by using the method adopted in 1884 for the computation of the values of mean temperature in the Weekly Reports.

In 1902 a slight change was made in Appendix I., the detailed values being given for periods of four or five weeks instead of for the calendar months. The map showing the district boundaries and the distribution of stations was increased to the size of a page of the Report and the names of the stations inserted on it.

The Monthly Supplement was increased from 6 to 8 pages; the values of bright sunshine were given in the first table, which included results from normal climatological stations (indicated by distinctive type) in addition to those from telegraphic reporting stations previously given. The second table was arranged under the different districts and extended over two pages. The supplement included values for 117 stations.

In 1903 an Annual Summary was issued, giving the values for the year of the results published in the Monthly Supplement, and an account of the conspicuous meteorological occurrences during the year, under the headings: Gales, Heavy Rains, Snowstorms, Thunderstorms, Droughts, Temperature, Fog, Dust Fall, Earthquake Shocks, Magnetic Storms, and Auroral Display. Charts corresponding with those issued each month were also given, the movements of depressions being summarised according to certain principal paths.

In 1904 the Monthly Supplement was extended to include additional stations, the total number being increased to 150, and in April the normal distribution of pressure for the month was first shown on the pressure chart. In the following year the cart-wheel wind roses on this chart were replaced by "arrow" roses, which indicated the frequency of winds of different forces—light, moderate, and strong—from the different directions.

A special supplement to the Annual Summary was issued in 1905, giving the readings of anemometers amounting to 44 statute miles per hour or more (factor 2.2). This table was in continuation of tables in the Annual Reports for the years 1902-4. Appendices III. and IV. were re-issued, and included the results for the new lustrum 1901-5.

In 1906 several changes were made in the Weekly Report. The General Remarks were put at the top of the first page, and in the re-arranged summary the aggregate values for the *season* as well as for the year were given; the Channel Islands became district 11; and the terms "Eastern" and "Western" were substituted for "Principal Wheat Producing" and "Principal Grazing" districts. The district values of rainfall which had previously been given roughly to the nearest  $\frac{1}{10}$ th inch were in 1906 given exactly as determined, and the differences from the average for temperature and rainfall were given exactly, and the signs + or — substituted for the words "above" or "below," "more" or "less." In the table of data for stations, the districts 2, 3, 4, 7, 8, 9, 10 were subdivided; on the last page was added a table of observations of temperature, humidity and wind in the upper air; and in May the table of additional values of bright sunshine was replaced by a

table giving for about 20 stations the results obtained from minimum thermometers on the grass and thermometers in the ground at depths of 1 foot and 4 feet. The temperature on the grass gives results of considerable agricultural importance, as it shows when ground frosts occur. A temperature of 30° or less was taken to indicate the occurrence of such a frost.

In the Monthly Supplement the height of the barometer above sea level was given next to the name of the station in the principal table. The values of pressure were obtained from the morning and evening observations instead of from the morning only; the hygrometric values, which had previously been the mean vapour pressure and relative humidity at the hour of morning observation, were extended to include the mean temperature, the depression of the wet bulb, the vapour pressure, and the relative humidity for both the morning and the evening observations. Mean values of the temperature of the ground at depths of 1 foot and 4 feet were given for selected stations. The number of days of fog was included for the first time among the elements under the heading "Weather," and the number of observations of fresh or strong winds under the heading "Wind Force." The amount of cloud at the hour of evening observation was also included.

The monthly averages of temperature, rainfall, number of rain-days, duration and percentage of bright sunshine were issued as Appendix III. to the Weekly Report. The number of stations in the Appendix had increased to 95 for temperature, 127 for rainfall, and 65 for sunshine, compared with 75, 77, and 48 in 1901, and 74, 72, and 46 in 1895.

In 1907 the Report was increased to eight pages, and important changes were introduced. The first page was devoted to General Remarks on the weather of the week and to tables showing for each district the character of the weather of the week in respect of rainfall, warmth and sunshine, and for the season and the preceding seasons, the number of weeks of unusual character owing either to excess or to deficiency in the elements mentioned. The classification was based on the results for the 25 years 1881-1905.

The district summary giving the actual values for the week, the season, and the year was transferred to the second page, and the table of data for individual stations to the third.

A new table was added, giving values for about twenty stations of the temperature of the sea taken daily near sunrise and in the afternoon.

The values for "difference from normal or average" in the district summaries were obtained from the district values and new district averages, instead of being taken as the mean of the corresponding differences for the individual stations. The new district averages were computed for each week from the existing data for the period 1881-1905.

The information for the upper air was increased by the inclusion of results obtained with pilot balloons and registering balloons.

In the daily charts, values for the Faroes and Iceland were included.

The Monthly Supplement, under the revived title of Monthly Weather Report, was enlarged by the addition of summaries for



climatological stations which had previously been published only in the Annual Volumes of Observations at Stations of the Second Order, and towards the end of the year by the inclusion of summaries from additional stations supplied by the Royal and the Scottish Meteorological Societies. Full summaries for 110 stations and abridged summaries for 82 stations were published in the Reports for November and December. The summary of observations was transferred to the third page, and the charts to the last page, the 8th. Isohyets were shown on the rainfall chart, which was supplied by Dr. H. R. Mill, Director of the British Rainfall Organisation. The mean values of the temperature of the sea were inserted in the temperature chart.

Proper notes on the Statistical Tables were introduced in this year, and a map showing the stations used in the Report.

In Appendix I. the quarterly summaries remained unaltered in form, but the summary for the whole year contained the district values of rainfall, temperature, and sunshine for each year and each lustrum from 1878 (sunshine 1880) to 1907, instead of the lustrum values only.

The wind force supplement became Appendix III. to the Weekly Weather Report.

In 1908 the only change in the Weekly Report was the inclusion of the dates of highest and lowest temperature in the table of data for stations, and the change in the charts from 8 a.m. to 7 a.m. in July.

A separate preface to the Monthly Weather Report was prepared, giving a short account of the publication of Monthly Summaries of observations in this country from 1869, and a special note of the Report for the current year, together with the list of stations contributing to the Weekly and Monthly Reports.

The Report itself was increased to ten pages. In the regular issues a column giving the number of ground frosts was added under "Weather," and district summaries of rainfall, temperature, sunshine, and cloud were included in the table of full summaries for telegraphic reporting and normal climatological stations. In the table of abridged summaries a column giving the height of the raingauge at the station was introduced and mean values of earth temperature and the number of ground frosts were also included.

Instead of the small chart of rainfall, a full-page map, prepared by Dr. H. R. Mill from the data for nearly 1,000 stations, was given, the variations in the distribution being indicated by black shading of varying intensity. The space previously occupied by the rainfall chart was filled by a map showing the distribution of bright sunshine, isohels being drawn from February onwards.

The "Summary of Observations" was arranged under the three general heads—(1) Pressure, Wind, and Weather; (2) Rainfall; (3) Bright Sunshine.

In Appendix I. the *quarterly* values were given for each year as in the section for the whole year 1907. The values for periods of four or five weeks were omitted, as well as the table giving the dates of the hottest and coldest, driest and wettest corresponding quarters in preceding years.

Appendix III. became a "Summary of Gales recorded at Anemograph Stations," and contained three tables. Table I. gave the number of hours for each month during which the wind reached gale force, 39 miles or more in an hour. Table II. gave "Occasions of Strong Gale, velocity 47 miles or more in an hour"; and Table III. gave occasions when gusts of Storm Force, *above* 55 miles per hour were recorded.

In 1909 the only change in the Report was the adoption for the results of the investigation of the upper air of absolute units of pressure and temperature, and the metre per second and degrees of angular measure for the values of wind velocity and direction. Heights have throughout been expressed in steps of 500 or 1,000 m. or their equivalents.

A table was added to Appendix III. giving the number of hours of wind within the limits of the separate numbers of the Beaufort Scale at 25 anemograph stations. In the Monthly Reports the hygrometric and cloud values at a third hour of observation (1 p.m. or 3 p.m.) were included in the table of full summaries. A column was also introduced giving the correction on account of diurnal variation to be applied to the values of mean pressure to reduce them to true mean values.

In 1910 the charts in the Monthly Report were lithographed in two colours, the permanent part being in black and the shading and isopleths in blue. A summary of observations of sea temperature for 13 periods of four weeks each was included in the Annual Summary to the Report. A summary of the observations in the Upper Air was added as a special supplement to the Weekly Report.

In 1911 Appendix I. was slightly modified and contained the values for each of the six lustra from 1881 to 1910, and the values for the current year. Slight alterations were also made in the form of the tables in Appendix III. (Summary of Gales). The number of hours of gale force for the whole year was added to Table I. and the time during which the velocity exceeded 39 miles per hour on the occasions of strong gale to Table II. Tables II. and III. were arranged according to stations instead of months.

In the Monthly Report the observations of wind were reduced to a comparable basis by multiplying the actual numbers by 3 and by  $\frac{3}{2}$  for stations where observations were made once or twice a day.

Several important changes were made in 1912. In the Weekly Report the order of the tables was changed. The Weekly Seasonal and Annual Summaries for Districts were transferred to the fourth page, and the values for stations were given with the notes referring to them, on the second and third pages.

The temperatures on the grass and in the ground, which had previously been given in a separate table, were included with the other data in the principal table of results. Averages of the temperature in the ground for each week were computed from the results already published during the five years 1907-1911, and columns giving the difference of the weekly values from the averages were included in the tables.



The observations of sea temperature continued to be published in a separate table, but averages for the five years 1907-1911 were computed and the differences of the weekly values from the averages included in the table.

The values for the duration of bright sunshine which had previously been expressed as the total duration for the week were given as the mean daily duration during the week.

The form of the synoptic charts included in the Weekly Weather Report was entirely modified. In place of three maps for each day, showing respectively the distribution of pressure and wind over Europe at 7 a.m. and 6 p.m., and the distribution of temperature and weather at 7 a.m., a single map was given for each day. It embraced a much larger area, including the whole of Europe, the North Atlantic Ocean north of latitude  $28^{\circ}$  N., and a portion of the North American Continent as far west as the great lakes. The maps showed the distribution of pressure, wind, weather and temperature at the hour of morning observation. The information for Europe was derived from the telegraphic reports received at the Office and from the Bulletin International issued by the Bureau Central Météorologique of Paris; the information for the Atlantic Ocean from reports received by wireless telegraphy, supplemented by reports received by post.

The normal surface temperature of the sea for each month was indicated by the intensity of the blue shading. The temperatures observed during the week to which the Report referred were shown in black on the last chart, the values given being the means of all readings for the week received up to the date of going to press for each two-degree square.

**Monthly Report, 1912.**—The Royal Meteorological Society, which had for 30 years collected and published climatological statistics, ceased to do so after the end of the year 1911, and about 50 stations, which had previously contributed returns to the Society exclusively came into connexion with the Office. Changes were made to accommodate the additional stations, and certain modifications and additional information were introduced. Information for 283 stations was included in the Report for December, 1912.

In the table of full climatological summaries the changes made were:—

- (1) The introduction of a column for the actual hours of observation at each station, which rendered unnecessary the variations of type used in previous years to indicate differences in this respect.
- (2) The substitution of a column containing the mean pressures at sea level *corrected* for diurnal range for the column containing the corrections themselves.
- (3) The substitution of the mean daily duration of sunshine during the month for the total number of hours recorded.
- (4) Under "Weather" a column giving the number of days on which the rainfall was 0.04 in. (1 mm.) or more was added.

In the table of abridged summaries the columns giving the number of days of rainfall and of ground frost were put with additional columns for snow, hail, thunderstorms and fog under the general heading "Weather."

The values for the different districts which were previously included in the table of data for stations were collected together into a single table, and values for earth temperature and extremes of pressure added.

A table was added to the Annual Summary giving monthly values of rainfall at about 90 additional stations from which observations were received, but had not previously been published.

In Appendix III. (Gale Summary) several changes were made:—

- (a) The values of velocity were given in metres per second, the corresponding values in miles per hour being added in certain of the tables.
- (b) Three new tables were added, giving the maximum velocities in a gust and for an hour, for different stations for each month of the year 1912, and the highest velocities recorded in gusts of storm force during each of the years 1906–1912.

The number of stations for which the tabulations were summarized according to the several numbers of the Beaufort Scale was reduced from 25 to 10.

In 1913 the area of the charts in the Weekly Report was further extended, and a chart showing the distribution over the European area at 6 p.m. was inset. The morning chart showed the results of observations from Siberia, obtained from the Russian Daily Weather Reports, and from the whole of the North American Continent south of latitude 60°.

No other changes were made in the form of the regular issues of the Weekly and Monthly Reports.

From the details of the various changes which have been made during the 35 years of the Report's existence, there emerges the evidence of a visible though gradual progress (1) towards a complete summary of the weather history of the United Kingdom for its own special interest, for which the week is an appropriate period. It is long enough to reduce the detailed statistics to manageable summaries, while it is at the same time short enough for the mean values to represent with reasonable accuracy the character of the weather, and (2) towards a climatological summary for comparative purposes in this country and for a contribution towards the climatic history of the world, for which the month has been adopted as a suitable period by general consent, and because a shorter period would involve work beyond the power at the disposal of meteorologists and would result in statistics too detailed for a general survey.

Further modifications will be found necessary principally because temperature, rainfall and sunshine alone cannot represent the "weather" of a week, and because mean values alone cannot represent fully the meteorology of a month, which may include weather types of definitely opposite characters.

Finally, for the homogeneity necessary for the district summaries to provide a trustworthy historical record, continuity of the contributing stations is essential; this is practically secured for a considerable number of coast stations which are telegraphic reporting stations of the Daily Weather Report, and for other places where the local authorities have undertaken responsibility; it is not yet assured for considerable inland areas.

**Year Book.**—Part III. (1), **Daily Readings at Meteorological Stations of the First and Second Orders**, has been issued regularly about six weeks after the end of each month. It contains daily observations at 16 Climatological Stations. From the beginning of 1912 the results have been expressed in absolute units, and, in consequence of the questions which arose in the course of preparation and the extra work in connexion with Part II., the publication was for some time in arrear. It was, however, brought up to date by the end of 1912, but since then there has been delay owing to changes requisite for uniformity of type throughout the Year Book, which has hitherto had anomalies in that respect. At present the copy for January is in proof, and that for February ready for the printers. (2) The "**Geophysical Journal**" has been issued with less promptitude. The monthly parts up to and including August, 1912, are now completed. It contains daily meteorological, magnetic, electrical, solar and seismic data for Kew and Eskdalemuir, meteorological and magnetic data for Valencia and values of the wind components for four hours each day for Deerness, Holyhead, Scilly and Yarmouth.

It includes also the results of the investigation of the upper air previously published in the Weekly Report, and particulars of the intensity of radiation recorded at South Kensington by the Callendar Instrument for recording the vertical component of the direct and diffuse solar radiation.

**Part IV. (1), Hourly Values from Autographic Records. Meteorological Section.** The publication of the hourly values of the meteorological elements at the normal observatories in connexion with the Office is not yet up to date, owing to the increased work in connexion with the necessary conversion from the units in which the results have been tabulated. The monthly issues for 1912 for Kew, Valencia, and Eskdalemuir, have been completed, and the monthly summaries for Falmouth and Aberdeen are prepared up to the end of May, 1912. The necessary alterations have been made for the direct tabulation of the photographic barograms in millibars, and this will reduce materially the labour of preparation.

The publication in absolute units made it necessary to revise the tables in the introduction to the annual volume. Short tables for reducing to sea-level the readings of the barometer expressed in millibars were prepared for Kew, Valencia, Falmouth, and Aberdeen, and an extended table for Eskdalemuir, for which the correction is considerable. A table was introduced, giving the effect of humidity upon the values of the corrections to sea-level.

The table giving the "possible" duration of sunshine was revised, and the values for Eskdalemuir added to it.

Extended tables were added for the conversion of values of pressure and temperature from inches of mercury and degrees F. to megadynes per square centimetre, or bars, and degrees Absolute.

**Part IV. (2), Hourly Values from Autographic Records. Geophysical Section.** The preparation of the meteorological summaries for the five observatories for this Section was undertaken by the Statistical Division, and a note upon them also prepared by the Division was published in the volumes.



**Returns for Registrars-General.**—Weekly summaries have been prepared regularly for the Registrars-General of Births, Deaths and Marriages for England and Wales and for Ireland.

A quarterly return of rainfall with general remarks upon the weather of the quarter is supplied to the Registrar-General for England and Wales.

A special quarterly summary of observations at Dublin, with remarks on the weather of Ireland during the quarter, has been supplied to the Registrar-General for Ireland.

**Seasons in the British Isles.**—Little progress has been made with the preparation of the Report on the Seasons in the British Isles, referred to on p. 35 of the Report for last year, and it has been impossible to complete the work.

Information based upon the weekly values of rainfall, temperature, and sunshine for the past 30 years has been sent regularly to the different agricultural shows at the request of the Board of Agriculture. The information has included a note of the weather of the week preceding the date of the show in the current year, and an indication of the statistical connexion between the weather of the corresponding week and of the following week during preceding years.

**Tables of Frequency of Day Temperatures.**—Tables showing the frequency of maximum temperatures for each month between given limits have been prepared for 1911 and 1912, and a closer investigation for the normal observatories indicates that in the course of the year there are two maxima of frequency (for Kew at temperatures at 52° and 65° F.), with a minimum between (for Kew at 56° F.). The results are not yet published.

#### CLIMATOLOGY. FOREIGN AND COLONIAL STATIONS.

A list of Foreign and Colonial Stations from which documents have been received in the course of the year is given in Circular 001.

Among the additions to the list during the year under review may be mentioned stations started in Uganda at Bugalla, Bunyarugueu, Kakumiro, Mbuva, and Sango Bay.

The returns received from many stations have been examined and summarised month by month.

The copies of meteorological returns reprinted from Colonial Government publications and sent to the Office for distribution have been issued for the year 1910. The reprints for the year 1911 have not yet been received from all the Colonies.

A Note on the Harmattan Wind, prepared by Mr. H. W. Braby, from the observations received in manuscript or in print from Nigeria, has been communicated to the Royal Meteorological Society for publication in their Quarterly Journal.

Material for a discussion of the climate of certain Pacific Islands has been collected and arranged.

#### INQUIRIES.

The inquiries dealt with in the Statistical and Library Branch during the year were 870, of which 464 were by letter and

the rest personal inquiries. The following table gives a classification of the inquiries with the corresponding figures for previous years :—

		For Scientific or Commercial Purposes.	For Evidence in Legal Proceedings.	For Forecasts of Weather.	From Newspaper Correspondents for Special In- formation.	Miscellaneous.	Answered by Letter.	Answered Personally.
1903-4	...	253	94	158	217	65	166	626
1904-5	...	259	116	89	221	70	136	619
1905-6	...	293	99	77	206	84	160	599
1906-7	...	427	73	79	166	24	247	522
1907-8	...	503	83	108	175	24	305	588
1908-9	...	540	99	83	99	87	301	607
1909-10	...	462	98	104	112	39	305	517
1910-11	...	516	107	76	115	62	351	525
1911-12	...	582	129	30	113	33	457	430
1912-13	...	533	159	48	106	24	464	406

The inquiries included in the table under the heading "for forecasts of weather" are personal inquiries for information supplementary to that contained in the official forecasts and exhibited at the entrance to the Office and in St. James's Park.

#### LIBRARY.

The Author Card Catalogue has been kept up to date. The index numbers corresponding with the classification adopted in the International Catalogue of Scientific Literature are entered on the cards so that the subject-catalogue can be prepared directly from them.

The subject card catalogue for the books added to the library since the last list of additions was printed *in extenso*, as an appendix to the Report of the Meteorological Council for the year 1904-5, has been completed up to the end of 1911. The additions to the library received during the past year include about 750 books and pamphlets. The total number of books in the library is now about 23,350.

Some progress has been made with the re-numbering of the books on the library shelves.

In Circular 303 will be found (1) a list of persons and institutions from whom publications containing meteorological data have been received during the last ten years with a brief indication of the nature of the information given; (2) a list of periodicals containing memoirs on meteorological subjects, which are received by the Office.

Among the most important additions to the library during the past year may be mentioned :—

Expédition antarctique française (1903-1905 et 1908-1910),  
commandée par le Dr. Jean Charcot.

Vorlesungen über Seismometrie. Von Fürst B. Galitzin.

Océanographische en meteorologische Waarnemingen in den Indischen Oceaan, Juni-Aug., Tabellen et Kaarten.

Scientific papers, by J. Y. Buchanan. Vol. I.

Atlas météorologique, 1911, par G. Eiffel.

Summaries of climatological data by Sections, vols. 1 and 2, published by the Weather Bureau, Washington.

Conférence internationale de l'heure, Paris, Octobre, 1912.

Weather Science, by R. G. K. Lempfert.

Among those acquired by purchase have been :—

Radioactive Substances and their Radiations, by E. Rutherford.

Atlas photographique des nuages, par J. Loisel.

Meteorology, by W. I. Milham.

Die Schneegrenze in verschiedenen Klimaten, von Viktor Paschinger.

The Sun, by C. G. Abbott.

Altitude Tables, by F. Ball.

Geographie des atlantischen Ozeans, von G. Schott.

The Structure of the Atmosphere in Clear Weather, by C. J. P. Cave.

Tägliche synoptische Wetterkarten für den nordatlantischen Ozean, 1905-6.

Scottish National Antarctic Expedition; Report on the scientific results of the voyage of S.Y. "Scotia," 1902-1904, Vol. 2.

Himmels- und Naturerscheinungen in Einblattedruckten des XV bis XVIII Jahrhunderts von W. Hess.

New land: four years in the Arctic regions. By Otto Sverdrup.

The Voyage of the "Why Not?" in the Antarctic, by Dr. Jean Charcot.

And a selection of the volumes of the International Catalogue of Scientific Literature.

#### IV.—INSTRUMENTS DIVISION.

*Report by F. J. W. Whipple, M.A., Superintendent.*

**Supply to the Navy.**—The instruments necessary to maintain the establishment numbers at H.M. Naval Dockyards have been sent from time to time. The system of book-keeping in use for Naval meteorological instruments has been modified after correspondence between the Admiralty and the Meteorological Committee. Hitherto lists have been kept at the Meteorological Office which purported to show the ship which carried each instrument. In future the Office will be responsible for supplying deficiencies at the dockyards, but will not be concerned with the subsequent history of the instruments.

**The Mercantile Marine.**—590 instruments were issued to the Mercantile Marine during the year. A sea-temperature thermometer



with the stem sunk in a wooden holder, and with german silver fittings has been designed. It is being issued instead of the ordinary thermometer with a copper holder.

**The Ice Scout.**—The instrumental outfit for the *Scotia* included a set of marine instruments: two anemometers; two rain-gauges, with special fittings; kites and winding-gear (including kites and instruments presented by Prof. Assmann, and a winch lent by C. J. P. Cave, Esq.); captive, sounding, and pilot balloons, with 1,500 cubic feet of hydrogen; and a Callendar Electrical Thermograph for determining the temperature of the sea and detecting icebergs by Prof. Barnes' method.

**Exhibition.**—The Meteorological Section in the Scientific Aeronautics Exhibition at South Kensington, Dec. 1912–Feb. 1913, was organised by this Office.

**Workshop.**—A lathe, a drilling-machine, and a grinder, all driven electrically, have been installed in the workshop.

**International Units.**—Barometers graduated in inches on one side, in millibars on the other, are being made, and will be issued regularly in future. It is proposed to regraduate in this way the old barometers belonging to the Office.

The rack barometer made by the Cambridge Scientific Instrument Company is graduated in millibars. In this instrument the last two significant figures are read directly on a dial instead of by means of a vernier.

Thermometers graduated on the absolute scale are also ready for issue from the Office.

**Frames.**—Frames for the display of information to the public—The Daily Weather Report, Storm Warnings, or Fishery Barometer Charts—have been designed. They are now issued from the Office on terms set out in Circular 005, which is reprinted as an Appendix on pp. 62 to 64.

**Storm Cones.**—Storm warning cones have been replaced at 43 stations.

**Fishery Barometers.**—Inspectors of the Fishery Board for Scotland, the Department of Agriculture and Technical Instruction for Ireland, and of the Board of Agriculture and Fisheries in England and Wales have continued to examine and report upon the barometers supplied for the use of fishermen in their respective districts. The stations supplied with these barometers now number 233, of which 65 are in England, 6 in Wales, 66 in Ireland, 91 in Scotland, 4 in the Isle of Man, and 1 in Jersey.

**Instruments in use at the Office.**—Apparatus for recording the electrical potential of the air of Imperial Institute Road by means of an Ionium Collector and a Bendorff recording electrometer has been maintained in operation; and, in connexion with a proposed co-operative investigation of atmospheric pollution, an Aitken dust-counter has been acquired.

V.—CENTRAL OBSERVATORY—KEW OBSERVATORY,  
RICHMOND, SURREY.

*Report by C. Chree, Sc.D., LL.D., F.R.S., Superintendent,  
Assistant-Director of Observatories.*

**Buildings.**—No large structural changes have yet been made, but various minor changes have been necessary in connexion with the transfer to the National Physical Laboratory at Teddington of part of the verification work. The removal of the watch rating in October entailed the removal of the large watch safes in the barometer room, the clock in the basement, and the hot and cold chronometer boxes, which were of the nature of semi-fixtures. The transfer of the testing of barometers and hydrometers also took place in October, and led to the severance from the Observatory of some time-honoured pieces of apparatus.

**Staff.**—During the joint use of the Observatory by the Meteorological Office and the National Physical Laboratory much of the observational work continued to be done by or under the direction of members of the staff of the National Physical Laboratory, so that changes affecting these gentlemen merit recording. The chief of these changes relate to the retirement on pension of Mr. T. W. Baker and Mr. J. Foster, and the removal to Teddington of Mr E. G. Constable. The magnetic work, whether required for observational or verification purposes, remained in charge of Mr. Baker up to the date of his retirement in September. The taking of some of the eye-reading observations and the checking of the meteorological tabulations made weekly to the Office continued to be done by Mr. Foster so long as he remained at the Observatory. Mr. Constable, in like manner, until transferred to Teddington, continued in general charge of the self-recording meteorological, electrical, and seismological apparatus, and of the meteorological work generally. The Office is much indebted to these three gentlemen for the interest which they took in their work up to the last, and for the good will they showed in training their destined successors, so that no avoidable troubles should arise on their retirement. Mr. E. Boxall, who had long served as Mr. Constable's chief assistant, succeeded him in charge of the meteorological, electrical, and seismological work. Mr. B. Francis succeeded Mr. Baker, who had trained him, in taking some of the magnetic observations and in the testing of some of the magnetic instruments. Part, however, of the magnetic work has continued to be done by members of the staff of the National Physical Laboratory, whose transfer to Teddington is imminent.

The staff attached to the Office has remained the same as last year, except that Mr. Gordon Dobson, B.A., who served as Graduate Assistant, has left the Observatory to take up the duties of his new post at the Royal Flying School at Upavon.

**Self-recording Instruments and Eye Observations.**—The magnetographs for the continuous record of magnetic declination, horizontal force and vertical force, have been maintained in regular operation.

Continuous records have been obtained of the meteorological elements barometric pressure, temperature of the dry bulb and wet bulb, direction and velocity of the wind (by the Robinson cup standard anemograph and the Dines pressure tube), rainfall (by the Beckley gauge) and bright sunshine (by the Campbell-Stokes recorder). The Kelvin water-dropping electrograph, recording the electric potential in the atmosphere, and the Milne seismograph, recording variations of level in the east-west direction, have also been maintained in continuous operation.

The continuous records have been supplemented by the usual eye readings and observations required to determine the scale values and the base line values of the curves.

In addition to the regular self-recording instruments, records have been obtained during part of the year from a Dines pressure-tube anemometer recording direction as well as velocity, and a float barograph designed by Mr. W. H. Dines. The former instrument was erected beside the old camera stand near the entrance to the Park, and while in operation there remained under the general supervision of Mr. J. S. Dines. When the examination was completed it was removed to Spurn Head. The float barograph was set up in the barometer room, and has been the subject of several sets of special observations.

All the meteorological records obtained—except those from the float barograph and the pressure-tube anemometer—have been tabulated for each hour at the Observatory. The electrograms have been measured at four fixed hours a day. For the first nine months of 1912, every day has had its electrical character assigned on an arbitrary scale, and hourly measurements have been made on ten days a month selected as representative of quiet conditions. The maximum and minimum values of magnetic declination and horizontal force have been measured for each day, and the times of their occurrence have been determined. The magnetic character of each day on the international scale has also been fixed, and the results duly reported, for international purposes, to the Royal Netherlands Meteorological Institute, at de Bilt. The declination and horizontal force magnetograms for the first nine months of 1912 have been measured at each hour on the five "quiet" days of each month selected in pursuance of international agreement. The magnetographs were run at the higher speed—twelve times the normal—during the term hours arranged for the Australasian Antarctic Expedition. The seismograms for the greater part of 1912 have been studied, and measurements made of the times and amplitudes of the principal movements. Regular cloud observations have been made with the Fineman nephoscope and contributed to the international scheme of investigation of the upper air for publication at Strassburg. On days of bright sunshine observations of the intensity of solar radiation have been made with the Angström pyrheliometer, within half an hour of noon.

Observations of the air-earth vertical current have been made with the Wilson apparatus, and observations of the positive and negative charges per c.c. in the atmosphere, and of the mobility of the more mobile positive and negative electric ions have been taken



with the aspiration apparatus of Ebert. These electrical observations have been taken on most fine afternoons between 2 and 4 p.m.; but the observations with the Ebert apparatus stopped in October. All the observations taken during 1912 with either the Wilson or Ebert apparatus have been reduced and checked.

In addition to the work represented by the tables of results published in the *British Meteorological and Magnetic Year Book*, the following experimental work has been conducted at the Observatory:—

**Fog and Mist.**—The observations of a series of distant objects have been continued as in previous years.

**Comparison of Marine Barometers.**—The observations referred to in last year's Report have been concluded, and a report on the subject will be printed in the series of *Geophysical Memoirs*.

**Electrical Observations.**—A number of observations were made by Mr. Gordon Dobson with a view to ascertaining the influence of position on the results obtained with the Wilson apparatus and the Ebert apparatus, and in order to see how the results obtained with the two sets of apparatus for the vertical air-earth current are related to one another.

**Solar Eclipse Observations.**—During the solar eclipse of April 17, 1912, a number of special observations of solar radiation and of electrical phenomena were taken by Mr. Constable and Mr. Dobson. These with some other eclipse results obtained at the Office have been discussed in a joint paper by Mr. Corless, Mr. Dobson and the Superintendent, which has been accepted for publication by the Royal Meteorological Society.

**Contributions to Scientific Journals, &c.**—A list of contributions to Scientific Journals, &c. is given on p. 21.

**Inspections.**—Mr. Constable has acted, as in previous years, as inspector of several Meteorological Observatories and Anemograph Stations.

**Publication of the Results.**—The *Geophysical Journal* (*British Meteorological and Magnetic Year Book, Part III., Section 2*) gives month by month particulars of barometric pressure, air temperature, humidity, wind direction and velocity, amount of cloud and weather at two fixed hours daily, also the daily totals of rainfall and duration of bright sunshine. It further includes for each day the minimum temperature on the grass, earth temperatures at two depths, values of the potential gradient at 4 fixed hours, the electric and magnetic "character," the extreme values of magnetic declination and horizontal force, and the ranges of these elements. The results are also given of all the observations of solar radiation with the Ångström pyrheliometer, and of electrical observations made near 3 p.m. with the Ebert and the Wilson apparatus.

Monthly summaries of the diurnal and seasonal variation of the magnetic declination and horizontal force, and of the electric potential gradient in the atmosphere are given, with corresponding data for other Meteorological Office Observatories when they are available, in *Hourly Values, Geophysical Section, Part IV., Section 2*, of the same

publication, which also contains mean monthly values of magnetic inclination, total force, vertical force, and north and west components, along with a table giving recent mean annual values of the magnetic elements at the Observatories whose publications are received at Kew.

**Library.**—The Library has received publications from 16 Scientific Societies and Institutions of Great Britain and Ireland, and 135 Colonial and Foreign Scientific Establishments. The card catalogue has been proceeded with.

**Requisitions.**—Prepared photographic paper, as used at Kew, has been supplied, on requisition, for the other Observatories of the Meteorological Office, the Radcliffe Observatory, Oxford, and the Indian Government.

**Loan of Instruments.**—The following instruments, apparatus, &c., the property of the Meteorological Office, are at the present date out of the custody of the Superintendent on loan from the Observatory:—

To whom Lent.	Articles.	Date of Loan.
Board of Education, Science Museum, South Kensington.	Articles specified in the list given in the Annual Report of the Kew Committee for 1893.	1876
New Zealand Government.	Dip Circle, by Barrow, with one pair of needles and bar magnets, and a tripod stand.	1899
" "	Unifilar Magnetometer, by Jones, marked N. A. B. C.	1909

#### VI.—MAGNETIC OBSERVATORY.—ESKDALE OBSERVATORY, LANGHOLM, DUMFRIES-SHIRE.

Questions of administration have occupied a good deal of attention during the year.

**Buildings.**—In April, 1912, the porch of the magnet house showed signs of damp which subsequently spread to the interior, and dry rot was detected in the floors of the rooms. The matter has been taken in hand by the Office of Works. The floor of the west room has been renewed and the same action is necessary in the east room which contains the instruments used to give continuous records of the magnetic elements. Steps have been taken to drain away the water from the soil covering and surrounding the magnet house and thus prevent the recurrence of the damp. So far the endeavours have been successful.

**Staff.**—The mechanic, who was also caretaker and whose wife was housekeeper for the assistants' house, left in May, the Seismological Assistant in October, and in December the Superintendent, who had been absent for six weeks in June and July on account of his health, expressed a wish to resign his appointment and left the Observatory on 31st December. New regulations for these appointments had accordingly to be framed and upon these matters the

Committee have taken the advice of the Gassiot Committee of the Royal Society.

Provisional arrangements were made for continuing the work of the Observatory from 1st January, 1913. For the month of January, Mr. G. Dobson, Student Assistant at Kew Observatory since October, 1911, was associated with Mr. L. H. G. Dines, who had been appointed Seismological Assistant, in the charge of the work, and for the six months from the beginning of February until the 1st August, by arrangement with the Executive Committee of the National Physical Laboratory, Dr. J. A. Harker, F.R.S., has taken over the duties of Superintendent.

On the nomination of the Gassiot Committee, Mr. L. F. Richardson, formerly an Assistant at the National Physical Laboratory, has been appointed Superintendent. He will take up his duties from 1st August, 1913.

**Terrestrial Magnetism.**—The recording instruments have been maintained in continuous operation, but dissatisfaction has been expressed with the results obtained from the magnet used for recording the variations of the earth's vertical magnetic force: so much so that on the advice of the Gassiot Committee the hourly readings of the vertical magnetic force for 1912 will not be published. During his tenure of the office of Superintendent, Mr. G. W. Walker gave much attention to this question and had an instrument constructed which was designed to give better results. Dr. Harker has also recognised its importance and has installed an instrument obtained on loan from Dr. W. Watson.

**Atmospheric Electricity.**—The electrical observations for the *Geophysical Journal* have been maintained.

**Seismology.**—The Omori seismograph which was borrowed for two years from the Japanese Department of Education has been installed in the Laboratory together with the Wiechert instrument, both of which use smoked paper and do not therefore require a darkened room. The Japanese Education Department have accepted the present of an English watch in lieu of the return of the seismograph.

The Committee are of opinion that in order to free the administration of the Observatory from difficulties which are characteristic of small isolated communities some considerable outlay is required, but the means at their disposal do not enable them immediately to carry out their wishes in that respect.

## VII.—WESTERN OBSERVATORY.—VALENCIA OBSERVATORY, CAHIRCIVEEN, CO. KERRY.

All the self-recording apparatus of a first-order meteorological station have been kept in continuous operation throughout the year, and the hourly tabulations are being published as usual. Cloud observations in connexion with the International investigation of the upper air have been made on the prescribed days of each month.

The fortnightly absolute observations of magnetic declination, inclination and intensity, have been regularly made throughout the year by the Superintendent. The results have been published monthly in the *Geophysical Journal*.



**VIII.—AEROLOGICAL OBSERVATORY AT PYRTON HILL.**

*Report by W. H. Dines, F.R.S.*

The ordinary work of the station has been carried on throughout the year excepting that comparatively few kite ascents were made.

Registering balloons were sent up at the times and dates appointed by the International Commission, except in August and on one or two occasions when a strong West to North-West wind rendered it fairly certain that the balloons would be lost. Balloons were also sent up on other days, selected on account of special conditions, such as an unusually high or low reading of the barometer, and on the date of the nearly total eclipse of the sun, April 17th. On this date two balloons were sent up, one an hour before and one an hour after the middle of the eclipse. Good observations with two theodolites were obtained for both ascents but unfortunately the second balloon has not been found.

During the early part of the year very bad luck was experienced in the matter of finding the balloons, and from January to April three only out of eleven were returned. For the whole year the record is 23 returned out of 41 sent up, an unusually low percentage, but all the records were readable and reached to 11 kms. at least.

During the first week in July which was, by agreement, a week of international ascents, nine balloons were sent up at Crinan, Argyllshire. The exceptional condition of an upper current from the East, increasing with height, prevailed, and probably as the result of this only three were returned, two of which fell in the sea; thus the ascents were not as successful as they have been in previous years.

The observations at Mungret College Observatory have been continued by the Rev. W. O'Leary, S.J., aided by a grant from the Royal Meteorological Society and the British Association for the Advancement of Science, and five successful records have been obtained. The loss from this station amounts to about 50 per cent. Unfortunately, here too the ascents during the international week were not as successful as might have been wished.

The observations have been continued at Manchester, Ditcham Park and Brighton, and thanks are due to Prof. Schuster, Prof. Rutherford, Mr. Cave, and Mr. Salmon for their co-operation. A registering balloon was also sent up at Southport by Mr. J. S. Dines and followed for some time by a theodolite on the occasion of the meeting of the Royal Meteorological Society in May at that town.

The observations on clouds have been made as in previous years at Greenwich, Kew, Aberdeen and Valencia, and the whole series of observations are sent to Prof. Hergesell for insertion in due course in the international publication.

The station at Pyrton Hill supplied in February a considerable amount of apparatus, including a hand winch, balloon meteorographs, kite meteorographs and kites to the Board of Trade for use on the Ice-Scout *Scotia*.

**IX.—ABERDEEN OBSERVATORY.**

Besides the ordinary work of a meteorological station of the first order, observations of cloud motion in connexion with the international investigation of the upper air have been made, and more recently, daily observations of cloud motion for transmission to de Bilt. Observations of the upper air by means of pilot balloons

have also been made regularly under Professor Niven's direction. Mr. G. A. Clarke has continued his studies of cloud forms and has obtained a remarkable set of sketches in illustration of six minutes of the life history of a cloud during the passage of a line-squall on October 14th, 1912. The sketches with the appropriate instrumental records were framed for exhibition at the Science Museum in connexion with the special section for Aeronautics.

#### X.—BRANCH OFFICE AT SOUTH FARNBOROUGH.

*Report by J. S. Dines, M.A., Meteorologist in Charge.*

The necessary accommodation at South Farnborough was not ready, and in consequence the experimental work in the investigation of wind structure for the Advisory Committee for Aeronautics under the direction of the Office has been carried on at Pyrton Hill throughout the year, with the exception of a period of one month in the autumn of 1912, when Mr. J. S. Dines, the meteorologist in charge of the experiments, took up temporary quarters in the buildings of the Royal Aircraft Factory at Farnborough. During this period weather charts were prepared each morning from telegraphic information despatched from the Office, and a series of pilot balloon ascents was made, observations being taken by this means three times daily. Mr. Dines was assisted in this work by Mr. Gordon Dobson, of Kew Observatory. During the year attention has been directed to the behaviour of anemometers of the pressure tube type in gusty winds, and the nature of these winds has been examined by means of records taken on quickly moving charts providing very open time scales. Other experimental work has been carried out, and some further comparisons made between the gradient and surface winds at different stations. The results of the investigations are printed in papers incorporated in the report of the Advisory Committee for Aeronautics.

#### XI.—STATIONS IN CONNEXION WITH THE OFFICE : INSPECTIONS IN 1912.

The inspectors were as follows :—

Districts 0, 1 and 6	...	...	Mr. A. Watt.
District 2	...	...	Mr. A. Watt.
" 3	...	...	Mr. R. Corless.
" 4	...	...	Mr. F. J. Brodie, Mr. R. Corless, Mr. R. Sargeant.
" 5	...	...	Mr. R. G. K. Lempfert.
" 7	...	...	Mr. F. J. Brodie, Mr. J. S. Dines.
" 8	...	...	Mr. E. Gold, Mr. R. Sargeant.
" 9	...	...	Mr. H. Harries.
" 10	...	...	Mr. E. G. Constable, Mr. H. Harries.

In consequence of the absorption in the Office system of the stations which formerly reported to the Royal Meteorological Society, the number of stations visited by representatives of the Office was larger than in previous years. The new arrangements for communicating to the Newspaper Press evening reports from Health Resorts, under which inspection on behalf of the Office is one of the conditions attaching to the inclusion of the

reports, has also increased the number of stations to be visited. A list of stations inspected under this arrangement is given below.

At the observatories and anemograph stations the instruments were dismantled and cleaned, and all necessary repairs were carried out. At those observatories which are also climatological or telegraphic reporting stations the arrangements for this work were examined.

The reports show that efficiency has been maintained on the whole; in a number of cases the inspectors were able to make suggestions for improving the observations by bringing them more into line with recognized conventions. Points requiring attention which could not be settled on the spot have been dealt with by correspondence.

The following is a list of the stations visited:—

#### OBSERVATORIES.

Armagh.	Stonyhurst.
Falmouth.	Valencia.

#### ADDITIONAL ANEMOGRAPH STATIONS.

Brighton.	Gorleston.	Plymouth.
Dover.	Holyhead.	Quilty.
Dublin (Phoenix	Kingstown.	Roche's Point.
Park).	Pendennis Castle	Scilly.
Fleetwood.	(Falmouth).	Yarmouth.

#### TELEGRAPHIC REPORTING STATIONS.

Bath.*	Holyhead.	Portland Bill.
Birr Castle.	Jersey.	Roche's Point.
Blacksod Point.	Leith.	St. Ann's Head.
Castlebay.	Malin Head.	Scilly.
Clacton-on-Sea.*	Nairn.*	Stornoway.
Donaghadee.	Newquay.*	Valencia.
Dover.*	North Shields.	Yarmouth.*
Dungeness.	Nottingham.	

#### HEALTH RESORTS CONTRIBUTING TO THE EVENING REPORTS FOR THE PRESS.

Aberystwyth.	Folkestone.	Rhyl.
Bexhill-on-Sea.	Harrogate.	St. Andrews.
Bettws-y-coed.	Hastings and	St. Scarborough.
Blackpool.	Leonards.	Seaford.
Bognor.	Ilfracombe.	Southend-on-Sea.
Bournemouth.	Littlehampton.	Southport.
Brighton.	Littlestone.	Southsea.
Buxton.	Llandudno.	Stonehaven.
Carnoustie.	Lowestoft.	Teignmouth.
Colwyn Bay.	Margate.	Torquay.
Deal.	Oban.	Weston-super-Mare.
Douglas.	Paignton.	Weymouth.
Eastbourne.	Ramsgate.	Worthing.
Felixstowe.		

\* Information from this station is included in the evening reports from Health Resorts supplied to the Newspaper Press.



CLIMATOLOGICAL STATIONS.

Ashburton.	Egremont.	Markree Castle.
Aspatia.	Foynes.	Mayfield.
Bellingham.	Garforth.	Mountmellick.
Bennington.	Guernsey	Newcastle
Braemar.	(Brooklyn).	(Wicklow).
Brighton (Preston).	Guernsey	Newton-Forbes.
Bristol.	(Villa Carey).	Plymouth.
Cheadle.	Gwernyfed Park.	Princetown.
Chelmsford.	Halstead.	Redruth.
Cheltenham.	Hampstead.	Salcombe.
Clongowes Wood	Kilkenny.	Sandown.
College.	Killarney.	Scaleby.
Cockle Park	Killeston.	Seathwaite.
(Morpeth).	Lincoln.	Shrewsbury.
Colmonell.	Little Massingham.	Skegness.
Dorchester.	Llanberis.	Southampton.
Dublin (Phoenix	Llangammarch	Tavistock.
Park).	Wells.	Tynemouth.
Dumfries.	Macclesfield.	Ushaw.
Dundee.	Malvern.	Welshpool.
Durham.		

Mr. H. Harries inspected the station at Gibraltar, from which daily reports are received by wireless telegraphy through the courtesy of the Lords Commissioners of the Admiralty.

Previous reports have been followed by a series of appendices giving a list of observing ships, a statement of the provisions for the supply of information to the public including a list of stations, publications, and other matters, a list of institutions in various parts of the globe from which meteorological data are received, and a list of institutions and persons to whom copies of the publications of the Office are sent. These appendices have generally been issued as separate pamphlets, revised as soon the report was issued, so that two editions have been made in the course of the year. It is thought that it will be more convenient for the matter to be dealt with by the issue of the separate pamphlets which can then be brought up to date irrespective of the date of issue of the report.

W. N. SHAW,

Meteorological Office.

*Chairman.*

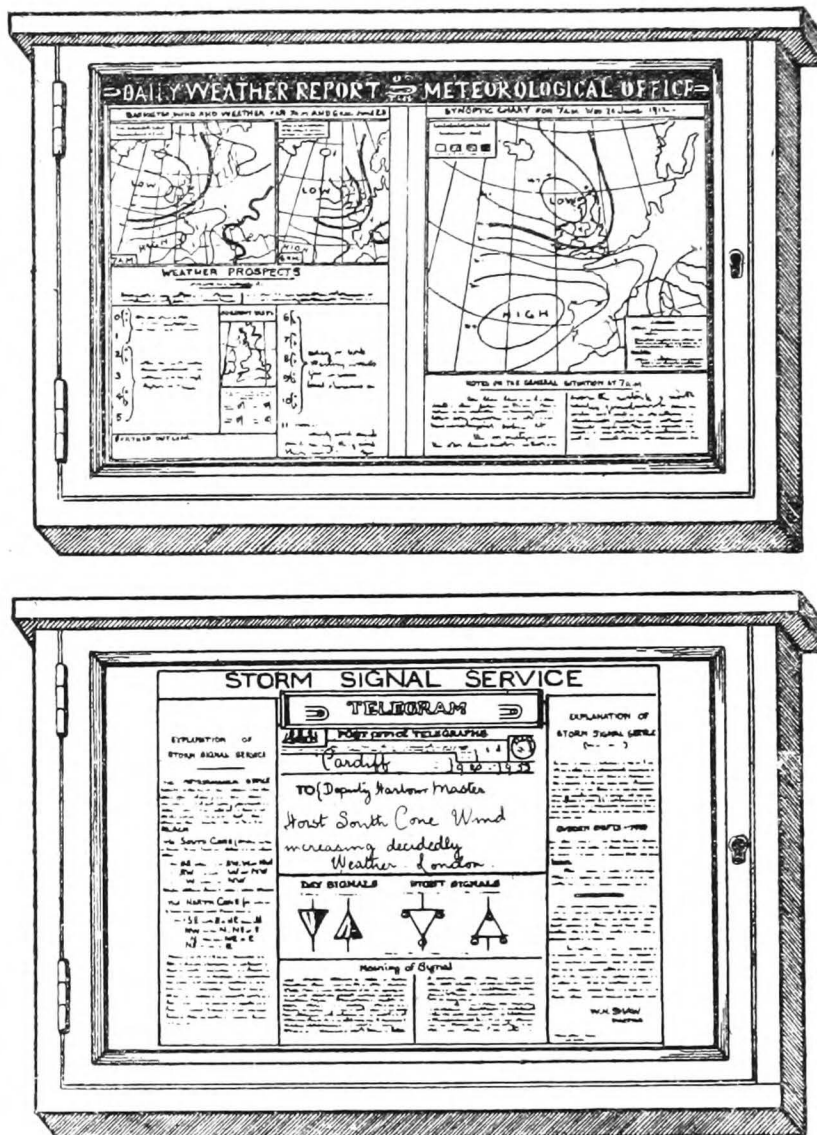
July 16, 1913.

## APPENDIX : CIRCULAR No. 005.

## METEOROLOGICAL OFFICE, LONDON.

## FRAMES FOR EXHIBITING WEATHER INFORMATION AT FISHING PORTS, &amp;c.

In accordance with the tradition initiated 50 years ago, the Meteorological Office has lent barometers to about 230 fishing villages, and now sends storm warnings by telegraph to 250 seaports. These provisions have for their object the diminution of the loss of life and property at sea. The regulations under which the loans have been made and the telegrams sent provide that the incidental cost of exhibiting the barometers and hoisting the signals have to be borne by the locality.



To enable fishermen and others to take advantage of these facilities for making use of our increasing knowledge of the laws of weather, the barometer diagram and the storm warning telegram, together with the explanation of the meaning of the warning, should be exhibited where they can be seen by all.





the whole of the information sent out by the Office in the forms mentioned above, four frames would be required, as shown in the accompanying sketch, but they may be obtained separately to meet the requirements of individual localities. The cost of the frames is £1 10s. 0d. each (carriage to any railway station in the British Isles included). Applications for supply should be addressed to the Director, Meteorological Office, South Kensington, London, S.W.

1 January, 1913.

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