

R E P O R T
OF THE
METEOROLOGICAL COUNCIL

TO THE
ROYAL SOCIETY,

For the Year ending 31st of March 1893.

Presented to both Houses of Parliament by Command of Her Majesty.



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1893.

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MAP SHOWING THE POSITIONS OF THE STATIONS FROM WHICH OBSERVATIONS ARE RECEIVED.



See Appendices Nos V, VII, XI, XIII & XIV.

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MAP OF STATIONS IN CONNEXION WITH THE OFFICE - - Faces title.

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THE METEOROLOGICAL COUNCIL,

1892-93.

Lieutenant-General RICHARD STRACHEY, R.E., C.S.I., LL.D.,
F.R.S., Chairman.

MR. ALEXANDER BUCHAN, M.A., LL.D., F.R.S.E.

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MR. FRANCIS GALTON, M.A., F.R.S.

MR. EDWARD J. STONE, M.A., F.R.S.

Captain WILLIAM J. L. WHARTON, R.N., F.R.S., Hydrographer of
the Admiralty.

R E P O R T
OF THE
M E T E O R O L O G I C A L C O U N C I L

TO THE
ROYAL SOCIETY,
For the Year ending March 31, 1893.

THERE has been no change in the Council during the year. Introductory.
The executive officers are, as stated in the last Report:—

Mr. R. H. Scott, M.A., F.R.S., Secretary.
Nav.-Lieut. C. W. Baillie, R.N., F.R.A.S., Marine Superintendent.

The Report is, as usual, divided into four sections or parts:

- I. OCEAN METEOROLOGY.
- II. WEATHER TELEGRAPHY.
- III. LAND METEOROLOGY.
- IV. MISCELLANEOUS.

PART I.

OCEAN METEOROLOGY.

Collection of Information.—The practice followed by the Office with reference to observers at sea, as described in former Reports, remains unchanged. Collection of information.

Appendix I. (p. 35) contains a list of all the observers who during the past year have contributed logs classed as “excellent.” Several of these observers have regularly co-operated with the Office for many years. The names which appear in the list for the first time are as follow:— Recognition of “excellent” observers.

Captain's Name.	Ship.
Armstrong, B. G. - - -	S.S. "Para."
Barclay, J. - - -	S.S. "Thermopylæ."
Hand, G. E., Lt. R.N. - -	H.M.S. "Egeria."
Jamieson, D. E. - - -	S.S. "Port Adelaide."
Tait, H. - - -	S.S. "India."
Tyson, J. - - -	S.S. "Arab."

Proportion of
"excellent" to
total number of
logs received.

The total number of Meteorological logs received in the year ending March 31, 1893, was 122, of which 91, or 74 per cent., have been classed as "excellent."

The average number of logs received annually during the five years, 1887-91, was 173, of which the per-centage of "excellent" logs was 75.

The Council have also received, through the Ocean Steamship Company of Liverpool, a considerable number of ships logs, mostly from voyages to and from the China Seas, *via* Suez.

The Council take this opportunity of expressing their best thanks to the observers who have assisted them during the past year.

They regret to have to announce the deaths of two of their observers. They were Captains E. Ashdown and A. Campbell.

Appendix II. (p. 37) gives a list of the meteorological logs and of meteorological reports from stations abroad, received at the Office during the year.

Districts from
which obser-
vations are
obtained.

The following summary of the voyages of the ships observing for the Office shows the districts from which observations were received during the year:—

To Baffin's Bay or Greenland	-	-	-	2
„ North America, East Coast	-	-	-	14
„ „ „ West „	-	-	-	7
Off East Coast of North America	-	-	-	2
To West Indies	-	-	-	5
„ South America, East Coast	-	-	-	11
„ „ „ West „	-	-	-	4
„ Australia and New Zealand, <i>via</i> Cape of Good Hope	-	-	-	27
„ „ „ „ <i>via</i> Suez	-	-	-	6
At Australian stations	-	-	-	1
To India, <i>via</i> Suez	-	-	-	4
„ India, <i>via</i> Cape of Good Hope	-	-	-	13
„ China, <i>via</i> Suez	-	-	-	1
In China Seas	-	-	-	6
To Cape of Good Hope	-	-	-	11
Off East Coast of Africa	-	-	-	2
To West Coast of Africa	-	-	-	1
Between British Ports	-	-	-	3
To Continental Ports	-	-	-	4

Red Sea Charts.—These charts have been completed, and they are now in the hands of the engraver.

Current Charts for the Atlantic, Pacific, and Indian Oceans.—Current Charts.
Great additions have been made to these charts during the past year. 750 Royal Navy logs have been dealt with, making a total of about 6,000 received from the Public Record Office for the period prior to the introduction of the uniform system of Remark Books on board Her Majesty's ships, and dating back to the year 1830. It was not thought desirable to obtain observations from the logs of an earlier date, owing to probable errors arising from the use of imperfect instruments. About 9,000 observations were supplied by the French Government; about 13,600 by Dr. Neumayer, of Hamburg; 3,500 by Baron van Heerdt of Utrecht; 550 observations from the Austrian Navy, and a few from the Russian Navy. In addition to these, valuable data have been obtained from the logs of various steamship companies which were courteously placed at the disposal of the Council. Nearly the whole of the observations collected from the foreign sources are for the Pacific Ocean, where, as compared with the Atlantic and Indian Oceans, observations are very scarce. In fact, for the central part of the Pacific Ocean scarcely any data exist.

Southern Ocean.—Cape of Good Hope to New Zealand. All available data for this district have been dealt with, and the monthly charts representing wind, barometrical pressure, air, and sea-surface temperature, fog, and currents, are now being drawn. In the wind charts, the new form of wind rose, shown in last year's report, page 7, is being adopted, as in the case of the Red Sea Charts.

Future Marine Work.—The Council have decided that the next district to be discussed shall be the South Atlantic, including the portions of the Pacific adjacent to the South American coast, extending in longitude from 90° W. to 20° E., and in latitude from the Equator as far south as observations are available. This inquiry will be carried out in a similar manner to that for the Cape to New Zealand district.

Arctic Currents.—A copy of the monthly current charts of the Arctic regions, have been supplied to Dr. Nansen for his contemplated Arctic expedition.

Supply of Instruments to distant Stations.—Distant stations. The instruments for St. Helena, as mentioned in last Report, have safely reached that island. The Council have entered into correspondence with Lloyd's with the view of organizing observing stations at some of their agencies in the Pacific islands. Applications have been received for the supply of instruments to Papeete, Tahiti, and Rarotonga, Cook's Islands, and the necessary outfits will be forwarded. The Council have also supplied instruments to a new station recently established by Lloyd's at Cape Spartel, Morocco.

Supply and Stock of Instruments.—In Appendix III. (p. 43) Stock of Instruments belonging to the Office. is given a list of the meteorological instruments supplied by the Office to ships in the Royal Navy during the year, with a statement for the 31st March 1893 of the stock and distribution

Stock of instruments belonging to the Office.

of the instruments standing on the books to the account of the Admiralty.

Appendix IV. (p. 44) gives similar information with regard to the disposal of the other instruments belonging to the Office, remaining in store, or which have been supplied to the Mercantile Marine, and to observatories, telegraph stations, &c.

PART II.

WEATHER TELEGRAPHY AND FORECASTS.

Administrative.

There have been no serious interruptions of telegraphic communication during the year, excepting that the cable to the Shetlands broke down in February, and communication was interrupted for a fortnight.

The Council have to regret the death on the 21st of February of their observer, at Mullaghmore, Mr. Kenneth Kerr, who had acted in that capacity for more than 14 years, since October 1878. Inasmuch as in 1884 the telegraph was extended through the county Mayo to Belmullet, a point about 100 miles to the westward of Mullaghmore, where a telegraphic reporting station has been established, the necessity for keeping up the latter station did not seem to the Council sufficiently great to justify the cost of the private wire connecting Mullaghmore with the Post Office telegraphs, and the station is therefore to be abandoned on April 1, 1893.

Among the observers the changes have been the substitution at Bidston observatory of Mr. Plummer for Mr. Hartnup, whose death was noticed in the last Report, at Cambridge of Mr. P. Morris for Mr. H. Todd, at Leith of Mr. Richardson for Mr. Newlands, and at Parsonstown of Mr. Perry for Mr. Haines.

Daily and Weekly Weather Reports.

A list of the telegraphic reporting stations, British and Foreign, is given in Appendix V. (p. 45).

The work in this branch of the Office continues to increase. The Daily and Weekly Weather Reports, in particular, have been extended and improved.

Inspection of the Stations.

Inspection of the Telegraphic Reporting Stations.—The telegraphic reporting stations have been inspected during the year, in England by Mr. Ley, in Scotland by Mr. Buchan, and in Ireland and Wales by Mr. Scott. The reports submitted by the Inspectors to the Council, which are printed in Appendix VI. (p. 46), show that the efficiency of the service continues to be satisfactorily maintained.

Discussion of the reports.

Discussion and Publication of the Information received.—The practice of the Office in collecting, discussing, and disseminating the meteorological information received by telegraph is described in Appendix VII. (p. 60). The Daily Weather Report has appeared regularly during the year; for details see that Appendix. It is distributed free of cost as follows:—To newspapers,

seven copies; to seaports, for public exhibition, 71 copies; to Government offices and public institutions, 66 copies; to correspondents of the Office, 73 copies; and to foreign meteorological establishments, 46 copies. Nearly 200 copies are issued regularly to subscribers.

Distribution of reports.

The Weekly Weather Report, with its Monthly Appendices, has also appeared regularly; for particulars of this publication see Appendix VII. (p. 60).

Public display at the Office of the State of the Weather on British Coasts.—This arrangement, which was made with a view to the earliest possible supply to the public of the latest information as to the weather received from the principal points on the eastern, southern, and western coasts, has been regularly carried out, and it is believed with general public approval. It supplies at 9.30 a.m. and 3 p.m. every week day the substance of the reports received by telegraph, of the state of the weather and sea at the following stations: Yarmouth, Dungeness, the Needles (Hurst Castle), Scilly, Holyhead, and Valencia, and this is displayed in a conspicuous manner on the front of the Office, 63, Victoria Street, S.W.

Display of information in front of the Office.

Supply of Forecasts to the Fleet.—At the request of the Admiralty daily forecasts were supplied to the Commander-in-Chief of the "A" Fleet during the continuance of the Manœuvres as in previous years, and also to the Commander-in-Chief, Devonport. This latter service is continued throughout the year. It commenced at the end of 1890.

Forecasts for the Fleet.

Weather Forecasts.—Forecasts are prepared three times a day, namely, at 11 a.m., at 3.30 p.m., and 8.30 p.m. The Forecasts prepared at 11 a.m., on the information derived from the 8 a.m. reports, refer to the probable weather between noon on the day of issue and noon on the following day. They are publicly exhibited in several places in London,* and are supplied to the afternoon editions of the newspapers. The 3.30 p.m. Forecasts are employed for storm warnings only, excepting in the hay harvest season, when they are issued as subsequently explained. The forecasts at 8.30 p.m. are specially prepared for publication in the morning newspapers, but all the forecasts are available for the information of anyone who applies for them at the Office.

Forecasts.

The inquiries received through the Post Office for special forecasts during the year amounted to 92, and the personal applications to 44. The rules of the Office relating to such inquiries are stated in Appendix VII., p. 64.

Inquiries at the Office.

* Viz., in the City at the Mansion House, Lloyd's Rooms, Messrs. R. & J. Beck's, Cornhill, and Messrs. de la Rue & Co.'s, Bunhill Row; in the West End, in the Libraries of the House of Lords and the House of Commons, at Messrs. Elliot's, St. Martin's Lane; Messrs. Stanford's, Charing Cross; Messrs. Negretti & Zambra's, Regent Street; and Messrs. Pastorelli's, New Bond Street; and at the Office, 63, Victoria Street.

Results of
Forecasts.

The results of a comparison of the Forecasts issued at 8.30 p.m. during the year, with the weather actually experienced, are given in Appendix VIII. (p. 65). The following summary shows the successes and failures over the whole United Kingdom, estimated as explained in that Appendix.

SUMMARY of RESULTS of 8.30 p.m. FORECASTS, 1892-93.

Districts.	Per-centages.				Total per-centage of Success.
	Complete Success.	Partial* Success.	Partial* Failure.	Total Failure.	
SCOTLAND, N. - -	45	36	13	6	81
" E. - -	47	31	16	6	78
ENGLAND, N.E. - -	49	32	15	4	81
" E. - -	47	34	15	4	81
MIDLAND COUNTIES -	47	31	16	6	78
ENGLAND, S. - -	48	35	14	3	83
SCOTLAND, W. - -	41	32	17	10	73
ENGLAND, N.W. - -	43	34	14	9	77
" S.W. - -	49	31	12	8	80
IRELAND, N. - -	46	32	13	9	78
" S. - -	41	34	15	10	75
Summary - -	46	33	14	7	79

* Note "partial" implies "more than half."

Testing of
Forecasts.

The following table shows for each year from 1883 to 1892, inclusive, the per-centages of complete and partial success of the Forecasts issued at 8.30 p.m. for the whole year.

PER-CENTAGES of RESULTS of FORECASTS for the whole of the
BRITISH ISLES.

Year.	Complete Success.	Partial, <i>i.e.</i> , more than Half Success.	Total Success.
1883 - -	48	33	81
1884 - -	50	31	81
1885 - -	59	34	84
1886 - -	49	31	80
1887 - -	52	32	84
1888 - -	51	31	82
1889 - -	49	32	81
1890 - -	50	32	82
1891 - -	50	30	80
1892 - -	46	33	79
Average -	49	32	81

Hay Harvest Forecasts.—The Council renewed in 1892 the offer made in previous years to the Royal Agricultural Society, the Royal Dublin Society, and the Highland and Agricultural Society to send Daily Forecasts *gratis* during the haymaking season to a number of observers selected by those Societies, on two conditions, viz., that the information should be made known as widely as possible, and a record of the weather actually experienced sent weekly to the Office. The Societies accepted the proposal, and the Forecasts were issued as shown in the following table:—

Hay Harvest Forecasts.

LIST of those who received HAY HARVEST FORECASTS in 1892.

Districts.	To whom sent.	Address.
0. SCOTLAND, N.	Rev. Dr. Joass - Major Smith -	Golspie. Munlochy, Inverness.
1. SCOTLAND, E.	J. Whitton - G. Murdoch - C. W. L. Forbes -	Glamis Castle, by Forfar. Rothiemay, Huntly. Aberfeldy.
2. ENGLAND, N.E.	Sir J. Wilson - J. Turner -	Chillingham Barns, Chatton, Northumberland. The Grange, Ulceby.
3. ENGLAND, E.	W. Birkbeck - Sir J. B. Lawes, Bt., and Sir J. H. Gilbert, Ph.D.	High House, Thorpe, Norwich. Rothamsted, Harpenden.
4. MIDLAND COUNTIES	Royal Agricultural College. E. E. Harcourt-Vernon	Cirencester. Grove Hall, East Retford.
5. ENGLAND, S.	C. Whitehead - E. P. Squarey - The Aylesbury Dairy Company. M. J. Sutton -	Barming House, Maidstone. The Moot, Downton, Wilts. Stammerham, Horsham. Kidmore Grange, Caversham.
6. SCOTLAND, W.	W. Calder - Sir M. J. Stewart, Bt., M.P. J. S. R. Ballingal -	Castle Hill, Dalreoch, Dum- barton. Ardwell, Stranraer. Eallabus House, Islay.
7. ENGLAND, N.W.	G. W. Wray - The Earl of Derby, K.G.	Leyburn, Yorkshire. Knowsley Hall, Prescott.
8. ENGLAND, S.W.	The Earl of Ducie - T. Dyke - R. Neville Grenville	Tortworth, Gloucestershire. Long Ashton, Clifton, Bristol. Butleigh Court, Glastonbury.
9. IRELAND, N.	E. F. Farrell - J. M. Wilson, J.P.	Moynalty, Co. Meath. Currygrane, Edgeworthstown.
10. IRELAND, S.	D. A. Milward - W. Talbot Crosbie, D.L. The Earl of Rosse, K.P.	Lavistown, Kilkenny. Ardfert Abbey, Tralee, Co. Kerry. Birr Castle, Parsonstown.

Hay Harvest
Forecasts.

In addition to the above names the forecasts were sent to six other gentlemen at their own cost.

The issue commenced over the Southern districts of England on the 13th June, and ended 16th July; but commenced and ended about a fortnight later in the more Western and Northern parts of the country.

The general result of the issue of these forecasts, shown by the subjoined table, has been prepared solely from the reports of the above-mentioned gentlemen, and is entirely independent of any estimate formed within the Office itself:—

SUMMARY OF RESULTS.—HAY HARVEST FORECASTS, 1892.

Districts.	Names of Stations.	Per-centages.				Total per-centage of Success.
		Complete Success.	Partial Success.	Partial Failure.	Total Failure.	
SCOTLAND, N.	Munlochy and Golspie	61	28	11	—	89
„ E.	Aberfeldy, Glamis, and Rothiemay	58	20	16	6	78
ENGLAND, N.E.	Chatton and Ulceby	46	35	14	5	81
„ E.	Rothamsted and Thorpe	50	32	15	3	82
MIDLAND COUNTIES	Cirencester and East Retford	44	38	15	3	82
ENGLAND, S.	Reading, Maidstone, Downton, and Horsham.	61	30	8	1	91
SCOTLAND, W.	Stranraer, Islay, and Dumbarton	63	29	5	3	92
ENGLAND, N.W.	Leyburn and Prescot	61	35	4	—	96
„ S.W.	Tortworth, Clifton, and Glastonbury	60	33	7	—	93
IRELAND, N.	Moynalty and Edgeworthstown	58	30	9	3	88
„ S.	Tralee, Kilkenny, and Parsonstown	58	38	6	—	94
	Mean for all districts	56	32	10	2	88

These figures show that the results for the forecasts for 1892 reached a total per-centage of success of 88, being one lower than was recorded in the three preceding years.

The Council have again been in communication with the Board of Agriculture on the subject of these forecasts.

Storm
Warnings.

Storm Warnings for the Coasts of the United Kingdom.—In Appendix IX., p. 67, are given the names of the stations furnished with signals for Storm Warnings, in accordance with Circular 717 of the Board of Trade, issued in February 1874.

These stations were, at the end of March 1893, 173 in number, situated:—

83 in England, 17 in Wales, 47 in Scotland, 20 in Ireland, 3 in the Isle of Man, and 3 in the Channel Islands.

A comparison has been made in the Office between the warnings issued during the year and the weather experienced on our coasts,

the warnings being tested by the method explained in Appendix VII., p. 64. The results of this comparison are shown in the following tables:—

Storm Warnings

RETURN of the RESULT of the COMPARISON between the WARNINGS ISSUED and the WEATHER EXPERIENCED in 1892.

Coasts.	Total No. of Orders to hoist and repetitions.	Warnings justified by subsequent gales. Force 8 and upwards.	Warnings justified by subsequent strong Winds. Forces 6 and 7.	Warnings not justified by subsequent Weather.	Warnings late. Force 9 reached at two Stations before issue.	Warnings partially late. Force 9 reached at one Station before issue.	Storms for which no Warning was issued.
Scotland, N.E.	46	30	14	2	—	—	Jan. 29, 30, March 16, April 22, Oct. 7.
" E.	30	7	17	6	—	—	Feb. 1.
" N.W.	49	29	14	3	—	3	Oct. 7.
" W.	43	24	15	4	—	—	—
Ireland, S.W.	45	26	15	2	1	1	March 16, Oct. 7.
" N.W.	49	36	10	2	1	—	—
Irish Sea	39	31	6	1	—	1	Feb. 15, Aug. 14-15.
St. George's Channel	30	13	14	2	1	—	—
Bristol Channel	32	20	9	1	1	1	Aug. 30, Oct. 29.
England, S.W.	32	22	8	1	1	—	—
" S.	23	12	10	—	—	1	Jan. 7.
" S.E.	23	11	8	4	—	—	Dec. 9.
" E.	23	11	8	4	—	—	—
" N.E.	24	18	4	1	—	1	Jan. 29-30, Feb. 1, Oct. 23, Dec. 17.
Totals -	488	290	152	33	5	8	
Per-centages -		59.4	31.2	6.8	1.0	1.6	

NOTE as to GALES experienced in 1892 on certain parts of our coasts, and for which WARNINGS were NOT ISSUED.

Gales of *January 7th, February 1st, August 30th, October 23rd, December 9th, and December 17th* were all caused by the extension to coasts, which were not considered threatened, of gales for which other coasts affected had been properly warned.

January 29th—30th.—W. to N.W. gale caused by a large depression over Scandinavia, and shallow secondaries over our northern districts. Wind rose very slowly; effect of secondaries under-estimated.

February 15th an Easterly gale over the Irish Sea, in rear of a depression which as it moved south-eastwards over our north-western districts grew much deeper. The 6 p.m. map of the 14th was not of a threatening type; next morning it was too late to issue warnings.

March 16th.—Southerly to South-westerly gale on our north and north-west coasts. A further examination of the charts fails to show anything to give warning of this gale.

Storm
Warnings.

April 22nd.—W. to N.W. gale in Scotland N.E. due to a large depression in the far north. Apparently caused by *rise* of barometer in far west—in rear of the disturbance.

August 14th to 15th.—Southerly to Westerly gale over Irish Sea prevailed round a very small depression, which at 6 p.m., 14th, was not at all of a threatening character, and by 8 a.m., 15th, had disappeared entirely.

October 7th.—Northerly and North-Westerly gales on our north and north-west coasts. The depression which caused this gale moved northwards over the North Sea, while pressure simultaneously increased over our western districts; consequently the gale occurred, though not looked for.

October 29th.—South-South-Westerly gale over the British Channel. Very local, not felt either at Pembroke or Scilly.

Comparison of
results for
1892 with
previous years.

The following table contains a comparative statement of the storm warnings and their results in 1892, and in the ten preceding years. It will be seen that the total per-centage of warnings justified is 90·6, being the highest on record.

Years.	Total No. of Warnings issued.	Warnings justified by subsequent Gales.	Warnings justified by subsequent strong Winds.	Total Warnings justified.	Warnings not justified by subsequent Weather.
		p.c.	p.c.	p.c.	p.c.
1883	610	56·2	21·6	77·8	20·8
1884	461	66·4	20·0	86·4	12·1
1885	591	55·3	24·0	79·3	19·5
1886	542	55·3	26·9	82·2	15·9
1887	472	55·5	26·1	81·6	16·4
1888	539	55·3	28·6	83·9	14·3
1889	373	47·7	33·5	81·2	16·9
1890	525	61·0	25·5	86·5	9·3
1891	522	62·3	24·5	86·8	7·5
1892	488	59·4	31·2	90·6	6·8

Fishery
Barometers.

Fishery Barometers.—To add to the means available to the sea-going population for obtaining warnings of stormy weather barometers were many years ago supplied by the Board of Trade on loan to fishing villages and other places on the coast, to be set up for public information. The whole number of stations supplied by the Office with these instruments is 192. Of these 62 are in England, 6 in Wales, 54 in Ireland, 65 in Scotland, 4 in the Isle of Man, and 1 in Jersey. The list is given in Appendix X., p. 69.

PART III.

LAND METEOROLOGY OF THE BRITISH ISLES.

Observatories and Stations.—The observations of the climate of the British Isles, which are received by the Office from certain stations, may be arranged in five classes, according to the degree of completeness with which they are made.

1. Seven Observatories, furnished with self-registering instruments by which all the principal meteorological phenomena are recorded continuously. These alone afford the materials necessary for the study of the periodic variations of the meteorological elements. Self-recording observatories.

2. Nine Anemographic stations furnished with instruments registering the wind only. The records from these stations relate rather to weather as distinguished from climate, and are especially important in connexion with storms. They are often useful in affording evidence available in courts of law with respect to collisions at sea, and damage done by wind. Anemographic stations.

3. Seventy-four stations of the Second Order, furnishing climatological information from eye observations taken twice a day. The observers at these stations are all volunteers. Stations of Second Order.

4. Thirty-two Telegraphic Reporting Stations, at which the observations are taken by eye, but supplemented in some cases by self-recording aneroids, &c., and supply the material upon which the daily weather reports and forecasts are based. The hours of observation at these stations are determined by the requirements of the telegraphic system, as explained in Part II., but the data which they furnish are also utilized to afford climatological information for parts of the country where Stations of the Second Order do not exist. Telegraphic Reporting Stations.

5. Extra stations furnishing returns with less completeness and detail than those of Class 3. Extra stations.

A continuous record of the amount of bright sunshine is received from 51 stations in the British Isles, of which some are First or Second Order stations, whilst from others the sunshine record alone is received. See Appendix XI., p. 70. Sunshine stations.

A fuller account of these several stations and of the methods employed by the Office in dealing with their records will be found in Appendix XII., p. 72.

Appendix XIII., p. 75, contains a list of all documents relating to the land meteorology of the British Isles received at the Office during the year. Documents received.

Death of Prof. Grant.—The Council have to mention their regret at the death of Prof. Robert Grant, F.R.S., which occurred on the 24th of October. Prof. Grant had, ever since 1868, been in charge of one of the seven observatories originally established by the Office. Glasgow was one of those which was not continued in operation at the charge of the Meteorological Office after 1884, but Prof. Grant by his own personal energy succeeded in obtaining from the local authorities at Glasgow funds sufficient to keep up the observations subsequently. Death of Prof. Grant.

Inspection of the Stations.—The self-recording observatories and the anemographic stations (Classes 1 and 2), as well as the Telegraphic Reporting Stations (Class 4), are regularly visited each year by the Inspectors of the Office. The extra stations (Class 5) are inspected as opportunity offers. Of the Stations of the Second Order (Class 3), some belong to the Royal Meteorological Society, and these are visited by an Inspector appointed by that Society, Inspection of stations.

Inspection
of stations.

an allowance being made by the Office toward the cost of the inspection, in accordance with the recommendation of the Treasury Committee (1877). The remaining Stations of the Second Order, including those belonging to the Scottish Meteorological Society, are visited, most of them annually, by the Inspectors of the Office. The inspection of the self-recording observatories, which is carried out by the staff of Kew Observatory, was interrupted during the year by the protracted illness of Mr. Whipple, and was only partially carried out by Mr. T. W. Baker, whose time could not be spared from his duties at Kew. Mr. Baker went to Glasgow Observatory in April, and replaced some instruments which had been damaged.

Death of Mr.
Whipple.

The death of Mr. Whipple, which occurred on the 8th of February, has been a very serious loss to the Council, for from his long experience of the work of the Kew Observatory he was eminently fitted to carry out his inspections efficiently, and otherwise to assist in the work of the Office in many important directions.

Extracts from the reports of the Inspectors are given in Appendix VI. p. 46.

Reports sup-
plied to
Registrar
General for
Ireland.

Information supplied to the General Register Office, Dublin.—Reports from the Irish stations of the Office have been regularly supplied to the Registrar General for Ireland, for his Weekly and Quarterly Returns.

Publications.

The Weekly Weather Report, which is prepared in the Telegraphic Branch of the Office (see Appendix VII., p. 60), supplies, by its synchronous charts and Monthly Summaries, a very complete and instructive view of the chief meteorological changes, day by day, over the greater part of Europe, such as is not to be found in the similar publications issued by any other office.

Appendix I. to the Weekly Weather Report for 1892 gives a summary for each quarter, and for the whole year, of the Rainfall and Temperature for each district, for the 27 years 1866–1892, and also the Monthly and Progressive values of Accumulated Heat, Rainfall, and Bright Sunshine for all the districts in each month of 1892. Appendix II. to the same Report gives the Weekly and Progressive values for the same elements during the year 1892 (in continuation of Appendix II. for the year 1891).

Hourly Read-
ings of Me-
teorological
Observations.

Hourly Readings of Meteorological Instruments.—The Volumes of Hourly Means for 1889 and 1890 have appeared, and that for 1891 has been commenced. These volumes differ in no respect, as to arrangement, from that for the year 1887, described in the Report for 1890.

Harmonic
Analysis of the
Hourly Read-
ings.

Harmonic Analysis of the Hourly Observations at British Observatories.—A discussion of the results obtained from the daily curves for temperature at the Observatories, which were published last year, has been laid before the Royal Society by Gen. R. Strachey, the Chairman, and an abstract of this communication is given as Note B., p. 27. The full paper appears in *Philosophical Transactions* for 1893.

Observations at Stations of the Second Order.—The volume for 1889 is now nearly complete. Stations for publication.

The following is the list of stations for which returns are being published for that year:—

STATIONS for PUBLICATION in DETAIL on Form A.,
21 in Number.

Stations.	In connexion with	Years already published in detail.	Remarks.
Glasgow - -	M. O.	13	Formerly observatories. 10 years hourly readings already published. Continuous records of pressure, temperature, wind, and rainfall still available, except for Armagh, which furnishes such records for wind and rain only. For Stonyhurst and Armagh the records from 1884 have been published on Form A.
Stonyhurst - -	M. O.	15	
Armagh - -	M. O.	15	
Dunrobin Castle -	S. Met. Soc.	9	High-level station (1,113 feet).
Braemar - -	S. Met. Soc.	9	
Dundee - -	S. Met. Soc.	9	
Wolfelee - -	S. Met. Soc.	3	
Scarborough -	R. Met. Soc.	8	
Hillington -	R. Met. Soc.	12	
Churchstoke -	R. Met. Soc.	13	
Carmarthen -	R. Met. Soc.	14	
Margate - -	R. Met. Soc.	7	
Babbacombe -	R. Met. Soc.	12	
Swanbister (Orkneys).	M. O.	3	This is the most northern station available, and there is a continuous record of wind.
Laudale - -	M. O.	10	
Douglas (Isle of Man).	M. O.	11	At both of these stations there are long series of observations available taken by the officers of the Ordnance Survey.
Southampton -	M. O.	11	
Dublin (Mountjoy Observatory).	M. O.	3	
Markree Castle -	M. O.	14	
Parsonstown -	M. O.	16	
Londonderry -	M. O.	10	

Stations for
publication.LIST for PUBLICATION on Form B. (Monthly Means and
Summaries).

	Swanbister.	❧ Buxton.
❧	Lairg.	❧ Cheadle.
❧	Dunrobin Castle.	❧ Hillington (Norfolk).
❧	Gordon Castle.	Uppingham.
❧	Glencarron.	❧ Churchstoke (Montgomeryshire).
	Aberdeen.	Geldeston (Beccles).
❧	Fort Augustus.	❧ Bennington.
❧	Braemar.	❧ Cheltenham.
❧	Fort William.	St. David's.
❧	Lednathie.	❧ Carmarthen.
	Laudale (Argyleshire).	❧ Berkhamsted.
❧	Dundee.	Kew.
❧	Ochertyre.	❧ Margate.
❧	Callton Mor.	Southampton (Ord. Survey Office).
	Glasgow.	Eastbourne.
❧	Rosewell.	❧ Rousdon.
❧	Rothesay (Isle of Bute).	❧ Dartmoor.
❧	Marchmont.	❧ Babbacombe (Torquay).
❧	Wolfelee.	Falmouth.
❧	Pinmore (Ayrshire).	
❧	Cramlington.	Londonderry.
❧	Glenlee.	❧ Lissan (Co. Tyrone).
❧	Cargen.	Armagh.
	Durham.	Brookeborough (Colebrooke Park)
	Newton Reigny.	Markree Castle (Co. Sligo).
	Aysgarth (Yorkshire).	Edgeworthstown.
❧	Scarborough.	Dublin (Glasnevin).
	Cronkbourne (Douglas), Isle of Man.	Dublin (Mountjoy Observatory,
	York.	Phoenix Park).
	Stouylurst.	Dublin (City).
❧	Wakefield.	Parsonstown (Birr Castle).
	Prestwich.	❧ Killarney.
	Liverpool (Bidston Observatory).	Valencia.
❧	Llandudno.	

The Stations marked ❧ belong to the Scottish, and those marked ❧ to the Royal Meteorological Society.

With reference to these stations and the arrangements with the Royal Meteorological Society and the Scottish Meteorological Society as to the supply of information therefrom, a considerable increase has been made in the allowances to the respective Societies, inasmuch as it was found that the terms hitherto existing were not sufficient to defray the cost of supply of the information.

PART IV.—MISCELLANEOUS.

Sea Surface
Temperature.

Sea Surface Temperature on the Coasts of the British Isles.—These observations, which are obtained through the courteous assistance of the Admiral Superintendent of Naval Reserves, the Trinity House, and the Commissioners of Irish Lights, are still continued, and a large amount of valuable information is thereby collected.

A list of the stations at which the observations are taken will be found at Appendix XIV., p. 81.

Anemometer
Experiments.

Anemometer Experiments.—The investigations on wind measurements which have been carried out for some time by Mr. W. H.

Dines, as mentioned in last Report, have for the present been concluded, and have resulted in the proposal of a new form of pressure gauge. One of these instruments has been constructed and erected on the roof of the Office in Victoria Street. A description of it will be found in Note A., p. 21. Anemometer Experiments.

A modification has been made in the bridled anemometer at Holyhead, used to record gales. It has been arranged that the pencil shall not commence to work unless the wind reaches a definite force, which can be fixed by the person in charge.

Seismometry.—An application was made to the Council in October by Prof. J. Ewing, F.R.S., to erect a seismometer at the Observatory at Fort William which is not very far distant from Comrie in Perthshire, a district frequently visited by slight shocks of earthquake. The Council at once granted permission for this interesting experiment. Seismometry.

Rain Means for the British Islands.—The Council have decided on publishing the means of Rainfall for the ten years 1881 to 1890, mainly from figures contributed by the Scottish Meteorological Society, and by Mr. G. J. Symons, F.R.S. It is intended that the distribution of the stations over the country shall be more uniform than was practicable in the former publication. The great and growing increase in the number of rain observers has rendered this course practicable. Rain Means.

Sunshine of the British Isles.—The Council have decided to undertake for the seven Observatories the regular tabulation of the hourly values of sunshine, from the year 1881, and the work is in hand. Sunshine.

Fog.—The examination of the weather reports for fog for the 15 years, 1875–1890, has now been completed by Mr. Scott, and the reports have been analysed and classified according to the force of wind reported. The results of the inquiry have been laid before the Royal Meteorological Society, and will shortly be published. Fog.

LIBRARY.

The library contains standard works on Meteorology and the allied Sciences, and is, besides, particularly rich in Transactions, Proceedings, Reports, and other Publications which give a large mass of Meteorological observational data from all parts of the world, extending over many years. It consists at present of about 12,000 volumes and pamphlets, exclusive of charts and MS. records of observations. The books and other documents are accessible to scientific men for reference at the Office. Library.

Appendix XV., p. 83, contains a list of the additions to the library during the year, which have been catalogued upon cards, and are entered in the reference catalogues under (1) Authors, and (2) Subjects.

EXPENDITURE.

Financial.

Appendix XVI., p. 105, shows the receipts and payments during the year ending 31st March 1893. The amount voted by Parliament was 15,300*l.*, as in the previous year.

The following abstract of expenditure shows the amount properly chargeable to the year in question, and its distribution under the various heads, together with the increase or decrease in 1892-93 as compared with the previous year :

NET EXPENDITURE.	1891-92.			1892-93.			Increase.			Decrease.		
	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
GENERAL ADMINISTRATION:												
<i>Payment of Council</i> -	992	10	0	993	15	0	1	5	0	—	—	—
<i>Secretary</i> -	800	0	0	800	0	0	—	—	—	—	—	—
<i>Office</i> -	793	6	0	793	0	0	—	—	—	0	6	0
<i>Rent, fuel, and lighting</i> -	700	11	3	720	18	2	20	6	11	—	—	—
<i>Alterations to premises, attendance, and contingencies</i> -	553	10	3	476	10	1	—	—	—	77	0	2
<i>Expenses incidental to International Meteorological Congress</i> -	32	16	9	2	8	0	—	—	—	30	8	9
<i>Pensions</i> -	186	16	4	186	16	4	—	—	—	—	—	—
SPECIAL RESEARCHES -	905	1	8	882	13	2	—	—	—	22	8	6
LAND METEOROLOGY -	5,182	2	9	3,671	8	0	—	—	—	1,510	14	9
WEATHER INFORMATION -	3,823	6	0	3,847	8	6	24	2	6	—	—	—
INSPECTIONS -	584	0	11	487	7	1	—	—	—	96	13	10
OCEAN METEOROLOGY -	2,351	5	0	2,360	6	0	9	1	0	—	—	—
Total -	£ 16,905	6	11	15,222	10	4	54	15	5	1,737	12	0

In the year 1892-93 the sum of 1,551*l.* 2*s.* 11*d.* was paid to the Post Office on account of inland and foreign telegrams, allowances to clerks, and rental of private wires. The decrease under Land Meteorology is chiefly due to the outlay on Valencia Observatory in the preceding year.

(Signed) R. STRAUGHY,
Chairman.

NOTE A.

TUBE ANEMOMETER (communicated by MR. W. H. DINES).

This instrument takes advantage of the small differences of pressure which occur inside a tube or vessel, when the wind blows across or into variously shaped openings in the tube.

Thus, if the wind blows straight at the opening, a small increase of pressure is caused in any tube or vessel that is in airtight communication with the opening; and if the wind blows across the opening, in general a decrease of pressure occurs.

A full description of the instrument, and of the manner in which advantage is taken of this fact, is given in the *Quarterly Journal of the Royal Meteorological Society* for July 1892 (Vol. XVIII., p. 165), and is here reproduced.

There are two parts, the head, figs. 1 and 2, and the recording apparatus, figs. 3 and 4, the connexion between the two being made by two tubes of lead or composition metal $\frac{3}{8}$ -in. diameter.

The head of the anemometer, which consists of two parts, is shown in Figs. 1 and 2.

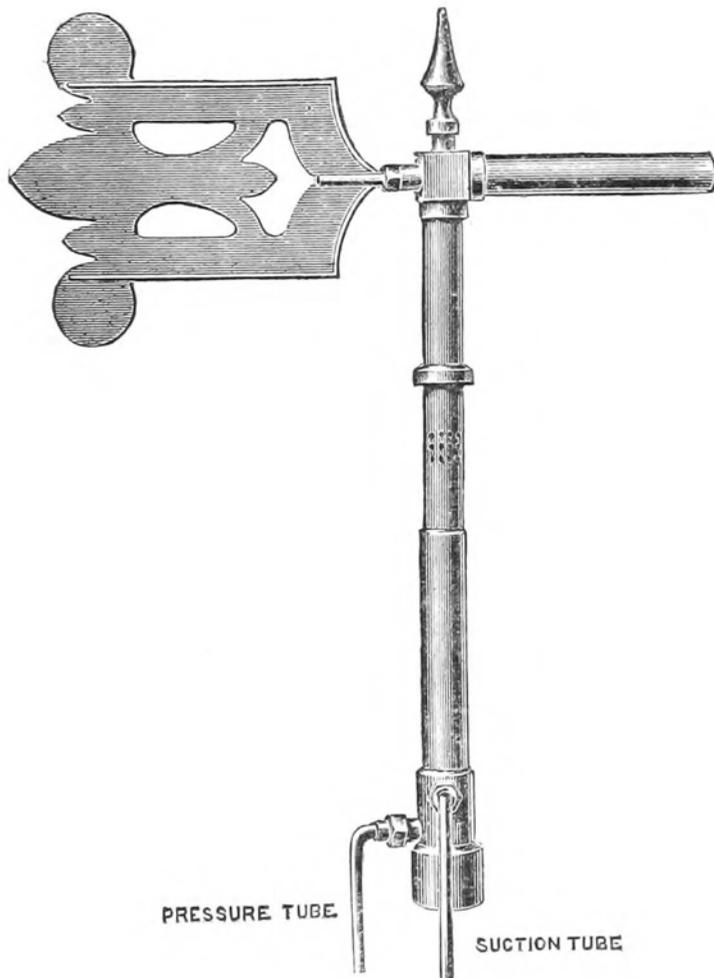


FIG. 1.

The moveable part of the head consists of two pieces of 1 in. tube connected at right angles, and a vane.

The horizontal tube is closed at one end, the other end (*A*) is kept facing the wind by the vane.

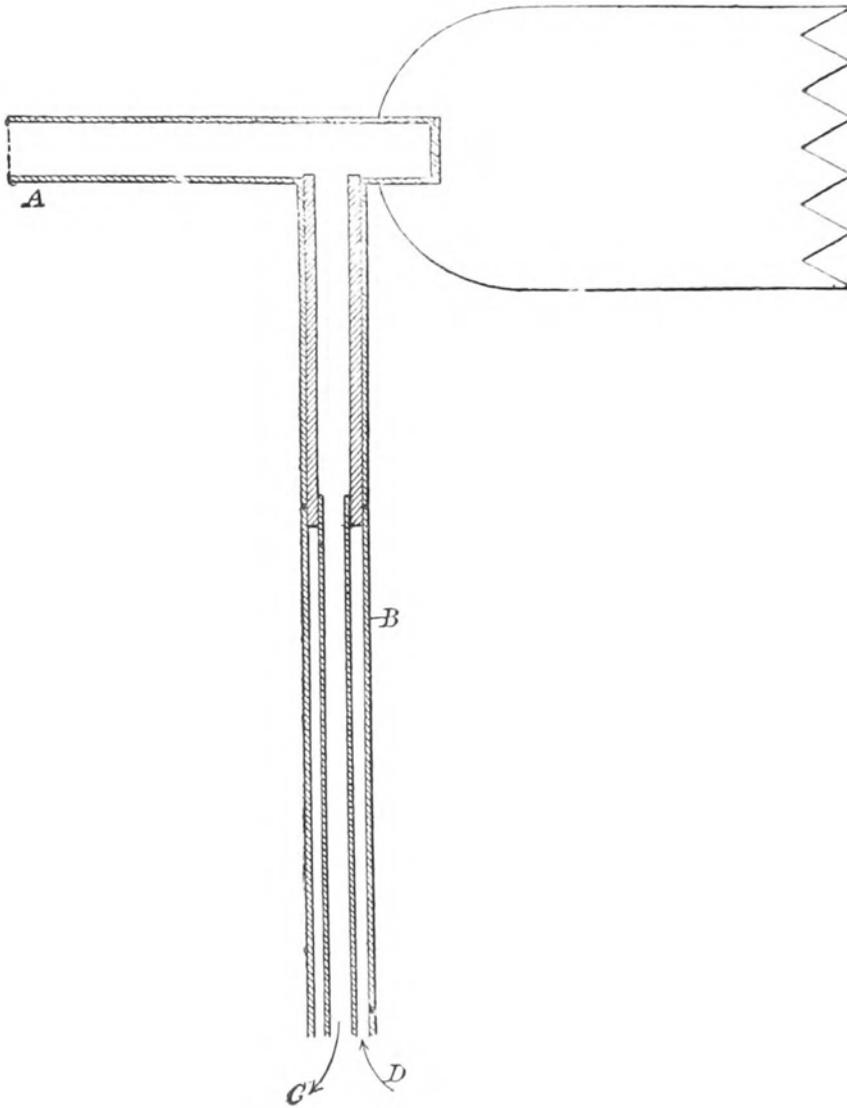


FIG. 2.—Head of Tube Anemometer in Section.

The fixed part is constructed out of three pieces of brass tube of consecutive sizes. The largest is $1\frac{1}{8}$ in. diameter, outside measurement. The medium size is of thicker metal than the others, and just fits into the largest size. The smallest piece is $\frac{3}{4}$ -in. diameter, and just fits into the medium-sized tube. The two extremes are placed at the bottom, one inside the other, an annular space being thus formed between them. The medium-size tube drops into this annular space, thus closing it at the top, and is also carried up, thus forming a bearing round which the movable part turns. Near the top of the annular space (at *B*) $12\frac{1}{2}$ -in. holes are drilled in the outer tube in a ring, by which holes the annular space is connected with the outer air.

Vol. XVI., p. 208, 1890, it was found that the vacuum produced by the wind blowing over the mouth of an open tube was very dependent upon the exact perpendicularity of the tube, and if that kind of head had been used a slight inclination of the wind, which might easily be produced by some adjacent building, would have seriously influenced the result.

The partial vacuum, produced by the action of the air in passing over the ring of holes in the upright tube, has been found not to be subject to this objection. The pressure of the air blowing against the mouth of the open tube has also been found to be independent of the inclination of the wind direction to the axis of the tube, so long as the angle does not exceed 15° to 20° ; hence the whole instrument, even if the vane did not act readily, would be independent of moderate changes of wind direction either in azimuth or inclination.

The way in which the change of pressure produced by the wind actuates the pen of the recording apparatus is shown in Fig. 3.

A cylinder (*G*) is filled with water up to the level *K*. A tube *F* passes up the centre, the mouth of the tube being about 1 in. above the surface of the water. A cylindrical copper vessel *M*, which will subsequently be called the float, is placed, mouth downwards, over this tube, so that the air space inside it can only communicate with the outer air through the tube *F*. On the outer side of the float a sealed air chamber *N* is formed, and a copper ring is attached to the bottom at *P*, of such a weight that the whole just floats with the top of the air chamber level with the surface of the water. A second cylinder *H* is placed mouth downwards in the outer cylinder *G*, fitting into it as closely as possible, and dipping below the surface of the water, forms a closed air space above the float. This space communicates with the outer air through the tube *E*. It will be seen that on either blowing into *F*, or sucking through *E*, the float will rise. It is also clear that if the float be raised by this means, the water level (*K*) outside the float is not disturbed, for the water which is driven or sucked from the inside exactly makes up for the smaller displacement of the float.

The tube *F* was connected with the inner tube *C* of the head (Fig. 5), and the tube *E* with the annular space *D*, the connexion being made in both cases by about 40 ft. of $\frac{5}{8}$ -in lead tube.

The inside cross section of the float is 20 sq. ins., and hence it is found that a wind velocity of 10 miles per hour causes an upward force of 371 grains to act on the float; 20 miles per hour produces a force of 1,484 grains, and so on. The outer surface of the air chamber *N* is so shaped that the float must rise 1 in. to displace 371 grains less water; 2 in. to displace 1,484 gr. less water, and so on, and thus the ordinate of the curve is made to correspond to the velocity, instead of to the pressure, of the wind. The chamber *N* is not exactly conical, but bulges out slightly in the central parts. The float is connected with the pen by a rod passing through a small hole in the top of the cylinder *H*. The hole is so nearly filled up by the rod that, in so far as this instrument is concerned, it may be considered air tight.

It is not, of course, absolutely air tight, but the case is similar to that of a small jet of common gas. The use of one small burner does not alter the pressure in the main by any perceptible amount.

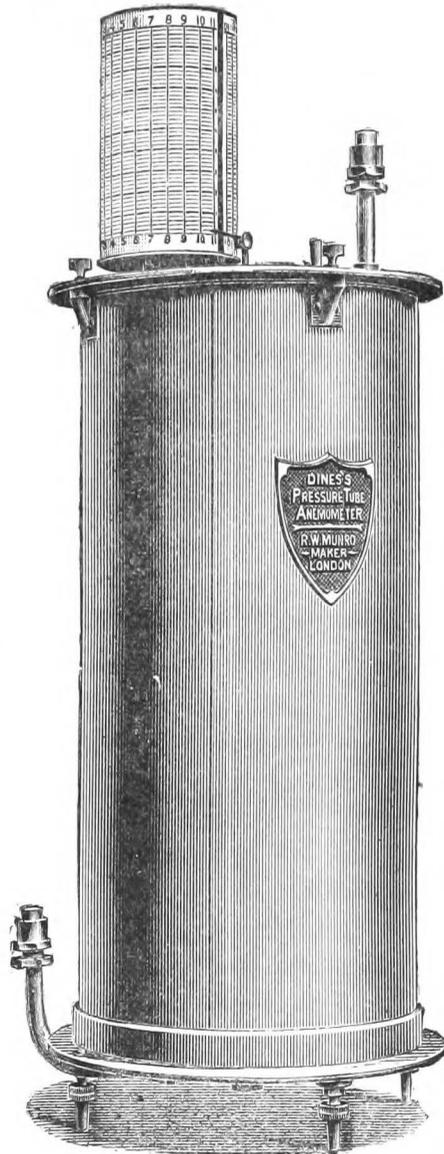


FIG. 4.

It is necessary to point out that the double tube and the closed space above the float are absolutely necessary to render the instrument independent of the accidental variations of pressure which may occur in the room in which the recording apparatus is placed. The pressures on which the action of the Tube Anemometer depends are very small; and hence if the instrument were constructed with one tube only, a slight alteration of the pressure in the room, which might easily be caused by opening or shutting a door or window, would alter the recorded velocity. There can be no doubt that the pressure in a room on the exposed side of a house during a gale is greater than in a room on the sheltered side, and if both doors be shut and both windows open, the difference may be considerable. Also in a closed room with an

open grate, making a good fire decreases the pressure by an appreciable amount. However, to test the point practically, the two tubes of the Anemometer were disconnected from the head and carried to two rooms on different sides of the house. The difference of pressure between the two rooms, acting upon the float of the recording apparatus, produced a curve which, had it been obtained in the ordinary way, would have indicated a mean velocity of about 12 to 15 miles per hour. The actual wind velocity, as shown by the Pressure Plate for the same period, was about 25 miles per hour. In this case care was taken to augment the difference of pressure between the rooms by suitably arranging the doors and windows; but it is clear that in the ordinary way great differences may exist, and if the instrument depended on one tube only, the indicated velocity would most probably be greater when placed in one room than it would be if placed in another.

NOTE B.

On the HARMONIC ANALYSIS of HOURLY OBSERVATIONS of
AIR TEMPERATURES at BRITISH OBSERVATORIES.

By LIEUT.-GEN. R. STRACHEY, the Chairman.

A paper read by me before the Royal Society on the 2nd of March 1893, contained a discussion of the results of the computations of the harmonic constants of the daily curves of temperature at Greenwich and at the seven observatories maintained by the Meteorological Office, contained in the volume recently published by the Office, to which reference was made in the last Report of the Council, p. 17.

The tables supply the values of the coefficients of the cosines and sines of the several terms of the usual harmonic series, representing any hourly value:—

$$A_n = p_0 + p_1 \cos n 15^\circ + q_1 \sin n 15^\circ + \&c. \quad . \quad . \quad . \quad (1).$$

They also give the amplitudes of the several components, and the epoch of maximum derived from the formula

$$A_n = p_0 + P_1 \sin (\mu 15^\circ + T_1) + P_2 \sin n (2 n 15^\circ + T_2), \&c. \quad (2).$$

A modification of the usual notation is made by introducing the value of the epoch of the first maximum that occurs after midnight, which is designated by the letter μ , and establishes more directly the connexion of the component with the hour of the day and the sun's place.

This system of analysis supplies the means of establishing an exact comparison between the characteristics of unsymmetrical curves, such as those that represent the hourly values of temperature, by resolving them into symmetrical components, having periods of 24 hours, 12 hours, 8 hours, 6 hours, and so forth; and its application to the records dealt with in these tables gives satisfactory proof of the important light it brings to bear on the nature and extent of the periodical changes of the diurnal temperature.

1. *Greenwich Temperature.*

The examination of the tables shows that, with very considerable variations of absolute magnitude, there is on the whole very marked consistency in the main characteristics of the components.

Taking as a test the position of the epoch of maximum, which may be regarded as more directly dependent on the sun's action and his position than the amplitude, it will be seen that the values of μ indicate very clearly the closeness of this connexion.

In all the components a truly periodical annual variation of the value of μ is apparent, and the period of maximum always travels

backwards, that is, it becomes earlier as the year passes from winter to summer, while it returns in the opposite direction in the change back to winter.

For the first component the variation of the five-years' mean of μ from the twenty years is in no month more than $2\frac{1}{2}^{\circ}$, or ten minutes of time, and the average for all months is less than half that amount.

In the second component the variation of the five-year mean of μ from the twenty-year mean is in no month more than 6° , and the average is only $2^{\circ}\cdot 3$, or nine minutes of time.

In the winter months the epoch of maximum of the third component is always between 4 a.m. and 5 a.m.; in March it changes rapidly, and in the summer is found invariably between midnight and 1 a.m., while after September it returns to its winter position. The variation of the five-year from the twenty-year mean of the values of μ in no month exceeds 5° , and the average in all months is only $2^{\circ}\cdot 1$, or $8\frac{1}{2}$ minutes of time.

The fourth component shows double maxima and minima, the former at the equinoxes, the latter at the solstices. The largest variation of the five-year mean of μ_4 for any month from the twenty-year mean is 10° , and the average for all months is $4^{\circ}\cdot 3$, or seventeen minutes. Considering how small are the absolute values of the coefficients p_4 and q_4 , on which the value of μ_4 depends, the average being a little less than $\frac{1}{10}$ th of a degree Fahrenheit, it is rather a matter of surprise that the variations should be so small than that they should reach their actual amounts.

It may be noticed that the total amplitude of the components being $\sqrt{(p^2 + q^2)}$, a considerable variation of its value is quite consistent with invariable, or slightly varying, values of μ , which depend on the ratio p/q .

The component of the first order, which in the winter is more than double the magnitude of any of the others, and in summer more than ten times as great, gives the dominant character to the daily curves of temperature. In the series of twenty years, variations in different years of as much as 100 per cent. are to be found for almost every month, but for the most part even these irregularities disappear in the mean of a series of five years, and the monthly means for the twenty years are remarkably consistent.

The progression of the value of P , in the course of the year, follows approximately the sine of the sun's meridional altitude, and the empirical formula

$$P = 10 \cos z - 0\cdot 91$$

gives a close approximation to the values shown in the tables, if a "lagging" of eight or ten days is allowed in reckoning the sun's place.

The second component has two clearly-marked *maxima* about the time of the equinoxes, and a principal *minimum* at midsummer.

The component of the third order varies in a converse manner, having two well-marked *minima* at the equinoxes, with a principal *maximum* at midsummer.

The component of the fourth order appears to combine the characters of the two previous ones, having two *maxima* about the time of the equinoxes, and a principal *minimum* in the winter.

The following empirical formulæ gives close approximations to the values of P_2 and P_3 :

$$P_2 = 1.08 + 0.20 \cos (\lambda + 126^\circ) + 0.41 \cos (2\lambda - 2^\circ),$$

$$P_3 = 0.42 + 0.16 \cos (\lambda + 260^\circ) + 0.10 \cos (2\lambda - 172^\circ),$$

in which λ is the sun's longitude.

The mean value of μ for the first component is 214° , corresponding to 2 h. 26 m. p.m., the variation due to season being 12° or 48 m. of time, by which the maximum is earlier in summer than in winter.

In the second order the first maximum in June is 24° , or 1 h. 20 m. earlier than in January.

In the third order the difference in the same direction is 63° , or 4 h. 12 m. of time.

In the fourth order there is some doubt as to the manner in which the change of epoch of the summer and winter maxima is brought about. From March, when the first maximum occurs about 60° after midnight, or 4 a.m., there is a continued retrogression till June, when the maximum is at 16° after midnight, or 1 h. 4 m. a.m. This is followed by a progression from June till October, when the maximum again occurs at about 60° , or 4 a.m.

In passing from October to November a sudden change takes place by which the maximum is established at about 10° after midnight. There is a like sudden change between January and February in the opposite direction, which again brings the maximum to 60° after midnight. From the component in November and February being very small, it is not improbable that these sudden changes may coincide with the component becoming zero.

Remembering that the fourth component includes four series of undulations, the most probable explanation of these changes is to be found in a change of the position of these undulations, during which, between January and February, the first recedes, and its place is taken by the second, which leads to the sudden appearance of a maximum about 60° , or 4 a.m. A similar change between October and November in an opposite direction would introduce the maximum at 10° , after midnight.

In the summer months (May, June, and July) the temperature curve during the day hours, from 8 a.m. to 8 p.m., hardly differs from a curve of sines, the first component being more than ten times as large as any of the others, which therefore influence the temperature, relatively, very little.

The relation of the epoch of the first maximum of the component of the third order to the time of sunrise is decidedly marked, the former occurring, on the average, about 12° , or 48 m. after sunrise; the mean deviation of the interval from that amount being only 7° or 28 m.

The periodical variation in the position of the maximum leads, during the winter months, to a *positive* maximum of this component about 1 p.m., which is combined with *negative* maxima four hours earlier and later, which correspond to the *reduced* temperature in the mornings and afternoons of the *shorter* days. In like manner, in the summer months, when this component has a *negative maximum* about 1 p.m., instead of a *negative minimum*, as in winter, there will be two *positive* maxima, one four hours earlier, the other four hours later, corresponding to the *higher* temperature in the mornings and afternoons of the *longer* days.

It will be seen that these positions of the midsummer and mid-winter maximum phases correspond respectively to days of 16 hours with nights of 8 hours, or days of 8 hours and nights of 16 hours, and that at these seasons, when the variations of temperature, due to these differences are greatest, the amplitudes of this component are also the greatest. At the equinoxes, with 12-hour days and nights, the component becomes a minimum; and at this season the change in the position of the maximum takes place as already noticed.

It might be supposed that an analogous relation between the fourth component and the occurrence of days of 18 hours, combined with nights of six hours, and *vice versâ*, is likely to arise. But the data are not forthcoming to test this.

Although the several components of the temperature curve cannot be regarded as indications of specific physical efficient causes, the examination of the graphical representations of the various curves presents points to which attention may usefully be drawn. The chief of these are the following:—

In the summer months the time of morning mean temperature is nearly where the first component becomes zero, the second and third components then balancing one another.

In the winter the time of morning mean temperature is later than in summer, and occurs when a positive value of the first component is equal to a negative value of the second.

The time of afternoon mean temperature throughout the year is somewhat either before or after 7 p.m., and almost exactly coincides with the time when the first and second components are equal, with opposite signs.

In the summer the time of absolute minimum is between the hours of 3 a.m. and 6 a.m., during which the whole of the components are negative.

Sunrise in December is about an hour and a half before the time of mean temperature, while in June it is more than four hours earlier.

Sunset in December is rather more than three hours *before* the time of mean temperature; in June it is about half an hour *after* that time.

The *rationale* of some of the empirical rules for obtaining the mean daily temperature from a limited number of observations is supplied by reference to the harmonic expressions for the hourly deviations of temperature from the mean value, it being borne in mind that the relative magnitude of the fourth component is very small.

In the first place it will be seen that by adding together the harmonic expressions for any two hours twelve hours apart, the whole of the *odd* components disappear, and that the sum is twice the mean value, added to twice the sum of the *even* components of the selected hours, which are equal. Disregarding the components above the fourth order, if the selected hours are such that the component of the second order is zero, which will be the case at hours corresponding to $\mu_2 + 45^\circ$ or $\mu_2 + 135^\circ$, then half the sum of the temperatures at the selected hours will be the true daily mean added to the fourth component for the selected hour, which at English stations will never amount to $\frac{1}{2}^\circ$, and on the average is less than $\frac{1}{6}^\circ$.

At Greenwich the mean between the observations at $4\frac{1}{2}$ a.m. or $10\frac{1}{2}$ a.m. and the corresponding afternoon hours in January, will differ by less than $\frac{1}{10}^\circ$ from the true value, and similar results will be obtained for June from the mean of observations made at 3 a.m. or 9 a.m. and the corresponding hours in the afternoon.

By taking the mean of observations at any four hours, at intervals of six hours, both the whole of the odd components, and those of the second order will disappear, and the result will only differ from the true mean by the amount of the fourth component for the selected hours.

As this component disappears when $\mu_4 \pm 22\frac{1}{2}^\circ = 0^\circ$ or 180° , the hours at Greenwich that will give the best result are 2, 8, 14, and 20, or 5, 11, 17, and 23.

So, if the mean of any three hours at equal intervals of eight hours be taken, the sums of the first, second, and fourth components will disappear, and the result will only differ from the true mean by the amount of the third component for the selected hours, which in no case can be so much as $\frac{3}{4}^\circ$.

By adopting hours when $\mu_3 \pm 30^\circ = 0^\circ$ or 180° , the third component disappears, and this result will be obtained at Greenwich by combining observations at 3, 11, and 19 hours, or 7, 15, and 23.

2. *Temperature at the Seven Observatories.*

The examination of the tables will show that in their main characteristics the results closely resemble those for Greenwich, and it will not be necessary to discuss them in any detail.

The amplitudes of the components of the first order are, however, in all cases less than that observed at Greenwich, the lowest values being those for Valencia and Falmouth, no doubt due to their position on the sea coast, for which stations the means for the years are $2^{\circ} \cdot 28$ and $2^{\circ} \cdot 35$ compared with $5^{\circ} \cdot 10$ at Greenwich.

The Kew values most resemble those at Greenwich, but the mean maximum at Kew is more than 1° less, and the mean for the year, $\frac{1}{2}^{\circ}$ less.

The mean values of μ_1 for the seven observatories lie between 205° and 220° , that for Greenwich being 214° . The means of the summer values are about 3° or 4° less than the mean of the year, and of the winter values as much above it, as in the case of Greenwich.

The amplitudes of the first components conform approximately, but not so closely as at Greenwich, with the sine of the sun's meridian altitude, but with a flattening of the curve in the summer months, and a tendency at some of the stations to a maximum value in May.

The components of the second and third orders, beyond which the analysis is not carried for these observatories, conform in all important respects to those for Greenwich, the numerical values of the latter being, however, in all cases somewhat higher. The epochs of maximum follow the same laws, with an increased divergence of the summer epoch from that of the winter at the more northern stations.

Making allowance for their smaller amplitude, the empirical formulæ expressing the mean values of the P_2 and P_3 components differ little from those obtained for Greenwich.

In order to test, and in some degree throw light, on the character and significance of the harmonic components of temperature that have been under discussion, and bearing in mind that they cannot be considered to represent separate effects of physical forces operating at the assumed periods of the components, I have, at the suggestion of Professor G. Darwin, computed the harmonic components that would produce a curve representing an intermittent heating action such as that of the sun, continued only during a portion of the day, and commencing and ending abruptly at sunrise and sunset.

All cooling effects have been disregarded, and the sun's direct heating action has been assumed to be proportional to the sine of his altitude; also following the empirical formulæ before given, the power of a vertical sun is taken to be 10. Having calculated the sun's altitude for each hour of the day, for midwinter, the equinox, and midsummer, for certain selected latitudes, the corresponding heating effects have been computed, to which the usual

method of analysis having been applied, the following results are obtained:—

Latitude.	Winter.				Equinox.				Summer.			
	Components.				Components.				Components.			
	I.	II.	III.	IV.	I.	II.	III.	IV.	I.	II.	III.	IV.
0°	-4.6	+1.9	0	-0.4	-5.1	+2.1	0	-0.5	-4.6	+1.9	0	-0.4
20	-3.4	+1.7	-0.3	-0.3	-4.7	+2.0	0	-0.4	-5.3	+1.7	+0.3	-0.3
30	-2.8	+1.4	-0.3	-0.3	-4.4	+1.7	0	-0.4	-5.3	+1.6	+0.4	-0.2
40	-1.9	+1.2	-0.4	-0.1	-3.9	+1.6	0	-0.4	-5.2	+1.2	+0.4	-0.1
45	-1.5	+1.0	-0.4	+0.1	-3.5	+1.5	0	-0.4	-5.2	+1.1	+0.4	+0.1
51½	-1.0	+0.8	-0.4	+0.1	-3.2	+1.3	0	-0.3	-4.8	+0.8	+0.4	+0.2
65	0	0	0	0	-2.2	+1.0	0	-0.2	-3.9	0	+0.1	+0.1

These figures represent the values of the components at mid-night. The signs indicate that the maximum of the first component is in all cases at 180°, or noon; of the second component the maximum in all cases, is at 0°, or midnight; of the third component in all latitudes the maximum in the winter is at 60°, or 4 A.M., in the summer at 0°, or midnight, the change taking place at the equinox, when the component becomes zero; of the fourth component in the lower latitudes up to 40°, the maximum is at 45°, or 3 A.M., at all seasons; in the higher latitudes the maximum is at 0°, or midnight, in winter and summer, and at 45° or 3 A.M., at the equinox.

For comparison, the following results from actual observations at latitudes specified are also given in similar form:—

Stations.	Winter.				Equinox.				Summer.			
	Components.				Components.				Components.			
	I.	II.	III.	IV.	I.	II.	III.	IV.	I.	II.	III.	IV.
Singapore (Lat. 1° 15' N.)	-5.0	+1.8	-0.3	-0.2	-6.5	+2.0	+0.7	-0.5	-4.6	+1.5	+0.3	-0.5
Hong Kong (Lat. 22° 18' N.)	-2.4	+1.0	-0.7	-0.8	-2.0	+0.7	0.0	-0.1	-1.9	+0.6	+0.1	-0.1
Lyons (Lat. 45° 46' N.)	-2.5	+1.0	-0.4	+0.1	-6.3	+1.5	+0.1	-0.3	-7.6	+0.8	+0.6	+0.2
Greenwich (Lat. 51° 30' N.)	-1.7	+0.8	-0.3	+0.1	-4.7	+1.3	+0.2	-0.2	-7.7	+0.6	+0.6	+0.2
Fort Rae (Lat. 62° 40' N.)	-1.1	+0.7	-0.3	+0.3	-7.7	+1.9	+0.4	-0.5	-6.0	+0.6	+0.2	+0.1

The close correspondence of the main features of these two tables is obvious.

The conclusion is unavoidable, that, although both in the actual and hypothetical cases the harmonic components, when combined, are truly representative of the peculiar forms of the curves from which they were derived, this affords no evidence of the existence of recurring cycles of action corresponding to the different components, but indicates that the results are, to a great extent, due to the form of the analysis.

The diurnal curve of temperature is not symmetrical in relation to the mean value, the maximum day temperature being much more in excess than the minimum night temperature is in defect. In order to adjust the first component, which is symmetrical about its mean value, to the actual unsymmetrical curve, it must be modified by the other components. That of the second order which has one of its maxima not far removed from the minimum of the first order supplies the chief portion of the compensation due to this cause.

Further from the character of the analysis, when the diurnal curve is symmetrical on either side of the hour half-way between noon and midnight, that is, when the day and night are equal in length, the third component becomes zero. Any departure from this symmetry introduces a component of the third order, with the result that with a day shorter than 12 hours one maximum will fall in the day between 6 A.M. and 6 P.M., and the other two in the night between 6 P.M., and 6 A.M., while with a day longer than 12 hours, two maxima will occur in the day and only one in the night. In the former case the negative portions of the component correspond with the reduced morning and afternoon temperatures of the short day, and in the latter the two positive phases correspond with the higher temperature of the mornings and afternoons of the longer day.

These conclusions are in conformity with those previously indicated.

The available data are insufficient to enable us to say whether the corresponding results connected with the fourth component are as fully supported by observation as in the case of the third, but the facts so far as they go confirm this view.

It may also be pointed out that, if instead of reckoning the epochs of maximum from midnight, that nearest to noon had been adopted, it would have been seen that there is a distinct tendency for all these epochs to approach noon, affording evidence which is perhaps hardly required that they are all closely dependent on the passage of the sun over the meridian.

For Greenwich the results would be—

	Winter.	Equinox.	Summer.
1st component	- 222°	215°	210°
2nd „	- 200	198	181
3rd „	- 194	—	(193)
4th „	- 190	(193)	196

In the case of the third and fourth components, the figures enclosed in brackets are epochs of minimum.

APPENDIX.

APPENDIX I.

LIST of CAPTAINS and OFFICERS who have sent in Logs classed as "Excellent" during the year ending March 31, 1893. The figures opposite to each show the total number of such Logs which they have returned to the Office during the period that they have been observing.

Name of Captain or Officer.	Number of "Excellent" Logs.	Ship.
Andersen, O. E. - - -	8	S.S. "Longhirst."
Angus, T. S. - - -	5	S.S. "Ballaarat."
Armstrong, B. G. - - -	2	S.S. "Para."
Atkinson, G. W. - - -	5	S.S. "Kaisar-i-Hind."
Barclay, J. - - -	1	S.S. "Thermopylæ."
Baxter, A. S. - - -	7	"City of York."
Belding, R. - - -	5	Barque "Atlantic."
Bennett, E. C. - - -	15	"Talus."
Bett, Dr. W., R.N. - - -	2	H.M.S. "Stork."
Blackburne, H. S. - - -	11	S.S. "Bombay."
Bolton, S. H. - - -	15	S.S. "Edith Hough" and S.S. "Baidar."
Bourke, Capt. E. G., R.N. - - -	8	H.M.S. "Ringarooma."
Bright, H. - - -	7	Barque "Beltana."
Buchan, J. - - -	22	S.S. "Deramore."
Cameron, J. G., R.N.R. - - -	9	S.S. "Germanic."
Campbell, R. - - -	9	S.S. "Elton."
Crotty, F. H. - - -	6	"Evesham Abbey."
Crowley, C. - - -	6	"Verajeau."
Crutchley, W. C., R.N.R. - - -	24	S.S. "Kaikoura."
Dart, L. C. - - -	13	Barque "Semantha."
Day, Lieut. E. A., R.N. - - -	4	H.M.S. "Dart."
Docherty, H. - - -	4	"Tinto Hill."
Dyke, H. W. - - -	10	"Tenasserim."
Elliott, W., R.N.R. - - -	5	S.S. "Clan Murray."
England, T. - - -	12	Barque "Glen Grant."
Exham, T. K., F.R.A.S. - - -	13	S.S. "Tamar."
Field, Comr. A. M., R.N. - - -	10	H.M.S. "Egeria."
Fraser, W. D. - - -	6	"Corolla."
Frederick, Lieut. and Comr. G. C., R.N. - - -	12	H.M.S. "Dart."
Hand, Sub.-Lt. G. E. B., R.N. - - -	2	H.M.S. "Egeria."
Irving, P. J. - - -	10	S.S. "Teutonic."
Jamieson, D. E. - - -	1	S.S. "Port Adelaide."

Name of Captain or Officer.	Number of "Excellent" Logs.	Ship.
Lehman, C.	3	"Loch Sloy."
Martin, Walter, R.N.R.	4	S.S. "German."
Millican, J. W.	7	S.S. "Loughbrigg Holme."
Milner, W. H.	14	S.S. "La Plata" and S.S. "Trent."
Mitchell, J.	2	Barque "Cape York."
Moignard, P.	6	"Garsdale."
Moore, Capt. W. U., R.N.	18	H.M.S. "Penguin."
Munn, L. A.	7	S.S. "Trojan" and S.S. "Spartan."
Murdoch, Peter	13	"Sierra Lucena."
Parry, M.	17	S.S. "Prydain."
Peebles, R.	16	Barque "Bracadale."
Peterkin, W.	2	"Holkar."
Pope, J.	8	S.S. "Dee," S.S. "Larne," S.S. "Tagus," and S.S. "Essequibo."
Price, J. H.	6	Barque "Viola."
Rosseter, W. L.	15	"Brenda."
Scott, G. P.	9	"Holyrood" and "Crompton."
Shearer, George	12	"Airlie."
Simpson, Alexander	15	S.S. "Thermopylæ."
Simpson, Alexander	22	S.S. "Traveller."
Smyth, Lieut. and Comr. M. H., R.N.	2	H.M.S. "Stork."
Spalding, T. F.	3	S.S. "Australasian."
Streater, R.	3	"Euterpe."
Tait, H.	1	S.S. "India."
Thompson, J. E.	5	S.S. "Monarch."
Thomson, A.S., R.N.R., F.R.G.S.	14	S.S. "Silvertown" and S.S. "Dacia."
Travers, H. de la Cour	10	S.S. "Scot."
Trenaman, R. W.	4	S.S. "Pascal."
Trott, S., F.R.Met.Soc.	22	S.S. "Minia."
Tyson, J.	1	S.S. "Arab."
Walker, H., R.N.R.	16	S.S. "Aurania."
Walker, J. J., F.L.S. Ch. E., R.N.	5	H.M.S. "Penguin."
White, W. E., R.N.R.	6	S.S. "Ormuz."
Wilson, J., R.N.R.	9	S.S. "Ethiopia."
Worrall, W. A.	2	Barque "Lebu."

APPENDIX II.—SHIPS supplied and DOCUMENTS returned during the year ending 31st March 1893.

The number of merchant ships supplied with standard instruments and meteorological logs during the above period was 116. The number of logs and documents from Foreign Stations, received during the same period, and registered in the Office, amounted altogether to 351, of which 155 were returned from ships, and the remainder from land stations, outside the British Isles.

LIST of DOCUMENTS received from FOREIGN LAND STATIONS.

Place.	Observer.	No. of Documents.	Nature of Observations.
Abaco (Bahamas)	Joshua Thompson and J. A. Williams, Lightkeepers.	2	Lighthouse Register, 1892, January to December.
Adelaide (Torrens Observatory)	C. L. Wragge, F.R.G.S.	1	One observation daily, 1884, July to December; 1885, January to April and July; 1886, January and February.
Benin River (W. Coast of Africa)	Capt. H. L. Galloway, Vice-Cousul.	3	Daily observations of barometer and thermometer, 1892, April, May.
Beyrout (Lee Observatory)	R. H. West, M.A.	11	Two observations daily, 1892, March to December; 1893, January, February.
Breaksea Island (King George's Sound).	J. A. Symonds	2	Lighthouse Register, 1892, January to December.
Brunana (Mt. Lebanon)	Thomas Little	7	Two observations daily, 1892, March to September.
Cape Juby (N.W. Africa)	W. B. Silverwood	12	" " " 1892, March to December; 1893, January and February.
Cape Pembroke (Falkland Islands)	G. K. Broom, Lightkeeper	3	Lighthouse Register, 1891, July to December; 1892, January to December.
Cay Lobos (Bahamas)	Byron N. Jones, Lightkeeper	1	" " " 1892, January to June.
Cay Sal (Bahamas)	T. R. Thompson, Sen., Light-keeper.	1	" " " 1892, January to June.
Famagusta (Cyprus)	G. Eliades	6	Two observations daily, 1892, January to December; 1893, January.
Futuna, New Hebrides	Rev. W. Gunn, L.R.C.P.	1	Notes of Cyclone on 17th February 1892.
" "	" "	6	Three observations daily, 1887, January to December; 1888, January to July.
" "	" "	5	Two observations daily, 1892, April to September.
George Town (British Guiana)	Robert Ward	8	" " " 1892, February to December.
Gibraltar	Staff-Sergeant K. Scott, Med. Staff Corps.	13	" " " 1892, February to December; 1893, January, February.

LIST of DOCUMENTS received from SHIPS.

Captain's Name.	Ship.	Voyage.	Year.
¹ Aagaard, O. O.	S.S. Bellucia	River Plate, Rio Janeiro, and Valparaiso	1891-92
Andersen, O. E.	S.S. Longhirst	Parozuelas and Philadelphia	1892
" "	"	Philadelphia, Marseilles, and Amsterdam	1892
" "	"	Venice, Philadelphia, and Bordeaux	1892
Anderson, Charles	S.S. Achilles	China and Japan, via Suez	1890
² Angus, T. S.	S.S. Ballarat	Australia, via Suez	1892-93
³ Armstrong, B. G.	R.M.S. Para	West Indies	1892
⁴ " "	"	"	1892-93
Asquith, William	S.S. Deucalion	China, via Suez	1890-91
⁵ Atkinson, G. W.	S.S. Kaiser-i-Hind	Calcutta, via Suez	1892
⁶ " "	"	"	1892-93
Barclay, James	S.S. Thermopylae	Australia, via Cape Good Hope	1892-93
Barr, J.	S.S. Orestes	China, via Suez	1890-91
Bartlett, T.	S.S. Diomed	" "	1890-91
Barwise, J.	S.S. Sarpedon	" "	1890-91
Baxter, A. S.	City of York	Cape Town, Astoria, and Valparaiso	1891-93
Belding, Rawstin	Barque Atlantic	River Plate and Valparaiso	1891-92
Bennett, E. C.	Talus	Melbourne, Newcastle (N.S.W.), and San Francisco	1891-92
⁷ Blackburne, H. S.	S.S. Bombay	China, via Suez	1892
Bolton, S. H.	S.S. Baidar	Mediterranean Ports	1892
⁸ " "	"	Ports in Sweden and Spain	1892-93
" "	S.S. Edith Hough	London to Liverpool	1892
Bourke, Capt. E. G., R.N.	H.M.S. Ringarooma	Australia, via Suez, and at New Zealand	1891-92
Bright, H.	Barque Beltana	Adelaide	1892-93
Brown, R. J.	S.S. Titan	China, via Suez	1890-91
⁹ Buchan, James	S.S. Deramore	Pernambuco and New York	1892
Cameron, J. G., R.N.R.	R.M.S. Germanic	New York	1892
¹⁰ Campbell, Robert	S.S. Elton	Savona, and S. Carolina, Baltimore, and Savannah	1892-93
¹¹ Clift, W. E.	S.S. Amaranth	Cape Town, Mauritius, Rangoon, and home via Suez	1892
¹² Clunie, —	S.S. Transvaal	Calcutta, via Cape, and home, via Suez	1892
¹³ Conby, H. B.	Garfield	Calcutta and San Francisco	1891-93
Couper, William	Clackmannanshire	San Francisco	1891-92
Crotty, F. H.	Evesham Abbey	Calcutta, New York, Yokohama, and San Francisco	1891-93
Crowley, C.	Verajeau	Newcastle (N.S.W.), Peru, and Otago	1891-92
¹⁴ Crutchley, W. C., R.N.R.	S.S. Kaikoura	Auckland, via Cape Town, and Rio Janeiro	1892
¹⁴ " " "	"	" " "	1892
¹⁵ " " "	"	" " "	1892-93
Dart, L. C.	Barque Semantha	San Francisco	1891-92
Davidson, D. C.	Loch Rannoch	Melbourne	1891-92
¹⁶ Davies, D.	Andora	Algoa Bay and Dunedin	1891-92
Day, Robert	S.S. Achilles	China, via Suez	1891
De Horne, Morris	S.S. Carthage	Australia, via Suez	1892
¹⁷ " "	"	Bombay, via Suez	1892
Docherty, Hugh	Tinto Hill	San Francisco	1891-93
¹⁸ Dulling, George	S.S. Port Pirie	Sydney, via Cape Good Hope, and Monte Video	1892

Captain's Name.	Ship.	Voyage.	Year.
Dulling, George	S.S. Port Pirie	Calcutta, Sydney, and home, viâ Suez	1892-93
Dyke, H. W.	Tenasserim	New York, Sydney, and Iquique	
Elliott, William, R.N.R.	S.S. Clan Murray	Cape Town, Ceylon, and home, viâ Suez	1891-92 1892
"	"	Natal, Madras, and home, viâ Suez	1892
England, Thomas	Barque Glen Grant	Apalachicola	1891-92
¹⁹ Exham, T. K.	R.M.S. Tamar	Brazil	1891-92
¹⁹ " "	"	Lisbon and E. coast of S. America	1892
²⁰ Field, Comr. A. M., R.N.	H.M.S. Egeria	Hong Kong and North Borneo	1892
²⁰ " "	"	Borneo	1892
Fisher, T. P.	S.S. Sirius	Rio Janeiro and New York	1892
²¹ Fordyce, William	County of Roxburgh	Mauritius and Calcutta	1892-93
Fraser, W. D.	Corolla	Valparaiso and Talcahuano	1891-92
²² Frederick, Lieut. and Comr. G. C., R.N.	H.M.S. Dart	New Hebrides	1891
Gregory, T. M.	S.S. Menelaus	China, viâ Suez	1890-91
Grier, J. K.	S.S. Antenor	" "	1890-91
²³ Griffin, E. J., R.N.R.	R.M.S. Moor	Cape Town	1892-93
Guthrie, W. E.	S.S. Bellerophon	China, viâ Suez	1890-91
Hannah, W. T.	S.S. Glaucus	"	1890
¹⁹ Hepworth, M. W. C.	S.S. Port Denison	Sydney, viâ Cape Town, Singapore, and home, viâ Suez	1891-92
¹⁹ " "	"	Australia, viâ Cape, and home, viâ Suez	1892
Huddy, G. R.	S.S. Akaba	New Orleans	1892
Hutchinson, John	S.S. Stentor	China, viâ Suez	1890-91
²⁴ Irving, P. J.	S.S. Teutonic	New York	1891-92
Jackson, Charles	S.S. Palamed	China, viâ Suez	1890-91
" M. H. F.	S.S. Telamon	"	1890-91
" T. S.	S.S. Palinurus	"	1890-91
²⁵ Jamieson, D. E.	S.S. Port Adelaide	Australia, viâ Cape Good Hope, Hong Kong and New York, viâ Suez	1891-92
Jones, Henry	S.S. Telemachus	China, viâ Suez	1890-91
²⁶ Keane, Lt.-Comr. H. J., R.N.	H.M.S. Herald	Zambesi and Shiré Rivers	1892
Lapage, W. P.	S.S. Anchises	China, viâ Suez	1890-91
Lee, W.	S.S. Cyclops	"	1890
" "	S.S. Polyphemus	"	1890-91
Lehman, C.	Loch Sloy	Melbourne	1891-92
Lourison, G. M.	Eaton Hall	Valparaiso and Pisagua	1891-92
Martin, T. C.	Loch Tay	Melbourne	1892-93
²⁷ " W., R.N.R.	S.S. German	Cape Town and Mauritius	1892
²⁷ " " "	"	Cape Town, Tamatave, and Port Louis	1892
²⁸ Miller, Lieut. A. T., R.N.	Training Ship Conway	Off Birkenhead	1892
¹⁹ Millican, J. W.	S.S. Loughrigg Holme	Quebec, Bilbao to Philadelphia, Galveston and Norfolk (Va.)	1892-93
Milne, W. F.	S.S. Mand	Davis Straits	1892
Milner, W. H.	R.M.S. La Plata	East Coast of South America	1891-92
" "	"	Pernambuco and Brazil	1892
" "	R.M.S. Trent	Brazil	1892
²⁹ Mitchell, John	Barque Cape York	San Francisco and Saigon	1891-92
Moignard, Philip	Garsdale	San Diego (Cal.)	1891-92
³⁰ Moore, Comr. W. U., R.N.	H.M.S. Penguin	N.W. Australia and Hong Kong	1891-92
³⁰ " "	"	China Seas	1892
³⁰ " "	"	"	1892
³¹ Munn, L. A.	R.M.S. Spartan	Cape Town	1892
³² " "	"	Mauritius, viâ Cape Town	1892-93
³¹ " "	R.M.S. Trojan	Cape Town	1892

Captain's Name.	Ship.	Voyage.	Year.
Murdoch, Peter	Sierra Lucena	San Francisco	1891-92
Nish, H.	S.S. Cyclops	China, viâ Suez	1890-91
Owen, O.	Barque Cordelia	Santos	1891
Parry, Moses	S.S. Prydain	Baltimore, Stettin, Barcelona, and New York	1892
Parson, G. F.	Earnock	Port Pirie	1891-92
Pattman, Robert	Barque Loch Torridon	Sydney	1891-92
Peebles, Robert	Barque Bracadale	Fredrikstad (Norway), Newcastle (N.S.W.), and San Francisco	1891-92
³³ Pentin, Walter	S.S. Wilcannia	Adelaide, viâ Cape Good Hope, and home, viâ Suez	1892
³³ " "	" "	Australia, viâ Cape, and home, viâ Suez	1892
Peterkin, William	Holkar	Calcutta	1892-93
Pope, James	R.M.S. Dec	West Indies	1891
³⁴ " "	R.M.S. Essequibo	" "	1892-93
" "	R.M.S. Larne	" "	1891
" "	R.M.S. Tagus	E. coast of South America	1891-92
Price, J. H.	Barque Viola	Townsville	1891-92
Pulford, I.	S.S. Patroclus	China, viâ Suez	1890-91
Purdy, Thomas	S.S. Dardanus	" "	1890-91
Rawlings, E. S.	S.S. Ajax	" "	1890-91
Reynolds, Robert	S.S. Pretoria	Cape Town, &c., Mauritius, and Natal	1892
³⁵ Rigaud, H. C.	S.S. Magdalena	Brazil and River Plate	1892
Riley, J.	S.S. Teucer	China, viâ Suez	1890
²⁶ Robertson, Lt. and Comr. C. H., R.N.	H.M.S. Herald	Shiré and Zambesi Rivers	1892
Rosseter, W. L.	Brenda	Philadelphia and Calcutta	1892
" "	" "	Calcutta and Demerara	1892-93
Scale, R. F.	S.S. Laertes	China, viâ Suez	1890
³⁶ Scott, G. P.	Crompton	Rangoon	1892-93
" "	Holyrood	Melbourne and Rangoon	1891-92
Scougall, H.	Barque Closeburn	Cape Town, Newcastle (N.S.W.), and Valparaiso	1891-92
Shearer, George	Airlie	Havre and Calcutta	1891-92
Simpson, Alexander	S.S. Thermopylæ	Australia, viâ Cape Good Hope	1892
" "	Barquentine Traveller	Ivigtut and Copenhagen	1892
²⁸ Smith, J. H., R.N.R.	Training Ship Worcester	Off Greenhithe	1892
³⁷ " W. J.	R.M.S. Tagus	River Plate	1892
³⁸ Smyth, Lieut. and Comr. M. H., R.N.	H.M.S. Stork	Formosa Bay	1891-92
Spalding, T. F.	S.S. Australasian	Australia, viâ Cape Town	1891-92
" "	" "	Cape Town, Melbourne, and home, viâ Suez	1892
Streater, R.	Euterpe	Wellington	1891-92
⁴⁰ Swale, William	S.S. Brenttor	Baltimore	1892
⁴¹ Tait, H.	S.S. India	Mediterranean Ports, New York, and Naples	1892
⁴² Thompson, J. E.	S.S. Monarch	Off coasts of British Isles	1892-93
" J. S.	S.S. Nestor	China, viâ Suez	1890-91
¹⁹ Thomson, A.S., R.N.R.	S.S. Dacia	West Coast of Africa	1893
" "	S.S. Silvertown	Brazil	1892
Towell, William	S.S. Jason	China, viâ Suez	1890-91
⁴³ Travers, H. D.	S.S. Scot	Cape Town	1892
⁴⁴ Trenaman, R. W.	S.S. Pascal	New Orleans and Monte Video	1891-92
⁴⁵ Trott, Samuel	S.S. Minia	Halifax and Boston Harbour	1892
⁴⁵ " "	" "	Halifax	1892
⁴⁶ Tyson, John	S.S. Arab	Natal, Tamatave, and Port Louis	1892
⁴⁷ Wait, A. McLean	R.M.S. Tartar	Cape Town	1891-92
⁴⁸ " "	" "	Natal, &c.	1892
⁴⁸ " "	" "	Cape Town, &c.	1892-93
Walker, Henry	S.S. Aurania	New York	1892
Webster, J. K.	S.S. Prometheus	China, viâ Suez	1890-91

Captain's Name.	Ship.	Voyage.	Year.
White, W. E., R.N.R.	S.S. Ormuz - -	Australia, viâ Suez - -	1892
⁴⁹ " " "	" - -	" " - -	1892
⁵⁰ " " "	" - -	" " - -	1892-93
Wilding, J. -	S.S. Priam - -	China, viâ Suez - -	1890-91
Williams, O. -	S.S. Agamemnon - -	" " - -	1890-91
Wilson, John, R.N.R.	S.S. Ethiopia - -	New York - -	1891-92
" " "	" - -	" - -	1892
Wishart, J. T. -	Sierra Parima - -	Mauritius and Rangoon - -	1892
Worrall, W. A. -	Barque Lebu - -	Vancouver Island - -	1891-92

Observations in the Atlantic during the months of October 1856 to March 1857, extracted from the logs of the Cunard steamers "Africa," "America," "Asia," "Arabia," "Canada," "Europa," "Niagara," and "Persia."

In cases distinguished by marginal numbers the Meteorological Registers were kept chiefly by Officers, as follows:—

- | | |
|---|---|
| ¹ Kept by E. Rice, Chief Officer. | ²⁴ Kept by G. J. Caven, 2nd Officer. |
| ² Kept by S. de B. Lockyer, 1st Officer, G. C. Cockman, 2nd Officer, and J. Mortimer, 5th Officer. | ²⁵ Assisted by G. W. B. Woods and G. Patrick. |
| ³ Kept by Messrs. Beall, 2nd Officer, and Custance, 4th Officer. | ²⁶ Kept by E. St. Maur Nepean, Surgeon, R.N. |
| ⁴ Kept by T. H. M. Custance, J. B. Thelwall, and G. B. M. Eldridge. | ²⁷ Kept by J. George, 3rd Officer. |
| ⁵ Assisted by Messrs. Smith and Hanswell. | ²⁸ Kept by the Cadets. |
| ⁶ Assisted by Messrs. House and Warren. | ²⁹ Assisted by Charles Ogilvie, 3rd Officer. |
| ⁷ Kept by A. B. Armitage, R.N.R., 2nd Mate. | ³⁰ Kept by J. J. Walker, F.L.S., Staff Engineer, R. |
| ⁸ Assisted by J. Richardson, Chief Officer. | ³¹ Kept by Messrs. Joyce and F. C. Dallas. |
| ⁹ Kept by Henry Ward, Chief Officer. | ³² Kept by F. C. Dallas, 4th Officer. |
| ¹⁰ Assisted by Messrs. Sowerby and Evans. | ³³ Kept by Coulton Elliott. |
| ¹¹ Assisted by George J. Perks, 2nd Officer. | ³⁴ Kept by M. Pearson. |
| ¹² Kept by W. M. Wright, 2nd Officer. | ³⁵ Kept by F. J. Stubbs, 5th Officer, and H. J. Latterley. |
| ¹³ Kept by S. H. Pascoe. | ³⁶ Assisted by J. J. Murphy and F. Lampard. |
| ¹⁴ Kept by W. K. McAlpine. | ³⁷ Kept by F. J. Stubbs and F. W. Fooks. |
| ¹⁵ Kept by W. K. McAlpine and E. C. Macey. | ³⁸ Kept by William Bett, Surgeon, R.N. |
| ¹⁶ Kept by J. H. Jones, 1st Mate. | ³⁹ Kept by Andrew Robb, 2nd Officer. |
| ¹⁷ Kept by H. S. Crauford, 5th Officer. | ⁴⁰ Kept by J. Seddon, 2nd Officer. |
| ¹⁸ Kept by Thomas Pott, 2nd Officer. | ⁴¹ Kept by D. J. Evans, 2nd Officer. |
| ¹⁹ Assisted by Officers. | ⁴² Kept by Officers. |
| ²⁰ Kept by Sub-Lieut. G. E. B. Hand, R.N. | ⁴³ Kept by Henry Bowyer, 2nd Officer. |
| ²¹ Kept by John MacDonald, Chief Mate, and Malcolm S. Wright, 2nd Mate. | ⁴⁴ Assisted by Mr. Williams, 2nd Officer. |
| ²² Kept by Lieut. E. A. Day, R.N. | ⁴⁵ Kept by W. G. Squares, Chief Officer. |
| ²³ Kept by Alexander L. Galt and T. B. O'Brien, 4th Officer. | ⁴⁶ Kept by J. W. Hague, Chief Officer. |
| | ⁴⁷ Kept by 3rd and 4th Officers. |
| | ⁴⁸ Kept by F. P. MacCarthy, 4th Officer. |
| | ⁴⁹ Assisted by Messrs. May, Coysh, and Truscott. |
| | ⁵⁰ Assisted by Messrs. Hoare, Coysh, Gace, and Truscott. |

APPENDIX III.

INSTRUMENTS supplied, &c. to the Royal Navy.

Per Account.	Baro- meters.	Ane- roids.	Thermometers.				Hydro- meters.
			Ordinary.	Max.	Min.	Screens.	
April 1st, 1892, afloat -	215	522	1,374	297	279	170	76
Issued since -	85	116	355	71	88	33	54
Returned since -	300	638	1,729	368	367	203	130
April 1st, 1893, afloat -	73	106	333	59	54	18	37
	227	532	1,396	309	313	185	93

INSTRUMENTS supplied, &c. for use at Naval Stations.

April 1st, 1892, in use -	70	66	288	29	28	5	11
Issued since -	5	7	29	8	11	2	2
Returned since -	75	73	317	37	39	7	13
April 1st, 1893, in use -	2	8	63	1	1	-	-
	73	65	254	36	38	7	13

DISPOSITION of ADMIRALTY INSTRUMENTS on April 1st, 1893.

Afloat in Royal Navy -	227	532	1,396	309	313	185	93
In use at stations -	73	65	254	36	38	7	13
In store at M.O. -	29	65	114	52	68	12	26
Chatham -	3	13	16	13	14	3	15
Sheerness -	7	6	13	6	5	5	6
Portsmouth -	16	48	29	11	12	5	5
Devonport -	14	23	28	7	7	4	16
Queenstown -	1	4	20	1	1	-	4
Gibraltar -	3	4	12	3	3	-	4
Malta -	13	16	52	10	9	2	6
Bombay -	4	6	17	3	4	1	4
Halifax -	4	8	24	5	4	-	14
Bermuda -	4	7	13	4	9	-	4
Jamaica -	6	3	29	2	2	-	-
Cape of Good Hope -	2	4	21	4	5	2	4
Trincomalee -	4	4	16	3	3	-	4
Hong Kong -	21	15	39	13	13	-	22
Coquimbo -	4	6	16	4	5	1	19
Sydney -	2	6	15	4	3	1	7
Esquimalt -	7	7	9	4	3	-	-
Total, April 1st, 1893 -	444	842	2,133	494	521	228	266
Lost, &c. since April 1st, 1892 -	9	15	294	31	17	14	19
Under repair -	20	-	-	-	-	-	-

APPENDIX IV.

INSTRUMENTS supplied, &c. to Mercantile Marine.

Per Account.	Baro- meters.	Com- passes.	Thermometers.				Hydro- meters.
			Ordinary.	Max.	Min.	Screens.	
April 1st, 1892, afloat -	106	—	667	—	—	102	361
Issued since -	70	—	410	—	1	68	218
Returned since -	176	—	1,077	—	1	170	579
	60	—	410	—	—	57	201
April 1st, 1893, afloat -	116	—	667	—	1	113	378

INSTRUMENTS at Stations, viz., Telegraph Offices, Observatories,
Fishing Villages, &c.

April 1st, 1892, in use -	278	2	251	54	60	54	11
Issued since -	14	—	24	8	6	6	2
Returned since -	292	2	275	62	66	60	13
	9	—	17	5	2	5	3
April 1st, 1893, in use -	283*	2	258	57	64	55	10

DISPOSITION of Board of Trade Instruments on April 1st, 1893.

In merchant ships -	116	—	667	—	1	113	378
In use at stations -	283	2	258	57	64	55	10
In store at M.O. -	19	4	207	—	25	13	37
At Liverpool Agency -	12	7	50	—	—	13	44
„ Aberdeen „ -	3	—	29	—	3	3	22
„ Glasgow „ -	4	—	12	—	—	3	8
„ Dundee „ -	11	—	18	—	—	9	14
„ Hull „ -	8	—	30	—	—	6	25
„ Cardiff „ -	4	—	36	—	—	6	16
„ Southampton „ -	7	—	42	—	—	9	27
Total, April 1st, 1893 -	467	13	1,349	57	93	230	581
Lost, &c. since April 1st, 1892 -	5	—	172	1	—	14	60

* Of these barometers 192 are lent for use of seafaring communities at fishing villages and ports.

APPENDIX V.

LIST of STATIONS reporting Meteorological Observations to the Office by Telegraph on 31st March 1893, with the Names of Observers.

*†Sumburgh Head	-	Rev. W. Brand	-	-	-	Minister of Dunrossness.
*†Stornoway	-	J. Forbes	-	-	-	Nicolson Institution.
Wick	-	J. Sinclair	-	-	-	Watchmaker.
Nairn	-	Miss Penny	-	-	-	Schoolmistress.
*†Aberdeen	-	W. Boswell	-	-	-	Assistant at the Observatory.
Leith	-	T. Richardson	-	-	-	Telegraph Clerk.
*†Shields	-	J. W. Irvine	-	-	-	Do.
Spurn Head	-	G. Freeman	-	-	-	Lightkeeper.
†York	-	H. M. Platnauer, F.G.S.	-	-	-	Curator of Museum.
Loughboro'	-	W. Berridge	-	-	-	
†Ardrossan	-	J. W. Mayes	-	-	-	Telegraph Clerk.
†Malin Head	-	O. O'Doherty	-	-	-	Signalman, Lloyd's.
*†Muilaghmore	-	K. Kerr†	-	-	-	Retired Coastguard Officer.
*†Belmullet	-	Miss M. J. Tolan	-	-	-	Telegraphist.
†Donaghadee	-	T. MacGowan	-	-	-	Postmaster.
Parsonstown	-	W. J. Perry	-	-	-	For The Earl of Rosse, K.P.
*†Holyhead	-	Capt. Richards	-	-	-	Keeper of Sailors' Home.
Liverpool	-	W. E. Piummer, F.R.A.S.	-	-	-	Bidston Observatory.
*†Valencia	-	J. E. Cullum, F.R.Met.Soc.	-	-	-	Superintendent of the Observatory.
†Roche's Point	-	W. Kennedy	-	-	-	Telegraph Clerk.
Pembroke	-	S. Blake	-	-	-	Lightkeeper.
*†Scilly	-	A. Hicks	-	-	-	Signalman.
Prawle Point	-	W. Hewitt	-	-	-	Coastguard Officer.
†Hurst Castle	-	G. G. Appleton	-	-	-	Lightkeeper.
†Jersey	-	J. Fisher	-	-	-	Station Master.
*†Dungeness	-	W. Batton	-	-	-	Assistant Lightkeeper.
†North Foreland	-	A. Cox	-	-	-	Signalman, Lloyd's.
*†London	-	F. Gaster, F.R.Met.Soc.	-	-	-	Clerk, Meteorological Office.
Oxford	-	W. Wickham	-	-	-	Radcliffe Observatory.
Cambridge	-	H. Todd and P. Morris	-	-	-	Observatory.
*†Yarmouth	-	G. T. Watson	-	-	-	Secretary, Sailors' Home.
§Hawes Junction	-	W. H. Bunce	-	-	-	Station Master.

In addition to the above, reports are received daily from the following Continental Stations.

Station.	Authority.	Station.	Authority.	
Haparanda	} Meteorological Office, Sweden.	†The Helder	} Bureau Central Météorologique, Paris.	
Hernösand		†Cape Gris Nez		
†Stockholm		†Brest (St. Mathieu)		
Wisby		Lorient (Île de Groix)		
Bodö	} Meteorological Institute, Norway.	*†Rochefort (Île d' Aix)		
†Christiansund		†Biarritz		
*†Skudesnaes		†Paris		
Færder		Belfort		
†The Scaw	} Meteorological Institute, Denmark.	Lyons		} Cent. Met. Inst. of Germany.
Fanø		Nice		
Cuxhaven		Perpignan		
	} Deutsche Seewarte, Hamburg.	Berlin	} Cent. Met. Inst. of Germany.	
		Wiesbaden		
		Munich		
		Corunna	} Observatory, Lisbon.	
		†Lisbon		

Note.—The stations marked with an asterisk (*) report also at 2h. p.m., and those with a dagger (†) at 6h. p.m.; Lisbon reports at 4h. p.m. instead of 6h. p.m. Paris and the Helder do not report at 6 p.m. on Sundays.

† Observer since dead.

§ This station now reports by post only at the close of each month.

|| Mr. Hartnup died on 21st April 1892.

APPENDIX VI.

REPORT OF INSPECTION OF THE IRISH AND WELSH STATIONS, 1892.

I have to report that I have completed the inspection of all the Irish stations, and of the Welsh ones, except Llandovery. The time occupied has been five weeks.

TELEGRAPHIC STATIONS.

Holyhead, visited September 15th.—The station is in good order, but the shrubs about the rain-gauge have been allowed to grow too high.

Donaghadee, visited September 15th.—At this station the instruments were all in good order. The observer's health has failed, and the observations are now taken, in bad weather, by his brother, who was at one time the regular reporter.

Malin Head, visited September 23rd.—I found this station in good order. The observer is very intelligent.

Mullaghmore, visited September 26th.—I deposited at this station the self-recording aneroid as authorised by the Council. The instruments were in good order.

Belmullet, visited September 28th.—At this station I found that the vane recently erected had been set to magnetic bearings, and this I had set right. The instruments were otherwise in good order. The observer's brother, who had formerly been the assistant, had left the place; a younger sister had taken his place.

Parsonstown, visited October 4th.—The observer here had been changed, and the present reporter is named William James Perry. He is a National school teacher, well educated, and careful. His absence from the observatory during school hours is a serious inconvenience, but I cannot see how this can be obviated.

Roche's Point, visited October 7th.—This station calls for no remark. The instruments were all in good order. The barometers have been placed in a much better light than formerly.

Valencia Observatory, visited October 11th.—At this station the instruments were all in good order. The Stevenson screen had fallen to pieces, and a new one has been ordered to replace it. I find that the hill opposite interferes with the sunshine for an hour or two in the mornings, at least in the winter half year.

St. Ann's Head, visited October 15th. At this station all was in good order. The observer, Mr. Blake, is likely to leave ere long on promotion. His successor will be Mr. Knott, and Mr. Blake is instructing him.

WEEKLY WEATHER REPORT STATIONS.

Llandudno, visited September 14th.—I inspected the sunshine recorder. Its action is not quite satisfactory, as it received accidental damage at its former position on the Great Orme's Head. I am recalling it for repair, supplying another for use in the interim.

Londonderry, visited September 22nd.—At this station the observer had recently procured a maximum thermometer, an instrument which

he had not had for some months, since the recall of one lent to him by the Office. Otherwise the instruments were in good order, as before.

Edenfel, Omagh, visited September 24th.—This is a new station. Colonel Buchanan, the observer, has a good situation, but the thermometer screen is placed in a corner, out of the way of lawn tennis. The instruments are good and in good order.

Mount Trenchard, visited October 5th.—This station was in good order. No other observations than rainfall and extreme temperatures, maximum and minimum, are taken.

Killarney, visited October 10th.—This station was in good order, as usual.

Waterford, visited October 13th.—This station was in good order.

Kilkenny Castle, visited October 14th.—This station was also in good order. I am glad to say that the inner can of the rain-gauge has been enlarged so as to receive a larger quantity without overflow.

STATIONS OF THE SECOND ORDER.

Dublin City, visited September 16th.—Was as satisfactory as is possible in a locality so confined as that which it occupies.

Mountjoy Observatory, visited September 16th.—This station is in good order. It is the most satisfactory, as to exposure, of all the stations that I visit.

Glasnevin, visited September 17th.—This station was in good order. I found a nest of a mason bee inside the rain-gauge. It did not interfere with the tube at the bottom, and had apparently not been there for long.

Lissan, visited September 20th.—At this station, which was in good order, the observer had been changed, the gardener, Donaldson, having left.

Armagh, visited September 20th.—This station was quite satisfactory. I found that the anemometer hut, which is placed standing loosely on a leaded roof, required to be moved, as a crack had apparently occurred in the lead under it. The hut has been in the same place for 40 years. Dr. Dreyer undertook that this operation should be carried out with the greatest care, so I authorised its being effected.

Colebrooke, visited September 21st.—The instruments were in very good order.

Londonderry, visited September 22nd.—At this station the exposure is very imperfect, as the bushes in the garden interfere with the rain-gauge. The observations are, however, taken carefully.

Markree, visited September 27th.—At this station, which is in very good order, a railing has been put up round the thermometer screen, which is a great improvement on previous arrangements.

Currygrane, Edgeworthstown, visited September 30th.—At this station the observer has been changed, and the present youth has not yet got quite experience enough. He is, however, careful and is improving.

Arley Cottage, visited October 3rd.—At this station Major Maxwell was absent, but H. Usher, the gardener, was in attendance. It is an exceptional station, being very close to a large sheet of water (Lough Sheelin). The observations are carefully taken.

Parsonstown, visited October 4th.—The remarks on this station are given under the head of Telegraphic Stations.

St. David's, visited October 17th.—This station was, as usual, in very good order.

(Signed) ROBERT H. SCOTT.

Corrections to be applied to the readings of the thermometers :—

STATIONS.	Dry Bulb.	Wet Bulb.	Max.	Min.	Spare.	Remarks.
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TELEGRAPHIC REPORTING STATIONS.

Holyhead -	0.0	-0.2	-0.5	+0.2	-0.5	Max. and min. thers. both new.
Malin Head -	-0.2	-0.2	0.6	-0.9	-0.7	
Mullaghmore -	-0.3	-0.3	-0.2	+0.7	-0.3	
Belmullet -	-0.4	-0.3	-0.1	-0.3	—	
Donaghadee -	-0.4	-0.4	+0.2	-0.1	-0.7	
Parsonstown -	-0.7	+0.1	-0.6	+1.1	—	
Valencia (Cahiriveen)	-0.6	-0.6	-0.6	-0.1	-0.4	
Roche's Point -	-0.4	-0.4	-0.4	0.0	—	
St. Ann's Head -	-0.6	0.0	+0.1	-0.1	-0.2	

WEEKLY WEATHER REPORT STATIONS.

Edenfel, Omagh -	—	—	-0.1	-0.1	—	New station for W. W. Report.
Kilkenny Castle -	—	—	-0.1	0.0	—	
Waterford -	-0.2	-0.2	0.0	0.0	—	
Killarney -	-0.4	-0.4	-0.1	0.0	—	
Foynes -	—	—	-0.3	+0.1	—	

STATIONS OF THE SECOND ORDER.

Armagh -	-0.4	-0.5	-1.3	—	-0.4	Grass min. +1.0. Min. therm. of Casella's pattern.
Brookeborough -	-0.6	-0.9	-0.4	-0.1	—	Grass min. -0.3. Do. 0.0. Do. -0.1. Do. +0.2.
Dublin (City) -	-0.4	-0.5	-0.8	0.0	—	
Dublin (Phoenix Park)	-0.5	-0.6	-0.3	+0.1	—	
Edgeworthstown -	-0.5	-0.5	-0.6	+0.3	—	
Glasnevin -	-0.3	-0.4	-0.9	+0.2	—	Do. +0.5. Do. +2.3. Do. 0.0.
Lissan -	-0.2	-0.3	-0.1	+0.1	—	
Londonderry -	-0.4	-0.3	+0.8	+0.6	—	
Markree Castle -	-0.2	-0.3	0.0	+0.3	—	
Mount Nugent -	-0.2	-0.2	+0.7	0.0	—	
Parsonstown -	-0.7	+0.1	-0.6	+0.2	—	
St. David's -	-0.4	-0.5	+0.2	-0.2	—	

REPORT OF INSPECTION OF SCOTTISH STATIONS FOR 1892.

BAROMETERS.

The comparison of these instruments was made with inspector's standard barometer No. 690, which I have reason to believe remained correct during the tour of inspection. The barometer at Braemar was found to read about half a tenth inch too low. The instrument was rectified, and read thereafter the same as the standard. The barometers at the other stations were in good order, and at all stations the readings were very accurately made, and reduced correctly, where it is the practice of the observer to reduce his observations. The following table gives the readings of the standard barometer alongside the station barometers :—

TABLE I.

Stations.	Inspector's Standard Barometer No. 690 corrected.	Reporting Barometer uncorrected.	Check Barometer uncorrected.	Remarks.
	Inches.	Inches.	Inches.	
Fort William	29·820	29·818	—	Check barometer is higher up in house.
Fort Augustus	29·842	29·826	—	
Lairg	29·585	29·570	—	
Dunrobin	29·860	29·863	—	
Wick	29·810	29·808	29·750	
Deerness	29·378	29·370	—	
Dunrossness	29·582	29·570	29·580	
Aberdeen	29·284	29·284	29·282	
Braemar	28·303	28·303	—	
Gordon Castle	29·486	29·492	—	
Stornoway	30·077	30·080	30·070	
Glencarron	29·558	29·561	—	
Nairn	29·793	29·786	29·790	
Lednathie	29·213	29·212	—	
Dundee	29·734	29·730	—	
Marchmont	29·156	29·160	—	
Ladylaw	29·152	29·154	—	
Wolfelee	28·610	28·608	—	
Ardrossan	29·262	29·252	—	
Glasgow Observatory	29·108	29·108	—	
Leith	30·127	30·128	30·131	
Rosewell	29·408	29·398	—	

THERMOMETERS.

These were all compared with standard thermometer No. 4433, and the results are detailed in Table II., which shows the readings of the standard and the errors of the different instruments ascertained by the comparison. The following minimum thermometers were found out of order:—At Gordon Castle 0°·6 of spirit was lodged at the very top of the tube; this was put right, and the observer was shown the method of doing it when the quantity evaporated is small. At Rosewell, 4°·0 was lodged near the top of the tube, which the observer, under direction, put right; and he was very specially shown the long time required till the whole of the spirit runs down and joins the column of spirit.

TABLE II.

Stations.	Standard No. 4433, corrected.	Dry Bulb.	Wet Bulb.	Spare Thermometer.	Max. Thermometer.	Min. Thermometer.	Time in Water.	Change of Temperature.	Remarks.
Fort William	60·0	+0·1	+0·1	—	0·0	0·0	90	Uniform	Min. was 0°·6 out of order.
Fort Augustus	56·5	+0·1	+0·1	—	+0·2	-0·4	90	Do.	
Lairg	62·7	+0·1	+0·2	—	-0·3	0·0	90	+0·3	
Dunrobin	61·9	-0·6	-0·6	—	-0·1	-0·4	135	+0·5	
Wick	58·8	+0·4	+0·5	—	0·0	+0·1	75	Uniform	
Deerness	58·7	+0·1	0·0	—	-0·8	-0·1	90	+0·3	
Dunrossness	55·3	+0·5	+0·5	+0·2	0·0	0·0	150	-0·4	
Aberdeen	55·7	+0·3	+0·3	—	+0·3	+0·1	80	Uniform	
Do. Observatory	55·7	—	—	—	-0·3	-0·3			
Braemar	54·2	+0·3	+0·4	—	-0·1	-0·2	95	Do.	
Gordon Castle	55·8	+0·2	+0·1	—	+0·2	0·0	75	Do.	
Stornoway	54·1	+0·5	+0·5	—	-0·4	-0·6	120	+0·5	
Glencarron	53·0	0·0	-0·1	—	-0·2	-0·2	130	+0·7	
Nairn	55·0	+0·7	+0·7	—	0·0	-0·2	65	+0·2	
Lednathie	55·3	+0·2	+0·1	—	+0·3	-0·2	120	+0·7	
Dundee	54·6	+0·4	+0·3	—	+1·3	-0·3	65	Uniform	
Marchmont	52·0	0·0	-0·1	—	0·0	0·0	240	+0·5	
Ladylaw	56·2	0·0	0·0	—	-0·2	0·0	75	+0·3	
Wolfelee	51·5	-0·2	-0·3	—	+0·1	-1·1	150	-0·4	
Ardrossan	49·5	+0·1	+0·2	—	-0·3	-0·3	140	Uniform	
Glasgow Observatory	47·9	—	—	—	0·0	0·0	200	Do.	
Leith	50·1	0·0	+0·2	—	0·0	-0·4	60	Do.	
Rosewell	54·0	-0·2	-0·2	—	+0·3	-0·4	80	Do.	

HYGROMETERS.

At Stornoway, on opening the screen, the difference between the dry and wet bulbs was only $0^{\circ}\cdot 8$, though at the time the weather was fine and the air dry. The wet-bulb was plainly out of order. A fresh piece of muslin was put on, and the hygrometer placed in the screen and read again after some time with a resulting difference of $5^{\circ}\cdot 8$, between the dry and wet-bulb readings. The observer was shown how to keep the instrument in better order. At all other stations the wet-bulbs were well-mounted and in good order. During the excessively damp atmosphere of October 3rd and 4th, differences of only $0^{\circ}\cdot 4$ between the dry and wet-bulbs were noted at Hawick and Marchmont.

OTHER INSTRUMENTS.

At Ardrossan it was necessary, as leaking had commenced, to order the receiver to be re-bottomed; and, owing to the erection of new buildings, to change somewhat the positions of the sunshine recorders at Stornoway and Fort William. Those instruments were in good order at all stations.

Fort William, August 19th.—The thermometer screen of the observatory was repainted in the end of June, and the Stevenson screen is ordered to be repainted. The Beckley rain-gauge now works well, and the differences between the two rain-gauges are very slight. As there is a difference for the year 1891 of about 9 inches between the annual amounts of the rainfall at the observatory and the schoolhouse (the old rain-gauge of station), it has been proposed to place another gauge in the grounds, with the view of seeing if the difference be due to the degree of proximity to the rising ground behind the houses in this part of Fort William. The building of a house on the ground adjoining has necessitated the removal of the sunshine recorder to a new position reached by the sun at all hours when above the visible horizon. The instruments are in excellent order, and the observations are made punctually and accurately.

Fort Augustus, August 20.—The instruments are all in good order. The Rev. A. W. Blundell and assistant were both from home at the time of my visit, Father Martin, the previous observer, being in temporary charge.

Lairg, August 22nd.—All the instruments are in admirable order, and are well observed.

Dunrobin, August 23rd.—The instruments are in good order, and the observations are made carefully and intelligently.

Wick, August 24th.—The minimum thermometer is in good order, and a new maximum was supplied to replace the one broken when the screen was blown down during a heavy gale. The garden having been considerably enlarged, the rain-gauge and Stevenson's screen have been removed to good and more open positions, the screen, a new one, being finished in a good workmanlike manner. Since last year's inspection the porcelain of the wet-bulb thermometer was broken at the upper screw and repaired at the time, so that the porcelain scale from which the readings are taken read $2^{\circ}\cdot 8$ too high; and as thereafter the observer subtracted only $2^{\circ}\cdot 0$ from each reading, these wet-bulb readings have been nearly a degree too high. Mr. Sinclair observes with great intelligence and care, and in future particular attention will be given to report extreme wind-force in gales.

Duerness, August 26th.—The maximum thermometer in use since the instruments were transferred to this station from Stennis reads $0^{\circ}\cdot 8$

too low. The thermometer, sunshine-recorder, and other instruments are particularly well attended to, and the observations are read expertly and correctly.

Dunrossness, August 30th.—In the absence of the Rev. W. Brand in Fair Isle, Mrs. Brand was in charge, who made all the observations with remarkable care and correctness, and the instruments, including the minimum thermometer, were all in excellent order. A Richard's barograph was added to the outfit of the station.

Aberdeen, September 2nd.—Everything as respects instruments and observations is in excellent condition, leaving, indeed, nothing to be desired.

Braemar, September 1st.—As had been suspected, the barometer was $0^{\circ}050$ inch too low; but after inversion and tapping, a second reading was taken, which agreed with standard No. 690 I carry with me. All the other instruments are in very good order, and the observations are made with much care and intelligence.

Gordon Castle, September 3rd.—A new maximum thermometer was added in November 1891, to replace the old one, a Phillips, whose index had been lost. About $0^{\circ}6$ of spirit at the top of the minimum tube was dislodged and the instrument put right, the observer being shown the way when the evaporated portion is small and at the very top of the tube. The instruments are otherwise in good order, and the observations made with intelligence and accuracy.

Stornoway, September 6th.—On opening the thermometer screen, the dry-bulb read $59^{\circ}6$ and the wet $58^{\circ}8$, the muslin being almost dry. After being properly wetted sometime after and exposed in the screen (closed) the readings were $58^{\circ}8$ and $53^{\circ}0$. Instructions were given as to obviating the recurrence of such faulty readings in future. The sunshine recorder was ordered to be raised 6 feet, owing to the additions which have just been made to the school buildings. Otherwise the instruments are in very good order, and much care and intelligence shown in making the observations.

Glencarron, September 8th.—The instruments continue to be in excellent order and are well attended to. The small barograph, thermograph, and hygograph were all in good working order.

Nairn, September 9th.—The Stevenson screen was ordered to be repainted, and furnished with new hinges and ventilator. Otherwise the instruments are in very good order; and much care is evidently taken by Miss Penny, her sister and brother, who assist, in securing uniformity in the methods of making the observations.

Lednathie, September 10th.—Since last inspection a H.C. anemometer has been added to this station. Mr. Morrison keeps the instruments in admirable order, and evinces much care and shrewd observation in carrying on the work.

Dundee, September 12th.—The instruments are all in good order, and the observations continue to be made with accuracy and intelligence.

Marchmont, October 3rd.—The instruments continue to be kept in very good order, and great intelligence is manifested in carrying on the observations.

Ladylaw, Hawick, October 4th.—The instruments and observations leave nothing to be desired, much enthusiasm and great labour in reducing the observations being manifested by Mr. Wilson.

Wolfelee, October 5th.—The instruments are in good order, and the observer is particularly careful and intelligent.

Ardrossan, October 6th.—The receiver of the rain-gauge was ordered to be repaired. The station is presently in charge of Mr. J. Scott, assistant, owing to the serious illness of the chief observer. Mr. Scott observes with care and correctness.

Glasgow Observatory, October 7th.—New tubes have been fitted to the thermograph to replace the old ones which had been broken. Everything was in excellent order and working well, and the observations are made with much care and correctness.

Clober, October 7th.—The observations at this station are at present in abeyance owing to the state of Mr. Bertram's health, which obliged him to leave Clober for the Continent in the beginning of the year.

Leith, October 11th.—The Stevenson screen and the railing round the outdoor instruments were ordered to be repaired; but everything else is in good order, and the new observer is attentive and accurate in what he does.

Rosewell, October 14th.—Nearly $4^{\circ}0$ of spirit was lodged near the top of the tube of the minimum thermometer, which had recently got out of order. Under my direction the observer put it right. With this exception the instruments are all in good order; and the observer is greatly interested in the work, which he does carefully, correctly, and with more than usual fulness.

(Signed) ALEXANDER BUCHAN.

REPORT OF INSPECTION OF THE ENGLISH STATIONS, 1892.

TELEGRAPHIC REPORTING STATIONS.

Dungeness, inspected June 9th.—Levelling once more at this station with such accuracy as the state of the tide would permit, I concluded that the real height of the barometer cisterns above M.S.L. is between five and six feet greater than that previously estimated; but I will endeavour in 1893 to secure finality on this question. The instruments at the station were all in excellent order, and the observers at the time of inspection read them correctly, although I regret to say that the barometric readings, as reported, are by no means in all cases dependable.

The frequent low temperatures of Dungeness beach and Romney Marsh in winter, as contrasted with temperatures of most other parts of our southern coasts, have been alluded to in a former report, as has also been the excellent exposure of the station to winds from all points. I will mention here my impression that over this very level promontory there is a remarkable deficiency in the quantity of summer cumulus.

Hurst Castle, inspected June 13th.—The instruments were all in good condition and are carefully attended to. Although little more than instrumental observations can be expected from Mr. Appleton, it may be worth remarking that halos are more frequently reported from this station and from St. Aubins, Jersey, than from other telegraphic stations. This simply indicates that the observers at these two stations pay attention to the appearance of the sky; and any inference to the effect that the frequency of the report adequately represents the frequency of the occurrence, and, still more, any inference that the phenomena mentioned are commoner in the south than in the north of the British Isles, would, I think, be inadmissible.

As formerly remarked, the force and direction of the wind at Hurst are considerably affected by the course of the Solent and by the elevations of adjacent land surfaces.

Prawle Point, inspected June 16th.—The barometers are very accurately read by Mr. Hewitt and by the assistant observer, Mr. Fenton. The wet-bulb reading higher than the dry bulb when the two are fairly compared, it happens that occasionally when saturation is attained or closely approached, the observer, in reading to whole degrees only, finds the wet bulb higher by a degree than the dry; in these cases he has habitually reported the dry-bulb reading as that of both the thermometers, for the purpose of avoiding queries. The instruments were all well attended to. Estimations of wind and of sea disturbance are (if we adopt the usual standards for these estimations) very correctly made at this station.

Scilly, visited June 18th–19th.—Except that the ventilator of the thermometer screen required a cap, all the apparatus and instruments at this station were in good condition. The anemographic tracings have undergone no alteration. The observer, Mr. Hicks, on his rare occasions of absence, leaves the work of observation to his son, or, now and then, to young Mr. Thomas, the son of the former observer. Each of these is a fairly efficient substitute. I had thought the observer to have made progress in attention to the telegraphy of important pressure changes indicated by the self-registering aneroid, but I regret to find that this part of his work is still inadequately performed.

I again called the observer's attention at this, as at some other stations, to the importance of reporting the duration of gales, an element of some slight difficulty when gales occur at night. Direction and force of wind are reported from Scilly as accurately as from any other station, but sea disturbance cannot in every instance be quite as correctly estimated.

Cambridge, visited July 16th.—The instruments here were in good order. Some of the barometer readings had not, previously to my visit, been accurately taken. I have lately learned that Mr. Todd has resigned his post, and the work is now under the superintendence of Mr. Morris.

North Shields, inspected July 22nd.—The reports from this station are promptly transmitted, and are, in general, dependable. Some cases had occurred in which the reported barometer readings were apparently too low. This I found to be probably due to want of experience on the part of a clerk, who had occasionally been deputed to read the instruments. A letter was sent by Mr. Scott to the observer soon after the receipt of my inspection notes calling attention to this matter, and the fault is not, I think, likely to recur.

The rain-gauge had again been repaired. The hygrometer was, as usual, somewhat dirty.

York.—Up to the date of my visit, July 23rd, no change had been traceable in the character of the reports from this station. The observations are fairly well taken, although the observer is sometimes not sufficiently careful in taking his barometer readings. I have, as usual, to complain of want of punctuality at this station. I laid a strong protest on this subject before Mr. Platnauer, the Curator of the Museum.

The hygrometer was this year found to be in a satisfactory state.

Liverpool (Bidston Observatory), inspected November 23rd.—The Council has, by the death of Mr. Hartnup, lost the services of an experienced observer. The observations are now under the superintendence

of Mr. Plummer, while Mr. Skinner continues, as assistant, to conduct a great part of the work.

The hygrometer was not perfectly clean, but the other instruments were in excellent order. As in 1891, the corrections required for all the thermometers were found to be trivial.

STATIONS OF THE SECOND ORDER.

Eastbourne, June 11th and 12th.—The observations at this station continue to be most carefully conducted, and the observer, Mr. Sheward, is very painstaking. None of the thermometers require the application of corrections. The barometer is a good instrument, but it is somewhat difficult to adjust the vernier, some of the cogs of the pinion being worn out. The observer, in mounting the hygrometer, winds the thread round the bulb without the use of a piece of muslin, because he does not trust himself to fasten the muslin at the screen, and his house is in a different part of the town. As carried out by him the plan need not, I think, be interfered with.

The new rain-gauge, mentioned as in readiness in my report for 1891, was placed in position immediately after my visit in August of that year. The utility of its external iron case was shown by some dents in the latter, and by the fact that a few stones lay round the instrument.

Plymouth, June 21st and 22nd.—At the date of my visit the barometer stood in one of the upstairs rooms of the Biological Laboratory, on the roof of which building the sunshine recorder had been placed, having here a better exposure than that which it first had at the Navigation School, and subsequently at the house of the late Dr. Merrifield. The thermometer screen and rain-gauge had a very good exposure on land which is the property of the borough. Mr. Dickson, who had conducted the observations admirably, had, at the time of my visit, just sent in his resignation. I obtained a promise from Dr. Williams, the Medical Officer of Health, that the observations should be continued by the Borough. The work is now under the superintendence of Mr. H. Victor Prigg, the Borough Surveyor, at whose residence the barometer is kept; and the record up to date is very good.

Sheffield, visited July 19th.—The observations at this station are conducted, as before, at the Museum at Weston Park, and are very satisfactory. The returns had been in arrear at the time of my visit, but this, owing to the duties of the Curator, is sometimes unavoidable. The records are admirably filled in. In the occasional absence of Mr. Howarth, his assistant takes the readings of the instruments, and does so with accuracy. Hitherto the 9 p.m. observations had not been entered, although I had repeatedly urged their importance. Arrangements were made that these observations should be commenced on January 1st, 1893. The barometer, as mentioned in previous reports, is a good one, on Fortin's principle, and requires no correction throughout the scale, but the surface of the mercury in the cistern has become dull, and the liquid might advisably be cleaned. The wet bulb was in a rather dirty condition, the water with which it is supplied containing salts, and the atmosphere of Sheffield being very smoky. I requested that it should be more frequently attended to. This promises to be a valuable station, and the returns will be published when the evening observations are reported.

Penrith, visited July 21st.—The evening observations at Newton Reigny, near Penrith, have been dropped, a fact which is much to be regretted. All the instruments at this excellent station were in

perfect condition, and the observer reads more accurately than any other with whom I am acquainted. His time is much occupied in other business.

York, visited July 23rd.—The returns from this station had not improved in quality since my inspection of 1891. No change has taken place with regard to the position of the sunshine recorder, or in that of any of the other instruments. I still consider that greater accuracy in the reading of the thermometers would be obtained if the two sets of maxima and minima employed for the telegraphic reports and for the 9 o'clock readings respectively were kept in different screens, and this not merely on account of the difficulty of handling the instruments in their present crowded position. The growth of trees at this station, nearly imperceptible in the interval between annual visits, has caused the thermometer screen and the rain-gauges to be more sheltered at the present time than they were in 1879. But I do not at present think it advisable to urge any change in their position.

Tealby (Market Rasen), visited November 4th.—The returns from this Second Order station continue to be fairly good, but the observer's avocations prevent punctuality on some occasions; and occasional errors are also noticeable in the barometer reductions. I advised the removal of the rain-gauge to a site near the Stevenson's screen, but no really open place can be found for it. I called on Mr. Jevons, of Market Rasen (who formerly began taking the observations), and asked him to undertake rainfall measurements, if written to, on behalf of the Council. To this he readily assented. Both his rain-gauge and its position are very greatly better than those in the hands of Mr. Lewin. Since my visit Mr. Jevons has begun sending in rainfall returns.

Liverpool, November 24th.—No change of any importance is noticeable since last year in the instruments at this Second Order station. The returns continue to be good.

No corrections are required for the thermometers. Some corrections, which appear to be erroneous, had recently been used by the observers.

WEEKLY WEATHER REPORT STATIONS.

Ketton Hall (Stamford), inspected November 3rd.—At this Weekly Weather Report station I found all the instruments in most satisfactory condition, and, as usual, carefully attended to. The thermometers require no corrections. Mr. Coventry had, since my inspection in 1891, again taken up his residence in Ketton, at a short distance from the Hall. The head gardener at the latter place, however, continues to take the most of the observations.

STATIONS FROM WHICH RETURNS ARE NOT AT PRESENT PUBLISHED.

Epsom, visited June 8th.—My visit to this station was not satisfactory, for although I had in this case sent a notice of it beforehand, Mr. C. I. Gardiner, who was responsible for the observations, was absent, and had left neither his forms for their entry, nor lists of instrumental corrections to be examined, and I could find none of the tables which he employed. The barometer had been removed into the visitors' sitting-room since my visit in 1891, but the level of the cistern was unchanged. Two of the students are accustomed to take the observations, and one of these failed to read the barometer correctly, a fact which probably indicates the source of some of the errors in the returns. The measuring-glass for the rain-gauge I found to be kept in the interior of the gauge; this habit, which I forbade, had probably been the cause of the breakage

during frost of the glass employed in 1891. It is a pity that this station cannot yet be made serviceable.

St. Leonards, inspected June 10th.—Of this station I regret to have to give an unfavourable report. The observer and his family were absent at the date of my visit, and I did not learn who was responsible for those entries of the barometer readings which I find in the returns during the rather prolonged absence of Mr. Colborne. The head gardener at the Gensing Gardens had for a long period taken the readings of the thermometers, the observer being in ill-health. He is an intelligent man, and can read the instruments with a fair amount of accuracy. The hygrometer was in a dirty condition.

Totland Bay, visited June 14th.—The returns from this station are not likely to be of any great value. The observer, Mr. John Dover, is occasionally absent in the summer for a considerable period, during which he lets his house and grounds, and he has no assistant. There is a good set of instruments by Negretti and Zambra. The barometer was compared at Kew in April of 1892, but subsequently a portion of mercury was by an accident abstracted from the cistern. The tube, however, contained no air at the time of my inspection. It has since been sent to the makers to be refilled.

The gusty west winds of the Solent are often strongly felt at this place, as may be inferred from the state of the trees. But the observer greatly over-estimates the force of the wind, and I found several entries of force 12 made in his book during the short time that he had carried on the observations.

Chilworth, June 24th.—The observations at the time of my visit were carried on much as in the previous year, frequent gaps in the returns being noticeable, together with occasional errors due to the absence from time to time of the observer, and to the fact that he had not trained any assistant, while the probability of more prolonged absence from home rendered the likelihood of permanency in the maintenance of the station rather precarious. The barometer, which is well lighted by electricity, was conveniently situated and was well read, but incorrectly reduced, by the observer on the occasion of my inspection. Since my visit the station does not seem to have at all improved.

Seaham, visited July 22nd.—My inspection of this station was this year somewhat disappointing, Mr. Aird being absent during the greater part of the time that I was there. Discrepancies occurred between the readings of the barometer as entered and reported and the same readings corrected and reduced in the month of January 1892, and no explanation of these errors was forthcoming.

The instruments, however, are good and are carefully attended to, while the exposure leaves little to be desired.

St. Helen's, inspected for the first time November 24th.—The observer at this new Second Order Station is Dr. Robertson, M.D., B.Sc., Medical Officer of Health, who undertook to commence returns from January 1st, 1893. I have every reason to anticipate that these returns will prove to be of good quality. The outdoor instruments have a perfect exposure in an open part of the public park. Young trees have been planted near the light iron railings which surround these instruments, but as trees can hardly be said to grow in the atmosphere of this place, those now planted are not likely to produce shelter. White stone has, unfortunately, been laid down under the Stevenson's screen. Distilled water is used for the wet-bulb, which however becomes quickly coated with chemical deposits. The thermo-

meters and rain-gauge were in good order, and the former were correctly read by the observer. The corrections needed for these are at present trivial. A good deal of time having been occupied in finding the observer, it was practically dark when I suspended my standard by the side of the reporting barometer, an Adie's Marine. I found the latter to contain air, the whole of which, as I think, I succeeded in expelling. After the completion, however, of this process, the reporting barometer, corrected for its index error and for the difference of its temperature, the corrections of its attached thermometer being employed, read somewhat lower than my standard, but the light was too bad for absolutely certain accuracy to be attained. The instrument is protected by a glass case, and stands in a shed at the back of one of the greenhouses in the park.

Returns have not yet reached the Meteorological Office from St. Helen's.

Manchester, inspected for the first time on November 25th.—The observations at this promising station are under the direction of the Medical Officer of Health for Manchester, Dr. J. Tatham, who devotes great attention to their supervision. All the instruments are at the observatory on the north-west side of the Oldham Road. This observatory, considering its position in the heart of a great city, occupies a very satisfactory site, the exposure of the outdoor instruments being good, and there being no prospect of the erection of any buildings likely to cause deterioration of this exposure, the ground being the property of the City Council. The equipment is very complete, there being, in addition to the necessary thermometers, a solar radiation thermometer and a grass minimum, also earth thermometers. These were in excellent condition, and the instrumental corrections are trivial. The Jordan's sunshine recorder has a very fair exposure, and it seemed most desirable to publish the records of bright sunshine derived from it, which it has been resolved to do.

STATIONS WHOLLY OR PARTIALLY DISCONTINUED.

I visited *Leeson*, near Swanage, in June, only to find that the station had just been dropped, which is to be regretted, as the observations promised well. The station of *Leighton Hall*, near Reading, has also, since my visit in June, been discontinued, a fact which I am sorry to have to report, since the locality was a favourable one and the instruments were satisfactory. At *Sudbury*, in Suffolk, Messrs. Rausome have again informed me by letter that they are not disposed to maintain observations necessary for a Second Order station. It is unsatisfactory to find that no station can at present be instituted in this district. At *Sutton Coldfield* the observer, confounding the Meteorological Office with the Royal Meteorological Society, had sent in a record of morning readings of the instruments to the Society. He is too much occupied to take evening observations, and my request made to the Mayor of the town that some clerical assistance should be given to him was not granted. The thermometer screen at this place has been shifted to an improved position.

GENERAL REMARKS.

I paid especial attention this year to the reports and entries of Mist, as made by different observers, with the unsatisfactory result which was to be anticipated. The observer at Jersey, who reported mist, for some years at all events, more frequently than any other of the observers at

our Telegraphic Reporting stations, informs me that he regards the atmosphere as "misty" when objects at 20 miles distant are invisible in the daytime. On the other hand, some observers in inland localities report mist when objects at two miles' distance are obscured. Between these extremes indefinite variation occurs.

As regards the report or entry "squally," I notice considerable difference in the ideas entertained by observers, inland observers generally tending to regard the weather as squally when its condition would not be thought by seamen, or by those that live upon the coast, to merit the title, the wind being merely gusty or irregular.

A far more important matter is the estimation of wind-force by Beaufort's scale. Observers on the west coasts in these Islands commonly estimate force somewhat lower than those on our eastern coasts, and both of these lower than the observers at inland localities, while I am justified in saying that there is a tendency amongst observers in general to over-estimate wind-force in relation to actual wind velocities.

REMARKS ON INSTRUMENTS.

At no station, with the exception of St. Helens, did the barometer contain air.

In none of the minimum thermometers was the column of alcohol found to be broken. At the stations inspected this year an improvement was, generally speaking, noticeable in the condition of the hygrometers.

STATIONS NOT INSPECTED.

Of Telegraphic Reporting stations, Jersey, Loughborough, and Spurn Head were, by permission, omitted. The last mentioned station shall be visited in 1893, as soon as the inspection can be undertaken with safety to the instruments. North Foreland was omitted owing to a misunderstanding, and Yarmouth was, I regret to say, left until late in the year, when indisposition prevented my going there.

Of other stations, those in the Isle of Man were omitted by permission, but I must express my regret that I was this year unable to inspect Aysgarth, Stonyhurst, and, still more, Uppingham, which specially required re-visiting.

(Signed) W. CLEMENT LEY.

NAME OF STATION.	BAROMETER.		THERMOMETER.										NAME OF STATION.
	Difference of Observers' from Inspector's Readings.	Difference of Check from Reporting Barometer.	Temperature of Water.	DRY BULB.	WET BULB.	Difference of Wet from Dry Bulb.	State of Hygrometer.	MAXI-MUM.	MINI-MUM.	SPARE ON GRASS.	General Condition.		
				Correction to re-duce to Inspec-tor's Standard.	Correction to re-duce to Inspec-tor's Standard.			Correction to re-duce to Inspec-tor's Standard.	Correction to re-duce to Inspec-tor's Standard.	Correction to re-duce to Inspec-tor's Standard.			
Cambridge	+003	-	58.3	-0.6	-0.6	0.0	A	0.9	+0.2	.	A	Cambridge.	
Chilworth	.000	-	62.1	+0.1	0.0	+0.1	A	+0.1	+0.1	.	A	Chilworth.	
Dungeness	-001	-004	51.4	-0.4	-0.2	-0.2	A	-0.5	+0.5	.	A	Dungeness.	
Eastbourne	.000	-	59.1	0.0	0.0	0.0	A	0.0	+0.5	.	A	Eastbourne.	
Epsom	.000	-	56.7	0.0	+0.1	+0.1	A	+0.1	-0.3	.	B	Epsom.	
Hurst Castle	-002	-010	57.0	-0.7	-0.1	+0.6	A	+0.3	+0.5	+0.3	A	Hurst Castle.	
Ketton	-	-	53.7	0.0	0.0	+0.1	A	-0.1	+0.2	.	A	Ketton.	
Liverpool	-002	+001	48.2	-0.1	0.0	-0.1	B	-0.2	+0.2	.	A	Liverpool.	
Manchester	.000	-	46.4	0.0	-0.1	+0.1	B	0.0	+0.1	.	A	Manchester.	
North Shields	-001	-003	58.2	0.0	+0.2	-0.2	B	+0.1	+0.1	-0.3	A	North Shields.	
Penrith	.000	-	53.8	-0.1	-0.1	0.0	A	-0.1	0.0	.	A	Penrith.	
Plymouth	.000	-	59.6	+0.1	-0.2	+0.3	A	+0.1	-0.1	0.0	A	Plymouth.	
Pravle Point	-001	+000	55.3	-0.1	-0.7	+0.6	A	-0.1	-0.3	0.0	A	Pravle Point.	
St. Helen's	.000	-	49.2	-0.2	0.0	+0.2	B	-0.3	+0.2	.	A	St. Helen's.	
St. Leonard's	-	-	64.1	-0.8	-0.8	0.0	C	-0.2	-0.2	.	C	St. Leonard's.	
Scilly	+002	+004	58.0	-0.6	-0.4	-0.2	A	-0.7	-0.1	0.0	A	Scilly.	
Seabam	+098	-	55.9	-0.4	-0.4	-0.1	A	-0.2	-0.3	.	A	Seabam.	
Sheffield	+001	-	55.0	-0.1	-0.3	+0.2	B	0.0	-0.1	.	A	Sheffield.	
Tealby	-001	-	49.6	-0.1	-0.1	0.0	A	-0.9	+0.6	-0.2	B	Tealby.	
Totland Bay	.000	-	56.5	+0.3	+0.1	+0.2	A	+0.1	+0.3	.	B	Totland Bay.	
York	-002	-	58.9	-0.3	-0.4	+0.1	A	-0.7	+0.2	.	B	York.	
York	-002	-	58.9	-0.3	-0.4	+0.1	A	-0.2	+0.2	.	B	York.	
Liverpool	-002	+001	48.2	-0.1	0.0	+0.1	B	0.0	+0.3	.	A	Liverpool.	

The names in italics are those of Telegraphic Reporting Stations.

APPENDIX VII.

METHOD OF DEALING WITH TELEGRAPHIC WEATHER
INTELLIGENCE.

THE operations connected with the preparation and issue of the Forecasts and Storm Warnings have not undergone any material change. Full details will be found in Appendix X. to the Report for 1891.

DAILY WEATHER REPORT.

No important change has been made during the past year in the Daily Weather Report, a detailed description of which is given in the Annual Report for 1887, and subsequent alterations have been noticed in the more recent Reports. The Report still fills four large quarto pages.

The standing portions (maps, &c.) are printed in blue, while the information for each day is in black.

The subscription for the Report is —

<i>For delivery by hand, where feasible,</i>	<i>£2 per annum ;</i>
<i>Do. by book post</i>	<i>£1 „</i>

MS. copies of the observations and remarks can be supplied at the rate of 2*l.* 10*s.* per annum. Arrangements can also be made for the supply of charts drawn from the 8*h.* a.m. or 6*h.* p.m. observations, such as appear in the "Times."

The Office receives, when the telegraphic communications are perfect, fifty-eight reports each morning, seventeen each afternoon (except on Sundays), and twenty-nine each evening, the arrangement of which is explained in the Annual Reports for recent years.

The Monthly "Correction and Addition List" is still published.

WEEKLY WEATHER REPORT.

The Weekly Weather Report, which has appeared since February 1878, and was re-arranged at the commencement of 1890, is still prepared for the calendar week, Sunday to Saturday. It is published regularly on Thursdays and is illustrated by three maps for each day. These, like the Daily Reports, show the outline of the land and sea in blue, while the information on them is in black. The maps show (1) for 8 a.m., the temperature, weather, and sea disturbance; and (2) for 8 a.m. and 6 p.m., the distribution of pressure and the winds, over, and on the coasts of, Europe. The information on the first and second pages of each report has been added to, and consists of observations of Temperature and Rainfall made at 79 stations, the individual values for which are given on the second page of the Report, and of Sunshine records taken at 47 stations.

Tables of *Accumulated Temperature* designed to give persons engaged in agriculture better means of estimating the manner in which vegetation is affected by temperature than that afforded by the more usual methods of treating the readings of the thermometer, are published on the first and second pages, and show for each week, and for the whole period from the beginning of the year, the weekly and progressive values respectively, of the combined amount and duration of the excess or defect of the air temperature, above or below a suitably fixed standard, or *base temperature*. The base value adopted is 42° Fahr.

Accumulated Temperature is expressed in *Day-degrees*; a Day-degree signifying 1° F. of excess or defect of temperature above or below 42° F. continued for 24 hours, or any other number of degrees

for an inversely proportional number of hours. An explanation of the rules by which it is obtained will be found in the Annual Report for 1889, while full details as to the facts on which the rules are founded are published in Appendix II. to the Quarterly Weather Report for 1878.

In addition to the reports from the Telegraphic Reporting Stations, and the returns from the self-recording Observatories, weekly schedules from 56 volunteer observers are used, the names of the stations and observers being given below:—

The MS. of the report is prepared on Tuesday in every week, and the summary on its first page is sent to several papers on that evening; the printed copies of the complete report are ready for sale on Thursday afternoon.

1. OBSERVERS FURNISHING TEMPERATURE, RAINFALL, and in some cases BRIGHT SUNSHINE RECORDS.

Names of Stations.	Names of Authorities.
Alnwick Castle - - -	Humphry Wilyams, Esq., for the Duke of Northumberland, K.G.
Arlington (N. Devon) - - -	W. Stewart, for Lady Chichester.
Bawtry (Hesley Hall) - - -	B. I. Whitaker, J.P., F.R. Met. Soc.
Blackpool - - -	J. Wolstenholme.
Braemar - - -	J. A. Aitken, J.P.
Brookeborough - - -	Mr. Ferguson, for Sir Douglas Brooke, Bt.
Cheadle - - -	J. C. Philips.
Churchstoke - - -	P. Wright, F.C.S., F.R. Met. Soc.
Cirencester - - -	The Royal Agricultural College.
Cullompton - - -	T. Turner, J.P., F.R. Met. Soc.
Douglas (Isle of Man) - - -	A. W. Moore, M.A., J.P.
Dublin - - -	J. W. Moore, M.D., F.R. Met. Soc.
Durham Observatory - - -	H. J. Carpenter, F.R.A.S.
Edgeworthstown (Currygrane) - - -	J. M. Wilson, J.P.
Fort Augustus - - -	Rev. A. Weld-Blundell, O.S.B.
Fort William - - -	R. T. Omond, F.R.S.E., for Directors of Ben Nevis Observatory.
Foynes - - -	W. Ward, for Lord Monteagle, K.P.
Geldeston - - -	E. T. Dowson, F.R. Met. Soc.
Glencarron - - -	D. D. Munro, for Lord McLaren.
Glenlee - - -	W. Melville, for G. Maxwell.
Hastings (St. Leonard's) - - -	H. Colborne, M.R.C.S.
Hereford - - -	T. A. Chapman, M.D.
Hillington - - -	Rev. H. E. B. Ffolkes, M.A., F.R. Met. Soc.
Kilkenny - - -	H. Carlton, for the Marquis of Ormonde, K.P.
Killarney - - -	The Ven. Archdeacon Wynne, F.R. Met. Soc.
Lairg - - -	J. Young, Schoolmaster.
Laudale (Loch Sunart) - - -	A. Fletcher, for T. H. G. Newton, M.A., F.R. Met. Soc.
Llandoverly - - -	J. Watkins, F.R. Met. Soc.
Llandudno - - -	J. Nicol, M.D., F.R. Met. Soc.
Londonderry - - -	J. Conroy, F.R. Met. Soc.
Marchmont - - -	P. Loney, for Sir Hugh P. Campbell, Bart.,
Markree Castle (Co. Sligo) - - -	A. Marth, F.R.A.S., for Colonel Cooper, F.R.A.S.
Newton Reigny (Penrith) - - -	T. G. Benn, F.R. Met. Soc.
Ochertyre - - -	G. Croucher, for Sir P. Keith Murray, Bart.
Plymouth - - -	H. N. Dickson, F.R.S.E., and H. V. Prigg, A.M.I.C.E.
Prestwich (Manchester) - - -	Fredk. Gore.
Rothamsted - - -	Rainfall by Sir J. B. Lawes, Bart., LL.D., F.R.S., and Sir J. H. Gilbert, Ph.D., F.R.S.; temperature by T. Wilson, F.R. Met. Soc.

Names of Stations.	Names of Authorities.
Scarborough - - - \mathfrak{M}	W. Robinson.
Southampton - - - -	J. T. Cook, R.E., Ordnance Survey Office.
Stamford (Ketton Hall) - - - -	Fred. Coventry.
Stowell - - - - \mathfrak{M}	Rev. H. J. Poole, F.R. Met. Soc.
Strathfield Turgiss - - - \mathfrak{M}	Rev. C. H. Griffith.
Waterford (Brook Lodge) - - - -	C. Percival Bolton, J.P.

The returns marked " \mathfrak{M} " are supplied through the Royal Meteorological Society, those marked " \mathfrak{S} " through the Scottish Meteorological Society.

2. OBSERVERS who furnish RECORDS of SUNSHINE only.

Names of Stations.	Authorities.
Edinburgh - - - -	R. C. Mossman, F.R. Met. Soc.
Oswaldkirk - - - -	R. Thompson.
Worksop - - - -	H. Mellish, J.P., F.R. Met. Soc.
Thurcaston - - - -	Rev. T. A. Preston, M.A., F.R. Met. Soc.
Margate - - - -	J. Stokes, F.R. Met. Soc.
*Brighton - - - -	A. Newsholme, M.D., F.R. Met. Soc.
Eastbourne - - - -	R. Sheward, F.R. Met. Soc.
*Westbourne - - - -	Rev. L. B. Birkett.
*Torquay - - - -	A. Chandler, F.R. Met. Soc.
*Guernsey - - - -	F. E. Carey, M.D., F.R. Met. Soc.
Newquay - - - -	J. Pearce.
*Tenby - - - -	J. E. Gower.
Arley Cottage (Co. Cavan) - - - -	Major Somerset H. Maxwell, F.R.A.S.

* Those marked with an asterisk use Jordan's (Photographic) Recorder; the others use the Stokes-Campbell (Burning) Recorder.

Appendices, &c.

Two Appendices, I. and II., have appeared, similar to those for recent years. The supplement in the form of a Monthly Summary has been improved by the addition to its Tables of Columns showing the difference between the Pressure, Temperature, Rainfall, and Bright Sunshine of the current month, and the means for the corresponding months in a long series of years.

ISSUE of FORECASTS.

There has been little change in this work.

Remarks on the actual state of the weather, and forecasts *for not more than one day in advance*, are prepared at the Meteorological Office as under:—

On Week Days.*

- (1.) At 11 a.m. (from the morning reports), for the 24 hours ending at Noon on the day following the date of issue. These are intended especially for the early editions of the evening papers, for the clubs, and for exhibition at certain selected stations. See page 9.

* Good Friday and Christmas Day are reckoned as Sundays.

- (2.) At 3.30 p.m. (from the morning and afternoon reports), for the day following that of issue. This set of forecasts is not intended for publication in newspapers, but a copy is exhibited regularly at the door of the Meteorological Office, and during the Hay Harvest they are telegraphed to about 28 well-known agriculturists to be made known in their neighbourhood. See p. 11.
- (3.) At 8.30 p.m. (from the 8 a.m., 2 p.m., and 6 p.m. reports), for the day following that of issue. These are supplied gratis to any newspaper or news agency which may apply for them, and send for them regularly. A very large number of the more important papers and news agencies avail themselves of this advantage.

The forecasts are made for the following districts :—



0. SCOTLAND, NORTH.
1. SCOTLAND, EAST.
2. ENGLAND, N.E.
3. ENGLAND, EAST.
4. MIDLAND COUNTIES.
5. ENGLAND, SOUTH.
6. SCOTLAND, WEST (with Isle of Man).
7. ENGLAND, N.W. (with North Wales).
8. ENGLAND, S.W. (with South Wales).
9. IRELAND, NORTH.
10. IRELAND, SOUTH.

The remarks and forecasts are posted at the doors of the Meteorological Office, 63, Victoria Street, S.W., on week days,* for the inspection of the public. Copies, or extracts from them, are communicated under the conditions stated below, but no information which is not substantially included in them can be supplied.

A series of boards is exhibited on the front of the Office showing in large type the state of the wind, weather, and sea disturbance at six stations, situated on our S.E., S., and W. coasts. The stations selected are Yarmouth, Dungeness, The Needles, Scilly, Holyhead, and Valencia Island, and the observations posted up are those for 8 a.m. and 2 p.m. daily, except on Sundays,* the boards being changed at about 9.45h. a.m. and 3h. p.m. The information can be easily read from the street.

FORECASTS FOR SUBSCRIBERS.—Any person can be supplied with a copy of the 11 a.m. Forecasts, once on each week day,* on payment of a subscription of ten shillings per annum, or 2s. 6d. per official quarter, or any part thereof, *in addition to the cost of transmission*; the charges will therefore be, by *letter* post, 9s., by *book* post, 5s. 9d., per quarter.

The forecasts for any of the districts and for any of the hours mentioned above can be forwarded by telegraph daily, on payment of 3d. per day for any definite period, in addition to the cost of telegraphy.

FORECASTS FOR CLUBS.—These are drawn up at 11 a.m., for all the districts, and are supplied to Clubs, for a subscription of ten shillings per annum. They are delivered by hand to Clubs situated in or near Pall Mall. Special arrangements can be made for delivery at a greater distance by hand or by post.

* Good Friday and Christmas Day are reckoned as Sundays.

FORECASTS FOR HAY AND CORN HARVESTS, OR FOR PUBLIC USE.—Special facilities are offered for the transmission of Forecasts for these purposes, a nominal fee of 2s. 6d. being charged for an official quarter or any part thereof, in addition to the cost of the telegrams.

EXHIBITION OF TELEGRAPHIC FORECASTS AT LOCAL POST OFFICES.—The Post Office has sanctioned the exhibition of Forecasts at Local Post Offices, provided space is available, if the persons to whom they are addressed desire them to be so exhibited instead of being delivered.

Unless otherwise arranged, all forecasts transmitted by post are sent by book post, not as letters.

INQUIRIES AS TO THE WEATHER.

INQUIRIES PERSONALLY OR BY MESSENGER.—Any person applying at the Meteorological Office between 11 a.m. and 8 p.m. on week days, and between 7 p.m. and 8 p.m. on Sundays,* can be supplied, in writing, with the latest information in the possession of the Office and with the latest forecast issued for any specified district, on payment of one shilling for each inquiry.

INQUIRIES BY LETTER.—Application may be made by letter, enclosing thirteen pence in stamps if the reply is to be *by post*, and one shilling in stamps, in addition to the cost of the reply (consisting of ten words, exclusive of the address) if the reply is to be *by telegraph*.

INQUIRIES BY TELEGRAPH.—Any person may obtain *by telegraph* from the Meteorological Office the latest information as to the weather in any district of the United Kingdom by payment of a fee of 1s. in addition to the cost of a telegram and reply to any post office. The telegram containing the inquiry must be addressed as follows :

To

WEATHER,

LONDON.

The payment for the reply should be for at least ten words in addition to the address.

Application may also be made for similar information to be sent either *by telegraph* or *post* on some future specified day.

CHECKING OF FORECASTS AND STORM WARNINGS.

The forecasts and storm warnings issued by the Office are carefully checked by being compared with the conditions actually experienced during the time to which they refer. The method adopted was fully explained in the Annual Report for 1891, and the results for 1892 will be found on pp. 10 and 13.

In order to render the information in the possession of the Office as to the weather experienced on our coasts still more complete, the Council have, as in preceding years, made application to the various Light-house Boards, and have obtained from them the original log-books from some of the most exposed lightships and lighthouses. They would again express their cordial thanks for the co-operation so readily granted to them by these Boards.

* Good Friday and Christmas Day are reckoned as Sundays.

APPENDIX VIII.

REPORT ON THE COMPARISON OF THE FORECASTS ISSUED AT 8h. 30m. p.m. WITH THE WEATHER SUBSEQUENTLY EXPERIENCED, for the 12 Months, April 1892 to March 1893. The results are for the United Kingdom as a whole.

The letters used have the following signification:—

a = complete success. | **c** = partial failure.
b = partial (more than half) success. | **d** = total failure.

The checking has been conducted on the same system as that employed in previous years, *i.e.*, each forecast has been considered under the separate headings of "Wind" and "Weather," but the results of the 8.30 p.m. Forecasts only are here published.

The first column gives the per-centage of success in "Wind," the second in "Weather," and the third the average of the two.

The Summary for the various districts is given on page 10.

Months.		Per-centages.				Months.	Per-centages.				
		Wind.	Weather.	Average.	a + b.		Wind.	Weather.	Average.	a + b.	
April	a	48	62	55	81	October	a	31	59	45	79
	b	28	24	26			b	44	24	34	
	c	15	6	11			c	14	11	13	
	d	9	8	8			d	11	6	8	
May	a	46	66	56	83	November	a	40	53	47	76
	b	33	21	27			b	34	25	29	
	c	14	9	12			c	19	14	17	
	d	7	4	5			d	7	8	7	
June	a	43	47	45	77	December	a	31	54	43	76
	b	31	32	32			b	39	28	33	
	c	18	15	16			c	23	12	18	
	d	8	6	7			d	7	6	6	
July	a	50	62	56	85	January	a	28	45	37	77
	b	31	27	29			b	42	39	40	
	c	12	6	9			c	25	8	17	
	d	7	5	6			d	5	8	6	
August	a	42	45	44	81	February	a	24	48	36	71
	b	40	35	37			b	38	32	35	
	c	12	14	13			c	26	14	20	
	d	6	6	6			d	12	6	9	
September	a	31	49	40	74	March	a	34	53	44	81
	b	34	33	34			b	43	32	37	
	c	25	11	18			c	15	9	12	
	d	10	7	8			d	8	6	7	

(continued.)

continued from p. 65.)

		Per-centages.			
		Wind.	Weather.	Average.	a + b.
The entire year	a	37	54	46	79
	b	37	29	33	
	c	18	11	14	
	d	8	6	7	

APPENDIX IX.

TELEGRAPHIC WEATHER INTELLIGENCE.

The Meteorological Office issues notices of atmospherical disturbances on or near the coasts of the British Islands (free of charge) to ports and fishing stations recommended by responsible local authorities.

The fact that one of these notices has been received at any station, is made known by hoisting a cone 3 feet high and 3 feet wide at base, which has the appearance of a triangle when hoisted. The telegram directing the cone to be hoisted should be exhibited near the signal staff.

At dusk, whenever a signal ought to be flying if it were daylight, a night signal consisting of three lanterns hung on a triangular frame, may be hoisted in place of the cone.

The Meteorological Office supplies the canvas cone, but does not undertake to supply the lanterns. In all cases the local authorities must undertake the charges incidental to the hoisting of the signal, such as flagstaff and gear, oil, &c., and also as to the keeping of the apparatus in repair, painting, &c.

The following is a list of the stations at which the signals are hoisted. They are situated, 100 in England and Wales, 47 in Scotland, 20 in Ireland, 3 in the Isle of Man, and 3 in the Channel Islands :—

NORTH.	WEST.	SOUTH.	EAST.
SCOTLAND, N.E.	IRELAND, S.W.	ENGLAND, S.W.	ENGLAND, E.
Lerwick.	New Ross.	Scilly.	Harwich.
Scalloway.	Dunmore East.	St. Just.	Ipswich.
Dunrossness.	Dungarvan.	St. Sennen.	Southwold.
Stromness.	Youghal.	Penzance.	Yarmouth.
Kirkwall.	Queenstown.	Newlyn, West.	Cromer.
Holborn Head.	Passage.	The Lizard.	Sheringham.
Dunnet Head.	Cork.	Falmouth.	Lynn.
Wick.	Kinsale.	Pendennis.	Sutton Bridge.
Avoch.	Do. (Old Head).	Mevagissey.	
Inverness.	Brow Head.	Plymouth.	
Nairn.	Tralee.	Devonport.	
Burghead.	Limerick.	Prawle Point.	
Lossiemouth.	Galway.	Teignmouth.	
Buckie.		Exmouth.	
Port Knockie.			
Cullen.			
Portsoy.	IRELAND, N.W.		
Banff.	Malin Head.		
Fraserburgh.	Portrush.		
Peterhead.	Port Ballintrae.		
Aberdeen.		ENGLAND, S.	ENGLAND, N.E.
	IRISH SEA.	Boston.	Cleethorpes.
SCOTLAND, E.	Belfast.	Guernsey.	Grimsby.
Stonehaven.	Donaghadee.	St. Helier's	Goole.
Montrose.	Howth.	(Jersey).	Hull.
Broughty Ferry.	Kingstown.	Gorey (Jersey).	Bridlington Quay.
Dundee.	Ramsey (I. of M.).	Weymouth.	Flamborough
St. Andrews.	Douglas "	Poole.	Head.
Anstruther.	Castletown "	Cowes.	Filey.
Pittenweem.	Silloth.	Ryde.	Whitby.
Burntisland.	Maryport.	St. Catherine's	Redcar.
Grangemouth.	Workington.	Point.	Middlesborough.
Bo'ness.	Whitehaven.	Portsmouth.	West Hartlepool.
Granton.	Barrow.	Southampton.	Sunderland.
Newhaven.	Morecambe.	Littlehampton.	South Shields.
Leith.	Fleetwood.	Brighton.	Tynemouth.
Fisherrow.	Blackpool.	Newhaven.	Berwick - on -
Dunbar.	Lytham.		Tweed.
Cockburnspath.	Preston.		
St. Abb's Head.	Southport.		
Eyemouth.	Liverpool.	ENGLAND, S.E.	
	Runcorn.	Hastings.	
	Connah's Quay.	Rye.	
	Penmaenmawr.	Sandgate.	
	Port Penrhyn.	Folkestone.	
	Port Dinorwic.	Dover.	
	Carnarvon.	Ramsgate.	
	Holyhead.	North Foreland.	
		Margate.	
	ST. GEORGE'S	Faversham.	
	CHANNEL.	Sheerness.	
	Aberystwith.	Chattau.	
	Milford.		

[continued.]

NORTH.	WEST.	SOUTH.	EAST.
<p>SCOTLAND, N.W. Stornoway. Port of Ness (Island of Lewis).</p> <p>SCOTLAND, W. Glasgow. Greenock. Rothesay. Campbelton. Girvan. Ballantrae.</p>	<p>BRISTOL CHANNEL. Pembrey. Llanelly. Swansea. Briton Ferry Porthcawl. Penarth. Cardiff. Do. Barry Dock. Newport. Weston-super- Mare. Burnham. Bridgewater. Ilfracombe. Barustaple. Appledore. Boscastle. Port Isaac. Newquay. Hayle. St. Ives.</p>		

APPENDIX X.

FISHERY BAROMETERS.

LIST of PLACES supplied with FISHERY BAROMETERS.

Shetland Isles.—Balta Sound, Uya Sound, Burray, Nesting, Lerwick, Sandsair, Scalloway, Symbister.

Orkney Isles.—Westray, Papa, Burray, Kirkwall.

Scotland, east coast.—Duncansbay, Freswick, Auchengill, Keiss, Staxigoe, Wick, Lybster, Dunbeath, Portmahomack, Cromarty, Avoch, Nairn, Burghead, Portessie, Port Knockie, Portsoy, Whitehills, Gardentown, Roseheart, Pitullie, Fraserburgh, Inverallochy, Pointlaw, Findon, Portlethen, Skateraw, Stonehaven, Arbroath, Broughty Ferry, St. Andrews, Crail, Cellardyke, St. Monance, Burntisland, Newhaven.

England, east coast.—Berwick, North Shields, South Shields, Sunderland, West Hartlepool, Staithes, Scarborough, Filey, Flamborough, Bridlington Quay, Withernsea, Hull, Lynn (2), Wells, Gorleston, Lowestoft, Orford Haven, Woodbridge Haven, Harwich, Brightlingsea, West Mersea, Margate, Deal, Kingsdown, Dover.

England, south coast.—Bognor, Ryde, Bembridge, Brixton, Atherfield, Ventnor, Gorey (Jersey), Haslar Hospital, Poole, Weymouth, Portland, Budleigh Salterton, Exmouth, Cawsand, Mevagissey, Gorranhaven, Devoran, Portscath, Penryn, Durgan, Porthallow, Falmouth, Coverack, Newlyn (2), Mousehole.

England, south-west coast.—St. Ives, Hayle, Port Isaac, Boscastle, Bideford, Burnham, Highbridge, Weston-super-Mare.

Wales.—Briton Ferry, Swansea, Angle, Milford, Nevin, Carnarvon.

England, north-west coast.—Fleetwood, Morecambe, Maryport.

Isle of Man.—Douglas, Port St. Mary, Peel (2).

Scotland, south-west coast.—Port Patrick, Stranraer.

Ireland, east coast.—Cushendall, Belfast, Bangor, Groomsport, Donaghadee, Ardglass, Warren Point, Carlingford, Greengore, Dundalk, Malahide, Howth, Kingstown (2), Bray, Wicklow.

Ireland, south coast.—Dunmore East, Dungarvan, Crosshaven, Kinsale, Union Hall, Castletownsend, Baltimore, Schull (2), Crookhaven.

Ireland, west coast.—Valencia, Dingle, Tralee, Tarbert, Kilcredane, Kilronan, Spiddal, Cleggan, Elly Bay, Ballyglass, Ballycastle (Co. Mayo), Donegal, Tribane, Killybegs, Teelin, Portnoo, Burton Port, Kincaslugh, Bunbeg.

Ireland, north coast.—Dunfanaghy, Rathmullen, Buncrana, Malin Head, Moville, Greencastle, Portstewart, Portrush, Ballycastle (Co. Antrim).

Scotland, west coast.—Tarbert (Loch Fyne), Campbeltown, Carradale, Portree, Armadale (Isle of Skye), Plockton, Gruinard, Ullapool, East Mey, Stroma.

Hebrides.—Stornoway, Portnaguairan, Obb, Valtos, Carloway, Ness.

SUMMARY of STATIONS supplied with INSTRUMENTS.

England and Wales	-	-	-	-	69
Scotland and Isle of Man	-	-	-	-	69
Ireland	-	-	-	-	54

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APPENDIX XI.

LIST of STATIONS from which CONTINUOUS RECORDS of BRIGHT SUNSHINE have been received.

Station.	Observer.
Aberdeen Observatory - - -	Prof. C. Niven, M.A., F.R.S.
Armagh - - - - -	J. L. E. Dreyer, Ph.D., F.R.A.S.
Blackpool - - - - -	J. Wolstenholme.
Cambridge - - - - -	H. Todd and P. Morris.
Churchstoke - - - - -	P. Wright, F.C.S., F.R. Met. Soc.
Cirencester - - - - -	Prof. Ohm, B.A., F.R. Met. Soc.
Cronkbourne, Isle of Man - - -	A. W. Moore, M.A., J.P.
Cullompton - - - - -	Thos. Turner, J.P., F.R. Met. Soc.
Deerness (Orkney) - - - - -	M. Spence.
Dublin, Mountjoy Observatory -	Lt.-Col. Kirkwood, R.E.
Durham - - - - -	H. J. Carpenter, F.R.A.S.
Eastbourne - - - - -	R. Sheward, F.R. Met. Soc.
Edinburgh - - - - -	R. C. Mossman, F.R. Met. Soc.
Falmouth Observatory - - - - -	E. Kitto, F.R. Met. Soc.; for the R. Cornwall Polytechnic Soc.
Fort Augustus - - - - -	Rev. M. Wall, O.S.B.
Fort William - - - - -	R. T. Omond, F.R.S.E.; for the Directors Ben Nevis Observatory.
Geldeston, Beccles - - - - -	E. T. Dowson, F.R. Met. Soc.
Glasgow - - - - -	The late Prof. R. Grant, M.A., LL.D., F.R.S.; and Prof. L. Becker, Ph.D.
Harpenden - - - - -	Sir J. H. Gilbert, Ph.D., F.R.S.
Hastings - - - - -	H. Colborne, M.R.C.S.
Hillington - - - - -	Rev. H. E. B. Pfolkes, M.A., F.R. Met. Soc.
Jersey (St. Helier's) - - - - -	Capt. Richard, Harbour Master.
Kew Observatory - - - - -	The late G. M. Whipple, B.Sc., F.R.A.S., and T. Baker, F.R. Met. Soc.; for the Kew Committee.
Leicester (Thurcaston) - - - - -	Rev. T. A. Preston, M.A., F.R. Met. Soc.
Llandudno - - - - -	J. Nicol, M.D., J.P., F.R. Met. Soc.
London, Bunhill Row - - - - -	Messrs. de la Rue.
„ Westminster - - - - -	The Staff, Meteorological Office.
Marchmont - - - - -	P. Laney; for Sir Hugh P. Campbell, Bt.
Margate - - - - -	J. Stokes, F.R. Met. Soc.
Markree Castle - - - - -	A. Marth, F.R.A.S.; for Col. E. H. Cooper, F.R.A.S.
Newquay (Cornwall) - - - - -	J. Pearce.
Newton Reigny (Penrith) - - - -	T. G. Benn, F.R. Met. Soc.
Oswaldkirk, Yorkshire - - - - -	R. Thompson.
Oxford - - - - -	E. J. Stone, M.A., F.R.S.
Parsonstown - - - - -	O. Boeddicker, Ph.D.; for the Earl of Rosse, K.P., F.R.S.
Plymouth - - - - -	H. N. Dickson, F.R. Met. Soc., and H. Victor Prigg, A.M.I.C.E.
St. Ann's Head - - - - -	S. Blake, Principal Lightkeeper.
Southampton - - - - -	Sir C. Wilson, Col., R.E., K.C.B., F.R.S.
Stonyhurst - - - - -	Rev. W. Sidgreaves, S.J.
Stornoway - - - - -	John Forbes.
Sutton Coldfield - - - - -	C. F. Marston, C.E.
Valencia - - - - -	J. E. Cullum, F.R. Met. Soc.
Worksop - - - - -	H. Mellish, J.P., F.R. Met. Soc.
York - - - - -	J. E. Clarke, B.A., B.Sc.
Georgetown, British Guiana - - -	G. S. Jenman.

In addition, the number of hours of sunshine recorded each day is reported from the following Stations :—

Arley Cottage (Co. Cavan) -	-	Major Somerset H. Maxwell, F.R.A.S.
Braemar - - -	-	James Aitken, J.P.
Brighton - - -	-	A. Newsholme, M.D., F.R. Met. Soc.
Guernsey - - -	-	F. E. Carey, M.D., F.R. Met. Soc.
Tenby - - -	-	J. E. Gower.
Torquay - - -	-	Alfred Chandler, F.R. Met. Soc.
Westbourne (Sussex) -	-	Rev. L. B. Birkett.

APPENDIX XII.

METHODS FOLLOWED IN DEALING WITH METEOROLOGICAL RETURNS FROM LAND STATIONS IN THE BRITISH ISLES.

These stations are of five classes, as stated on page 14.

I.--*Observatories continuously observing all the Meteorological Elements.*

Returns from observatories.

Hourly measurements of the curves obtained from the self-recording instruments at the observatories of the Office are made by the observers at each station, on printed forms supplied for the purpose, which, together with the curves, are forwarded to the Office weekly. They comprise measurements of the barograms, of the dry bulb and wet-bulb thermograms, of the anemograms, and of the rain-gauge curves.

Examination of returns.

The measurements are subjected to a careful examination in order to ensure as far as possible their accuracy, and the revised regulations which have been adopted to secure this end will be found in the Report of the Office for 1890. They comprise rules for the guidance of observers, as well as of the assistants charged with the examination of the work at the Office. Attention need be called here to only two of these rules, viz., (*a*) the use of subsidiary sheets on which are entered the results of a second set of measurements of the curves made after, and quite independently of, the first set, and with a different form of scale, the two sets of measurements being afterwards compared together, and any differences found inquired into and set right; and (*b*) the re-measurements of the curve made by the assistants at the Meteorological Office, and which always amount to 40, and in doubtful cases to many more, per month, for each element. The attention of the observers is always drawn to such errors as may be detected, and to any failures in the continuity of the curves arising from failure of the light, stoppage of the clock, defective photography, faulty action of the wet-bulb thermometer, &c.; a report containing the results of the examination of each Observatory being also submitted to the Council periodically. The curves and tabulations are eventually bound and stored in the Office.

Results of examination and report to Council.

General supervision of observatory work.

In connexion with this work should be mentioned the general watch which has to be kept over the working of the observatories and of the instruments, not only to secure uniformity amongst them and observance of rules, but also to guard against small changes which are liable to occur at certain times, especially with the thermographs, and which may affect the scale-values of the instrument or the datum lines used for the tabulation of the curves. About twice a year this work calls for special examination, entailing some considerable time and occasionally the engraving of new scales for measuring the curves.

METHOD OF DEALING WITH THE NUMERICAL RESULTS FROM THE SELF-RECORDING OBSERVATORIES.

Interpolations.

In dealing with the tabulations the first step is to go over the sheets and fill up by interpolation, wherever possible, any gaps or breaks in the continuity of the record.

The records having been made as complete as possible, are then used for the calculation of daily and hourly mean values, for periods of five days, calendar months, and for the year; which, together with other data obtained from the same source, are published under the title of "Hourly Means of the Readings obtained from the Self-recording Instruments at the Four Observatories under the Meteorological

“ Council.” The volumes for 1889 and 1890 have been issued during the year, and some progress has been made with the calculations for the year 1891.

II.—*Anemographic Stations at which the Wind is recorded continuously.*

The anemograms received from the stations enumerated on page 75 are regularly examined and tabulated in the Office, and the sheets bound up in volumes. Besides special inquiries on legal and other points that from time to time arise, and in which these documents are of high importance, the tabulations are always employed in the preparation of the various Reports issued by the Office. They are also regularly used in the checking of the Storm Warnings.

III.—*Land Stations of the Second Order.*

Ever since the year 1866 returns of more or less completeness have been received from land stations in the United Kingdom. In that year there was only one station, but by 1871 the number had increased to 15, and five years later to 49, including 14 stations belonging to the Royal Meteorological Society, copies of the returns from which were sent to the Office under a special arrangement with the Society.

Origin and progress of system.

At the end of March 1892 the total number of stations was 103, including 17 belonging to the Royal Meteorological Society and 19 belonging to the Scottish Meteorological Society.

It must, however, be observed that while this number is exclusive of the self-recording observatories and of the anemographic stations, it includes several others from which only very scanty information is received.

The stations are distributed as follows: 45 in England, 4 in Wales, 28 in Scotland, and 26 in Ireland.

The methods followed with regard to the examination and publishing of these returns have been fully detailed in previous reports, and need not now be repeated. The changes introduced into the volume for 1886 have been continued in those for later years. These refer to the barometer readings, which are now given at station-level instead of being reduced to the mean sea-level; and to the humidity, where the depression of wet-bulb is shown, the international forms A and B being modified accordingly.

The volume for 1889 contains returns from 65 stations.

Arrangements have been made under which it is hoped that the arrears of this publication will be rapidly reduced.

Reports from the Irish stations are regularly supplied to the Registrar-General for Ireland for his Weekly and Quarterly Returns.

When an application for the adoption of a new station is received, a schedule is forwarded to the observer containing a series of questions as to the outfit of the station, the exposure of the instruments, and the influence likely to be exerted on their indications by surrounding objects, such as houses and trees. Only mercurial barometers are accepted, and only such as have been duly verified. All thermometers must have been tested at Kew. A plan of the station, showing the positions of the instruments with regard to neighbouring objects, is also required.

New stations

On the return of this schedule the answers are considered, and, where necessary, alterations are advised.

If, however, the existing arrangements are satisfactory, tables for reducing the barometer readings to 32° Fahrenheit at mean sea-level are prepared and duplicates sent to the observer, together with a set of Hygrometrical Tables, and a copy of "Instructions in the Use of Meteorological Instruments."

The first returns are compared and examined with special care, and a report of the result of the examination is forwarded to the observer, with instructions how best to improve and complete the returns.

There are still many parts of the British Islands very poorly represented by the existing stations, and any information for these districts would be valuable.

Sunshine
records.

The daily records of sunshine which are now received from 51 Stations in the British Islands are examined generally, to guard against accidental changes in the adjustment of the instruments. Notes explaining any omission or accidental defect are added to the cards if required, and after their receipt has been acknowledged, they are duly stamped and dated and then stored in the Office.

Weekly totals.

A tabulation of these curves is published as part of the Weekly Weather Report, mentioned in Appendix VIII., and for those stations which are also Stations of the Second Order the monthly totals of bright sunshine in hours, together with the per-centages of its possible duration, are published as Part IV. of "Returns from Stations of the Second Order." A table showing the daily amount of sunshine at Bunhill Row, one of the London stations, is also prepared quarterly for the Royal Meteorological Society.

INSPECTION.

The Stations of the Second Order are regularly inspected, the attention of the inspector being directed by the Office to any special point which may require investigation.

IV.—*Telegraphic Reporting Stations.*

Full particulars relating to these stations, the information received from them, and the method of dealing with that information, will be found in Appendix VII. to the Report for the year 1888-9. A paragraph in that Appendix (p. 60) explains the use that is made of the monthly schedules sent in by the observers.

V.—*Extra Stations.*

The returns from Stations of the Fifth Class are not regularly published by the Office, but they are available for any special investigation that may be taken up. The rainfall values at these stations are, however, copied and supplied to Mr. Symons, F.R.S., for publication in "British Rainfall."

APPENDIX XIII.

LIST OF DOCUMENTS RELATING TO THE LAND METEOROLOGY OF THE BRITISH ISLANDS, RECEIVED DURING THE YEAR ENDING MARCH 31ST, 1893.

Stations.	Observers.	Nature of Information received.	Notes.
Class I. Valencia	J. E. Cullum, F.R. Met. Soc.	Continuous records of pressure, temperature, wind, sunshine, and rain, with eye observations of the clouds and notes on the weather.	Except wind.
Aberdeen	Prof. C. Niven, M.A., F.R.S.		
Falmouth	E. Kitto, F.R. Met. Soc.		
Kew	The late G. M. Whipple, B.Sc., F.R.A.S., F.R. Met. Soc.		
Fort William	R. T. Omond, F.R.S.E.	Continuous records of pressure, temperature, wind, sunshine, and rain.	
Glasgow	The late Prof. R. Grant, M.A., LL.D., F.R.S., and Prof. L. Becker, Ph.D.		
Stonyhurst	Rev. W. Sidgreaves, S.J.		
Class II. †Armagh	J. L. E. Dreyer, Ph.D., F.R.A.S.	Continuous record of wind, rainfall, and sunshine.	
Alnwick Castle	Humphry Wiliams, Esq., for the Duke of Northumberland, K.G.	Continuous record of wind (direction and velocity).	
†Dublin (Phoenix Park)	Lt.-Col. Kirkwood, R.E.	"	
Fleetwood	M. S. Gaultier, C.E.	"	
†Holyhead	Hugh Williams, C.E.	"	
North Shields	Capt. W. Harrison	"	
Seilly	A. Hicks	"	
†Deerness (Orkney)	M. Spence	"	
Yarmouth	G. T. Watson	"	
†Kilkenny Castle	The Marquis of Ormonde, K.P.	Continuous record of pressure.	
London	The Athenæum Club	"	
Penbedw (Mold)	H. W. Buddiwm	"	
Plymouth	H. N. Dickson, F.R.S.E.	"	Till June 1892.
†Waterford	The Harbour Authorities	"	

LIST OF DOCUMENTS—continued.

Stations.	Observers.	Nature of Information received.	Notes.
Class III. † Armagh	J. L. E. Dreyer, Ph.D., F.R.A.S.		
Aysgarth	Rev. Fenwick W. Stow, M.A., F.R. Met. Soc.		
† Babbacombe	E. E. Glyde, F.R. Met. Soc.		
† Braemar	James Aitken, J.P.		
† Brookeborough	W. Ferguson, for Sir Douglas Brooke, Bt.		
† Carmarthen	G. J. Hearder, M.D.		
† Chilworth	Chas. S. Bell		
Cronkbourne, I. of Man	A. W. Moore, M.A., J.P.		
† Deerness (Orkney)	M. Spence		
† Dublin (City)	J. W. Moore, M.D., F.R. Met. Soc.		
† Dublin (Phoenix Park)	Corporal Stone for Lt.-Col. Kirkwood, R.F.		
† Dublin (Glasnevin)	E. W. Moore, M.R.I.A.		
† Dundee	W. Ross McKelvie		
† Dunrobin Castle	D. Melville, for the Duke of Sutherland, K.G.		
Durham	H. J. Carpenter, F.R.A.S.		
† Eastbourne	R. Sheward, F.R. Met. Soc.		
† Edgeworthstown	J. M. Wilson, M.A., J.P.		
Edinburgh	R. C. Mossman, F.R. Met. Soc.		
† Epsom (Royal Med. College)	C. I. Gardiner		
Geldeston (Beccles)	E. T. Dowson, F.R. Met. Soc.		
† Glasgow	The late Prof. R. Grant, M.A., LL.D., F.R.S., and Prof. L. Becker, Ph.D.		
Heysham Hall (Lancs.)	S. Lomas for Miss Grafton		
Hillington, Norfolk	Rev. H. E. B. Folkes, M.A., F.R. Met. Soc.		
† Ladylaw, Hawick	W. R. Wilson		
Laudale (Argyleshire)	A. Fletcher, for T. H. G. Newton, M.A., J.P.		
† Liverpool	W. E. Plummer, F.R.A.S., and Fredk. Skinner		
† Londonderry	J. Conroy, F.R. Met. Soc.		
† Margate	J. Stokes, F.R. Met. Soc.		From February 1893.

Regular observations at 9 a.m. and 9 p.m. of pressure, temperature (dry-bulb and wet-bulb), wind, cloud and weather, with the daily maxima and minima of temperature, the daily rainfall, and general remarks on the weather.

LIST OF DOCUMENTS--continued.

Stations.	Observers.	Nature of Information received.	Notes.
†Markree Castle, Sligo	A. Marth, F.R.A.S., for Col. Cooper, F.R.A.S.	-	-
†Mount Nugent (Arley Cottage).	Major Somerset H. Maxwell, F.R.A.S.	-	-
†Newton Reigny (Penrith).	T. G. Benn, F.R. Met. Soc.	-	Till December 1892.
Parkstone (Bourne-mouth).	R. H. Barnes, B.A., F.L.S., F.R. Met. Soc.	-	-
†Parsonstown -	W. J. Perry, for the Earl of Rosse, K.P., F.R.S.	-	-
†Plymouth -	H. N. Dickson, F.R.S.E.	-	-
Plymouth -	H. Victor Prigg, A.M.I.C.E.	-	-
Prestwich (Manchester)	Fredk. Gore	-	-
†St. David's, Pembroke	W. P. Probert, LL.D., F.G.S., F.R. Met. Soc.	-	-
St. Leonards -	H. Colborne, M.R.C.S.	-	-
Scarborough -	W. Robinson	-	-
†Seaham -	G. H. Aird	-	-
Southampton -	J. T. Cook, for Dir. Gen. of Ordnance Survey	-	-
Stokesay -	Miss M. A. Digges La Touche	-	-
Stonyhurst -	Rev. W. Sidgreaves, S.J.	-	-
†Tealby (Lincolnshire)	Rev. S. Lewin	-	-
Uppingham -	Rev. G. H. Mullins, M.A.	-	-
†Wolfelee (Roxburghshire).	M. W. Cockburn, for Sir W. Elliott, K.S.I.	-	-
†York -	J. Wright, for Yorkshire Phil. Soc.	-	-
CLASS IIIA.			
†† Bennington, Herts	Rev. J. Dunne Parker, LL.D., F.R. Met. Soc.	-	-
†† Berkhamsted	E. Mawley, F.R.H.S., F.R. Met. Soc.	-	-
†† Buxton	E. J. Sykes, M.B., F.R.A.S., F.R. Met. Soc.	-	-
†† Callton Mor	J. Russell, for J. Malcolm of Poltalloch, M.P.	-	-

Regular observations at 9 a.m. and 9 p.m. of pressure, temperature (dry-bulb and wet-bulb), wind, cloud and weather, with the daily maxima and minima of temperature, the daily rainfall, and general remarks on the weather.

Monthly means and summaries on Form B. of observations taken at 9 a.m. and 9 p.m. each day as above.

LIST OF DOCUMENTS—continued.

Stations.	Observers.	Nature of Information received.	Notes.
Cargen (Dumfries)	P. Dalgleon, F.R.S.E., and Alex. Peacock		
Cheadle	J. C. Philips		
Cheltenham	R. Tyer, B.A., F.R. Met. Soc.		
Churchstoke	P. Wright, F.C.S., F.R. Met. Soc.		
Cramlington	W. Bond		
Dartmoor	F. W. S. Stone, M.B.		
Fort Augustus	Rev. A. Weld-Blundell, O.S.B.		
Fort William	R. T. Omond, F.R.S.E., for Directors of Ben Nevis Observatory.		
Glencarron	D. D. Munro, for Lord McLaren		
Glennie (Kirkcudbrightshire).	W. Melville, for George Maxwell		
Gordon Castle	J. Webster, for the Duke of Richmond, K.G.		
Killarney	The Ven. Archdeacon G. R. Wynne, M.A., F.R. Met. Soc.		
Lairg	J. Young, for the Duke of Sutherland		
Lednathie (Forfarshire).	W. Morrison, for Stormonth Darling, Q.C.		
Lissan (Co. Tyrone)	Sir Nathaniel Staples, Bart.		
Llandudno	J. Nicol, M.D., F.R. Met. Soc.		
Marchmont	Peter Loney, for Sir Hugh P. Campbell, Bt.		
Ochertyre	G. Croucher, for Sir Patrick Keith Murray, Bt.		
Pimmore	Peter Donald, for Capt. Hamilton		
Rosewell	R. W. D. Cameron, M.D.		
Rothsay (Isle of Bute)	James Kay		
Rousdon	C. E. Peek, M.A., F.R.A.S., F.R. Met. Soc.		
Wakefield	H. Clarke, L.R.C.P., F.S.S., F.R. Met. Soc.		

CLASS IV. The Telegraphic Stations, see List on page 45.

Monthly means and summaries on Form B. of observations taken at 9 a.m. and 9 p.m. each day as above.

LIST OF DOCUMENTS—continued.

Stations.	Observers.	Nature of Information received.	Notes.
CLASS V. Ballycastle	Coast Guard - - -	Pressure, temperature, wind, and weather, four times daily.	
Baltimore - - -	J. Halsey - - -	Pressure, temperature, wind, and weather, once daily.	
Bolton - - -	W. W. Midgley, F.R. Met. Soc.	Full monthly summary.	
Bray (Co. Wicklow) -	Coast Guard - - -	Pressure and temperature, four times daily, with wind and weather, twice daily.	
Bristol - - -	J. H. Jones, F.R.A.S.	Daily rainfall, maximum and minimum temperatures, and remarks.	From March 1893.
Castletownsend -	Coast Guard - - -	Pressure and temperature, four times daily, and wind, twice daily.	
Chatham (School of Military Engineering).	L. M. S. Hall, for Instructor in Surveying	Full return for 9 a.m.	
Cooper's Hill (Egham)	Prof. H. McLeod, F.R.S.	Full return for 9 a.m. and 3 p.m.	
Crookhaven - - -	Coast Guard - - -	Pressure and temperature, four times daily, and wind, twice daily.	
Crosshaven - - -	J. W. Bridle - - -	Pressure, temperature, and wind, twice daily.	
Cuckfield - - -	John Howe - - -	Daily rainfall.	
Dover (Kearsney Abbey).	C. W. Curtis - - -	Daily rainfall	From November 1892.
Ennis - - -	J. Hill, M.I.C.E., F.R. Met. Soc.	Daily rainfall.	
Glanlea (Valencia) -	Miss E. FitzGerald - - -	Daily rainfall.	
Gorleston - - -	R. J. C. Day - - -	Pressure and wind, twice daily.	
Harpenden - - -	T. Wilson, F.R. Met. Soc.	Pressure, temperature, and wind, once daily, with rainfall.	
Haslar Hospital -	G. Coppen - - -	Pressure and temperature, four times daily.	
Hurdlestown - - -	Capt. W. O. Bentley, R.A.	Daily rainfall.	
Killiney - - -	R. O'Brien Furlong - - -	Daily rainfall	From January 1893.
Knightstown (Valencia).	Coast Guard - - -	Pressure, wind, and weather, once daily.	

LIST OF DOCUMENTS—continued.

Stations.	Observers.	Nature of Information received.	Notes.
Lowestoft -	J. Andrew, Secretary, Seamen's Missions -	Pressure, temperature, wind, and weather, at 9 a.m.	From January 1893.
Manchester -	John Tatham, M.A., M.D. -	Full set of morning observations.	
Market Rasen -	W. B. Jevons -	Daily rainfall.	
Milford Haven (Hakin) -	D. Hussey -	Pressure and temperature, once daily.	
Northallerton -	W. Stead, M.I.C.E. -	Daily rainfall -	
North Arran -	Coast Guard -	Pressure, temperature of air and sea, four times daily, with wind and weather, at noon.	
Ragby -	H. P. Highton, B.A. -	Full set of 9 a.m. observations with 9 p.m. temperatures.	
Schull -	Coast Guard -	Pressure, temperature, and wind, twice daily.	
†Sheffield (Weston Park) -	Elijah Howarth, F.R.A.S. -	Full return for 9 a.m. and 6 p.m.	
Spiddal -	Coast Guard -	Pressure and temperature, four times daily, with wind and weather, at noon.	
†Stamford (Ketton Hall) -	Fred. Coventry -	Pressure, temperature (max., min., min. on grass), rainfall, and wind, once daily.	
Stranraer -	P. Doran -	Pressure, wind, and weather, once daily.	
Sudbury -	W. Bayley Ransome -	Pressure, temperature (dry-bulb, max., min.), wind, cloud, and rainfall, once daily, with general remarks.	
Swineshead (Boston) -	J. H. Brown -	Daily rainfall.	
Symbister, Shetland -	J. S. Nicolson -	Pressure and temperature, twice daily.	
†Totland Bay -	John Dover, B.A., F.R. Met. Soc. -	Full return for 9 a.m.	
Union Hall (Glandore) -	Coast Guard -	Pressure, temperature, and wind, twice daily.	
Westray (Orkney) -	Capt. J. Hewison -	Pressure, temperature, and wind, twice daily.	

NOTES.—In addition to the above a daily record of observations made at the Royal Observatory, Greenwich, is kindly supplied by the Astronomer Royal. The Stations marked "†" belong to the Royal Meteorological Society; those marked "‡" belong to the Scottish Meteorological Society. Those marked thus † have been inspected during the year.

APPENDIX XIV.

LIST of STATIONS from which SEA TEMPERATURE RETURNS have
been received during 1892-93.

English Coastguard Stations.

Newquay.
Salcombe.
Searborough.
Sunderland.

English Light Vessels.

Bahama Bank.
Caernarvon Bay.
Cardigan Bay.
East Goodwin.
English and Welsh Grounds.
Leman and Ower.
Liverpool, North-west.
Newarp.
Outer Dowsing.
Owers.
Royal Sovereign.
Seven Stones.
Shambles.
Shipwash. (Oct. 1892 to March 1893 only.)
Solway.
Spurn.

Irish Coastguard Stations.

Ballydonegan. (Cork.)
Ballyglass, Broad Haven. (Mayo.)
Blacksod Point. (Mayo.)
Cleggan. (Galway.)
Kilcredane. (Clare.)
Minard. (Kerry.)
North Arran. (Galway.)
Portrush. (Antrim.)
Seafield. (Clare.)
Sheephaven, Dunfanaghy. (Donegal.)
Teelin. (Donegal.)

Irish Light Vessels.

Coningbeg.
Daunt's Rock.
Kish Bank.
South Rock.

Scotch Coastguard Stations,

Ballantrae.
Barnmouth.
Burntisland.
Cove Bay, Aberdeen.
Cromarty.
Kirkwall.
Lamlash.
Lerwick.
Pennant Bay, Aburdour.
Stornoway.
Uzon, Montrose.
Wick.

APPENDIX XV.

ACCESSIONS TO THE LIBRARY DURING THE YEAR ENDING
31ST MARCH 1893.

* **(Abbe, C.)**—Atmospheric radiation of heat and its importance in meteorology. la. 8°. (*Amer. Journ. Sc.*, 3rd ser., xliii., 1892, p. 364.)

|| ——— Cloud observations at sea. la. 8°. (*Amer. Meteor. Journ.*, 1891, Oct., p. 250.)

|| ——— Memoir of William Ferrel. 1817–1891. Read before the Nat. Acad., Apl., 1892. (? *Rep. Nat. Acad. Sc.*, 1892, p. 265.)

|| **Adams, W. G.**—Comparison of simultaneous magnetic disturbances at several observatories. Read June 18, 1891. la. 4°. London, 1892. (*Phil. Trans.*, clxxxiii., 1892, A., p. 131.)

Adelaide Observatory.—Meteorological observations made at the Adelaide Observatory, and other places in South Australia and the Northern Territory, during the year 1890, under the direction of C. Todd. sm. f°. Adelaide, 1892.

[———] Rainfall in South Australia and the Northern Territory during 1889 and 1891; with weather characteristics of each month. By C. Todd. 2 vols. f°. Adelaide, 1891–92.

|| **Aitken, John.**—On some phenomena connected with cloudy condensation. 8°. (*Proc. R. Soc.*, li., 1892, p. 408.)

* **Aldrich, H. L.**—Arctic Alaska and Siberia, or, eight months with the Arctic whalemen. sm. 8°. Chicago and New York, 1889.

[**Algiers, Service Météorologique du Gouvernement Général de l'Algérie.**]—Bulletin météorologique de l'Algérie. 1892, Jan. 1—Dec. 31. sm. f°. Sheets.

[**Allahabad, Meteorological Office.**]—Brief sketch of the meteorology of the North-Western Provinces and Oudh and adjacent parts of Rajputana and the Panjab for the year 1891. sm. f°. s.l.e.a.

American Meteorological Journal.—A monthly review of meteorology. Vols. viii.–ix., 1891–1893. 2 vols. la. 8°. Ann Arbor and Boston, s.a.

Amsterdam, Kon. Nederlandsch Aardrijkskundig Genootschap.—Nomina geographica Neerlandica. Geschiedkundig onderzoek der nederlandsche aardrijkskundige namen, . . . ii^{de} Deel. la. 8°. Leiden, 1892.

——— Tijdschrift . . . onder redactie van C. M. Kan en J. Æ. C. A. Timmerman. Tweede serie. Deel ix. 2 vols. 8°. Leiden, 1892.

André, C.—Contribution à l'étude de l'électricité atmosphérique. 4°. [*Compt. rend. acad. sc.*, Paris, cxii., 1891, p. 1509.]

——— Relations des phénomènes météorologiques déduites de leurs variations diurnes et annuelles. la. 8°. Lyon, 1892.

|| **Andrews, T.**—Address on ozone. la. 8°. Edinburgh, 1874. (*Journ. Scott. Meteor. Soc.*, iv. 1876, p. 122.)

* **Anglo-American.**—In the United States Weather Office. 4°. (*Cassell's Family Mag.*, 1893, Jan., p. 92.)

Antigua, Government Laboratory.—Meteorological record for 1892. Suppl. to the Leeward Islands Gazette, 16 Feb. 1893. la. 8°.

Australia.—[Rainfall and meteorological observations in the Australian Colonies, 1884 and 1888–1889.] 2 parts. 8°. (*Year Book of Australia*, 1886, p. 63; 1890, p. 59.)

Azambuja, G. A. de.—Anuario do Estado do Rio Grande do Sul para o anno de 1893. Anno ix. sm. 8°. Porto Alegre, 1892.

* **Ball, E. A. R.**—Mediterranean winter resorts; a practical handbook to the principal health and pleasure resorts on the shores of the Mediterranean. sm. 8°. London, 1888.

NOTE.—Books marked * have been acquired by purchase; the others are donations from institutions, societies, or authors. Those marked || are excerpt papers, extra copies of which have been separately printed.

In some cases additional publications have been received besides those specified, but only completed volumes or years are given here.

* (Ball, Sir R. S.)—The recent heat-wave. 1a. 8°. (*Contemp. Rev.*, 1892, Oct., p. 478.)

|| Ballou, S. M.—The eye of the storm. Papers from the Laboratory of Phys. Geogr. of Harvard Coll., No. 6. 1a. 8°. Boston, 1892. (*Amer. Meteor. Journ.*, ix., Nos. 2 and 3.)

Batavia, Magnetical and Meteorological Observatory.—Observations . . . Published under the direction of J. P. Van der Stok. Vols. xiii.–xiv. 1891–1892. 2 vols. f°. Batavia, 1891–92.

— Observatorium.—Regenwaarnemingen in Nederlandsch—Indië. xii.–xiii. Jahrg. 1890–91. Door J. P. Van der Stok. 2 vols. 8°. Batavia, 1891–92.

* Bateman, T.—Reports on the diseases of London, and the state of the weather, from 1804 to 1816; . . . 8°. London, 1819.

|| Baxendell, J.—Abstract of meteorological results for the Borough of Southport. Averages for the 20 years, 1872–91, inclusive. 18°. Slip. (*Southport Corporation Year Book for 1892–93.*)

— Abstracts of observations at the Southport meteorological observatory for the weeks ending Jan. 8 to Dec. 30, 1892. Slips.

Belize.—Summary of meteorological observations at St. Joseph's Observatory during the months of Jan.—Dec. 1892. 4°. Sheets. (*The Angelus, Belize*, 1892–93.)

* Belville, J. H.—A manual of the barometer; . . . also a description of the aneroid barometer. 3rd ed. sm. 8°. London, 1858.

Benn, T. G.—Observations in meteorology . . . being the result of a meteorological register kept for ten years (1883–1892) at Newton Reigny, Cumberland. 8°. Penrith, [1893].

* Berghaus, H.—Atlas der Geologie. Berghaus' Physikalischer Atlas, Abteilung i. Unter beratender Mitwirkung von K. v. Zittel bearbeitet von H. Berghaus. f°. Gotha, 1892.

Berlin, Königlich Preussisches meteorologisches Institut.—Ergebnisse der meteorologischen Beobachtungen im Jahre 1889. 1a. 4°. Berlin, 1892.

|| ——— Witterung nach den Beobachtungen des königlichen meteorologischen Instituts. 1892, Jan.—Dec. 1a. 4°. (*Statist. Korresp.*)

|| Bezold, W. von.—Die Meteorologie als Physik der Atmosphäre. 1a. 8°. Berlin, 1892. (*Himmel und Erde*, v., Hef 1 u. 2.)

|| ——— Der Wärmeaustausch an der Erdoberfläche und in der Atmosphäre. 1a. 8°. (*Sitzungsber. k. preuss. Akad. Wissensch. Berlin. Sitz. phys.-math. Cl.*, 22 Dec. liv., 1892, p. 1139.)

Bibliothèque Universelle [et Revue Suisse]. Archives des sciences physiques et naturelles. Troisième période. Tomes xxvii.–xxviii. 2 vols. 8°. Genève, 1892.

|| Binnie, A. R.—On mean or average annual rainfall, and the fluctuations to which it is subject. By A. R. Binnie. With an abstract of the discussion upon the paper. Edited by J. Forrest. 8°. London, 1892. (*Min. Proc. Inst. Civ. Eng.*, cix., 1891–92, Part iii.)

|| Black, W. G.—Description of exhibits by W. G. Black at the Liverpool International Exhibition. Slip. (*Railway Supplies' Journ.*, Aug. 23, 1886.)

|| Blakesley, T. H.—On a new barometer, called the amphibæna. 8°. (*Phil. Mag.*, 1882, Nov., p. 458.)

|| Blanford, H. F.—On meteorological observations in tropical countries. 8°. (*Compt. rend. v^e. Congr. Internat. Sc. Geogr.*)

|| Boedl, W.—Die Schneedecke in Bayern im Winter 1890–91. 1a. 4°. (*Beob. meteor. Stat. K. Bayern*, xiii., 1891.)

|| ——— Temperaturmittel für Bayern 1881–90. 1a. 4°. (*Beob. meteor. Stat. K. Bayern*, xiii., 1891.)

Bombay, Government Observatory.—Magnetical and meteorological observations made at the Government Observatory, Bombay, in the year 1890, under the direction of C. Chambers, together with an appendix containing an account of a magnetic research. f°. Bombay, 1892.

(———) Report on the condition and proceedings of the Government Observatory, Colaba, for the year which ended with the 30th June 1892. f°. s.l.e.a.

[**Bombay Meteorological Office.**—Brief sketch of the meteorology of the Bombay Presidency in 1891-92. f°. s.l.e.a.

* **Bonney, T. G.**—The year-book of science. Edited by T. G. Bonney. 1891, 1892. 2 vols. sm. 8°. London, 1892-93.

Boston, Mass., Weather Bureau.—Bulletin of the New England Weather Service, under the direction of the United States Department of Agriculture, Weather Bureau. 1892, Mch.-Dec. 4°. s.l.e.a.

For previous years, see CAMBRIDGE, MASS., NEW ENGLAND METEOROLOGICAL SOCIETY.

Bremen.—Ergebnisse der meteorologischen Beobachtungen. Herausgegeben von P. Bergholz. Jahrg. ii., 1891. la. 4°. Bremen, 1892.

Brisbane, Chief Weather Bureau.—Meteorological report for 1888, 1889, 1890, and 1891. f°. (Brisbane, 1892.)

British North Borneo Herald and Official Gazette. Vol. x. 1892. Nos. 1-12. f°. Sandakan, 1892.

Contains meteorological observations.

Broounof, P.—Etude sur la couche de neige dans le bassin du Dnièpre en Octobre 1892. Travaux du réseau météorologique du bassin du Dnièpre. Tome i., No. 1. la. 8°. [Kieff], 1892.

Text in the Russian language.

Brown, A. S.—Madeira and the Canary Islands, a practical and complete guide for the use of invalids and tourists. Second edition. sm. 8°. London, 1890.

Brussels, Etat Indépendant du Congo.—Le climat de Banana en 1890, suivi des observations météorologiques faites du 1^{er} décembre 1889 au 16 mai 1891 par E. Etienne. Publications de l'Etat Indépendant du Congo, No. 7. la. 8°. Bruxelles, 1892.

— **Observatoire Royal.**—Bulletin météorologique. 1892, Jan. 1—Dec. 31. f°. Sheets.

Bucharest, Institutul Meteorologic al Romaniei.—Analele . . . de S. C. Hepites. Tom. v., 1889. la. 4°. Bucuresti, 1892.

In the French language also.

— **Buletinul observatiunilor meteorologice din Romania** publicat de S. C. Hepites. Anul i., 1892. sm. f°. Bucuresti, 1892.

|| — **Resumatul observatiunilor meteorologice făcute la București (Filaret) în anul 1890 și în perioada de la 1885 la 1890.** la. 4°. Bucuresti, 1893.

(*Anal. Inst. Meteor. Roman.*, vi., 1890, part 3.)

In the French language also.

Cairo, Ministère de l'Intérieur. Administration des Services Sanitaires et d'Hygiène Publique.—Bulletin hebdomadaire. 7^{me} année, 1892, Nos. 1-52. Suppl. au Journ. Officiel, 1892-93. la. 4°.

[**Calcutta, Meteorological Office, Bengal.**—Bay of Bengal weather chart. 1892, Jan. 1—Dec. 31. sm. f°. Sheets.

— **Bengal daily weather report.** 1892. sm. f°. Sheets.

These reports are only published during the rainy season.

(—) **Meteorological and rainfall table of the Province of Bengal for the weeks ending January 9 to December 31, 1892.** f°.

(—) **Meteorological and rainfall table of the Province of Bengal for the months of January to December, 1892, with annual tables.** sm. f°.

— **Meteorological summary for the monsoon period of 1892.** sm. f°. s.l.e.a.

[—] **Summary of the meteorology of the year 1891.** sm. f°. s.l.e.a.

— **Meteorological Office, India.**—Abstract of the results of meteorological observations taken at the Alipore Observatory in the months of Jan.—Dec. 1892. sm. f°. Sheets.

— **Abstract of the results of the barometric and thermometric observations taken at the Meteorological Office, Chowringhee.** 1892, Jan.—Dec. sm. f°. Sheets.

— **India daily weather report.** 1892, Jan. 1—Dec. 31. f°. Sheets.

[**Calcutta, Meteorological Office, India.**—The India weather review for the year 1891. 1°. Calcutta, 1892.

This is a continuation of "Report on the meteorology of India."

[— — —] Memorandum on the snowfall in the mountain districts bordering Northern India and the abnormal features of the weather in India during the past five months, with a forecast of the probable character of the south-west monsoon rains of 1892. 1°. Simla, 1892.

[— — —] Meteorological observations recorded at seven stations in India in the year 1891, corrected and reduced. 1°. Calcutta, 1892.

1889 and 1890 were not published separately but are printed as Appendix B. of the "Report of the Meteorology of India," for these years.

(— — —) Report on the administration of the Meteorological Department of the Government of India in 1891-92. 1°. s.l.e.a.

— — — Report on the meteorology of India in 1890. By J. Eliot. 16th year. 1°. Calcutta, 1892.

Continued as the "The India Weather Review."

— — — Results of the meteorological observations taken at the Alipore Observatory, from Jan. 3 to Dec. 31, 1892. sm. 1°. Sheets.

— — — Results of the barometrical and thermometrical observations taken at the Meteorological Office, Chowringhee, from 3rd January to 31st December 1892. sm. 1°. Sheets.

Cambridge (Mass.), Astronomical Observatory of Harvard College.—Annals. Vol. xxx., Part iii. Measurements of cloud heights and velocities, by H. H. Clayton and S. P. Fergusson. 1a. 4°. Cambridge, 1892.

— — — Annals. Vol. xl. Part i. Observations made at the Blue Hill meteorological observatory, Mass., U.S.A., in the year 1891. Under the direction of A. L. Rotch. 1a. 4°. Cambridge, 1892.

— — — **New England Meteorological Society.**—Bulletin. 1892. Jan., Feb., Nos. 87, 88. 4°. s.l.e.a.

For continuation, see BOSTON, MASS., WEATHER BUREAU.

|| — — — Investigations of the New England Meteorological Society for the year 1890. 1a. 4°. Cambridge, Mass., 1892. (*Ann. Astr. Obs. Harvard Coll.*, xxxi., Part i.)

Cambridge Philosophical Society.—Proceedings. Vol. vii. 1889-92. 8°. Cambridge, 1892.

Cape Town, Meteorological Commission, Cape of Good Hope.—Report of the Meteorological Commission for the year 1891. sm. 1°. Cape Town, 1892.

* **Capus, G.**—Observations et notes météorologiques sur l'Asie centrale et notamment les Pamirs. 8°. (*Bull. Soc. Géogr. Paris*, 7^e sér., xiii., 1892, p. 316.)

Carlsruhe, Centralbureau für Meteorologie und Hydrographie.—Beiträge zur Hydrographie des Grossherzogthums Baden. Heft vii. Die Waldbedeckung des Grossherzogthums Baden. Uebersichtskarte mit erläuterndem Text. 4°. Karlsruhe, 1892.

— — — Deutsches meteorologisches Jahrbuch für 1891. Grossherzogthum Baden. Die Ergebnisse der meteorologischen Beobachtungen im Jahre 1891. Bearbeitet von C. Schultheiss, zugleich ü. Theil des Jahresber. . . . für 1891. 1a. 4°. Karlsruhe, 1892.

— — — Niederschlagsbeobachtungen der meteorologischen Stationen im Grossherzogthum Baden. 1890-1892. 1-2 Halb. 6 vols. 1a. 4°. Karlsruhe, 1892.

— — — Uebersicht der Ergebnisse der an den badischen meteorologischen Stationen angestellten Beobachtungen, nebst Wasserstandsaufzeichnungen an den wichtigsten Hauptpegeln des Rheins. 1892. Jan.—Dez. 1°. Sheets.

Chandler, A.—Abstract of meteorological observations made at Torquay during the year 1892. Oblong sm. 8°. Sheet.

|| — — — Sunshine recording. The instruments and their uses. 1°. Sheet. (*Torquay Directory*, 1892, May 18.)

Chemnitz, K. Sächsisches meteorologisches Institut.—Deutsches meteorologisches Jahrbuch für 1891. Beobachtungssystem des Königreiches Sachsen. 1a. 4°. Chemnitz, 1892.

— — — Wetterbericht. 1891, Jan. 1—Dec. 31. oblong 8°.

[— — —] Wetterbericht. 1892, Jan.—Dec. 1a. 4°. (*Wissensch. Beil. der Leipziger Zeitung*, 1892-93.)

- || **Chree, C.**—On vortices. 8°. [*Proc. Edinb. Math. Soc.*, v., p. 52.]
 || ——— On vortex motion in a rotating fluid. 8°. (*Proc. Edinb. Math. Soc.*, vii., 1888–89, p. 29.)

Christiania, Den Norske Nordhavs-Expedition. 1876–1878.—xxi. Zoologi. Crinoida og Echinida ved D. C. Danielssen. 8°. Christiania, 1892.

In the English language also.

——— **Norwegisches meteorologisches Institut.**—Jahrbuch. . . . für 1890. Herausgegeben von H. Mohn. sm. 8°. Christiania, 1892.

|| **Chwolson, O.**—Über den gegenwärtigen Zustand der Actinometric. Lu le 4 décembre 1891. sm. 8°. St. Petersburg, 1892. (*Repert. Meteor.*, xv., No. 1.)

|| ——— Actinometrische Untersuchungen zur Construction eines Pyrheliometers und eines Actinometers. Der Akademie vorgelegt am 4 Nov. 1892. sm. 8°. St. Petersburg, 1893. (*Repert. Meteor.*, xvi., No. 5.)

* **Ciel et Terre.**—Revue populaire d'astronomie, de météorologie, et de physique du globe. xiii^e année; 1892–93. 8°. Bruxelles, s.a.

|| **Clayton, H. H.**—The Lawrence tornado. Investigations of the New Engl. Meteor. Soc. for the year 1890. la. 8°. Cambridge, Mass., 1892. (*Ann. Astr. Obs. Harvard Coll.*, xxxi., part 1., p. 137.)

Clements, H.—Clements' weather almanack, 1893, containing, in addition to the ordinary almanack, a detailed forecast for each day of the year. sm. 4°. London, [1892].

——— Clements' weather chart almanac for 1893. Specially prepared for London . . . and based entirely upon the moon's motions. oblong la. 8°. Sheet.

——— Weather prediction: or, how the weather, for any given place, may be forecasted, by means of the moon's motions and the weather records of the past. sm. 8°. London, [1892.]

——— Weather prediction No. 2; or the mistakes of the Greenwich observers and the Washington International Meteorological Conference, &c., &c. sm. 8°. [London, 1893.]

Coimbra, Observatorio Meteorologico e Magnetico da Universidade.—Observações meteorologicas e magneticas . . . 1891. 8°. Coimbra, 1892.

Colombo, Public Works Department.—Return of rainfall in Ceylon during 1891, and the means during different periods. la. 8°. Sheet. Dated, Colombo, 1892.

|| ——— **Surveyor General's Office.**—Report on the meteorology of Ceylon for 1891. sm. 8°. (*Ceylon Administr. Rep.*, 1891, Part ii., p. B 1.)

|| ——— Results of meteorological observations in Ceylon during the months of January to December 1891. 8°. Sheets. (*Suppl. Ceylon Gov. Gazette*, 1891–92.)

——— Return of rainfall in Ceylon during 1891, and the means during different periods. la. 8°. Sheet.

|| **Cominelli, P. F.**—Rivista meteorologica dell' anno 1891–92. Fasc. 1. sm. 8°. Torino, 1893. (*Boll. mens. Osserv. Moncalieri, ser. ii., vol. xii.*)

Copenhagen, Dansk Meteorologisk Institut.—Bulletin météorologique du Nord, publié par les Instituts météorologiques de Norvège, de Danemark et de Suède. Année 1892. oblong 8°. Copenhagen, s.a.

——— Maanedsoversigt over Vejrforholdene. 1892, Jan.—Dec. 8°.

——— Meteorologisk Aarbog. 1888–1889. 2 vols. 8°. Kjøbenhavn, 1889–90.

In the French language also.

——— **Kongelige Danske Videnskabernes Selskab.**—Oversigt over det . . . Forhandlinger og dets Medlemmers Arbejder i Aaret 1891. la. 8°. Kjøbenhavn, 1891–92.

——— Fortegnelse over de af det Kongelige Danske Videnskabernes Selskab i Tidsrummet 1742–1891 udgivne videnskabelige Arbejder. la. 8°. Kjøbenhavn, 1892.

——— **und Hamburg, Dänisches meteorologisches Institut und Deutsche Seewarte.**—Tägliche synoptische Wetterkarten für den nordatlantischen Ozean und die anliegenden Theile der Kontinente. vii. Jahrg., 1–4 Quart. Dec. 1887—Nov. 1888. 4 vols. 8°. Copenhagen et Hambourg, 1892.

In the French language also.

Cordoba, Academia Nacional de Ciencias.—Boletin. Tom. x.-xi. la. 8°. Buenos Aires, 1887.

* || **Coxworthy, F.**—On the constitution of the atmosphere. 8°. (*The Chemist, May, 1847.*)

|| **Cracow, C. K. Akademii Umiejętności w Krakowie.**—Materiały do klimatografii Galicyi zebrane przez sekcję meteorologiczną komisji fizyograficznej . . . 1891. la. 8°. Kraków, 1892. (*Odbitek ze Sprawozd. Kom. fizyogr.*)

— **K. K. Sternwarte in Krakau.**—Meteorologische Beobachtungen. 1892. la. 8°. Krakau, 1892.

* **Croll, J.**—Discussions on climate and cosmology. 8°. London, 1889.

Croydon Microscopical and Natural History Club.—[Daily rainfall at stations in Kent and Surrey.] 1892. Jan.—Dec. 4°. Sheets.

|| ——— Report of the Meteorological Sub-Committee for 1891. 8°. [*Proc. and Trans. Croydon Microsc. Nat. Hist. Club, 1891-92, p. 348.*]

Contains rainfall obsns. only.

Cruls, L.—O clima do Rio de Janeiro. Segundo as observações meteorológicas feitas durante o período de 1851 a 1890. sm. f°. Rio de Janeiro, 1892.

In the French language also.

|| **Cyprus.**—Meteorological observations. 1887-1891. 5 parts. sm. f°. [*Cyprus Blue Book.*]

* **Dalton, J.**—Meteorological observations and essays. 2nd edition. 8°. Manchester, 1834.

|| **Davis, W. M.**—The Lawrence tornado of July 26, 1890. The features of tornadoes and their distinction from other storms. Investigations of the New Engl. Meteor. Soc. for the year 1890. la. 4°. Cambridge, Mass., 1892. (*Ann. Astr. Obs. Harvard Coll., xxxi., part i., p. 119.*)

— Meteorology in the schools. la. 8°. (*Amer. Meteor. Journ., ix., 1892, p. 1.*)

|| ——— The theories of artificial and natural rainfall. la. 8°. (*Amer. Meteor. Journ., 1892, Mch., p. 493.*)

D[avis], W. M.—Professor William Ferrel. la. 4°. (*Science, xviii., 1891, p. 272.*)

Davos.—Davoser Wetterkarte. Nach dem Schema von Herrn C. Wetzel, Ingenieur, herausgegeben im Auftrag des Curvereins Davos-Platz vom Amtl. Beobachter der Schweiz. meteor. Station Davos. 1892. Jan.—Dec. la. f°. Sheets.

In the French and English languages also.

[**Dehra Dun, Surveyor General of India.**]—General report on the operations of the Survey of India Department . . . during 1890-91. sm. f°. Calcutta, 1892.

|| **Denza, F.**—Gli strumenti registratori della Specola Vaticana e lo scoppio della polveriera del 23 Aprile 1891. la. 4°. (*Atti Accad. Pontif. Nuovi Lincei, xlv., 1891.*)

— Pioviggia di sabbia. la. 4°. (*Atti. Accad. Pontif. Nuovi Lincei, xlv., 1891.*)

|| ——— Macchie solari, perturbazioni magnetiche ed aurore polari. la. 4°. Roma, 1893. (*Atti. Accad. Pontif. Nuovi Lincei, xlvi.*)

|| **Devon.**—Report of the Committee on the climate of Devon. Edited by E. E. Glyde. 10th, 2nd series, 1891. 8°. (*Trans. Devon. Assoc. Advanc. Sc., xxiv., 1892, p. 55.*)

Dewar, D.—Weather forecasts. 1893. sm. 4°. Dalkeith, s.a.

|| **Dickson, H. N.**—The meteorology of India and the surrounding sea-arcas. la. 8°. (*Scott. Geogr. Mag., 1892, May.*)

|| ——— The physical conditions of the waters of the English Channel. la. 8°. (*Scott. Geogr. Mag., 1893, Jan.*)

Dorpat, Kaiserliche livländische gemeinnützige und ökonomische Sozietät.—Bericht über die Ergebnisse der Beobachtungen an den Regenstationen. . . für die Jahre 1889, 1890 und 1891. la. 4°. Dorpat, 1892.

|| **Dove, K.**—Niederschlagsmengen am Kap der Guten Hoffnung. 4°. (*Petermann's Mitteil., 1892, p. 167.*)

Dublin, General Register Office.—Quarterly returns of the marriages, births, and deaths registered in . . . Ireland; . . . 1892. Nos. 113–116. la. 8°. Dublin, 1892–93.

—— Weekly returns of births and deaths in Dublin (including its suburban districts), and in fifteen of the principal urban sanitary districts in Ireland, 1892. la. 8°. Dublin, 1893.

Dulier, [E. E.]—A natural process of dissolution for smoke and fogs. 8° London, s.a.

Duponchel, A.—La circulation des vents et de la pluie dans l'atmosphère. la. 8°. Paris, 1892.

Eastbourne.—Abstracts of weather reports for five years. July 1887–1892. 18°. (Eastbourne, 1892.)

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——— ——— **Weather Bureau.**—Bulletin No. 1. Notes on the climate and meteorology of Death Valley, California. By M. W. Harrington. 1a. 8°. Washington, 1892.

——— ——— ——— Bulletin No. 2. Notes on a new method for the discussion of magnetic observations. By F. H. Bigelow. 1a. 8°. Washington, 1892.

——— ——— ——— Bulletin No. 3. A report on the relations of soil to climate. By E. W. Hilgard. 1a. 8°. Washington, 1892.

——— ——— ——— Bulletin No. 4. Some physical properties of soils in their relation to moisture and crop distribution. By M. Whitney. 1a. 8°. Washington, 1892.

——— ——— ——— Bulletin No. 5. Observations and experiments on the fluctuations in the level and rate of movement of ground-water on the Wisconsin Agricultural Experiment Station Farm and at Whitewater, Wisconsin, by F. H. King. 1a. 8°. Washington, 1892.

——— ——— ——— Monthly weather review. 1892. 4°. Washington, 1892–93.

|| ——— ——— ——— Report of the Chief of the Weather Bureau for 1891. By M. W. Harrington. 1a. 8°. Washington, 1892. (*Rep. Sec. of Agric.*, 1891, p. 539.)

——— ——— ——— Weather map. 1892. Jan. 1—Dec. 31. 1a. f°. Sheets.

——— ——— ——— Wreck chart of the great lakes, showing the location of wrecks occasioned through foundering, gales of wind, fogs, and general stormy weather conditions from 1886 to 1891. 1a. f°. Sheet.

——— **Hydrographic Office.**—Pilot charts of the North Atlantic Ocean. 1892, Jan.—Dec. and supplements. Charts. 1a. f°.

——— **Signal Office.**—Charts showing maximum and minimum temperatures, by decades, for all years. 1a. f°. Dated, Washington, 1891.

——— ——— Diurnal fluctuations of atmospheric pressure at twenty-nine selected stations in the United States, by A. W. Greely. 1a. 4°. Washington, 1891.

Washington, Signal Office.—Irrigation and water storage in the arid regions. Letter from the Secretary of War transmitting a report of the Chief Signal Officer of the Army in response to House resolution dated May 23, 1890, relating to irrigation and water storage in the arid regions. 4°. Washington, 1891.

——— Letter from the Acting Secretary of War, . . . transmitting a report of the Chief Signal Officer of the Army on the climatic conditions of the State of Texas. 1a. 4°. Washington, 1892.

|| ——— Report of Mr. O. L. Fassig, bibliographer and librarian. Extract No. 11, from Ann. Rep. of the Chief Signal Officer, 1891. 8°. Washington, 1892.

——— **Smithsonian Institution.**—Smithsonian contributions to knowledge. Vol. xxviii. 1a. 4°. Washington, 1892.

|| ——— **United States Naval Observatory.**—Magnetic observations at the United States Naval Observatory, by J. A. Hoogewerff. 1890, 1891. 2 vols. 1a. 4°. Washington, 1891-92. (*Washington Obsns.*, 1887, 1888, *App.* 2.)

——— Magnetic disturbances, 1892. 1a. f°. Sheet. s.l.e.a.

|| ——— Meteorological observations and results at the United States Naval Observatory, 1883-1887, 1888. 2 vols. 1a. 4°. Washington, 1891-92. (*Washington Obsns.*, 1887, *App.* 3, 1888, *p.* D 1.)

[——— **War Department.**]—Report of the Secretary of War; being part of the message and documents communicated to the two Houses of Congress at the beginning of the first Session of the fifty-second Congress. Vol. iv. House of Representatives, Ex. Doc. 1, Part 2. 8°. Washington, 1892.

Comprises "Rep. of the Chief Signal Officer for the year ending June 30, 1891."

|| **Watts, F.**—The hurricane over the West Indies, August 18th-19th, 1891. 1a. 8°. (*Quart. Journ. R. Meteor. Soc.*, xviii, 1892, *p.* 185.)

Weiss, Edmund.—Berichte der zur Beobachtung der totalen Sonnenfinsterniss des Jahres 1868 nach Aden unternommenen österreichischen Expedition. v. Bericht. Beitrag zur Klimatologie von Aden. 1a. 8°. (*Sitzb. math.-naturw. Cl., Akad. Wien*, lviii., *Abth.* ii., *p.* 882.)

Wellington, Meteorological Office.—Annual rainfall (return of), in inches, for each year from 1864 to 1891 inclusive, with diagrams for the four principal stations. f°. Wellington, 1892.

|| ——— [Meteorological observations in New Zealand.] 1891. sm. f°. (*Statist. New Zealand*, 1891, *p.* 80.)

* **Wetter, Das.**—Meteorologische Monatschrift für Gebildete aller Stände. Herausgegeben von R. Assmann. ix. Jahrg., 1892. 1a. 8°. Braun-schweig, 1892.

|| **Whipple, G. M.**—On the rate at which barometric changes traverse the British Isles. 1a. 8°. (*Quart. Journ. Meteor. Soc.*, vi., 1880, *p.* 136.)

——— Composite portraiture adapted to the reduction of meteorological and other similar observations. 1a. 8°. (*Quart. Journ. Meteor. Soc.*, ix., *p.* 189.)

|| ——— Results of a comparison of Richard's anémo-cinémographe with the standard Beckley anemograph at the Kew Observatory. 1a. 8°. (*Quart. Journ. R. Meteor. Soc.*, xviii., 1892, *p.* 257.)

|| **Wild, H.**—Instrument für erdmagnetische Messungen und astronomische Ortsbestimmungen auf Reisen. 1a. 4°. St. Petersburg, 1892. (*Repert. Meteor.*, xvi., *No.* 2.)

|| ——— Die Normalbarometer des Physikalischen Central-Observatoriums zu St. Petersburg. sm. f°. St. Petersburg, 1892. (*Repert. Meteor.*, xvi., *No.* 4.)

|| ——— Über die Darstellung des täglichen Ganges der Lufttemperatur durch die Besselsche Interpolationsformel. Lu le 2 décembre 1892. sm. f°. St. Pétersbourg, 1893. (*Mél. phys. chim.*, xiii., *livr.* 2.)

|| **Wilson, W. E., and Rambaut, A. A.**—The absorption of heat in the solar atmosphere. 8°. Dublin, 1892. (*Proc. R. Irish Acad.*, 3rd ser., ii., *p.* 299.)

Wiltshire Rainfall.—1892. oblong 8°. Marlborough, 1893.

|| **Woeikof, A.**—Klima des Puy de Dome in Central-frankreich. 1a. 8°. (*Meteor. Zeitschr.*, 1892, *Oct.*, *p.* 361.)

|| **Wollny, E.**—Untersuchungen über die Bildung und die Menge des Thaus. 8°. (*Forschungen auf dem Geb. Agrik.-phys.*, Heidelberg, xv., *Heft* 1, 2.)

* **Yeo, J. B.**—Climate and health resorts. New and cheaper edition, with an appendix. sm. 8°. London, 1890.

York, Yorkshire Philosophical Society.—Annual report for 1891. la. 8°. York, 1892.

Zi-ka-wei, Observatoire Magnétique et Météorologique.—Bulletin mensuel. Tome xvii., 1891. sm. f°. Zi-ka-wei, 1892.

Zürich, Schweiz. Departement des Innern.—Graphische Darstellung der schweizerischen hydrometrischen Beobachtungen. 1892. la. f°. Sheets.

For the second half of the year the title is in French.

——— Tabellarische Zusammenstellung der Haupt-Ergebnisse für das Jahr 1889. f°. Bern, s.a.

In the French language also.

——— **Schweizerische Meteorologische Central-Anstalt.**—Annalen. 1890. Der "Schweiz. meteor. Beob." xxvi. Jahrg. 4°. Zürich, s.a.

——— Wetterbericht. 1892, Jan. 1—Dec. 31. sm. f°. Sheets.

APPENDIX XVI.

ACCOUNT OF RECEIPTS AND PAYMENTS for the year ending 31st March 1893.

RECEIPTS.		PAYMENTS.	
£	s. d.	£	s. d.
Balance from year 1891-92 -	1,703 7 10	ADMINISTRATION:	£ s. d.
Parliamentary Vote -	15,300 0 0	Payment of Council -	993 15 0
Repayment of expenses charged under—		Secretary -	800 0 0
(1.) Incidental expenses -	7 8 8	Salaries and wages -	793 0 0
(2.) Expenses incidental to International Meteorological Congress -	1 8 0	Rent, fuel, and lighting	731 6 9
(3.) Observatories	32 4 1	Incidental and contingent expenses:—	
	41 0 9	Attendance, cleaning, &c. -	375 5 4
SUPPLY OF INFORMATION:		Furniture and fittings	141 0 0
Daily Weather Charts and Forecasts -	285 11 3	Expenses incidental to International Meteorological Congress -	2 8 0
6 p.m. Charts -	25 0 0	Pensions -	186 16 4
Reports for Press Agencies, &c.	91 0 7		4,023 11 5
Telegrams -	197 3 3	SPECIAL RESEARCHES	878 19 8
	598 15 1	LAND METEOROLOGY:	
SALE OF INSTRUMENTS, &c.:		Observatories and stations -	2,737 5 8
Royal Navy account -	14 13 1	Salaries:—Discussion and reduction of observations -	1,274 15 2
Mercantile Marine account -	19 4 4		4,012 0 10
M.O. (Stations) account -	26 0 0	WEATHER INFORMATION AND FORECASTS:	
	59 17 5	Telegraphic reports and storm warnings, &c.	2,616 19 0
Commissions executed for Colonial and Foreign Institutions, &c. -	352 8 3	Salaries:—Preparation and issue of reports and forecasts -	1,829 15 9
Commission charged on work done for Colonies, &c. -	17 3 7		4,446 14 9
		INSPECTIONS:	
		Salaries and travelling expenses -	487 7 1
		OCEAN METEOROLOGY:	
		Salaries:—Discussion and reduction of observations -	1,656 1 10
		Expenses incidental to the supply of instruments:—	
		Proportion for care and issue of instruments -	200 0 0
		Royal Navy -	329 6 11
		Mercantile Marine -	268 15 10
		Distant island and coast stations -	22 8 2
			2,476 12 9
		Commissions executed for Colonial and Foreign Institutions, &c. -	246 18 8
		BALANCE:	
		Cash at Bank -	1,399 8 3
		„ at Office -	80 19 11
		Advance for travelling expenses -	20 0 0
			1,500 8 2
	£ 18,072 12 11		£ 18,072 12 11

In the year 1892-93 the sum of 1,551*l.* 2*s.* 11*d.* was paid to the Post Office on account of inland and foreign telegrams, allowances to clerks, rental of private wires, &c.

APPENDIX XVII.

LIST OF PUBLICATIONS, &c. issued under the Authority
of the Meteorological Council.

OFFICIAL.

- No. 1. Report of the Meteorological Committee for 1867. 1s.
2. Instructions for Meteorological Telegraphy. New Edition, 1891. Prepared for the use of observers exclusively.
3. Fishery Barometer Manual. (New edition, 1887.) 6*d*.
4. Charts showing the Surface Temperature of the South Atlantic Ocean in each Month of the Year. 2*s*. 6*d*.
5. Report of the Meteorological Committee for 1868. 5*d*.
6. Report of the Meteorological Committee for 1869. 10*d*.
7. Quarterly Weather Report for 1869.—Parts I. to IV. 5*s*. each.
8. Barometer Manual. (Out of print. See Nos. 3, 24, 40, 60, and 61.)
9. Quarterly Weather Report for 1870.—Parts I. to IV. 5*s*. each.
10. Report of the Meteorological Committee for 1870. 10*d*.
11. Contributions to our Knowledge of the Meteorology of Cape Horn and the West Coast of South America. 2*s*. 6*d*.
12. Currents and Surface Temperature of the North Atlantic Ocean, from the Equator to Lat. 40° N., for each month of the year, with a General Current Chart. 2*s*. 6*d*.
13. A Discussion of the Meteorology of that Part of the Atlantic lying North of 30° N., for the Eleven Days ending 8th February 1870. With Book of Charts, 5*s*.
14. Quarterly Weather Report for 1871.—Parts I. to IV. 5*s*. each.
15. Report of the Meteorological Committee for 1871. 10*d*.
16. Quarterly Weather Report for 1872.—Parts I. to IV. 5*s*. each.
17. Report of the Meteorological Committee for 1872. 1*s*.
18. Contributions to our Knowledge of the Meteorology of the Antarctic Regions. 2*s*.
19. Quarterly Weather Report for 1873.—Parts I. to IV. 5*s*. each.
20. Charts of Meteorological Data for Square 3. Lat. 0°—10° N. Long. 20°—30° W., and Remarks to accompany the Monthly Charts, which show the Best Routes across the Equator for each Month, &c. 20*s*.
21. Report of the Proceedings of the Meteorological Congress at Vienna. 1873. 1*s*.
22. Report of the Meteorological Committee for 1873. 4*d*.
23. Report of the Proceedings of the Conference on Maritime Meteorology held in London, 1874. 2*s*.
24. Instructions in the Use of Meteorological Instruments. [Reprinted 1892.] 2*s*. 6*d*.
25. Quarterly Weather Report for 1874.—Parts I., II., and IV., 5*s*. each. Part III., 5*s*. 9*d*.
26. Report of the Meteorological Committee for 1874. 6*d*.

LIST OF PUBLICATIONS, &c.—*continued.*

- No. 27. Charts of Meteorological Data for the Nine 10° Squares of the Atlantic which lie between 20° N. and 10° S., and extend from 10° to 40° W., with accompanying Remarks, ending with the Best Routes across the Equator. 24s.
28. Contribution to the Meteorology of Japan. By Staff-Commander Thomas H. Tizard, H.M.S. *Challenger*. 1s.
29. Report of the Meteorological Committee for 1875. 4d.
30. Quarterly Weather Report for 1875.—Parts I.—IV. 5s. each.
31. Report of the Meteorological Committee for 1876–7. 3s. 5d.
32. The Meteorology of the North Atlantic during August 1873, with 31 Synoptic Charts. With Book of Charts. 15s.
33. Quarterly Weather Report for 1876 (New Series).—Part I., 6s.; Parts II., III., and IV., 5s. each.
- *33A. Meteorological Observations at Stations of the Second Order for the year 1876.
- 33B. Meteorological Observations at Stations of the Second Order for the year 1877.
34. Contributions to our Knowledge of the Meteorology of the Arctic Regions.—Vol. I.: Part I., 2s.; Part II., 10s.; Part III., 6s.; Part IV., 5s.; Part V., 6s.
35. Report of the Meteorological Council for 1877–8. 1s.
36. Report of the Proceedings of the Second International Meteorological Congress at Rome, 1879. 1s. 6d.
37. Report on the Meteorology of Kerguelen Island. By Rev. S. J. Perry, S.J., F.R.S. 3s.
38. Report of the Meteorological Council for 1878–9. 5d.
39. Meteorological Observations at Stations of the Second Order for the year 1878. 20s.
40. Aids to the Study and Forecast of Weather, by W. Clement Ley, M.A. 1s.
41. Report of the Meteorological Council for 1879–80. 1s.
42. Report of the Meteorological Council for 1880–81. 1s. 2d.
43. Meteorological Charts for the Ocean District adjacent to the Cape of Good Hope, with accompanying Remarks. Charts, 25s.; Remarks, 7s.
44. Report on the Gales experienced in the Ocean District adjacent to the Cape of Good Hope, between Lat. 30° and 50° S., and Long. 10° and 40° E., by Capt. H. Toynebee, F.R.A.S. 7s. 6d.
45. Meteorological Observations at Stations of the Second Order for the year 1879. 20s.
46. Report on the Storm of October 13–14, 1881. By Robert H. Scott, F.R.S. 1s. 6d.
47. Rainfall Tables of the British Isles for 1866–80. Compiled by G. J. Symons, F.R.S. 7s. 6d.
48. Report of the Meteorological Council for 1881–2. 1s.
49. Quarterly Weather Report for 1879. (New Series.) Parts I., II., and III., 6s. each; Part IV., 5s. 6d. Appendices and Plates. 27s.
50. Quarterly Weather Report for 1880. (New Series.) Parts I. and II., 6s. each; Part III., 4s.; Part IV., 6s. Appendices and Plates. 28s.

* The Observations at Stations of the Second Order for the years 1873–1875 will be found in the Quarterly Weather Report for the respective years.

LIST OF PUBLICATIONS, &c.—continued.

- No. 51.* Hourly Readings from the Self-Recording Instruments at the Seven Observatories under the Meteorological Council, 1881. (New Series.) Part I., 10s. 6d. Parts II., III., and IV., 21s. each.
52. Quarterly Weather Report for 1877. (New Series.) Part I., 10s.; Part II., 5s.; Part III., 4s. 6d.; Part IV., 6s. Appendices and Plates. 27s.
53. Meteorological Atlas of the British Isles. 5s. 6d.
54. Hourly Readings from the Self-Recording Instruments at the Seven Observatories under the Meteorological Council, 1882. Parts I. and II., 20s. each; Part III., 22s. 6d.; Part IV., 26s.
55. Quarterly Weather Report for 1878. (New Series.) Parts I., II., III., and IV., 6s. each. Appendices and Plates. 28s.
56. Sunshine Records of the United Kingdom for 1881. 4s.
57. Meteorological Observations at Stations of the Second Order for the year 1880. 34s. 6d.
58. Report of the Meteorological Council for 1882-3. 10½d.
59. Charts showing the Surface Temperature of the Atlantic, Indian, and Pacific Oceans. 21s.
60. Principles of Forecasting by means of Weather Charts. By the Hon. Ralph Abercromby, F.R.Met.Soc. (Second edition, revised.) 2s.
61. A Barometer Manual for the Use of Seamen. 1s. 3d.
62. Monthly Weather Reports for 1884. Jan., Feb., March, May—Nov., 1s. 6d. each. April (with 2 Appendices), 2s. 6d. Dec., 1s. 9d.
63. Hourly Readings from the Self-Recording Instruments at the Seven Observatories under the Meteorological Council, 1883. Parts I., II., and III., 21s. each; Part IV., 30s.
64. Report of the Meteorological Council for 1883-4. 1s. 2d.
65. Monthly Weather Reports for 1885. Jan. to Dec., 1s. 6d. each.
66. Meteorological Observations at Stations of the Second Order for the year 1881. 35s.
67. Report of the Meteorological Council for 1884-5. 4s. 4d.
68. Monthly Weather Reports for 1886. Jan. to Dec., 1s. 6d. each.
69. Meteorological Observations at Stations of the Second Order for the year 1882. 35s.
70. Hourly Readings from the Self-Recording Instruments at the Four Observatories under the Meteorological Council, 1884. Part I., 12s.; Part II., 10s.; Part III., 10s. 6d.; Part IV., 15s.
71. Synchronous Weather Charts of the North Atlantic and the adjacent Continents. Aug. 1, 1882, to Sept. 3, 1883. Parts I. to IV. (33 sheets each.) 17s. each.
72. Report of the Meteorological Council for 1885-86. 8d.
73. Meteorological Observations at Stations of the Second Order for the year 1883. 30s.
74. Hourly Readings from the Self-Recording Instruments at the Four Observatories under the Meteorological Council, 1885. Parts I. and II., 11s. each; Part III., 10s. 6d.; Part IV., 12s.

* For the years 1874-1880 the Hourly Readings were issued in lithographed form. Price 20s. per annum.

LIST OF PUBLICATIONS, &c.—*continued.*

- No. 75. Report of the Meteorological Council for 1886–87. 8*d.*
76. Charts showing the Mean Barometric Pressure over the Atlantic, Indian, and Pacific Oceans. 10*s.* 6*d.* Supplementary Chart, 6*d.*
- *77. Monthly Weather Reports for 1887. January to April, 1*s.* 6*d.* each. May to December, in wrapper, 12*s.*
78. Meteorological Observations at Stations of the Second Order for the year 1884. 32*s.*
79. Report of the Meteorological Council for 1887–88. 1*s.*
80. Daily Weather Charts for the period of six weeks ending June 25, 1885, to illustrate the tracks of two cyclones in the Arabian Sea. 10*s.*
81. Hourly Readings from the Self-Recording Instruments at the Four Observatories under the Meteorological Council, 1886. Parts I., II., and III., 10*s.* 6*d.* each. Part IV., 12*s.* 6*d.*
82. Meteorological Observations at Stations of the Second Order for the year 1885. 31*s.*
83. Meteorological Observations at the Foreign and Colonial Stations of the Royal Engineers and the Army Medical Department. 1852–1886. 23*s.*
84. Report of the Meteorological Council for 1888–89. 5½*d.*
- †85. Weekly Weather Report for the year 1888. Vol. V. Second Series. 4*d.* per week. With Appendices and Monthly Supplements, priced separately.
86. Weekly Weather Report for the year 1889. Vol. VI. Second Series. 6*d.* per week. With Appendices and Monthly Supplements, priced separately.
87. Weekly Weather Report for the year 1890. Vol. VII. Third Series. 6*d.* per week. With Appendices and Monthly Supplements, priced separately.
88. Meteorological Observations at Stations of the Second Order for the year 1886. 25*s.*
89. Meteorological Observations made at Sanchez, Samaná Bay, St. Domingo. 1886–88. By the late W. Reid, M.D. 8*s.* 6*d.*
90. Cyclone Tracks in the South Indian Ocean. From information compiled by Dr. Meldrum, C.M.G., F.R.S. 7*s.*
91. Report of the Meteorological Council for 1889–90. 7½*d.*
92. Meteorological Charts of the portion of the Indian Ocean adjacent to Cape Guardafui and Ras Hafún. 6*s.*
93. Harmonic Analysis of Hourly Observations of Air Temperature and of Pressure at British Observatories. 12*s.*
94. Hourly Means of the Readings obtained from the Self-Recording Instruments at the Four Observatories under the Meteorological Council, 1887. 16*s.*
95. Meteorological Observations at Stations of the Second Order for the year 1887. 24*s.*
96. Weekly Weather Report for the year 1891. Vol. VIII., Third Series. 6*d.* per week. With Appendices and Monthly Supplements, priced separately. Annual subscription, including Supplements and Appendices, post paid, 30*s.*

* Publication continued after this year as a Supplement to the Weekly Weather Report.

† The publication of the Weekly Weather Report began in February 1878. Annual subscription, 1878–1883, 12*s.* 6*d.*; 1884–1887, 21*s.* 2*d.*

LIST OF PUBLICATIONS, &c.—continued.

- No. 97. Hourly Means of the Readings obtained from the Self-Recording Instruments at the Four Observatories under the Meteorological Council, 1888. 20s.
98. Ten Years Sunshine in the British Isles, 1881-90. 2s.
99. Report of the Meteorological Council for 1890-91. 5½d.
100. Weekly Weather Report for the year 1892. Vol. IX., Third Series. 6d. per week. With Appendices and Monthly Supplements, priced separately. Annual Subscription, including Supplements and Appendices, Post paid, 30s.
101. Meteorological Observations at Stations of the Second Order for the year 1888. 22s.
102. Report of the International Meteorological Conference at Munich in 1891. 1s. 6d.
103. Hourly Means of the Readings obtained from the Self-Recording Instruments at the Four Observatories under the Meteorological Council, 1889. 15s.
104. Report of the Meteorological Council for 1891-92. 6d.
105. Hourly Means of the Readings obtained from the Self-Recording Instruments at the Four Observatories under the Meteorological Council, 1890. 20s.
106. Wind and Current Charts of the Red Sea. (In the Press.)
107. Weekly Weather Report for the year 1893. Vol. X., Third Series. 6d. per week. With Appendices and Monthly Supplements priced separately. Annual Subscription, including Supplements and Appendices, post paid, 30s.
108. Meteorological Observations at Stations of the Second Order for the year 1889. (In the Press.)
109. Report of the Meteorological Council for 1892-93.

NON-OFFICIAL.

- No. 1. Report of an Inquiry into the Connexion between Strong Winds and Barometrical Differences.—By Robert H. Scott, Director of the Office. 6d.
2. Report to the Committee of the Meteorological Office on the Meteorology of the North Atlantic.—By Captain H. Toynbee, F.R.A.S., Marine Superintendent. 1s.
3. Report to the Committee of the Meteorological Office on the Use of Isobaric Curves.—By Captain H. Toynbee, F.R.A.S., Marine Superintendent. 1s.
4. Routes for Steamers from Aden to the Straits of Sunda and back. Translated from a Paper issued by the Royal Meteorological Institute of the Netherlands. 6d.
5. On the Winds, &c. of the North Atlantic along the Tracks of Steamers from the Channel to New York. Translated from a Paper issued by the Deutsche Seewarte, Hamburg. 6d.
6. Report of the Proceedings of the Meteorological Conference at Leipzig. 1872. 1s.

LIST OF PUBLICATIONS, &c.—*continued.*

- No. 7. Notes on the Form of Cyclones in the Southern Indian Ocean.—By C. Meldrum, M.A., F.R.S. [Out of Print.]
 8. Report on Weather Telegraphy and Storm Warnings. Presented to the Meteorological Congress at Vienna. 1873. 6*d.*
 9. Report of the Permanent Committee of the First International Meteorological Congress at Vienna for 1874. 1*s.* 6*d.*
 10. On the Physical Geography of the part of the Atlantic which lies between 20° N. and 10° S. and extends from 10° to 40° W. A Paper read before the British Association at Bristol, in August 1875.—By Capt. Toyne, F.R.A.S., F.R.G.S., Marine Superintendent. 1*s.* 6*d.*
 11. Report of the Permanent Committee of the First International Congress at Vienna for 1876. With Supplement. 2*s.*
 12. Reports to the Permanent Committee of the First International Meteorological Congress at Vienna on Atmospheric Electricity, Maritime Meteorology, and Weather Telegraphy, 1878. 2*s.*
 13. Report of the Permanent Committee of the First International Congress at Vienna for 1878. 6*d.*
 14. Report of the International Meteorological Committee. Meeting at Berne, 1880. 1*s.*
 15. Report of the Second Meeting of the International Meteorological Committee, held at Copenhagen, August 1882. 2*s.* 6*d.*
 16. Report of the Third Meeting of the International Meteorological Committee, held at Paris, September 1885. 1*s.*
 17. Report of the Fourth Meeting of the International Meteorological Committee, held at Zürich, September 1888. 4*d.*
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