REPORT

OF THE

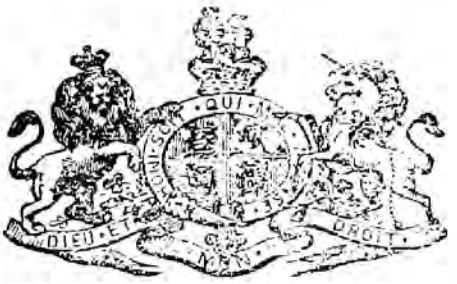
METEOROLOGICAL COUNCIL

TO THE

ROYAL SOCIETY,

For the Year ending 31st of March 1888.

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



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THE METEOROLOGICAL COUNCIL,

1887–88.

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

MR. ALEXANDER BUCHAN, LL.D., F.R.S.E. (appointed December 24, 1887).

Professor GEORGE HOWARD DARWIN, M.A., LL.D., F.R.S.

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

Professor GEORGE GABRIEL STOKES, LL.D., P.R.S. (resigned November 7, 1887).

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

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

REPORT

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For the Year ending March 31, 1888.

Introductory.

THE COUNCIL has to record the resignation by Professor Stokes, President of the Royal Society, of his seat, which he has held since the formation of the Council in 1877; and in so doing they desire to express the sense they entertain of the high value of his services, and their regret that circumstances should have deprived them of a colleague so eminently qualified to aid them with his advice, and to give weight to the results of their deliberations. The vacancy thus caused has been filled by the appointment of Mr. Alexander Buchan, LL.D., F.R.S.E., Secretary to the Scottish Meteorological Society. The executive officers continue as before:—

Mr. R. H. Scott, M.A., F.R.S., Secretary.
Captain H. Toynbee, F.R.A.S., Marine Superintendent.
Navigating-Lieutenant C. W. Baillie, F.R.A.S., Assistant do.

The present Report is as usual arranged under three headings:—

I. Ocean Meteorology.
II. Weather Telegraphy.
III. Land Meteorology of the British Isles.

PART I.

OCEAN METEOROLOGY.

Collection of information.

Collection of Information.—The practice followed by the Office as regards its dealing with observers at sea has not been changed, and is described in former Reports.

Recognition of "excellent" observers

Appendix I. (p. 41) contains a list of all the observers who have contributed "excellent" logs during the past year. Some of them have regularly co-operated with the Office for many years; the names which now appear in the list for the first time are as follows:—

Captain's Name.	Ship.
Ashdown, Edward - - -	S.S. "Brindisi."
Cameron, H. - - - -	S.S. "Ardandhu."
Cameron, J. G. - - -	S.S. "Adriatic."
Cromarty, D. S. - - -	"Cassandra."

Captain's Name.	Ship.
Dark, Samuel	"Blairgowrie."
Donaldson, J.	"Gareloch."
Ewan, John	S.S. "Kenmore."
Exham, T. K.	S.S. "Severn."
Hood, William	"County of Edinburgh."
Janes, George	"Middlesex."
Jones, Richard	"Thomas Hilyard."
Kempe, A. H.	"Hudson."
Millican, J. W.	"Myrtle Holme."
Milner, W. H.	S.S. "Severn" and S.S. "Solent."
Mitchell, John	"Cape Verde."
Read, G. W., F.R.G.S.	S.S. "Auretta."
Richardson, Mr. W. H.	Do.
Ross, James	S.S. "Ben Alder."
Tancred, Sub.-Lieut. J. C., R.N.	H.M.S. "Egeria."

The Council regret to record the death of Captains George Denham, John Peach Holdich, R.N.R., and R. S. Tannock, who were "excellent" observers.

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

The following is the total number of logs received from April 1, 1887, to March 31, 1888, and the number of logs which have been classed as "excellent":—

Total No. of Logs received.	No. of Excellent Logs.	Per-centage of Excellent Logs.
182	128	70

The average number of logs received annually during the five years, 1882–86, was 175, and the per-centage of excellent logs among these was 73.

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

Districts from which observations are obtained.

On the 31st of March 1888 the ships observing for the Office were pursuing the following voyages:—

To Baffin's Bay or Greenland	4
„ North America, East Coast	15
„ „ „ West „	8
Off East Coast of North America	3
To South America, East Coast	10
„ „ „ West „	5
„ Australia and New Zealand, viâ Cape of Good Hope	33
„ „ „ „ Suez	4
„ India, viâ Suez	8
„ India, viâ Cape of Good Hope	24
„ China Seas, viâ Suez	7
„ West Coast of Africa	1
„ Cape of Good Hope	2
„ West Indies	10
Between British Ports	6
Unknown	5
Total number of ships	145

Appendix II. (p. 44) supplies a list of the logs and of all the documents from stations abroad received at the Office during the year.

Resignation of Captain Toynbee.

Contemplated Resignation of Captain Toynbee.—The Council have to announce, with great regret, that Captain Toynbee has intimated to them his wish to retire from the Office at the end of June 1888. He has discharged the duties of Marine Superintendent for a period of over 21 years, and the Council desire to record their high sense of the intelligence and untiring devotion he has exhibited in the discharge of his duties. They contemplate the appointment of Mr. Baillie to the post to be vacated by Captain Toynbee.

Synchronous weather charts.

North Atlantic Weather Charts.—The investigation of the weather over the North Atlantic Ocean for the 13 months, beginning August 1st, 1882, and ending August 31st, 1883, the period during which the International System of Circumpolar Observations was carried out, has employed nearly the whole Marine Branch of the Office during the interval covered by this Report. The work is now completed.

An additional sheet has been given for September 1st to 3rd, 1883, to show more satisfactorily the progress of an important cyclonic system which originated near 20° N., 55° W., on the 21st August, and gradually developed into the severe cyclone which crossed the British Islands on September 1st to 3rd. It passed north of Norway after the 6th.

The method adopted for carrying out the investigation, with specimen charts, will be found at pp. 8–10 of the Report for 1883. A note, drawn up by the Secretary, stating some results of a consideration of these charts with respect to the light thrown by them on the probable utility of telegraphy of storms from America, will be found at Note A., p. 22.

Meteorology of the Red Sea.

Red Sea Charts.—The discussion of the Meteorology of the Red Sea, based on information obtained from the Admiralty, the Royal Meteorological Institute of the Netherlands, and the Peninsular and Oriental Steamship Company, as well as from logs obtained from other sources, has been continued on the system explained in last year's Report.

The tracks of steamers through the Red Sea are confined to such a narrow strip that it was thought best to represent the barometrical and thermometrical data by projections along lines indicating the course down the axis of the sea, while the winds are shown in "roses" along the average track, and the currents in their observed position.

Barometrical pressure charts

The Charts of Barometrical Pressure for the Atlantic, Pacific, and Indian Oceans for the months of February, May, August, and November are in the publisher's hands. A chart showing the mean barometrical pressure for the year has also been prepared for the same oceans, and will soon be published.

Foreign stations.

Supply of Instruments to Foreign Stations.—On the recommendation of the Hydrographer instruments have been supplied on loan to the Spanish National and West African Coast Cable Co., for use at their stations at Teneriffe, Bathurst, Grand Bassin, Saint Thomas, and the Gaboon River.

Instruments have also been supplied to Watling Island, an additional lighthouse station in the Bahamas.

A rain gauge has been supplied to Mr. Ford, a resident on Valua Island, in the Banks Group, near the New Hebrides.

Current charts.

Current Charts for the Atlantic, Pacific, and Indian Oceans.—Considerable progress has been made during the past year in the construction of these charts, and the staff employed on them having been gradually increased, as the North Atlantic Weather Charts were finished, they will proceed more rapidly in future.

The charts representing the winds, currents, temperature of the sea, &c., off Cape Guardafui during the South-west Monsoon, which have been constructed with the object of assisting seamen when rounding that Cape, in the vicinity of which casualties are frequent, have had valuable additions made to them, and it is hoped that they will soon be ready for publication.

Charts of the Aden cyclone, 1885.

The Aden Cyclone of June 1885.—At the suggestion of Dr. Meldrum, of the Mauritius, the Council have collected, from all available sources, information as to the weather over the North Indian Ocean in the months of May and June 1885. 233 logs having been received, synchronous daily charts of that ocean have been prepared for the space of about six weeks with the view of throwing some light on the history of this storm, particularly as regards its unusual course over the Arabian Sea and Gulf of Aden.

Indian Ocean cyclone tracks.

Cyclone Tracks in the Southern Indian Ocean.—Monthly charts are being prepared to show the seasonal distribution of cyclones in the Southern Indian Ocean for the years 1848–1886. The material for these charts has been received from Dr. Meldrum, of Mauritius, who, in concert with the local Meteorological Society, has long been engaged in the study of these storms, a knowledge of the occurrence of which is of great practical interest to the inhabitants of the island, and to navigators on the South Indian Ocean. As this information is highly important to seamen, the Council have resolved to aid in its publication.

Charts to accompany meteorological logs.

Charts for Meteorological Logs.—It is intended by the Council, to issue in future, with the "Instructions for Keeping the Meteorological Log," which are supplied to intending observers at sea, who make use of the form of log prepared by the Office, a copy of each of the four small quarterly index charts of surface temperature, and of barometrical pressure over the ocean, which have been published by the Office. These charts will be accompanied by a copy of the latest Admiralty chart of Magnetic Variation. The information thus supplied cannot fail to be useful

to captains of ships, and likely to assist them in the careful record of the meteorological data which they enter in their logs.

Arctic meteorology.

Contributions to our Knowledge of the Meteorology of the Arctic Regions.—Part V. of this work is now in the press. It deals with documents relating to the following wintering stations situated in the neighbourhood of Behring Straits:—

Wintering Station.	Ships.	Commanders.	Years.	Information already published.
Port Providence	H.M.S. Plover	T. E. L. Moore	1848–9	Nothing published.
Chamisso Island	,,	,,	1849–50	,, ,,
Port Clarence -	,,	,,	1850–1	,, ,,
,, -	,,	,,	1851–2	,, ,,
,,	H.M.S. Rattlesnake.	H. Trollope -	1853–4	,, ,,
Point Barrow -	H.M.S. Plover	R. Maguire -	1852–4	Temperature by Dr. Simpson, R.N.

The future Marine Work of the Office.—It is contemplated, as soon as the Red Sea work is completed, to take up the discussion of the weather, in the manner adopted for parts of the Atlantic, for the region lying between the Cape of Good Hope and New Zealand, the outward track of the Australasian trade.

Instruments belonging to the Office.

Supply and Stock of Instruments.—In Appendix III. (p. 61) will be found a list of the meteorological instruments supplied by the Office to ships in the Royal Navy during the year, with a statement of the entire stock and distribution of instruments standing on the books, to the account of the Admiralty, on the 31st March 1888.

Appendix IV. (p. 62) gives similar information with regard to the disposal of the other instruments belonging to the Office, which are mainly supplied to the Mercantile Marine.

PART II.

Weather Telegraphy.

Administrative.

The service has been generally conducted as in previous years. In the middle of March the telegraphic communication between Stornoway and the mainland broke down, and had not been restored at the date of this Report.*

The following have been the only changes worth notice in the reporting staff during the year. At Prawle Point Mr. Hewitt has been appointed officer of the coast-guard station, and has taken over the duty of reporting from Mr. John. At Parsonstown and Pembroke (St. Anne's Head) there have been slight changes.†

* Communication was restored on April 13th.

† The Council have to regret the loss by death, early in the month of April, of Mr. J. M'Cormack, who had been for many years their meteorological reporter at Aberdeen.

Administrative.

A list of the telegraphic reporters will be found in Appendix V. (p. 63), and a Map of all the stations is appended to Note D., p. 33.

The work in this branch of the Office continues to increase. The addition of the new foreign reports (as mentioned in the Report for 1886, App. VII.) to the other information received daily by telegraph, and the daily entry on special charts of the information received by telegraph from the United States, entail a material increase in routine work, such as correction of the ordinary errors of reporting and transmission, and there has besides been a steady increase in the amount of information conveyed by the Daily and Weekly Weather Reports. The time required for this must be taken from the scanty margin available for scientific investigation. The death in the month of September of Mr. H. J. Stevens, the telegraphist, has also seriously delayed the work.

Inspection of the stations.

Inspection of the Telegraphic Reporting Stations.—The telegraphic reporting stations have been inspected during the year, in England (including Jersey) by the Rev. W. Clement 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. 64), show that the efficiency of the service has been maintained.

Discussion of the reports.

Discussion and Publication of the Information received.—An account of the practice of the Office in the collection, discussion, and dissemination of the meteorological information received by telegraph is given in Appendix VII. (p. 81), and a list of the institutions and persons who received the Daily Weather Reports and Charts free of cost in 1887–8 in Appendix VIII. (p. 92).

Forecasts.

Weather Forecasts.—There has been no material change in the system of preparation and issue of the forecasts during the year.

Forecasts are prepared three times a day, at 11h. a.m., at 3h. 30m., and 8h. 30m. 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 posted up in several places in London,* and supplied for the afternoon editions of the newspapers. The forecasts prepared at 8h. 30m. p.m. are intended primarily for the newspapers, but any of the forecasts are available for the information of persons requiring them.

Inquiries at the Office.

The inquiries received through the Post Office for special forecasts during the year amounted to 63, and the personal applications to 71. The rules of the Office relating to such inquiries

---

* Viz., in the City, at the Mansion House, Lloyd's Rooms, Messrs. R. & J. Beck's, Cornhill, and Messrs. Thos. de la Rue & Co.'s, Bunhill Row; in the West End, in the Libraries of the House of Lords and 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.

continue the same as in previous years. See Appendix VII. (p. 81).

The results of a comparison of the Forecasts issued at 8 p.m. during the year with the weather actually experienced are given in Appendix XI. (p. 98). The following summary of successes and failures, estimated as explained in that Appendix, shows that the average of success over the whole United Kingdom has been 84 per cent., 3 per cent. more than for the previous year. Testing of the forecasts.

SUMMARY OF RESULTS of 8.30 p.m. FORECASTS, 1887.

Districts.	Percentages.				Total percentage of Success.
	Complete Success.	Partial* Success.	Partial* Failure.	Total Failure.	
SCOTLAND, N. - -	52	33	10	5	85
„ E. - -	51	32	11	6	83
ENGLAND, N.E. - -	57	30	8	5	87
„ E. - -	54	32	9	5	86
MIDLAND COUNTIES -	53	32	11	4	85
ENGLAND, S. - -	56	30	10	4	86
SCOTLAND, W. - -	46	34	12	8	80
ENGLAND, N.W. -	55	27	11	7	82
„ S.W. -	57	28	8	7	85
IRELAND, N. - -	49	31	12	8	80
„ S. - -	50	30	11	9	80
Summary - -	53	31	10	6	84

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

Hay Harvest Forecasts.—The Council renewed in 1887 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 the two conditions, that the information should be made known as widely as possible, and that a record should be kept of the weather actually experienced and be sent weekly to the Office. The Societies again cordially accepted the proposal, and the following list of recipients was prepared:— Hay Harvest Forecasts.

Hay Harvest Forecasts.

List of those who received Hay Harvest Forecasts in 1887.

Districts.	To whom sent.	Address.
0. Scotland, N.	Rev. Dr. Joass	Golspie.
	Major Smith	Munlochy, Inverness.
1. Scotland, E.	G. Johnstone	Glamis, by Forfar.
	W. W. Kerr	Ferrygate, North Berwick.
	A. F. Leslie	Braco, Keith.
	C. L. W. Forbes	Aberfeldy.
2. England, N.E.	J. Wilson	Chillingham Barns, Chatton, Northumberland.
	J. Turner	The Grange, Ulceby.
3. England, E.	W. Birkbeck	High House, Thorpe, Norwich.
	Sir J. B. Lawes, Bt., and J. H. Gilbert, Ph.D.	Rothamsted, Harpenden.
4. Midland Counties	Royal Agricultural College.	Cirencester.
	E. E. Harcourt-Vernon	Grove Hall, East Retford.
5. England, S.	C. Whitehead	Barming House, Maidstone.
	E. P. Squarey	The Moot, Downton, Wilts.
	G. M. Allender	Stammerham, Horsham.
6. Scotland, W.	W. Calder	Castle Hill, Dalreoch, Dumbarton.
	M. J. Stewart, M.P.	Ardwell, Stranraer.
	J. S. R. Ballingal	Eallabus House, Islay.
7. England, N.W.	G. W. Wray	Leyburn, Yorkshire.
	The Earl of Derby, K.G.	Knowsley Hall, Prescot.
	F. W. Earle, Esq.	Edenhurst, Roby, Liverpool.
8. England, S.W.	Colonel J. B. Turbervill	Ewenny Priory, Bridgend, Glamorganshire.
	The Earl of Ducie	Spring Park, Gloucestershire.
	T. Dyke	Long Ashton, Clifton, Bristol.
9. Ireland, N.	Rev. A. Brown	The Manse, Hollymount, Co. Mayo.
	E. F. Farrell	Moynalty, Co. Meath.
10. Ireland, S.	D. A. M'Cready	Larchvale, Moneygall, King's Co.
	D. A. Milward	Lavistown, Kilkenny.
	W. Talbot Crosbie, D.L.	Ardfert Abbey, Tralee, Co. Kerry.

The issue of the forecasts commenced (June 13th) with those for England, E., the Midland counties, and England, S., and later those for the other districts were added. The forecasts were issued daily (excepting on Sundays), and in most instances they were continued for about five weeks.

The general result of the issue of these forecasts is shown by the subjoined table, which has been compiled solely from the

reports of the above-mentioned gentlemen, and is entirely independent of any estimate formed within the Office itself:— Hay Harvest Forecasts.

SUMMARY of RESULTS.—HAY HARVEST FORECASTS, 1887.

Districts.	Names of Stations.	Percentages.				Total percentage of Success.
		Complete Success.	Partial Success.	Partial Failure.	Total Failure.	
SCOTLAND, N. -	Golspie and Munlochy - - -	54	38	8	—	92
„ E. -	North Berwick, Glamis, Aberfeldy, and Braco.	49	26	2	23	75
ENGLAND, N.E. -	Chatton and Ulceby - - -	45	39	13	3	84
„ E. -	Thorpe and Rothamsted - -	71	22	3	4	93
MIDLAND COUNTIES	Cirencester and East Retford - -	50	30	12	8	80
ENGLAND, S. - -	Horsham, Maidstone, and Downton -	66	31	3	—	97
SCOTLAND, W. -	Dumbarton, Islay, and Stranraer -	61	33	6	—	94
ENGLAND, N.W. -	Leyburn, Prescot, and Liverpool -	56	35	6	3	91
„ S.W. -	Bridgend (Glamorgan), Clifton and Spring Park (Gloucestershire).	55	37	8	—	92
IRELAND, N. - -	Moynalty, and Hollymount - -	52	34	14	—	86
„ S. - -	Moneygall, Kilkenny, Ardfert Abbey -	58	33	9	—	91
	Mean for all districts, 1887 - -	56	32	8	4	88
	„ „ 1886 - -	53	31	13	3	84

The result of this year's checking shows that the general per-centage was 4 per cent. higher than in the preceding year. The largest general per-centage (97) was reached in England, S., while the smallest (75) was in Scotland, E.

In addition to the gentlemen who acted as recipients of these forecasts in 1887, and whose names are given on page 12, nine large landowners residing in different parts of the country applied for receipt of the forecasts at their own expense.

Independent testimony as to the correctness of the forecasts during the summer of 1887, and as to their value to, and appreciation by, the agricultural community was borne by Major Smith (Invernesshire), Mr. Boothby (Derbyshire), Mr. Fergusson (Suffolk), Sir J. Shelley (Devonshire), and Mr. Turner (Lincolnshire).

Storm Warnings for the Coasts of the United Kingdom.—In Appendix X. (p. 96) will be found the names of the stations which are furnished with signals for Storm Warnings, in accordance with Circular 717 of the Board of Trade issued in February 1874. Storm warnings.

Storm warnings.

These stations were, at the end of March 1888, 146 in number situated :—

70 in England, 14 in Wales, 41 in Scotland, 15 in Ireland, 3 in the Isle of Man, and 3 in the Channel Islands.

The usual comparison has been instituted in the Office between the warnings issued in 1887 and the weather experienced on our coasts, the warnings being tested by the method explained in Appendix VII. (p. 91). The results of the comparison are shown in the following tables:—

RETURN of the Result of the Comparison between the Warnings issued and the Weather experienced in 1887.

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.	Warnings in Error owing to telegraphic mistakes.	Storms for which no Warning was issued.
Ireland, South -	58	32	12	12	—	1	1	Jan. 3.
„ East -	68	34	20	12	—	1	1	—
Scotland, East -	62	37	13	11	—	1	—	—
„ West -	52	25	18	8	—	1	—	Dec. 17.
England, North-west	57	42	5	8	—	1	1	Dec. 17.
„ West -	42	19	17	5	—	—	1	Dec. 6.
„ South-west	38	22	8	7	—	—	1	Dec. 6.
„ South -	34	19	10	5	—	—	—	March 31, April 6.
„ South-east	29	15	12	2	—	—	—	April 6.
„ East -	32	17	8	7	—	—	—	—
Totals - -	472	262	123	77	—	5	5	
Per-centages -	—	55·5	26·1	16·4	—	1·0	1·0	

NOTES as to GALES in 1887 for which WARNINGS were not issued.

Gale of January 3rd, in Ireland, S.—This gale came on suddenly early on January 3rd, but at 6 p.m., on the 2nd, there was no indication of its approach.

Gale of March 31st—April 1st, in England, S.—This was a local extension of a Northerly gale, which was felt on many parts of our coasts during the night of March 31st—April 1st. The other coasts were all duly warned, but there was no reason to suppose that the south coast would feel much of it, and in fact Hurst Castle and the Owers Lightship were the only stations which reported it as a strong gale.

Gale of April 6th in England, S. and S.E.—North-easterly winds were setting in on the evening of the 5th, and the northern and north-eastern parts of our Islands were warned. During the night, however, the barometer rose very quickly in the N., and as the change spread rapidly the gradients became steep in the S.

and S.E., and the gale set in before morning. I do not see how this mistake was to be avoided. Storm warnings.

Gale of December 6th, in England, W. and S.W.—A Southerly and South-westerly gale, caused by the approach of a deep depression to the Hebrides during the night of December 5th–6th, and a "V"-shaped secondary to the Irish Sea. Of the advance of the latter which caused the gale in question, there was no indication at 6 p.m. on the 5th; the more northern of our western coasts were duly warned.

Gale of December 17th, in Scotland, W., and England, N.W.—At 6 p.m. on the 16th there was a large depression in the N., moving eastwards, and having slight gradients near its centre. A rapid rise of the barometer in the W. and S.W. during the night caused an increase of the gradient on our north-western coasts, and hence the gale,—which, however, was duly warned for on the other coasts.

The following table contains a comparative statement of the storm warnings and their results in 1887, and in the ten preceding years. It will be seen that the percentage of warnings justified is slightly lower than in the preceding year:— Comparison of results for 1887 with previous years.

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.
1877	475	53·3	25·9	79·2	16·4
1878	485	56·7	20·8	77·5	17·9
1879	509	50·5	25·1	75·6	20·6
1880	390	58·2	24·6	82·8	13·3
1881	454	58·6	23·3	81·9	14·8
1882	503	61·4	21·1	82·5	14·9
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

Fishery Barometers.—In connexion with the subject of storm warnings the supply of public barometers on loan to fishing stations and other places on the coast should be mentioned. The whole number of stations supplied by the Office with these instruments is 167. Of these stations, 57 are in England, 5 in Wales, 46 in Ireland, 55 in Scotland, 3 in the Isle of Man, and 1 in Jersey. The list is given in Appendix IX., p. 95. Fishery barometers.

As in many cases a long time had elapsed since the issue of these instruments, circulars were issued in the course of the year to collect information as to their present condition. The replies have been of a satisfactory nature. In the great majority of cases the barometers are stated to be well cared for and prized by the fishing population of the respective districts.

Fishery barometers.

The Council propose, as opportunity offers, to have the several stations visited, and, if possible, to provide the means of giving oral explanations to fishermen and others of the utility of these instruments in connexion with weather forecasting. A commencement has already been made with these visits on parts of the coast between Edinburgh and Dundee, and the results appear to justify the further prosecution of the plan.

The new edition of the Fishery Barometer Manual was issued during the year, and has been distributed to the fishery barometer stations as indicated in last report.

Distribution of gales on the coasts.

Distribution of Gales on the Coasts of the British Isles.—In last year's report a table was given showing the relative prevalence of gales in the four quadrants (N. to E., E. to S., &c.) in different districts of the coast. A further investigation has been made of the distribution of severe local gales in different districts. The result is given in Note B. (p. 26).

Observations on Ben Nevis.

Observations on Ben Nevis.—The arrangements with the Directors of the Observatory established on the summit of Ben Nevis, at a height of 4,406 feet above the sea, detailed in the Report for 1885, have been continued during the year. The Council have continued the annual grant of 100*l.* towards the expenses of the observatory, and have received MS. copies of all the meteorological observations taken. No telegrams have been received from the summit during the year.

The Council have been in communication with the Directors of the Observatory regarding its present condition, and certain contemplated arrangements in connexion with it; and with reference to these, the Council resolved to make proposals to the Directors for co-operation, and the grant of further pecuniary aid, subject to conditions which are under their consideration.

Atlantic telegrams.

Atlantic Telegrams.—The transmission of these telegrams which give a general summary of the principal features of the atmospherical conditions over the United States, supplemented by ship reports, have been continued during the past year.

As explained in last year's report, this service has been carried on conjointly by the Central Meteorological Office in Paris and the Meteorological Council, and it was continued for about 18 months, the telegrams being received in Paris, and their contents transmitted to London by post. The collection of the information and transmission of the telegrams is undertaken by the Chief Signal Office, Washington, whose staff in New York and Boston are charged with the execution of the duty.

The conclusion having been come to that the information conveyed by these telegrams has not been of any practical utility in the issue of forecasts and storm warnings, the Council have resolved to discontinue their participation in the payment for their transmission. This step was not taken without consultation with the eminent Director of the Paris Meteorological Office, who was unable to satisfy the Council that any practically useful result had been obtained by their means at that Office. Although Mons.

Mascart proposes to continue the service for a further period, the Council did not feel themselves justified in applying the funds at their disposal to this object for the reasons now explained. They have, however, invited M. Mascart to let them hear if he is able to make a more favourable report regarding the telegrams, and as he has offered to supply copies of them, for transmission by post to London, they will continue to be watched here in connexion with this branch of the Office. Atlantic telegrams.

Some remarks on the probable value to this country of such a service of telegrams as indicated by the consideration of the Atlantic Weather Charts will be found in Note A., p. 22.

Weather Reports.—The Daily Weather Report has appeared regularly, and has again been added to. For details, see Appendix VII., p. 81. Publications.

The Weekly Weather Report has appeared in its enlarged form, as explained in the last Report, and has been further improved by the addition since 1st January 1887, of six new stations situated in the inland districts of Scotland.

The Quarterly Summary, issued as Appendix I. to the Weekly Weather Report, gives the Monthly and Progressive values of Accumulated Heat, Rainfall, and Bright Sunshine for all the districts in each month of the current year—in continuation of the Tables published in Appendix I. for 1886. Appendix II. to the same Report gives the Weekly and Progressive values for the same elements during the year 1887 (in continuation of Appendix II. for the year 1886), and Appendix III. gives the *Mean* Weekly values for the following number of years :—

Accumulated Heat and Rainfall,	9	years,	1878	to	1886.
,, ,, ,,	10	,,	1878	,,	1887.
Bright Sunshine - -	6	,,	1881	,,	1886.
,, - -	7	,,	,,	,,	1887.

Appendix IV. gives for each district, (*a*) for the eight years 1878 to 1885, (*b*) for the nine years 1878 to 1886, and (*c*) for the 10 years 1878 to 1887, the mean temperature of the air for each week in the year. This Appendix is new.

The Monthly Weather Report for 1887, which has fallen into arrear, will shortly be published.

Simultaneous Observations.—The Office has continued its co-operation in the system of International simultaneous observations, taken at Greenwich mean noon, which was organised in 1874, at the request of the Chief Signal Officer of the United States. Simultaneous observations.

The list of observers on this system at land stations for 1887 is given in Appendix XII., p. 103.

A form for the entry of the simultaneous observations is bound up with every ship's log issued by the Office. In previous Reports it has been stated that the Lords Commissioners of the Admiralty had, at the request of the Council, issued instructions for these observations to be taken (in addition to those made by the Service Regulations) on board each detached ship-of-war on foreign service; or, in the case of a squadron acting together, on board the ship of the senior officer. The number of these

Simultaneous observations.

observations which have been received during the year from the Royal Navy has been 7,490, and from the Mercantile Marine, 6,690.

PART III.

Land Meteorology of the British Isles.

Observatories and Stations.—Records of the climate of the British Isles are received by the Office from certain stations with different degrees of fulness of organisation, which may be arranged in five classes.

Self-recording observatories.

1. The Observatories furnished with self-registering instruments by which all the principal meteorological phenomena are recorded continuously, and which thus afford materials for the study of the periodic variations of the meteorological elements.

Anemographic stations.

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

Stations of Second Order.

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

Telegraphic Reporting Stations.

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

Extra stations.

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

Sunshine stations.

A continuous record of the amount of bright sunshine is received from 35 stations in the British Isles, some of which are first or second order stations, whilst from others the sunshine record is alone received. See p. 112.

A fuller account of these several stations and of the methods employed by the Office in dealing with the records will be found in Appendix XIII., p. 104, and a Map of all the stations is appended to Note D., p. 33.

Documents received.

Appendix XIV., p. 108, contains a list of all documents relating to the land meteorology of the British Isles received at the Office during the year.

The only changes in the self-recording stations during the year have been the erection of two anemometers of a smaller size during the year, one at the Mountjoy Observatory, Phœnix Park, Dublin, the other in the Island of Heligoland.

Inspection of Stations.

Inspection of the Stations.—The self-recording observatories and the anemographic stations (Classes 1 and 2), as well as the Tele-

graphic Reporting Stations (Class 4), are regularly visited each year by the Inspectors of the Office before mentioned (p. 10). 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; these are visited by an Inspector appointed by the Society, an allowance being made by the Office toward the cost of the inspection, in accordance with the recommendation of the Treasury Committee (1877); and some belong to the Scottish Meteorological Society. The remaining Stations of the Second Order are visited at least once in every two years by the Inspectors of the Office. The Superintendent of the Kew Observatory, Mr. G. M. Whipple, is specially employed to inspect and report on the self-registering apparatus, and on the photographic processes at the observatories. Extracts from the Reports of the Inspectors will be found in Appendix VI., p. 64. Inspection of Stations.

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

Quarterly Weather Report.—Parts I. and II. of the volume for 1879 in the old form have appeared, and the volume will soon be completed. This form of Report will end with the publication of the results for 1880. Publications.

The volumes of the *Monthly Weather Report* for 1887 and 1888, some parts of which have appeared, will soon be completed and issued. This publication takes the place of the Quarterly Weather Report.

The publication of the *Hourly Readings* obtained from the records of the self-registering instruments at the four principal observatories for 1885, is nearly completed.

Reports from Stations of the Second Order.—The volume for 1883 has appeared, and that for 1884 is in an advanced state.

Electric Anemometer.—This instrument has now been erected at Kilbeg Hill, situated above and at a distance of about a mile from the observatory at Valencia, but various unforeseen difficulties have arisen in connexion with the mechanism, and it has not yet been brought into operation. Electric Anemometer.

The Harmonic Analyser.—The results of the analysis of the thermograms for the 12 years 1871–82 appeared as an appendix to the volume of Hourly Readings for 1883. They are given in three tables, of which the first two contain, in different forms, the harmonic coefficients of the first three orders of the formulæ expressing the diurnal variation of temperature; while the third, by a comparison of the monthly mean values obtained from the hourly values by computation with those derived from the analyser, supplies a means of testing the accuracy with which the machine works. The barograms are now being dealt with in a similar manner, and are finished up to the end of 1879. Harmonic Analyser.

Hygrometrical investigations.

Experiments on Hygrometry and Evaporation.—In the report of the Office for 1883, it was mentioned that an investigation of this nature had been entrusted to Mr. W. N. Shaw, M.A., of Emmanuel College, Cambridge, and that a preliminary report on Evaporation from his pen had appeared in the Quarterly Weather Report for 1877. Mr. Shaw has continued his researches, and in the course of last autumn forwarded to the Council a report on Hygrometric Methods, which has been considered by them of such importance that it has been forwarded to the Royal Society. It has been accepted for publication in the Philosophical Transactions, and will be reprinted by the Office in the volume of the Quarterly Weather Report for 1879, now in the press. An abstract of this report, reproduced from the proceedings of the Royal Society, is given in Note C., p. 30.

Cloud photography.

Cloud Photography.—In the report for the year ending March 31, 1886, at p. 22, mention was made of a series of cloud photographs which had been taken at the Kew Observatory, by the use of two cameras at a distance of 800 yards apart. The photographs obtained have been measured in the manner described in the report quoted, but it has appeared to the Council desirable to have the measurements repeated, by an independent investigator, before publishing results. This re-measurement is now in progress, and the photographs continue to be taken when the conditions are favourable.

International Tables.

International Meteorological Tables.—At the International Congress of Rome in 1879 it was decided that it was desirable that an authoritative series of tables for use in meteorological and other scientific reductions should be prepared and issued, the necessary funds being raised by international subscription. The subject was entrusted to Professor E. Mascart, of Paris, and Professor H. Wild, of St. Petersburg. The computation of the tables is now nearly complete, and the work is in the press. The Council have agreed to contribute their share of the necessary expenditure, by purchasing a number of copies of the work.

Krakatoa Report.

Krakatoa Eruption.—The report on the air-waves caused by the explosion that attended this eruption was submitted in June 1886 to a Committee appointed by the Royal Society; but during the past year, while the sheets have been passing through the press, a great deal of additional work has been done upon the entire report, in checking statements as to positions of vessels, distances from Krakatoa, numerical calculations, &c., and in carefully reading the sheets with a view to secure uniformity among the authors with reference to the facts and data mentioned.

Records from stations of the Army Medical Department.

Records from Military Stations.—In the year 1886 the Office received a contribution to its records of the climatology of the globe of considerable value in a complete series of the observations made by the officers of the Army Medical Department, at both home and foreign stations, during the years 1866–1884. These returns, together with those made by the Royal Engineers in the years 1852–1862, which were received from the

Office of the Ordnance Survey in 1879, supply information as to the climate of many parts of the world about which comparatively little is at present known, and the Council, therefore, decided to publish the returns from all the foreign stations on a definite system, in the form of monthly means and summaries, so that this information may be generally accessible to meteorologists. It has also been decided to obtain from the Army Medical Department the returns for the years 1885–6, and to include these results in the publication. A list of stations will be found in Appendix XIVA., p. 113. Records from stations of the Army Medical Department.

This work is now nearly completed and will be published during the present year.

Library.

The library contains standard works on Meteorology and the allied sciences. It consists at present of nearly 11,000 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. 115, contains a list of the additions to the library during the year. These have been catalogued upon cards as before, besides being entered in the reference catalogues under (1) Authors, and (2) Subjects.

Expenditure.

Appendix XVI., p. 143, shows the receipts and payments during the year ending 31st March 1888. The amount voted by Parliament was 15,300*l.*, as in the previous year. Financial.

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 1887–88, as compared with the previous year :—

Net Expenditure.	1886-87.	1887-88.	Increase.	Decrease.
General Administration.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Payment of Council -	1,000 0 0	1,000 0 0	—	—
Secretary - -	800 0 0	800 0 0	—	—
Office - - -	792 12 0	806 15 6	14 3 6	—
Rent, fuel, and lighting -	721 6 1	738 17 10	17 11 9	—
Alterations to premises, attendance, and contingencies - -	596 19 1	437 5 11	—	159 13 2
Expenses incidental to International Meteorological Congress -	11 0 0	—	—	11 0 0
Pensions - -	42 16 4	42 16 4	—	—
Special Researches -	494 12 3	734 11 10	239 19 7	—
Land Meteorology -	3,207 15 4	3,141 10 10	—	66 4 6
Weather Information -	3,681 6 5	3,929 15 5	248 9 0	—
Inspections - -	559 16 9	524 10 4	—	35 6 5
Ocean Meteorology -	2,924 8 1	2,517 4 6	—	407 3 7
Total £	14,832 12 4	14,673 8 6	520 3 10	697 7 8

(Signed) Richard Strachey,
Chairman.

NOTE A.

On the History of the Severe Storms which visited the British Isles between August 1, 1882, and September 3, 1883, as traceable from the Atlantic Charts published by the Office. By Robert H. Scott, F.R.S., Secretary.

The most obvious mode of discussion of the possibility of obtaining practically useful information as to probable weather on our coasts from telegraphic reports sent from America is to trace the movements of the several cyclonic systems which show themselves day by day on the charts in their passage across the Atlantic. I have prepared a series of 13 charts, one for each month, showing the tracks of all the clearly marked barometrical depressions, or cyclonic systems, I was able to recognize as having been accompanied by gales. As the Atlantic charts are drawn at intervals 24 hours apart, it is evident that they cannot afford as complete a history of the phenomena as if charts for more frequent intervals were available, accordingly it is not improbable that more complete information might have shown that some of the connexions between storm positions on successive days were not well founded, and that some storms were not really so long lived as my preliminary investigation would appear to show. In fact the phenomenon of the complete dying out of an atmospheric eddy, and of the appearance of a fresh disturbance in its vicinity is not very uncommon.

In many cases cyclonic systems coming from low latitudes appear to merge in a large area of depression, which is very generally prevalent over the region stretching from Baffin's Bay to Iceland, and it is a matter of uncertainty whether a system of cyclonic wind circulation, which apparently disentangles itself from this region, and advances over Iceland to Europe, is really the same system that moved up to Davis Straits a few days before. I have, however, assumed that this last-named sequence of conditions has taken place. Another very common occurrence, which often gives the appearance of a recoil of the advancing storm, or of a kink in its track, arises when an area of depression, say with readings as low as 29·4 inches, is extremely elongated, being either oval or even lemniscate-, or kidney-shaped. Under such circumstances the barometer at one focus of the ellipse frequently falls lower than at the other, but if this relation be not permanent, and if for instance the readings at the eastern focus become higher, while the western disturbance becomes more accentuated, the resulting appearance is that the storm as a whole has receded. Again, such an oval may extend from Iceland to the Bay of Biscay, and if the centre of chief disturbance was situated at first over Iceland, and next day near Biarritz, the track chart would make it appear that the storm had travelled over the entire distance named in 24 hours. That this had really happened is not very probable.

The total number of depressions whose tracks appear in the 13 charts does not fall far short of 250, but out of these there are a limited number which present special interest to us in the British Isles, in fact, those which produced gales on our coasts.

For the purposes of a paper entitled "The Equinoctial Gales —do they occur in the British Isles?" which I prepared for the Royal Meteorological Society, and which was printed in their Quarterly Journal, Vol. X., p. 236, I drew up a list of all the serious storms which had occurred on our coasts between 1870 and 1884. In the interval covered by the Atlantic charts, from August 1, 1882, to September 3, 1883, the number of such storms recorded on our coasts was 37, and the dates were as follows:— 1882, August 23; September 2; October 1, 19, 24, 28; November 1, 4, 5, 8, 14, 16, 20, 28; December 2, 5, 7. 1883, January 2, 10, 14, 19, 24, 25, 27, 28; February 1, 6, 9, 12, 14, 17; March 6, 8, 17, 22, 29; April 17; September 1.

These have been arranged in four classes:—

A	17	in No.	- Those first appearing to the westward of the meridian of 40° W.
B	8	„	- Those first appearing in mid-Atlantic.
C	9	„	- Those first appearing over the British Isles, often being secondary to large depressions outside.
D	3	„	- Those first appearing to the eastward or over Europe.
Total	37		

It is evident that for the purpose of ascertaining the possibility of obtaining from American telegrams warning of these storms, we need only consider class A, for unless a storm is distinctly recognisable in the United States either by cloud observations or from ship logs received at American ports, no telegram of a positive character regarding it can be despatched. It seems reasonable to assume that unless a storm has manifested itself within the limits bounded by the parallels of 40° and 52° N. (Philadelphia and Straits of Belle Isle), and on the western side of the meridian of 40°, it would not be possible for a report of it to be made early enough for anyone in the United States to telegraph its probable approach to Europe in time to be of any practical utility.

Out of the 17 storms of Class A only 12 can be considered as fulfilling this condition of passing at some time of their course within the area specified.

In order that warnings of storms should be effectual, some judgment must be formed as to the probable length of time required for them to cross the Atlantic. If we assume, for the sake of argument, three days as a fair average time for crossing, it is evident that a storm travelling either much faster or slower than this will either outstrip the warning or be "distanced" by it.

In the first case the warning must be a practical failure, and in the second its utility rendered very doubtful.

Of these 12 storms, four, those of February 1, 9, 14, and September 1, 1883, crossed apparently in two days; three, those of October 1, December 2 and 7, in three days; one, January 14, in four days; one, February 17, in five days; two, September 2 (1882) and November 20, in six days; and finally one, November 4, took 10 days to cross. It will be seen from this that the chances of success in the 13 months investigated lay heavily against any American forecaster.

Let us now consider these 12 storms more in detail.

September 2nd, 1882.—The storm appeared first on August 26th in 42° N. 58° W. It crossed the Atlantic in a nearly straight line, and on September 2nd its centre lay over Sutherlandshire.

October 1st.—This commenced in a very low latitude in 22° N. 59° W. September 22nd. It took the regular course of a West India Hurricane, recurving near Bermuda and crossing the ocean on the parallel of 42° N.; it finally rose to 51° N. in 18° W. and there died out on the 2nd of October.

November 4th.—This commenced near the Havana on October 21st. It travelled along the American coast till it reached the latitude of 53° N. to the north of the straits of Belle Isle. It crossed the ocean very slowly, approached closest to us on November 1st, then recoiled and again approached us on the 4th, at which time its centre lay over the Faroes, and on this day, and *not before*, it produced a gale.

November 20th.—This commenced in 43° N. 98° W. not far from Omaha on the 10th, on the 14th its centre lay near Anticosti. It then travelled due north for two days, crossed Greenland and reached Iceland on the 18th, whence its track was south-eastward. Its centre lay near Barra Head in the Hebrides on November 20th, the day of the storm.

December 2nd.—This track is almost exactly parallel to the foregoing. The storm commenced in the Gulf of Mexico; on the 20th November it travelled along the coast to Cape Breton Island, where its centre lay on the 30th. Its track then lay northwards to near Cape Farewell, and then eastwards to Iceland, whence it moved south to 61° N. 18° W. on the 4th. The gale with us occurred on the 2nd, when the centre lay off Iceland in 63° N. 21° W.

December 7th.—This first appeared near Lake Erie on the 2nd of the month. It travelled rapidly and its centre lay close to Cherbourg on the 7th, the day of the gale.

January 14th.—This storm started from the coast of Florida on the 9th, on the 11th its centre lay near Cape Race, then it apparently dipped down about five degrees of latitude, and thence travelled north-eastwards, producing a gale on our coasts when its centre lay in 23° W. 52° N.

February 1st.—This started on Lake Huron on the 27th; then apparently it dropped to the south of Kentucky in 24 hours, thence it travelled on a straight east-north-east course with great rapidity, passing over forty degrees of longitude in 18 hours. Our gale was felt when the centre was in 20° W.

February 9th.—This also apparently travelled with great speed. Its centre lay on the 7th near Kingston (Canada), on the 8th it had reached 43° W., and on the 9th, when we had our gale, the centre lay in 30° W.

February 14th and 17th.—These were two gales produced by the same cyclonic disturbance at different periods of its existence. The depression originated over Lake Superior on the 11th. It travelled very rapidly, and in three days the centre lay in 21° W. 54° N., and we had a storm. The depression passed northwards, and on the 17th, when the centre lay off the north-west point of Iceland, we had another gale. This latter was probably due in part to a rise of the barometer over the Baltic, and in

part to the formation of an imperfect secondary depression off our north-west coasts on the 17th.

September 1st, 1883.—This followed a course very similar to that of October 1st, 1882, above-mentioned; it arose near the Island of Porto Rico, skirted the coast of North America, crossed the Atlantic about 48° N., and its centre on the 1st lay just outside Scilly.

The great irregularity which is shown, by the above remarks, to exist between these storms as to their tracks and rate of advance, proves that any attempt to telegraph storms from America to Europe, with the means at present available, must be beset with great difficulties.

A further investigation of the Atlantic Charts showed that for a protracted interval in the month of March 1883, a band of high barometrical readings stretched across the North Atlantic from north to south, between the meridians of 20° and 40° W. This formed an absolute barrier to the advance to Europe of any storm from the westward, and of its existence and persistence no official in America could have any sufficient knowledge, and any forecaster might easily forward useless telegrams.

The general outcome of the investigation has been to show that it is extremely improbable that telegraphic reports of weather received from the other side of the Atlantic could be of a nature to assist in the forecasting of weather on our coasts, and this conclusion is fully sustained by the actual results of the experimental system of reporting which has been in operation during the past year.

NOTE B.

REPORT on the SEVERE PARTIAL GALES experienced on the Coasts of the British Islands, during the 15 Years 1871 to 1885.—By F. J. BRODIE, F.R. Met. Soc.

Meteorological Office. Telegraph Branch.

A minute examination into the circumstances under which each of these gales occurred seems to show that they may fairly be classified under one or other of the following headings:—

a. Gales which were more or less general in the neighbourhood of the district, but which were felt only locally in the district itself.

b. Gales which extended from adjacent coasts to the borders of the district in question.

c. Gales which were occasioned by depressions skirting our coasts, and only affected portions of the districts near which they passed.

d. Gales which were local only as regards *direction* of wind, storms from other quarters being felt on adjacent coasts.

e. Gales which were the effect simply of very small systems (or "swirls"), and were consequently felt only over limited portions of the districts visited.

f. Gales which were felt in a part of one district only.

g. Gales which, though reported, were in all probability so reported owing to an error in judgment of the observer.

In the table herewith the results of this classification are given for each district, and also for the various quarters from which the gales were experienced.

The aggregate values for the whole of the districts are given at the foot of the table, and show:—

1. That in 46 per cent. of the cases the gales, although more or less general in the neighbourhood of the district, were felt only locally in the district itself. In many instances it is difficult to see why certain of the stations should have failed to record the gale. As regards the telegraphic reporting stations, however, there can be little doubt that the occurrence of a gale during the night frequently escapes the notice of the observer.

2. It would appear that a considerable number (21 per cent.) of instances were due to the extension of storms from other coasts to a portion of the districts in question.

3. That in 11 per cent. of the cases the gales reported indicate, in all probability, an over-estimation of wind-force.

4. That in some few instances (8 per cent.) the gales were occasioned by depressions skirting our coasts, and only affecting portions of the districts near which they passed.
5. That in six per cent. of the cases the gales were purely local, no other district being affected.
6. That in six per cent. of the cases the gales were the effect simply of local squalls. In cases where these squalls were felt only in one district, the gale was of course classed under the previous heading.
7. That in the remaining instances (2 per cent.) the gale was local only as regards the *direction* of the wind, storms from other quarters being felt on adjacent coasts.

TABLE showing the NUMBER and NATURE of the SEVERE PARTIAL GALES experienced on the COASTS of the BRITISH ISLANDS during the years 1871 to 1885.

DISTRICTS.	Quarter from which the Gale blew.	Total Number of Severe Partial Gales experienced.	Classification of Gale.							REMARKS.
			Gales more or less general in the Neighbourhood of the District, but felt only locally in the District itself.	Gales extending from adjacent Coasts to borders of Districts.	Gales caused by Depressions just skirting Districts.	Gales local only as regards *Direction* of Wind. Storms from other quarters felt on adjacent Coasts.	Gales the effect simply of local Squalls.	Gales purely local. No other Districts affected.	Gales probably reported in error owing to over-estimation of Wind-Force.	
E. SCOTLAND	From between N. and E. by N.	3	1	1	0	0	0	0	1	The two instances given under the first heading are somewhat doubtful. In each case the gale was felt in the N.E. of England, as well as in the Nn. part of Scotland, and it seems almost impossible that the Sn. part of the district should have escaped.
	„ E. and S. by E.	5	2	0	0	1	0	1	1	
	„ S. and W. by S.	9	3	2	3	0	0	0	1	
	„ W. and N. by W.	7	3	0	2	0	0	2	0	
	From all directions	24	9	3	5	1	0	3	3	
N.E. ENGLAND	From between N. and E. by N.	2	1	0	0	0	0	1	0	The gale inserted under the last heading is very doubtful. The only station on our E. coast which was affected by the gale was Whitby.
	„ E. and S. by E.	2	2	0	0	0	0	0	0	
	„ S. and W. by S.	20	1	15	0	0	3	0	1	
	„ W. and N. by W.	8	0	6	0	0	1	0	1	
	From all directions	32	4	21	0	0	4	1	2	
E. ENGLAND	From between N. and E. by N.	3	3	0	0	0	0	0	0	
	„ E. and S. by E.	2	1	1	0	0	0	0	0	
	„ S. and W. by S.	1	0	1	0	0	0	0	0	
	„ W. and N. by W.	2	0	2	0	0	0	0	0	
	From all directions	7	3	4	0	0	0	0	0	
S. ENGLAND	From between N. and E. by N.	0	0	0	0	0	0	0	0	
	„ E. and S. by E.	0	0	0	0	0	0	0	0	
	„ S. and W. by S.	4	2	0	0	0	2	0	0	
	„ W. and N. by W.	4	3	0	0	0	1	0	0	
	From all directions	8	5	0	0	0	3	0	0	

N.W. Scotland	From between N. and E. by N.	4	4	0	0	0	0	0	0	Many of the severe partial gales in this district were reported at Stornoway only. The observer at that station had apparently a tendency to over-estimate the wind-force, but taking into account the exposed situation of the place, it is impossible to say that severe local squalls do not occur there.
	„ E. and S. by E.	2	2	0	0	0	0	0	0	
	„ S. and W. by S.	20	6	0	10	0	3	0	1	
	„ W. and N. by W.	7	4	3	0	0	0	0	0	
	From all directions	33	16	3	10	0	3	0	1	
N. Ireland	From between N. and E. by N.	1	0	1	0	0	0	0	0	
	„ E. and S. by E.	3	1	2	0	0	0	0	0	
	„ S. and W. by S.	5	1	2	1	0	0	0	1	
	„ W. and N. by W.	6	5	1	0	0	0	0	0	
	From all directions	15	7	6	1	0	0	0	1	
Irish Sea	From between N. and E. by N.	4	2	0	0	1	0	0	1	
	„ E. and S. by E.	9	5	1	0	0	0	0	3	
	„ S. and W. by S.	10	6	1	0	1	0	0	2	
	„ W. and N. by W.	10	6	1	0	0	0	1	2	
	From all directions	33	19	3	0	2	0	1	8	
S.W. England	From between N. and E. by N.	3	1	0	0	0	1	0	1	
	„ E. and S. by E.	7	5	0	0	0	0	0	2	
	„ S. and W. by S.	4	2	0	0	0	0	0	2	
	„ W. and N. by W.	6	4	0	0	1	0	1	0	
	From all directions	20	12	0	0	1	1	1	5	
S.W. Ireland	From between N. and E. by N.	2	1	0	0	0	0	1	0	
	„ E. and S. by E.	1	1	0	0	0	0	0	0	
	„ S. and W. by S.	9	8	0	0	0	0	0	1	
	„ W. and N. by W.	8	3	0	0	0	0	5	0	
	From all directions	20	13	0	0	0	0	6	1	
All Districts	From between N. and E. by N.	21	12	2	0	1	1	2	3	
	„ E. and S. by E.	31	19	4	0	1	0	1	6	
	„ S. and W. by S.	82	29	21	14	1	8	0	9	
	„ W. and N. by W.	58	28	13	2	1	2	9	3	
	From all directions	192	88	40	16	4	11	12	21	
	Per-centages	—	46	21	8	2	6	6	11	

NOTE C.

ABSTRACT of a REPORT on HYGROMETRIC METHODS, by W. N. SHAW, M.A., reprinted from the "Proceedings of the Royal Society," No. 262.

With the exception of certain "absolute hygrometers," the behaviour of which has not yet been sufficiently tested, the determination of the pressure of water vapour in the air is indirect, and requires a formula of reduction. The formulæ in use are based upon assumptions which are at present not so completely verified by experiment that any hygrometric method can be relied upon to give measures of the pressure of aqueous vapour trustworthy to within 0·1 mm. of mercury. The authority for these statements is given in detail in an account of the hygrometric work done since 1830. This account is appended to the report as Note A.

In the report, the chemical hygrometric method is provisionally regarded as a standard. The formula of reduction applicable in this case is—

$$e = \frac{760\,(1 + \alpha t)}{\Delta d}\, f.$$

where e is the pressure of aqueous vapour in millimetres; f the number of grammes of moisture per cubic metre in the air at temperature t° C.; α the coefficient of expansion of air per degree C; Δ the density of dry air at 0° and 760 mm., *i.e.*, 1293 grammes per cubic metre; and d is the specific gravity of the moisture referred to air at the same temperature and pressure.

The assumptions upon which the formula is based are—(1.) That it is possible to absorb the whole of the moisture from air by passing it over desiccating substances; and (2) that a numerical value can be assigned to d. The first assumption has been discussed by Regnault and others, and is sufficiently nearly accurate for all hygrometric calculations. With regard to the second, Regnault's direct observations upon steam (free from air) and other evidences point to the value 0·622. The assumption can, moreover, be tested by applying the chemical method to air saturated at a known temperature, assuming the value 0·622 for d, and comparing the results with the table of saturation pressures *in vacuo*. This, however, *assumes Dalton's law to be strictly accurate*, an open question, upon which opinion is reserved until further experimental investigation is concluded. Regnault made the comparison in 68 experiments, in 59 of which the air was practically saturated when it entered the drying tubes. For these he found that the value 0·622 gave results which were less than the tabulated pressure, the errors being always of the same sign, but so small in amount that he neglected them in his subsequent work.

The ultimate object of the experiments described in the report was to examine the behaviour of dew-point instruments in air of

known state, and for this purpose air was saturated at a known temperature, and drawn by an aspirator through vessels in which the dew-point instrument could be placed when required, and subsequently through drying tubes of special pattern. The vapour-pressure was thus obtained at the two extremities of the train of apparatus and the results compared.

The following questions are raised and discussed:—

i. Were the drying tubes used as efficient as Regnault's?

ii. Does the pressure of vapour in the air become changed by passing through the apparatus designed to contain the dew-point instruments, or by the mere presence of those instruments themselves?

iii. Do the results of the chemical method agree with the tabulated vapour-pressures *in vacuo* when the air is more or less heated after being saturated?

iv. Can the observed differences between the results be obviated by assuming the value for d (other than 0·622) which is compatible with values obtained by other methods?

v. Can any reason be assigned for the differences observed by Regnault in the case of saturated air?

(i.) The answer to the first question is given in an account of a series of 12 experiments practically repeating Regnault's observations with saturated air. The tabulated results show divergences in the same direction and of the same order of magnitude as those in Regnault's paper. Some incidental points are also discussed, namely, the comparative efficiency of phosphoric anhydride, sulphuric acid, and calcium chloride, and the effect of india-rubber and glass connexions between drying tubes. It is shown that the sulphuric acid and phosphoric anhydride tubes are efficient, that, as a rule, one tube is all that is strictly necessary, but that two should be used to provide for the case of exhaustion of the first tube or too rapid flow of air, and further, that the glass and mercury connexions between the tubes employed in the second series of experiments cannot be regarded as producing any effect.

(ii. and iii.)—The answers to the second and third questions are furnished by the results of 82 experiments with the chemical method upon air saturated at known temperatures by a specially designed "saturator" in a water bath. The temperatures of saturation lay between 1° C. and 21° C., and, with one exception, were below the temperature of the surrounding air. Each experiment involved upwards of 30 readings of weight, pressure, and temperature. The temperature readings were corrected by means of a special comparison at Kew. Of the 82 observations 32 are retained as being free from any known disturbing causes, and from them it appears that, with d equal to 0·622, the pressure deduced by the chemical method is on the average greater by 0·03 mm. than that given in Regnault's table of vacuum pressures, as re-calculated in Landolt and Börnstein's

tables. This difference is very small compared with the discrepancies from Dalton's law observed by Regnault in the case of water vapour.

(iv.) With regard to the fourth question; if the observations be employed to determine the value which must be substituted for d, the specific gravity of saturated steam referred to air at the same temperature and pressure, the mean value of d so obtained is 0·6245, which agrees very closely with 0·6240, the mean value for the same range of temperature deduced from Clausius's calculations based on thermo-dynamical reasoning. The value 0·622 is probably correct if the air is not nearly saturated; in that case the measure of the pressure of vapour in the air is 2/622 greater than it would be if the same air were reduced in temperature (at constant pressure), until it was saturated.

(v.) The one observation of the second series with saturated air gives a result 0·18 mm. smaller than the tabulated pressure, and thus with the 12 experiments of the first series confirms the results of Regnault's observations. To account for this, it is suggested that air which is very nearly or quite saturated, would deposit some of its moisture on the glass tubes used to conduct it from one vessel to another. This behaviour of nearly saturated air has been already noticed, and it is confirmed by the observations on dew-point instruments, and, moreover, by experiments directly intended for the purpose, quoted in a note.

Details are given of observations with Regnault's hygrometer and Dines's hygrometer when exposed in glass vessels between the saturator and the drying tube. The two instruments are separately discussed. With Regnault's instrument, after some practice, two different observers obtained practically identical results. In ordinary observations, the observed temperatures of the dew-point were below the temperature of saturation, but seldom by more than 0°·1 C. A considerable amount of uncertainty was shown to be attached to the readings, and by very close inspection readings of the dew-point were obtained above the temperature of saturation, in one case by as much as 0°·7 C.

From the experiments with Dines's hygrometer, it appears that the instrument is likely to give very easy determinations of the dew-point that are within small limits of error, but that if the instrument be observed with the closest attention, the result will be considerably too high, in consequence of the formation of a dew deposit at a temperature above the true dew-point, and it may possibly be erroneous in consequence of variations in temperature of the different parts of the box containing the thermometer.

An account is given of Alluard's modification of Regnault's hygrometer, and of Bogen's hygrometer.

A second note, B, is appended to the report, showing the tables used in various countries for the reduction of wet and dry-bulb observations.

Plate I.

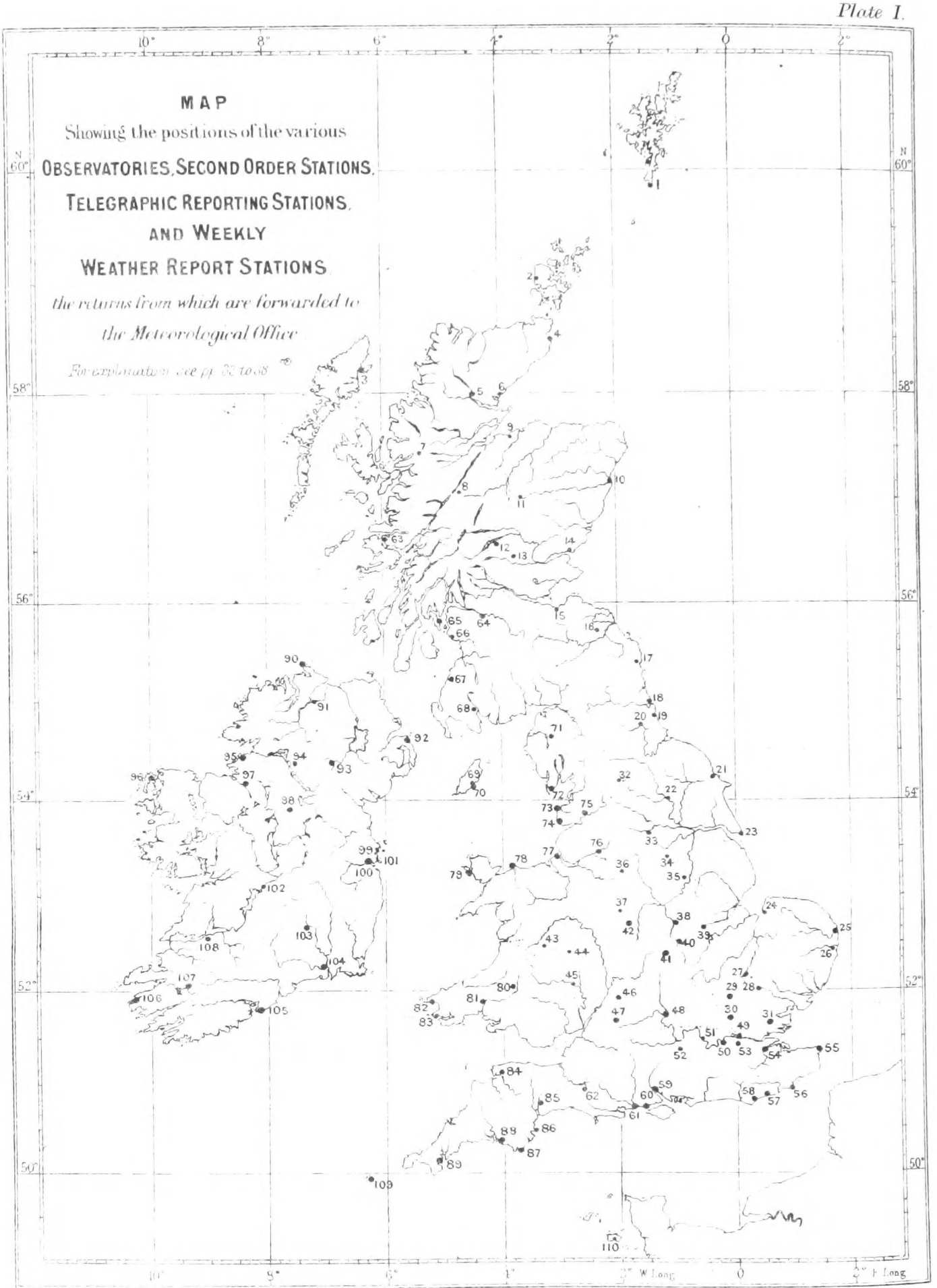
MAP

Showing the positions of the various

OBSERVATORIES, SECOND ORDER STATIONS, TELEGRAPHIC REPORTING STATIONS, AND WEEKLY WEATHER REPORT STATIONS

the returns from which are forwarded to the Meteorological Office

For explanation see pp. 32 to 38



DANGERFIELD LITH. 22 BEDFORD ST COVENT GARDEN. 16545 6/88

DANGERFIELD LITH. 22, BEDFORD ST COVENT GARDEN.

NOTE D.

TABLE giving the Names of the OBSERVATORIES, STATIONS of the SECOND ORDER, ANEMOMETER STATIONS, TELEGRAPHIC REPORTING STATIONS, and WEEKLY WEATHER REPORT STATIONS, in the BRITISH ISLANDS, OBSERVATIONS from which were forwarded to the METEOROLOGICAL OFFICE during the year 1887.

The Stations are grouped into the Meteorological Districts to which they belong, and arranged according to the numbering on the Map, Plate I.

References.—Column 3. Stations marked ℳ are in connexion with the Royal Meteorological Society.
" " " Stations marked 𝒮 are in connexion with the Scottish Meteorological Society.
" " 4. "Obs." = Observatory (first order); S.O. = Second Order Station; A. = Anemometer Station; T. = Telegraphic Reporting Station; W. = Weekly Weather Report Station.

District.	No. of Station on Map (see Plate I.).	Name of Station.	Class of Station.	Notes.
0. Scotland, North.	1	Sumburgh Head (Dunrossness).	T.; W.	
	2	Swanbister -	A.; S.O.	Sunshine recorder.
	3	Stornoway -	T.; W.	S.R. Aneroid and Sunshine recorder.
	4	Wick - -	T.; W.	
	5	𝒮 Lairg - -	W.	
	6	𝒮 Dunrobin -	S.O.	
	7	𝒮 Glen Carron -	W.	Sunshine recorder.
	8	𝒮 Fort Augustus -	W.	
1. Scotland, East.	9	Nairn - -	T.; W.	
	10	Aberdeen -	Obs.; T.	S.R. Aneroid and Sunshine recorder.
	11	𝒮 Braemar - -	S.O.; W.	Sunshine recorder.
	12	𝒮 Ochtertyre -	W.	
	13	Glenalmond -	S.O.	
	14	𝒮 Dundee - -	S.O.	
	15	Leith - -	T.; W.	
	16	𝒮 Marchmont -	W.	Sunshine recorder.
2. England, N.E.	17	Alnwick Castle -	A.; W.	
	18	N. Shields -	T.; W.	
	19	Seaham - -	S.O.	
	20	Durham - -	S.O.; W.	Sunshine recorder.
	21	ℳ Scarborough -	S.O.; W.	Sunshine recorder at Oswaldkirk.
	22	York - -	S.O.; T.; W.	Sunshine recorder.
	23	Spurn Head -	T.; W.	

District.	No. of Station on Map (see Plate I.).	Name of Station.	Class of Station.	Notes.
3. England, East.	24	Hillington	S.O.; W.	Sunshine recorder.
	25	Yarmouth	A.; T.; W.	S.R. Aneroid.
	26	Geldeston	S.O.; W.	Sunshine recorder.
	27	Cambridge	T.; W.	Do. do.
	28	Saffron Walden	S.O.	
	29	Bennington	S.O.	
	30	Rothamsted	S.O.; W.	
	31	Ingatestone	W.	Sunshine recorder.
4. Midland Counties.	32	Aysgarth	S.O.	
	33	Wakefield	S.O.	
	34	Sheffield	S.O.	
	35	Bawtry	W.	Sunshine recorder at Worksop.
	36	Buxton	S.O.	
	37	Cheadle	S.O.; W.	
	38	Loughborough	T.; W.	
	39	Uppingham	S.O.	
	40	Leicester	S.O.; W.	Sunshine recorder.
	41	Rugby	S.O.	
	42	Uttoxeter	S.O.	
	43	Churchstoke	S.O.; W.	Sunshine recorder.
	44	Stokesay	S.O.	
	45	Hereford	W.	
	46	Cheltenham	S.O.	
	47	Cirencester	W.	Sunshine recorder.
	48	Oxford	T.; W.	Do. do.
5. England, South.	49	London	T.; W.	S.R. Aneroid and Sunshine recorder.
	50	Kew	Obs.	Sunshine recorder.
	51	Cooper's Hill (Egham).	S.O.	
	52	Strathfield Turgiss	W.	
	53	Epsom	S.O.	
	54	Chatham	S.O.	
	55	Margate	S.O.	
	56	Dungeness	T.; W.	
	57	Hastings (St. Leonards).	S.O.; W.	Sunshine recorder.
	58	Eastbourne	S.O.	
	59	Southampton	S.O.; W.	Sunshine recorder.
	60	Hurst Castle	T.; W	
	61	Southbourne	S.O.	
	62	Stowell	W.	Sunshine recorder.
6. Scotland, West.	63	Laudale	S.O.; W.	
	64	Glasgow	Obs.; S.O.; W.	Sunshine recorder.
	65	Rothesay	S.O.	
	66	Ardrossan	T.; W.	
	67	Pinmore	S.O.	
	68	Glenlee	W.	
	69	Cronkbourne, Isle of Man.	S.O.; W.	Sunshine recorder.
	70	Douglas, Isle of Man.	S.O.	

District.	No. of Station on Map (see Plate I.).	Name of Station.	Class of Station.	Notes.
7. England, N.W.	71	Newton Reigny	S.O.; W.	Sunshine recorder.
	72	Barrow-in-Furness.	T.; W.	
	73	Fleetwood	A.	
	74	M Blackpool	W.	Sunshine recorder.
	75	Stonyhurst	Obs.; S.O.; W.	Do. do.
	76	Manchester (Prestwich).	S.O.; W.	
	77	Liverpool (Bidston).	T.; W.	
	78	M Llanduduo	S.O.; W.	Sunshine recorder.
	79	Holyhead	A.; T.; W.	S.R. Aneroid.
8. England, S.W.	80	Llandovery	W.	
	81	M Caermarthen	S.O.	
	82	St. David's	S.O.	
	83	St. Anu's Head, (Pembroke).	T.; W.	Sunshine recorder.
	84	Arlington	W.	
	85	M Cullompton	W.	Sunshine recorder.
	86	M Babbacombe	S.O.	
	87	Prawle Point	T.; W.	
	88	Plymouth	W.	Sunshine recorder.
	89	Falmouth	Obs.; W.	Do. do.
9. Ireland, North.	90	Malin Head	T.; W.	
	91	Londonderry	S.O.; W.	
	92	Donaghadee	T.; W.	
	93	Armagh	A.; S.O.; W.	Sunshine recorder.
	94	Brookeborough	S.O.; W.	
	95	Mullaghmore	T.; W.	
	96	Belmullet	T.; W.	
	97	Markree Castle	S.O.; W.	Sunshine recorder.
	98	Edgeworthstown	S.O.; W.	
	99	Dublin, Glasnevin	S.O.	
10. Ireland, South.	100	Dublin, Phœnix Park.	A.; S.O.	Sunshine recorder.
	101	Dublin City	S.O.; W.	
	102	Parsonstown (Birr Castle).	S.O.; T.; W.	Sunshine recorder.
	103	Kilkenny	W.	S.R. Aneroid.
	104	Waterford	W.	
	105	Roche's Point	T.; W.	
	106	Valencia	Obs.; T.; W.	S.R. Aneroid and Sunshine recorder.
	107	M Killarney	S.O.; W.	
	108	Foynes	W.	
Channel Islands.	109	Scilly	A.; T.; W.	S.R. Aneroid.
	110	Jersey	T.; W.	Sunshine recorder.

TABLE giving the NAMES of the OBSERVATORIES, STATIONS of the SECOND ORDER, ANEMOMETER STATIONS, TELEGRAPHIC REPORTING STATIONS, and WEEKLY WEATHER REPORT STATIONS in the BRITISH ISLANDS, OBSERVATIONS from which were forwarded to the METEOROLOGICAL OFFICE during the year 1887. The Stations are arranged alphabetically.

Reference.—Column 1. Stations marked Ⓜ are in connexion with the Royal Meteorological Society.
" " " Stations marked Ⓢ are in connexion with the Scottish Meteorological Society.
" " 4. "Obs." = Observatory (first order); S.O. = Second Order Station; A. = Anemometer Station; T. = Telegraphic Reporting Station; W. = Weekly Weather Report Station.

Names of Stations.	No. on Map.	Class of Station.	Notes.
Aberdeen	10	Obs.; T.	S.R. Aneroid and Sunshine recorder.
Alnwick Castle	17	A.; W.	
Ardrossan	66	T.; W.	
Arlington	84	W.	
Armagh	93	A.; S.O.; W.	Sunshine recorder.
Aysgarth	32	S.O.	
Ⓜ Babbacombe	86	S.O.	
Barrow-in-Furness	72	T.; W.	
Bawtry	35	W.	Sunshine recorder at Worksop.
Belmullet	96	T.; W.	
Ⓜ Bennington	29	S.O.	
Ⓜ Blackpool	74	W.	Sunshine recorder.
Ⓢ Braemar	11	S.O.; W.	Do. do.
Brookeborough	94	S.O.; W.	
Ⓜ Buxton	36	S.O.	
Ⓜ Caermarthen	81	S.O.	
Cambridge	27	T.; W.	Sunshine recorder.
Chatham	54	S.O.	
Ⓜ Cheadle	37	S.O.; W.	
Ⓜ Cheltenham	46	S.O.	
Ⓜ Churchstoke	43	S.O.; W.	Sunshine recorder.
Cirencester	47	W.	Do. do.
Cooper's Hill (Egham)	81	S.O.	
Cronkbourne (Isle of Man)	69	S.O.; W.	Sunshine recorder.
Ⓜ Cullompton	85	W.	Do. do.
Donaghadee	92	T.; W.	
Douglas (Isle of Man)	70	S.O.	
Dublin, City	101	S.O.; W.	
Ⓢ Dundee	14	S.O.	
Dungeness	56	T.; W.	
Ⓢ Dunrobin	6	S.O.	
Durham	20	S.O.; W.	Sunshine recorder
Eastbourne	58	S.O.	
Edgeworthstown	98	S.O.; W.	
Epsom	53	S.O.	

Names of Stations.	No. on Map.	Class of Station.	Notes.
Falmouth	89	Obs. ; W.	Sunshine recorder.
Fleetwood	73	A.	
Fort Augustus	8	W.	
Foynes	108	W.	
Geldeston	26	S.O. ; W.	Sunshine recorder.
Glasgow	64	Obs. ; S.O. ; W.	Do. do.
Glasnevin (Dublin)	99	S.O.	
Glenalmond	13	S.O.	
Glencarron	7	W.	Sunshine recorder.
Glenlee	68	W.	
Hastings (St. Leonards)	57	S.O. ; W.	Sunshine recorder.
Hereford	45	W.	
Hillington	24	S.O ; W.	Sunshine recorder.
Holyhead	79	A. ; T. ; W.	S.R. Aneroid.
Hurst Castle	60	T. ; W.	
Ingatestone	31	W.	Sunshine recorder.
Jersey	110	T. ; W.	Sunshine recorder.
Kew	50	Obs.	Sunshine recorder.
Kilkenny	103	W.	S.R. Aneroid.
Killarney	107	S.O. ; W.	
Lairg	5	W.	
Laudale	63	S.O. ; W.	
Leicester	40	S.O. ; W.	Sunshine recorder.
Leith	15	T. ; W.	
Liverpool (Bidston)	77	T. ; W.	
Llandovery	80	W.	
Llandudno	78	S.O. ; W.	Sunshine recorder.
London	49	T. ; W.	S.R. Aneroid and Sunshine recorder.
Londonderry	91	S.O. ; W.	
Loughborough	38	T. ; W.	
Malin Head	90	T. ; W.	
Manchester (Prestwich)	76	S.O. ; W.	
Marchmont	16	W.	Sunshine recorder.
Margate	55	S.O.	
Markree	97	S.O. ; W.	Sunshine recorder.
Mullaghmore	95	T. ; W.	
Nairn	9	T. ; W.	
Newton Reigny	71	S.O. ; W.	Sunshine recorder.
Ochtertyre	12	W.	
Oxford	48	T. ; W.	Sunshine recorder.
Parsonstown (Birr Castle)	102	S.O. ; T. ; W.	Sunshine recorder.
Phœnix Park (Dublin)	100	A. ; S.O.	Do. do.
Pinmore	67	S.O.	
Plymouth	88	W.	Sunshine recorder.
Prawle Point	87	T. ; W.	
Roche's Point	105	T. ; W.	
Rothamsted	30	S.O. ; W.	
Rothesay	65	S.O.	
Rugby	41	S.O.	

Names of Stations.	No. on Map.	Class of Station.	Notes.
Saffron Walden - -	28	S.O.	
M Scarborough - -	21	S.O.; W.	Sunshine recorder at Oswaldkirk.
Scilly - - -	109	A.; T.; W.	S.R. Aneroid.
Seaham - - -	19	S.O.	
Sheffield - - -	34	S.O.	
Shields, N. - - -	18	T.; W.	
Southampton - -	59	S.O.; W.	Sunshine recorder.
M Southbourne - -	61	S.O.	
Spurn Head - -	23	T.; W.	
St. Ann's Head (Pembroke)	83	T.; W.	Sunshine recorder.
St. David's - - -	82	S.O.	
Stokesay - - -	44	S.O.	
Stonyhurst - - -	75	Obs.; S.O.; W.	Sunshine recorder.
Stornoway - - -	3	T.; W.	S.R. Aneroid and Sunshine recorder.
M Stowell - - -	62	W.	Sunshine recorder.
M Strathfield Turgiss - -	52	W.	
Sumburgh Head (Dunrossness).	1	T.; W.	
Swanbister - - -	2	A.; S.O.	Sunshine recorder.
Uppingham - -	39	S.O.	
Uttoxeter - - -	42	S.O.	
Valencia - - -	106	Obs; T.; W.	S.R. Aneroid and Sunshine recorder.
M Wakefield - - -	33	S.O.	
Waterford - - -	104	W.	
Wick - - -	4	T.; W.	
Yarmouth - - -	25	A.; T.; W.	S.R. Aneroid.
York - - -	22	S.O.; T.; W.	Sunshine recorder.

APPENDIX.

APPENDIX.

APPENDIX I.

LIST of CAPTAINS (and Officers) who have sent in Logs classed as "Excellent" during the year ending March 31, 1888. 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.

Captain's Name.	Number of "Excellent" Logs.	Ship.
Adamson, A. W.	5	S.S. "Briudisi."
Alderton, T.	3	S.S. "Brindisi."
Aldrich, Pelham, R.N.	13	H.M.S. "Egeria."
Ashdown, Edward	1	S.S. "Brindisi."
Atkinson, S. P. H.	2	"Earl of Aberdeen."
Balfour, Lieut. Andrew, R.N.	21	H.M.S. "Rambler."
Baxter, A. S.	3	"City of York."
Becket, Alexander	9	"Amana."
Blacklin, R. J.	2	S.S. "Maryland."
Bright, H.	2	"Beltana."
Brown, E.	2	"Moorhill."
Cameron, H.	1	S.S. "Ardandhu."
Cameron, J. G.	1	S.S. "Adriatic."
Campbell, Hugh	6	"Bolan."
Campbell, James	6	"Saint Patrick."
Chaddock, G. A.	2	"Elissa."
Clapp, Staff Comr. E. S., R.N.	5	L.H. Tender "Richmond."
Clarke, James	9	S.S. "Olbers."
Cooke, C. F.	4	"Melbourne."
Crighton, A. T.	2	S.S. "Colina."
Cromarty, D. S.	1	"Cassandra."
Crutchley, W. C., R.N.R.	14	S.S. "Kaikoura."
Dark, Samuel	2	"Blairgowrie"
Dart, L. C.	8	"Alcester."
Davies, Joseph	3	S.S. "Flaxman."
Dawson, Comr. L. S., R.N.	5	H.M.S. "Sylvia."
Denham, George	9	S.S. "Ocean King."
Donaldson, J.	1	"Gareloch."
Douglas, Lt. H. H., R.N.	5	H.M.S. "Sylvia."
Draper, R.	5	S.S. "Monarch."
Dunbar, J. I.	11	S.S. "Arracan."
Ellery, William	17	"Talookdar."
England, Thomas	6	"Jane."
Ewan, John	1	S.S. "Kenmore."
Exham, T. K.	1	S.S. "Severn."

Captain's Name.	Number of "Excellent" Logs.	Ship.
Fraser, W. D.	2	"Thomas S. Stowe."
Fullarton, D.	3	"Timaru."
Gordon, James	13	S.S. "City of Agra."
Graham, W. V.	4	"Tenasserim."
Gray, David	14	S.S. "Eclipse."
Gray, John	11	S.S. "Hope."
Halley, Edward	3	"City of Madras."
Hepworth, C. M. W., R.N.R., F.R.Met. Soc.	6	S.S. "Port Pirie."
Hird, W.	3	"Marlborough."
Hood, William	1	"County of Edinburgh."
Hoskyn, Comr. R. F., R.N.	16	H.M.S. "Myrmidon."
Irving, P. J.	4	S.S. "Celtic."
James, George	2	"Middlesex."
Jones, Richard	1	"Thomas Hilyard."
Kemp, A. H.	1	"Hudson."
King, J. W.	2	"Philomene."
Lailey, W. N.	10	S.S. "Boyne."
Leportier, T.	6	S.S. "Mira."
Lyne, Lieut. W. O., R.N.	7	H.M.S. "Flying Fish."
Machugh, R. H.	2	S.S. "Ching Wo."
McLean, Archibald	4	S.S. "Concordia."
Maclear, J. F. L. P., R.N., F.R. Met. Soc.	18	H.M.S. "Flying Fish."
Marshall, Frederick	3	"Berkshire."
Maxwell, Joseph	3	"Oamaru."
Mesnard, Thomas	6	"Sierra Miranda."
Millican, J. W.	1	"Myrtle Holme."
Milne, W. F.	5	S.S. "Esquimaux."
Milner, W. H.	2	S.S. "Severn" and S.S. "Solent."
Mitchell, John	1	"Cape Verde."
Moignard, Philip	2	"Astoria."
Molony, E. J.	6	"British Merchant."
Moore, W. U., R.N.	11	H.M.S. "Rambler."
North, W. G.	7	S.S. "Tiger."
Parry, Moses, F.R.Met.Soc.	11	S.S. "Prydain."
Parsell, Henry	13	S.S. "Adriatic."
Parson, G. F.	7	"Earnock."
Pearson, C. W.	27	S.S. "Strathleven."
Peebles, R.	11	"Tweedsdale."
Plater, H. B. F.	2	"Patriarch."
Price, J. H.	3	"Viola."
Prout, J. C.	6	"Cape St. Vincent."
Read, G. W., F.R.G.S.	1	S.S. "Auretta."
Ross, Alexander	3	"Berbice."
Ross, James	1	S.S. "Benalder."
Richardson, Mr. W. H.	1	S.S. "Auretta."
Rosseter, W. L.	10	"St. Kilda" and "British Nation."
Russell, C. J.	7	"Khyber."

Captain's Name.	Number of "Excellent" Logs.	Ship.
Sargent, A. H. - - -	3	"Glenlora."
Scott, William - -	19	"Commewyne."
Simpson, Alexander - -	7	S.S. "Australasian."
Smith, Lieut. F. B., R.N. -	6	H.M.S. "Myrmidon."
Spratly, W. - - -	10	S.S. "Mozart."
Sturdee, H. K. - -	8	L.H. Tender "Richmond."
Tancred, Sub.-Lt. J. C., R.N. -	2	H.M.S. "Egeria."
Thomson, A. S., F.R.Met.Soc.-	9	S.S. "Buccaneer."
Tomlin, P. S. - - -	3	S.S. "Ballaarat."
Travers, H. D. - -	5	S.S. "Tartar."
Trott, Samuel, F.R.Met.Soc. -	10	S.S. "Minia."
Trunks, H. - - -	2	"Aldborough."
Walker, Henry - -	9	S.S. "Cephalonia."
Waring, William - -	13	S.S. "Breconshire."
Wheaton, N. J. - -	7	"Eliza."

Names of observers deceased printed in italics.

APPENDIX II.—Ships supplied and Documents returned during the year ending 31st March 1888.

The number of merchant ships supplied with standard instruments and meteorological logs during the above period was 138.

The number of meteorological logs, and documents from Foreign Stations, received during the same period, and registered in the Office, amounted altogether to 350, of which 219 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) - -	C. H. Bode, Lightkeeper -	2	"Lighthouse" Register, July 1886 to June 1887.
Akassa, Nun River, Niger Delta -	Frank Russell, F.R.G.S. -	9	Two observations daily, February to November 1887.
Barbados (Commercial Hall) -	T. L. Ince - - -	1	"Lighthouse" Register, January to June 1887.
,, (Joe's River House) -	R. B. Walcott, M.D., F.R. Met. Soc.	1	,, ,, ,, ,, ,,
Beyrout (Lee Observatory) -	R. H. West, M.A. - -	11	Two observations daily, March 1887 to January 1888.
Breaksea Island (King George's Sound).	H. K. Toll, Arthur Robinson, and G. T. Powney.	2	"Lighthouse" Register, January to December 1887.
Cape Juby (North-West Africa) -	S. Morris, for the North-west African Co., Limited.	12	Two observations daily, March 1887 to February 1888.
Cape Palmas - - -	Dr. Gill - - -	1	Observations made under the direction of Dr. Theodore Vogel, the botanist of the Niger Expedition organised by the African Civilization Society; 1840 and May and June 1841.
Cape Pembroke (Falkland Islands)	G. K. Broom, Lightkeeper -	2	"Lighthouse" Register, January to December 1887.
Cay Lobos (Bahamas) - -	R. A. A. Espie and N. H. E. Garner, Lightkeepers.	2	,, ,, July 1886 to June 1887.
Cay Sal (Bahamas) - -	T. R. Thompson, Lightkeeper	2	,, ,, ,, ,,
Famagusta (Cyprus) - -	G. Eliades - - -	4	Two observations daily, August 1886 to February 1887.
Fernando Po - - -	—— Rosoher - -	1	Observations made under the direction of Dr. Theodore Vogel, the botanist of the Niger Expedition organised by the African Civilization Society; October 1841.
Gaboon River - - -	Louis Borgela, Supt. West African Tel. Co.	2	Two observations daily, December 1887 and January 1888.

LIST of DOCUMENTS—*continued.*

Place.	Observer.	No. of Documents.	Nature of Observations.
George Town (British Guiana) -	Robert Ward - -	12	Two observations daily, March 1887 to February 1888.
Gibraltar - - - -	Corporal T. Doolan and Privates E. Herrick and F. Herbert, Med. Staff Corps.	10	" " " " "
Grand Bassam - - -	A. Jouve, Supt. West African Tel. Co.	3	" " " November 1887 to January 1888.
Great Basses - -	Lightkeepers - -	3	Eight observations daily, March–July 1883; February–April, July–September 1884; February–December 1885; January–June, August–December 1886; January–October 1887.
Heligoland - - -	J. J. Friederichs, Lightkeeper	12	Two observations daily, March 1887 to February 1888.
Inagua (Bahamas) - -	N. H. E. Garner, C. S. E. Lotmore, and B. N. Jones, Lightkeepers.	2	"Lighthouse" Register, July 1886 to June 1887.
Kyrenia (Cyprus) - -	C. Natai - -	4	Two observations daily, August 1886 to February 1887.
Larnaca (Cyprus) - -	A. Tsepis, I. Laffan, and W. Hoad.	4	" " " " "
Limassol (Cyprus) - -	Luigi Béraud - -	4	" " " " "
Little Basses - - -	Lightkeepers - -	3	Eight observations daily, March–July 1883; February–April, July–September 1884; February–December 1885; January–June, August–December 1886; January–October 1887.
Minicoy - - -	" - - -	2	Eight observations daily, January to October 1887.
Nicosia (Cyprus) - -	G. Stephen - -	4	Two observations daily, August 1886 to February 1887.
Papho (Cyprus) - - -	E. A. Malliotis - -	4	" " " " " "
Point King (King George's Sound)	S. Mitchell - - -	1	"Lighthouse" Register, January to June 1887.
Ponto Grande (St. Vincent) -	Dr. Theodore Vogel -	1	Forms of clouds, June 4–16, 1841.
São Thomé (West Africa) -	E. W. Parsoné - -	1	Two observations daily, October 1887 to January 1888.
Sombrero - - -	J. A. Richardson, Lightkeeper	1	"Lighthouse" Register, December 1886 to May 1887.
Suva (Fiji) - - -	J. D. W. Vaughan, F.R.Met. Soc.	2	One observation daily, December 1886 and January 1887.
Trinidad - - - -	J. H. Hart, Supt. Botanic Gardens.	7	Two observations daily, June and August to December 1887 and January 1888.

List of Documents received from Ships.

Captain's Name.	Ship.	Tons.	Owners.	Voyage.	Year.
[1] Adamson, A. W. -	S.S. Brindisi - -	2,143	P. & O. Steam Navigation Co., London.	London to Madras, Calcutta, Madras, Marseilles, and London, viâ Suez -	1887
[2] Alderton, T. -	" - -	"	" " "	To and from Calcutta, viâ Suez -	1887–88
[3] Aldrich, Pelham, R.N.	Egeria - -	940	H.M.S. - - - -	Plymouth to Colombo, viâ Suez -	1886–87
[3] " "	" - -	"	" - - - -	Surveying off south-east coast of Ceylon	1887
[4] " "	" -	"	" - - - -	Surveying off Batticoloa, Trincomalee, Singapore, Batavia, Christmas Island, and Mauritius - - -	1887
Anderson, C. A. -	Amphitrite - -	1,708	Colin S. Caird, Greenock -	Cardiff to Hong Kong and Havre -	1886–87
[5] Anderson, F. -	S.S. Durham - -	1,466	Walter S. Bailey, Hull - -	To and from Lyttleton. London to Bremerhaven. Antwerp, Bordeaux, River Plate, Bremerhaven, and London - - - -	1880–81
Ashdown, Edward -	S.S. Brindisi - -	2,143	P. & O. Steam Navigation Co., London.	To and from China, viâ Suez - -	1887
Asquith, W. -	S.S. Deucalion -	1,374	Ocean S.S. Co., Liverpool -	" " - -	1886
Atkinson, S. P. H. -	Earl of Aberdeen -	2,133	Earl Sailing Ship Line, Lim., London.	To Colombo, Diamond Island, Akyab and home - - - -	1886–87
[6] Babot, E. S. -	S.S. Kent - -	1,620	Money Wigram and Sons, Lim., London.	To and from Australia, viâ Suez -	1883
[7] " " -	S.S. Northumberland -	—	" " "	To and from Wellington, viâ Cape. London to Bremen, Antwerp, Pauillac, Monte Video, Buenos Ayres, Monte Video, Bahia, Bremen, and London. London to Sydney, Melbourne, and home, viâ Cape -	1880–82
Balderston, R. J. -	Bactria - -	2,122	Sir Thomas Brocklebank, Bart., Liverpool.	To and from Calcutta - - -	1887
Batt, H. - -	S.S. Hector - -	1,590	Ocean S.S. Co., Liverpool -	To and from China, viâ Suez - -	1886

List of Documents, &c.—*continued.*

Captain's Name.	Ship.	Tons.	Owners.	Voyage.	Year.
Baxter, A. S.	City of York	1,195	G. Smith and Son, Glasgow	Liverpool to Astoria and Queenstown	1887–88
Becket, Alexander	Amana	1,299	John Smith, Glasgow	London to Coquimbo, Honolulu, Portland (Oregon), and Queenstown	1886–87
Bigley, H. B.	S.S. Diomed	1,471	Ocean S.S. Co., Liverpool	To and from China, viâ Suez	1886
Blacklin, R. J.	S.S. Maryland	1,852	"Maryland" S.S. Co., Lim., London.	Swansea to Philadelphia, Baltimore, and London	1887
Bremner, A. W.	S.S. Ulysses	1,301	Ocean S.S. Co., Liverpool	To and from China, viâ Suez	1886
Bright, H.	Barque Beltana	741	A. Lang Elder, London	To and from Adelaide	1887–88
Brown, E.	Barque Moorhill	484	E. Brown, Liverpool	Newport to Buenos Ayres, Barbados, Galveston, and Havre	1887–88
Brown, R. J.	S.S. Titan	1,554	Ocean S.S. Co., Liverpool	To and from China, viâ Suez	1886
Butler, S. H.	S.S. Priam	1,402	„ „	To China, Madras, and home, viâ Suez	1885–86
[8] Callaghan, J. P.	S.S. Norfolk	—	Money Wigram and Sons Lim., London.	To Cape Town, New Zealand, China, New York, viâ Suez, and London. To Cape Town, New Zealand, China, and London, viâ Suez. To Cape Town, Australia, and home, viâ Suez	1880–82
Callaghan, M.	S.S. Comeragh	467	Waterford S.S. Co., Lim., Waterford.	Trading between Waterford, Liverpool, and Bristol	1887
„ „	„	„	„ „ „	„ „ „	1887
„ „	„	„	„ „ „	„ „ „	1887–88
Cameron, H.	S.S. Ardandhu	757	Ardan S.S. Co., Lim., Glasgow	To Havana, Guadaloupe, Gibraltar, Marseilles, Gibraltar, and Newport (Mon.)	1887
[9] Cameron, J. G.	S.S. Adriatic	2,458	Oceanic S. Nav. Co., Liverpool	Three voyages to and from New York	1887
„ „	S.S. Ionic	3,070	„ „ „	From London to New Zealand, viâ Cape, Rio Janeiro, and London. (3 voyages)	1884–86
Campbell, Archibald	S.S. Circassia	2,770	Barrow S.S. Co., London	Five voyages to and from New York	1886–87

LIST of DOCUMENTS, &c.—*continued.*

Captain's Name.	Ship.	Tons.	Owners.	Voyage.	Year.
Campbell, Archibald	S.S. Circassia	4,272	Barrow S.S. Co., London	Five voyages to and from New York	1887
Campbell, Hugh	Bolan	1,999	Sir Thomas Brocklebank, Bart., Liverpool.	Liverpool to Calcutta, and back	1887
Campbell, James	Saint Patrick	992	"Saint Patrick" Shipowning Co., Lim., Liverpool.	Maryport to Cooktown, Phœnix Islands, Samoa, and Plymouth.	1886–87
Campbell, R.	S.S. Lufra	1,134	Robert Ropner, West Hartlepool	Cardiff to Alexandria, Odessa, and home	1887
Chaddock, G. A.	Barque Elissa	409	H. F. Watt, Liverpool	Pensacola to Rosario, and towards Mauritius	1886–87
Chrimes, Henry	S.S. Sarpedon	1,592	Ocean S.S. Co., Liverpool	To and from China, viâ Suez	1886
[10] Clapp, Staff-Comr. E. S., R.N.	Schooner Richmond	183	Board of Trade, London	At the Bahamas	1886–87
,, ,,	,, ,,	,,	,, ,,	,, ,,	1887
Clarke, James	S.S. Olbers	2,168	Liverpool, Brazil, and River Plate S. Nav. Co., Liverpool.	Two voyages from Liverpool to Lisbon, Bahia, Rio Janeiro, and home	1887
,, ,,	,,	,,	,, ,, ,,	Two voyages from Southampton, to Monte Video, Rio Janeiro, and Southampton	1887–88
[11] Conby, H. B.	Gilcruix	2,239	North-Western Shipping Co., Lim., Liverpool.	Liverpool to Melbourne, Calcutta, and London	1886–87
Cooke, C. F.	Melbourne	1,867	Joseph Moore, junr., London	London to Melbourne and back, viâ Cape of Good Hope	1886–87
Couper, William	Clackmannanshire	1,482	James and William Law, Glasgow	From Cardiff to Rangoon and Bremerhaven	1886–87
Crighton, A. T.	S.S. Colina	2,001	Donaldson Bros., Glasgow	To Monte Video, Barbadoes, Baltimore, and Glasgow. To and from Quebec	1886–87
Cromarty, D. S.	Barque Cassandra	711	J. Steel and Son, Liverpool	To and from New Zealand	1886–87
Crutchley, W. C., R.N.R.	S.S. Kaikoura	2,885	New Zealand Shipping Co., Christchurch, N.Z.	London to Cape Town, Hobart, Wellington, Rio Janeiro, and Plymouth	1887

List of Documents, &c.—*continued.*

Captain's Name.	Ship.	Tons.	Owners.	Voyage.	Year.
[12] Crutchley, W. C., R.N.R.	S.S. Kaikoura - -	2,885	New Zealand Shipping Co. Christchurch, N.Z.	Plymouth to Cape Town, New Zealand, Rio Janeiro, and home - -	1887
[12] ,, ,, -	,, - -	,,	,, ,, ,, -	Plymouth to Cape Town, Hobart, Lyttelton, Rio Janeiro, and Plymouth	1887–88
Dark, Samuel -	Blairgowrie - -	1,550	G. W. Gray, Glasgow - -	To Port Darwin, Java, and Liverpool -	1886–87
,, ,, -	,, - -	,,	,, ,, - -	Liverpool to Calcutta and Dundee -	1887–88
Dart, L. C. - -	Alcester - - -	1,597	R. C. Haws, Liverpool - -	To Madras, Rangoon, and home -	1886–87
Davies, Joseph -	S.S. Flaxman -	1,418	Liverpool, Brazil, and River Plate S. Nav. Co., Lim., Liverpool.	Two voyages to River Plate; one to River Plate and Antwerp - -	1886–87
Davison, H. -	S.S. Arabic - -	788	Oceanic Steam Nav. Co., Lim., Liverpool.	From Hong Kong to Manila, London, viâ Suez, and Liverpool - -	1885
,, ,, -	S.S. Gaelic - -	2,691	,, ,, ,, -	From Cardiff to Hong Kong, viâ Cape	1885
[13] Dawson, Comr. L. S., R.N.	Sylvia - - -	1,050	H.M.S. - - - -	In the Mediterranean - -	1887
[13] ,, ,, -	,, - - -	,,	,, - - - -	In the Mediterranean and Arabian Seas	1887
[13] ,, ,, -	,, - - -	,,	,, - - - -	Surveying in Red Sea, and thence to Malta - - - -	1887–88
Denham, G. - -	S.S. Ocean King -	1,606	W. Ross, Glasgow - -	Two voyages to and from Montreal, one from Swansea to New Orleans -	1887
Docherty, Hugh -	Baron Colonsay -	1,632	John Neill, Greenock - -	Cardiff to Singapore and Queenstown -	1887–88
Donaldson, J. -	Gareloch - -	1,177	P. Rintoul, Glasgow - -	Glasgow to Sydney, Newcastle (N.S.W.), Rangoon, and home - -	1886–87
[11] Draper, R. - -	S.S. Monarch - -	2,072	H.M. Telegraph Ship - -	Off coasts of British Isles - -	1886–87
[11] ,, ,, - -	,, - -	,,	,, ,, - -	,, ,, ,, - -	1887
[14] ,, ,, - -	,, - -	,,	,, ,, - -	,, ,, ,, - -	1887–88
Dulling, George -	S.S. Port Phillip -	1,732	The Anglo-Australian Steam Navigation Co., Lim., London.	From Middlesboro' to Bombay, Moulmein, Bombay, and Antwerp, viâ Suez - - - -	1886–87

LIST of DOCUMENTS, &c.—*continued.*

Captain's Name	Ship.	Tons.	Owners.	Voyage.	Year.
[15] Pullug, George -	S.S. Port Phillip -	1,732	The Anglo-Australian Steam Navigation Co., Lim., London.	To Hobart, viâ Cape, Newcastle (N.S.W.), Singapore, and Hamburg, viâ Suez - - - -	1887
Dunbar, J. -	S.S. Arracan - -	1,856	British and Burmese Steam Navigation Co., Lim., Glasgow.	Liverpool to Rangoon and London, viâ Suez - - - - -	1887
" " -	" -	"	" " "	To and from Rangoon, viâ Suez -	1887
Edwards, T. T. -	S.S. Stentor - -	1,307	Ocean S.S. Co., Liverpool -	To and from China, viâ Suez - -	1885–86
Ellery, William -	Talookdar - -	2,053	T. and J. Brocklebank, Liverpool	To and from Calcutta - - -	1886–87
England, Thomas -	Barque Jane - -	636	James Sutherland, Liverpool -	From Miramichi to Glasson Dock. To and from Quebec. From Troon to Matanzas (Cuba) - - -	1886–87
Ewan, John -	S.S. Kenmore -	495	Albany Shipping Co., Lim., Dundee.	To and from ports in Denmark, Norway, Sweden, and Spain - - -	1886–87
[11] Exham, T. K. -	S.S. Severn - -	1,119	Royal Mail Steam Packet Co., London.	Southampton to West Indies and Havre - - - -	1887–88
[12] Field, A. M., R.N. -	Dart - - -	470	H.M.S. - - - -	Surveying off New Guinea and Townsville (Queensland) - - -	1885
[13] "	" - - -	"	" - - - -	Surveying off New Guinea and Townsville (Queensland), and at Sydney -	1886–87
[14] "	" - - -	"	" - - - -	Surveying off Tasmania, Townsville, Louisiade Archipelago (New Guinea), and Sydney - - - -	1887
Fisher, F. -	Barque Cawdor -	2,355	John Houston, Liverpool -	Penarth to Singapore, Bassein, and Queenstown - - -	1886–87
Fordyce, William -	County of Haddington	1,865	Robert Craig, Glasgow - -	Penarth to Bombay - - -	1886
Fraser, W. F. -	Barque Thomas S. Stowe	686	Alfred Horsfall, Liverpool -	To Rockhampton (Queensland), Vancouver Island, and home - -	1886–87
Fullarton, D. -	Timaru - -	1,306	Shaw, Savill, & Albion Co., Lim., London.	To and from Wellington - -	1886–87

LIST of DOCUMENTS, &c.—*continued.*

Captain's Name.	Ship.	Tons.	Owners.	Voyage.	Year.
[13] Gordon, James -	S.S. City of Agra -	2,133	G. Smith, Glasgow - -	To and from Calcutta, viâ Suez -	1887
[13] " " -	" -	"	" " - -	Liverpool to Calcutta and London, viâ Suez - - -	1887–88
[11] Graham, W. V. -	Tenasserim - -	1,419	Thomas Brocklebank, Liverpool -	To and from Calcutta - - -	1887
Gray, David -	S.S. Eclipse - -	435	D. Gray, Peterhead - -	To and from Greenland - -	1887
Gray, John - -	S.S. Hope - -	450	R. Kidd, Peterhead - -	" " - -	1887
Grey, C., R.N.R. -	MacMillan - -	1,450	John MacMillan, junr., Dumbarton.	Cardiff to Monte Video. Melbourne to Valparaiso - - - -	1885–87
[19] Griffin, E. J., R.N.R.	S.S. Moor - -	2,352	Union S.S. Co., Lim., London -	Plymouth to Cape Town and back -	1887
Hailey, Edward -	City of Madras -	1,57	George Smith, Glasgow - -	Cardiff to San Francisco and Queenstown - - - -	1886–88
Hamilton, James -	Milton Park - -	1,461	Henry Grierson, Glasgow -	Glasgow to Sydney, San Francisco, and Queenstown - - - -	1885–86
Hannay, C. E. -	Prince Edward -	2,180	Robert B. Crowe, Liverpool -	Cardiff to Rio Janeiro, Chittagong, and Dundee - - - -	1886–87
[20] Hepworth, C. M. W., F.R. Met.Soc.	S.S. Port Pirie -	2,049	W. Milburn, London - -	From Plymouth to Cape Town, Adelaide, Newcastle (N.S.W.), Singapore, Calcutta, and London, viâ Suez -	1887
[20] " " -	" -	"	" " - -	To and from Adelaide, viâ Suez -	1887
Hinrichs, C. A. -	Barque Aline - -	718	James Grieve, jun., Greenock -	Glasgow to Brisbane, Newcastle (N.S.W.), Batavia, and Queenstown	1887–88
Hird, W. - -	Marlborough - -	1,124	John Leslie, London - -	To and from Otago - - -	1886–87
Hood, William -	County of Edinburgh -	2,078	Robert Craig, Glasgow - -	From Penarth to Bombay, Calcutta, and Hull - - - -	1886–87
Horne, James -	Loch Garry - -	1,493	John P. Kidston, Glasgow -	From Melbourne to London, viâ Cape Horn - - - -	1886–87
" " -	" - -	"	" " " -	Glasgow to Melbourne and London -	1887–88

LIST of DOCUMENTS, &c.—*continued.*

Captain's Name.	Ship.	Tons.	Owners.	Voyage	Year.
[illegible] Hoskyn, Comr. R. F., R.N.	Mermaid - -	877	H.M.S. - - - -	Surveying off Sydney, Melbourne, and Launce-ton, Tasmania - -	1886–87
[illegible] " " -	" - -	"	" - - - -	Surveying off Sydney and Townsville -	1887
[illegible] " " -	" - -	"	" - - - -	Surveying in Bass Straits, and at Sydney - - - -	1887
[illegible] Huddy, G. H. -	S.S. Durham - -	1,460	Walter S. Bailey, Hull - -	To Colombo, Batavia, Brisbane, Batavia, and home, viâ Suez. To Cape Town, Adelaide, Melbourne, Sydney, Hong Kong, Yokohama, Shanghai, New York, viâ Suez, and London -	1881–83
[illegible] " " -	S.S. Essex - -	1,673	Money Wigram, and Sons, Lim., London.	To and from Australia, viâ Suez. Viâ Suez to Australia, China, Japan, New York, Norfolk (Virginia), Liverpool, and London. - - -	1883–84
Hutchinson, J. -	S.S. Orestes - -	1,327	Ocean S.S. Co., Liverpool -	To and from China, viâ Suez - -	1886
[illegible] Irving, P. J. -	S.S. Celtic - -	2,439	Oceanic S. Nav. Co., Lim., Liverpool.	Six voyages to and from New York. (One voyage being on the S.S. "Republic") - - - -	1887
" " -	" -	"	" " " -	Five voyages to and from New York -	1887–88
Jackson, Charles -	S.S. Palamed - -	1,536	Ocean S.S. Co., Liverpool -	To and from China, viâ Suez - -	1885–86
Jackson, M. H. F. -	S.S. Telamon - -	1,555	" " " -	" " - -	1886
Jackson, T. S. -	S.S. Palinurus - -	1,536	" " " -	" " - -	1886
Janes, George -	Middlesex - -	1,742	G. Marshall and Sons, London -	Cardiff to Singapore, Chittagong, and Dundee - - - -	1886–87
" " -	" - -	"	" " " -	" " " -	1887–88
Jennings, J. W. -	S.S. Doric - -	3,071	Oceanic S. Nav. Co., Lim., Liverpool.	To New Zealand, viâ Cape, Rio Janeiro, and London. (Two voyages) -	1885–86
Jones, Henry -	S.S. Telemachus -	1,421	Ocean S.S. Co., Liverpool -	To and from China, viâ Suez - -	1885–86

LIST of DOCUMENTS, &c.—*continued.*

Captain's Name.	Ship.	Tons.	Owners.	Voyage.	Year.
21 Hoskyn, Comr. R. F., R.N.	Myrmidon - -	877	H.M.S. - - - -	Surveying off Sydney, Melbourne, and Launceston, Tasmania - -	1886–87
21 " " -	" - -	"	" - - - -	Surveying off Sydney and Townsville -	1887
21 " " -	" - -	"	" - - - -	Surveying in Bass Straits, and at Sydney - - - -	1887
22 Huddy, G. R. -	S.S. Durham - -	1,466	Walter S. Bailey, Hull - -	To Colombo, Batavia, Brisbane, Batavia, and home, viâ Suez. To Cape Town, Adelaide, Melbourne, Sydney, Hong Kong, Yokohama, Shanghai, New York, viâ Suez, and London -	1881–83
23 " " -	S.S. Essex - -	1,675	Money Wigram, and Sons, Lim., London.	To and from Australia, viâ Suez. Viâ Suez to Australia, China, Japan, New York, Norfolk (Virginia), Liverpool, and London. - - -	1883–84
Hutchinson, J. -	S.S. Orestes - -	1,323	Ocean S.S. Co., Liverpool -	To and from China, viâ Suez - -	1886
24 Irving, P. J. -	S.S. Celtic - -	2,439	Oceanic S. Nav. Co., Lim., Liverpool.	Six voyages to and from New York. (One voyage being on the S.S. "Republic") - - - -	1887
" " -	" -	"	" " "	Five voyages to and from New York -	1887–88
Jackson, Charles -	S.S. Palamed - -	1,536	Ocean S.S. Co., Liverpool -	To and from China, viâ Suez - -	1885–86
Jackson, M. H. F. -	S.S. Telamon - -	1,555	" " " -	" " - -	1886
Jackson, T. S. -	S.S. Palinurus - -	1,536	" " " -	" " - -	1886
Janes, George -	Middlesex - -	1,742	G. Marshall and Sons, London -	Cardiff to Singapore, Chittagong, and Dundee - - - -	1886–87
" " -	" - -	"	" " " -	" " " -	1887–88
Jennings, J. W. -	S.S. Doric - -	3,071	Oceanic S. Nav. Co., Lim., Liverpool.	To New Zealand, viâ Cape, Rio Janeiro, and London. (Two voyages) -	1885–86
Jones, Henry -	S.S. Telemachus -	1,421	Ocean S.S. Co., Liverpool -	To and from China, viâ Suez - -	1885–86

Captain's Name.	Ship.	Tons.	Owners.	Voyage.	Year.
Jones, Richard -	Thomas Hilyard -	1,500	David V. Roberts, St. John, N.B.	Liverpool to New York, Sydney, Newcastle (N.S.W.), Manila, New York, and Liverpool - - -	1886–88
Kemp, A. H. -	Hudson - -	797	Shaw, Savill, and Albion Co., Lim., London.	To and from Wellington (N.Z.) -	1886–87
Kidley, W. H. -	S.S. Coptic - -	2,857	Oceanic S. Nav. Co., Lim., Liverpool.	From Wellington to Rio Janeiro and London. To New Zealand, Rio Janeiro, and Teneriffe. To New Zealand, viâ Cape Good Hope, and thence to London, viâ Cape Horn - -	1884–86
King, J. W. -	Philomene - -	1,423	D. Fernie, Liverpool - -	Cardiff to Rangoon and Queenstown -	1886–87
Lailey, W. N. -	S.S. Boyne - -	1,306	Mercantile S.S. Co., Lim., London	Cardiff to Alexandria and London. Swansea to Alexandria, Odessa, and Rotterdam. Cardiff to Singapore, viâ Suez, and Rangoon - -	1886–87
,, ,, -	,, - -	,,	,, ,, ,, -	Rangoon to Genoa, viâ Suez, and Cardiff. Cardiff to Massowah, Rangoon, and Alexandria, viâ Suez - -	1887
Lamb, Owen -	Iron Cross -	1,508	David Fernie, Liverpool - -	From Calcutta to New York - -	1887
Lapage, W. P. -	S.S. Anchises - -	1,304	Ocean S.S. Co., Liverpool -	To and from China, viâ Suez - -	1886
Leportier, T. -	S.S. Mira -	1,669	Star Navigation Co., Lim., Liverpool.	To and from Calcutta, viâ Suez -	1887
,, ,, -	,, - -	,,	,, ,, ,,	,, ,, - -	1887
,, ,, -	,, - -	,,	,, ,, ,,	,, ,, - -	1887
,, ,, -	,, - -	,,	,, ,, ,,	Liverpool to Calcutta, and London, viâ Suez - - - -	1887–88

LIST of DOCUMENTS, &c.—*continued.*

Captain's Name.	Ship.	Tons.	Owners.	Voyage.	Year.
[25] Longley, P. -	S.S. Essex - -	1,675	Money Wigram & Sons, Lim., London.	Viâ Suez to Australia, China, Japan, New York, and London. To Australia, Bombay, and home, viâ Suez. To Hobart, Melbourne, Launceston, and Sydney, viâ Cape Good Hope, and thence, viâ Suez, to Antwerp and London - - - -	1885–87
[26] Lugar, W. R. -	S.S. Fee Chew -	643	William Keswick, London -	London to China, viâ Suez, and on China Coast - - -	1887
McConnel, James -	Barque Matilda C. Smith	670	James McCausland, Belfast -	Ardrossan to St. Martinique, Pensacola, and Fleetwood - - -	1886–87
,, ,, -	,, ,, -	,,	,, ,, ,, -	Ardrossan to Martinique, Pensacola, and Fleetwood. Newport (Mon.) to Ponta Lara (Brazil), Pernambuco, and Liverpool - - -	1886–88
Maclaugh, R. H. -	S.S. Ching Wo -	1,556	China Shippers Mutual Stm. Nav. Co., London.	To and from China, viâ Suez - -	1887
,, ,, -	,, - -	,,	,, ,, ,, -	,, ,, - -	1887–88
McLean, Archibald -	S.S. Concordia -	1,617	John Donaldson, Glasgow -	Four voyages to and from Montreal, &c. - - - - -	1886–87
,, ,, -	,, - -	,,	,, ,, -	Five voyages to and from Montreal -	1887
[27] Maclear, J. F. L. P., R.N.	Flying Fish - -	940	H.M.S. - - - -	From Port Darwin to Christmas Island, Colombo - - - -	1886–87
[27] ,, ,, -	,, - -	,,	,, - - - -	From Colombo to Portsmouth, viâ Suez	1887
McNeil, Ronald -	S.S. City of Agra -	2,133	G. Smith, Glasgow - -	To and from Calcutta, viâ Suez -	1887
Marshall, Frederick	Barque Berkshire -	1,472	George Marshall, London -	To Diamond Island and from Rangoon	1886–87
[28] Mathias, I. - -	Barque Hampshire -	1,164	Joseph Hossack, Liverpool -	To and from Melbourne - -	1882–83
Maxwell, Joseph -	Oamaru - -	1,306	Shaw, Savill, and Albion Co., Lim., London.	To and from New Zealand - -	1887

LIST of DOCUMENTS, &c.—*continued.*

Captain's Name.	Ship.	Tons.	Owners.	Voyage.	Year.
Meredith, John -	Brigantine Meg Merrilies - - -	- - - - -	- - - - -	From Suva (Fiji) to New Hanover and back - - - - -	1886–87
Mesnard, Thomas -	Sierra Miranda - -	1,808	A. M. Anderson, Liverpool -	To and from Rangoon - - -	1886–87
Milburne, W. L. -	S.S. Ocean Prince -	1,120	Prince Stm. Shipping Co., Lim., Newcastle-on-Tyne.	Barrow to Montreal and London. Liverpool to Galveston and back. Sunderland to Galveston - -	1887–88
[28] Miller, A. T., R.N. -	Conway - - -	- -	H.M.S. (Training Ship) - -	Off Birkenhead - - -	1887
Millican, J. W. -	Barque Myrtle Holme -	902	Wilfrid Hine, Maryport - -	To and from Melbourne - -	1886–87
Milligan, Samuel -	S.S. Jason -	1,412	Ocean S.S. Co., Liverpool -	To and from China, viâ Suez - -	1886
[29] Milne, W. F. -	S.S. Esquimaux -	466	Dundee Whale and Seal Fishing Co., Dundee.	To and from Davis Straits - -	1887
[4] Milner, W. H. -	S.S. Severn - -	1,119	Royal Mail Steam Packet Co., London.	Southampton to West Indies and Havre	1887
[30] ,, ,, -	S.S. Solent - -	1,206	,, ,, ,, -	In the West Indies - - -	1887
Mitchell, George -	S.S. Trinacria -	1,466	T. Henderson, Glasgow - -	Glasgow to Mediterranean Ports, New York, Mediterranean Ports, and Gibraltar - - - -	1887
[31] Mitchell, John -	Cape Verde - -	1,711	Alexander P. Lyle, Greenock -	From Cardiff to Singapore. Java, and Falmouth - - -	1886–87
[32] Mitchell, W. H. -	S.S. Kent - -	1,620	Money Wigram and Sons, Lim., London.	Two voyages to and from Australia, viâ Suez. To Australia. Bombay, and London, viâ Suez. To Australia, viâ Cape, China, Japan, New York, viâ Suez, and London - - -	1884–87
Moigard, Philip -	Barque Astoria -	1,429	Peter Iredale, Liverpool - -	Glasgow to Melbourne, Portland (Oregon), and Falmouth - - -	1886–87
Molony, E. J. -	British Merchant -	1,696	British Shipowners' Co., Lim., Liverpool.	To San Francisco and Havre - -	1886–87

LIST of DOCUMENTS, &c.—*continued.*

	Captain's Name.	Ship.	Tons.	Owners.	Voyage.	Year.
33	Moore, Comm. W. U., R.N.	Rambler - -	835	H.M.S. - - - -	Surveying in China Seas - -	1887
33	" " -	" - -	"	" - - - -	" " - - -	1887
33	" " -	" - -	"	" - - - -	" " - - -	1887
	Nelson, Robert -	S.S. Menelaus - -	1,300	Ocean S.S. Co., Liverpool -	To and from China, viâ Suez - -	1886
	Nish, H. - -	S.S. Cyclops - -	1,403	" " -	" " - -	1886
	North, W. G. -	S.S. Tiger - -	510	Wilson and Sons, Hull - -	Trading between Hull and Hamburg -	1887
	" "	" - -	"	" " - -	" " -	1887
	" " -	" - -	"	" " - -	" " -	1887–88
34	O'Callaghan, J. P. -	S.S. Sussex - -	1,620	Money Wigram and Sons, Lim., London.	To and from Australia, viâ Suez. To Australia, viâ Suez, China, Japan, New York, viâ Suez, and London. To Australia, viâ Suez, China, Japan, New York, viâ Suez, Bombay, Naples, Cardiff, and London. To Australia, viâ Cape, and home, viâ Suez -	1883–87
35	Parke, R. H. -	Barque Hampshire -	1,164	Joseph Hossack, Liverpool -	Three voyages to and from Melbourne	1880–82
36	" "	S.S. Kent - -	1,620	Money Wigram and Sons, Lim., London.	To and from Australia, viâ Suez -	1883–84
	Parry, Moses, F.R. Met.Soc.	S.S. Prydain - -	1,252	Prydain S.S. Co., Lim., Nevin, Caernarvonshire.	Palermo to New York and Dublin. Cardiff to Malta, Palermo, Boston, and London. London to Boston and back - - - - -	1887
	Parsell, R. -	S.S. Adriatic - -	2,458	Oceanic S. Nav. Co., Lim., Liverpool.	Six voyages from, and five to, New York - - - - -	1886–87
9	" " - -	" - -	"	" " " " -	Three voyages to and from New York -	1887
31	Parson, G. F. -	Earnock - -	1,198	W. Fraser, London - -	Liverpool to Sydney and Rotterdam -	1887
	Pattman, Robert -	Barque Loch Torridon -	2,000	James Aitken, Glasgow - -	Cardiff to Bombay and Dunkirk -	1886–87

LIST of DOCUMENTS, &c.—*continued.*

Captain's Name.	Ship.	Tons.	Owners.	Voyage.	Year.
[37] Pearson, C. W.	S.S. Strathleven	2,436	W. Burrell, Glasgow	Glasgow to Japan, viâ Suez, China, New York, viâ Suez, and Gibraltar	1887–88
Peebles, R.	Barque Tweedsdale	1,403	John A. Roxburgh, Glasgow	Glasgow to Sydney, Newcastle (N.S.W.), San Francisco, and Hull	1886–87
[38] Perrin, T.	Barque Willowbank	811	Andrew Weir, Glasgow	Glasgow to Adelaide, Newcastle (N.S.W.), Valparaiso, Pisagua, and Falmouth	1885–87
Plater, H. R. F.	Patriarch	1,339	William Henderson, Aberdeen	To and from Sydney	1887–88
Price, J. H.	Barque Viola	595	C. T. Bowring, Liverpool	London to Vancouver Island, Iquique, and London	1886–88
Prout, J. C.	Cape St. Vincent	1,422	A. P. Lyle, Greenock	Cardiff to Basilon, Akyab, and Liverpool	1886–87
[39] Pullen, Lieut. and Comr. T. F., R.N.	Lark	—	H.M.S.	At Cooktown, New Guinea, and Sydney	1885–87
[40] Read, G. W., F.R.G.S.	S.S. Auretta	1,729	Auretta Steam Ship Co., Lim., London.	Cardiff to Bombay and Genoa, viâ Suez, Odessa, and Antwerp	1887
,, ,,	,,	,,	Oriental S.S. Co., Lim., London	Cardiff to Kurrachi, Bimlipitam, Marseilles, viâ Suez, Odessa, and Hull	1887–88
Ritchie, Alexander	Four Winds	1,799	J. J. Gardiner, Liverpool	To and from Calcutta	1886–87
Ross, Alexander	Berbice	717	D. Kerr, Greenock	From Cardiff to Manilla	1886
Ross, James	S.S. Ben Alder	1,331	W. Thomson, jun., Leith	London to Japan, viâ Suez, New York, viâ Suez, and London	1886–87
[41] Ross, Sir J. C.	Erebus	—	H.M.S.	To Antarctic Regions	1839–43
Rosseter, W. L.	Barque British Nation	1,302	Samuel S. Parker, Liverpool	Calcutta to Trinidad, Barbados, and Demerara	1887
,, ,,	,, ,,	,,	,, ,,	From Demerara to Delaware, and Liverpool	1888
,, ,,	Barque St. Kilda	865	A. T. Parker, Liverpool	Liverpool to Jamaica, and Calcutta	1886–87
Russell, C. J.	Khyber	1,967	Ralph Brocklebank, Liverpool	To and from Calcutta	1886–87

LIST OF DOCUMENTS, &c.—*continued.*

Captain's Name.	Ship.	Tons.	Owners.	Voyage.	Year.
Sargent, A. H. -	Barque Glenlora -	774	Shaw, Savill, and Albion Co., Lim., London.	To and from Wellington - -	1887–88
Scott, William -	Barque Commewyne -	315	J. Grierson, Glasgow - -	Glasgow to Paramaribo, and London -	1886–87
Setton, William -	Pleiades - -	997	Shaw, Savill, and Albion Co., Lim., London.	To and from Otago, N.Z. - -	1886–87
Sheldrake, J. W. -	Iron Cross - -	1,508	D. Fernie, Liverpool - -	New York to Calcutta - - -	1886
Simpson, Alexander	S.S. Australasian -	2,343	W. Henderson, Aberdeen -	London to Melbourne, via Cape, Sydney, Mauritius, Bombay, and London, via Suez - - -	1886–87
,, ,, -	,, -	,,	,, ,, -	London to Melbourne, via Cape Town, and home, via Suez - - -	1887
Smith, J. H. -	Worcester - -	—	H.M.S. (Training Ship) - -	Off Greenhithe - - -	1886–87
Spratly, W. -	S.S. Mozart - -	1,304	Liverpool, Brazil, and River Plate Steam Nav. Co., Liverpool.	From Buenos Ayres to Antwerp, and Liverpool. Liverpool to Monte Video and back Liverpool to Monte Video, and Dunkirk - -	1886–87
Stewart, C.E., R.N.R.	S.S. Ceylon - -	1,277	Michael D. Lavin, Iver Heath, Bucks.	Two voyages to and from Norway and the Baltic - - - -	1887
Thearle, John -	S.S. Lennox - -	1,327	John Warrack, Leith - -	From Liverpool to Penang, viâ Suez, China, Japan, New York, viâ Suez, and Glasgow - - -	1887
Thompson, A. -	S.S. Patroclus - -	3,386	Ocean S.S. Co., Liverpool. -	To and from China, viâ Suez - -	1886
Thomson, A. S. -	S.S. Buccaneer -	460	W. African Telegraph Co., London	Off West Coast of Africa, and home -	1887
Thompson, J. S. -	S.S. Nestor - -	1,269	Ocean S.S. Co., Liverpool -	To and from China, viâ Suez - -	1886
Ticehurst, R. -	S.S. Essex - -	1,675	Money Wigram and Sons, Lim., London.	To Australia, viâ Cape, and home, viâ Suez. To Australia, Calcutta, and home, via Suez - - -	1882–83
Tomlin, P. S. -	S.S. Ballaarat - -	2,679	P. & O. Steam Navigation Co., London.	To and from Melbourne, viâ Suez -	1887

LIST OF DOCUMENTS, &c.—*continued.*

Captain's Name.	Ship.	Tons.	Owners.	Voyage.	Year.
Sargent, A. H.	Barque Glenlora	774	Shaw, Savill, and Albion Co., Lim., London.	To and from Wellington	1887–88
Scott, William	Barque Commewyne	315	J. Grierson, Glasgow	Glasgow to Paramaribo, and London	1886–87
[42] Setton, William	Pleiades	997	Shaw, Savill, and Albion Co., Lim., London.	To and from Otago, N.Z.	1886–87
Sheldrake, J. W.	Iron Cross	1,508	D. Fernie, Liverpool	New York to Calcutta	1886
Simpson, Alexander	S.S. Australasian	2,343	W. Henderson, Aberdeen	London to Melbourne, viâ Cape, Sydney, Mauritius, Bombay, and London, viâ Suez	1886–87
" "	"	"	" "	London to Melbourne, viâ Cape Town, and home, viâ Suez	1887
[28] Smith, J. H.	Worcester	—	H.M.S. (Training Ship)	Off Greenhithe	1886–87
Spratly, W.	S.S. Mozart	1,304	Liverpool, Brazil, and River Plate Steam Nav. Co., Liverpool.	From Buenos Ayres to Antwerp, and Liverpool. Liverpool to Monte Video and back Liverpool to Monte Video, and Dunkirk	1886–87
Stewart, C.E., R.N.R.	S.S. Ceylon	1,277	Michael D. Lavin, Iver Heath, Bucks.	Two voyages to and from Norway and the Baltic	1887
Thearle, John	S.S. Lennox	1,327	John Warrack, Leith	From Liverpool to Penang, viâ Suez, China, Japan, New York, viâ Suez, and Glasgow	1887
Thompson, A.	S.S. Patroclus	1,386	Ocean S.S. Co., Liverpool	To and from China, viâ Suez	1886
Thomson, A. S.	S.S. Buccaneer	460	W. African Telegraph Co., London	Off West Coast of Africa, and home	1887
Thompson, J. S.	S.S. Nestor	1,269	Ocean S.S. Co., Liverpool	To and from China, viâ Suez	1886
[5] Ticehurst, R.	S.S. Essex	1,675	Money Wigram and Sons, Lim., London.	To Australia, viâ Cape, and home, viâ Suez. To Australia, Calcutta, and home, via Suez	1882–83
[43] Tomlin, P. S.	S.S. Ballaarat	2,679	P. & O. Steam Navigation Co., London.	To and from Melbourne, viâ Suez	1887

LIST of DOCUMENTS, &c.—*continued.*

	Captain's Name.	Ship.	Tons.	Owners.	Voyage.	Year.
	Townsend, W. -	Barque Birker - -	1,008	J. H. Bushby, London - -	London to Adelaide, San Francisco, and Dublin - - - -	1886–87
	" " -	Titania - - -	- - - -	- - - -	From Bimlipitam to Hull - -	1885
	Travers, H. D. -	S.S. Tartar - -	2,755	Union S.S. Co., Lim., Southampton	Two voyages to and from Cape Town -	1886–87
	" " -	" - -	"	" " " -	Three voyages to and from Cape Town	1887
	" " -	" - -	"	" " " -	Two voyages to and from Cape Town -	1887–88
43	Trott, Samuel, F.R. Met.Soc.	S.S. Minia - -	1,350	Anglo-American Telegraph Co., London.	From Falmouth to Halifax and London, and cable laying in North Atlantic -	1887
44	" " -	" - -	"	" " " -	From Falmouth to Halifax, and at Halifax - - - -	1887
	Trunks, H. - -	Barque Aldborough -	1,425	British and Eastern Shipping Co., Lim., Liverpool.	Cardiff to Colombo, Rangoon, and Antwerp - - - -	1886–87
45	Wait, A. McLean, R.N.R.	S.S. Spartan - -	2,223	Union S.S. Co., Lim., Southampton	Two voyages to and from Cape Town, &c. - - - - -	1886–87
56	" " -	" - -	"	" " " -	" " " " -	1887
57	" " -	" - -	"	" " " -	" " " " -	1887–88
	Walker, Henry -	S.S. Cephalonia -	3,490	Cunard S.S. Co., Lim., Liverpool	Six voyages to and from Boston -	1887
	" -	" -	"	" " " -	" " " -	1886–87
	Walker, W. H. -	S.S. Belgic - -	2,695	Oceanic Steam Nav. Co., Lim., Liverpool.	From Belfast to London. London to Sydney, viâ Cape, Newcastle (N.S.W.), and San Francisco - -	1885
58	Ward, J. -	Pegasus - -	2,564	T. C. Wilkinson, Liverpool -	Liverpool to Calcutta and back -	1886–87
	" " -	" - -	"	" " -	Liverpool to Calcutta and London -	1887–88
59	Waring, W. -	S.S. Breconshire -	1,648	D. J. Jenkins, London - -	To and from China and Japan, viâ Suez - - - - -	1886–87
60	" " -	" - -	"	" " - -	" " " " -	1887
61	Watson, Alexander -	Barque Elvira -	464	Henry F. Watt, Liverpool -	To Hobart Town, and from Newcastle (N.S.W.), to Java and home -	1886–87
	Webster, J. K. -	S.S. Prometheus -	1,538	Ocean S.S. Co., Liverpool -	To and from China, viâ Suez - -	1886

List of Documents, &c.—*continued.*

Captain's Name.	Ship.	Tons.	Owners.	Voyage.	Year.
[32] West, Frederick -	S.S. Port Adelaide -	1,783	Anglo-Australian Steam Nav. Co., London.	London to Australia, viâ Cape, China, Japan, New York, viâ Suez, and Liverpool - - - -	1887–88
Wheaton, N. J. -	Barquentine Eliza -	299	J. H. Goodyear, Liverpool -	To Demerara, Barbados, and Nantes -	1887
,, ,, -	,, -	,,	,, ,, -	Liverpool to St. Domingo and Havre -	1887–88
Wilding, J. - -	S.S. Agamemnon -	1,523	Ocean S.S. Co., Liverpool -	To and from China, viâ Suez - -	1886
[33] Wilson, John -	S.S. Ethiopia - -	2,604	Barrow S.S. Co., Lim., Barrow -	Five voyages between Glasgow and New York - - - - -	1886–87
[34] ,, ,, -	,, - -	,,	,, ,, ,,	,, ,, ,, -	1887
[34] Unknown - -	S.S. Somersetshire -	- - -	- - - - -	To and from Australia, viâ Cape of Good Hope - - - -	1880–81

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

[1] Kept by R. A. Lindau, 3rd Officer.
[2] Kept by E. Simmons.
[3] Kept by Sub-Lieut. J. C. Tancred, R.N.
[4] Kept by Chen Ngen Tao, Lieut. I.C.N.
[5] Kept by H. C. Carr.
[6] Kept by F. T. Kimpton.
[7] Kept by G. T. Woods, Mate, and G. R. Huddy, Chief Officer.
[8] Kept by John Mathias.
[9] Kept by T. D. Blower, 3rd Officer.
[10] Kept by H. K. Sturdee.
[11] Assisted by Officers.
[12] Kept by J. L. Berryman, 4th Officer.
[13] Kept by Lieut. H. H. Douglas, R.N.
[14] Kept by C. J. Hall, 3rd Officer.
[15] Kept by O. W. Read.
[16] Kept by Lieut. W. P. Dawson, R.N.
[17] Kept by W. H. Jones.
[18] Assisted by Messrs. D. Morrison and W. R. More.
[19] Kept by J. E. Pierce, 4th Officer.
[20] Kept by Walter Newman, 2nd Officer, and other Officers.
[21] Kept by Lieut. F. Bowden Smith, R.N.
[22] Kept by H. C. Carr and J. Tracy.
[23] Kept by F. Johnson.
[24] Kept by John Christie.
[25] Kept by F. Johnson and A. H. Burgess.
[26] Kept by S. Stanton, 2nd Officer.
[27] Kept by Lieut. W. O. Lyne, R.N.
[28] Kept by the Boys.
[29] Kept by G. G. Tyson, Surgeon.
[30] Assisted by Messrs. Down, 2nd Officer, and G. Hunt, 4th Officer.
[31] Assisted by 1st and 3rd Officers.
[32] Kept by J. Prior and W. D. Stanney.
[33] Kept by Lieut. Andrew Balfour, R.N.
[34] Kept by B. Atkinson Finlay and J. Tracy.
[35] Kept by J. E. Fenton and F. Johnson.
[36] Kept by Joseph Prior.
[37] Assisted by A. Keith, 2nd Officer.
[38] Kept by J. Smith.
[39] Kept by Lieut. G. W. Gubbins, R.N.
[40] Kept by W. H. Richardson, 1st Mate.
[41] Observations by J. D. Hooker.
[42] Kept by Robert Findlay, Chief Officer.
[43] Kept by S. de B. Lockyer, 2nd Officer.
[44] Kept by Thomas C. Newton, F.R. Met. Soc., Chief Officer.
[45] Kept by V. E. Berg, 4th Officer.
[46] Kept by F. J. Kennedy, 4th Officer.
[47] Kept by F. I. Moseley.
[48] Kept by G. Leach, 2nd Mate.
[49] Assisted by J. H. Lashbrooke and G. W. Cundy, 2nd and 3rd Officers.
[50] Kept by J. H. Lashbrooke and E. N. Reed, 2nd and 3rd Officers.
[51] Assisted by Cecil Newby, Apprentice.
[52] Kept by D. E. Jamieson, 2nd Officer, and F. Williams, 3rd Officer.
[53] Kept by David Morgan, 3rd Officer.
[54] Kept by A. L. Paget.

APPENDIX III.

Instruments supplied, &c. to the Royal Navy.

Per Account.	Barometers.	Aneroids.	Thermometers.				Hydrometers.
			Ordinary.	Max.	Min.	Screens.	
April 1st, 1887, afloat	190	413	1,312	224	182	141	118
Issued since	65	153	445	67	70	29	50
	255	566	1,757	291	252	170	168
Returned since	60	121	474	42	41	34	60
April 1st, 1888, afloat	195	445	1,283	249	211	136	108

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

April 1st, 1887, in use	83	109	266	20	28	2	20
Issued since	4	4	37	2	8	1	1
	87	113	303	22	36	3	21
Returned since	20	29	64	17	11	1	3
April 1st, 1888, in use	67	84	239	5	25	2	18

Disposition of Admiralty Instruments on April 1st, 1888.

Afloat in Royal Navy	195	445	1,283	249	211	136	108
In use at stations	67	84	239	5	25	2	18
In store at M.O.	90	73	129	38	59	30	50
,, Chatham	5	2	12	2	1	3	1
,, Sheerness	8	15	34	6	5	5	13
,, Portsmouth	4	13	14	6	5	17	8
,, Devonport	8	5	49	5	5	9	20
,, Queenstown	3	5	1	1	1	—	8
,, Gibraltar	1	3	14	—	—	—	4
,, Malta	5	8	16	7	6	—	17
,, Bombay	5	5	21	3	3	1	—
,, Halifax	4	10	26	5	6	—	14
,, Bermuda	3	10	—	2	4	—	15
,, Jamaica	3	3	19	3	2	—	—
,, Cape of Good Hope	5	7	31	10	5	3	30
,, Trincomalee	2	1	11	2	3	—	—
,, Hong Kong	8	12	46	15	14	2	12
,, Coquimbo	4	8	29	3	2	—	19
,, Sydney	3	2	10	4	3	—	—
,, Esquimalt	3	4	22	3	3	—	—
Total, April 1st, 1888	426	715	2,006	368	363	208	337
Lost, &c. since April 1st, 1887	13	31	358	34	25	20	21
Under repair	7	4	10	—	—	—	—

APPENDIX IV.

Instruments supplied, &c. to Mercantile Marine.

Per Account.	Barometers.	Compasses.	Thermometers.				Hydrometers.
			Ordinary.	Max.	Min.	Screens.	
April 1st, 1887, afloat	138	—	790	—	1	141	420
Issued since	75		498	1	1	73	262
	213	—	1,288	1	2	214	682
Returned since	91	—	544	—	1	89	302
April 1st, 1888, afloat	122	—	744	1	1	125	380

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

April 1st, 1887, in use	250	4	248	62	58	35	21
Issued since	14	—	50	8	8	8	—
	264	4	298	70	66	43	21
Returned since	10	1	31	13	6	7	8
April 1st, 1888, in use	254	3	267	57	60	36	13

Disposition of Board of Trade Instruments on April 1st, 1888.

In merchant ships	122	—	744	1	1	125	380
In use at stations	254	3	267	57	60	36	13
In store at M.O.	32	1	121	5	32	33	120
At Liverpool Agency	6	7	24	—	—	8	22
„ Aberdeen „	6	—	45	—	1	5	24
„ Glasgow „	6	—	18	—	—	8	10
„ Dundee „	15	—	28	—	—	12	30
„ Hull „	7	—	36	—	—	8	26
„ Southampton „	3	—	20	—	—	6	23
„ Cardiff „	4	—	22	—	—	2	23
Total, April 1st, 1888	455	11	1,325	63	94	243	671
Lost, &c. since April 1st, 1887	5	1	149	4	2	37	93
At opticians	7	—	14	—	—	4	—

APPENDIX V.

LIST of STATIONS reporting Meteorological Observations to the Office by Telegraph on 31st March 1888, with the Names of Observers.

*†Sumburgh Head	Rev. W. Braud	Minister of Dunrossness.
*†Stornoway	J. Forbes	Nicolson Institution.
Wick	J. Sinclair	Watchmaker.
Nairn	Miss Penny	School mistress
*†Aberdeen	J. McCormack§	Telegraph Clerk.
Leith	W. Hay	Do.
*†Shields	J. W. Irvine	Do.
Spurn Head	J. B. Smith	Assistant Lightkeeper.
†York	H. M. Platnauer, F.G.S.	Curator of Museum.
Loughboro'	W. Berridge, F.R.Met.Soc.	
†Ardrossan	J. W. Mayes	Telegraph Clerk.
Malin Head	J. O'D. Farren	Signalman, Lloyd's.
*†Mullaghmore	K. Kerr	Retired Coastguard Officer.
*†Belmullet	Miss M. J. Tolan	Telegraphist.
†Donaghadee	T. MacGowan	Postmaster.
Parsonstown	W. Harding	Assistant Observer at Lord Rosse's Observatory.
Barrow-in-Furness	W. S. Whitworth	Engineer, Barrow-in-Furness Railway.
*†Holyhead	Capt. Richards	Keeper of Sailors' Home.
Liverpool	J. Hartnup, F.R.Met.Soc.	Bidston Observatory.
*†Valencia	J. E. Cullum	Superintendent of the Observatory.
†Roche's Point	W. Kennedy	Telegraph Clerk.
Pembroke	S. Blake	Lightkeeper.
*†Scilly	W. Thomas	Signalman.
Prawle Point	W. Hewitt	Coastguard Officer.
†Hurst Castle	G. G. Appleton	Lightkeeper.
†Jersey	J. Fisher	Signalman.
*†Dungeness	P. Curnow	Lightkeeper.
*†London	F. Gaster, F.R.Met.Soc.	Clerk, Meteorological Office.
Oxford	W. Wickham	Radcliffe Observatory.
Cambridge	H. Todd	Observatory.
*†Yarmouth	G. T. Watson	Secretary, Sailors' Home.
‡Hawes Junction	W. H. Bunce	Station Master

Note.—Those stations marked with an asterisk (*) report also at 2h. p.m.; and those with a dagger (†) at 6h. p.m.

‡ This station now reports by post only.

§ Since dead. Mr. W. Boswell, of the Aberdeen Observatory, has been appointed observer in his stead.

APPENDIX VI.

Report of Inspection of the Irish Stations, with Holyhead.

Telegraphic Reporting Stations.

Holyhead, visited August 11.—The instruments at this station were clean and in good order. As regards the sand-glass anemometer, I think that the reason that the estimates for this station fall below those from Sumburgh Head and North Shields is to be found in the position of the Sailors' Home at Holyhead, on the slope of a small hill rising from the harbour. I have had a post for the reception of the instrument erected on Salt Island, close to the site of the bridled anemometer, and have directed Captain Richards to make a series of comparative observations in the two sites.

Belmullet, visited August 30.—I found nothing calling for remark at this station. The observer is rapidly learning to observe and report clouds accurately.

Roche's Point, visited September 9.—This station was in good order, as usual.

Valencia, visited September 14.—As regards the telegraphic observations there is nothing to report.

Parsonstown, visited September 19.—The observer at this station has been changed, but in all other respects no remarks are necessary.

Donaghadee, visited September 27.—This station is in good condition.

Malin Head, visited September 28.—The circumstances at this station are not satisfactory. The observer, J. O'D. Farren, at times hands over the work to an imperfectly trained assistant, and the Office can never be sure who is observing. The observer raises a difficulty about the 6 p.m. reports, inasmuch as the tower at which the barometer, &c. are placed is on a rocky hill, the descent of which after dark in winter is not easy.

Mullaghmore, visited September 30.—This station is, as usual, in good order.

Weekly Weather Report Stations.

Carrygraue, visited September 2.—I found this station in good order. I am trying to induce Mr. Wilson, who has the requisite instruments, to institute readings at 9 p.m., so as to raise the station to the Second Order.

Killarney, visited September 13.—There is nothing to remark about this station.

Foynes, visited September 16.—The position of the instruments has been slightly changed, and they are all in good order.

Waterford, visited September 21.—This station continues fairly satisfactory.

Kilkenny, visited September 22.—There is nothing to remark about this station, except that the rain-gauge requires alteration, as it is of faulty construction.

STATIONS OF THE SECOND ORDER.

Dublin (*Fitzwilliam Square*), visited August 25.—This station is, as usual, in as good condition as is possible in the locality.

Dublin (*Glasnevin*), visited August 26.—I have nothing to remark about this station. The rainfall has during the first seven months of the year been exceptionally small, only 6·77 inches.

Dublin (*Mountjoy Observatory*), visited August 26.—The instruments were in very good order.

Markree, visited September 1.—This station also was in very good order. The mercury in the cistern of the Fortin's barometer is, however, much oxidised.

Parsonstown, visited September 19.—There is a change of observers at this station, and for the present Dr. Bœddicker is taking the observations. The regular observer has not yet been appointed.

Colebrooke, visited October 1.—This station does not call for remark.

Armagh Observatory, visited September 26.—The instruments are all in good condition. Dr. Dreyer has applied for a grass minimum and a solar radiation thermometer, which have been supplied.

(Signed) ROBERT H. SCOTT.

The following table shows the results of the thermometric comparisons:—

Corrections to be applied to the readings of—

STATIONS.	Dry Bulb.	Wet Bulb.	Max.	Min.	Spare Therm.	Remarks.
STATIONS OF THE SECOND ORDER.						
Armagh	+0·1	0·0	−0·7	—	—	
Brookborough	−0·9	−0·9	−0·4	−0·1	—	
Dublin (City)	−0·3	−0·2	−0·6	−0·1	—	Grass min. +0·1.
Dublin (Phœnix Park O.S.O.)	−0·5	−0·4	−0·6	+0·1	—	Do. +0·1.
Glasnevin	−0·1	−0·2	−0·7	+1·4	−0·2	Do. −0·1.
Londonderry	−0·3	−0·3	+0·3	+0·5	−0·1	
Markree Castle	−0·1	+0·1	0·0	+0·1	—	
Parsonstown	−0·4	+0·1	−0·3	0·0	—	
TELEGRAPHIC REPORTING STATIONS.						
Holyhead	+0·2	+0·1	0·0	+0·7	0·0	
Malin Head	−0·3	−0·2	−0·2	+0·5	−0·2	
Mullaghmore	−0·3	−0·2	−0·8	+0·2	−0·4	
Belmullet	−0·4	0·0	−0·2	−0·1	—	No spare thermometer.
Donaghadee	−0·2	−0·2	+0·3	+0·4	−0·1	
Parsonstown	+0·5	0·0	−0·2	−0·1	—	Do. do.
Valencia	−0·8	−0·6	−0·4	0·0	—	Do. do.
Roches Point	−0·7	−0·5	−0·8	−0·1	—	Do. do.
WEEKLY WEATHER REPORT STATIONS.*						
Edgeworthstown	−0·4	−0·3	−0·4	−0·6	−0·1	Grass min. +0·3.
Kilkenny	—	—	+0·1	0·0	—	
Waterford	−0·5	−0·4	−0·1	0·0	—	
Foynes	−0·3	−0·2	−0·1	+0·8	—	
Killarney	−0·6	−0·6	−0·4	−0·2	—	Screen is only single louvred.

* Observations from the dry and wet-bulb thermometers at these stations are not used in preparing the Weekly Weather Report.

Report of Inspection of the Scottish Stations for 1887.

Barometers.

The barometers at the stations were compared with inspector's mercurial standard barometer No. 532, except those at Pinmore and at Leith. The inspector's standard was accidentally broken on the journey from Glenlee to Pinmore, and consequently at the latter place the station barometer only was read. The barometer at Leith was compared with the Board of Trade barometer No. 958, which is one of the 12 barometers presented to the Scottish Meteorological Society in 1858 by the Board of Trade. It was compared with No. 532 on August 12 before setting out on the tour of inspection.

The results of the inspection are presented in the following table, which shows the "corrected" readings of the standard barometer and the uncorrected readings of the station barometers. The inspection shows that each of these important instruments remains in the excellent condition in which it was reported to be in 1885.

	Inspector's Standard, corrected.	Not corrected.		Remarks.
		Rep. Baro.	Check Baro.	
	ins.	ins.	ins.	
Nairn	29·834	29·832	29·832	
Stornoway	29·623	29·628	29·626	
Glenalmond	29·368	29·366	—	
Dundee	29·940	29·940	—	
Braemar	28·795	28·800	—	
Aberdeen	29·880	29·885	—	In Post Office.
Do.	29·785	—	29·780	In house, Braemar Place.
Swanbister	29·902	29·914	—	
Dunrossness	29·883	29·888	29·892	
Wick	30·050	30·050	—	In shop.
Do.	29·964	—	29·969	In house.
Dunrobin	30·032	30·036	—	
Lauder	29·477	29·476	29·458	Check barometer is 8 feet higher in flat above.
Rothesay	29·362	29·365	—	
Ardrossan	30·278	30·278	—	In Post Office.
Pinmore	—	29·475	—	Inspector's standard barometer broken.
Leith	30·296	30·299	—	In Post Office. Check barometer, see Inspector's Notes for Station.
King's College, Aberdeen	29·909	29·896	—	

In no instance did the difference between the inspector's readings and those of the observers or their assistants exceed 0·002 inch.

Thermometers.

The various thermometers at the stations were compared in water with the standard thermometer No. 2395, to the readings of which the following "corrections" were applied, viz., at 42°, −0°·4; at 52°, −0°·4; and at 62°, −0°·3. The table gives the "corrected" readings of the standard and the *errors* of each instrument as ascertained by the comparison. In all cases these errors closely correspond with those previously ascertained.

It is now rare to find any minimum thermometer out of order by showing a detached portion near the top of the tube. At Fort Augustus, 0°·1 was lodged at the top of the tube, but in such a way that it was not detected till after a comparison with the standard had been made. At Ardrossan the small portion separated from the rest of the spirit had been detected by the observer immediately before my visit, but he required a little instruction in the use of a small gas flame to restore it.

—	Standard No. 2,395, Corrected.	Dry Bulb.	Wet Bulb.	Spare Thermometer.	Max. Thermometer.	Min. Thermometer.	Time in Water in Minutes.	Change of Temperature.	Notes.
	°	°	°	°	°	°		°	
Nairn -	51·3	+0·6	+0·6	+0·1	−0·1	+1·0	75	+0·3	
Lairg - -	51·8	+0·1	+0·1	—	0·0	+0·1	90	Uniform	
Glencarron	48·7	+0·1	+0·2	—	+0·1	+0·1	60	Do.	
Stornoway -	52·4	+0·5	+0·5	+0·3	−0·4	−0·4	180	Do.	
Ochtertyre -	62·7	0·0	0·0	+0·5	+0·5	−0·1	150	Do.	
Glenalmond	60·1	+0·2	+0·3	—	+0·2	−0·1	120	Do.	
Dundee -	61·1	+0·4	+0·6	—	+1·1	−0·2	60	+0·2	
Braemar	55·3	+0·4	+0·5	—	+0·6	−0·1	150	+0·2	
Aberdeen -	57·1	+0·2	+0·5	—	+0·6	0·0	120	+0·3	
„ King's College.	57·2	+0·4	+0·3	—	+0·4	0·0	80	Uniform	In Stevenson's screen.
„ „	57·2	+0·1	+0·6	—	−0·2	−0·2	80	Do.	At Tower.
Swanbister -	57·9	+0·1	+0·1	—	0·0	−0·3	60	Do.	
Dunrossness	53·1	+0·4	+0·3	—	+0·3	−0·9	135	+0·3	
Wick - -	57·5	+0·3	+0·4	+0·4	−0·3	−0·2	60	Uniform	
Dunrobin -	61·8	−0·4	−0·6	—	+0·5	−0·5	70	+0·3	
Fort Augustus.	57·5	+0·1	+0·1	—	+0·1	−0·1	120	Uniform	
Laudale -	62·0	+0·2	+0·2	—	+0·2	+0·2	105	Do.	
Rothesay -	61·2	0·0	0·0	—	+0·1	−0·4	80	Do.	
Ardrossan -	57·2	+0·1	+0·1	—	−0·3	−0·5	60	+0·2	
Glenlee -	55·9	+0·3	+0·3	—	−0·2	+0·1	135	Uniform	
Pinmore -	50·9	+0·2	+0·4	—	0·0	+0·1	135	+0·3	
Leith - -	52·6	+0·1	+0·5	—	0·0	−0·5	60	Uniform	
Marchmont	50·8	−0·1	−0·2	—	+0·1	+0·1	140	+0·2	

Hygrometers.

Some attention was given during this inspection in preparing the following table with view of submitting to the Meteorological Council the data from which an idea may be formed as to the condition in which these instruments were found at the time of inspection.

—	Dry Bulb.	Wet Bulb.	Difference.	Hour of Reading.	Remarks on Weather.
	°	°	°		
Nairn - -	47·4	45·4	2·0	6 30 p.m.	Cloudy, with passing showers.
Lairg - -	53·9	46·2	7·7	3 0 „	Clear and dry.
Glencarron -	42·5	37·5	5·0	12 45 „	Sunshine and strong wind, with flying showers of rain, hail, and sleet.
Stornoway - -	—	—	—	—	New observer and position for station.
Ochtertyre - -	65·5	60·2	5·3	4 30 „	Sunshine, with occasional heavy showers.
Glenalmond -	63·6	55·0	8·6	1 0 „	Strong sunshine; breezy.
Dundee - -	69·8	61·2	8·6	2 0 „	Fine and bright.
Braemar - -	51·8	44·8	7·0	1 0 „	Sunshine, with occasional showers.
Aberdeen - -	54·3	52·1	2·2	7 35 „	Raining; overcast.
Do. King's College.	58·4	50·2	8·2	12 15 „	Fine and bright (in garden).
Do. do.	58·1	48·1	10·0	12 30 „	Do. (at tower).
Swanbister - -	54·1	51·7	2·4	9 40 a.m.	Dull and showery.
Dunrossness -	50·6	47·8	2·7	10 30 „	Slight drizzle, with blinks of sunshine.
Wick - -	55·5	53·9	1·6	4 30 p.m.	Dull and misty, but beginning to clear.
Dunrobin - -	58·4	55·8	2·6	11 45 a.m.	Sun breaking through mist.
Fort Augustus -	58·7	55·9	2·8	8 45 „	North wind, with mist.
Laudale - -	64·0	59·1	4·9	2 15 p.m.	Sunshine, with flying showers.
Rothesay - -	62·2	57·8	4·4	4 6 „	Half clouded, with occasional showers.
Ardrossan - -	55·7	51·2	4·5	8 20 a.m.	Clear and bright.
Glenlee - -	55·8	51·3	4·5	12 30 p.m.	Clearing after heavy rain.
Pinmore - -	60·0	53·2	7·8	1 40 „	Fine and breezy.
Leith - -	54·9	50·5	4·4	3 0 „	Overcast with haze.
Marchmont -	42·9	41·7	1·2	9 10 a.m.	A comparatively fair interval of 20 minutes during heavy rain of some hours' duration.

The instruments were all read in precisely the same way, viz., immediately on opening the thermometer screen; the dry and wet bulbs were rapidly read, and a note was made at the same time of the state of the weather. In each case I was satisfied that the wet bulb was in good order, the observed differences being due to the different hours, and the hygrometric condition of the air at the time.

NOTES ON THE STATIONS.

Nairn, May 17.—The instruments were in very good order. Special attention was drawn to the errors referred to in the notes sent from the Meteorological Office, and the course to be systematically pursued in order to secure their non-repetition in future was explained at length. In about three weeks after my visit Miss Penny, who has been sometime assistant in a school near Banff, returns to be first assistant at Delnies School under Mrs. Penny, when the observations will be immediately under her charge. Each of the observers can read the instruments correctly, and make up a weather telegram with correctness and despatch.

Lairg, May 18.—The four thermometers now in use were quite recently compared at Kew, and the corrections are very trifling. The method of reading the new maximum thermometer, which was not understood, was explained and is now understood. The thermometer screen is to be placed on new posts, and arrangements made by Mr. Ross to prevent shaking of the maximum and minimum thermometers during high winds, which has probably been of occasional occurrence in the past. The minimum thermometer previously in use was found to have 2°·0 of spirit detached from the column. This instrument was correct when the station was inspected in September 1886. The observing instruments were all in good order.

Glencarron, May 19.—The instruments were in excellent order and read with much intelligence. This is a well-appointed station, possessing, in addition to the usual instruments, a barograph and a thermograph, the latter in a Stevenson's screen close to the other thermometers, and three snow gauges, of 5, 10, and 15 inches diameter respectively, which are read daily when snow has fallen. Glencarron is situated in the valley of the Carron, which is steep and narrow, mountains rising on all sides, some of them to heights exceeding 3,000 feet. The situation is absolutely open on all sides.

Stornoway, May 20 and 21.—I spent nearly the whole of Friday and Saturday in removing the instruments to their new positions at Nicholson Institution, and in seeing that Mr. Forbes, the new observer, was thoroughly prepared to serve as reporter. Mr. Forbes showed a remarkable readiness in reading the instruments and making up the daily telegrams, and gives good promise of being an excellent observer. Before I left, Miss Riddoch, his sister-in-law, read the thermometers and set the vernier correctly, and three weeks thereafter I was informed that she had learnt to read all the instruments and prepare the daily telegram.

Ochtertyre, July 13.—The instruments here are remarkably well kept and observed, and a duplicate set is kept. There is also a snow gauge. The grass plot where they are placed is on a slope facing the south, and is open to the sun nearly the whole day. The grounds are richly wooded with trees and shrubs, and are thus less open to the winds than is generally the case.

Glenalmond, July 14.—The instruments are well kept and carefully observed. Mr. Reid is assisted by Mr. Delius, master of foreign languages, with whose assistance every effort will be made to observe the 9 p.m. readings, but the engagements of both observers in the college will preclude anything like a continuous record being made at this hour.

Dundee, July 15.—The instruments were in very good order, and evidently are carefully attended to. The observations are made correctly and expertly. The wind estimations at the time of my visit were again made correctly.

Braemar, August 13.—The instruments were found to be in excellent order, and both Mr. Aitken and Miss Kelly, the assistant, are remarkably good observers.

Aberdeen, August 15.—The instruments were in excellent order, and the observations made intelligently and accurately. The thermometer screen had been painted a few days before my visit. An extreme reading of the barograph, showing the extreme value, highest or lowest, will in future be forwarded to the Office.

Swanbister, August 18.—The condition of the instruments and the methods of observing were such as to leave nothing to be desired. Mrs. Fortescue read the barometer and other instruments with exactness. The observations of the direction of the wind no doubt approximate closely to the direction for the district; if there be any deviation from this, it can be no more than a slight modification due to the low ridge, lying from N.W. to S.E., on which the anemometer is placed. This instrument appeared to be in very good order.

Dunrossness, August 20.—The instruments were in very good order, and the observations made carefully and correctly by the three observers. Miss Brand now makes up the daily telegram correctly and with tolerable despatch. Much attention has been given by Mr. Brand and assistants to observations of the force of the wind by the hand anemometer, and in every case, without exception, the estimated force is written down before the observation with the anemometer is made. So far as Mr. Brand remembers, every case of difference between the estimated and the observed force, amounting to three miles per hour or more, was explained by short-lived gusts, or temporary lulls, or diminished force during the revolutions of the anemometer.

Wick, August 23.—The instruments were in very good order, and intelligently observed. The thermometer screen had been painted a month before my visit, and was in very good condition. As regards the late arrival of the telegrams in London, Mr. and Miss Sinclair promise that every effort will be made to have them delivered at the post office not later than 8.30 a.m.

Dunrobin, August 24.—The instruments were in good condition, and the observations are made with care. The rain-gauge was slightly deformed, but was put right. Observations of wind-force will probably be commenced soon.

Fort Augustus, August 26.—A portion of spirit, equal to $0^{\circ}\cdot4$, was separated from the column of the minimum thermometer and lodged at the top of the tube. With the help of the observer it was put right. With this exception the instruments were in excellent order, and the observations made with much intelligence. The positions of the various instruments are remarkably good. The observations are made here at 8.45 instead of 9 o'clock, as the regulations of the Monastery preclude the observations being taken at the latter hour.

Laudale, August 29.—The instruments were in very good order, and well observed. The "weather initials" were carefully gone over, and will in future be strictly adhered to, and such observations as those of "frost" will be entered in the "Remarks" column. As regards the back schedules from January 1886, Mr. Fletcher will have them copied and transmitted as soon as possible.

Rothesay, August 30.—Everything at this station was in excellent order, and the observations are made with much care.

Ardrossan, September 8.—Before opening the thermometer screen, Mr. Mayes informed me that on the previous day he had observed a small portion of the spirit of the minimum thermometer detached, but had been unable to put it right. This proved to be 0°·6. It was put right in his presence, and partly with his assistance, by means of a small gas flame. The rain-gauge was slightly deformed, but was set right. Otherwise the instruments were in good order, and there is much interest and intelligence in the work of observing.

Glenlee, September 26.—The instruments were in very good order, and were correctly and intelligently observed. The height above mean sea level, determined from a B. M. a little way off, is 206 feet. The station is on a low, rather broadish ridge, between two streams which join the Ken near this place. It seems probable from the appearance of the district that W.N.W. winds will unduly preponderate over the winds immediately contiguous to them, but otherwise the winds will fairly represent the general direction for that part of Scotland.

Pinmore, September 29.—The instruments were all in particularly good order. The assistant observer has recently been engaged as apprentice gardener. At present he reads the thermometer correctly to whole degrees, and it is expected that he will soon be able to read all of them in the usual way. Mr. Donald had been called to Girvan the morning of my visit, where I saw him for half an hour on my way to Ayr.

Leith, October 5.—The instruments here are all well kept, and the observations accurately made. A ventilator was added to the thermometer screen since last inspection, and a new glass measure for the rain-gauge has been got. Mr. Hay's family removed in May to Hawthornbank Place, and the check barometer was found to be correct in its new position.

Marchmont, October 8.—The instruments are well placed and in excellent order, and the observations are carefully made. The sun shines on the thermometer box at all hours and seasons, except for about three weeks in the depth of winter, when they are shaded for a brief interval after sunrise by a clump of ash, birch, and sycamore trees about 100 yards off.

The Observatory, King's College, Aberdeen, August 15.—The attached thermometer of the standard barometer was found some time ago to have slipped down, and consequently reading too low. It was correct when compared with inspector's standard in 1885, but as I did not carry a barometer with me in 1886, there was no comparison that year. The accident had taken place some time after 1885. It would assist in detecting an error of this sort if the stems of the attached thermometer were always graduated, which is seldom the case. With this exception all the instruments were in excellent order, and excellently manipulated and observed.

(Signed) A. Buchan.

Report of Inspector of the English Stations, 1887.

Telegraphic Reporting Stations.

Dungeness, inspected June 18.—There continue to be occasional errors in the barometric reports from this station, due, as I think, to inaccuracy on the part of some of the observers. As I have previously reported, the readings are taken by the light-keepers in rotation as they are on duty. All the instruments were found to be in good order, and the thermometers read well together. The low temperatures occasionally reported from this station, as compared with temperatures reported from stations at no great distance on the coast, are, as I feel convinced, correct. The estimated wind-force in gales, as reported from this station, appears somewhat low; but I venture to question whether it is incorrect. I consider that there is a slight tendency at nearly all our inland and east coast stations to over-estimate the wind-force; and it may be observed in this connexion that the observer, Mr. P. Curnow, who is responsible for the wind reports at Dungeness, has spent the greater part of his life on the Cornish coast. The direction of the wind does not always seem to be reported with exact accuracy from this station. It was correctly estimated by the observers on the day of my visit; but I noticed what I have observed with surprise of light-keepers at many other localities, that they estimated with hesitation and inaccuracy the compass direction of various objects on the horizon. The reports from this useful station will, I think, improve.

Jersey, June 21–22.—The observer, Mr. Fisher, had recently been appointed station-master at the railway station of St. Aubins, and had therefore removed one of the barometers from his house at Noirmont to the booking office at the terminus. The thermometer screen was also removed from Noirmont to a small piece of ground adjoining the railway station, of which I have sent a plan to the Meteorological Office. The barometer now in use, No. 531, is that which was formerly used as the check barometer at Noirmont, the height of the cistern above mean sea level I estimate as 25 feet. I recommend that this barometer should be moved from the booking office into a waiting-room which is little used and is visible from the office. In its present position it will in winter be in too close proximity to a gas stove. No fire is ever lighted in the waiting-room. The 8 a.m. readings of the barometer were at the date of inspection still taken at Noirmont. The thermometer screen has a pretty fair exposure. The change of altitude will necessarily cause the summer maxima to be somewhat higher than those previously reported from Noirmont.

Hurst Point, June 24.—I found all the instruments at this station in excellent order, and the observer, Mr. Appleton, certainly improves to some extent in care and accuracy. It must, however, be admitted that as regards correctness in taking the bearings of distant objects, the remarks made for Dungeness apply to the observers here also. Sea disturbance can never be exactly estimated from this point.

Prawle Point, June 26.—A new observer, Mr. Hewitt, has been appointed at this station. He is a man of intelligence, and takes the observations with much accuracy; while his assistants, Mr. Mehegan, is (as mentioned in last year's report) a very efficient observer. All the instruments, excepting the minimum thermometer, were in excellent order. The minimum, No. 307, contained 0°·9 of detached spirit, and for the first time in my experience, I failed to restore this. I gave the

necessary instructions to the observer as to the method of doing this, and requested him in the meantime to make the necessary correction. The rain gauge had been torn away from its supports and partially injured a few days before my visit, during rainless weather, by the fall of one of the stays of the flagstaff. I had this remedied during my visit. I think that the reports from this station, as regards wind, weather, and sea disturbance, are as good as can be obtained from any point on our south coast.

Scilly (*St. Mary's*), June 28 and 29.—The observations at this station continue to be well conducted, although the observer, Mr. Thomas, is somewhat aged. His son occasionally assists in taking observations, but my opinion is that a most efficient substitute will be found in Mr. Alfred Hicks (strongly recommended by Mr. Smith Dorrien), whom I carefully examined in the knowledge of meteorological instruments, and who at any time could undertake the work, should the health of Mr. Thomas break down.

The barometers and thermometers read fairly well together, but the maximum on this occasion read 0·6 too high. Since last year some more of the louvre work of the door of the screen has gone to pieces, and I ordered that the door should be taken off (being temporarily replaced by perforated canvas), and completely repaired; that the whole screen should be repainted, and the cap should be repaired. Repairs were also required for the block holding the rain-gauge, which I ordered to be done at once. The moisture conveyed by the atmosphere over these islands contains a remarkable amount of salt, one of the results of which is that the velocity-trace of the anemograph is frequently dim, especially about midnight, and the paper is blurred with a yellow tint.

I had undertaken to fix a new brush for the anemometer, but this had not arrived at the time of my visit.

It appears as though the estimated wind-forces reported from this station are, in the cases of strong breezes and gales, somewhat too high. It is impossible for me without carefully comparing the estimated forces with the anemographs to pronounce an opinion on this subject, but it is certain that the force of the wind in gales, as felt at Scilly, appears extraordinary to those who are not accustomed to it.

Loughborough, August 25.—I found all the instruments at this station in excellent order, and the observations are carried on, as usual, with the utmost accuracy.

Barrow-in-Furness, September 3.—The instruments at this station were in fairly good order. The higher wind-forces appear to be somewhat over estimated, but the observer's house has a very bleak exposure to Westerly winds. As regards the direction of the winds, I have previously called attention to the diversion of Southerly air currents on this coast as explained by orographical considerations. The barometer is in good order, yet the readings reported appear not uncommonly to be too low.

North Shields, September 6.—The observations at this station continue to be carefully carried on, and the instruments are in fairly good order, with the exception of the rain-gauge. The latter instrument is nearly worn out. The large anemometer, erected since the last inspection, on the Dockwray Square Lighthouse, works well, but the clock has not always been accurately regulated. The results of the comparisons between the estimated wind-forces and the indications of the small hand anemometer have been satisfactory at this station, but as the

latter observations have to be taken at some distance from the post office, the official duties of Mr. Irvine prevented his continuing them. I have asked Mr. J. Foster Spence to take for some time the readings of the hand anemometer on his lawn (which is the place at which they have hitherto been taken), independently of, but simultaneously with, the estimations taken by Mr. Irvine in Dockwray Square. The results will be sent to the Meteorological Office.

York, September 7 and 8.—Although the barometer readings from this station occasionally appear too high, the observer seems to read with complete accuracy, and I can find no fault with the barometer. The absence of reported strong winds or gales from this station is somewhat remarkable, but that gales are practically almost unknown in York is a statement confirmed, so far as my inquiries have gone, by independent evidence.

Cambridge, September 20.—The observer was absent at the time of my visit. All the instruments were in very good order. The wind-forces reported from this station are, I believe, still deduced from the readings of the anemometer, and the instrument is considerably sheltered by trees on all sides of the observatory, and to some extent by the dome of the observatory itself. It is, I think, partly in consequence of this fact that the wind-forces reported seem to be almost always too low. It is, however, quite possible that the mean velocity of the wind over this district may be actually low. Every careful observer who has studied the effects of wind on trees, &c. in localities apparently similar must have been struck by the magnitude of the difference in these effects, and by the difficulty of accounting for this magnitude.

Yarmouth, September 21.—The reports from this station continue to be good. The self-registering aneroid works well, but has not been adjusted as frequently as it ought to have been. The anemometer, barometers, and thermometers are all in good order.

Stations of the Second Order, and those supplying Weekly Reports only.

St. Leonard's.—I inspected this station on June 20th. All the instruments were found to be in good order, and to be thoroughly well attended to. Some imperfections were noted in the returns from this station in the winter and early spring of this year, and the later returns of this year are not very satisfactory. It is not possible to obtain the services of a deputy for the 9 p.m. observations, and the observer is now and then obliged in very cold weather, such as we experienced last winter, to omit these observations.

The sunshine recorder is well placed, and is most carefully attended to by the reservoir keeper.

Leicester, August 25.—The instruments at this station were in tolerably good order, with the exception of a new grass minimum, which has an error of $-4^{\circ}\cdot5$. The observer is by no means accurate in taking readings of the instruments, especially of the barometer, and I see no prospect of improvement. The error in the hygrometrical reductions was again pointed out to the observer.

Sheffield, August 26.—It will still be impossible to obtain 9 p.m. readings at this station, unless the Meteorological Council see fit to pay about 1*s.* a week to the gardener. Mr. Howarth already bears (as I understand) the expense of the Sunday observations. The observations are admirably conducted, although a certain number of errors occurred

during the absence of Mr. Howarth, the curator of the Museum, in the spring of this year. The outdoor instruments have been moved about 21 yards from their former position, owing to the completion of the Art Gallery. The exposure is good, but the screen is painted green.

Prestwich, August 26.—The observer, Dr. Clunn, being absent at the time of my visit, and having the keys of the outdoor instruments, I was unable to obtain access to the thermometer screen and rain-gauge. No comparisons, therefore, could be made. The barometer has been moved to the site which it occupied before 1885. The instrument is in good order. The returns from this station are now very good.

Douglas (*Prospect Hill*), August 31 and September 1.—A new site has been obtained for the thermometric observations at this station, on the grounds upon which stands the Roman Catholic Church of St. Mary's, at an elevation of a few feet above the previous position on the roof of the observer's house. Little exception can now be taken to the position of the thermometers, although the screen is by no means entirely unsheltered. The rain-gauge still occupied an undesirable position on the roof of Mr. Keig's house, and I recommended that it should be removed to a position which I have marked out for it on the lawn in which the screen is placed. At this spot its exposure will not be perfect, but will be, I think, more satisfactory than in its former situation. I have sent to the Office a plan of the locality of the outdoor instruments. The barometer, though not very incorrect, is not a good instrument. This station possesses conditions of permanence which will probably render it a valuable one, and both the observer and his son-in-law, who assists in taking the observations, are careful and painstaking.

Douglas (*Cronkbourne*), inspected September 1.—The returns from this station continue to be very complete, and I found all the instruments in good order. The observer, Mr. A. Moore, no longer resides in Cronkbourne, but visits the instruments daily, and his assistant takes the observations accurately.

Hawes Junction, September 5.—Since this station was last inspected there has been a change of observers, and the new railway station master, Mr. W. H. Bunce, appears to take the observations with great care and accuracy. All the instruments were in excellent condition, but the barometer, when corrected for index error, read (at 28·2) somewhat low.

Seaham, September 7.—Mr. Aird was ill at the date of my visit, and I was unable to have an interview with him. The readings of the outdoor instruments are taken at the Cemetery Grounds by Mr. Leith, who is a most acute and accurate observer. The instruments are all in good order, but in the hygrometrical results mistakes still occasionally occur.

Durham, September 7.—Mr. Carpenter was absent on the day of my visit. The temporary substitute took the readings of the instruments most accurately. Everything was in excellent order at this station, and the returns are very careful and complete. The grass minimum reads very low.

York, September 8.—The observations at this station are now very carefully taken, and the observer reads the instruments with great accuracy. It might perhaps be well if a new rain-gauge were supplied, as it is somewhat inconvenient to employ the same instrument for the 8 a.m. and 9 a.m. readings. I am still of opinion that the meagre report of bright sunshine from this station is due to an unusual amount of haze produced by smoke.

Bawtry, Hesley Hall, September 9.—Owing to the rebuilding of the observer's house, all the instruments have been shifted since the last inspection. The outdoor instruments have a very fair exposure on a lawn on the north-west side of the house. The barometer is extraordinarily sluggish, but I ascertained that it contained no air. I requested the observer to have a guard made for the cistern of the barometer, without which the instrument is sure to receive injury. The observations at this station are fairly good.

Market Rasen, September 10.—This is a new station, of which I have sent a scale plan. The instruments are thoroughly good, excepting that the maximum at all temperatures between 52 and 82 inclusive, reads about ·9 too high, whereas the correction hitherto applied is +·2. I have requested the observer to compare the thermometers in melting ice, and meanwhile to apply a correction of −·9. The rain-gauge has hitherto been situated in the vicarage gardens, where it is very seriously sheltered by the house. I marked out a new and good site for it on the observer's lawn. Mr. Jevons appears to me to be very careful and accurate, and I highly recommend the station. The country round is nearly level, but the land on which the town is situated slopes downward slightly towards the north.

Geldeston, September 27.—The observer was absent at the time of my visit. The returns from this station are most excellent. All the instruments were in admirable order, except that the thermograph, which had been sent to Paris for repairs, had been roughly treated in the custom-house on its return. I adjusted it as well as I could.

Ingatestone, September 22.—This new Weekly Weather Reporting Station is a very promising one. The outdoor instruments, of the site of which we have a photograph, are well exposed and in very good order. The cistern of the barometer is 246 feet above mean sea level. The ground slopes gently down towards the S.E. The district is somewhat thickly wooded, especially to the northward of the observer's house. The set of instruments comprises a Stevenson's screen, fully equipped with thermometers, a high mast with vane, an anemometer, rain gauges, a Jordan's sunshine recorder, and a grass minimum and grass maximum, together with a black bulb *in vacuo*.

Eastbourne, September 23.—This new station is a very good one indeed. The instruments, which are all of the best description, are situated in different parts of the town ; but the observer, who has had several years experience, attends to them most carefully. He has also, a good deputy. The barometer is in a Parade shelter close to the sea, and its cistern is 33 feet above mean sea level. The rain-gauge is situated on a triangular lawn at some distance from this place. It has a very fair exposure. The screen is on a public lawn near the Grand Hotel, and is perfectly exposed. The anemometer is upon a martello tower between this and the sea. The sunshine recorder is fixed on the highest part of the roof of the Grand Hotel. It required a slight

adjustment. It is sheltered for a short period at present at 3 p.m. by an iron rod. The probability that the observations will be permanently kept up is an important consideration in favour of this station.

Epsom, September 24.—There have been some errors in the readings of the instruments at this station, and occasionally in the reductions, but there is every prospect of improvement. It is desirable that the barometer should be moved to the observer's new rooms where the altitude of the cistern will be 12 feet above the present height. I think that strong winds have hitherto been somewhat over-estimated at this station.

(Signed) W. Clement Ley.

Barometer and Thermometer Readings.

Name of Station. (The Names of the Telegraphic Reporting Stations are in *Italics.*)	Barometer: Difference of Reporting from Inspector's Barometer.	Barometer: Difference of Check from Inspector's Barometer.	Barometer: Difference of Observer's from Inspector's Readings.	Thermometer: Dry Bulb: Temperature in Water.	Thermometer: Dry Bulb: Correction to reduce to Inspector's Standard.	Thermometer: Dry Bulb: Correction hitherto applied.	Thermometer: Wet Bulb: Correction to reduce to Inspector's Standard.	Thermometer: Wet Bulb: Correction hitherto applied.	Thermometer: Maximum: Correction to reduce to Inspector's Standard.	Thermometer: Maximum: Correction hitherto applied.	Thermometer: Minimum: Correction to reduce to Inspector's Standard.	Thermometer: Minimum: Correction hitherto applied.	Thermometer: Spare or Grass: Correction to reduce to Inspector's Standard.	General Condition.	Name of Station.
Dungeness	+ ·002	·000	+ ·002	58·4	0·0	—	+0·1	—	0·0	—	−0·1	—	—	B	*Dungeness.*
St. Leonards	+ ·002	—	·000	65·9	−0·3	−0·4	−0·3	−0·4	+0·1	0·0	+0·1	0·0	—	A	St. Leonards.
Jersey	+ ·002	+ ·001	·000	61·2	0·0	0·0	−0·3	0·0	+0·1	0·0	+0·2	0·0	—	A	*Jersey.*
Hurst Point	+ ·003	+ ·001	·000	63	−0·1	0·0	0·0	0·0	0·0	0·0	+0·1	0·0	—	A	*Hurst Point.*
Prawle Point	− ·002	− ·003	− ·002	55	+0·1	0·0	0·0	0·0	−0·4	0·0	−1·1	0·0	−0·1	A	*Prawle Point.*
Scilly	− ·016	− ·014	− ·004	65·1	−0·1	0·0	+0·1	0·0	−0·6	0·0	+0·1	0·0	0·0	A	*Scilly.*
Leicester	—	—	− ·023	60·9	+ ·1	—	+ ·2	—	+ ·4	—	+ ·8	—	+4·5	B	Leicester.
Loughborough	—	—	·000	61·2	+ ·1	—	0·0	—	+ ·1	—	+ ·2	—	—	A	*Loughborough.*
Sheffield	—	—	− ·002	60·6	0·0	0·0	− ·1	− ·1	+ ·1	0·0	+ ·1	− ·1	—	A	Sheffield.
Prestwich	− ·005	—	—	—	—	− ·3	—	− ·2	—	− ·4	—	− ·2	—	A	Prestwich.
Douglas (Prospect Hill)	+ ·009	—	+ ·002	64·6	0·0	0·0	0·0	0·0	0·0	− ·3	+ ·4	− ·2	—	B	Douglas (Prospect Hill).
,, (Cronkbourne)	− ·003	—	+ ·002	59·7	− ·1	—	0·0	—	+ ·1	—	+ ·6	—	—	A	,, (Cronkbourne).
Barrow-in-Furness	− ·006	—	0·0	60·8	− ·3	− ·4	− ·3	− ·3	− ·1	− ·1	0·0	− ·1	—	A	*Barrow-in-Furness.*
Hawes Junction	+ ·004	—	0·0	52·9	0·0	—	− ·1	—	0·0	—	0·0	—	0·0	A	Hawes Junction.
North Shields	− ·015	− ·001	0·0	58·6	+ ·8	—	+ ·5	—	0·0	—	+1·6	—	+ ·6	A	*North Shields.*
Seaham	—	—	—	55·5	+ ·1	—	− ·1	—	+ ·7	—	+ ·6	—	—	A	Seaham.
Durham	—	—	0·0	53·4	0·0	—	+ ·1	—	+ ·1	—	+ ·6	+ ·4	+1·1	A	Durham.
York	0·0	—	0·0	57·1	+ ·1	—	+ ·1	—	+ ·3	—	+1·2	—	—	A	York.
York	0·0	—	0·0	57·1	+ ·1	—	+ ·1	—	+ ·1	—	+1·0	—	—	A	*York.*
Bawtry	—	—	—	56·1	+ ·6	—	0·0	—	0·0	—	+ ·2	—	—	A	Bawtry.
Market Rasen	− ·011	—	0·0	54·9	−0·0	− ·1	0·0	− ·1	− ·9	+ ·2	+ ·1	—	−·1	A	Market Rasen.
Cambridge	+ ·003	—	—	53·4	0·0	—	−0·1	—	− ·2	—	0·0	—	—	A	*Cambridge.*
Yarmouth	+ ·013	− ·004	+ ·001	57·5	0·3	—	+0·1	—	0·0	—	+0·3	—	—	A	*Yarmouth.*
Geldeston	·000	—	—	56·4	+0·0	0·0	−0·1	−0·1	0·0	−0·3	+0·1	−0·1	—	A	Geldeston.
Ingatestone	− ·016	—	·000	58·3	0·0	0·0	0·0	0·0	0·0	0·0	+0·4	+0·4	+0·2	A	Ingatestone.
Eastbourne	− ·016	—	− ·001	56·3	0·0	0·0	+0·1	0·0	+ ·1	0·0	+ ·1	0·0	—	A	Eastbourne.
Epsom	+ ·001	—	·000	55·0	0·0	− ·1	+0·1	0·0	+ ·2	0·0	0·0	0·0	—	B	Epsom.

REPORTS on INSPECTIONS of OBSERVATORIES, 1887.

Falmouth Observatory, visited August 24.—The instruments at this observatory were found in good order, the lenses and fittings of both barograph and thermograph being cleaned and the clocks oiled.

The attached thermometer of the standard barometer was found to be properly fitted, and to have its graduations engraved upon its stem, but owing to its having risen through age, a correction of $-0^{\circ}\cdot6$ is now requisite to be applied to its scale readings.

The wet-bulb thermometers were all in good order, clean muslin and threads having been recently fitted.

The following corrections were determined at temperature of 66°:—

Dry standard No. 383, $-0^{\circ}\cdot7$; wet No. 388, $-0^{\circ}\cdot4$.

Maximum M.O. 104, $-0^{\circ}\cdot3$; minimum M.O. 308, $-0^{\circ}\cdot1$.

Notes were also made of the zero values both for summer and winter temperatures.

The anemograph was dismounted temporarily and thoroughly cleaned; the orientation showed an irregularity in the working of the direction pencil. This was found to be due to the shaft having split asunder at the clamping piece, and was rectified by having a brass collar soldered on, and filing the shaft down a little. My attention was called to an error in the adjustment of the pricker, by which means the setting of the instrument differed by some minutes from the times as indicated by the curves on the paper; this defect was rectified by packing the fitting piece of the pricker up with a morsel of paper, and instructions were given to the assistant to press the teeth of the cylinder into proper gear when starting the instrument, as the amount of backleash is rather large.

A close examination was made of the different rain-gauges, and squeezes made of the funnels. The exposure of all three is good on all sides, there being no trees or shrubs near to exert an injurious effect; the only possible sources of difference are, that the slightly broader edge of the funnel of the Beckley may cause splashing, and the allowance for incomplete discharge of the siphon made in tabulating may be somewhat inadequate.

The pencil used now is an ordinary lead pencil, a holder of larger size than usual having been fitted; the spring, however, appeared to be pressing harder upon the paper than was desirable.

Necessary instructions were given to Mr. Kitto to make certain alterations in his tabulations in accordance with memoranda supplied in the inspection notes handed me.

Valencia Observatory, visited September 5–10.—The photography at this observatory has been very unsatisfactory during the summer, on account of the inadequate water supply caused by the drought, and also to its very impure quality. The stock of waxed paper at the observatory is now approaching exhaustion, and Mr. Cullum hopes to be permitted to make use of A. C. B. paper after it is all expended. I gave certain instructions as to fitting up ruby blinds and employing ruby lanterns in the photographic work if the new process is adopted, as the present appliances are inadequate for working with a more sensitive medium than that at present in use. Meanwhile the results obtained are somewhat better than those got some months back.

A serious difficulty with the new paper will be the exclusion of light from the thermograph traces, the blackening varnish having greatly decayed on the thermometer stems. I took down both thermometers and tried to remove the old paint and apply new, but was unable for

want of materials to perform the operation satisfactorily. I, however, instructed Mr. Cullum in the method of performing the various processes, so that on the proper solvent, varnish, brush, and paint being forwarded to Valencia, he will be able to do what is necessary himself.

At the time of dismounting the wet-bulb thermometer, I carefully examined the tube at the point where the definition of the curve is defective, but found the tube so roughened by the abrasion previously reported that nothing can be done to rectify the defect.

The metal fittings of the instrument have corroded a good deal, and the upper band of the wet-bulb standard is broken quite away. I temporarily secured it by a wire binding.

The corrections to the thermometers were found to be at 60° :—

Dry-bulb standard K. S. 399, −0°·8; wet-bulb standard K. S. 398, −0°·6.

Maximum M. O. 1,003, −0°·0; minimum, 2,497, −0°·3.

The minimum figure scale differs nearly 1° from the graduations on the tube.

The wet-bulbs were found kept in good order, but the lamp-wicks are much discoloured from corrosion derived from the copper water-tank.

The barograph was dismounted and cleaned, and the air-tube in the cistern found to have the plug slightly corroded; this was removed, and the air-hole cleared by means of a knitting needle. The tube of the standard barometer is also much corroded, and the bands holding the attached thermometer were broken away. The tube, which is not divided on the stem, was detached from its scale, and its error found to be −1°·7.

The anemograph was dismounted and cleaned, but is in good order, and, with the exception of the needle lubricators to the fan shaft, which have both proved failures, does not call for special remark. The Beckley rain-gauge was also in good order, with the exception of a defective pipe. The tube which conveys the rain from the funnel to the receiver is made of a very soft composition metal, which becomes so plastic in hot weather as to be unable to support its own weight. It then drops until it rests upon the floating receiver, thereby vitiating the rain record.

I should recommend the substitution of a brass or copper tube at the earliest convenience, and also that a Stonyhurst discharger and new pencil-holder should be fitted at the same time, in order that more distinct traces might be obtained than those now procured.

As at Falmouth, I examined the gauges in order to find, if possible, a cause for the disagreements occasionally observed between the indications of the Beckley and check gauges, but nothing appeared sufficiently marked to be assigned as a cause of error, and it appears probable that rain-gauges side by side may differ in their catches during gusty weather and heavy falls, from natural causes.

Kew Observatory, October 1887. (Signed) G. M. Whipple.

Dear Sir, Kew Observatory, October 1887.

I beg leave to hand you herewith my report and inspection notes regarding the self-recording instruments of the observatories at Stonyhurst and Aberdeen.

Stonyhurst, visited September 28–29.—At this observatory the whole of the instruments were in a satisfactory condition and call for no special remark.

The standard dry and wet thermometers as well as the maximum and minimum were carefully examined with the standard K.S. 642, and the following corrections were determined at 60° :—

Dry bulb, 619 - - -	−0°·2
Wet bulb, 382 - - -	−0·4
Maximum, M.O. 439 - -	−0·4
Minimum, B.T. 501 - -	+0·1

Aberdeen, October 1–7.—Here I found everything working well. Both the barograph and thermograph clocks were taken to pieces and the usual cleaning performed.

My attention having been called to the attached thermometer of the standard barometer, I found that a temporary tube, divided to every 2 degrees on the glass stem, had been fitted up by Professor Niven, as a substitute for the original thermometer which is an undivided one, and now quite useless, as the brass band fixing it to the outer casing of the barometer (which in itself is much corroded) is quite worn away, and in consequence there is no means of securing the tube to the ivory degree scale.

I would therefore suggest that another thermometer divided on the glass stem to single degrees and ranging from +10° to 120° be supplied, and, together with a small bracket for supporting it, be sent to the observatory.

The barograph was in good order and the air plug of cistern quite free from dirt or other obstruction. Its thermometer was tested and found to read 2° too high.

Anemograph.—The whole of the external parts were dismounted and thoroughly cleaned and oiled. The instrument was in a satisfactory condition, with the exception of the fans and screw of spindle, which are very much worn, so that it is very questionable whether the fans will hold together during the coming winter. I would therefore respectfully beg to draw the especial attention of the Council to Mr. Whipple's report of last year concerning these defects.

The dimensions of the spindle to which the fans are fixed are appended to my inspection notes, as well as certain measurements as to height of cups above the roof of the astronomical observatory.

The orientation was examined before and after dismounting and cleaning, and the sheet containing the results is forwarded herewith.

"Squeezes" of both the self-recording and spare rain-gauge funnels are also enclosed. The clock of the former instrument only required oiling, as it had been thoroughly cleaned (prior to my visit) at the time of attaching a new line to weight.

The following are the corrections obtained by comparison of the thermometers with the Kew Standard 642 at 55° :—

Dry-bulb, 458 - - -	−0°·15
Wet-bulb, 395 - - -	−0·6
Maximum, M.O. 1,002 - -	+0·1
Minimum, M.O. 89 - -	+0·1

Yours, &c.

R. H. Scott, Esq., F.R.S. (Signed) T. W. Baker.

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 with regard to the home stations, but there has been some change in connection with the information received from the United States. The existing arrangements are referred to fully further on. The Daily Weather Report also has again been improved by the introduction of new averages for pressure and temperature, and by a paragraph explanatory of the meaning of the storm signals exhibited on our coasts.

The Office still receives, when the telegraphic communications are perfect, fifty-nine reports every morning, seventeen every afternoon (except on Sundays), and twenty-nine each evening.

The foreign reporting stations, 28 in number, extend along the entire western coast of the Continent, from Bodö in Lat. 67° N. to Lisbon in Lat. 38° N., and include four stations on the coast of the Baltic, three in Germany, and two in the Mediterranean. The information is received in accordance with arrangements made with the various Meteorological organisations in Portugal, France, Holland, Germany, Denmark, Norway, and Sweden.

At the British and Irish stations the morning observations are taken at 8 a.m. Greenwich time, and most of the telegrams arrive in London at about 9 o'clock, when the Intelligence Department of the Post Office extracts from them the portions required for its wind and weather reports. They are then transmitted to the Meteorological Office by its private wire, where the majority of them usually arrive between 9 a.m. and 10 a.m. No material interruptions have occurred in the communication with Sumburgh Head, but there was a serious breakdown in those from Stornoway, at the end of the year.

As the reports come in, the information is entered on a chart, showing for each station at 8 a.m. the barometrical and thermometrical readings, with their respective alterations during the preceding 24 hours, the direction and force of the wind, and the state of the weather, together with any changes of importance which may have been noticed in the course of the preceding day. From this chart, which is preserved in the Office, other charts are drawn for publication in the newspapers, as described further on.

If necessary telegraphic warnings of storms or of atmospherical disturbance are immediately sent to our own coasts and to foreign countries. A brief telegraphic resumé of the weather is despatched shortly after 11 a.m. to the Harbour Authorities and the Chamber of Commerce in Jersey. Another telegraphic message, of about 75 words, is sent to the Underwriters' Association, Liverpool, containing reports of the pressure, wind and weather at 14 stations on the coasts of the British Islands; and a third message of about the same length is forwarded to the Central News and to the Exchange Telegraph Company for despatch to the provinces. The last of these messages consists of a brief statement of the general condition of weather over Western Europe, as shown by the morning reports. It is, however, not in the morning

only that storm warnings are issued to the coasts, a constant watch being kept during the day, and whenever on the receipt of the regular or of special telegrams the condition of the weather appears to be threatening, cautionary messages are at once issued to such parts of the coast as are thought to be menaced by a gale.

During the year 1886 there were prepared each morning, afternoon, and evening, Forecasts of the weather, for a day in advance; these were drawn up for eleven districts in the British Islands, and issued to subscribers, to certain Clubs, and to many of the London and Provincial newspapers in accordance with the arrangements referred to on p. 10. The districts for which the Forecasts were prepared are those into which the returns for the Weekly Weather Report are grouped, viz.:—

0. Scotland, North.
1. „ East.
2. England, N.E.
3. „ East.
4. Midland Counties.
5. England, South.
6. Scotland, West.
7. England, N.W. (with N. Wales).
8. England, S.W. (with S. Wales).
9. Ireland, North.
10. „ South.

About an hour and a quarter is occupied in the preparation and transmission of the provincial and foreign telegrams, and in the drawing up of the "Remarks" and 11 a.m. Forecasts for the London newspapers, so that the MS. copies for the "Times" and other papers are ready for issue soon after 11 a.m.

Charts are prepared daily for newspaper publication as follows:—

For the "Times," - -	two daily, viz.:	for 8 a.m. and 6 p.m.
For the Patent Type Founding Company, on behalf of the "Shipping Gazette," and for distribution to the provincial press -	one „	for 8 a.m.

The 8 a.m. charts are sent out at about 10.15 a.m. and the 6 p.m. chart at about 8.30 p.m.

In addition to the charts here referred to, the Patent Type-founding Company are supplied with various diagrams showing the changes in Pressure, Temperature, Rainfall, Wind, and Weather for the London district. These are engraved *daily* for the "Daily Chronicle," *weekly* for the "Graphic," and *monthly* for the "Miller," and are all accompanied by remarks on the phenomena exhibited.

Charts are drawn for 8 a.m. and 6 p.m. daily for exhibition at the Office door, and special Remarks, with the latest Forecasts issued, are prepared and posted at the door three times daily.

The draft of the Daily Weather Report, with two charts attached, is drawn on transfer paper, and is ready by noon, when it is at once sent to the lithographer to be printed. The copies for delivery by hand and by early post in London are issued at about 1.30 p.m., while the remainder are received at the Meteorological Office at about 3.30 p.m. whence they are transmitted by post to the subscribers and others.

The 2 p.m. observations, taken at fifteen home and two foreign stations (Skudesnaes and Rochefort) are received at about 3 o'clock.

Copies of these are issued, together with the 8 a.m. report, to certain newspapers and subscribers, and two copies of the "Remarks" (8 a.m. and 2 p.m.) are sent to the Type-founding Company for issue to provincial newspapers, in order to explain the 8 a.m. charts mentioned above.

The evening (6 p.m.) reports arrive at about 7 to 7.30 p.m., and are charted and discussed for the morning daily papers in accordance with the arrangement referred to on p. 10. The forecasts and remarks are usually ready by 8.30 p.m., but in bad weather, owing to the delay of the reports, and the additional care which is necessary in dealing with them, it is occasionally 9 p.m. before they are issued. The "Times" publishes in its First Edition the map showing the distribution of pressure, the winds, temperature, and weather at 6 p.m. on the previous day, and in its Second Edition the similar map for 8 a.m. on the day of issue.

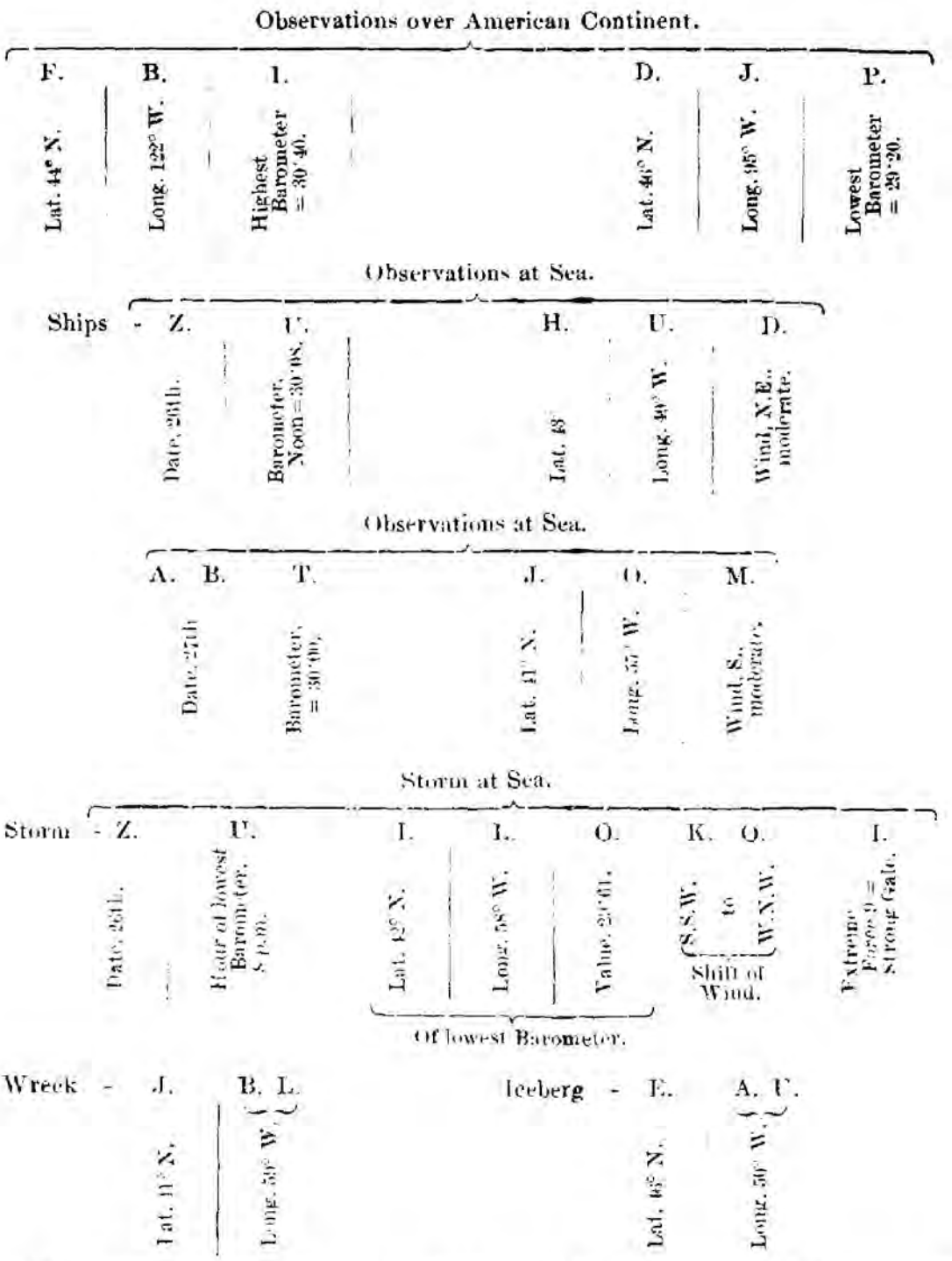
The charts for 2 p.m. and for 6 p.m. are still much less complete than that for 8 a.m., notwithstanding the great improvements recently made. That for 2 p.m. is drawn on the information received from fifteen home stations, supplemented by two foreign ones, whenever the latter arrive in time to be used. The material for the 6 p.m. charts is now supplied by reports from twenty stations in the United Kingdom, supplemented by nine from continental stations, but the latter occasionally arrive late at the very time when they are most wanted, *i.e.*, during bad weather.

The Sunday duty is still conducted as follows:—Two of the clerks attend on Sunday mornings at the Central Telegraph Station from 8.30 a.m. to about 10.15 a.m. By an arrangement with the Post Office these clerks are supplied with the telegrams immediately they arrive in London. These are examined and charted, with the view of issuing, when necessary, warnings of coming storms, to our own and neighbouring coasts. It is necessary that great promptitude should be observed in this service, as the observations must be dealt with and the warnings issued so that the latter may reach the coast before the telegraph offices at the outports close for the day, which is usually at about 10 a.m. No work of any kind is transacted for the newspapers on Sunday mornings, the main object of the service being to give early information of storms to our coasts; but a telegram is sent to Jersey in the same form as on week days, and there is the ordinary interchange of messages with foreign countries. A copy of the Valencia message is sent to Lisbon as on week days. At 6 p.m. the same clerks attend at the Meteorological Office to receive the evening reports and to prepare the 8.30 p.m. Forecasts, and another opportunity is thus afforded for the correction or extension of any warnings which may have been issued in the morning.

Atlantic Telegrams.

In the course of the year the arrangements for receiving from the United States occasional reports of gales, icebergs, and derelict ships, which have been met with by passenger steamers of the principal lines running from various European ports to New York or Boston have been modified. The information is conveyed by means of a Code, drawn up in the following manner, and further changes are contemplated

by the French Authorities, as the Meteorological Council do not feel justified in continuing expenditure on this branch of the work:—



This arrangement has been made through M. Mascart, the Director of the French Meteorological Bureau, to whom the messages are telegraphed direct from the United States. They are forwarded from Paris to this country by post, in order to curtail the cost of transmission.

Daily Weather Report.

No considerable change has been made during the past year in the *form* of the Daily Weather Report, but improved average values for pressure and temperature are now given in the margin on p. 2. The values now quoted are, the monthly averages of pressure for 8 a.m. with Maximum, Minimum, and 8 a.m. temperatures for 25 stations, during the 15 years 1871–85. The mean monthly rainfall values are those for the

20 years 1866–85. The Report fills four large quarto pages, and is arranged as follows:—

Page 1 contains the whole of the 59 reports from which the maps for the day (given on page 2) are prepared, and the 6 p.m. reports of the previous day, together with the maximum and minimum temperatures of the air, and the Rainfall for the previous 24 hours.

Page 2 contains (1) a map of North-western Europe showing for 8 a.m. on the date of publication, the distribution of pressure, the prevalent winds, and the sea disturbance, with necessary explanations; together with a table showing the mean atmospheric pressure for the month at 25 stations; (2) a similar map showing the distribution of temperature at 8 a.m., the weather at each station, and the distribution of rainfall during the past 24 hours; together with a table of the mean temperature of the air and of evaporation at 8 a.m., the means of the daily maximum and minimum temperatures, and the mean rainfall for the month at the same 25 stations in the United Kingdom.

Page 3 contains (1) notes on the "General situation at 8 a.m.," and the "Probable changes in system now prevalent;" and (2) the forecasts drawn up for each district at 11 a.m., relating to the weather likely to be experienced during the 24 hours ending at noon on the day succeeding that of publication, and an explanation of the meaning of the storm signals exhibited on our coasts.

Page 4 contains the reports for 2 p.m. on the previous day, an account of the distribution of pressure, temperature, wind, and weather experienced over the European Continent on the previous day, and, on Mondays, a brief summary of the weather experienced during the previous week.

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

The lithographed Reports have the Forecasts issued at 11h. a.m. incorporated with them on each week day. The subscription for the Report is—

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

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 8h. a.m. or 6h. p.m. observations, such as appear in the "Times."

Correction and Addition List.

Additional steps are taken to insure accuracy in the Daily Weather Report. At the close of each month a return is received from nearly all of the telegraphic reporting stations, containing a copy of all the observations which have been transmitted to London by wire during the month. These schedules are used for checking the daily telegrams, for the preparation of the average and other values of the different elements, and also as evidence in the case of legal proceedings. About the middle of every month a lithographed sheet has for many years past been issued with the Daily Weather Report, containing corrections for all discrepancies which have been discovered, and supplying any observations which have been omitted in the daily reports for the previous month. This monthly sheet contains also tables showing, for each telegraphic reporting station within our Islands, the mean values for pressure, temperature, and humidity, together with the total rainfall, and the prevalence of various kinds of weather and of winds from each of the eight principal points during the month.

Weekly Weather Report.

The Weekly Weather Report, which has appeared since the beginning of February 1878, has been further improved by the insertion on the last page of reports from six new inland Scotch stations, the values for which are included in preparing the summary given on the first page.

The Summary on the first page contains the average and extreme temperatures, the rainfall values and the total amount of bright sunshine in each week, for twelve districts in Great Britain and Ireland, together with the difference between them and the respective mean values for the corresponding week in previous years. In addition to this, the district values for Accumulated Temperature, Rainfall, and Bright Sunshine are given, both for the week and for the whole period since the beginning of the year, with their difference from the average values. This information is derived from observations made at 77 stations, the individual values for which are given on the last page of the Report.

The tables of Accumulated Temperature are 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. They 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 adopted is 42° F., as being nearly equivalent to 6° Cent. which has been considered by Continental writers on these subjects to be the critical value, the temperature above which is mainly effectual in starting and maintaining the growth, and in completing the ripening of agricultural crops in a European climate. This base is also convenient as being 10° F. above the Freezing Point.

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.

It has been ascertained by calculation from a considerable series of hourly observations at various places, that the accumulated temperature may be computed, with a very tolerable approximation to the truth, from the observed daily maximum and minimum temperatures alone.

When the temperature during any period remains either wholly above or below the base temperature, the difference between the base and the mean temperature gives the correct accumulated value. In other cases this difference gives an approximate value of the accumulated temperature which does not depart greatly from the truth, the deviation depending on the greater or less extent of the daily variations of the temperature above or below the base. Further, since the mean between the maximum and minimum of any day is nearly equal to the mean temperature of the day, the difference of the mean of the maximum and minimum from the base also will give directly a fair approximation to the accumulated temperature for the day.

The following rules, however, supply still more closely the values sought, and they have been adopted for the preparation of the table in the Weekly Weather Report. They may be applied to any other base temperature as well as to 42° F., with the slight modification of the numerical coefficients.

RULES for computing for a WEEKLY PERIOD the ACCUMULATED TEMPERATURE above or below 42° F. from the observed MAXIMA and MINIMA.

1. Obtain the mean temperature from the means of the seven observed maxima and minima by multiplying the difference between them by the proper coefficient for the month, and adding the result to the mean of the minima.

2. In obtaining the accumulated temperature four cases may occur, to which the following rules will apply :—

Conditions of Temperature.	To obtain the Accumulated Temperature.	
	Above 42° F.	Below 42° F.
If the minimum is *above* 42° F. or *equal* to 42° F.	Subtract 42° F. from the mean.	There is none.
If the minimum is *below* 42° F., but the mean for the day is *above* 42° F.	From the difference between the mean for the day and the minimum deduct the accumulated temperature below 42° F., calculated as stated in the next column.	The required quantity is the excess of 42° F. over the minimum multiplied by the coefficient 0·4.
If the mean for the day is *below* 42° F., but the maximum is *above* 42° F.	The required quantity is the excess of the maximum over 42° F. multiplied by the coefficient 0·4.	From the difference between the mean for the day and the minimum deduct the accumulated temperature above 42° F., calculated as stated in the preceding column.
If the maximum is *below* 42° F., or *equal* to 42° F.	There is none.	Subtract the mean from 42° F.

In each case the result will be the mean *daily* value for the week, and must be multipled by 7 in order to obtain the value for the whole week.

The coefficient varies both with the length of the period and the value of the base line. In the above instance the base is 42°; when it is 32° the coefficient is 0·4; when 52° it is 0·33; and when 62° it is 0·25.

A full explanation of these rules will be found in Appendix II. to the Quarterly Weather Report for 1878.

The temperature means derived from the daily maxima and minima are corrected so as to agree as closely as possible with the true mean daily value, and, the average values for the corresponding period in former years having been recomputed, those now in use are :—

For Temperature	- -	20 years 1861–80
„ Rainfall	- -	20 „ 1866–85

These statistics are given on the first page of the publication, the temperature, accumulated heat, rainfall, and sunshine values for *each station** being given on the last page of each report.

In addition to the telegraphic reports, and the returns from the self-recording observatories, weekly returns from 43 volunteer observers are

* The sunshine values are furnished for only a limited number of carefully selected stations. See p. 112.

used in preparing this report, the names of the observers at each station being as under—

Names of Stations.	Names of Authorities.
Alnwick Castle - - -	Lieut.-Col. F. Holland, for the Duke of Northumberland, K.G.
Arlington (N. Devon) - -	J. Carter, for Lady Chichester.
Bawtry (Hesley Hall) - -	B. I. Whitaker, F.R. Met. Soc.
Blackpool - - -	J. Wolstenholme, F.R. Met. Soc.*
Braemar - - -	J. A. Aitken.
Brookeborough - -	Mr. Ferguson, for Sir Victor Brooke, Bt., F.L.S.
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.
Edgeworthstown (Currygrane) -	J. M. Wilson, D.L., J.P.
Fort Augustus - -	Rev. W. M. Wall.
Foynes - - - -	W. Ward, for Lord Monteagle, K.P.
Geldeston - - - -	E. T. Dowson, F.R. Met. Soc.
Glen Carron - -	D. D. Munro.
Glenlee - - -	G. Maxwell and W. Melville.
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.
Ingatestone - - - -	L. J. Petre, F.R. Met. Soc.
Kilkenny - - - -	H. Carlton, for the Marquis of Ormonde.
Killarney - - - -	The Ven. Archdeacon Wynne, F.R. Met. Soc.
Lairg - - - -	W. Ross, Ground Officer.
Laudale (Loch Sunart) - -	A. Fletcher, for T. H. G. Newton, F.R. Met. Soc.
Leicester - - - -	J. C. Smith, the Museum.†
Llandovery - - - -	J. Watkins, F.R. Met. Soc.
Llandudno - - -	J. Nicol, M.D., F.R. Met. Soc.
Londonderry - - -	J. Conroy, F.R. Met. Soc.
Manchester (Prestwich) - -	T. R. H. Clunn, M.D., F.R. Met. Soc.
Marchmont - - -	P. Louey.
Markree Castle (Sligo) - -	A. Marth, F.R.A.S., for Colonel Cooper, F.R.A.S.
Newton Reigny (Penrith) - -	T. G. Benn, F.R. Met. Soc.
Ochtertyre - - -	G. Croucher.
Plymouth - - - -	J. Merrifield, LL.D., F.R.A.S.
Rothamsted - - -	Rainfall by Sir J. B. Lawes, Bart., LL.D., F.R.S., and J. H. Gilbert, Ph.D., F.R.S.; temperature by T. Wilson, F.R. Met. Soc.
Scarborough - - -	W. Robinson.‡
Southampton - - -	J. T. Cook, R.E., Ordnance Survey Office.
Stowell - - -	Rev. H. J. Poole, F.R. Met. Soc.
Strathfield Turgiss - -	Rev. C. H. Griffith.
Waterford (Brook Lodge) - -	C. Percival Bolton, J.P.

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

* Rev. C. T. Ward ceased reporting at the end of June, 1887.

† Mr. Smith has since died, and the observations at Leicester have ceased.

‡ Mr. Rowntree ceased reporting early in the year.

The report is prepared on Wednesday in every week, and is ready for sale early on Saturday morning, but the summary on its first page is sent to the "Times," "Daily News," and some other papers on Wednesday evening.

Appendices.

Appendix I.—This contains (1) Summaries for each Quarter and for the whole year of the Temperature and Rainfall records for each District, and (2) Tables giving for each district the monthly values for Rainfall, Accumulated Temperature (above and below 42° F.), and Bright Sunshine, as well as the progressive values for each from the commencement of the year, in continuation of the values given for 1878 to 1886.

Appendix II. gives for year 1887, and for each District, the weekly and progressive values for Rainy days, Amount of Rainfall, Accumulated Temperature (above and below 42° F.), and Bright Sunshine, in continuation of the values for the years 1878–86 printed in Appendix II. to the Weekly Weather Report for 1886.

Appendix III. gives for each District, during the nine years 1878–86, and also during the ten years 1878–87, the mean aggregate values from the beginning of the year to the end of each week in the year for the following years 1881–86, and for the seven years 1881–87 the corresponding values for Bright Sunshine (both the Number of Hours recorded, and the per-centages of possible duration. These are in continuation of the values published in Appendix III. of the Report for 1886.

Appendix IV. gives for each District—(*a*) for the eight years 1878–85, (*b*) for the nine years 1878-86, and (*c*) for the ten years 1878–87—the Mean Temperature of the Air for each Week in the year. This Appendix is entirely new.

Monthly Weather Report.

The publication of the *Monthly Weather Report*, though interrupted for a time by various unavoidable causes, is being continued. It contains, as hitherto, (1) A General Summary for the Month, of the weather experienced over the United Kingdom and its neighbourhood; (2) Tables of the principal Cyclonic and Anticyclonic Systems which have passed over our area during the month; and (3) Tables of Pressure, Temperature, Hygrometric Deductions, Rainfall, Weather, Wind, and Bright Sunshine experienced at a large number of stations scattered over the United Kingdom, together with remarks thereon; it is illustrated by two plates. The report is, therefore, as far as possible, similar to the Quarterly Weather Report, but cannot contain either the Gale Tables, or the Tables of Mean Values for the Observatories, which are found in its predecessor.

Issue of Forecasts.

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. This issue is intended especially for the early editions of the evening papers, for the clubs, and for exhibition at certain selected stations. See p. 10.

(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.

(3.) At 8.30 p.m. (from the 6 p.m. reports), for the day following that of issue. These are now supplied gratis to any newspaper or news agency which may apply for them, and send for them regularly. A very large number of the most important papers 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, 116, 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.

Forecasts for Private 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 2*s.* 6*d.* per official quarter, *or any part thereof, in addition to the cost of transmission*; the charges will therefore be, by *letter* post, 9*s.*, by *book* post, 5*s.* 9*d.* 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 3*d.* per day for any definite period of not less than one week, in addition to the cost of telegraphy.

Forecasts for Clubs.—Forecasts, drawn up at 11 a.m., for all the districts, are supplied to Clubs, for a subscription of ten shillings per annum. These are delivered free, 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.

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 2*s.* 6*d.* being charged for a 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.

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* Good Friday and Christmas Day are reckoned as Sundays.

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 1*s*. in addition to the cost of a telegram and reply to any post office. The telegram containing the inquiry must be addressed as follows:

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.

In order to test the accuracy of the forecasts they have been compared carefully with the weather reported in the various districts on the days to which they referred, and the results of this checking for 8.30 p.m. are given in the Report (p. 11).

In carrying out this comparison the portions of the forecasts which referred to wind have been carefully separated from those relating to weather. The detailed results of the comparison will be found in Appendix XI., p. 98.

Checking of Storm Warnings.

The testing of the warnings is conducted in the following manner. The intelligence issued is compared with the weather experienced on the coasts, as indicated by the various self-recording anemometers, by the telegraphic reporters, and by several gentlemen who have volunteered to observe for the Office, and whose names will be found in Appendix XIV., p. 108.

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 here express their cordial thanks for the co-operation so readily granted to them by these Boards.

The result of the checking for 1887 will be found on p. 14.

The coasts are subdivided into ten districts, as will be seen in the table. Two large tracts of coast are entirely omitted: viz., the west of Ireland from the Shannon to Malin Head, and the West of Scotland from the Mull of Cantyre to Cape Wrath. No warnings are issued to any place within the limits indicated, except to Galway, and

the amount of information as to the weather received from the omitted portion of the Scotch coast is, as yet, very scanty.

It should be remembered that in analysing the reports, all observations of the wind in which the force *exceeded* 7 (a "moderate gale") or the velocity exceeded 40 miles an hour, have been quoted as instances of the occurrence of a gale; but it has not been considered that the signal was hoisted late or was hauled down too soon, unless the force of 9 (a "strong gale") or the velocity of 50 miles an hour, was reached prior to the issue of the order to hoist, or subsequent to the issue of the order to lower.

In the Summaries all cases in which the signal has been shown to be late by a single report either of force 9, or of a velocity of 50 miles an hour, have been specially noted.

APPENDIX VIII.

LIST of PERSONS, PLACES, &c. to which the Lithographed Daily Weather Report is supplied, free of cost.

Newspapers:

Lloyd's Shipping List.
New York Herald.
Times.

For Exhibition at Seaports:

Banff.
Barrow-in-Furness.
Belfast.
Blackpool.
Bo'ness.
Boscastle.
Brighton.
Briton Ferry.
Broughty Ferry.
Buckie.
Budehaven.
Caernarvon (2 copies).
Cork.
Cowes.
Crail.
Cromer.
Cullercoats.
Dover.
Dundee.
Eastbourne.
Exeter.
Exmouth.
Falmouth.
Glasson Dock, Lancaster.
Great Grimsby (2 copies).
Groomsport.
Hastings.
Hayle.
Holyhead.
Kingstown (2 copies).
Leith.
Lowestoft.
Margate.
Morecambe (2 copies).
Nairn.
Newquay.
Penarth.
Plymouth.
Plymouth, G. W. Docks.
Port Dinorwic.
Porthcawl.
Queenstown.
St. Leonard's.
St. Sennen Cove.
Scarboro'.
Southport.
Teignmouth.
Ventnor (2 copies).
Whitby.
Wisbech.
Yarmouth.

Offices, Institutions, &c.:

Aberdeen Observatory.
Admiralty (11 copies).
Aldershot, Garrison Library.
Armagh Observatory.
Army Medical Department.
Ben Nevis Observatory.
Board of Trade (3 copies).
"Britannia," H.M.S., Dartmouth.
British Museum.
Channel Squadron (Admiral).
Chatham, Instructor in Surveying (2 copies).
Commons, House of.
Cooper's Hill, Royal Indian C.E. College.
Deptford, Naval Storekeeper.
Devonport Dockyard (2 copies).
" Commander-in-Chief.
" Captain of Steam Reserve.
" Master Attendant.
Dublin, General Register Office.
" Royal College of Science.
Durham, University Observatory.
Eastern Telegraph Company.
Edinburgh, Scottish Meteorological Society.
Falmouth Observatory.
Farnborough Station, Staff College.
Fleetwood, L. & W.N. Railway Company.
General Register Office.
" " " for Seamen.
Glasgow Observatory.
Greenwich, Royal Observatory.
" R.N. College.
Haslar, R.N. Hospital.
"Indus," H.M.S., Devonport.
Kew Observatory.
Lords, House of.
"Nankin," H.M.S., Milford Haven.
Navy Medical Department.
Oxford, Radcliffe Observatory (2 copies).
Portland, Senior Naval Officer.
Portsmouth, Commander-in-Chief.
" Dockyard.
" R. N. College Observatory.
Prestwich Asylum, near Manchester.
Queenstown, Rear-Admiral.
Royal Meteorological Society.
Royal Society (2 copies).
Rugby Natural History Society.
Science and Art Department (2 copies).
Sheerness, Commander-in-Chief.
" Dockyard.
Sheffield, Public Museum.
Southampton, Ordnance Survey Office.
Southport, Fernley Observatory.
Stonyhurst Observatory.
Valencia Observatory.

Offices, Institutions, &c.—cont.

War Office, Adjutant General, Horse Guards.
„ Commander-in-Chief.
Woolwich, Army Medical Department.
„ Royal Military Academy.
Yorkshire Philosophical Society (2 copies).

Miscellaneous Persons:

Agents at Out-ports (2 copies).
Aird, G. H., Seaham.
Benn, T. G., F.R. Met. Soc., Newton Reigny.
Clark, J. E., B.A., B.Sc., York.
Colborne, H., M.R.C.S., St. Leonard's.
Conroy, J., F.R. Met. Soc., Londonderry.
Cooper, Col., F.R.A.S., Markree, near Sligo.
Crossley, Mrs., Halifax.
De La Rue and Co.
Dowson, E. T., F.R. Met. Soc., Geldeston, Beccles.
Farrer, Sir T. H., Bart.
Freeden, W. H. von, Bonn.
Griffith, Rev. C. H., Strathfield Turgiss.
Ley, Rev. W. C., M.A., Lutterworth.
Mann, J. R., Osborne.
Mellish, H., F.R. Met. Soc., Worksop.
Meteorological Council (3 copies).
Moore, A. W., M.A., J.P., Douglas, Isle of Man.
Moore, F. W., Glasnevin, Botanic Gardens, Dublin.
Moore, J. W., M.D., F.R. Met. Soc., Dublin.
Mullins, Rev. G. H., M.A., F.R. Met. Soc., Uppingham.
Northumberland, Duke of, K.G., Alnwick.
Preston, Rev. T. A., M.A., F.R. Met. Soc., Leicester.
Propert, W. P., LL.D., F.R. Met. Soc., St. David's.
Richards, Adm. Sir G. H., K.C.B., F.R.S., London.
Rosse, Earl of, F.R.S., Parsonstown.
Stow, Rev. F. W., M.A., F.R. Met. Soc., Aysgarth, Bedale.
Telegraphic Reporters (25 copies).
Wilson, J. M., J.P., Blackrock, Dublin.

Foreign Places:

Algiers, Meteorological Service.
Amsterdam Meteorological Institute.
Bombay, Observatory.
Brussels, Royal Observatory.
Cairo, Observatoire Khédivial.
Calcutta, Meteorological Department.
Chemnitz, Meteorological Service of Saxony.
Christiania, Meteorological Institute.
Constantinople, Imperial Meteorological Observatory.
Copenhagen, Meteorological Institute.
Cracow, Observatory.
Florence, Museum.

Foreign Places—cont.

Hamburg, Deutsche Seewarte (2 copies).
Lisbon, Observatory.
Madrid, Royal Observatory.
Melbourne, Observatory.
Munich, Meteorological Office.
Paris, Central Meteorological Bureau.
„ Meteorological Society.
„ Ministry of Marine.
Rome, Meteorological Institute.
San Fernando, Observatory.
St. Petersburg, Central Physical Observatory.
Stockholm, Meteorological Institute.
Tokio, Imperial Meteorological Observatory.
Toronto, Meteorological Office.
Upsala, University Observatory.
Utrecht, Royal Meteorological Institute.
Vienna, Imperial Meteorological Institute.
Washington, Smithsonian Institution.
„ United States Naval Observatory.
„ Chief Signal Officer, War Office.
Zürich, Central Meteorological Institute.

APPENDIX IX.

Fishery Barometers.

List of Places supplied with Fishery Barometers.

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

Orkney Isles.—Burra. Kirkwall.

Scotland, east coast.—Stroma, Keiss, Staxigoe, Wick, Sarclet, Lybster, Dunbeath, Portmahomack, Cromarty, Avoch, Nairn, Burghead, Portessie, Port Knockie, Portsoy, Whitehills, Gardenstown, Rosehearty, Pitullie, Inverallochy, Pointlaw, Findon, Portlethen, Muchals, Skateraw, Stonehaven, Arbroath, Broughty Ferry, St. Andrews, Crail, Cellardyke, St. Monance, Burntisland, Newhaven.

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

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

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

Wales.—Briton Ferry, Swansea, Angle, Milford, Abersoch.

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

Isle of Man.—Douglas, Port St. Mary, Peel.

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

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

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

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

Ireland, north coast.—Dunfanaghy, Rathmullen, Buncrana, Moville, Portrush, Portstewart.

Scotland, west coast.—Tarbert, Campbeltown, Carradale, Portree (Isle of Skye), Plockton.

Hebrides.—Stornoway, Cromore, Babyle, Obb, Ness.

Summary of Stations supplied with Instruments.

England and Wales - - - - -	66
Scotland - - - - - -	55
Ireland - - - - - -	46
	167

APPENDIX X.

Telegraphic Weather Intelligence.

The following stations are supplied with telegraphic information of storms, free of expense, and signal "cones" have been furnished to most of them, all further expenses attendant on the maintenance and repair of the apparatus being borne locally. The stations are situated,

84 in England and Wales, 41 in Scotland, 15 in Ireland, 3 in the Isle of Man, and 3 in the Channel Islands.

NORTH.	WEST.	SOUTH.	EAST.
SCOTLAND, EAST COAST.	ENGLAND, N.W.	ENGLAND, S.W.	ENGLAND, E.
Dunrossness.	Ramsey.	Ilfracombe.	Eyemouth.
Lerwick.	Douglas.	Appledore.	Berwick-on-Tweed.
Scalloway.	Castletown.	Boscastle.	Tynemouth.
Stromness.	Silloth.	Port Isaac.	S. Shields.
Kirkwall.	Maryport.	Newquay.	Sunderland.
Holborn Head.	Workington.	Hayle.	Middlesborough.
Wick.	Whitehaven.	Scilly.	Redcar.
Inverness.	Barrow.	St. Sennen.	Whitby.
Nairn.	Morecambe.	St. Just.	Filey.
Burghead.	Fleetwood.	Penzance.	Bridlington Quay.
Lossiemouth.	Blackpool.	Falmouth.	Hull.
Buckie.	Lytham.	Pendennis.	Goole.
Port Knockie.	Southport.	Mevagissey.	Grimsby.
Portsoy.	Runcorn.	Plymouth.	Boston.
Banff.	Liverpool.	Teignmouth.	Sutton Bridge.
Cullen.	ENGLAND, W.	Exmouth.	Lynn.
Fraserburgh.	Connah's Quay.		Sheringham.
Peterhead.	Port Penrhyn.		Cromer.
Aberdeen.	Holyhead.		
Stonehaven.	Port Dinorwic.		
Montrose.	Carnarvon.		
Broughty Ferry.	Aberystwith.	ENGLAND, S.	ENGLAND, S.E.
St. Andrews.	Milford.		
Dundee.	Pembrey	Guernsey.	Yarmouth.
Bo'ness.	Llanelly.	St. Helier's (Jersey).	Southwold.
Grangemouth.	Swansea.	Gorey (Jersey).	Ipswich.
Anstruther.	Briton Ferry.	Weymouth.	Harwich.
Pittenweem.	Portheawl.	Poole.	Chatham.
Burntisland.	Penarth.	Cowes.	Sheerness.
Granton.	Cardiff.	Ryde.	Faversham.
Newhaven.	Newport.	Portsmouth.	
Leith.	Weston-super-Mare.	Littlehampton.	
Fisherrow.	Burnham.	Brighton.	
Dunbar.		Newhaven.	
Cockburnspath.		Hastings.	
	IRELAND, E.	Rye.	
	Belfast.	Sandgate.	
	Donaghadee	Folkestone.	
	Howth.	Dover.	
FIRTH OF CLYDE.	Kingstown.	Margate.	
Glasgow.	IRELAND, S. and W.		
Greenock.	New Ross.		
Rothesay.	Dunmore East.		
Campbelton.	Dungarvan.		
Girvan.	Youghal.		
Ballantrae.	Queenstown.		
	Passage.		
	Kinsale.		
	Cork.		
	Tralee.		
	Limerick.		
	Galway.		

The signals used consist of:—

1. Cone, point downwards for Southerly gales; S.E. round by S. to N.W.
2. Cone, point upwards for Northerly gales; N.W. round by N. to S.E.

The signals are to be kept hoisted *during the daylight only*, until 48 hours have elapsed from the time *the telegram was despatched*, unless countermanded. At night, lanterns may be used wherever the local authorities deem it desirable to do so.

The meaning of the signals is that an atmospherical disturbance exists (which will be explained in the telegram), and will probably, but not *necessarily*, cause a gale at the place warned, *from the direction* indicated by the signal.

The Meteorological Office supplies the canvas shapes and lanterns to such places as require them, on loan, but 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 to the keeping of the apparatus in repair, painting, &c.

APPENDIX XI.

REPORT ON THE COMPARISON OF THE FORECASTS ISSUED AT 8h. 30m. p.m. WITH THE WEATHER SUBSEQUENTLY EXPERIENCED, for the 12 Months, April 1887 to March 1888.

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 p.m. Forecasts only are here published.

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

The Summary for the whole year is given at page 11.

Districts.		April 1887. Percentages. Wind.	Weather.	Average.	a + b.	May 1887. Percentages. Wind.	Weather.	Average.	a + b.	June 1887. Percentages. Wind.	Weather.	Average.	a + b.
Scotland, N.	a	40	47	44		61	48	55		63	57	60	
"	b	40	40	40	84	23	39	31	86	37	27	32	92
"	c	13	7	10		10	10	10		0	3	2	
"	d	7	6	6		6	3	4		0	13	6	
Scotland, E.	a	47	57	52		58	52	55		63	63	63	
"	b	37	30	34	86	39	22	31	86	30	20	25	88
"	c	13	3	8		3	13	8		7	7	7	
"	d	3	10	6		0	13	6		0	10	5	
England, N.E.	a	60	60	60		74	48	61		67	60	64	
"	b	27	30	29	89	20	26	23	84	27	30	28	92
"	c	10	3	6		3	16	10		3	3	3	
"	d	3	7	5		3	10	6		3	7	5	
England, E.	a	47	60	54		71	58	65		60	70	65	
"	b	30	30	30	84	23	23	23	88	33	13	23	88
"	c	20	10	15		0	6	3		7	10	9	
"	d	3	0	1		6	13	9		0	7	3	
Midland Cos.	a	50	67	59		74	32	53		67	70	69	
"	b	40	27	33	92	20	45	33	86	30	17	23	92
"	c	10	3	7		0	10	5		3	10	7	
"	d	0	3	1		6	13	9		0	3	1	
England, S.	a	47	63	55		74	32	53		77	77	77	
"	b	30	27	29	84	16	36	26	79	17	10	14	91
"	c	20	10	15		3	19	11		6	7	6	
"	d	3	0	1		7	13	10		0	6	3	
Scotland, W.	a	30	57	44		68	48	58		60	64	62	
"	b	47	23	35	79	29	26	28	86	27	20	24	86
"	c	17	7	12		3	13	8		10	3	6	
"	d	6	13	9		0	13	6		3	13		
England, N.W.	a	27	70	49		78	49	64		70	53	62	
"	b	50	23	36	85	16	29	22	86	20	27	23	85
"	c	17	0	9		6	6	6		7	10	9	
"	d	6	7	6		0	16	8		3	10	6	
England, S.W.	a	47	67	57		65	65	65		60	70	65	
"	b	43	27	35	92	29	23	26	91	30	14	22	87
"	c	3	0	2		6	6	6		3	3	3	
"	d	7	6	6		0	6	3		7	13	10	
Ireland, N.	a	33	63	48		61	58	60		57	53	55	
"	b	44	27	36	84	29	26	27	87	30	30	30	85
"	c	13	0	6		3	3	3		7	7	7	
"	d	10	10	10		7	13	10		6	10	8	
Ireland, S.	a	43	70	57		65	52	59		63	64	64	
"	b	37	23	30	87	19	26	22	81	23	23	23	87
"	c	13	0	6		13	6	10		7	3	5	
"	d	7	7	7		3	16			7	10	8	

Summary.

British Isles	a	43	62	53		68	49	59		64	64	64	
"	b	39	28	33	86	24	29	26	85	28	21	25	89
"	c	13	4	9		5	10	8		5	6	5	
"	d	5	6	5		3	12	7		3	9	6	

Districts.		July 1887. Percentages. Wind.	Weather.	Average.	a+b.	August 1887. Percentages. Wind.	Weather.	Average.	a+b.	September 1887. Percentages. Wind.	Weather.	Average.	a+b.
Scotland, N.	a	65	36	51		55	65	60		53	47	50	
"	b	26	32	29	80	29	13	21	81	27	33	30	80
"	c	6	16	11		13	19	16		13	17	15	
"	d	3	16	9		3	3	3		7	3	5	
Scotland, E.	a	61	52	57		42	45	44		37	40	39	
"	b	29	29	29	86	40	36	42	86	40	50	45	84
"	c	10	10	10		6	13	10		17	10	13	
"	d	0	9	4		3	6	4		6	0	3	
England, N.E.	a	58	48	53		68	58	63		50	43	47	
"	b	42	36	39	92	23	32	28	91	33	33	33	80
"	c	0	13	7		6	7	6		10	17	13	
"	d	0	3	1		3	3	3		7	7	7	
England, E.	a	45	58	52		62	52	57		54	53	54	
"	b	45	13	29	81	32	32	32	89	30	27	28	82
"	c	10	16	13		3	6	5		13	17	15	
"	d	0	13	6		3	10	6		3	3	3	
Midland Cos.	a	61	58	60		61	55	58		50	67	59	
"	b	36	16	26	86	32	32	32	90	27	20	23	82
"	c	3	10	6		7	3	5		20	10	15	
"	d	0	16	8		0	10	5		3	3	3	
England, S.	a	42	48	45		65	55	60		50	54	52	
"	b	42	26	34	79	26	39	33	93	30	30	30	82
"	c	16	23	20		6	0	3		17	13	15	
"	d	0	3	1		3	6	4		3	3	3	
Scotland, W.	a	61	45	53		49	39	44		33	44	39	
"	b	26	39	33	86	45	39	42	86	40	43	41	80
"	c	7	10	8		6	3	5		20	10	15	
"	d	6	6	6		0	19	9		7	3	5	
England, N.W.	a	65	58	62		48	45	47		43	60	52	
"	b	23	29	26	88	39	23	31	78	20	27	23	75
"	c	6	10	8		10	6	8		27	10	19	
"	d	6	3	4		3	26	14		10	3	6	
England, S.W.	a	58	48	53		58	49	54		57	53	55	
"	b	26	26	26	79	20	19	19	73	23	27	25	80
"	c	6	16	11		19	6	13		10	10	10	
"	d	10	10	10		3	26	14		10	10	10	
Ireland, N.	a	42	42	42		42	55	49		27	50	39	
"	b	45	32	39	81	32	29	30	79	37	37	37	76
"	c	13	13	13		16	6	11		23	10	16	
"	d	0	13	6		10	10	10		13	3	8	
Ireland, S.	a	39	39	39		55	49	52		33	40	37	
"	b	35	39	37	76	23	29	26	78	33	47	40	77
"	c	23	16	20		13	6	10		17	3	10	
"	d	3	6	4		9	16	12		17	10	13	

Summary.

British Isles	a	54	48	51		55	52	54		44	50	47	
"	b	34	29	32	83	32	29	30	84	31	34	33	80
"	c	9	14	11		10	7	9		17	12	14	
"	d	3	9	6		3	12	7		8	4	6	

Districts.		October 1887. Percentages. Wind.	Weather.	Average.	a+b.	November 1887. Percentages. Wind.	Weather.	Average.	a+b.	December 1887. Percentages. Wind.	Weather.	Average.	a+b.
Scotland, N.	a	58	68	63		47	43	45		39	39	39	
"	b	29	23	26	89	37	43	40	85	29	45	37	76
"	c	7	3	5		13	7	10		32	10	21	
"	d	6	6	6		3	7	5		0	6	3	
Scotland, E.	a	65	74	70		47	34	41		35	39	37	
"	b	26	16	21	91	33	40	36	77	26	45	36	73
"	c	6	3	4		17	13	15		29	16	22	
"	d	3	7	5		3	13	8		10	0	5	
England, N.E.	a	61	68	65		47	43	45		42	48	45	
"	b	32	23	27	92	33	30	32	77	32	42	37	82
"	c	7	3	5		17	17	17		20	10	15	
"	d	0	6	3		3	10	6		6	0	3	
England, E.	a	50	65	58		33	37	35		36	52	44	
"	b	50	26	38	96	43	47	45	80	58	35	47	91
"	c	0	9	4		17	10	14		6	3	4	
"	d	0	0	0		7	6	6		0	10	5	
Midland Cos.	a	50	61	56		43	20	32		35	45	40	
"	b	43	23	33	89	37	67	52	84	42	35	39	79
"	c	7	13	10		17	7	12		23	10	16	
"	d	0	3	1		3	6	4		0	10	5	
England, S.	a	64	68	66		50	54	52		39	55	47	
"	b	33	19	26	92	40	33	37	89	48	26	37	84
"	c	3	10	7		3	10	6		13	10	12	
"	d	0	3	1		7	3	5		0	9	4	
Scotland, W.	a	35	29	32		50	50	50		35	39	37	
"	b	39	49	44	76	37	33	35	85	26	26	26	63
"	c	23	3	13		10	10	10		29	19	24	
"	d	3	19	11		3	7	5		10	16	13	
England, N.W.	a	55	65	60		43	47	45		42	49	46	
"	b	32	26	29	89	30	30	30	75	23	35	29	75
"	c	10	3	7		27	13	20		26	10	18	
"	d	3	6	4		0	10	5		9	6	7	
England, S.W.	a	55	58	57		52	58	55		58	55	57	
"	b	39	42	40	97	28	21	25	80	23	26	24	81
"	c	6	0	3		17	7	12		6	16	11	
"	d	0	0	0		3	14	8		13	3	8	
Ireland, N.	a	27	39	33		35	72	54		52	35	44	
"	b	47	45	46	79	34	14	24	78	16	45	30	74
"	c	20	10	15		17		15		23	10	17	
"	d	6	6	6		14		7		9	10	9	
Ireland, S.	a	50	42	46		35	48	42		39	55	47	
"	b	33	45	39	85	34	31	32	74	32	35	34	81
"	c	17	0	9		17	11	14		16	0	8	
"	d	0	13	6		14	10	12		13	10	11	

Summary.

British Isles	a	52	58	55		44	46	45		41	47	44	
"	b	37	31	34	89	35	35	35	80	32	36	34	78
"	c	9	5	7		16	11	14		20	10	15	
"	d	2	6	4		5	8	6		7	7	7	

Districts.		January 1888. Percentages. Wind.	Weather.	Average.	a+b.	February 1888. Percentages. Wind.	Weather.	Average.	a+b.	March 1888. Percentages. Wind.	Weather.	Average.	a+b.
Scotland, N.	a	45	48	47		35	52	44		55	71	63	
"	b	39	39	39	86	52	31	41	85	23	26	25	88
"	c	10	10	10		3	14	9		13	3	8	
"	d	6	3	4		10	3	6		9	0	4	
Scotland, E.	a	58	65	62		45	41	43		45	61	53	
"	b	23	32	27	89	31	38	35	78	13	32	23	76
"	c	13	0	7		14	14	14		23	0	11	
"	d	6	3	4		10	7	8		19	7	13	
England, N.E.	a	64	78	71		52	52	52		42	71	57	
"	b	23	16	20	91	28	35	32	84	36	20	28	85
"	c	13	3	8		10	3	6		3	3	3	
"	d	0	3	1		10	10	10		19	6	12	
England, E.	a	65	58	62		45	52	49		42	52	47	
"	b	26	26	26	88	45	28	36	85	32	29	31	78
"	c	9	13	11		10	3	7		7	16	11	
"	d	0	3	1		0	17	8		19	3	11	
Midland Cos.	a	49	61	55		48	45	47		35	52	44	
"	b	32	23	28	83	28	45	36	83	32	29	30	74
"	c	16	16	16		21	7	14		23	16	20	
"	d	3	0	1		3	3	3		10	3	6	
England, S.	a	68	65	67		42	66	54		36	55	46	
"	b	29	32	30	97	41	27	34	88	35	32	33	79
"	c	0	0	0		17	7	12		16	3	10	
"	d	3	3	3		0	0	0		13	10	11	
Scotland, W.	a	42	58	50		45	41	43		26	52	39	
"	b	48	26	37	87	41	28	35	78	35	22	29	68
"	c	10	10	10		7	21	14		29	13	21	
"	d	0	6	3		7	10	8		10	13	11	
England, N.W.	a	58	71	65		59	48	54		32	71	52	
"	b	39	10	24	89	24	31	27	81	42	13	27	79
"	c	3	10	7		10	14	12		13	10	12	
"	d	0	9	4		7	7	7		13	6	9	
England, S.W.	a	49	55	52		41	55	48		65	58	62	
"	b	39	26	33	85	52	28	40	88	16	23	19	81
"	c	6	16	11		7	14	11		13	6	10	
"	d	6	3	4		0	3	1		6	13	9	
Ireland, N.	a	55	61	58		50	52	56		35	58	47	
"	b	16	23	20	78	24	31	27	83	23	29	26	73
"	c	19	10	14		14	17	16		19	7	13	
"	d	10	6	8		3	0	1		23	6	14	
Ireland, S.	a	58	58	58		66	52	59		48	39	44	
"	b	19	29	24	82	21	35	28	87	10	39	24	68
"	c	13	13	13		10	10	10		23	9	16	
"	d	10	0	5		3	3	3		19	13	16	

Summary.

British Isles	a	56	62	59		49	51	50		42	58	50	
"	b	29	26	28	87	35	32	34	84	27	27	27	77
"	c	10	9	10		11	11	11		17	8	13	
"	d	4	3	3		5	6	5		14	7	10	

APPENDIX XII.

LIST of STATIONS from which DAILY SIMULTANEOUS OBSERVATIONS (at 0h. 8m. p.m. G. M. T.) have been received in 1886.

Stations.	Observers.	Remarks.
	ENGLAND AND WALES.	
Bradford - -	J. McLandsborough, F.R.A.S., F.R. Met. Soc. and A. E. Preston, F.R. Met. Soc.	—
Chatham, School of Military Engineering.	Percy McHugo, Bugler, R.E.	—
Falmouth Observatory -	The Staff.	—
Greenwich Observatory -	The Staff, for the Astronomer Royal.	—
Guernsey - -	A. Collenette, F.R. Met. Soc.	—
Kew Observatory -	The Staff.	—
Leicester (Museum) -	J. C. Smith.	—
Liverpool Observatory (Bidston).	J. Hartnup, F.R. Met. Soc.	—
Oxford, Radcliffe Obs. -	The Staff.	—
Plymouth - -	J. Merrifield, LL.D., F.R.A.S.	—
Stonyhurst Observatory -	The Staff.	—
	SCOTLAND.	
Aberdeen Observatory -	The Staff.	—
Orkney, Swanbister -	W. I. Fortescue.	—
	IRELAND.	
Galway, Queen's College	W. Ryan.	—
Valencia Observatory -	The Staff.	—
	BRITISH COLONIES, POSSESSIONS, &c.	
Barbados, W. I. - -	Surgeon-Maj. in charge.	—
Gibraltar - -	Surgeon-Gen. in charge.	—
Malta - - -	R. R. Willan.	—
Nassau (Bahamas) -	J. A. Kerr	—
Natal - - -	Surgeon-Maj. in charge.	—
Scutari, British Cemetery	Serg. W. H. Lyne, R.E.	—
Sierra Leone - -	Surgeon-Maj. in charge.	—

SUMMARY.

—	—
England and Wales -	11
Scotland - - -	2
Ireland - - -	2
British Colonies and Possessions - -	7
Total	22

APPENDIX XIII.

Methods followed in dealing with Meteorological Returns from Land Stations in the British Isles.

These stations are of five classes, as stated on page 18.

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 regulations which have been adopted to secure this end are in the main the same as those which will be found in the Report of the Office for 1868. 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 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.

Harmonic analyser.

The photographic curves are also used in the harmonic analyser; and for this purpose the barograms require a slight special preparation.

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.

Means.

The record having been made as complete as possible, the daily, five-daily, and monthly means of the barometer and of the dry-bulb and wet-bulb thermometers are deduced.

Vapour tension.

The hourly vapour tension is then computed by an expansion of Glaisher's Hygrometrical Tables, prepared in the Office, and the work is independently checked.

A copy is next prepared of the above-mentioned hourly measurements of the barometer, dry-bulb and wet-bulb thermometers, wind and rain curves, and of the computed values of vapour tension. To these are added the daily means of the three first-mentioned elements, the extremes and daily range of pressure and temperature, and the daily totals of rainfall, and the whole series is printed and published under the title of "Hourly Readings from the Self-recording Instruments "at the Four Observatories under the Meteorological Council." Hourly Readings.

To ensure accuracy the sheets are read over in proof with the original measurements of the curves. The interpolated readings are printed in *italic* type, but no distinguishing mark is affixed to means which are partly based on them. When the gap in the record is too long to be dealt with by an interpolation of the missing hourly readings, the mean for the day is obtained either from the maximum and minimum readings for the day, or by an interpolation from the adjacent daily means, and the result thus obtained is printed as an approximation.

The five-daily, monthly, and annual means, together with the absolute extremes of pressure and temperature for each month, are printed as part of the "Hourly Readings." The tables are repeated in French measures. Annual Tables.

The gale tables printed in the text of the Quarterly Weather Report, which show the extent, duration, and degree of severity of all the stronger gales, are prepared from the tabulations of the anemograms received from the self-recording observatories, together with those received from the extra anemographic stations. Tables for the Quarterly Weather Reports. Gale tables.

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

The anemograms received from the stations enumerated on page 108 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 summary of weather and gale tables for the Quarterly Weather Report. They are also regularly used in the checking of the Storm Warnings issued by the Office.

III.—*Method followed with regard to the Returns from 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 the present year the total number of stations was 77, including 15 belonging to the Royal Meteorological Society and 5 belonging to the Scottish Meteorological Society.

This number is exclusive of the self-recording observatories, and of the anemographic stations, but it includes several from which only very scanty information is received.

The stations are distributed as follows: 43 in England, 3 in Wales, 12 in Scotland, and 19 in Ireland.

The returns are received at the Office monthly, and are duly entered and stored.

The publication of the returns is carried out in the following way: For a certain number of stations the observations of pressure (to the Publication on Form A.

second place of decimals), temperature, wind, cloud amount, and weather, at 9 a.m. and 9 p.m. each day, together with the computed vapour tension and relative humidity at those hours, and the daily maxima and minima of temperature, and daily rainfall, are published *in extenso* on the Form, A., proposed by the Permanent Committee of the First International Meteorological Congress at Vienna in 1874, and adopted for international use by the Second International Meteorological Congress at Rome in 1879.

The Permanent Committee assigned an inferior limit to the number of stations from which returns should be published *in extenso*, varying from 2 for Belgium to 100 for Russia in Asia, the number in the case of the United Kingdom being 15. In 1875, when the systematic publication of returns from Stations of the Second Order began, the results from only nine stations in connexion with the Office were available, but this number has steadily grown, until for 1880 returns from 33 stations were published on the A. Form. Though this list could be extended if desired, it has been thought better to curtail it somewhat on account of the size of the publication. The volume for 1883, the last published, contains therefore, like that for 1881 and 1882, returns, *in extenso*, from only 30 stations. The volume for 1884, however, which is now passing through the press, will contain returns from 32 stations.

Additions to the list for publication.

Care is taken in adding to the list for publication to see, first, that the station is satisfactory as regards its instruments, their exposure, &c.; secondly, that the returns bear internal evidence of accuracy and care in their preparation; and thirdly, that the district represented by the station is one for which information is needed.

Examination.

Full particulars as to the methods adopted in the examination of the returns will be found in previous reports.

Publication on Form B.

Besides this publication in full, the monthly means of the various elements, together with summaries of the wind direction and of the weather, are published on the Form B., also devised by the Permanent Committee of the Vienna Congress, and adopted by the Roman Congress.

Returns from six stations were published in this manner for the year 1873, and from nine stations for the year 1874. In 1875 the list included the names of 26 stations. This number has grown to 46 for the year 1884, and might be even further increased.

All the stations, returns from which are published *in extenso* on Form A., are included in the Form B. list. But this list also includes others, either not quite so good, not so representative, or not so long established. The method of preparation is in the main the same as in the case of the Form A. But the summaries of wind and weather for all the stations are specially prepared for this publication. For wind, the summary shows the number of *observations* at 9 a.m. and 9 p.m. under each of the semi-quadrantal points N., N.E., E., &c., the observations under intermediate points being thrown alternately forward and backward. For weather, the summary gives the number of *days* of rain, snow, hail, thunderstorm, clear sky, overcast, and gale. The days of clear sky and overcast are those when the means of the cloud-amounts at 9 a.m. and 9 p.m. are less than 2, and more than 8 respectively. The days of gale are those when force 7 or upwards, by Beaufort scale, is recorded.

British rainfall.

The monthly rainfall values (total, number of rainy days, and maximum) for the observatories and all the Stations of the Second Order are supplied each year to Mr. Symons, F.R.S., for publication in his "British Rainfall."

Unpunctual observations.

The observations are taken at 9 a.m. and 9 p.m. local time each day. It sometimes happens, however, that strict punctuality cannot be observed. In such cases, if the difference in time does not exceed 30 minutes, the

observations are, in most cases, printed without alteration. When the difference exceeds 15 minutes, a note is inserted in the remarks showing the exact time of observation. If the difference in time is more than half-an-hour, the readings are usually rejected and an interpolation made.

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 complete and perfect the returns.

The daily records of sunshine which are now received from 35 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. Sunshine records.

A tabulation of these curves is published as part of the Weekly Weather Report, mentioned in Appendix VII., and for those stations which are also Stations of the Second Order the monthly totals of bright sunshine in hours, together with the percentage of its possible duration, is 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. Weekly totals.

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. A paragraph in that Appendix (p. 85) explains the use that is made of the monthly schedules sent in by the observers.

V.—*Extra Stations.*

No returns from Stations of the Fifth Class are published by the Office, but some of them are regularly used in the checking of the Storm-Warnings, and all 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 XIV.

List of Documents relating to the Land Meteorology of the British Islands, received during the Year ending March 31st, 1888.

	Stations.	Observers.	Nature of Information received.	Notes.
I.	†Valencia	J. E. Cullum	Continuous records of pressure, temperature, wind, sunshine, and rain, with eye observations of the clouds and notes on the weather.	
	Glasgow	Prof. R. Grant, M.A., LL.D., F.R.S.		
	†Aberdeen	Prof. C. Niven, M.A., F.R.S.		
	†Falmouth	E. Kitto, F.R. Met. Soc.		
	†Stonyhurst	Rev. S. J. Perry, S.J., F.R.S.		
	†Kew	G. M. Whipple, B.Sc., F.R.A.S., F.R. Met. Soc.		
II.	†Armagh	J. L. E. Dreyer, Ph.D., F.R.A.S.	Continuous record of wind, rainfall, and sunshine.	
	Alnwick Castle	Lt.-Col. F. Holland, for the Duke of Northumberland, K.G.	Continuous record of wind (direction and velocity).	
	Dublin (Phœnix Park)	Lt.-Col. A. B. Coddington, R.E.	,, ,,	From December 1887.
	Fleetwood	M. S. Gaulter, C.E.	,, ,,	
	†Holyhead	Hugh Williams, C.E.	,, ,,	
	†North Shields	Capt. W. Harrison	,, ,,	
	†Swanbister (Orkney)	W. I. Fortescue, Esq.	,, ,,	
	†Scilly	W. Thomas	,, ,,	
	†Yarmouth	G. T. Watson	,, ,,	
	Heligoland	J. J. Friederichs	,, ,,	From September 1887.
	†Kilkenny Castle	The Marquis of Ormonde	Continuous record of pressure.	
	†Waterford	The Harbour Authorities	,, ,,	
III.	†Armagh	J. L. E. Dreyer, Ph.D., F.R.A.S.	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.	
	Aysgarth	Rev. Fenwick W. Stow, M.A., F.R. Met. Soc.		
	Babbacombe, Devon	E. E. Glyde, F.R. Met. Soc.		
	Bennington, Herts.	Rev. J. Dunne Parker, LL.D., F.R. Met. Soc.		
	†Braemar	James Aitken, J.P.		
	†Brookeborough (Colebrooke Park).	W. Ferguson, for Sir Victor Brooke, Bt., F.L.S.		
	†Buxton	E. J. Sykes, M.B., F.R.A.S., F.R. Met. Soc.		

LIST OF DOCUMENTS—*continued.*

Stations.	Observers.	Nature of Information received.	Notes.
M Carmarthen - -	G. J. Hearder, M.D. - - - -		
M †Cheadle - -	J. C. Philips, Esq. - - - -		
M Cheltenham - -	R. Tyrer, B.A., F.R. Met. Soc. - -		
M Churchstoke - -	Philip Wright, F.C.S., F.R. Met. Soc. -		
†Cronkbourne, Isle of Man.	A. W. Moore, M.A., J.P. - - -		
†Douglas, Isle of Man	Thos. Keig, Esq. - - - -		
†Dublin (Botanic Gardens, Glasnevin).	F. W. Moore, M.R.I.A. - - -		
†Dublin (City) -	J. W. Moore, M.D., F.R. Met. Soc. - -	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.	
†Dublin (Mountjoy Observatory).	Sergt. Lipscombe, for Lt.-Col. A. B. Coddington, R.E., Ordnance Survey Office.		
S †Dundee - -	W. Ross McKelvie, Esq. - - -		
S †Dunrobin Castle -	D. Melville, for the Duke of Sutherland, K.G.		
†Durham - -	H. J. Carpenter, Esq. - - - -		
†Eastbourne - -	R. Sheward, Esq., F.R. Met. Soc. -	- - - - - -	From July 1887.
†Edgeworthstown -	J. M. Wilson, J.P. - - - -	- - - - - -	From January 1888.
†Epsom (Royal Med. College).	J. S. Jackson, Esq. - - - -		
†Geldeston (Beccles) -	E. T. Dowson, F.R. Met. Soc. - -		
Glasgow - -	Prof. R. Grant, M.A., LL.D., F.R.S. - -		
†Glenalmond - -	Arthur S. Reid, M.A., F.G.S. - -		
M Hillington, Norfolk -	Rev. H. E. B. Ffolkes, M.A., F.R. Met. Soc. -		
M Killarney - -	The Ven. Archdeacon G. R. Wynne, M.A., F.R. Met. Soc.		
†Laudale (Argyleshire)	A. Fletcher, for T. H. G. Newton, M.A., J.P., F.R. Met. Soc.		
†Leicester - -	J. C. Smith, for Museum Authorities - -		
M Llandudno - -	J. Nicol, M.D., J.P., F.R. Met. Soc. - -		

LIST OF DOCUMENTS—*continued.*

Stations.	Observers.	Nature of Information received.	Notes.
† Londonderry - -	J. Conroy, F.R. Met. Soc. - - -	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.	
M Margate - -	J. Stokes, F.R. Met. Soc. - - -		
†Market Rasen -	W. B. Jevons, Esq. - - - -		From May 1887.
† Markree Castle, Sligo	A. Marth, F.R.A.S., for Col. Cooper, F.R.A.S.		
M Marlborough - -	C. E. B. Hewitt, B.A., F.R. Met. Soc. -		
Newton Reigny (Penrith).	T. G. Benn, F.R. Met. Soc. - - -		
† Parsonstown - -	O. Boeddicker, Ph.D., for the Earl of Rosse, F.R.S.		
S† Pinmore - -	Peter Donald - - - - -		
† Prestwich (Manchester)	T. R. H. Clunn, M.D., F.R. Met. Soc. - -		
S† Rothesay - -	James Kay, Esq. - - - -		
M† Scarborough - -	Allan Rowntree, F.R. Met. Soc. - -		
† Seaham - -	G. H. Aird - - - - -		
Southampton	J. T. Cook, R.E., for Director General of the Ordnance Survey.		
M Southbourne - -	T. A. Compton, B.A., M.D., F.R. Met. Soc. -		
Stokesay - -	Miss M. A. Digges La Touche - -		
† Stonyhurst - -	Rev. S. J. Perry, S.J., F.R.S. - - -		
† St. David's, Pembroke	W. P. Propert, LL.D., F.G.S., F.R. Met. Soc.		
† St. Leonards -	H. Colborne, M.R.C.S. - - -		
† Swanbister - -	W. I. Fortescue, Esq. - - - -		
Uppingham - -	Rev. G. H. Mullins, M.A., F.R. Met. Soc. -		
Uttoxeter - -	Rev. R. Barker, F.R. Met. Soc. - -		From October 1887.
M† Wakefield - -	H. Clarke, L.R.C.P., F.S.S., F.R. Met. Soc. -		
† York - -	J. Wright, for H. M. Platnauer, F.G.S. -		
IV. The Telegraphic Stations, see List on page 63 - - - -		Regular observations twice (and in some cases three times) daily of pressure, temperature, wind, weather, and sea disturbance.	
V. Arlington Court, Devon	J. Carter, for Lady Chichester - -	Pressure, temperature (dry-bulb, wet-bulb, max., min.), wind and rainfall, once daily.	
Baltimore - -	J. Halsey - - - - -	Pressure, temperature, wind, and weather, once daily.	

LIST OF DOCUMENTS—*continued.*

Stations.	Observers.	Nature of Information received.	Notes.
Castletownsend -	Lieut. T. W. Cobb, R.N. - - -	Pressure and temperature four times daily, and wind twice daily.	
Crookhaven - -	" " - - - -		
Chatham (School of Military Engineering).	P. McHugo, 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.	
Crosshaven - -	J. W. Bridle - - - -	Pressure, temperature, and wind, twice daily.	
Cuckfield -	John Howe, Esq. - - - -	Daily rainfall. - - - -	From October 1887.
Ennis - -	J. Hill, C.E., F.R. Met. Soc. - - -	Daily rainfall.	
Galway - -	E. G. Shaw - - - - -	Pressure and temperature four times daily, with wind.	From February 1888.
Gorleston, Norfolk -	R. J. C. Day - - - - -	Pressure and wind twice daily.	
Harpenden - -	T. Wilson, F.R. Met. Soc. - - -	Pressure, temperature, and wind, twice daily, with rainfall.	
Haslar - -	G. Coppen - - - - -	Pressure and temperature four times daily.	
Knightstown (Valencia).	John Doughty - - - -	Pressure, wind, and weather once daily -	From September 1887.
Rugby - -	C. H. Hodges, M.A., Geo. M. Seabrooke, F.R.A.S., and W. N. Wilson, M.A.	Full set of 9 a.m. observations with 9 p.m. temperatures.	
Saffron Walden -	J. G. Bellingham - - - -	Pressure and temperature twice daily, with 9 a.m. wind and rainfall.	
Schull - -	Lieut. T. W. Cobb, R.N. - - -	Pressure, temperature, and wind twice daily.	
†Sheffield (Weston Park)	Elijah Howarth, F.R.A.S. - - -	Full returns for 9 a.m. and 6 p.m.	
Stamford (Ketton Hall)	Fred. Coventry, Esq. - - - -	Full monthly summary.	
Stranraer - -	P. Doran - - - - -	Pressure, wind, and weather once daily -	From February 1888.
Sudbury - -	W. Bayley Ransom - - - -	Pressure, temperature (dry-bulb, max., min.), wind, cloud, and rainfall, once daily, with general remarks.	
Symbister, Shetland -	J. S. Nicolson - - - -	Pressure and temperature twice daily.	
Tarbert (Harris) -	Donald Bethune - - - -	Pressure and wind twice daily.	
Union Hall - -	Lieut. T. W. Cobb, R.N. - - -	Pressure, temperature, and wind, twice daily.	

NOTE.—The Stations marked "𝔐" belong to the Royal Meteorological Society; those marked "𝔖" belong to the Scottish Meteorological Society; those marked thus † have been inspected during the year.

List of Stations from which Continuous Records of Bright Sunshine have been received.

Station.	Observer.
Aberdeen	Prof. C. Niven, M.A., F.R.S.
Armagh	J. L. E. Dreyer, Ph.D., F.R.A.S.
Blackpool	J. Wolstenholme, F.R. Met. Soc.
Cambridge	H. Todd.
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.
Dublin	A. B. Coddington, Lt. Col. R.E.
Durham	H. J. Carpenter.
Falmouth	E. Kitto, F.R. Met. Soc.
Geldeston, Beccles	E. T. Dowson, F.R. Met. Soc.
Glasgow	Prof. R. Grant, M.A., LL.D., F.R.S.
Hastings	H. Colborne, M.R.C.S.
Hillington	Rev. H. E. B. Ffolkes, M.A., F.R. Met. Soc.
Jersey (Noirmont)	J. Fisher.
Kew Observatory	G. M. Whipple, B.Sc., F.R.A.S.
Leicester	J. C. Smith.
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. Loney.
Markree Castle	A. Marth, F.R.A.S.; for Col. E. H. Cooper.
Newton Reigny (Penrith)	T. G. Benn, F.R. Met. Soc.
Oswald Kirk, Yorkshire	R. Thompson.
Oxford	E. J. Stone, F.R.S.
Parsonstown	O. Boeddicker, Ph.D.; for the Earl of Rosse, F.R.S.
Plymouth	J. Merrifield, LL.D., F.R.A.S.
St. Ann's Head	S. Blake.
Southampton	Sir C. Wilson, Col. R.E., K.C.B., F.R.S.
Stonyhurst	Rev. S. J. Perry, M.A., F.R.S.
Stornoway	John Forbes.
Swanbister (Orkney)	W. Irvine Fortescue.
Valencia	J. E. Cullum.
Worksop	H. Mellish, F.R. Met. Soc.
York	J. E Clarke, B.A., B.Sc.

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

Braemar	J. A. Aitken.
Ingatestone	L. J. Petre, F.R. Met. Soc.
Stowell	Rev. H. J. Poole, F.R. Met. Soc.

APPENDIX XIVa.

LIST of DOCUMENTS relating to the Meteorology of various Colonial and Foreign Military Stations, received from the Office of the Ordnance Survey in 1879, and from the Army Medical Department in 1886, and now being prepared for publication.

District.	Station.	Observations made by	Period.	Total No. of Sheets.
NORTH AMERICA AND NORTH ATLANTIC.	New Westminster (B. Columbia).	R.E.	1860–1861	2
	Newfoundland - -	R.E.	1852–1862	11
	Newfoundland - -	A.M.D.	1866–1870	5
	Quebec - - -	R.E.	1853–1861	6
	Quebec - - -	A.M.D.	1866–1870	5
	Halifax - - -	R.E.	1852–1862	11
	Halifax - - -	A.M.D.	1866–1875	9
	Kingston - -	R.E.	1853–1861	9
	Bermuda - -	R.E.	1852–1862	11
	Bermuda - -	A.M.D.	1866–1884	19
MEDITERRANEAN -	Gibraltar - -	R.E.	1852–1862	11
	Gibraltar - -	A.M.D.	1866–1884	19
	Malta - - -	R.E.	1852–1861	9
	Malta - - -	A.M.D.	1866–1884	19
	Corfu - - -	R.E.	1852–1861	10
	Scutari - - -	A.M.D.	1866–1884	19
WEST INDIES -	Bahamas - -	R.E.	1852–1862	11
	Bahamas - -	A.M.D.	1866–1884	18
	Jamaica (Newcastle) -	A.M.D.	1866–1884	19
	Jamaica (Up Park Camp)	R.E.	1852–1861	10
	Jamaica (Up Park Camp)	A.M.D.	1866–1884	19
	Honduras - -	A.M.D.	1866–1870	5
	Barbados - -	R.E.	1853–1862	10
	Barbados - -	A.M.D.	1866–1884	19

District.	Station.	Observations made by	Period.	Total No. of Sheets.
West Coast of Africa and South Atlantic.	Bathurst - - -	A.M.D.	1869	1
	Sierra Leone - -	A.M.D.	1874–1884	11
	Sierra Leone - -	General Lawson.	1847–1851	5
	Sierra Leone (night obs.)	General Lawson.	1849–1851	3
	St. Helena - -	R.E.	1853–1862	10
South Africa -	Natal - - -	A.M.D.	1868–1884	17
	Grahamstown - -	R.E.	1853–1862	10
	Grahamstown - -	A.M.D.	1867–1870	4
	Capetown -	A.M.D.	1870–1875	6
Indian Ocean -	Trincomalee - -	A.M.D.	1865–1875	11
	Kandy - - -	A.M.D.	1866–1875	10
	Colombo - -	R.E.	1852–1862	11
	Colombo - -	A.M.D.	1866–1875	10
	Newera Eliya - -	A.M.D.	1866–1872	7
	Singapore - -	A.M.D.	1868–1884	16
	Mauritius - -	R.E.	1852–1861	10
	Mauritius (night obs.) -	R.E.	1852–1861	10
China - -	Hong Kong - -	R.E.	1853–1862	10
	Hong Kong - -	A.M.D.	1866–1884	19
Australasia -	Freemantle -	R.E.	1852–1859	5
	Auckland - -	R.E.	1853–1862	10
	Auckland - -	A.M.D.	1866–1869	4

APPENDIX XV.

ACCESSIONS TO THE LIBRARY DURING THE YEAR ENDING 31ST MARCH 1888.

A—AGRICULTURE AND BOTANY.

* **Drude, O.**—Atlas der Pflanzenverbreitung. (Berghaus' Physikalischer Atlas, Abteilung v.) 6 pp., 8 charts, f°. Gotha, 1887.

Ufficio centrale di Meteorologia, Roma.—Rivista Meteorico-Agraria. Anno viii., 1887, Nos. 1-36. la. 8°. (Roma, 1887-88.)

‖ **Wollny, E.**—Forstlich-meteorologische Beobachtungen. 34 pp. 8°. (*Forschungen auf dem Geb. Agrik.-phys., Heidelberg, Bd.* x., *Heft* 4/5.)

‖ ———.—Untersuchungen über das Verhalten der atmosphärischen Niederschläge zur Pflanze und zum Boden. 26 pp. 8°. (*Forschungen auf dem Geb. Agrik.-phys., Heidelberg, Bd.* x., *Heft* 1/2.)

‖ ———.—Untersuchungen über den Einfluss der Pflanzendecke und der Beschattung auf die physikalischen Eigenschaften des Bodens. Zweite Mittheil. 84 pp. 8°. (*Forschungen auf dem Geb. Agrik.-phys., Heidelberg, Bd.* x., *Heft* 4/5.)

‖ ———.—Untersuchungen über die Temperaturverhältnisse des Bodens bei verschiedener Neigung des Terrains gegen die Himmelsrichtung und gegen den Horizont. (Nachträge.) 20 pp., 8°. (*Forschungen auf dem Geb. Agrik.-phys., Heidelberg, Bd.* x., *Heft* 4/5.)

B—ASTRONOMY.

‖ **Exner, K.**—Ueber die Scintillation. 66 pp. la. 8°. (*Exner's Repert.*, xxiii., pp. 371 *u.* 426.)

Government Observatory, Madras.—Results of observations of the fixed stars made with the meridian circle at the Government Observatory, Madras, in the years 1862, 1863 and 1864, under the direction of **N. R. Pogson.** xlvii. + 314 pp. 4°. Madras, 1887.

‖ **Grant, R.**—The proper motions of the stars. Read . . . 5th Nov. 1884. 14 pp. 8°. (*Proc. Phil. Soc. Glasgow.*)

‖ **Marangoni, C.**—L'eccliss totale di luna del 4-5 Ottobre 1884. 13 pp. la. 8°. Firenze, 1885. (*Riv. scient.-industr.*)

* **(Nautical Almanac Office.)**—The nautical almanac and astronomical ephemeris for the year 1888, for the meridian of the Royal Observatory at Greenwich. xi. + 515 + 13 pp., 8°. London, 1884.

Royal Astronomical Society, London.—Memoirs. Vol. xlix., Part i. 1 vol., 4°. London, 1888.

———.—Monthly Notices . . . From November 1886 to November 1887. Vol. xlvii., with plates, 8°. London, 1887.

Royal Observatory, Greenwich.—Report of the Astronomer Royal to the Board of Visitors of the Royal Observatory, Greenwich, read at the annual visitation of the Royal Observatory, 1887, June 4. (By **W. H. M. Christie.**) 22 pp. la. 4°. s.l.e.a.

United States Naval Observatory.—Observations made during the year 1883, at the United States Naval Observatory. Rear-Admiral R. W. Shufeldt, Superintendent. 1 vol., with plates, la. 4°. Washington, 1887.

Venturi, A.—Di una notevole semplificazione nel calcolo delle perturbazioni dei piccoli pianeti. Pubbl. R. Osserv. Brera in Milano, N. xxviii. 15 pp. sm. f°. Milano, 1886.

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.

Warner Observatory, Rochester, N.Y.—History and work. 1883–1886. vol I. 70 pp., 3 plates, 8°. Rochester, N.Y., 1887.

C—ATMOSPHERIC PRESSURE.

* ‖ **Broun, J. A.**—On simultaneous variations of the barometer in India. 16 pp. 8°. [*Proc. R. Soc.*, xxv., 1876, *p.* 24.]

* ‖ ———.—Supplementary note on simultaneous barometric variations. 5 pp., 1 plate, 8°. [*Proc. R. Soc.*, xxv., 1876, *p.* 39.]

Hann, J.—Die Vertheilung des Luftdruckes über Mittel- und Süd-Europa dargestellt auf Grundlage der 30 jährigen Monats- und Jahres-Mittel 1851–80, nebst allgemeinen Untersuchungen über die Veränderlichkeit der Luftdruck-Mittel- und -Differenzen sowie deren mehrjährige Perioden. Geograph. Abhandl. herausgegeben von Prof. Dr. A. Penck in Wien. Bd. II. Heft 2. vi. + 220 pp., 3 plates, la. 8°. Wien, 1887.

[Hazen], H. A.—Barometer exposure. 8°. slip. [*Science*, 1887, *Apl.* 29.]

‖ **Hazen, H. A.**—On the projection of lines of equal pressure in the United States, west of the Mississippi River. 12 pp. la. 8°. (*Amer. Journ. Sc.*, xxi., 1881, *May*, *p.* 361.)

‖ ———.—On the reduction of air-pressure to sea-level, and the determination of elevations by the barometer. Read at the April Meeting of the Conn. Acad. and Sc. 9 pp. la. 8°. (*Amer. Journ. Sc.*, 3*rd ser.*, xxi., 1881, *June*, *p.* 453.)

‖ ———.—On the retardation of the maxima and minima of air-pressure at high stations. 9 pp. la. 8°. (*Amer. Journ. Sc.*, xxiv., 1882, *Aug.*, *p.* 105.)

‖ **(Hazen, H. A.)**—Reduction of air pressure to sea level. 12 pp., 1 plate, 8°. (*Amer. Meteor. Journ.*, 1887, *June*.)

* ‖ **Howard, L.**—On the barometrical variation as affected by the moon's declination. Read June 19, 1845. 7 pp. la. 4°. (*Phil. Trans.*, 1846, *p.* 441.)

‖ **Monaco, S. A. le Prince Albert de.**—Sur des courbes barométriques enregistrées pendant la troisième campagne scientifique de l'Hirondelle. 5 pp. 4°. (Paris, 1888.) [*Compt. rend. acad. sc., Paris*, cvi., 1888, *p.* 177.]

‖ **Ragona, D.**—Andamento diurno della pressione atmosferica dedotto da un ventennio di rilievi del barometro registratore del R. Osservatorio di Modena. Dicembre. 61 pp., 3 plates, sm. f°. Roma, 1887. (*Annal. Meteor. Ital.*, vii., 1885, *parte* 1.)

D—AURORA.

* ‖ **De La Rive, A.**—Nouvelles recherches sur les aurores boréales et australes et description d'un appareil qui les reproduit avec les phénomènes qui les accompagnent. 29 pp. la. 4°. Genève, 1862. (*Mém. Soc. phys. hist. nat. Genève*, xvi., 2e *partie*.)

Lemström, S.—L'aurore boréale. Étude générale des phénomènes produits par les courants électriques de l'atmosphère. xiii. + 199 pp., 14 plates, la. 8°. Paris, 1886.

E—BIBLIOGRAPHY.

New York State Library.—Annual report of the Trustees . . . for the years 1884–86. 67th to 69th. 3 vols. la. 8°. Albany, 1885–87.

F—CLIMATE AND HYGIENE.

* ‖ **Frankland, E.**—Climate in town and country. Read Feb. 10, 1882. 11 pp. 8°. [*Proc. R. Inst. Gt. Brit.*, x., *No.* 75, *p.* 17.]

‖ **Gordon, C. A.**—Remarks on climate in relation to organic nature. 37 pp. 8°. London, s.a. [*Trans. Vict. Inst., London*, xvii.]

‖ **Grimshaw, T. W.**—On the prevalence and distribution of phthisis and other diseases of the respiratory organs in Ireland. 28 pp., 4 plates, 8°. Dublin, 1887. (*Trans. Acad. Med. Ireland*, v.)

* **Harwood, W.**—On the curative influence of the Southern coast of England; especially that of Hastings: with observations on diseases in which a residence on the coast is most beneficial. viii. + 326 pp. sm. 8°. London, 1828.

Hinrichs, G.—The climate of southern Russia and Iowa compared. A climatological study on the transplantation of Russian fruit to Iowa and the Upper Mississippi Valley. 16 pp. la. 8°. [*Amer. Meteor. Journ.*, iv., 1888, *p.* 460.]

* **Hough, J.**—Letters on the climate, inhabitants, productions, &c., &c., of the Neilgherries, or Blue Mountains of Coimbatoor, South India. iv. + 172 pp. 8°. London, 1829.

Inspector General of Customs, Peking.—Medical reports for the half-years ended 30th September 1886 and 31st March 1887. 32nd and 33rd Issues. 2 vols., with plates, 4°. Shanghai, 1886-87.

Lima, J. A. de.—Breve noticia sobre o clima da cidade do Rio Grande do Sul. 16 pp. 8°. (*Rev. Soc. geogr. Rio de Janeiro*, II., 1886, *p.* 277.)

* **Lindsay, J. A.**—The climatic treatment of consumption. A contribution to medical climatology. xii. + 228 pp. sm. 8°. London, 1887.

* **Mackness, J.**—Hastings considered as a resort for invalids. With tables, illustrative of its temperature, salubrity, and the general character of the climate, showing its suitability in pulmonary and other diseases. Also, directions for the choice of a residence, and hints as to diet, regimen, bathing, &c. xii. + 151 pp. sm. 8°. London, 1842.

Nicol, J.—The climate of Llandudno. Second edition. 35 pp., 3 plates, sm. 8°. London, 1885.

Physiographical Commission of the I. R. Academy of Science at Cracow.—Materials for Galician climatology, collected by the Meteorological section . . . 1886. 297 pp. la. 8°. Cracow, 1887. (*Extract Rep. Physiogr. Comm.*)

In the Polish language.

Registrar General, London.—Weekly return of births and deaths in London and in twenty-seven other great towns. Vol. xlviii., 1887. Nos. 1-52. la. 8°. London, 1887.

Registrar General of Births, Deaths and Marriages in Ireland.—Quarterly returns of the marriages, births, and deaths registered in . . . Ireland; . . . 1887. 1st—4th quarters, Nos. 93-96. la. 8°. Dublin, 1887-88.

———.—Weekly returns of births and deaths in Dublin (including its suburban districts), and in fifteen of the principal urban sanitary districts in Ireland, 1887. Vol. XXIV. la. 8°. Dublin, 1888.

(Sanitary Commissioner, Punjab.)—Report on the Sanitary Administration of the Punjab for the year 1886. 1 vol., with plates, f°. Lahore, 1887.

(Scott, R. H.)—Is climate changing? 7 pp. 8°. [*Longman's Mag.*, xi., 1888, *Mch.*, *p.* 535.]

* **Shapter, T.**—The climate of the south of Devon; and its influence upon health: with short accounts of Exeter, Torquay, Babbicombe, Teignmouth, Dawlish, Exmouth, Budleigh-Salterton, Sidmouth, &c. x. + 258 pp., 1 plate, sm. 8°. London, 1842.

Société de Médecine et de Climatologie de Nice.—Nice-Médical. 11e Année, 1886-87, Nos. 1-12. la. 8°. Nice, 1886-87.

‖ **(Tacchini, P.)**—Sul clima di Massaua. 21 pp. sm. f°. Roma, 1888. (*Annal. Meteor. Ital.*, 1886, *parte* i.)

* **Where to take a holiday.**—Reports on some home and foreign health resorts. The holiday number of the London Medical Record. July 1, 1887. 102 pp. la. 8°. London, 1887.

* **Williams, J.**—The climate of Great Britain; or remarks on the change it has undergone, particularly within the last fifty years. Accounting for the increasing humidity and consequent cloudiness and coldness of our springs and summers; . . . . Including various experiments to ascertain the causes of such change. ix. + 358 pp. 8°. London, 1806.

G—EARTHQUAKES.

Denza, F.—Alcune notizie sul terremoto del 23 febbraio 1887. 56 pp., 2 plate, sm. 8°. Torino, 1887.

(Hall, M.)—Second report on earthquakes in Jamaica. 1881, December 26th to 1886, June 3rd, inclusive. 5 pp. f°. Kingston, 1887.

This forms No. 77 of the "Jamaica Weather Report."

O'Reilly, J. P.—Alphabetical catalogue of the earthquakes recorded as having occurred in Europe and adjacent countries, arranged to serve as a basis for an earthquake map of Europe. Read, 13th April, 1885. 220 pp. la. 4°. (*Trans. R. Irish Acad.*, xxviii., *Science*, *p.* 489.)

———.— Catalogue of the earthquakes having occurred in Great Britain and Ireland during historical times; arranged relatively to localities and frequency of occurrence, to serve as a basis for an earthquake map of the three kingdoms. Read, April 28, 1884. 32 pp., 1 plate, la. 4°. (*Trans. R. Irish Acad.*, xxviii., *Science*, *p.* 285.)

* **(Proctor, R. A.)**—Earthquakes in England. 11 pp. 8°. [*Longman's Mag.*, iv., *No.* xxii., *p.* 382.]

* **Shaler, N. S.**—The stability of the earth. 21 pp. la. 8°. (*Scribner's Mag.*, I., 1887, *Mch.*, *p.* 259.)

* **Wark, —.**—Method of determining the strength and direction of earthquakes. 3 pp. 8°. (*Essays obsns. Phil. Soc. Edinb.*, iii., 1771, *p.* 142.)

H—ELECTRICITY AND MAGNETISM.

* ‖ **Chambers, C.**—On the luni-solar variations of magnetic declination and horizontal force at Bombay, and of declination at Trevandrum. Read April 1, 1886. 43 pp., 5 plates, la. 4°. London, 1887. (*Phil. Trans.*, clxxviii., 1887, *A.*, *p.* 1.)

‖ **Colladon, D.**—Renseignements sur un coup de foudre d'une intensité très exceptionnelle. Séance du 25 avril 1887. 6 pp. 4°. (*Compt. rend. acad. sc., Paris*, *t.* civ.)

‖ ———.—Sur les origines du flux électrique des nuages orageux. Séances des 12 et 19 avril 1886. 13 pp. 4°. (*Compt. rend. acad. sc., Paris*, *t.* cii.)

‖ **Contarino, F.**—Determinazioni assolute della componente orizzontale della forza magnetica terrestre fatte nel R. Osservatorio di Capodimonte negli anni 1883 ed 84 ed in epoche anteriori. 15 pp. la. 4°. Napoli, 1887. (*Atti Accad. Pontaniana*, xvii.)

‖ **Davis, W. M.**—Thunder-storms in New England in the summer of 1885. A report on observations made by volunteer observers for the New England Meteorological Society. 45 pp. la. 8°. Cambridge, 1886. (*Proc. Amer. Acad. Arts Sc.*, xxii., 1886, *p.* 14.)

‖ **Falmouth Observatory.**—Falmouth Observatory magnetographs. 12 pp. 8°. Falmouth, 1887. (*Ann. Rep. R. Cornw. Polyt. Soc.*, 1886.)

‖ **Ferrari, C.**—Risultati ottenuti dalle ricerche del Dr. Ciro Ferrari sulle osservazioni dei temporali raccolte nel 1882-1883. 78 pp., 10 plates, sm. f°. Roma, 1887. (*Ann. Meteor. Italiana*, vii., *Parte* 1, 1885.)

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Gordon, A. R.—Charts showing the mean, monthly and annual temperatures of Hudson's Bay region and Eastern Canada, October 1885 to September 1886. 13 charts, oblong f°. s.l.e.a.

Haughton, S.—New researches on sunheat, terrestrial, radiation, &c. Read, Nov. 9, 1885. 76 pp., 9 plates, la. 4°. Dublin, 1886. (*Cunningham Mem., No.* iii., *R. Irish Acad.*)

‖ **Hazen, H. A.**—Effects of solar radiation upon thermometer bulbs having different metallic coverings. Abstract. 2 pp. 8°. (*Trans. Phil. Soc. Washington.*)

‖ ———.—Thermometer exposure. 11 pp. 8°. (*Amer. Meteor. Journ.*, 1886, *June.*)

* **Henslow, G.**—The Journal of the Royal Horticultural Society. Vol. VIII. The frost report on the effects of the severe frosts on vegetation during the winters 1879–80 and 1880–81. 5 + lxv. + 338 pp. 8°. s.l., 1887.

‖ **Hill, S. A.**—On the ground temperature observations made at the Old Observatory, Allahabad. 24 pp., 2 plates, f°. (*Indian Meteor. Mem., iv., part* iii., *p.* 139.)

‖ ———.—Professor Langley's researches on solar heat. A criticism of certain points. 7 pp. la. 8°. (*Quart. Journ. R. Meteor. Soc.*, xiii., 1887, *p.* 85.)

‖ **Kostlivy, S.**—Über die Temperatur von Prag. 32 pp. la. 4°. Prag, 1887. (*Abhandl. k. böhm. Gesellsch. Wissensch., vii. Folge*, ii. *Bd.*)

‖ **Lang, C.**—Die Vorausbestimmung des Nachtfrostes. Vortrag, gehalten im Gartenbauverein zu München. 17 pp. la. 8°. Braunschweig, 1887. (*Das Wetter.*)

‖ **Lefroy, Sir. J. H.**—Second report of the Committee . . . appointed for the purpose of reporting upon the depth of permanently frozen soil in the polar regions, its geographical limits and relation to the present Poles of greatest cold. Drawn up by General Sir J. H. Lefroy (Reporter). 7 pp. 8°. (*Rep. Brit. Assoc. advanc. sc.*, 1887.)

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Meteorological Office, India.—Abstract of the results of the thermometric observations taken at the Meteorological Office, Chowringhee, in the months of January to December, 1887. sm. f°. Sheets.

———.—Results of the thermometrical observations taken at the Meteorological Office, Chowringhee, from 2nd January 1887 to 31st December 1888. sm. f°. Sheets

‖ **Meyer, H.**—Ueber die Häufigkeit des Vorkommens gegebener Temperaturgruppen in Norddeutschland. 15 pp. la. 8°. (*Meteor. Zeitschr.*, 1887, *Dez.*, *p.* 428.)

‖ **Mill, H. R.**—Marine temperature observations. 9 pp. la. 8°. (*Quart. Journ. R. Meteor. Soc.*, xiii., 1887, *p.* 192.)

‖ ———.—On the physical conditions of the water in the Clyde sea-area. Read before the Soc., 16th Feb. 1887. 25 pp. 8°. (*Proc. Phil. Soc. Glasgow.*)

* ‖ **Newbold, [T. J.]**—On the temperature of the springs, wells and rivers of India and Egypt, and of the sea and table-lands within the tropics. Read, Feb. 22, 1844. 15 pp. la. 4°. [*Phil. Trans.*, 1845, *p.* 125.]

‖ **Wild, H.**—On the determination of the true air temperature. (Zeitschr. oesterr. Gesellsch. Meteor., Wien, 1885, May, p. 161.) Translated by **H. A. Hazen,** with additional notes. 15 pp. la 8°. (*Amer. Meteor. Journ.*, II., 1886, *Jan.*, *p.* 401.)

‖ **Wollny, E.**—Untersuchungen über die Feuchtigkeits- und Temperaturverhältnisse des Bodens bei verschiedener Neigung des Terrains gegen den Horizont. 70 pp. 8°. (*Forschungen auf dem Geb. Agrik.-phys., Heidelberg. Bd.* ix., *Heft* 1.)

‖ ———.—Untersuchungen über die Feuchtigkeits- und Temperaturverhältnisse des Bodens bei verschiedener Neigung des Terrains gegen die Himmelsrichtung und gegen den Horizont. 54 pp. 8°. (*Forschungen auf dem Geb. Agrik.-phys., Heidelberg, Bd.* x., *Heft* 1.)

X—WEATHER TELEGRAPHY AND PREDICTION.

* **Blake, C. C.**—The Future. A calculation of the coming weather through astronomical mathematics. Vol. i. Nos. 1–12; ii. Nos. 1–10. la. f°. sheets. Richland, 1885–87.

* **Dallet, G.**—La prévision du temps et les prédictions météorologiques. 336 pp. sm. 8°. Paris, 1887.

D[avis], W. M.—Weather prediction in New Zealand. sm. f°. Slip.

‖ **(Hinrichs, G.)**—Examination of the practical value of the flag signals of the U. S. Signal Service. 4 pp. la. 8°. (*Iowa Weather Bull.*, 1886.)

‖ **Hoffmann, H.**—Phaenologie und Wetterprognose. 4 pp. la. 8°. (*Meteor. Zeitschr.*, 1887, *Apl.*, *p.* 129.)

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‖ **Jenkins, B. G.**—On forecasting the weather. 7 pp., 1 plate, 8°. Brussels, 1887. (*Bull. acad. R. Belgique*, 3me *série*, *t.* xiii., 1887, *No.* 4.)

Y—WINDS, STORMS, AND CYCLONES.

‖ **Augustin, F.**—Über die jährliche Periode der Richtung des Windes. Zweiter Theil. 42 pp. 8°. (*Sitzungsb. königl. böhm. Gesellsch. Wissensch.*, 1887, *Juni* 17.)

‖ **Colladon, D.**—Réponse aux observations de M. H. Faye, formulées dans les séances des 14 et 21 mars, sur la théorie des trombes ascendantes. Séance du 18 avril 1887. 8 pp. 4°. (*Compt. rend. acad. sc., Paris*, civ.)

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‖ ———.—On vertical currents in cyclones. [Translated by **H. A. Hazen**, with additional note.] 18 pp. la. 8°. (*Amer. Meteor. Journ.* 1886, *Aug.*, *p.* 170.)

‖ **Hann, J.**—Der tägliche und jährliche Gang der Windgeschwindigkeit und der Windrichtung auf der Insel Lesina. Mit einem Beitrag zur Charakterisirung der Bora und des Scirocco. Erste Mittheil. 13 pp. la 8°. (*Ann. Hydr. Mar. Meteor., Berlin*, 1888, *Heft* 1, *p.* 30.)

‖ **Harding, C.**—The storm and low barometer of December 8th and 9th, 1886. 13 pp. la. 8°. (*Quart. Journ. R. Meteor. Soc.*, xiii., 1887, *p.* 201.)

(Harries, H.)—Cold winds. 11 pp. 8°. [*Longman's Mag.*, 1888, *Apl.*, *p.* 620.]

[Hazen], H. A.—A sensitive wind-vane. 2 pp. 8°. (*Science*, ix., 1887, *p.* 295.)

‖ **Hazen, H. A.**—Tornado generation. 5 pp. la. 8°. (*Amer. Meteor. Journ.*, 1884, *Sept.*, *p.* 172.)

‖ **[Hazen], H. A.**—Wind and barometer. 6 pp. la, 8°. (*Amer. Meteor. Journ.*, 1887, *Apl.*, *p.* 561.)

‖ **Hill, S. A.**—Some anomalies in the winds of northern India, and their relation to the distribution of barometric pressure. 44 pp., 3 plates, la. 4°. London, 1887. (*Phil. Trans., col.* 178, 1887, *A.*, *p.* 335.)

(Hong-Kong Observatory.)—Report on information issued in 1886 concerning typhoons. 2 pp. sm. f°. (*Gov. Notification, No.* 534.)

Hydrographic Office, Washington.—Waterspouts off the Atlantic coast of the United States. January and February, 1888. Suppl. to the Pilot Chart of the North Atlantic Ocean for March, 1888. f°. Sheet.

‖ ———.—West Indian hurricanes and the law of storms. f°. Sheet. (*From the Pilot Chart of the N. Atlantic Ocean, Sept.*, 1887.)

‖ **Knipping, E.**—Taifunbahnen bei Japan, nebst Winken zum Manövriren. 6 pp., 1 plate, la. 8°. (*Ann. Hydr. Mar. Meteor.*, 1887, *März.*)

‖ **Montigny, C.**—Influence des bourrasques sur la scintillation des étoiles. 25 pp. 8°. Bruxelles, 1887. (*Bull. acad. R. Belgique*, 3me *série*, xiv., 1887, *No.* 12.)

‖ **Ragona, D.**—Studii comparativi sulla frequenza dei venti in tre luoghi della provincia di Modena. 40 pp. 8°. (Venezia, 1887.) (*Atti. R. Ist. veneto sc. lett. ed arti, serie* vi., *t.* v.)

‖ **Rykatschew, —.**—Die Vertheilung der Winde und des Luftdruckes am Caspischen Meere. Der Akademie vorgelegt am 26 Mai, 1887. 61 + xxxvi. pp., 6 plates. sm. f°. (St. Petersburg), 1887. (*Report. Meteor.* xi., *No.* 2.)

‖ **Schück, A.**—Taifune an der Südküste Japans 20–23 und 30 September 1869. 20 pp., 1 plate, 8°. (*Verhandl. Ver. Naturw. Unterhalt. Hamburg*, vi., 1883–85.)

* **Shaler, N. S.**—The instability of the atmosphere. 25 pp., 1 plate, la. 8°. [*Scribner's Mag.*, ii., 1887, *Aug.*, *p.* 197.]

‖ **Waldo, F.**—Absolute reduction of wind observations at sea. 7 pp. la. 8°. (*Amer. Meteor. Journ.*, 1887 *Oct.*)

* **White, M.**—Remarks on the winds, tides and currents of the ocean, with other phenomena. iv. + 175 pp. 8°. London, 1846.

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* **Admiralty, London.**—East coast of Ireland, with the Irish Channel. Compiled from the latest Government Surveys. 1885. 1 chart, la. f°. London, 1886.

* ———.—Holyhead Harbour. Surveyed by Staff Commr. T. H. Tizard, R.N., assisted by Staff Commr. C. H. Langdon and Mr. G. Jamieson, R.N. 1880. 1 chart, la. f°. London, 1881.

* **Arctic Expeditions.**—Further papers relative to the recent Arctic expeditions in search of Sir John Franklin, and the crews of H.M.S. "Erebus" and "Terror." iv. + 958 pp., 29 maps and plates, sm. f°. London, 1855.

* ———.—Further papers relative to the recent Arctic expeditions in search of Sir J. Franklin, and the crews of Her Majesty's Ships "Erebus" and "Terror"; including the reports of Dr. Kane and Messrs. Anderson and Stewart. . . . . In continuation of Papers presented in September 1854-5. Presented to the House of Commons, 1856. v. + 95 pp., 2 plates, sm. f°. London, [1856].

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Burgess, B.—A brief history of the Royal United Service Institution. 37 pp., 4 plates, 8°. London, 1887.

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Fleming, S.—Universal or cosmic time. Together with other papers, communications and reports in the possession of the Canadian Institute respecting the movement for reforming the time-system of the world, and establishing a prime meridian as a zero common to all nations. vi. + 97 pp., 1 plate, 8°. Toronto, 1885. (*Proc. Canadian Inst., Toronto*, 3rd *ser.*, III., *Fasc.* 2.)

* || **Frankland, G. C., and Frankland, P. F.**—Studies on some new micro-organisms obtained from air. 31 pp., 4 plates, la. 4°. London, 1887. (*Phil. Trans.*, clxxviii., 1887. *B.*, *p.* 257.)

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* **Gerland, G.**—Beiträge zur Geophysik. Abhandlungen aus dem geographischen Seminär der Universität Strassburg. I. Bd. liv. + 374 pp., 7 plates, la. 8°. Stuttgart, 1887.

* **Hydrographic Office, Admiralty, London.**—Arctic America. oblong 8°. chart. London, 1856.

* ———.—Arctic Sea. Behring Strait. Sheet iii. 1853. Additions to 1881. 1 chart, la. f°. London, s.a.

* ———.—British North America. Hudson Bay and Strait. . . . . With additions from various authorities to 1881. 1 chart, la. f°. London, s.a.

* ———.—Valentia Island. Corrections 1861 and 1875. 1 chart, la. f°.

Inspector General of Customs, Shanghai.—List of the Chinese lighthouses, light-vessels, buoys, and beacons for 1887. (Corrected to 1st December, 1886.) 15th Issue. 46 pp., 5 plates, 4°. Shanghai, 1887.

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Domänen und Forsten, herausgegeben von **H. A. Meyer, K. Möbius, G. Karsten, V. Hensen, J. Reincke.** xii. – bis. xvi. Jahrg. 1 vol., with plates, f°. Berlin, 1887.

* **Konkoly, N. von.**– Practische Anleitung zur Himmelsphotographie nebst einer kurzgefasssten Anleitung zur modernen photographischen Operation und der Spectralphotographie im Cabinet. xvi. + 372 pp., 1 plate, la. 8°. Halle, a.s. 1887.

‖ **Lefroy, Sir J. H.**–Obituary notice of. General W. J. Smythe, late R.A., F.R.S. 4 pp. la. 8°. Woolwich, 1887. (*Proc. R. Artill. Institute.*, xv., *No.* 13.)

‖ **Lindelöf, L.**—Trajectoire d'un corps assujetti à se mouvoir sur la surface de la terre sous l'influence de la rotation terrestre. 60 pp., 1 plate, 4°. Helsingfors, 1887. (*Acta. Soc. Sc. Fenn*, xvi.)

* **Marshall, W.**—Atlas der Tierverbreitung. (Berghaus' Physikalischer Atlas, Abteilung vi.) 10 pp., 9 charts, f°. Gotha, 1887.

* **Mason, M.**—Aeronautica; or, sketches illustrative of the theory and practice of aerostation: comprising an enlarged account of the late aerial expedition to Germany. vii. + 355 pp., 6 plates, 8°. London, 1838.

Preussische Schlagwetter-Commission.—(Commission on Colliery Explosions.) Anlagen zum Haupt-Berichte. Bd. v. 1 vol., with plates, la. 8°. Berlin, 1887.

———.—(Commission on Colliery Explosions.) Haupt-Bericht. Erstattet im Namen der Commission durch **A. Hasslacher.** vi. + 259 pp. la. 8°. Berlin, 1887.

‖ **(R[ichards], G. H.)**—Obituary notice of Capt. Sir Frederick J. O. Evans, R.N., K.C.B. 7 pp. 8°. (*Proc. R. Soc.*, 1886, *No.* 242.)

* **"The Times"** register of events in 1887. clv. + 216 pp. 8°. London, 1888.

* **Thomson, Sir W., and Tait, P. G.**—Treatise on natural philosophy. Vol. I. part ii. New edition. xxvii. + 527 pp. 8°. Cambridge, 1883.

* **Todd, T. J.**—The book of analysis, or a new method of experience; whereby the induction of the *Novum Organon* is made easy of application to medicine, physiology, meteorology, and natural history; to statistics, political economy, metaphysics, and the more complex departments of knowledge. ii. + iv. + iii + 186 pp. la. 8°. London, 1831.

APPENDIX XVI.

METEOROLOGICAL OFFICE: ACCOUNT of RECEIPTS and PAYMENTS for the year ending 31st March 1888.

RECEIPTS.

	£ s. d.	£ s. d.
Balance from year 1886–87		2,382 8 9
Parliamentary Vote		15,300 0 0
Repayment of expenses charged under—		
(1.) Incidental expenses	14 18 1	
(2.) Special researches	14 7 8	
		29 5 9
SUPPLY OF INFORMATION:		
D.W. Charts and Forecasts	243 2 4	
6 p.m. Charts	25 0 0	
Information for Press Agencies, &c.	101 0 8	
Telegrams	241 19 8	
		611 2 8
SALE OF INSTRUMENTS, &c.:		
Royal Navy (A)	3 8 0	
Mercantile Marine account (B)	16 11 9	
		19 19 9
Commissions executed for Colonial and Foreign Institutions, &c. (C)		276 1 11
Commission charged on work done for Colonies, &c.		8 11 10
		£18,627 10 8

PAYMENTS.

	£ s. d.	£ s. d.
ADMINISTRATION:		
Payment of Council	1,000 0 0	
Secretary	800 0 0	
Salaries and wages	806 15 6	
Rent, fuel, and lighting	716 2 7	
Incidental and contingent expenses:—		
Attendance, cleaning, &c.	373 15 2	
Furniture and fittings	98 4 8	
Pensions	42 16 4	
		3,837 14 3
SPECIAL RESEARCHES		773 7 3
LAND METEOROLOGY:		
Observatories and stations	1,874 11 2	
Salaries: — Discussion and reduction of observations	1,299 18 0	
		3,174 9 2
WEATHER INFORMATION AND FORECASTS:		
Telegraphic reports and storm warnings	2,720 0 4	
Salaries:— Preparation and issue of reports and forecasts	1,659 13 3	
		4,379 13 7
INSPECTIONS:		
Salaries and travelling expenses		524 10 4
OCEAN METEOROLOGY:		
Salaries: —Discussion and reduction of observations	1,884 6 0	
Expenses incidental to the supply of instruments:—		
Proportion for care and issue of instruments	200 0 0	
Royal Navy	277 17 0	
Mercantile Marine	257 18 5	
Distant island and coast stations	79 13 7	
		2,699 15 0
Commissions executed for Colonial and Foreign Institutions, &c.		276 16 2
BALANCE:		
Cash at Bank	2,893 9 6	
„ at Office	67 15 5	
		2,961 4 11
		£18,627 10 8

APPENDIX XVII.

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

OFFICIAL.

No. 1. Report for 1867. Presented to Parliament. 1*s.*
2. Instructions for Meteorological Telegraphy. New Edition. (1883.) 6*d.*
3. Fishery Barometer Manual. (New edition, 1887.) 6*d.*
4. Charts of Surface Temperature, South Atlantic Ocean. 2*s.* 6*d.*
5. Report for 1868. Presented to Parliament. 5*d.*
6. Report for 1869. Presented to Parliament. 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 for 1870. Presented to Parliament. 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 the Part of the Atlantic lying North of 30° N., for the Eleven Days ending 8th February 1870. Price, with Book of Charts, 5*s.*
14. Quarterly Weather Report for 1871.—Parts I. to IV. 5*s.* each.
15. Report for 1871. Presented to Parliament. 10*d.*
16. Quarterly Weather Report for 1872.—Parts I. to IV. 5*s.* each.
17. Report for 1872. Presented to Parliament. 1*s.*
18. Contributions to our Knowledge of the Meteorology of the Antarctic Regions. 2*s.*
19. Quarterly Weather Report, 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. 1*s.*
22. Report for 1873. Presented to Parliament. 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 1888.] 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 for 1874. Presented to Parliament. 6*d.*

* The Meteorological Council have given away the copies which were placed at their disposal, but they can be purchased from the Publishers.

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. 24*s.*

28. Contributions to our Knowledge of the Meteorology of Japan. By Staff-Commander Thomas H. Tizard, H.M.S. *Challenger.* 1*s.*

29. Report for 1875. Presented to Parliament. 4*d.*

30. Quarterly Weather Report for 1875.—Parts I.—IV. 5*s.* each.

31. Report for 1876–7. Presented to Parliament. 3*s.* 5*d.*

32. A Discussion of the Meteorology of the North Atlantic during August 1873, with 31 Synoptic Charts. 15*s.*

33. Quarterly Weather Report for 1876 (New Series).—Part I., 6*s.*; Parts II., III., and IV., 5*s.* each.

*34. Contributions to our Knowledge of the Meteorology of the Arctic Regions. Vol. I.,—Part I., 2*s.*; Part II., 10*s.*; Part III., 6*s.*; Part IV., 5*s.*; Part V., 6*s.*

35. Report for 1877–8. Presented to Parliament. 1*s.*

36. Report of the Proceedings of the Meteorological Congress at Rome, 1879. 1*s.* 6*d.*

37. Report on the Meteorology of Kerguelen Island. By the Rev. S. J. Perry, S.J., F.R.S. 3*s.*

38. Report for 1878–9. Presented to Parliament. 5*d.*

39. Meteorological Observations at Stations of the Second Order for the year 1878. 20*s.*

40. Aids to the Study and Forecast of Weather, by the Rev. W. Clement Ley, M.A. 1*s.*

41. Report for 1879–80. Presented to Parliament. 1*s.*

42. Report for 1880–81. Presented to Parliament. 1*s.* 2*d.*

43. Charts of Meteorological Data for the Ocean District adjacent to the Cape of Good Hope, with accompanying Remarks. Price of the Charts, 25*s.*; of the Remarks, 7*s.*

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. Toynbee. 7*s.* 6*d.*

45. Meteorological Observations at Stations of the Second Order for the year 1879. 20*s.*

46. Report on the Storm of October 13–14, 1881. By Robert H. Scott, F.R.S. 1*s.* 6*d.*

47. Rainfall Tables of the British Isles for 1866–80. Compiled by G. J. Symons, F.R.S. 7*s.* 6*d.*

48. Report for 1881–2. Presented to Parliament. 1*s.*

49. Quarterly Weather Report for 1879. (New Series.) Appendices and Plates. 27*s.* Parts I., II., and III., 6*s.* each. (Part IV., in the Press.)

50. Quarterly Weather Report for 1880. (New Series.) Appendices and Plates. 28*s.*

51. Hourly Readings, 1881. (New Series.) Part I., 10*s.* 6*d.* Parts II., III., and IV., 21*s.* each.

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* The Meteorological Council have given away the copies which were placed at their disposal, but they can be purchased from the Publishers.

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

No. 52. Quarterly Weather Report for 1877. (New Series.) Appendices and Plates. 27*s.*; Part I., 10*s.*; Part II., 5*s.*; Part III., 4*s.* 6*d.*; Part IV., 6*s.*

53. Meteorological Atlas of the British Isles. 5*s.* 6*d.*

54. Hourly Readings, 1882. Parts I. and II., 20*s.* each. Part III., 22*s.* 6*d.* Part IV., 26*s.*

55. Quarterly Weather Report for 1878. (New Series.) Appendices and Plates. 28*s.*; Parts I., II., III., and IV., 6*s.* each.

56. Sunshine Records of the United Kingdom for 1881. 4*s.*

57. Meteorological Observations at Stations of the Second Order for the year 1880. 34*s.* 6*d.*

58. Report for 1882–3. Presented to Parliament. 10½*d.*

59. Sea Temperature Charts for the Atlantic, Pacific, and Indian Oceans. 21*s.*

60. Principles of Weather Forecasting. By the Hon. Ralph Abercromby, F.R.Met.Soc. (Second edition, revised), 2*s.*

61. The Barometer Manual for the Use of Seamen. 1*s.* 3*d.*

62. Monthly Weather Report, 1884. Jan., Feb., March, May—Nov., 1*s.* 6*d.* each. April (with 2 Appendices), 2*s.* 6*d.* Dec., 1*s.* 9*d.*

63. Hourly Readings, 1883. Parts I., II., and III., 21*s.* each. Part IV., 30*s.*

64. Report for 1883–4. Presented to Parliament. 1*s.* 2*d.*

65. Monthly Weather Reports for 1885. Jan. to Dec. 1*s.* 6*d.* each.

66. Meteorological Observations at Stations of the Second Order for the year 1881 35*s.*

67. Report for 1884–5. Presented to Parliament. 4*s.* 4*d.*

68. Monthly Weather Reports for 1886. Jan. to Dec., 1*s.* 6*d.* each.

69. Meteorological Observations at Stations of the Second Order for the year 1882. 35*s.*

70. Hourly Readings, 1884. Part I., 12*s.*; Part II., 10*s.*; Part III., 10*s.* 6*d.*; Part IV., 15*s.*

71. Synchronous Weather Charts of the North Atlantic and the adjacent Continents. Aug. 1, 1882 to Sept. 3, 1883. Parts I., II., III. and IV. (33 sheets each.) 17*s.* each.

72. Report for 1885–86. Presented to Parliament. 8*d.*

73. Meteorological Observations at Stations of the Second Order for the year 1883. 30*s.*

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* The Meteorological Council have given away the copies which were placed at their disposal, but copies can be purchased from the Publishers.

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