

R E P O R T
OF THE
METEOROLOGICAL COUNCIL

TO THE
ROYAL SOCIETY,

For the Year ending 31st of March 1881.

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



L O N D O N :
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THE METEOROLOGICAL COUNCIL

1880-81.

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ROYAL SOCIETY,
For the Year ending March 31, 1881.

THERE has been no change in the Council during the year, and the executive of the Office is the same as before, Mr. R. H. Scott, F.R.S., being the Secretary and Captain H. Toynbee, F.R.A.S., the Marine Superintendent.

In the last Report it was stated that the Council had sanctioned the acceptance by Mr. Scott of the honorary post of Secretary to the International Meteorological Committee, appointed by the Congress held at Rome in 1879, to facilitate the maintenance of combined action between the meteorological systems of different countries.

In that capacity he attended a meeting of the Committee which took place at Berne in the month of August 1880, and of which the Report will shortly appear, the English edition having been prepared in the Office, with the sanction of the Council.

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.—The methods followed by the Office in collecting and tabulating the observations relating to Marine Meteorology have undergone no change. A concise account of these methods will be found in Appendix I. (p. 36). Collection and tabulation of observations.

Appendix II. (p. 40) contains a list of all the observers who have contributed “excellent” logs during the past year. Some of the observers have regularly co-operated with the Office for

Presentation
of charts to
observers.

many years; the names which now appear in the list for the first time are as follows:—

Captain's Name.	Ship.
Aldrich, Pelham, R.N.	H.M.S. "Sylvia."
Bainbridge, W.	S.S. "Nubian."
*Balfour, Andrew, R.N.	H.M.S. "Magpie."
†Barker, D. W.	"Superb."
Bar, Bonham W., B.N. (the late)	H.M.S. "Sylvia."
Berridge, Henry	"Superb."
Blacklin, Richard James	S.S. "Wyberton."
Bourke, Edmund, R.N.	H.M.S. "Gannet."
Campbell, James	"Hope."
Candler, William	"Decapolis."
Crutchley, William Caius, R.N.R.	S.S. "African."
‡Goulden, G. H. N.	S.S. "Baltic."
Gubbins, George William, R.N.	H.M.S. "Sylvia."
*Havergal, A., R.N.	Ditto.
§Helby, Edward Capel Hasler, R.N.	Ditto.
Hoskyn, Richard Fraser, R.N.	Ditto.
Jones, S. Griff	"Victoria Nyanza."
†Kirkpatrick, John	S.S. "Strathleven."
Ladd, Richard	S.S. "Nubian."
Legg, William	"Star of Greece."
§Loane, Arthur Jabez, R.N.	H.M.S. "Sylvia."
McKenzie, Allan	"Candahar."
Mitchell, Thomas	S.S. "Ethiopia."
Murray, Alexander	S.S. "Windward."
Nicholson, Malcolm	"John Rennie."
Olver, William	"Prince Hassan."
Parsell, Henry	S.S. "Baltic."
Parson, George Fry	"Astarte."
Powell, Charles Atherton F.	S.S. "Lusitania."
Smith, J.	"Naiad."
Spalding, Hinton	"Doehra."
Swan, John	"City of Madrid."
Thorne, J. W.	"British Commodore."
Youlden, H.	"Chin Yang."

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

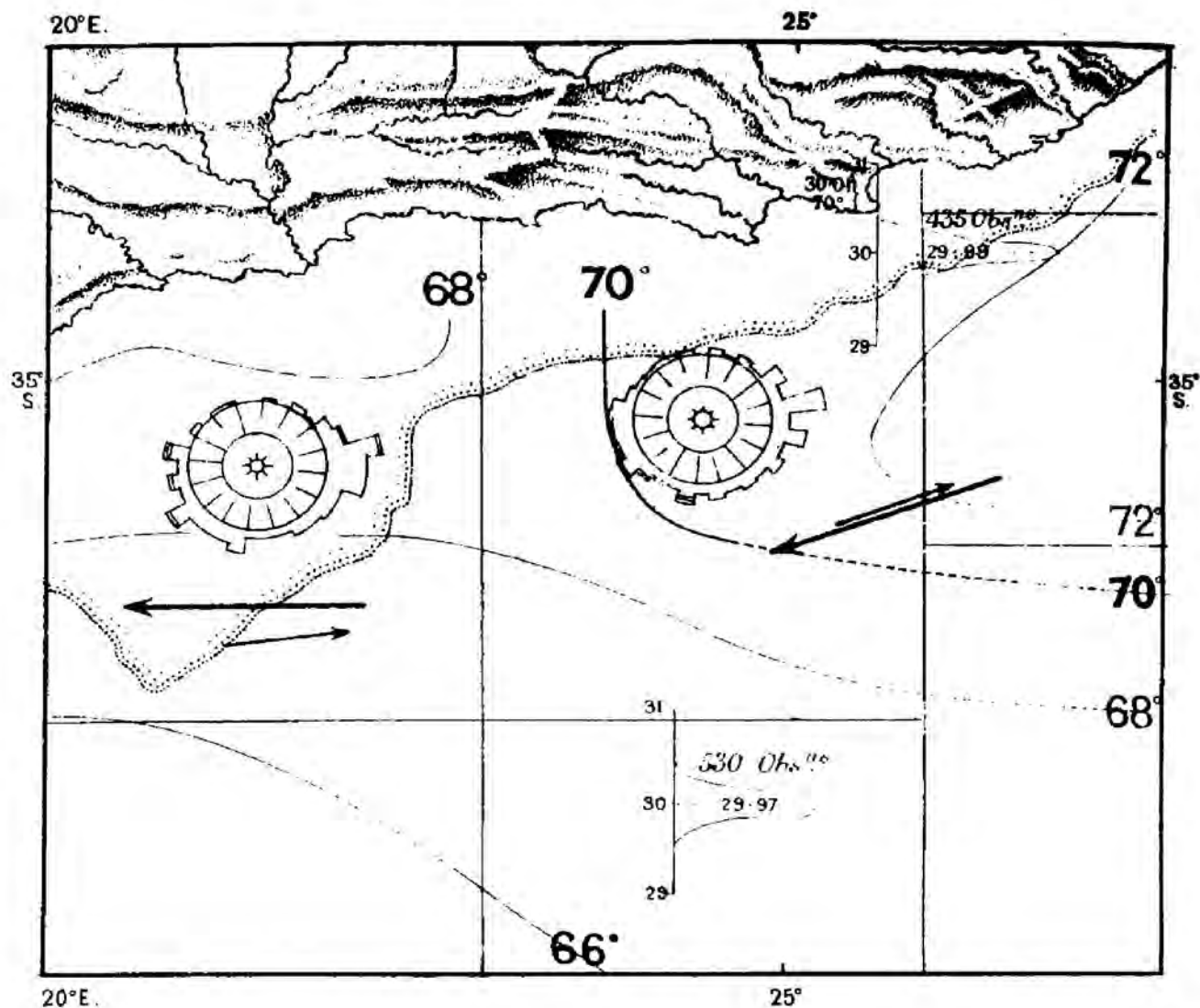
The following is the total number of logs received from April 1, 1880, to March 31, 1881, and the number of logs which have been classified as "excellent":—

Total No. of Logs received.	No. of Excellent Logs.	Per-centage of Excellent Logs.
159	115	72

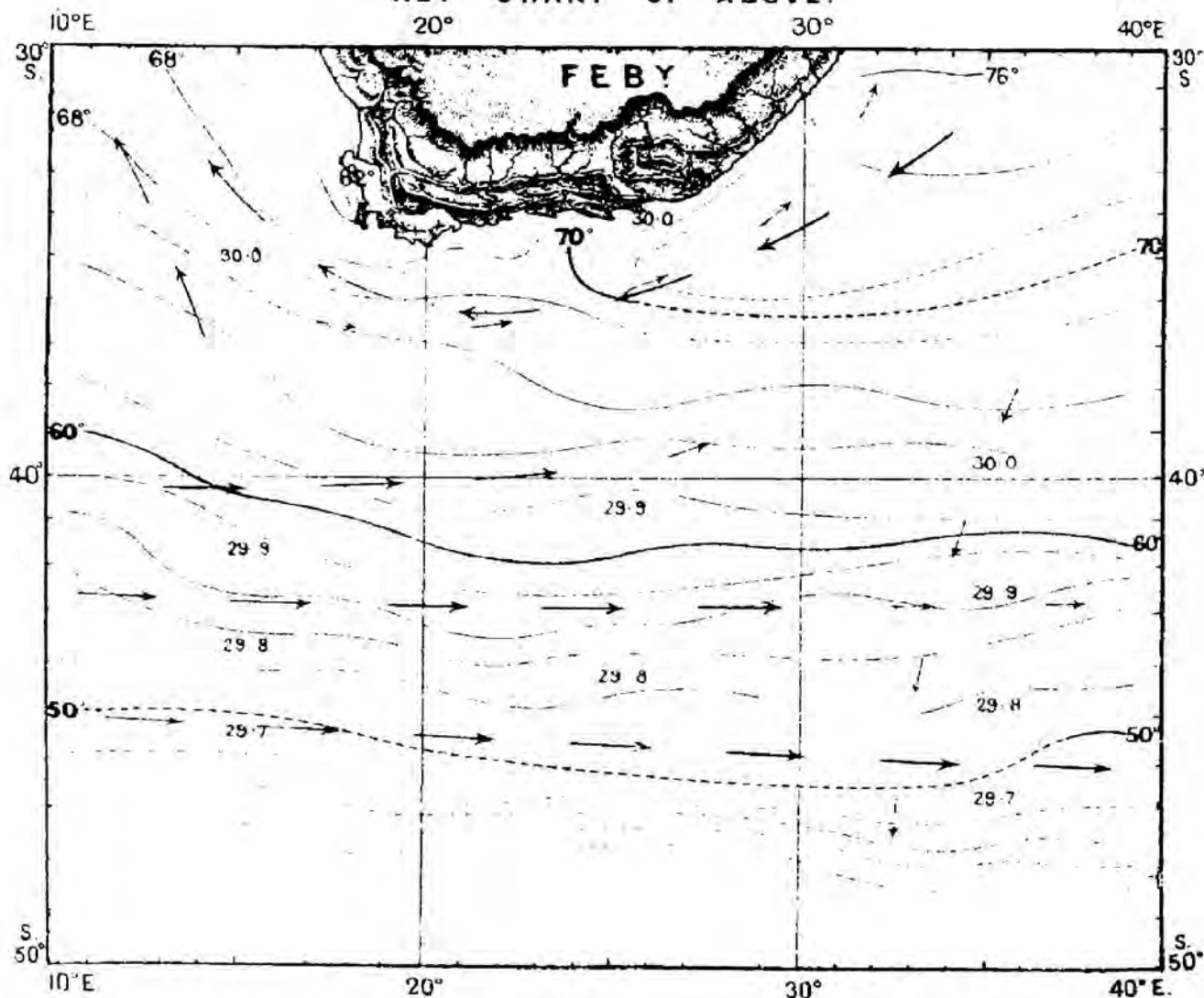
The average number of logs received annually during the five years, 1875–9, was 117, and the per-centage of excellent logs among these was 69.

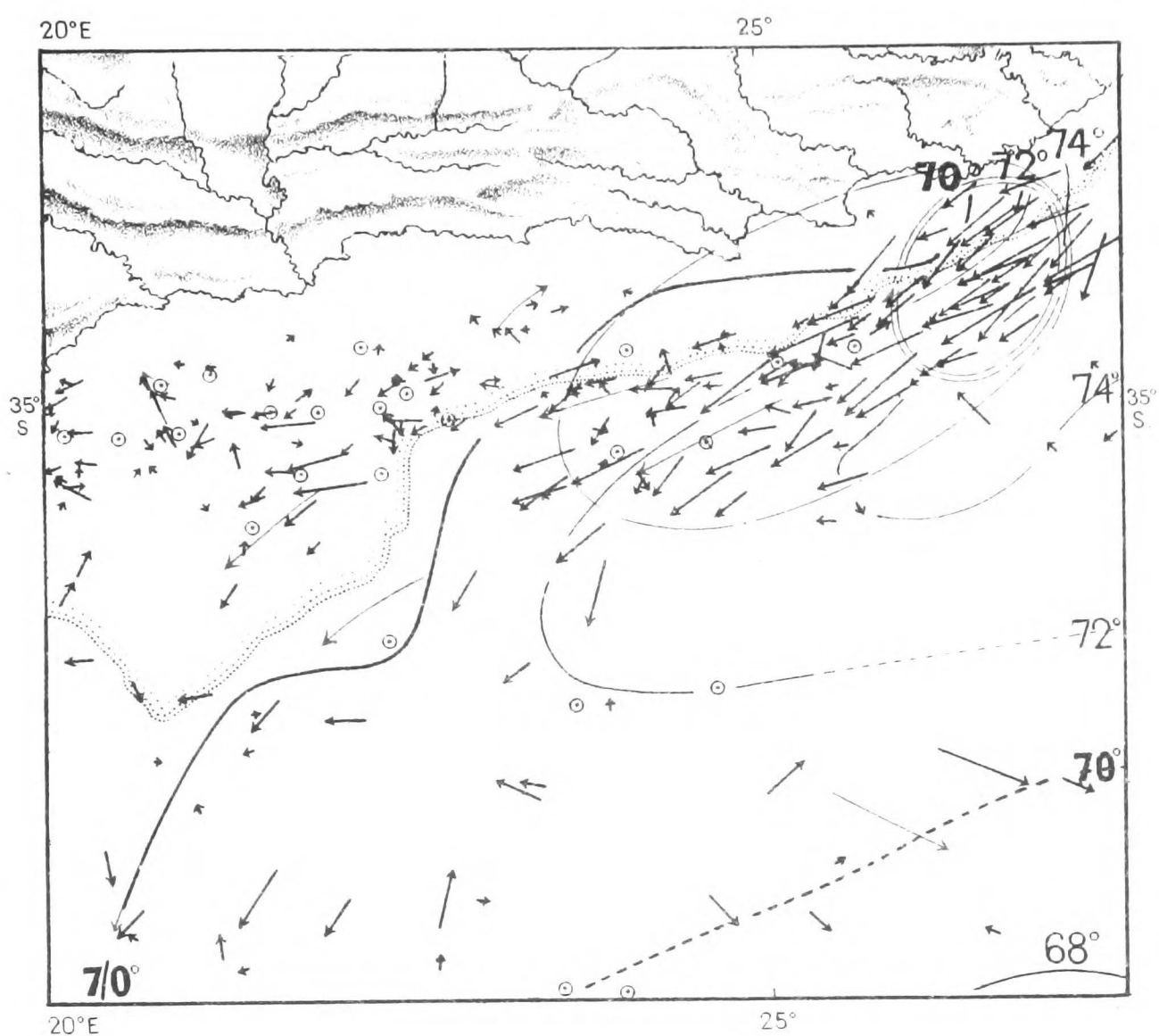
The Council take this opportunity of expressing their best thanks to the observers who have assisted them during the past year.

* Lieutenant. † Second Officer. ‡ Third Officer.
§ Sub-Lieutenant. || Chief Officer.

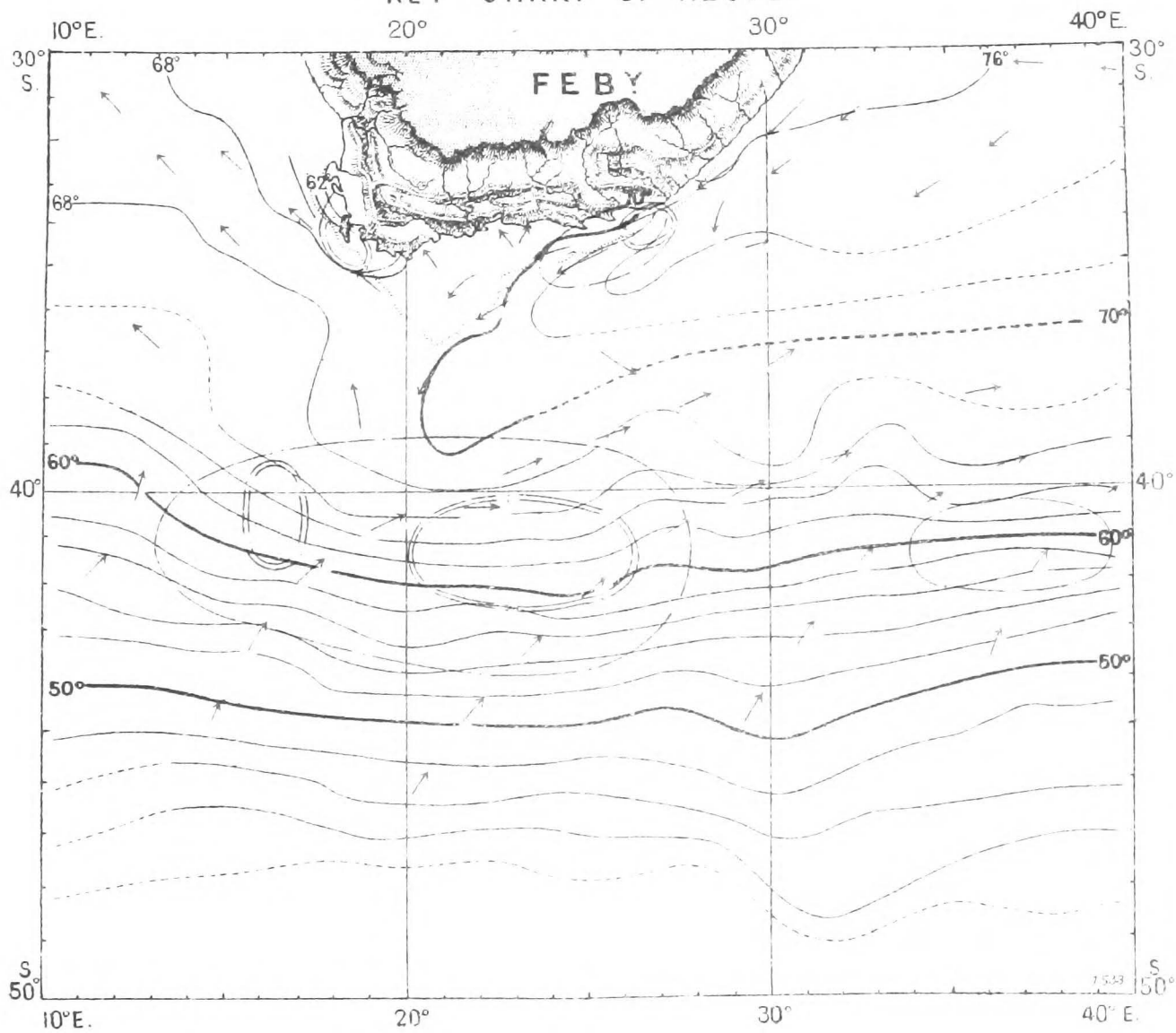


KEY CHART OF ABOVE.





KEY CHART OF ABOVE.



On the 31st of March 1881 the ships carrying instruments supplied by the Office were pursuing the following voyages:—				Districts from which observations are obtained.
To Baffin's Bay or Greenland	-	-	4	
„ North America, East Coast	-	-	14	
„ „ „ West „	-	-	10	
Off East Coast of North America	-	-	3	
To South America, East Coast	-	-	4	
„ „ „ West „	-	-	7	
„ Australia and New Zealand	-	-	17	
„ India, viâ Cape of Good Hope	-	-	10	
„ China Seas, viâ Cape of Good Hope	-	-	8	
„ „ „ Suez	-	-	6	
„ Mediterranean Ports	-	-	1	
„ Cape of Good Hope	-	-	5	
„ East Indies, viâ Suez	-	-	1	
Total number of ships				
	-	-	90	

Appendix III., p. 42, supplies a list of the logs and of all the documents from stations abroad received at the Office during the year.

The Discussion of the Meteorology of the district lying near the Cape of Good Hope.—The discussion of the mean meteorological elements of the six ten-degree squares lying near the Cape of Good Hope, has occupied much attention during the past four years, and is now completed. The charts are in the hands of the printer, and will be published in the course of the summer.

The principle of their construction is new in some respects; and small portions are annexed as specimens.

The series consists of—

A. Twenty-four large monthly charts, in twelve pairs, one pair for each month. These contain the original observations in as much detail as is practicable. They also contain generalized results printed in a different colour. Each pair of charts lies face to face in the volume; the chart to the left, when the book is opened, refers to wind, air-temperature, and pressure; the chart to the right refers to currents and sea surface temperature. (See the upper halves of the accompanying specimen pages, Plates I. and II.).

B. Two index charts for the whole year, face to face, to match with the above-mentioned set. They are divided into compartments, each of which contains on a small scale the generalized results only. (See the lower halves of the specimen pages, Plates I. and II.)

C. Quarterly charts, in tabular compartments, of the specific gravity of sea water, of the distribution of floating ice, and of the times taken by different ships to traverse the district.

The general method by which the wind observations are treated was explained in some detail in the Report for 1879, pp. 7 and 22. The essential features are that they are grouped in natural areas, and not, as usual hitherto, between arbitrary limits of latitude and longitude, and that they are weighted before they are combined statistically.

Treatment of wind observations.

"Weighting."

The object of the weighting is to avoid, at least in some degree, the over-estimation of adverse winds, due to the fact that an adverse wind keeps a ship for a long time in nearly the same position, and is therefore more frequently recorded than a favourable wind. The weighting is effected by assigning the same value 10, to all the observations made by any one ship in the same day in the same one-degree square. If the ship has met with winds from different directions, the number 10 is divided and assigned to the different winds as nearly as may be in the true proportion, without using decimals. If all the observations record the same wind, then the whole of the 10 is entered under that wind.

"Natural areas."

The total number of weighted observations in each one-degree square is put on a map, so as to show at a glance their frequency in different parts of the area under discussion. The natural areas are then formed by grouping together, at first provisionally, those adjacent one-degree squares in which the conditions of the wind appear to be similar, and in which the observations are sufficiently numerous for statistical use.

Wind roses.

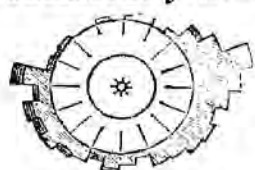


FIG. 1.

The form of the wind-rose is new; a specimen is given in Fig. 1, but the principle of its construction will be better understood by the help of Figs. 2 and 3.

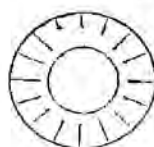


FIG. 2.

The shaded portions of Fig. 2 refer to wind direction and to calm. They consist of a central circular speck, C, which is proportional to the frequency of calms, and of a large irregularly shaped figure, A, disposed in sectors of various lengths around a circle, to show the frequency with which the winds blow from different directions.

The shaded portions are so drawn that (1) the sum of the areas of A and of C is the same in every wind-rose; (2) the area of C as compared to the sum of the areas of A and C, is as the number of calms observed to the total number of observations; and (3) the area of that part of which is intercepted between any two compass bearings, say N.E. and E., is to the sum of the areas of A and C, as the number of times in which the wind has been observed to blow between N.E. and E. is to the total number of observations.

The scale used in drawing the wind-roses was constructed on the following principle: 32 radiating lines were drawn towards the 32 points of the compass, including as many equal sectors. A series of concentric circles was then drawn, dividing the sectors into compartments of uniform area, each equal to two hundredth parts of the entire area of a wind-rose. The relative frequency of the different winds was calculated in percentages, and the results were plotted to scale, taking each compartment as the equivalent of .1 per cent. As regards the force of the wind, the cases in which it reaches a gale (that is, exceeds force 7) have been separated from the rest. The frequency of the gales is

shown by the darkly shaded tips to the wind-rose (see Fig 1). Wind roses. The gales bear the same proportion to the other winds that the

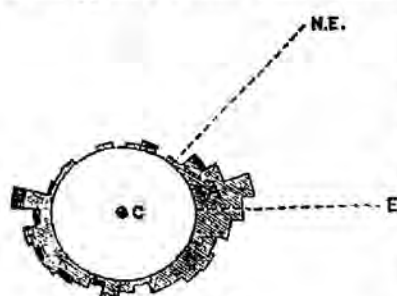


FIG. 3.

darkly shaded part of the rose bears to the less darkly shaded part. The mean force of the winds from each point of the compass that fall short of gales is shown by the length of the radiating lines opposite to that point, Fig. 3. The scale on which they are drawn is such that a line reaching the whole way from the circumference of the circle to the centre would have the value of force 10, and one

reaching to the half-way circle would have the value of force 5. As all wind exceeding force 7 has been excluded, the mean of the remainder can never exceed 7, and will usually fall much short of that amount.

The number of observations is indicated roughly by marks, or the absence of a mark, in the middle of the rose, just outside the central circle of calms. A star, such as that in Fig. 1, means that the number of observations on which the rose is founded exceeds 100. A cross would signify that it lay between 50 and 100, and the absence of any mark at all would show that it was less than 50.

The data comprised in each wind-rose will be published independently, in a tabular form.

The general motion of the air currents, as shown by the wind-roses, is indicated in the charts by arrows. Where there is more than one considerable current, the less important one is shown by a fainter or smaller arrow. Generalized wind arrow.

The air temperatures are shown by isotherms, dotted wherever the data are inadequate to justify their being drawn with a firm line, the line being continuous wherever the data are inadequate, and dotted where they are insufficient. Air temperatures.

The barometric results are not given in the ordinary form of isobaric lines, which would fail to show the striking increase in the district under discussion of barometric range and variability with increasing latitude. Diagrams of barometric frequency.

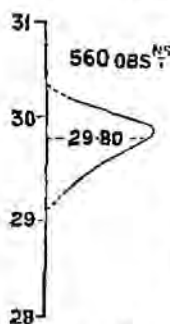


FIG. 4.

Diagrams of barometric frequency are used in their place, as shown in Fig. 4. The scale on the left represents that of the barometer, and the ordinate of the curve at any scale reading is proportionate to the frequency at which the barometer has been observed to stand at that height. The space enclosed by the curve is constant in all the diagrams, so that their ordinates are comparable with one another, and the relative frequency at which the barometer stands at the same height in different parts of the district can also be learnt from them. These diagrams are placed at intervals over the chart, so as to afford a fair representation of the distribution and range of barometrical readings over the whole district.

**Current
arrows.**

In the charts of Ocean Currents and Sea Surface Temperature, arrows indicating the mean of the current observations taken by each ship in each 24 hours are inserted at the position occupied by the ship at noon, and the length of the arrow is proportional to the strength of the current. The general direction of the currents is shown by bolder arrows.

**Sea-surface
isotherms.**

The isotherms of sea-surface temperature are shown in black. The regions where considerable range of temperature is met with are enclosed in blue lines.

Index charts.

The first of the two index charts gives the generalized wind arrows, the isotherms, and mean barometrical readings. The second gives the generalised current arrows, the isotherms of sea-surface temperature, and the regions of considerable range of temperature.

**Sea tempera-
ture charts of
the Pacific
Ocean,**

Sea Surface Temperature Charts.—The Charts of the Pacific Ocean for the four representative months (February, May, August, and November), referred to in the last Annual Report (p. 7), have been completed. The charts for the months of May, August, and November show a marked similarity in the contour of the lines of equal temperature. In the month of February, however, in which the temperature of the sea surface as a whole is low, a decided change appears in the form of the thermal curves.

**of the Indian
Ocean,**

Charts of the Indian Ocean on the same scale for the same months, and therefore comparable with those constructed for the Pacific, are in preparation, and it appears from them that in the month of August the band of warm water which extends across the Pacific near the Equator, as explained in the last Report, can be traced through the East Indian Archipelago, and westward into the Indian Ocean as far as the meridian of 55° E., where it meets the cool water on the eastern Coast of Africa. In breadth it extends from the shores of British India to the parallel of 10° South Latitude, its temperature varying from 80° to 85° (F.). In the month of February this band of warm water extends completely across the Indian Ocean to the Coast of Africa, its influence being felt as far south as the 20th parallel.

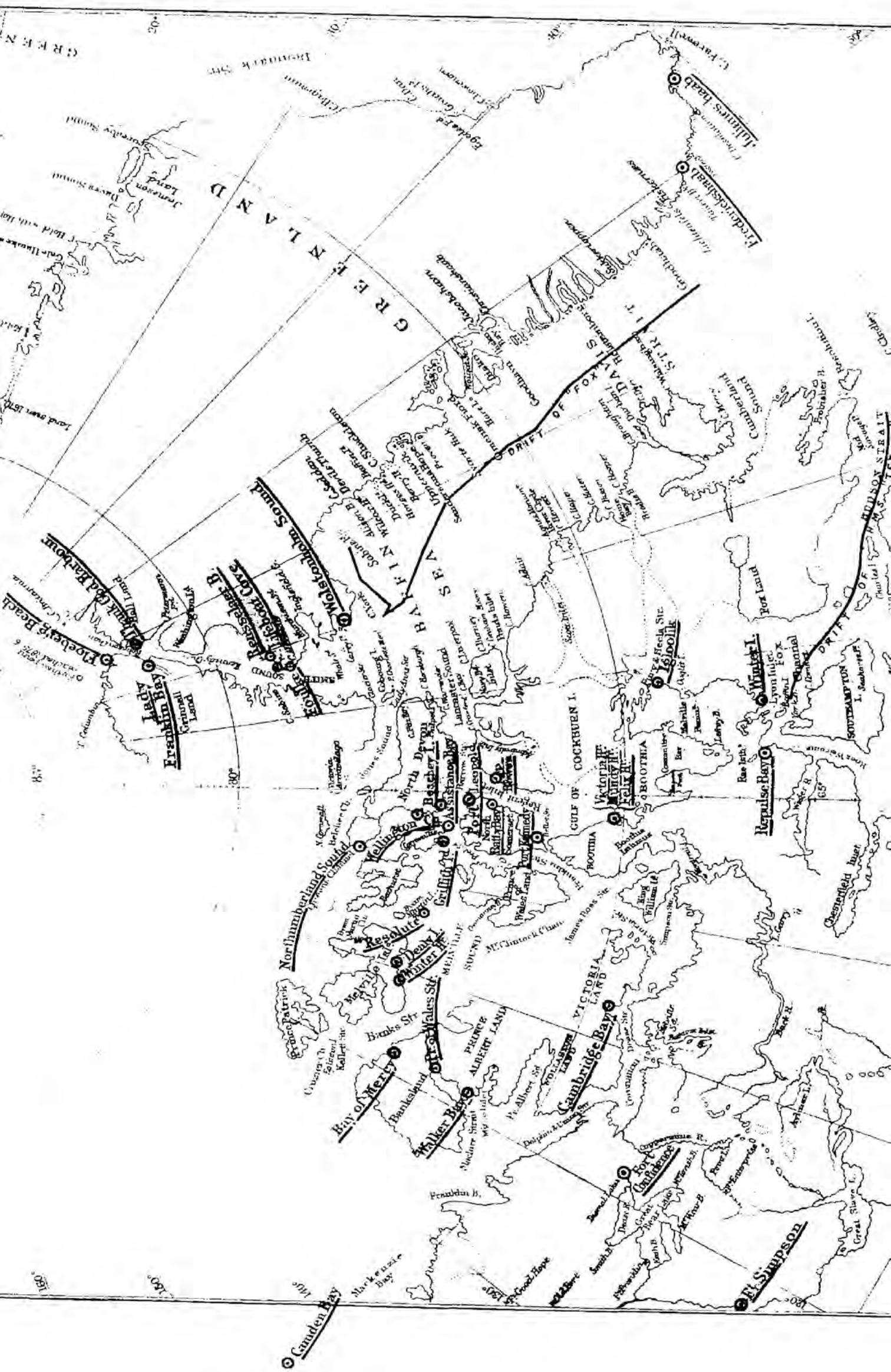
**of the Atlantic
Ocean.**

The Council have resolved to extend the investigation to the Atlantic Ocean, and the Charts for that region are already far advanced.

The Sea Surface Temperature Charts for the three great oceans and for the four cardinal months of the year will probably be completed within the present year.

**Arctic
Meteorology.**

"Contributions to our Knowledge of the Meteorology of the Arctic Regions."—An account of the general plan of these Contributions appeared in the last Report. Since the date of that Report the Second Part, which relates to the records of ships frozen in, has been completed and published. The following is a list of the expeditions, the records of which have been employed in Part II., together with a revised list of the expeditions the records of which it is proposed to discuss in Part III. A map of the



SHOWING THE STATIONS FOR WHICH DATA ARE GIVEN IN PARTS I, II, AND III.
OF "CONTRIBUTIONS TO OUR KNOWLEDGE OF THE METEOROLOGY OF THE ARCTIC REGIONS."



district to which the observations refer is repeated from the Arctic meteorology Report of last year (Plate III.) :—

Wintering Stations.	Ships.	Commanders.	Year.	What Information has been published.
Boothia	"Victory"	Sir John Ross	1829-32	27 months' hourly observations.
Hudson's Strait	H.M.S. "Terror"	Sir G. Back	1836-7	12 " two-hourly "
Griffith Island	H.M.S. "Resolute"	Sir H. Austin	1850-1	12 " do. "
Assistance Bay	"Lady Franklin"	W. Penny	1850-1	12 " four-hourly "
Northumberland Sound.	H.M.S. "Assistance"	Sir E. Belcher	1852-3	12 " two-hourly "
Do.	H.M.S. "Pioneer"	Sherard Osborn	Do.	12 " do. "
Wellington Channel	H.M.S. "Assistance"	Sir E. Belcher	1853-4	12 " do. "
Do. do.	H.M.S. "Pioneer"	Sherard Osborn	Do.	12 " do. "
Baffin's Bay	"Fox"	Sir F. Leopold M'Clintock.	1857-8	9 " four-hourly "
Port Kennedy	Do.	Do. do.	1858-9	12 " do. "
Melville Island	H.M.S. "Hecla" and "Griper."	Sir W. E. Parry	1819-20	Abstracts published in Parry's first, second, and third voyages.
Lyon's Inlet	H.M.S. "Fury" and "Hecla."	Do. -	1821-2	
Igloodik	Do. do.	Do. -	1822-3	
Port Bowen	H.M.S. "Hecla" and "Fury."	Do. -	1824-5	Mean monthly temperatures published in the "Last of the Arctic Voyages."
Port Leopold	H.M.S. "Enterprise" and "Investigator."	Sir James Ross	1848-9	
Wolstenholme Sound	H.M.S. "North Star"	J. Saunders	1849-50	
Walker Bay	H.M.S. "Enterprise"	Sir R. Collinson	1851-2	Nothing published.
Cambridge Bay	Do.	Do.	1852-3	
Camden Bay	Do.	Do.	1853-4	
Prince of Wales's Strait.	H.M.S. "Investigator"	Sir R. McClure	1850-1	Monthly means of Meteorological elements are given in Sir W. Armstrong's "Personal Narrative."
Mercy Bay	Do.	Do.	1851-2	
Do. do.	Do.	Do.	1852-3	
Dealy Island	H.M.S. "Resolute" and "Intrepid."	Sir H. Kellett	1852-3	Abstracts in Capt. McDougall's "Voyage of the 'Resolute.'"
Melville Sound	Do. do.	Do.	1853-4	
Beechy Island	H.M.S. "North Star"	W. J. S. Pullen	1852-3-4	
Floeberg Beach	H.M.S. "Alert"	Sir G. S. Nares	1875-6	Nothing published.
Lady Franklin Sound.	H.M.S. "Discovery"	H. F. Stephenson		
Drifting in the pack.	"Advance" and "Rescue"	E. J. De Haven, U.S.N.	1850-1	Published as a Parliamentary Paper, [C. 2176.] Session 1878.
Rensselaer Harbour.	"Advance"	E. K. Kane, M.D., U.S.N.	1853-4-5	
Port Foulke	"United States"	Isaac J. Hayes, M.D., U.S.N.	1860-1	Abstract log in "U.S. Grinnell Expedition," by E. K. Kane, M.D. Meteorological Abstracts in "Arctic Explorations," by E. K. Kane, M.D., and discussed in "Smithsonian Contributions to Knowledge, No. 104."
Thank God Bay	"Polaris"	C. F. Hall	1871-2	
Life Boat Cove	"	S. O. Buddington	1872-3	

Part II

Part III.

The Council believe that the foregoing list exhausts the catalogue of British and United States expeditions wintering in the area under discussion.

Considerable progress has been made in the preparation of the data for Part III. The documents which have been consulted for H.M.S. "Enterprise" are the ship's log, obtained from the Hydrographic Office, the Master's log obtained from the Record Office, the Captain's private journal, and the Meteorological Journal for the first wintering, these latter two kindly lent to the Office by Admiral Sir R. Collinson. The ship's log of H.M.S. "North Star," Captain W. J. S. Pullen, has been obtained from the Record Office.

Sea Temperature Observations round the Coasts of the British Islands.—The results for the year ending June 30, 1880, of these observations, which, as stated in the last Report, have been carried on with the courteous assistance of the Admiral Superintendent of Naval Reserves, the Trinity House, and the Com-

Sea temperatures round the British Isles.

Sea temperatures round the British Isles.

missioners of Irish Lights, have now been discussed, and it is proposed that the mean values for the two years during which the system has been maintained should appear in the Meteorological Atlas of the British Isles which the Office, as will be explained hereafter, has undertaken to prepare. The number of stations is 48, of which 20 are lightships and 28 coastguard stations. A chart, showing their distribution round the coasts of Great Britain and Ireland, was given in the last Annual Report. The Council hope, with the consent of the above-named authorities, to continue this useful system of observations throughout the year 1881-2.

Stations in Cyprus.

Meteorological Stations in Cyprus.—In the course of the year 1879 an application was received through the Foreign Office from the High Commissioner of Cyprus for a supply of instruments, with a view of establishing meteorological stations in that island. Under the exceptional circumstances of the case the Council felt themselves justified in acceding to this application, and a certain number of stations are now in operation, the requisite outfit of instruments and forms having been forwarded in 1880.

Instruments belonging to the Office.

Supply and Stock of Instruments.—In Appendix IV. (p. 55) 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 1881.

Appendix V (p. 56) 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.

Reporting stations.

Telegraphic Reporting Stations.—The communication with the stations has been maintained with some interruptions in the case of a few stations during the year. The four cables to the Shetlands, Hebrides, Scilly, and the Channel Islands all suffered damage to a greater or less extent; and in the case of the two first-named lines the enforced cessation of communications for four months in the winter was productive of serious inconvenience not only to the British system of weather telegraphy, but also to that of all the countries of Northern Europe, which depend on reports from Sumburgh Head and Stornoway to show the earliest signs of Atlantic storms threatening the North Sea.

The recent modifications in the issue of forecasts, as well as the change in the time of the simultaneous observations taken at the request of the United States Government, both of which will be explained subsequently, have taken away the ground for the change in the hour of the first afternoon observation mentioned in the last report. From Jan. 1, 1881, this observation has been taken at 2 p.m. Greenwich time as formerly.

A list of the telegraphic reporters will be found in Appendix VI.

(p. 57). The only changes during the year have been the substitution of Mr. Keeping for Dr. Purves at York, Mr. T. MacGowan for his brother at Donaghadee, of Mr. Phillips for Mr. Harding at Parsonstown, Mr. John for Mr. Blackler at Prawle, and of Messrs. Blake and Baker for Mr. Walker at St. Ann's Head. Reporting stations.

Inspection of the Reporting Stations.—The reporting stations have been inspected during the year, in England (including Jersey and the Isle of Man) by the Rev. W. C. 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 VII. (p. 58), show that the efficiency of the service has been adequately maintained. Inspection of the stations.

Discussion and Publication of the Information received.—A description of the practice of the Office in the collection, discussion, and dissemination of the meteorological information received by telegraph is given in Appendix VIII. A list of the institutions and persons who received the Daily Weather Charts free of cost in 1880 forms Appendix IX. (p. 77). Discussion of the reports.

Weather Forecasts.—A complete change in the system of issue of the forecasts has been effected during the year. Forecasts.

The 8 p.m. forecasts were at first maintained at the sole cost of the "Times," which continued to publish them exclusively until May 1879, when the "Standard" and "Daily News" joined, the charge to each being fixed at 300*l.* per annum, at which rate it was agreed that any newspapers subsequently wishing to participate should be admitted.

Application having been made to the Treasury on the part of the press for a reduction of these terms, the Council, with the concurrence of the Treasury, undertook as a tentative measure to supply the evening forecasts to London papers at a charge of 25*l.* per annum, and to country papers at the same price in addition to the cost of telegraphy, the Treasury on its part undertaking to make good to the Office any loss which might be incurred.

This system began in August 1880, and continued in operation up to the end of the year, about 40 papers receiving the 8 p.m. forecasts on the terms stated.

In December the Treasury, after communication with the Council, arrived at the conclusion that it would be for the public advantage to issue these Forecasts gratis to all papers which would send for them to the Office; and to enable the Council to carry this arrangement into effect increased the annual grant to the Office by 500*l.* As this increase falls considerably short of the amount (900*l.*) which had been received from the three subscribing newspapers, the Council modified their arrangements for the Forecasts so as to reduce the cost. The public issue of the afternoon Forecasts has been discontinued, and at the present time (April 1881) Forecasts are only issued twice a day, at 11 a.m. and at 8h. 30m. p.m. The Forecast prepared at 11 a.m. on the information derived from the 8 a.m. reports is posted up in several public places communicated gratis to newspapers.

Forecasts
communicated
gratis to
newspapers.

in London,* and supplied to the afternoon editions of the newspapers. The 8 p.m. Forecast is at present supplied to the public through the newspapers only. The number of papers which publish this forecast is at present 94.

The additional information afforded to the public by the appearance of the Forecasts in many of the daily papers has naturally reduced the number of special inquiries. The inquiries received through the Post Office during the year amounted to 136, and the personal applications 51, being not quite one half as many as in the previous year. The rules of the Office relating to such inquiries continue the same as in previous years.

Testing of
the forecasts.

The results of a comparison of the Forecasts issued at 8 p.m. during the year with the weather actually experienced is given in Appendix XII., p. 83, and the following summary shows that the average of success over the whole United Kingdom has been 75 per cent. The district of Scotland (West), giving the lowest percentage, and that of England (South) the highest:—

SUMMARY OF RESULTS.

Districts.	Percentages.				Total per-centage of Success.
	Complete Success.	Partial Success.	Partial Failure.	Total Failure.	
SCOTLAND, N. -	39	38	15	8	77
" E. - -	35	42	16	7	77
ENGLAND, N.E. -	33	40	19	8	73
" E. - -	35	41	16	8	76
MIDLAND COUNTIES -	34	44	15	7	78
ENGLAND, S. - -	41	41	11	7	82
SCOTLAND, W. - -	30	38	20	12	68
ENGLAND, N.W. -	35	38	18	9	73
" S.W. -	36	39	16	9	75
IRELAND, N. - -	32	39	19	10	71
" S. - -	35	38	15	12	73
Summary - - -	35	40	16	9	75

Hay harvest
forecasts.

Hay Harvest Forecasts.—The Council in continuation of their endeavour to test the usefulness of the forecasting system, renewed the proposal which they had made in 1879 to the Royal Agricultural Society, the Royal Dublin Society, and the Highland Society to send daily Forecasts *gratis* during the hay season to a number of observers selected by the Councils of those Societies, on the two conditions, that the information should be made as widely known as possible, and that a record should be kept of the value of each prediction and sent in weekly to the Office. The Societies again

* Viz., in the City, at the Mansion House, at Lloyd's Rooms, and at Messrs. R. & J. Beck's, Cornhill; in the West End, in the Libraries of the House of Lords and House of Commons, at Messrs. Elliott's, Strand, Messrs. Stanford's, Charing Cross, Messrs. Negretti & Zambra's, Regent Street, and Messrs. Pastorelli's, New Bond Street.

cordially accepted the proposal, and the following list of recipients was prepared:—

Hay harvest forecasts.

LIST of those who received HAY HARVEST FORECASTS in 1880.

Districts.	To whom sent.	Address.
0. SCOTLAND, N.	Rev. Dr. Joass - J. R. Mitchell -	Golspie. Drynie, Inverness.
1. SCOTLAND, E.	J. Armand - G. Johnstone (for the Earl of Strathmore). - W. S. Macdonald -	Inverurie. Glamis, by Forfar. Craigielaw, Longniddry.
2. ENGLAND, N.E.	J. Wilson - J. Turner -	Woodhorn Manor, Morpeth. The Grange, Ulceby, Lincolnshire.
3. ENGLAND, E.	J. B. Lawes, F.R.S. -	Rothamsted, Harpenden.
4. MIDLAND COUNTIES	W. T. Carrington - Prof. E. W. Prevost - C. King (for the Duke of Somerset, K.G.) -	Croxden Abbey, Uttoxeter. Roy Agr. College, Cirencester. Gerrard's Cross, Bucks.
5. ENGLAND, S.	C. Whitehead - E. P. Squarey -	Barning House, Maidstone. The Moot, Downton, Wilts.
6. SCOTLAND, W.	C. H. H. Wilsone, of Dalnair. - J. S. R. Ballingal - J. Chisholm -	Endrick Bank, Drymen Ballabus House, Islay. Chapel Rossan, Strathraer.
7. ENGLAND, N.W.	G. W. Wray - F. Harrison (for the Earl of Derby). - D. R. Davies (the late) -	Leyburn, Yorkshire. Knowsley Hall, Prescott. Agden Hall, Lymm, Warrington.
8. ENGLAND, S.W.	J. Harle (for the Earl of Ducie). - T. Dyke - R. Neville -	Whitfield, Falfield, R.S.O., Gloucestershire. Long Ashton, Clifton, Bristol. Butleigh Court, Glastonbury.
9. IRELAND, N.	J. Simson -	Cloona Castle, Ballinrobe.
10. IRELAND, S.	D. A. Milward -	New Ross.

The general result of this repetition of the experiment of 1879 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:—

The table shows that a percentage of successes has been attained, varying from 56 in "Ireland N." to a little above 80 in "Scotland E.," "England E.," and the Midland Counties, 86 in "England S. W.," and 90 in "Scotland N." The percentage of completely successful forecasts is somewhat smaller than last year, and that of partial successes is higher, while the proportion of

Test applied to them.

Test applied
to the hay
harvest
forecasts.

total failures is lower. The average is therefore about the same as it was in 1879.

SUMMARY of RESULTS.

Districts.	Names of Stations.	Percentages.				Total percentage of Success.
		Complete Success.	Partial Success.	Partial Failure.	Total Failure.	
SCOTLAND, N.	Golspie and Drynie - - -	48	42	8	2	90
" E.	Inverurie, Glammis, and Longniddry -	52	29	16	3	81
ENGLAND, N.E.	Morpeth and Uleaby - - -	39	31	24	6	70
" E.	Rothamsted (two observers) - -	44	40	12	4	84
MIDLAND COUNTIES	Uttoxeter, Cirencester, and Gerrard's Cross (Bucks).	49	34	15	2	83
ENGLAND, S.-	Maidstone and Downton - - -	32	41	22	5	73
SCOTLAND, W.	Drymen, Islay, and Stranraer - -	31	37	18	14	68
ENGLAND, N.W.	Leyburn, Prescott, and Warrington -	29	42	25	4	71
" S.W.	Falfield, Clifton, and Glastonbury -	42	44	11	3	86
IRELAND, N.-	Ballinrobe - - - - -	17	39	39	5	56
" S. -	New Ross - - - - -	36	36	28	—	72
Mean for all districts - - -		38	38	20	4	76

The values for "Scotland W." have been greatly modified by the very low percentage of success obtained at Stranraer. The weather at this place was exceptional, exhibiting very little agreement with the general character of the weather in the district, as shown by the Daily Weather Charts.

It will be seen that for Ireland the test applied to the forecasts was not very satisfactory, since two stations in that island are not sufficient to give a fair account of the weather prevailing generally. The Council hope if the experiment is repeated in 1881 to increase the number of recipients in Ireland.

Storm warn-
ings.

Storm Warnings for the Coasts of the United Kingdom.—In Appendix XI. (p. 81) 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.

These stations were, at the end of March 1881, 136 in number, situated:—

68 in England, 13 in Wales, 35 in Scotland, 14 in Ireland, 3 in the Isle of Man, and 3 in the Channel Islands.

Result of storm
warnings in
1880.

The usual comparison has been instituted in the Office between the warnings issued in 1880 and the weather experienced on our coasts, the warnings being tested by the method explained in Appendix VIII. 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 1880.

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 -	48	30	11	6	—	1	—	Jan. 1, Jan. 30, May 26, Aug. 7.
„ East -	46	20	18	7	—	1	—	Feb. 29.
Scotland, East -	38	24	7	4	1	2	—	Jan. 1, Jan. 2, Jan. 30, March 1, May 26, Oct. 31, Dec. 10, Dec. 23 p.
„ West -	37	19	11	6	—	1	—	March 1, May 26, Dec. 10.
England, North-west -	36	20	3	8	1	4	—	March 1, Nov. 14, Dec. 24 p.
„ West -	51	26	17	8	—	—	—	Nov. 23.
„ South -	61	38	16	4	1	2	—	Feb. 7*, Feb. 18, March 2, Sept. 18, Nov. 25, Dec. 29.
„ South-east -	26	17	6	3	—	—	—	—
„ East -	47	33	7	6	—	1	—	Jan. 2†, March 1†, Dec. 8†
Totals -	390	227	96	52	3	12	—	
Per-centages -		58·2	24·6	13·3	0·8	3·1	—	

* Storms on the S. Coast marked thus were only felt at the entrance to the Channel.

† „ „ E. Coast „ „ on the north-east coast of England.

The following table contains a comparative statement of the storm warnings and their results in 1880 and in the ten preceding years. It will be seen that the percentage of warnings justified shows a slight improvement:—

Comparison of results for 1880 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.
1870	349	46·7	21·7	68·4	22·4
1871	299	46	17·7	63·7	22·0
1872	379	61	19·5	80·5	11·9
1873	250	45·2	34·0	79·2	16·8
1874	317	45·4	32·8	78·2	16·4
1875	248	41·1	35·1	76·2	21·0
1876	265	61·1	21·5	82·6	11·7
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

Fishery Barometers.—The Office still continues to issue barometers on loan for public exhibition at the smaller ports and fishing stations. The whole number of stations on our coasts supplied with these instruments by the Office is at present 151, being four in excess of the previous year. Of these stations, 55 are in England, 5 in Wales, 37 in Ireland, 50 in Scotland, 3 in the Isle of Man, and 1 in Jersey. The list is given in Appendix X, p. 80.

Fishery barometers.

Simultaneous
observations.

Change of hour.

Simultaneous Observations.—The Office has continued its co-operation with the system of simultaneous observations, taken once in every 24 hours, which was organised eight years ago at the request of the Chief Signal Office of the United States. In the course of the year 1880 the Council were requested to change the time of observation from 0h. 43m. p.m. G.M.T., which it originally was, to 0h. 8m. p.m. The matter having been fully discussed, the Council intimated to the Chief Signal Office that as they had ascertained that other European nations would consent to the proposed change, they would themselves raise no objection to it, but that they could not ensure its being carried into effect, as the co-operation of their observers was entirely voluntary. The change took place Jan. 1, 1881. The list of observers at land stations for 1881 is given in Appendix XIV., p. 89.

A form for the entry of the simultaneous observations is bound up with every ship's log issued by the Office, and whenever a captain has filled up this form, a copy of his entries is supplied to the Chief Signal Office.

Co-operation of
the Admiralty.

In the course of the year 1879 the Chief Signal Officer of the United States, the late Brigade-General Myer, then on an official visit to Europe, brought under the review of the Hydrographer of the Admiralty, as a member of the Council, the advantages that would accrue to meteorological science were the ships of the Royal Navy, stationed as they are in every quarter of the globe, to take part in the existing organised system of daily simultaneous observations.

The Council, before whom the subject was brought by the Hydrographer, recognised the importance to meteorology of such co-operation, and addressed a request to the Lords Commissioners of the Admiralty for the required daily observation at 0h. 8m. p.m. Greenwich mean time 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, confining this daily observation to the ship of the senior officer. Their Lordships readily assented, and the necessary instructions were at once issued from the Admiralty, accompanied with blank forms: the latter drawn up under the immediate supervision of the Council.

A large number of these returns have already been received, copies of which will be forwarded to Washington at short intervals, in common with similar observations made in the United Kingdom and by co-operating observers in the Mercantile Marine.

The Council desire to express their sense of the great service rendered to meteorological science by the action of the Admiralty in this matter.

Sunshine
Records.

Sunshine Records.—The registration of sunshine has been regularly maintained throughout the past year. A detailed description of the instrument by which the records are taken and of the different adjustments which it requires, will be found in the last Annual Report. The records consist of lines burnt on

cards of a pale blue tint by the image of the sun formed by a glass sphere and focussed on the card. They are capable of being represented graphically in a compact form, of which the following is a specimen:—

Specimen of
sunshine
record.

FIG. 4.—*Falmouth*, July 1880.



The white line corresponding to each day of the month, on which there was any bright sunshine at all, shows the times at which it occurred. Thus, on the 5th and the 15th bright sunshine at Falmouth was nearly continuous from half an hour after sunrise until half an hour before sunset; on the 28th there were but a few intervals of sunshine about 3 p.m. The white converging lines on the left and right give the times of sunrise and sunset. They converge because in July the days are shortening. It should be noticed that the heat of the sun is insufficient to make a record for about half an hour after sunrise, and for about half an hour before sunset.

The Council have it in contemplation, in addition to the numerical data which appear in the Weekly Weather Report, to publish the records on the foregoing plan, which will admit of exhibiting, on a single quarto page, the entire year's records for two stations.

Cirrus Observations.—As stated in the last Report, a plan for regularly observing and reporting “cirrus” clouds has been adopted as a tentative measure, with the view of ascertaining whether the phenomena presented by the upper clouds do or do not afford indications of impending changes of weather sufficiently early and sufficiently trustworthy to be used in the preparation of the forecasts. The observers during the year were Mr. Cullum at Valencia, Mr. Gaster at Brixton, Mr. Glyde at Torquay, Mr. Kerr at Mullaghmore, and Mr. Ley at Lutterworth. The Council consider the results obtained sufficiently satisfactory to induce them to continue the observations for

another year. A report of the working of the plan will be found in Note D, p. 31.

Weekly
Weather
Report.

Weekly Weather Report.—The publication of the Weekly Weather Report, of which, with the Quarterly Summary, specimens in their present form will be found in Appendix XV., p. 91, has been continued, and the Council have again to express their thanks to the Meteorological Society (of London) for supplying to this publication returns from several of its stations at a cost little above that of copying.

By comparison of the specimen of the report as now published with that given in the preceding Annual Report, it will be noticed that the arrangement of the whole has been altered, and that for greater clearness of printing the scale of the maps has been increased.

In the tables for the United Kingdom, moreover, two new columns have been introduced, showing respectively the weekly means of the daily maximum and minimum temperatures.

Aids to the
study and
forecast of
weather.

Aids to the Study and Forecast of Weather.—This treatise, which has been prepared at the request of the Council by the Rev. W. Clement Ley, is intended to describe the principles by which the changes of weather shown in any series of daily weather maps are to be interpreted.

Contents of
the work.

In the first chapter a short preliminary account is given of observations of winds, of clouds, and of some local weather signs.

In the second chapter the relation which exists between the movements of the atmosphere and the distribution of barometric pressures is briefly explained, and is exemplified, first, in the distribution of mean pressures and prevailing winds over the globe, and, secondly, in those local cyclonic and anticyclonic circulations which determine the changes of wind over the British Isles and their neighbourhood. Two plates, showing the mean pressures and prevailing winds of the globe in January and July, and several small charts presenting typical examples of local and temporary systems of circulation, are given in illustration.

The prevalent courses of barometric depressions over the British Isles are next described, and an attempt is made to show how they can be explained by the condensation theory of cyclones, of which theory the author is an advocate.

The final chapter contains a short account of the conditions of weather characterising cyclonic and anticyclonic systems, concluding with some specimens of the kind of forecasts of weather which the observer can form on the principles previously described.

The Council are glad to report that the usefulness of this manual has been recognized outside the British Isles, for they learn from the "*Revue Maritime et Coloniale*," that it has been translated into French, and that a copy of it is supplied to every ship in the French Navy.

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 Stations of different degrees of fulness of organisation, which may be arranged in five classes.

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. Observatories.

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. Anemographic stations.

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

4. The Telegraphic Reporting Stations at which eye observations are taken, 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 occasionally utilized to afford climatological information for parts of the country where Stations of the Second Order do not exist. Telegraphic reporting stations.

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

A detailed account of these several stations and of the methods employed by the Office in dealing with the records they respectively furnish will be found in Appendix XVI., p. 97.

Appendix XVII., p. 102, contains a list of all documents relating to the land meteorology of the British Isles received at the Office during the year. Documents received.

Inspection of the Stations.—The self-recording observatories and the anemographic stations (Classes 1 and 2), as well as the Telegraphic Reporting Stations (Class 4), are regularly visited each year by the inspectors of the Office. The extra stations (Class 5) are inspected as opportunity offers. Of the Stations of the Second Order (Class 3), some belong to the Meteorological Society (of London); 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). The remaining Stations of the Second Order, which are in immediate connexion with the Meteorological Office, are visited at least once in every two years Inspection of the stations.

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 of the Office and of Mr. Whipple will be found in Appendix VII., p. 58.

Reports supplied to Registrar General for Ireland.

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

Quarterly Weather Report.

Quarterly Weather Report.—The engraving of the plates for the Quarterly Weather Report has been continued; the plates for the year 1879 are completed, and those for 1876 and 1880 are in a very advanced state; those for 1877 and 1878 are still in arrears.

The first quarterly part of the Report on the new plan, as indicated in the last Report, that for January to March, 1876, has been issued, and that for the corresponding quarter of 1879 is in the press.

Harmonic Analyser.

The Harmonic Analyser.—This instrument is at present in use. A report by Professor Stokes on its working will be found in Note A, p. 25.

London fog.

Inquiry into the Causes and Prevalence of London Fog.—In November 1880 Dr. Abel, Professor Frankland, and Dr. W. J. Russell consented, at the request of the Council, to act as a committee for the purpose of undertaking an investigation of the chemical and physical properties of London fog. It was agreed that the research should consist of two branches (1) an analytical investigation of both the solid and liquid and also of the gaseous constituents of foggy air; and (2) a series of synthetical experiments, undertaken with a view of determining the conditions which conduce to the production of fog. The conduct of the experiments was entrusted to Dr. Russell, whose account of the processes adopted in the preliminary stages of the inquiry is given in Note B, p. 27.

In order to obtain some information as to the history of London fogs, the Council have tabulated for the use of the committee the records taken at Greenwich, at Kew, and at the office of the Local Government Board in Whitehall, for 40, 31, and 18 years respectively.

As far as these tabulations extend there is no evidence of a progressive increase in the prevalence of fog in London.

Hygrometry and Evaporation.

Experiments on Hygrometry and Evaporation.—The experiments undertaken on behalf of the Council by Mr. W. N. Shaw as to the comparison of different hygrometers have been continued during the past year, and the Council have also entrusted to him an inquiry upon a closely allied subject, the comparison of the different evaporimeters which are in actual use or have been suggested. An account of the progress of both investigations will be found in Mr. Shaw's Report, Note C, p. 28,

The Photography of Clouds.—It was stated in the last Report that an apparatus for the photographic observation of clouds, with a view to determine their height and velocity of motion, had been designed by Captain Abney, F.R.S. This apparatus is now complete, and preliminary trials with it have been already made, as will be seen from Captain Abney's Report, Note E, p. 33. Cloud photography.

Rainfall of the United Kingdom.—The work on the rainfall of the British Isles, undertaken, as stated in the last Report, at the request of the Council, by Mr. G. J. Symons, F.R.S., is making satisfactory progress, as will be seen from the statement of Mr. Symons, Note F, p. 35. Rainfall of the British Isles.

Meteorological Atlas of the British Isles.—The Council have resolved upon the publication of a meteorological atlas for popular use, giving the normal values of the principal meteorological elements for the British Isles. It is proposed that the atlas should contain (1) four monthly charts of mean barometric pressure, viz., for January, April, July, and October, and also one for the year; (2) charts of air temperature for each month and for the year; (3) charts of the sea surface temperature for each of the four quarters; making in all 22 maps. Meteorological Atlas of the British Isles.

With the exception of the sea temperature charts, for which (as has been already said) the observations as yet extend over two years only, the observations used in this work will be those of the 20 years, 1861–80, as the earlier records are not sufficiently numerous and continuous. It is also convenient, as has been recommended by the International Meteorological Congress, that the meteorological elements should be calculated in *lustra* of five years, each *lustrum* ending with a multiple of five. The collection of data for these maps has been already commenced,* and it is hoped that the atlas will be ready for publication by the end of the year.

As the time of the staff is at present fully occupied in the other branches of the work of the Office, the preparation of the materials for the atlas, involving the examination and discussion of numerous documents, has been entrusted to Mr. W. Marriott, F.M.S., the Assistant Secretary of the Meteorological Society, with the sanction of the Council of that body.

LIBRARY.

The library contains standard works on Meteorology and the allied sciences. It consists at present of upwards of 3,000 volumes, with about 3,000 pamphlets, exclusive of charts and MS. records of observations. The books and other documents are accessible to scientific men. Accessions to Library.

Appendix XVIII., p. 105, contains a list of the accessions to the library during the year. A few volumes have been purchased.

In conformity with a practice now generally recommended by authorities on bibliography, all books and pamphlets received during the year have been catalogued upon cards, besides being entered in the existing reference catalogue.

* Monthly results for the 20 years have already been extracted for 50 stations.

EXPENDITURE.

Appendix XIX., p. 128, shows the receipts and payments during the year ending 31st March 1881. The amount voted by Parliament was 15,000*l.*, a supplementary estimate of 500*l.* having been granted to enable the Office to issue *gratis* to newspapers the 8h. 30 p.m. Forecasts which had hitherto been paid for by the newspapers that published the information.

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 1880-81, as compared with the previous year :—

NET EXPENDITURE.	1879-80.	1880-81.	Increase.	Decrease.
Payment of Council -	1,000 0 0	1,000 0 0	—	—
Secretary -	800 0 0	800 0 0	—	—
Office salaries -	712 1 0	711 7 5	—	0 13 7
Rent, fuel, and lighting -	778 1 2	666 4 7	—	111 16 7
Alterations to premises, attendance, and contingencies -	504 16 11	462 8 11	—	42 8 0
Expenses incidental to International Meteorological Congress -	104 8 1	33 10 9	—	70 17 4
Special Researches -	941 3 10	735 10 5	—	205 13 5
Land Meteorology -	3,847 5 1	3,766 10 8	—	80 14 5
Weather Information -	3,191 9 7	3,314 6 5	122 16 10	—
Inspections -	508 15 7	520 10 6	11 14 11	—
Ocean Meteorology -	2,371 3 4	2,108 14 5	—	262 8 11
Total -	£ 14,759 4 7	14,119 4 1	134 11 9	774 12

(Signed) HENRY J. S. SMITH,
Chairman of the Council.

NOTE A.

ON THE WORKING OF THE HARMONIC ANALYSER.

Harmonic Analyser.—The harmonic analyser at the Office is now in regular use. It has been applied in the first instance to the analysis of air temperatures. The numbers on the seven cylinders give respectively for each day the mean temperature, and the coefficients of the first three pairs of terms in the variable part of the diurnal fluctuation. It has not, however, been considered necessary to read all the cylinders for each day. The mean cylinder and the pair which give the coefficients of the two terms in the component of the 24-hour period are read for each day, and the others only at the end of each period of five days and at the end of each civil month. Whether the coefficients of the two principal terms in the diurnal fluctuation will be published for each day, or only as hitherto the mean temperature, is not yet decided. In any case they would be published for suitable intervals.

The numbers on the cylinders are carried on by the machine, so that no numerical additions are required in getting the mean coefficient for any interval that may be chosen. Suppose the year divided into equal or nearly equal parts, say into months. From the mean coefficient, for each month, of any one of the terms in the diurnal fluctuation, it will be easy to deduce, either by direct numerical calculation or by the use of the machine, the harmonic expansion of the annual fluctuation of the coefficient, and by treating each coefficient in this way we may express the average temperature as a function of the time of day and time of year, by a series involving only a moderate number of coefficients derived from observation. A comparison of the more important coefficients as obtained for the same year for two different places, or for the same place for two different years, would afford a general view of the leading differences of climate of two places, or of the leading differences of weather in different years.

We are hardly yet in a condition to pronounce definitively upon the degree of accuracy to which the machine practically works. No investigation of the diurnal fluctuation of temperature has hitherto been made at the Office, with which to compare the work of the machine. The mean temperature alone admits, with the data at present in our hands, of thorough comparison, and with regard to it we are able to affirm with confidence that the work of the machine is perfectly satisfactory. In fact, the mean temperature for the year came out the same by the machine as by numerical calculation, from ordinates measured for each hour on the photograms, to the hundredth part of a degree, or thereabouts. It must be noticed however, that there are no cross-heads with slots in which pins work involved in the government of the motion of the mean cylinder as there are for the others, so that we must not jump to the conclusion that the working of the latter is equally satisfactory.

With the view to obtain some data for a fair comparison, a book belonging to the Office was employed, in which are entered the hourly temperatures for Valencia for the year 1871, the place and year with which the work of the analyser was begun. From the entries, the mean monthly temperatures were calculated numerically for the even hours; and then these, as well as the annual means obtained from them, were expressed by the usual arithmetical process, in a harmonic series with a year for period. On comparing the coefficients thus obtained with those got by the machine, discrepancies were found amounting perhaps to $0^{\circ}2$ or $0^{\circ}3$ in the larger terms, but generally smaller. In the small terms, the discrepancies were usually considerably smaller. This gave an idea of the greatest error to be feared, but left the question undecided which was the more near to the truth. Independently of arithmetical mistakes, which can be guarded against by sufficient careful checking, the first process is open to the imperfection of disregarding all changes that take place between one even hour and the next. The principle of the Harmonic Analyser is perfect in this respect, but the employment of the machine is subject to the finiteness of accuracy which belongs to every mechanical process.

To give some idea of the degree to which the coefficients were liable to be vitiated in the first process by the disregard of all changes that occurred between one even hour and the next, the means for one month were taken for the odd hours only, and then expressed arithmetically in a harmonic series. The coefficients thus got from the even hours alone and the odd hours alone certainly agreed with one another a good deal better than either agreed with the coefficients got by the machine, the discrepancies between the first two sets reaching only to about $0^{\circ}05$.

This seems to make it pretty clear that the chief source of error is in the use of the machine, though it is true that the basis of the induction on which this conclusion rests is rather limited. That errors of some such magnitude should occur is not to be wondered at when it is considered that the tenth of a degree, which is a convenient measure of liability to error, is represented on the photograms by only the 1-150th of an inch. That the errors should be comparable with so minute a quantity, shows that the machine must have been worked with great care.

On examining the errors (assumed to belong to the coefficients got by the machine) it was noticed that in general if one coefficient of a pair belonging to the same order were too large, the other would be too small, and it was found that the square root of the sum of the squares agreed with the same quantity as obtained by measurement and calculation a good deal better than did the coefficients individually. The error in fact fell rather upon the epoch than upon the coefficient when the two terms were combined into one. The sign of the error of the epoch indicated a lagging. It is probable that the results got by the machine might be improved by introducing a correction to the

epoch which may be expected to be in the proportion of the numbers 1, 2, 3 for the pairs of terms of those orders respectively.

But even if we take the results as they are, seeking for no further correction, the error is so small as not to be likely to be of any practical importance, especially as it does not affect the mean, and as to other terms tends to be alike for different places or different years that may be compared. If the accuracy be sufficient for all practical purposes, it would surely be unreasonable to refuse to employ the machine merely because results slightly more accurate could be obtained by a vastly greater expenditure of time and labour; an expenditure so great that hitherto it has not been attempted by the Office.

(Signed) G. G. STOKES.

NOTE B.

REPORT ON FOGS.

Chemical Laboratory,
St. Bartholomew's Hospital, E.C.,
May 6, 1881.

GENTLEMEN,

THE Sub-Committee you appointed to investigate the nature and chemical composition of fog beg to report that they met on December 10th last, and after duly considering the matter, determined to commence the investigation by undertaking the following determinations: (a) The amount of carbon and nitrogen in the solid form in the air, during fog, removing it by filtering the air through asbestos; (b) The amount of ammonia which would be given under similar conditions by a similar asbestos plug; (c) The amount of carbonic acid in the air both before and after filtration through cotton wool; (d) The total amount of moisture and suspended matter in the air; and (e) A chemical and microscopical examination of the impurities which would be removed from the air by thorough washing. The Committee considered that the above determinations would be simply tentative, and that the results obtained would probably indicate numerous modifications in the methods of experiment and additions to the directions in which the inquiry should be pursued.

The first experiments were to be made in the City, at St. Bartholomew's Hospital, and the reporter undertook to carry them out. Some half-dozen experiments of the above character have been carried out. Two circumstances, however, acted adversely to the carrying on of the investigation the first was the absence to a great extent of fogs, more especially in the City, as on several occasions during last winter there was at the West End a considerable fog when it was comparatively clear in the City. The other circumstance was that the bulk of air, such as in an ordinary laboratory experiment can be operated on, is too small in amount to yield definite and satisfactory results; the fogs often lasting comparatively a short time, means must therefore be provided for aspirat-

ing considerable quantities of air. In the experiments that have been made, aspirators holding 2 cubic feet of water were used, and from about 4 to 8 or 9 cubic feet of air experimented on, and in no case were the experiments made during a dense fog. The results obtained showed clearly that very much larger quantities of air must be used. In carrying out the seven experiments that have been made valuable experience and information has, however, been obtained, especially as to the method of thoroughly washing the air, and also as to the estimation of the sulphuric acid found in such wash water; but as the above experiments are imperfect and can only be regarded as preliminary, it is thought best not to append the numbers obtained.

Another branch of the inquiry which the Committee think it desirable to pursue, is the investigation of the circumstances under which artificial fog can be produced; with this object in view they have had some apparatus constructed, but have not been able yet to experiment with it.

The purely preliminary work which has thus far been undertaken has shown that to pursue the subject with a probability of the attainment of useful data, necessitates preparations for experiments on a much larger scale, and the Committee will be glad to be informed whether they have the sanction of the Meteorological Council to make such preparations before next autumn.

I have, &c.

(Signed) W. J. RUSSELL.

To the Meteorological Council.

NOTE C.

REPORT ON HYGROMETERS and EVAPORIMETERS, presented to the METEOROLOGICAL COUNCIL May 10, 1881.

Hygrometers.

During the past year experiments have been made with most of the instruments under my charge. But Schwackhöfer's instrument, all the important glass parts of which were broken on arrival here, is not yet in working order. The glass work was replaced by Mr. Hicks, of Hatton Garden, but an accident in fitting the parts together reduced the instrument practically to its previous state. It has, however, been refurnished with the necessary glass, and I now hope that it will be in full working order in a few days.

The dew-point hygrometers, including two specimens of Regnault's, Alluard's, and Dines's instruments, have been enclosed in a glass case, the aspiration tubes passing through the sides, so that the same mass of air remained in contact with the instruments throughout a series of observations, and no evaporation of ether or water took place in the case. The observations made with these instruments showed very little discordance. They were discontinued in order that some of the thermometers employed might

be compared at Kew. A hair hygrometer was included in the case and its indications compared with those of the dew-point instruments.

A few wet-bulb thermometers have been arranged on the screen mentioned in the previous report; the bulbs of the thermometers differed in size, but not very widely; the method of moistening was the same for all. The effect of regulating the motion of the air past the bulbs was made very distinct by a large number of observations; the indications, which were almost always discordant, becoming identical as soon as the current of air was established.

In reference to observations with wet-bulb thermometers, it should be noticed that there are two sets of tables published by which the Relative Humidity of the air may be obtained from the observations made: (1.) Glaisher's tables, in use in English meteorological stations, and formulated by experimental comparison of the dry and wet bulb with Daniell's dew-point instrument; (2.) Jelinek's tables calculated from empirical formulæ established by Regnault. These two sets of tables show a considerable divergence when the difference between the wet and dry bulb readings is large. The following instance will illustrate this:—

Temp. of Dry Bulb F.	Temp. of Wet Bulb F.	Relative Humidity according to	
		Glaisher.	Jelinek.
41	41	100	100
—	40	92	91
—	39	84	83
—	38	77	74
—	37	70	66
—	36	64	57
—	35	58	49
—	32	43	25

It thus appears that important differences occur when the air is in a state in which psychrometric observations may often be made.

I am unable at present to offer reasons for preferring one of these sets of tables to the other.

I have made various experiments upon the influence of the radiation from surrounding objects upon the temperature of the wet bulb, but the results at present are not very decisive.

It has occurred to me that some valuable information as to the processes going on in the neighbourhood of the wet bulb might be obtained by using some other volatile fluid than water for the moistening liquid. I accordingly mounted two wet bulbs, one moistened with water and the other with methylated spirit, upon

an ordinary dry and wet-bulb stand. The difference of their readings was initially 10° but in the course of 12 hours it was reduced to 1° and was maintained for days uniformly at that amount, through considerable variations of temperature of the air. Further experiments on the subject are in progress.

Evaporimeters.

In August last a number of evaporimeters were received by me from the Meteorological Office for experiments upon the relative value of their indications. The selection comprises instruments on Wild's and Lamont's patterns in which water is evaporated from a free water surface. Also two specimens of De la Rue's evaporator, and one by Piche, where the evaporation takes place from a wetted parchment surface and a blotting-paper surface respectively.

These instruments have been exposed to the air together, and a number of comparative readings obtained. They show a very wide divergence; as an instance, the total evaporation between March 3 and March 10 of this year, as determined by the different instruments, was as follows:—

Lamont 1·84 lines	-	-	-	=	3·88 mm.
Wild -	-	-	-	=	2·85 „
De la Rue (1) ·143 in.	-	-	-	=	3·61 „
De la Rue (2) ·125 in.	-	-	-	=	3·16 „

During this time 97·3 mm. of the water in the tube of Piche's evaporimeter were evaporated, the instrument being hung in the same room in a position more favourable for evaporation. This instrument requires an experimental comparison with some other of the instruments in order to obtain from its indications the equivalent depth of water evaporated. My temporary estimate of this absolute value of its indications is that 20 mm. of Piche's scale are equivalent to 1 mm. of evaporation from free water surface.

(Signed) W. N. SHAW.

Emmanuel College, May 10, 1881.

NOTE D.

AD-INTERIM REPORT on the OBSERVATION of CLOUDS of the
"CIRRUS" TYPE.

R. H. Scott, Esq.

In the course of the year an experiment has been made, by direction of the Council, in order to ascertain how far observation of the movements of the highest forms of clouds may be rendered useful in the preparation of forecasts. This work was undertaken at the suggestion of the Rev. W. C. Ley, and a code for the transmission of the information having been devised, the system was brought into operation on the 1st April 1880, and has been continued ever since.

Observations are made at—

Valencia, by J. E. Cullum, The Observatory.
Mullaghmore, by K. Kerr, Coastguard Officer.
Lutterworth, by Rev. W. C. Ley, M.A., F.M.S.
Torquay, by E. E. Glyde, F.M.S.
London, by F. Gaster, F.M.S., Meteorological Office.

The information forwarded consists of a statement as to—

- (1.) The precise form of the upper cloud observed ;
- (2.) Its amount ;
- (3.) The precise direction whence it is moving ;
- (4.) The estimated rate of its apparent angular motion (*i.e.*, whether stationary, moving slowly, moving with moderate rapidity, or with unusual rapidity) ;
- (5.) The point on the horizon from which the cloud appears to radiate.

When the clouds appear in a bank on the horizon, there is added—

- (6.) The bearing of the middle of the bank ;
- (7.) An estimate of the density of the bank.

The direction and force of the surface wind current and the weather prevailing at the time of observation are also stated.

The information from Lutterworth and Torquay is usually transmitted by post, but the observers at those stations have authority to send their observations to the Office by telegraph whenever they are of opinion that the appearance and motion of the clouds threaten the advent of stormy weather. At Mullaghmore and Valencia the observations are added to one of the three telegraphic reports which are transmitted to the Office daily.

Owing to the nature of their other duties the observers at Valencia, Mullaghmore, and London are not able to watch the appearance and movements of clouds with the same constancy as those at Lutterworth and Torquay ; and as it requires some considerable experience to enable an observer to estimate cloud motion with accuracy the earlier observations from the three

former stations were in some respects less satisfactory than those made later. Partly for this reason, and partly because the indications furnished by the upper clouds are more complex and therefore more difficult to interpret during the close thundery weather of summer than during the winter time, and partly because the aid which the observations afford is of much greater value during the prevalence of our winter gales than during merely squally weather, the examination of these records has, for the present, been confined to the observations made during the six months which ended on March 31st, 1881.

The first step taken has been to group together all those instances in which cirrus clouds were observed to be moving from certain definite points, and in doing this the values have been referred to each alternate point of the compass. Each group is then carefully examined and compared with the weather subsequently felt and the observations are sub-divided into separate sets, depending on the existence, or not, of a "bank" of clouds, on the distribution of pressure at the time, &c., as it is found that the mere fact that cirrus cloud is observed to be moving from *any* given point is, *taken alone*, an observation of no value whatever.

The examination has not as yet been completed, and it would at the present stage be premature to give any detailed statement of the probable results of the investigation. But sufficient experience has been already gained to make it safe to say that a well organised system of cirrus observations, made by carefully trained observers, would be of great value in the preparation of forecasts and storm warnings. The observations have often been of material assistance by indicating the approach of depressions from the Atlantic; and used by an expert observer like Mr. Ley they have rendered possible the preparation of occasional forecasts of singular accuracy, with no other information than that derived from his own barometer and thermometers, and from the Daily Weather Report of the previous day. Instances of this occurred on October 4, 21; November 9, 18, 22; December 2, 21, 23, 26; January 11, 17; February 9, 12; and March 3, 18, 22. Less important changes were fairly accurately predicted on October 18, and December 20; while, on the other hand, on two days only were erroneous or quite useless forecasts prepared by him, December 28 and March 14.

A fuller report on the subject will be submitted to the Council as soon as possible.

(Signed) FREDC. GASTER.

Meteorological Office,
8th June 1881.

NOTE E.

PRELIMINARY REPORT on the PHOTO-NEPHOGRAPH.

The model photo-nephograph which I designed and submitted for the approval of the Committee was manufactured in a practical form by the Cambridge Philosophical Instrument Company, under the superintendence of Mr. H. Darwin, who was also good enough to design an electrical shutter, by which two or more cameras would be exposed at the same moment for any required duration. Two cameras were completed at the beginning of the year, and, after some delay caused by necessary alterations, they were handed over to me for trial. The only drawback to them in any way that I can see at present, is the fact that to work the shutter four or five Le Clanché cells are required, which is a serious inconvenience when the cameras have to be transported any distance for work; it may prove necessary to re-wind the magnets.

My attention has been once more directed to the best photographic process to employ for the delineation of the clouds, a certain inconvenience having attached to the use of collodion-emulsion which at first I had not foreseen. I had then recourse to gelatine plates, but the manner in which they are ordinarily prepared induces a sensitiveness which becomes unmanageable even when a diaphragm with a small aperture is used in the lenses. The great desideratum in the plates appears to be that a small variation in the intensity of the light proceeding from the sky or cloud shall produce a great contrast in the intensity of the developed image. A very rapid plate does not answer for this purpose; hence I tried several modifications. The process which at present has given the best results is as follows:—

150 grains of bromide of ammonium and 10 grains of iodide of potassium are dissolved in 3 oz. of water, to which 80 grains of Nelson's No. 1 photographic gelatine and 80 grains of Coignet's gelatine have been added. This is dissolved by the aid of heat, and 200 grains of silver nitrate dissolved in $1\frac{1}{2}$ oz. of water are added. The whole is warmed to 100° F. for five minutes, and allowed to set after being poured out in a flat dish. The emulsion thus produced is washed (in the usual manner) from the soluble salts, and is then remelted and plates coated and dried as is customary in the gelatine process.

This formula gives very constant results, and great contrasts of image are obtained by careful development.

The first point to which attention in the cameras was required was to find the errors which might arise from faulty construction. It will be recollected that in principle the instrument is a theodolite, in which the telescope is replaced by a camera and a lens, and the eye-piece by a sensitive plate. In front of the sensitive plate, in fact in contact with it, is a piece of transparent glass attached to a slide, on which are ruled two cross-lines. For each slide the intersection of these cross-lines is a fiducial point

from which our measurements have to be made. As there are three slides to each camera, the error in position of the intersection of the cross-lines had to be determined.

Owing to the limited space at my disposal, I have taken the instruments down to the School of Military Engineering, Chatham, and by the kind co-operation of Lieutenant Darwin, R.E., their errors have been determined there. For both cameras the errors in azimuth are so small as to be quite negligible. The corrections for zenith distance are as follows :—

Camera A.	Camera B.
Slide I. $+16''$	Slide I. $+3'$
„ II. $+13'$	„ II. $+7'$
„ III. $+13'$	„ III. $+7'$

The smallness of these errors show the care with which the instruments have been constructed.

The next point to determine was the accuracy of the instruments in determining distances ; and here I may say, that the results obtained are very favourable. A base line of 200 yards was taken and photographs of a distant landscape taken from each end, and the distances calculated for prominent points.

As an example, the spire of a church was one of the objects selected, and the calculated distance was 3,040 yards from camera A. Measuring the distance on the 6-inch map, the true distance proved to be 3,070 yards, and the error would have been reduced had some slight corrections been made with which I am now acquainted.

Regarding the recognition of points in a cloud, I think there is not much difficulty. For example, in the measurement of the height of a cloud, one edge gave a height of 2,050 feet, and the opposite edge gave 2,070 feet, a difference which would not materially affect the general results. The instrument can be perfectly well applied to clouds within a zenith distance of 60° , and there will be no difficulty, as far as I can see, in finding which is the lowest point of a cloud.

I propose to carry on experiments during the summer, as far as my time will allow, and I trust that by the fall of the year the operations will have gone beyond the experimental stage, and have reached such a practical state as to admit of regular observations being made. I have not as yet paid much attention to the velocity and direction of clouds. The few experiments made indicate that no difficulty should be met with, supposing two exposures are made within a short interval of time ; that is to say, an exposure must be made from each end of a base line simultaneously, and another made from one end to ascertain the displacement of the cloud after some short interval of time. This will give the velocity and direction, supposing the magnetic bearing of the base line is known.

(Signed) W. DE W. ABNEY

NOTE F.

62, Camden Square, London, N.W.,

May 24, 1881.

DEAR MR. SCOTT,

IN reply to your inquiry I am happy to be able to say that the rainfall tables for your Council are in a very forward state, and I have no doubt that they will be delivered complete at your Office on the date originally named, July 1st, 1881.

I cannot yet say decidedly what the total number of returns will be, but probably more than 350, as the number of those stations (in the list sent you in April 1880) which have broken down in 1880 is much less than I expected, and, on the other hand, I have obtained several valuable long registers since that list was compiled, and those I intend to add.

As a specimen I enclose return from one station, the first in the order of sequence adopted in my own publication "*British Rainfall*."

I shall deliver the sheets in the order of the list already sent to you, but it would be for the Council to decide in what grouping they will have them published.

Yours, &c.

R. H. Scott, Esq., M.A., F.R.S.,
Sec. Met. Council.

G. J. SYMONS.

STATION—Hampton Wick, The Grove.

COUNTY—Middlesex.

OBSERVER—Sir T. J. Nelson.

LAT.: 51° 25' N.

LON.: 0° 19' W.

RAIN GAUGE { Diameter—5 inches.
Height above ground—1 ft. 1 in.
" " Sea level—27 ft.

Year.	Monthly Rainfall, in Inches.												Total.
	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	
1866-	2·61	3·98	1·34	1·80	1·35	3·73	2·19	2·35	3·42	1·51	1·47	1·98	27·73
1867-	2·85	1·53	1·57	1·91	1·36	1·79	4·30	2·66	2·25	1·87	·70	1·38	24·17
1868-	3·58	·53	1·57	1·44	1·66	·37	2·15	2·39	1·09	2·35	1·21	4·87	23·21
1869-	2·32	2·46	1·15	1·12	3·05	1·35	·89	1·42	3·74	1·59	2·21	2·46	23·76
1870-	1·13	1·37	2·01	·11	·78	·47	·94	2·66	1·47	3·06	1·30	2·51	17·81
Total	12·49	9·87	7·64	6·38	8·20	7·71	10·47	11·48	11·97	10·38	6·89	13·20	116·68
Mean	2·498	1·974	1·528	1·276	1·640	1·542	2·094	2·296	2·394	2·076	1·378	2·640	23·330
1871-	1·94	·86	1·08	3·01	·87	3·45	3·75	·79	4·46	·83	·55	1·16	22·75
1872-	3·70	·78	1·62	·98	2·91	2·25	1·42	1·25	1·35	4·46	3·63	3·69	28·04
1873-	2·42	1·51	3·16	·62	1·41	1·51	2·89	1·77	2·43	3·00	1·69	·98	23·39
1874-	·99	1·18	·45	1·53	·35	2·35	1·32	1·34	2·94	3·92	1·59	1·98	19·94
1875-	3·25	·90	·49	1·48	1·13	2·12	4·70	·38	1·12	3·78	2·94	·98	23·27
Total	12·80	5·23	6·89	7·62	6·67	11·68	14·08	5·53	12·30	15·99	10·40	8·79	117·39
Mean	2·460	1·046	1·360	1·524	1·334	2·336	2·816	1·106	2·460	3·198	2·080	1·758	23·470
1876-	·76	1·03	2·73	1·87	1·31	1·50	1·14	2·14	2·58	1·55	2·53	5·08	25·42
1877-	4·75	2·03	2·36	3·11	2·25	2·60	2·31	3·15	·89	1·81	3·73	1·66	30·55
1878-	1·22	1·16	·52	2·76	3·42	1·94	1·54	4·82	1·01	1·69	3·01	1·63	24·72
1879-	2·37	3·37	·67	2·98	3·66	4·23	3·60	4·97	3·15	·61	·69	·55	30·85
1880-	·42	1·96	·30	1·96	·27	2·90	5·77	·62	4·33	5·30	1·69	3·01	28·53
Total	9·52	10·45	6·58	12·68	10·91	13·17	14·36	16·00	11·96	10·96	11·65	11·83	140·07
Mean	1·904	2·090	1·316	2·536	2·182	2·634	2·872	3·200	2·392	2·192	2·330	2·366	28·014

APPENDIX.

APPENDIX I.

METHOD followed by the OFFICE in the EXTRACTION of DATA from SHIPS' LOGS.

THE method which has been followed by the Office, since its first establishment in 1854 up to the present date, in the collection of information on Ocean Meteorology, has been to supply observers with a complete outfit of verified instruments, on the condition of their returning the instruments, and the log of observations made with them, to the Office, or to one of the agents mentioned below, at the completion of the voyage.

Every instrument supplied has been originally verified at Kew Observatory, and on the completion of the voyage it is compared with standard instruments by a duly authorised observer. Under ordinary circumstances it is not requisite to send the instruments to Kew for re-verification after every voyage, as the changes in their errors are generally slight.

The regular outfit of a ship consists of :—

- 1 Barometer (Kew pattern).
- 6 Thermometers, with a thermometer screen.
- 4 Hydrometers.

The first record of observations is made in a Rough Book supplied for the purpose, which is retained by the captain, who copies the observations into a regular form of log kept for the Office.

As regards the Royal Navy, Her Majesty's ships have been supplied by the Office, since its foundation in 1854, with the meteorological instruments used in the service, and for this provision is annually made in the Estimates furnished by the Office to the Treasury upon which the vote for the Meteorological Council is based. The records of observations made by naval officers are in due course deposited at the Admiralty, where they are available. It is optional with the observers to keep the Meteorological Log of the Office in addition to the regular record of observations required by the rules of the service. The Council are glad to say that they receive from time to time Meteorological Logs of high value from Her Majesty's ships.

In order to facilitate the communications between the Office and the observers, agencies are established at some of the principal ports, and instruments are supplied directly from such agencies to the ships.

The following is a list of the agents at present in connexion with the Office :—

Aberdeen	-	J. R. Jones	-	-	-	Navigation School.
Cardiff	-	H. J. Thatcher	-	-	-	Bute Docks.
Dundee	-	P. A. Feathers	-	-	-	40, Dock St.
Glasgow	-	Messrs. D. M'Gregor & Co	-	-	-	44, Clyde Place.
Greenock	-	Do.	do.	-	-	32, Cathcart St.
Hull	-	Z. Scaping	-	-	-	Trinity House.
Liverpool	-	J. Gill	-	-	-	Sailors' Home.
Southampton	-	C. H. Permain	-	-	-	13 Oriental Place.

A set of instruments is kept in working order at the Office in London and at each agency. A notice to captains is inserted as a standing advertisement in the "Nautical Magazine," and copies of it are supplied to each agent. When a captain expresses himself willing to observe, he is invited to inspect the instruments and learn what will be required of him. If this takes place at one of the agencies, and the captain decides to undertake the work, his name is submitted to the Marine Superintendent, who, if the owners of the ship are British subjects, and she is likely to return to some port in the United Kingdom, sanctions the supply, having due regard to the nature of the proposed voyage and giving preference to captains intending to visit the districts whence the information existing in the Office is scanty.

In a few exceptional cases captains are supplied at ports where there are no agencies, and in these cases the instruments are sent from the Office in London.

Agents receive a fee of 1*l.* 5*s.* for each case of supply and return of instruments, and an additional fee of 1*l.* for the first "excellent" log sent in by any observer whom they may have invited to begin keeping a log, but the Council reserve to themselves the right of deducting the fees for both supply and return of the instruments, if no log is returned, or one which is worthless.

Captains are requested to give notice of their return to any port in the United Kingdom to the agent at the port, if there be one, or else to the Office in London, and steps are then taken to send for the instruments and log. The latter is sent up to London, and the instruments are at once compared with a standard set, and if received at an agency, the results of such comparison are duly forwarded to London.

The log is tested according to a definite form (the "test sheet," which has been published in the Report of the Maritime Conference of London, 1874, p. 35), and the observations are classified according to their quality.

As soon as this first testing has been effected, a letter is written to the captain, and if any questions arise to which he can probably give an answer, he is requested to do so while the incidents are fresh in his memory. When his reply is received it is noted in the log for future reference when the observations come for discussion.

The first step in the process of discussion is the extraction of the observations (which in the original documents are of course in chronological order, and follow the tracks of the ships for the time being) into forms in which they are grouped for the different months of the year and for definite areas of the sea-surface. These forms are called Data Books, and the actual process of transference of the observations into them is mainly clerical, but the operations of "examination" and "preparation," which are preliminary to the transference, are of a different character, and of these the former demands the higher degree of experience in the person to whom it is entrusted.

The examination of a log requires a careful reading of the test sheet, and of any correspondence which may have been conducted with the observer. The hours for which the observations are to be used must be selected. The instrumental corrections must be considered for the whole log, and it must be finally decided whether they shall be applied or not. The observations are then looked over, so as to detect by inspection obvious errors (such as of half-an-inch or an inch in the barometer, or of 5° or 10° in the thermometer); evidence of accidental exposure of the thermometers to the sun is also carefully sought for, and indications of mismanagement of the wet-bulb thermometer. These are all precau-

tionary measures, not peculiar to sea records, but it must not be forgotten that as regards the thermometric observations the instruments at sea are placed under different conditions from those which can be obtained on land, for it is impossible on board ships to have the screen always in the shade and yet freely exposed to the air, so that any instances of undue heating of the thermometers in the daytime must be noted. The compass entries must be considered in order to see if they are sufficiently exact for extraction. The ship's positions must be examined, and corrected for current when requisite, and the number of the next subsquare into which the ship moves, or the direction of the ship's head for every observation entered for subsequent use as a record of the ship's course when the observation is isolated in the Data Book.

The wind observations are examined in order to ascertain the method employed by each observer, to decide what correction for compass error is to be applied, and to see that the records have been consistently entered.

Finally, the "Remarks" column is to be read, and portions of its contents are to be marked for extraction.

The results of the examination are entered in the log in red ink.

When the examination is complete, the work of preparation begins. This consists in carrying out the instructions entered in red ink in the log, and is always done in pencil. It may be classified under the following heads :—

1. Interpolation of the ship's position at each hour for which the observations are extracted, and notation of the ten-degree square and one-degree subsquare to which each observation belongs.
2. Transference of the Current observations, which are given at intervals of 24 hours, to their midway position.
3. Application of instrumental corrections to each reading.
4. Correction of the observations of Wind, Sea, and Cloud motion for compass error.

When the preparation has been completed, the copying into Data Books is undertaken.

The Meteorological Committee having decided in 1867 to sift the data into one-degree squares for each month, the following method was then devised for carrying out that object. Monthly books are prepared for each ten-degree square for the part of the ocean under discussion from time to time. These books are paged so as to represent the *unit* figures of the *degrees* of latitude and longitude of the position in which a given observation was taken. For instance, an observation recorded in $8^{\circ} 45'$ N. or S. and $0^{\circ} 18'$ E. or W. would be entered on page 80 of the Data Book for the month, and for the ten-degree square in which it had been taken, and 80 would be considered to be the number of the subsquare to which it belonged. The same page would receive all observations taken between 8° and 9° N. or S. lat. and between 0° and 1° E. or W. long. The same number 80 would equally represent all observations recorded between 18° and 19° lat. and 10° and 11° long., each ten-degree square having its one-degree subsquares numbered similarly, but every Data Book bears the number of the ten-degree square to which it refers.

The ten-degree squares are numbered on the following system. Square 1 commences with lat. 0° N. and longitude 0° W., and the numbering is carried on with increasing W. longitude until the circuit of the globe is completed with Square 36. The first number in the southern hemisphere is 300 and the last in the zone nearest the equator is 335.

The following diagram shows the way in which the pages in the Data Books are numbered.

By using the numbers of the subsquares in quoting extracts from a log, the locality of an observation is shown to a degree, but in the Data Book itself the minutes of latitude and longitude are given with each entry.

10 W.										Square 1.										Square 36.										10 E.										
10 N.										9	8	7	6	5	4	3	2	1	0	0	1	2	3	4	5	6	7	8	9	10 N.										
										9	99	98	97	96	95	94	93	92	91	90	90	91	92	93	94	95	96	97	98	99										
										8	89	88	87	86	85	84	83	82	81	80	80	81	82	83	84	85	86	87	88	89										
										7	79	78	77	76	75	74	73	72	71	70	70	71	72	73	74	75	76	77	78	79										
										6	69	68	67	66	65	64	63	62	61	60	60	61	62	63	64	65	66	67	68	69										
										5	59	58	57	56	55	54	53	52	51	50	50	51	52	53	54	55	56	57	58	59										
										4	49	48	47	46	45	44	43	42	41	40	40	41	42	43	44	45	46	47	48	49										
										3	39	38	37	36	35	34	33	32	31	30	30	31	32	33	34	35	36	37	38	39										
										2	29	28	27	26	25	24	23	22	21	20	20	21	22	23	24	25	26	27	28	29										
										1	19	18	17	16	15	14	13	12	11	10	10	11	12	13	14	15	16	17	18	19										
										0	09	08	07	06	05	04	03	02	01	00	00	01	02	03	04	05	06	07	08	09										
Equator.										0	09	08	07	06	05	04	03	02	01	00	00	01	02	03	04	05	06	07	08	09	Equator									
										1	19	18	17	16	15	14	13	12	11	10	10	11	12	13	14	15	16	17	18	19										
										2	29	28	27	26	25	24	23	22	21	20	20	21	22	23	24	25	26	27	28	29										
										3	39	38	37	36	35	34	33	32	31	30	30	31	32	33	34	35	36	37	38	39										
										4	49	48	47	46	45	44	43	42	41	40	40	41	42	43	44	45	46	47	48	49										
										5	59	58	57	56	55	54	53	52	51	50	50	51	52	53	54	55	56	57	58	59										
										6	69	68	67	66	65	64	63	62	61	60	60	61	62	63	64	65	66	67	68	69										
										7	79	78	77	76	75	74	73	72	71	70	70	71	72	73	74	75	76	77	78	79										
										8	89	88	87	86	85	84	83	82	81	80	80	81	82	83	84	85	86	87	88	89										
										9	99	98	97	96	95	94	93	92	91	90	90	91	92	93	94	95	96	97	98	99										
10 S.										9	8	7	6	5	4	3	2	1	0	0	1	2	3	4	5	6	7	8	9	10 S.										
10 W.										Square 300.										Square 335.										10 E.										
										Meridian																														

APPENDIX II.

LIST of CAPTAINS (and Officers) who have sent in Logs classed as "Excellent" during the year ending March 31, 1881. 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.
Aldrich, Pelham, R.N.	3	H.M.S. "Sylvia."
Bainbridge, W.	2	S.S. "Nubian."
Balfour, Lieut. Andrew, R.N.	2	H.M.S. "Magpie."
*Barker, D. W.	2	"Superb."
Barron, William	11	S.S. "Sultan."
Bax, Bonham W., R.N., The late	1	H.M.S. "Sylvia."
Beresford, Lieut. C. W. De La Poer.	3	H.M.S. "Alert."
Berridge, Henry	2	"Superb."
Blacklin, Richard James	1	S.S. "Wyberton."
Blake, Edwin John	7	"Tilkhurst."
Bourke, Comr. Edmund, R.N.	1	H.M.S. "Gannet."
Brown, Alfred John	7	"Belleisle."
Buchan, James	8	"Commewyne."
Caborne, Warren Frederick, R.N.R., F.M.S.	5	"Oakdale."
Campbell, Archibald	9	S.S. "Ethiopia."
Campbell, James	1	"Hope."
Candler, William	1	"Decapolis."
Chitham, Robert	5	"Torrington."
Coxwell, Charles Duncan	4	S.S. "German."
Crutchley, William Caius, R.N.R.	1	S.S. "African."
Dobson, Charles Meadows	8	S.S. "Sunbeam."
Dyke, Harry William	2	"Markland."
Ellery, William	11	"Majestic."
Freedon, H. v.	3	"W. v. Freeden."
Freeman, Thomas William	10	S.S. "Bellerophon."
Gordon, James	3	S.S. "City of Agra."
†Goulden, G. H. N.	1	S.S. "Baltic."
Gray, David	7	S.S. "Eclipse."
Gray, John	7	S.S. "Hope."
Gray, John McDonald	11	"Shun Lee."
Gray, Samuel B.	3	"Letterewe."
Greig, J. G.	2	"British Peer."
Greive, William M.	3	"City of Cashmere."
Gubbins, Sub-Lieut. George Wm., R.N.	2	H.M.S. "Sylvia."
Havergal, Lieut. A., R.N.	1	H.M.S. "Sylvia."
Helby, Sub-Lieut. Edward Capel Hasler, R.N.	1	" "
Heggum, Edward Carl V.	13	"Blythswood."
Holdich, John Peach, R.N.R.	6	"Overdale."
Hoskyn, Richard Fraser, R.N.	1	H.M.S. "Sylvia."
Hughes, W. P.	3	"Royal Alexandra."

* 2nd Officer,

† 3rd Officer

Captain's Name.	Number of "Ex- cellent" Logs.	Ship.
Jackson, John Nugent -	4	"Pizarro."
Johnson, Charles -	5	"St. Lawrence."
Jones, George Henry -	15	S.S. "Lamperts."
Jones, S. Griff -	1	"Victoria Nyanza."
Kidder, John -	3	S.S. "Fleurs Castle."
† Kirkpatrick, John -	1	S.S. "Strathleven."
‡ Ladd, Richard -	1	S.S. "Nubian."
Legg, William -	1	"Star of Greece."
Loane, Sub.-Lieut. Arthur Jabez, R.N.	1	H.M.S. "Sylvia."
Longley, Herbert -	7	S.S. "Yorkshire."
McKenzie, Allan -	1	"Candahar."
Maclear, John F. L. P., R.N. -	4	H.M.S. "Alert."
Manning, Henry -	4	S.S. "Seine."
Mesnard, Thomas -	3	"Eaton Hall."
Metcalf, John -	3	S.S. "Oceanic."
Miller, A. John -	3	"Cannanore."
* Mitchell, Thomas -	1	S.S. "European."
Murdoch, Henry -	4	"Denbighshire."
Murray, Alexander -	1	S.S. "Windward."
Napier, Richard Henry, R.N. -	14	H.M.S. "Magpie."
Nicholson, Malcolm -	1	"John Rennie."
Olver, William -	1	"Prince Hassan."
Parsell, Henry -	2	S.S. "Baltic."
Parson, George Fry -	1	"Astarte."
Pearson, Charles William -	17	S.S. "Strathleven."
Peebles, Robert -	5	"Otago."
Powell, Charles Atherton F. -	2	S.S. "Lusitania."
Prehn, Carl Christian -	5	"Mikado."
Raeburn, John, R.N.R. -	4	"Lochee."
Randall, William -	5	"Iron Cross."
Raymond, Charles Tenzer -	10	"Theophane."
Renaut, Charles Henry -	9	"Pleione."
Scott, William -	7	"Commewyne."
Seymour, John -	2	S.S. "Kangaroo."
Shearer, George -	3	"Early Morn."
Simpson, Alexander -	11	"Traveller."
Smith, J. -	2	"Naiad."
Smith, William Charles -	6	"Kingdom of Sweden."
Smith, William Henry, R.N.R. -	14	S.S. "Peruvian."
Spalding, Hinton -	2	"Dochra."
Stiven, John H. -	2	"Arethusa."
Stuart, George Rennie -	9	"Oamaru."
Stuart, W. H. -	11	Colonial Tender "Richmond."
Swan, John -	1	"City of Madrid."
Symington, William -	18	S.S. "Hankow."
Thorne, J. W. -	1	"British Commodore."
Tizard, Staff-Comr. T. H., R.N.	5	H.M. hired steam-vessel "Knight Errant."
Turner, Edward Wrake -	7	"Mertola."
Warden, William -	6	S.S. "Elizabeth Martin."
Waring, William -	6	S.S. "Gordon Castle."
Wight, Henry Potts -	9	"Taranaki."
Youlden, H. -	1	"Chin Yang."
Young, Thomas -	3	"City of Agra."

* 2nd Officer.

† 3rd Officer.

‡ Chief Officer.

List of Documents—continued.

Place.	Observer.	No. of Documents.	Nature of Observations.
Famagusta (Cyprus)	-	-	Charles Irving, M.R.C.S.
Gibraltar	-	-	Corp. S. Cordue, A.H.C., and Corp. O. Baldwin, A.H.C.
Hankow	-	-	Lightkeepers
Heligoland	-	-	Samuel H. Hall, Lightkeeper
Inagua	-	-	C. Carletti, D.M.O.
Kyrenia (Cyprus)	-	-	F. D. Heidenstam, M.D.
Larnaca (Cyprus)	-	-	J. D. W. Vaughan
Levuka (Fiji)	-	-	Andres Basurto and Maximo Angeles.
Mexico	-	-	T. Rossiter
Norfolk Island	-	-	H. Thompson, L. Olive, and A. H. Young.
Papho (Cyprus)	-	-	S. Mitchell, Lightkeeper
Point King (King George's Sound, W. Australia.)	-	-	H. B. Joyner, F.R.G.S., F.M.S.
Sao Paulo (Brazil)	-	-	J. A. Richardson, Lightkeeper
Sombrero	-	-	
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List of Documents received from SHIPS.

Captain's Name.	Ship.	Tons.	Owners.	Voyage and Year.	Months of Register.
¹ Aldrich, Pelham, R.N.	Sylvia	865	H.M.S. -	Surveying in China and Japan seas, 1877-80,	28
² " "	"	"	" -	Surveying in China and Japan seas, and voyage home from Hong Kong, via Cape of Good Hope, 1880	10
Anderson, B. N.	Atma	523	J. R. Anderson, London	To and from Adelaide, 1879-80	8
Arbuckle, John	S.S. Buteshire	872	J. Turnbull, Glasgow	To New Orleans and thence to Rotter- dam, 1880	2
³ Bainbridge, W.	S.S. German	3,028	Union S.S. Co. Lim., Southampton	To and from Cape Town, 1880	2
⁴ " "	S.S. Nubian	1,998	" "	"	2
⁵ Barlow, A. E.	S.S. Nizam	2,725	The P. & O. Steam Navigation Co., London.	To Bombay (via Suez), Point de Galle, China, and back to Bombay, 1879-80	3
Barron, William	S.S. Sultan	1,025	W. Liddell, Hull	Between Hull and Hamburg, 1880	4
" "	"	"	"	"	4
" " "	"	"	"	"	4
⁶ <i>Bax, B. W., R.N.</i>	Sylvia	865	H.M.S. -	Surveying in China and Japan seas, 1877	3
Becket, Alexander	Anana	1,299	J. Smith, Glasgow	To and from Calcutta, 1879-80	7
⁷ Benson, Michael	Woodburn	1,425	R. Shankland, Greenock	To and from Calcutta, 1880-81	7
⁸ Berridge, Henry	Superb	1,451	H. Green, Blackwall	To and from Melbourne, 1879-80	7
⁹ " "	S.S. Wyberton	"	"	To and from Melbourne, 1880-81	7
Blacklin, R. J.	"	1,314	Commercial S.S. Co., London	To Batavia, Colombo, and home, 1880	3
" "	"	"	"	To Batavia, Marseilles, via Suez, and Rotterdam, 1880	3
Blake, E. J.	Tilkhurst	1,527	W. R. Price, London	To Bombay, Bassin, and home, 1880	8
Bourke, Edmund, R.N.	Gannet	1,124	H.M.S. -	Off coast of Chili and Peru, to Gulf of Panama, Honolulu, San Francisco, Acapulco (Mexico), and Callao, 1880	12

List of Documents, &c.—continued.

Captain's Name.	Ship.	Tons.	Owners.	Voyage and Year.	Months of Register.
Bourner, P. C.	Ethelberht	768	W. White, Liverpool	To Manila, thence towards New York to Lat. 34° S., Long. 27° E., 1879-80	8
¹¹ Brady, G. W.	S.S. Nizam	2,725	The P. & O. Steam Navigation Co., London.	From Bombay to China, and back to Bombay, 1880	2
¹² " "	"	"	"	From Bombay to Southampton, Bombay, China, Bombay and home, via Suez, 1880	5
Brooker, —	Carle and Auguste	-	-	Outward passage round the Cape of Good Hope, 1875, 1876, 1878	4
Brown, A. J.	Belleisle	388	J. Anderson, London	To and from Jamaica, 1880	3
Brown, James	Perseverance	164	R. J. Kydd, Peterhead	To and from Cumberland Gulf, 1879-80	14
Buchan, James	Coppename	316	J. C. Pearson, Glasgow	To and from Surinam, 1880	3
Caborne, W. F., R.N.R., F.M.S.	S.S. Oakdale	1,408	W. Young, London	To and from Rangoon, via Suez, 1880	3
¹³ " "	"	"	"	To and from Denerara, 1880	1
Campbell, Archibald	S.S. Ethiopia	4,005	Barrow S.S. Co., Barrow	Five voyages to and from New York, 1880	4
¹⁴ " "	"	"	"	Five voyages to and from New York, 1880-81	4
¹⁵ Campbell, Hugh	Tenasserim	1,419	T. & R. Brocklebank, Liverpool	To and from Calcutta, 1880	7
Campbell, James	Hope	250	T. W. Karrau, Castletown	To and from Galveston, 1879-80	4
Candler, William	Decapolis	632	T. B. Walker, London	To and from Brisbane, 1880-81	6
Carpenter, Lieut. A., R.N.	Sparrowhawk	86	H.M.S.	At Jamaica, 1880	1
¹⁶ Cato, W. R.	S.S. Scotia	2,931	Telegraph Construction and Maintenance Co., Lim., London.	To and from Heart's Content (N.F.), 1880	1
Chitham, Robert	S.S. Torrington	1,946	Commercial S.S. Co., London	To Batavia, and thence to Rotterdam, via Suez, 1880	3

LIST of DOCUMENTS, &c.—*continued.*

Captain's Name.	Ship.	Tons.	Owners.	Voyage and Year.	Months of Register.
Chitham, Robert	S.S. Torrington	1,946	Commercial S.S. Co., London	To Batavia and Marseilles, via Suez, 1880 -	2
¹⁷ Coxwell, C. D.	S.S. German	3,028	Union S.S. Co., Lim., Southampton	To and from Cape Town, 1880 -	3
Crowell, S. O.	S.S. Alpha	653	W. Cunard, Halifax, N.S.	Four voyages from Halifax to Kingston and back, via Bermuda, 1880 -	3
"	S.S. Delta	428	G. E. Francklyn, Halifax, N.S.	From Halifax to Jamaica, via Bermuda, 1881 -	7 days.
¹⁸ Crutchley, W. C., R.N.R.	S.S. African	2,019	Union S.S. Co., Lim., Southampton	To Cape Town, Zanzibar, Cape Town, and home, 1879-80 -	4
¹⁹ " "	S.S. Asiatic	"	"	To and from Cape Town, 1880-81 -	3
²⁰ " "	"	1,557	"	To Natal, Zanzibar, back to Natal and home, 1880 -	4
Dart, L. C.	Fylde	365	Fylde Shipping Co., Lim., Blackpool.	From Baltimore to Bilbao and back; thence to Gloucester, 1879-80 -	3
Dixon, W. J.	Black Hawk	113	Falkland Islands Co., London	From Stanley (Falkland Isles) to Monte Video, and back, 1880 -	1
²¹ Dobson, C. M.	S.S. Sunbeam	1,784	W. E. Woolf, Hull	To China and Japan, thence to Hamburg, via Suez, 1880 -	5
Dyke, H. W.	Markland	920	W. H. De Veber, St. John's, N.B.	To and from Baltimore, 1880 -	3
Ellery, William	Majestic	1,884	T. & R. Brocklebank, Liverpool	To and from Calcutta, 1879-80 -	7
"	"	"	"	" " 1880-81 -	7
²² Franklin, E. B. H., R.N.	Conway	-	Training Ship	Off Birkenhead, 1880 -	4
Freedon, H. v.	W. v. Freedon	330	-	To and from Monte Video, 1879-80 -	5
"	"	"	-	To and from Pernambuco, 1880-81 -	3
Freeman, T. W.	S.S. Bellerophon	1,397	Ocean S.S. Co., Liverpool	To and from China, via Suez, 1880 -	4
"	S.S. Nestor	1,869	"	Two voyages to and from Shanghai, via Suez, 1879-80 -	8

List of Documents, &c.—continued.

Captain's Name.	Ship.	Tons.	Owners.	Voyage and Year.	Months of Register.
Gordon, James	S.S. City of Agra	2,133	G. Smith, Glasgow	To and from Calcutta, via Suez, 1880-81	2
Gray, David	S.S. Eclipse	435	D. Gray, Peterhead	To and from Greenland, 1880	5
Gray, John	S.S. Hope	452	R. Kidd, Peterhead	" " " " " "	6
Gray, J. McD.	Shun Lee	669	J. Graham, Whitehaven	To Algoa Bay, Cochin and Hamburg, 1880	7
Gray, S. B.	Letterwe	798	D. Irwin, Liverpool	To and from Adelaide, 1879-80	7
Greig, J. G.	British Peer	1,428	The British Shipowners Co., Lim., Liverpool.	To Rangoon, Chittagong, and Akyab, 1879-80	5
Greive, W. M.	City of Cashmere	980	G. Smith, Glasgow	To Otago, Astoria, and home, 1879-80	9
Heggum, E. C. W.	Blythswood	1,607	R. Cuthbert, Greenock	To Algoa Bay, Madras, Bassein, and towards home to Lat. 2° N., Long. 24° W., 1880-81	8
Holdich, J. P., R.N.R.	Overdale	882	J. Hay, Liverpool	To Bombay, Akyab, and home, and thence to Copenhagen, 1879-80	3
" Hoskyn, R. E., R.N.	Sylvia	865	H.M.S. "	Surveying in China and Japan Seas, 1877	10
Hughes, W. P.	Royal Alexandra	1,332	H. Fernie, Liverpool	To and from Calcutta, 1879-80	8
Jackson, J. N.	Pizarro	1,358	C. Myers, Liverpool	To Newcastle and Anjer, and home from San Francisco, 1879-81	10
Johnson, Charles	St. Lawrence	1,073	G. Luckley, Newcastle	To Sydney and home, 1879-80	7
Jones, G. H.	S.S. Lamperts	2,020	T. Bell, Newcastle-on-Tyne	To Genoa, Alexandria, and home. To Bassein (via Suez), and back to Aden, 1879-80	4
" "	"	"	" "	From Aden. To Kurrachee, Bombay, and home. To New York, 1880	4

List of Documents, &c.—*continued*.

Captain's Name.	Ship.	Tons.	Owners.	Voyage and Year.	Months of Register.
²⁴ Jones, S. G.	Victoria Nyanza	1,022	T. H. Jackson, Liverpool	To and from San Francisco, 1879-80	10
²⁵ Kellet, Arthur	S.S. Kangaroo	1,101	Telegraph Construction and Maintenance Co., Lim., London.	To and from Newfoundland, 1880	2
Kiddler, John	S.S. Fleurs Castle	2,472	T. Skinner, Glasgow	Via Suez to China, New York, London, China, New York, and home, 1879-80	9
Kroll, H.	Condor	-	-	Outward passage round Cape of Good Hope, 1872	1
"	Picciola	-	-	Outward passage round Cape of Good Hope, 1865-67	3
Lailey, W. N.	S.S. Cipro	908	D. Caw, Glasgow	To Trinidad, Demerara, and back, 1881	2
Legg, John	Jane Porter	953	John Corry, Croydon	To Calcutta and towards home to Lat. 35° S., Long. 24° E., 1879	5
"	"	"	"	To Calcutta and towards home to Lat. 31° S., Long. 31° E., 1880	4
Legg, William	Star of Greece	1,227	"	One voyage to and from New York. One to and from Calcutta, 1879-80	9
Little, W. T.	Corinth	614	T. B. Walker, London	To and from Brisbane	7
²⁶ Longley, Herbert	S.S. Yorkshire	2,273	W. H. Tindall, London	To China, Japan, Madras, and home, via Suez, 1877	4
"	"	"	"	To Bombay, Mouline, and Bremerhaven, via Suez, 1879	3
"	"	"	"	To Marseilles, Philadelphia, Ferrol, and Antwerp, and one voyage from Elba to Baltimore and St. Nazaire, 1879-80	4
McDougall, Alexander	Auckland	1,245	The Albion Shipping Co., Lim., Glasgow.	To and from Port Chalmers, N.Z., 1879-80	6

List of Documents, &c.—continued.

Captain's Name.	Ship.	Tons.	Owners.	Voyage and Year.	Months of Register.
McFee, J. R.	Childers	896	P. G. Carvill, Liverpool	To Bombay, Moulmein, and home, 1879-80	9
McKenzie, Allan	Candahar	1,418	R. Brocklebank, Liverpool	To and from Calcutta, 1879-80	7
27 Maclear, J. F. L. P., R.N.	Alert	1,240	H.M.S.	Surveying in Straits of Magellan and Patagonian Channel, thence to Talcahuano, Valparaiso, Tahiti, and Leveka (Fiji), 1880	8
28 "	"	"	"	Surveying near the Fiji and Tonga Islands, 1880	3
29 Manning, Henry	S.S. Seine	3,579	Telegraph Construction and Maintenance Co., Lim., London.	To Java, Singapore, Akyab, and home, 1879-80	5
30 "	"	"	"	To and from Heart's Content, 1880	2
Mesnard, Thomas	Eaton Hall	1,779	Sun Shipping Co., Lim., Liverpool	To and from Calcutta, 1879-80	8
31 Metcalfe, John	S.S. Oceanic	3,707	The Oceanic Steam Navigation Co., Lim., Liverpool.	Two voyages from Yokohama to Hong Kong and back; two from San Francisco to Yokohama; and three from Yokohama to San Francisco, 1880	4
Miller, A. J.	Cannanore	1,599	W. H. De Wolf, Liverpool	To Calcutta, San Francisco, and towards home to Lat. 19° N., Long. 28° W., 1879-80	13
Milne, A. S.	S.S. Xanthus	212	J. Duthie, London	To Cumberland Gulf, St. John's (Newfoundland), and Cumberland Gulf, 1879-80	9
Mitchell, John	Cape Wrath	1,199	Abram Lyle, Greenock	To Singapore, and towards home to Lat. 30° S., Long. 35 E., 1880	4
Morrison, Robert	Goatfell	716	A. O. Leitch, Greenock	To Rio Janeiro, New York, Java, and home, 1879-80	13
Murdoch, Henry	Deubighshire	1,367	C. Pierce, Bangor	To and from Singapore, 1879-80	8
Murray, Alexander	S.S. Windward	321	W. Baxter, Peterhead	To and from Greenland, 1880	6

LIST OF DOCUMENTS, &c.—continued.

Captain's Name.	Ship.	Tons.	Owners.	Voyage and Year.	Months of Register.
Napier, R. H., R.N.	Maggie	774	H.M.S.	In China Sea, 1879	4
"	"	"	"	" 1880	4
"	"	"	"	"	4
"	"	"	"	"	4
Nicholson, Malcolm	John Reunie	848	J. L. Devitt, London	To and from Adelaide, 1879-80	7
Niven, W.	Nairnshire	965	T. Law, Glasgow	To Rangoon, and back to Lat. 34° N., Long. 36° W., 1879-80	9
"	"	"	"	From Hamburg to Charleston (N.A.), and Liverpool, 1880	3
Oliver, Hamilton	Victoria Cross	1,262	J. Coupland, Leicester	To Melbourne, San Francisco, Astoria, and towards home to Lat. 0° N., Long. 124° W., 1879	7
Olver, William	Prince Hassan	400	F. Cheesman, Shorham	To Algoa Bay, Mauritius, Melbourne, Algoa Bay, Mauritius, Port Chalmers (N.Z.), Wallaroo Bay (S. Aust.), Mauritius, and home, 1878-80	16
Owen, Thomas	Cambrian Monarch	1,306	T. Williams, Liverpool	To Sydney, San Francisco, and home, 1880-81	9
Park, H.	Gem	459	T. Hick, Scarborough	To Demerara, Jamaica, and home, 1880	3
³⁴ Parsell, H.	S.S. Baltic	2,209	Oceanic Steam Navigation Co., Lim., Liverpool.	Five voyages to and from New York, 1880	4
³⁵ " "	"	"	"	Four voyages to and from New York, 1880-81	4
Parson, G. F.	Astarte	910	J. Shepherd, London	To Manila, San Francisco, and Dublin, 1879-80	11
Partridge, T. C.	British Peer	1,428	British Shipowners Co., Lim., Liverpool.	From Akyab to Lat. 14° S., Long. 87° E., 1880	1

List of Documents, &c.—continued.

Captain's Name.	Ship.	Tons.	Owners.	Voyage and Year.	Months of Register.
³⁶ Pearson, C. W.	S.S. Strathleven	2,436	W. Burrell, Glasgow	To China, Japan, Batavia, Marsilles, and home, via Suez, 1880	4
³⁷ " "	"	"	"	To and from Bombay, via Suez, 1880-81	2
Peebles, Robert	Otago	993	Albion Shipping Co., Glasgow	To and from Otago, N.Z., 1880	6
Pepper, George	S.S. Hero	671	C. H. Wilson, Hull	Trading between Hull and Christiania, 1880	2
³⁸ Powell, C. A. F.	S.S. Lusitania	2,425	J. Anderson, London	To and from Adelaide, via Suez, 1880	3
³⁹ " "	"	"	"	To Australia (via Cape Town), and thence to Naples, via Suez, 1880-81	3
Prehn, C. C.	Mikado	643	W. Lund, London	To China, Sydney, Melbourne, and home, 1878-1880	11
Raeburn, John, R.N.R.	Lochee	1,728	D. Bruce, Dundee	To and from Calcutta, 1879-80	7
Randall, William	Iron Cross	1,508	H. Fernie, Liverpool	To and from New Orleans, 1880	4
" "	"	"	"	" " " " 1880-81	3
Raymond, C. T.	Theophane	1,525	J. M. Heap, Liverpool	To and from Melbourne, 1879-80	6
Renaud, C. H.	Pleione	1,092	W. Savill, London	To Lyttelton, San Francisco, and home, 1879-80	9
Robinson, Thomas	Burdwan	803	T. & R. Brocklebank, Liverpool	To Anjer, Singapore, and home, 1880	7
Russell, C. J.	Baroda	1,364	R. Brocklebank, Liverpool	To and from Calcutta, 1880-81	8
Schweer, C.	Formosa	"	"	China Sea, 1876	1
Scott, William	Commewyne	315	J. Grierson, Glasgow	To and from Surinam, 1880	3
" "	"	"	"	" " " " 1880-81	3
⁴⁰ Seymour, John	S.S. Kangaroo	1,773	Telegraph Construction and Maintenance Co., Ltd., London.	To Zanzibar, Mauritius, Wellington (via Suez), and home, via Cape of Good Hope, 1879-80	6
Shaw, Gilbert	S.S. Alpha	653	W. Cunard, Halifax, N.S.	One voyage from Halifax to Kingston and back, via Bermuda, 1880	18 days.

LIST OF DOCUMENTS, &c.—continued.

Captain's Name.	Ship.	Tons.	Owners.	Voyage and Year.	Months of Register.
Shaw, Gilbert	S.S. Beta	1,087	W. Cunard, London	Five voyages between Halifax and St. Thomas, via Bermuda; and two voyages between Halifax and Kingston, via Bermuda, 1879-80	5
"	"	"	"	One voyage from Bermuda to Kingston and back, two from Bermuda to Halifax, and one from Halifax to Bermuda, 1880	1
"	"	"	"	Six voyages between Halifax and Jamaica, via Bermuda, 1880-81	4
Shearer, George	Early Morn	1,057	P. Bicknell, London	To Rangoon, Moulmein, and home, 1879-80	8
Simpson, Alexander	Traveller	196	A. Simpson, Peterhead	To Ivigtut, Dantzic, Ivigtut, Philadelphia, and home, 1880	7
Smith, J.	Naiad	1,039	J. B. Walmsley, Liverpool	To Calcutta, San Francisco, Callao, Valparaiso, Talcahuano, and home, 1878-80	15
¹¹ Smith, J. H., R.N.R.	Worcester	-	Training Ship	Off Greenwich, 1879-80	4
¹² " " " "	" Kingdom of Sweden	788	A. Gosman, London	" 1880-81	4
Smith, W. H., R.N.R.	S.S. Peruvian	3,038	R. G. Allan, Liverpool	To Madras, Mauritius, Madras, Balasore, Mauritius, Colombo, and home, 1879-80	14
¹³ Spalding, Hinton	Dochra	966	J. Scott, Hawkhill, Largs	Two voyages from Liverpool to Halifax and Baltimore, three from Baltimore and Halifax to Liverpool, and three to and from Quebec, 1879-80	4
Stephen, J. C. (Mate)	Victoria Cross	1,262	J. Coupland, Leicester	To Canterbury (N.Z.), Astoria, (Oregon), and home, 1879-80 Home from Lat. 0° N., Long. 124° W., 1879-80.	9
					4

LIST OF DOCUMENTS, &c.—continued.

Captain's Name.	Ship.	Tons.	Owners.	Voyage and Year.	Months of Register.
Steven, David	City of Vienna	1,000	G. Smith, Glasgow	To and from Calcutta, 1880	6
Stiven, J. H.	Arethusa	1,272	J. Hamilton, Liverpool	Home from Lyttelton, 1880	3
Stuart, G. R.	Oamaru	1,306	Albion Shipping Co., Lim., Glasgow	-	-
Stuart, W. H.	Richmond	183	Board of Trade, London	To and from Otago, 1879-80	7
"	"	"	"	At the Bahamas, 1876-77	8
"	"	"	"	" 1879-80	4
Swan, John	City of Madrid	1,191	G. Smith, Glasgow	" 1880	4
Symington, William	S.S. Hankow	3,594	W. Milburn, Newcastle-on-Tyne	To Honolulu, Astoria, and home, 1880-81	9
"	"	"	"	To and from Madras and Calcutta, via Suez, 1880	3
Thorne, J. W.	British Commodore	1,390	British Shippers Co., Lim., Liverpool	To and from China, via Suez, 1880	3
Thorpe, John	Dallam Tower	1,499	Lancaster Shipowners Co., Lim., Lancaster.	To Calcutta, New York, and home, 1879-80	9
Tizard, T. H., R.N.	Knight Errant	-	H.M. Hired Steam Vessel	To Melbourne, San Francisco, and home, 1879-80	9
Turner, E. W.	Mertola	392	F. T. Barry, London	Surveying on West Coast of United Kingdom, 1880	3
Wait, A. McLean	S.S. German	3,028	Union S.S. Co., Lim., Southampton	Three voyages to and from Pomaron, 1880	4
"	"	"	"	To and from Cape Town, 1880	2
"	"	1,998	"	" 1881	2
Ward, John	S.S. Nubian	1,389	R. H. Dixon, Liverpool	" 1880	2
"	North Riding	"	"	To Bombay, Calcutta, and home, 1879-80	7
"	"	"	"	"	6
Warden, William	S.S. Elizabeth Martin	809	A. Currie, Greenock	To Bombay, Calcutta, and home, 1880	-
"	"	"	"	Five voyages between Natal and Mauritius; and one voyage from Natal to London, 1879-80	4
"	"	"	"	To and from Cape Town, 1880-81	2

List of Documents, &c.—continued.

Captain's Name.	Ship.	Tons.	Owners.	Voyage and Year.	Months of Register.
48 Waring, William	S.S. Gordon Castle	2,031	T. Skinner, London	To China and back to Gibraltar, via Suez, New York, and home, 1879-80.	5
49 " "	" "	"	"	To China, thence to New York, via Suez, and home, 1880	4
Watson, Alexander	Elissa	409	H. F. Watt, Liverpool	To Buenos Ayres, Santos, Pernambuco, Montreal, and home, 1879-80	7
Wight, H. P.	Taranaki	1,126	J. Galbraith, Glasgow	To Port Chalmers (N.Z.), Port Broughton (S. Aust.), and home, 1879-80	8
Williams, H. H.	Harvest Home	547	W. Just, Liverpool	To and from Pisagua, 1880	8
Wilson, Alexander	Kryolith	297	J. G. Ross, Quebec	To Iquitos, Philadelphia, Iquitos, Philadelphia, and home, 1880	6
50 Wilson, Frederick	Mahanada	1,003	R. Brocklebank, Liverpool	To and from Anjer, 1880	6
Youlden, H.	Chin Yang	555	J. Kauson, Southampton	To Java, Mauritius, Calcutta, Mauritius, Bombay, Mauritius, and thence to Cadiz, and home, 1878-80	16
51 Young, Thomas	City of Agra	1,074	W. B. McGavin, London	To Auckland, Melbourne, and home, 1879-80	7

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

- 1 Kept by Sub-Lieutenants G. W. Gubbins, R.N., and E. C. H. Helby, R.N.
 2 Kept by Sub-Lieutenant G. W. Gubbins, R.N., and Lieutenant A. Havergal, R.N.
 3, 4, 17 Kept by Richard Ladd.
 5, 11, 12 Kept by E. Bingham, 3rd Officer.
 6, 23 Kept by Sub-Lieutenants A. G. Louue, R.N., and E. C. H. Helby, R.N.
 Assisted by Thomas Barrett, Chief Mate
 8, 9 Kept by D. W. Barker, 2nd Officer.
 10 Kept by Henry E. Collis, 2nd Mate.
 13, 14 Kept by T. Mitchell, 2nd Officer.
 15 Assisted by Messrs. Bill and Leigh.

- 16 Kept by F. H. Street.
 18 Kept by W. E. Foster, 2nd Officer, and R. W. Hancock, 4th Officer.
 19, 26 Kept by the Officers.
 20 Kept by Ernest G. Schenck, 2nd Officer.
 21 Assisted by H. T. Bone, Chief Officer.
 22, 31, 42 Kept by the Boys.
 23, 31, 47, 48, 49 Assisted by Officers.
 25, 40 Kept by Thomas Wm. Madge, 2nd Officer.
 27, 28 Kept by Sub-Lieutenant C. W. de la Poer Beresford, R.N.
 29 Kept by Wm. Symes.

- 30 Kept by C. O. Madge.
 32, 33 Kept by Lieutenant Andrew Balfour, R.N.
 34, 35 Kept by H. N. Goulden, 2nd Officer.
 36, 37 Assisted by John Kirkpatrick, 2nd Officer.
 38, 39 Kept by Anthony Standidge Thomson.
 41 Assisted by T. D. Wilkinson, 2nd Mate.
 43, 46 Kept by Campbell M. W. Hopworth.
 45 Kept by C. M. W. Hopworth, and C. H. Bond, Chief Officer.
 50 Assisted by Messrs. Dover and Richards, 1st and 2nd Officers.
 51 Assisted by W. P. Reade, 2nd Officer.

APPENDIX IV.

INSTRUMENTS supplied, &c. to the Royal Navy.

Per Account.	Baro- meters.	Ane- roids.	Thermometers.				Hydro- meters.
			Ordinary.	Max.	Min.	Screens.	
April 1st, 1880, afloat -	193	406	1,023	151	140	76	137
Issued since -	60	91	328	25	23	18	18
Returned since -	253	497	1,351	176	163	94	155
	72	117	278	33	27	8	23
April 1st, 1881, afloat -	181	380	1,073	143	136	86	132

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

April 1st, 1880, in use -	77	115	220	23	34	5	16
Issued since -	1	4	26	10	1	1	—
Returned since -	78	119	246	33	35	6	16
	1	4	24	12	2	—	—
April 1st, 1881, in use -	77	115	222	21	33	6	16

DISPOSITION of ADMIRALTY INSTRUMENTS on April 1st, 1881.

Afloat in Royal Navy -	181	380	1,073	143	136	86	132
In use at stations -	77	115	222	21	33	6	16
In store at M.O. -	116	35	62	71	83	21	94
" Chatham -	4	2	12	5	5	1	4
" Sheerness -	1	8	4	11	9	3	8
" Portsmouth -	5	1	24	6	11	11	27
" Devonport -	5	12	16	6	6	3	20
" Queenstown -	3	3	4	1	1	—	8
" Gibraltar -	1	4	2	—	—	—	4
" Malta -	8	12	28	—	—	4	15
" Halifax -	—	8	21	2	5	—	12
" Bermuda -	2	—	6	2	2	—	15
" Jamaica -	2	4	5	2	3	—	8
" Cape of Good Hope -	—	3	12	8	7	—	31
" Trincomalee -	3	2	4	—	—	—	—
" Hong Kong -	6	2	7	3	6	1	14
" Coquimbo -	5	7	28	4	3	—	23
" Sydney -	4	5	9	1	2	—	—
" Esquimalt -	7	8	24	3	3	—	8
Under repair -	8	25	4	2	—	—	—
Total, April 1st, 1881 -	438	636	1,567	291	315	136	439
Lost, &c. since April 1st, 1880.	8	28	188	14	13	2	7

APPENDIX V.

INSTRUMENTS supplied, &c. to Mercantile Marine.

Per Account.	Baro- meters.	Com- passes.	Thermometers.				Hydro- meters.
			Ordinary.	Max.	Min.	Screens.	
April 1st, 1880, afloat -	125	—	734	—	—	130	478
Issued since -	88	—	564	—	—	80	329
Returned since -	213	—	1,298	—	—	210	807
	101	—	602	—	—	91	369
April 1st, 1881, afloat -	112	—	696	—	—	119	438

INSTRUMENTS at Stations, viz., Telegraph Offices, Observatories,
Navigation Schools, &c.

April 1st, 1880, in use -	86	2	233	53	52	36	46
Issued since -	49	—	50	10	11	10	6
Returned since -	135	2	283	63	63	46	52
	39	—	33	4	4	5	10
April 1st, 1881, in use -	96	2	250	59	59	41	42

DISPOSITION of Board of Trade Instruments.

In merchant ships -	112	—	696	—	—	119	438
In use at stations -	96	2	250	59	59	41	42
In store at M.O. -	69	45	253	28	72	23	128
At Liverpool agency -	14	8	59	—	—	17	45
„ Aberdeen „ -	6	—	33	—	—	3	30
„ Glasgow „ -	4	—	10	—	—	5	9
„ Dundee „ -	4	—	14	—	1	5	6
„ Hull „ -	8	—	27	—	—	5	16
„ Southampton „ -	4	—	24	—	—	4	24
„ Cardiff „ -	6	—	14	—	—	2	12
Under repair -	8	—	—	—	—	—	—
Total, April 1st, 1881 -	331	55	1,380	87	132	224	750
Lost, &c. since April 1st, 1880	2	—	157	—	—	18	73

APPENDIX VI.

LIST of STATIONS reporting Meteorological Observations by Telegraph to the Office on 31st March 1881, with the Names of Observers.

*†Sumburgh Head -	Rev. W. Brand -	-	-	Minister of Dunroaness.
*†Stornoway -	J. Sutherland -	-	-	Schoolmaster.
Wick -	J. Sinclair -	-	-	Watchmaker.
Nairn -	W. D. Penny -	-	-	Schoolmaster.
*†Aberdeen -	J. McCormack -	-	-	Telegraph Clerk.
Leith -	J. Hutchison -	-	-	Do.
*†Shields -	J. W. Irvine -	-	-	Do.
Spurn Head -	J. Sibert -	-	-	Assistant Lightkeeper.
†York -	W. Keeping, M.A. -	-	-	Museum.
Nottingham -	E. J. Lowe, F.R.S. -	-	-	Highfield House Observa- tory.
†Ardrossan -	G. Carrick -	-	-	Telegraph Clerk.
*†Mullaghmore -	K. Kerr -	-	-	Coastguard Officer.
Donaghadee -	T. MacGowan -	-	-	Telegraph Clerk.
Parsonstown -	G. Phillips -	-	-	Assistant Observer at Lord Rosse's Observatory.
Barrow-in-Furness -	W. S. Whitworth -	-	-	Engineer, Barrow-in-Fur- ness Railway.
*†Holyhead -	J. Tilston -	-	-	Keeper of Sailors' Home.
Liverpool -	J. Hartnup, junr. -	-	-	Bidston Observatory.
*†Valencia -	J. E. Cullum -	-	-	Superintendent of the Ob- servatory.
Roche's Point -	W. Kennedy -	-	-	Telegraph Clerk.
Pembroke -	Messrs. Blake and Baker -	-	-	Lightkeepers.
*†Scilly -	W. Thomas -	-	-	Signalman.
Prawle Point -	J. John -	-	-	Coastguard Officer.
†Hurst Castle -	G. G. Appleton -	-	-	Lightkeeper.
†Jersey -	J. Fisher -	-	-	Signalman.
*†Dover -	J. Costello -	-	-	Telegraph Clerk.
*†London -	F. Gaster, F.M.S. -	-	-	Clerk, Meteorological Office.
Oxford -	H. E. C. Bellamy -	-	-	Radcliffe Observatory.
Cambridge -	H. Todd -	-	-	Observatory.
*†Yarmouth -	G. T. Watson -	-	-	Secretary, Sailors' Home.
†Hawes Junction -	G. Wooding -	-	-	Station Master.

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

APPENDIX VII.

EXTRACTS FROM INSPECTORS' REPORTS—

- I. Mr. R. H. Scott's Report (Ireland and Wales).
- II. Mr. A. Buchan's Report (Scotland).
- III. The Rev. W. Clement Ley's Report (England).
- IV. Mr. Whipple's Report; Instruments and Photography of the Self-Recording Stations.

I. REPORT ON THE IRISH AND WELSH STATIONS.

GENTLEMEN,

I HAVE the honour to report that I have completed the inspection of the Irish and Welsh stations, and that I have found nothing calling for serious alteration in the way of amendment of the methods of observing, &c.

I shall deal first with the Observatories, next with the Telegraph Stations, and finally with the Stations of the Second Order.

OBSERVATORIES.

Valencia.—Visited on the 23rd ultimo. There was nothing calling for special remark as regards the instruments; the repairs to the house seem to have been effectively carried out, and it only remains to lay a tiled drain to carry off the surface water and the house sewage.

Armagh, visited on the 4th inst.—There is nothing calling for remark at this observatory.

TELEGRAPHIC REPORTING STATIONS.

The barometers at St. Ann's Head, Roche's Point, Donaghadee, and Mullaghmore, have all been changed, as I took a supply of the new instruments with uncontracted tubes with me.

St. Ann's Head, visited September 20th.—At this station Mr. Walker, the old observer, having been promoted to a postmastership at Exmouth, the duty of reporting has, with the sanction of the Trinity House, been transferred to two of the light-keepers, Messrs. Blake and Baker. The only change in the instrumental arrangements has been the removal of the barometers to the upper lighthouse, which is an improvement as regards illumination, &c.

The thermometer screen, rain-gauge, and sunshine recorder are, as formerly, placed on the open ground near the lighthouse.

The new observers seem intelligent and careful.

Valencia, visited September 23rd.—This station is in good order. The sunshine recorder has been erected at the S.E. corner of the house, where it commands an uninterrupted view of the sun as far as the mountains, close to the horizon, will permit; but their influence is slight.

Roche's Point, visited September 24th.—The exposure of the thermometer and rain-gauge has been seriously interfered with by recent building operations on the Point, and I have directed the observer, W. Kennedy, to ascertain whether Lord Fermoy would be willing to grant a site for these instruments on the headland close to the station. Since my visit I have learned that his Lordship has granted the necessary permission.

Parsonstown, visited October 1st.—The observer at this station, Mr. Harding, is attentive and diligent. The only matters calling for remark

are that I am informed that the barometer (on Fortin's principle), will not register correctly below 29 inches, as there is too much mercury in the cistern. I hope this may soon be set to rights. The thermometer screen was rather too low. The sunshine recorder is placed on one of the walls of the six-foot Reflector building.

Donaghadee, visited October 4th.—At this station Mr. J. McGowan has resigned the post as observer, and has been replaced by his brother Thomas, who seems intelligent and willing. An improvement has been effected in the arrangements, as the new barometers can both be suspended in the Post Office, whereas formerly the check instrument was placed in an inconvenient position in another room.

The exposure of the thermometer screen and rain-gauge is not satisfactory, as they are in a narrow garden, but no better site is obtainable in the town.

Mullaghmore, visited October 8th.—This station is very satisfactory, but I think it may, perhaps, be advisable to lay a private wire to it from Clifony, as the expense of the foot messenger three times a day (24*l.* per annum) is considerable, and the Post Office may possibly reduce the proposed annual rent of the wire (38*l.* per annum).

Holyhead, visited October 12th.—At this station the barometers had been changed before my visit. I have to recommend the Council to send down a Stevenson's screen to be set up in the garden. The wall screens hitherto in use are not quite satisfactory.

STATIONS OF THE SECOND ORDER.

St. David's, visited September 18th.—This station calls for no special remarks. The instruments were in good order.

Waterford.—The station at the Friend's School, Newtown, was visited September 21st. This station is not thoroughly efficient, for the continuity of the observations is interrupted in vacation time. The situation of the thermometers and rain-gauge is pretty good, but the latter instrument is not of a good pattern.

Cork (Queen's College).—At this station verified instruments have been procured. The situation is good, and Professor A. Jack, the Registrar, hopes to begin observing with the year 1881.

Foynes (Mount Trenchard), visited September 29th.—This station simply supplies readings for the Weekly Weather Report.

The thermometers and rain-gauge are in good order, and well placed on the side of a hill, no level ground being obtainable in the demesne.

Parsonstown.—This station has already been mentioned in the list of telegraphic stations.

Dublin (Mountjoy Observatory).—This station was visited on the 2nd of October. It is in good order, the observer, Sergeant Gwynne, being very attentive. The sunshine recorder is placed on the lofty scaffolding mentioned in my last year's report.

Dublin (Fitzwilliam Square).—This station was visited October 11th. Dr. Moore, the observer, sends in the fullest returns we receive from any of the Second Order stations, but as his house is in the town, the exposure is not open enough.

Dublin (Glasnevin Gardens).—This is a recent station maintained at the Botanic Gardens in connexion with the Science and Art Department. The thermometer exposure is far from satisfactory, as the instruments are in a large closed shed, with very little ventilation. A Stevenson's screen is required. The barometer was placed in the screen, but I at once removed it to the library.

I have great hopes that this station may be rendered efficient by the end of the year.

Londonderry.—The observer, Sergeant Conroy, late R.E., is very careful. The situation is as good as a town garden can be expected to afford, but it does not satisfy all the requirements of a complete station, and Sergeant Conroy's occupation, that of Assistant to the County Surveyor, interferes to some extent with the regularity of his own observations. The readings are, however, taken by his assistant in his absence.

Colebrooke, visited October 6th.—The instruments here are in good order, but the observer, Mr. Ferguson, gardener and forester to Sir Victor Brooke, finds himself unable to keep up the reductions, so that the schedules are not completely filled up.

Markree Observatory.—At this station the observations are taken by Mrs. Salles, the housekeeper, as Mr. Doberck, the astronomer, declines to take any part in them. The instruments are well placed, with the exception of the rain-gauge, which might have a better exposure. The sunshine recorder is situated on the wall of the observatory in a perfectly open position. The condition of the station on the whole was satisfactory.

Colonel Cooper is anxious to retain the original sunshine cards if the Council will consent to his doing so.

October 13th, 1880.

(Signed) ROBERT H. SCOTT.

II. REPORT on the SCOTTISH METEOROLOGICAL STATIONS of the METEOROLOGICAL OFFICE for 1880.

BAROMETERS.

The barometers at the stations were compared with the small pocket aneroid No. 11, and those at Nairn, Laudale, Ardrossan, Glasgow, Leith, and Glenalmond, also with the mercurial marine standard barometer No. 456. It is believed that this standard barometer was entirely free from air during the whole time of the inspection.

The small aneroid, No. 11, had since the inspection of 1879 been sent for repair to London, with an improvement, undoubtedly, in the readings made from it; but these readings still are far from satisfactory. Such as they were they are given in this report.

The following table gives the corrected readings of inspector's standard No. 456; the readings of aneroid No. 11; and the uncorrected readings of the reporting and check barometers at each of the stations, to which is added a column showing the readings of the attached thermometers, which may be useful in connexion with the readings of the aneroid.—

TELEGRAPH REPORT- ING STATIONS.	Insp. St. No. 456.	Aneroid, No. 11.	Reporting Baro- meter.	Check Baro- meter.	Att. Therm.	REMARKS.
Aberdeen - -	—	29·495	29·555	—	64	In house.
Do. - - -	—	—	—	29·542	66	In office.
Nairn - - -	30·081	30·035	30·060	30·063	69	
Wick - - -	—	30·385	30·396	—	70	In shop.
Do. - - -	—	30·320	—	30·331	67	In house.
Dunrossness -	—	30·215	30·218	30·215	65	
Sandwick - -	—	30·230	30·218	—	64	
Stornoway - -	—	30·260	30·230	30·230	61	
Laudale - - -	29·730	29·700	29·718	—	58	In ground floor.
Do. - - -	—	29·690	—	29·718	58	In upper floor, 8 feet higher.
Ardrossan - -	29·842	29·825	29·837	29·840	59	
Glenalmond -	29·551	29·670	29·650	—	52	
Leith - - -	30·557	30·565	30·553	30·552	66	
OBSERVATORIES.						
Aberdeen - -	—	29·470	29·530	—	66	
Glasgow - - -	29·677	29·670	29·659	—	55	

Since last inspection new barometers have been supplied to the reporting stations, with tubes less contracted than those formerly used at the stations.

Two sets of these I took with me, one set being for Wick and the other for Dunrossness, and returned the old barometers to the Meteorological Office, *via* Mr. Jones, Aberdeen. At Wick readings were taken of the two sets after the new had hung beside the old barometer at the house (check barometer) 1h. 20m. and at the shop (reporting barometer) 2h. 30m.—

		New.	Old.
Reporting barometer	-	30·396	30·396
Check barometer	-	30·331	30·327

And at Dunrossness after the two sets had been hanging together upwards of two hours—

		New.	Old.
Reporting barometer	-	30·218	30·218
Check barometer	-	30·215	30·216

These results show that the new barometers at Wick and Dunrossness are in good order.

I drew attention in last report to the barometric means of the stations at Stornoway, Leith, Ardrossan, and the observatory at Glasgow on which I make a few additional brief remarks.

Stornoway Barometer.—Since last year, Mr. Sutherland has, as requested, re-levelled his barometer with the result that the height of its cistern had been previously understated, which accounts for part of the suspected error of the instrument. As regards the readings of the instrument, Mr. McDonald, assistant observer, set and read it accurately. Unfortunately Mr. Sutherland was accidentally detained at Ullapool and did not arrive at Stornoway till I was on the point of leaving. The following are the means at 32° and sea-level for the stations at Stornoway Castle and Nicolson's Institution for last three months:—

	Stornoway Castle.	Nicolson's Institution.
July -	29·850	29·822
August -	30·003	29·969
September -	29·838	29·792

To an inquiry into the cause of this difference, I shall give very special attention next inspection, before which a comparison, month by month and day by day, will be instituted so as to ascertain under what observer it arises. I am convinced that the difference arises in the setting of the instrument before reading it.

Leith Barometer.—I have been several times at Leith since last year, and now understand that the barometer there has been set too low. Mr. Hutchinson, the new observer, informs me that he was instructed by the late observer to bring the vernier down till the two specks of light were just visible; in other words, were brought near the point of being shut off. If I was correct in last report in supposing that the means of this barometer were 0·020 inch too low, the greater part of the error of the past observations, if not the whole of it, will now be accounted for.

Ardrossan Barometer.—This is the station at which the barometer was systematically set too low. At this inspection the new observer, Mr. Carrick, set and read the one barometer, with an error of -0·003 inch and the other correctly. It is highly probable that this barometer is now set and read correctly.

Glasgow Barometer.—As the work on which I have been engaged for some time proceeds, viz. an investigation of the atmospheric pressure of the British Islands, it seems clear that Glasgow barometer is a little

more than 0·010 inch lower than Kew standard. During this year's inspection, after standard No. 456 had hung beside the station standard barometer for two hours the readings were—

Standard No. 456 -	-	-	-	29·677
Observatory standard	-	-	-	29·659

I am inclined to think it extremely probable that this standard instrument to which the photographic records are reduced, reads about 0·015 inch too low, and has done so throughout. As the instrument, besides, is an old one, and the scale not easily read from, it might be worth considering whether a new standard might not be supplied to the Glasgow Observatory.

The table of the results of comparisons made during inspection (page 60) shows from the readings of the reporting and check barometers that these instruments at the stations are generally in a very satisfactory state. The difference of the two is always small, and would no doubt be still smaller if the readings themselves were corrected for instrumental errors.

Inspector's Standard Barometer.—This is one of the ordinary marine barometers, the movements of which being sluggish, it follows that when atmospheric pressure at the time of inspection happens to be rising or falling, it cannot serve as a satisfactory inspector's standard. An instance illustrative of this will be seen in the table, for the station at Laudale. The results for Nairn also point in the same direction, the difference being in all likelihood due not to errors in the station's barometers, but merely to the sluggish movement of the inspector's standard.

May I take the liberty of suggesting to the Meteorological Council that the standard barometer for the inspector's use might be of the same description as the barometers supplied to the Telegraphic Reporting Stations, constructed in as handy and light a form as may be consistent with the efficiency of the instrument.

THERMOMETERS.

The following table gives the results of the comparison with inspector's standard No. 2420, of the thermometers at the various stations, the readings of the standard being corrected for instrumental errors, whilst those at the stations are not corrected:—

Telegraph Reporting Stations.	Insp. Stand No. 2420 Corrected.	Dry Bulb.	Wet Bulb.	Spare do.	Max.	Min.	Time in Water in Minutes.	Change of Temperature of Water.
Aberdeen - - -	64·3	+0·4	+0·6	+0·5	+0·6	+0·8	105	-0·2
Nairn - - -	68·9	+0·2	+0·6	+0·5	+0·1	+0·9	-	-
Wick - - -	66·9	+0·4	+0·3	+0·3	+0·1	-0·1	75	uniform.
Sandwick - - -	61·5	+0·4	-0·1	-	+0·0	-0·7	120	-0·3
Dunrossness - - -	62·4	+0·2	+0·2	+0·2	+0·3	-0·3	150	-0·2
Sternoway - - -	61·3	+0·6	+0·4	+0·5	-0·1	-0·4	140	+0·1
Laudale - - -	60·8	+0·1	+0·1	-	+0·1	-0·1	60	uniform.
Glenalmond - - -	51·7	+0·2	+0·2	-	+0·2	0·0	80	do.
Ardrossan - - -	55·8	+0·2	+0·2	+0·4	0·0	-0·2	110	-0·2
Leith - - -	60·6	+0·3	+0·5	+1·5	-0·2	-	100	-0·3
OBSERVATORIES.								
		Max. No. 48.	Min. No. 89.	Eye Obsns.				
				Dry.	Wet.			
Aberdeen - - -	52·1	+0·5	-0·1	0·0	+0·5	30	uniform.	
Glasgow - - -	54·5	+0·3	+0·2	+0·3	+0·1	120	uniform.	

The above corrected readings of Standard No. 2420 were obtained by subtracting $0^{\circ}\cdot3$ from each reading, in accordance with the certificate of errors received from the Office.

As explained in "*Inspection Notes*" already forwarded to the Office, the minimum thermometer at Sandwick was found to be out of order, and that at Stornoway considerably so. Both were put right by the observers themselves under my immediate instructions; and directions, very special, were given occasionally to examine the instrument.

The minimum thermometer at Aberdeen Telegraphic Reporting Station reads no lower than $+10^{\circ}\cdot0$, and that at Landale does not go low enough. In both cases it is desirable that new thermometers, going down to say $-20^{\circ}\cdot0$, were sent to replace the old ones. In December the temperature at Aberdeen fell to $+12^{\circ}\cdot0$. If the great frost of the 4th of that month had extended to this station, its thermometer could not have registered it. On that night the temperature at Springwood Park, Kelso, fell to $-16^{\circ}\cdot0$, the thermometer there being well protected in a Stevenson's screen. I inspected this station in May last, and from the state of the thermometer and its position there can be no doubt of the correctness of the observation, which the unexampled destruction to vegetation all round only too faithfully confirmed. As it is desirable to record such low readings at the telegraphic reporting stations when they do occur, a thermometer reading to about $-20^{\circ}\cdot0$ is most desirable, at least at all inland and eastern stations.

When the Stevenson's box has been properly placed at Nicolson's Institution, Stornoway, I shall be able to report that all the telegraphic reporting stations have their thermometers so placed that they may be regarded, with the exception of Sandwick, the peculiarity of which has been referred to in a previous report, as good, and some of them as first-class climatological stations.

Reading of the Thermometers.—I learned during this inspection from Mr. McDonald, assistant observer at Stornoway, that he has been in the practice of reading the thermometers only to that degree which the temperature has passed or reached. Thus, $40^{\circ}\cdot0$, $40^{\circ}\cdot1$, $40^{\circ}\cdot2$, $40^{\circ}\cdot8$, and $40^{\circ}\cdot9$ are all read as $40^{\circ}\cdot0$. I thought I had specially drawn attention to this point, but next year I shall again state to the observers, very particularly, to read off the nearest degree, and, as regards the wet bulb, to endeavour to make their daily report show the approximate difference in degrees between the dry and the wet bulbs. I believe such readings as these have been sent:—

Actual Readings.				Readings sent.	
Dry.	Wet.			Dry.	Wet.
$40^{\circ}\cdot6$	$39^{\circ}\cdot4$	-	-	41°	39°
$40^{\circ}\cdot9$	$40^{\circ}\cdot0$	-	-	40°	40°

RAIN GAUGES.

According to instructions received from the Office, I ordered all the rain-gauges to be placed at the uniform height of 12 inches above the ground.

SUNSHINE RECORDERS.

These extremely valuable additions to the observing instruments were placed in either good or excellent positions, except at Stornoway, where the position and fixing of the instrument were not good. I gave orders to have its position and fixing made satisfactory.

I have the greatest pleasure in reporting a growing interest in the work of observing on the part of all the observers, and a readiness to make such additional observations for the Office as are asked for.

OBSERVATORIES.

Glasgow Observatory.—The tree referred to in a previous report as interfering in some degree with the rain-gauge has been cut down. The hitch in the tracing of the anemometer referred to last year still remains visible in most of the lines traced by the instrument, but the curious point is that the hitch is not always found in the sheets. With certain velocities it perhaps occurs invariably. It is a point of considerable interest to discover the cause of it, particularly from its bearing on the important practical question of extreme recorded velocities spread over short intervals of time.

I again looked at the question of the anemometer appearing to fail in registering what seems to be the true direction of the wind, as that is estimated from the general drift of the smoke all around. As it seemed possible that it might be due to the form of the building taken in connection with the comparatively low height of the anemometer above the extended flat roof of the transit room, &c., Mr. Maclean, the observer, has kindly agreed to note all occasions on which any deviation occurs, together with the force and direction of the wind at the time. The results I shall refer to in next report.

At the time of inspection four drops of water were falling each minute from the wet-bulb of the self-recording thermometers.

Aberdeen Observatory.—There is no remark to be made regarding the instruments at this observatory, excepting the barometer which has been already referred to.

Mr. Boswell kindly directed my attention to the photographic records of the thunderstorm of August 2nd, as showing very remarkable meteorological changes, accompanying it, which are of the greatest interest.

(Signed) ALEXANDER BUCHAN,
Inspector.

III. REPORT ON THE ENGLISH METEOROLOGICAL STATIONS FOR 1880.

DEAR SIR,

I HAVE the honour to submit to the attention of the Meteorological Council the following report of the stations in England inspected by me in the course of 1880:—

TELEGRAPHIC REPORTING STATIONS.

I have inspected all the telegraphic reporting stations, with the exception of Nottingham, Cambridge, and Yarmouth. It did not appear to be worth while to visit Nottingham, as the reports from that station will be shortly discontinued. As Cambridge and Yarmouth were inspected by me last winter, and as I intend to inspect them in the earlier part of 1881, I hope that their omission this year will not be considered of serious importance.

Altitude.—The only station whose altitude above mean sea level, as previously determined, I have found it necessary to correct, is Prawle Point. The height of this station I have this year determined from simultaneous barometric observations taken at the station, and on the beach beneath it, as about 335 feet.

Barometers.—New sets of these instruments with uncontracted tubes have been taken to Spurn Head, Hurst Point, and Prawle Point.

At Spurn Head the old and new barometers were compared with the inspector's standard, the results showing that both sets were in good order. The results of the readings of the old and new reporting barometers, and of the standard (the Kew corrections being applied to each) were as follows :—

Old reporting barometer, B.T. 450	-	-	29·793
New reporting barometer, M.O. 542	-	-	29·803
Inspector's standard, B.T. 405	-	-	29·799

The new reporting and new check barometers (M.O. 542 and M.O. 541) agree perfectly.

Similar comparisons of the old and new barometers were made at Hurst Point, before the old barometers were finally dismantled and the new substituted. I mentioned in my last year's report that the old barometers at Hurst gave readings as much as ·020 too low. The result of the comparison made this year confirmed this. Squalls were passing at the time of my visit, and the barometers were much agitated. The mean result of several comparisons, made at intervals of 15 minutes, was that the new reporting barometer read ·004 below the new spare barometer, and ·004 above the inspector's standard; being also ·023 above the old reporting barometer, and ·022 above the old check barometer.

The set of new barometers for Prawle Point have been sent by Mr. Scott to that station since my visit of inspection.

At the telegraphic reporting stations the results of the comparisons of the barometers with the standard have been generally satisfactory.

The largest discrepancies were as follows: At Scilly the barometer reads ·010 too high, and at Oxford the barometer reads ·007 too low as compared with the inspector's standard.

Several observers were found to have relapsed into the habit of setting the verniers too low. From this cause the observer at Dover read his barometer ·003 too low. At Noirmont, Jersey, the error in reading, due to this cause, amounted to —·004, at Prawle to —·002, and at Scilly to —·003 at the times of my visits of inspection.

At Dover, a serious error, which I failed to discover last year, was noted in the observer's mode of reading the barometer. The observer regarded each short line on the vernier as representing *one* thousandth of an inch, and informed me that he had been in the habit of doing so since the commencement of the observations.

Thermometers.—At all the telegraphic reporting stations these instruments were found to be in good order, except that at Barrow-in-Furness the maximum No. 494 at 64°, read, without the Kew correction, 0°·3, and with the Kew correction 1°·2 too low; that at Shields the minimum 2493, at 60° read 1° too high, and that at Spurn Head the minimum at 55° read 1°·1 too low.

At Hurst Point the observer had, from the date of his appointment at the end of last year up to the time of my visit, July 27, 1880, regarded the tenths of a degree in the table of instrumental corrections as whole degrees, and had so applied them. As he does not appear to understand decimals, to prevent the repetition of so serious a mistake, I ordered him for the future to apply no corrections to the readings of the thermometers.

Thermometer Screens.—No change has been made in the screens at any of the telegraphic reporting stations since my last report. At Prawle

Point the observer has undertaken to lay down turf round the screen this winter.

Rain-Gauges.—At Prawle Point the rain-gauge has been slightly shifted in accordance with my previous recommendation. At Noirmont, Jersey, the gauge was found to be almost entirely worn out, and a new instrument to be requisite, which has since been supplied. At Dover the rain-gauge was greatly inclined. The position of the instrument on the top of the railway station is very objectionable, and I think that the gauge is not well attended to, owing to its difficulty of access in wet and slippery weather. I regret to say that I failed to find any other available site.

STATIONS of the SECOND ORDER and those furnishing DATA for WEEKLY WEATHER REPORT.

Douglas, Isle of Man.—The observer, Mr. Moore, is very careful and attentive. The instruments are in excellent order. The Sunshine Recorder is truly fixed, and has a perfect exposure.

Silloth.—The observer, the Reverend F. Redford, is very painstaking. The instruments are in good order. The screen (Stevenson pattern) stands over grass. The Sunshine Recorder stands on a sandbank, in the grounds of the Convalescent Hospital, and has a perfect exposure.

Seaham.—None of the instruments at the station are satisfactorily placed. The work of observation is carried on in a negligent manner.

Durham.—The observing barometer at this station reads $\cdot 008$ too low. The rain-gauge readings have always to be taken at 10 a.m. The thermometers are in good order. Sunshine can reach the recorder at all hours, except about one hour before sunset in summer when some trees interfere. The observer promised me to have the trees cropped this winter. I found the sunshine recorder to be not quite correctly mounted.

York.—The meteorological observations have been of late left to the gardener of the museum grounds, who is scarcely competent for this work. The Honorary Secretary of the Museum Council promised me that in future thorough attention should be paid to the observations. The sunshine recorder (on the roof of the Friends' School, Bootham Street), I found to be not quite correctly mounted. I think that shortly before sunset in April and August the sunshine will be cut off by a chimney stack, but the exposure is otherwise good.

Hull.—The instruments were in good order at the time of my visit, June 23rd. The remarks sent from this station are very scanty, and are not likely to become more satisfactory, as the observer is under the necessity of frequent absence, and (though much interested in meteorological work) can devote but little time to the matter.

Southampton.—(Northam.) No station possesses an observer more careful and accurate than this one. The instruments were in perfect order. No unexceptionable places can be found for the thermometers and rain-gauge at this station. At the time of my visit (July 27th) the observer intended to make a change of position of the thermometer screen, which will be desirable. I found the sunshine recorder to be sheltered to some extent by a chimney, but a higher stage was in process of erection, and the instrument is now (I think) unsheltered at all hours.

Southampton.—(Netley.) There was a serious interruption of the observations in the earlier part of 1880, owing to a change of observer.

A new barometer has been in use since July 1st. This instrument at the date of my visit was found to have, without the Kew corrections, an error of $-.042$, and with the Kew corrections, of $-.046$.

Jersey.—(St. Aubins.) The instruments at the date of my inspection, July 28th, were all in good order. A hill on the W.N.W. must, I think, prevent sunshine from reaching the recorder after 6.45 p.m.

Plymouth.—The observer, Dr. Merrifield, is attentive, but the position of the instruments is very unsatisfactory. At the top of the rain-gauge the house on the N.W. subtends 43° , and a tree on the S.E. 53° . The gauge stands 9 feet 2 inches above the ground. A wall-screen is employed for the thermometers.

Barnstaple.—The instruments are in good order, but are not very correctly read by the observer, and are most disadvantageously situated. The rain-gauge is considerably sheltered. The thermometer-screen is a louver-boarded shed 6 feet by 5 feet in the clear, and 8 feet in height. The roof is of black tarred felt. This shed stands over gravel, with walls and buildings all round, and the readings of the thermometers therein are necessarily much too high. There is a prospect that the Literary and Philosophical Institute will shortly be moved to another locality on the outskirts of the town, where a good exposure (and it is to be hoped a Stevenson's screen) will be obtained.

Leicester.—The instruments were in fairly good order at the date of my last visit. I could not obtain the corrections for the thermometers; the grass minimum, 25221, reads, uncorrected, at the temperature of 60° , as much as $2^\circ.5$ too low. There is a slight instrumental defect in the sunshine recorder, M.O. 3, the ring of which has not been correctly cut. The instrument must, I think, be sheltered by chimneys, about the equinoxes, a little after sunrise and before sunset.

Loughborough.—The instruments, at the date of my inspection, September 26, were in good order, but a very good exposure cannot be obtained. The observer, Mr. Berridge, is very careful and painstaking.

Cirencester.—The outdoor instruments have been removed about 85 yards north-west of their previous position. Here their exposure is complete. The screen, a modification of Stevenson's, is rather too high, and stands over bare soil. Turf will be laid down this winter. I ordered some changes to be made in the fixing of the sunshine recorder. The exposure of this instrument is perfect. And the atmosphere here being remarkably free from dust, the sun burns when very close to the horizon.

Stokesay.—At the date of my visit, November 26, the observer's barometer (corrected for index error) read $.103$ too low as compared with the inspector's standard, and gave indications of air in the tube. The thermometer screen stands on bare soil. The rim of the rain-gauge I found to be greatly indented; this defect the observer promised to have immediately rectified. The position of the station, shut in by wooded hills, is exceptional, and the winds suffer extreme deflections.

I remain, &c.

W. CLEMENT LEY.

December 31, 1880.

The Secretary of
the Meteorological Council.

IV. REPORT of INSPECTION of SELF-RECORDING OBSERVATORIES of the METEOROLOGICAL COUNCIL, 1880.

Falmouth Observatory, visited August 25-27.—The instruments were all in good condition, and the photography was good.

The instrument clocks were all cleaned and oiled, and the lenses wiped.

During my visit, at the desire of W. Fox, Esq., a new gas governor was fitted, with the view of reducing the consumption of gas in the observatory; and at the same time I had new connections fitted to the burners, the old ones having become defective.

The external part of the anemograph was in good order, as was also the registering apparatus, with exception of the velocity pencil, which does not mark quite satisfactorily, although improved slightly by the filing and polishing by Mr. Olive.

The Beckley rain-gauge was in good order.

The sunshine recorder was found to be well placed, but the card appears to be slightly out of focus.

The minimum thermometer reads low, but was not defective from evaporation of alcohol.

The maximum was in good order.

Valencia Observatory, visited September 1-3.—Both barograph and thermograph at this observatory were in good order, and merely had their lenses cleaned and clocks oiled.

I examined the wet-bulb tube of the thermograph, and found that the defective definition which is observed when the photographic trace is between 35° and 45° is due to some accidental roughening of the surface of the glass which I could not remove. The black varnish had also been scraped off part of the tube: this I replaced. It is possible that the defect may have been caused by the workmen who have painted the building internally since my last visit.

The thermometers for eye observations were all in good order, with the exception of the maximum, which I exchanged for one I took out with me. As Mr. Cullum was of opinion that the ventilation of his thermometer screen was somewhat defective at times of great heat, owing to its closed top, I bored several holes in the upper part of the woodwork to enable a current of air to pass through.

The anemograph was in good order both inside and out, with the exception of a loose joint in the velocity shaft. This was remedied by the insertion of a brass pin.

The rain-gauge was quite right. The sunshine recorder is firmly fixed on the top of a wall, the situation being the best available.

Armagh Observatory, visited September 8-9.—The thermograph and barograph were found in good order; both clocks were cleaned, and the lever of the barograph shutter weighted to improve its action, which was somewhat uncertain. A new mirror is required for the dry-bulb thermograph, the present one being much dimmed (size $5\frac{1}{4} \times 2\frac{3}{8} \times \frac{1}{8}$ in.).

We cleaned and oiled the anemograph throughout, and eased the fitting of the velocity pencil, which was a little too tight; otherwise the instrument was in good order.

The rain-gauge was also examined, and the capacity of its bottle receiver re-adjusted, as it was found to have become slightly increased. The cause of the defective going of the clock, which had been noted for some time, was detected and removed.

The photography was in a very unsatisfactory condition. Suggestions were offered for its improvement, and Mr. Call has since obtained better results.

The barograph tabulator, which was not working well, was oiled and readjusted. A new ivory scale is, however, wanted for the subsidiary measurement of the barogram, the present being almost worn out.

Aberdeen Observatory, visited September 14-16.—The barograph, thermograph, and anemograph at this observatory were all in very good order, and the photography was good. After cleaning the barograph clock, the re-adjustment of the light shutter was somewhat difficult, but it was left in proper action.

The Beckley rain-gauge was in good order, with the exception of the clock spindle, which is defective, having been acted on by the mercury; a new one is required. A spare gauge and funnel is also wanted for measuring amount of snow. The practice of the observer hitherto has been to estimate it from the weight of the snowball formed by snow collected in the funnel of the Beckley gauge.

The thermometers for eye observations were also in good order.

Glasgow Observatory.—This observatory was visited on September 11th, but owing to absence of Professor Grant I did not inspect it until the 18th, 20th, and 21st.

I found the instruments all in good order, and the usual cleaning operations only were performed.

The mounting of the sunshine recorder is somewhat rougher than at the other observatories, and the adjustment for latitude did not appear to have been quite satisfactorily performed. Professor Grant promised to rectify it when suitable opportunity occurred.

The minimum thermometer for eye observations was found to have a little alcohol in its chamber and was set right.

The photography was excellent.

Stonyhurst Observatory, visited September 22.—All the instruments at this observatory were found in excellent condition. The anemograph still possesses the slight defect alluded to last year, which appears inherent in the form of instrument, but does not appear to detract from the value of its indications. Owing to the illness of the former photographic assistant the photography was for a time somewhat less satisfactory than usual, but his successor is now producing good results.

Radcliffe Observatory, visited September 25.—The instruments lent by the Council to this observatory, having been very recently set up, were all found to be in thorough order, and the photography was good. The exposure of the rain-gauge is not altogether satisfactory, but Mr. Stone has placed it in the most suitable locality at his disposal.

(Signed) G. M. WHIPPLE.

Kew Observatory, October 1880.

APPENDIX VIII.

METHOD OF DEALING WITH TELEGRAPHIC WEATHER INTELLIGENCE.

The operations connected with the preparation and issue of the Daily Weather Report, Forecasts, and Storm Warnings have been modified greatly since the beginning of the present year, and are now as follow :—

The Office receives, when the telegraphic communications are perfect, fifty-three reports every morning, thirteen every afternoon (except on Sundays), and nineteen each evening. The interruptions which have occurred during the winter in the communication with Sumburgh Head and Stornway have been of a serious description, both cables having been broken for several months. The suspension of the afternoon reports on Sundays is due to the fact that almost all the telegraphic circuits are closed at the hours at which the messages would be transmitted.

The foreign reporting stations, 23 in number, extend along the entire western coast of the Continent, from Christiansund in lat. 63° N. to Corunna in lat. 43° N., and include four stations on the coast of the Baltic, and one in the Mediterranean. The information is received in accordance with various arrangements made with the Meteorological organisations in France, Holland, Germany, Denmark, Norway, and Sweden.

At the British 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.

As fast as the reports come in the information is entered on a chart, which shows 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 then drawn for publication in the newspapers, as described further on.

If necessary, telegraphic intelligence of storms or of atmospherical disturbance is 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 in Jersey and also to the Marine Ministry in Paris, by which department it is afterwards transmitted to Florence for the benefit of the Italian Naval Service. 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 for despatch to the provinces. The last of these messages consists of a brief statement of the general condition of the weather in Western Europe, as shown by the reports for the morning.

It is, however, not only at 11 a.m. that storm warnings are issued to the coasts, for a constant watch is 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 1880, there were prepared each morning, afternoon, and evening, Forecasts of the weather, for one 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. 75. The districts for which the Forecasts were prepared were those into which the returns for the Weekly Weather Report are divided (see p. 91), with the addition of Scotland, N., viz. :—

- | | |
|------------------|-----------------------------------|
| 0. Scotland, N. | 4. Midland Counties. |
| 1. " E. | 5. England, S. |
| 2. England, N.E. | 6. Scotland, W. |
| 3. " E. | 7. England, N.W. (with N. Wales). |
| | 8. England, S.W. (with S. Wales). |
| | 9. Ireland, N. |
| | 10. " S. |

The demand for these Forecasts was considerable, and efforts are being made to increase their accuracy. At the commencement of 1881, however, some changes were made with regard to the issue of those drawn up in the afternoon and evening, to which reference is made further on.

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.

The Charts prepared daily for newspaper publication are 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.

The draft of the Daily Weather Report, which has been considerably enlarged and improved, is issued as a separate sheet, 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 in London are issued by the lithographer 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.

In addition to the charts referred to above, 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 "Observer," "Graphic," "Lloyd's Weekly London Newspaper," and the "Agricultural Gazette," and *monthly* for the "Miller." They are all accompanied by remarks on the phenomena exhibited.

At about 3 p.m. the observations taken at eleven home stations at 2 p.m. are received, and those for two foreign stations (Skudesnaes and Rochefort) come in soon after. Copies of these reports are issued, together with the 8 a.m. report, to several newspapers and subscribers. Two copies of the "Remarks" (8 a.m. and 2 p.m.) are sent to the Type-founding Company for issue to provincial newspapers for publication, in order to explain the 8 a.m. charts. On the information derived from the morning and afternoon reports a second telegram of

about 200 words is prepared and transmitted soon after 6 p.m. to the Intelligence Department of the Post Office for the Central News, and a second copy is sent to the Press Association for publication in the next morning's provincial newspapers.

Thus it will be seen that the demand for the earlier information has decreased considerably, greater facility having been offered for the spread of the later (8.30 p.m.) reports and forecasts, as explained further on.

At 7 to 7.30 p.m. the nineteen evening (6 p.m.) reports arrive and are charted and discussed for the morning daily papers in accordance with the arrangement referred to on p. 70. The forecast 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 frequently 9 p.m. before they are issued. The "Times" still publishes the daily map showing the distribution of pressure, the winds, temperature, and rainfall at 6 p.m., the importance of which can hardly be overestimated.

It will be seen that the official charts for 2 p.m. and for 6 p.m. are less complete than that for 8 a.m. That for 2 p.m. is drawn on the information received from eleven 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 fifteen stations in the United Kingdom, supplemented by four from continental stations, but the latter frequently 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 morning 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. They 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 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 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 prompt information of storms to our coasts; but a telegram is sent to Paris and Jersey in the same way as on week days, and there is the ordinary interchange of messages with foreign countries. 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 offered for the correction or extension of any warnings which may have been issued in the morning. The evening message is sent to the Press Association for transmission to the provinces, the same as on week days.

Daily Weather Report.

On the 1st January 1881 considerable alterations were made in the form of the Daily Weather Report. The information now published fills four (instead of two) pages of foolscap paper, and is arranged as follows:—

Page 1 contains at present only the title and date of the report; p. 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 pressure of the atmosphere for the month; (2) a

similar map showing the distribution of temperature, the weather at each station, and the distribution of rainfall during the past 24 hours; together with tables of mean temperature and rainfall at a large number of stations over the United Kingdom.

Page 3 contains (1) remarks on the principal features exhibited by the reports for the day; 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 after that of publication.

Page 4 contains the whole of the reports from which the above charts, remarks, and forecasts have been drawn, together with the 2 p.m. and 6 p.m. reports of the previous day.

The standing portion of the report (the maps, &c.) is printed in blue, while the information for each day is in black. The whole report is consequently much clearer than it used to be, and no delay has been caused in its publication by the improvements referred to.

Weekly Summary.

Soon after the end of each week a copy of the Weekly Weather Report (Appendix XV., p. 91), printed on large paper, is issued as a supplement to the Daily Weather Report, giving an account of the changes which have been observed in the weather from day to day, together with a brief general statement showing what have been the more prominent features in the weather conditions during the whole period.

In this manner the main meteorological features of the week are presented as a connected story, and additional facility is afforded for future reference.

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; and about the middle of every month a lithographic sheet is 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 published reports.

Weekly Weather Report.

The Weekly Weather Report is a publication which has appeared since the beginning of February 1878. It has been improved by the addition of four new columns, containing the number of hours of bright sunshine recorded at several stations, and the means of the daily maximum and minimum temperatures recorded at each station during the week. The scale of the maps has been enlarged, and the maps themselves have been engraved by a new process which adds to their clearness generally. A specimen will be found as Appendix XV., p. 91. The Report consists of the average and extreme temperatures and the rainfall values in each week for ten districts in Great Britain and Ireland, together with the difference between them and their respective mean values for the corresponding weeks in previous years. These statistics are now given on page 1 of the publication, the corresponding values for *each station* being given on page 4. In addition to the telegraphic reports, and the returns from the self-recording observatories, weekly

returns from 35 volunteer observers are used in preparing this report, the names of the observers at each station being as under—

Names of Stations.	Names of Authorities.
Alnwick Castle - - -	Major F. Holland, for the Duke of Northumberland, K.G.
Arlington (N. Devon) - - -	J. Carter, for Lady Bruce-Chichester.
*Barnstaple - - -	W. Knill.
Bawtry (Hesley Hall) - - -	B. J. Whitaker.
Birmingham (Oscott) - - -	Revs. S. Whitty, B.A., and J. MacElmail, St. Mary's College.
Blackpool - - -	♣ C. T. Ward, F.M.S.
Brookeborough - - -	Mr. Ferguson, for Sir Victor Brooke, F.L.S.
Cheadle - - -	♣ J. C. Phillips, F.M.S.
Churchstoke - - -	♣ P. Wright, F.C.S., F.M.S.
Cirencester - - -	The Royal Agricultural College.
Douglas (Isle of Man) - - -	A. W. Moore, Cronkbourne.
Dublin - - -	J. W. Moore, M.D.
Durham - - -	G. A. Goldney, the Observatory.
Foynes - - -	T. J. Carey, for Lord Monteagle.
Geldeston - - -	E. T. Dowson, F.M.S.
*Glenalmond - - -	Rev. W. P. Robinson, D.D., F.M.S., Trinity College.
Hastings (St. Leonards) - - -	H. Colborne, F.M.S.
Hereford - - -	♣ T. A. Chapman, M.D., F.M.S.
Hillington - - -	♣ Rev. H. E. B. Ffolkes, M.A., F.M.S.
*Kelstern (Lincolnshire) - - -	♣ D. G. Briggs, F.M.S.
Laudale (Loch Sunart) - - -	A. Fletcher, for T. H. G. Newton.
Leicester - - -	J. E. Carryer, the Museum.
Llandudno - - -	♣ J. Nicol, M.D., F.M.S.
Londonderry - - -	J. Conroy, F.M.S.
Loughborough - - -	W. Berridge, F.M.S.
Manchester (Prestwich) - - -	H. R. O. Sankey, M.D.
Markree Castle (Sligo) - - -	E. Salles, for Colonel Cooper, F.R.A.S.
Marlborough - - -	♣ Rev. T. A. Preston, M.A., F.M.S.
Plymouth - - -	J. Merrifield, F.R.A.S.
Rothamsted - - -	Rainfall by J. H. Gilbert, Ph.D., F.R.S., and J. B. Lawes, LL.D., F.R.S., temperature by T. Wilson, F.M.S.
*Shrewsbury - - -	♣ Rev. E. V. Pigott, F.M.S.
Silloth - - -	Rev. F. Redford, F.R.S.E.
Southampton - - -	J. T. Cook, R.E., Ordnance Survey Office.
Strathfield Turgiss - - -	♣ Rev. C. H. Griffith, F.M.S.
Waterford - - -	J. Neale.

The returns marked "♣" are supplied through the Meteorological Society (London).
* Have now ceased.

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

ISSUE OF FORECASTS.

Descriptions of 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.

- (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 general publication, 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 have availed themselves of this advantage, and one result has been a falling off in the number of inquiries made personally for forecasts of the weather to be expected under various circumstances, to which reference is made further on.

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 descriptions 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, *in addition to the cost of transmission*; the charges will, therefore, be, by *letter post*, 9s. per quarter, by *book post*, 5s. 9d.

FORECASTS FOR CLUBS.—Forecasts, drawn up at 11 a.m., for all the districts, will be 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.

SUBSCRIBERS FOR THE LITHOGRAPHED COPY OF THE DAILY REPORT will have the 11 a.m. Forecast incorporated with their Report on each week day. The subscription for the Report is—

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

N.B.—Subscriptions must be paid in advance, and end at the usual official quarter day.

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

* 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 6.30 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 two shillings in stamps if the reply (not exceeding twenty words) is to be *by telegraph*.

INQUIRIES BY TELEGRAPH.—Any person may obtain *by telegraph* from the Meteorological Office the latest information as to the weather in any district of the United Kingdom by payment of a fee of 1s., in addition to 2s., the cost of the message to the Meteorological Office and the reply. The telegram containing the inquiry must not exceed 20 words in length, and must be addressed to the

METEOROLOGICAL OFFICE,
LONDON.

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 have been already given in the Report (p. 14).

In carrying out this comparison the portions of the forecasts which referred to wind have been carefully separated from those relating to weather. The final results of the comparison will be found in Appendix XII., p. 83.

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 the several gentlemen who have volunteered to observe for the Office, and whose names will be found in App. XVII.

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 1881 will be found on p. 17.

The coasts are subdivided into nine districts, as will be seen in the table. Two large tracts of coast are entirely omitted: 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 tracts of 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 IX.

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

Newspapers :

- *Echo.
- *Globe.
- Lloyd's Shipping List.
- Mark Lane Express.
- Morning Advertiser.
- New York Herald.
- †Observer.
- *Pall Mall Gazette.
- Press Association (Plymouth Daily Mercury).
- Shipping and Mercantile Gazette (with special daily chart).
- Standard (Morning and Evening).
- Times (1st and 2nd editions).

For Exhibition at following Seaports :

Banff.	Callerecoats.
Barrow-in-Furness.	Deptford Yard.
Belfast.	Dover.
Blackpool.	Exeter (2 copies).
Bo'ness.	Falmouth.
Boscastle.	Glasson Dock.
Bournemouth.	Great Grimsby (2 copies).
Brighton.	Groomsport.
Briton Ferry.	Hastings.
Broughty Ferry.	Hayle.
Buckie.	Holyhead.
Budehaven.	Kingstown.
Caernarvon.	Morcambe.
Cork.	Lancaster.
Cowes.	Leith.
Cromer.	Lowestoft.

* "Remarks" only.

† Saturdays only.

For Exhibition at following Seaports—cont.

Margate.	Silloth.
Nairn.	Southport.
Newquay.	Teignmouth.
Penarth.	Ventnor (2 copies).
Plymouth.	Weston-super-Mare.
„ G. W. Docks.	Whitehaven.
Port Dinorwic.	Wick.
Porthcawl.	Wisbech.
Queenstown.	Worthing.
Scarboro'.	Yarmouth.

In exchange for Observations :

Aird, G. H., Seaham.
 Barnstaple Meteorological Committee.
 Bellingham, J. G., Saffron Walden.
 Cambridge Observatory.
 Campbell J., R.N., M.D., Chigwell Row.
 Chatham, The Instructor in Surveying.
 Clark, J. E., York.
 Clouston, Rev. C., LL.D., Sandwick, Orkney.
 Colborne, H., M.R.C.S., F.M.S., St. Leonard's-on-Sea.
 Cooper, Col., F.R.A.S., Markree, nr. Sligo.
 Conroy, J., F.M.S., Londonderry.
 Cooper, W. F., Sheffield.
 Dowson, E. T., F.M.S., Geldeston, Beccles.
 Durham, University Observatory.
 Fernley Observatory, Southport.
 Greenwich Observatory.
 Hoskins, S. E., M.D., F.R.S., Guernsey.
 Leicester Museum.
 Liverpool Observatory.
 Lowe, E. J., F.R.S., Nottingham.
 McCormack, J., Aberdeen.
 Mackay, Rev. W. P., M.D., Hull.
 Miller, S. H., F.R.A.S., Lowestoft.
 Moore, A. W., Isle of Man.
 Moore, J. W., M.D., Dublin.
 Mullins, Rev. G. H., Uppingham.
 Neale, J., Waterford.
 Netley, Army Medical School.
 Northumberland, Duke of, Alnwick.
 Ordnance Survey Office (Southampton).
 Prestwich Asylum, near Manchester.
 Propert, W. P., LL.D., St. David's.
 Radcliffe Observatory, Oxford.
 Richards, W. H., Penzance.
 Rosse, Earl of, F.R.S., Parsonstown.
 Royal Horticultural Society.
 Royal Indian C.E. College, Staines.
 Rugby Natural History Society.
 St. Mary's College, Oscott.
 Vibert, J. E., M.A., St. Aubin's, Jersey.
 Yorkshire Philosophical Society.

Government Offices :

Admiralty : 12 copies.
 Aldershot, Garrison Library.
 Army Medical Department.
 Board of Trade : 3 copies.
 "Britannia," H.M.S., Dartmouth.
 Commons, House of.
 Devonport Dockyard : 2 copies.
 " Commander-in-Chief.
 " Captain of Steam Reserve.
 " Master Attendant.
 Greenwich, R.N. College.
 "Indus," H.M.S., Devonport.
 Ireland, Royal College of Science.
 Lords, House of.
 Mann, J. R., Osborne.
 Medical Department of the Navy.
 "Nankin," H.M.S., Milford Haven.
 Portland, Senior Naval Officer.
 Portsmouth, Commander-in-Chief.
 " Dockyard.
 " R. N. College Observatory.
 Registrar General.
 " of Seamen.
 "Resistance," H.M.S., Rock Ferry.
 Royal Military Academy.
 Sandhurst Staff College.
 Science and Art Department : 2 copies.
 Sheerness, Commander-in-Chief.
 " Dockyard.
 War Office, Adjutant General, Horse Guards.
 " Commander-in-Chief.

Societies, &c. :

Association of Underwriters, Liverpool.
 Do. Lloyd's.
 British Museum.
 Buchan, A., F.R.S.E., Edinburgh.
 Crossley, L. J., Halifax.
 Griffith, Rev. C. H., Strathfield Turgiss.
 Meteorological Council : 4 copies.
 " Society, London.
 Observatories : 7 copies.
 Reuter's Telegram Company.
 Richards, Vice-Adm., Sir G. H., F.R.S., London.
 Royal Society.
 Rundell, W. W.
 Scottish Meteorological Society.
 Trinity House.

Foreign Places :

Algiers, Meteorological Service.
 Bombay, Observatory.
 Brussels, Royal Observatory.
 Calcutta, Meteorological Department.

Foreign Places—cont.

Christiania, Meteorological Institute.
 Constantinople, Imperial Meteorological Observatory.
 Copenhagen, Meteorological Institute.
 Cracow, Observatory.
 Florence, Meteorological Office.
 Freedon, W. H. v., Bonn.
 Hamburg, Seewarte.
 Hébert, M., Draguignan.
 Leipzig, Observatory.
 Lisbon, Observatory.
 Madrid, Royal Observatory.
 Melbourne, Observatory.
 Meudon, French Balloon Corps.
 Nice, Société de Médecine.
 Paris, Meteorological Observatory, Montsouris.
 „ Meteorological Society.
 „ Ministry of Marine.
 „ Observatory.
 „ M. Harold Tarry.
 Rome, Ministry of Agriculture.
 San Fernando, Observatory.
 St. Petersburg, Central Physical Observatory.
 Stockholm, Meteorological Institute.
 Tiflis, Physical 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 X.

FISHERY BAROMETERS.

LIST of PLACES supplied with FISHERY BAROMETERS.

Shetland Isles.—Sandsair, Lerwick.

Orkney Isles.—Burray. Kirkwall.

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

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

England, south coast.—Bognor, Portsea, Ryde and Ventnor (2) (Isle of Wight), Gorey (Jersey), Haslar Hospital, Poole, Weymouth, Portland, Budleigh-Salterton, Cawsand, Charlestown, Mevagissey, Gorranhaven, Devoran, Portscath, Penryn, Falmouth, Coverack, Newlyn, Mousehole.

England, south-west coast.—St. Ives, Hayle, Padstow, Port Isaac Boscastle, Fremington, Burnham, Highbridge.

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, Strangford, Ardglass, Carlingford, Greenore, Dundalk, Malahide, Howth, Kingstown (2).

Ireland, south coast.—Dunmore, Dungarvau, Kinsale, Castletownsend, Crookhaven.

Ireland, west coast.—Port Magee, Valencia, Dingle, Tralee, Tarbert, Kilcredane, Barna, Ballyglass, Elly Bay, Ballina, Tribane, Killybegs, Teelin, Portnoo, Burton Port, Bunbeg.

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

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

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

SUMMARY OF INSTRUMENTS ON SERVICE.

England and Wales -	-	-	-	-	64
Scotland -	-	-	-	-	50
Ireland -	-	-	-	-	41
					<hr/>
					155
					<hr/>

APPENDIX XI.

TELEGRAPHIC WEATHER INTELLIGENCE.

The following stations, having been approved by the Board of Trade, 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, 81 in England and Wales, 35 in Scotland, 14 in Ireland, 3 in the Isle of Man, and 3 in the Channel Islands.

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

Circular No. 717.

TELEGRAPHIC WEATHER INTELLIGENCE.

Board of Trade, February 14th, 1874.

THE Board of Trade have been informed by the Meteorological Committee that they are now prepared to re-introduce the use of Admiral FitzRoy's signals (cones and drum) with slightly modified significations, and that the change will take effect on and after 15th March 1874.

The signals to be used will 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.
- 3°. Drum, *with cone*, to indicate the probable approach of a *very heavy gale* from the direction indicated by the cone.*

The drum will not be used without the cone.

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, as pointed out in the explanatory pamphlet† sent herewith, copies of which are supplied for gratuitous distribution.

It will be seen from the pamphlet in question that 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 will supply 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., as directed by the Circular No. 278, dated 30th November 1867.

THOMAS GRAY.

APPENDIX XII.

REPORT ON THE COMPARISON OF THE FORECASTS WITH THE WEATHER SUBSEQUENTLY EXPERIENCED, for the 12 Months, April 1880 to March 1881.

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 during the first three months of 1881, *i.e.*, each forecast has been considered under the separate headings of "Wind" and "Weather," but for this year the results of the 8 p.m. Forecasts only have been 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 14.

* The "drum" is not in use at present.

† The "explanatory pamphlet" referred to is a circular entitled "Telegraphic Weather Intelligence," printed in large type on four pages, so as to be posted up on a board.

APPENDIX XII.

DISTRICTS.		APRIL 1880.				MAY 1880.				JUNE 1880.			
		Percentages.				Percentages.				Percentages.			
		Wind.	Weather.	Average.	a + b	Wind.	Weather.	Average.	a + b	Wind.	Weather.	Average.	a + b
SCOTLAND, N.	a	35	35	35	72	38	50	41	77	42	34	38	82
"	b	38	35	37		35	31	33		38	50	44	
"	c	19	19	19		15	11	13		12	16	14	
"	d	8	11	9		12	8	10		8	—	4	
SCOTLAND, E.	a	23	35	29	73	27	27	27	73	19	54	37	83
"	b	58	31	44		46	46	46		61	31	46	
"	c	4	19	12		12	15	14		16	15	15	
"	d	15	15	15		15	12	13		4	—	2	
ENGLAND, N.E.	a	31	27	29	78	23	38	31	75	42	54	48	84
"	b	54	43	49		54	35	44		38	24	36	
"	c	4	15	9		12	12	12		16	8	12	
"	d	11	15	13		11	15	13		4	4	4	
ENGLAND, E.	a	23	38	31	81	31	50	41	73	38	34	36	80
"	b	62	39	50		46	19	32		38	50	44	
"	c	11	19	15		19	23	21		12	12	12	
"	d	4	4	4		4	8	6		12	4	8	
MIDLAND COS.	a	31	35	33	77	31	54	43	86	36	38	38	88
"	b	38	50	44		54	31	43		50	50	50	
"	c	23	15	19		15	8	11		12	8	10	
"	d	8	—	4		—	7	3		—	4	2	
ENGLAND, S.	a	35	65	50	94	50	42	46	83	50	46	48	86
"	b	61	27	44		42	31	37		46	30	38	
"	c	—	4	2		4	19	11		4	16	10	
"	d	4	4	4		4	8	6		—	8	4	
SCOTLAND, W.	a	19	46	33	75	27	31	29	71	58	61	60	85
"	b	54	31	42		38	46	42		35	16	25	
"	c	4	19	11		27	19	22		3	19	11	
"	d	23	4	14		8	4	6		4	4	4	
ENGLAND, N.W.	a	28	46	37	74	42	46	44	81	34	27	31	81
"	b	42	31	37		38	35	37		58	42	50	
"	c	15	15	15		12	4	8		8	23	15	
"	d	15	8	11		8	15	11		—	8	4	
ENGLAND, S.W.	a	31	46	39	75	35	31	33	70	35	34	35	77
"	b	50	23	36		46	27	37		42	42	42	
"	c	11	16	14		4	23	13		19	12	15	
"	d	8	15	11		15	19	17		4	12	8	
IRELAND, N.	a	23	61	42	79	42	23	33	67	22	26	24	78
"	b	50	23	37		27	42	34		58	50	54	
"	c	4	8	6		19	23	21		16	16	16	
"	d	24	8	15		12	12	12		4	8	6	
IRELAND, S.	a	31	50	40	71	23	50	37	75	42	46	44	88
"	b	31	31	31		42	35	38		46	42	44	
"	c	19	11	15		16	4	13		8	8	8	
"	d	19	8	14		19	4	12		4	4	4	
SUMMARY.													
BRITISH ISLES	a	28	44	36	77	34	40	37	76	38	41	40	83
"	b	49	33	41		43	34	39		47	40	43	
"	c	10	14	12		14	15	14		11	14	13	
"	d	12	8	10		9	11	10		4	5	4	

DISTRICTS.		JULY 1880.				AUGUST 1880.				SEPTEMBER 1880.			
		Percentages.				Percentages.				Percentages.			
		Wind.	Weather.	Average.	a + b	Wind.	Weather.	Average.	a + b	Wind.	Weather.	Average.	a + b
SCOTLAND, N.	a	50	42	46	83	44	30	37	72	15	38	27	68
"	b	42	31	37		37	33	35		58	24	41	
"	c	4	19	11		15	26	21		19	23	21	
"	d	4	8	6		4	11	7		8	15	11	
SCOTLAND, E.	a	42	46	44	77	52	44	48	84	31	27	29	61
"	b	42	23	33		37	34	36		31	43	32	
"	c	12	19	15		7	15	11		31	23	27	
"	d	4	12	8		4	7	5		7	7	7	
ENGLAND, N.E.	a	38	31	35	62	59	33	46	68	31	43	37	62
"	b	27	27	27		23	22	22		31	19	25	
"	c	35	34	34		15	30	23		19	27	23	
"	d	0	8	4		4	15	9		19	11	16	
ENGLAND, E.	a	42	42	42	77	44	33	39	71	38	54	46	70
"	b	31	38	35		37	26	32		31	55	33	
"	c	27	8	17		11	30	20		8	4	6	
"	d	0	12	6		8	11	9		23	7	15	
MIDLAND COS.	a	46	27	37	81	41	26	34	71	50	27	39	81
"	b	31	53	44		37	37	37		27	58	42	
"	c	19	11	15		11	33	22		8	8	8	
"	d	4	4	4		11	4	7		15	7	11	
ENGLAND, S.	a	50	38	44	88	59	30	45	73	38	50	44	77
"	b	38	50	44		26	30	28		39	27	33	
"	c	8	8	8		11	25	18		8	15	11	
"	d	4	4	4		4	15	9		15	8	12	
SCOTLAND, W.	a	39	42	41	81	30	30	30	52	23	19	21	62
"	b	42	38	40		26	18	22		43	39	41	
"	c	15	8	11		26	48	37		19	27	23	
"	d	4	12	8		18	4	11		15	15	15	
ENGLAND, N.W.	a	19	31	25	64	48	48	48	74	19	28	21	68
"	b	50	27	39		33	19	26		43	50	47	
"	c	19	38	28		15	22	19		23	12	17	
"	d	12	4	8		4	11	7		15	15	15	
ENGLAND, S.W.	a	31	38	35	75	41	15	28	54	27	39	33	72
"	b	42	38	40		25	26	26		50	27	39	
"	c	15	12	13		30	33	31		12	27	19	
"	d	12	12	12		4	26	15		11	7	9	
IRELAND, N.	a	23	42	33	75	26	30	28	57	27	31	29	74
"	b	38	46	42		37	22	29		50	39	45	
"	c	27	12	19		30	41	36		8	23	15	
"	d	12	0	6		7	7	7		15	7	11	
IRELAND, S.	a	35	27	31	75	26	33	29	57	23	31	27	78
"	b	42	46	44		30	26	28		58	43	51	
"	c	4	19	12		26	30	28		12	19	16	
"	d	19	8	13		18	11	15		7	7	7	

SUMMARY.

BRITISH ISLES	a	38	37	38	76	43	32	38	67	29	35	32	71
"	b	38	38	38		31	27	20		42	37	39	
"	c	17	17	17		18	30	24		15	19	17	
"	d	7	8	7		8	11	9		14	9	12	

DISTRICTS.		OCTOBER, 1880.				NOVEMBER, 1880.				DECEMBER, 1880.			
		Percentage.				Percentage.				Percentage.			
		Wind.	Weather.	Average.	a+b.	Wind.	Weather.	Average.	a+b.	Wind.	Weather.	Average.	a+b.
SCOTLAND, N.	a	42	54	48	90	43	43	43	80	26	33	30	74
"	b	50	34	42		39	35	37		41	45	44	
"	c	8	8	8		3	15	9		19	11	15	
"	d	—	1	2		15	7	11		11	11	11	
SCOTLAND, E.	a	38	35	37	89	43	31	37	82	30	22	26	65
"	b	54	50	52		35	54	45		41	37	39	
"	c	4	11	7		7	8	7		22	37	30	
"	d	4	4	4		15	7	11		7	4	5	
ENGLAND, N.E.	a	27	46	37	81	43	19	31	84	15	19	17	63
"	b	54	35	44		39	66	53		44	48	46	
"	c	19	19	19		15	11	13		30	30	30	
"	d	—	—	—		3	4	3		11	3	7	
ENGLAND, E.	a	15	38	27	75	43	19	31	70	33	19	26	78
"	b	63	35	48		35	43	39		45	59	52	
"	c	12	19	16		19	35	27		11	19	55	
"	d	11	8	9		3	3	3		11	3	7	
MIDLAND COS.	a	31	27	29	75	39	27	33	64	48	22	35	82
"	b	50	42	46		23	39	31		34	59	47	
"	c	19	12	16		23	23	23		11	19	15	
"	d	—	19	9		15	11	13		7	—	3	
ENGLAND, S.	a	31	35	33	75	47	27	37	76	48	33	41	86
"	b	59	34	42		31	47	39		38	52	45	
"	c	8	27	18		15	15	15		7	11	9	
"	d	11	4	7		7	11	9		7	4	5	
SCOTLAND, W.	a	27	31	29	72	19	35	27	66	7	15	11	62
"	b	50	35	43		39	39	39		56	45	51	
"	c	15	19	17		27	19	23		22	33	27	
"	d	8	15	11		15	7	11		15	7	11	
ENGLAND, N.W.	a	39	46	43	76	27	47	37	74	33	48	41	76
"	b	31	35	33		43	31	37		33	37	35	
"	c	15	8	11		19	19	19		26	11	19	
"	d	15	11	13		11	3	7		7	4	5	
ENGLAND, S.W.	a	39	54	47	77	43	35	39	89	41	33	37	82
"	b	38	23	30		46	54	50		45	45	45	
"	c	15	19	17		4	11	8		7	19	13	
"	d	8	4	6		7	—	3		7	3	5	
IRELAND, N.	a	31	31	31	73	35	39	37	76	19	41	30	69
"	b	42	38	40		39	39	39		44	33	39	
"	c	12	12	12		11	19	15		22	22	22	
"	d	15	19	17		15	3	9		15	4	9	
IRELAND, S.	a	50	42	46	67	27	47	37	68	30	37	34	73
"	b	27	15	21		35	27	31		37	41	39	
"	c	8	31	20		23	23	23		15	7	11	
"	d	15	12	13		15	3	9		8	15	16	

SUMMARY.

BRITISH ISLES	a	34	49	37	77	37	34	36	76	30	29	30	74
"	b	46	34	40		37	43	40		42	46	44	
"	c	12	17	15		15	18	16		17	20	18	
"	d	8	9	8		11	5	8		11	5	8	

DISTRICTS.		JANUARY, 1881.				FEBRUARY, 1881.				MARCH, 1881.			
		Percentages.				Percentages.				Percentages.			
		Wind.	Weather.	Average.	a+b.	Wind.	Weather.	Average.	a+b.	Wind.	Weather.	Average.	a+b.
SCOTLAND, N.	a	38	39	38	78	39	43	41	75	29	43	36	70
"	b	39	42	40		29	39	34		39	29	34	
"	c	9	16	13		18	14	16		23	19	21	
"	d	16	3	9		14	4	9		9	9	9	
SCOTLAND, E.	a	29	32	31	81	36	46	41	81	26	45	36	75
"	b	48	52	50		36	43	40		39	39	39	
"	c	10	13	11		21	7	14		29	13	21	
"	d	13	3	8		7	4	5		6	3	4	
ENGLAND, N.E.	a	23	19	21	69	25	48	37	77	13	36	25	76
"	b	52	43	48		43	37	40		58	45	51	
"	c	16	29	22		21	8	14		16	16	16	
"	d	9	9	9		11	7	9		13	3	8	
ENGLAND, E.	a	26	29	28	58	25	41	35	82	30	39	35	83
"	b	32	29	30		64	29	47		57	39	48	
"	c	19	26	23		—	19	9		10	16	13	
"	d	23	16	19		11	8	9		3	6	4	
MIDLAND COS.	a	26	19	23	68	18	44	31	76	30	30	30	83
"	b	52	39	45		46	44	45		58	48	55	
"	c	13	23	18		25	—	13		9	13	11	
"	d	9	19	14		11	12	11		3	9	6	
ENGLAND, S.	a	39	29	34	76	25	29	27	85	52	39	46	90
"	b	39	45	42		64	52	58		39	49	44	
"	c	16	13	15		7	7	7		9	6	7	
"	d	6	13	9		4	12	8		—	6	3	
SCOTLAND, W.	a	16	26	21	66	25	39	32	63	19	42	31	65
"	b	45	45	45		25	36	31		39	29	34	
"	c	13	13	13		21	14	17		23	26	24	
"	d	26	16	21		29	11	20		19	3	11	
ENGLAND, N.W.	a	19	26	23	52	22	39	31	77	19	18	34	75
"	b	39	29	29		46	47	46		42	40	41	
"	c	29	29	29		25	14	20		23	9	16	
"	d	23	16	19		7	—	3		16	3	9	
ENGLAND, S.W.	a	24	24	24	71	43	46	45	82	39	39	39	76
"	b	43	50	47		36	39	37		29	45	37	
"	c	13	16	14		18	11	15		23	13	18	
"	d	20	10	15		3	4	3		9	3	6	
IRELAND, N.	a	7	29	18	64	21	50	36	70	35	55	45	71
"	b	48	43	46		36	32	34		39	13	26	
"	c	26	19	22		32	18	25		13	26	20	
"	d	19	9	14		11	—	5		13	6	9	
IRELAND, S.	a	26	33	30	73	21	36	29	73	30	45	38	75
"	b	42	45	43		46	43	44		42	33	37	
"	c	9	13	11		4	18	11		9	19	14	
"	d	23	9	16		29	3	16		19	3	11	

SUMMARY.

BRITISH ISLES	a	25	28	27	69	28	42	35	76	29	42	36	76
"	b	42	42	42		43	40	41		44	37	40	
"	c	16	19	17		17	12	15		17	16	17	
"	d	17	11	14		12	6	9		10	5	7	

APPENDIX XIII.

CHART SHOWING DISTRICTS.



Meteorological Office, 116, Victoria Street,
London, S.W.

FORECASTS of WEATHER

For the 24 hours ending at
Noon on Tuesday, 10th May 1881.

(Issued at 11 a.m. on the previous day.)

DISTRICTS.

0. SCOTLAND, N.	-	} Northerly breezes, light or moderate ; fine but cool.
1. Do. E.	-	
2. ENGLAND, N.E.	-	
3. Do. E.	-	Northerly breezes, moderate or fresh ; fine.
4. MIDLAND COUNTIES	}	Northerly and North-easterly breezes, moderate ; fine generally, but clouding over at times ; cool in shade.
5. ENGLAND, S. (with London and Channel.)		
6. SCOTLAND, W. (and I. of Man.)	-	Light easterly breezes ; fine.
7. ENGLAND, N.W. (and N. Wales.)	-	Variable breezes to South-easterly winds ; fine to dull.
8. ENGLAND, S.W. (and S. Wales.)	-	Easterly and South-easterly winds, moderate ; fine.
9. IRELAND, N.	-	} Variable to South-easterly breezes ; fine to cloudy ; warm.
10. Do. S.	-	

GENERAL - -

WARNINGS - -

By Order,
ROBERT H. SCOTT,
Secretary.

APPENDIX XIV.

LIST of STATIONS from which DAILY SYNCHRONOUS OBSERVATIONS
(at 0h. 43m. p.m. G. M. T.) have been received in 1880.

Stations.	Observers.	Remarks.
ENGLAND AND WALES.		
Bolton - - -	T. Mackereth.	—
Bradford - - -	J. McLandsborough.	—
Cambridge - - -	H. Todd.	—
Cardington - - -	J. McLaren.	—
Chatham, School of Military Engineering.	M. G. Morris, Lieut., R.E.	—
Dover - - -	J. Costello.	—
Falmouth Observatory -	The Staff.	—
Greenwich Observatory -	The Staff, for Sir G.B. Airy.	—
Guernsey - - -	Dr. Hoskins, F.R.S.	—
Helston - - -	Dr. Moyle.	Dr. Moyle died in August.
Holyhead - - -	J. Tilston.	—
Jersey (St. Helier's) -	J. Fisher.	—
Kew Observatory -	The Staff.	—
Leicester (Museum) -	J. E. Carryer.	—
Liverpool Observatory (Bidston).	J. Hartnup, Jun.	—
Nottingham - - -	E. J. Lowe, F.R.S.	Ceased in August.
Oscott (St. Mary's Col.)	Rev. S. Whitty.	—
Oxford, Radcliffe Obs. -	E. J. Stone, F.R.S.	—
Plymouth - - -	J. Merrifield, LL.D., F.R.A.S.	—
Sheffield - - -	W. F. Cooper, F.M.S.	—
Silloth - - -	Rev. F. Redford, M.A., F.R.S.E.	—
St. Ann's Head (Milford Haven).	J. C. Walker.	—
Stonyhurst Observatory -	The Staff.	—
Strathfield Turgiss -	Rev. C. H. Griffith, M.A.	—
Truro (Royal Institution)	W. Newcombe.	—
Yarmouth (Norfolk) -	G. T. Watson.	—
SCOTLAND.		
Aberdeen Observatory -	The Staff.	—
Ardrossan - - -	G. Carrick.	—
Glasgow Observatory -	The Staff.	—
Nairn - - -	W. D. Penny.	—
Orkneys (Sandwick Mause).	Rev. C. Clouston, LL.D.	—
IRELAND.		
Armagh Observatory -	S. Call, for Dr. Robinson.	—
Donaghadee - - -	T. McGowan.	—
Galway, Queen's College	M. J. O'Donoghue.	—
Roche's Point -	W. Kennedy.	—
Valencia Observatory -	The Staff.	—

Stations.	Observers.	Remarks.
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BRITISH COLONIES, POSSESSIONS, &C.

Barbados, W. I. -	-	Surgeon-Maj. in charge.	—
Gibraltar -	-	Surgeon Gen. in charge.	—
Malta -	-	F. S. Vine, A.H.C.	—
Nassau (Bahamas) -	-	C. L. Duncombe.	—
Natal -	-	Surgeon-Maj. in charge.	—
Scutari, British Cemetery	-	Serg. W. H. Lyne, R.E.	—
Sierra Leone -	-	Surgeon-Maj. in charge.	—

SUMMARY.

England and Wales -	-	26
Scotland -	-	5
Ireland -	-	5
Colonies and British Possessions -	-	7
Total		43

Appendix XV. APPENDIX XV. WEEKLY WEATHER REPORT.

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ISSUED BY THE METEOROLOGICAL OFFICE, LONDON.

PUBLISHED BY J. D. POTTER, 31 POULTRY, AND 11 KING STREET, TOWER HILL;
AND E. STANFORD, 55 CHANCING CROSS.

VOL. IV. No. 23.]

WEEK ENDING MONDAY, JUNE 13, 1881.

[Price 2d.
Annual subscription,
post paid, 12s. 6d.]

I.—SUMMARY OF TEMPERATURE, RAINFALL, AND DURATION OF SUNSHINE IN THE UNITED KINGDOM, FOR AGRICULTURAL AND SANITARY PURPOSES.



Explanation of the Map. The United Kingdom has been divided into Meteorological districts, ten of which are included in the following Summary. They are separately numbered and shaded on the Map, and are similarly numbered in the letterpress, where also they are named.

The black dots show the positions of the stations furnishing the reports on which the Summary is based. The names of the Stations are given in the following list under those of the districts to which they severally belong.

1. SCOTLAND, E.—Nairn, Aberdeen, Leith.
2. ENGLAND, N.E.—Abwick Castle, Shields, Durham, York, Spurn Head, Bruce.
3. ENGLAND, E.—Hillingdon, Yarmouth, Geddston, Cambridge, Rothamsted.
4. MIDLAND COUNTIES.—Buxton (Hesley Hall), Nottingham, Loughborough, Leicester, Loughborough (Oscott), Cheddle, Churchstoke, Hereford, Gloucester, Oxford.
5. ENGLAND, S.—London, Marlborough, Strathfield Turgiss, Dover, Hastings (St. Leonard's), Southampton, Hurst Castle.
6. SCOTLAND, W.—Laudals (Loch Sunart), Glasgow, Arrossan, Silloth (Cumberland), Douglas (Isle of Man).
7. ENGLAND, N.W.—Barrow-in-Furness, Stonyhurst, Blackpool, Manchester, Liverpool Observatory (Burdett), Llandudno, Holyhead.
8. ENGLAND, S.W.—Pembroke, Arlington (N. Devon), Falmouth, Plymouth, Prawle Point.
9. IRELAND, N.—Londonderry, Mullaghmore, Markree Castle, Brookborough, Armagh, Banagher.
10. IRELAND, S.—Dublin, Parsonstown, Waterford, Roche's Point, Valence, Fynes.

Explanation of Summary.—“The words ‘Mean for the Week,’ under *Temperature*, signify the mean Temperature in the corresponding week derived from the 13 years observations (1857–69), as determined by Mr. Buchan; the corresponding words under *Rainfall* signify the mean Rainfall obtained from the 10 years observations 1866–75. A ‘Rainy Day’ is one on which at least a hundredth of an inch has fallen.”

DISTRICTS.	Temperature. (In Degrees Fahrenheit.)						Rainfall. (Amounts in tenths of an inch.)			Bright Sunshine.	
	Highest observed.	Lowest observed.	Averages for the Week			Above or below the Mean for the Week.	Number of Rainy Days.	Rainfall for the Week.	More or less than the Mean for the Week.	Number of Hours recorded.	Percentage of possible Duration.
			Highest each day.	Lowest each day.	Of Mean for each day.						
Principal Wheat-producing Districts.											
1. SCOTLAND, E.	66	52	56	44	48	2 below	3	2	2 less.	39	32
2. ENGLAND, N.E.	63	51	54	42	48	10 below	2	1	4 less.	28	24
3. ENGLAND, E.	68	57	58	43	51	8 below	3	3	3 less.	40	41
4. MID. COUNTIES	71	54	58	42	50	9 below	3	3	3 less.	33	28
5. ENGLAND, S.	71	55	58	44	52	9 below	3	1	1 less.	42	36
Principal Grazing, &c. Districts.											
6. SCOTLAND, W.	67	57	58	44	49	7 below	3	3	2 less.	42	35
7. ENGLAND, N.W.	63	56	56	44	50	8 below	2	2	3 less.	41	35
8. ENGLAND, S.W.	71	55	57	45	54	8 below	4	3	1 less.	65	57
9. IRELAND, N.	62	50	56	43	50	7 below	1	3	2 less.	33	28
10. IRELAND, S.	64	52	59	44	50	7 below	3	3	2 less.	37	32

General Remarks.

Weather has been dull and unsettled with showers of cold rain or hail in all districts.

Temperature has been very low for the season, the readings being from 7° to 10° below the mean in all parts of the country. The minima were exceedingly low, shade readings of 20° to 32° being registered at Markree and Parsonstown on the 9th, and similar readings in the northern parts of Scotland on the 10th. Over England the sheltered thermometer did not fall below 33°, but on the grass a sharp frost was experienced. At Durham 6° of frost was registered, while even in the neighbourhood of Arlington (North Devon) ice was formed. Towards the close of the period temperature was higher, maxima of 71° to 74° being recorded over central England.

Rainfall was a little less than the mean in all districts.

Bright sunshine shows a decided decrease in duration. The percentage was greatest (57) in “England, S.W.,” and least (24) in “England, N.E.”

Depressions observed.—From the commencement of the period until the 9th, the barometer was highest in the W. and lowest in the E., and moderate or fresh northerly breezes prevailed all over the country; but on the 10th, pressure gave way on our western coasts, and a shallow depression, travelling in a south-easterly direction, caused easterly winds in the N. of England, north-westerly in the S.W., and southerly in the E. At the close of the week the depression had disappeared, and light northerly breezes again prevailed in nearly all parts of the country.

APPENDIX XV. WEEKLY WEATHER REPORT.

ISSUED BY THE METEOROLOGICAL OFFICE, LONDON.

PUBLISHED BY J. D. POTTER, 31 POULTRY, AND 11 KING STREET, TOWER HILL;
AND E. STANFORD, 55 CHARING CROSS.

VOL. IV. No. 23.]

WEEK ENDING MONDAY, JUNE 13, 1881.

[Price 2d.
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Explanation of the Map.—The United Kingdom has been divided into Meteorological districts, ten of which are included in the following Summary. They are separately numbered and shaded on the Map, and are similarly numbered in the letterpress, where also they are named.

The black dots show the positions of the stations furnishing the reports on which the Summary is based. The names of the Stations are given in the following list under those of the districts to which they severally belong.

1. SCOTLAND, E.—Nairn, Aberdeen, Leith.
2. ENGLAND, N.E.—Alnwick Castle, Shields, Durham, York, Spurn Head, Brigg.
3. ENGLAND, E.—Hillington, Yarmouth, Gildesdon, Cambridge, Rothamsted.
4. MIDLAND COUNTIES.—Bawtry (Hesley Hall), Nottingham, Loughborough, Leicester, Birmingham (Oscott), Cheadle, Churchstoke, Hereford, Cirencester, Oxford.
5. ENGLAND, S.—London, Marlborough, Strathfield Turgiss, Dover, Hastings (St. Leonard's), Southampton, Hurst Castle.
6. SCOTLAND, W.—Laudale (Loch Sunart), Glasgow, Ardrossan, Sillioth (Cumberland), Douglas (Isle of Man).
7. ENGLAND, N.W.—Barrow-in-Furness, Stonyhurst, Blackpool, Manchester, Liverpool Observatory (Bidston), Llandudno, Holyhead.
8. ENGLAND, S.W.—Pembroke, Arlington (N.Devon), Falmouth, Plymouth, Prawle Point.
9. IRELAND, N.—Londonderry, Mullaghmore, Markree Castle, Brookeborough, Armagh, Donaghadee.
10. IRELAND, S.—Dublin, Parsonstown, Waterford, Roche's Point, Valencia, Foynes.

Explanation of Summary.—*The words "Mean for the Week," under *Temperature*, signify the mean Temperature in the corresponding week derived from the 13 years observations (1857-69), as determined by Mr. Buchan; the corresponding words under *Rainfall* signify the mean Rainfall obtained from the 10 years observations 1866-75. A "Rainy Day" is one on which at least a hundredth of an inch has fallen.

on which at least a hundredth of an inch has fallen.												
DISTRICTS.		Temperature. (In Degrees Fahrenheit.)					Rainfall. (Amounts in tenths of an inch.)			Bright Sunshine.		
		Highest observed.	Lowest observed.	Averages for the Week.			Above or below the Mean* for the Week.	Number of Rainy Days.*	Rainfall for the Week.	More or less than the Mean* for the Week.	Number of Hours recorded.	Percentage of pos- sible Duration.
				Of Highest each day.	Of Lowest each day.	Of Mean for each day.						
Principal Wheat- producing Districts.	1. SCOTLAND, E. -	66	32	55	41	48	7 below.	3	12	2 less.	39	32
	2. ENGLAND, N.E. -	68	34	54	42	48	10 below.	12	1	4 less.	28	24
	3. ENGLAND, E. -	68	35	59	43	51	8 below.	3	12	3 less.	49	41
	4. MID. COUNTIES -	74	33	59	42	50	9 below.	3	12	3 less.	33	28
	5. ENGLAND, S. -	71	35	59	44	52	8 below.	3	4	1 less.	42	36
Principal Grain- &c. Districts.	6. SCOTLAND, W. -	67	35	56	41	49	7 below.	3	3	2 less.	42	55
	7. ENGLAND, N.W. -	63	36	56	44	50	8 below.	2	12	3 less.	41	35
	8. ENGLAND, S.W. -	71	35	57	45	51	8 below.	4	3	1 less.	65	57
	9. IRELAND, N. -	62	30	56	43	50	7 below.	4	3	2 less.	33	28
	10. IRELAND, S. -	64	32	59	44	51	7 below.	3	3	2 less.	37	32

General Remarks.

Weather has been dull and unsettled with showers of cold rain or hail in all districts.

Temperature has been very low for the season, the readings being from 7° to 10° below the mean in all parts of the country. The minima were exceedingly low, shade readings of 30° to 32° being registered at Markree and Parsonstown on the 9th, and similar readings in the northern parts of Scotland on the 10th. Over England the sheltered thermometer did not fall below 33°, but on the grass a sharp frost was experienced. At Durham 6° of frost was registered, while even in the neighbourhood of Arlington (North Devon) ice was formed. Towards the close of the period temperature was higher, maxima of 71° to 74° being recorded over central England.

Rainfall was a little less than the mean in all districts.

Bright sunshine shows a decided decrease in duration: the percentage was greatest (57) in "England, S.W.," and least (24) in "England, N.E."

Depressions observed.—From the commencement of the period until the 9th, the barometer was highest in the W. and lowest in the E., and moderate or fresh northerly breezes prevailed all over the country; but on the 10th, pressure gave way on our western coasts, and a shallow depression, travelling in a south-easterly direction, caused easterly winds in the N. of England, north-westerly in the S.W., and southerly in the E. At the close of the week the depression had disappeared, and light northerly breezes again prevailed in nearly all parts of the country.

II.—SUMMARY OF WEATHER IN WESTERN EUROPE
during the Week ending June 13, 1881.

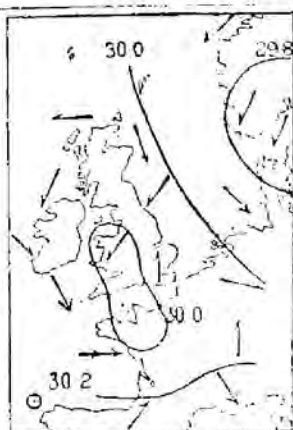
Synoptic Weather Charts.—8 a.m.		Weather during the 24 hours succeeding the date of the Charts.
BAROMETER AND WIND.	CLOUD, RAIN, SEA, AND TEMPERATURE.	
		<p>Tuesday, June 7.</p> <p><i>Weather</i> fine at the majority of stations, but dull and rainy over the S.E. of England and at the mouth of the Tyne. Moderately fine at times in most places, but showers very general.</p> <p><i>Temperature</i> fallen; readings ranging from 52° in S.W. to 43° at Nairn. Thermometer low all day and maxima varying between 47° and 57° only.</p> <p><i>Wind</i> northerly all over these Islands and the N. of France, but drawing into W. in the S. of that country and over N. Germany. Fresh to strong in force generally. Fresh to strong northerly winds holding all day.</p> <p><i>Sea</i> rough in the S.W. and round the Hebrides.</p> <p><i>Barometer</i> rising generally but depression shown over the Skager Rack, and pressure decreasing quickly there. Barometer rising slowly over these Islands. Readings highest in west.</p>
		<p>Wednesday, June 8.</p> <p><i>Weather</i> still fine in most places, but hail showers falling in N. Scotland and rain in E. France. Showers occurring during the day but weather fair in the intervals.</p> <p><i>Temperature</i> fallen and still low, ranging from 53° at Prawle Point to 41° at Aberdeen. Maxima between 50° and 60° generally but below 50° at Shields and Stornoway.</p> <p><i>Wind</i> northerly all over the United Kingdom and France, blowing freshly except in the S.E. Fresh to strong northerly winds prevailing all day.</p> <p><i>Sea</i> rough in the N. and S.W.</p> <p><i>Barometer</i> rising everywhere. Area of high pressure shown in the extreme S.W. with depression over N. Norway. Mercury rising all day and readings highest off our western coasts.</p>
		<p>Thursday, June 9.</p> <p><i>Weather</i> fine in the S.W. and W., cloudy or dull in the N. and E., rain falling at Sumburgh Head. Cloudy all day, with slight showers of rain in many places.</p> <p><i>Temperature</i> fallen in the S.E., risen slightly elsewhere; ranging from 54° at Valentia to 43° at Nairn. Maxima between 50° and 60° generally, but below 50° at Stornoway and Shields.</p> <p><i>Wind</i> northerly to north-westerly in all parts of western Europe, blowing lightly on most of our coasts, but strongly over the North Sea. Backing to W. in Ireland later, but little other change.</p> <p><i>Sea</i> rough on some parts of our N. and E. coasts.</p> <p><i>Barometer</i> rising everywhere—most in Norway. Large area of high pressure over our western coasts with depression over the Baltic. Mercury giving way slowly in W. and N. later, but increase continuing elsewhere.</p>
		<p>Friday, June 10.</p> <p><i>Weather</i> fine in a few places, but generally cloudy or dull; rain falling all over the western and north-western districts. Cloudy in most places all day, with rain in the W. and S.</p> <p><i>Temperature</i> risen slightly, except in "England, S.W."; readings ranging from 56° at Valentia to 41° in the Shetlands. Maxima again between 50° and 60°.</p> <p><i>Wind</i> drawing from S.W. through S. into S.E. on our western coasts, and blowing from N. and N.W. all over the eastern half of our area and over France. Strong over Denmark, moderate elsewhere. Shifting to N.W. in Ireland later, and backing to S.W., S., and S.E. elsewhere.</p> <p><i>Sea</i> rather rough at the mouth of the Humber.</p> <p><i>Barometer</i> falling except over Spain and S. France. Area of high pressure lying over N. Spain, with well marked depression over Baltic and shallow disturbance on our N.W. coasts. Latter disturbance advancing slowly over us later.</p>

Synoptic Weather Charts. — 8 a.m.

Weather during the 24 hours succeeding the date of the Charts.

BAROMETER AND WIND.

CLOUD, RAIN, SEA, AND TEMPERATURE.



Saturday, June 11.

Weather cloudy or dull except over N. Germany and our S.E. coasts; mist prevailing in many places, and rain in S.W. France. More or less cloudy all day, but rainfall very slight.

Temperature risen in the S., fallen in most other places; readings ranging from 57° in London to 45° at Wick. Maxima between 50° and 60° generally, but 65° in London and 60° at Leith.

Wind easterly in the N., northerly to north-westerly in the W. and S.W., westerly over France, and southerly to south-easterly in the S.E. Moderate or light in force. Little change during day.

Sea slight or smooth.

Barometer fallen everywhere. Readings still highest over Spain, with shallow depression over the W. of England and N.W. of France, and rather deep depression over Baltic. Mercury steady during day in S.W., falling a little elsewhere.

Sunday, June 12.

Weather moderately fair on the whole, but dull in the N., with rain at Aberdeen. Fine in the S.E. during day, but dull in the W. and N. with some rain.

Temperature risen except in N.W. France; readings ranging from 61° at Nottingham to 48° in N. Scotland. Maxima higher than of late, reaching 74° at Nottingham and 69° in London.

Wind northerly and north-westerly, moderate to light in force except in N. Germany. Moderate or light northerly to westerly winds blowing all day.

Sea slight or smooth.

Barometer rising everywhere except the N. of Scotland. Readings higher on our S.W. and W. coasts and lower over the Baltic than in any other part of western Europe, but uniform everywhere. Slight depression forming in S.E. later.

Monday, June 13.

Weather fine on our N.W. coasts as well as over central and south-eastern England and the N.E. of France; cloudy or dull elsewhere, with rain at Stormoway. Fine on the whole during day, and scarcely any rain falling.

Temperature fallen a little; readings ranging from 61° at Dover to 47° at Wick. 60° reached in London later, but nowhere not so high as on 12th.

Wind northerly all over the United Kingdom, the North Sea, and greater part of France; light or moderate on all coasts. Light variable breezes all day.

Sea rough in S.W.

Barometer rising except in S. Ireland. Readings very uniform over the whole of western Europe. Mercury falling in west all day, and slight depression appearing over Ireland.

Explanation of Charts.—The two Charts for each day show the general condition of the weather over Western Europe at 8 a.m. In the left-hand Chart the height of the barometer is expressed by "isobars," the value of each line being given in figures. The prevalent winds are shown by arrows, which are drawn flying *with the wind*, the force being indicated thus: \Rightarrow = a heavy gale; \Rightarrow = a gale; \Rightarrow = a fresh to strong breeze; \Rightarrow = light to moderate breeze; and \odot = a calm. In the right-hand Chart the weather is indicated as follows: —b = blue sky; c = detached clouds; o = overcast; m = misty (hazy); f = foggy; q = squally; r = rain; h = hail; s = snow; l = lightning; and t = thunder. The general distribution of temperature is shown by "isotherms," and the readings at certain places are given in figures. Diagonal lines = rough sea, the shading being proportional to the disturbance.

VALUES for each STATION in SCOTLAND, N. and the CHANNEL ISLANDS.

DISTRICTS.	NAMES OF STATIONS.	Temperature. (In Degrees Fahrenheit.)						Rainfall.			Bright Sunshine	
		Highest observed.	Lowest observed.	Averages for the Week.			Differ- ence of Daily Average from Mean for the Week.	Number of Rainy Days.	Rainfall in the Week.	Differ- ence from the Mean for the Week.	Number of Hours recorded.	Percentage of pos- sible Duration.
				Of Highest each day.	Of Lowest each day.	Perwaded each day.						
SCOTLAND, N.	Sumburgh Head	52	51	49.6	38.6	43.8	-8.9	3	0.09	-0.61	•	•
	Stornoway	55	39	51.1	37.6	44.4	-9.0	4	0.20	-0.10	•	•
	Wick	•	•	•	•	•	•	•	•	•	•	•
CHANNEL ISLANDS	Seilly (St. Mary's)	61	46	57.3	48.9	53.1	-6.7	5	0.36	-0.12	•	•
	Jersey (Noirmont)	61	43	56.6	50.1	51.4	-8.1	3	0.91	+0.56	54	48

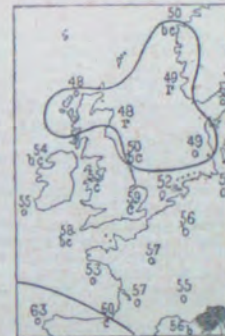
The above observations made in "Scotland, N." and the "Channel Islands" are not included in the Summary on page 1.

Synoptic Weather Charts.—8 a.m.

Weather during the 24 hours succeeding the date of the Charts.

BAROMETER AND
WIND.

CLOUD, RAIN, SEA, AND
TEMPERATURE.



Saturday, June 11.

Weather cloudy or dull except over N. Germany and our S.E. coasts; mist prevailing in many places, and rain in S.W. France. More or less cloudy all day, but rainfall very slight.

Temperature risen in the S., fallen in most other places; readings ranging from 57° in London to 45° at Wick. Maxima between 50° and 60° generally, but 65° in London and 66° at Leith.

Wind easterly in the N., northerly to north-westerly in the W. and S.W., westerly over France, and southerly to south-easterly in the S.E. Moderate or light in force. Little change during day.

Sea slight or smooth.

Barometer fallen everywhere. Readings still highest over Spain, with shallow depression over the W. of England and N.W. of France, and rather deep depression over Baltic. Mercury steady during day in S.W., falling a little elsewhere.

Sunday, June 12.

Weather moderately fair on the whole, but dull in the N., with rain at Aberdeen. Fine in the S.E. during day, but dull in the W. and N. with some rain.

Temperature risen except in N.W. France; readings ranging from 61° at Nottingham to 48° in N. Scotland. Maxima higher than of late, reaching 74° at Nottingham and 65° in London.

Wind northerly and north-westerly, moderate to light in force except in N. Germany. Moderate or light northerly to westerly winds blowing all day.

Sea slight or smooth.

Barometer rising everywhere except the N. of Scotland. Readings higher on our S.W. and W. coasts and lower over the Baltic than in any other part of western Europe, but uniform everywhere. Slight depression forming in S.E. later.

Monday, June 13.






Weather fine on our N.W. coasts as well as over central and south-eastern England and the N.E. of France; cloudy or dull elsewhere, with rain at Stornoway. Fine on the whole during day, and scarcely any rain falling.

Temperature fallen a little; readings ranging from 61° at Dover to 47° at Wick; 69° reached in London later, but maxima not so high as on 12th.

Wind northerly all over the United Kingdom, the North Sea, and greater part of France; light or moderate on all coasts. Light variable breezes all day.

Sea rough in S.W.

Barometer rising except in S. Ireland. Readings very uniform over the whole of western Europe. Mercury falling in west all day, and slight depression appearing over Ireland.

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VALUES for each STATION in SCOTLAND, N. and the CHANNEL ISLANDS.

[illegible]

The data from which the summary on page 1 has been calculated, are as follow:

DISTRICTS.	NAMES OF STATIONS.	Temperature. (In Degrees Fahrenheit.)						Rainfall.			Bright Sunshine	
		Highest observed.	Lowest observed.	Averages for the Week.			Difference of Daily Average from Mean for the Week.	Number of Rainy Days.	Rainfall in the Week.	Difference from the Mean for the Week.	Number of Hours recorded.	Percentage of possible duration.
				Of Highest each day.	Of Lowest each day.	For whole of each day.						
1. SCOTLAND, E.	Nairn	57	35	52.4	42.0	47.2	- 7.3	3	Inches. 0.36	Inches. -0.03	*	*
	Aberdeen	54	32	53.6	39.9	46.8	- 8.1	4	0.07	-0.34	39	32
	Leith	66	39	58.1	42.0	50.1	- 4.9	3	0.30	-0.12	*	*
2. ENGLAND, N.E.	Alnwick Castle	57	35	51.3	41.7	46.5	-10.2	3	0.02	?	*	*
	Shields	53	37	50.7	41.4	46.1	-10.0	2	0.09	-0.31	*	*
	Durham	65	34	55.2	38.1	46.7	-10.4	2	0.10	-0.30	25	21
	York	67	37	58.9	41.3	49.1	- 8.7	1	0.04	-0.47	30	25
	Spurn Head	62	34	53.4	44.7	49.1	- 8.8	12	0.12	?	*	*
3. ENGLAND, E.	Brigg†	68	35	58.3	41.3	49.8	- 8.6	1	0.02	?	30	25
	Hillington	68	37	58.5	42.0	50.3	- 8.2	3	0.21	-0.16	49	41
	Yarmouth	63	41	57.0	44.9	51.0	- 7.5	3	0.20	-0.29	*	*
	Geldeston	66	37	58.9	42.2	50.6	- 8.4	3	0.15	-0.34	57	49
	Cambridge	67	35	60.7	42.0	51.4	- 8.2	2	0.14	-0.26	40	34
4. MIDLAND COUNTIES.	Rothamsted	67	35	58.4	43.0	50.7	- 9.3	5	0.26	-0.22	*	*
	Bawtry (Hesley Hall)	67	36	60.3	42.7	51.5	- 6.5	1	0.02	-0.49	*	*
	Nottingham	74	33	63.4	41.6	62.0	- 6.9	13	0.07	-0.44	*	*
	Loughborough	68	36	59.1	42.8	51.0	- 8.0	4	0.08	-0.47	*	*
	Leicester	66	36	58.9	41.4	50.2	- 9.2	3	0.44	-0.12	33	28
	Birmingham (Oscott)	68	37	57.5	41.4	49.5	-10.0	3	0.36	-0.23	*	*
	Cheadle	63	37	54.9	41.1	48.0	-11.2	4	0.36	?	*	*
	Churchstoke	66	33	57.6	40.8	49.2	- 9.7	3	0.19	?	*	*
	Hereford	69	34	59.7	41.2	50.5	- 8.5	4	0.40	-0.01	33	28
	Cirencester	66	36	58.0	41.6	49.8	-10.1	3	0.23	-0.23	29	24
5. ENGLAND, S.	Oxford	66	39	58.7	44.4	51.6	- 8.7	2	0.14	-0.33	38	33
	London†	69	39	62.1	45.4	53.8	- 6.1	1	0.07	-0.43	48	41
	Marlborough	66	35	57.7	41.9	49.8	-10.2	3	0.24	-0.22	*	*
	Stratfield Turgiss	71	35	60.9	43.4	52.2	- 7.4	3	0.29	-0.11	*	*
	Dover	63	42	56.7	45.3	51.0	- 7.2	3	0.70	+0.25	*	*
	Hastings (St. Leonard's)	64	40	57.4	45.2	51.3	- 7.2	3	0.55	+0.23	*	*
	Southampton	65	37	60.1	45.2	52.7	- 6.8	3	0.25	?	35	30
6. SCOTLAND, W.	Hurst Castle	60	38	58.1	43.1	50.6	- 8.3	3	0.34	?	*	*
	Laudale (Loch Sunart)	61	37	54.5	40.5	48.5	- 6.5	1	0.09	?	*	*
	Glasgow	62	37	55.6	40.4	48.0	- 7.8	3	0.15	-0.50	37	30
	Ardrossan	62	37	56.0	41.7	48.9	- 6.8	4	0.30	-0.21	*	*
	Silloth (Cumberland)	67	35	59.6	40.6	50.1	- 6.7	3	0.21	-0.23	33	28
7. ENGLAND, N.W.	Douglas (Isle of Man)	61	36	55.6	42.0	48.8	- 8.7	3	0.70	+0.31	57	48
	Barrow-in-Furness	62	41	57.7	44.7	51.2	- 6.7	2	0.17	?	*	*
	Stonyhurst	61	39	55.3	41.4	48.4	- 9.4	1	0.08	-0.60	30	25
	Blackpool	61	36	55.6	43.8	49.7	- 8.2	3	0.07	-0.35	*	*
	Manchester	63	37	54.8	41.2	48.0	-10.5	3	0.19	-0.36	*	*
	Liverpool Obs. (Bidston)	62	42	56.9	45.1	51.0	- 7.5	3	0.25	-0.20	*	*
	Llandudno	62	40	55.8	43.4	50.6	- 7.6	3	0.45	+0.07	52	45
8. ENGLAND, S.W.	Holyhead	61	44	54.6	47.1	50.9	- 7.0	2	0.25	-0.13	*	*
	Pembroke	59	41	54.7	45.4	50.1	- 7.7	4	0.43	+0.13	71	62
	Arlington (N. Devon)	62	35	56.9	41.7	48.8	-10.2	4	0.42	?	*	*
	Falmouth	66	43	58.0	47.5	52.8	- 7.1	4	0.24	-0.36	71	63
	Plymouth	71	40	61.6	45.7	53.7	- 6.1	4	0.29	-0.11	53	47
9. IRELAND, N.	Prawle Point	61	39	58.3	44.4	51.4	- 8.4	3	0.33	?	*	*
	Londonderry	60	37	57.0	42.7	49.9	- 6.9	4	0.28	-0.22	*	*
	Mullaghmore	59	44	56.6	48.3	52.5	- 4.6	5	0.39	?	*	*
	Markree Castle	60	39	57.6	40.2	48.9	- 8.6	4	0.30	-0.42	34	28
	Brookeborough	62	34	57.2	41.8	49.5	- 7.6	4	0.20	?	*	*
	Armagh	59	36	56.1	43.8	49.7	- 7.2	4	0.26	-0.06	32	27
10. IRELAND, S.	Donaghadee	57	40	54.0	43.6	48.8	- 8.0	2	0.31	?	*	*
	Dublin	61	37	57.2	44.0	50.6	- 6.7	4	0.37	-0.19	36	31
	Parsonstown	62	32	58.9	40.9	49.9	- 7.4	4	0.26	-0.24	32	27
	Waterford										*	*
	Roche's Point	63	41	60.7	45.3	53.0	- 5.2	2	0.20	-0.40	*	*

Stations marked *fr* are in connection with the Meteorological Society.

* An asterisk is inserted in all places for which the information is not usually received.
† For London the Sunshine Values are the means of observations made in the City (Banhill Row), at Hampstead, and the Kew Observatory.
‡ The sunshine values quoted for Brigg are those obtained from a recorder placed at Worksop.

SUMMARY OF RAINFALL AND TEMPERATURE for the FIRST QUARTER of the YEAR (January 1st to March 31st).

Vol. IV., No. 13a. (Issued as Part of the Weekly Weather Report for the year 1881.)

YEARS.	PRINCIPAL WHEAT-PRODUCING DISTRICTS.							PRINCIPAL GRAZING, &c. DISTRICTS.					MEAN FOR ALL THE GRAZING, &c. DISTRICTS.	BRITISH ISLANDS GENERALLY.
	0. SCOTLAND, N.	1. SCOTLAND, E.	2. ENGLAND, N.E.	3. ENGLAND, E.	4. MIDLAND COUNTIES.	5. ENGLAND, S.	MEAN FOR ALL THE WHEAT-PRODUCING DISTRICTS.	6. SCOTLAND, W.	7. ENGLAND, N.W.	8. ENGLAND, S.W.	9. IRELAND, N.	10. IRELAND, S.		
RAINFALL (in inches).	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.	ins.
1866	14.8	11.3	5.8	7.4	7.1	11.4	9.6	15.4	13.4	16.9	13.7	12.0	14.3	11.7
1867	10.7	9.5	5.4	5.7	8.1	8.8	8.0	9.9	11.1	15.2	11.8	10.7	11.7	9.7
1868	19.1	11.7	4.9	5.4	6.7	7.5	9.2	17.6	13.3	11.9	13.0	10.5	13.3	11.1
1869	11.8	8.9	6.2	6.2	7.7	9.0	8.3	11.4	12.2	14.0	12.1	12.1	12.4	10.1
1870	6.4	6.7	4.8	3.9	5.1	6.0	5.5	8.8	9.0	10.7	8.6	9.7	9.4	7.2
1871	9.4	6.9	3.8	3.9	4.8	6.1	5.8	11.7	8.7	10.0	10.7	9.4	10.1	7.8
1872	8.2	11.2	7.8	6.1	9.8	10.1	8.9	15.2	14.0	19.5	12.7	13.1	14.9	11.6
1873	7.9	7.2	5.3	5.4	7.1	8.4	6.9	10.0	9.6	14.1	8.8	11.9	10.9	8.7
1874	11.5	6.5	3.5	3.1	5.7	4.4	5.8	8.6	11.0	12.5	8.4	7.7	9.6	7.5
1875	8.4	7.0	3.9	3.7	5.8	6.7	5.9	9.8	8.7	12.6	7.1	10.2	9.7	7.6
Means for 10 years, 1866 to 1875	10.8	8.7	5.1	5.1	6.8	7.8	7.4	11.8	11.1	13.7	10.7	10.7	11.6	9.3
1876	13.4	9.5	6.3	6.7	8.2	7.5	8.6	12.1	12.0	10.9	10.0	10.0	11.0	9.7
1877	11.9	9.8	7.1	7.6	8.3	10.7	9.2	14.2	15.4	14.2	13.4	11.4	13.7	11.3
1878	9.3	4.3	4.9	4.6	3.8	4.9	5.3	11.0	7.3	6.2	8.2	7.9	8.1	6.6
1879	5.5	7.0	5.2	6.3	6.2	8.3	6.4	8.5	6.7	11.2	6.7	11.4	8.9	7.5
1880	7.4	5.3	3.1	3.3	4.2	4.6	4.7	9.1	6.2	6.7	7.6	9.9	7.9	6.1
1881	9.4	7.4	6.2	5.9	6.7	6.8	7.1	9.4	8.6	9.8	7.7	8.7	8.8	7.9
Means for 16 years, 1866 to 1881	10.3	8.1	5.2	5.3	6.6	7.6	7.2	11.4	10.5	12.3	10.0	10.4	10.9	8.9
TEMPERATURE (in degrees Fahrenheit).	°	°	°	°	°	°	°	°	°	°	°	°	°	°
1866	38.3	38.8	39.1	40.9	40.4	41.9	39.9	49.0	40.6	43.4	39.9	40.3	40.8	40.3
1867	36.9	37.2	36.8	38.6	38.2	39.2	37.8	37.7	38.6	41.4	38.1	39.9	39.1	38.4
1868	40.7	41.7	41.1	41.4	41.9	42.0	41.5	42.3	42.4	44.4	42.1	44.3	43.1	42.2
1869	40.0	40.3	40.6	41.1	41.2	42.0	40.9	42.0	42.1	45.1	42.9	44.6	43.3	42.0
1870	37.9	37.4	37.1	37.4	38.0	38.2	37.7	38.6	38.7	41.3	39.8	41.6	40.0	38.7
1871	40.0	39.7	38.8	39.2	40.1	40.3	39.7	40.0	40.0	43.3	41.6	43.4	41.7	40.6
1872	40.9	40.9	41.3	42.3	42.9	43.7	42.0	42.9	43.3	46.1	42.4	44.5	43.8	42.8
1873	39.0	38.4	38.5	38.9	39.1	39.9	39.0	39.2	39.7	42.6	39.8	41.0	40.5	39.6
1874	41.7	41.8	41.3	40.4	41.0	42.0	41.4	42.3	41.8	45.0	42.8	45.2	43.4	42.3
1875	39.5	39.0	38.8	38.6	39.2	40.2	39.2	39.8	40.2	42.9	41.6	44.6	41.8	40.4
Means for 10 years, 1866 to 1875	39.5	39.5	39.3	39.9	40.2	40.9	39.9	40.5	40.7	43.6	41.0	42.9	41.8	40.7
1876	38.7	38.3	39.2	39.0	38.9	40.0	39.0	39.5	39.8	42.4	40.1	43.3	41.0	39.9
1877	38.4	38.8	40.4	41.7	41.8	43.1	40.7	40.5	41.8	44.9	41.4	45.2	42.8	41.6
1878	39.4	40.1	40.8	40.6	41.8	41.7	40.7	41.9	42.2	44.2	42.5	45.1	43.2	41.8
1879	35.8	34.2	35.9	36.5	36.4	37.8	36.1	36.5	36.8	40.8	38.0	40.5	38.5	37.2
1880	40.6	39.8	39.5	39.2	39.9	40.5	39.9	41.3	40.6	43.5	42.2	44.1	42.3	41.0
1881	34.4	33.5	34.3	36.1	35.8	38.2	35.4	35.8	36.6	39.9	37.5	39.8	37.8	36.5
Means for 16 years, 1866 to 1881	38.9	38.7	38.9	39.5	39.8	40.6	39.4	40.0	40.3	43.2	40.7	42.9	41.5	40.3

TABLE showing the DATES of the DRIEST and WETTEST, and the COLDEST and WARMEST corresponding Quarters for the 16 years, 1866 to 1881.

		WHEAT DISTRICTS.			GRAZING, &c. DISTRICTS.			GENERALLY.		
		inches.			inches.			inches.		
Rainfall	{ Driest	1880	-	4.7	1880	-	7.9	1880	-	6.1
	{ Wettest	1866	-	9.6	1872	-	14.9	1866	-	11.7
Temperature	{ Coldest	1881	-	35°·4	1881	-	37°·8	1881	-	36°·5
	{ Warmest	1872	-	42°·0	1872	-	43°·8	1872	-	42°·8

NOTES.

1.—Rainfall.

The mean values for the Rainfall in the various districts given in this Table for the years 1866 to 1877 were obtained from observations made at the following stations :—

Districts.	Stations.	Districts.	Stations.
0. SCOTLAND, N.	{ Loch Broom. Helmsdale. Sandwick Manse. Inverness. Aberdeen.	5. ENGLAND, S.	{ Bridport. Selborne. Maidstone. London (Camden Town).
1. SCOTLAND, E.	{ Ballater. Logierait. Stirling. Hawick.	6. SCOTLAND, W.	{ Dumfries. Ayr. Castle Toward.
2. ENGLAND, N.E.	{ N. Shields. York. Grimsby. Boston.	7. ENGLAND, N.W. and N. WALES.	{ Llandudno. Manchester. Skipton.
3. ENGLAND, E.	{ Fakenham. Reeces. Witham. Bury St. Edmunds. Yarmouth. Cambridge. Bury St. Edmunds. Leicester. Derby. Tisbury. Shiffnal. Cirencester. Banbury. Hitchin.	8. ENGLAND, S.W. and S. WALES.	{ Barnstaple. Bodmin. Haverfordwest. Bhayader.
4. MIDLAND COUNTIES		9. IRELAND, N.	{ Galway. (Doo Castle). Banni- nadden, Co. Sligo. Waringstown. Strabane.
		10. IRELAND, S.	{ Cork. Waterford. Killaloe. Portarlinton. Monkstown, Co. Dublin.

(The values were obtained mainly from Symons' Monthly Meteorological Magazine, supplemented by some of the values contained in the Reports of the Rainfall Committee of the British Association, 1868-1876.)

2.—Temperature.

The Temperature values for the years 1866 to 1877 have been obtained from the following stations :—

Districts.	Stations.	Districts.	Stations.
0. SCOTLAND, N.	{ Sandwich Manse. Stornoway. Dunrobin.	7. ENGLAND, N.W. and N. WALES.	{ Stonyhurst. Bradford. Leeds. Eccles. Liverpool. Llandudno.
1. SCOTLAND, E.	{ Culloden. Aberdeen. Perth. Leith.	8. ENGLAND, S.W. and S. WALES.	{ Gloucester. Taunton. Barnstaple. Truro. Helston.
2. ENGLAND, N.E.	{ Bywell. N. Shields. Hull.	9. IRELAND, N.	{ Belfast. Milltown (Banbridge). Armagh.† Athlone.* Moville. Milltown. Armagh. Donaghadee.
3. ENGLAND, E.	{ Royston. Holkham. Norwich. Wisbeach. Somerleyton. Derby. Nottingham. Cardington. Oxford.	10. IRELAND, S.	{ Dublin.* Curragh Camp. Buttevant.* Cork. Valentia.† Kingstown. Parsonstown. Cork. Roche's Point. Valentia.
4. MIDLAND COUNTIES	{ Marlborough. Greenwich. Streantley. London (Camden Town). Weybridge. Strathfield Turgiss. Osborne. Bournemouth. Worthing.		
5. ENGLAND, S.	{ Greenock. Cockermouth. Silloth. Carlisle.		
6. SCOTLAND, W.			

(The values were obtained mainly from the returns published quarterly by the Registrar General and those published by the Scottish Meteorological Society, in their Quarterly Journal, and the reports of the Army Medical Department, besides the records of the two Irish observatories, Valentia and Armagh. The returns for Cork were furnished by R. Caulfield, Esq., LL.D.)

For the years 1878 to 1881 the means are obtained from the observations published in the Weekly Weather Report.

* Did not commence till January 1867.

† Did not commence till January 1869.

By Order,

ROBERT H. SCOTT.

Secretary.

APPENDIX XVI.

METHODS FOLLOWED IN DEALING WITH METEOROLOGICAL RETURNS FROM LAND STATIONS IN THE UNITED KINGDOM.

These stations are of five classes, as stated on page 21.

I.—Observatories continuously observing all the Meteorological Elements.

Hourly measurements of the curves obtained from the self-recording instruments at the seven 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 and wet-bulb thermograms, of the anemograms, and of Beckley's rain-gauge curves.

Returns from observatories.

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 will be found fully detailed 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 measures 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 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 each month and printed in their minutes. The curves and tabulations are eventually bound and stored in the Office.

Examination of returns.

Results of examination and report to Council.

In addition to the publication of the "Hourly Values" and mean results, tracings of the curves themselves upon a reduced scale are engraved on copper plates and published in the "Quarterly Weather Report." The instruments by which this reduction is effected are described in the Report of the Office for 1870; but since that time many improvements have been effected in the methods of dealing with the curves; sources of error unavoidable in the original traces have been detected and are now allowed for, or met by special contrivances, and as the result, greater faithfulness is secured in the reproductions. The average degree of accuracy now attained is within $0^{\circ} \cdot 2$ for the thermograms, and $0 \cdot 004$ inch for the barograms (see note accompanying Quarterly Weather Report, Part IV., 1874).

Plates of Quarterly Weather Report

Accuracy of the plates.

In addition to the curves obtained from the self-recording instruments, a continuous curve of vapour tension is got from the reduced thermogram traces by means of the instrument invented for the purpose, and described in the Report of the Office for 1871, and is engraved on the copper plates with the automatic records.

Curve of vapour tension.

Chart plates.

In the more recent numbers of the Quarterly Weather Report (for 1876, *et seq.*) plates of charts are issued showing the conditions of barometrical pressure and wind for Western Europe for 8 a.m. and 6 p.m. each day, each plate containing 36 charts. The whole of this work is done in the Office, the copper plates being sent to the printer ready for press.

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 at present those for the year 1871 are being dealt with; they require little or no preparation for this purpose beyond that necessary for their reduction for the Quarterly Weather Report.

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 obtained by addition.

Vapour tension.

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

Hourly readings.

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, and the whole series is lithographed and published under the title of "Hourly Readings from the Self-recording Instruments at the seven Observatories in connexion with the Meteorological Office."

To ensure accuracy the sheets are read over in proof with the originals. The interpolated readings are not published, but are only used for obtaining the means. No distinguishing mark is affixed to a mean thus partly based on interpolated readings. 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 by an interpolation from the adjacent daily means, and the result thus obtained is printed as an approximation.

Tables for the Quarterly Weather Report.

The five-daily, monthly, and annual means are published in the Quarterly Weather Report, together with the absolute extremes of pressure and temperature for each month, and the values are repeated in French measures.

Gale 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 seven self-recording observatories, together with those received from the six extra anemographic stations.

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

The anemograms received from the six stations enumerated on page 102 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 the highest importance, the tabulations are always employed in the preparation of the chronicle and gale tables for the Quarterly Weather Report. They are also regularly used in the checking of the storm warnings issued by the Office.

The anemograms from the instrument on the East Pier of Kingstown Harbour, for the 24 years 1856–1879, have been received at the Office during the year, but no commencement has yet been made of their tabulation. This anemometer was of an old pattern, giving the traces of velocity and direction on different circular sheets. It has now been replaced by an instrument of the standard type.

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 Meteorological Society (London), copies of the returns from which were sent to the Office under a special arrangement with the Society.

Origin and progress of the system.

At the end of the present year the total number of stations is 63, including 15 belonging to the 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 : 44 in England, five in Wales, three in Scotland, and 12 in Ireland.

While the number of stations has thus increased, the quality of the information supplied has also on the whole considerably improved, so that the number of first-class stations is now larger in proportion to the whole number of stations than it has ever been.

Quality of the returns.

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, 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.

Publication on Form A.

The Permanent Committee assigned an inferior limit to the number of stations returns from which should be published *in extenso*, varying from two 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, only nine British stations were available, but this number has steadily grown, until for 1879 returns from 26 stations are actually published on the A. Form, and the list could be at once increased, if thought desirable.

Addition 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 of the returns.

All the returns selected for publication on Form A. are carefully examined and compared before being copied for the printer. The reduction of all the barometer readings to 32° Fahr. at mean sea level is checked, and the corrected readings are then compared with the isobars on the Daily Weather Charts and readings at neighbouring stations, allowance being made for any difference in time and the corresponding change in barometric pressure.

The correction of the readings of the dry-bulb and damp-bulb thermometers is checked, and the maxima and minima temperatures are compared with the dry-bulb thermometer readings over the same periods to ensure that they are the extreme temperatures registered.

The computed values of the vapour tension and the relative humidity are examined from the tables. The cloud amount is compared with the weather at the time of observation, and finally, the sums and means are all re-calculated.

Doubtful readings.

If any readings are doubtful, reference is made through the observer to the original observation book. If no fresh light is thrown on the question by this means, and if on reconsideration the reading still appears to be wrong, it is rejected, and the probable reading is inserted in its place, but printed in different type as an interpolation. These probable readings are used in obtaining the monthly means. Similarly, if from any cause a set of readings has been omitted, the gap is filled by an interpolation, and the probable values are printed in different type.

Apparent errors, or discrepancies, in the working on the sheet are also referred to the observer before alteration.

Unpunctual observations.

The observations are taken at 9 a.m. and 9 p.m. 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.

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 36 for the year 1879, 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 Forms A. But the summaries of wind and weather 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 bi-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 mean 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.

When the 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 29 Stations in the British Islands are examined generally to guard against accidental changes in the adjustment of the instrument. After their receipt has been acknowledged, the cards are duly stamped and dated and stored in the Office. Sunshine records

A tabulation of these curves is published as part of the Weekly Weather Report mentioned in Appendix VII.

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

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. 73) 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 XVII.

LIST OF DOCUMENTS RELATING TO THE LAND METEOROLOGY OF THE BRITISH ISLANDS, RECEIVED DURING THE YEAR ENDING
MARCH 31ST, 1881.

Stations.	Observers.	Nature of Information received.	Notes.
I. Valencia - Armagh - Glasgow - Aberdeen - Falmouth - Stonyhurst - Kew -	J. E. Callum - S. Call, for Rev. T. R. Robinson, D.D., F.R.S. - Prof. R. Grant, LL.D., F.R.S. - Prof. C. Niven - Lovell Squire - Rev. S. J. Perry, F.R.S. - G. M. Whipple, B.Sc., F.R.A.S. -	Continuous records of pressure, temperature, wind, sunshine, and rain, with notes on the weather.	
II. Alnwick Castle - Holyhead - Sandwich - Seaham - Scilly - Yarmouth - Waterford -	Major F. Holland, for the Duke of Northum- berland, K.G. - Hugh Williams, C.E. - Rev. C. Clouston, LL.D. - G. H. Aird - W. Thomas - G. T. Watson - The Harbour Authorities -	Continuous record of wind (direction and velocity). " " " " " " " " " " Continuous record of pressure.	
III. Aysgarth - Babbacombe - Buxton - Carmarthen - Chatham - Cheddar - Cheltenham - Chigwell Row - Churchstoke - Colebrooke - Dartmoor -	Rev. W. Fenwick Stow, M.A., F.M.S. - E. E. Glyde, F.M.S. - E. J. Sykes, F.R.A.S., F.M.S. - G. J. Hearder, M.D. - Lieut.-Col. C. Warren, R.E., C.B., C.M.G. - J. C. Philips, F.M.S. - R. Tyrer, B.A., F.M.S. - J. Campbell, Staff Surgeon, R.N. - Philip Wright, F.C.S., F.M.S. - W. Ferguson, for Sir Victor Brooke, Bt., F.L.S. - W. H. Tooker -	Regular observations at 9 a.m. and 9 p.m. of pressure, temperature, wind, cloud and weather, with the daily maxima and minima of temperature, and rainfall, and remarks on the weather generally.	

List of Documents—continued.

Stations.	Observers.	Nature of Information received.	Notes.
+ Douglas, Isle of Man -	A. W. Moore -	-	-
+ Dublin (City) -	J. W. Moore, M.D., F.M.S. -	-	-
+ Dublin (Phoenix Park) -	Lieut.-Col. C. N. Martin, R.E. -	-	-
Folkestone -	A. Henry Taylor, F.M.S. -	-	Stopped, Sept. 1880.
Gdeston (Suffolk) -	E. T. Dowson, F.M.S. -	-	-
+ Botanic Gardens Glasnevin (near Dublin) -	F. W. Moore -	-	-
+ Glenalmond -	Rev. W. Percy Robinson, D.D., F.M.S. -	-	Dr. Robinson, died March 1881.
† Hillington -	Rev. H. Folkles, M.A., F.M.S. -	-	-
† Hall -	Rev. W. P. Mackay, M.A., M.D. -	-	-
+ Jersey (St. Aubin's) -	J. E. Vibert, M.A. -	-	-
† Kelstern -	D. G. Briggs, F.M.S. -	-	-
+ Landale -	A. Fletcher, for T. H. G. Newton, F.M.S. -	-	-
† Llandudno -	J. Nicol, M.D., F.M.S. -	-	-
+ Leicester -	W. J. Harrison, F.G.S., and J. E. Carryer -	-	-
+ Londonderry -	J. Conroy, F.M.S. -	-	-
+ Markree Castle, Sligo -	E. Salles, for Col. Cooper, F.R.A.S. -	-	-
† Marlborough -	Rev. T. A. Preston, M.A., F.M.S. -	-	-
+ Netley -	Prof. F. De Chaumont, M.D., F.R.S. -	-	-
Oscott -	Revs. S. J. Whitty, B.A., and R. Pate -	-	-
+ Parsonstown -	W. Harding, for the Earl of Rosse, F.R.S. -	-	-
-	H. R. O. Sankey, M.D. -	-	-
-	Rev. T. E. Egan, O.S.B. -	-	-
† Ramsgate -	Rev. C. Clouston, LL.D. -	-	-
+ Sandwick -	R. A. Allison, F.M.S. -	-	-
† Scaleby -	G. H. Aird -	-	-
+ Seabam -	J. T. Cook, R.E., for Director General of Ordnance Survey. -	-	-
+ Southampton -	Rev. J. Digges La Touche -	-	-
† Stokesay -	Rev. C. H. Griffith, B.D., F.M.S. -	-	-
† Strathfield Turgiss -	W. P. Probert, LL.D., F.G.S., F.M.S. -	-	-
+ St. David's, Pembroke-shire.	-	-	-

Regular observations at 9 a.m. and 9 p.m. of pressure, temperature, wind, cloud and weather, with the daily maxima and minima of temperature, and rainfall, and remarks on the weather generally.

Stopped, Nov. 1880.
Mr. Whitty left Oscott,
Dec. 1880.

LIST OF DOCUMENTS—continued.

Stations.	Observers.	Nature of Information received.	Notes.
St. Leonards -	H. Colborne, M.R.C.S., F.M.S.	-	-
Totnes -	T. H. Edmunds, F.M.S.	-	-
Uppingham -	Rev. G. H. Mullins, M.A., F.M.S.	-	-
Wakefield -	H. Clarke, L.R.C.P., F.S.S., F.M.S.	-	-
Waterford -	Joseph Neale -	-	-
† York -	W. Keeping, B.A., F.G.S.	-	-
IV. The Telegraphic Stations, see List on p. 57			
V. Alnwick Castle	Major F. Holland, for the Duke of Northumberland, K.G.	-	-
Castletownsend	Lieut. T. W. Cobb, R.N.	-	-
Crookhaven -	"	-	-
Coleford, Gloucester -	J. Maclean -	-	-
Cooper's Hill (Egham)	Prof. H. McLeod, F.C.S.	-	-
Ennis -	J. Hill, C.E.	-	-
Galway -	Lieut. J. W. S. Hardinge, R.N.	-	-
Gorleston -	R. C. J. Day -	-	-
Harpندن -	T. Wilson, F.M.S.	-	-
Haslar -	G. Coppen -	-	-
Killingholme -	Rev. J. Byron -	-	-
Llandoverly -	J. Watkins -	-	-
Rugby -	Rev. T. N. Hutchinson, M.A.	-	-
Saffron Walden	J. G. Bellingham -	-	-
Sheffield -	W. F. Cooper -	-	-
Winchester -	Rev. G. Richardson, M.A.	-	-
Workshop -	H. Mellish, F.M.S.	-	-
		Regular observations at 9 a.m. and 9 p.m. of pressure, temperature, wind, cloud and weather, with the daily maxima and minima of temperature, and rainfall, and remarks on weather generally.	In place of Hastings, discontinued.
		Regular observations twice (and in some cases three times) daily of pressure, temperature, wind, weather, and sea disturbance.	
		10 a.m. obs. of pressure and weather, with daily max. and min., and rainfall.	
		Pressure and temp. four times daily, and wind twice daily.	
		Weather, and wind once daily, with max. and min.	
		Full return for 9 a.m. and 3 p.m.	
		Daily rainfall.	
		Pressure, temp., wind, and weather twice daily.	
		Pressure and wind twice daily.	
		Pressure, temperature, and wind, twice daily, with rainfall.	
		Pressure and temperature four times daily.	
		Wind, cloud, and weather three times daily.	
		Daily rainfall.	
		Full 9 a.m. obs. with 9 p.m. temperatures.	
		Pressure and temperature twice daily, with a.m. wind and rainfall.	
		Full return for 8 a.m. and 11 p.m.	
		Full report for 9 a.m. and 2 p.m.	
		Full return, except for want of 9 p.m. temperatures.	

The Stations in the above List marked "†" belong to the Meteorological Society: those marked thus † have been inspected during the year.

APPENDIX XVIII.

ACCESSIONS TO THE LIBRARY DURING THE YEAR ENDING
31st MARCH 1881.

A—AGRICULTURE AND BOTANY.

|| **Bruhns, C.**—Die Benützung der Meteorologie für landwirthschaftliche Arbeiten. A lecture delivered 6th Feb. 1880. 16 pp. 8°. Dresden, 1880. (*Mitth. Oekon. Gesellsch. Sachsen.*)

Cantoni, G.—Su le osservazioni Meteorico-Agrarie. 8 pp., 1 plate, 8°. Varese, 1880.

|| **Hildebrandsson, H. H.**—État des glaces, époques de la végétation et de la migration des oiseaux en Suède. 16 pp., 4 plates, la. 4°. [*Ann. Bureau central météor. France*, 1878. I. p. C. 31.]

Hinrichs, G.—Directions for Crop Reporters of the Iowa Weather Service. 4 pp. la. 8°. Iowa, 1880.

Morton, J. C.—The past agricultural year [1878-9]. 40 pp. 8°. [*Journ. R. Agric. Soc. Engl.*, xvi. s.s., p. 210.]

Ufficio centrale di Meteorologia, Rome.—Servizio Meteorico-Agrario. Bollettino di Notizie Agrarie, 1879, Nos. 27-37; Anno II. 1880, Nos. 1-58, la. 8°. (*Roma*, 1879-80.)†

B—ASTRONOMY.

Committee on Solar Physics, London.—Preliminary Report by the Committee on Solar Physics appointed by the Lords of the Committee of Council on Education. With Appendices A. B. F. G. H. 1 paper f°. 5 papers 8°. 2 plates. (*London*, 1879-81.)

K. K. Sternwarte zu Prag.—Astronomische, magnetische und meteorologische Beobachtungen an der k. k. Sternwarte zu Prag im Jahre 1879. Auf öffentliche Kosten herausgegeben von C. Hornstein. xviii. + 56 pp. la. 4°. Prag, [1880].

|| **Osservatorio astronomico dell' Università degli Studi di Torino.**—Effemeridi del Sole, della Luna e dei principali Pianeti calcolate per Torino in tempo medio civile di Roma per l'anno 1879, dell' A. Charrier. 23 pp. 8°. Turin, 1878. (*Atti R. Accad. Sc. Torino* xiii.)

Royal Astronomical Society.—Memoirs. Vol. xlv., 1879-80. 189 pp., 1 plate, 4°. London, 1880.

———, —Monthly Notices. Vol. xl. With plates, 8°. London, 1880.†

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, 1880, June 5. 21 pp. la. 4°. [*London*, 1880.]

Solar Physics.—Return to an Address of the Honourable the House of Commons, dated 20th March 1879, for Copy of Correspondence and Papers relating to a Committee to report on the method of conducting observations in Solar Physics. 11 pp. f°. (*London*, 1881.)

C—ATMOSPHERIC PRESSURE.

|| **Blanford, H. F.**—On the high Atmospheric pressure of 1876-78 in Asia and Australia, in relation to the Sun-spot Cycle. Read Jan. 6, 1880. 13 pp., 1 plate, 8°. (*Journ. Asiat. Soc. Beng.* xlix., Part II. p. 70.)

(**Chambers, F.**)—Abnormal variations of barometric pressure in the Tropics and their relation to sun-spots, rainfall, and famines. 16 pp., 1 plate, sm. f°. (*Bombay*, 1880.)

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.

† Some loose parts for the next vol. or year also received.

* **Dove, H. G. [H. W.]**—De barometri mutationibus. Dissertatio inauguralis in Universitate litteraria Berolinensi rite adipiscendis die IV. m. Mart. MDCCCXXVI. 48 pp. sm. 8°. Berolini, s.a.

Guldberg, C. M., et Mohn, H.—Études sur les mouvements de l'Atmosphère. 2^e Partie. 53 pp. 4°. Christiania, 1880. (*Univ. Programme*, 1880, 2^e Semestre.)

* **Rougerie, —**Recherches sur la loi fondamentale qui relie la pression barométrique moyenne d'un point de l'Atlantique nord à la direction et à la vitesse des vents en ce même point. 4 pp., 4 plates, la. 4°. Paris, [1880].

|| **Whipple, G. M.**—On the rate at which barometric changes traverse the British Isles. 7 pp., 1 plate, la. 8°. (*Quart. Journ. Meteor. Soc.*, vi., n.s., 1880, p. 136.)

|| **Wild, H.**—Über die Beziehungen zwischen Isobaren und Isanomalen der Temperatur. 24 pp., 2 charts, la. 8°. St. Petersburg, 1881. (*Mél. phys. chim.*, xi., p. 329.)

D—AURORA.

|| * **Poej, A.**—Sur la neutralité de la force électro-magnétique de la terre et de l'atmosphère observée à la Havane durant les aurores boréales de 1859; expériences qui confirment ou qui annulent l'action électrique des aurores polaires dans les basses régions de l'atmosphère. Séance 19 Fev., 1861. 16 pp. la. 8°. s.l.e.a. (*Ann. Soc. météor. France*, ix., p. 42.)

|| **Tromholt, S.**—Iagttagelser over Nordlys anstillede i Norge, Sverige og Danmark. I. September 1878–April 1879. 148 pp., 5 plates, la. 8°. Christiania, 1880. (*Christiania Vidensk.-Selsk. Forhandl.*, 1880, No. 6.)

E—BIBLIOGRAPHY.

|| **Holden, E. S.**—A subject-index to the publications of the United States Naval Observatory, 1845–1875. 74 pp. la. 4°. Washington, 1879. (*Washington Astr. Obs.*, 1876, App. 1.)

F—CLIMATE AND HYGIENE.

|| **Augustin, F.**—Das Klima von Prag. Mitgetheilt 10 Dec. 1880. 34 pp. 8°. Prag, 1881. (*Sitzb. k. böhm. Gesellsch. Wissensch.*)

* **Bonwick, J.**—Climate and Health in South Africa. 125 pp. sm. 8°. London, 1880.

Borius, A.—Recherches sur le climat des établissements français de la côte septentrionale du Golphe de Guinée. 24 pp. la. 8°. Paris, 1880. (*Ann. Soc. météor. France*, xxvii, 1879, p. 148.)

Inspector General of Customs, Peking.—Medical Reports for the half years ended 30th September 1879 and 31st March 1880. 18th and 19th Issues. With plates, 4°. Shanghai, 1880.

|| * **Kreil, [K.]**—Beitrag zur Klimatologie von Central-Afrika. Vorgelegt 8 Juni 1860. 22 pp. la. 8°. (*Wien, Sitzb. k. Akad. Wissensch.*, xli., p. 377.)

Lawes, J. B., and Gilbert, J. H.—Our Climate and our Wheat Crops. 38 pp. 8°. [*Journ. R. Agric. Soc. Engl.*, xvi., s.s., p. 173.]

Ministerio de Fomento. Observatorio meteorologico central, Mexico.—Revista mensual climatologica. Tomo I, Nos. 1, 2. sm. f°. Mexico, 1881.

Office of the Government Statist, Melbourne.—Statistical Register of the Colony of Victoria, for the year 1879. Part iv. Vital Statistics, &c. 42 pp. f°. Melbourne, [1880].

Pamard, A.—La mortalité dans ses rapports avec les phénomènes météorologiques dans l'Arrondissement d'Avignon, 1873–1877. 52 pp., 2 plates, sm. f°. Paris, 1880.

|| **Physiographical Commission of the I. R. Academy of Science at Cracow.**—Materials for Galician climatology, collected by the Meteor. section of the 1879. 243 pp. la. 8°. Cracow, 1880. (*Extract Rep. Physiogr. Comm.*)
In the Polish language.

|| **Power, J. B.**—On the Climate of Kingstown. 13 pp., 1 plate, 8°. Dublin, 1881. (*Dublin Journ. Med. Sc.*, 1881, Feb.)

Registrar General of Births, Deaths, and Marriages in Ireland.—Weekly returns of births and deaths in Dublin (including its suburban districts), and in fifteen other town districts in Ireland. Vol. xcii., 1880. la. 8°. Dublin, 1881.

Registrar General, London.—Weekly Return of births and deaths in London and in twenty-two other large towns of the United Kingdom. Vol. xli., 1880. la. 8°. (London, 1880.)

Sanitary Commissioner of the Punjab.—Reports, on the Sanitary Administration of the Punjab, 1878, 1879. 2 vols., 15 plates, la. 4°. Lahore, 1879-80.

Schiaparelli, G.—Sull' umidità atmosferica nel clima di Milano. Risultati di 35 anni di osservazioni fatte nell' osservatorio di Brera (1845-1879). 35 pp., 3 plates, sm. 4°. Milano, 1880. (*Pubbl. R. Osserv. di Brera, N. xv.*)

Société de Médecine et de Climatologie de Nice.—Nice-Médical. Année iv. 1879-80. la. 8°. Nice, 1879-80.†

Symons, G. J.—Some deficiencies in our knowledge respecting Health Resorts. Read at the Sanitary Congress, Exeter, 1880. 8 pp., 1 plate, 8°. London, [1880].

Tifiser physikalisches Observatorium.—Materialien zu einer Klimatologie des Kaukasus, gesammelt und herausgegeben von A. Moritz u. J. Mielberg, Direct. des. Observ. in Tiflis. Abth. I. Meteorol. Beobachtungen, Bd. II. Tiflis, 1876-1879. 18 pp., 3 photographs and 3 plates, 4°. Tiflis, 1880.

In Russian language also.

|| **Woeikoff, A. J.**—Climate of the Monsoon Region of Eastern Asia. 90 pp., 2 plates, la. 8°. St. Petersburg, 1880. (*Proc. Imp. Russ. Geogr. Soc., xv., No. 5.*)

In the Russian language.

———.—Climatological conditions of present and past glacial epochs. 70 pp. la. 8°. (*Printed by order of the Imp. St. Petersb. Musc. Soc.*)

In the Russian language.

H—ELECTRICITY AND MAGNETISM.

|| **Adams, W. G.**—Comparison of curves of the declination magnetographs at Kew, Stonyhurst, Coimbra, Lisbon, Vienna, and St. Petersburg. 8 pp., 3 plates, 8°. (*Report Brit. Assoc., 1880, p. 201.*)

* **Anderson, R.**—Lightning Conductors, their history, nature, and mode of application. With numerous illustrations. xv. + 256 pp. la. 8°. London, 1879.

Bureau central météorologique de France.—Annales de publiées par E. Mascart. 1879, I. Étude des orages en France et mémoires divers. x. + 41 + 113 pp., 18 plates, la. 4°. Paris, 1880.

|| **De La Rue, W., and Müller, H. W.**—On the length of a spark from a battery of 600, 1,200, 1,800, and 2,400 red-chloride-of-silver-cells, and some phenomena attending the discharge of 5,640 cells. 4 pp. 8°. (*Proc. Roy. Soc., 1876, p. 167.*)

|| **Denza, F.**—Leggi della variazione diurna dell' elettricità atmosferica dedotte dalle osservazioni diurne fatte all' Osservatorio del R. Collegio Carlo Alberto in Moncalieri dal 1871 al 1878. Adunanza 11. Gennaio 1880. 19 pp., 1 plate, la. 8°. Torino, 1880. (*Atti. R. Accad. Sc. Torino, xv.*)

* **Dove, H. W.**—Correspondirende Beobachtungen über die regelmässigen stündlichen Veränderungen und über Perturbationen der magnetischen Abweichung im mittleren und östlichen Europa. [*Preface by A. v. Humboldt.*] 35 pp., 8 sheets of tables, 2 plates, sm. 8°. s.l.c.a.

|| **Ellis, W.**—On the relation between the diurnal range of magnetic declination and horizontal force, as observed at the Royal Observatory, Greenwich, during the years 1841 to 1877, and the period of solar spot frequency. Read May 8, 1879. 22 pp., 3 plates, sm. 4°. (*Phil. Trans. 1880, Part II., p. 501.*)

|| **Hasselt, W. van.**—Toetsing eener methode, waardoor ten allen tijde de afwijking van het kompas kan worden gevonden. 14 pp. sm. 8°. Dated at Utrecht, 1879. (*De Zee, 1879.*)

Karsten, G.—Gemeinfassliche Bemerkungen über die Elektricität des Gewitters und die Wirkung der Blitzableiter und mit Vorschlägen für die Brandversicherungs-Gesellschaften. Dritte vermehrte Auflage mit Anhängen. 64 pp., 1 tabular form, 8°. Kiel, 1880.

Registrar General of Births, Deaths, and Marriages in Ireland.—Weekly returns of births and deaths in Dublin (including its suburban districts), and in fifteen other town districts in Ireland. Vol. xviii., 1880. la. 8°. Dublin, 1881.

Registrar General, London.—Weekly Return of births and deaths in London and in twenty-two other large towns of the United Kingdom. Vol. xli., 1880. la. 8°. (London, 1880.)

Sanitary Commissioner of the Punjab.—Reports, on the Sanitary Administration of the Punjab, 1878, 1879. 2 vols., 15 plates, la. 4°. Lahore, 1879–80.

Schiaparelli, G.—Sull' umidità atmosferica nel clima di Milano. Risultati di 35 anni di osservazioni fatte nell' osservatorio di Brera (1845–1879). 35 pp., 3 plates, sm. 8°. Milano, 1880. (*Pubbl. R. Osserv. di Brera*, N. xv.)

Société de Médecine et de Climatologie de Nice.—Nice-Médical. Année iv. 1879–80. la. 8°. Nice, 1879–80.†

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Tizard, T. H.—Voyage between New South Wales and China (with letter from **G. S. Nares**). 12 pp., 8°. [*Newcastle N.S.W. Naut. Almanac*, 1881, p. 96.]

U.S. Naval Observatory.—Narrative of the second Arctic expedition made by **Charles F. Hall**, his voyage to Repulse Bay, sledge journeys to the Straits of Fury and Hecla and to King William's Land, and residence among the Eskimos during the years 1864-69. Edited by **J. E. Nourse**. I. + 644 pp., with plates, maps, and portraits, 4°. London, [1880].

|| **Wild, H.**—Bericht über den Stand der Arbeiten, welche durch die internationale Meter-Convention vom 8 (20) Mai 1875 veranlasst worden sind. 33 pp., 1a. 8°. (*Mél. phys. chim., St. Petersbourg* xi., p. 181.)

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APPENDIX XX.

LIST OF PUBLICATIONS, &c. issued by the Meteorological Office.

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- No. 1. Report for 1867. Presented to Parliament. 1*s*.
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36. Report of the Proceedings of the Meteorological Congress at Rome, 1879. 1s. 6d.
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39. Meteorological Observations at Stations of the Second Order for the year 1878. 20s.
40. Aids to the Study and Forecast of Weather, by the Rev. W. Clement Ley, M.A. 1s.
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- No. 5. On the Winds, &c. of the North Atlantic along the Tracks of Steamers from the Channel to New York. Translated from a Paper issued by the Deutsche Seewarte, Hamburg. 6*d*.
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