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THE METEOROLOGICAL COUNCIL1878.

Professor HENRY J. S. SMITH, F.R.S., Chairman.

Mr. WARREN DE LA RUE, F.R.S.

Captain FREDERIC J. O. EVANS, C.B., F.R.S., Hydrographer to
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Mr. FRANCIS GALTON, F.R.S.

Professor GEORGE GABRIEL STOKES, F.R.S.

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

R E P O R T

OF THE

METEOROLOGICAL COUNCIL

TO THE

ROYAL SOCIETY.

THE Council has remained unchanged since the date of the last Report with the single exception that, during Lieutenant-General Strachey's absence in India, his place was taken by Lieutenant-General Sir J. H. Lefroy, who was appointed to the *ad interim* vacancy by the President and Council of the Royal Society, with the approval of the Treasury. Administration.

The executive department of the Office remains in the hands of Mr. R. H. Scott, F.R.S., the Secretary to the Council, assisted by Captain H. Toynbee, F.R.A.S., as Marine Superintendent.

The Council, having been informed that an International Congress of Meteorology was to be held at Rome in April 1879, on the invitation of the Italian Government, deputed their Chairman and Secretary to represent the Office at the meeting. International Congress at Rome.

The present Report is arranged under three headings:—

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

PART I.

OCEAN METEOROLOGY.

In Appendix I. (p. 27), will be found a concise account of the methods followed by the Office in collecting and tabulating the observations relating to Marine Meteorology. Collection of information.

Appendix II. (p. 31), contains a list of all the observers whose logs have been classed as "excellent," during the past year: some of the names being those of men who have regularly co-operated with the Office for many years. The names which appear in the list for the first time in the year 1878-9, are as follows:— List of observers who have contributed "excellent" logs.

Captain's Name.	-	-	Ship.
*Aldrich, Pelham, R.N.	-	-	H.M.S. "Alert."
Coxwell, C. D.	-	-	S.S. "German."
Greive, William M.	-	-	Ship "City of Cashmere."

* Lieutenant.

Captain's Name.	Ship.
Kidder, John - - -	S.S. "Triton."
McBride, Andrew - - -	Barque "Royal Alice."
*May, William H., R.N. - - -	H.M.S. "Alert."
†Ninnis, Belgrave, M.D., R.N. - - -	H.M.S. "Discovery."
*Rawson, Wyatt, R.N. - - -	H.M.S. "Discovery."
Spratly, William - - -	Barque "Virginia."
Stephenson, Henry Frederick, R.N. - - -	H.M.S. "Discovery."
Tannock, Robert Stewart - - -	Ship "Pomona."
‡Thomson, Anthony Standidge - - -	S.S. "Elbe."

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

The following is the total number of logs received from Jan. 1, 1878, to March 31, 1879, 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.
155	95	61

The average number of logs received annually during the five years, 1873-7, was 92.4, and the per-centage of excellent logs among these was 67.

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

Districts from which observations are obtained.

On the 31st of March 1879 the ships carrying instruments supplied by the Office were pursuing the following voyages:—

To Baffin's Bay or Greenland - - -	3
„ East Coast, North America - - -	7
On East „ „ - - -	4
To West „ „ - - -	4
To West Indies - - -	3
„ East Coast, South America - - -	2
„ West „ „ - - -	2
„ West Coast of Africa - - -	1
To Australia and New Zealand - - -	27
„ India, viâ the Cape - - -	30
„ „ „ Suez - - -	1
To China Seas, viâ the Cape - - -	8
„ „ „ Suez - - -	4
To Mediterranean Ports - - -	6
„ Ports in the North Sea, &c. - - -	4
„ Cape of Good Hope - - -	6
„ „ „ viâ Suez - - -	1
„ East Indies - - -	1
Total number of ships - - -	114

This statement shows that, as in previous years, the observations which come directly to the Office relate mainly to certain definite routes, and that many parts of the sea are still almost unrepresented.

* Lieutenant.

† Surgeon.

‡ Chief officer.

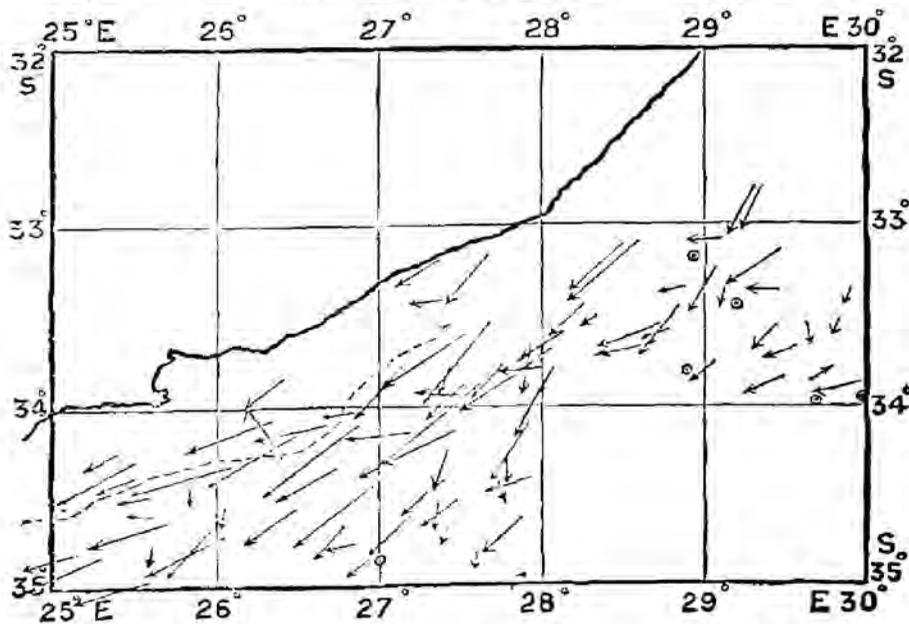
Appendix III. (p. 33), supplies a list of all the logs and other documents received at the Office during the year. Documents received.

In the Report of the Meteorological Committee for 1876 will be found a series of charts affording an analysis of the information existing in the Office for the entire ocean and for each month. The index from which these charts were compiled shows for each 10-degree square, and for each month, the number of days observations which the Office possesses, and the individual logs in which the information is contained. This index is intended for official reference, and has been carefully kept up to the present time. Index of material existing in the Office.

Cape Squares.—The extraction of the entire data for the six 10-degree squares lying near the Cape of Good Hope has been completed; but inasmuch as the materials available in the Office for charting the three squares south of the parallel of 40° S. are scanty, as compared with those existing for the three squares north of the same parallel, application was made to the Royal Meteorological Institute of the Netherlands at Utrecht to supply copies of their logs for the southern region. A large amount of additional information, comprising upwards of 40,000 observations, was thus obtained. Meteorology of the neighbourhood of the Cape of Good Hope.

The Council have given much consideration to the best methods of dealing with the data relating to the meteorology of this region, and have arrived at the following conclusions:— Information obtained from Holland.

First, with respect to Currents. It was found on trial that owing to the comparatively small number of the Current observations, and to their character, they could be collated to the best advantage by charting them in their respective geographical positions on large maps, one for each month; arrows being drawn in the directions of the currents, of a length proportional to their rates. A specimen of a portion of one of these maps is annexed. Methods of discussion.



A limited number of lithographic copies will be made from the original drawings, some for the convenience of the Office in working out results, others for presentation, as compendious Currents.

epitomes of all the information possessed by the Office relating to the currents in the Cape squares.

Winds.

Secondly, as regards the winds. It was found difficult to deal with the winds on the same principle as with the currents, owing to the greater number of the observations and the confusing variety of the recorded directions.

It therefore became necessary to retain the old method of grouping in the same table the observations made over a considerable area, and then drawing wind-roses from them. The Council have, however, introduced considerable modifications into this method. They have adopted the principle of *natural areas*, that is to say, they have treated districts characterised by the same general conditions as wholes, and have abandoned the plan hitherto pursued of dealing with areas bounded by lines of latitude and longitude, over which the same meteorological conditions might not prevail. They have also introduced an important correction into the wind data before summarising them, in order to avoid a source of error which has long been pointed out, and which they found to have considerable influence on the results in the Cape squares. This error is due to the over-estimation of the frequency of adverse winds; such winds keeping ships for a long time in nearly the same position, and being thus more frequently recorded than favourable winds. The tracks of outward- and homeward-bound ships through the Cape squares are different, and consequently if every observation were retained, the frequency of unfavourable winds would in each case be greater than it should be. Lastly, the Council have adopted a new form of wind-rose, which appears to give a more scientifically correct representation of the conditions of the wind than those in previous use. [Specimens of the wind-roses and some further details regarding the three modifications just mentioned will be found in Note A. p. 21.]

Gales of the Cape district.

The gales of the Cape district will form the subject of a special investigation in which some progress has already been made.

The remaining meteorological elements (pressure, temperature, &c.) will be discussed when the winds and currents have been dealt with.

Surface temperature and currents of the Pacific Ocean.

The Council have undertaken an investigation of the surface temperature and of the currents of the Pacific Ocean, and have commenced the inquiry by causing the data for four representative months (February, May, August, and November) to be plotted on charts. It is hoped by this means to throw some light on the physical conditions of that ocean, the meteorology of large portions of which is comparatively unknown.

Station at Norfolk Island.

The instruments sent out to Norfolk Island, as mentioned in last Report, have reached their destination in safety, and the Office may now expect to receive regular information from that important outlying station.

Report on the Meteorology of Samoa.

Among the documents which have reached the Office during the 25 years of its existence there have been several from stations in the Pacific, and wherever these on examination have appeared

to be of sufficient importance, they have been discussed, and the results have been communicated from time to time to the Meteorological Society for publication in its Journal as "Contributions to our Knowledge of the Meteorology of the Pacific." Of these contributions three have already appeared: "On the Meteorology of Vancouver Island" (Quarterly Journal, Vol. II., p. 1), "On the Meteorology of Fiji" (Quarterly Journal, Vol. III., p. 384), "On the Meteorology of Rapá or Oparu" (Quarterly Journal, Vol. III., p. 448). A fourth contribution, "On the Meteorology of Samoa," completing the list of records from land stations in the Pacific, has been prepared in the Office, and has been communicated to the Society.

Report on the Meteorology of Samoa.

The observations taken by Dr. R. J. Mann, F.R.A.S., in Natal, during the years 1860-65 have also been discussed, and the results, a portion of which were published by Admiral Fitz Roy in the Fifth number of Meteorological Papers, have appeared in the Quarterly Journal of the Meteorological Society, Vol. IV. (p. 173).

Report on the Meteorology of Natal.

In the year 1859, in accordance with a recommendation from the British Association, an anemograph was sent out to Bermuda by the Meteorological Department of the Board of Trade, and a discussion of the records furnished by it during the first years of its maintenance has been published in the Quarterly Weather Report for 1872. The instrument, after nearly 20 years' service, was returned home for repair in 1878, and has now been sent out again with the view of continuing this useful series of records.

Wind observations at Bermuda.

In connexion with the meteorology of the western portion of the Atlantic the Council have received a communication from the Colonial Office respecting a suggestion to that Department made by a resident in Jamaica, to the effect that a system of meteorological observations and storm warnings, with a central station in Jamaica, ought to be organised, by means of funds contributed *pro ratâ* by the various West Indian islands to be benefited thereby. The Council, while fully recognising the importance to the West Indies of a meteorological system, have not been able to give their support to the whole of the proposal submitted to them, but have recommended that a system of storm warnings should be tried in the British West Indian Islands before inviting contributions from foreign Governments, and that Antigua should be preferred as a central station, owing to its position to the windward of the other islands, and to its being therefore the first to feel the influence of an approaching hurricane.

Proposed Meteorological organisation for the West Indian Islands.

The Office has now completed and published the work "On the Meteorology of the North Atlantic during August 1873," to which reference has been made in previous Reports, consisting of a volume of charts with explanatory letter-press. The work contains a synoptic chart for each day of the month, showing the meteorological conditions of the North Atlantic at 0h. 43m. p.m. Greenwich time, at which hour simultaneous observations are taken over the greater portion of the Northern Hemisphere in connection with the Chief Signal Office of the United States of America.

Discussion of the weather over the North Atlantic in August 1873.

Contributions
to Arctic
Meteorology,
Part I.

During the year the first part of "Contributions to our Knowledge of Arctic Meteorology" has been published. This work has been undertaken with the view of bringing together and discussing on an uniform plan the information as to the climate of the Polar Regions, especially of the portion in the vicinity of the American continent, contained in the log books and journals of the various British Expeditions. This first instalment of the investigation refers to land stations;—York Factory, Fort Confidence, Frederikshaab, Julianeshaab, Batty Bay, and Repulse Bay. The trustworthiness of the instruments used has been carefully considered; and care has been taken to correct the winds, for variation of the compass, where necessary. It is proposed that the second and third parts shall respectively contain the results obtained from ships frozen up and from ships at sea within the region embraced by the investigation.

Meteorology of
Kerguelen
Island.

The situation of Kerguelen Island in the South Indian Ocean and in lat. 50° S. and long. 90° E. renders the study of its meteorology of some value, as its climate is probably typical of that of a large and unfrequented zone of the earth's surface. The Council therefore determined to undertake a discussion of the three series of observations taken at Kerguelen by British observers, namely:—

- 1°. May 12–July 20, 1840. H.M.S.S. "Erebus" and "Terror,"
Capts. Sir J. C. Ross and Crozier, at Christmas Harbour.
- 2°. Jan. 7–31, 1874. H.M.S. "Challenger," Capt. Sir G.
Nares.
- 3°. Nov. 6, 1874–Feb. 21, 1875. The Transit of Venus Ex-
pedition, at Observatory Bay, Royal Sound.

The discussion was entrusted to the Rev. S. J. Perry, S.J., F.R.S., who was the superintendent of the Kerguelen party in the Transit of Venus Expedition. It has now been completed by him and is ready for press.

Information
supplied to In-
dian and French
Governments.

A copy of the information existing in the Office relating to the Meteorology of the Northern Indian Ocean and Bay of Bengal, in the month of January, was supplied to the Meteorological Office, Calcutta, in the year 1876. In June 1878 the Council received a request from the India Office to supply similar information for the remaining months of the year. The cost of this work is estimated at about 1,000*l.*, and will be borne by the Indian Government.

The Office has also, at the request of M. Mascart, Director of the Bureau Central Météorologique, in Paris, supplied that Bureau with copies of certain data for the western part of the Atlantic. In this case, too, the cost of copying has been borne by the office applying for the information.

Sea tempera-
ture observa-
tions on the
coasts of the
British Isles.

The Council have for some time collected observations on sea-surface temperature from certain stations on the coasts of England and Ireland. They have recently, at the suggestion of the Hydrographer, resolved to extend the area of these operations, so as virtually to embrace the whole of the shores of the United

Kingdom, and have obtained the ready consent of the Admiral Superintendent of Naval Reserves to the employment of the coastguard on this service in districts where their co-operation was desirable. The Trinity House and the Board of Irish Lights have intimated their readiness to supply returns from an additional number of lightships. Co-operation of the Department of Naval Reserves, the Trinity House, and Board of Irish Lights.

In Appendix IV. (p. 42), will be found a list of all the instruments supplied 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 1879. This latter statement is prepared from the latest returns furnished by the storekeepers at the respective dockyards, &c. Stock of instruments.

Appendix V. (p. 43), gives similar information with regard to the Board of Trade instruments.

PART II.

WEATHER TELEGRAPHY.

The communication with all the stations has been maintained without serious interruption during the year. The cable to Shetland, however, sustained some damage at the end of March. Two important changes have been made in the arrangements for the collection of information, which have been already productive of useful results. Telegraphic communications.

The new station on the north-west coast of Ireland,—Mullaghmore on the coast of Sligo,—was organised in the autumn of 1878, and commenced reporting in October. The messages from this station have to be carried three miles to Cliffony, the nearest telegraph office, but, even with this disadvantage, the gain to the service in obtaining information from a well-exposed station on the Atlantic coasts has been so evident that the Council have felt themselves justified in discontinuing observations at Moville (Greencastle), inasmuch as that place is so sheltered by high land that it hardly feels any south-west wind. Changes in stations. Mullaghmore. Greencastle.

A change of a similar nature has been made on the south coast of England. The comparatively inland position of Plymouth has rendered the reports from that place a very imperfect representation of the weather prevailing in the Channel outside. Negotiations were therefore opened with the proprietors of the "Shipping Gazette," for the employment of their signalman at Prawle Point as Meteorological reporter, and for the transmission of the messages along their private wire to Kingsbridge. The required consent having been accorded, and the sanction of the Admiralty to the employment of the Coastguard signalman having been obtained, the station was established at the end of the year 1878, and has worked satisfactorily. The station at Plymouth ceased reporting on the 31st December 1878. Prawle Point. Plymouth.

In addition to Greencastle and Plymouth, Portishead, near the mouth of the Avon, has been superseded during the year. This Portishead.

station was originally established to afford some information for agricultural purposes, as to the weather in the lower Severn Valley, but since the commencement of the issue of the Weekly Weather Report, which includes information from the Royal Agricultural College at Cirencester, the daily reports from Portishead became less useful, and as the wind reports from that point were an unsafe guide as to the weather prevailing farther down the Bristol Channel, it was determined to discontinue the station altogether. The Council have endeavoured to find a reporter resident in a suitably exposed locality on the north coast of Devon, but hitherto without success. Most of that coast is so hilly that any wind reports from it must be seriously influenced by local eddies.

Thurso.

It is also in contemplation to abandon the station at Thurso, which is distant only 20 miles from Wick, whence reports are regularly received.

Proposed substitution of Spurn Head for Scarborough.

The Council also propose to carry out a change of stations on the east coast of England, which will, it is hoped, be as beneficial as the substitution of Prawle Point for Plymouth. Scarborough has been a reporting station for more than 20 years, but the situation of the town, on a steep bank sloping down to the sea, affects the observations taken there to a serious extent, especially those of temperature and wind. The Council therefore, finding that Spurn Head is a telegraphic signal station, have made application to the Trinity House for permission to employ the principal lightkeeper at Spurn as reporter, and arrangements are in progress for the substitution of Spurn for Scarborough. The new station will afford a much more open exposure for temperature and wind, and will at the same time divide the distance between Yarmouth and the Tyne more equally than Scarborough.

Inspections.

The stations have, with few exceptions, been inspected during the year; the English by Mr. Scott, the Scotch by Mr. Buchan, the inspector for Scotland. As regards Ireland no appointment having been made to the inspectorship before the autumn of 1878, the Council, with the sanction of the Kew Committee, instructed Mr. Whipple to combine with his regular visit to the self-recording observatories the inspection of their telegraphic and climatological stations in Ireland. The reports of the several inspectors have been presented to the Council, and instructions have been given to remedy any defects to which attention has been drawn.

Appointment of an Inspector for England.

In the original arrangements sketched out by the President and Council of the Royal Society it had been proposed that paid Inspectors should be appointed for Scotland and Ireland, while the duty of visiting the English stations was left to the Secretary to the Council, who had previously been sole Inspector for the three kingdoms.

With the sanction of the Treasury the Council have diverged in one respect from the recommendation of the Royal Society, and have appointed a paid Inspector for England instead of Ireland, delegating the duties of the Irish Inspectorship to Mr. Scott, who, from his connexion with and long residence in Ireland,

possesses the local knowledge requisite for such a post. By this arrangement Mr. Scott will not be absent from the Office on inspection duty for more than three weeks in the year, instead of four or five. For the English Inspectorship the Council have been fortunate enough to secure the services of the Rev. W. Clement Ley, well known for his valuable contributions to Meteorological science.

In consequence of the proposal to issue Forecasts, to which reference will presently be made, a re-organisation of the arrangements for reports at 2 and 6 p.m. became advisable. Hitherto reports for 2 p.m. have been received from seven stations and for 6 p.m. from eleven stations, but the stations which reported at 2 did not all report again at 6. Re-organisation of afternoon reports.

The list of stations has now been re-arranged so as to obtain information at 2 p.m. from most of the stations which send in reports at the later hour. These improvements were being gradually carried out at the end of the financial year.

A list of the telegraphic reporters will be found in Appendix VI. In addition to the changes already noticed, the place of observer at York has been taken by Dr. Purves, instead of Mr. Wakefield, the former curator of the Museum, and at Oxford Mr. Lucas has been replaced by Mr. Jenkins. List of reporters.

The arrangements with the "Times," described in former reports, have been maintained during the year, and have continued to be of great advantage to the Office.* Arrangements with the "Times."

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 VII. A list of the institutions and persons who received the Daily Weather Charts free of cost in 1878 forms Appendix VIII. Storm warnings.

In Appendix IX. 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 1879, 129 in number, situated :—

66 in England,
13 in Wales,
31 in Scotland,
13 in Ireland,
3 in the Isle of Man, and,
3 in the Channel Islands.

The usual comparison has been instituted in the Office between the warnings issued in 1878 and the weather experienced on our coasts, the warnings being tested by the method explained in Appendix VII. The results of the comparison are shown in the following tables :— Results of storm warnings.

* Since the close of the financial year these arrangements have been very materially modified, as will be explained further on.

RETURN of the Result of the Comparison between the Warnings issued and the Weather experienced in 1878.

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	51	29	12	9	—	1	—	Nov. 8.
" East	56	32	12	11	—	1	—	March 24 ^p , Nov. 8.
Scotland, East	44	25	10	7	1	1	—	Sept 22, Dec. 31.
" West	45	26	9	8	2	—	—	Nov. 12.
England, North-west	53	31	4	14	—	4	—	Nov. 6, Nov. 12.
" West	59	35	14	9	—	1	—	March 29.
" South	80	44	18	11	2	5	—	Mar. 24 ^p *, Mar. 29, May 15, Aug. 22 ^p .*
" South-east-	37	23	7	6	1	—	—	Aug. 30,
" East	60	30	15	12	1	2	—	March 5, Nov. 15.
Totals -	485	275	101	87	7	15	—	
Per-centage -	—	56·7	20·8	17·9	1·4	3·1	—	

" p " in the last column indicates that the storm was only partially felt.

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

The following table contains a comparative statement of the storm warnings and their results in 1878 and the eight preceding years. It will be seen that the percentage of warnings justified remains about the same:—

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

Issue of Weather Forecasts.

For several years Forecasts not intended for publication had been daily prepared in the Office, and the experience thus gained by the staff has emboldened the Council to announce their readiness to commence in April 1879 the issue to the public of Forecasts for the different parts of the United Kingdom.

The Forecasts are drawn thrice a day, at 11 a.m., 4 p.m., and 8 p.m., and the same division into districts is adopted as in the Weekly Weather Report, Appendix XI. The Forecasts for 11 a.m. and 4 p.m. are supplied at a low rate of subscription to the public and to the Press; those at 8 p.m., being entirely based upon information obtained at the cost of the "Times," are not supplied

to any newspapers which are not willing to share equally with that journal the cost of obtaining the information.*

In addition to the regular issue of Forecasts, the Office has announced its readiness to answer, by telegraph, inquiries as to probable weather for not more than one day in advance. The charge for each inquiry is 3s., of which 2s. are for the message and reply, and 1s. for the trouble to the postal authorities and the Meteorological Office. Replies to inquirers.

The Office has continued its co-operation with Captain Hoffmeyer in his issue of Synoptic Charts for 1875 and 1876; and with the system of synchronous observations, at Oh. 43m. p.m. Greenwich time, which was organised in 1873 by the Chief Signal Office at Washington. The list of observers who have supplied observations at this hour during 1878 will be found in Appendix X. It will be found to comprise the names of 38 observers resident in the United Kingdom, while (as in former years) most valuable information has been supplied by the Army Medical Department, and by colonial observers, at extra-European stations, which serve to extend the network of observation over the entire globe. Synchronous observations.

The publication of the Weekly Weather Report has been continued, but the arrangement of the matter contained in it has been modified. A specimen of the Report in its present form will be found in Appendix XI. Weekly Weather Report.

The Council have again to express their thanks to the Meteorological Society (of London) for supplying to the Weekly Weather Report returns from six of its stations.

A work entitled "Aids to the Study and Forecast of Weather" (prepared at the request of the Council by the Rev. W. Clement Ley, and intended to supply the place of that part of the Board of Trade Barometer Manual which relates to Land Meteorology) is now in the press, and will be published as soon as the necessary illustrations are engraved. The completion of the part of the work entrusted to the Hon. R. Abercromby has been delayed by his continued ill-health. "Aids to the Study and Forecast of Weather."

Fishery barometers have been issued on loan to four new stations. The whole number of stations on our coasts supplied with these instruments by the Office is at present 147. Of these 56 are in England, 5 in Wales, 34 in Ireland, 50 in Scotland, and 2 in the Isle of Man. Fishery barometers.

PART III.

LAND METEOROLOGY OF THE BRITISH ISLES.

The seven self-recording observatories, Aberdeen, Glasgow, Armagh, Valencia, Stonyhurst, Falmouth, and Kew, have been maintained in regular action during the year. They have all been inspected by Mr. Whipple, Superintendent of Kew Observatory, and any defects pointed out by him in the instrumental arrangements have been remedied. The observatories.

The volume of the Quarterly Weather Report for 1875 having been completed, the Council determined, in February 1879, Quarterly Weather Report.

* Since the date of this Report the "Standard" and the "Daily News" have joined in the arrangement made by the "Times" with the Office.

to begin without delay the preparation of the plates for the current year, making arrangements at the same time to take up the arrears of work for the years 1876-8. Fair progress has been made in engraving the plates for the two years 1876 and 1879, but the Council have not yet finally decided on the precise form of the text which will accompany these plates.

Hourly observations.

The hourly tabulations for 1878, obtained by measuring the photographic curves, and the calculated hourly results for Vapour Tension, have been lithographed. The calculations of Daily, Five-Day, and Monthly Means for Temperature, (Dry and Wet,) and for Pressure for 1878, are in hand.

Harmonic Analyser.

In the last Report it was stated that the Council contemplated the employment of the Harmonic Analyser, invented by Sir William Thomson, in order to facilitate the reduction and discussion of the photographic records of the seven observatories. Having been satisfied with the performance of a working model lent to them by Sir William Thomson, the Council have ordered the construction of an harmonic analyser containing seven cylinders, one for the mean and three pair for the first three pair of terms of the expansion, to be executed by a skilful engineer in a manner suitable for permanent use. [See Note B., p. 24.]

The form taken by the reductions and the mode of publication will probably be modified when the harmonic analyser comes to be regularly employed; but until the instrument is actually in use any final determination on these points would be premature.

Sunshine records.

In the last Report a brief notice was given of the method employed at Kew Observatory, as well as at Greenwich and a few other stations, in order to obtain a record of the daily duration of sunshine by the use of a spherical lens which burns a mark or hole in a slip of millboard placed at the proper focal distance. Inasmuch as a cloud is a local phenomenon, it is important that records of sunshine should be kept in many different places, and the Council have accordingly ordered 20 4-inch glass spheres to be used as sunshine recorders. [See Note C., p. 24.]

Photographic records of clouds.

It was stated in the last Report that the Council contemplated the organization of a series of photographic observations of the height of clouds and of the direction and velocity of their motion. After some preliminary experiments tending to show the feasibility of the method proposed, the Council have placed this important research in the hands of Captain W. de W. Abney, R.E., F.R.S., from whom they have received a preliminary Report. [See Note D., p. 25.]

Arrangements are in progress for the construction of the apparatus recommended by him.

Comparison of records at Kew and Greenwich.

As explained in the last Report, the Council undertook a comparison of the curves of self-recording instruments at neighbouring stations with a view of ascertaining to what extent their more minute variations might be due to local causes, and to what extent they might express meteorological conditions of a more general character.

For the purpose of obtaining some of the required data, a series of the Greenwich curves was obtained on loan from the Astronomer Royal, with permission to reduce and adapt them to the scale employed in the Quarterly Weather Report, and to publish selections from them, side by side with those of Kew, the distance between the two observatories being only 14 miles.

It results from the inquiry that such a comparison of minute differences as that originally contemplated by the Council, cannot be effectually carried out unless the methods employed at the two stations are the same and the instruments precisely similar. At the same time the comparison has afforded satisfactory evidence of the close similarity of the meteorological conditions at the two observatories, separated as they are by so short a distance.

A specimen of the plates embodying the comparison was inserted in the Report of the Council for 1877-8; the entire series is now complete, and will be published in the next number of the Quarterly Weather Report.

In addition to the information derived from the seven observatories, continuous records of the wind are received from the five following stations, which are all provided with anemographs similar to those erected at the self-recording observatories:—

Information from anemometers.

Station.	Supplied by	Superintended by
Alnwick Castle	Duke of Northumberland, K.G.	Major F. Holland,
Holyhead	Meteorological Office	The Harbour authorities.
Orkney	"	Rev. C. Clouston, LL.D.
Seaham	L. J. Crossley, Esq.	G. H. Aird.
Yarmouth	Meteorological Office	Secretary, Sailors' Home.

The Council contemplate the erection of instruments of a simpler form at certain other coast stations. Arrangements are already in an advanced stage for the erection in the Scilly Isles of a self-recording anemometer of a simple construction; and the Council hope gradually to increase the number of such self-registering instruments, in order to obtain a more complete record of the force and direction of the wind over the British Isles.

The following is a list of the stations (33 in number) from which returns for the year 1878 are being published on the international plan, as explained in the last Report, either in full or as monthly summaries of mean results:—

List of stations of "Second Order."

Names of Stations.	Observers.
ENGLAND AND WALES.	
▲* Audley End, Essex	Mr. J. Bryan.
▲* Babbacombe	E. E. Glyde, F.M.S.
▲* Buxton, Derbyshire	E. J. Sykes, F.R.A.S., F.M.S.
▲* Carmarthen	G. J. Hearder, M.D.
* Cheadle, Cheshire	J. C. Phillips, Esq.
Chigwell Row, Essex	J. Campbell, Staff Surgeon, R.N.
▲* Churchstoke, Montgomery	Philip Wright, F.C.S., F.M.S.

Names of Stations.	Observers.
ENGLAND AND WALES—continued.	
A* Dartmoor Prison, Devonshire - - - - -	R. E. Power, L.R.C.P., F.M.S.
Δ Douglas, Isle of Man - - - - -	A. W. Moore, Esq.
Δ Durham - - - - -	G. A. Goldney, Esq.
Folkestone - - - - -	A. Henry Taylor, Esq.
Δ Hastings, Sussex - - - - -	Alex. E. Murray, F.M.S.
A* Hereford - - - - -	T. Algernon Chapman, M.D.
A* Hillington, Norfolk - - - - -	Rev. H. Ffolkes, M.A., F.M.S.
Hull, Yorkshire - - - - -	Rev. W. P. Mackay, M.A., M.D.
A* Kelstern, Lincolnshire - - - - -	D. G. Briggs, F.M.S.
Leicester - - - - -	W. J. Harrison, F.G.S.
A* Llandudno - - - - -	J. Nicol, M.D., F.M.S.
A* Marlborough, Wilts - - - - -	Rev. T. A. Preston, M.A., F.M.S.
Netley - - - - -	F. de Chaumont, M.D., F.R.S.
Δ Oscott, Warwickshire - - - - -	Rev. S. J. Whitty, B.A.
Prestwich, Lancashire - - - - -	T. R. H. Clunn, M.D.
A* Ramsgate - - - - -	Rev. A. E. O'Gara, O.S.B., F.M.S.
Δ St. Aubin's, Jersey - - - - -	J. E. Vibert, M.A.
Seaham, Durham - - - - -	Mr. G. H. Aird.
Southampton (Ordnance Survey Office)	Col. A. C. Cooke, R.E., C.B.
A* Strathfield Turgiss, Hants - - - - -	Rev. C. H. Griffith, B.D., F.M.S.
Δ Uppingham, Rutlandshire - - - - -	Rev. G. H. Mullins, M.A.
A* Wakefield - - - - -	H. Clarke, L.R.C.P., F.S.S.
York - - - - -	J. Purves, M.D.
SCOTLAND.	
Δ Glenalmond, Perthshire - - - - -	Rev. W. P. Robinson, D.D.
Sandwick Manse, Orkneys - - - - -	Rev. C. Clouston, LL.D.
IRELAND.	
Δ Dublin - - - - -	J. W. Moore, M.D.
Δ Markree Castle, Sligo - - - - -	E. Salles, for Col. Cooper, F.R.A.S.
Δ Parsonstown (Birr Castle), King's Co. -	J. Dreyer, M.A., and J. Mitchell, for the Earl of Rosse, F.R.S.

Relations with
Meteorological
Society.

The stations marked A in the preceding list are those for which the observations are being published for 1878 *in extenso*. Those marked with an asterisk are stations in connexion with the Meteorological Society (of London) from which returns are received, as explained in the Report for 1874, for publication on the international form, the cost of copying being defrayed by the Meteorological Office.

It has been usual to publish these returns in the form of Appendices to the Quarterly Weather Reports, and it is proposed for the future to issue them as a separate publication.

Returns from
extra stations.

In addition to the above, returns of various degrees of completeness are received from the following observers, besides monthly copies of the observations taken at all the telegraphic stations:—

Names of Stations.	Observers.
ENGLAND.	
Alnwick Castle, Northumberland - - - - -	Major F. Holland, for the Duke of Northumberland, K.G.
Barnstaple, Devonshire - - - - -	W. Knill.
Chatham (School of Military Engineering), Kent	Lieut.-Col. C. M. Martin, R.E.

Names of Stations.	Observers.
ENGLAND—continued.	
Chiswick (Royal Horticultural Society), Middlesex	W. P. Thomson.
Cooper's Hill (Indian Civil Engineering College), Surrey	Prof. H. McLeod, F.C.S.
Farley, near Cheadle, Cheshire	C. L. Wragge, F.G.S.
Gorleston, Norfolk	R. J. C. Day, Piermaster.
Harpenden, Hertfordshire	T. Wilson, F.M.S.
Haslar, Hants	G. Coppen, Inspector of Police.
Helston, Cornwall	M. P. Moyle, F.R.C.S.
Killing holme, Lincolnshire	Rev. J. Byron, F.M.S.
Rugby, Warwickshire	Rev. T. N. Hutchinson, M.A.
Saffron Walden, Essex	J. G. Bellingham, Esq.
St. David's, Pembrokeshire	W. P. Probert, LL.D.
Sheffield, Yorkshire	W. F. Cooper, F.M.S.
Silloth, Cumberland	Rev. F. Redford, F.R.S.E.
Southport, Lancashire	J. Baxendell, F.R.A.S.
Stockbridge, Hants	C. B. Scott.
Stokesay, Salop	Rev. J. D. La Touche.
Winchester, Hants	Rev. G. Richardson, M.A.
Worksop, Notts	H. Mellish, Esq.
SCOTLAND.	
Annanhill, Ayrshire	W. H. Dunlop, F.M.S.
Laudale, Argyllshire	T. H. G. Newton, Esq.
IRELAND.	
Castletownsend, Co. Cork	T. W. Cobb, C.G. Officer.
Dunfanaghy, Co. Donegal	C. B. Wolseley, M.D.
Ennis, Co. Clare	J. Hill, C.E.
Waterford	Joseph Neale.

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.

Information supplied to the General Register Office, Ireland.

The Office has received a valuable contribution to its records of British climatology, in the shape of the complete series of observations made for 24 years at the Ordnance Survey Office, Southampton, under the direction of the late Sir H. James and his successors. The observations at that establishment are now organized in entire accordance with the system adopted in the Office.

Records from Ordnance Survey Office, Southampton.

LIBRARY.

The Office possesses a small library containing the standard works on Meteorology and the allied sciences. It consists at present of 3,000 volumes, with nearly 3,000 pamphlets, exclusive of charts and MS. records of observations. The books and other documents are accessible to scientific men, under the necessary restrictions.

Appendix XIII. contains a list of the donations made to the library during the year. In addition a few volumes have been purchased.

Donations Library.

REVENUE AND EXPENDITURE.

Receipts and
Payments for
the year.

Appendix XIV. shows the receipts and payments during the year ending 31st March 1879. The amount voted by Parliament was 14,500*l.* The actual receipts from all sources, exclusive of a balance of 509*l.* 3*s.* 0*d.* at the commencement of the year, amounted to 16,999*l.* 13*s.* 4*d.* and the payments amounted to 15,781*l.* 11*s.* 3*d.*, leaving a balance of 1,727*l.* 5*s.* 1*d.* on the 1st April 1879.

The following abstract of income and expenditure shows the true amount chargeable to the year in question, and its distribution under the various heads, together with the increase or decrease in 1878-9, as compared with the previous year :—

	1877-78.			1878-79.			Increase.			Decrease.		
	£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
INCOME - - -	12,146	1	7	14,536	0	8	2,389	19	1	—		
EXPENDITURE.												
Payment of Council - -	749	19	10	1,000	0	0	250	0	2	—		
Secretary - - -	800	0	0	800	0	0	—			—		
Special Researches - -	52	0	6	775	3	11	723	3	5	—		
Office salaries - - -	621	6	5	712	10	8	91	4	3	—		
Rent, attendance, and contingencies - - -	903	9	0	961	15	0	58	6	0	—		
Land Meteorology* - -	3,503	10	9	3,832	5	6	328	14	9	—		
Weather Telegraphy* - -	2,988	19	2	3,074	13	5	85	14	3	—		
Inspections* - - -	244	18	11	407	18	5	162	19	6	—		
Ocean Meteorology - -	2,325	13	1	2,218	7	10	—			107	5	3
Balance from 1877-8 - -	—			43	16	1	43	16	1	—		
Total - - -	£ 12,189	17	8	13,826	10	10	1,743	18	5	107	5	3

* The items charged under Inspections were formerly those for Scotland and Ireland only, and these and other similar expenses were included under the heads "Land Meteorology" and "Weather Telegraphy." As it has been since decided that *all such items* should henceforward be charged under Inspections and be shown as a distinct head of expenditure, the separation has here been made, for the sake of better comparison in this and future years.

Analysis of
income and ex-
penditure.

In this abstract, the figures shown under income and expenditure are the net amounts for the year; all items of expense for which the Office would be reimbursed being first deducted. These figures show that although the increase to the Vote was 2,500*l.*, the real increase of income as compared with the previous year was somewhat less than that amount, owing to there being a larger available balance at the commencement of 1877-8, and also to some receipts, *e.g.*, for work done for Colonies, &c. having been greater in that year. The expenditure under the head "Payment to Council," is for the whole year, as compared with nine months in the previous year. The amount charged to "Special Researches" falls somewhat short of the sum (1,000*l.*) allocated to that branch, on account of its not having yet reached its complete development. The increase under "Office Salaries" is chiefly owing to the increased hours of attendance. The

large increase under "Land Meteorology" is partly due to the purchase of a new Galton pantagraph, to increments of salaries to clerks, to additional assistance, and to increased activity generally. The addition under the head "Weather Telegraphy" is due partly to the fact that in the year 1877-8, the Sunday Reports were suspended for nearly seven months, and partly to some extra reports obtained in the last year. The payments under "Inspections" have not yet reached their maximum amount, the English Inspector (as already stated) having been only recently appointed. The decrease under the head Ocean Meteorology is more apparent than real, in fact there has been a considerably increased activity under this head, the net decrease shown being on account of data supplied in that year to the Government of India, for publication by the Meteorological Office of Calcutta, the sum repayable amounting altogether to about 340*l*.

HENRY J. S. SMITH,
Chairman of the Council.

NOTE A, p. 8.

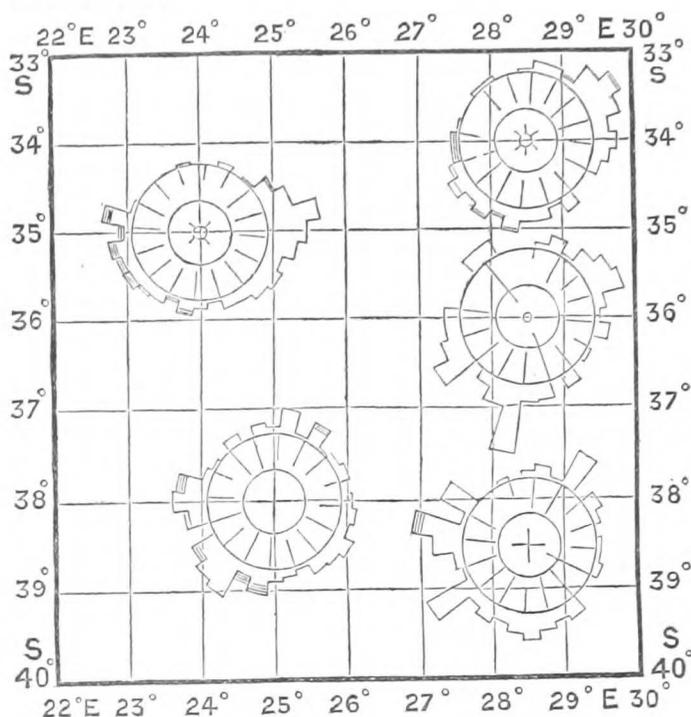
The wind data are revised by admitting them at the rate of only one observation per day in each one-degree square. The observations are made at four-hourly intervals so that there are six observations to a day; it is, however, only with unfavourable or adverse sailing winds that a ship would record more than two or three observations in a single-degree square. To avoid decimals in the first working, the weight 10 is assigned to all the observations taken on one day by each ship in each single-degree square. When these observations (be they one or more than one) are all of the same wind, say of a north wind, 10 is tabulated under N.; when there are two observations of different winds, say north and east, 5 is entered under N. and 5 under E.; if there are three or more observations, 10 is divided among them, preserving the true ratio as nearly as possible, without using a decimal. After all the figures referring, say, to the N. wind, have been added together, a decimal point is placed before the last figure. This process of revision or "weighting" introduces very little additional labour beyond that of writing the figures and adding another row of them, while its importance in the Cape squares is great.

The wind-rose adopted by the Council was devised by one of its members, Mr. Francis Galton, and indicates the frequency of winds blowing between any specified points of the compass by the *area* of the portion of the wind-rose comprised between the corresponding limits.

Mr. Galton has further devised two machines for drawing these "area wind-roses" on paper, or on copper covered with an etching ground, directly from the numerical data, and without first reducing them to per-centages. The simpler of these machines is only capable of drawing the wind-roses on separate pieces of paper, or scratching them on separate templets; the

Specimen of
area wind-
roses.

other, which is in use in the Office, is more complicated, but it etches the wind-roses in their proper positions on the sheet of copper, whence, after biting in, an impression can at once be taken. Specimens of the area wind-roses are annexed: the charts of which they form part will contain an epitome of all our knowledge of the winds in the Cape squares. The Charts are drawn on the same scale as the Current Charts, and will be used for the same purposes as the latter.



The area of the outermost circle is, in each figure, 200 units. The wind-rose proper is the part of the figure (consisting of truncated sectors) outside this circle. The area of the wind-rose, together with the very small circle of calms which appears at the centre of most of the figures, is always 200 units. The area of the truncated sector between any two radial boundaries denotes the percentage of winds of which the direction lies within these boundaries. The area of the very small central circle indicates the per-centage of calms, and the shaded ends of the sectors show the per-centages of gales. The lines radiating inwards from the circumference of the outermost circle are proportional to the mean forces of the winds, exclusive of the gales. When the force amounts to 5, the line extends to the circumference of the inner circle. Lastly, the wind-roses are divided into three classes; those which are compiled from 100 observations and upwards have an eight-armed star in the centre, those from 50 to 99 have a cross, and those in which the observations are fewer than 50, have no mark at all. The object of these distinctions is to indicate the weight to be attached to the several wind-roses when making deductions from them.

Selection of
natural areas.

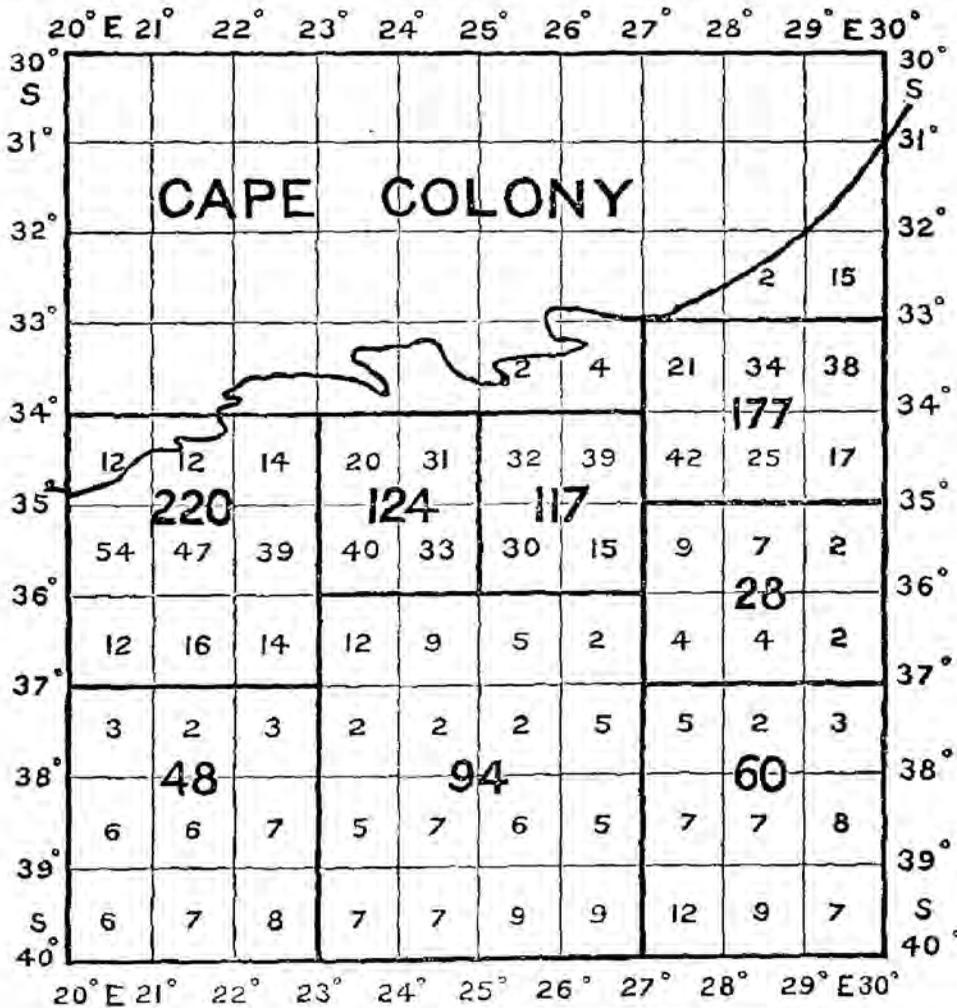
It remains to show how far the principle of natural areas is attended to in selecting the position of the wind-roses and how far it will be regarded in subsequent discussions. The numerical

data whence the wind-roses are drawn appear in lines like the following, which give the total of the corrected entries extracted from each page of the Data Book; each set of three lines refers to a separate single-degree square:—

Single-Degree Square.	N.	1	2	3	4	5	6	7	E.	7	6	5	...	Vble.	Calms.	Weighted Obs	
53 {	Frequency of all winds	0'3		1'0			1'0	2'3	4'3	5'0	4'2	1'5	4'2	0'4		40'0
	Frequency of gales only			1'0			1'0									
	Number of obs. of forces under 8, and their sum†	1)3					3)14	7)36	7)36	6)23	2)9	5)16	1)2			

The total number of weighted observations for each month in each single-degree square is charted on a map in the following manner, to show at a glance their frequency in different parts of the area under discussion.

NUMBER of WEIGHTED OBSERVATIONS of WINDS in different parts of one of the Cape Ten-degree Squares during the month of January.



* For want of space the remaining points of the compass have been omitted in this specimen.

† This line contains the number of observations of force and the sum of those forces; the mean for the one-degree square can of course be obtained by division, but as it is usual to combine the observations of several one-degree squares, this is the most convenient method for recording them.

With the assistance of these maps the numerical data are combined into groups, sufficient in number in each case to form a trustworthy wind-rose, but the figures, before adding them, are examined to judge whether they harmonise sufficiently to justify the belief that they may be accepted as belonging to the same natural area. If they do so harmonise, they are combined; otherwise a different distribution is tried. The knowledge which is already possessed of the meteorology of the district is of material assistance in making these natural divisions.

It is expected that the general appearance of the chart after the small wind-roses have been drawn on it, will afford a final and conclusive check against the error of combining dissimilar types of weather in the same statistical series.

NOTE B, p. 16.

It had been suggested by Professor Everett that three cylinders would suffice, if a provision were introduced for altering the velocity-ratio of the record-cylinder to the remaining disks and cylinders, and that thus a good deal of expense might be saved in the construction. This no doubt is true, but it would involve going over the records afresh for each new order introduced; so that in an instrument intended for constant use the saving in prime outlay would before long be more than counterbalanced by the increased expense of working. Accordingly it was thought best to construct an instrument containing as many cylinders as were ever likely to be generally employed. It seems almost certain that the first three orders will suffice; but the Council have so far adopted Professor Everett's suggestion as to provide means for doubling the velocities of the analysing cylinders of the orders 2 and 3 in relation to the record-cylinder. By going over the records a second time with the doubled velocities, the terms of the orders 4 and 6 would be found, and, in addition, a verification would be obtained of the mean and of the two terms of the first order.

The doubling wheels might occasionally be resorted to, were it only for the sake of affording proof, independent of existing analysed results, that the first three orders suffice.

NOTE C, p. 16.

Some difficulty has been experienced in finding a suitable and not too costly frame to carry the millboard slips. A slip cut from a flat sheet cannot be applied to the surface of a sphere, except approximately, and under the condition that the slip shall be narrow. When a narrow slip is used, it might easily be so placed by an unskilful observer that the sun's image should run off it in the course of a day, and thus the record be lost. As the spheres which will be furnished by the Council may in some cases be placed in the hands of observers from whom no observation

requiring much mechanical skill can be expected, the following plan is under trial.

The portion of a spherical surface swept by the image of the sun during several days in succession may be replaced without sensible error by the corresponding portion of a developable surface touching the sphere. The developable surface which touches a sphere along a small circle is of course a circular cone, which becomes a circular cylinder when the small circle becomes a great one, or when the sun is in the equator. Accordingly it is proposed to replace the zone of a spherical surface which is swept by the sun in the course of a year by a zone of a cylinder from declination 8° S. to 8° N., and by a zone of a conical surface from 8° N. to 24° N., and by an equal zone inverted from 8° S. to 24° S. Thus two sets of slips cut from a circular sheet, one straight, and the other set bounded by concentric circular arcs, may be made to serve for registration for the whole year.

The bowl for the slips may be a mere skeleton, presenting four fiducial edges forming the interior edges of four arcs of annuli in planes parallel to the plane of the equator, the centres of the annuli being in a line passing through the centre of the sphere and parallel to the axis of the earth. These annuli it is intended to mount on pillars parallel to the earth's axis. The equatorial slips, which would be used for about a fortnight on each side of each equinox, would rest on the pair of fiducial edges nearest to the equator. The other slips would rest each on one of these edges and on the other fiducial edge at the same side of the equator.

NOTE D, p. 16.

EXTRACT FROM A LETTER FROM CAPTAIN ABNEY.

“Ascertaining the Height of Clouds.”

*“1st. The apparatus to be employed.—*From experiments I have made expressly, and which confirm my past experience in the matter, I am of opinion that, in the majority of cases, clouds which lie somewhat in the direction of the sun, will be more easily photographed and identified than those which are further removed from it. Such being the case, the apparatus required would consist of cameras mounted on an altazimuth mounting, with divided circles to read to (say) $5'$ of arc, together with a means of adjusting the cameras, so that they shall occupy a fixed position in regard to one another. The lenses to be employed should be ordinary photographic doublets known as the ‘rectilinear,’ but whether of the ‘rapid’ or wide angle form has yet to be determined. There is no distortion in either form.

*“2nd. As to the process to be employed.—*I am of opinion that a dry-plate process possesses many advantages over the wet-plate process for this work, and the most simple of them is that known as the ‘collodio-bromide emulsion process.’ This process I therefore recommend for adoption, having found it thoroughly capable of doing this particular class of photography.

“3rd. *The mode of exposure.*—I believe that no mode of exposure will be satisfactory unless it be one by which the lenses can be uncovered simultaneously and for equal times when cameras are placed in position at the ends of a base line. The exposure will ordinarily be the fraction of a second, and it will be evident that no exposure that can be given by hand will be sufficiently exact. I therefore submit that an electric arrangement be worked out for this purpose. It must be one in which the exposure given can be varied as necessity arises. It must be one which can be worked automatically from one station, and it also must be one which is not dependent on the action of gravity for moving the shutter, since in some cases the lenses may point to the zenith. There are certain practical difficulties in designing such an apparatus so as to give it a light and simple form, but I am in hopes that they may be overcome.

“4th. *Measurements of the photographs.*—The measurements of clouds should be made from the negative pictures, since certain faint forms of clouds would be hard to distinguish from the sky in positive pictures.

“5th. *Length of base line.*—The distance apart of the cameras must depend on the probable height of the clouds to be photographed, and on this point I can say nothing.

“*Registration of the Velocity and Direction of Motion of Clouds.*

“As to the registration of the velocity and direction of motion of a cloud I cannot offer a definite opinion; but as far as my experiments have gone, I believe that it will be necessary to take a second negative from the station after the negatives for ascertaining its height have been exposed. This second plate should be exposed twice, a recorded time elapsing between the two exposures. This would enable the velocity of the cloud to be calculated, and would at the same time show the direction of motion.”

APPENDIX I.

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 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 observations are entered in a regular Form of Log, which is supplied together with the instruments, while for the first record of the observations a rough book is supplied, which is retained by the captain.

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. 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	-	-	-	Sailor's Home.
Southampton	-	Messrs. King, Seymour, & Co.	-	-	-	South-western Terminus.

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 or 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.

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 "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 so as to decide 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 precautionary 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 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 receives all observations taken between 8° and $9^{\circ} N.$ or $S.$ lat. and between 0° and $1^{\circ} E.$ 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. $0^{\circ} N.$ and longitude $0^{\circ} W.$, 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.

All pages having a number *commencing* with the same digit have the same unit figure for their degree of *latitude*, whilst all *ending* with the same digit have the same unit figure for their degree of *longitude*.

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

All pages having a number *commencing* with the same digit have the same unit figure for their degree of *latitude*, whilst all *ending* with the same digit have the same unit figure for their degree of longitude.

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

APPENDIX II.

LIST of CAPTAINS (and Officers) who have sent in Logs marked "Excellent" during the year ending March 31, 1879. The figures opposite to each show the total number of such Logs that they have returned to the Office during the period that they have been observing.

Captain's Name.	Number of "Excellent" Logs.	Ship.
Aldrich, Lieut. Pelham, R.N.	1	H.M.S. "Alert."
Almond, Thomas Michael, F.R.A.S.	6	"Decapolis."
Barlow, Arthur Edward -	2	S.S. "Nizam."
Barron, William -	5	S.S. "Sultan."
Becket, Alexander -	4	"City of Perth" and "Amana."
Bennett, Edwin Charles -	5	"Thessalus."
Blackie, Alexander Hamilton, R.N.R.	3	"Melpomene."
Brown, Alfred John -	4	"Maroon."
Bruce, John -	5	"City of Adelaide" and "South Australian."
Buchan, James -	4	"Commewyne."
Caborne, Warren Frederick, F.M.S.	2	"Waitara."
Campbell, Hugh -	4	"Burdwan" and "Rajmahal."
Carpenter, Lieut. Alfred, R.N. -	4	"H.M.S. "Nassau."
Coxwell, Charles Duncan -	1	S.S. "German."
Dobson, Charles Meadows -	6	S.S. "Beta."
Ellery, William -	8	"Bowfell," "Baroda," and "Majestic."
Frederick, Lieut. George C., R.N.	5	H.M.S. "Fawn."
Freeman, Thomas William -	7	S.S. "Wisconsin" and S.S. "Nes- tor."
Gray, David -	6	S.S. "Eclipse."
Gray, John -	5	S.S. "Mazinthien" and S.S. "Hope."
Gray, John McDonald -	9	"Speranza," "Melpomene," and "Shun Lee."
Greive, William Miller -	2	"City of Cashmere."
Heggun, Edward Carl V. -	11	"Czar" and "Rozelle."
Jackson, John Nugent -	3	"Knowsley Hall."
Jones, George Henry -	12	S.S. "Nile," S.S. "Quang-se," S.S. "Niger," S.S. "Dwina," and S.S. "Craigforth."
Kerr, Alexander -	5	"Ardgowan."
Kidder, John -	1	S.S. "Triton."
Longley, Herbert -	6	S.S. "Yorkshire."
Luxmoore, Percy P., R.N., C.B.	1	H.M.S. "Malabar."
McBride, Andrew -	1	"Royal Alice."
Marshall, David -	3	"Ardgowan" and "Lady Octavia."
May, Lieut. William H., R.N. -	1	H.M.S. "Alert."

Captain's Name.	Number of "Excellent" Logs.	Ship.
Napier, Richard Henry, R.N. -	8	H.M.S. "Nassau."
Nares, Sir George Strong, R.N., F.R.S.	3	H.M.S. "Challenger" and H.M.S. "Alert."
Ninnis, Dr. Belgrave, R.N. -	1	H.M.S. "Discovery."
Parry, Moses - - -	2	"Queen of Cambria."
Pearson, Charles William -	13	S.S. "Strathclyde" and S.S. "Strath- leven."
Peebles, Robert - - -	3	"Margaret Galbraith" and "Otago."
Pollard, Lieut. G. N. A., R.N.	7	H.M.S. "Nassau" and H.M.S. "Ma- labar."
<i>Potts, Thomas Crosby</i> -	10	"Tenasserim" and "Majestic."
<i>Prehn, Conrad</i> - - -	1	"Ambassador."
Prehn, Carl Christian - -	4	"Eleanor" and "Mikado."
Raeburn, John, R.N.R. -	2	"Airlie."
Rawson, Lieut. Wyatt, R.N. -	1	H.M.S. "Discovery."
Raymond, Charles Tenzer -	8	"British India," "British Consul," "Cicero," and "Theophane."
Renaut, Charles Henry -	8	"Celaeno," "Glenlora," "Pleione," and "Crusader."
Scott, William - - -	3	"Alliance."
Simpson, Alexander - - -	9	"Traveller."
Smith, William Charles -	5	"Kingdom of Saxony" and "King- dom of Sweden."
Smith, William Henry, R.N.R.	12	S.S. "Hibernian," S.S. "Peruvian," S.S. "Scandinavian," and S.S. "Circassian."
Spratley, W. - - - -	1	"Virginia."
Stephenson, Henry Frederick, R.N.	1	H.M.S. "Discovery."
Stuart, George Rennie - -	7	"Otago," "Oamaru," and S.S. "Ne- mesis."
Symington, William - - -	14	"Northfleet," "Flying Venus," S.S. "Hong Kong," and S.S. "Han- kow."
Tannock, Robert Stewart -	1	"Pomona."
*Thomson, Anthony Standidge -	2	S.S. "Elbe" and S.S. "Don."
Turner, Edward Wrake - -	4	"Mertola."
Waring, William - - - -	3	S.S. "Atalanta" and S.S. "Gordon Castle."
Watson, William, F.M.S. -	20	S.S. "Palmyra," S.S. "Parthia," and S.S. "Algeria."
Wharton, William J. L., R.N.	5	H.M.S. "Fawn."
Wight, Henry Potts - - -	7	"Gosforth," "Dunalistair," and "Taranaki."

* Second Officer.

Names of Officers deceased, *in italics*.

List of Documents—continued.

Place.	Observer.	No. of Documents.	Nature of Observations.
Cay Sul (Bahamas) - - -	J. C. Mitchell, Lightkeeper -	2	"Lighthouse" Register, July 1877 to June 1878.
Gibraltar - - -	Sergeants C. Aitken and W. Allen, A.H.C.	12	Two observations daily and monthly means, March 1878 to February 1879.
Heligoland - - -	Lightkeepers - - -	12	Eight observations daily, March 1878 to February 1879.
Manitoba - - -	R. Bourne, M.A., and R. E. Machray.	3	Two observations daily, February to June 1878.
Northern and Southern Hemispheres.	Capt. T. Oliphant Watson -	1	Diagrams illustrating gales.
Ramah (Labrador) - - -	Rev. Samuel Weiz - - -	1	Two observations daily, January to July 1878.
Sombrero - - -	J. A. Richardson, Lightkeeper	2	"Lighthouse" Register, December 1877 to November 1878.
Yenisei River - - -	Capt. Joseph Wiggins - - -	1	Three observations daily of temperature, wind and weather, from June 10 to October 2, 1877.
		61	

List of Documents received from SHIPS.

Captain's Name.	Ship.	Tons.	Owners.	Voyage.	Months of Register.
Almond, T. M., F.R.A.S.	Decapolis	632	T. B. Walker, London	Brisbane	7
¹ Balderston, R. J.	Tenasserim	1,419	T. & R. Brocklebank, Liverpool	Calcutta	7
² Barlow, A. E.	S.S. Nizam	2,725	The P. & O. Steam Navigation Co., London.	From Bombay to Southampton and back, thence to and from China and home, via Suez.	4
³ " "	"	"	" "	One voyage from Gibraltar. One to Bombay, Singapore, China and back, via Suez.	4
Barron, William	S.S. Sultan	1,025	W. Liddell, Hull	Between Hull and Hamburg	4
" "	"	"	" "	" " " "	4
" "	"	"	" "	" " " "	4
Becket, Alexander	Amara	1,299	J. Smith, Glasgow	To Sydney, San Francisco, and home	9
Bennett, E. C.	Thessalus	1,782	J. H. Carmichael, Greenock	To Melbourne, Calcutta, and home	8
Birnie, John	I'olar Star	216	W. Mitchell, Peterhead	Cumberland Gulf	11
Blackie, A. H., R.N.R.	Melpomene	1,439	H. Fernie, Jun., Liverpool	To Melbourne, Newcastle (N.S.W.), San Francisco, Astoria (U.S.), and home.	11
Blake, E. J.	Tilkhurst	1,527	W. R. Price, London	To Rio Janeiro, Calcutta, and home from Bimlipatam.	9
Brown, A. J.	Maroon	362	Anderson, Anderson, & Co., London	Jamaica	3
" James	Perseverance	164	R. J. Kydd, Peterhead	To and at Cumberland Gulf	9
Bruce, John	South Australian	1,040	J. L. Devitt, London	To Adelaide and home via Cape of Good Hope.	6
Buchan, James	Commevyne	315	J. Grierson, Glasgow	Surinam	3
" "	"	"	" "	"	3
Caborne, W.F., F.M.S.	Waitara	833	The New Zealand Shipping Co., Christchurch, N.Z.	To Nelson (N.Z.)	3

LIST OF DOCUMENTS, &c.—continued.

Captain's Name.	Ship.	Tons.	Owners.	Voyage.	Months of Register.
⁴ Campbell, Hugh	Rajmahal	1,302	J. Brocklebank, Liverpool	Calcutta	7
Chatfield, A. J., R.N.	Amethyst	1,934	H.M.S. -	To South-east coasts of America	1
Chitham, Robert	S.S. Torrington	1,946	The Commercial S.S. Co. Lim, London.	To Padang, Batavia, Marseilles, and Rotterdam, via Suez.	3
Clayton, F. S., R.N.	Rifleman	592	H.M.S. -	In Persian Gulf, Arabian Sea, and Bay of Bengal. One voyage from Port Blair to Mauritius, Seychelles, and Zanzibar.	6
⁵ Colomb, P. H., R.N.	Andalouis	6,034	H.M.S. -	To China, via Suez, and in China Sea	7
Cook, J. E. H.	Champion	1,441	H. Fernie, Liverpool	To Calcutta and New York	7
⁶ Coxwell, C. D.	S.S. German	3,028	The Union S.S. Co. Lim., London	Cape Town	2
⁷ " "	" "	" "	" "	"	3
⁸ " "	" "	" "	" "	"	2
Crowell, S. O.	S.S. Alpha	653	W. Cunard, Halifax, N.S.	Two voyages between Halifax, Bermuda, and St. Thomas.	1
" "	" "	" "	" "	Four " " "	3
⁹ Dobson, C. M.	S.S. Beta	1,293	H. F. Smith, Hull	Odessa, two voyages	2
Draper, H. E.	S.S. Danube	2,039	The Union S.S. Co., Lim., Southampton.	Natal	3
" "	" "	" "	" "	" one voyage, and one voyage between Natal and Zanzibar.	6
Dyke, H. W.	Cambrian	1,125	J. Pritchard, St. John's, N.B.	To Rio Janeiro, Callao, Pabellon de Pica, thence to Lat. 48° S. Long. 87° W.	7
Ellery, William	Baroda	1,364	R. Brocklebank, Liverpool	Calcutta	7
Emmett, Henry	Sophia Jonkim	1,007	P. Bennett, London	Singapore and Calcutta	9
Fox, Frederick	Oithona	1,342	J. H. Worthington, Liverpool	From St. Helena	2

LIST of DOCUMENTS, &c.—continued.

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⁴ Campbell, Hugh	Rajmahal	1,302	J. Brocklebank, Liverpool	Calcutta	7
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Chitham, Robert	S.S. Torrington	1,946	The Commercial S.S. Co. Lim, London.	To Padang, Batavia, Marseilles, and Rotterdam, via Suez.	3
Clayton, F. S., R.N.	Rifleman	592	H.M.S.	In Persian Gulf, Arabian Sea, and Bay of Bengal. One voyage from Port Blair to Mauritius, Seychelles, and Zanzibar.	6
⁵ Colomb, P. H., R.N.	Audacious	6,034	H.M.S.	To China, via Suez, and in China Sea	7
Cook, J. E. H.	Champion	1,441	H. Fernie, Liverpool	To Calcutta and New York	7
⁶ Coxwell, C. D.	S.S. German	3,028	The Union S.S. Co. Lim., London	Cape Town	2
⁷ " "	" "	" "	" "	" "	3
⁸ " "	" "	" "	" "	" "	2
Crowell, S. O.	S.S. Alpha	653	W. Cunard, Halifax, N.S.	Two voyages between Halifax, Bermuda, and St. Thomas.	1
" "	" "	" "	" "	Four "	8
" "	" "	" "	" "	" "	"
⁹ Dobson, C. M.	S.S. Beta	1,993	H. F. Smith, Hull	Odessa, two voyages	2
Draper, H. E.	S.S. Danube	2,039	The Union S.S. Co., Lim., Southampton.	Natal	3
" "	" "	" "	" "	" one voyage, and one voyage between Natal and Zanzibar.	6
Dyke, H. W.	Cambrian	1,125	J. Pritchard, St. John's, N.B.	To Rio Janeiro, Callao, Pabelon de Pica, thence to Lat. 48° S. Long. 87° W.	7
Ellery, William	Baroda	1,364	R. Brocklebank, Liverpool	Calcutta	7
Emmett, Henry	Sophia Joakim	1,007	P. Bennett, London.	Singapore and Calcutta	9
Fox, Frederick	Oithona	1,342	J. H. Worthington, Liverpool	From St. Helena	2

LIST of DOCUMENTS, &c.—continued.

Captain's Name.	Ship.	Tons.	Owners.	Voyage.	Months of Register.
Franklin, E. B. H., R.N.	Conway	—	School Frigate	Off Liverpool	4
Freeman, T. W.	Nestor	1,869	The Ocean S.S. Co., Liverpool	To Colombo, Penang, China, and Tarifa, via Suez.	5
"	"	"	"	China, via Suez	4
Gaye, Gerard	Enone	1,437	W. Battersby, Liverpool	Bombay	8
Gray, David	S.S. Eclipse	435	D. Gray, Peterhead	Greenland	5
Gray, John	S.S. Hope	452	R. Kidd, Peterhead	"	5
Gray, J. McD.	Shun Lee	669	J. Graham, Whitehaven	To Algoa Bay, Bassein, and home	9
Greenwood, William	Gareloch	1,177	P. Wintoul, Glasgow	From Lat. 7° N. Long. 24° W. to Bombay, and from Calcutta to New York.	8
Greig, J. G.	British Enterprise	1,640	The British Shipowners Co., Lim., Liverpool.	To Port Adelaide, Calcutta, Cape Town, and home.	13
Greive, W. M.	City of Cashmere	980	G. Smith, Glasgow	San Francisco	9
"	"	"	"	Calcutta	7
Harkness, J. N.	Shieve Bloom	816	R. G. Moran, Liverpool	To Aden, Mouhmein, and home	13
Heggum, E. C. W.	Rozelle	1,286	R. Cuthbert, Greenock	Calcutta	8
Inglefield, Edward, R.N.	S.S. Isabel	—	"	Smith's Sound	4
Jackson, J. N.	Knowsley Hall	1,774	The Sun Shipping Co., Lim., Liverpool.	Calcutta	8
Jones, G. H.	S.S. Dwina	978	C. M. Norwood, Hull	Baltic Ports, five voyages	4
"	"	"	"	Cronstadt, two voyages; one to Cronstadt, Rotterdam, Dantzic, and home.	4
Kerr, Alexander	Ardgowan	1,283	G. Adam, Greenock	To Bombay, Bassein, and home	10
Kidder, John	S.S. Triton	1,411	R. C. Denton, Norton, Stockton-on-Tees.	To Ports in the Mediterranean and Black Sea, two voyages.	3

LIST of DOCUMENTS, &c.—continued.

Captain's Name.	Ship.	Tons.	Owners.	Voyage.	Months of Register.
¹⁰ Franklin, E. B. H., R.N.	Conway	—	School Frigate	Off Liverpool	4
Freeman, T. W.	Nestor	1,869	The Ocean S.S. Co., Liverpool	To Colombo, Penang, China, and Tarifa, via Suez.	5
"	"	"	"	China, via Suez	4
Gaye, Gerrard	Enone	1,437	W. Battersby, Liverpool	Bombay	8
Gray, David	S.S. Eclipse	435	D. Gray, Peterhead	Greenland	5
Gray, John	S.S. Hope	452	R. Kidd, Peterhead	"	5
Gray, J. McD.	Shun Lee	669	J. Graham, Whitehaven	To Algoa Bay, Bassein, and home	9
Greenwood, William	Gareloch	1,177	P. Rintoul, Glasgow	From Lat. 7° N. Long. 24° W. to Bombay, and from Calcutta to New York.	8
Greig, J. G.	British Enterprise	1,640	The British Shipowners Co., Lim., Liverpool.	To Port Adelaide, Calcutta, Cape Town, and home.	13
Greive, W. M.	City of Cashmere	980	G. Smith, Glasgow	San Francisco	9
"	"	"	"	Calcutta	7
Harkness, J. N.	Slieve Bloom	816	R. G. Moran, Liverpool	To Aden, Moulmein, and home	13
Heggum, E. C. W.	Rozelle	1,286	R. Cuthbert, Greenock	Calcutta	8
Inglefield, Edward, R.N.	S.S. Isabel	—	-	Smith's Sound	4
Jackson, J. N.	Knowsley Hall	1,774	The Sun Shipping Co., Lim., Liverpool.	Calcutta	8
Jones, G. H.	S.S. Dwina	978	C. M. Norwood, Hull	Baltic Ports, five voyages	4
"	"	"	"	Cronstadt, two voyages; one to Cronstadt, Rotterdam, Dantzic, and home.	4
Kerr, Alexander	Ardgowan	1,283	G. Adam, Greenock	To Bombay, Bassein, and home	10
Kidder, John	S.S. Triton	1,411	R. C. Denton, Norton, Stockton-on-Tees.	To Ports in the Mediterranean and Black Sea, two voyages.	3

LIST OF DOCUMENTS, &c.—continued.

Captain's Name.	Ship.	Tons.	Owners.	Voyage.	Months of Register.
Longley, Herbert	S.S. Yorkshire	2,273	W. H. Tindall, London	Philadelphia	2
¹¹ Luxmoere, P. P., C.B., R.N.	Malabar	6,211	H.M.S.	Bombay, via Suez	3
¹² Macaulay, R. H.	S.S. Elbe	3,063	Royal Mail Steam Packet Co., London.	To Brazil and Lisbon	3
MacDougall, W. B.	Clairmont	755	E. L. Alexander, Glasgow	Rio Janeiro and Iquique	5
Marshall, David	Lady Octavia	1,172	G. Adam, Greenock	Calcutta	9
McBride, Andrew	Royal Alice	1,199	H. Fernie, Liverpool	"	8
McFee, J. R.	Childers	896	P. G. Carvill, Liverpool	Rangoon	8
"	"	"	"	From the Equator to Calcutta	3
McKenzie, Allan	Candabar	1,418	R. Brocklebank, Liverpool	Calcutta	7
McMoutrey, W. R.	S.S. Hampton	1,850	Commercial S.S. Co., London	From Suez to Sumatra, thence to Rotterdam, via Suez.	3
McRae, Thomas	Comischiff	346	J. H. Watson, Sunderland	To Penang, Colombo, and New York	8
Metcalfe, John	S.S. Oceanic	3,707	The Oceanic Steam Navigation Co., Lim., Liverpool	Two voyages from San Francisco to Hong Kong and back, via Yokohama, and one from San Francisco to Yokohama.	4
Mornish, Samuel	Pendragon	1,278	J. E. Greenshields, Liverpool	Chittagong	8
Murdoch, Peter	Sierra Madrona	1,430	A. M. Anderson, Liverpool	To Calcutta, Chittagong, and home	8
"	S.S. Windward	"	W. Baxter, Peterhead	To Bombay, Rangoon, and home	7
Murray, Alexander	"	321	"	Cumberland Gulf	15
¹³ Napier, R. H., R.N.	Magpie	774	H.M.S.	In Hong Kong Harbour	11 days.
¹⁴ "	Nassau	877	"	In China Sea	6
¹⁵ "	Alert	"	"	"	4
¹⁶ Narves, Sir G.S., K.C.B.	"	1,331	"	Smith Sound	7
¹⁷ "	"	"	"	In Winter Quarters	10
"	"	"	"	"	10

LIST of DOCUMENTS, &c.—continued.

Captain's Name.	Ship.	Tons.	Owners.	Voyage.	Months of Register.
Langley, Herbert	S.S. Yorkshire	2,273	W. H. Tindall, London	Philadelphia	2
¹¹ Laxmoore, P. P., C. B., R. S.	Malabar	6,211	H.M.S.	Bombay, via Suez	3
¹² Macanlay, H. H.	S.S. Elbe	3,063	Royal Mail Steam Packet Co., London.	To Brazil and Lisbon	3
MacDougall, W. B.	Clairmont	755	E. L. Alexander, Glasgow	Rio Janeiro and Iquique	5
Marshall, David	Lady Octavia	1,172	G. Adam, Greenock	Calcutta	9
McBride, Andrew	Royal Alice	1,199	H. Fernie, Liverpool	"	8
Mollee, J. R.	Childers	896	P. G. Carvill, Liverpool	Rangoon	8
"	"	"	"	From the Equator to Calcutta	3
McKenzie, Allan	Candahar	1,418	R. Brocklebank, Liverpool	Calcutta	7
McMontrey, W. R.	S.S. Hampton	1,850	Commercial S.S. Co., London	From Suez to Sumatra, thence to Rotterdam, via Suez.	3
Mellae, Thomas'	Coniscliffe	346	J. H. Watson, Sunderland	To Penang, Colombo, and New York	8
Metallic, John	S.S. Oceanic	3,707	The Oceanic Steam Navigation Co., Lim., Liverpool	Two voyages from San Francisco to Hong Kong and back, via Yokohama, and one from San Francisco to Yokohama.	4
Morrish, Samuel	Pendragon	1,278	J. E. Greenshields, Liverpool	Chittagong	8
Murdoch, Peter	Sierra Madrona	1,430	A. M. Anderson, Liverpool	To Calcutta, Chittagong, and home	8
"	"	"	"	To Bombay, Rangoon, and home	7
Murray, Alexander	S.S. Windward	321	W. Baxter, Peterhead	Cumberland Gulf	15
¹³ Napier, R. H., R.N.	Magpie	774	H.M.S.	In Hong Kong Harbour	11 days.
¹⁴ "	Nassau	877	"	In China Sea	6
¹⁵ "	"	"	"	"	4
¹⁶ Nares, Sir G. S., K.C.B.	Alert	1,331	"	Smith Sound	7
¹⁷ "	"	"	"	In Winter Quarters	10
"	"	"	"	"	10

LIST of DOCUMENTS, &c.—continued.

Captain's Name.	Ship.	Tons.	Owners.	Voyage.	Months of Register.
Owen, Robert	Victoria Cross	669	W. Hoop, Liverpool	Baltimore, one voyage; one to Valparaiso and home from Salaverry (Peru).	9
Parry, Moses	Queen of Cambria	865	W. Thomas, Nevill, Carnarvon	To Monte Video, Valparaiso, Iquique, and home.	7
Parsons, E. T., R.N.	Beacon	584	H.M.S.	Voyage to, and cruising on, South-East Coast of America.	11
¹⁸ Pearson, C. W.	S.S. Strathleven	2,436	W. Burrell, Glasgow	Bombay, via Suez	2
¹⁹ Peebles, Robert	Otago	993	The "Albion" Shipping Co., Glasgow.	China, via Suez	3
Pepper, George	S.S. Tasso	608	A. Wilson, Hull	Otago	6
Pifford, E. J.	Chandiere	470	Savill and Temple, London	Between Hull and Drontheim	4
Potts, T. C.	Majestic	1,884	T. & R. Brocklebank, Liverpool	Wellington (N.Z.)	7
Prehn, Conrad	Ambassador	692	W. Lund, London	To Calcutta	3
Prehn, C. C.	Mikado	643		To Yokohama and New York, thence to Lat. 36° N. Long. 55° W.	8
Press, J. B.	Crest of the Wave	759	D. King, London	Shanghai	7
²⁰ Purdy, John	British Commodore	1,390	The British Shipowners' Co. Lim., Liverpool.	Singapore	3
Quaile, D. W. A.	Margaret Smith	631	R. Kerr, Greenock	San Francisco	4
²¹ Raeburn, John, R.N.R.	Airlie	1,500	D. Bruce, Dundee	Havana	9
Raymond, C. T.	Theophane	1,525	J. M. Heap, Liverpool	To Sydney, San Francisco, and home	8
Reed, F. P., R.N.R.	Oithona	1,342	J. H. Worthington, Liverpool	To Melbourne, Calcutta, Rangoon, and home.	7
Renaut, C. H.	Pleione	1,092	W. Savill, London	To Bombay, Calcutta, and St. Helena	7

List of DOCUMENTS, &c.—continued.

Captain's Name.	Ship.	Tons.	Owners.	Voyage.	Months of Register.
Tancock, R. S.	Pomona	1,200	A. Allen, Glasgow	To Otago, Astoria (U.S.), and home	9
Thorpe, John	Tewkesbury	1,088	W. Herron, Liverpool	To Rio Janeiro, Callao, Pabellon de Pica, and home.	7
Tickle, William	Windermere	1,193	J. Fisher, Liverpool	Sydney	6
Turner, E. W.	Mertola	393	F. T. Barry, London	Pomeron, three voyages	4
"	"	"	"	"	3
³⁰ Unknown	Rolla	—	-	From Torres Straits to Canton	2
Waring, William	S.S. Gordon Castle	2,020	T. Skinner, London	To Singapore and China, thence to New York, via Suez, and home.	4
Watson, William	S.S. Algeria	3,428	C. McIver, Liverpool	New York, five voyages	4
³¹ Wharton, W. J. L., R.N.	Fawn	1,045	H.M.S.	Off Zanzibar, and from Zanzibar to Natal and Simon's Bay.	4
"	"	"	"	From Table Bay to Mauritius, Madagascar, Zanzibar, Aden, Suez, Smyrna, and Sea of Manuora.	4
Wight, H. P.	Taranaki	1,126	J. Galbraith, Glasgow	To New Zealand, Astoria (U.S.), and home.	8
Wilson, Alexander	Catherine	191	W. Baxter, Peterhead	To Iviglut and Philadelphia, thence to and from Iviglut, and home.	6
³³ Woolward, Robert	S.S. Dor	3,805	Royal Mail Steam Packet Co., London.	To West Indies and Central America	1
Wright, Samuel	Armsphere	1,378	T. A. DeWolf, Halifax, N.S.	To Bombay, Calcutta, Callao, Huanillos, Falmouth and Hamburg.	11

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

¹ Assisted by Messrs. Jones and Nightingale.

² Kept by L. G. Puckle, 4th Officer.

³ Assisted by Officers.

⁴ Kept by Staff Commander Frederick A. Johnston.

⁵ Kept by F. K. Thimm, 2nd Officer.

⁶ Kept by R. C. Keys, 2nd Officer, R. Dowling, 3rd Officer, and J. C. Wilcocks, 4th Officer.

⁷ Assisted by R. W. Harvey, Chief Officer.

¹⁰, ²¹ Kept by the Boys.

¹¹ Kept by Lieut. G. N. A. Pollard.

¹², ³³ Kept by Anthony Standidge Thomson, 2nd Officer.

¹³, ¹⁴, ¹⁵ Kept by Lieutenant Alfred Carpenter.

¹⁶ Kept by Lieutenant William H. May.

¹⁷ Kept by Lieutenant Pelham Aldrich.

¹⁸, ¹⁹ Assisted by 2nd Officer.

²⁰ Kept by G. A. Jones, Chief Officer.

²¹ Assisted by G. McNab, 3rd Officer.

²² Kept by Charles Orr Madge, 2nd Officer.

²³ Kept by C. H. Kempson, Chief Officer.

²⁴ Assisted by T. Claydon, 1st Mate.

²⁶, ²⁷, ²⁸ Kept by Belgrave Ninnis, M.D.

²⁹ Kept by H. G. Story, 3rd Officer.

³⁰ Kept by John Franklin, Master's Mate of H.M.S. "Investigator."

³¹, ³² Kept by Lieutenant G. C. Frederick.

LIST of DOCUMENTS, &c.—continued.

Captain's Name.	Ship.	Tons.	Owners.	Voyage.	Months of Register.
Tannock, R. S.	Pomona	1,200	A. Allen, Glasgow	To Otago, Astoria (U.S.), and home	9
Thorpe, John	Tewkesbury	1,088	W. Herron, Liverpool	To Rio Janeiro, Callao, Pabellon de Pica, and home.	7
Tickle, William	Windermere	1,193	J. Fisher, Liverpool	Sydney	6
Turner, E. W.	Mertola	392	F. T. Barry, London	Pomeron, three voyages	4
"	"	"	"	"	3
Unknown	Rolla	—	-	From Torres Straits to Canton	2
Waring, William	S.S. Gordon Castle	2,020	T. Skinner, London	To Singapore and China, thence to New York, via Suez, and home.	4
Watson, William	S.S. Algeria	3,428	C. McIver, Liverpool	New York, five voyages	4
Wharton, W. J. L., R.N.	Fawn	1,045	H.M.S.	Off Zanzibar, and from Zanzibar to Natal and Simon's Bay.	4
"	"	"	"	From Table Bay to Mauritius, Madagascar, Zanzibar, Aden, Suez, Smyrna, and Sea of Marmora.	7
"	"	"	"	To New Zealand, Astoria (U.S.), and home.	8
Wight, H. P.	Taranaki	1,126	J. Galbraith, Glasgow	To Ivigut and Philadelphia, thence to and from Ivigut, and home.	6
Wilson, Alexander	Catherine	191	W. Baxter, Peterhead	To West Indies and Central America	1
Woolward, Robert	S.S. Dor	3,805	Royal Mail Steam Packet Co., London.	To Bombay, Calcutta, Callao, Huanillos, Falmouth and Hamburg.	11
Wright, Samuel	Atmosphere	1,378	T. A. DeWolf, Halifax, N.S.		

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

- 1 Assisted by Messrs. Jones and Nightingale.
- 2 Kept by L. G. Fuckle, 4th Officer.
- 3 Assisted by officers.
- 4 Kept by Staff Commander Frederick A. Johnston.
- 5 Kept by F. K. Rhinam, 2nd Officer.
- 6 Kept by E. C. Keys, 2nd Officer; R. Dowling, 3rd Officer, and J. C. Wilcocks, 4th Officer.
- 7 Assisted by R. W. Harvey, Chief Officer.
- 8 Kept by the Boys.
- 9 Kept by Charles Orr Madge, 2nd Officer.
- 10 Kept by C. H. Kempson, Chief Officer.
- 11 Assisted by T. Claydon, 1st Mate.
- 12 Kept by Belgrave Nimis, M.D.
- 13 Kept by H. G. Story, 3rd Officer.
- 14 Kept by John Franklin, Master's Mate of H.M.S. "Investigator."
- 15 Kept by Lieutenant G. C. Frederick.
- 16 Kept by Lieut. G. N. A. Pollard.
- 17 Kept by Anthony Standidge Thomson, 2nd Officer.
- 18 Kept by Lieutenant Alfred Carpenter.
- 19 Kept by Lieutenant William H. May.
- 20 Kept by Lieutenant William Aldrich.
- 21 Assisted by 2nd Officer.
- 22 Kept by G. A. Jones, Chief Officer.
- 23 Assisted by G. McNab, 3rd 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, 1878, afloat - -	196	392	990	148	145	66	138
Issued since - - -	60	97	318	42	43	21	32
Returned since - - -	256	489	1,308	190	188	87	170
April 1st, 1879, afloat - -	53	88	247	32	34	15	36
	203	401	1,061	158	154	72	134

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

April 1st, 1878, in use - -	49	87	70	12	6	4	14
Issued since - - -	6	20	19	11	10	3	—
Returned since - - -	55	107	89	23	16	7	14
April 1st, 1879, in use - -	4	5	8	3	2	—	3
	51	102	81	20	14	7	11

DISPOSITION OF ADMIRALTY INSTRUMENTS on April 1st, 1879.

Afloat in Royal Navy - -	203	401	1,061	158	154	72	134
In use at stations - - -	51	102	81	20	14	7	11
In store at M.O. - - -	127	46	191	35	26	37	72
" Chatham - - -	3	9	8	2	2	6	12
" Sheerness - - -	6	11	27	4	4	8	26
" Portsmouth - - -	5	10	29	3	4	11	18
" Devonport - - -	9	6	18	7	7	2	20
" Queenstown - - -	2	2	4	1	1	—	8
" Gibraltar - - -	1	2	9	—	—	—	4
" Malta - - -	1	8	8	—	—	4	20
" Halifax - - -	1	5	10	3	5	—	12
" Bermuda - - -	4	6	21	4	4	—	15
" Jamaica - - -	2	4	7	2	3	—	8
" Cape of Good Hope - -	1	4	18	2	2	—	31
" Trincomalee - - -	4	6	9	1	1	—	—
" Hong Kong - - -	4	2	6	7	8	1	14
" Coquimbo - - -	—	—	1	1	—	—	23
" Sydney - - -	4	6	16	2	2	—	—
" Esquimalt - - -	3	5	8	—	—	—	—
Total - - -	431	635	1,532	252	237	148	428
Lost, &c. since April 1st, 1878. - - -	—	3	209	15	11	—	13
On way to Hong Kong - -	8	8	36	—	—	—	—
" Coquimbo - - -	6	7	36	3	3	—	—

APPENDIX IV.

INSTRUMENTS supplied, &c. to the Royal Navy.

Per Account.	Baro- meters.	Ane- roids.	Thermometers.				Hydro- meters.	
			Ordinary.	Max.	Min.	Screens.		
April 1st, 1878, afloat -	-	196	392	990	148	145	66	138
Issued since -	-	60	97	318	42	43	21	32
Returned since -	-	256	489	1,308	190	188	87	170
April 1st, 1879, afloat -	-	53	88	247	32	34	15	36
	-	203	401	1,061	158	154	72	134

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

April 1st, 1878, in use -	-	49	87	70	12	6	4	14
Issued since -	-	6	20	19	11	10	3	-
Returned since -	-	55	107	89	23	16	7	14
April 1st, 1879, in use -	-	4	5	8	3	2	-	3
	-	51	102	81	20	14	7	11

DISPOSITION of ADMIRALTY INSTRUMENTS on April 1st, 1879.

Afloat in Royal Navy -	-	203	401	1,061	158	154	72	134
In use at stations -	-	51	102	81	20	14	7	11
In store at M.O. -	-	127	46	191	35	26	37	72
" Chatham -	-	3	9	8	2	2	6	12
" Sheerness -	-	6	11	27	4	4	8	26
" Portsmouth -	-	5	10	29	3	4	11	18
" Devonport -	-	9	6	18	7	7	2	20
" Queenstown -	-	2	2	4	1	1	-	8
" Gibraltar -	-	1	2	9	-	-	-	4
" Malta -	-	1	8	8	-	-	4	20
" Halifax -	-	1	5	10	3	5	-	12
" Bermuda -	-	4	6	21	4	4	-	15
" Jamaica -	-	2	4	7	2	3	-	8
" Cape of Good Hope -	-	1	4	18	2	2	-	31
" Trincomalee -	-	4	6	9	1	1	-	-
" Hong Kong -	-	4	2	6	7	8	1	14
" Coquimbo -	-	-	-	1	1	-	-	23
" Sydney -	-	4	6	16	2	2	-	-
" Esquimalt -	-	3	5	8	-	-	-	-
Total -	-	431	635	1,532	252	237	148	428
Lost, &c. since April 1st, 1878.	-	-	3	209	15	11	-	13
On way to Hong Kong -	-	8	8	36	-	-	-	-
" Coquimbo -	-	6	7	36	3	3	-	-

APPENDIX V.

INSTRUMENTS, &c. supplied to Mercantile Marine.

Per Account.	Baro- meters.	Com- passes.	Thermometers.				Hydro- meters.
			Ordinary.	Max.	Min.	Screens.	
April 1st, 1878, afloat -	121	1	739	—	9	112	470
Issued since -	86	—	505	—	3	94	315
Returned since -	207	1	1,244	—	12	206	785
April 1st, 1879, afloat -	90	—	531	—	5	88	325
April 1st, 1879, afloat -	117	1	713	—	7	118	460

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

April 1st, 1878, in use -	79	2	212	52	52	41	42
Issued since -	17	—	20	5	5	7	—
Returned since -	96	2	232	57	57	48	42
April 1st, 1879, in use -	5	—	12	4	3	7	—
April 1st, 1879, in use -	91	2	220	53	54	41	42

DISPOSITION of Board of Trade Instruments.

In merchant ships -	117	1	713	—	7	118	460
In use at stations -	91	2	220	53	54	41	42
In store at M.O. -	33	45	95	5	36	10	102
At Liverpool agency -	7	8	19	—	—	2	16
„ Aberdeen „ -	6	—	46	—	—	5	32
„ Glasgow „ -	5	—	18	—	—	6	14
„ Dundee „ -	5	—	28	—	1	5	16
„ Hull „ -	4	—	20	—	—	4	11
„ Southampton* „ -	1	—	6	—	—	1	4
„ Cardiff „ -	2	—	15	—	—	1	16
„ Kew Observatory -	—	—	2	6	5	—	—
Under repair -	—	—	—	—	—	2	—
Total, April 1st, 1879 -	271	56	1,182	64	103	195	713
Lost, &c. since April 1st, 1879 -	5	—	115	—	—	17	51

* No return since June 30th.

APPENDIX VI.

LIST of STATIONS reporting Meteorological Observations by Telegraph to the Office, with the Observers.

Sumburgh Head	-	Rev. W. Brand	-	-	Minister of Dunrossness.
†*Stornoway	-	J. Sutherland	-	-	Schoolmaster.
Thurso	-	J. Trotter	-	-	— ⁽¹⁾
Wick	-	J. Sinclair	-	-	Watchmaker.
Nairn	-	W. D. Penny	-	-	Schoolmaster.
†*Aberdeen	-	J. McCormack	-	-	Telegraph Clerk.
Leith	-	J. Turnbull	-	-	Do.
†*Shields	-	J. Irvine	-	-	Do.
Scarborough	-	F. Shaw, F.M.S.	-	-	Do.
York	-	Dr. Purves	-	-	Museum.
Nottingham	-	E. J. Lowe, F.R.S.	-	-	Highfield House Observa- tory.
†Ardrossau	-	W. McNeil	-	-	Telegraph Clerk.
Greencastle (Moville)	-	J. Lowry	-	-	Schoolmaster. ⁽²⁾
†*Mullaghmore	-	K. Kerr	-	-	Coastguard Chief Boat- man. ⁽³⁾
Donaghadee	-	J. MacGowan, jr.	-	-	Telegraph Clerk.
Kingstown	-	G. Mitchell	-	-	Keeper of Sailors' Home.
†*Holyhead	-	J. Tilston	-	-	Do.
Liverpool	-	J. Hartnup, junr.	-	-	Bidston Observatory.
†*Valencia	-	J. E. Cullum	-	-	Superintendent of the Ob- servatory.
Roche's Point	-	W. Kennedy	-	-	Telegraph Clerk.
Pembroke	-	J. C. Walker	-	-	Do.
Porrishead	-	W. Sandford	-	-	— ⁽⁴⁾
†*Scilly	-	W. Thomas	-	-	Signalman.
Plymouth	-	J. Merrifield, LL.D., F.M.S.	-	-	Teacher of Navigation. ⁽⁵⁾
Prawle Point	-	W. Blackler	-	-	Coastguard Officer. ⁽⁶⁾
Hurst Castle	-	T. Lanceley	-	-	Lightkeeper.
Jersey	-	J. Fisher	-	-	Signalman.
Dover	-	J. Costello	-	-	Telegraph Clerk.
†*London	-	F. Gaster, F.M.S.	-	-	—
Oxford	-	C. A. Jenkins	-	-	Radcliffe Observatory
Cambridge	-	H. Todd	-	-	Observatory.
†*Yarmouth	-	G. T. Watson	-	-	Secretary, Sailors' Home.

(¹) Ceased reporting April 16, 1879; (²) Ceased reporting March 24, 1879; (³) Commenced reporting November 11, 1878; (⁴) Commenced reporting October 30, 1878; (⁵) Ceased reporting December 31, 1878. (⁶) Commenced reporting January 1, 1879.

It will be seen from the above list that the stations are being re-organised, and in addition to the alterations shown in the Table a station is being established at Spurn Head in lieu of that at Scarborough, which is too much sheltered from Northerly, Westerly, and Southerly winds.

Summary of Stations Reporting at the Close of the Financial year.

England and Wales	-	-	-	16
Scotland	-	-	-	7
Ireland	-	-	-	5

The Foreign stations are 24 in number; viz., in SWEDEN and NORWAY, Haparanda, Hernösand, Stockholm, Wisby, Christiansund, Skudenaes* and Oxö; in DENMARK, the Seaw and Fanö; in N. GERMANY, Cuxhaven; in HOLLAND, Groningen, the Helder, and Flushing; in BELGIUM, Brussels; and in FRANCE, Cape Gris Nez, Brest (St. Mathieu), Lorient (Grognon), Rochefort* (Ile d'Aix), Biarritz, Toulon (Cape Siciè), Charleville, Paris, and Lyons; in SPAIN, Corunna.

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

APPENDIX VII.

The principal operations connected with the preparation and issue of the Daily Weather Report and of Storm Warnings are as follows:—

The Office receives, when the telegraphic communications are perfect, fifty-two reports every morning, ten every afternoon (except on Sundays), and eleven each evening. The reason of the suspension of the afternoon reports on Sundays is that almost all the telegraphic circuits are closed at the hour at which the messages would be transmitted.

The foreign reporting stations, 24 in number, extend along the entire western coast of the Continent, from Christiansund in lat. 63° N. to Corunna in lat. 43° N., and also 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 Office by its private wire, where the majority of them usually arrive between 9 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.

Since April 1st, 1879, there have been prepared each morning, afternoon, and evening, forecasts of the weather, for one day in advance; these are drawn up for eleven districts in the British Islands, and are issued to subscribers, to certain Clubs, and to many of the London and Provincial newspapers. The districts for which the forecasts are prepared are those into which the returns for the Weekly Weather Report are divided (*see p. 57*), 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 is increasing considerably, but the work has not been in hand long enough for any decided opinion to be given as to its success.

About an hour and a quarter is occupied in the preparation and transmission of these provincial and foreign telegrams, and in the drawing up of the "Remarks" and 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.
" "Shipping Gazette" } and "Morning Chronicle" }	one	for 8 a.m.
For the Patent Type-found- ing Company, to be dis- tributed to the provincial press - - - - - }	one	for 8 a.m.

The first and second of these are sent out at about 10.15 a.m.; the third at 11.30 a.m.

The draft of the Daily Weather Report, which is issued as a separate sheet, with four 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 remaining portion are received at the Meteorological Office at about 3.30 p.m., and 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. 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 eight 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. Eleven 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 8 a.m. and 2 p.m. 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 is distributed by that agency in the provinces for publication in the next morning's newspapers.

At 7 to 7.30 p.m. the eleven* evening (6 p.m.) reports arrive and are charted and discussed for the "Times," in accordance with the arrangement referred to on p. 13. The chart and remarks are usually ready by 8 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 8.30 or 9 p.m. before they are issued.

It is scarcely necessary to remark that the charts for 2 p.m. and for 6 p.m. are far less complete than that for 8 a.m. That for 2 p.m. is drawn on the information received from seven home stations, supplemented by that from two foreign ones, whenever these latter arrive in time to be used, which is a rare occurrence. The material for the

* It is proposed to increase considerably the number of stations for this service.

6 p.m. charts has been hitherto supplied by reports from only eleven stations in the United Kingdom. It is evident that all that is wanted to render the telegraphic weather service more efficient is the power to expend more money on the collection and transmission of reports. This difficulty is now likely to disappear in the case of the 6 p.m. chart, as explained in the body of the Report.

Whenever the telegrams come in (*i.e.*, at about 10 a.m., 3 p.m., and 7 p.m., and also on the receipt of any special telegram,) the condition of the weather is carefully considered, the Forecasts are modified, and, when necessary, cautionary messages are issued to any of our coasts which may be threatened by bad weather, and also to the neighbouring continental coasts, in accordance with the special arrangements for each country.

The Sunday duty is 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 the utmost 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 Forecasts for the "Times," and another opportunity is thus offered for the correction or extension of any warnings which may have been issued in the morning. Forecasts for the Provincial press are prepared at 6.30 p.m.

Weekly Summary.

Soon after the end of each week a Summary of the Weather in Western Europe 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.

Some further steps are taken to insure accuracy in the Daily Weather Report. At the close of each month a return is received from each 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. A specimen of the publication will be found as Appendix XI. It 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 given on page 1 of the publication, the corresponding values for *each station* being given on page 2. In addition to the telegraphic reports weekly returns from 17 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.
Audley End (Saffron Walden)	Ⓕ	J. Bryan.
Cirencester - - -	-	The Royal Agricultural College.
Douglas, Isle of Man - -	-	A. W. Moore, Esq.
Dunfanaghy - - -	-	C. Brooke Wolseley, M.D.
Durham - - -	-	G. A. Goldney, the Observatory.
Glenalmond - - -	-	Rev. W. P. Robinson, D.D., Trinity College.
Hastings - - -	-	A. E. Murray, F.M.S.
Hereford - - -	Ⓕ	T. A. Chapman, M.D.
Kelstern (Lincolnshire) -	Ⓕ	D. G. Briggs, F.M.S.
Laudale (Loch Sunart) - -	-	A. Fletcher, for T. G. Newton, Esq.
Leicester - - -	-	W. J. Harrison, F.G.S., the Museum.
Marlborough - - -	Ⓕ	Rev. T. A. Preston, M.A., F.M.S.
Parsonstown - - -	-	J. Dreyer, for the Earl of Rosse, F.R.S.
Prestwich (near Manchester)	-	T. R. H. Clunn, Esq., M.D.
Rothamsted - - -	-	Rainfall by Messrs. Lawes and Gilbert; temperature by T. Wilson, Esq., F.M.S.
Shrewsbury - - -	Ⓕ	Rev. E. V. Pigott, F.M.S.
Silloth - - -	-	Rev. F. Redford, F.R.S.E.
Strathfield Turgis - - -	Ⓕ	Rev. C. H. Griffith, F.M.S.

The returns from stations marked "Ⓕ" are supplied by the Meteorological Society (of London).

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" and "Daily News" on Thursday morning.

Testing the Storm Warnings.

The method of testing the warnings is as follows: The intelligence issued has usually been 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 at pp. 17-19. 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 the preceding year, made application to the various Lighthouse Boards, and have obtained from them the original log-books from some of the best exposed lightships and lighthouses. They would here express their cordial thanks for the co-operation so readily granted to them by these Boards.

The coasts were subdivided into nine districts, as will be seen in the table on p. 14. 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.

Any spare time of the clerks engaged on Weather Telegraphy is employed in obtaining average values for the different elements, and in such other meteorological investigations as may be directed by the Council.

APPENDIX VIII.

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

Newspapers :

Daily News.
 *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.	Brighton.
Barrow-in-Furness.	Briton Ferry.
Belfast.	Broughty Ferry.
Blackpool.	Buckie.
Bo'ness.	Budehaven.
Boscastle.	Caernarvon.
Bournemouth.	Cork.

* "Remarks" only.

† Saturdays only.

For Exhibition at following Seaports—cont.

Cowes.	Penarth.
Cromer.	Plymouth.
Deptford Yard.	" G. W. Docks.
Dover.	Port Dinorwic.
Exeter (2 copies).	Porthcawl.
Falmouth.	Queenstown.
Great Grimsby (2 copies).	Scarboro'.
Hastings.	Silloth.
Hayle.	Southport.
Holyhead.	Teignmouth.
Kingstown.	Ventnor (2 copies).
Lancaster.	Weston-super-Mare.
Leith.	Whitley.
Lowestoft.	Wick.
Margate.	Worthing.
Nairn.	Yarmouth.
Newquay.	

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.
 Clouston, Rev. C., LL.D., Sandwick, Orkney.
 Clum, T. R. H., M.D., Prestwich, Manchester.
 Cooper, Col., F.R.A.S., Markree, nr. Sligo.
 Conroy, J., Londonderry.
 Cooper, W. F., F.M.S., Sheffield.
 Durham, University Observatory.
 Fernley Observatory, Southport.
 Greenwich Observatory.
 Harrison, W. J., F.G.S., Leicester.
 Hoskins, Dr. S. E., F.R.S., Guernsey.
 Indian C.E. College, Staines.
 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.
 Moyle, M. P., F.R.C.S., Helston.
 Mullins, Rev. G. H., Uppingham.
 Murray, A. E., F.M.S., Hastings.
 Neale, J., Waterford.
 Netley, Army Medical School.
 Northumberland, Duke of, Alnwick.
 Ordnance Survey Office (Southampton).
 Propert, W. P., LL.D., St. David's.
 Radcliffe Observatory, Oxford.
 Richards, W. H., Penzance.

Government Offices, Societies, Individuals, &c.—cont.

Trinity House.

War Office, Adjutant General, Horse Guards.

„ Commander-in-Chief.

Foreign Places :

Algiers, Meteorological Service.
 Bombay Observatory.
 Brussels, Royal Observatory.
 Calcutta, Meteorological Department.
 Christiania, Meteorological Institute.
 Constantinople, Imperial Meteorological Observatory.
 Copenhagen, Meteorological Institute.
 Cracow Observatory.
 Emden, Dr. Prestel.
 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.
 „ Bureau Central de Météorologie.
 „ 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 IX.

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 “drum” and “cone” signal shapes 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, 80 in England and Wales, 30 in Scotland, 13 in Ireland, 3 in the Isle of Man, and 3 in the Channel Islands.

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

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.

* 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 X.

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

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.	—
Dartmoor - - -	R. E. Power, L.R.C.P.	—
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.	—
Holyhead - - -	J. Tilston.	—
Jersey (St. Helier's) -	J. Fisher.	—
Kew Observatory -	The Staff.	—
Leicester (Museum) -	W. J. Harrison, F.G.S.	—
Liverpool Observatory (Bidston).	J. Hartnup, Jun.	—
Nottingham - - -	E. J. Lowe, F.R.S.	—
Oscott (St. Mary's Col.)	Rev. S. Whitty.	—
Oxford, Radcliffe Obs. -	H. J. Bellamy.	—
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 - - -	W. McNeil.	—
Glasgow Observatory -	The Staff.	—
Nairn - - -	W. D. Penny.	—
Orkneys, Sandwick -	Rev. C. Clouston, LL.D.	—
Thurso - - -	J. Trotter.	—
IRELAND.		
Armagh Observatory -	S. Call, for Dr. Robinson.	—
Donaghadee - - -	J. McGowan.	—
Galway, Queen's College	B. G. Clare, for Professor Curtis.	—
Roche's Point - - -	W. Kennedy.	—
Valencia Observatory -	The Staff.	—

Stations.	Observers.	Remarks.
BRITISH COLONIES, POSSESSIONS, &C.		
Barbadoes, W. I.	Surgeon-Maj. Doran.	—
Gibraltar	W. Allen, Serg. A.H.C.*	—
Malta	H. J. Beckett, Serg., A.H.C.	—
Nassau (Bahamas)	C. L. Duncombe.	—
Natal	Priv. G. Salmon, A.H.C.	—
Scutari, British Cemetery	Serg. W. H. Lyne, R.E.	—
Sierra Leone	—	—

SUMMARY.

England and Wales	27
Scotland	6
Ireland	5
Colonies and British Possessions	7
Total	45

* A.H.C.—Army Hospital Corps.

WEEKLY WEATHER REPORT.

ISSUED BY THE METEOROLOGICAL OFFICE, LONDON.

PUBLISHED BY J. D. POTTER, 51 POULTRY, AND 11 KING STREET, TOWER HILL
AND E. STANFORD, CHARING CROSS.

VOL. II. No. 20.]

WEEK ENDING MONDAY, MAY 19, 1879.

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

I.—SUMMARY OF TEMPERATURE AND RAINFALL 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 they are also 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, Glenalmond, Leith.
2. ENGLAND, N.E.—Shields, Durham, Scarborough, York, Kelstern (Lincolnshire)
3. ENGLAND, E.—Yarmouth, Cambridge, Audley End (Saffron Walden), Rothamsted.
4. MIDLAND COUNTIES.—Nottingham, Loughborough, Leicester, Shrewsbury, Hereford, Cirencester, Oxford.
5. ENGLAND, S.—London, Marlborough, Strathfield Turgiss, Dover, Hastings, Hurst Castle.
6. SCOTLAND, W.—Laudale (Loch Sunart), Glasgow, Ardrrossan, Sillioth, Douglas (Isle of Man).
7. ENGLAND, N.W.—Stonyhurst, Manchester, Liverpool Observatory (Bidston), Holyhead.
8. ENGLAND, S.W.—Pembroke, Barnstaple, Falmouth, Plymouth, Prawla Point.
9. IRELAND, N.—Mullaghmore, Brookeborough, Armagh, Donaghadee.
10. IRELAND, S.—Dublin, Kingstown, Parsonstown, Roche's Point, Valentia.

Explanation of Summary.—The data for mean *Temperature* in the corresponding week of previous years are derived from the 13 years observations 1857-69, as determined by Mr. Buchan. Those for mean *Rainfall* have been 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.)			
	Highest observed.	Lowest observed.	Average for the Week.	Above or below the Mean for Week.	Number of Rainy Days.	Rainfall for the Week.	More or less than the Mean for Week.	
Principal Wheat-producing Districts.	1. SCOTLAND, EAST	61	31	46	5 below.	3	3	1 less.
	2. ENGLAND, NORTH-EAST	61	37	46	6 below.	5	10	6 more.
	3. ENGLAND, EAST	64	33	48	7 below.	5	9	5 more.
	4. MIDLAND COUNTIES	66	37	49	6 below.	6	11	6 more.
	5. ENGLAND, SOUTH	63	36	50	5 below.	5	5	2 more.
Principal Grazing, &c. Districts.	6. SCOTLAND, WEST	60	34	48	4 below.	4	8	3 more.
	7. ENGLAND, NORTH-WEST	61	37	49	5 below.	5	6	2 more.
	8. ENGLAND, SOUTH-WEST	67	41	50	5 below.	5	7	2 more.
	9. IRELAND, NORTH	58	36	48	4 below.	5	14	?
	10. IRELAND, SOUTH	62	38	50	3 below.	5	11	6 more.

General Remarks.

Weather cloudy and unsettled generally. A severe thunderstorm experienced in many parts of England on the 14th, with very heavy rain in some places. Slight thunderstorm in "Scotland, W.," on the 17th. Temperature again below the mean, but the deficit not so large as in previous weeks. Maxima frequently below 55°, but exceeding 60° on some occasions, and reaching 66° at Nottingham on the 17th, and 67° at Barnstaple on the 15th. No night frosts reported.

Rainfall more than the mean in all districts except "Scotland, E.," the excess ranging from two tenths of an inch to the W. and S. of England, to six tenths in "England, N.E.," the Midland Counties, and "Ireland, S." The heaviest amounts recorded during the thunderstorm of the 14th were 0.79 in. at Leicester, 0.83 in. at Kelstern, 1.15 in. at Nottingham, and 1.40 in. at Scarborough. Heavy rain fell over Ireland on the 16th.

Wind light westerly to southerly at first, but afterwards veering to N. and blowing strongly on the 15th, with a gale on the north-east coast of England. Southerly winds appearing in the west and north on the 16th, but falling light and becoming variable at the close of the week.

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

DISTRICTS.	NAMES OF STATIONS.	Temperature.				Rainfall. ∞		
		Highest observed.	Lowest observed.	Average for the Week.	Difference from the Mean.	No. of Days with Rain.	Total fall in the Week.	Difference from the Mean.
1. SCOTLAND, E.	Nairn	61	39	47.6	- 2.1	4	0.58	+0.21
	Aberdeen	56	36	45.7	- 5.1	1	0.05	-0.38
	Glennalmond	57	31	44.2	- 6.9	4	0.38	?
	Leith	61	35	46.4	- 4.7	3	0.13	-0.25
2. ENGLAND, N.E.	Shields	56	39	44.9	- 7.1	6	0.40	0.00
	Durham	61	38	46.0	- 5.9	5	0.67	+0.25
	Scarborough	56	40	45.2	- 7.5	6	2.11	+1.69
	York	60	39	47.7	- 5.9	4	0.43	+0.05
3. ENGLAND, E.	Keilster (Lincolnshire)	59	37	46.9	- 6.3	4	1.28	+0.95
	Yarmouth	54	40	45.9	- 7.8	3	0.39	-0.02
	Cambridge	61	37	49.2	- 5.5	5	1.05	+0.67
	Audley End (Saffron Walden)	63	34	47.5	- 7.4	6	1.11	+0.73
4. MIDLAND COUNTIES	Rothamsted	60	33	47.5	- 7.3	6	0.95	+0.53
	Nottingham	66	37	48.9	- 4.9	6	2.23	+1.75
	Loughborough	63	39	49.1	- 5.3	6	0.95	+0.47
	Leicester	60	40	48.6	- 6.0	6	1.50	+1.07
	Shrewsbury	61	37	48.1	- 4.3	6	0.60	+0.17
	Hereford	62	38	49.6	- 7.2	6	0.93	+0.51
	Cirencester	64	42	49.6	- 3.4	6	0.81	+0.32
5. ENGLAND, S.	Oxford	59	43	49.7	- 3.4	5	0.56	+0.10
	London	62	36	50.2	- 4.0	4	0.41	+0.03
	Marlborough	61	40	50.4	- 4.5	5	0.61	+0.14
	Strathfield Turziss	63	38	49.5	- 5.4	4	0.52	+0.18
	Dover	59	41	48.8	- 4.8	5	0.55	+0.10
	Hastings	59	41	49.1	- 5.0	5	0.65	+0.29
6. SCOTLAND, W.	Hurst Castle	60	41	50.2	- 4.4	4	0.51	?
	Laudale (Loch Sunart)	38	35	47.6	- 2.9	2	0.94	?
	Glasgow	59	36	48.5	- 3.3	5	1.10	+0.53
	Ardrossan	60	39	49.4	- 2.3	5	1.06	+0.56
	Sulloth	60	34	47.7	- 4.3	2	0.28	-0.12
7. ENGLAND, N.W.	Douglas (Isle of Man)	56	38	47.6	- 4.8	4	0.63	+0.25
	Stonyhurst	59	37	47.8	- 5.2	4	0.23	-0.32
	Manchester	61	40	48.4	- 5.6	5	0.41	0.00
	Liverpool Observatory (Bidston)	60	43	49.7	- 4.1	5	0.74	+0.41
8. ENGLAND, S.W.	Holyhead	59	44	50.2	- 3.0	5	1.11	+0.75
	Pembroke	54	43	48.0	- 7.0	5	0.99	+0.51
	Barnstaple	67	42	52.5	- 2.8	5	0.42	-0.05
	Falmouth	57	45	50.6	- 5.4	5	0.60	+0.02
	Plymouth	62	43	51.6	- 3.8	5	0.86	+0.40
9. IRELAND, N.	Prawle Point	61	41	48.9	- 6.3	5	0.42	?
	Malbegmore	55	43	49.1	- 3.3	4	0.92	?
	Brookborough	58	36	47.9	- 4.2	4	1.53	?
	Annagh	58	37	49.1	- 3.7	5	1.61	+1.27
10. IRELAND, S.	Donaghadee	57	36	47.5	- 5.0	5	1.58	?
	Dublin	60	38	50.1	- 2.9	6	0.69	+0.21
	Kingstown	59	38	49.4	- 3.4	6	0.75	+0.38
	Parsonstown	62	38	50.1	- 2.8	4	1.26	+0.73
	Roche's Point	60	42	51.8	- 2.1	4	1.51	+0.79
SCOTLAND, N.	Valentia	59	43	50.5	- 3.3	5	1.34	+0.71
	Sumburgh Head *							
	Stornoway	53	34	44.1	- 4.7	4	0.51	+0.18
	Wick	54	35	45.5	- 3.7	3	0.41	+0.14
—	Seilly (St. Mary's)	55	48	51.1	- 5.1	5	0.69	+0.43
	Jersey (Noirmont)	56	46	49.9	- 4.9	4	0.63	+0.21

The observations made in "Scotland N." and the "Channel Islands" are not included in the Summary on page 1. The stations marked with "ft" are in connection with the Meteorological Society.

* The returns from this station have not arrived during this week, telegraphic communication being interrupted.

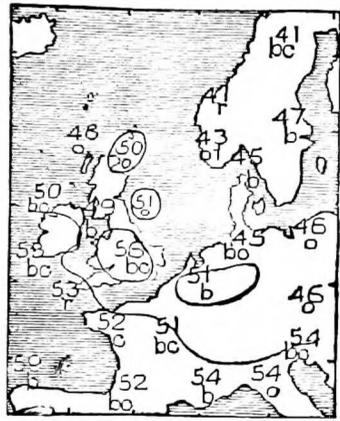
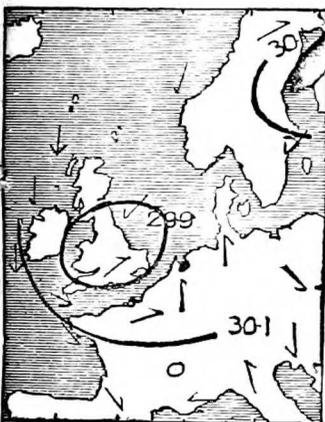
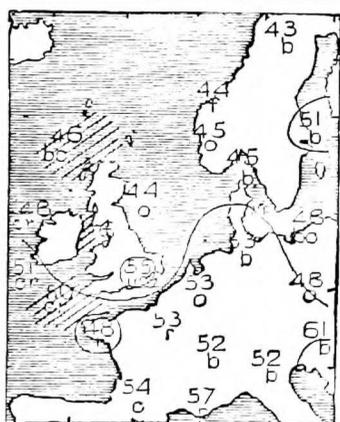
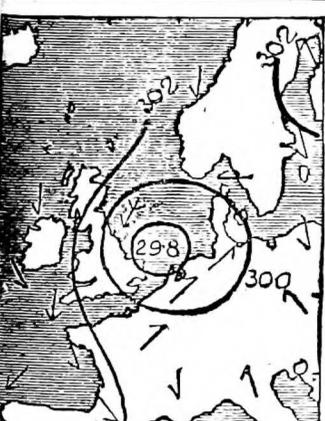
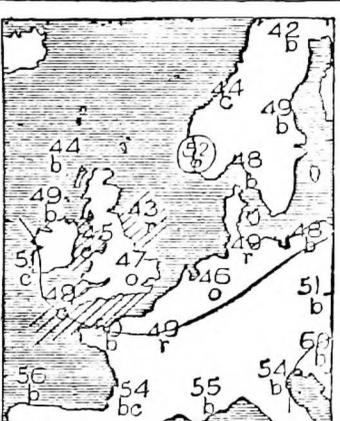
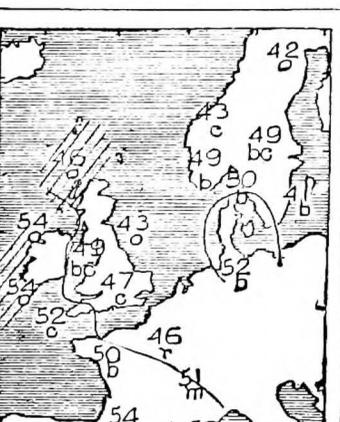
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DISTRICTS.	NAMES OF STATIONS.	Temperature.				Rainfall.		
		Highest observed.	Lowest observed.	Average for the Week.	Difference from the Mean.	No. of Days with Rain.	Total fall in the Week.	Difference from the Mean.
1. SCOTLAND, E.	Nairn	61	39	47.0	- 2.0	4	Inches. 0.58	Inches. +0.21
	Aberdeen	56	36	45.7	- 5.1	1	0.05	-0.28
	Glenalmond	57	31	44.2	- 6.9	4	0.38	?
	Leith	61	35	46.4	- 4.7	3	0.13	-0.23
2. ENGLAND, N.E.	Shields	56	39	44.9	- 7.1	6	0.40	0.00
	Durham	61	38	46.0	- 5.9	5	0.67	+0.25
	Scarborough	56	40	45.2	- 7.5	6	2.11	+1.00
	York	60	39	47.7	- 5.0	4	0.43	+0.05
3. ENGLAND, E.	Kelstern (Lincolnshire)	59	37	46.9	- 6.3	4	1.28	+0.05
	Yarmouth	54	40	45.9	- 7.8	3	0.39	-0.02
	Cambridge	64	37	49.2	- 5.5	5	1.05	+0.07
	Audley End (Saffron Walden)	63	34	47.5	- 7.4	6	1.11	+0.73
4. MIDLAND COUNTIES	Rothamsted	60	33	47.5	- 7.3	6	0.95	+0.33
	Nottingham	66	37	48.9	- 4.9	6	2.23	+1.75
	Loughborough	63	39	49.1	- 5.3	6	0.95	+0.47
	Leicester	60	40	48.0	- 6.0	6	1.50	+1.07
	Shrewsbury	61	37	48.1	- 4.3	6	0.60	+0.17
	Hereford	62	38	49.6	- 7.2	6	0.93	+0.51
5. ENGLAND, S.	Cirencester	64	42	49.6	- 4.4	6	0.81	+0.32
	Oxford	59	43	49.7	- 4.0	5	0.50	+0.10
	London	62	36	50.2	- 4.0	4	0.41	+0.03
	Marlborough	61	40	50.4	- 4.5	5	0.61	+0.14
	Strathfield Turgiss	63	38	49.5	- 5.4	4	0.52	+0.18
	Dover	59	41	48.8	- 4.8	5	0.55	+0.10
6. SCOTLAND, W.	Hastings	59	41	49.1	- 5.0	5	0.65	+0.29
	Hurst Castle	60	44	50.2	- 4.4	4	0.51	?
	Laudale (Loch Sunart)	58	35	47.6	- 2.9	2	0.94	?
	Glasgow	59	36	48.5	- 3.3	5	1.10	+0.33
	Ardrossan	60	39	49.4	- 2.3	5	1.06	+0.96
	Silloth	60	34	47.7	- 4.3	2	0.28	-0.12
7. ENGLAND, N.W.	Douglas (Isle of Man)	56	38	47.6	- 4.8	4	0.63	+0.25
	Stonyhurst	59	37	47.8	- 5.2	4	0.23	-0.22
	Manchester	61	40	48.4	- 5.6	5	0.41	0.00
	Liverpool Observatory (Bidston)	60	43	49.7	- 4.1	5	0.74	+0.41
8. ENGLAND, S.W.	Holyhead	59	44	50.2	- 3.0	5	1.11	+0.75
	Pembroke	54	43	48.0	- 7.0	5	0.09	+0.51
	Barnstaple	67	42	52.5	- 2.8	5	0.42	-0.05
	Falmouth	57	45	50.6	- 5.4	5	0.60	+0.02
	Plymouth	62	43	51.0	- 3.8	5	0.86	+0.40
	Prawle Point	61	41	48.9	- 6.3	5	0.42	?
9. IRELAND, N.	Mullaghmore	55	43	49.1	- 3.3	4	0.02	?
	Brookeborough	58	36	47.9	- 4.2	4	1.53	?
	Armagh	58	37	49.1	- 3.7	5	1.61	+1.27
	Donaghadee	57	36	47.5	- 5.0	5	1.58	?
10. IRELAND, S.	Dublin	60	38	50.1	- 2.9	6	0.69	+0.21
	Kingstown	59	38	49.4	- 3.4	6	0.75	+0.35
	Parsonstown	62	38	50.1	- 2.8	4	1.26	+0.73
	Roche's Point	60	42	51.8	- 2.1	4	1.51	+0.79
	Valentia	59	42	50.5	- 3.3	5	1.34	+0.71
	SCOTLAND, N.	Sumburgh Head*						
Stornoway		53	34	44.1	- 4.7	4	0.51	+0.15
Wick		54	35	45.5	- 3.7	3	0.41	+0.14
Scilly (St. Mary's)		55	48	51.1	- 5.1	5	0.69	+0.43
Jersey (Noirmont)		56	46	49.9	- 4.9	4	0.63	+0.21

The observations made in "Scotland N." and the "Channel Islands" are not included in the Summary on page 1. The stations marked with "fr" are in connection with the Meteorological Society.

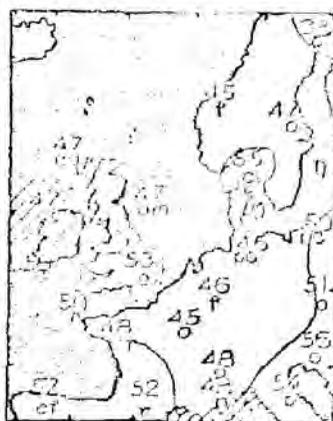
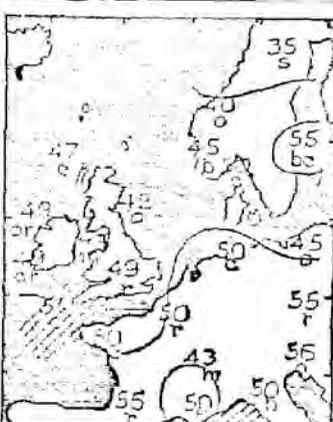
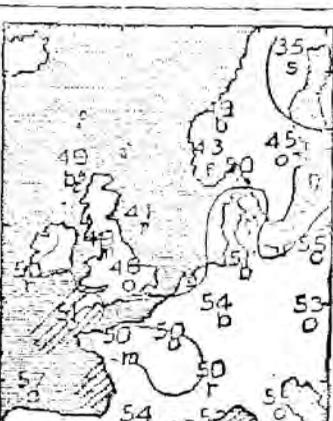
* The returns from this station have not arrived during this week, telegraphic communication being interrupted.

II.—SUMMARY OF WEATHER IN WESTERN EUROPE during the Week ending May 19, 1879.

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, May 13.</p> <p><i>Weather</i> variable; fine at many western and northern stations, as well as over the greater part of France; cloudy or dull elsewhere, with rain in the S.W. and at Ardrossan. Fine day over England but rain occurring generally later.</p> <p><i>Temperature</i> changed irregularly, but risen over France and at a few of our central stations; varying at 8 A.M. from 56° in London to 43° at Yarmouth, and 45° at Prawle Point. Maxima during day higher than of late over central England.</p> <p><i>Wind</i> light or moderate in force and generally westerly to southerly in direction, veering to N.W. in the S.W. districts at night.</p> <p><i>Sea</i> moderate to calm.</p> <p><i>Barometer</i> risen a little over France, the eastern shores of the North Sea, and Scandinavia, fallen elsewhere. Band of high pressure lying over France and N. Germany. Well marked depression forming over these Islands in evening.</p>
		<p>Wednesday, May 14.</p> <p><i>Weather</i> very fine over Sweden, Denmark, N. Germany, and E. France, dull elsewhere, with rain in N.W. and W. Rain, except in the extreme W. later. Thunderstorms in several places, with heavy falls of rain; more than an inch at Scarborough and Nottingham.</p> <p><i>Temperature</i> risen several degrees on our S.E. coasts and over the Netherlands, fallen elsewhere, uniform over western Europe. Maxima low for season, particularly in the N.W.</p> <p><i>Wind</i> northerly in the N. and W., north-westerly in the S.W., westerly in the S., and southerly in the E. Fresh in force in the W. and N.W., moderate to light elsewhere. Light variable airs over the N. of England. Northerly breeze extending all over England during day, increasing and becoming strong in N.E.</p> <p><i>Sea</i> rough Stornoway, Kingstown, and Scilly.</p> <p><i>Barometer</i> rising in extreme W., falling elsewhere, briskly over England. Depression noticed on 13th now over England, becoming deeper and moving south-eastwards.</p>
		<p>Thursday, May 15.</p> <p><i>Weather</i> fine over the W. of France, Ireland, the W. of Scotland, and Sweden, but cloudy or dull elsewhere, with rain over central England. Rain in the E., S.E., and central districts all day—heavy in some places.</p> <p><i>Temperature</i> little changed in the W., lower elsewhere; very uniform over western Europe. Maxima again low, particularly in the N.E. of England, where they did not exceed 45°.</p> <p><i>Wind</i> northerly on most of our coasts, but drawing into N.W. in the S.E., into S.W. in the Netherlands, and into S.E. in Denmark. Strong over these Islands all day, and blowing a strong gale at Shields, and fresh gale on Lincolnshire coast.</p> <p><i>Sea</i> rough in the N.E., N.W., and S.W.</p> <p><i>Barometer</i> falling on eastern shores of North Sea, rising elsewhere. Depression now off our S.E. coasts, and highest readings to the westward of Ireland. Fresh decrease appearing in N.W. at night.</p>
		<p>Friday, May 16.</p> <p><i>Weather</i> cloudy or dull in Ireland, the E. of England, and the greater part of France, moderately fine elsewhere; rain at Paris and Rochefort. Rain falling in W. and S.W. later, but weather improving generally elsewhere.</p> <p><i>Temperature</i> slightly higher Ireland, slightly lower France, little changed in any other places. Still very uniform. Maxima between 50° and 60°, except in N.E., where temperature continued low.</p> <p><i>Wind</i> southerly on our western and northern coasts, as well as in Paris, northerly in most other places. Moderate to fresh in force at 8 A.M., but falling lighter in E. and N. during day.</p> <p><i>Sea</i> moderate to smooth, except near Stornoway and Valentia.</p> <p><i>Barometer</i> rising on our S.E. coasts, over Holland and N. Germany, falling elsewhere. Readings highest in S.W., depression still shown in S.E., but fresh disturbance appearing in N.W.</p>

(Continued over.)

(Continued.)

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 align="center">Saturday, May 17.</p> <p><i>Weather</i> still fine in Sweden, Denmark, and fair at a few of our central stations; cloudy or dull generally, with rain in the N.W., W., and S.W. Rain extending eastward, and reaching London by night.</p> <p><i>Temperature</i> rather higher over our Islands, and lower on the continent than on the 16th, uniform over western Europe and over these Islands, the S.A.M. readings varying from 55° at Liverpool to 45° at Yarmouth.</p> <p><i>Wind</i> southerly on most of our coasts, but fresh northerly again in W. Ireland, while north-westerly breezes are reported over Norway, strong northerly in Sweden, and variable breezes in France. Wind south-easterly in N. later.</p> <p><i>Sea</i> moderate to slight, except at Mullachmore and Scilly.</p> <p><i>Barometer</i> rising slightly in N. Germany, falling elsewhere, —rather bristly over Ireland, where an elongated depression appeared moving south-eastwards to Bristol Channel during day.</p>
		<p align="center">Sunday, May 18.</p> <p><i>Weather</i> fine over the Baltic and at a few of the Dutch and French stations, cloudy and unsettled generally, with rain in many parts of these Islands; snow in the N. of Sweden.</p> <p><i>Temperature</i> fallen except over the Netherlands; varying over these Islands from 51° at Scilly to 41° at Aberdeen. The barometer low all day especially in N.E.</p> <p><i>Wind</i> westerly over the Channel, southerly to south-easterly over the S.E. of England, easterly in the N., and northerly in the W.; strong in force in the W. and S.W., light elsewhere. Shifting to E. in the S. later on.</p> <p><i>Sea</i> moderate to slight except at Scilly and Jersey.</p> <p><i>Barometer</i> recovering slightly in S. Ireland, falling elsewhere; briskly over England and France. Depression shown over south-western England, but moving south-eastwards over France during day, and barometer rising slightly in its rear.</p>
		<p align="center">Monday, May 19.</p> <p><i>Weather</i> still moderately clear in N. Germany and the Netherlands, cloudy or dull in nearly all other places. Some rain in Ireland and the W. and N.E. of England during day, but weather improving about London.</p> <p><i>Temperature</i> little changed at 8 A.M., risen slightly in W., fallen in N. and E. Readings varying from 51° in the S.W. to 41° in the N.E. Maximum day temperature slightly exceeding 60° in the S. and S.E. of England.</p> <p><i>Wind</i> variable, southerly on our N.W. coasts, north-westerly in the S.W., and over the W. of France, and northerly elsewhere. Light to moderate except in the S.W.; southerly breeze extending eastward later.</p> <p><i>Sea</i> rough at Scilly and Rochefort, nearly smooth on the other coasts.</p> <p><i>Barometer</i> falling on the eastern shores of the North Sea and on our extreme western coasts, rising elsewhere, briskly in Sweden. Pressure high over Sweden and Spain, low off the Hebrides and also over the Netherlands and E. of France.</p>

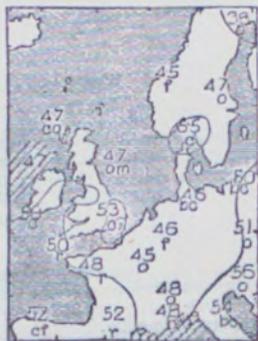
Explanation of Charts.—The two Charts for each day show the general condition of the weather over Western Europe at 8 a.m. In the left-hand Chart the height of the barometer is expressed by "isobars," the value of each line being given in figures. The prevalent winds are shown by arrows, which are drawn flying *with the wind*, the force being indicated thus: \Rightarrow = a heavy gale; \Rightarrow = a gale; \Rightarrow = a fresh to strong breeze; \Rightarrow = a 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," the readings at certain places being given in figures. Diagonal lines = rough sea, the shading being proportional to the disturbance.

(Signed) ROBERT H. SCOTT,
Secretary.

METEOROLOGICAL OFFICE,
116, VICTORIA STREET, S.W.

(Continued.)

Synoptic Weather Charts.—8 a.m.

BAROMETER AND
WIND.CLOUD, RAIN, SEA, AND
TEMPERATURE.Weather during the 24 hours succeeding the
date of the Charts.

Saturday, May 17.

Weather still fine in Sweden, Denmark, and fair at a few of our central stations; cloudy or dull generally, with rain in the N.W., W., and S.W. Rain extending eastward, and reaching London by night.

Temperature rather higher over our Islands, and lower on the continent than on the 16th, uniform over western Europe and over these Islands, the 8 A.M. readings varying from 55° at Liverpool to 45° at Yarmouth.

Wind southerly on most of our coasts, but fresh northerly again in W. Ireland, while north-westerly breezes are reported over Norway, strong northerly in Sweden, and variable breezes in France. Wind south-easterly in N. later.

Sea moderate to slight, except at Mullaghmore and Scilly. Barometer rising slightly in N. Germany, falling elsewhere,—rather briskly over Ireland, where an elongated depression appeared moving south-eastwards to Bristol Channel during day.

Sunday, May 18.

Weather fine over the Baltic and at a few of the Dutch and French stations, cloudy and unsettled generally, with rain in many parts of these Islands; snow in the N. of Sweden.

Temperature fallen except over the Netherlands; varying over these Islands from 51° at Scilly to 41° at Aberdeen. Thermometer low all day especially in N.E.

Wind westerly over the Channel, southerly to south-easterly over the S.E. of England, easterly in the N., and northerly in the W.; strong in force in the W. and S.W., light elsewhere. Shifting to E. in the S. later on.

Sea moderate to slight except at Scilly and Jersey.

Barometer recovering slightly in S. Ireland, falling elsewhere, briskly over England and France. Depression shown over south-western England, but moving south-eastwards over France during day, and barometer rising slightly in its rear.

Monday, May 19.

Weather still moderately clear in N. Germany and the Netherlands, cloudy or dull in nearly all other places. Some rain in Ireland and the W. and N.E. of England during day, but weather improving about London.

Temperature little changed at 8 A.M., risen slightly in W., fallen in N. and E. Readings varying from 51° in the S.W. to 41° in the N.E. Maximum day temperature slightly exceeding 60° in the S. and S.E. of England.

Wind variable, southerly on our N.W. coasts, north-westerly in the S.W. and over the W. of France, and northerly elsewhere. Light to moderate except in the S.W., southerly breeze extending eastward later.

Sea rough at Scilly and Rochefort, nearly smooth on the other coasts.

Barometer falling on the eastern shores of the North Sea and on our extreme western coasts, rising elsewhere, briskly in Sweden. Pressure high over Sweden and Spain, low of the Hebrides and also over the Netherlands and E. of France.



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: \gg = a heavy gale; \gg = a gale; \rightarrow = a fresh to strong breeze; \rightarrow = a light to moderate breeze; and \circ = 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," the readings at certain places being given in figures. Diagonal lines = rough sea, the shading being proportional to the disturbance.

(Signed) ROBERT H. SCOTT,
Secretary.METEOROLOGICAL OFFICE,
116, VICTORIA STREET, S.W.

APPENDIX XII.

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, Dunbeath, Portmahomack, Cromarty, Avoch, Nairn, Burghead, Portessie, Port Knockie, Portsoy, Whitehills, Gardenstown, Roseheart, 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, Swausea, Angle, Milford, Abersoch.

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

Isle of Man.—Port St. Mary, Peel.

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

Ireland, east coast.—Cushendall, Belfast, Bangor, Strangford, Ardglass, Carlingford, Greenore, Dundalk, Malahide, Howth, Kingstown (2).

Ireland, south coast.—Dungarvan, Kinsale, Castletownsend, Crookhaven.

Ireland, west coast.—Valencia, Dingle, Tralee, Tarbert, Kilcredane, Elly Bay, Ballina, Tribane, Killybegs, Teelin, 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 -	-	-	-	-	63
Scotland -	-	-	-	-	50
Ireland -	-	-	-	-	34
					<hr/>
					147
					<hr/>

APPENDIX XIII.

DONATIONS RECEIVED DURING THE YEAR ENDING 31 MARCH 1879.

Presented by Societies, Institutions, &c.

Adelaide	-	Observatory - -	Meteorological Observations, 1877, Jan.—May 1878.
Algiers	-	Service météorologique de l'Algérie.	Bulletin Météorologique, 1878.
Allahabad	-	Met. Reporter of the N.W. Provinces.	Rainfall Returns from N.W. Provinces and Oudh, 1877-8, and abstracts of observations, 1877-8.
Aschaffenburg	-	K. Först-academie - -	Beobachtungs-Ergebnisse der im Königreich Bayern zu fürstlichen Zwecken errichteten meteorologischen Stationen, Jan. and Feb. 1878.
Barbados	-	- - -	Meteorological Observations, 1878, Jan. and Feb. 1879. Abstracts of do., 1877. Rainfall, 1878.
Batavia	-	Observatory - -	Contributions to the Meteorology of the Coast of Atjeh.
Berlin	-	K. Hydrographisches Bureau.	Nachrichten für Seefahrer.
		" " "	Annalen der Hydrographie und maritimen Meteorologie.
		K. Statistisches Bureau -	Preussische Statistik. No. 47 : Monthly means of Pressure, Temperature, &c. for 1877.
Bombay	-	Colaba Observatory -	Meteorology of the Bombay Presidency, with charts and diagrams. Report for the year ended June 30, 1878, with Review of the last 10 years.
Brussels	-	Observatoire Royal -	Annales, 1877, pp. 49-64; 1878, pp. 1-28.
		" "	Bulletin Météorologique, 1878.
		" "	Observations Météorologiques faites aux Stations Internationales, 1878.
Calcutta	-	Meteorological Office -	Abstract of Observations, Dec. 1877-Dec. 1878.
		"	Weekly Report of Rainfall, 1878, and Jan. and Feb. 1879.
		"	Telegraphic Reports, 1878, Jan. and Feb. 1879.
		"	Results of Observations at Alipore, 1878, and Jan. and Feb. 1879.
		"	Abstract of do., 1878, and Jan. 1879.
		"	Administration Reports, 1877-8.
		"	Report on the Meteorology of India in 1876.
		"	Report to the Congress at Rome on Hourly Meteorological Observations within the Tropics.
		"	Indian Meteorological Memoirs, Vol. I., Part II.
		"	Catalogue of the recorded Cyclones in the Bay of Bengal up to the end of 1876.
Carlsruhe	-	Meteorologische Central-Station.	Jahresbericht, 1877.
			Übersicht der Resultate, 1877-8.

Christiania	-	Norske Meteorologiske Institut.	Reports to the Congress at Rome:— a. Über Grösse und Aufstellung des Regenmessers. b. Weyprecht's Plan:—Establishment of Stations round the Pole. c. Entlegene Stationen. Meteorologisk Aarbog, 1876.
		" "	On the Meteorological Observations made in the Norwegian Deep-sea Research Expedition, 1876-7.
		" "	Oversigt over Veirforholdene i Norge, 1877.
Coimbra	-	Observatorio - - -	Observações, Meteorologicas e Magneticas, 1877.
Colombo (Ceylon).	-	Surveyor General's Office	Results of Meteorological Observations at Ceylon, 1878. Results of Observations in Colombo during 1878. Rainfall in Ceylon, during 1877; and Means during eight years.
Copenhagen	-	Danske Meteorologiske Institut.	Bulletin Météorologique du Nord, 1877
		" "	Rapport sur les Cartes Synoptiques (to the Congress at Rome).
		" "	Weitere Bemerkungen über die Luftdruckvertheilung im Winter.
		" "	Nautisk-Meteorologisk Konferencø i Kjøbenhavn, 1878.
		" "	Vertheilung des Luftdruckes über den N. Atlantischen Ocean während des Winters, &c. Das Wetter auf Island im Winterhalbjahre, 1877-78
		" "	Havets stromninger ved Island.
		" "	Hovedtroeffene i Danmarks Klima.
		" "	Weather Charts, 1877. Maanedsoversigt over Veirforholdene, March 1878 to Feb. 1879. Meteorologisk Aarbog, 1876, Part 2; 1877, Part 1.
		K. Danske Videnskaberne Selskab.	Forhandlinger, 1876, Part 3; 1877, Part 3; 1878, Part 1.
Cordova	-	Observatorio Nacional	Anales, Vol. 1.
Cracow	-	K.K. Sternwarte - - -	Meteorologische Beobachtungen, Feb. 1878 to Feb. 1879. Resultate 1878. Materyaly do Klimatografii Galicyi, 1877.
Cronstadt	-	Compass Observatory -	Russian Nautical Compendium, 1878.
Dorpat	-	Meteorolog. Observatorium der K: Universität.	Meteorologische Beobachtungen, 1876.
Dublin	-	General Register Office -	Weekly and Quarterly Returns of Marriages, Births, Deaths, &c.
Eberswalde (Prussia).	-	K. Först-akademie -	Jahresbericht, 1877. Beobachtungs-Ergebnisse, 1878.
Edinburgh	-	Royal Society - - - Scottish Meteorological Society.	Proceedings, Session 1877-8. Journal, Nos. 55-56.
Fiume	-	I. R. Academia di Marina	Osservazioni delle Statione Meteorologica, 1878. Risultati, 1878.
Geneva	-	Bibliothèque Universelle Société Géographique -	Archives des Sciences, Vols. 62-63. Troisième Période, Vol. I., Nos. 1-3. Le Globe, Vol. XVI., No. 4; Vol. XVII., Nos. 1-4.

Göttingen	-	K. Sternwarte	-	-	Veröffentlichungen von der K. Sternwarte zu Göttingen.
Gotha	-	Geographische Anstalt	-	-	Mittheilungen, and Ergänzungsheft.
Greenwich	-	Royal Observatory	-	-	Weekly Returns to the Registrar-General.
		"	-	-	Daily Weather Report.
		"	-	-	Reduction of 20 years' Photographic Records of the Barometer (1854-73), and Dry and Wet Bulb Thermometers, (1849-68), and 27 years' Observations of the Earth Thermometers (1847-73).
Hamburg	-	Seewarte	-	-	Wetterbericht.
		"	-	-	Monatliche Übersicht der Witterung, Oct. 1877—Feb. 1878. Bericht über eine Konferenz in Hamburg (on Weather Telegraphy, &c.).
		"	-	-	Bericht über die Pflege der maritimen Meteorologie in Deutschland (to the Congress at Rome).
Havana	-	Observatorio Magnético y Meteorológico.			Apuntes relativos a los Huracanes de las Antillas en Setiembre y Octubre de 1875 y 1876.
Hobarton	-	Royal Society of Tasmania			Meteorological Observations, 1878. Results, 1877.
		"	"		Synchronous Observations, 1878. Report, 1876.
Hong Kong	-	Government Lock Hospital			Meteorological Observations in Victoria, 1878.
		Harbour Office	-	-	China Coast, Meteorological Register, Jan. 1878 to Feb. 1879.
Kew	-	Observatory	-	-	Report of the Kew Committee for year ending 31st Oct. 1878.
Kiel	-	Ministerial-Commission zur Untersuchung der deutschen Meere.			Ergebnisse der Beobachtungs-Stationen an den deutschen Küsten, March 1877 to May 1878. Biologische Beobachtungen bei künstlichen Aufzucht des Herings der westlichen Ostsee.
Kremsmünster		Sternwarte	-	-	Resultate der meteorologischen Beobachtungen 1860, 1863. Über die mittlere Temperatur von Kremsmünster.
Leicester	-	Literary and Philosophical Society.			Transactions, Part 4. Report, to 18th June 1878.
Leipzig	-	Sternwarte	-	-	Meteorologische Beobachtungen in Deutschland angestellt an 17 Stationen II. Ordnung, 1876. Monatliche Berichte über die Resultate, &c. an den k. sächsischen Stationen, 1877. Resultate, &c. in Leipzig, 1877. Protokolle der Verhandlungen des permanenten Comités, Utrecht, 1878.
		"	-	-	Über das Meteorologische Bureau für Witterungsprognosen im Königreich Sachsen.
Lemberg	-	Universität	-	-	Meteorologische Beobachtungen, March 1875—March 1878.
Limoges	-	Commission Météorologique de la Haute Vienne.			Discussion des Orages de 1876, par F.F. Hébert.

Lisbon -	Observatory - - -	Postos Meteorologicos, 1875; 1876, Part 1.
	„ - - -	Boletim Meteorologico, 1878. Observações das Estações Internacionais Portuguezas, 1875-8. Resumo das principais Observações Meteorologicas, &c. Lisboa, 1856-75.
	„ - - -	Annaes, Vols. XIII. and XIV.
London -	Admiralty - - -	Temperatura do ar em Lisboa, 1856-73. Tide Tables for 1879. Hydrographic Notices. Nautical Almanac, 1878-9. Report for 1877.
	Army Medical Department	Report of Wrecks, Casualties, &c. from July 1876 to June 1877.
	Board of Trade - - -	Report for 1877.
	British Association - - -	Returns from various colonies.
	Colonial Office - - -	Returns from various Observers in India.
	India Office - - -	Report for 1877.
	Medical Department of the Navy.	Quarterly Journal, Parts 25-29.
	Meteorological Society -	Catalogue of Library.
	Museum of Practical Geology.	
	Post Office - - -	Twenty-fourth Report of the Postmaster General.
	Royal Astronomical Society	Monthly Notices.
	Royal Geographical Society	Proceedings, Vol. XXII., Nos. 2-6; Vol. I. (New Series), Nos. 1-4. Journal, Vols. 46 and 47.
	Royal Institution of Great Britain.	Proceedings, No. 68.
	Royal National Lifeboat Institution.	Journal, Nos. 108-111.
	Royal Society - - -	Proceedings, Nos. 186-193.
	Royal United Service Institution.	Journal Nos. 94-98. Index to Vols. XI.-XX.
	Society of Arts - - -	Journal, Nos. 1323-1375.
	Standards Department (Board of Trade).	Equivalents of Metric and Imperial Weights and Measures, Tables 1-4.
Lyon -	Commission de Météorologie.	Reports, 1874-6.
Madrid -	R. Observatorio - - -	Daily Weather Reports, 1878.
Manila -	Observatorio Meteorologico.	Observaciones, 1871, 1876.
Marlborough	Natural History Society -	Summary of the Weather for 1877.
Mauritius -	Observatory - - -	Synoptic Weather Charts of the Indian Ocean, Feb. 1861.
Meibourne -	Flagstaff Observatory -	13th Report of the Board of Visitors.
	„ - - -	Monthly Record of Results of Observations in Meteorology, &c., Nov. 1877 to Sept. 1878.
Mexico -	Observatorio Meteorológico Central.	Anales del Ministerio de Fomento, Tom. III. Revista Meteorológico Mensual, Feb. to June 1878. Boletín de Ministerio de Fomento.
	„ „	Synchronous Observations, Jan. to May 1878.
Milan -	Observatorio Reale - - -	Corrispondenza Astronomica (Publication No. VI.).
Modena -	Società Meteorologica Italiana.	Annuario, Nos. 11-32.
Moncalieri -	Observatory - - -	Buletino Meteorologico.
	„ - - -	Osservazioni Meteor. fatte nelle stazioni presso le Alpi et gli Appennini. Results of do. for 1874-5 and 1875-6.

Moncalieri	-	Observatory - - -	Asservazioni delle Meteore Luminose, 1875-9, and other smaller papers.
		" - - -	Corrispondenza Meteorologica Italiani Alpini—Appennina. Riviste mensuali di Meteorologia agraria, 1876-7.
Munich	-	K. Meteorologische Bureau	Instructions for Meteorological Observers.
Naples	-	Observatorio Astronomico	Bulletino Meteorologico, 1877.
Neuchatel	-	Société des Sciences Naturelles.	Bulletin, Tom. XI. Cahier II.
New York	-	Central Park Observatory	Abstract of Registers from S. R. Instruments. 1878.
		" " -	Annual Tables, 1877-8. The total Solar Eclipse of July 29, 1878.
		" " -	Report, 1877.
Nice	-	Société de Médecine et de Climatologie.	Nice-Médical.
Palermo	-	R. Osservatorio - -	Bullettino Meteorologico, 1876-7.
Paris	-	Académie des Sciences -	Comptes-Rendus Hebdomadaires.
		Association Scientifique de France.	Bulletin Hebdomadaire, Nos. 542-595.
		Bureau des Longitudes -	Annuaire, 1878.
		Dépôt des Cartes et Plans	Annales Hydrographiques.
		" "	Phares des Côtes.
		" "	Atlas des Routes, Vents, et Courants Généraux, by M. de Kerhallet.
		Ministère de la Marine, &c.	Revue Maritime et Coloniale, Nos. 198-210.
		Observatoire de Paris -	Bulletin International.
		Observatoire de Montsouris.	Annuaire Météorologique, 1879.
		Service Hydrométrique (Seine).	Résumé des Observations Centralisées, 1876.
		" "	Observations sur les Cours d'Eau et de la Pluie, 1876.
		Société Météorologique -	Nouvelles Météorologiques, Part I., Dec. 1872-Nov. 1873; April-Nov. 1874. Part II., 7-17, 1873; 10-16, 1874.
		" "	Annuaire:
		" "	Vol. Bulletin. Tab. Met. 26 3-32 1-3
		" "	La Quinzaine Météorologique, 1877, pp. 145-240.
Pekin	-	Customs - - -	Medical Reports, Half-years ended 30th Sept. 1877 and 31st March 1878.
Perth (W. Australia).	-	Surveyor-General's Office	Meteorological Report, 1877.
Perpignan	-	Commission Météorologique.	Bulletin, 1876.
Pesaro	-	Observatorio Meteorico e Magnetico.	Diagram of Mag. and Met. Observations, Sept. 1877, to Feb. 1878.
Pesth	-	K. Ung. Central-Anstalt für Meteorologie und Erdmagnetismus.	Jahrbuch, 1876.
Philadelphia	-	American Phil. Society -	Proceedings, Nos. 100-101.
		Franklin Institute - -	Journal, Nos. 628-639.
Pola	-	K.K. Hydrographisches Amt.	Meteorologische Beobachtungen, March to Dec. 1878.
		" "	Jahresbericht, 1878.
		" "	Mittheilungen aus dem Gebiete des Seewesens.
Porto Rico	-	Department of Public Works.	Resumen de las observaciones meteorológicas, May 1874 to June 1875 and July 1876 to Dec. 1878.

Prague	-	K.K. Sternwarte	-	-	Astronomische, magnetische und meteorologische Beobachtungen, 1877.
Rome	-	Ministero d'Agricoltura, &c.			Memorie e Notizie, 1878. I. & II.
		"	"		Meteorologia Italiana, 1877, pp. 257-372; 1878, pp. 1-376.
		Ministero dell' Interno	-		Bolletino Idrographico, Parts 4-9.
		Osservatorio del Collegio Romano.			Bullettino Meteorologico, Vol. XVI., Nos. 11-12; Vol. XVII., 1-9, 11.
Rugby	-	Natural History Society	-		Memorial of M. Secchi. Report, 1877.
San Fernando	-	Observatory	-		Anales, 1875-6.
St. Petersburg	-	Central Physical Observatory.			Annalen, 1876-7. Meteor. Bulletin, 1878. Jahresbericht, 1875 and 1876. Repertorium. Band VI. Heft 1.
		"	"		Sturmbahnen der Jahre 1875-7 by Lt. J. Spindler. Über die Bodentemperaturen in St. Petersburg und Nukuss. Rapports succinets sur quelques articles du Programme du Congrès à Rome en 1879. Controll-Barometer. Aufstellung der Thermometer zur Bestimmung der wahren Lufttemperatur.
		"	"		Über die Bestimmung der absoluten Inclination mit dem Inductions-Inclinatorium. Vergleichung der Normal-barometer aller Meteor. Institute in Europa. On the determination of the direction of a Barometric Minimum. Description of Pawlowsk Observatory.
Santiago	-	Officina Central Meteorologica.			Anuario, 1869-70.
		"	"		Meteorological Diagrams, 1870-72; 1861-74.
Singapore	-	Convict Jail Hospital	-		Meteorological Observations and register of rainfall, 1877. Abstracts for 1873-5.
Stuttgart	-	Meteorological Station.	Central		Übersicht über die Witterungsverhältnisse, &c., July 1876 to Dec. 1877. Results for 1876-7.
Sydney	-	Observatory	-		Meteorological Observations, April, Oct., Nov. 1876; July to Sept. 1877.
		Royal Society, N.S.W.	-		Journal and Proceedings, 1877, Vol. XI.
		"	"		Remarks on the Sedimentary Formations of N.S. Wales, by the Rev. W. B. Clarke, M.A.
Syracuse	-	Observatory	-		Osservazioni Meteorologiche, Jan. 1878 to Feb. 1879.
Tiflis	-	Observatory	-		Materialien zu einer Klimatologie des Kaukasus, 1876-8.
Токей (Japan)		Imperial Meteorological Observatory.			Meteorological Observations, 1877-8; Sept. 1872 to Nov. 1877.
Toronto	-	Education Office	-		Report of the Normal, Public, High, and Model Schools of Ontario, 1877.

Toronto	-	Meteorological Office	-	Monthly Meteorological Register, 1877
		"	"	General Meteorological Register, 1877-78.
		"	"	Monthly Weather Review, March 1878 to Feb. 1879.
		"	"	Report of the Meteorological Service of the Dominion of Canada, 1877.
		"	"	Instructions to Observers.
Trieste	-	R. Accademia di Commercio e Nautica.	-	Osservazioni Meteorologiche, Dec, 1877—Jan. 1879.
Turin	-	R. Osservatorio Astronomico.	-	Bollettino Meteorologico 1877, and some astronomical papers.
Upsala	-	Observatoire	-	Bulletin Météorologique Mensuel.
Utrecht	-	K. Nederlandsch Meteor. Instituut.	-	Meteorologisch Jaarboek, 1869, I. 1873, II. 1877, I. Monthly Wind Charts of North Atlantic Ocean. June to November.
		"	"	De winden op de kust van Atjeh. Sailing Directions, Channel to Java, 1877. Reizen van Australie to Java, 1872. Reports to the Congress at Rome on Simultaneous Observations; Observations in Polar Regions; Reduction of means of observations to true means. Report of Permanent Committee, 1878.
Vienna	-	Adria Commission	-	Vierter Bericht, 1871-3.
		K. K. Central-Anstalt für Meteorologie, &c.	-	Beobachtungen, February 1878 to January 1879. Meteor. Beobachtungen, an 10 Stationen in Oesterreich, 1878, Jan. to Nov. Internationaler telegraphische Wetterbericht 1878. Bemerkungen und Vorschläge zu den gegenwärtigen Grundlagen der Wetterprognose. Bericht über die Beobachtungen auf hohen Bergen und im Luftballon. Zur Meteorologie der Alpengipfel. Über die täglichen Schwankungen des Luftdruckes, von Karl Kreil. Über die Aufgaben der Meteorologie der Gegenwart. Über den Luftdruck zu Wien. Bericht über die Fortschritte der geographischen Meteorologie.
		K.K. Geographische Gesellschaft.	-	Mittheilungen, 1876-7.
		Oesterreichische Gesellschaft für Meteorologie.	-	Zeitschrift.
		K. K. Sternwarte	-	Meteor. Beobachtungen, 1874-6.
Washington	-	Department of Agriculture	-	Report of Commissioner 1867, 1874, 1876.
		"	"	Monthly Reports, 1868, 1873.
		Hydrographic Office	-	Meteorological Charts of the N. Pacific. Remarks on Nordenskiöld's voyage along the N. coast of Siberia.
		U.S. Geological Survey	-	Geological Survey of the Territories for 1867-8-9; of Wyoming, 1870; Colorado, &c. 1874-5.
		War Office	-	Daily Weather Reports, 1878. Daily Bulletin, Synopses, Probabilities, and Facts, Sept., Oct. 1874; Feb. to Dec. 1878; Jan., Feb. 1879.
		"	"	Bulletin of International Synchronous Meteor. Observations, April 1877 to June 1878. Monthly Weather Review. Report 1877.

Wellington, N.Z.	Observatory - - -	Abstract of Meteorological Observations in New Zealand, Aug. 1877 to Feb. 1878. Meteorological Observations at Wellington, July 1877 to April 1878.
York - -	Philosophical Society -	Annual Report for 1877.
Zi-ka-wei -	Observatory - - -	Bulletin Mensuel, Sept. 1874 to July 1878. Magnétisme, 1874-5. Recherches sur les Variations des Vents.
Zürich - -	Meteor. Central-Anstalt der schweizerischen naturforschenden Gesellschaft.	Meteorologische Beobachtungen: 1876, pp. 289-366 1878, „ 9-240 1879, „ 1-28

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Aksel, S. S. - -	-	Ein Beitrag zur climatologie Novaja Semlia's.
Allison, F. - -	-	General Meteorological Register for 1877, for Halifax, Nova Scotia.
Astrand, J. J. - -	-	Manouever for at klare en Orkan af Capt. C. T. Petersen.
Blasius, W. - -	-	Meteorological Method. Causes of the Huron Disaster.
Boltshauser, Prof. G. A. -	-	Descrizione di Alcuni rari Fenomeni Atmosferici.
Carl, Dr. P. - -	-	Repertorium für Experimental-Physik. Bd. XIV., Nos. 5-12. Bd. XV., 1-3.
Carlier, H. - -	-	Comparison des seize directions et de l'intensité du vent du 1 Decembre 1866—30 Nov. 1877 à St. Martin-de-Hinx (Landes). Essai de Climatologie.
Carpmael, Chas., M.A., F.R.A.S.	-	On the reduction of the Barometer to Sea Level (with tables).
Collazó, J. - -	-	Metódo ozonométrico.
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Danckelmann, Baron - -	-	Die meteor. Beobachtungen der Güssfeldt'schen Loango-Expedition.
De La Rue, W., F.R.S. - -	-	Das Oberengadin in seinem Einfluss auf Gesundheit und Leben, by Dr. J. M. Ludwig.
De Rance, C. E., F.G.S. - -	-	The Secondary Rocks of England, as a Source of Water Supply for Towns and Districts.
Dunlop, W. H. - -	-	Abstract of Meteorological Observations made at Annanhill during the year 1878.
Ebermayer, Prof. E. - -	-	Reports to the Congress at Rome. I. On the methods for determining Earth Temperature. II. On the progress in methods for determining Evaporation.
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Ekman, G. - -	-	Hydrografiska vinterobservationer vid Bohuskusten.
Everett, Prof. J. D., F.R.S.	-	Report on Atmospheric Electricity.
Ferrari, G. St. - -	-	Meteorologia Romana, 1878.
Freedon, W. H. v. - -	-	"Hansa."

Hasselt, Lt. W. van	-	On the magnetic Coefficients of Iron Ships.
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Hellmann, Dr. G.	-	On the Meteorological Organizations of the principal European States. Vergleichung der Normalbarometer von St. Petersburg, &c., &c. On Dust-falls which frequently occur in the Atlantic.
Hildebrandsson, H. H., et Rundlund, C. A.	-	Prise et Débacle des lacs en Suède, Automne 1871. Printemps 1877.
Hiru, G. A.	-	Étude sur une classe particulière de Tourbillons.
Hürichs, Dr. G.	-	Iowa Weather Bulletin, Vol. I., March, Oct. 1878. Second Annual Report, 1877.
Hooker, Sir J. D., C.B., K.C.S.I.	-	Addresses delivered at the Anniversary Meeting of the Royal Society, 1874-78.
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Jevons, W.S., LL.D., F.R.S.	-	On the movement of microscopic particles suspended in liquids.
Krümmel, Dr. O.	-	Die Vertheilung der Regen in Europa. Die mittlere Tiefe der Océane, &c.
Kopp, H.	-	Einiges über Witterungs-angaben.
La Cour, P.	-	Resumé du Journal météorologique du célèbre Astronome Tyco Brahe, tenu à Uraniborg, île de Hyeen, pendant les années 1582-1597.
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Lorenz, Ritter von Liburnau, Dr. J. R.	-	Report to the Congress at Rome on the possible development of Agriculture and Forestry.
Lowe, E. J., F.R.S.	-	Tables of Rainfall at Highfield House Observatory, Nottingham, and various other places adjacent, 1840-1878.
Luvini, G.	-	Intorno alla Induzione Elettrostatica. Una sperienza di Magnetismo.
Malden, C.	-	Rainfall at St. Lawrence Rectory, Isle of Wight, 1868-77.
Marriott, W.	-	Sur le Psychromètre.
McLandsborough, J., C.E., F.R.A.S., F.G.S.	-	Meteorology of Bradford, 1878.
Melsens, M.	-	Quatrième et Cinquième Notes sur les Paratonnerres. Notice sur le coup de foudre de la Gare d'Anvers du 10 Juillet, 1865.
Merrifield, J., LL.D., F.R.A.S., F.M.S.	-	Meteorological Summary of Observations taken at Plymouth during 1878.
Miller, S. H., F.R.A.S., F.M.S.	-	Prize Essay on Evaporation. The motion of Storms; or Science of Sailors.
Mübry, Dr. A.	-	Über die exacte Natur-Philosophie.
Negretti and Zambra	-	Catalogue of Instruments.
Niepee, Fils, Dr. A.	-	Des Climats et en particulier de celui de Nice.
Nipher, F. E.	-	Missouri Weather Bulletin, December 1877-February 1879. On the determination of the true Rainfall by elevated Gauges.
Pearson, Rev. J., M.A.	-	Computation of Tides at Fleetwood.
Pernet, Dr. J.	-	Report to the Congress at Rome. Über die Bestimmung der Fixpunkte der quecksilber normal Thermometer und die Messung der Temperaturen.
Plantamour, Prof. E.	-	Résumé météorologique de l'année 1877 pour Genève et le Grand Saint-Bernard.
Prestel, Dr.	-	Ergebnisse der Beobachtungen auf dem meteor. Observatorium zu Emden, 1878.
Rikatscheff, Capt.	-	Die Vertheilung der Winde über dem baltischen Meere.
Richards, W. H.	-	Abstracts of the Weather at Penzance and the Neighbourhood, 1878.

Riecke, Dr. K. v. - -	Hailstorms and Damage by them in Württemberg, 1828-1877.
Robinson, Rev. T. R., D.D., F.R.S.	On the determination of the Constants of the Cup Anemometer by experiments with a whirling machine.
Rowell, G. A. - -	Letters on Meteorological Phenomena.
Reyes, V. - -	La Tempestad, 7-8 Abril 1878.
Schück, Capt. A. - -	Technological Dictionary. Part II.
Scott, R. H. - -	Cartes du Temps et Avertissements de Tempêtes, by MM. Zurcher et Margollé.
Seeland, F. - -	Magnetische und Meteorologische Beobachtungen, March 1878 to February 1879.
Stewart, Prof. B., LL.D., F.R.S. - -	On the variation of the Diurnal Range of the Magnetic Declination as recorded at the Prague Observatory. On the Diurnal Range of the Magnetic Declination as recorded at the Trevandrum Observatory. Suspected relation between the Sun and Planets.
Symons, G. J., F.R.S. -	Monthly Meteorological Magazine, April 1878-March 1879. British Rainfall, 1877.
Tarry, H. - - -	Echange de Télégrammes Météorologiques entre l'Europe et l'Afrique, &c.
Violle, J. - - -	Mémoire sur la temp. moyenne de la Surface du Soleil. Mesures actinométriques relevées en Algérie pendant l'été de 1877. La chaleur solaire. Rapport pour le Congrès à Rome relative à une méthode pour mesurer la radiation.
Walker, Col. J. T., C.B., F.R.S.	General Report of the Great Trigonometrical Survey of India.
Weyprecht, Lt. C. -	Observations taken during the Austro-Hungarian Arctic Expedition, 1872-74.
Whipple, G. M., B.Sc., F.R.A.S., F.M.S.	On the Comparison of the Standard Barometers of the Royal Observatory, Greenwich, and the Kew Observatory. On the determination of the scale value of a Thomson's Quadrant Electrometer used for registering the Variations in Atmospheric Electricity at the Kew Observatory. On the relative duration of Sunshine at the Greenwich and Kew Observatories during 1877.
Wills, F., F.C.S. - -	Three lectures on Explosions in Coal Mines.
Wilson, C. J. - - -	History of Meteorological Research in India, with observations made at Aden from 1847-1850.
Woeikof, A. - - -	Mémoire explicatif pour les Cartes et Diagrammes à l'Exposition universelle à Paris.

APPENDIX XIV.

METEOROLOGICAL OFFICE : ACCOUNT OF RECEIPTS AND PAYMENTS for the year ending 31st March 1879.

RECEIPTS.			PAYMENTS.		
	£	s. d.		£	s. d.
Balance from year 1877-8	-	539 3 0	ADMINISTRATION:		
Parliamentary Vote	-	14,500 0 0	Payment of Council	-	1,000 0 0
Sale of Instruments:—			Secretary	-	800 0 0
Royal Navy Account (A)	£	s. d.			1,800 0 0
Mercantile Marine do. (B)	-	84 16 9	Special Researches and Experiments	-	270 3 11
Commissions executed for Colonial and Foreign Institutions, &c. (C)	-	77 4 10	OFFICE EXPENSES:		
			Salaries and Wages	-	712 10 8
			Rent, fuel, and lighting	-	576 8 7
			Incidental and Contingent Expenses	-	387 0 8
					1,675 19 11
			LAND METEOROLOGY:		
			Observatories and other Stations	-	2,433 19 1
			Discussion and Reduction of Observations	-	1,361 19 0
					3,795 18 1
			WEATHER TELEGRAPHY:		
			Telegrams, Storm Warnings and Reports	-	3,148 5 9
			Inspectors	-	292 18 1
			Preparation, issue, and discussion of Weather Reports	-	1,266 4 4
					4,707 8 2
			OCEAN METEOROLOGY:		
			Supply of Instruments, and other Expenses:		
			Royal Navy	-	353 11 0
			Mercantile Marine	-	571 17 1
			Distant Island (and Coast) Stations	-	51 9 6
			Reduction and Discussion of Observations and care of Instruments	-	1,737 9 7
					2,714 7 2
			Commissions executed for Colonial and Foreign Institutions, &c.	-	817 14 0
					15,781 11 3
			Balance:		
			Cash in hand	-	211 12 6
			Bank of England	-	1,435 12 7
			Advance to Valencia Observatory	-	50 0 0
					1,727 5 1
					£17,508 16 4
					£17,508 16 4

APPENDIX XIV.

METEOROLOGICAL OFFICE: ACCOUNT OF RECEIPTS AND PAYMENTS for the year ending 31st March 1879.

RECEIPTS.			PAYMENTS.		
	£	s. d.		£	s. d.
Balance from year 1877-8	-	509 3 0	ADMINISTRATION:	£	s. d.
Parliamentary Vote	-	14,500 0 0	Payment of Council	-	1,000 0 0
Sale of Instruments:—			Secretary	-	800 0 0
Royal Navy Account (A)	-	84 16 9			1,800 0 0
Mercantile Marine do. (B)	-	77 4 10	Special Researches and Experiments	-	270 3 11
Commissions executed for Colonial and Foreign Institutions, &c. (C)	-	790 13 6	OFFICE EXPENSES:		
			Salaries and Wages	-	712 10 8
Subscriptions for Daily Weather Charts	-	231 5 11	Rent, fuel, and lighting	576 8 7	
Hourly Readings of S.R. instruments	-	12 0 0	Incidental and Contingent Expenses	-	387 0 8
Danish Synoptic Charts	-	12 10 0			1,675 19 11
		255 15 11	LAND METEOROLOGY:		
Supply of Meteorological Information:—			Observatories and other Stations	-	2,433 19 1
Telegrams	-	603 17 2	Discussion and Reduction of Observations	1,361 19 0	
Weather Charts, Remarks, &c.	-	370 3 11			3,795 18 1
Ocean Statistics	250 0 0		WEATHER TELEGRAPHY:		
Miscellaneous	-	16 14 9	Telegrams, Storm Warnings and Reporters	-	3,148 5 9
		1,240 15 10	Inspectors	-	292 18 1
Commission charged on work done for Colonial and Foreign Institutions, &c.	-	30 3 3	Preparation, issue, and discussion of Weather Reports	-	1,266 4 4
Sundry small items	-	20 3 3			4,707 8 2
			OCEAN METEOROLOGY:		
			Supply of Instruments, and other Expenses:		
			Royal Navy	-	353 11 0
			Mercantile Marine	-	571 17 1
			Distant Island (and Coast) Stations	-	51 9 6
			Reduction and Discussion of Observations and care of Instruments	-	1,737 9 7
					2,714 7 2
			Commissions executed for Colonial and Foreign Institutions, &c.	-	817 14 0
					15,781 11 3
			Balance:		
			Cash in hand	-	241 12 6
			Bank of England	-	1,435 12 7
			Advance to Valencia Observatory	-	50 0 0
					1,727 5 1
					£17,508 16 4
					£17,508 16 4

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of the Meteorological Committee.

OFFICIAL.

- No. 1. Report for 1867. Presented to Parliament. 1s.
2. Instructions for Meteorological Telegraphy. New Edition. (1875.) 6d.
3. Fishery Barometer Manual. 6d.
4. Charts of Surface Temperature, South Atlantic Ocean. 2s. 6d.
5. Report for 1868. Presented to Parliament. 5d.
6. Report for 1869. Presented to Parliament. 10d.
7. Quarterly Weather Report for 1869.—Parts I. to IV. 5s. each.
8. Barometer Manual. 1s. [New Edition in the Press.]
9. Quarterly Weather Report for 1870.—Parts I. to IV. 5s. each.
10. Report for 1870. Presented to Parliament. 10d.
11. Contributions to our Knowledge of the Meteorology of Cape Horn and the West Coast of South America. 2s. 6d.
12. Currents and Surface Temperature of the North Atlantic Ocean, from the Equator to Lat. 40° N., for each month of the year, with a General Current Chart. 2s. 6d.
13. A Discussion of the Meteorology of the Part of the Atlantic lying North of 30° N. for the Eleven Days ending 8th February 1870. Price, with Book of Charts, 5s.
14. Quarterly Weather Report for 1871.—Parts I. to IV. 5s. each.
15. Report for 1871. Presented to Parliament. 10d.
16. Quarterly Weather Report for 1872.—Parts I. to IV. 5s. each.
17. Report for 1872. Presented to Parliament. 1s.
18. Contributions to our Knowledge of the Meteorology of the Antarctic Regions. 2s.
19. Quarterly Weather Report, 1873.—Parts I. to IV. 5s. each.
20. Charts of Meteorological Data for Square 3. Lat. 0° - 10° N. Long. 20° - 30° W., and Remarks to accompany the Monthly Charts, which show the Best Routes across the Equator for each Month, &c. 20s.
21. Report of the Proceedings of the Meteorological Congress at Vienna. 1s.
22. Report for 1873. Presented to Parliament. 4d.
23. Report of the Proceedings of the Conference on Maritime Meteorology held in London, 1874. 2s.

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25. Quarterly Weather Report for 1874.—Parts I., II., and IV. 5s. each. Part III., 5s. 9d.
26. Report for 1874. Presented to Parliament. 6d.
27. Charts of Meteorological Data for the Nine 10° Squares of the Atlantic which lie between 20° N. and 10° S., and extend from 10° to 40° W., with accompanying Remarks, ending with the best routes across the Equator. 24s.
28. Contributions to our Knowledge of the Meteorology of Japan. By Staff-Commander Thomas H. Tizard, H.M.S. *Challenger*. 1s.
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35. Report for 1877–8. 1s.
36. Report of the Proceedings of the Meteorological Congress at Rome. 1s. 6d.
37. Report on the Meteorology of Kerguelen Island. By the Rev. S. J. Perry, S.J., F.R.S. [In the press.]
38. Report for 1878–9. 5d.

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3. Report to the Committee on the Use of Isobaric Curves.—By Captain H. Toynbee, Marine Superintendent. 1s.
4. Routes for Steamers from Aden to the Straits of Sunda and back. Translated from a Paper issued by the Royal Meteorological Institute of the Netherlands. 6d.
5. On the Winds, &c. of the North Atlantic along the Tracks of Steamers from the Channel to New York. Translated from a Paper issued by the Deutsche Seewarte, Hamburg. 6d.
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8. Report on Weather Telegraphy and Storm Warnings. Presented to the Meteorological Congress at Vienna. 6d.

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