

METEOROLOGICAL
COMMITTEE MINUTES.

1876-77.

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MINUTES OF THE PROCEEDINGS

OF THE

METEOROLOGICAL COMMITTEE,

January 1876—July 1877.



LONDON:
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FOR HER MAJESTY'S STATIONERY OFFICE.

1877.

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Submitted—The following letter—
M.O. 2728.
Stone
I am directed by the Lords of the Committee of Council on Education to request you that their Lordships have received through Her Majesty's Secretary of State for Foreign Affairs, with a request that it might be forwarded to its proper destination; the accompanying testimonial or letter of distinction, awarded to the Meteorological Office of Great Britain by the International Geographical Congress which was held this year at Paris.
It is stated in the depositions of the witnesses that the testimonial awarded by the Congress to the Meteorological Office.

MINUTES OF PROCEEDINGS

OF THE

METEOROLOGICAL COMMITTEE.

Submitted—A Report by R. Beckley giving the account of his inspection of the observatories in 1875.
Reported—That the service of 6 p.m. reports for the "Times" had commenced on the 31st ult., and that on the 1st inst. the supply to the "Observer" of a weekly diagram of pressure, temperature, and weather had commenced.
At the request of the Committee, Mr. Scott was struck off the list for the supply of the Daily Weather Charts.

116, Victoria Street, January 3, 1876.

PRESENT :

Major-General Strachey in the Chair.

Mr. De La Rue.

Capt. Evans.

Mr. Galton.

The Director was in attendance.

The Minutes of last meeting (December 20) were read and confirmed.

Reported—That the following reply had been sent to the Royal Society as directed at last meeting—

SIR,

Meteorological Office, December 23, 1875.

I AM instructed by the Committee to inform you, in reply to your letter of the 17th inst., that it will give them the greatest pleasure to furnish the President and Council with a résumé of their proceedings since 1867.

At the same time I am to draw your attention to the fact that the Treasury Minute of which you enclose a copy appears to contain certain inaccuracies as to matters of fact which I am instructed to communicate to you.

As to paragraph 4, I would remark that it was at the commencement of 1855 that the Meteorological Department of the Board of Trade was formally organised, but that in a circular letter from that Board, signed by Mr. Booth in September 1854, it was stated that "Parliament has sanctioned a vote for instruments and for the tabulation of logs and other meteorological records, and Captain FitzRoy of the Royal Navy has been appointed to assist this Board in the discussion of the observations." I am further to say that the date of Admiral FitzRoy's death was in April 1865, and that the nomination of the Committee of Inquiry took place in November of that year.

With reference to paragraph 5, I am to observe that the statement that the Royal Society, "in return for an annual grant of 10,000L., agreed to appoint a committee," is hardly in accordance with the correspondence on the relations of the Society to the Meteorological Committee and to the Government respectively, as defined in the original letters from the Society to the Board of Trade of October 27, and from the Board of Trade to the Royal Society of December 5, 1866, (Parliamentary Paper No. 240, Session 1867,) or in the correspondence between certain Fellows of the Royal Society and the secretary, Dr. Sharpey, which passed in April 1869, and was published in the "Times" of May 3rd of the same year.

I am, &c.

(Signed) R. H. Scott,
Director.

The Summary of Work done in the Office was reconsidered and amended, and it was resolved to hold a meeting on Friday the 7th inst. for its final consideration.

Submitted—The following letter—

M.O. 2728.

SIR,

South Kensington Museum, December 23, 1875.

I AM directed by the Lords of the Committee of Council on Education to acquaint you that their Lordships have received through Her Majesty's Secretary of State for Foreign Affairs, with a request that it might be forwarded to its proper destination, the accompanying testimonial or letter of distinction, awarded to the Meteorological Office of Great Britain by the International Geographical Congress which was held this year at Paris.

It is stated in the despatch received from Lord Lyons that letters of this description are the highest testimonials awarded by the Congress to exhibitors.

I am, &c.

NORMAN MACLEOD.

To the Director,
Meteorological Office.

Mr. Scott reported that he had heard from Dr. Neumayer that the Conference at Hamburg on the 11th ult. had been attended by Professor Buys Ballot and Capt. Hoffmeyer, and he was instructed to forward to these gentlemen a copy of his remarks on the memorandum printed on the Minutes of last meeting.

Submitted—A Report by R. Beckley giving the account of his inspection of the observatories in 1875.

Reported—That the service of 6 p.m. reports for the "Times" had commenced on the 31st ult., and that on the 1st inst. the supply to the "Observer" of a weekly diagram of pressure, temperature, and weather had commenced.

At the request of the Commander, H.M.S. "Squirrel" was struck off the list for the supply of the Daily Weather Charts.

The following cheques for December were drawn on the 28th of that month on the signature of Captain Evans:

For Office:	£	s.	d.	£	s.	d.
Cole and Leigh, coals - - - -	-	-	-	7	5	0
C. W. Jacques, rent - - - -	-	-	-	133	13	0
For Observatories:						
D. Thomson, Aberdeen - - - -	-	-	-	*61	17	6
T. R. Robinson, Armagh - - - -	-	-	-	40	14	0
„ expenses for quarter - - - -	-	-	-	9	3	4
				49	17	4
W. P. Dymond, Falmouth - - - -	-	-	-	*65	12	6
Less waxed paper - - - -	-	-	-	9	10	0
				56	2	6
R. Grant, Glasgow - - - -	-	-	-	*61	17	6
H. Williams, Holyhead - - - -	-	-	-	2	13	6
S. Jeffery, Kew - - - -	-	-	-	62	10	0
„ Examination of Records - - - -	-	-	-	100	0	0
				162	10	0
C. Clouston, Orkney - - - -	-	-	-	3	0	6
G. H. Aird, Seaham - - - -	-	-	-	2	17	8
S. J. Perry, Stonyhurst - - - -	-	-	-	*49	7	6
„ postage - - - -	-	-	-	0	12	6
				50	0	0
J. E. Cullum, Valencia - - - -	-	-	-	52	7	3
G. T. Watson, Yarmouth - - - -	-	-	-	4	0	6
R. Beckley, inspections - - - -	-	-	-	40	16	7
Less amount advanced - - - -	-	-	-	20	0	0
				20	16	7
Carried forward	-	-	-	£668	18	10

* 12s. 6d. deducted for forms.

£ s. d.

Brought forward - - - 668 18 10

For Telegraphy :

N. J. Holmes, Scilly Telegraph Co.	-	-	-	1	13	9
H. Todd, Cambridge	-	-	-	3	19	0
J. Costello, Dover	-	-	-	3	5	10
J. Tilston, Holyhead	-	-	-	3	7	6
G. Mitchell, Kingstown	-	-	-	3	8	5
F. Gaster, London	-	-	-	3	5	0
W. D. Penny, Nairn	-	-	-	4	4	6
E. J. Lowe, Notts	-	-	-	3	18	0
J. Lucas, Oxford	-	-	-	3	6	0
J. Merrifield, Plymouth	-	-	-	3	5	0
W. Sandford, Portishead	-	-	-	3	19	6
W. Thomas, Scilly	-	-	-	4	6	11
J. Smith, Stornoway	-	-	-	3	10	0
W. Brand, Sumburgh Head	-	-	-	3	3	0
J. Trotter, Thurso	-	-	-	3	14	9
J. Sinclair, Wick	-	-	-	3	5	3
G. T. Watson, Yarmouth	-	-	-	3	6	7
C. Wakefield, York	-	-	-	3	6	2

For Ocean Meteorology :

J. H. Woodstock, packing cases	-	-	-	3	3	0
J. Gill, Liverpool Agent	-	-	-	18	16	4
D. McGregor & Co., Glasgow Agents	-	-	-	5	11	9
Street Brothers, advertisements	-	-	-	1	2	6

For Office expenses :

J. S. Harding, jun., on account	-	-	-	150	0	0
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Total	-	-	-	£909	17	7
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The Committee then adjourned.

116, Victoria Street, January 7, 1876.

PRESENT :

Major-General Strachey in the Chair.

Mr. De La Rue.

Captain Evans.

Mr. Galton.

The Director was in attendance.

The Minutes of last meeting (January 3) were read and confirmed.

Mr. Scott reported he had been examined by the Treasury Committee on the 5th inst., and had been instructed to prepare a digest of the Reports of the Committee since their appointment, for the information of the members of the Treasury Committee.

The consideration of the Report of the Committee to the Royal Society was again taken up, and the Report was amended and referred for further consideration on the 17th inst.

Submitted—The following list of the errata discovered in the tables of maxima and minima, in the Quarterly Weather Report, 1871.

QUARTERLY WEATHER REPORT, 1871.

A comparison of the Monthly Maxima and Minima (both Temperature and Pressure) obtained by measurement of the plates with those printed in Table I. shows for the whole year 6 errors.

Valencia, April.—In the table the maximum barometer is said to have occurred on the 4th at noon; it really occurred on the 1st at noon, as shown by the Plate. The difference of the two readings (on the 1st and 4th) was $\cdot 019$ in.

Valencia, June.—The minimum temperature is in the Table $46^{\circ} \cdot 3$, by the Plate $45^{\circ} \cdot 0$. This is due to poor photography, the curve appears double and the upper part has been tabulated and printed in the Table, while the lower part has been pantagraphed.

Armagh, April.—The minimum temperature is $0^{\circ} \cdot 6$ higher on the Table than in the Plate. The curve appears to have been tabulated $0^{\circ} \cdot 3$ high and pantagraphed $0^{\circ} \cdot 3$ low.

Aberdeen, December.—In the Table the maximum temperature is printed as occurring at "18d. 18h." i.e. 19th 6 a.m.; it really occurred at "18d. 6h." i.e. 18th 6 p.m. It is correctly shown on the Plate.

Stonyhurst, March.—The minimum barometer in the Table reads $\cdot 034$ in. higher than that shown by the Plate. This is due to poor definition on the lower edge of the barogram.

Kew, March.—The minimum temperature is in the Table $0^{\circ} \cdot 8$, and 1 hour wrong, owing to error in tabulation at Kew. The Plate gives the correct reading at the right hour.

Beside the above there were printed in the Errata for the year 8 errors and 3 misprints. One of these errors, that of Kew September Mean Pressure, caused 10 alterations.

In the Monthly Tables for Temperature and Pressure, constructed for civil time, there are 6 errors:—

On page 23, January, the "day and hour" of Glasgow Minimum should be "16th 8 a.m." instead of "16th 4 a.m."

On page 25, January, Kew Minimum Temperature should have been $17^{\circ} \cdot 1$ on the 1st 8 a.m., with $27^{\circ} \cdot 5$ of range, instead of $19^{\circ} \cdot 2$ on the 1st 7 p.m. with $25^{\circ} \cdot 4$ of range.

On page 25, February.—The minimum temperatures at Valencia ($1^{\circ} \cdot 2$), Glasgow ($1^{\circ} \cdot 1$), and Falmouth ($0^{\circ} \cdot 4$), are wrong from a similar cause, the minimum reading for the month (civil time) occurring before noon on the first day. (The amount of each error is given in brackets.)

On page 36, April.—The Maximum Barometer for Valencia occurs at 1 a.m. on the 1st (for the month, civil time) when the reading is $\cdot 059$ higher than that printed.

Read—A letter from Captain Toynbee, submitting excellent Logs by—

Captain F. J. Gray, H.M.S. "Nassau." (Minutes 1875, p. 60.)

Log kept by Lieutenant G. N. A. Pollard.

„ T. W. Freeman, ss. "Wisconsin." (Minutes 1875, p. 4.)

Mr. Scott was instructed to convey the marked thanks of the Committee to these gentlemen.

Submitted—Applications for fishery barometers for—

Elly Bay, County Mayo.

Kilcredane, County Clare.

Padstow, Cornwall.

Tarbert, County Limerick.

Granted.

Reported—That the Deutsche Seewarte had commenced the issue of a lithographed daily Weather Bulletin.

The Committee then adjourned.

116, Victoria Street, January 17, 1876.

PRESENT :

Mr. De La Rue in the Chair.

Captain Evans.

Mr. Galton.

Major-General Strachey.

The Director was in attendance.

The Minutes of last meeting (January 7) were read and confirmed.

Submitted—The following report, which was adopted, and Mr. Scott was instructed to send it, as finally approved, to the Royal Society, requesting that copies be sent to the Treasury Committee, and expressing a wish on the part of the Committee of this Office that it be communicated to the Society and printed,—

Report of the Meteorological Committee to the President and Council of the Royal Society on the Work done in the Meteorological Office since their appointment in 1866 to December 31, 1875.

The business of the Office will be reviewed under the three heads into which it is subdivided and which are as follows:—

I.—Ocean Meteorology.

II.—Weather Telegraphy.

III.—Land Meteorology of the British Islands.

I.—OCEAN METEOROLOGY.

The most important task of the Committee at its first institution was to examine and to take stock of all the instruments and materials for work existing in the Office.

Inquiry was made into the actual condition and employment of all instruments outstanding on the books, whereby several were recovered, and several proved to be non-existent. Since 1867 no instruments have been supplied, except for the public service.

The books in the Office, which have been kept since 1854, enable us to trace the history and corrections of every instrument which has ever been purchased.

The entire store of documents in the Office was carefully examined by Capt. Toynbee; those that were worthless were set aside, and in the remainder the quality of each element which they contained was marked.

The Office then resumed the supply of instruments to observers at sea, and reorganised the agencies at certain ports. These agencies are paid according to results. The outcome of these operations is shown in the Annual Reports.

Among the most important benefits to the science attributable to the action of the Committee has been the great improvement in the quality of the logs sent in, owing to the care taken to select observers.

The following figures show the total number of logs, and the number of first class logs, classed "*excellent*," which have been received each year from the *Mercantile Marine*, since the management of the Office has been under the Meteorological Committee.

Year.	Total No. of Logs received.	No. of Excellent Logs.	% of Excellent Logs.	Year.	Total No. of Logs received.	No. of Excellent Logs.	% of Excellent Logs.
1867	21	7	33	1871	150	72	48
1868	50	10	20	1872	110	64	58
1869	67	21	31	1873	92	52	57
1870	81	41	51	1874	88	56	64

The marked improvement shown in the last few years is doubtless entirely due to a thoroughly systematic supervision by Captain Toynbee of all logs received. In every case where improvement is considered necessary, and reasonably practicable, the captain responsible for the log has been communicated with, and in many cases induced to call at the Office for a personal interview.

The high percentage of excellent logs in recent years is in no way to be attributed to a lower standard of excellence being used; on the contrary, the standard of excellence may be considered to have increased rather than to have diminished.

It seems that greater weight should be attached to the relative values above, from the fact that the classification has been carried out by the same person throughout the whole period, so that the method of classification would doubtless be uniform.

The continuity of the observations and the hours at which observations have been recorded are of late years more in accordance with the generally accepted principles for the calculation of mean results.

At the same time it should be remarked that there is great difficulty in securing a supply of observers, and that it is in contemplation to relax in some measure the rigour of the tests applied to the observations.

As regards our Methods of Operation and our Instructions for keeping the Log, the latter were printed in full by the recent Maritime Conference held in London in 1874, and an extract of the Methods was also given.

The works published by the Office in this Department have been:—

O. 4. Charts of Surface Temperature for the South Atlantic, Monthly, and for 5° Squares, representing the Observations from Board of Trade Registers, and also results for smaller spaces from the Dutch Records published in *Onderzoekingen met den Zeethermometer*.

O. 11. Contributions to our Knowledge of the Meteorology of Cape Horn and the West Coast of South America. Monthly tables, charts, and summaries of observations from 5° Squares; materials collected by Admiral FitzRoy, and supplemented by data from other sources and for other localities. This contribution is of some importance as preliminary to a more complete investigation into the meteorology of that region. Among the points brought out by it are the existence of an area of high barometrical pressure on the Tropic of Capricorn in the South Pacific, like those on the two tropics in the Atlantic, and also the fact that sea surface temperature ranges *above* that of the air, even in the region of Humboldt's Current.

O. 12. The Currents and Surface Temperature in the North Atlantic, 0° — 40° N., giving, for $2\frac{1}{2}^{\circ}$ Squares, Monthly Charts for Direction and Velocity, and for Temperature, and an Annual Chart.

These were the first monthly current charts which were published, excepting those of Lieut. Fergusson for the Indian Ocean, &c.

O. 13. On the Weather of the North Atlantic in February 1870. This paper will be noticed under Weather Telegraphy.

O. 18. Contributions to our Knowledge of the Meteorology of the Antarctic Regions. This was a discussion, according to date and locality, of the materials contained in the logs of H.M.S. "Erebus" and "Terror," in 1840–43, and threw much additional light on the meteorological conditions of that region of the globe.

O. 20. Charts of Meteorological Data for Square 3, Lat. 0° — 10° N., Long. 20° — 30° W., and Remarks to accompany the Monthly Charts, 319 pp.

The Charts show the means for all the elements for 2° Squares, and consequently the best routes across the Equator in each month, and the remarks contain extracts relating to currents, clouds, sea temperature, specific gravity, wind, weather, natural history, &c.

In an Appendix is given a Discussion of Four-hourly means of the Barometer, and Air and Sea Temperature for each Month and for the Year in the Northern and Southern Halves of the Square, from which have been calculated the diurnal range corrections for the district.

This is the most elaborate paper ever published for any portion of the ocean, and the large relative proportion of labour bestowed on the district is justified by the considerations that the amount of material existing for it is quite exceptional, and that it lies on the high road between the North and South Atlantic, and is the meeting place of the two trade winds.

The meteorologist thus finds the materials for a study of the conditions of wind, ocean currents, weather, &c., in a region where two great currents of air are always meeting, with information as to the diurnal march of pressure and temperature in the region of the Equator and at sea; while the sailor finds, in the monthly charts, diagrams of what he may expect to encounter on his passage through the Square at any season, and in the text containing the explanations he finds a discussion of the entire mass of information, and, as a final conclusion, advice as to the best route for crossing the Line in each month.

The public will, however, be in a much better position to judge of the work of the Office when the charts, &c. now in the press, for the nine squares (Lat. 10° S.— 20° N., Long. 10° — 40° W.), of which Square 3 forms the centre, are published. In these charts, as dealing with a larger area and stretching from shore to shore of the Atlantic, are given not only charts of the same character as those above described (though for larger areas, owing to comparative deficiency of material), but also diagrams showing the direction of wind in connexion with atmospherical pressure and temperature, and of ocean currents with sea temperature.

There is also given a tabular statement contrasting the specific gravity of the sea in the easterly [going] or "Guinea" current and in the westerly currents due to each trade wind.

In the Remarks copious quotations are made from the Logs in relation to the various phenomena which come under the seaman's observation, such as the weather, the wind, the motion of the clouds in relation to the lower wind, the direction of the swell, the colour and luminosity of the sea, and the current rips; as well as information relating to the birds, fish, and insects that are met with, and the variation from month to month of the localities in which they are seen, and also appearances of submarine volcanic action in certain localities.

By these investigations it is believed that important light has been thrown on several subjects of general as well as of special interest.

1. As to the tendency of the wind blowing along a coast line to draw round a cape.
2. As to the relation of the surface temperature and the currents of the sea near the equator to the westerly gales of high northern and southern latitudes in their respective winters; as to the dipping of a cold current under a warm one, and the variation with the seasons in the amount of easterly current near the Equator.
3. As to a probable relation between the well-known rollers of Ascension and St. Helena, and the winter gales of the North Atlantic, and a corresponding relation of the rollers on the west coast of Africa to the winter gales of high southern latitudes.
4. As to the remarkable difference in direction of the wind in December on opposite sides of the Cape Verde Islands, being *easterly* to the westward and *north-north-east* to the eastward of them.
5. As to the remarkable unsteadiness and gustiness of the north-east trade with a clear sky in Square 40 (Lat. 10° — 20° N., Long. 30° — 40° W.), in certain months.
6. As to the difference between the wind and weather of Square 303 (Lat. 0° — 10° S., Long. 30° — 40° W.), off Cape St. Roque, and its neighbourhood, and those of the Squares lying to the eastward of that point, more especially in regard of the fact that in certain months the wind in Square 303, during the squalls which frequently occur, constantly changes between south-east and south-south-west in such a way that the seaman finds very great difficulty in working to the southward if he approaches too near the Brazilian coast.
7. As to the relation of the upper currents of the atmosphere (indicated by cloud motion) to the lower winds, *e.g.*, how the equatorial margin of one Trade appears to rise above the edge of the other Trade, how the upper clouds move from the north-east over the south-west monsoon on the coast of Africa, and how sometimes clouds move from the south-east, the sky looking very heavy towards that quarter, while the surface wind is steady from south-west.
8. As to the relation between heavy dew and sea temperature in some parts and at certain seasons, and the connexion between mist (haze) and African dust.
9. The diagrams give a picture of Maury's "wedge-shaped doldrums" which any sailor can understand, and the remarks show the weather experienced in them.

In these discussions the object of the Meteorological Office has been to determine the meteorological statistics of limited portions of the ocean in each separate month by means of results obtained by discussion of original observations extracted from the logs in the Office.

The scope of these publications is consequently different from that of the charts published by the Admiralty, which aim at giving a general view of what may be expected at each season (three monthly period) over the Atlantic Ocean, as in the "Pilot" Charts, or the whole navigable globe, as in the "Wind and Current" Charts.

Of the two investigations in question Capt. Toynbee has given popular accounts in papers read before the United Service Institution (in 1873), and before the British Association (in 1875) respectively.

The Office having thus completed the examination of the district close to the Equator in the Atlantic Ocean, about the most important and interesting to the navigator and meteorologist of any region in the world, has commenced the investigation of the meteorology of another great district lying on the high road between Europe and the Indian and Australian seas, that of the Cape of Good Hope, which will be prosecuted in due course: the question of the best method of dealing with that district being under consideration.

Another inquiry of considerable interest, of the same nature as that noted as O. 13, is being instituted into the wind and weather of the North Atlantic during the month of August 1873. For this the Office has obtained the loan of 280 logs, as will be mentioned later on.

While thus working at its own materials the Office has not been neglectful of foreign publications of value bearing on Ocean Meteorology.

Three of these have been specially published, in addition to the reproduction of the Dutch Sea-Temperature Observations for the Atlantic, which have been already mentioned.

These three are:—

N. O. 4. Routes for Steamers from Aden to the Straits of Sunda and back. Translated from a paper by Lieut. J. E. Cornelissen, of the Royal Meteorological Institute, Utrecht.

N. O. 5. On the Winds, &c. of the North Atlantic along the Tracks of Steamers between Europe and America. Translated from a paper by Herr von Freeden, of the Deutsche Seewarte, Hamburg.

N. O. 7. Notes on the Form of Cyclones in the Southern Indian Ocean. Reprint of a paper by C. Meldrum, M.A., F.R.A.S., Secretary of the Meteorological Society of the Mauritius.

With reference to the Recommendations contained in the Report of the Committee of Inquiry (1866) in relation to the subject of Ocean Meteorology (p. 15 of their Report) it may be said:—

a. As regards the works and discussions of observations now in progress.

Recommendations have been carried out in principle, but with such variations in detail as appeared necessary.

b. As regards the collection of further observations.

Recommendations have been carried out as closely as it was found feasible to do so.

c. As regards the method of extracting the observations.

The plan of loose cards suggested was tried for a certain time but was subsequently given up for another (described in the Report of the Meteorological Committee for 1867, pp. 8 and 60) which experience showed to be preferable.

d. As regards the method of discussing and tabulating the results of observations when extracted.

These recommendations have not been fully carried out; on the one hand the work has been conducted to a much greater degree of minuteness and over more limited areas than was contemplated in the report, such a plan being considered to afford results of a more valuable character in the interests of navigation.

On the other hand, with every desire to carry out the recommendations of the Report, it has not been found practicable to *weight* the observations, and consequently to assign *the degree of probable precision* to the results.

e. As regards the publication of meteorological results.

The recommendations have been carried out in principle but not to the letter. The publications of the Office have been more methodical than those criticised in the report.

f. As regards the publication of other results useful to navigation.

The recommendations as regards communication of hydrographical notices to the Admiralty have been fully carried out. The report, however, did not apparently contemplate the publication of any data in the form of charts by the Meteorological Office; it was, however, considered by the Meteorological Committee that for certain purposes, as indicated by the foregoing statement, the form of a chart was preferable to ordinary letter-press.

II.—WEATHER TELEGRAPHY.

The first action prior to the resumption of the issue of storm warnings was the inspection of the stations.

This has been annually carried out ever since. Much that was objectionable has been gradually improved, and at present 16 out of the 29 stations are provided with the Stevenson's thermometer screen.

Observers have been changed from time to time, so that at present only 12 are telegraph clerks, and all are distinctly and immediately responsible to the Office.

The Office may fairly claim for its service a higher degree of scientific accuracy and completeness than exists in any *at present* in operation in Europe. It must always be remembered that, as a rule, telegraphic stations are not likely to be good stations for general climatology, the conditions which determine the choice of locality being widely different in the two cases. It seems therefore less incumbent on the Office to publish means for temperature, &c. for these stations than would appear to have been held by some authorities, to judge from the evidence on the subject laid before the recent Science Commission.

A difficulty in dealing with Weather Telegraphy is to be found in the frequency of telegraphic errors, which renders any absolute dependence on figures received by telegraph impossible. Some idea of the extent to which this evil affects the scientific prosecution of weather study and interferes with the formation of correct views of the essential facts with the promptitude that is required for the practical application of the deduced results—the issue of warnings to the coasts—may be gathered from the fact that in the case of one single station, Oxford, 49 errors were detected (on receipt of the original MS. messages) in the space of 18 months, which were all proved to be due to inaccurate transmission, and were in addition to a considerable number which had been discovered at first inspection of the telegrams (owing to the glaring discrepancy of the reports from those of adjacent stations), and had been corrected by repetition of the message.

This number gives about 32 errors per annum, so that on this hypothesis there would be 32×29 or 928 errors from British stations coming in every year, which it is apparently impossible to detect by simple inspection of the telegrams.

Of errors in barometrical and thermometrical readings as received by telegraph and suspected from their discrepancy *inter se*, the Office discovers more than 1,000 every year, frequently eliciting a correction by repetition of the telegram and correspondence with the observers.

The following memorandum shows the present condition of the Weather Service :—

A COMPARISON of the “DAILY WEATHER REPORT,” as it appeared at the time of the REPORT of the COMMITTEE of INQUIRY in 1866, with the same REPORT as now published.

CONTENTS.

1866.	1875.
1.—REPORTS GIVEN, FOR 8 A.M., FROM 20 STATIONS.	1.—REPORTS GIVEN, FOR 8 A.M., FROM 51 STATIONS.
16 in the United Kingdom.	29 in the United Kingdom.
4 on the Continent.	22 on the Continent.
Countries represented being,—	Countries represented being—
British Isles, exclusive of the Shetlands, Hebrides, and Scilly.	British Isles, including the Shetlands, Hebrides, and Scilly.
France and Holland.	France, Holland, North Germany, Denmark, Norway, Sweden.
2.—NATURE OF INFORMATION GIVEN.	2.—NATURE OF INFORMATION GIVEN.
A.— <i>Tabular Matter.</i>	A.— <i>Tabular Matter.</i>
For 8 a.m. :—	For 8 a.m. :—
Barometer.	Barometer, and change in past 24 hours.
Dry bulb thermometer.	Dry bulb thermometer do. do.
Wind.	Wet bulb.
Weather.	Wind.
Sea disturbance.	Weather.
For past 24 hours :—	Sea disturbance.
Extreme wind.	For past 24 hours :—
General weather.	Maximum temperature in shade.
Rainfall.	Minimum do. do.
	Rainfall.

1866.	1875.
<p>B.—<i>Written Matter.</i> Explanation of table. Remarks. Forecasts, for two days.</p> <p>C.—<i>Graphic Representations.</i> Nil.</p> <p>D.—<i>Corrections and Additions.</i> Nil.</p> <p>E.—<i>Weekly Summary.</i> Nil.</p>	<p>For 6 p.m. on previous day (44 stations) :— Barometer. Dry bulb thermometer. Wind. Weather.</p> <p>For 2 p.m. on previous day (9 stations) :— Barometer. Dry bulb thermometer. Wet do. do. Wind. Weather. Sea disturbance.</p> <p>B.—<i>Written Matter.</i> Explanation of table. Remarks.</p> <p>C.—<i>Graphic Representations.</i> Four small charts of Western Europe, showing for 8 a.m. :— 1. The distribution of pressure, with notes as to the changes which have occurred in the different localities since the previous morning. 2. Similar information as to the air temperature in the shade. 3. The prevalent winds; the sea disturbance (when rough or high); and the portion of our coasts (if any) which has been warned. 4. The weather at each station; and the regions in which a measurable quantity of rain has fallen in the past 24 hours. When the fall at any station has been heavy (i.e., more than 0.5 in.), the amount is entered in figures (to the nearest tenth of an inch) close to the position of the station at which it has been measured.</p> <p>D.—<i>Corrections and Additions.</i> At the end of each month a sheet is published containing the corrections (when obtainable) for all the errors which have been detected throughout the month, together with copies of all returns which have been received too late for insertion in their proper places.</p> <p>E.—<i>Weekly Summary.</i> A summary of the weather over North-Western Europe is published each week, giving a brief resumé of the conditions observed on each day, and a <i>general</i> summary for the whole week, calling attention to the more general changes reported.</p>
<p>3.—<i>Issue.</i> A very few copies used to be issued, viz., to certain newspapers, and one or two subscribers.</p>	<p>3.—<i>Issue.</i> In addition to about 10 written copies (for 2nd edition of "Times" and some other evening papers, and one or two subscribers), 595 lithographed reports are printed daily. Of these about— 525 copies are issued daily. 6 do. do. weekly. 8 do. do. monthly. 16 do. do. half yearly. Of those issued <i>daily and weekly</i>, about 300 are issued to subscribers, and the remainder are sent free to Public Offices or for exhibition at seaports, or in return for observations from volunteer observers.</p>

It should also be remarked that since the 1st of April 1875, Daily Weather Charts have appeared in the "Times" and other newspapers. The form of these charts and the method of producing them in time for publication were first initiated by a member of the Committee.

Since January 1, 1876, arrangements have been made by which a chart for 6 p.m. is supplied to the "Times" at the expense of that journal.

As regards actual work effected in this Department, the Office may point to the following papers :—

N. O. 1. A Paper by Mr. Scott confirming the universal relation between the direction and force of the wind and the differences in barometrical readings, which had been already propounded by Professor Buys Ballot. This paper tended to establish the value of gradients for the purposes of weather study.

N. O. 2. A Paper by Capt. Toynbee on the curves of the Meteorological Observations taken on board the steamers running between Europe and America, showing that as on their voyages outward they meet, and on their homeward route they run with, cyclonic systems of wind which are crossing the Atlantic, the succession of the phenomena is much more rapid in the former than in the latter case. In fact, in some of the homeward runs the barometer is found to *rise when the wind is southerly*, thus showing that the ship is outstripping the disturbance.

N. O. 3. Also by Capt. Toynbee, shows by a number of instances the value of isobaric curves for the purposes of weather study, and also draws the attention of sailors to the fact that the tack on which they are from time to time (that is the direction in which they are sailing with regard to the wind) affects very materially the rate of the changes that are taking place in the indications of the meteorological instruments, the barometer falling less rapidly, or even rising, when they are on the starboard tack (that is with the wind on the right), and the converse when they are on the port tack, in the Northern Hemisphere.

O. 13. Also by Capt. Toynbee, was undertaken in order to throw light on the storm in which the "City of Boston" is supposed to have foundered. It is the most elaborate discussion of Atlantic weather which has appeared, and it shows, *inter alia*, how incomplete the materials are, and must be, for any synoptic weather charts extending over a wide stretch of ocean. It illustrates the generation of the Atlantic winter gales over the warm water area on the prolongation of the Gulf Stream, and proves that the centres of disturbances in some cases move to the east or north-east, at a rate exceeding 30 miles an hour, a fact which is confirmed by the records of the self-recording observatories in these islands, and by the general results of the observations made over the whole of Northern Europe.

In order to carry out the same method of investigation over a more extensive field, the Office has undertaken the examination of the weather of the Atlantic for the entire month of August 1873, when a very severe cyclonic storm swept along the American coast and did enormous damage in Nova Scotia. It is hoped that light will be thrown on the actual formation of, and the subsequent modifications in, this serious storm, so that some attempt may be made to solve the vexed problem of the precise direction of the motion of the air in cyclones in reference to the position of the centre of the disturbance. The Office has appealed to the owners of all British vessels at sea in the Atlantic during the month in question, and has met with a very satisfactory response, having received no less than 280 logs; a larger number than has ever before been available for such an inquiry.

The charge of the issue of Storm Warnings, &c. has necessarily been wholly confided by the Committee to the Director of the Office, who, in reply to our inquiry how far the principles by which he is guided admit of being formulated, has furnished us with the following remarks :—

"The chief of these principles, which are only announced with very great diffidence, as being liable to material modification with the growth of experience, are as follows :

"I. *The Law known as Buys Ballot's*, which is simply a general application of the Law of Storms announced by Redfield and Reid.

"The intelligent application of this principle to wind motion, even on the most extensive scale, has been the chief point in which modern meteorology offers a contrast to prior investigations into the science.

"This law gives not only the direction of the wind, but also its force, which is measured with more or less accuracy by means of gradients. That it is not absolutely true in all cases and conditions is more than probable, although precise statements on this subject are not accessible as yet.

"As regards Direction, the indraught of wind across the isobars in front of an advancing storm is indisputable, as is the effect of land in modifying the motion of the air.

As regards Force, it is clear that the same gradient does not accompany the same force of wind from all points. A further proof of this statement is to be found in a fact which has been elicited by the investigations into the meteorology of the sea, that for the same force of wind the gradient is less in the S.E. than in the N.E. Trade.

"II. *The mutual Relation of areas of low and of high Barometrical Pressure*, the former being to a great extent regulated as to their motion by the latter, and skirting them on their western, northern, and eastern sides, at least, so that when we have an area of high pressure situated over a portion of these islands we can form a good idea of the probable direction of motion of cyclones in our neighbourhood, *e.g.*, the existence of an anticyclone over Ireland is accompanied by the advance of cyclonic disturbances southwards over the Baltic or North Sea, causing northerly gales on the east coast of England.

"The above principle is manifestly incomplete, inasmuch as it takes no account of the rarity of any westward motion in the cyclones. This latter circumstance, however, appears to be a local peculiarity, and it is probable that if the weather were studied over a wider area, as in the synoptic charts of Capt. Hoffmeyer, or those projected, but not yet carried out, by the United States Signal Office, light would be thrown upon it. It is certain that a motion westward does sometimes occur even over these islands, as well as in lower latitudes, as *e.g.*, over Turkey-in-Asia from Bagdad to Salonika, Nov. 3-6, 1869.

"The appearance of secondary cyclones in connexion with larger disturbances of the same nature is gradually attracting more and more attention. These systems are imperfectly developed, inasmuch as, generally speaking, they exhibit no easterly winds of much force, manifesting themselves on the southern side of their primaries, and intensifying the violence of the westerly winds which blow under such circumstances.

"It must be admitted that, not unfrequently, the arrival of one of these satellite depressions, in advance of a more serious storm, has enabled the Office to give timely warning of the latter.

"The comparative rarity of the easterly winds in our cyclonic storms is probably traceable to the constant existence of an area of deficient pressure near Iceland, which renders the formation of steep gradients for easterly winds an unusual phenomenon.

"There appear to be some indications of principles by which we can recognise whether or not a cyclonic disturbance is speedily to be succeeded by another.

"If, after the centre of a depression has passed over us, the shift of wind and fall of temperature causes a great clearness of the air, intense radiation occurs at night, the thermometer on the grass falling 10° to 14° below that in the shade, 4 feet above the ground. Under such circumstances it has been noticed that the advent of a new depression is imminent. When, however, the series of successive depressions has ceased for a while, the weather clears much less rapidly and radiation is not nearly so marked.

"On the whole thus much may be affirmed that it is to the general conditions of atmospherical pressure *over as large an area as possible*, that we are to look for an insight into the probable changes which are likely to ensue. To this subject I shall shortly recur.

"III. *Temperature*.—As regards the relation of this element to atmospherical disturbance there are no definite principles which can be said to be generally admitted as true. This may be gathered from the almost total silence on this subject on the part of those who replied to the Circular of the Leipzig Storm-Warning Committee in 1872.

"Thus much may, however, be said:—

"A great contrast of temperature over a limited area, or, so to speak, a great thermometric gradient, being an indication of serious atmospherical disturbance, is a precursor or concomitant of a storm. This fact has been clearly pointed out by Dove, but more recent evidence on the same head is to be found in the circumstance that for the five days, January 26-30, 1870, the mean of the temperatures at 8 a.m. at London and Valencia differed 16° , being 28° and 44° respectively, a heavy southerly gale blowing all the time over Ireland. A more recent instance, in which a remarkable contrast of temperature immediately preceded a very serious storm, was on the 13th of November, 1875, when the reading at Scilly was 57° , and at Wick 21° . These figures give the very large difference of 36° . The gale of Sunday, November 14th, with its accompanying high tide, will be fresh in the memory of all.

"Another mode of utilizing temperature in the forecasting of storms is to be found in the long-established fact that an abnormally high temperature, close stuffy weather, frequently precedes a storm. This principle has not been reduced to numerical measure as yet.

"IV. *Vapour Tension and Rainfall*.—Very much weight is attached by several meteorologists to the indications obtainable from these elements, as Mohn and Loomis consider that their disturbance and intensity determine the direction and velocity of motion of cyclones, and that even the very existence of a cyclonic disturbance depends on the presence of aqueous vapour in abundance.

"For the area of our storm-warning system this indication is necessarily of minor value, inasmuch as our district is so intersected by water that no portion of it will show such contrasts in regard of vapour tension as subsist in continental stations.

"V. *Sea Disturbance*.—This is at times a most valuable help towards gaining a knowledge of coming storms, but it is very untrustworthy. The sea disturbance, being caused by the wind, is propagated in the direction in which that wind is *blowing*, not in that in which it is *advancing*. Thus a very heavy sea may roll in on our coasts without any gale reaching them, and conversely heavy gales, even westerly gales, like that of November 22, 1872, may come on, without any premonition in the way of a ground swell.

"The distance to which waves may be propagated is indicated by what has already been mentioned as probable, that the 'rollers' of Ascension and St. Helena may be due to N.W. gales in the North Atlantic.

"VI. *Local Signs*.—These are really among the most important indications of coming change, but practically they can scarcely be utilized by us. They cannot be reduced to rule, and they depend almost entirely on personal experience. It is impossible in a telegram to convey the entire line of reasoning which leads one, in the absence of instruments, to know that a storm is impending. The character, elevation, and motion of clouds; the colour of the sky; the clearness, or the contrary, of the air; the appearance of the Aurora, and numerous other signs, are well known to every one who studies weather, and from these helps the cabinet meteorologist is entirely debarred. He is like a physician dealing with a case by correspondence without the chance of a personal interview with his patient; for what can a resident in an inland town like London, on any given day, know of the look of the weather on the sea coast on the same day.

"If, in conclusion, I were asked how our weather service could be most directly improved, on the supposition that larger means were available for its prosecution, I should say,—

"A. The supply of cheap self-recording instruments to our principal stations, so that the reporters should be able to furnish intelligence as to the changes which have taken place immediately previous to the epoch for which the report is framed.

"The erection at a number of well exposed outlying stations of the automatic signalling anemometers, described in the Report of the British Association for 1874, p. 37, in order to warn the nearest telegraphic stations of the fact that the wind has reached a given velocity, say 30 miles an hour. Want of funds has hitherto prevented the carrying out of this plan.

"B. Additional stations at well selected points on our west coast, as at Mullaghmore, on Donegal Bay, and at high levels, as at Settle, in Yorkshire.

"The former especially to give more accurate indications of wind, which from our present stations is often necessarily incorrect, owing to the precipitous character of our western coasts, which affects the direction and force of the wind. The latter to furnish means for a study of the differences of atmospherical conditions in a vertical direction, which has yielded very valuable results whenever it has been prosecuted.

"C. Additional reports daily. This is a most pressing want; it has been partially met by the enterprise of the public press: the 'Times' having begun (Jan. 1876) to bear the expense of an evening message from some stations.

"D. Improved accuracy in transmission of the reports. This is, I fear, hopeless!

"E. Extension of the area covered by our reports. This raises the question of international exchanges, and in this particular it must be remembered that stations are

not of equal value, for a report from an outlying post, as Valencia or Sumburgh Head, is worth to the continental meteorologists many times more than a report from a continental station is to us.

"The extension of our system westwards, were it possible, would be of incalculable value, but America and even Newfoundland are too distant for us to reason with any degree of certainty on what the changes taking place there may portend to us.

"Reports from the Azores, if supported by others from Spain and Portugal, would be of value, but they would require confirmation. At least two simultaneous reports from independent stations in that group of islands would be required, in order to afford means for checking doubtful statements or errors in telegraphy.

"F. An increase of the staff of the Office.

"To summarize. More information from existing stations, a large extension of our area of observation, and a reinforcement of the staff for weather study, are the chief requirements of our telegraphic system at present."

In the matter of the "Recommendations on the subject of Weather Telegraphy, Daily Forecasts and Storm Warning, and upon observations of Weather within or affecting the British Isles," made by the Committee of Inquiry (1866) it may be said that the progress of this department of meteorology since 1866 has been so considerable that the importance of several of the Recommendations has been materially modified by recent experience. The Office has carried out the recommendations in principle as regards the development of the observing system, the issue of storm warnings, and the discontinuance of weather forecasts, and as to the checking of the warnings. It has not, however, for reasons which will be stated hereafter, published a series of maxims, nor has it been found possible, with the present staff, to analyse strictly the principles on which the issue of warnings, &c. has been carried out from day to day.

The staff has been quite insufficient to cope with the serious discussion of the weather charts which are daily accumulating.

The Office has co-operated readily with the United States Signal Office in its project for synchronous observations over the whole globe.

III.—*Land Meteorology of the British Islands.*

This branch of the Office has been carried out in accordance with the plan sketched out in the letter from the President and Council of the Royal Society to the Board of Trade of June 15, 1865, approved by the Committee of Inquiry (1866), and sanctioned generally by the Treasury in a letter to the Board of Trade dated November 30, 1866. The number of stations originally proposed was six, with possibly two additional points of observation, situated in the south-west and in the north-west of Ireland respectively. The six stations specified were accepted and have been in continual operation until now. The Treasury did not sanction the insertion on the estimates of the full sum proposed by the Meteorological Committee for the year 1867–8, and accordingly the Committee at first determined to defer the establishment of the station at Aberdeen, in consideration of the greater importance of records from Valencia. At the request of the authorities at Aberdeen, conveyed through the Duke of Richmond, Chancellor of that University, the Committee resolved to reconsider their proposal, and ultimately Aberdeen was included in the list of places fitted out with self-recording instruments.

The choice of these stations was guided by the fact of the existence in each locality, except Valencia, of some scientific body to whom the instruments could be intrusted. This involved the necessity of placing the instruments in the best available positions on the premises of the respective institutions, the funds available being totally inadequate for the erection of special structures for the reception of the instruments or the maintenance of special observing establishments. Hence have arisen the defects in arrangements as concerns temperature in regard of elevation above the ground at Falmouth and Aberdeen, and to a less degree at Valencia, and as to proximity to buildings in all the observatories. In respect of the four other observatories, not above named, there is no doubt the thermometrical indications do afford as thoroughly satisfactory a record of temperature as is required; this point having been proved by direct experiments by Dr. Stewart for Kew, and by the Rev. Dr. Robinson for Armagh.

Absolute uniformity in conditions of exposure is totally unattainable, as was fully recognised at the Vienna Meteorological Congress in 1873.

The observatories were set in action in 1868, and with the year 1869 the publication of the Quarterly Weather Report was commenced. This was projected in order to

overcome the difficulty, universally recognised, of the absence of uniformity in epochs of observation in the different countries. A reproduction of the automatic curves was considered to be of paramount importance in order that the records at observatories should be independent of any choice of hours for observation or of any scales, and the value of such a reproduction was strongly urged by the Committee of Inquiry (1866).

The execution of the plates was rendered possible by the invention of certain special instruments and processes for which the Office is indebted to Mr. F. Galton and Mr. De La Rue, and which are in constant use, as explained in the several Annual Reports of the Office.

The curves were at first reproduced by the lithographic process, but of late years that of copper-plate printing has been introduced.

The degree of accuracy aimed at is 0.02 in. for the barometer, and 0.5° for the thermometer, and the plates furnish a continuous record of—

Pressure.

Temperature (Dry and Wet Bulb).

Vapour Tension.

Wind (Direction and Hourly Velocity).

Rain (Hourly Amount).

It may be asserted, without fear of contradiction, that no record of a completeness and accuracy at all approaching that attained by the plates in question has yet been attempted in any other country, and that moreover the Meteorological Office is the only Meteorological establishment which itself publishes the materials for testing the accuracy of its published numerical values.

In the matter of accuracy many important advances have been made since 1867, owing to the growth of experience, and the methods of treatment of the records have much improved.

The text of the Quarterly Weather Report has been a consecutive journal of the weather, and the tables have given the five-day means of the barometer and the dry and wet thermometer, from hourly measurements of the curves, together with monthly means of the same elements, and of vapour tension and deduced dry air pressure, as well as the extreme readings of the barometer and dry thermometer.

A request having been made for the publication of the actual hourly readings of the measurements of the curves, this has been complied with. These volumes have been issued since January 1874, and distributed to the principal libraries at home and abroad.

The preparation of the plates and tables above mentioned occupies nearly the entire time of the available staff of the Office, so that no present prospect exists of a systematic discussion of the returns so as to calculate the periodical variations of the different elements. This for the seven observatories will be a heavy task, and it is for consideration whether some special steps should not be taken for effecting it, as the first five yearly period over which the observations extended closed with the past year, and it was held by the Vienna Congress that such calculations should be effected for "lustra" (periods of five years) ending with years which according to our present calendar are multiples of 5.

The Quarterly Weather Report has contained in addition various appendices which are as follows :

1869. Notes on easterly gales.

1870. Mean barometrical pressure at telegraphic reporting stations.

Rainfall at telegraphic reporting stations.

A translation of Bessel's Paper on the Determination of the Law of a Periodical Phenomenon.

1871. A discussion of the anemometrical results for Sandwick Manse, Orkney, 1863-68.

Mean monthly rainfall at certain stations in the United Kingdom.

Constants for Bessel's Formula for the Observatories for 1869-70.

1872. Discussion of the anemometrical results at Bermuda, 1859-63.

1873. Rainfall of the London district for 60 years, 1816-1872, by G. Dines, F.M.S.

Results of observations taken at certain stations of the Second Order for the year 1873.

The Appendix last mentioned leads to an important subject calling for remark ; the study of the climatical conditions of these islands by means of returns from stations auxiliary to the self-recording observatories.

Such stations have been gradually organised, and in January 1873, the Committee were able to inform the Registrar-General, in reply to an inquiry made by him, that if the Office were called upon to furnish materials to him for his statistical returns it was in a position to do so.

Of late the list of stations in connexion with the Office has received an important reinforcement by the conclusion of an arrangement by which the Meteorological Society (of London) supplies returns from some of its stations, in return for a small annual grant to defray the expense of copying.

That society has recently organised a system of stations with much care, which exhibit a satisfactory agreement as to the character of the instruments and the conditions under which all the observations are taken.

This co-operation of the Society, and of a considerable number of private observers throughout the country who have volunteered to supply their schedules of observations gratis, renders it possible for the Office to take its part in the general international scheme of publication of returns from eye observations proposed by the Permanent Committee of the Vienna Congress, in order to facilitate climatological inquiries.

The publication of these returns, demanded for 15 stations in the United Kingdom, has been commenced for England and Ireland. As for Scotland, it is hoped that the Scottish Meteorological Society will supply their quota of materials for this international object.

The Committee have felt it their duty to afford every facility to their Director to attend, as their representative, the meetings of the various Meteorological Congresses which have been held of late years, and moreover have entertained the members of the Conference on Maritime Meteorology, which was held at their Office in August 1874.

The Office is therefore at present fulfilling all that is called for from this country for international purposes, as defined by the Permanent Committee of the Vienna Congress, and there can be no doubt that the information now coming in is, as regards accuracy, fully equal, if not superior, to any published from a similar system of stations in any country.

Further may be mentioned the fact of the recent publication by the Office, at the request of the Government, of a volume entitled "Instructions in the Use of Meteorological Instruments," which has been compiled with the assistance of several meteorologists unconnected with the Office.

The Scottish Society have sought to obtain a grant in aid of their general objects from the Parliamentary vote; but the Committee have considered that as they are only agents for directing the application of the fund at their disposal, they have no authority to make grants to be dealt with at the discretion of other bodies, and that their action is restricted by the conditions that the objects to which it is directed shall be among those for which the grant is made, and that the expenditure shall take place in a manner that admits of their exercising a control over its objects and results.

Before leaving this branch of the subject, the Committee would remark that their operations would have been seriously crippled in the year 1871, when the British Association withdrew its annual subsidy to Kew Observatory, the central observatory of their system, had not Mr. Gassiot, one of their own body, come forward and most munificently placed in the hands of the Royal Society a sum of 10,000*l.* for the endowment of the establishment, thereby affording ample funds for the continuance of the observatory in full activity.

In conclusion the Committee would make a few general remarks on the principles that have guided them in organizing the Meteorological Office and controlling its operations.

They have considered it to be their duty to give general effect to the recommendations of the Committee of 1866, and to establish and carry on for a considerable length of time, with the least possible amount of change, a well arranged and uniform system of observation and of publication, being satisfied that continuity of method is one of the most essential elements of success in dealing with complicated physical phenomena.

The Committee on their first appointment laid down with much deliberation the course to be pursued by the Office, and gave considerable attention to the removal of the numerous difficulties which necessarily occurred in the establishment of so much that was novel, especially in connexion with the self-recording instruments.

Seeing that the Committee of 1866 had recommended a renewed inquiry into the proceedings of the Office, after three years' trial, and feeling that under any circumstances its constitution was only provisional, the Committee have aimed at leaving the principal officers employed in the duties of the department as little fettered as possible as to the precise manner in which details were conducted, looking rather to securing satisfactory results of the work, and to exercising that strict financial control over the application of

the funds placed at their command which their duty to the Royal Society and the Government required of them.

They have also felt that in the existing condition of meteorological knowledge it would have been not only presumptuous on their part, but positively mischievous, to have attempted to assume a position of authority in enunciating new doctrines of their own, or in criticising the opinions of others; and that their power of producing useful results would have been seriously impaired if they had in any way departed from the purely neutral attitude of accumulating a faithful record of facts destined to furnish materials for scientific discussion.

Although there exists a large quantity both of published and unpublished data in the possession of the Office which places their staff in an exceptional position for conducting elaborate investigations into the conditions of the weather; nevertheless, the Committee have found it impossible to provide for the adequate carrying on of such investigations by means of their own staff; the time of their chief executive officers being so much occupied by the heavy current business of the Office as to leave them no leisure for the purpose, nor have the Committee been able to assign out of the funds at their disposal enough to secure additional assistance of a proper scientific character. If they had diverted any of these funds to purely scientific discussions it would have crippled other parts of their work, which appeared to them, under the existing conditions and for the time being to be still more important and to be, in a measure, obligatory on them.

It will readily be understood that the Committee holding such views makes no claim to having given an independent impetus to the progress of any special branch of meteorological science, though they feel satisfied that their operations have in an important manner facilitated the natural development of accurate meteorological conceptions. All conversant with the facts will agree that a very great advance has been made in this respect since the Committee was formed. The Committee will not attempt to distinguish all the various causes that have conduced to this advance, but among them are certainly to be recognised the organization of the system of continuously self-recording observatories and the publication in the Quarterly Weather Reports, with a remarkable degree of accuracy, of a graphical reproduction of the records thus obtained; the constantly increasing attention paid by the officers of the Meteorological Office to the accurate and prompt preparation and distribution of the lithographed Daily Weather Charts; their intelligent study of the facts recorded under their direction, and their cordial co-operation with other bodies interested in similar objects, whether in this country or abroad. The experience gained in the preparation of the Daily Morning Weather Charts has enabled the Office to prepare smaller Charts, which are supplied for publication in several daily papers in London and the provinces. This indication that such information is appreciated by the public is further corroborated by the fact that similar Charts containing information for the evening have been asked for and are now furnished by the Office to the "Times."

The Committee being aware that the Government has entrusted to another body the duty of inquiring how the functions they have performed may best be discharged in the future, they will only permit their remarks to extend beyond a review of the past in three particulars.

First. They look forward with great hope to the effect of increased international co-operation on a large scale, towards which important steps have already been taken at recent Meteorological Congresses. The detached labours of numerous meteorological institutions will thereby be presented in a strictly comparable form, and may readily be combined in synoptic charts or in any other manner into a single whole. They think it is impossible to overstate the importance of measures tending to such a result.

Secondly. They consider it to be a point of much importance, that the meteorological societies and independent observers of this country should be more generally induced to work in unison with an Office maintained by grants from Parliament, so far as their several efforts are directed to the same field of inquiry. Administrative difficulties have hitherto prevented the accomplishment of as much in this direction as could be desired, but the Committee fully recognise that it would be advisable to utilise more completely than has yet been done the energy of independent meteorological societies or individuals, and they believe that this admits of being effected on conditions that would be suitable and acceptable to them.

Lastly. They feel it necessary to say that for the further advancement of Meteorology greater attention to its more strictly scientific aspect will in the future be essential. Merely empirical rules, however sound be their foundation, can never become really trustworthy guides of action until the principles that underlie them are established, and the circumstances are appreciated under which deviations from the ordinary course of events arise. It can hardly be disputed that in the course of the past nine years, since

the appointment of the Committee, the general progress of the science of Meteorology in this country and abroad has been such that the application to it of exact principles seems to have become not only possible, but requisite; without them the full practical advantage of existing means of observation will not be secured, and it is only by aid of scientific discussion of the facts that these principles are to be ascertained.

They would suggest, as a probable mode of attaining the object they have in view, the application of a portion of any future grant to the preparation of reports, or the carrying out of researches on special subjects connected with Meteorological science by qualified persons to be selected from without and employed independently of the ordinary staff of officers engaged on other duties.

The Committee are only too well aware of the difficulties that are likely to attend the progress of Meteorology as an exact science, but difficulties apparently as great have been overcome in other directions, and perseverance and time will doubtless remove those now in question.

Submitted—A memorandum which had been drawn up in pursuance of the instructions of the Treasury Committee (Minutes, January 7.) It was approved, and Mr. Scott was instructed to forward copies of it to the Treasury.

Mr. Scott stated that he had written to Sir G. Airy and Professors Buys Ballot, Jelinek, and Wild, with reference to the subject of "weighting" observations, as suggested by the Committee of Inquiry (1866), and he submitted the following correspondence, the letters to the three gentlemen last named being identical:—

MY DEAR SIR,

Meteorological Office, December 22, 1875.

YOU are doubtless aware that the Treasury have appointed a committee to inquire into the working of this Office.

Inasmuch as the subject of Maritime Meteorology will be discussed by that Committee, and I shall be examined thereupon, I venture to ask if you would kindly give me the benefit of your opinion on two questions which particularly affect the principles of discussion applied to the subject in question.

They are as follows:—

I. Do you conceive it possible that any method of "weighting" observations could be employed, bearing in mind the fact that meteorological means are taken from observations taken by different observers in ships in motion, and, possibly, under very different meteorological conditions? In fact the observations differ not only as to the character of the observers, but also as to *time* and *space*?

II. Can any estimate of "probable precision" be properly applied to such quantities as meteorological means, where we are simply dealing with the averages of a certain number of observations, and have, at least in the case of Ocean Meteorology, no knowledge of what the true mean of any element for any place or district is?

Both these principles have been urged upon us here, and I can only say that I cannot see any possible mode of carrying either of them out.

Hoping that you will forgive my troubling you,

Sir G. B. Airy, F.R.S.

I am, &c.

(Signed) ROBERT H. SCOTT.

M.O. 2749.

MY DEAR SIR,

1875, December 28.

I AM not very well acquainted with your method of treating observations, or even with the nature of the observations which come before you and the nature of the results which *in the first instance* you deduce from them. Perhaps, therefore, my replies may not be strictly applicable to your purpose.

1. In the most precise of all observations, viz., astronomical observations all directed to one special measure (*e.g.*, the measure of the angular distance between the two components of a double star), it is not uncommon for an observer to give different weights to his own different measures, determined entirely by his mental estimate, at the moment, of the relative accuracy of each observation. But he, perhaps, would hardly dare to give weight to his results as for combination with those of other observers. A person unconnected with the observers and observation—as yourself—might give weights (and perhaps *must* do it in some circumstances), but it must unavoidably be a terribly arbitrary process. If *very numerous* measures are made of one physical quantity which (in the nature of things) cannot have varied during the making of these measures, then (as I will mention below) a probable error of each observer's result may be found, and, upon these, combination-weights may be founded.

But I apprehend that this is not your case, and I should think that you can do nothing but turn over in your mind all the circumstances, moral and physical, which can have affected the accuracy of each observer's observation, and thereupon (without numerical process) assign a weight to each.

2. An estimate of "probable precision" can very well be given where a considerable number of observations has been taken of a physical quantity, which either is absolutely invariable, or of which the changes during the observations are antecedently known. It is of no importance that there is no antecedent knowledge of the true mean, the rule applicable to this case is to be found in all books on combination of observations. But this estimate does not in any degree remove the effects of what is known as "constant error," different for different persons. For instance, in the case of double-star

measures, to which I have alluded, the mean of ten thousand observations by one person will differ from the mean of ten thousand observations by another person, by a sensible quantity. It is very hard to say that this can be removed, except by a purely arbitrary decision made by a person not concerned in the observations.

I shall be glad to know that these remarks meet your inquiries.

R. H. Scott, Esq.

I am, &c.

(Signed) G. B. AIRY.

MY DEAR SIR,

Meteorological Office, December 10, 1875.

THERE is a scientific question of some importance to us, which I should like to put before you for the benefit of your opinion as a mathematician and meteorologist.

Do you think it possible to apply any method of "weighting" to meteorological observations made at sea, so that by a judicious selection of observations results could be obtained with less labour, and of more accuracy than by the present process.

The subject is frequently mentioned in the Report of the Committee on this Office (1866), which you doubtless have.

I should be very glad of an answer to this, and am referring the question to MM. Buys Ballot and Jelinek and Wild.

I am, &c.

(Signed) ROBERT H. SCOTT.

M.O. 2705.

MY DEAR MR. SCOTT,

Utrecht, December 20, 1875.

THE question you put before me is a very delicate one. MM. Jelinek and Wild will no doubt say so likewise.

I can only tell you in what manner we have endeavoured to appreciate our journals, and I think M. Cornelissen has already shown you, but I fear that we do not know how to do it better than what is proposed in the Report of the Committee to which you allude.

A journal can scarcely be weighted by the method of probabilities by which we are induced to give such and such value to a series of observations. It is a matter of tact to see what care has been given to the observations.

If, after having carefully examined a journal, the remarks bear testimony that the author has had both will and sufficient knowledge to put things right, I think that we have no right to reject an observation, unless the error or mistake is beyond doubt, by comparison with the indications of the other instruments.

Of course we judge not only on internal evidence, but as much as possible on external also, viz., by comparison with the journals of other ships which were in the neighbourhood at the same time.

We often point out that in the papers, and caution sailors that it is to their own prejudice if they do not take careful observations and that we can check them.

If we especially approve of any journal we may put it before or after another for the award of a gold medal, but we do not give precedence to the observations, because perhaps one has given tenths and the other only whole numbers. It is dangerous to give double or threefold weights to any journal.

Let three journals give 6, 8, 9 degrees in a certain month at a given place, and a fourth only 2; even if the latter is thought inferior to the former, I think it better to consider $\frac{6 + 8 + 9 + 2}{4}$ as the mean, than to say $\frac{3(6 + 8 + 9) + 2}{10}$. If the journal which gave 2° is often at variance with other journals, whether always too low, or sometimes too low and some times too high, and you should not have taken it, what matters, 2° occurring seldom? It may occur, and because it occurs seldom you only find it in one of the journals. It may be an error, but 9 may also have been an error, and you have no right to give a threefold weight to 9 and no weight to 2.

Supposing that the series of observations of that day and a comparison with the other instruments give no indication of error in the statement, I know no other means unobjectionable. It is the shortest and at the same time the surest way I think I can recommend.

(Signed) BUYS BALLOT.

Mr. Galton submitted the following letter :—

DEAR SIR,

January 8, 1876.

WHEN you submitted yesterday to the Meteorological Committee, for insertion in its Minutes, the copy of a letter written by yourself, asking the opinion of certain eminent authorities in regard to the weighting of meteorological observations at sea, and their replies thereto, I felt in a position of some difficulty. Your letter did not, in my opinion, bring the subject adequately before the gentlemen you addressed; consequently their replies, though most valuable in themselves, did not appear to me to deal with the arguments I have used when discussing the subject with yourself and others. If these replies had been simply entered in the minutes, they might have been quoted as confirming your views in opposition to mine, whereas mine had never been properly submitted to your referees. Under these circumstances, the other members of the Committee who were present, suggested that I should put my views on paper, that you should submit them to the same gentlemen whom you had previously addressed, and that the whole correspondence should appear in our Minutes.

Every log that is sent to the Meteorological Office undergoes a very careful scrutiny by the Marine Superintendent, who examines the internal evidences of its merit, and is not regardless of such external evidences as the previous performances and general reputation of the officer who sent it. The result is, that he assigns a definite grade of excellence to each class of observations that it contains, and gives a compendious term (excellent, very good, good, middling) to the log as a whole. It may be that the grade of excellence is made partly to depend on quantity of work, but there is no reason whatever why a special mark should not be given to quality alone. It is to this latter kind of mark that I henceforth refer.

In order to obtain a clear idea of what is meant by different grades of quality, it is best to take one class of observations for illustration, say *currents*. The evidence of a current depends on the difference found to exist between the estimated distance run by the ship during a definite period of time, from one position in the ocean to another, as defined by astronomical observation, and the measured distance of its route on the map. Thus there are five principal elements, in the determination of each of which more or less error will occur; namely, the astronomical determination of the first position, the estimate per log of the distance run, the correct charting of the various courses pursued while running that distance, the duration of the period, and the astronomical determination of the last position. Each of these admits of being subdivided into many component acts, severally subject to error; the general result being that an observer who is intelligent, well-educated, methodical, interested in his work, and supplied with good instruments, will habitually give a much closer estimate of currents than one who is not. The same sort of reasoning will refer to the estimate of the wind's direction and force, and to that of every other meteorological phenomenon.

It is needless to urge that the value of a set of meteorological observations as a basis for statistics depend principally upon their accuracy, but it is not to be forgotten that there is also an advantage in those conditions which are implied by mere number of observations. These are, that the observations have been spread pretty uniformly over a lengthened period of time, which eliminates the accidental influence of exceptional weather lasting for a short period, and that they have been spread pretty uniformly over the ocean area under discussion, which eliminates local peculiarities. Hence, the value of a set of ocean data depends partly on their intrinsic excellence and partly on their number; the question is how far, all things being taken into account, will a small number of "excellent" observations of each several meteorological element, be the equivalent of a larger number of "very good" or of a still larger number of "good" observations.

The method of solution of this question was, I thought, sufficiently indicated in the Report of the Committee of Inquiry into the Meteorological Department of the Board of Trade in 1866, of which I was a member, but I now doubt whether the proposed method has been rightly understood, and therefore desire to submit a somewhat fuller explanation. By an example in page 9 of the Report it was shown, that in a particular case that was tried as an illustration, 427 observations for the direction of wind, that had been taken from moderately good logs, gave results that were less congruous than those taken from 127 superior logs. The 127 superior observations "gave a 'Wind Rose' bounded by points that, after the averages of adjacent observations had been taken, fell naturally into a continuous curve, and therefore had a *prima facie* appearance of truth. This was increased almost to a certainty, by finding that the observations, when divided at haphazard, still gave rise to the same appearance, though with inferior regularity. On the other hand, Maury's 427 observations resulted in a much less regular figure, and therefore, though nearly four times as numerous [as the former] had not in their aggregate so high a value." I should here remark that congruity admits of being tested not only by internal regularity as in the shape of a wind rose, but also by accordance with neighbours (in respect to space) as in synoptic charts, and again, by accordance with preceding and succeeding determinations in respect to time. If it had so happened in the example just quoted, that the results had been equally congruous, and if it had been found on making other trials that the same conclusions were generally arrived at, then the two descriptions of logs ought thenceforward to be weighted by the numbers 127 and 427 respectively, when any general deductions concerning the direction of the wind had to be drawn from them.

The weights to be assigned to each grade of excellence for each class of observations (winds, currents, &c.) have yet to be determined, and I regretted much that the exceptional opportunity afforded by the late elaborate investigation made by the Meteorological Office into the very numerous ocean statistics of "Square 3" was not made use of for the determination and application of these weights.

The plan I desired to have followed was to separate the extracts from the logs into different groups, according to the grade of excellence of the logs, and to treat them separately. Then, to compare mean results derived from various sized groups of the different grades of excellence, proceeding tentatively until some general conclusions were sufficiently established. Thus the mean of 200 "excellent" in currents might be compared consecutively with those of 400, 600, and 800 "good" and a first approximation to their relative weights obtained. Suppose it was found to be as 200 to 500; then we should examine other ocean districts and we should now be able to compare within the narrower limits of 200 "excellent" to say, 400, 500, and 600 "good." In this way, the correct weights for "excellent" and "good," as regards currents, would be ascertained. These, it is almost needless to say, are expected to be very simple figures, as over-refinement would be absurd. By precisely similar processes all the other weights would be obtained. They would then be applied to bring out mean results, and such other general deductions as usually find their place in a chart. Of course it is not proposed to meddle in any way with the original data.

It will be further seen, in the example already referred to in page 9 of the Report, that the introduction of the 427 inferior observations on equal terms, actually diminished the value of the results

obtained separately by the 127 superior ones. It is therefore evident that the method of treatment was not only wasteful in effort but positively mischievous in result; on the other hand, it would have been wasteful to have wholly disregarded the 427, for they were by no means valueless, as proved by their showing themselves adequate to give a useful approximation to the facts of the case. If the two groups had been properly weighted, the whole of the information at the disposal of the computers would have been utilised.

The general result of what I have urged is that the practice of weighting appears likely to produce much economy of work; which in large undertakings like that of the Meteorological Office means large economy of money. Also, that no practical difficulty appears to stand in the way of ascertaining or of applying weights to ocean statistics. Lastly, that a serious effort should be made to ascertain the weights under varied conditions, and thereby to give the system a satisfactory trial. Finally, if it should prove as advantageous in practice, as I think it promises to be, to carry it thenceforward into effect.

Yours, &c.

R. H. Scott, Esq.

(Signed) FRANCIS GALTON.

The whole correspondence was ordered to be entered on the Minutes, Mr. Scott was instructed to prepare a letter to be sent to the four gentlemen before addressed embodying the substance of the above letter, and to submit it to Mr. Galton before despatching it.

General Strachey submitted the following letters from Sir W. Thomson, which were ordered to be printed on the Minutes.

DEAR GENERAL STRACHEY,

The University, Glasgow, December 10, 1875.

It happens that I was actually engaged in writing to you about the tides (observations and reductions for India) when your letter of yesterday reached me. Through pressure of business I had been compelled to delay writing in answer to your letter of the 12th, but yesterday evening I had taken up the subject again, and began this morning writing a short statement. It is now being copied and will go by a post later than this, this evening. Let me know if it is what you wish, or if I should address a formal letter to the Under Secretary of State for India. It will be no trouble to me to copy out the statement and address it to the Under Secretary, if that would be right, or I could add to it if you think more information desirable. Meantime, I send it in the form of a letter to you, which, if you think proper you can lay before the Indian Council.

I wished to write to you on another matter, the Meteorological Department. We have seen some notices to the effect that an attempt is to be made to transfer from the observatories of Aberdeen and of the University of Glasgow the work at present done for you by them, of conducting photographically self-recording instruments, and putting it into the hands of the Scottish Meteorological Society. I do not think it probable that you would listen to such a proposal, however inclined you might be to do something for the Scottish Meteorological Society, if you think you could do good by so doing and have funds to spare. I have been requested to write to Sir W. S. Maxwell, our Chancellor, on the subject, who is chairman of a committee which has been appointed, I believe, by the Government to consider the matter, but before doing so I would like to know how it stands, and what is contemplated, and I should be much obliged by your giving me a line to say how it is, if you know.

I shall write to you to-morrow I hope, on the atmospheric wave question, though I fear not to throw much light on it.

I am, &c.

Major-General Strachey, R.E.,

(Signed) WILLIAM THOMSON.

DEAR GENERAL STRACHEY,

The University Glasgow, December 14, 1875.

YOUR letter on Meteorology has interested me very much. I feel very strongly with you in all the sentiments you express as to the mere accumulation of observatories, and the necessity, if science is to be advanced, of importing dynamical and physical ideas, and seeking for tests of them and suggestions of fresh ideas from the results of observations already obtained.

I have shown your letter to my brother, Professor James Thomson, and spoken a good deal with him on the subject. He suggests that reductions should be made to show the whole amount of the component motion of the air in the north and south direction and in the east and west direction, and this at as many places as possible. The object is not so much to verify and illustrate his theory of atmospheric circulation, (which seems to me quite sure, without direct proof from observation,) as to give some approach to an estimate of the absolute values of the quantities of the counter-agencies which that theory indicates.

In consequence of your letter I have urged my brother to prepare a paper on this theory for the Royal Society with diagrams and experimental illustrations. I don't know whether you chance to have noticed a short sketch of it which appeared in the Report of the British Association for Dublin, 1857. I enclose a separate copy of it which he has given me for you.

It seems to me that a great deal should be done also in the way of harmonic reduction of the observations which have already been made. At present we have rough and uncertain information as to the diurnal and semi-diurnal variations of barometric pressure and of temperature, compared with what we might have if the harmonic reduction was systematically applied to all trustworthy observations which have been collected.

The semi-diurnal variation of the barometric pressure is of great interest and importance in respect to physical theory. It seems that there is maximum of barometric pressure about two hours before

noon and two-hours before midnight. If this is confirmed by thorough analysis of observations made in different places, it will prove that solar attraction and heat act as a thermo-dynamic engine in accelerating the earth's rotation, or more properly speaking, diminishing the retardation produced by the tides. The amount of this thermo-dynamic effect could be calculated with some degree of accuracy if we had a thorough analysis of trustworthy barometric observations.

A thorough harmonic analysis not only of barometric pressure, but of temperature, rainfall and motion of the air ought certainly to be made for conceivable lunar terms, as, for example, lunar diurnal and semi-diurnal and luni-solar syzygial. The only scientific attempt I am aware of to test the notion that the weather is influenced by changes of the moon was made by Airy, who gave quite enough to disprove the idea that there is any influence sufficiently considerable to be perceived by ordinary observation. But the popular idea of a close connection between changes of the moon and the weather is still so very prevalent, that I do think it is an object which should commend itself to statesmen to bring forward the whole weight of scientific observation to absolutely disprove the error, if it is altogether an error, or to show what degree of truth, if any, is at the foundation of the popular notion.

We hear a great deal of the connection between the sun-spot period of about 11 years and terrestrial storms, whether of air or of magnetism. We have absolutely no information I believe, from accurate reduction of meteorological observations to show whether or not there is any such connection in respect to the temperature and motions of the air or the intensity of solar radiation. It is highly important to find how much the sun's heat varies on the average from year to year during the 11 years period, if it has any such periodic variation.

I therefore think that all trustworthy meteorological observations, but with still another application of the harmonic analysis, ought to be analysed for the sun-spot period.

(Signed) WILLIAM THOMSON.

DEAR GENERAL STRACHEY,

The University, Glasgow, January 14, 1876.

I HOPED before now to have been able to write to you that I was ready to go on with the construction of an instrument, or at all events a rough model towards an instrument, for executing the harmonic analysis of the variations of any elements which have been recorded in the usual manner by a curve. I have the principle complete in my mind, but am stopped by the difficulty of dimensions and other details on which the practical working of the instrument will depend.

I have no doubt but that the thing can be done, so that by running the paper through a machine while the operator simply keeps a moveable point always touching a curve which has been traced on the paper, the value of the particular harmonic element sought will be read off as the area is read on the Amsler's planimeter.

This will enormously diminish the labour of the harmonic analysis whether for tides or for meteorological observations. To wait for such a machine, however, might be to postpone indefinitely the acquisition of the desired knowledge.

I hope the Meteorological Committee will see it proper to order, as soon as may be, a thorough harmonic analysis for different terms, such as those suggested in my letter of the 14th December, for some of the available series of trustworthy meteorological observations in different localities. I think it would be a pity to discontinue operations in any of the places where trustworthy instruments are at present in action, and satisfactory results are being obtained from them, until you get some of this analysis done, and help your judgment by means of it as to what observations it is desirable should be continued and what suspended. I think it should depend on the results of the harmonic analysis of magnetic observations in several localities, what answer should be given to the two questions put by Mr. Ellery, in his letter to Mr. Scott, of the 11th December, before answering Mr. Scott's circular of January 5th, of which a copy has been sent to me. I should be glad to hear from you what chance you think there may be of the Meteorological Committee taking action in the way I have been recommending.

Meantime I feel rather strongly that the Melbourne observations ought to be continued permanently, as I suppose there are no other self-recording observations in the Southern Hemisphere, or, at all events, at all near Melbourne. As terrestrial magnetism has secular variations and particularly one chief one in a period of 960 years, as shown by Barlow in his Essay on Magnetic Attractions, Second Edition, London, 1823, page 210, I do not see any prospect of being able to recommend an early suspension of self-recording magnetic observations in at least several localities distributed widely over the earth's surface. But we must make good use of the observations already made. This can be done by applying the harmonic analysis to them, and can scarcely be done at all satisfactorily in any other way.

As to the self-recording meteorological observations in Glasgow Observatory and other places under the Meteorological Committee I think it would be a pity to suspend any of them which have been giving satisfactory results, at least until they shall have been carried on continuously through at least 12 years, so as to include one full sun-spot period.

Major-General Strachey.

I remain, &c.

(Signed) WILLIAM THOMSON.

P.S.—I am afraid I have nothing more to say about the prickly mathematical problem you put to me at Bristol just yet. I am overwhelmed with other matters urgently demanding all the time I can give, but I hope some time to be able to take it up, though not to be able to make much of it mathematically.

W. T.

Mr. Scott stated that the Permanent Committee of the Vienna Congress proposed to hold a meeting at Easter, and he asked permission to invite them to hold the meeting in London, at the Office.—Permission granted.

Mr. Scott submitted the following list of erroneous data which had been issued by the Office, and he was instructed to issue fresh sheets containing the corrected values. (Minutes 1874, p. 95.)

Owing to the use of faulty scales the thermograms for the following dates have been re-tabulated, subsequent to the publication of the original measurement in the "Hourly Values":

Valencia.—Wet bulb about 35 days, between September 30 and February 25, 1874–5.

Armagh.—Dry 36 days, wet 45 days, between September 28 and December 29, 1874.

Aberdeen.—Dry and wet, from 24th October to 30th November 1874.

Stonyhurst.—Dry 7 days, wet 16 days, between December 13th and February 9th, 1874–5.

R. H. CURTIS.

Read—A letter from Captain Toynbee submitting an excellent log by Captain J. J. Price, barque "Sorata" (Minutes 1875, p. 45.)

Mr. Scott was instructed to convey the marked thanks of the Committee to Captain Price.

Submitted—The following Abstract of Accounts from 1st April 1875 to 31st December 1875.

	Received.	Due.	Paid.	Estimated Liabilities.
	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Balance from 1874-5 - - -	1,826 15 5	—	—	—
Vote for Year - - -	10,000 0 0	—	—	—
Interest on Deposit Accounts - - -	32 11 4	—	—	—
OFFICE :—				
Salaries - - -	—	—	1,020 10 6	—
Rent, fuel, &c. - - -	—	—	478 15 10	19 15 0
Contingencies - - -	1 12 6	2 5 10	197 18 1	5 9 7
LAND METEOROLOGY :—				
Expenses at observatories - - -	28 4 0	15 10 0	1,979 12 10	105 10 4
New instruments for ditto - - -	262 11 0	133 17 2	286 5 8	170 2 8
Computations - - -	—	—	647 15 11	—
Telegraphy - - -	2 0 9	—	883 2 2	721 13 2
Inspections, D.W. Charts, &c. - - -	242 9 6	15 12 6	392 4 10	107 9 1
Computations - - -	6 15 10	2 10 0	530 14 5	—
OCEAN METEOROLOGY :—				
Marine Superintendent - - -	—	—	300 0 0	—
Admiralty Instruments - - -	2 5 6	—	320 12 8	6 13 4
Ditto Mercantile Marine - - -	126 13 8	5 2 0	262 5 1	70 16 5
Computations and care of instruments - - -	0 12 6	23 13 3	711 7 5	—
	12,532 12 0	198 10 9	8,011 5 5	1,207 9 7
Balances - - -	—	1,008 18 10	4,521 6 7	—
Totals - - -	12,532 12 0	1,207 9 7	12,532 12 0	1,207 9 7

Probable net amount available on 1 January 1876, 3,512*l.* 7*s.* 9*d.*

A cheque for 25*l.* for Office expenses was drawn.

SUBMITTED—The following STATEMENT respecting the RECORDS for OCTOBER 1875, received from the SELF-RECORDING OBSERVATORIES, which have been examined at KEW OBSERVATORY (see Minutes, 21st December 1868).

	Aberdeen.	Armagh.	Falmouth.	Glasgow.	Kew.	Stonyhurst.	Valencia.
ANEMOGRAPH :—							
Action - - - - -	Direction. Good.	Direction. Good.	Direction. Good.	Direction. Good.	Direction. Good.	Direction. Good.	Direction. Good.
Records deficient, due to stoppage of clock	Velocity. Good.	Velocity. Good.	Velocity. Good.	Velocity. Good.	Velocity. Good.	Velocity. Good.	Velocity. Good.
" " other causes - - -	0	0	7 hrs.	0	0	0	0
Orientation verified - - -	0	0	0	0	0	1 hr.	0
No. of errors discovered by subsidiaries	30th	—	14th	28th	25th	—	—
" " irregular differences	0	0	0	0	0	0	0
<i>Result of 40 Remasurements :—</i>							
Greatest difference - - -	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Mean difference irrespective of sign - - -	0.1	0.1	0.1	0.0	0.1	0.1	0.3
Residual difference (—Kew) - - -	0.0	+0.1	-0.1	-0.1	+0.1	0.0	0.0
RAIN GAUGE :—							
Action - - - - -	Direction. Good.	Direction. Good.	Direction. Good.	Direction. Good.	Direction. Good.	Direction. Good.	Direction. Good.
Records deficient, due to stoppage of clock	Velocity. Good.	Velocity. Good.	Velocity. Good.	Velocity. Good.	Velocity. Good.	Velocity. Good.	Velocity. Good.
" " other causes - - -	0	0	0	0	0	0	0
Errors in tabulation - - -	0	0	0	2	0	0	1

116, Victoria Street, January 31, 1876.

PRESENT :

Major-General Strachey in the Chair.

Mr. Galton.

The Director was in attendance.

The Minutes of last meeting (January 17) were read and confirmed.

Mr. Scott reported—That he had been re-examined on the 26th inst. by the Treasury Committee, and had been instructed to supplement the memorandum on the organization of the Office, submitted at last meeting, with additional information.

Reported—That the Report had been sent to the Royal Society as directed.

Submitted—The following estimate of the property of the Office, which was ordered to be printed :—

STATEMENT showing the estimated value of the property standing on the books of the Office on the 1st January 1876.

	£
Office furniture, presses, book shelves, &c.	750
Instruments at observatories, (exclusive of fittings, &c.)	2,600
Pantagraphs used in the Office, and spare set of S.R. instruments	850
Admiralty instruments	5,000
Mercantile marine do.	1,900
Total	<u>£11,100</u>

A value has not been put on the following :—

Library books, charts, &c.
Office publications.
Signal shapes, and lanterns.
Ships' registers.
Stationery stores.

Submitted—The following letter, which had been prepared and despatched in pursuance of the instructions given at last meeting.

DEAR SIR,

ON submitting my letter of December 10, and your kind reply to it, to the Committee yesterday, a member present, who was also one of the members of the Committee of Inquiry, 1866, handed in a letter containing the subjoined remarks, which I was instructed to forward to you, in the hope that you might be able to find time to give the views contained in it your consideration, inasmuch as it appeared to the Committee that my letter hardly put the question fully before you.

To this the following replies had already been received :—

M.O.—216.

Royal Observatory, Greenwich.

MY DEAR SIR,

January 25, 1876.

IN reply to your letter of January 20, and the printed paper which it enclosed.

The statements and instances in the printed paper enable me to understand more clearly the points under consideration. And possibly, by some reference to the more exact theories, we may aid a little in treatment of the rougher matters before us.

For the combination of the results of different groups of observations of different merits, we must have a fair idea of the proportion of weights which we attach to each. It is quite correct, as is noticed in the paper, that if a rather large group of bad observations is combined on equal terms with a small group of good ones, they may totally swamp the good ones, and produce a result of low character. But how to form this proportion of weights? As I said in my preceding letter, I fear that this must be somewhat arbitrary. And I scarcely think that much assistance will be given here by the rule of accurate theory (it depends entirely on the presumed constancy of the physical fact under consideration). Suppose you have n numerical observations of some physical fact whose value is really constant. Take the mean of the numbers, take the discordance of each from the mean, square these discordances (the square being always +), add the squares, and divide the sum by $n - 1$. The quotient so found represents, proportionally, the square of probable error of one observation; and if

you again divide by n (so that the complete divisor is $n(n-1)$), the new quotient represents, proportionally, the *square of probable error of the mean of the group*.

Now I do not recommend that this formula be applied to any of the cases that come before you. But I think that consideration of, and familiarity with, this formula will give some accuracy to the mental consideration of the real cases. Then, for application, the grand theorem of combination of observations is, that *the weight is as the reciprocal of the square of probable error of the mean of the group*.

If, however, you choose to form in your mind an estimate of the weight of every individual observation in a group, then the weight of the mean of the entire group will be the sum of all these weights,—so that the weight of the mean of a group of n observations (all considered equally good) is $n \times$ weight of one.

And if you have two groups, one of m observations, each observation having weight W , and one of n observations, each observation having a weight w ; then the mean of first group must have the weight mW and the mean of the second group must have the weight nw , and so they must be combined.

It is difficult for me to say how much of this is likely to be useful, or how much is wanting, but this I state as certain. If possible, the proportional weights ought to be assigned, even by arbitrary process, and then the result ought to be combined by use of the weights.

R. H. Scott, Esq.

I am, &c.
(Signed) G. B. AIRY.

M.O., 223.

MY DEAR SIR,

Utrecht, 24th January 1876.

YOU gave me again in consideration the question about "weighting" the observations. I will consider more fully on that point, which is an intricate one.

What I now see is, that it is more the question how different series of observations should be entered with different weights, than how the observations themselves should be weighted.

It is very difficult, for we have to reckon with such variable elements.

1°. *The Direction and Velocity of Currents.*

If it be derived currents, and not the principal ones, they may indeed differ in one year from those in another, and if we have once seen (the Committee is very right in this) that the astronomical positions are taken with care, and the course and velocity, as we have done since 1863, well-determined by shipmasters whose observations bear the mark of accuracy, I cannot see in what proportion I have to assign a weight to the result, greater or less than to the result derived from the observations of other shipmasters, even if they were excellent.

2°. *Take the Barometer Height.*

What do you say to the mean pressure of March? The difference of the average of Oxford before 1860, reduced to the sea level, differs from that of 1860–70, say 5 mm. In what proportion would you weight the first result and the latter for that latitude?

You would be quite at a loss if it were a spot in the ocean. Now, as we have at both places, and a number of others in England, a longer series, we find easily that both observations were true, and that indeed barometric pressure differed 5 mm. in 10 years before and 10 years past 1860.

I note this because I am now writing to you and wish to fill up the paper, and not let you or the Committee wait. But it is only a preparatory answer, and I will continue to think on the question.

R. H. Scott, Esq.

Yours, &c.
(Signed) BUYS BALLOT.

M.O. 273.

DEAR SIR,

K. K. Central Anstalt für Meteorologie, Vienna,
January 29, 1876.

YOU have had the kindness to send me some printed Remarks about the use of "weighting" in ocean statistics, and I readily avow that I am now viewing the subject in a more distinct way.

Notwithstanding this my opinion upon the question in general has not been altered sensibly.

As I allowed myself to state already,—

1. The work entrusted to the Maritime Department of the Meteorological Office would have to be done *twice*; in the first instance the different groups of logs would have to be treated separately, then by a process which till now is not explained quite distinctly, the weights corresponding to the different groups would have to be ascertained, and then it would be possible to arrive at the definite results with regard to the weights.

2. It is not expressed distinctly in the Remarks whether the ascertaining of weights should be done *separately for every square and for every element*, or if weights found out by investigation of a special square and a special element should be applied to other squares and other elements.

If the first method should have to be followed it would be extremely tedious, and moreover for many squares there would be wanting the necessary amount of logs for deducing the weights from them.

By adopting the second method the whole process of weighting would lose the strictly scientific character of an application of the Theory of Probabilities, as the results would depend from what square and which elements had been used to arrive at the weights of the respective groups.

3. Practically it would be impossible to follow strictly the former method; then if weights deduced from a limited space of the ocean or from a single element should be made use of for other parts of the ocean or other elements, there would be something arbitrary introduced in the process of weighting.

4. The selection of the logs in different groups would always remain arbitrary and entrusted to the individual judgment of the person entrusted with the classification of the registers.

5. If this person changes there would be no guarantee that the grouping of logs would be effected absolutely in the same manner as before, and in general the standard for classification will change with time, the more recent observations generally being better than the older ones.

6. The weights to be obtained by the method alluded to in the Remarks would be different from the degree of exactness of the observations as in most cases the deviations of the different elements from the normal values may be much larger than the errors of observation. If, for instance, the normal atmospheric pressure has to be deduced, it is quite possible that of two logs the former—the degree of exactness (of which) to the second is as 1:3—would give more correct results, if the first ship had been favoured by settled weather.

7. The whole question seems to have arisen from the fact that 427 observations collected by Maury gave a less trustworthy result than 127 observations taken from superior logs.

It should be borne in mind that this is a single instance only. Of course I am not able to give a judgment on the value of the 427 observations, without having seen and scrupulously investigated them, but from experience in somewhat analogous matters, I should think there must have been included in this series of 427 observations some, and not few, bad ones to adulterate completely the results deduced from the totality of the 427 logs.

In conclusion I beg to be allowed to express my opinion as follows:—

I. The introduction of the principle of weighting into ocean statistics would considerably augment the work to be done.

II. It would be practically not feasible to deduce weights strictly according to the rules of the Theory of Probabilities, therefore something arbitrary in the process could not be avoided.

III. The advantage arising from the introduction of weights would hardly be equivalent to the increase of labour and to the stopping of the work in the Maritime Department of the Meteorological Office, as a large part of the documents would have to be again perused and treated in a different way.

IV. The method followed till now by the Maritime Department of the Meteorological Office has this advantage, that it allows us to add together in a very simple way observations made in subsequent years and by ships of other nations where no “weighting” is made use of.

I am, &c.

R. H. Scott, Esq., F.R.S.

(Signed) CH. JELINEK.

Submitted—The following reply to the former letter of December 10:—

M.O. 182.

K. K. Central-Anstalt für Meteorologie, Vienna,

DEAR MR. SCOTT,

17th January 1876.

IN a letter of December 10th, last year, you honoured me by asking my opinion on the method to be adopted for deriving results from meteorological observations made at sea.

I am very sorry that I have not been able till this day to answer your letter, firstly, because my health in the last time was not quite good, and then because at the end of the year there is always a quantity of official business, and partly of an urgent character.

You did put the before-mentioned question in this way:—

“Do you think it possible to apply any method of ‘weighting’ to meteorological observations made at sea, so that by a judicious selection of observations results could be obtained with less labour and of more accuracy than by the present process?”

For thoroughly understanding this question, and being able to answer it fully, one should know practically the process used in the different maritime departments, *i.e.*, have occupied himself some time with extracting, tabulating, taking of means and deriving results out of meteorological observations made at sea. This sort of work I have never done, and I can, therefore, give my opinion only after a general knowledge of the method followed in the Maritime Department of the British Meteorological Office, a method which, I think, is substantially the same as that used by the Meteorological Institute of the Netherlands and the German Seewarte at Hamburg.

Generally it must be much more difficult to deal with observations made at sea than with those taken at land stations. Meteorological observers at land stations are ordinarily making their observations in a quite regular way, so that the variations of the meteorological elements in the daily and in the yearly periods may easily be ascertained. Besides this it is, if not always easy, yet not impossible to organize new stations by which gaps in the existing system may be filled up.

All this is very different in observations made at sea. Ships are generally following determined routes, so that some parts of the ocean are traversed by many ships, and consequently much more information can be obtained, while other parts of the ocean are rarely visited and but scanty observations obtained from them.

Observations made at sea will for these reasons, I think, always be somewhat inferior in quality to observations made at land stations. There will be needed a much larger interval of time for obtaining results of somewhat equal accuracy with that for stations on land, while for some parts of the ocean the results arrived at will never equal in exactitude those from stations on land.

Any method of “weighting” the observations is founded on the supposition that these are not of equal value. Practically, observations will be of less value—

1°. If taken with less exact instruments.

2°. If the instruments previous to the journey, and after it, have not been compared with standards, and the corrections of the former not ascertained.

3°. If less attention and diligence has been bestowed in the making of the observations.

4°. If for a given part of the ocean or a given part of the year there are too few observations for deriving trustworthy results.

With regard to points 1-3 I think your Maritime Department takes care to fulfil all the conditions; it distributes tested instruments, and looks that they are duly compared before and after the journey, the gentlemen entrusted with extracting meteorological registers kept at sea will have acquired the necessary experience to be able to judge whether sufficient care and diligence have been bestowed on the taking of the observations.

If the conditions above-mentioned are not fulfilled, the observations are, I suppose, rejected at once and this seems to me to be an easier and surer way than any weighting. If, therefore, only trustworthy observations are made use of, they will be almost equal in value, and there will be no necessity of "weighting." A saving of labour or time cannot generally be effected by introducing a system of weighting.

The idea which I have formed of such a method is this, that for the first instance one would have to go through the present process, and by comparison of the data given by individual ships with the mean results deduced out of the totality of observations, ascertain the degrees of exactness and give their due weight to the individual registers, after which the whole process should be recommenced till the new results should have been obtained.

It is easily to be seen that the work would be doubled by this method, and I don't know if the accuracy of the results obtained by it would be so much superior as to pay for the addition of labour necessitated by it.

I have alluded to another serious defect of the meteorological observations made at sea, namely, that they are not uniformly distributed with regard to space or time. For this most serious defect there is no aid in the method of weighting; on the contrary, when observations are so scarce one will be obliged to take in observations of lesser value.

If I have made a mistake in comparing what I thought to be the method of weighting with the processes actually followed in the various Maritime Departments, I may be excused by this reason, that the method of weighting is not a definite one; I could therefore only give my opinion about the course I was likely to pursue if I had to put down the principles of such a method.

Yours very truly,
(Signed) CH. JELINEK.

Submitted—A specimen of the charts issued by the Paris Observatory for publication in the "Opinion Nationale" and other papers.

Mr. Scott stated that as the preparation of charts for newspapers was becoming rather serious, he would suggest that he be permitted to make a charge to the recipients for the time actually occupied in such work.—Sanctioned.

Read—A letter from Captain Toynbee, submitting excellent Logs by—

Captain H. Faithfull, ship "Haddon Hall."

Captain H. Longley, s.s. "Yorkshire" (Minutes, 1875, p. 60).

Captain Allen Young, s.s. "Pandora."

Log kept by A. C. Horner, M.R.C.S.

Mr. Scott was instructed to present the charts to Captain Faithfull, and to express the marked thanks of the Committee to the other gentlemen.

Reported—That the Daily Weather Charts had been supplied free to Mr. J. M'Cormack, Aberdeen, in return for observations.

Submitted—The following memorandum :—

GENTLEMEN,

As I learn that the first year's issue of Captain Hoffmeyer's charts has resulted in a loss to him of 1000 fr. (40*l.*), I venture to ask if you would allow me to subsidize the undertaking to the extent of say 20*l.* a year. At present I subscribe for 25 copies, all of which are sold, at least for most of the quarters, and I do not anticipate a larger demand for them from subscribers, but I should be very glad if permitted to send a sum of money to recoup him in part for his loss.

ROBERT H. SCOTT.

Resolved—That the sum of 1,000*l.* be transferred from the deposit account of the Committee to their current account in the Bank of England.

The following cheques for January were drawn :—

For Office :

				£	s.	d.
R. H. Scott	} Salaries and wages			66	13	4
J. S. Harding, jun.				20	0	0
J. S. Harding, sen.				*9	12	6
T. D. Bell				6	13	4
C. Gillman, gas company		-	-	3	17	8
Williams and Norgate, books		-	-	2	15	11
Carried forward		-	-	£109	12	9

* Five weeks to the 31st inst.

Five weeks to the 31st inst.

116, Victoria Street, February 7, 1876.

PRESENT :

The Earl of Rosse in the Chair.

Mr. De La Rue.

Mr. Galton.

Major-General Strachey.

The Director was in attendance.

The Minutes of last meeting (Jan. 31) were read and confirmed.

Mr. Scott drew the Committee's attention to the memorandum printed on the last Minutes, with reference to Captain Hoffmeyer's charts, and he was instructed to subscribe for 50 copies of the Charts for the year 1875, for distribution to such captains as might wish to possess them.

Submitted—A new projection for the lithographed Daily Weather Charts, viz., a conical projection, identical with that of Captain Hoffmeyer's charts.—Approved.

Submitted—The following memorandum by General Strachey, and Captain Toynbee's remarks thereon :

COULD not we supply ship captains with blank charts on some fixed uniform projection on which they should enter the essential features of their logs day by day? From such charts the collection of the data would be simpler than from books, and having a daily series of charts in the Office all observations might be entered up with any corrections thought proper whenever they were procured.

Certainly the importance of a connected series of simultaneous observations cannot be overstated, and it should be our aim to obtain it. Could we not get the United States to undertake the Pacific and we take the North Atlantic, and make other arrangements with other nations, mutually supplying one another with the data that came to our hands in the best shape possible?

Although the idea of keeping a precise record of each day's anticipatory judgment of the weather seems to be impracticable and of doubtful utility, it would I think be quite otherwise with a careful analysis of the actual weather month by month. Not such a mere recapitulation of the facts as has hitherto been given, which I confess not to appreciate, but the best possible discussion of the resulting weather in relation to the chief known disposing causes of the wind and sea combined with remarks as to apparent inconsistencies or deviations from ordinary results, and probable physical causes of the observed changes of temperature, pressure, wind, &c. or difficulties in the way of accounting for such changes. I am convinced that much more good would come of such a method of dealing with the observations than from any mere manipulation of figures and calculation of means or calling attention to extreme numerical data.

It cannot be too distinctly remembered that in our latitudes the *non-periodic* changes of the atmosphere are of more immediate importance than the *periodic*, and that for the former the calculation of mean values is not only useless but directly misleading. Without being at the trouble of making the calculations we may quite safely assume that there will be a tolerable approximation to some yearly mean value of all the meteorological elements at every place, and the general causes of such mean values for the various epochs of the solar year are fairly well known. But what we do not know, except in a very partial manner, is the nature of the specific disturbances that bring about the variations of the weather, &c. on either side of the mean values. The mean values are purely fictitious, and the actual facts are to be found in the variations or departures from the mean, and it is to them that attention is really required.

Of course I do not mean to say that mean results are to be wholly neglected, but only that as regards the daily variations of the weather they will be of quite secondary value. There is no doubt still much that requires explanation which can only be dealt with through mean results, and for which the daily fluctuating observations are useless. Each system of facts must be dealt with in the manner suited to the problems they involve.

I have read General Strachey's letter which in substance agrees with what I have frequently proposed to Mr. Scott, but he (Mr. Scott) though agreeing with the idea, has always said it was opposed to, or rather differed entirely from the style of work which we were instructed to carry out.

I do not think that the mass of captains would undertake to enter data on charts for us, neither do I think such a method advisable, because the data need various corrections which they would not apply; but I do think that the directors or owners of most ships and steamers trading on the Atlantic would request their captains to record certain observations for us in their *ships' logs*, and lend those logs to the Office, if the Office undertook all expenses of transmission, and copied and *returned the logs at once*.

If it is decided to ask for only one observation daily from each ship, and that at a certain hour of Greenwich time (on the American plan), then I think stamped forms might be supplied to the captains all ready addressed to the Office, so that there would be no trouble beyond that of observing. I am inclined to think that many captains would carry out such observations well.

In either case we must either supply them with instruments and keep them supplied, which with so large a number would be a tremendous undertaking, or establish a system of comparing their own instruments with standards.

February 1st, 1876.

H. T.

Resolved—That the points referred to in the above notes may be more conveniently considered when the proceedings before the Treasury Committee are concluded.

FALMOUTH, OCTOBER 1875.

THERMOGRAPH:—						Good. Do.	
Action	-	-	-	-	-	Dry.	Wet.
Photography	-	-	-	-	-	0	0
Records deficient, due to stoppage of clock	-	-	-	-	-	—	2 hrs.
" " failure of light	-	-	-	-	-	—	0
" " imperfectly moistened bulb	-	-	-	-	-	—	0
" " partially frozen	-	-	-	-	-	0	0
" " other causes	-	-	-	-	-	0	0
No of errors discovered in entry of Standard	-	-	-	-	-	0	0
" " by subsidiary measurements	-	-	-	-	-	0	0
" " of subtraction in do. tables	-	-	-	-	-	0	0
" " detected under glass scale	-	-	-	-	-	2	2
<i>Result of 40 Remeasurements:—</i>							
Greatest difference	-	-	-	-	-	0.20	0.20
Mean difference irrespective of sign	-	-	-	-	-	0.06	0.07
Residual difference (—Kew)	-	-	-	-	-	—0.06	0.00
Mean monthly difference between simultaneous Thermograph and Thermometer readings	-	-	-	-	-	0.12	0.11
No. of errors in maxima and minima	-	-	-	-	-	1	0

From October 23rd to 31st dry bulb, and 25th, 26th, 29th, and 30th wet bulb tabulations have been corrected at Kew.

Submitted—The following memorandum:

Memorandum.

February 7, 1876.

IN December 1874 I submitted to you a report of the results of an examination into the accuracy of the scales used for measuring the thermograms of the seven observatories. In it I stated "that the values found have in no case been the same for both dry and wet bulbs," but that (excepting Aberdeen) Valencia was the only place where the difference was sufficiently great to need two scales.

Since then more experience has been obtained in the use of the zero lines, and I find that temperatures often occur in which the distance to be measured is sufficient to cause errors of half a degree.

I therefore beg to suggest that it be decided to use two scales (dry and wet) for each observatory (except Stonyhurst, where the difference is very slight), in place of the one now in use, which is a mean between the two, and that the new scales be made in the Office.

I am, &c.

R. H. Scott, Esq.

R. H. CURTIS.

		DRY.			Mean of Dry and Wet.		WET.	
		Upper.	Mean.	Lower.	Upper.	Mean.	Lower.	
Valencia	-	·664	·655	·645	·694	·688	·682	
		Value now in use	-	·668	·672	Value now in use	-	
Armagh	-	·689	·695	·701	·700	·706	·713	
				·700 (now in use).				
Glasgow	-	—	—	·755	—	—	·763	
				·759				
				·770 (now in use).				
Aberdeen	-	—	—	—	—	—	—	
Falmouth	-	·745	—	—	·757	—	—	
				·751				
				·760 (now in use).				
Stonyhurst	-	·722	·720	·717	·722	·726	·729	
				·723 (now in use).				
Kew	-	·761	·756	·752	·751	·750	·750	
				·753				
				·750 (now in use).				

Resolved—That Mr. Curtis' suggestion be complied with.

Read—A letter from Captain Toynbee, submitting an excellent Log by Captain W. C. Smith, ship "Kingdom of Sweden." (Minutes p. 1874, p. 80.)

Mr. Scott was instructed to convey the marked thanks of the Committee to Captain Smith.

Mr. Scott reported that there was in the Office a stock of nearly 50 Azimuth compasses, which were hardly ever issued, and required extensive repairs, while even if repaired they were not required for the service of the Office.

He was authorised to sell those instruments.

General Strachey pointed out the desirability of obtaining the results of observations of temperature and pressure at several stations within the tropics worked out on Bessel's system, as Sir W. Thomson had proposed to take up the mathematical investigation of certain problems, for which such data would be required.

The Committee agreed to devote a sum, not exceeding 50*l.*, to the above purpose.

The Committee then adjourned.

116, Victoria Street, February 21, 1876.

PRESENT :

Major-General Strachey in the Chair.

Mr. De La Rue.

Mr. Galton.

The Director was in attendance.

The Minutes of last meeting (February 7) were read and confirmed.

Mr. Scott reported that he and Captain Toynbee had been examined on the 16th inst., and he submitted copies of three letters (Letter 398) addressed by the Chairman of the Treasury Committee to the

Admiralty,
Board of Trade,
Royal Society,

respectively, asking for opinions on the work of the Office, &c., and stating that copies of a selection of the works published by the Office should be sent to the recipients of the letters.

He was instructed to forward the following works: O. 4, O. 11, O. 12, O. 13, O. 20, N. O. 1, 2, 3, with certain numbers of the Quarterly Weather Report and the Hourly Tabulations.

Mr. Galton submitted an extract from the Minutes of the Council of the Scottish Meteorological Society, which had been placed in his hands by Mr. D. Milne Home, with the request that he would bring it under the notice of the Meteorological Committee.

Scottish Meteorological Society, Edinburgh,

January 21, 1876.

EXCERPT FROM MINUTES OF COUNCIL OF THE SCOTTISH METEOROLOGICAL SOCIETY,
held on 21st January 1876.

THE Council had its attention drawn to the evidence of Mr. R. H. Scott, Director of the Board of Trade Meteorological Committee, given by him on the 22nd April 1874, before the Royal Commission on Scientific Instruction. On this occasion, Mr. Scott, having been asked as a witness whether any correspondence had taken place between him and the Scottish Meteorological Society, stated that much correspondence had taken place, that part of this correspondence had been in a printed form laid by the Scottish Society before the Government when asking for a grant in aid of the Society, but that in this printed correspondence one letter had been suppressed by the Society, dated 9th May 1870, which Mr. Scott states to have been a private letter to himself by Dr. Keith Johnston of Edinburgh, and the terms of which letter Mr. Scott gives in his evidence.

With reference to this charge against the Scottish Society of suppressing the letter so given in by Mr. Scott, the Council have to state that they knew nothing of the letter in question until they saw it, within the last few days, in Mr. Scott's evidence; and as this evidence has been laid before the Commissioners for inquiring into the administration of the Parliamentary grant of 10,000*l.* for

Meteorological purposes, one of whom is Mr. Milne Home, the Chairman of the Council of the Scottish Society, the Council authorizes Mr. Milne Home to state to the other Commissioners that this charge by Mr. Scott against the Scottish Society of suppressing the letter in question is unfounded, and at which they feel exceedingly aggrieved.

Mr. Scott stated that the word "private" in his evidence if used should not have been used by him, and that its insertion must have escaped his notice when revising his evidence for press. He submitted the letter in question and his reply to it. They are as follows:—

M.O. 793.

Scottish Meteorological Society [M.S.], Edinburgh,

DEAR SIR,

4, St. Andrew Square, May 9, 1870.

ON the 27th ult. I transmitted to you extract from Minutes of Council of the Meteorological Society, asking your Committee to suggest terms of an arrangement between you and us.

Some of our friends in Parliament have written to say that, in the view of the impending discussions in the House of Commons on the subject of the annual grant of 10,000*l.*, they are very anxious to learn whether a satisfactory agreement has been effected between your Committee and us.

They say that such an agreement, if it could be referred to in the course of the discussion, would strengthen their hands in upholding the Grant against sundry enemies to its continuance.

We shall be glad to receive an immediate reply from your Committee.

I remain, &c.

Robert H. Scott, Esq.

(Signed) A. KEITH JOHNSTON,
Hon. Sec.

DEAR SIR,

Meteorological Office, May 10, 1870.

THE excerpt from your Minutes was laid before the Committee, but they did not instruct me to send any further reply.

It does not contain any request that this Committee should "suggest terms of an arrangement." It simply asks us to let you know when we are about establishing new stations in Scotland, which we shall of course do.

The co-operation which we *have* asked for is as regards the observations of wind and weather, out of my application for which, in January last, the correspondence has arisen.

The Committee do not meet till Monday next. Could you kindly let me know whether there could have been any mistake in copying the words of the excerpt sent me? It most certainly contains no request of the nature indicated in your letter.

Yours, &c.

A. Keith Johnston, Esq., LL.D.

(Signed) ROBERT H. SCOTT.

He further pointed out that these letters form an integral part of the correspondence between the Meteorological Committee and the Scottish Meteorological Society, that their place is between Nos. IV. and V. of the correspondence published in Appendix XIII., Enclosure No. 2, Report of Royal Commission on Science Instruction, Minutes of Evidence, Vol. II., p. 67.

The Meteorological Committee having reviewed the whole subject find no difference either in the form of the letter or in the signature of the letters of May 9, and May 13, the latter of which has been printed by the Council of the Scottish Meteorological Society, but they have the pleasure of informing Mr. Milne Home that they have noted the disavowal on the part of the Council of the Scottish Meteorological Society of their knowledge of the letter of May 9th.

Mr. Scott was instructed to forward a copy of the above Minute to Mr. Galton.

Submitted—The following letter:

M.O. 388.

SIR,

India Office, February 16, 1876.

WITH reference to your letter of the 11th April 1871, on the subject of an Indian Meteorological Department, I am directed by the Secretary of State for India in Council to transmit to you herewith copy of the scheme devised by Mr. H. F. Blanford, and sanctioned by the Government of India for the organization of Meteorological Observatories and Offices in India, and I am to request that you will beg the Meteorological Committee to favour the Secretary of State with any observations they may have to offer thereon.

I am, &c.

R. H. Scott, Esq.

(Signed) GEORGE HAMILTON.

Mr. Scott was instructed to send the enclosed Report to the members of the Committee for their perusal and remarks.

Submitted—The following additional correspondence on the subject of "weighting" observations:

DEAR SIR,

Utrecht, February 12, 1876.

I HAVE nothing to add to my former letter in respect of "weighting" the observations. I let M. Cornelissen see it, and neither had he anything more to suggest.

You are right in saying it is (for) the sake (*sic.*) of mathematicians, but the cases are different, and I am at a loss to bring out a method which should really give the truth better than a simple juxta-

position of observations which *à priori* and by comparison with the rest of the observations in the journal were admitted as "good."

I am, &c.
(Signed) BUYS BAILLOT.

M.O. 358.

Central Physical Observatory, St. Petersburg,

DEAR SIR,

February 4, 1876.

I HAVE looked through the article on the "weighting" of observations made at sea, and will give you my opinion on it freely.

It appears to me that the result obtained by carrying out this proposal is not commensurate with the labour spent upon it, and that, generally speaking, it is contrary to the laws of objective observation to give a greater weight to one or another series of observations from frequently quite subjective reasons.

By this means more harm than good will frequently be done. Our practice is to reject entirely observations which appears decidedly doubtful either from defective instruments or from proved untrustworthy observers, and to consider the remainder as of equal value.

I am, &c.
(Signed) H. WILD.

Mr. Galton submitted to the Committee certain results which he had obtained, exhibiting the advantage which could be gained by applying "weighting" to currents; and he requested permission to carry on the inquiry further.—Approved.

Mr. Scott reported that as the term of seven years, mentioned in the agreement for the Office (Minutes, 1869, pp. 40, 41, 52) would expire on the 31st prox., he had written the following letter:—

DEAR SIR,

February 9, 1876.

AS our seven years' agreement for rent of this Office terminates on the 31st March next, and as the future of the Office is now under consideration by a Treasury Committee, I should be greatly obliged if you would inform me, at your earliest convenience, for the information of the Meteorological Committee, whether we can continue our tenancy for another year, viz., to the 31st March 1877, on the present terms.

C. W. Jacques, Esq.

I am, &c.
(Signed) ROBERT H. SCOTT.

And had received the following reply:—

M.O. 347.

DEAR SIR,

4, Victoria Street, S.W., February 10, 1876.

IN reply to your letter of yesterday I beg to say there will be no objection to your continuing the tenancy of your offices for another year, viz., to the 31st of March 1877, on the present terms.

R. H. Scott, Esq.

I am, &c.
(Signed) CHAS. W. JACQUES.

The action was approved.

Read—A letter from Captain Toynbee, submitting an excellent Log by the late Captain F. J. Gray, H.M.S. "Nassau," which had been kept by Lieut. G. N. Pollard. (Minutes, p. 4.)

Mr. Scott was instructed to convey the marked thanks of the Committee to Mr. Pollard.

Reported—That Captain Allen Young had expressed a wish for the Pilot and Wind and Current Charts (Minutes, January 31), and that they had accordingly been presented to him.

Submitted—A letter (No. 399) from Captain Hoffmeyer, acknowledging with thanks the resolution of the Committee of February 7th, and asking if the Office would supply him with the observations in its possession for 8 a.m. daily during 1875, for insertion on his Synoptic Charts.

Mr. Scott stated that he had already replied (Letter No. 340) to the effect that he had no funds to devote to such a purpose. He was instructed to ascertain what the probable cost would be and report to the Committee.

Submitted—The new Weather Charts issued by the Deutsche Seewarte at Hamburg.

Reported—That copies of the Daily Weather Charts had been supplied to the following:

Royal College of Science for Ireland	-	-	On Free List.
Meteorological Office, Florence	-	-	"
Great Grimsby (2nd copy)	-	-	For Exhibition.

SUBMITTED.—The following STATEMENT respecting the RECORDS for January 1876, received from the SELF-RECORDING OBSERVATORIES, which have been examined at KEW OBSERVATORY (see Minutes, 21st December 1868).

Points noticed at Kew.	Aberdeen.		Armagh.		Falmouth.		Glasgow.		Kew.		Stonyhurst.		Valencia.	
	Direction. Good.	Velocity. Good.	Direction. Good.	Velocity. Good.	Direction. Good.	Velocity. Good.	Direction. Good.	Velocity. Good.	Direction. Good.	Velocity. Good.	Direction. Good.	Velocity. Good.	Direction. Good.	Velocity. Good.
ANEMOGRAPH :—														
Action - - -	23 hrs.	23 hrs.	0	0	4 hrs.	4 hrs.	0	0	0	0	0	0	0	0
Records deficient, due to stoppage of clock - - -	0	0	0	0	0	0	0	0	0	0	0	0	0	0
" other causes - - -	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Orientation verified - - -	0	0	6th	-	18th	-	0	0	30th	-	0	0	0	0
No. of errors discovered by subsidiaries - - -	0	0	1	0	0	0	0	0	0	0	0	0	0	0
" irregular differences - - -	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Result of 40 Remasurements :—														
Greatest difference - - -	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Mean difference irrespective of sign - - -	0.1	0.5	0.2	0.4	0.2	0.4	0.3	0.5	0.0	0.2	0.0	0.4	0.3	0.5
Residual difference (— Kew) - - -	0.0	+0.1	0.0	-0.1	-0.1	0.0	0.0	-0.1	0.0	0.0	-0.1	0.0	0.0	0.0
RAIN GAUGE :—														
Action - - -	Fair.	Fair.	Fair.	Fair.	Fair.	Fair.	Fair.	Fair.	Fair.	Fair.	Fair.	Fair.	Fair.	Fair.
Records deficient, due to stoppage of clock - - -	0	0	0	0	0	0	0	0	0	0	0	0	0	0
" other causes - - -	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Errors in tabulation - - -	0	0	3	0	0	0	2	0	0	0	0	0	0	0

BAROGRAPH:—

BAROGRAPH :—		Good. Do.	Good. Fair.	Good. Do.	Good. Fair.	Good. Do.	Good. Fair.
Action	-	-	-	-	-	-	-
Photography	-	-	-	-	-	-	-
Records deficient, due to stoppage of clock	-	-	-	-	-	-	-
"	"	-	-	-	-	-	-
"	"	-	-	-	-	-	-
No. of errors discovered—	-	-	-	-	-	-	-
In entry of standard	-	-	-	-	-	-	-
" calculating residual correction	-	-	-	-	-	-	-
" applying residual correction	-	-	-	-	-	-	-
" subtraction in subsidiary tables	-	-	-	-	-	-	-
" tabulation by subsidiaries	-	-	-	-	-	-	-
"	"	-	-	-	-	-	-
" irregular differences	-	-	-	-	-	-	-
<i>Result of 40 Remeasurements :—</i>							
Greatest difference	-	-	-	-	-	-	-
Mean difference irrespective of sign	-	-	-	-	-	-	-
Residual difference (— Kew)	-	-	-	-	-	-	-
Mean monthly difference between simultaneous barograph and barometer readings	-	-	-	-	-	-	-

THERMOGRAPH:—

THERMOGRAPH :—					
Action	-	-	-	-	-
Photography	-	-	-	-	-
Records deficient, due to stoppage of clock	-	-	-	-	-
" " failure of light	-	-	-	-	-
" " imperfectly moistened bulbs	-	-	-	-	-
" " partially frozen bulbs	-	-	-	-	-
" " other causes	-	-	-	-	-
No. of errors discovered in entry of standard	-	-	-	-	-
" " by subsidiary measurements	-	-	-	-	-
" " of subtraction in do. tables	-	-	-	-	-
" " detected under glass scale	-	-	-	-	-
<i>Result of 40 Remasurements :—</i>					
Greatest difference	-	-	-	-	-
Mean difference irrespective of sign	-	-	-	-	-
Residual difference (-Kew)	-	-	-	-	-
Mean monthly difference between simultaneous thermograph and thermometer readings	-	-	-	-	-
No. of errors in maxima and minima	-	-	-	-	-

Submitted—The following Report on the experiments made to discover the cause of the irregularity in the Aberdeen thermogram tabulations, which has been repeatedly brought before the Committee.

Memo.

February 21, 1876.

I HAVE measured the photograph taken by Mr. Whipple to try the effect which inclining the thermometer tube of a thermograph would produce upon the size of the image, with a view to throwing light upon the error of the Aberdeen dry bulb.

The photograph is in three sections. In Nos. 1 and 3 the tube was as nearly as possible vertical, but in No. 2 it was inclined 3° ; the definition of the lines in No. 1 not being so good as in No. 3, I think the comparison between Nos. 2 and 3 better than that between Nos. 2 and 1. The following table gives the measurements and comparisons made:—

No. of Line.	Distance from Zero.			Differences.			Distance between Lines.				Differences.		
	No. 1.	No. 2.	No. 3.	2 ± 1.	2 ± 3.	1 ± 3.	Nos. of Lines.	No. 1.	No. 2.	No. 3.	2 ± 1.	2 ± 3.	1 ± 3.
1	—	0.148	—	—	—	—	—	—	—	—	—	—	—
2	—	0.404	—	—	—	—	1 and 2	—	0.256	—	—	—	—
3	—	0.659	0.671	—	-0.012	—	2 - 3	—	.255	—	—	—	—
5	—	0.913	0.921	—	-0.008	—	3 - 5	—	.254	0.250	—	+0.004	—
6	—	1.169	1.174	—	-0.005	—	5 - 6	—	.256	.253	—	+0.003	—
7	—	1.421	1.420	—	+0.001	—	6 - 7	—	.252	.246	—	+0.006	—
8	1.688	1.674	1.673	-0.014	+0.001	+0.015	7 - 8	—	.253	.253	—	.000	—
9	1.943	1.923	1.927	-0.020	-0.004	+0.016	8 - 9	0.255	.249	.254	-0.006	-0.005	+0.001
11	2.194	2.179	2.178	-0.015	+0.001	+0.016	9 - 11	.251	.256	.251	+0.005	+0.005	.000
12	2.448	2.430	2.431	-0.018	-0.001	+0.017	11 - 12	.254	.251	.253	-0.003	-0.002	+0.001
13	2.700	2.683	2.686	-0.017	-0.003	+0.014	12 - 13	.252	.253	.255	+0.001	-0.002	-0.003
14	2.955	2.937	2.937	-0.018	.000	+0.018	13 - 14	.255	.254	.251	-0.001	+0.003	+0.004
15	3.209	3.192	3.189	-0.017	+0.003	+0.020	14 - 15	.254	.255	.252	+0.001	+0.003	+0.002
17	3.467	3.452	3.442	-0.015	+0.010	+0.025	15 - 17	.258	.260	.253	+0.002	+0.007	+0.005
18	3.708	3.707	3.697	-0.001	+0.010	+0.001	17 - 18	.241	.255	.255	+0.014	.000	-0.014
19	3.953	3.960	3.943	+0.007	+0.017	+0.010	18 - 19	.245	.253	.246	+0.008	+0.007	-0.001
20	4.204	4.216	4.201	+0.012	+0.015	+0.003	19 - 20	.251	.256	.258	+0.005	-0.002	-0.007
21	—	4.474	—	—	—	—	20 - 21	—	.258	—	—	—	—
23	—	4.734	—	—	—	—	21 - 23	—	.260	—	—	—	—

It will be noticed that the distances from zero of the lines of No. 2 as compared with Nos. 1 and 3 are at first *less*, but increase till at the bottom of the photograph they become *greater*. The same thing is found on comparing the distances between the "White lines" on the Aberdeen thermograms:—

Values of White lines.

Distance apart in ins.

38°-43°

0.361

43°-48°

.367

48°-53°

.363

53°-58°

.354

58°-63°

.345

63°-68°

.343

Further experiments are being made by Mr. Whipple to confirm the above, but in the meantime it would seem that want of perpendicularity in the thermometer stem is the cause of the Aberdeen error, and from the way in which it changes I further think the raising or lowering of the frame is the immediate cause of the production of the angle.

R. H. Scott, Esq.

(Signed) R. H. CURTIS.

Reported—That Mr. John Dallas had been appointed a temporary clerk at the salary of 17. 10s. per week—Approved.

Reported—That on the 10th inst. the supply to the "Graphic" and "Lloyd's Newspaper" of Weekly Diagrams of Meteorological Curves had commenced, and that from the 14th inst. the Chart was supplied to the "Times" at 10.15 a.m. for their second edition, and similar charts to the "Standard" at the same hour from the 21st inst.—Approved.

A cheque for 30*l.* was drawn in favour of J. S. Harding, Jun., for Office expenses.

The Committee then adjourned.

Mr. Scott submitted the following correspondence, which has formerly taken place on the subject, and was ordered to be printed on the Minutes:

Board of Trade, January 6, 1855.

I am requested by my Lords of the Privy Council for Trade to acknowledge the receipt of your letter of the 29th ult. transmitting for their consideration and suggestion a draft of the proposed 116, *Victoria Street, February 28, 1876.*

PRESENT:
Mr. De La Rue in the Chair.
Major-General Smythe.

The Director was in attendance.

The Minutes of last meeting (February 21) were read and confirmed.

Mr. Scott reported that he had been re-examined on the 23rd inst.

Reported—That the selection of the Publications of the Office had been sent to the Board of Trade, Admiralty, and Royal Society as directed.

Submitted—The following correspondence—

M.O., 447. Hydrographic Department, Admiralty,
February 28, 1876.

MY DEAR MR. SCOTT,

WILL you kindly send me a specimen (latest pattern) of each of the Meteorological Instruments your Department furnishes for the use of Her Majesty's Fleet, namely—

Barometer.
Ditto Aneroid,
Thermometer, ordinary,
" maximum,
" minimum,
Hydrometer,

together with the average contract price for each?

On the first page of your Memorandum for Treasury Committee, last paragraph, you speak of the supply of "meteorological instruments under an arrangement with the Admiralty." I do not quite grasp the meaning implied. Will you be good enough to explain the nature of the arrangement, as our books fail to furnish such exact particulars as the phrase would appear to imply?

Yours, &c.

(Signed) FREDK. JNO. EVANS.

Press copy 391.

DEAR CAPTAIN EVANS,

Meteorological Office, February 28, 1876.

I HAVE great pleasure in sending you a specimen of each of the instruments usually supplied to Her Majesty's ships.

The prices appended are our contract prices, and include the verification fee, except in the case of the Aneroids.

As to the "arrangement" to which I refer in my Memorandum, I would only draw your attention to the letter from the Admiralty to the Board of Trade of January 11, 1855, signed W. A. B. Hamilton, and enclosing instructions (dated December 24, 1854) to Admiral (then Captain) FitzRoy, for the supply of instruments to Her Majesty's ships, and to Circular No. 258 of July 25, 1856, addressed Commanders-in-Chief, &c. This correspondence appears in the Report of the Meteorological Department of the Board of Trade for 1857, pp. 65-68.

The Committee of Inquiry of 1866 in their Report (p. 6, § 3, line 5) speak of the supply to the Royal Navy.

The Meteorological Committee were formally entrusted with all the duties and functions of the old Meteorological Department of the Board of Trade, and the "Meteorological Services under the Admiralty," which I describe as an arrangement, were specially mentioned in a letter from the Treasury to the Board of Trade of June 5, 1867.

I am, &c.

R. H. SCOTT.

P.S.—List of instruments kept at the Meteorological Office for the ordinary demands of Her Majesty's ships:—

		Average values.
Barometer	- - -	£4 0 0
" "Gun," with India rubber packing	- - -	4 10 0
Aneroid	- - -	2 10 0
Thermometer, ordinary	- - -	0 7 0
" maximum	- - -	0 12 0
" minimum	- - -	0 12 0
Hydrometer	- - -	0 5 0

Mr. Scott submitted the following correspondence, which has formerly taken place on the subject, and was ordered to be printed on the Minutes :

ADMIRALTY INSTRUCTIONS.

SIR,

Board of Trade, January 6, 1855.

I AM requested by my Lords of the Privy Council for Trade to acknowledge the receipt of your letter of the 29th ult., transmitting for their consideration and suggestion a draft of the proposed instructions to Captain FitzRoy, as chief of the Meteorological Department, and in reply I am to request you to inform the Lords Commissioners of the Admiralty that it appears to my Lords that some inconvenience might arise were Captain FitzRoy to receive separate instructions for his guidance from two distinct departments, and they desire me to suggest for the consideration of the Lords Commissioners whether this object would not be answered equally well if their wishes with respect to his proceedings were addressed officially to my Lords, in order that they might be communicated by and through them to Captain FitzRoy.

(Signed) T. H. FARRER.

To the Secretary to the Admiralty.

SIR,

Admiralty, January 11, 1855.

I AM commanded by my Lords Commissioners of the Admiralty to transmit to you the enclosed copy of their instructions to Captain FitzRoy, with reference to meteorological observations to be made on board Her Majesty's ships, and I am to request that the President of the Board of Trade will be pleased to communicate them to that Officer in the manner he may deem most convenient.

I am, &c.

James Booth, Esq., Board of Trade.

(Signed) W. A. B. HAMILTON.

SIR,

Admiralty, December 24, 1854.

THE Lords Commissioners of the Admiralty having, on the representation of the Royal Society, decided that Her Majesty's ships shall take a part in the extended series of meteorological observations to be made chiefly at sea, and it having been arranged between the President of the Board of Trade and the First Lord of the Admiralty that you should take charge of measures necessary to carry the above-mentioned observations into effect, both on board ships of war and merchant ships, I am commanded to acquaint you that you have been appointed by their Lordships to that duty, as far as relates to Her Majesty's ships, and that your appointment is to date from the 1st of August last.

War having, unhappily, broken out since the original proposal for such observations was made, it will not for the present be practicable to carry out the measure so extensively as was at first intended, but there are still many cases in which it may be effected, as on board the ships on the North American and West India station, the Brazils, the Coast of Africa, India, Australia, and the Pacific. You will therefore place yourself in communication with the Hydrographer to the Admiralty, and in conjunction with him, order the requisite standard instruments to be prepared, and when properly tested, to be sent out by any convenient and safe opportunity to those stations for distribution among the ships.

A copy of the form of register which was sanctioned in April last is sent herewith for your information; but it is the wish of their Lordships to act in concert as much as possible with the Board of Trade, so that the observations may be uniform throughout the Royal Navy and Mercantile Marine, so far as is consistent with the established regulations and the usual routine of duties in Her Majesty's service.

A sufficient supply of the blank forms of register is to be sent to all ships and stations to which instruments are sent; and it may be desirable that they should be accompanied by explicit and detailed instructions for making observations, should it be considered that those already issued in the Admiralty Manual are not sufficiently comprehensive.

When the instruments, registers, and instructions are ready, their Lordships will issue the necessary orders to the fleet for the observations being regularly carried out whenever the more immediate duties of the public service admit of it. Meteorological observations are now being made, and have been made for some years past under the orders of the Admiralty, at Halifax, Bermuda, Valparaiso, Ascension, and at Trincomalee, Columbo, and Point de Galle in Ceylon, and the records are periodically transmitted to England: these registers you can have access to on application to the Hydrographer. It will be for you to consider whether it is desirable to continue observations at those places, and if so, to ascertain whether the instruments by which they are made are equal to the standard barometers and thermometers which it is understood have been lately perfected, and if not, to exchange them, as opportunities may arise, for the improved instruments.

All registers received will in future be sent to you for examination and discussion. It will be a part of your duty also to examine all the "Remark Books" periodically transmitted to the Admiralty, and on all occasions that you obtain information which can be useful to the navigator, as with reference to winds, currents, soundings, &c., you will at once acquaint the Hydrographer, in order that it may be inserted in the Charts and Sailing Directions issued by the Admiralty for the public benefit.

The vote sanctioned by Parliament in the Admiralty estimates for these purposes is 1,000*l.* a year, which is considered will be ample for all the requirements of the service, and you will be careful that the whole expenses connected with carrying out this measure shall not exceed the sum in any single year, without their Lordships' express sanction.

Captain FitzRoy, R.N., F.R.S.

LETTER TO AUTHORITIES AT HER MAJESTY'S DOCKYARDS.

Admiralty and Board of Trade Meteorological Office,
In obedience to the orders of my Lords Commissioners of the Admiralty, (referring to their Lordships' Circular, No. 258, July 25, 1856,) I have the honour to send you the articles specified on the other side.

I am, &c.

To

LIST.

Registers or Weather-books	
Barometers : Nos.	
Aneroid barometers : Nos.	
Thermometers : Nos.	
Hydrometers : Nos.	

Circular, No. 258.

Admiralty, July 25, 1856.

METEOROLOGICAL OBSERVATIONS.

HER Majesty's Government having undertaken to promote and take part in an extended system of Meteorological Observations at sea, and having caused the requisite instruments, forms of register, and instructions to be provided and placed at the principal seaports of the United Kingdom for the use of the Mercantile Marine, the Lords Commissioners of the Admiralty direct that all captains and commanding officers of Her Majesty's ships will co-operate in this undertaking, whenever and as far as their respective opportunities and means will admit.

Standard barometers, tested thermometers, and registers, with the necessary instructions, will be supplied from Her Majesty's dockyards, in the usual manner, on demand. The observations are to be carefully made, and recorded in the mode pointed out in the instructions; and the registers, when filled up, are to be transmitted to the Admiralty through the same channels as the ship's log books.

Stationary ships, or ships fitting out or re-fitting in a home port, where a regular series of meteorological observations is established, will not be required to make the above observations while remaining at such port.

This order does not affect Art. I., sect. IX., chapter V., of the Admiralty printed Instructions, which still remains in force.

By command of their Lordships,
R. OSBORNE.

To all Commanders-in-Chiefs, Captains, Commanders,
and Commanding Officers of Her Majesty's Ships
and Vessels.

N.B.—Screens or stands for thermometers may be obtained by application at the Dockyards, or can be made on board according to the patterns at each depository of instruments.

SIR,

Meteorological Department, December 13, 1860.

I HAVE the honour to submit for consideration, the question whether it is now desirable to cause the Admiralty Circular No. 258 (July 25, 1856) to be altered, if not abrogated?

Since 1855 large quantities of meteorological records have been accumulated in this Office, which, added to those stores of similar information existing previously at the Admiralty and elsewhere, constitute an extensive mine of such facts as it is a principal duty of this Office to collate and render available.

With such materials in possession, requiring many years of combined industry to utilize, it may be doubted, I venture to submit, whether the Circular in question should continue in force.

The barometers and thermometers supplied now to Her Majesty's ships are so constructed that, while unbroken, their indications are reliable under all circumstances; and, as the log books kept officially in such ships have spaces specially appropriated to such meteorological facts as it is desirable to record for general purposes, it may be deemed unnecessary, in future, to keep a special log for Meteorology alone.

Under existing Admiralty arrangements the ordinary log books of Her Majesty's ships are conveniently and readily accessible.

My own humble opinion is that the Circular No. 258 might be cancelled, without any real loss or disadvantage. That special logs (or meteorological registers) should still be available at the respective dockyards for occasional use in scientific expeditions; and that a supply of good barometers (mercurial and aneroid), with various thermometers, should be kept at dockyards and depôts visited for supplies by Her Majesty's ships.

The Secretary of the Admiralty.

I have, &c.,
(Sd.) ROBERT FITZROY.

SIR,

Admiralty, January 15, 1861.

IN reply to your letter of the 13th ultimo, I am commanded by My Lords Commissioners of the Admiralty, to acquaint you that their Lordships concur in opinion with you that it will be sufficient in future to send observations on the barometer and thermometer at the end of each watch (except during a storm when the barometer is to be recorded every hour) and that such a regulation will be incorporated in the printed instructions* now in course of revision.

The above observations will be recorded in the ship's log, so that for the future a special log for Meteorology will not be required, but may be obtained on application at the dockyards respectively as at present by any captain wishing to have one.

It will not be necessary specially to cancel Circular No. 258 as on the issue of the new edition of printed instructions all existing circulars will at once be cancelled.

Rear Admiral FitzRoy.

I am, &c.
(Sd.) W. G. ROMAINE.

Reported—That the cost of supplying Captain Hoffmeyer with the information he requested for 1875 would be about 15%.

Resolved—That, in order that Captain Hoffmeyer's Charts, to which the Office subscribes, may be made as complete as possible, Mr. Scott be authorized to supply the information he has asked for, as its cost is not likely to exceed 15%.

Read—A letter from Captain Toynbee, submitting excellent Logs by—

Captain J. T. Sutherland, brigantine "Glenesk" (Minutes 1874, p. 8).

„ A. H. Blackie, Chief Officer, ship "Melpomene."

Mr. Scott was instructed to present the Wind and Current Charts to Mr. Blackie, and to express the marked thanks of the Committee to Captain Sutherland.

The following cheques for February were drawn:—

For Office :

		£	s.	d.
R. H. Scott	-	66	13	4
J. S. Harding, jun.	-	20	0	0
J. S. Harding, sen.	-	7	14	0
T. D. Bell	-	6	13	4
The Pall Mall Coal Co.—Coals	-	7	0	0
Salaries and wages				

For Observatories :

R. and J. Beck, Zinc Plates	-	10	11	6
Malby and Sons, Anemo Forms	-	6	5	0
„	-	13	12	0
		19	17	0

R. H. Curtis	-	13	6	8
C. H. Thompson	-	*5	4	0
C. Stodart	-	*8	8	0
J. A. Curtis	-	9	3	4
Computations				

For Telegraphy :

Postmaster-General, for M. Hoffmeyer (Charts)	-	12	9	3
F. Gaster	-	15	0	0
W. L. Dallas	-	8	6	8
F. Brodie	-	7	3	4
H. W. Chivers	-	*2	16	0
Computations				

Carried forward - - - 220 6 5

* The following are the paragraphs relating to Meteorological observations contained in the "Queen's Regulations," pp. 170, 171, edition 1862, and are supposed to be the "Instructions" referred to. They will be found at p. 49.

† Four weeks to the 26th.

Brought forward		-	-	-	£	s.	d.
For Ocean Meteorology :					220	6	5
H. Toynbee, Marine Superintendent					33	6	8
Negretti and Zambra, Repairing Aneroids					6	15	6
Pewtress & Co., Notice to Captains					8	0	0
J. D. Potter, Pilot Charts, &c.					1	14	6
R. Riviere, Binding Charts					9	0	0
R. Strachan	} Computations				+20	16	8
C. Harding							
T. E. Allen							
					14	3	4
					9	3	4
For Offices Expenses :							
J. S. Harding, jun., on account					100	0	0
					50	0	0
					150	0	0
Total		-	-	-	473	6	5

* Four weeks to the 26th instant.

† Including allowance for care of instruments.

The Committee then adjourned.

116, Victoria Street, March 6, 1876.

PRESENT :

Major-General Smythe in the Chair.

Mr. De La Rue.
Captain Evans.

Mr. Galton.
Admiral Richards.

The Director was in attendance.

The Minutes of last meeting (February 28) were read and confirmed.

Mr. Scott reported that at Mr. Galton's request he had forwarded to Mr. D. Milne-Home a copy of the resolution of the Committee of the 21st ult. (Minutes, p. 35).

Mr. Scott reported that he had received a letter from Sir W. Stirling Maxwell, intimating to him that the Treasury Committee had no further questions to put to him, and suggesting that if he had any remarks to submit he should furnish them to Mr. Fanshawe, the Secretary to the Committee.

He stated that he had replied finally that he would be ready at any time to furnish evidence on any points on which the Committee might wish to examine him.

He submitted the memorandum on Organization (Minutes, p. 26), which had been considerably altered from the original draft, under instructions from the Treasury Committee. The memorandum was amended in a few particulars, and ordered to be inserted on the Minutes (see p. 49). Copies also to be sent to the Treasury Committee.

SUBMITTED—The following STATEMENT respecting the RECORDS for December 1875, received from the SELF-RECORDING OBSERVATORIES, which have been examined at KEW OBSERVATORY (see Minutes 21st December 1868).

	Aberdeen.	Armagh.	Falmouth.	Glasgow.	Kew.	Stonyhurst.	Valencia.
	Direction. Good.	Direction. Good.	Direction. Good.	Direction. Good.	Direction. Good.	Direction. Good.	Direction. Good.
	Velocity. Good.	Velocity. Good.	Velocity. Good.	Velocity. Good.	Velocity. Good.	Velocity. Good.	Velocity. Good.
ANEMOGRAPH:—							
Action	0	24 hrs.	0	0	0	0	0
Records deficient, due to stoppage of clock	0	0	0	0	0	0	0
" other causes	—	—	—	—	—	—	—
Orientation verified	31st	—	—	—	29th	—	29th
No. of errors discovered by subsidiaries	0	1	0	1	0	0	0
" irregular differences	0	0	0	1	0	0	0
Result of 40 Remeasurements:—							
Greatest difference	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Mean difference irrespective of sign	0.1	0.2	0.1	0.1	0.0	0.1	0.1
Residual difference (—Kew)	0.0	0.0	+0.1	0.0	0.0	—0.1	—0.1
RAIN GAUGE.							
Action	Fair.	Fair.	Fair.	Fair.	Fair.	Fair.	Fair.
Records deficient, due to stoppage of clock	0	0	0	0	0	0	0
" other causes	0	0	0	0	0	0	0
Errors in tabulation	0	2	0	0	0	0	0

BAROGRAPH:—

Good.

Good.

Good.

Good.

Good.

Good.

Good.

BAROGRAPH:—

BAROGRAPH :—		Good. Do.	Good. Do. 1 hr.	Good. Do.	Good. Do.	Good. Do. 7 hrs.	Good. Do.
Action	-	0	0	0	0	0	0
Photography	-	0	0	0	0	0	0
Records deficient, due to stoppage of clock	-	0	0	0	0	0	0
failure of light	-	0	0	0	0	0	0
"	"	0	0	0	0	0	0
"	"	0	0	0	0	0	0
No. of errors discovered—							
In entry of standard	-	1	0	5	0	0	0
" calculating residual correction	-	4	1	3	0	0	0
" applying residual correction	-	3	0	3	0	1	0
" subtraction in subsidiary tables	-	0	0	0	0	1	0
" tabulation by subsidiaries	-	0	0	7	0	1	0
" irregular differences	-	0	0	0	0	0	0
<i>Result of 40 Remeasurements :—</i>							
Greatest difference	-	·0050	·0050	·0050	·0040	·0050	·0040
Mean difference irrespective of sign	-	·0020	·0018	·0024	·0014	·0017	·0023
Residual difference (— Kew)	-	·0013	+ ·0004	— ·0005	+ ·0002	— ·0001	+ ·0005
Mean monthly difference between simultaneous barograph and barometer readings	-	·0016	·0020	·0017	·0022	·0017	·0016

THERMOGRAPH:—

Action	-	-
Photography	-	-
Records deficient, due to stoppage of clock	-	-
" failure of light	-	-
" imperfectly moistened bulbs	-	-
" partially frozen	-	-
" other causes	-	-
No. of errors discovered in entry of standard	-	-
" by subsidiary measurements	-	-
" of subtraction in do. tables	-	-
" detected under glass scale	-	-
<i>Result of 40 Remasurements :—</i>		
Greatest difference	-	-
Mean difference irrespective of sign	-	-
Residual difference (<i>(— Kew)</i>)	-	-
Mean monthly difference between simultaneous thermograph and thermometer readings	-	-
No. of errors in maxima and minima	-	-

Read—A letter from Captain Toynbee, submitting excellent Logs from—

Captain W. Greenwood, Ship "Gareloch" (Minutes, 1874, p. 80).

" L. F. Jones, R.N., H.M.S. "Valorous."

Log kept by Nav. Lieut. G. A. Broad.

" F. W. Latham, Ship "Sumatra."

" F. T. Thomson, R.N., H.M.S. "Challenger" (Minutes, 1875, p. 14).

Log kept by Staff Commander T. H. Tizard, and Nav. Sub-Lieut.

A. Havergal.

" T. L. Wadham, Ship "The Murray" (Minutes, 1875, p. 33).

" H. G. Wilcox, Ship "Glenfinlas" (Minutes, 1875, p. 61).

Mr. Scott was instructed to present the Charts to Captain Latham, and to express the marked thanks of the Committee to the other gentlemen.

The attention of the Committee having been drawn to the fact that Professor Dove had celebrated his "Doctor's Jubilee" on the 4th inst., it was resolved that the Chairman do write a letter of congratulation to him on the occasion.

20. of stars in machine not noticed	0.12	0.11	0.12	0.13	0.14	0.15	0.16	0.17	0.18	0.19	0.20	0.21	0.22	0.23	0.24	0.25	0.26	0.27	0.28	0.29	0.30	0.31	0.32	0.33	0.34	0.35	0.36	0.37	0.38	0.39	0.40	0.41	0.42	0.43	0.44	0.45	0.46	0.47	0.48	0.49	0.50	0.51	0.52	0.53	0.54	0.55	0.56	0.57	0.58	0.59	0.60	0.61	0.62	0.63	0.64	0.65	0.66	0.67	0.68	0.69	0.70	0.71	0.72	0.73	0.74	0.75	0.76	0.77	0.78	0.79	0.80	0.81	0.82	0.83	0.84	0.85	0.86	0.87	0.88	0.89	0.90	0.91	0.92	0.93	0.94	0.95	0.96	0.97	0.98	0.99	1.00	1.01	1.02	1.03	1.04	1.05	1.06	1.07	1.08	1.09	1.10	1.11	1.12	1.13	1.14	1.15	1.16	1.17	1.18	1.19	1.20	1.21	1.22	1.23	1.24	1.25	1.26	1.27	1.28	1.29	1.30	1.31	1.32	1.33	1.34	1.35	1.36	1.37	1.38	1.39	1.40	1.41	1.42	1.43	1.44	1.45	1.46	1.47	1.48	1.49	1.50	1.51	1.52	1.53	1.54	1.55	1.56	1.57	1.58	1.59	1.60	1.61	1.62	1.63	1.64	1.65	1.66	1.67	1.68	1.69	1.70	1.71	1.72	1.73	1.74	1.75	1.76	1.77	1.78	1.79	1.80	1.81	1.82	1.83	1.84	1.85	1.86	1.87	1.88	1.89	1.90	1.91	1.92	1.93	1.94	1.95	1.96	1.97	1.98	1.99	2.00	2.01	2.02	2.03	2.04	2.05	2.06	2.07	2.08	2.09	2.10	2.11	2.12	2.13	2.14	2.15	2.16	2.17	2.18	2.19	2.20	2.21	2.22	2.23	2.24	2.25	2.26	2.27	2.28	2.29	2.30	2.31	2.32	2.33	2.34	2.35	2.36	2.37	2.38	2.39	2.40	2.41	2.42	2.43	2.44	2.45	2.46	2.47	2.48	2.49	2.50	2.51	2.52	2.53	2.54	2.55	2.56	2.57	2.58	2.59	2.60	2.61	2.62	2.63	2.64	2.65	2.66	2.67	2.68	2.69	2.70	2.71	2.72	2.73	2.74	2.75	2.76	2.77	2.78	2.79	2.80	2.81	2.82	2.83	2.84	2.85	2.86	2.87	2.88	2.89	2.90	2.91	2.92	2.93	2.94	2.95	2.96	2.97	2.98	2.99	3.00	3.01	3.02	3.03	3.04	3.05	3.06	3.07	3.08	3.09	3.10	3.11	3.12	3.13	3.14	3.15	3.16	3.17	3.18	3.19	3.20	3.21	3.22	3.23	3.24	3.25	3.26	3.27	3.28	3.29	3.30	3.31	3.32	3.33	3.34	3.35	3.36	3.37	3.38	3.39	3.40	3.41	3.42	3.43	3.44	3.45	3.46	3.47	3.48	3.49	3.50	3.51	3.52	3.53	3.54	3.55	3.56	3.57	3.58	3.59	3.60	3.61	3.62	3.63	3.64	3.65	3.66	3.67	3.68	3.69	3.70	3.71	3.72	3.73	3.74	3.75	3.76	3.77	3.78	3.79	3.80	3.81	3.82	3.83	3.84	3.85	3.86	3.87	3.88	3.89	3.90	3.91	3.92	3.93	3.94	3.95	3.96	3.97	3.98	3.99	4.00	4.01	4.02	4.03	4.04	4.05	4.06	4.07	4.08	4.09	4.10	4.11	4.12	4.13	4.14	4.15	4.16	4.17	4.18	4.19	4.20	4.21	4.22	4.23	4.24	4.25	4.26	4.27	4.28	4.29	4.30	4.31	4.32	4.33	4.34	4.35	4.36	4.37	4.38	4.39	4.40	4.41	4.42	4.43	4.44	4.45	4.46	4.47	4.48	4.49	4.50	4.51	4.52	4.53	4.54	4.55	4.56	4.57	4.58	4.59	4.60	4.61	4.62	4.63	4.64	4.65	4.66	4.67	4.68	4.69	4.70	4.71	4.72	4.73	4.74	4.75	4.76	4.77	4.78	4.79	4.80	4.81	4.82	4.83	4.84	4.85	4.86	4.87	4.88	4.89	4.90	4.91	4.92	4.93	4.94	4.95	4.96	4.97	4.98	4.99	5.00	5.01	5.02	5.03	5.04	5.05	5.06	5.07	5.08	5.09	5.10	5.11	5.12	5.13	5.14	5.15	5.16	5.17	5.18	5.19	5.20	5.21	5.22	5.23	5.24	5.25	5.26	5.27	5.28	5.29	5.30	5.31	5.32	5.33	5.34	5.35	5.36	5.37	5.38	5.39	5.40	5.41	5.42	5.43	5.44	5.45	5.46	5.47	5.48	5.49	5.50	5.51	5.52	5.53	5.54	5.55	5.56	5.57	5.58	5.59	5.60	5.61	5.62	5.63	5.64	5.65	5.66	5.67	5.68	5.69	5.70	5.71	5.72	5.73	5.74	5.75	5.76	5.77	5.78	5.79	5.80	5.81	5.82	5.83	5.84	5.85	5.86	5.87	5.88	5.89	5.90	5.91	5.92	5.93	5.94	5.95	5.96	5.97	5.98	5.99	6.00	6.01	6.02	6.03	6.04	6.05	6.06	6.07	6.08	6.09	6.10	6.11	6.12	6.13	6.14	6.15	6.16	6.17	6.18	6.19	6.20	6.21	6.22	6.23	6.24	6.25	6.26	6.27	6.28	6.29	6.30	6.31	6.32	6.33	6.34	6.35	6.36	6.37	6.38	6.39	6.40	6.41	6.42	6.43	6.44	6.45	6.46	6.47	6.48	6.49	6.50	6.51	6.52	6.53	6.54	6.55	6.56	6.57	6.58	6.59	6.60	6.61	6.62	6.63	6.64	6.65	6.66	6.67	6.68	6.69	6.70	6.71	6.72	6.73	6.74	6.75	6.76	6.77	6.78	6.79	6.80	6.81	6.82	6.83	6.84	6.85	6.86	6.87	6.88	6.89	6.90	6.91	6.92	6.93	6.94	6.95	6.96	6.97	6.98	6.99	7.00	7.01	7.02	7.03	7.04	7.05	7.06	7.07	7.08	7.09	7.10	7.11	7.12	7.13	7.14	7.15	7.16	7.17	7.18	7.19	7.20	7.21	7.22	7.23	7.24	7.25	7.26	7.27	7.28	7.29	7.30	7.31	7.32	7.33	7.34	7.35	7.36	7.37	7.38	7.39	7.40	7.41	7.42	7.43	7.44	7.45	7.46	7.47	7.48	7.49	7.50	7.51	7.52	7.53	7.54	7.55	7.56	7.57	7.58	7.59	7.60	7.61	7.62	7.63	7.64	7.65	7.66	7.67	7.68	7.69	7.70	7.71	7.72	7.73	7.74	7.75	7.76	7.77	7.78	7.79	7.80	7.81	7.82	7.83	7.84	7.85	7.86	7.87	7.88	7.89	7.90	7.91	7.92	7.93	7.94	7.95	7.96	7.97	7.98	7.99	8.00	8.01	8.02	8.03	8.04	8.05	8.06	8.07	8.08	8.09	8.10	8.11	8.12	8.13	8.14	8.15	8.16	8.17	8.18	8.19	8.20	8.21	8.22	8.23	8.24	8.25	8.26	8.27	8.28	8.29	8.30	8.31	8.32	8.33	8.34	8.35	8.36	8.37	8.38	8.39	8.40	8.41	8.42	8.43	8.44	8.45	8.46	8.47	8.48	8.49	8.50	8.51	8.52	8.53	8.54	8.55	8.56	8.57	8.58	8.59	8.60	8.61	8.62	8.63	8.64	8.65	8.66	8.67	8.68	8.69	8.70	8.71	8.72	8.73	8.74	8.75	8.76	8.77	8.78	8.79	8.80	8.81	8.82	8.83	8.84	8.85	8.86	8.87	8.88	8.89	8.90	8.91	8.92	8.93	8.94	8.95	8.96	8.97	8.98	8.99	9.00	9.01	9.02	9.03	9.04	9.05	9.06	9.07	9.08	9.09	9.10	9.11	9.12	9.13	9.14	9.15	9.16	9.17	9.18	9.19	9.20	9.21	9.22	9.23	9.24	9.25	9.26	9.27	9.28	9.29	9.30	9.31	9.32	9.33	9.34	9.35	9.36	9.37	9.38	9.39	9.40	9.41	9.42	9.43	9.44	9.45	9.46	9.47	9.48	9.49	9.50	9.51	9.52	9.53	9.54	9.55	9.56	9.57	9.58	9.59	9.60	9.61	9.62	9.63	9.64	9.65	9.66	9.67	9.68	9.69	9.70	9.71	9.72	9.73	9.74	9.75	9.76	9.77	9.78	9.79	9.80	9.81	9.82	9.83	9.84	9.85	9.86	9.87	9.88	9.89	9.90	9.91	9.92	9.93	9.94	9.95	9.96	9.97	9.98	9.99	10.00	10.01	10.02	10.03	10.04	10.05	10.06	10.07	10.08	10.09	10.10	10.11	10.12	10.13	10.14	10.15	10.16	10.17	10.18	10.19	10.20	10.21	10.22	10.23	10.24	10.25	10.26	10.27	10.28	10.29	10.30	10.31	10.32	10.33	10.34	10.35	10.36	10.37	10.38	10.39	10.40	10.41	10.42	10.43	10.44	10.45	10.46	10.47	10.48	10.49	10.50	10.51	10.52	10.53	10.54	10.55	10.56	10.57	10.58	10.59	10.60	10.61	10.62	10.63	10.64	10.65	10.66	10.67	10.68	10.69	10.70	10.71	10.72	10.73	10.74	10.75	10.76	10.77	10.78	10.79	10.80	10.81	10.82	10.83	10.84	10.85	10.86	10.87	10.88	10.89	10.90	10.91	10.92	10.93	10.94	10.95	10.96	10.97	10.98	10.99	11.00	11.01	11.02	11.03	11.04	11.05	11.06	11.07	11.08	11.09	11.10	11.11	11.12	11.13	11.14	11.15	11.16	11.17	11.18	11.19	11.20	11.21	11.22	11.23	11.24	11.25	11.26	11.27	11.28	11.29	11.30	11.31	11.32	11.33	11.34	11.35	11.36	11.37	11.38	11.39	11.40	11.41	11.42	11.43	11.44	11.45	11.46	11.47	11.48	11.49	11.50	11.51	11.52	11.53	11.54	11.55	11.56	11.
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MEMORANDUM

ON THE

Organization of the Office, &c., and Digest of the Annual Reports since 1867.

LOCALITY.

The Office from the time the Committee took charge of it, up to the end of May 1869, was situated at No. 1, Parliament Street, in a house belonging to the Government, and was consequently rent free, &c. &c. Rent, &c.

Since that time it has been situated at 116, Victoria Street, Westminster, where it now occupies three floors at an annual rent of 574*l.* 12*s.*, and has furthermore to pay fuel, light, &c., and to bear all costs of fitting and furniture. In fact the Office bears all expenses connected with its management, &c., excepting those for stationery and printing.

The organization will now be treated under the three heads into which the Office business is divided, concluding with some remarks on the administration, accounts, &c.

I.—OCEAN METEOROLOGY.

The Meteorological Department of the Board of Trade, from its first establishment under Admiral FitzRoy in September 1854, laid the greatest stress on the importance of the selection of observers and the supply of first-class instruments, duly tested before issue, and the Committee have been guided by the same principles, attaching weight to the *quality*, as contrasted with the *quantity*, of the records to be obtained. Accuracy of instruments.

In order that nothing should be wanting on the part of the newly-founded Office to secure the accuracy of the instruments employed, almost the first action of the Board of Trade in 1855 was to invite the Kew Committee of the British Association to devise improvements in the instrumental appliances for Marine observations, and the most important outcome of their deliberations was the recommendation of the Kew pattern Marine Barometer, the principle of which has been generally adopted as that best suited for use at sea. Kew Marine Barometer.

The Office possesses a large stock of these and other instruments, as will be seen below, and its practice as to the collection of observations is to supply on loan to captains a set of instruments properly verified at Kew, which are returned to the Office for recomparison with standards as soon as the voyage is over. The loan is granted on condition of observations being taken with the instruments, and entered in a log supplied for the purpose, which is returned to the Office when filled. No payment is made to the observers as will be explained later on. Supply to ships.

The instruments supplied to a ship consist of—

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

Observations made with instruments which have not been supplied by the Office, or authentically verified, are not employed in the investigations. Aneroid readings are never used, as that instrument cannot yield satisfactory scientific information. Readings from inferior instruments.

The foregoing remarks apply to the Merchant Service. As regards the Royal Navy, H.M. ships are supplied with Meteorological instruments under an arrangement made with the Admiralty in 1854, and the Meteorological observations are returned to that Department in the form adopted in the Naval Service.* It is voluntary whether the Co-operation of the Royal Navy.

* The following are the paragraphs relating to Meteorological observations contained in the "Queen's Regulations," pp. 170, 171, edition 1862:—

Her Majesty's Government having undertaken to promote and take part in an extended system of Meteorological observations at sea, and having caused the requisite instruments, forms of register, and instructions to be provided and placed at the principal seaports of the United Kingdom, for the use of the Mercantile Marine, the captains of Her Majesty's ships are to co-operate in this undertaking whenever, and as far as, their respective opportunities and means will admit, taking care that the officers in charge of watches note the height of the barometer and thermometer, and the temperature of the sea, at the hours specified in the following article.

Standard barometers and tested thermometers will be supplied from Her Majesty's dockyards in the usual manner, on demand. Printed registers, with the necessary instructions, will also be supplied, on demand, to any officer who may feel disposed to record the Meteorological observations with greater minuteness than is imperatively required; and such registers are to be forwarded to the Secretary of the Admiralty, at the end of each year, by the officer who kept them.

The barometer, sympiezometer, or aneroid supplied, is to be carefully suspended in some secure and accessible part of the ship, and the height of the mercury therein, and in the attached thermometer, correctly observed and registered in the log every day at the hours of 4, 8, and 12 am. and p.m.

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II.—LOG USED IN THE ROYAL NAVY.

H.M.S. _____ day of _____ 18____

From _____, To _____, or At _____.

Initials of the Officer of the Watch.	Hours.	Knots.	Tenths.	Standard Compass Courses.	Leeway Pts.	Wind.		Weather.	Deviation of Stand. Comp.	Height of		Temperature of the Sea.	Remarks.
						Direction.	Force.			Bar.	Ther.		
	1												A.M.
	2												
	3												
	4												
	5												
	6												
	7												
	8												
	9												
	10												
	11												
	Noon												

Course.	Distance.		Latitude.	Longitude.	Variation allowed.	Water remaining.	True Bearing and Distance.	No. on Sick List.
	Made good.	Through the Water.						
Current.	Miles.	Miles.	D.R.	D.R.		Daily Expendre.		
			Obs.	Chro.		Distilled since yesterday.		

	1								P.M.
	2								
	3								
	4								
	5								
	6								
	7								
	8								
	9								
	10								
	11								
	Mid.								

Signals, &c.	Coals expended during the 24 hours	Tons.	Cwt.
	For Engines	"	"
	For Ship	"	"
	For Distilling	"	"

III.—SPECIMEN OF WEATHER-BOOK REGISTER AT

Meteorological Register kept on board

Date 18 _____		Latitude.		Longitude.		Current in 24 hours.	Sea Surface.		Magnetic Variation.		Wind.		Barometer No. Height of Cistern ft.	
Month, Day, and Moon.	Civil Time, Hours.	Observed.	D. R.	Observed.	D. R.	Direction and Rate.	Temperature by No. _____	Specific Gravity by No. _____	Observed Az. or Amp.	Ship's Head.	Direction.	Force. Beaufort Scale.	Uncorrected Reading.	Attached Thermometer.
	2													
	4													
	6													
	8													
	10													
	Noon													
	2													
	4													
	6													
	8													
	10													
	Midt.													
* 1	2	3	4	5	6	7 and 8	20	21	9	9a	10	11	12	13

* The columns correspond to the columns of Brussels "Abstract Log;" the only

IV.—SHIP'S METEOROLOGICAL LOG PROPOSED

Date.		Latitude.		Longitude.		True Course and Distance by Log each Four Hours.		Total Compass-Error, of Compass used for wind, being Variation and Deviation combined. State whether by Az., Amp., or otherwise.	Ship's Head. By same Compass as Wind; and degrees of Heel to Port or Starboard. (P. or S.)	Wind.	Barometer No. Height of Cistern above the Sea, — feet,	Thermo-meters.			
Every two Hours at the time of observation. Give the times of Changes in Direction and Force in the Remark Column.		Direction. State if true or subject to Compass Error, or only to Variation.		Force. Beaufort Scale. 0 — 12 See p. 2 of Log.		Uncorrected Reading.				Att. Ther.		Dry Bulb.	Damp Bulb.		
Month, Day, Civil Time.	Hour.	Observed.	D.R.	Observed.	D.R.	Course.	Distance.					No. —	No. —		
	2														
	4														
	6														
	8														
	10														
	Noon														
	2														
	4														
	6														
	8														
	10														
	Midt.														
1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16

SUMMARY OF COLUMNS OF No. IV.

- Nos. 1- 6. - - Same as proposed at Brussels (1-6).
 „ 7- 8. - - Additional.
 „ 9-10. - - Modification of Brussels log (9).
 „ 11-16. - - Same as (10-15) of „ but asking for wind *at the time of observation*.
 „ 17-19. - - Modifications of (16-17) of Brussels log.

PRESENT IN USE IN METEOROLOGICAL OFFICE.

Captain _____ from _____ to _____

Hours.	Thermometer.		Clouds.			Weather.	State of the Sea.	Meteorological Remarks, including any Observations on the 22. Temperature at Depths:—and Deep Soundings (to be inserted at the nearest Hour Lines).
	Dry Bulb. No. _____	Damp Bulb. No. _____	Lower : Name and Position.	Upper : Name and Direction from	Total Amount 0-10.	According to Beaufort Notation.		
2								
4								
6								
8								
10								
Noon								
2								
4								
6								
8								
10								
Midt.								
2a	14	15	16	17a	17	18 and 23	19	22 24

exceptions being that 9a is added, and 7 and 8, and 18 and 23 are thrown together.

BY MARITIME CONFERENCE OF 1874.

Hour.	Clouds. When Lower Clouds do not move with the Wind give the Direction they come from in the Remarks. For Plates, see p. 55 of Instructions.			Weather. According to Beaufort Notation. See p. 2 of Log.	Sea Surface.				REMARKS. Here give any important Remarks, with the Times of their Occurrence; especially the Times of Changes in Direction and Force of Wind, as well as the Direction, Force, and Duration of Squalls. Also note the Hour at which the Ship arrives in or leaves Port. (See "Instructions" for further Particulars.)
	Lower : Names.	Upper : Names. Direction from	Proportion of Sky clouded. 0 - 10		Direction from. Record when confused, also when only Swell or Swells.	Disturbance, 0 - 9. See p. 2 of Log.	Temperature by No. .	Specific Gravity by No. .	
2									
4									
6									
8									
10									
Noon									
2									
4									
6									
8									
10									
Midt.									
2a	17	18	19	20	21	22	23	24	25

AS COMPARED WITH No. I.

- Nos. 20. - - Same as (18 and 23) of Brussels log.
 " 21-22. - - Additional.
 " 23-25. - - Same as (20, 21, and 24) of Brussels log respectively.
 — Column 22 omitted.
 Currents (columns 7 and 8 Brussels log) carried to (Remarks) in 25.

Contents of
different logs.

The following table shows the amount of information contained in the respective forms of log.

No. of Cols.	Abstract Log, Brussel's Conference.	Board of Trade Weather Book Register.	Meteorological Log, London Conference, 1874.	Admiralty Log.
1	Date, month and day -	Yes, with "moon" additional.	Month and day.	Month and day.
2	Hour, 2, 4, 6, 8, 9, 10, Noon 2, 3, 4, 6, 8, 10, Midnight -	2, 4, 6, 8, 10, Noon. 2, 4, 6, 8, 10, Midnight.	2, 4, 6, 8, 10, Noon. 2, 4, 6, 8, 10, Midnight.	Hourly spaces, but 4, 8, Noon, 4, 8, Midnight, ordered by Queen's Regulations.
3-4	Lat. { Observations - D. R. - } -	Yes.	Yes.	Yes.
5-6	Long. { Observations - D. R. - } -	Yes.	Yes.	{ Observation. Chronometer.
	No information -	No information -	True course and distance by log each four hours.	Distance made good. ,, through the water.
7-8	Currents { Direction - Rate - } -	{ Yes Yes } in 24 hours.	Given in Remarks.	{ Course. Current.
9	Magnetic variation -	Yes, with "Ship's Head.	{ Total compass error. Ship's Head. }	Variation allowed.
10-11	Winds { Direction - Force - } -	{ Yes Yes } with Beaufort's scale.	Yes. Yes.	Yes. Yes.
12-13	Barometer { Height - Thermometer - } -	Yes, "uncorrected." Yes.	Yes. Yes.	Yes. ? *
14-15	Thermometer { Dry bulb - Wet bulb - } -	Yes. Yes.	Yes. Yes.	? * ○ means "no information."
16	Clouds { Forms and Direc- tion. }	Upper clouds, name and direction from. Lower clouds, name and position.	Upper, names and direc- tion from. Lower, names.	○ ○
17	Proportion of sky clear -	Total amount of cloud 0-10.	Proportion of sky clouded 0-10.	○
18	Hours of { Fog A - Rain B - Snow C - Hail D - } -	{ Given under "Weather."	Given under "Weather."	Given under "Remarks."
19	State of the sea -	Yes.	{ Yes. Direction of swell from }	○
20	Water { Temp. at surface - Specific gravity - Temp. at depths - }	Yes.	Yes.	Yes.
21		Yes.	Yes.	○
22		In "Remarks."	○	○
23	State of weather -	According to Beaufort's notation.	According to Beaufort's notation.	Yes.
24	Remarks -	Including temperature at depths, &c.	Yes.	Yes.

* One column is given in the Admiralty Log for "thermometer," but there is no explanation to show whether this is intended for the "attached" or "dry bulb" thermometer.

The following additional information is contained in the Admiralty log :—

Initials of Officer of the Watch.
Knots and Tenths.
Standard Compass Courses.
Leeway, Points.
Deviation of Standard Compass.
True Bearing and Distance.
Particulars as to expenditure of stores.
Sick List, Signals, &c.

The following returns show the extent to which the supply of instruments has been carried on, and also the number of instruments procured by the Office for Colonial and Foreign Establishments, &c. :—

ADMIRALTY ACCOUNT.

INSTRUMENTS *supplied* to the ROYAL NAVY.

			Barometers.	Aneroids.	Thermometers.			Hydrometers.
					Ordinary.	Max.	Min.	
1867, Jan. 1st, Afloat	-	-	216	406	866	—	—	316
Issued in 1867	-	-	63	112	270	33	28	69
" 1868	-	-	65	110	267	25	23	40
" 1869	-	-	38	74	213	28	22	24
" 1870	-	-	52	79	266	27	27	36
" 1871	-	-	52	82	244	29	29	33
" 1872	-	-	56	92	269	35	36	37
" 1873	-	-	63	106	242	31	35	64
" 1874	-	-	67	93	358	36	39	38
Totals	-	-	672	1,154	2,995	244	239	657
Less returned	-	-	481	763	2,034	208	175	510
1875, Jan. 1st, Afloat	-	-	191	391	961	36	64	147

INSTRUMENTS *returned* from the ROYAL NAVY.

			Barometers.	Aneroids.	Thermometers.			Hydrometers.
					Ordinary.	Max.	Min.	
Returned in 1867	-	-	67	98	255	19	15	152
" 1868	-	-	89	114	342	29	24	112
" 1869	-	-	56	111	213	31	20	42
" 1870	-	-	47	92	245	22	18	48
" 1871	-	-	58	79	233	29	25	36
" 1872	-	-	58	85	244	22	18	31
" 1873	-	-	51	91	225	25	24	44
" 1874	-	-	55	93	277	31	31	45
Totals	-	-	481	763	2,034	208	175	510

INSTRUMENTS *supplied* to NAVAL STATIONS.

			Barometers.	Aneroids.	Thermometers.			Hydrometers.
					Ordinary.	Max.	Min.	
1867, Jan. 1st, in use	-	-	84	98	177	33	35	40
Issued in 1867	-	-	8	11	25	10	7	—
" 1868	-	-	5	10	5	1	1	—
" 1869	-	-	4	11	19	2	3	—
" 1870	-	-	4	6	6	—	1	16
" 1871	-	-	5	16	11	2	2	5
" 1872	-	-	7	10	13	4	4	4
" 1873	-	-	—	10	16	8	5	4
" 1874	-	-	18	22	66	20	21	18
Totals	-	-	135	194	338	80	79	87
Less returned	-	-	78	101	225	50	52	59
1875, Jan. 1st, in use	-	-	57	93	113	30	27	28

INSTRUMENTS returned from NAVAL STATIONS.

	Barometers.	Aneroids.	Thermometers.			Hydrometers.
			Ordinary.	Max.	Min.	
Returned in 1867 -	22	18	12	3	3	—
" 1868 -	12	20	62	9	10	1
" 1869 -	14	31	55	16	14	24
" 1870 -	5	10	24	8	6	4
" 1871 -	9	7	25	4	6	26
" 1872 -	4	4	7	2	2	—
" 1873 -	6	7	23	5	5	4
" 1874 -	6	4	17	3	6	—
Totals -	78	101	225	50	52	59

INSTRUMENTS LOST, DESTROYED, &c.* and written Off the Books.

	Barometers.	Aneroids.	Thermometers.			Hydrometers.
			Ordinary.	Max.	Min.	
1867 -	15	23	165	16	11	96
1868 -	5	20	268	14	9	51
1869 -	27	34	179	23	16	45
1870 -	4	2	138	16	10	20
1871 -	3	3	141	14	9	15
1872 -	2	6	161	19	12	14
1873 -	2	6	136	16	12	18
1874 -	1	29	283	28	18	14
Totals -	59	123	1,471	146	97	273

* These instruments include those sold as unserviceable. The large number of instruments written off during the first three years was a necessary result of the Committee's action in revising the condition of the instruments and books of the Office.

STOCK OF METEOROLOGICAL INSTRUMENTS.—ADMIRALTY ACCOUNT.

	Barometers.	Aneroids.	Thermometers.			Hydrometers.
			Ordinary.	Max.	Min.	
1869, Jan. 1st -	505	691	1,467	99	98	563
1875, " -	439	645	1,369	129	154	471

If we compare the stock of instruments on the 1st of January 1869 and on the 1st of January 1875, we see that the Admiralty instruments show a reduction as regards barometers and hydrometers. We found that Admiral FitzRoy had laid in a larger stock than was likely to be required, and therefore we have not kept up that stock to the same extent. We have more than they demand.

Moreover, the first barometers procured are now comparatively useless for the Navy, as the use of heavy guns has rendered it necessary to supply barometers packed with india rubber to protect the tubes against concussion. By this change many old barometers have been rendered unserviceable for the Navy but are quite available for the Merchant service, where there is no firing of heavy guns.

MERCANTILE MARINE ACCOUNT.

INSTRUMENTS *supplied to the* MERCANTILE MARINE.

			Barometers.	Thermometers.			Hydrometers.
				Ordinary.	Max.	Min.	
1867, January 1st, Afloat -	-	-	46	226	—	—	133
Issued in 1867 -	-	-	48	268	—	—	174
" 1868 -	-	-	49	271	—	—	192
" 1869 -	-	-	52	305	—	—	197
" 1870 -	-	-	118	636	—	—	393
" 1871 -	-	-	105	555	1	1	298
" 1872 -	-	-	71	438	—	—	273
" 1873 -	-	-	59	407	—	—	233
" 1874 -	-	-	67	390	—	—	230
Totals -	-	-	615	3,496	1	1	2,123
Less returned -	-	-	532	3,013	1	1	1,810
1875, January 1st, Afloat -	-	-	83	483	—	—	313

INSTRUMENTS *returned from the* MERCANTILE MARINE.

			Barometers.	Thermometers.			Hydrometers.
				Ordinary.	Max.	Min.	
Returned in 1867 -	-	-	36	162	—	—	87
" 1868 -	-	-	45	210	—	—	158
" 1869 -	-	-	45	268	—	—	168
" 1870 -	-	-	64	334	—	—	212
" 1871 -	-	-	123	649	—	—	369
" 1872 -	-	-	78	481	—	—	284
" 1873 -	-	-	75	492	1	1	301
" 1874 -	-	-	66	417	—	—	231
Totals -	-	-	532	3,013	1	1	1,810

INSTRUMENTS *supplied to* TELEGRAPH STATIONS, LIGHTSHIPS, OBSERVATORIES, &c.

			Barometers.	Thermometers.			Hydrometers.
				Ordinary.	Max.	Min.	
1867, Jan. 1st, in use -	-	-	109	279	44	38	57
Issued in 1867 -	-	-	19	25	3	—	6
" 1868 -	-	-	10	29	6	9	4
" 1869 -	-	-	20	40	6	11	10
" 1870 -	-	-	11	24	6	6	2
" 1871 -	-	-	15	56	16	13	19
" 1872 -	-	-	18	45	13	13	1
" 1873 -	-	-	8	16	8	11	1
" 1874 -	-	-	7	70	15	16	—
Totals -	-	-	217	584	117	117	100
Less returned -	-	-	119	331	68	63	46
1875, Jan. 1st, in use -	-	-	98	253	49	54	54

INSTRUMENTS returned from STATIONS.

				Barometers.	Thermometers.			Hydrometers.
					Ordinary.	Max.	Min.	
Returned in 1867	-	-	-	19	50	9	5	—
" 1868	-	-	-	18	29	4	3	12
" 1869	-	-	-	27	70	11	14	7
" 1870	-	-	-	14	57	4	4	17
" 1871	-	-	-	15	61	13	9	9
" 1872	-	-	-	7	14	3	4	—
" 1873	-	-	-	10	22	9	5	—
" 1874	-	-	-	9	28	15	19	1
Totals	-	-	-	119	331	68	63	46

INSTRUMENTS LOST, DESTROYED, &C. AND WRITTEN OFF BOOKS.*

				Barometers.	Thermometers.			Hydrometers.
					Ordinary.	Max.	Min.	
1867	-	-	-	11	106	—	—	30
1868	-	-	-	10	157	—	—	82
1869	-	-	-	18	190	8	9	81
1870	-	-	-	4	154	1	1	56
1871	-	-	-	10	222	8	2	90
1872	-	-	-	3	176	1	0	61
1873	-	-	-	4	135	0	0	77
1874	-	-	-	1	276	5	2	52
Totals	-	-	-	57	1,416	23	14	529

* These lists comprise *inter alia* the instruments, to the value of 100*l.*, lent at various times prior to Feb. 1867, and presented to the Scottish Meteorological Society in 1869.

STOCK of METEOROLOGICAL INSTRUMENTS.—BOARD OF TRADE ACCOUNT.

				Barometers.	Aneroids.	Thermometers.			Hydrometers.
						Ordinary.	Max.	Min.	
1869, Jan. 1st	-	-	-	279	—	1,164	52	52	571
1875, "	-	-	-	255	—	1,118	58	61	500

METEOROLOGICAL INSTRUMENTS ordered through the METEOROLOGICAL OFFICE by FOREIGN GOVERNMENTS, COLONIAL OBSERVATORIES, and PRIVATE OBSERVATORIES, in connexion with the OFFICE.

		Barometers.	Aneroids.	Thermometers.			Hydrometers.
				Ordinary.	Max.	Min.	
During the year 1867	-	—	2	—	—	—	—
" 1868	-	1	—	—	—	—	—
" 1869	-	1	2	2	2	1	—
" 1870	-	—	—	2	—	—	—
" 1871	-	3	—	15	6	6	2
" 1872	-	11	—	60	16	12	—
" 1873	-	18	—	71	17	15	4
" 1874	-	29	—	56	31	37	—
" 1875	-	46	—	110	32	38	1
		109	4	316	104	109	7

The practice as regards obtaining observers is that a circular letter is sent to every captain arriving in London who seems likely to keep a good register, requesting him to call at the Office and by a personal interview with Capt. Toynbee learn the nature of the observations, &c. required by the Office. Observers.

The observers are not paid or remunerated for their work in any sort of way, unless by having the use of first-class instruments. If they send in "excellent" observations we present them with a copy of the Admiralty "Pilot," or "Wind and Current" Charts, worth 2*l.* or so, as explained below.

In addition to the supply of instruments direct from the Office in London, a stock is kept at some of the more important seaports, *e.g.*, at Liverpool, Glasgow, and Aberdeen, the agents in charge of them receiving a fee for each case of issue and return, and a further fee for each observer obtained through them who furnishes first-class observations. The names of all applicants for instruments are submitted to Capt. Toynbee for approval prior to the supply. Agencies at ports.

The amount of money spent in fees is not very much, as about 20 or 30 ships a year may be said to be supplied at the outports. The fees allowed are,— Fees to agents.

	£	s.	d.
A. For supplying a complete set of instruments - - -	1	5	0
B. For receiving and verifying a set, or their parts if damaged, and a filled up log - - -	1	5	0
N.B.—If the log is either not filled up, or is quite worthless, the Office reserves to itself the right to refuse the fee B.			
C. For an excellent log, the <i>first</i> of any observer, the agent receives -	1	0	0
D. For short voyages, the instruments are not changed so often, and so the fee for each filled up log is - - -	1	0	0

In relation to this entire subject, reference may be made to answers 13,896–13,904, in the Minutes of Evidence, Science Commission.

Special attention may be drawn to the fact that of all the Meteorological establishments in existence that of the United Kingdom is the only one which can exercise a reasonably complete control over the character and condition of the instruments, especially of the barometers, employed for the observations. This is rendered possible by the fact that the entire store of instruments, *almost without exception*, belongs to the Office, and that all the correction certificates for them, many hundreds in number, are carefully preserved and the corrections applied, while the instruments themselves are re-examined after each voyage. Control over accuracy of observations, &c.

As soon as a log is received at the Office it is examined and classified according to its quality on a definite plan (which has been reproduced in the Report of the Maritime Conference, 1874, p. 35), and an acknowledgment is immediately made to the captain sending it; and at the same time if explanations on any points arising out of the inspection of the log are found to be requisite, the captain is requested to furnish the information while the circumstances are still fresh in his memory. Replies received from the captain are at once noted in the log for future reference when the observations are discussed. Examination of logs.

To each observer who has obtained the mark "excellent" a copy of the Atlantic Pilot Charts, or of the Wind and Weather Charts of the Atlantic, Pacific, and Indian Recognition of good work.

Oceans, published by the Admiralty, is presented. Observers who have already received these charts, and who may continue to observe for the Office, have the special thanks of the Committee for each register which has received the mark of "excellent." They also receive such publications of the Office as are likely to be of interest to them.

Among the most important benefits to the science attributable to the action of the Committee has been the great improvement in the quality of the logs sent in, owing to the care taken to select observers.

The following figures show the total number of logs, and the number of first class logs, classed "*excellent*," which have been received each year from the *Mercantile Marine*, since the management of the Office has been under the Meteorological Committee.

Year.	Total No. of Logs received.	No. of "Excellent" Logs.	% of "Excellent" Logs.	Year.	Total No. of Logs received.	No. of "Excellent" Logs.	% of "Excellent" Logs.
1867	21	7	33	1872	110	64	58
1868	50	10	20	1873	92	52	57
1869	67	21	31	1874	88	56	64
1870	81	41	51	1875	94	58	62
1871	150	72	48				

Admiralty "Weather Book Registers," received at the Office :—

Year.	Total No.	No. of "Excellent."	Year.	Total No.	No. of "Excellent."
1867	6	0	1872	12	2
1868	10	0	1873	9	2
1869	7	0	1874	10	5
1870	11	3	1875	14	8
1871	5	1			

The marked improvement in all logs shown in the last few years is doubtless entirely due to the thoroughly systematic supervision by Captain Toynbee of all logs received. In every case where improvement is considered necessary, and reasonably practicable, the captain responsible for the log has been communicated with, and in many cases induced to call at the Office for a personal interview.

The high percentage of excellent logs in recent years is in no way to be attributed to a lower standard of excellence being used; on the contrary, the standard of excellence may be considered to have increased rather than to have diminished.

The treatment of the observations contained in the logs may be generally considered under the head of Discussions.

The instrumental corrections, &c. are applied to the individual observations for that portion of the log which refers to the district under examination.

The corrected observations are then copied into data books and grouped according to position (one degree squares) and month.

When this has been done the calculation of averages and other results can be commenced.

The following is the approximate cost at which this work can now be done, according to the experience of the Office, but the estimate is subject to variation :—

The most convenient method of dealing with the cost of the extraction into 1° squares is to consider the cost per day's observations; this we take as 9½d., but as the observations per day are sometimes five and sometimes six, we cannot exactly say what is the actual cost per observation; but supposing on the average that we extract 5½ observations per day this would give a cost of 7l. 4s. 0d. for the extraction of 1,000 observations, such cost including examination, preparation, and extraction of data. There is, however, a matter of expense for which it is extremely difficult to state the cost, i.e., the sifting of the logs available for extraction from the logs not available for extraction for the special discussion; roughly speaking the additional cost on this head would be about 1/10 of the cost of the extraction, so that the actual cost of extracting 1,000 sets of observations would be about 8l.

The cost of making a MS. copy of 1,000 sets of observations on forms exactly similar to our data books may be estimated to be about 1l. 11s. 0d. This would give a total cost of 175l. for making one copy of the data extracted from the nine squares of the

Progressive improvement in quality of logs.

Admiralty weather book registers.

Care taken to communicate with observers.

Discussion of observations.

Correction.

Extraction.

Cost of correction and extraction.

Cost of copying large quantities of data.

Atlantic Equatorial Region, including 30 degrees of latitude and longitude, not including the cost of the paper.

If our data books were used and charged for, the total cost would be 210*l*.

With reference to the cost of printing, as compared with that of writing, the following estimate has been furnished unofficially by one of the staff of the Stationery Office:—

Cost of
printing data.

“ 1,056 lines will, I estimate, make 24 foolscap pages, and the cost would be, including paper, but excluding all charges for corrections and binding,—

For 50 copies -	-	-	-	£18	9	9
„ 100 „ -	-	-	-	18	11	11
„ 150 „ -	-	-	-	18	17	7

As regards the cost of discussing and charting the materials, once they have been entered into data books, it is almost impossible to give even an approximate estimate, as the degree of minuteness to which the discussion is carried affects most materially its cost. It appears to the Office, however, that 5*l*. per 1,000 observations would about cover the cost of discussing and charting materials contained in data books.

This subject raises the entire question of dealing with the data in the logs, so as to adapt them for discussion.

The method of loose cards, proposed by the Committee of Inquiry (1866), was tried for a certain time, and the plan was proved to be unsuitable.

Objections
to cards.

1. The number of cards would be quite unmanageable, as the work has been carried out to much greater minuteness than was then contemplated.
2. The figures entered on the cards must be copied out afresh on special sheets if they are to be totalled and averaged.

The Dutch method of dealing with logs is far preferable to the use of cards. It consists in copying out the observations on a ruled form, like a page of our data book, and then cutting up this form into slips according to date and locality. These slips can be as easily handled and rearranged as the cards, and possess the grand advantage that any number of them can be placed in a frame and dealt with without re-copying, as the ruling preserves the columns.

Dutch method.

By our method the great disadvantage of loose slips is set aside, as the data books are bound, and show at a glance the locality where the observations were taken.

As regards the dealing with the arrears of material in the Office the investigation for the equatorial region of the Atlantic was carried on by using everything available in the Office up to the end of 1871, the latest log “extracted” having been No. 2,843, received December 23, 1871. The investigation into the meteorology of the South Point of Africa, now in progress, is being conducted with all the materials in the Office.

Arrears of
materials are
worked up,

There is, therefore, no ground for any idea that the stores of information in the Office are not utilized.

It must, however, be understood that we only correct, or deal with in any way, such materials as we require for any investigation, but with this reservation every log worth having is *exhausted* by our method.

but only for
such regions
as are being
treated.

I believe that from the first the Dutch have extracted on to their slips all the materials which they required out of every log, and that consequently the information existing at Utrecht is in a much more readily available form than that in our hands, as the observations are corrected and sifted according to the date and locality.

Dutch records
believed to be
all extracted.

This, however, admits of two remarks.

Firstly. The Dutch logs are mostly for the narrow route from the Dutch East Indian Colonies to the Channel, and back again, so that every observation copied was for a region which it was intended to discuss speedily, as there was no doubt as to the rapid accumulation of material for the route. The case is widely different with our logs, dealing with less frequented parts of the sea, in which case the materials must probably lie by for 10 or 15 years at least, before enough are accumulated to repay discussion.

Contrast of
Dutch informa-
tion to our
own.

Secondly. Although such a current transference of material from logs to data books would be most desirable in the interests of science, funds were never supplied to Admiral FitzRoy for operations on so comprehensive a scale, so that when the Meteorological Committee took up the work the arrears of uncopied observations were too formidable for them to face in the way suggested.

Reasons why
this extraction
of information
has not been
carried out.

The work can at once be undertaken if funds are supplied; it would be most popular, as it would enable this Office to supply all foreign institutions with materials for discussion. At present we charge all applicants with the costs of copying such information as they require. It is evident that no limit could be set to the demands on the Office under any other system.

Supply of
information
to other
establishments.

The following is a list of some Colonial and Foreign Government Establishments to which meteorological information from logs in the Office has been supplied to a considerable extent:—

Country.	Establishment.	District.	Amount.	Approximate Cost.
* Denmark -	Royal Meteorological Institute.	Arctic Seas, including voyages to Cape Farewell and the Baltic.	All observations made since 1866.	20l.
† France -	National Observatory.	North Atlantic Ocean from 60° to Equator, including inland seas.	All observations for the years 1865-1867 inclusive.	31l.
" -	Dépôt des Cartes et Plans.	New Caledonia to Cape Horn.	Copy of <i>tabulated</i> observations for the route.	Trifling.
India -	Meteorological Office, Calcutta.	Bay of Bengal -	Extracts referring to Calcutta cyclone of October 1864.	Do.
* " -	Do. -	North Indian Ocean, Lat. 0°-30°; Long. 50°-100° E.	All observations (corrected and copied into Data Books) for January. (In progress.)	100l.
† Mauritius -	Government Observatory.	Indian Ocean -	Dates of gales since 1855. Extracts from Registers, Jan.-March 1861.	10l.

* Cost of copying repaid. † Cost for 1867 (about 2l. 10s. 0d.) only repaid. ‡ Cost of latter portion only repaid.

This matter naturally raises the important questions: I. In what manner can the materials collected be brought within the reach of the institutions or individuals who wish to discuss them? II. In what way can the study of Maritime Meteorology best be prosecuted?

With reference to the first question the remarks already made throw important light on the cost at which materials can be supplied by this Office.

On a very recent occasion the Committee were informed that the Royal Meteorological Institute of Holland, and the Deutsche Seewarte of Hamburg, had agreed to interchange the materials in their respective offices for two districts which they had respectively undertaken to investigate, and the Meteorological Office was requested to join in the scheme by supplying such information for the districts in question as it might happen to possess, and receiving in return information for its investigations. The reply sent by the Committee was to the effect, that while ready to supply all that it possessed which would be of value to the two offices named, on condition of being repaid the cost of copying, it was for its part ready to pay for the cost of copying any information which it might require, and which existed either at Utrecht or Hamburg.

The above proposal was made in accordance with Resolution 32 of the Maritime Conference, 1874, (p. 21) which runs as follows:—

"The division of labour, as regards investigations, can only be carried out by mutual agreement between the several institutions, and each institution should announce to other institutions what investigations it proposes to undertake."

"It is very desirable that such divisions of labour should be effected."

It may here be said that both at Vienna 1873, and in London 1874, there has been a formal statement of the conditions on which the Meteorological Office would supply information to other institutions.

With reference to the second question, it has been frequently proposed that the attention of the Office and of similar institutions should be directed to the preparation of Synoptic Charts, and consequently to the study of *weather* instead of to that of *climate* at sea. The only serious attempts to carry out this idea hitherto have been those in connexion with the "Atlas des Mouvements Généraux de l'Atmosphère" as explained in the reply to question 14,454, p. 53, Report Science Commission.

In considering this question in relation to the estimates above given for copying 1,000 sets of observations, it must be remembered that observations extracted from logs are not in a fit state to be used for the construction of Synoptic Charts. An interpolation is requisite, rendering it necessary to have several successive observations together to afford the data for this. Ship's time has to be converted to Greenwich Mean Time by the longitude of previous noon, in accordance with the universal practice at sea. Accordingly the cost of copying data for synoptic chart work would be higher than that of copying the same quantity of information for climatal work.

Proposed inter-
national co-
operation.

Resolution of
Maritime Con-
ference, 1874.

"Synoptic"
and "Mean"
Charts.

The cost of this branch of the Office in the year 1874-5 has been 2,384*l.* 6*s.* 4*d.* The staff employed in it and their present salaries are as follows:—

	£	s.	d.	
Captain H. Toynbee, Marine Superintendent	400	0	0	Annual.
R. Strachan.* Charge and disposal of instruments and reduction of Meteorological returns	200	0	0	Do
Additional for management of instruments	50			
C. Harding	170	0	0	Annual.
T. E. Allen	110	0	0	Do.
H. Harries	1	15	0	Weekly.
W. Allingham	1	18	6	Do.
H. J. Green	0	12	0	Do.

* Much of Mr. Strachan's time is taken up by correspondence, &c. &c. in connexion with the supply and return of instruments.

II.—WEATHER TELEGRAPHY.

The operations in this branch are carried out by the organization of a series of stations in these islands which transmit reports by telegraph to London, and by the receipt of reports from foreign stations which are transmitted in exchange for reports forwarded from this country to foreign Meteorological establishments.

The Office receives, or would receive, were the telegraphic communications with Corunna and with the Shetlands perfect, 51 reports every morning, and nine every afternoon, except on Sundays. The observations are taken on Sundays, as on other days, but are not received at the Meteorological Office until Monday morning, when the report for Sunday is made out. This statement has been modified since January 1, 1876, as will be seen further on. The stations are situated along the entire coast of the Continent from Christiansund, in lat. 63° N. to Corunna, in lat. 43° N., with four stations on the coast of the Baltic, and one at Cap Sicié in the Mediterranean.

The information received from the Continent in accordance with various arrangements is obtained from France, Holland, Hamburg, Denmark, Norway, and Sweden.

Any cost incurred in transmission of these telegrams over the British lines falls on the Office; but, as regards the French telegrams, their transmission is free over the French wires; while in the case of the messages crossing the North Sea, a free transit has been most liberally granted by the Great Northern Telegraph Company.

The Committee of late have paid at press rates for the transmission of reports to the Office, in consideration of allowing the Post Office to extract from the messages *en route* any information it may require. The following is the list of the stations with the occupations of the observers for December 31, 1875:—

Sumburgh Head	Rev. W. Brand	Minister.
Stornoway	J. Smith	Gardener.
*Thurso	J. Trotter	Ship Carpenter.
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	C. Wakefield	Curator of Museum.
Nottingham	E. J. Lowe, F.R.S.	Highfield House Observatory.
Ardrossan	W. McNeil	Telegraph Clerk.
*Greencastle (Merville)	W. Lowry	Schoolmaster.
Donaghadee	J. MacGowan, jr.	Telegraph Clerk.
Kingstown	G. Mitchell	Keeper of Sailor's Home.
*Holyhead	J. Tilston	Do.
Liverpool	J. Hartnup, junr.	Bidston Observatory.
*Valencia	E. O'Sullivan	Telegraph Clerk.
Roche's Point	W. Kennedy	Do.
Pembroke	J. C. Walker	Do.
Portishead	W. Sandford	Late Station Master.
*Scilly	W. Thomas	Signalman.
Plymouth	J. Merrifield, LL.D., F.R.A.S.	Teacher of Navigation.
Hurst Castle	R. T. Jobbins	Telegraph Clerk.
Dover	J. Costello	Do.
*London	F. Gaster, F.M.S.	Clerk in Meteorological Office.
Oxford	J. Lucas	Assistant, Radcliffe Observatory.
Cambridge	H. Todd	Assistant, Observatory.
Yarmouth	G. T. Watson	Secretary, Sailor's Home.

Cost of
stations.

The remuneration to these observers is 5s. a week, with some exceptions, when an extra allowance of 1s. 6d. a week is made if the duty of reporting entails a long walk, &c. Accordingly the cost of each station, on the average, is, per annum,—

£	s.	d.	
13	0	0	to observers.
15	14	0	314 reports at 1s. each.
1	6	0	postage, &c. &c.
30	0	0	

This cost is increased if the station sends more than one report daily.

Cost of
warnings.

Each Storm Warning sent all round the coast costs the Office at least 6l. There are upwards of 120 stations.

Office arrange-
ments.

The daily observations are taken at 8 a.m., Greenwich time, and most of the telegrams arrive in London 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 at once transmitted to the Office by the private wire. About two hours are required for their reduction, discussion, and the preparation of the Daily Weather Report, copies of which are ready by about 11 a.m., and are at once supplied for the afternoon issue of several of the London papers. Charts are then drawn for publication in the newspapers.

A brief telegraphic resumé of the weather is despatched to the Marine Ministry in Paris, and if necessary, telegraphic intelligence of storms or of atmospherical disturbance is sent to our own coasts and to foreign countries. Later in the day the afternoon reports come in. The Daily Weather Charts are drawn by noon, and forwarded to the lithographers to be printed. The copies for postal distribution are received at the Office at about 3.30 p.m.

Evening and
Sunday service.

Since the 1st of January 1876, arrangements have been made with the "Times" by which the Office is kept open daily until 9 p.m., and on Sunday evenings also from 6 to 9 p.m., and reports are received from certain stations for 6 p.m., so as to admit of the preparation of a special chart by that journal. The extra expense incurred by these operations is borne by the "Times," and the cost will not be far short of 500l. a year. The arrangement has been approved by the Board of Trade and concluded for 3 months.

Warning
stations.

The intelligence of storms which is sent out from the Office varies in character, according to the requirements of the place which receives it. In Appendix IX. to the Report for 1874 will be found a list of the stations which are furnished with signals, in accordance with Circular 717 of the Board of Trade, issued in February 1874.

These stations were, at the end of December, 130 in number, situated :

64 in England.	13 in Ireland.
15 in Wales.	3 in the Isle of Man, and,
32 in Scotland.	3 in the Channel Islands.

Night signals.

Lamps for night use are supplied to a few of the stations. All the stations have been established under and are in accordance with, the terms laid down in the Circular, excepting the Royal Dockyards, which are of course under Admiralty management.

Special reports
to Liverpool,
&c.

In addition to the foregoing, a telegram consisting of reports of the atmospherical pressure and the wind at 14 of the most important stations, is sent daily to the Underwriters' Rooms, Liverpool, the entire expense of the transmission being borne by that association.

All intelligence sent to the coasts is also forwarded to Lloyd's Rooms, where it is at once posted up for the information of the members.

Information to
the Continent.

The intelligence of storms which is supplied to foreign countries is of a two-fold character.

Warnings to
France.

To the Ministère de la Marine at Paris warnings are issued in the same form as to our own coasts, but these are only destined for the portion of the French coast which lies within a reasonable distance of our own shores. The Committee, when the arrangement in question was originally set in action, stipulated that their warnings were not to extend farther to the southward than Nantes, and accordingly for the purposes of these telegrams the coast of France is divided into two districts. North from Dunkerque to Cap la Hague, and West from Cap la Hague to Nantes.

Warnings to
other countries.

To the Meteorological establishments of the other countries which exchange information with the Office no direct warnings of storms are issued, unless in rare instances, but a regular service of cautionary telegrams is in action, by which the London Office transmits to Utrecht and Copenhagen, and to Christiania (when necessary), a telegram containing the most important barometrical readings and wind observations, whenever the total amount of barometer difference over the area covered by the network of the British system amounts to 0.7 in.

The results of the warnings *to our own coasts* have been printed as Parliamentary papers for several years back. The following is the abstract of these results for the year 1874 (Parl. Paper No. 210, 1875) :—

RETURN of the Result of the Comparison between the Warnings issued and the Weather experienced in 1874.

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 late, owing to Sundays, or Telegraphic Errors.	Storms for which no Warning was issued.
Ireland, South	37	17	6	6	4	4	—	Apr. 13, Sept. 22, Oct. 21.
„ East	43	19	15	8	—	1	—	Jan. 18, Sept. 22, Oct. 21.
Scotland, East	35	15	9	10	—	1	—	Jan. 11, Jan. 18, Jan. 26, Apr. 16, Aug. 6, Oct. 21, Dec. 8, Dec. 11.
„ West (Clyde)	42	15	21	5	—	1	—	Jan. 18, Mar. 27, Oct. 21.
England, North-west	41	25	7	6	1	1	1	Oct. 21.
„ West	37	19	12	5	—	—	1	Oct. 21.
„ South	36	17	14	4	—	1	—	Oct. 21, Nov. 29.
England, South-east	19	5	11	3	—	—	—	Sept. 21, at entrance of channel.
„ East	27	12	9	5	—	1	—	Dec. 11, in eastern portion of channel.
Totals	317	144	104	52	5	10	2	Oct. 21, Nov. 29.
Per-centages	—	45·4	32·8	16·4	1·6	3·2	0·6	Jan. 18, Oct. 21, Nov. 29.

If these figures be compared with those for the previous years in which the system has been checked, we arrive at the following result in per-centages :

Comparison with previous years.

—	Warnings justified			Warnings not justified by subsequent Weather.
	By subsequent Gales.	By subsequent strong Winds.	Total.	
1870	46·7	21·7	68·4	22·4
1871	46	17·7	63·7	22·0
1872	61	19·5	80·5	11·9
1873	45·2	34·0	79·2	16·8
1874	45·4	32·8	78·2	16·4

It will be seen that the results for the years 1873–4 are nearly identical with each other, and a closer investigation into the reason of the excess in the figures in the first column for the year 1872, has shown that it was attributable to the fact that in the comparison for that year the occurrence of Force 7, called in Beaufort's scale a “moderate gale,” was considered as entitling the result of the warning to be entered in the first column, instead of the occurrence of Force 8, a “fresh gale,” as assumed in the other years, in which Force 7 was reckoned among the “strong winds.”

The correctness of this explanation of the discrepancy is confirmed by the fact that the per-centage of “total warnings justified” remains almost identical in the last three years.

As regards the value of the warnings issued by the Office to the coasts of Germany, the following table extracted from the Report of the Deutsche Seewarte at Hamburg for 1874, gives conclusive evidence :—

Value of English Warnings to Germany.

Value of
English warn-
ings to Ger-
many.

Year.	No. of Telegrams received.	No. followed by		Light Winds.	Telegrams late.
		Gales.	Strong Winds.		
1868	37	19	9	6	3
1869	48	17	16	15	—
1870	27	14	11	2	—
1871	30	12	13	5	—
1872	44	10	24	10	—
1873	59	28	7	24	—
1874	56	7	27	22	—
	301	107	107	84	3

In the year 1869 23 storms occurred at Hamburg and 22 of these had previously passed over the British Isles.

The discrepancies in the last years may partially be accounted for by the fact that the telegrams are now sent whenever certain conditions arise, without regard to the question of whether or not there is a storm blowing, or expected, at the time the message is sent off.

These figures are sufficient to show the value of the British stations as the outposts of Europe for storm warnings, and the contrast which European organizations present to that of the Chief Signal Office at Washington, which is situated to the eastward of the bulk of its observing stations. In fact it is believed that the forecasts of the Signal Office do not extend beyond the Rocky Mountains, while the area with which the Meteorological Office has to deal, for our own coasts, may be compared to the Pacific slope of that chain.

The Office has entered cordially into the proposal made at the Vienna Congress in 1873, by Brigadier-General Myer, in relation to the organization of a system of really synchronous observations at 0^h 43^m p.m. Greenwich mean time.

The invitation to British observers to join in the scheme was at once responded to, and upwards of 60 observers resident in the United Kingdom joined in the work, while the Army Medical Department has from some of its foreign stations supplied most valuable contributions to the stock of materials.

The list of those who have co-operated in the work will be found at Appendix X. (Report 1874).

In the course of the last two years Capt. Hoffmeyer, director of the Meteorological Institute of Copenhagen has commenced the publication of synoptic charts of Europe, based on the Daily Telegraphic Reports of various countries. This work is issued to subscribers, and the result of the first year's issue has been a pecuniary loss to him. It is a matter of serious consideration among the meteorological organizations of Europe, in what way this undertaking can best be supported and forwarded.

The Meteorological Committee have recently (February 1876) resolved to subscribe for copies of his Charts for distribution to captains, and to furnish him free of cost, with information from their logs relating to the Atlantic for his Charts.

Fishery Barometers are issued on loan to small ports and fishing stations,—and 129 stations on our coasts have been supplied by the Office with barometers for public use. They are situated, 49 in England, 5 in Wales, 44 in Scotland, 29 in Ireland, and 2 in the Isle of Man. See Appendix XI. (Report 1874).

This department occupies the services of—

Mr. R. H. Scott, general supervision, &c.

„ F. Gaster	-	Preparation of Weather Reports, discussions, and computations	£	s.	d.	Yearly.
„ W. L. Dallas	-		180	0	0	
„ F. Brodie	-		100	0	0	
„ G. G. Francis	-		86	0	0	
„ H. Chivers	-		80	0	0	
			0	12	0	Weekly.

These gentlemen are all allowed to work at extra hours for telegraphic purposes at their ordinary hourly rate of pay for such work.

The new arrangements with the "Times" for the preparation of a 6 p.m. chart entail also much additional attendance and some Sunday work. This is paid for by the "Times."

The subject of overtime work will be mentioned later on.

The entire cost of the department in 1874-5 was 3,387*l.* 17*s.* 8*d.*, but this included a back payment of 750*l.* to the Post Office (Report 1875, page 31).

Contrast of
British system
with that of
Washington
Signal Office.

U.S.
synchronous
observations.

Hoffmeyer's
Charts.

Fishery
Barometers.

III.—LAND METEOROLOGY OF THE BRITISH ISLES.

This branch is conducted in the first instance by means of the seven self-recording observatories, Observatories.

Aberdeen, 250*l*. Valencia, Falmouth, 265*l*.
Glasgow, 250*l*. Stonyhurst, 200*l*. Kew, 250*l*.
Armagh,

It seems hardly necessary to state further particulars than those already in print in the Introduction to the Quarterly Weather Report for 1870 in reference to these establishments.

The annual allowance to each, which is intended to cover the current expenses of management and of keeping the instruments in action, is stated above, with the following exceptions:— Cost of each station.

Valencia, of which the entire cost, averaging 540*l*. per annum, has been borne by the Meteorological Office.

Armagh, where the cost is 206*l*. per annum, Dr. Robinson only charging what he is actually out of pocket by the maintenance of the establishment.

These two averages are for the six years 1869–1874 inclusive.

In addition Kew receives a further sum of 400*l*. per annum in consideration of its undertaking the duty of examining the work of all the observatories before sending it to the Office.

The subsequent treatment of the returns is divided into two branches. The numerical computations and the preparation of the plates for the Quarterly Weather Report.

The computations are simply the calculation of mean results for five day and monthly periods which are published in the Quarterly Weather Report. There are no funds available for more elaborate discussion of the materials. Computations.

Since January 1874, the hourly tabulations have been lithographed and distributed. The cost in time of preparing and copying these for the lithographer, including the calculation of hourly vapour tension, is 21 days per month for one person. Practically it occupies the entire time of one person. Lithographed hourly values.

This entire department is under the general supervision of Mr. R. H. Scott.

The work occupies the time of the following clerks:—

	£	s.	d.	
Mr. John Curtis	110	0	0	yearly.
„ H. N. Cobley	1	3	0	weekly.
„ R. Sargeant	1	3	0	„

The whole of Mr. Sargeant's time is not available for the work of this branch at present, as he is partly occupied in connexion with the extra telegraphic service for the "Times" newspaper. Only one extra hand has as yet been taken on for this work, pending the result of the present inquiry.

The methods of preparation of the plates of the report are fully described in the annual reports of the Committee for 1870 and 1871. The accuracy aimed at is 0·02 in. for the barometer and 0°·5 F. for the thermometer. Quarterly Weather Report.

The instrumental appliances are in great measure perfectly unique and have been invented specially for the work by Mr. Galton and Mr. De La Rue. The copper plates are supplied by the Stationery Office, with the standing portion produced by the electrotyping process, and are engraved and etched in the Meteorological Office. Processes and methods unique.

These operations employ the following persons:—

	£	s.	d.	
Mr. Richard Curtis	160	0	0	yearly.
Mr. A. J. Rigby	1	18	6	weekly.
Mr. C. H. Thompson	1	6	0	„
Mr. C. Stodart	2	2	0	„

In addition to the seven observatories the Office is in connexion with a number of other stations whence returns of various degrees of completeness are received, and in Appendix A. to Mr. Scott's evidence before the recent Commission on Scientific Instruction, Vol. III., p. 14, will be found a list of stations as contrasted with those for which returns are published by the Registrar-General for England, in order to show that, if called upon by the Treasury to do so, the Meteorological Office could supply to that officer the materials for his returns. This question was not raised by the Meteorological Office as implied by the Rev. R. Main, Qu. 14,180, but by the Treasury. Subsidiary stations.

The Office has not in the first years of its existence published results from such stations, as it did not seem necessary to do so, and such a measure would give an appearance of rivalry in publication between two Government offices, but since the Permanent Committee of the Vienna Congress in 1874 have called for the publication of returns for international objects, the Committee have commenced such a publication.

Vienna
Congress.

The Vienna Congress undertook the task of attempting to call into existence a real international publication, and the members deemed it advisable, as a first step, to propose that at least it should be recommended to publish the observations and mean results, on definite forms, and on the same size of paper, so that the returns for different countries could be bound up together.

Each country was to be invited to contribute its quota to the common stock of information, by publishing actual observations from a number of stations proportional to its territorial area.

International
stations.

The carrying out of this course of action fell to the Permanent Committee who have devised the forms which are published in its Report (p. 47), and have proposed the following inferior limit for the number of stations for the several European governments:—

Norway	-	-	-	10	Germany	-	-	-	12
Sweden	-	-	-	10	France	-	-	-	12
Denmark, with Iceland and Faroe	-	-	-	6	Austria and Hungary	-	-	-	15
Great Britain and Ireland	-	-	-	15	Turkey	-	-	-	10
Russia in Europe	-	-	-	50	Switzerland	-	-	-	5
„ Asia	-	-	-	100	Italy	-	-	-	12
Netherlands	-	-	-	2	Spain, Portugal, and Azores	-	-	-	12
Belgium	-	-	-	2	Greece	-	-	-	3

It remains open for the directors of the individual systems not only to select the stations which are best suited for the purpose, but also to increase at pleasure the number above given.

It is naturally of importance that these 15 stations, which fall to our share over and above the seven observatories in connexion with the Office, should be distributed pretty uniformly over these islands; and accordingly the opportunity seemed to be offered, by this proposed international publication, for instituting satisfactory relations of co-operation between the Office and the several independent organizations of observers in the United Kingdom, in order that the information to be published should be as fairly representative of our climate as possible.

Arrangements
with
Meteorological
Society.

In the month of November an invitation was issued to the Meteorological Society (of London) to supply to the Office certain returns from several of its newly-established stations. The proposal was at once favourably received, and the terms of agreement were speedily settled. The most important of these are as follows:—

Verified copies of detailed observations at 9 a.m. and 9 p.m. are to be supplied monthly from at least five stations in consideration of a minimum payment of 25*l.* per annum, and from any further number of stations agreed upon at 5*l.* per annum per station.

Verified copies of mean monthly values to be supplied from certain other of the society's stations, not exceeding 20, at the rate of 2*l.* 10*s.* per annum per station.

A similar invitation was issued to the Scottish Meteorological Society in January 1875, but up to the present date it has not led to a satisfactory result.

The list of stations whence observations were to be received in 1875, either from volunteer observers in direct connexion with the Office, or in pursuance of the arrangement just mentioned with the Meteorological Society, will be found in the Report of the Committee for 1874, pp. 27, 28, and at the same place are given lists of other stations in connexion with the Office.

Instruments
not lent for use
on land.

No instruments are supplied on loan for use at land stations unless to paid observers. In the case of ships the instruments are only supplied for one voyage unless in the instances of Transatlantic steamers. Instruments lent for use on shore are lent for a longer time and the observers come to consider them their private property, and in case of death it has sometimes been impossible to recover them.

The Office in 1868 presented 100*l.* worth of instruments to the Scottish Society, which had been originally lent to that body.

Sea
temperature
observations.

With reference to the subject of sea temperature on the coasts of England and Ireland arrangements have been made at the suggestion of the Harbour Department of the Board of Trade, and observations are taken at the following stations, by the co-operation of the Trinity House and the Commissioners of Irish Lights:—

ENGLAND.		Morecambe Bay Lightship.
Fern Islands	Lighthouse.	Bahama Bank "
Dudgeon	Lightship.	
		IRELAND.
Lemon and Ower	"	Kish Lightship.
Galloper	"	Arklow, South "
South Sand Head	"	Coning Beg "
Owers	"	Daunt's Rock "
Seven Stones	"	

The entire cost of this department in 1874-5 was 3,799*l.* 7*s.* 10*d.*

There is a most pressing want in this branch of additional funds for the more comprehensive treatment of the materials accumulated.

IV.—OFFICE.

The expenses of management in salaries and wages in the year 1874-75 have been 1,314*l.* 19*s.* 0*d.* Expenses of Management.

The other charges incident on the Office for rent, furniture, postage, &c. in the same year have amounted to 798*l.* 19*s.* 8*d.*

The staff employed in the general business of the Office is as follows :—

	£	s.	d.	
R. H. Scott, Director	-	-	-	800 0 0 yearly.
J. S. Harding, Jun., correspondence, accounts, library, &c.	-	240	0 0	"
T. D. Bell, assistance in do., registering of documents, &c.	-	80	0 0	"
J. S. Harding, Sen., office keeper	-	1	18 6	weekly.
Commissionaire, messenger	-	1	1 0	"

Mr. Strachan also devotes much of his time to the routine work of the Office in so far as it relates to the supply and return of instruments.

There is one matter which requires notice relative to the arrangements of the Office, and the pay of the staff. All the clerks are allowed to work at overtime, the regular hours of the Office being now, as in former years, six. The only rule about this overtime is that the work is, generally speaking, different from that carried on during office hours, and that the allowance is 1*s.* to 1*s.* 3*d.* per hour. Overtime.

The following is a statement showing the amount of *registered* correspondence during the years 1866 and 1867, being the years preceding and following the appointment of the Meteorological Committee, and for the year 1875. Also the number of documents received from ships and *stations outside the British Isles*, the average number of telegrams received, and of Reports issued *for each day* for the same years :— Correspondence.

Years.	1866.	1867.	1875.
Letters written -	614	1,553	4,834
Circulars written	733	228	2,643
Letters received	650	1,121	2,794
Total	1,997	2,902	10,271
No. of documents registered*	127	68	216
Telegrams received daily	24	26	60
Reports issued daily†	10	15	550

* In addition returns are regularly received from British and Irish Observatories and Volunteer Stations. Each set or series receives one number only.

† Weather Reports were *not printed* in 1866-7.

Constant reference is made to the Office for information on meteorological subjects, both for scientific objects and in connexion with legal inquiries. No charge is made for such information over and above the cost of copying and of special calculations if required.

The following Table shows the annual expense of the Office since 1867 :—

ABSTRACTS of the ACCOUNTS of the METEOROLOGICAL

Years ending 31st March.	1868.			1869.			1870.		
	£	s.	d.	£	s.	d.	£	s.	d.
RECEIPTS.									
Balance from previous year				12	4	0	1,743	11	3
Parliamentary Vote	10,570	0	0	10,000	0	0	10,000	0	0
Various sources (<i>vide</i> explanation on p. 72)	22	11	3	247	1	2	161	14	5
Totals	10,592	11	3	10,259	5	2	11,905	5	8
PAYMENTS.									
Office—									
Salaries	2,875	11	0	2,653	2	0	1,562	1	3
Rent, Fuel, and Furniture							1,128	12	9
Contingencies, Printing, &c.	297	4	3	396	18	11	275	10	10
Land Meteorology—									
Expenses at Observatories	876	12	8	2,014	9	4	2,277	3	9
New Instruments for do.†	(1) 3,826	8	0	550	9	10	519	15	2
Computations	* Charged under "Salaries."						377	6	3
Telegraphy	(2) 1,954	1	9	(2) 2,441	9	7	2,193	16	7
Inspections, D. W. Charts, &c.							87	9	11
Computations	* Charged under "Salaries."						357	13	7
Ocean Meteorology—									
Marine Superintendent	* Charged under "Salaries."						400	0	0
Admiralty Instruments	324	0	9	289	9	7	111	13	6
Mercantile Marine do.† (3)	426	8	10	169	14	8	262	8	5
Computations, &c.	* Charged under "Salaries."						864	19	7
	10,580	7	3	8,515	13	11	10,418	11	7
Balances	12	4	0	1,743	11	3	1,486	14	1
Totals	10,592	11	3	10,259	5	2	11,905	5	8

(1) Including Outfit and Fittings. (2) Including Travelling Expenses for Inspections, &c. (3) Including Instruments and Agency Accounts (sea-ports).

* In the first two years the classification of the accounts was not carried out in the present detail.

† The purchases of instruments for colonial establishments, &c. are included under the heads of "New Instruments for Observatories" and of "Mercantile Marine Instruments."

Office for eight years ended 31st March 1875.

1871.	1872.	1873.	1874.	1875.
£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
1,486 14 1	1,826 17 3	1,496 3 6	1,643 12 5	2,290 12 2
10,000 0 0	10,000 0 0	10,000 0 0	10,000 0 0	10,000 0 0
100 10 9	229 16 9	632 3 3	643 1 0	1,221 13 9
11,587 4 10	12,056 14 0	12,128 6 9	12,286 13 5	13,512 5 11
1,195 7 0	1,222 15 2	1,255 12 2	1,275 12 3	1,314 19 0
473 12 1	629 9 11	641 5 4	645 9 10	603 2 8
313 19 9	237 1 4	478 14 3	171 13 3	195 17 0
2,613 17 3	2,588 11 1	2,632 1 8	2,722 9 10	2,644 3 11
978 17 3	225 6 4	—	—	391 12 9
782 17 3	807 8 2	831 7 10	783 16 5	763 11 2
850 19 2	2,393 12 6	1,769 2 4	1,182 4 2	2,139 8 9
160 19 8	171 18 3	219 13 1	479 6 10	583 2 3
382 1 6	457 4 5	534 17 11	522 18 4	665 6 8
400 0 0	400 0 0	400 0 0	400 0 0	450 0 0
103 4 6	90 9 2	277 3 8	338 5 7	265 15 0
648 5 2	433 4 6	480 15 3	419 0 7	575 4 11
856 7 0	903 9 8	964 0 10	1,055 4 2	1,093 6 5
9,760 7 7	10,560 10 6	10,484 14 4	9,996 1 3	11,685 10 6
1,826 17 3	1,496 3 6	1,643 12 5	2,290 12 2	1,826 15 5
11,587 4 10	12,056 14 0	12,128 6 9	12,286 13 5	13,512 5 11

Extra sources
of income.

Under the head of Receipts there is an entry of "Various sources," the chief of these are,—

Moneys remitted by colonial authorities, &c. for the purchase of instruments. (*Vide* Qu. 1407–8, vol. III. of the Minutes of Evidence, Science Commission, p. 13.)

Subscriptions to the Daily Weather Reports, Hoffmeyer's Charts, and the Hourly Values of the Observatory Records, which are payments for the transmission of information.

Payments for work done in copying information for applicants.

Interest on the Deposit Account of the Committee.

These sums are stated in detail in the Annual Reports, and the following is a statement showing the amounts received from other sources than the Parliamentary Vote during the three years ending 31st March 1875 :—

	1873.	1874.	1875.
Commissions for instruments -	150 11 0	177 12 9	725 1 7
Subscriptions for D. W. Charts -	335 0 9	243 2 11	297 2 11
" Hourly observations -	—	6 0 0	14 0 0
" Danish synoptic charts -	—	—	17 1 6
" MS. weather reports -	18 11 8	15 16 8	15 0 0
Meteorological data, &c. -	7 13 0	13 17 2	23 16 11
Interest on deposit account -	120 6 10	186 11 6	129 10 10
Totals -	632 3 3	643 1 0	1,221 13 9

Proportion of
funds devoted
to the
Meteorology
of the three
Kingdoms.

As regards the apportionment of the expenditure on Weather Telegraphy and Land Meteorology between the three kingdoms, the following tables may be quoted, Report, Science Commission, vol. iii. p. 8. The figures are for 1869–70, but the proportion has not altered materially since.

Services.	England.	Ireland.	Scotland.
	£ s. d.	£ s. d.	£ s. d.
* Establishment of observatories -	959 4 6	822 16 10	782 17 10
Expenses at observatories -	1,398 10 3	811 14 2	586 14 6
Observatory computations -	161 14 3	107 16 0	107 16 0
Telegraphy—Reports to Office† -	458 17 8	458 17 8	458 17 8
Telegraphy—Warnings issued -	157 17 0	52 12 4	105 4 8
Telegraphy—Computations -	168 18 9	75 1 8	112 12 6
Fishery Barometers supplied -	12 15 0	4 5 0	9 8 0
Totals -	2,358 12 11	1,510 6 10	1,380 13 4

* The establishment was *prior* to the year 1869; all other charges were actually paid within the year.

† The cost of telegrams is roughly estimated to be about equal for the three kingdoms. In 1869, an Irish message cost more than two English, and a Scotch message cost about 1½ English. These figures have therefore been altered since 1870, but not materially.

Estimated
value of
property
in the Office.

The subjoined statement shows the estimated value of the Office property :—

Furniture, bookcases, presses, &c. -	£750
Instruments at observatories -	2,600
Pantagraphs and spare S.R. instruments -	850
Admiralty instruments -	5,000
Board of Trade do. -	1,900
	<u>£11,100</u>

This estimate does not include the value of the library, or of the store of meteorological records both in ships' logs and in the schedules, &c. from land stations of all kinds, both discussed and awaiting discussion. Nor does it include the value of fittings and fixtures in the Office, or of signal apparatus, &c.

Lastly, the following statement shows the condition of the Library, &c. :—

LIBRARY, &c.

I.—PRINTED BOOKS.

The library contains about 2,000 volumes and above 2,000 pamphlets bound in volumes, and contains for the most part works on meteorology and kindred subjects, proceedings of scientific societies, &c. The great majority of the books, &c. have been presented to the Office, but, in some special cases, purchases have been made. The books are lent to the staff of the Office under the usual regulations.

Catalogues for easy reference, and for use in the Office, have been prepared and arranged under the following heads :—

1. Subjects.

2. Authors' names.

II.—MS. DOCUMENTS.

These include two series, viz. :—

1°. The observations made on ship-board and at lighthouses and other stations *outside* the British Isles. The number of such returns has reached nearly 3,700. In the case of ships' logs, each number represents a complete voyage, irrespective of the number of books used, and almost all the instruments employed in taking the observations have been supplied and verified by the Office. Registers for reference have been made out on the following plans :—

1. In order of date of receipt.

2. Under captains' names.

3. Under district or voyage.

2°. The observations made within the British Isles, *e.g.*, at observatories supplied with self-registering instruments, and by volunteer observers (stations of the second order), &c. These stations have been in regular operation since 1867, and the returns are properly registered and filed for easy use and reference.

The following are detailed lists of the information actually existing in the Office, in a more or less advanced stage of discussion.

LIST of the *principal unpublished* MATERIALS in the METEOROLOGICAL OFFICE.

TABLE I.—MARINE.

Ocean.	District discussed.	Nature of Work done.	Remarks.
North Atlantic (1)	Lat. 0° to 60°	Wind data in 5° squares. Direction and force for each month. Maury's observations combined with those of Meteorological Office.	This work was done by Admiral FitzRoy; and the middle months of each quarter were published in 1859.*
" (2)	" 40 to 60	Sea temperatures and currents, extracted from Meteorological Office logs, in 5° squares.	Used by Admiralty for Physical Charts.
" (3)	" 0 to 60	Observations of barometer, thermometer, wind and weather, specific gravity, &c. grouped in Data books for each 5° square.	Collected by Admiral FitzRoy; scanty.
" (4)	" 0 to 60	*The observations contained in item (1) from Meteorological Office logs only, grouped in a tabular form.	Printed, but not published.
" (5)	0 to 20	All meteorological observations grouped in 1° squares for each month.	Collected in data books. In the press.
South Atlantic (6)	" 0 to 10	Wind data corresponding to item (1)	Collected, &c. by Admiral FitzRoy.
" (7)	" 0 to 60	Observations of barometer, &c. corresponding to item (3).	Collected, &c. by Admiral FitzRoy; scanty.
" (8)	" 0 to 60	Currents, grouped in a table of 5° squares for each month.	
" (9)	" 0 to 60	*Wind data corresponding to item (4)	Printed, but not published.
North Pacific (10)	" 0 to 60	Meteorological data. Three equidistant observations daily, grouped in 5° squares for each month, with totals and averages of observations.	Part for Vancouver's Island published; part for seas of China and Japan in the press.
" (11)	Whole surface		
South Pacific (12)	"	" " "	A portion (Cape Horn and west coast of South America) published in No. 11.
Indian Ocean (13)	"	Observations as in item (3) - - -	Collected by Admiral FitzRoy.
Mediterranean and other inland seas. (14)	"	" " " - - -	" "
All Oceans (15)	- - -	Collection of remarkable passages, gales, ice, &c. from Meteorological registers.	Printed, but not published.
" (16)	- - -	Collection of currents, from Meteorological Office and Admiralty logs (eight MS. vols.).	By Admiral FitzRoy.
Southern Atlantic and Indian. (17)	Cape of Good Hope	Observations corresponding to item (5) -	Collecting into data books.
Bay of Bengal and Arabian Sea. (18)	- - -	" " " - - -	" "
" (19)	- - -	Observations on the temperature of the sea, &c. at English and Irish lighthouses, &c.	From March 1875 continuing.

* N.B.—This statement does not take into account the undigested observations not yet extracted from the registers.

TABLE II.—BRITISH ISLANDS.

Station.	Nature of Work done.	Date.	Remarks.
7 Self-recording Observatories :—			
Aberdeen - - -	Hourly tabulations of barometer, thermometer, and wind and rainfall - - -	Since 1868.	5-day means of barometer and thermometer, and continuous curves, published in Quarterly Weather Report. Hourly observations printed by lithography from 1874.
Armagh - - -			
Falmouth - - -		Since January 1871.	
Glasgow - - -			
Kew - - -			
Stonyhurst - - -			
Valencia - - -			
7 Anemograph Stations :—			
Alnwick - - -	Hourly tabulations of direction and velocity - - -	From March 1870.	None yet published, except Orkney for six years ending 1868.
Halifax - - -		„ January 1871.	
Holyhead - - -		„ August 1869.	
*Kensington - - -		„ September 1869.	
Orkney - - -		„ July 1869.	
Seaham - - -		„ November 1872.	
Yarmouth - - -		„ September 1869.	
Oban - - -	Monthly abstracts made by Captain Thomas, R.N., during Admiralty Survey.	1858–1865 - - -	Some of these means were published by the Scottish Meteorological Society.
Miscellaneous - - -	Observations received monthly from about forty stations distributed over the British Isles, and specified in annual reports of the Office.	- - -	None yet published; but the observations are to some extent utilized in writing the Chronicle of the Quarterly Weather Report. Publication for some stations commenced for 1873 in the Quarterly Weather Report.
	These stations are in addition to the telegraphic reporting stations, and commence at dates.	Subsequent to 1867.	
„ - - -	†Synchronous observations taken at 0h. 43pm. at about 60 stations in United Kingdom.	From February 1874 -	Copies supplied to Washington for publication by the Chief Signal Officer.

* Two years only.

† A considerable series was also collected by Admiral FitzRoy in 1857 and 1859–60, and the materials were partly utilized in drawing maps for weather study.

TABLE III.—FOREIGN AND COLONIAL.

Station.	Nature of Observations.	Date.	Remarks.
Angra do Heroismo (Azores), Funchal (Madeira).	One observation daily. Readings corrected and reduced in millimetres and Centigrade.	Since January 1870.	Means from these stations are published in Portugal.
Apia, Samoa (Navigators' Islands).	Meteorological observations un-reduced. One observation daily.	Twenty months, not continuous, in 1862–1865.	By J. C. Williams, Consul.
Ascension - - -	Hourly observations with monthly means of barometer and thermometer. Anemometrical observations and reductions.	October 1863 to October 1865.	By Lieutenant Rokeby. Preparing for publication with marine work for Equatorial District. (See item 5.)
Bangkok (Siam) - - -	Two observations daily, with monthly means.	January to December 1858.	By Dr. Campbell, attached to H.M. Consulate.
	Three observations daily, no means deduced.	{ 1859–1861 } - - -	There are several interruptions in the series.
Bermuda - - -	Anemometrical observations (not all tabulated).	{ 1863–1867 } - - -	Observations for previous years, so far as reliable, published in the Quarterly Weather Report, 1872.
		Since 1868 - - -	By D. Blyth, Master Attendant.
Ceylon, Point de Galle - - -	Two observations daily, and monthly means.	From January 1869, continuing.	
Corfu - - -	Mean, maximum, and minimum readings of barometer and thermometer.	October 1859 to September 1860.	
Fiji - - -	Bi-daily observations of barometer, thermometer, rain, &c.	January 1865 to June 1867	By Mr. Binner, Wesleyan Training Master.
Gibraltar - - -	Two observations daily, with monthly means.	Since June 1870, continuing.	The original observations are supplied to Army Medical Department.
Lighthouses :—			
* Cape Pembroke (Falk-lands).	Observations of barometer, thermometer, wind, &c., made several times daily.	From July 1859, continuing.	Not very trustworthy.
* King George's Sound (2) - - -	- - -	July 1861 to Dec. 1869.	
Abaco (Bahamas) - - -	- - -	{ March 1858 to June 1860 } - - -	
	- - -	{ July 1871, continuing. } - - -	
Cay Sul (Bahamas) - - -	- - -	{ March 1858 to June 1860. } - - -	
	- - -	{ July 1871, continuing. } - - -	
Great Isaacs (Bahamas) - - -	- - -	August 1859 to Jan. 1860.	
Gun Cay - - -	- - -	Jan. 1858 to July 1859.	
Inagua - - -	- - -	July 1871 to June 1872.	
Sombrero - - -	- - -	September 1867, continuing.	
Natal (Maritzburg) - - -	Complete observations three times daily; monthly averages are made out.	January 1860 to February 1866.	By Dr. R. J. Mann, F.R.A.S. January 1858 to March 1859, published in 5th Number of Meteorological Papers.
Tahiti - - -	Means of observations taken four times daily. The measures are French.	May 1865 to June 1860.	Extracts from the "Messager de Tahiti."
Trinidad - - -	Observations twice daily of barometer, thermometer, wind, &c. Monthly means are deduced.	February 1862 to June 1864.	Mr. Crüger, the observer, published a pamphlet embodying some of the results.

* The monthly averages for Cape Pembroke and King George's Sound for the barometer have been obtained for seven years.

The Committee then adjourned.

116, Victoria Street, March 20, 1876.

PRESENT :

Mr. De La Rue in the Chair.

Mr. Galton. | Major-General Smythe.
Lieut.-General Strachey.

The Director was in attendance.

The Minutes of last meeting (March 6) were read and confirmed.

Read—A letter from the Patent Type Founding Co. (No. 560), inquiring if it would be possible for them on any terms to obtain the copy of chart for 6 p.m., which appears in the "Times," for publication in other daily morning papers. (Minutes 1875, pp. 70, 71.)

Mr. Scott was instructed to send the following reply—

I AM directed to inform you that the arrangement made by this Office is that the "Times" undertakes to pay the entire cost of the evening observations and reports, and consequently is entitled to the exclusive use of them. If, however, you see your way to raising a fair proportion of the expense (500*l.* per annum about) there will be no difficulty in your having the information for distribution.

Reported—That the Barometer Manual, O. 8, was out of print as stated by the Stationery Office. Of this work 1,565 copies had been received from the Stationery Office, and 500 returned to that office on requisition, so that as about 30 copies were still in the Office, the free distribution of the book had been about 1,030 copies.

Mr. Scott was instructed to report to the Committee as to the kind of information which could be included in a new edition of a publication under the title named.

Read—A letter from Capt. Hoffmeyer (No. 502), expressing his thanks to the Committee for their liberality in supplying him with the Atlantic Observations for 1875 (Minutes pp. 37 and 44), and stating that he proposed to issue his Charts for the three months, September–November 1873, if he could obtain subscribers.

Mr. Scott stated that he had replied that he would take 25 copies for the Office, which number he hoped to dispose of—Approved.

Read—A letter from Captain Toynbee submitting an excellent Log by Captain W. H. Stuart, schooner "Richmond." (Minutes 1874, p. 96.)

Mr. Scott was instructed to convey the marked thanks of the Committee to Captain Stuart.

The question of the propriety of making some charge on the orders received on commission for foreign institutions, &c. was discussed, and it was

Resolved—That from the 1st of April next a percentage be charged on all such orders, to cover expenses, varying from 2½ to 5 per cent., according to the trouble involved.

Reported—That the Daily Weather Charts had been supplied to James Conroy, Rosenallis, Ireland (late Sergeant R.E.), in return for observations.

A cheque for 30*l.* was drawn in favour of J. S. Harding, junr., for petty cash.

The Committee then adjourned.

116, Victoria Street, April 3, 1876.

PRESENT :

Mr. De La Rue in the Chair.

Mr. Galton.

Major-General Smythe.

Capt. Evans.

The Director was in attendance.

The Minutes of last meeting (March 20) were read and confirmed.

Submitted—The following draft reply to the letter from the India Office (Minutes, p. 36) :

In reply to your letter of February 16th I am instructed by the Meteorological Committee to request you to express to the Secretary of State for India their thanks for having afforded them the opportunity of reading Mr. Blanford's report.

They consider the entire paper as a document of very high value as regards the present condition of the Meteorological service of India, and the suggestions for its future consolidation and improvement, and they sincerely hope that the Government may be disposed to give effect to the several recommendations contained in the Report, and which appear to them most judicious.

Mr. Scott reported that he had received a very full report (Letter 691) of the proceedings of the private Conference on Weather Telegraphy held at Hamburg in December last (Minutes 1875, p. 82) with the request that he would send in his adhesion, or the contrary, to the proposals in the Report.

He stated that he had sent the following reply :

DEAR SIR,

March 28, 1876.

IN reply to your letter of the 25th inst., with the accompanying memorandum of the proceedings at the private Conference on Weather Telegraphy held at Hamburg in December 1875, I must only say that I decline to affix my signature or to express any opinion on the matter until I shall have had the opportunity of discussing the subject with Professors Buys Ballot and Mohn, who will be in London in three weeks.

I have sent a copy of this reply to all the gentlemen named in your letter of invitation of November 15th 1875.

Yours, &c.,

Dr. G. Neumayer,
Director Deutsche Seewarte.

ROBERT H. SCOTT,
Director.

Submitted—Mr. Rundell's paper on the Winds of Liverpool (Minutes 1872, pp. 38, 39, 59, 68; and 1873, p. 3) with the following letter :

DEAR MR. SCOTT,

Liverpool, March 9, 1876.

HEREWITH I at length send you my revised paper on the Winds at Liverpool. If you knew how much work the revision has occasioned you would not think I had been long over it. The suggestions made by your referees have had careful attention, as I hope the paper will show.

Yours, &c.

(Signed) W. W. RUNDELL.

Mr. Scott stated that, with Mr. Rundell's permission, he had again referred to Professor Stokes to know if the paper were suitable for the Philosophical Transactions, and had received a reply (Letter 696) to the effect that in Professor Stokes' opinion it was not so.

Resolved—That Mr. Rundell's paper, as amended by him, be printed as an appendix to the Quarterly Weather Report.

Read—A letter from Mr. H. B. Joyner (No. 660) enclosing some printed Meteorological returns from Japan and asking the Committee to represent through the British Minister to the Japanese Government that the service was likely to be of importance to the science.

Mr. Scott was instructed to send the following letter to Sir H. Parkes :

I am instructed by the Meteorological Committee to inform Your Excellency that they have learnt with great satisfaction that regular Meteorological returns are now being published for a station in Japan, and they would be much indebted to you, if you could induce the Japanese Government to furnish them with these returns from the commencement and at regular intervals in future.

At the same time they would venture to express the hope that Your Excellency would use your influence to impress on the Japanese Government the advisability of continuing the Meteorological observations established at Tokai.

Reported that there were only 45 Rough books and 58 Weather Book Registers in the Office.

Mr. Scott was instructed to order 250 copies of a new edition of the latter with Rough Books to correspond.

Mr. Scott was instructed to apply to the Treasury for an imprest of 2,000*l.* to meet the current expenses of the Office.

Reported—That the sum of 2,000*l.* had been transferred from the deposit account of the Committee to their current account on the 27th ult. on the signature of General Smythe.

The officers and clerks were re-appointed for the ensuing financial year at the following salaries (See Minutes, 1875, pp. 32–3) :

	£	s.	d.
R. H. Scott, Director	800	0	0
H. Toynbee, Marine Superintendent	400	0	0
J. S. Harding, jun., Chief Clerk	*250	0	0
R. Strachan, 1st Senior	*200	0	0
(With 50 <i>l.</i> additional for instruments.)			
F. Gaster, 2nd Senior Clerk	*190	0	0
C. Harding, 3rd	*180	0	0
R. H. Curtis, 4th	*170	0	0
J. A. Curtis, 1st Junior Clerk	*120	0	0
T. E. Allen, 2nd	*120	0	0
W. L. Dallas, 3rd	*110	0	0
F. Brodie, 4th	*96	0	0
G. G. Francis, 5th	*90	0	0
T. D. Bell, 6th	*90	0	0

The following scale of weekly salaries was approved :—

	Increase.	
J. S. Harding, sen., Office Keeper	1 18 6	
A. J. Rigby, Temporary Clerk	1 18 6	
W. Allingham	1 18 6	
H. Harries,	0 3 6	1 18 6
J. Dallas,		1 10 0
C. H. Thompson,	0 3 0	1 9 0
R. Sargeant,	0 3 0	1 6 0
H. N. Cobley,	0 3 0	1 6 0
H. W. Chivers,	0 2 6	0 16 6
H. F. Green,	0 2 6	0 14 6
C. Stodart, Engraver	2 2 0	

Mr. J. E. Cullum was re-appointed Superintendent of Valencia Observatory, at a salary of 160*l.* per annum.

Reported—That the following cheques for March were drawn on the 27th of that month, on the signature of General Smythe :—

For Office :		£	s.	d.	
R. H. Scott	} Salaries and wages	66	13	4	
J. S. Harding, jun.		20	0	0	
J. S. Harding, sen.		17	14	0	
T. D. Bell		6	13	4	
G. S. Freeman, fire insurance, policy 124817		1	6	0	
" " " 133438		1	2	0	
			2	8	0
C. W. Jacques, rent			133	13	0
Waterlow & Sons, Limited, paper, &c.		2	17	6	
" " books		2	1	6	
			4	19	0
Carried forward		£242	0	8	

* Increase of 10*l.* since last year.

† Four weeks to the 25th March.

			£	s.	d.
	Brought forward	-	-	242	0 8
For Observatories, Quarterly Allowances, &c. :					
D. Thomson, Aberdeen	-	-	-	†61	11 3
T. R. Robinson, Armagh	-	-	40	14	0
„ expenses for quarter	-	-	8	12	3
				49	6 3
W. P. Dymond, Falmouth	-	-	-	†65	0 0
R. Grant, Glasgow	-	-	†61	5	0
„ postage and repairs	-	-	2	11	0
				63	16 0
H. Williams, Holyhead	-	-	-	2	13 5
G. M. Whipple, Kew	-	-	62	10	0
„ examining observatory returns	-	-	100	0	0
				162	10 0
C. Clouston, Orkney	-	-	-	2	10 0
G. H. Aird, Seaham	-	-	-	2	13 9
S. J. Perry, Stonyhurst	-	-	†49	1	3
„ postage	-	-	0	6	5
				49	7 8
J. E. Cullum, Valencia	-	-	-	32	17 9
G. T. Watson, Yarmouth	-	-	-	4	13 6
W. Marriott, Meteorological Society's Observations	-	-	-	15	0 0
P. Adie, repairing pantagraphs	-	-	-	28	12 0
„ barometers for Christiania, &c.-	-	-	-	37	13 0
G. M. Whipple, verification of observatory instruments	-	-	-	29	7 6
T. De La Rue & Co., metallic paper	-	-	-	6	16 6
Malby and Sons, anemograph forms	-	-	-	3	0 0
Negretti and Zambra, new instruments (Commissions, &c.)	-	-	-	91	19 6
R. H. Curtis	} Computations	-	-	13	6 8
C. H. Thompson		-	-	*5	4 0
C. Stodart		-	-	*8	8 0
J. A. Curtis		-	-	9	3 4
For Telegraphy :					
The Postmaster-General, December quarter	-	-	360	2	3
„ „ January	-	-	113	0	1
„ „ private wire	-	-	22	0	0
				495	2 4
N. J. Holmes, Shetland Telegraph Co.	-	-	-	3	5 0
H. Todd, Cambridge	-	-	-	3	19 0
J. Costello, Dover	-	-	-	3	6 0
J. Tilston, Holyhead	-	-	-	3	19 0
G. Mitchell, Kingstown	-	-	-	3	6 4
F. Gaster, London	-	-	-	3	5 0
J. Lowry, Moville	-	-	-	6	8 6
W. D. Penny, Nairn	-	-	-	4	4 6
E. J. Lowe, Notts	-	-	-	3	18 0
J. Lucas, Oxford	-	-	-	3	6 0
J. Merrifield, Plymouth	-	-	-	3	5 0
W. Sandford, Portishead	-	-	-	3	19 0
J. C. Walker, St. Ann's Head	-	-	-	2	0 0
W. Thomas, Scilly	-	-	-	4	7 9
W. Brand, Shetland	-	-	-	2	13 6
J. Smith, Stornoway	-	-	-	3	18 0
J. Trotter, Thurso	-	-	-	3	6 5
J. Sinclair, Wick	-	-	-	3	5 0
G. T. Watson, Yarmouth	-	-	-	4	7 1
C. Wakefield, York	-	-	-	3	5 9
	Carried forward	-	-	£1,555	17 11

* Four weeks to the 25th March.

† Deduction made for forms supplied.

SUBMITTED.—The following STATEMENT respecting the RECORDS for February 1876, received from the SELF-RECORDING OBSERVATORIES, which have been examined at KEW OBSERVATORY (see Minutes, 21st December 1868).

Points noticed at Kew.	Aberdeen.		Armagh.		Falmouth.		Glasgow.		Kew.		Stonyhurst.		Valencia.	
	Direction. Good.	Velocity. Good.	Direction. Good.	Velocity. Good.	Direction. Good.	Velocity. Good.	Direction. Good.	Velocity. Good.	Direction. Good.	Velocity. Good.	Direction. Good.	Velocity. Good.	Direction. Good.	Velocity. Good.
ANEMOGRAPH :—														
Action - - -	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Records deficient, due to stoppage of clock	0	0	0	0	0	0	0	0	0	0	0	0	0	0
" " other causes -	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Orientation verified - -	29th	—	28th	—	11th	—	—	—	—	—	—	—	—	—
No. of errors discovered by subsidiaries	0	0	0	0	0	0	0	0	0	0	0	0	0	0
" " irregular differences -	0	0	0	0	0	0	0	0	0	0	0	0	0	1
Result of 40 Remeasurements :—														
Greatest difference - -	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Mean difference irrespective of sign -	0.2	0.5	0.1	0.2	0.3	0.5	0.3	0.5	0.0	0.1	0.3	0.5	0.3	0.6
Residual difference (— Kew) -	0.0	0.0	0.0	0.0	0.0	+0.1	0.0	0.0	0.0	-0.1	+0.1	0.0	-0.1	+0.1
RAIN GAUGE :—														
Action - - -	Fair.	Fair.	Fair.	Fair.	Fair.	Fair.	Fair.	Fair.	Fair.	Fair.	Fair.	Fair.	Fair.	Fair.
Records deficient, due to stoppage of clock	0	0	0	0	30 hrs.	0	0	0	0	0	0	0	0	0
" " other causes -	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Errors in tabulation - -	0	0	0	0	0	0	1	0	0	0	0	0	0	0

116, Victoria Street, May 1, 1876.

PRESENT :

Mr. De La Rue in the Chair.

Mr. Galton.

The Director was in attendance.

The Minutes of last meeting (April 3) were read and confirmed.

Reported—That the imprest for 2,000*l.* had been received (Minutes, April 3).

Mr. Scott reported that he had received the following letter:—

M.O. 814.

DEAR MR. SCOTT,

Board of Trade.

THE Meteorological Committee is anxious to obtain some idea of the cost of obtaining Meteorological Observations in foreign countries. * * *

Application has been made to the Foreign Office to obtain from foreign countries, as far as possible, the costs of Meteorological offices in each.

Mr. Milne Home has put in the enclosed list of questions to be sent also through the Foreign Office, but the Chairman wishes me to ask you whether it is not probable that if you had these questions lithographed, leaving spaces for replies, and you were yourself to forward them to the offices in respective countries abroad, asking the chiefs to be good enough to answer the queries so far as possible for the use of our Committee, this information might not be obtained more expeditiously than if sent to our representatives abroad?

I am, &c.

(Signed) J. G. FANSHAWE.

April 5, 1876.

Mr. Scott stated that he had received the following list of questions from Mr. Fanshawe:—

METEOROLOGICAL ORGANIZATIONS IN QUESTIONS.

1. How many stations are there in your system?
 - (a.) How many of the 1st order?
 - (b.) " 2nd "
 - (c.) " 3rd "
2. Are these stations at which no self-recording instruments are used but only eye observations made?

If so to what uses are the latter put?
3. What means are taken to ensure correctness at all the stations?
4. How often, and at what hours are observations made?
5. How are the observations recorded? Who supplies the schedules?
- 5a. If supplied from the Central Office, is their cost defrayed from its own funds?
6. Are the observers paid? and if so, at what rate?
7. Who appoints the observers?
8. Can they be changed?
9. How often are the stations inspected?
10. By what persons and at whose expense?
11. Who supplies instruments?
- 11a. Are they verified before or after erection?
12. What staff is employed at the Central Office?
- 12a. Have any of the staff any other sources of official income?
- 12b. What are the usual office hours?
- 12c. Is residence or any other *special advantage* enjoyed by the director, or any of the staff?
13. How is the work divided at the Central Office?
14. Who appoints the clerks?
15. What salaries are paid to them and to the superintendents?
16. Who pays these?
- 16a. Are their appointments permanent, and is there any provision for superannuation?
- 16b. Are there any extra allowances, *e.g.*, for additional work or special services?
17. What publications issue from the Central Office?
- 17a. From what fund is the printing paid?
- 17b. How many copies of your publications are distributed free?

- 17c. How many are sold?
18. Are there daily observations published from any stations as well as average (weekly or monthly), and, if so, from how many stations?
19. Is provision made for the discussion of particular points in reference to storms, weather, public health, agriculture, &c., or in reference to more scientific questions?
20. Have any researches been carried on with a view to the improvement of instruments, or methods of reducing observations?
21. What is the cost of the Meteorological Department under all its different heads?
- | | |
|--|---|
| (1.) For instruments. | (6.) For verification of observations. |
| (2.) For stations. | (7.) For publication of results. |
| (3.) For observers. | (8.) For warnings of storms. |
| (4.) For cost of records. | (9.) For abstract physical or scientific results. |
| (5.) For transmission to Central Office. | |
22. Does your Department deal with both Land and Ocean Meteorology?

The above list had been forwarded with the following letter to the gentlemen named below:—

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

SIR,

27 April 1876.

I HAVE been requested by the Committee appointed by the Government to inquire into the present condition of Meteorology in the United Kingdom to obtain information for them as to existing Meteorological organisations, and I should, therefore, be very much obliged if you could kindly furnish me, at your early convenience, with replies to the questions contained in the enclosed circular.

I am, &c.

(Signed) ROBERT H. SCOTT,
Director.

Portugal	-	-	Sr. de Brito Capello, Lisbon.
Spain	-	-	Sr. Antonio Aguilar, Madrid.
"	-	-	Capt. C. Pujazon, San Fernando.
France	-	-	M. Le Verrier, Observatoire National, Paris.
"	-	-	M. C. Ste. Claire Deville, Inspecteur Général des Stations Met., Paris.
"	-	-	M. des Noyers, Telegraphic Service, Paris.
"	-	-	M. C. Ploix, Dépôt des Cartes et Plans, Paris.
Switzerland	-	-	Herr Billwiller, Zürich.
Italy	-	-	M. Cantoni, Pavia.
"	-	-	M. Pittei, Marine, Florence.
Belgium	-	-	M. E. Quetelet, Brussels.
Holland	-	-	M. Buys Ballot, Utrecht.
Germany	-	-	Dr. Neumayer, Hamburg.
"	-	-	" Bruhns, Leipzig.
"	-	-	" Ebermayer, Bavaria.
"	-	-	" Schoder, Würtemberg.
"	-	-	" Sohnecke, Baden.
Austria	-	-	" Jelinek, Vienna.
Hungary	-	-	" Schenzl, Pesth.
Denmark	-	-	Capt. Hoffmeyer, Copenhagen.
Norway	-	-	Prof. Mohn, Christiania.
Sweden	-	-	Dr. Rubenson, Stockholm.
Russia	-	-	Prof. Wild, St. Petersburg.
United States	-	-	Brig. Gen. Myer, Washington.
Canada	-	-	Dr. Kingston, Toronto.

Mr. Scott reported that the Permanent Committee of the Vienna Meteorological Congress had met and had held their sittings at the Office from the 18th to the 22nd ult. inclusive.

The following gentlemen had been present with him:—

Prof. Buys Ballot of Utrecht (President),

Prof. Bruhns, Leipzig,

" Cantoni, Pavia.

" Mohn, Christiania,

" Wild, St. Petersburg,

and that he had consented to continue to act as Secretary (Minutes 1874, p. 67).

The expenses of the Meeting did not exceed 4l., and the sum was ordered to be paid.

He had been requested to convey to the Committee the marked thanks of the members, for the reception which had been given to them.

Submitted—The following abstract of the Report of proceedings of the Private Conference on Weather Telegraphy (Minutes, April 3).

ABSTRACT of the REPORT of the PRIVATE CONFERENCE on WEATHER TELEGRAPHY (Minutes April 3, 1876).

The meeting took place at Hamburg, December 11–14, and was attended by—

Professor Buys Ballot, of Utrecht.
 Captain Hoffmeyer, of Copenhagen.
 Dr. Neumayer, } of Hamburg.
 Dr. Köppen, }
 Captain-Lieutenant Hoffmann, of Berlin.

No minutes were taken, and the report under consideration was drafted from notes, and signed by the gentlemen present at the meeting.

The various questions discussed and the results arrived at are as follows. Vide Minutes 1875, p. 76.

“1.—1. Can the wish expressed at the Meteorological Congress of Vienna in favour of a bi-daily exchange of telegrams be generally carried out for the district represented by the directors of the Meteorological Institutes of Denmark, Germany, England, Holland, Norway, and Sweden?

“2. If so, suitable principles must be defined, as to time, extent, and arrangement, so that uniformity and certainty may be brought into the Weather Report service for the district of North-west Europe.

“3. In the event of individual countries not being able to undertake the obligation of such an extended service; this is to be stated, and the method indicated how their participation with the general and more perfect system may be effected.

“4. Plans are to be discussed as to how the co-operation of the other European countries in Weather Telegraphy with the system of the countries of North-west Europe, which should form the nucleus for a more comprehensive system, should be organized.”

The meeting states that an international exchange of at least two reports per day is urgently required for the purposes of Weather Telegraphy.

- a. The main report to be that for 8 a.m. local time.
- b. Afternoon reports from certain extra stations ought to be organized.
- c. The hours of observation, for the purposes of subsequent weather study should be 8 a.m., 2 p.m., 8 p.m., the same as for the usual climatological observations.

The afternoon observations for Denmark, Holland, and Germany to be at 4 p.m.

In order to facilitate the service, the international telegraphic code may be shortened.

Germany and Denmark wish for reports of three groups each from six stations in the United Kingdom, instead of reports of six groups each from three stations.

The detailed arrangements.

The different heads of the Meteorological services in Europe are to be requested to state in how far they can alter their arrangements so as to accord with the proposed hours.

It is announced that the Seewarte has received powers which ensure the free transmission of Weather Telegrams in Germany.

“5. The bearings of the system of the United States of America to that of North-west Europe is to be made the subject of special discussion and consideration.

As regards the American system, it was decided that General Myer's system of synchronous observations should be supported.

The utility to the European system of telegrams from America is not yet apparent, but the meeting is glad to learn that cables to the Azores, Faroe Islands, and Iceland are projected.

“6. What should be the nature of the systematic publications, and how can the individual central offices most effectively aid in this respect? Can a method of international division of labour be brought about in the publication of synoptic charts and bulletins specially devoted to the subject?

“7. What method of carrying on the publications of the individual central offices is specially recommended so that the object sought, viz., the facilitating of the study and general understanding of Weather Telegraphy, may be most surely attained.

As regards international publications, Captain Hoffmeyer's charts and Professor Buys Ballot's Jaar Boek are to be maintained. Germany undertakes to issue monthly weather reviews for Europe, and the nations present at Hamburg undertake to supply materials for these in the hope that other nations will follow their example and send monthly summaries to Hamburg.

It is to be hoped that the Permanent Committee will organize this undertaking on an international basis, as it is admittedly very important.

It was stated that Germany and Holland would supply materials for the Atlantic Ocean to Captain Hoffmeyer for his charts, and it was hoped that other nations would follow their example.

The publication of daily weather reports is considered very important, and charts should be added if possible.

The regular daily communication of meteorological information by telegraph to the ports is most important, for this purpose the forms used in Holland for posting up the telegrams are good.

A public barometer and thermometer should be set up at each port. The contents of telegrams may be announced to passing ships, &c. by Major Kromhout's system, a modification of the aeroklinoscope.

It is very important to construct a code of weather types.

"II.—8. What rules should be established for the extraordinary Weather-Report service, so that the final result 'to be able to communicate trustworthy Storm Warnings' may be, as far as possible, reached."

Special warning messages on the model of the English ones, which have proved very useful, are to be sent at the discretion of the sender.

"9. Are any improvements or extensions of FitzRoy's apparatus as recommended by the Meteorological Congress at Vienna to be introduced, with the view of effecting an international value in signals used for Storm Warning purposes, and how are the Meteorological notices (placards) in connexion with the signals to be managed?"

FitzRoy's system of signals cannot be given up, but it would be good if this method could be made to indicate the direction more precisely, and the chance of shift of wind.

No system of warnings to be commenced in any country until their telegraphic service has been established for at least a year, nor until the regular service of two reports a day has been organized.

"10. The results of the Storm Warnings in the N.-W. European system are to be published in a suitable organ, which is to be specified, at short intervals, and as quickly as possible with explanatory remarks."

It is very important to publish a journal of the results of weather study, and the Seewarte undertakes to do this, and to form into one single report the individual contributions received, which will constitute an Appendix to the *Annalen der Hydrographie*.

APPENDIX.

- I. The Report to be signed by those present at Hamburg.
- II. To be sent to those invited, but not present (Mohn, Rubenson, and Scott) for their opinions and signatures, if possible; the final report to be then drawn up.
- III. This final report to be printed and circulated, in order to obtain signatures from directors who were not invited to go to Hamburg.
- IV. The final result to be communicated to the Permanent Committee.

He stated that he conjointly with Professor Mohn had sent the following reply:—

REMARKS on the REPORT of PROCEEDINGS of the HAMBURG CONFERENCE.

WE have read most carefully the Report submitted to us by Dr. Neumayer, on the part of the private conference which took place at Hamburg in December 1875, and we shall arrange our observations thereon according to the sections of the circular letter of November 15, 1875, by which the meeting in question was convened.

I.—IV. We do not find that any wish was expressed at Vienna in favour of a bi-daily international interchange of telegrams.

The combination of hours, 8 a.m., 2 p.m., 8 p.m., proposed will suit for Norway, as the hours for ordinary observations in that country have been arranged independently of the requirements of Meteorological telegraphy, and they fortunately coincide with the selection proposed at Hamburg.

As for England, that selection cannot be adopted, as regards 8 p.m., for many telegraphic offices are closed at that hour, and the latest observation which is taken by present arrangements is at 6 p.m.

We both consider that 4 p.m. Greenwich, is far too late an hour for the afternoon telegrams, for the British Isles especially. The Report for Skudesnaes taken at 3.40 p.m. (local time) practically never reaches London before dark in winter, *i.e.*, in time to be of much use.

A 4 p.m. telegram from Thurso would not reach Christiania in time to be used before many of the Norwegian telegraph offices were closed for the night.

Warnings issued after sunset are practically useless until next day.

We are both of opinion that the full telegrams of six groups each, according to the international code, are requisite, and that no omission of groups, except for the afternoon telegrams, can be admitted.

The information for the previous evening contained in the morning telegrams is of the very highest importance, as this affords the only practical means of forming a judgment as to the changes which may be in progress on any morning.

Our united experience leads us to say that the changes from the previous evening furnish frequently the most secure basis on which a warning can be issued.

In fact, in addition to the evening report in the morning telegram, extra reports appended to that message of still later readings, as at 10 or 11 p.m., *e.g.*, at Valencia, are frequently of very great value, but the possibility of obtaining these depends on circumstances special to each station.

In Europe, as the frequency of telegrams is ruled by financial considerations, it appears to us that the morning telegram is the only one which affords sufficient information for warning purposes, and that therefore that telegram should be as full as possible.

As regards the proposed exchange with England, no system of direct exchange exists between the Meteorological Office and the Seewarte, except that daily reports from Cuxhaven are sent to London in return for occasional telegrams from London of a warning nature, whenever the same appear to be requisite. The British reports received regularly at Hamburg are received from Denmark, not from England direct.

No system of exchange exists between Utrecht and London, except that the London Office receives, free of charge, a copy of the reports from the Helder, which are sent to London for other purposes, and that it exchanges with Holland occasional telegrams of a warning nature when requisite.

The system of daily reports from the British Isles to Holland has been organized by the Dutch Institute and at its own expense. If it wishes to give up this system, in order to receive its information free, the fact should be stated.

Any exchange must be station for station, gratis, and every extra daily report to be paid for. England only wants the Helder from Holland, but wants it on Sundays as well as on other days.

The proposed substitution of three groups each from six stations for six groups each from three stations, would probably involve additional expense, or else cause serious delay. The telegraph officials could not be trusted to do more than put together the entire messages from the stations so far as to form one collective telegram and could not select certain groups.

The collective telegrams sent to Copenhagen from London at present are not made up in the Meteorological Office at all, as such a practice would cause a delay of probably an hour *at least*; the messages are handed over to the St. Nord Telegraph, Selsk, by the T.O. officials.

In our united opinion the practice of sending collective telegrams is economical, but causes great loss of time. The system in existence between London and Christiania of sending separate despatches from 3 stations in the British Isles is found quite satisfactory.

V. We are fully prepared to agree with the opinion expressed at Hamburg as to the possible value of telegraphic communication with the United States, but we have neither of us any information as to the prospects of a speedy extension of the telegraphic system to the Faroes or even to the Azores.

VI., VII. With reference to the monthly review to be prepared at Hamburg, the Daily Weather Reports and the Bulletin Météorologique du Nord contain all the material which we are in a position to supply to Hamburg for such a compilation.

The question of the support to be given to Capt. Hoffmeyer's Synoptic Charts will be dealt with by the Permanent Committee.

The question of daily announcements to be transmitted to, and posted up at the ports is a financial one, depending on local circumstances; with 120 warning stations, as in the British Isles, the cost would be prohibitory, at least 6*l.* per diem.

In Norway such matters are departmental arrangements of the Telegraphic Service.

We both have to express our conviction that the Aeroklinoscope is not suited for use on extensive lines of coast containing harbours and roadsteads exposed to very different winds, like those with which we have to deal respectively.

Moreover it is a matter of the greatest difficulty to introduce a new signal system of any kind among such a class of men as coasting seamen and fishermen.

VIII. We have no remarks to offer on the observations on this head.

IX. We consider that the question of the introduction of symbols which shall indicate the direction of probable change of wind, &c., &c. is one which has not yet received an approximate solution, and that *for the present* it is best to adhere to the simple FitzRoy Signal Shapes, attaching to them the meaning they possess in the British Isles.

X. We do not see that we are, either of us, able at present to contribute materials for such a résumé of the statistics of the results of Storm Warnings as is proposed to be published occasionally at Hamburg.

We have therefore the honour to submit the above as our opinion of the Report of Proceedings of the Private Conference at Hamburg, to which accordingly we decline to affix our signatures.

We would, in conclusion, enter our protest against the communication of the Report of the *Private Meeting* to any person not invited originally to be present at it, in order to obtain his adhesion to the principles adopted by the gentlemen present at Hamburg. Such action belongs solely to the Permanent Committee, and not to any chance body of men invited by any individual office to take part in a Private Conference.

H. MOHN.

ROBERT H. SCOTT.

Submitted—The following letter :—

Mo. 935.

Deutsche Seewarte, Hamburg, 15th April 1876.

As the organization by the direction of the Seewarte of an interchange of telegrams with foreign countries has lately been facilitated by the courtesy of the Imperial General Telegraph Office of Germany, and as you are aware, sir, from the report of the conference held at Hamburg in December last, of the mutual wishes of the Directors of the Meteorological Institutes of Copenhagen, Hamburg, and Utrecht, it appears to the Seewarte that, in the interest of both countries, the time has arrived for giving a much greater extension to the exchange of weather telegrams between England and Germany than has hitherto existed.

The Seewarte is ready to transmit a collective telegram to London at 10h. a.m. daily, containing observations taken at 8h. (or 7h.) a.m. at about eight German stations, and also a second telegram in the afternoon, containing observations taken at 4h. p.m. at Hamburg and eventually at other stations.

For the morning telegram the Seewarte proposes to adopt the form and contents of the telegram it sends to Copenhagen, with the addition of Carlsruhe, if desired. This telegram would contain three groups of figures (III, IV. and V. of the Utrecht form) from eight stations, together perhaps with remarks including the reproduction of reports of sea-disturbance by a single figure transmitted in words (scale 0-9). The form and contents of the afternoon telegram may be settled afterwards.

As soon as these more complete communications from the Seewarte begin, that office would desire that the reports now sent to London from Cuxhaven should cease. But if you should desire it, for the sake of safety, it could be continued for a month after the commencement of the collective telegram.

It is very desirable that the Seewarte on its side should receive more ample data daily from the British Islands, whose position at the outposts renders them of eminent importance for giving warning of storms to the whole of northern and central Europe; while on the other hand, the state of the weather in those islands, owing to their importance for trade and navigation, is regarded with special interest by merchants and sea-faring men in Germany.

The number of stations from which the Seewarte wishes to receive information amounts to at least 8 or 10. With this object, it begs to propose the following method.

1°. It wishes to see the communications now sent simultaneously to Copenhagen and Hamburg via Fredericia maintained without curtailment, further developed and perhaps modified, and will consider the same as an equivalent for the telegram from Germany above offered.

2°. But in addition to these communications, it wishes to receive a telegram containing reports from several stations and sent direct from London to Germany (via Borkum), for which it is prepared to defray the cost of transmission itself.

The settlement of the details of the request of the Seewarte in this respect can take place when it is known how far you, sir, deem it practicable to give effect to the wish of the Danish Meteorological Institute and of the Seewarte, as set forth in the Report of the Hamburg Conference, by which on the one hand, the morning telegram from England will include observations from 6 stations instead of 3, and on the other, a 2 p.m. observation from London containing reports from 3 stations in the United Kingdom will be communicated. In short, the Seewarte wishes to receive, besides Thurso, Valencia, and Yarmouth, morning reports from 1 or 2 stations in the Channel, 3 stations in middle latitudes (Greencastle, Holyhead, Shields) and 1 or 2 stations in Scotland and adjacent islands (perhaps Ardrossan and Stornoway).

The absence of English telegrams on Sundays and Holydays, which is much to be regretted and is very dangerous, may be to some extent remedied by a communication from at least one station.

This is apparently the case with Greencastle, which sends reports to Paris on Sundays.

The communication of this same telegram to the Seewarte also would be of great value to the Seewarte.

The Seewarte earnestly requests you to be good enough to send an early reply, as to how far you may be able to comply with its wishes, and what would be the cost to the Seewarte of the Reports to be newly organized.

R. H. SCOTT, Esq.

The direction of the Seewarte,
DR. G. NEUMAYER.

Mr. Scott was instructed to make the arrangements necessary for carrying out an exchange of telegrams with Germany and to report to the Committee.

Read—A letter from Captain Toynbee, submitting excellent Logs from—

- Capt. W. Ellery, ship "Bowfell," (Minutes 1875, p. 60).
- „ J. McDonald Gray, barque "Speranza," (Minutes 1875, p. 34).
- „ J. A. Martyn, ss. "Cuba," "Siberia," "Java," (Minutes 1875, p. 29).
- „ H. C. St. John, R.N., H.M.S., "Sylvia."
- Log kept by Nav.-Lieut. F. S. Wheeler.
- „ G. Shaw, ss. "Alpha," } (Minutes 1875, p. 60).
- „ W. Warden, ss. "Beta," }
- „ W. Watson, ss. "Parthia," (Minutes 1875, p. 74).

Mr. Scott was instructed to convey the marked thanks of the Committee to these gentlemen.

SUBMITTED—The following STATEMENT respecting the RECORDS for MARCH 1876, received from the SELF-RECORDING OBSERVATORIES, which have been examined at KEW OBSERVATORY (see Minutes, 21st December 1868).

	Aberdeen.	Armagh.	Falmouth.	Glasgow.	Kew.	Stonyhurst.	Valencia.
	Direction. Good.	Direction. Good.	Direction. Good.	Direction. Good.	Direction. Good.	Direction. Good.	Direction. Good.
	Velocity. Good.	Velocity. Good.	Velocity. Good.	Velocity. Fair.	Velocity. Good.	Velocity. Good.	Velocity. Good.
ANEMOGRAPH :—							
Action - - -	-	-	-	-	-	-	-
Records deficient, due to stoppage of clock	-	-	-	-	-	-	-
” other causes -	-	-	-	-	-	-	-
Orientation verified -	-	-	-	-	-	-	-
No. of errors discovered by subsidiaries	-	-	-	-	-	-	-
” irregular differences	-	-	-	-	-	-	-
Result of 40 Remeasurements :—							
Greatest difference -	-	-	-	-	-	-	-
Mean difference irrespective of sign	-	-	-	-	-	-	-
Residual difference (—Kew)	-	-	-	-	-	-	-
RAIN GAUGE :—							
Action - - -	-	-	-	-	-	-	-
Records deficient, due to stoppage of clock	-	-	-	-	-	-	-
” other causes -	-	-	-	-	-	-	-
Errors in tabulation	-	-	-	-	-	-	-

Mr. Scott reported that for several months he had been carrying on experiments at Kew with Campbell's Registering Sun Dial with fair success, as he obtained a daily record of the time during which the sun had sufficient power to burn a hole in paper. He stated that he now required a true sphere of glass for the instrument, and submitted an estimate (Letter 961) for such for 15*l.* 15*s.* 0*d.* which he was authorised to accept.

Reported—That the three months fixed (Minutes 1875, p. 83) for the arrangements with the "Times" for the evening reports had expired. Resolved that the arrangements be renewed.

Reported—That the Rev. J. Taylor, Folkestone, was placed on the free list for the Daily Weather Report in exchange for observations.

Submitted—The following Abstract of Accounts from 1st April 1875 to 31st March 1876.

	Received.	Due.	Paid.	Liabilities. (Partly Estimated.)
	£ s. d.	£ s. d.	£ s. d.	£ s. d.
Balance from 1874-5	1,826 15 5	—	—	—
Vote for Year	10,000 0 0	—	—	—
Interest on Deposit Account	58 19 0	—	—	—
OFFICE :—				
Salaries	—	1 17 6	1,365 11 6	—
Rent, fuel, &c.	—	—	625 14 6	33 2 9
Contingencies	2 17 10	2 4 10	265 2 0	11 2 0
LAND METEOROLOGY :—				
Expenses at observatories	28 4 0	15 10 0	2,593 2 11	85 15 9
New instruments, Commissions, &c.	271 0 4	309 18 6	474 11 5	157 17 6
Computations	3 8 6	1 5 0	856 6 8	—
Telegraphy	2 0 9	51 16 7	1,744 12 0	305 8 10
Inspections, D.W. Charts, &c.	324 6 8	1 17 6	485 7 8	88 12 2
Computations	12 16 10	67 5 2	777 1 8	—
OCEAN METEOROLOGY :—				
Marine Superintendent	—	—	400 0 0	—
Admiralty Instruments	2 5 6	—	394 17 6	104 2 4
Mercantile Marine	135 12 5	2 10 6	420 5 5	114 0 6
Computations and care of instruments	0 12 6	76 16 8	987 17 5	—
Balances	12,668 19 9	531 2 3	11,390 10 8	900 1 10
	—	368 19 7	1,278 9 1	—
Totals	12,668 19 9	900 1 10	12,668 19 9	900 1 10

Probable net amount available on 1 April 1876, 909*l.* 9*s.* 6*d.*

It was resolved to request Lord Rosse to act as auditor of the accounts with Mr. Galton.

Reported—That a cheque for Office expenses for 35*l.* had been drawn on the 17th ult. by Capt. Evans.

The following cheques for April were drawn on the 25th of that month, on the signature of General Strachey :—

For Office :

	£ s. d.
R. H. Scott	66 13 4
J. S. Harding, jun.	20 16 8
J. S. Harding, sen.	*7 14 0
T. D. Bell	7 10 4
Charles Gilman, Gas Co.	4 18 7
The Pall Mall Coal Co., coals	2 12 0
Wightman and Co., printing	2 18 0
Williams and Norgate, books	3 7 2
Carried forward	£116 10 1

* Four weeks to the 22nd.

		Brought forward	-	-	116	10	1
For Observatories :							
J. E. Cullum, Valencia	-	-	-	-	13	6	8
W. Marriott, Meteorological Returns	-	-	-	-	17	10	0
Allen Bros., freight	-	-	-	-	3	8	6
R. Strachan, Pitkin's aneroids	-	-	-	35	0	0	
"	"	-	-	4	4	0	
					39	4	0
R. H. Curtis	} Computations, &c.	-	-	-	14	3	4
C. H. Thompson		-	-	-	*5	16	0
C. Stodart		-	-	-	*8	8	0
J. A. Curtis		-	-	-	10	0	0
For Telegraphy :							
Postmaster General, telegrams for February	-	-	-	-	98	19	2
S. M. Clare, Submarine Co., July-December	-	-	-	-	35	7	1
F. Dangerfield, dely. of D.W. Charts	-	-	-	-	13	6	4
F. Gaster	} Computations, &c.	-	-	-	15	16	8
W. L. Dallas		-	-	-	9	3	4
F. Brodie		-	-	-	8	0	0
H. Chivers		-	-	-	*3	6	0
For Ocean Meteorology :							
Captain H. Toynbee, Marine Superintendent	-	-	-	-	33	6	8
D. Currie & Co., freight	-	-	-	-	1	5	6
Elliott Brothers, repairing aneroids	-	-	-	-	10	9	6
R. Strachan	} Computations, &c.	-	-	-	†20	16	8
C. Harding		-	-	-	15	0	0
T. E. Allen		-	-	-	10	0	0
H. Harries		-	-	-	†5	15	6
For Office Expenses :							
J. S. Harding, jun., on account	-	-	-	-	100	0	0
"	-	-	-	-	50	0	0
					150	0	0
					£658	18	8

* Four weeks to the 22nd.

† Including allowance for care of instruments.

‡ Three weeks to the 22nd.

The Committee then adjourned.

116, Victoria Street, May 15, 1876.

PRESENT :

Major-General Smythe in the Chair.

Mr. De La Rue.

The Director was in attendance.

The Minutes of last meeting (May 1) were read and confirmed.

Mr. Scott reported that he had sent the following preliminary reply to the letter from the Deutsche Seewarte mentioned in last Minutes :—

SIR,

Meteorological Office, 116, Victoria Street, May 13, 1876.

I HAVE the honour to inform you that your letter of April 15 has been laid before the Meteorological Committee, and I am instructed by them to intimate to you that they will be happy to entertain the proposal made by you for an interchange of daily weather telegrams between this Office and the Deutsche Seewarte, on terms to be hereafter arranged.

In the first place this Office wishes that all telegrams sent to it shall consist of the six groups of the International Code proposed at Utrecht, and that all reports shall be delivered in London not later than 9 a.m. Greenwich time.

It does not as a rule approve of the practice of sending collective telegrams, containing the reports of several stations, owing to the loss of time involved by the practice of delaying the message until all the telegrams have been received.

An afternoon telegram at 4 p.m. would be of comparatively little use to this Office. We should be very glad, however, of reports for 2 p.m. from two or three German stations.

The stations for the 8 a.m. reports which we should propose would be,—

Cuxhaven or Hamburg.

Swinemunde.

Dantzig.

Berlin.

Breslau.

Cassel.

Treves or Strassburg.

Munich.

The stations underlined [printed in *italics*] are proposed for 2 p.m. reports.

As to the reports from this country, the Seewarte can receive any of our reports in exchange for as many German reports, but this matter will require some arrangement as regards the cost of transmission of the telegrams by cable between Germany and England.

In the case of the daily exchange existing between this country and Norway and Denmark respectively, the British charges are borne by this Office, but all charges for transmission each way, outside the English coast, are borne by the offices in question. In fact, I believe the messages go free. The warnings sent from England have been paid for by this Office as far as the English coast in the case of Christiania and Copenhagen, and *the whole way* to Utrecht and Hamburg.

I should therefore be very glad to learn what your proposal is as regards the cost of the submarine transmission each way.

If the Seewarte consents to the proposal herein made, in its broad features, this Office will deliver all the English messages free of charge to the Office of the Borkum Cable in London as soon after 9 a.m. as is possible.

A copy of the Sunday report from Greencastle shall also be supplied. There is not much prospect of Sunday work being undertaken, that day being a holiday in most postal telegraph offices, and its observance is being more and more strictly enforced.

No intimation has been received from Copenhagen informing this Office that any alteration in the telegraphic exchange between this Office and the Danish Institute was desirable.

As soon as this is received, this Office will give it due attention.

Professor G. Neumayer,
Deutsche Seewarte, Hamburg.

I am, &c.,
(Signed) ROBERT H. SCOTT,
Director.

Reported—That the data for the Indian Ocean for the month of January had been copied as requested by the India Office (Minutes 1875, p. 70), as explained in the subjoined memorandum :—

R. H. SCOTT, Esq.,

THE extraction of the Meteorological Data for January in the district selected by the Indian Government is now completed as far as Log 3630, which was the last log in Office at time of estimate—it seems as well that the extraction should end here, in preference to carrying it up to date. The Logs extracted extend over years 1856–1875. The cost is as below :—

	£	s.	d.
Extraction, &c. of Data - - -	90	7	3
Additional ruling of books - - -	2	8	0
*Cost of Books (16) - - -	4	10	8
Totals - - -	97	5	11

Considering a few unavoidable interruptions to Office time we might perhaps fairly take the total cost at 100l., which was the amount estimated.

Will you kindly say whether you wish to have a copy of the data extracted made for keeping in this Office—the cost of such a copy, not including cost of books, would be about 20l.?

11/5/76.

C. H.

Mr. Scott was instructed to have a second copy made, and to forward a copy to the India Office, with a request for information as to whether more data would be required on the same terms.

* This is probably an item for the Stationery Office to be taken into account by this Office.

There are about 11,400 sets of observations extracted for January, so that there will probably be about 137,000 for the year.

Read—A letter from Captain Toynbee, submitting an excellent Log by Captain J. E. Mouland, s.s. "Batavia" (Minutes, 1875, p. 74).

Mr. Scott was instructed to convey the marked thanks of the Committee to Captain Mouland.

Submitted—The following Report :—

I HAVE to report that on the 4th inst I inspected the reporting station of Cambridge. I found everything in good order. The Stevenson's screen has been erected for the thermometers, so that their exposure is now very satisfactory.

Yarmouth was inspected on the 5th; there, too, the station was in good condition. Some slight repairs were however required for the recording anemograph, and the necessary instructions have been given.

ROBERT H. SCOTT.

A cheque for 60*l.* for Office expenses was drawn.

The Committee then adjourned.

116, Victoria Street, May 29, 1876.

PRESENT :

The Earl of Rosse in the Chair.

Rear-Admiral Richards.

Lieut.-General Strachey.

The Director was in attendance.

The Minutes of last meeting (May 15) were read and confirmed.

Submitted—The following Report :—

I HAVE to report that I have completed my inspection of the South-western Telegraphic Stations and of Falmouth Observatory.

Portishead, visited May 22.—This station was in good order, but there is a difficulty about obtaining observations during Bristol office hours, for the observer has resigned his post of piermaster for a situation in Bristol, so that he is absent from Portishead for several hours daily. I do not see any present prospect of improvement in this respect, as Portishead is a very small place, and there are no educated people residing there who could undertake the duty of reporting.

Plymouth, visited May 22.—This station is in very good order, but possesses all the disadvantages of a town reporting station as regards insufficient exposure for wind, rain, and temperature. The only mode of remedying this defect is to remove the station to Bolt Head, or some similar outlying situation.

Scilly, visited May 24.—This station is in a thoroughly satisfactory condition, but the cable to the Scilly Isles parted in December 1875 and has not yet been repaired.

Hurst Castle, visited May 27.—This station too is in a quite satisfactory state.

Falmouth Observatory was visited on the 26th inst., and at the station everything was found in good order.

It will be necessary to make arrangements for the special examination of the instruments this summer at all the Observatories.

ROBERT H. SCOTT.

Read—A letter from Capt. Toynbee, submitting excellent Logs by—

Capt. T. M. Almond, ship "Decapolis," (Minutes, 1875, p. 34.)

Capt. C. T. Raymond, ship "Cicero," (Minutes, 1874, p. 26.)

Capt. W. G. North, s.s. "West Riding,"

and recommending Capt. North for the Pilot Charts.

Mr. Scott was instructed to express the marked thanks of the Committee to Capts. Almond and Raymond, and to present the Pilot Charts to Capt. North.

SUBMITTED—The following STATEMENT respecting the RECORDS for April 1876, received from the SELF-RECORDING OBSERVATORIES, which have been examined at KEW OBSERVATORY (see Minutes 21st December 1868).

	Aberdeen.	Armagh.	Falmouth.	Glasgow.	Kew.	Stonyhurst.	Valencia.
ANEMOGRAPH:—							
Action - - -	Direction. Good. 0 Velocity. Good. 0	Direction. Good. 0 Velocity. Good. 0	Direction. Good. 0 Velocity. Good. 0	Direction. Fair. 0 Velocity. Fair. 0	Direction. Good. 0 Velocity. Good. 0	Direction. Good. 0 Velocity. Good. 0	Direction. Good. 0 Velocity. Good. 0
Records deficient, due to stoppage of clock	29th	—	—	—	21	7th	—
" " other causes -	0	0	0	0	0	0	0
Orientation verified -	0	0	0	0	0	0	0
No. of errors discovered by subsidiaries	0	0	0	0	0	0	0
" " irregular differences	0	0	0	0	0	0	0
Result of 40 Remeasurements:—							
Greatest difference -	1.0	0.10	1.0	1.0	1.0	1.0	1.0
Mean difference irrespective of sign -	0.2	0.01	0.5	0.5	0.1	0.4	0.6
Residual difference (— Kew) -	0.0	0.00	0.0	0.0	0.0	0.0	0.0
RAIN GAUGE:—							
Action - - -	Direction. Good. 0 Velocity. Good. 0	Direction. Good. 0 Velocity. Good. 0	Direction. Fair. 0 Velocity. Fair. 0	Direction. Fair. 0 Velocity. Fair. 0	Direction. Good. 0 Velocity. Good. 0	Direction. Good. 0 Velocity. Good. 0	Direction. Good. 0 Velocity. Good. 0
Records deficient, due to stoppage of clock	0	20 hrs.	0	0	0	0	0
" " other causes -	0	0	0	0	0	0	0
Errors in tabulation	0	0	0	3	0	0	0

BAROGRAPH :—		Good. Do.		Fair. Do.		Good. Do.		Good. Do.		Good. Do.	
Action -	-	0	0	0	0	0	0	0	0	0	0
Photography -	-	0	0	0	0	0	0	0	0	0	0
Records deficient, due to stoppage of clock	-	0	0	0	0	0	0	0	0	0	0
" failure of light	-	0	0	0	0	0	0	0	0	0	0
" other causes -	-	0	0	0	0	0	0	0	0	0	0
No. of errors discovered—	-	0	0	0	0	0	0	0	0	0	0
In entry of standard	-	0	0	0	0	0	0	0	0	0	0
" calculating residual correction -	-	0	0	0	0	0	0	0	0	0	0
" applying residual correction -	-	0	0	0	0	0	0	0	0	0	0
" subtraction in subsidiary tables -	-	0	0	0	0	0	0	0	0	0	0
" tabulation by subsidiaries -	-	0	0	0	0	0	0	0	0	0	0
" irregular differences -	-	0	0	0	0	0	0	0	0	0	0
Result of 40 Remasurements :—		Good. Do.		Fair. Do.		Good. Do.		Good. Do.		Good. Do.	
Greatest difference	-	0	0	0	0	0	0	0	0	0	0
Mean difference irrespective of sign	-	0	0	0	0	0	0	0	0	0	0
Residual difference (— Kew) -	-	0	0	0	0	0	0	0	0	0	0
Mean monthly difference between simultaneous barograph and barometer readings -	-	0	0	0	0	0	0	0	0	0	0
Result of 40 Remasurements :—		Good. Do.		Fair. Do.		Good. Do.		Good. Do.		Good. Do.	
Greatest difference	-	0	0	0	0	0	0	0	0	0	0
Mean difference irrespective of sign	-	0	0	0	0	0	0	0	0	0	0
Residual difference (— Kew) -	-	0	0	0	0	0	0	0	0	0	0
Mean monthly difference between simultaneous thermograph and thermometer readings -	-	0	0	0	0	0	0	0	0	0	0
No. of errors in maxima and minima -	-	0	0	0	0	0	0	0	0	0	0

* Caused by improper re-adjustment of zero position.

The following cheques for May were drawn :—

For Office :

R. H. Scott	Salaries and wages	
J. S. Harding, jun.		
J. S. Harding, sen.		
T. D. Bell		
P. S. King, books		
Taylor and Francis, books		

£ s. d.

66 13 4
20 16 8
*9 12 6
7 10 0

For Observatories :

J. E. Cullum, Valencia	
P. Adie, experimental anemometer	
„ thermograph tabulating scales	

13 6 8

8 0 0

2 8 6

10 8 6

Malby and Sons, anemograph forms	
„ rain gauge	

4 7 6

6 2 0

10 9 6

J. J. Hicks, thermometer screens	Computations	
R. Strachan, Pitkin's aneroids		
R. H. Curtis		
C. H. Thompson		
C. Stodart		
J. A. Curtis		

5 9 6

4 4 0

14 3 4

*7 5 0

*10 10 0

10 0 0

For Telegraphy :

Postmaster-General, telegrams, March	Computations	
G. Young, Seaham telegrams		
F. Gaster		
W. L. Dallas		
F. Brodie		
H. Chivers		

109 7 0

9 3 9

15 16 8

9 3 4

8 0 0

4 2 6

For Ocean Meteorology :

H. Toynbee, Marine Superintendent	
J. J. Hicks, boiling point thermometers	
„ thermograph screens	

33 6 8

3 18 0

26 13 4

30 11 4

D. MacGregor, & Co., Glasgow agents	Contingencies	
R. Strachan		
C. Harding		
T. E. Allen		
H. Harries		

2 5 0

†20 16 8

15 0 0

10 0 0

9 12 6

For Office Expenses :

J. S. Harding, jun., on account	
„ „	

130 0 0

50 0 0

180 0 0

Total

£653 18 9

* Five weeks to the 29th May.

† Including allowance for care of instruments.

The Committee then adjourned.

116, Victoria Street, June 5, 1876.

PRESENT:

Mr. De La Rue in the Chair.

Major-General Smythe.

Lieut.-General Strachey.

The Director was in attendance.

The Minutes of last meeting (May 29) were read and confirmed.

Submitted—The Auditors' Report, as follows:

METEOROLOGICAL OFFICE: ACCOUNT OF RECEIPTS AND PAYMENTS for the year ending the 31st March 1876.

RECEIPTS.

	£	s.	d.
Balance from year 1874-5	-	1,826	15 5
Parliamentary vote	-	10,000	0 0
Receipts from various sources:			
H. Mohn	-	66	0 0
H. de Vismes	-	4	1 0
J. E. Vibert	-	11	1 0
Power Brothers	-	2	18 4
Bishop of Rupert's Land	15	11	0
G. T. Kingston	-	161	3 3
R. Maguire	-	1	5 0
Duke of Marlborough	-	1	19 0
Dr. Forster	-	8	7 0
Capt. Hoffmeyer	-	5	2 0
Gregor, Turnbull, & Co.	1	0	0
Kew Committee	-	7	13 0
C. Meldrum	-	7	6 0
R. Rubenson	-	4	17 0
E. Hubbard, M.P.	-	1	2 0
E. R. Owen	-	1	2 6
C. Wilee	-	47	5 0
J. B. Whitaker	-	10	10 0
R. M. Barrington	-	1	14 6
J. Quinton, jr.	-	3	3 0
H. Story	-	9	0 0
Rev. J. Taylor	-	4	0 0
Rev. W. P. Mackay, D.D.	2	5	6
Maj.-Gen. Smythe, R.A.	1	2	9
Board of Trade	-	27	8 0
Dunsink Observatory	-	7	18 6
W. F. Cooper	-	4	2 6
A. O. Walker	-	3	8 6
R. J. Ellery	-	8	9 4
Patent Type Founding Co.	5	8	6
Sundry small amounts	8	14	6
Subscribers to Daily			
Weather Charts	-	282	4 1
Do. Capt. Hoffmeyer's Charts	-	42	2 7
Do. hourly observations	-	14	0 0
		783	5 4
Interest on deposit account	-	58	19 0
		£12,668	19 9

PAYMENTS.

Office.				£	s.	d.	£	s.	d.
Salary of Director	-	800	0	0					
Do. two Clerks	-	399	11	0					
Office Keeper and Messenger	-	166	0	6			1,365	11	6
Rent of office	-	534	12	0					
Fuel and gas	-	33	15	3					
Furniture and fittings, &c.	57	7	3				625	14	6
Postage	-	60	10	4					
Printing and books	-	43	0	10					
Attendance and other contingencies	-	161	10	10			265	2	0
Land Meteorology.									
Expenses at observatories	-	2,593	2	11					
New instruments (commissions, &c.)	-	474	11	5					
Computations	-	856	6	8			3,924	1	0
Telegraphy	-	1,744	12	0					
Inspections, issue of D. W. Charts, &c.	-	485	7	8					
Computations	-	777	1	8			3,007	1	4
Ocean Meteorology.									
Marine Superintendent	400	0	0						
Supply and return of instruments, &c.:									
Admiralty	-	394	17	6					
Mercantile Marine	420	5	5						
Computations and care of instruments	-	987	17	5			2,203	0	4
							11,390	10	8
Cash in hand	-	84	2	7					
Advance to Valencia Observatory	-	50	0	0					
Bank of England	-	414	15	4					
London and Westminster Bank	-	729	11	2			1,278	9	1
							£12,668	19	9

Examined and compared with the vouchers, and found correct.

(Signed)

ROSSE,

FRANCIS GALTON,

} Auditors.

31st March 1876.

BALANCE SHEET, 31st March 1876.*

£	s.	d.	£	s.	d.	£	s.	d.	£	s.	d.
To sundry creditors	-	900	1	10		By balance of receipts and payments account	-	1,278	9	1	
„ probable net surplus	-	900	9	6		„ sundry debtors	-	531	2	3	
			1,809	11	4				1,809	11	4

* The value of stock of Instruments, &c. is not included in this Statement.

Mr. Scott was instructed to forward the above Report, with the accounts, to the Treasury.

116, Victoria Street, June 19, 1876.

PRESENT :

Rear-Admiral Richards in the Chair.

Captain Evans.
Mr. Galton.

The Earl of Rosse.
Major-General Smythe.

The Director was in attendance.

The Minutes of last meeting (June 5) were read and confirmed.

The Draft Report for 1875 was reconsidered and approved, with certain alterations, and Mr. Scott was instructed to forward it to the Board of Trade for presentation to Parliament.

Mr. Scott reported that he had offered to exhibit at South Kensington the spare set of self-recording apparatus belonging to the Committee, and that the offer had been accepted. The instruments would be erected in the same temporary house as has been prepared for the Magnetographs.—Approved.

He also stated that he had consented, at the request of the authorities of the Exhibition, to attend there for one hour weekly for a month, to explain the apparatus exhibited by the Office.

Read—A letter from Captain Toynbee, submitting an excellent Log kept by Captain A. J. Brown, barque "Maroon," and recommending him for a copy of the Wind and Current Charts.

Mr. Scott was instructed to present the Charts to Captain Brown.

A conversation having arisen as to the possibility of conducting a storm-warning service on Sundays, it was resolved—

"That inquiry should be made of the Postmaster-General of the probable cost of collecting and distributing weather information to the 120 stations on Sundays at 2 p.m., or at such other hour in the afternoon as would be more convenient to the Telegraphic Administration."

A cheque was drawn in favour of J. S. Harding, Jun., for 25*l.* for Office expenses.

SUBMITTED—The following STATEMENT respecting the RECORDS from the SELF-RECORDING OBSERVATORIES, which have been examined at KEW OBSERVATORY (see Minutes, 21st December 1868).

—	Aberdeen.	Armagh.	Falmouth.	Glasgow.	Kew.	Stonyhurst.	Valencia.
ANEMOGRAPH :—							
Action - - - - -	Direction. Good.	Direction. Good.	Direction. Good.	Direction. Good.	Direction. Good.	Direction. Good.	Direction. Good.
Records deficient, due to stoppage of clock	Velocity. Good.	Velocity. Good.	Velocity. Good.	Velocity. Good.	Velocity. Good.	Velocity. Good.	Velocity. Good.
" " other causes - - -	0	0	0	0	0	0	0
Orientation verified - - -	0	0	0	0	0	0	0
No. of errors discovered by subsidiaries	—	11th	12th	2nd	29th	—	—
" " irregular differences	0	0	0	0	0	0	0
Result of 40 Remasurements :—							
Greatest difference - - -	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Mean difference irrespective of sign - - -	0.4	0.2	0.1	0.3	0.1	0.4	0.6
Residual difference (—Kew) - - -	+0.1	+0.1	—0.1	0.0	—0.1	0.0	—0.1
RAIN GAUGE :—							
Action - - - - -	Good.	Good.	Good.	Good.	Good.	Good.	Good.
Records deficient, due to stoppage of clock	0	0	0	0	0	0	0
" " other causes - - -	0	0	0	0	0	0	0
Errors in tabulation - - -	0	0	0	0	0	0	0

116, Victoria Street, July 3, 1876.

PRESENT :

The Earl of Rosse in the Chair.

Mr. De La Rue.
Captain Evans.

Mr. Galton.
Rear-Admiral Richards.
Lieut.-General Strachey.

The Director was in attendance.

The Minutes of last meeting (June 19) were read and confirmed.

Reported—That the letter respecting Sunday Warnings had been sent as directed :

SIR,

June 20, 1876.

WILL you oblige me by stating what would be about the *extra expense* incurred for attendance, &c. on Sunday mornings to enable the Office to receive a report from the stations marked on the accompanying List No. 1 (of Reporting Stations), the observations being already made at 8h. a.m.?

Also the extra expense for attendance for an hour between 2h. and 4h., as most convenient to the Post Office, at the stations specified on List No. 2 (of Signal Stations) (the method of distributing telegrams being known at the Post Office), to enable this Office to despatch a Storm Warning telegram to any, or all, *when required*, on Sunday.

C. H. B. Patey, Esq.,
General Post Office, E.C.

I am, &c.
(Signed) ROBERT H. SCOTT,
Director.

And that the following reply had been received :—

M.O. 1410.

SIR,

General Post Office, June 28, 1876.

I BEG leave to acknowledge the receipt of your letter with regard to the transmission of Meteorological intelligence by telegraph on Sundays, and in reply to inform you that there will be no difficulty or expense so far as the provincial officers are concerned in making arrangements for the despatch of telegrams at 8 a.m. from the places named on List No. 1, inasmuch as every head and sub-postal telegraph office in the United Kingdom is, with some few exceptions, open for the transaction of telegraphic business between the hours of 8 a.m. and 10 a.m. on Sundays.

With regard to the transmission of Storm Warnings to the towns specified on List No. 2, I fear that there will be some difficulty in making the arrangement you desire. I am having inquiries made into the matter, and I will communicate further with you so soon as I am in possession of the necessary information.

I am, &c.
(Signed) HENRY W. CRESWELL.

Reported—That replies to the Circular (Minutes, p. 82) had been received from the following gentlemen, and had been forwarded to Mr. Fanshawe :—

Portugal	-	Sr de Brito Capello.
France	-	M. LeVerrier.
"	-	M. Charles Ploix.
Switzerland	-	M. Billwiller.
Italy	-	M. Cantoni.
Holland	-	M. Buys Ballot.
Germany	-	Dr. Neumayer, Hamburg.
"	-	" Bruhns, Saxony.
"	-	" Ebermayer, Bavaria.
"	-	" Sohncke, Baden.
Austria	-	" Jelinek.
Hungary	-	" Schenzl.
Denmark	-	Capt. Hoffmeyer.
Norway	-	M. Mohn.
Sweden	-	Dr. Rubenson.
Russia	-	Prof. Wild.
Canada	-	Mr. Kingston.

Submitted—The following return of the comparison between the warnings issued and the weather experienced in 1875 (Minutes, 1872, p. 59; 1873, pp. 7, 20; 1874, p. 49; 1875, p. 24.)

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 late, owing to Sundays or Telegraphic Errors.	Storms for which no Warning was issued.
Ireland, south -	31	15	7	6	—	3	—	Mar. 5th, Sept. 27,, Dec. 31st.
„ east -	37	10	17	10	—	—	—	Feb. 24th,, Sept. 27th,, Nov. 9.
Scotland, east -	22	8	8	5	—	—	1	Jan. 24th,, Feb. 24th, Sept. 27th,, Nov. 13th,, Nov. 19th, Dec. 24th.
„ west (Clyde)	28	9	7	11	—	—	1	Sept. 27th,, Nov. 19th,, Dec. 24th.
England, north-west -	32	16	12	4	—	—	—	Feb. 24th,, July 15th,, Sept. 27th,, Nov. 19th.
„ west -	30	12	13	4	—	1	—	Sept. 27th,, Nov. 19th,, Nov. 19th.
„ south -	33	14	13	6	—	—	—	Sept. 27th,, and Nov. 9th, at entrance to channel.
„ south-east -	15	4	7	4	—	—	—	Jan. 24th, Nov. 13th.
„ east -	20	14	3	2	—	1	—	Mar. 9th, Sept. 27th,, Nov. 13th, Dec. 24th.
Totals -	248	102	87	52	—	5	2	
Per-centages -	—	41·1	35·1	21·0	—	2	1	

“p” in the last column indicates that the storm was only *partially* felt.

“s” “ ” “ ” the warning was not issued owing to Sundays or telegraphic errors.

If these figures be compared with those for the previous years in which the system has been checked, we arrive at the following results in per-centages :—

—	Warnings justified by subsequent Gales.	Warnings justified by subsequent Strong Winds.	Total Warnings justified.	Warnings not justified by subsequent Weather.
1870	46·7	21·7	68·4	22·4
1871	46	17·7	63·7	22·0
1872	61	19·5	80·5	11·9
1873	45·2	34·0	79·2	16·8
1874	45·4	32·8	78·2	16·4
1875	41·1	35·1	76·2	21·0

Mr. Scott was instructed to forward the above return to the Board of Trade for presentation to Parliament.

Reported—That Miss O’Sullivan, the telegraphic reporter at Valencia, had resigned, and that the duty of furnishing the Reports had been handed over to Mr. Cullum at the Observatory.

The pecuniary arrangements rendered necessary by the change had not yet been made, but would be submitted to the Committee for their decision.—Approved.

Read—A letter from Mr. Cullum (No. 1392) applying for an increase of salary of 1*l.* per month to Mr. Sugrue, the assistant.

Resolved—That an increase of 10*s.* per month be granted, Mr. Scott to report further on the subject after visiting Valencia in the autumn.

The following cheques for the month of June were drawn on the 26th of that month on the signature of Capt. Evans:—

For Office :		£	s.	d.	£	s.	d.
R. H. Scott	-	-	-	-	66	13	4
J. S. Harding, jr.	-	-	-	-	20	16	8
J. S. Harding, senr.	-	-	-	*	7	14	0
T. D. Bell	-	-	-	-	7	10	0
E. Higgs, repair, &c. in Office	-	-	-	-	33	2	9
C. W. Jacques, rent	-	-	-	-	133	13	0
Williams & Norgate, books	-	-	-	-	6	15	0
For Observatories, Quarterly Allowances, &c. :							
D. Thomson, Aberdeen	-	-	-	-	†61	17	6
T. R. Robinson, Armagh	-	-	-	-	40	14	0
„ expenses for quarter	-	-	-	-	6	9	2
W. P. Dymond, Falmouth	-	-	-	-	†65	12	6
„ postages, 1875	-	-	-	-	1	5	11
R. Grant, Glasgow	-	-	-	-	†61	17	6
Less waxed paper supplied	-	-	-	-	9	10	0
H. Williams, Holyhead	-	-	-	-	52	7	6
G. M. Whipple, Kew	-	-	-	-	2	13	5
„ examination of observatory returns	-	-	-	-	62	10	0
„ postage, repairs, &c.	-	-	-	-	100	0	0
C. Clouston, Orkney	-	-	-	-	27	15	4
G. H. Aird, Seaham	-	-	-	-	190	5	4
S. J. Perry, Stonyhurst	-	-	-	-	3	4	2
„ postage	-	-	-	-	2	13	9
J. E. Cullum, Valencia	-	-	-	-	†49	7	6
„ expenses for quarter	-	-	-	-	0	6	8
G. T. Watson, Yarmouth	-	-	-	-	49	14	2
Hopkins & Williams, chemicals	-	-	-	-	13	6	8
R. J. Lecky, glass sphere	-	-	-	-	45	13	6
L. P. Casella, anemometer, &c.	-	-	-	-	59	0	2
R. H. Curtis	-	-	-	-	4	9	6
C. H. Thompson	-	-	-	-	4	2	0
C. Stodart	-	-	-	-	15	15	0
J. A. Curtis	-	-	-	-	3	18	4
For Telegraphy, Quarterly Allowances, &c. :	-	-	-	-	14	3	4
Her Majesty's Postmaster General—	-	-	-	-	* 5	16	0
April	-	-	-	-	* 8	8	0
May, and allowances to clerks	-	-	-	-	10	0	0
W. McNeil, Ardrossan	-	-	-	-	85	0	9
„ for postmaster	-	-	-	-	127	3	4
H. Todd, Cambridge	-	-	-	-	212	4	1
J. Costello, Dover	-	-	-	-	1	6	0
J. Tilston, Holyhead, reporter	-	-	-	-	0	13	0
The Postmaster, Holyhead	-	-	-	-	1	19	0
G. Mitchell, Kingstown	-	-	-	-	4	0	0
F. Gaster, London	-	-	-	-	3	6	0
J. Lowry, Moville	-	-	-	-	3	18	0
Carried forward	-	-	-	-	1	7	0
	-	-	-	-	3	6	2
	-	-	-	-	3	5	0
	-	-	-	-	5	6	0
	-	-	-	-	£1,117	5	9

* Four weeks to the 24th June.

† 12s. 6d. deducted for forms supplied.

			£	s.	d.
Brought forward	-	-	1,117	5	9
W. D. Penny, Nairn	-	-	4	4	6
E. J. Lowe, Notts	-	-	3	18	0
J. Lucas, Oxford	-	-	3	6	0
J. Merrifield, Plymouth	-	-	3	5	0
W. Sandford, Portishead	-	-	3	19	6
J. C. Walker, St. Ann's Head	-	-	2	0	0
W. Thomas, Scilly	-	-	4	7	11
J. Smith, Stornoway	-	-	3	18	6
The Postmaster	-	-	1	6	0
W. Brand, Sumburgh Head	-	-	1	14	0
J. Trotter, Thurso	-	-	3	6	2
E. O'Sullivan, Valencia	-	-	1	8	5
J. Sinclair, Wick	-	-	3	5	0
G. T. Watson, Yarmouth	-	-	4	4	7
C. Wakefield, York	-	-	3	5	8
F. Gaster	Computations	-	15	16	8
W. L. Dallas			9	3	4
F. Brodie			8	0	0
H. W. Chivers			* 3	6	0
Wightman & Co., wrappers	-	-	15	8	0
For Ocean Meteorology :					
H. Toynbee, Marine Superintendent	-	-	33	6	8
J. H. Woodstock, packing cases	-	-	3	0	0
F. Pastorelli, "A" thermometers	-	29 19 0			
" " "B. T." "	-	3 18 0			
			33	17	0
L. P. Casella, "B. T." "	-	-	22	7	0
Elliott, Brothers, prize aneroid	-	-	2	19	0
J. R. Jones, Aberdeen agent	-	-	1	15	6
Street Brothers, advertisements	-	-	1	2	6
G. M. Whipple, verifications at Kew	-	-	4	8	0
R. Urquhart, instruments	-	8 0 6			
" " "	-	0 14 0			
			8	14	6
R. Strachan	Computations	-	†20	16	8
C. Harding			15	0	0
T. E. Allen			10	0	0
H. Harries			* 7	14	0
J. S. Harding, jun., on account	-	100 0 0			
" " "	-	50 0 0			
			150	0	0
Total	-	-	£1,531	9	10

Reported—That the sum of 500*l.* had been transferred, on the 26th ult., from the deposit account of the Committee to their current account at the Bank of England, on the signature of Captain Evans.

Mr. Scott was instructed to apply for an imprest for 1,000*l.* to meet the expenses of the Office.

The Committee then adjourned.

* Four weeks to the 24th June.

† Including allowance for care of instruments.

116, *Victoria Street*, July 17, 1876.

PRESENT :

Major-General Strachey in the Chair.

Mr. De La Rue.

The Minutes of last meeting (July 3) were read and confirmed.

Submitted—The following letter (Minutes July 3).

163917.

M. O. 1465.

SIR,

General Post Office, July 4, 1876.

WITH further reference to your letter of the 20th ultimo on the subject of the transmission of Meteorological intelligence on Sundays, I beg leave to inform you that, with the exception of the towns named in the accompanying list,* none of the places specified in your list No. 2 can be communicated with by telegraph on Sunday afternoon, in consequence of the local post offices being closed.

	NORTH.	WEST.	SOUTH.	EAST.
SCOTLAND.—EAST COAST.	Kirkwall. Inverness (4-5). Nairn. Burghead. Lossiemouth. Buckie. Portsoy. Banff. Fraserburgh. Peterhead. Aberdeen (all day). Stonehaven. Montrose. Broughty Ferry. St. Andrews. Dundee (all day). Anstruther. St. Monance. Burntisland. Alloa. Grangemouth. Bo'ness. Granton. Leith (4-6). Fisherrow. Dunbar. Eyemouth.	ENGLAND, N.W.	ENGLAND, S.W.	ENGLAND, E.
	FRITH OF CLYDE.	IRELAND, S. and W.	IRELAND, E.	ENGLAND, S.E.
	Glasgow (all day). Greenock (6-7). Rothsay. Campbelton. Girvan.	Silloth (4-5). Maryport. Workington. Whitehaven. Ramsey. Douglas (4-6). Castletown. Barrow. Morecambe. Fleetwood. Blackpool. Lytham. Runcorn. Southport (6-7). Liverpool (all day). Queensferry. Hawarden. Mostyn. Bangor. Port Penrhyn. Holyhead (5-6). Carnarvon. Port Dinorwic. Aberystwith. Milford. Pembrey. Llanelly. Swansea (5-6). Briton Ferry. Porthcawl. Penarth. Cardiff (all day). Newport (5-6). Weston-super-Mare. Burnham. Belfast (all day). Howth. Kingstown (5-6). New Ross (3-4). Dunmore, East. Dungarvan. Youghal. Queenstown (all day). Passage. Cork (all day). Tralee. Limerick (2.30-4.) Galway (3-4).	Ilfracombe. Barnstaple. Port Isaac. Boscastle. Newquay. Hayle. Pendennis. Scilly. Penzance (5-6). Falmouth (all day). Plymouth (all day). Teignmouth. Exeter (all day). Exmouth. Guernsey (5-6). St. Helier } Jersey. Gorey } Weymouth. Poole. Cowes (5-6). Ventnor. Portsmouth (5-6.30). Littlehampton. Brighton (all day). Newhaven. Hastings (5-6). Rye. Dover.	Tynemouth. S. Shields. Sunderland. Middlesborough (5-6). Redcar. Whitby (4-5). Filey. Withernsea. Hull (all day). Goole. Grimsby (5-6). Boston. Sutton Bridge. Lynn (7-9). Cromer. Yarmouth (7-9). Southwold. Ipswich (7-9). Harwich. Chatham. Sheerness. Faversham.

* The list subjoined is the entire list No. 2 with the stations and hours of afternoon attendance marked.

The requirements of the public would not justify the Department in extending the Sunday attendance at the towns not included in this list, nor would the Postmaster General feel disposed to render compulsory any extra attendance which was not absolutely necessary. If, however, you are of opinion that the sending of Storm Warning Telegrams on Sunday afternoon cannot safely be dispensed with, his Lordship will not place any difficulty in the way of the Meteorological Office making arrangements for specially remunerating the postmasters at such towns where the attendance of a clerk between 2 p.m. and 4 p.m. on Sunday afternoons may be desired, provided that a list of the towns selected is forwarded to the Department, and that the arrangements are carried out in a similar manner to those lately made in the case of the offices from which Meteorological observations are transmitted on Sunday afternoons.

The rate of remuneration would in each case be about the same as that at present paid at those offices which are specially kept open for the despatch of meteorological observations on Sundays.

R. H. Scott, Esq., F.R.S.
Meteorological Office.

I am, &c.
(Signed) JOHN TILLEY.

Resolved—"That in order to obviate needless attendance on Sundays at the several stations to which Storm Warnings are issued, Mr. Scott be instructed to endeavour to arrange with the Postmaster-General for a message to be sent in the morning to any selected station to indicate the necessity for the attendance of a clerk on any particular Sunday afternoon."

Mr. Scott asked for instructions as to the inspection of the stations in the coming autumn, and was directed to inspect as usual, and to make arrangements for Mr. Whipple to visit the observatories in order to overhaul the condition of the self-recording instruments, a duty which has been hitherto performed by Mr. Beckley.

Read—A letter from Captain Toynbee, submitting excellent Logs from the following gentlemen:

- Capt. A. Becket, ship "Amana." (Minutes 1875, p. 14.)
- E. C. Bennett, ship "Thessalus." (Minutes 1875, p. 45.)
- H. Blomfield, ship "Thomas Stephens."
- C. M. Dobson s.s. "Beta." (Minutes 1875, p. 77.)
- T. W. Freeman, s.s. "Wisconsin" and "Nevada." (Minutes 1875, p. 4.)
- H. Longley, s.s. "Yorkshire." (Minutes 1876, p. 29.)
- D. Marshall, ship "Ardgowan."
- J. A. Martyn, s.s. "Java" and "Samaria." (Minutes 1876, p. 87.)
- C. C. Prehn, barque "Eleanor." (Minutes 1875, p. 45.)
- J. J. Price, barque "Sorata." (Minutes 1876, p. 23.)
- W. H. Smith, s.s. "Scandinavian." (Minutes 1875, p. 34.)
- F. T. Thomson, R.N., H.M.S. "Challenger." (Minutes 1876, p. 48.)

Log kept by Staff Commander T. H. Tizard and Navigating Sub.-Lieut. A. Havergal.

Mr. Scott was instructed to present the Wind and Current Charts to Captains Blomfield and Marshall, and to convey the marked thanks of the Committee to the other gentlemen.

Submitted—The following Abstract of Accounts from 1st April 1876 to 30th June 1876:—

Receipts.				Payments.			
	£	s.	d.		£	s.	d.
Balance from 1875-6 -	1,278	9	1	OFFICE:			
Vote for year (amount received to date)	2,000	0	0	Salaries -	349	7	9
Commissions for instruments, &c.	218	18	4	Rent, fuel, &c. -	174	6	4
Subscriptions for D.W. Charts	70	19	8	Contingencies -	90	12	4
Interest on deposit account	2	7	2	LAND METEOROLOGY:			
Subscriptions to Danish Synoptic Charts	8	2	6	Expenses at observatories	630	9	1
Meteorological information, &c.	127	0	3	New instruments for ditto	56	4	4
				Computations, &c.	232	6	0
				Telegraphy	540	10	6
				Inspections, D.W. Charts	103	3	2
				Computations	269	13	9
				OCEAN METEOROLOGY:			
				Marine Superintendent	100	0	0
				Instruments, Admiralty	75	5	4
				Ditto Mercantile Marine,			
				Agencies, &c.	47	9	6
				Computations and care of instru-			
				ments -	287	17	3
					£2,957	5	4
				Balance	748	11	8
				Total	£3,705	17	0
	£3,705	17	0				

BALANCE SHEET, 30TH JUNE 1876.*

	£	s.	d.		£	s.	d.
To sundry creditors (ledger accounts)-	623	18	10	By balance of receipts and payments	748	11	8
„ probable net surplus on 30th June -	8,527	6	11	„ balance of parliamentary vote estimated at -	8,000	0	0
				„ sundry debtors (ledger accounts) -	402	14	1
	<u>£9,151</u>	<u>5</u>	<u>9</u>		<u>£9,151</u>	<u>5</u>	<u>9</u>

* The value of stock of instruments, &c., is not included in this statement.

Reported—That the Imprest for 1,000*l.* had been received and lodged to the Committee's account.

Mr. Scott stated that a small work by him, entitled "Weather Charts and Storm Warnings," of which he submitted proof sheets, was to be published in a few days by Messrs. H. S. King & Co., and he was instructed to order 100 copies for the Office, for distribution to the telegraphic observers, &c.

The Committee then adjourned.

116, *Victoria Street*, July 31, 1876.

PRESENT :

Mr. De La Rue in the Chair.

Mr. Galton.

Lieut.-General Strachey.

The Director was in attendance.

The Minutes of last meeting (July 17) were read and confirmed.

Mr. Scott reported that he had had an interview with Mr. Patey at the General Post Office on the 25th inst., with reference to the issue of Sunday warnings (Minutes July 17), and had learned from that gentleman that the Post Office saw that there would be considerable difficulty in inducing the telegraph clerks at small offices to forego their Sunday holiday by attending at extra hours, when required to do so, by telegram, considering the small rate of pay allowed for such extra attendance, and that the Post Office therefore was not disposed to enforce such regulations as would be required to ensure extra attendance on Sundays without very urgent necessity.

Mr. Scott was instructed to write to the Post Office to ascertain in what way the wishes of the Treasury Commission in regard of Sunday Warnings could best be carried out.

Mr. Scott reported that with reference to the transference of the duty of telegraphic reporting at Valencia to the Observatory, he had learnt from the Post Office (letter 1,591) that the cost of a private wire thence to Knightstown would be 23*l.* 10*s.* per annum. Mr. Scott was authorized to conclude such an arrangement.

Read—A letter from Prof. Grant asking for the supply of the Hourly Tabulations to Glasgow observatory.

Resolved—That they be presented to the seven observatories.

Read—A letter from Capt. Toynbee, submitting excellent Logs by—

Capt. W. Symington, s.s. "Hankow" (Minutes, 1875, p. 83).

Capt. Jas. Gordon, s.s. "City of Oxford."

Mr. Scott was instructed to express the thanks of the Committee to Capt. Symington and to present the "Wind and Current" Charts to Capt. Gordon.

Reported—That an additional reply to the circular (Minutes pp. 82, 102) had been received from Senor Aguilar of Madrid Observatory, and had been forwarded to Mr. Fanshawe.

Reported—That meteorological information had been supplied gratis—

To Dr. Hann, copy of the Observations in the Logs of H.M.S. "Erebus" and "Terror" at Kerguelen Island May 1 to July 20, 1840.

Dr. B. Stewart, copies of Canadian Observations, 1854–71.

The following cheques for July were drawn:—

For Office:

		£	s.	d.
R. H. Scott	Salaries and wages	66	13	4
J. S. Harding, jun.		20	16	8
J. S. Harding, sen.		*9	12	6
T. D. Bell		7	10	0
The Pall Mall Coal Co., coals		9	12	0
E. W. Stibbs, books		2	8	0

For Observatories:

J. E. Cullum, Valencia		13	6	8
Wightman & Co., printing		2	10	0
R. H. Curtis	Computations	14	3	4
C. H. Thompson		*7	5	0
C. Stodart		*10	10	0
J. A. Curtis		10	0	0
R. Sargeant		†5	4	0
H. N. Cobley		‡5	4	0

For Telegraphy:

F. Dangerfield, delivery of D.W. charts		13	19	7
F. Gaster	Computations	15	16	8
W. L. Dallas		9	3	4
F. Brodie		8	0	0
H. Chivers		*4	2	6

For Ocean Meteorology:

H. Toynbee, Marine Superintendent		33	6	8
Cashiers, Bank of England, Bermuda anemometer		1	8	2
G. M. Whipple, verifications		12	7	0
P. Adie, repairing "A." instruments		7	9	0
" " "B.T." "		4	11	0
P. A. Feathers, Dundee agent		12	0	0
D. MacGregor & Co., Glasgow agent		2	13	3
J. Gill, Liverpool		1	0	0
R. Strachan	Computations	21	10	0
C. Harding		\$20	16	8
T. E. Allen		15	0	0
H. Harries		10	0	0
		*9	12	6

On Account:

R. H. Scott, inspections		50	0	0
G. M. Whipple "		25	0	0
J. S. Harding, jun., office expenses		100	0	0
		100	0	0
		200	0	0

Total - £650 11 10

* Five weeks to the 31st July.

† Four " " 26th August.

‡ Including allowance for care of instruments.

SUBMITTED—The following STATEMENT respecting the RECORDS for June 1876, received from the SELF-RECORDING OBSERVATORIES, which have been examined at KEW OBSERVATORY (see Minutes 21st December 1868).

	Aberdeen.	Armagh.	Falmouth.	Glasgow.	Kew.	Stonyhurst.	Vaencia.
ANEMOGRAPH :—							
Action - - -	Direction. Good. 0	Direction. Good. 0	Direction. Good. 2 hrs. 2 hrs.	Direction. Fair. 2 hrs. 2 hrs.	Direction. Good. 0	Direction. Good. 0	Direction. Fair. 0
Records deficient, due to stoppage of clock	Velocity. Good. 0	Velocity. Good. 0	Velocity. Good. 2 hrs. 2 hrs.	Velocity. Fair. 2 hrs. 2 hrs.	Velocity. Good. 0	Velocity. Good. 0	Velocity. Fair. 0
" " other causes - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
Orientation verified - -	Direction. Good. 22nd	Direction. Good. 13th	Direction. Good. 2 hrs. 2 hrs.	Direction. Fair. 2 hrs. 2 hrs.	Direction. Good. 0	Direction. Good. 0	Direction. Fair. 0
No. of errors discovered by subsidiaries	0	1	0	0	0	0	0
" " irregular differences	0	0	0	0	0	0	0
Result of 40 Remasurements :—							
Greatest difference - -	1.0	1.0	1.0	1.0	1.0	1.0	1.0
Mean difference irrespective of sign - -	0.1	0.3	0.3	0.3	0.0	0.2	0.1
Residual difference (— Kew) - -	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RAIN GAUGE :—							
Action - - -	Direction. Good. 0	Direction. Fair. 0	Direction. Fair. 52 hrs.	Direction. Fair. 0	Direction. Good. 0	Direction. Good. 0	Direction. Good. 0
Records deficient, due to stoppage of clock	Velocity. Good. 0	Velocity. Good. 0	Velocity. Good. 0	Velocity. Fair. 0	Velocity. Good. 0	Velocity. Good. 0	Velocity. Good. 0
" " other causes - -	- - -	- - -	- - -	- - -	- - -	- - -	- - -
Errors in tabulation - -	0	0	0	5	0	0	0

BAROGRAPH :-		Good.	Good.	Good.	Good.	Good.	Good.	Good.	Good.
Action	Do.	Do.	Do.	Do.	Do.	Do.	Do.	Do.	Do.
Photography	0	0	0	0	0	0	0	0	0
Records deficient, due to stoppage of clock	0	0	0	0	0	0	0	0	0
failure of light	0	0	0	0	0	0	0	0	0
other causes	0	0	0	0	0	0	0	0	0
No. of errors discovered—									
In entry of standard	0	0	0	0	0	0	0	0	0
calculating residual correction	0	0	0	0	0	0	0	0	0
applying residual correction	0	0	0	0	0	0	0	0	0
subtraction in subsidiary tables	0	0	0	0	0	0	0	0	0
tabulation by subsidiaries	0	0	0	0	0	0	0	0	0
irregular differences	0	0	0	0	0	0	0	0	0
Result of 40 Remeasurements :-									
Greatest difference	0	0	0	0	0	0	0	0	0
Mean difference irrespective of sign	0	0	0	0	0	0	0	0	0
Residual difference (— Kew)	0	0	0	0	0	0	0	0	0
Mean monthly difference between simultaneous barograph and barometer readings	0	0	0	0	0	0	0	0	0
THERMOGRAPH :-									
Action	Do.	Do.	Do.	Do.	Do.	Do.	Do.	Do.	Do.
Photography	0	0	0	0	0	0	0	0	0
Records deficient, due to stoppage of clock	0	0	0	0	0	0	0	0	0
failure of light	0	0	0	0	0	0	0	0	0
imperfectly moistened bulbs	0	0	0	0	0	0	0	0	0
partially frozen	0	0	0	0	0	0	0	0	0
other causes	0	0	0	0	0	0	0	0	0
No. of errors discovered in entry of standard	0	0	0	0	0	0	0	0	0
by subsidiary measurements	0	0	0	0	0	0	0	0	0
by subtraction in do. tables	0	0	0	0	0	0	0	0	0
detected under glass scale	0	0	0	0	0	0	0	0	0
Result of 40 Remeasurements :-									
Greatest difference	0	0	0	0	0	0	0	0	0
Mean difference irrespective of sign	0	0	0	0	0	0	0	0	0
Residual difference (— Kew)	0	0	0	0	0	0	0	0	0
Mean monthly difference between simultaneous thermograph and thermometer readings	0	0	0	0	0	0	0	0	0
No. of errors in maxima and minima	0	0	0	0	0	0	0	0	0

* Pencils not lowered.

The Committee then adjourned.

116, Victoria Street, November 6, 1876.

PRESENT :

Mr. Galton in the Chair.

Mr. De La Rue.

Lieut.-General Strachey.

The Director was in attendance.

The Minutes of last meeting (July 31) were read and confirmed.

Submitted—The following correspondence relative to the Sunday Telegraphic Service (Minutes, July 31).

SIR,

Meteorological Office, August 1, 1876.

WITH reference to your letter of the 4th July (No. 163,917) respecting the transmission of Meteorological information on Sundays, and to my interview with Mr. Patey on the 25th of that month on the subject.

I beg to inform you that notwithstanding the great public advantage of extending the warning system to Sundays, this Office is unwilling to ask the Post Office authorities to put pressure upon its officers with the view of their attendance at extra-official hours.

Under the circumstances the only solution seems to be that the messages should be sent, if possible, during the hours at which attendance is given in the morning.

I should be obliged, therefore, if you will grant permission for the attendance of two clerks from this Office from about 8.30 to 9.30 a.m. at the Central Office on Sundays, to receive, reduce, and despatch messages (if required) *without unnecessary delay*.

I am, &c.

John Tilley, Esq.,
Secretary, General Post Office.

(Signed) ROBERT H. SCOTT,
Director.

M.O. 1646.
No. 89,140.

SIR,

General Post Office, August 4, 1876.

WITH reference to your letter of the 1st instant, on the subject of the transmission of Meteorological intelligence on Sundays, I beg leave to inform you that accommodation can be provided in the Intelligence Department of the Central Station for the clerks from your Office who will be employed upon the examination and despatch of Meteorological telegrams on Sunday mornings.

I am, &c.

R. H. Scott, Esq., F.R.S.

(Signed) C. H. B. PATEY.

Mr. Scott was instructed to report to the Committee on the probable cost of the Sunday Service up to the end of the financial year, and, without waiting for that report, to make arrangements for carrying on the work.

Submitted—The following letter.

M.O. 2080.

SIR,

Board of Trade, October 7, 1876.

I AM directed by the Board of Trade to transmit to you, for the information of the Meteorological Committee, the enclosed copy of a despatch which they have received through the Colonial Office from the Governor of Heligoland asking that assistance may be given from the Imperial funds with a view to the establishment of a first-class Meteorological station in that colony.

The Board of Trade will be obliged to your Committee if they will favour them with their opinion on the subject.

I am, &c.

The Secretary to the
Meteorological Committee.

(Signed) THOMAS GRAY.

GOVERNOR MAXSE to the EARL OF CARNARVON.

MY LORD,

Heligoland, September 1, 1876.

I HAVE the honour to enclose a copy of a letter which I have received from Dr. Neumayer, Director of the German Meteorological Department, on the subject of the erection of a Meteorological station in this colony.

2. The subject is one which has long attracted my attention, as it is evident, situated as Heligoland is, the island is peculiarly adapted for giving to passing vessels such storm warnings as are customary on the coast of England.

3. Dr. Neumayer is of opinion that the apparatus of a so-called first-class station could be established for the sum of one hundred pounds (100*l.*), and that besides a small yearly expenditure for keeping instruments in order, an annual charge of twenty-seven pounds ten shillings (27*l.* 10*s.*) would be incurred for the salary of the keeper.

4. It will be in the recollection of your Lordship that the community of the island have already done good work in the establishment of a ship signal station in connection with the submarine cable to the Elbe; this station they maintain at their own expense, but I am of opinion that they can, and ought to bear in addition the annual charge of twenty-seven pounds ten shillings (27*l.* 10*s.*) for the purpose mentioned in this despatch.

I have to add that they are quite prepared to do so.

5. Mr. Schmidt, the teacher of the fourth class of the Colonial School, will readily undertake the duties of the station for a salary of eighteen pounds (18*l.*) per annum, and he has hitherto been in the habit of preparing and forwarding such meagre weather reports as have hitherto been transmitted hence to the continent.

The surplus sum of nine pounds ten shillings (9*l.* 10*s.*) would be sufficient for keeping the instruments in order, &c.

6. As bearing on the financial side of the question I trust that your Lordship will permit me to observe that the public debt, which had reached formerly the large sum of seven thousand two hundred pounds (7,200*l.*), will be reduced by the end of the current year to three thousand pounds (3,000*l.*), and that notwithstanding the abolition of the play-tables, the commercial income, owing to the happily increasing prosperity of the island, is considerably larger than when the above-named illicit source of revenue existed. I have therefore no hesitation in advising agreement to Dr. Neumayer's propositions.

7. Under the above circumstances, and seeing the general utility to shipping, such indeed overweighing any local advantages which the erection of a station at Heligoland may present, I trust that your Lordship will allow the charge of one hundred pounds (100*l.*) for the first establishment to be made on Imperial funds.

8. In conclusion I would observe that Dr. Neumayer, with whom I am acquainted, is worthy of all trust in such matters, he is noted for the interest which he takes in Meteorology and for his highly successful labours in that science.

I am, &c.,

The Right Honourable The Earl of Carnarvon,
&c. &c. &c.

Dr. NEUMAYER to Governor MAXSE.

(Translation.)

M.O. 2080.

Imperial German Meteorological Department, Hamburg,

SIR,

August 20, 1876.

WHEN I had the honour of speaking to your Excellency here, and later in Heligoland, on the subject of the establishment of a proper Meteorological station at Heligoland for normal observations similar in principle to those now established on the German Coast, and by this means enabling the Imperial Meteorological Institution at Hamburg to publish more extended information as regards the weather, your Excellency was so kind as to interest yourself very much in the matter.

With reference, therefore, to these interviews, and also to the reports of Mr. Theodor Schmidt to yourself, and which you were kind enough to hand to me, and which I have the honour herewith to return, I beg in the name of the German Meteorological Department to make the following further remarks on the question; the Department quite agrees with the remarks of Mr. Schmidt—who at present, by the permission of the Governor, has been in the habit of forwarding such weather reports as the limited means at his command enabled him to perfect—that of all places in the North Sea, Heligoland is probably of the greatest importance in a Meteorological sense, and I have to add that this Department is of opinion that weather reports from Heligoland would be of immense assistance to the common end. It would be sufficient if this Department received once daily an accurate and complete weather report with four groups, of five figures, on the International Cypher system, and which should give an accurate account of each morning's observations.

A monthly report in detail of the Meteorological observations made of Heligoland would also be of immense assistance in a Meteorological sense to this Department, and would aid their labours considerably; on the other hand this Department are of opinion that an equivalent for the reports as above-mentioned will be found by the transmission from this Office of the regular and of the extraordinary weather reports to Heligoland. And this Department is further prepared to forward to the Meteorological station at Heligoland the daily printed Weather Charts and similar information, and these will be supplied free of cost and on the same scale as they are at present furnished to all first-class Meteorological stations on the German Coast.

In order, however, to obtain the required results, it is absolutely necessary that the Meteorological station at Heligoland should, as far as it is possible, conform on all points with the other Meteorological stations.

This Department trusts most earnestly that your Excellency will be prepared to institute such a station at Heligoland, as such a one will be of great local assistance in the way of storm signals and weather reports, not only to the inhabitants of the island but also to the numerous vessels of all nations which are constantly passing Heligoland.

This Department, under the impression that the Government of Heligoland will have difficulty in finding the necessary funds for such a purpose, beg to state that the following instruments, &c. will be necessary, a standard barometer, psychrometer, anemometer, wind register, and rain register.

This Department begs to enclose a copy of the instructions as forwarded to their own Meteorological stations, showing the use of the instruments, the reports to be made, &c., &c., &c., and the Department will be prepared to furnish all necessary instruments as cheaply as possible, such a proceeding on their part being easier as they have a good supply of instruments in hand as a reserve for their own stations.

The sum of 800 reichsmark, forty pounds (40*l.*), will be sufficient for the purpose.

The Director mentioned to your Excellency also the necessity of his having a control over the station in matters of instruction and discipline, such of course to be conducted through the Government of the Island in the same manner as the present telegraphic business is carried on. A signal mast with certain extra apparatus will further be necessary, the cost attached to this will be about 1,200 reichsmark, sixty pounds (60*l.*)

This Department begs also to draw your Excellency's attention to the fact that a certain yearly sum, inconsiderable in its amount, must be set aside for keeping the instruments in order and for replacing any damages, and that to this sum must be added the salary of the official.

The salary of the agents of this Department for normal observations amounts to 300 reichsmark, fifteen pounds (15*l.*), a year, and for the storm signal-station 150 reichsmark, seven pounds ten shillings (7*l.* 10*s.*) extra, making a total expenditure of 450 reichsmark.

In conclusion, this Department beg to express their most particular thanks to your Excellency for the trouble you have taken in this matter and the great interest you have shown in aiding this Department in obtaining such Weather Reports as have been possible at Heligoland up to the present moment, and the Department have to add that in any possible mode in which they can be of assistance in advancing the good work of the establishment of a proper Meteorological establishment at Heligoland, such matter is only to be named to be attended to at once

The Direction of the Imperial German Meteorological Department,
To His Excellency Lt.-Col. Maxse, (Signed) DR. NEUMAYER.
Governor of Heligoland.

Mr. Scott was instructed to prepare a reply for the consideration of the Committee.

Mr. Scott reported, in connection with the question of the proposed exchange of telegrams with Germany, and his letter of May 13 (Minutes, p. 91), that Dr. Neumayer had called on him on the 19th and 31st of that month, and that on the 2nd of June he had written to the German Union Telegraph Company (Letter 1,019), asking what reduction, if any, they would grant on messages of the nature in question.

No reply having been received to this communication up to October 18, a reminder was forwarded on that day, which elicited the fact that the former letter had been mislaid at the Company's office.

At the request of the Company another copy of the letter was forwarded, and to that no reply has as yet arrived.

Meanwhile Dr. Neumayer had made a similar application to the same company at Berlin, and had received a refusal to lower their tariff, as explained in the subjoined letter.

M.O. 2251.

Deutsche Seewarte, Hamburg, October 30, 1876.

The negotiations between the Seewarte and the German Union Telegraph Company, respecting the transmission of Meteorological telegrams, have unfortunately led to an entirely unfavourable result, as the company in question, as shown by the accompanying communication (not printed here), are unable to make any allowance in favour of these telegrams.

Under these circumstances, the Seewarte wishes, in the first place, to maintain the present exchange of telegrams between England and Germany unaltered, and will take care to improve the organisation of the station at Cuxhaven, which certainly is of no great importance to the Seewarte itself, owing to its proximity to Hamburg. Besides the existing exchange, the Seewarte proposes the following between the Meteorological Office and itself.

Owing to the high charge for telegrams between Germany and England, the Seewarte is obliged to revert to its original proposal for the transmission of two telegrams only on each side, in which, as regards both telegrams to be sent from Germany to London, it leaves to you the choice and arrangement, but for its own part, as regards the telegrams from England, it adheres to the system of collective telegrams which has been well tried in the exchange between the Seewarte and the Meteorological Institutes of Vienna, St. Petersburg, Stockholm, Paris, and partially with Copenhagen. If a reduction of the present high tariff, by the introduction of word-rates, or if concessions for Meteorological telegrams, should take place, or if the absolute necessity of direct transmission of the messages for the purpose of expediting them should arise, and the Seewarte should have more funds than hitherto for this purpose placed at its disposal, the separation of the collective telegram into several direct ones must be the subject of further negotiations between the Seewarte and the Meteorological Office.

As in the present state of the matter, in the event of the proposed exchange of telegrams, each of the two establishments provides for the cost of the transmission of its own telegrams, the Seewarte hereby declares itself ready to undertake the daily transmission of any two telegrams chosen at pleasure from the German stations contained in its Weather Report, of which each should contain a maximum of 20 words, if, on the other hand, it can receive daily two telegrams from the British

Islands, containing information to be detailed below. It is left free to your judgment to determine, whether these telegrams shall be direct from one station, with the six groups of the Utrecht code, or a collective telegram despatched from Hamburg, with the data of several stations also; whether both telegrams shall refer to 8 a.m., or one of them to 2 p.m., in which case it must be remarked that for this last hour no information is at present received at Hamburg, and therefore for 2 p.m. only a direct telegram with the observations of a single station can be forwarded.

These telegrams would be furnished on Sundays as well as on week days.

On its part the Seewarte desires to receive the following telegraphic reports through the Meteorological Office :

1°. On week days.

a. A collective telegram, containing, besides the address ("Seewarte, Hamburg," = 2 words), the groups III., IV., and V. for six stations, for 8 a.m., omitting the names of the stations and remarks, altogether 20 tariff words. The telegraphing of the names of the stations is unnecessary, as soon as the order of the stations has been settled. The Seewarte wishes the following to be included in the telegram: Greencastle, Shields, Hurst Castle, Holyhead, Scilly, and Roche's Point; if, after experience, the reports from Scilly or Roche's Point appear unsuitable for the purpose, either from delay or irregularity, the Seewarte would wish to replace one of these stations by Stornoway. It is desirable that this telegram should be despatched from London not later than 10 a.m., and that, if the report from any station is wanting at that time, the word "fehlt" or "wanting" should be put in its place. The system here proposed has been extensively used in the exchange between Vienna and Hamburg.

b. The Seewarte would also prefer receiving a 2 p.m. collective telegram with the data from several stations; if, however, this appears impracticable, a direct telegram from Greencastle would be much desired.

2°. On Sundays.

c. A direct telegram from Greencastle in the morning.

The Sunday morning observations from the other stations would be very valuable to the Seewarte, sent in a later telegram, separated from the reports on Monday, and this would only complete the average number of two telegrams per day, as on Sunday the afternoon telegram is omitted, but the Seewarte is ready to dispense entirely with this supplementary telegram if it should be inconvenient to the Meteorological Office.

As already remarked, the existing exchange between the Office and the Seewarte remains intact, but the Seewarte thinks it is of mutual interest to recommend the adoption of the international Utrecht code for the Cuxhaven telegram, but it will only modify the same with the approval of the Meteorological Office.

In case the funds of the Meteorological Office do not permit the establishment of the proposed exchange of telegrams, the Seewarte requests to be informed to what extent you are ready to send the desired communications from London, &c. to Hamburg at the expense of the Seewarte, in which case the money for payment of the telegrams, say quarterly in advance, shall be remitted to the Meteorological Office.

R. H. Scott, Esq., Director,
Meteorological Office, London.

DR. NEUMAYER,
Director of the Seewarte.

On receipt of the above letter a communication had at once been addressed to the Submarine Telegraph Company, inquiring if that company would make any reduction in their tariff for the proposed exchange of telegrams.

REPORT.

I HAVE to submit the following Report of my inspection of the Northern Telegraphic Reporting Stations, Observatories, and Stations of the Second Order.

REPORTING STATIONS.

Nottingham, visited August 5.—The inspection of this station could not be carried out satisfactorily owing to the state of Mr. Lowe's health.

York, visited August 7.—This station was in good order; the reporter has been changed since last year, the former assistant in the Museum having died.

Scarborough, visited August 7.—This station continues one of the best, excepting in the matter of punctuality of the reading for 8 a.m. The observer complains of the length of hours entailed on him, so I have relieved him from the synchronous reading at 0.43 p.m.

North Shields, visited August 8.—This station is in a very satisfactory condition.

Leith, visited August 9.—I was unable to inspect the thermometers on this visit, owing to the absence of the observer at the hour of my visit. All else seemed in very good order.

Nairn, visited August 10.—The only particular calling for notice about this station is that owing to its distance from the town ($1\frac{1}{2}$ miles) there is great difficulty in procuring a substitute to undertake the observations during the temporary absence of the reporter on his school holidays. I have sanctioned the occasional removal of the instruments to the railway station, the situation of which is very similar to that of the present school-house.

Aberdeen, visited August 11.—The station was quite satisfactory.

Sumburgh Head, visited August 14.—The instruments at this station are in very good order, and the observations carefully taken, but the service of the Shetland Telegraph Company has been so

irregular that the reports have been comparatively worthless for the periods that the cable has been working. I have addressed a letter to the Post Office authorities directing their attention to this subject.

Thurso and Wick, both visited August 16, and both found in good order.

Stornoway, visited August 19, and found in a satisfactory condition.

Ardrrossan, visited August 29.—Here too there was nothing calling for special remark.

St. Ann's Head, visited September 20.—This station continues to be one of the best reporting stations that we have.

Valencia, visited September 26.—The duty of reporting has been transferred to Mr. Cullum at the observatory since July last. There is every reason to expect that this change will materially improve the character of the reports, but there are two serious inconveniences involved by the change. Firstly, the distance of the observatory from Knightstown involves additional expense of 23*l.* per annum for the rent of a private wire. This wire has been in operation for a month past. Secondly, the position of the observatory renders it quite impossible to obtain trustworthy observations of sea disturbance for the reports, and also materially interferes with the force of certain winds. This last-named circumstance is unavoidable on such a rugged coast, for while the observatory is sheltered from the north and north-west, Knightstown is more or less sheltered from the southward. However, I am disposed to think that great benefit will arise from the change of observers.

Roche's Point, visited September 28.—This station continues to work very well. From the long experience of the observer, and his exposed situation, his reports are of great value.

Kingstown, visited October 23.—This station does not call for any remark, except that no adequate provision can be made for securing continuity of readings in case of illness.

Donaghadee, visited October 26.—This station is in fairly good order.

Moville, visited October 27.—The instruments at this station have been removed to the school-house, and thereby a great improvement in the exposure of the thermometers and rain-gauge has been secured. The new observer, Mr. John Lowry, is very intelligent, and his reports are very good.

Holyhead, visited October 21.—This station is in a satisfactory condition, but the same remark, as to want of assistance, applies to it as to Kingstown.

Liverpool, visited October 19.—Here, too, Mr. Hartnup complains most seriously of the want of assistance; the entire labour of the observatory falling on himself and his son, while the latter has been in delicate health for some months.

This completes the inspection in the present year of all the telegraphic reporting stations, except *Oxford, Dover, and London*, all of which I hope to visit in the course of the current month.

OBSERVATORIES.

I have visited all the observatories, except Falmouth and Kew, during my tour. As Mr. Whipple has submitted a detailed report on the condition of the instruments, I need offer no further observations, beyond recommending that his suggestions be carried out.

As regards Valencia, however, a question has arisen as to the external repairs, for which the Knight of Kerry is legally liable, while at the same time he has the power of raising the rent, as we have no lease of the observatory. I beg, therefore, to recommend that the cost of such repairs should be divided equally between the Knight and the Office, and would submit the same for your approval.

STATIONS OF THE SECOND ORDER.

I have also visited several of the extra stations for which we publish results, which lay in the course of my tour. They are as follows:—

Seaham, visited August 8.—The exposure here is good, and the observer, Mr. G. H. Aird, is fairly accurate, but he has not received scientific education, and is not methodical enough in entering his observations in the small register.

Durham.—I did not visit this station, having done so last year, but I saw Mr. Goldney, the astronomer, at the observatory. At this station there is want of assistance; if such could be provided it would be a very useful local centre for the north of England.

Sandwich Manse, visited August 15.—This station continues in a very satisfactory condition, considering the character and amount of observations which are taken.

Giggleswick (near Settle), visited August 30.—I hope that this station may eventually prove satisfactory; the only difficulty connected with it is the providing of assistance for observations during the school vacations.

Parsonstown, visited October 3.—These observations are satisfactory, excepting those of wind, which are seriously affected by the trees in the adjacent parts of the demesne.

Tinnehinch, Rosenallis, Queen's County, visited October 24.—This is a station established by Mr. James Conroy, formerly sergeant, Royal Engineers, and observer at Chatham. If he remains at the place his observations will be valuable, as he is a trained observer, and the exposure is good, except as regards the wind, which is affected by the proximity of the Slieve-Bloom range of hills, lying immediately to the south of it.

Markree, visited October 28.—This station can hardly be said to promise very satisfactorily. Col. Cooper has agreed to transfer the observatory altogether to Dr. Dobereck, allowing him a certain yearly sum. It does not appear that this sum will suffice to provide adequate assistance for the Meteorological observations.

The exposure is good, except as regards the wind, which is affected by trees. The rain-gauge, too, is on the top of the observatory wall.

Oscott, visited October 30.—This station promises extremely well, the situation is very good, and the observer, Rev. S. Whitty, is most careful. There is no anemometer as yet.

M.O. 2172.

REPORT ON VISIT to the SELF-RECORDING OBSERVATORIES of the METEOROLOGICAL COMMITTEE by G. M. WHIPPLE.

Aberdeen Observatory.—This Observatory was visited on the 4th and 5th of September; the instruments all appeared in good order, with the exception of the brasswork, which in most cases is much corroded by the sea air. I cleaned all the clocks, fittings, and lenses, which were dimmed by the smoke of the past year, and examined the thermograph particularly, but was unable to find any cause to account for the unsatisfactory condition of the dry bulb.

The external portion of the anemometer being in fair order was not dismantled, the bearings only being cleaned and oiled. The fan screw is almost worn out, and a new one is wanted at once.

I observed a constant difference of $2^{\circ}0$ in temperature as indicated by the thermometers attached to the barograph and the standard barometer, although they are in close proximity, and accordingly directed Mr. Boswell to determine the freezing points of both, and if necessary correct the readings.

There is great need for a deputy observer, Mr. Boswell being without assistance, and not having been absent from the Observatory a day for three years.

A spirit lamp is needed for the warming of the self-recording rain-gauge in time of frost.

Glasgow Observatory was visited on September 7th, 8th, 9th, and 11th, and I regret to state that I found all the Committee's instruments in a very unsatisfactory condition, although favourable results were being obtained from them. There was great accumulation of dirt and soot upon all of them, and no care appears to have been taken of their external appearance.

The lenses of the barograph were much dimmed by fungus and smoke, and therefore taken apart and cleaned, the clock was also cleaned, and the winding cords put the right way on the clock barrel.

The guide to the temperature lever is lost.

The focus is indifferent, but was not changed on account of the alteration such an operation would effect in the scale value of the instrument.

The attached thermometer to the standard barometer has been broken, and its readings are replaced by those of an old thermometer, whose errors are unknown, but Professor Grant promised to examine it.

The thermograph was in similar state to the barograph, and received similar treatment. The lens of the dry bulb was found unscrewed, and when screwed home improved the focus considerably. New muslins and threads were fitted to the wet bulb.

The Negretti maximum thermometer is useless on account of air in the tube.

The anemometer had to be completely taken to pieces, both externally and internally, and every part cleaned; there was no oil in the bearing or oil cups. Copper ears were fitted to the Robinson cups, the attachments being almost worn through for want of painting. The fan shaft is worn out and new one needed.

The recording rain-gauge had had its clock recently cleaned. The mercury in the cistern was dirty, and without glycerine, and considerable deposit was found in the receiver and removed.

The journals at this observatory are written up weekly, not kept as journals, and the anemometer sheets have their dates, &c. entered before they are used.

Stonyhurst Observatory.—I visited this establishment on September 13th and found all the instruments and apparatus in excellent order, nothing requiring attention, as Mr. Hostage takes great care of all.

He requests a spare cylinder for the barograph and thermograph on account of the frequent failure of his binding rods, but, having appliances on the spot for repairing them, I do not recommend that one be supplied, spare springs being sufficient.

I examined the attachment to the Beckley gauge, which works very well, and would suggest that eventually this, or a modification of it, might with advantage be fitted to the gauges at the other observatories.

Armagh Observatory, September 14th and 15th,—All the instruments were in very fair order. I cleaned the clocks and lenses, and oiled the bearings of the anemometer.

The driving axis of the clock of the Beckley rain-gauge is split by repeated over winding and a new one is required.

The growth of shrubs is very thick round the thermometer screen and they should be cut away if possible.

Valencia Observatory, visited on 20th, 21st, 22nd, and 23rd September.—I found the vane of the anemograph stuck fast, and on examining the instrument saw that it wanted completely overhauling, not having been looked at for some years on account of the difficulty of access to it. I therefore had a scaffold erected round it and the whole apparatus eventually brought down to the ground, where after considerable labour it was taken to pieces.

All the parts were either much rusted or clogged with thick oil, the rust was scraped off and the oil removed by soda water, and the instrument again erected, adjusted, and painted. At the same time opportunity occurred for determining the true meridian by solar observation and orienting the vane, accordingly the point formerly referred to as due North was found to be about 15° to the east of North.

The clock and registering mechanism of the anemograph were also cleaned and the glass case belonging to the instrument, which had been set aside, replaced over it.

The clocks and levers of both barograph and thermograph were cleaned, and the slit of the first-named instrument, which was found displaced, was set right.

The fulcrum of the temperature compensating lever is out of place, Mr. Kerr having been accustomed to vary its position occasionally; it was, however, left as it stood, in order not to change the scale value; at present I would, however, recommend that as soon as convenient its proper place be re-determined, for the residual correction at Valentia changes frequently, and Mr. Cullum is continually obliged to re-adjust the zero of the tabulating instrument.

The self-recording rain-gauge was in fair order. I cleaned the clock, cistern, float, and mercury and put fresh paraffin in.

The instrument requires painting.

Falmouth Observatory, September 28th and 29th.—Examined all instruments and found in good order with the exception of the anemometer, which had no oil in its bearings and requires a new screw shaft to the vanes.

I cleaned lenses, clocks, and mechanism of barograph, thermograph, and anemograph, and lengthened the duration of the light stop in the second-named instrument to six minutes, the air specks of the thermometers being unusually wide.

I also re-determined the local meridian by means of a solar observation, and observed anew the freezing points of the standard thermometers.

The self-recording rain-gauge clock having been recently cleaned it was only necessary to purify the mercury and apply new paraffin to the float.

I would recommend that the authorities should be instructed to have the wooden support for the anemometer painted, as it is showing signs of rottenness, and that a new thermometer should be supplied to replace the Casella minimum, which is unreliable.

Kew Observatory, October 1876.

(Signed) G. M. WHIPPLE.

Mr. Scott stated that a question had arisen as to the liability for external repairs at Valencia, as the Knight of Kerry had objected to executing these at his own expense, though legally liable to do so, on the ground that the rent of the observatory was so small. He had proposed (Letter 2,186) that the Committee should divide the cost of such repairs equally with him.—Sanctioned.

Submitted—A letter (No. 1972) from the Board of Trade, enclosing copy of a despatch from Mr. Morier, at Lisbon, to the Foreign Office, containing an account of the establishment in Portugal of a system of Storm Signals similar to that existing in the United Kingdom.

Read.—A letter from Captain Toynbee, submitting excellent Logs from the following gentlemen—

Captain R. Owen, barque "Victoria Cross."

" R. Peebles, ship "Margaret Galbraith."

" H. Campbell, ship "Rajmahal" (Minutes, 1875, p. 60).

" G. Gaye, ship "Enone" (Minutes, 1875, p. 9).

" D. Gray, s.s. "Eclipse" (Minutes, 1875, p. 71).

" J. Gray, s.s. "Hope" (Minutes, 1875, p. 71).

" E. C. V. Heggum, ship "Rozelle" (Minutes, 1875, 60).

" C. Maples, ship "Riversdale" (Minutes, 1875, p. 60).

" R. H. Napier, R.N., H.M.S. "Nassau." (Log kept by Lieutenant G. N. A. Pollard (Minutes, 1876, p. 37).

" C. W. Pearson, s.s. "Strathleven" (Minutes, 1875, p. 61).

" C. R. Renaut, ship "Crusader" (Minutes, 1875, p. 61).

" G. Shaw, s.s. "Beta" (Minutes, 1876, p. 87).

" G. R. Stuart, ship "Oamaru" (Minutes, 1875, p. 61).

" C. E. Le Poer Trench, ship "Newcastle" (Minutes 1875, p. 61).

" W. Warden, s.s. "Alpha" (Minutes, 1876, p. 87).

" H. P. Wight, ship "Dunalistair" (Minutes, 1875, p. 61).

Mr. Scott was instructed to present the Wind and Current Charts to the two first-named gentlemen, and to convey the marked thanks of the Committee to the others.

Submitted—Applications for Fishery Barometers for Point Law, Aberdeenshire, Tarbert, Loch Fyne, Argyllshire.—Granted.

Submitted—A copy of the newly published Daily Weather Chart of the Brussels Observatory, and reported that the Daily Weather Chart of the Office had been supplied in exchange.

Reported—That Mr. John Dallas had resigned his temporary clerkship on the 6th of September, and that Mr. A. R. Simpkins had been appointed in his place at a salary of 1*l.* a week.—Approved.

Reported—That the order for 7,000*l.*, being the balance of the Parliamentary grant, had been received and lodged to the credit of the Committee in the Bank of England, August 31st.

Submitted—The following Abstract of Accounts from 1st April 1876 to 30th September 1876.

RECEIPTS.				PAYMENTS.			
		£	s. d.			£	s. d.
Balance from 1875-6 -	-	1,278	9 1	OFFICE :—			
Vote for Year -	-	10,000	0 0	Salaries -	-	695	10 3
Commissions for instruments, &c.	-	415	15 2	Rent, fuel, &c. -	-	318	3 1
Subscriptions for D. W. Charts -	-	97	4 4	Contingencies -	-	167	12 7
Interest on deposit account -	-	2	7 2	LAND METEOROLOGY :—			
Subscriptions for Danish Charts -	-	8	15 0	Expenses at observatories -	-	1,207	9 3
„ „ Hourly Observations -	-	6	0 0	New instruments for ditto -	-	197	17 4
Meteorological information, &c. -	-	257	4 0	Computations -	-	450	16 5
				Telegraphy -	-	701	2 11
				Inspections, D.W. Charts, &c. -	-	247	10 9
				Computations -	-	541	14 0
				OCEAN METEOROLOGY :—			
				Marine Superintendent -	-	200	0 0
				Instruments, Admiralty -	-	180	15 8
				„ Ditto Mercantile Marine, Agencies, &c. -	-	168	10 9
				Computations and care of instruments -	-	570	9 6
						5,647	12 6
				Balance -	-	6,418	2 3
Total -	-	£12,065	14 9	Total -	-	£12,065	14 9

BALANCE SHEET, 30th September 1876.*

	£	s. d.		£	s. d.
To sundry creditors -	836	17 6	By balance of receipts and payments account -	6,418	2 3
„ „ probable net surplus on 30th Sept. -	5,918	11 3	„ „ sundry debtors -	337	6 6
	6,755	8 9		6,755	8 9

* The value of Stock of Instruments, &c. is not included in this statement.

Submitted.—The following STATEMENT respecting the RECORDS for July 1876, received from the SELF-RECORDING OBSERVATORIES, which have been examined at KEW OBSERVATORY (see Minutes, 21st December 1868).

	Aberdeen.	Armagh.	Falmouth.	Glasgow.	Kew.	Stonyhurst.	Valencia.
	Direction. Good.	Direction. Good.	Direction. Good.	Direction. Good.	Direction. Good.	Direction. Good.	Direction. Good.
	Velocity. Good.	Velocity. Fair.	Velocity. Good.	Velocity. Good.	Velocity. Good.	Velocity. Good.	Velocity. Good.
ANEMOGRAPH :—							
Action - - -	0	0	0	0	0	0	0
Records deficient, due to stoppage of clock	0	0	0	0	0	0	0
" " other causes -	0	0	0	0	0	0	0
Orientation verified - - -	0	0	0	0	0	0	0
No. of errors discovered by subsidiaries	0	0	0	0	0	0	0
" " irregular differences -	0	0	0	0	0	0	0
Result of 40 Remeasurements :—							
Greatest difference - - -	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Mean difference irrespective of sign -	0.0	0.0	0.0	0.0	0.0	0.0	0.0
Residual difference (— Kew) -	0.0	0.0	0.0	0.0	0.0	0.0	0.0
RAIN GAUGE :—							
Action - - -	0	0	0	0	0	0	0
Records deficient, due to stoppage of clock	0	0	0	0	0	0	0
" " other causes -	0	0	0	0	0	0	0
Errors in tabulation - - -	0	0	0	0	0	0	0

Submitted—The following STATEMENT respecting the RECORDS for August 1876, received from the SELF-RECORDING OBSERVATORIES, which have been examined at KEW OBSERVATORY (see Minutes, 21st December 1868).

	Aberdeen.	Armagh.	Falmouth.	Glasgow.	Kew.	Stonyhurst.	Valencia.
ANEMOGRAPH:—							
Action - - - - -	Direction. Good. 0 Velocity. Good. 0	Direction. Good. 0 Velocity. Good. 0	Direction. Good. 0 Velocity. Good. 0	Direction. Fair. 1 hr. Velocity. Fair. 1 hr.	Direction. Good. 0 Velocity. Good. 0	Direction. Good. 0 Velocity. Good. 0	Direction. Fair. 0 Velocity. Fair. 0
Records deficient, due to stoppage of clock	0	0	0	0	0	0	0
” other causes - - -	*1 hr.	0	0	0	0	1	0
Orientation verified - - -	—	—	14th	—	31st	—	—
No. of errors discovered by subsidiaries	0	0	0	0	0	0	0
” irregular differences	0	0	0	2	0	5	2
Result of 40 Remeasurements:—							
Greatest difference - - -	0.0	0.0	0.0	1.0	0.0	0.0	1.0
Mean difference irrespective of sign - - -	0.0	0.0	0.0	0.2	0.0	0.1	0.1
Residual difference (—Kew) - - -	0.0	0.0	0.0	—0.2	0.0	0.0	+0.1
RAIN GAUGE:—							
Action - - - - -	Good.	Good.	Good.	Fair.	Good.	Good.	Fair.
Records deficient, due to stoppage of clock	0	0	7 hrs.	0	0	0	9 hrs.
” other causes - - -	0	0	0	0	0	0	0
Errors in tabulation - - -	0	1	0	1	0	0	1

BAROGRAPH :—

[illegible]

THERMOGRAPH:—

[illegible]

* Stopped on account of painting of Observatory.

SUBMITTED.—The following STATEMENT respecting the RECORDS for September 1876, received from the SELF-RECORDING OBSERVATORIES, which have been examined at KEW OBSERVATORY (see Minutes 21st December 1868).

	Aberdeen.		Armagh.		Falmouth.		Glasgow.		Kew.		Stonyhurst.		Valencia.	
	Direction.	Velocity.	Direction.	Velocity.	Direction.	Velocity.	Direction.	Velocity.	Direction.	Velocity.	Direction.	Velocity.	Direction.	Velocity.
ANEMOGRAPH:—	Good.	Good.	Good.	Fair.	Good.	Good.	Good.	Fair.	Good.	Good.	Good.	Good.	Bad.	Good.
Action - - -	0	0	0	0	0	0	0	3 hrs.	0	0	0	0	0	0
Records deficient, due to stoppage of clock -	0	0	1	0	*3 hrs.	*5 hrs.	3 hrs.	*48 hrs.	0	0	54 hrs.	53 hrs.	+14 d. 14 h.	+2 d. 18 h.
" " other causes -	—	—	—	—	15th	—	—	9th	—	—	—	—	23rd	—
Orientation verified - - -	0	0	0	0	0	0	0	0	0	0	1	4	0	0
No. of errors discovered by subsidiaries -	0	0	0	0	0	0	0	4	0	0	0	0	0	0
" " irregular differences -	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Result of 40 Remasurements:—														
Greatest difference - - -	0.0	1.0	0.0	1.0	0.0	1.0	0.0	1.0	0.0	1.0	0.0	1.0	0.0	1.0
Mean difference irrespective of sign -	0.0	0.2	0.0	0.3	0.0	0.4	0.0	0.1	0.0	0.3	0.0	0.3	0.0	0.3
Residual difference (—Kew) -	0.0	0.0	0.0	0.0	0.0	+0.2	0.0	—0.1	0.0	0.0	0.0	—0.1	0.0	0.0
RAIN GAUGE:—														
Action - - -	Good.	Good.	Good.	Good.	Good.	Good.	Good.	Good.	Good.	Good.	Good.	Good.	Good.	Good.
Records deficient, due to stoppage of clock -	0	0	24 hrs.	0	0	0	0	0	0	0	0	0	0	0
" " other causes -	0	0	0	0	0	0	0	0	0	0	0	0	0	0
Errors in tabulation - - -	0	0	0	0	0	0	1	0	0	0	11	0	1	0

BAROGRAPH:—

Action	Good. Do.	Good. Do.	Good. Do.	Good. Do.	Good. Do.	Good. Do.	Fair. Do.
Photography - - -	0	0	0	0	0	0	0
Records deficient, due to stoppage of clock	0	0	0	0	0	0	0
" failure of light	0	0	0	0	0	0	0
" other causes -	0	*1 hr.	*1 hr.	0	0	0	0
No. of errors discovered—							
In entry of standard	0	0	1	1	0	0	0
" calculating residual correction	1	0	2	3	0	3	0
" applying residual correction	1	0	0	1	0	9	0
" subtraction in subsidiary tables	0	0	0	0	0	0	0
" tabulation by subsidiaries	0	0	3	0	0	2	0
" irregular differences	0	0	3	0	0	2	0
<i>Result of 40 Remeasurements :—</i>							
Greatest difference - - -	·0040	·0040	·0040	·0040	·0040	·0050	·0040
Mean difference irrespective of sign - - -	·0020	·0023	·0016	·0016	·0020	·0021	·0018
Residual difference (— Kew) - - -	+ ·0009	+ ·0005	+ ·0007	+ ·0001	— ·0004	— ·0006	— ·0003
Mean monthly difference between simultaneous barograph and barometer readings - -	·0013	·0025	·0020	·0015	·0018	·0029	·0013

THERMOGRAPH:—

Action	Good.		Good.		Good.		Good.		Good.		Good.	
	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.
Photography - - -	0	0	0	0	0	0	0	0	0	0	0	0
Records deficient, due to stoppage of clock	0	0	0	0	0	0	0	0	0	0	0	0
" failure of light	0	0	0	0	0	0	0	0	0	0	0	0
" imperfectly moistened bulbs	0	0	0	0	0	0	0	0	0	0	0	0
" partially frozen	0	0	0	0	0	0	0	0	0	0	0	0
" other causes -	0	0	0	0	0	0	0	0	0	0	0	0
No. of errors discovered in entry of standard by subsidiary measurements -	0	0	0	0	0	0	0	0	0	0	0	0
" of subtraction in do. tables -	0	0	0	0	0	0	0	0	0	0	0	0
" detected under glass scale -	0	0	0	0	0	0	0	0	0	0	0	0
<i>Result of 40 Remasurements:—</i>												
Greatest difference - - -	0.20	0.10	0.10	0.20	0.20	0.10	0.20	0.10	0.20	0.10	0.20	0.20
Mean difference irrespective of sign -	0.02	0.01	0.05	0.04	0.04	0.02	0.04	0.04	0.05	0.03	0.07	0.04
Residual difference (— Kew) -	0.00	0.00	—0.02	0.00	+0.01	—0.01	+0.01	0.00	0.00	0.00	+0.01	0.00
Mean monthly difference between simultaneous thermograph and thermometer readings -	0.13	0.14	0.16	0.15	0.10	0.08	0.10	0.15	0.10	0.13	0.11	0.11
No. of errors in maxima and minima -	0	0	0	0	0	0	4	1	0	0	0	1

* Mr. Whipple examining instrument.

† Instrument out of order and under repair.

The following cheques for August were drawn on the 28th of that month, on the signature of Capt. Evans:—

For Office :				£	s.	d.		
R. H. Scott	-	Salaries and wages	-	66	13	4		
J. S. Harding, jun.	-		20	16	8			
J. S. Harding, sen.	-		* 7	14	0			
T. D. Bell	-		7	10	0			
Waterlow & Sons, Limited, Repairing Press, &c.				-	2	0	6	
For Observatories :								
Hopkin and Williams, chemicals	-	-	-	7	8	1		
J. E. Cullum, Valencia	-	-	-	13	6	8		
G. M. Whipple, verifications	-	-	-	14	9	6		
R. H. Curtis	Computations	-	-	14	3	4		
A. J. Rigby				† 5	15	6		
C. H. Thompson				* 5	16	0		
C. Stodart				* 8	8	0		
J. A. Curtis				10	0	0		
For Telegraphy :								
Postmaster General, telegrams for June	-	-	-	80	0	10		
N. J. Holmes, Scilly Co., July	-	-	-	4	8	0		
Rex & Co., "Weather Charts, &c."	-	-	-	12	10	0		
Wightman & Co., Printing, &c.	-	-	1	12	6			
" B.P. wrappers	-	-	7	0	0			
					8	12	6	
F. Gaster	Computations	-	-	15	16	8		
W. L. Dallas				9	3	4		
F. Brodie				8	0	0		
H. W. Chivers				3	6	0		
For Ocean Meteorology :								
H. Toynbee, Marine Superintendent	-	-	-	33	6	8		
R. Strachan	Computations	-	-	† 20	16	8		
C. Harding				15	0	0		
T. E. Allen				10	0	0		
H. Harries				7	14	0		
On Account :								
J. S. Harding, jun., Office Expenses	-	-	100	0	0			
" "	-	-	100	0	0			
				200	0	0		
R. H. Scott, Inspections	-	-	-	50	0	0		
Total				-	-	662	16	3

The following cheques for the month of September were drawn on the 2nd October, on the signature of Captain Evans:—

	£	s.	<i>d.</i>
For Office:			
R. H. Scott -	-	-	-
J. S. Harding, jun. } Salaries and Wages -	-	-	-
J. S. Harding, sen. }	-	-	-
T. D. Bell -	-	-	-
C. W. Jacques, rent - - -	-	-	-
W. Harmer and Son, repairs, &c. - -	-	-	-
E. Higgs, repairs, &c. - - -	-	-	-
Cashiers, Bank of England - - -	3	14	8
" books from Stationery Office - -	0	17	0
	<hr/>	<hr/>	<hr/>
		4	11 8
Carried forward - - -	-	-	-
	£251	15	1

* Four weeks to the 26th August.
† Three " "
‡ Including allowance for care of instruments.
§ Five weeks to the 30th September.

			£	s.	d.
	Brought forward	-	-	-	251 15 1
For Observatories, Quarterly Allowances, &c. :					
D. Thomson, Aberdeen	-	-	*54	9	5
„ postages	-	-	1	10	0
					55 19 5
T. R. Robinson, Armagh	-	-	40	14	0
„ expenses for quarter	-	-	8	5	5
					48 19 5
W. P. Dymond, Falmouth	-	-	-	-	*65 12 6
R. Grant, Glasgow	-	-	-	-	*61 17 6
H. Williams, Holyhead	-	-	-	-	2 13 5
G. M. Whipple, Kew	-	-	62	10	0
„ examination of returns	-	-	100	0	0
					162 10 0
C. Clouston, Orkney	-	-	-	-	2 10 0
G. H. Aird, Seaham	-	-	-	-	2 13 10
S. J. Perry, Stonyhurst	-	-	-	-	*49 7 6
J. E. Cullum, Valencia, salary	-	-	13	6	8
„ expenses for quarter	-	-	49	5	2
					62 11 10
G. T. Watson, Yarmouth	-	-	-	-	4 0 6
Hopkin and Williams, chemicals	-	-	9	5	6
„ „	-	-	1	5	10
					10 11 4
Malby and Sons, anemometer forms	-	-	-	-	6 5 0
R. W. Munro, fitting up instruments	-	-	-	-	4 16 6
P. Adie, barometers, &c.	-	-	-	-	27 6 6
K. I. Mark, S.R. rain-gauge	-	-	-	-	20 0 0
Negretti and Zambra, thermometers, &c.	-	-	-	-	79 17 0
R. H. Curtis	-	-	-	-	14 3 4
C. H. Thompson	-	-	-	-	†7 5 0
C. Stodart	-	-	-	-	†10 10 0
J. A. Curtis	-	-	-	-	10 0 0
For Telegraphy, Quarterly Allowances, &c. :					
W. McNeil, Ardrossan	-	-	0	13	0
„ for postmaster	-	-	0	6	6
					0 19 6
H. Todd, Cambridge	-	-	-	-	4 6 0
J. Costello, Dover	-	-	-	-	3 8 0
J. Tilston, Holyhead,	-	-	-	-	4 0 0
G. Mitchell, Kingstown	-	-	-	-	3 6 1
F. Gaster, London	-	-	-	-	3 5 0
J. Lowry, Merville	-	-	-	-	5 10 0
W. D. Penny, Nairn	-	-	-	-	4 17 4
E. J. Lowe, Notts	-	-	-	-	3 18 0
J. Lucas, Oxford	-	-	-	-	3 6 0
J. Merrifield, Plymouth	-	-	-	-	3 5 0
W. Sandford, Portishead	-	-	-	-	3 19 9
W. Thomas, Scilly	-	-	-	-	5 7 1
J. Smith, Stornoway	-	-	-	-	3 19 0
W. Brand, Shetlands	-	-	-	-	2 0 6
J. Trotter, Thurso	-	-	-	-	3 6 3
J. E. Cullum, Valencia	-	-	-	-	6 0 0
J. Sinclair, Wick	-	-	-	-	3 5 0
G. T. Watson, Yarmouth	-	-	-	-	4 2 0
C. Wakefield, York	-	-	-	-	3 6 1
F. Gaster	-	-	-	-	15 16 8
W. L. Dallas	-	-	-	-	9 3 4
F. Brodie	-	-	-	-	8 0 0
H. W. Chivers	-	-	-	-	†4 2 6
Carried forward	-	-	£1,073	4	9

* Deduction for forms, &c. supplied.

† Five weeks to the 30th September.

	£	s.	d.
Brought forward	-	-	1,073 4 9
For Ocean Meteorology :			
H. Toynbee, Marine Superintendent	-	-	33 6 8
P. Adie, Admiralty instruments	-	-	16 1 6
" Mercantile Marine instruments	-	-	88 7 0
			<hr/> 104 8 6
Negretti and Zambra, Admiralty instruments	-	-	63 17 6
" Mercantile Marine instruments	-	-	1 17 6
			<hr/> 65 15 0
Cashiers, Bank of England, Bermuda anemometer	-	-	1 15 8
J. H. Woodstock, packing cases	-	-	2 11 6
Street Brothers, advertisements	-	-	1 2 6
R. Strachan	-	-	*20 16 8
C. Harding	-	-	15 0 0
T. E. Allen	-	-	10 0 0
H. Harries	-	-	9 12 6
For Office Expenses :			
J. S. Harding, jun., on account	-	-	100 0 0
" "	-	-	80 0 0
			<hr/> 180 0 0
Total	-	-	<hr/> 1,518 3 9

The following cheques for October were drawn on the 21st of that month, on the signature of Capt. Evans :—

For Office :		£	s.	d.
R. H. Scott	} Salaries and wages	66	13	4
J. S. Harding, jun.		20	16	8
J. S. Harding, sen.		7	14	0
T. D. Bell		7	10	0
Thomas Toon, books	-	2	16	0
Williams & Norgate, books	-	2	8	0

For Observatories :

J. E. Cullum, Valencia	-	-	-	-	13	6	8
W. Marriott, Meteorological Returns	-	-	-	-	15	0	0
G. M. Whipple, Travelling	-	-	-	-	12	10	5
„ Postages, &c., June and August				2	8	9	
„ Verifications	-	-	-	-	24	18	6
					<hr/>		
					27	7	3
L. P. Casella, Instruments	-	-	-	-	30	17	6
J. J. Hicks, Solar Radiation Thermometers	-	-	-	-	2	10	0
F. Pastorelli, Thermometers	-	-	-	-	18	0	0
R. H. Curtis	-						
C. H. Thompson	-						
J. A. Curtis	-						
	} Computations			-	-	-	-
					14	3	4
					75	16	0
					10	0	0

For Telegraphy :

Postmaster-General, Telegrams for July	-	87	4	4
" Private Wire, Valencia	-	23	10	0
			<hr/>	110 14 4
S. M. Clare, Submarine Telegraph Co.	-	-	-	52 15 2
N. J. Holmes, Scilly Telegrams, August	-	5	14	3
" " September	-	5	17	0
			<hr/>	11 11 3
A. Adie & Son, Thermometer Screen	-	-	-	1 18 6
			<hr/>	
Carried forward	-	-	-	£434 8 5

* Including allowance for care of instruments.

† Four weeks to the 28th.

		£	s.	d.
Brought forward	-	434	8	5
F. Dangerfield, delivery of D. W. Charts	-	12	15	8
F. Gaster	-	15	16	8
W. L. Dallas	-	9	3	4
F. Brodie	-	8	0	0
H. W. Chivers	-	*3	6	0
Computations	-			

For Ocean Meteorology :

H. Toynbee, Marine Superintendent	-	33	6	8
McGregor & Co., Freight	-	1	10	6
G. M. Whipple, Verifications	-	6	6	6
"	-	17	15	6
J. R. Jones, Aberdeen Agent	-	24	2	0
Z. Scaping, Hull	-	4	5	6
D. McGregor & Co., Glasgow Agent	-	5	13	10
James Gill, Liverpool	-	6	10	0
Robt. Riviere, Binding Charts	-	22	0	9
R. Strachan	-	9	18	0
C. Harding	-	20	16	8
T. E. Allen	-	15	0	0
H. Harries	-	10	0	0
Computations	-	*7	14	0

For Office Expenses :

J. S. Harding, jun., on account	-	150	0	0
"	-	50	0	0
		200	0	0
Total	-	£844	8	0

Submitted—A copy of the Appendix to the Quarterly Weather Report for 1875, being the detailed observations from stations of the second order for the first four months of the year in question.

The Committee then adjourned.

116, Victoria Street, November 20, 1876.

PRESENT :

Mr. De La Rue in the Chair.

Mr. Galton. | Major-General Smythe.

Lieutenant-General Strachey.

The Director was in attendance.

The Minutes of last meeting (November 6) were read and confirmed.

The Committee, on consideration of Mr. Whipple's report on the state of the instruments, which have now been at work for nearly nine years, and which had not been inspected, except by Mr. Beckley, since 1869,—

Resolved—That it is evident that, owing to wear, the action of the atmosphere, and other causes, it is necessary to remove the instruments for thorough repair periodically, and that the set of spare instruments at Kew should be kept in readiness to replace any instrument in course of cleaning, and that the Glasgow instruments should be taken first.

Mr. Scott was instructed to communicate Mr. Whipple's report on each observatory to the respective superintendent.

* Four weeks to the 28th.

Submitted—A draft reply to the letter of the Colonial Office about Heligoland, which Mr. Scott was instructed to modify and re-submit to the Committee.

Mr. Scott submitted the following memorandum :—

MEMORANDUM on the STATE of the WORK in the OFFICE, and especially on the COST of SUNDAY TELEGRAPHY.

As the annual vacations of the staff are now at an end, I venture to submit to you a few remarks on the general condition of the work of the Office.

Marine Work.—In this department it cannot be said that the work has fallen into arrear, for the materials for discussion are so copious that we cannot speak of “arrears.” The staff are working regularly, and turn out as much as they can. An increase in their number would of course accelerate the production of results.

Land Meteorology.—In the *Pantagraph room* the work does not keep pace with the current production of the photographic curves. The delay is caused mainly by difficulties about the management of the zinc plates and the electrotypes. These difficulties are mechanical, and can be overcome, in fact I hope they *will* be overcome shortly; but it would be most desirable to have another clerk in that room to work at the pantographs, and set Mr. R. Curtis free to exercise general supervision, a duty which occupies much of his time at present.

I ought to say that much of the delay in this part of the work has arisen from the necessity of preparing new scales for the tabulation of the barograms and thermograms, to replace the original scales, found to be inaccurate.

The *numerical calculations* have fallen seriously into arrear, partly owing to illness, Mr. Cobley having been on sick leave 10 weeks, and Mr. John Curtis having been in a delicate state of health.

The discussion of the daily, five-day, and monthly results for the observatories does not take up quite the whole time of three clerks, working full time, but the preparation of the hourly tabulations occupies all their spare time, while the preparation of the returns for stations of the second order throws the work of the room into arrear.

There is absolutely no time available for any scientific discussion of the materials in the Office.

An extra clerk is much wanted in this room, to keep the current work up to date,—leaving the question of scientific discussions untouched.

Telegraphy.—The work of this room has grown so rapidly that it is now more strikingly the case that we are over-worked that it was last January, when I stated to the Treasury Committee that our time was occupied in working for newspapers, Daily Weather Reports and Storm Warnings, and that we had no spare time for discussion of scientific questions, or even examining into our past work. The only operations of this nature which are carried out are the writing of the chronicle of the Quarterly Weather Report, and the checking of Storm Warnings for the House of Commons.

The clerks in the room attend in two shifts :

The first, 8.30 a.m.—4.30 p.m. } This gives entire force of room daily from 1–4.30 p.m.
The second, 1 p.m.—9 p.m.

And on Sundays, 6–9 p.m.

The shifts change every week.

It is of course understood that the whole expense of this attendance does not fall on the Office, as the “Times” pays for all work after 5 p.m., but it will be admitted that a clerk who has been employed for eight hours a day at his regular semi-mechanical work, could not have much spare energy for scientific discussions.

Now as to the Sunday morning work. It requires two men. The cost of their services for five months, till April 1, will be 16*l*. If allowance be made to them for train or omnibus fare, an extra sum of, say, 2*l*. will be required. The cost of transmission of the reports from, say, 30 stations will be at least 22*l*. 10*s*. There will be extra charges for telegraphic overtime at some post offices, and of course, if the exchange of information with Foreign Offices be kept up on Sundays, the cost will be increased. On the whole the cost of the experiment for this winter will be at least 50*l*.

The Committee will, however, see that what has been said about tasking the energies of the clerks by their regular work of drawing charts, correcting telegrams, &c., &c., comes with still more force if Sunday service is thrown on the same men.

I have already partially provided for the due discharge of the telegraphic work by engaging one extra temporary clerk at 1*l*. per week, but if the Committee wish any real discussion of the materials for weather study which we possess to be undertaken extra assistance is urgently required.

November 17th, 1876.

ROBERT H. SCOTT.

P.S.—It may be advisable to draw the attention of the Committee to our present financial state, so as to show what funds are available to meet any increased charges for additional work (such as this Sunday work), and for the possible demand for 200*l*. a year (viz., 10*s*. per day) for the cost of telegrams to Germany.

The balance in hand, April 1, 1876, was about 900*l*.

The net expenditure, April 1–October 1, 1876, has been 5,042*l*., so that we have already reduced this balance by 42*l*.

No income will be derivable from interest on deposit this year.

I should, therefore, humbly suggest that it would be a dangerous measure to put a permanent charge on the small balance standing to our credit until such time as such increased expenditure shall have been guaranteed by the Treasury.

He further stated that the reports from certain stations arrived too late on Sundays to be of any use, owing to the fact of the local offices not opening until 9 (or 9.25 in Ireland), whereas the reports ought to reach London at 9 a.m. or very soon after, so as to allow of the issue of warnings before 10 a.m.

The expenditure of 50*l.* on Sunday Telegraphy during the current winter was sanctioned, and Mr. Scott was instructed to write to the Post Office to accelerate the messages as much as possible.

Mr. Scott was further instructed to arrange with Mr. Whipple for the relinquishment by Kew of the examination of the records and tabulations from all the observatories, (Minutes 1869, p. 103,) together with a reduction of the sum allocated to Kew by the Meteorological Office, and to propose that in future a sum of 400*l.* a year shall be given in lieu of the present sum of 650*l.*, (250*l.* Observatory, and 400*l.* examinations,) on condition that a qualified assistant be kept at the Observatory, ready to be sent wherever his services may be from time to time required.

Pending this change, Mr. Scott is authorised to take the necessary steps to bring up all arrears of work before the end of the financial year, 100*l.* being placed at his disposal for the present for that object.

Submitted—The following letters:—

Press copy 1,972.

DEAR SIR,

Meteorological Office, London, November 13, 1876.

My friend, Dr. Moore, tells me that he has communicated to you the substance of a conversation I had with him on the 23rd ult., relative to the publication of Meteorological Reports in your periodical returns. He has also sent me your note to him, so I think it is best to open direct communications with you.

We have, as you know, several stations in Ireland, and from these we could supply you with returns on the enclosed form, which extends over two pages, as you will see. It is the form recommended for international adoption by the Permanent Committee of the Vienna Meteorological Congress.

I should be glad to know how often your reports appear, and how the returns should be prepared.

If you will let me have this information I shall bring the matter before my Committee next Monday.

The stations we have in Ireland are:

A. Observatories recording continuously.—Armagh and Valencia.

B. Eye stations, observing 9 a.m. and 9 p.m. (inspected).—Dublin, Parsonstown, Rosenallis, Markree.

C. Telegraphic stations, observing 8, 2, 6, the 2 p.m. observations not regular.—Kingstown, Donaghadee, Moville, Valencia, Roche's Point.

I have some hopes that the number of these stations, especially of class B, will increase.

Yours, &c.

W. M. Burke, Esq., F.R.C.S.

(Signed) ROBERT. H. SCOTT.

M.O., 2,355.

5,210.

General Register Office, Dublin,
November 16, 1876.

DEAR SIR,

ALLOW me to thank you for your kind favour of the 13th inst.

Herewith are copies of our weekly and quarterly publications; for the former we should only require Dublin City, Kingstown, and Markree, as we hope to obtain returns from the Queen's Colleges in Belfast, Cork, and Galway. The accompanying forms are submitted for your consideration, and, if approved of, I shall have them printed, and, together with addressed envelopes, forwarded to the various stations.

I need scarcely say how thankful I shall be if your Committee will sanction the furnishing me with such valuable returns.

I remain, &c.

R. H. Scott, Esq., F.R.S.

(Signed) W. M. BURKE.

Mr. Scott was instructed to inform Dr. Burke that the Committee would be happy to furnish him with information as far as lay in their power to do so, and was authorised to make such arrangements as may be necessary.

Submitted—An application for special telegraphic information to be supplied daily to the Central Press Association for transmission to their subscribers.

It was resolved that any new information, not prepared for the regular operations of the Office, should be supplied to any applicant on condition that in addition to the actual cost to the Office a sum to cover contingencies be charged, Mr. Scott to fix the scale of payment and to report at next meeting.

Mr. Scott submitted the following particulars of information at present supplied, with a proposed scale of payment for consideration next meeting :—

WEATHER INFORMATION SUPPLIED.

Recipient.	Information.	Payments.	
		Present.	Proposed.
NEWSPAPERS.			
Times - - -	Special morning Chart - - -	1s. 6d. each	1s. 6d. each.
	Six o'clock evening Reports - - -	Specially paid.	
	MS. copy "Reports," Remarks, D. W. Charts -	Nil	Nil.
Shipping Gazette -	Special morning Chart - - -	Nil	1s. 6d. each.
	MS. copy "Reports," Remarks, D. W. Charts -	Nil	Nil.
Standard - - -	Do. do. do. - - -	Nil	Nil.
Echo - - -	Remarks only - - -	Nil	Nil.
Globe - - -			
Pall Mall Gazette -			
Daily News - - -	D. W. Charts and 2 p.m. Observations - - -	Nil	Nil.
Advertiser - - -	Special Telegrams - - -	Nil	6d. each.
Saunders' News -			
Sunderland Daily Post -			
ASSOCIATIONS, &c.			
Reuters - - -	MS. copy of Reports, and Remarks - - -	Nil	Nil.
Lloyds' - - -			Sent in exchange } for Lloyds' List. }
Liverpool Underwriters -	Special telegrams - - -	Nil	6d. each.
Central News - - -			
INDIVIDUALS.			
Lee & Sons - - -	MS. Reports, with Remarks - - -	50s. annually	50s. annually.
Patent Type Co. -	Special morning Chart, and Remarks - - -	1s. 6d. each	1s. 6d. each.
	Diagrams, weekly, and Remarks for "Lloyds,"	8s. weekly	8s. weekly.
	"Graphic," and "Observer" - - -		
Occasional Applicants -	Information as to past weather - - -	According to information required, 10 per cent. additional to actual cost of clerk's time. Minimum charge, 2s. 6d.	

Read—A letter from from Captain Toynbee, submitting an "excellent" log by Captain W. H. Smith, R.N.R., s.s. "Peruvian," (Minutes, p. 107).

Mr. Scott was instructed to convey the marked thanks of the Committee to Captain Smith.

Mr. Scott reported that he proposed to employ the logs of the lighthouses and light-ships in the checking of storm warnings for 1876, in order to get more complete reports of wind at night-time than were now available. He had applied to the three lighthouse boards for the loan of their logs, and had received favourable replies from the Trinity House and the Irish Lights Office, but the Secretary of the Northern Lights had declined to allow the logs in his possession to leave his office (Letter 2369), but referred him to Mr. Buchan, to whom he was instructed by the Committee to apply.

Mr. Scott drew the attention of the Committee to the fact that the Office had a supply of instruments and a paid observer at Jersey, and asked for permission to obtain telegraphic reports, as he understood that the cost would now be only 1s. per message.—Sanctioned.

Reported—That Mr. W. E. Brodie had been engaged as a temporary clerk at 1l. per week, to relieve the pressure in the telegraph room as mentioned in the above report.

Submitted—The Programme and Byelaws proposed by the Permanent Committee, for the next International Congress, to be held at Rome in September 1877.

The Committee then adjourned.

116, Victoria Street, December 4, 1876.

PRESENT:

Major-General Smythe in the Chair.

Mr. De La Rue.
Captain Evans.

Mr. Galton.
Lieut.-General Strachey.

The Director was in attendance.

The Minutes of last meeting (November 20) were read and confirmed.

Submitted—The following Memorandum:

I BEG to express my sincere thanks to the Committee for permitting me to expend the sum of 100*l.* on completing the arrears of calculation in connexion with Land Meteorology and Telegraphy.

I think it may be satisfactory to sketch out the work to which I propose to devote this sum:—

1. Calculation of Five Day and Monthly Means for the year 1875. Tables I. and II. for the Quarterly Weather Report. (This is partly done.)
2. Similar calculations for the year 1876.
3. The year 1875, being the last of a "lustrum," I propose to calculate the simple arithmetical mean (for civil time) of each value in the above-mentioned Tables I. and II. for the five years 1871–5 inclusive. This will practically ignore the years 1869–70, but the advantages obtained by the use of lustra for means overbalances this defect.
4. I propose to calculate the Monthly Mean Temperature at 8 a.m. for the Telegraphic Reporting Stations for the same five years.
5. I propose to calculate the Daily Mean Temperature from maximum and minimum readings, for the last four of the years in question.

These operations will clear off all the simple "meaning" work which it seems incumbent on the Office to publish, up to the end of 1875, and I have hopes that it will all be completed for the sum allotted to me.

ROBERT H. SCOTT.

Reported—That the following reply had been sent to the letter of the Board of Trade (Minutes, p. 112):—

M.O. 2080.

I AM instructed by the Committee to inform you, in reply to your letter of the 7th ult. (No. 13466), that they recognise fully the importance of a reporting station in Heligoland to Germany and Eastern Europe in general. To this country the value of such a station is not so great, but if reports could be received from thence regularly and at a reasonable rate, the Committee would be willing to maintain a station there on their own system. In fact Admiral FitzRoy formerly had a station there, but it was discontinued on the fracture of the direct cable early in January 1865; since which date all telegraphic communication with the island has been *via* Germany. But as there seems to be no probability of such reports being obtained at a reasonable rate, the Committee would be disposed to recommend that Governor Maxse should be authorised to establish a station at Heligoland on the German system; in which case the sum of 40*l.* is mentioned by Dr. Neumayer as the cost of outfit if the instruments be procured from the Seewarte at Hamburg.

The Committee would, however, remark that the cost of outfit supplied by the Meteorological Office to their own telegraphic Reporting Stations in the United Kingdom is less than the sum above named, being only 20*l.*, even if an anemometer be supplied, as is shown by the following list:—

2 Barometers	-	-	-	-	-	£8	0	0
3 Thermometers (2 for Psychrometer and 1 spare)	-	-	-	-	-	1	1	0
2 Registering thermometers, maximum and minimum	-	-	-	-	-	2	2	0
1 Thermometer screen	-	-	-	-	-	1	15	0
1 Raingauge	-	-	-	-	-	2	0	0
						<hr/>		
						£14	18	0

An anemometer could be supplied extra at a cost of 5*l.* The Committee supply all forms and registers gratis.

With reference to the estimate of 60*l.* for "a signal mast with extra apparatus," the Committee can offer no opinion, as no detailed explanation of what is proposed has been given by Governor Maxse.

The allowance of 18*l.* a year to the Observer seems to the Committee to be reasonable, though they themselves are only able to afford about 13*l.* to their Telegraphic Reporters.

Mr. Scott stated that he was not yet in a position to state exactly the cost of Sunday telegraphy, but that he had written to all the offices to request them to open at 8 a.m., Greenwich time, and offering to pay any extra fees which might be required. Several of the postmasters had waived their right to a fee for the service, but all replies had not yet been received.

He further stated that the cost of transmission of the regular messages sent from London to the Continent was about 10s. daily in the case of the Paris Observatory, and about 5s. daily in the case of the messages to Christiania and Copenhagen. He was authorised to transmit these messages on Sundays up to the end of March 1877 at a total cost of about 14l.

At the same time the Committee decided that they could not undertake to bear any expense in the present financial year in connexion with the proposed exchange of information with Germany.

Read—The following letter:—

9265.

SIR,

Stationery Office, November 25, 1876.

REFERRING to your requisition of the 29th January last, for printing the "Remarks to accompany the Monthly Charts, &c.," I beg to acquaint you that the selling price of this work will be 24s. per copy, and that I am unable to supply you with 1,250 copies, or any larger number than 50 without special Treasury sanction.

I am, &c.

R. H. Scott, Esq., F.R.S.

(Signed) H. G. REID,

Meteorological Office.

for Comptroller.

Mr. Scott stated that he had at once forwarded a copy of the letter to Mr. Farrer, who had replied to the effect that the Committee ought to refer the matter to the Treasury.

He explained that no objection to the number of copies had been raised when the requisition was sent in to the Stationery Office in January, and that the number of copies requested was the same as had been supplied in the case of the work on Square III. (Official No. 20).

He was instructed to apply to the Treasury for permission to receive the copies.

Read—A letter from the Board of Trade applying for the estimates for the Office for the financial year 1877–8.

Mr. Scott was instructed to inform the Board of Trade that the sum required by the Committee for the ensuing financial year would be 10,000l., being the same sum as was voted during the current year.

The following detailed estimate was ordered to be printed on the Minutes:—

METEOROLOGICAL OFFICE ESTIMATES for the Year 1877–8.

	Proposed for 1877–8.	Voted for 1876–7.	1877–8.			
			Increase.		Decrease.	
	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.	£ s. d.
OFFICE:						
Salaries and wages - - -	1,400 0 0	1,370 0 0	30 0 0	—	—	—
Rent, fuel, fittings, &c. - - -	570 0 0	650 0 0	—	80 0 0	80 0 0	—
Office expenses - - -	320 0 0	250 0 0	70 0 0	—	—	—
LAND METEOROLOGY:						
Expenses at observatories - - -	2,230 0 0	2,400 0 0	—	170 0 0	170 0 0	—
Computations - - -	1,100 0 0	900 0 0	200 0 0	—	—	—
Telegraphy - - -	1,360 0 0	1,680 0 0	—	320 0 0	320 0 0	—
Daily Weather Charts, Inspections, &c. - - -	220 0 0	450 0 0	—	230 0 0	230 0 0	—
Computations - - -	820 0 0	650 0 0	170 0 0	—	—	—
OCEAN METEOROLOGY:						
Marine Superintendent - - -	400 0 0	400 0 0	—	—	—	—
Instruments, Admiralty - - -	220 0 0	250 0 0	—	30 0 0	30 0 0	—
Ditto Mercantile Marine - - -	260 0 0	200 0 0	60 0 0	—	—	—
Computations and care of instruments - - -	1,100 0 0	800 0 0	300 0 0	—	—	—
Totals - - -	10,000 0 0	10,000 0 0	830 0 0	830 0 0	830 0 0	—

Mr. Scott reported that he had communicated to Mr. Whipple the resolution of the Committee taken at last meeting (p. 131), and had received the following reply:—

M.O. 2484.

SIR,

Kew Observatory, Richmond, December 2, 1876.

I HAVE to acknowledge the receipt of yours of the 28th November, and would beg to state in reply that the Kew Committee accept the proposal contained in the resolution of the Meteorological Committee with reference to the future relations to exist between the Kew Observatory and the Meteorological Office.

I have also to state that in consequence, the work of examining the records of the S. R. Observatories terminated here with the completion of the October work, and that I will take steps forthwith to forward all documents received since that period, together with the forms and appliances employed in the operation of checking, to your office at the earliest opportunity.

R. H. Scott, Esq., F.R.S.

I am, &c.
(Signed) G. M. WHIPPLE,
Superintendent.

Read—The following letter :—

SYNOPTIC METEOROLOGICAL CHARTS.

India Office, November 26, 1876.

CAPTAIN HOFFMEYER having raised the question whether it will be desirable to change the scale of the synoptic maps that he has been publishing, has led me to consider the general subject of the preparation of such maps, and I desire to submit my conclusions to the Committee.

I am strongly impressed with the value that charts of this sort possess, and feel satisfied that it will be chiefly by their improvement, and by their careful study, that progress will be made in a knowledge of the causes of the variations of atmospheric conditions which are among the chief matters dealt with by Meteorology.

I think, therefore, that it will be a proper step for the Committee to take, to set about the preparation of type charts of this description, with a view of suggesting the adoption by other countries of a common uniform system of recording meteorological phenomena in this way, and of distributing the area to be dealt with among them, in a way that shall, as far as possible, prevent useless repetition of labour.

I am at present disposed to think that the charts should follow nearly the system adopted for our daily reports, with separate maps for pressure, temperature, wind, and condition of sky, and rain. Further, it seems to me, that those features of the surface configuration which are of practical importance in determining the direction of wind, or otherwise affecting the atmosphere, should be shown on the maps, and that this would require the insertion of the chief mountain ranges, and of the depths of the sea in the oceanic regions.

I do not think that the scale of Capt. Hoffmeyer's present charts is too large for the purpose of the primary delineation of the phenomena, though in the end some less detailed charts on a smaller scale would very likely serve usefully in presenting to the eye the general character of the variations of conditions over large areas.

Further it seems to me that a practically useful result is more likely to be attained by our at once taking the initiative in the way I suggest, than by preliminary discussions which might lead to nothing.

All that I now propose is that the subject shall be considered, and type charts prepared, on such system as further discussion might indicate to be most convenient, and that when this has been done the question shall be further gone into, as to how other countries shall be invited to co-operate in the arrangement.

It occurs to me as likely to be the best way of effecting what I have in view, if it be generally approved by the Committee, that the matter shall be referred to a small sub-committee, of which I should be ready to be a member.

(Signed) R. STRACHEY.

A Sub-Committee was appointed to consider the subject, consisting of General Strachey, Mr. Galton, and Captain Evans.

Mr. Scott was instructed to apply to the Science and Art Department for the return of the self-recording apparatus in the Loan Exhibition (p. 99).

Submitted—Applications for a public barometer for Dublin, from Staff-Commander W. W. Kiddle—Refused.

And for a fishery barometer for Sunderland Coast Guard Station, from Capt. Johnson, Inspecting Commander—Granted.

Read—A letter from Captain Toynbee submitting "excellent logs" kept by:

Captain R. D. Lunham, s.s. "Sumatra" (Minutes 1875, p. 45).

" A. Simpson, schooner "Traveller" (Minutes 1875, p. 83).

" W. Watson, s.s. "Algeria" (Minutes 1876, p. 87).

" W. J. L. Wharton, R.N., H.M.S. "Fawn." Log kept by Sub-Lieutenant G. C. Frederick.

Mr. Scott was instructed to express the marked thanks of the Committee to the above gentlemen.

BAROGRAPH:—

Action	Good. Do.	Good. Do.	Good. Do.	Good. Do.	Good. Do.	Good. Do.
Photography	0	0	0	0	0	0
Records deficient, due to stoppage of clock	0	0	0	0	0	0
failure of light	0	0	0	0	0	0
other causes	17 hrs.†	0	0	0	0	0
No. of errors discovered—						
In entry of standard	0	1	4	0	3	0
calculating residual correction	0	2	3	0	4	1
applying residual correction	0	0	2	0	1	1
subtraction in subsidiary tables	0	0	0	0	0	0
tabulation by subsidiaries	0	0	0	0	0	0
irregular differences	3	0	2	0	0	0
<i>Result of 40 Remeasurements :—</i>						
Greatest difference	·0050	·0050	·0050	·0040	·0040	·0040
Mean difference irrespective of sign	·0012	·0019	·0026	·0019	·0021	·0018
Residual difference (— Kew)	+ ·0002	+ ·0005	+ ·0008	—	—	+ ·0003
Mean monthly difference between simultaneous barograph and barometer readings	·0018	·0017	·0018	·0023	·0022	·0011

THERMOGRAPH:—

Action - Photography	Good. Do.		Good. Do.		Good. Do.		Good. Do.		Good. Do.	
	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.
Records deficient, due to stoppage of clock	0	0	0	0	0	0	0	0	0	0
failure of light -	6 hrs.	0	0	0	0	0	0	0	0	0
imperfectly moistened	0	0	0	0	0	0	0	0	0	0
bulbs	0	0	0	0	0	0	0	0	0	0
partially frozen	0	0	0	0	0	0	0	0	0	0
other causes	0	0	0	0	0	0	0	0	0	0
No. of errors discovered in entry of standard	0	0	0	0	0	0	0	0	0	0
by subsidiary measurements	0	0	0	0	0	0	0	0	0	0
by subtraction in do. tables	0	0	0	0	0	0	0	0	0	0
detected under glass scale	0	0	0	0	0	0	0	0	0	0
<i>Result of 40 Remasurements :</i>										
Greatest difference	0.20	0.20	0.10	0.10	0.20	0.20	0.20	0.20	0.20	0.10
Mean difference irrespective of sign	0.07	0.08	0.04	0.03	0.06	0.07	0.06	0.07	0.03	0.04
Residual difference (— Kew)	-0.02	-0.07	+0.01	+0.01	-0.04	+0.01	-0.03	-0.02	+0.01	0.00
Mean monthly difference between simultaneous thermograph and thermometer readings	0.12	0.13	0.13	0.17	0.06	0.11	0.11	0.12	0.12	0.10
No. of errors in maxima and minima	2	0	0	1	0	0	0	0	2	1

* Curves from 19th to 31st tabulated at Kew.

† Shield displaced.

Reported—That the following gentlemen had been appointed temporary clerks in consideration of the increase of work to the Office, owing to the transference of the examination of records from Kew to the Office :

Mr. E. G. Aldridge, at 25s. per week.

Mr. A. H. Bell, at 12s. 6d. „

—Approved.

The following cheques for November were drawn on the 24th of that month, on the signature of General Smythe :—

For Office :		£	s.	d.
R. H. Scott	Salaries and wages	66	13	4
J. S. Harding, jun.		20	16	8
J. S. Harding, sen.		*7	14	10
T. D. Bell		7	10	0
J. Rowsell, books		2	4	0
T. Toon		1	6	6
For Observatories :				
J. E. Cullum, Valencia		13	6	8
Malby & Sons, anemometer forms		3	12	6
R. H. Curtis	Computations	14	3	4
C. H. Thompson		*5	16	0
J. A. Curtis		10	0	0
For Telegraphy :				
Postmaster-General, telegrams, August, &c.		142	7	1
N. J. Holmes, Scilly telegrams, October		5	6	9
F. Gaster	Computations	15	16	8
W. L. Dallas		9	3	4
F. Brodie		8	0	0
H. Chivers		*3	6	0
For Ocean Meteorology :				
H. Toynbee, Marine Superintendent		33	6	8
J. H. Woodstock, packing cases		4	17	0
R. Strachan	Computations	†20	16	8
C. Harding		15	0	0
T. E. Allen		10	0	0
H. Harries		*7	14	0
For Office Expenses :				
J. S. Harding, jun., on account		120	0	0

* Four weeks to the 25th.

† Including allowance for care of instruments.

The Committee then adjourned.

116, Victoria Street, December 18, 1876.

PRESENT:

Major-General Smythe in the Chair.

Mr. Galton.

Lieut.-General Strachey.

The Director was in attendance.

The Minutes of last meeting (December 4) were read and confirmed.

Reported—That the following letter had been forwarded as directed at last meeting:—

SIR,

Meteorological Office, 116, Victoria Street,
December 7, 1876.

I AM instructed by the Meteorological Committee to forward to you the enclosed copy of a letter received by them from the Stationery Office, and to request that the Treasury will be pleased to grant the required permission.

The number of 1,500 copies of the work in question was the same as that printed by the Stationery Office of the former work, "Charts of Meteorological Data for Square 3, Lat. 0°–10° N., Long. 20°–30° W.," and "Remarks to accompany the Monthly Charts, &c.," of which 1,250 copies were received at the Meteorological Office of the Charts, and 750 of the Remarks, for free distribution, and 250 retained for sale.

The copies are wanted for exchange with scientific institutions and scientific men at home and abroad in return for their publications, and also for presentation to the officers in the Royal Navy and Mercantile Marine who observe gratuitously for the Office, and who have furnished the materials from which the work has been constructed.

The number ordered was also intended to obviate the possibility of a reprint being wanted.

The Secretary of the Treasury.

I am, &c.
(Signed) ROBERT H. SCOTT,
Director.

9265.

SIR,

Stationery Office, November 25, 1876.

REFERRING to your requisition of the 29th January last for printing the "Remarks to accompany the Monthly Charts, &c.," I beg to acquaint you that the selling price of this work will be 24s. per copy, and that I am unable to supply you with 1,250 copies, or any larger number than 50, without special Treasury sanction.

R. H. Scott, Esq.,
Meteorological Office.

I am, &c.
(Signed) H. G. REID,
for Controller.

Reported—in connexion with the supply of information to the General Register Office, Dublin—That Dr. Burke wished to have the materials for his Weekly Returns furnished on Mondays, and that as it had been explained to that gentleman that it would be impossible for the Office to furnish the information in a revised condition for publication by that date, he had proposed (Letter 2576) that the information should be supplied direct from the stations to his office, and printed in the Weekly Return as "unrevised," the figures as revised by the Meteorological Office appearing in the Quarterly Return.

Mr. Scott was authorised to accede to this proposal.

Reported—That, in pursuance of the instructions given at last meeting, a letter had been written to Dr. Neumayer, suggesting that, as the Committee could not bear any expense for the transmission of telegrams from Germany, the service from England to the Seewarte should commence at once at the expense of the latter institution. Dr. Neumayer had readily acceded to this proposal, and the service had already been set on foot.

Reported—That Professor Houzeau, director of the Brussels Observatory, had written (Letter 2581) to propose an exchange of telegrams between London and Brussels, and that Mr. Scott had replied to him according to the tenour of his last communications with Dr. Neumayer, but suggesting that possibly he might obtain the English reports *gratis* from Paris.—Approved.

Reported—That the Submarine Telegraph Company had refused to grant any reduction on their charges for the transmission of messages to Germany, as is shown by the following letter:—

M.O. 2554.

Submarine Telegraph Company,
December 8, 1876.

SIR,

I AM sorry I have been unable to reply sooner to your letter of the 6th ult.

As far as I understand your letter, you appear to be under the impression that we have reduced our ordinary rate for the transmission of Meteorological Office telegrams for Paris. This is not the case. It is true that the Meteorological messages transmitted from London to Paris are subject only to a charge of 1s. 8d., while 3s. 4d. is the ordinary rate for similar messages received from the public, but then this reduction of 1s. 8d. is borne by the French Administration and not by this company.

If the German Administration consents to make any abatement of its proportion of the charge for messages to Hamburg, this company, of course, has nothing to say in the matter; but so far as the

tariff which is applicable to this company, the German Union Telegraph Company, and to the Post Office, forms a part of the charge of the messages in question, I am afraid there will be great difficulty in getting all parties interested in this tariff to agree to any reduction in the charge for the transmission of Meteorological messages to Hamburg.

I am, &c.
(Signed) S. M. CLARE,
Secretary.

R. H. Scott, Esq.

Mr. Scott was instructed to make arrangements for the despatch of post cards from certain of the signal stations, stating at what hour each warning reached them, in order to ascertain the efficiency of the existing arrangements for distribution of the warnings.

Read—A letter from Captain Toynbee, submitting excellent logs kept by—

Captain A. H. Blackie, R.N.R., ship "Melpomene," (Minutes, p. 44.)

" A. J. Brown, barque "Maroon," (Minutes, p. 99.)

" Allen Young, s.s. "Pandora," R.Y.S. (Minutes, p. 29.) Log kept by Mr. A. C. Horner.

Mr. Scott was instructed to express the marked thanks of the Committee to these gentlemen.

Reported—That the arrangements for the transference of the examination of the records of the observatories from Kew to the Office had been completed, and the furniture belonging to the Committee at Kew had likewise been returned.

Submitted—An application from the Forest Academy of Neustadt Eberswalde (Prussia) for an exchange of publications.—Granted.

Reported—That the following names had been placed on the free list for the Daily Weather Charts:—

Margate, for exhibition.

Rev. G. H. Mullins, in return for observations.

The following cheques for December were drawn:—

For Office:

R. H. Scott	-	} Salaries and wages	£	s.	d.
J. S. Harding, jun.	-		66	13	4
J. S. Harding, sen.	-		20	16	8
T. D. Bell	-		* 7	14	0
			7	10	0

For Observatories:

R. H. Curtis	-	} Computations	£	s.	d.
C. H. Thompson	-		14	3	4
E. J. Aldridge	-		* 5	16	0
J. A. Curtis	-		† 1	5	0
			10	0	0

For Telegraphy:

F. Gaster	-	-	-	-	15	16	8
W. L. Dallas	-	-	-	-	9	3	4
F. Brodie	-	-	-	-	8	0	0
H. W. Chivers	-	-	-	-	* 3	6	0

For Ocean Meteorology:

Capt. H. Toynbee, Marine Superintendent	-	-	-	-	33	6	8
R. Strachan	-	-	-	-	† 20	16	8
C. Harding	-	-	-	-	15	0	0
T. E. Allen	-	-	-	-	10	0	0
H. Harries	-	-	-	-	* 7	14	0

For Office Expenses:

J. S. Harding, jun., on account	-	-	-	-	50	0	0
					£307	1	8

The Bank of England had charged 4*l.* 3*s.* 4*d.* for 1,000 cheques.

* Four weeks to the 23rd instant.

† One week to the 23rd instant.

‡ Including allowance for care of instruments.

The Committee then adjourned.

LONDON:

Printed by GEORGE E. EYRE and WILLIAM SPOTTISWOODE,

Printers to the Queen's most Excellent Majesty.

For Her Majesty's Stationery Office.

[—50.—1/77.]

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Reported—That the following cheques for the month of December were drawn on the 20th of that month, on the signature of Mr. De La Rue:—
For Office: Atkinson & Co., Furniture
Priest Brothers
O. W. Jacques, rent
J. Wheldon, books
For Observatories, Quarterly Allowances, &c.: D. Thomson, Aberdeen
Sanger's Bill for repairs
MINUTES OF THE PROCEEDINGS

OF THE
METEOROLOGICAL COMMITTEE.

116, Victoria Street, January 1, 1877.

PRESENT:

Mr. De La Rue in the Chair.

Rear-Admiral Richards.

Lieut.-General Strachey.

The Director was in attendance.

The Minutes of last meeting (December 18) were read and confirmed.

Read—The following letter:—

M.O. 2858. 19,446.

SIR,

Treasury Chambers, December 29, 1876.

I AM directed by the Lords Commissioners of Her Majesty's Treasury to acquaint you, in reply to your letter of the 7th inst., for the information of the Meteorological Committee, that their Lordships have desired the Comptroller of the Stationery Office to supply to your Department 1,250 copies in all of the "Remarks to accompany the Monthly Charts, &c.," referred to in your letter.

I am, however, to state that their Lordships' sanction is given on the understanding that the gratuitous distribution of this work is expressly confined to cases of exchange with scientific institutions and scientific men at home and abroad in return for their publications, and also of presentation to the officers in the Royal Navy and Mercantile Marine, who observe gratuitously for the Office, and who have furnished the materials from which the work has been constructed.

I am, &c.

The Director

of the Meteorological Office.

(Signed) R. R. W. LINGEN.

Mr. Scott was instructed to revise the list of persons to whom the publications of the Office are sent, in accordance with the wishes of the Treasury.

Reported—That the arrangements with the Registrar-General for Ireland had been concluded as directed at last meeting, and that the following stations would supply weekly returns to that officer:—

Armagh, Dublin, Markree, Parsonstown.

Read—Letter 2818 from Professor Grant criticizing Mr. Whipple's Report on Glasgow Observatory (Minutes, 1876, p. 117).

Mr. Scott was instructed to forward the letter to Mr. Whipple for his remarks thereupon.

Read—Letter 2677 from Mr. Perry asking for an increase of the allowance to Stonyhurst Observatory from 200*l.* to 250*l.* per annum, so as to be equal to the normal allowance of the observatories.

Mr. Scott was instructed to inform Mr. Perry that the Committee was disposed to consider his application favourably, but that until they know the decision of the Government in reference to the Treasury Committee's Report, they are unable to increase the expenditure of the Office.

Read—A letter from Captain Toynbee submitting an "excellent" log kept by Captain James Buchan, barque "Commewyne."

Mr. Scott was instructed to present him with the Wind and Current Charts.

It was resolved—That a present of books be made to Mr. A. C. Horner, yacht "Pandora."

Reported—That the following cheques for the month of December were drawn on the 29th of that month, on the signature of Mr. De La Rue :—

For Office :			£	s.	d.	£	s.	d.
Atkinson & Co., furniture	-	-	18	18	0			
„ „ „	-	-	2	1	0			
						20	19	0
Priest Brothers	-	-	-	-	-	5	12	0
C. W. Jacques, rent	-	-	-	-	-	133	13	0
J. Wheldon, books	-	-	-	-	-	1	18	6
Williams and Norgate, books	-	-	-	-	-	1	14	10
For Observatories, Quarterly Allowances, &c. :								
D. Thomson, Aberdeen	-	-	*61	17	6			
„ Sangster's bill for repairs	-	-	0	12	6			
						62	10	0
T. R. Robinson, Armagh	-	-	40	14	0			
„ expenses for quarter	-	-	8	9	6			
						49	3	6
W. P. Dymond, Falmouth	-	-	-	-	-	*65	12	6
R. Grant, Glasgow	-	-	-	-	-	*61	15	0
H. Williams, Holyhead	-	-	-	-	-	3	3	5
G. M. Whipple, Kew	-	-	87	10	0			
„ examination of returns (October)	-	-	33	6	8			
„ postages, &c. (3 months)	-	-	1	3	3			
						121	19	11
C. Clouston, Orkney	-	-	-	-	-	3	3	9
G. H. Aird, Seaham	-	-	-	-	-	2	13	10
S. J. Perry, Stonyhurst	-	-	*49	7	6			
„ postages (6 months)	-	-	0	12	2			
						49	19	8
J. E. Cullum, Valencia, salary	-	-	13	6	8			
„ expenses for quarter	-	-	53	10	2			
						66	16	10
G. T. Watson, Yarmouth	-	-	-	-	-	4	3	9
J. O'Driscoll, rent at Valencia	-	-	-	-	-	50	1	0
P. Adie, barometers for Christiania, &c.	-	-	-	-	-	37	5	0
For Telegraphy, Quarterly Allowances, &c. :								
H. Todd, Cambridge	-	-	-	-	-	4	6	0
J. Costello, Dover	-	-	-	-	-	3	6	0
J. Tilston, Holyhead	-	-	-	-	-	3	18	0
The Postmaster, Inverness	-	-	-	-	-	2	19	0
G. Mitchell, Kingstown	-	-	-	-	-	3	6	3
F. Gaster, London	-	-	-	-	-	3	5	0
J. Lowry, Moville	-	-	-	-	-	6	0	4
W. D. Penny, Nairn	-	-	-	-	-	4	13	6
E. J. Lowe, Notts	-	-	-	-	-	3	18	0
J. Lucas, Oxford	-	-	-	-	-	3	6	6
J. Merrifield, Plymouth	-	-	-	-	-	3	5	0
W. Sandford, Portishead	-	-	-	-	-	3	19	0
W. Thomas, Scilly	-	-	-	-	-	4	19	3
J. Smith, Stornoway	-	-	-	-	-	3	19	0
W. Brand, Sumburgh Head	-	-	-	-	-	2	17	6
J. Trotter, Thurso	-	-	-	-	-	3	6	4
J. Sinclair, Wick	-	-	-	-	-	3	5	0
G. T. Watson, Yarmouth	-	-	-	-	-	4	6	3
C. Wakefield, York	-	-	-	-	-	3	5	9
The Postmaster-General, September	-	-	130	9	10			
„ „ October	-	-	127	0	0			
						257	9	10
Carried forward	-	-				£1,071	17	0

* Deductions made for forms, &c. supplied.

		£	s.	d.
Brought forward	-	-	1,071	17 0
For Telegraphy, Quarterly Allowances, &c.— <i>cont.</i>				
N. J. Holmes, Scilly, November	-	-	5	5 6
The Postmaster-General, P.O.O. for Capt. Hoffmeyer	-	-	13	3 8
Malby and Sons, printing, &c.	-	-	8	12 6
The Patent Type Founding Co., blocks	-	-	3	3 0
Wightman & Co., B.P. wrappers	-	-	7	0 0
For Ocean Meteorology :				
P. Adie, repairing "A." instruments	-	-	17	14 4
" " "B.T." "	-	-	7	0 6
				24 14 10
L. P. Casella, rain gauges	-	-	24	0 0
For Office Expenses :				
J. S. Harding, jun., on account	-	-	150	0 0
" " "	-	-	50	0 0
Total			£1,357	16 6

The Committee then adjourned.

116, Victoria Street, January 15, 1877.

PRESENT :

Mr. De La Rue in the Chair.

Captain Evans. | Mr. Galton.

The Director was in attendance.

The Minutes of last meeting (January 1) were read and confirmed.

Read—Letter 150, being Mr. Whipple's reply to Professor Grant's letter mentioned at last meeting.

Mr. Scott was instructed to write to Professor Grant as follows :

"The Committee have under consideration Professor Grant's comments on Mr. Whipple's report, and a rejoinder thereto from Mr Whipple, and I am instructed to say that there evidently exists some misunderstanding on both sides. Not wishing to prolong a controversy which might not lead to any satisfactory conclusion, they would ask Professor Grant to be so good as to direct his assistants to keep the lenses and other parts of the instruments free from dust, as it forms no part of an inspector's business to clean apparatus.

"He is furthermore requested to inform the Office immediately whenever any portion of the apparatus gets out of order."

Submitted—The following letters :

Mo. 171.

Hamburg, January 9, 1877.

It appears not to have come to the certain knowledge of the Meteorological Office that the German Seewarte, in order to comply with the expressed wish of that Office, has extended its investigation of the North Atlantic Ocean, which was undertaken some time ago, southwards to the 20th parallel of latitude.

The Seewarte therefore has the honour of stating that, now, that portion of the Atlantic Ocean lying between 20° and 50° N. latitude, from coast to coast, is under discussion by it. The material collected here, as well as that supplied by the Royal Meteorological Institute of the Netherlands for the eastern portion of the above district, to 30° W. long. is nearly completely extracted;

but in order to attain greater certainty in the results, the Seewarte is very desirous to be able to utilize the observations collected at the London Office. It therefore begs to inquire whether the material existing there can be placed at the disposal of the Seewarte in order to be incorporated with work on the above-named district.

In case this is possible, the Seewarte begs to be informed what would be the cost of extracting all the observations made in the Squares 145-7, 109-11, 74 and 75 if the work were undertaken by the Office staff. Further it desires to know how the total number of observations would be distributed over the individual squares named.

(Signed) Dr. G. NEUMAYER.

The Meteorological Office, London.

Mo. 172.

Hamburg, January 10, 1877.

FOR the purpose of discussing the meteorological observations made by the German expeditions for the observation of the Transit of Venus at Kerguelen and Auckland Islands between the 1st November 1874 and the end of February 1875, the Seewarte wishes to collect more complete materials and therefore begs the Meteorological Office kindly to supply all observations made at that time on board ships which may exist there and which refer to the zone of the Southern Ocean between 40°-55° S. lat. and 0°-180° E. long. Those ships therefore would chiefly come into consideration which have made voyages from the Atlantic to Australia, Java, and China.

At the same time the Seewarte requests that it may be charged with the expense incurred.

(Signed) Dr. G. NEUMAYER.

The Meteorological Office, London.

Mr. Scott was instructed to report on the probable expense and arrangements proposed, to furnish the Committee with the necessary funds, and to suggest that Dr. Neumayer should depute some person informed of his exact views to see, at the outset, that the information he required is prepared in a manner suitable for his purpose.

Read—A Circular from the Science and Art Department relative to the closing of the Loan Collection of Scientific Instruments.

Mr. Scott was instructed to request that the instruments be returned, with an offer on the part of the Committee to aid in case of a permanent museum being established.

Submitted—The following report on the cost of Sunday Telegraphy :

EXPENSE OF SUNDAY MORNING TELEGRAMS, estimated from the latest information received, from 12 November to 31 March (21 days).

	Per Sunday.	To 31 Mar. 1877.
	£ s. d.	£ s. d.
FOR STORM SIGNAL PURPOSES:		
28 telegrams, at 1s.; Scilly cable charge, at 1s. 3d.; clerks' salaries, 15s.; fees and stations, 13s.; travelling, 1s. 3d.	2 18 6	61 8 6
TRANSMISSION TO PARIS:		
Ministry of Marine, 3s. 4d.; observatory (say), 5s.; grouping at Central Office, 1s. 6d.	0 9 10	10 6 6
TRANSMISSION TO NORWAY:		
Three direct telegrams, at 1s. (omitting Sumburgh Head, broken down)	0 3 0	3 3 0
TRANSMISSION TO DENMARK:		
Copies made at Central Station, three at 3d.	0 0 9	0 15 9
	<u>£3 12 1</u>	<u>75 13 9</u>

For each complete "warning" telegram issued, the cost will be about 7l. additional.

Submitted—The following Memorandum by Captain Toynbee relative to his investigation into the weather of August 1873 over the Atlantic (Minutes 1873, p. 79), with a specimen chart (not printed here).

SIR,

Meteorological Office, January 12, 1877.

WITH this I beg to hand you, for the consideration of the Committee, a tracing of the Synoptic Chart for August 1st, 1873, showing the method we are following in dealing with the weather of that month.

Defects of Data.

It may be well to say that in very many cases we have been obliged to use observations from unverified instruments, which have only been checked by readings in port, or near another ship which had verified instruments, so that the results are only approximations, and it has not been thought right to round off the isobars, &c., and to make the Chart appear so complete as to lead to the mistake that nothing better is needed; for it is believed that the defects shown are the strongest reason for asking for better observations.

Good Results in spite of Defects.

In spite of grave defects these Charts seem to give a better picture of the normal state of the Meteorology of the North Atlantic in August than any previously produced; besides their illustrating the rise and progress of a very destructive hurricane.

Perhaps it may be well for me to remark on a few of the facts which I have noticed when writing the notes to accompany each Chart.

Permanent High Pressure.

1st. The permanent high pressure in the neighbourhood of the Azores, which generally maintains a similar shape throughout the month, though it sometimes has its north-western side, as it were, eaten away by the advance of another area of high pressure from the Westward, which causes, so to speak, a temporary north-east Trade on the western side of the Atlantic, similar to the permanent one on its eastern side.

Barometer at the Azores.

The highest pressure near the Azores is generally about 30·50 throughout the month, but during the hurricane it was much lower, and it remains to be proved whether this is always the case; if so the barometer at the Azores will be a useful indicator. Its reading compared with that of Lisbon is certainly a good indication as to the force of the northerly wind between them.

Wavy shape of Isobars in High Latitudes.

2nd. The wavy shape of the isobars on the northern side of the area of highest pressure, the crests and hollows of the waves having westerly winds, whilst the western side of a crest has south-westerly and the eastern side north-westerly wind. These waves are better shown on some of the other Charts. They seem to roll to the north-eastward along the north-western slope of the area of highest pressure, and are generally unaccompanied by easterly winds, though sometimes in the hollow of a wave there is a complete cyclonic movement.

Branching of Isobars near English Channel.

3rd. The permanent branching of the isobars in the neighbourhood of the English Channel, part going to the N.E. and part to the S.W., being respectively accompanied by south-westerly and north-westerly to north-easterly winds. They seem to account for the permanency of the north-westerly winds which are frequently experienced in the Chops of the Channel in summer.

French Thunder Storms.

It may perhaps be worth remarking that the summer thunder storms, which are so frequent in France, seem to originate in the fork of the isobars, where the winds branch S.W. and N.W.

Low Pressure near West Coast of Africa.

4th. The curving of the isobar of 29·9 round the West Coast of Africa, and the drawing of both the north-east and south-east Trades towards it.

Wind of Hurricanes stronger on one side than another.

5th. Whilst remarking on the barometer it may be well to say that the great hurricane which blew so violently in Halifax, N.S., on the 24th, seemed to get most of the gradient for its destructive northerly and north-easterly wind from an area of high pressure near Quebec, and there is evidence to show that the wind on one side of the hurricane was on different occasions stronger than that on another.

Tracks of Hurricanes governed by disposition of Areas of High Pressure, which disposition may be known by Telegraph.

It seems probable that the tracks of hurricanes which have appeared in the West Indies may be foretold, as they, like the areas of low pressure so common in Europe, do not appear to go over but along areas of high pressure, for the August Charts show that an area of high pressure sometimes extends from the east coast of America to Bermuda, in which case it is probable that a hurricane coming from the eastward would continue its course to the westward instead of recurving round Bermuda. The disposition of pressure may probably be known by telegraph from Bermuda and the West Indies, before a hurricane which has shown signs of its existence to the eastward of the Virgin Islands has reached the longitude where they generally recurve.

Motion of Air with regard to the Centre of the Hurricane.

The way in which the air drew towards the centre of the hurricane has not yet been fully worked out, but there is evidence of its shape being something like that shown by Mr. Meldrum for the hurricanes of Mauritius.

Direction of normal Winds in relation to Distribution of Pressure.

6th. The circulation of wind round the area of highest pressure, and its undulation with the waves of pressure to the northward of it are generally permanent throughout the month, though sometimes affected by local disturbances of pressure.

Motion of Upper Clouds and Winds at Mountain Stations.

7th. The motion of upper clouds, and direction of wind at mountain stations seem to show a general tendency of upper currents of air from the westward. There are clear indications of a westerly upper current of air to the westward of the Azores, whilst there is a south-westerly one near the Canaries, showing part of a counter-circulation round the area of highest pressure. Near the Equator there are signs of an upper current of air from the north-eastward above the south-westerly monsoon. Unfortunately the observations on Pike's Peak in Colorado, 14,216 feet above the sea, were not commenced in 1873, but those of 1874 have been compared with those of Mt. Washington with interesting results. Mt. Washington had 49% of north-westerly winds in August, which include five gales of 70 to 75 miles, and six of 60 to 65 miles per hour. In January the westerly gales got up to 105 miles an hour!

Direction of Isotherms and the cause of their irregularity.

8th. The isotherms of air seem very suggestive, for although the local time is from 11 a.m. to 3 p.m. on the eastern half of the Chart, whilst it is from 5 a.m. to 10 a.m. on the western side, the isotherms of 80° and 70° dip to the southward on the eastern side, showing a colder temperature there at noon, than that which exists on the western side in the same latitude at 8 or 9 a.m. This seems to be caused by the northerly wind on the eastern side of the area of highest pressure. The isotherm of 60°, which passes to the northward of the area of highest pressure, and does not cross the northerly wind, is not similarly affected.

Defects of present Data.

These Charts only give a rough idea of what would have been the result if every observation had been from verified instruments by a careful observer, who had also given the direction from which upper clouds were moving. As it is, numbers of ships give no barometer or thermometer readings, and scarcely any ships record the motion of upper clouds.

Suggestions for future Data.

Perhaps I may be permitted to suggest that if the Committee contemplate carrying out such work for a year or more, it would be well to hand a circular to the owner and captain of every vessel about to leave a British port, stating that the Committee purpose asking for the loan of the ship's log on her return, and requesting the captain to be so good as to give special attention to his observations, and asking him to record at least one observation daily when in port, *at home or abroad*, so that we may check his instruments. Such a letter carefully worded would I think produce useful results.

HENRY TOYNBEE,
Marine Superintendent.

R. H. Scott, Esq., F.R.S., Director.

P.S.—The accompanying list (not printed here) contains the data from ships' logs which have been used in the construction of the Chart for August 1st, and also the sea temperature, weather, and state of sea. It is proposed to print these data, in a tabular form.

Read—A letter from Captain Toynbee submitting excellent logs kept by—

Captain C. Johnson, ship "St. Lawrence" (Minutes 1875, p. 60).

„ R. H. Napier, H.M.S. "Nassau" (Minutes 1876, p. 118). Log kept by Lieutenant G. N. A. Pollard.

„ J. F. Ruthven, ship "Whittington."

Mr. Scott was instructed to convey the marked thanks of the Committee to Captain Johnson and Captain Napier, and to present the Charts to Captain Ruthven.

Submitted—A Memorandum on the mode of keeping the accounts of the Office, which was referred to Mr. De La Rue.

Mr. Scott reported that an assistant was badly wanted to keep up the Office work to date.

He was authorised to engage a youth.

A cheque for 60*l.* was drawn in favour of J. S. Harding, jun., for Office expenses.

The Committee then adjourned.

116, Victoria Street, January 29, 1877.

PRESENT :

Lieut.-General Strachey in the Chair.

Mr. De La Rue.

Captain Evans.

The Director was in attendance.

The Minutes of last meeting (January 15) were read and confirmed.

Mr. Scott submitted the following memorandum on Dr. Neumayer's letter, No. 171, and stated that the work referred to in letter No. 172, was being carried out at an estimated cost of 3*l*. 10*s*. 0*d*. to Dr. Neumayer.

SIR,

Meteorological Office, January 19, 1877.

I BEG to submit the following estimate for the extraction of data specified in Dr. Neumayer's letter dated the 9th inst.

If the work is done under the superintendence of the Office staff especially engaged on similar work, the estimated cost of extracting into data books all the observations at present available in the Office for squares 145-7, 109-111, 74 and 75 is 1,400*l*.

The distribution of the number of observations is estimated as follows :—

Square.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Year.
145 - - -	2,050	1,150	1,300	750	1,350	2,450	1,750	3,000	1,600	1,400	1,300	1,550	19,650
146 - - -	4,500	2,850	4,300	3,800	3,400	5,700	3,550	5,500	4,400	4,050	4,250	5,800	52,100
147 - - -	1,600	1,300	2,050	1,400	1,850	2,000	1,800	2,850	2,450	1,500	1,550	1,550	21,900
109 - - -	—	—	200	550	250	200	150	150	400	50	650	—	2,600
110 - - -	3,300	1,500	3,600	3,100	2,250	4,250	1,900	3,400	3,750	3,650	1,750	2,800	35,250
111 - - -	1,950	550	850	1,150	750	450	450	850	400	1,100	1,050	1,800	11,350
74 - - -	500	350	600	750	400	1,050	200	450	500	1,600	800	950	8,150
75 - - -	3,350	1,350	1,650	2,350	1,400	2,700	1,900	2,700	2,450	2,050	1,950	2,650	26,500
Total -	17,250	9,050	14,550	13,850	11,650	18,800	11,700	18,900	15,950	15,400	13,300	17,100	177,500

The cost of the data books into which the observations are extracted will be about 30*l*., so that the entire cost of work is estimated at 1,430*l*.

R. H. Scott, Esq.

CHAS. HARDING.

SIR,

January 19, 1877.

I BEG most respectfully to submit a word or two as to the practicability of complying with Dr. Neumayer's request, the method of doing the work seeming to me inseparable from the estimated cost.

If the "Seewarte" requires the work to be done and the Committee sanction its being supplied, considering that the staff of Marine Room is now nearly free from extra work, I would submit, subject to your approval, that the marine staff be allowed to take the responsibility of the work, with the *most distinct* understanding that it *in no way interferes with the ordinary Office work*.

With the assistance of the Marine Room staff, for the working of the specially technical branch of the work (working at extra time only), and with two *good copyists* employed solely (throughout the day) for the extraction of data I consider that the whole of the work can be completed in one year.

We could so arrange to work that the data should be supplied by monthly instalments, January (or any other month) being completed within two months of the time of commencing, and each subsequent month could be completed in the space of a month.

The additional experience to the Office staff, consequent on the working of a new district, &c., is not to be underrated.

It is perhaps unnecessary to add that numerous, and to me insurmountable, difficulties present themselves in carrying out such work with a staff unassisted by those in the Office.

I will also mention the item of copying the data for the Office: this will amount to about 280*l*., but is work such as can be carried out by any careful copyist as the work advances.

R. H. Scott, Esq.

CHAS. HARDING.

I have considered Mr. Harding's statement carefully, and both Captain Toynbee and I are of opinion that a foreigner could not be employed in superintending this work, owing to the length of time (several years) required to gain the necessary experience for a satisfactory examination of logs so as to test their quality.

I should propose to add 10% to Mr. Harding's estimates, making it 1,570*l*., in order to allow for any risk of miscalculation having been made, &c. &c. If then Dr. Neumayer be charged with the cost of the copy which we must keep, the total expense to him would be 1,850*l*.

When Dr. Neumayer first proposed to this Office to supply him with data for the district of the Atlantic between 30° and 50° N. (14 squares), I stated to him by Letter 2,142, Oct. 27/75: "The cost of copying for the Atlantic would not fall short of 2,000*l.* or 3,000*l.*, and the time required would be some years. * * * * The last log come in is 3,640. At least 2,500 of these logs will contain materials for the N. Atlantic."

Dr. Neumayer has extended his area to 20° N., but only asks for information as far out as to 30° W. This gives eight squares, but they are more frequented than the western part of the Atlantic Ocean.

ROBERT H. SCOTT.

Mr. Scott was instructed to reply to Dr. Neumayer in the following terms :

SIR,

I HAVE the pleasure of sending you, by the instructions of the Meteorological Committee, a copy of the estimated amount of information existing in this Office relating to the Atlantic area referred to in your letter dated January 9th.

Square.	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.	Total.
145 - - -	2,050	1,150	1,300	750	1,350	2,450	1,750	3,000	1,600	1,400	1,300	1,550	19,650
146 - - -	4,500	2,850	4,300	3,800	3,400	5,700	3,550	5,500	4,400	4,050	4,250	5,800	52,100
147 - - -	1,600	1,300	2,050	1,400	1,850	2,000	1,800	2,850	2,450	1,500	1,550	1,550	21,900
109 - - -	—	—	200	550	250	200	150	150	400	50	650	—	2,600
110 - - -	3,300	1,500	3,600	3,100	2,250	4,250	1,900	3,400	3,750	3,650	1,750	2,800	35,250
111 - - -	1,950	550	850	1,150	750	450	450	850	400	1,100	1,050	1,800	11,350
74 - - -	500	350	600	750	400	1,050	200	450	500	1,600	800	950	8,150
75 - - -	3,350	1,350	1,650	2,350	1,400	2,700	1,900	2,700	2,450	2,050	1,950	2,650	26,500
Total -	17,250	9,050	14,550	13,850	11,650	18,800	11,700	18,900	15,950	15,400	13,300	17,100	177,500

The probable cost of correcting and extracting into monthly data books, similar to those used in this Office, and giving the information in one-degree squares will be about 1,850*l.*

This includes the cost of the data books themselves.

This estimate is framed on the supposition that the work will be executed under the superintendence of the staff of this Office, and it is hoped that it could be completed in about the space of a year. The first month, January, could be finished in about two months from the time of commencing, and each subsequent month in the space of one month. At the same time I am to suggest that you should depute some person informed of your exact views to see, at the outset, that the information you required is prepared in a manner suitable for your purpose.

You will see that the sum required will be very large, and the time occupied very considerable, and under the circumstances in which the Meteorological Committee is placed it is considered by them that it will not be prudent, or consistent with the practice of official bodies in this country, for them to enter into an arrangement with you for giving effect to your wishes, should you desire this work to be carried out, otherwise than with the cognizance of our Governments and their formal approval.

The Meteorological Committee is at the present time, as you are perhaps aware, in a state of transition, and it might lead to embarrassment if any engagement were entered into by them, the completion of which might devolve on some other body differently organized, and with possibly very different views, unless it were formally recognized at the outset by the Governments of Germany and the United Kingdom.

Mr. Scott submitted certain correspondence that he had with the Governor of Heligoland (letters 198 and 270 received and 207 despatched) relative to the establishment of a reporting station in that island (Minutes 1876, p. 133).—Consideration postponed.

Mr. De La Rue submitted the following memorandum on the accounts, &c. of the Office (Minutes, 15th January), the proposals wherein were adopted:—

(1.) Proposed that all Returns published in the Appendix of the Annual Report be made up to the 31st March.

(2.) That in the event of supplementing the abstract of the cash account hitherto published, by an account of the property of the Office, the accumulated value of the stock of accounts be not brought forward as a balance of revenue. The *available* assets, *e.g.*, cash, &c., to be shown as distinct from such property as instruments, furniture, &c.

(3.) That the published return of the disposal and stock of instruments include some miscellaneous instruments, *e.g.*, fishery barometers, thermometer screens, rain-gauges, &c. &c.

(4.) That at the end of the present financial year, 10 years' depreciation at the rate of 5% per annum be allowed on the cost of observatory instruments, reducing them to half their original cost. The stock of ordinary instruments and furniture to be subject also to a percentage depreciation, varying according to their nature and their present condition.

(5.) That the cash book should be an ordinary cash book (as at present in use), and any classification required by the Audit Office should be made in another book.

(6.) That "invoice" and "day" books be kept in a modified form (a pattern of which was submitted for approval) to suit the requirements of the Office. The invoices to be *preserved* and numbered.

(7.) That the heads of expenditure of the Office be slightly modified after March 31, as follows:—

<i>Management of Office.</i>	
? Committee fees.	Rent, fuel, &c.
Salaries and wages.	Incidental expenses.
<i>Land Meteorology.</i>	
Observatories and other stations.	Weather telegraphy.
Reduction of observations.	Computations.
<i>Ocean Meteorology.</i>	
Royal Navy.	Reduction of observations, and care of
Mercantile Marine.	instruments.

Submitted—A circular from the Chief Signal Office, Washington, stating that the United States Navy had begun to take the synchronous observations, at 0·43 p.m., G.M.T.

The attention of the Committee was drawn to the fact that the new logs of the Meteorological Office contain a special sheet for these observations.

Submitted—Letter 221 from Professor Grant stating that he would carry out the wishes of the Committee (Minutes, January 15).

Read—A letter from Captain Toynbee submitting “excellent” logs kept by :

Captain O. Churchill, R.N., H.M. Gunboat “Ariel.” Log kept by Nav. Sub.-Lieut. C. E. Pritchard.

„ J. J. Price, barque “Sorata” (Minutes 1876, p. 107).

Mr. Scott was instructed to convey the marked thanks of the Committee to both gentlemen.

Reported—That the information extracted under Admiral FitzRoy’s superintendence for the China Seas, monthly means, in five-degree squares, had been supplied to Professor Buys Ballot at a cost to the Meteorological Office of 2*l.* 17*s.* 6*d.*

Reported—That the following had been appointed as temporary clerks :

Mr. Horace Bourne, at 25*s.* per week.

Mr. Arthur Green, at 12*s.* 6*d.* „

Mr. Bourne to assist in the examination of the observatory records. Mr. Green in accordance with the permission granted at last meeting.

The following cheques for January were drawn :—

For Office :

	£	s.	d.
R. H. Scott	66	13	4
J. S. Harding, jun.	20	16	8
J. S. Harding, sen.	*9	12	6
T. D. Bell	7	10	0
H. Bond, fittings, &c.	8	17	9
C. Gilman, gas company	5	6	0
E. Higgs, repairs, &c.	16	2	3

For Observatories :

J. E. Cullum, Valencia	13	6	8
R. and J. Beck, zinc plates	10	10	10
L. P. Casella, repairs to anemometers	9	3	0
Malby and Sons, copper plates	5	0	0
R. W. Munro, removing S.R. instruments	3	5	0
J. J. Hicks, repairing Rain Gauge, &c.	4	5	0
„ new instruments	17	16	0
	22	1	0
H. Porter,	11	7	0
G. W. Whipple, verifications	5	6	6
R. H. Curtis	14	3	4
C. A. Thompson	*7	5	0
J. A. Curtis	10	0	0
E. G. Aldridge	*6	5	0

Carried forward - - - £252 11 10

* Five weeks to the 27th instant.

				£	s.	d.
	Brought forward	-	-	252	11	10
For Telegraphy :						
The Postmaster-General, November	-	-	-	165	4	6
F. Dangerfield, delivery of D.W. Charts	-	-	-	14	4	3
F. Gaster	} Computations	-	-	15	16	8
W. L. Dallas		-	-	9	3	4
F. Brodie		-	-	8	0	0
H. Chivers		-	-	*4	2	6
For Ocean Meteorology :						
Cashiers, Bank of England, Bermuda Anemometer	-	-	-	1	12	6
J. J. Hicks, repairing thermometers	-	-	3 6 0			
" " "	-	-	4 14 6			
" Fishery Barometers	-	-	24 0 0			
				32	0	6
Negretti and Zambra, Thermometers, &c.	-	-	82 3 6			
" Hydrometers, &c.	-	-	23 0 6			
				105	4	0
G. M. Whipple, Verifications	-	-	14 4 6			
" " "	-	-	6 0 0			
				20	4	6
Pewtress & Co., printing	-	-	-	8	0	0
J. Gill, Liverpool Agent	-	-	-	11	4	7
J. R. Jones, Aberdeen	-	-	-	1	12	8
Z. Scaping, Hull	-	-	-	9	10	10
Capt. H. Toynbee, Marine Superintendent	-	-	-	33	6	8
R. Strachan	} Computations	-	-	+20	16	8
C. Harding		-	-	15	0	0
T. E. Allen		-	-	10	0	0
H. Harries		-	-	*9	12	6
For Office Expenses :						
J. S. Harding, jun., on account	-	-	-	150	0	0
" " "	-	-	-	100	0	0
Total	-	-	-	997	8	6

* Five weeks to the 27th instant.

† Including allowance for care of instruments.

The Committee then adjourned.

116, Victoria Street, February 19, 1877.

PRESENT:

Mr. De La Rue was the only member present.

He read and compared the Minutes of the last meeting (January 29).

Reported—That the letter had been sent to Dr. Neumayer as directed.

Mr. Scott reported that the vote proposed for the Office in the Civil Service Estimates for 1877–8 was 10,000*l.* and asked for instructions as to the future management of the Office funds.

He was instructed to ask Mr. Farrer as to the continuation of Sunday telegraphy, which is estimated to cost 500*l.* annually in the Report of the Treasury Committee just issued, and which sum is not provided for in the estimates.

Reported—That in pursuance of the instructions, Minutes, p. 1, the list of distribution of the publications of the Office had been carefully revised with the following results:—

The No. of those receiving all the publications of the Office is now	-	-	191
The No. of those who receive everything except the Marine Publications is now	-	-	65
The No. of those who receive everything except Q.W.R. is now	-	-	125
The No. of those who receive everything except the Q.W.R. and Marine Publications is now	-	-	30

The total reduction is 34.	Total on list	-	411
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Reported—That in reply to a demand on the Stationery Office for additional copies of certain publications of the Office, of which the No. originally received was exhausted, an inquiry had been received from that Office asking if the Committee proposed to pay for the copies.

Mr. Scott was instructed to apply for instructions from the Treasury.

Read—Letter No. 400 from Dr. Robinson, asking for an increase of salary to Mr. Call, the assistant at Armagh Observatory.

Mr. Scott was instructed to reply to him in the same terms as he had replied to Mr. Perry (Minutes, p. 1).

Read—An application (Letter 425) from the Glasgow Underwriters' Association for a daily telegram of reports from various stations, and proposing that the same telegram should be sent to them as has been sent to the Liverpool Underwriters for the last ten years, but that the number of stations should be increased from 14 to 29.

The application was granted provided the Glasgow Underwriters pay the cost of telegraphy and a contingent addition thereto to cover casual expenses.

Read—An application from Messrs. King, Seymour, & Co., to act as agents of the Office at Southampton—Approved.

Read—A letter from Capt. Toynbee submitting excellent logs by,—

- Capt. John Blair, ship "Firth of Clyde," (Minutes 1875, p. 60.)
- " G. H. Jones, s.s. "Quang-se," (Minutes 1875, p. 60.)
- " Gilbert Shaw, R.M.S. "Beta," (Minutes 1876, p. 118.)
- " John Raeburn, R.N.R., ship "Airlie."

Capt. Raeburn remarks, Jan. 4. Lat. 4° 49' N. Long. 28° 17' W.,—

"Breeze freshening. I believe I have the N.E. Trades without having had any doldrum weather. When from India or China I have never before crossed the Equator so far to the westward. Have done so this time by Capt. Toynbee's advice."

And again at end of the log,—

"You will be pleased to know that the 'Airlie' has won the race by three days over the 'Culzean,' 12 days over the 'Lady Ruthven,' and 12 days over the 'Earl of Zetland,' and that vessel is not yet arrived; also a great number of days on five or six others."

Mr. Scott was instructed to present the Wind and Current Charts to Capt. Raeburn, and to convey the marked thanks of the Committee to the other gentlemen.

Submitted—The Charts of Meteorological Data for nine Ten-degree Squares of the Atlantic with accompanying Remarks (Official No. 27).

It was determined that this work be presented to all observers who have received at least the mark "V. G.," and that a special label be attached for the mark "excellent."

Reported—That certain data as to the amount of cloud at British Stations had been supplied to Professor Ragona of Modena, at his request. The cost of preparation had been 2*l.* 5*s.* 0*d.*

Reported—That the Daily Weather Charts had been supplied to,—

The Harbour Commissioners Office, Queenstown, for exhibition.

The Société de Médecine et de Climatologie, Nice, in exchange.

Mr. Scott was instructed to apply for a renewal of the lease of the Office for another year from March 25.

Mr. Scott reported with reference to the sum of 100*l.* placed at his disposal "for the present," Nov. 20, 1876 (Minutes 1876, p. 131) for bringing up the arrears of work, that the sum of 103*l.* 9*s.* 6*d.* had been expended and that the estimated cost of completion was 40*l.* 13*s.* 0*d.*

The sum of 50*l.* was granted, as it will complete the work.

Submitted—The following abstract of accounts from April 1st, 1876, to December 31st, 1876 :—

RECEIPTS.				PAYMENTS.			
	£	s.	d.		£	s.	d.
Balance from 1875-6 -	1,278	9	1	OFFICE :—			
Vote for Year -	10,000	0	0	Salaries and wages -	1,039	10	1
Commissions for instruments, &c. -	452	19	0	Rent, fuel, and lighting -	479	6	1
Subscriptions for D. W. Charts -	173	0	4	Contingencies -	248	0	9
„ Danish Synoptic Charts	24	6	10	LAND METEOROLOGY :—			
„ Hourly Observations	8	0	0	Expenses at observatories -	1,838	7	10
Meteorological information, &c. -	389	12	6	New instruments, &c. -	311	8	4
Interest on deposit account -	2	7	2	Computations (reduction of obser- vations) -	969	12	11
				Weather telegraphy -	1,362	0	2
				Inspections, &c. -	400	9	4
				Computations -	818	19	8
				OCEAN METEOROLOGY :—			
				Marine Superintendent -	300	0	0
				Admiralty instruments -	212	19	6
				Mercantile Marine -	266	1	10
				Computations and care of instru- ments -	849	3	10
					8,896	0	4
				Balance -	3,432	14	7
Total -	£12,328	14	11	Total -	£12,328	14	11
Liabilities.				Assets.			
	£	s.	d.		£	s.	d.
To sundry creditors (partly estimated)	762	7	4	By balance of receipts and payments account -	3,432	14	7
„ probable net surplus on Jan. 1, 1877	3,041	4	7	By sundry debtors -	370	17	4
	3,803	11	11		3,803	11	11

The value of Stock of Instruments, &c. is not included in this statement.

A cheque for 50l. for petty cash was drawn.

Mr. De La Rue instructed Mr. Scott to print the above Minutes.

116, *Victoria Street*, March 5, 1877.

PRESENT :

Mr. De La Rue was the only member present.

He read and compared the Minutes of the last meeting (Feb. 19).

Mr. Scott reported that the following letter had been sent as directed :—

Meteorological Office, 116, *Victoria Street*,
February 22, 1877.

SIR,

I AM desired by the Meteorological Committee to request you to furnish them with instructions for their guidance under the following circumstances :—

In the month of November they were given to understand by a member of the late Treasury Committee, that the organisation of a Sunday telegraphic service was a definite recommendation in the Report of that Committee, and the Meteorological Committee notice that a sum of 500*l.*, for this special purpose, has been recommended by that Committee in their Report, paragraph 21, just published.

In order to carry out the understood wishes of the Treasury Committee, they resolved to devote a portion of their available balance to defray the cost of such Sunday service from November 12th, 1876, to March 31st, 1877, estimated at nearly 100*l.*

They have furthermore devoted another portion of their balance to the completion of such discussions of the materials in their Office as would clear off the heaviest portion of the arrears of work by the end of the present financial year, so that they should be prepared to hand over the Office to Her Majesty's Government at that date.

They see from the Civil Service Estimates for 1877-8 that the sum proposed for the Office is 10,000*l.*, as in former years. This sum will not admit of the continuance of Sunday telegraphy after March 31st, and I am therefore to inquire what are the wishes of the Board of Trade on the subject.

Thomas Gray, Esq.,
Assistant Secretary,
Marine Department, Board of Trade.

I have, &c
(Signed) ROBERT H. SCOTT,
Director.

Mr. De La Rue decided that pending the receipt of the answer to the above, it is desirable to continue the Sunday service during the month of April.

Mr. Scott reported that Professor Everett, who had undertaken to prepare a report on Atmospheric Electricity for the coming Congress at Rome, had written him the following letter :—

M.O. 486.

DEAR SIR,

Malone Road, Belfast, February 19, 1877.

I HAVE been making inquiries regarding the observations of Atmospheric Electricity taken at Kew, partly because I thought it might be desirable to make an application for a portion of the 4,000*l.* which has been placed at the disposal of the Royal Society and apply it to the reduction of these observations. I find, however, that there is not a very long accumulation. Since the old observations, which were reduced under my superintendence, there has been a gap of 10 years. The new observations were begun in the beginning of 1874 and have been continued to the present time with two interruptions, one of about a month in 1875, and the other of six months in 1876. Interruptions of this kind are very unfavourable for the application of Sir W. Thomson's favourite system of reduction, harmonic reduction. But there is one way in which the results might be presented that would be very instructive, and would be completely novel as regards its application to Atmospheric Electricity—the plan which you have adopted with so much success for other meteorological elements. If you would put the curves of electricity along with the other curves at Kew, we should have such an opportunity as has never yet been given for detecting the correspondence between electrical variations and the variations of other elements. The most convenient plan for the reader would be to have a year's curves for Kew printed in a book by themselves ; but if this would involve too much extra expense, the electrical curve would be simply introduced along with the other curves for Kew in your regular Quarterly Reports. In reducing the previous electrical observations at Kew, I had no information about the other meteorological elements, and indeed it would involve a frightful amount of labour to get up data for a comparison between it and the other elements by arithmetic, especially as the comparison ought to relate not only to contemporaneous values but ought to throw light on prediction. A graphical comparison would, in the present imperfect state of our knowledge, be much more serviceable, and would only involve the pantagraphic reduction of one curve in addition to those which you reduce at present.

Pray consider this matter carefully, and oblige,

R. H. Scott, Esq.

Yours, &c.
(Signed) J. D. EVERETT.

Submitted.—The following STATEMENT respecting the RECORDS for November 1876, received from the SELF-RECORDING OBSERVATORIES, which have been examined at the METEOROLOGICAL OFFICE (see Minutes 21st December 1868).

	Aberdeen.	Armagh.	Falmouth.	Glasgow.	Kew.	Stonyhurst.	Valencia.
	Direction. Velocity. Good. Good.	Direction. Velocity. Good. Good.	Direction. Velocity. Good. Good.	Direction. Velocity. Good. Good.	Direction. Velocity. Good. Good.	Direction. Velocity. Good. Good.	Direction. Velocity. Good. Good.
ANEMOGRAPH:—							
Action	0 0	18 hrs. 19 hrs.	0 0	0 0	0 0	0 0	0 0
Records deficient, due to stoppage of clock	0 0	0 0	*29	0 0	*29	0 0	0 0
" " other causes	Not recorded.	Not recorded.	Not recorded.	0 0	0 0	0 0	0 0
Orientation verified	0 0	0 0	0 0	0 0	0 0	0 0	0 0
No. of errors discovered by subsidiaries	0 0	0 0	0 0	0 0	0 0	0 0	0 0
" " irregular differences	0 0	0 0	0 0	0 0	0 0	0 0	0 0
Result of 40 Remasurements:—							
Greatest difference	1.0	0.0	1.0	1.0	1.0	1.0	0.0
Mean difference irrespective of sign	0.1	0.2	0.0	0.3	0.1	0.1	0.0
Residual difference (—Kew)	—0.1	0.0	+0.1	0.0	—0.1	0.0	—0.1
RAIN GAUGE:—							
Action	Good.	Traces very faint.	Good.	Traces faint.	Good.	Good.	Traces faint.
Records deficient, due to stoppage of clock	0 0	‡31 hrs.	0 0	0 0	0 0	0 0	0 0
" " other causes	0 0	§ 325 "	0 0	0 0	0 0	0 0	0 0
Errors in tabulation	0 0	2 "	0 0	1 1	0 0	2 2	0 0

Reported—That the lease of the Office had been continued for another year.
(Letter 502.)

Reported—That the stock of logs in the Office was nearly exhausted. Mr. Scott was instructed to order 250, with rough books to correspond, if required.

Reported—That Daily Weather Charts had been supplied to

Commander Pengelly, R.N., dockmaster, Penarth, }
Captain E. Byrne, harbourmaster, Cork, } for exhibition.

Reported—That the following cheques for February were drawn, on the 26th of that month, on the signature of Mr. De La Rue.

For Office :

			£	s.	d.
R. H. Scott	-		66	13	4
J. S. Harding, jun.	} Salaries and wages		20	16	8
J. S. Harding, sen.			*7	14	0
T. D. Bell			7	10	0
Atkinson & Co., furniture	-		3	3	0
The Pall Mall Coal Co., coals	-		9	12	0
W. G. Schoof, clock	-		4	10	0

For Observatories :

J. E. Cullum, Valencia	-		13	6	8
R. and J. Beck, zinc plates	-		38	19	11
The Meteorological Society, registers	-		35	0	0
V. Smith, stencils	-		3	3	0
R. H. Curtis	} Computations		14	3	4
C. H. Thompson			*5	16	0
E. J. Aldridge			*5	0	0
J. A. Curtis			10	0	0

For Telegraphy :

The Postmaster General, Telegrams, December	-	189	4	9
Do. Private wire	-	22	0	0
		211	4	9
J. McDonald, Telegrams	-	1	2	3
F. Gaster	} Computations	15	16	8
W. L. Dallas		9	3	4
F. Brodie		8	0	0
H. W. Chivers		*3	6	0

For Ocean Meteorology :

Capt. H. Toynbee, Marine Superintendent	-	33	6	8
Street, Brothers, advertisements	-	1	2	6
J. H. Woodstock, packing cases	-	3	2	6
R. Strachan	} Computations	†20	16	8
C. Harding		15	0	0
T. E. Allen		10	0	0
H. Harries		*7	14	0

For Office Expenses :

J. S. Harding, jun., on account	-	150	0	0
		100	0	0
		£835	3	3

Mr. De La Rue instructed Mr. Scott to print the above Minutes.

* Four weeks to the 24th February.

† Including allowance for care of instruments.

116, Victoria Street, March 19, 1877.

PRESENT :

Lieut.-General Strachey in the Chair.

Mr. De La Rue.

Captain Evans.

The Director was in attendance.

The Minutes of the last meeting (March 5) were read, and they, as well as the Minutes of the two preceding meetings (February 5 and February 19), were confirmed.

Submitted—The following reply received through the Board of Trade to the letter printed on the Minutes of last meeting :—

M.O. 676.—M. 3918.—3757.

SIR,

Treasury Chambers, March 13, 1877.

THE Lords Commissioners of Her Majesty's Treasury have had before them Mr. Gray's letter of the 28th ultimo, forwarding a copy of a letter dated the 22nd ultimo, received from the Director of the Meteorological Office, pointing out that there is no provision in the Civil Service Estimates for the year 1877-8 for the cost of maintaining the system of Sunday telegraphy.

I am to request that you will move the Lords of the Committee of Council for Trade to express to the Meteorological Committee the extreme surprise with which my Lords have read the Director's letter.

My Lords could not have supposed that the Meteorological Committee would take as authority, for the expenditure of public money, the report of a Committee of Inquiry, as if it were tantamount to the sanction of the Treasury.

My Lords have come to no decision upon the Report, which they have referred to the Council of the Royal Society, and they decline to authorise the continuance of any expenditure for which the present votes and estimates do not provide.

I am, &c.

The Secretary, Board of Trade.

(Signed) R. R. W. LINGEN.

Mr. Scott was instructed to send the following reply :—

SUNDAY TELEGRAPHY.

SIR,

Meteorological Office, March 20, 1877.

IN reply to your letter of the 17th instant (M. 3918), I am instructed to inform you that it appeared to the Committee that it was extremely desirable to obtain weather information on Sundays, during the winter months, in order to give signal warnings of danger at seaports, and the Treasury Committee having expressed an opinion in favour of such warnings being given, the Meteorological Committee appropriated funds at their disposal to make a tentative experiment in order to test the cost and utility, but only up to the 31st of March.

They did not feel warranted in continuing the Sunday telegraphy without the express approval of the Board of Trade, and the object of the letter of the 22nd ultimo was to ascertain the views of the Board on the matter.

The Committee specially desire to say that they had no intention of referring to the views of the Treasury Committee of Inquiry with any other object than that of explaining the ground of their action in respect to Sunday telegraphy, and as a matter of course they will restrict their expenditure, as they always have done, within the grant from time to time placed at their disposal.

I am, &c.

Thomas Gray, Esq.,
Assistant Secretary, Marine Department,
Board of Trade.

(Signed) ROBERT H. SCOTT,
Director.

Submitted—The following correspondence (*vide* Minutes, February 14) :—

SIR,

Meteorological Office, February 20, 1877.

I HAVE the honour to enclose a copy of a letter received from the Controller of the Stationery Office, in reply to our requisition for 50 copies each of two of the Committee's publications.

The works in question are published at 1s. each, and are required for issue to merchant captains, and others, who undertake to observe for the Office.

I have to request that you will be good enough to inform me whether or not this Office should pay for the copies in question from its vote.

I have, &c.

The Secretary of the Treasury.

(Signed) ROBERT H. SCOTT,
Director.

M.O. 385.

SIR,

Stationery Office, February 8, 1877.

WITH reference to your demand of the 6th inst., No. 207, for 50 copies each of certain publications of the Meteorological Committee, I beg to say that as you appear to have been already supplied with 750 copies of each of these papers for official use, and as our remaining stock is intended for sale, I shall be glad to know whether you propose to pay for the additional copies now asked for.

R. H. Scott, Esq., Meteorological Office.

I am, &c.

W. R. GREG.

M.O. 652.—3. 14. 77.

SIR,

Treasury Chambers, March 15, 1877.

THE Lords Commissioners of Her Majesty's Treasury have had before them your letter of the 20th ulto., forwarding a copy of a letter received from the Comptroller of the Stationery Office, in reply to the requisition of the Meteorological Committee for 50 copies each of two of the Committee's publications, in which he states that as the Committee appears to have been already supplied with 750 copies of each of these papers for official use, and as the remaining stock is intended for sale, he will be glad to know whether the Committee proposes to pay for the additional copies now asked for.

My Lords desire to call the serious attention of the Committee to the necessity of keeping within moderate limits the gratuitous distribution of works printed at the public expense.

No authority can be given for paying for such works out of votes taken for the purpose.

My Lords consider that the answer of the Comptroller of the Stationery Office affords a sufficient reason for not increasing the gratuitous supply, already very large, of these particular works, and they decline to authorize any such increase.

I am, &c.

R. R. W. LINGEN.

The Director, Meteorological Office.

Submitted—The following letter (Minutes, p. 8):—

GOVERNOR MAXSE to the EARL OF CARNARVON.

M.O. 675.—M. 3842. Miscellaneous, No. 6.

MY LORD,

Heligoland, Feb. 16, 1877.

I HAVE the honour to acknowledge your Lordship's dispatch of the 9th of Decr. 1876, inclosing the copy of a letter from the Board of Trade, written in answer to my dispatch No. 27 of the 18th of Sept. last.

2. In reply I beg to express the gratitude of the Colony to the Board of Trade for the handsome way in which they seem to be inclined to support the establishment of a first class meteorological station at Heligoland.

3. Mr. Scott in his letter to the Board of Trade, with reference to my proposal, founded on the advice of Dr. Neumayer (Director of the German Meteorological Department), that the official in charge should be remunerated at the rate of 18*l.* per annum, states that in England these officials are only paid about 13*l.* a year. I have now the honour to inform your Lordship that Mr. Schmidt, whom I propose to appoint to this office, is prepared to accept the smaller sum for such service.

4. Mr. Scott further remarks upon the estimate of 60*l.* for a signal mast with extra apparatus, and in reading his letter and the pamphlets with which he has been kind enough to furnish me, I am of opinion that the more economical style of signal mast, as in use in England, will be sufficient for all purposes in Heligoland. I do not consider that it is necessary for Heligoland to be a Night Station.

5. Mr. Scott further observes that the Committee would remark that the cost of the general outfit of such stations in the United Kingdom is only about half the amount proposed by Dr. Neumayer, even if an anemometer be supplied, thus making the whole outlay amount to about 20*l.*

6. As Dr. Neumayer was in private communication with myself on the possibility of establishing such a station on Heligoland, I have drawn his attention in a private letter to the above points.

7. Dr. Neumayer in reply states as he first advanced both to myself, and as it seems to Mr. Scott, that nothing could possibly be more advantageous for the English Meteorology, as also for the German institution, as the establishment of a Government Meteorological Office at Heligoland reporting officially and directly to Mr. Scott, failing this he had been prepared to support in every way, if so permitted, the establishment of a smaller local institution at this colony. He repeats with emphasis that a Meteorological reporting department at Heligoland would be of immense service practically and scientifically, and adds that he is ready to give any aid in support which may be required of him.

8. Dr. Neumayer observes that with reference to the anemometer which is supplied to British stations at 5*l.*, that it is impossible that this can be a self-registering anemograph, such as one in the possession of first class Meteorological stations, for he adds, such would cost at Casella's in London at least 25*l.* to 27*l.*

9. Dr. Neumayer closes his communication with a reference to the self-registering tide measure, which Dr. Börgen, Director of the Hydrographical Department of the Imperial German Admiralty, is desirous of placing at Heligoland under charge of some competent person to be recommended to him by this Government, and to which proposal I have had the honour of drawing your Lordship's attention.

10. In conclusion I beg to be permitted to point out how infinitely preferable it will be that a Meteorological station at Heligoland should be a branch of the Meteorological Department in

London, as indeed it was in a smaller degree in the time of Admiral FitzRoy, than that such should be in any way officially connected with a foreign power.

11. If the Board of Trade shall in view of the circumstances of the case, and of the general imperial utility of such an institution recommend that the necessary funds be granted, I can strongly recommend, as before remarked to your Lordship, Mr. Schmidt, one of the teachers of the Colonial Schools, who at present conducts such comparatively trifling weather reports as are now sent, as Meteorological telegraphic reporter at this station.

The Right Hon. the Earl of Carnarvon,
&c. &c. &c.

I have, &c.
(Signed) FITZ MAXSE.

Submitted—A letter from Mr. W. W. Rundell, of Liverpool, requesting the Committee to forego the charge for contingent expenses in the case of the telegrams requested by his son Mr. R. C. Rundell for the Glasgow underwriters (Minutes February 19).

Mr. Scott was instructed to reply that the Committee were unable to increase their expenditure unless their grant be increased.

Mr. Scott drew the attention of the Committee to a letter (No. 590) from Sir G. Nares, in which it was stated that certain instruments used on the Arctic Expedition had been presented to some of the officers by the Admiralty, with permission of the Treasury. He was instructed to apply to the Admiralty for authority to write these instruments off the books.

Read—A letter from Capt. Toynbee submitting excellent logs by,—

Mr. F. W. Allen, chief officer ship "Collingwood."

Capt. E. C. Bennett, ship "Thessalus" (Minutes, 1876, p. 107).

„ W. H. Smith, R.N.R., s.s. "Peruvian" (Minutes, 1876, p. 132).

Mr. Scott was instructed to present the Charts (O. 27) to Mr. Allen, and to express the marked thanks of the Committee to the other gentlemen.

Mr. Scott was instructed to procure an estimate for lithographing the Charts referred to by Capt. Toynbee in his memorandum, Minutes p. 3 (Minutes, 1873, p. 79).

Mr. Scott reported that he understood that Prof. v. Oettingen's integrating anemometer, which was exhibited at South Kensington last summer, was procurable at a cost of about 150*l*. He was instructed to report on its condition and the possibility of erecting it at Kew.

The Committee then adjourned.

116, Victoria Street, April 16, 1877.

PRESENT :

Major-General Smythe in the Chair.

Mr. De La Rue.

Captain Evans.

Mr. Galton.

Lieut.-General Strachey.

The Director was in attendance.

The Minutes of last meeting (March 19) were read and confirmed.

Mr. Scott reported that on the 28th ult. the following letter had been drawn up and signed by all the members of the Committee, excepting those who were prevented by illness from doing so, and that it had been forwarded by him to the Secretary of the Royal Society on the 31st ult. (Letter 711).

GENTLEMEN,

116, Victoria Street, March 31, 1877.

HER Majesty's Government laid before Parliament, early in the present session, the Report of the Treasury Committee that assembled last year to consider the results obtained by the expenditure of the annual grant of 10,000*l.* for Meteorological purposes.

From our connexion with the Royal Society we are aware that the Council of the Society has lately been consulted by the Treasury on the recommendations made in this Report, and is about to communicate with the Treasury on the subject.

Some of our body having been members of the Treasury Committee of Inquiry, and of the Council of the Royal Society, while these discussions have been going on, we have necessarily been informed of the general scope of the proposals that have been put forward, and of the opinions held by the various scientific and other authorities consulted on the subject, and we have thought it to be our duty to consider, from our own point of view, the steps that should guide our action under the circumstances in which the Meteorological Committee is now placed.

The conclusion to which we have been led, after careful consideration, is that it is very important that no delay that can be avoided should be permitted to take place in giving to the Committee the constitution it is finally to receive.

On several occasions to which it is not necessary to refer in detail, we have found that our present position, which has now become essentially provisional, is one that leads to embarrassment and hesitation in our proceedings. We have been unable to make changes which in themselves seemed desirable, knowing that our successors, who may be appointed at any moment, might hold different views from our own, while our financial position has become uncertain; and a similar feeling stands in the way of our adopting any measures other than those connected with the merely current administrative work of the Office.

The objections that exist to continuing the Committee on its present footing of gratuitous service have been universally admitted, and without attaching undue weight to this consideration, we have no hesitation in expressing the opinion that a modification of the present system in this respect is essential for ensuring that increased activity of the Office which is so desirable.

The inquiry undertaken by the Treasury Committee has clearly shown the direction which, in the opinion of men of science, should be given to the action of the Meteorological Office. We feel, however, that in our present position we are no longer able to give proper effect to the calls that have thus been made upon us, and we have therefore come to the conclusion that we should as soon as possible be relieved from that position.

We accordingly desire to place in the hands of the Council of the Royal Society the resignation of our offices in the Meteorological Committee, expressing a hope that it may be found convenient to act on this at an early date.

We have, &c.

The President and Council of the Royal Society.

Mr. Scott was instructed to forward a copy of the above letter to the Board of Trade.

Submitted—The following letters:

M.O. 684.—M. 3920.—1877.

SIR,

Miscellaneous.

Board of Trade, March 19, 1877.

I AM directed by the Board of Trade to transmit to you, for the information of the Meteorological Committee, the enclosed copy of a letter which they have received from the Foreign Office, forwarding copy of a note from the Italian Ambassador in London, containing copies of the Programme of the International Meteorological Congress to be held in Rome next September, and inviting the co-operation of Her Majesty's Government on that occasion.

I am, &c.

The Secretary to the Meteorological Committee.

(Signed) THOMAS GRAY.

M. 3920.

SIR,

Foreign Office, March 12, 1877.

I AM directed by the Earl of Derby to transmit to you a copy of a note from the Italian Ambassador at this Court, enclosing Programmes of the International Meteorological Congress to be

held at Rome on the 24th of September next, and inviting the co-operation of Her Majesty's Government on that occasion, and I am to request that in laying these papers before the Lords of Trade you will move their Lordships to favour Lord Derby with their opinion as to the answer which should be returned to Count Menabrea on this subject.

The Secretary, Board of Trade.

I am, &c.

(Signed) TENTERDEN.

M. 3920.

MONSIEUR LE COMTE,

35, Queen's Gate, Mars 3, 1877.

PAR décision du Comité central de Londres (Victoria Street 116, S.W.) le 24 du mois de Septembre année courante aura lieu à Rome le deuxième Congrès International de Météorologistes. Le dit Comité ayant compilé le Programme spécial pour la circonstance s'est adressé au Gouvernement du Roi pour qu'il se charge de le faire parvenir aux différents états qui ont pris part aux travaux du premier Congrès Météorologique tenu à Vienne en 1873, et pour qu'il invite les dits états à vouloir bien nommer ses propres délégués au prochain Congrès de Rome.

D'après les instructions du Ministère Royal des Affaires Etrangères j'ai pour cela l'honneur de vous remettre sous ce pli M. le Comte No. 4 copies du dit Programme, et de vous prier d'avoir la bonté de me faire connaître, en temps utile, les décisions du Gouvernement Britannique à ce sujet.

Veuillez, &c.

(Signed) H. MENABREA.

The Earl of Derby,
&c. &c. &c.

Mr. Scott was instructed to send the following reply :—

SIR,

Meteorological Office, April 17, 1877.

IN reply to your letter of the 19th ultimo (M. 3,920, 1877), I am instructed by the Committee to inform you that as they have already expressed to the Royal Society their desire to be relieved at an early date from the superintendence of this Office, they can hardly prescribe any course of action for so distant a period as September next.

They are, however, disposed to consider that it would be desirable that this country should be represented at the proposed Congress at Rome, inasmuch as it was represented at the previous Congress at Vienna, in 1873.

I am, &c.

(Signed) ROBERT H. SCOTT,
Director.

Thomas Gray, Esq.,
Assistant Secretary, Marine Department,
Board of Trade.

Mr. Scott reported that Commandant Labrano, Naval Attaché to the Italian Embassy, had called at the Office to say that his Government contemplated the establishment of an office for Maritime Meteorology, either at Genoa or Florence, to be placed under a committee of scientific men.

Mr. Scott reported that he had been informed by the Hydrographer (Letter 797) that seven aneroids had been presented to the Arctic officers, and that he had written these off accordingly. (Minutes, p. 19.)

Mr. Scott reported that Professor v. Oettingen's anemometer was still in the galleries of the Exhibition, and he was instructed to ascertain from Major Festing whether or not the guarantors to the Exhibition would permit it to be lent to the Committee for temporary erection at Kew.

Submitted—An estimate for printing the Charts for the Atlantic for August 1873, (Letter 811), (Minutes, p. 19)—

At 6 $\frac{1}{2}$ per sheet for 1,000 copies.

At 7 $\frac{1}{2}$ „ „ 1,500 „

Consideration deferred.

Read—A letter from Captain Toynbee submitting excellent logs kept by—

Captain R. J. Balderston, ship "Tenasserim" (Minutes, 1875, p. 60).

„ W. J. Greenwood, ship "Gareloch" (Minutes, 1876, p. 48).

* „ Henry Murdoch, ship "Denbighshire."

„ H. C. St. John, R.N., H.M.S. "Sylvia" (Minutes, 1876, p. 87). Log kept by Nav. Sub-Lieutenant F. S. Wheeler.

„ W. C. Smith, ship "Kingdom of Sweden" (Minutes, 1876, p. 35).

Submitted—The following Report:—

I HAVE to report that I inspected the station at *Dover* on the 14th inst. I found everything in good order. The station, however, is so situated as to render it impossible to get really good observations of temperature, rain, or wind.

I took this opportunity of inspecting two of the stations of the second order on that coast.

Hastings.—Inspected April 13. Observer A. E. Murray, Esq. This station is very well situated,

and the instruments are well exposed. As regards wind, however, the place is so hilly that the observations are much affected. The station is near the top of the hill, but still the wind only blows up or down the valley, as is shown by Mr. Murray's plotted wind rose.

Folkstone.—Inspected April 14. Observer A. H. Taylor, Esq. This station is also in good order. The exposure is as good as the situation of the Vicarage Gardens will allow, but the town is rapidly extending westwards, and the wind observations will be seriously influenced.

April 16, 1877.

ROBERT H. SCOTT.

Submitted—The following Memorandum.

THE "GREAT QUEENSLAND" INQUIRY.

Mr. Charles Harding attended at the Wreck Commissioners' Court April 9th, 10th, 11th, and 16th, and gave evidence on 9th and 16th respecting the winds, weather, and ocean currents obtained from the Meteorological logs of seven vessels which were near the probable track of the "Great Queensland" between the 12th and 26th August 1876. Evidence was also given respecting the air temperature about this time on the West Coast of France, &c.; also as to the probable track of a storm experienced by the ships "Rajmahal" and "Enone" on the 12th August 1876 in 46° N. and 20° W.

The information was charted in a convenient form. The Charts and various extracts from logs, &c. were handed into the court.

Submitted—A copy of the Monthly Weather Review for Canada, for January last.

Reported—That Mr. W. E. Brodie had died of rheumatic fever on the 3rd inst.

Mr. Horace Newton had been engaged in his place at a salary of 12s. 6d. per week.

Reported—That Mr. C. Stodart was very seriously ill from rheumatic affections. Mr. Scott was authorized to give him some assistance, as in the case of Mr. E. Magrath (Minutes, 1872, p. 24).

The officers and clerks were reappointed for the ensuing financial year at the following salaries (see Minutes, 1875, pp. 32-3) :—

	s.	d.	£	s.	d.
R. H. Scott, Director - - - - -	-	-	800	0	0
H. Toynbee, Marine Superintendent - - - - -	-	-	400	0	0
J. S. Harding, jun., Chief Clerk - - - - -	-	-	250	0	0
R. Strachan, 1st Senior - - - - -	-	-	200	0	0
(With 50l. additional for instruments.)					
F. Gaster, 2nd Senior Clerk - - - - -	-	-	190	0	0
C. Harding, 3rd " - - - - -	-	-	180	0	0
R. H. Curtis, 4th " - - - - -	-	-	170	0	0
J. A. Curtis, 1st Junior Clerk - - - - -	-	-	*130	0	0
T. E. Allen, 2nd " - - - - -	-	-	*130	0	0
W. L. Dallas, 3rd " - - - - -	-	-	*120	0	0
F. Brodie, 4th " - - - - -	-	-	*106	0	0
G. G. Francis, 5th " - - - - -	-	-	*100	0	0
T. D. Bell, 6th " - - - - -	-	-	*100	0	0

The following scale of weekly salaries was approved :—

	Increase.	
J. S. Harding, sen., Office Keeper - - - - -	—	1 18 6
A. J. Rigby, Temporary Clerk - - - - -	—	1 18 6
H. Harries " - - - - -	—	1 18 6
W. Allingham, " - - - - -	—	1 18 6
C. H. Thompson, " - - - - -	3 0	1 12 0
R. Sargeant, " - - - - -	3 0	1 9 0
H. N. Coble, " - - - - -	3 0	1 9 0
A. R. Simpkins, " (6 months' service only) - - - - -	2 0	1 2 0
E. G. Aldridge, " - - - - -	—	1 5 0
H. H. Bourne, " - - - - -	—	1 5 0
H. W. Chivers, " - - - - -	3 0	0 19 6
H. F. Green, " - - - - -	3 0	0 17 6
A. H. Bell, " - - - - -	—	0 12 6
A. W. Green, " - - - - -	—	0 12 6
H. Newton, " - - - - -	—	0 12 6
C. Stodart, Engraver - - - - -	—	2 2 0

Mr. J. E. Cullum was re-appointed Superintendent of Valencia Observatory, at a salary of 170l. per annum (Minutes, 1875, p. 77).

* Increase of 10l. since last year.

		£ s. d.		
Brought forward		-	-	240 13 6
For Observatories, Quarterly Allowances, &c. :				
D. Thomson, Aberdeen	-	+53	0 0	
" Coutts' bill for repairs	-	0	6 0	
				53 6 0
T. R. Robinson, Armagh	-	40	14 0	
" expenses for quarter	-	10	5 0	
				50 19 0
W. P. Dymond, Falmouth	-	+65	12 6	
" postages for 1876	-	1	4 3	
				66 16 9
R. Grant, Glasgow	-	-	-	+61 17 6
H. Williams, Holyhead	-	-	-	2 13 5
G. M. Whipple, Kew	-	100	0 0	
" portorage and other expenses	-	3	8 5	
" verifications, &c.	-	10	10 0	
				113 18 5
C. Clouston, Orkney	-	-	-	3 6 9
G. H. Aird, Seaham	-	-	-	2 13 9
S. J. Perry, Stonyhurst	-	-	-	+49 7 6
J. E. Cullum, Valencia,	-	34	4 1	
" salary	-	13	6 8	
				47 10 9
G. T. Watson, Yarmouth	-	-	-	3 19 6
R. and J. Beck, altering pantagraphs	-	-	-	6 15 0
Malby and Sons, anemograph forms	-	-	-	6 15 0
W. Marriott, Meteorological returns	-	-	-	7 10 0
L. P. Casella, instruments for Copenhagen	-	-	-	12 10 0
J. J. Hicks, " Toronto	-	-	-	7 10 0
F. Pastorelli " "	-	-	-	7 10 0
R. H. Curtis	-	-	-	14 3 4
C. H. Thompson } Computations	-	-	-	* 7 5 0
E. G. Aldridge } " "	-	-	-	* 6 5 0
J. A. Curtis } " "	-	-	-	10 0 0
For Telegraphy, Quarterly Allowances, &c. :				
N. J. Holmes, Scilly Telegraph Co.	-	-	-	8 0 0
W. McNeil, Ardrossan reporter	-	0	17 11	
" for Ardrossan postmaster	-	0	6 6	
				1 4 5
H. Todd, Cambridge	-	-	-	4 11 3
J. C. MacGowan, Donaghadee	-	-	-	1 0 0
J. Costello, Dover	-	-	-	3 5 6
J. Tilston, Holyhead	-	-	-	3 19 6
G. Mitchell, Kingstown	-	-	-	3 6 2
F. Gaster, London	-	-	-	3 5 0
J. Lowry, Moville	-	-	-	6 13 0
W. D. Penny, Nairn	-	-	-	4 4 6
E. J. Lowe, Notts	-	-	-	3 18 0
J. Lucas, Oxford	-	-	-	3 12 0
J. Merrifield, Plymouth	-	-	-	3 5 0
W. Sandford, Portishead	-	-	-	3 18 9
J. C. Walker, St. Ann's Head	-	-	-	2 6 0
W. Thomas, Scilly	-	-	-	4 8 6
J. Smith, Stornoway	-	-	-	4 2 0
W. Brand, Sumburgh Head	-	-	-	1 13 3
J. Trotter, Thurso	-	-	-	3 6 4
Postmaster, Thurso	-	-	-	1 0 0
Carried forward	-	-	-	£854 5 4

* Five weeks to the 31st March.

† Deductions made for forms, &c. supplied.

				£	s.	d.
	Brought forward	-	-	854	5	4
For Telegraphy, Quarterly Allowances, &c.— <i>cont.</i>						
J. Sinclair, Wick	-	-	-	3	5	0
G. T. Watson, Yarmouth	-	-	-	4	13	3
C. Wakefield, York	-	-	-	3	6	3
F. Gaster	Computations	-	-	15	16	8
W. L. Dallas				9	3	4
F. Brodie				8	0	0
H. W. Chivers				*4	2	6
For Ocean Meteorology :						
H. Toynbee, Marine Superintendent	-	-	-	33	6	8
Negretti and Zambra, repairing aneroids	-	-	-	4	17	9
J. H. Woodstock, packing cases	-	-	-	3	0	6
C. M. Whipple, verifications "A"	-	-	1 7 0			
" " "B T"	-	-	1 10 0			
				2	17	0
Street Brothers, advertisements	-	-	-	1	2	6
T. A. Feathers, Dundee agent	-	-	-	3	15	0
R. Strachan	Computations	-	-	†20	16	8
C. Harding				15	0	0
T. E. Allen				10	0	0
H. Harries				*9	12	6
For Office Expenses :						
J. S. Harding, jun., on account	-	-	-	200	0	0
" "	-	-	-	50	0	0

* Five weeks to the 31st March.

† Including allowance for care of instruments.

SUBMITTED.—The following STATEMENT respecting the RECORDS for December 1876, received from the SELF-RECORDING OBSERVATORIES, which have been examined at the METEOROLOGICAL OFFICE (see Minutes, 21st December 1868).

—	Aberdeen.	Armagh.	Falmouth.	Glasgow.	Kew.	Stonyhurst.	Valencia.
	Direction. Velocity. Good. Good.	Direction. Velocity. Fair. Fair.	Direction. Velocity. Good. Good.	Direction. Velocity. Fair. Fair.	Direction. Velocity. Good. Good.	Direction. Velocity. Fair. Fair.	Direction. Velocity. Good. Good.
ANEMOGRAPH :—							
Action - - - -	0 0	0 0	0 0	24 hrs. 24 hrs.	0 0	0 0	0 0
Records deficient, due to stoppage of clock -	0 0	0 0	0 0	0 0	0 0	5 hrs. 13 hrs.	0 0
" " other causes -	No record.	7th	27th	5th (?)	No record.	No record.	No record.
Orientation verified - - -	0 0	0 0	2 2	2 0	0 0	1 6	0 0
No. of errors discovered by subsidiaries -	0 0	0 0	0 0	0 1	0 4	0 0	0 0
" " irregular differences -							
Result of 40 Remeasurements :—							
Greatest difference - - -	·0 2·0	1·0 2·0	1·0 2·0	·0 2·0	·0 1·0	1·0 1·0	·0 2·0
Mean difference irrespective of sign -	·0 ·9	·1 ·6	·1 1·0	·0 ·6	·0 ·5	·1 ·5	·0 ·8
Residual difference (— M. O.) -	·00 —·15	—·07 ·00	+·05 +·12	·00 +·10	·00 +·10	+·07 —·10	·00 —·22
RAIN GAUGE :—							
Action - - - -	Good.	No rainfall traces.	Good.	Good.	Good.	Good.	Good.
Records deficient, due to stoppage of clock -	0	0	0	0	0	0	24 hrs.
" " other causes -	0	Gauge under repair.	0	0	0	0	0
Errors in tabulation - - -	0	0	0	0	0	10	0

BAROGRAPH:—

[illegible]

'THERMOGRAPH:—

THERMOGRAPH :—					
Action	-	-	-	-	-
Photography	-	-	-	-	-
Records deficient, due to stoppage of clock	-	-	-	-	-
" failure of light	-	-	-	-	-
" imperfectly moistened bulbs	-	-	-	-	-
" partially frozen bulbs	-	-	-	-	-
" other causes	-	-	-	-	-
No. of errors discovered in entry of standard	-	-	-	-	-
" by subsidiary measurements	-	-	-	-	-
" of subtraction in do. tables	-	-	-	-	-
" detected under glass scale	-	-	-	-	-
<i>Result of 40 Remeasurements :—</i>					
Greatest difference	-	-	-	-	-
Mean difference irrespective of sign	-	-	-	-	-
Residual difference (— M. O.)	-	-	-	-	-
Mean monthly difference between simultaneous thermograph and thermometer readings	-	-	-	-	-
No. of errors in maxima and minima	-	-	-	-	-

* Light on binding rods.

† Barometer very low; trace below paper in consequence.

SUBMITTED—The following STATEMENT respecting the RECORDS for January 1877, received from the SELF-RECORDING OBSERVATORIES, which have been examined at the METEOROLOGICAL OFFICE (see Minutes, 21st December 1868).

	Aberdeen.	Armagh.	Falmouth.	Glasgow.	Kew.	Stonyhurst.	Valencia.
ANEMOGRAPH:—							
Action - - - - -	Direction. Good. 0	Direction. Good. 0	Direction. Good. 0	Direction. Fair. 8	Direction. Good. 0	Direction. Good. 0	Direction. Good. 0
Records deficient, due to stoppage of clock	Velocity. Good. 0	Velocity. Good. 0	Velocity. Good. 0	Velocity. Indifferent. 9	Velocity. Good. 0	Velocity. Good. 0	Velocity. Good. 0
" " other causes - - -	0	0	0	0	*23 hrs. #23 hrs.	0	0
Orientation verified - - -	No record.	No record.	15th	2nd ?	31st	8th	No record.
No. of errors discovered by subsidiaries	0	0	1	0	0	3	0
" " irregular differences	0	0	0	0	0	0	0
<i>Result of 40 Remeasurements:—</i>							
Greatest difference - - -	1.0	2.0	0	0	1.0	1.0	1.0
Mean difference irrespective of sign - -	.2	.7	0	0	.5	.5	0
Residual difference (—M. O.) - - -	+ .2	+ .2	0	0	0	— .5	— .1
RAIN GAUGE:—							
Action - - - - -	Good.	Good.	Good.	Good.	Good.	Good.	Good.
Records deficient, due to stoppage of clock	0	13 hrs.	0	0	0	0	0
" " other causes - - -	0	†9½ days.	0	0	0	0	0
Errors in tabulation - - -	0	2	0	2	0	12	0

116, *Victoria Street*, April 30, 1877.

PRESENT :

Mr. De La Rue in the Chair.

Mr. Galton. | Major-General Smythe.
Lieut.-General Strachey.

The Director was in attendance.

The Minutes of last meeting (April 16) were read and confirmed.

Read—The following letter :—

M.O. 1013.
GENTLEMEN,

The Royal Society, Burlington House,
April 19, 1877.

IN reply to your letter of the 31st March, I am desired by the President and Council of the Royal Society to offer you their best thanks for your labours as Members of the Meteorological Committee, and to request that you will be good enough to continue your services until the completion of the new arrangements contemplated by the Government.

I am further to inform you that your wish to be relieved of your offices at an early date has been brought under the notice of the Treasury.

The Members of the Meteorological Committee.

I have, &c.
(Signed) T. H. HUXLEY,
Secretary, R.S.

Read—Letter 1060 from the South Kensington Museum, stating that the guarantors to the Permanent Exhibition would permit Prof. von Oettingen's anemometer to be removed to Kew.

Resolved—That the anemometer be taken down to Kew under the superintendence of an instrument maker.

Mr. Scott reported with reference to the question of Telegraphy with Jersey, (Minutes 1876, p. 132,) that he proposed to change the observer, as the Submarine Telegraph Company's Office did not afford a good site for thermometers or rain-gauge; and he also proposed to substitute for the present service of information to Jersey from Paris a service direct from London similar to that in operation between London and the Marine Ministry, Paris. He hoped by this to ensure a material saving of expense, as the telegrams from Paris were very costly. The arrangements were still in progress.

The question of the continuance of Sunday Telegraphy, (Minutes, p. 13,) was considered, and it was resolved that Sunday morning Telegraphy be stopped in consequence of the Treasury Letter of March 13, (Minutes, p. 17,) with the exception of the report from Greencastle, which is essential to M. Le Verrier, and is to be sent to Paris, inasmuch as it will reach London regularly at the expense of the Deutsche Seewarte (Letter 1,000).

Submitted—The following report on the amount of information for the Ocean existing in the Office :

Memo.

INDEX of METEOROLOGICAL OBSERVATIONS in OCEAN 10° SQUARES.

All Marine Meteorological documents received since the commencement of the Office (to Register 4,000) have been gone through, and an index has been made of the number of days' observations contained in each 10° Square for all oceans and for all months.

All ships' observations have been included in index, whether at sea or in harbour, but the colour of ink used separates sea observations from those in harbour.

The form of index is as follows :—

SQUARE 216.

Lat. 50° to 60° N. - - - Long. 0° to 10° E.

January.		February.		March.		April.		May.		June.		Land Stations.
Log.	Days.	Log.	Days.	Log.	Days.	Log.	Days.	Log.	Days.	Log.	Days.	
1,045	2	906	1	1,088	4	301	2	126	9	111	5	
"	2	2,213	3	1,677	5	434	1	941	9	499	1	

(continued.)

July.		August.		September.		October.		November.		December.		Land Stations.
Log.	Days.	Log.	Days.	Log.	Days.	Log.	Days.	Log.	Days.	Log.	Days.	
743	1	1,005	1	507	1	49	4	60	2	591	4	
945	9	1,247	1	1,040	2	507	1	415	1	965	2	

Black ink (Roman type) entries are from outward bound ships, or show direction in which ship was running.
 Blue ink (Egyptian type) " " homeward " " " "
 Red ink (italics) " " ships at anchor.

In addition to dealing with ships' observations, the index will also contain the names of land stations, from which observations have been received, grouped in their respective 10° Squares, and giving the years in which observations were made.

The number of days' observations for January and July have been plotted in geographical order, and Charts are submitted herewith.

CHAS. HARDING,
30th April 1877.

R. H. Scott, Esq.

Mr. Scott was instructed to embody this Index in the Annual Report.

Read—A letter from Captain Toynbee, submitting excellent logs kept by—

Captain A. Becket, ship "Amana" (Minutes, 1876, p. 107).
 " C. M. Dobson, s.s. "Beta" (Minutes, 1876, p. 107).
 " C. W. Pearson, ship "Strathleven" (Minutes, 1876, p. 118).
 " George Innes, barque "Silistria."
 " George Shearer, ship "Early Morn."

Mr. Scott was instructed to convey the marked thanks of the Committee to the three first-named gentlemen, and to present the Charts to the last two.

Mr. Scott submitted the results of the discussion of the thermometer observations taken at the Pagoda in Kew Gardens, (Minutes, 1872, p. 89,) and he was instructed to embody the results in the Quarterly Weather Report and to send a short summary to the Royal Society for their Proceedings.

Reported—That the following information had been supplied during the current month :

Gedge, Kirby, and Millett :

Victoria Gravings Dock Company v. City of Dublin Steam Packet Company.
 Weather at Holyhead, November 1876.

General Nautical Insurance Association :

Weather off Souter Point Lighthouse, 19-20 April.

Chinese Maritime Customs :

Instruction in the Use of Meteorological Instruments to six Lightkeepers.

Applicant (name unknown) :

Rainfall in London, September 1876 to February 1877.

Mr. Scott reported that Mr. Stodart was improving in health (Minutes, April 16).

Resolved—That the sum of 5*l.* be given to Mr. Stodart to meet the expenses of his illness.

Resolved—That the wages of the Commissionaire, Petchley, be raised 2*s.* 6*d.* per week, making them 1*l.* 3*s.* 6*d.* per week.

Reported—That the imprest for 2,000*l.* had been received on the 18th and lodged next day.

Reported—That a cheque for 30*l.* for petty cash had been drawn on the 23rd instant on the signature of General Smythe.

The following cheques for April were drawn :—

For Office :

		£	s.	d.
R. H. Scott	-	66	13	4
J. S. Harding, jun.	} Salaries and wages	20	16	8
J. S. Harding, sen.		*7	14	0
T. D. Bell		8	6	8
C. Gilman, Gas Co.	-	5	9	0
The Pall Mall Coal Co., coals	-	3	12	0
Williams and Norgate, books	-	6	5	3

For Observatories :

H. Bond, copying press (Valencia)	-	3	4	6
Malby and Sons, printing, &c.	-	2	9	6
J. E. Cullum, salary	-	14	3	4
R. H. Curtis	} Computations	14	3	4
C. H. Thompson		*6	8	0
E. G. Aldridge		*5	0	0
J. A. Curtis		10	16	8

For Telegraphy :

The Postmaster General, Telegrams, January	-	232	3	0
Do. February	-	164	6	11
		396	9	11
F. Dangerfield, delivery of D. W. Charts	-	12	11	3
Wightman & Co., B. P. wrappers	-	7	0	0
F. Gaster	} Computations	15	16	8
W. L. Dallas		10	0	0
F. Brodie		8	16	8
H. W. Chivers		*3	18	0

For Ocean Meteorology :

P. Adie, repairing "A" barometers	-	3	6	0
Do. Do. "BT" Do.	-	6	18	0
		10	4	0
L. P. Casella, anemometer, &c.	-	4	7	1
Negretti & Zambra, repairing aneroids	-	1	9	6
Do. "B.T." instruments	-	1	6	0
		2	15	6
Malby and Sons, printing	-	1	5	0
J. Pattison, thermometer glasses	-	2	7	4
Pickford & Co., carriage	-	2	17	0
R. Rivière, binding Charts, &c.	-	5	17	0
J. R. Jones, Aberdeen agent	-	3	12	11
D. McGregor & Co., Glasgow agent	-	6	0	0
Z. Scaping, Hull agent	-	6	0	3
J. Gill, Liverpool	-	15	15	8
H. Toynbee	} Computations, &c.	33	6	8
R. Strachan		†20	16	8
C. Harding		15	0	0
T. E. Allen		10	16	8
H. Harries		*7	14	0

Miscellaneous :

C. and E. Layton, arithmometer	-	16	10	4
F. Pastorelli, anemometer	-	4	1	0
J. S. Harding, jun., on account	-	200	0	0
		50	0	0

£1,049 1 10

* Four weeks to the 28th.

† Including allowance for care of instruments.

The Committee then adjourned.

116, *Victoria Street*, May 28, 1877.

PRESENT :

Lieut.-General Strachey in the Chair.

Mr. Galton.

Major-General Smythe.

The Director was in attendance.

The Minutes of last meeting (April 30) were read and confirmed.

Submitted—The following correspondence (Minutes, p. 21) :—

M. 6290.—M.O. 1138.

SIR,

Board of Trade, May 8, 1877.

I AM directed by the Board of Trade to transmit to you, for the information of the Meteorological Committee, the enclosed copy of a letter which they have received from the Treasury, on the subject of the representation of England at the forthcoming International Meteorological Congress at Rome.

The Secretary to the Meteorological Committee.

I am, &c.
(Signed) THOMAS GRAY.

7023.

SIR,

Treasury Chambers, May 1, 1877.

I AM directed by the Lords Commissioners of Her Majesty's Treasury to return to you the enclosures to Mr. Gray's letter of the 21st ultimo, relative to the International Meteorological Congress to be held at Rome in September next, and to acquaint you, with reference thereto, for the information of the Lords of the Committee of Council for Trade, that my Lords are in communication with the Royal Society as to the course which should be taken upon the Report of the recent Committee of Inquiry.

When the nature of the Authority which is in future to undertake the administration of the vote for the promotion of Meteorology has been determined, questions such as that of representation at Congresses, &c. will be referred to it, and it will be for the same Authority to decide whether or not they will devote part of the funds at their disposal to any such purpose.

My Lords have no intention of proposing any separate vote to Parliament in order to promote the proposed Meteorological Conference at Rome, nor are they prepared to authorise expenditure for the purpose, except such (if any) as the new Authority to be entrusted with the Administration of the vote for the promotion of Meteorology may decide to make from that vote.

The Secretary Board of Trade.

I am, &c.
(Signed) R. R. W. LINGEN.

Mr. Scott reported with reference to Governor Maxse's letter respecting telegraphy with Heligoland (p. 18), that he had written to that gentleman pointing out that further action in the matter lay with him.

Mr. Scott submitted the following correspondence :—

Press Copy.—1035.

DEAR SIR,

Meteorological Office, May 10, 1877.

I ENCLOSE copies of the replies I have received from Sir G. Nares and Captain Stephenson, relative to the Meteorological instruments which were not returned from the Arctic ships. You will see that more than 7 aneroids are missing.

I enclose also a note of the instruments returned broken by the Expedition, and should be much obliged if you could give me your opinion as to whether or not the whole of these instruments should now be written off. Their value is so large that I do not venture to write them off at once.

Captain Evans, F.R.S.

Yours, &c.
(Signed) ROBERT H. SCOTT.

M.O. 1274.

DEAR SIR,

Hydrographic Department, Admiralty, May 26, 1877.

IN reply to your letter of the 10th instant, having reference to certain meteorological instruments of the late Arctic Expedition unaccounted for, I think, under the explanations given by Sir George Nares and Captain Stephenson, there is no course left but to write such instruments off the books of the Meteorological Office. It is a matter for regret that so many of these delicate instruments should have been broken, but the exceptional nature of the service under which they were used may perhaps excuse much of these damages. The statement made as regards seven aneroids, presented to certain officers by their Lordships' orders and under Treasury sanction, is correct.

Robert Scott, Esq., F.R.S.

Yours, &c.
FREDK. JNO. EVANS.

Instruments supplied to "Alert" not returned.

- 4 Aneroids ; Pocket, S. 23, 25, 26 ; Portable \nearrow 327.
- 1 Glass ; No. 47, for rain-gauge.
- 10 Portable Thermometers ; Casella, spirit, A. 1516, 1517, 1518, 1520, 1521, 1522, 1523, 1524.
Mercury 6150, 6146.
- 6 Thermometers ; Pastorelli, mercurial, A. 441, 447, 449, 452 ; Hicks, spirit, 223, 224,
- 3 Glacier Thermometers ; Hicks, 1, 2, 3.
- 1 Minimum Thermometer ; hollow bulb, Hicks, 23013.
- 1 Large Thermometer Screen.
- 2 Small Thermometer Screens.
- 1 Hydrometer ; Casella, A. 742.
- 12 Registers.

Instruments returned from "Alert" broken.

- 2 Maximum Thermometers ; in vacuo, Hicks, 38, 23296.
- 2 Maximum Thermometers ; Negretti. A. 420, 422.
- 2 Minimum Thermometers ; Negretti, A. 418, Hicks, 23012.
- 8 Thermometers ; Pastorelli, Mercury, A. 442, 445, 446, 450, 454, 455, 458, Hicks, spirit, A. 230.
- 1 Hygrometer ; Pfister, 2.
- 1 Anemometer ; Pastorelli.

Instruments supplied to "Discovery" not returned.

- 5 Aneroids ; Pocket, S. 27, 28, 29, 30 ; Portable \nearrow 16.
- 1 Glass ; No 130, for rain-gauge.
- 8 Portable Thermometers ; Casella, Mercury, 6145 ; Spirit A, 1507, 1508, 1509, 1510, 1513, 1514, 1515.
- 1 Minimum Thermometer ; Negretti, A. 415.
- 1 Large Thermometer Screen.
- 2 Small Thermometer Screens.
- 1 Solar Thermometer ; No. 43.
- 1 Hollow Bulb Thermometers ; 23014, 23015.
- 9 Thermometers ; Mercurial, Pastorelli, A. 460, 461, 462, 466, 467, 468, 473, 475, 476.
- 1 Hygrometer, by Pfister No. 6.
- 1 Hydrometer, Casella, A. 946.
- 1 Rain-gauge ; No. 29.
- 12 Registers.

Instruments returned from "Discovery" broken.

- 1 Maximum Thermometer ; in vacuo, Hicks, 42.
- 10 Thermometers, Pastorelli ; Mercury A. 459, 463, 464, 465, 469, 470, 471, 472, 474, Casella, Portable, spirit, A. 1511.
- 1 Barometer ; Casella, A. 17.
- 3 Glacier Thermometer ; Hicks, 4, 5, 6,
- 1 Anemometer ; Pastorelli.

He was instructed to write off the instruments in accordance with Captain Evans' letter.

He further reported—That Commander Pelham Aldrich had returned his Watch Aneroid S. 24, and it was resolved that this instrument be presented to him.

Reported—That von Oettingen's anemometer had been removed from the Exhibition Galleries by Messrs. Elliott and erected at Kew (p. 26).

Reported—That Captain Toynbee had been requested to give a lecture at the Royal United Service Institution on the "Weather over the Atlantic in August 1873"—Sanctioned.

Read—A letter from Captain Toynbee submitting "excellent" logs by—

Captain G. R. Stuart, s.s. "Nemesis" (Minutes, 1876, p. 118).

" R. H. Napier, H.M.S. "Nassau." Log kept by G. N. A. Pollard, Esq., R.N. (Minutes, p. 6).

" W. R. Cato, s.s. "Hibernia." Log kept by Campbell M. W. Hepworth.

" E. W. Turner, barque "Mertola."

" J. N. Jackson, ship "Knowsley Hall."

Mr. Scott was instructed to present the Charts to the four last-named gentlemen as well as to Captain Murdoch (Minutes, p. 21), and to present the marked thanks of the Committee to the first three, and to the others mentioned on p. 21.

Reported—That the Charts had been presented to the following gentlemen, who had only previously received letters of thanks:—

Navigating Lieutenant G. A. Broad, R.N., H.M.S. "Valorous."
 Captain J. Bythesea, V.C., R.N., H.M.S. "Phœbe."
 Lieutenant Orford Churchill, R.N., H.M.S. "Ariel."
 Sub-Lieutenant G. C. Frederick, R.N., H.M.S. "Fawn."
 John J. Hayward, Esq., R.N., H.M.S. "Hydra."
 Timotheus J. Haran, Esq., Surgeon, R.N.
 Captain J. O. Hopkins, R.N., H.M.S. "Liverpool."
 A. C. Horner, Esq., M.R.C.S., s.s. "Pandora."
 Staff-Commander Henry Hosken, R.N., H.M.S. "Pearl."
 " " Robert Jackson, R.N., H.M.S. "Glasgow."
 Captain Loftus Francis Jones, R.N., H.M.S. "Valorous."
 " T. M. Jones, R.N., H.M.S. "Glasgow."
 Rear-Admiral M. S. Nolloth, R.N., H.M.S. "Frolic."
 Commander R. H. Napier, R.N., H.M.S. "Nassau."
 Captain Sir G. S. Nares, K.C.B., H.M.S. "Challenger."
 Staff-Commander J. A. R. Petch, R.N., H.M.S. "Phœbe."
 Lieutenant G. N. A. Pollard, R.N., H.M.S. "Nassau."
 Navigating Sub-Lieutenant C. E. Pritchard, R.N., H.M.S. "Ariel."
 Captain H. C. St. John, R.N., H.M.S. "Sylvia."
 Staff-Commander W. H. Sharp, R.N., H.M.S. "Liverpool."
 Rear-Admiral P. F. Shortland, R.N., H.M.S. "Hydra."
 Captain F. T. Thomson, R.N., H.M.S. "Challenger."
 Staff-Commander T. H. Tizard, R.N., H.M.S. "Challenger."
 " " W. W. Vine, R.N., H.M.S. "Orontes."
 Commander W. J. L. Wharton, R.N., H.M.S. "Fawn."
 Navigating Sub-Lieutenant F. S. Wheeler, R.N., H.M.S. "Sylvia."

Resolved—That the Charts of the Atlantic for August, 1873, (Minutes, p. 21,) be forwarded to the Stationery Office to be printed, 750 copies.

Reported—That meteorological information had been supplied during the month to—

J. E. Clark, Esq.:

Data for Paris.

The Deutsche Seewarte:

Data for a Typhoon in the China Seas.

J. Westlake, Esq.:

Max. and min. temperatures for certain stations for 1876.

Mr. Thos. Cooper:

Information as to Winds, &c. near Pernambuco.

C. W. Waylen, Esq. (Deptford Hospital):

Data for the United Kingdom for past winter.

The "Clerkenwell News":

A daily diagram commencing May 28.

The cost of this information had been paid in each case.

Submitted—The following correspondence:

M.O.—1088.
 DEAR SIR,

Office of the Chief Signal Officer, War Department,
 Washington, April 19, 1877.

GENERAL MYER is desirous of getting copies of such portions of the logs of vessels plying between Europe and America as refer to Meteorological matters, especially at those hours which correspond to the simultaneous international observations made at 7:35 a.m., Washington mean time, and directs me to inquire if you will furnish him with copies of those received at your Office, on payment of the cost of transcribing and mailing. Please advise me in your answer of the average number of logs received regularly from which such abstracts could be made monthly, and also the probable cost of the work.

R. H. Scott, Esq.

Very respectfully,
 H. W. HOWGATE.

Press Copy.—1022.
 DEAR SIR,

Meteorological Office, May 7, 1877.

I SHALL be happy to supply you with whatever information you require from the logs of vessels plying between Europe and North America, for the purposes of your synchronous observations, but I should be obliged if you will let me know precisely *what data* should be extracted.

I think we could supply about 1,000 observations a year pretty evenly distributed over the different months, and the cost would probably not exceed 7l. per annum.

We have much more material, if wanted, from ships running to West Indies, Surinam, Davis Straits, &c., and between Halifax and St. Thomas.

Your letter does not state at what date the extraction should commence.

Yours, &c.

(Signed) ROBERT H. SCOTT,

Director.

Brig-Gen. A. J. Myer, U.S.A.

Submitted—The following return of the comparison between the warnings issued and the weather experienced in 1876. (Minutes, 1872, p. 59; 1873, pp. 7, 29; 1874, p. 49; 1875, p. 24; 1876, p. 103.)

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 late, owing to Sundays or Telegraphic Errors.	Storms for which no Warning was issued.
Ireland, south -	30	14	7	3	2	4	—	Jan. 22 ^p , Feb. 18 ^p , Feb. 23.
" east -	36	21	10	5	—	—	—	Feb. 18 ^p , Mar. 6 ^p , Mar. 18 ^p .
Scotland, east -	27	20	5	2	—	—	—	Feb. 15, Feb. 18 ^p , Feb. 23, Mar. 6 ^p , Mar. 8, Mar. 18, Oct. 30 ^p , Dec. 31.
" west (Clyde)	26	18	3	5	—	—	—	Feb. 23, Mar. 6.
England, north-west -	27	19	5	2	—	1	—	Mar. 18, Aug. 31 ^p .
" west -	28	17	8	3	—	—	—	Apl. 10, Apl. 14 ^s , Aug. 31 ^p .
" south -	39	23	7	3	2	4	—	Feb. 18 ^p , Feb. 26, Mar. 6 ^p , Mar. 12 ^s , Apl. 10 ^p ? Apl. 14 ^s , Sept. 24 ^s .
" south-east -	19	11	3	4	—	1	—	Entrance of Channel only, Feb. 23 ^p , Aug. 2 ^p , Dec. 20.
" east -	33	19	9	4	—	1	—	Mar. 12 ^s .
								Feb. 18 ^p , Mar. 6 ^p , Mar. 18.
Totals -	265	162	57	31	4	11	—	
Per-centages -	—	61.1	21.5	11.7	1.5	4.1	—	

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

"s" that the warning was not issued owing to the intervention of a Sunday or to telegraphic errors.

If these figures be compared with those for the previous years in which the system has been checked, we arrive at the following results in per-centages:—

—	Warnings justified by subsequent Gales.	Warnings justified by subsequent Strong Winds.	Total Warnings justified.	Warnings not justified by subsequent Weather.
1870	46.7	21.7	68.4	22.4
1871	46	17.7	63.7	22.0
1872	61	19.5	80.5	11.9
1873	45.2	34.0	79.2	16.8
1874	45.4	32.8	78.2	16.4
1875	41.1	35.1	76.2	21.0
1876	61.1	21.5	82.6	11.7

Mr. Scott stated that he attributed the great improvement in the results for 1876, as compared with those for previous years, partly to the fact of the Office having been open in the evening, and partly to the increased information as to the winds felt on the coast which had been derived from the Lighthouse records. (Minutes, 1876, p. 132.) He was instructed to forward the return to the Board of Trade for presentation to Parliament.

Mr. Scott submitted a report on the Inspection of the Telegraphic Reporting Stations at Cambridge and Yarmouth, and on the station of the second order at Norwich, which had been carried out by Mr. Gaster on the 25th and 26th inst.

Cambridge.—Instruments in good order, but inspector recommends that Professor Adams be requested to procure a new minimum thermometer and rain-gauge.

Yarmouth.—Instruments in good order; recommended that a Stevenson's thermometer screen be supplied.

Norwich.—The position of the instruments has been changed, and the observations, though well taken, are no longer representative of the climate of the country about.

Mr. Scott was instructed to proceed on his inspection of the South Coast, as usual, on the 4th proximo.

Submitted—The following revenue account and balance sheet, 1876-7:

Dr. METEOROLOGICAL OFFICE : REVENUE ACCOUNT for the Year ending 31st March 1877.				Cr.			
INCOME.				EXPENDITURE.			
	£	s.	d.		£	s.	d.
To H. M. Exchequer - -	10,000	0	0	By depreciation of furniture, &c. -	27	10	0
Interest on deposit account -	2	7	2	Salaries and wages -	1,386	15	9
Commission on instruments sold, &c. -	18	4	0	Rent, fuel, &c. -	589	16	4
Balance charged to capital account	974	19	11	Contingencies -	317	9	6
					2,321	11	7
				Expenses at observatories -	2,549	5	3
				Observatory computations -	1,211	11	11
					3,760	17	2
				Telegrams and reporters -	1,853	19	7
				D. W. charts and other expenses -	210	7	9
				Telegraphy computations -	798	2	10
					2,862	10	2
				Marine superintendent -	400	0	0
				Supply of instruments, &c.			
				Royal Navy -	293	14	4
				Mercantile marine	237	5	11
				Marine computations -	1,119	11	11
					2,050	12	2
					£10,995	11	1
					£10,995	11	1

Dr. BALANCE SHEET, 31st March 1877.				Cr.			
LIABILITIES.				ASSETS.			
	£	s.	d.		£	s.	d.
To sundry creditors - -	897	6	1	By Cash in hand, viz.:			
Capital on 1st April 1876 -	7,500	11	2	At Bank of England	236	7	1
Balance of revenue account -	974	19	11	At office (petty cash) -	127	14	1
				At London and Westminster Bnk.	231	18	4
				Advance to Valencia Observatory -	50	0	0
					645	19	6
				Sundry debtors -	-	-	-
					318	14	3
				Stock in hand, viz.:			
				Observatory instruments -	1,892	7	9
				Admiralty do. -	2,445	2	2
				Board of Trade do. -	1,657	16	8
					5,995	6	7
				Furniture and fittings, valued at -	-	-	-
					462	17	0
					£7,422	17	4
					£7,422	17	4

* NOTE.—From 1 April 1877 the *available* assets only, e.g., cash, &c., will be brought forward, in accordance with Mr. De La Rue's Memo. of 29 January (Minutes, p. 8). The balance to be carried forward is therefore 67*l.* 7*s.* 8*d.*

SUBMITTED—The following STATEMENT respecting the RECORDS for February 1877, received from the SELF-RECORDING OBSERVATORIES, which have been examined at the METEOROLOGICAL OFFICE (see Minutes 21st December 1868).

	Aberdeen.		Armagh.		Falmouth.		Glasgow.		Kew.		Stonyhurst.		Valencia.	
	Direction.	Velocity.	Direction.	Velocity.	Direction.	Velocity.	Direction.	Velocity.	Direction.	Velocity.	Direction.	Velocity.	Direction.	Velocity.
ANEMOGRAPH:—														
Action - - - - -	Good.	Good.	Fair.	Fair.	Good.	Good.	Good.	Indifferent.	Good.	Good.	Good.	Fair.	Good.	Good.
Records deficient, due to stoppage of clock -	0	0	0	0	0	0	0	0	0	0	0	0	0	0
" " other causes -	*6 hrs.	0	0	0	†3 hrs.	0	0	0	0	0	†3 hrs.	†7 hrs.	†3 hrs.	†4 hrs.
Orientation verified - - -	2nd	—	7th	—	14th	—	23rd	—	Not recorded.	Not recorded.	Not recorded.	Not recorded.	22nd	—
No. of errors discovered by subsidiaries -	0	0	0	0	0	0	0	1	0	0	0	7	0	0
" " irregular differences -	0	0	0	0	0	0	0	0	18	0	0	4	0	1
<i>Result of 40 Remeasurements:—</i>														
Greatest difference - - -	1.0	2.0	0.0	2.0	0.0	2.0	1.0	1.0	1.0	1.0	1.0	2.0	1.0	2.0
Mean difference irrespective of sign -	.02	.5	.0	.6	.0	.7	.0	.5	.0	.3	.1	.6	.05	.8
Residual difference (— Meteorological Office) -	+ .02	— .02	.00	— .10	.00	— .02	— .02	— .10	+ .02	— .02	— .02	— .05	.0	+ .02
RAIN GAUGE:—														
Action - - - - -	Good.		Good.		Good.		Fair.		Good.		Good.		Good.	
Records deficient, due to stoppage of clock -	0		§ 24 hrs.		0		0		0		0		0	
" " other causes -	0		0		0		0		0		0		0	
Errors in tabulation - - -	0		3		0		2		0		15		2	

The following cheques for May were drawn :—

For Office :

		£	s.	d.
R. H. Scott	-	66	13	4
J. S. Harding, jun.	} Salaries and wages	20	16	8
J. S. Harding, sen.		*7	14	0
T. D. Bell		8	6	8
Wightman and Co., printing	-	6	16	6

For Observatories, &c. :

T. W. Baker, "Pagoda" observations	-	16	5	0
Hopkin and Williams, chemicals	-	5	9	8
J. E. Cullum, salary	-	14	3	4
R. H. Curtis	} Computations	14	3	4
C. H. Thompson		*6	8	0
E. G. Aldridge		*5	0	0
J. A. Curtis		10	16	8

For Telegraphy :

Postmaster-General, March	-	176	1	5
L. Squire, Falmouth	-	11	17	8
F. Gaster	} Computations	15	16	8
W. L. Dallas		10	0	0
F. Brodie		8	16	8
H. Chivers		*3	18	0

For Ocean Meteorology :

Pickford and Co., railway charges	-	6	19	2
J. H. Woodstock, packing cases	-	5	6	0
J. J. Hicks, thermometer screens	-	25	8	4
H. Toynbee	} Computations, &c.	33	6	8
R. Strachan		†20	16	8
C. Harding		15	0	0
T. E. Allen		10	16	8
H. Harries		*7	14	0

Miscellaneous :

Bates, Walker, & Co., on account G. T. Kingston	-	5	11	0
Negretti and Zambra	1 17 10			
Ditto	7 17 9			
		9	15	7
J. S. Harding, jun., on account of Office expenses	-	200	0	0
"	-	50	0	0
Total	-	£799	17	8

* Four weeks to the 26th instant.

† Including allowance for care of instruments.

The Committee then adjourned.

116, Victoria Street, June 18, 1877.

PRESENT :

Lieut.-General Strachey in the Chair.

Mr. De La Rue.

Captain Evans.

Mr. Galton.

Major-General Smythe.

The Director was in attendance.

The Minutes of last meeting (May 28) were read and confirmed.

Reported—That the accounts for the year 1876–7 had been audited on the 11th instant by Mr. De La Rue and General Smythe, and sent to the Treasury next day. The statement is substantially the same as that already printed (Minutes, p. 23), the corrected available balance on the entire ten years' transactions being 67*l.* 7*s.* 8*d.*

Mr. Scott read a private letter from Mr. Buchan to Mr. De La Rue, which had been forwarded to him by the latter gentleman, and he was instructed to print it on the Minutes as follows :—

Scottish Meteorological Society, General Post Office Buildings,

DEAR SIR,

Edinburgh, June 11, 1877.

I CALLED at the Meteorological Office the day after that on which I met you at the Royal Institution in April last year, when Captain Toynbee and Mr. Curtis very courteously showed me the whole of the Instruments in use there. It gave me the greatest possible pleasure to see these beautiful Instruments at work.

The exquisite beauty of the Instruments makes one wish strongly that a higher degree of accuracy were aimed at than 0·020 inch for the Barometer. All our best Meteorologists are of opinion that barometrical data which do not ensure a degree of accuracy less than one hundredth of an inch are insufficient for the investigation of many of the vital questions of Meteorology.

It is, of course, not in the instruments at work in Victoria Street, but in the process of producing the automatic curves that the errors of 0·005, 0·010 and possibly 0·020 inch have their origin. Until a greater degree of accuracy be attained in the production of the automatic curves, no refinement in the processes by which these curves are converted into figures or reproduced on plates can bring the result to the degree of accuracy of eye observations.

It was on these grounds I gave my evidence on this point before the Duke of Devonshire's Commission and the Treasury Meteorological Commission. I unfortunately missed seeing the Kew Observatory, having been delayed about two hours on the way by train, owing to the Boat Race that day.

I am, &c.

Warren De La Rue, Esq., D.C.L., F.R.S.

(Signed) ALEXANDER BUCHAN.

Read—A letter from Captain Toynbee, submitting Excellent Logs by—

Captain C. E. Le Poer Trench, ship "Newcastle" (Minutes, 1876, p. 118).

„ W. Waring, s.s. "Atalanta."

Mr. Scott was instructed to present the Charts to Captain Waring, and to send the best thanks of the Committee to Captain Trench.

Mr. Scott stated that the United Service Institution did not intend to print Captain Toynbee's Lecture (Minutes, p. 34), but that as Captain Toynbee and he himself thought it advisable that the Lecture should be printed, he had entered into correspondence with the Editor of the Nautical Magazine, and wished to know if the Committee would sanction the appearance of the Lecture in that Magazine, and would contribute towards the expense of illustrating it.

Resolved—That 10*l.* be granted in consideration of 500 copies of the Lecture, with illustrations, being supplied to the Office.

Mr. Scott submitted a letter from Professor Thomson (No. 1275), asking the Committee to send a locum tenens to Aberdeen to take Mr. Boswell's post during his vacation in August (Minutes, 1876, pp. 117 and 131).

Resolved—That a sum of 12*l.* be allowed for the extra expenses of Mr. Harrison, the assistant to be sent from Kew, a portion of this allowance to be recovered from Aberdeen Observatory.

SUBMITTED—The following STATEMENT respecting the RECORDS for March 1877, received from the SELF-RECORDING OBSERVATORIES, which have been examined at the METEOROLOGICAL OFFICE (see Minutes, 21st December 1868).

	Aberdeen.	Armagh.	Falmouth.	Glasgow.	Kew.	Stonyhurst.	Valencia.
ANEMOGRAPH :—							
Action - - -	-	-	-	-	-	-	-
Records deficient, due to stoppage of clock	-	-	-	-	-	-	-
" " other causes - -	-	-	-	-	-	-	-
Orientation verified - -	-	-	-	-	-	-	-
No. of errors discovered by subsidiaries	-	-	-	-	-	-	-
" " irregular differences	-	-	-	-	-	-	-
Result of 40 Remeasurements :—							
Greatest difference - -	-	-	-	-	-	-	-
Mean difference irrespective of sign - -	-	-	-	-	-	-	-
Residual difference (-M.O.) - -	-	-	-	-	-	-	-
RAIN GAUGE :—							
Action - - -	-	-	-	-	-	-	-
Records deficient, due to stoppage of clock	-	-	-	-	-	-	-
" " other causes - -	-	-	-	-	-	-	-
Errors in tabulation - -	-	-	-	-	-	-	-

Submitted the following report:—

I have to report that on the 4th instant I visited the station of *Hurst Castle*. The former observer there, Mr. Jobbins, died on the 4th of February, and the present clerk in charge, Mr. A. James, is only temporarily stationed there. As the post is an important one, and the clerk has to learn the International Signal Code, it may be expected that the permanent clerk will be of superior ability to ordinary telegraph clerks. There is no prospect of finding any other observer at the place.

The instruments are in good order, the thermometers and rain-gauge having a perfectly free exposure on one of the casemates.

Plymouth was visited on the 5th instant. There is nothing to say about this station except that the observations are very well taken by Dr. Merrifield, but the position of the instruments is unavoidably bad.

Scilly, visited June 6. The station is in very satisfactory order. The situation of the thermometer screen and rain-gauge is unexceptionable, being on a neatly kept grass plot, open on all sides, being the enclosure of the Coast Guard Signal Staff.

The cable to Scilly was repaired last autumn, but it parted again Jan 5, 1877. It is hoped that ere long communication will be restored.

Portishead, visited June 9. This station is satisfactory, excepting that the observer is absent for several hours daily at his office in Bristol; but there does not seem to be any other observer available at the place.

Falmouth Observatory, visited June 7 and 8. The instruments appear to be working well. The replacement of the screw shaft of the vanes had not been effected (*Minutes*, 1876, p. 118) prior to my visit owing to the difficulty of obtaining the services of a workman. It has, however, now been changed.

ROBERT H. SCOTT.

Reported—That the United States Signal Office (*Minutes*, p. 35) had applied (Letter 1876) for the information to be supplied from the 1st proximo.

That M. Capello had applied for information relative to a storm in the neighbourhood of Madeira in November 1876, which had been supplied to him, no charge being made.

Mr. F. Gaster had attended at the Chancery Court, on the 6th instant, to give evidence on the state of the weather on the Thames, March 15th, 1876, and in the Admiralty Court, May 24, to give evidence on the weather on the Tyne in a case of collision.

The Committee then adjourned.

116, Victoria Street, July 9, 1877.

PRESENT :

Rear-Admiral Richards in the Chair.

Mr. De La Rue.

Mr. Galton.

Captain Evans.

The Director was in attendance.

The Minutes of last meeting (June 18) were read and confirmed.

The Report for the year 1876 as corrected by the Committee was adopted, and Mr. Scott was instructed to forward it to the Board of Trade for presentation to Parliament.

Mr. Scott reported that Captain Toynbee was anxious that his Lecture be published officially by the Committee, instead of its appearing first in the Nautical Magazine, and being reprinted as authorised at last meeting.

Resolved—That this question be referred to the future Council.

Reported—That the relief at Aberdeen had been arranged by Professor Thomson, without requiring the services of an assistant from Kew.

Professor Stokes, Secretary to the Royal Society, attended, and communicated the following letter addressed by the Secretary of the Treasury to the President of the Royal Society :—

10036/77.

SIR,

Treasury Chambers, June 28, 1877.

IN reply to your letter of the 15th instant, I am directed by the Lords Commissioners of Her Majesty's Treasury to acquaint you that my Lords offer no objection to the proposal of the Council of the Royal Society that the new Meteorological Council should consist of a chairman and four (instead of three) nominated members, in addition to the Hydrographer of the Admiralty, who is to be a member *ex officio* of the Council, on the understanding that no greater sum than 1,000*l.* will be required for the remuneration of the Council when thus enlarged.

My Lords foresee no difficulty in expressing on their own part a formal approval of the selection by the Council of the Royal Society of the members of the new Meteorological Council, the names being communicated to the Treasury for that purpose; but my Lords would not be disposed to take any step which would raise or leave a doubt whether the members of the new Council were selected and appointed by Her Majesty's Government, or by the Council of the Royal Society.

My Lords entirely concur in the view taken by the Council of the Royal Society as to the exclusive responsibility of the new Council for its Annual Report. The part of the Council of the Royal Society is clearly understood to be confined to that of assisting and advising my Lords by means of such observations on the Council's Report as it may be found proper to suggest.

My Lords agree that the supplementary vote to be taken for the present year shall be 2,000*l.*, of which, as only three quarters will be needed for the proposed annual remuneration of the Council during the nine months to end 31st March 1878, the balance will be available for immediate extensions of work, inspection, &c.

My Lords approve of the nomination of the eminent gentlemen whose names are given at the end of your letter to be members of the new Council.

My Lords assume that the new Council and the late Committee will arrange for taking over furniture and cash balances.

No reference to the Treasury is necessary; but the transfer of accounts (only) should be so recorded as to enable the Comptroller and Auditor-General to understand what has occurred.

I am, &c.

The President of the Royal Society.

(Signed) R. R. W. LINGEN.

Professor Stokes further stated that the new Council was composed of the following members :—

Professor Henry J. S. Smith (Chairman);

Mr. De La Rue;

Mr. Galton;

Professor G. G. Stokes;

Lieut.-General Strachey;

and the Hydrographer to the Admiralty (as an *ex-officio* member).

It was resolved—That the cash balances, amounting on the 31st March 1877 to 645*l.* 19*s.* 6*d.*, together with the instruments, furniture, and fittings, as per schedules handed in, library, and all things pertaining to the department, be transferred to the new Council. That the Council be informed that since closing the accounts on the 31st of March, and which have been duly audited, an imprest for 2,000*l.* has been obtained from the Treasury, in addition to receipts from other sources, and cheques drawn amounting to 2,919*l.* 1*s.* 9*d.* (including payments in advance on account of current expenses). The available balance, after deducting claims on the Office, was on March 31, 1877, 67*l.* 7*s.* 8*d.*, as shown by the balance sheet in the Annual Report (Appendix I.)

Resolved—That a copy of the Minutes of to-day's proceedings be furnished to the Council.

The Chairman and members of Council as follows :—

Professor Henry Smith,

Mr. De La Rue,

Mr. Galton,

Professor Stokes,

The Hydrographer,

were in attendance and accepted the charge of the Office.

Mr. Scott was instructed to forward a copy of these Minutes to the Board of Trade, and to the Royal Society.

The proceedings then terminated.

LONDON:

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For Her Majesty's Stationery Office.