METEOROLOGICAL COMMITTEE MINUTES

1873

METEOROLOGICAL OFFICE

MINUTES OF THE PROCEEDINGS

OF THE

METEOROLOGICAL COMMITTEE,

1873.

LONDON:
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1874.

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MINUTES OF THE PROCEEDINGS

OF THE

METEOROLOGICAL COMMITTEE.

116, *Victoria Street, January* 6, 1873.

PRESENT:

Sir E. Sabine in the Chair.

Mr. De La Rue.	Rear-Admiral Richards.
Mr. Galton.	Mr. Spottiswoode.
Mr. Gassiot.	Sir C. Wheatstone.

The Director was in attendance.

The Minutes of last meeting (Dec. 30) were read and confirmed.

Mr. Scott was instructed to send the following reply to the Registrar General:

I am instructed by the Meteorological Committee to inform you, in reply to your letter of the 17th ult., that having examined the list of stations from whence meteorological reports are printed in your various returns, they are of opinion that there would be no difficulty in their supplying you with information of a similar character to that now published by you, without any additional charge to the Government beyond their annual grant.

Several private observers whose names appear in the returns already supply observations to this Office, and the Committee think it probable that a large proportion of the remainder would do so if requested.

In order that you may be acquainted with the amount of information the Committee are now in a position to supply, I am instructed to send you the map herewith enclosed, on which I have marked n red the stations from which the Committee receive reliable daily observations.

The number of these stations could be increased.

The Committee, having a staff competent to discuss the returns, would be most happy to meet the wishes of the Treasury by supplying such returns free of charge.

I am instructed to point out to you that they could not undertake to pay any sum of money out of the grant, with the management of which they are entrusted, for work to be carried on by any gentleman not under the entire control of and in direct communication with the Committee.

Sir C. Wheatstone reported that he had examined the correspondence with the Scottish Meteorological Society, and submitted a draft resolution, which was ordered to be printed for the consideration of the Committee.

Reported—That the Royal Geographical Society had paid the sum of 10*l.* 10*s.* 0*d.* for the meteorological instruments supplied for use at Zanzibar (Minutes 1872, p. 65).

The Committee proceeded to the consideration of the opinions on the Chart of Square III. for January, which have been printed in the Minutes.

Mr. Scott submitted the track chart with the two degree squares marked on it, as directed at the meeting of December 16th.

After considerable discussion, Mr. Scott was instructed to undertake the calculation of the data for the wind, for two degree squares, for the most frequented portion of the district for which the materials have been extracted.

Reported—That a copy of the Daily Weather Chart had been supplied to each of the following gentlemen, in return for observations:

G. T. Kingston, Observatory, Toronto.
Rev. W. P. Mackay, Hull.
Charles Woollett, Acrise.

The Committee then adjourned.

116, *Victoria Street, January* 13, 1873.

PRESENT:

Sir E. Sabine in the Chair.

Mr. Gassiot. | Mr. Spottiswoode.

The Director was in attendance.

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

Reported—That the reply had been sent to the Registrar General, as directed at last meeting.

The consideration of the correspondence with the Scottish Meteorological Society was then taken up, and the following Resolution was adopted, which Mr. Scott was instructed to forward to the Secretary of that Society :—

Resolved—That while this Committee regrets that the Council of the Scottish Meteorological Society should have objected to their having appointed as their telegraphic reporter at Stornoway, a gentleman who already gratuitously furnishes observations to the Society, they would remark that this is a matter which simply concerns the relations between the Society and that gentleman.

The Meteorological Committee have considered that by the correspondence which passed between January 19 and May 16, 1870, as well as by the following paragraph in the Memorial of the Society, dated June 14, 1870—

> " The Council having given consideration to these statements, agreed that the failure of
> " their negotiations with the Royal Society Committee should be reported to the Board of
> " Trade and to the Treasury, with the view of asking both bodies to concur in recommending
> " a special annual grant to the Society "—

the whole basis of an arrangement between themselves and the Scottish Meteorological Society had been abandoned.

Read—A letter from Capt. Toynbee, submitting excellent logs by—

Capt. D. Harris, SS. " Medway " (Minutes, 1871, p. 47).
Capt. John A. Martyn, SS. " Java " (Minutes, 1872, p. 10).

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

Reported—That in consequence of the increase of routine work in the Office, that part connected with the library, including the acknowledgment of presents, &c., had fallen somewhat in arrear, and that Mr. J. S. Harding, jun., had been directed to devote an extra hour daily to it, from 4 to 5 o'clock, until such time as the arrears are cleared off, and from time to time in future, when found to be requisite. Payment for this work to be in proportion to his regular salary.—Sanctioned.

Reported—That in consequence of the arrangements made with the Post Office for the supply of Wind and Weather Reports, it had been found necessary to make a change in the mode of supply of the daily information for London, and that the duty of furnishing the observations had been entrusted to Mr. F. Gaster, instead of being divided between three of the staff. Permission was requested to pay Mr. Gaster 5*s.* per week like the other telegraphic reporters.—Sanctioned.

Reported—That Capt. Toynbee had been requested to deliver a lecture at the Royal United Service Institution on the 4th of April, " On the Meteorology, Sea Temperature and Currents of Square III."—Sanctioned.

Mr. Scott reported that he had been requested to deliver a lecture at the Midland Institute, Birmingham, " On Recent Progress in Weather Knowledge."—Sanctioned.

The Committee then adjourned.

116, *Victoria Street, January* 27, 1873.

PRESENT:
Sir E. Sabine in the Chair.
Mr. De La Rue.

The Director was in attendance.

The Minutes of last meeting (January 13) were read and confirmed.

Reported—That the resolution of the Committee had been communicated to the Scottish Meteorological Society as directed.

The question of Mr. Rundell's paper on the wind at Liverpool (Minutes, December 2, 1872) was taken up, and Mr. Scott was instructed to inform Mr. Rundell that the Committee are disposed to publish his paper as an appendix to the Quarterly Weather Report, provided he consents to certain modifications founded on the remarks contained in the letters printed in the Minutes.

Submitted—The results of the discussion of the Anemometry at Bermuda for four years (Minutes, 1869, p. 103).

Mr. Scott reported that the plan of the tables which were submitted met several of the objections raised by Mr. Rundell to the discussion of the Orkney results, and he was authorized to print the paper as an appendix to the Quarterly Weather Report.

Submitted the following memorandum :—

GENTLEMEN,

I TRUST you will pardon my taking the extreme liberty of asking you to modify in some respects your instructions as to the future work of the Marine Department of the office, as intimated to me on the 6th instant.

The 10° square which was under discussion is admittedly a most exceptional district, lying between the trade winds, and being traversed by almost every ship crossing the equator in the Atlantic.

The amount of material which is available for it is very copious, as out of 124,600 observations over the entire district of 30 degrees of latitude in the Atlantic, 73,100 fall in this square.

It has been discussed with the view of possibly publishing monthly charts for 1° squares. This idea is given up, and Captain Toynbee and I submit that one quarter of that size, or 2° squares, would be sufficient.

The explanatory remarks with the small charts of isobars and isotherms (air and sea) have been prepared, with the notes of various phenomena, such as thunderstorms, &c. Their extent will not be more than one half of that of the specimen already printed for the month of January.

We would most respectfully ask whether in the opinion of any experienced navigator or practical scientific man the information which has already been obtained as to this very important district would not justify the publication of the 12 charts as a monograph.

It does not appear probable that materials will be afforded for the discussion of any of the adjacent squares in a similarly minute manner. If the proposed publication be sanctioned, the office will at all events be able to produce some definite result from its six years' work.

May I therefore most respectfully request permission to have the charts engraved and published with explanations?

ROBERT H. SCOTT.

Mr. Scott was instructed to have a specimen chart prepared so as to exhibit the plan of publication which he proposed.

Reported—That Mr. S. C. Whitbread, F.R.S., had kindly presented to the Office through Mr. De La Rue his record of 24 years meteorological observations at Cardington.

Submitted—The following STATEMENT respecting the Records for DECEMBER 1872, received from the self-recording Observatories, and which have been examined at Kew Observatory (see Minutes, 21st December 1868).

Points noticed at Kew.	Aberdeen.	Armagh.	Falmouth.	Glasgow.	Kew.	Stonyhurst.	Valencia.
ANEMOGRAPH :—							
Action	Good.	Good.	Good.	Good.	Good.	Good.	Good.
Records deficient	None.	None.	1 hour in V.	None.	None.	None.	None.
Orientation verified	—	14th.	25th.	1st.	31st.	30th.	—
Result of 40 *Remeasurements :—*	Direction. | Velocity.	Direction. | Velocity.	Direction. | Velocity.	Direction. | Velocity.	Direction. | Velocity.	Direction. | Velocity.	Direction. | Velocity.
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	0·4 | 0·6	0·3 | 0·3	0·2 | 0·2	0·3 | 0·3	0·3 | 0·2	0·3 | 0·5	0·4 | 0·6
Residual difference (— Kew)	−0·1 | −0·2	0·0 | 0·0	−0·1 | 0·0	+0·1 | −0·1	0·0 | 0·0	−0·1 | −0·1	−0·1 | −0·4
No. of errors discovered	0 | 9	1 | 0	0 | 0	2 | 3	0 | 0	0 | 1	0 | 2
Errors in rain tabulation	0	0	0	6	0	0	0
BAROGRAPH :—							
Action	Good.	Good.	Good.	Good.	Good.	Good.	Good.
Photography	Do.	Do.	Do.	Fair.	Do.	Do.	Do.
Records deficient	1 hour lost.	17 hrs. stoppage of clock. 1 hour lamp glass became blackened.	None.	None.	None.	None.	None.
Result of 40 *Remeasurements :—*							
Greatest difference	·0040	·0050	·0050	·0040	·0050	·0050	·0050
Mean difference irrespective of sign	·0015	·0021	·0020	·0018	·0018	·0021	·0021
Residual difference (— Kew)	−·0004	−·0002	+·0003	+·0012	−·0010	+·0004	+·0003
Mean monthly difference between simultaneous barograph and barometer	·0020	·0023	·0022	·0034	·0017	·0020	·0024
No. of errors discovered in entry of standard	0	0	1	3	0	1	3
„ in calculating residual correction	0	1	0	1	0	0	1
„ in applying residual correction	1	0	0	1	0	3	0
„ in tabulation	0	0	0	0	0	0	2
Subtraction in subsidiary tables	0	0	0	0	0	0	1
THERMOGRAPH :—							
Action	Good.	Good.	Good.	Good.	Good.	Good.	Good.
Photography	Do.	Do.	Do.	Do.	Do.	Do.	Do.
Records deficient	* 44 hrs. wet bulb out of action. 3 hrs. wet, doubtful. 5 „ by frost.	15 hrs. wet bulb, owing to frost.	19 hrs. wet bulb out of action.	15 hrs. wet bulb, owing to frost.	6 hrs. wet bulb, owing to frost.	7 hrs. wet bulb, owing to frost.	None.
Result of 40 *Remeasurements :—*	Dry. | Wet.	Dry. | Wet.	Dry. | Wet.	Dry. | Wet.	Dry. | Wet.	Dry. | Wet.	Dry. | Wet.
Greatest difference	0·30 | 0·30	0·30 | 0·30	0·20 | 0·20	0·30 | 0·30	0·10 | 0·10	0·20 | 0·20	0·20 | 0·20
Mean difference irrespective of sign	0·13 | 0·12	0·14 | 0·14	0·10 | 0·10	0·13 | 0·14	0·02 | 0·04	0·11 | 0·12	0·12 | 0·11
Residual difference (— Kew)	+0·02 | +0·06	−0·08 | −0·08	−0·01 | −0·01	0·00 | −0·14	+0·01 | −0·01	−0·11 | −0·01	+0·01 | −0·05
Mean monthly difference between simultaneous thermograph and thermometer	0·14 | 0·15	0·11 | 0·13	0·08 | 0·10	0·11 | 0·09	0·06 | 0·10	0·13 | 0·15	0·24 | 0·19
No. of errors discovered in entry of standard	0 | 0	0 | 0	0 | 0	0 | 0	0 | 0	0 | 0	0 | 0
„ discovered by subsidiary measurements	0 | 1	0 | 0	0 | 0	0 | 1	0 | 0	1 | 0	0 | 0
„ in maximum and minimum	1 | 2	0 | 0	0 | 0	0 | 0	0 | 0	0 | 0	3 | 0
Subtraction in subsidiary tables	3 | 0	0 | 0	0 | 0	0 | 0	0 | 0	1 | 0	0 | 0

* Also 1 hour each dry and wet bulb, through gas being turned off.

Submitted—The following statement of accounts paid and liabilities to 31st December 1872:—

	Paid.	Estimated Liabilities.
	£ s. d.	£ s. d.
OFFICE :—		
Salaries - - -	937 8 10	—
Rent, fuel, &c. - -	464 9 8	8 0 0
Contingencies - - -	354 8 7	11 0 0
LAND METEOROLOGY :—		
Expenses at observatories -	1,981 8 2	64 0 0
Computations - - -	649 12 1	—
Telegraphy - - -	1,158 4 0	518 0 0
Inspections, &c. - -	164 4 7	8 0 0
Computations - -	403 19 11	—
OCEAN METEOROLOGY :—		
Marine Superintendent -	300 0 0	—
Instruments, Admiralty -	144 0 10	295 0 0
Ditto Mercantile Marine -	301 10 0	199 0 0
Computations and care of instruments - -	715 8 10	—
Totals - - -	7,574 15 6	1,103 0 0

Grand total - - £8,677 15*s.* 6*d.*

Resolved—That the sum of 500*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 :—

		£ s. d.
For Office :		
R. H. Scott	Salaries and wages - - -	66 13 4
J. S. Harding, jun.		*18 3 4
J. S. Harding, sen.		†7 14 0
T. D. Bell		†4 8 0
Davey, Thompson, & Co., coals - - - - -		8 15 0
C. Gilman, gas company - - - - -		3 14 11
Williams and Norgate, books - - - - -		3 12 6
For Observatories :		
P. Adie, repairs, scales, &c. - - - - -		9 4 10
Malby & Sons, printing, &c. - - - - -		29 9 11
T. Kerr (Valencia) - - - - - -		20 16 8
R. H. Curtis	Computations, &c. - - -	10 0 0
F. C. Steventon		9 3 4
C. Stodart		†8 0 0
H. W. Woodward		†4 0 0
J. Curtis		†6 8 0
J. P. Cutts		†4 0 0
W. L. Dallas		†6 0 0
For Telegraphy :		
F. Gaster, London observations, 6 months - - -		6 10 0
N. J. Holmes, Scilly Co., November - -	3 4 0	
„ „ December - -	2 19 0	
		6 3 0
S. M. Clare, Submarine Co. - -	October - 1 3 9	
	November - 1 14 0	
	December - 1 8 7	
		4 6 4
A. Adie, thermometer screens - - - - -		7 11 6
F. Gaster	Computations, &c. - - - -	*16 7 11
F. Brodie		*†5 12 0
G. G. Francis		*†5 9 4
R. Sargeant		*†3 14 5
Carried forward - - -		£275 18 4

* Including allowance for extra attendance.
† Four weeks to the 25th.

	£	s.	d.
Brought forward - - -	275	18	4
For Ocean Meteorology:			
H. Toynbee, Marine Superintendent - - - -	33	6	8
P. Adie, repairing "A." barometers - - 6 4 0			
" "M. O." " - - 29 16 0			
	36	0	0
L. P. Casella, "A." thermometers, &c. - - - -	29	8	0
J. J. Hicks, "A." thermometer screens - - - -	11	0	10
W. Oxley, anemometer - - - - - -	7	0	0
R. Riviere, binding Pilot Charts - - - -	13	12	0
W. Salmon -	20	16	8
R. Strachan -	*19	3	4
C. Harding -	†13	7	10
W. G. James - } Computations, &c. - - - -	‡6	8	0
T. E. Allen -	‡6	8	0
J. W. McVeagh	‡3	4	0
For Office Expenses:			
J. S. Harding, jun., on account - - - -	80	0	0
Total - - - -	£555	13	8

* Allowance for care of instruments.
† Allowance for extra attendance.
‡ Four weeks to the 25th.

The Committee then adjourned.

116, *Victoria Street, February* 3, 1873.

PRESENT:

Sir E. Sabine in the Chair.

Mr. Galton. | Major-Gen. Smythe.

The Director was in attendance.

The Minutes of last meeting (Jan. 27) were read and confirmed.

Read—The following letter:

Scottish Meteorological Society,
Edinburgh, 20th January 1873.

EXCERPT from MINUTES of Meeting of the Council of the Scottish Meteorological Society held this day.

Inter alia,

The Council having had read to them a minute from the Meteorological Committee of the Board of Trade, dated 13th instant, in which they state that the appointment of the Society's observer at Stornoway to be the telegraphic reporter for the Meteorological Committee at that place, is a matter which simply concerns the relations between the Society and that gentleman; and further that they have considered that the basis of an arrangement between themselves and the Scottish Meteorological Society had been abandoned:

The Council admit that the question rests exactly as the London Committee has stated, viz., the relation between the Scottish Society and its own observer, who has been appropriated by the London Committee without any previous communication through the Scottish Society, who feel that they cannot hope to command as heretofore the services of their observer, for they are unable to offer him any payment, while the London Committee backed with Government money can pay him, and will thus command his services to the exclusion of the Scottish Society. The Council object to such an interference with their observers, and protest against what they consider as a misapplication of the Government grant, which is thus employed in destroying the influence of the Scottish Society over an observer who was trained by themselves in their own office in Edinburgh under the secretary's immediate superintendence. Even although no agreement had been entered into between the two bodies for the

protection of the Society's interests, the Council conceive that in common fairness and courtesy they should first have been consulted as to whether the proposed arrangement might not interfere with the observations which have been sent to them from Stornoway for the last 18 years. But in point of fact an agreement for protecting the Scottish Society against such interference was entered into by both bodies, which agreement the London Committee now, in justification of their recent proceedings, declare has been abandoned, but which the Council can easily show to be still existing in full force.

The truth is, the London Committee has confounded two separate matters, and has quoted a passage from the Council's memorial, dated 14th June 1870, relative to the failure of the negociations regarding *one* of these matters as if it had referred to both, whereas they were wholly distinct. The one emanated from the Scottish Society, and solicited a share of the London Committee's annual grant, which application was rejected by the London Committee. The other emanated from the London Committee, and had reference to dealings between the two bodies in the prosecution of meteorology, which application was agreed to by both bodies, and it was at the same time stipulated that all communication with the Scottish Society's observers should be made through the Council of that body. Those applications were made at different dates, that by the London Committee being on the 19th January 1870, and that by the Scottish Society being on 26th April of the same year.

It will thus be seen that the applications were made at different dates, and emanated from different parties. The first was rejected, while the other was agreed to by both bodies, and still remains binding upon them.

But the Council of the Scottish Society feel that in the prosecution of science some bond of a far higher nature than mere obligations in writing ought to protect their interests. Supposing, as already stated, that no arrangements had ever been made between the parties debarring the London Committee from communicating directly with the Scottish Society's observers, they would ask whether it be consistent with fairness that the London Committee, aided by 10,000*l.* grant from Government, should not only refuse to give any portion of their large grant to the Scottish Society when that society applied for it at the suggestion of the Board of Trade, but should employ this grant of public money to the serious injury of the Scottish Society, which depends wholly on voluntary subscriptions from private individuals, and which as regards money is comparatively helpless, but which as regards scientific arrangements and provisions, to say nothing of the original investigations which have been promoted by it, has been acknowledged to have done good work in meteorology.

Unless the Council have an assurance from the Committee that they will hereafter hold themselves bound to their agreement, and communicate with no other of the Society's observers except through the Council, they, though most reluctant to adopt such a course, must, in order to prevent the most serious consequences which must result to the Society, from a superior power derived from the grant of public money to the London Committee, take instant measures for protecting their interests in such manner as they may find to be most expedient.

(Signed) D. Milne Home,
Chairman.

Mr. Scott was instructed to prepare a reply for the consideration of the Committee at their meeting on the 17th inst., and to forward a copy of the correspondence to the Board of Trade.

Submitted—The result of the comparison of the warnings issued and of the weather experienced in 1871 (Minutes, 1872, p. 59).

—	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 warnings were issued.
Ireland, South	34	13	3	7	3	4	4	Jan. 9$_p$ Feb. 19$_s$ Oct. 27 Oct. 29 Dec. 27
—— East	37	19	4	9	1	2	2	Jan. 15 Feb. 19$_s$ Oct. 27 Dec. 27
Scotland, East	30	14	8	7	—	—	1	Jan. 16$_s$ Mar. 7$_p$
—— West (Clyde)	36	11	8	14	—	1	2	Jan. 16$_s$ Feb. 19$_s$ Feb. 22$_p$ May 3$_p$ Aug. 20$_s$ Oct. 27
England, North-west	38	17	7	6	—	5	3	Jan. 15 Feb. 20$_s$ Aug. 20$_s$ Oct. 27 Nov. 17$_p$ Dec. 1$_p$ Dec. 28
—— West	36	24	5	3	2	1	1	Jan. 15 Jan. 16$_s$ Oct. 1$_s$ Oct. 29 Dec. 28
—— South	37	19	7	3	3	4	1	Jan. 15 Jan. 16$_s$ Mar. 16$_p$ Oct. 29
—— South-east	23	11	3	8	—	1	0	Jan. 16$_s$ Dec. 1
—— East	29	10	8	9	—	2	—	Jan. 16$_s$ Dec. 1
Totals	300	130	53	66	9	20	14	p indicates partially late; s late, owing to Sundays, &c.
Per-centages	—	46°/$_o$	17·7°/$_o$	22°/$_o$	3°/$_o$	6·7°/$_o$	4·7°/$_o$	

In the above return force 8 is considered to justify a warning; but a warning is not *late* unless force 9 has been reached.

It will be seen that the per-centage figures in the last line are almost identical with those for 1870 (Minutes, 1871, p. 60).

Mr. Scott stated that the comparison for 1872 was in an advanced state, and he hoped soon to submit it.

Submitted—The following publications:—

Official, No 14. Quarterly Weather Report, 1871, Part II.
„ No. 16. „ „ „ 1872, Part I.
Non-Official, No. 6. Report of the Leipzig Conference.

The Committee then adjourned.

116, *Victoria Street, February* 17, 1873.

PRESENT:

Sir E. Sabine in the Chair.

Mr. De La Rue.	Rear-Admiral Richards.
Mr. Galton.	Mr. Spottiswoode.
Mr. Gassiot.	Sir C. Wheatstone.

The Director was in attendance.

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

The consideration of the excerpt from the Minutes of the Council of the Scottish Meteorological Society (Minutes February 3) was taken up, and Mr. Scott was instructed to send the following reply:—

I AM instructed by the Committee to inform you, in reply to your letter of the 29th ult., that they neither have had nor have any intention of interfering with the returns supplied from Stornoway to the Scottish Meteorological Society. As already stated in my letter of November 9, 1872, before they arranged for the services of the observer at Stornoway, they required him to give an assurance that the Scottish Meteorological Society should be in no way prejudiced by his undertaking new duties.

As regards the alleged agreement, the Committee have considered that the application to them for a grant of money to "enable the Society to engage a clerk and other assistants" modified completely the terms of agreement contained in the first portion of the excerpt from the Minutes of Council of date April 26, 1870, in the same way as the letter of the Scottish Meteorological Society of March 28, 1870, entirely modified the former letter of that body of March 7, 1870.

The Committee cannot see that in the letters from the Board of Trade to the Scottish Meteorological Society, (April 6 and May 10, 1870,) any other co-operation is contemplated than such as should from time to time be proposed by the Meteorological Committee. For such co-operation they would always be ready "to pay to the Scottish Society a proper sum in consideration of the services rendered."

Co-operation was requested by the Committee in 1870, and the Committee would point out to the Council that for the space of nearly three years they have received no official reply to my letter of May 16, 1870, nor any intimation of the readiness of the Society to afford such co-operation.

The Committee consider the negotiations which are mentioned in the third paragraph of the Memorial of the Society as having failed, to have been all the negotiations, *without exception*, which had taken place between the two bodies in the early part of the year 1870.

The Committee wish me to assure the Council that they have no intention of employing the Government funds, with the management of which they are entrusted, in any way detrimental to the welfare of the Scottish Meteorological Society. Their action is simply directed to the gradual development of the scheme of general meteorology of the United Kingdom, with the carrying out of which they have been charged by H. M.'s Government.

Reported—That the Daily Weather Charts had been supplied to the

Lord Lieutenant of Ireland.	
Bournemouth Meteorological Society -	For exhibition.
L. J. Crossley, Halifax - -	In exchange.
Editor "Opinion Nationale," Paris -	„
Indian C. E. College, Staines - -	„

The Committee then adjourned.

116, *Victoria Street, February* 24, 1873.

PRESENT:
Sir E. Sabine in the Chair.
Mr. De La Rue.

The Director was in attendance.

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

Reported—That the letter had been sent to the Scottish Meteorological Society as directed, and that a copy of the correspondence had been forwarded to the Board of Trade.

Mr. Scott reported that he had received a letter from Mr. Lockyer, secretary to the Commission on Scientific Instruction, asking him what evidence he wished to lay before the Commission, and had replied that he was ready to give evidence on the management of the office.—Approved.

Read—A letter from Capt. Toynbee, submitting excellent logs by—

Capt. C. T. Raymond, ship "British Consul" (Minutes, 1871, p. 47, &c.).
Capt. G. H. Jones, SS. "Niger" (Minutes, 1872, p. 33, &c.).
Capt. G. Grigs, R.N.R., SS. "Helvetia" (Minutes, 1872, p. 21).

As the above gentlemen have already received the Pilot Charts, Mr. Scott was instructed to convey to them the marked thanks of the Committee for their logs.

The following cheques for February were drawn:—

		£	s.	d.
For Office:				
R. H. Scott	Salaries and wages	66	13	4
J. S. Harding, jun.	Salaries and wages	*18	13	4
J. S. Harding, sen.	Salaries and wages	†7	14	0
T. D. Bell	Salaries and wages	†4	8	0
For Observatories:				
R. and J. Beck, repairs, plates, &c.		37	9	11
Hopkin and Williams, chemicals		9	13	3
T. Kerr, Valencia		20	16	8
R. H. Curtis	Computations, &c.	10	0	0
F. C. Steventon	Computations, &c.	9	3	4
C. Stodart	Computations, &c.	†8	0	0
H. W. Woodward	Computations, &c.	†4	0	0
J. Curtis	Computations, &c.	†6	8	0
J. P. Cutts	Computations, &c.	†4	0	0
W. L. Dallas	Computations, &c.	†6	0	0
For Telegraphy:				
V. Brooks, Day, & Co., delivery of Daily Weather Charts		8	18	7
W. Wightman & Co., wrappers for do.		2	15	0
F. Gaster	Computations, &c.	*16	4	5
F. Brodie	Computations, &c.	*†6	3	4
G. G. Francis	Computations, &c.	*†6	4	0
R. Sargeant	Computations, &c.	*†3	7	6
Carried forward		£256	12	8

* Allowance for extra attendance.
† Four weeks to the 22nd.

				£	s.	d.
Brought forward -	-	-	-	256	12	8
For Ocean Meteorology:						
H. Toynbee, Marine Superintendent - -	-	-	-	33	6	8
Elliott, Brothers, repairing "A" Instruments		13 16 6				
Ditto do. "M.O." Instruments		2 7 0				
				16	3	6
Malby and Sons, Variation Charts - -	-	-	-	25	0	0
W. Salmon -				20	16	8
R. Strachan -				*19	3	4
C. Harding -				†13	9	4
W. G. James -	Computations, &c. -	-	-	‡6	8	0
T. E. Allen -				‡6	8	0
J. W. McVeagh -				‡3	4	0
For Office Expenses:						
J. S. Harding, jun., on account -	-	-	-	90	0	0
Total -	-	-	-	£490	12	2

Resolved—That the sum of 500*l.* be transferred from the deposit account of the Committee to their current account in the Bank of England.

* Allowance for care of instruments.
† Allowance for extra attendance.
‡ Four weeks to the 22nd.

SUBMITTED the following STATEMENT respecting the RECORDS for JANUARY 1873, received from the SELF-RECORDING OBSERVATORIES, and which have been examined at KEW OBSERVATORY (*see* Minutes, 21st December 1868).

Points noticed at Kew.	Aberdeen.	Armagh.	Falmouth.	Glasgow.	Kew.	Stonyhurst.	Valencia.
ANEMOGRAPH:—							
Action	Good.	Good.	Good.	Good.	Good.	Good.	Good.
Records deficient	None.	12 hrs. lost by stoppage of clock.	None.	None.	None.	None.	None.
Orientation verified	25th.	27th.	27th.	2nd.	23rd.	—	31st.
Result of 40 *Remeasurements:—*	Direction. / Velocity.	Direction. / Velocity.	Direction. / Velocity.	Direction. / Velocity.	Direction. / Velocity.	Direction. / Velocity.	Direction. / Velocity.
Greatest difference	1·0 / 1·0	1·0 / 1·0	1·0 / 1·0	1·0 / 2·0	1·0 / 1·0	1·0 / 1·0	1·0 / 2·0
Mean difference irrespective of sign	0·1 / 0·4	0·1 / 0·5	0·2 / 0·3	0·2 / 0·4	0·2 / 0·5	0·2 / 0·4	0·2 / 0·5
Residual difference (—Kew)	0·0 / 0·0	0·0 / 0·0	0·0 / 0·0	+0·1 / 0·0	+0·1 / +0·1	0·0 / 0·0	+0·1 / 0·0
No. of errors discovered	0 / 0	0 / 1	0 / 2	0 / 3	0 / 0	0 / 0	1 / 12
Errors in rain tabulation	0	0	0	0	0	0	0
BAROGRAPH:—							
Action	Good.	Good.	Good.	Good.	Good.	Good.	Good.
Photography	Do.	Do.	Do.	Indifferent.	Do.	Do.	Do.
Records deficient	None.	None.	None.	48 hrs. lost.* 3 hrs. stoppage of clock.	None.	1 hour lost through failure of gas.	None.
Result of 40 *Remeasurements:—*							
Greatest difference	·0040	·0050	·0050	·0050	·0040	·0050	·0050
Mean difference irrespective of sign	·0016	·0024	·0017	·0017	·0017	·0018	·0020
Residual difference (—Kew)	+·0002	—·0001	+·0007	+·0009	+·0002	—·0012	—·0006
Mean monthly difference between simultaneous barograph and barometer reading	·0026	·0024	·0021	·0024	·0021	·0019	·0029
No. of errors discovered in entry of standard	0	0	0	0	0	2	8
„ in calculating residual correction	0	1	1	0	0	0	0
„ in applying residual correction	0	0	0	2	0	1	7
„ in tabulation	0	1	1	0	0	0	0
THERMOGRAPH:—							
Action	Good.	Good.	Good.	Good.	Good.	Good.	Good.
Photography	Do.	Do.	Do.	Fair.	Do.	Do.	Do.
Records deficient	22 hrs. W. insufficient water. 8 hrs. by frost.	5 hrs. wet bulb out of action. 15 hrs. through frost.	None.	11 hrs. wet bulb no trace. 38 hrs. W. through frost.	9 hrs. wet bulb by frost.	9 hrs. wet by frost. 22 hrs. wet not sufficient water.	7 hrs. wet bulb through frost. 1 hr. wet bulb no trace.
Result of 40 *Remeasurements:—*	Dry. / Wet.	Dry. / Wet.	Dry. / Wet.	Dry. / Wet.	Dry. / Wet.	Dry. / Wet.	Dry. / Wet.
Greatest difference	0·20 / 0·20	0·20 / 0·20	0·20 / 0·20	0·30 / 0·30	0·10 / 0·10	0·30 / 0·20	0·20 / 0·20
Mean difference irrespective of sign	0·08 / 0·09	0·09 / 0·09	0·10 / 0·11	0·11 / 0·13	0·05 / 0·06	0·09 / 0·11	0·12 / 0·11
Residual difference (—Kew)	—0·04 / —0·03	—0·02 / +0·01	—0·02 / +0·01	—0·11 / —0·07	—0·04 / 0·00	+0·03 / +0·05	—0·11 / 0·00
Mean monthly difference between simultaneous thermograph and thermometer reading	0·17 / 0·18	0·08 / 0·13	0·10 / 0·10	0·09 / 0·09	0·05 / 0·07	0·11 / 0·13	0·22 / 0·19
No. of errors discovered in entry of standard	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 2
„ discovered by subsidiary measurements	0 / 0	0 / 0	0 / 1	5 / 1	0 / 0	0 / 0	0 / 0
„ in maximum and minimum	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	8 / 3
„ in tabulation	3 / 4	1 / 0	0 / 1	0 / 0	0 / 0	0 / 0	0 / 0

* Through indifferent photography.

The Committee then adjourned.

116, *Victoria Street, March* 3, 1873.

PRESENT:

Sir E. Sabine in the Chair.

Mr. De La Rue.	Mr. Gassiot.
Mr. Galton.	Sir C. Wheatstone.

The Director was in attendance.

The Minutes of last meeting (February 24) were read and confirmed.

Read—The following communication:—

(Copy.) Scottish Meteorological Society, Edinburgh, February 25, 1873.

EXCERPT from Minutes of Meeting of Council of the Scottish Meteorological Society, held this day.

Inter alia.

The Council of the Scottish Meteorological Society have received the Meteorological Committee's letter of the 18th current, and have now to reply to the statements therein contained.

The London Committee state "that they neither have had nor have any intention of interfering with "the returns supplied from Stornoway to the Scottish Meteorological Society."

The Council in reply have to state that they never alleged that their "*returns*" from Stornoway were to be interfered with. What they did state and what they now reiterate is, that the London Committee have interfered with their *observer*, and this allegation is admitted by the Committee.

The London Committee state that "before they arranged for the services of the observer at Stornoway "they required him to give an assurance that the Scottish Meteorological Society should be in no way "prejudiced by his undertaking his new duties."

Surely the Scottish Society were the proper judges in such a case, and should have been the first parties to be consulted as best qualified to form a judgment as to the peculiarities of their own system of management.

The Council regret to observe that the London Committee content themselves with alleging that the agreement, the protective clauses of which were framed solely for the Scottish Society's interests, was no longer binding upon them, which statement, even had it been correct, would have furnished no justification of their entire disregard of the feelings expressed by the Society. A word or two, however, will be quite sufficient to disprove the allegation that the agreement is no longer binding on the two bodies.

The London Committee state that the Minute of Council of the Scottish Society (April 26th, 1870), was modified by the application to them for a grant of money "to engage a clerk and other assistants."

So far from this being the case, the quotation which has just been made bears on the face of it a reference to a matter totally different from what is now in dispute, viz., the application by the Society to the London Committee for a share of the annual grant. Both parties admit that this proposal fell to the ground. It seems strange that it should be necessary to repeat that these were two wholly separate matters, *originating at different dates and emanating from different parties.*

The London Committee state that they have had no official reply to Mr. Scott's letter of 16th May 1870, nor any intimation of the readiness of the Society to afford such co-operation as was asked.

The letter referred to required no answer whatever, and the readiness of the Society to co-operate had been previously expressed. Mr. Scott's letter contained the rejection by the London Committee of the Society's application for a share of the grant, but it also contained directions for carrying out the agreement for the Society supplying the information asked for by the London Committee in the following terms: "The form" (a printed copy of which accompanied the letter) "is to be filled only "whenever a storm or a very sudden change of weather is noticed, and also occasionally when specially "requested by letter." The letter concluded as follows: "The expense incurred from time to time "in obtaining and forwarding this information the Meteorological Committee are prepared to "defray."

It thus appears that the same letter which rejects the Society's application for a share of the annual grant ratifies and confirms the agreement of 4th and 26th April 1870. Subsequently to all this the Committee acted upon the agreement by obtaining information as provided for by the words "when "specially requested by letter," on 20th September 1870, when an application was made to the Society for returns from several of the Society's stations relative to the "City of Boston" storm, and the infor-

mation was duly forwarded to the London Committee. In further corroboration of this, though such proof seems to be supererogatory, Mr. Buchan has informed the Council that so late as November last, Mr. Scott, in justification of the Stornoway appointment, stated that he had been waiting for further information under the agreement, and that as this had not been supplied he concluded that the Scottish Society wished to discontinue all negotiations with the London Committee. This statement shows, what Mr. Scott will not dispute, that up to that date (November 1872), being two years and a half after the agreement was concluded, he considered the agreement binding.

The London Committee state in the conclusion of their letter that "their action is simply directed " to the gradual development of the scheme of General Meteorology of the United Kingdom."

The Council fully approve of the object, and as mentioned in a former letter, they would under other circumstances have been glad to have co-operated with them in the work; what they complain of is the development of this scheme *to the detriment of the Scottish Meteorological Society.*

The Council fail to find in the Committee's letter any expression of regret for having, in carrying out the Stornoway appointment, acted contrary to the wishes of the Scottish Society, to say nothing of the terms of the agreement; and while the London Committee disclaim any intention to injure the Society, they clearly indicate that they are fully determined to employ the Government grant for what may indeed be a gradual development of a scheme of British Meteorology, but what the Society consider involves also the gradual extinction of their own stations.

Under the circumstances stated, the Council decline to hold any further communication with the Meteorological Committee on this subject, and will now take other and immediate steps for vindicating their position and protecting their interests.

(Signed) D. Milne Home,
Chairman.

Mr. Scott reported that he had acknowledged the receipt of the above excerpt.

Read—The following letter:—

The Owens College, Manchester,
27th February 1873.

Sir,

I am requested by the Committee of the British Association on science lectures and organization to transmit to you the following resolution which was passed at the last meeting of the Committee, and to ask you to lay the same before your Committee, and to be good enough to inform me whether they propose to take any action in the matter, and if so, what.

I am, &c.
(Signed) Henry E. Roscoe,
Hon. Sec.

R. H. Scott, Esq.

Resolved—That in the opinion of this Committee it is advisable that the individual tabulated results obtained by the Meteorological Committee from their self-recording instruments be published for the benefit of meteorologists.

Mr. Scott was instructed to send the following reply:—

I am instructed by the Meteorological Committee to inform you that they are not prepared to recommend to Government that so serious an expenditure should be incurred as would be entailed by publishing the individual tabulated results from their self-recording instruments.

It appears to them that the demand for a publication of such a nature would necessarily be very limited.

At the same time I am to draw your attention to my letter to you of April 30, 1872, in which I stated the terms on which copies of the information in question could be supplied.

Read—The following letter:—

The Owens College, Manchester,
28th February 1873.

Dear Sir,

I beg to enclose the copy of a resolution passed at a late meeting of the Observational Sub-Committee of the Science Organization Committee of the British Association, and to ask that you will have the goodness to bring request No. 1 before the Meteorological Committee, it being understood that request No. 2 has been already complied with in a previous communication from your office.

Yours truly,
B. Stewart,
Sec. to Sub-Committee.

R. H. Scott, Esq.

Observational Sub-Committee of the Science Organization Committee of the British Association.

(B. Stewart, Secretary.)

This Committee met on 13th February 1873 and passed the following resolution:—

Resolved—That this Sub-Committee are of opinion that it is desirable that the individual observations in magnetism and meteorology which at present exist should as much as possible be accessible to all those men of science who may wish to make use of them.

They therefore request their secretary to put himself in communication with the Director of the Meteorological Office with the view of ascertaining—

1. What unpublished observations in meteorology, or allied branches of science, the Meteorological Office possess, specifying the most important.
2. On what terms, if any, will the Meteorological Committee consent to open them up to men of science desirous to obtain them.

Mr. Scott was instructed to supply Professor Stewart with the desired information.

Submitted—A specimen Chart for Square III. for January, prepared in accordance with instructions (Minutes, p. 3).

Resolved—That such Charts be published for the 12 months, the size to be reduced as far as practicable.

Submitted—The following note, which was ordered to be printed.

March 3, 1873.

NOTE respecting the alleged necessity to correct the Barometer Observations for Diurnal Range, and to find the Mean Day of the Month for each 2° Square.

It has been suggested that the barometer observations used in constructing the January Chart for Square 3 ought to have been corrected for diurnal range, and that we ought to give the mean day of the month on which the observations were taken for each sub-square.

Diurnal range.

With the object of testing the value of this remark, I have had the diurnal range for January calculated from the 2,095 observations taken in that month,* and applied to the observations in each square; the resulting mean pressure is shown in Egyptian figures on the following diagram, the Arabic figures being the uncorrected mean pressure; their difference is given in Italic between them; the mean difference for Square 3 is little more than a thousandth, being ·0015, whilst in no 2° Square does it amount to more than five thousandths. To show the effect of the correction on the isobars, the following diagram gives the uncorrected isobars by faint and the corrected ones by full lines.

From the experience gained by the above work, I am led to suppose that it may not be considered requisite to correct the observations of future months for diurnal range, but that it would be right to find the diurnal range for each month and publish it. (On this point I shall be glad to know the Committee's wish.) We are now finding the diurnal range for the hottest and coldest months in the square, to see if there be any great difference between them.

Mean day of the month.

We have also found the mean day of the month in each 2° Square, and it is given in the upper part of each square. In one 2° Square only it was as low as the 10th, and in another as high as the 20th; the mean for the whole square is 14·4. Now, as the mean height of the barometer in Square 3 in January is 29·934, whilst that in December is the same, and that in February is 29·943, only differing nine thousandths from January, it does not seem necessary to apply any correction to bring the observations up to the mean day of the month, especially as the barometer changes very irregularly in different parts of the square, having in January risen in the northern and fallen in the southern part since December. In October the mean pressure has decreased ·04 since September, but the decrease amounts to about ·03 in the northern and ·06 in the southern part of the square.

HENRY TOYNBEE.

Read—A letter from Capt. Toynbee, submitting an excellent log kept by Capt. James Hayes, SS. "Camoens" (Minutes, 1872, p. 38, &c.).

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

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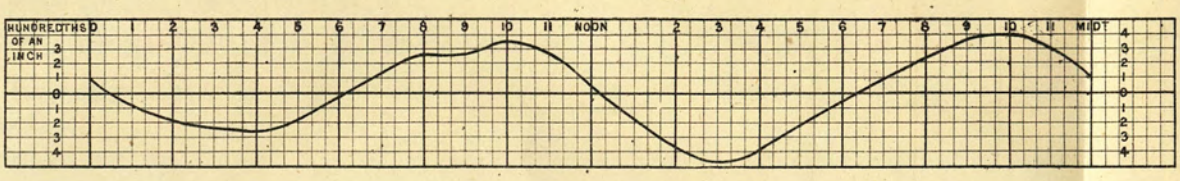
* The diurnal ranges for those hours which have few observations will be much improved by combining those for the year, and applying to their mean any monthly change which may be found from the more abundant observations.

The Committee then adjourned.

SQUARE 3, JANUARY.

DIURNAL RANGE OF THE BAROMETER FROM OBSERVATIONS MADE IN SQ. 3.

	A.M.												P.M.												
HOUR	1	2	3	4	5	6	7	8	9	10	11	NOON	1	2	3	4	5	6	7	8	9	10	11	MIDT	
OBSNS				(379)		(16)		(195)	(146)	(54)		(496)			(123)	(248)				(254)		(59)		(125)	TOTAL 2095
RANGE				− ·027		− ·002		+ ·026	+ ·025	+ ·035		+ ·006			− ·048	− ·038				+ ·021		+ ·040		+ ·010	



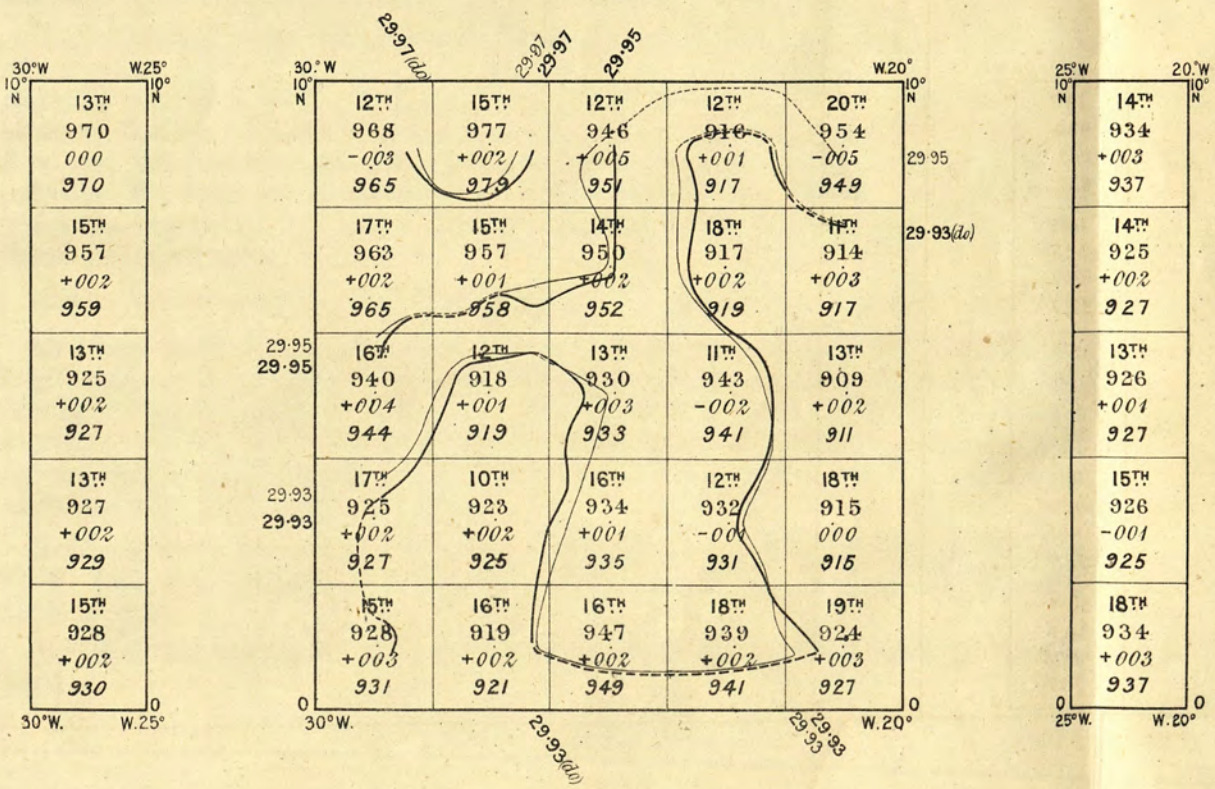
Isobars for each ·02 of an inch.

The figures showing the resulting mean day of month corresponding to mean barom: thus 12TH

The figures and isobars uncorrected for diurnal range shown thus 968

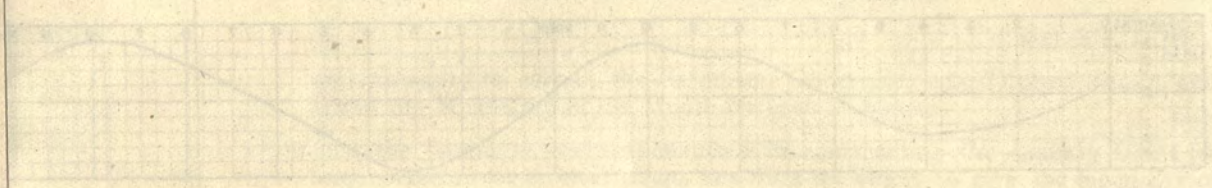
The figures showing the correction due for diurnal range thus ·003

The figures and isobars corrected for diurnal range thus 965



Vincent Brooks, Day & Son, Lith.

Diurnal range.



Mean day of the month.

116, *Victoria Street, March* 17, 1873.

Present:

Sir E. Sabine in the Chair.

Mr. De La Rue.	Admiral Richards.
Mr. Galton.	Sir C. Wheatstone.

The Director was in attendance.

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

Reported—That the reply had been sent to Professor Roscoe, as directed at last meeting.

Read—A letter (No. 524) from Captain Hoffmeyer, Director of the Meteorological Institute of Denmark, stating that he was now ready to accede to the proposals made by the Committee (Minutes, 1871, p. 46), and to forward reports daily from Skagen and Fanö, and requesting that the Meteorological Office would send in return reports from three British stations, Thurso, Yarmouth, and Valentia. The reports to be made up in London in one single message, and handed to the Great Northern Telegraph Company, who have most liberally undertaken to forward the messages both ways cost free.

Mr. Scott was authorised to accept this arrangement.

Read—A letter from Mr. Jeffery respecting the cost of the proposed experiments on temperature at the Pagoda in the Royal Gardens, Kew (Minutes, 1872, p. 89), and stating that the work could be done for 10*s.* 6*d.* a week.—Accepted.

Read—A letter from Mr. Jeffery respecting some photographic curves which had recently been received at Kew from Glasgow in a very unsatisfactory state, showing in places no impression at all. Professor Grant on inquiry had stated that it was "very evident" that the fault lay in the wax paper, but Mr. Jeffery had tested the papers at Kew, and had found that the defect had arisen from the papers having been imperfectly iodized.—Mr. Scott was instructed to write to Professor Grant enclosing the leaves on which the experiment had been made, and requesting him to take care that such defects should not occur again.

Read—A letter from Mr. J. P. Cutts resigning his appointment as a temporary clerk.

Mr. Scott stated that having had a year's experience of the issue of the Daily Charts, it had appeared to him that it would be desirable to modify the statement in the original circular (Minutes, 1872, p. 18), that "the subscription would cover any reasonable number of copies," in the following way, viz., that only one copy can be sent for each subscription, unless the recipient undertakes to exhibit a copy publicly, in which case an additional copy can be sent.—Approved.

Read—A letter from Captain Toynbee, submitting an excellent log kept by Captain C. W. Reid, ship "Haddon Hall," who has already received the Pilot Charts (Minutes, 1870, p. 60).

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

The Committee then adjourned.

116, *Victoria Street, March* 24, 1873.

PRESENT:

Sir E. Sabine in the Chair.

Rear-Admiral Richards. | Sir C. Wheatstone.

The Director was in attendance.

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

Read the following letter:—

M. 4227. Meteorology.

Board of Trade, March 20, 1873.

SIR,

I AM directed by the Board of Trade to transmit to you the accompanying copy of a letter from the Scottish Meteorological Society, and to request that in laying it before the Meteorological Committee of the Royal Society, you will be so good as to inform them that the Board would be glad if the Committee would favour them with any observations they may wish to make thereon, in order that the Board of Trade may consider them before deciding as to receiving a deputation from the Scottish Society.

I am, &c.

(Signed) THOMAS GRAY.

The Director,
Meteorological Office.

Scottish Meteorological Society,
General Post Office Buildings,
Edinburgh, March 12, 1873.

SIR,

I HAVE been asked by the Council of the Scottish Meteorological Society to express the extreme regret with which they find themselves compelled again to trouble the Board of Trade with their affairs. The accompanying printed correspondence will show that the proceedings of the Meteorological Committee of the Board of Trade have left them no alternative.

The Council would remind their Lordships that the Society is a body deriving its income wholly from the voluntary contributions of persons interested in science. Although the results of their labours are adopted by Government, and are regularly published as an integral part of the Registrar-General's Reports for Scotland, they not only receive no pecuniary aid from Government, but have to pay a rent to Government for the rooms which they occupy in the General Post Office Buildings in Edinburgh.

It was under these circumstances that on 5th March 1870 the Council applied to the Board of Trade in the hope that they might receive a small grant to assist them in carrying on and extending their numerous investigations, the value of which has been freely and frequently acknowledged by Government as well as by foreign and British meteorologists. To this application the Board of Trade replied on 6th April 1870 that they could not give any separate grant to the Scottish Society, but referred the Council to the Meteorological Committee, expressing at the same time the hope that some arrangement might be made between the two bodies. The application was accordingly made but without success, and *there this matter ended.*

Prior to that date, however, the Meteorological Committee had applied for certain information to the Scottish Society, which application was acceded to by the Society, and at the same time a written agreement was entered into and signed by the then Chairman of the Meteorological Committee (see Appendix A, No. II.), that, with four specified exceptions, they were not to communicate directly with the Society's observers, but that all communications were to be conducted exclusively through the Society's Council.

The Council had this agreement put in writing, though it is felt that this should not have been needed, since the courtesy and mutual consideration which are usual between individuals and societies engaged in similar pursuits ought to have secured all that a written agreement could secure.

It will be seen from the accompanying documents (to Nos. VI. and VIII. Appendix C. of which they beg particularly to refer), that this agreement was subsequently acted upon, but that it has recently been violated by the Meteorological Committee, who now *for the first time* assert, in justification of their recent proceedings, that no such agreement was ever confirmed.

The Meteorological Committee, without any communication with the Council, have appropriated the Society's observer at Stornoway, who was trained in the Society's office in Edinburgh before commencing his observations, and to whom the Society were unable, from want of funds, to give any pecuniary remuneration. It is right, however, to add here that every such appointment involves a considerable expenditure of the Society's funds. As the Meteorological Committee are enabled, out of their annual Parliamentary grant of 10,000*l.*, to give remuneration to their observers, it is not difficult to see what will be the effect of such interference with the Society's observers, who hitherto have given their services gratuitously to the Society.

Not only have the Committee thus broken their written agreement in this particular appointment, but they have also declined to promise that they will not further interfere in a similar manner with the observers of the Society. Under these circumstances the Council request the assistance and advice of the Board of Trade.

The Council cannot but feel that they have all along been hardly dealt with, but they certainly did

expect that at least they might have been let alone and allowed to prosecute unmolested their voluntary labours. Such hopes have, however, proved fallacious, and a portion of the Government grant is now employed in obstructing and undermining the Scottish Meteorological Society, by offering payment to their necessarily unpaid observers. The Council are at a loss to understand why Government money should be employed to counteract the efforts of individual societies. They are fully alive to the utility of grants for scientific purposes; but such grants should be supplementary to private enterprise, and when the two are put into competition one with another, when in short Government money is employed to interfere with voluntary and gratuitous exertions in pursuance of the same object, the Council consider it a waste of national funds, and an application of public money which is directly hurtful to the cause of science.

I am further requested to state that the Council will be glad to send a deputation of their number to wait upon the Board of Trade, if necessary, and to afford such other information as may be required, on hearing when it will suit their Lordships' convenience to receive them.

I am, &c.

To the Secretary of the Board of Trade. (Signed) TWEEDDALE.

A draft reply was prepared, to be submitted to the members of the Committee for consideration by the 31st inst.

Reported—That the arrangements as to Telegraphy with Copenhagen had been concluded, as directed at last meeting.

Read—A letter from M. Poëy, requesting the Committee to adopt his new classification of Clouds. Mr. Scott stated that he had replied to M. Poëy that it might in his opinion be well to await the publication of the decisions of the Vienna Congress, before introducing such a serious change in Meteorological nomenclature.—Approved.

Read—A letter from Professor Grant, admitting that the defects in the photographic curves from Glasgow had arisen from imperfect iodization, and promising that such defects should not occur again.

Reported—That Mr. C. H. Thompson had been appointed a temporary clerk in the place of Mr. Cutts, at a weekly salary of 18*s.*, to rise to 1*l.* in three months if he should give satisfaction.

Reported—That meteorological information had been supplied to

Capt. Le Gras, Dépôt des Cartes et Plans, Paris.
Capt. Hoffmeyer, Copenhagen.
Padre Denza, Moncalieri.
M. Harold Tarry, Paris.

In the first three cases, the information being small in quantity, no charge had been made, but M. Tarry had agreed to pay for the information received by him.

Resolved—That the sum of 1,500*l.* be transferred from the deposit account of the Committee to their current account at the Bank of England.

Submitted—The following statement respecting the records for FEBRUARY 1873, received from the self-recording Observatories, and which have been examined at Kew Observatory.
(See Minutes, 21st December 1868.)

Points noticed at Kew.	Aberdeen.	Armagh.	Falmouth.	Glasgow.	Kew.	Stonyhurst.	Valencia.
ANEMOGRAPH:—							
Action	Good.	Good.	Good.	Good.	Good.	Good.	Good.
Records deficient	None.	None.	None.	None.	None.	None.	None.
Orientation verified	—	28th.	14th.	1st.	—	28th.	6th.
Result of 40 *Remeasurements:—*	Direction. | Velocity.	Direction. | Velocity.	Direction. | Velocity.	Direction. | Velocity.	Direction. | Velocity.	Direction. | Velocity.	Direction. | Velocity.
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 | 0·4	0·2 | 0·3	0·1 | 0·4	0·1 | 0·4	0·0 | 0·1	0·1 | 0·3	0·1 | 0·4
Residual difference (— Kew)	+0·1 | +0·1	0·0 | 0·0	0·0 | 0·0	+0·1 | −0·1	0·0 | 0·0	0·0 | 0·0	+0·1 | −0·1
No. of errors discovered	0 | 0	1 | 0	0 | 0	0 | 2	0 | 0	0 | 0	0 | 1
Errors in rain tabulation	0	0	1	0	0	1	6
BAROGRAPH:—							
Action	Good.	Good.	Good.	Good.	Good.	Good.	Good.
Photography	Do.	Do.	Do.	Indifferent.	Do.	Do.	Fair.
Records deficient	None.	None.	15 hours lost by stoppage of clock.	93 hours owing to bad photography.	None.	None.	27 hrs. not carried into corrected column, there being no appliable residual correction.
Result of 40 *Remeasurements:—*							
Greatest difference	·0040	·0050	·0040	·0050	·0040	·0040	·0050
Mean difference irrespective of sign	·0017	·0024	·0017	·0030	·0019	·0018	·0012
Residual difference (— Kew)	—·0014	—·0011	—·0004	—·0010	+·0003	—·0007	—·0013
Mean monthly difference between simultaneous barograph and barometer	·0018	·0024	·0021	·0024	·0019	·0018	·0024
No. of errors discovered in entry of standard	0	0	0	0	0	0	0
„ in calculating residual correction	0	0	0	1	0	0	0
„ in applying residual correction	0	0	0	2	0	0	3
„ in tabulation	0	0	0	0	0	0	0
THERMOGRAPH:—							
Action	Good.	Good.	Good.	Good.	Good.	Good.	Good.
Photography	Do.	Do.	Do.	Fair.	Do.	Do.	Do.
Records deficient	71 hrs. wet bulb through frost.	59 hrs. wet by frost	11 hrs. wet by frost	* 21 hrs. W. and 23 D. by indifferent photography.	39 hrs. by frost	62 hrs. W. by frost; 27 hrs. W. out of action.	35 hrs. wet by frost; 2 hrs. wet, trace invisible.
Result of 40 *Remeasurements:—*	Dry. | Wet.	Dry. | Wet.	Dry. | Wet.	Dry. | Wet.	Dry. | Wet.	Dry. | Wet.	Dry. | Wet.
Greatest difference	0·20 | 0·20	0·20 | 0·10	0·10 | 0·20	0·20 | 0·10	0·20 | 0·20	0·20 | 0·20	0·20 | 0·20
Mean difference irrespective of sign	0·05 | 0·09	0·10 | 0·08	0·05 | 0·06	0·11 | 0·09	0·06 | 0·08	0·05 | 0·07	0·06 | 0·09
Residual difference (— Kew)	—0·03 | —0·01	—0·08 | 0·00	—0·01 | —0·04	—0·08 | —0·05	—0·06 | —0·07	—0·03 | —0·02	—0·05 | —0·09
Mean monthly difference between simultaneous thermograph and thermometer	0·15 | 0·15	0·10 | 0·11	0·09 | 0·08	0·08 | 0·09	0·05 | 0·08	0·09 | 0·17	0·25 | 0·15
No. of errors discovered in entry of standard	0 | 0	| 0	0 | 0	0 | 0	0 | 0	0 | 0	0 | 1
„ errors in substraction in subsidiary tables	5 | 4	| 0	0 | 0	0 | 0	0 | 0	0 | 1	0 | 0
„ discovered by subsidiary measurements	1 | 0	0 | 0	0 | 0	0 | 0	0 | 0	0 | 0	0 | 0
„ in maximum and minimum	1 | 4	0 | 1	0 | 0	0 | 0	0 | 0	1 | 0	5 | 5
„ in tabulation	0 | 0	0 | 15	0 | 1	0 | 0	0 | 0	0 | 0	1 | 0

* 38 hrs. wet bulb through frost.

The Committee then adjourned.

116, *Victoria Street, March* 31, 1873.

PRESENT:

Sir E. Sabine in the Chair.

Mr. De La Rue. | Mr. Gassiot.
Mr. Galton. | Rear-Admiral Richards.
Sir Charles Wheatstone.

The Director was in attendance.

The Minutes of last meeting (March 24) were read and confirmed.

The following draft reply to the Board of Trade was adopted:—

SIR,

I AM instructed by the Meteorological Committee to acknowledge the receipt of your letter of the 20th inst. enclosing the copy of a communication from the Scottish Meteorological Society to the Board of Trade, dated the 12th inst., and requesting to be favoured with any observations which the Committee may desire to make thereon.

The portion of the letter from the Scottish Meteorological Society, which appears to call specially for a reply on the part of the Meteorological Committee, is the paragraph wherein it is stated that the "Committee without any communication with the Council have appropriated the Society's Observer at Stornoway, &c."

In reply to this statement, the Committee would desire to refer to their letter of the 9th November 1872 to the Scottish Meteorological Society, a copy of which is subjoined, and they would assure the Board of Trade that, in establishing a telegraphic reporting station at Stornoway, nothing could have been further from their desire than to interfere with or cause any inconvenience to the Scottish Meteorological Society.

The Committee would further remark, that the observations which they receive from Stornoway are not only different from those supplied by the Observer at that station to the Scottish Meteorological Society, but are of such a character that they might readily be supplied by any one Observer to a number of societies or individuals without prejudice to any of them, and moreover that the entire special outfit of the station has been supplied direct from London.

As, however, it is the wish of the Scottish Meteorological Society that Observers furnishing information to them should not be engaged to observe also for the Committee without the previous concurrence of the Council of the Scottish Meteorological Society, the Committee will most readily conform to this wish on the part of the Society, and are desirous to continue their friendly relations with that Society in the interests of the science which they cultivate in common.

The Committee take occasion to remark that it is only at a very few small localities in Scotland that it would be difficult for them to find Observers independently of those who furnish observations to the Scottish Meteorological Society.

The Committee refrain from offering any observations on other portions of the Scottish Meteorological Society's communication to the Board of Trade, feeling assured that it is not necessary for them to disclaim the idea that any portion of a public vote could have been employed by them in "obstructing and undermining another society," or that they have any other object beyond the advancement of the science of Meteorology, which they have undertaken at the desire of the Government, and in the public interest.

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

Thomas Gray, Esq.,
Assistant Secretary, Board of Trade.

SIR,

Meteorological Office, November 9, 1872.

I HAVE the honour to inform you that I have received instructions from the Meteorological Committee to establish a telegraphic reporting station at Stornoway.

The result of my inquiries from the local authorities has been that the name of Mr. John Smith, the gardener at Lews Castle, has been submitted to me as a probable observer for that station.

Knowing that he supplied the reports from Sir J. Matheson's station at Stornoway to your society, I took no steps to appoint him until I had satisfied myself that his undertaking his new duties would not in any way interfere with his relations to the society. Having received his written assurance, and a further statement that his employers are "well pleased" that he should undertake the reports, I have entered into correspondence with him, and shall hope to establish the station before the 1st of December next.

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

The Secretary, Scottish Meteorological Society,
Edinburgh.

Read—A letter from Captain Toynbee, submitting an excellent log kept by Captain C. W. Pearson, S.S. "Strathclyde," who has already received the Pilot Charts (Minutes, 1872, p. 33).

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

Submitted—The following return of the result of the comparison between the warnings issued and the weather experienced in 1872 (Minutes, 1872, p. 59).

—	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 Storms.	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 -	48	23	10	6	1	7	1	April 2nd$_p$ and 21st$_s$ Oct. 17th$_p$ and 23rd Nov. 9th and 22nd and Dec. 22nd.
„ east - -	48	36	6	3	1	1	1	April 21st$_s$ Oct. 17th$_p$ and Nov. 9th$_p$.
Scotland, east -	30	18	5	5	—	1	1	Jan. 3rd$_p$ April 16th$_p$ Sept. 28th$_p$ and Oct. 4th$_p$
„ west (Clyde)	43	16	16	10	—	—	1	April 16th and Sept. 28th.
England, north-west -	49	34	7	3	3	1	1	April 21st$_s$ Sept. 28th Oct. 23rd Nov. 9th Dec. 22nd$_s$.
„ west -	47	40	4	1	1	1	—	—
„ south -	61	35	17	6	1	2	—	April 3rd and Nov. 22nd.
„ south-east -	25	15	4	4	—	2	—	Jan. 3rd April 21st$_s$ and Dec. 9th$_s$.
„ east -	28	14	5	7	—	2	—	April 3rd$_p$ April 8th$_s$ Nov. 9th Dec. 17th.
Totals - -	379	231	74	45	7	17	5	
Per-centages -	—	61·0	19·5	11·9	1·8	4·5	1·3	

Mr. Scott was instructed to forward the above return, with that for 1871 (p. 7), to the Board of Trade for presentation to Parliament.

The following cheques for March were drawn :—

	£	s.	d.
For Office:			
R. H. Scott -	66	13	4
J. S. Harding, jr.	*17	18	4
J. S. Harding, sr.	†9	12	6
T. D. Bell -	†5	10	0
Salaries and wages - - - -			
Davey, Thompson, & Co., coals - - - -	3	16	0
E. Higgs, fittings, &c. - - - - -	20	2	0
C. W. Jacques, rent for quarter - - - -	133	13	0
J. Davy & Sons, printing - - - - -	6	5	0
Williams and Norgate, books - - - -	4	5	11
For Observatories, quarterly allowances, &c.:			
D. Thomson (Aberdeen) - - - ‡61 17 6			
Less chemicals - - - - - 10 17 3			
—	51	0	3
T. R. Robinson (Armagh) - - - 36 5 0			
Do. expenses - - - 7 1 2			
—	43	6	2
W. P. Dymond (Falmouth) - - - -	‡65	12	6
R. Grant (Glasgow) - - - - -	‡61	17	6
H. Williams (Holyhead) - - - -	2	15	7
S. Jeffery (Kew) - - - 62 10 0			
„ examination of records - - 100 0 0			
—	162	10	0
Carried forward - - -	654	18	1

* Including allowance for extra attendance.
† Five weeks to the 29th.
‡ 12*s.* 6*d.* deducted for forms.

			£	s.	d.
Brought forward			654	18	1
C. Clouston (Orkney)			3	2	1
S. J. Perry (Stonyhurst)			‡49	7	6
T. Kerr (Valencia)	54 17 10				
„ salary for March	20 16 8				
			75	14	6
G. T. Watson (Yarmouth)			3	19	9
R. H. Curtis			10	0	0
F. C. Steventon			9	3	4
C. Stodart			†10	0	0
H. W. Woodward — Computations, &c.			†5	0	0
J. A. Curtis			†8	0	0
J. P. Cutts — (Three weeks)			3	0	0
W. L. Dallas			†7	10	0
For Telegraphy, quarterly allowances, &c.:					
Postmaster General, December quarter	499 0 9				
„ private wire	22 0 0				
			521	0	9
N. J. Holmes, Scilly, January	3 15 9				
„ „ February	3 0 6				
			6	16	3
H. Todd (Cambridge)			4	1	6
J. Costello (Dover)			3	5	10
J. Tilston (Holyhead)			3	6	6
G. Mitchell (Kingstown)			3	10	9
F. Gaster (London)			3	5	0
W. D. Penny (Nairn)			4	7	2
E. J. Lowe (Nottingham)			3	18	0
J. Lucas (Oxford)			3	5	6
W. Sandford (Portishead)			3	19	0
J. Merrifield (Plymouth)			3	5	0
J. Hoar (Portsmouth)			3	5	10
Smith, Payne, & Co., for Scilly			4	5	6
W. Lawrence (Shetland)			3	5	0
J. Smith (Stornoway)			4	5	3
J. Trotter (Thurso)			3	5	6
J. Sinclair (Wick)			3	5	6
G. T. Watson (Yarmouth)			4	12	6
C. Wakefield (York)			3	12	8
J. Davy and Sons, printing, &c.			19	10	0
Wightman & Co., B.P. wrappers			5	10	0
F. Gaster — Computations, &c.			*15	12	2
F. Brodie — Computations, &c.			*†7	14	4
G. G. Francis — Computations, &c.			*†7	14	4
R. Sargeant — Computations, &c.			*†4	7	6
For Ocean Meteorology:					
H. Toynbee, Marine Superintendent			33	6	8
Elliott, Bros., "A" aneroids			62	10	0
Cashiers of Bank of England: Bermuda anemometer			9	15	0
L. P. Casella, rain gauges	24 0 0				
„ D.S. thermometers	11 17 0				
			35	17	0
E. Higgs, packing cases			2	5	6
J. J. Hicks, instruments	24 15 0				
„ repairing barometer	1 10 0				
			26	5	0
Carried forward			1,664	1	9

* Including allowance for extra attendance.
† Five weeks to the 19th.
‡ 12*s.* 6*d.* deducted for forms.

		£	s.	d.
Brought forward - - -		1,664	1	9
J. R. Jones, Aberdeen agent - - - - -		11	9	5
H. J. Smart, Liverpool „ - - - - -		17	12	0
W. Salmon -	Computations, &c. - - -	20	16	8
R. Strachan -		*19	3	4
C. Harding -		†13	18	4
W. G. James -		‡8	0	0
T. E. Allen -		‡8	0	0
J. W. McVeagh		‡4	0	0
For Office Expenses :				
J. S. Harding, jun., on account - - - - -		100	0	0
Total - - - - -		£1,867	1	6

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

* Including allowance for care of instruments.
† Including allowance for extra attendance.
‡ Five weeks to the 29th.

The Committee then adjourned.

116, *Victoria Street, April* 7, 1873.

PRESENT:

Mr. De La Rue in the Chair.

Mr. Gassiot.

The Director was in attendance.

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

Reported—That the letter had been sent to the Board of Trade, as directed at last meeting.

Reported—That the application for an imprest of 2,000*l.* had been forwarded to the Treasury as directed.

Submitted—An estimate for erecting double windows in the Marine Room for the sum of 13*l.* 10*s.* 0*d.*—Accepted.

Read—A letter from Capt. Toynbee submitting an excellent log kept by Capt. T. C. Potts, ship "Tenasserim" (Minutes, 1871, p. 47).

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

Reported—That the Daily Weather Charts had been supplied to—

The Transport Office, Admiralty - -	4 copies.
G. J. Jones, Esq., Lymington - - -	in exchange.
E. J. Lowe, Esq., F.R.S., Nottingham - -	"
University Observatory, Durham - -	"

The officers and clerks were re-appointed for the ensuing financial year, at the following salaries (see Minutes, 1867, p. 16; 1868, p. 100; 1869, p. 38):—

	£	*s.*	*d.*
R. H. Scott, Director of the Office - - - -	800	0	0
Captain H. Toynbee, Marine Superintendent - -	400	0	0
W. Salmon, chief clerk - - - - -	250	0	0
J. S. Harding, junior, first senior clerk - - -	200	0	0
R. Strachan, second senior clerk - - - - (with 50*l.* additional for care of instruments.)	180	0	0
F. Gaster, senior clerk - - - - -	160	0	0
C. Harding, first junior clerk - - - -	*150	0	0
R. H. Curtis, second junior clerk - - - -	‡140	0	0
F. C. Steventon, junior clerk - - - -	‡130	0	0

The following scale of weekly salaries was approved:—

	Increase. *s.*	*d.*			
J. S. Harding, senior - - - - -	-	-	1	18	6
J. A. Curtis - - - - -	2	6	1	14	6
W. G. James - - - - -	2	6	1	14	6
T. E. Allen - - - - -	2	6	1	14	6
W. L. Dallas - - - - -	2	6	1	12	6
C. Stodart - - - - -	2	0	2	2	0
F. Brodie - - - - -	2	0	1	5	0
G. G. Francis - - - - -	2	0	1	5	0
T. D. Bell - - - - -	3	0	1	5	0
H. W. Woodward - - - - -	2	0	1	2	0
J. W. McVeagh - - - - -	4	0	1	0	0
C. H. Thompson - - - - -	†2	0	1	0	0
R. Sargeant - - - - -	2	0	0	17	0

* Increase 10*l.* since last year.
† Increase to date from 1st July.
‡ Increase 20*l.* since last year.
Allowance to be made for attendance at extra hours.

The Rev. T. Kerr was re-appointed Director of Valencia Observatory at a salary of 250*l.* per annum.

The case of the two clerks charged with pantagraphic work was specially considered. In the case of Mr. Curtis it was resolved that his maximum salary should be fixed at 140*l.*, and in the case of Mr. Steventon, that the maximum should be fixed at 130*l.* Both these salaries to take effect in the year 1873–4.

It was resolved—That the maximum salary of a temporary clerk should be 1*l.* 18*s.* 6*d.* per week.

The Committee then adjourned.

116, *Victoria Street, April* 21, 1873.

PRESENT:

Sir E. Sabine in the Chair.

Mr. De La Rue. | Sir C. Wheatstone.

The Director was in attendance.

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

Reported—That the imprest for 2,000*l.* had been received from the Treasury and lodged to the credit of the Committee.

Reported—That a letter had been received from Dr. Rubenson, director of the newly-established Meteorological Institute of Sweden, stating that he would soon be ready to transmit reports from Swedish stations to London, in accordance with the request of the Committee. (Minutes, 1871, pp. 46, 56.)

Submitted—The following statement of accounts paid and liabilities to 31st March 1873:—

	Paid.	Estimated Liabilities.
	£ *s.* *d.*	£ *s.* *d.*
OFFICE :—		
Salaries - - -	1,255 12 2	—
Rent, fuel, &c. - -	641 5 4	—
Contingencies* - -	478 14 3	—
LAND METEOROLOGY :—		
Expenses at observatories -	2,632 1 8	50 0 0
New instruments for ditto -	—	—
Computations - - -	831 7 10	—
Telegraphy - - -	1,769 2 4	394 0 0
Inspections, &c. - -	219 13 1	10 0 0
Computations - -	534 17 11	—
OCEAN METEOROLOGY :—		
Marine Superintendent -	400 0 0	—
Instruments, Admiralty -	277 3 8	196 0 0
Ditto Mercantile Marine -	480 15 3	77 0 0
Computations and care of instruments - -	964 0 10	—
Totals - -	10,484 14 4	727 0 0

Grand total - - £11,211 14*s.* 4*d.*

ROBERT H. SCOTT.

Major-Gen. Smythe and Mr. Galton were requested to act as auditors of the accounts for the past year.

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* A portion of this amount is chargeable to the postage of the Daily Weather Charts, and will be included under the sub-heading of inspections, &c. connected with land meteorology.

Submitted—The following STATEMENT respecting the Records for MARCH 1873, received from the self-recording Observatories, and which have been examined at Kew Observatory (see Minutes, 21st December 1868).

Points noticed at Kew.	Aberdeen.	Armagh.	Falmouth.	Glasgow.	Kew.	Stonyhurst.	Valencia.
ANEMOGRAPH :—							
Action	Good.	Good.	Good.	Fair.	Good.	Fair.	Good.
Records deficient	None.	None.	None.	None.	None.	1 hour lost in direction.	None.
Orientation verified	—	—	27th.	10th.	6th.	—	1st.
Result of 40 *Remeasurements :—*	Direction. | Velocity.	Direction. | Velocity.	Direction. | Velocity.	Direction. | Velocity.	Direction. | Velocity.	Direction. | Velocity.	Direction. | Velocity.
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 | 0·2	0·1 | 0·3	0·0 | 0·3	0·2 | 0·3	0·1 | 0·3	0·1 | 0·3	0·1 | 0·3
Residual difference (— Kew)	0·0 | 0·0	0·0 | 0·0	0·0 | 0·0	0·0 | 0·0	0·0 | 0·0	0·0 | 0·0	+0·1 | 0·0
No. of errors discovered	0 | 0	0 | 0	0 | 0	0 | 1	0 | 1	0 | 0	0 | 3
Errors in rain tabulation	0	1	0	0	0	4	11
BAROGRAPH :—							
Action	Good.	Good.	Good.	Fair.	Good.	Good.	Good.
Photography	Do.	Do.	Do.	Indifferent.	Do.	Do.	Do.
Records deficient	None.	None.	None.	1 hour lost; trace indistinct.	None.	None.	None.
Result of 40 *Remeasurements :—*							
Greatest difference	·0050	·0040	·0050	·0050	·0050	·0040	·0050
Mean difference irrespective of sign	·0025	·0019	·0021	·0023	·0016	·0020	·0022
Residual difference (— Kew)	—·0013	+·0003	—·0001	—·0016	—·0005	·0000	+·0005
Mean monthly difference between simultaneous barograph and barometer	·0017	·0023	·0018	·0022	·0019	·0020	·0025
No. of errors discovered in entry of standard	0	0	0	0	0	0	1
„ in calculating residual correction	0	0	0	2	0	1	0
„ in applying residual correction	0	0	0	2	0	0	0
„ in tabulation	0	0	0	1	0	0	0
THERMOGRAPH :—							
Action	Good.	Good.	Good.	Good.	Good.	Good.	Good.
Photography	Do.	Do.	Do.	Do.	Do.	Do.	Do.
Records deficient	*8 hrs. wet and 1 dry lost.	12 hrs. wet by frost.	25 hrs. dry bulb, thermometer broken	1 hr. each D. and W. lost; photographic blemish; 1 hr. W. out of action.	†4 hrs. W. and 1 hr. dry.	11 hrs. wet bulb, out of action through frost.	None.
Result of 40 *Remeasurements :—*	Dry. | Wet.	Dry. | Wet.	Dry. | Wet.	Dry. | Wet.	Dry. | Wet.	Dry. | Wet.	Dry. | Wet.
Greatest difference	0·20 | 0·10	0·20 | 0·20	0·10 | 0·10	0·20 | 0·20	0·10 | 0·10	0·20 | 0·20	0·20 | 0·20
Mean difference irrespective of sign	0·08 | 0·07	0·07 | 0·07	0·07 | 0·06	0·08 | 0·07	0·05 | 0·07	0·09 | 0·09	0·07 | 0·08
Residual difference (— Kew)	—0·04 | —0·03	—0·06 | —0·06	—0·02 | +0·04	—0·05 | —0·05	+0·01 | —0·03	—0·05 | —0·08	—0·05 | —0·05
Mean monthly difference between simultaneous thermograph and thermometer	0·17 | 0·14	0·09 | 0·11	0·09 | 0·10	0·11 | 0·11	0·07 | 0·08	0·19 | 0·17	0·19 | 0·24
No. of errors discovered in entry of standard	0 | 0	0 | 1	0 | 0	0 | 0	0 | 0	0 | 0	0 | 0
„ discovered by subsidiary measurements	5 | 1	0 | 1	0 | 0	0 | 0	1 | 0	1 | 0	0 | 0
„ in maximum and minimum	1 | 0	4 | 0	0 | 0	1 | 1	0 | 0	0 | 0	2 | 1
In tabulation	3 | 3	1 | 1	0 | 2	0 | 0	0 | 0	0 | 0	1 | 10

* { 1 hour each by cleaning of instruments, 3 hours wet by frost, and 4 hours wet insufficient water.

† { 1 hour each dry and wet owing to failure of gas. 3 hours wet bulb out of action.

The Committee then adjourned.

116, *Victoria Street, May* 5, 1873.

PRESENT:

Sir E. Sabine in the Chair.

Mr. De La Rue.	Mr. Gassiot.
Mr. Galton.	Rear-Admiral Richards.

The Director was in attendance.

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

Read the following letter (Minutes, p. 9) :—

M. 5168.
M. O. 910.

Board of Trade,
April 28, 1873.

SIR,

I AM directed by the Board of Trade to acknowledge the receipt of your letter of the 1st inst., enclosing copy of a letter addressed by you to this Board in reply to my letter of March 20th, concerning the Scottish Meteorological Society, relative to the appointment of their observer at Stornoway, Mr. John Smith, as observer to the Meteorological Committee also.

In reply I am to state that a copy of your letter has been forwarded to the Scottish Meteorological Society, and to express a hope that notwithstanding what has passed, the two societies will be able to agree to some common plan, whereby they can work in harmony in future.

I am, &c.

The Director, Meteorological Office. (Signed) THOMAS GRAY.

Read the following letter :—

H. 1959.
M. O. 905.

Board of Trade,
April 22, 1873.

SIR,

I AM directed by the Board of Trade to transmit herewith a communication which has been received from Mr. Thomas Moore suggesting that means should be taken to obtain information as to the migration, &c. of the different food-supplying fish, and to request that the Board may be favoured with any observations which you may have to offer thereon.

I am, &c.

R. H. Scott, Esq.,
Meteorological Office. (Signed) C. CECIL TREVOR.

SHIPS' LOGS and the MIGRATORY HABITS of FISH.

4, Canterbury Terrace, Catford Bridge, S.E.
April 5, 1873.

SIR,

THE supply of fish as an article of diet, and the employment of so large a population in fishing pursuits, makes it highly necessary that more attention should be bestowed on the migration of the various species of food-supplying fishes. Very little is known at present as to where herrings, mackerel, and pilchards go, or from whence they come. If our fishermen wish to track them or to anticipate their advent, they do not, as a rule, know where to look for them.

With regard to the herring more particularly, I believe it to be quite possible to trace their passage to and from certain spawning grounds, and along given lines of temperature.

During a seven years' cruising in the Pacific, I often passed through shoals of herrings, and what struck me forcibly, on the last cruise, when the vessel was homeward bound, was the fact that we had met with those fish in about the same latitude and longitude, at different periods of time, but nearly always in the same localities at different seasons. I then regretted not having made notes of the migratory habits of the herring, from my own experience; and believing it to be quite possible, in process of time, to prepare charts showing the passage of shoals of fish along the ocean, into and out of deep water, and their spawning beds, I invite the attention of the Board of Trade to this subject. If the Lords Commissioners of the Admiralty would co-operate, the work would be better completed. All that is necessary is the issue of a circular to commanders of all ships to furnish information through the medium of their log-books. Most masters will take a pleasure in entering memoranda of this description; and in examining the log-books, for the extraction of meteorological data, observations respecting fish might be collated and a Fishery Chart compiled therefrom.

The navigator may not desire to learn much about the passage of fish, but it should be borne in mind that fishing employs men in the navigation of vessels, and is a nautical and commercial pursuit. That trade might give employment to many more seamen and fishermen, to the advantage of fish consumers, if it were better known where fish might be found at most seasons of the year.

I remain, &c.

T. H. Farrer, Secretary,
Board of Trade. (Signed) THOS. MOORE.

Mr. Scott reported that he was in correspondence with Professor Buys Ballot and Professor Mohn on the subject, and he was instructed to prepare a reply for the consideration of the Committee.

Read the following letter :—

M. 6002. METEOROLOGY.
M. O. 929.

Board of Trade,
April 25, 1873.

SIR,

I AM directed by the Board of Trade to forward to you copies of certain enclosures received from the Foreign Office relating to the proceedings of a Meteorological Conference assembled last autumn at Leipzig, and I am to request to be favored with such observations as the Committee may have to offer in the matter, in order that this Board may be in a position to advise the Foreign Office as to the reply to be returned to the Austro-Hungarian Ambassador.

I am, &c.,
(Signed) THOMAS GRAY.

The Director, Meteorological Office.

Belgrave Square,
Le 7 Avril 1873.

M. LE COMTE,

LA réunion de Météorologues assemblés à Leipsic en autômne dernier ayant délibéré sur l'utilité d'établir une certaine unité dans les observations météorologiques, et ayant trouvé que le moyen le plus efficace pour atteindre ce but, serait un congrès international de météorologues, à l'instar du congrès de statistique et d'autres réunions internationales est tombé d'accord de tenir le premier congrès de météorologues à Vienne en autômne 1873, et chargea son comité permanent, composé de MM. H. Wild, C. Bruhns, et C. Jelinek, Directeurs des observations météorologiques de S^{t}. Petersbourg, de Leipsic, et de Vienne des démarches préliminaires à ce sujet.

Pour donner à la réunion projetée un caractère officiel, M. Jelinek s'est adressé au Ministère de l'Instruction Publique pour obtenir son entremise officielle afin que les différents Gouvernements qui maintiennent ou subventionnent des stations météorologiques envoient des délégués à ce congrès, et le mémoire présenté par M. Jelinek appuyait particulièrement sur le fait que les Directeurs des différents instituts météorologiques et des stations indépendantes paraissent éminemment être appelés à cette délégation.

Le Gouvernement Impérial et Royal m'a, par conséquent, chargé de transmettre à V. E. la publication des travaux de la réunion de Leipsic et d'inviter le Gouvernement de S.M.B. à se faire représenter au congrès météorologique de Vienne qui se réunira le 1er Septembre pour une durée de 15 jours ou plus s'il le faut.

En vous joignant ici 10 exemplaires de cette publication, je vous prie, M. le Comte, de vouloir bien me faire connaître, si le Gouvernement Britannique est disposé à prendre part à ce congrès, et, le cas échéant, me faire communiquer le nom des délégués anglais.

Veuillez, etc.
(Sd.) BEUST.

Mr. Scott reported that he had received a further communication for the subject from Dr. Jelinek.

In reference to the great interest with which the idea of a Meteorological Congress, to be held at Vienna in the autumn of 1873, has on all sides been hailed, the undersigned considers himself bound to report on the steps which have been taken towards the realization of the project in question.

It is known that the Meteorological Conference which met at Leipzig August 14-16, 1872, has recognised that the holding of such a congress would be the best means of attaining uniformity in the department of meteorological investigations—an object of equal importance to science as to the interest of navigation and of agriculture. The Conference therefore entrusted the duty of taking the necessary steps for bringing the congress together to a committee consisting of Director H. Wild of St. Petersburg, Director C. Bruhns of Leipzig, and the undersigned.

In the first place it was necessary to wait for the appearance of the report of the Leipzig meeting, and this caused considerable delay, as it seemed desirable to submit the proposed report in the first instance to several of the prominent members of the Conference.

As soon as the results of the Leipzig Conference were in print, the undersigned with the previous approval of the other members of the committee, addressed himself in the name and by the authority of that committee in an application of February 25, 1873 (Z. 176/C. A.), to the Imperial and Royal Ministry of Instruction with the request that that office would be pleased to grant its support to the realization of the undertaking which promised to be both of scientific importance and of credit for the Austrian empire.

As to the character of the projected Meteorological Congress it was stated in the application just mentioned that it was desirable that the proposed Meteorological Congress should possess *an official character* in contrast to the free meeting at Leipzig, the entrance to which was open to every meteorologist.

The object to be attained by such a meeting consists not in a theoretical exchange of ideas, but in the agreement and harmonious action between members in whose sphere of action it rests to carry into effect in their several systems of observation the regulations the introduction of which may be generally decided to be desirable.

The proposed Meteorological Congress for the autumn of 1873 should accordingly be constituted in a similar way to the Maritime Conference at Brussels in 1853, *of delegates from the several Governments which have hitherto either organized or subsidized meteorological organizations.* Naturally it must be left

to the individual Governments to fix the number of their delegates and to nominate their representatives; but in the above-mentioned application it was expressly urged on the Austrian Ministry of Instruction, that *in consideration of the nature of the subject to be considered, the heads of the various Meteorological Institutes, and—what is not in all cases the same thing—the managers of independent systems of observations, seemed to be especially designated to take part in the proceedings.*

In regard of the time for the meeting of the Meteorological Congress the 1st of September was proposed, and a probable duration of the proceedings of 14 days was suggested, without excluding the possibility of a prolongation of the meeting.

At the close of the above application the request was made that the K. K. Ministry of Instruction would address itself to the K. K. Ministry of Foreign Affairs, with the request that it would invite the governments named in an Appendix*, to take part in the Congress, and inasmuch as invitations are included which affect in part transoceanic countries and colonies, *these invitations should be made as pressing as possible.* The Government of Hungary should in the same way be invited to send representatives to the Congress.

The reply was dated March 25, 1873, Z 2670, and it conveyed the information that His Excellency Dr. Carl von Stremeyer, the Minister of Instruction, *had been pleased to accede to the proposal.* It was stated in the reply that the Minister of Instruction had at the same time forwarded a request to the Foreign Ministry with reference to the invitation to foreign Governments to send representatives to the Meteorological Congress, and had invited the K. K. Ministry for Trade, the Marine Department of the K. K. Ministry for War, and the K. Hungarian Ministry for Religious Worship and Instruction to send their own representatives.

On the part of the Ministry of Instruction the undersigned and Dr. Julius Hann were nominated to represent the Austrian Government at the contemplated Congress.

Hohe Warte, Vienna, April 9, 1873. (Signed) C. JELINEK.

Mr. De La Rue having kindly consented to assist Mr. Scott in drawing up a reply; the further consideration of the matter was postponed until next meeting.

Read the following letter:—

M. O. 937.

SIR, Hydrographic Department, Admiralty, April 28, 1873.

I BEG to enclose you a list of meteorological instruments, which the Astronomer Royal suggests should be supplied to the Transit of Venus parties which will leave England during the early part of 1874.

As these instruments are for the service of the Government, probably the Committee may see fit to cause them to be furnished from the Meteorological Office; and if so, I will communicate to you as to the packing of them, and as to the time they will be required.

The instruments could of course be returned on the return of the parties.

I am, &c.,

R. H. Scott, Esq., F.R.S. (Signed) GEO. HENRY RICHARDS.

(List not printed here.)

Mr. Scott was instructed to inform the Hydrographer that the instruments required would be supplied.

Reported—That Mr. Beckley had been sent to Falmouth to repair damage done to the thermograph during the painting of the Observatory, and that he had inspected the condition of the several instruments—Approved.

Read—A letter from Capt. Toynbee submitting excellent logs by

Capt. T. M. Almond, ship "Decapolis" (Minutes, 1871, p. 3).
„ H. Henderson, s.s. "Cleveland" (Minutes, 1872, p. 17).

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

Mr. Galton stated that he had been in communication with the Patent Type Foundry Company with reference to the possibility of providing Weather Charts suitable for publication in newspapers, and submitted specimens of such charts.

Mr. Scott was instructed to inform the company that the office would be ready to furnish them with the earliest information in their power, if there should be any demand for such charts.

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* The Governments mentioned in the Appendix were those of Great Britain and Ireland, the Netherlands, Belgium, Spain, Portugal, Sweden, Norway, Denmark, Prussia, Saxony, Bavaria, Wurtemburg, Baden, Switzerland, Italy, Russia, Turkey, Greece, the United States of America, and of Costa Rica.

NOTE.—May 12. By letter from Dr. Jelinek, dated May 6th, it appears that the omission of France was due to a clerical error, which has been corrected.

Reported—That the exchange of telegrams with Sweden had commenced on the 1st inst. The stations whence the reports are received are Haparanda, Hernosand, Stockholm, and Wisby.

The following cheques for April were drawn on the 28th ultimo, on the signature of Sir E. Sabine:—

		£	s.	d.
For Office:				
R. H. Scott	Salaries and wages	66	13	4
J. S. Harding, jun.	Salaries and wages	*18	3	4
J. S. Harding, sen.	Salaries and wages	†7	14	0
T. D. Bell	Salaries and wages	†5	0	0
For Observatories:				
S. Jeffery, Kew, postages, &c.		4	6	10
T. Kerr (Valencia), salary		20	16	8
R. H. Curtis	Computations, &c.	11	13	4
F. C. Steventon	Computations, &c.	10	16	8
C. Stodart	Computations, &c.	†8	8	0
H. W. Woodward	Computations, &c.	†4	8	0
J. A. Curtis	Computations, &c.	†6	18	0
W. L. Dallas	Computations, &c.	†6	10	0
C. H. Thompson	Computations, &c.	†3	12	0
For Telegraphy:				
A. Adie & Son, thermometer screen		2	0	6
F. Gaster	Computations, &c.	*14	16	5
F. Brodie	Computations, &c.	*†6	8	0
G. G. Francis	Computations, &c.	*†6	8	0
R. Sargeant	Computations, &c.	*†4	3	6
For Ocean Meteorology:				
H. Toynbee, Marine Superintendent		33	6	8
Cashiers of Bank of England, Bermuda, anemometer		8	18	6
W. Salmon	Computations, &c.	20	16	8
R. Strachan	Computations, &c.	‡19	3	4
C. Harding	Computations, &c.	*14	3	3
W. G. James	Computations, &c.	†6	18	0
T. E. Allen	Computations, &c.	†6	18	0
J. W. McVeagh	Computations, &c.	†4	0	0
For Office Expenses:				
J. S. Harding, jun., on account		99	11	4
Total		£422	12	4

* Including allowance for extra attendance.
† Four weeks to the 26th.
‡ Including allowance for care of instruments.

The Committee then adjourned.

116, *Victoria Street, May* 12, 1873.

PRESENT:
Sir E. Sabine in the Chair.
Sir C. Wheatstone.

The Director was in attendance.

The Minutes of last meeting (May 5th) were read and confirmed.

Submitted—A draft reply to the Board of Trade respecting the proposed Vienna Congress, which was ordered to be printed for approval.

Submitted—The draft Report of the Office for the year 1872.—Consideration postponed.

Read—The following letter from Captain Toynbee to Mr. Scott:—

May 10th, 1873.

I HAVE read Mr. Meldrum's paper "On the Forms of Cyclones in the South Indian Ocean, and on some of the Rules given for avoiding their Centres," with great care; and think that the *facts* given are of such practical importance to navigators that it would be well to publish it.

To make it more clear, I have had the observations on which his arguments are based laid down on two small charts, which, with his diagrams, make it very clear.

Yours faithfully,
HENRY TOYNBEE.

Resolved—That the suggestion be complied with, and Mr. Meldrum's paper published as a non-official paper.

Read—A letter from Mr. Jeffery suggesting the advisability of keeping in stock at Kew some spare thermometers for thermographs.

Mr. Scott was authorised to procure six sets.

Read—A letter from Dr. Robinson asking for an increase of salary for each of his two assistants.—Consideration postponed.

The Committee then adjourned until the 26th inst., as Mr. Scott requested permission to be absent from the office on Monday the 19th, as he purposed inspecting the stations in the south-west of England.

116, *Victoria Street, May* 26, 1873.

PRESENT:

Sir E. Sabine in the Chair.

Mr. De La Rue. | Maj.-Gen. Smythe.

Sir C. Wheatstone.

The Director was in attendance.

The Minutes of last meeting (May 12) were read and confirmed.

Reported—That the vote for the Office had been passed by the House of Commons.

Mr. Scott was instructed to apply to the Treasury for the balance due.

The following reply to the Board of Trade (Minutes, p. 26) was adopted:—

May 26, 1873.

I AM instructed by the Committee to inform you in reply to your letter of the 22nd April (M. 1,959) that they have instituted inquiries into the extent to which the fisheries of Holland and Norway are conducted with reference to the temperature of the sea. They find that since the date (1857) of the publication bearing on the subject, translations of which were published by the Board of Trade—and a copy lately sent to you—annual reports were issued by the Royal Meteorological Institute of Holland up to 1863, since which year the subject appears to have been dropped, perhaps owing to the falling off in the amount of information sent in by the fishermen, which is more than once noticed in the Reports. In Norway the subject has not yet been treated by the Meteorological Institute.

The Dutch plan was to obtain observations from the fishermen of the temperature at the time of shooting the nets, and of the take of fish.

The Committee are of opinion that judging from the small size of the boats, and of the character of the population engaged at least in the Scotch fisheries, there would not be much use in trying to institute such a system of observation in that country. The crews of the Cornish and East Country boats are of a higher class of men, but even with them the prospect of success would be questionable.

With reference to the idea of obtaining information as to the motions of fish from ships' logs, they would draw the attention of the Board of Trade to the fact that in the abstract Log adopted at the Brussels Conference, and in the Weather Books of the Meteorological Office, provision is made for the recording of observations on natural history, such as the appearance of whales, seals, or of fish, but not much information has hitherto been received bearing on the migration of the ordinary net-fish, such as mackerel, herrings, &c.

Most of the captains do not begin their observations until they are in the open sea, and are already at the extreme limits of the fishing ground, and many of them are not well acquainted with the fish so as to know them.

From the North Sea, and the north coast of Scotland very little information has been received, as hardly any of the ships observing for the Meteorological Office frequent those waters, which are the most important for herrings.

The Dutch have never combined information received from ships with observations taken on board fishing boats, and they have the widest experience on the subject.

There would be no difficulty whatever, if the Board of Trade thought it desirable, to draw the attention of captains more particularly to the importance of recording the occurrence of fish, and to request the Trinity House and the Ballast Board to direct their lightkeepers to note the passage of fish, and to register sea temperature, whenever possible, in a careful manner, once a week, on a uniform system. The Board of Northern Lights have already taken up the subject at the instance of the Scottish Meteorological Society.

The Committee will be happy to render any assistance that they can in the matter, and to supply thermometers to the lighthouse stations, on condition of the records being taken regularly and sent to them for preservation.

Sir C. Wheatstone stated that he had consulted Mr. Frank Buckland on the subject, and had received from him the following letter, which was ordered to be placed on the minutes:—

MY DEAR SIR CHARLES, Salmon Fisheries Office, 4, Old Palace Yard, May 14, 1873.

I AM much obliged to you for your kindness in communicating to me the general effect of Capt. Moore's letter sent by the Board of Trade to the Meteorological Office.

This Office has now an opportunity of conferring very great services to the fisheries of this country I would classify these as follows:—

1st. Deep sea fisheries.
2nd. Oyster fisheries.
3rd. Salmon fisheries.

1. The deep-sea fisheries. The migrations of all fish are much regulated by temperature. Herrings and pilchards and mackerel live, I believe, when not in a spawning condition, in the deep valleys formed by irregularities of level in the deep ocean. They do not approach the land as a rule except to deposit their ova, which in my opinion require comparatively shallow water to develope them; but whether this shoal water is hotter or colder than the deep sea is a fact that the Meteorological Office should endeavour to find out. For this purpose I should propose that the following stations should be chosen: On the East coast, Wick, Montrose, Grimsby, Yarmouth, Ramsgate. On the South coast, Brighton, Portsmouth, Plymouth, Falmouth. On the West coast, Barnstaple, Swansea, Pembroke, Holyhead, Maryport, Ardrossan, Oban.

The daily temperature of the sea should be taken by a self-recording thermometer at the pier-head at each of these places. I should propose at 12 mid-day and 12 midnight. The temperature of the air should also be taken and also readings of the barometer and ozonometer, as I believe fish are very sensitive to ozone. Every opportunity should be taken to get temperatures from the fishermen who should take them at or near the legal three mile limit (*see* Sea Fisheries Act) and again when they arrive actually among the herrings, pilchards, mackerel, &c.

Soles and cod are also migratory in May. The soles go over to the coast of Heligoland to spawn. In the winter they are found dispersed on the sandbanks between Norfolk and the coast of Holland. I should like to know the temperature at the top and bottom of the water agreeable to the soles in their winter residence, and also the same in the summer when they are spawning.

The cod live at and about the Dogger Bank in the winter. In February and March they come nearer inshore to spawn; in June, July, and August they go towards Iceland, where the fishers follow them with their nets. I should like the Meteorological Office to follow them with their thermometers.

2. As regards oyster fisheries I myself first started the idea, which I have proved to demonstration by experiments in a small sea laboratory near Herne Bay, that although young oysters are born in millions every year, yet if the thermometer sinks during the time the young spat are in a swimming state they all or nearly all perish. If however the water rises to a certain point and remains there, from 15th June to 15th July or thereabouts, a valuable crop of young oysters will be procured. I have already published, in "Land and Water," records of temperature of several oyster fisheries.

Temperatures should therefore be taken of oyster fisheries during February, March, April, May, June, July, August, and September at the following places: Whitstable, Herne Bay, Paglesham (Essex), Colchester, Ipswich, Medina River (Isle of Wight), Brading Harbour, Falmouth, Swansea, and Milford. Those are the chief oyster beds in England. The temperatures obtained should be carefully compared with temperatures taken in France at the Isle of Ré, Obéron and Arcachon; also with that of the oyster beds at the mouth of the Tagus at Lisbon. The reason the French succeed so well with their artificial oyster breeding is solely that the temperature is higher.

3. As regards salmon fisheries the Meteorological Office would indeed assist this vast and important national industry very much by obtaining temperatures.

The facts are about as follows: All salmon spawn about Christmas week; yet some rivers are "early" some "late." Thus in the Tay, Severn, Tyne, Dee, and Eden fresh run fish appear in February and they get red, out of condition, about August, when the present close season begins.

There is a second class of rivers, such as all the small rivers in Wales and Devon, and rivers from the Conway round the coast to the Exe (the Usk and Wye excepted), where the early clean run do not appear till May and June.

The latest rivers in England are the Fowey and Camel in Cornwall. Meteorological observations would *I am sure* solve the difficult problem of the reason why salmon run up some rivers earlier than others, and if we could obtain this information, owners of the salmon fisheries would be under the greatest obligation to the Meteorological Office, while, at the same time, the Parliament would be much assisted in framing future laws on the subject.

I should propose for example that the daily temperature of the Tay should be taken at the exit of Loch Tay, at Killin Bridge, at Perth Bridge, and at Dundee. The fisheries of the Tay are worth from 16,000*l.* to 17,000*l.* per annum.

The Spey and the Forth should be tested at places I could indicate. The Chester Dee at the locks belonging to the Shropshire Union Canal Co., at the exit of Bala Lake, at Llangollen, at Chester Bridge, and at Connah's Quay in the estuary. The Severn should be tested at the estuary, at Portskewet, at Newnham, at Worcester, at Shrewsbury, and Newtown. The Ribble at Preston and Clitheroe. The Wye at Chepstow and Builth. The Usk at Newport, Ross, and Brecon, &c. &c.

The advantages which I feel sure would be derived from the results of such observations would be that an immense saving of wear and tear of boats and tackle would be made by fishermen who would be warned that if the temperature went over a certain point the fish would not run, and if it fell to a certain point they would run, or as the case may be.

When in Scotland I told the owner of a certain stake net that if the temperature fell to a certain point his nets would not fish; if it rose above a certain point they would fish. I subsequently heard from this gentleman that the facts proved my theory correct.

Thus, then, it will be seen that the Meteorological Office are in a position to erect guide posts for the deep sea, oyster, and salmon fisheries, and I sincerely trust that they will be patriotic enough to set these observations on foot at once. Even though the experiments be carried out on a small scale and with comparatively rude instruments, I feel sure that before the end of the year some light or other would appear amid the present obscurity which surrounds the question of the "Effects of the temperature on the migrations of fish both in sea and river," and also on the breeding of oysters.

I needly hardly say that I shall be glad either in my official or private capacity to render the Office any assistance in my power.

I have, &c.
(Signed) F. Buckland,
Inspector of Salmon Fisheries.

Mr. Scott was instructed to inform Mr. Buckland that the Committee had no funds at their disposal to carry on such a series of experiments as he suggested, but that they would be very glad to obtain observations on sea temperature on our coasts, if the same could be furnished without serious expense to the Office.

The following reply to the Board of Trade, with respect to the proposed congress at Vienna, was adopted :—

I AM instructed by the Committee to inform you in reply to your letter of the 25th ult., that while in their opinion important results for the prosecution of meteorology might be anticipated from such a discussion as it is proposed to inaugurate at a meteorological congress at Vienna, they would yet venture to point out that in their opinion it is essential that all the subjects to be brought under discussion should be definitely arranged, and the method of voting agreed upon, some time prior to the meeting. They consider that the synopsis of discussion should be circulated previous to the meeting amongst those who are to take part in its deliberations, so that it seems probable to them that the main result of the present congress would be to fix the subjects on which decisions might be obtained at a future meeting.

Of all the sciences Meteorology is perhaps the most dependent on conjoint action between the several independent organizations in existence, on a plan as uniform as possible, as it is not to be expected that *absolute* identity in the methods of obtaining and discussing the results can ever be attained.

The Committee would, however, suggest for the consideration of the Board of Trade that the questions originally proposed for the consideration of the conference at Leipzig in 1872, and which are contained in the English translation of the report of that meeting, sent herewith, would form an admissible basis of discussion, on which the programme for the proposed Congress might be founded.

The consideration of several of the questions in the lists referred to has been expressly postponed to the projected Congress at Vienna, some of the others have already received a solution.

The Committee do not consider that it would be advisable to discuss the subject of Marine Meteorology, excepting with relation to Weather Telegraphy, inasmuch as the settlement of the various questions connected therewith may safely be left to mutual arrangements between the individual nations which possess marine meteorological organizations.

In the letter from the Austro-Hungarian Embassy of which you have enclosed a copy, Count de Beust suggests that delegates from the independent meteorological systems should take part in the Congress.

The separate meteorological organizations, of noticeable importance, in connexion with the Government are in addition to the Meteorological Office those of—

1. The Army Medical Department.
2. The General Register Office.
3. The Colonial systems.
4. The Indian systems.

Of the above the Army Medical Department publishes returns from 23 home and 8 foreign stations.

The system of the General Register Office may possibly be merged in that of the Meteorologica Office, in accordance with certain correspondence which passed on the subject at the close of the year 1872.

The Canadian system under Dr. Kingston of Toronto, and the system of Bengal under Mr. Blanford of Calcutta, are both of them extensive organizations, and exclusively supported by Government.

Of systems indirectly recognized by the Government the Committee would mention—

The Scottish Meteorological Society, Mr. Thos. Stevenson, Hon. Sec.
The Meteorological Society of the Mauritius, Mr. Chas. Meldrum, Sec.

Of totally independent systems they would cite—

The Meteorological Society, 30 Great George Street, S.W., Mr. Chas. Brooke, F.R.S., Hon. Sec.
The British Rainfall system.

The last-named organization is of an entirely private character, but it numbers about 1,600 observers, and is managed solely by Mr. G. J. Symons, 62 Camden Square.

The Committee would point out to the Board of Trade that this country is quite exceptional in regard of the extent to which the science is prosecuted by private enterprise, and that some notice might reasonably be taken of this fact by recognizing the existence of the more important of the systems named, and nominating one or more delegates to represent them.

If the Board of Trade were to request the Committee to nominate a representative of their own system, they would submit the name of the Director of their Office, Mr. Robert H. Scott, F.R.S. who has already acted for them in the same capacity at the meteorological conference at Leipzig.

They would, however, point out to the Board of Trade that in the vote for this Office which has just been taken no provision was contemplated nor has any been made for the expense of sending a delegate to Vienna, and that under no circumstances could they be prepared to defray the expenses of any excepting their own representative.

Read—The following letters:

M. 6682.
M. O. 1017.

SIR, Board of Trade, May 12, 1873.

WITH reference to previous correspondence on the subject of the relations between your Committee and the Scottish Meteorological Society, I am directed by the Board of Trade to forward for your information the enclosed copy of a letter received from the latter body.

I am, &c.,

The Director, Meteorological Office. (Signed) THOMAS GRAY.

Scottish Meteorological Society,
Edinburgh, May 2, 1873.

SIR,

I HAVE the honor to acknowledge the receipt of your letter of the 23rd ultimo, inclosing a copy of a communication from the Meteorological Committee to the Board of Trade, dated 1st April, 1873 (No. 5163), in which the Meteorological Committee intimate that they will most readily conform to the wish of the Society; that observers furnishing information to them shall not be engaged to observe also for the Committee without the previous concurrence of the Council of the Society, and that they are desirous of continuing their friendly relations with the society.

I have to communicate to the Board of Trade the satisfaction of the Council with the result of this correspondence, and their wish to continue friendly relations with the Meteorological Committee.

With reference to the concluding paragraph of your letter, I am directed to say that the Council heartily subscribe to the hope expressed that the two societies will be able to agree to some common plan whereby they can work in harmony in future. The Council will be ready to give their best attention to any plan that may be suggested, and will be glad if it should result in securing full harmonious action between the two bodies in the prosecution of Meteorology, a science which presents so many different fields for separate lines of investigation, and for the successful carrying out of which friendly co-operation among those who are engaged in these investigations is so very desirable.

I am, &c.

The Assistant Secretary, (Signed) THOMAS STEVENSON,
Marine Department, Board of Trade. Hon. Sec.

Submitted—The following Report:

I HAVE to report that I have completed the inspection of the south-western stations.

Plymouth was visited on the 15th inst., and everything was as usual in good order. The instruments have been removed to their fresh situation, alluded to in my last Report.

Scilly visited on the 16th and found in a satisfactory condition.

Portishead was visited on the 19th. This station, which has only been established since my last visit, has proved a very good one, and is in complete order.

I also visited the observatory at Falmouth on the 17th, and there I found everything going on well.

May 26, 1873. ROBERT H. SCOTT.

Read—A letter from Capt. Toynbee, submitting excellent logs kept by—

Capt. D. Hunter, S.S. "Alpha" (Minutes, 1872, p. 33).
Capt. C. Johnson, ship "St. Lawrence,"
Capt. D. F. M'Kechnie, barque "Cottica" (Minutes, 1872, p. 33).
Capt. G. Rennie Stuart, ship "Otago" (Minutes, 1872, p. 19).
Capt. J. L. Perry, R.N., H.M.S. "Orontes." Log kept by W. W. Vine, Esq. (Minutes, 1872, p. 43).
Capt. W. Watson, S.S. "Parthia" (Minutes, 1872, p. 43).

Resolved—That the Pilot Charts be presented to Capt. Johnson, and that the thanks of the Committee be conveyed to the other gentlemen.

Dr. Robinson's application for an increase of salary to his assistants was considered, and it was resolved that the request be complied with. The increase in the case of Mr. Call to be 10*l.* a year, and in the case of Mr. Hunter 3*s.* a week.

SUBMITTED—The following STATEMENT respecting the RECORDS for APRIL 1873, received from the SELF-RECORDING OBSERVATORIES, and which have been examined at KEW OBSERVATORY (*See* Minutes, 21st December 1868).

Points noticed at Kew.	Aberdeen.	Armagh.	Falmouth.	Glasgow.	Kew.	Stonyhurst.	Valencia.
ANEMOGRAPH :—							
Action	Good.	Fair.	Good.	Fair.	Good.	Good.	Good.
Records deficient	None.	None.	* 27 hrs. each Velocity and D.	None.	None.	None.	None.
Orientation verified	30th.	—	21st.	1st.	21st.	1st.	7th.
Result of 40 *Remeasurements :—*	Direction. | Velocity.	Direction. | Velocity.	Direction. | Velocity.	Direction. | Velocity.	Direction. | Velocity.	Direction. | Velocity.	Direction. | Velocity.
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 | 0·3	0·2 | 0·5	0·1 | 0·3	0·2 | 0·3	0·1 | 0·3	0·1 | 0·3	0·1 | 0·3
Residual difference (—Kew)	0·0 | +0·1	+0·1 | 0·0	0·0 | 0·0	—0·1 | 0·0	0·0 | 0·0	0·0 | 0·0	—0·1 | +0·1
No. of errors discovered	0 | 0	0 | 14	0 | 0	0 | 0	0 | 0	0 | 1	0 | 2
Errors in rain tabulation	0	0	0	0	0	1	8
BAROGRAPH :—							
Action	Good.	Good.	Good.	Good.	Good.	Good.	Good.
Photography	Do.	Do.	Do.	Fair.	Do.	Do.	Do.
Records deficient	None.	None.	None.	None.	None.	None.	None.
Result of 40 *Remeasurements :—*							
Greatest difference	·0050	·0050	·0050	·0050	·0050	·0040	·0050
Mean difference irrespective of sign	·0017	·0018	·0017	·0019	·0020	·0016	·0017
Residual difference (—Kew)	—·0010	—·0001	—·0010	—·0005	—·0016	·0000	—·0007
Mean monthly difference between simultaneous barograph and barometer reading	·0017	·0024	·0015	·0020	·0021	·0016	·0024
No. of errors discovered in entry of standard	0	0	0	0	0	0	2
„ in calculating residual correction	0	0	0	0	0	0	3
„ in applying residual correction	0	0	0	2	0	0	1
„ in tabulation	0	0	0	1	0	0	0
THERMOGRAPH :—							
Action	Good.	Good.	Tabulating scale not ready.	Good.	Good.	Good.	Good.
Photography	Do.	Do.		Fair.	Do.	Do.	Do.
Records deficient	1 hour lost wet bulb out of action.	18 hrs. wet bulb out of action.		5 hrs. D. and W. by stoppage of clock. 3 hrs. wet bulb out of action.	14 hrs. wet bulb out of action.	None.	9 hrs. each dry and wet bulb by stoppage of clock.
Result of 40 *Remeasurements :—*	Dry. | Wet.	Dry. | Wet.	Dry. | Wet.	Dry. | Wet.	Dry. | Wet.	Dry. | Wet.	Dry. | Wet.
Greatest difference	0·20 | 0·10	0·20 | 0·20		0·10 | 0·10	0·20 | 0·20	0·10 | 0·10	0·20 | 0·20
Mean difference irrespective of sign	0·09 | 0·06	0·07 | 0·08		0·09 | 0·08	0·05 | 0·04	0·08 | 0·09	0·10 | 0·08
Residual difference (—Kew)	—0·06 | —0·05	—0·07 | —0·09		—0·08 | —0·08	—0·05 | —0·04	—0·05 | —0·08	—0·09 | 0·00
Mean monthly difference between simultaneous thermograph and thermometer	0·16 | 0·17	0·09 | 0·11		0·09 | 0·11	0·12 | 0·08	0·17 | 0·18	0·19 | 0·18
No. of errors discovered in entry of standard	0 | 0	0 | 0		0 | 0	0 | 0	0 | 0	0 | 0
„ discovered by subsidiary measurements	0 | 0	0 | 0		0 | 0	0 | 0	0 | 0	0 | 0
„ errors of subtraction in subsidiary tables	0 | 2	2 | 1		0 | 0	0 | 0	0 | 0	0 | 0
„ in maximum and minimum	0 | 0	0 | 0		2 | 1	0 | 0	0 | 0	1 | 2
„ in tabulation	2 | 7	5 | 1		0 | 1	0 | 0	1 | 0	0 | 1

* Anemometer taken down to be painted.

The following cheques for May were drawn :—

		£	s.	d.
For Office :				
R. H. Scott	Salaries and wages	66	13	4
J. S. Harding, jun.	Salaries and wages	*18	3	4
J. S. Harding, sen.	Salaries and wages	†7	14	0
T. D. Bell	Salaries and wages	†5	0	0
Davey, Thompson, and Co., coals		3	15	0
C. Gillman, gas, March quarter		4	0	3
For Observatories :				
T. Kerr, Valencia, salary		20	16	8
S. Jeffery : Mr. Beckley's Inspection of Falmouth		12	2	0
Malby : printing forms, &c.		29	10	6
G. H. Simmonds, calculations		5	10	0
R. H. Curtis	Computations, &c.	11	13	4
F. C. Steventon	Computations, &c.	10	16	8
C. Stodart	Computations, &c.	†8	8	0
H. W. Woodward	Computations, &c.	†4	8	0
J. A. Curtis	Computations, &c.	†6	18	0
W. L. Dallas	Computations, &c.	†6	10	0
C. H. Thompson	Computations, &c.	†3	12	0
For Telegraphy :				
N. J. Holmes, Scilly Company, March		3	2	6
V. Brooks, Day, & Son, delivery of Daily Weather Charts		10	16	10
J. W. Moore, translations		5	5	0
F. Gaster	Computations, &c.	*16	4	5
F. Brodie	Computations, &c.	*†6	10	0
G. G. Francis	Computations, &c.	*†6	9	4
R. Sargeant	Computations, &c.	*†3	19	9
For Ocean Meteorology :				
H. Toynbee, Marine Superintendent		33	6	8
Negretti and Zambra, "A" Instruments	9 16 3			
Ditto "M.O." Instruments	9 0 3			
		18	16	6
W. Salmon	Computations, &c.	20	16	8
R. Strachan	Computations, &c.	‡19	3	4
C. Harding	Computations, &c.	*14	6	5
W. G. James	Computations, &c.	†6	18	0
T. E. Allen	Computations, &c.	†6	18	0
J. W. McVeagh	Computations, &c.	†4	0	0
For Office Expenses :				
J. S. Harding, jun., on account		90	0	0
Total		£492	4	6

* Including allowance for extra attendance.
† Four weeks to the 24th.
‡ Including allowance for care of instruments.

The Committee then adjourned.

116, *Victoria Street, June* 2, 1873.

PRESENT:

Sir E. Sabine in the Chair.

Mr. De La Rue. | Mr. Galton.

Major-General Smythe.

The Director was in attendance.

The Minutes of last meeting (May 26) were read and confirmed.

Reported—That the letters to the Board of Trade regarding respectively Fisheries and the proposed Vienna Congress had been forwarded as directed.

Submitted—The following Report of the Auditors:—

METEOROLOGICAL OFFICE: ACCOUNT of RECEIPTS and PAYMENTS for the year ended March 1873.

RECEIPTS.

	£	s.	d.
Balance from year 1871–2 -	1,496	3	6
Parliamentary vote - -	10,000	0	0
W. F. Cooper - 0 13 0			
C. Meldrum - - 4 0 0			
Lt. Colonel Hamilton - 2 15 0			
Messrs. Power Bros. - 3 6 8			
Dr. C. Jelinek - 1 1 0			
Mrs. Torrens - - 1 19 6			
The Bishop of Rupert's Land - - 21 9 0			
S. W. Hodding - 3 15 0			
E. E. Morris - - 10 14 4			
G. Dornbusch - 10 0 0			
H. Lee and Sons - 2 10 0			
Rev. W. P. Mackay, D.D. - - 7 6 2			
R. Geographical Socy. 10 10 0			
Dr. G. T. Kingston - 72 13 0			
Dr. C. Smallwood - 6 1 6			
F. Gaster - - 2 0 0			
Dr. Gilbert Smith - 0 18 0			
W. Galloway - - 2 19 6			
The Earl of Rosse - 7 10 0			
Sale of old instruments, &c. - - 2 2 0			
Do. old books - 2 12 0			
Subscriptions to D. W. charts - - 335 0 9			
	511	16	5
Interest on deposit account -	120	6	10
	£12,128	6	9

PAYMENTS.

	£	s.	d.	£	s.	d.
Office.						
Salary of Director -	800	0	0			
Do. two Clerks -	297	13	2			
Office Keeper and Messenger - -	157	19	0			
				1,255	12	2
Rent of office, &c. -	538	17	0			
Fuel and gas - -	34	17	3			
Furniture and fittings	67	11	1			
				641	5	4
Postage - -	70	2	1			
Printing, &c. - -	57	12	1			
Attendance and other contingencies -	111	16	7			
				239	10	9
Land Meteorology.						
Expenses at observatories -	2,632	1	8			
Computations -	831	7	10			
				3,463	9	6
Telegraphy - -	1,769	2	4			
Inspections, issue of D. W. charts, &c. -	458	16	7			
Computations -	534	17	11			
				2,762	16	10
Ocean Meteorology.						
Marine Superintendent	400	0	0			
Supply and return of instruments:						
Admiralty -	277	3	8			
Mercantile Marine	480	15	3			
Computations and care of instruments -	964	0	10			
				2,121	19	9
				10,484	14	4
Cash in hand -	95	8	8			
Advance to Valencia Observatory -	50	0	0			
Bank of England account - -	143	13	11			
London and Westminster Bank -	1,354	9	10			
				1,643	12	5
				£12,128	6	9

Examined and compared with the vouchers and found correct.

27 May 1873.

(Signed) W. J. SMYTHE, Major General, F. GALTON, } Auditors.

Read—A letter (M.O. 1,130) from the Royal Cornwall Polytechnic Society, applying for an increase of at least 100*l.* in the amount allowed annually for the observatory at Falmouth.

Mr. Scott was instructed to reply that the Committee regretted to be unable to comply with the above request as long as their grant from Parliament remained unaltered.

Mr. Galton, on behalf of Mr. Spottiswoode, requested the Committee to accept his (Mr. Spottiswoode's) resignation of his seat on the Committee, as he found himself unable to attend its meetings.

Resolved—That this resignation be accepted, and that the Director be instructed to express to Mr. Spottiswoode the sincere regret of the Committee that he found himself no longer able to spare time to take part in their proceedings.

Resolved—That the Council of the Royal Society be requested to nominate Major-General R. Strachey, F.R.S., C.S.I., to fill up the vacancy on the Meteorological Committee, left by the resignation of Mr. W. Spottiswoode.

Mr. Scott was instructed to request the Earl of Rosse to allow his name to be suggested to the Council of the Royal Society as a member of the Meteorological Committee.

The Committee then adjourned.

116, *Victoria Street, June* 9, 1873.

PRESENT:

Mr. De La Rue in the Chair.

Major-General Smythe.

The Director was in attendance.

The Minutes of last meeting (June 2) were read and confirmed.

Reported—That Lord Rosse had consented to his name being submitted to the Council of the Royal Society as a member of the Committee.

Resolved—That the names of the Earl of Rosse and Major-General R. Strachey be submitted to the Council of the Royal Society for nomination on the Meteorological Committee, through the intervention of Admiral Richards, who should also notify the resignation of Mr. Spottiswoode.

The Report for 1872 was adopted.

Resolved—That the Report be forwarded to the Board of Trade for presentation to Parliament.

Reported—That 8,000*l.*, being the balance of the Parliamentary grant for the current year, had been received from the Treasury and lodged to the deposit account of the Committee at the London and Westminster Bank.

Mr. Scott stated that Mr. J. C. Haile, of the Local Government Board, had called on him with reference to Campbell's Registering Sundial, which he had had in action for nine years at Richmond Terrace, S.W. Mr. Haile had received directions to discontinue the observations at the expense of his own office, and he applied to the Meteorological Committee to know whether or not they would continue them, the annual expense being only 12*s.* a year.

Resolved—That the apparatus be tried for six months, and experiments on it be carried on in the meantime.

Mr. Scott requested permission to commence the publication in the Appendices to the Quarterly Weather Report of results from additional stations, the plan to be submitted to the Committee on a future occasion.—Approved.

Mr. De La Rue placed on the table a magneto-electric signalling anemometer which he had devised and had made at his expense, the object of which is to indicate from points not readily accessible, a given wind velocity, say 30, 40, or 50 miles per hour, at the nearest telegraph stations. The several selected telegraph stations would then be in a position to send a single letter signal A, B, C, D, &c., to the Meteorological Office, and thus indicate, by the letter appropriated to each station, those localities where the wind was blowing at a given velocity. The information thus communicated would, it is believed, tend to increase the reliability of the storm warnings issued by the Office.

Resolved—That the instrument be tested by placing it at the top of the house and connected with a signal bell in Mr. Scott's room.

Mr. Kerr applied for leave to take his annual vacation.—Granted.

The Committee then adjourned.

116, *Victoria Street, June* 16, 1873.

PRESENT:

Sir E. Sabine in the Chair.

Mr. Galton. | Maj.-Gen. Smythe.
Sir Charles Wheatstone.

The Director was in attendance.

The Minutes of last meeting (June 9) were read and confirmed.

Read—The following letter:

M. 7857.
M.O. 1204.

SIR, Board of Trade, June 9, 1873.

I AM directed by the Board of Trade to acknowledge the receipt of your letter of the 27th ultimo, submitting the name of your Director, Mr. Robert H. Scott, F.R.S., as a fitting delegate to represent the Meteorological Office at the forthcoming Meteorological Congress at Vienna, and stating that no provision has been made in the vote taken for your Office for defraying the necessary expenses which would be incurred by Mr. Scott in this capacity.

In reply I am to state that the Board of Trade have no funds available for the payment of his expenses, which they are of opinion should, if incurred at all, be charged in the annual vote of 10,000*l.* granted to the Meteorological Office.

I am, &c.

The Director, Meteorological Office. (Signed) THOMAS GRAY.

Mr. Scott reported that Admiral Richards wished that a letter should be written to the Secretary of the Royal Society with respect to the proposed changes in the Committee, and he was instructed to send the following letter:

SIR, June 16, 1873.

I AM instructed by the Meteorological Committee to inform you that Mr. W. Spottiswoode having expressed a wish to resign his seat on the Meteorological Committee, they would venture to submit the name of Major-General R. Strachey, to be nominated by the President and Council to fill the vacancy thus caused in their body.

I am further instructed to say that they are desirous of increasing their number, and that they would suggest to the President and Council the name of the Right Honourable the Earl of Rosse, as one that might with great advantage be added to their list.

I am, &c.

The Secretary of the Royal Society. (Signed) ROBERT H. SCOTT,
Director.

Submitted—The following opinion on the discussion of the anemometry at Sandwick Manse (Minutes, 1872, pp. 59, 70, &c.), from Prof. Arthur von Oettingen, Dorpat:—

Dorpat, May 27, 1873.

YOUR investigation about the Orkney Islands has interested me very much. I found it on my return home from Leipzig last summer, and as you kindly asked for a criticism of it, I venture to offer some remarks.

I regret above all that the opposite components are always combined to form a resultant; you have

yourself felt the inconvenience and expressed it at p. 6, where it is said, "the decrease of the com-
"ponents in approaching midsummer is not entirely due to any diminution in the velocity of the wind,
"but to easterly changes in its direction." On the same page you compare the West component with the South component; similarly you might compare West with East, and North with South. For publication you would certainly want N., E., S., W., that is four columns, and that would require double as much space for printing; but against this objection I might remark that (instead of 24) 12 data, or two-hourly observations, with four components, would have much more value than hourly, with simply paying attention to the difference; and Table II., p. 33, and Table III., are not the expression for prevalent wind; thus, *e.g.*, I do not think that in January *the mean velocity* is $V = 6{\cdot}6 = \sqrt{(4{\cdot}54)^2 + (4{\cdot}75)^2}$, but that the name *atmospheric translation* is the only right one for this. It is not until the "general summary" that I find a surrogate for the *true* FOUR components. Such and similar comparisons every meteorologist could have made from your material if you had stuck to the four components. Allow me still another remark; in the general summary you have thrown together all winds from 0° — 45°, 45° — 90°, &c., on the whole eight groups; but 337½° — 22½°, 22½° — 67½°, 67½° — 112½°, are generally taken together.

Further, you give V and D for each year within the groups indicated. I now ask how shall I compare such data with those of other stations? How complicated does the representation appear, and finally, what is the interest to see that, *e.g.*, in January, in the same group—

1863 V = 20·4 and D = 30°.
1865 V = 8·8 „ D = 28°.

Instead of this I should wish for only four components, hourly, three-hourly, daily, &c. I have been very glad to see that you have chosen for the three-hourly observations as a centre 1, 4, 7, 10, &c.

It would be well worth the trouble, placed in such an interesting situation as Sandwick is, to give all the hourly four wind components in a later publication. England does not mind the expense of printing.

You will, however, allow me to remark that the direct determination of components, given by the apparatus directly, would give you more completely and accurately that which you want to observe. The process described on p. 4 is only an approximation; I mean the sentence, "the direction given is that recorded exactly at the hour-line, &c." You are certainly not far from the truth, but I glean from your publication the hope that you will recognize my new integrator for wind components. My apparatus is ready; I have tried to get it to Vienna, but I cannot succeed. I addressed myself to Dr. Jelinek, who told me that at the Congress of Vienna there would be no exhibition of meteorological apparatus. Yet my instrument must be represented there, and I do not know how to attain it. Nor can Wild help in the matter. I should prefer to send my anemometer to London and America, where we should certainly have a fair decision on it, and we could expect its most rapid adoption, as soon as the principle is recognized as practical, and moreover as the only one which is scientifically justifiable.

DR. ARTHUR VON OETTINGEN.

Read—A letter from Captain Toynbee, submitting excellent logs from the following gentlemen:—

Capt. John Bruce, S.S. "Australian" (Minutes, 1872, p. 9).
„ T. E. Hassell, ship "Mervyn" (Minutes, 1872, p. 9).
„ J. J. Price, barque "Sorata" (Minutes, 1872, p. 43).

Mr. Scott was instructed to convey the marked thanks of the Committee to the above-named gentlemen.

Submitted—The Quarterly Weather Report, 1871, Part III.

Reported—That the Daily Weather Charts had been supplied to the Mercantile Marine Office, Lancaster, for exhibition; and the Engineer's Department, Local Government Board, on the free list.

The Committee then adjourned.

116, *Victoria Street, June* 30, 1873.

PRESENT:

Mr. De La Rue in the Chair.

Mr. Galton.	Major-General Smythe.
The Earl of Rosse.	Major-General Strachey.

Sir C. Wheatstone.

The Director was in attendance.

The Minutes of last meeting (June 16) were read and confirmed.

Read—The following letter :—

SIR, The Royal Society, June 24, 1873.

WITH reference to your letter intimating that Mr. Spottiswoode had resigned his seat on the Meteorological Committee, I am directed to inform you that the Council of the Royal Society at their meeting on Thursday last appointed General Strachey and the Earl of Rosse to be members of that Committee.

I remain, &c.
WALTER WHITE.

Mr. Scott reported that he had acted upon the foregoing letter, and had summoned Gen. Strachey and Lord Rosse to the Meeting, and that he proposed notifying the fact of the appointment of the new members to the Board of Trade.—Approved.

Read—The following letter :—

H. 3191; M. O. 1272. Board of Trade (Harbour Department),
SIR, June 20, 1873.

I AM directed by the Board of Trade to inform you that upon receipt of your letter of the 26th ultimo, on the subject of the migrations of food-producing fish, they requested the Commissioners of Northern Lighthouses to inform them as to what steps, if any, they had taken or were taking in the matter, and I am now to forward to you the copy of the reply of the Commissioners of Northern Lighthouses.

The Board of Trade will be prepared to adopt your suggestion as to communicating with the three general Lighthouse Authorities, if you will kindly favour them with a draft form of the return which you propose should be filled up by the light-keepers.

They are also inclined to think that it may be of some use if the attention of the captains was, as you suggest, more particularly drawn to the value of recording the occurrence of shoals of fish.

I am, &c.
R. H. Scott, Esq., F.R.S. C. CECIL TREVOR.

Northern Lighthouses' Office, Edinburgh,
SIR, June 12, 1873.

I AM directed by the Commissioners of Northern Lighthouses to acknowledge receipt of your letter of 6th curt., No. H. 2869, on the subject of a record of observations with regard to the migration of food-supplying fishes. Having laid this letter before the Commissioners, I am directed to state that the Commissioners have not as yet had any communication with the Scottish Meteorological Society on the subject, nor with anyone else. The inquiry appears to the Commissioners to fall more under the Fishery Board than the Commissioners; but they will be glad to forward in any way in their power the proposed investigation.

I am, &c.
The Assistant Secretary, ALEXR. CUNINGHAM, Secretary.
Harbour Department, Board of Trade.

Mr. Scott was instructed to prepare a form for Observations of Sea Temperature, and to submit it to the Committee. The observations to be taken at an uniform depth of 1 fathom, and also at greater depths where practicable.

Read—The following correspondence, which was approved :—

SIR, Army Medical Department, June 26, 1873.

WITH reference to the forthcoming Meteorological Congress, I have the honour to inform you that it had been recommended by this Department that a delegate should be sent to Vienna, but that a reference has been made to this Office by Mr. Vivian inquiring whether the representation of this Department on that occasion might not be entrusted to you, so as to save the expense of a second delegate. I have therefore to request you to be kind enough to state whether you would be willing to undertake this responsibility, or whether it would in your opinion be preferable, notwithstanding the additional expense, that this Department should be separately represented.

I have, &c.
R. H. Scott, Esq. T. G. LOGAN.

SIR, Meteorological Office, June 27, 1873.

I HAVE the honour to acknowledge the receipt of your letter of the 26th instant, asking whether I am willing to represent your Department at the proposed Meteorological Congress at Vienna.

In reply I beg to inform you that while I am quite ready to take the responsibility so far as regards the general Science of Meteorology, I am of opinion that it might possibly be better to appoint a separate delegate who would be more conversant with the special requirements of Medical Meteorology, which the Army Medical Department has particularly to deal with.

I have, &c.

Sir T. G. Logan, K.C.B., M.D. ROBERT H. SCOTT, Director.

Mr. Scott reported that he had written to Sir H. Rawlinson requesting him to be so kind as to use his influence to have Meteorological Stations established in Persia, and that he had received the following reply.

(M.O. 1389.) 21, Charles Street, Berkeley Square, W.

MY DEAR SIR, June 30, 1873.

I HAVE spoken to the Grand Vizier about Meteorological Observations in Persia, and he suggests that Major Murdoch Smith, the head of the Telegraphic Establishment, should on his return to Persia be required to organise some means for obtaining regular Weather Reports.

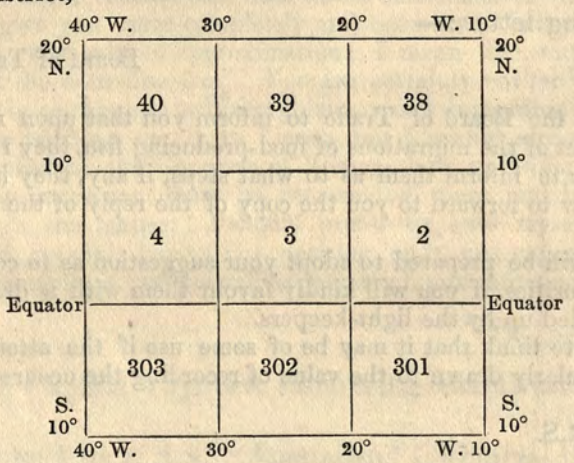
He doubts if matters are yet ripe for an official observatory, but he will give every facility to Major M. Smith for pursuing meteorological researches.

Yours, &c.
H. RAWLINSON.

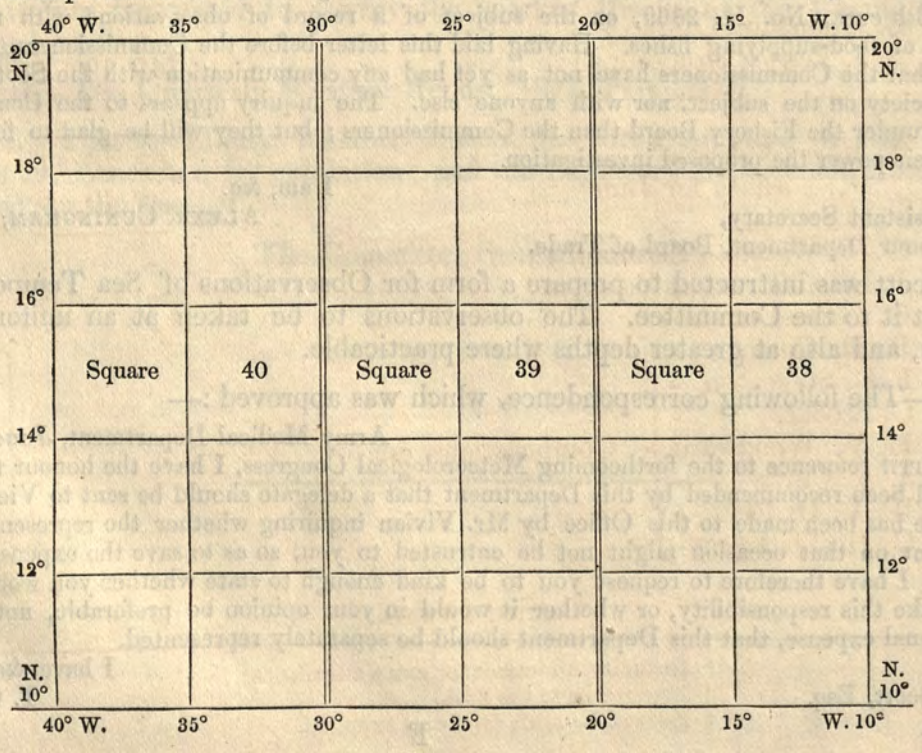
Approved.

Submitted—The following memorandum :—

As the Marine Branch of the Office is now at work on the wind data for the following nine most important squares in our district,



and as it may be some time before the Committee meet again, I shall feel obliged by your bringing to their notice the following method for publishing those data, with the view of learning their will on the subject, as it is important that we should know how it is to be dealt with eventually.



The above method sifts the data into spaces containing 5° of longitude by 2° of latitude, and the data of three squares can be given on one sheet. As the wind and weather changes in this part of the sea depend much more on latitude than longitude, perhaps this division will be considered sufficiently minute.

If it be thought requisite, the weather and sea observations can be given similarly; if so, this method proposes to give the same data for each of the nine squares as are given in the eastern and western strips of the Chart for Square 3.

June 24, 1873. H. TOYNBEE.

Read—A letter from Capt. Toynbee submitting excellent logs kept by

Capt. A. Campbell, ss. "Europa." (Minutes, 1872, p. 92.)
Capt. H. K. Lindsay, ship "Valparaiso." (Minutes, 1872, p. 30.)
Capt. T. Tully, ship "Baroda."
Capt. T. Littleford Wadham, barque "Vere."

Mr. Scott was directed to present the Pilot Charts to Captains Tully and Wadham, and to convey to the other two gentlemen the marked thanks of the Committee.

Reported—That the Daily Weather Charts had been supplied to

J. C. Walker, St. Ann's Head
F. E. Sawyer, Brighton
} in exchange for Observations.
Cullercoats (in place of Tyneside Naturalists Field Club) for exhibition.

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

The following cheques for June were drawn :—

			£	s.	d.
For Office :					
R. H. Scott	Salaries and wages		66	13	4
J. S. Harding, jr.			*18	13	4
J. S. Harding, sr.			†9	12	6
T. D. Bell			†6	5	0
C. W. Jacques, rent for quarter			133	13	0
For Observatories, quarterly allowances, &c. :					
D. Thomson (Aberdeen)			‡62	3	9
T. R. Robinson (Armagh)	40 14 0				
Do. expenses	8 12 10				
			49	6	10
W. P. Dymond (Falmouth)			‡65	0	0
R. Grant (Glasgow)			‡61	17	6
H. Williams (Holyhead)			2	13	5
S. Jeffery (Kew)	62 10 0				
„ examination of records	100 0 0				
			162	10	0
C. Clouston (Orkney)			2	14	9
S. J. Perry (Stonyhurst)	‡49 10 8				
„ postage	0 12 9				
			50	3	5
T. Kerr (Valencia)	63 16 11				
„ salary for June	20 16 8				
			84	13	7
G. T. Watson (Yarmouth)			3	18	6
J. Driscoll, rent at Valencia			25	0	0
G. Grove, sun-bowls			3	12	0
R. H. Curtis	Computations, &c.		11	13	4
F. C. Steventon			10	16	8
C. Stodart			†10	10	0
H. W. Woodward			†5	10	0
J. A. Curtis			†8	12	6
W. L. Dallas			†8	2	6
C. H. Thompson			†4	10	0
Carried forward			868	5	11

* Including allowance for extra attendance.
† Five weeks to the 28th.
‡ Deductions made for forms supplied.

	£	s.	d.
Brought forward	868	5	11
For Telegraphy, quarterly allowances, &c.:			
Postmaster General, March quarter	330	9	2
H. Todd (Cambridge)	3	18	9
J. Costello (Dover)	3	5	10
J. Tilston (Holyhead)	3	6	0
G. Mitchell (Kingstown)	3	5	4
F. Gaster (London)	3	5	0
W. D. Penny (Nairn)	4	4	6
E. J. Lowe (Notts)	3	18	0
J. Lucas (Oxford)	3	5	6
J. Merrifield (Plymouth)	3	5	0
W. Sandford (Portishead)	3	19	3
J. Hoar (Portsmouth)	3	6	0
Smith, Payne, & Co., for Scilly	4	4	11
W. Lawrence (Shetland)	3	5	0
J. Smith (Stornoway)	4	5	0
J. Trotter (Thurso)	3	5	8
J. Sinclair (Wick)	3	5	2
G. T. Watson (Yarmouth)	3	6	0
C. Wakefield (York)	3	5	4
F. Gaster — Computations, &c.	*17	14	2
F. Brodie — Computations, &c.	*†8	5	0
G. G. Francis — Computations, &c.	*†8	3	8
R. Sargeant — Computations, &c.	*†5	4	0
For Ocean Meteorology:			
H. Toynbee, Marine Superintendent	33	6	8
P. Adie "A" instruments — 42 16 10			
„ "M O" „ — 54 8 0			
	97	4	10
J. R. Jones, Aberdeen agent	1	16	1
H. J. Smart, Liverpool „	14	3	8
W. T. Black, rain gauge	1	14	6
W. Salmon — Computations, &c.	20	16	8
R. Strachan — Computations, &c.	§19	3	4
C. Harding — Computations, &c.	*14	17	6
W. G. James — Computations, &c.	†8	12	6
T. E. Allen — Computations, &c.	†8	12	6
J. W. McVeagh — Computations, &c.	†5	0	0
For Office Expenses:			
J. S. Harding, jun., on account	90	0	0
Total	£1,617	6	5

* Including allowance for extra attendance.
† Five weeks to the 28th.
§ Including allowance for care of instruments.

Submitted—The following statement respecting the records for MAY 1873, received from the self-recording Observatories, and which have been examined at Kew Observatory.
(See Minutes, 21st December 1868.)

Points noticed at Kew.	Aberdeen.	Armagh.	Falmouth.	Glasgow.	Kew.	Stonyhurst.	Valencia.
ANEMOGRAPH:—							
Action	Good.	Good.	Good.	Fair. 2 hrs. direction; no trace visible.	Good.	Good.	Fair. 23 hrs. direction, doubtful, but found out of order.
Records deficient	None.	None.	None.	1st.	None.	None.	26th.
Orientation verified	—	31st	8th.		13th.	7th.	
Result of 40 *Remeasurements:—*	Direction. / Velocity.	Direction. / Velocity.	Direction. / Velocity.	Direction. / Velocity.	Direction. / Velocity.	Direction. / Velocity.	Direction. / Velocity.
Greatest difference	1·0 / 1·0	1·0 / 1·0	1·0 / 2·0	1·0 / 1·0	1·0 / 1·0	1·0 / 1·0	1·0 / 1·0
Mean difference irrespective of sign	0·1 / 0·2	0·2 / 0·3	0·2 / 0·3	0·1 / 0·5	0·1 / 0·3	0·2 / 0·3	0·2 / 0·4
Residual difference (— Kew)	−0·1 / 0·0	+0·1 / +0·1	−0·1 / +0·1	−0·1 / +0·1	0·0 / 0·0	+0·1 / +0·1	−0·1 / +0·1
No. of errors discovered	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0	0 / 0
Errors in rain tabulation	0	0	0	0	0	6	8
BAROGRAPH:—							
Action	Good.	Good.	Good.	Good.	Good.	Good.	Good.
Photography	Do.	Do.	Do.	Fair.	Do.	Do.	Fair.
Records deficient	None.	None.	None.	1 hr. lost; light passing over the binding rods.	None.	None.	None.
Result of 40 *Remeasurements:—*							
Greatest difference	·0040	·0050	·0050	·0050	·0050	·0050	·0050
Mean difference irrespective of sign	·0019	·0018	·0018	·0020	·0021	·0025	·0019
Residual difference (— Kew)	+·0001	−·0002	+·0006	−·0002	+·0004	−·0021	−·0005
Mean monthly difference between simultaneous barograph and barometer	·0016	·0020	·0017	·0020	·0020	·0018	·0027
No. of errors discovered in entry of standard	0	0	0	0	0	0	1
„ in calculating residual correction	0	0	0	0	0	0	3
„ in applying residual correction	0	0	0	1	0	0	1
„ in tabulation	0	0	0	0	0	0	0
THERMOGRAPH:—							
Action	Good.	Good.	Awaiting scale.	Good.	Good.	Good.	Good.
Photography	Do.	Do.		Fair.	Do.	Do.	Fair.
Records deficient	None.	1 hr. wet bulb out of action.		3 hrs. wet bulb out of action.	1 hr. dry bulb; lamp glass blackened.	None.	None.
Result of 40 *Remeasurements:—*	Dry. / Wet.	Dry. / Wet.	Dry. / Wet.	Dry. / Wet.	Dry. / Wet.	Dry. / Wet.	Dry. / Wet.
Greatest difference	0·20 / 0·20	0·10 / 0·20		0·20 / 0·20	0·20 / 0·10	0·10 / 0·20	0·20 / 0·20
Mean difference irrespective of sign	0·09 / 0·09	0·08 / 0·11		0·09 / 0·08	0·05 / 0·05	0·06 / 0·08	0·12 / 0·08
Residual difference (— Kew)	−0·03 / −0·07	−0·07 / −0·11		−0·06 / −0·01	−0·01 / −0·04	−0·02 / −0·07	−0·06 / −0·03
Mean monthly difference between simultaneous thermograph and thermometer	0·18 / 0·17	0·12 / 0·13		0·12 / 0·12	0·11 / 0·14	0·17 / 0·18	0·18 / 0·15
No. of errors discovered in entry of standard	0 / 0	0 / 0		0 / 0	0 / 0	0 / 0	0 / 0
„ discovered by subsidiary measurements	7 / 12	0 / 0		1 / 0	0 / 0	1 / 0	0 / 2
„ in maximum and minimum	0 / 1	0 / 0		1 / 0	0 / 0	0 / 0	0 / 2
„ in tabulation	0 / 0	1 / 0		0 / 0	0 / 0	0 / 0	2 / 0
„ in substraction in subsidiary tables	1 / 1	0 / 0		1 / 0	0 / 0	1 / 0	0 / 0

The Committee then adjourned.

116, *Victoria Street, July* 7, 1873.

PRESENT:

The Earl of Rosse in the Chair.

Major-General Strachey. | Sir C. Wheatstone.

The Director was in attendance.

The Minutes of last meeting (June 30) were read and confirmed.

Submitted—The following scheme for Observations of Sea Temperature (Minutes, June 30), which was approved, and Mr. Scott was instructed to forward it to the Board of Trade, with a request to be informed of the number of stations at which it was proposed to make the observations.

The temperature of the sea at a lightship, lighthouse, or near the shore should be taken daily at high water, and also at noon whenever the depth of water will allow of it. The thermometer should be sunk 6 feet below the surface from a boat, a pier, or other convenient situation, and left there at least five minutes to ensure its acquiring the true temperature of the water. It should then be hauled up rapidly, and read *immediately*. The observer must be careful to note the day and hour, and to observe the temperature to the nearest tenth of a degree. Thus—

Year.	Month.	Day.	Hour.	Temperature of sea 6 feet below surface (high water).
1873	7	7	4 p.m.	60°·3

In all localities where observations can be taken at depths of 2 fathoms or more, the temperatures should be taken at those depths also in addition to the regular observation at 1 fathom.

In making returns to the Meteorological Office, the observer must always state the maker's name and number of the instrument used, and whether it is mercurial or spirit, registering or ordinary.

The suggestions as to marine work made by Captain Toynbee in his letter read at last meeting were approved.

Read—A letter from Captain Toynbee, submitting an "excellent" log by Captain John A. Martyn, S.S. "Java" (Minutes, p. 2), being the tenth excellent log which he had sent in.

Mr. Scott was directed to express to Captain Martyn the marked thanks of the Committee for his continued co-operation in the work.

Submitted—The Quarterly Weather Report, 1872, Part III.

Reported—That Mr. G. G. Francis had left the Office on the 2nd instant, and had not since been heard of, up to that date.

The Committee then adjourned.

116, *Victoria Street, July* 21, 1873.

PRESENT:

The Earl of Rosse in the Chair.

Mr. De La Rue.

The Director was in attendance.

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

Reported—That the letter respecting Sea Temperatures had been sent to the Board of Trade as directed.

Read—The following letter :—

M. 9604.
M. O. 1453.

Board of Trade,
July 8, 1873.

SIR,

I AM directed by the Board of Trade to acquaint you that they have been informed by the Foreign Office that Her Majesty's Government have decided to nominate you and Mr. Buchan, the secretary of the Scottish Meteorological Society, as delegates to represent this country at the Meteorological Conference to be held at Vienna in September next.

I am, &c.
(Signed) THOMAS GRAY.

Read—The following letter :—

M. 9669.
M. O. 1400.

Board of Trade,
July 14, 1873.

SIR,

WITH reference to your letter of the 10th ultimo, forwarding a proof copy of the Report of the Meteorological Committee for the year 1872, and requesting that this Board would obtain the sanction of the Treasury to 500 copies of the Report being supplied for the use of your Office as heretofore, I am directed by the Board of Trade to forward herewith a copy of a letter received from the Treasury for your observations as to the future supply of copies of this Report at the expense of the Royal Society.

I am, &c.
R. H. Scott, Esq. (Signed) THOMAS GRAY.

M. 9669.
M. O. 1430.

Treasury Chambers,
July 5, 1873.

SIR,

I AM commanded by the Lords Commissioners of Her Majesty's Treasury to acquaint you, for the information of the Lords of the Committee of Council for Trade, that my Lords have authorized the Comptroller of the Stationery Office to supply 500 copies of the Report of the Meteorological Committee for the year ended 31st December 1872, for the use of the Committee as requested in the letter from your Department of 16th instant.

I am to state that my Lords would be glad to know whether in the opinion of the Board there is any adequate reason why the Report of this Committee should not in future be left to be printed at the expense of the Royal Society if they think it desirable.

I am, &c.
T. H. Farrer, Esq. (Signed) WM. LAW.
&c. &c. &c.

The following draft reply was adopted :—

With reference to your letter of the 14th inst. (M. 9669), enclosing a copy of a communication received from the Treasury respecting the future printing of the annual Report of this Office;

I beg to point out that in the letter of the Royal Society to the Board of Trade, dated the 27th October 1866 (W. 4653), it was expressly stipulated that the scientific body to whom the management of the Office should be entrusted should render an account to Parliament of the money spent, and of the results effected in each year, and further that the Treasury in their letter to the Board of Trade, dated 30th November 1866 (W. 5215), gave a general approval to the recommendations contained in the Royal Society's letter.

These papers were subsequently laid before Parliament and ordered to be printed (see Paper No. 240, Session 1867).

I would also venture to point out, with reference to the last phrase of the letter from the Treasury, that the *Royal Society* do not contribute any funds towards the expenses of this Office, which is managed entirely by the *Meteorological Committee* appointed by that Society at the request of the Government, and that the Royal Society is in no way concerned in the publication of the work done by the Committee, beyond the receipt of a single copy sent to that body as to some other learned Societies.

I am, &c.

(Signed) ROBT. H. SCOTT,
Director.

Read—A letter from the Scotch Fishery Board applying for the loan of a fishery barometer for Wick, on the north side of the river, and for authority to change the position of the barometer at Sarclet.—The suggestions were complied with.

Read—A letter from Capt. Toynbee, submitting excellent logs by—

W. Greenwood, Esq., ship "Assaye" (Minutes, 1872, p. 38).
Capt. A. A. Jones, ship "Chevy Chase" (Minutes, 1871, p. 6).

Mr. Scott reported that some serious defects had been discovered in the photography at Glasgow, and that he proposed to direct special attention to this subject on his approaching visit to Glasgow.—Approved.

Mr. Scott stated that he proposed to send Mr. Beckley on his usual tour of inspection of the observatories.—Approved.

Reported—That Mr. Francis had gone to Liverpool, and not being able to find employment had written to ask for assistance to go to America. Mr. Scott requested permission to allow him to return to the Office, so as to try to regain the character he had lost by running away.—Permission granted.

Submitted an estimate for papering the marine room, &c. for 12*l.* 6*s.*—Approved.

Submitted—The following statement of accounts paid and liabilities to 30th June 1873:

——	Paid.	Estimated Liabilities.
	£ *s.* *d.*	£ *s.* *d.*
OFFICE :—		
Salaries - - -	319 18 3	—
Rent, fuel, &c. - -	142 8 3	—
Contingencies - -	35 10 5	6 0 0
LAND METEOROLOGY :—		
Expenses at observatories -	670 15 2	36 0 0
New instruments for ditto -	—	—
Computations - - -	203 6 6	—
Telegraphy - - -	397 7 11	360 0 0
Inspections, &c. - -	111 12 3	23 0 0
Computations - -	121 18 9	—
OCEAN METEOROLOGY :—		
Marine Superintendent -	100 0 0	—
Instruments, Admiralty -	63 4 8	220 0 0
Ditto Mercantile Marine -	94 5 5	164 0 0
Computations and care of instruments - -	252 4 8	—
Totals - -	2,512 12 3	809 0 0

Grand total - - £3,321 12*s.* 3*d.*

ROBERT H. SCOTT.

Submitted—The following STATEMENT respecting the Records for JUNE 1873, received from the self-recording Observatories, and which have been examined at Kew Observatory (see Minutes, 21st December 1868).

Points noticed at Kew.	Aberdeen.	Armagh.	Falmouth.	Glasgow.	Kew.	Stonyhurst.	Valencia.
ANEMOGRAPH :—							
Action	Good.	Fair.	Fair; direction pencil works stiffly.	Fair.	Good.	Fair.	Good.
Records deficient	None.	None.	None.	None.	None.	None.	None.
Orientation verified	—	23rd.	19th.	3rd.	30th.	30th.	—
Result of 40 *Remeasurements :—*	Direction. | Velocity.	Direction. | Velocity.	Direction. | Velocity.	Direction. | Velocity.	Direction. | Velocity.	Direction. | Velocity.	Direction. | Velocity.
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 | 0·2	0·2 | 0·3	0·2 | 0·2	0·3 | 0·4	0·1 | 0·1	0·3 | 0·3	0·3 | 0·3
Residual difference (— Kew)	0·0 | −0·1	0·0 | 0·0	0·0 | 0·0	−0·1 | +0·2	0·0 | +0·1	−0·2 | 0·0	0·0 | +0·2
No. of errors discovered	0 | 0	0 | 0	0 | 0	0 | 1	0 | 0	0 | 0	0 | 2
Errors in rain tabulation	1	0	0	2	0	2	4
BAROGRAPH :—							
Action	Good.	Good.	Good.	Good.	Good.	Good.	Good.
Photography	Do.	Do.	Do.	Indifferent.	Do.	Do.	Do.
Records deficient	None.	None.	None.	None.	None.	None.	9 hours lost, owing to blackening of lamp glass.
Result of 40 *Remeasurements :—*							
Greatest difference	·0050	·0050	·0050	·0050	·0050	·0050	·0050
Mean difference irrespective of sign	·0015	·0015	·0015	·0021	·0013	·0020	·0017
Residual difference (— Kew)	—·0004	—·0001	+·0005	+·0005	—·0003	—·0008	—·0005
Mean monthly difference between simultaneous barograph and barometer	·0016	·0020	·0017	·0020	·0020	·0018	·0027
No. of errors discovered in entry of standard	0	0	0	1	0	0	0
„ in calculating residual correction	0	0	0	0	0	0	0
„ in applying residual correction	0	0	0	0	0	0	3
„ in tabulation	0	0	0	0	0	0	0
THERMOGRAPH :—							
Action	Good.	Good.	Awaiting scale.	Good.	Good.	Good.	Good.
Photography	Do.	Do.		Indifferent.	Do.	Do.	Do.
Records deficient	2 hrs. wet bulb, out of action.	*1 hr. each D. & W., clock stopped.		None.	1 hour wet bulb, out of action.	None.	† 8 hrs. wet bulb, lamp glass blackened. 3 hrs. do. out of action.
Result of 40 *Remeasurements :—*	Dry. | Wet.	Dry. | Wet.	Dry. | Wet.	Dry. | Wet.	Dry. | Wet.	Dry. | Wet.	Dry. | Wet.
Greatest difference	0·20 | 0·20	0·20 | 0·20		0·20 | 0·20	0·20 | 0·10	0·20 | 0·10	0·20 | 0·10
Mean difference irrespective of sign	0·05 | 0·08	0·10 | 0·10		0·08 | 0·07	0·06 | 0·04	0·11 | 0·09	0·06 | 0·04
Residual difference (— Kew)	−0·01 | −0·08	−0·09 | −0·09		−0·05 | −0·04	−0·06 | −0·04	−0·10 | −0·08	−0·06 | −0·01
Mean monthly difference between simultaneous thermograph and thermometer	0·17 | 0·21	0·13 | 0·13		0·08 | 0·10	0·13 | 0·11	0·17 | 0·16	0·20 | 0·21
No. of errors discovered in entry of standard	0 | 0	0 | 0		0 | 0	0 | 0	0 | 0	0 | 0
„ discovered by subsidiary measurements	1 | 0	0 | 0		5 | 0	0 | 0	0 | 0	0 | 0
„ „ „ inspection	0 | 0	0 | 1		1 | 0	0 | 0	1 | 0	1 | 0
„ in maximum and minimum	1 | 0	0 | 0		0 | 0	1 | 0	0 | 0	3 | 6
Subtraction in subsidiary tables	0 | 1	0 | 0		2 | 4	0 | 0	0 | 1	0 | 0

* June 15–17, dry bulb re-tabulated at Kew in consequence of the wrong setting of scale.

† June 24–25, wet bulb re-tabulated at Kew, original measurements in error.

The following cheques for July were drawn:—

		£	s.	d.
For Office:				
R. H. Scott	Salaries and wages	66	13	4
J. S. Harding, jun.	Salaries and wages	*18	3	4
J. S. Harding, sen.	Salaries and wages	†7	14	0
T. D. Bell	Salaries and wages	†5	0	0
For Observatories:				
T. Kerr (Valencia), salary		20	16	8
R. H. Curtis	Computations, &c.	11	13	4
F. C. Steventon	Computations, &c.	10	16	8
C. Stodart	Computations, &c.	†8	8	0
H. W. Woodward	Computations, &c.	†4	8	0
J. A. Curtis	Computations, &c.	†6	18	0
C. H. Thompson	Computations, &c.	†4	0	0
For Telegraphy:				
R. H. Scott, inspections, on account		25	0	0
P. M. Shanks, experiments for Mr. Galton		10	0	0
F. Gaster	Computations, &c.	*15	15	8
W. L. Dallas	Computations, &c.	*†7	4	8
F. Brodie	Computations, &c.	*†6	4	0
R. Sargeant	Computations, &c.	*†3	11	6
For Ocean Meteorology:				
H. Toynbee, Marine Superintendent		33	6	8
W. Salmon	Computations, &c.	20	16	8
R. Strachan	Computations, &c.	‡19	3	4
C. Harding	Computations, &c.	*13	18	6
W. G. James	Computations, &c.	†6	18	0
T. E. Allen	Computations, &c.	†6	18	0
J. W. McVeagh	Computations, &c.	†4	0	0
For Office Expenses:				
J. S. Harding, jun., on account		70	0	0
Total		£407	8	4

* Including allowance for extra attendance.
† Four weeks to the 26th.
‡ Including allowance for care of instruments.

The Committee then adjourned.

116, *Victoria Street, October* 20, 1873.

PRESENT:

Mr. Gassiot in the Chair.

General Strachey.

The Director was in attendance.

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

Read—The following letter:—

M. 10,587.
M.O. 1707.

SIR, Board of Trade, September 2, 1873.

IN reply to your letter of the 24th July last, respecting the payment of the cost for printing the future Annual Reports of the Meteorological Office, I am directed by the Board of Trade to state to you, for the information of the Meteorological Committee, that the Board are of opinion that the cost for printing the copies of the future Reports required by the Committee would be properly a charge upon the vote for Meteorological purposes, and that they have informed the Treasury accordingly.

I am, &c.

R. H. Scott, Esq. (Signed) W. R. MALCOLM.

Read—The following letters:—

M. 14,106.
M.O. 1883.

SIR, Board of Trade, October 3, 1873.

WITH reference to previous correspondence in 1868, I am directed by the Board of Trade to transmit, for your information, the inclosed copy of a letter received from the Treasury, and at the same time I am to request you to be so good as to forward to this Department any observations the Meteorological Committee may make on it.

I am, &c.

R. H. Scott, Esq. (Signed) THOMAS GRAY.

SIR, Treasury Chambers, September 27, 1873.

WITH reference to the letter from this Department of 25th April 1868, relative to the grant of Parliament for the Meteorological Committee of the Royal Society, I am directed by the Lords Commissioners of Her Majesty's Treasury to state that their Lordships have reconsidered their decision conveyed in that letter that the accounts of the Committee need not be audited on behalf of the public; and My Lords are of opinion that as it appears that the sum of 10,000*l.* granted for the Committee covers the entire expenses of the observations and experiments conducted by them, accounts and vouchers for such expenses should be furnished to their Lordships' Department in order that it may be ascertained that the grant has been expended in accordance with the terms of the estimate presented to Parliament.

I am therefore to request that you will move the Board of Trade to cause the necessary communication to be addressed to the Meteorological Committee.

I am, &c.

The Secretary to the Board of Trade. (Signed) WILLIAM LAW.

Mr. Scott was instructed to reply as follows:—

I am instructed by the Committee to inform you in reply to your letter of the 3rd inst. (M. 14,106), that the accounts and vouchers for the past six years' expenditure, being the period for which they have had charge of the Office, shall be furnished to the Treasury as soon as they are informed to what department of that office they are to be delivered.

Submitted—The following correspondence:—

M. 15,072.
M.O. 1938.

SIR, Board of Trade, October 16, 1873.

I AM directed by the Board of Trade to transmit to you the enclosed copy of a further despatch from the governor of Western Australia, relating to instruments and registers required at the lighthouses at King George's Sound; and to state that this Board will be glad to hear what observations your Committee have to make on it.

I am, &c.

R. H. Scott, Esq. (Signed) R. G. C. HAMILTON.

Copy M. 15,072.

GOVERNOR WELD to the EARL OF KIMBERLEY.

No. 111. Western Australia, Government House, Perth,

MY LORD, August 13, 1873.

IN reply to your Lordship's despatch, No. 46, of the 12th June 1873, transmitting a letter from the Board of Trade on the subject of the Meteorological returns from the lighthouses at George's Sound, it is only necessary for me to report to your Lordship, for the information of the Board of Trade, that the Colonial Legislature has placed no funds at my disposal for the purchase of instruments, but that if the Board can place proper registers and instruments at the disposal of the Colony, I will do my best to insure that good observations shall be regularly taken.

2. I am always anxious to promote the cause of science, but the Colony when asked to perform a gratuitous service will expect, when a money vote is wanted, that I should be able at the same time to assure them that they are asked in a spirit of co-operation. To have placed Mr. Gray's letter before the Legislature would I fear have only been to court a refusal of what might otherwise be granted, a result I personally should deeply regret.

I am, &c.

The Right Honorable The Earl of Kimberley. (Signed) FRED. A. WELD,
Governor.

Mr. Scott explained that the previous correspondence referred to had arisen out of the circumstance that Admiral FitzRoy in the year 1859 had issued some instruments for use in West Australia, and that observations taken with these instruments had been received from two lighthouses in King George's Sound up to the end of 1869. On inquiry being made by him (Mr. Scott) as to the reason of the non-arrival of the registers, an exchange of letters had taken place, and the letter just read brought the question to an issue. Mr. Scott was instructed to prepare a draft reply by next meeting.

Submitted the following correspondence in continuation of that contained in the Minutes, pp. 41, 42:—

M. 10,564.
M.O. 1569.

SIR, Board of Trade, July 29, 1873.

WITH reference to your appointment as a representative of Her Majesty's Government at the Meteorological Conference at Vienna, I am directed by the Board of Trade to inform you that the Foreign Office have requested this Board to cause yourself and Mr. Buchan to be furnished with such instructions for your guidance as may seem best to them.

I am therefore to state that, as one of the two representatives chosen, you should attend at the Conference as a deliberative assembly, and impart and glean such information as you may be able.

I am, however, to observe that you should abstain from pledging Her Majesty's Government in any way, and that you should report to Her Majesty's Government on the termination of your labours.

The Board of Trade have also been informed by the Foreign Office that on learning the date on which you and Mr. Buchan (to whom a similar letter has been addressed) are ready to proceed to Vienna, Lord Granville will be prepared to furnish you with letters of introduction to Her Majesty's ambassador at that capital.

I am, &c.

R. H. Scott, Esq. (Signed) THOMAS GRAY.

M.O. 1823.

SIR, Army Medical Department, August 23, 1873.

WITH reference to your letter of 26th June last, I am instructed to inform you that it has been decided not to send a separate delegate from this office to Vienna, and that in consequence the Director-General gladly avails himself of your kind consent to act as the representative of this department at the forthcoming Meteorological Congress.

A brief statement of the system of observing, which is here in force, is enclosed for your guidance, and it is hoped that it will enable you to form an idea to what extent any proposed alterations will affect this department.

I am, in conclusion, to express the Director-General's gratification at being afforded the opportunity of confiding the interests of the Army Medical Department to such safe and able hands; and, in the event of proposals involving expense being made, of securing the assistance of so sound a judgment in selecting for support such only as are necessary for the *bonâ fide* furtherance of the science.

I have, &c.

R. H. Scott, Esq. (Signed) W. M. MUIR,
Surgeon General.

Submitted—The following Report:—

I have to report my return from Vienna, where I attended the Meteorological Congress in accordance with the instructions received from the Board of Trade (Minutes, July 21st).

I was furthermore honoured with instructions to represent the Army Medical Department at the Congress, and I received private communications from the British Meteorological Society, and from Mr. G. T. Kingston, of Toronto, requesting me to take care of their respective interests at the meeting.

I have ventured to address a short letter to the editor of the "Times," conveying information as to some of the resolutions adopted, which appeared on the 1st inst. I trust that the Committee will not find fault with me for having done so without first consulting them. The protocols of the proceedings are in the press, and I am engaged in the preparation of an English translation of them. Until the entire body of the reports are in type, it would be premature for me to bring forward any proposals for action based thereon.

I may, however, venture to express my hope for your approval of my having consented to accept a seat on the permanent committee for carrying out the resolutions of the Congress.

It is not improbable that I may have to ask your sanction to my issuing invitations for a private maritime conference in London in the course of next summer.

ROBERT H. SCOTT.

Oct. 20, 1873.

Submitted—The following Reports :—

REPORT.

I have to report that I have completed the inspection of most of the English and Scotch stations.

Yarmouth was visited July 22nd. On the death of the late observer, T. Robinson, the instruments were transferred from the Postal Telegraph Office to the Sailors' Home at the close of the year 1872 (Minutes, /72, p. 63). The new site is only a few yards distant from the old one, while the exposure of the thermometers and rain gauge is more open, and consequently more satisfactory. The observer, Mr. Watson, secretary of the Sailors' Home, is careful, and the instruments were in good order except the Milne barograph, which I have brought away as its indications were not correct.

Cambridge was visited on the 23rd. Here I was received by Professor Adams. I found Mr. H. Todd, the second assistant, in charge of the Meteorological Observations. The register was well kept, but I ventured to point out to Professor Adams that his thermometers were not quite of so good a quality as was desirable, and that the exposure was somewhat defective, being outside a north window over a courtyard somewhat embayed in the building of the Observatory. Professor Adams has at once undertaken to have the observations improved in this particular.

York was visited July 29th. Everything was in good order.

Scarborough has not been visited this year, as that station has been invariably found in complete order.

North Shields was visited July 30th. There is nothing calling for remark except that there seems little hope of securing a good exposure for the thermometers and rain gauge, which are still in the Post Office back yard. Mr. Irvine's observations are and have been quite satisfactory.

Leith was visited July 31st. Everything was in a thoroughly good condition. I regret to say that Mr. Bolton, our former observer there, has had to give up the duty of reporting, as he no longer resides at Leith. He has transferred it to Mr. Turnbull, whom he has trained, and who has been acting for him for some little time past.

Aberdeen inspected August 1st. Mr. McCormack was absent on leave, but I saw the gentleman who is acting for him, and found all the instruments in good condition.

Wick inspected August 2nd. I am glad to say that the appointment of Mr. Sinclair as reporter has been a very good one. His reports are quite satisfactory, and the exposure of his thermometers and rain gauge leaves little to be desired.

Thurso also inspected August 2nd. Mr. Trotter has changed his residence, but only to a short distance. His instruments are clean and in good condition, and his reports satisfactory.

Stornoway visited August 5th. This station promises to be an exceedingly good one, excepting that no good judgment can be formed of the sea unless it runs high in the Minch. The rain gauge is in the open lawn of the castle, the thermometers attached to a wall in the garden facing N. by W. Mr. Smith is most intelligent, and, over and above his reporting, he takes a special interest in trying to trace out the history of the weather in the Hebrides.

Sumburgh Head was not visited this year. The reports have been arriving so very irregularly that I hardly deemed it worth the time and expense required to go there, as I found Mr. Lawrence's instruments in perfect order on my last visit.

Ardrossan inspected August 8th. Everything here was in perfect order.

Furthermore, I visited the observatory of Aberdeen on the 1st of August. Professor Thomson was unfortunately absent, but Mr. Boswell, the assistant, was present, and with him I examined the condition of the several instruments, which was uniformly good.

At Glasgow, on the 9th, I met Mr. Beckley, and we together examined into the causes of the recent failure of photography. Professor Grant explained to me that he had as yet been unable to find a good assistant to succeed Mr. McGregor.

August 11, 1873.

REPORT.

I have to report that I have completed my inspection of the Irish and Welsh stations.

Holyhead visited September 27th. There has been a change at this station since the date of the last inspection. The instruments are now at the Sailors' Home, and well placed. The observer is careful, and the station is in good order.

Donaghadee visited October 2nd. This station continues to be in a satisfactory condition.

Moville visited October 3rd. In good order.

Kingstown visited October 7th. The rain gauge here has been removed to a new locality, which gives a very good exposure. The station is in good order.

Valencia visited October 9th. This station is in good order, excepting that the rain gauge was out of shape, having been blown down in a gale.

St. Ann's Head visited October 13th. In good order.

I am glad to say that I am having observations of sea temperature taken at almost all the stations. I did not visit the stations at Bidston Observatory or at Roches Point, as I did not consider it necessary to do so this year, the observations having been uniformly of first-class character. I also visited the observatories of Stonyhurst, Armagh, and Valencia. I found nothing calling for special remark at any of them.

October 15, 1873. ROBERT H. SCOTT.

Mr. Scott further reported that he had received from Mr. Beckley a report of his inspection of the self-recording instruments at the various observatories, and would take such action on it as seemed advisable in regard of issuing instructions for oiling the anemographs, &c., &c.

Mr. Scott stated that he had learnt that there was a probability of a telegraphic line being extended to Mullaghmore, a low-lying point in Donegal Bay between Sligo and Bundoran. As this was a post which would be very well suited for a reporting station, and lay in a district of coast whence as yet no telegraphic information was obtainable, he requested permission to institute negotiations with the Right Hon. W. Cowper Temple, the landlord, with the view of possibly having a station established there.—Sanctioned.

Submitted—The following correspondence :—

(M.O. 1821.) 96, Richmond Road, Bayswater,

SIR, August 2, 1873.

I BEG leave to refer to you the enclosed memorandum by Mr. Hart, the inspector-general of Chinese maritime customs, upon the establishment of meteorological stations in China; and I hope that you will be kind enough to favour me with your views upon the subject generally, and especially upon the points to which my attention is called in the paragraphs 4 and 8.

2. Mr. Hart named in this memo. certain gentlemen from whom he instructed me to obtain information in the first instance; and I have been advised by the Astronomer Royal, Admiral Richards, Prof. Tyndall, and others, to consult yourself as the first authority on this question.

3. Acting upon my instructions, I ordered at once 20 sets of the instruments recommended by the Astronomer Royal, which Mr. Glaisher is to examine and test; but there will be more stations established by and bye and more instruments wanted. In a few days I expect another memo. from Mr. Hart, concerning weather telegraphy, and the establishment of meteorological stations at Passiette, Yokohama, Nagasaki, Hong Kong, Manila, Saigon, Bankok, Singapore, and Batavia.

4. I enclose for your perusal the remarks with which the Astronomer Royal has been pleased to furnish me, and I shall be much obliged if you will return them to me with your own. You will observe, at the end of his remarks, the Astronomer Royal refers me to you as the "legitimate officer of the Government for external meteorology."

5. In paragraph 7, Mr. Hart states that the observations are to be entrusted *chiefly* to lighthouse keepers, who are fairly intelligent Europeans, but I imagine that at the ports the observations may perhaps be made by the surgeons attached to the Customs establishments or other officers of superior education. Mr. Hart observes also that the *stations must not attempt too much at first.* And in this respect your experience will be very valuable to him. With what observations, for instance, shall they begin? What will be the very smallest number to be taken daily compatible with utility? What will be the best hours to take them? To what extent and by what degrees can the observations be advantageously extended? Should there be a few principal stations, say at Peking, Shanghai, Amoy, and Canton? &c. &c. &c.

I have, &c.

R. H. Scott, Esq. (Signed) J. D. CAMPBELL,
Chief Secretary and Commissioner of Customs, China.

DEAR SIR, August 6, 1873.

I RECEIVED a second memo. from Mr. Hart yesterday, and I hope next week to send you some printed copies of a paper entitled—"Documents relating to

"1°. Establishment of meteorological stations in China; and,

"2°. Proposals for co-operation in the publication of meteorological observations and exchange of weather news along the Pacific Coast of Asia."

I see from the report of the Conference held at Leipzig last year that there is to be another at Vienna this year, and I should like to submit Mr. Hart's plan for their consideration and advice. Remembering that the foreigners in China are of various nationalities, and that Mr. Hart's *projet* takes in Russia, China, Japan, England, (Hong Kong and Singapore), France (Saigon), Spain (Manila), Holland (Java), and Siam, we ought to have the instruments and registers that are most likely, as being accepted of Science everywhere, to meet the views, and not hurt the national susceptibilities of the people engaged in the work (for instance, at Saigon they might prefer the centigrade to the Fahrenheit). We want, in fact, the instruments, &c. which will suit English, French, Dutch, Spanish, Japanese, and Russian equally well. I cousulted the Astronomer Royal and Mr. Glaisher only with reference to the instruments to be used by the Customs people in China, but Mr. Hart's

new scheme opens a far wider field, and I think I could not do better than refer to the Vienna Conference.

The organisation of Meteorological stations in China may be the introduction to the prosecution of scientific research generally, and the West will receive sets of facts concerning the East that must prove most useful to scientific men.

Will you kindly inform me when the Conference is to take place, and I may try to be there at the time. The Chinese exhibition in Vienna is due to Mr. Hart, and we have a Customs Commission there.

I am, &c.
(Signed) J. D. CAMPBELL.

R. H. Scott, Esq.

DEAR SIR, Meteorological Office, August 12, 1873.

IN reply to your letters of the 2nd and 6th instant, I beg to say that I think it would be very well if you were present at Vienna to consult the Meteorologists who will be assembled there for a Congress in the month of September, before finally deciding on a scheme for Meteorological investigations in the China Seas, &c.

Two of the gentlemen who will be there, MM. Wild and Buys-Ballot, have respectively Russian and Dutch Observatories at two of the points, Pekin and Batavia, mentioned by Mr. Hart in the second memo. which you showed me to day.

With reference to the list of instruments which you showed me, I am very decidedly of opinion that Kew barometers, price (including verification) under 5*l.*, would be far better suited to your purposes in most cases than the more expensive Fortin's.

Yours faithfully,
(Signed) R. H. SCOTT,
Director.

J. D. Campbell, Esq.

METEOROLOGICAL STATIONS IN CHINA, &c.

LETTERS FROM THE ASTRONOMER ROYAL TO MR. CAMPBELL.

1.

Royal Observatory, Greenwich, S.E.
1873, Aug. 21.

SIR,

ACKNOWLEDGING receipt of your letter of 18th instant, I have to state that I think you are certainly taking the best course for the advantage of the proposed Eastern Meteorological Observations, in co-operating with the International Meteorological Congress in Vienna.

And with respect to the remarks which I have addressed to you in previous correspondence, I beg that you will consider them entirely at your service, to be used in any way which you may think best.

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

J. D. Campbell, Esq., &c., &c., &c.

2.

Royal Observatory, Greenwich, S.E.,
1873, June 24.

SIR,

I TAKE the earliest opportunity of offering my remarks on the papers relating to the establishment of Meteorological Observatories in China; to which, when you called at the Observatory, I could scarcely give a moment's attention.

1. The objects of such observatories may be considered, I imagine, as in some measure separable into two classes; one, applying to general science and to navigation; the other bearing more closely upon the climatic character of the country.
2. For the general science and navigation, I conceive the register of the barometer and the winds to be the most important matters of observation. As regards mere changes of atmospheric pressure, much confidence may be placed in an aneroid, which, with ordinary care in packing, can be conveyed to the stations with ease and safety. But there are various questions about the permanent difference in the mean state of the barometer in different latitudes, which can be settled only by the use of the barometer itself. It is, however, an instrument which it is very difficult to convey so far in safety: it cannot be trusted to any commercial conveyance. I must leave it to you to decide between these considerations.
3. For direction of the wind, there is no need (at least in the first instance) to use any instrument; an ordinary vane, properly balanced in respect of weight, with eye-observations both at pre-arranged hours and at any sudden changes, storms, &c., will be quite sufficient. For force or velocity of the wind, I should *not* recommend a Robinson's anemometer. A hurricane may blow for a few minutes, carrying destruction through an entire province, which will scarcely leave a mark on the Robinson. If a self-registering instrument must be used, I should adopt one of the class of Osler's anemometers. But it will be better to use no instruments, but to take care that the observers be well trained to estimate the strength of the wind by Beaufort's scale, or something equivalent.
4. For climatic information, the observations desired are those of temperature and of moisture of the air, and of radiation from the sun and to the sky in all their variations. The three classes of instruments are requisite,—ordinary thermometers, placed out of the reach of sun and rain; wet bulb thermometers, which require very little attention, but that attention of the most regular and

careful kind; and black-bulb thermometers enclosed in vacuum cases. All these should be read at pre-arranged hours and aiso in special disturbances; but for the air temperatures, and also, if possible, for the wet-bulb temperatures, it is very desirable that maximum and minimum self-registering thermometers be provided.

5. The temperature of the sea, the rivers, or the land (according to circumstances) ought to be noted. For the land, a tube ought to be thrust down, say 4 feet, and a thermometer lowered into it from time to time.
6. It will be seen that I contemplate that the principal expense will be incurred for thermometers.
7. A simple rain gauge ought to be used with the utmost regularity.
8. Clouds, thunderstorms, &c., can only be observed by eye, and the record must depend on the judgment of the observer.
9. Tidal observations, where circumstances are favourable, especially where there is general protection from the violence of the sea, are much to be desired. A graduated tide-pole fixed among stones or fastened to a wharf is all that is required. But the time ought to be well known; and this may sometimes cause a difficulty. But, supposing difficulties to be overcome, then in any case the times and heights ought to be observed at every high water and every low water. If circumstances are more favourable, they ought to be taken at every few minutes, say for half an hour before and half an hour after every estimated high and low water, and sometimes they might be taken at every hour of the day.

I shall be happy to give any further explanation on this subject.

I am, &c.

J. D. Campbell, Esq., &c., &c., &c. (Signed) G. B. Airy.

3.

Royal Observatory, Greenwich, S.E.,

Sir, 1873, July 10.

I am so pressed with business of my office that I cannot attend in great detail to the matters in your letter of June 26. But I will set down my answers on some; referring you always to my former letter.

1. The instruments probably would be best procured from Mr. Ackland (Horne and Thornthwaite's), and should be subject to the approval of Mr. Glaisher. Mr. Glaisher would test them here.
2. The instruments should probably be :—
   Two barometers (Mr. Glaisher can indicate the most prudent method of conveyance).
   Six (say) thermometers.
   One maximum and minimum thermometer with dry bulb.
   One do. do. do. wet do.
   Frame for carrying thermometer (see Sir H. James's book, with corrections that Mr. Glaisher will indicate).
   Thermometer for solar radiation.
   Thermometer for ground radiation.
   (No anemometer; observations of direction and force of wind to be taken by estimation.)
   An aneroid.
   A rain gauge.
3. For registers and records, perhaps those taken at the Office of the Surveyor General of Calcutta may be adopted as pattern.
4. For the number of regular observations, I should take three; the earliest in the morning, compatible with the habits of the people; the middle of the practical day; and the latest in the evening. But the hours must be regular.
5. Irregular observations must be taken of everything unusual; a sudden heavy gust of wind, a torrent of rain, a thunderstorm, an aurora, &c., &c., &c.
6. It is very difficult, *à priori*, to give a more scientific direction to the observations, &c.; perhaps this can be done when we see the tendency of ordinary results.
7. Among practical books, I give the preference to Sir Henry James's "Instructions for taking Meteorological Observations," which apparently is published by Eyre and Spottiswoode. Among theoretical books, I should recommend either Herschell's Meteorology or Buchan's Handy Book of Meteorology (Blackwood). Glaisher's Tables are constantly wanted.

I should now be glad to be allowed to refer you to Mr. Glaisher or to Mr. Scott; the latter gentleman is the legitimate officer of the Government for External Meteorology.

I am, &c.

J. D. Campbell, Esq., &c., &c., &c. (Signed) G. B. Airy.

Sir, (Vienna.) Meteorological Office, September 10, 1873.

In reply to your request for my opinion as to the proposed organisation of a Meteorological system for China under the auspices of the Inspectorate General of Customs, I beg to say that I consider that the question of the scale on which it would be advisable to commence the system may be best left in hands of the Meteorological Congress now assembled here, as it contains representatives of the Russian and Dutch systems, as well as of the British.

As regards the instruments which will be required, I have no hesitation in giving you my individual opinion as to the respective forms of apparatus which it will be best to adopt.

I regret to find myself obliged to differ in some respects from so high an authority as the Astronomer Royal, who has done me the honour of referring you to me for advice, but I cannot but express my conviction that in more than one instance the instruments ordered by you, as I understand, at his

suggestion, have, as to their pattern, been scarcely suitable for the purpose for which they are wanted, and in other instances would not be of much use to the Science.

Fortin's barometer is certainly the best instrument for your principal stations, where the services of skilled observers can be secured, but it ought not to be placed in the hands of ordinary observers, owing to the difficulty of adjusting the scale accurately at each reading, while it is costly, and furthermore liable to damage in transit.

I recommend most strongly the Kew marine barometer, which admits of reading to 0·001 inch, does not require correction either for capacity or capillarity, bears transport better than any other mercurial barometer, and can be obtained for half the cost of Fortin's. It is in all respects a first-class instrument, and possesses another advantage, namely, that it is the same pattern of barometer as the proposed observers would be likely to see on board the best equipped ships which may visit Chinese ports.

Each station should have two such barometers. Every barometer, and in fact all instruments, should be supplied with a certificate of verification from Kew Observatory, or equally competent authority, and should be subject to the same conditions of rejection as are stipulated in the contracts for the Meteorological Office.

I do not consider an aneroid as an indispensable portion of the outfit of a station; my reasons for this opinion need not be detailed at length.

As regards thermometers, the best form is that supplied to the Meteorological Office, on porcelain scales, but graduated on the glass tube. For the extreme cold of China, care should be taken that the porcelain scale should not crack or chip. The contract price for these instruments, ranging from *circa* 10°—120°, with verification, is only 6*s*.

On the subject of maximum and minimum thermometers there is not much to be said—Negretti's maximum is perhaps that most practically useful, Rutherford's minimum is certainly the best to order. These instruments should all have certificates of verification as a guarantee of the accuracy of *graduation*, but the accuracy of *registration* is not perfectly guaranteed by a Kew certificate, *i.e.*, it is not determined there at what angle each individual instrument should be hung in order to obtain a correct result. This might be determined, but of course it would involve an additional fee.

I do not attach any importance to maximum and minimum readings of the dry and wet bulb thermometers, inasmuch as the records of our self-registering observatories show clearly that the two instruments give their extreme indications at different periods of the day, while what is required is the difference between simultaneous readings taken with them.

As regards wind, Sir G. Airy's objection to Robinson's anemometer is undoubtedly well founded, but if the costly anemographs be employed, the remarks lose some of their force, and practically we do obtain a good record of a gale from our observatories, but not of individual gusts.

The objections to Osler's instrument are, that while it too is very costly, we are not as yet in a position to state in what proportions the indications vary with the size and shape of the pressure plate.

I am, however, myself in doubt as to the necessity for an extensive supply of anemometers at first, and should agree with the Astronomer Royal in recommending you to begin with an estimation of wind by Beaufort's scale of force and to 16 points as to direction; the latter to be always true, *i.e.* by the sun, not by a compass. Each station should most carefully note and report its own position as regards hills, &c., which may affect the wind currents.

The rain gauge should be of Glaisher's pattern, and for snow it should have a deep cylindrical rim to the receiver.

As to a thermometer stand, the question is so difficult that I refrain from expressing an opinion thereon when dealing with a climate so different from our own as that of China is. I do not, however, at all approve of Glaisher's screen.

It is hardly necessary to observe that you should have a complete outfit of the most perfect instruments for your central stations.

I do not recommend observations on radiation, earth temperature, or even water temperature, &c. at first. These may be introduced gradually, when the more important duties of the stations have been mastered.

Tidal observations would be most useful. For instructions on this subject, I would refer you to the Admiralty, and in a more special way to Mr. W. Parkes, C.E., a very high authority on the subject.

I am, &c.

J. D. Campbell, Esq. R. H. Scott, Director.

Submitted—"Contributions to our Knowledge of the Meteorology of the Antarctic Regions."

Mr. Scott stated that the Astronomer Royal had written to him in the following words:—"I have perused with much interest the Notes on Antarctic Meteorology which "you have kindly sent to me. I should now be greatly obliged if you could send to me "an extension of them to lower southern latitudes."

He had at once given directions for the preparation of tables showing the meteorological conditions of Kerguelen's Island, as far as the materials in the Office would allow of a judgment being formed, that being the district to which Sir G. Airy specially referred.

Reported—That Professor Balfour Stewart had applied for copies of the hourly rain tabulations from the Observatories, which had been supplied to him on the terms laid down by the Committee.

SUBMITTED—The following STATEMENT respecting the RECORDS for JULY 1873, received from the SELF-RECORDING OBSERVATORIES, and which have been examined at KEW OBSERVATORY (*See* Minutes, 21st December 1868).

Points noticed at Kew.	Aberdeen.	Armagh.	Falmouth.	Glasgow.	Kew.	Stonyhurst.	Valencia.
ANEMOGRAPH :—							
Action	Good.	Fair.	Good.	Fair.	Good.	Good.	Fair.
Records deficient	None.	None.	None.	None.	None.	None.	†14 hrs. velocity lost
Orientation verified	—	31st.	18th.	1st.	31st.	—	21st.
Result of 40 *Remeasurements :—*	Direction. | Velocity.	Direction. | Velocity.	Direction. | Velocity.	Direction. | Velocity.	Direction. | Velocity.	Direction. | Velocity.	Direction. | Velocity.
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 | 0·3	0·1 | 0·3	0·3 | 0·2	0·2 | 0·5	0·1 | 0·2	0·3 | 0·3	0·3 | 0·4
Residual difference (—Kew)	−0·1 | +0·1	−0·1 | +0·1	+0·1 | 0·0	0·0 | +0·1	0·0 | −0·1	0·0 | +0·1	−0·1 | +0·1
No. of errors discovered	0 | 0	0 | 0	0 | 0	0 | 0	0 | 0	0 | 0	3 | 2
Errors in rain tabulation	0	0	0	*4	0	8	23
BAROGRAPH :—							
Action	Good.	Good.	Good.	Good.	Good.	Good.	Good.
Photography	Fair.	Do.	Do.	Indifferent.	Do.	Do.	Fair.
Records deficient	None.	2 hrs. lost, gas out.	14 hrs., failure of gas; 2 hrs. clock stopped.	3 hours lost owing to photographic blemishes.	None.	None.	1 hr. lost, owing to stoppage of clock.
Result of 40 *Remeasurements :—*							
Greatest difference	·0050	·0050	·0050	·0050	·0050	·0050	·0050
Mean difference irrespective of sign	·0019	·0018	·0018	·0025	·0018	·0028	·0019
Residual difference (—Kew)	—·0009	—·0009	—·0006	+·0004	—·0010	—·0018	—·0001
Mean monthly difference between simultaneous barograph and barometer	·0017	·0024	·0020	·0019	·0021	·0018	·0025
No. of errors discovered in entry of standard	0	0	0	1	0	0	1
„ in calculating residual correction	0	0	0	0	0	0	1
„ in applying residual correction	0	0	0	0	0	0	0
„ in tabulation	0	0	0	0	0	0	0
THERMOGRAPH :—							
Action	Good.	Good.		Good.		Good.	Good.
Photography	Do.	Do.		Indifferent.		Do.	Do.
Records deficient	1 hour wet bulb, out of action.	4 hrs. wet bulb, out of action; and 2 hrs. each D. and W., gas out.		‡ 5 hrs. wet bulb; 7 hrs. dry bulb.		3 hours dry bulb lost; the temperature ranging higher than the light.	§None.
Result of 40 *Remeasurements :—*	Dry. | Wet.	Dry. | Wet.	Dry. | Wet.	Dry. | Wet.	Dry. | Wet.	Dry. | Wet.	Dry. | Wet.
Greatest difference	0·20 | 0·20	0·20 | 0·20		0·20 | 0·20		0·20 | 0·10	0·20 | 0·20
Mean difference irrespective of sign	0·04 | 0·08	0·08 | 0·07		0·08 | 0·09		0·07 | 0·08	0·10 | 0·08
Residual difference (—Kew)	−0·02 | −0·07	−0·08 | −0·03		−0·07 | −0·04		−0·06 | −0·05	−0·08 | −0·05
Mean monthly difference between simultaneous thermograph and thermometer	0·21 | 0·18	0·12 | 0·12		0·09 | 0·08		0·18 | 0·17	0·19 | 0·19
No. of errors discovered in entry of standard	0 | 0	0 | 0		0 | 0		0 | 0	1 | 0
„ discovered by subsidiary measurements	0 | 0	0 | 1		2 | 0		0 | 0	1 | 0
„ „ „ inspection	0 | 0	1 | 3		0 | 0		1 | 0	1 | 1
„ in maximum and minimum	0 | 0	1 | 0		0 | 1		0 | 0	0 | 3
„ subtraction in subsidiary tables	0 | 0	0 | 1		3 | 0		1 | 0	3 | 0

* Clock stated to be much out of order.
† Clock stopped by the setting pin.

‡ 4 hours wet bulb out of action, and 1 hour through air bubble ; 6 hours dry bulb temperature ranged beyond the light, and 1 hour through air bubble.
§ 12½ days have been retabulated at Kew, on account of wrong settings of scale.

Points noticed at Kew.	Aberdeen.	Armagh.	Falmouth.	Glasgow.	Kew.	Stonyhurst.	Valencia.
ANEMOGRAPH :—							
Action	Good.	Fair.	Good.	Fair.	Good.	Good.	Good.
Records deficient	* 31 hrs. Direction and Velocity. 9th.	* 7 hrs. Velocity and 6 Direction. —	† 2 hrs. Velocity and 1 hr. Direction. 14th.	* 29 hrs. Velocity and Direction. 1st.	None. —	* 5 hrs. Direction and Velocity. 7th.	‡ 53 hrs. Velocity and Direction, also 4 hrs. of Direction, trace invisible. —
Result of 40 *Remeasurements :—*	Direction. | Velocity.	Direction. | Velocity.	Direction. | Velocity.	Direction. | Velocity.	Direction. | Velocity.	Direction. | Velocity.	Direction. | Velocity.
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 | 0·3	0·2 | 0·3	0·1 | 0·2	0·2 | 0·3	0·1 | 0·2	0·1 | 0·2	0·2 | 0·3
Residual difference (—Kew)	—0·1 | +0·2	0·0 | —0·1	0·0 | +0·1	— ·1 | +0·2	—0·1 | 0·0	—0·1 | +0·1	—0·1 | +0·2
No. of errors discovered	0 | 1	0 | 0	0 | 0	0 | 0	0 | 0	0 | 0	0 | 3
Errors in rain tabulation	6	2	0	3	0	12	7
BAROGRAPH :—							
Action	Good.	Good.	Good.	Good.	Good.	Good.	Good.
Photography	Good.	Good, with one exception.	Good.	Good, with a few exceptions.	Do.	Good.	Fair.
Records deficient	§ 6 hrs. lost.	30 hrs. lost through bad photography.	11 hrs. failure of gas; 14 hrs. by stoppage of clock.	4 hrs. lost by stoppage of clock.	None.	None.	1 hr. through stoppage of clock.
Result of 40 *Remeasurements :—*							
Greatest difference	·0050	·0050	·0050	·0050	·0050	·0050	·0050
Mean difference irrespective of sign	·0017	·0022	·0019	·0018	·0020	·0019	·0020
Residual difference (—Kew)	—·0015	+·0014	—·0010	—·0009	—·0013	—·0012	—·0014
Mean monthly difference between simultaneous barograph and barometer	·0016	·0023	·0014	·0020	·0020	·0015	·0028
No. of errors discovered in entry of standard	0	0	0	0	0	0	2
„ in calculating residual correction	1	0	0	0	0	0	1
„ in applying residual correction	0	0	0	7	0	0	1
„ in tabulation	1	1	0	0	0	0	0
THERMOGRAPH :—							
Action	Good.	Good.		Fair.		Good.	Good.
Photography	Do.	Do.		Good.		Do.	Do.
Records deficient	‖ 24 hrs. wet bulb, 19 hrs. dry bulb.	11 hrs. each dry and wet owing to clock stopping and repairs to thermograph.		46 hrs. dry bulb and 48 hrs. wet bulb from various cases.		None.	1 hr. wet bulb out of action, corrections have been applied at Kew to all wet bulb readings from the 2nd to the 26th, and also for the dry bulb 6 days between the 14th and 31st.
Result of 40 *Remeasurements :—*	Dry. | Wet.	Dry. | Wet.	Dry. | Wet.	Dry. | Wet.	Dry. | Wet.	Dry. | Wet.	Dry. | Wet.
Greatest difference	0·20 | 0·20	0·10 | 0·20		0·20 | 0·20		0·20 | 0·20	0·20 | 0·20
Mean difference irrespective of sign	0·09 | 0·06	0·07 | 0·09		0·09 | 0·08		0·07 | 0·09	0·05 | 0·07
Residual difference (— Kew)	—0·01 | —0·02	—0·05 | —0·07		0·00 | —0·09		—0·02 | —0·07	—0·01 | —0·01
Mean monthly difference between simultaneous thermograph and thermometer	0·19 | 0·17	0·10 | 0·11		0·09 | 0·07		0·14 | 0·15	0·16 | 0·16
No. of errors discovered in entry of standard	0 | 0	0 | 0		0 | 0		0 | 0	1 | 0
„ discovered by subsidiary measurements	5 | 7	0 | 0		0 | 0		0 | 1	4 | 0
„ „ „ inspection	0 | 1	4 | 0		4 | 5		0 | 0	0 | 0
„ in maximum and minimum	0 | 0	0 | 0		0 | 0		1 | 1	3 | 7
Subtraction in subsidiary tables	7 | 0	0 | 0		1 | 1		0 | 1	0 | 0

* Instruments dismounted for cleaning by Mr. Beckley.
† Through painting anemometer.
‡ Instruments dismounted for repairs by Mr. Beckley.

§ 3 hrs. lost; instruments being examined by Mr. Beckley. 1 hr. gas out, 1 hr. instrument not started, and 1 hr. light on binding rods.
‖ 5 hrs. wet bulb out of action, 1 hr. each gas out, 5 hrs. each not started, and 13 hrs. each through stoppage of clock.

Points noticed at Kew.	Aberdeen.	Armagh.	Falmouth.	Glasgow.	Kew.	Stonyhurst.	Valencia.
ANEMOGRAPH:—							
Action	Good.	Fair.	Good.	Fair.	Good.	Good.	Good.
Records deficient	None.	None.	None.	None.	8 hrs. V. and D. lost, Mr. Beckley examining and cleaning anemometer.	None.	4 of D. and V. doubtful, caused by setting pin stopping clock.
Orientation verified	—	—	—	4th.	8th.	16th.	—
Result of 40 *Remeasurements:—*	Direction. | Velocity.	Direction. | Velocity.	Direction. | Velocity.	Direction. | Velocity.	Direction. | Velocity.	Direction. | Velocity.	Direction. | Velocity.
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	0·3 | 0·4	0·2 | 0·3	0·1 | 0·2	0·3 | 0·5	0·1 | 0·2	0·1 | 0·4	0·3 | 0·5
Residual difference (— Kew)	0·0 | 0·0	0·0 | +0·1	0·0 | 0·0	−0·1 | +0·2	0·0 | 0·0	0·0 | 0·0	−0·1 | +0·2
No. of errors discovered	0 | 2	0 | 0	0 | 0	0 | 3	0 | 0	0 | 0	0 | 5
Errors in rain tabulation	0	0	0	0	0	7	5
BAROGRAPH:—							
Action	Good.	Good.	Good.	Good.	Good.	Good.	Fair.
Photography	Do.	Do.	Do.	Do.	Do.	Do.	Good.
Records deficient	13 hrs. lost through failure of gas.	5 hours lost by stoppage of clock.	None.	None.	None.	None.	* 8 hours lost.
Result of 40 *Remeasurements:—*							
Greatest difference	·0050	·0050	·0050	·0050	·0050	·0040	·0050
Mean difference irrespective of sign	·0019	·0018	·0017	·0024	·0018	·0016	·0020
Residual difference (— Kew)	—·0008	+·0006	—·0004	—·0016	—·0003	—·0009	—·0009
Mean monthly difference between simultaneous barograph and barometer	·0016	·0024	·0019	·0018	·0021	·0016	·0027
No. of errors discovered in entry of standard	0	0	0	1	0	0	1
„ in calculating residual correction	0	1	0	0	0	0	1
„ in applying residual correction	1	1	0	1	0	0	0
„ in tabulation	0	0	0	0	0	0	1
THERMOGRAPH:—							
Action	Good.	Good.		Good.		Good.	Good.
Photography	Do.	Good, with one exception.		Do.		Do.	Fair.
Records deficient	†13 hrs. each D. and W. lost by failure of gas, and 9 hrs. wet bulb out of action.	‡3 hours dry bulb, through bad photography.		4 hrs. wet bulb out of action.		None.	None.§
Result of 40 *Remeasurements:—*	Dry. | Wet.	Dry. | Wet.	Dry. | Wet.	Dry. | Wet.	Dry. | Wet.	Dry. | Wet.	Dry. | Wet.
Greatest difference	0·20 | 0·20	0·20 | 0·20		0·20 | 0·20		0·20 | 0·20	0·20 | 0·20
Mean difference irrespective of sign	0·11 | 0·07	0·09 | 0·08		0·09 | 0·11		0·08 | 0·08	0·09 | 0·08
Residual difference (— Kew)	−0·08 | +0·04	−0·06 | +0·02		−0·03 | −0·05		−0·04 | −0·05	−0·04 | −0·06
Mean monthly difference between simultaneous thermograph and thermometer	0·14 | 0·18	0·13 | 0·12		0·12 | 0·09		0·15 | 0·19	0·13 | 0·17
No. of errors discovered in entry of standard	3 | 1	3 | 0		0 | 0		0 | 0	2 | 1
„ discovered by subsidiary measurements	4 | 5	0 | 0		0 | 0		1 | 1	0 | 0
„ „ „ inspection	4 | 0	7 | 0		2 | 2		0 | 0	4 | 3
„ in maximum and minimum	3 | 2	0 | 0		0 | 0		1 | 0	1 | 4
Substraction in subsidiary tables	9 | 7	0 | 0		1 | 0		1 | 0	0 | 0

* 5 hours light out, and 3 hours clock stop, obscuring light.

† A correction has been applied to wet bulb tabulations from the 5th to the 7th.

‡ A correction has been applied to both dry and wet bulb tabulations through parts of the first 5 days of the month.

§ „ „ „ wet bulb tabulations for 11 days, and dry bulb tabulations 18 days.

Read—A letter from Captain Toynbee submitting excellent logs by—

Capt. E. H. Blake, ship "Gitana" (Minutes, 1872, p. 27).
W. Ellery, ship "Bowfell" (Minutes, 1872, p. 85).
J. M,Donald Gray, barque "Speranza" (Minutes, 1872, p. 59).
G. Grigs, R.N.R., S.S. "France" (Minutes, 1873, p. 9).
E. Carl V. Heggum, ship "Rozelle" (Minutes, 1872, p. 85).
G. H. Jones, S.S. "Niger" (Minutes, 1873, p. 9).
C. W. Kennedy, S.S. "Baltic" (Minutes, 1871, p. 20).
A. Kerr, ship "Ardgowan."
J. T. Lewis, R.N.R., S.S. "Chaldea" (Minutes, 1872, p. 27).
Thos. Mackie, S.S. "Mazinthien."
C. W. Pearson, S.S. "Strathclyde" (Minutes, 1873, p. 19).
J. J. Price, barque "Sorata" (Minutes, 1873, p. 40).
C. H. Renaut, ship "Celaeno" (Minutes, 1872, p. 43).
J. P. Sutherland, schooner "Maggie."
W. Symington, S.S. "Hongkong" (Minutes, 1872, p. 92).
W. Watson, S.S. "Parthia" (Minutes, 1873, p. 34).

With a letter from J. R. H. Macfarlane, Esq., Nav. Sub.-Lieut. H.M.S. "Plover," giving an extract from his register during the storm of August 22, 1873, on the coast of North America.

Mr. Scott was instructed to present the Wind Charts to Capts. Kerr, Mackie, and Sutherland, and to express the marked thanks of the Committee to the other gentlemen.

Reported—That the Daily Weather Charts had been supplied to—

Cambridge Observatory, in exchange.
Wick, Kingstown, Geological Survey, Ireland, Sheerness Yard, Royal Naval College, Greenwich, } for exhibition.

Read—A letter from Mr. Kerr stating that Mr. Sandiford, his assistant, had been appointed assistant to Professor Grant at Glasgow, and asking the Committee to allow him 5*l.* for travelling expenses.—Sanctioned.

Submitted—The following statement of accounts paid and liabilities to 30th September 1873:

——	Paid.	Estimated Liabilities.
	£ s. d.	£ s. d.
OFFICE :—		
Salaries	643 14 6	—
Rent, fuel, &c.	276 1 3	59 0 0
Contingencies	79 2 4	5 0 0
LAND METEOROLOGY :—		
Expenses at observatories	1,322 16 4	160 0 0
New instruments for ditto	—	—
Computations	409 2 11	—
Telegraphy	478 3 0	478 0 0
Inspections, &c.	256 5 7	18 0 0
Computations	246 18 5	—
OCEAN METEOROLOGY :—		
Marine Superintendent	200 0 0	—
Instruments, Admiralty	172 8 7	152 0 0
Ditto Mercantile Marine	172 16 3	127 0 0
Computations and care of instruments	503 3 5	—
Totals	4,760 12 7	999 0 0

Grand total - - £5,759 12*s.* 7*d.*

ROBERT H. SCOTT.

Reported—That the following cheques for August were drawn on the 11th August, on the signature of Sir E. Sabine :—

		£	s.	d.
For Office:				
R. H. Scott -	Salaries and wages - - - -	66	13	4
J. S. Harding, jun.		*18	13	4
J. S. Harding, sen.		†7	14	0
T. D. Bell -		†5	0	0
Williams and Norgate, books - - - - -		5	15	2
For Observatories:				
T. Kerr, Valencia, - - - - - -		20	16	8
R. and J. Beck, zinc plates, &c. - - - -		13	7	10
R. H. Curtis -	Computations, &c. - - - -	11	13	4
F. C. Steventon -		10	16	8
C. Stodart -		†8	8	0
H. W. Woodward		†4	8	0
J. A. Curtis -		†6	18	0
C. H. Thompson -		†4	0	0
For Telegraphy :				
N. J. Holmes, Scilly Company, April - -	2 17 6			
„ „ May - -	3 15 0			
„ „ June - -	3 0 0			
		9	12	6
V. Brooks, Day, & Son, Daily Weather Charts - - -		11	2	3
W. Wightman, printing - - - -	1 17 6			
„ wrappers - - - -	11 11 4			
		13	8	10
F. Gaster -	Computations, &c. - - - -	*13	18	11
W. L. Dallas -		*†7	4	8
F. Brodie -		*†6	3	4
R. Sargeant -		*†4	16	0
For Ocean Meteorology :				
H. Toynbee, Marine Superintendent - - -		33	6	8
Elliott Bros., repairing " A." aneroids - - -		7	17	6
J. J. Hicks, „ " A." barometers, &c. - -		50	15	10
S. Jeffery, " A." verifications - - -	19 12 0			
„ " M.O." „ - - - -	9 0 0			
		28	12	0
D. McGregor & Co., Glasgow Agents - - - -		4	5	0
Williams and Norgate, Wind Charts - - - -		13	15	0
W. Salmon -	Computations, &c. - - - -	20	16	8
R. Strachan -		‡19	3	4
C. Harding -		*13	18	6
W. G. James -		†6	18	0
T. E. Allen -		†6	18	0
J. W. McVeagh -		†4	0	0
On account:—				
R. H. Scott, travelling expenses - - - -		50	0	0
J. S. Harding, jun., office expenses - - - -		70	0	0
Total - - - -		£580	17	4

* Including allowance for extra attendance.
† Four weeks to the 23rd.
‡ Including allowance for care of instruments.

The following cheques for September were drawn on the 29th of that month, on the signature of General Strachey:—

	£	s.	d.
For Office:			
R. H. Scott - } Salaries and wages - - -	66	13	4
J. S. Harding, jun. - }	*17	13	4
J. S. Harding, sen. - }	†9	12	6
T. D. Bell - - }	†6	5	0
C. W. Jacques, Rent for Quarter - - - -	133	13	0
For Observatories; Quarterly Allowances, &c.:			
D. Thomson, Aberdeen - - - - -	62	10	0
T. R. Robinson, Armagh - - - - -	40	14	0
W. P. Dymond, Falmouth - - - - -	66	5	0
R. Grant, Glasgow - - - - 62 10 0			
„ less photo. trays - - - 3 16 0			
———	58	14	0
H. Williams, Holyhead - - - - - -	2	13	8
S. Jeffery, Kew - - - - - 62 10 0			
„ Examination of Records - - 100 0 0			
———	162	10	0
C. Clouston, Orkney - - - - -	2	10	0
S. J. Perry, Stonyhurst - - - 50 0 0			
„ Adding Machine, &c. - - 2 11 0			
———	52	11	0
T. Kerr, Valencia - - - - 20 16 8			
„ Expenses for Quarter - - - 53 10 9			
———	74	7	5
G. T. Watson, Yarmouth - - - - -	4	0	9
Bates, Elliot, & Co., Photo. Trays - - 3 16 0			
„ „ (Spare) - - - 9 6 9			
———	13	2	9
Hopkin and Williams, Chemicals - - - -	3	7	3
R. H. Curtis - }	11	13	4
F. C. Steventon - }	10	16	8
C. Stodart - } Computations, &c. - - -	*10	10	0
H. W. Woodward }	*5	10	0
J. A. Curtis - }	*8	12	6
C. H. Thompson- }	*5	0	0
For Telegraphy; Quarterly Allowances, &c.:—			
N. J. Holmes, Scilly Co., July - - - 3 15 0			
„ „ August - - 3 0 0			
„ Shetland Co., August and September 1 9 0			
———	8	4	0
H. Todd, Cambridge - - - - - -	4	0	0
J. Costello, Dover - - - - - -	3	6	10
J. Tilston, Holyhead - - - - - -	3	6	0
G. Mitchell, Kingstown - - - - -	3	5	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	5	6
J. Merrifield, Plymouth - - - - -	3	5	0
W. Sandford, Portishead - - - - -	3	19	0
J. Hoar, Portsmouth - - - - - -	3	6	0
Smith, Payne & Co., for Scilly - - - - -	4	5	1
W. Lawrence, Shetland - - - - -	3	5	0
J. Smith, Stornoway - - - - - -	3	5	0
J. Trotter, Thurso - - - - - -	3	5	8
Carried forward - - -	£890	11	6

* Including allowance for extra attendance.
† Five weeks to the 27th.

	£	s.	d.
Brought forward	890	11	6
J. Sinclair, Wick	3	5	0
G. T. Watson, Yarmouth	3	6	3
C. Wakefield, York	3	5	4
F. Gaster, W. L. Dallas, F. Brodie, R. Sargeant — Computations, &c.	18	9	11
	*†9	17	4
	*†7	15	8
	*†5	11	0
For Ocean Meteorology:—			
H. Toynbee, Marine Superintendent	33	6	8
L. P. Casella, "A." Instruments — 25 13 0			
" "M.O." " — 7 15 8			
	33	8	8
Negretti and Zambra, "A." Instruments — 4 13 3			
" "M.O." " — 15 18 6			
	20	11	9
Harrison and Sons, Printing	6	7	0
J. J. Hicks, Thermometers	13	10	6
W. Salmon, R. Strachan, C. Harding, W. G. James, T. E. Allen, J. W. McVeagh — Computations, &c.	20	16	8
	‡19	3	4
	*14	17	6
	†8	12	6
	†8	12	6
	†5	0	0
On account:—			
J. S. Harding, jun., Office Expenses	90	0	0
R. H. Scott, Travelling "	25	0	0
Total	-£1,241	9	1

Reported—That the following sums had been transferred from the deposit account of the Committee to their current account:—

500*l.* August 12, on the signature of Sir E. Sabine.
1,500*l.* Sept. 27, " General Strachey.

* Including allowance for extra attendance.
† Five weeks to the 27th.
‡ Including allowance for care of instruments.

The Committee then adjourned.

116, *Victoria Street, October* 27, 1873.

PRESENT:

Mr. Galton in the Chair.

Mr. De La Rue. | Adm. Richards.
Mr. Gassiot. | Sir E. Sabine.
Gen. Strachey.

The Director was in attendance.

The confirmation of the Minutes of the last meeting was postponed.

The following draft reply to the Board of Trade was adopted:—

In reply to your letter of the 16th inst. M. 15,072, and the copy of the despatch from His Excellency the Governor of Western Australia, I am instructed by the Committee to remind you that the land observations under their management are limited "to those made within the British Isles." (Letter W. 4653 of 1866, from Royal Society to Board of Trade.) The only instances in which a departure from this principle has been sanctioned have been the cases of certain lighthouses maintained abroad, as, *e.g.*, at the Bahamas, under the direct control of the Board of Trade.

The instruments in Western Australia were supplied in the year 1859 by Admiral FitzRoy, and the records of observations were supplied regularly to the Meteorological Department for 10 years.

This regularity having been interrupted since the year 1869, it was requested by the Committee in their letter to the Colonial Office, dated 13th December 1872, in the cause of science, that their transmission be resumed.

It is not within the powers of the Committee to subsidize the Meteorological service of Western Australia, any more than they subsidize any colonial services, nor even to lend other instruments for use in the colony.

With reference to the second paragragh in His Excellency's letter, I am instructed to assure him through you that the colony is asked to perform this service simply as a contribution to Meteorology of the nature of similar work performed by other colonies, in a spirit of co-operation for the advancement of science. All they ask in effect is that Western Australia will send them as heretofore a manuscript copy of their observations, in exchange for which the Committee will not only send a copy of their own publications as soon as they are issued, but also hold themselves ready at all times to procure such verified instruments as the colony may wish to purchase, or to perform any other service within their power.

Mr. Scott reported, with reference to the correspondence respecting Weather Telegraphy with France (Minutes, 1870, p. 14), that the Marine Ministry had recently determined to allow the Maritime Prefect of the 4th Arrondissement, in connexion with the Observatory at Rochefort, to issue warnings for the coast of the Bay of Biscay, as explained in the subjoined notice.

AVIS AUX NAVIGATEURS.

Annonce Météorologique.

Signal d'avis de tempêtes dans le 4e arrondissement.

Depuis l'année 1870 on a organisé, sur les côtes nord et nord-ouest de France (de la frontière à Cherbourg et de Cherbourg à Nantes), un service de *signaux de mauvais temps*, d'après les avis du bureau météorologique de Londres. Mais M. Scott, le savant directeur de cet établissement, n'a pas cru pouvoir, faute d'éléments suffisants d'observation, prendre la responsabilité d'indications du même genre pour toute la longue ligne de côtes situées plus au sud.

Ces côtes sont battues par de nombreuses tempêtes, et les fréquents sinistres qui y ont eu lieu ont démontré l'urgence de combler la lacune existant dans le système des annonces du mauvais temps.

Grâce à l'expérience acquise à l'observatoire de la marine, à Rochefort, le Préfet maritime du 4e arrondissement a exposé au ministre de la marine que, au moyen de l'observation méthodique des instruments servant à prévoir le temps, combinée avec les avis de tempêtes envoyés éventuellement par le "Meteorological office," les calculs de l'observatoire de Rochefort acquerraient un degré de certitude suffisant pour pouvoir être portés à la connaissance du public.

D'un autre côté, M. Scott, directeur du bureau météorologique de Londres, ayant été consulté, n'élève aucune objection contre l'usage qu'on se propose de faire des *avis de tempêtes* émanant de lui, pourvu qu'il soit bien entendu que le système organisé à Rochefort restera sous la responsabilité des observateurs français.

En conséquence, M. le Préfet maritime, à Rochefort, a été autorisé à prévenir les navigateurs et les pêcheurs du 4e arrondissement du *mauvais temps qui semblera les menacer*, toutes les fois que les avertissements de tempêtes probables, reçus de Londres, seront d'accord avec les propres prévisions de l'observatoire de la marine, à Rochefort.

Read—A letter from Captain Toynbee, submitting an excellent register kept by Capt. T. Littleford Wadham, barque "Vere" (Minutes, p. 43).

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

Mr. Scott reported that having a large number of surplus copies of Maury's Sailing Directions and Charts, he had offered to return them to the Bureau of Navigation at Washington; the offer had been accepted, and the books handed over to the agent of the Bureau for transmission to Washington.—Approved.

It was resolved to transfer the sum of 500*l.* from the deposit account of the Committee to their current account at the Bank of England.

The following cheques for October were drawn:—

For Office:		£	*s.*	*d*
R. H. Scott -	Salaries and wages - - -	66	13	4
J. S. Harding, jun.		*17	13	4
J. S. Harding, sen.		†7	14	0
T. D. Bell -		†5	0	0
J. Merren, fittings and repairs - - - - -		44	6	7
Cole and Leigh, coals - - - - - -		14	0	0
Williams and Norgate, books - - - - -		4	4	11
Carried forward - - -		159	12	2

* Including allowance for extra attendance.

† Five weeks to the 25th.

				£	s.	d.
	Brought forward			159	12	2
For Observatories:						
R. and J. Beck, zinc plates, &c.				17	13	9
R. Beckley, inspections		51 6 0				
„ „ (Yarmouth)		8 0 6				
		59 6 6				
Less amount advanced		20 0 0				
				39	6	6
T. Kerr (Valencia)				20	16	8
Malby and Sons, printing, &c.		10 1 3				
„ „		6 0 0				
				16	1	3
T. R. Robinson (Armagh)				8	17	10
S. Jeffery (Kew)				39	1	1
R. H. Curtis	Computations, &c.			11	13	4
F. C. Steventon				10	16	8
C. Stodart				†8	8	0
H. W. Woodward				†4	8	0
J. A. Curtis				†6	18	0
C. H. Thompson				†4	0	0
For Telegraphy:						
V. Brooks, Day, and Son: D. W. Charts				11	11	7
Wightman and Co., wrapper for do.				5	10	0
F. Gaster	Computations, &c.			*16	0	11
W. L. Dallas				*†7	19	4
F. Brodie				*†6	7	4
R. Sargeant				*†4	11	6
For Ocean Meteorology:						
H. Toynbee, Marine Superintendent				33	6	8
L. P. Casella, "A" instruments		21 1 6				
„ „		36 0 0				
				57	1	6
J. J. Hicks „				9	10	6
F. Pastorelli „		16 15 0				
„ "M. O." „		3 10 0				
				20	5	0
J. Jobbins, printing				7	10	0
H. J. Smart, Liverpool agent				13	15	10
W. Salmon	Computations, &c.			20	16	8
R. Strachan				‡19	3	4
C. Harding				*14	8	0
W. G. James				†6	18	0
T. E. Allen				†6	18	0
J. W. McVeagh				†4	0	0
For Office Expenses:						
J. S. Harding, jun., on account				90	0	0
Total				£703	7	5

* Including allowance for extra attendance.
† Four weeks to the 25th.
‡ Including allowance for care of instruments.

The Committee then adjourned.

116, *Victoria Street, November* 4, 1873.

PRESENT:

Sir E. Sabine in the Chair.

Mr. Gassiot. | Maj.-Gen. Smythe.

The Director was in attendance.

The Minutes of the last two meetings (October 20 and 27) were read and confirmed.

Reported—That the reply respecting Western Australia had been sent to the Board of Trade as directed.

Submitted—The following opinions on the anemometrical reductions recently published by the Office (Minutes, 1872, p. 70) :—

On the RESULTS of the ANEMOMETRICAL OBSERVATIONS at SANDWICK MANSE (1863–8), and the DISCUSSION of ANEMOGRAMS generally.—By Dr. C. JELINEK.*

The London Meteorological Office has undertaken the labour of the reduction and discussion of these anemometrical observations, and we are indebted to it for a carefully discussed and very interesting paper, which is published in the Quarterly Weather Report for 1871, Part I. (pp. [7]–[56], App.).

Dr. Robinson's opinion was taken as to the principle on which the observations should be worked up, and he recommended the use of a method which is also adopted by Prof. A. v. Oettingen, viz., to resolve the wind velocity for each hour into components. While, however, M. v. Oettingen separates the southerly winds from the northerly, and the easterly winds from the westerly, and so forms four distinct groups, the plan recommended by Dr. Robinson resolves the winds along two axes corresponding with North and East. In southerly winds the first component becomes negative, and the second is negative with westerly winds. The *algebraic* sum of the components is then taken, and the resulting wind direction and velocity deduced therefrom.

It will be seen that the operations carried out on Dr. Robinson's plan correspond to the calculation by Lambert's formula, whilst the method recommended by Prof. v. Oettingen takes a middle course between that and the usual procedure of grouping the observations under 8 or 16 directions separately. In the paper published by the Meteorological Office, in which six years' Anemometrical observations have been discussed with great care by Mr. J. S. Harding, jun., there is also at the end (Table VI.) a general summary of the wind observations given according to the last-mentioned point of view. The description of it states that it is supposed that this summary would be more *interesting* to the *general reader* than the components. In each month the mean velocity and mean direction of the wind are given for each octant of the compass, and the number of hours during which the wind blew in each octant. The force and direction are treated *separately*, and the arithmetical means taken (within each octant). In addition, the number of hours are given during which the velocity exceeded 30 miles an hour, and also the time during which the anemometer was at rest.

We must freely confess that on this point we sympathise with the "general" reader. The reason is, that the second method, the grouping of the observations under eight directions, gives a much more perfect representation of the wind conditions than the first. The components can be obtained at once from the numbers deduced according to the second method; on the other hand, the distribution of the wind cannot be derived from the components at all, or most imperfectly. In the event of the polar and equatorial currents completely equalizing each other, the first method gives no result whatever, *i.e.*, the components disappear, and we are left entirely ignorant with regard to the distribution of the wind. The result is nearly as unfavourable wherever there are two currents, as in Europe, the S.W. and N.E. struggling with each other for supremacy.

Supposing the wind velocities are grouped according to the second or usual method, in 8 or 16 sets, as the march of these numbers is generally rather irregular, we can apply Bessel's formula to them—

$$u_0 + u_1 \sin (x + U_1) + u_2 \sin (2x + U_2) + u_3 \sin (3x + U_3) + \&c.$$

(which, moreover, the Meteorological Office has used for other elements), and calculate the co-efficients u_0, u_1, u_2, u_3, and the angles U_1, U_2, U_3, &c. The resulting expression would then give the sum of the wind velocities contained in any given octant, beginning with a certain angle x, and by differentiating the expression we should be able to calculate the relative velocity corresponding to each given direction. This method would give a complete solution of the problem.

Now what is done in the first method, the method of components recommended by Dr. Robinson? The values of the N. and E. components are calculated from the formulæ—

$$N = V \cos D. \qquad E = V \sin D.$$

in which V denotes the velocity, and D the angular direction of the wind, reckoned from the North. By the summation of all the N. and E. components we get two expressions—

$$N^1 = V^1 \cos D^1 \quad \text{and} \quad E^1 = V^1 \sin D^1,$$

in which N^1 and E^1 are known, and therefore the resulting velocity V^1 and the corresponding direction D^1 may be calculated.

* "Journal of the Austrian Meteorological Society," vol. viii., No. 16.

It is clear, therefore, that this process really corresponds to the calculation of the values of the two constants u_1 and U_1 of Bessel's formula; in fact u_1 is identical with V^1; U_1, on the other hand, equal to $90° - D_1$.*

> Whilst, therefore, Bessel's formula would give the complete representation of the wind relations, we are contented in the first-mentioned method of components with a single term of this formula. We cannot wonder, therefore, that this single term cannot bring to view the wind relations as accurately as the complete formula.

The above digression will be excused since the subject has a very great practical importance. In the interest of a more accurate knowledge of wind observations, we must urge the importance of the erection of S. R. anemometers at many well-selected stations in every great country. But a necessary consequence is the discussion of the results; without this discussion the amount spent on the S. R. instruments is for the most part useless. Since, however, the discussion of anemometrical results is only effected at the cost of great time and labour,† it is desirable that we should agree to a uniform system. At the last Meteorological Conference at Leipzig, the question of wind observations formed an important part of the proceedings, but owing to the short time available, a settlement of the subject was from the first not to be expected.

The point of view taken by Dr. Robinson for the discussion of the Anemometrical observations at Orkney, seems to us to be much too limited. In the introduction to the paper in question (p. 8), Dr. Robinson's own words are quoted (*see* Minutes, 1869, p. 10).

Accordingly, Dr. Robinson's intention was, firstly, to investigate the law of the daily and yearly variations of the wind's motion. Now there can be no doubt that such an investigation is not without interest, as if we know the variations of temperature, pressure, humidity, rainfall, &c., in the daily or yearly period, it cannot be immaterial to investigate the law followed by analogous changes of the wind.

Similar investigations have already been carried out by Kreil, in his Climatology of Bohemia, with the anemometrical observations of the Prague observatory. But the subject is hereby in nowise exhausted. The inquiry into the connexion between wind-direction and the other elements offers problems of general interest, in fact a part of modern meteorology is based upon the deduction of the thermic, baric, and other windroses.

However just Dr. Robinson's remark may be in general, that the wind relations are ultimately affected only by temperature, the cause and effect are here linked in a chain, and from a practical point of view, especially when dealing with observations made in a limited district, or at *one* station, it may be said that wind affects temperature, pressure, rain, and other conditions, and that it is not superfluous to treat anemometrical observations from a standpoint by which the specific character peculiar to each wind shall not be effaced in general means, but be brought clearly to view in the respective results obtained.

Extract from Letter from Prof. Buys Ballot respecting Orkney and Bermuda Anemometry.

(M.O. 1833.) September 27, 1873.

I DO not see a great difference between the two methods, in so far as relates to the definitive result. Tables II. and III. are alike in the two discussions, and so are nearly the following tables.

In higher latitudes where the wind does not blow at different seasons or months from very different quarters, I think we may do as well with the Bermuda system as with the Orkney discussions. For if the wind varies only, I say, 60° in mean direction in the different months (*see* April and November at Orkney for July I suppose to be not yet well enough defined), then we are not very sure that we may say the maximum deviation from the W. is obtained at this date of April, and the minimum at this date of November, or otherwise, less sure can we be about the mean direction of a certain day; and so I think that the method used at the Bermudas might have been followed for the calculations of the winds at Orkney *practically*, though not theoretically. It is, however, not to be allowed that the mode of discussion followed at Bermuda should be applied to observations at Orkney, where the wind direction varies so much more.

The Orkney mode of discussion may be applied everywhere for it has no theoretical stain; you do not intermix different directions which are different by nature and not only by chance; the last ones you may, the former not. *At* the same date the wind may blow in different years from different, even from opposite, quarters, but only by chance, and you are therefore allowed to combine; according to the laws of probability you will at length arrive at a true result.

At other dates of the same year the wind has different directions *by nature*, because the season is more or less advanced, and only by chance can the directions be the same; therefore you are by no means allowed to intermix the result of different dates as only for giving a view of the whole, or so that you combine those following dates for which the direction is nearly the same.

If you follow the Bermuda discussion you will never find the maximum and minimum deviation from W., nor the epoch when this maximum and minimum is observed, but by the Orkney method you will.

It is so erroneous to follow the Bermuda method, as Maury was in error, as he combined *à priori* 10° latitude and longitude into a square, for half the square may have warm water and the other half cold, and you find nothing (*see* Sequel Suggestions 43–48, and the last lines of 46).

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* In the special case of the Orkney observations, U_1 is not $= 90° - D^1$, but $= 67\frac{1}{2}° - D^1$, because in the distribution of the winds under eight octants, those included in the first are not N.N.W. to N.N.E., but N. to N.E. exclusively, and so on. The first octant therefore does not correspond to the mean direction N. (or 0°), but to N.N.E. (or $22\frac{1}{2}°$).

† A single year gives 8760 data for direction, and as many for velocity.

The mode of computation followed at Bermuda would not be shorter if you have a series of 31 years, but on the whole, after having rejected the application of Lambert's formula, I think that not too great an amount of work must be done in this way. It is, however, now and then to be applied in the inquiry into the influence of a certain periodical cause on the direction.

On the whole I should like to give the wind in our tables, if not by arrows, for simplicity (and without doubt always by arrows when we can place near each other a great number of stations), then by the components of Dr. A. von Oettingen.

Pray read once more over pp. 13, 14, and 15 of the Sequel to the Suggestions; suppose we have observed on different dates:—

	S.	W.
June 1	2	3
„ 2	3	2
„ 3	3	3
„ 4	−1	4
„ 5	−2	3

	S.	W.
June 6	−2	5
„ 7	−3	2
„ 8	−3	−1
	&c.	&c.

I give only small numbers as components; we should see that the three first days could be combined safely, and so the following four, that the seven first days the current was to the west; we could tell during that state of barometer and thermometer (or following), the wind was so strongly towards that direction, we could combine whatever we would choose to combine. But if we do not do that and we combine different directions, then I should prefer the Orkney method as a general one, and not disapprove on theory to the Bermuda method.

(Signed) BUYS BALLOT.

M. O. 1980.

Armagh Observatory,
October 24, 1873.

MY DEAR SIR,

I THANK you for the opportunity of reading Dr. Jelinek's remarks on the reduction of the Orkney anemograms; I have read them with the attention due to the high character of their author, but I cannot find in them any sufficient ground for preferring the method of reduction which he proposes to that which you have employed.

In his method he would group the winds according to their direction, giving the mean velocity and direction in each octant or sixteenth; and from these means deducing by Bessel's formula an expression of V in terms of D. This he says gives "a complete solution of the problem." How it does so I am unable to see.

The "problem" at which meteorologists should aim is to assign the velocity *and* direction *at a given time.*

They may perhaps never be able to solve this completely, but they may hope to make some approximation to it. In this, however, Dr. Jelinek's formula does not seem likely to help them; it merely expresses one unknown quantity in terms of another equally unknown. It even fails to express perfectly the character of the wind, for this depends not merely on V and D, but also on the number of hours during which it blows in a given octant. It may also be questioned whether the process of giving the arithmetical mean of V and of D is, however fit for a general view, an exact method of grouping the quantities.

In my opinion they should be combined into a resultant, according to the principles of the composition of forces, the nth part of which would give the true mean, and its D would be the true direction for the octant.

But my chief objection is that this method cannot be connected with time. The Vs which are combined for each octant occur at all possible hours, and if a mean of hours were taken for each octant, there would be in these hour-means no regular sequence whatever. His objection to the method of rectangular co-ordinates, that in the case of the polar current being equal to the equatorial the sum of the Ns. = 0, which is "no result," is not correct; in my opinion such an occurrence *is* a real definite result, telling that during its period the northern and southern anemic influences are equal.

His statement that "the components can be obtained at once from the number deduced according to the second method," must not be taken rigorously. This would give for, say mean E $\frac{Sum\ (V)}{n} \times \mathrm{Sin}\ \frac{(Sum\ D)}{n}$ while its true value is $\frac{Sum\ (V \sin D)}{n}$ which are not identical. His opinion that his method is to be preferred to mine "because the constants of the second term of his formula give at once V^1 and D^1, the mean velocity and direction of the whole series," rather surprises me. To obtain these two constants he must *first* compute Bessel's p_1 and q_1. Now these are 2 N^1 and 2 E^1; and u_1 and U_1 are derived from them by the very process which I use to obtain V^1 and D^1; so that the amount of labour in both cases is the same.

The method of components, on the other hand, is far more likely to lead to practical results. In every part it refers to time, and it is a mere application to the wind of the method used in other dynamical problems; the resolution into rectangular components of the forces which act on any system of bodies. If we know the forces we can determine the motions which they produce; if we know the motions we have at least a clue which may guide us to a knowledge of the nature of the forces. We know that at least two of these forces are due to the rotation of the earth, and the difference of equatorial and polar temperatures; this indicates, as the axes of co-ordinates, lines parallel and perpendicular to the meridian. We know also that the wind varies with the hour of the day, and the day of the year. Let us in the first instance determine precisely the normal effects of these influences, "Est quiddam prodire tenus si non datur ultra." When these are

expressed by Bessel's interpolation we can deduct them from any given pair of components, and study in the residuals the effect of any other forces. Yet more, when the time formula has been deduced for other stations, we can by comparing the various constants ascertain how the diurnal and annual variations are modified by geographical elements, latitude, longitude, mountains, proximity to sea, &c. Even in the case of cyclones the curvature of the wind's track, and the motion of the centre of that curvature, are as easily determined from rectangular as from polar co-ordinates; the latter indeed more easily.

The same method applies also to the effects of variation of pressure, temperature and, humidity.

If these elements are known at several stations, whose positions with respect to the observatory are known, the wind-forces resulting from them can be resolved into their components, and by comparing these with the residuals, we may hope to obtain numerical values of their respective influences, or at least to approximate them. This can scarcely be done with the polar co-ordinates, unless by a process of composition of motions, which would be much more troublesome than the simple addition or subtraction of components.

If each individual hour's observation were published, there could be no objection (except the extra printing) to Prof. Von Oettingen's proposal of giving for it, in separate columns, the positive and negative components, which would give to any intelligent reader, the character of the wind with sufficient distinctness. But if means even of hours for six or seven years, and still more of days, were given, the difference would be greatly marked. It might, however, be sufficient to give the numbers of + and − for each hour, and the extreme ranges.

Dr. Buys Ballot appears to consider the method of components superior to the other.

(Signed) T. R. Robinson.

R. H. Scott, Esq.

Submitted—The following telegram :—

M. O. 2019. Telegram. Received 3 November 1873.

General Myer to Mr. R. Scott.

Was compelled to hasten home for annual report. Will you commence exchange with United States, on January 1st next, of one daily simultaneous observation from your stations taken at 12 o'clock and 43 minutes p.m., Greenwich mean time? The observations to be mailed semi-monthly. Russia, which has part of night work, has agreed to that. Your details can be arranged by mail. I telegraph because I wish to mention our co-operation in annual report now going in.

Mr. Scott stated that as he had only received the telegram that morning, he had at once replied as follows, in order to avoid further loss of time :—

Mr. Scott to General Myer.

Can commence exchange for some stations new year. Arrange details by mail. Must develop plan gradually.

Mr. Scott stated that he would at the next meeting submit a memorandum on the subject of the above telegram, and on various other subjects connected with weather telegraphy.

The Committee then adjourned.

116, *Victoria Street, November* 17, 1873.

Present :

Sir E. Sabine in the Chair.

Mr. De La Rue.	Major-General Smythe.
Mr. Galton.	Major-General Strachey.

The Director was in attendance.

The Minutes of last meeting (Nov. 4) were read and confirmed.

Read—The following letter :—

M. 16,829.
M.O. 2,063.

Sir, Treasury Chambers, 7 November 1873.

With reference to Mr. Hamilton's letter of the 25th ult., forwarding copy of a letter from the Meteorological Office, I am directed by the Lords Commissioners of Her Majesty's Treasury to request that you will move the Board of Trade to cause the Meteorological Committee to be informed that their accounts and vouchers should be sent to the Secretary of this Board.

I am, &c.

The Secretary, Board of Trade. (Signed) William Law.

Mr. Scott was instructed to forward the accounts as directed by the Treasury.

Mr. Scott was instructed to inform the Board of Trade that the sum required by the Committee for the financial year 1874-5 would be 10,000*l.*, being the same sum as that voted during the current year.

The following detailed estimate was ordered to be printed on the Minutes:—

METEOROLOGICAL OFFICE.—ESTIMATE for the Year 1874-5.

	£	s.	d.	£	s.	d.
Office:						
Salaries	1,300	0	0			
Rent, fuel, &c.	600	0	0			
Office expenses	150	0	0			
				2,050	0	0
Land Meteorology:						
Expenses at Observatories	2,720	0	0			
Computations	850	0	0			
				3,570	0	0
Telegraphy	1,450	0	0			
„ D.W. Charts, inspections, &c.	500	0	0			
Computations	500	0	0			
				2,450	0	0
Ocean Meteorology:						
Marine Superintendent	400	0	0			
Admiralty instruments	250	0	0			
Mercantile Marine do.	250	0	0			
Computations	1,030	0	0			
				1,930	0	0
Total				£10,000	0	0

Mr. Scott reported that with reference to the telegram from the Chief Signal Office, Washington, he had written to General Myer to explain that the Meteorological Office was not in such a pecuniary position as would enable it to impose much additional work on its telegraphic observers, but that it would willingly endeavour to obtain volunteer co-operation from as many stations as possible.

He had also pointed out that the allotment of a mid-day epoch for observation to the British Islands would preclude the Office from obtaining any but self-recorded observations on Sunday.

Submitted—The following report:—

GENTLEMEN,

I FEEL it my duty to anticipate, in some measure, the publication of the Report of the Vienna Congress, as regards certain measures which I would request you to consider, and possibly to grant permission to me to adopt, with reference to our arrangements for weather telegraphy. They concern three points:—

I. Telegraphy of *reduced* barometer readings.
II. Employment of a signal for the probable direction of wind in storms.
III. Issue of announcements of probable weather.

I. It has been the practice of this Office to receive the observations by telegraph *as made*, and to apply all corrections in London. In our system of exchange with foreign institutions, economy of time in transmission is of paramount importance, and therefore copies of the reports sent to this Office are sent off from the central station, or from other stations, such as Aberdeen (for Norway), immediately after the despatch of the messages to this Office.

We have therefore furnished copies of our corrections for each station whence reports are transmitted, to the several institutions concerned. These are those of Paris, Hamburg, Copenhagen, Christiania, and Stockholm, and probably ere long Florence will be added to the list.

Application was made to me by Professor Rubenson, of Stockholm, in July last, to introduce the reduction of readings *by the observers*, so that the readings as transmitted could at once be entered on the charts, and a considerable saving of time in publication of the reports abroad might be effected.

I learn from Professor Mohn that according to his experience serious errors do not occur in the application of corrections by the observers.

I therefore ask your permission to alter our arrangements to the extent of transmitting only reduced readings.

II. In the replies received by myself and the other members of a sub-committee appointed at Leipzig to report on storm warnings, a very general wish was expressed that some indication of the direction of the apprehended winds should be given.

On some coasts, as in Norway, where the vessels in the Fjords are not anchored, owing to the depth of water, but moored to rings in the rocks, a knowledge of the probable direction of the wind is of most vital importance.

The utility of some information on the subject, if such could be given with confidence, to every seaman is indisputable.

I therefore venture to submit to you that our six years' experience of the system of Telegraphic Weather Intelligence, adopted with your approval in 1867, added to the knowledge of weather gained in the Office under the management of Admiral FitzRoy and his successor, emboldens me to announce my readiness to re-introduce the use of Admiral FitzRoy's signals (drum and cones) as to direction, though with a meaning similar to that now conferred on the drum signal, viz., the hoisting of the drum does not imply *any prophecy of wind or weather;* it is only intended to convey information that there is an atmospherical disturbance somewhere which may possibly reach the place where the signal is hoisted, and the knowledge of which is likely to be of use to the mariners and fishermen of that part of the coast. Its meaning is, "Look out, bad weather *may* be approaching you," and that if it does come the probable direction of the wind will be that indicated by the particular signal employed.

If you approve of this my proposal, it will be necessary for you to remember that it entails an immediate expenditure of about 100*l.* out of your surplus, for a new cone must be supplied to each station, 129 in all.

I feel confident that if my request meets with your approval, your action will be hailed as a great boon by our coasting traders.

III. As to the announcement of probabilities for the future, a wish for them has been expressed in some quarters, but they are not of such importance, more especially as there is no present idea of issuing them by telegraph.

I consider that while we could generally announce our ideas as to probable weather for the major portion of England with a considerable degree of confidence, I should feel some hesitation in announcing my ideas as to the weather in Ireland, Scotland, and the S.W. of England.

If I were allowed to begin by announcing weather for London, and, as occasion offered, to give opinions as to weather for other parts, I should be prepared gradually to extend the area embraced by these announcements, and ultimately to assume the responsibility for the major part of the United Kingdom.

I am not of opinion that a system of tentative announcements to be kept private, and tested in the Office, although theoretically advisable, would be practicable in an office so pressed with work as this is. There would be great danger that the duty of making such private "forecasts" would be postponed for an hour or two, and perhaps forgotten on a day on which a serious storm was announced.

In my opinion the duty of preparing and publishing such announcements in the afternoon papers, is the pressure necessary to ensure proper and regular attention to the duty.

If the Committee wish me to do so I am perfectly ready to make a trial of such announcements for London for one month, and test them scrupulously here, but I do not consider the demand for them at all so urgent as that for the probable direction of the wind in storms.

It is hardly necessary for me to say that in all cases of predictions the greatest caution will be exercised, as heretofore, in our storm warnings.

ROBERT H. SCOTT.

Submitted—The following letter :—

(M.O. 2,092.)

SIR, 10, Marine Square, Brighton, 15 November 1873.

REFERRING to your letter of the 10th of September last, to our several conversations, and to the proceedings of the Vienna Congress, in respect to the establishment of Meteorological stations in China, I shall now be glad to consult you with regard to the necessary registers and records, &c., and also with regard to general instructions for the guidance of observers.

The Astronomer Royal recommended as pattern the registers and records taken at the office of the Surveyor General of Calcutta; General Myer proposed those of the Signal Office of the United States; but you advised me to wait until the forms of your own Office had been revised and adopted.

If Meteorological returns, according to prescribed forms, are to be forwarded to your Office from all stations in the British colonies as well as the British Isles, then I conceive, for the purpose of comparative Meteorology over the globe, it would be well that the forms, &c., used in China should be similar to yours.

I telegraphed to General Myer on the 14th inst. for copies of all his publications, and he telegraphed back that they had been sent the same day. The telegraph will shortly unite America with Japan and China; and General Myer has expressed the desire of his government to co-operate in every way, with a view to an uniform system of observations on both sides of the Pacific. I shall receive his registers, &c., in about a fortnight. Meanwhile I shall be much obliged to you for any information you can give me in regard to this important question.

I have, &c.

R. H. Scott, Esq. (Signed) J. D. CAMPBELL.

At a suggestion from Captain Toynbee it was resolved to present to Captain Watson (Minutes, p. 61) a copy of the Wind and Current Charts.

Mr. Scott reported that Mr. De La Rue's signalling anemometer (Minutes, p. 39) had been tested for five months at the Office, and that it appeared to work satisfactorily, and he was instructed to have one made so as to be tested in actual service.

Reported—That the Daily Weather Charts had been supplied to the coast-guard station, Ventnor, for exhibition.

Reported—That the following cheque had been drawn on the 3rd instant:—

	£	s.	d.
S. Jeffery, "M.O." verifications - - -	11	13	0
„ "A." do. - - - -	25	16	6
	£37	9	6

Cheque drawn this day, for Office expenses:—

J. S. Harding, jun., on account - - - - £10 0 0

The Committee then adjourned.

116, *Victoria Street, November* 25, 1873.

PRESENT:

Sir E. Sabine in the Chair.

Mr. De La Rue.	Major-General Smythe.
Mr. Galton.	Major-General Strachey.

The Director was in attendance.

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

Reported—That the estimate for the year 1874-5 had been forwarded to the Board of Trade, as directed.

Submitted—A letter from the Board of Trade, M.O. 2,133, enclosing a copy of a letter from the Meteorological Society of the Mauritius (of date September 18), stating that "circumstances had prevented the Society from availing itself of the invitation "(to send a delegate to the Meteorological Congress at Vienna), but that they hope to "have an opportunity of sending a delegate to a future congress of the same nature."

The Director's Report, read at last meeting, was then considered, and the following action was taken:—

I. Telegraphy of *reduced* barometer readings.

The reduction to sea level and to 32° of these readings by the observers to be tested experimentally, so as not to be introduced until there is a reasonably perfect security against errors.

II. Employment of a signal for the probable direction of wind in storms.

Mr. Scott was directed to prepare a memorandum explanatory of the system which he proposed. Meanwhile a supply of cones is to be procured in case of approval of the plan proposed.

III. Issue of announcements of probable weather.

A memorandum is to be prepared daily in the Office of the immediate probabilities of the weather, and to be distributed to the members of the Committee, as an experiment.

Mr. Campbell's application for registers and forms was considered, and Mr. Scott stated that he had been requested to draw up a set of instructions for British observers, by the Congress at Vienna, and that he had given directions for a draft of such instructions to be prepared.—Approved.

It was resolved that the sum of 500*l.* be transferred from the deposit account of the Committee to their current account at the Bank of England

Submitted—The following STATEMENT respecting the Records for OCTOBER 1873, received from the self-recording Observatories, and which have been examined at Kew Observatory (see Minutes, 21st December 1868).

Points noticed at Kew.	Aberdeen.		Armagh.		Falmouth.		Glasgow.		Kew.		Stonyhurst.		Valencia.	
ANEMOGRAPH :—														
Action	Good.		Good.		Good.		Fair.		Good.		Good.		Good.	
Records deficient	None.		None.		None.		*10 hrs. direction lost, and 27 doubtful.		None.		None.		Clock stopped by the setting pin on 14th; 5 hrs. of Velocity lost, and 5 hrs. Direction doubtful; 3 hrs. Direction no trace, and 1 hr. doubtful on the 21st; 1 hr. on 25th for Direction, owing to oiling instrument.	
Orientation verified	30th.		27th.		27th.		1st.		—		—		6th.	
Result of 40 *Remeasurements :—*	Direction.	Velocity.	Direction.	Velocity.	Direction.	Velocity.	Direction.	Velocity.	Direction.	Velocity.	Direction.	Velocity.	Direction.	Velocity.
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	0·4	0·1	0·3	0·1	0·2	0·3	0·4	0·1	0·2	0·2	0·3	0·2	0·5
Residual difference (— Kew)	+0·1	0·0	−0·1	+0·1	0·0	0·0	0·0	+0·2	0·0	0·0	0·0	0·0	+0·1	+0·2
No. of errors discovered	0	0	0	0	0	0	0	2	0	0	0	0	0	0
Errors in rain tabulation	0		0		0		0		0		12		19	
					Rain gauge clock out of order on the 4th.		Rain gauge clock stopped on the 22nd.							
BAROGRAPH :—														
Action	Good.		Good.		Good.		Good.		Good.		Good.		Good.	
Photography	Do.		Do.		Do.		Do.		Do.		Do.		Do.	
Records deficient	None.		None.		None.		None.		20 hours lost owing to failure of gas.		None.		None.	
Result of 40 *Remeasurements :—*														
Greatest difference	·0050		·0050		·0050		·0050		·0050		·0050		·0050	
Mean difference irrespective of sign	·0029		·0029		·0024		·0021		·0017		·0017		·0020	
Residual difference (— Kew)	−·0009		+·0012		·0000		−·0012		−·0009		−·0007		−·0009	
Mean monthly difference between simultaneous barograph and barometer	·0019		·0028		·0019		·0018		·0021		·0018		·0027	
No. of errors discovered in entry of standard	0		1		1		1		0		0		3	
„ in calculating residual correction	0		0		0		0		0		0		1	
„ in applying residual correction	0		0		0		1		0		0		7	
„ in tabulation	0		0		0		0		0		0		0	
THERMOGRAPH :—														
Action	Good.		Good.				Good.				Good.		Good.	
Photography	Do.		Do.				Do.				Do.		Do.	
Records deficient	15 hrs. wet bulb out of action.		†6 hrs. wet bulb out of action.		Awaiting scale.		‡5 hrs. wet bulb out of action.		Scale lent to Falmouth.		1 hour wet bulb, owing to frost.		§25 hrs. wet bulb out of action.	
Result of 40 *Remeasurements :—*	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.	Dry.	Wet.
Greatest difference	0·20	0·20	0·20	0·20			0·20	0·20			0·20	0·20	0·20	0·20
Mean difference irrespective of sign	0·08	0·05	0·07	0·08			0·09	0·12			0·09	0·06	0·08	0·08
Residual difference (— Kew)	+0·01	0·00	−0·05	−0·04			−0·06	−0·11			−0·05	−0·05	−0·08	−0·04
Mean monthly difference between simultaneous thermograph and thermometer	0·13	0·12	0·10	0·12			0·09	0·08			0·15	0·13	0·14	0·16
No. of errors discovered in entry of standard	0	0	1	1			0	0			0	0	0	0
Errors in copying from tabulation sheet into subsidiary sheet	4	0	0	0			0	0			0	0	5	15
Errors discovered by subsidiary measurements	0	0	0	0			1	1			0	0	0	0
„ „ „ inspection	1	1	3	0			1	0			0	0	5	0
„ in maximum and minimum	2	2	1	2			0	2			1	0	2	4
Subtraction in subsidiary tables	3	2	0	0			0	0			0	0	0	0

* Direction pencil fails to mark at times.
† 14 hours have been re-tabulated at Kew.
‡ Two days' traces have been re-tabulated at Kew.
§ Two days' dry bulb and four days' wet bulb traces have been re-tabulated at Kew.

The following cheques for November were drawn:—

		£	s.	d.
For Office:				
R. H. Scott	Salaries and wages	66	13	4
J. S. Harding, jun.	Salaries and wages	*17	13	4
J. S. Harding, sen.	Salaries and wages	†7	14	0
T. D. Bell	Salaries and wages	†5	0	0
For Observatories:				
T. Kerr (Valencia), salary		20	16	8
R. & J. Beck, repairing anemometer		2	10	6
J. J. Hicks, thermometers		21	15	6
Hopkin and Williams, chemicals		1	18	10
R. H. Curtis	Computations, &c.	11	13	4
F. C. Steventon	Computations, &c.	10	16	8
C. Stodart	Computations, &c.	†8	8	0
H. W. Woodward	Computations, &c.	†4	8	0
J. A. Curtis	Computations, &c.	†6	18	0
C. H. Thompson	Computations, &c.	†4	0	0
For Telegraphy:				
The Postmaster General, June quarter		274	16	7
N. J. Holmes, Scilly Co., September	£3 0 6			
„ „ October	3 16 3			
		6	16	9
S. M. Clare, Submarine Co., January—September		22	0	3
F. Gaster	Computations, &c.	*15	5	2
W. L. Dallas	Computations, &c.	*†7	14	9
F. Brodie	Computations, &c.	*†6	6	0
R. Sargeant	Computations, &c.	*†4	6	0
For Ocean Meteorology:				
H. Toynbee, Marine Superintendent		33	6	8
F. Pastorelli, "A" thermometers		3	11	4
J. R. Jones, Aberdeen		7	18	11
W. Salmon	Computations, &c.	20	16	8
R. Strachan	Computations, &c.	‡19	3	4
C. Harding	Computations, &c.	*14	8	0
W. G. James	Computations, &c.	†6	18	0
T. E. Allen	Computations, &c.	†6	18	0
J. W. McVeagh	Computations, &c.	†4	0	0
For Office Expenses:				
J. S. Harding, jun., on account		100	0	0
Total		£744	12	7

* Including allowance for extra attendance.
† Four weeks to the 22d.
‡ Including allowance for care of instruments.

The Committee then adjourned.

116, *Victoria Street, December* 15, 1873.

PRESENT:

Sir E. Sabine in the Chair.

Mr. De La Rue.	Admiral Richards.
Mr. Galton.	Major-General Smythe.

Major-General Strachey.

The Director was in attendance.

The Minutes of last meeting (November 25) were read and confirmed.

Mr. Scott submitted a circular explanatory of a system of storm signals proposed by him. After considerable discussion the following resolutions were adopted:—

That it is expedient to supply cones to the signalling stations, in order to afford the means of indicating the direction of probable strong winds.

That the cone be hoisted to indicate the probability of winds having a force of not less than 7 (a moderate gale).

That an additional signal be employed in connexion with the cone whenever a wind of the force of 9 and upwards is probable.

That the additional signal (the danger signal) be a drum.

That the drum be not used in future except in connexion with the cone.

Mr. Scott was instructed to modify his circular, which in the main agreed with the above resolutions, in a few particulars, where necessary, and his proposal was then adopted.

Mr. Scott reported that at the Vienna Congress it had been determined to employ civil time for Meteorological Reductions in future, and accordingly the decision of the Committee of June 7, 1869 (Minutes, 1869, p. 61) respecting the use of astronomical time was rescinded, and instructions were given to employ civil time in future.

Mr. Galton submitted a proposal to test the amount of error occasioned by the existing system of calculating Meteorological means from hourly observations. He desired to have a comparison made between the means so calculated with those obtained by the direct measurement of the areas of the tracings of the self-recording instruments, to be made by means of the planimeter.

It was resolved—That a planimeter be procured and a comparison be made between the mean temperatures obtained from the photographic record by it and those obtained in the usual way from hourly observations.

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

Capt. J. E. Mouland, ss. "Batavia" (log kept for short period).
„ M. Vowell, ship "Undine" (Minutes, 1872, p. 27).
„ T. C. Potts, ship "Tenasserim" (Minutes, p. 23).

Mr. Scott was instructed to convey to Captains Mouland and Vowell the marked thanks of the Committee, and to present to Captain Potts the "Wind and Current" Charts.

Reported—That the information as to Kerguelen's Island had been supplied to the Astronomer Royal (p. 57).

The Committee then adjourned.

116, *Victoria Street, December* 22, 1873.

PRESENT:

Sir E. Sabine in the Chair.

Mr. De La Rue. | Mr. Galton.

Major-General Strachey.

The Director was in attendance.

The Minutes of last meeting (December 15) were read and confirmed.

Read—The following letter:—

The Owens' College, Manchester,
December 15, 1873.

DEAR SIR,

I BEG to enclose a petition numerously signed by persons interested in Meteorology, representing to the Meteorological Committee the desirability of their publishing the individual tabulations from their self-recording instruments.

If the Meteorological Committee were disposed to comply with the request, one way of doing it would be to add an additional daily sheet to their bulletin. Such a sheet would embrace all that could be wished, and I believe the lithographer's cost for throwing off 100 copies would not exceed 6*s.* 6*d.* per day.

I enclose a sheet of the size of the bulletin, showing how such a thing might be done. I enclose letters from Mr. Buchan and Mr. Baxendell, stating that they have been prevented from pursuing entire enquiries on account of the difficulty of obtaining the original observations.

I may also add, that if it were not on account of a grant received by me from the Royal Society, I could not have pursued an investigation which I have in hand, and for which I have received (on the usual terms) information from your Office.

Requesting that you will lay the memorial before the Meteorological Committee,

I remain, &c.

R. H. Scott, Esq., F.R.S. (Signed) B. STEWART.

MEMORIAL.

WE, the undersigned, being interested in Meteorology and desirous to promote its progress, beg to represent to the Meteorological Committee of the Royal Society the desirability of their publishing the individual numbers for the 24 hourly readings from each of their seven Observatories, for every element which is observed continuously.

Were such numbers published, meteorologists would possess a record of individual facts, which each one might reduce according to his own requirements, without the necessity of incurring great expense in obtaining his facts.

(Signed) JAMES P. JOULE,
And 31 other Signatures.

The letters from Messrs. Baxendell and Buchan are not reprinted.

Mr. Scott was instructed to prepare a statement showing the estimated cost of production of the proposed tables.

Read—The following letters:—

(M. 2299.)

DEAR SIR,

The Royal Society, December 20, 1873.

I AM directed to forward to you, to be laid before the Meteorological Committee, the accompanying copy of a letter from the War Office, addressed to the Secretary of the Royal Society, together with the book therein referred to; and I am to request that you would be good enough to obtain from the Committee the favour of an opinion on the book such as may enable the Council of the Royal Society to give an answer to Mr. Secretary Cardwell's letter.

I remain, &c.

R. H. Scott, Esq. (Signed) WALTER WHITE,
Assistant Secretary.

(Copy) $\frac{7609}{531}$

SIR,

War Office, November 29, 1873.

As the Royal Society are engaged in the collection of meteorological observations, and are no doubt in possession of valuable experience on the subject, I am desired by Mr. Secretary Cardwell to request that you will have the goodness to submit the accompanying copy of Sir H. James's Meteorological Instructions to the Council of the Royal Society, with the view of ascertaining whether it

would, in their opinion, be desirable to publish a new edition of this work, and, if so, whether there are any corrections or additions, the insertion of which may be rendered advisable by recent advances in meteorological science.

I have, &c.

The Secretary, Royal Society. (Signed) LANSDOWNE.

Mr. Scott was instructed to reply as follows:—

I AM instructed by the Committee to inform you in reply to Mr. White's letter of the 20th inst. that they are of opinion that it would not be advisable to prepare a new edition of Sir H. James's Instructions in their present shape.

It appears to them that Section III. (Notes on Meteorological Subjects), is out of place in such a work as that under consideration, while as regards Section II. (Description of Instruments), there are several statements which require serious modification to suit them to the present state of the science.

Mr. Scott submitted the amended circular respecting the new (proposed) system of storm signals, which was approved.

He then requested and obtained permission to submit the proposal to the several continental meteorological offices which are in receipt of warnings from the Meteorological Office, before bringing the matter under the notice of the Board of Trade.

Read—The following letter:—

Reference, M.O. 2259, /73.

Central Anstalt für Meteorologie, Vienna, December 11, 1873.

EXTRACT from a Letter from Dr. J. Hann to Mr. Scott.

I AM, however, not at all convinced of the practical and theoretical value of the reduction by Lambert's formula, either according to Robinson's or v. Oettingen's method. From an abstract theoretical point of view, there can be no objection raised, provided we know the velocity of the wind with some certainty. But this is only the case with the very lowest strata, and according to the mode of the exposure of the anemometer you obtain different velocities. We have now more than double what we had formerly in the town, when the anemometer, although freely exposed, was only 5 — 6 metres above the tops of the houses, and the proportion of the increase of the velocity does not remain the same for all wind directions. Of the velocity a few hundred feet above us in the free air, we know nothing whatever. The mechanical resultant of the motion of the air over the station itself, up to very slight heights, cannot be given to us by Lambert's formula. For it one sacrifices valuable advantages which the simple communication of the frequency of the winds offers, especially for climatology. When, for instance, Robinson says that the objection, that $N^s = O$, when South and North winds have blown equally frequently and strongly, there being therefore no resultant, is not correct, he is practically right from the mechanical point of view, but not from the meteorological, in general. For the cases are clearly not the same, when for the whole month there have been calms and constant weather, and when there have been changes from South to North, together with change of temperature and weather generally. If you give the frequency these may all be recognised. No direction of the wind is lost which has prevailed during the month. The reduction to the co-ordinate axes gives abstract results, which could never give an answer to many questions; all the specialities of the different stations are lost thereby. I am convinced that the general adoption of Lambert's formula, if it were used as is generally done for giving monthly means, would be a decided step backwards in Meteorology. Our endeavour must be not to attempt too much to theorise, but to offer monthly resumés which should be as complete as possible, and should be capable of being utilized in all directions. From the frequency and mean force and direction of the wind, at every moment, a mechanical resultant may be deduced, but conversely, from the mechanical resultants the individual directions can never be obtained. It has often been said, and must continually be repeated, that the mean direction of the wind often falls on points of the compass whence the wind never blows; as a mechanical resultant it is unassailable, but it is practically worthless for the meteorologist. When Dr. Robinson says that the forces which act on the masses of air are the contrasts of temperature between the pole and the equator N.—S., and the axes of rotation of the earth W.—E. and that the axes of the co-ordinate systems correspond to it, this is in fact not according to nature in its principles. In winter the temperature contrasts in Europe between E. and W., and in summer between N.W. and S.E., and so this alters itself according to the direction of land and water, &c. and for various localities we should alter the axes according to the position of the station, as Dr. Köppen did for the winds in Tauris, and thereby has attained much clearer and more natural results.

But herein we bring in an element of volition, which, at least, ought to be left out on principle. As for the self-recording stations I fully agree with you, when your number increases you must take care to reduce the observations so as to afford a general view. Clearly I think that the best plan for these stations would be a combined method, to give the resultants for each individual day and for each month (according to Robinson or v. Oettingen) but always add, in the monthly results, the frequency of the principal wind directions.

Read—The following letter of Instructions to Agents, proposed by Captain Toynbee, which was adopted.

SIR,

THE experience gained by this Office, since it was placed under the management of the Meteorological Committee of the Royal Society, has led them to reconsider the Instructions to their agents who supply instruments, &c. to ships in various parts of the United Kingdom.

A copy of the new instructions is herewith submitted for your guidance if you are willing to continue their agent on the terms proposed; if not will you be so good as to say so.

I am, &c.
HENRY TOYNBEE.

	£	s.	d.
1st. The fee for supplying a complete set of instruments and the necessary books -	1	5	0
2nd. The fee for receiving and verifying a complete set of instruments, or their parts if broken, with filled-up logs, &c. - - - - - - -	1	5	0
Note.—If an agent supplies a ship and gets no log, or one which is quite worthless, the Committee reserve to themselves the right of refusing to pay the fee for receiving the returned instruments; the decision to depend on the circumstances of the case.			
3rd. When a captain returns a full and excellent log the agent who proposed him will receive an extra fee of - - - - - - - - for his *first excellent log*, but this will not be continued for his future logs.	1	0	0
4th. In the case of short voyage ships or steamers, the usual fee will be paid for supplying, but as their instruments only need changing when broken, or at the special request of the captain, no further fee will be given until a log has been sent in. If it is thoroughly filled, a fee of - - - - - - will be allowed to the agent; if only partially filled a proportional part of a pound will be given. This fee is supposed to cover the trouble of replacing broken instruments during the time of keeping the log. Of course the first excellent log of such an observer will earn an extra 1*l.* for the agent who induced him to work for the Office.	1	0	0

You will be allowed to charge this Office with postage, and the expense of carriage of instruments and books to and from this Office, for which vouchers must be sent in. All other incidental expenses must be borne by yourself.

No instruments are to be sent to captains at other ports, nor are any repairs to be done at the out-ports without the special sanction of this Office.

Read—A letter from Capt. Toynbee submitting "excellent" logs by
Capt. F. W. Banner, ship "Kenilworth" (Minutes 1872, p. 37.)
„ R. J. Balderston, ship "Rajmahal."

Resolved—That the Wind and Current Charts be presented to Capt. Balderston, and that best thanks of the Committee be conveyed to Capt. Banner.

Read—The following letter:—

DEAR SIR, December 18, 1873.

As it is probable that the storm of August 1873, which did so much damage at Halifax, N.S., and other places, will be carefully worked up, I shall be glad to know whether the committee will sanction the sending of a circular letter to various captains and shipowners, asking for the loan of their logs. Whether the work is done by America or England, it seems right that we should help to collect the data. Meldrum's "Notes on the Form of Cyclones in the Southern Indian Ocean" make it very important that similar inquiries should be instituted into the form of those of the northern hemisphere, and this gale would be a good one to commence upon. If we deal with it, perhaps daily charts similar to those in No. 13, for 11 days of February 1870, would be most useful.

Yours very truly,
HENRY TOYNBEE.

R. H. Scott, Esq.,
Director, Meteorological Office.

Resolved—That Capt. Toynbee's suggestion be complied with.

Mr. Scott reported that Thomson's self-recording electrometer which had been purchased in 1869 for the sum of 74*l.* (Minutes 1867, p. 71), had been sent to Kew in 1869, but had never been in working order. Mr. White, the maker, had after repeated applications, at last called at Kew in September 1872, and had taken part of the instrument away to set it to rights. Since that date it had not been returned, and the Kew Committee had requested the Meteorological Committee to undertake the matter and recover the instrument or its price.

Resolved—That Mr. White be required to return the portions of the instrument, without further delay, or to remit the full price, 74*l.*

Resolved—That the sum of 1,500*l.* be transferred from the deposit account of the Committee to their current account at the Bank of England.

A cheque for office expenses in favour of J. S. Harding, for 20*l.*, was drawn.

SUBMITTED the following STATEMENT respecting the RECORDS for NOVEMBER 1873, 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.
ANEMOGRAPH :—							
Action	Good.	Good.	Good.	Fair.	Good.	Good.	Good.
Records deficient	None.	None.	None.	7 hours direction, no trace.	13 hrs. V and 2 D.*	None.	10 hrs. direction lost, no trace.
Orientation verified	—	—	14th.	1st.	28th.	—	—
Result of 40 *Remeasurements :—*	Direction. | Velocity.	Direction. | Velocity.	Direction. | Velocity.	Direction. | Velocity.	Direction. | Velocity.	Direction. | Velocity.	Direction. | Velocity.
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	0·1 | 0·4	0·2 | 0·4	0·1 | 0·3	0·1 | 0·2	0·2 | 0·4	0·2 | 0·3
Residual difference (— Kew)	0·0 | −0·1	−0·1 | +0·1	−0·1 | −0·1	+0·1 | 0·0	−0·1 | +0·1	−0·1 | 0·0	−0·1 | 0·0
No. of errors discovered	0 | 0	0 | 0	0 | 1	0 | 2	0 | 0	0 | 0	0 | 0
Errors in rain tabulation	0	0	0	0	0	0	7 Rain gauge clock stopped from 1a.m. to 10a.m. on 2nd.
BAROGRAPH :—							
Action	Good.	Good.	Good.	Good.	Good.	Good.	Good.
Photography	Do.	Do.	Do.	Fair.	Do.	Do.	Fair.
Records deficient	None.	None.	2 hrs. lost through stoppage of clock.	None.	None.	None.	None.
Result of 40 *Remeasurements :—*							
Greatest difference	·0040	·0050	·0050	·0050	·0050	·0050	·0050
Mean difference irrespective of sign	·0012	·0021	·0019	·0026	·0014	·0021	·0019
Residual difference (— Kew)	+·0003	−·0004	−·0007	−·0019	+·0002	−·0016	−·0012
Mean monthly difference between simultaneous barograph and barometer	·0018	·0025	·0019	·0020	·0020	·0018	·0029
No. of errors discovered in entry of standard	0	0	0	1	0	1	2
„ in calculating residual correction	0	0	1	0	0	1	0
„ in applying residual correction	0	1	0	1	0	0	4
„ in tabulation	0	0	0	0	0	0	0
„ discovered by inspection	0	0	0	1	0	0	0
THERMOGRAPH :—							
Action	Good.	Good.	Delayed, waiting for the new tabulating scale.	Good.	Delayed, the scale having been lent to Falmouth.	Good.	Good.
Photography	Do.	Do.		Do.		Do.	Fair.
Records deficient	30 hours wet bulb, out of action.	5 hours wet bulb, out of action.		10 hrs. each D. and W.,† 5 hrs. wet bulb out of action.		None.	None.
Result of 40 *Remeasurements :*	Dry. | Wet.	Dry. | Wet.	Dry. | Wet.	Dry. | Wet.	Dry. | Wet.	Dry. | Wet.	Dry. | Wet.
Greatest difference	0·20 | 0·20	0·20 | 0·20		0·20 | 0·20		0·20 | 0·20	0·20 | 0·20
Mean difference irrespective of sign	0·04 | 0·08	0·07 | 0·10		0·10 | 0·07		0·07 | 0·07	0·08 | 0·06
Residual difference (— Kew)	0·00 | −0·05	+0·07 | +0·03		−0·10 | +0·05		+0·02 | −0·03	+0·02 | +0·01
Mean monthly difference between simultaneous thermograph and thermometer	0·09 | 0·14	0·10 | 0·10		0·09 | 0·07		0·14 | 0·11	0·15 | 0·16
No. of errors discovered in entry of standard	0 | 0	0 | 0		0 | 0		0 | 0	0 | 0
„ discovered by subsidiary measurements	3 | 1	0 | 0		0 | 2		1 | 0	0 | 1
„ in maximum and minimum	0 | 1	0 | 1		1 | 1		0 | 0	3 | 0
„ subtraction in subsidiary tables	1 | 0	0 | 0		0 | 1		1 | 0	0 | 0

* Velocity shaft discovered out of order.

† Through stoppage of clock.

The Committee then adjourned.

[.—50.—1/74.]