

METEOROLOGICAL
COMMITTEE MINUTES.

1872.

286
415
METEOROLOGICAL OFFICE

MINUTES OF THE PROCEEDINGS
OF THE
METEOROLOGICAL COMMITTEE.
1872.



LONDON:
PRINTED BY GEORGE EDWARD EYRE AND WILLIAM SPOTTISWOODE,
PRINTERS TO THE QUEEN'S MOST EXCELLENT MAJESTY.
FOR HER MAJESTY'S STATIONERY OFFICE.

1873.

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MINUTES OF THE PROCEEDINGS OF THE METEOROLOGICAL COMMITTEE.

116, Victoria Street, January 15, 1872.

PRESENT :

Sir E. Sabine in the Chair.

Mr. De La Rue.

Mr. Galton.

Mr. Gassiot.

Admiral Richards.

Mr. Spottiswoode.

Sir C. Wheatstone.

The Director was in attendance.

The Minutes of last meeting, December 18, were read and confirmed.

Mr. Scott reported with reference to the letter from the Astronomer Royal which was mentioned in the Minutes of December 18, that it had contained an inquiry relative to the cost of the Quarterly Weather Report, to which he had replied that he was not able to give the precise cost of the publication of the curves in the Quarterly Weather Report, as the expense of that work was borne by the Stationery Office.

On the 12th instant he had received from the Controller of the Stationery Office a letter containing the information required by the Astronomer Royal.

Mr. Scott had himself *not* applied for this information.

On the 13th he had received the following letter :

DEAR SIR,

THE Controller of the Stationery Office informs me that he has placed in your hands a statement of the annual expenditure on account of plates in the Quarterly Weather Report.

Perhaps you could now let me know its amount.

Royal Observatory,
1872, January 13.

(Signed) G. B. AIRY.

Resolved—That Mr. Scott do send the following reply :

The Meteorological Committee hope that the Astronomer Royal will not attribute to them any discourtesy if they ask him to be so good as to inform them whether he requests to have the information he desires in his private capacity, or as President of the Royal Society, because a question of grave import may arise if there should exist any misunderstanding as to the constitution of the Committee and its relation to the Royal Society.

On this point they take leave to refer the Astronomer Royal to the 3rd paragraph on page 3 of Parliamentary Paper No. 246, Session 1869, enclosed herewith, which runs as follows:—

“It may seem scarcely necessary to state that the Royal Society, further than having at the request of the Government nominated the Superintending Committee (of the Meteorological Office), and retained the right of filling up vacancies, should such occur, is in no way connected with the Meteorological Office.”

The Committee, with the sanction of the Board of Trade, would have no objection to furnishing the Astronomer Royal, in his private capacity, with the facts relative to the cost of the plates in the Quarterly Weather Report, which have been recently communicated to them by the Controller of the Stationery Office.

Submitted—Specimens of the proposed Daily Weather Chart. Mr. Scott was instructed to issue a number of specimens of various forms of this chart, to be approved of by Mr. Galton, in order to obtain an expression of opinion from the public as regards the most acceptable mode of publication of the observations.

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

- Captain D. Hunter, S.S. "Alpha" and "Delta" (Minutes, 1869, p. 113; 1871, p. 10).
 „ J. G. Stephen, S.S. "St. Patrick" (Minutes, 1869, p. 113).
 „ R. D. Lunham, S.S. "Durley" (Minutes, 1871, p. 40).
 „ J. L. Perry, R.N., H.M.S. "Orontes." Log kept by Navigating Lieutenant W. W. Vine.

As the above gentlemen, except Mr. Vine, have already received the Pilot Charts, Mr. Scott was instructed to convey to them the best thanks of the Committee for their observations.

Read—A letter from Mr. Jeffery, suggesting that the escapements of the instrumental clocks should be jewelled where necessary, according to a proposal made by Dr. Robinson—Approved.

Submitted—The following statement of accounts paid, and liabilities to 31st December 1871:

| | Paid. | Estimated Liabilities. |
|--|-------------|------------------------|
| | £ s. d. | £ s. d. |
| OFFICE :— | | |
| Salaries - - - | 919 3 11 | — |
| Rent, fuel, &c. - - | 424 0 11 | 31 2 3 |
| Contingencies - - - | 173 12 1 | 5 0 0 |
| LAND METEOROLOGY :— | | |
| Expenses at observatories - | 1,862 1 2 | 109 0 11 |
| New instruments for ditto - | 145 3 4 | 80 0 0 |
| Computations - - - | 614 16 6 | — |
| Telegraphy - - - | 1,888 19 11 | 359 6 4 |
| Inspections, &c. - - - | 161 1 8 | — |
| Computations - - - | 340 11 8 | — |
| OCEAN METEOROLOGY :— | | |
| Marine Superintendent - | 300 0 0 | — |
| Instruments, Admiralty - | 43 11 5 | 39 13 2 |
| Ditto Mercantile Marine - | 274 11 7 | 95 11 8 |
| Computations and care of instruments - - - | 678 12 8 | — |
| Totals - - - | 7,826 6 10 | 719 14 4 |

Grand Total - - - £8,546 1s. 2d.

ROBERT H. SCOTT, Director.

Reported that the following cheques for December quarter had been drawn on the 22nd December, on the signature of Sir E. Sabine:—

For Observatories (quarterly allowances, &c.):

| | |
|----------------------------------|----------|
| | £ s. d. |
| D. Thomson (Aberdeen) - - - | 62 10 0 |
| T. R. Robinson (Armagh) - - - | 36 5 0 |
| Do. expenses for quarter - - - | 7 5 10 |
| | 43 10 10 |
| W. P. Dymond (Falmouth) - - - | 66 5 0 |
| less photographic trays - - - | 3 6 3 |
| „ paper - - - | 6 10 4 |
| | 9 16 7 |
| | 56 8 5 |
| R. Grant (Glasgow) - - - | 62 10 0 |
| Less anemograph scale - - - | 1 0 0 |
| „ photographic paper - - - | 6 10 4 |
| | 7 10 4 |
| | 54 19 8 |
| H. Williams (Holyhead) - - - | 2 13 6 |
| R. H. Scott (Kew) - - - | 62 10 0 |
| Do. examination of records - - - | 100 0 0 |
| Do. expenses for quarter - - - | 14 3 2 |
| | 176 13 2 |
| Carried forward - - - | 396 15 7 |

| | £ | s. | d. |
|--|------|----|----|
| Brought forward | 396 | 15 | 7 |
| C. Clouston (Orkney) | 3 | 9 | 0 |
| S. J. Perry (Stonyhurst) | 50 | 0 | 0 |
| Less max : thermometer replaced | 1 | 2 | 0 |
| | 48 | 18 | 0 |
| Postages, &c. for quarter | 0 | 14 | 7 |
| | 49 | 12 | 7 |
| G. T. Watson (Yarmouth) | 3 | 18 | 3 |
| J. Driscoll, rent at Valencia | 25 | 0 | 0 |
| For Telegraphy (quarterly allowances, &c.): | | | |
| J. Costello (Dover) | 3 | 5 | 10 |
| H. Weaver (Heart's Content), to 1st November | 1 | 2 | 6 |
| W. D. Penny (Nairn) | 4 | 5 | 1 |
| Do. storm signal staff | 2 | 10 | 0 |
| | 6 | 15 | 1 |
| J. Merrifield (Plymouth) | 3 | 5 | 0 |
| J. Hoar (Portsmouth) | 3 | 5 | 9 |
| Sir W. Mitchell (Scilly) | 4 | 4 | 10 |
| W. Lawrence (Shetlands) | 3 | 5 | 0 |
| J. Trotter (Thurso) | 3 | 5 | 0 |
| T. Robinson (Yarmouth) | 3 | 5 | 0 |
| N. J. Holmes, Scilly Telegraph Company, November | 4 | 1 | 3 |
| For Office Expenses, on account : | | | |
| J. S. Harding, jun. | 100 | 0 | 0 |
| Total | £614 | 10 | 8 |

The Committee then adjourned.

116, Victoria Street, January 22, 1872.

PRESENT :

Sir E. Sabine in the Chair.

Mr. De La Rue.

Mr. Gassiot.

Sir C. Wheatstone.

The Director was in attendance.

The Minutes of last meeting (January 15) were read and confirmed.

Mr. Scott reported that he had forwarded a copy of the resolution contained in the last Minutes to the Astronomer Royal, and had received the following reply :—

DEAR SIR,

Royal Observatory, January 18, 1872.

I HAVE to acknowledge your letter of the 16th, conveying the request of the Meteorological Committee to be informed whether the communication of the amount of expense incurred for meteorological plates was asked by me in my private capacity, or as President of the Royal Society.

I admit the propriety of this inquiry, and reply as follows:—I disclaim any authority in connexion with the Royal Society to control the daily proceedings of the Meteorological Committee. (For precise understanding of the relation between the two bodies I am indebted to your courtesy in sending me a copy of the letter M. 3,611.) Nevertheless the close connexion implied by the original formation of the Committee, and the continued appointment of members in case of vacancy, seems to make it matter of duty in the officer representing the Royal Society to be acquainted with the general proceedings of the Committee. These, whether in action or in expense, are subjects not of private but of public interest, and are so recognised by the Committee in the publication both of its active measures and of its immediate expenses; and it would seem, therefore, that the communication of amount of another branch of expense, hitherto not known to the Committee, might now be expected by the Royal Society.

Probably if I had not become President I might not have made this inquiry, and so far the inquiry is connected with my presidential character. I should, however, be glad on other grounds to be possessed of the knowledge to which I refer. I might, perhaps, consider the propriety of thus recording the observations of this observatory, which would depend (among other elements) on the expense.

I have only to add that I am fully sensible of the respect which is due to a committee of gentlemen who have gratuitously given so much time and labour to an object whose importance with them I entirely appreciate.

R. H. Scott, Esq.

(Signed) G. B. AIRY.

Mr. Scott was instructed to furnish the information received from the Stationery Office. His reply to be approved by Mr. De La Rue and submitted to the members of the Committee before being despatched.

Read—A letter from Mr. Kerr, asking for leave of absence to go to Liverpool on private business for a few days.—Sanctioned.

Read—A letter from the captain in charge of the dockyard at Bermuda stating that the anemometer had been thoroughly repaired before the instructions from the office to send it back to England (Minutes, 1871, p. 56) had been received, and requesting permission to retain it.—Approved.

Read—A letter from Captain Toynbee, submitting an excellent log kept by Mr. C. J. Menzies (Minutes, 1871, p. 30) on board the S.S. "Austrian" and "Sarmatian," Captain Jas. Wylie (Minutes, 1870, p. 58), who have both received the Pilot Charts. Mr. Scott was instructed to convey to Captain Wylie and Mr. Menzies the marked thanks of the Committee for their excellent observations.

| Points noticed at Kew. | Aberdeen. | Armagh. | Falmouth. | Glasgow. | Kew. | Stonyhurst. | Valencia. |
|--|-----------------------------------|-----------------------------------|-----------------------------------|---|-----------------------------------|-----------------------------------|-----------------------------------|
| ANEMOGRAPH :— | | | | | | | |
| Action | Good. None. | Good. None. | Good. None. | Fair. | Good. None. | Good. | Good. None. |
| Records deficient | 25th. | 1 hr. Velocity. 23rd. | 7th. | *24hrs. each V.&D. 30th. | 28th. | †28 hrs. Velocity. | — |
| Orientation verified | | | | | | | |
| Result of 40 Remasurements :— | | | | | | | |
| Greatest difference | Direction. Velocity. 1.0 1.0 | Direction. Velocity. 1.0 1.0 | Direction. Velocity. 1.0 1.0 | Direction. Velocity. 1.0 1.0 | Direction. Velocity. 1.0 1.0 | Direction. Velocity. 1.0 1.0 | Direction. Velocity. 1.0 1.0 |
| Mean difference | 0.2 0.5 | 0.1 0.5 | 0.0 0.5 | 0.1 0.5 | 0.1 0.4 | 0.3 0.3 | 0.1 0.5 |
| Mean difference irrespective of sign | +0.1 -0.1 | 0.0 +0.1 | 0.0 -0.1 | -0.1 0.0 | -0.1 +0.1 | 0.0 0.0 | 0.0 0.0 |
| Residual difference (—Kew) | 0 0 | 0 0 | 0 1 | 0 4 | 0 0 | 0 0 | 0 19 |
| No. of errors discovered | 0 | 0 | 0 | 0 | 0 | 0 | 8 |
| Do. in Rain entry | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| BAROGRAPH :— | | | | | | | |
| Action | Good. Do. | Good. Do. | Good. Do. | Good. Do. | Good. Do. | Good. Do. | Good. Do. |
| Photography | None. | None. | †7 hrs. | §6 hrs. | 3 hrs. failure of gas. | None. | None. |
| Records deficient | | | | | | | |
| Result of 40 Remasurements :— | | | | | | | |
| Greatest difference | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 |
| Mean difference | 0.015 | 0.025 | 0.024 | 0.024 | 0.028 | 0.022 | 0.025 |
| Residual difference (—Kew) | 0.000 | +0.012 | +0.006 | +0.001 | +0.001 | +0.009 | +0.003 |
| Mean monthly difference between simultaneous barograph and barometer | 0.023 | 0.025 | 0.018 | 0.027 | 0.025 | 0.013 | 0.022 |
| No. of errors discovered in entry of standard | 0 | 2 | 0 | 1 | 0 | 1 | 3 |
| „ in calculating residual correction | 0 | 0 | 2 | 2 | 0 | 0 | 1 |
| „ in applying residual correction | 0 | 0 | 0 | 2 | 0 | 0 | 2 |
| „ in tabulation | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| THERMOGRAPH :— | | | | | | | |
| Action | Good. Do. | Good. Do. | Good. Do. | Good. Do. | Good. Do. | Good. Do. | Good. Do. |
| Photography | 25 hrs. W. through frost. | 26 through frost. | 18 hrs. by frost. | 3 hrs. to frost, and 2 hrs. each D.&W. by failure of gas. | 29 hrs. by frost. | 12 hrs. by frost. | None. |
| Records deficient | 5 do. insufficient water. | | | | | | |
| Result of 40 Remasurements :— | | | | | | | |
| Greatest difference | Direction. Velocity. 0.20 0.20 | Direction. Velocity. 0.20 0.30 | Direction. Velocity. 0.20 0.20 | Direction. Velocity. 0.30 0.30 | Direction. Velocity. 0.10 0.10 | Direction. Velocity. 0.20 0.20 | Direction. Velocity. 0.30 0.30 |
| Mean difference | 0.09 0.11 | 0.12 0.11 | 0.08 0.11 | 0.12 0.15 | 0.04 0.05 | 0.10 0.12 | 0.12 0.15 |
| Mean difference irrespective of sign | -0.03 -0.04 | -0.12 -0.04 | 0.00 +0.07 | +0.06 +0.07 | -0.01 -0.01 | +0.01 +0.01 | +0.06 +0.07 |
| Residual difference (—Kew) | 0.10 0.18 | 0.11 0.14 | 0.11 0.10 | 0.13 0.11 | 0.13 0.11 | 0.11 0.15 | 0.33 0.23 |
| Mean monthly difference between simultaneous thermograph and thermometer | 0 0 | 1 0 | 0 0 | 0 0 | 0 0 | 0 0 | 2 2 |
| No. of errors discovered in entry of standard | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| „ discovered by subsidiary measurements | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| „ in maximum and minimum | 0 | 1 | 0 | 0 | 0 | 0 | 8 |
| „ in tabulation | 2 | 0 | 0 | 0 | 0 | 0 | 0 |

* Observer inattentive to the recording pencils.

† Velocity rod loose.

‡ 2 hrs. owing to the stoppage of clock, and 5 hrs. through lamp glass being blackened.

§ 6 hrs. lost through stoppage of clock.

The Committee then adjourned.

116, Victoria Street, January 29, 1872.

PRESENT :

Sir E. Sabine in the Chair.

Mr. De La Rue.
Mr. Galton.

Mr. Gassiot.
Admiral Richards.

Mr. Spottiswoode.

The Director was in attendance.

The Minutes of last meeting (January 22) were read and confirmed.

Mr. Scott reported that pursuant to the directions given at last meeting, the following reply had been sent to the Astronomer Royal, the approval of every member of the Committee having first been obtained.

DEAR SIR,

I AM instructed by the Committee to inform you, in reply to your letter of the 18th, that the Controller of the Stationery Office has intimated to them in his letter of the 11th inst., that the cost of transferring and lithographing the plates for the seven observatories in the Report is 88*l.* 3*s.* 1*d.* per quarter, or 352*l.* 12*s.* 4*d.* per annum.

I am to draw your attention to the fact that this estimate is framed on the cost of the first two quarters for 1870, being the latest for which the accounts have been received at the Stationery Office. These very plates have been executed at a far cheaper rate than those for the year 1869, owing to the various mechanical appliances invented by members of the Committee and adopted in the office in order to effect certain necessary corrections which had previously been carried out at the lithographic establishment.

The methods of reproduction of the curves have been gradually improved, so that the cost of the plates for Part III. 1870, which will be in your hands very shortly, will be further reduced owing to the completion of the plates under my immediate superintendence here.

Whenever you do this office the honour of visiting it, as you propose to do, I shall be happy to show you the several instruments, and explain the precautions which we have been obliged to take to ensure the perfect accordance with each other of so large a number as seven independent records.

Submitted the following letter :

Royal Observatory, Greenwich,
1872, January 22.

DEAR SIR,

AT the meeting of the Council of the Royal Society on the 18th instant, I submitted for the consideration of the Council, the question of charging the Royal Observatory of Greenwich with those meteorological observations which are at present carried on at Kew Observatory for the purposes of the Meteorological Committee, and for which at present a subvention of 250*l.* annually is paid by the Government.

At the suggestion of the officers of the society, my paper addressed to the council had been printed ; and I now enclose a copy, which I request you to lay before the Meteorological Committee.

It will be perceived that my idea was (and I still judge it most probable) that the selection of observatories had been made by the Royal Society, and therefore that all remarks on them ought to be addressed to that Society. Some doubts, however, having been expressed on that subject, I most willingly undertook to communicate my proposal to the Meteorological Committee also, a course which, under any circumstances, I should have considered at some time indispensable.

Should the Royal Observatory be charged, as I propose, with the observations in question, the Meteorological Committee may be assured that the most careful attention will be given to their requirements.

R. H. Scott, Esq.

I am, &c.
G. B. AIRY.

[*Confidential, for the use of the members of the Council of the Royal Society only.*]

The President submits the following remarks to the Council:—

The institution and discussion of extensive meteorological observations has been undertaken by Her Majesty's Government mainly at the instance of the President and Council of the Royal Society. The Meteorological Committee is virtually a committee of the council, and the annual accounts of expenditure are published by that committee. These circumstances appear to leave it perfectly within the competence of the President to remark on the nature of some parts of the outlay incurred in prosecuting the objects of the Meteorological Committee.

Among the expenses is an annual grant of 250*l.* to the Kew observatory for meteorological observations made there as at one of the stations of the Meteorological Committee. Now, in estimating the propriety of this grant, it is to be remarked that within a few miles of Kew is the Meteorological Department of the Royal Observatory of Greenwich, instituted by Her Majesty's Government several years before the establishment of that of Kew, maintained by the Government at considerable expense, more complete in its equipment than the Kew Observatory, at least equal to it in the excellence of its instruments, and under the most careful daily superintendence, and perfectly able to furnish to the Meteorological Committee, at insignificant expense, all that is now furnished with an annual expense of 250*l.* to the Government.

It cannot, I think, be considered right still to load the Government with this unnecessary expense. And I propose to the council that steps be immediately taken for the transference, to the Royal Observatory, of the observations in conjunction with the Meteorological Committee now taken at Kew. As superintendent of the Royal Observatory, I engage that everything practicable shall be done to render its observations available to the Meteorological Committee.

My remarks do not in any degree apply to other expenses incurred at Kew for the Meteorological Committee, to which, on general grounds, I see no objection.

G. B. AIRY.

January 1872.

After the consideration of various drafts proposed by the several members of Committee, Mr. Scott was directed to prepare a reply in accordance with the general opinions expressed, and to forward it to Mr. Airy.

Read—A letter from Captain Toynbee, submitting an excellent log, kept by Captain S. Brooks, S.S. "City of Brooklyn" (Minutes, 1869, p. 103; 1871, p. 3).

Mr. Scott was instructed to convey to Captain Brooks the marked thanks of the Committee for his excellent observations.

Mr. Scott mentioned to the Committee that he proposed, with their approval, to make an application to the Government Grant Committee for a sum of money to be expended in testing various anemometers in the Old Deer Park at Richmond.—Approved.

Reported—That the Daily Weather Report had been supplied to the Provost of Nairn for exhibition.

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

The following cheques for January were drawn:—

For Office:

| | | | | | £ | s. | d. |
|-----------------------------------|---|---|---|---|----|----|----|
| R. H. Scott | - | | | | 66 | 13 | 4 |
| J. S. Harding, jun. | - | | | | 15 | 16 | 8 |
| J. S. Harding, sen. | - | | | | *7 | 14 | 0 |
| T. D. Bell | - | | | | *4 | 1 | 9 |
| Davey, Thompson, and Alder, coals | - | - | - | - | 4 | 12 | 0 |
| J. Merrin, blinds | - | - | - | - | 4 | 12 | 9 |
| G. Taylor, gas fittings | - | - | - | - | 20 | 1 | 7 |
| Wickwar & Co., paper trays | - | - | - | - | 3 | 7 | 6 |
| Williams & Norgate, books | - | - | - | - | 2 | 4 | 6 |

For Observatories:

| | | | | | | | | | |
|-------------------------------|---|---|---|---|----|----|---|----|------|
| T. Kerr, Valencia, expenses | - | - | - | - | 56 | 0 | 0 | | |
| Do. salary for January | - | - | - | - | 20 | 16 | 8 | | |
| | | | | | | | | 76 | 16 8 |
| E. Stanford, advertisements | - | - | - | - | - | - | - | 5 | 16 6 |
| R. & J. Beck, zinc plates, &c | - | - | - | - | 18 | 2 | 9 | | |
| Do. instruments | - | - | - | - | 80 | 3 | 0 | | |
| | | | | | | | | 98 | 5 9 |
| R. H. Curtis | - | | | | | | | 9 | 3 4 |
| F. C. Steventon | - | | | | | | | 8 | 6 8 |
| C. Stodart | - | | | | | | | *8 | 0 0 |
| T. E. Allen | - | | | | | | | *6 | 0 0 |
| E. Magrath | - | | | | | | | *6 | 0 0 |
| J. P. Cutts | - | | | | | | | *3 | 10 0 |
| Computations, &c. | | | | - | - | - | - | | |

Carried forward - - £351 3 0

* Four weeks to the 27th.

| | £ | s. | d. |
|--|------|----|----|
| Brought forward | 351 | 3 | 0 |
| For Telegraphy : | | | |
| N. J. Holmes, Scilly Islands Company, December | 3 | 3 | 9 |
| S. M. Clare, Submarine Company, November | 17 | 14 | 4 |
| Do. do. December | 17 | 6 | 9 |
| | 35 | 1 | 1 |
| A. Adie, thermometer screen | 1 | 17 | 6 |
| F. Gaster | † | 17 | 9 |
| F. Brodie | † | 4 | 13 |
| G. G. Francis | † | 5 | 9 |
| R. Sargent | † | 3 | 6 |
| Computations, &c. | | | |
| | | | |
| For Ocean Meteorology : | | | |
| H. Toynbee, Marine Superintendent | 33 | 6 | 8 |
| Elliott Brothers, repairing "A" instruments | 4 | 12 | 0 |
| J. J. Hicks, " | 19 | 12 | 8 |
| Negretti & Zambra, " | 10 | 8 | 6 |
| S. Jeffery, Kew, "A" verifications | 9 | 12 | 0 |
| Do. M.O. " | 18 | 17 | 0 |
| | 28 | 9 | 0 |
| P. Adie, repairing "M.O." instruments | 13 | 16 | 0 |
| L. P. Casella, D.S. thermometers | 6 | 17 | 6 |
| E. Higgs, packing cases | 15 | 7 | 3 |
| R. Rivière, binding Pilot Charts | 6 | 6 | 0 |
| McGregor & Co., Glasgow agents | 8 | 3 | 6 |
| H. J. Smart, Liverpool agent | 17 | 0 | 0 |
| E. Stanford, advertisements | 4 | 9 | 0 |
| W. Salmon | 20 | 0 | 0 |
| R. Strachan | † | 18 | 6 |
| C. Harding | † | 12 | 10 |
| J. A. Curtis | † | 6 | 0 |
| W. G. James | † | 6 | 0 |
| J. W. McVeagh | † | 2 | 16 |
| Computations, &c. | | | |
| | | | |
| For Office Expenses : | | | |
| J. S. Harding, jun., on account | 80 | 0 | 0 |
| Total | £736 | 4 | 8 |

* Four weeks to the 27th.

† Including allowance for extra attendance.

‡ Including allowance for care of instruments.

The Committee then adjourned.

116, Victoria Street, February 5, 1872.

PRESENT:

Sir E. Sabine in the Chair.

Mr. De La Rue.

Mr. Spottiswoode.

The Director was in attendance.

The Minutes of last meeting (Jan. 29) were read and confirmed.

Mr. Scott reported that he had forwarded the following letter to the Astronomer Royal on 2nd inst., as directed at last meeting.

DEAR SIR,

IN reply to your letter of 22nd ult., I am directed to state in the first place, with reference to the second and third paragraphs in that letter, that the Meteorological Committee are not *officially* informed of what may have taken place at the council of the Royal Society on 18th ult.

They consider that the relations between the Society and themselves are fully and explicitly defined in the correspondence contained in Parliamentary paper No. 240, 1867, and in the "Report of a Committee appointed to consider certain questions relating to the Meteorological Department of the Board of Trade, &c.," presented to Parliament in 1866, where the original letter from the president and council of the Royal Society, dated June 15th, 1865, has been reprinted (App. p. III.).

In this Report you will find the original recommendation of the Kew observatory as the central observatory of the land meteorology of the British islands, and a summary of the relative duties and responsibilities of the central observatory, and of the five* affiliated observatories to be established in different parts of the British islands, and to be supplied with S. R. instruments verified and compared with the Kew standards. The scheme thus originally suggested, and afterwards examined and approved by a committee appointed at the request of the Board of Trade, was adopted by Her Majesty's Government, and is carried out by the Meteorological Committee.

It is not in the opinion of the Committee their duty to report to the council of the Royal Society any portion of their proceedings. As a matter of courtesy, however, a copy of their Minutes, which are printed but not published, is forwarded annually to the Society. A full report is regularly sent to the Board of Trade, which is subsequently presented to Parliament, by which body the requisite funds for carrying on the whole of their establishment are voted.

The Committee would express their well-considered opinion, that it would not be possible for them to retain Kew as an efficient establishment for the control of their other observatories, and for the verification of meteorological instruments, unless the various operations of a continuously recording meteorological observatory were carried on there.

It is an essential part of any system, such as theirs is, that the normal observatory should be controlled by an independent unpaid governing body, and should not be connected with an official paid department of the Government, over which they have no power.

In conclusion I am directed to add, that the Committee do not consider it their province to enter into any discussion with the head of any other observatory, of the suggestion contained in paragraph III. of your enclosure, wherein you proposed "to the council of the Royal Society that steps be immediately taken for the transference to the Royal Observatory of the observations in conjunction with the Meteorological Committee now taken at Kew, &c.," but will be ready to advise the Board of Trade, under which department they act, if they should be consulted in the matter.

G. B. Airy, Esq.

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

Read—A letter from M. Fjord of Copenhagen (Minutes, 1871, p. 46), stating that it was nearly decided that a Meteorological Institute should be established in Denmark in the course of the spring.

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

Capt. J. Bruce, ship "City of Adelaide" (Minutes, 1871, p. 13).

Capt. T. E. Hassell, ship "Mervyn" (Minutes, 1870, p. 76).

Capt. Clement Mossop, ship "Candahar" (Minutes, 1870, p. 72; 1871, p. 20).

These gentlemen having already received the Pilot Charts, Mr. Scott was instructed to convey to them the best thanks of the Committee.

Mr. Scott requested permission to alter the arrangements as to the issue of Telegraphic Intelligence of Storms, in so far as to have the drum kept up for 48 hours instead of 36 hours, as heretofore. In any case when in the opinion of the Office the storm was over orders to be issued to lower the drum.

* Subsequently increased to six.

Submitted—An application from the Observatoire de Montsouris, Paris, for certain observations from Kew for the months of November and December 1870 and 1871, to be inserted in the “Nouvelles Météorologiques.” Mr. Scott was authorised to supply the data.

Submitted—The results of the discussion of Anemograph Records from Orkney for six years (Minutes, 1869, p. 103). Mr. Scott was instructed to forward them to Dr. Robinson for his opinion before printing them.

Reported—That the Daily Weather Report had been supplied to Mr. H. M. Brunel, C.E.

The Committee then adjourned.

116, Victoria Street, February 12, 1872.

PRESENT :

Sir E. Sabine in the Chair.

Mr. De La Rue.

Sir C. Wheatstone.

The Director was in attendance.

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

Submitted—The following letter :—

DEAR SIR,

Royal Observatory, Greenwich,
February 8th, 1872.

I HAVE not yet succeeded in procuring the two papers (of 1866 and 1867) to which you refer in your letter of February 2d, and would ask if you could lend them for a day or two.

On other points I would only assure you that I make no claim of interference with the proceedings of the Meteorological Department, and that I have no feeling but one of respect towards the Meteorological Committee.

But the question of original organization, which naturally was not determined by them, appears to be open to me. The opinion which you cite, on the necessity of retaining Kew as an active observatory, is worthy of the most respectful attention, however much it may differ from my own.

Will there be any objection to my reading your letter at the Council of the Royal Society on February 15th ?

R. H. Scott, Esq.

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

Mr. Scott was instructed to reply that the Committee had no objection to Mr. Airy's reading their letter as proposed by him.

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

Captain A. Campbell, S.S. “Europa” (Minutes, 1871, p. 47),

Captain John A. Martyn, S.S. “Java” (Minutes, 1869, pp. 21, 61 ; 1870, pp. 21, 76 ; 1871, pp. 13, 40),

Captain Thos. Watkins, barque “Emulation ;”

and recommending Captain Watkins for the Pilot Charts.

Resolved—That Captains Campbell and Martyn be thanked, and that the Pilot Charts be presented to Captain Watkins.

Read—A letter from M. C. Ste. Claire Deville, stating that he would be very much obliged if he could receive regularly from the Office the observations from Kew for the Nouvelles Météorologiques, as described in last Minutes.—Request acceded to.

Mr. Scott reported that the office had received two publications, one issued by the Norddeutsche Seewarte, on the routes for steamers crossing the Atlantic, and the other by the Royal Meteorological Institute of the Netherlands, on the routes for steamers between Aden and the Straits of Sunda, and he stated that Captain Toynbee and he himself were of opinion that a translation of the more important portions of these investigations would be of value to the British seafaring public.

He was authorised to prepare such a translation, and issue it as Non-official Paper No. 4.

The Committee then adjourned.

116, Victoria Street, February 19, 1872.

PRESENT :

Sir E. Sabine in the Chair.

Mr. De La Rue.
Mr. Galton.

Mr. Gassiot.
Mr. Spottiswoode.

The Director was in attendance.

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

Read—A letter from Dr. Robinson stating his approval of the discussion of the anemometrical results from Orkney (Minutes, February 5).

Mr. Scott was instructed to print the paper as an Appendix to the Quarterly Weather Report for 1871.

Mr. Scott submitted specimens of Daily Weather Charts, and was instructed to adopt for publication one in which the various elements were represented on four separate small charts.

Read—A letter from Capt. Toynbee submitting an excellent log by Capt. A. Simpson, schooner "Traveller." (Minutes, 1871, p. 13.)

Resolved—That the marked thanks of the Committee be given to Capt. Simpson, who has received the Pilot Charts.

Mr. H. Willoughby Woodward was appointed a temporary clerk, at a salary of 1*l*. per week.

Reported—That applications for telegraphic weather intelligence from Boscastle, Dunmore East, Guernsey, Wisbech, and Scilly, having been approved by the Board of Trade, these stations had been added to the list of places warned.

| 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. | *6 V. and 1 D. | None. |
| Orientation verified - - - | 31st. | — | 23rd. | — | 29th. | 25th. | — |
| Result of 40 Remasurements :— | | | | | | | |
| Greatest difference - - - | Direction. Velocity. | Direction. Velocity. | Direction. Velocity. | Direction. Velocity. | Direction. Velocity. | Direction. Velocity. | Direction. Velocity. |
| Mean difference irrespective of sign - - - | 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 |
| Residual difference (— Kew) - - - | 0.3 0.5 | 0.2 0.6 | 0.1 0.5 | 0.1 0.6 | 0.1 0.2 | 0.1 0.4 | 0.1 0.5 |
| No. of errors discovered - - - | -0.2 -0.1 | 0.0 +0.1 | -0.2 -0.3 | 0.0 -0.2 | -0.1 -0.1 | 0.0 -0.1 | 0.0 +0.1 |
| | 0 0 | 0 0 | 0 0 | 0 0 | 0 0 | 0 0 | 1 30 |
| 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. | †11 hourly values. |
| Result of 40 Remasurements :— | | | | | | | |
| Greatest difference - - - | ·0050 | ·0050 | ·0050 | ·0050 | ·0050 | ·0050 | ·0040 |
| Mean difference irrespective of sign - - - | ·0018 | ·0024 | ·0019 | ·0025 | ·0024 | ·0021 | ·0014 |
| Residual difference (— Kew) - - - | + ·0006 | + ·0016 | - ·0013 | + ·0009 | - ·0003 | - ·0003 | + ·0003 |
| Mean monthly difference between simultaneous barograph and barometer - - - | ·0025 | ·0026 | ·0025 | ·0028 | ·0023 | ·0013 | ·0024 |
| No. of errors discovered in entry of standard - - - | 0 | 0 | 0 | 1 | 0 | 0 | 2 |
| " in calculating residual correction - - - | 0 | 0 | 0 | 2 | 0 | 0 | 7 |
| " in applying residual correction - - - | 0 | 0 | 1 | 1 | 4 | 0 | 1 |
| " 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 - - - | None. | 2 hrs. dry bulb. | None. | §79 D. & 31 W. | 2 hrs. wet bulb. through frost. | 1 hr. wet bulb. by frost. | 2 hrs. wet bulb. insufficient water. |
| Result of 40 Remasurements :— | | | | | | | |
| Greatest difference - - - | Wet. 0.30 | Wet. 0.30 | Wet. 0.20 | Wet. 0.30 | Wet. 0.10 | Wet. 0.20 | Wet. 0.30 |
| Mean difference irrespective of sign - - - | 0.11 0.14 | 0.10 0.14 | 0.09 0.09 | 0.13 0.17 | 0.05 0.04 | 0.09 0.11 | 0.12 0.14 |
| Residual difference (— Kew) - - - | -0.01 -0.08 | +0.05 +0.06 | 0.00 -0.04 | -0.06 -0.09 | 0.00 0.00 | +0.09 +0.11 | -0.11 -0.14 |
| Mean monthly difference between simultaneous thermograph and thermometer - - - | 0.12 0.14 | 0.13 0.13 | 0.09 0.09 | 0.12 0.13 | 0.11 0.13 | 0.11 0.15 | 0.28 0.16 |
| No. of errors discovered in entry of standard - - - | 0 0 | 0 0 | 0 0 | 0 0 | 0 0 | 0 0 | 2 1 |
| " discovered by subsidiary measurements - - - | 0 0 | 0 1 | 0 0 | 2 1 | 0 0 | 0 0 | 1 0 |
| " in maximum and minimum - - - | 0 0 | 0 0 | 0 0 | 2 1 | 0 0 | 0 0 | 1 3 |
| " in tabulation - - - | 0 0 | 0 1 | 0 0 | 0 0 | 0 0 | 0 0 | 1 0 |

* No explanation given why the pencil marks the lower part of curve only.

† Through stoppage of clock.

‡ Through action of frost, wet bulb curve 28-30 re-tabulated at Kew.

§ 17 D. and 17 W. through stoppage of clock.
62 D. and 8 W. owing to defective action clock stop.
6 W. rendered doubtful by frost.

The Committee then adjourned.

116, Victoria Street, February 26, 1872.

PRESENT:

Sir E. Sabine in the Chair.

Sir C. Wheatstone.

The Director was in attendance.

The Minutes of last meeting (February 19) were read and confirmed.

Read—A letter from Mr. Whitehouse, proposing to supply two of his self-recording micro-barographs to be erected at two of the distant telegraphic stations in connexion with the office.

Mr. Scott was instructed to reply that prior to accepting Mr. Whitehouse's liberal offer, the Committee would wish to have one of the instruments tested for a time at Kew.

Submitted—The Quarterly Weather Report for 1870, Part III.

The following cheques for February were drawn:—

For Office:

| | £ | s. | d. |
|----------------------------------|----|----|----|
| R. H. Scott | 66 | 13 | 4 |
| J. S. Harding, jun. | 15 | 16 | 8 |
| J. S. Harding, sen. | *7 | 14 | 0 |
| T. D. Bell | *4 | 0 | 0 |
| C. Gilman, gas, December quarter | 4 | 19 | 6 |
| J. H. Parsons, office fittings | 10 | 10 | 8 |
| Asher & Co., books | 2 | 3 | 0 |

For Observatories:

| | | | |
|--------------------------------|----|----|---|
| T. Kerr, Valencia, salary | 20 | 16 | 8 |
| Hopkin and Williams, chemicals | 21 | 14 | 3 |
| Malby and Sons, printing, &c. | 46 | 8 | 0 |
| R. H. Curtis | 9 | 3 | 4 |
| F. C. Steventon | 8 | 6 | 8 |
| C. Stodart | *8 | 0 | 0 |
| T. E. Allen | *6 | 0 | 0 |
| E. Magrath | *6 | 0 | 0 |
| J. P. Cutts | *3 | 10 | 0 |

For Telegraphy:

| | | | |
|-----------------------------------|-----|----|----|
| N. J. Holmes, Scilly Co., January | 3 | 5 | 0 |
| Postmaster General, private wire | 22 | 0 | 0 |
| F. Gaster | †13 | 6 | 8 |
| F. Brodie | *†4 | 16 | 10 |
| G. G. Francis | *†5 | 2 | 9 |
| R. Sargent | *3 | 5 | 10 |

For Ocean Meteorology:

| | | | |
|-------------------------------------|-----|----|---|
| H. Toynbee, Marine Superintendent | 33 | 6 | 8 |
| F. Pastorelli, altering rain gauges | 4 | 4 | 0 |
| W. Salmon | 20 | 0 | 0 |
| R. Strachan | †18 | 6 | 8 |
| C. Harding | †12 | 10 | 8 |
| J. A. Curtis | *6 | 0 | 0 |
| W. G. James | *6 | 0 | 0 |
| J. W. McVeagh | *2 | 16 | 0 |

For Office Expenses:

| | | | |
|---------------------------------|----|---|---|
| J. S. Harding, jun., on account | 60 | 0 | 0 |
|---------------------------------|----|---|---|

Total - - - - £456 17 2

* Four weeks to the 24th.

† Including allowance for extra attendance.

‡ " " care of instruments.

The Committee then adjourned.

116, Victoria Street, March 4, 1872.

PRESENT :

Sir E. Sabine in the Chair.

Mr. De La Rue.
Mr. Galton.

Mr. Gassiot.
Admiral Richards.

The Director was in attendance.

The Minutes of last meeting, February 26, were read and confirmed.

Read—A letter from Captain Toynbee, submitting excellent logs by Captain James Hayes, S.S. "Camoens" (Minutes 1869, p. 53; 1870, pp. 38, 76; 1871, p. 10), Captain G. Olive Hayward, S.S. "Durley."

Mr. Scott was instructed to convey to the above gentlemen the marked thanks of the Committee for their registers.

Submitted—An application from the Briton Ferry Dock Office for the loan of a fishery barometer.—Granted.

Mr. Scott reported that he had received from the Board of Trade an official intimation that the Italian Government were establishing semaphore stations on the coast of Italy, and that it was intended that meteorological observations should be taken at these stations.

The Committee then adjourned.

116, Victoria Street, March 18, 1872.

PRESENT :

Sir E. Sabine in the Chair.

Mr. De La Rue.
Mr. Galton.

Mr. Gassiot.
Mr. Spottiswoode.

The Director was in attendance.

The Minutes of last meeting, March 4, were read and confirmed.

Reported—That the issue of the Daily Weather Charts had been commenced on Monday the 11th inst., and that the following circulars A. and B. had been issued with it :—

SIR,

A.

I AM instructed to inform you that the Meteorological Committee propose to issue lithographed Charts illustrative of the Daily Weather Report.

Such Charts can be delivered in London, within a reasonable distance from the office of the printer (in Lincoln's Inn Fields), between 1 and 2 o'clock p.m., or posted in time for the evening despatch to the country.

(The Charts for Sundays cannot be delivered before Tuesday morning, as the office is closed on Sunday.)

The cost of delivery of the Charts by hand, and of postage, will entail some outlay, which it will be necessary for the recipients of the Charts to defray.

These charges it is proposed to meet by a subscription, payable in advance, of

Ten shillings per quarter for a copy to be delivered by hand before 2h. p.m.

Five shillings per quarter for a copy sent by book-post.

The Charts will be sent gratuitously until the 31st of March.

If you should wish to receive them you will please to let me know, stating the number of copies you will require. The subscription will cover any reasonable number of copies.

The Committee reserve to themselves the right of declining to supply copies by hand on the ground of distance.

(FREE.)

SIR,

B.

I AM instructed to inform you that the Meteorological Committee propose to issue lithographed Charts illustrative of the Daily Weather Report.

Such Charts could be delivered at your office between 1 and 2 o'clock p.m.

The Charts for Sundays cannot be supplied before the Tuesdays, as the Meteorological Office is closed on Sundays.

The Charts will be sent regularly until the 31st of March; should you wish to receive them after that date, I must request you to inform me, and to state the number of copies you will require.

Of circular A. 163 copies had been issued to the public, and of circular B. 23 copies to public offices.

The number of subscribers' names already received amounted to 23, and 6 public offices had also requested to be supplied with the Charts.—Approved.

Mr. Scott reported that he found that the postage of three copies would be covered by one halfpenny, so that he had fixed that number to be the "reasonable" number for postal delivery mentioned in circular A.—Approved.

Mr. Scott reported that the Astronomer Royal had expressed a wish to have a copy free, and that he had supplied it.—Approved.

Reported—That a copy of the Minutes of the Committee for 1871 had been forwarded to the Board of Trade and to the Royal Society respectively, as in former years.—Approved.

Mr. Scott was instructed to have a wood block of the Vapour Tension Instrument engraved, for the insertion of a description of the instrument in the Annual Report.

Resolved—That the sum of 2,000*l.* be transferred from the deposit account of the Committee to their current account in the Bank of England.

| Points noticed at Kew. | Aberdeen. | Armagh. | Falmouth. | Glasgow. | Kew. | Stonyhurst. | Valencia. |
|--|----------------------|-----------------------------------|----------------------|--|----------------------|----------------------|--|
| ANEMOGRAPH :— | | | | | | | |
| Action | Good. | Good. | Good. | Fair. | Good. | Good. | Good. |
| Records deficient | None. | None. | * 1 hr. V. & D. | — | None. | None. | None. |
| Orientation verified | — | — | 26th. | — | 28th. | 23rd. | 28th. |
| Result of 40 Remeasurements :— | | | | | | | |
| Greatest difference | Direction. Velocity. | Direction. Velocity. | Direction. Velocity. | Direction. Velocity. | Direction. Velocity. | Direction. Velocity. | Direction. Velocity. |
| Mean 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 |
| Residual difference | 0.1 0.5 | 0.2 0.4 | 0.1 0.4 | 0.2 0.5 | 0.1 0.3 | 0.1 0.4 | 0.1 0.5 |
| No. of errors discovered | +0.1 +0.1 | -0.2 -0.2 | -0.1 +0.1 | 0.0 -0.2 | 0.0 +0.1 | -0.1 -0.2 | -0.1 -0.1 |
| Errors in tabulating rain-curve | 0 0 | 2 2 | 0 0 | 6 6 | 0 0 | 0 1 | 1 4 |
| BAROGRAPH :— | | | | | | | |
| Action | Good. | Good. | Good. | Good. | Good. | Good. | Fair. |
| Photography | Do. | Do. | Do. | Fair. | Do. | Fair. | Good. |
| Records deficient | None. | None. | None. | 13 hrs. by stoppage of clock. | None. | None. | 24 hrs. lost by stoppage of clock and defect of shuttle. |
| Result of 40 Remeasurements :— | | | | | | | |
| Greatest difference | Direction. Velocity. | Direction. Velocity. | Direction. Velocity. | Direction. Velocity. | Direction. Velocity. | Direction. Velocity. | Direction. Velocity. |
| Mean difference | 0.050 0.050 | 0.050 0.050 | 0.050 0.050 | 0.050 0.050 | 0.050 0.050 | 0.050 0.050 | 0.040 0.040 |
| Residual difference | 0.020 0.020 | 0.017 0.017 | 0.015 0.015 | 0.023 0.023 | 0.014 0.014 | 0.022 0.022 | 0.011 0.011 |
| No. of errors discovered | 0.000 0.000 | +0.010 0.010 | 0.000 0.000 | +0.005 0.005 | +0.006 0.006 | -0.013 0.013 | -0.001 0.001 |
| Mean monthly difference between simultaneous barograph and barometer | 0.017 0.017 | 0.024 0.024 | 0.022 0.022 | 0.025 0.025 | 0.023 0.023 | 0.014 0.014 | 0.024 0.024 |
| No. of errors discovered in entry of standard | 0 0 | 0 0 | 0 0 | 1 1 | 1 1 | 0 0 | 0 0 |
| " in calculating residual correction | 1 1 | 1 1 | 1 1 | 0 0 | 0 0 | 0 0 | 2 2 |
| " in applying residual correction | 0 0 | 0 0 | 0 0 | 4 4 | 0 0 | 0 0 | 2 2 |
| " in tabulation | 0 0 | 0 0 | 0 0 | 0 0 | 0 0 | 0 0 | 2 2 |
| Discovered in subsidiary tables | 0 0 | 0 0 | 0 0 | 0 0 | 1 1 | 1 1 | 0 0 |
| THERMOGRAPH :— | | | | | | | |
| Action | Good. | Good. | Good. | Good. | Good. | Good. | Good. |
| Photography | Do. | Do. | Do. | Do. | Do. | Do. | Do. |
| Records deficient | 5 hrs. Wet by frost. | 1 hr. Dry and Wet failure of gas. | None. | 11 hrs. D. & W. by stoppage of clock and 1 hr. W. out of action. | † 1 hr. D. and 6 W. | None. | 1 hr. D. & W. by stoppage of clock. 1 hr. W. not in proper action. |
| Result of 40 Remeasurements :— | | | | | | | |
| Greatest difference | Direction. Velocity. | Direction. Velocity. | Direction. Velocity. | Direction. Velocity. | Direction. Velocity. | Direction. Velocity. | Direction. Velocity. |
| Mean difference | 0.20 0.20 | 0.20 0.20 | 0.20 0.20 | 0.30 0.30 | 0.10 0.10 | 0.20 0.20 | 0.30 0.30 |
| Residual difference | 0.09 0.12 | 0.10 0.12 | 0.08 0.11 | 0.16 0.18 | 0.04 0.05 | 0.08 0.11 | 0.12 0.13 |
| No. of errors discovered | -0.04 +0.01 | +0.05 +0.05 | +0.08 +0.11 | +0.08 +0.12 | +0.03 +0.01 | +0.00 +0.01 | -0.06 -0.06 |
| Mean monthly difference between simultaneous thermograph and thermometer | 0.12 0.15 | 0.14 0.14 | 0.07 0.08 | 0.11 0.14 | 0.10 0.12 | 0.11 0.14 | 0.26 0.18 |
| 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 0 | 0 0 | 0 0 | 0 0 | 0 0 | 0 0 | 0 0 |
| " in maximum and minimum | 0 0 | 0 0 | 0 0 | 1 1 | 0 0 | 0 0 | 1 7 |
| " in tabulation | 0 0 | 0 0 | 0 0 | 1 1 | 0 0 | 0 0 | 0 0 |

The Committee then adjourned.

* Pencils not in contact.

† Velocity lost through the trace being invisible, and the direction owing to the vane being out of order.

‡ 1 hr. each by stoppage of clock, and 5 hrs. W. by blackening of lamp glass.

116, Victoria Street, March 26th, 1872.

PRESENT :

Sir E. Sabine in the Chair.

Mr. De La Rue.

Sir C. Wheatstone.

Mr. Gassiot.

The Director was in attendance.

The Minutes of last meeting (March 18) were read and confirmed.

Reported—That a letter had been received from Col. H. Ponsonby stating that the Daily Weather Charts might be forwarded regularly to Her Majesty the Queen.

Resolved—That the Daily Charts be supplied free of charge to the Royal United Service Institution, the Meteorological Society, and to Prof. Balfour Stewart (in consideration of his services as Secretary to the Committee).

Read—A letter from Captain Toynbee, submitting an excellent log by Capt. H. Henderson, barque "Hope" (Minutes, 1868, p. 60; 1869, p. 53; 1870, p. 36; 1871, pp. 44 and 61).

Mr. Scott was instructed to convey to Capt. Henderson the marked thanks of the Committee for his valuable observations.

The following cheques for March were drawn :—

For Office :

| | | £ | s. | d. |
|---------------------------------|----------------------|-----|----|----|
| R. H. Scott | - | 66 | 13 | 4 |
| J. S. Harding, jun. | } Salaries and wages | 15 | 16 | 8 |
| J. S. Harding, sen. | | *9 | 12 | 6 |
| T. D. Bell | | *5 | 0 | 0 |
| C. W. Jacques, rent for quarter | - | 133 | 13 | 0 |
| Davey, Thompson, & Co., coals | - | 4 | 12 | 0 |
| C. Dunning, office fittings | - | 19 | 3 | 6 |

For Observatories (quarterly allowances, &c.) :

| | | | | | | | | | |
|-----------------------------------|---|---|---|----|----|---|------|----|----|
| D. Thomson (Aberdeen) | - | - | - | 62 | 10 | 0 | | | |
| Less anemograph forms | - | - | - | 1 | 5 | 0 | | | |
| | | | | | | | 61 | 5 | 0 |
| T. R. Robinson (Armagh) | - | - | - | 36 | 5 | 0 | | | |
| Do. expenses for quarter | - | - | - | 6 | 14 | 2 | | | |
| | | | | | | | 42 | 19 | 2 |
| W. P. Dymond (Falmouth) | - | - | - | 66 | 5 | 0 | | | |
| Less anemograph forms | - | - | - | 1 | 5 | 0 | | | |
| | | | | | | | | | |
| | | | | 65 | 0 | 0 | | | |
| Postages for 1871 | - | - | - | 1 | 5 | 0 | | | |
| Photographs of thermometer screen | - | - | - | 1 | 0 | 6 | | | |
| Erecting S.R. rain gauge | - | - | - | 1 | 0 | 6 | | | |
| | | | | | | | 68 | 6 | 0 |
| R. Grant (Glasgow) | - | - | - | 62 | 10 | 0 | | | |
| Less anemograph forms | - | - | - | 1 | 0 | 0 | | | |
| | | | | | | | 61 | 10 | 0 |
| H. Williams (Holyhead) | - | - | - | - | - | - | 2 | 13 | 8 |
| | | | | | | | | | |
| Carried forward | - | - | - | - | - | - | £491 | 4 | 10 |

* Five weeks to 30th.

| | | | | £ | s. | d. |
|---|------------------------------|-----|-----|-------|----|----|
| | Brought forward | - | - | 491 | 4 | 10 |
| S. Jeffery (Kew) | - | - | 62 | 10 | 0 | |
| Less anemograph forms | - | - | 1 | 5 | 0 | |
| | | | 61 | 5 | 0 | |
| Examination of records | - | - | 100 | 0 | 0 | |
| | | | | 161 | 5 | 0 |
| C. Clouston (Orkney) | - | - | - | 2 | 15 | 6 |
| S. J. Perry (Stonyhurst) | - | - | 50 | 0 | 0 | |
| Less anemograph forms | - | - | 0 | 18 | 9 | |
| | | | 49 | 1 | 3 | |
| Postage during quarter | - | - | 0 | 7 | 1 | |
| | | | | 49 | 8 | 4 |
| T. Kerr (Valencia), salary | - | - | 20 | 16 | 8 | |
| Do. expenses for quarter | - | - | 41 | 13 | 0 | |
| | | | | 62 | 9 | 8 |
| G. T. Watson (Yarmouth) | - | - | - | 3 | 19 | 2 |
| R. & J. Beck, repairs to instruments | - | - | 3 | 15 | 0 | |
| Do. zinc plates | - | - | 3 | 18 | 2 | |
| Do. do. | - | - | 5 | 17 | 10 | |
| | | | | 13 | 11 | 0 |
| R. H. Curtis | - | | | 9 | 3 | 4 |
| F. C. Steventon | - | | | 8 | 6 | 8 |
| C. Stodart | - | | | *10 | 0 | 0 |
| H. W. Woodward | - | | | 4 | 6 | 8 |
| T. E. Allen | - | | | *7 | 10 | 0 |
| E. Magrath | - | | | *7 | 10 | 0 |
| J. P. Cutts | - | | | *4 | 7 | 6 |
| | Computations, &c. (4½ weeks) | - | - | | | |
| For Telegraphy (quarterly allowances, &c.): | | | | | | |
| J. Costello (Dover) | - | - | - | 3 | 6 | 0 |
| W. D. Penny (Nairn) | - | - | - | 4 | 4 | 6 |
| J. Merrifield (Plymouth) | - | - | - | 3 | 5 | 0 |
| J. Hoar (Portsmouth) | - | - | - | 3 | 8 | 0 |
| A. Smith, for Scilly | - | - | - | 3 | 19 | 2 |
| J. Trotter (Thurso) | - | - | - | 3 | 9 | 1 |
| W. Lawrence (Shetlands) | - | - | - | 3 | 12 | 8 |
| T. Robinson (Yarmouth) | - | - | - | 3 | 9 | 3 |
| Postmaster General, telegrams, December quarter | - | 363 | 13 | 3 | | |
| Do. postages, &c. 1871 | - | 2 | 8 | 0 | | |
| | | | | 366 | 1 | 3 |
| N. J. Holmes, (Shetland), August to December 1871 | - | - | - | 3 | 14 | 4 |
| Do. (Scilly), February | - | - | - | 4 | 0 | 0 |
| S. M. Clare, Submarine Company, January | - | 19 | 2 | 6 | | |
| Do. do. February | - | 19 | 11 | 0 | | |
| | | | | 38 | 13 | 6 |
| F. Gaster | - | | | +15 | 14 | 11 |
| F. Brodie | - | | | *+ 6 | 3 | 1 |
| G. G. Francis | - | | | *+ 6 | 6 | 3 |
| R. Sergeant | - | | | *+ 4 | 2 | 6 |
| | Computations, &c. | - | - | | | |
| For Ocean Meteorology: | | | | | | |
| H. Toynbee, Marine Superintendent | - | - | - | 33 | 6 | 8 |
| L. P. Casella, D.S. thermometers | - | - | 11 | 7 | 6 | |
| Do. do. | - | - | 20 | 8 | 6 | |
| | | | | 31 | 16 | 0 |
| Carried forward | - | - | - | 1,374 | 9 | 10 |

* Five weeks to 30th.

† Including allowance for extra attendance.

| | £ | s. | d. |
|---------------------------------|---|--------|------|
| Brought forward | - | 1,374 | 9 10 |
| J. R. Jones, Aberdeen agent | - | 8 | 5 4 |
| H. J. Smart, Liverpool agent | - | 11 | 6 4 |
| W. Salmon | - | 20 | 0 0 |
| R. Strachan | - | 18 | 6 8 |
| C. Harding | - | 12 | 9 3 |
| J. A. Curtis | - | 7 | 10 0 |
| W. G. James | - | 7 | 10 0 |
| J. W. McVeagh | - | 3 | 10 0 |
| Computations, &c. | | | |
| For Office Expenses: | | | |
| J. S. Harding, jun., on account | - | 70 | 0 0 |
| Total | - | £1,533 | 7 5 |

The Committee then adjourned.

116, Victoria Street, April 1, 1872.

PRESENT:

Sir E. Sabine in the Chair.

Mr. Gassiot.

Admiral Richards.

The Director was in attendance.

The Minutes of last meeting (March 25) were read and confirmed.

Mr. Scott was instructed to supply the Daily Weather Charts free of charge to the Royal Society.

Reported—That the applications for the Daily Weather Charts which had been received up to the present date were as follows:—

| | | | |
|-------------------------------------|---|---|------------------------------|
| For delivery by hand | - | - | 9, requiring 25 copies. |
| " post | - | - | 76, " 133 " |
| For free delivery to public offices | - | - | 23, " 42 " |

Mr. Scott was instructed not to advertise the charts in the daily newspapers.

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

Captain G. Rennie Stuart, ship "Otago,"

Captain W. Ellery, ship "Bowfell,"

and recommending them for presentation copies of the Pilot Charts.—Approved.

Submitted—A specimen of a chart containing all the meteorological information which had been obtained in the office for Square III. in the month of January.

Resolved—That the chart be lithographed and that 50 copies be distributed, in order to obtain opinions on the proposed method of publication of the results.

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

* Five weeks to 30th.

† Including allowance for extra attendance.

‡ Including allowance for care of instruments.

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 - | *180 | 0 | 0 |
| (with 50% additional for care of instruments.) | | | |
| F. Gaster, senior clerk - | *160 | 0 | 0 |
| C. Harding, first junior clerk - | *140 | 0 | 0 |
| R. H. Curtis, second junior clerk - | *120 | 0 | 0 |
| F. C. Steventon, junior clerk - | *110 | 0 | 0 |

The following scale of weekly salaries was approved:—

| | | | | | | | |
|--|---|-----|---|---|---|----|---|
| J. S. Harding, senior | - | - | - | - | 1 | 18 | 6 |
| T. E. Allen, increase 2s. per week | - | - | - | - | 1 | 12 | 0 |
| E. Magrath | „ | „ | „ | - | 1 | 12 | 0 |
| J. A. Curtis | „ | „ | „ | - | 1 | 12 | 0 |
| W. G. James | „ | „ | „ | - | 1 | 12 | 0 |
| C. Stodart, mechanician | - | - | - | - | 2 | 0 | 0 |
| F. Brodie, increase 2s. per week | - | - | - | - | 1 | 3 | 0 |
| G. G. Francis | „ | 3s. | „ | - | 1 | 3 | 0 |
| T. D. Bell | „ | 2s. | „ | - | 1 | 2 | 0 |
| H. W. Woodward | - | - | - | - | 1 | 0 | 0 |
| J. P. Cutts, increase 2s. 6d. per week | - | - | - | - | 1 | 0 | 0 |
| J. W. M'Veagh | „ | 2s. | „ | - | 0 | 16 | 0 |
| R. Sargeant | „ | 1s. | „ | - | 0 | 15 | 0 |

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

The Committee then adjourned.

116, Victoria Street, April 15, 1872.

PRESENT:

Mr. Spottiswoode in the Chair.

Mr. Galton.

Major-General Smythe.

Sir E. Sabine.

Sir C. Wheatstone.

The Director was in attendance.

The Minutes of last meeting (April 1) were read and confirmed.

Submitted—The following letter:—

British Association for the Advancement of Science.—Committee on Science Lectures and Organization.

SIR,

At the last meeting of the above committee held in London it was resolved—

“That a sub-committee, consisting of Sir W. Thomson, Joseph Baxendell, Esq., A. Buchan, Esq., Warren De La Rue, Esq., D. Milne Home, Esq., J. P. Joule, Esq., J. N. Lockyer, Esq., B. Stewart, Esq., Colonel A. Strange, and G. V. Vernon, Esq.; be appointed for the purpose of putting themselves into communication with the observational establishments of the United Kingdom, with the view of ascertaining from the Directors of these establishments what information, besides that which they publish, they are willing to communicate to men of science, and upon what terms.”

This sub-committee will esteem it a favour if you will assist their object by replying to the questions which they have appended to this communication.

H. E. ROSCOE, Secretary.

1. Could accurate copies of the hourly tabulated values taken from the traces of the various self-recording instruments of the Meteorological Committee be procured, and on what terms?

2. Could accurate copies of certain portions of logs relating to meteorological observations, or of any other meteorological information in the possession of the Meteorological Committee, be procured, and on what terms?

* Increase in each of these cases 10*l.* since last year. Allowance to be made to those clerks who attend at extra hours.

Mr. Scott was instructed to prepare a reply for consideration at next meeting of Committee.

Submitted—The following proposal:—

To the Meteorological Committee.

Considering the probability of a large and early demand for weather charts, possibly for insertion in the later editions of the afternoon newspapers, I would submit that it is expedient for the Committee to commence experiments on promising methods for the rapid production of equivalents to woodcuts.

With this view, I propose that experiments be made, at a cost not exceeding 15*l*. (I have made some rough ones myself), with short type, shod with iron, set in an iron tray, whose bottom has been planed flat, and which is laid on the end or on the face of, and near one end of, a large bar-magnet. The type will, under the circumstances, stand singly and erect on their small bases, in stable equilibrium, because their axes tend to conform to the lines of magnetic force; also whilst erect they can easily be slid into any desired position, so long as they are not brought too nearly alongside of one another, in which case their mutual magnetic repulsion disturbs their uprightness. Single adjacent types would, however, seldom be wanted, because our entries mainly consist of detached and often recurring words, which might be set up for the occasion, or fixed, once for all, each in its separate small, solid, iron shoe. The geographical outlines would be lightly etched on the bottom of the tray for the convenience of the clerk, who would probably sketch the design of his diagram upon it before beginning to place the type. The type for the geographical outlines would be a properly shaped riband of brass, with protruding points, to drop into holes drilled in the bottom of the tray to receive them.

The isobaric and other lines would be dotted; they would be produced by flat chains whose links admitted of easy detachment, and the pivots of whose links were prolonged upwards into short rods to act as type. Each link would overlap its neighbour on the one side and be overlapped by its other neighbour. Where it overlapped it would admit its neighbour's pivot rod through a hole; where it was overlapped it would have a pivot rod fixed into it, to pass into the hole of its other neighbour's link. Thus a chain could be readily constructed of any length, and the isobaric lines be brought, say, from the margin of the map close up to the geographical outlines; then another length of chain would be over the space corresponding to the land, and a third piece would continue the isobar over the sea beyond.

After the type had been placed, a process which would be rapidly effected, I should cause a brass plate to gently descend down vertical slides fixed to the tray, and to subside like a damper upon the type, in order to hold them steadily in position by the pressure of its weight. Then I should remove the magnet and lay the tray horizontally on a support touched below by the top of a vessel containing boiling water, and set over a gas flame. When the tray and its contents were heated I should pour with a ladle into it a measured quantity of molten fusible metal, enough to fill the tray up to within, say, from $\frac{1}{8}$ th to $\frac{1}{16}$ th of an inch of the damper. Then I should remove the vessel of hot water and turn away the gas. As soon as the tray had cooled the type would be firmly imbedded in the metal, and paper or other casts could be taken from it in the usual way.

I may add that if the exposed iron should be found liable to rust, it might be electro-plated. Also I find that type metal may easily be shod with iron by simple soft-soldering.

(Signed) FRANCIS GALTON.

13th April 1872.

Mr. Galton was authorized to make experiments as to the feasibility of his plan. Expense not to exceed 15*l*.

Submitted—"Currents and Surface Temperature Charts of the North Atlantic Ocean, from the Equator to 40° N." (Minutes, 1871, p. 10).

Mr. Scott submitted a translation which he had prepared of Bessel's paper "On the Determination of the Law of a Periodic Phenomenon," from Schumacher's *Astronomische Nachrichten*, No. 136, which he intended to insert in the next number of the Quarterly Weather Report as an appendix, and stated that, in order to introduce the modes of discussion therein recommended into the publications of the Office, he would require the temporary assistance of some gentlemen who were skilled in the use of Bessel's formulæ.

He was authorized to expend a sum not exceeding 25*l*., as suggested by him.

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

Captain G. Grigs, R.N.R., S.S. "Helvetia."

" T. Coulter Kerr, ship "Durham" (Minutes, 1871, p. 30).

" G. H. Jones, S.S. "Nile" (Minutes, 1871, p. 55).

Resolved—That the Pilot Charts be presented to Captain Grigs, and that thanks be given to the other two gentlemen.

The Committee then adjourned.

116, Victoria Street, April 29, 1872.

PRESENT :

Sir E. Sabine in the Chair.

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

Mr. Spottiswoode.
Sir C. Wheatstone.

The Director was in attendance.

The Minutes of last meeting (April 15) were read and confirmed.

Mr. Scott submitted the following draft reply to the application from the British Association committee, read at last meeting, which was adopted, and he was instructed to forward it.

I AM instructed to inform you that the Committee will be ready to afford to gentlemen recommended by the council of any recognized scientific body facilities for obtaining accurate copies of MS. meteorological information which may be in their office.

1. Accurate copies of the hourly tabulated values taken from the traces of their self-recording instruments can be supplied.

2. Accurate copies of portions of logs relating to meteorological observations, and of other meteorological information in the Meteorological Office, can be supplied.

In every instance the cost of copying must be defrayed by the applicant, who in the case of ships' logs must state whether he prefers to have the observations corrected, or to receive the corrections and apply them himself.

I am further to draw your attention to the fact that in the First Annual Report of this Committee, at p. 11, it was stated that copies of information in the Meteorological Office could be supplied on the terms mentioned in the enclosed circular, which are identical with those above mentioned. I may say that several gentlemen have availed themselves of the opportunities offered.

Reported that the imprest for 2,000*l*. (Minutes, April 1) had been received and lodged to the credit of the Committee.

Read—A letter from Capt. Toynbee submitting an excellent log kept by Capt. A. D. Fernie, ship "Sir John Lawrence," and recommending him for a presentation copy of the Pilot Charts.—Approved.

Submitted—A specimen of the chart showing the meteorological information for Square III. for the month of February.

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

| | Paid. | Estimated Liabilities. |
|--|-------------|------------------------|
| | £ s. d. | £ s. d. |
| OFFICE :— | | |
| Salaries - - - | 1,222 15 2 | — |
| Rent, fuel, &c. - - - | 629 9 11 | — |
| Contingencies - - - | 237 1 4 | 31 0 0 |
| LAND METEOROLOGY :— | | |
| Expenses at observatories - - - | 2,588 11 1 | 43 0 0 |
| New instruments for ditto - - - | 225 6 4 | — |
| Computations - - - | 807 8 2 | — |
| Telegraphy - - - | 2,393 12 6 | 368 0 0 |
| Inspections, &c. - - - | 171 18 3 | — |
| Computations - - - | 457 4 5 | — |
| OCEAN METEOROLOGY :— | | |
| Marine Superintendent - - - | 400 0 0 | — |
| Instruments, Admiralty - - - | 90 9 2 | 61 0 0 |
| Ditto Mercantile Marine - - - | 433 4 6 | 70 0 0 |
| Computations and care of instruments - - - | 903 9 8 | — |
| Totals - - - | 10,560 10 6 | 573 0 0 |

Grand total - - - £11,133 10s. 6d.

ROBERT H. SCOTT, Director.

SUBMITTED—The following STATEMENT respecting the RECORDS for MARCH 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. | None. | None. | None. | None. | * 24 hrs. V. & D. |
| Orientation verified | 30th. | — | 21. | 1st. | — | 20th. | — |
| Result of 40 Remasurements:— | | | | | | | |
| Greatest difference | Direction. Velocity. | Direction. Velocity. | Direction. Velocity. | Direction. Velocity. | Direction. Velocity. | Direction. Velocity. | Direction. Velocity. |
| Mean difference irrespective of sign | 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 |
| Residual difference (—Kew) | 0.2 0.5 | 0.1 0.4 | 0.1 0.5 | 0.1 0.4 | 0.0 0.3 | 0.2 0.3 | 0.1 0.5 |
| No. of errors discovered | 0.0 -0.1 | -0.1 +0.1 | -0.1 -0.1 | -0.1 +0.1 | 0.0 -0.1 | -0.1 -0.1 | -0.1 +0.1 |
| | 0 0 | 0 0 | 0 1 | 1 2 | 0 0 | 0 0 | 0 6 |
| BAROGRAPH:— | | | | | | | |
| Action | Good. | Good. | Good. | Good. | Good. | Good. | Good. |
| Photography | Do. | Do. | Do. | Fair. | Do. | Do. | Do. |
| Records deficient | None. | + 4 hourly values. | None. | † 8 hours lost. | None. | None. | § 14 hours lost. |
| Result of 40 Remasurements:— | | | | | | | |
| Greatest difference | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 |
| Mean difference irrespective of sign | 0.020 | 0.020 | 0.019 | 0.017 | 0.015 | 0.019 | 0.020 |
| Residual difference (—Kew) | -0.002 | +0.005 | +0.003 | -0.001 | +0.010 | -0.009 | +0.013 |
| Mean monthly difference between simultaneous barograph and barometer | 0.021 | 0.026 | 0.021 | 0.027 | 0.018 | 0.009 | 0.022 |
| No. of errors discovered in entry of standard | 0 0 | 0 0 | 0 0 | 0 1 | 0 0 | 0 2 | 0 4 |
| " in calculating residual correction | 0 1 | 11 0 | 0 0 | 3 0 | 0 0 | 2 2 | 3 0 |
| " in applying residual correction | 0 0 | 0 0 | 1 1 | 0 0 | 0 0 | 0 0 | 0 0 |
| " in tabulation | | | | | | | |
| THERMOGRAPH:— | | | | | | | |
| Action | Good. | Good. | Good. | Good. | Good. | Good. | Good. |
| Photography | Do. | Do. | Do. | Fair. | Do. | Do. | Do. |
| Records deficient | 16 hrs. by frost, 1 hr. D. & W. gas meter examined. | 10 hrs. W. by frost. | 4 hrs. W. by frost. | 119 hrs. D. & W. by stoppage of clock, 26 hrs. W. by frost. | 6 hrs. W. by frost. | 8 hrs. W. by frost. 14 " doubtful. | 1 hour W. trace invisible. |
| Result of 40 Remasurements:— | | | | | | | |
| Greatest difference | Direction. Velocity. | Direction. Velocity. | Direction. Velocity. | Direction. Velocity. | Direction. Velocity. | Direction. Velocity. | Direction. Velocity. |
| Mean difference irrespective of sign | 0.20 0.30 | 0.20 0.20 | 0.10 0.20 | 0.30 0.30 | 0.10 0.10 | 0.20 0.20 | 0.20 0.20 |
| Residual difference (—Kew) | 0.11 0.14 | 0.12 0.14 | 0.08 0.10 | 0.17 0.20 | 0.05 0.05 | 0.09 0.11 | 0.11 0.13 |
| Mean monthly difference between simultaneous thermograph and thermometer | +0.04 +0.05 | 0.00 0.00 | -0.08 -0.05 | +0.01 0.00 | +0.01 +0.01 | -0.09 -0.11 | +0.05 +0.06 |
| 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 0 | 0 0 | 0 0 | 0 0 | 0 0 | 0 0 | 0 0 |
| " in maximum and minimum | 0 0 | 1 0 | 0 0 | 0 1 | 0 0 | 0 0 | 1 0 |
| " in tabulation | | | | | | | |

* From inattention to clock.

† By stoppage of clock, 4 hours. Light falling on binding rods, 1 hour.

‡ Clock undergoing examination.

§ Clock stopped by shutter.

|| Also two day curves retabulated at Kew, but readings are still doubtful.

Mr. De La Rue and Major-General Smythe were requested to act as auditors for the annual accounts.

Reported—That Edwin Magrath had handed in a medical certificate stating that a sea voyage would be requisite to restore him to health.

Mr. Scott was instructed to communicate with the gentleman who had supplied the certificate, and if it appeared that the voyage was absolutely necessary, he was authorized to receive Mr. Magrath's resignation and to hand him three months wages in advance.

The following cheques for April were drawn:—

For Office:

| | | | | £ | s. | d. |
|-------------------------------|---|---|---|-----|----|----|
| R. H. Scott | - | | | 66 | 13 | 4 |
| J. S. Harding, jun. | - | | | 16 | 13 | 4 |
| J. S. Harding, sen. | - | | | *7 | 14 | 0 |
| T. D. Bell | - | | | *†4 | 14 | 5 |
| C. Gilman, gas, March quarter | - | - | - | 2 | 11 | 4 |
| J. H. Parsons, fittings, &c. | - | - | - | 4 | 4 | 5 |

For Observatories:

| | | | | | | |
|-----------------------------|---|---|---|-----|----|---|
| S. Jeffery, Kew, on account | - | - | - | 200 | 0 | 0 |
| T. Kerr, Valencia, salary | - | - | - | 20 | 16 | 8 |
| R. H. Curtis | - | | | 10 | 0 | 0 |
| F. C. Steventon | - | | | 9 | 3 | 4 |
| C. Stodart | - | | | *8 | 0 | 0 |
| H. W. Woodward | - | | | *4 | 0 | 0 |
| T. E. Allen | - | | | *6 | 8 | 0 |
| E. Magrath | - | | | *6 | 8 | 0 |
| J. P. Cutts | - | | | *4 | 0 | 0 |

For Telegraphy:

| | | | | | | |
|---|---|---|---|----|----|----|
| N. J. Holmes, Shetland, January, February | - | - | 1 | 7 | 7 | |
| „ Scilly, March | - | - | 3 | 3 | 9 | |
| | | | | 4 | 11 | 4 |
| V. Brooks, Day, and Son, printing, &c. | - | - | - | 12 | 1 | 5 |
| F. Gaster | - | | | 15 | 4 | 3 |
| F. Brodie | - | | | *5 | 14 | 9 |
| G. G. Francis | - | | | *5 | 15 | 0 |
| R. Sargeant | - | | | *3 | 7 | 11 |
| H. Chivers | - | | | *1 | 8 | 0 |

For Ocean Meteorology:

| | | | | | | |
|-----------------------------------|---|---|---|-----|----|----|
| H. Toynbee, Marine Superintendent | - | - | - | 33 | 6 | 8 |
| F. Pastorelli, "A" thermometers | - | - | - | 19 | 7 | 0 |
| W. Salmon | - | | | 20 | 16 | 8 |
| R. Strachan | - | | | †19 | 3 | 4 |
| C. Harding | - | | | 13 | 16 | 10 |
| J. A. Curtis | - | | | *6 | 8 | 0 |
| W. G. James | - | | | *6 | 8 | 0 |
| J. W. McVeagh | - | | | *3 | 4 | 0 |

For Office Expenses:

| | | | | | | |
|---------------------------------|---|---|---|------|---|---|
| J. S. Harding, jun., on account | - | - | - | 80 | 0 | 0 |
| Total | - | - | - | £622 | 0 | 0 |

* Four weeks to the 27th.

† Including allowance for extra attendance.

‡ „ „ care of instruments.

The Committee then adjourned.

116, Victoria Street, May 6, 1872.

PRESENT :

Sir C. Wheatstone in the Chair.

Mr. De La Rue.

Mr. Galton.

Mr. Gassiot.

Admiral Richards.

Major-General Smythe.

The Director was in attendance.

The Minutes of last meeting were read and confirmed.

Submitted—The following Report of the auditors :

METEOROLOGICAL OFFICE REVENUE and EXPENDITURE ACCOUNT for the year ended 31st March 1872.

| Dr. | REVENUE. | EXPENDITURE. | Cr. |
|-----------------------------|--------------|------------------------|--------------|
| | £ s. d. | £ s. d. | £ s. d. |
| To Parliamentary vote | - 10,000 0 0 | Office. | |
| Balance from 1870-71 | - 1,826 17 3 | By Salary of Director | - 800 0 0 |
| Dr. C. Jelinek | - 26 13 6 | Do. two Clerks | - 261 15 2 |
| Colonel Walker | - 3 0 0 | Office keeper and Mes- | |
| W. W. Rundell | - 2 3 1 | senger | - 161 0 0 |
| J. R. Stebbing | - 6 10 0 | | 1,222 15 2 |
| G. Dornbusch | - 10 0 0 | Rent of office | 520 3 9 |
| H. Lee & Sons | - 2 10 0 | Fuel and gas | 29 9 5 |
| M. von Wojeikoff | - 6 0 0 | Furniture and fittings | 79 16 9 |
| Prof. H. Mohn | - 34 1 0 | | 629 9 11 |
| Herr von Freeden | - 44 5 0 | Postage | 97 5 7 |
| Dr. J. W. Moore | - 3 3 0 | Printing, &c. | 22 2 6 |
| J. Hartnup | - 2 5 0 | Attendance and other | |
| F. Dun | - 9 11 0 | contingencies | - 117 13 3 |
| G. T. Kingston | - 9 19 8 | | 237 1 4 |
| Dr. E. Henderson | - 4 13 9 | Land Meteorology. | |
| Sale of old instruments, | | Expenses at observa- | |
| &c. | - 5 5 0 | tories | - 2,588 11 1 |
| | 170 0 0 | New instruments for | |
| Interest on deposit account | - 59 16 9 | do. | - 225 6 4 |
| | | Computations | - 807 8 2 |
| | | | 3,621 5 7 |
| | | Telegraphy | - 2,393 12 6 |
| | | Inspections and other | |
| | | expenses | - 171 18 3 |
| | | Computations | - 457 4 5 |
| | | | 3,022 15 2 |
| | | Ocean Meteorology. | |
| | | Marine Superintendent | 400 0 0 |
| | | Supply and return of | |
| | | instruments: | |
| | | Admiralty | - 90 9 2 |
| | | Mercantile Marine | 433 4 6 |
| | | Computations and care | |
| | | of instruments | - 903 9 8 |
| | | | 1,827 3 4 |
| | | | 10,560 10 6 |
| | | Cash in hand | - 72 4 1 |
| | | Advance to Valencia | |
| | | Observatory | - 50 0 0 |
| | | Bank of England ac- | |
| | | count | - 639 16 5 |
| | | London and Westmin- | |
| | | ster Bank | - 734 3 0 |
| | | | 1,496 3 6 |
| | | | £12,056 14 0 |
| | | | £12,056 14 0 |

Examined and compared with the vouchers and found correct.

6th May 1872.

28859.

WARREN DE LA RUE, } Auditors.
W. J. SMYTHE, }

STATEMENT showing Balance on April 1st, 1872, and an estimated Amount of
LIABILITIES payable from the same.

| | £ | s. | d. | £ | s. | d. |
|---------------------------------------|-----|----|----|-------|----|----|
| Balance on 1st April - - - - | - | - | - | 1,496 | 0 | 0 |
| Furniture and Fittings - - - - | 31 | 0 | 0 | | | |
| Expenses at Observatories - - - - | 43 | 0 | 0 | | | |
| Telegraphy from 1st January - - - - | 368 | 0 | 0 | | | |
| Admiralty instruments - - - - | 61 | 0 | 0 | | | |
| Mercantile Marine do. - - - - | 70 | 0 | 0 | | | |
| | | | | 573 | 0 | 0 |
| Leaving a probable surplus of - - - - | - | - | - | £923 | 0 | 0 |

Submitted—The following Report :

I HAVE to report that on the 1st inst. I visited the Telegraphic Reporting Station of Dover, where I found everything in very good order. I visited the station at Yarmouth on the 2d, where, also, I found nothing calling for remark.

Both the observers are careful and attentive.

Read—A letter from Capt. Toynbee submitting an excellent log kept by Capt. F. P. Carruthers, ship "Minero." (Minutes 1870, p. 15; 1871, p. 13).

Mr. Scott was instructed to convey to Capt. Carruthers the marked thanks of the Committee for his excellent register.

Mr. De La Rue reported that the anemometer as altered at his suggestion (Minutes 1871, p. 10), was now in working at Kew, and performed satisfactorily.

The Committee then adjourned.

116, Victoria Street, May 20, 1872.

PRESENT :

Sir E. Sabine in the Chair.

Mr. De La Rue.

Mr. Galton.

The Director was in attendance.

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

Read—The following letter with reference to the addition of reports from Inland Stations to the Daily Weather Reports (Minutes, 1870, p. 57).

SIR,

General Post Office, 13th May 1872.

WITH reference to previous correspondence and to personal communication which has taken place upon the subject of the publication of Meteorological Reports from Inland Stations in the Wind and Weather Reports issued by the Press Association and Central News, I beg leave to state that the department, in consideration of the Meteorological Office providing the necessary instruments, and allowing the department to take a copy of a portion of the report which is received from the towns named in the accompanying list, will, instead of as at present charging the Meteorological Office for the transmission of their messages at the full commercial rates, charge them from such time as the new arrangements shall commence at press rates, viz., 1s. for every 75 words transmitted between the hours 9 a.m. and 6 p.m., and 1s. for every 100 words transmitted between 6 p.m. and 9 a.m., it being of course understood that the department is put to no expense whatever on account either of the instruments or of the payment to any persons taking the observations on behalf of the Meteorological Office, the information which the Post Office seeks to obtain not being made use of by the department, but being simply collected gratuitously for the Press Association and Central News.

The department will be prepared to undertake the transmission of these reports from the new stations so soon as the Meteorological Office shall have completed their arrangements, and it is proposed that the new arrangement should commence on and from the 1st proximo.

I am, &c.

Robert H. Scott, Esq.

(Signed)

FRANK IVES SCUDAMORE.

PROPOSED LIST OF STATIONS.

| | | |
|-------------|----------------|----------------|
| Aberdeen. | London. | Roche's Point. |
| Ardrossan. | Milford Haven. | Scarborough. |
| *Belfast. | Moville. | Scilly. |
| *Cambridge. | Nairn. | *Stafford. |
| Dover. | *Northampton. | *Taunton. |
| *Dublin. | North Shields. | Thurso. |
| *Hereford. | *Oxford. | Valencia. |
| Holyhead. | Plymouth. | *Wexford. |
| Leith. | Portsmouth. | Yarmouth. |
| Liverpool. | | |

* These are new stations.

Mr. Scott stated that the reduction of rate proposed by Mr. Scudamore would amount to a saving of 150*l.* per annum to the Office; and inasmuch as the cost of each station to the Office would be about 30*l.* per annum, he asked permission to suggest to Mr. Scudamore the names of the following seven stations, in lieu of the new stations proposed by Mr. Scudamore (being an increased expense of 50*l.* per annum)—the stations are Oxford, Cambridge, Portishead (Bristol), Nottingham, York, Kingstown, Donaghadee—and on all other points to accede to his terms.—Sanctioned.

It was resolved that M. De La Rue's anemograph should be set in action at Kew, and the returns sent up regularly to the Office for a period of three months.

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

Capt. W. H. Stuart, schooner "Richmond" (Minutes, 1871, p. 47).

„ E. J. Blake, ship "Gitana" (Minutes, 1870, p. 60; 1871, p. 27).

„ J. T. Lewis, R.N.R., S.S. "Scotia."

„ J. J. Price, barque "Sorata."

„ Michael Vowell, barque "Kelso."

Mr. Scott was instructed to convey the marked thanks of the Committee to Captains Stuart and Blake, to present the Pilot Charts to Captains Vowell and Price, and to present an equivalent to Captain Lewis in case he does not wish for the Charts.

Read—The following letter:—

SCIENCE ORGANIZATION COMMITTEE.

British Association for the Advancement of Science,

22, Albemarle Street, W., 18th May 1872.

SIR,

I AM instructed to transmit to you the following resolution passed this day at a meeting of the above Committee:—

"That the thanks of this Committee be given to the Meteorological Committee for Mr. Scott's letter of April 30th, as complying with the request of the sub-committee on observational results."

R. H. Scott, Esq.

I am, &c.

(Signed) HENRY E. ROSCOE.

A cheque for 15*l.* 15*s.* 11*d.* was drawn for Office expenses.

| 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. | { 18 hrs. V. } estimated. and D. } whilst 3 hrs. D. } oiling the instrument. |
| Orientation verified - - - - - | — | — | 12th. | 1st. | 13th. | 22nd. | — |
| Result of 40 Remeasurements:— | | | | | | | |
| Greatest difference - - - - - | Direction. Velocity. 1.0 1.0 | Direction. Velocity. 1.0 1.0 | Direction. Velocity. 1.0 1.0 | Direction. Velocity. 1.0 1.0 | Direction. Velocity. 1.0 1.0 | Direction. Velocity. 1.0 1.0 | Direction. Velocity. 1.0 1.0 |
| Mean difference irrespective of sign - - - - - | 0.2 0.5 | 0.1 0.4 | 0.2 0.4 | 0.2 0.4 | 0.0 0.3 | 0.2 0.4 | 0.2 0.3 |
| Residual difference (— Kew) - - - - - | +0.1 0.0 | +0.1 -0.1 | +0.1 -0.2 | -0.2 +0.1 | 0.0 0.0 | -0.2 0.0 | +0.1 -0.2 |
| No. of errors discovered - - - - - | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| Errors in rain tabulation - - - - - | 0 | 0 | 0 | 0 | 0 | 0 | Rain gauge not in action throughout the month. |
| 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. | 8 hourly values through failure of gas. 1 hourly value by stoppage of clock. |
| Result of 40 Remeasurements:— | | | | | | | |
| Greatest difference - - - - - | 0.050 | 0.050 | 0.050 | 0.040 | 0.050 | 0.040 | 0.050 |
| Mean difference irrespective of sign - - - - - | 0.017 | 0.021 | 0.016 | 0.019 | 0.019 | 0.018 | 0.021 |
| Residual difference (— Kew) - - - - - | -0.009 | +0.003 | +0.009 | -0.009 | +0.009 | -0.001 | +0.003 |
| Mean monthly difference between simultaneous barograph and barometer - - - - - | 0.019 | 0.026 | 0.017 | 0.022 | 0.019 | 0.018 | 0.020 |
| No. of errors discovered in entry of standard - - - - - | 0 | 0 | 1 | 0 | 0 | 0 | 0 |
| " in calculating residual correction - - - - - | 0 | 1 | 0 | 2 | 0 | 0 | 2 |
| " in applying residual correction - - - - - | 0 | 0 | 0 | 1 | 0 | 0 | 2 |
| " in tabulation - - - - - | 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 - - - - - | — | None. | None. | None. | 2 hrs. values lost, clock run down. | 6 hrs. wet rendered doubtful by frost. | 2 hrs. wet owing to failure of light. |
| Result of 40 Remeasurements:— | | | | | | | |
| Greatest difference - - - - - | 1 hr. on 19th, 5 on 20th, & 1 on 21st. | Dry. Wet. 0.20 0.20 | Dry. Wet. 0.20 0.20 | Dry. Wet. 0.30 0.30 | Dry. Wet. 0.10 0.10 | Dry. Wet. 0.20 0.20 | Dry. Wet. 0.20 0.30 |
| Mean difference irrespective of sign - - - - - | 0.13 0.17 | 0.11 0.14 | 0.09 0.12 | 0.14 0.17 | 0.05 0.06 | 0.10 0.10 | 0.15 0.20 |
| Residual difference (— Kew) - - - - - | +0.07 +0.09 | 0.00 0.00 | +0.06 +0.07 | +0.02 +0.03 | -0.01 -0.03 | -0.04 -0.04 | +0.15 +0.20 |
| Mean monthly difference between simultaneous thermograph and thermometer - - - - - | 0.16 0.16 | 0.13 0.15 | 0.09 0.09 | 0.12 0.12 | 0.12 0.14 | 0.17 0.18 | 0.25 0.22 |
| No. of errors discovered in entry of standard - - - - - | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| " discovered by subsidiary measurements - - - - - | 1 | 0 | 0 | 0 | 0 | 3 | 0 |
| " in maximum and minimum - - - - - | 1 | 0 | 0 | 0 | 0 | 0 | 1 |
| " in tabulation - - - - - | 2 | 0 | 0 | 1 | 0 | 0 | 0 |

* April 22, 10.30 a.m., omitted to adjust the pencils: put right at 11.30 a.m.

† " 23, 10.45 a.m., clock line broken: set right 24th, 10.10 a.m.

‡ Clock stopped for 3 hours on the 4th, and 5 hours on the 5th.

§ April 25-27, difference of clock time and curve excessive.
|| 7 hourly values lost through imperfect action of stop.

The Committee then adjourned.

116, Victoria Street, June 3, 1872.

PRESENT :

Sir E. Sabine in the Chair.

Mr. De La Rue.
Mr. Galton.

Mr. Gassiot.
Mr. Spottiswoode.

The Director was in attendance.

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

Submitted—Proofs of the Annual Report for 1871, which was approved, with verbal alterations.

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

Submitted the following Report :

REPORT.

I VISITED the station of Plymouth on the 21st ult. and found everything in good order. I am glad to learn from Mr. Merrifield, the observer, that he has succeeded in obtaining a more satisfactory situation for his thermometers and rain gauge than was previously available, so that in respect of temperature and rain his observations will in future be improved.

Scilly was visited on the 23d, and the station was found in a very satisfactory condition.

The only point calling for remark as regards the reports from our south-west coasts is, that it will be desirable, when opportunity offers, to substitute for Plymouth a more exposed locality, such, *e.g.* as Prawle Point, inasmuch as the wind force reported from Plymouth is necessarily inaccurate as regards the wind in the Channel.

There can be no doubt that Mr. Merrifield furnishes as correct reports as could possibly be obtained from anyone in his locality.

On my return I went on the 27th to Portishead, one of the stations mentioned in the last day's Minutes as proposed additional observing points.

I find the station is well exposed to all points of the compass except the west, but as the Severn is very wide at the spot, the effect of the wind can be well observed, although the place itself is somewhat sheltered. The station-master, William Sandford, is very intelligent and likely to make a good observer, and as soon as I hear from the Post Office that they consent to accept Portishead as a station, I shall supply him with instruments and direct him to commence reporting.

On the 25th I visited Falmouth observatory, where I found everything going on well.

Kew was visited on the 31st, and there also I found nothing calling for remark.

Mr. De La Rue brought forward a proposition, of which he had given notice, that solar photography should be undertaken at Kew at the expense of the Meteorological Committee. He estimated the annual cost of the photography and reduction at about 200*l.* After discussion, the further consideration of the question was deferred for a month.

Read—The following letter ; Mr. Scott was instructed to prepare a draft reply thereto by next meeting :—

Royal Geographical Society, 1, Savile Row, W.,

SIR,

May 31, 1872.

I AM instructed to inform you that the President and Council of the Royal Geographical Society, on the recommendation of a special committee of their body, comprising many eminent Arctic authorities,* have determined at the earliest convenient opportunity to renew their application to Her Majesty's Government, with a view to the fitting out of an expedition for scientific research in the North Polar region.

The former occasion on which this society took active steps in this direction was in 1865, when, after some weeks' discussion, a deputation waited, at his request, upon the Duke of Somerset, then First Lord of the Admiralty, and discussed with him the project of an expedition. His Grace, although

* Admiral Sir George Back, Admiral R. Collinson, Admiral Ommanney, Admiral Sir L. McClintock, Admiral G. H. Richards, Captain Sherard Osborn, Dr. Rae, Mr. A. G. Findlay ; Mr. Clements R. Markham, Secretary.

manifesting great interest in the project, and giving much attention to the arguments adduced in favour of an expedition, could not then decide to recommend it to the Government, owing to the divergence of opinion among Arctic authorities as to the best route to be adopted, and he informed the deputation that he would wait until he should have received the results of the Swedish expedition then engaged in exploring the seas of Spitzbergen. The Council of the Royal Geographical Society have carefully watched, since then, the proceedings not only of the Swedish expeditions, but of those sent by the Germans and others, and believe themselves now to be in a position to recommend, with much greater cogency than before, the route by Smith's Sound as the safest and most likely to yield important results in various departments of science. To this conclusion the above-named Committee of Council have unanimously arrived, and it is towards the realisation of an expedition in this direction that the efforts of the Society will be turned in the representation which will shortly be again addressed to Her Majesty's Government.

As the memoranda furnished by other scientific bodies, pointing out the questions in their respective departments which an Arctic expedition of this nature is required to elucidate, were found to be of great value in strengthening the representations that were put forward on the former occasion, it is intended to renew and augment them in the fresh effort about to be made. The Council hope, therefore, that yourself and the Meteorological Committee will give the subject their best consideration, with a view to co-operating, in so far as supplying a statement to them of the questions in meteorology which require for their solution observations made by well-qualified observers in an expedition such as that they are about to propose.

I enclose, for the information of yourself and the Committee, copies of a memorandum which has been prepared on this subject, and of the papers which were read by Captain Sherard Osborn in 1865 and 1872.

I have, &c.
(Signed) CLEMENTS R. MARKHAM,
Secretary, Royal Geographical Society.

General Sir Edw. Sabine, K.C.B.,
Chairman of the Meteorological Committee.

Read—A letter from Captain Hoffmeyer, of Copenhagen, stating that the Danish Government had established a Meteorological Institute, and had nominated him to the directorship of it.

Reported—That copies of the Daily Weather Charts are supplied free to the following places and persons, in addition to those who had already received the reports:—

PUBLIC OFFICES, &c.

Her Majesty.
H.R.H. the Commander-in-Chief.
Admiralty.
Army Medical Department.
Board of Trade.
"Britannia," H.M.S.
British Museum.
Civil Service Commission.
Colonial Office.
Foreign Office.
Home Office.
House of Lords.
House of Commons.
India Office.
International Exhibition.
Local Government Board.

Meteorological Society.
Navy Medical Department.
Office of Works.
Plymouth Yard, Superintendent.
Portsmouth, Commissioner-in-Chief.
Portsmouth, Royal Naval College.
Privy Council Office.
Registrar General.
Registrar General of Seamen.
Royal Society.
Science and Art Department.
Sheerness Yard, Superintendent.
Staff College.
United Service Institution.
War Office.

FOR EXHIBITION.

Barrow-in-Furness.
Dover.
Hastings.

Thurso.
Weston-super-Mare.

IN EXCHANGE, &c.

Barnstaple Literary and Scientific Institution.
Clouston, Dr. C., Sandwick Manse, Orkney.
Cooper, Colonel, Markree Castle, Sligo.
Curtis, Professor A. H., Queen's College, Galway.
Gerhardi, C., Jersey.
Greenwich Observatory.
Hills, Staff Comr. G. H., Mersey Dock Board, Liverpool.
Liverpool Observatory.

Moyle, M. P., Helston.
Northumberland, Duke of, Alnwick Castle.
Observatories (seven in number).
Radcliffe Observatory, Oxford.
Rosse, Earl of, Parsonstown, Ireland.
Schomberg, Admiral, Holyhead.
Stewart, Professor B., Manchester.
Stow, Rev. F., Harpenden, Herts.
Tyneside Naturalists' Field Club.
Wilson, J. M., Rugby Natural History Society.

Read—A letter from Captain Toynbee, submitting an excellent log kept by Captain H. K. Lindsay, ship "Valparaiso," and recommending him for a presentation copy of the Pilot Charts.—Approved.

Reported—That the following cheques for May had been drawn on the 28th May, on the signature of Sir E. Sabine :—

For Office :

| | £ | s. | d. |
|---------------------------|-----|----|----|
| R. H. Scott | 66 | 13 | 4 |
| J. S. Harding, jun. | 16 | 13 | 0 |
| J. S. Harding, sen. | *7 | 14 | 0 |
| T. D. Bell | *†4 | 15 | 7 |
| Sadgrove & Co., furniture | 6 | 11 | 6 |
| T. S. King, books | 3 | 12 | 2 |

For Observatories :

| | | | | | | |
|-----------------------------------|---|---|---|----|----|---|
| De La Rue & Co., rain gauge paper | - | - | - | 8 | 16 | 4 |
| J. J. Hicks do. | - | - | 6 | 9 | 10 | |
| „ repairing rain gauge | - | - | 1 | 13 | 5 | |
| | | | | 8 | 3 | 3 |
| Thomas Kerr, Valencia, salary | - | - | - | 20 | 16 | 8 |
| D. Thomson, Aberdeen, chimneys | - | - | - | 3 | 12 | 6 |
| R. H. Curtis | - | - | - | 10 | 0 | 0 |
| F. C. Steventon | - | - | - | 9 | 3 | 4 |
| C. Stodart | - | - | - | *8 | 0 | 0 |
| H. W. Woodward | - | - | - | *4 | 0 | 0 |
| T. E. Allen | - | - | - | *6 | 8 | 0 |
| E. Magrath | - | - | - | *6 | 8 | 0 |
| J. P. Cutts | - | - | - | *4 | 0 | 0 |

For Telegraphy :

| | | | | | | |
|-----------------------------------|---|---|---|-----|----|----|
| N. J. Holmes, Scilly Co., April | - | - | - | 3 | 5 | 0 |
| S. M. Clare, Submarine Co., March | - | - | - | 18 | 16 | 11 |
| F. Gaster | - | - | - | †15 | 15 | 8 |
| F. Brodie | - | - | - | *†6 | 2 | 8 |
| G. G. Francis | - | - | - | *†6 | 4 | 0 |
| R. Sargeant | - | - | - | *†3 | 7 | 1 |

For Ocean Meteorology :

| | | | | | | |
|-----------------------------------|---|---|---|-----|----|---|
| H. Toynbee, Marine Superintendent | - | - | - | 33 | 6 | 8 |
| W. Salmon | - | - | - | 20 | 16 | 8 |
| R. Strachan | - | - | - | †19 | 3 | 4 |
| C. Harding | - | - | - | †13 | 9 | 4 |
| J. A. Curtis | - | - | - | *6 | 8 | 0 |
| W. G. James | - | - | - | *6 | 8 | 0 |
| J. W. McVeagh | - | - | - | *3 | 4 | 0 |

For Office Expenses :

| | | | | | | |
|---------------------------------|---|---|---|-----|---|---|
| J. S. Harding, jun., on account | - | - | - | 100 | 0 | 0 |
|---------------------------------|---|---|---|-----|---|---|

Total - - - - £451 15 0

* Four weeks to the 25th.

† Including allowance for extra attendance.

‡ „ „ care of instruments.

The Committee then adjourned.

116, Victoria Street, June 17, 1872.

PRESENT :

Sir E. Sabine in the Chair.

Mr. Gassiot.

Admiral Richards.

Major-General Smythe.

The Director was in attendance.

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

The following draft reply to the Royal Geographical Society was adopted :

SIR,

YOUR letter of the 31st ult., addressed to Sir E. Sabine, in which you do him and the Meteorological Committee the honour of requesting them to supply to the President and Council of the Royal Geographical Society "a statement of the questions in Meteorology which require for their solution" observations made by well-qualified observers in an expedition such as they are about to propose," (viz., to the North Polar regions), has been laid before the Committee.

I am instructed to inform you in reply that in their opinion accurate meteorological observations taken in the Arctic regions would be of very high value indeed to the cause of Meteorology.

The information which is at present obtainable from latitudes north of 60° or 65° is very scanty, with the sole exception of that furnished by the stations situated in the north of Europe and in Iceland.

Of late years a few whaling ships have contributed observations of considerable value, and the Committee are in hopes that the proposed Danish stations in Greenland, and the Swedish expedition to Spitzbergen, will help to throw light on Arctic Meteorology.

As regards the precise questions, which require for their solution observations made under the conditions you describe, they may almost be stated to be co-extensive with the science itself, as there is no subject in Meteorology, in Physical Geography, and in Terrestrial Physics, the thorough elucidation of which does not call for a more extended area of observation than that at present available.

It need hardly be stated that the Meteorological Office would, as a matter of course, supply instruments and registers for such an expedition, and they think that the instructions and circular letter which they issue to intending observers, and of which they enclose a specimen, will be sufficient to indicate to the Council the special lines of investigation, which can be carried out to best effect on board ship.

The important subjects of deep-sea soundings, and of temperatures below the sea surface have not been touched upon in drawing up these instructions, as the operations necessary for determining these points cannot, under ordinary circumstances, be carried out on board merchant ships. The Committee, however, do not doubt that these questions will have already received from the Council the consideration which they deserve.

In all matters concerning the circulation of the currents of the air and sea and the relations existing between the conditions of barometrical pressure, and of temperature in the Arctic regions, and those prevailing in the Temperate Zone, observations from high northern latitudes cannot fail to possess very high interest and value.

C. R. Markham, Esq.

Submitted—The following letter from the Post Office.

General Post Office,

7 June 1872.

SIR,

WITH reference to your letter of the 28th ultimo, on the subject of the compilation of the Wind and Weather Reports supplied by the Post Office to the subscribers of the News Associations, I beg leave to state that the list of reporting stations proposed by your Committee is approved of, and I shall be glad to hear from you immediately you have completed your arrangements at the reporting stations, in order that I may be able to make the necessary arrangements for commencing the new system on the 1st of July next.

I am, &c.

R. H. Scott, Esq.

(Signed) F. I. SCUDAMORE.

Mr. Scott reported that he had made arrangements to receive the reports from the following observers :

| | | | |
|------------|---|---|------------------------------------|
| Oxford | - | - | Radcliffe Observatory. |
| Cambridge | - | - | Observatory. |
| Nottingham | - | - | E. J. Lowe, Esq. |
| Portishead | - | - | William Sandford (station master). |
| York | - | - | Negotiations in progress. |
| Kingstown | - | - | G. Mitchell. |
| Donaghadee | - | - | Telegraph Clerk. |

Submitted—The Quarterly Weather Report for 1870, Part IV.

Read—A letter from Captain Toynbee, submitting the following registers to the Committee:

Captain McKechnie, barque "Cottica."

" C. W. Pearson, SS. "Strathclyde."

" D. Hunter, SS. "Alpha" (Minutes, 1869, p. 113; 1871, p. 10; 1872, p. 2).

" G. H. Jones, SS. "Nile" (Minutes, 1871, p. 55; 1872, p. 21).

Resolved—That the Pilot Charts be presented to the two first-named gentlemen, and that the others be specially thanked.

Reported—That copies of the Daily Weather Charts had been supplied to the Royal Military Academy, and, in exchange for observations, to the Royal Horticultural Society.

The Committee then adjourned.

116, Victoria Street, June 24, 1872.

PRESENT:

Sir C. Wheatstone in the Chair.

Mr. De La Rue.

Mr. Spottiswoode.

The Director was in attendance.

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

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

Mr. Scott submitted the following Report:—

I BEG to report that I visited the reporting station at Portsmouth on the 22d inst. The observer, Mr. Hoar, was unfortunately absent, but I found his instruments and register in good order. He is especially careful about his reports of the state of the sky.

Read a letter from Captain Toynbee submitting excellent logs by

Capt. W. H. Stuart, schooner "Richmond" (Minutes, 1872, p. 27).

Capt. W. R. Barwood, barque "Fugitive" (Minutes, 1871, p. 40).

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

Reported—That the Daily Weather Charts had been supplied, free of charge, to the Officers' Library, Aldershot, and in exchange for observations to F. E. Sawyer, Esq., Brighton.

Submitted—The following statement respecting the Records for May 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. | †Fair. |
| Records deficient | None. | None. | None. | None. | None. | None. | { 75 hrs. V. & { instrument 95 hrs. D. { repairing. 5 hrs. V. & { clock 6 hrs. D. { stopped. 1 hr. V. & { coiled in. 4 hrs. D. { instrument. 32 hours D. spindle became unscrewed. |
| Orientation verified | — | — | 14th. | 1st. | 25th. | 1st. | — |
| <i>Result of 40 Remeasurements:—</i> | | | | | | | |
| Greatest difference | Direction. Velocity. 1.0 1.0 | Direction. Velocity. 1.0 1.0 | Direction. Velocity. 1.0 1.0 | Direction. Velocity. 1.0 1.0 | Direction. Velocity. 1.0 1.0 | Direction. Velocity. 1.0 1.0 | Direction. Velocity. 1.0 1.0 |
| Mean difference irrespective of sign | 0.1 0.5 | 0.1 0.4 | 0.1 0.3 | 0.2 0.4 | 0.1 0.3 | 0.2 0.4 | 0.0 0.5 |
| Residual difference (—Kew) | 0.0 -0.1 | -0.1 0.0 | -0.1 0.0 | -0.1 -0.1 | 0.0 -0.1 | +0.1 0.0 | 0.0 +0.1 |
| No. of errors discovered | 0 0 | 0 3 | 0 0 | 0 1 | 0 0 | 0 5 | 0 1 |
| Error in rain tabulation | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| BAROGRAPH:— | | | | | | | |
| Action | Good. | Good. | Good. | Good. | Good. | Good. | Good. |
| Photography | Do. | Do. | Do. | Fair. | Do. | Do. | Do. |
| Records deficient | None. | None. | None. | None. | None. | 6 hrs. lost on 11th by clock stopping. | 5 hrs. lost (repair- ing clock). |
| <i>Result of 40 Remeasurements:—</i> | | | | | | | |
| Greatest difference | Direction. Velocity. 0.050 | Direction. Velocity. 0.050 | Direction. Velocity. 0.040 | Direction. Velocity. 0.040 | Direction. Velocity. 0.050 | Direction. Velocity. 0.050 | Direction. Velocity. 0.050 |
| Mean difference irrespective of sign | 0.013 | 0.022 | 0.015 | 0.015 | 0.018 | 0.023 | 0.019 |
| Residual difference (—Kew) | +0.003 | +0.011 | +0.007 | -0.006 | +0.012 | -0.001 | +0.005 |
| Mean monthly difference between simultaneous barograph and barometer | 0.019 | 0.025 | 0.021 | 0.022 | 0.018 | 0.020 | 0.024 |
| No. of errors discovered in entry of standard | 0 0 | 0 0 | 0 0 | 0 0 | 0 0 | 1 1 | 2 0 |
| ” in calculating residual correction | 0 0 | 0 0 | 0 0 | 0 0 | 0 0 | 0 0 | 0 1 |
| ” in applying residual correction | 0 0 | 0 0 | 0 0 | 0 0 | 0 0 | 0 0 | 0 0 |
| ” in tabulation | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| THERMOGRAPH:— | | | | | | | |
| Action | Good. | Good. | Good. | Good. | Good. | Good. | Good. |
| Photography | Do. | Do. | Do. | Do. | Do. | Do. | Fair. |
| Records deficient | None. | None. | 3 hrs. W. out of action. | None. | None. | None. | { 6 D. & 6 W. repairing clock. 8 W. trace invisible. 4 W. out of action. |
| <i>Result of 40 Remeasurements:—</i> | | | | | | | |
| Greatest difference | Direction. Velocity. 0.30 0.30 | Direction. Velocity. 0.30 0.30 | Direction. Velocity. 0.30 0.30 | Direction. Velocity. 0.30 0.30 | Direction. Velocity. 0.30 0.30 | Direction. Velocity. 0.30 0.30 | Direction. Velocity. 0.30 0.30 |
| Mean difference irrespective of sign | 0.18 0.20 | 0.14 0.16 | 0.10 0.12 | 0.13 0.14 | 0.10 0.10 | 0.12 0.15 | 0.15 0.16 |
| Residual difference (—Kew) | +0.11 +0.12 | 0.00 -0.01 | 0.00 +0.02 | -0.07 -0.07 | +0.03 +0.02 | +0.08 +0.03 | -0.09 -0.08 |
| Mean monthly difference between simultaneous thermograph and thermometer | 0.19 0.16 | 0.15 0.14 | 0.10 0.10 | 0.13 0.13 | 0.13 0.18 | 0.16 0.15 | 0.18 0.21 |
| 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 | 9 5 | 2 1 | 0 0 | 0 0 | 0 0 | 0 0 | 0 4 |
| ” in maximum and minimum | 3 2 | 0 0 | 1 0 | 0 0 | 0 0 | 0 0 | 1 0 |
| ” in tabulation | 0 | 0 | 0 | 2 | 0 | 0 | 0 |

† In all 81 hours V. and 137 hours D. have been lost.

* Missed dates on two days.

The following cheques for June were drawn:—

For Office:

| | | £ | s. | d. |
|---------------------------------|----------------------|-----|----|----|
| R. H. Scott | - | 66 | 13 | 4 |
| J. S. Harding, jun. | } Salaries and wages | 16 | 13 | 4 |
| J. S. Harding, sen. | | *9 | 12 | 6 |
| T. D. Bell | | *15 | 17 | 4 |
| C. W. Jacques, rent for quarter | - | 133 | 13 | 0 |
| E. Higgs, repairs in office | - | 3 | 7 | 0 |

For Observatories (quarterly allowances, &c.):

| | | | | |
|--------------------------------|---------------------|----------|----------|-----------|
| D. Thomson (Aberdeen) | - | 62 | 10 | 0 |
| Less anemograph forms | - | 0 | 5 | 8 |
| Do. chemicals | - | 3 | 18 | 4 |
| | | <u>4</u> | <u>4</u> | <u>0</u> |
| | | 58 | 6 | 0 |
| Postages and carriages | - | 2 | 5 | 2 |
| | | | | <u>60</u> |
| T. R. Robinson (Armagh) | - | 36 | 5 | 0 |
| Do. expenses for quarter | - | 6 | 16 | 10 |
| | | | | <u>43</u> |
| W. P. Dymond (Falmouth) | - | 66 | 5 | 0 |
| Less anemograph forms | - | 0 | 12 | 6 |
| | | | | <u>65</u> |
| R. Grant (Glasgow) | - | 62 | 10 | 0 |
| Less anemograph forms | - | 0 | 12 | 6 |
| | | | | <u>61</u> |
| H. Williams (Holyhead) | - | 3 | 1 | 3 |
| C. Clouston (Orkney) | - | 2 | 14 | 9 |
| S. J. Perry (Stonyhurst) | - | 50 | 0 | 0 |
| Less anemograph forms | - | 0 | 12 | 6 |
| | | | | <u>49</u> |
| T. Kerr (Valencia), salary | - | 20 | 16 | 8 |
| Do. expenses for quarter | - | 67 | 0 | 7 |
| | | | | <u>87</u> |
| G. T. Watson (Yarmouth) | - | 3 | 18 | 9 |
| R. & J. Beck, zinc plates, &c. | - | 12 | 19 | 7 |
| A. Burgess, engraving | - | 15 | 0 | 0 |
| J. Driscoll, rent at Valencia | - | 25 | 0 | 0 |
| Hopkin & Williams, chemicals | - | 3 | 18 | 4 |
| Malby & Sons, printing | - | 19 | 13 | 0 |
| 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 |
| T. E. Allen | | *8 | 0 | 0 |
| E. Magrath | | *8 | 0 | 0 |
| J. P. Cutts | | *5 | 0 | 0 |

For Telegraphy (quarterly allowances, &c.):

| | | | | |
|--|---|---|----|---|
| J. Costello (Dover) | - | 3 | 5 | 9 |
| H. Williams (Holyhead) | - | 3 | 11 | 8 |
| W. D. Penny (Nairn) | - | 4 | 4 | 6 |
| J. Merrifield (Plymouth) | - | 3 | 5 | 0 |
| J. Hoar (Portsmouth) | - | 3 | 5 | 9 |
| Smith, Payne, & Co., Scilly (14 weeks) | - | 4 | 16 | 0 |
| W. Lawrence (Shetlands) | - | 3 | 5 | 0 |
| J. Trotter (Thurso) | - | 3 | 6 | 3 |
| T. Robinson (Yarmouth) | - | 3 | 5 | 0 |

Carried forward - - - £777 18 2

* Five weeks to 30th June.

† Including allowance for extra attendance.

| | | | | £ | s. | d. |
|---------------------------------------|---|-------------------|---------|---|-----|------------|
| Brought forward | | | | - | - | 777 18 2 |
| For Telegraphy— <i>continued</i> . | | | | | | |
| Postmaster General, March quarter | - | - | - | - | 352 | 7 3 |
| N. J. Holmes, Scilly Company, May | - | - | - | - | 4 | 1 3 |
| S. M. Clare, Submarine Company, April | - | - | 18 4 7 | - | - | - |
| Do. do. May | - | - | 19 10 0 | - | - | - |
| | | | | - | 37 | 14 7 |
| F. Gaster | - | Computations | - | - | †16 | 14 11 |
| F. Brodie | - | | - | - | *† | 7 10 0 |
| G. G. Francis | - | | - | - | *† | 7 11 0 |
| R. Sargeant | - | | - | - | *† | 3 17 6 |
| For Ocean Meteorology : | | | | | | |
| H. Toynbee, Marine Superintendent | - | - | - | - | 33 | 6 8 |
| Elliott, Brothers, aneroid | - | - | - | - | 4 | 0 0 |
| E. Higgs, packing cases | - | - | - | - | 10 | 19 0 |
| H. J. Smart, Liverpool agent | - | - | - | - | 12 | 0 1 |
| Williams & Norgate, Pilot Charts | - | - | - | - | 10 | 0 0 |
| W. Salmon | - | Computations, &c. | - | - | 20 | 16 8 |
| R. Strachan | - | | - | - | †19 | 3 4 |
| C. Harding | - | | - | - | †13 | 6 4 |
| J. A. Curtis | - | | - | - | *8 | 0 0 |
| W. G. James | - | | - | - | *8 | 0 0 |
| J. W. McVeagh | - | | - | - | *4 | 0 0 |
| For Office Expenses : | | | | | | |
| J. S. Harding, jun., on account | - | - | - | - | 90 | 0 0 |
| Total | | | | - | - | £1,441 6 9 |

The following accounts were presented by the Kew Committee :

| | | | | | | |
|------------------------------------|---|---|---|-----|----|---|
| Allowance for quarter | - | - | - | 62 | 10 | 0 |
| Less anemograph forms | - | - | - | 0 | 12 | 6 |
| | | | | 61 | 17 | 6 |
| Examination of Observatory Returns | - | - | - | 100 | 0 | 0 |
| Postages, &c., to 31st May | - | - | - | 4 | 0 | 7 |
| Verification of "A" instruments | - | - | - | 3 | 11 | 0 |
| Do. "M.O." do. | - | - | - | 6 | 8 | 0 |
| | | | | 175 | 17 | 1 |

Leaving a balance of 24*l.* 2*s.* 11*d.* to the credit of the Meteorological Committee on the sum of 200*l.* drawn 29th April.

* Five weeks to 30th June.

† Including allowance for extra attendance.

‡ Including allowance for care of instruments.

The Committee then adjourned.

116, *Victoria Street*, July 1, 1872.

PRESENT :

Sir C. Wheatstone in the Chair.

Mr. De La Rue.

Mr. Galton.

Mr. Gassiot.

Admiral Richards.

Mr. Spottiswoode.

The Director was in attendance.

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

Mr. Scott brought under the notice of the Committee an invitation to a meeting of meteorologists to be held at Leipsic, August 14-16, in order to discuss the advisability of holding a Meteorological Congress at Vienna in 1873. The invitation had been issued by—

Dr. C. Bruhns, of Leipsic.

Dr. C. Jelinek, of Vienna.

Dr. H. Wild, of St. Petersburg.

Resolved—That Mr. Scott be instructed to accept the invitation, and to represent the Meteorological Office at the proposed meeting at Leipsic.

At Mr. De La Rue's suggestion, the consideration of the question of Solar Photography being undertaken at Kew was postponed till November.

Reported—That three of the new telegraphic reporting stations had commenced reporting on this day, the 1st inst., and that the other four would shortly be in working order.

Read—A letter from Captain Toynbee, submitting an excellent log kept by—

Captain F. W. Banner, ship "Kenilworth" (Minutes, 1871, p. 20).

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

Mr. Scott reported that he had appointed Mr. W. L. Dallas a temporary clerk at the salary of 1*l.* 10*s.* per week, in the place of Mr. E. Magrath, who had resigned owing to ill-health.—Approved.

Mr. Galton reported progress with regard to his experiments on the mode of production of small weather charts, and was authorised to expend the remainder of the grant made April 15 (Minutes, p. 21,) on trying other experiments towards the same end.

Mr. Galton then drew attention to his proposals for discussing the continuous records from the observatories which were printed in the Minutes for January 2, 1871, p. 1, and he proposed that—

An hourly trace for January 1872 be made, representing the inclination of the barometrical plane passing through Armagh, Falmouth, and Kew, compared with the force of wind experienced at the same time at Holyhead.

Also a trace representing the direction of the inclination of the plane with the direction of the wind at Holyhead.

Tables for the above purpose to be calculated to each tenth of an inch from the formula already given by Mr. Galton, in the Minutes of the Committee in the paper above quoted.

Resolved—That Mr. Galton's proposal be carried out, the expense of the tables not to exceed 7*l.*, the sum already named in the Minutes.

Reported—That the Daily Weather Charts had been supplied, free of charge, to the Royal Artillery Institution, Woolwich, and in exchange for observations to C. L. Prince, Esq., M.D.

The Committee then adjourned.

116, Victoria Street, July 15, 1872.

PRESENT :

Sir C. Wheatstone in the Chair.

Mr. Galton.
Mr. Gassiot.

Admiral Richards.
Mr. Spottiswoode.

The Director was in attendance.

The Minutes of last meeting (July 1) were read and confirmed.

Reported—That an additional imprest for 1,000*l.* had been applied for from the Treasury (received July 16).

Read—The following letter :

DEAR SIR,

Royal Observatory, Greenwich, 3d July 1872.

A PAPER by Mr. W. W. Rundell (Litherland Park, Liverpool) on the Winds at Liverpool was by me laid before the Secretaries of the Royal Society. They think that its character does not very well suit the Transactions, but that it probably would very well suit the publications of the Meteorological Committee. I almost gathered from the expression that Professor Stokes had made it generally known to you. I take leave therefore (with the consent of all other parties) to send the paper, by book post, for your decision.

The result is curious: that on the whole the course of a particle of air at Liverpool may be represented as a species of elliptical trochoid.

Robert H. Scott, Esq.

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

Mr. Scott was instructed to prepare a special report on the paper for the next meeting of the Committee.

Read—A letter from Mr. Rundell, containing certain criticisms on the mode of discussion of the anemometrical results for Orkney, submitted to the Committee, Feb. 5 (Minutes, pp. 10 & 11).

Mr. Scott was instructed to request Mr. Rundell to state his views more fully.

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

Capt. A. Campbell, SS. "Europa" (Minutes, 1872, p. 10, &c.)

Capt. Jas. Hayes, SS. "Camoens" (Minutes, 1872, p. 14, &c.)

Mr. W. Greenwood, ship "Assaye" (Minutes, 1871, p. 47, &c.)

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

Reported—That the Daily Weather Charts had been supplied to the Observatory of Madrid in return for the Bulletin published by that office, and to the Royal Botanic Society, Regent's Park, in return for observations.

Submitted—The following publications of the Office (Minutes, p. 10)—

Non-official, No. 4, "Routes for Steamers from Aden to the Straits of Sunda and Back."

Non-official, No. 5 "Winds of the North Atlantic, &c."

The Committee then adjourned.

116, Victoria Street, July 29, 1872.

PRESENT :

Sir E. Sabine in the Chair.

Mr. De La Rue.

The Director was in attendance.

The Minutes of last meeting, July 15, were read and confirmed.

Reported—That the vote for the Office had not yet been passed by the House of Commons. Mr. Scott was instructed, as soon as it should pass, to lodge 5,000*l.* to the deposit account of the Committee at the London and Westminster Bank, and the balance to their current account at the Bank of England.

Submitted the following report :

I BEG to report that I have read Mr. Rundell's paper on the Winds at Liverpool very carefully, and that I consider it to be very valuable. The materials on which it is based are contained almost entirely in Mr. Hartnup's published Reports, and they extend over a period of 15 years, during which the observations were taken at the old observatory.

The mode of treatment of the subject differs in many particulars from that recommended by Dr. Robinson to the Committee, and adopted by them for the discussion of the Anemometry for the Orkney Isles, which has just appeared, but I consider that it would be very desirable that this Office should publish Mr. Rundell's paper, as it touches on many points which are not included in the Orkney discussion.

The diagrams and the comparison of the results obtained for Liverpool with those for Oxford, Kew, and for Bombay, are extremely interesting.

Perhaps I might be permitted to observe that possibly Dr. Robinson might be disposed to favour the Committee with his views on the subject before they finally decided as to publishing the paper.

ROBERT H. SCOTT.

Mr. Scott was instructed to request Dr. Robinson to favour the Committee with his opinion on the paper.

Mr. Scott reported that as the Scottish Meteorological Society had referred to their correspondence with the Meteorological Office in the year 1870, in their Memorial to the Science Commission now sitting, he had, at the request of Mr. Lockyer, Secretary to that Commission, furnished him, unofficially, with a complete copy of the correspondence in question.—Approved.

Reported—That Mr. R. Beckley had been instructed to go to the several observatories on a tour of inspection, in order to clean the instruments, &c.

SUBMITTED the following STATEMENT respecting the RECORDS for JUNE 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. | Fair. | Good. | Good. |
| Records deficient - - | None. | None. | None. | None. | * 27 hours D. | ‡ 8 hrs. D. and V. | 18 hrs. V. & 31 D. |
| Orientation verified - - | — | — | 14th. | 1st. | 13th. | 14th. | 3rd. |
| <i>Result of 40 Remasurements :—</i> | | | | | | | |
| Greatest difference - - | Direction. Velocity. | Direction. Velocity. | Direction. Velocity. | Direction. Velocity. | Direction. Velocity. | Direction. Velocity. | Direction. Velocity. |
| Mean difference irrespective of sign - - | 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 |
| Residual difference (— Kew) - - | 0.2 0.4 | 0.3 0.4 | 0.1 0.4 | 0.2 0.3 | 0.1 0.3 | 0.2 0.4 | 0.2 0.6 |
| No. of errors discovered - - | 0.0 -0.2 | -0.1 -0.1 | -0.0 +0.1 | 0.0 0.0 | -0.1 0.0 | -0.1 -0.2 | -0.1 +0.1 |
| Errors in rain tabulation - - | 0 0 | 0 0 | 0 0 | 0 0† | 0 0 | 0 0 | 0 10 |
| BAROGRAPH :— | | | | | | | |
| Action - - - | Good. | Good. | Good. | Good. | Good. | Good. | Good. |
| Photography - - - | Do. | Do. | Do. | Fair. | Do. | Do. | Do. |
| Records deficient - - | None. | None. | None. | 6 hours lost. | 10 hrs. lost through failure of gas. | None. | 27 hours. |
| <i>Result of 40 Remasurements :—</i> | | | | | | | |
| Greatest difference - - | ·0050 | ·0050 | ·0050 | ·0050 | ·0050 | ·0050 | ·0050 |
| Mean difference irrespective of sign - - | ·0020 | ·0022 | ·0016 | ·0018 | ·0015 | ·0019 | ·0019 |
| Residual difference (— Kew) - - | + ·0012 | + ·0018 | ·0000 | + ·0005 | + ·0004 | + ·0006 | — ·0003 |
| Mean monthly difference between simultaneous barograph and barometer - - | ·0015 | ·0023 | ·0019 | ·0024 | ·0017 | ·0023 | ·0022 |
| No. of errors discovered in entry of standard - - | 0 0 | 2 1 | 0 1 | 1 1 | 0 0 | 0 0 | 0 0 |
| " in calculating residual correction - - | 0 0 | 1 1 | 0 0 | 1 1 | 0 0 | 0 0 | 0 0 |
| " in applying residual correction - - | 1 1 | 1 1 | 0 0 | 0 0 | 1 1 | 0 0 | 4 4 |
| " in tabulation - - | 0 0 | 0 0 | 0 0 | 0 0 | 0 0 | 0 0 | 0 0 |
| THERMOGRAPH :— | | | | | | | |
| Action - - - | Good. | Good. | Good. | Good. | Good. | Good. | Good. |
| Photography - - - | Do. | Do. | Do. | Do. | Do. | Do. | Do. |
| Records deficient - - | 1 hour wet. | None. | 5 hrs. wet bulb, out of action. | None. | 10 hrs. wet bulb, out of action. | (38 hrs. lost. §) | 4 hrs. dry bulb, no trace visible. |
| <i>Result of 40 Remasurements :—</i> | | | | | | | |
| Greatest difference - - | Dry. Wet. | Dry. Wet. | Dry. Wet. | Dry. Wet. | Dry. Wet. | Dry. Wet. | Dry. Wet. |
| Mean difference irrespective of sign - - | 0.20 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 |
| Residual difference (— Kew) - - | 0.16 0.19 | 0.15 0.13 | 0.13 0.13 | 0.14 0.16 | 0.05 0.06 | 0.10 0.12 | 0.13 0.13 |
| Mean monthly difference between simultaneous thermograph and thermometer - - | + 0.13 + 0.15 | - 0.15 - 0.12 | - 0.02 + 0.05 | - 0.06 - 0.06 | - 0.05 - 0.03 | - 0.06 - 0.06 | - 0.01 0.00 |
| No. of errors discovered in entry of standard - - | 0.17 0.16 | 0.13 0.15 | 0.10 0.10 | 0.12 0.13 | 0.12 0.15 | 0.17 0.15 | 0.19 0.22 |
| " discovered by subsidiary measurements - - | 0 0 | 0 0 | 0 0 | 0 0 | 0 0 | 0 0 | 0 1 |
| " in maximum and minimum - - | 2 1 | 0 0 | 0 0 | 1 1 | 0 0 | 1 0 | 0 1 |
| " in tabulation - - | 4 5 | 0 48 | 0 0 | 1 1 | 0 0 | 0 0 | 0 6 |

* Anemograph discovered out of order on June 19th, see note on curve 18-19.

† June 6, 5 p.m. to wind, and June 16, 1 a.m. to 10 a.m. tabulated at Kew.

‡ Instrument dismounted and cleaned.

§ 17 hours dry bulb, trace invisible.
10 hours D. and W., by stoppage of clock.
11 hours wet bulb, out of action.

The following cheques for July were drawn :—

For Office :

| | £ | s. | d. |
|------------------------------|----|----|----|
| R. H. Scott - | 66 | 13 | 4 |
| J. S. Harding, jun. - | 16 | 13 | 4 |
| J. S. Harding, sen. - | *7 | 14 | 0 |
| T. D. Bell - | *4 | 8 | 0 |
| Salaries and wages - - - - - | | | |

For Observatories :

| | | | |
|--|----|----|---|
| Thomas Kerr, Valencia, salary - | 20 | 16 | 8 |
| R. H. Curtis - | 10 | 0 | 0 |
| F. C. Steventon - | 9 | 3 | 4 |
| C. Stodart - | *8 | 0 | 0 |
| H. W. Woodward - | *4 | 0 | 0 |
| T. E. Allen - | *6 | 8 | 0 |
| E. Magrath - | *6 | 8 | 0 |
| J. P. Cutts - | *4 | 0 | 0 |
| W. L. Dallas - | †3 | 0 | 0 |
| R. Beckley on account for inspection - | 25 | 0 | 0 |
| Computations, &c. - - - - - | | | |

For Telegraphy :

| | | | |
|-----------------------------|-----|----|----|
| F. Gaster - | †17 | 8 | 11 |
| F. Brodie - | *†4 | 18 | 8 |
| G. G. Francis - | *†5 | 19 | 4 |
| R. Sargeant - | *†3 | 17 | 6 |
| Computations, &c. - - - - - | | | |

For Ocean Meteorology :

| | | | |
|-------------------------------------|-----|----|----|
| H. Toynbee, Marine Superintendent - | 33 | 6 | 8 |
| W. Salmon - | 20 | 16 | 8 |
| R. Strachan - | †19 | 3 | 4 |
| C. Harding - | †12 | 15 | 10 |
| J. A. Curtis - | *6 | 8 | 0 |
| W. G. James - | *6 | 8 | 0 |
| J. W. McVeagh - | *3 | 4 | 0 |
| Computations, &c. - - - - - | | | |

For Office Expenses :

| | | | |
|--------------------------|-----|---|---|
| R. H. Scott on account - | 100 | 0 | 0 |
|--------------------------|-----|---|---|

Total - - - - - £426 11 7

* Four weeks to 27th.

† Two weeks to 27th.

‡ Including allowance for extra attendance.

§ " " care of instruments.

The Committee then adjourned.

116, Victoria Street, October 28, 1872.

PRESENT :

Mr. Galton in the Chair.

Mr. De La Rue.

Mr. Gassiot.

Maj.-Gen. Smythe.

Sir C. Wheatstone.

The Director was in attendance.

The Minutes of last meeting (July 29) were read and confirmed.

Reported—That the Treasury Order for 7,000*l.*, being the balance of the vote for the office for the current year, had been received on the 20th of August, and lodged as directed at last meeting.

Submitted—The following Report :—

I visited the station of *Nottingham* on the 3d of August. This is a new station, the observations are taken by Mr. E. J. Lowe, F.R.S., at Highfield House. I was unable to verify, by actual inspection, the several instruments, as Mr. Lowe was making some alterations in his house and pleasure grounds.

York, visited August 5th. This station is also new. The observations are taken at the museum of the Yorkshire Philosophical Society, by Mr. C. Wakefield, the curator. The thermometers and rain gauge are placed in the garden in a very good situation, and I have every hope that the station will be a satisfactory one.

The stations of *Scarborough*, *North Shields*, and *Liverpool*, were also inspected, and were found to be in as good order as could be wished.

I have further to report that in the month of August I completed my inspection of the northern stations, with the exception of the telegraphic stations at *Leith* and *Ardrossan*, which I have uniformly found to be in such good order that the visit for this year seemed unnecessary.

Nairn, visited August 26th. Everything as usual in good order.

Aberdeen, visited August 27th. The position of the instruments here has been changed, and, as I am glad to say, much for the better, the observer, Mr. McCormack, having an open garden which affords a good site for both the thermometer screen and the rain gauge.

Sumburgh Head, visited August 29th. Everything in good order.

Thurso, visited August 31st. Mr. Trotter, the observer, has changed his residence, and thereby has been enabled to obtain a site for the thermometer and rain gauge in his own garden, whereby they are protected from casual interference on the part of the public. The instruments are in good order, and the register well kept.

Wick, visited August 31st. At this station Mr. Sinclair, the new reporter, has been in performance of the duties since June 5th. I am very glad to report that there is every prospect of this station becoming a most useful one, a quality which it has hitherto not possessed, owing to the fact of the former reporter, the postmaster, being too much occupied to perform its duties satisfactorily. Mr. Sinclair is a watchmaker, and very intelligent, taking a great pride in furnishing accurate reports. He has himself some years ago erected a public barometer for the use of the fishermen. The position of the thermometer screen and rain gauge was in a private garden and was not satisfactory; however, I have directed that these should be transferred to Mr. Sinclair's own garden, which is an almost unexceptionable situation for them.

I visited the Irish and Welsh stations in the course of the current month.

Holyhead, visited October 10th. Since my last report of inspection of this station the instruments have been removed from the post office to the harbour lighthouse, where the anemometer is placed, and the wind and sea observations from this new station have shown a marked improvement since the change was made. I regret, however, to have to report that the observer finds himself unable to continue to discharge the duties, so that I have had to look for a successor. I have been able to make satisfactory arrangements by obtaining reports from Mr. John Tilston, at the Sailors' Home, and have directed the instruments to be transferred before the end of the month.

Kingstown, visited October 12th. This is a new station. The instruments are at the Sailors' Home, and the observer, Mr. G. Mitchell, though not a seafaring man, seems very trustworthy and careful. The only objection to the station as regards the instrumental exposure is, that the thermometers and rain gauge are in a yard which is very confined, but from the position of the house on the open pier, no better site for the instruments could be found. The wind reports may be expected to be good, excepting in so far as the station is sheltered from southerly winds by high land.

Donaghadee, visited October 15th, also a new station. The instruments are at the post office, and the reporter, Mr. John MacGowan, jun., is very intelligent, and is likely to make a good observer. The opportunities for observing wind and sea are good, as the land all about is very low, and a fair opinion can be formed of the sea in the North Channel. The exposure of the thermometers and rain gauge is not as good as might be wished; they are in the post office garden, but no better position can be found. I found that Mr. MacGowan did not thoroughly understand the management of his minimum thermometer.

The other stations were visited as follows:—

Moville, on the 16th.

Valencia, 21st.

Roche's Point, 22d, and

St. Ann's Head, 24th.

They were all found in good order, especially the two places last named.

I find that the sea temperature has not been taken regularly at Valencia and Moville, but I hope for an improvement in this respect.

The observatories of Stonyhurst, Glasgow, Aberdeen, Armagh, and Valencia were also visited, and everything was in a satisfactory condition, excepting the clock stop of the barograph at the last-named station. I have, however, given instructions which will, I hope, set this to rights.

ROBERT H. SCOTT.

Submitted also—Mr. R. Beckley's report to the Director stating that he had visited all the observatories (Minutes, July 29), and had satisfied himself that all the instruments were in proper order.

Mr. Scott reported that, as a telegraphic cable had been now laid down to the Hebrides, he had made inquiries as to the possibility of obtaining telegraphic reports from Stornoway, and had ascertained that Mr. John Smith, the gardener at Lews Castle, was ready to undertake the office of reporter, and was in all respects a suitable observer. He pointed out the importance of an additional station off the west coast of Scotland.

Resolved—That Mr. Scott be allowed to establish an additional reporting station at Stornoway.

Mr. Scott reported that he had attended the Meteorological Conference at Leipzig (Minutes, July 1), and that as soon as he received the official report of the proceedings he would submit it to the Committee.

Read—A letter from Captain Toynbee, submitting the following Registers kept by gentlemen who have already received the Pilot Charts:—

Captain T. Donkin, ship "Inverness" (Minutes, 1871, p. 40).

" J. Finlay, ship "Duncairn" (Minutes, 1871, p. 47).

" J. D. Lunham, SS. "Durley" (Minutes, 1872, p. 2).

" J. Perry, R.N., H.M.S. "Orontes" (Minutes, 1872, p. 2).
(Register kept by Nav. Lieut. W. W. Vine.)

" J. J. Price, barque "Sorata" (Minutes, 1872, p. 27).

" C. H. Renaut, ship "Celaeno" (Minutes, 1871, p. 47).

" W. H. Smith, SS. "Peruvian" (Minutes, 1871, p. 27).

" W. H. Stuart, schooner "Richmond" (Minutes, 1872, p. 33).

" W. Symington, SS. "Hong Kong" (Minutes, 1871, p. 60).

" W. Watson, SS. "Parthia" (Minutes, 1871, p. 47).

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

Reported—That applications had been received from the Inspecting Commander of Coastguard at Ballycastle, county Antrim, for the loan of fishery barometers for Cushendall and Portrush, and that instruments had been supplied, and also that the barometer at Douglas, Isle of Man, had been repaired.—Approved.

Mr. Scott reported that he had been requested to deliver a lecture on meteorology at the London Institution on the 26th of February.—Sanctioned.

Submitted—The following publications of the office:—

Official, No. 13.—A Discussion of the Meteorology of the Atlantic at the beginning of February 1870 (Minutes, 1871, p. 56).

Official, No. 14.—Quarterly Weather Report, 1871, Part I.

Reported—That the Daily Weather Charts had been supplied in exchange for observations to—

W. F. Cooper, Sheffield.

E. E. Morris, Esq., Head Master, Middle Class School, Bedford.

Yorkshire Philosophical Society, York.

JULY.

| 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. | None. | None. | *17 hrs. V. and D. | †14 hrs. D. |
| Orientation verified | - | 31st. | — | 11th. | 1st. | 31st. | 22nd. | 7th. |
| <i>Result of 40 Remasurements :—</i> | | | | | | | | |
| Greatest difference | - | Direction. Velocity. | Direction. Velocity. | Direction. Velocity. | Direction. Velocity. | Direction. Velocity. | Direction. Velocity. | Direction. Velocity. |
| Mean difference irrespective of sign | - | 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 |
| Residual difference (—Kew) | - | 0.1 0.6 | 0.2 0.3 | 0.2 0.3 | 0.2 0.5 | 0.2 0.2 | 0.2 0.3 | 0.2 0.3 |
| No. of errors discovered | - | +0.1 +0.1 | +0.1 +0.1 | +0.1 +0.1 | 0.0 0.0 | +0.1 +0.1 | 0.0 -0.1 | 0.0 0.0 |
| Errors in rain tabulation | - | 0 0 | 0 2 | 0 2 | 0 0 | 0 0 | 1 0 | 0 5 |
| BAROGRAPH :— | | | | | | | | |
| Action | - | Good. | Good. | Good. | Good. | Good. | Good. | Good. |
| Photography | - | Do. | Do. | Do. | Indifferent. | Do. | Indifferent. | Do. |
| Records deficient | - | None. | 2 hrs. glass chimney blackened by smoke. | 2 hrs. gas out. | 9 hrs. clock stopped. 2 hrs. photo. blemished. | None. | 41 hours trace indistinct. | 5 hrs. lost owing to imperfect action of clock stop. |
| <i>Result of 40 Remasurements :—</i> | | | | | | | | |
| Greatest difference | - | .0050 | .0050 | .0050 | .0050 | .0050 | .0050 | .0050 |
| Mean difference irrespective of sign | - | .0014 | .0019 | .0020 | .0020 | .0019 | .0021 | .0016 |
| Residual difference (—Kew) | - | + .0004 | + .0010 | + .0008 | — .0011 | + .0003 | + .0005 | — .0007 |
| Mean monthly difference between simultaneous barograph and barometer | - | .0016 | .0024 | .0018 | .0024 | .0017 | .0016 | .0021 |
| No. of errors discovered in entry of standard | - | 0 | 1 | 0 | 0 | 0 | 0 | 0 |
| ” in calculating residual correction | - | 0 | 1 | 0 | 0 | 0 | 0 | 2 |
| ” in applying residual correction | - | 0 | 0 | 0 | 0 | 0 | 0 | 29 |
| ” in tabulation | - | 0 | 0 | 0 | 2 | 0 | 2 | 0 |
| THERMOGRAPH :— | | | | | | | | |
| Action | - | Good. | Good. | Good. | Good. | Good. | Good. | Good. |
| Photography | - | Do. | Do. | Do. | Fair. | Do. | Do. | Do. |
| Records deficient | - | 3 hrs. wet, not sufficient water. | †15 hrs. dry, and 25 hrs. wet lost. | 8 hrs. W. out of action. 1 D. & W. by failure of gas. | 5 hrs. D. trace indistinct. 5 hrs. W. insufficient water. | 13 hrs. W. out of action. 1 hr. D. & W. §. | 2 hrs. D. and W., clock stopped. | None. |
| <i>Result of 40 Remasurements :—</i> | | | | | | | | |
| Greatest difference | - | Dry. Wet. | Dry. Wet. | Dry. Wet. | Dry. Wet. | Dry. Wet. | Dry. Wet. | Dry. Wet. |
| Mean difference irrespective of sign | - | 0.30 0.30 | 0.30 0.30 | 0.20 0.20 | 0.30 0.30 | 0.10 0.10 | 0.20 0.20 | 0.30 0.30 |
| Residual difference (—Kew) | - | 0.19 0.19 | 0.15 0.15 | 0.10 0.10 | 0.17 0.15 | 0.04 0.05 | 0.10 0.12 | 0.13 0.14 |
| Mean monthly difference between simultaneous thermograph and thermometer | - | +0.01 +0.09 | —0.04 —0.06 | —0.07 —0.09 | +0.10 —0.06 | —0.01 +0.02 | +0.09 —0.04 | +0.08 +0.07 |
| No. of errors discovered in entry of standard | - | 0.20 | 0.14 | 0.08 | 0.12 | 0.13 | 0.16 | 0.19 |
| ” discovered by subsidiary measurements | - | 1 1 | 0 0 | 0 0 | 0 0 | 0 0 | 0 0 | 0 0 |
| ” in maximum and minimum | - | 3 3 | 0 0 | 1 0 | 0 0 | 0 0 | 0 0 | 1 3 |
| ” in tabulation | - | 3 | 0 | 0 | 1 | 0 | 1 | 0 |

* Doubtful, owing to the loosening of the pin of the cylinder.

† 4 hours lost through failure of trace, and 10 hours owing to the pin of direction shaft becoming loose.

‡ 15 hours D. and W. clock line broken; 8 hours W. lamp glass blackened; 2 hours W. insufficient water. § Owing to the cylinder being started in wrong position, the lights having passed over the binding rods.

| Points noticed at Kew. | | Aberdeen. | | Armagh. | | Falmouth. | | Glasgow. | | Kew. | | Stonyhurst. | | Valencia. | |
|--|---|------------|--|----------------------|--|------------------|--|----------------|--|------------------|--|---------------------|--|-----------------------|--|
| ANEMOGRAPH:— | | Good. | | Good. | | Good. | | Good. | | Good. | | Good. | | Good. | |
| Action | - | None. | | 1 hourly value of D. | | None. | | None. | | 9 hours V. | | None. | | None. | |
| Records deficient | - | — | | 1st. | | 24th. | | 1st. | | — | | 28th. | | — | |
| Orientation verified | - | — | | 1st. | | 0.13 | | 0.10 | | 0.03 | | 0.11 | | 0.10 | |
| Result of 40 Remasurements:— | | Direction. | | Direction. | | Direction. | | Direction. | | Direction. | | Direction. | | Direction. | |
| Greatest difference | - | 1.0 | | 1.0 | | 1.0 | | 1.0 | | 1.0 | | 1.0 | | 1.0 | |
| Mean difference irrespective of sign | - | 0.1 | | 0.3 | | 0.2 | | 0.2 | | 0.2 | | 0.3 | | 0.1 | |
| Residual difference (— Kew) | - | 0.0 | | -0.1 | | -0.1 | | -0.1 | | +0.1 | | -0.1 | | 0.0 | |
| No. of errors discovered | - | 0 | | 1 | | 0 | | 1 | | 0 | | 0 | | 0 | |
| Errors in rain tabulation | - | 0 | | 1 | | 1 | | 0 | | 0 | | 0 | | 7 | |
| BAROGRAPH:— | | Good. | | Good. | | Good. | | Good. | | Good. | | Good. | | Good. | |
| Action | - | Do. | | Do. | | Do. | | Do. | | Do. | | Do. | | Do. | |
| Photography | - | None. | | None. | | 3 hours on 23rd, | | None. | | None. | | None. | | None. | |
| Records deficient | - | — | | — | | failure of gas. | | — | | — | | — | | — | |
| Result of 40 Remasurements:— | | Direction. | | Direction. | | Direction. | | Direction. | | Direction. | | Direction. | | Direction. | |
| Greatest difference | - | 0.050 | | 0.050 | | 0.050 | | 0.050 | | 0.050 | | 0.040 | | 0.050 | |
| Mean difference irrespective of sign | - | 0.012 | | 0.019 | | 0.013 | | 0.023 | | 0.016 | | 0.018 | | 0.017 | |
| Residual difference (— Kew) | - | +0.0003 | | -0.0005 | | +0.0003 | | -0.0005 | | +0.0003 | | -0.0008 | | -0.0009 | |
| Mean monthly difference between simultaneous barograph and barometer | - | 0.0015 | | 0.0025 | | 0.0021 | | 0.018 | | 0.019 | | 0.017 | | 0.020 | |
| No. of errors discovered in entry of standard | - | 0 | | 1 | | 0 | | 1 | | 0 | | 0 | | 9 | |
| " in calculating residual correction | - | 0 | | 0 | | 0 | | 0 | | 0 | | 0 | | 3 | |
| " in applying residual correction | - | 1 | | 0 | | 0 | | 3 | | 1 | | 0 | | 3 | |
| " in tabulation | - | 0 | | 0 | | 0 | | 0 | | 0 | | 0 | | 1 | |
| THERMOGRAPH:— | | Good. | | Good. | | Good. | | Good. | | Good. | | Good. | | Good. | |
| Action | - | Do. | | Do. | | Do. | | Fair. | | Do. | | Do. | | Do. | |
| Photography | - | None. | | 10 hrs. D. and W. | | 18 hours wet | | 1 D. and W. | | 14 hrs. wet bulb | | 1 hour W. | | 23 hrs. wet bulb | |
| Records deficient | - | — | | clock stopped. | | out of action. | | out of action. | | out of action. | | failure of the gas. | | partly out of action. | |
| Result of 40 Remasurements:— | | Direction. | | Direction. | | Direction. | | Direction. | | Direction. | | Direction. | | Direction. | |
| Greatest difference | - | 0.20 | | 0.20 | | 0.10 | | 0.20 | | 0.10 | | 0.20 | | 0.20 | |
| Mean difference irrespective of sign | - | 0.09 | | 0.11 | | 0.08 | | 0.11 | | 0.05 | | 0.11 | | 0.11 | |
| Residual difference (— Kew) | - | +0.06 | | -0.06 | | -0.08 | | +0.03 | | +0.01 | | +0.06 | | -0.06 | |
| Mean monthly difference between simultaneous thermograph and thermometer | - | 0.12 | | 0.14 | | 0.10 | | 0.09 | | 0.09 | | 0.12 | | 0.19 | |
| No. of errors discovered in entry of standard | - | 0 | | 0 | | 0 | | 0 | | 0 | | 0 | | 1 | |
| " discovered by subsidiary measurements | - | 0 | | 0 | | 0 | | 1 | | 0 | | 0 | | 0 | |
| " in maximum and minimum | - | 0 | | 0 | | 0 | | 0 | | 0 | | 0 | | 0 | |
| " in tabulation | - | 0 | | 0 | | 0 | | 1 | | 0 | | 0 | | 2 | |

SEPTEMBER.

| 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. | 23 hrs. V. and D. | None. | None. | None. |
| Orientation verified | - | — | — | Sept. 20th. | 1st. | 30th. | — | — |
| Result of 40 Remasurements :— | | | | | | | | |
| Greatest difference | - | Direction. Velocity. | Direction. Velocity. | Direction. Velocity. | Direction. Velocity. | Direction. Velocity. | Direction. Velocity. | Direction. Velocity. |
| Mean difference irrespective of sign | - | 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 |
| Residual difference (— Kew) | - | 0.2 0.5 | 0.1 0.4 | 0.1 0.4 | 0.1 0.5 | 0.1 0.2 | 0.2 0.2 | 0.1 0.4 |
| No. of errors discovered | - | +0.1 -0.1 | -0.1 -0.1 | -0.1 -0.1 | 0.0 -0.1 | 0.0 0.0 | -0.1 -0.1 | +0.1 -0.2 |
| Errors in rain tabulation | - | 0 0 | 0 0 | 1 1 | 0 1 | 0 0 | 0 0 | 0 4 |
| BAROGRAPH :— | | | | | | | | |
| Action | - | Good. | Good. | Good. | Good. | Good. | Good. | Good. |
| Photography | - | Do. | Do. | Do. | Do. | Do. | Do. | Do. |
| Records deficient | - | None. | None. | None. | 18 hours lost.* | 20 hours lost through stoppage of clock. | None. | 14 hours lost; clock stopped by the shutter. |
| Result of 40 Remasurements :— | | | | | | | | |
| Greatest difference | - | 0.0050 | 0.0050 | 0.0050 | 0.0050 | 0.0030 | 0.0050 | 0.0050 |
| Mean difference irrespective of sign | - | 0.0016 | 0.0018 | 0.0016 | 0.0015 | 0.0012 | 0.0017 | 0.0020 |
| Residual difference (— Kew) | - | +0.0005 | +0.0002 | -0.0001 | -0.0005 | +0.0002 | +0.0006 | +0.0006 |
| Mean monthly difference between simultaneous barograph and barometer | - | 0.0018 | 0.0022 | 0.0018 | 0.0023 | 0.0017 | 0.0022 | 0.0022 |
| 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 | 4 |
| " in applying residual correction | - | 0 | 0 | 0 | 2 | 1 | 3 | 5 |
| " in tabulation | - | 0 | 0 | 0 | 0 | 2 | 0 | 0 |
| THERMOGRAPH :— | | | | | | | | |
| Action | - | Good. | Good. | Good. | Good. | Good. | Good. | Good. |
| Photography | - | Do. | Do. | Do. | Do. | Do. | Do. | Do. |
| Records deficient | - | 2 hours wet bulb, light out. | None. | 3 hrs. wet bulb, out of action. | 25 hours D.; 38 hours W.† | 15 hours D.; 17 hours W.† | None. | 16 hours wet bulb, not sufficient water. |
| Result of 40 Remasurements :— | | | | | | | | |
| Greatest difference | - | Dry. Wet. | Dry. Wet. | Dry. Wet. | Dry. Wet. | Dry. Wet. | Dry. Wet. | Dry. Wet. |
| Mean difference irrespective of sign | - | 0.30 0.30 | 0.20 0.30 | 0.30 0.30 | 0.30 0.20 | 0.10 0.10 | 0.20 0.20 | 0.20 0.20 |
| Residual difference (— Kew) | - | 0.14 0.13 | 0.12 0.12 | 0.14 0.12 | 0.13 0.11 | 0.03 0.04 | 0.10 0.11 | 0.09 0.10 |
| Mean monthly difference between simultaneous thermograph and thermometer | - | -0.14 -0.06 | -0.14 -0.06 | -0.14 -0.06 | +0.04 +0.05 | -0.01 0.00 | +0.10 +0.11 | -0.06 -0.05 |
| No. of errors discovered in entry of standard | - | 0.16 0.15 | 0.12 0.12 | 0.11 0.12 | 0.09 0.10 | 0.08 0.11 | 0.12 0.14 | 0.16 0.23 |
| " discovered by subsidiary measurements | - | 0 0 | 0 0 | 0 0 | 0 0 | 0 0 | 0 0 | 0 0 |
| " in maximum and minimum | - | 2 1 | 0 0 | 1 0 | 1 1 | 0 0 | 0 2 | 2 2 |
| " in tabulation | - | 0 0 | 0 0 | 0 0 | 1 1 | 0 0 | 0 2 | 1 3 |

* Through oversight of assistant, who was deputed to change the photographic sheet.

† 18 hours each; dry and wet, from oversight of assistant, who was deputed to change the photographic sheet; 7 hours each; dry and wet; curve invisible; 13 hours wet; light out.
‡ 9 dry and 6 wet; trace invisible; 6 dry and 6 wet; clock stopped; 5 wet bulb out of action.

Submitted—The following statement of accounts paid and liabilities to 30th September 1872:—

| | Paid. | Estimated Liabilities. |
|--|-------------|------------------------|
| OFFICE :— | £ s. d. | £ s. d. |
| Salaries - - - | 624 9 1 | — |
| Rent, fuel, &c. - - - | 294 2 11 | 14 0 0 |
| Contingencies - - - | 247 11 6 | 10 0 0 |
| LAND METEOROLOGY :— | | |
| Expenses at observatories - - - | 1,333 12 10 | 82 0 0 |
| New instruments for ditto - - - | — | — |
| Computations - - - | 441 18 4 | — |
| Telegraphy - - - | 508 4 8 | 550 0 0 |
| Inspections, &c. - - - | 107 16 9 | 9 0 0 |
| Computations - - - | 265 3 10 | — |
| OCEAN METEOROLOGY :— | | |
| Marine Superintendent - - - | 200 0 0 | — |
| Instruments, Admiralty - - - | 106 5 10 | 252 0 0 |
| Ditto Mercantile Marine - - - | 208 2 0 | 191 0 0 |
| Computations and care of instruments - - - | 472 19 7 | — |
| Totals - - - | 4,810 7 4 | 1,108 0 0 |

Grand total - - £5,918 7s. 4d.

ROBERT H. SCOTT, Director.

Reported—That the following cheques had been drawn, on the signature of the Hydrographer, for August, on the 20th August:—

For Office:

| | | |
|-------------------------|--------------------|---------|
| R. H. Scott - | Salaries and wages | £ s. d. |
| J. S. Harding, jun. - | | 66 13 4 |
| J. S. Harding, sen. - | | 16 13 4 |
| T. D. Bell - | | *7 14 0 |
| J. Rowsell, books - - - | | *4 8 0 |
| " " - - - | | 3 10 0 |
| " " - - - | | 2 4 6 |
| | | 5 14 6 |

For Observatories:

| | | |
|--------------------------------------|-------------------|---------|
| T. Kerr (Valencia), salary - - - | | 20 16 8 |
| R. & J. Beck, zinc plates, &c. - - - | | 6 7 2 |
| " " - - - | | 3 11 2 |
| | | 9 18 4 |
| Hopkin & Williams, chemicals - - - | | 14 18 0 |
| 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 |
| T. E. Allen - | | *6 8 0 |
| E. Magrath - | | *6 8 0 |
| J. P. Cutts - | | *4 0 0 |
| W. L. Dallas - | | *6 0 0 |

For Telegraphy:

| | | |
|--|--------------|-----------|
| N. J. Holmes, Scilly Telegrams, June - - - | | 3 5 0 |
| " " July - - - | | 3 6 3 |
| | | 6 11 3 |
| V. Brooks, Day & Son, printing, &c. - - - | | 8 15 3 |
| F. Gaster - | Computations | 16 6 2 |
| F. Brodie - | | *† 5 12 0 |
| G. G. Francis - | | *† 4 18 8 |
| R. Sargeant - | | *† 3 12 1 |

Carried forward - - 246 10 11

* Four weeks to the 24th.

† Including allowance for extra attendance.

| | | | | £ s. d. | | |
|-------------------------------------|---|---|---------|---------|----|----|
| Brought forward | | | | 246 | 10 | 11 |
| For Ocean Meteorology : | | | | | | |
| H. Toynbee, Marine Superintendent | - | - | - | 33 | 6 | 8 |
| Elliott, Brothers, "A." instruments | - | - | - | 5 | 10 | 0 |
| F. Pastorelli | - | - | - | 4 | 12 | 0 |
| J. J. Hicks | - | - | 21 12 8 | | | |
| " | - | - | 26 10 0 | | | |
| " " M. O." instruments | - | - | 16 10 0 | | | |
| " | - | - | 2 5 3 | | | |
| | | | | 66 | 17 | 11 |
| McGregor & Co., Glasgow, agents | - | - | - | 16 | 5 | 0 |
| W. Salmon | - | - | - | 20 | 16 | 8 |
| R. Strachan | - | - | - | *19 | 3 | 4 |
| C. Harding | - | - | - | †13 | 0 | 4 |
| J. A. Curtis | - | - | - | ‡6 | 8 | 0 |
| W. G. James | - | - | - | ‡6 | 8 | 0 |
| J. W. McVeagh | - | - | - | ‡3 | 4 | 0 |
| Computations, &c. | | | | | | |
| For Office Expenses : | | | | | | |
| J. S. Harding, jun., on account | - | - | - | 130 | 0 | 0 |
| Total | - | - | - | £572 | 2 | 10 |

The following account was presented by the Kew Committee :

Verification of "M. O." instruments - £2 8 0

Leaving a balance of 21l. 14s. 11d. to the credit of the Meteorological Committee on the sum drawn 29th April.

For September on the 14th of that month :—

For Office :

| | | | | | |
|-------------------------------|---|--|-----|----|---|
| R. H. Scott | - | | 66 | 13 | 4 |
| J. S. Harding, jr. | - | | 16 | 13 | 4 |
| J. S. Harding, sr. | - | | \$9 | 12 | 6 |
| T. D. Bell | - | | \$5 | 10 | 0 |
| J. H. Parsons, Office repairs | - | | 8 | 14 | 8 |

For Observatories :

| | | | | | |
|-----------------------------|---|--|------|----|---|
| T. Kerr, Valencia, Salary | - | | 20 | 16 | 8 |
| Malby & Sons, Printing, &c. | - | | 23 | 2 | 0 |
| R. H. Curtis | - | | 10 | 0 | 0 |
| F. C. Steventon | - | | 9 | 3 | 4 |
| C. Stodart | - | | \$10 | 0 | 0 |
| H. W. Woodward | - | | \$5 | 0 | 0 |
| T. E. Allen | - | | \$8 | 0 | 0 |
| E. Magrath | - | | 8 | 5 | 4 |
| J. P. Cutts | - | | \$5 | 0 | 0 |
| W. L. Dallas | - | | \$7 | 10 | 0 |

For Telegraphy :

| | | | | | |
|---|---|--|----|----|---|
| N. J. Holmes, Shetland telegrams to 27th July | - | | 1 | 1 | 3 |
| W. Godward, calculating tables | - | | 2 | 10 | 0 |
| F. Gaster | - | | 16 | 13 | 2 |
| F. Brodie | - | | 7 | 1 | 8 |
| G. G. Francis | - | | 7 | 2 | 4 |
| R. Sargeant | - | | 3 | 18 | 4 |

Carried forward - £252 7 11

* Including allowance for care of instruments.

† Including allowance for extra attendance.

‡ Four weeks to the 24th.

§ Five weeks to 28th September.

|| 5½ weeks.

| | | | £ | s. | d. |
|-------------------------------------|---------------------|--------|------|----|----|
| Brought forward | - | - | 252 | 7 | 11 |
| For Ocean Meteorology : | | | | | |
| H. Toynbee, Marine Superintendent | - | - | 33 | 6 | 8 |
| Negretti & Zambra, "A." Instruments | - | 4 1 6 | | | |
| Do. "M.O." „ | - | 43 4 3 | | | |
| | | | 47 | 5 | 9 |
| L. P. Casella „ | - | - | 23 | 14 | 6 |
| J. J. Hicks „ | - | - | 17 | 4 | 6 |
| P. Feathers, Dundee agent | - | - | 4 | 0 | 2 |
| W. Salmon - | } Computations, &c. | - | 20 | 16 | 8 |
| R. Strachan - | | - | *19 | 3 | 4 |
| C. Harding - | | - | †13 | 7 | 10 |
| J. A. Curtis - | | - | ‡8 | 0 | 0 |
| W. G. James - | | - | ‡8 | 0 | 0 |
| J. W. McVeagh } | | - | ‡4 | 0 | 0 |
| For Office Expenses : | | | | | |
| J. S. Harding, jun., on account | - | - | 125 | 0 | 0 |
| Total | - | - | £576 | 7 | 4 |

And the following cheques for allowances, &c., due for quarter ending 30th September on the 7th instant :—

For Office :

C. W. Jacques, Rent - - - - - 133 13 0

For Observatories :

| | | | | | |
|---------------------------|---|--------|------|----|----|
| D. Thomson (Aberdeen) | - | - | 62 | 10 | 0 |
| Less waxed paper | - | 6 10 4 | | | |
| Less anemograph forms | - | 0 12 6 | | | |
| | | | 7 | 2 | 10 |
| | | | 55 | 7 | 2 |
| T. R. Robinson (Armagh) | - | - | 36 | 5 | 0 |
| Do. expenses | - | - | 7 | 12 | 9 |
| | | | 43 | 17 | 9 |
| W. P. Dymond (Falmouth) | - | - | 66 | 5 | 0 |
| Less anemograph forms | - | - | 0 | 12 | 6 |
| | | | 65 | 12 | 6 |
| R. Grant (Glasgow) | - | - | 62 | 10 | 0 |
| Less anemograph forms | - | - | 0 | 12 | 6 |
| | | | 61 | 17 | 6 |
| Postages and repairs | - | - | 2 | 13 | 6 |
| | | | 64 | 11 | 0 |
| H. Williams (Holyhead) | - | - | 2 | 13 | 5 |
| S. Jeffery (Kew) | | | | | |
| Balance due, see below | - | - | 180 | 8 | 0 |
| C. Clouston (Orkney) | - | - | 2 | 14 | 9 |
| S. J. Perry (Stonyhurst) | - | 50 0 0 | | | |
| Less rain gauge glass | - | 0 7 5 | | | |
| Do. forms | - | 0 12 6 | | | |
| | | | 0 | 19 | 11 |
| | | | 49 | 0 | 1 |
| Postages to September 5th | - | - | 0 | 12 | 1 |
| | | | 49 | 12 | 2 |
| T. Kerr (Valencia) | - | - | 70 | 5 | 3 |
| G. T. Watson (Yarmouth) | - | - | 4 | 17 | 0 |
| Carried forward | - | - | £673 | 12 | 0 |

* Including allowance for care of instruments.

† Including allowance for extra attendance.

‡ Five weeks to 28th September.

| | | £ | s. | d. |
|-----------------------------------|---|------|----|----|
| Brought forward | - | £673 | 12 | 0 |
| For Telegraphy : | | | | |
| H. Todd (Cambridge) - | - | 5 | 0 | 0 |
| J. Costello (Dover) - | - | 3 | 5 | 9 |
| H. Williams (Holyhead) - | - | 3 | 5 | 0 |
| G. Mitchell (Kingstown) - | - | 3 | 12 | 5 |
| W. D. Penny (Nairn) - | - | 4 | 4 | 6 |
| J. Merrifield (Plymouth) - | - | 3 | 5 | 0 |
| W. Sandford (Portishead) - | - | 4 | 7 | 6 |
| J. Hoar (Portsmouth) - | - | 3 | 5 | 9 |
| Smith, Payne, & Co., for Scilly - | - | 4 | 5 | 5 |
| W. Lawrence (Shetland) - | - | 3 | 5 | 0 |
| J. Trotter (Thurso) - | - | 3 | 11 | 4 |
| T. Robinson (Yarmouth) - | - | 3 | 9 | 10 |
| C. Wakefield (York) - | - | 2 | 13 | 5 |
| For Ocean Meteorology : | | | | |
| J. R. Jones (Aberdeen) agent - | - | 3 | 3 | 7 |
| H. J. Smart (Liverpool) - | - | 8 | 16 | 6 |
| Total | - | £733 | 3 | 0 |

The following accounts were presented by the Kew Committee :—

| | | | | |
|--|---|------|----|----|
| Allowance to observatory - | - | 62 | 10 | 0 |
| Less anemograph forms - | - | 0 | 12 | 6 |
| | | 61 | 17 | 6 |
| Examination of Returns - | - | 100 | 0 | 0 |
| Postages and waxed paper - | - | 15 | 6 | 5 |
| Verification of "A" instruments - | - | 18 | 4 | 0 |
| Do. "M.O." do. - | - | 6 | 15 | 0 |
| | | 202 | 2 | 11 |
| Deduct balance to credit of Meteorological Committee on sums advanced 29th April - | - | 21 | 14 | 11 |
| | | £180 | 8 | 0 |

The following cheques for October were drawn—

For Office :

| | | | | | | |
|--------------------------------|--------------------|---|---|----|----|---|
| R. H. Scott | Salaries and wages | - | - | 66 | 13 | 4 |
| J. S. Harding, junior | | | | 16 | 13 | 4 |
| J. S. Harding, senior | | | | *7 | 14 | 0 |
| T. D. Bell | | | | *4 | 8 | 0 |
| Davey, Thompson & Co., coals - | - | - | - | 11 | 4 | 0 |
| Williams and Norgate, books - | - | - | - | 5 | 7 | 0 |

For Observatories :

| | | | | | |
|--------------------------------------|--------------|---|----|----|----------|
| R. Beckley, inspecting observatories | - | - | 41 | 13 | 6 |
| Less amount advanced | - | - | 25 | 0 | 0 |
| | | | | | |
| T. Kerr, Valencia salary | - | - | - | - | 16 13 6 |
| R. H. Curtis | Computations | - | - | - | 20 16 8 |
| F. C. Steventon | | | | | 10 0 0 |
| C. Stodart | | | | | 9 3 4 |
| H. W. Woodward | | | | | *8 0 0 |
| T. E. Allen | | | | | *4 0 0 |
| J. P. Cutts | | | | | *6 8 0 |
| W. L. Dallas | | | | | *4 0 0 |
| | | | | | *6 0 0 |
| Carried forward | - | - | - | - | £197 1 2 |

* Four weeks to 26th October.

| | | | | £ | s. | d. |
|--|---------------------|---|---------|------|----|----|
| | Brought forward | - | - | 197 | 1 | 2 |
| For Telegraphy : | | | | | | |
| Postmaster-General, to June 30 | - | - | - | 298 | 18 | 3 |
| N. J. Holmes, Scilly Company, August | - | - | 4 6 3 | | | |
| " " September | - | - | 3 5 0 | | | |
| | | | | 7 | 11 | 3 |
| S. M. Clare, Submarine Company, June, August | - | - | 14 17 6 | | | |
| S. M. Clare, Submarine Company, September | - | - | 2 13 2 | | | |
| | | | | 17 | 10 | 8 |
| V. Brooks, Day and Son, printing, &c. | - | - | - | 8 | 14 | 5 |
| F. Gaster | } Computations, &c. | - | - | *17 | 5 | 5 |
| F. Brodie | | | | †6 | 11 | 8 |
| G. G. Francis | | | | †6 | 14 | 4 |
| R. Sargeant | | | | †3 | 9 | 2 |
| For Ocean Meteorology : | | | | | | |
| H. Toynbee, marine superintendent | - | - | - | 33 | 6 | 8 |
| W. Ladd, carbonic acid | - | - | 1 10 0 | | | |
| " " | - | - | 1 10 0 | | | |
| | | | | 3 | 0 | 0 |
| W. Salmon | } Computations | - | - | 20 | 16 | 8 |
| R. Strachan | | | | †19 | 3 | 4 |
| C. Harding | | | | †14 | 4 | 4 |
| J. A. Curtis | | | | †6 | 8 | 0 |
| W. G. James | | | | †6 | 8 | 0 |
| J. W. M-Veagh | | | | †3 | 4 | 0 |
| For Office Expenses : | | | | | | |
| J. S. Harding, junior, on account | - | - | - | 125 | 0 | 0 |
| Total | - | - | - | £795 | 7 | 4 |

Reported—That the audited Accounts of the Office for the past five years had been deposited at the Bank of England.—Approved.

The Committee then adjourned.

* Including allowance for extra attendance.

† Including allowance for care of instruments.

‡ Four weeks to 26th October.

116, Victoria Street, November 4, 1872.

PRESENT :

Mr. Galton in the Chair.

Mr. De La Rue.

Mr. Gassiot.

Major-General Smythe.

The Director was in attendance.

The Minutes of last meeting, October 28, were read and confirmed.

Submitted—The opinions, 35 in number, relative to the Chart for Square III. for January, which had been received in reply to the circular issued (Minutes, p. 19).

Resolved—That the following extracts from the letters be printed on the Minutes. The writers whose names are marked with an asterisk have been observers for the Office.

Sir G. B. Airy, Astronomer Royal.

There are to be considered two distinct purposes for these charts. One is, the giving of climatic information in an orderly form to men of science (which may indirectly contribute to the advantage of navigation). The other is, giving information to navigators in a shape which immediately leads to the formation of precepts for their guidance in navigation.

In regard to the mode of giving information to men of science, I think the form excellent. I do not know that anything better could be devised. Naturally it demands a little quiet attention at first for entire mastery of the symbolical language; but when that is attained I think that the eye picks up the meaning of every part very readily. The knowledge thus placed within reach will undoubtedly prove most valuable.

In regard to the information given to practical navigators, I do not think that the advantage is so great. Few merchant captains at sea will go through the trouble of learning the meaning of the symbols, or of then interpreting each square by that knowledge; and I think that the spaces are too small for them. This may not be felt very much in the "doldrums," but in the region of the trade winds, where a ship may run through three of the squares in a day, it will be annoying.

As far as the immediate interests of practical navigators are concerned, I think I would prefer squares of 2° or 3° , and explanation in words, as "winds in any direction from — to —, but most frequent and strongest from —." I am not sure that all the remarks in the book are needed.

A. Buchan, Secretary, Scottish Meteorological Society.

As regards the barometers and thermometers, since you do not propose to correct the results by range corrections, it will be necessary that the mean day of the month and the mean hour of the day of each of the results printed be given; and for each degree square for which comparatively few observations have been obtained, a note be given drawing attention to and detailing any *unusually low* or *high* readings which may have been noted.

Prof. Buys Ballot, Royal Meteorological Institute, Utrecht.

I object only against the form, but so positively that I cannot but dissuade following that method of publishing.

The method is too expensive and laborious; laborious for you in composing, and laborious for others to get a view of the distribution of every one of the circumstances you propose to show.

Shipmasters are not able generally, and if they are able they cannot find the time, to collate the data from such a chart. It is the same error by which the charts of Maury were useless for practice. Shipmasters should have a clear very easy view of the general direction of the wind and of its force on one table; of the height and variation of the barometer on another chart; of temperature, &c. on another. I do not deny that you have given an elaborate exposition; but by embracing too much, so many things, you give only a little spot of the ocean at once; and we want, the shipmasters want, a view of the whole of a given area, that he may choose at once the track where he probably will pass with the greatest speed and the least danger.

It is true everyone *can*, from your charts, compose other charts exhibiting separately the diverse phenomena over the whole of the ocean, but it is infinitely more troublesome to derive such charts from yours than to derive yours from such charts.

Then it is an arbitrary division to combine hundred *squares*. If once we have the state of an instrument for every single degree square all over the ocean, we will see where, at how many squares and how situated, in an ellipse, between parallels, or bounded by another curve, the state is nearly the same, and then we can express by *one figure* the state within such boundaries; and you can do it, I agree with you, also from your charts, but not so easily; and now at the moment, before *all* is completed, you are not able to do it. If you choose the other form and give first the wind, then the barometer, and so forth, you are much sooner able to have at least one of the phenomena perfectly and clearly proposed.

I think one of the first requisites of our publications is that they may be very easily understood by any one, even by him who is not acquainted with any learning. So I beg your pardon if I call this publication more typographically beautiful than practically useful. It is not for savants but for practical men, who must make use of the charts at one given moment of time, that we must write.

You will, I hope, not think it too arrogant of me if I have thus stated my opinion.

Sr. J. C. de Brito-Capello, Lisbon Observatory.

I see that the investigations embrace a large quantity of Meteorological data, and are very minute for each square of one degree; this will give results of incalculable importance; but if this system were adopted for the entire ocean, it would be an almost interminable work. Even if adopted for the more important parts, for instance, the whole district of the Doldrums, the region of the Monsoons of the Indian and China Seas, &c., I think it would be a very costly enterprise, and therefore the charts would not be easily accessible to the majority of navigators.

I think that the chief merit of this very minute and important investigation is its capability of being discussed, at some period more or less distant, for each particular route, so that the navigator will only have to consult a less number of charts.

I conclude by offering you a number of Meteorological Journals kept on board our ships of war and merchant vessels during late years. Some are of great value having hourly observations of barometer and thermometer, and the instruments have been nearly all compared with the standards of the Observatory.

You can extract all the data that you wish for, and keep the journals as long as you think necessary. I beg, therefore, that you will kindly tell me the safest way of sending them.

Capt. W. Dawson, R.N.

The chart strikes me as too full of information for the seaman; and one is inclined to ask, could not the *number* of observations be omitted from the chart and relegated to a table, and could not per-centages (where necessary) be substituted for number of observations.

Your isobars and isotherms (p. 43) are more intelligible charts as to their subjects than the large one with so much crowded into it.

The varieties of shading in the circles are hardly sufficiently decided to catch the eye easily.

Would it be possible to add one or two suggested *tracks* right across all the other lines? say where the No. 3 square should be crossed outwards from England to the Cape and to Rio, and homewards from Rio and from the Cape, by steamers and by sailing ships.

To meteorologists the additional information would be most valuable, and when the other principal squares are completed will prove most invaluable, and as they would make a special study of hieroglyphics bearing on meteorology, an over abundance of figures and signs on the chart would be a merit rather than a drawback.

I do not quite see why the divisions of the circles should not be prolongations of the points of the compass, instead of the half points? Nor why the intermediate points should be distinguishable from the cardinal ones otherwise than by the lettering.

Your "conclusions" in the "remarks" are very interesting and very clear.

**Capt. T. Donkin, R.N.R., ship "Interness."*

General approval.

**Capt. A. D. Fernie, ship "Sir John Lawrence."*

General approval.

Herr W. H. v. Freeden, Norddeutsche Seewarte, Hamburg.

I wonder at the assiduity with which you have gathered all the data in square No. 3, and the miraculous skill by which all the data are grouped. Yet for practical use of *seamen* is there not given too much to be seen quickly through, and to be published in a short time beginning again from the first square? You know I am a single track man by business, occasionally making incursions into the meteorological science by "*naturam expellas furcâ ; tamen usque recurret*," so I look more on the immediate practical use of charts.

**Capt. A. Fry, late ship "Aconside."*

It is a most elaborate work, and worthy of all praise both for ingenuity and the patient carrying out of all details. Still from what I know of the British shipmaster, I am afraid there are very few indeed who will attempt to investigate the maze of figures; the array will frighten them.

For that district I should recommend a supplementary chart, showing graphically the average limits of N.E. and S.E. trades, line of doldrums, with average width, &c.; and by some system of *shading*, the prevalence of calms, rains, &c.; this would be useful to the *comparatively* illiterate man who hates figures. Many years ago I constructed such charts for every month from Maury's data; I found them very useful, and they enabled me to be "*lucky*" in crossing the calms, and my homeward passages were usually below the average.

Now for your chart as it is:—

I regret to see the materials to work from so bare, in many squares the observations so few, that a fair average can scarcely be expected.

1. The wind *roses* are much the same as Maury's, and have some of the objectionable features to be found in them; they are too crowded for some intellects to attempt to grasp.

2. The *force of wind* is good.

3. Is not the average of the force of *variables* a very doubtful quantity? Some might be force 1 and others 11.

4. The average height of barometer does not appear to me to be so regular as in my experience, and without egotism I think I have watched, registered, analysed, and studied its fluctuations in *that* region as much as most people.

The average should be of readings at the *same* hour, say *noon*.

5. The temperature of sea would be very useful. Any sudden change from such ought to put one on his guard against some unusual current, which is well known to be the reason given for the loss of many valuable ships, the neighbourhood of the Rocas, to wit.

6. The average of air temperature is not of much use, I should say, in the tropics; beyond them, *very valuable*.

In the northern hemisphere air above the average would show the coming wind more or less southerly; and if below, more or less northerly. *Vice versâ* for southern hemisphere.

7. Difference of dry and wet bulb thermometers ought to show the approach of trade winds, but it must be remembered that the southern edge of north-east trade and the northern edge of the south-east are nearly *saturated*; it is when emerging from them, or losing them going north in north-east and south in south-east, that their extreme dryness is felt.

8. The mean rate of currents would not be of much use unless they were nearly always in the *same* direction.

9. Wind *arrows* good, but I must object to the plan of showing the prevalence of certain winds by numbers; it should be how much *per cent.* of all the observations for wind in that square. A man would wish to run his finger along the squares and see at once the *comparative* prevalence of certain winds; this he can do if they are all brought to *one standard "per cent."* but as they stand in this chart he must make some such calculation before he can compare one square with another; the same will apply to prevalence of calms. I felt this so strongly several years ago, that I took Maury's charts for the outward and homeward tracks between England and West Coast of Africa, and converted all the wind roses and calms into "per-centages," tabulating them in a book (from 7,000 to 8,000 calculations). Besides if a person were so far an enthusiast as to attempt a "pilot chart," he must have the "per-centages."

10. The prevalence of calms by shading "excellent."

11. In the average of specific gravity the remark in paragraph 5 will apply. I think 1.0291 in square 74 a printer's mistake.

12. The "variation" would be useful if trustworthy, but much is required to make it so, viz., the quality of observations, and if the local deviation of the observer's ship is accurately known. I always found the motion of the ship a great drawback to close compass observations.

Captain J. G. Goodenough, R.N.

I have to acknowledge the receipt of the chart (square 3) of Ocean Meteorography for January. It seems to me impossible to speak too highly of the care, sagacity, labour, and quality of the labour which has been employed in its construction.

I understand from the chart itself and remarks accompanying it, that the form in which the observations are now thrown is one which is considered most useful at once to the superior navigator and to the comparative meteorologist.

If such charts were designed for the ordinary navigators alone, I should (though in this matter Captain Toynbee has far more experience than myself) suggest the simplification of the record of observations and of more frequent graphical representations of wind and current either by use of curves or colours.

For instance, the ordinary navigator would prefer being relieved of the vertical and horizontal strips, and also of the observations of specific gravity of sea water, wet bulb thermometer; while he might very reasonably doubt the accuracy of observations of variation unless they are understood to be expressly selected.

But until it is thought useful to have separate charts for the ordinary navigator and for the meteorologist, I would not suggest the omission of these records.

But I would suggest the addition of either a line representing the theoretic best courses for outward and homeward bound *sailing* ships; or, what would amount to the same thing as the former nearly (in this square), a line showing where most winds are to be found.

If the suggestion of Captain John Steele be carried out would it not be clearer if the curve were shown in red or blue? And would it not be better to consider the distance from inner circle to centre, as 8 of Beaufort's scale at most, instead of 12?

The mode of showing calms seems to me to be very satisfactory, attracting the eye at once, as rocks to be avoided.

It might be more convenient to give a sheet of theoretic best courses in the "Remarks to accompany," &c., full page size.

I think that I almost prefer *not* to have the wind curves *yet*, until you get more data.

Does not the continuity hinted at by the wind-curve rather want as yet a sufficiency of data, and do not the curves rather halt when one seeks to trace them?

Without the wind curves the chart is a rigid record of facts to which every one is invited to add more.

The tracing of the curves seems to indicate a law which does undoubtedly exist as every one knows, but which does not yet sit comfortably on the data.

But the best reason I have against them is that they tend to confuse the diagrams.

* *W. Greenwood, Chief Officer, ship "Assaye."*

I received the January chart of the doldrums in due course, and I have shown it to a few captains of my acquaintance. They all appear to view it with favour, though at first sight to them it appears rather complicated; still, with a very little trouble I was able to master it fully myself. Like all new and good things it will however take some time to introduce it to the notice of the nautical public, and they are, I must say, very backward many of them to adopt anything new, however much it may be for their benefit, if it has the least appearance of being difficult to understand. Of these charts I much approve myself, and hope to see them in general favour, they show what I have always advocated to the westward on the line and well to the northward, when entering the channel bound home in the spring month of the year.

* *Captain James Hayes, SS. "Camoens."*

General approval.

Captain John Vine Hall.

I have looked closely into the chart, &c. of that region where my patience has been so often sorely tried, and upon which I have in former times bestowed no little thought.

I cannot sufficiently admire the results of your lengthened investigations and enlightened labour, for which we, and more especially those in active service, ought to feel deeply indebted.

At first sight I was inclined to think the mode of record too complicated for ordinary use, but reflecting that it was not a subject in which quick reference was required, but rather one for previous study and consideration at leisure, before approaching this—to a sailing ship—trying spot, often the turning point of a voyage, my first suggested objection, of course, vanished.

Captain N. Heckford.

Looking at the system adopted by you, it appears to me to embody all that is requisite for the meteorologist, and for the perfecting the object you have in view, but for the ordinary navigator I am of opinion that the system is too elaborate, and would therefore propose (when completed) it should be condensed and published in the form of a track chart (with marginal notes) for every month or half-month in the year, showing the best routes to be adopted by steam or sailing vessels, and which would materially assist them through the most intricate portion of the passage when bound to ports within or south of the latitudes comprised in the limits to which such track chart would refer.

**Captain H. Henderson, late barque "Hope."*

I have studied the January wind chart of the monthly series with great interest and pleasure, intensified by reminiscences of the locality, and consider they will be of great practical benefit to the navigator.

In the charts heretofore published the squares were too large, and had to be interpolated with the adjacent ones to ascertain which side was the best.

Likewise the season represented by the chart was too long, and sometimes necessitated the interpolation of two 3-monthly charts, causing doubt regarding the result.

In the present, bad squares may be avoided without much, if any, increase of distance, and the time is certain.

I think (and some friends—shipmates—to whom I have shown the chart made the same remark) that coloured lines indicating the best probable track across the chart, outward and homeward, might be drawn for the benefit of those who otherwise might be deterred from availing any of its benefits, either from want of ability or carelessness.

With such charts on board I know I should have saved several days on my last passage home from China, without much increase of distance from St. Helena to the equator.

**Captain E. Hight, Local Marine Board, London.*

The chart and remarks you so kindly sent for my consideration I have carefully studied, and arrived at the conclusion that the amount of information condensed in so small a compass is of great value for reference to the meteorologist, and the arrangement all that is desirable, which is also applicable to the navigator who wants to go into detail.

For practical purposes in navigation it seems to me too elaborate to refer to at the time it is wanted. How would it do to have a chart of these regions with a track projected for each month on it, from the given date, so that the navigator could take it up and see at a glance the route marked out for the month required? but you have no doubt thought this over. I am thinking only of the practical use of such an arrangement.

J. K. Laughton, M.A., R.N. College.

To students of anemology, myself for example, I think your undertaking will be as valuable as the labour is stupendous; but I doubt very much whether the practical navigator will go through the work of even learning the language in which the chart is written, and whether the very look of it will not frighten him off. You, and still more Captain Toynbee, ought to be much better judges of that than I am, but I am strongly inclined to think that most navigating officers in our service would *shy* at the very sight of this chart. But our navigating officers, though good practical men, are, as a rule, the very reverse of scientific.

Professor E. Loomis, Yale College, Connecticut, U.S.

I admire the care which you have taken to give the results of the observations with such minuteness and precision, and do not doubt that the results will be of the highest value to science, and also to practical navigation. In order, however, to secure the latter object most effectually, I think it will be necessary to present the results in a much more condensed form, for most navigators would be discouraged by such an amount of detail, or would be most likely to profit by the details after they had obtained a general idea of the subject from a more condensed statement.

William Lund, Esq.

General approval.

Captain N. Marder.

General approval.

Rear-Admiral Sir F. L. McClintock.

To afford information and to afford it clearly to men who are not much accustomed to charts of this kind, is what is to be most desired. I will mention my own crude ideas on the subject. If I were about to sail through this space, say from north to south, I would carefully note the squares lying in this direction which showed the most favourable winds and currents, and I would then draw a pencil line through them, and sail if possible along it. Perhaps the outward and homeward route across this space might be shown by dotted or coloured lines, and be of some use. I think the distinction between "italic" and Roman figures is insufficient, and that the former being merely for the number of observations, should be in smaller type also. And I think that where the observations are sufficiently numerous to afford confidence (and this number you would have to decide), it would be unnecessary to insert them, consequently where the number was shown, it would also serve as a caution not to rely too much upon the indication given.

This chart affords all the information the most accomplished meteorologist and navigator could desire. I think most captains would be content with squares of 2° , the circles not being larger than in this proposed chart, so that he would have blank space between them for laying down his track and noting his winds and currents; a simpler form also in left and bottom margins, omitting the columns for "weather" and "clouds."

J. Merrifield, F.R.A.S., Navigation School, Plymouth.

The only remarks I have made in considering the chart, &c. are:—

1. Directions should be given to all who use them that a slight variation from the normal height of the barometer is likely to presage a change.
2. I quite agree with Captain Steele that a graphical representation of the force of the wind would be an advantage.

The charts, as far as I can judge, will prove of the utmost utility both to seamen and meteorologists.

Com. M. F. Maury, LL.D., Lexington College, Virginia.

Square "No. 3" lies in the Atlantic, between the equator and 10° N. longitude, 20° and 30° W.; and it is divided into 100 fields of 1° square each. Of all parts of the open sea this is perhaps the most frequented. The 10° squares, which include the "chops of the channel" and the approaches to Liverpool, are doubtless more traversed than this; but out upon the wide ocean and beyond the sight of land, there is perhaps no field that is so frequently "ploughed by keels" as this. As a rule, all vessels in the Atlantic passing from one hemisphere to the other, whether bound for Rio, South America, Australia, or around either of the capes, usually traverse this square.

Being such a highway in which observations are so frequent, and being in a meteorological position of such importance, as it is, viz., at the meeting of the trade winds in the doldrums, and in the wedge of the westerly monsoons that feed the springs of the Niger, all these circumstances conspire to make it an inviting field of research. Wisdom has been displayed in the selection of this square for minute investigation.

These investigations are in continuation of the wind and current charts; and they not only confirm several important discoveries announced in the "sailing directions" as they were uttered, but they develop, for the first time, other phenomena of a highly important and interesting nature.

They show that the atmosphere is not smooth like the sea, but corrugated somewhat like the ripples in the rapids of a river, perhaps "lumpy" would be a better term, for the isobars show permanent (?) irregularity as well as inequality in pressure, even over so small an area.

There seems to be a clue here, which, if followed up, might enable us to determine the upward force of the trade wind air, after it is poured into the belt of equatorial calms. They remind one of the trough in the atmosphere which my friend, the late Lieutenant Herndon, discovered during his exploration of the Amazon. As he descended the river, he found, for a certain distance from the eastern base of the Andes, the barometric pressure to be less than it was above or below. In other words, his barometer indicated that he was going up-hill, notwithstanding he knew that he was drifting down stream in a canoe.

You have observed that when a rapid tide covers up a sunken rock, there is always a depression in the water a little way up stream from the rock; and such a depression to *windward* was made in the air by the trade winds as they bounded over that range of mountains.

A skilful use of colours on "No. 3" would have brought out these barometric as well as other anomalies most beautifully.

Your specific gravities—surface water—will vary with the cloud ring. As long as specific gravity observations are confined to the surface they will be deceptive. They vary with the rain-fall at sea, with evaporation, and with the river discharge into littoral waters.

See Plate XVII., Vol. I., 8th edition, Maury's Sailing Directions. There you have specific gravity and temperature curves for every degree of latitude from Behring's Strait, via Cape Horn to New York. These curves are a study. See Figure 2. Here in lat. 34° N. the vessel bound to New York got inside the Gulf Stream and into the littoral waters of North Carolina, Virginia, Pennsylvania, &c., which receive the river drainage from Albemarle Sound, Chesapeake Bay, Delaware Bay, &c. Note this anomaly:—"Lat. 34° , temp. 80, sp. 1.0255. Lat. 40° (off Sandy Hook), temp. 71, sp. gr. 1.0230." So here, as the water gets cold, it grows lighter.

In like manner, in crossing the equator in the Atlantic, the water decreases 1° in temperature and .0005 in sp. gr., i.e., changed from 1.0250 to 1.0245. So that the answer to this question has, as far as I know, yet to be given, viz., at what depth ought the water for specific gravity of the sea to be taken to give us fair measures?

This is a most valuable contribution to our knowledge touching the physics of sea and air. It is of practical use to navigators also, and I thank you heartily for it.

Prof. T. B. Maury, Chief Signal Office, Washington.

General approval.

Captain M. S. Nolloth, R.N.

General approval.

Dr. A. Petermann.

If I should infer from the more general physical and meteorological maps suitable to the public at large, I should prefer a separation of the different items to be shown, and devote a complete map to each.

* Captain C. H. Renaut, ship "Celaeno."

It is, I think, a very valuable chart, as it comprises the information wanted by a shipmaster, in the most trying part of the voyage to the southward. Of course, this chart by itself is of no use. I shall look forward with impatience for the production of those charts of the same space in the Atlantic for the months of the last quarter of the year. I have shown the chart to several masters, who think with me it is a very valuable production.

Rear-Admiral A. P. Ryder.

I think the Meteorological Chart is likely to be very useful to seamen. To introduce it in the navy with the best chance of being successful,—

1. The charts should be supplied to the "*Britannia*" training ship and her tenders, and it should be explained to the pupils.
2. They should be supplied to all men-of-war.
3. A knowledge of how to use them should be required from all midshipmen when passing for sub-lieutenants, all staff midshipmen for navigating sub-lieutenants, and each subsequent examination.

Messrs. Shaw, Savill, & Co.

We have examined the chart and remarks, and our opinion is that the information given is highly valuable. We consider that the method has much to recommend it to masters in the merchant service, but we doubt if many could be found to use the charts. As a rule, we believe shipmasters of any standing prefer acting on their own experience to taking other data, however trustworthy and valuable.

G. H. Simmonds, late Meteorological Office.

The graphic representation of the mean results of meteorological observations on the scale of the specimen chart for any great extent of the ocean, such as one wants when taking a general view, would take up so much room that it would be too cumbersome for use or purpose of study.

The squares are so small that in many cases, from the uncertainty of the ship's position, the mean results would be in part determined from a large number of observations made in adjacent squares.

The mean results obtained for the sub-squares of square 3 show that there is no necessity for graphically representing the mean elements for such small spaces; any variation that there may be only arises from the want of a sufficient number of observations.

The chart is a graphic representation of the *direction of the wind* and of *calms only*, all the other information is given in a tabular form (), and would be more readily referred to if printed as a regular tabular statement.

The variation of the compass has no explained connection with meteorology, and so few observations of any value are made on board of merchant ships, that placing it on the chart is only a useless encumbrance, serving to make the chart more confused.

* Captain John Steele, late SS. "Erl King."

Do you not think that for practical purposes the chart is wanting in distinctness, and that its elaboration will mystify a vast number of very worthy men? Much is said now-a-days about studying at leisure, but both you and I have had sufficient experience to arrive at the conclusion that the careful navigator must exclude memory in all matters where time elapses between their occurrence, and that prudence dictates a constant reference to authority. This allowed, it is important that reference for correction of memory should be simple and distinct. It is true there is no risk attached to an erroneous view of this chart, but its object is of sufficient importance to make its study profitable; and, to be profitable to the man who may have his mind pre-occupied by "deck duties," and body animated by heat and the excessive humidity of the equatorial regions, the charts should be more simple.

The eye, when first resting upon the chart, "instinctively lays hold of the arrow pointing inwards from the inner circle," as denoting the "force and direction of the wind." To meet the grievous disappointment on the discovery that this arrow represents, the number of observations for that direction of wind and for the strength of that wind he must refer to figures in the circle immediately behind the arrow. This disappointment destroys the charm of research. The necessity for reference to the explanation of the chart upon a point averse to his own judgment tells against the arrangement of the chart.

The figures in the left-hand upper corner, representing the strength of the wind in the square, are simple and comprehensive; but to the sailing ship, direction is equal, if not superior, in importance to strength, and I think both might have been represented by an arrow showing direction, and graduated in length in proportion to strength of wind; with a second arrow of different colour running parallel with it, or "tailed" on to it, showing strength and direction of squalls; the number of squalls could be shown by strokes across the arrow. The eye would thus receive at a glance all the mind requires.

The current denoted by the arrow on the outward rim of the circle appears to me arbitrary, and in places inconsistent with the figures showing strength. Would not a colour covering points of compass (same as the dark shade showing calms), deepened in hue where current is strongest, give more correct representation? The numerals representing number of knots in 24 hours to stand as they are.

To the man bent upon scientific scrutiny, who requires data to satisfy his scruples, your chart must be invaluable; but for the man seeking your guidance, whose last thought would be a doubt upon your integrity, the chart is wanting in distinctness and simplicity.

Both of the above parties will appreciate your marginal weather and cloud "forms."

As a geographical basis, I am not in favour of 1° squares, because they necessitate the splitting up of a ship's track into portions of a day, and grouping the observations under unsymmetrical series of hours. As regards time, the basis of grouping I think should be the civil day; and squares of 5 do not seem to me too large for this period of time, and for the gigantic proportions of the work to be done, at least for the first opening up of the subject. The study of the relative results obtained on such a plan would show for what regions it would be profitable to go into more detail, or smaller areas, and for what objects.

As a consequence of the small areas, the method of extraction is faulty. The registers furnish sets of observations for every four hours generally, hence the reason for extracting five entries for the 24 hours is not apparent. There cannot be a doubt that, as the hours are not symmetrically selected for each square, "the various hours at which the observations were taken may not give the mean result for the 24 hours;" therefore, this seems to me to constitute a radical defect. I think the observations should be grouped in sets which will give the most probable daily means. As the work has been done, the pressure, temperatures, and difference between wet and dry thermometers are neither daily averages nor means for any particular hour as 9 a.m., or noon; nor are they simultaneous values for the same hour of Greenwich or other special time. They are general averages, which do not strictly admit of intercomparison.

I would prefer that strictly daily averages should be given, and would suggest that the diurnal range for pressure and temperature should be computed from the collected data, for selected areas, and published with the text. Having such data the scientist could readily deduce from them whatever hourly values he might require. The navigator could do the same, and compare his actual experience with the chart at any time. The grand advantage would be in having strictly comparable results.

It appears to have been felt that the information was so attenuated, by the grouping into 1° squares, as to lead to the device of the strips, latitudinal and longitudinal, for which there seems no more reason than for transversal strips, or in fact than for larger squares entirely; and the same method of treatment for pressure, &c. as for weather and cloud. For, if these strips are sufficient for the weather, they ought to suffice for the other data, and the squares are hardly necessary. We really have the data worked upon three plans—squares, latitudinal strips, and longitudinal strips—which seems to be a sort of "table turning," especially when we remember that the method of percententing everything is superadded. This latter is objectionable, because it gives a fictitious weight to a paucity of observations, and tends to confusion and unsound reasonings.

After what I have said of the method of averaging, I cannot admit that the values on the chart for pressure and temperature, however combined, can serve satisfactorily for drawing isobars and isotherms; and, consequently, the relation of wind and weather to these lines cannot be traced with reliance.

Barring the mode of grouping, the method of dealing with the direction of the wind is admirable, both as regards the record of data and its pictorial representation. So of calms, and the same may be said of the force of wind, admitting the practice, which is certainly not sound, of averaging the figures of Beaufort's scale.

Referring to the remarks, page 4, I for one do not believe in any general accuracy in observing winds to a point, still less to a quarter-point of the compass, under any circumstances; and it would seem quite near enough to group for every two points. I am astonished to find that force 4 means five knots an hour for a ship's speed, while force 5 means 10 knots; for, according to Mr. Scott's investigation, 4 is velocity of air current 24 miles an hour, and 5 is 30 miles. Surely if a wind of 24 miles drives a ship 5 knots, one of 30 will not drive her 10. We seem to be getting into greater confusion with Beaufort's scale than ever.

Barring the percentages, I like the cloud statistics and those for weather, but the latter are given too much in detail. At page 55 it is said that the weather, sea, &c., are given for each subsquare, but this is evidently a mis-statement; I wish they were.

As regards the currents, I am perhaps biased in favour of my own experience. Barring the percentages I do not dislike the plan of charting, but the method of grouping I think defective, because it does not admit the same observation into each square that the ship passed through while experiencing it. I certainly do not see the use of the average rate of all the currents in a square.

The specific gravity of the sea water is given in a manner free from any objection.

The variation of the compass is given on the chart, but there is nothing whatever said about it in the remarks. It should have been stated to what epoch the observations have been reduced, for data many years old are not comparable in a medley with those of recent years.

The notes on currents, with a very few exceptions, might all have been incorporated with the charted observations. About half the notes on the clouds seem useless. The state of the sea is well given, but the remarks on its appearance might be generalised and brevity attained, thus on page 10, they amount to "water blue and luminous." The remarks on wind and weather are nearly all superfluous. The general remarks could not be dispensed with in any instance.

* *Captain J. F. Trivett, R.N.R., Local Marine Board.*

It is with some diffidence that I venture to hazard an opinion that the information conveyed by the method proposed in the chart, however valuable and important to the meteorologist and man of science, is of too minute a character, entering too deeply into particulars to be of any very great value to the generality of our navigators, many of whom, I regret to say, would be totally at a loss to comprehend the chart, or its explanation.

All that is required by the practical navigator is to know the prevailing winds and currents during every month of the year on each square of 10 degrees on the surface of the navigable ocean, with some other particulars, all of which are given in the charts known as the "Board of Trade Wind Charts," published in the years 1855-9. These charts no doubt may be considerably improved without going very elaborately into details.

(Second letter).

In my opinion such a mass of elaborate detail is not required by the practical navigator. From what I see of the men who come before me, a very large majority of them could not comprehend one half of what you have inserted in these charts. Give them some plan by which they can readily discern the prevailing winds and currents in any square of 10° —or in the doldrums say 5° —and I think that you will have all that is required by the mass.

But for scientific research your charts have an important value.

* Captain M. Vowell, barque "Kelso."

General approval.

Lieut. F. Zurcher, Harbour Master, Toulon.

M. Margollé and I return you and the Meteorological Committee our thanks for sending us the meteorological chart for square 3, January, and the explanatory text. On examining it, according to your invitation, we find that the graphical representation and notation of the data is a remarkable advance on the methods hitherto used. The meteorological character of each square is clearly shown to the seaman at the first glance, and whether he is under sail or steam he can choose the most favorable route for a quick passage.

The method used for indicating calms appears especially excellent. The data referring to currents, sea temperature, and specific gravity, which are so important for navigation, and the physics of the globe, are all easily understood.

We are convinced that the International Meteorological Congress to be held at Vienna during the approaching Exhibition will highly appreciate the merit of your labours. We heartily wish that the very practical method of observation proposed by you were universally adopted. It is also very desirable that the Congress should come to an agreement as to the similar graduation of the instruments of observation.

Read—A letter from Dr. Robinson, containing his opinion on Mr. Rundell's paper on the wind at Liverpool (Minutes, p. 39).

Resolved—That the letter be referred to the Rev. Robert Main, F.R.S., who should be requested to give his opinion on the matter to the Committee.

Read—A letter from Mr. Rundell, containing his criticisms on the mode of discussion of the anemometry at Orkney (Minutes, p. 38).—Major-General Smythe was requested to give the Committee his opinion on the question.

Read—A letter from Mr. G. J. Symons requesting the Committee to grant a loan of certain meteorological instruments to the Rev. H. A. Boys, British chaplain at Patras, and stating that he had been referred to the Committee by Mr. De La Rue, President of Section A. of the British Association.

Resolved—That the instruments be supplied on loan, on condition that the observations be forwarded to this Office.

Read—A letter from Captain Toynbee, submitting a register by Capt. J. McDonald Gray, barque "Speranza" (Minutes, 1871, p. 47).

Mr. Scott was instructed to express the thanks of the Committee to Capt. Gray for his register.

Mr. Scott was instructed to prepare a comparison of the warnings issued and the weather experienced in 1871, similar to that printed for 1870 (Minutes, 1871, p. 43), and to submit it to the Committee.

The Committee then adjourned.

116, *Victoria Street*, November 18, 1872.

PRESENT :

Sir E. Sabine in the Chair.

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

The Director was in attendance.

Mr. Scott was instructed to inform the Board of Trade that the amount required by the Committee for the financial year 1873-4 would be 10,000*l.*, being the same sum as that voted for the present year.

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

ESTIMATE for Year 1873-74.

| Office : | £ | s. | d. | £ | s. | d. |
|-------------------------------------|-------|----|----|---------|----|----|
| Salaries - - - - - | 1,250 | 0 | 0 | | | |
| Rent and fuel - - - - - | 600 | 0 | 0 | | | |
| Office expenses - - - - - | 400 | 0 | 0 | | | |
| | | | | 2,250 | 0 | 0 |
| Land Meteorology : | | | | | | |
| Expenses at Observatories - - - - - | 2,500 | 0 | 0 | | | |
| Computations - - - - - | 800 | 0 | 0 | | | |
| | | | | 3,300 | 0 | 0 |
| Telegraphy - - - - - | 2,000 | 0 | 0 | | | |
| Inspections, &c. - - - - - | 150 | 0 | 0 | | | |
| Computations - - - - - | 500 | 0 | 0 | | | |
| | | | | 2,650 | 0 | 0 |
| Ocean Meteorology : | | | | | | |
| Marine Superintendent - - - - - | 400 | 0 | 0 | | | |
| Instruments, Admiralty - - - - - | 150 | 0 | 0 | | | |
| Do. Mercantile Marine - - - - - | 300 | 0 | 0 | | | |
| Computations - - - - - | 950 | 0 | 0 | | | |
| | | | | 1,800 | 0 | 0 |
| Total - - - - - | | | | £10,000 | 0 | 0 |

Mr. Scott was instructed to reply to Sr. de Brito Capello (Minutes, November 4), that the Committee would be most happy to receive the information which he proposes to forward to them.

Submitted—A diagram showing the Chrono-isothermals for Kew for the year 1868, on the method adopted by Sir E. Sabine in his paper “on the Periodic and Non-periodic Variations of Temperature at Toronto,” Phil. Trans., 1853.

Mr. Scott reported that he had received the proofs of the Report of the Meteorological Conference at Leipzig, and he was instructed to have a translation prepared, and to publish it as one of the non-official papers issued by the Office.

Read—A letter from Mr. W. Oxley, offering to lend one of his newly-invented pressure anemometers to be tested at Kew.

Mr. Scott was instructed to purchase one of the instruments.

Reported—That Mr. L. J. Crossley had offered to lend to the Committee an anemograph similar to their other instruments, and that Mr. G. H. Aird, of the Londonderry Offices, Seaham Harbour, had offered, with the sanction of Earl Vane, to have it erected at that place. Both offers had been accepted, and the instrument was now in operation.

Resolved—That the thanks of the Committee be given to Mr. Crossley and Mr. Aird for their liberal assistance to the Office.

Submitted—The following STATEMENT respecting the Records for OCTOBER 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. | Fair. | Good. | Good. | Good. |
| Records deficient - | 20 hrs. V. lost through clock line breaking. | 11 hrs. V. caused by stoppage of clock. | None. | 15 hours D. trace invisible. | None. | 1 hour D. | None. |
| Orientation verified - | — | — | 23rd. | 1st. | 31st. | 28th. | — |
| Result of 40 Remesurements :— | 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 0.5 | 0.2 0.3 | 0.1 0.4 | 0.2 0.2 | 0.1 0.2 | 0.2 0.5 | 0.2 0.4 |
| Residual difference (— Kew) - | +0.1 +0.2 | 0.0 -0.1 | +0.1 0.0 | -0.1 0.0 | -0.1 -0.1 | -0.1 -0.1 | -0.1 -0.3 |
| No. of errors discovered - | 0 0 | 0 0 | 0 0 | 1 0 | 0 0 | 0 0 | 2 1 |
| Errors in rain tabulation - | 0 0 | 0 0 | 0 0 | 0 0 | 0 0 | 0 0 | 1 0 |
| BAROGRAPH :— | | | | | | | |
| Action - | Good. | Good. | Good. | Good. | Good. | Good. | Good. |
| Photography - | Do. | Do. | Do. | Do. | Do. | Do. | Do. |
| Records deficient - | None. | None. | None. | None. | None. | None. | 1 hour lost. |
| Result of 40 Remesurements :— | Direction. Velocity. | Direction. Velocity. | Direction. Velocity. | Direction. Velocity. | Direction. Velocity. | Direction. Velocity. | Direction. Velocity. |
| Greatest difference - | .0050 .0050 | .0050 .0050 | .0050 .0050 | .0040 .0040 | .0050 .0050 | .0050 .0050 | .0050 .0050 |
| Mean difference irrespective of sign - | .0022 .0022 | .0020 .0020 | .0023 .0023 | .0019 .0019 | .0018 .0018 | .0017 .0017 | .0024 .0024 |
| Residual difference (— Kew) - | -.0017 -.0017 | -.0009 -.0009 | +.0008 +.0008 | -.0012 -.0012 | +.0002 +.0002 | -.0007 -.0007 | +.0016 +.0016 |
| Mean monthly difference between simultaneous barograph and barometer - | .0018 .0018 | .0027 .0027 | .0015 .0015 | .0021 .0021 | .0014 .0014 | .0019 .0019 | .0020 .0020 |
| No. of errors discovered in entry of standard - | 0 0 | 0 0 | 0 0 | 2 4 | 0 0 | 0 0 | 2 3 |
| " in calculating residual correction - | 0 0 | 0 0 | 1 1 | 0 0 | 0 0 | 2 2 | 7 7 |
| " in applying residual correction - | 0 0 | 0 0 | 0 0 | 0 0 | 0 0 | 0 0 | 2 2 |
| " in tabulation - | 0 0 | 0 0 | 0 0 | 0 0 | 0 0 | 0 0 | 0 0 |
| THERMOGRAPH :— | | | | | | | |
| Action - | Good. | Good. | Good. | Good. | Good. | Good. | Good. |
| Photography - | Do. | Do. | Do. | Do. | Do. | Do. | Do. |
| Records deficient - | None. | None. | None. | None. | None. | None. | 19 hours W. insufficient water. |
| Result of 40 Remesurements :— | Direction. Velocity. | Direction. Velocity. | Direction. Velocity. | Direction. Velocity. | Direction. Velocity. | Direction. Velocity. | Direction. Velocity. |
| Greatest difference - | 0.30 0.20 | 0.30 0.20 | 0.20 0.20 | 0.20 0.30 | 0.10 0.10 | 0.20 0.20 | 0.20 0.30 |
| Mean difference irrespective of sign - | 0.13 0.10 | 0.12 0.13 | 0.10 0.11 | 0.11 0.09 | 0.04 0.05 | 0.13 0.12 | 0.10 0.11 |
| Residual difference (— Kew) - | +0.05 +0.06 | +0.05 +0.05 | +0.04 +0.07 | -0.11 -0.06 | 0.00 0.00 | +0.13 +0.03 | +0.04 +0.11 |
| Mean monthly difference between simultaneous thermograph and thermometer - | 0.18 0.16 | 0.11 0.15 | 0.08 0.09 | 0.10 0.09 | 0.09 0.09 | 0.12 0.16 | 0.18 0.22 |
| No. of errors discovered in entry of standard - | 0 0 | 0 0 | 0 0 | 0 0 | 0 0 | 0 0 | 1 1 |
| " discovered by subsidiary measurements - | 0 0 | 2 0 | 0 0 | 0 0 | 0 0 | 0 0 | 0 0 |
| " in maximum and minimum - | 0 1 | 0 0 | 0 0 | 1 1 | 0 0 | 0 1 | 2 3 |
| " in tabulation - | 0 0 | 0 0 | 0 0 | 0 0 | 0 0 | 0 0 | 0 0 |

Reported—That the fishery barometer at Portpatrick had been repaired, and that the second fishery barometer at Falmouth had been recalled.—Approved.

Read—A letter from the Rev. R. Weekes, applying for the loan of a fishery barometer for the village of Angle on Milford Haven.—Loan granted.

Read—The following letter, which had been received from the Hydrographer :—

H.M. ship "Achilles," Portland,
6th November 1872.

SIR,

I BEG to submit for their Lordships' consideration the advantage of supplying this ship and the senior officer at Portland with the "Weather Charts" published daily by the Meteorological Office, by which vessels proceeding abroad, not intended to call in at western ports, might be saved encountering heavy weather off the chops of the Channel, and when time was of no great consequence.

2. Last autumn in reading one of the meteorological reports I found a rule laid down, "that nearly all the westerly gales in the Channel are preceded by the barometer in the north of Scotland falling from 4 to 5 tenths lower than in the south of England a day or two previously," and that by studying the weather reports in the newspapers from the law of Professor Buys Ballot (viz., that westerly winds are preceded by comparatively lower barometer to the northward, easterly by a lower to southward, northerly by the same to eastward, and southerly to westward), useful practical results might be deduced.

3. I have found these simple practical rules most useful when giving orders to my cruisers, and in making removals last winter—an unusually stormy one—none of the cutters were out in weather that reduced them to lower canvass than a double-reefed mainsail, and only once was I surprised by a westerly gale, the fall in Scotland only having commenced 12 hours before the gale commenced, as I afterwards discovered by the papers.

4. The newspapers don't arrive here till 3 or 4 p.m., and no practical use can be made of the meteorological information till the next forenoon (sailing orders being usually given then), nearly 48 hours after it is received at the Meteorological Office; whereas by the charts being sent it would only be 15 or 18 hours late, consequently a much better guide. The barometer alone is here no use in foretelling weather, as its fall accompanies the change.

5. Sir J. Coode, the resident engineer of the Portland breakwater for three years, tried to plan his work by the barometer, but gave it up, finding it no guide. I have known the barometer fall to 28.88 in the winter of '70-'71; nothing more than a fresh breeze followed. I have also known several heavy gales commencing with the barometer above 30. I place no reliance on the barometer here, but a great deal on a comparison of it with other stations.

6. In recently detaining the "Lively," I was solely guided by the state of the barometer to the northward, as it stood 30.10 here, weather fine, but wind backing against the sun.

I have, &c.

(Signed) R. V. HAMILTON,
Captain.

The Secretary of the Admiralty, Whitehall.

Reported that the Daily Weather Charts had been supplied to—

G. H. Aird, Esq., Seaham, in exchange for observations.

Capt. Hamilton, R.N., H.M.S. "Achilles," Portland }
The Senior Naval Officer, Portland } for exhibition.

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 Committee then adjourned.

116, Victoria Street, November 25, 1872.

PRESENT:

Sir E. Sabine in the Chair.

Mr. De La Rue.

Maj.-Gen. Smythe.

The Director was in attendance.

The Minutes of the last two meetings (November 4 and 18) were read and confirmed.

Mr. Scott reported that he had had an interview with Mr. Farrer and Mr. Gray at the Board of Trade, with reference to a letter received by that department from the Treasury inquiring if the Meteorological Committee could supply certain meteorological returns to the Registrar General of births, deaths, &c. The result of the conversation had been that the Board of Trade would reply to the Treasury that the Meteorological Committee would be glad to supply to the Registrar General any information which it was in their power to give from their own stations, but that that officer should be asked to specify the information which he required in order that the Committee might form an opinion as to whether they could supply it or not.—Approved.

Read—A letter from Mr. Whipple suggesting certain experiments to be made on the spare barograph with the view of throwing light on the “bagging” of the curves and on the irregularity of the “residual correction.”—Experiments authorised, Mr. Whipple to communicate with Mr. De La Rue on the subject.

Read—A letter from Mr. C. R. Markham applying for a set of meteorological instruments to be used by Major Ewan Smith at Zanzibar, in connexion with Lieut. Cameron’s expedition to East Africa.

Resolved—That the application for meteorological instruments to be used by Lieut. Cameron being of an informal nature is *not one which would warrant* the Committee in dealing with public property, but they would be willing to take into consideration an application from the Royal Geographical Society for the loan of the instruments.

Submitted—An application for a fishery barometer for Cowes.—Refused.

Read—A letter from Dr. H. Bence Jones, F.R.S., asking Mr. Scott to deliver a lecture on “Recent Progress in Weather Knowledge,” at the Royal Institution on the 14th of February.—Sanctioned.

Mr. Scott reported that T. Robinson, who had been reporter to the office at Yarmouth for many years, had died, and that the postmaster of the town had reported to him that the family were in considerable distress.—Resolved that a gratuity of a quarter’s salary be given.

Reported that the Daily Weather Charts had been supplied to the Collector of Customs, Cowes, for exhibition.

The following cheques for November were drawn:—

For Office:

| | | | | £ | s. | d. |
|-----------------------------|---|---|---|------|----|----|
| R. H. Scott | - | | | 66 | 13 | 4 |
| J. S. Harding, jun. | - | | | 16 | 13 | 4 |
| J. S. Harding, sen. | - | | | *9 | 12 | 6 |
| T. D. Bell | - | | | *5 | 10 | 0 |
| C. Dunning, office fittings | - | - | - | 17 | 1 | 0 |
| Carried forward | - | - | - | £115 | 10 | 2 |

* Five weeks to the 30th November.

| | | £ | s. | d. |
|---|---|------|----|----|
| Brought forward | - | 115 | 10 | 2 |
| For Observatories : | | | | |
| T. Kerr, Valencia | - | 20 | 16 | 8 |
| R. W. Munro, repairing anemograph, &c. | - | 10 | 15 | 6 |
| R. H. Curtis | - | 10 | 0 | 0 |
| F. C. Steventon | - | 9 | 3 | 4 |
| C. Stodart | - | *10 | 0 | 0 |
| H. W. Woodward | - | *5 | 0 | 0 |
| T. E. Allen | - | *8 | 0 | 0 |
| J. P. Cutts | - | *5 | 0 | 0 |
| W. L. Dallas | - | *7 | 10 | 0 |
| Computations, &c. | - | | | |
| For Telegraphy : | | | | |
| N. J. Holmes, Scilly Co., to 2nd November | - | 4 | 1 | 3 |
| F. Gaster | - | +16 | 11 | 5 |
| F. Brodie | - | *+7 | 9 | 0 |
| G. G. Francis | - | *+7 | 6 | 4 |
| R. Sargeant | - | *+4 | 4 | 5 |
| Computations, &c. | - | | | |
| For Ocean Meteorology : | | | | |
| H. Toynbee, Marine Superintendent | - | 33 | 6 | 8 |
| J. J. Hicks, "A." thermometers | - | 6 | 19 | 6 |
| J. Pitkin, "A." aneroids | - | 2 | 11 | 0 |
| S. Jeffery, "M. O." verifications | - | 19 | 4 | 0 |
| W. Salmon | - | 20 | 16 | 8 |
| R. Strachan | - | +19 | 3 | 4 |
| C. Harding | - | 13 | 7 | 10 |
| J. A. Curtis | - | *8 | 0 | 0 |
| W. G. James | - | *8 | 0 | 0 |
| J. W. McVeagh | - | *4 | 0 | 0 |
| Computations, &c. | - | | | |
| For Office Expenses : | | | | |
| J. S. Harding, jun., on account | - | 100 | 0 | 0 |
| Total | - | £476 | 17 | 1 |

* Five weeks to the 30th November.

† Including allowance for extra attendance.

‡ Including allowance for care of instruments.

The Committee then adjourned.

Mr. Scott reported that T. Robinson, who had been reported to the office at Yarmouth for many years, had died, and that the postmaster of the town had reported to him that the family were in considerable distress.—Resolved that a gratuity of a quarter's salary be given.

Reported that the Daily Weather Charts had been supplied to the Collector of Customs, Cowes, for exhibition.

The following cheques for November were drawn :—

| For Office : | |
|---------------------------|---|
| H. H. Scott | - |
| J. S. Harding, jun. | - |
| J. S. Harding, sen. | - |
| T. D. Bell | - |
| C. Dunning, office stamps | - |
| Salaries and wages | - |
| Carried forward | - |
| £115 10 2 | |

* Five weeks to the 30th November.

116, Victoria Street, December 2, 1872.

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 (November 25) were read and confirmed.

Submitted—The following correspondence :—

SIR,

1, Savile Row, Burlington Gardens, W.,

28th November 1872.

I AM directed by the President of the Royal Geographical Society to request that you will submit this application to the Meteorological Committee, for the loan of instruments, including a barometer, to be used at Zanzibar.

The observations will be taken by Major Ewan Smith, C.S.I., private secretary to Sir Bartle Frere, on board the "Enchantress," so long as that vessel remains at Zanzibar, after which time Major Smith will make the best possible arrangements for continuing the series. Such a series of observations will, it is believed, further objects of the Meteorological Committee, while they will be of the utmost value to Lieut. Cameron, who will thus have the means of comparing his observations with a series, taken at the sea level, from instruments with which his own will have been compared.

If this request be complied with, Capt. George, the curator of maps to the Royal Geographical Society, will call for the instruments at the Meteorological Office on Tuesday morning the 3rd of December, and himself take them on board the "Agra" steamer, which sails the same day. Capt. George will give the instruments in special charge to the captain of the "Agra," and will see that the instruments are properly placed on board.

I have, &c.

(Signed) CLEMENTS R. MARKHAM,
Secretary R.G.S.

Robert H. Scott, Esq.

SIR,

29th November 1872.

I AM directed by the President of the Royal Geographical Society, with reference to my letter dated yesterday, to add that the Council will undertake responsibility for the value of the meteorological instruments to be sent to Zanzibar, to the amount of ten guineas.

I have, &c.

(Signed) CLEMENTS R. MARKHAM.

Robert H. Scott, Esq.

Mr. Scott reported that considering the urgency of the case (the SS. "Agra" leaving the docks on the 3rd) he had supplied the meteorological instruments as requested by Mr. Markham. The further consideration of the subject was deferred till the next meeting of the Committee.

The consideration of the opinions on the Chart for Square III. for January was then taken up, and it was decided that Captain Toynbee should be requested to put his remarks, on the various points which had been raised by the respective writers of the letters, into the form of a memorandum which should be printed and submitted to the Committee.

Mr. Galton submitted a memoir and a specimen of an "Isodic" chart, which was directed to be inserted on the Minutes, with lithographic illustrations.

PREFACE.

The consideration whether the whole of the data of winds and currents, which have been sorted out at the Meteorological Office with great labour and expense into "single degree squares," for the several months of the year, can or cannot be usefully applied to navigation, has so immediate a bearing on the question of publication now before the Committee, that the following memorandum may be thought acceptable. Its object is to point out one practical method by which those data can be

usefully applied, not perhaps to the full degree of subdivision to which they have been sorted but certainly to that of a division into "two-degree squares," and a distribution of winds and currents into angular spaces, each including two points of the compass. It would be immaterial for the purposes about to be explained, whether the data were furnished in a tabular or in any other form.

Nov. 28, 1872.

MEMORANDUM ON the CONSTRUCTION of "ISODIC CHARTS," by which the average length of a day's sail by any particular class of vessels, in any direction, at any place, may be readily found, and the average duration of passages along suggested tracks determined and compared.—By FRANCIS GALTON.

If vessels could do no more than drift helplessly before the wind, an inspection of the wind and current data for any small part of the surface of the ocean might enable us to give a fair estimate of the average length of a day's drift and its direction. But this is, of course, by no means the real case: vessels can make some way, though but a little, by beating directly to windward. They sail fastest when the wind is not right astern, and their performance on intermediate courses bears a complex relation to those courses, which again varies for different degrees of wind-force. It is, therefore, far beyond the power of the human brain to justly estimate by the mere inspection of a wind and current chart the distances, to within 5 or 10 per cent., which might *on an average* be traversed by ships in a day or hour, if they sailed in diverging courses from the same point of departure, to each of the 32 points of the compass. Yet it is this, which those who make use of wind and current charts primarily desire to extract from them, for they wish to learn how the length of passages may be shortened even by very small amounts. I shall proceed to show how comparatively easy it is to obtain that knowledge by direct calculation from the wind and current data, and then I shall point out the extreme facility with which it may be applied to practical questions.

I employ the word "isodic curve" (*ισοδική*) to express the curved line surrounding a point of departure, which indicates the distance ("isod") in every direction, which ships of a particular class might *on the average* make good, during the same or equal periods of time. As an illustration of what is meant, it may be said that everyone knows it occupies a longer time to walk the same direct distance from his house in some directions than in others, and that he has probably a pretty exact knowledge of the distance of the extreme point which he could reach by an hour's walk in each direction. It is only necessary to draw a line on his map, connecting those points, just as isotherms connect points where the temperature is the same, in order to produce (a pedestrian's) "hour-isodic curve" round his house. The "isod" is the radius, the "isodic curve" is the periphery.

In a memoir read in 1866 before the British Association (Transactions of Sections, p. 17), I showed how these isods should be calculated (although I did not then employ that phrase), and I have now procured calculations of them for each two-degree sub-square in the 10° square, number 3, for the month of January. The materials for its construction were extracted from the specimen sheet of data which has been compiled at the Meteorological Office, and which gives the results in two-degree squares. Consequently 25 isodic curves have been calculated. They are 8-hourly figures; that period being the largest fraction of 24 hours which could be represented within a two-degree square.

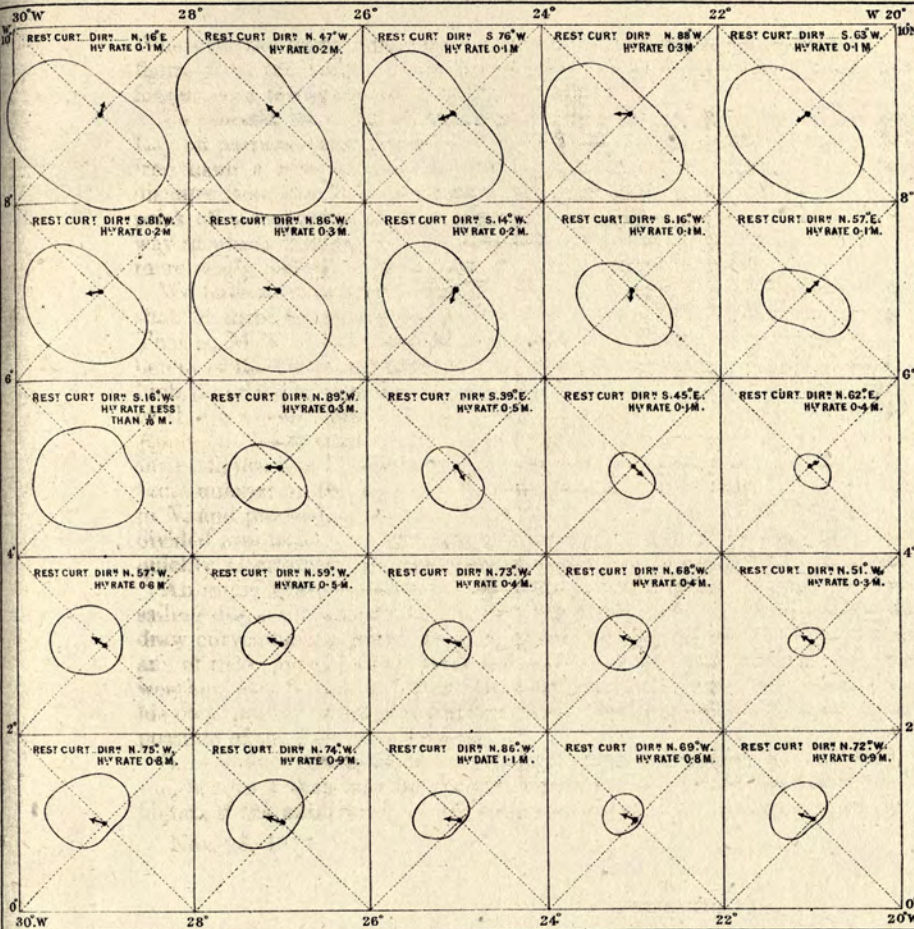
In making the calculations, the currents have first to be dealt with, by dividing the horizon into eight parts (which subdivision seemed quite minute enough for an experiment), the first octant containing all the observations that were recorded, as N., N. by E., N.N.E., and N.E. by N. The second octant contained those recorded in the four succeeding points, and so on, all round the compass. A mean was then taken of the daily rate of the currents in each octant, which being multiplied by the number of observations in it, gave the total drift observed, and this was referred to the middle line of the octant, and thence resolved by a "traverse table" in the direction of the two adjacent cardinal points N., E., S., or W., as the case might be. By combining the results of all the octants, the average daily drift, in amount and in direction, was quickly obtained (*see* Table II., Appendix). Calling the centre of the square the "point of departure," and marking it with a dot, a line was drawn in the direction of the set of the current of a length equal to its drift during eight hours. The other end of the line served as a "point of construction," whence the effect of the various winds upon the sailing was protracted. This procedure was as follows: first, a table was constructed (*see* Appendix, Table I.) of the performance of a standard ship, a "Beaufort ship," under varying conditions of direction of wind, relatively to the course sailed, and under varying conditions of wind-force. Then the winds were treated in octants just like the currents to obtain a proportionate frequency of wind and of wind-force, for the middle line of each octant. Then it was calculated (*see* Table III., Appendix) that ship A. sailing along the middle of octant I. would make such and such way, by the effect of all the winds observed to have blown in that octant, supposing each wind to have lasted eight hours. The same was done for the effect on the same ship of the winds observed in octant II., III., and the rest. Similarly for ship B. C., and the rest. The total distance run over by each ship, divided by the total number of winds, *plus* calms, gave the mean 8-hourly distance appropriate to the track of that ship, and was pricked on the chart. A curved line, swept with a free hand through all the eight points, gave the required isodic curve. If no current existed the point of construction would be identical with that of departure. A specimen of the construction is shown in Fig. V.

It will be observed that I have only dealt with one class of ships, while the performance of ships notoriously differs. It would not, however, be a serious matter to calculate and protract isods appropriate to a moderate number of classes of ships, especially as the calculation for currents has to be done once for all, but this would be proceeding to greater refinement than is attempted in the ordinary sailing directions, which specify certain lines of passage as the best, without taking any notice of the peculiarities of different ships.

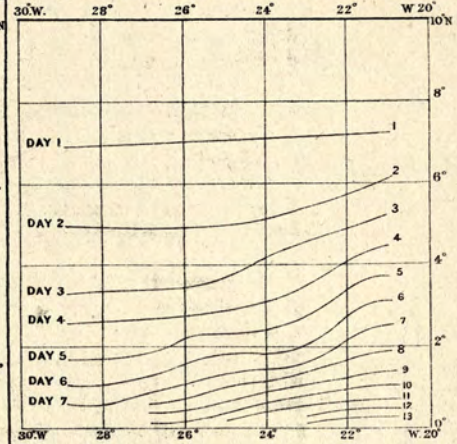
I now proceed to show how easily a practical application can be made of these 8-hourly isodic charts. Suppose we desire to learn the average length of passage along the suggested track X, Y, Fig. 1.

ILLUSTRATIONS OF THE PRINCIPLE AND CONSTRUCTION OF 'ISODIC' CHARTS BY FRANCIS GALTON, F.R.S.

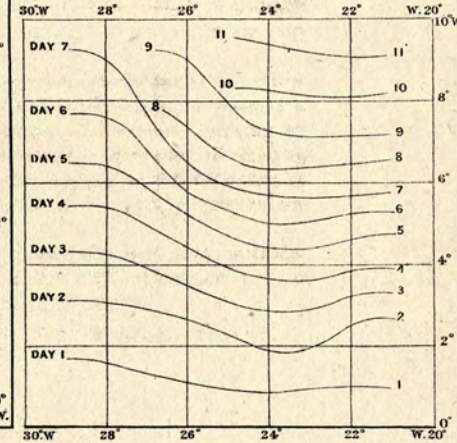
8 Hourly Isodic Curves in Square 3, January
The direction and amount of the Current is shewn, and its effect is included in the isod.



24 hour Isods, Course due South.



24 hour Isods, Course due North.



Note: REST. CURT. = RESULTANT CURRENT.

Fig.V.

2° Sub Square {28-29} for Square 3 Jan.
Isodic Curve

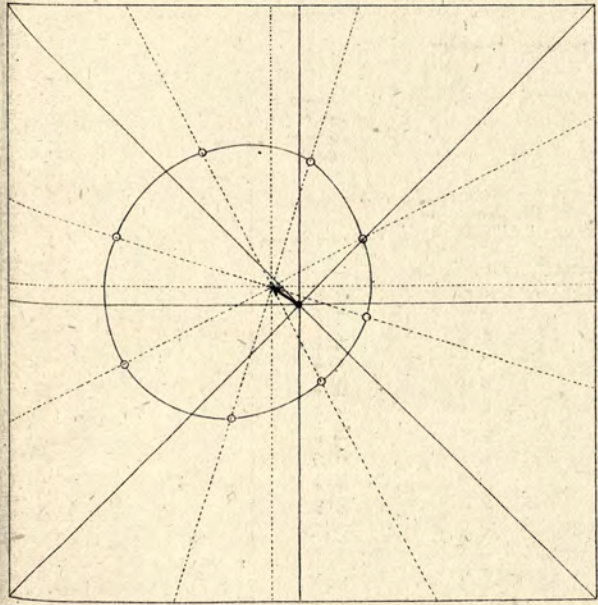


Fig.I.

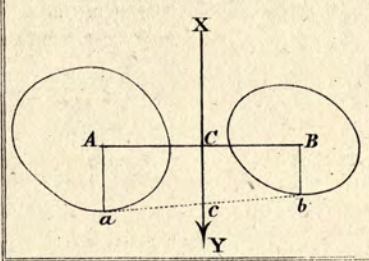


Fig.IV.

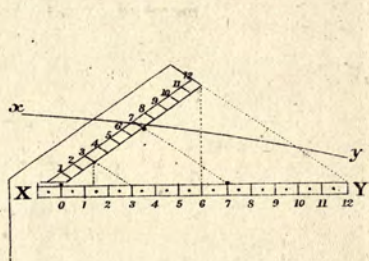


Fig.II.

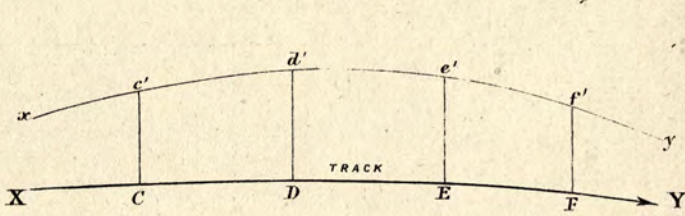
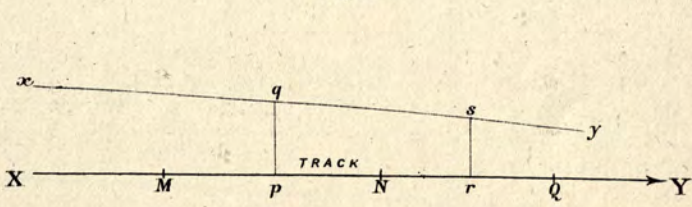


Fig.III.



Wherever the track cuts a line A B, joining the points of departure of two isods, as it does in the figure at C, the length of the appropriate 8-hourly isod from C towards Y ($=C c$) is immediately to be found, as in the figure, by graphical interpolation.

To proceed, let C, D, E, &c., Fig. II., be points on the track whose isods have thus been determined. Lay off perpendicular distances $C c^1$, $D d^1$, &c., equal to the several isods C c, D d, &c., and draw with a free hand a line x, y , through c^1 , d^1 , &c. It follows that at every point in X, Y, the perpendicular distance from it to x, y , represents the isod appropriate to that point. It is now a rapid operation to prick off a succession of daily isods on the suggested track X, Y. It is hardly necessary to describe the way in which it might be approximately done with a pair of compasses, but a more accurate and still more ready method, with a piece of card, deserves mention.

We have so to arrange, Fig. III., that the length of each successive daily isod along the track X, Y, shall be three times as great as that of the perpendicular from its middle point, reaching to the line x, y . That is, $M N = 3 p q$, and $M p = p N$, similarly $N Q = 3 r s$ and $N r = r Q$. If then a piece of card be cut of the shape and construction shown in the figure (Fig. IV.) where the graduation 3 in the upper limb is vertically over that of $1\frac{1}{2}$ in the lower limb, and the distance between them is equal to one third of that between 0 and 3 in the lower limb, all that is required to find N, in Fig. III., is as follows. Apply the lower edge to the track, bringing 0 opposite to M; note the graduation (in the case shown in the figure it is 7) where the line $x y$ cuts the upper limb and prick off at the graduation, having the same number on the lower limb; this gives N. For finding Q, move the card till its zero is opposite to N, and proceed as before. Thus the card is moved on from point to point, and the track is rapidly divided into isods. In this way the average length of passage along any suggested track can be very quickly ascertained, and the quickest tracks can be sought for and noted.

An isodic chart is shown in the accompanying plate, whence the two small side charts, for ships sailing due north and due south, have been deduced. Another application of the principle of isods is to draw curves having ports for their points of convergence. Then the captain of a vessel, making for any of these ports, having such and such a wind, and making such and such a forecast of coming weather, may be enabled to decide what course to shape, that when the time during which he relies on his own prediction of the weather shall have passed by, he may be within as few isodic intervals as possible of the port he is seeking.

To conclude, these isodic curves have been calculated as described by octants, but this is rather rougher work than may be thought desirable. It would therefore be a pity with reference to this object, if the publication of wind and current were not grouped under at least 16 points.

Nov. 28, 1872.

FRANCIS GALTON.

APPENDIX.

- I. Table of sailing under different force of wind.
- II. Example of calculation for current.
- II. Example of calculation for wind.

The following table is the basis of the work; it was drawn up after consultation with naval authorities, but does not profess to be as correct as if it had been established by direct experiment. It will, however amply serve the present purpose, which is to explain a principle:—

TABLE I.

| Force of Wind. Beaufort Scale. | Speed of "Beaufort" ship in any given direction when acted on by a wind of given force. (Beaufort scale.) | | | | |
|-----------------------------------|---|----------------|------------------|----------------|--------------------|
| | Points off the Wind. | | | | |
| | 0 Dead to windward. | 4 | 8 Wind abeam. | 12 | 16 Wind astern. |
| | Miles an hour. | Miles an hour. | Miles an hour. | Miles an hour. | Miles an hour. |
| 5·0 | 2·6 | 3·7 | 9·6 | 10·8 | 8·4 |
| 4·7 | 2·3 | 3·3 | 8·5 | 9·5 | 7·5 |
| 4·4 | 2·0 | 2·9 | 7·4 | 8·4 | 6·6 |
| 4·1 | 1·7 | 2·5 | 6·4 | 7·2 | 5·6 |
| 4·0 | 1·6 | 2·2 | 5·8 | 6·6 | 5·2 |
| 3·8 | 1·4 | 2·0 | 5·3 | 6·0 | 4·7 |
| 3·3 | 1·2 | 1·7 | 4·2 | 4·8 | 3·8 |
| 3·0 | 1·0 | 1·4 | 3·7 | 4·2 | 3·3 |
| 2·8 | 0·9 | 1·3 | 3·2 | 3·6 | 2·8 |
| 2·3 | 0·6 | 0·9 | 2·1 | 2·4 | 1·9 |
| 2·0 | 0·4 | 0·6 | 1·6 | 1·8 | 1·4 |
| 1·5 | 0·3 | 0·4 | 1·1 | 1·2 | 0·9 |
| 1·0 | 0·2 | 0·3 | 0·5 | 0·6 | 0·5 |

Variables.—These have not been considered as equally liable to blow from every point of the compass, but as more especially confined to one half of the compass. A separate allowance was made, after consideration, to each sub-square, but it is not worth while to give the details, as the effect of the variables is of small importance in the general result.

TABLE II.

SPECIMEN CALCULATION for CURRENT.

For sub-square { 28-29.
38-39.

| Octant. | Bearing of its middle point. | No. of Obs. | Mean-drift in 24 hrs. | N. | S. | E. | W. |
|------------|------------------------------|-------------|-----------------------|------|------|-------|------|
| | | | Miles. | | | | |
| I. | N. + 17° E. | 2 | 14 | 26·8 | — | 8·2 | — |
| II. | + 62° E. | 5 | 19 | 44·5 | — | 84·0 | — |
| III. | E. + 17° S. | 4 | 15 | — | 17·6 | 57·2 | — |
| IV. | + 62° S. | — | — | — | — | — | — |
| V. | S. + 17° W. | 1 | 9 | — | 8·6 | — | 2·6 |
| VI. | + 62° W. | — | — | — | — | — | — |
| VII. | W. + 17° N. | — | — | — | — | — | — |
| VIII. | + 62° N. | 1 | 29 | 25·6 | — | — | 13·6 |
| No current | — | 3 | — | — | — | — | — |
| | | — | — | 96·9 | 26·2 | 149·4 | 16·2 |
| | | — | — | 26·2 | — | 16·2 | — |
| | | 16 | — | 70·7 | — | 133·2 | — |
| | | — | — | 4·4 | — | 8·3 | — |

Daily rate of current = 9·4 miles, and direction N. 62° E.
Hourly " = 0·4 mile.

TABLE III.

SPECIMEN CALCULATION for WINDS.

For sub-square { 28-29.
38-39.

| — | No. Obs. | Average Force. | (I.) N.-N.E. by N. | (II.) N.E.-E. by N. | (III.) E.-S.E. by S. | (IV.) S.E.-S. by E. | (V.) S.-S.W. by S. | (VI.) S.W.-W. by S. | (VII.) W.-N.W. by W. | (VIII.) N.W.-N. by W. |
|-------------------------------------|----------|--------------------------|-----------------------|------------------------|-------------------------|------------------------|-----------------------|------------------------|-------------------------|--------------------------|
| In octant I. | 15 | 3·6 | 19·5 | 28·5 | 73·5 | 84·0 | 64·5 | 84·0 | 73·5 | 28·5 |
| II. | 9 | 2·8 | 11·7 | 8·1 | 11·7 | 28·8 | 32·4 | 25·2 | 32·4 | 28·8 |
| III. | 14 | 3·2 | 56·0 | 22·4 | 15·4 | 22·4 | 56·0 | 64·4 | 50·4 | 64·4 |
| IV. | 14 | 3·5 | 74·2 | 65·8 | 25·2 | 18·2 | 25·2 | 65·8 | 74·2 | 58·8 |
| V. | 3 | 2·8 | 8·4 | 10·8 | 9·6 | 3·9 | 2·7 | 3·9 | 9·6 | 10·8 |
| VI. | 2 | 2·0 | 3·6 | 2·8 | 3·6 | 3·2 | 1·2 | 0·8 | 1·2 | 3·2 |
| VII. | 2 | 1·5 | 2·2 | 2·4 | 1·8 | 2·4 | 2·2 | 0·8 | 0·6 | 0·8 |
| VIII. | — | — | — | — | — | — | — | — | — | — |
| Calms | 2 | — | — | — | — | — | — | — | — | — |
| Variables | 3 | { 1 in II. 1·2 2 ⊕ | 0·3 1·2 | 0·3 1·2 | 0·3 1·2 | 0·8 1·2 | 0·8 1·2 | 0·7 1·2 | 0·8 1·2 | 0·8 1·2 |
| Totals | 64 | — | 177·1 | 142·3 | 142·3 | 164·9 | 186·2 | 246·8 | 243·9 | 197·3 |
| Hourly speed not regarding current. | | | 2·8 | 2·2 | 2·2 | 2·6 | 2·9 | 3·9 | 3·8 | 3·1 |

Submitted—A memorandum by the Rev. R. Main on Mr. Rundell's paper on the wind at Liverpool (Minutes, p. 59), and also some remarks by Mr. Strachan on the same subject.

These letters with Dr. Robinson's were ordered to be printed.

MY DEAR SIR,

23rd August 1872.

I HAVE looked over Mr. Rundell, and as far as I am able to judge, his process is inferior in accuracy to the method of co-ordinates. He forms a polygon of lines whose length and inclination to a meridian line represent the spaces described by the wind in 16 directions, and infers from this the direction and magnitude of the resultant. To do this by calculation with the requisite precision, except by the method of co-ordinates, will not be very easy, and no mere diagram can give the amount of accuracy required for such high numbers.

Again, such diagrams must be laid down on different systems for years, months, weeks, or hours. It may be added that if, instead of beginning, as he does in Fig. 1, with N., and going on regularly through N.N.E. and the rest of the points, he had put N. at the time of the year when it most predominates, and the other winds in the places due to them, the apparent symmetry of the spiral which he obtains would have changed into a very irregular zigzag.

A still greater objection is this—that he does not explain how he gets, for example, the number which in his first table stands under big N. It must represent the northern component of all the winds which occur during the period within two points east and two points west of N.

I know no way in which this could be obtained except by adding the northern components of all the winds recorded in those limits. But then what becomes of their E. components, which we may be pretty sure will neutralize each other? Perhaps Mr. Hartnup may have explained this in his reports; but however this may be, it seems evident to me that Mr. Rundell's process is not at all likely to supersede that which you have adopted.

The components which he gives in his tables are merely those deduced from the numbers that he gives, and the angles corresponding to the points to which they belong. Had they been deduced from individual hour, or even day, observations, there would have been no such agreement as they show.

Under these circumstances I should not feel myself justified in recommending you to publish this paper.

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

Yours truly,
(Signed) T. R. ROBINSON.

Radcliffe Observatory, Oxford,
22nd November 1872.

MY DEAR SIR,

I HAVE looked through Mr. Rundell's paper with some attention, and have arrived at a rather different conclusion from Dr. Robinson.

His process is not exactly similar to that which I pursue here, but it appears to me to be perfectly correct, and the results deduced are of very great value and importance.

In Table I., to which Dr. Robinson first refers, the process has evidently been to collect for the whole year from the daily records the horizontal motions corresponding to the 16 compass directions. We in fact do the same (for our scales cannot be read with accuracy to smaller angles), and I know of no other method for getting the resultant directions. These resultants, both in magnitude and direction, he gives in Table III., on page 5, and I have here for the first time the means of comparing the mean yearly directions of the wind at Oxford with those at another station, and that a coast station.

I do not here trace the law of change depending on the solar spots which comes out so clearly at Oxford, but the comparison is interesting.

I do not attach, with Dr. Robinson, very much importance to the graphical calculations of the final resultant for the 15 years, but it is good of its kind, and should not certainly detract from the general merits of the paper.

On page 7 is a direct comparison of the resultant mean annual directions at Liverpool and Oxford.

At page 8 there is an interesting graphical representation of the mean monthly and yearly resultant directions and velocities of the wind at Bombay and at Liverpool.

The elaborate tables giving the mean monthly results from 12 years' observations are, I think, very valuable, and the labour bestowed upon them, and which does not appear on the surface, very great indeed.

In the particular discussions for 1863 which follow, I could have wished that the daily inequalities had been formulated. The interpolation equations have evidently been solved, and from them he deduces the inequality curves on page 27, but the formula should have been exhibited as in the Oxford observations.

I am not sure that I have grasped every step of his processes, and I have not been able to see the original observations as published by Mr. Hartnup, as they are not in any of the reports which I have from him, but I have convinced myself that the paper is of considerable value, and that it is highly desirable that it should be published. In the event of its publication, however, it would probably admit of considerable condensation, and should be sent to the author for that purpose and for general revision.

R. H. Scott, Esq.

I am, &c.
(Signed) ROBERT MAIN.

REMARKS ON MR. RUNDSELL'S MEMOIR ON THE WINDS AT LIVERPOOL.

Having carefully read Mr. Rundell's memoir, and Dr. Robinson's and Professor Main's reports upon it, I beg to submit the following remarks:—

The anemograms of the Liverpool Observatory, like those of the Oxford Observatory, appear to have been tabulated for each hour, but only to 16 points of the compass for the direction of the winds. The anemograms of the observatories of the Meteorological Committee are tabulated for each hour to the nearest point of the compass. It follows, therefore, that the computed components and resultants of the winds at Liverpool and at Oxford cannot pretend to the accuracy of those deduced for the observatories of the Meteorological Committee.

In Mr. Rundell's Table I. there can be no doubt that the miles under each direction are greater than would have resulted from tabulating to 32 points, and it has also the disadvantage of not showing the duration of each direction of the wind.

The "drift," so called on page 4, has been computed from Mr. Hartnup's Table, No. 2, given in his report for 1864, which is for the 12 years 1852 to 1863 inclusive, whereas the mean direction of each wind ought to have been computed for the 15 years 1852 to 1866. This is another defect arising from the manner in which the material was prepared to Mr. Rundell's hands. Had the true resultant directions for the 15 years been deducible, it is very probable that the drift computed would have afforded a different figure. It may in consequence be worth consideration whether or not to omit all relating to this novel feature of "drift," including computed results, figure and text on page 4.

At page 8 the 15 years are dropped and 12 only taken into consideration. Fig. 5 represents the resultant winds at Bombay, but the number of years are not stated.

Tables VI. to XVII. are reproductions from Mr. Hartnup's Tables II. and III., Report 1864, with computations therefrom. I do not understand what use there can be in columns 7, 8, 9, and 10; an explanation seems required of the process for calculating them, for in several cases which I have tried I have not been able to get precisely the same figures as those given. I do not think there would be any loss in omitting these columns and the elliptical appendages to figures 6, 7, 8, and 9 drawn from them. Table XVIII. will not be readily understood, and being founded on columns 9 and 10 of the preceding tables, it would necessarily be omitted with them.

At page 19 the series of 12 years is dropped, and the periodicity of the hourly velocity is exhibited from the results of the four years 1852 to 1855. Results for six years are also quoted. Finally, in paragraph 18, attention is directed only to the year 1863. For this year the constants of periodicity have been computed from the "inequalities" of the components, northerly and easterly. The components might have been used for this object, and half the tabulation and much labour would have been saved. Professor Main, in the Oxford observations, exhibits the formula for periodicity in velocities and not in their inequalities, and this plan is simpler than Mr. Rundell's, and can be more readily understood by the generality of persons who take an interest in meteorology.

On the whole it is evident that Mr. Rundell's memoir is not a systematical and complete discussion of the anemometry of the Liverpool Observatory. Having mainly worked upon the results published by Mr. Hartnup at various times he has had to work backward for some of his columns, and the whole is fragmentary. He appears to have gone to the original records for the data of 1863 only. Nevertheless, with the material before him, he appears to have proceeded upon entirely correct principles. He does not put his memoir forth as a model to be followed in discussing original anemometrical records. Most certainly his method would bear no comparison for thoroughness with that pursued at the Meteorological Office. Here I would suggest that Dr. Robinson has misconceived Mr. Rundell's diagrams; they appear to me to be intended as graphical exhibitions of results all duly calculated beforehand.

As regards Professor's Main's suggestion as to condensation, it appears to me that it could only be effected by leaving out all relating to "drift," and re-computing the periodic constants from the component velocities instead of from their "inequalities." The mode of computing these constants, both for the northerly and for the easterly components, is novel. I have no knowledge of the same thing having been done before, but their value for one year is not apparent, unless it be as an example. Mr. Rundell's method gives the constants for velocity combined with direction; Professor Main's plan would give them for absolute velocity. I have seen no attempt to determine the constants for direction of wind alone. It seems to me that the question whether they should be determined for direction and velocity combined or separated is an important one, because upon the decision will depend the method of tabulating the anemograms. Dr. Robinson's method of tabulating by components combines direction with velocity throughout; an entirely different plan must be followed to treat them separately. In connexion with this view of the constants of periodicity, attention may be called to the following quotations from Herschell's Meteorology:—"There can be no doubt that by persevering and long-continued observations the same laws of diurnal and annual periodicity will be found to be observed in the direction and force of the wind as in the other meteorological elements; but they are so much more masked by what we must at present term casual and accidental causes, that, except in certain great features, and in certain geographical situations, they cannot emerge from the mass of overlying irregularities except in very long periods," p. 206.

"But as regards the wind in general, it is found more advantageous to abandon this point of view, and to regard it, not in its remote connexion with the general cause of periodicity, but in its immediate relation to the other meteorological elements with which it stands in more obvious connection," p. 207.

Thus, according to Herschell, the wind constants should be determined from a long series of observations; and meteorological constants in relation to the resultant wind should be sought in preference to the laws of periodicity of the winds in relation to the primary cause, the sun.

1872, Nov. 30.

R. STRACHAN.

Submitted—Maj.-Gen. Smythe's report on Mr. Rundell's criticism of the mode of discussion of the anemometry at Sandwick Manse (Minutes, p. 59), which with Mr. Rundell's letter was also ordered to be printed.

Robert H. Scott, Esq.,

Director of the Meteorological Office, London.

Litherland, near Liverpool,

DEAR SIR,

24th September 1872.

ON examining the "Discussion of the Anemometrical Results at Orkney," printed in your Quarterly Weather Report, I thought I observed in it a neglect of some of the principles which are enunciated by Dr. Robinson, and quoted in the paper itself, or of principles which have been so far sanctioned by your Committee as to appear in your printed reports. I therefore first wrote to you privately on the subject, and afterwards offered to go into fuller details if your Committee wished it. This, on their request, I now propose to do, observing that the subject is made more important by the intimation that similar data are to be published for other districts.

The principles to which I refer are—

- I. "To obtain from these data any information which may lead to general views, it is necessary so to combine them as to bring out any laws by which they are connected."
- II. "Nearly all the causes of wind depend on variations of temperature; these again vary with the hour of the day and the season of the year. The rule of grouping should therefore be by hours in the first instance, and of such a kind that any number of each can be combined without limit and without repeating previous work for days or years."—Dr. Robinson's quoted remarks."

III. "If we calculate from the observations the formulæ corresponding to them, they can be brought into the shortest and most complete form, so that we can determine from them more immediately what theory has to explain than from the observations themselves."—Bessel's paper on the Determination of a Law of a Periodic Phenomenon.

IV. "A general summary, it is thought, will be more interesting to *general* readers than the components."—Introduction to "Discussion, &c."

To these I would add—

V. A good general summary is of use to the meteorologist as well as to the general reader, and should show as concisely as may be (a) the actual annual and monthly movement of the air in amount and direction, and the mean movement and direction of the wind for the whole of the period under discussion; (b) the hourly movement of the air (in means for months, or for any shorter period which may be decided upon), so as to bring out the hourly inequality, both as regards velocity (without reference to direction) and as regards its resolved motion to the north and to the east.

Assuming that the Committee agree with me on these principles, I proceed at first to test the completeness of the general summary in the 'Discussion' by asking a few questions—

1. What number of miles of air passed over the Orkney station in the year 1863, or in either of the following five years, and what is the mean amount for the six years?

No direct answer can be given to this primary question either from the general summary or from any other part of the paper.

2. What was the average velocity of the wind per hour during the year 1863, or for any month of the year 1863, or for any other month of either of the six years in question?

Neither the general summary nor any other part of the paper affords a direct reply to this inquiry.

3. What was the monthly average velocity of the winds for the six years under discussion?

The general summary does not even reply, but by turning to Table IV. and to the explanation at page 6, these particulars may be found. The reason for the incongruous insertion of these data with the 3-hourly components of the wind in Table IV. is not apparent.

4. How many hours in the year and with what mean velocity does the wind blow from the North or the South, or the East or West, or from any other of the principal points of the compass?

The paper does not give a reply, for although it is stated that these data have actually been taken out for each of the 32 points of the compass, they are, in the summary, grouped in octants which do not represent the cardinal points, or the four points intermediate to the cardinal points. I am not aware that this mode of grouping has been adopted by any other meteorological authority. It thus makes comparison with the data for other places difficult or impossible.

5. What is the monthly mean hourly velocity of the wind for each hour of the day and night, without reference to direction? and what is the hourly inequality in the velocity of the wind for each month and for the year, and the average for the whole six years?

There is no possibility of getting a reply either directly or indirectly from the printed paper.

It gives, however, at great length the resolved hourly velocities towards the north and the east *for the six years together*, but not for either year separately. This point will be again referred to.

Had the winds in the summary been given for each of the 32 points, or, in accord with the usual practice, been grouped under the 16 principal points, no separate column for direction would have been required. The giving in the printed tables the direction in degrees is objectionable, for it conveys an impression of accuracy which is unreal.

If the tables in the Orkney summary had been arranged like those given by Mr. Hartnup in his report for 1864 to the Liverpool Dock Board, with the addition of columns for hourly velocity, they would have afforded immediate answers to most of the above questions, and the whole space occupied would not have been more than one fourth of that taken for the present summary.

Before leaving the summary it may be as well to note that the lines preceded by the word "mean" do not give proper means. The figures under these lines in columns 2, 5, 8, and 11 are sums, not means. These under columns 3, 6, 9, and 12 are certainly arithmetical means of the figures above them, but cannot be considered the mean velocity of the wind, as the number of hours which the wind blew with each velocity is omitted from the calculation. The calculation proceeds on the supposition that the mean velocity of the wind in the following example would be 50 miles an hour, instead of less than 5 miles an hour. As an illustration merely, suppose—

| | | | | |
|----------|---|-----------------------------|---|------------|
| 1st year | - | 98 hours at 2 miles an hour | = | 196 miles. |
| 2nd year | - | 2 hours at 98 miles an hour | = | 196 miles. |
| 3rd year | - | 2 hours at 50 miles an hour | = | 100 miles. |

That is 3 years 102 hours (150 miles) 492 miles.

Here during the three years the wind travelled 492 miles in 102 hours, or at the mean rate of 4.8 miles an hour. 50 miles an hour is certainly the mean of the three velocities, but it is not the mean velocity of the wind for the three years which is required.

For an actual example take, from the summary, the first octant for October, page 50. Opposite the word "mean" we have 258 hours, velocity 7.2 miles. The true figures are 43 hours, velocity 15.1 miles an hour; the velocity being more than double that which is printed in the table.

For similar reasons it is submitted that the arithmetical mean of the direction column is also erroneous.

Reverting now to the remark that as regards the hourly velocity of the wind, we have the mean hourly components of the wind in Table I. for each month *for the six years together*, but not for either year separately, it may be observed that this is not in accordance with quotation No. II., for by it we ought, without repeating previous work, to be able to combine results without limit. Here we have not the materials for combining the results of two, three, four, or five years, if that were thought desirable. In this case it would not be difficult to show that the results for any year separately are of

more value to the meteorologist than either of these combinations, or of the six years together as printed in the "Discussion, &c." in Tables I. and II.

All that most meteorologists would desire from Table I. is given in Table II.; thus the whole of the 24 pages, 8 to 31 inclusive, seem to be superfluous, and are certainly useless for the purposes contemplated by Bessel in quotation III.

Table I. and the synopsis of it in Table II. are both open to the objection, that while they profess to give the means of six years' observations, they are vitiated, as is pointed out in the paper itself, by frequently giving means of five years, which five years is not stated. This objection would not have applied if each year's observations had been given separately. It will I think be readily admitted that a table similar in form to Table II. (omitting the 3-hourly means) should have been given for each of the six years under discussion. These would have afforded useful data, and have enabled the meteorologist to obtain these co-efficients which are so much desired for analytic inquiry.

There are some remarks in the Introduction, page 5, relating to these hourly means which provoke comment. They are as follows: "As was to be expected these means do not exhibit any particular accord." Again, and referring to the same data: "The numbers in Table II. though more regular are yet to discordant to be used singly, and they have therefore been grouped in 3-hourly periods."

What accordance is desired? Why are the numbers too discordant to be used singly? What is gained by the "grouping" in 3-hourly periods? Surely the fact is that in so short a period as six years the means of single months afford the most valuable data, and so far as my experience goes cannot be discordant. I have in several cases found the hourly means of only 10 days' wind give beautifully accordant results, if by accordance is meant complete representation by the three or four first terms of Bessel's formula. The reducing the 24 hourly observations to eight 3-hourly is in effect substituting eight equations for obtaining Bessel's co-efficients when 24 are given; and so for as the important "sextantal" co-efficient is concerned it introduces what may be termed "irregular periods" for the regular periods which the hourly means afford. To use Herschel's words when speaking on this subject, the one case "is attended with a frightful amount of calculation," while as regards the other case "nothing can be simpler or more expeditious."

The Table No. III. contains information relating to the hourly inequality of the wind which will no doubt interest the general reader, yet in several respects it is open to objection. To the meteorologist the same with much additional information would have been given had each column of Table II. been expressed by Bessel's formula. This interesting part is comprised in the three lines of Table III. which follow at the bottom of each monthly section. The other parts of the table only repeat data already given in Tables I. and II., and which are given again in a summarised form in Table V., or give details of sun's altitude and azimuth, which, if wanted, could be easily obtained from other works. The interest which attaches to this table would have been greater had similar information respecting the hourly inequality of the wind been given for each year.

I would further observe that in Table III. the numbers representing the resultant movement or translation of the air over the place are rather roughly given, apparently through the mean hourly velocity being carried to only one place of decimals. When there are several numbers, as in this case, carried to two places of decimals, the mean of these numbers can be safely carried to three places of decimals; but in this table, by taking one place of decimals only and multiplying the number by a large factor, the rough result has the singular effect of making, in several cases in this table, the third side of a plane triangle exceed the sum of the remaining two sides. Take for example the month of September, the translation of the air during the night hours for six years is 8,640 miles in a direction S. 51° W., and for the day hours 10,152 miles in a direction S. 42° W. The resultant of the two would manifestly be a somewhat smaller number than their sum, or 18,792 miles; but the resultant is said to be 19,008 miles in the direction S. 46° W. The error here amounts to about 270 miles.

There were some other points on which I intended to offer some remarks, but my letter has grown so long, that I desist with the observation that the additional matter which I have ventured to suggest, together with what I have called the useful and interesting parts of the present tables, could, I think, be printed on 12 pages instead of the 45 pages now employed.

Had the Orkney winds only been in question, probably it would not have been worth while to occupy so much of the time of your Committee with this letter, but if meteorological data for other stations are to be published, I trust I have said enough to cause a very careful consideration being given to the best mode of giving them to the public.

Possibly the Orkney winds, through their not being accompanied by continuous hourly temperature observations, can never be of more than very partial use for meteorological analysis of the kind spoken of by Bessel and Dr. Robinson, and so much desired by yourself.

Submitting these remarks for the consideration of your Committee,

I remain, &c.,
(Signed) W. W. RUNDELL.

Mr. RUNDELL's Remarks on the discussion of the ANEMOMETRICAL RESULTS furnished by the ANEMOMETER at Sandwick Manse, Orkney, 1863-68.

Report by Major-General Smythe:—

The discussion of the Orkney anemometrical results adheres very closely to Dr. Robinson's suggestions.

Mr. Rundell's objections may be summarized into two:—

1. That the observations are too much combined for the whole period of six years, and do not in many instances afford the elements for a different treatment.
2. That the method of obtaining the mean velocity of the wind (namely, by taking the arithmetical mean,) in Table VI. is erroneous.

He states that there is no direct means of ascertaining from the printed tables—

1. The number of miles of air passed over the station in any one year, or the mean amount for the six years.
2. The average velocity of wind per hour for any year, or any month of any year.
3. The monthly average velocity of wind for the six years.
4. How many hours in the year and with what velocity the wind blows from the principal points of the compass.
5. The monthly mean hourly velocity of wind for each hour, without reference to direction, the hourly inequality in the velocity for each month and for each year, and average for the six years.

This information is given in Table IV., where Mr. R. thinks it misplaced.

This information is arranged in the summary in octants, an arrangement which Mr. R. thinks novel, and which renders comparison with other places difficult.

With reference to these questions, Mr. Rundell adds that immediate answers would have been furnished to most of them if the tables in the Orkney summary had been arranged like those given by Mr. Hartnup in his Report for 1864 to the Liverpool Dock Board, with the addition of columns for hourly velocity.

To come now to the tables :—

Mr. Rundell considers Table I. unnecessary, all the information really required being given in Table II.

In Table II. he considers the 3-hour means unnecessary, and that the table should be for *each* year of the six.

He thinks the interest which attaches to Table III. would have been greater had similar information respecting the hourly inequality of the wind been given for *each* year.

In the Summary (Table VI.) he thinks the arrangement by octants objectionable, that it should be by the 32, or at least by the 16 principal points of the compass; that giving the direction by *degrees* conveys an impression of accuracy which is unreal; and he shows by two examples, one hypothetical, the other taken from the tables, that the mean velocity (and also direction) of the wind given in this Summary is erroneous, the arithmetical mean only having been employed.

These remarks of Mr. Rundell's on the tables appear to me worthy the consideration of the Committee, and I would in addition suggest the desirability of tabulating the wind under four components (as in the Dorpat Observations) instead of two, as with us.

November 28th, 1872.

(Signed) W. J. SMYTHE.

The further consideration of these subjects was postponed.

Reported—That Stornoway had been established as a telegraphic reporting station (Minutes, p. 43). The reporter was Mr. John Smith, gardener to Sir James Matheson, the Lews Castle. The first report had been received on the day of meeting, December 2nd.—Approved.

Reported—That a cheque of 100*l.* had been drawn on the signature of Sir E. Sabine on the 28th in favour of Mr. Jeffery, being an advance to Kew Observatory on account of their allowance due at the end of the quarter.

Read—An application from Captain David Gray, of the whaler "Eclipse," for the supply of deep-sea thermometers, stating that he would provide the sounding line.—Resolved that three thermometers be supplied as requested.

The Committee then adjourned.

116, Victoria Street, December 16, 1872.

PRESENT :

Sir E. Sabine in the Chair.

Mr. De La Rue.

Mr. Gassiot.

Mr. Galton.

Maj.-Gen. Smythe.

Mr. Spottiswoode.

The Director was in attendance.

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

Reported—That the estimate for the year 1873-4 (Minutes, p. 60) had been forwarded to the Board of Trade.

Reported—That a letter had been received from the Board of Trade stating that the Registrar General had been requested by the Treasury to communicate with the Committee respecting his Returns (Minutes, p. 63).

At the request of the Committee I beg to submit for their consideration the following remarks on the extracts from letters respecting the January Chart of Square 3 circulated for opinions. In these remarks I propose to give extracts from letters which do not seem to be fairly represented by the words "General Approval," and to say a few words on the various objections raised in the order in which they are extracted from the letters.

The letters are taken in the order in which they appear on the "Minutes."

| Writer of the Letter. | Opinions on the Value of the Chart | | REMARKS. |
|------------------------------|--|---|--|
| | To Science. | To Navigation. | |
| No. 1. Sir G. B. Airy. | Excellent - - | 1st Objection.—Thinks that navigators would not learn symbols. | <i>Answer.</i> —There are only three symbols in the body of the chart, they are in the centre of each square, and since Sir G. B. Airy's letter was written the explanation of the chart has been modified so as to call immediate attention to them. All navigators to whom the charts have been shown like these graphic representations of the prevalence and force of wind and amount of calm; the fact being that they afford a much quicker and easier means for comparison than words. We must also remember that we have training ships for officers in the merchant service, so that now they need something more than that which satisfied their predecessors. |
| | | 2nd Objection.—That spaces are too small for trade-wind regions. | <i>Answer.</i> —In trade-wind regions we should probably give the data similarly, but in 5° squares. |
| | | (3.) Suggests 2° or 3° squares and explanation in words. | <i>Answer.</i> —I agree, and think 2° squares better than 1° for publishing, and submit a specimen chart for January. The question of giving words instead of symbols is answered when dealing with the 1st Objection. |
| | | 4th Suggestion.—Would not publish all the Remarks. | <i>Answer.</i> —I agree, and do not think it necessary to publish all the remarks extracted from the logs, but propose to deal with them generally. See the altered copy of Remarks for January. |
| No. 2. A. Buchan, Esq. | Gives no opinion in letter, but spoke highly of them when he saw them here. | <i>Suggestion.</i> —Asks for the mean day of the month and mean hour of the day. Also for highest and lowest readings of barometer and thermometer. | <i>Answer.</i> —The barometer observations were not considered sufficiently correct for supplying a diurnal range correction, and it was not supposed that the estimated correction already worked out in the office from part of those observations was sufficiently correct. The barometer observations in the early logs frequently show very little diurnal range, owing to a rather loose way of observing during fine weather in the tropics. Still a comparison of the isobars for January and July in square 3 shows the wisdom of not rejecting them, for they give valuable results. (See the above-named isobars on the reduced January chart.) See the memorandum on the question of barometer and temperature range which follows these remarks. The highest and lowest readings of barometer and thermometer in each square might also be given with their dates if thought requisite. |
| No. 3. Prof. Buys Ballot. | "A publication of great value, containing every ample elucidation and in great detail, about the state of the atmosphere above the sea." "I object only to the form, &c. &c." | 1st Objection.—"The form being expensive and laborious." | <i>Answer.</i> —I should not think of dealing with more than three squares in this minute manner, and they give a section of the doldrums, which may be considered analogous to other doldrums, so that they need not be worked in this special way; in fact we have not a sufficient number of observations for so working them. |

| Writer of the Letter. | Opinions on the Value of the Chart | | REMARKS. |
|--|------------------------------------|---|--|
| | To Science. | To Navigation. | |
| No. 3. Prof. Buys Ballot— <i>cont.</i> | - - - - - | - - - - - | <p>The same method might be applied to squares of 5° or 10° in less important parts of the sea.</p> <p>This objection will also be met by our reducing the chart to a quarter of its original size in giving 2° squares, if the Committee sanction that reduction.</p> <p><i>Answer.</i>—In this important part of the sea the <i>general</i> direction of the wind is not sufficient; a change of one point is of great value. Surely no <i>table</i> of direction and force can equal the arrows and curves in their simplicity for reference.</p> <p>In the centre of each square the ship-master has a "clear and easy view of the <i>particular</i> direction of the wind and its "force."</p> <p>Since Professor Buys Ballot's letter was written the curve of force has been devised and an introductory paragraph added to the "Explanation of the Chart."</p> <p><i>Answer.</i>—Our isobars and isotherms seem to meet this difficulty, besides showing the relation between the prevailing pressure, temperature, wind, and current; also between the prevailing currents and sea temperature which seem very important. (<i>See</i> those given for January and July).</p> <p><i>Answer.</i>—This square has been selected because it is "the whole of a given area" and the general route through the doldrums, so that we have a sufficient number of observations to enable us to deal with it in this minute way. We have not observations enough for the square to the eastward and westward of it; they must be dealt with in 5° squares. Mr. Galton's curves, showing the number of days which Beaufort's ship would require for sailing north or south through the square, give the most complete answer to this question.</p> <p><i>Answer.</i>—We never shall have data for every one-degree square all over the ocean, because ships keep to beaten tracks. It is only because all <i>outward</i> and <i>homeward</i> bounders pass through square 3 that we have so much data for that square.</p> <p>A general conviction that there is a very great difference in the meteorology of the different parts of this square, that it is the <i>most</i> important square in the whole Atlantic for navigators, and that we have plenty of observations to deal with it led to its selection. The fallacy of supposing that observations are, or ever will be, available for the whole sea is the error in Professor Buys Ballot's argument. It is very probable that he was led to this error by the remark which accompanies the reduced chart, showing the various squares for which we have extracted data. Since that was written we have mapped the number of observations extracted for each month in each of the most important squares, and find that many of them are very bare of observations.</p> |
| | | <p><i>2nd Objection.</i>— "Ship-masters should have a clear and easy view of the general direction of the wind, and of its force on one table, &c."</p> | |
| | | <p><i>3rd Objection.</i>—"Ship-masters should have " . . . height and " variation of barometer on another " chart; of temperature, &c. on " another."</p> | |
| | | <p><i>4th Objection.</i>—"Ship-masters want a " view of the whole " of a given area that " they may choose " the track of greatest " speed."</p> | |
| | | <p><i>5th Objection.</i>—"If " once we have the " state of an instrument for every " single degree square " all over the ocean, " &c."</p> | |

| Writer of the Letter. | Opinion on the Value of the Charts | | REMARKS. |
|--|--|---|--|
| | To Science. | To Navigation. | |
| No. 3. Prof. Buys Ballot— <i>cont.</i> | | 6th Objection. — "I think one of the first requisites of our publications is, that they may be very easily understood by any one, even by him who is not acquainted with any learning." | <i>Answer.</i> —The Admiralty charts meet this requirement. We are training our officers and asking them to take careful observations with standard instruments; must we keep down the results merely to satisfy the most ignorant man who gets charge of a ship? or shall we give those men whose intellects are trained something useful to employ them upon? But it seems to me that the graphic representations in the centre of each square, together with their explanation in the first paragraph of the "Explanation of Chart," and more especially Mr. Galton's most simple and practical curves showing the number of days required to get through the square must answer the purposes Professor Buys' ballot has in view, so that our reduced January Chart, with wind force added, and its modified explanation, together with Mr. Galton's curves, do really meet his requirements, besides doing more. |
| No. 4. Sr. J. C. de Brito-Capello. | "This investigation will give results of incalculable importance." | 1st Objection. — "If this system were adopted for the entire ocean, or whole district of doldrums, &c. &c. I think it would be very costly," &c. | <i>Answer.</i> —This objection is similar to one raised by Professor Buys' ballot, and is met by the fact that we never shall have such an amount of observations for large spaces of the ocean. In fact we have not data to deal in the same minute way, with the squares to the eastward and westward of No. 3 square. Still the same method could be followed with 5° or 10° squares. |
| No. 5. Capt. Dawson, R.N. | Favourable | 1st Objection.—"Too full of information for seamen. Would give number of observations in a table, or would only give percentages." | <i>Answer.</i> —The graphic representation in the centre of each square may be consulted without looking at a figure. The number of observations gives the means of weighing one square with another, and is much better where it is than in a table. Per-centages are very deceptive unless the number of observations is also given, as they give too much value to a small number of observations. |
| No. 6. Capt. Donkin, R.N.R. | | Suggests one or two tracks of best routes. | <i>Answer.</i> —By means of Mr. Galton's curves a Track Chart might be easily constructed if necessary. |
| | | Favourable | "General approval" hardly sufficient; the letter says: "Having carefully and with great interest examined the Wind Chart, I am convinced of its usefulness to seamen; and I am sure all navigators will be glad to learn that the method is being carried out for other important parts of the various seas. I hope the money necessary for such a useful and valuable boon to owners as well as the captains of our large mercantile marine, will be forthcoming." |
| No. 7. Capt. A. D. Fernie. | | Favourable | "General approval" hardly sufficient; the letter says: "I have with much pleasure examined the Chart for the month of January for that most vexatious part of the ocean, the variables between the trade winds. I have also shown and explained it to a number of my friends, shipmasters, who are all much pleased with it, not only on account of the information contained in it, but for the excellent way in which it is compiled, it being so easy for reference. They all agree with me that the publication of such charts for every month in the year will be most useful to all navigators crossing the Equator." |

| Writer of the Letter. | Opinions on the Value of the Chart | | REMARKS. |
|-----------------------------------|------------------------------------|---|--|
| | To Science. | To Navigation. | |
| No. 8. Herr W. H. v. Freeden. | Favourable - - - | 1st Objection.—“Yet “for practical use of “seamen is there not “given too much to “be seen quickly “through?” | <i>Answer.</i> —The graphic representations in the centre of each square are seen and compared very quickly. Reduction of Chart to 2° squares and modification of 1st paragraph of the “Explanation” help also to meet this difficulty; but Mr. Galton’s curves of days required to get through the square will make such an objection impossible. |
| No. 9. Capt. Fry. | - - - | Unfavourable - - | All Capt. Fry’s objections seem to have been met in dealing with other letters. Why he objects to the temperature of the air I do not know. I think with him the variation of the compass is not worth giving, and have not entered it on the reduced Chart. |
| No. 10. Capt. Goodenough, R.N. | Favourable - - - | Favourable - - 1st Objection.—For the ordinary navigation I should suggest the simplification of the record of observations, and of more graphic representations of wind and current, either by curves or colours. | <i>Answer.</i> —Wind and its force, also calms, are graphically represented for each point, how could more be done? The reduction of the Chart to 2° squares, together with the graphic representations in the centre of each square, which are explained in the first paragraph of the “Explanation” meet this objection. Mr. Galton’s curves of days through the square may be understood by a child, and almost answer the purpose of a track chart. Capt. Goodenough suggests that all wind observations should be in blue; this certainly would be a great advantage. I think all other slight objections or suggestions have been met in dealing with the previous letters. |
| No. 11. Mr. Greenwood. | - - - | Favourable - - - | In a second letter he says: “The Chart for January appears to gain in favour; several of my friends have asked me if they could be purchased.” |
| No. 12. Capt. James Hayes. | - - - | Favourable - - - | “General approval” hardly sufficient. He says: “As a commander of steamers with few sails, after 4 years’ experience in using the less perfect or rather less detailed Wind Charts hitherto published, I am sure such a plan as the present Chart must be useful even to steamers. In the tropics steamers want a beam wind as much for improved draught to their fires and ventilation for passengers, as to aid with sails. Your Chart shows a choice of weather with little loss of distance, and whilst affording minute details to those who care to study it, shows at a glance the route each one wants as to winds and current. I believe its publication will be a success, and duly appreciated for steamers as well as sailing ships.” |
| No. 13. Capt. Vine Hall. | Favourable - - - | Favourable - - - | No real objection, but the reduction of the Chart is likely to please him. (See his letter already printed.) |
| No. 14. Capt. Heckford. | Favourable - - - | 1st Suggestion.—For the ordinary navigator, I am of opinion that the system is too elaborate. | <i>Answer.</i> —This objection has already been dealt with. Mr. Galton’s curves add to the completeness of the answer. |
| No. 15. Capt. Henderson. | - - - | Favourable - - Suggests a track chart. | This may be given after other squares are given; at present Mr. Galton’s Curves meet the difficulty. |
| No. 16. Capt. Hight. | Favourable - - - | Favourable. 1st Objection.—Thinks it too elaborate to refer to at the time. Wants a track chart. | <i>Answer.</i> —Graphic representations in the centre of the square, and reduction to 2° squares answer this objection. Mr. Galton’s curves meet the demand for a track chart until all squares are finished. |

| Writer of the Letter. | Opinions on the Value of the Chart | | REMARKS. |
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| | To Science. | To Navigation. | |
| No. 17. J. K. Laughton, Esq. | Favourable - - | 1st <i>Objection</i> .—Practical navigators will not go through the work of learning the language of the Chart, &c. | <i>Answer</i> .—Most practical navigators like it. Now the 2° Chart reduces this difficulty, as also the modification of the "Explanation." Mr. Galton's curves will satisfy the practical navigator. Men whose success in life depends on making good passages jump at the information given in these charts. |
| No. 18. Professor E. Loomis. | "Highest value" - | "Highest value." <i>Suggestion</i> .—For navigators he would present the results in a much more condensed form. | <i>Answer</i> .—This has been done by reducing the square to a quarter of its original size. By modifying the explanation the navigator is first shewn how he may get the main facts from the centre of each square without consulting figures at all. Mr. Galton's curves give a main fact in the most condensed form. Sufficiently explains his opinion. |
| No. 19. Mr. Lund. | General approval - | General approval - | |
| No. 20. Capt. Marder, R.N.R. | Favourable - - | Favourable - - | "General approval" not sufficient; he says; "It certainly is most complete in all details of weather, winds, currents, &c., and my own experience fully corroborates the same. I imagine you intend publishing a chart for each month in the year, which, when completed, will, I consider, be a work of the greatest service to commanders of both steam and sailing ships. More especially to those who have not had much experience in going southern voyages." |
| No. 21. Rear-Admiral Sir F. L. McClintock. | Favourable - - | Favourable. 1st <i>Suggestion</i> .—"Perhaps the outward and homeward routes across this space might be shown." | <i>Answer</i> .—A track chart might be published when two or three squares are worked up, in the meantime Mr. Galton's curves answer this suggestion. The suggestion about type might perhaps be carried out. The suggestion of having 2° squares I agree to. The best change of type would be to have all relating to currents printed in red. |
| No. 22. J. Merrifield, F.R.A.S. | Utmost utility | Utmost utility. <i>Suggestion</i> .—"Directions should be given to all who use the charts, that a slight variation from the normal height of the barometer is likely to presage a change." | <i>Answer</i> .—I do not know that the number of observations in each square is sufficient to show the normal height, and we have no experience to show that if it were known, and the barometer differed from it, there would be a change. In the doldrums the weather is little else than change. |
| No. 23. Com. M. F. Maury, LL.D. | Favourable - - | Favourable. <i>Suggestion</i> .—"A skillful use of colours would have brought out these barometric as well as other anomalies most beautifully." | I think the small charts of isobars and isotherms to some extent answer this suggestion. If colours could be allowed, it would be well to give all entries relating to currents in red, this would separate the current observations from those of the wind, and be a great advantage, the outer circles need not then be shaded. Capt. Goodenough proposed to give the wind observations in blue; this would be an additional advantage. |
| No. 24. Prof. T. B. Maury, Chief Signal Officer, Washington. | Excellent - - | Excellent - - | "General approval" does not express this letter. He says, The Chart is a model of combined beauty and utility. Continental and oceanic meteorology are so intimately connected and correlated that I am sure your Chart, while leaving nothing further for the practical seaman to desire, will be highly prized by the practical meteorologist on land. In order to bring your work more fully to the mind |

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| No. 24. Prof. T. B. Maury, Chief Signal Officer, Washington— <i>cont.</i> | - - - - - | - - - - - | and attention of the United States Government, and also before the nautical public of this country, I have just written a short "Editorial" on the subject and forwarded it to my friend "Commodore" Bennett, the proprietor of the New York Herald, who takes a deep interest in such scientific labours. Commodore Wyman, the chief of the Hydrographic Bureau of the Navy Department, has asked me to prepare a plan of meteorological observations for the North Pacific surveying fleet now being fitted out, and I shall advise the adoption of observations similar to those used in the construction of your beautiful Chart." |
| No. 25. Capt. M. S. Nolloth, R.N. | - - - - - | Favourable - - - | General approval does not express this letter. He says, "I feel obliged to you "for sending me the Meteorological "Chart and Remarks with which I am "greatly pleased. "I imagined after a first perusal that I "might venture to suggest one or two "ideas on minor points, but on more "careful consideration it appears to me "that Mr. Scott and you could not have "put before ocean navigators a bill of " (wind) fare more concisely, yet compre- "hensively, in a more complete and un- "derstandable form." |
| No. 26. Dr. Petermann. | - - - - - | Suggests a complete map to each subject. | This suggestion seems to be met by the small charts of isobars and isotherms, with prevailing winds and currents on them. The squares must be the given size to enable us to represent the winds to a point, and it is well to use their spare parts for other data. Besides it is much easier to compare winds and currents, &c. in any square when they are in the same chart. |
| No. 27. Capt. Renaut. | - - - - - | Favourable - - - | Already printed in full in the "Minutes." |
| No. 28. Rear-Admiral Ryder. | - - - - - | Very useful - - - | Already printed in full in the "Minutes." |
| No. 29. Messrs. Shaw, Savill, & Co. | - - - - - | Highly valuable - - - | Already printed in full in the "Minutes." |
| No. 30. G. H. Simmonds. | - - - - - | 1st Objection.—Method too cumbersome for whole ocean. 2nd Objection.—Squares so small, that uncertainty of position would give the observations of one square to another. 3rd Objection.—Would only give wind and calms graphically, the rest in tables. | <i>Answer.</i> —Have not observations for the whole ocean, and if we had should represent less important districts in 5° squares, following the same method. <i>Answer.</i> —In so far as there is any value in this objection, it is met by our increasing the squares to four times the size, but it militates against all endeavours to sift observations into small spaces. Our isobars and isotherms, &c. show the value of such work. <i>Answer.</i> —The squares must be as large as those given to enable us to represent the wind to a point, and it is thought more convenient to use the corners of the squares for other observations than merely to give them in a table; now they are shown in their geographical position, and are handy for reference when studying the small charts of isobars and isotherms. The objection as to variation I agree to, and would reject it. |

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| No. 31. Capt. J. Steele. | Favourable - | Favourable, with suggestions. | <p>The following is the beginning of the letter, which was followed by the part already printed in the "Minutes":</p> <p>"The Chart, a careful arrangement of facts, is a most interesting study. Your data for the eastern and middle routes is in excess of that for the western route, but you have no doubt ample data in each and all for correct results. This allowed, I consider, the western route for January most advantageous for both outward and homeward bound sailing vessels. Calms on this western route are almost nil, winds steadier and more vigorous, also less southerly or adverse for the outward bounder on approaching the Equator. Currents on the whole less northerly, without exceeding in strength those on the middle or easterly routes. Squalls appear to be heaviest and most frequent on the middle route, or between 25° and 27° W. and 4° to 6° N."</p> <p>After making this very practical use of the Chart, and coming to a right conclusion as to the best routes both outward and homeward, and noticing the style of weather which might be experienced. Capt. Steele complains that the Chart wants distinctness (see part of letter already in "Minutes") and asks for the force of the wind to be graphically represented.</p> <p>These objections have been met by reducing the Chart to a quarter of its size, and modifying the "Explanation" so as to call attention to the graphic representations immediately needed by the navigator. The wind force has been represented by a curve, and Capt. Steele having seen the changes, has expressed himself quite satisfied with its present state. His objection respecting the current has still to be answered.</p> <p><i>Answer.</i>—He was told that the percentage of current in each quarter of the compass is given in the marginal strips, which better shows the prevailing current. That the prevailing current in each square is generally in the neighbourhood of the strongest current. It is now better shown with the sea isotherms. It is a great advantage to the navigator to be able to find the force of <i>individual</i> currents, as well as to know their means. For instance, in January, between the Equator and 2° N., and from 20° to 25° W., there is 68% of north-westerly current, having a mean force of 27 miles in the 24 hours, but several single observations show more than 30 miles, and some over 40 miles, whilst one is 49 miles in the 24 hours, all of which facts the careful navigator likes to know. For this work I would rather have the figures than attempt to represent the current's force by variety in shading. As I have already said, I should like to represent all that relates to currents in red, which would be a sufficient distinction.</p> <p>It is now proposed not to shade the whole of the circles devoted to current observations, but only that octant of the compass towards which there is the most current.</p> |
| | | <p>"The currents denoted by the arrow on the outward rim of the circle appears to me arbitrary, and in places inconsistent with the figures showing strength."</p> | |

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| No. 32. R. Strachan. | - - - - - | <p>1st Objection.—1° squares too small, would have 5° squares.</p> <p>2nd Objection.—To the hours used for extraction.</p> <p>3rd Objection.—I would suggest that the diurnal range of pressure and temperature should be computed, &c. from the collected data.</p> <p>4th Objection.—Would not give strips.</p> <p>5th Objection.—Against drawing isobars and isotherms.</p> <p>6th Objection.—Would not average Beaufort's scale of force.</p> <p>7th Objection.—Does not believe the wind can be observed to points, and is astonished to find the different estimates of Beaufort's scale of force.</p> | <p>Answer.—Have increased to 2° squares. Squares of 5° would not sift the data so as to show minute changes; see our isobars and isotherms which could not have been drawn if the data were in 5° squares.</p> <p>Answer.—The question of what hours were to be extracted was frequently asked and carefully considered before the work was commenced and the present plan settled on. There are several 10 a.m. and 10 p.m. observations which being about the time of highest reading of the barometer it was thought wrong to reject them. The isobars and isotherms show important facts, even though the observations are not so perfect as we could have wished. If we had picked only certain hours we should not have had enough data for the work.</p> <p>Answer.—I have already stated that we did not think the barometer observations good enough for such work, though very useful for the work in hand.</p> <p>See the memorandum on the question of barometer and temperature range which follows these remarks.</p> <p>Answer. These (as given in the 2° square chart) show the navigator the difference between the data of the eastern and western halves of the square. They also cut the square into five vertical strips showing the per-centages of winds, currents, &c. in each strip. For instance, in February the eastern strip has 30 % of N.E. wind strong enough to drive a ship 3½ miles an hour, whilst the western has 80 % of N.E. wind strong enough to drive a ship 7 miles an hour. This information is of the greatest value to seamen and they seem to thoroughly appreciate it.</p> <p>Answer.—The interesting facts shown by the isobars and isotherms of January and July submitted with the 2° Chart for January sufficiently answer this objection.</p> <p>Answer.—As we cannot give each observation, the method followed seems to be the best available, and gives most valuable results for comparing the relative forces of winds. All forces amounting to 7 or upwards are remarked upon, so they do not get lost by meaning.</p> <p>Answer.—All practical men can estimate the direction of the wind to a point. When a ship is "on a wind" it can be estimated to half a point.</p> <p>No doubt Beaufort's scale is handled very differently by a telegraph clerk, or even by a sailor in a light-ship, from what it is by a captain of a ship at sea. The seaman in a light-ship has not always a ship before him to show the amount of sail carried. Then again ships near shore do not generally carry a press of sail. For instance, Beaufort's force 5, in which a man-of-war could just carry royals "full and by" when in chase, would reduce most ships to topgallant sails or even less sail when sailing "full and by" near a coast and not in chase.</p> <p>Admiral Beaufort tells us that force 4 means 5 to 6 miles an hour for a well-conditioned man-of-war sailing "full and by" in a smooth sea. He also tells that force 5 means that the same ship under the same</p> |

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| No. 32. R. Strachan— <i>cont.</i> | - - - - - | - - - - - | circumstances could just carry her royals when in chase. Now the best authorities say that such a ship would be going 9 knots an hour, and all practical men with whom I have talked on the subject agree that this is right. It is on these grounds that a curve of wind force is entered on the Chart. |
| | | 8th Objection.—Does not like the method of grouping currents. | Answer.—As the current is found by the difference between a ship's observed and estimated positions at noon on each day, it seems best to allow the position for the current to be that of the ship at mid-night, or half-way between those of the two noons. |
| No. 33. Capt. Trivett, R.N.R. | Favourable - - - - - | 1st Objection.—Information too minute. All that is required by the practical navigator is the prevailing winds and currents during every month in the year, on each square of 10°, &c. &c. | Answer.—This would not show that whilst there is 30 % of N.E. wind to drive a ship 3 miles an hour between 20° and 21° W., there is 80 % to drive a ship 6 miles an hour between 28° and 29° W. This opinion quite differs from my experience of navigators. Even the most stupid could understand the graphic centres of our squares. |
| No. 34. Capt. Vowell. | Invaluable - - - - - | Invaluable - - - - - | "General approval" hardly expresses this letter. He says, "From what I see of the work, it will be invaluable to the seaman, as well as to those who attend to it for the advancement of science." |
| No. 35. Lieut. F. Zurcher. | Favourable - - - - - | Favourable - - - - - | Given in full in previous "Minutes." |
| No. 36. A. G. Findlay, Esq., F.R.G.S., &c. | Favourable - - - - - | Favourable - - - - - | This letter has come in since the last letters were printed; it says: "I have examined with great interest the diagram and remarks on the January Chart for No. 3 square of the equatorial doldrums, and have mastered its scope and intention. I do not think that I can suggest any improvement. The only requirements I had thought of are quite fully met on the other diagrams you showed me, by the curve showing the force of the wind, and the general relation of wind and current (which relation is very complicated here) on the epitomized sketches you showed me. "I think that this will be beyond question the most important addition to marine meteorology, and will give clues to so many subjects now most obscure and ill understood, besides settling for all time the vexed question of the equatorial crossing. By analogy, also, it will throw great light on the meteorology of similar areas in the other great oceans." |
| No. 37. Capt. Gaye, ship "Eliza Shaw." | - - - - - | Favourable - - - - - | Came in since the last letters were printed: "I beg to say that the Doldrum Chart appears to me to be the very thing required and likely to be of the greatest service to sailing ships." "I particularly admire the method you have adopted for denoting the force of the wind, and the arrangement of the whole is so compact, and gives so much valuable information at a glance, that I am sure shipmasters in general will find it well worth their attention."* |

* See page 84 for an opinion received from His Excellency Governor Rawson, C.B., Barbadoes, and the answers to his various objections or suggestions.

In conclusion, I think that the reduction of the Charts to 2° squares, the modification of the explanation, the addition of the curve of wind force, the representing prevailing currents by shading, printing the names of data in the corners of the 2° squares, and the giving small diagrams of isobars and isotherms with prevailing winds and currents on them in the corners of the Charts, meet most of the objections raised.

If the suggestions that various colours should be used might be carried out, and I see they are used on the Admiralty Charts, I think the printing of winds in blue and currents in red would make the Chart very complete and clear.

The addition of Mr. Galton's curves of days required to get through the square would of course increase the practical value of the work very much.

HENRY TOYNBEE.

December 11th, 1872.

MEMORANDUM for the COMMITTEE on the DIURNAL RANGE of BAROMETER and THERMOMETER.

Mr. Buchan has recommended that we should give the mean day of the month and mean hour of the day for the observations in each square, I suppose with the object of applying diurnal range corrections to them, when those corrections are known.

We find that any attempt to correct the mean of observations for such a mean hour would be worse than useless; but if we had a correct diurnal range it would be easy to apply the sum of the various corrections for each hour to the mean of a certain number of observations.

I have already said that many of the barometer observations do not give so marked a diurnal range as might be expected, and that I think this is the result of careless readings in fine weather (especially at night in our early logs); still it is the opinion of some people that they might give very useful corrections for the various readings, perhaps the more useful from the fact of their being deduced from the observations to be corrected, and that if we work out the diurnal ranges for each month they will be likely to give fair relative values, though none may be absolutely correct. In the course of a few years we may hope to have a few specially good logs for each month which might give absolute values to the monthly ranges.

It seems then probable that we ought to work out the diurnal range of the barometer in square 3, and I shall be glad to know if the Committee are willing that the work be done, and if so, what method they would have followed?

With the object of discovering whether there was any important change in the diurnal range for various months in the year I have taken three of my own logs which passed through our district in July or August outward bound each year, and returned through it in February or March of the following year.

Readings of the barometer were taken at various hours, but those of 6 and 8 a.m., and 4 and 8 p.m., were selected and dealt with in the following manner:—

All the differences between 6 and 8 a.m. readings for an outward passage in July or August were meaned, those of 4 and 8 p.m. were dealt with in a similar way; these means were compared with others at the same hours taken in February or March during the homeward passages. The results are given in the following table, where the readings of July or August are in italics, and those of February or March in Egyptian type.

| Year. | 6 A.M. to 8 A.M. Rise. | | 4 P.M. to 8 P.M. Rise. | |
|--------------|---------------------------|------------------------|---------------------------|------------------------|
| | July and August. | February and March. | July and August. | February and March. |
| | in. | in. | in. | in. |
| 1862-3 - - - | <i>·026</i> (18) | ·036 (17) | <i>·050</i> (17) | ·064 (18) |
| 1863-4 - - - | <i>·023</i> (20) | ·035 (16) | <i>·043</i> (19) | ·058 (18) |
| 1864-5 - - - | <i>·028</i> (18) | ·029 (19) | <i>·048</i> (19) | ·062 (18) |
| Mean - - - | <i>·026</i> | ·033 | <i>·047</i> | ·061 |

In this table 1862-3, &c. means that the outward passage (July and August) was made in 1862, and the homeward (February and March) in 1863, &c.

(The small figures in brackets are No. of Observations.)

The result being that in February or March the range between 6 and 8 a.m. is *·007* greater than it is in July or August, whilst that between 4 and 8 p.m. is *·014* greater in the former than in the latter named months. This difference is confirmed by the observations of other ships, so that it seems necessary for us to work the diurnal range for each month.

Then comes the question of whether we should treat square 3 as a whole, or find the diurnal range in parts, say in 5° squares. We have an indication that it differs on different sides of the square, and it is possible that during the month of January it may differ in its northern and southern halves, which have different winds; the northern a fresh N.E. trade, and the southern a light S.E. trade.

In the seventh number of Meteorological Papers published by this office, 2,277 barometer observations have been used for finding the diurnal range in square 3, but they were for the whole year, and had only 40 observations in January, whilst we have 2,105 for that month alone, and these are about equal, divided between that zone of the square lying between 4° and 10° N. where the north-easterly wind prevails, and the rest of the square between the equator and 4° N. where the south-easterly wind prevails. Perhaps it might be considered well to find a separate diurnal range for these two zones? I shall be glad to have instructions on these points.

I shall also be glad to know if the Committee would like us to work out the diurnal ranges of air and sea temperatures. It does not seem necessary to apply any correction for them to our mean results in each 2° square, but the observations are good and abundant for some hours, and their ranges might be easily worked out at the same time as that of the barometer. The question is, are they of sufficient scientific interest to justify our doing the work? if so, I think time would be saved by our doing them with the barometer.

December 16, 1872.

H. T.

Read—The following additional opinion on the Chart of square III., which was ordered to be printed.

His Excellency Governor Rawson, C.B., Barbadoes.

It appears to me that the information is most valuable, and the mode of exhibiting it very ingenious, but I suspect that the chart and the instructions are too complicated for the majority of shipmasters; that two-fifths of them would not take the trouble to try to understand them, that another two-fifths would not be able to do so if they tried, and that only a small number would appreciate and use the information which the chart affords.

But this further appears to me to arise from bringing into one point of view all the information which the observations supply, much of which the seaman is not in the habit of observing, though he may record it, and which, if I am not mistaken, he could and would, when he requires it, examine more conveniently in a tabular form.

Judging from my own habit and experience, I am sure that the meteorologist would prefer examining the observations of barometer, thermometer, anemometer, and other phenomena, with the figures placed below or aside of one another, instead of having to pick them out from the corners of the squares, as in the chart. But each of these might be arranged in its table of 10×10 degrees, and all might be contained in two or four pages, so that they might be read side by side.

It would be of more or less importance and interest, both to the seaman and the meteorologist, to trace the gradual change of both the barometer and thermometer as he progresses in any particular direction, but it would be very troublesome to pick this out from the chart.

The seaman wishes to know, sometimes hurriedly, whether a change is constant or accidental. He would find this out much easier in a table than in the chart. But I think the chart would be easily understood and much appreciated if it were confined to the winds and currents; and that it would be better understood, and would exhibit at a coup d'œil these phenomena within the given area, if the winds were shown in the manner in which the calms are shown in the chart, by shading, which catches the eye at once, while the thin lines and tiny arrow heads fail to do this.

It appears to me also, not being a seaman, that the exhibition of all the lines of the 32 points of the compass radiating to the centre were not required, and the shading of the two outer circles, in which the currents are recorded, confuse the eye, and increase the difficulty of reading the chart.

I have made two sketches of the manner in which the circle would appear more distinct to myself. One of a complicated wind area, and one of a very simple one, which I enclose.

I have put the cardinal points outside the circle instead of inside, where in the chart they confuse the vision; and I have marked the record of a current by something more noticeable than an arrow, but I am not sure that this is an improvement.

Calms might be noted in figures in any vacant segment of the circle; or, if it be considered desirable to show these also by shading, it might be done by shading a portion of the two outer rings, as in my No. 91.

I would venture upon two other trifling suggestions: one that the number of observations in the two sets of rings should be inserted in the smaller circle; and the other, that as the fractions in noting the strength of the wind do not appear to be important, as they are never likely to be exact, it would be sufficient to insert one figure, with a dot before or behind it, to show that it exceeds in one or the other direction, more or less, but not exceeding one half, thus—

3 would stand for 3.

3 " " 2.5 up to 2.9.

3 " " 3 up to 3.5.

I hope that some of my suggestions, if not my opinion, may prove useful.

ANSWERS to the OBJECTIONS in the above Letter.

Governor Rawson's objection "that the Chart is too complicated for the majority of shipmasters," is met by our reducing it to 2° square, by adding a graphic representation of wind force and prevailing current, and by printing the names of the data in the corners of each 2° square.

It must be remembered that the class of shipmasters with whom Governor Rawson has to deal are amongst the least-educated of those who go on foreign voyages.

His suggestion that tables would show gradual changes better than the Chart does, is met by the isobars and isotherms which picture the gradual changes at once to the eye much better than it could be done by tables.

He "would confine the Charts to winds and currents." *Answer.* Using the corners of the squares does not rob other parts of distinctness, especially now that we propose printing the names of the various data in the corners.

He "would show prevailing winds by shading." *Answer.* This would rob us of the present method of showing calms, which is praised on all sides.

He "would not draw all points of the compass in the blank form." *Answer.* I agree to this, and propose only to give every fourth point, which makes the Chart more distinct. It also does away with the necessity for lettering every fourth point.

He "would shade part of the outer circle to represent the proportion of calm." *Answer.* I do not propose to make this change, but have taken the suggestion to represent the octant of prevailing currents.

He "would transpose the number of observations from the outer to the inner circles." *Answer.* This would do away with the advantage of having the force of the wind close to its arrow, and would give little if any more room.

He "would give dots instead of decimals for wind force." *Answer.* This would not be sufficiently correct, as it would sometimes leave a doubt of nearly two miles an hour in a ship's speed.

H. TOYNBEE.

Mr. Scott was instructed to have a large track chart prepared which should exhibit the number of two-degree squares traversed over the entire ocean on the ordinary routes of ships.

Mr. Galton made some observations on the subject of the issue of telegraphic weather intelligence. He pointed out that when the periods of the gales and strong winds actually experienced at Falmouth, as shown by the self-recording instruments, were compared with those during which the drum was hoisted at that place, there was a great discordance between the two.

Mr. Scott stated that as he had to deliver a lecture on "Recent Progress in Weather Knowledge" at the Royal Institution in February (Minutes, p. 63), he would endeavour to include in that lecture the result of any system of testing the warnings issued which might be desired by the Committee.

Read—A letter from Captain Toynbee submitting registers kept by the following gentlemen, all of whom except Captains Gaye, Hayward, and Holdich have already received the Pilot Charts :—

Captain W. Ellery, ship "Bowfell" (Minutes, 1872, p. 19).

„ Gerard Gaye, ship "Eliza Shaw."

„ G. Olive Hayward, SS. "Durley" (Minutes, 1872, p. 14).

„ E. Carl V. Heggum, ship "Rozelle" (Minutes, 1871, p. 47).

„ John Peach Holdich, ship "Agra."

„ F. Wherland, ship "Galatea" (Minutes, 1871, p. 58).

Resolved—That the Pilot Charts be presented to Captains Gaye, Hayward, and Holdich, and that the thanks of the Committee be given to the other gentlemen.

Resolved—That in future the "Wind and Current Charts for Pacific, Atlantic, and Indian Oceans," recently issued by the Admiralty, be presented to captains instead of the Atlantic Pilot Charts.

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

The Committee then adjourned.

116, Victoria Street, December 30, 1872.

PRESENT :

Sir E. Sabine in the Chair.

Mr. Gassiot.

Admiral Richards.

Sir C. Wheatstone.

The Director was in attendance.

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

Reported—That the sum of 1,500*l.* had been transferred from the Deposit Account to the Current Account of the Committee as directed.

Read—The following letter, respecting the supply of Meteorological information to the General Register Office :

(17,087.)

Treasury Chambers,

19th November 1872.

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 for some years past an annual payment has been made through the Registrar General to Mr. Glaisher, one of the assistants of the Astronomer Royal, on account of the preparation by him of certain tables of Meteorological Observations which are published by the Registrar General with his reports.

My Lords have received from the Registrar General a copy of a letter from the Royal Society (a copy of which is herewith enclosed), dated 6th November 1872, from which it appears that some misapprehension exists as to the terms on which these returns are supplied ; and, bearing in mind the arrangement made in 1866 by which the sum of 10,000*l.* was placed on the estimates in order to provide for scientific Meteorological Observations, &c. to be undertaken by a committee appointed by the Royal Society at the request of the Government, My Lords would be glad if their Lordships of the Committee of Council for Trade would cause a communication to be addressed to the Committee of the Royal Society, with a view to ascertain whether the tables now furnished by Mr. Glaisher might not be supplied to the Registrar General by that committee without incurring any charge beyond the 10,000*l.* a year they now receive.

I am to transmit copies of the Registrar General's returns with Mr. Glaisher's tables appended.

I am, &c.

(Signed) WILLIAM LAW.

T. H. Farrer, Esq.,
Board of Trade.

The Royal Society, Burlington House,
November 6th, 1872.

SIR,

IN reply to the enquiry contained in your letter of the 18th September 1872, I am directed by the President and Council of the Royal Society to explain that the weekly Meteorological Returns transmitted to your office from the Royal Observatory, Greenwich, are supplied by the Astronomer Royal, and free of expense.

In case of any other information being desired from the Meteorological Committee, the President and Council suggest that application be made to the Board of Trade, under which Department the Committee acts.

I have, &c.

G. Graham, Esq.,
Registrar General, &c. &c.

(Signed) W. SHARPEY, M.D.,
Secretary, R.S.

General Register Office, Somerset House, London, W.C.,
17th December 1872.

" SIR,

I AM commanded by the Lords Commissioners of Her Majesty's Treasury again to place myself in communication with the Meteorological Committee of the Royal Society with respect to the furnishing of particulars as to Meteorology to be published in my Weekly, Quarterly, and Annual Reports.

I now transmit in a separate parcel:—

A copy of my Weekly Report.

A copy of my Quarterly Report.

* A copy of letter to Treasury, 21st December 1864.

* A letter from Dr. Farr, 12th December 1872.

A copy of letter from Board of Trade, 29th November 1872.

Answers to queries.

4 Forms in which at stated times particulars are now sent to me here.

I am of opinion, for reasons stated in the papers above mentioned, that these returns should still that continue to be published by me as they now are, and that the various particulars should be forwarded here, as at present, at the precise hours stated.

The Lords Commissioners of Her Majesty's Treasury appear to think that 150*l.* should no longer be paid to Mr. Glaisher for this information out of the public revenue, seeming to be of opinion that henceforth the expense should be defrayed out of the sum of 10,000*l.* placed annually at the disposal of the Royal Society for meteorological investigations.

I am inclined to agree with their Lordships; and, being unwilling now to interrupt what I have during many years regularly published, I beg leave to suggest that the Meteorological Committee should perhaps arrange with Mr. Glaisher that he continue to furnish to me here the same particulars at the same periods, being paid by the Meteorological Committee, not by me.

If he is satisfied with 150*l.* annually, that would seem to be a small sum to be deducted from the large sum of 10,000*l.*, considering the amount of valuable information circulated by me throughout England and Wales and foreign countries.

I will thank you to submit the papers now forwarded to the consideration of the Meteorological Committee.

The Secretary,
Royal Society.

I have, &c.

GEORGE GRAHAM,
Registrar General.

The Royal Society, Burlington House, London, W.,

21st December 1872.

DEAR SIR,

THE accompanying packet contains a letter from the Registrar General to the Secretary of the Royal Society, and other letters and printed documents.

Mr. Graham has been informed that the Royal Society have nothing to do with the Meteorological Committee, beyond the appointment of the members thereof; that these members render their services gratuitously, and that not one farthing of the 10,000*l.* to which he refers passes into the hands of the Royal Society.

Under these circumstances Mr. Graham requests that his communication, with the documents, may be forwarded to you, and I hereby comply with that request.

(Signed) WALTER WHITE.

R. H. Scott, Esq.

Board of Trade, Whitehall Gardens,

29th November 1872.

SIR,

I AM directed by the Board of Trade to acknowledge the receipt of your letter of the 19th inst. (17,087) inquiring whether certain tables of meteorological observations, now furnished by Mr. Glaisher, might not be supplied to the Registrar General of Births, Deaths, and Marriages by the Meteorological Committee of the Royal Society, without incurring any charge beyond the 10,000*l.* a year they now receive.

Before taking the matter into further consideration, this Board would be glad if the Lords Commissioners of Her Majesty's Treasury would cause them to be informed specifically what particulars the Registrar General would require, also in what forms and at what periods these particulars would have to be furnished.

The Meteorological Committee have certain stations, observatories, telegraphic and others, from which they obtain reports, and it would be of importance to know whether the Registrar General would be satisfied with these, or if he thinks it necessary that reports should still be obtained from Mr. Glaisher's present stations, whether he can guarantee that the Committee would in future be able to obtain information from Mr. Glaisher's present stations.

Having regard to them, I am to suggest that it might be desirable that the Registrar General of Births, Deaths, and Marriages should be instructed to place himself in direct communication with the Meteorological Committee, who are ready to render all the help in their power.

I have, &c.

The Secretary,
Treasury.

(Signed) W. R. MALCOLM.

ANSWERS to QUESTIONS in Board of Trade Letter.

1. The Registrar General requires the returns as shown in the annexed forms, and at the times therein specified, for his weekly, quarterly, and annual publications. He does not object to certain modifications, but is of opinion that for public health purposes, and for comparison with the various prevailing diseases in different parts, all the particulars are required as to,

(a.) Atmospheric pressure; temperature of air, earth, and water; humidity; fog; wind, rainfall; ozone; and electricity; in at least 50 stations all over the country.

(b.) The periodical phenomena in the vegetable world as affecting crops he also thinks have a close connexion with the health of the people.

2. As to whether "he can guarantee that the committee would in future be able to obtain information from Mr. Glaisher's present stations." The Registrar General is not prepared to say.

These stations have been fixed by Mr. Glaisher, and are properly called by the committee "Mr. Glaisher's stations." Mr. Glaisher not only induced many of those 50 observers to go to the expense of procuring instruments, but all of them to take observations on the plan he arranged regularly, to submit to criticism and to correction by him; they are all now in working order, and Mr. Glaisher gets the observations reduced with comments, suited to sanitary purposes, at the small cost of 150*l.* a year. The observers, it is presumed, work gratuitously. Whether they would continue to do so, if the control were taken out of Mr. Glaisher's hands, the Registrar General has no means of knowing. Perhaps he may presume to suggest that the better course would be for the committee to employ and pay Mr. Glaisher to perform this part of the work, as it would probably be difficult to get the work required done better or cheaper. But of this the Meteorological Committee will be better able than

the Registrar General to form a judgment, derived as it would be from their experience in judiciously expending 10,000*l.* on meteorological observations and reductions every year.

(Signed) GEORGE GRAHAM,
General Register Office, Somerset House,
17th December 1872. Registrar General.

Mr. Scott was instructed to prepare a draft reply for the approval of the Committee.

Read—The following correspondence :—

SIR, Meteorological Office, 9th November 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 enquiries 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.

The Secretary, I am, &c.
Scottish Meteorological Society, Edinburgh. (Signed) ROBERT H. SCOTT, Director.

Scottish Meteorological Society,
Edinburgh, 26th November 1872.

EXCERPT from MINUTES of MEETING of the Council of the Scottish Meteorological Society, held this day.
Admiral Sir William J. Hope Johnstone in the Chair.

Inter alia,

The Council had laid before them a letter from Mr. Scott, Director of the Royal Society's Committee of the Board of Trade, dated 9th inst., stating that the Committee having authorised the establishment of a meteorological station at Stornoway, he (Mr. Scott) had entered into communication with Mr. Smith, the society's observer at that place, in order that he should make observations for the Committee, and send telegraphic reports.

The Council deeply regret to receive this communication, because they feel satisfied that the result of such a practice will, if extended, tend to deprive the society, which is maintained entirely by voluntary contributions, of the services of those observers whom they have secured and trained at much trouble and expense.

The Council have also to state that in carrying out the instructions of the Royal Society's Committee to establish a station at Stornoway, the agreement has been overlooked which was entered into between the Royal Society's Committee and this Council in 1870 (see relative documents of dates 4th and 26th April 1870), when it was stipulated by the Council and agreed to by the said Committee that the latter should not communicate with the Society's observers except through the Council.

The Council cannot but think that the Royal Society's Committee has authorised the arrangement notified in Mr. Scott's letter, in forgetfulness of the agreement just referred to, and in ignorance of the evil consequences which are likely thus to accrue to this Society; and they have further respectfully to state that even although no such written agreement had existed, they deprecate such interference as inimical to the interests of science.

The Council have to add that under other circumstances they would have cheerfully aided the Royal Society's Committee in carrying out so desirable an object as the proposed establishment of a telegraphic reporting station at Stornoway.

The Council further direct the honorary secretary before transmitting this Minute to the Royal Society's Committee, to submit it to the President of the Society, and to the Chairman of the Council for their approval.

(Signed) W. J. HOPE JOHNSTONE,
Chairman, *pro temp.*

Edinburgh, 2nd December 1872.

Approved by me.

(Signed) DAVID MILNE HOME,
Chairman of Council.

Folkestone, 6th December 1872.

Approved by me.

(Signed) TWEEDDALE,
President of Society.

MY DEAR SIR,

Meteorological Office, 10th December 1872.

I VENTURE, in reply to your letter of the 9th, to submit to you some remarks which appear to me to have a most important bearing on its subject matter, and I would most earnestly ask you whether, in consideration of them, it would not be advisable to call a special meeting of your council, to take the matter into consideration afresh.

I presume the reply of the Meteorological Committee to the excerpt would be that they have received no reply whatever from the Council to my letter of May 16th, 1870, to the effect that the Council were still prepared to act on the first portion of their resolution of April 26th. Till such official reply is received, it seems to me that the Council have placed themselves in the wrong.

The Committee could not consider that the proposed agreement had been really accepted until they were officially informed that their refusal to recommend a grant to the Society of the salary of a "clerk and other assistants," in the very words of Dr. Johnston's letter of May 13th, did not render null and void all previous negotiations.

I am, however, in a position to put the case far more strongly, for on the 8th July 1870, Dr. Johnston forwarded to me the memorial of the Society to the Scientific Commission, in which the council, after expressly referring to these especial negotiations, and stating their opinion of the probable benefit which would accrue to the Society from its supplying the returns asked for by the committee "agreed that the failure of their negotiations with the Royal Society Committee should be reported, &c."

This I have always considered as a distinct and public statement on the part of the Society that the negotiations had been futile, and I have therefore held them as null and void.

If however your Council think fit, even now, to send an official letter stating that they wish to be bound by the agreement, and will fulfil their part of the bargain, inasmuch as the wording of the memorial has not the slightest reference to the agreement proposed for filling up the schedules, I shall be prepared at once to act on the proposals in my former letters, and shall send down the schedules by return of post.

My own *private* opinion, not in any way official, is that it would be much better for all parties to disregard the negotiations "in toto," and to act as if the whole correspondence on the subject had led to no result.

The difficulty about this correspondence is that to the memorial a fragment of it has been appended, and with your present letter you forwarded a portion out of the middle, neglecting the beginning and end. The correspondence as a whole has never been placed in the hands of the recipients of your memorial.

As I say, I would most earnestly beg you to consider this matter with the utmost attention, and to submit this my letter to the Marquis of Tweeddale, Mr. Milne Home, and Sir Hope Johnstone.

If in their opinion the points which I raise are of no importance, I have nothing further to say, and of course a special council meeting will not be wanted.

T. Stevenson, Esq.,
Hon. Sec. Scottish Meteorological Society.

Yours, &c.
(Signed) R. H. Scott,
Director.

P.S.—You are perhaps unaware that we have sent a complete outfit to Stornoway, so that the Society's instruments are not used for our reports.

Scottish Meteorological Society,
Edinburgh, 18th December 1872.

EXCERPT FROM MINUTES OF MEETING of the Council of the Scottish Meteorological Society held
this Day.

Inter alia,

The Council having had under consideration a letter from Mr. Scott, Director of the Meteorological Committee, dated 10th inst., to the honorary secretary, acknowledging receipt of the Excerpt Minute of the Council, of date 26th ult., see no cause for making any observations on its contents except to point out that Mr. Scott has treated as one, what are really two distinct matters.

The one is the formal agreement entered into between the Meteorological Committee and the Council, precluding the Committee from communicating directly with the Society's observers; and the other is the application made thereafter to the Meteorological Committee, at the suggestion of the Board of Trade, for a portion of their annual grant of 10,000*l*. With the latter of these this correspondence has nothing whatever to do, but refers solely to the former.

The Council await an official reply from the Committee to their Minute of 26th ult., before taking further steps in the matter.

(Signed) DAVID MILNE HOME, Chairman.

Sir C. Wheatstone was requested to give the Committee his opinion on the entire correspondence.

Read—A letter from the Secretary of the Liverpool Underwriters Room, expressing the thanks of the Committee of that room for the telegraphic information sent them during the year, and asking further whether or not they could in future receive *daily* telegrams in a definite form, at their own expense, instead of occasional ones, as heretofore.

Mr. Scott having reported that the proposed change would not entail additional work on the Office, he was instructed to comply with the request.

Mr. Scott stated that having been requested by the Meteorological Conference at Leipzig to undertake a series of observations of temperature at various heights, he had applied to H.M.'s Office of Works, and had received permission to use the Pagoda at Kew for that purpose. He stated that he hoped shortly to be in a position to furnish the Committee with an estimate of the probable cost.—Approved.

Submitted—An application for a Fishery Barometer for the Coast Guard station at Ventnor.—Granted.

Submitted—The following report (Minutes, p. 27):—

DEAR SIR,

Kew Observatory, 16th December 1872.

HAVING received from the Meteorological Office an anemometer which the Committee desired to be placed on trial for three months, and to test more particularly the action of a new arrangement in the recording part of the velocity, I take leave to report on the behaviour of the instrument.

The change which was made in its construction is designed to provide means to bring the pencil at every hour back to the zero line of the sheet from which the curve of velocity begins afresh, and also that it should be capable of recording to the extent of 100 miles within the hour.

The instrument has been in operation for comparison with the Kew anemograph from the beginning of September (the time it was last brought back from Mr. Munro) to the end of November, and it is fixed over the ridge of the magnetic verification house at about 100 feet S.W. of the main building, having the velocity cups about 20 feet from the ground.

Its position is far from favourable, since not only the house on the N.E. side, but large trees at no great distance stand generally on all sides, and which help to interrupt the free current of approaching air, so as, to a certain extent, to affect its indications both of direction and velocity. With regard to the first this is small, even with wind north-easterly, and a comparison of the daily records of the two instruments seldom shows a difference of more than two points, and commonly very nearly corresponds.

But the same records show a far greater disproportion in the velocity traces, the new instrument being always behind the Kew one by about four tenths of the amount for the day.

So large a difference seems more than can fairly be ascribed to the causes named, and would appear to indicate that the additional mechanism tends to counteract the free motion of the velocity shaft and reduce the rotation of the cups. The only proof for this will be by giving the instrument a position equal in all respects to the one with which its action is compared.

In the accompanying sheet I have tabulated the results of 10 days in each month, which appeared the most windy and blowing from different quarters, to exhibit the disproportion of recorded velocity between the two instruments, giving the direction of the wind and the ratio of velocity recorded by the new instrument. A good deal of range appears in each of the three wind quarters in respect of this proportion, yet the mean results are not very different.

I have measured the loss of time occurring in 24 hours from the hourly inaction of the pencil from the moment it is freed to run back, to that moment when it falls again into gear. This amounts to nearly 54 minutes, and by restoring the proportion of velocity thus lost the mean ratio is a little raised in favor of this instrument.

In some instances there appears to have been something to check the return of the velocity pencil when released, but as I have tried it independently at every slot of the wheel and found it work well, probably a little fresh cleaning is all that is required to prevent the above occurring.

The elapsing time of inaction of the pencil is irregular, varying from 20 seconds to 4 minutes at the different hours.

R. H. Scott, Esq.

I remain, &c.,
(Signed) SAMUEL JEFFERY.

TABLE of COMPARISON of Anemograph Results *re* Velocity.

| Date. | Anemometers. | | Proportion of Munro's to Kew. | Prevailing Winds. | Pr. hour miles. | S.Wly. | N.Wly. | Ely. |
|---|--------------|----------|----------------------------------|------------------------|--------------------|--------|--------|------|
| | Kew. | Munro's. | | | | | | |
| Sept. | | | | | | | | |
| 5 to 6 | 263 | 172 | .65 | S. to S.S.W. | 11 | 65 | — | — |
| 6 to 7 | 311 | 182 | .60 | S.S.W. to W.S.W. | 22 | 60 | — | — |
| 7 to 8 | 226 | 150 | .67 | S.W. to W.N.W. | 9 | — | 67 | — |
| 16 to 17 | 193 | 153 | .78 | W.N.W. to S.W. | 8 | — | 78 | — |
| 23 to 24 | 278 | 170 | .61 | W. by S. to S.S.W. | 12 | 61 | — | — |
| 25 to 26 | 410 | 230 | .56 | W.N.W. to W.S.W. | 18 | — | 56 | — |
| 26 to 27 | 293 | 168 | .57 | W. to S.W. | 12 | 57 | — | — |
| 27 to 28 | 622 | 398 | .64 | S.W. and Westly. | 26 | 64 | — | — |
| 28 to 29 | 404 | 232 | .57 | W. and S.W. | 17 | 57 | — | — |
| 30 to 1 | 250 | 144 | .58 | S.W., Wly., and Sly. | 11 | 58 | — | — |
| Oct. | | | | | | | | |
| 1 to 2 | 270 | 172 | .64 | S.S.W. to S.S.E. | 11 | 64 | — | — |
| 5 to 6 | 167 | 84 | .50 | N.E. to N., then calm | 7 | — | — | 50 |
| 10 to 11 | 516 | 320 | .62 | S. to W. | 21 | 62 | — | — |
| 15 to 16 | 183 | 110 | .60 | S.W., E., and S. | 8 | — | — | 60 |
| 17 to 18 | 311 | 191 | .61 | E. to N.E. | 13 | — | — | 61 |
| 18 to 19 | 192 | 112 | .59 | N.E., S.W., and E.S.E. | 8 | — | — | 59 |
| 24 to 25 | 318 | 230 | .70 | S., S.E., and S. | 15 | — | — | 70 |
| 25 to 26 | 246 | 165 | .67 | S. to S.E. | 10 | — | — | 67 |
| 29 to 30 | 478 | 296 | .60 | S.W. to S.S.W. | 20 | 60 | — | — |
| 30 to 31 | 209 | 130 | .60 | S.W. and Westly. | 9 | 60 | — | — |
| Novr. | | | | | | | | |
| 10 to 11 | 433 | 270 | .62 | N.W. | 18 | — | 62 | — |
| 13 to 14 | 532 | 283 | .53 | N. to N.W. | 22 | — | 53 | — |
| 14 to 15 | 457 | 218 | .48 | N. to N.E. | 19 | — | — | 48 |
| 15 to 16 | 417 | 212 | .50 | N.N.W. to N.E. | 17 | — | — | 50 |
| 21 to 22 | 434 | 270 | .62 | S. | 18 | 62 | — | — |
| 22 to 23 | 509 | 336 | .66 | S. and Westly. | 21 | 66 | — | — |
| 23 to 24 | 670 | 455 | .68 | S. and Westly. | 28 | 68 | — | — |
| 24 to 25 | 448 | 303 | .68 | S.S.W., S.E., and S. | 19 | — | — | 68 |
| 25 to 26 | 697 | 460 | .66 | S., S.S.E., and S.W. | 29 | 66 | — | — |
| 26 to 27 | 720 | 480 | .67 | S.W. and Sly. | 30 | 67 | — | — |
| Mean | | | .61 | | | .62 | .63 | .59 |
| For 54 min. lost during time of pencil being out of gear, allow | | | 5 | | | | | |
| True mean | | | .66 | | | | | |

Submitted—The following STATEMENT respecting the Records for NOVEMBER 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. | Fair. | Good. | Good. | Good. |
| Records deficient - - - | None. | None. | None. | 21 hours Direction, trace invisible. | None. | None. | None. |
| Orientation verified - - - | — | — | 8th. | 1st. | 20th. | — | 17th. |
| <i>Result of 40 Remasurements :—</i> | 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 0.4 | 0.2 0.3 | 0.2 0.4 | 0.2 0.3 | 0.3 0.4 | 0.3 0.5 |
| Residual difference (— Kew) - - - | +0.1 -0.2 | -0.1 -0.1 | -0.1 0.0 | 0.0 -0.1 | 0.0 0.0 | 0.0 +0.1 | +0.1 -0.2 |
| No. of errors discovered - - - | 0 0 | 0 1 | 0 2 | 1 2 | 0 0 | 0 0 | 0 10 |
| Errors in rain tabulation - - - | 0 | 1 | 2 | 2 | 0 | 0 | 4 |
| BAROGRAPH :— | | | | | | | |
| Action - - - | Good. | Good. | Good. | Good. | Good. | Good. | Good. |
| Photography - - - | Do. | Do. | Do. | Fair. | Do. | Do. | Do. |
| Records deficient - - - | None. | None. | None. | 1 hour lost through stoppage of clock. | None. | None. | None. |
| <i>Result of 40 Remasurements :—</i> | Direction. Velocity. | Direction. Velocity. | Direction. Velocity. | Direction. Velocity. | Direction. Velocity. | Direction. Velocity. | Direction. Velocity. |
| Greatest difference - - - | 0.040 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 | 0.050 |
| Mean difference irrespective of sign - - - | 0.013 | 0.019 | 0.015 | 0.020 | 0.018 | 0.023 | 0.019 |
| Residual difference (— Kew) - - - | +0.001 | -0.001 | -0.004 | -0.007 | -0.006 | -0.009 | 0.000 |
| Mean monthly difference between simultaneous barograph and barometer - - - | 0.0024 | 0.025 | 0.018 | 0.024 | 0.022 | 0.018 | 0.027 |
| No. of errors discovered in entry of standard - - - | 0 | 1 | 1 | 3 | 0 | 1 | 7 |
| " in calculating residual correction - - - | 0 | 0 | 0 | 0 | 0 | 0 | 3 |
| " in applying residual correction - - - | 0 | 1 | 0 | 0 | 0 | 1 | 2 |
| " in tabulation - - - | 0 | 0 | 0 | 0 | 0 | 0 | 0 |
| THERMOGRAPH :— | | | | | | | |
| Action - - - | Good. | Good. | Good. | Good. | Good. | Good. | Good. |
| Photography - - - | Do. | Do. | Do. | Do. | Do. | Do. | Fair. |
| Records deficient - - - | 3 hrs. wet bulb, insufficient water. | 3 hrs. wet bulb, owing to frost. | 40 hrs. wet bulb, out of action. | * 2 D. and 8 W. | None. | 9 hrs. wet bulb, owing to frost. | 14 hrs. wet bulb, out of action. |
| <i>Result of 40 Remasurements :—</i> | Direction. Velocity. | Direction. Velocity. | Direction. Velocity. | Direction. Velocity. | Direction. Velocity. | Direction. Velocity. | Direction. Velocity. |
| Greatest difference - - - | 0.20 0.30 | 0.30 0.30 | 0.30 0.30 | 0.30 0.30 | 0.10 0.10 | 0.20 0.20 | 0.30 0.30 |
| Mean difference irrespective of sign - - - | 0.14 0.16 | 0.16 0.14 | 0.14 0.12 | 0.14 0.15 | 0.04 0.05 | 0.09 0.08 | 0.12 0.13 |
| Residual difference (— Kew) - - - | +0.14 +0.16 | +0.16 +0.08 | +0.07 +0.07 | -0.06 +0.07 | +0.04 +0.04 | -0.06 +0.01 | -0.08 +0.08 |
| Mean monthly difference between simultaneous thermograph and thermometer - - - | 0.14 0.17 | 0.10 0.10 | 0.11 0.11 | 0.10 0.10 | 0.07 0.07 | 0.15 0.15 | 0.27 0.12 |
| 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 - - - | 10 2 | 0 0 | 0 0 | 1 1 | 0 0 | 0 0 | 0 1 |
| " in maximum and minimum - - - | 0 0 | 0 0 | 0 0 | 2 1 | 0 0 | 0 0 | 1 1 |
| " in tabulation - - - | 0 | 0 | 0 | 1 | 0 | 0 | 2 |

* 8 hours wet bulb, owing to frost, and 2 hours dry bulb, through photographic blemishes.

Read—A letter from Capt. Toynbee, submitting excellent logs kept by the following gentlemen, who have already received the Pilot Charts:—

- Capt. Archibald Campbell, SS. "Europa" (Minutes, p. 38.)
 „ Chas. Rawle, ship "Star of the North" (Minutes, 1869, p. 53).
 „ A. Simpson, schooner "Traveller" (Minutes, p. 11).
 „ W. Symington, SS. "Hong Kong" (Minutes, p. 43).

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

The following cheques for December were drawn—

For Office:

| | | | £ | s. | d. |
|---------------------------------|--------------------|---|---|----|----------|
| R. H. Scott | Salaries and wages | - | - | - | 66 13 4 |
| J. S. Harding, junior | | | | | 16 13 4 |
| J. S. Harding, senior | | | | | *7 14 0 |
| T. D. Bell | | | | | *4 8 0 |
| C. W. Jacques, rent for quarter | - | - | - | - | 133 13 0 |
| E. Higgs, repairs in office | - | - | - | - | 6 2 6 |
| T. King, books | - | - | - | - | 2 10 0 |
| J. Rowsell, books | - | - | - | - | 7 3 0 |

For Observatories: Quarterly allowances, &c.:

| | | | | | |
|--|-------------------|---|-----|------|----------|
| D. Thomson (Aberdeen) | - | - | - | - | †61 17 6 |
| T. R. Robinson (Armagh) | - | - | 36 | 5 0 | |
| Do. expenses | - | - | 7 | 13 9 | |
| | | | | | 43 18 9 |
| W. P. Dymond (Falmouth) | - | - | - | - | †65 12 6 |
| R. Grant (Glasgow) | - | - | - | - | †61 17 6 |
| H. Williams (Holyhead) | - | - | - | - | 3 9 3 |
| S. Jeffery (Kew), Balance due, see below | - | - | - | - | 61 17 6 |
| C. Clouston (Orkney) | - | - | - | - | 2 10 0 |
| S. J. Perry (Stonyhurst) | - | - | †49 | 7 6 | |
| Postage to December 19th | - | - | 0 | 9 11 | |
| | | | | | 49 17 5 |
| T. Kerr (Valencia) | - | - | 42 | 17 3 | |
| Ditto Salary for December | - | - | 20 | 16 8 | |
| | | | | | 63 13 11 |
| G. T. Watson (Yarmouth) | - | - | - | - | 3 19 0 |
| R. & J. Beck, repairing anemograph, Yarmouth | - | - | 4 | 17 6 | |
| Ditto do. Holyhead | - | - | 2 | 15 6 | |
| | | | | | 7 13 0 |
| J. Driscoll, Rent at Valencia | - | - | - | - | 25 0 0 |
| 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 |
| T. E. Allen | | | | | *6 8 0 |
| J. P. Cutts | | | | | *4 0 0 |
| W. L. Dallas | | | | | *6 0 0 |

For Telegraphy: Quarterly allowances, &c.,

| | | | | | |
|---|---|---|---|-----|-------------|
| Postmaster General, telegrams | - | - | - | - | 250 15 11 |
| H. Todd (Cambridge) | - | - | - | - | 3 19 2 |
| J. Costello (Dover) | - | - | - | - | 3 7 6 |
| J. Tilston (Holyhead) | - | - | - | - | 2 1 6 |
| H. Williams (Holyhead) | - | - | - | - | 1 2 6 |
| G. Mitchell (Kingstown) | - | - | - | - | 3 11 7 |
| W. D. Penny (Nairn) | - | - | - | - | 4 4 6 |
| E. J. Lowe (Nottingham) September quarter | - | - | 5 | 0 6 | |
| Ditto do. December do. | - | - | 4 | 1 6 | |
| | | | | | 9 2 0 |
| Carried forward | - | - | - | - | £1,021 19 6 |

* Four weeks to 28th.

† 12s. 6d. deducted for forms.

| | | | | £ | s. | d. | |
|-------------------------------------|---------------------|---|---------|--------|-----|----|---|
| Brought forward | - | - | - | 1,021 | 19 | 6 | |
| J. Lucas (Oxford), six months | - | - | - | 6 | 15 | 6 | |
| W. Sandford (Portishead) | - | - | - | 3 | 19 | 0 | |
| J. Merrifield (Plymouth) | - | - | - | 3 | 5 | 0 | |
| J. Hoar (Portsmouth) | - | - | - | 3 | 6 | 0 | |
| Smith, Payne, & Co., for Scilly | - | - | - | 4 | 6 | | |
| W. Lawrence (Shetland) | - | - | - | 3 | 5 | 0 | |
| J. Trotter (Thurso) | - | - | - | 3 | 7 | 2 | |
| J. Sinclair (Wick), six months | - | - | - | 7 | 14 | 0 | |
| C. Wakefield (York) | - | - | - | 3 | 5 | 0 | |
| F. Gaster | } Computations, &c. | - | - | } | *15 | 19 | 2 |
| F. Brodie | | | | | *†6 | 2 | 0 |
| G. G. Francis | | | | | *†5 | 16 | 8 |
| R. Sargeant | | | | | *†3 | 12 | 9 |
| For Ocean Meteorology : | | | | | | | |
| H. Toynbee, Marine Superintendent | - | - | - | 33 | 6 | 8 | |
| Negretti & Zambra, "A." Instruments | - | - | 3 6 6 | | | | |
| Do. "M. O." " | - | - | 22 17 0 | | | | |
| | | | | 26 | 3 | 6 | |
| F. Pastorelli, "A." | - | - | 21 7 0 | | | | |
| Do. "M. O." " | - | - | 7 0 0 | | | | |
| | | | | 28 | 7 | 0 | |
| E. Higgs, packing cases | - | - | - | 13 | 4 | 6 | |
| J. R. Jones (Aberdeen), agent | - | - | - | 1 | 19 | 7 | |
| McGregor & Co. (Glasgow), agents | - | - | - | 2 | 10 | 0 | |
| H. J. Smart (Liverpool), agent | - | - | - | 11 | 1 | 0 | |
| W. Salmon | - | - | - | 20 | 16 | 8 | |
| R. Strachan | } Computations, &c. | - | - | } | †19 | 3 | 4 |
| C. Harding | | | | | *13 | 15 | 4 |
| J. A. Curtis | | | | | †6 | 8 | 0 |
| W. G. James | | | | | †6 | 8 | 0 |
| J. W. McVeagh | | | | | †3 | 4 | 0 |
| For Office Expenses : | | | | | | | |
| J. S. Harding, jun., on account | - | - | - | 100 | 0 | 0 | |
| Total | - | - | - | £1,379 | 0 | 5 | |

The following accounts were presented by the Kew Committee :—

| | | | | | | |
|-----------------------------------|---|---|----------|----|----|---|
| Allowance for Quarter less forms | - | - | £61 17 6 | | | |
| Examination of Returns | - | - | 100 0 0 | | | |
| | | | 161 17 6 | | | |
| Deduct amount drawn 29th November | - | - | 100 0 0 | | | |
| | | | | 61 | 17 | 6 |

* Including allowance for extra attendance.

† Four weeks to 28th.

‡ Including allowance for care of instruments.

§ 12s. 6d. deducted for forms.

The Committee then adjourned.

| | | | | |
|---|----|---|---|-------------------------------|
| £ | 10 | 0 | 0 | Brought forward |
| £ | 10 | 0 | 0 | J. Lucas (Oxford) six months |
| £ | 10 | 0 | 0 | W. Sandford (Portsmouth) |
| £ | 10 | 0 | 0 | J. Merrifield (Plymouth) |
| £ | 10 | 0 | 0 | J. Hour (Portsmouth) |
| £ | 10 | 0 | 0 | Smith, Payne & Co. for Kelly |
| £ | 10 | 0 | 0 | W. Lawrence (Scotland) |
| £ | 10 | 0 | 0 | J. Trotter (Tunaro) |
| £ | 10 | 0 | 0 | J. Sinclair (Wick) six months |
| £ | 10 | 0 | 0 | G. Wakefield (York) |
| £ | 10 | 0 | 0 | F. Gaster |
| £ | 10 | 0 | 0 | H. Brodie |
| £ | 10 | 0 | 0 | G. G. Francis |
| £ | 10 | 0 | 0 | H. Sargeant |

For Ocean Meteorology:

| | | | | |
|---|----|---|---|------------------------------------|
| £ | 10 | 0 | 0 | H. Toynbee, Marine Superintendent |
| £ | 10 | 0 | 0 | Negretti & Zamboni "A" Instruments |
| £ | 10 | 0 | 0 | Do. "M.O." |
| £ | 10 | 0 | 0 | F. Pastorelli "A." |
| £ | 10 | 0 | 0 | Do. "M.O." |
| £ | 10 | 0 | 0 | E. Higgins, packing cases |
| £ | 10 | 0 | 0 | J. R. Jones (Aberdeen), agent |
| £ | 10 | 0 | 0 | McGregor & Co. (Glasgow), agents |
| £ | 10 | 0 | 0 | H. J. Smart (Liverpool), agent |
| £ | 10 | 0 | 0 | W. Salmon |
| £ | 10 | 0 | 0 | H. Strachan |
| £ | 10 | 0 | 0 | G. Harding |
| £ | 10 | 0 | 0 | J. A. Curtis |
| £ | 10 | 0 | 0 | W. G. James |
| £ | 10 | 0 | 0 | J. W. McVagh |

LONDON:
 Printed by GEORGE E. EYRE and WILLIAM SPOTTISWOODE,
 Printers to the Queen's most Excellent Majesty,
 For Her Majesty's Stationery Office.
 [50.—1/73.]

For Office Expenses:

| | | | | |
|---|----|---|---|---------------------------------|
| £ | 10 | 0 | 0 | J. S. Harding, Jan., on account |
| £ | 10 | 0 | 0 | Total |

The following accounts were presented by the Kew Committee:—

| | | | | |
|---|----|---|---|-----------------------------------|
| £ | 10 | 0 | 0 | Allowance for Quarter less funds |
| £ | 10 | 0 | 0 | Examination of Returns |
| £ | 10 | 0 | 0 | Deduct amount drawn 23rd November |
| £ | 10 | 0 | 0 | |

* Including allowance for extra attendance.
 † Four weeks to 25th.
 ‡ Including allowance for care of instruments.
 § 12s. 6d. deducted for foun.

The Committee then adjourned.

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