SYMONS'S

MONTHLY

METEOROLOGICAL MAGAZINE.

CXXXIV.] MARCH, 1877. [PRICE FOURPENCE *or 5s. per ann. post free.*

GOVERNMENTAL METEOROLOGY.

DURING the ten years for which Admiral FitzRoy presided over the Meteorological Department, its aggregate cost was about £50,000. In 1866, the duties were transferred to the Meteorological Committee, who have since spent between £100,000 and £150,000. The Treasury, by a minute dated 1875, November 2, resolved that an enquiry should be held as to this expenditure; the report has at last been published,* and we do not think that we should be doing our duty as representing the meteorological and tax-paying public, if we allowed this report to pass without comment. The Treasury Minute is so clearly worded, and gives such a succinct account of governmental action, that we reprint it *in extenso* :—

Treasury Minute dated 2nd November, 1875.

MY LORDS read a letter, dated 21st April 1874, from the Marquis of Tweeddale, President of the Scottish Meteorological Society, submitting the claims of the Society for aid from the State, also previous applications of similar purport from the same Society, and the several replies thereto from this Board, which have been to the effect that my Lords were unwilling to propose to Parliament any grant in aid of Meteorological Science beyond that made to the Committee of the Royal Society, but that recognising the value of the labours of the Scottish Society, they should be glad if an arrangement could be made by which it should participate in the Parliamentary grant in proportion to the services rendered by it in furtherance of the objects of that grant.

To this decision my Lords would, under present circumstances, be disposed to adhere, seeing that the grant of £10,000 a year is made, not to a kindred English society, but to a scientific committee which undertakes in return to conduct, for the Government, business formerly entrusted to a public department.

But their attention having thus been drawn to the subject, my Lords are led to think that a general inquiry into the working of the present arrangements might with advantage be instituted, nine years having elapsed since they were entered into.

* Report of the Treasury Committee appointed to inquire into the conditions and mode of administration of the annual grant in aid of Meteorological Observations, London: Eyre and Spottiswoode, 1877. Price 2s. 4d.

It was in the year 1856 that the Government first began to give direct assistance to the study of Meteorology. In that year the Meteorological Department of the Board of Trade was constituted, with the primary object of collecting, and subsequently discussing, facts and observations too numerous to be collected and discussed by private persons. It continued in existence for ten years, under the direction of Admiral FitzRoy. On the death of that gentleman in 1866, a Committee, consisting of Mr. Galton, Commander Evans, and Mr. Farrer, was appointed to review the results of the labours of the department, and to make such a report as would enable the Government to decide on the policy to be adopted in the future.

In consequence of their recommendations, the control of the department was transferred to a Committee appointed by the Royal Society, who, in return for an annual grant of £10,000 per annum, agreed to carry out the duties connected with the Office. They were to be left perfectly free in their method, and in their choice of labour, and the only condition attached to the grant was that an annual account should be rendered to Parliament of the expenditure, and of the results obtained in each year.

This is the arrangement now in force and into the working of which my Lords think that the time has arrived for an inquiry. Judging by the annual reports of the Committee, they feel sure that it has spared no pains to carry out effectively the duties with which it was entrusted, and it is from no want of confidence in their method of proceeding that their Lordships have decided on this step. But the grant is so considerable that they do not think they would be justified in continuing for any lengthened period without satisfying themselves that the results obtained are such as to warrant the application of so large a sum of public money.

The inquiry should, They consider, be directed to the following points :—

I. How far have the statistics hitherto collected led to the discovery or confirmation of any Meteorological Laws ?

II. How far have the principles on which storm warnings are given, been justified by results ? The second of these questions is practically iucluded in the first, but on the answers of the two will depend the further question of—

III. How far the appropriation of a large sum of public money in aid of Meteorology is justified, bearing in mind the fact that it is not the policy of Government in this country to give direct assistance to the study of any science, except with a view to the more immediate application of scientific theories to practical purposes in which the public rather than individuals have a direct interest.

IV. Should the Committee decide to recommend that public expenditure for Meteorological purposes be continued, they should proceed further to consider upon what system it may be best administered. With this object full information should be obtained with regard to the mode in which the present grant is applied, and in connexion with this part of the inquiry my Lords would wish that the representations of the Scottish Meteorological Society should receive the consideration of the Committee.

They propose that the Committee should consist of the following gentlemen :—

Sir W. Stirling Maxwell, Bart., M.P.
T. Brassey, Esq., M.P.
R. R. W. Lingen, Esq., C.B. (their permanent Secretary).
T. H. Farrer, Esq.
J. D. Hooker, Esq., M.D., C.B.
F. Galton, Esq., F.R.S.
Lieutenant-General R. Strachey, C.S.I.

Subsequently, Mr. D. Milne Home was added to the Committee, as a representative of the Scottish Meteorological Society.

The Committee, therefore, consisted of two members of the House of Commons, one representative of the Treasury, one of the Board of Trade, one of the Royal Society, two of the Meteorological Committee, and one of the Scottish Meteorological Society. Mr. Farrer and Mr. Galton, who sat on this Committee, were also two out of the three members of the Committee of 1866, who proposed the establishment of the office, into the operations of which the present enquiry was to be made; and as above mentioned, Mr. Galton and General Strachey are members of the very Committee whose operations were to be passed in review. Some of these gentlemen were, therefore, enquiring into the success of the plans which they had recommended, and others into the success of what they themselves had done; their criticism was not, therefore, likely to be very severe.

In the next place, we will give a list of the witnesses, printing in italics the names of members or officers of the Meteorological Committee:—

Warren De La Rue, Esq., D.C.L., F.R.S.	J. Knox Laughton, Esq.
Robert H. Scott, Esq., F.R.S.	Mr. C. Dawson.
Captain Henry Toynbee.	Mr. G. T. Watson.
Captain Fredk. Evans, C.B., R.N., F.R.S.	Thomas Stevenson, Esq., F.R.S.E.
Rear-Admi. G. H. Richards, C.B., F.R.S.	Alexander Buchan, Esq., M.A., F.R.S.E.
Admi. the Hon. Sir F.W. Grey, G.C.B.	Robert James Mann, Esq., M.D.
Captain D. Murray.	Prof. Sir William Thomson, F.R.S.
Sir G. B. Airy, K.C.B., F.R.S.	James Caird, Esq.
W. Farr, Esq., M.D.	*The Rt. Hon. the Earl of Rosse, F.R.S.*

The first thing which strikes anyone is the absence from this list of many names which one would have expected to have seen there. Surely the opinions of Baxendell, Balfour Stewart, Glaisher. Ley, Stow, and other outsiders, would have been of great value. Secondly, we note that one-third of the witnesses were connected with the present Meteorological Committee, and, lastly, that they gave more than half the evidence. This would have been both natural, and perhaps necessary, had the Enquiry Committee been a strictly independent body, but that, as we have shown, it was not.

We cannot pretend to epitomize the 216 foolscap folio pages of which the Blue Book consists, and if we single out the flatly-contradictory statements of the various witnesses, we are not aware that much benefit will arise. We therefore leave the evidence and the appendices, and pass to the report.

REPORT.

TO THE LORDS COMMISSIONERS OF HER MAJESTY'S TREASURY.

MY LORDS,

1. WE have, in accordance with the Treasury Minute of the 2nd November, 1875, made the inquiries therein mentioned. In doing so we have asked for the opinion of the President and Council of the Royal Society, who have favoured

us with an elaborate report. We have also taken evidence from members and officers of the Committee which has hitherto administered the grant; and from many other persons whose opinions appeared to us to be important, either on account of their scientific eminence, their official position, or their practical knowledge and experience of the subjects in respect of which, and the classes to whom, meteorological knowledge is specially useful. To this report and evidence, which are contained in the Appendix to our Report, we desire to refer in support of the following conclusions :—

2. The business of the Committee may be considered under two heads, viz. :—

(1.) The Meteorology of the Ocean.

(2.) The Meteorology of the British Isles.

And the business relating to the latter of these may again be subdivided as follows, viz. :—

(*a.*) That branch which by the use of the telegraph collects materials for, and issues daily weather charts and storm warnings.

(*b.*) That branch which collects, digests, and publishes meteorological statistics. This last branch depends on two sources of information; viz., (1) on observations taken at a limited number of stations which are provided with self-recording instruments, and which furnish continuous observations; and (2) on observations taken by the eye at stated daily periods at more numerous intermediate stations.

3. All these divisions and sub-divisions of the business have produced results of value, and should be continued. For more specific information on these points we beg to refer to the evidence, and especially to the Report of the President and Council of the Royal Society.

4. Ocean Meteorology should, we think, be transferred to the Hydrographical Department of the Admiralty. The reasons for this are: first, that whilst this Department is equally able with the present Committee to collect observations from merchant ships, it must be better able to collect similar observations from Her Majesty's ships; and, secondly, that from its experience in chartography and in nautical wants, it is specially competent to put the results in a form useful to navigators.

5. In performing this new duty the Hydrographical Department should be in such relation with the Office or Department which manages Land Meteorology, as to insure that the observations taken at sea will be so made and digested as to be available for scientific purposes in connexion with those made on land.

6. Every effort should be made to act in concert with other nations in Ocean Meteorology, so that labour may be economised, and the utmost possible use be made of all available materials.

7. In recommending the above transfer, we assume that the Lords of the Admiralty will be willing that the Hydrographical Department should undertake the duty; that that Department will be organised and made in all respects adequate for the purpose; that the observations from merchant ships which have been hitherto successfully collected by the present Committee, and which are necessarily more numerous and more varied than any which can be obtained from the Royal Navy, will continue to be collected; and that the advancement of science, so far as the ocean is concerned, will be no less an object with the Hydrographical Department of the Admiralty than it has hitherto been with the present Committee.

8. As to Land Meteorology, we have considered the alternative proposals of

appointing one permanent head, as was the case before 1866, and of leaving matters to be managed by a Committee in the same manner in which they have since been managed. But we cannot recommend either of these proposals. As regards the first, although it may be desirable at some future time to create a permanent meteorological establishment on some such footing as that of the Astronomical Observatory at Greenwich, with an officer of scientific eminence at its head, we think that matters are scarcely ripe for such a step at present. As regards the second, it cannot be expected that the gentlemen who now constitute the Meteorological Committee, and who have by way of experiment given much valuable time to the work in its initial stages, will continue to do so under the existing conditions.

9. We think, however, that the Royal Society should be invited to continue to recommend to the Government persons eminent in science to superintend the work, under the title of the Meteorological Council. They should be appointed for limited periods and should be eligible for re-appointment. They should be fewer in number than the present Committee, and the means should be provided of remunerating them in the shape of fees for attendance. They should have and exercise complete control and supervision over and be responsible for the business, expenditure, and staff, the chief officer of which would be more appropriately designated by the title of Secretary than by his present title of Director. The important duty of selecting a Chairman, would rest with the Royal Society, or with the members of the Council.

It seems to us that these two paragraphs (8 and 9) are contradictory. The 8th begins by stating that there was one permanent head before 1866, and then it states that matters are scarcely ripe for such a step at present. That is to say, the time has not arrived in 1876 for doing what was done before 1866. The second half of the paragraph is equally obscure. If the Committee had abstained from giving reasons, and merely said that they thought the office would be best managed by a Secretary acting under a paid Committee, no exception could have been taken to the grounds of their decision, although it does seem rather hard that the Committee do not think any Englishman worthy of occupying Admiral FitzRoy's post, or of ranking with Buys Ballot, Wild, and Hann.

10. The present system of collecting daily information by telegraph and of issuing storm-warnings should continue. There is evidence that it is of real value to the seafaring population, and that it leads them to thought and observation on the subject of Weather. The want of communication by telegraph on Sundays causes a serious defect in the system, which ought to be remedied.

We have urged the absurdity of interrupting the telegraphy on Sunday for years, and are glad to find it recognised by the Committee. Either the storm warnings are useless, or it is as criminal to stop them on Sundays as it would be to extinguish the lamps in all the lighthouses at 12 o'clock on Saturday night.

11. An endeavour should be made to put into clear shape, and to issue, for public information, the maxims or principles upon which storm-warnings are in future to be given. This information should be revised from time to time, so as to embody the latest results of experience.

The report is very merciful in many respects. When the office was established, one leading duty was imposed upon it, viz., to compare its own forecasts with the weather which followed them. This was given out as one of the reasons for the costly self-recording observatories, and generally for the office taking up the Land Meteorology of the British Isles. For it must be remembered that the office was originally established for sea work, and therefore as it is now proposed to transfer all the sea statistics to the Admiralty, there is stronger reason than ever for using every effort to perfect the storm-warnings. The following questions and Mr. Scott's answers seem to us very unpromising, and yet the report passes over them without a word of comment :—

519. (MR. MILNE HOME.) Have you been able to carry out the recommendations of the Commiitee of 1866 which say "that the practice of issuing storm warnings shall be continued. That the officer of the Meteorological Department issuing the storm warning for force, should also at the same time, so far as he is able so to do, make, but not issue or publish, a prediction of the probable direction of the coming gale, endeavouring in so doing to render it as specific as possible, *e.g.*, whether within any particular quarter of the circle. That this officer shall note down at the time, and reduce into an exact shape afterwards, the maxims or principles which have guided him in making the signal of force or prediction of direction ; the facts to which those maxims are applied, the mode in which he has applied and combined them, the value he has attached to each of them, and the value of the probability which he has thus obtained, and which is indicated by the signal or prediction. That the maxims so acted upon shall be reduced into a clear and definite shape, and kept in the office ready for reference." Has any attempt been made to carry out those maxims for issuing storm warnings ? No, that has not been carried out in the detail recommended.

520. Why not ? I do not consider that it is possible.

12. The process of issuing daily weather-charts, with explanations, should continue, with such improvements as experience may from time to time suggest. The information thus given not only creates a general interest in the subject, but is of value to persons who are disposed to engage in the discussion of scientific meteorological problems.

This is probably a judicious recommendation, but we are not sure that it is dignified for a Government office to supply illustrated newspapers with engravings and copy for half-a-crown a week (Question 494), and if there were a Meteorological Trades Union there would certainly be some trials for "rattening" the Meteorological Office thermometers.

13. A certain number of continuously self-recording stations should be retained. But it may deserve consideration by the Council whether some at any rate of the existing stations may not be discontinued, and others obtained on more eligible sites. Doubts have also been expressed whether in the present state of meteorological science the minute exactness of the observations now taken at these stations is of sufficient comparative value to justify the whole of the costs which they involve, when there are so many other objects of meteorological inquiry which call for increased expenditure.

This half-hearted paragraph is a true reflex of the evidence respecting the self-recording observatories—which is contradictory in the extreme. We are glad to find that the Astronomer Royal objects to

the reproduced curves as strongly as we have done ever since they were reduced to their present form.

14. The present system of supplementing self-recording observations by returns from eye-observers at intermediate stations should be continued. The positions of these latter stations should, however, be revised, and their number increased, especially in Ireland (where at present there are but few of them); so that the returns may exhibit a fair representation of the different climates and weather of the British Isles. Every possible endeavour should be made to secure the co-operation and assist the efforts of the different societies or other local bodies engaged in meteorology, and to further the adoption of uniform methods.

We are very glad to see the second half of this paragraph. No one supposes that the Government office concentrates all the knowledge of the country, and the old plan of ignoring the Meteorological Societies was a mistake. This recommendation implies the recognition of the true condition of affairs, and it only remains for the Government to pay well for work well done, but not to part with a sovereign for anything but first-rate work.

15. The evidence of the Astronomer Royal and of other scientific witnesses contains some important observations on the form and extent in and to which the results of the observations should be published. This is a subject which deserves the careful attention of the Council, with a view to saving all unnecessary expense on the one hand, and on the other to publishing the results in such a form as may render them most available for use by men of science.

16. There is evidence to show that the system adopted in the United States, by which observations are taken over the large area of the North American continent and are communicated by telegraph to Washington, is of great value both for the immediate practical purposes of agriculture and navigation, and also as throwing light on the general movement of the atmosphere. The position and extent of the United Kingdom do not admit of any similar system of equal value. But it is desirable in the general interests of science as well as for practical purposes, that, by means of co-operation between the different European nations, synchronous observations should be made throughout Europe and the adjacent seas, so as to afford all possible facilities for synoptic charts of the weather in Europe. To this end this country should give all the help it can.*

17. There is important evidence that the science of Meteorology at the present moment stands in need of hypothesis and discussion at least as much as, if not more than, of observation. It is not easy to lay down any rule concerning the method by which such investigations may be promoted. But we think that the Council should be at liberty to appropriate a part of their annual grant to the purposes of any special researches which they may think important, and in such cases it should rest with them to select the investigators, and fix the remuneration.

We do not see any statement of the number of persons of whom the proposed Council is to consist, but we see in paragraph 9 that they are to be fewer than the present Committee. It appears

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* A note upon the United States synchronous observations will appear in our next issue.

to us that the satisfactory working of the scheme suggested in this paragraph will require considerable tact—for original investigators if often poor, are always an independent race, and if the Council accept the somewhat stilted position implied in several parts of this report they may find it more difficult than is here implied to "select the investigators and fix the remuneration."

18. There is evidence of a connection between weather and health; but it does not appear that any special meteorological observations are wanted at present, or are likely to be wanted in future for this special purpose, other than the observations, which, under the scheme we have recommended, the Council should collect for general purposes.

This paragraph read in connection with the evidence means a great deal more than it says. What it really means is, we believe, that the Registrar-General of England (what is to be done in Scotland is not clear) shall discontinue the publication of the tables which have been compiled for him for more than a quarter of a century by Mr. Glaisher, and be supplied instead with data collected by the newly-proposed Meteorological Council. If this is a specimen of the support to be given to "original investigators," we do not think that the Council will receive many valuable offers. Mr. Glaisher has been very harshly treated lately. We know that his tables are far from perfect, but he has not had £10,000 a year to spend upon them, and latterly even the miserable pittance of £150 per annum, which he used to receive for compiling them, has been withdrawn. We have neither desire nor necessity to use strong language upon the subject. Pages 62 and 63 of this report adequately show the fate of an English man of science who is not in favour with the powers that be.

19. Again, the importance of meteorological data to the agriculturist and dealer in agricultural produce is clearly established. But neither do their requirements demand other observations than should be included in the general returns and information obtained by the Meteorological Council.

Here again a great deal more is implied than is said, and the new "Meteorological Council," who are to do everything, seem also instructed to spend any amount of money. This 19th paragraph is evidently based upon the examination of Mr. Caird. If our readers will turn to his evidence they will find that he laid primary stress upon the importance of information respecting rainfall, but that not one word was said either by him, or by any of the Committee, as to the existence of two thousand rainfall stations in the British Isles. Mr. Caird went to the Meteorological Office, he heard what was being done there, and seems to have believed (and not to have been informed to the contrary) that the stations connected with that office were the only ones in the country, instead of there being, as is really the case, 20 non-official records for each official one. The fact is, evidence without cross-examination, is of very little use. We yield to no one in our appreciation of Mr. Caird's skill as an agriculturist, but it surely would have been better not to have allowed him, to be so ignorant of the true state of affairs as, to suppose that Leith

was the sole and best representative station for all the Lothians, Stirlingshire and Fifeshire [answer to question 1854]. Why the Scottish Meteorological Society alone has a dozen fully equipped stations in that district, there are 33 rainfall stations, and how far Leith is fairly typical may be judged from the fact that the rainfall even in the lowlands is twice as great in some parts as others. Leith is not even an average station, but if it were, an average of a value of which the maximum is twice the minimum would hardly be of much use.

Subsequently Mr. Caird, still regarding the stations of the Meteorological Office as the only ones, pointed out the deficiencies near Lincoln, Shrewsbury and Gloucester. Perhaps the finest station of the Meteorological Society is in Lincoln, another very good one is within a few miles of Shrewsbury, Mr. Glaisher has a station at Gloucester, and in the three counties concerned, viz., Lincoln, Shropshire and Gloucester there are 84 rainfall stations. What is the use of an enquiry with so many of the facts left out?

20. As regards the forms in which the information thus collectod can be made most available for sanitary and agricultural purposes, it appears desirable that the Meteorologieal Council should place themselves from time to time in communication with the Registrars General, and with such bodies as the Medical Council, and the Agricultural Societies of the United Kingdom.

21. The expense of the scheme we have suggested may be estimated as follows:—

The following return has been prepared by members of our Committee who are also members of the Meteorological Committee of the approximate present cost of the Meteorological Office:—

	£
Director's Office and general control	2,500
Ocean Meteorology, excluding supply of instruments ...	1,500
Land Meteorology, including self-recording observations and supply of instruments	3,500
Telegraphy and storm-warnings...	2,500
Total	£10,000

The modifications that have been proposed would lead to certain additions to the necessary outlay, among which may be specified—

	£
Remuneration of Council, say	1,000
Special Scientific researches	1,000
Extension of telegraphy on Sundays	500
New land stations	1,500
Inspection of Stations	500
Total	£4,500
Deduct for Ocean Meteorology transferred to Admiralty ...	1,500
Net increase	£3,000

This sum being added to the present grant of £10,000 would bring the whole sum to be placed at the disposal of the Council up to £13,000 yearly. Assuming the expense of Ocean Meteorology transferred to the Admiralty to remain under the new arrangement at its old figure, £1,500, the whole additional annual burden on the National Exchequer proposed in the above suggestions is £4,500, or £14,500 instead of the existing grant of £10,000.

(To be continued.)

RAINFALL OF JANUARY AND FEBRUARY.

To the Editor of the Meteorological Magazine.

SIR,—The rainfall in January, 1877, was exceedingly heavy here, viz., 9.38 inches, or 1·38 in. more than in any January since 1863, and 5·36 in. above the mean of the previous 13 years. The January rainfall at The Folds, Bolton (which is usually much more than we have here) was 2·50 in. *less* than at Braystones. Last month (February) the rainfall here was only 3·00 in., while in Bolton we had 6·19 in. (3·19 in. more than at Braystones).—Yours very truly,

JOHN DALTON WATSON.

Braystones, Beckermet, Cumberland, March 12th, 1877.

THE ASSENDEN SPRING.

To the Editor of the Oxford Journal.

SIR,—The breaking of the Assenden Spring or Bourn, falsely called a land-spring, as noticed in the *Journal* last week, is of more than local interest, as it is one of the most remarkable phenomena of the chalk so-called water-bearing stratum, which extends over a large extent of the south and south-eastern parts of England, and whence the greater portion of the perennial waters of the Thames are derived. It might be expected that in an exceptionally wet season, as in 1852, this phenomenon would be repeated. It may interest some of your readers to know the very remarkable identity of the two seasons, as observed at a place about 14 miles from the spot in question, with little probable difference in meteorological results. Taking the three months, or 91 days, previous to the 2nd of December, 1852, and the 23rd of January, 1877, the total rainfall for the first period was 12·22 inches, and for the latter period 12·16, a difference of less than one-tenth of an inch, so small that if it were not a copy from a record existing before the breaking of the Bourn it would not be believed. Then on the first period rain was noted on 49 days, on the latter 52. On one day only, 11th of November, 1852, did the rainfall exceed one inch in 24 hours, and on one only did it exceed half an inch. On December 7th, 1876, only it reached 0·92, or nearly an inch, and on two days only did it exceed half an inch; the further details show moderate and continued rainfall; added to this on both occasions the spring burst 18 days after the flood in the river Thames attained its extreme height. If there is any memorandum or remembrance of the day on which the Bourn ceased to run in 1852, it will probably furnish another proof of the identity of the two seasons.

It may be asked why did not the Bourn run in 1875, when the rainfall was as great as, if not greater than, in the two seasons 1852 and 1876-7, and when the flood attained a greater height by a few inches? The reason seems to be that the rainfall in 1875 came in storms and very heavy showers in 28 days only; in 91 days with two records, namely, 1·44 and 1·70 in 24 hours, with a total of 7·39 inches in October when the soil was not fully saturated, and the evaporation considerable; moreover, the very high flood was due to two inches of

heavy rain in five days, when the river was already in flood. It is the continued rains that sink to augment the springs, not sudden and heavy storms. The explanation of the bursting of these springs or bourns at high levels in the chalk district is easily explained.

The surface of the water in the chalk is described by a line inclining towards the natural vent or outfall of the water (in this case the Thames), at an angle of not less than 10 feet in the mile; when after heavy rain the angle of this line exceeds that of the surface of the ground in the same direction, the water shows itself above ground, as in this case, and runs till the angle is reduced by the discharge of water; this may be before the end of March.

There are many local sayings connected with the running of these Bourns, such as "When the Bourn runs, bread and wheat will he dear." The markets rise with the springs. This was before free-trade. In one place at least it is said that of old the farmers had a merry-making at a public-house at a Bourn End when the Bourn ran, and no doubt many an acre of would-be wheat will be unsown in the season 1876-77, to the loss of the farmer, though not of the public, who consume the corn from the whole habitable globe.

I am, Sir, yours obediently,

J. C. CLUTTERBUCK.

Jan. 29, 1877.

[The practical utility of the above letter is, we believe, ample justification for its reproduction in our pages.—ED.]

EXTRAORDINARY DRYNESS.

To the Editor of the Meteorological Magazine.

SIR,—The following readings almost, if not quite, considering the difference of situation, "cap" those given by the Rev. F. Stow in the January Magazine:—

Date.	Dry Bulb.	Wet Bulb.	Dew Point.	Vapour Tension.
Feb. 27, 9 p.m	29·5	24·5	7·5	·061
,, 28, 9 a.m	29·7	25·9	13·4	·079
,, 27, 10.45 p.m	29·0	24·1	6 5	·058
,, 28, 8 a.m	27·9	24·8	11·9	·073

The first two observations were made with Kew Certified Thermometers, protected from radiation in a double Louvre-boarded stand. The last two with a separate pair uncertified, but good ones, outside a north window. They had been wetted about half-an-hour previously.

The 27th was the night of the eclipse of the moon. I well remember how cutting the wind was, although not strong. The sky, of course, was cloudless. The moon when totally eclipsed was of a coppery hue, the centre dark shadow, being plainly visible; the colour reminded one of the sun in a London fog. I looked at it through an ordinary Dolland, with a terrestrial eye-piece, and a two-inch object-glass. When the eclipse was total I could see small stars close to the moon's disc. The telescope was then turned to the nebula in Orion. I was much struck with its unusual brilliancy. A triangle of three

bright little stars was clearly visible, even with so small a telescope. Not being an astronomer, I leave others to judge whether the atmosphere was not unusually clear.—I am, Sir, faithfully yours,

ALEX. E. MURRAY.

Hastings, 6th March, 1877.

STORM OF FEBRUARY 19TH AND 20TH, 1877.

RECORD OF OSLER'S ANEMOMETER.

A fierce gale set in last evening from S.W., veering at midnight to W.N.W., Osler's anemometer registering per square foot 20 to 25 lbs. pressure, a velocity of 63 to 70 miles an hour. Between 3 and 6 a.m. the pressure in the squalls reached 27 to 35 lbs., equal to 73 to 83 miles. The gale has somewhat moderated, but it still blows very hard.

T. L. MANSELL, M.D.

Guernsey, 2 p.m., Feb. 20, 1877.

GREENWICH EXTREME TEMPERATURES.

The extreme Shade Temperatures of the month of February at the Royal Observatory, Greenwich, during the past 36 *years.*

Year.	Maximum.		Minimum.		Year.	Maximum.		Minimum.	
	deg.	date.	deg.	date.		deg.	date.	deg.	date.
1841	54·6	20	12·4	3	1859	59·0	16	30·5	5
1842	53·2	15	26·4	18	1860	53·5	28	23·2	11
1843	51·9	21	20·3	14	1861	56·0	17	24·4	12
1844	50·4	23	20·0	13	1862	56·3	20	24·4	8
1845	48·5	26	7·7	11	1863	55·7	28	27·2	18
1846	62·3	28	26·9	10	1864	53·8	13	20·1	10
1847	55·0	17 18	11·2	11	1865	52·7	28	15·5	15
1848	55·0	24	30·2	18	1866	57·0	1	24·2	18
1849	58·0	22	23·5	13	1867	57·1	16	32·9	3
1850	58·2	15	30·0	14	1868	61·7	25	26·7	9
1851	57·1	18	23·7	17	1869	61·6	5	31·7	13
1852	57·4	2 17	24·9	21	1870	55·6	28	19·4	11
1853	45·0	28	20·5	19	1871	57·0	27	25·0	11
1854	57·0	6	23·5	14	1872	57·9	9	32·4	28
1855	48·4	25	11·1	19	1873	50·1	26	25·0	24 25
1856	58·0	9	27·5	1	1874	55·9	28	21·0	11
1857	56·9	28	20·0	1	1875	51·3	15	23·3	24
1858	52·8	5	23·5	26	1876	59·0	18	21·8	13

Extremes in 1877, Max. : 59°·1 on 7th ; Min. : 24°·7 on 28th.

	Year.	Max.	Date.	Min.	Date.	Year.
Means of 36 years	...	55·3	19	23·1	14	...
Highest	1846	62·3	28	32·9	3	1867
Lowest.....	1853	45·0	28	7·7	11	1845
Range	...	17·3	...	25·2	...	...

FEBRUARY, 1877.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1860–5	Greatest Fall in 24 hours. Dpth	Date.	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date.	Min. Deg.	Date.	No. of Nights below 32° In shade	On grass
			inches	inches.	in.								
I.	ENGLAND.	Camden Town	1·78	+ ·56	·34	13	17	58·5	7	25·3	28	2	6
II.		Maidstone (Hunton Court)	1·83	+ ·61	·47	13	15	...	...	....	...	...	...
,,		Selborne (The Wakes)	1·91	+ ·20	·43	19	17	54·0	7, 14	25·0	28	2	6
III.		Hitchen	1·76	+ ·50	·30	19	16	51·0	7, 10	20·0	27‡	11	...
,,		Banbury	1·72	+ ·29	·46	19	21	54·0	7, 14	23·0	28	8	...
IV.		Bury St. Edmunds (Culford)	3·05	+ 1·63	·51	20	21	54·0	7	21·0	28	6	11
,,		Norwich (Sprowston)	2·52	...	·40	20	23	...	...	...	...	...	...
V.		Bridport	1·31	— ·75	·29	15	13	56·0	7	25·0	28	5	..
,,		Barnstaple	3·33	+ 1·25	·59	12	23	58·0	16	33·0	28	0	...
,,		Bodmin	3·27	+ ·48	·49	12	24	55·0	14	33·0	27‡	0	0
VI.		Cirencester	2·01	+ ·40	·41	19	15	...	...	...	...	...	...
,,		Shifnal (Haughton Hall)	2·72	+ 1·83	·41	19	18	55·0	10	23·0	28	6	12
,,		Tenbury (Orleton)	2·09	+ ·52	·42	19	17	56·3	14	28·0	28	4	8
VII.		Leicester (Belmont Villas)	2·17	...	·72	25	18	55·8	14	23·0	28	2	...
,,		Boston	2·09	+ ·88	·48	25	18	55·0	13	23·0	28	3	...
,,		Grimsby (Killingholme)	2·10	...	·57	25	18	54·0	14	23·0	28	2	...
,,		Mansfield	2·40	...	·73	25	25	53·8	15	20·0	27‡	4	9
VIII.		Manchester	4·29	+ 2·34	1·16	25	22	55·0	14	24·0	28	3	15
IX.		York	2·09	+ ·71	·44	25	18	54·0	14	20·2	28	6	...
,,		Skipton (Arncliffe)	6·56	+ 2·89	·62	6	22	...	...	...	...	...	...
X.		North Shields	1·58	+ ·05	·30	10	18	52·6	6	22·0	28	5	9
,,		Borrowdale (Seathwaite)	14·42	+ 3·04	1·63	11	20	...	...	...	...	..	...
XI.	WALES.	Cardiff (Crockherbtown)	2·79	...	·42	11	20	56·0	14	27·0	28	...	...
,,		Haverfordwest	3·77	+ ·91	·50	2	18	55·0	14	25·0	28	2	4
,,		Aberdovey	4·75	...	...	...	19	59·0	15	26·0	28	2	...
,,		Llandudno	4·14	+ 2·79	·91	25	22	56·0	2	28·5	28	2	..
XII.	SCOTLAND.	Dumfries (Crichton Asylum)	2·66	+ ·33	·51	12	17	52·8	16	21·0	28	6	8
,,		Hawick (Silverbut Hall)	2·55	...	·39	2	18	...	...	..	...	...	...
XIV.		Kilmarnock (Annanhill)	4·42	...	·60	11	24	53·0	15	17·5	27	6	8
XV.		Castle Toward	7·12	+ 3·38	1·25	12	25	51·0	6	16·0	27	13	...
XVI.		Mull (Quinish)	6·17	...	·82	10	23	...	...	...	...	...	...
,,		St Andrews (Cambo Ho.)	1·50	...	...	...	...	..	...	...	...	...	...
,,		Grandtully	2·38	...	·65	2	9	...	...	...	...	...	...
XVII.		Braemar	3·03	+ 1·05	·55	8	21	46·8	15	17·0	27	14	25
,,		Aberdeen	2·68	...	·58	12	19	51·9	15	22·0	27	7	25
XVIII		Gairloch	6·53	...	·84	10	27	...	...	...	...	...	..
,,		Portree	...	...	...	...	...	...	...	...	...	...	...
,,		Inverness (Culloden)	3·12	+ 1·24	·81	12	11	52·0	6	21·8	27	4	24
XIX.		Helmsdale	5·53	...	·72	9	23	...	...	...	...	...	...
,,		Sandwick	4·33	+ 1·85	·64	12	26	48·2	6, 15	20·3	27	5	8
XX.	IRELAND.	Caherciveen Darrynane Abbey	...	...	...	...	...	...	...	...	...	...	...
,,		Cork	2·56	...	1·20	14	16	...	...	...	...	...	...
,,		Waterford	1·20	— ·83	·18	19	19	59·0	15	26·0	28	2	...
,,		Killaloe	4·72	+ 1·82	·56	19	21	58·0	14*	19·0	28	6	...
XXI.		Portarlington	2·50	+ ·47	·40	14	27	54·0	14	25·0	27	2	...
,,		Monkstown, Dublin	1·29	— ·35	·43	13	15	58·0	2, 8	26·0	28	2	...
XXII.		Galway	3·22	...	·47	13	23	56·0	25†	32·0	27	1	...
,,		Ballyshannon	5·69	...	1·23	25	25	...	...	...	...	...	...
XXIII		Waringstown	2·64	...	·76	25	24	55·0	5	24·0	28	6	15
,,		Edenfel (Omagh)	3·40	...	·79	25	24	52·0	14	25·0	27	7	...

* And 19. † 26. ‡ 28.

+Shows that the fall was above the average; —that it was below it.

METEOROLOGICAL NOTES ON FEBRUARY.

ABBREVIATIONS.—Bar. for Barometer; Ther. for Thermometer; Max. for Maximum; Min. for Minimum; T for Thunder; L for Lightning; TS for Thunderstorm; R for Rain; H for Hail; S for Snow.

ENGLAND.

SELBORNE.—The wind frequently very high; on the 20th, about 8,30 a.m., a violent gale from N.W. uprooted a large spruce fir-tree in my ground, planted by Gilbert White, in 1751; it was about 90 feet in height, and 7 ft. 6in. in girth at 4ft. from the ground—the long continued wet had completely softened the ground in which it grew. Extremely mild month, becoming colder towards the end; temp. 30° on 27th, 25° on 28th, and 18° on 1st of March.

BANBURY.—High wind on 19th and 25th; S on 22nd, 26th, and 27th.

CULFORD.—The weather up to the 19th was unusually mild, with much R. The first S of the season fell here on the night of the 19th, and S fell almost daily to the close of the month, and a low temp. prevailed. The month has been remarkable on account of the entire absence of E. wind. The mean temp. of the month was 42°·2, and the rainfall is above the average.

SPROWSTON.—A very mild month, and a very wet one; stormy, with strong gale from N.W. on 20th; frequent S after the 19th.

BODMIN.—During the last 98 days there have been only 10 without R; mean temp. of month, 47°·7.

HAUGHTON HALL, SHIFNAL.—With the exception of last year (when 3·20 in. of R fell) the wettest February since 1848, when 2·81 in. was measured. Almost daily R after the 10th, the temp. falling so much that the latter part of the month was colder than the beginning. The rose, gooseberry, and currant trees so forward as to be injured by the March frost, which proved more severe than any during the winter. Heavy storm on 19th, and again on 25th. Aconite open on 2nd snowdrops open on 6th, blackbird singing on 8th.

ORLETON.—A very warm, dull, cloudy month, with very little sunshine; frequent falls of fine R; the last three days very cold, with slight showers of S covering the ground on the 27th. A sudden fall of the bar. on the 19th, followed by heavy R and violent wind; great wind again on 26th. The mean temp. of the month was more than 4°·5 above the average, but rather less than it was in 1869. Clee Hills covered with S on 20th.

LEICESTER.—First three weeks unusually mild, causing vegetation to be very forward; last week cold; heavy S on morning of 26th, followed by frost. Mean temp. of the month, 42°·9. Much S.W. wind, except during the last week. Eclipse well seen on 27th.

GRIMSBY.—Snowdrops began to flower on 1st, crocus on 3rd, sweet violet on 7th, pilewort on 13th, apricot on 25th, yews shedding pollen on 28th, tortoise-shell butterfly seen on the 14th. Soon after noon on 10th the temp. fell from 53° to 46°. The month remarkably mild till the close, and vegetation I think forwarder than in any year since 1859. There was great visibility of the air on 25th and 26th, with low bar., and the weather became much colder.

MANSFIELD.—Very heavy Snow in the early morning of 26th. February has throughout been damp, mild, and occasionally pleasant month, but the weather has been far from healthy till the close, when winter seemed to come in earnest. The mean temp. for the month is 41° 8.

YORK.—S on 21st, 22nd, and 26th.

ARNCLIFFE.—S and H on 19th, S at night on 25th, and hard frost on 27th.

NORTH SHIELDS.—S on 26th, yellow crocus in flower on 10th, purple crocus on 11th, and blue hepatica on 12th.

SEATHWAITE.—Seven days on which the R exceeded an inch.

WALES.

HAVERFORDWEST.—Frequent but not heavy R during the month, which is the usual character of the month in this locality. The weather has been mild and very stormy—on the 2nd and 3rd very stormy, with T, L, and H; the gales on 20th and 21st were of extreme violence, uprooting three large oaks of some

centuries growth in Picton Park; the last four days were cold, the mercury down to 25° on stand and 20° on grass on the night of 28th.

ABERDOVEY.—Generally wet though mild; a great storm of wind from N.N.W. in the night of the 19th; frost and S at the close, the S being 1 in. deep on the ground on the 28th.

LLANDUDNO.—The month stormy and wet, but mild, the temp. being nearly 2° above the mean, and the rainfall nearly 3·00 in. Feb. here is on the average the driest month of the year, but on this occasion the fall exceeded 4·00 in. and only six days were without R. Snowdrops and palm willow in full flower on 1st, jonquil in open garden on 13th, mazereon in bloom on 8th, thrush singing on 1st and blackbird on 16th.

SCOTLAND.

DUMFRIES.—The month has been moist, though the rainfall is about the average. S fell on 26th to the depth of 3 in., and was followed by a day or two of hard frost. The mean temp. (42°·83) is nearly 3° higher than that of last year. Northerly winds prevailed in the latter half of the month.

HAWICK.—Hurricane on 2nd and 3rd. The month until the last two days was wet and mild, but the temp. fell to 22° and 20° on those days; so much heat and moisture in the earlier part of the month set the sap of the trees and shrubs early into circulation, and gooseberry trees were just expanding into leaf when they were checked for their forwardness by the frost.

ANNANHILL.—Temperature of the month generally mild, even more so than January, but on the 27th it fell to the exceptionally low temp. of 9°·5. Winds principally W. Hard gale on 3rd from W.S.W.; ozone very abundant. S fell on 20th, 21st and 27th. Eclipse well seen here on 27th, the evening being very clear.

CASTLE TOWARD.—Wet, stormy month, R falling on every day but three, and the amount being nearly double the average. On the 12th, before daylight, we had the heaviest fall of R this season (1·25 in.), the burns on this estate overflowing their banks, and doing much damage in the way of cutting up roads; there has not been much S this month. On the 21st frost set in, and continued to the end of the month, the lowest being 16° on 26th; the ice being three inches thick, and the S from two to three inches deep on 27th. The weather has been very unfavorable for all kinds of out-door labour.

BRAEMAR.—A very severe month, with S and drift. Very violent hurricane from 4.30 to 6 a.m. on 17th.

ABERDEEN.—A month of rather unsettled weather, with rainfall and temp. above the average, and bar pressure below it.

SANDWICK.—February has been very wet and cold, R or S falling on every day but two; the 26th and 27th were particularly severe, there being a gale of wind, with hailstorm and drift, made the feeling of cold intense, though the temp. had not fallen below 20°. A gale of 60 miles per hour, 10 to 11 p.m. on 2nd, and another from 40 to 50 miles an hour in early morning of 26th. Aurora on 11th and 13th, and large lunar halo on 21st.

IRELAND.

WATERFORD.—Prevailing wind N.; extremely high wind on 19th; high wind also on 25th; slight fall of S on 27th.

KILLALOE.—Month very wet and unfavourable for spring agricultural operations up to the 20th; gale from W. on 19th; very severe for about 36 hours; followed on 24th by another from N. of less severity, but longer continuance, veering back to S.W., and ending on 27th. Eclipse seen on 27th under the most favourable conditions of weather; same night the heaviest frost of the season, 19°.

MONKSTOWN.—A decidedly mild February, with the exception of the last few days, which were cold and frosty, temp. on the night of the 28th February and 1st March falling to 23°.

BALLYSHANNON.—The month has been a wet one throughout, notwithstanding the heavy rainfall of December and January, February (5·69 in.) has exceeded the

corresponding period last year by 1·09 in. High winds have been prevalent, with an unsteady bar., and mostly high temp. Showers of H, with slight frost, marked the last few days of the month.

WARINGSTOWN.—Rainy and mild, except a few days in the end of the month; heavy gales on the night of the 19th.

EDENFEL, OMAGH.—With the exception of the last three days, on which there was S and frost, the weather was of the same abnormally mild and wet character as that which has prevailed during the entire winter.

SUPPLEMENTARY TABLE OF RAINFALL IN FEB., 1877.

[For the Counties, Latitudes, and Longitudes of most of these Stations, see Met. Mag., Vol. XI., p. 28., but the list is under revision and further details will be given in a month or two.]

Div.	Station.	Total Rain.	Div.	Station.	Total Rain.
		in.			in.
II.	Acol	1·49	XI.	Llanfrechfa	4·04
,,	Hailsham	2·28	,,	Castle Malgwyn	...
,,	St. Lawrence, I. of W.	1·90	,,	Heyope	...
,,	Andover	1·35	,,	Carno	6·04
,,	Strathfield Turgiss	1·42	,,	Rhug, Corwen	5·38
III.	Addington Manor	1·87	,,	Port Madoc	6·32
,,	Oxford	1·59	XII.	Melrose	2·89
,,	Northampton	1·79	XIV.	Cessnock, Glasgow	4·84
,,	Cambridge	1·99	XV.	Gruinart	5·48
IV.	Sheering	2·15	XVII.	Keith	2·45
,,	Ipswich	1·83	XVIII.	Dalwhinnie	·77
,,	Diss	2·63	,,	Auchnasheen	9·64
,,	Swaffham	3·00	,,	Springfield, Tain	3·80
V.	Compton Bassett	1·50	XX.	Skibbereen	2·74
,,	Dartmoor	6·67	,,	Glenville, Fermoy	2·48
,,	Teignmouth	1·09	,,	Tralee	3·76
,,	Langtree, Torrington	4·07	,,	Newcastle W., Limerick	3·06
,,	Cosgarne, St. Austell	3·57	,,	Kilrush	3·52
,,	Taunton	1·48	XXI.	Kilkenny	1·48
VI.	Bristol	2·34	,,	Kilsallaghan	1·77
,,	Sansaw	2·03	,,	Twyford, Athlone	2·48
,,	Cheadle	3·66	XXII.	Ballinasloe	2·89
VII.	Coston, Melton Mowbray	1·91	,,	Kylemore	8·31
,,	Bucknall	2·13	,,	Carrick on Shannon	2·65
VIII.	Walton, Liverpool	3·23	XXIII.	Rockcorry	3·11
,,	Broughton-in-Furness	5·04	,,	Warrenpoint	2·09
IX.	Stanley, Wakefield	1·99	,,	Carnlough, Larne	...
X.	Gainford	1·52	,,	Bushmills	3·75
,,	Shap	4·66	,,	Buncrana	4·02