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THE ANEMOMETER EXHIBITION.

OUR last number was printed on the day of the opening of the exhibition of anemometers, and therefore we were merely able to announce it, and to add that it contained a remarkably fine series of instruments, of drawings, and of photographs both of apparatus and of damage by whirlwinds. Such a collection has never previously been formed; and having been held at a time when two or more historical instruments were temporarily dismounted, and therefore available, it is certain that many years must elapse before an equally fine one can be formed.

The address of the President of the Meteorological Society, Mr. Laughton, was extremely able and exhaustive, and will, we trust, in due time be published in the Society's Quarterly Journal, and in the *interim* an abstract of it will be found on page 40.

There is, however, we think, still room, and indeed a necessity for placing before our readers, who unfortunately are not all Fellows of the Society, a running commentary upon the various exhibits.

Before commencing, we think it right to mention that, by the kind permission of the Institution of Civil Engineers, in whose library the Exhibition was held, two large photographs of the collection were taken, and that copies can be obtained for a few shillings from the Assistant-Secretary, Meteorological Society, 30, Great George-street, Westminster. As all the instruments bore numbered tickets, these photographs, in which the numbers are very legible, will form a useful adjunct to the following notes, which adopt the sequence and numbering of the catalogue :—

ANEMOMETERS.

1. **Osler's Self-recording Pressure Anemometer.**—*A. F. Osler, F.R.S.*

Very fortunately for the Exhibition, the Osler anemometer belonging to the Midland Institute, Birmingham, has recently been taken down during the rebuilding of the Institute, and had not been re-erected. Mr. Osler was good enough to send it up to London, and on several occasions to attend and personally explain it. An

engraving of an early form of it will be found in Vol. II. (1867), page 111 of this magazine; but the instrument exhibited was in many respects superior. The leading features of this anemometer are (*a*), a long vane or a windmill governor to indicate direction, and also to keep (*b*) a pressure plate precisely perpendicular to the wind as regards azimuth. (*c*) Springs of various degrees of strength, so arranged that as the wind increases in force, stronger and stronger springs are brought into action, and thus as delicate a record as one or two ounces per square foot can be recorded, and yet the instrument would bear without injury nearly or quite 56lbs. per square foot. The pressure and direction of the wind are recorded on a large sheet of paper held on a cylinder with a vertical axis, on which also, by a self-weighing and emptying rain-gauge, the rainfall is continuously recorded. Lastly, as it is very desirable to ascertain the ratio, if any, between the horizontal motion of the air and its pressure, Mr. Osler has arranged a set of Robinson's cups to record upon the same sheet.

2. **Cator's Self-recording Pressure Anemometer.** — *E. E. Dymond, F.M.S.*

In this case, also, the original instrument was exhibited; its two peculiarities are, the form of the pressure-plate, and the manner in which the movement of the plate is resisted.

For the purpose of avoiding the eddy at the back of the plate, which is thought to create a species of vacuum, and so to cause the indicated pressure to be in excess of the real force of the wind, the plate is made the base of a cone.

To receive the pressure, and to enable the instrument while recording light winds to indicate also heavy gales, without a greatly enlarged scale, the chain brought down from the pressure-plate, after passing round a spiral on one side of a light circular plate, is fixed to its axle. On the other side of the plate is another spiral turned the reverse way, round which a string, fixed to the axle, and carrying a weight at the other end, is passed. The power is consequently exerted at a constantly diminishing distance from the centre, while the resistance of the weight is applied at a constantly increasing distance.

The pressure-plate has a square foot of surface. The instrument is calculated to record pressures up to 50lb. on a sheet of paper 4·85 inches wide. The first lb. occupies nearly ·4 inch; the first 5lbs. 1·36 inches; the next 5lbs. ·66, and so on diminishing, until the last 5lbs. (from 45lbs. to 50lbs.) is indicated in a space of about ·24 inch.

A further description and account of the instrument will be found in *Proc. Met. Soc.* iii. 49, 214; iv. 27, 273; and *Meteorological Mag.* ii. (1867), p. 123; v. (1870), p. 181.

3. **Whewell's Anemometer** (a new one).—*Elliott Bros.*

4. **Whewell's Anemometer.** The instrument used at the Royal Observatory, Greenwich, from 1843 to 1862.—*W. H. M. Christie, F.R.S., Astronomer Royal.*

A very good engraving of this instrument will be found in Drew's *Practical Meteorology*. Its leading features are (1) a vane which causes a pencil to mark against different portions of a paper-covered cylinder according as the wind blows from one point or another; (2) a windmill governor, which turns a very long screw, and by so doing causes the direction pencil to descend. The curve on the paper, therefore, shows from what direction the wind was blowing when the velocity of the wind was greatest. There is no indication of time—simply horizontal motion and direction.

5. **Robinson's cup and dial Anemometer.** — *Meteorological Council.*

6. ,, ,, ,, (two dials).—*L. P. Casella, F.M.S.*

These two may advantageously be taken together. We may surely assume that all our readers are familiar with the very simple form of anemometer known as Robinson's cups, in which four extremely light hollow hemispheres are fixed on four radial arms, with the opposite hemispheres facing in opposite directions, so that from whatever direction the wind may blow, the excess of pressure in the hollow of the cups over that on their exteriors, will cause the system to revolve in one direction. It was originally assumed that these cups travelled through one third of the distance of the wind which turned them and they are at present all made to indicate on their dials or recording sheets three times the space through which the cups travel, but recent experiments have shown that this is not correct, and that about $2\frac{3}{4}$ is nearer the truth.

The above were small-sized instruments, indicating by trains of wheels the total distance travelled.

7. **Fletcher's Anemometer.**—*Chadburn & Sons.*

This was an adaptation of Lind's anemometer (which will be mentioned immediately) to the measurement of currents, chiefly for ventilating or manufacturing purposes.

8. **Robinson's cup Anemometer with direction fans and Electrical Registering Apparatus,** designed by S. M. Yeates.— *Yeates & Son.*

A rather neat arrangement for electrically registering at any distance the direction and horizontal motion of the wind. The direction is obtained by a windmill governor, and the velocity by Robinson's cups—the recording apparatus is neatly mounted in plate glass frames, well adapted for a library ornament and would apparently work well. The anemometer might with advantage be mounted on a tall column or a stout mast with efficient stays, and thus the injurious effect of proximity to a building would be avoided.

9. **Lind's Anemometer.** An old form of this instrument in which the force of the wind is measured by water.— *Meteorological Council.*

If a glass tube be bent into the form of the letter U, and partly filled with water, the liquid will stand at the same height in both legs, but if one leg be bent at a right angle and held so that the wind may blow into it, the water in that leg will be lowered, and that in the other leg raised by distances the sum of which is equal to the pressure of the wind on the surface exposed, so that a difference of level of an inch corresponds to about 5lbs. per square foot.

10.—**Sir Snow Harris' Wind Gauge.** An improved form of Lind's Anemometer.—*Meteorological Council.*

This is a rather complicated form, being provided with a level to ensure its perpendicularity, and with a trigger and two caps, one fitting on to each end of the tube, the idea being that by this means the observation could be read off at leisure, the column of water being locked up under pressure.

11. **Modification of Lind's Anemometer,** one limb of the tube being inclined at a small angle to the horizon.—*Kew Committee.*

We do not know whether this was a model, or whether any observations have ever been made with it—if they have it must surely have been in Liliput—for the entire apparatus would hardly weigh an ounce, and the bore of the tube is so small that we should think it a better test of capillary action than of the velocity of the wind.

12. **Pressure Anemometer,** by Sir F. Ronalds, in which the force of the wind is determined by means of a simple balance. This instrument was erected at the Kew Observatory in 1844.—*Kew Committee.*

The best general idea of this apparatus is afforded by a pair of scales, of which the beam is about 18 inches long, and from the index of which rises a rod carrying a plate about 1 foot square. In a calm the pressure on the board is *nil ;* the bowls of the scales are level, and the board is vertical. If the wind is blowing, its pressure drives the board out of the vertical, and by adding weights to one bowl until the board is again vertical, the pressure exerted is ascertained. Obviously this gives no continuous record, and must be entirely inoperative in gusts which would not last long enough for the weight to be determined, and, moreover, from the very first impact of wind, the plate will cease to be truly vertical.

13. **Original Model of Beckley's Self-registering Anemometer,** exhibited at the Meeting of the British Association in 1856.—*Kew Committee.*

14. **Recording Apparatus for a Beckley Anemometer,** designed by Mr. De La Rue with a view of affording wind's velocity curve directly applicable to the Galton Pantagraph and Thomson Harmonic Analyser.—*Kew Committee.*

15. **Casella's Improved Self-recording Beckley Anemometer.** *L. P. Casella, F.M.S.*

These three may be taken together. No. 13 shows the first arrangement for causing a windmill governor to record direction on a paper-covered cylinder, driven by clockwork. (Although, of course, direction and time combined had been previously recorded *e.g.*, by Osler's anemometer), and the first arrangement for causing Robinson's cups to record velocity on the same paper. No. 14 differs from No. 13, chiefly in possessing what was rather irreverently described as a "fly-back-to-zero" arrangement.

No. 15 was a full sized Beckley Anemometer of the best pattern.

16. **Cups and Shaft of Robinson's Anemometer,** fixed on the dome of the Kew Observatory in 1856; dismounted in 1867. Since then it has been fitted with a simple counting apparatus (not exhibited) and employed as a standard for comparisons. In 1872 it was used at the Crystal Palace by Messrs. Jeffreys and Whipple for the purpose of determining the correct value of Robinson's factor.—*Kew Committee.*

17. **Registering Apparatus for the above Anemometer.** The wind's velocity only was recorded, the instrument being fitted inside a movable dome was not adapted for registration of direction.

18. **Howlett's Self-recording Anemometer.**—*Elliott Bros.*

This is a very peculiar pattern of pressure anemometer, consisting of a large metal ball sliding on a rod, which rod passes through a ball and socket-joint, and has on its lower end a heavy cylinder of lead, and at its lower extremity a pencil. In calm the rod remains vertical, but when there is any wind its pressure drives the ball over, and consequently forces the pencil to pass in the opposite direction, thus indicating on a paper fixed beneath it the direction of every puff of wind. A rough indication of the *force* of the wind is given by the length of the trace, but as there is evidently liability to pendulous motion being set up, the indications of force cannot be reduced to absolute measure. A facsimile of the traces of this instrument will be found in *Met. Mag.* vol. iii. (1868), p. 9. What with the ball being painted a brilliant red, and what with its pendulous motion, the apparatus bore a remarkable resemblance to a model buoy or floating beacon.

19. **Oxley's Anemometer.**—*Meteorological Council.*

This is a pressure anemometer, with a small plate 6 in. by 6 in. kept face to wind by a vane; the resistance is given by a spring which causes a hand to rotate over a graduated circular dial. Underneath the dial is a circular disc of slate, and a slate pencil carried by the indicating hand marks on this slate the extreme point to which it has been driven, *i.e.*, the max. pressure since the slate was cleaned,

and the compass point whence such pressure was exerted. We believe that a description of one form of this instrument is given in the *Mem. Lit. & Phil. Soc., Manchester*, 1869, but have not verified the reference.

20.—**Wild's Anemometer.**—*Meteorological Council.*

This, which is sometimes known as Prestel's and sometimes as the pendulum anemometer, is a modification of a very old pattern—nearly 200 years old. It is a square iron plate, freely swung, flap-wise, from its two upper corners, and, therefore, deflected from the perpendicular to a greater or less extent, according to the strength of the wind.

21. **Hall's Electro-Magnetic Anemometer.**—*J. J. Hall, F.M.S.*

An early pattern (1870) for electrically registering the indications of a Robinson anemometer—the special feature being that, if desired, a striking train can be thrown into action, and a stroke given on a bell for each one-twentieth of a mile of passing wind. By timing these strokes by a seconds watch, velocities can be determined for very short intervals. It seems to us that a very careful series of such observations might be useful for comparison with the indications of pressure anemometers, at any rate they would afford much fuller information than any velocity anemometer at present at work. For engravings and details, see *Proc. Met. Soc.*, vol. v., p. 301, *Met. Mag.*, vol. v. (1870), p. 168, and vol. vi. (1871), p. 222, also *Horological Journal*, vol. xiv., p. 7.

22. **Registering Wind Gauge,** for recording gusts of wind in pounds pressure per square foot.—*J. Somerville.*

This was a large and novel form of anemometer. A funnel somewhat like a rain gauge funnel with a square aperture 12 in. by 12 in. led to a pipe about 1 in. in diameter, which communicated with an air chamber. The funnel was kept face to wind by a powerful vane. Any pressure of wind exerted upon the funnel is transmitted (? minus loss by friction) down the tube into the air chamber, and there causes a float to rise proportionately to that pressure. Attached to the float is a pen. Behind the pen, and in contact with it, is a circular disc covered with paper, which disc revolves once in 24 hours. If perfect calm reigns throughout, a line is traced near the circumference of the paper, but when wind prevails the line is carried nearer and nearer to the centre of the disc; therefore, the disc being segmentally divided, the time of each gust is shown, and being concentrically divided into rings corresponding to the pressure, its amount can also be read off. The instrument gives no record of direction.

23. **Experimental Anemograph.**—*H. S. H. Shaw.*

This, as the title implies, was not a completed instrument, but merely one fitted up for experimental purposes. The two leading novelties in it are the facts that (1) the cups are supported by friction balls, which, in order to prevent their ever remaining at rest, are turned

by a cone instead of by a flat plate; and (2) an arrangement of steam engine governors attached to the lower part of the shaft coming from the cups.

24. **Wind Indicator, constructed by Beckley for use at Telegraph Reporting Stations.** The first instrument in which chain connection was used in lieu of shafting.—*Kew Committee.*

25. **Galton's Torsion Spring Anemometer** (rough model).—*Kew Committee.*

Small-sized Robinson's cups so fitted that they could only rotate through a very small segment of a circle, and with gradually increasing resistance. Virtually the arrangement seems to amount to Robinson's cups used as a pressure anemometer.

26. **Hagemann's Anemometer** (pattern No. 1).—*Meteorological Council.*

27. **Hagemann's Anemometer** (pattern No. 2).—*Cowl Committee of Sanitary Institute.*

28. **Hagemann's Anemometer** (pattern No. 2) in pieces, showing working parts.—*Cowl Committee of Sanitary Institute.*

No. 26 may be briefly dismissed as closely resembling in general principle the reverse of Lind's (No. 9), for whereas in Lind's the water level is displaced by the wind blowing into one leg, in Hagemann (No. 26) the displacement is produced by the wind passing over an orifice, and so producing a diminution of pressure. In Nos. 27 and 28 the same principle is applied to an arrangement much resembling a gasometer (*not* a gas meter be it observed), and the force of the wind by producing diminished pressure causes a hand to revolve over a dial about 4 in. in diameter.—For further details see *Quar. Jour. Met. Soc.*, vol. V., p. 203.

29. **6 in. Air Meter,** special construction.—*Cowl Committee of Sanitary Institute.*

Following, as we are doing, the order of the catalogue, which depended to a considerable extent upon what may be classed as accidental circumstances, we are suddenly brought to an instrument differing widely, both in its construction and application, from all that we have hitherto described.

All the instruments previously described (except No. 7) have been intended for recording the motion of the wind. This air meter would of course be capable of registering the horizontal motion of the air, but it is intended only for use in determining slight currents of air, chiefly artificial ones in questions of ventilation, &c. Nearly all these air meters, current meters, &c., have for their motive power the impingement of the current on very light fans attached obliquely to the radii of a wheel—in fact, very small windmill governors. The special feature of No. 29 is that, instead of the registering dials being in the centre of the rotating fans (and thus creating an obstacle in

the very centre of the passing air stream), the registering train is carried by the external ring which surrounds and protects the fans.

30. **3 in. Air Meter,** Lowne's pattern.—*Cowl Committee of Sanitary Institute.*

A smaller pattern with the registering apparatus behind about half of the rotating fans, the dial being at a right angle to the plane of the cups.

31. **Quadrant for measuring light draughts by inclination of candle flame.**—*Cowl Committee of Sanitary Institute.*

The flame of a candle is, perhaps, almost the most delicate indicator of slight currents which we have. In this apparatus the candle is placed at the end of a radius bar which traverses a quadrant. In perfect calm the flame is, of course, vertical; if there be any motion in the air the flame will be deflected, and the amount is ascertained by moving the candle until the flame is exactly in the same straight line as the candle and the radius bar, and then the deflection is read off on the graduated quadrant.

32. **Hicks's Air Meter** on Robinson's principle.—*Kew Committee.*

We have no knowledge of the degree of accuracy attained by this instrument, but there seems no reason why it should be less than that with the small windmill governors, though at first sight of the four little cups (not an inch across), one wonders whether it is not a model or a toy—the whole apparatus, four cups, registering dial, &c., would easily go inside one cup of a Kew pattern Robinson. However, Mr. Hicks is hardly likely to turn out a toy, and it would be disrespectful to suppose that the Kew Committee would exhibit one, and as we have already said, there seems no obvious reason why small sized Robinson's cups should not work as well as large ones.

(To be continued.)

THE METEOROLOGICAL SOCIETY.

THE usual monthly meeting of this society was held on Wednesday, March 15th, at the Institution of Civil Engineers, 25, Great George-street, Mr. J. K. Laughton, F.R.A.S., president, in the chair. The following gentlemen were balloted for and duly elected Fellows of the society:—T. H. Baker, J. T. Barber, W. H. Jackson, Captain J. Simpson, R. F. Sturge, and Sir B. J. Sulivan, K.C.B. The president (Mr. J. K. Laughton) gave a historical sketch of the different classes of anemometers. He remarked that anemometers are of different classes according as the strength is estimated by the pressure on a surface, or by the velocity, by its power of suction, or by its cooling effects. Those that measure pressure may do so either by causing the plate which receives the wind to swing backwards along a graduated quadrant, or by bridling—that is, restraining that motion, and observing the resistance called into play; or by receiving the

wind on a plate which can only move backwards against either a spring, a lever attached to a weight, or a column of liquid. Others, again, receive the wind on the surface of the liquid, and show the pressure by the disturbance of the equilibrium in a siphon tube. At the present time, and in this country, the instruments generally used are those which measure velocity, the type now commonly adopted being that known as Robinson's Cups, in which four hemispherical bowls placed at the arms of a horizontal cross cause it to rotate freely as the wind blows against them. But many very different instruments have been used for measuring velocity, the most primitive of which was a disc of cork, fringed with light feathers—a species of shuttlecock—travelling freely along a considerable length of fine wire stretched in the direction of the wind. Rotation has, however, been the favourite way of bringing the motion of the wind within reach of the observer, and to get that rotation almost every conceivable form of wheel or fan seems to have been tried. What are known as suction anemometers depend on the hydraulic principle of the lateral communication of motion by a stream. A current of air blowing across the open end of a pipe draws the air out of that pipe, causing within it a partial vacuum, which by various arrangements can be measured, the relative vacuum depending on the strength or velocity of the wind which gives rise to it. Several different methods have been adopted for measuring this vacuum; but though anemometers constructed on this principle take hold of the imagination by their neatness and simplicity, the unknown amount of disturbance due to friction, or, when long pipes are used, to vibration, prevent their being received at present as satisfactory gauges of the wind's velocity. Other anemometers have been made on the principle that the evaporation of water, or the cooling of a heated surface—other things being equal—goes on at a rate proportional to the velocity of the wind; but in practice it has been found difficult to insure the equality or uniformity of conditions, or to make correct allowance for their difference. One very ingenious instrument, by receiving the air into different pipes, and opening different valves according to its varying strength, causes them to give out two simultaneous but distinct musical notes, the one of which answers to a definite direction, the other to a definite velocity. Such things can, at present, only be considered as pretty and ingenious toys; they can undoubtedly mark a difference between one wind and another, but are quite unequal to giving any exact measure of relative, and still more of absolute force. Even the more generally recognised types of anemometers, the very commonly used pressure plates of Mr. Osler, or the revolving cups of the late Dr. Robinson, are by no means entirely satisfactory. The action of stream lines in front, or of the partial vacuum behind the exposed surface, leads to curious vagaries, difficult to understand, and as yet impossible to correct; but until they are understood and corrected, anemometry, as a science, stands on a very uncertain basis. The president, in conclusion, said that what we want is not so much

new and improved apparatus for registering or recording, for though those we have are not perfect, they are far superior to the anemometers they are applied to. What we want is rather some radical improvement in the instrument itself, or in the theory which translates its action. It is to this that he wished more especially to call the attention of all meteorologists.

THE LATE WINTER.

To the Editor of the Meteorological Magazine.

SIR,—When a general who has taken up an untenable position is compelled to retire from it in the face of the enemy, he sometimes finds it expedient to throw out a cloud of skirmishers to mask his retreat. Similarly, Mr. Brumham, having hazarded some predictions regarding the late winter, which have been somewhat signally falsified by the event, effects his retreat in your last number behind a cloud of figures. Still the fact remains that Mr. Brumham made two definite predictions—1st, that the winter of 1881-2 would be "colder than the average," and 2nd, that the month of February especially, would be "decidedly cold,"—and that neither of these predictions has been fulfilled.

Mr. Brumham finds "a curious reversal of figures," in the fact that while the Greenwich minimum temperature for the winter of 1880-1 was 12 degrees; in the winter of 1881-2 it was 21 degrees. This seems to me to be very instructive; I am not writing ironically, but in all seriousness, for it is very suggestive of the purely arbitrary nature of the coincidences and contrasts on which Mr. Brumham relies, that he should find anything "curious," or worth directing attention to in the fact that the minimum temperature of a given winter, *read backwards in degrees of the Fahrenheit scale*, should be identical, or nearly identical, with that of another winter.

As regards the Greenwich averages, quite apart from the question raised by Mr. Stow as to the reliableness of the methods by which they have been arrived at, it has long seemed to me a great misfortune, meteorologically speaking, that they should have been adopted as the standard for England. It is true that no one observatory could furnish averages that would be generally suitable for a country like England, with so many local varieties of climate; but Greenwich, situated as it is in the extreme S.E. corner of our island, on the E. edge of a Sahara of a hundred square miles or so of brick and mortar, and slate and asphalte, with its semi-continental climate, its short spells of almost tropical heat in summer, and its smoke-fogs in winter, is probably about the very worst that could have been selected to represent England generally.—I am, Sir, yours faithfully,

G. T. RYVES.

Tean Vicarage, Stoke-on-Trent, April 10th, 1882.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, SEPT., 1881.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Absolute. Maximum. Date.	Absolute. Minimum. Temp.	Absolute. Minimum. Date.	Average. Max.	Average. Min.	Average. Dew Point.	Average. Humidity.	Absolute. Max. in Sun.	Absolute. Min. on Grass.	Total Rain. Depth.	Total Rain. Days.	Aver. Cloud.
	°		°		°	°	°	0–100	°	°	inches		
England, London	73·7	18	41·7	16	65·4	49·7	52·0	88	119·3	36·3	2·03	11	7·9
Cape of Good Hope	90·6	25	37·0	7	71·5	50·6	52·11	77	...	...	1·23	7	4·0
Mauritius	76·4	26	58·0	4	74·3	65·0	58·3	69	...	...	1·01	14	5·9
Calcutta	92·2	11	74·5	17	88·3	78·3	78·7	87	162·3	72·8	6·75	19	7·7
Bombay	86·5	21	74·4	13	84·6	76·8	75·6	84	152·8	68·9	4·56	21	7·6
Ceylon	...	...	...	...	...	...	...	...	...	...	...	...	...
Melbourne	78·0	16	34·9	13	63·7	44·5	41·0	64	116·6	25·5	·61	10	5·1
Adelaide	85·8	16	40·2	22	65·9	48·3	44·7	63	143·0	29·0	1·81	11	5·6
Wellington	68·0	21	37·9	8	58·1	46·4	...	...	128·0	33·0	3·88	10	...
Auckland	68·3	...	38·2	...	...	...	...	81	123·5	...	2·16	13	7·6
Falkland Isles	51·3	8	27·0	23	42·6	33·9	36·4	90	105·0	19·7	1·87	22	8·0
Jamaica	92·0	10	71·4	14	88·5	73·7	72·8	83	...	...	2·28	15	6·5
Barbados	86·0	7	69·0	16	83·0	73·0	74·0	80	154·0	69·0	13·82	23	6·0
Toronto	92·7	6	45·5	12	76·9	59·2	59·6	75	144·5	39·0	·90	14	6·5
New Brunswick, S. John	80·0	1	38·0	22	64·3	51·1	52·8	85	...	...	3·48	10	5·8
Cape Breton, Sydney	76·4	7	38·6	25	64·5	48·7	52·6	85	...	...	2·26	11	6·3
Newfoundlnd, S. John's	67·6	20	40·0	30	58·1	46·6	48·0	85	126·0	40·0	5·85	9	6·5
Manitoba, Winnipeg	81·0	13	24·8	28	62·2	39·7	44·7	78	...	...	2·60	17	7·1

REMARKS, SEPTEMBER, 1881.

Mauritius.—Rainfall, 0·33 in. below average; mean bar. 30·222 in. Mean hourly velocity of wind, 12·5 miles; greatest, 31·9 miles on 11th; least, 2·0 miles on 18th; prevailing direction, E.S.E. to E. C. MELDRUM, F.R.S.

Melbourne.—Mean temp., humidity and pressure all about the average; rainfall 1·73 in. below it. Prevailing wind, N.; strong breezes on 6 days; H, T and L on 21st, aurora australis on 13th. R. L. J. ELLERY, F.R.S.

Adelaide.—Mean bar. 30·107 in. The rainfall over the agricultural portions of the colony was below the mean, but throughout the northern pastoral district it exceeded the average, though none fell between lat 30° and 15°. Mean temp. at Adelaide, average. C. TODD.

Auckland.—Very wet up to 13th. Wind, chiefly N.W. and S.W., strong on 11th and 12th; remainder of month tolerably fine, though cloudy. Average velocity of wind, 12·9 miles; max. in 24 hours, 720 miles on 20th. Mean pressure, 30·096 in., ·100 in. above the average. E. B. DICKSON.

Wellington.—First few days fine and bright; from 8th to 22nd, fine bright weather, prevailing winds N.W., sometimes strong; from 23rd to 26th, wet and rather windy; remainder of month fine, prevailing wind N.W. Smart shock of earthquake on 1st, very slight shock on 14th. Mean pressure ·066 in., and mean temp. 1°·0 above the average of 17 years. R. B. GORE.

Falkland Isles.—Strong gales throughout the month. F. E. COBB.

BARBADOS.—Mean atmospheric pressure ·18 in. below the average of 17 years; mean temp., average. The wind was from N.E. on 26 days, and S.E. on 3 days; average velocity, 7·3 miles per hour, extremes 11·7 miles and 2·8 miles. Rainfall, 30 per cent. above the average of 25 years. 15 days were overcast, TSS on 5 days, and L on 3 other days. R. BOWIE WALCOTT.

NEWFOUNDLAND.—One half of the month was more or less fair; the remainder, rainy and foggy. On the whole weather very unsettled. J. DELANEY.

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STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Absolute. Maximum. Date.	Absolute. Minimum. Temp.	Absolute. Minimum. Date.	Average. Max.	Average. Min.	Average. Dew Point.	Average. Humidity.	Absolute. Max. in Sun.	Absolute. Min. on Grass.	TotalRain. Depth.	TotalRain. Days.	Aver. Cloud.
	°		°		°	°	°	0–100	°	°	inches		
England, London	62·8	1	27·3	17	52·6	39·6	39·9	82	112·4	20·6	2·99	12	6·4
Cape of Good Hope	99·7	16	41·2	24	79·1	51·4	52·24	67	...	...	1·06	6	3·4
Mauritius	79·0	29	63·1	2	77·1	67·4	60·7	69	...	...	1·83	14	6·2
Calcutta	90·4	3	67·5	25	87·0	73·6	73·5	82	153·0	58·0	1·50	8	3·4
Bombay	92·4	23	73·1	28	87·4	75·5	74·5	79	151·4	61·8	4·17	4	2·2
Ceylon	89·0	28	72·3	29	86·8	75·9	74·3	79	160·0	64·0	9·71	20	5·0
Melbourne	84·9	29	35·4	7	68·5	47·0	44·0	68	130·2	29·5	3·05	18	6·2
Adelaide	89·3	28	41·2	22	68·5	50·4	43·9	56	154·0	29·5	1·31	15	6·1
Wellington	68·3	22	40·5	18	60·5	48·1	...	...	136·0	37·0	3·50	12	...
Auckland	...	...	...	...	...	...	...	...	...	...	...	...	...
Falkland Isles	62·4	25	31·6	7†	49·5	37·6	39·6	80	122·9	26·0	1·95	12	5·7
Jamaica	91·6	17	69·7	15	86·7	72·4	72·5	83	...	...	7·89	15	6·2
Barbados	85·0	6, 8	71·0	25	83·0	74·0	73·9	81	163·0	70·0	11·64	20	6·0
Toronto	77·0	3	27·0	27	58·2	40·9	49·3	80	135·0	17·4	3·82	20	6·8
New Brunswick,S.John	66·0	9	24·0	27	50·3	37·7	40·0	82	...	...	3·94	13	5·7
Cape Breton, Sydney...	81·3	1	26·3	25	52·2	37·6	40·2	80	...	...	3·76	17	6·6
Newfoundlnd, S.John's	55·3	4*	27·6	21	48·3	36·4	40·0	91	125·0	24·0	4·97	13	6·5
Manitoba, Winnipeg ...	63·3	7	11·0	22	44·6	24·8	29·0	79	...	...	1·51	15	7·2

* And 26 † And 15

REMARKS, OCTOBER, 1881.

Mauritius.—Rainfall about the average; mean bar. 30·165 in. Mean hourly velocity of wind, 12·4 miles; greatest, 28 miles on 31st; least, 2·1 miles on 28th; prevailing direction, E.S.E. to E. by N. C. MELDRUM, F.R.S.

CEYLON.—TSS occurred on five days; L was seen on nine. J. STODDART.

Adelaide.—Mean bar., 30·105 in., about the average. Rainfall below the mean, the deficiency being more marked over Yorke's Peninsula and about Lake Torrens. In the neighbourhood of Lake Eyre, the fall exceeded the mean, but throughout the tropics it was 50 per cent. below it. Mean temp., nearly 3° below the average, the lowest ever recorded. C. TODD.

Melbourne.—Mean temp. of air, 2°·1, and of dew-point, 2°·6 below average; humidity and amount of cloud, both slightly below it. Rainfall and mean pressure slightly above the average. Prevailing winds, S.W. and S.; strong breezes occurring on 7 days Heavy dew on 6 days, H on 3, L on 2. R. L. J. ELLERY, F.R.S.

Wellington.—Fine, bright weather from 1st to 6th, showery to 8th; generally fine from 9th to 12th; showery and squally from 13th to 15th; then followed fine, bright weather to 22nd; wet on 23rd, 24th and 25th; remainder of month, fine and bright; frequent strong winds. Mean pressure, average; mean temp. above the average; rainfall, below it. R. B. GORE.

Falkland Isles.—Weather generally fine and bright; strong winds. F. E. COBB.

BARBADOS.—Mean bar. below average; mean temp., 1° above it. N.E. winds prevailed on 27 days; average velocity, 7·5 miles; extremes 15·2 miles and 3·1 miles. The rainfall was 19 per cent. above average. TSS on 23rd and 26th. R. BOWIE WALCOTT.

NEWFOUNDLAND.—The month was for the most part rainy, hazy and misty. On the 19th, 8 in. of 8. J. DELANEY.

SUPPLEMENTARY TABLE OF RAINFALL, MARCH, 1882.

[For the Counties, Latitudes, and Longitudes of most of these Stations, see *Met. Mag.*, Vol. XIV., pp. 10 & 11.]

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			in.
II.	Dorking, Abinger	·94	XI.	Castle Malgwyn	2·77
,,	Margate, Acol	1·32	,,	Rhayader, Nantgwillt..	4·25
,,	Littlehampton	·99	,,	Carno, Tybritle	5·17
,,	St. Leonards	1·38	,,	Corwen, Rhug	2·63
,,	Hailsham	1·37	,,	Port Madoc	3·86
,,	I. of W., St. Lawrence.	·79	,,	Douglas.....	..
,.	Alton, Ashdell.....	1·51	XII.	Carsphairn	5·89
III.	Great Missenden.....	2·04	,,	Melrose, Abbey Gate...	2·74
,,	Winslow, Addington ...	1·43	XIII.	N. Esk Res. [Penicuick]	5·50
,,	Oxford, Magdalen Col...	1·18	XIV.	Ayr, Cassillis House ...	4·05
,,	Northampton	1·23	,,	Glasgow, Queen's Park.	3·50
,,	Cambridge, Beech Ho...	1·32	XV.	Islay, Gruinart School..	3·73
IV.	Southend	·98	XVI.	Cupar, Kembach.....	2·33
,,	Harlow, Sheering	1·49	,,	Aberfeldy H.R.S.	4·20
,,	Diss	1·52	,,	Dalnaspidal	9·08
,,	Swaffham	1·41	XVII.	Tomintoul.....	3·07
,,	Hindringham	1·33	,,	Keith H.R.S.	2·96
V.	Salisbury, Alderbury...	·87	XVIII.	Forres H.R.S.	3·03
,,	Calne, Compton Bassett	1·82	,,	Strome Ferry H.R.S....	7·88
,,	Beaminster Vicarage ...	1·74	,,	Lochbroom	10·50
,,	Ashburton, Holne Vic..	2·35	,,	Tain, Springfield.....	3·30
,,	Langtree Wick	1·61	,,	Loch Shiel, Glenaladale	16·05
,,	Lynmouth, Glenthorne.	2·36	XIX.	Lairg H.R.S.	6·99
,,	St. Austell, Cosgarne...	...	,,	Forsinard H.R.S.	5·89
,,	Taunton, Fullands	·84	,,	Watten H.R.S.	2·68
VI.	Bristol, Clifton	2·29	XX.	Fermoy, Glenville	2·81
,,	Ross	1·04	,,	Tralee, Castlemorris ...	2·52
,,	Wem, Sansaw Hall.....	1·59	,,	Cahir, Tubrid	2·08
,,	Cheadle, The Heath Ho.	2·07	,,	Newcastle West	2·67
,,	Worcester, Diglis Lock	1·24	,,	Kilrush	3·20
,,	Coundon	1·86	,,	Corofin	4·17
VII.	Melton, Coston	·98	XXI.	Kilkenny, Butler House	1·73
,,	Ketton Hall [Stamford]	1·04	,,	Carlow, Browne's Hill..	2·07
,,	Horncastle, Bucknall ...	1·35	,,	Navan, Balrath	2·58
VIII.	Macclesfield Park	2·08	,,	Athlone, Twyford	4·73
,,	Walton-on-the-Hill.....	2·34	XXII.	Mullingar, Belvedere...	2·34
,,	Broughton-in-Furness..	4·96	,,	Ballinasloe	3·45
IX.	Wakefield, Stanley Vic.	1·70	,,	Clifden, Kylemore	8·68
,,	Ripon, Mickley	2·45	,,	Crossmolina, Enniscoe..	5·33
,,	Scarborough.....	1·52	XXIII.	Carrick-on-Shannon ...	3·53
,,	East Layton[Darlington]	2·26	,,	Dowra	...
,,	Mickleton.....	3·95	,,	Rockcorry.....	3·88
X.	Haltwhistle, Unthank..	3·69	,,	Warrenpoint	3·31
,,	Shap, Copy Hill	5·67	,,	Newtownards	2·16
XI.	Llanfrechfa Grange	2·61	,,	Belfast, New Barnsley .	3·33
,,	Llandovery	3·84	,,	Bushmills	3·32
,,	Solva	1·34	,,	Buncrana	3·08

MARCH, 1882.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1870–9	Greatest Fall in 24 hours. Dpth	Greatest Fall in 24 hours. Date.	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Max. Date.	Min. Deg.	Min. Date.	No. of Nights below 32°. In shade.	No. of Nights below 32°. On grass.
			inches	inches.	in.								
I.	ENGLAND.	Camden Square	1·35	— ·26	·67	25	11	63·9	20	28·5	4	3	15
II.		Hunton Court	·95	— ·63	·46	25	11	...	...	...	...	...	...
,,		Strathfield Turgiss	·93	— ·47	·45	25	11	64·2	18	28·6	4, 23	9	20
III.		Hitchin	1·15	— ·33	·57	25	12	58·0	20	27·0	3, 22	13	...
,,		Banbury	1·17	— ·43	·61	25	13	59·5	18	27·0	23	15	...
IV.		Bury St. Edmunds	1·93	+ ·37	1·10	25	11	60·0	20*a*	26·0	3, 22	13	...
,,		Cossey	1·26	— ·43	·83	25	11	63·8	18	29·0	22	10	15
V.		Bridport	1·34	...	·67	31	15	...	...	...	...	...	...
,,		Barnstaple	1·71	— ·78	·39	25	16	62·5	8	31·0	4	...	...
,,		Bodmin	1·74	— 1·42	·47	25	17	58·0	18	31·0	4	1	11
VI.		Cirencester	1·99	— ·08	·53	25	14	...	...	...	...	...	...
,,		Woolstaston	2·62	+ ·46	·79	25	15	63·0	18	27·0	22	4	10
,,		Orleton, Tenbury	1·23	— ·64	·51	25	13	64·8	16	26·7	4	11	14
VII.		Leicester	...	...	...	...	...	...	...	...	...	...	...
,,		Boston	1·18	— ·11	·72	25	8	63·0	18	29·0	23	4	...
,,		Grimsby	1·31	— ·35	·43	25	13	61·5	18	31·0	22	1	...
,,		Mansfield	...	...	...	...	...	...	...	...	...	...	...
VIII.		Manchester (Ardwick)	2·45	— ·07	·51	26	13	56·0	...	32·0	22	1	...
IX.		Ribstone Hall	1·98	— ·15	·52	26	8	...	...	...	...	...	...
,,		Arncliffe	7·49	+ 2·73	1·39	24	22	57·0	15	29·0	22	6	...
X.		North Shields	·99	— ·46	·60	1	11	63·5	16	28·2	7, 23	4	7
,,		Seathwaite (Borrowdale)	13·78	+ 3·89	1·95	24	24	...	...	...	...	..	...
XI.	WALES.	Ely	1·37	— 1·32	·38	1	17	...	...	...	...	...	...
,,		Haverfordwest	2·33	— ·86	·62	25	17	57·0	16	29·0	3	6	10
,,		Plinlimmon (Cwmsymlog)	3·95	...	1·12	2	22	...	...	...	...	...	...
,,		Llandudno	2·62	+ ·74	·58	25	17	56·3	19	34·0	21	0	...
XII.	SCOTLAND.	Cargen	4·74	+ 1·96	1·06	24	20	56·2	16	32·2	22	0	...
,,		Hawick	3·23	+ 1·27	·54	9	20	...	...	...	...	...	...
XIV.		Newmains	4·81	+ 1·67	·78	9	24	...	...	...	...	...	...
XV.		Kilmory	6·84	+ 2·23	·84	7	25	...	...	27·0	31	6	...
,,		Appin (Airds)	7·48	...	...	...	...	...	...	...	...	...	...
,,		Quinish (Mull)	5·81	...	·60	28	27	...	...	...	...	...	.
XVI.		Loch Leven Sluices	3·50	+ 1·38	·60	10	16	...	...	...	...	...	...
,,		Arbroath	1·66	+ ·03	·63	1	13	59·0	16	32·0	7, 25	2	...
XVII.		Braemar	4·08	+ 1·89	1·10	2	24	55·8	16	25·0	7	11	26
,,		Aberdeen	1·86	...	·63	1	19	65·0	16	29·0	6	5	...
XVIII		Sligachan	15·57	...	2·14	24	27	...	...	...	...	..	...
,,		Culloden	3·23	+ 1·48	·46	8	13	...	...	...	...	3	18
XIX.		Dunrobin	4·61	...	·53	1	22	57·0	17	27·0	7	4	...
,,		Sandwick	5·81	+ 3·17	·74	6	29	53·2	9	28·5	7	3	5
XX.	IRELAND.	Blackrock	2·19	— ·57	·55	19	18	64·0	15	30·0	11	6	...
,,		Dromore Castle	4·50	...	·73	25	25	58·0	17	30·0	2	...	...
,,		Brook Lodge	1·76	...	·36	25	15	60·0	15*b*	29·0	30	4	...
,,		Killaloe	5·76	...	1·59	1	19	64·0	15	29·0	31	3	...
XXI.		Portarlington	3·07	+ ·91	·75	25	23	60·5	7	30·0	21	2	...
,,		Monkstown	2·64	...	·68	25	18	...	...	...	...	...	...
XXII.		Queen's College (Galway)	3·70	+ ·96	·51	7	23	...	...	...	...	...	...
XXIII.		Waringstown	2·44	+ ·38	·31	2	21	61·0	9	31·0	21	2	4
,,		Londonderry	...	...	...	...	...	...	...	...	...	...	...
,,		Edenfel	3·55	+ 1·46	·41	9	26	56·0	16	30·0	4*c*	6	...

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

a And 29. *b* And 24. *c* And 20 and 21.

METEOROLOGICAL NOTES ON MARCH.

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

ENGLAND.

STRATHFIELD TURGISS.—The season as a whole from November up to the present time has been the most favourable for many years. The wheat season finished with very suitable weather at the time, and the acreage in wheat will far exceed any recent year. First dog violet seen on 2nd; thrushes' nest with eggs seen on 7th; brimstone and nettle tortoiseshell butterflies flying on 9th; anemone in flower 13th; wild hyacinth, 24th; pear on 27th.

BANBURY.—Whitethorn hedges in leaf at latter part of month. Mean temp. 43°·9. High wind on 7 days; H, sleet, and S on 21st; R and S on night of 25th; bats seen flying on 18th.

CULFORD.—The weather of the early part of the month was very fine and mild; slight touches of wintry weather towards the close. Stormy on 2nd and 26th; S and sleet on 21st; S, R, and H on 22nd.

COSSEY.—A very fine month, favourable to agricultural pursuits.

BODMIN.—Another very mild genial month; first glowworm seen on 7th.

CIRENCESTER.—A mild genial month with moderate rainfall.

WOOLSTASTON.—A very warm month till 20th; then S and cold winds. Gale with sleet and S on 25th and 26th. Mean temp. of month, 45°·4.

ORLETON.—A dry month with an average amount of sunshine and frequent frosty mornings, but not severe. Mean temp. of month more than 3° above the average of 20 years, and only once exceeded in that period, viz., in 1868. A sudden fall of S occurred on the evening of the 21st, covering the ground. Weather very favourable for farming operations: plums beginning to blossom on the 21st, damsons on the 25th; brooks and rivers flooded on 1st; great wind on 2nd, 7th, and 24th.

GRIMSBY.—A very fine month; vegetation very forward and farm work going on rapidly. T, L, and S on 21st.

MANCHESTER.—The month was fine and pleasant, unlike the traditional March; the weather was generally fine and mild and quite genial; although S fell on the 21st, and the weather for a few days was stormy, it was altogether quite an exceptional month.

ARNCLIFFE.—The month on the whole was rather wet; beautiful weather from the 12th to the 18th.

NORTH SHIELDS.—S on 21st and 22nd.

SEATHWAITE.—H on 5th, 20th, 21st, and 25th. Six falls of R exceeding 1in. in 24 hours.

WALES.

HAVERFORDWEST.—The month commenced with a bleak north-wester blowing furiously, followed by a night of sharp frost, Precelly capped with S for the first time during the winter. From 7th to 10th very mild and damp, sky completely overcast; from 11th to 17th fine, clear, and bright, with sunny days and rather cold nights, slight frost at times; broken weather with some heavy gales and R from the 20th to the end; the last two days cold and stormy; on the whole a very mild March. Blackthorn in blossom on 18th; honeysuckle in full leaf; plenty of grass, fruit trees fast blossoming. I never remember such a winter and spring previously.

LLANDUDNO.—A fine and mild month, though rather showery, excepting from the 9th to the 18th inclusive, when drought and sunshine prevailed. The temp. was over 6° above the average. There was no frost, and the duration of bright sunshine was 92 hours. S on distant hills from 1st to 4th, and from 20th to 26th.

SCOTLAND.

CARGEN.—Mean temp. 44°·3, 3°·1 above average. Sunshine 107 hours, five hours above average.

HAWICK.—Fine spring-like weather from the 10th to 20th. Hills white with S on 6th, 21st, 22nd, 24th, 28th, and 29th. Sharp frost on the night of the 24th; on the whole the month was a wet and cold one. H on four days.

ABERDEEN.—The first few days of March were stormy and unsettled, strong easterly gales and snow squalls being prevalent. Thereafter the wind changed to S.W., with fine dry weather and occasional high temp. Rainfall about the average for March. Lunar halo on night of 3rd.

SANDWICK.—March was remarkably wet and stormy, the rainfall being more than twice the average of the previous 41 years, while there were gales of from 50 to 60 miles an hour on the 4th, 7th, 8th, 9th, 13th, 16th, 21st, 22nd, and 27th. The ground was white with S on 1st, 21st, and 22nd. This was most of the S we had during the winter, and it was of short duration, for the sun thawed it quickly. There was L on the 4th, morning and evening, and auroræ on 8th, 9th, and 14th.

IRELAND.

BLACKROCK.—Stormy on 25th and 26th, mean temp. 47°·1.

DROMORE.—A very favourable month for agricultural operations, everything well forward. Mean temp. 47°·8.

WATERFORD.—The month was generally very wild, blowing hard from S.W. and N.W. Snow on 21st, hailstones on 30th, as large as peas. Snow on Comeragh Mountains on 31st. On 1st gale from N.W., on 8th gale from S.W.

KILLALOE.—Rainfall much above the average for March; scarcely any frost; vegetation very forward.

EDENFEL.—With the exception of a fine summer-like week from the 11th to the 18th, the weather of the month was the most severe of this winter. There were almost constant violent squalls and gales generally accompanied by rain, but on the 20th and 21st by deep drifting snow, which, however, disappeared on 22nd. Vegetation and farm labour at a standstill.

THE COLD IN RUSSIA.

Whilst we enjoy such a wonderfully warm winter, some parts of Russia are visited by terrific cold weather. The Trans-Caucasia, which is generally warm, has been exceptionally cold this winter; the oldest inhabitants do not remember having witnessed such a persistent frost. The gigantic chain of the Caucasus is covered by snow to its very foot. The immense and flat valley of the Kur and Arax rivers present only an illimitable snowy plain Rivers which had never been seen frozen over, and rivulets which had not been so for twenty years, are now covered with a thick layer of ice. The inhabitants of that district, unaccustomed to cold, are obliged to stay in their wretchedly-built smoky little huts, packed up together round their *toundihrs* (holes dug in the ground of the hut to bake the bread), where some few pieces of charcoal are burning. The workmen and labourers, whose houses have no doors, are submitted to the most terrible privations. In the valleys the snow is several yards deep. In the forestless plains, where the wood is always very dear, it can only be had now at exorbitant prices, and the poor are almost condemned to be frozen to death. The cattle, which are generally fed on the pasturage at the bottom of the mountains, are also condemned to a sure death from starvation, as it is not the habit of the country to make provisions of hay; the flocks of sheep will doubtless share the same fate. The coming spring promises to be terrible for the Caucasian mountaineers.—*Golos.*