

# SYMONS'S MONTHLY METEOROLOGICAL MAGAZINE.

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## METEOROLOGICAL BIBLIOGRAPHY.

WE are glad to appropriate our first page this month to a notice of Dr. Hellmann's Repertorium,\* a work of which any man might be proud, a work without parallel or precedent in our branch of science, and one which, while absolutely indispensable to every student of the meteorology of Germany, cannot be safely ignored by any one who desires (before rushing into print) to ascertain what has been suggested, what has been found useful, and what has been proved useless by those who have gone before him.

Dr. Hellmann was supposed to be preparing a bibliography; he has done that, and he has also done very much besides. In upwards of five hundred large octavo pages he gives a mass of information, of which the following is a brief list:—

### PART I.—BIBLIOGRAPHY.

- (1) A list of German authors, their writings and inventions, classed alphabetically under author's names.
- (2) A subject catalogue referring for details to the previous section.

### PART II.—CATALOGUE OF OBSERVATIONS.

- (3) A list of all the places in Germany at which Meteorological observations are being, or have been, made, arranged alphabetically under the names of the stations.
- (4) List of the stations grouped in States, and various other important lists of stations and systems.

### PART III.—HISTORICAL.

- (5) Epitome of the History of Meteorological observations in Germany.
- (6) Chronological notes upon the progress of Meteorology in Germany.
- (7) Statistical.

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\* Repertorium der Deutschen Meteorologie. Leistungen der Deutschen in Schriften, Erfindungen und Beobachtungen auf dem Gebiete der Meteorologie und des Erdmagnetismus von den ältesten Zeiten bis zum Schlusse des Jahres 1881. Von G. Hellmann. Mit einer Karte und einer lithographischen Tafel. Leipzig: Wilhelm Engelmann, 1883.

We cannot, within any ordinary limits, lay before our readers a full account of the contents of this Repertorium, but we will take it systematically according to the sections we have just quoted, and reprinting the first entry in each, both in the original and translation; we shall at any rate give our readers some idea of the labour which Dr. Hellmann has undertaken and completed.

**Abendroth, William.**—Dr. phil. Prof. d. Math. u. Phys. a. Gymn. zum heiligen Kreuz in Dresden (*Or*), geb. 1838, Juli . . ., Pirna.

Ueb. die opt. Erscheinungen in d. Atmosphäre. Jahresb. Ver. Erdk. Dresden, xv, 1878, p. 40.

**ABENDROTH, WILLIAM**, Doctor in Philosophy, Professor of Mathematics and Physics at the College of the Holy Cross at Dresden. (*Information specially communicated.*) Born 1838, July (? date), at Pirna.

"On optical phenomena in the Atmosphere." Fifteenth Annual Report of the Geographical Society at Dresden, 1878, p. 40.

Thus it will be seen that the bibliography is also a biography. Take for instance the next entry, that of the author of one of the best treatises upon Hail.

"**ABICH, WILLIAM HERRMANN**, Doctor of Philosophy (Berlin, 1831). After scientific travels, appointed in 1842 Professor of Mineralogy at the University of Dorpat, but in order to further his geological studies residing chiefly in Transcaucasia; later (1853) made a member of the Academy of Sciences, St. Petersburg, and in 1866 elected an honorary member of that body. Since 1877 has resided principally at Vienna. Born December 11th, 1806, at Berlin."

On the next page we find a notice of a Yorkshire meteorologist, who lived about 250 years before William the Conqueror. We are not joking. The details are too full for us to quote them all, but the following is an abstract:—

"**ALCUINUS** (Alchuin), Director of the Cloister School at York, in England, until (in 782) Charles the Great made him a member of the learned body attached to his Court. Subsequently Alcuinus established numerous schools in France, and became Abbot of St. Martin at Tours (France). He was born at York in 736, and died May 19th, 804, at Hersfeld, in Hesse. According to some authorities it was Alcuinus, and according to others it was his patron, Charles the Great, who first adopted the plan of indicating wind direction to 16 points, by compounds of the four words, East, South, West and North."

We must pass to Section (2) Subject Catalogue, and give a few lines as a specimen of it:—

**Abenddammerung.**—s. Dämmerung.

**Abendroth** (Abendröthe).—s. Dämmerung.

**Abendwind** (Nachtwind).—s. Winde lokalen Charakters.

. . . . .

**Aequatorialstrom.**  
Mühry 20. 29 (1866-7).

**EVENING TWILIGHT.**—See Twilight.

**EVENING RED.**—See Twilight.

**EVENING WIND** (Night wind).—See Wind, its local phenomena.

**EQUATORIAL CURRENTS.**—Mühry, 20 and 29, 1866-7. (*i.e.* See, in the first section, the works by Mühry, which have the rotation numbers 20 and 29, and which were printed in the years 1866 and 1867).

Section (3) is the alphabetical list of stations, but, as will be seen it not only gives their names, but almost a history of each. The first is a very good example—it is Aachen, or, as it is more generally called in this country, Aix-la-Chapelle.

**Aachen (Preussen 50° 47' N, 6° 5' E, 177m.)**

(a) 1838–47 Nov. ; 6, 2, 10 ;  
Heis ; Heis 1. Berlin (c) 1.

(b) 1847 Dec. —52 Feb. ; 6, 2,  
10 ; Heis ; Berlin (c).

(c) 1868 Apr. ff. (m. Unterbr.) ;  
6, 2, 10 ; Schaper, Sieberger ;  
Berlin (c). Seit 1879 in extenso :  
Deutschland.

*Lit:* Heis 1. Schervier. Sie-  
berger.

AIX-LA-CHAPELLE, (Prussia, lat. 50° 47' N., long. 6° 5' E., (of Greenwich), altitude 177 metres (581 ft.) above sea level.

(a) Observations from January 1838, to November, 1847, taken at 6 a.m., 2 p.m., and 10 p.m. daily, by Prof. Heis, and published both by himself and also by the Royal Prussian Meteorological Institute.

(b) A second series in continuation of the first (but not published by Prof. Heis), and ending with February, 1852.

(c) A third series, beginning in April, 1868, and continuing to the present time (but with interruptions), made by Messrs. Schaper and Sieberger, and published similarly to *a* and *b*. Since 1879 the observations have been published *in extenso*.

The literature upon the climate of the city consists of papers by Prof. Heis, Dr. Schervier, and Prof. Sieberger.

Concerning Section (4), we have space to give only the titles of the various groups of data, *e.g.*, List of stations grouped in States ; List of stations at which the observations are printed *in extenso* ; Stations at which observations are made at least six times a day ; Forestry stations ; Signal stations belonging to the German Naval Observatory ; Stations making synchronous observations for the U. S. Signal Office ; Stations at altitudes exceeding 600 metres (1969 feet). (There have been altogether 66 such stations, and 44 are still at work) Stations at which observations have been made for 50 years or more. Of these there are 51, some with tremendously long records, *e.g.*, Breslau, 126 ; Danzig, 205 ; Berlin, 210 years. (While we regard these records with considerable reverence, we cannot help thinking that during such long periods, the changes in instruments, observers, and exposure must have been such that they can hardly be regarded as single and strictly comparable.) List of observers' names (1155) classed alphabetically.

Section (5) is appropriately divided into three periods :—

- (1) Weather observations made without instruments.
- (2) Instrumental records not systematically organized by the State.
- (3) Modern organizations.

We cannot go through these in detail, but together they form a

complete history (comprised in about 50 pages) of the meteorological observations and societies of Germany.

Section (6) is much shorter. It gives in chronological order the leading features of meteorological progress in Germany. We take the first and a few other entries.

Middle of 8th century. The monk Vergilius, who was preaching Christianity in Bavaria, wrote a "*Decalogium de Metheorologicis impressionibus.*"

1480. An anonymous author wrote "*Ein hübscher schoener Kalender mit etlicher zugehörung . . . vnd von den vier winden vnd irer Natur.*"

1497. First published description of a storm (in Pomerania).

1576. Weather observations begun at Dresden.

1604. Kepler began regular weather observations at Prague.

1691. Camerarius began at Tübingen regular records of barometer and thermometer—probably the first in Germany.

1712. Algöwer made at Ulm the first records of rainfall in Germany.

1761. Aepinus made the first investigation of the distribution of temperature over the earth.

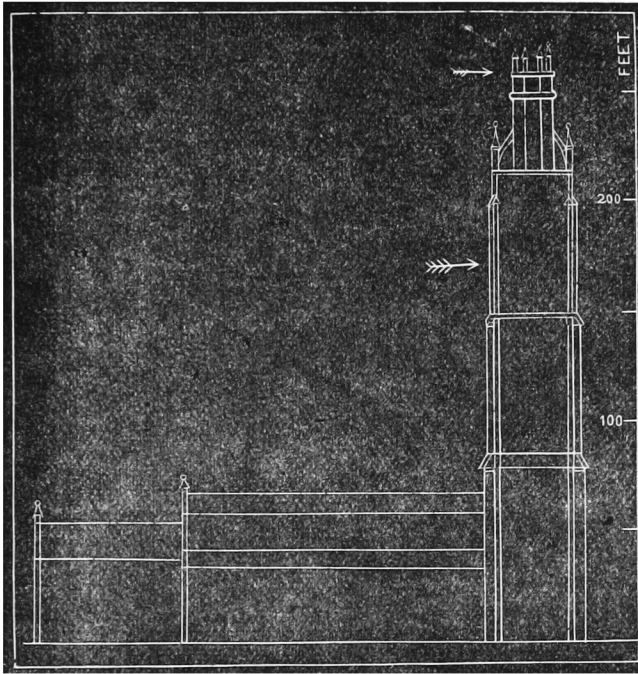
The seventh and last section is entitled Statistical, and gives the number of publications and of stations in each year, and various deductions from those numbers; of course they show very markedly the great activity which has characterized meteorological work in recent years. Possibly the following paragraph is as well worthy of thoughtful consideration as any wherewith we could close this notice of Dr. Hellmann's extremely useful book:—

"I estimate the number of books and papers upon Meteorology and Terrestrial Magnetism which appear yearly at present at 800. Therefore, anyone who wishes to read them all must read two every day in the year, which no one would do for pleasure, and few from a sense of duty. I must, therefore, with relation to these facts, bring prominently forward the suggestion (which I have long discussed personally with leading meteorologists) that a *Yearly Report on the Advance of Meteorology*, prepared by the joint labour of experts, is a pressing need, as is also the combination in one General Catalogue of all the separate lists yet published."

## TEMPERATURE OBSERVATIONS AT BOSTON, LINCOLN

IN the *Meteorological Magazine*, vol. xvii., p. 20 (March, 1882), we gave a description of the arrangements then recently made for determining the temperature at 4, 170 and 260 ft. above the ground at Boston in Lincolnshire. To save trouble we reprint the sketch of the church, with the arrows pointing to the sites of the upper thermometers, and may remind our readers that there is a complete set

of thermometers in a Stevenson screen in the churchyard, another at 170 ft., and at 260 ft. there is a thermometer, the indications of which are recorded electrically at the base of the tower.



At the last meeting of the Royal Society before its adjournment, a paper was read by Mr. G. J. Symons, entitled, "Note on the Establishment and First Results of Simultaneous Thermometric and Hygrometric Observations at Heights of 4 and 170 feet, and of Siemens' Electrical Thermometer at 260 feet above the ground."

We think that it may be of interest to reprint some portions of this paper, referring those who desire full details to the Proceedings of the Royal Society.

It is just a century since James Six (the inventor of the well-known Six's registering thermometer), commenced some occasional comparisons of the temperature of the air at the top and bottom of the tower of Canterbury Cathedral. We do not know precisely the position in which the instruments were placed, and, as thermometer screens had not then been invented, his observations can only be accepted as approximately correct; but as the work in which they are recorded is rather scarce, it may be well to give an analysis of the results. The observations were not consecutive, but made at various dates during 1784-92; the lower thermometer was five feet, and the upper one 220 feet above the ground. The daily maxima were about  $1^{\circ}$  warmer at the top during all frosty periods; alike at the top and the bottom when the temperature was between  $40^{\circ}$  and  $50^{\circ}$ , and lower at the top by from  $3'$  to  $5'$  when the temperature was above  $50^{\circ}$ . The minima gave analogous but more marked differences. Some very severe frosts occurred while these experiments were in progress, and

with bottom temperatures of  $-2^{\circ}5$ ,  $+6^{\circ}$ , and  $+6^{\circ}5$  respectively, the top temperatures were  $15^{\circ}$ ,  $17^{\circ}$ , and  $21^{\circ}$ , showing an excess at the top of  $17^{\circ}5$ ,  $11^{\circ}$ , and  $14^{\circ}5$ . In ordinary weather the excess of the top minima was not so great, but the average excess was  $6^{\circ}$ , and there was not a single night when it was colder at the top than at the bottom.

The author is not aware of any further experiments having been made upon this subject until 1861, when the Rev. R. Main, F.R.S., had a record commenced of a Six's registering thermometer, and dry and wet bulb thermometers placed near the anemometer on the Radcliffe Observatory, Oxford. These instruments were 105 feet above the ground, and were read about 9 a.m. in conjunction with other thermometers at 5 feet above the ground. The readings of these instruments have since that time been published *in extenso*, but the author has seen no discussion of them, and is not aware whether the thermometers have been verified or not, nor how they are mounted.

In 1868 Mr. James Glaisher, F.R.S., instituted a series of readings of the dry and wet bulb thermometers at the Royal Observatory, Greenwich, at the respective heights of 4 feet, 22 feet, and 50 feet above the ground. The observations, which are published *in extenso* in the "Proceedings of the Meteorological Society," vol. v., p. 29, extend only from June 25 to August—a period of six weeks during the hottest part of the year. The results show that during the day hours the temperature at 4 feet was at times  $7^{\circ}$  and  $8^{\circ}$  higher, and at night  $3^{\circ}$ ,  $4^{\circ}$ , and  $5^{\circ}$  lower than at 50 feet above the ground.

In 1872-74 Professor H. Wild carried out experiments with thermometers and hygrometers placed at the heights of 6 feet, 52 feet, and 86 feet above the ground on a scaffolding at the Pulkowa Observatory. ("Repertorium für Meteorologie," vol. v.)

During 1873-75 readings of maximum and minimum, and dry and wet bulb thermometers were made on behalf of the Meteorological Office at the Kew Observatory, 10 feet, and on the ornamental Pagoda in the Royal Gardens, Kew, at the respective heights of 22 feet, 69 feet, and 129 feet above the ground. Mr. R. H. Scott, F.R.S., in concluding his report on these observations ("Quarterly Weather Report," 1876, Appendix 3), says: "That so far as the evidence adduced in this paper goes, it indicates that, on the average of a considerable series of observations, the influence of height on mean thermometrical and hygrometrical results is not very great, but that on individual occasions very material differences are observed."

Lastly, Mr. G. Dines has recently communicated to the Meteorological Society ("Quarterly Journal," vol. viii., p. 189), the results of observations which he has made with thermometers placed 4 feet and 50 feet above the ground at his residence, Hersham, Walton-on-Thames. These observations, which extended from September, 1876, to September, 1878, inclusive, show that on the average the mean daily range of temperature at 50 feet was  $2^{\circ}1$  less than at 4 feet, the mean of the maxima at 50 feet being  $1^{\circ}2$  lower, and the mean of the minima  $0^{\circ}9$  higher than at 4 feet.

It will be seen from the above abstract that up to the end of 1881, there was no precise information as to the form of the curve of daily temperature at considerable heights above the ground. It was known that the amplitude of the daily range was materially reduced, but the amount of the reduction was unknown, and, owing to the absence of hourly readings at night, no data existed for determining the shape of the curve during the night and early morning hours.

The paper then gives full details as to the instruments and their positions, also a synopsis worked out by Mr. Marriott of the results hitherto obtained. Leaving all the tables and details the following are the principal results :—

#### 4 FEET AND 170 FEET.

From April to December, 1882, the mean maximum temperature at 4 feet exceeded that at 170 feet by  $1^{\circ}9$ , while the mean minimum temperature at 4 feet fell below that at 170 feet in almost every month, the mean difference being  $0^{\circ}4$ . The range of temperature was, therefore,  $2^{\circ}3$  less on the belfry, than at 4 feet above the ground.

The temperatures at 9 a.m. show that on the average the air at 4 feet was  $1^{\circ}3$  warmer than at 170 feet.

These results are generally consistent with the assumption that the heat felt near the earth's surface is due to the action of the heat rays on that surface, and not on the air through which they pass—but the excess of the 4 feet temperature at 9 a.m. is somewhat greater than we expected. However, we see from the next series of observations that at 9 a.m. the difference between 4 ft. and 260 ft. is  $1^{\circ}9$ , therefore we have in that corroboration of the above values, for the figure run thus :—4 ft.,  $51^{\circ}0$ ; 170 ft.  $49^{\circ}7$ ; 260 ft.  $49^{\circ}1$ . Now if we plot these values, we shall find that while the observed temperature at 170 ft. was  $49^{\circ}7$ , the temperature calculated from the 260 ft. and 4 ft. observations, assuming a uniform rate of decrease, gives  $49^{\circ}8$ , in fact the results of the two methods agree within a tenth of a degree.

#### 4 FEET AND 260 FEET.

Night observations are generally difficult to obtain, hence it was only possible to arrange for the electrical thermometer being read bi-hourly between 9 a.m. and 9 p.m. This, however, was done daily from April 1st to December 31st. The result was to give for every month, and for every hour (day only be it remembered) a higher mean temperature near the ground than at 260 feet. The greatest mean excess at 4 feet was  $3^{\circ}6$  at 9 a.m. and at 11 a.m. in July; the least was  $0^{\circ}2$  at 9 p.m. in November. The following are the mean values for the 10 months.

9 a.m. hotter at 4 ft. than at 260 ft. by $1^{\circ}9$			
11 a.m.	„	„	$2^{\circ}3$
1 p.m.	„	„	$2^{\circ}2$
3 p.m.	„	„	$2^{\circ}2$
5 p.m.	„	„	$1^{\circ}7$
7 p.m.	„	„	$1^{\circ}3$
9 p.m.	„	„	$0^{\circ}8$

On examining the individual readings for each day, two interesting features are clearly brought out, viz., (1) that in fine bright weather the temperature at 4 feet during the day is much higher than on the top of the tower,—in summer the difference sometimes reaches  $5^{\circ}$  at 1 p.m.; and (2) that in foggy weather the temperature at the top of the tower is always higher than at 4 feet, the upper part of the tower being generally free from fog. In cloudy and wet

weather the temperature is uniformly higher in the churchyard than at the top of the tower.

On eight occasions during last winter it was found to be possible to read the thermometers every hour day and night, and the results prove that especially on clear nights, when terrestrial radiation is active, it is not infrequently warmer at 260 feet than at 4 feet. The difference on the night of Nov. 11th, which was clear and cold, was very great, the temperature at the top of the tower being warmer than in the churchyard by  $5^{\circ}\cdot6$  at 11 p.m.,  $6^{\circ}\cdot8$  at midnight, and  $6^{\circ}\cdot4$  at 1 a.m.

More observations of this class are urgently needed, but the following conclusions appear to be supported by the records hitherto obtained.

The prevalence of fine clear nights is readily seen by the increased temperature at the upper station; the presence of fog is also indicated in a similar manner; while cloudy skies, rain, and wind prevent radiation, and so on days and nights of their occurrence the temperature is always highest near the ground.

From the foregoing it seems that the difference between the temperature at 4 feet and 260 feet is chiefly regulated by the amount of cloud, and by the relation of the temperature of the surface of the ground to that of the general body of air passing over it. If so, it will follow that the mean difference between the temperature at the two heights can only be determined by very numerous observations, or by careful considerations of the conditions of weather and of soil temperature under which each individual set is made.

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### ON LIGHTNING FIGURES.

*To the Editor of the Meteorological Magazine.*

SIR,—I am glad to see that you and Mr. Bruce have adopted my views as to the formation of ramified figures, which have frequently been noticed on human beings and animals that have been struck by lightning. A ramified figure, produced under such circumstances, would naturally lead a non-scientific observer to associate such a figure with that of a neighbouring tree, and in reporting the occurrence, he would be likely to call it “an exact representation of the tree;” while any little blotch he would represent as “a bird and nest on one of its branches.” I am not aware that any scientific man has ever actually witnessed a case of this kind, but when the patient is taken to a medical man, he is apt to fall back upon his knowledge of anatomy for an explanation, and speak of “the eruption of blood in the vessels of the skin, producing an effect like that of an injection.” In a case reported by a medical man in the *Lancet*, for July, 1864, Dr. Mackintosh, referring to a boy who took refuge under a straw stack, says, “The figures on either hip were so exceedingly alike, and so striking, that an observer could not but be impressed with the idea that they were formed in obedience to some prevailing law.” In this case, and many others, no tree was near. One case recorded in *Nature*, for March 25th, 1875, by Mr. Pidgeon, at Torbay, close



to the sea, is very well reported, because he relates the facts as they occurred, without any attempt to explain them. Mr. Pidgeon, his wife, and his son, were standing under a flag-staff, looking out upon the bay, when the vane was struck by lightning, and shivered. Mrs. Pidgeon was struck, and fell to the ground, and her lower limbs and left hand became rigid. On examining the body from the feet to the knees she was splashed with rose-coloured tree-like marks, branching upwards; while a large tree-like mark, with six principal branches diverging from a common centre, 13 in. in its largest diameter, and bright rose-red, covered the body." On recovering, Mrs. Pidgeon declared that she saw nothing of the flash, but described her feeling as that of "dying away gently into darkness, and being roused by a tremendous blow on the body, where the chief mark was afterwards found."

When my paper was read before the Physical Section of the British Association at Manchester, in 1861, the astronomer royal was in the chair, and on showing him some of my electrical figures after the sitting, he patted me on the back, and said, "You have settled that matter!" I also produced the figures in the presence of my friend, the late Professor Miller, of King's College; and on breathing on one of the plates, he exclaimed, "There's the tree, capitally made bird's nest, and all!" I may remark that persons have complained to me of their inability to produce these figures. The following directions will make their production easy. Squares of common crown window glass, about 4 in. to the side should be steeped in a strong solution of soap and water; and before an experiment, a plate should be taken out, and wiped dry with a duster. This will leave an exceedingly thin film of soap on the surface of the glass. A Leyden jar of about a pint capacity should be charged, and the plate being held by one corner, be brought up to the knob of the jar, while one knob of the discharging rod should be placed on the outer coating of the jar, and the other knob be brought opposite the knob of the jar, in contact with the glass. A discharge will now take place over the surface of the plate; and passing over its edge reach the upper knob of the discharging rod. If we now breathe on the surface of the plate, a tree-like figure, consisting of trunk, branches, and spray, will be beautifully made out, because wherever the electricity touched the plate, the soapy film is burnt off, and the plate rendered chemically clean, so that the breath condenses in watery lines on those parts, and in minute globules of dew on those parts where the film still remains. On the other side of the plate, there is also a figure, but it is marred by contact with the knob of the discharging rod.

In the last edition of my book on "The Thunder Storm," published in June, 1877, by the S.P.C.K., a long account is given of these figures (p. 331 to 358), and the subject is so far completed that the production of other figures is explained, which were inexplicable at the time when my first paper was written. For example, a sailor,

sitting under the mast of a brigantine, was struck dead by lightning, and on his back was found the impression of a horse-shoe, similar in size to one fixed at the mast-head. And in another example, a sailor had on his body the impression of a number "4·4," with a dot between the two figures, being the same in all respects as the brass number "4·4" which was at the extremity of one of the masts. In another example, a young man struck by lightning had on a girdle containing gold coins; these were imprinted on his skin, in the same manner in which they had been placed in the girdle.

In such cases as these an explanation is to be found in some phenomena brought before the Royal Society by Mr. C. F. Varley (*Proceedings*, January 12th, 1871). He was working a Holtz electrical machine, the poles of which were furnished with brass balls, about an inch in diameter. Noticing some specks on the ball of the positive pole, he tried to wipe them off with a silk handkerchief, but in vain. He then examined the negative pole, and discovered a minute speck corresponding to the spots on the positive pole. This pole sometimes exhibited a glow, and if in this state three or four bits of wax or even a drop or two of water were placed on the negative pole, corresponding non-luminous spots appeared on the positive pole. Hence it is clear that by means of the lines of force existing between the two poles, we may telegraph through the air from the negative to the positive pole; and in explanation of the above cases, in which the lightning-burn on the skin is of the same shape as the object from which the discharge proceeded, all that is necessary is that the object struck be positive to the horse shoe, brass number, &c., the discharge being negative; in this way such cases as those alluded to are taken out of the region of the marvellous, and become instructive, illustrative facts in science.

Illustrations of similar phenomena may also be deduced from some of the appearances in Mr. Crookes's Vacuum Tubes.

The figures obtained by my method have nothing in common with "such as occur on deflagrating a sheet of gold leaf," as you suppose. My figures illustrate in a variety of ways the complicated action of a flash of lightning; but for these details I must refer to my book, and to the wood engravings which illustrate it.

I remain, Sir, sincerely yours,

CHARLES TOMLINSON.

*Highgate, N., 18th July, 1883.*

## PROF. LEMSTRÖM'S OBSERVATIONS ON AURORÆ.

*To the Editor of the Meteorological Magazine.*

SIR,—I have the honour to inform you that the Government has granted a sum of 37,000 marks (£1,480) for the continuing of scientific inquiries in Finnish Lapland.

These investigations will include the electrical current which

produces the aurora and the terrestrial currents, the magnetic perturbations, &c.

The expedition will depart for Lapland, the 25th of August, 1883.

Your obedient servant,

SELIM LEMSTRÖM.

*Laboratoire de Physique, Université de Helsingfors,  
Finlande, 6th Aug., 1883.*

[We are sure that the above announcement will be read with extreme pleasure; it is creditable to the Finnish Government to have furnished the necessary funds; it is courageous of Prof. Lemström to face the discomforts, not to say dangers, of night observations with temperatures far below zero. With such men as Lemström and Tromholdt attacking the problem of the aurora from different points, there can be little doubt that its precise nature and cause will soon be determined. It would probably be well for all observers to be especially watchful for auroral phenomena during the coming winter.—ED.]

### VAPOUR TENSION.

*To the Editor of the Meteorological Magazine.*

SIR,—At the last exhibition of meteorological instruments at the Meteorological Society, the drawings of two Atmospheric Vapour Meters were exhibited, one by my father, the other by myself. The latter has been in use since last January, and I now send you a specimen of the results obtained.

Dry Bulb.	Wet Bulb.	Tension.	
		By calculation.	By meter.
60·5	57·8	·439	·302
64·5	58·8	·418	·263
64·0	57·4	·387	·249
64·0	56·6	·367	·223
64·8	56·5	·355	·205

The method employed is to take a given volume of air, and after extracting the vapour by means of sulphuric acid, and restoring the air to its original volume and temperature, to note the loss of pressure. It will be seen that the tension obtained by experiment is less than that given by the tables, and I have no doubt that further investigation will show that the tension of vapour when mixed with air, and not in the presence of water, is less than is generally supposed.

Yours truly,

W. H. DINES.

*Burgess Hill, Sussex, July 28th.*

[We are not aware whether Mr. W. H. Dines has yet sufficiently tested his apparatus to enable him to regard the construction as finally adopted, but if so, we think it is very desirable that it should be engraved and fully described—our pages are at his service for that purpose.—ED.]

## CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, FEB., 1883.

STATIONS.  (Those in italics are South of the Equator.)	Absolute.				Average.				Absolute.		Total Rain.	Aver. Cloud.	
	Maximum.		Minimum.		Max.	Min.	Dew Point.	Humidity.	Max. in Sun.	Min. on Grass.	Depth.		Days.
	Temp.	Date.	Temp.	Date.									
England, London .....	57·3	28	29·3	17	49·0	36·5	38·8	85	100·8	24·4	3·62	14	6·3
Cape of Good Hope ...	...	...	...	...	...	...	...	...	...	...	...	...	...
Mauritius .....	83·8	7	70·4	26	82·5	74·6	70·0	76	...	...	4·38	19	6·2
Calcutta .....	89·5	20	46·2	8	79·4	57·1	55·8	67	145·0	32·3	2·09	2	2·4
Madras .....	...	...	...	...	...	...	...	...	...	...	...	...	...
Bombay .....	85·7	24	61·0	2	82·5	67·8	64·2	67	143·6	51·3	·00	0	1·2
Ceylon, Colombo .....	89·7	18	67·8	10	86·7	73·4	68·4	67	151·0	60·0	1·69	3	4·7
Melbourne .....	100·0	16	46·4	20	78·2	58·2	54·1	66	162·0	37·9	1·57	7	5·6
Adelaide .....	109·3	15	49·0	28	82·9	60·1	51·0	50	164·3	44·4	·38	6	4·6
Wellington .....	85·0	21	51·0	28	72·3	59·2	...	...	144·0	49·0	5·22	12	...
Auckland .....	80·4	15	58·2	27	74·9	64·6	62·6	78	131·5	43·0	4·80	16	7·9
Falkland Isles .....	62·2	17	33·0	28	54·7	42·0	45·7	86	124·8	28·8	2·99	14	7·2
Jamaica, Kingston .....	90·4	4	64·9	23	86·3	68·6	66·3	74	...	57·0	·31	6	2·8
Barbados .....	79·0	var.	67·0	20†	78·0	70·0	69·8	78	143·0	65·0	2·15	15	6·0
Toronto .....	44·1	16*	-10·5	10	27·4	11·3	17·2	80	118·0	-14·0	2·85	18	6·2
New Brunswick, S. John	40·0	17	-10·0	11	26·6	8·8	18·0	91	...	...	2·85	9	5·0
Cape Breton, Sydney ..	...	...	...	...	...	...	...	...	...	...	..	...	...
Manitoba, Winnipeg ...	33·3	27	-40·9	2	5·9	-17·9	-1·5	76	100·5	...	·68	5	3·7
British Columbia, Yale	43·7	28	-36·3	4	23·2	-1·7	...	...	...	...	1·64	8	4·4

\* And 17 † And 27.

## REMARKS, FEBRUARY, 1883.

*Mauritius*.—Rainfall 1·29 in. below the average; mean temp. 0°·5 below it; mean pressure (29·908 in.) ·032 in. below the average; mean hourly velocity of wind 11·3 miles, extremes 28 miles on 7th, and 0 miles on 20th; T and L on 12th, 13th, and 19th.

C. MELDRUM, F.R.S.

*Ceylon*.—TSS occurred on the 5th, 6th, 7th, and 8th; L was seen on 4th and 9th.

*Melbourne*.—Mean temp. of air and of dewpoint, and mean amount of cloud all slightly above the average; humidity the same as the average; mean pressure and total R both below it; prevailing direction of wind S. and S.W., strong breezes occurring on seven days, violent squalls on the 28th; TSS on the evenings of the 8th and 9th; thick fog on the morning of the 12th.

R. L. J. ELLERY, F.R.S.

*Adelaide*.—The month was exceptionally cool, the mean temp. being 2°·7 below the average, and the max. reaching 90° on only six days; rainfall only about half the average; mean pressure 29·896 in., being ·076 in. below the average of twenty-six years.

C. TODD.

*Wellington*.—Generally stormy and unsettled, with some heavy R up to the 6th; from 7th to 16th generally fine with N.W. wind; stormy on 8th, 9th, and 13th; very heavy R on 17th and 18th; showery from 21st to the end of the month. Earthquakes occurred on 5th and 14th—both slight. Mean pressure slightly, and mean temp. 3° above the average; rainfall also considerably in excess.

R. B. GORE.

*Auckland*.—Warm, but more than usually dull and showery; excessive R twice during the month, on 25th 2·64 in. fell; mean pressure 30·094 in.; greatest velocity of wind 626 miles from N.E., and N. on the 20th.

E. B. DICKSON.

BARBADOS.—Mean temp. 0°·4 above the average of 25 years; prevailing direction of wind N.E.; rainfall 39 per cent. below the average of 25 years; evaporation 4 per cent. above it; two days were overcast.

R. BOWIE WALCOTT.

## SUPPLEMENTARY TABLE OF RAINFALL,

JULY, 1883.

[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.	Rain.
		in.			in.
II.	Dorking, Abinger .....	2.32	XI.	Llanfrechfa Grange .....	4.93
"	Margate, Birchington ...	3.82	"	Llandovery .....	5.67
"	Littlehampton .....	1.98	"	Solva .....	2.13
"	St. Leonards .....	2.11	"	Castle Malgwyn .....	3.15
"	Hailsham .....	2.21	"	Rhayader, Nantgwillt..	6.14
"	I. of W., St. Lawrence.	2.28	"	Carno, Tybrith .....	3.34
"	Alton, Ashdell .....	3.27	"	Corwen, Rhug .....	1.93
III.	Winslow, Addington ...	3.53	"	Port Madoc .....	3.16
"	Oxford, Magdalen Col...	3.43	"	I. of Man, Douglas .....	1.75
"	Northampton .....	2.77	XII.	Carsphairn .....	4.70
"	Cambridge, Beech Ho...	2.96	"	Melrose, Abbey Gate...	3.68
IV.	Southend .....	2.14	XIII.	N. Esk Res. [Penicuik]	4.10
"	Harlow, Sheering .....	3.15	XIV.	Ayr, Cassillis House ...	2.33
"	Diss .....	4.92	"	Glasgow, Queen's Park.	3.48
"	Swaffham .....	2.92	XV.	Islay, Gruinart School..	1.57
"	Hindringham .....	3.90	XVI.	Forres H.R.S. ....	5.40
V.	Salisbury, Alderbury ...	4.08	"	Aberfeldy H.R.S. ....	6.79
"	Warminster .....	2.67	"	Dalnaspidal H.R.S. ...	5.03
"	Calne, Compton Bassett	3.06	XVII.	Keith H.R.S. ....	4.96
"	Beaminster Vicarage ...	3.99	XVIII.	Forres H.R.S. ....	4.38
"	Ashburton, Holne Vic..	...	"	Strome Ferry H.R.S. ...	2.62
"	Torrington, Langtree W.	2.87	"	Lochbroom .....	4.29
"	Lynmouth, Glenthorne.	3.80	"	Tain, Springfield .....	4.32
"	Probus, Lamellyn .....	2.57	"	Loch Shiel, Glenaladale	3.90
"	Taunton, Fullands .....	3.67	XIX.	Lairg H.R.S. ....	4.54
VI.	Bristol, Clifton .....	3.27	"	Forsinard H.R.S. ....	3.92
"	Ross .....	1.97	"	Watten H.R.S. ....	2.03
"	Wem, Sansaw Hall .....	2.63	XX.	Fermoy, Glenville .....	4.97
"	Cheadle, The Heath Ho.	2.91	"	Tralea, Castlemorris ...	4.85
"	Worcester, Diglis Lock	3.87	"	Tipperary, Henry Street	3.31
"	Coventry, Coundon .....	3.18	"	Newcastle West .....	3.22
VII.	Melton, Coston .....	3.20	"	Kilrush .....	...
"	Ketton Hall [Stamford]	2.18	"	Corofin .....	4.35
"	Horncastle, Bucknall ...	2.34	XXI.	Carlow, Browne's Hill..	4.50
"	Mansfield, St. John's St.	3.13	"	Navan, Balrath .....	2.52
VIII.	Macclesfield, The Park.	3.85	"	Athlone, Twyford .....	4.38
"	Walton-on-the-Hill .....	2.19	XXII.	Mullingar, Belvedere ...	3.31
"	Lancaster, South Road.	2.42	"	Clifden, Kylemore .....	6.51
"	Broughton-in-Furness ..	3.12	"	Crossmolina, Enniscoe..	5.28
IX.	Wakefield, Stanley Vic.	3.76	"	Carrick-on-Shannon ...	3.52
"	Ripon, Mickley .....	2.98	XXIII.	Dowra .....	...
"	Scarborough .....	...	"	Rockcorry .....	3.62
"	East Layton [Darlington]	3.47	"	Warrenpoint .....	3.83
"	Middleton, Mickleton ..	3.53	"	Newtownards .....	1.66
X.	Haltwhistle, Unthank..	3.65	"	Belfast, New Barnsley .	2.57
"	Shap, Copy Hill .....	...	"	Bushmills .....	2.23
			"	Buncrana .....	3.01

JULY, 1883.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.					Days on which .01 or more fell.	TEMPERATURE.				No. of Nights below 32°	
		Total Fall.	Difference from average 1870-9	Greatest Fall in 24 hours.		Dpth Date.		Max.		Min.			
				inches.	inches.			in.	Deg.	Date.	Deg.	Date.	In shade.
I.	London (Camden Square) ...	2.92	+	.45	1.43	14	14	84.7	2	42.1	16	0	0
II.	Maidstone (Hunton Court)...	2.95	+	.91	.46	12	17	...	...	...	...	...	...
III.	Strathfield Turgiss .....	2.81	+	.51	.98	31	19	81.5	2	41.9	16	0	0
III.	Hitchin .....	3.56	+	.86	.68	14	17	75.0	2,3	42.0	15	0	...
IV.	Banbury .....	4.16	+	1.18	1.18	2	20	79.0	2	41.5	15	0	...
IV.	Bury St. Edmunds (Culford)	4.15	+	1.18	.93	14	19	86.0	2	39.0	19	0	...
V.	Norwich (Cossey) .....	2.66	—	.09	.60	3	19	83.5	3	39.0	20	0	...
V.	Bridport .....	2.79	...	...	.37	6d	18	...	...	...	...	...	...
"	Barnstaple .....	4.73	+	1.18	.87	22	21	76.0	3	47.0	27	0	...
"	Bodmin .....	5.04	+	1.60	.69	13	21	69.0	30	47.0	13	0	0
VI.	Cirencester .....	3.17	+	.16	.71	20	18	...	...	...	...	...	...
"	Churchstretton (Woolstaston)	2.66	—	.37	.55	20	21	73.5	2	42.0	15	0	...
"	Tenbury (Orleton) .....	3.07	+	.16	.91	20	21	77.0	2	38.0	15	0	0
VII.	Leicester .....	4.74	...	...	1.06	2	23	...	...	...	...	...	...
"	Boston .....	2.49	—	.04	.85	20	15	80.0	2	43.0	20	0	...
"	Grimsby (Killingholme) .....	3.56	+	.78	.77	2	22	74.5	2	47.0	20	0	...
"	Hesley Hall [Tickhill] .....	2.79	...	...	.81	20	17	76.0	2	39.0	20	0	...
VIII.	Manchester (Ardwick) .....	2.77	—	1.04	.66	23	19	78.0	2	45.0	20	0	...
IX.	Wetherby (Ribston Hall) ..	4.39	+	1.78	2.03	22	14	...	...	...	...	...	...
IX.	Skipton (Arncliffe) .....	5.61	+	.66	1.14	21	24	75.0	1,2	37.0	14	0	...
X.	North Shields .....	4.05	+	1.50	1.53	21	18	77.2	1	41.0	23	0	...
X.	Borrowdale (Seathwaite) .....	6.18	—	2.59	.86	16	25	...	...	...	...	...	...
XI.	Cardiff (Ely) .....	3.56	—	.25	.88	20	19	...	...	...	...	...	...
"	Haverfordwest .....	3.53	—	.40	.54	4	20	69.0	7a	43.0	20b	0	...
"	Plinlimmon (Cwmsymlog) ...	5.22	...	...	1.04	30	22	...	...	...	...	...	...
"	Llandudno .....	1.15	—	1.56	.30	4	13	67.8	2	47.8	20	0	...
XII.	Cargen [Dumfries] .....	2.49	—	.64	.59	7	16	72.2	28	40.2	20	0	...
"	Hawick .....	4.04	+	.92	.92	2	17	...	...	...	...	...	...
XIV.	Douglas Castle (Newmains)	2.77	—	.52	.50	21	14	...	...	...	...	...	...
XV.	Lochgilphead (Kilmory) .....	2.57	—	1.97	.64	4	13	...	...	...	...	...	...
"	Appin (Airds) .....	3.58	...	...	...	...	...	...	...	...	...	...	...
"	Mull (Quinish) .....	2.15	...	...	.33	4	17	...	...	...	...	...	...
XVI.	Loch Leven Sluices .....	6.60	+	3.55	2.60	21	13	...	...	...	...	...	...
"	Arbroath .....	4.23	+	1.59	.84	2	19	72.0	10	46.0	16c	0	...
XVII.	Braemar .....	3.68	+	.82	.58	3	22	68.0	1	34.2	23	0	...
"	Aberdeen .....	3.64	...	...	.87	21	19	72.0	8	42.0	16	0	...
XVIII.	Skye (Sligachan) .....	3.50	...	...	.43	12	24	...	...	...	...	...	...
"	Culloden .....	4.24	+	1.46	.78	19	...	74.0	1	37.2	15	0	1
XIX.	Dunrobin .....	4.62	...	...	1.25	3	18	69.5	8	39.0	15	0	...
"	Orkney (Sandwick) .....	1.85	—	.81	.55	22	12	69.0	1	45.0	15	0	0
XX.	Cork (Blackrock) .....	4.26	+	1.42	1.30	8	21	80.0	28	45.0	14	0	0
"	Dromore Castle .....	4.39	...	...	.65	5	23	66.0	1	41.0	27	0	...
"	Waterford (Brook Lodge) ...	4.51	...	...	.73	3	20	72.0	28	42.0	28	0	...
"	Killaloe .....	7.26	...	...	1.30	8	24	78.0	28	43.0	28	0	...
XXI.	Portarlington .....	3.08	+	.40	.49	4	24	71.0	1	46.5	27	0	...
"	Dublin (Fitz William Square)	2.22	—	.20	.57	23	22	69.2	28	45.4	15	0	0
XXII.	Ballinasloe .....	3.32	+	.44	.60	6	22	68.0	28	43.0	15	0	...
XXIII.	Waringstown .....	2.99	—	.59	.46	8	18	76.0	4,9	40.0	19	0	0
"	Londonderry (Creggan Res.) ..	3.26	...	...	.57	11	24	...	...	...	...	...	...
"	Omagh (Edenfel) .....	3.59	+	.34	.52	6, 11	20	69.0	8	44.0	13	0	...

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

a And 8, 9, 30.

b And 21.

c And 17, 19

d And 29.

# METEOROLOGICAL NOTES ON JULY.

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.

STRATHFIELD TURGISS.—Very unsettled during the greater part of the month, heavy storms being prevalent, but no serious damage was done; hay harvest much impeded, but many crops derived great benefit from the R.

BANBURY.—Very unfavourable for getting in the hay, and grain crops suffered from want of sun; mean temp. 3° below the average; TS on 2nd and 3rd, the most severe and longest for many years; T and L on 15th and 21st, T on 16th, high wind on 11th.

COSSEY.—A cold, wet month after the 13th, the max. temp. never reaching 70° after that date.

BODMIN.—A cold, rainy month; crops very backward. Mean temp. 59°·3, 2°·3 below the average.

CIRENCESTER.—A cool month; rainfall moderate in quantity, but in consequence of its general distribution over the month, the weather was not good for hay making.

WOOLSTASTON.—A cold month after the first week; mean temp. 56°·9.

ORLETON.—Mean temp. of the month nearly 3° below the average of 22 years. The first thirteen days were warm and pleasant, followed by a cold period of eleven days, with a mean temp. about 7° below the average; the last seven days were warmer, but still below the average. The sky was generally obscured by cloud, with intervals of bright sunshine, and the air was damp, with a few spots of R almost every day, but the total rainfall was not greatly in excess of the average. Distant T was heard on five days, and L was seen on the night of the 2nd. Grass crops generally good, but much of the hay was injured.

LEICESTER.—The month was unsettled, R having fallen on 23 days; severe T and L early on the morning of the 3rd, and T and L with very heavy R on the evening of 13th, ·88 in. falling in 35 minutes. Bright sunshine much needed.

KILLINGHOLME.—A hailstorm of unprecedented severity occurred on the 3rd, accompanied by T, making fearful havoc amongst the corn; T and L on 4th and 14th, T on 11th.

MANCHESTER (ARDWICK).—The month opened with some genial showers, which were much needed by the country, and the temp., though not high, was moderately warm and genial, but as the month advanced, the weather became broken, and the temp. fell considerably, which retarded the crops very much, and interfered with haymaking, which was already late, owing to the dry spring.

## WALES.

HAVERFORDWEST.—Another bad July, almost as bad as July, 1882, for the hay crop, much of which has unavoidably been damaged; there was very little sunshine, and the temp. was much below the average, never reaching 70°; cloudy, damp, and close weather prevailed throughout the month.

LLANDUDNO.—Temp. low, especially from 13th to 24th inclusive; the mean for the month was 3°·5 below the average, and the range, both diurnal and total, was very small. Only 136 hours of bright sunshine were recorded.

## SCOTLAND.

CARGEN.—Many TSS occurred during the month, but none near this station; mean temp. 56°·8, 2°·9 below the average.

HAWICK.—A very fine growing month; TSS occurred on 2nd, 3rd, 11th, 13th and 14th.

KILMORY.—The weather at the beginning of the month was showery, close and warm, but after the 13th it became very dry, with rather cold winds; the

last 6 days were remarkably hot, and vegetation began to suffer from want of E.

QUINISH.—Cold and dry from the 17th to the 31st. Much of the hay crop was secured in splendid condition, and all other crops promise unusually well.

ABERDEEN.—Rainfall excessive, about an inch above the average; T and L on 12th, 17th and 23rd.

CULLODEN.—Temp. below the average, the 1st being the warmest day of the month. Frost on grass on night of 14th; distant T frequent; cereals all promising.

SANDWICK.—The rainfall was below the average, and the month was cold, owing to the prevalence of N.W. and S.E. winds; it was also very cloudy, there being only 20 minutes of bright sunshine during the last five days.

#### IRELAND.

CORK.—General deficiency of warmth and sunshine and excess of rainfall.

DROMORE.—A most favourable month for vegetation, but the great number of wet days caused much delay in the hay harvest; the potato crop is the finest for thirty years, with scarcely a trace of blight; oat crops very fine.

WATERFORD.—A month of cold, wet, and very unsettled weather throughout; rainfall 1·51 in. above the average of 8 years; blight showing in the potatoes, and hay very difficult to secure; T on 12th and 18th; L on 12th.

KILLALOE.—Rainfall much above the average; mean temp. (60°·6) below it.

DUBLIN, FITZWILLIAM SQUARE.—A changeable, cool, and very showery month, with but little sunshine; at the beginning southerly winds prevailed, but after the 12th it blew most frequently from the north-westward; mean temp. nearly 3° below the average of the previous 18 years; rainfall below the average, but number of rainy days considerably in excess. Distant T heard on the 5th, 13th and 21st, but no severe TS occurred; H fell on 21st.

WARINGTOWN.—The first fortnight though generally warm was wet, heavy T showers being frequent; the latter half was fine and genial, all that could be desired.

EDENFEL.—Although the temp. of the month was low (there not having been one summer's day), and the first half wet, it was on the whole not unfavourable; hay well saved, and all crops promise abundance.

#### TEMPERATURES OF JULY 16TH AND JAN. 1ST, 1883.

*To the Editor of the Meteorological Magazine.*

SIR,—The temperature of the 16th instant was the lowest I have yet recorded in the month of July. The shade minimum was 43°·3, and the mean temperature of the day only 52°·1 (11°·4 under the average).

The mean temperature of the 1st January was 53°·0, and the air minimum 50°·7; being respectively 0°·9 and 7°·4 higher than on July 16th.

I am, Sir, yours respectfully,

GEO. T. GWILLIAM.

35, Lansdowne Crescent, W., July 31.