

S Y M O N S ' S
M O N T H L Y
M E T E O R O L O G I C A L M A G A Z I N E .

CCLXXIV.] NOVEMBER, 1888. [PRICE FOURPENCE,
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AN IMPROVEMENT IN ANEMOMETERS.

ONE of the most interesting and practically important questions in relation to wind is, what is its maximum velocity or pressure? I say velocity *or* pressure, because the one depends upon the other.

I need hardly state that many attempts have been made to devise instruments capable of answering this question. It has been generally admitted that existing anemometers using Robinson's Cups are unequal to the task, because a gust lasts but a few seconds—often not more than 5 or 6—and the recording parts, made to register an hour's work on half-an-inch or one inch of paper, will not show satisfactorily a gust lasting 10 secs., that is, 1-360th part of an hour, or in other words, if one could measure such a gust, it would be 1-360th part of an inch on the paper, and the smallest error in measuring becomes so magnified when the measured velocity in 10 secs. is converted into velocity per hour, that results are rendered very uncertain.

Pressure plates have also been tried in many forms, but the results are not satisfactory, because when a gust of wind coming along at a velocity of, say 50 miles an hour strikes a pressure plate, it sets it into rapid motion, which, by acquired momentum, carries it much farther than it ought to do.

Now, Robinson's Cups are free from this defect, and although not without drawbacks, they are, in my opinion, the best means we have of recording gusts of wind. Of course, the open cup, like the pressure plate, is struck by the advancing gust, but at the same moment the same gust strikes the back of the opposite cup, and resists any tendency to run away.

It seemed to me that what was wanted was a means of recording with all possible accuracy the interval of time which the cups took to run a given number of revolutions; and I have accomplished this by putting in a series of pins in the first wheel, so that they may make an electrical contact on a light gold spring for every ten revolutions of the cups.

So far there is nothing new. Many anemometers have been made to record by electrical contacts. The point which I think is new is,

that these contacts are recorded on either of the astronomical chronographs at pleasure, so that the interval between two contacts can be determined with certainty to within one-tenth of a second, or even less, for the chronograph paper runs nearly an inch (0·8) per second, or 240 feet per hour.

The intention is to use this method only for very strong winds. The Observatory anemometer has an ordinary scale of one inch of paper to the hour, which may be increased to two inches; and this is quite enough for all ordinary winds, and more than it is usual to have in observatories. The new method is one that can at any moment be put into operation by turning an electrical key, and at all other times it is at rest, and costs nothing either in paper or battery force.

H. C. RUSSELL.

September 8th, 1888.

GREAT RAIN AT GENEVA, OCT. 2ND-3RD, 1888.

WE are indebted to Mr. Fordham for copies of the *Journal de Genève*, and the *Gazette de Lausanne*, containing details of a very heavy rain which fell over some parts of Switzerland, on October 2nd. The accounts are too long and too diffuse for translation; we shall, therefore, state the facts as briefly and clearly as we can:—

<i>How the rain fell.</i> —Rain began Oct. 1st, 8 p.m., and thence till						
7 a.m., 2nd, there fell	...	...	...	...	0·51
7 a.m., 2nd, to 2 p.m., 2nd, showers yielding	6·22 in the 24 hours.			}	4·89 in. {	
2 p.m., 2nd, to 10 p.m., 2nd						0·08
10 p.m., 2nd, to 7 a.m., 3rd						2·21
7 a.m., 3rd, to 2 p.m., 3rd						2·60
2 p.m., 3rd, to 6 p.m., 3rd					1·41	
					·41	
					—	
					7·22	

In the rainfall day, which in Switzerland ends at 7 a.m., this Geneva value is 4·89 in., which is far in excess of other stations, where in the same period it was respectively, at Castasegna 3·86 in., at Berne 3·82 in., at Lausanne 3·74 in., St. Gothard 1·54 in., Bâle and Locarno 1·50 in., Coire 1·02, Zurich 0·98 in., and still less at other stations.

A more intense previous fall.—A correspondent of the *Journal de Genève*, reminds its readers of a rainfall more remarkable than the above, because instead of yielding 6·22 in. in 24 hours, it gave 6·38 in. in three hours; this occurred in the afternoon of May 20th, 1827, and the writer, who was out in it, gives ample details of its effects and of the height at which the water stood in different parts of the town.

Limnimetric observations.—Everybody does not know what a limnimeter is, so we begin by explaining that it is the equivalent of

a tide gauge. But as there are no perceptible tides on European lakes, the instruments which by clock-work record on paper the level of the water in lakes are called limnimeters, and automatically produced records of variations in the level of the lakes are called limnimetric records.

Prof. Forel (at least the article is signed F.A.F., so that there is not much room for doubt) has written an interesting account of the effect of this great rain on the level of Lake Lemman (*i.e.*, the Lake of Geneva).

The lake of Geneva is about 46 miles long, by an average breadth of nearly six miles, its total area being 240 square miles. So large a lake requires an enormous volume of water to render any change of level visible—to raise it a single inch, 3,500,000,000 gallons of water must flow in. Remembrance of this fact will explain the importance of some of the values which we are about to quote.

Infinitely more care is taken in other countries than in England, over questions of this kind. Windermere or Haweswater, or Ullswater may rise or fall, but neither John Bull, nor his Government cares—no, nor probably will the new County Councils care—in the least; but it is not so on the Continent. On the shores of the lake of Geneva, there are no fewer than nine regular records kept, several, if not all, with self-recording apparatus which gives a curve showing every change in the level.

The sharpest rise was in the morning of Oct. 3rd, when the lake rose nearly half-an-inch an hour—that is to say, the increase in the volume of the lake was about *thirty million gallons a minute*. Taking a period of 24 hours, the greatest rise was 9·37 inches between 6 p.m. on 2nd, and 6 p.m. on 3rd.

Old Observations.—Floods have previously raised the lake $2\frac{1}{2}$, 3 and even 4 inches; that of March 5th, 1817, is said to have raised it 6·38 in., but there was only one observation taken, and Prof. Forel doubts it. M. Lauterburg, of Berne, speaks of a flood on Nov. 2nd, 1870, raising it 9·49 in., but Prof. Forel states that that was quite erroneous, the true value being about two inches. Since limnimeters have been verified regularly and continuous records obtained, there occurred on May 24th and 25th, 1878, the greatest accurately recorded flood previous to the present, *viz.*, one which raised the lake level 6·10 in. This flood was caused by a warm general rain, producing rapid melting of previous mountain snows, while that of 1888 is due to the single fall. As, however, is pointed out in the following account kindly passed on to us by Miss B. Metcalfe, the change in the lake level cannot be used as a check on the record of the rainfall—(1) because, as most persons are aware, the lake is, like so many others, merely a broadening of a river—the Rhone—and therefore its rise is due merely to the difference between the inflow and the outflow; and (2) because even this outflow can be regulated by sluices, and was so regulated on the occasion under notice; because as the writer at Arzier explains, the Arve was so flooded, that the outflow

was actually not only checked, but the Arve was filling the outflow channel so rapidly, that the Rhone was running backwards into the lake. This is just what we consider from the data before us was probable, but it certainly bears testimony to the nerve and to the judgment of the engineer in charge of the sluices.

The following is the note above mentioned, from Arzier, 18 miles N.N.E. of Geneva :—

“For three days rain fell all about Arzier, with snow above 4,000 ft. up. On the Alps and Jura, the two sides of the lake of Geneva, the snow made a line at the same height, so that on each bank there was fresh bright white above a line, all beneath which was black with rain. The effect as the snow soon melted, was but transient, and soaking wet made all very dull, and so swelled the rivers that houses, land, cattle and people were swept away, holes washed in railroads, and ruin everywhere ; for when the water had subsided such a depth of mud was left, that it will be long before the fields recover their vegetation, houses are clean or re-built, and the roads and bridges can be safely used. From 5 p.m. to 4 a.m., Oct. 2nd-3rd, 1888, was continuous thunder and lightning, which fired some large stores near Geneva, and a house not far distant. The Arve from Chamonix was so high that it drove the Rhone back into the Lake ; the flood sluices had to be shut to keep the Arve coming up from the “junction” into the Lake, instead of being shut occasionally to prevent the Lake getting too low.”

RATIONAL TIME COUNTING.

IN Mr. Ellis's Presidential Address to the Royal Meteorological Society he joined the minority who have long complained of the absurdity of our present calendar, where we not only have months of every number of days from 28 to 31, but are not even content to halve the year properly, but put 181 or 182 days in the first half and 184 in the second. But it is no use talking about it ; every nation in the world has learned the irregular muddle of 31, 28, 31, 30 and so forth, and we do not believe sufficiently in the progress of common sense to expect to see any change.

And it is just the same with the reckoning of hours. There was just the possibility a year or two since that Englishmen and Americans, and perhaps others, would learn to count beyond 12, even as far as 24. There *was* a chance for the New time, but it suited some people for personal pique to make fun of it ; they succeeded—24 hour clocks and watches were laughed out of court, hundreds and thousands of pounds were expended over scores of patents and over watches and clocks which were made but never sold, and now doubtless it would be urged that the scheme has been tried and failed. It was not tried, and therefore it neither could fail nor did fail. The trial was thwarted, and not even Mr. Ellis's sound arguments coming so long afterwards can galvanize the new time into making a single tick. We regret to believe that we shall have to go on with a.m. and p.m. until for us, all time counting has passed away.

RAIN IN 1888.

To the Editor of the Meteorological Magazine.

SIR,—It may be worth noting that in my register of rainfall, extending over 36 years, the present year stands pre-eminent in the following particulars:—

1. The fall in July (6·225 inches) is the largest recorded in that month.
2. The fall in June and July (10·223 inches) is the largest recorded in those two months.
3. The fall in October (1·063 inches) is the smallest recorded in that month.
4. The fall in September and October (2·347 inches) is the smallest recorded in those two months.
5. The fall in August, September and October (4·894 inches) is the smallest recorded in those three months.

GEORGE F. BURDER, M.D.

Clifton, 5th November, 1888.

[We have often called attention to the contrasts as to rainfall which frequently occur even in the small area of England. From the above letter we find that October at Clifton was drier than for 35 previous years. From the letter reprinted below, we see how great was the fall in the Lake District. We have searched the Wythburn register, which is perfect back to 1867, and there are but three years in which October has equalled or exceeded 1888, viz. :—

1870	1874	1877	1888
October, 21·75 in.	23·25 in.	17·50 in.	15·14 in.—ED.]

A WET WEEK IN THE ENGLISH LAKES.

To the Editor of the Times.

SIR,—The rainfall in the English Lake District at the end of October was so exceptionally heavy, that I think the following details may be acceptable.

Total Rainfall in each day from October 25th to October 30th.

Station.	25th in.	26th. in.	27th. in.	28th. in.	29th. in.	30th. in.	25th-30th in.
Broughton-in-Furness.....	·43	·54	1·83	·10	·16	·94	4·00
Broughton-in-Furness,Ulpha	·85	·86	2·06	·10	·24	1·45	5·56
Hawkshead, Esthwaite	·93	1·66	2·48	·24	·18	1·10	6·59
Windermere, Bowness	·92	1·68	2·45	·41	15	1·15	6·76
Windermere, Ambleside ...	1·80	2·57	3·63	·41	·20	1·25	9·86
Borrowdale, Seathwaite ...	1·50	3·56	4·57	·24	·29	1·65	11·81
Borrowdale, Vicarage	1·46	3·38	4·80	·40	·18	1·56	11·78
Borrowdale, Grange	1·55	3·15	4·61	·30	·18	1·34	11·13
Thirlmere, Wythburn	1·94	3·78	5·20	·67	—	1·80	13·39
Buttermere, Hassness	1·85	3·21	4·56	·46	·14	1·53	11·75
Ulleswater, Patterdale	1·31	2·30	4·45	1·03	·11	2·07	11·27
Shap	·89	2·39	3·50	1·12	·24	·81	8·95

This shows that at the heads of Windermere, Derwentwater Thirlmere, Buttermere, and Ulleswater the fall on the 26th and

27th exceeded six inches, and at Thirlmere very nearly reached nine inches, and that the fall in those localities during the six days ranged from about 10 to about $13\frac{1}{2}$ inches. When I mention that the total fall here for the whole of October was less than an inch and a quarter, the contrast becomes very striking. So large a fall in so short a time would do mischief almost anywhere, and even in the Lakes such a fall is quite unusual. Many roads became impassable, temporary streams rushed through many houses, at two (if not more) places of worship service was impossible, as the surrounding roads were flooded; gates, fences, and timbers were carried down the streams, as well as numerous fowls and other small animals. One farmer in Borrowdale had 20 sheep washed away. The waters of Lodore could be seen from Keswick coming down the gorge in a foaming torrent, and the roaring was like continuous thunder, but as the road from Keswick to Lodore was under water, few could get a close view.

The total quantity of water deposited is almost incredible; it was certainly 10 inches deep over an area of 400 square miles, and therefore if spread over the area of the City of London would have risen everywhere to about the level of the golden gallery of St. Paul's. Or, to put it in another form, had Messrs. Hemans and Hassard's scheme for supplying London with pure mountain water been carried out, these six days would have provided all that London needs, and waste, for half a year. Or, to put it as weight, it must have exceeded 200 million tons.—I am, sir, your obedient servant,

G. J. SYMONS.

62, Camden-square, N. W., Nov. 6th.

REVIEWS.

Annales de l'observatoire Impérial de Rio de Janeiro. Par L. CRULS, Directeur. Tome III. Observation du Passage de Vénus en 1882. Rio de Janeiro, 1887. 4to, xxvi.—687 pages, many photogravures, diagrams and illustrations.

SOME one will probably think—Whatever has the *Meteorological Magazine* to do with the Transit of Venus? He will get the answer before we have finished with this magnificent volume. We purposely refrain from touching upon the astronomical part of the volume except as far as is absolutely necessary in order to explain its origin.

At intervals of alternately 8 and 120 years, Venus passes between the Earth and the Sun, and appears to cross the disc of the latter as a round black spot. By measuring with extreme precision the path across the disc as observed from different parts of the earth's surface, it is possible to calculate with considerable accuracy what is the distance of the sun from the earth. As this is a quantity very necessary to be known, many Government expeditions were

sent to remote parts of the world, so as not only to get pairs of observations in different latitudes, but also to lessen the risk of failure owing to clouds.* The Brazilian Government, while reserving some assistants for the observatory of Rio, decided upon organizing three separate expeditions. The present volume describes these expeditions, and what they accomplished.

Expedition to St. Thomas', West Indies.—The vote for the cost of this expedition seems to have fared in the Brazilian Parliament no better than scientific votes do sometimes in England. It was refused altogether, and some Brazilian capitalists found the money which the nation refused. It seems to us strange that in this record, where every clock, barometer and thermometer taken, is fully recorded, the names of these benefactors do not appear. No passenger vessels run from Rio to St. Thomas's, therefore Baron de Tefé and the staff of this little expedition had to go on an overloaded coffee ship, which at its best, and with a strong current, made twelve miles an hour. The author gives a history of St. Thomas's back to the time of Columbus, but we need not follow him there, but we may quote his opinion of St. Thomas's as a residence. "No one, unless ordered to reside there by superior authority, or tempted by the hope of fabulous profits, would stop on a barren soil, constantly trembling with earthquakes, ravaged by epidemics, and at uncertain intervals swept by terrible cyclones."† Apropos to this comes a chapter (14 pages long) upon Cyclones, largely formed of extracts from Contre-Amiral Bourgois's book,‡ and from Padre Viñes's Memoir, read before the Academy of Sciences of Havana, in 1881. The author gives a map of the Island, and an excellent photograph of the capital, Charlotte-Amélie, which, however, does not look so barren as his description would lead one to expect. The narrative of how the Observatory was built, and the anxiety of all as the time approached when it was a question of cloud or sunshine to crown their efforts with success, or to leave all an utter failure, irremediable until June, 2004, is as interesting as a novel, and it is a good novel, too, for there are no murders in it, and all ends happily—how we are not bound to tell. We cannot speak very highly of the meteorological work of this party. They have not given us a single figure respecting the normal climate of the Island; they do not even give us the result of one quarter of the instruments they took with them; e.g., they tell us that outside the three observatories were the rain gauge and two anemometers, and yet they give us not a single figure

* Aggravating cases of this kind occurred at the Imperial Observatory at Rio de Janeiro, where the Emperor of Brazil and the Count and Countess d'Eu waited all through the phenomenon, yet, owing to nearly constant rain, obtained only a momentary glimpse; and to the expedition sent from Denmark to the West Indies and which saw nothing.

† See the Tortola Cyclone, *Met. Mag.*, vol. ii., p. 125.

‡ "Des mouvements de l'atmosphère."

from any one of the three. Between November 22nd and December 10th the shade temperature apparently (for they do not seem to have used their max. and min. thermometers) ranged between 65° and 84°, and had a mean of about 75°. The means for the observation hours were—

7 a.m.	10 a.m.	1 p.m.	4 p.m.
72·1	75·4	78·6	76·6

Mission to Olinda (Pernambuco).—The chief of this mission, Sig. J. de Oliveira Lacaille, tells nothing of his story, and the whole text of his report occupies less than three pages of Spanish. He had just the same fate as the observers at St. Thomas's, saw two of the contacts, and lost two. He appears to have made use of all his meteorological instruments, and prints the observations in extenso.

Mission to the Straits of Magellan (Tierra del Fuego).—This expedition was under the personal direction of Senor Cruls, and though placed last, the account occupies more than half of this handsome volume. Sig. Cruls implies that a German meteorological station having long been established in the town (Puntas Arenas), near which the observatory was erected, he did not try to make his set perfect; we need not, therefore, do more than convert a few of his values into English measures. The meteorological observations extended from November 15th to December 14th, 1882, and the results were—

Maximum temperature.....	71·8
Minimum ,,	31·3
Mean humidity ,,	75
Total rainfall	1·87 inches.

In comparison with the above (made, be it remembered, at Mid-summer), it may be well to quote some of the results of the observations made in Orange Bay by the French during a whole year—

Absolute maximum	76·1
Mean of the year	41·9
Absolute minimum	18·9

An extremely interesting narrative of the voyage from Rio de Janeiro to Puntas Arenas, and account of that Chilian colony, is given by the captain of the frigate (the Parnahyba) which took out the expedition. Captain Louis Philippe de Saldanha da Gama is evidently well worthy of his position in the Brazilian Navy, and we regret that we cannot quote the many interesting bits in his narrative. We must take one, but where the interest and the importance are equally balanced it is difficult to select. Here is an account of a mirage—the Parnahyba was steaming south a few miles off the east coast of Patagonia in about 50 S. :—

“In the course of the day (November 9th, 1882,) we saw some remarkable effects of atmospheric refraction. After midday the wind fell, and the air became warmer, unusually transparent, and pure. The coast, from which we were not far distant, took the most varied and extraordinary forms, sometimes its height was greatly exaggerated, sometimes the salient points, the hills, appeared

turned upside down, or lost in the space between them and the clouds, like the fantastic visions of a dream. One could not distinguish sea from sky, and the froth on the waves resembled fleecy cirri dotted on a blue sky. At one time the reflected images of the hills looked like a row of ships, and the solar rays crossing in various directions made them look as if they were firing a salute. This, however, soon vanished, but only to give place to still stranger appearances.

"The Parnahyba seemed transported into Fairy land, sometimes she seemed to climb a lofty white mountain, at another to slide down the steep slope of a precipice; no horizon could be seen, and, but that we were certain of our position, prudence would have advised our heaving to.

"The mirage of the African desert never produced stranger phenomena than those seen by the travellers on board the Parnahyba.

"The cool of evening dissipated all these extravagances of a rarefied and heated atmosphere, as vanish the fantasies of an over-excited imagination when the mind resumes its natural calm. A little before sunset the whole phenomenon had ceased; on one hand we had the ill-defined sea horizon, on the other the monotonous outline of the Patagonian coast, nearly lost in the shades of evening."

How the expedition succeeded in Patagonia; how some of the party were nearly lost in the lagunes and bogs in the interior of Tierra del Fuego; how the ship struck on a rock, and another time was left perfectly dry standing on her keel on a sand bank; how she passed safely through all troubles, with all sorts of details as to winds, currents, clouds, barometer and temperature, is told most pleasantly in this volume, which reflects credit on printer (we have never seen better photolithography), author, and on the Brazilian Government.

The Meteorite of the 20th of November, 1887. By H. GEORGE FORDHAM, F.G.S. [Excerpt Trans. Hertfordshire Nat. Hist. Soc.] 8vo. 30 pages; 1 map.

OUR readers may recollect that last year a reported "earthquake" was shown to be more probably due to the bursting of a Meteor or Bolide. This was done in the *Met. Mag.* for December, 1887, and we mentioned that Mr. Fordham was taking up the subject on behalf of the Hertfordshire Natural History Society, and that we hoped that our readers would give to him every help in their power. His report is now before us. The evidence is given fully and clearly, the conclusions are well grounded, the paper is illustrated by an excellent map, and altogether the hypothesis is established as conclusively as if a piece of the meteor had been picked up.

BRONTOLOGY.

WE are very glad to see from the following portion of a letter by Dr. Lodge, that he approves of the suggestion as to interrupted conductors made at Bath. (See *Met. Mag.*, Vol. XXIII., page 135.) The war between Theory and Practice is not yet ended, and the more facts are ascertained the more surely will victory crown truth.

LIGHTNING.

To the Editor of the Electrician.

SIR,—I may take this opportunity of remarking how much work can be done at meteorological stations and observatories in the matter of accurately observing and recording lightning; photographic records, obtained by proper appliances for distinguishing multiple from successive flashes, being, of course, superior to all others.

An experimental lightning conductor on a flagstaff near every meteorological observatory would also be a most desirable addition. It need not be associated with danger; a system of fuses or cut-outs, or an east and west steel bar, might be used to record the passage of a flash, and the rod need not be examined until after the cessation of violent disturbances. By having the conductor of different thickness at different parts one could learn what size is really likely to be melted. One could also arrange so as to gain information about side-flashes.—Yours, &c.

OLIVER J. LODGE.

A P U Z Z L E.

To the Editor of the Meteorological Magazine.

SIR,—I send you an extract from a letter I received yesterday from near Wallingford, as I think it may interest you, and possibly you may be able to give some explanation:—

“Last Saturday (November 3rd) evening, we had a most remarkable thing happen in this neighbourhood. Almost every flock of sheep was driven out, the hurdles broken down, and nearly every lot went out towards the east or south-east. From five miles below Abingdon, to Goring and to Nettlebed, and Watlington, and for several miles each side of the Thames, and from all I can hear, it happened to each flock about a quarter to eight in the evening. It was very still and dark at the time, and from people who were out and about I cannot hear of any lightning, or any meteor of any kind. It could not have been done wilfully, because it would have taken no end of men to work the thing, and had they been let out the hurdles would have been opened, and not the sheep driven over them. At present the matter is quite a mystery.”

Yours truly,

RICHARD H. WAKE, M.D.

Wood Cottage, Ballyhooly, Nov. 12th, 1888.

[If any of our readers can suggest the explanation of this we shall be very glad. It is curiously near the locality where the bolide, mentioned on p. 153 of this number, is supposed to have burst.—ED.]

THIRD GENERAL MEETING OF THE ITALIAN METEOROLOGICAL SOCIETY.

[We are indebted to Padre Denza for a MS. account of this meeting, from which we have prepared the following note.—ED.]

The third general meeting of the Italian Meteorological Society was held at Venice, September 14 to 21. The municipality and the inhabitants did everything possible to render the meeting agreeable and successful. The meetings were held in the magnificent rooms of the Istituto Musicale Benedetto Marcello, but the opening and closing ones were held in the Ducal Palace. The number of adherents was 170, of whom 140 were present. Sixty papers were presented for discussion; the most important being as follows:—

(1). *General Meteorology and Climatology*.—Among the most important papers in this section may be noticed Prof. Luigi Palmieri on the origin of atmospheric electricity; The results of magnetic observations at 103 stations in Italy; Summary of results from 8 Italian stations in S. America; Heliophotometric (*i.e.* sunshine) observations made by Professor Craveri, of the observatory at Bra, since 1874 with an instrument of his own invention. [We shall be glad to see a description of it. Ed. *M.M.*] Two important memoirs by Prof. Busin, of Rome, one on the distribution of temperature in Italy, the other on high and low pressure areas in the northern hemisphere; and one by Prof. D. Ragona on the daily range of temperature. P. G. Giovannozzi called attention to the relation between telescopic definition and meteorology; Prof. I. Galli spoke on the hourly velocity of wind at Velletri; Prof. I. Golfarelli on lightning conductors; and Prof. G. Roberto on a new hygrometer invented by Prof. A. Pizzarello.

(2). *Agricultural Meteorology*.—P. S. Ferrari read an important paper on the present relation between meteorology and agriculture, and on the steps necessary to be taken to further their mutual progress; Count A. Da Schio reported upon the history and development of phenological observations in Italy.

(3). *Hygienic Meteorology and Hydrology*.—A long and important discussion took place on the arrangements and classification of climatic stations, and it was decided that observations of this class should be established in Naples, Turin, and Padua. Prof. G. Roster read a paper on the results of daily observations on the amount of carbonic acid in the air and soil of Florence during 1886; P. V. Siciliani read a paper on the relation between the level of water in wells and the height of the barometer; and Prof. G. Bellucci one on the presence of sea salt in the rain water collected at Perugia.

Seismology.—The most important were by P. Denza on earthquakes in 1887, and by Prof. G. De Luca on the Solfatara of Pozzuoli.

The members were in all respects most hospitably received. On the 15th there was a grand concert and the Piazza S. Marco was illuminated. On the 18th a Serenade on the Grand Canal and a reception by the Municipality, and on the 21st an excursion to the University and Observatory at Padua.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, FEB., 1888.

STATIONS. <i>(Those in italics are South of the Equator.)</i>	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.									
	°		°		°	°	°	0-100	°	°	inches		0-10
England, London	52·0	6	19·1	2	40·1	31·4	31·7	86	59·3	28·2	·78	14	7·9
Malta	66·0	23	40·4	29	59·6	47·4	44·8	79	122·1	34·0	1·73	11	3·9
Cape of Good Hope. ...	98·8	13	52·0	18	85·1	60·4	...	...	...	...	·02	2	3·5
Mauritius	85·4	3	70·3	12	82·6	73·7	71·1	81	139·1	62·0	8·76	16	7·0
Calcutta	89·4	27	50·9	1	81·0	59·8	55·0	54	143·5	42·1	1·60	2	1·9
Bombay	86·8	22	65·0	10	83·1	70·1	66·5	71	138·3	53·2	·02	1	0·8
Ceylon, Colombo	93·4	1	66·0	8	88·7	71·5	68·1	71	143·0	57·4	3·27	3	1·9
Melbourne	97·2	12	43·1	15	76·5	54·1	51·7	64	148·0	32·6	·42	6	3·9
Adelaide	100·5	11	47·5	17	83·7	58·4	49·9	47	149·2	38·7	·07	2	2·6
Wellington .....	...	...	...	...	...	...	...	...	...	...	...	...	...
Auckland	80·5	17	49·0	1	70·9	56·3	52·4	67	145·0	38·0	·79	5	4·0
Falkland Isles .....	...	...	...	...	...	...	...	...	...	...	...	...	...
Jamaica, Kingston	88·0	27	60·6	25	86·1	64·6	66·2	73	...	...	·69	...	..
Barbados	80·0	27 ^a	66·0	23	77·0	69·0	65·7	74	...	...	4·86	13	6·0
Toronto	43·2	20	—16·1	9	29·0	13·7	19·6	81	...	—23·0	1·68	20	7·4
New Brunswick, Fredericton	45·4	26	—14·2	1	26·6	3·9	12·0	70	...	...	4·07	14	4·8
Manitoba, Winnipeg ...	37·0	23	—46·4	...	8·5	—14·0	6·3	94	...	...	·31	6	5·5
British Columbia, Victoria	52·0	23	28·0	29	46·0	37·1	...	...	...	...	1·77	11	..

^a And 28.

REMARKS, FEBRUARY, 1888.

MALTA.—Mean temp. 52°·6; mean hourly velocity of wind 11·5 miles. Sea temp. ranged between 57°·8 and 59°·5. TSS on 4 days; H on 3 days. Waterspout seen on 29th, about 2 miles off E.N.E. J. SCOLES.

Mauritius.—Mean temp. of air 0°·6 below, of dew point 1°·2 above, and R 3·64 in. above, their respective averages. Mean hourly velocity of wind 7·8 miles, or 3·3 below average; extremes 20·9 (for 1 hour) on 6th and 0·0 on 10th. Prevailing direction E. by N. to N.E. by E. T and L on 8 days, L on 4, T on 2. Floods in different parts of the island on 6th, 7th, 16th, and 18th. C. MELDRUM, F.R.S.

Melbourne.—Mean temp. of air 0°·8 below, of dew point 1°·5 below, amount of cloud 1·4 below, R 1·56 in. below, and pressure and humidity slightly below their respective averages for 30 years. Prevailing winds S. and S.E. Heavy dew on 5 days, TSS on 2 days. R. L. J. ELLERY, F.R.S.

Adelaide.—Unusually cool, especially at night. Mean temp. 2°·9 below average, the max. exceeding 90° on only 7 days. Total R 60 in. below average. C. TODD.

Auckland.—A fine and dry, but cool month, with an unusual predominance of S.W. winds. Mean temp. nearly 4° below, and R not more than a fifth of the average. T. F. CHEESEMAM.

BARBADOS.—Mean temp. 72°·7, a trifle below the average. Mean hourly velocity of wind 8·8 miles, 25 per cent. below the average. R. ROWIE WALCOTT.

SUPPLEMENTARY TABLE OF RAINFALL, OCTOBER, 1888.

[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	1·66	XI.	Castle Malgwyn	4·03
„	Margate, Birchington...	1·61	„	Rhayader, Nantgwillt..	4·49
„	Littlehampton	2·37	„	Carno, Tybrith	2·90
„	Hailsham	3·11	„	Corwen, Rhug	2·08
„	Ryde, Thornbrough	2·37	„	Port Madoc	4·30
„	Alton, Ashdell	1·79	„	I. of Man, Douglas	3·12
III.	Oxford, Magdalen Col...	·77	XII.	Stoneykirk, ArdwellHo.	·51
„	Banbury, Bloxham	·51	„	New Galloway, Glenlee	3·70
„	Northampton	·51	„	Melrose, Abbey Gate...	1·28
„	Cambridge, Beech Ho...	·80	XIII.	N. Esk Res. [Penicuick]	2·15
„	Wisbech, Bank House..	·50	XIV.	Ballantrae, Glendrishaig	1·12
IV.	Southend	1·22	„	Glasgow, Queen's Park.	2·10
„	Harlow, Sheering	1·08	XV.	Islay, Gruinart School..	3·25
„	Rendlesham Hall	·78	XVI.	St. Andrews, PilmourCot	1·23
„	Diss	1·47	„	Balquhider, Stronvar..	7·85
„	Swaffham	1·08	„	Dunkeld, Inver Braan..	3·51
V.	Salisbury, Alderbury ...	1·87	„	Dalnaspidal H.R.S. ...	7·21
„	Warminster	1·54	XVII.	Keith H.R.S.	2·70
„	Bishop's Cannings	1·25	„	Forres H.R.S.	2·98
„	Ashburton, Holne Vic...	2·70	XVIII.	Strome Ferry H.R.S....	9·53
„	Hatherleigh, Winsford.	2·66	„	Fearn, Lower Pitkerrie.	3·17
„	Lynmouth, Glenthorne.	1·55	„	Loch Shiel, Glenaladale	10·07
„	Probus, Lamellyn	2·37	„	S. Uist. Ardkenneth ...	...
„	Launceston, S. Petherwin	2·53	„	Invergarry	6·89
„	Wincanton, StowellRec.	1·67	XIX.	Lairg H.R.S. ....	...
„	Taunton, Ly-leard Ho...	1·04	„	Forsinard H.R.S. ....	...
„	Wells, Westbury	1·55	„	Watten H.R.S.	3·45
VI.	Bristol, Clifton	1·06	XX.	Dunmanway, Coolkelure	4·79
„	Ross	·91	„	Fermoy, Gas Works ...	3·29
„	Wem, Clive Vicarage ...	·97	„	Tipperary, Henry Street	1·79
„	Cheadle, The Heath Ho.	·83	„	Limerick, Kilcornan ...	1·57
„	Worcester, Diglis Lock	·74	„	Miltown Malbay.....	2·33
„	Coventry, Coundon	·47	XXI.	Gorey, Courtown House	2·40
VII.	Melton, Coston	·50	„	Navan, Balrath	·82
„	Ketton Hall [Stamford]	·41	„	Mullingar, Belvedere...	1·48
„	Horncastle, Bucknall ...	·56	„	Athlone, Twyford	1·39
„	Mansfield, St. John's St.	·62	„	Longford, Currygrane...	1·75
VIII.	Knutsford, Heathside ...	1·20	XXII.	Galway, Queen's Coll...	1·82
„	Walton-on-the-Hill.....	1·31	„	Clifden, Kylemore	5·51
„	Lancaster, South Road.	3·28	„	Crossmolina, Enniscoe..	5·06
„	Broughton-in-Furness ..	5·54	„	Collooney, Markree Obs.	2·95
IX.	Shipley, Esholt Vic. ...	...	XXIII.	Rockcorry.....	...
„	Ripon, Mickley	·85	„	Warrenpoint	·88
„	Scarborough, West Bank	1·23	„	Seaforde	1·13
„	East Layton [Darlington]	·54	„	Belfast, New Barnsley ..	1·62
„	Middleton, Mickleton..	1·66	„	Cushendun	1·86
X.	Haltwhistle, Unthank..	2·16	„	Bushmills	2·03
„	Shap, Copy Hill	9·50	„	Stewartstown	1·14
XI.	Llanfrechfa Grange	1·71	„	Buncrana	2·98
„	Llandovery	3·74			

OCTOBER, 1888.

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.	Differ- ence from average, 1870-9	Greatest Fall in 24 hours.		Max.		Min.					
				inches	inches.			in.	Dpth	Date.	Deg.	Date	Deg.	Date	In shade.	On grass.
I.	London (Camden Square) ...	1.23	—	1.47	.51	29	7	68.8	27	28.2	8	5	18
II.	Maidstone (Hunton Court)...	1.48	—	.98	.57	29	5	...	...	...	...	...	...
III.	Strathfield Turgiss	1.56	—	1.18	.63	29	12	67.1	28	25.8	15	15	23
IV.	Hitchin .....	.80	—	1.38	.24	28	8	68.0	27	26.0	8, 21	10	...
V.	Winslow (Addington) .....	.72	—	1.90	.24	28	11	68.0	27	25.0	9	17	18
VI.	Bury St. Edmunds (Culford)	1.08	—	1.09	.32	29	5	63.0	27	23.0	23	24	...
VII.	Norwich (Cossey)	2.36	+	.03	.68	2	10	...	...	...	...	...	...
VIII.	Weymouth (Langton Herring)	2.39	...	...	.81	29	11	63.0	28	32.0	7	1	...
IX.	Barnstaple	2.15	—	3.30	.39	2	14	64.0	29	29.0	15	...	...
X.	Bodmin	2.43	—	3.84	.49	28	19	60.0	27	35.0	15	0	...
XI.	Stroud (Upfield) .....	.80	—	2.21	.15	29	10	70.0	27	27.0	7	6	...
XII.	Church Stretton (Woolstaston)	1.27	—	3.33	.41	28	13	61.5	27	30.0	2	3	15
XIII.	Tenbury (Orleton) .....	.68	—	2.56	.23	28	9	65.2	27	26.0	7, 24	13	16
XIV.	Leicester (Barkby) .....	.52	—	1.83	.12	28	11	68.0	27	22.0	13d	19	23
XV.	Boston .....	.48	—	1.55	.15	4	7	70.0	27	25.0	21	13	...
XVI.	Hesley Hall (Tickhill) .....	.54	...	...	.25	1	9	65.0	27	24.0	23	11	...
XVII.	Manchester (Ardwick)	1.67	—	2.76	.40	28	9	63.0	27	29.0	2, 7	9	...
XVIII.	Wetherby (Ribston Hall) ...	.58	—	2.78	.18	29	4	...	...	...	...	...	...
XIX.	Skipton (Arncliffe)	2.45	—	4.81	.42	30	13	60.0	26	32.0	19	1	...
XX.	Hull (People's Park) .....	.99	—	1.81	.22	4	10	...	...	...	...	...	...
XXI.	North Shields .....	.83	—	1.68	.28	30	9	66.5	27	27.5	2	4	9
XXII.	Borrowdale (Seathwaite)	14.51	—	2.04	.57	27	15	...	...	...	...	...	...
XXIII.	Cardiff (Ely)	1.92	—	3.31	.50	28f	9	...	...	...	...	...	...
XXIV.	Haverfordwest	2.63	—	3.82	.55	28	20	60.8	26	29.8	14	4	13
XXV.	Plinlimmon (Cwmsymlog) ...	4.53	...	...	1.04	28	15	...	...	...	...	...	...
XXVI.	Llandudno	1.94	—	2.65	.30	27	16	66.3	28	33.4	2	0	...
XXVII.	Cargen [Dumfries]	3.02	—	2.69	.94	27	8	58.6	27	25.4	2	8	...
XXVIII.	Jedburgh (Sunnyside)	1.69	—	.98	.33	28a	14	60.0	26b	28.0	2	4	...
XXIX.	Old Cumnock	2.33	—	2.83	.41	26	16	62.0	27	22.0	1, 13	10	...
XXX.	Lochgilthead (Kilmory)	4.22	—	4.10	.75	30	17	...	...	29.0	4, 21	5	...
XXXI.	Oban (Craigvarren)	4.80	...	...	1.45	30	20	64.8	12	34.3	5	0	...
XXXII.	Mull (Quinish)	4.69	...	...	.77	30	21	...	...	...	...	...	...
XXXIII.	Loch Leven Sluices	2.10	—	2.21	.50	31	8	...	...	...	...	...	...
XXXIV.	Dundee (Eastern Necropolis)	1.45	—	1.72	.20	2	16	61.9	12	31.9	4	1	...
XXXV.	Braemar	3.02	—	1.46	.95	28	23	60.5	27c	29.0	5	3	11
XXXVI.	Aberdeen .....	...	...	...	...	...	...	...	...	...	...	...	...
XXXVII.	Lochbroom	6.67	...	...	1.15	27	25	...	...	...	...	...	...
XXXVIII.	Culloden	2.31	+	.02	...	...	...	63.0	27	34.0	3, 5g	0	11
XXXIX.	Dunrobin	5.34	...	...	1.04	4	19	64.0	27	32.0	4	1	...
XL.	Kirkwall (Swanbister) .....	...	...	...	...	...	...	...	...	...	...	...	...
XLI.	Cork (Blackrock)	3.12	—	1.62	1.16	27	19	62.0	27	29.0	14	5	...
XLII.	Dromore Castle	2.99	...	...	.61	31	16	63.0	1	33.0	1	0	...
XLIII.	Waterford (Brook Lodge) ...	2.43	...	...	1.20	27	13	59.0	...	27.0	15	4	...
XLIV.	O'Briensbridge (Ross)	2.04	...	...	.52	31	17	61.0	27c	30.0	22e	...	...
XLV.	Carlow (Browne's Hill)	2.30	—	1.81	.76	27	12	...	...	...	...	...	...
XLVI.	Dublin (Fitz William Square)	1.23	—	2.19	.33	27	16	66.6	27	32.9	2	0	10
XLVII.	Ballinasloe	1.10	—	3.33	.25	27	15	60.0	26b	27.0	15	8	...
XLVIII.	Waringstown	1.15	—	2.46	.25	2	15	70.0	28	28.0	1	3	11
XLIX.	Londonderry (Creggan Res.) ..	2.79	...	...	.41	30	21	...	...	...	...	...	...
L.	Omagh (Edenfel)	1.35	—	2.97	.23	27	15	63.0	27	34.0	3, 13	0	4

a And 30. b And 27. c And 28. d And 20. e And 23. f And 31. g And 14.

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

METEOROLOGICAL NOTES ON OCTOBER, 1888.

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.—Up to the 24th, the weather was unusually severe for the season; frosts in the morning were followed by much fog and an absence of wind. The end of the month was warm and close, warmer than in July and August.

HITCHEN.—On the 27th the mean temp. was 63°, the highest recorded so late in October, higher than that of June 28th. Extraordinary darkness on 10th. S on 2nd.

ADDINGTON.—Perhaps one of the most remarkable Octobers on record for number of frosty nights (17), and small rainfall, none falling in the 17 days ending 23rd. There were many very fine days, and a few dense fogs after the 16th. The min. temperatures were exceptionally low for the first three weeks, and as remarkably high during the remainder of the month.

CULFORD.—Very fine weather the whole month.

LANGTON HERRING.—On the whole, a very fine month, R having fallen on only 11 days. From 7th to 24th the weather was very fine, though on some days the mornings were foggy. It was the fourteenth consecutive month with low temp., the mean at 9 a.m. being 2°·7 below the average, though from 24th to 28th it was unusually warm.

BODMIN.—A remarkably fine month. Mean temp. 49°.

WOOLSTASTON.—An extremely dry month. The first week was very cold—S falling on 1st—the temp. then rose, but it became very cold again for some days after the 20th, and then very warm for the last week. Mean temp. 47°·2.

ORLETON.—On the night of the 1st R set in, which changed to S and covered the land two inches deep next morning, not clearing off the hills till after mid-day. The weather afterwards was remarkably dry and fine, with frequent frosty nights and clear days till 24th, no measurable R falling in 17 days ending on that date. The mean temp. of the first 24 days was lower than that of any October for 30 years, and the wind was generally between N.E. and N.W. At 9 a.m. on the 24th the temp. in shade was 33°, at night the wind changed to S.E., and at 9 a.m. on 25th it was 56°. This was followed by rough S.E. wind, and four warm days and nights, and the last four days were cloudy, with frequent small R. Fogs were frequent from 16th to 24th.

BARKBY.—A fine dry month, so that leaves remained on the trees ten days after keen frosts. The last week very warm. Strong winds on 25th and 26th. Mean temp. 43°·7. T on 26th and 27th.

MANCHESTER.—October began with a wintry aspect, and there were several frosty nights, and some slight falls of S, but taken altogether, it was a fine month, but cold.

HULL.—With the exception of the first week, the weather was fine, mild, and calm, sometimes with fogs or mists.

SEATHWAITE.—Very wet in the last week, 12·03 in. of R falling after the 24th, and 9·63 in. in the three days ending 27th.

WALES.

HAVERFORDWEST.—The first and last weeks were very stormy and wet, the first extremely cold. Mean temp. of first six days, 42°·4; of last eight, 54°·5; and of the month, 47°·7. From 9th to 23rd, the weather was splendid, plenty of bright sunshine, with cold nights, heavy fogs at times, wind generally from N. or E., and a plentiful harvest well gathered, if deficient in quality. Aurora on 31st.

SCOTLAND.

CARGEN.—The first three weeks were unusually cold, and almost without R, while the last week was unusually warm and wet. The mean temp. of the first week was $40^{\circ}7$; of the last week, $52^{\circ}7$, only $2^{\circ}3$ below that of July. Mean temp. of the month ($46^{\circ}5$) $1^{\circ}7$ below the average. The R, with the exception of $\cdot 16$ in., all fell in the last week. S on 1st and 4th; L on 29th.

JEDBURGH.—The temp. was variable, but lower than the average, the dry, cold weather of the middle of the month being valuable for securing cereal crops.

OBAN.—The 1st showed S on the hills—a very early date; this lasted till 7th, and there were several light falls of S; a cold period prevailed till the middle; then followed a short summer, and the month closed with gales, R, and high temp. T and L on 30th and 31st.

BRAEMAR.—A month of unsettled weather. Crops still unsecured, and in bad condition.

LOCHBROOM.—Except for a few days about the middle, the month was one continued storm of R and wind.

DUNROBIN.—Wet and sunless. A good deal of grain still in the fields.

IRELAND.

CORK.—Except a few slight showers, fine autumn weather with frosts to the 19th, thence dull and often misty, with more or less R every day.

DROMORE.—Very fine, with the exception of two or three rather stormy days at the end.

O'BRIEN'S BRIDGE.—Some of the most beautiful days of the whole season were those from 9th to 23rd. R was wanted for wells and streams, and sufficient fell in the latter days of the month.

DUBLIN.—A generally favourable month, with much quiet weather, except at the beginning and end. The first week was very cold and showery, with fresh northerly winds. Anticyclonic weather followed, dry, but foggy or cloudy. The last seven days were remarkably warm, with strong S.W. winds or gales, and frequent showers.

WARINGSTOWN.—A wonderfully fine month, which enabled the late harvest to be well secured; the last ten days unusually warm.

EDENFEL.—With the exception of some days at the beginning and end of the month, the weather was uniformly fine, calm and generally clear. The polar winds, which prevailed without intermission to the 16th, reduced the temp. much below the average, but there was a rebound during the last fortnight, culminating in a mean temp. of $60^{\circ}5$ on the 27th. At the close, the springs were lower than during any period of 1887.

GREAT OCEAN DEPTHS.—Her Majesty's surveying ship, *Egeria*, under the command of Captain P. Aldrich, R.N., has, during a recent sounding cruise and search for reported banks to the south of the Friendly Islands, obtained two very deep soundings of 4,295 fathoms and 4,430 fathoms, equal to five English miles, respectively, the latter in latitude $24^{\circ}37'S$, longitude $175^{\circ}8'W$, the other about 12 miles to the southward. These depths are more than 1,000 fathoms greater than any before obtained in the Southern Hemisphere, and are only surpassed, as far as is yet known, in three spots in the world—one of 4,655 fathoms off the north-east coast of Japan, found by the United States steamship *Tuscarora*; one of 4,475 fathoms south of Ladrone Islands, by the *Challenger*; and one of 4,561 fathoms north of Porto Rico, by the United States ship *Blake*. Captain Aldrich's soundings were obtained with a Lucas sounding machine and galvanized wire. The deeper one occupied three hours, and was obtained in a considerably confused sea, a specimen of the bottom being successfully recovered. Temperature of the bottom, $33^{\circ}7$ deg. Fahr.