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THE GREAT RAIN OF JULY 17TH, 1890.

WE do not call this the St. Swithin's rain of 1890, because we wish the tradition as to the 40 consecutive days of rain to die out; but the latter half of July is not an infrequent date for a great rainfall. Cases similar to the recent fall were that of July 26th, 1867 (which we worked up fully and described in vol. ii. (1867) of this magazine, p. 75), and that of July 14th, 1875, specially treated in *British Rainfall*, 1875, and in a paper on the floods of 1875, printed in the *Proc. Inst. C.E.*

The rain of 1867 extended into two days. At two stations near Sittingbourne and Chatham the total reached 5 inches, and at seven stations it reached or exceeded 3 inches in the two days.

The rain of 1875 also extended into two days, but it was heaviest in Monmouthshire and the S.W. of England; there, at some stations, the total fall exceeded 5 inches.

The rain of 1890 fell chiefly on one day (the 17th), and though about half an inch more fell on the 18th, it was separated by a dry period, and therefore, in the following notes and in the accompanying map, we deal with the fall of the one day (the 17th) only.

We have been favoured by many of our correspondents with notes on the fall. We shall quote here those daily totals only which exceed three inches. Others are given on the map, and the whole facts will have to be thoroughly discussed in *British Rainfall*, 1890.

The largest records which we have yet received are—

4·19 in. at Moor Park, Rickmansworth, Herts.
3·68 ,, Langley, Slough, Bucks.
3·60 ,, Belle Vue, Staines, Middlesex.
3·45 ,, Taplow Court, Maidenhead, Berks.
3·37 ,, Cookham Vicarage, Maidenhead, Berks.
3·33 ,, Cooper's Hill [Staines], Surrey.
3·24 ,, Portland Place, Reading, Berks.
3·20 ,, Knowle Green, Staines, Middlesex.
3·10 ,, East Thorpe, Reading, Berks.

The following gauges ran over. As regards these stations, therefore, our knowledge is limited to the fact that the rain was greater than

4·00 in. at Hillingdon, Uxbridge.
2·08 ,, Gorhambury, St. Albans.
2·00 ,, Greenlands, Henley-on-Thames.
1·94 ,, Pinner Hill.

PHENOLOGICAL OBSERVATIONS.

(Translated from "Ciel et Terre").

The utility of these observations as an auxiliary to the study of climates has long been recognized.

In five years a phenological observer may have obtained mean dates sufficiently accurate to enable him to judge of the successive advent of the various phases of vegetation. If one has ascertained the mean date for five years of the principal phenomena, *e.g.*, when in the immediate neighbourhood of the observer the first blooms of the blackthorn open, or the first fields of barley are cut, one is in a position to decide; (1) How the station is related to one of which the averages have already been long determined; (2) How various localities are related to the principal station, whether they are colder or hotter, as indicated by the relative maturity of plants in the two localities; one obtains these results much better than if one had established and compared hundreds of thermometers and rain gauges in a hundred different positions, putting aside the impossibility of observing them all, and the difficulty of procuring and erecting them; phenological observations cost nothing, while meteorological instruments are expensive; (3) Each year, and each week of the year, one can compare the observations of the progress of vegetation with the means, and ascertain whether at one's own station the season is early, normal or late. Phenology is a species of thermometry which may even occasionally correct erroneous conclusions from thermometric records. Thus Hoffmann has remarked that it is a peculiarity of oak brushwood to leaf much later than full grown trees of the species, although, if considered from the thermometric stand-point only, one would be inclined to attribute it to the dampness and consequent coldness of the positions occupied by the brushwood. A plant is, in fact, a sort of registering thermometer, which like the thermometer shows us present temperature, but in addition the final effect of past temperatures, a result we can arrive at only imperfectly by summing up the daily mean temperatures. Phenological observations, with figures founded on comparisons, have the advantage of presenting to the mind facts easily grasped. As regards biological problems, isotherms are not necessary, because they do not give the real average temperature. That is why isotherms cannot coincide with isophanes (lines of equal phases of vegetation). Accurate observations of the phases of vegetation, and the determination of their mean value, furnish important indications as to the further progress of the plant, by the differences which they present from the normal value. But it has another result. By comparing during a year the flowering of certain plants in different places in a district, we may be able to determine the amount of heat received in each of these positions in a given time. These phenological observations enable us to examine predictions which have come down to us from remote ages, such as the speedy

arrival of winter, after the fall of the bloom of the heath, and the larch losing its leaves. Hoffmann has observed that out of 29 years, in 21 the early or late opening of the buds of the chestnut has corresponded with a following winter warm or cold. In fact, phenology may attain the same precision as meteorology, for the two modes of observation can each give only approximate values.

BALL LIGHTNING.

Dr. E. Cabellero, who is professor of physics and director of the Electrical Works at Pontevedra, has sent to the observatory at Madrid, the following account of phenomena seen by himself :—

On January 2nd (1890 ?) at 9.15 p.m., the sky being cloudless and the weather calm, a ball of fire about the size of an orange, suddenly entered the works. This ball of fire entered by a window or light, after having probably come along one of the conductors for the electric light. [Very respectfully, we think it more likely that it came along the conductors the whole distance, and not through the window ; open windows at 9.15 p.m. in January, in Madrid, scarcely seem probable, and Dr. Cabellero evidently did not see it enter, or he would not say, " par une fenêtre ou une lucarne."—ED. *Met. Mag.*]

From the window it went to the switch-board and thence to the dynamo. Twice in the sight of the frightened engineers and workmen, it darted from the switch-board to the dynamo, and from the dynamo to the switch-board, and finally fell on the ground and burst into fragments, leaving, however, no traces except by fusing some of the thick copper conductors on the switch-board. A noise like the discharge of a cannon accompanied its dissipation. The street lamps were extinguished for a few seconds, but as the dynamo was not injured the current was speedily restored.—*Ciel et Terre.*

NEW METEOROLOGICAL STATION AT POMPEI.

Although unable to accept the invitation to be present at the inauguration of the above, we are glad to devote a few lines to record that which brings, so strangely, ancient and modern times together. We are indebted to Avv. Bartolo Longo for several papers,* whence we gather that considerable ecclesiastical and charitable buildings are rising on a site near to, or actually over, Pompei. That the organizers of this new Pompei attach considerable importance to intimate relations existing between Religion and Science ; and, as one step in that direction, they have provided all the apparatus required for a second order station, with the addition of seismometers and photographic apparatus for recording the smoke from

* Le Armonie della Religione e della Civilità nella Nuova Pompei. Programma delle Feste di Maggio, 1890, and others.

Vesuvius, and have established what with some grandiloquence they term the "Osservatorio Meteorico-Geodinamico-Vulcanologico." The inauguration took place on May 15th, 1890, when many leading Italian observers were present, addresses being delivered by Padre Denza, Prof. Stefano de Rossi and others.

CAUSE OF ATMOSPHERIC DEPRESSION.

To the Editor of the Meteorological Magazine.

SIR,—In the number of this magazine for June, 1890, p. 75, occurs the following sentence, by the Rev. Clement Ley, in a letter on this subject:—"Now, after full attention has been devoted to the works of Faye, Hazen, and other oppositionists, the fact remains that the character of the current of scientific theory on this subject is strong enough to be, to most of us, unmistakable." A little later, reference is made to the work of Prof. Ferrel as being fundamental and conclusive. It is probable that meteorologists in England, and on the Continent, are not fully aware of the true inwardness (*sic*) of scientific theories in meteorology in America, nor of the extreme contradictions between such theories and the facts. Your correspondent should have stated that Prof. Ferrel is second in this field so well studied by Espy half-a-century ago. Here are Prof. Ferrel's own words. He says, in describing the force needed to maintain a storm, "This force may be furnished by the condensation of vapour ascending in the upward current in the middle of the hurricane, in accordance with Prof. Espy's theory of storms and rains." This is sufficient to show that, after all, we must go back, not to Ferrel, but to Espy. If it can be shown that Espy was entirely misled by his experimental researches, that the proofs which he thought he had were entirely incorrect, and more than all, that a careful repetition of his experiments shows that absolutely no energy can be obtained in the maintenance of storms by the liberation of latent heat from condensing moisture, and a consequent increase in the rarefaction at the centre, as he thought, then a death-blow has been struck to all theories founded upon his researches. I think it may be fairly admitted that Espy's work has been shown to be exceedingly faulty, and it may be hoped that meteorologists ere long will be enabled to cast off this millstone which has so long been dragging them down, and, by a series of careful experiments, make a fair start toward building up a science. It is an astonishing fact that students of meteorology are the only ones who have been content with vague speculations, and have not founded their science upon a firm and substantial groundwork of fact.

It is probable that nothing could emphasize the necessities of the case better than the recent most extraordinary statements of Dr. Hann, of Vienna. He has made a study of the temperature conditions at high and low stations during the passage of storms and high pressure areas, and has come to the conclusion that above the earth's surface the temperature in our storms is markedly *diminished*, while in our

high pressure areas it is *increased*. The uttter lack of faith in present theories of storm formation could hardly be better shown than by the extraordinary rapidity with which they were brushed aside by meteorologists to accept this new dictum by an *authority*.* It is true that Dr. Hann has been woefully misled by his researches, and that the temperature is certainly higher in the centre of our storms up to 14,134 ft., the height of Pike's Peak, than it is before or after the centre has passed. The surprising thing is, that no one questions the results of another, nor has faith enough in his own views to maintain them until forced to yield inch by inch.

One other point I will mention. It is hardly true that the arguments of the oppositionists have had full attention paid to them. These arguments have either been ignored as unworthy of attention, or, where an attempt has been made to answer them, the results showed how utterly weak the ordinary theories were. It is a remarkable fact that every theory of storm formation, from its beginning by an abnormal heating at the earth's surface to its maintenance by rarefactions in the upper air, due to a peculiar distribution of temperature with height, has had no fact as a basis. The present theories in meteorology can be likened to nothing better than "the baseless fabric of a vision."

H. A. HAZEN.

Washington, July 1, 1890.

SOLAR RADIATION THERMOMETERS.

To the Editor of the Meteorological Magazine.

SIR,—You have kindly sent me some back numbers of the *Meteorological Magazine* containing articles and letters on solar radiation instruments, and consequently it was only last week that I saw the letter of Mr. H. Sowerby Wallis in the number for January of this year, and it must have appeared discourteous of me not to have replied to it before.

The cases of the thermometers described in my paper to the British Association had an external diameter of 63 millimetres. The large thermometer bulb had a diameter of 11·1 mm.; it was made of white glass, and was coated with lamp black. The small bulbs were 5·6 mm. in diameter, and were made of black glass, which had, however, a smooth surface, and therefore reflected some light and heat.

The instruments have, unfortunately, been broken, but this has given me the opportunity of measuring the thickness of the cases. That which enclosed the thermometer with the large bulb had a knob of glass on it, produced by closing the bulb after the thermometer had been introduced. Two pieces of glass near the equator of the bulb were measured, and were found to have a thickness of ·52 mm.

The cases of the two small thermometers were made as nearly

* We do not follow this argument; Prof. Hazen evidently accepts Dr. Hann as an "authority," yet condemns meteorologists for doing the same thing.

uniform in thickness as possible, the thermometers having been introduced from the other ends of the tubes. The thin case had a thickness of ·59 mm, and the thick case was no less than 5 mm. in thickness, much stouter than I intended it to have been.

On looking through the back numbers, I find that the theory propounded in my paper last year was published nearly 20 years ago; for on September 26th, 1870, Mr. Henry R. Procter wrote to you a letter printed in the number for December, 1870 (*Met. Mag.* v. 183), which contains all I wrote on the subject. I need hardly say that I had no idea that I had been anticipated so completely, and no one has ever directed my attention to this letter.

In view of this theory it appeared possible that the blackening of the stem of the thermometer, as well as of the bulb, might have some influence on the readings, for additional heat would be absorbed by the blackened stem which would, by radiation, raise the temperature of the case, so it seemed of importance to diminish the length of the blackened portion of the stem.

Mr. Stow's letter of July 18, 1868 (*Met. Mag.* iii. 115), shows so clearly the necessity of blackening the stem to prevent conduction removing heat from the thermometer bulb that it seems hopeless to dispense with it; however, it appeared worth while to try some experiments on the conduction of heat along a stem. For this purpose a thermometer was placed horizontally, and a piece of filter paper was tied round the stem a quarter of an inch from the bulb, and a screen of card, with a hole in it, was fixed between the bulb and the paper. Ether was dropped on the filter paper, and at first no effect was observed. After a minute and a quarter the mercury began to fall, and in four minutes the temperature had fallen 5°, moisture being deposited on the stem, between the bulb and the filter paper. With another thermometer the temperature began to fall in 50 seconds, and at the expiration of $4\frac{1}{2}$ minutes the temperature was lowered 8·1°. The object of the screen was to prevent the cold vapour of the ether from coming in contact with the bulb, which would, of course, lower the reading.

In another experiment with the first thermometer the filter paper was placed one inch from the bulb. The paper was kept wetted with ether for 8 minutes, and the temperature fell only 0°·4. Moisture was deposited on the tube, and extended about half an inch from the paper. Probably some of this apparent fall of temperature was due to the cooling of the thread of mercury, as a considerable length of the tube was cooled. On placing filter paper on the bulbs of the thermometers and wetting it with ether, the temperature was lowered about 53°, which is probably not far from the difference of temperature between the bulb and stem of a black bulb thermometer in vacuo when the sun is shining on it. So conduction may seriously affect the readings of such an instrument, if a sufficient length of the stem is not blackened.

I still think that the blackening of the stem should be diminished

as much as possible, and perhaps another way to check the conduction would be to lessen the cross section of the stem close to the bulb, by making a narrow neck between the bulb and the tube. If the bulb and neck only were blackened, it would materially diminish the quantity of heat radiated to the inside of the case.

Faithfully yours,

HERBERT McLEOD.

Cooper's Hill, August 7th, 1890.

THE COLD WEATHER OF MARCH.

To the Editor of the Meteorological Magazine.

SIR,—Though I am very late in making this communication, yet I think that it may still interest some of your readers to know that the above cold spell reached even Madeira, and that the lowest temperature ever observed in Funchal was recorded on March 6th, 1890. I then registered in a Stevenson's screen a minimum of 43° F, and though my instruments are placed at an altitude of about 350 ft. above the sea, identically the same temperature was recorded at the Government Observatory in the town. The lowest temperature previously recorded was 45°·7 on March 11th, 1883, but this year on four consecutive nights I registered a minimum lower than that, viz.—

March 5th, 45°·0 F.	March 7th, 44°·0 F.
,, 6th, 43 ·0	,, 8th, 44 ·2

At 7 a.m. on the 7th, there was a single clap of thunder, followed by a sharp hailstorm, which quite whitened the ground, and remained for a quarter of an hour or so before melting. It caused a good deal of interest, for our native Madeira servants and others around had never previously seen any snow or hail fall, though, of course, snow falls frequently enough on the higher mountains of the island.

I am, yours truly,

H. COUPLAND TAYLOR, M.D., F.R.MET.SOC.

Madeira.

REVIEWS.

Wanderings in Search of Health, or Medical and Meteorological Notes on various Foreign Health Resorts. By H. COUPLAND TAYLOR, M.D., F.R.Met.Soc. London: Lewis, 1890. 8vo, cloth, 259 pages, 5 plates.

DR. COUPLAND TAYLOR was for some time one of our rainfall observers, but ill-health compelled him to leave the wet locality in which he had been practising, and for the last four years he has been, as the title of his book says, "Wandering in search of Health." We are glad to know that not only has he found it, but in the work before us he has recorded his views as to the *pros* and *cons* of most of the places usually visited.

It is not for us to discuss medical questions, but there is one idea which frequently recurs in this book which has startled us, and set us thinking and making some enquiries. Evidently consulting physicians (whom, by the bye, he somewhat drolly calls "consultants"), do not stand high in Dr. Coupland Taylor's opinion, and he, both on his own account and by quotations from other medical men, implies (and illustrates by examples) carelessness and want of knowledge and of judgment in the advice they give as to the localities to which phthisical patients should go. It is difficult to believe that a sweeping charge like that can be substantiated. We know that it is not true of some consulting physicians, because we could name one who is not merely wearing himself out by the thought which he bestows on each individual case, but who stops at neither distance nor expense in order, by personal inspection at various seasons, to make himself familiar with each new health resort as it comes into notice; but, on the other hand, we have just applied what seems a reasonable test with a very unsatisfactory result.

An expert on any subject should surely be well acquainted with the literature upon it. A doctor who professes to advise as to climate might be supposed to take sufficient interest in the subject to seek election into the Royal Meteorological Society, in order (even if he had not time to attend the meetings) that he might see the quarterly journal and keep himself *au courant* with the published data as to climate. We have been through the last list of Fellows, and can find only seven London medical men—and of those we believe that there is only one—who is an expert in consumptive cases. Surely there is more than one London physician who advises on climatic matters. It does look therefore as if Dr. Coupland Taylor's criticisms have some foundation.

The special characteristics of the book seem to us to be fairness and common-sense. Dr. Coupland Taylor comes down alike on the profession and on the patients. We give a specimen of each:—*Place aux Dames*: Dr. Taylor is writing of the dances at Davos—

"It is impossible to keep some ladies away from this amusement, for if there is a dance taking place in any of the hotels, they will dance all the evening, in spite of the doctor's strictest orders to the contrary, and suffer for days after in consequence."

Now for the doctors.

"At the present day but little seems known of the climate of Madeira among the medical profession at large. When a London specialist, on this subject, describes the climate to be like the atmosphere of the 'hot and well-steamed room of a patient suffering from bronchitis,' one can see how little its real climate is known and appreciated."

"Again, Prof. Charteris, in his work on 'Health Resorts,' makes the astonishing statement: 'During the season of 1881-82 there was at Davos a clear, unclouded sky from the beginning of November to the end of March.

Unfortunately I cannot obtain the statistics of the weather for that year, but the correctness—[incorrectness—ED. *M.M.*]—of the statement may be gathered from the fact that in the exceptionally fine season of 1879-80, 'perhaps one of the most perfect ever known in the Alps' (Yeo), rain or snow fell on 36 days between November and March."

The author, being himself a skilled observer and F.R.Met.Soc., the meteorological data in this book are exceptionally trustworthy; but we find one new term as to the adoption of which there may be some doubt. Dr. Taylor seems to take it for granted as if already accepted, but we never met with it before. "The absolute humidity, however, is the absolute quantity of aqueous vapour which is suspended in a given volume of air." "Absolute humidity" is of course much shorter than "Grains of vapour in a cubic foot of air," but it is liable to be confused with "Relative humidity," and there is the further question whether the term is legitimate.

The places chiefly dealt with are the Ocean, the Engadine, Davos, Madeira, Canary Isles, and Western Riviera. On each and all Dr. Taylor gives much valuable information, so that there are few practitioners or patients who would not profit by reading his book.

There is in it a large amount of useful meteorological information, and while not suggesting that it should be taken from where it is, we think that two or three pages devoted to a tabular summary of the figures scattered through the book would be a handy addition. It is well printed, and the plates are excellent specimens of some process of photographic reproduction.

Congrès International d'Hydrologie et de Climatologie.—Compte Rendu de la Deuxième Session, Paris, 1889. Doin: Paris, 1890. 8vo., 504 pages.

AT the first Congress at Biarritz, it was resolved that by exception the next should be held in Paris during the Exhibition. There had been too many Congresses, and coming as the Hydrological one did nearly the last, and in cold rainy weather it suffered seriously and afforded a painful contrast to the bright, enthusiastic and well attended one at Biarritz. It remains to be seen by the gathering at Rome in 1893, whether the Congress supplies a real need or not.

The volume before us is a handsome and substantial one. The first 250 pages are wholly medical. On some of the papers in the latter half we intend to offer a few notes.

On the precautions requisite in observing accurately the temperature of thermal springs, by M. Renou. The author called attention to the fact that mercurial thermometers rise with age, and to the possibility of avoiding this error by applying Denton's process before graduating them. He also urged that thermometers be sent to the Bureau Central or to the observatory at Parc St. Maur for verification. He expressed his belief that the majority of clinical thermometers read

too high, and that the real temperature of the human blood is 98°·33, which is his normal state. [On looking at our pocket Immisch thermometer, the red arrow for blood heat points to 98°·2, so, apparently Frenchmen and Englishmen do not differ much. ED. *Met. Mag.*] M. Renou considered that the most accurate mode of taking the temperature of a thermal spring is to place a thermometer in a bottle, sink the whole to the bottom, and after a suitable time to draw all up together. M. Youji-Wada, of Tokio, said that in Japan there was an intimate relation between the temperature of springs and the occurrence of squalls. Dr. Fines called attention to the influence of rain on the temperature and mineralization of some thermal sources. Mr. Symons explained the precautions which he had taken in determining the temperature of Pyrenean springs, and also urged that the verification of thermometers should be put in France as in England, on a commercial footing, so that verified thermometers should be the rule rather than the exception.

There is a very puzzling fact shewn by the reproduced traces of a Richard thermograph, in a paper by Dr. Lalesque, on the climate of Arcachon. Dr. Lalesque notices the fact, but offers no explanation. He gives the curves for 26 days, and on 14 of them the usual fall of temperature from sunset to sunrise is stopped or replaced by a rise between 9 p.m. and midnight. The author states that he has a Montsouris thermometer stand, and speaks much of the verification of his instruments. We can hardly doubt that the thermograph was on this stand, but if so, and suitably distant from buildings, the rise in question is a perfect mystery.

Dr. Gandy in a paper on the Climatology of the S.W. of France, tells us that as the result of the discussions at the Biarritz meeting, M. Henri Léon, of Bayonne, has established a fortnightly *Bulletin de Climatologie*, which gives the records at several stations between Arcachon and Bagnères de Bigorre. We have not yet seen that periodical, and we think that either through the printing of some extra copies of it, or by the insertion of abstracts of the records in the *Annuaire* of the *Soc. Met. de France*, the results ought to be generally accessible.

M. Mendez Guerreiro of Villa Fernando, Portugal, stated that having been charged with the establishment of a reformatory school in a marshy district, where the daily range of the thermometer was sometimes 54° F., he had planted 100,000 eucalypti, dried the marsh, equalized the rivers and brought the extreme daily range down to 32° F.

One would much like the details of this remarkable case—including evidence that the climatic conditions over that part of Portugal were identical at the two times—*i.e.*, that the difference between 54° and 32°, was really wholly due to the planting.

The volume closes with a paper on a Programme of a course of Lectures on Climatology, by M. Georges Lemoine, concerning which

we need say only that it is worthy of the author and of the attention of all who intend to treat the subject either in a volume or in lectures. There are two points upon which we should be glad of enlightenment.—(1). What experience induces M. Lemoine to recommend the Piche evaporator? (2). Where is it possible to procure one of the books recommended for study, viz., *Cours de météorologie*, by M. Millot?

Weather Forecasting for the British Islands, by means of a barometer, the direction and force of the wind, and cirrus clouds. By CAPT. H. TOYNBEE, F.R.A.S., F.R.Met.Soc., late Marine Superintendent, Meterological Office. London: Stanford, 1890. sm. 8vo., iv. 36 pages and 8 plates.

FROM the preface to this little book, we learn that after Captain Toynbee's retirement from the superintendence of the marine department of the meteorological office, the Meteorological Council requested him to go on tours round parts of our coasts, and give lectures to the seamen on storms and how to avoid them. We are not sure that the Council ever expended money more wisely. Captain Toynbee's life-long experience, his kindliness and his earnest desire to do good, would give him a hold upon his audiences such as few men could obtain, and when he had secured their attention, instead of frightening them, or sending them to sleep by abstruse technicalities, we have no doubt that many a bright story from his own experience would be brought in to fix the lessons he had to teach.

This little book seems to be one or more of the lectures written out for publication, and therefore, perhaps rather stiffer and less homely than as verbally delivered. But it is very unpretentious and practical, admirably suited for beginners, while those who know everything in it are not numerous enough seriously to affect its circulation.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, JAN., 1890.

STATIONS. (*Those in italics are South of the Equator.*)	Absolute. Maximum. Temp.	Absolute. Maximum. Date.	Absolute. Minimum. Temp.	Absolute. Minimum. Date.	Average. Max.	Average. Min.	Average. Dew Point.	Average. Humidity.	Absolute. Max. in Sun.	Absolute. Min. on Grass.	Total Rain. Depth.	Total Rain. Days.	Aver. Cloud.
	°		°		°	°	°	0-100	°	°	inches		0-10
England, London	55·6	25	26·1	2	48·9	37·9	40·1	87	83·1	18·3	2·46	21	7·4
Malta	67·5	26	46·2	16	61·4	52·2	48·6	80	117·1	39·3	1·32	8	4·9
Cape of Good Hope	92·0	7	53 0	15*a*	77·7	59·6	...	...	...	...	·44	...	2·8
Mauritius	84·4	15	69·0		82·4	72·7	68·6	77	139·5	61·2	5·01	16	6·1
Calcutta	81·7	24	47·6	28	77·0	56·5	57·2	74	135·5	38·6	·77	1	8·2
Bombay	89·5	14	65·6	22*b*	84·7	68·6	63·4	65	135·9	50·5	·00	...	0·4
Ceylon, Colombo	91·4	10	66·0	25	86·9	71·1	67·2	71	151·0	58·0	·81	6	3·8
Melbourne	101·5	25	47·9	8	83·8	60·4	57·2	63	156·5	38·0	1·37	7	4·3
Adelaide	105·0	18	54·7	4	91·4	68·0	55·3	42	163·9	43·7	·62	10	3·1
Wellington	80·0	8	44·0	14	68·5	52·4	48·7	66	138·0	37·0	3·25	9	3·8
Auckland	...	...	...	...	...	...	...	...	...	...	...	...	...
Jamaica, Kingston	90·9	2, 12	62·0	14	88·9	64·5	65·8	72	...	...	·34	...	...
Trinidad	87·0	var.	64·0	16	84·3	68·8	69 7	80	158·0	...	7·76	22	...
Toronto	53·9	6	6·4	11	36·9	22·3	25·7	83	...	4·0	3·36	21	8·1
New Brunswick, Fredericton	51·8	2	—24·0	10	23·4	— 0·5	11·8	80	...	...	3·21	17	5·0
Manitoba, Winnipeg	26·4	28	—39·4	17	—2·9	—22·3	—9·0	98	...	...	·51	10	4·6
British Columbia, Victoria	47·0	27	12·0	15	37·5	27·3	...	...	...	...	3·96	15	...

a And 28. *b* And 27.

REMARKS, JANUARY, 1890.

MALTA.—Mean temp. 56°·0; mean hourly velocity of wind 11·3 miles. Sea temp. fell from 61°·0 to 60°·0. TS with H on 13th. Pressure unusually steady, and temp. much above the average. J. SCOLES.

Mauritius.—Mean temp. of air 1°·5, dew point 1°·2, and R 1·99 in., below their respective averages. Mean hourly velocity of wind 10·6 miles, or 0·6 below average; extremes, 25·3 on 20th, and 2·0 on 10th; prevailing direction, E.S.E. to E. by N. L on 15th, T and L on 17th and 18th, and T on 20th and 31st.—C. MELDRUM, F.R.S.

CEYLON, COLOMBO.—L seen on the night of the 31st. J. C. H. CLARKE, Lt. Col. R.E.

Melbourne.—Mean temp. of air 5°·3, and of dew point 4°·3 above, humidity ·01, of cloud 0·9, and of R ·42 in., below their respective averages. Prevailing wind S., strong on 6th from S., and on 9th and 21st from N., and on 29th, 30th, and 31st from S.E. and E. TS on 3 days, L on 2 days. Weather sultry and oppressive almost throughout the month. R. L. J. ELLERY, F.R.S.

Adelaide.—A most disagreeable month. Mean pressure about the average, but the mean temp. 5°·1 above previous 33 years, and greatest on record since 1858. No very hot days, but excessively humid. C. TODD, F.R.S.

Wellington.—Fine early part of the month; heavy R on the night of the 7th, and continued showery for some days; fine during latter part of the month, and very warm at times. Prevailing N.W. wind, and occasionally strong; on the whole a fine month. R. B. GORE.

TRINIDAD.—The R for January is 5·15 in. above the 25 years' average. J. H. HART.

SUPPLEMENTARY TABLE OF RAINFALL, JULY, 1890.

[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 Hall.	3·54	XI.	Castle Malgwyn	2·94
,,	Margate, Birchington...	3·62	,,	Builth(LlanwrtydWells)	4·92
,,	Littlehampton	2·97	,,	Rhayader, Nantgwillt..	2·79
,,	Hailsham	3·07	,,	Carno, Tybrith	2·40
,,	Ryde, Thornbrough	3·78	,,	Corwen, Rhug	2·64
,,	Alton, Ashdell.....	3·31	,,	I. of Man, Douglas	2·54
III.	Oxford, Magdalen Col...	2·96	XII.	Stoneykirk, Ardwell Ho.	2·84
,,	Banbury, Bloxham	2·76	,,	New Galloway, Glenlee	3·81
,,	Northampton	2·96	,,	Melrose, Abbey Gate...	2·82
,,	Cambridge, Fulbourne..	4·87	XIII.	N. Esk Res. [Penicuick]	5·15
,,	Wisbech, Bank House..	2·56	XIV.	Ballantrae, Glendrishaig	2·79
IV.	Southend	2·83	,,	Glasgow, Queen's Park.	4·33
,,	Harlow, Sheering	...	XV.	Islay, Gruinart School..	3·58
,,	Rendlesham Hall	4·91	XVI.	Dollar.....	3·51
,,	Diss	3·43	,,	Balquhidder, Stronvar..	5·15
,,	Swaffham	4·11	,,	Coupar Angus Station..	3·38
V.	Salisbury, Alderbury...	3·60	,,	Dunkeld, Inver Braan..	3·83
,,	Warminster	3·50	,,	Dalnaspidal H.R.S. ...	4·68
,,	Bishop's Cannings	3·44	XVII.	Keith H.R.S.	3·94
,,	Ashburton, Holne Vic....	4·26	,,	Forres H.R.S.	3·88
,,	Hatherleigh, Winsford.	...	XVIII.	Fearn, Lower Pitkerrie.	..
,,	Lynmouth, Glenthorne.	2·87	,,	Loch Shiel, Glenaladale	9·73
,,	Probus, Lamellyn	3·75	,,	N. Uist. Loch Maddy ...	4·93
,,	Launceston, S. Petherwin	3·73	,,	Invergarry	5·63
,,	Wincanton, Stowell Rec.	3·32	,,	Aviemore H.R.S.	3·32
,,	Taunton, Lydeard Ho...	...	,,	Loch Ness, Drumnadrochit	3·09
,,	Wells, Westbury.....	4·46	XIX.	Lairg H.R.S.	...
VI.	Bristol, Clifton	3·41	,,	Scourie	4·30
,,	Ross	3·33	,,	Watten H.R.S.	3·79
,,	Wem, Clive Vicarage ...	3·20	XX.	Dunmanway, Coolkelure	5·09
,,	Cheadle, The Heath Ho.	2·68	,,	Fermoy, Gas Works ...	2·42
,,	Worcester, Diglis Lock	1·91	,,	Tipperary, Henry Street	2·10
,,	Coventry, Coundon	2·21	,,	Limerick, Kilcornan ...	2·30
VII.	Ketton Hall [Stamford]	2·65	,,	Miltown Malbay..	4·49
,,	Grantham, Stainby	2·31	XXI.	Gorey, Courtown House	1·70
,,	Horncastle, Bucknall ...	2·04	,,	Navan, Balrath	2·02
,,	Worksop(Hodsock Priory)	2·12	,,	Mullingar, Belvedere ...	2·67
VIII.	Neston, Hinderton	2·10	,,	Athlone, Twyford	2·69
,,	Knutsford, Heathside ...	2·33	,,	Longford, Currygrane...	2·95
,,	Lancaster, South Road.	3·87	XXII.	Galway, Queen's Coll...	3·29
,,	Broughton-in-Furness ..	5·29	,,	Clifden, Kylemore	5·89
IX.	Wakefield Prison	1·89	,,	Crossmolina, Enniscoe..	3·38
,,	Ripon, Mickley	1·17	,,	Collooney, Markree Obs.	3·77
,,	Scarborough, West Bank	1·65	,,	Ballinamore, Lawderdale	...
,,	East Layton[Darlington]	2·70	XXIII.	Warrenpoint	3·02
,,	Middleton, Mickleton..	1·37	,,	Seaforde	2·35
X.	Haltwhistle, Unthank..	2·14	,,	Belfast, New Barnsley..	2·59
,,	Shap, Copy Hill	4·07	,,	Bushmills, Dundarave...	...
XI.	Llanfrechfa Grange	3·32	,,	Stewartstown	1·96
,,	Llandovery	4·57		Buncrana	3·78

JULY, 1890.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average. 1880–9	Greatest Fall in 24 hours. Dpth	Date.	Days on which ·01 or more fell.	TEMPERATURE Max. Deg.	Max. Date	Min. Deg.	Min. Date	No. of Nights below 32° In shade.	On grass.
			inches	inches.	in.								
I.	ENGLAND.	London (Camden Square) ...	4·20	+ 1·52	1·67	17	14	76·2	23*a*	45·1	4	0	0
II.		Maidstone (Hunton Court)...	3·53	+ 1·35	1·85	4	16	...	...	...	...	...	...
,,		Strathfield Turgiss	3·44	+ 1·05	1·73	17	19	77·6	23	41·9	4	0	1
III.		Hitchin	4·11	+ 1·39	1·88	17	19	73·0	23	44·0	11	0	...
,,		Winslow (Addington)	4·56	+ 1·27	2·20	17	21	76·0	13*b*	42·0	4*f*	0	...
IV.		Bury St. Edmunds (Westley)	5·35	+ 2·78	2·70	17	17	...	...	...	...	...	...
,,		Norwich (Cossey)	...	...	...	...	...	...	...	...	...	...	...
V.		Weymouth(LangtonHerring)	2·66	+ ·51	·61	7	19	73·0	26	46·0	4, 6	0	...
,,		Barnstaple	2·73	— ·74	·74	16	13	70·0	31	43·0	10*g*	0	..
,,		Bodmin (Fore Street)	5·07	+ ·46	1·46	16	23	...	...	...	...	...	...
VI.		Stroud (Upfield)	2·84	— ·73	·72	17	17	79·0	23	45·0	6	0	...
,,		ChurchStretton(Woolstaston)	2·10	— ·87	·43	16	22	70·0	22	44·0	12	0	...
,,		Tenbury (Orleton)	2·50	— ·36	·60	16	19	75·0	13*b*	38·0	4	0	0
VII.		Leicester (Barkby)	2·50	— ·49	·63	2	21	79·0	13	40·0	9, 11	0	...
,,		Boston	1·60	— 1·19	·33	18	16	81·0	17	41·0	6	0	...
,,		Hesley Hall [Tickhill].....	1·90	— ·77	·35	18	16	75·0	16	43·0	12	0	...
VIII.		Manchester(PlymouthGrove)	2·63	— 1·16	·39	25	16	76·0	16	43·0	11	0	...
IX.		Wetherby (Ribston Hall) ...	1·32	— 1·86	·56	16	8	...	...	...	...	...	...
,,		Skipton (Arncliffe)	5·16	— ·48	·69	7	24	76·0	20	40·0	11	0	...
,,		Hull (People's Park)	1·57	— 1·02	·28	23	15	...	...	...	...	...	...
X.		North Shields	1·43	— 1·96	·50	2	15	74·5	30	..	...	0	...
,,		Borrowdale (Seathwaite).....	13·43	+ 2·44	2·14	29	22	...	...	...	...	...	...
XI.	WALES.	Cardiff (Ely).....	3·47	— ·59	·80	7	19	...	...	...	...	...	...
,,		Haverfordwest	4·15	— ·06	1·05	7	19	70·0	21	40·5	9	0	...
,,		Plinlimmon (Cwmsymlog) ...	5·81	...	·91	30	20	...	...	...	...	...	...
,,		Llandudno.....	1·64	— 1·36	·25	25	14	69·2	13*c*	45·0	12	0	...
XII.	SCOTLAND.	Cargen [Dumfries]	3·23	— ·70	·56	7	19	69·6	21	41·0	11	0	...
,,		Jedburgh (Sunnyside).....	2·23	— 1·21	·62	7	17	71·0	21	39·0	20	0	...
XIV.		Old Cumnock	4·36	+ ·84	·63	14	23	73·0	13	36·0	10	0	...
XV.		Lochgilphead (Kilmory).....	4·59	+ ·29	·63	13	21	...	...	..	...	...	...
,,		Oban (Craigvarren)	6·07	...	2·47	13	19	65·2	2	43·3	8	0	...
,,		Mull (Quinish).....	6·05	+ 2·00	·79	13	25	...	...	...	...	...	...
XVI.		Loch Leven Sluices	3·20	— ·42	1·00	8	14	...	...	...	...	...	...
,,		Dundee (Eastern Necropolis)	3·25	— ·21	·95	7	17	77·6	21	43·2	10	0	...
XVII.		Braemar	3·35	+ ·14	1·11	7	22	69·8	21	36·8	26	0	1
,,		Aberdeen (Cranford)	2·42	...	1·12	7	23	74·0	31	40·0	19	0	...
XVIII		Strome Ferry.....	6·94	+ 2·65	·90	12	23	63·0	23	...	...	0	...
,,		Culloden	3·45	+ ·46	1·02	14	...	69·0	20	41·0	16	0	1
XIX.		Dunrobin	2·64	— ·21	·78	12	18	...	..	...	...	...	...
,,		S. Ronaldsay (Roeberry).....	...	...	...	...	...	...	...	...	...	...	...
XX.	IRELAND.	Cork (Blackrock)	2·40	— ·78	·52	7	16	75·0	21	42·0	3	0	...
,,		Dromore Castle	4·99	+ ·01	1·50	30	16	68·0	24	43·0	16	0	...
,,		Waterford (Brook Lodge) ...	2·40	— 1·13	·54	7	17	75·5	21	42·0	10*h*	0	..
,,		O'Briensbridge (Ross)	2·99	...	·65	25	22	76·0	27	44·0	7*i*	0	...
XXI.		Carlow (Browne's Hill)	1·78	— 1·74	·32	7	17	...	...	...	...	...	...
,,		Dublin (FitzWilliam Square)	2·17	— ·51	·38	25	24	72·8	13	44·4	5	0	0
XXII.		Ballinasloe	2·81	— ·74	·62	25	19	67·0	13*d*	37·0	11	0	...
XXIII		Waringstown	2·77	— ·75	·70	16	21	73·0	19*e*	44·0	1, 17	0	...
,,		Londonderry (Creggan Res.).	4·01	— ·11	·65	13	26	..	...	...	...	...	...
,,		Omagh (Edenfel)	2·66	— 1·06	·65	30	24	68·0	13	43·0	10	0	...

a And 24. *b* And 23. *c* And 14. *d* And 31. *e* And 22, 25. *f* And 10, 12. *g* And 12. *h* And 17. *i* And 8, 9.

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

METEOROLOGICAL NOTES ON JULY, 1890.

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.—A very wet month, with a phenomenal downpour on the 17th. This heavy fall laid the wheat extensively, and spoiled much hay. The excessively wet weather brought about the potatoe disease, and in some places the root crops are suffering from excessive R.

ADDINGTON.—Frequent R interrupted hay-making very much. A great quantity of hay was carried away by the large flood, resulting from the heavy R on the 17th. The nights were often very cold, 36° being registered on the grass once, and 37° twice.

BURY ST. EDMUNDS. WESTLEY.—Up to the 19th the weather was cold and very wet. The 2·70 in. recorded on 17th is the greatest fall registered in 24 hours since 1856, when observations commenced. The last part of the month was favourable for the corn crops, and helped them to recover from some of the damage caused by the exceptional R. Distant T on the 2nd.

LANGTON HERRING.—Another cold month, the weather throughout being very unsettled. On the 17th (the day of heavy R), only ·21 in. fell here. The mean temp. at 9 a m., 59°·9, was 3°·4 below the average, and the lowest in July for 19 years, with the exception of 1879. At 9 a.m. on 5th the temp. was only 52°, the lowest 9 a.m. reading in July for 19 years. Fog on several days.

BODMIN, FORE STREET.—A very wet, cold, and unseasonable month. T, L and heavy R on 16th.

WOOLSTASTON.—A dreary month, with cold nights and constant R, though there were no very heavy falls; most unfavourable for the hay crop, which was generally harvested in a damaged condition. Mean temp. 56°·9.

ORLETON.—The first 12 days very cold, the max. on no day reaching 70°, but the remainder of the month much warmer, there being only four days with a max. under 70°. Mean for the month about 1° below the average. The R again slightly below the average, making six months in succession with less than an average fall. T heard only on the 2nd. [In the table for June, the difference from the average should have been —·68 in. not + ·68 in.]

LEICESTER, BARKBY.—"Catchy" weather for hay-getting. Crops rather light. Not much sunshine. L and T on the 2nd. T on 3rd.

HULL.—The weather during the month was rather showery, with a great amount of cloud, and sometimes with strong winds.

WALES.

HAVERFORDWEST.—The first week was cold and gloomy with strong gales, ending with a heavy fall of R; the second week was milder, but constantly wet and damp with a fine day in between, so it continued up to the 21st; from that to the 24th the weather improved considerably, warmer days and warm nights, with several hours of bright sunshine. Up to the 28th the weather continued tolerably fine, from that to the end very wet weather prevailed, with warm days and nights. The temp. of the month was below the average, and only once reached 70°. The potatoes are rotting extensively. Corn crops likely to be light in grain from the great absence of heat and sunlight. Hay harvesting late and precarious. Prevailing winds W., S.S.W., and N.W. There were 17 nights with the temp. below 50°, ten were at or below 45°.

SCOTLAND.

CARGEN.—The mean temp. of the month 56°·2 is 3°·1 below the average. With the exceptions of 1888 and 1862, it is the lowest for July during 30 years. The first part of the month was unusually inclement, the mean temp. of the

first 12 days being only 54°. The max. temp. never reached 70°, which with the exception of 1862, has not occurred before in July. The atmosphere throughout was highly charged with moisture, the hygrometer showing a mean difference between the dry and wet bulbs of only 1°·7, the average difference being 2°·6. There was no day on which sunshine did not occur for one or more hours, but the total number of hours is 55 hours below the average. T on the 2nd, 3rd and 4th, and H showers on 3rd.

JEDBURGH.—The temp. was below the average, still vegetation went on well. Crops of all kinds being in fair condition and promising an abundant yield Health of the district very good.

CULLODEN.—Sunshine deficient, the hay crop suffering from the heavy rains, and harvest must be late.

IRELAND.

CORK.—Very changeable throughout, with cold winds and absence of sunshine. Mean temp. 59°·6, 2°·6 below the average of 14 years.

DROMORE.—A wet month, with very little summer weather. Very little prospect of turf fuel being got dry this year.

WATERFORD, BROOK LODGE.—The weather very broken all the month, and the temp. very low; mean 57°·5.

ROSS, O'BRIENSBRIDGE.—Very little sunshine, and vapour and fog even on days when no R fell. A bad month for hay.

DUBLIN.—A very unsettled, squally, showery, cool month. Rainfall, although frequent, perceptibly below the average.

OMAGH, EDENFEL.—Notwithstanding that R fell on 24 days, and that there was not a true "summer's day" during the month, the total fall is considerably under the average. A heavy crop of hay has been well saved, and all other crops promise great abundance.

PROF. HAZEN'S TABLES.

To the Editor of the Meteorological Magazine.

SIR,—I have been pleased at the kindly notice of my meteorological tables in the July number of this magazine. My agents in London are the well-known firm of W. Wesley, of Essex Street, Strand, and Hirschfeld Bros., from either of whom the book may be purchased.

As to rainfall conversions, I am inclined to think the table as given is more satisfactory than any table for single millimetres. It is a very simple matter, and very often more expeditious to work from the body of the table to the margin than *vice versâ*. I will give a few examples. To convert millimetres to inches between 1 and 400, enter body of Table xxxi. for mms. and the inches will be found in the margin, *e.g.*, 114 mm. = 4·49 in. : 2,563 mm. = 100·9 in. : 8,103 mm. = 319·0 in., &c. To convert inches to millimetres for values above 32 in., move the decimal point one place to the right in Table xxxi., *e.g.*, 38·6 in. = 980·4 mm. : 319·9 in. = 8,125·4 mm., &c. The same plan of use will help us in getting feet into metres, and kilometres into miles.

H. A. HAZEN.

July 29th, 1890.

[Prof. Hazen is fully entitled to express his opinion, but we retain our own; if tables are so handy when used in the reverse direction, it is not obvious why any are given both ways.—ED. *M.M.*]