

SYMONS'S  
MONTHLY  
METEOROLOGICAL MAGAZINE.

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CCLXX.]

JULY, 1888.

[PRICE FOURPENCE,  
or 5s. per ann. post free.]

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RAINFALL OF SPAIN AND PORTUGAL.\*

PERHAPS there is climatic reason for it, but at any rate the fact is noteworthy, that the first general treatise on the amount of cloud in the Peninsula, and the first general treatise on its rainfall, are due not to a Spaniard, not to a Portuguese, but to a German. Dr. Hellmann has such a capacity for work that we should not be much surprised to receive some morning a complete treatise on the Climate of English Health Resorts, with descriptions of all the instruments used, and biographies of the observers, all worked up in Berlin.

The present is not Dr. Hellmann's first paper on Peninsula rainfall. He wrote a short one in Spanish ("Distribucion de la lluvia en la Peninsula Ibérica") in 1887, but the present is a really complete treatise.

Rainfall observations, though commenced in England in 1677, and at Paris Observatory in June, 1688, do not seem to have been made either in Spain or Portugal until nearly a century later, and then they were very fragmentary. Dr. Hellmann can, therefore, give nothing for the 17th century, and only two records, one for four years (1783-86, at Mafra, near Lisbon), and one for two years (1785-86, at Lisbon), for the 18th century.

The years 1816 and 1817 are noteworthy in rainfall annals, as those for which the outrageously erroneous observations were published for Coimbra, in the valley of Mondego, which has really a rainfall of 35 inches, was variously reported to have a mean rainfall of 224 or of 119 inches. In Symons's "Rain, How, When, Where, and Why," published in 1867, this value is marked with a query, though further on, in the same work, it is apparently supposed to be correct. However, Dr. Hellmann shows that even up to 1883 the 13th edition of Brockhaus's "Konvers-Lexicon" perpetuates the error, whereby this pleasant little town has the unjust reputation of being the wettest place in Europe. But what with the Peninsular War and other subsequent political troubles, the final result is that

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\* Die Regenverhältnisse der Iberischen halbinsel, von G. Hellmann. [Excerpt Zeits. der Gesell. für Erdkunde zu Berlin]. Berlin: W. Pormetter. 1888. Svo. 98 pages, 1 coloured map.

there are only two records which extend back beyond 1850, and they only go to 1836 and to 1837 respectively—and one of them ceased in 1864. How scanty is, therefore, the information as regards the secular variation of rainfall in Spain and Portugal as compared with their nearest neighbour, France, or with Germany, or the British Isles, need not be pointed out. One register, Lisbon, is continuous for 49 years, one other reaches 35 years, and there are 26 each extending from 16 to 29 years, so that by differentiating from these Dr. Hellmann has been able to compute fairly trustworthy means for 76 stations. He points out, however, what must not be forgotten, that most rain gauges in these countries are from 15 to 60 feet above the ground, and therefore the mean values are too small. As, however, his table of mean annual rainfall is undoubtedly by far the best yet given, we append a conversion and translation of it:—

*Mean and Extremes of Rainfall in Spain and Portugal.*

PROVINCE— Station.	Altitude. feet.	Years of Observation.	Mean. in.	YEARLY Max. in.	RAINFALL. min. in.	Ratio, M m
<b>BASQUE AND ASTURIA—</b>						
San Sebastian .....	82	... 5	53·0	...	—	—
Vergara .....	551	... 7	51·1	...	—	—
Orduña .....	994	... 1	28·8	...	—	—
Bilbao .....	52	... 25	47·0	53·5	35·4	1·5
Santander .....	33	... 5	34·0	...	—	—
Oviedo .....	738	... 30	35·1(?)	...	—	—
<b>GALICIA—</b>						
La Coruña.....	82	... 6	34·0	...	—	—
Santiago .....	863	... 25	64·8	92·0	37·1	2·5
Orense .....	472	... 13	38·0	55·6	27·3	2·0
Pontevedra .....	39	... 2	64·6	...	—	—
La Guardia .....	26	... 2	55·7	...	—	—
<b>PORTUGAL—</b>						
Montalegre .....	3182	... 4	54·5	...	—	—
Porto .....	328	... 20	52·6	80·3	31·9	2·5
Moncorvo .....	1362	... 6	25·9	...	—	—
Guarda .....	3409	... 20	38·0	64·8	23·1	2·8
Vizéu .....	1621	... 4	61·9	...	—	—
Serra da Estrella ...	4728	... 5	137·8	...	—	—
Coimbra.....	463	... 20	35·3	52·8	20·0	2·6
Mafra .....	771	... 4	37·2	...	—	—
Lissabon .....	295	... 29	29·3	45·1	17·3	2·6
Campo Maior .....	945	... 19	21·9	34·9	11·9	2·9
Evora.....	1027	... 13	24·1	37·3	13·7	2·7
Lágos.....	43	... 16	20·3	30·9	12·6	2·5
<b>ANDALUSIA—</b>						
San Fernando .....	95	... 35	28·6	50·0	11·9	4·2
Tarifa.....	46	... 16	26·4	48·1	14·3	3·4
Tanger (Africa) ...	33	... 6	28·0	...	—	—
Gibraltar .....	49	... 16	29·8	...	—	—
Málaga .....	75	... 6	24·3	...	—	—
Archidona .....	2165	... 1	15·9	...	—	—
Sevilla .....	98	... 21	16·1	34·6	6·3	5·5
Jáen .....	1926	... 13	25·7	46·7	16·9	2·8
Granada .....	2198	... 22	22·1	48·5	12·3	3·9

MURCIA AND VALENCIA—

Cartagena .....	20	...	3	...	13·6	...	—	...	—	...	—
Murcia .....	138	...	20	...	13·3	...	22·6	...	7·6	...	3·0
Alicante .....	13	...	22	...	16·0	...	26·6	...	7·2	...	3·7
Yecla .....	1969	...	1	...	13·8	...	—	...	—	...	—
Albacete .....	2251	...	17	...	13·3	...	22·0	...	7·0	...	3·1
Carcagente .....	98(?)	...	28	...	22·7	...	—	...	—	...	—
Valencia .....	59	...	22	...	15·9	...	28·2	...	7·0	...	4·0
Palma (Mallorca)...	66	...	18	...	17·4	...	24·1	...	9·4	...	2·6
Mahon (Menorca)...	33(?)	...	5	...	27·2	...	—	...	—	...	—

CATALONIA—

Barcelona .....	69	...	21	...	22·4	...	38·5	...	10·7	...	3·6
Igualada .....	1017	...	2	...	20·0	...	—	...	—	...	—
Lérida .....	492	...	2	...	10·7	...	—	...	—	...	—
Balaguer .....	755	...	3	...	15·7	...	—	...	—	...	—
Berga.....	2362	...	1	...	36·1	...	—	...	—	...	—
Olot .....	994	...	2	...	40·3	...	—	...	—	...	—

ARAGON AND NAVARRE—

Teruel .....	3005	...	5	...	15·1	...	—	...	—	...	—
Molina de Aragon..	3465	...	2	...	19·7	...	—	...	—	...	—
Zaragoza .....	656	...	22	...	13·0	...	22·2	...	8·5	...	2·6
Barbastro .....	1037	...	2	...	17·7	...	—	...	—	...	—
Huesca .....	1598	...	20	...	22·1	...	33·8	...	13·6	...	2·5
Jaca .....	2690(?)	...	1	...	27·2	...	—	...	—	...	—
Logroño.....	1220	...	2	...	15·4	...	—	...	—	...	—
Pamplona .....	1532	...	2	...	25·4	...	—	...	—	...	—

OLD CASTILE AND LEON—

Oña.....	1906	...	1	...	19·1	...	—	...	—	...	—
Búrgos .....	2822	...	21	...	21·5	...	30·6	...	12·6	...	2·4
Soria .....	3504	...	18	...	25·7	...	34·2	...	16·8	...	2·0
Valladolid.....	2346	...	22	...	12·7	...	17·4	...	5·6	...	3·1
Palencia .....	2461	...	1	...	15·7	...	—	...	—	...	—
Leon .....	2789	...	6	...	16·7	...	—	...	—	...	—
Salamanca .....	2671	...	21	...	10·8	...	14·6	...	4·9	...	3·0
Segovia .....	3297	...	2	...	19·3	...	—	...	—	...	—
'Avila.....	3609	...	1	...	23·1	...	—	...	—	...	—

NEW CASTILE AND ESTRAMADURA—

El Escorial .....	3018	...	4	...	27·0	...	—	...	—	...	—
Madrid... ..	2149	...	29	...	14·9	...	23·2	...	9·1	...	2·6
Villaviciosa .....	2185	...	9	...	14·1	...	—	...	—	...	—
Guadalajara .....	2231	...	3	...	12·2	...	—	...	—	...	—
Ciudad Real .....	2247	...	10	...	15·9	...	26·2	...	12·1	...	2·2
Cáceres .....	1148	...	1	...	22·8	...	—	...	—	...	—
Badajoz .....	561	...	15	...	14·0	...	23·6	...	5·1	...	4·6
Valdesevilla.....	912	...	2	...	10·2?	...	—	...	—	...	—

We have, therefore, Castille, Murcia and Valencia, with the small rainfall of less than 16 in., and the smallest fall of all (11 in.) at Salamanca. There are three areas of heavy fall. (1.) In the Mountains of Serra d'Estrella (138 in.). (2.) About 60 in. near Cape Finistere. (3.) About the same amount on the S.W. slopes of the Pyrenees. Dr. Hellmann gives reasons for believing the astonishing records from Serra d'Estrella, but until we hear positive details respecting the gauge, and that there has been no muddle in the size

of the measuring glass (as at Stornoway), we are rather afraid that it may turn out another Coimbra. Is it not curious that it is reported to be twice as great as at any station either in the Galician Mountains or in the Pyrenees ?

The author then gives a table of the mean monthly fall, which brings out very prominently the excessive drought of the Spanish summers. There are twelve stations at which the mean yearly fall in July or August, is less than  $\frac{1}{4}$  in. ; at Badajoz, the mean amounts are June 0.32, July 0.20, August 0.12. Dr. Hellmann describes so well the effects of these droughts when vegetation withers beneath a burning sun in a cloudless sky, and everything is covered with thick white dust, that he must surely have had personal experience of the weary waiting for the first of the autumn rains.

*(To be continued.)*

## WATERSPOUTS IN THE EAST RIDING OF YORKSHIRE.

### A VILLAGE INUNDATED AND CROPS DESTROYED.

About one o'clock on Saturday afternoon, June 9th, whilst a party of engineers (forming the Government survey for Yorkshire) were out in the neighbourhood of Langtoft, about eight miles N. of Driffield, they observed what appeared to be a dense cloud of smoke approaching from the sea. Driven furiously by the wind, it suddenly burst close to the village, and appeared to sweep everything before it. The water was observed rolling down the hill into the village like a dark brown wall, and many of the people were seized with panic. It was the villagers' dinner-hour, and some having their doors open, the flood rushed in, and in a moment, almost, the cottages were deep in water, the smaller articles of furniture being set afloat and swept out of the rooms. The flood came in such swirling force that many people were obliged to hold by the doors or something firm to prevent their being carried away. Great alarm was occasioned amongst the inhabitants, as the place was quickly flooded, the women and children having to seek refuge from the in-rushing waters in the upper rooms of their houses, which were three and four feet deep at the base.

The waterspout caused immense destruction to the field where it fell, ploughing three huge holes seven feet deep, and denuding this and other fields of nearly all the surface soil. The farms of Messrs. Savile, Featherstone, Wilson, and Shipley suffered most ; seven acres of turnips in one case were washed away, and cereal crops were also largely spoilt. Hundreds of tons of soil, boulders, and gravel are said to have been rooted up and carried down with the flood, strewing the village streets and the highways in their progress with an admixture of these substances. Much land was completely bared to the rock and will be a great loss to the occupiers. A field gate

was washed away and travelled a distance of over a hundred yards before its progress was stopped at a bridge. The villagers' gardens are in some instances wasted by the washing away of soil, and the produce and seedlings were also destroyed. A grass field in the occupation of Mr. Sharp may now be seen covered with a deposit of soil by the action of the waterspout, and it will not be of much service this year.

The Rev. T. D. Speck, Vicar of Langtoft, stated that he tasted the flood water and found it salt, so that it would appear to have come from the sea, which is probably fifteen miles distant from the village ; or the salt taste may be accounted for by the fact that one of the damaged fields had recently been covered with coarse salt manure.

When the flood subsided towards Saturday night, it was necessary to clear the streets of the deposited mud and stones. Some of the boulders found in the streets weighed several stones each, and had been carried a long distance.

There was a similar flood some 30 years ago, but it did not cause anything like so much destruction as this has done.

Another, nearly simultaneous, destructive waterspout is reported from the same district, the locality being seven miles S.W. from Langtoft, where the one above reported caused so much damage, namely, at Towthorpe, near Fimber, on the Malton and Driffield Railway. The area of destruction was more confined than in the Langtoft waterspout, this descended with great force upon a field of turnips on the farm of Mr. Farthing, the result being total destruction of the crop, and the laying bare of the field to the chalk rock. The waterspout also washed up the posts and rails (along with soil) forming part of the fencing, drove the water out of the ponds and filled them up with the soil it had carried from the field. The weight of water also forced large holes in the field, as at Langtoft. The damage will be very considerable, and the field will be valueless except for chalk. The waterspout fell about the same time as at Langtoft—between noon and one o'clock—and is described as of a conical shape, or as an eye-witness graphically put it, "Like Sir Tatton Sykes's monument coming down the wrong way up."

Further information from reliable sources (whilst confirming the particulars already published) is to the effect that the phenomenon was observed by numbers of persons in the neighbourhood of Cottam, Sledmere, and Langtoft, and is described as being of large proportions. The column of water presented in the distance the appearance of smoke ; it passed through the air at a great rate, and whilst it drifted along appeared to ascend and descend at short intervals. Until the news of its destructive character had been made known there was, however, no idea in the minds of those who witnessed it that the phenomenon was a waterspout. The flood came down the village without a moment's warning, and exclamations were heard " Oh, here's a flood coming ! "

The streets of Langtoft are still in a sorry plight with the deposited mud, and men have been employed every day clearing them.—  
*Driffield Observer, June 16th.*

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### ROYAL METEOROLOGICAL SOCIETY.

The concluding meeting of this society for the present session was held on June 20th, at the Institution of Civil Engineers, 25, Great George-street, Westminster, Dr. W. Marcet, F.R.S., President, in the chair.

Mr. F. de B. Collenette, L.R.C.P., M.R.C.S., Mr. J. Ewart, M.R.C.S., Mr. F. A. Velschow and Mr. J. T. Wills, F.R.G.S., were elected Fellows of the society.

The following papers were read :—

1. "First Report of the Thunderstorm Committee." (See notice under the title "Brontology.")

2. "The Cold Period from September, 1887, to May, 1888," by Mr. C. Harding, F.R.Met.Soc. The mean temperature for each of the nine months from September, 1887, to May, 1888, was below the average, while for October there has been no corresponding month as cold during the last half century, and there have been only three colder Aprils. In London the mean temperature for the period was only 42°·4, and there has been no similarly low mean for the corresponding period since 1854-5, which will be remembered as the time of the Crimean War, and only three equally cold periods during the last fifty years. The temperature of the soil at Greenwich at 3 ft. below the surface was below the average in each month from October to April; in October and April the temperature at this depth was the coldest on record, observations being available for the last forty-two years, and in November it was the coldest for thirty-seven years.

3. "Observations on Cloud Movements near the Equator, and on the General Character of the Weather in the 'Doldrums,'" by Hon. R. Abercromby, F.R.Met.Soc. The author gives the results of observations made during four voyages across the equator and the "Doldrums," with special reference to the motion of clouds at various levels. Two voyages were across the Indian Ocean during the season of the North-west Monsoon, and two across the Atlantic in the months of July and December. The nature of the general circulation of the atmosphere near the "Doldrums" is discussed as regards the theory that the Trades, after meeting, rise and fall back on themselves; or, according to the suggestion of Maury, that the Trades interlace and cross the Equator; or as following the analogy of Dr. Vettin's experiment on smoke. It is shown that the materials at present available are insufficient to form a definite conclusion; but details are given of the general character of the weather, and of the squalls in the "Doldrums," with a view of showing what kind of

observations is required to solve this important problem. The old idea of a deep trade—with a high opposite current flowing overhead—is certainly erroneous; for there is always a regular vertical succession of the upper currents as we ascend.

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REVIEW.

*Meteorological Tables for West Cornwall and the Scilly Islands for 1887, also additional tables for Falmouth, 1871-85, with notes by W. L. FOX, F.R. Met.Soc. [Reprint from Rep. Roy. Cornwall Polytechnic Soc.]. Lake and Co., Falmouth, 1888. 8vo, 20 pages, 1 table.*

WE are sorry to find that Mr. Fox has given up those observations of sea temperature, which used to add largely to the value of his reports. It is rather curious that in a country surrounded by sea, and dependent on that sea for the habitability of its climate, dependent on the sea for much of its political influence, and much of its wealth, the temperature of that sea is terribly neglected. There is our Government meteorological office with its liberal endowment, and its large staff, spending its time and money over harmonic analysers and hundredths of a Fahrenheit degree of air temperature, and not (as far as we can recollect) publishing any continuous records of sea temperature. However, this rests with the council; it is no business of ours.

Mr. Fox gives the place of honour to his note on the sunshine records, and as 1887 was notable for sunshine, he is doubtless right. He shows that the mean yearly total number of hours was—

Years.....	1881	1882	1883	1884	1885	1886	1887
Hours ...	1847	1730	1615	1535	1605	1539	2074

which shows that 1887 had more than 25 per cent. in excess of the average of the six previous years. They must have had some lovely days in June, 1887, for one of them is reported to have had burning sun during 15 hours 12 minutes, as the day there cannot be much more than 16 hours even on June 21st, the sky must have been absolutely cloudless throughout.

A page or two further on are the details of the storm of March 22nd and 23rd, 1887, and this suggests a query based upon the report by Messrs. Whipple and Dines, at a recent meeting of the Roy. Met. Soc. Mr. Fox, following everybody else, gives the maximum velocity as 61 miles—this is the indication of the Beckley Anemometer reduced with the factor 3; but we now know that this is much too large; if we take it at 2·15, which was we think about the value given in the report just mentioned, the 61 miles an hour comes down to about 44!

With respect to rain he gives for the (15 years) 1872-86, the following values:—Mean 51·24, max. (1872) 64·53 min. (1884), and then adds that the 1887 total was only 29·77, this would bring the 16 years mean down to 49·90, of which the max. 1872, would be 29 per cent. in excess, and the min. 1887, 40 per cent. in defect. No wonder that, as he tells us, the drought greatly inconvenienced the residents of this neighbourhood. There was absolutely no rain for 32 consecutive days.

The pamphlet closes with an interesting and useful series of tables.

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## BRONTOLOGY.

### FIRST REPORT OF THE THUNDERSTORM COMMITTEE.

THE Thunderstorm Committee of the Royal Meteorological Society has issued its first report, and with a promptitude worthy of imitation, has copies ready for sale. As they cost only 1s., and contain four exquisite autotype reproductions of photographs of lightning flashes, we give merely the following epitome of the report and advise those of our readers who are not Fellows of the Society to apply for copies before they are all distributed. The Fellows will eventually get a copy in the *Quarterly Journal*.

This report deals with the photographs of lightning flashes—some sixty in number—which have been received by the Society. From the evidence now obtained, it appears that lightning assumes various typical forms under conditions which are at present unknown. The Committee consider that the lightning flashes may be arranged under the following types:—(1) Stream; (2) sinuous; (3) ramified; (4) meandering; (5) beaded or chapleted; and (6) ribbon lightning. In one of the photographs there is a *dark* flash of the same character as the bright flashes; but the Committee defer offering any explanation of the same until they get further examples of dark flashes.

The Committee appeal strongly for additional photographs to explain how easily they may be obtained.

### ELECTRICITY IN A LIGHTNING FLASH.

W. Kohlrausch (*Electrotechnische Zeitschrift*, March, 1888) has estimated the current and quantity of electricity in a lightning flash. He calculated that it will take 9,200 ampères to melt a copper rod of 2·5 centimètres diameter. Preece's constant (*Proc. R.S.*, March, 1888) makes it 10,244. Such a current concentrated in a flash would contain from 52 to 270 coulombs, which would decompose from 5 to 25 milligrammes of water, and generate from 9 to 47 cubic centimètres of explosive gas ( $H_2 + O$ ). If this energy were stored up and distributed for electric lighting, it would require from 7 to 35 such flashes to keep one glow-lamp alight for an hour.

## THE JUNE THUNDERSTORMS.

We do not know precisely how the Thunderstorm Committee of the Royal Meteorological Society intend to tabulate and publish the information they collect in response to their circular and appeals. We, however, feel so strongly that concentration of energy is imperative, that although we have been favoured with exceptionally full and interesting details of the damage produced by the June thunderstorms, we have sent the whole on to the Committee. It seems to us waste of strength and resources to print it here, and then for the Royal Meteorological Society to reprint it—and it seems better for it to be all in one place, than part here and part in their report. We hope that those who have so kindly forwarded to us valuable information, will approve of the course we have adopted.

## THE HAILSTORMS OF JUNE 25TH.

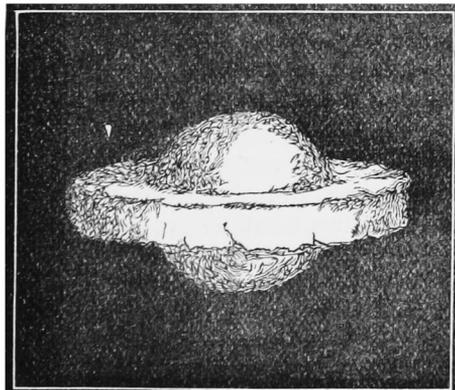
AS explained under the article BRONTOLOGY, we omit here all details of the heavy thunderstorms of June, hoping that they will eventually be published by the Royal Meteorological Society.

That, however, in no way precludes our reporting upon the remarkable hail which fell, and the damage done by it.

We give first two letters, one from the vicinity of Guildford, and one from near Buckingham, and subsequently some shorter notes in illustration and confirmation thereof.

*To the Editor of the Meteorological Magazine.*

SIR,—I have only time to send you the enclosed rough sketch of *Ice Stones* which fell here yesterday afternoon, during one of the heaviest thunderstorms we have had for many years. The sketch



is not an exaggerated one, but for your information. My coachman and gardener went out and gathered up some, and five filled the

gardener's hands. The hail stones were very large and my garden was soon white. The fall of water (rain) was .94 in. in about two hours. There appeared three storms going on at the same time, and we were in the centre. The flashes were most peculiar, two following each other quickly and the thunder at once. The report was like the breaking of a lot of heavy sticks. Damage around, I hear, was great.—Yours sincerely,

E. W. MATHEW.

*Wern, Guildford, 26th June, 1888.*

*To the Editor of the Meteorological Magazine.*

SIR,—Late at night though it is, I must tell you what a very destructive hail storm has passed over North Bucks, but which fortunately did not touch us at all. The day has been extremely hot (max. 82°). It began to thunder between one and two o'clock. When standing in the park just after two o'clock, I heard a wonderful and continuous rushing sound to the north, passing from east to west, the clouds of an inky blackness. I observed to those near me that there must be a heavy hail storm passing in that direction. The sound lasted for a quarter of an hour or twenty minutes and then died away; we had not a drop of rain nor any hail. This evening I took a walk into the course of the storm, and I never saw such complete destruction of crops. The village of Adstock, about a mile north of us, suffered a little, a few squares of glass being broken, but every step I took going north, evidence of the storm increased, the road being covered with leaves and twigs of trees. About a mile from that village I came upon many large elm and ash trees rooted up, some broken in two and large limbs carried 50 and 60 yards into the fields. Beans, potatoes, and wheat utterly ruined by the hail, which I found run into great heaps. I could have collected bushels of the hailstones as large as blackbird's eggs, and that at half-past eight in the evening. I was told by those on the spot that the hailstones were the size of guinea fowls' eggs, and I could well believe it. One farm house I called at, had almost every square of glass broken and everything in the garden utterly wrecked. I did not go so far as the village of Thornborough, which is three miles from here, but I am told it has suffered even to a greater extent than what I have seen, and so has Padbury, all places near to us. I fancy your station, Adstock Fields, must have had a good share of it.

I have not had time nor opportunity to get information as to damage done, but what I saw this evening is enough to stamp it as the most destructive storm that has visited this part. The storm we had on the 10th of May, 1867, did more damage to property, but not to growing crops, for they were not so far advanced. No doubt you will get full accounts of this storm from other sources. I

may add that I carried home some hailstones in my pocket handkerchief, and found them three-quarters of an inch in diameter seven hours after they fell.—I am Sir, yours truly,

JOHN MATHISON.

*Addington, Winslow June 25th.*

*Guilford.*—At Box Grove House, Clandon, about 800 square feet of glass were broken. At the lodge to the Earl of Onslow's at Merrow nearly every pane was broken. At Glebe House, Box Grove, much glass was broken. At Warpleston and Sutton an exceptional storm. Hailstones larger than pennies, of irregular shapes, some quite flat. Mangolds were washed completely out of the soil. Trees were entirely stripped of their foliage, and even branches lopped off by the violence and weight of the hail. The country roads in places impassable from the rain and washed-up soil.

*Box Hill.*—Hail very large.

*Furnham.*—Hail large, especially at Tongham, and much flooding.

*Woking.*—Hail as large as ordinary lumps of sugar.

*Haslemere.*—Water in the streets 3ft. deep; a drain opposite the "White Lion" burst from internal pressure.

*Leatherhead.*—At East Horsely the storm was exceptionally heavy, and the hail as large as hazel nuts.

*St. Albans (The Grange).*—Very heavy rain, especially about 7.40 p.m., on 26th. Total between 7 p.m., and 4 a.m. (27th), 2.40 in. At Rothamstead the 5 in. gauge collected 3.25 in.; the other gauges were allowed to run over!

*Gloucestershire.*—At Coleford the rainfall was so heavy that at the Lindars the flood ran through the house some feet deep. At Tintern also, on the other side of the Wye, some houses are stated to have had in them from 6ft. to 8ft. of water.

### HEAVY SNOWSTORM IN CORNWALL.

The *Daily News* of June 14th gave the following paragraph:—  
 "A snowstorm in Cornwall in the middle of June is almost unprecedented, but yesterday some parts of the county were visited by a fall of snow and hail which covered the ground for a considerable distance to a depth of about an inch. The morning was beautifully fine and warm, but towards noon heavy clouds covered the sky, and these were followed by pelting showers of rain, accompanied by loud peals of thunder and vivid flashes of lightning. The atmosphere suddenly became bitterly cold as if it were midwinter, and the rain was succeeded by hail and snow, which fell uninterruptedly for more than an hour. In the neighbourhood of Callington the hailstones were so large, and fell with such force, that twigs were cut clean off the trees. Fortunately, no hail fell in the fruit-growing districts, and the fruit crops have escaped injury."

## A FURTHER CORRECTION FROM MR. VELSCHOW.

*To the Editor of the Meteorological Magazine.*

SIR,—In your issue for June, my diagram has been made somewhat unintelligible by having got the peculiar heading “Inches of Mercury.” On the corrected proof, these two words are placed alongside of the figures at the top of the diagram, and a star is attached to indicate that they refer to the column in my table from Langley, with the heading, “Weight of vapour in inches of mercury.”

Also in the table you have reprinted from Williamson, is a grave error. The bottom figures in the 7th column from the left should be .255, .236 ; instead of .236, .160.

Yours &c.,

F. A. VELSCHOW.

53, Parliament Street, S. W., London, July 7th, 1888.

[Mr. Velschow might have added that the table is reprinted verbatim from Williamson, with whom, and not with us, the misprint lies ; and as regards the heading to the diagram, Mr. Velschow himself on the proof erased the very words he now uses. ED.]

## ERRATA IN METEOROLOGICAL MAGAZINE, 1887.

## REGULAR TABLE.

Hunton Court	Dec.	<i>should be</i>	1·83 in.	Haverfordwest	Jan.	<i>should be</i>	5·79 in.
Leicester.....	Mar.	„	1·78 „	Braemar .....	Sept.	„	2·98 „
Ardwick.....	Feb.	„	·79 „				
Wolstaston .....		<i>difference from average</i>		Dec.	<i>should be</i>	+	·14
Orleton .....		„	„	„	„	—	·08
Ribston .....		„	„	Mar.	„	—	·66

## SUPPLEMENTARY TABLE.

Bloxham .....	Oct.	<i>should be</i>	2·42 in.	NewcastleWest	Mar.	<i>should be</i>	·63 in.
Stowell Rec....	Sept.	„	2·44 „	Currygrane ...	April	„	1·55 „
Lydeard House	May	„	2·74 „	„	Sept.	„	3·09 „
Lancaster .....	Nov.	„	2·76 „	Cushendun.....	Feb.	„	2·19 „
Glenlee .. .....	Jan.	„	6·88 „				
„	Oct.	„	2·50 „				

We are sorry for the length of the above list ; 18 errors in 1,680 entries, or 1 entry wrong in 94, is too bad—and for only three out of the eighteen can we plead guilty. We hope that all our correspondents (to whom we are greatly indebted) will strive to avoid appearing in this list next year.

SUPPLEMENTARY TABLE OF RAINFALL,  
JUNE, 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 .....	3·55	XI.	Castle Malgwyn .....	3·26
„	Margate, Birchington...	1·55	„	Rhayader, Nantgwillt..	3·29
„	Littlehampton .....	2·82	„	Carno, Tybrith ... ..	3·10
„	Hailsham .....	2·71	„	Corwen, Rhug .....	2·65
„	Ryde, Thornbrough .....	3·05	„	Port Madoc .....	3·82
„	Alton, Ashdell .....	2·22	„	I. of Man, Douglas .....	2·33
III.	Oxford, Magdalen Col...	3·19	XII.	Stoneykirk, ArdwellHo.	3·07
„	Banbury, Bloxham .....	2·42	„	New Galloway, Glenlee	4·10
„	Northampton .....	1·47	„	Melrose, Abbey Gate...	2·71
„	Cambridge, Beech Ho...	1·64	XIII.	N. Esk Res. [Penicuick]	2·05
„	Wisbech, Bank House..	1·35	XIV.	Ballantrae, Glendrishaig	3·21
IV.	Southend .....	2·28	„	Glasgow, Queen's Park.	2·03
„	Harlow, Sheering ... ..	3·00	XV.	Islay, Gruinart School..	2·98
„	Rendlesham Hall .....	1·46	XVI.	St. Andrews, PilmourCot	2·22
„	Diss .....	2·09	„	Balquhiddel, Stronvar..	4·32
„	Swaffham .....	1·02	„	Dunkeld, Inver Braan..	3·49
V.	Salisbury, Alderbury ...	2·33	„	Dalnaspidal H.R.S. ...	3·52
„	Warminster .....	3·15	XVII.	Keith H.R.S. ....	2·65
„	Bishop's Cannings .....	4·60	„	Forres H.R.S. ....	1·27
„	Ashburton, Holne Vic....	4·11	XVIII.	Strome Ferry H.R.S....	1·64
„	Hatherleigh, Winsford.	3·43	„	Fearn, Lower Pitkerrie.	2·31
„	Lynmouth, Glenthorne.	2·47	„	Loch Shiel, Glenaladale	4·05
„	Probus, Lamellyn .....	3·24	„	S. Uist. Ardkenneth ...	1·80
„	Launceston, S. Petherwin	3·38	„	Invergarry .....	1·24
„	Wincanton, Stowell Rec.	3·17	XIX.	Lairg H.R.S. ....	...
„	Taunton, Lydeard Ho...	2·80	„	Forsinard H.R.S. ....	2·35
„	Wells, Westbury .....	3·01	„	Watten H.R.S. ....	1·73
VI.	Bristol, Clifton .....	4·00	XX.	Dunmanway, Coolkelure	5·55
„	Ross .....	2·72	„	Fermoy, Gas Works ...	3·95
„	Wem, Clive Vicarage ...	2·27	„	Tipperary, Henry Street	3·18
„	Cheadle, The Heath Ho.	3·26	„	Limerick, Kilcornan ...	3·67
„	Worcester, Diglis Lock	2·36	„	Miltown Malbay .....	4·20
„	Coventry, Coundon .....	1·89	XXI.	Gorey, Courtown House	4·50
VII.	Melton, Coston .....	2·43	„	Navan, Balrath .....	3·90
„	Ketton Hall [Stamford]	1·55	„	Mullingar, Belvedere ...	4·48
„	Horncastle, Bucknall ...	1·68	„	Athlone, Twyford .....	4·51
„	Mansfield, St. John's St.	2·49	„	Longford, Currygrane...	5·01
VIII.	Knutsford, Heathside ...	2·19	XXII.	Galway, Queen's Coll...	4·67
„	Walton-on-the-Hill .....	2·12	„	Clifden, Kylesmore .....	4·46
„	Lancaster, South Road.	1·90	„	Crossmolina, Enniscoe..	5·14
„	Broughton-in-Furness ..	1·86	„	Collooney, Markree Obs.	5·49
IX.	Shipley, Esholt Vic. ...	2·64	XXIII.	Rockcorry .....	3·77
„	Ripon, Mickley .....	2·53	„	Warrenpoint .....	3·40
„	Scarborough, West Bank	2·54	„	Seaforde .....	5·11
„	EastLayton[Darlington]	2·10	„	Belfast, New Barnsley .	4·65
„	Middleton, Mickleton ..	1·98	„	Cushendun .....	3·15
X.	Haltwhistle, Unthank..	3·32	„	Bushmills .....	2·61
„	Shap, Copy Hill .....	1·50	„	Stewartstown .....	5·38
XI.	Llanfrechfa Grange .....	3·82	„	Buncrana .....	4·67
„	Llandovery .....	4·29			

JUNE, 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° On gross.
		Total Fall.	Differ- ence from average. 1870-9	Greatest Fall in 24 hours.		Max.		Min.				
				Dpth	Date.			Deg.	Date	Deg.	Date.	
I.	London (Camden Square) ...	inches 2·31	inches. — ·36	in. ·60	26	20	84·7	25	43·9	18	0	0
II.	Maidstone (Hunton Court)...	2·77	+ ·70	·46	13	17	...	...	...	...	...	...
III.	Strathfield Turgiss .....	2·47	+ ·37	·43	21	17	80·3	3	36·8	18	0	1
IV.	Hitchin .....	1·98	— ·15	·75	26	18	78·0	25	44·0	30	0	0
V.	Bury St. Edmunds (Culford)	1·92	— ·59	·43	27	17	82·0	25	35·0	18	0	0
VI.	Norwich (Cossey) .....	1·59	— ·68	·35	27	12	86·0	25 <sup>b</sup>	36·0	1	0	0
VII.	Weymouth (Langton Herring)	1·31	— ·91	·42	21	13	85·0	4	38·0	14	0	0
VIII.	Barnstaple .....	3·15	...	·81	5	16	72·0	25	44·0	18	0	0
IX.	Bodmin .....	2·79	+ ·07	·59	5	15	78·0	26	39·5	14	0	0
X.	Stroud (Upfield) .....	3·72	+ ·51	·81	7	18	74·0	25	41·0	14	0	0
XI.	Churchstretton (Woolstaston)	3·27	+ ·89	·79	21	14	80·0	25	41·0	18	0	0
XII.	Tenby (Orleton) .....	2·08	— ·79	·42	27	17	72·0	27	40·0	20	0	0
XIII.	Leicester (Barkby) .....	3·21	+ ·47	·57	27	16	79·5	25	37·2	13	0	0
XIV.	Boston .....	1·79	— ·72	·55	20	15	84·0	26	34·0	13 <sup>d</sup>	0	4
XV.	Hesley Hall [Tickhill] .....	1·33	— ·92	·35	8	11	90·0	26	42·0	18	0	0
XVI.	Manchester (Ardwick) .....	2·25	...	·72	9	16	82·0	26	38·0	18	0	0
XVII.	Wetherby (Ribston Hall) ...	3·13	— ·03	·84	27	15	82·0	26	43·0	6	0	0
XVIII.	Skipton (Arncliffe) .....	1·71	— 1·16	·34	3	9	...	...	...	...	...	...
XIX.	Hull (People's Park) .....	3·89	+ ·07	1·38	9	15	88·0	27	34·0	14	0	0
XX.	North Shields .....	1·81	— ·46	·48	2	17	...	...	...	...	...	...
XXI.	Borrowdale (Seathwaite) .....	1·92	— ·11	·54	2	15	70·5	11	37·2	5	0	0
XXII.	Cardiff (Ely) .....	2·35	— 5·46	·65	12	11	...	...	...	...	...	...
XXIII.	Haverfordwest .....	3·60	+ ·54	·70	21	18	...	...	...	...	...	...
XXIV.	Plinlimmon (Cwmsymlog) ...	3·53	+ ·50	·95	5	20	79·0	25	37·0	13	0	2
XXV.	Llandudno .....	4·16	...	1·00	27	18	...	...	...	...	...	...
XXVI.	Cargen [Dumfries] .....	2·51	+ ·51	·79	27	18	76·8	25	43·0	14	0	0
XXVII.	Jedburgh (Sunnyside) .....	1·60	— 1·57	·47	2	12	85·0	26	35·8	5	0	0
XXVIII.	Old Cumnock .....	2·65	+ ·25	·87	28	12	76·0	26	33·0	5	0	0
XXIX.	Lochgilphhead (Kilmory) .....	1·77	— 1·15	·36	2	12	86·8	25	30·0	29	2	0
XXX.	Oban (Craigvarren) .....	4·34	+ ·50	2·05	11	13	...	...	...	...	...	...
XXXI.	Mull (Quinish) .....	3·85	...	1·11	2 <sup>a</sup>	11	82·1	25	37·0	5	0	0
XXXII.	Loch Leven Sluices .....	3·55	...	1·47	11	9	...	...	...	...	...	...
XXXIII.	Dundee (Eastern Necropolis)	2·50	— ·27	1·00	3	8	...	...	...	...	...	...
XXXIV.	Braemar .....	2·30	— ·36	·95	2	8	76·2	26	34·6	5	0	0
XXXV.	Aberdeen .....	2·75	— ·34	·71	3	10	77·0	25	26·3	6	3	12
XXXVI.	Lochbroom .....	2·57	...	1·01	3	10	70·0	26	30·0	4	1	0
XXXVII.	Culloden .....	1·33	...	·30	10	10	...	...	...	...	...	...
XXXVIII.	Dunrobin .....	1·32	— ·93	...	...	...	78·0	26	32·0	6	1	8
XXXIX.	Kirkwall (Swanbister) .....	2·40	...	·88	3	9	68·0	26	34·0	2, 5	...	...
XL.	Cork (Blackrock) .....	...	+ 1·25	1·61	11	17	76·0	18 <sup>c</sup>	38·0	13	0	0
XLI.	Dromore Castle .....	4·80	...	1·45	11	19	78·0	24	43·0	9	0	0
XLII.	Waterford (Brook Lodge) ...	3·41	...	1·60	5	16	72·5	18	38·0	14	0	0
XLIII.	O'Briensbridge (Ross) .....	4·61	...	1·73	5	19	78·0	25	42·0	14	0	0
XLIV.	Carlow (Browne's Hill) .....	4·57	...	·98	5	18	...	...	...	...	...	...
XLV.	Dublin (Fitz William Square)	3·72	+ 1·06	·95	27	18	72·4	26	43·2	14	0	0
XLVI.	Ballinasloe .....	3·04	+ ·84	1·58	5	18	70·0	25	40·0	10	0	0
XLVII.	Waringstown .....	4·55	+ 1·36	1·50	27	15	84·0	26	39·0	13	...	...
XLVIII.	Londonderry (Creggan Res.) ..	4·15	+ 1·49	·93	11	17	...	...	...	...	...	...
XLIX.	Omagh (Edenfel) .....	3·65	...	1·40	27	15	79·0	25	42·0	17 <sup>e</sup>	0	0
L.	...	5·34	+ 2·29	1·40	27	15	...	...	...	...	...	...

a And 10. b And 26. c And 23, 24. d And 17, 20. e And 30.

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

METEOROLOGICAL NOTES ON JUNE, 1888.

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

ENGLAND.

STRATHFIELD TURGISS.—Crops about a fortnight late. The colour of the wheat was excellent. Hay was light and the making was much interfered with by R. Severe TS on the 25th, many trees were destroyed and a cow was killed at Rotherwick; T on five other days and L on two. Butterflies and caterpillars were abundant.

ADDINGTON.—A good deal of cold, unsettled weather was experienced. The much needed R rapidly improved all kinds of crops, which were not looking well at the end of May. The destructive H storm on the 25th, which we just escaped, did much damage in the neighbourhood. All kinds of crops in the track of the storm were completely destroyed, numbers of large trees were uprooted and many were broken in two, the tops being carried some distance. The centre of the storm seemed to be about two miles N. of this station. Dense fog at night on 6th; heavy T with H and R on 14th; T on 21st and 28th also. Hay was cut on 22nd.

CULFORD.—T was frequent and much dull weather prevailed.

LANGTON HERRING.—E 1.14 in. above the average of 13 years and a striking contrast to that of June, 1887. Mean temp. at 9 a.m. 1°.9 below the average of 16 years, the tenth month in succession with temp. below the average. The rains in the early part of the month produced an unusually rapid growth of grass, and there was a heavy hay crop, but the weather was variable for carrying it. On many days there were fogs. T and L on 24th.

BODMIN.—A cold month with much R. Mean temp. 59°.

WOOLSTASTON.—A cold, cheerless, and very backward month, with constant E. winds. Mean temp. 55°·5.

ORLETON.—With the exception of a few days in the first week the weather was generally cloudy, showery, and cold, with winds from N. or E. till the 25th, when it suddenly became warm and continued so for several days, with distant T and much R. The mean temp. till the 25th was lower than that of any June for 30 years, and the mean of the month was 3° below the average of 27 years. Pressure was low throughout, but not subject to rapid changes. T on 13th, 14th, 21st, and 25th; L on 2nd and 21st; solar halo on 19th; dense fog on 30th.

BARKBY.—The direction of the wind for the first few days was W. or S.W., then for nearly three weeks it was N.E. We just missed two heavy H storms. The weather was generally cold and there was a scarcity of water. Vegetation generally was rather backward, and there was some blight. Hay harvest commenced during the last week. T on 6 days.

MANCHESTER.—The month opened with a fall of much needed R. The water supply had got very low, and in some places in Lancashire much inconvenience was felt, but the R in the early part of the month and at its close brought relief to a certain extent. Temperature was very low, except for a few days towards the close. The total R for the six months was only about two-thirds of the average for Manchester. TS on 13th.

HULL.—The weather was remarkable for the prevalence of cloud, with frequent, though generally slight showers, and often with cold winds.

WALES.

HAVERFORDWEST.—A sudden change succeeded the fine summer weather of the last week of May, and unsettled and cold wet weather prevailed throughout the month, the only exception being the very hot, fine days from 23rd to 29th; hay was abundant, but difficult to save; corn crops were luxuriant. No TS occurred.

## SCOTLAND.

**CARGEN.**—The most striking characteristics of the month were the unusual prevalence of easterly winds (22 days), the low mean temperature, and a deficiency again in the R. E. winds prevailed continuously for the last 15 days, accompanied by an unusually low night temperature. The mean temp. was  $2^{\circ}4$  below the average, and, but for a few exceptionally hot days at the close, would have been considerably lower. The max. temp. ( $85^{\circ}$ ) has been exceeded only six times during 28 years. The average R for the first six months of the year is 19.72 in., and this year the fall has been only 12.26 in. T and L on 9th and 14th.

**JEDBURGH.**—Very cold, wind mostly E., N.E., or N., but vegetation well forward. The E. winds affected the turnip crop considerably, but the R at the close did much good. Tree fruit blossom was slightly affected. The cornrake was not heard during the month. T heard on 9th; white butterfly and wasp seen on 9th.

**OBAN.**—The early part of the month was very cold and unseasonable, with much R and broken weather, but from the 15th to the close there was constant sunshine, giving on the 25th the highest temperature known here for 30 years. All grass was sunburnt and for six days a constant E. wind blew, sometimes in heavy hot squalls, a phenomenon quite unusual in this district.

**QUINISH.**—From 1st to 14th very cold and stormy; from 14th to the end very dry with great heat.

**LOCHBROOM.**—The month began with heavy S on the heights on 2nd and 3rd; it then improved until the 12th, which was a boisterous day. From 15th to the close it was cloudless and rainless, with great heat by day and cold frosty air at night. Grass was nearly burnt up and grain and crops were making no progress for want of R at the close, and in many places a scarcity of water was experienced.

**CULLODEN.**—Most of the month was exceedingly dry, with strong, cold E. winds, frosty air at night, and no T.

## IRELAND.

**BLACKROCK.**—Showery and cold to the 16th, with mean temp.  $56^{\circ}5$ ; then fine and mostly bright to the 20th, after which there were frequent showers, and it was at times gloomy and misty. Vegetation was very luxuriant. Mean temp.  $58^{\circ}4$ . T on 2nd.

**DROMORE.**—Very fine. All sorts of crops were in a flourishing condition at the close.

**WATERFORD.**—Mean temp.  $54^{\circ}8$ . R 2.05 in. above the average; T on 2nd and 21st; thick fog on 25th.

**O'BRIENSBRIDGE.**—Very heavy R in the first fortnight was followed by fine summer weather. The air seemed in a highly electrical condition on 24th, 25th, and 26th, but there was little T or L. Very heavy R fell one mile to the north of this station on 29th, but there was none here.

**DUBLIN.**—A marked contrast to June, 1887, which will be long remembered as one of the driest and warmest months on record in Dublin. The only meteorological factor which corresponded in the two Junes was the direction of the wind, there being a singular preponderance of polar winds in each. But for a bright period in the third week the month would have been a singularly cheerless one. Mean temp ( $56^{\circ}2$ )  $1^{\circ}6$  below the average. The coldest Junes in 23 preceding years were in 1882 and in 1879, with mean temp.  $55^{\circ}8$ . Temp. reached  $70^{\circ}$  on only one day. Luminous cirri were seen on the northern horizon on the 15th and 26th. Fog on 2nd; TS on 2nd; solar halo on 20th; high winds on five days. Mean humidity 81; mean amount of cloud 6.6.

**EDENFEL.**—The month was somewhat remarkable. By the 14th the average R had been reached; then followed 12 clear, warm, rainless days, succeeded by a fall of 2.28 in. of R in 36 hours on 27th and 28th. Vegetation of all kinds was unusually luxuriant at the close.