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THE HEAT AND THUNDERSTORMS OF JULY 22ND.

Temperatures exceeding 90° in the shade, are infrequent in this country, and therefore their occurrence is worthy of chronicle and of study. Moreover, they are almost always followed by violent electrical phenomena, and it is the duty of meteorologists, not merely to record what occurs, but to endeavour to trace out cause and effect.

On the present occasion, we confine our remarks to the temperature in the shade on the 22nd.

In the first place, we give a few extracts to show the exceptional character of the temperature observed :—

Harpenden.—During the last few days we have had great heat. Maximum, 350 ft. and 4 ft. above ground, July 21st 84°, 22nd 86°·2, 23rd 82°·5 ; 380 ft., 4 ft. above ground (J. Wilson, Esq.), 21st 83°·5, 22nd 85, 23rd 83° ; 420 ft. 4 ft. above ground, 21st 83°·5, 22nd 85°, 23rd 80° ; 434 ft. 18 ft. above ground, 21st 82°, 22nd 83° ; 23rd 79°. All thermometers in louvre board screens, and *not* exposed to heat radiated or reflected from ground. A maximum in first named screen exposed to this registered 85°·5, 87°·6, 84°·5 on the three days.—F. W. STOW, M.A., F.M.S.

Clifton.—During 21 years the temperature has only reached 90° four times, viz. : 1856, Aug. 2, = 91°·4 ; 1868, Aug. 4, = 90°·2 ; 1870, July 24, = 91°·3 ; and 1873, July 22, = 90°·9.—G. F. BURDER, M.D.

Bath.—The temperature on July 22nd in a Stevenson's stand was 90°·2, being the highest recorded during 25 years.—C. S. BARTER, M.D.

Heaton Chapel.—Since 1863 the temperature has exceeded 90° only on the following days :—1866, June 27th, 90°·9 ; 1868, July 15th, 91°·1 ; and Aug. 4th, 91°·8 ; 1869, July 17th, 92°·1, and August 28th, 91°·1 ; 1873, July 22nd, 91°·9.—J. CURTIS, F.M.S.

Trevalyn Hall, Wrexham.—The temperature on July 22nd, 91°·6, is the highest I have recorded since observations were commenced in 1865.—B. T. GRIFFITH.

Cargen, Kirkcudbright.—The temperature on 22nd is the highest ever observed here.—P. DUDGEON.

Secondly, inasmuch as the halcyon days of uniform thermometer stands are not yet come, we may give for a few hot days in July, 1872, the results of the Strathfield Experimental Thermometers. They are expressed as differences from the record of the maximum in the Kew Thermometer Stand :—

Date.	Kew.	James.	Stow No. 2	Martin.	Stevenson.	Glaisher.	Morris.	Griffith.
July 5	80·3	+3·7	+4·6	+0·8	—4·0	+4·7	—4·9	+3·9
6	83·3	+2·7	+2·9	0·0	—4·7	+3·7	—6·9	+2·9
21	84·4	+3·2	+ ·6	+1·3	—4·8	+1·4	—7·1	+2·5
25	85·7	+2·8	+ ·5	+1·3	—4·4	+2·3	—5·2	+3·3
Mean..	83·3	+3·1	+2·2	+0·9	—4·5	+3·0	—6·0	+3·2

These differences are extremely large, and, perhaps, for certain reasons, which we cannot stop to explain, rather too large, but they sufficiently show that in the ordinary grounds of an English Rectory, it follows that if the observer uses the form of stand employed at Greenwich, he will on a day of great heat record a temperature of $7\frac{1}{2}^{\circ}$ hotter than if he used one of those recommended by the Scottish Meteorological Society.

Such a fact would dishearten many from an attempt to deal with questions of temperature, until such anarchy is a thing of the past. There are, however, generally two ways of viewing a question, and it must not be forgotten (1) that it would be fatal to all comparison of past, with present or future weather, if the old stands were abandoned without comparison with whatever new pattern may be adopted; and (2) that as there is no regularity in the "geographical distribution" of different patterns of thermometer stands, it is probable that the variations produced by their faulty construction will be neutralised by the presence of different patterns in the same neighbourhood.

Acting under these considerations, we have drawn up the following table :—

Maxima in the British Isles, July 21st-23rd, 1873.

Station.	21st.	22nd.	23rd.	Station.	21st.	22nd.	23rd.
Camden Sq., London (G)	88·0	90·1	86·6	Tavistock	92·0	...	...
Pinner Hill	...	82·0	...	Barnstaple	...	...	90·0
Winchmore Hill (G)	90·0	91·9	88·0	Trevarrick, St. Austell	..	74·8	...
Croydon (G)	84·9	87·0	84·5	Taunton	...	91·0	...
Surbiton (G)	92·6	93·2	86·1	Bath (S)	...	90·2	...
Linton Park, Maidstone	...	92·0	...	Clifton, Gloucester	...	90·9	...
Bromley, Kent	...	85·0	...	Upfield, Stroud	...	88·0	...
Eltham, ,, (P)	89·3	90·8	89·0	Haughton Hall, Shifnal	78·0	84·0	...
Roy. Obs., Greenwich (G)	86·5	88·7	87·2	Sansaw Hall, Salop	...	87·5	...
Selborne, Hants	79·0	82·2	...	Cheadle	...	...	85·0
Hitchin	...	79·0	...	Orleton, Worcester	84·5	89·6	...
Addington, Bucks	...	87·0	..	Bromsgrove	...	83·8	...
Banbury	...	88·0	...	Oscott, Birmingham	...	77·1	...
Oxford	..	89·0	...	Wigston, Leicester	...	92·0	...
Wisbech	86·2	88·3	88·4	Belmont Villas, Leicester	86·7	91·7	82·5
Bury St. Edmunds	...	..	86·0	Horncastle	...	85·0	...
Diss	...	83·0	...	Calcethorpe, Brigg	...	89·0	...
Sprowston, Norfolk	...	...	92·0	Grimsby	80·0	...	80·0
Coston, Norwich	..	83·8	...	Mansfield	88·0	..	...
Hillington, Lynn	87·3	87·3	86·0	Derby	...	88·0	...
Bridport	...	84·0	...	Buxton, Derbyshire (G)	83·0	88·0	79·0
Ashburton, Devon	...	82·0	...	Macclesfield	...	90·0	...

Station.	21st.	22nd.	23rd.	Station.	21st.	22nd.	23rd.
Old Trafford, Manchester	...	95·0	...	Llandudno	...	93·0	...
HeatonChapel,Lancashire	86·3	91·9	76·9				
Parsonage, Garstang (P)...	..	92·6	...	SCOTLAND.			
Broughton-in-Furness ...	85·0	...	...	Cargen, Kirkcudbright...	...	87·1	...
Stanley, Wakefield.....	82·0	89·0	...	Dumfries	...	84·0	...
Halifax	...	88·3	...	Melrose, Roxburgh	...	87·0	...
York	...	85·5	...	Annanhill, Kilmarnock...	...	81·2	...
Arncliffe	...	87·0	...	Nookton, Fife	...	83·0	...
North Shields	...	...	75·6	Logierait, Perth.....	...	89·0	...
Elterwater, Ambleside....	...	86·0	...	Dundee	82·0	...	..
Surbiton	92·6	93·2	86·1	Aberdeen.....	80·4	81·0	...
Harpenden	84·0	86·2	82·5				
,, ...	83·5	85·0	83·0	IRELAND.			
,, ...	83·5	85·0	80·0	Waterford	...	76·0	...
,, ...	82·0	83·3	79·0	Killaloe, Clare	83·0	...	...
,, ...	85·5	87·6	84·5	Portarlington...	...	78·0	...
				Black Rock, Dublin	84·0on	20th.	...
WALES.				Monkstown, ,, ...	,,	,,	...
Llanfrechfa, Monmouth...	...	84·0	...	Twyford, Westmeath	...	73·0	73·0
Haverfordwest	..	83·6	...	Galway	..	80·0	...
Cefnfaes, Radnor	...	92·0	...	Waringstown, Down... ..	...	...	83·0
Wrexham	...	91·6	...	Edenfell, Tyrone	76·0	..	...

N.B.— (G) Glaisher's stand. (P) Pastorelli's stand. (S) Stevenson's stand.

Unless for known error we have, in compiling this table, rejected no returns, there are, however, some which differ very widely from their neighbours; but considering the variation due to stands, and the, in some respects, capricious distribution of temperature during the period, we leave all records unsifted, and resting on the responsibility of the various observers. As an illustration of the care required in any such process of sifting, we may instance the recorded maximum at North Shields, 75°·6 on 23rd; looking merely at the context, many people would think the true maximum must have been nearly 8° higher and one day earlier. Irrespective, however, of reliance on our excellent correspondent, we have the confirmatory evidence of a second observer, who reports the maximum for the 22nd as 72°.

The first feature which requires notice is the prevalence of the maximum on the 22nd at the great majority of stations; with, however, some subsidiary indications of an easterly progression in its occurrence on the 20th on the Irish Coast, on 22nd generally, but on the 23rd on the Norfolk, Lincolnshire, and Northumbrian coasts.

Then, with respect to the distribution of temperature on 22nd, we notice that there is great general agreement among the records, that with scarcely an exception the maximum at coast stations was under 80°; at stations not more than 10 miles inland, 85°; and at all places further inland, between 85° and 95°. Temperatures exceeding 90° seem to be confined to—(1) Middlesex and West Kent, (2) Somerset and South Gloucester, (3) Leicester, Cheshire, and Lancashire, (4) Central and N.E. Wales.

Some idea of the effect of this temperature may be gained from the

statement of one of our correspondents that on that one day twelve persons were killed by sunstroke.

We hope in our next to be able to discuss the thunderstorms which followed this heat, and in which we are told by the same authority, ten persons were killed by lightning.

METEOROLOGY IN DENMARK.

ONE by one each civilized nation is establishing, under some title or other, a Meteorological Department, and it is well that thus it should be. Considering the general feelings of our countrymen, the status of the two principal Meteorological Societies, and, above all, the band of trained observers in the British Isles, there was, probably, no country which needed such an establishment less than we did. If, therefore, it was wise for the British Government to devote £10,000 or £15,000 per annum to such a purpose, it necessarilly follows that it is still more wise of other nations to establish offices with endowments proportional to their area and national prosperity.

Although for some reasons we regret that the pressure on our space has prevented our earlier referring to the welcome intelligence of the establishment of the Danish Meteorological Institute, under the direction of Captain Hoffmeyer, there is the advantage that now we can judge of the organization by work done, instead of merely by promises made.

For its size Denmark has, for nearly half a century, contributed a fair quota to the general store of meteorological statistics. The Copenhagen record goes back, we believe, to 1822; three or four other stations were started in 1846, and others between 1848 and 1852. Moreover, between 1849 and 1859, perhaps the longest series of comparative evaporation experiments yet published, were made at Emdrup.

In 1861 the Royal Danish Agricultural Society organized a series of stations, in order to ascertain the relative climate of various parts of the country, and the results have been published annually since that time.

In the autumn of 1872, the Danish Government resolved upon the establishment, under the auspices of a Special Committee, of the Danish Meteorological Institute, charging it with the supervision of all branches of Meteorology, but specially with the establishment of telegraphic Meteorological stations throughout Denmark, both for Danish purposes and for interchange with the rest of Europe. Moreover, arrangements were contemplated, and are now far advanced, for the establishment of six stations, in the Faroe Isles, in Iceland, and in Greenland, respecting which every one will agree with, and approve, the following remarks by Captain Hoffmeyer:—

"Outre l'intérêt général que présenteront ces stations, elles pourront à une époque prochaine devenir d'une grande importance pour la météorologie internationale et la prévision du temps par la submersion eventuelle d'un cable télégraphique par cette voie de l'Europe à l'Amérique du Nord. Les observations de ces stations seront publiées explicitement."

The mention of Iceland reminds us of a Danish meteorological publication which quite supports our previous remarks on the good position in Meteorology long held by Denmark, and of which it may, perhaps, be convenient to some of our readers to be informed. The work in question* gives an unbroken series of observations for 15 years in the early part of the present century, including for the greater part of that time the pressure, highest and lowest temperature of the air, temperature of the sea, depth of rain, direction of wind and state of weather for each day, printed *in extenso*, with abstracts and discussions. We have, however, on the present occasion to deal with the present rather than the past, with recent publications and arrangements rather than with those of a third of a century back.

We have already mentioned that the Royal Danish Agricultural Society established a series of stations in 1861. This Society has now published† an abstract of the results obtained during their supervision, and, having done so, they have transferred all the documents to the new office, and will, we presume, in future confine their attention to agricultural matters. We hope that this not the case, for (except perhaps in Bavaria) there is no country or society in Europe devoted to the study of the mutual interdependence of agriculture and climate, and the Danish Society seem to have done so well that which they undertook to do, that we should have been glad to have seen the connexion perpetuated. However, in any case, they are entitled to the thanks of meteorologists for their past services, and for enabling the new Institute to start with the support of previous records.

It would be inexpedient for us to remark in detail on the contents of this pamphlet; suffice it to say, that it is a very useful compilation, and gives almost all the information which can be desired; not quite all, we believe, for after more than one search we are unable to find the total rainfall in each year at each individual station. Various tables are given, but the only one which would inform us of the relative rainfall of various parts of the country being omitted, we are obliged to content ourselves with converting, and placing before our readers, the average (at an irregular number of stations) rainfall over the whole country:—

Average Rainfall in Denmark, 1861—1870.

Year.	Amount. In.	Year.	Amount. In.
1861	24·89	1866	29·44
2	24·98	7	26·95
3	24·20	8	24·63
4	21·63	9	22·23
1865	17·68	1870	20·94
Mean 10 years			23·76
,, 50 years at Copenhagen			23·09

**Observationes Meteorologicæ a* 1 *Jan.* 1823, *ad.* 1 *Aug.* 1837 *in Islandia factæ a Thorstensenio, Medico.* Hafniæ 1839.

†*Femaarsbereitning fra det Kongelige Landhusholdningsfelftabs Meteorologiste Committee for* 1866—1870. BED POUL LA COUR. Copenhagen: Schultz, 1872.

It will be noticed that these figures present a very similar progression to those representing the rainfall fluctuations in England; the wettest year being in both countries 1866, but the driest was 1864 in the British Isles, and 1865 in Denmark.

The observations reduced in this work have been made with perseverance worthy of a more complete equipment than the stations appear to have possessed, and with the not infrequent result of determining some elements better than where though the apparatus is more elaborate, there is less zeal.

Lastly, we have briefly to refer to the publications of the new Institute. These are issued with exemplary promptitude. We have already (July 26th) received the monthly packet of observations for June printed *in extenso*. The tables issued by the Institute are arranged to contain tri-daily observations (8 a.m., 2 p.m., 9 p.m.) of the following elements, (1) barometer at 32°; (2) temperature; (3) elastic force of vapour; (4) relative humidity; (5) direction and force of wind; (6) amount of cloud; (7) weather. In additon to which is given (8) maximum and minimum temperature; (9) amount of rain; (10) temperature of the sea. The sheets received are for the month of June, from what may be called the Home stations of Skagen, Ringkjöbing, Fanö, Samsö, Bogö, and Hammershus, and for April and May, from Thorshaven, in the Faroe Isles.

EXTRAORDINARY FLASH OF LIGHTNING.

To the Editor of the Meteorological Magazine.

SIR,—A very remarkable flash of lightning occurred here on July 16th. The morning was showery, and thunder-clouds formed in different directions at 9 a.m. About 10 a large cumulus rose in W.S.W., and broke in rain about 5 miles from this place, its summit at the same time, as is usual in incipient storms, assuming the cirriform appearance. The first thunder-clap soon followed, and was succeeded by seven or eight others as the storm travelled to N.W. The sky overhead was quite clear, and also over Hereford, 3 miles east of this place, and the storm-cloud had a very isolated appearance, though there were other distant clouds on the horizon. I was standing in my garden watching the distant lightning, when a flash left the cloud 2 or 3 miles to W.N.W. of this place, passed almost directly overhead, but a little to N.E., and descended upon Hereford, traversing in a horizontal direction a space of about five miles of clear blue sky, devoid of cloud. The clap commenced nearly in the zenith, the time interval showing the part of the flash nearest to this place to be about 1½ miles; it then became loud both over Hereford, in the east, and in the storm, in the west. Hereford lies comparatively low, and the electric fluid travelled near the earth over high ground covered with trees, buildings, &c.; avoided All Saints' and St. Peter's spires, very near which it must have passed, and singled out a house in the more eastern part of the city. The house struck is lower than others in the same row, and the adjoining

house on the west has much higher chimneys. Not much injury was done, though two persons suffered from a temporary paralysis. The inhabitants of Hereford, few of whom had noticed the distant storm, were greatly startled by the terrific flash and clap under a clear sky and brilliant sun.

As observed here, the flash appeared straight, almost resembling a rocket fired horizontally, but Mr. Isbell informs me that as seen in Hereford it was very zigzag, and seemed to come along near the ground.

I sent you last summer an account of several similar flashes, which passed in succession out of a thunder-cloud west of this place. Once before, in April, 1865, I was watching from Sellack Vicarage, near Ross, a violent storm fully six miles distant, the sky overhead being almost perfectly clear, when I was astonished by a tremendous flash of lightning at a distance of about 500 yards. These are the only examples of lightning striking the earth at a distance from a storm which I have myself observed in the course of about twenty years, during which I have minutely watched every thunder-storm in my neighbourhood; but there are records of occasional accidents from lightning at the distance of one or two miles from a thunder-storm.

The ancients, as school boys know, regarded such occurrences as portents of evil omen.—Yours truly,

W. CLEMENT LEY.

Breinton, Hereford, August 5th, 1873.

RAINFALL OF JULY 13TH.

Although the total amount on this day was not excessively large, the following details respecting its progress are of sufficient interest to merit insertion :—

Muswell Hill.—Fall of R in 24 hours ending at 9 a.m., 14th, 1·24, a greater fall than I have recorded in this or last year, of this 1·12 fell between 10.30 a.m. and 10 p.m. on 13th.

Winchmore Hill.—On 13th, R commenced at 10.30 a.m., and continued till 3.15 p.m., when 1·09 had fallen, ·70 of which fell between 1.30 and 3.15 p.m.. Heavy showers afterwards made the total in 24 hours 1·25. A heavy gale from the S. from 3 to 7 p.m., doing much damage. A large chesnut tree snapped off a few feet from the ground during a heavy squall about 4 p.m.

Culverlands, Farnham.—On 13th, R 1·72, of which 1·42 fell between 10.30 a.m. and 3 p.m.

Morehill, Shedfield, Fareham.—On 13th, R began about 9 a.m., and up to 2.30 p.m. 1·50 had fallen. Slight showers afterwards made the total for the day 1·67. Gale in after part of the day.

Berkhampstead.—On 13th the large amount of 1.69 fell between 10 a.m. and 8 p.m. It fell heavily from 11 a.m. to 3 p.m. (1·10), then gently till 7, when it again fell heavily, and ceased at 8, adding ·59. There was neither T or L, and but little wind. So heavy a fall has not been recorded here since 22nd of October, 1857, when 2·65 was collected in the 24 hours.

Harpenden.—13th. An apparently cyclonic storm with very heavy rain commencing about 11 a.m., and becoming heavy by noon. The wind was exceedingly strong during the afternoon, coming in violent squalls most unusual in summer. The following amounts were recorded by my electrical gauge at the anemometer station (415 feet) and 3 feet above ground, opposite to which I have placed those observed at my house (350) :—

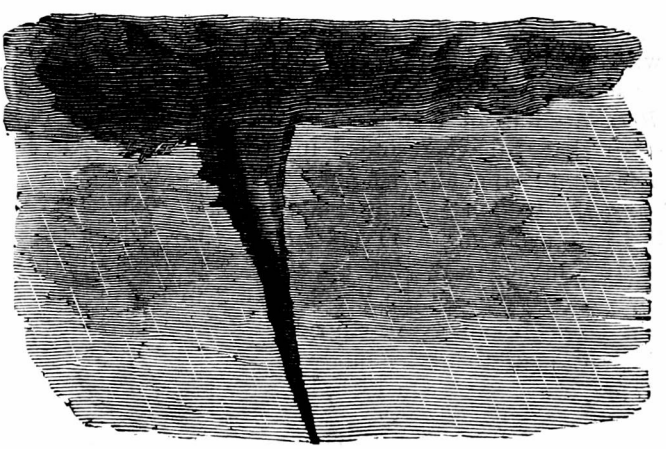
	Electrical Gauge 415 feet. Total.	In each hour.	Harpenden 350 feet. Total inches.	Velocity of wind by Anemometer. Miles.
Up to noon	·07	·07	—	15
1 p.m.	·30	·23	·37	10
2 p.m.	·75	·45	·77	11
3 p.m.	·86	·11	·95	32
4 p.m.	1·01	·15	—	21
5 p.m.	1·22	·21	1·32	28
6 p.m.	1·32	·10	1·40	31
7 p.m.	1·39	·07	—	33
8 p.m.	1·49	·10	1·61	27
11 p.m.	1·50	·01	1·62	17

F. W. STOW.

WATERSPOUT AT MANCHESTER.

To the Editor of the Meteorological Magazine.

SIR,—Enclosed I send a sketch, in the rough, of a waterspout I saw on Saturday, the 26th :—



This peculiar cloud appeared at 3.15 p.m. in the E.S.E. The lower tapering part appeared to wave about, and apparently had a spiral motion. The appearance was that accompanying a waterspout. There was rain at the time, and indication of electrical disturbance. You will see further particulars in the enclosed extract from the *Manchester Guardian* :—

A WATERSPOUT IN MANCHESTER.—On Saturday afternoon a phenomenon which is frequently noticed at sea, but is very rare on land, was witnessed on the

southern side of Manchester. About four o'clock a heavy black cloud drifted slowly up before the wind, and from its edge, which was at that moment over Alexandra Park, a column, in the shape of an inverted cone, began to form, and descended towards the earth. The upper part of the column was considerably agitated, and the mass rapidly grew in length and density until the end hung suspended, apparently not more than 150 feet from the ground. The spectacle was exceedingly singular. At the moment when the spectators were expecting the "spout" to burst the wind increased and a violent rain fell, in the midst of which the threatening appearance of the cloud gradually disappeared, and in a quarter of an hour the long waving pillar of cloud lost its previously well-defined shape and became merged in the surrounding masses of vapour.

Very truly yours,

G. V. VERNON.

Old Trafford, Manchester, July 28th, 1873.

RAIN GAUGES IN TROPICAL COUNTRIES.

To the Editor of the Meteorological Magazine.

SIR,—Will you allow me to suggest for the consideration of manufacturers and those who may contemplate at any time taking rain gauges into hot climates that the metallic gauges generally supplied are not advisable for that purpose.

It frequently occurs that when a smart shower falls, while the greater part, of course, falls into the receiver, a considerable amount collects on the funnel, then sunshine succeeding, it does not take long to evaporate this, while, especially if, as in Messrs. Negretti's 8 inch gauge, the receiver take the form of a cup, a great quantity is evaporated from within, and again condensed on either the convex side of the funnel, or the inside of the gauge itself, in either case defying measurement. This occurring often, must destroy to a considerable extent the value of the returns.

It seems to me that the best material for a gauge in hot climates is white glazed earthenware, or porcelain; the whole vessel to act as receiver without any smaller one inside.

A day or two ago (24th) we had a rainfall (I believe unprecedented for this locality) of *ten inches* in the twenty-four hours. The consequence was that my rain gauge (N. & Z.'s 8 inch) was on the point of overflowing, and a quarter of an hour's more rain would have entirely destroyed my observation. This, however, might not happen again for a long time, but still, I would point out the fact that in a tropical climate where, in addition to extreme heat, there are many light casual storms which admit of measurement, and also at times an extremely heavy diurnal rainfall, rain-gauges should be made of a material which should be affected to the least possible degree by the sun's rays, and capable in point of size of holding the greatest daily fall in any country. I think this might be done at a small cost, but of that I leave others who are better qualified to judge to decide.—I am, Sir, yours obediently,

T. FELTON FAULKNER, F.M.S.

St. Thomas' College, Colombo, Ceylon, May 26th, 1873.

HAILSTORM IN EAST KENT.

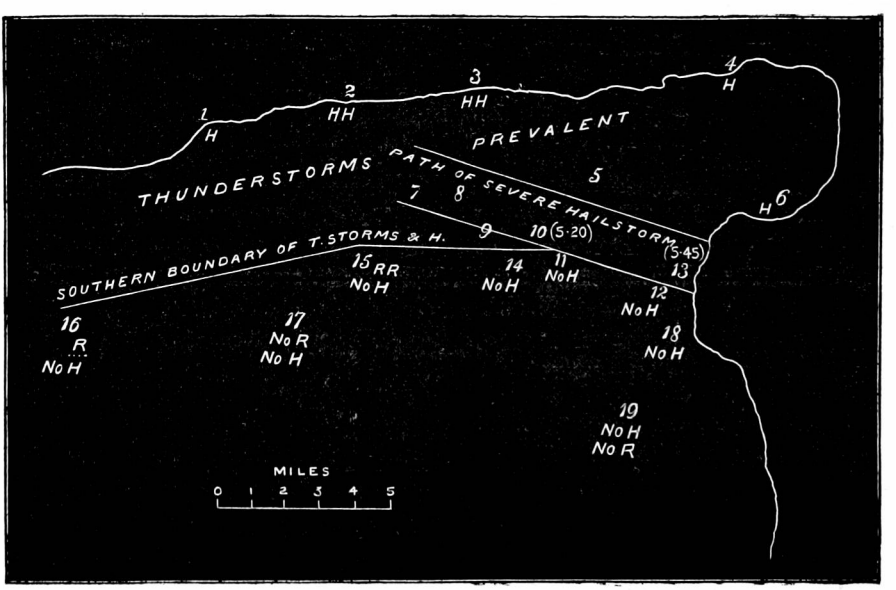
To the Editor of the Meteorological Magazine.

SIR,—I enclose a paper showing (as far as data allow) the path of the severe hail storm in Kent, on July 15th, between 5 and 6 p.m. It seems to me that that the opposing forces of the winds were very equally balanced, if the *regular* width of the hail storm (1½ miles) during a course of ten miles be their result. The surface current over Kent was S.W., the hail clouds coming over in W.N.W. current. The speed is very clearly shown from Stourmouth to Salterns to have been 1 mile in 5 minutes. The severity of the hail was about equal at all places; the size of the larger stones varied from 1½ to 2¾ inches (circumference); at some stations irregular in shape, at others quite spherical. No rain was mixed with the hail at Stourmouth and Salterns. It is remarkable that no discharge of electricity took place from the hail cloud after the coast line was reached, though the hail was fully as heavy up to the shore. The duration of the storm was alike, or nearly so, at all the stations (about 10 minutes). Corn and fruit were much injured, and greenhouses suffered severely. At 6.15 to 6.30 a violent thunderstorm was bursting about midway between Reculvers and Margate, the lightning being intensely vivid and frequent.

I am, yours truly,

G. WARREN.

Merton Villa, Cambridge, August 6th, 1873.



REFERENCES.

1 Whitstable	8 Chislett	14 Preston
2 Herne Bay	9 Grove Ferry	15 Sturry
3 Reculvers	10 Stourmouth	16 Selling
4 Margate	11 West Marsh	17 Canterbury
5 Monkton	12 Richborough	18 Sandwich
6 Ramsgate	13 Salterns	19 Eastry
7 Hoath		

JULY, 1873.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1860–5	Greatest Fall in 24 hours. Dpth	Date.	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date.	Min. Deg.	Date.	No. of Nights below 32°. In shade	On grass.
			inches	inches.	in.								
I.	ENGLAND.	Camden Town	1·81	+ ·02	·97	13	12	90·1	22	45·8	19	0	0
II.		Maidstone (Linton Park)	1·60	— ·38	·74	13	9	92·0	22	46·0	15	...	...
,,		Selborne (The Wakes)	3·48	+ 1·28	2·16	13	13	82·2	22	41·0	29	0	0
III.		Hitchen	1·99	+ ·09	1·24	13	10	79·0	22	44·0	5, 18	0	...
,,		Banbury	2·48	+ ·42	·73	13	15	88·0	22	43·5	29	...	...
IV.		Bury St. Edmunds (Culford)	2·23	+ ·24	·77	13	9	86·0	23	43·0	4, 18	0	0
V.		Bridport	1·61	— ·50	·48	13	12	84·0	22	42·0	19	...	...
,,		Barnstaple	4·49	+ 1·63	·74	3	20	90·0	23	44·5	8	...	...
,,		Bodmin	4·23	+ 1·12	·81	24	19	78·0	27	49·0	16	0	0
VI.		Cirencester	2·94	+ ·50	·80	13	14	...	...	...	...	...	...
,,		Shiffnal (Haughton Hall)	2·73	+ ·56	·83	3	16	84·0	22	45·0	13	0	...
,,		Tenbury (Orleton)	2·63	+ ·25	·85	3	17	89·6	22	40·2	19	0	0
VII.		Leicester (Wigston)	2·34	+ ·24	·59	13	14	92·0	22	42·0	18	...	...
,,		Boston	2·25	— ·05	1·15	13	11	90·0	23	43·0	19	...	...
,,		Grimsby (Killingholme)	2·97	...	1·06	3	15	80·0	21†	47·0	5, 19	...	...
,,		Derby	2·14	— ·05	·51	13	15	88·0	22	46·0	5	0	...
VIII.		Manchester	4·65	+ 1·96	·77	3	18	95·0	22	45·5	14	0	...
IX.		York	1·74	— ·20	·61	13	13	85·5	22	46·5	5	...	...
,,		Skipton (Arncliffe)	5·47	+ 2·24	1·23	3	20	87·0	22	38·0	4	...	...
X.		North Shields	2·27	+ ·46	·45	25	16	75·6	23	46·2	5	...	...
,,		Borrowdale (Seathwaite)	16·96	+ 8·82	2·90	2	20	...	...	...	..	...	...
XI.	WALES.	Cardiff (Ely)	...	...	...	..	...	...	...	...	...	...	...
,,		Haverfordwest	4·23	+ ·93	·60	2	20	83·6	22	48·0	4, 14	.	...
,,		Rhayader (Cefnfaes)	3·78	+ ·93	1·00	27	22	92·0	22	43·0	...	...	...
,,		Llandudno	2·28	— ·01	1·11	25	15	93·0	22	48·4	14	...	...
XII.	SCOTLAND.	Dumfries	6·08	+ 3·83	1·30	30	25	84·0	22	42·5	5	...	..
,,		Hawick (Silverbut Hall)	4·06	...	·92	25	15	...	...	...	...	...	...
XIV.		Kilmarnock (Annanhill)	5·81	...	1·42	17	26	81·2	22	41·1	5	.	...
XV.		Castle Toward	5·36	+ 2·22	·77	31	16	79·0	22	...	...	...	...
XVI.		Leven (Nookton)	3·62	+ 1·35	·83	17	21	83·0	22	41·0	4	0	0
,,		Stirling (Deanston)	...	...	...	...	...	...	...	...	...	...	...
,,		Logierait	4·06	...	·56	4	19	89·0	22	42·0	14	...	...
XVII.		Braemar	4·21	+ 1·93	·50	3	23	79·5	22	35·8	15	0	1
,,		Aberdeen	3·97	...	·66	13	19	81·0	22	41·1	15	0	0
XVIII		Inverness (Culloden)	3·50	+ ·83	1·06	28	16	74·6	21	47·0	15	0	0
,,		Portree	5·83	— ·24	·53	19*	26	...	...	...	...	...	...
,,		Loch Broom	3·54	...	·45	22	23	...	...	...	...	...	...
XIX.		Helmsdale	4·44	...	1·07	27	20	...	...	...	...	...	...
,,		Sandwick	2·39	+ ·50	·48	22	18	75·3	22	44·9	13	0	0
XX.	IRELAND.	Caherciveen Darrynane Abbey	6·07	...	1·10	28	29	...	...	...	...	..	...
,,		Cork	3·40	...	·73	13	15	...	...	...	...	...	...
,,		Waterford	3·73	+ ·41	·54	24	22	76·0	22	47·0	13	...	...
,,		Killaloe	4·17	+ ·98	·59	17	20	83·0	21	43·0	15	...	...
XXI.		Portarlington	3·17	— ·37	·34	13	27	78·0	22	44·0	13	...	...
,,		Monkstown	3·86	+ 1·43	1·95	22	20	84·0	20	...	...	...	...
XXII.		Galway	6·47	...	·68	28	24	80·0	22	45·0	13‡	0	...
,,		Bunninadden (Doo Castle)	4·23	...	...	...	...	...	...	...	...	...	...
XXIII		Waringstown	5·32	...	·99	22	27	83·0	23	42·0	16	...	...
,,		Edenfell (Omagh)	4·43	...	·80	24	27	76·0	21	41·0	4	...	...

*And 29. †And 23. ‡And 17.

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

METEOROLOGICAL NOTES ON JULY.

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

ENGLAND.

LINTON.—Second half of month warm, dry, and fine, the hottest days being the 21st, 22nd, and 23rd; very little T; brisk wind and heavy rain on 13th; winds all from S., S.W., and W., not any from N. or N.E., which is very unusual here. On the whole a favourable month; vegetation making much progress, and the harvest not likely to be as late as was at one time expected.

SELBORNE.—13th high wind and heavy rain from 9 a.m. to 7 p.m.—2·16; 15th short storm of R and H, with T and L at 12.30 p.m. on 15th; a very dry month if you eliminate the 13th; weather very oppressive from 19th to 26th.

BANBURY.—23rd, from 3.40 to 4.10 a.m. T S; T again at 6 a.m.

CULFORD.—T on 3rd, 4th, 14th, 15th, and 18th. That on the 15th (St. Swithin's) was accompanied by H and R; S.E. winds on 12, and S.W. on 19 days.

BRIDPORT.—There has been a prevalence of S.W. gales and windy days; no calm sea during the month. On 22nd a heavy T S began about 8 p.m., lasting to 2 a.m. on 23rd, the L was bluish, and flashes more frequent than I have seen before, mostly sheet but some forked. Within 6 miles there was much damage done, and some gentlemen in a yacht, trying to make for Lyme Regis, were caught in the centre of the storm, wind blowing in gusts from N.W. to S.W., and so dark they could not see their hands when close to their faces, the L was fearful and the rain so heavy that they were as wet in two minutes as if they had plunged into the water. The boatman said he had never seen anything to equal it.

BODMIN.—Average of Bar. 29·98; average Temp. 62°·3.

HAUGHTON HALL, SHIFFNAL.—With the exception of the 20th, 21st, and 22nd, when the max. suddenly reached 79°, 78°, and 84° respectively, the month has been by no mean shot; on the 22nd it was intensely so, but distant T ensued, in S at 7 p.m., with slight rain, and next day the temperature fell to 74°, T also on the 4th and 18th. Although the frequent rainfall was trying for haymaking, none was much injured, while the crops of grain were much benefitted, and the swedes and mangolds thoroughly established. Wind throughout ranged from W. to S.W.; remarkably few butterflies of all sorts, even of white ones; and as yet but few wasps.

ORLETON.—A fine month for vegetation, with a low temperature, but generally steady; a great prevalence of cloud, and but few sunny days till the 20th, then bright sunshine and great heat, on that day the ther. rose to 79°·7 in the shade (fully protected); on the 21st it reached 84°.5 with sky nearly cloudless; at 9 a.m. it stood at 78° on 22nd, and at 1 p.m. it reached 89·6, with bright sunshine and few cumulus clouds; after 3 p.m. great piles of T clouds passed over from S. to N., forming at 6.30 p.m. grand masses in the N., with several peals of distant T, Ther. at this time being 85°, and 9 p.m. 70°, the min. of following night was 63°·5 in the shade; on the morning of the 23rd distant T and L passed across to the E. between 3 and 4 a.m., with a very slight fall of rain, followed by a bright day and brisk wind, ther. reaching 80° about noon; the remainder of the month was the same in character as the beginning, but rather warmer.

WIGSTON.—A fine month, which has improved the corn surprisingly, and with the many showers which have fallen the pastures have been good in many situations; 21st and 22nd were oppressively hot.

BOSTON.—TS on 3rd, 13th, 14th, and 16th.

GRIMSBY.—T S on 12th, 14th, 15th, 22nd, and 30th. A fine month, corn crops greatly improved; all kitchen and garden produce abundant.

ARNCLIFFE.—Violent T S at 8.30 a.m. on 23rd; weather very variable, difficult haymaking—as we call it here, kittle; 21st, 22nd, 23rd, and 24th very sultry; 1·20 fell in 4 hours on the 2nd during T S.

WALES.

NORTH SHIELDS.—T S on 12th, 14th, 15th, and 23rd; L on 22nd.

HAVERFORDWEST.—Constant rain, no heavy rain, but unfortunate for haymaking; temperature very cool for July, exceeding 70° on 7 days only; great heat from 21st to 23rd, which terminated in a T S of moderate violence; from

23rd to the end of the month it was constantly damp, sultry, and rainy, the nights were all, with three exceptions, warm; plenty of grass, and the corn looking very well. Health of this locality excellent.

RHAYADER.—Temperature low for the season, and damp; much T and L, slight showers very frequent; prevailing winds S.W. and S.E.

LLANDUDNO.—T on 4th at 10.15 a.m., on 22nd from 4 to 5.30 p.m., and on 23rd at 2 a.m. On 22nd the day was very hot, the greatest heat being about 1 p.m., 93°, when there was a difference of nearly 20° between the wet and dry bulbs; at 4 p.m. a TS of unusual severity commenced in S.E., and gradually approached Llandudno as it travelled westward. The T became almost incessant till 5.30; the L was mostly forked with some very vivid flashes; R set in about 5, and was very heavy for about 10 minutes, a good many hail (or rather ice) stones fell with the rain, they were very transparent and all one shape, viz., circular and double convex, resembling both in size and shape the confection known as "acid drops"; about 5.30 when the storm had nearly cleared away, I noticed that the dry bulb stood at 73°, and the wet about 4° lower, but though the temperature was thus 20° lower than at 1 p.m., the air felt really warmer and more oppressive, which I attributed to its comparative excess of moisture. During the night another storm occurred, which, though not so severe, was still peculiar: a dark cloud hung over the sea, the L behind which, at every flash, so illuminated it, that it had the appearance of a transparent white sheet, the T was loud, but not so incessant as the storm of the preceding afternoon.

SCOTLAND.

DUMFRIES.—This has been the wettest month of July, that has occurred here for more than 25 years, the rainfall for the month is 3·39 above the average of the preceding five years. Extraordinary TS on evening of 22nd and morning of 23rd; T on 26th; the country looking very fresh and beautiful, but cereal crops now require dry weather.

HAWICK.—A fine, warm, genial month; terrific TS on the night of 22nd, nothing like it ever before seen here. Crops looking well, splendid crops of gooseberries, strawberries and currants.

ANNANHILL, AYR.—Several severe TSS over the county, but none were felt here. On the night of the 22nd-23rd, a severe TS took place, which was general over the island, doing much damage in many places. Haymaking was general by the middle of the month, and finished by the end, the crop rather light; a considerable quantity of potatoes raised by the 19th, quality good; oats and wheat much improved, as are crops of all kinds. The harvest commenced early in S. Ayrshire. A field of oats cut on 28th; potatoes and bulbs of all kinds good as yet, the prospect of wall fruit rather small; berries of all kinds plentiful; shrubs of all kinds looking well. Ozone well developed, but in no case exceeding the maximum (11). Sky was usually half covered with clouds; severe TS on 27th over South Ayrshire. Country generally free from cattle disease. Death rate at Kilmarnock, only at the rate of 23 in a 1,000 per annum; consumption heading the list.

CASTLE TOWARD.—The crops have made great progress, the hay is mostly cut except in the high lying districts, the crop is said to be light except in meadows. In fields unaffected or slightly affected by the grub, there is some prospect of a good harvest. Potatoes promising well, but within the few days back disease has commenced. In several districts round here the fruit crop is above the average; small fruits, gooseberries, strawberries, currants, &c. very plentiful, and the large fruits with the exception perhaps of plums are not far behind. Cattle and sheep healthy and pasturage in abundance.

LOGIERAIT.—Severe TS commenced about 9 p.m. on 22nd, in the S., towards midnight it travelled westward, and raged with great violence from 11.30 to 1 a.m. (on 23rd) flashes very frequent and at times the sky presented the appearance of a brilliant Aurora; about 5 a.m. the storm began a new and lasted for more than an hour and a half, at this time being much nearer, heavy R fell from 6 to 7 a.m. The heat was very great from the 21st to the 24th, the mean of those 4 days being 83·8, the highest reached was 89° on the 22nd; the temp. has greatly cooled since the 24th; the rainfall was general and heavy throughout the month; the hay

crop when not secured has been considerably damaged. A few peals of T on the 27th.

BRAEMAR.—T heard on 14th, 22nd, 27th, and 28th; the T on 22nd continued from 4 p.m. on 22nd to 2 a.m. on 23rd, with very vivid sheet L.

ABERDEEN.—Rainfall, temp., and prevalence of S.W. wind above the average, bar. and pressure of wind below it. A month of warm and rather wet weather; remarkable TS on the night of 22nd and morning of 23rd, perhaps more correctly TSS as there appeared to be three, 11 p.m. to 1.30 a.m., 2 a.m. to 4 a.m. and 6.30 to 9 a.m., but there was distant T and L all through the intervals.

PORTREE.—A very wet and squally month, but notwithstanding all this, the crops are doing well, but the harvest will be late. No blight as yet in the potatoes. The TS of the 22nd did not reach this island.

LOCHBROOM.—A very wet month, propitious for growing crops, but detrimental to hay-making. On 21st and 22nd the heat was very oppressive; about midnight on the 22nd, the most severe TS I ever remember, continuing for three hours; no damage done in this district, but a man and horse were killed not far from here.

SANDWICK.—13th, T about 1 p.m.; 14th, about 10 peals of T at noon and at 5 p.m.; 22nd, severe TS, sheet and forked L from 7 to 9 p.m; 23rd, TS during the past night, and till 10 a.m. July has been 2° warmer than the mean; the R has also been in excess; the weather generally pleasant and favourable to vegetation; but on the 13th and 14th we had TSS, on the latter day a waterspout is reported to have burst a few miles distant, H and large pieces of ice fell; again on 22nd there was one of the most severe TS we have had for some years, by which two sheep were killed.

IRELAND.

DERRYNANE ABBEY.—Wind almost constantly W. during the month, heavy R (1·10) on 28th; potatoe stalks nearly all destroyed by blight, but tubers pretty sound yet.

WATERFORD.—Gale of wind W. on 4th, and strong wind on 7th S.

MONKSTOWN.—Severe TS from 1.30 to 3 a.m. on 23rd, accompanied by heavy R, which continued 4 hours, during which time 1·95 in. fell. A very showery month.

DOO CASTLE.—A wet month, which has benefitted grass meadows, and oats. Potatoe blight very perceptible but the tubers not affected.

WARINGSTOWN.—Heavy showers with T and L. The crops in general very good.

OMAGH.—Weather humid and rainy, very unfavourable for haymaking, but favourable for the growth of green crops and cereals.

REVIEWS.

Sussex Meteorology, 1872. By F. E. SAWYER, F.M.S. Robinson: Brighton. Post 8vo, 15 pp.

Temperature of Brighton. [From *Brighton Herald.*] By F. E. SAWYER, F.M.S.

MR. SAWYER is continuing his efforts to secure efficient observations throughout Sussex, and having the satisfaction of seeing them gradually crowned with success. The first of the two above-mentioned papers is "a complete summary of the Meteorological Observations made in the county," and is decidedly in advance of that for 1871. We trust that the series thus initiated will go on for many years, and that similar publications will be started in many counties, and have no doubt that Mr. Sawyer would be able and willing to give many useful hints to those who might be inclined to undertake their preparation.

The author says (and we agree with him) that "Rainfall observers are still greatly required at, or in the neighbourhood of, West Grin-

stead or West Chiltington, Newhaven or Seaford, and Rye or Winchelsea." But the rainfall details are the strong point of Mr. Sawyer's paper; he must keep that branch up to its present level, but he must try and induce the observers to enable him to make the particulars of pressure, temperature, and natural history worthy of their position by the side of his rainfall statistics.

One other point really ought to be looked to—Sussex is essentially a seaside county. Is it not too bad, that with observers at Hastings, Pevensey, Eastbourne, Brighton, Worthing, and even on Thorney Island, with piers running out to sea every ten or a dozen miles, not a single record appears to be taken of the temperature of the sea. Can any one explain why English observers always neglect this subject?

The second paper contains the result of much hard work, and gives valuable information respecting the temperature in Brighton during the last 33 years, from which we may extract a few of the leading results :—

Absolute highest temperature.....	90·0 on July 6th and 10th, 1852.
Highest monthly mean ,, ...	68·9 July, 1852
,, mean monthly ,, ...	62·0 July
,, ,, yearly ,, ...	52·1 1859
Mean temperature of 33 years	49·9
Lowest mean yearly temperature	46·5 1853
,, ,, monthly ,, ...	39·1 January
,, monthly mean ,, ...	30·6 February, 1855
Absolute lowest temperature	12·0 on January 19th, 1838.

In preparing the elaborate tables contained in this paper, Mr. Sawyer has combined observations made in various parts of the town. For the object which he had in view there was no objection to the adoption of that course, but it seems probable that the data in his possession are worthy of more elaborate treatment, and publication in greater detail. Comparison of what may be described as the overlapping portions of the registers in his possession would, doubtless, indicate peculiarities appertaining to each record, and due to differences of position, of instruments, and of exposure. Careful scrutiny of this kind might lead to the discovery of features at present unexpected.

Cousen's Concentrated Weather Guide, or Perpetual Table for the United Kingdom, intended as a companion to the Barometer. Morrell: *Bury Standard* Office, Bury St. Edmunds.

It would be faint praise to say that this is a better thing than its title implies, or that it is better than any similar broadside we have seen, for no one used to such matters would expect much from the title, and most broadsides are such arrant rubbish that the only difficulty is in surpassing them in uselessness.

It would be perfectly easy to extract a considerable amount of fun from the card now before us, but that is scarcely the reception which should be given to that which the author says has "been tested for more than 20 years, and has rarely been known to fail." The table has

the appearance of having been constructed from actual observation, is so clearly arranged that any one who can read can understand it, and is, we should imagine, very inexpensive. We doubt if others will find it so good as the author says, but as it can probably be purchased for a few pence, and the general arrangement is good, it will be useful in the many houses where a barometer is simply a piece of furniture and an "umbrella guide," and also to those to whom it is too much trouble to master such publications as the *Barometer Manual*, and even to observers as a design which they may adapt to their own localities.

The author says nothing as to the influence of elevation on the reading of the barometer, but merely heads the column "Barometer Scale." As the author presumably resides in the vicinity of Bury St. Edmunds (say 200 feet above sea) the disturbance which would result from the use of the table in such localities as Buxton, Shap, or Braemar has been overlooked. As the table is said to be available for "the United Kingdom," this requires correction.

BOOKS RECEIVED.

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