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THE THUNDERSTORM AND RAIN OF JUNE 29TH.

Although any individual rainfall cannot be fully treated until all the returns are received at the close of the year, it does not follow that no interim details should be given. The rainfall of June 29th appears to have in almost all cases begun with suddenness, been of considerable intensity, and at isolated stations large in amount. We therefore proceed to submit the following abstract of the returns at present received, grouping them in the order they would occupy in "*British Rainfall.*"

*Camden Square.* Slight R began about 4 p.m., but it was heaviest between 5 and 7 p.m., the fall between 6 and 7 p.m. was .40, and between 6.15 and 6.22 .09 fell, being at the rate of .77 per hour; R .69.—*Muswell Hill.* R fell from 4.30 to 7.30 p.m.; R .54.—*Winchmore Hill.* R from 5 to 7.15 p.m.; R .47.

*Croydon* (Addiscombe Road). T S from 4 to 7 p.m., but no R.—*Sevenoaks* (Riverhead Vic.). Half an in. of R fell between 6.15 and 8 p.m.; R .94.—*Chiselhurst* (Heathfield Lodge). R began at 4.15 p.m., with occasional T, R .43.—*Margate* (Acol). R .94.—*Horsham* (Swallowfield). R 1.04.—*Strathfield Turgiss, Winchfield.* Heavy R .90 in. fell in 45 minutes between 4.20 and 5.5 p.m. R, .97 in.—*Newbury.* A vast quantity of R fell in a short time, and in several parts of the town and neighbourhood the roads and houses were flooded. At the Great Western Railway station the rain water washed the approaches, and the booking-offices were flooded several inches deep. No serious damage was done, and the R was greatly needed for the crops.

*Addington, Winslow.* The morning of 29th was warm and bright; ther. 76° in the shade; bar. sinking all morning; overcast towards noon. There was distant T, the wind a point or two East by South. Rain began to fall heavily shortly after 3 p.m.; by 5 p.m. .845 in. had fallen; the weather was fair between 5 and 6 p.m., after which time it rained all the evening. Rain measured at 9 o'clock, Monday morning, 2.645.

*Great Missenden.* R .95.—*Oxford* (Magdalen Coll. Lab.). Distant T and heavy R 3.30 to 9 p.m.; R .85.—*Banbury.* 4 to 5.45 p.m. T S, with heavy R; and again at 7 p.m.; R 1.46.

*To the Editor of the Meteorological Magazine.*

SIR,—A few notes on the rainfall of June 29th and 30th, and the thunderstorms of July 4th, may be of interest, if compared with the fall at other stations :—

June 29th.—2 p.m., sky almost cloudless, hot, light airs from S.E. ; 3.30 p.m., sky clouded ; 4.30 p.m., rain began, continuing at intervals through the night, heaviest from 7 to 9 p.m. ; 4.45 p.m., distant thunder in S. Rainfall to 9 a.m. (30th), 0.32 inch.

June 30th.—Heavy rain, with fresh N.W. wind, from 4 to 5.30 p.m. Rainfall, 0.12 inch.

July 4th.—Two short thunderstorms passed over from S.W. to N.E. at 0.30 and 1.45 a.m. Rainfall during the storms, 0.14 inch ; lightning excessively vivid with loud thunder ; wind S.S.W.

On the previous evening was observed a swarm of gnats, so dense as to obscure the top of a tree. Some weather *savans* hold this to be a sure forerunner of thunder. Is there foundation for this entomological theory ?—Yours truly,

G. WARREN.

*Merton Villa, Cambridge, July 5th, 1873.*

*Sandy (The Lodge). T, R .50.*

*Ipswich.* Distant T, R .92.—*Culford.* No T, but R 1.06 in evening and night.—*Brandon (W. Tofts).* No T, R 1.19.—*Diss.* R began at 7 p.m., R 1.21.—*Norwich (Sprowston).* Slight R from 7, very heavy from 10 p.m. to midnight, ceased at 2 a.m. ; R 1.01.—*Reepham.* R .85.—*Swaffham.* R .48.

*Bridport.* The morning of the 29th was very fine, but sultry ; temp. 75° at 10 a.m. ; at 0.45 p.m. heavy R fell (but without T or L), lasting till 2.30 p.m., temp. at 1 p.m. 70° ; 0.42 in. of R fell, but the R must have been much heavier a mile or two inland.—*Ashburton.* T shower at 0.30 p.m.—*Teignmouth (Brookbank).* R .29.—*Tavistock (Kidworthy Hill).* Heavy R began at 2 p.m. - *Taunton (The Castle).* R .40.—*Burnham.* R .51.

*The Graig, Ross.*—Very warm and sunny till 1.30 p.m., when a thunderstorm came on, not, however, with much electrical display. It continued to rain steadily, at times very fast, till 6 p.m., when 1.54 had fallen, and by 7.20 p.m. another .28 in, making 1.82 in 6 hours.

*Breinton Vicarage, near Hereford.*—The evening of the 28th was fine. Much cirrus had prevailed during the day, except in the district N.N.W., where the sky was perfectly clear. The wind, which had been fresh from W., went down suddenly at sunset. The upper current was very rapid, and was backing towards S.W. The night was sultry, and rather overcast with hazy stratus. Perfectly calm. Minimum temperature, 60°. The morning of the 29th was rather hazy, with a good deal of low dry-looking stratus. I noticed a few cumulostrata above, in the N.W. bar. falling briskly. Breeze rose at 7 a.m. from S, and then backed. About noon, cumulo stratous clouds began to appear, flying very rapidly from S.S.W., and cirrus from S.W. by S., and nimbus began to overspread the sky in the S. and S.W. First

thunder in S.W. by S. at 12.30, but not again until 1.20 p.m. A little rain began at 1 p.m., and the sky became thick all round. Rattling thunder-clap in S.W. at 1.20. The cloud-canopy became slowly thicker and remarkably dark, and the rain increased. Distant, but very frequent, thunder in S. and S.S.E. at 2.40 gradually approaching. The heaviest part of the storm, as far as thunder was concerned, appeared to be to the E. and S.E. The clouds were remarkably wild and gloomy at 4 p.m., the upper current being from S., which cumulus drove rapidly from E.; and there was a gusty north wind on the earth, carrying flying fragments of mist. Nearest lightning to E.,  $1\frac{3}{4}$  miles. This storm travelled from the S., but the thunder did not seem to extend north of this place. The rain continued violent at 5 p.m., but the atmosphere was calmer, and the thunder ceased. At 7 p.m. it cleared very bright in distant S.W., the watery cirrus lying in a long, well-defined arch. In N.E. the sky was very black, while white fragments of low cloud were blowing up from that quarter. Evening cloudy, with much cumulus driving, with a strong breeze from N. by W., but no cirrus above. Temp. max.  $78^{\circ}$  (about 12 o'clock). Afternoon,  $69^{\circ}$ . R fell at Sellack Vicarage, Ross, to the amount of 1.76 in. The storm there was heavy at 3 p.m. The Wye rose 4 ft. at Hereford.—*Wem* (Sansaw Hall). T, R .61.—*Shiffnal*. Fine morning, suddenly overcast at 3 p.m., followed by heavy R rest of the evening; R 1.14 in.—*Market Drayton* (Adderley). R 1.04.—*Buildwas*. R began at 3 p.m.; R .75 in.—*Orleton*. A great and sudden fall of R on the 29th from 1 p.m. to 9 p.m. after a bright and hot morning; R very heavy from 2 to 8 p.m.; T heard at 3 p.m.—*Bromsgrove*. R 1.83, being with two exceptions the largest amount recorded here in 24 hours.—*Droitwich*. On Sunday afternoon and until the following morning the heaviest down fall of R, which has been witnessed by the oldest inhabitant in the borough, occurred here. At the commencement of the storm, and for a continuation of three or four hours, the rain came down in complete sheets of water, deluging the streets in many places, every available watercourse being utterly inadequate to carry off the rapid accumulation of water; many of the first floors of the houses were flooded with the overthrow, carrying with it large quantities of the soil and sand from the streets and roads, the top surface of which was washed so as to have the appearance of pebble pavements. In the neighbourhood some damage has been sustained to the cereal and hay crops, but this fortunately has not occurred to any great extent.

*The Heath House, Cheadle*. 9 a.m. bar. rising (29.36); difference between dry and wet bulb  $5^{\circ}$ ; ther. in sun  $113^{\circ}$ ; ther. in shade max.  $74^{\circ}$ ; ther. in shade min.  $53^{\circ}$ ; wind backed from S.W. to S.E.; no indication of R until 2.30 p.m., when heavy watery clouds appeared; at 4 p.m. rain commenced falling very gently, and gradually increased up to 2.30 a.m. (30th), it then ceased until 6.30 a.m., and from then rained fast up to 9.30 a.m.; T was heard in the distance before the rain commenced. but neither T nor L accompanied the R.; rainfall from 4 p.m. on the 29th to 9 a.m. on the 30th, 2.36. *Coventry*. R 1.08.

*Leicester* (Belmont Villas). Heavy T S from 5.30 to 6.30 p.m.; R, 4.30 to 7.0 p.m., 1.00; 7.0 to 10.0 p.m., .30; 10.0 to 9.0 a.m. 30th, .96; total R 2.26.—*Melton Mowbray* (Coston). T at 6.30 p.m.; R .73.—*Mansfield*. R .56.

*Broughton in Furness*. T, R .61.

*Wakefield* (Stanely Vic.). R began at 7.15 p.m.; .48.

*Llanfrechfa*. Violent T S, doing much damage westward; R 1.24.

—*Llandudno*. Fine till 4 p.m. on 29th, then wet till the evening; R 0.30.

From the above it appears that the only localities in which the fall exceeded 2 inches were, Winslow, 2.65; Cheadle, 2.36; and Leicester, 2.26 in. There seem to have been two separate falls, of different character, the first, a thunder-shower, occurring shortly after noon, in Devon and due N. thereof, and travelling Eastwardly at the rate of some 30 miles per hour, until it reached Norfolk about 7 p.m., before reaching which its character of a thunder-shower had vanished, no T being heard in that county. The other falls are local rains of long continuance, but small area, through which mainly the above specified maxima were produced.

#### MEASUREMENT OF SNOW.

*To the Editor of the Meteorological Magazine.*

SIR,—In the discussion of this subject in *British Rainfall*, 1872, I notice the following suggestion and comment, “*Make all rain gauge funnels deeper.* We see no objection to this, except the increased surface to be wetted.”

May I refer your readers to the reports of my experiments at Hawsker, in the two preceding numbers of the Annual? In that for 1870, Table III., “Form series,” we find a 5-inch gauge with 2½ inch upright rim, the funnel and rim being of zinc, with turned brass edge, giving a slight excess in every month over one with an ordinary copper funnel and brass rim; the total from April to December, being 21.362 against 19.935 inches, and 17.917 against 17.535 if rain only is counted. In 1871, a gauge with a rim 6 inches high was used instead, the results being (see Table I.) a total of 21.451 against 21.332 inches from January 1st to October 24th, but a loss of about 1 per cent. during the summer months. There was only one snowstorm in that year, viz., in February. My own opinion is that a gauge with *straight upright rim 3 inches high* will accurately catch 19 out of 20 falls of snow at most of our stations, and will not fail even for the 20th, if during the progress of the fall of the snow be occasionally pressed down into the bottom of the funnel. I have had several such made and used ever since, and I do not think the loss by evaporation from increased surface is appreciable, although occasionally there is a slight difference, owing to such gauges having less dew deposited in them.—I am, Sir, your obedient servant,

F. W. STOW.

*Harpden, Mag 13th, 1873.*

## CYCLONE AND ANTI-CYCLONE.

*To the Editor of the Meteorological Magazine.*

SIR,—Dr. Burder's last letter on the above subject puts the question at issue between us so clearly, that I ought, perhaps, to leave it as it stands for the decision of your readers; but I am tempted to trouble you once more with a few remarks.

I will select two simple and ordinary instances of "anti-cyclones."

I have before me weather-charts for September 21st, 1870, with reports from the stations throughout Europe, Western Asia, North Africa, and the Western shores of the North Atlantic. The centre of an "anti-cyclonic" system, which had been developed on September 15th, and which was maintained until October 7th, then hung precisely over London. The isobars around this described nearly exact circles. The winds were in accordance with what might be expected from the pressure distribution, Stornoway, North Unst, Thorshaven, and the Icelandic stations reporting S. and S.W. currents, the stations up the Norway coast to Fruholmen westerlies, the Swedish north-westerlies, and most of the French, Italian, North African, and Spanish stations N.E. and E. currents. The nearest depressions were:—1st, a shallow one, whose centre occupied Central Russia; and 2nd, a large and intense system, lying over the South of Greenland. No one, I think, will maintain that the circulation of winds then noticeable in the British Isles was due to a cohesion of this mass of atmosphere to masses circulating in an opposite direction, at a distance of 1000 miles, on the cog-wheel principle. A balloon sent up in the S.S.E. current at Liverpool or Holyhead, and carried by the surface-wind, would then have travelled with an inclination to the right for a distance of 1400 English miles, at the least, before falling into a retrograde current and commencing to turn to the left.

For a second instance, I refer your readers to the British Weather Chart for January 27th, 1873, which shows the west border of an anti-cyclone which extended eastwards into Russia. A balloon sent up at one of the French or North German stations, would then have travelled a very long distance before falling into a "cyclonic" current.

I have taken pains to compare the mean relation between the intensity of the central and the exterior portions of "cyclonic" systems with that which prevails between the corresponding portions of "anti-cyclonic" systems, and I can find very little or no difference. In the case of many small, and nearly all, widely-expanded depressions, the area of low gradients and light winds near the centre is of larger diameter than the belts of strong winds and high gradients on the exterior; and the same is the case with areas of elevation.

It is, however, most true that "cyclones" are commonly more intense than "anti-cyclones." I attribute this, 1st, and principally:—to the energetic action of precipitation in the former; 2ndly, to the effects of the inertia of the atmosphere itself, the tangential force always tending to increase the intensity of the "cyclones," and to diminish that of the "anti-cyclones." This, which certainly gives a more *active*

character to the former systems, is probably also the cause of the greater circularity which they commonly, though not always, possess. It is worthy of remark, that those "anti-cyclones" also which have the steepest gradients have commonly the greatest regularity of form.

There is, indeed, a sense to which Dr. Burder has not referred, in which "anti-cyclones" may be regarded as simply the results of "cyclones." They are fed by upper currents from the latter. This I regard as demonstrable from cirrus observations, and it is, indeed, the only hypothesis on which their maintenance seems intelligible. In this respect, they might be said to have a merely *passive* existence. But, on the other hand, it must be remembered, that the "cyclones" appear to be also maintained by surface-winds from the "anti-cyclones."

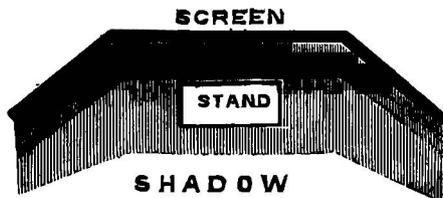
Yours truly,

W. CLEMENT LEY.

### THERMOMETER SCREEN.

*To the Editor of the Meteorological Magazine.*

SIR,—While ruminating this morning upon the correspondence which has, from time to time, appeared in the columns of the *Meteorological Magazine*, with regard to "shade," it has occurred to me that a Glaisher stand placed in the middle of an open lawn is exposed (in summer) to an undue amount of heat, consequent upon the intensity with which the solar rays strike, not only the stand itself, but the ground immediately surrounding it. After a long "spell" of dry weather, the soil becomes as hot as a furnace, proved by the number of fissures on its surface, and the parched appearance of the vegetation which grows upon it. To obviate this difficulty, I propose to erect a wooden hoarding several feet behind the stand, and (say) eight or ten feet in height, in the shadow of which the stand will, of course, be placed; and I shall be glad to hear your opinion, and those of your readers, upon the merits and demerits of this proposal. The annexed rough ground-plan illustrates my meaning perhaps more forcibly:—



I remain, Sir, faithfully yours,

E. G. ALDRIDGE.

P.S.—Perhaps hurdles, covered thickly with gorse or heather, would be better than the hoarding.

24, Guildford Street, W.C., 29th June, 1873.

## WATERSPOUTS NEAR DUNMOW.

*To the Editor of the Meteorological Magazine.*

DEAR SIR,—Though not myself a witness of what I refer to below, I think that you will be interested to hear that on Thursday, June 5th, "waterspouts" were seen by several persons in this neighbourhood. They appeared between 2 and 3 p.m., and, as well as I can make out, must have passed to the S.W. of this place, and in a direction from N.W. to S.E. The first person who called my attention to this was my own servant. On my return home, about 6 p.m., he stated that he had noticed a strange cloud, with a point towards the ground. And on my showing him a picture of a waterspout in an old book, "*The 100 Wonders of the World*," he at once recognised it as like what he had seen. His brother was coming home with a waggon, about 3 miles north-west of this (direct), when a sudden fall of water wetted him through before he could get under the tilt of the waggon. Other men have mentioned seeing 3 or 4 of these curious shaped clouds. In one place the water could be seen from a distance pouring down. I heard it remarked, by more than one person, that the water in the streams had run quite thick and muddy after the rain. Here, and in Dunmow, where I happened to be, there was a steady rain, but nothing extraordinary. Total R 0·18 inch.

The newspapers report that a waterspout was seen on the same day, about 6 p.m., from Shepton Mallet, in the direction of the Bristol Channel.—Yours truly,

EDWARD MAXWELL.

*High Roding Rectory, Dunmow, Essex, 10th June, 1873.*

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 REVIEWS.

*La Seine, Études Hydrologiques, Régime de la Pluie, des Sources, de Eaux Courantes. Applications à l'Agriculture, par M. BELGRAND, Membre de l'Institut, Inspecteur Général des Ponts et Chaussées, &c.*  
Paris: Dunod. 1 thick vol. royal 8vo. and folio atlas of plates.

TRULY this is a splendid illustration of the occasional truth of the saying, "They do these things better in France." We have often had the pleasure of calling attention to excellent papers in the *Annales* of the *Corps des Ponts et Chaussées*, but the above work by M. Belgrand, Inspector General of the Department, is one which has few (if any) equals in any language. Although written with a different object, it possesses many points of resemblance to the *Report on the Physics and Hydraulics of the Mississippi*, by Capt. Humphreys and Lieut. Abbot, which, so far as we know, is the only work which can challenge comparison with the present publication.

We were much surprised to see that upon the first page of the preface, the author describes the term "hydrologiques" as a *new* word, whereas Beardmore's work, published in 1862, under the title of

"Manual of Hydrology," sufficiently indicated the long anterior use of its English equivalent. It is impossible, without largely drawing upon our space, to give more than a general sketch of the contents of this handsome volume. The work is divided into two parts: the first treats of the physical geography and geology of the basin of the Seine, its rainfall,\* and the relation between the depth of rain and the volume of the floods thereby produced. Then the author discusses the mode by which the water passes to its destination, by traversing permeable strata to form springs, and by filling the streams and rivers; and after classifying the various affluents of the Seine, he gives for each stream, and for many stations on each, particulars the completeness of which will be realized by the fact that details similar to the following are given for some hundred stations.

Designation of source—*Springs of Briant.*

Locality and river into which they flow—*Near Brunoy, in the valley of the Yères.*

Importance of the source—*A large spring.*

Temperature of the water— $53^{\circ}2$ .

Titre } *Pour tous les sels de chaux et de magnésie.—23.50*

Hydrotimétrique } *Pour les sulfates seulement.—Considerable.*

REMARKS.—*There are at the bottom of the Yères Valley many springs which yield water abundant, in quantity and of good quality, but unfortunately at too low a level to be available for the supply of Paris.*

The analysis of water for drinking purposes is in England carried to such a degree of refinement as to puzzle all but those who specially devote themselves to the subject, with, moreover, the not very remarkable result that different reports of the same water are given by different analysts. It appears that in the work before us attention is almost wholly given to the hardness of the waters, and none to the amount of organic impurity which they contain.

In the above quoted particulars of the water from the Brunoy springs we gave the analytical remarks untranslated, because we are not acquainted with the "Hydrotimètre" by which they are determined. It is thus described by M. Belgrand:—

"The hydrotimeter is an instrument now too well known to need description, my own researches having perhaps not a little contributed to familiarise its use throughout France. According to Messrs. Boutron and Boudet, who have introduced among us this very simple mode of analysis, one hydrotimetric degree indicates that a cubic metre of the water experimented upon contains sufficient earthy salts to neutralise a hectogramme of ordinary soap. The Grenelle water, varying from  $9\frac{1}{2}^{\circ}$  to  $12^{\circ}$ , neutralises nearly one kilogramme of soap per cubic metre. The water of the Seine, which marks from  $18^{\circ}$  to  $20^{\circ}$ , two kilogrammes; that of the Ource, which gives from  $30^{\circ}$  to  $34^{\circ}$ , three kilogrammes; and the Arcueil, which marks nearly  $40^{\circ}$ , from  $3\frac{1}{2}$  to 4 kilogrammes."

From the above it seems that the hydrotimeter is the French equivalent of the English "soap test," and that hydrotimetric degrees correspond to, and are convertible into, the English "degrees of hardness." We should be greatly indebted to any of our Continental

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\* The rainfall observations in the basin of the Seine are now under the direction of M. Georges Lemoine, and we believe most efficiently worked.

friends who would favour us with a description and, if necessary, drawings of the instrument, for we are sure that simple means for testing drinking water (a development in fact of Danchell's pocket apparatus) are required, and that they should be in the hands of every medical man who holds the appointment of Health officer.

We must pass a very interesting chapter relating to the circumstances which regulate the deposit of carbonate of lime by waters which hold it in solution, commending it to the careful consideration of all engineers who are obliged to use water largely charged therewith. The next subject discussed is the "Springs which may be led to Paris." This is partially of local interest, but contains many useful hints, *e.g.* :

*Temperature of the water of the Dhuis.*—The aqueduct of the Dhuis is 81 miles long. Many persons have thought that in this great length the water would lose its freshness. The following tables prove that the greatest changes of temperature in the transit from the springs at Pargny to Paris are unimportant. [Tables are then given showing the temperature at Pargny and at the Ménilmontant reservoir each day during 1867, 1868 and 1869.] We see at once, by mere inspection of these tables, that during these three years the temperature of the Dhuis water, on its arrival at Ménilmontant reservoir (that is to say, after a journey of 81 miles in the aqueduct), has not been higher than  $56^{\circ}\cdot7$  (August, 1867), nor lower than  $45^{\circ}\cdot1$  (December, 1867). The maximum has always occurred in August, and ranged between  $54^{\circ}\cdot7$  and  $56^{\circ}\cdot7$ ; the minimum has occurred either in December or January, and ranged between  $45^{\circ}\cdot1$  and  $47^{\circ}\cdot8$ . At the springs at Pargny the range is only from  $49^{\circ}\cdot5$  to  $51^{\circ}\cdot3$ .

In subsequent chapters M. Belgrand traces, more fully than we believe any one has ever before done, the course of water falling on different geological formations, tracing the relative surface and subsoil flow, and the relative number of streams per square kilometre in every variety of permeable and impermeable strata. This is followed by a discussion of the records obtained by the following system:—

"By virtue of a ministerial decree of February 3rd, 1854, regular observations are made of the state of the Seine and its affluents. We record especially the variation in the flow of each stream, and with this object gaugings are now taken at 37 stations; at ordinary times, when the rivers are in their usual state, observations are taken once a day; but when they are in flood, gaugings are taken every three hours. The values are entered on a form which is sent to Paris at the end of each month."\*

Comparisons of summer and winter floods; details of all the important ones for several hundred years; a coloured plan showing the portions of Paris submerged by the floods of 1658, 1740 and 1802; remarks on the means by which Paris can be completely protected from floods, are followed by equally full details of droughts and by an exhaustive analysis of the discharging capacity of the various bridges, wherein the mischief produced by some few, which afford insufficient water way, is clearly shown.

The chapters on the influence of forests on rainfall, or rather on the flow from certain districts, on the navigation, including particulars of

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\* Frequent reference is made to the serious loss which the department sustained by the destruction of nearly all its records, which were in the Hotel de Ville when it was burnt during the Commune. We find in the above account no reference to duplicates being kept by the observers, but doubt not that this obvious precaution is now taken.

the various works constructed for its benefit, the lengths, altitudes, locks, &c. of the various canals, and the traffic upon them, on running water considered as motive power, are much to the point; as indeed are all the subsequent ones which deal chiefly with the filtration of water (M. Belgrand points out clearly the imperfections of the English method) and with the relation of the precedent facts to agricultural matters.

With reference to the atlas of plates, we need only say they are worthy of the author, and of the text.

We have noticed this work at unusual length, on account of its great excellence, and because throughout we have had before us, with constant pressure for an answer, the question—Why have we not a similar work on the chief of English Rivers?

Parliament, we believe, some years back placed the control of the river in the hands of a body of gentlemen representing the interests of navigation, commerce, crown property, the corporation of London and riparian proprietors. Science was of course not considered worthy of a representative, though happily there was elected (on other grounds) perhaps the very person whom of all others one would have chosen for his intimate acquaintance with the hydrology of the Thames. Although this body (the Thames Conservancy) might not easily find one man with the wide range of attainments of M. Belgrand, there could be no difficulty in obtaining the co-operation of a group of men each of whom in his own province has few superiors. M. Belgrand's *La Seine* is an honour to himself and to his country; we should be glad to say the same of a work on the Thames.

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*Relazione tra le variazioni diurne della Elettività atmosferica a ciel sereno e quelle del Barometro Nota, del PROF. DOMENICO RAGONA, Direttore del R. Osservatorio di Modena.—Modena, 1873, 11 pages, 8vo.*

IN this pamphlet Prof. Ragona offers some remarks upon the note by Dr. Jelinek in the *Zeitschrift* for March 1st, 1873, respecting Prof. Ragona's previous paper upon another branch of this subject. The author seems to consider that a distinct connection is established between the hourly variation in the amount of atmospheric electricity, and the oscillations of the barometer, and quotes Quetelet's *Météorologie de la Belgique* (1867) and Duprez *Sur l'Électricité aérienne*, as well as the observations of Kew, Utrecht, and Melbourne, in support of his views. He will, however, doubtless be glad to know that he will find stronger and more complete evidence in Kaempts's *Meteorology* (either the German, French, or English edition), and better still in the paper in the *Phil. Trans.* of the Royal Society of London, by Prof. Everett, upon "Results of Observations of Atmospheric Electricity at Kew Observatory and King's College, Windsor, Nova Scotia,"—the latter being a very careful paper, well illustrated, and giving charts of the hourly changes in the amount of atmospheric electricity.

It augurs well for an author, when evidence of which he is not aware, is brought forward in support of the views he has enunciated. At the same time, we cannot help asking, if there is anything surprising in the fact of this relation? Would it not be more remarkable if the curves of (say) pressure and electricity did not agree than if they did? Both are produced by the one great cause of all diurnal atmospheric changes—the earth's rotation on its axis—and although we can readily understand that there may be occasional exceptions, we should be at a loss to explain systematic discordance between two of the effects of one cause.

*L'Umidità, lettura del PROF. D. RAGONA, direttore del R. Osservatorio di Modena* Milan: Fratelli Treves. Post 8vo, 52 pages.

WRITTEN in an essentially popular style, this pamphlet contains a complete resumé of the hygrometric observations made at Modena, during the years 1864 to 1871, from which we have compiled the following abstract:—

TENSION.						HUMIDITY (Saturation = 100)				
YEAR.	Mean.	MAX.		MIN.		Mean.	MAX.		MIN.	
		Amnt.	Date Year	Amnt.	Date Year		Amnt.	Date Year	Amnt.	Date Year
Jan. ...	·183	·311	31 1866	·078	30 1868	86·1	100	several times.	30	30 1868
Feb. ...	·208	·340	12 1866	·050	8 1870	80·6	100	several times.	13	22 1870
March.	·223	·375	13 1867	·055	5 1869	72·5	100	20 1865	13	20 1872
April..	·281	·491	30 1866	·057	9 1867	60·7	97	several times.	7	9 1867
May ...	·383	·657	29 1869	·100	1 1871	60·7	97	25 1866	14	2 1871
June...	·439	·725	28 1868	·140	28 1871	59·9	95	5 1868	16	28 1871
July ...	·484	·754	10 1869	·204	12 1871	52·7	94	15 1868	12	20 1866
Aug...	·480	·825	16 1868	·155	5 1865	58·7	95	29 1867	16	5 1865
Sept ...	·437	·678	24 1867	·186	8 1870	63·1	98	20 1868	15	8 1870
Oct. ...	·324	·662	3 1868	·090	27 1869	73·5	100	27 1865	17	2 1871
Nov....	·249	·439	4 1865	·089	17 1866	82·1	100	several times.	24	5 1869
Dec. ...	·207	·357	5 1865	·097	31 1869	84·4	100	several times.	31	13 1867
Totals	·325	·551	...	·104	..	69·6	98·0	...	17·3	...

The extreme dryness occasionally reached will immediately attract the attention of English observers; that the humidity should be below 20 in nine months out of twelve is a remarkable fact, surpassed only

by the record for April 9th, 1867, of a humidity of 7. As in this country it seldom falls below 33, one has difficulty in realising the dessicating effects of a reduction to 7. Even Prof. Ragona regarded it as "so extraordinary a phenomenon," that he published a separate notice of its occurrence.

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*Seven Years' Meteorology of Sidmouth, 1865-1871*, by J. I. MACKENZIE, M.B. Cantab, M.R.C.S., &c.—[From Trans. Dev. Ass.] 8vo. 12 pages.

ANOTHER of Dr. Mackenzie's carefully compiled papers on the climate of Sidmouth, bringing up the information to the close of 1871. It is satisfactory in every respect but one, and having said that, it will be readily understood that in raising *one* objection, we by no means condemn the paper, quite the contrary, the paper is a thoroughly good one. On page 7 Dr. Mackenzie gives an elaborate table containing some 200 or 300 entries, of which we doubt the utility. It is headed "Barometric Range 1865-1871," and gives for each month of each year the highest and lowest reading of the barometer, and the differences between those values. It will facilitate discussion should our views be thought erroneous if we number our objections. (1) There is nothing to show whether the values are, as indicated by the use of the term "barometer reading" uncorrected, or whether they are sea level pressures. (2) If the former, they are absolutely valueless, being unaccompanied by the readings of the attached thermometer. (3) If the latter, their value is extremely small, because neither the date nor hour of their occurrence is given. (4) We are not aware that Dr. Mackenzie possesses a self-recording barometer, and without it, much self-denial and unexampled patience are requisite to secure records of the extremes of each month. Here we may appropriately raise a question, which, like many of the others, affects nearly all British publications, and not Dr. Mackenzie's alone. The point is (5) one of insufficient definition. We do not think records of barometric range are comparable, because (a) the true barometric range is the difference between the *absolute* maximum and *absolute* minimum corrected reading, which by (4) we have shewn to be difficult of observation, (b) with many, if not most observers, "barometric range" is merely the difference between the greatest and least *observed* heights, (c) with others it is merely the difference between the extremes at the regular hour or hours of observation. (d) Now it is evident that *b* and *c* will both be less than the truth, and that their approximation thereto depends partly upon the frequency of observations, and partly upon the chance accordance of the extremes with the times of observation, and therefore we hold that, with the exception of the values published by the Meteorological Office, and those of the Royal Observatory, all records of barometric range in this country are delusive and incomparable. Lastly (6) we should be glad

to know the object contemplated by the determination of the amount of barometric range.

Should our views be correct, and should our criticism of the present want of uniformity lead to improvements or to its abandonment, Dr. Mackenzie will unintentionally have added one more to the many benefits which directly and indirectly he has conferred upon local climatology.

*Presidential Address*, by A. BUCHAN, M.A., F.R.S.E. [Trans. Botanical Society of Edinburgh.] 8vo, 15 pages.

DEVOTED mainly to tracing the interdependence of Meteorology and Botany, this paper concludes with the excellent suggestion that local Natural History Societies might render good service by preparing local maps, recording *precisely* the spots in which various plants are found, and upon other impressions from the same maps preparing charts illustrative of the physical geography of the district.

*Results of Meteorological Observations made at the Radcliffe Observatory, Oxford, in the year 1869, under the superintendence of the REV. ROBERT MAIN, M.A., Radcliffe Observer.* 8vo, 72 pages. Oxford: Parker, 1872.

WE admit that this work, like too many others, has been for some months waiting notice, but the date appended to the Introduction is June 15th, 1872, or two years and a half after the last observation contained in it was made. If the work were a new one, or one of which the matter changed from year to year, this great delay would be less remarkable, but far from that being the case, much of the matter is identical from year to year, and might, with economy and advantage, be either stereotyped, or omitted.

Having a tower 105 feet high, the Radcliffe Observatory has special facilities for comparing the temperature of the stratum of air at that height with that 4 feet above the ground, and it is distressing to find so excellent an opportunity frittered away by the use of a Six's thermometer, which being (page 29) between 1° and 2° in error, is altogether unworthy of a richly endowed University establishment.

*On the Optics of Mirage*, by PROFESSOR EVERETT, M.A., D.C.L., Queen's College, Belfast. [Phil. Mag., March 1873.] 8vo, 12 pages.

THE title of this paper at once stamps its precise character. Professor Everett devotes the early part of it to determining the path of rays through air of various densities and temperatures, and then proceeds to apply the results of the mathematical investigation of the problem to the several varieties of mirage which have been observed, and which he groups with his usual exactness and lucidity.

JUNE, 1873.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.					TEMPERATURE.				No. of Nights below 32°	
		Total Fall.	Difference from average 1860-5	Greatest Fall in 24 hours.		Days on which $\geq 1$ or more fell.	Max.		Min.		In shade	On grass.
				Dpth	Date.		Deg.	Date.	Deg.	Date.		
I.	Camden Town	2.24	— .81	.69	29	11	79.2	22	42.3	7	0	0
II.	Maidstone (Linton Park)	3.70	— .96	.86	18	13	84.0	29	44.0	1, 26	...	...
III.	Selborne (The Wakes)	1.53	— 1.70	.29	4	11	76.0	22	38.5	4	0	0
IV.	Hitchen	1.68	— .96	.37	4	16	75.0	21	39.0	6	0	...
V.	Banbury	3.68	+ .40	1.46	29	12	78.0	29	40.0	14	...	...
VI.	Bury St. Edmunds (Culford)	2.50	— .08	1.06	29	10	80.0	22	37.0	6	0	0
VII.	Bridport	1.76	— 1.48	.45	12	10	75.0	29	41.0	15	...	...
VIII.	Barnstaple	1.50	— 2.62	.63	29	11	73.0	7*	44.0	1	...	...
IX.	Bodmin	2.34	— 1.70	.68	11	14	69.0	30	47.0	16	0	0
X.	Cirencester	2.21	— 1.17	.58	29	13	...	...	...	...	...	...
XI.	Shifnal (Haughton Hall)	2.61	— .50	1.14	29	13	76.0	21	43.0	4	0	...
XII.	Tenbury (Orleton)	2.78	— .74	1.49	29	12	78.7	21	38.8	4, 8	0	0
XIII.	Leicester (Wigston)	4.06	+ 1.30	1.61	29	10	84.0	29	40.0	6	...	...
XIV.	Boston	2.13	— .06	.98	29	8	82.0	21	41.0	2	...	...
XV.	Grimsby (Killingholme)	1.34	...	.26	14	14	74.0	21†	43.0	2	...	...
XVI.	Derby	2.21	— .68	1.36	29	9	78.0	21	43.0	2	0	...
XVII.	Manchester	2.97	— .37	1.37	3	12	80.6	29	43.0	14	0	...
XVIII.	York	...	...	...	...	...	...	...	...	...	...	...
XIX.	Skipton (Arncliffe)	2.53	— 1.57	.46	24	21	75.0	8	37.0	15	...	...
XX.	North Shields	1.43	— 1.31	.26	15	10	...	...	...	...	...	...
XXI.	Borrowdale (Seathwaite)	7.78	— 2.73	1.90	27	12	...	...	...	...	...	...
XXII.	Cardiff (Ely)	...	...	...	...	...	...	...	...	...	...	...
XXIII.	Haverfordwest	2.11	— 1.87	.80	10	11	71.0	17	40.0	4	...	...
XXIV.	Rhayader (Cefnfaes)	1.95	— .34	.60	30	15	75.0	...	37.0	...	...	...
XXV.	Llandudno	.60	— 1.69	.30	29	7	78.0	21	46.0	14	...	...
XXVI.	Dumfries	1.90	— 1.00	.35	4	15	72.5	5	40.0	16	...	...
XXVII.	Hawick (Silverbut Hall)	1.52	...	.50	3	14	...	...	...	...	...	...
XXVIII.	Kilmarnock (Annanhill)	...	...	...	...	...	...	...	...	...	...	...
XXIX.	Castle Toward	2.39	— 1.10	.50	22	12	77.0	5	...	...	...	...
XXX.	Leven (Nookton)	1.39	— .85	.37	13	15	75.0	20	40.0	1	0	3
XXXI.	Stirling (Deanston)	2.06	— .86	.26	21	19	72.3	5	34.3	1	0	1
XXXII.	Logierait	1.40	...	.41	14	13	74.0	20	40.0	22	...	...
XXXIII.	Braemar	2.83	— .61	.71	14	15	68.8	2	32.7	1	0	2
XXXIV.	Aberdeen	1.01	...	.25	13	15	79.5	21	42.9	12	0	0
XXXV.	Inverness (Culloden)	1.45	— .47	.76	14	18	66.9	22	44.2	1	0	0
XXXVI.	Portree	5.90	+ 1.12	1.27	27	18	...	...	...	...	...	...
XXXVII.	Loch Broom	2.49	...	.54	13	14	...	...	...	...	...	...
XXXVIII.	Helmsdale	2.13	...	.40	23	16	...	...	...	...	...	...
XXXIX.	Sandwick	1.82	+ .28	.28	27	13	68.1	2	36.9	1	0	1
XL.	Caherciveen Darrynane Abbey	2.99	...	.49	3	20	...	...	...	...	...	...
XLI.	Cork	2.43	...	.52	18	9	...	...	...	...	...	...
XLII.	Waterford	1.44	— 1.55	.42	18	10	74.0	8	45.0	7, 16	...	...
XLIII.	Killaloe	2.91	— .72	.43	23	17	79.0	21	40.0	16	...	...
XLIV.	Portarlington	1.47	— 1.78	.48	12	18	77.0	21	43.0	1	...	...
XLV.	Monkstown	.48	— 2.13	.15	29	11	...	...	...	...	...	...
XLVI.	Galway	3.54	...	.52	3	21	71.0	2, 7	45.0	15	0	...
XLVII.	Bunninadden (Doo Castle)	1.39	...	...	...	...	...	...	...	...	...	...
XLVIII.	Waringstown	1.58	...	.32	14	11	88.5?	30	42.5	16	...	...
XLIX.	Edenfell (Omagh)	2.14	...	.50	21	20	71.0	21	36.0	15	...	...

\*And 18, 21. †And 22.

+ Shows that the fall was above the average : —that it was below it

METEOROLOGICAL NOTES ON JUNE.

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.

LINTON PARK.—T on 4th, 18th and 29th; first 20 days mostly dull, with frequent heavy rain, then a few dry but not hot days, with rain again on 29th and 30th; so that vegetation, which was late at the beginning of the month, still continues so, wheat not being generally in ear till 27th; winds various; bar. highest on the 21st. Taken on the whole it has been more favourable than May, still there has been little that can be called summer weather.

SELBORNE.—Wind very variable; fog on 3rd, 4th (dense), 5th, and 6th; TS at 4 p.m. on 5th; T at 9 p.m. on 22nd; difference between max. and min. on 6th only 7°, and on 22nd 20°.

BANBURY.—TS with H on 3rd; heavy R (1·25) on 4th; TS with ·43 of R on 13th; and TS with heavy R from 4 to 5.45 p.m.; and again at 7 p.m. on the 29th, causing the max. fall of the month to be 1·46.

CULFORD.—The month has passed without T being heard here, but a heavy rainfall was experienced in this neighbourhood in the evening and night of the 29th, amounting to 1·06, the heaviest fall in the month.

BRIDPORT.—TS on 2nd, 5th and 29th; the morning of the 29th was very fine, but sultry, the ther. being 75° at 10 a.m.; at 0.45 p.m. heavy R fell (but without T or L), lasting till 2.30 p.m., temp. at 1 p.m. being 70°; 0·42 in. of R fell, but the R must have been very heavy a mile or two inland.

BODMIN.—Bar. average during the month 30·01; average temp. 59·3; rainfall considerably below the average.

SHIFFNAL.—The month, although cold during the first half, was free from frost and favourable for vegetation; TS on 3rd, at 3.30 p.m. in S.E.; on the 21st it became warmer, the max. reaching 76°; on 29th, after a cloudless morning, it suddenly became overcast at 3 p.m., followed by heavy R the rest of the evening, making the greatest fall of the month—1·14 in. The wind was in E. or N.E. during the first week, when it changed to N., and varied from that to W. and S.W. till the close of the month.

ORLETON.—The sky generally clouded and very little sunshine, but the temp., even though low; a great and sudden fall of rain on the 29th from 1.30 p.m. to 9 p.m. after a bright and hot morning, R very heavy from 2 to 8 p.m., distant T heard at 3 p.m.; T heard on the 3rd, 7th, 12th, 13th, 14th, 15th, and 29th; L seen on 3rd; rough winds frequent during the month; all the crops later than usual, wheat only coming into ear at the end of the month.

WIGSTON.—The mean temp. of the month was about the average of a number of years; corn looking very healthy but thin and backward; vegetation unusually luxuriant; T and H on 3rd; T on 13th, and max. fall 1·61 on 29th.

BOSTON.—Gooseberries very plentiful on 22nd; wheat in ear on 22nd, hay being cut on 24th; and strawberries ripe on 26th.

GRIMSBY.—Cold up to the 8th, then warmer; max. temp. 74° on 21st and 22nd. Wheat in ear on 25th; wild roses began to flower on 26th.

MANCHESTER.—1·37 (max. of month) during a TS on 3rd, the whole in two hours; TS on 18th and 28th.

ARNcliffe.—A cloudy month, with small rainfall, and yet it fell on 21 days; TS on 13th.

NORTH SHIELDS.—T on 8th; laburnum in flower on 3rd; white and purple lilac on 4th; globe ranunculus on 8th; double narcissus on 11th; grass iris on 14th; and St. Bernard's lily on 15th.

WALES.

Haverfordwest.—The month commenced cold and cloudy, with N.E. winds; throughout it was damp, at times very wet; very sultry the third week, temp. however below the average, reaching 70° on two days only. A fine month for vegetation; every prospect of good hay and corn.

**CEFNFAES.**—The month an ungenial one, cold and damp, the hills generally covered with thick haze and mist; wind N. E. and S. W.

**LLANDUDNO.**—At 10 p.m. on 2nd a heavy T shower; on 3rd, at 11 a.m. a TS, and another slight one at 5.30 p.m.; fine till 4 p.m. on 29th, then wet till 8 p.m.; 0.30 fell, which was the max. of the month, only about the same quantity having fallen during the preceding 28 days; began to cut hay on 13th; month dry, with much sunshine.

#### SCOTLAND.

**DUMFRIES.**—The first three weeks warm, with occasional showers; towards the end of the month alternate sunshine and showers; the rainfall 1.90 is 3.70 in. below that of June 1872; the mean temp. was 58°.4, or nearly 3° higher than last June; T on 4th, 12th and 26th; the crops in this locality looking remarkably fine, but potatoes rather later than for two years past.

**HAWICK.**—A dry month with cold easterly winds prevailing; T on the 10th, but it brought no rain; hay crop thin, and the corn fields densely yellow with ketlocks or mustard; a good soaking rain very much needed.

**CASTLE TOWARD.**—A fine month for putting in turnips and carrying on outdoor labour of all sorts; turnips in this quarter got in, and thinning going on vigorously; from 21st to the end of the month having such a heavy fall of rain has caused grass pastures and every other thing to be luxuriant; every appearance of good fruit crops; potatoes look well and free from disease; sheep and cattle healthy, and no appearance of foot and mouth disease; on the whole June being a fine month for all classes.

**DEANSTON.**—A good month; in the latter part somewhat broken and wet; crops of all sorts looking well and growing rapidly.

**BRAEMAR.**—TS on 17th, and T with rain at 5.30 p.m. on 4th.

**ABERDEEN.**—A month of fine warm dry weather, but fogs rather prevalent; rainfall and barometer pressure below the average, temperature above it, and wind pressures about the average.

**PORTREE.**—More frost than usual in June; the end of the month wet and squally.

**LOCHBROOM.**—The first eleven days very dry and cold, then for 4 days heavy falls of rain, then dry till the 21st, and thence we had not a dry day during the month; finer weather for turnip sowing we never had, and the latter rain has made the grass grow up, to the graziers and sheep farmers' entire satisfaction.

**SANDWICK.**—The latter part of May, as well as the first part of June, was very dry, but from 20th to 27th of June there was copious rain and mild weather, very favourable to vegetation; on the 22nd there was a TS from 1 to 2 p.m., with heavy rain.

#### IRELAND.

**DARRYNANE.**—Early part showery, with principally N.W. winds; T on 3rd, and heavy T on 5th; latter part of the month foggy with westerly winds, with very rapid vegetation; potato blight showing slightly during the last 10 days.

**WATERFORD.**—The long continuance of dry weather has greatly retarded the growth of the grass, and the hay will be very light; on high lands the grass is quite withered and burnt up.

**MONKSTOWN.**—Total rainfall for past three months, April 0.62, May 0.67, June 0.48. Average for the last 10 years, April 1.59 + 0.97, May 1.89 + 1.22, June 1.49 + 1.01., Total + 3.20.

**DOO CASTLE.**—Remarkable for drought and a prevalence of wind; farmers complain of short meadows, and the oat crop it is feared will be also short; fuel got up in abundance.

**WARINGSTOWN.**—The weather in this month has been generally bright, and the showers have improved the crops very much.

**OMAGH.**—Very seasonable; all crops promise an abundant harvest.