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REMARKABLY COMPLEX FLASH OF LIGHTNING.

[THE following narrative is so lucid, that were it an account of an ordinary accident, our duty would merely consist in placing it before our readers, but the facts are so unusual, and are reported by so experienced an observer, that too careful attention cannot be given to the circumstances. It will be noticed that Admiral the Hon. Sir F. W. Grey, Bt., describes it as a "bright double flash" with a "single discharge" of thunder "like that of a gun," and yet we have six separate cases of injury, distinctly isolated, the least intervening space being 35 ft., several spaces more than 50 ft., while altogether they are spread over an area of 315 ft. by 145 ft. Cases of bifurcation, and even trifurcation, are not very unusual, but we know of no parallel to the ramification of this flash, and that it must all be due to one stroke is proved by the expression, "there was no other discharge in the immediate neighbourhood." Among the many puzzles involved in the following narrative perhaps the greatest is the fact that part of the bark of the tree F was found inside the greenhouse. Our impression is that the injury to the greenhouse arose either simply from an upstroke, or from superheated steam being formed in the pipes by either an up or down stroke, the fact of seventeen panes being broken in the end of the greenhouse at A, and most of the glass falling outwards seems to indicate expansion of air or steam inside, and an outrushing current, yet we find the bark of F was propelled with sufficient force to travel 40 or 50 ft., and force its way against the currents and through the shattered window frames. It would at first appear that the injury to F must have occurred later than that to A, as otherwise the glass would not have been broken, and no entrance could have been gained; but the instantaneity of lightning is both proverbial and true, whereas the flight of the fragments of bark would take perhaps two or three seconds, affording ample time for the displacement of the glass. — Ed.]

BERKSHIRE.

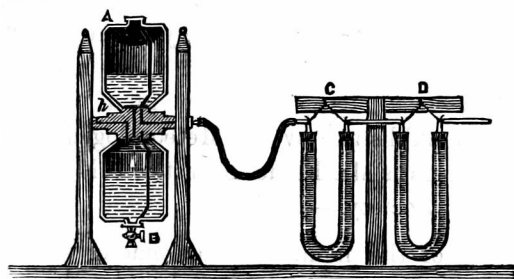
LYNWOOD.—On Saturday, July 13th, the morning was fine, but with thunder-clouds in various directions. About noon these clouds assumed a more threatening appearance, and at 1 p.m. began to rise

more rapidly from the southward ; several claps of thunder were heard, and rain began to fall heavily. About 1.30 there was a bright double flash of lightning, and at the same instant a terrific crash of thunder—one single discharge, like that of a gun. The rain fell in sheets. There was no other discharge in the immediate neighbourhood, and the storm passed away to the N.E. On examination, it was found that the five trees, E, F, H, J, and K, had been struck, that the electric fluid had made a hole in the brick-work of the greenhouse wall at A, about a foot from the ground ; had split the *lower* hot-water pipe at B, broken the joint of the elbow of the *upper* pipe at C, and had burst out large pieces of the lower pipe in the stove at D. The red lead in the joints was disturbed in several places, both in the house and frames ; none of the plants were injured. Two panes in the partition between the stove and greenhouse were broken, and at the end A, 17 panes were broken, the glass chiefly falling outwards. The boiler-house, which is sunk in a pit, and rises only 3 feet above the ground on the outer side, shows no mark whatever. None of the trees near the greenhouse showed any marks more than 10 or 12 feet from the ground. The tree F was most injured, a strip of bark four inches wide being taken off, and the wood laid bare ; some of the bark was carried into the greenhouse. A watering hose was hanging on the tree E, and the bark was most injured between the nozzle and the ground. Two men and a boy were in the shed G, and were thrown against the wall, but were uninjured ; a scythe was hanging up in it, and a considerable quantity of galvanized wire and netting was on the ground. In the greenhouse, pieces of the iron pipe at C were thrown across the house, the force of the explosion apparently acting outwards from the interior of the pipe. The pipes were full, or partly filled with water. Another tree was struck at K, and the earth removed for a short distance from the roots, probably by a separate current. During the passing of the thunder cloud, about seven-tenths of an inch of rain fell, as shown by Pastorelli's storm gauge, and between 10 p.m. and midnight a still heavier fall occurred, so that on the morning of the 14th, 1.62 in. was registered, the heaviest fall registered here in the last five years. The conductor on the dwelling house is about 90 yards from the greenhouse, the space between chiefly occupied by fir trees from 30 to 40 ft. high. The ground is level, but falls to the eastward, the plateau on which the house and garden are, forming part of a ridge running N.E. and S.W. The surrounding country generally undulating and wooded, with Chobham Common to the southward.—*F. W. Grey.*

CHEMICAL HYGROMETER.

[From the *English Mechanic*.]

A hygrometer is an instrument for measuring the degree of saturation of the atmosphere. There are several kinds of hygrometers, one of which I will describe, called the chemical hygrometer. In this hygrometer a given volume of air is made to pass through chloride of calcium, or very strong sulphuric acid which has been previously weighed. The increase of weight shows the amount of moisture in the volume of air. Two brass reservoirs of the same construction, and holding a gallon each, are fixed on the same axis, but on opposite sides, as in the appended figure, and made to turn about it. The interior of each vessel is connected by a central tubulure, and the lower one is always in connection with the air outside by means of tubes running through the axis, while the upper one is connected by means of guttapercha tubes to the tubes c and d, which are filled with chloride of calcium or some porous substance saturated with sulphuric



acid. The tube c prevents any vapour from escaping from the reservoirs to d, and d absorbs the vapour of the air which passes through it. The lower reservoir B being filled with water is inverted, so that the water running slowly from it expels the air in A through the tubulure h which connects it with the air outside. The vacuum now formed in A causes a draught of air through the bent calcium tubes c and d, and the calcium absorbs the moisture in the air which passes through it. When all the water has run into B, the reservoirs are again inverted, and the same process commences again. If the reservoirs have been turned six times, it is evident it is evident that six gallons of air have passed through the tubes c and d, and have been deprived of the moisture in them. The contents of the tubes c and d are then weighed, and the increase of weight gives the amount of vapour contained in six gallons of air at the time of the experiment. I do not think Leslie ever made use of the hygrometer to convert water or mercury into ice. It is true that he converted both water and mercury into ice by a method of rapid evaporation, which I will endeavour to describe. He placed under the receiver of an air pump a vessel containing strong sulphuric acid, and over it a thin metallic shallow box, in which was placed some water. When the air is drawn from the receiver the water boils, and since the vapours are absorbed by the sulphuric acid as soon as they are formed, a rapid evaporation takes place, which soon causes the water or mercury to freeze.—W. H. H. C.

DAILY VARIATION IN THE PREVALENCE OF RAIN
DURING AUGUST, 1872.

[WITH this month's issue we commence a series of brief notes on the daily distribution of rain over the British Islands, thus affording an explanation (necessarily brief and imperfect at first) of the excessive or deficient monthly values reported from different parts of the country. We also intend to give at the end of the year a short summary of the facts thus adduced, and, perhaps, to draw some conclusions from them. It is hoped that by this means we may not only gain a clearer view of the laws which regulate the distribution of rain, but that at the same time some additional light may be thrown on the concurrent conditions of pressure, wind, &c., over our islands. We think it only right that our readers should know the data upon which the remarks are based, and to whom we are indebted for the series of articles. The observations employed are a portion of those sent to ourselves for the formation of our usual monthly table, and some others we receive regularly, supplemented by reference to the daily weather charts published by the Meteorological Committee, and the author of the papers is Mr. Frederic Gaster, F.M.S., Hon. Librarian of the Meteorological Society.—ED.]

At the beginning of the month the barometer stood highest over the north of France, lowest in Norway; and under these circumstances the *prevailing* wind would be, and was, from W. to N.W. Some local disturbance occurred, however, on our north-west coasts, producing an intermingling of the south-westerly current with the more general north-westerly one, in a manner very similar to what is often found in thundery weather. Thunderstorms prevailed in many parts of England during the day, with rain varying from 0.01 in. to 0.81 in. Some fell in Ireland and the west of France also, but scarcely any in Scotland. This weather seems to have travelled slowly to the eastwards, and next day (2nd) we find the storms and rain fell chiefly over southern and south-eastern stations, while in Ireland northerly winds and clearer skies were reported. At 8 a.m., on the 4th, the barometer was really highest over France, but *comparatively* high pressure had also formed over the central and northern parts of Great Britain. Thus while the northerly current of the previous disturbance still held over the east of England, with considerable rain in some places, the southerly wind was restored in the south-west of our islands, where rain had recommenced. The new disturbance crossed our islands very rapidly, but produced little rain except at Dover. What did fall was confined entirely to the southern parts of Ireland and England, and the French stations, but was very general in those neighbourhoods. The morning of the 6th brought new broken weather to the western coasts. A very complicated series of thunderstorms was approaching us, accompanied by a

depression of rather peculiar nature. Already nearly 0·9 in. of rain had fallen on the north-east coast of Ireland, and a less quantity on the other coasts of that country and England. As the day passed the heavier falls travelled to Great Britain, and France was included in the general disturbance. The western districts suffered most, for we find 1·9 in. at Portishead, and 1·2 in. at Rhayader, in the day, while large amounts fell in different parts of Ireland. More than an inch fell at Biarritz, where, in common with our stations, a thunderstorm occurred. On the following day the wet weather moved eastwards, and northerly winds began to return; the sky cleared in Ireland, but England still felt the rain, 1·2 in. falling at Shifnall. Again on the 9th, the old conditions were restored; at eight o'clock the weather was yet very fine, but the barometer was falling in the west, and the southerly current was restored as a light breeze in that region. The new depression was more simple and clearly defined than its predecessor, but its sway more extensive and its influence more uniform. None of our coasts, and only the southern parts of France, escaped without a moderate fall of rain. The disturbance travelled slowly, and it was not until the morning of the 11th that its centre had reached the east coast of Scotland. Rain fell generally each day; first Ireland, then the west of England, and lastly, Scotland, receiving the heaviest falls. It should be noted that in the north and east of Scotland the largest falls appear to have occurred with the northerly or north-westerly winds which prevailed in the rear of the depression. On the 12th the weather was finer, and until the 15th very little general rain occurred anywhere beyond slight showers in Scotland. We must not omit to notice a very local fall of 1·03 in. reported from Galway on the 14th, the only other report for that day being 0·05 in. at Killaloe. During the 15th, however, renewed diminution of pressure was observed in the west, accompanied by an increase over all the eastern stations. The southerly winds were thus restored in our western districts, and were fresh, with rain, while light south-easterly breezes and summer-like weather prevailed in England and France, but as pressure remained very high in the east the disturbances which followed travelled nearly due north, and the wet weather was confined to our most western and northern counties. From the 17th to the 21st the weather was very fine; but on the latter day a slight local depression, such as is constantly associated with thunderstorms, only in this case *very* isolated and clearly defined, showed itself in the south-east of Ireland. A thunderstorm and heavy rain occurred at Roche's Point early in the morning, after which the storm travelled rapidly to the eastwards, heavy rain falling in many parts of the west and south of England, with more or less thunder and lightning. Unhappily, the reports from northern and central France are few, and appear to be of very poor quality, so that the tracing of any disturbance in that country is attended with too great uncertainty to be easily carried out; but it seems that this same disturbance was next morning at Charleville. Some rain fell also at one or two isolated stations in the north of the kingdom, and on the 23rd similar local

showers were reported from some of the midland towns. The morning of the 24th found pressure very uniform in these islands, variable airs and calms prevailing; but in the succeeding twenty-four hours the barometer again fell briskly, chiefly in the west, and rose in France, so that we again had southerly winds established at our western stations, and heavy rain with them; these gradually extended, and on the 25th only the extreme north of Scotland was free from rain. Thunder occurred locally in the north of England, where the rain was heaviest. On the 26th the wind gradually veered northwards throughout the kingdom, and with its advent the rain left us for a while. By the 28th a new slight diminution of pressure had occurred in the extreme north, while uniformly high readings were reported elsewhere; with this slight disturbance we find a renewal of rain at the Scotch stations and in the north of Ireland, extending southwards very gradually till the 30th, when it had reached all places but the extreme south-east of England. On the 30th hail fell at Valencia; thunderstorms were very general in England, and reached some parts of the Continent, and, with some local exceptions, rain fell throughout the country. Very similar weather occurred on the 31st, but both the thunder and rain were less general than on the 30th.

In this notice we have said little as to the quantity of rain measured, except in a few marked cases, but on another occasion it is proposed to discuss the amounts registered during the prevalence of certain distinct conditions of pressure, wind, &c. This will probably be done at the completion of the volume of the year's magazine.

HEAT AS INDICATED BY THE STATE OF THE CROPS v. THE THERMOMETER.

To the Editor of the Meteorological Magazine.

SIR,—It is certainly too much the fashion for those who report the meteorology of their respective districts to confine themselves too much to such notes as their instruments give them, and neglect those other natural indications, which are not so liable to go wrong as the best made thermometer that skill or ingenuity can contrive; in other words, it has often occurred to me that the temperature as reported in many places is very liable to give an erroneous impression as to what the heat or cold may have been; for instance, many meteorologists confine themselves to giving merely the highest and lowest readings of their respective instruments. Now, I would ask, if this be sufficient? as a sudden rise in temperature in the middle of an otherwise cold day may give a maximum much higher than it ought to be, as the warm period of that day may not perhaps be more than an hour, and such sudden rises are not unusual, and the same may be said of depressions at night. Certainly more frequent readings would obviate this to a great extent; still the whole system is artificial, and certainly not without its defects, and taken in contrast with the natural mode of indicating the average temperature of a given district in a given period of say a whole winter and a summer, as exhibits itself in the earling,

or otherwise, of some of the chief crops of the earth, not affected by artificial means ; and taking one of these as an example, let us see how it coincides with the opinion expressed of the character of the present season.

Taking it, therefore, as one of the unerring laws of nature that heat hastens on crops, and taking wheat as one occupying as extensive an area as any other, we have only to consult the farming papers to find out that the harvest has been a late one, perhaps a week later than the average in the south of England, and more than that in the north and west. Now, if we had had a hot summer this would not have been the case, *as wheat as well as all other crops is influenced by the temperature every minute during the whole twenty-four hours of every day*, whereas the meteorologist draws his conclusion simply from two especial periods of perhaps only a few minutes each—the highest and lowest points attained by his instruments ; this assuredly can have no claim to the accuracy with which nature does her work, and no mechanical contrivance involving the use of quicksilver or spirits of wine can perform the duty of registering heat and cold with such nicety as is done by Dame Nature, where the deductions to be drawn extend over a considerable period, as that of a whole season ; and taking the present one as an example, and the harvest a late one, it is evident there has been a deficiency of heat in the summer months, taking the whole of them collectively, from the 1st of May up to the end of September, for it must be observed that up to the end of April vegetation was in a forward state, but May and June being both cold months, and the heat of a certain portion of July being counter-balanced by some dull cold periods of the same month, neither the wheat nor other crops regained the position they lost in May and June. August was perhaps the finest month in the year, and September, up to 18th, was also fine, helping to ripen fruits and other late crops ; the wheat having been all secured in this neighbourhood long before this ; but as we have taken wheat as the criterion, I think it cannot be denied that it was late, and being so, the natural conclusion to be drawn from that is, that there has been a lack of heat in the aggregate, which is the cause of its lateness. Might I ask if the averages, as given by the readings of the thermometer, confirm this, taking the whole of the period from the 1st of May up to the 12th August, when the corn was mostly ripe ? and if the figures given support me in that, the period in question has been a cold one, then it may be taken for granted that the season has been a cold one, in spite of the hot periods we have had in it ; if, on the other hand, the figures indicate a contrary state of things—viz., give a degree of heat above the average of years for the same period, then it becomes us to inquire whether the artificial temperature obtained by mechanical means be the real temperature of the atmosphere, or whether some error or other has crept in. I confess having a strong predilection for giving a higher position to vegetation as a heat-indicator than is generally done by the mechanical world, for a plant is a far superior finished machine

to anything produced by the most skilful workman. The difficulty seems to be in the reading; that I fear we must be satisfied by only doing at points of time a long way apart. Say, in the matter of the wheat crop; notice when it comes into ear, and when it is ripe, and I am very much mistaken if heat, or its absence, is not exemplified here more accurately than is done by any contrivance of expanding or contracting fluids in the way of thermometers or other instruments. More might be said on this head, but enough has been given to make my views understood.

Taking another view of the past or passing season, I may add that the three months of July, August, and September, have been drier than any similar period during the last eighteen years, excepting that of 1855, 1858, 1864, and 1869, while the total rainfall of the nine months that has elapsed this year is greater than any other like period during the above time, excepting those of 1860 and 1866. 1872 has also been more prolific in thunderstorms, and I have no record for upwards of twenty years in which I have noticed such things as so late spring frosts and so early autumn ones as the present season has furnished us with; the other features of it have not been remarkable, unless it be mentioned that it has afforded sufficient diversity to enable both the weather prophets who predicted a hot season, and those who foretold a dull cold one, to claim fulfilment in both their cases. This anomalous state of matters I must leave to them to explain; at the same time if any one had foretold an unusual amount of thunder, and very late spring and very early autumn frosts, they would certainly have been nearer the mark, as far as this district is concerned, than either of the above, widely different as they are.

J. ROBSON.

THE BRITISH ASSOCIATION AT BRIGHTON.

(Continued from page 143.)

FORESTS IN THEIR RELATIONS TO HYDROLOGY.

The President introduced Monsieur G. Lemoine, Secretary of the Meteorological Society of Paris, who read a paper on this subject, drawn up in French, of which the following is an abstract:—

The action of forests on the climate of a country must be considered as extremely doubtful. In the basin of the Seine it has been established in respect to forests, as compared with soil covered with grass, or even with other permanent cultivation, that they have no influence on the watercourses. The only absolutely certain action of forests is their influence on the protection of the soil. They prevent the earth being carried away; but, from this single fact, it follows immediately that, in mountainous countries they can retard the flow of torrent waters. In fact, in the *Département des Hautes Alpes*, the presence of forests prevents the formation of torrents; the replanting of woods extinguishes torrents already existing; but in most cases turfing alone is sufficient to produce the same effect. These conclusions must be carefully limited to the countries in which they have been obtained; but they show at once the weakness and the power of man. He acts on the soil, he controls torrents; but the great general phenomena of the atmosphere, the great streams of air, which determine the climate of a country, are beyond his reach.

Dr. Brown, formerly of South Africa, said there were indications that a great portion of South Africa had been under water at one time, but at what period had not yet been ascertained. The trees varied in magnitude in different quarters,

and yet were of the same magnitude in each locality. It appeared as if these trees were the product of seed which germinated when the water-level has sunk a little below the spot on which they were growing; and if we could only ascertain the age of those trees, we might determine the period when the waters receded. Some of these trees were 70 and 80 feet in diameter, and Mr. Chapman had given him an instance of a tree 104 feet in diameter. But the dessication of the country had been going on since the draining off of the waters, owing to evaporation. The destruction of herbage and grass by fire, the use of the axe by native and colonist, and the formation of sheepwalks, had facilitated the process of evaporation. As an illustration of the effects of evaporation producing dessication, he quoted an experiment made by Mr. Wm. Blore, a Fellow of the Meteorological Society of London, and Secretary of the South African Meteorological Society, at Wynberg Hill, about eight miles from Capetown.

He sunk two cylindrical jars of the same size in the ground to the depth of four inches, leaving them projecting an inch above the surface as a precaution against sand and other matters being blown into them, and covering each with wire gauze to keep out flies, &c. The one was placed where it was partially protected, but not covered by bush, the other was sunk in a newly cleared plot of ground, measuring about 60 feet in diameter, surrounded by sugar bushes, *Protea mellifera*, *Thumberg*, of a considerable height, and otherwise protected from the prevailing wind by a belt of pine trees, about 120 feet distant.

Into each of these jars was put 20 oz. of water on January 31st, at 10 a.m. On February 5th, at 5 p.m., the water remaining in each was carefully measured, and the evaporation was calculated, when it was found that the evaporation from the jar sunk in the cleared ground had been more than double the evaporation from that which was partially protected, though not covered by the bush; the former being 1·854 in.; the latter, ·863 in.; giving an excess of ·991 in. The experiment was repeated with similar results.

In reporting these results, Mr. Blore remarked that had the experiment been made in a more arid district, the evaporation would have been greater; and that had it been made in the open country, the difference would have been marked. But taking the results obtained as the basis of calculation, he arrived, by the following process, at a conclusion, for which probably few who have not given attention to the subject, are prepared.

The excess of evaporation from the more exposed jar above that from the jar partially shaded, but not covered, being 1 in., more strictly speaking upwards of 99·100ths of an inch of water, and more than double that of the latter, "An inch in six days," says he, "will give for 102 days, the ordinary duration of the hot windy and dry season in the district, 17 in. This is equal to about 384,000 gallons per acre, and supposing 1,000 acres to be burned, blackened and dried, what with sunlight, fire, heat, and wind, the evaporation would be an excess of three hundred and eighty-four millions of gallons of water above what would have been evaporated if the bush or grass had been left unburned.

In the prosecution of his researches, Mr. Blore ascertained by experiment that on Wynberg Hill, while the deposit of dew on a green surface amounted to 4·75, that on a white surface amounted only to 2, showing that the deposit of dew upon a green surface is more than double that upon a white; and he further ascertained that while the difference of temperature in the water in the two jars employed in the former experiment was only a few degrees, the difference of temperature between black ground and ground shaded by bush was about 25°, which would occasion a vastly greater difference in the amount of evaporation than that which occurred in his experiment. He proceeded to state that humidity of air is of more importance than rainfall, and that it is not necessary, in order to account for phenomena observed, to suppose that forests attract clouds; neither is it necessary to suppose that they increase the rainfall, otherwise than they do by the repeated precipitation of the same moisture in the form of rain; that forests, whatever their effect upon the quantity of the rainfall, produce a diffusion of this both in time and space, and tend thus to diminish the frequency and the violence of thunderstorms and of torrents; that the moisture of the humid atmosphere, charged with carbonic acid and ammonia, attracted by the soil, does more to promote vegetation than would the same quantity of moisture falling as rain or applied

by irrigation ; and that the humidity of the atmosphere tended to equalize the temperature of day and night—of summer and winter.

Mr. John Ball said he did not agree with M. Lemoine in thinking that forests afforded no greater protection against the formation of torrents than pasturage, and he mentioned instances in proof which had now come under his observation.

THE RAINFALL OF SUSSEX.

Mr. F. E. Sawyer read the following paper on the Rainfall of Sussex :—

The county of Sussex is divided by the range of hills known as the South Downs, into two meteorological districts of unequal extent, and very different in their climates. In the western part of the county these hills are about ten miles distant from the sea, and they continue eastward for a distance of about forty-five miles, gradually approaching nearer to the sea, and terminating at length in the bold headland of Beachy Head. Of the two districts thus formed, the coast district, or that to the south of the Downs, has the smallest rainfall, and the air is drier, the temperature more equable, and the daily range of temperature much less than in the other district. To the east of Beachy Head all that part of the coast which is not distant from the sea more than about a mile, appears to have the same climate as that to the south of the Downs, and may, therefore, be included in the coast district. Even in this district the rainfall increases so much as we proceed further inland that it appears doubtful whether we should not consider the northern part of the coast district as an intermediate or sub-district. The second district, or that to the north of the Downs, and in the east, to the north of the coast district (generally known as the Weald) has a much greater rainfall, with extremes of temperatures and high daily range.

The causes of the increased rainfall in the Weald are threefold ; firstly, the Downs, which, rising up in the path of the rain-clouds from the coast to the Weald, attract and condense their moisture ; secondly, the woods, or the remains of the wealden forests ; and thirdly, the rivers, the beds of which form a path up which the rain storms can travel, and which also condense the vapour in their immediate vicinity.

The extreme effect of the first of these causes on the rainfall is to increase it in the Weald by about seven inches ; but although this, probably, does not extend to a distance of more than about four or five miles away from them, yet there is nevertheless a distinct increase in the rainfall at nearly all the stations in the Weald owing to this influence. Beachy Head has a great effect on the rainfall in the east part of the county, by attracting the rain-clouds from Pevensay, which decreases the rainfall there, and also by dividing the clouds into two parts, one of which passes round by Eastbourne into the Weald, the other to the westward over the Downs and also into the Weald. Hailsham, which is a few miles to the north of Beachy Head, thus escapes many showers, and its inhabitants often see the rain falling at Eastbourne whilst there is none there. The divided rain-clouds, after missing Hailsham, unite again at Heathfield.

The second of the three causes is irregular in its influence. In the time of the Romans the Weald was almost entirely covered with forests, Tilgate, Ashdown, and St. Leonard's forests being the chief remains of the ancient forests, whilst the names in other parts indicate their wooded character ;—as Hurstpierpoint, the wood of the Pierpoints (Hurst meaning wood), Midhurst, Fernhurst, Billinghurst, Ashurst, and about twenty-eight more places the names of which commence or terminate with "Hurst."

These forests are supposed to have been interspersed with lagoons, and the rainfall at this time must have been very great, as we find that several centuries after all the valley of the Adur up to Bramber, was under water. The greater portion of the wealden forests was cut down for fuel, when iron was manufactured in this county, and this fact doubtless will account for the diminished rainfall in several parts of the Weald. Trees increase the rainfall by breaking the wind and also by condensing vapour.

The third cause of increase in the wealden rainfall is slighter in its effects. Rain storms, and more particularly thunderstorms, have a great tendency to pass up river beds, and it has been observed at Brighton that thunderstorms, when two or three miles out at sea, either go wholly east or west, or else split up into two parts and go in the direction of the nearest river beds, namely, those of the

Ouse and Adur, up which they pass into the Weald. The other influence of rivers on the rainfall is by condensation of vapour. At Petworth it has been observed that about the turn of the tide, when the water begins to run up the Arun, the wind springs up, and showers frequently accompany it, and they are consequently known as "tidal winds" and "tidal showers." This phenomenon is probably caused by a cooling of the atmosphere, arising from the influx into the bed of the river of a quantity of water at a lower temperature than that of the atmosphere, which causes the air above it to contract, when the warm air on the banks rushes in to supply its place, and thus the wind currents are created, and when the condensation of vapour is very great rain follows. The greatest influence of the Downs on the rainfall is in the western part of the county. Whether this arises from the increased width of the Downs in that part, or whether the rainfall is increased by the greater breadth of land, the rain-clouds have to traverse before reaching the Downs, is uncertain. In the north-eastern part of the county there is another range of hills, known as the Forest Ridge, and these, doubtless, have some influence on the rainfall of that district. The average coast rainfall is about twenty-five to twenty-six inches, whilst that of the Weald is nearly thirty-three inches; the combination of the causes before-mentioned, however, increases this amount in some parts, whilst the absence of these influences in other parts decreases it. The wealden rainfall is then about 33 per cent. greater than that of the coast, and it is chiefly to this circumstance that its fertility is owing. The greatest rainfall occurs in the north western part of the county, and Lynch, near Midhurst, appears to be the most rainy place in the county; but as only two or three years' observations have been made there, the correct average fall cannot be ascertained, but by comparison with that of West Dean, the average is probably about 38 or 39 inches. Pevensey has the smallest rainfall in the county, as far as present observation shows; and this is owing, so the observer there says, "to the attraction by the Downs of rain clouds coming from the south-west, and by Fairlight Cliffs of rain clouds coming from the east; but it has been suggested that the rapidity with which the wind passes over this low flat part of the coast, prevents much rain from falling there. The average fall for thirty years at Pevensey was 24·07 inches." The influence of the Downs on the fall will be plainly seen by the following comparison. At West Thorney, near Emsworth, on the coast, the mean rainfall for the ten years ending 1869 was 26·87 inches, and at West Dean, which is in a valley of the Downs, it was 37·08 inches, or 38 per cent. more. At Bognor, on the coast, the mean of the ten years ending 1869 was 24·2 inches, and at Dale Park, Arundel, 33·73 inches, being 39 per cent. more. At Worthing, farther east, the mean of the last three years was 23·88 in., whilst at Steyning, in the Weald, and to the north of the Downs, the mean for the same period was 34·25 inches, or nearly 50 per cent. more. At Brighton (Buckingham-place) the mean rainfall of the last three years was 25·39 inches; and at Glynde, to the north of the Downs, it was 30·69 inches, or 20 per cent. more; and at Beachy Head the mean of three years was only 21·82 inches, whilst at Eastbourne, to the north east, it was 27·40 inches, or 26 per cent. more. The greatest rainfall which has been yet recorded in the county was in 1852, which year had the greatest rainfall of the last 150 years. In that year the total at West Dean, near Chichester, was 54·20 inches; at Dale Park, Arundel, 52·03 in.; at Chilgrove, near Chichester, 50·87 inches; and at Uckfield, 50·55 inches. The smallest amount yet registered was 13·11 inches at Pevensey in 1858. The following table gives the mean rainfall at those places where it has been longest observed:—

Chichester Infirmary.....	30 years mean, 28·27 inches.
" (Chilgrove)	" 32·95 "
Pevensey	" 24·07 "
Uckfield	28 " 29·38 "
Hastings	23 " 27·20 "
Brighton	21 " 26·20 "
Worthing	20 " 26·29 "
Arundel (Dale Park)	20 " 33·65 "
Maresfield (Forest Lodge).....	15 " 30·12 "

The monthly totals are generally very varied, but on comparing the mean monthly totals for twenty-eight years at Uckfield, and twenty-one years at Brighton, there does not appear to be much difference in the seasonal distribution, February and April having the smallest totals, whilst October has the largest.

Mean Monthly Rainfall.

	Brighton.	Uckfield.		Brighton.	Uckfield.
	in.	in.		in.	in.
January ...	2·43	2·88	July	1·94	2·34
February ...	1·44	1·68	August ...	2·00	2·51
March	1·70	1·86	September	2·68	2·78
April	1·43	1·72	October ...	3·83	4·21
May	2·05	2·22	November	2·41	2·70
June	1·80	2·01	December	2·49	2·47

The greatest amount of rainfall recorded in any month was in October, 1865, when the total at Dale Park, Arundel, was 12·23 inches ; at Uckfield, 11·23 in. ; Worthing, 10·60 inches ; and Lewes-road, Brighton, 9·59 inches. The smallest amount recorded was no rain in May, 1844, at Brighton. The heaviest falls of rain in 24 hours recorded in the county were on October 18th, 1865, 2·40 inches at Uckfield, and on the 19th 2·27 inches at West Thorney, and on September 27th, 1854, 2·38 inches at Uckfield. When the rainfall is very great, the low districts in the county become flooded. The chief places thus inundated are the levels round Pulborough, Arundel, Bramber, Beeding, Henfield, Lewes, and Pevensey. In November, 1810, these places were flooded, and at Arundel the water was seven feet deep in the levels ; in December, 1821, there was another flood, and the water was breast high on the ground floors of houses at Bramber. In January, 1828, the level at Brighton was flooded, and the rest of the county suffered much ; in December, 1839, severe floods ; also from October to December, 1841, and in February, 1847, floods were caused by the melting of snow. In the autumn of 1834 there was a severe drought in the county, which continued throughout the next winter, spring, and summer, until August, 1835. In a village near Littlehampton, cider was said to be more plentiful than water, the latter being sold at 3d. per pail. In November, 1847, the water became very low in the wells at Brighton, and in the spring of 1852, many springs were dry, which were never known to be so before. Sea salt is often contained in rain, and after the "great storm" on November 27th, 1703, salt was found on the trees fourteen or fifteen miles from the coast. A letter from John Fuller, of Sussex, dated December 6th, 1703, published in the *Philosophical Transactions* for 1704, says, "We live ten miles off the sea in a direct line, and yet can scarce persuade the country people but that the sea-water was blown thus far, or that during the tempest the rain was salt, for all the twigs of the trees the day after were white, and tasted very salt." After the severe storm of November 29th, 1836, a similar deposit of salt was seen on the windows at Lewes. The earliest rainfall observations in this county were made in 1790, by the Rev. J. Mossop, at Brighton, and published in the *Gentleman's Magazine* for 1791. No observations were then made until 1834, since which there are continuous records, and owing chiefly to the great stimulus given to rainfall observation by the Rainfall Committee of this Association, and its energetic secretary, Mr. G. J. Symons, the number of observers is now upwards of 35. There is only one rainfall proverb peculiar to this county—

"When Wolsonbury has a cap,
Hurstpierpoint will have a drap."

Wolsonbury Hill is a summit in the Downs, near Clayton, and when it is enveloped in clouds rain may be expected to fall at Hurstpierpoint. Similar proverbs exist in many hilly localities.

Mr. Glaisher corroborated the fact that the thunderstorms often become divided, and pass on both sides of Greenwich Observatory so as scarcely to be felt there.

Mr. Symons followed with some remarks further explanatory of the statements of Mr. Sawyer in his paper, and stated that the extremely exposed situation of the rain gauge at Pevensey led to the registering of less rain there than really fell.

SEPTEMBER, 1872.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.					Days on which 41 or more fell.	TEMPERATURE.				No. of Nights below 32°	
		Total Fall.	Difference from average 1860-5	Greatest Fall in 24 hours.		Deg.		Date.	Deg.	Date.			
				Inches.	in.						Max.	Min.	
													Dpth.	Date.	In shade	On grass.
I.	Camden Town	1.64	— .62	.38	23	13	83.1	3	33.0	23	0	1	
II.	Maidstone (Linton Park)	2.01	— .21	.94	24	9	84.0	13	29.0	23	3	1	
III.	Selborne (The Wakes)	2.28	— .16	.53	24	9	75.2	2	32.0	23	1	2	
IV.	Hitchin .....	.69	+ 1.17	.11	4	12	74.0	3	35.0	21	0	...
V.	Banbury	1.46	— .91	.25	1	15	76.0	3	32.0	23	1	...	
VI.	Bury St. Edmunds (Culford)	2.35	+ .74	.90	25	16	75.0	3, 11	30.0	22	2	4	
VII.	Bridport	1.76	— .56	.43	24	13	76.0	3	30.5	23	2	0	
VIII.	Barnstaple	5.14	+ 1.38	.92	23	25	75.0	5	35.5	23	0	...	
IX.	Bodmin	4.79	+ 1.12	.75	23	24	71.0	7	36.0	23	0	1	
X.	Cirencester	3.05	+ .19	.80	29	9	...	...	...	...	...	...
XI.	Shifnal (Haughton Hall)	3.72	+ 1.77	.85	4	21	71.0	2*	33.0	22	0	...	
XII.	Tenbury (Orleton)	2.08	— .60	.38	1	17	75.0	12	33.5	23	0	2	
XIII.	Leicester (Wigston)	2.28	+ .07	.41	27	16	79.0	2, 4	34.0	22†	0	...	
XIV.	Boston	2.19	+ .62	.57	1	20	76.5	11	37.0	23	0	3	
XV.	Grimsby (Killingholme)	2.76	...	.71	1	21	74.0	4, 12	36.0	23	0	...
XVI.	Derby	2.93	+ .59	.65	1	19	74.0	4	37.0	25	0	...	
XVII.	Manchester	7.04	+ 3.35	1.24	1	24	75.0	5	33.5	25	0	2	
XVIII.	York	3.63	+ 1.30	.65	1	22	72.0	5	37.0	22	0	...	
XIX.	Skipton (Arncliffe)	9.59	+ 4.63	.86	12	28	72.0	4	31.0	20	4	...	
XX.	North Shields	4.79	+ 3.09	.93	23	18	70.0	11	35.8	21	0	0	
XXI.	Borrowdale (Seathwaite)	20.85	+ 7.64	2.34	30	27	...	...	...	...	...	...
XXII.	Cardiff (Ely) .....	...	...	...	...	...	...	...	...	...	...	...
XXIII.	Haverfordwest	5.50	+ 1.79	2.04	6	23	72.2	3	38.0	29	0	...	
XXIV.	Rhayader (Cefnfaes)	5.75	+ 1.91	1.10	27	18	71.0	...	35.0	...	...	...
XXV.	Llandudno	6.83	+ 4.49	1.40	1	22	79.6	4	43.6	24	...	...
XXVI.	Dumfries	4.71	+ 1.98	.69	27	24	...	...	...	...	...	...
XXVII.	Hawick (Silverbut Hall)	3.84	...	.68	2	25	...	...	...	...	...	...
XXVIII.	Ayr (Auchendrane House)	9.84	+ 6.11	1.18	6	22	72.0	4	30.0	25	2	3	
XXIX.	Castle Toward	8.39	+ 3.77	1.35	12	21	71.0	3	...	...	...	...
XXX.	Leven (Nookton)	3.92	+ 1.44	.50	7	22	67.0	5, 11	33.0	20§	0	6	
XXXI.	Stirling (Deanston)	7.11	+ 3.96	.94	30	21	66.9	4	29.8	24	3	6	
XXXII.	Logierait	4.79	...	.68	1	24	66.0	11†	33.0	23	0	...
XXXIII.	Ballater .....	...	...	...	...	...	...	...	...	...	...	...
XXXIV.	Aberdeen	6.96	...	2.16	25	26	65.7	6	37.8	23	0	8	
XXXV.	Inverness (Culloden)	3.76	...	.54	23	27	62.7	12	38.6	23	0	6
XXXVI.	Portree	11.02	+ .25	1.54	27	29	...	...	...	...	...	...
XXXVII.	Loch Broom	6.90	...	1.52	28	26	...	...	...	...	...	...
XXXVIII.	Helmsdale	3.50	...	.71	3	23	...	...	...	...	...	...
XXXIX.	Sandwick	3.50	— .16	.63	5	25	60.8	5	39.0	22	0	4	
XL.	Cork	4.24	...	1.20	2	10	...	...	...	...	...	...
XLI.	Waterford	3.20	+ .07	.82	9	18	73.0	13	37.0	26	0	...	
XLII.	Killaloe	4.60	+ .44	.70	26	26	77.0	13	38.0	26	0	1	
XLIII.	Portarlington	2.59	— .69	.35	5	27	74.5	13	35.5	21	0	...	
XLIV.	Monkstown	2.38	+ .39	.52	5	19	...	...	...	...	...	...
XLV.	Galway	6.90	...	1.03	5	20	67.0	13	32.0	4||	3	...	
XLVI.	Bunninadden (Doo Castle)	6.96	...	.72	2	27	...	...	...	...	...	...
XLVII.	Bawnboy (Owendoon) .....	...	...	...	...	...	...	...	...	...	...	...
XLVIII.	Waringstown	4.88	...	.60	2	25	75.0	14	35.0	24	0	1
XLIX.	Strabane (Leckpatrick)	7.22	...	.63	11	29	...	...	...	...	...	...

* And 3, 4, 13. †And 15. ‡And 24. §And 22. ||And 15, 19.
 †Shows that the fall was above the average ; —that it was below it.

METEOROLOGICAL NOTES ON SEPTEMBER.

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.—First 18 days warm and fine, then cold set in, with sharp frosts on 20th, 21st, and 22nd; Heavy R on the 24th; L on the evening of the 19th; high wind on the 27th; bar. unsteady from the 18th to the end of the month; winds mostly W. and S.W.; on the whole a fine month, the middle part of it very dry; only .06 of R falling from 5th to 23rd; temp. about the average; rainfall below it.

SELBORNE.—A gorgeous sunset on the 2nd, followed by R at 9 p.m. On 3rd, T occasionally, TS and violent R at 11 p.m.; L, T, and heavy R at 6 p.m. on 4th; violent wind on 26th and 27th, from N. and N.W.; prevailing winds S.W. and W. An exceeding windy month, but on the whole favorable harvest weather; crops below the average, but well got in; the largest crop of hops known for many years.

BANBURY.—T and L at 3 a.m. on 4th; H at 0.30 p.m. on 21st; high wind on 26th and 27th.

CULFORD.—T on 3rd, 4th, and 29th; heavy fall of R on 25th, amounting to .90 in.; a very sudden and remarkable depression of temp. took place on the 19th, and continued during the three following days; on the night of the 22nd, at four feet from the ground the ther. registered 30°, while that on the grass went down to 26°, and many plants which are usually expected to resist 8° or 10° of frost, were found to be much injured, this injury from frost does not appear to have been general, as in localities only a mile or two from this station the same species of plants are uninjured, although the sudden change of temp. appears to have been universally felt.

BRIDPORT.—T and L on 3rd, 4th, and 24th; on 4th a very heavy TS from 6.30 to 7.15 p.m.; T very loud, and L very vivid and forked.

SHIFNAL.—To the 11th a copious daily rainfall, except on 5th and 8th; a cessation till 17th, when it set in again, and fell daily to the end, except on 22nd, 28th, and 30th; TS from S.W. at 5.30 p.m. on 4th, and again from S.E. at 4 p.m. on 21st, with H, which fell heavily with large stones not far off, especially at Shrewsbury; up to the 20th the temp. was warm, on that day a sudden and remarkable change came on, for some days max. 52°, 50°, 51°, 50°, 50°, and 52°, respectively, when it rose again above 55° to the end of the month; on the nights of the 21st and 22nd the tender plants were cut down; the wind, which began from S.E. changed on the 7th to S.W., and varied from that to N.W. to the end; heavy gales from S.W. on 27th and 28th; partridges very scarce, drowned in the egg or while young by the thunder-showers; many Red Admiral butterflies, and several Camberwell Beauties seen here. Few damsons, nuts, or walnuts; blackberries abound, but not a mushroom has yet appeared.

ORLETON.—Very warm, but generally cloudy, with frequent R till the 10th, then dry and warm but cloudy, to the 17th, when the wind and temp. changed, and the remainder of the month was very cold, with rough winds; frost on the mornings of the 23rd and 24th; TS on 4th; T heard on 3rd; L seen 3rd, 4th, 23rd, and 24th; H on 19th and 21st, and rough winds on 25th, 26th, 27th, and 28th.

WIGSTON.—T on 3rd and 4th; T, with H and S on 21st, and with H on 29th; very stormy on 25th and 27th.

GRIMSBY.—T, L, R, and squalls at 1.30 p.m., and again at 9.30 p.m. on 4th, and the night hot; a little S fell on the 20th, and H on 21st; wind high on 25th, 27th and 28th; max. temp. only 49° on 24th; harvest finished by the middle of of the month; less gossamer than usual; many red admiral butterflies.

MANCHESTER.—TSS on 4th, 6th, 9th, and 29th; H and sleet on 21st.

YORK.—S in the morning of the 21st in the neighbourhood; gale on 27th; heavy H storm on 28th.

ARNcliffe.—TS on 3rd; very wet and dark from 9th to 13th; high flood on 27th.

N. SHIELDS.—TSS on 3rd and 4th; stormy, with H on 24th.

SEATHWAITE.—T on 3rd, 5th, and 29th ; H on 28th ; the rainfall of 9th, 10th, 11th, 12th, and 13th (5 days), amount to more than 7 in. in the five consecutive days, and upward of 6½ in. fell from the 27th to the end of the month, though the fall on the 29th was only .27.

W A L E S.

HAVERFORDWEST.—A very wet month, scarcely 24 hours dry, consequently great difficulty in saving the late harvest ; very stormy at times, particularly about the 5th and 6th ; from the 24th to the 27th, accompanied by L and H ; very bleak and cold during the last week ; general health very good ; an entire absence of zymotic disease.

CEFNFAES.—The month damp and cold for the season ; wind S., S.W. and N.W. ; TSS, with H, slight frosts at night.

LLANDUDNO.—On 3rd T at 4 a.m., and from 11 p.m. to 1.30 a.m. on 4th ; a short and sharp TS at 3 p.m. on 9th ; TS, with H on 21st ; the commencement of the month the air full of electricity, either aurora or sheet L nearly every night ; the latter part of the month the equinoctial gales more frequent and higher than usual ; S on the distant hills on the 21st and 22nd ; On the morning of the 20th, about 7 a.m., a beautiful waterspout (which travelled rapidly from N.W. to S.E.) was seen in the bay.

S C O T L A N D.

DUMFRIES.—The first half of the month wet, and most unfavourable for the harvest, the temp. being high caused much sprouting of grain ; a few dry days after the middle of the month, and a good deal was secured in better condition than was expected ; the close of the month wet ; potatoe crop much diseased ; T on 3rd and 4th.

HAWICK.—A remarkably wet and stormy month ; much T and L on 3rd, 4th, and 5th ; slight frost on the night of 20th ; potatoes more than three-parts lost by disease ; turnip crop looking well ; cereals much injured by the heavy rains, and much standing in stooks, which cannot be got in from the almost incessant rain.

AUCHENDRANE.—TSS on 3rd, 4th, 5th, and 7th ; wind, rain, and cloud above the average for September ; evaporation below it ; with so great an excess of rain the crops have of course suffered severely, and the rivers have been in high flood.

CASTLE TOWARD.—Only one fine day from the 2nd to the 20th ; TSS on the 5th and 28th ; high wind on 28th ; harvest operations being rapidly pushed forward, every available minute taken advantage of notwithstanding the backwardness of the season ; potatoe crops getting worse every day, and all hope is gone regarding them.

DEANSTON.—The wettest September for 34 years ; some frosty nights ; stormy on 25th and 28th, with T and L on the latter day ; some corn still not gathered, potatoe crop much diseased.

LOGIERAIT.—Very wet month, only 9 dry days since 21st August ; harvest greatly retarded, and part of the crop is still unsecured ; potatoe disease very severe ; tops of hill covered with S on 21st.

ABERDEEN.—A dull and wet month, with low day temperature ; latter part of the month stormy ; much S in the country districts during the last ten days ; grain crops much injured, a great deal is still uncut ; TS at noon on 3rd, and from 8.30 to 10.30 a.m. on the 4th ; fog on five days ; H on 20th, and sleet on 22nd ; more than 2.00in. of rain fell on the 25th, and the streams were much flooded.

PORTREE.—A wet and stormy month ; fog on 6th, 7th, and 13th ; TS from 10 p.m. on 27th to 8 a.m. on 28th ; from 1.30 to 1.55 a.m. of 28th the L was incessant and vivid, and the storm was the worst ever remembered ; heavy gales from the N. on 25th ; the crops are in a very backward condition, not a stook in the stackyard yet, and about two-thirds of the potatoes are diseased ; cattle and sheep in good condition, and sell at high prices.

LOCHBROOM.—A ruinous month for the agriculturist, only four days without rain, and they were murky ; crops cut six weeks ago are still out ; our greatest arable farmer has not housed a single stook, the rain began just as they were going to cart it at the beginning of the month, and not a dry day have they had since, and October has begun with a terrible flood ; potatoes stand wonderfully.

SANDWICK.—T on 4th and 5th ; lunar rainbow on 19th ; H on 21st ; frequent auroræ ; the month 2°·3 colder than the mean of the previous 45 years, this was owing to the northerly winds which prevailed on and after the 18th, which though disagreeable to people in general was very acceptable to the farmer, as it prevented the wet grain from sprouting.

I R E L A N D.

DOO CASTLE.—Floods the order of the day ; oats and hay, particularly the latter, are almost beyond recall, there are not a dozen stacks of corn made within a radius of three miles, and the late cut meadows are entirely lost. Potatoe crop poor and much diseased ; the people are in despair, and well they may, another such a year and famine would walk through the land.

WARINGSTOWN.—More rain has fallen this month than during any other this year by '78 ; the crops are suffering much from the constant rain.

LECKPATRICK.—Wettest September ever registered here.

BOOKS RECEIVED.

Fourth Report of the Underground Temperature Committee. [From the *Brit. Ass. Report.*] 8vo.

On the connexion between Explosions in Collieries and Weather. By R. H. SCOTT, M.A., F.R.S., and W. GALLOWAY. [From *Proc. Roy. Soc.*] 8vo.

On the General Circulation and Distribution of the Atmosphere. By Prof. J. D. EVERETT. [From the *Phil. Mag.*] 8vo.

Meteorological Tables, &c., Truro, 1871. By C. BARHAM, M.D. [From *Journal of Royal Institution of Cornwall.*] 8vo.

Climate of Sidmouth, with results of Met. Obs., 1865-1870. By J. I. MACKENZIE, M.B. Cantab. [Reprint from *British Medical Journal.*] 8vo. Richards, Great Queen Street, London.

Sussex County Lunatic Asylum Reports, 1868-69, 1870 and 1871. 8vo.

St. Swithin and other Weather Saints. By Rev. L. JENYNS, M.A. [From *Proc. of the Bath Nat. Hist. and Antiquarian Field Club.*] 8vo. "Chronicle" Office, Bath.

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A contribution to our knowledge of Atmospheric Waves. By W. R. BIRT, F.R.A.S., F.M.S. [From *Phil. Mag.*] 8vo, 14pp.

A Puzzle in Rain, and an attempt to solve it. By GEORGE F. BURDER, M.D., F.M.S. [From *Proc. of Bristol Naturalists' Society.*] 8vo, 7pp.

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Inaugural Address. By A. BUCHAN, M.A., F.R.S.E., as President of the Botanical Society of Edinburgh. 8vo, 15pp.

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. Large 8vo, 72pp. Oxford : J. Parker and Co.

Report of the Meteorological Committee of the Royal Society, for the year ending December 31st, 1871. 8vo, 72pp., 1 plate. Eyre and Spottiswoode.

Quarterly Weather Report. 1871. Part I. Jan.-March. [Published by authority of the Meteorological Committee.] 4to, 86pp. 18 plates. Stanford.

A Discussion of the Meteorology of the part of the Atlantic lying North of 30° N., for the eleven days ending February 8th, 1870, by means of Synoptic Charts, Diagrams, and extracts from Logs, with Remarks and Conclusions. [Published by the authority of the Meteorological Committee.] 4to, 164pp., 20 plates. Stanford.