SYMONS'S

MONTHLY

METEOROLOGICAL MAGAZINE.

CLXIII.] AUGUST, 1879. [PRICE FOURPENCE, *or 5s. per ann. post free.*

THE THUNDER AND HAIL STORM OF AUGUST 2ND–3RD.

THE extreme severity of this storm, and the very great destruction of property which it caused have combined to call considerable attention to it, and to the phenomena which are in many respects of great interest.

Thanks to the ready help of many of our correspondents, we have received a considerable number of reports respecting the storm, and most of these we print on subsequent pages. But it is necessary that we should receive much more information before we can write the full history of the night of August 2nd-3rd. We, therefore, ask all our readers to collect, before it is too late, all the information which they can respecting the storms of that night, in any part of the country. Storms of T, L, and tremendous R occurred in many parts of the southern half of England and Wales, details of which will be found on pages 110 to 113.

It rests with our readers to determine what amount of information we shall receive, and we know what that store may be. Newspaper reports are always acceptable, especially when corroborative evidence accompanies them. We also desire the loan of the records, or copies of the records, of any self-recording instruments, especially barometers and anemometers for that night.

On the present occasion we confine our remarks to that which may be designated the Richmond Hail Storm; but we strongly recommend our readers to peruse the reports of our correspondents from other districts, for many of them are of very unusual interest, *e.g.*, the fall of 3·92 inches of rain in four or five hours at Granchester Mill, Cambridge.

THE RICHMOND HAIL STORM.

Personal.—We do not like putting personal matters in front, but people are so loth to believe in exceptional phenomena, until they witness them themselves, that it is always well to state precisely the authority for the facts recorded.

Having, by its bearing and by the time interval of some of the L and

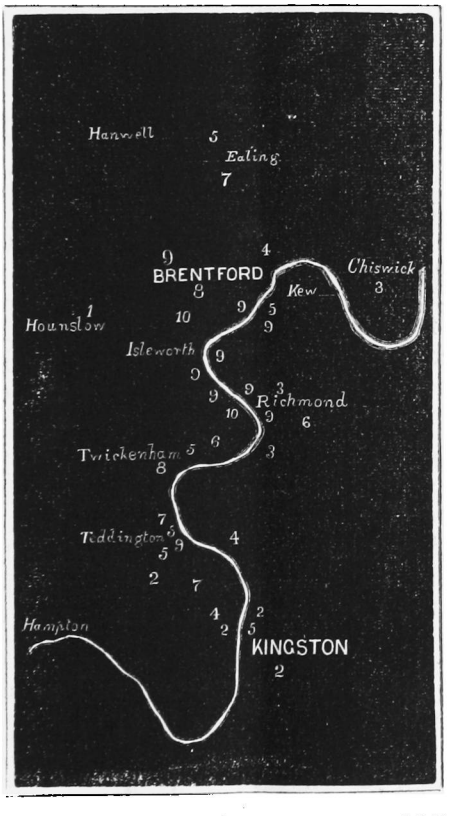
T, fixed one of the storms as being near Mortlake, we were quite prepared for the report of destruction at the adjacent town of Richmond, which appeared in the morning papers on August 4th. Having telegraphed enquiries to a few of our correspondents in the district, we started at once for Richmond, and spent the whole day mapping down the damage done between Brentford and Kingston. During that day also Miss E. A. Ormerod, of Spring Grove, very kindly had enquiries made as to the damage at various places between Brentford and Hounslow. Miss Ormerod's report, those from the other observers, and the results of our own observations, were during the evening all laid down on the ordnance maps, and the next day our two assistants went over nearly 30 miles of the roads in the district, checking off the various entries previously made, and adding very materially to our knowledge of the limits of the damage. In the appended details of damage, entries made by ourselves are simply entered as "Ed.," reports by our observers bear their signatures, and extracts from newspapers state their origin. Amid all the mass of newspaper statements we have not detected one misrepresentation, and the reports of our correspondents contain more startling facts than any in the newspapers. We have, therefore, left almost all the descriptive matter as given in the local paper, the *Richmond Times*. We could not pay it a higher compliment.

Value of Property destroyed.—We may as well dismiss this first, as it will tend to give a general idea of the storm, and will leave us clearer for other matters. No amount can be specified, because even had we all the glaziers' bills they would represent but a small part of the total loss, for when a conservatory is smashed or a drawing-room window burst in, the cost of the glass by no means represents the total damage. £1,000 will, in these days of cheap glass, pay for many superficial feet, yet we know of two establishments where the repairs will cost at least twice that sum; and we are certainly within the mark in stating that there are dozens of places where it will cost £100 and upwards. Judging from our own inspection, from that of our assistants, and from other indisputable evidence, we believe that the total cost of replacing glass alone will be between £20,000 and £30,000.

Area of Damage.—We incline to the belief that this hailstorm was nearly as remarkable for its large extent as for the size of the hailstones, or the damage done, but we do not speak *ex cathedrâ*, and state merely the impression left upon our minds by the many analogous scenes of ruin which we have visited. The usual area which we should assign to an English hailstorm is a mile or two long and a few hundred yards broad. But even assuming that the storm at Harrow (see p. 110), and another which broke many thousand squares of glass near Reigate, are unconnected with the present one, we still have damage from one mile south of Kingston to a little north of Ealing, or seven miles from south to north, and an average breadth

of two miles. This gives an area of damage equal to fourteen square miles, which far exceeds any case that we can recollect.

The damage produced depends on so many causes, the thickness of glass, the size of panes, the angle of roofs, the force of the wind, the exposure of the premises, &c., that it is very difficult to judge from the damage of the intensity of the storm, but this was the all essential element for us to determine, and the annexed sketch map gives an epitome of the results. The figures placed upon the map state our opinion of the damage done to glass, relatively to the maximum possible; total destruction is represented by 10, and 9 is so near to total destruction that most persons would describe a place as "utterly smashed" which we should enter as 9. Of course 1 indicates the least amount of damage. As additional information is still arriving, we have not marked upon the map the limit of destruction, but, roughly speaking, it is an oval as long and as broad as the woodcut would contain.



Size of the Hail.—We have given on page 115 a few notes as to the relations between the size and the weight of hailstones. We here quote the statements of our own correspondents as to size and weight, and though in order to save space we do not also classify the

newspaper reports as to size, it will be found that they and our own are mutually confirmatory.

GOMER HOUSE.—"A hail-bolt which fell through a carpenter's window was found by him to be 4½ in. in length." This was the largest of which we have heard, but we quite believe in the statement. Assuming that the real length was 4¼ in., it must be remembered that the probabilities are great that it was not measured until some little time after it fell, and thus that it would have decreased in size. We therefore accept the 4½ in.; we are told it was a "bolt" —that implies a cylinder whose diameter is from a sixth to a third of its length—but unless the diameter of this ice bolt had been considerable in proportion to its length, it must have broken across during the shock of breaking through the window; we doubt if an ice cylinder 4½ in. long, would have escaped breakage if less than 1½ in. in diameter; if so, it must have contained 7¾ cubic inches of ice, and may have weighed more than ¼ lb.

HALFORD HOUSE.—"A neighbour gathered some of the stones; the weight of four of them was 1 lb."

DUNSTER LODGE.—"The largest measured was 5¾ in. in circumference after being carried in the hand for about three minutes."

Other evidence as to the size of some of the hail is afforded by the damage done; it is impossible to see a conservatory, roofed in comparatively small panes, with ribbed glass nearly 0·2 in. thick—so strong, in fact, as to suggest walking upon it—with few sound panes left, without feeling that the stones must have been very large, and must have fallen from a great height. Note also the piercing of a zinc roof, the scoring of an iron one as by a sledge-hammer, the injury to the anemometer cups at Kew, and the depth to which the hailstones penetrated the lawns.

Descriptive Accounts.—There are very few remarks requisite respecting the following ample details. In some cases the date is omitted; it is to be understood that all the times mentioned are between 9 p.m., August 2nd, and 9 a.m., August 3rd. The accounts are arranged from S. to N., no separation being made between those on the west of the river, which are in Middlesex, and the others, which are in Surrey.

MITRE HOTEL, HAMPTON COURT.—We had no damage done to our premises, and cannot hear of any being done at Hampton. At Hampton Court, Ivy House had about 270 panes of glass broken in the conservatory and greenhouses. Hampton House, about 20 in the conservatory and house, and 3 or 4 panes of glass broken at the large vine house in the Palace Gardens, and slight damage in the Kitchen Gardens. The places near here where most damage happened were Teddington, Kingston, Twickenham, and Richmond. —*Charles Sadler.*

SURBITON HALL, KINGSTON.—Conservatories destroyed.—*Daily Telegraph.*

KINGSTON.—Hailstones were picked up by the inspector of police which measured 5 in. in circumference.—*Daily Telegraph.*

KINGSTON.—A range of glass houses two hundred yards south of Kingston Station was injured, but not very seriously—perhaps one pane broken out of five.—*Ed.*

HAMPTON WICK.—Some houses damaged, but not very badly; much more injury about half a mile N.N.W.—*Ed.*

BUSHY PARK.—A greenhouse near the north entrance was much damaged.—*Ed.*

GOMER HOUSE, TEDDINGTON.—The storm was at its height here at 1.45 a.m. The hailfall lasted for about 15 minutes. The entry was 0·68 in. There must have been more, as the hail-stones jumped out; moreover, a small flint was dashed into the receiver, so that it may have been choked. Unluckily, I did not collect any of the hail-stones, for I thought that before I could dress they might cease. But I watched them from a window, and the grass being lit with incessant blue lightning, I could see them well. They quite covered the ground, and seemed to be at least as large as nutmegs. But I saw that among them, at intervals of a few yards, were much larger ones, which stood out among the rest like rocks among pebbles. And from the sound upon the roof, it was clear that now and then one fell of monstrous calibre. I do not know how far the hailstorm extended, but am told that it was worse to the N.E. than here. It came to us from the N.E. undoubtedly. A neighbour of mine who collected a quart of hail-stones, says that they were as large as full-grown chestnuts, and of that shape. Another person says they were "as big as a watch." I saw one large stone conspicuous on the grass, and glittering in the L like a diamond, which really must have been "as big as a watch." One "hail-bolt" which fell through a carpenter's window was found by him to be 4½ inches in length. My vineries are riddled, even those that face the south; glass facing north is entirely destroyed; I fear that my neighbours have fared even worse. Some of the stones must have had jagged edges; they have cut their own shape out on leaf and fruit. Hundreds of pears are cut clean through. One of the noticeable points seems to be that the storm was preceded by no high temperature, neither was there much wind with it. I have heard much louder thunder, but never seen more continuous or more blue lightning. Saturday evening was cool, with a N.E. breeze, and a few drops of R, but nothing to indicate so violent a storm.. T began about 11 o'clock; but I went to sleep and slept till the H awoke me.—*R. D. Blackmore.*

TEDDINGTON.—This town did not escape the severity of the storm, and much glass is destroyed in all directions.

STONEYDEEP HOUSE, TEDDINGTON GROVE. — The neighbourhood of Teddington was this morning the scene of a most destructive hailstorm, many of the hailstones being an inch in diameter. The storm commenced in the

early part of the evening with T and L, accompanied towards midnight by a tropical downpour of R, which about 1.30 a.m. changed to hailstones of such a size as to break plate glass in my conservatory. I had over fifty squares of rough plate-glass broken. I enclose you a specimen of the glass, which is 3-16ths of an inch thick. At a neighbouring nurseryman's the houses of ordinary glass have been completely wrecked. I sincerely trust this destructive storm is local, otherwise I fear the damage to farm crops will be enormous." —E. BEALE.—*Times.*

TEDDINGTON STATION.—A few lamp-tops smashed.—*Ed.*

STRAWBERRY HILL.—Railway station and street lamps mostly sound.—*Ed.*

TWICKENHAM.—A greenhouse a little to the west of Twickenham escaped entirely, but one south-east of it, near Strawberry Hill, though roofed with heavy glass, was smashed.—*Ed.*

TWICKENHAM.—At about two o'clock a severe storm of R was succeeded by a tremendous downpour of hailstones the size of walnuts, intermixed with others which measured four, five, and six inches in circumference, and which were several ounces in weight, their appearance, when held up to the light, being very beautiful. These were carried by the wind in an easterly direction, and but few panes of glass with which they came in contact were saved, the total smash resulting in the destruction of some thousands of pounds' worth of property. The crash was terrific, the lightning at the same time being of an unprecedented character, illuminating the town in a manner seldom witnessed. The storm continued for upwards of five minutes, during which time many people—some lying in bed, but the majority running with excitement from room to room of their houses in their night garments—anticipated the near arrival of something still more terrible.

Perhaps the greatest individual loss is that which has happened to Messrs. T. and J. Smith, of Richmond-road, who have no less than 13,740 square feet of glass completely pulverised, involving a loss, irrespective of the stock beneath, of between £200 and £300.

Writing from the Orleans Club, a correspondent says:—"The TS, which had been raging for an hour, culminated about half-past one o'clock in a tremendous shower of H. Several of the stones were as large as a potato, and the majority quite as big as plover's eggs. Not a whole pane of glass remains in any of the roofs of the ball-room, dining-room and conservatories. The force and weight of the hailstones may be imagined from the fact of the lawn facing the river being indented with thousands of holes an inch or so in diameter and over an inch deep." We have been shown a specimen of rough plate-glass from the dining-room of the Orleans Club, which is about 3-16ths of an inch thick. The total loss here is stated to be several hundred pounds.

Mr. Bohn's green house, vinery and stove are complete wrecks; about 1,500 panes of glass are smashed, together with 100 ft. of framing, which will probably cost £200 to make good. Many of the windows of Mr. Bohn's residence are also broken.

Mr. Laing, the well-known florist, has also suffered severely. Lady Peel, Mr. Cunard, Mr. Grant-Duff, the Vicar, the Rev. H. F. Limpus, and others in the locality are also great losers. About twenty panes of glass are broken at St. Stephen's Church.

At Montpelier-row the front windows and many frames are completely destroyed on account of facing the storm. Orleans-road, also, has fared almost as badly. This locality appears to have been the very centre of the storm. In some instance slates are perforated, and thick glass broken into clean circular holes as if they had been shot at with bullets. Large boughs are twisted off trees, and outdoor plants and vegetables are cut down as with a knife.

Twickenham Railway Station exhibits but little evidence of the force of the storm except at the signal boxes, where numerous panes of glass are shattered. The front of Albany Hotel, too, though facing due east, escaped the storm's fury. The same, however, cannot be said of the Railway Hotel, where a number of large squares have had uncomfortable ventilating holes made in them. On the Isleworth-road, Messrs. Hawkins and Bennett have extensive glass houses, all of which are more or less wrecked, thousands of squares of glass being destroyed. The storm, indeed, has been a very considerable loss to all the nurserymen and gardeners in the neighbourhood, Mr. Poupart, we observe, being a great sufferer.—*Richmond Times.*

HALFORD HOUSE, RICHMOND.—The storm which visited this place on Sunday morning was the most severe for a great number of years. The rainfall was 0·50 in.; I should imagine it would have been greater had the hailstones been smaller, for I think they must have rebounded from the gauge, as they were of an extraordinary size. From the impressions left on the lawn they appeared to be mostly of a globular shape, but several must have been square and jagged; some of the impressions were nearly 2 in. in depth; and were distinctly visible more than 24 hours afterwards. A neighbour gathered some of the stones; the weight of four of them was 1 lb., so you can imagine somewhat of the size and damaging power of them. A conservatory at the rear of the house was almost a complete wreck, nearly half the glass being smashed; some lights in the kitchen garden in the same state; all windows facing the E. more or less broken. The noise from the falling stones was simply fearful, combined with the T, which was continuous. The radius of the storm seemed to be limited between the Kew-road and Richmond Park, for the trees in the park seemed to be very little damaged, and yet the terrace (which is not far distant), was covered with little branches cut from the trees; the heaviest part of the storm seemed to pass directly over the town from E. to W. The duration of the hailstorm was, I should think, not more than ten minutes or a quarter of an hour; the R, T, and L lasted from 10 p.m. until 3 a.m.—*J. Billett, Junr.*

CHURCH ROAD, RICHMOND.—From 9 p.m. until nearly 3 a.m., we had constant L, the most continuous, for so long a time I ever saw but most of it was very distant; there were occasional downpours of R, with violent gusts of wind from the east and north-east; about 10 minutes to 2 a.m. there was the most violent hailstorm I ever recollect, lasting about 10 minutes; the hailstones were of a very large size, nearly all I saw being in the shape of flattened spheres, like the common acidulated drops, one on my window-sill was 1½ in. in diameter and many others nearly as large. The destruction done was very great, every house looking east and north-east seems to have suffered more or less. Hillside has the appearance of a street in which there had been a riot and the military had fired at the windows; in many cases the stones have gone clean through like a bullet. In Maid of Honor-row, there is not a whole pane of glass.

The Catholic Chapel has nearly every pane broken on one side, all the conservatories not protected from the east are wrecked, and the lawns are punctured with holes from 1 to 2 inches in diameter, and about 3 to 5 deep. As far as I can ascertain, the storm passed over part of Brentford, Kew, Richmond, Twickenham, and Kingston, other districts adjoining have not suffered.—*Arthur Brewin.*

RICHMOND.—The windows all along the river side of Hill-street and King-street have been smashed without mercy. Maid of Honour-row presented a most "attractive" appearance during the whole of Sunday, there being scarcely a perfect window in the front part of any one of the houses. Here the stones had dashed through the windows like rifle bullets, sending the broken glass flying all over the rooms, and fairly driving everybody away from the east side of the house.

It is impossible to exaggerate the scene at Mr. Saddington's nursery, for his piece of ground is more than half covered with frames and greenhouses, in which there is scarcely a whole pane of glass remaining. Houses containing valuable grape vines, with the fruit just ripening, have had their roofs all cut to pieces, and the falling glass has mutilated and quite ruined the rich clusters of grapes; whilst in other houses where the fruit is not so advanced it will now be impossible to ripen it. A large number of frames in which there are flowers are also broken, and the plants themselves are cut to pieces with the glass. Mr. Saddington has done what he could by replacing the broken panes by some glass which happily he had stacked in a portion of his ground, but this will not prevent his being a very serious loser; indeed, we may add that Mr. Saddington will be almost ruined unless he obtains outside help.

The glass houses of Messrs. Steell and Brown are also a complete wreck.

Compared with his neighbours, Mr. Kinghorn was lucky, the total amount of damage to his extensive houses being not more than £10 and £15. The back of Elleker House came in for a share of the mischief; many of the large windows are broken, and the conservatories almost wrecked, the total damage being estimated at between £50 or £100. At Cholmondeley Villa, the residence of Mr. Hilditch, is an arched zinc covering which has been indented in every direction by the force of the hailstones, and in one case one of these heavy ice balls has gone clean through the metal! The residence of Mr. Cave, M.P., has many of its windows and skylights broken, and the extensive range of glass houses are a mass of ruin. Mr. Chancellor's residence, close to the above and near the Green, has also suffered by the breakage of thick panes of rolled glass, and, in addition, upwards of seven hundred panes in his various greenhouses are shattered, whereby plants have been spoiled and other damage has been done.

Messrs. Reynolds' showrooms, which are covered in with plate glass, were in a deplorable condition on Sunday morning, most of the glass being destroyed. At the Richmond Hospital about 40 squares were broken and at the Union Workhouse between 70 and 80. At the railway stations, too, there is great devastation. Mr. Byrne, photographer, had his two galleries almost destroyed, but one of these was quickly repaired and made fit for use. Mr. Tuohy, also, had his studio totally wrecked, his damage being estimated at over £20. He requests us to mention that he is carrying on business as before. An excellent photograph of the wrecked studio has been forwarded to us, showing the extent of the mischief. The Star and Garter Hotel has come off lightly; so, too, has the majority of houses in that neighbourhood, with the exception of Mr. Cook's handsome conservatory, facing the main road, which has been extensively riddled. The skylights of the Vestry Hall are smashed, and on Wednesday at the Petty Sessions, the broken glass fell with a crash, necessitating the speedy adjournment of the magistrates and officials to safer quarters. —*Richmond Times.*

RICHMOND, ROMAN CATHOLIC CHAPEL.—One side faces N.E., and

although not in an exposed position, nearly one-fourth of the panes, both of ground and coloured glass, were broken.—*Ed.*

RICHMOND, CASTLE HOTEL.—The newspapers report—"As far as glass is concerned, a total wreck." This can scarcely be called an exaggeration, for though some panes in the front of the house and all the back windows escaped, the conservatory fared very badly; we do not remember seeing one sound pane of glass in it.—*Ed.*

RICHMOND, POLICE STATION.—Hailstorm occurred at 1.50 a.m. Inspector Pearman drew for us the outline of the usual size and shape of the stones: it is oval, 1·6 in. by 1·3 in.; these, if ¾ of an inch thick would about equal spheres of 4 inches in circumference. Only a few panes of glass were broken at the station.—*Ed.*

ST HELENA TERRACE, RICHMOND.—One or two houses here had overhanging eaves, and by measuring how much they overhung and the distance above which no glass was broken, the angle of the falling hail could be approximately determined, and it comes out only 20° from the vertical. This indicates either the great weight of the stones in that locality, or the absence of as much wind as in other parts of Richmond—the former is believed to be the true explanation.—*Ed.*

ST. MARGARET'S STATION.—Tops of the lamps smashed.—*Ed.*

ST. MARGARET'S.—Mr. Budd and other gentlemen, having glass-houses, are great sufferers, as hardly a pane of glass is left intact. Lady John Chichester's glass-houses, which are extensive, appear to be almost destroyed. Indeed, at the east-end of Twickenham there is scarcely a house but what has left some serious traces of the ravages and destructive force of the storm. Neither did the other parts of Twickenham escape. From every street and lane in the centre of the town may be witnessed evidence of the severity of the storm, and in some of the poorer districts are broken squares, the mending of which, we fear, will be long delayed unless some help is forthcoming by the aid of a local subscription. The grass in some of the gardens has been likened to ground round a rifle butt, so much is it cut up and indented by the falling ice balls, only that the holes are larger than those made by bullets.

The outbuildings, &c., belonging to Mr. G. G. Mackintosh, J.P., Mr. F. Ashton, J.P., Col. Gardiner, and Lady Adeliza Manners, also those at Poulett Lodge, and other well-known residences, are more or less reduced to a wreck, scarcely a single piece of glass being left whole that faced the storm, or that was in a horizontal or standing position. Mr. Richard Clarke's glass houses, we hear, are much damaged, as also his stock.—*Richmond Times.*

ST. MARGARET'S.—"The storm of this morning, commencing about 1.30 a.m., probably unprecedented in the valley of the Thames, will live in the memory of the frightened people north and south of the river at this spot. Never certainly, within the experience of a sexagenarian have we had a truer rendering of the fine lines by Hayley,—

> From clashing clouds their mingled torrents gush,
> And hail and rain with rival fury rush:
> Bolts of loud thunder, floods of lightning rend
> The opening skies, and into earth descend.

The war of elements in my grounds, with its destructive effects, cannot be adequately described. Trees were not, it is true, torn up by the roots; but branches of cedar, ailanthus, and lime were torn off. The most remarkable

feature of the storm was the size of the hailstones, the circumference of some of them being over 5 in. The velocity is indicated by the fact that the indentations on the lawns were in many cases 2in. in diameter and 3in. in depth. In my vineries and flower-houses I have counted over 900 broken panes of glass the total number of panes barely exceeding 1,000. On the balcony of the house, every pane of thick, rough glass in the roof was destroyed, and a stained-glass staircase-window shared the same fate. The market-gardeners in the neighbourhood will be half-ruined and have a claim upon the sympathy of the residents."—G. S. MEASOM, the *Times*.

"CASSILLIS," ST. MARGARET'S:—"The awful T and hailstorm seems to have visited St. Margaret's with greater severity than most districts, and as my house and garden, situated near the edge of the river, came in for its full brunt, a short relation of my experience may not be unacceptable. As to the house itself, the window panes of the whole frontage were smashed by the H, except some extra thick plate glass. An iron verandah, too, was scored as though by the blows of a sledge hammer. In the garden I lost about 2,000 superficial feet of glass, only a single pane remaining unbroken in the roof of the vinery. Even a stout canvas tent succumbed, having its tough roof perforated and torn in many places, a striking instance of the force and size of the hailstones. I can vouch for some having measured from two to three inches in diameter, and the indentations created by them on my lawn and cement terrace are wonderful in their size and number, there being in some places from forty to fifty to the square yard, many of them as big as the bowl of a large wine glass. I may mention, too, the singular circumstance of having picked up a large wild fowl, evidently a sea bird (web footed), but of a species unknown to the many watermen I have shown it to. This unfortunate *rara-avis* had been beaten on to the gravel walk of my garden, and had the appearance of being pinned to the earth, its body riddled with hailstones, and its feathers driven into the ground.—WILLIAM CUNNINGHAM.

KEW OBSERVATORY, RICHMOND.—T and L commenced about 10.40 p.m.; apparently reached its max. about 1.30 a.m. and about 1.50 the H fell, R having been falling since 0.50 a.m. The hailstones averaged from an inch to an inch and a half in diameter, and were here driven by the wind with such force as to break nearly all glass exposed to the N. and N.E., driving the fragments to considerable distances; in one case they marked the paint of a wall ten feet distant from the window. Our radiation thermometers were of course, with one exception, smashed, and the anemometer cups considerably knocked out of shape. The damage to the crops and fruit trees is very serious, and the grass regularly ploughed up by the H. I have tried an experiment, and find that with all my strength I can only just throw a stone on to the grass with sufficient force to make an indentation equal in depth to those remaining even now, thirty hours after the storm. It appears to have been very limited in its extent, or at least we were just on its borders; for instance, at my own residence, three quarters of a mile due E., I suffered severely, having conservatory wrecked and several windows broken. Mr. Baker, about a quarter of a mile farther on, states that there was not any material damage in his neighbourhood. In the Royal Gardens, about a mile to the N.E. there are a great many panes of glass broken in the various green-houses, but on the whole they cannot have experienced the full force of the storm. The total R measured by the self-registering gauge was 0·55 in. by the

ordinary one standing beside it 0·72 in. I suppose that the rebound of the stones must account for the difference. 0·43 fell between 1.45 and 1.55 a.m. The barometer was much disturbed, but the photographic trace is not yet ready for measurement. From the reports current, I gather that the most damage was done on the S. side of Richmond and in East Twickenham. None is spoken of at Mortlake and East Sheen. I do not hear of any buildings or trees in the neighbourhood having been struck by the L, and one of my assistants, who watched the progress of the storm, remarked the absence of forked L. The same gentleman timed one continuous roll of T, which lasted twenty minutes without a break.—*G. M. Whipple.*

DUNSTER LODGE, SPRING GROVE, ISLEWORTH.—We had a tremendous TS here on Saturday night which is reported to have done £4000 worth of damage to glass and plants between here and Brentford alone. I counted about 300 panes of glass broken in one row of forcing houses, and the windows of the dwelling houses that face east are shattered as if stones had been sent through them except where the glass is very strong. The cloud currents had been variable during the day, and the wind E; vivid L was first noticed at 11.20 p.m., and from 0.45 a.m. to 2.30 a.m. continued almost without any intermission in sheets of light (sometimes slightly rose coloured) over the whole observable part of the sky; one flash about 2 a.m. being extremely vivid. The T was pretty constant, but not in heavy peals. At 2.10 a.m., following a drop of the barometer, a single long gust of wind. lasting about four minutes, passed by with a heavy rushing sound, audible long before it struck the house, howling in the trees and chimneys. At 2 a.m. the H broke some of our windows, but I could not go out to get any, which I regret; for one cannot be sure from reports, but it is stated that the stones varied from the size of strawberries to pieces 6 inches in circumference. A neighbour of mine says about half of the fall was in hailstones of the usual shape, and half as pieces of ice with jagged edges. The hailstones he estimated as averaging about 3 or $3\frac{1}{4}$ in. in circumference. The pieces of ice were larger: the largest measured was $5\frac{3}{4}$ in. in circumference after being held in the hand for about three minutes; it was clear ice outside and milky in the centre. The fall broke many panes in a conservatory close by, glazed with stout glass more than an eighth (0·17) of an inch thick. I sent our gardener, who is an intelligent man, to obtain information on the subject. It is said to be quite impossible at present, to give any estimate of the damage to plants, but the following statement of the glass broken at a few nurseries close by, shows that the loss will be deplorable.

Mr. Smith, Smallberry Green.....	Damage to glass.....				£30.
Mr. Curtis	2,000	squares	broken,	value	£35.
Messrs. Lee.....	7,000	,,	,,	,,	£200.
Mr. Edwards	7,000	,,	,,	,,	£100.
Mr. Denyer.....	14,000	,,	,,	,,	£200.
Mr. Jordan, Isleworth	5,000	,,	,,	,,	£100.

The different values are presumably attributable to the various sizes of the squares and panes broken.

The greatest amount of damage is at Sion House, where it is said that nearly every pane of glass in the place is destroyed, and the damage estimated at £2,000. From this, and the general reports, it appears that the violence of the hail was mainly along the river.—*E. A. Ormerod.*

BRENTFORD.—Hailstones, or rather large balls of ice (in many instances as big as a teacup) came dashing down with unparalleled violence, splintering glass into fragments, perforating slates and tiles like bullets from a rifle, and even making deep indentations in the ground to the extent of several inches. Daylight broke upon a scene of unprecedented wreck and ruin; the storm in its rage had smitten all alike, and it would be impossible to form anything like a correct estimate of the amount of damage done. At Sion House, Isleworth, the seat of his Grace the Duke of Northumberland, thousands of pounds worth of damage was done, the roofs, and in many instances the sides of the various hot and greenhouses being completely gutted, while irreparable injury was done to the plants, &c., contained therein. The splendid vinery and tropical house especially sustained great injury. The conservatory at Gordon House, Isleworth, the residence of Lord Kilmorey, was considerably damaged, scarcely a whole square of glass being left intact; and at Isleworth House close by, the residence of Mrs. McAndrews, the hailstones are said to have penetrated glass a quarter of an inch in thickness. Every residence boasting of a conservatory or greenhouse suffered in a similar manner, and scarcely a house in Brentford, Isleworth, or Kew Bridge escaped without a broken window. At the Brentford Workhouse, between three and four hundred panes were broken, and the inmates were naturally much alarmed. At Wyke House Asylum, Syon-lane, upwards of two thousand squares of glass were demolished, the loss being very considerable. The greatest sufferers by the storm, however, are the market gardeners and florists, by whom the Brentford and Isleworth districts are largely inhabited. Many of these are never in particularly affluent circumstances; they invest their whole savings in erecting greenhouses and frames, and have to depend almost entirely upon the produce which they raise for their living. To such persons the effect of the storm of Sunday morning, following upon a long and expensive winter and an uncommonly dull season, was most disastrous, and unless something is done to assist them, absolute ruin stares in the face of many. One of the saddest cases is that of Mr. Pestridge, florist, Boston Park-road, Brentford, who had "locked up" in his nurseries the accumulated saving of years, and most of whose greenhouses were completely demolished, upwards of 4,000 squares of glass being smashed to atoms, without counting the panes that were cracked and rendered so useless that it is imperative they should be replaced. A more complete wreck, perhaps, has never been witnessed. Mr. Pestridge states that it will take at least 10,000 feet of glass to repair the damage, which he estimated as over £300, for besides the destruction of glass, the injury to plants, &c., was very great. As an instance of the size of the hailstones, and the terrible force with which they dashed through Mr. Pestridge's greenhouses, we may mention that several flower pots were broken in two, as if they had been dashed to the ground. For the most part the houses facing the North East sustained the greatest amount of damage, but all more or less suffered, none escaping without a number of broken panes. Mr. Wilmot, market gardener, also sustained a heavy loss. Upwards of four or five acres of glass were destroyed, and the fruit trees, &c., considerably damaged. Mr. Mann, market gardener, Twickenham-road, had nearly every inch of glass on his premises shattered, his riddled greenhouses presenting the appearance of having been fired at with grape shot. Hundreds of gooseberry bushes, and acres of currants were also destroyed, the damage amounting to many hundreds of pounds. The market garden of Mr

Meyers, Brentford, suffered to a considerable extent, but it is said the loss will be fully covered by insurance. Strange to relate, but little damage was sustained in the Hounslow and Whitton districts, and Gunnersbury, Chiswick, and Turnham Green, too, escaped almost scathless.—*Richmond Times.*

BRENTFORD.—Much glass broken on the south side of the High-street, but less after leaving the town for Hounslow; great damage near Isleworth station (see Miss Ormerod's report), less towards Hounslow, and two nurserymen just beyond Hounslow report "heavy H but no glass broken."—*Ed.*

ROYAL HORTICULTURAL GARDENS, CHISWICK.—Damage only slight, about 300 squares.—*Journal of Horticulture.*

OSTERLEY PARK.—In the west half no injury was done, but the lodge at the eastern entrance, near Wyke Green, had its windows broken. (We only obtained this intelligence after having laid down the first boundary of damage, and it is curious and satisfactory to find that that line runs through the middle of this park exactly where the above evidence would have placed it).—*Ed.*

GUNNERSBURY.—Saw a conservatory which did not appear to have been injured, and, although informed that *it* was bad there, believe that little real damage occurred.—*Ed.*

ACTON.—Very bad TS, but no damage by H.—*Ed.*

EALING.—The nurserymen at Ealing appear to be the chief sufferers. Thousands of squares of glass were riddled by the hail, and at Mr. Hawkin's establishment the damage is set down at £1,000. The injury to house property was general. At Hanwell, trees were struck by the lightning, and the Central London District Schools damaged to the extent of £500.—*Richmond Times.*

EALING DEAN.—Greenhouse roofs much damaged, especially those facing E., some of which had 50 per cent. broken.—*Ed.*

HANWELL.—A correspondent at Hanwell sends us the following graphic account of the hailstorm of Sunday morning:—"No doubt you will have plenty of information respecting the terrible and awful storm with which we were visited last night; but possibly the following particulars may interest some of your readers. The T and L commenced between eleven and twelve o'clock, and continued with more or less violence until about two, when it was accompanied by, I should think, the most terrific hailstorm that was ever witnessed in this country. Large balls of ice came dashing through the windows like rifle bullets, sending the broken glass flying all over the rooms, and fairly driving everybody away from the east side of the house. After the storm had abated I went into my garden, where I found the ground covered with balls of ice, which looked like a good crop of white potatoes or eggs. I picked some up, and brought them in. The largest measured five inches in circumference, and weighed about three-quarters of an ounce. About twenty minutes after they had fallen I picked up nine and put them in a glass, and to-day I found the water from them weighed six ounces. The grass part of my garden this morning reminds me of the ground round a rifle butt, so much is it cut up and indented by the falling ice balls, only that the holes are larger than those made by bullets. The force of the storm may be imagined by the fact that one of my neighbours has 28 window panes broken on the east side of his house."—*Echo.*

SOUTHALL.—No damage.—*Ed.*

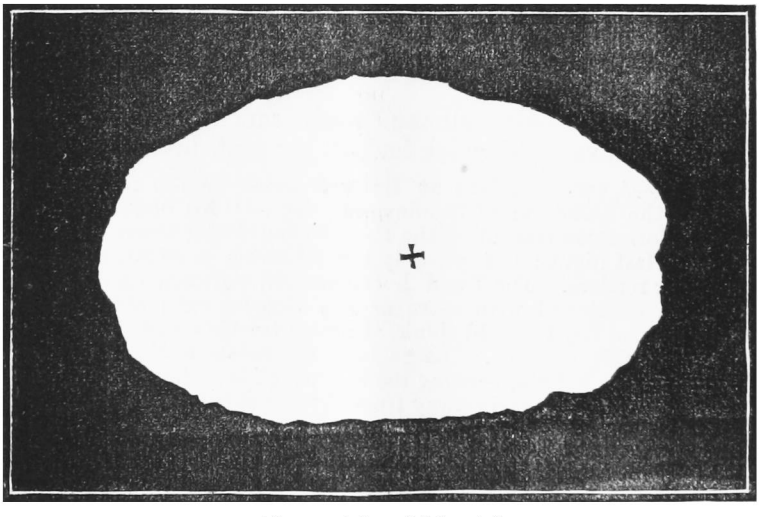
WILLESDEN.—Bad TS, but no H.—*Ed.*

NOTES UPON THE THUNDERSTORMS OF AUGUST 2ND–3RD.

[Although we have added eight pages to the present number, we are still reluctantly obliged to postpone the insertion of many notes already in type.—ED.]

THE KNOLL, HARROW.—A little before 1 a.m., a thunderstorm came up from the direction of London, but never approached very close, and after twice receding so as to be almost inaudible, the thunder returned just after 2 a.m., accompanied by a strong wind and very heavy H from the east. The H lasted between seven and eight minutes, during which time, and until nearly three o'clock, the flashes of distant L were almost incessant. The largest hailstone which came under my notice was the one of which I enclose an accurate outline, taken about five minutes after it crashed through one of the windows. A bason of hailstones collected at haphazard, and fully half-an-hour after they fell, were spherical in form, and varied from half-inch to $1\frac{1}{4}$ inch in diameter. Nearly every window in the town facing east is perforated by round holes, and four conservatories I have seen can hardly muster a dozen panes of glass on their roofs. The lawn this morning shows a series of deep indentations on the average about six inches apart.—*Claude L. Bicknell.*

Hailstone which fell at Harrow, about 2.5 *a.m., August* 3*rd,* 1879.



About $1\frac{1}{4}$ in. thick at *

ENFIELD.—A protracted and most severe TS, accompanied by a magnificent but most extraordinary display of L, occurred here. L was first seen in W. at 9 p.m., with distant T. Soon after 10 p.m. there were almost incessant flashes in S.W. and W., which gradually increased in brightness till, by 11 p.m., the whole sky, from S. to N.W., was ablaze with vivid flashes of L. The storm was severest from midnight till 2.30 a.m. During the whole of this time the

electrical discharges appeared almost continuous. There was a heavy fall of R from 2.16 to 2.25 a.m. The storm gradually subsided after 2.30 a.m., but the L continued till daylight. The rainfall was ·36 in.—*Thomas Paulin.*

THE BOURNE VICARAGE, FARNHAM.—*(a).* Wind E.N.E., force 1·0 to 1·5; at 10.20 p.m. bar. 29·82, L and heavy R till 10.25; *(b)* 10.50, L and distant T till 11.45; *(c)* at 0.10 a.m. another storm from S.W., distant L followed by distant T. The L was almost incessant—scarcely a second of darkness between the flashes, as if the whole heavens were ablaze; the whole landscape was lighted up. It came nearer till *(d)*, at 0.25 bar. 29·75, the storm burst with torrents of R and H. Heavy T till 0.40, when R ceased and storm passed, seeming to divide, one part going N.E., the other due E; L equally vivid in both quarters, with distant T. *(e).* At 1.5, bar. 29·70; heavy R for five minutes, another distinct storm from S.W., not so violent. At 1.35 (bar. 29·79), sky heavily overcast, wind, S.W., rose to force 2·5, and bar. fell in five minutes to 29·69; wind and clouds in scuds; bar. alternately rising and falling; L lasted without any intermission, but becoming more distant till 2.30, when the intervals between the flashes became longer, and I soon ceased to observe. Total rainfall ·56 in the gauge, which I register, while in another, 8 ft. above the ground, it was ·60. This must all have fallen in showers *(a)*, *(d)*, and *(e)*, *i.e.*, in 25 minutes. I never before knew R in the high gauge more than in that on the ground.—*T. W. Sidebotham.*

WERN, STOKE NEXT GUILDFORD, SURREY.—We had an awful TS for two hours or more, from 11 p.m. to past 1 a.m. I never saw the like before—one continued blaze of light, and one continuous roll of T. There must have been three storms raging at the same time. My man woke up and thought his room and the stables were on fire.—*E. W. Mather.*

WOODSIDE, HERSHAM, SURREY.—Only 0·15 in. R in the TS, and 0·20 in. at Cobham. We appear to be out of the track of heavy thunder-rain.—*G. Dines.*

ADDISCOMBE.—9 p.m., frequent L; 11 p.m., L still frequent; 1.15 a.m., vivid L, with loud T; 1.19 a.m., time interval, L and T, 5 secs.; 1.20 a.m., R first began to fall; 1.22 a.m., heavy R; 1.25 a.m., time interval, L and T, 8 secs.; 1·28 a.m., time interval, L and T, 9 secs.; 1.30 a.m., distant and continuous rumbling of T; 1.38 a.m., very heavy R; 1.44 a.m. R almost ceased; 1.45 a.m., R again heavy (large drops of driving R), no H; 1.50 a.m., R ceased; afterwards frequent but distant L and T. R: 9 a.m. to 9 p.m. of 2nd, 0.004 in.; 9 p.m. of 2nd to 9 a.m. of 3rd, 0·121 in.; raining from 1.20 a.m. to 1.50 a.m.; total, 30 min.—*Edward Mawley.*

ROUND OAK, GREENHAM, NEWBURY.—Bar. fell on the 2nd till about 3 p.m., then rose; east wind, fine and hot, then cold, and bar. fell about 8 p.m.; 9 p.m., T, R, and L; 9.20 p.m., moon out, with clouds

passing it from S.W.; R and TS passing to N.W., wind E.; about 11. heavy T, L, and R till about 2.30 a.m.; 3 a.m., moon out and cloudy; total R, 1·57 in.—*J. Ward.*

PURLEY, READING.—R from about 11 p.m. to about 4 a.m., 1·61 in.; heavy T; total rainfall this year, 25·53 in.—*R. Boyle.*

COOKHAM, BERKS.—Tremendous TS, with R and H from N.E. from 0 till 3 a.m., chiefly from 2 till 3 a.m. 2·07 in. of R fell, beside H, which must have leaped out of the funnel, for it seemed as large as marbles at times.—*R. W. Rogers.*

WANSFORD HOUSE, WATFORD.—L most of Saturday evening, but the severe storm with H (which sounded like a few large stones occasionally thrown as in handfuls at our windows) lasted from about 0.30 to 3.30 a.m., and the L appeared almost simultaneously in S.W., N.W., and N.; total R, 1·20 in.—*John Hopkinson.*

MOUNT PLEASANT, RICKMANSWORTH.—Total R, 1·37 in.—*W. B. Butler.*

GREAT GADDESDEN VICARAGE, HERTS.—A most violent TS last night; incessant sheet L; R began to fall between 10 and 11 p.m., and up to 9 a.m. 2·36 in. fell.—*W. T. Tyrwhitt Drake.*

BERKHAMPSTEAD.—We had a most terrific TS (or rather succession of TSS); they commenced before 10 p.m. and continued till about 3.15 a.m. The L was incessant, and the T remarkably loud. Several times it seemed to subside, and returned shortly afterwards with renewed violence. The R measured 2·5 in. I hear that the storm was also very heavy at Hemel Hempsted and Watford.—*Wm. Squire.*

KENSWORTH, HERTS, NEAR DUNSTABLE.—The most terrific storm ever witnessed or remembered by the oldest inhabitant of this parish occurred here on Saturday night. T and L commenced about 9.30 p.m.; at 11.30 an ash tree within 150 yards of this house was struck, the head of the tree being completely split off, the L having pierced to the centre of the stem; the bark was split off and carried away for yards; the storm continued incessantly until daybreak. The R during the six hours' storm was tremendous; the gauge records 2·34 in., the greatest rainfall I have yet measured. The river Ver is supposed to rise at Kensworth, but except in unusual seasons its course is dry, the excessive rain produced quite a torrent in this bed, the water during part of the night being between 5 and 6 feet deep. The roads in the valley were torn up with great force; huge stones hurled along for considerable distances, walls washed down, and one unfortunate farmer has lost 35 pigs by drowning, besides a quantity of other valuable property.—*S. Grace Jones.*

HENLEY-ON-THAMES.—I happened to be at Henley-on-Thames on August 2nd and 3rd, and the TS there was very violent. I did not notice any H, but the R was extraordinarily heavy. There is no rain-gauge kept at Henley so far as I could learn, but from some

rough measurement I made in boats (punts) and pans the fall must have been between 2½ and 3 in. I afterwards ascertained that the amount measured in the rain-gauge at Greenlands (Right Hon. W. H. Smith) was 2·25 in., and at Rotherfield Greys (Rev. N. Pinder) about 2·40 in. Both these gauges were, however, 2 or 3 miles from Henley, where the rain had apparently not been quite so heavy, and one of them (Greenlands) was in a sheltered position, so that I am inclined to think that my estimate is not far from the mark. A good deal of damage was done, a wall washed down, houses flooded, roads cut up, &c. The Thames also rose considerably in the course of the night and overflowed its banks.—*Rogers Field.*

ADDINGTON, WINSLOW, BUCKS.—The most violent TS we have had for years in this district visited us last night; indeed, there were four distinct TSS—the first from 8.30 until about 10 p.m. The storm rose in the W. and seemed to have spent itself out in the E. by 10 o'clock. Another and more violent TS followed from the same direction before midnight, lasting a considerable time; the T one continual rumble with frequent very loud crashing peals; the L incessant, the whole country side lit up; most distant objects seen with great distinctness. R during the storm, 0·85.—*John Mathison.*

TETWORTH HALL, SANDY.—Total R during the TSS, 2·24 in.; much damage is done here.—*M. Kaye.*

FARM HALL, NEAR HUNTINGDON.—Very heavy TS between 2 and 3 a.m. Total R, 1·57 in.—*G. J. Bevan.*

BANK, BIGGLESWADE, BEDS.—During the severe TS which raged here last night I registered the exceptionally heavy rainfall of 2·36 in. A greater flood than has ever been known in this district has risen to-day.—*C. T. Newbery.*

ODSEY GRANGE, ROYSTON.—R in the TS of Saturday evening and Sunday morning, 1·81 in.—*H. George Fordham.*

GRANCHESTER MILL AND BEECH HOUSE, CAMBRIDGE.—The extraordinary storms of T, L and R of Saturday night and Sunday morning suggest a special notice. The first commenced about 10.30 p.m., and was over about 11 p.m., but at 1 a.m. another TS began, which lasted till 4.30 a.m., and the L and T were incessant. There were about 56 flashes every minute. I never saw anything like it. I do not think it was at any time quite over us, but four claps of T were remarkably loud and awful. I found to my surprise we had had 3·60 in. of R at Beech House. The largest quantity I have previously known in 24 hours in the 16 years I have observed, was 1·59 in. in three hours on June 17th, 1875. At Granchester Mill, about two miles distant, 3·92 in. fell. The fields are very much flooded, and there were two fires near—one at Fulbourn and another at Haslingfield. Two remarkable things attended these storms; one was the high state of the bar. being 30·10, and the other the low state of the thermometer, the highest having been only 66° the previous day.—*Jas. Nutter.*

(To be continued.)

STRATUS AND CIRRO-STRATUS.

To the Editor of the Meteorological Magazine.

SIR,—Mr. Dillworth Howard's letter contains one indictment, to which I at once plead guilty. Cloud observations are to me, as I think they should be to every meteorologist, principally valuable as giving us information on the subject of the atmospheric currents.

Still, a critic, if he quotes at all, should do so correctly. I did not "aver that the varying habitat of Cirro-stratus has made confusion worse confounded;" but that the application of the term Cirro-stratus by the older observers to some of our fogs does so. That application I regard as a misapplication.

However, the question between us is one of wider import than that of the correctness of a phrase in a lecture. "One thing," Mr. Howard writes, "is certain, that there is no better way to introduce confusion into a science than to take names already of universal application and pin to them new and widely different meanings." Is the study of the clouds, in its present condition, a "science" at all? Can it be formulated? Can it be by fixed rule methodized? Is it clearly capable of being communicated? Is it a progressive branch of knowledge, or has it in the last forty years made any distinct advance? I fear that to these questions we must reluctantly answer, No; And if any thing is to be done to clear the way for such a study to spring up into a science, our first endeavour will be to prune the obstructive growth of its vaguer phrases, and to give definitiveness and restriction to its terminology. But there is an alternative. If the effort fail, *e.g.*, with regard to the word "Cirro-stratus," it does not matter much. It is easy to foresee what will then occur. A word of such "universal application," that hardly any two observers are agreed as to its meaning, will be tacitly dropped by the meteorologist, and some other will take its place. Already I perceive that the half-English expression "Sheet-Cirrus" is, for this reason, beginning to do duty for the Latin "Cirro-stratus" in the restricted sense of the halo-forming canopy. And for a similar reason, a fog is called a fog, and is not called a "Stratus" by any but a few, and those mostly old-fashioned observers. "Cirrus" keeps its title, and is likely to do so; and why? Because that title represents a certain distinctly recognisable entity, and calls up a fixed idea. The same is true of "Cumulus." And we should wish the same to become true of our other old and favourite cloud names. But if they are too sacred to have their interpretation meddled with at all, we shall be driven to find others instead.

Cloud-lore is intimately connected with Wind-law. But the latter *is* a science, young indeed, yet robust and progressive. Must the union prove like that of Tithonus and Aurora, because "the gods themselves cannot recall their gifts;" because the Howards can permit neither modifications nor substitutes in the phraseology which

they have given us? Then will the "strong hours," unable to "end" the study of the cloud-forms, at least "leave it maimed, immortal age beside immortal youth," a study of beautiful objects, and full of the reminiscences of justly honoured names, but eminently non-progressive, because burdened with a terminology both inadequate and rigid.—Yours truly,

W. CLEMENT LEY.

Ashby Parva, Lutterworth, July 19th, 1879.

HAILSTONES—RELATION OF WEIGHT TO SIZE.

WE are not aware that any calculations or observations have been made as to the relation which exists between the dimensions of hailstones and their weight. It is evident that precise values cannot be given, because the density of hailstones varies with their nature: some are true spheres of crystalline ice, others are formed of alternate layers of clear and opaque ice, while others are chiefly opaque with but a thin crystalline coating.

Nothing but a long and troublesome series of observations can determine precisely the specific gravity of these various forms, but fortunately it is possible to determine their greatest weight—they cannot be heavier than if they were spheres of pure ice. A cubic inch of water weighs 253 grains, but the specific gravity of ice is 0·93, therefore a cubic inch of ice cannot weigh more than 235 grains, or a trifle over half an avoirdupois ounce.

The following table has been computed on the assumptions:—

(1) That the hailstones are truly spherical.
(2) That they consist wholly of clear ice.

Although the first condition is rarely fulfilled, the table is certainly useful as a check upon the random statements as to weight and size frequently made.

Although it is always desirable to obtain measures of size whenever practicable, it is also well to supplement them by determinations of the volume or weight. The best way to ascertain the former is to collect ten of the largest and place them in the measuring glass of the rain gauge (with a card laid on the top to check evaporation), and read off the amount when melted—

| Each 0·01 in. in the measuring jar of an 8 in. rain gauge contains 127 grains.
,, 0·01 in. ,, ,, a 5 in. ,, ,, 50 grains.

Consequently it is very easy to find the weight of each hailstone; *e.g.*, supposing that the ten yield water which in a 5 in. jar reads 0·13, then

$$10\overline{)650} \begin{matrix} 13 \\ 50 \end{matrix} = \text{total weight in grains.}$$

65 = average weight of each stone.

By the following table it will be seen that such a stone corresponds with a sphere of clear ice rather less than 1 inch in diameter.

Diameter.	Approximate Circumference.	Weight.	
		Grains.	Ounces Avoird.
inches.	inches.		under
$\frac{1}{4}$	$\frac{3}{4}$	2	$\frac{1}{4}$
$\frac{1}{2}$	$1\frac{1}{2}$	15	
$\frac{3}{4}$	$2\frac{1}{3}$	52	
1	3	122	$\frac{1}{2}$
$1\frac{1}{4}$	4	240	$\frac{3}{4}$
$1\frac{1}{2}$	$4\frac{3}{4}$	416	1
$1\frac{3}{4}$	$5\frac{1}{2}$	660	$1\frac{1}{2}$
2	$6\frac{1}{4}$	984	$2\frac{1}{4}$
$2\frac{1}{4}$	7	1400	$3\frac{1}{4}$
$2\frac{1}{2}$	8	1920	$4\frac{1}{2}$
$2\frac{3}{4}$	$8\frac{1}{2}$	2560	6
3	$9\frac{1}{2}$	3320	$7\frac{3}{4}$

RAINLESS WEEKS.

To the Editor of the Meteorological Magazine.

SIR,—Seeing a letter from you in the *Times* a short time since, as to the period that has elapsed since there has been a week without rain or snow at Camden Square, you may, perhaps, think the following statement worth notice in your Magazine.

It is now more than a year since there have been seven consecutive days here without R or S, to the extent of at least ·01 of an inch having been recorded; July 23rd, 1878, was the last of 14 consecutive days without R; in fact, excepting ·02 on the 9th of that month, no R had fallen since the 3rd, giving twenty dry days, the 9th only excepted; since that time, as I have said, no single week has escaped either R or S.

There have been, however, some dry periods in which the above has only just been true, thus—October, 1878, 11th to 20th inclusive, ten days, ·01 and ·02 on 15th and 16th only; December 8th to 14th, seven days, ·01 on 11th only; January 4th to 10th, seven days, ·01 on 7th only; January 19th to 31st, thirteen days, ·02 on 24th, ·01 on 25th, and ·01 on 30th only.

Since the beginning of February we have only once had *four* days consecutively without R, March 6th to 9th; and since the 4th of May, now just upon three months, we have not had *three* days consecutively fine.—I am, Sir, yours obediently,

J. W. SCOTT.

Muswell Hill, Hornsey, Middlesex, July 31st, 1879.

SUPPLEMENTARY TABLE OF RAINFALL IN JULY, 1879.

[For the Counties, Latitudes, and Longtitudes of most of these Stations, see *Met. Mag.*, Vol. XIV., pp. 11 & 10.]

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			in.
II.	Margate, Acol	2·71	XI.	Port Madoc	6·00
,,	Littlehampton	2·99	,,	Douglas	..
,,	Dorking Abinger.....	4·05	XII.	Carsphairn	5·88
,,	Hastings, Manor House	3·29	,,	Melrose, Abbey Gate...	4·32
,,	Hailsham	3·89	XIV.	Douglas Newmains.....	4·94
,,	I. of W., St. Lawrence.	3·66	XV.	Islay, Gruinart School..	3·71
,,	Strathfield Turgiss	2·71	XVI.	St. Andrew's, Cambo...	4·05
III.	Great Missenden.....	5·06	,,	Aberfeldy H.R.S.	2·32
,,	Winslow, Addington ...	4·13	XVII.	Tomintoul.....	2·47
,,	Oxford, Magdalen Col...	3·68	,,	Keith H.R.S.	3·41
,,	Northampton	3·39	,,	Forres H.R.S.	3·40
,,	Cambridge, Merton Vil.	3·64	XVIII.	Strome Ferry H.R.S....	6·98
IV.	Harlow, Sheering	4·21	,,	Lochbroom	4·83
,,	Diss	5·44	,,	Auchnasheen H.R.S. ...	2·77
,,	Swaffham	5·37	,,	Tain, Springfield.....	4·95
,,	Hindringham	5·32	,,	Loch Shiel, Glenfinnan.	11·41
V.	Salisbury, Alderbury...	3·15	,,	Dalwhinnie H.R.S.....	...
,,	Calne, Compton Bassett	3·82	XIX.	Lairg H.R.S.	...
,,	Beaminster Vicarage ...	4·10	,,	Altnabreac H.R.S.	2·89
,,	Dartmoor Prison.....	8·68	,,	Watten H.R.S.	3·50
,,	Langtree Wick	3·70	XX.	Fermoy, Glenville	3·68
,,	Lynmouth, Glenthorne.	3·09	,,	Tralee, Godfrey Place...	3·86
,,	St. Austell, Cosgarne...	5·05	,,	Cahir, Tubrid	2·10
,,	Taunton	2·83	,,	Tipperary, Henry St....	3·20
VI.	Bristol, Ashleydown ...	3·88	,,	Newcastle West	3·63
,,	Wem, Sansaw Hall.....	3·82	,,	Kilrush	2·96
,,	Cheadle, The Heath Ho.	3·67	,,	Corofin	3·76
,,	Bickenhill Vicarage ...	3·87	XXI.	Kilkenny, Butler House	3·47
VII.	Melton Mowbray	4·25	,,	Ballymore, Eustace ...	...
,,	Horncastle, Bucknall...	3·51	,,	Kilsallaghan.....	4·55
VIII.	Walton-on-the-Hill.....	3·46	,,	Navan, Balrath	4·34
,,	Broughton-in-Furness ..	8·76	,,	Athlone, Twyford	4·72
IX.	Wakefield, Stanley Vic.	3·26	,,	Mullingar, Belvedere...	4·14
,,	Ripon, Mickley	4·57	XXII.	Ballinasloe	3·71
X.	Gainford	3·39	,,	Clifden, Kylemore	6·76
,,	Haltwhistle, Unthank..	4·51	,,	Crossmolina, Enniscoe..	5·67
,,	Shap, Copy Hill	5·19	,,	Carrick-on-Shannon ...	5·59
XI.	Llanfrechfa Grange	4·47	,,	Dowra	5·76
,,	Llandovery	5·76	XXIII.	Rockcorry.....	5·32
,,	Solva	2·70	,,	Warrenpoint	5·68
,,	Castle Malgwyn	2·74	,,	Newtownards	5·89
,,	Rhayader, Nantgwillt..	7·88	,,	Larne, Carnlough	5·58
,,	Carno, Tybritle	6·09	,,	Bushmills	4·44
,,	Corwen, Rhug	5·13	,,	Buncrana, Rockfort ...	6·42

JULY, 1879.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1860–5	Greatest Fall in 24 hours. Dpth	Date.	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date.	Min. Deg.	Date.	No. of Nights below 32°. In shade.	On grass.
			inches	inches.	in.								
I.	ENGLAND.	Camden Square	4·17	+ 2·38	·91	19	20	80·2	30	45·6	11	0	0
II.		Maidstone (Hunton Court)	2·72	+ 1·08	·47	2	14	...	...	...	...	...	...
,,		Selborne (The Wakes)	4·14	+ 1·94	·96	19	20	75·0	29	45·5	11	0	0
III.		Hitchen	3·78	+ 1·88	·62	13	20	73·0	30	45·0	5	0	0
,,		Banbury	3·78	+ 1·72	·63	20	20	75·0	29	44·0	6	0	0
IV.		Bury St. Edmunds (Culford)	5·09	+ 3·10	1·18	21	19	79·0	30	42·0	24	0	0
,,		Norwich (Cossey)	4·62	+ 2·65	1·37	21	18	80·0	30	42·0	19	0	0
V.		Bridport	3·96	+ 1·85	1·25	19	16	...	...	...	...	...	...
,,		Barnstaple	3·57	+ ·71	·82	19	24	80·0	30	...	...	...	...
,,		Bodmin	4·92	+ 1·81	1·05	16	27	76·0	29	50·0	11	0	0
VI.		Cirencester	3·77	+ 1·33	·72	19	19	...	...	...	...	...	...
,,		Shifnal (Haughton Hall)	3·69	+ 1·52	·76	13	20	75·0	29	44·0	26	0	0
,,		Tenbury (Orleton)	3·44	+ 1·06	·86	13	22	77·2	29	42·0	6	0	0
VII.		Leicester (Town Museum)	3·72	...	·75	13	23	75·6	29	46·5	11	0	0
,,		Boston	3·42	+ 1·12	·55	26	17	80·0	29	47·0	26‖	0	0
,,		Grimsby (Killingholme)	3·70	...	·64	21	18	75·0	28*	46·0	12	0	...
,,		Mansfield	3·27	...	·75	19	18	76·2	29	45·8	12	0	0
VIII.		Manchester (Ardwick)	...	...	...	...	...	...	...	...	...	...	...
IX.		York	2·87	+ ·93	1·00	18	13	...	...	...	...	...	...
,,		Skipton (Arncliffe)	8·14	+ 4·91	1·31	20	29	...	...	...	...	...	..
X.		North Shields	4·35	+ 2·54	1·00	21	23	70·7	28	46·5	16	0	0
,,		Borrowdale (Seathwaite)	13·60	+ 5·46	1·56	7	28	...	...	...	...	..	...
XI.	WALES.	Cardiff	4·00	...	·81	19	21	78·2	29	45·4	11	0	0
,,		Haverfordwest	3·19	— ·11	·70	20	21	74·5	29	46·4	10	0	0
,,		Lampeter (St. David's Coll.)	6·64	+ 3·09	·89	20	25	...	...	...	...	...	...
,,		Llandudno	3·33	+ 1·04	·64	1	19	74·4	29	50·0	2,11	0	0
XII.		Cargen	4·14	+ 1·42	·68	13	22	71·4	22	45·2	11	0	0
,,		Hawick (Silverbut Hall)	4·89	...	·70	13	20	...	...	...	...	...	...
XIV.		Annanhill	3·90	...	·50	31	22	69·1	23	44·6	23	0	0
XVI.		Kilmory	6·86	...	·81	31	22	...	...	40·0	31	0	...
,,		Mull (Quinish)	7·54	...	1·52	1	20	...	...	...	...	...	..
,,		Loch Leven	4·10	+ 1·53	·60	2	17	...	...	...	...	...	...
,,		Loch Long (Arddaroch)	6·60	+ 2·18	...	...	...	...	...	...	...	...	...
XVII.		Arbroath	5·67	+ 3·12	·82	31	18	71·0	29	45·0	11	0	...
,,		Braemar	2·96	+ ·68	·62	31	22	66·2	30	38·5	22	0	1
XVIII		Aberdeen	3·96	...	·86	31	26	70·7	28*	45·8	11	0	0
,,		Portree	6·11	+ ·04	1·93	2	19	...	...	...	...	...	...
,,		Inverness (Culloden)	3·90	+ 1·23	·86	21	11	70·5	29	40·0	16	0	0
XIX.		Dunrobin	5·13	+ 3·38	1·00	31	17	66·7	28†	43·0	11	0	...
,,		Sandwick	3·17	+ 1·28	·72	1	19	63·2	29	45·8	11	0	0
XX.	IRELAND.	Cork	...	...	...	...	...	...	...	...	...	...	...
,,		Cahercivеen Darrynane Abbey	5·26	...	·71	27	28	...	...	...	...	...	...
,,		Waterford	...	...	...	...	...	...	...	...	...	...	...
,,		Killaloe	3·88	+ ·69	·40	19	23	80·0	18	41·0	11	0	...
XXI.		Portarlington	3·74	+ ·20	·50	19	28	72·0	28	45·0	26	0	..
,,		Monkstown, Dublin	3·51	+ 1·08	·47	12	22	...	...	...	...	...	...
XXII.		Galway	3·87	...	·49	7	23	66·0	15‡	44·0	11	0	...
XXIII		Waringstown	6·30	...	1·25	19	27	75·0	10	45·0	2	0	0
,,		Edenfel (Omagh)	6·78	...	1·31	1	26	68·0	18	44·0	23	0	0
,,		Ballinful	...	...	...	...	...	...	...	...	...	...	...

* And 29. † And 30. ‡ And 16. ‖ And 11, 12.

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

METEOROLOGICAL NOTES ON JULY.

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

ENGLAND.

SELBORNE.—Prevailing wind S. and S.W., occasionally N.W.

HITCHEN.—The coldest and most sunless July on record except 1875, harvest cannot commence until September, half the hay is still out and spoilt. Mean temp. 4° below the average of 30 years.

CULFORD.—A month of almost continuous rainfall, resulting in destructive floods, with, in some instances, the entire loss of the hay crop, and much injury to grain crops of all kinds. Harvest will necessarily be late, even rye showing no indication of changing colour yet, while in 1868 the entire harvest was completed by the last day of this month. Easterly winds prevailed during six days. Mean temp. 58°·2.

COSSEY.—A dull cold month, only six days on which the temperature reached 70 degrees.

BODMIN.—Mean temp of month 61°·2.

CIRENCESTER.—Another wet ungenial month, with a remarkable absence of sunshine, particularly in the early morning. The thermometer only rose to 80° once during the month.

SHIFNAL.—Rain fell daily with two exceptions till the 15th, and afterwards at intervals till the close. Hay crop heavy, but much of it badly housed. TS on 13th and 14th. Bar. very equable. Peas first gathered on 11th, strawberries on 13th, no butterflies, not even white.

ORLETON.—Cloudy, gloomy, and cold, with very little sun, R almost every day, and frequent gales of wind till the 23rd, when the sky became clearer and the air drier and warmer. On the 18th the ther. in shade reached 70°·8, which was the highest temp. registered since last autumn. Mean temp. nearly 4°·5 below the average, and below that of any July for more than 25 years past, the nearest approach to it being July, 1862, which was more than half a degree higher. TS on 14th, and distant T on 10th and 26th. The hay harvest was very late, and the wheat generally not in blossom till the last week of the month.

LEICESTER.—TS with H at 2.30 p.m. on 13th; T on 8th and 19th.

BOSTON.—Mean temp. of month 5° below the average, and the lowest recorded during the past 16 years. The max. in shade did not occur till the end of the month, and then only reached 80°, the min., however, (47°) has frequently been lower. The rainfall, 3·42 in., has frequently been exceeded, but the water in the Witham rose a foot higher than it has ever done in July during the last 30 years, but very little land is flooded. On the Welland the wash lands have been under water all the summer, and the hay and pasturage destroyed. Wheat first in ear about the 3rd, which is from three weeks to a month late, and the latest for 20 years, except 1860, when reaping did not begin till the 12th of September.

KILLINGHOLME.—Sunshine very deficient during the whole month, and no summer weather till quite the end. Everything very backward, and the barley on heavy land will not be half a crop. TS at noon on 9th.

WALES.

HAVERFORDWEST.—Although rain fell on 21 days, there were not more than three or four wet days, the fall taking place principally at night, which coupled with the heavy gales from W. and N.W. causing rapid evaporation, allowed a large per-centage of hay to be harvested in good condition. Mean temp. much below the average.

LLANDUDNO.—A variable month with deficient sunshine, and therefore most unfavourable for hay-making and ripening of fruits; mean temp. more than 1° below the average.

SCOTLAND.

CARGEN.—A dull gloomy month, with very little sunshine. Mean temp. 2°·5 below average. Vegetation has made little progress during the month; peaches, apples and pears will apparently be a complete failure. T and L at 4 p.m. on 9th.

HAWICK.—A cold, wet and sunless month, vegetation of all kinds fully a month behind. The dragon fly has never yet been seen, and the common black flies are so scarce that the swallows have been on short allowance for many weeks past; the grasshopper was seen and heard for the first time on the 16th.

ARBROATH.—The atmospheric pressure temperature and humidity throughout the month were altogether of an abnormal character, the outcome of which was the unusual rainfall of more than double the average of the last 37 years.

BRAEMAR.—Although the month has been dull, dark, damp, and cold, the crops with favourable weather would yet be very productive.

ABERDEEN.—A cold, wet ungenial month; only on six days did the temp. rise above 65°.

PORTREE.—A wet stormy month and extremely cold; fruit three weeks behind the usual time of ripening. Harvest will be very late here.

CULLODEN.—Bar. generally low during the month; temp. below the average. Fruit crop disappointing, all other crops promising, but suffering from want of heat and sunshine.

SANDWICK.—The rainfall was ·74 in. more that the average of the previous 38 years, and the month was colder than the mean till the 26th, from the prevalence of northerly and easterly winds; indeed W. wind has been rare, not only during the month, dut during all this year, and this, has no doubt, been the cause of our remarkably cold winter and summer.

IRELAND.

KILLALOE.—A very bad month for haymakers, only eight days without R. All crops from a month to five weeks late; potato blight appearing everywhere.

MONKSTOWN.—A dull, chilly, sunless month, with a large number of wet days, but no very heavy fall of R; T, L and H on 2nd. The only warm summer-like days were about the 18th.

WARINGSTOWN.—Unprecedently wet, but not so cold as preceding months. Crops in this district excellent, and except a few potatoe fields, as yet uninjured; turnips little grown here, but the crop will be deficient. Heavy thundershower at 3 p.m. on 26th, ·60 in. in 20 minutes.

EDENFEL.—Another month of excessive rain, low temperature, and absence of sunshine. Although 68° has been the highest temp. reached this year, the crops (being still in their growing stage) have suffered more from excessive moisture than from deficient heat. Grazing is extremely bad, as are also all green crops. Even should heat and drought now ensue, the harvest of cereals cannot take place till near the beginning of October. Altogether agricultural prospects have not been so bad since 1816.

RAINFALL IN THE N.W. OF ENGLAND.

To the Editor of the Meteorological Magazine.

SIR,—In an editorial note in your July number, p. 91, you state that there has been a great deficiency of rainfall in the north-western counties, and in the lake district, during the six months, January—June, 1879.

This remark certainly does not hold good for this part of Cheshire. I find that during these six months, the rainfall here has exceeded the average of the same months taken over the ten years 1869—1878, by 35 per cent.—Yours faithfully,

REGINALD BUSHELL.

Hinderton, Neston, Cheshire, August 5th, 1879.