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ENGLISH THUNDERSTORMS.

THIRTY-TWO years ago I started single-handed a system of collecting information respecting English thunderstorms. I was (as I always have been) most kindly helped by observers in many parts of the country, and I rejoice to think that several of them have proved lifelong friends, and are among the best meteorological observers of the present day. I gathered material, which competent authorities have recently examined and spoken highly of; but in those days I was young, unknown, and without influence. I worked up the data to the best of my ability, with what result I proceed to relate.

First attempt.—Paper prepared with the title, "On the Thunderstorms of 1857," accepted by the British Meteorological Society, read at its meeting on June 9th, 1858, when the great engineer, Robert Stephenson, was presiding, but not even the title of the paper was recorded in the publication of the Society.

Second attempt.—In 1859 another paper was prepared, dealing with the phenomena recorded during the years 1857 and 1858. This I took to the Aberdeen meeting of the British Association. It was accepted, read in Section H, led to a long and complimentary discussion, in which the late Earl of Rosse, Prof. (now Sir) William Thomson and other distinguished men took part, but again the paper was excluded from the volume, the title only being printed.

Third attempt.—In 1860 I prepared a paper, embodying 1889 separate observations of thunderstorms made in England during the three years 1857, 1858 and 1859, and presenting with the necessary maps and diagrams such an epitome of the subject as had never before been prepared. This I took to the British Association Meeting at Oxford, and this time I was rewarded by the publication of an abstract extending to 27 lines. So much for three years' work. Maps, tables, diagrams all went into the waste basket together. This is the way to encourage young workers!

However, that is all in the dim past. And now that once more an attempt is to be made to deal with the subject, I hope that we shall be able to show that, as our French friends would say, "*Nous avons changé tout cela.*"

The initiative now is being taken by the Hon. Ralph Abercromby, with some support from the Royal Society, and the hearty co-operation of the Royal Meteorological Society, and I hope that I may add of the readers of the *Meteorological Magazine*.

The following is the circular which has been issued, and it will be seen from it that the work is so easy that everyone is competent to become a reporter, and that all communications are to go to Mr. W. Marriott, Ass. Sec. Roy. Met. Soc. :—

Royal Meteorological Society.

30, GREAT GEORGE STREET,
WESTMINSTER, S.W.

SIR,

The Council of the Royal Meteorological Society have appointed a committee to collect observations on British Hail and Thunder Storms from volunteer observers.

The objects which they hope to attain thereby are :—

- I. A knowledge of the nature and causes of the different kinds of Thunder Storms ; attention having been specially called to the subject by the great loss of life and property during the past summer.
- II. A discovery of the localities where Hail and Thunder are most frequent and destructive.
- III. If possible, to obtain an increased power of forecasting Hail and Thunder, whereby it is hoped that eventually damage to persons, stock, and property, may be lessened.

Volunteers can select to observe in either Class A, B or C, but this division into classes need not be closely followed.

Class A (no instruments required).—Simple records of the times when Thunder, Lightning, Rain or Hail begin and end, when they are loudest, brightest, or heaviest.

Class B (no instruments required).—A record, in addition to the above of the direction and force of the wind before, during and after the storm, and of the times when it changed.

Class C (good instruments required).—In addition to both the above, careful observations on the shape and motion of Clouds and, if possible, frequent readings of the barometer, dry and wet bulb thermometers.

The general nature of the observations required will be easily gathered from an inspection of the enclosed sample form.

The Council would be very pleased if you would assist them by becoming an observer under any class, but if you are unable to do so, perhaps you would favour them by handing this circular to some one else, or by furnishing the Council with the names of persons who are likely to be interested in Hail or Thunder observations.

It is believed that many intelligent young persons, of each sex,

would be willing and capable of making observations in the A or B Class.

In the event of a favourable reply, a stock of forms and a copy of instructions will be forwarded.

All communications should be addressed to the Assistant Secretary, Mr. W. Marriott.

J. W. TRIPE }
G. J. SYMONS } *Secretaries.*

It is evident that the present effort is not quite in the same direction as was mine. The present attempt is to dissect the storms, to ascertain their characteristics, their anatomy so to speak, whereas in my early attempts I aimed specially at ascertaining the intensity of the storms, the extent and nature of damage to life and property, whether or not there were indications of selectiveness in the action of lightning upon terrestrial objects. But I have no doubt that all useful material will be fairly dealt with, and that instead of going into the waste basket it will be printed and issued to all contributors.

G. J. SYMONS.

THE JANUARY BLIZZARD.

WE are astonished to find that few Englishmen know what a blizzard is, and that in many dictionaries the word is not to be found.

When we were recently asked, "What is a blizzard?" we replied by asking another question, "Do you remember the snow storm of January 18th, 1881?" because, if so, that is the nearest English equivalent to a blizzard. Perhaps our reply would have been improved by joining with the mention of that snow storm a reminder of the Eurydice squall, but the addition would not have been important.

We hope that the January number of the Weather Bulletin of the United States Signal Office will give us full details of the recent blizzard, which has wrought much damage in Dakota and the N.W. States, but in the interim we think that the principal features may be described as—

- (1) Rapid fall of temperature to a point below zero, *i.e.*, 32° at least below freezing.
- (2) The formation of ice needles, instead of snow.
- (3) Steep barometric gradients, causing a gale from a polar quarter.

All these features are requisite to produce that which we understand by a blizzard. Cold alone, wind alone, snow alone, or any two of them alone, will not produce the full discomfort of a genuine blizzard. Dry, calm, cold is by no means unpleasant, and though a gale with a low temperature is very trying, it needs the painful effect of an atmosphere loaded with ice-needles to account for the frenzy which unprotected exposure to a blizzard not unfrequently produces. We have just used the word frenzy. Some may think that it is too

strong, but if the fact that those who die from exposure to blizzards have not unfrequently torn off all their clothing be not a proof of frenzy, we do not know what would be.

Those of our readers who were in the south of England on January 18th, 1881, will now see why we called that an English blizzard. There was low temperature, not of course below zero, as recently in Dakota and other States ; there was such a gale that we remember seeing the Robinson anemometer on Hankey's buildings flying round with only two arms left out of the four ; and there was ice-needle snow so fine and so dry that it went through keyholes, window sashes, and all sorts of places where snow had hardly ever gone before.

And, as shown in the *Meteorological Magazine* for February, 1881, the loss of life and property in the southern half of England was proportionally great.

The true blizzard is an American phenomenon, and rightly has an American name ; but when our weather so nearly approaches its characteristics as it did in 1881, we might not unwisely adopt the name.

ROYAL METEOROLOGICAL SOCIETY.

The monthly meeting of this Society was held on Wednesday evening, the 18th ultimo, at the Institution of Civil Engineers, 25, Great George-street, Westminster ; Mr. W. Ellis, F.R.A.S., President, in the chair.

Messrs. C. H. Blackley, M.D., H. E. Brameld, E. S. Bruce, W. Forrest, J. Groves, M.D., C. Harrison, M.D., G. C. Harrison, N. R. Haswell, R. Laing, H. J. Lloyd, H. T. H. Mead, C. Perks, W. R. Pike, J. L. Rushton, M.D., and J. H. Walker were elected Fellows of the Society.

The paper read was "The Non-Instrumental Meteorology of England, Wales and Ireland," by Mr. G. M. Whipple, B.Sc., F.R.A.S., F.R.Met.Soc. This is a discussion of the observations of wind, cloud, thunderstorms, hail, snow, &c., made at the stations of the Royal Meteorological Society during the eight years, 1878-1885, and published in the *Meteorological Record*. The S.W. wind is the most prevalent, and blows on the average 74 days in the year ; the W. wind occurs almost as frequently, blowing 65 days. The least dominant winds are the S.E. and N., which occur on 27 days, and the N.E. on 32 days. Thunderstorms are most frequent in the eastern and midland counties, and least frequent in the north of Wales.

After the reading of this paper the Annual General Meeting was held. The report of the Council showed the Society to be in a satisfactory condition, the number of Fellows being 522.

Mr. Ellis, in his presidential address, reviewed briefly the work and position of the Society, remarking that such a society, whilst

unable to carry out expensive original or experimental work, could yet act with great advantage in inciting volunteer workers throughout the country to united action, of which one recent example was the ready response to the request of the Society for photographs of lightning, an excellent collection of which had been obtained, and which would shortly be exhibited ; in addition to which, arrangements were being made for the more systematic observation of thunderstorms. Referring to the question of sympathetic relation between sun spots and magnetism and meteorology, he thought that any complete treatment of the question in its meteorological aspect seemed to require that it should be dealt with in a much more comprehensive manner than before, for which purpose observations more nearly covering the surface of the globe might be necessary, if indeed not necessary also for the solution of many other meteorological questions, the present meteorological stations being distributed over the earth in isolated clusters. The attention given to synoptic charts was most important, but the general meteorological characteristics of places should also still continue to be studied. After remarking upon other matters, he laid before the meeting, tables showing the monthly means of amount of cloud from observations made in three different series at the Royal Observatory, Greenwich, extending in all from 1818 to the present time. In concluding, Mr. Ellis said that at one time the science of meteorology seemed likely to form an exception to the general rule of advance, for more than any other it has required the united action of many workers, but the field of inquiry opened out of late years allows us already to talk of the new or modern meteorology, phrases typical of the advance achieved, although the knowledge gained seems only to remind us of how much has yet to be done.

The following gentlemen were elected the officers and council for the ensuing year :—

President, William Marcet, M.D., F.R.S., F.C.S.—*Vice-Presidents*, Francis Campbell Bayard, LL.M. ; William Ellis, F.R.A.S. ; Charles Harding ; Richard Inwards, F.R.A.S.—*Treasurer*, Henry Perigal, F.R.A.S., F.R.M.S.—*Trustees*, Hon. Francis Albert Rollo Russell, M.A. ; Stephen William Silver, F.R.G.S.—*Secretaries*, George James Symons, F.R.S. ; John William Tripe, M.D., M.R.C.P.ED.—*Foreign Secretary*, Robert Henry Scott, M.A., F.R.S., F.G.S.—*Council*, Hon. Ralph Abercromby ; Robert Andrew Allison, M.P. ; Edmund Douglas Archibald, M.A. ; William Morris Beaufort, F.R.A.S., F.R.G.S. ; Henry Francis Blanford, F.R.S., F.G.S. ; Arthur Brewin ; George Chatterton, M.A., M.Inst.C.E. ; William Henry Dines, B.A. ; Henry Storks Eaton, M.A. ; Baldwin Latham, M.Inst.C.E., F.G.S. ; Edward Mawley, F.R.H.S. ; Charles Theodore Williams, M.A., M.D., F.R.C.P.

REVIEW.

Bulletin Météorologique du département de l'Hérault publié sous les auspices du Conseil Général. Année 1886. Boehm et Fils, Montpellier, 1887.

4to. 96 pages and 17 plates.

It would be a capital thing if the nominal leaders of British meteorological work could be compelled to go for a month's tour to the principal observatories on the Continent. They could hardly complain of it as a hardship, and the experience which they would gain would be worth all its cost. They would get a host of new ideas, and learn that England has not a monopoly of all the good methods for carrying on meteorological work, even if they did see a few things of which they would not approve. Such as the perversity whereby our French friends spoil their records with the Stokes-Campbell sunshine recorder by using any slip of blue paper which may come handy, instead of the proper cards. They maintain that the price of the regular cards is far too high. We do not say that they are wrong, but surely the proper course is to induce a French paper maker to bring out identical cards at a reasonable price, instead of the present makeshift plan, which renders all utilization of French sunshine records, and all comparison between them and those made in the British Isles, impossible. They would not, we believe, find that error at Montpellier, as other and very beautiful methods are adopted by Prof. Crova, to whom we owe the volume we are about to notice.

This is the 14th annual report upon the Meteorology of the Department of l'Hérault, which extends from the Mediterranean on its S.E., to the ridge of the Cévennes, which forms its N.W. boundary. We shall state briefly the contents of the volume, adding such comments and criticisms as may seem desirable.

(1). Complete tables of the observations made in 1886 at the observatory of the National Agricultural School, Montpellier.

We are not sure that Prof. Crova does himself justice here. He has a very fine set of self-registering instruments (as will be shown later on), and our impression is, that observations for their control are made at intervals during the day. In these tables, however, the 9 a.m. readings of barometer, temperature, hygrometer and direction and force of wind are alone given, with, of course, max. and min. temperatures, total daily rainfall, and total evaporation. We regret to find that the civil year is not adopted, but one running from December 1st to November 30th; but we may quote a few values, nevertheless:—Mean 9 a.m. pressure reduced to sea level, 29.989 inches; absolute max. temp., 98°.8; mean max., 69°.7; mean, 58°.5; mean min., 47°.2; absolute min., 20°.3; mean humidity, 66. Total evaporation (by a Piche instrument), 64.57 inches (!) Total rain, 29.76 inches.

(2). Abstracts of the observations at two other stations in Montpellier, viz., the Jardin des Plantes and the Normal School.

These agree fairly well with those at the observatory, but the school rain return looks too small ; the total is only 22·60 in. against 29·76 in. and 32·68 in. at the other stations. Perhaps it is on a roof ? or some decimal points have been misplaced ?

(3). Complete observations from the station of Fraïsse.

But the report does not tell us where Fraïsse is, and although we have searched five atlases (including a large but rather old French one) and sundry gazetteers, guide books, &c., we cannot find it. Probably it is in the Cevennes, for we are told that its altitude is 3051 feet, and the total rainfall, 69·69 in., and the mean temperature only 48°·7, or less than that of London. We hope that next year Prof. Crova will give the latitude and longitude.

(4). Summary of observations at Clermont l'Hérault.

This is a well-known town, formerly called Clermont de Lodève, it is W. of Montpellier, and therefore further inland, 295 ft. above sea, cooler than Montpellier (mean temp. 55°·0). Total rain 25·90 in.

(5). Monthly rainfall at 18 stations belonging to the *Ponts et Chaussées*, and at 2 kept by private observers.

These stations are grouped according to the river basins in which they are situated, one of them being on the summit of the Sommail at the altitude of 3314 ft., and others, Cette for example, being at sea level. The greatest fall in 1886 was 63·82 in. at La Salvetat in the basin of the Agout, at an altitude of 2303 ft., and the least, 13·58 in., at Lunel, in the extreme N.E. of the department, on the road towards Nîmes.

(6). A notice by Prof. Crova on the actinometric observations made at the observatory by M. Houdaille, illustrated by two tables and two plates.

(7). Note by Prof. Crova on his electrically recording actinometer.

These sections must be reserved for separate notice, as we do not appear to possess a copy of one of Prof. Crova's papers, which is necessary to enable us to do them full justice. And even if we had a copy, it would probably be wiser to devote a separate notice to his important work in this direction.

(8) On the rainfall in 1886, by M. Houdaille.

In this article, after pointing out the relation of the monthly, seasonal, and total fall in 1886 to the average, the author proceeds to deal with the number of days of rain. It appears that the average number with 0·02 in. or upwards is only 49, but in 1886 the number was quite unusually great, reaching 90, 15 of them being in October, and being of course related to the great floods of that year, when for miles between Marseilles and Lyons, the view from the windows of the railway carriages was almost limited to water and trees. In 1884 M. Houdaille designed a pattern of self-recording rain gauge, and in the present volume he gives two sheets of reproductions of the records. The ratio of the ordinates to the abscissæ is about 0·10 in. of rain to 1 hour, the diagrams being twice that scale, and beautifully lithographed, every detail of all but the

most insignificant rains of the year (except in September, while the apparatus broke down) is given on these two quarto sheets.

(9). Annual variation in the humidity of the soil.

This is an excellent note by M. Houdaille, of which we must give a brief *resumé*. The mean humidity of upper layers of the soil and its variation with depth at first sight appear little related to meteorology ; but it is easy to prove the intimate relation between the temperature of the air and that of the soil, and that between atmospheric humidity and the water contained in arable land. In fact, just as the amount of nocturnal radiation depends partly on the surface temperature and partly on that of the soil below the surface, so is the amount of evaporation from the surface of the soil modified by the amount and distribution of the water in the layers beneath.

Experience has shown that with a sandy soil evaporation changes little, as long as the water in the superficial layer remains within certain limits. If the soil could part only with the water in this superficial layer, evaporation would soon be stopped for want of supply, and herein the store of water in the soil below the surface enters as the modifying cause.

In that southern climate the soil sometimes, especially in summer, becomes dried a foot deep ; below this is found a soil containing much water, and it is the rate at which this water can be drawn to the surface which regulates the amount evaporated. This rate is itself variable, because it depends on the character of the soil and on the thickness of the layer through which it has to be drawn. In fact the soil may be regarded as a series of capillary tubes of different diameters. If the layer through which the water has to be raised be thin, all the tubes would act, but the thicker the layer the smaller would be the tubes which would act, and therefore the slower the transmission. Hence one sees why there can be no agreement between the indications of the evaporimeters generally used by meteorologists and the actual loss from the surface of the ground.

The plan adopted has been to take about $\frac{1}{4}$ lb. weight of soil from within two inches of the surface, and (by a boring tool) similar weights from depths of 1 ft. 8 in. and 3 ft. 3 in. respectively ; to put them immediately into glass jars, and subsequently to evaporate them to dryness in a Weisnegg stove, thus determining precisely the amount of water each had contained. Identical methods were adopted with two different soils, one naturally much denser and wetter than the other.

The author then gives the values obtained at each of the three depths and on each soil on twelve occasions during the two years 1885—86 (only four times, however, in 1886), and adds diagrams of the results. We prefer to wait until the series is longer before offering any opinion upon them.

(10). The progress of vegetation during the year, and the influence of meteorological phenomena upon it.

This section (by M. Chabaneix) treats of what are known as

phenological phenomena, but the method adopted at Montpellier we have never seen elsewhere. Closely adjoining the meteorological instruments a portion of the gardens is devoted to a series of plants, trees, &c., specially selected and planted with a view to systematic observation. The total number is 63, but they are all so compactly arranged that they are easily and constantly under the eye of the observer; this ensures early and systematic record, while the same tree, plant, &c., being observed each year, the observations are more rigorously comparable than those made hap-hazard. We may, however, suggest that perhaps a tree 5 years old and one 25 years old, even if under identical conditions of soil and climate, would not come into leaf simultaneously, *i.e.* that there is a personal element as well as the generic one.

(11). Meteorological and agricultural notes collected and co-ordinated by M. Chabaneix.

Abstracts of the meteorological observations in each month, and notes upon the influence of the weather changes on agriculture. We do not understand why the rainfall given here (p. 83) should for ten months agree precisely with that on p. 16, but should suddenly differ as under for—

	Page 16.		Page 83.
September	161·5 mm.	.....	157·5 mm.
October	285·5 „	.....	234·2 „

It is not a misprint, for the same values are given on pp. 79 and 80.

(12). Evaporation from soil.

A note upon M. Chabaneix's work in this direction is being prepared for *British Rainfall*, 1887, with the necessary engraving, and therefore we need not remark upon it here.

(13). Monthly plates reproducing the curves of the self-registering and other instruments at the observatory.

These are excellent. The only criticism which we have to offer is that it is rather puzzling to find a series of weather symbols of which several differ from those adopted by the International Congress, and some are identical in form, but different in what they denote. The following are illustrations:—

	○	⊕	△	▲
International	Solar halo.	Solar corona.	Soft hail.	Hail.
Bulletin de l'Hérault	Fine.	Fog.	White frost.	Frost.

As, however, the explanation is repeated on every plate, no serious mischief can result.

Our readers will now form a fair idea as to the high value of the *Bulletin Météorologique du département de l'Hérault*.

“GOAT'S HAIR” CLOUD.

To the Editor of the Meteorological Magazine.

SIR,—May I ask some of your readers to favour me with their ideas of the form of cirrus cloud, to which the name “goat's hair” is popularly applied?

What I want to know specially is, whether the name refers simply to a bundle of white fibres on a blue sky, or whether the term is applied to the dark fibrous clouds seen over rocky cumulus before thunder or heavy rain.—I am, &c., &c.,

RALPH ABERCROMBY.

21, Chapel-street, London, S. W.,
Jan. 16th, 1888.

LOW TEMPERATURE IN FEBRUARY.

To the Editor of the Meteorological Magazine.

SIR,—The exceptionally low temperature of last night for the month of February induces me to send you a note of it. Yesterday was a clear, cold day, with a max. of 30°, and a keen N.E. wind; by 10 p.m. the min. in shade stood at 20°, and at 6 o'clock this morning it stood at 9°, and the grass thermometer at 5°. I have no record of so low a reading in February; ice on lake 3 inches thick.

I am, sir, yours obediently,

JOHN MATHESON.

Addington, 2nd February, 1888.

EXTRAORDINARY WHIRLWIND AT JARROW-UPON-TYNE.

A correspondent, telegraphing from Jarrow, says that at about twelve o'clock last night, during a severe snow-storm, what is supposed to have been a whirlwind passed along the Grange-road, Jarrow. A cart, in which were George Atkinson, James Teesdale, and the driver, was passing up the street at the time. The snow was seen to be circling round in a curious fashion in advance, and the driver was called upon to stop the horse. Before he could do so, however, the horse and cart were caught up by the wind carried a short distance, and then thrown down. Atkinson was carried a distance of 150 yards before touching the ground, when he was thrown on his back, his leg being badly injured by coming in contact with the wall of a house. Teesdale was thrown against some iron railings, to which he clung until the storm had abated, while the driver was carried into Gray-street and deposited with force against the door of a house. The seat of the trap was found in Perry-street and the rug in Bodale-street, about 250 yards

distant. A number of persons collected and the horse was found to be badly injured. A shop window was blown in at the same time, and the chimney of the Prince of Wales Hotel was blown down. The hurricane lasted about a minute.—*St. James's Gazette*, 30th January, 1888.

WHITE FOG BOWS.

To the Editor of the Times.

SIR,—I observed the beautiful phenomenon, described by Professor Tyndall in your columns of the 12th inst., here on the 22nd of December last at 10.30 a.m.

The sky at the time was clear, except round the horizon. The shaded thermometer at 9 a.m. had been 29° Fahrenheit; sun just peeping through the clouds over the lower hills which form the south bank of the estuary of the Shannon. It was still freezing in the shade.

The bow was perfectly white, except near the cloudy horizon, where it became slightly opalescent, but no prismatic colours were discernible. I could see nothing peculiar in the state of the atmosphere, but the bow (which I watched for 15 or 20 minutes) gradually faded away as the sun rose clear above the cloudy horizon, and a rapid thaw set in during the next hour or so, the maximum shaded thermometer that day registering over 45°.

The white bow over the Shannon (which was singularly calm) was most beautiful, but part of the fascination was doubtless in the novelty of the sight. I wish Professor Tyndall would explain to a humble unscientific observer why the bow is white and not prismatic, and under what conditions the "minute aqueous particles" are formed, and how they may be discerned.

MONTEAGLE.

Mount Trenchard.

[We have reason to believe that Dr. Tyndall never saw this letter. It would require his ability to explain the details as to why a rainbow is coloured and a fogbow white, but the rough outline of the explanation is that the water particles producing a fogbow are not large enough to produce the coloured bow.—ED.]

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, JULY, 1887.

STATIONS. (Those in <i>italics</i> are South of the Equator.)	Absolute.				Average.				Absolute.		Total Rain.		Aver.
	Maximum.		Minimum		Max.	Min.	Dew Point.	Humidity.	Max. in Sun.	Min. on Grass.	Depth.	Days	
	Temp.	Date.	Temp.	Date.									
	°		°		°	°	°	0-100	°	°	inches		0-10
England, London	88·8	3	45·6	18	78·9	55·6	53·8	67	133·4	43·8	1·07	9	3·9
Malta.....	100·2	24	68·0	11	88·8	71·5	67·3	67	158·4	60·5	·00	0	0·7
Cape of Good Hope ...	70·0	27	37·0	...	61·4	46·2	...	87	...	...	2·90	16	7·3
Mauritius.....	75·2	18	57·0	30	73·2	62·7	59·0	75	127·6	47·3	1·96	22	4·9
Calcutta.....	92·4	17	76·4	10 <i>b</i>	87·1	78·2	77·5	82	155·9	73·1	18·19	27	8·7
Bombay.....	87·1	1	74·3	4	82·9	76·3	75·5	87	142·7	72·9	30·98	28	9·0
Ceylon, Colombo	85·9	30	73·8	15	84·6	75·8	69·3	73	145·7	68·8	1·18	6	6·4
Melbourne.....	59·9	25	34·9	11	55·0	43·8	43·7	80	113·0	27·3	2·68	17	7·4
Adelaide	61·5	18	36·5	12	57·3	46·2	44·6	76	119·7	30·6	2·57	26	6·3
Wellington .....	...	...	...	...	...	...	...	...	...	...	...	...	...
Auckland	63·0	7 <i>a</i>	35·5	4	57·6	46·3	45·5	79	123·0	26·0	5·92	24	7·0
Falkland Isles.....	...	...	20·2	2	...	33·4	36·2	95	89·0	24·0	1·65	20	7·1
Jamaica, Kingston.....	93·3	21	69·0	2	90·3	72·4	71·9	70	...	...	7·10	...	...
Barbados	83·0	var.	69·0	19	82·0	73·0	70·6	83	143·0	...	10·04	20	6·0
Toronto.....	97·2	16	57·2	24	83·4	62·9	62·4	70	...	51·0	·66	9	4·6
New Brunswick, Fredericton	91·7	2	47·0	16	73·3	58·9	61·2	77	...	...	2·91	16	6·2
Manitoba, Winnipeg ...	93·2	6	39·0	22	78·8	53·4	57·1	70	...	...	1·98	13	5·4
British Columbia, Victoria.....	77·0	19	38·0	10 <i>c</i>	68·6	46·7	...	...	...	..	·27	2	...

a And 11. b And 15. c And 16.

REMARKS, JULY, 1887.

MALTA.—Mean temp. 79°·2. Mean hourly velocity of wind 6·2 miles. Sea temp. rose from 78°·1 to 84°·3. Earthquake shocks on 17th. J. SCOLES.

Mauritius.—Mean temp. of air 1°·1, of dew point 0°·3, and rainfall ·51 in. below average. Mean pressure 30·214 in., ·018 above average. Mean hourly velocity of wind 11·1 miles, 0·6 mile below average; extremes 29·3 miles on 9th, and 1·9 miles on 6th, 22nd, and 29th; prevailing direction E.S.E. C. MELDRUM, F.R.S.

Melbourne.—Mean temp. of air 2°·1, of dew point 2°·4, mean amount of cloud 1·2, and rainfall ·99 in. above the average; mean pressure ·120 in. below average. Prevailing wind N.; strong on 10 days. L on 16th, 17th and 19th; H on 31st; fog on four days, heavy dew on three, and hoar frost on two days.

Adelaide.—Mean ressure 30·119 in., ·055 in. below the average of 30 years. Mean temp. same as average, but diurnal range 3°·3 less. Rainfall average. C. TODD.

AUCKLAND.—A wet, stormy, and disagreeable month. Rainfall 1·50 in., and mean temp. slightly above average, pressure considerably below average.

KINGSTON.—Rainfall 4·07 in. above average. T. F. CHEESEMAN.

BARBADOS.—Pressure not steady. Mean temp. (76°·7) the same as the average of 30 years. Mean hourly velocity of wind 1·3 miles below the average of 15 years. Rainfall considerably below average. Severe TS on 20th, a boy being killed and two houses burnt by L. R. BOWIE WALCOTT.

SUPPLEMENTARY TABLE OF RAINFALL, JANUARY, 1887.

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

Div.	STATION.	Total Rain.	Div.	STATION.	Total Rain.
		in.			in.
II.	Dorking, Abinger	1·19	XI.	Castle Malgwyn	2·23
„	Margate, Birchington...	·79	„	Rhayader, Nantgwillt..	2·75
„	Littlehampton	1·22	„	Carno, Tybrith	1·83
„	Hailsham	1·08	„	Corwen, Rhug	1·45
„	Ryde, Thornbrough	1·12	„	Port Madoc	3·26
„	Alton, Ashdell	1·29	„	I. of Man, Douglas	1·95
III.	Oxford, Magdalen Col...	·70	XII.	Stoneykirk, Ardwell Ho.	1·95
„	Banbury, Bloxham	·81	„	New Galloway, Glenlee	26·31
„	Northampton	·89	„	Melrose, Abbey Gate...	1·74
„	Cambridge, Beech Ho...	·54	XIII.	N. Esk Res. [Penicuik]	2·95
„	Wisbech, Bank House...	·83	XIV.	Ballantrae, Glendrishaig	3·35
IV.	Southend	·75	„	Glasgow, Queen's Park.	2·82
„	Harlow, Sheering	·82	XV.	Islay, Gruinart School..	3·39
„	Rendlesham Hall	1·52	XVI.	St. Andrews, Pilmour Cot	1·74
„	Diss	1·18	„	Balquhiddel, Stronvar..	8·29
„	Swaffham	1·11	„	Dunkeld, Inver Braan..	1·67
V.	Salisbury, Alderbury ...	1·15	„	Dalnaspidal H.R.S. ...	5·68
„	Warminster	·81	XVII.	Keith H.R.S.	1·98
„	Bishop's Cannings	1·10	„	Forres H.R.S.	1·70
„	Ashburton (Holne Vic.)	2·58	XVIII.	Strome Ferry H.R.S....	5·53
„	Hatherleigh, Winsford.	1·25	„	Fearn, Lower Pitkerrie.	1·41
„	Lynmouth, Glenthorne.	1·58	„	Loch Shiel, Glenaladale	12·23
„	Probus, Lamellyn	2·17	„	S. Uist, Ardkenneth ...	...
„	Launceston, S. Petherwin	1·82	„	Invergarry	6·25
„	Wincanton, Stowell Rec.	1·58	XIX.	Lairg H.R.S.	2·05
„	Taunton, Lydeard Ho ...	·99	„	Forsinard H.R.S.	1·72
„	Wells, Westbury	1·50	„	Watten H.R.S.	1·60
VI.	Bristol, Clifton	1·11	XX.	Dunmanway, Coolkelure	6·73
„	Ross	·69	„	Fermoy, Gas Works ...	4·00
„	Wem, Clive Vicarage ...	1·00	„	Tipperary, Henry Street	4·91
„	Cheadle, The Heath Ho.	1·29	„	Limerick, Kilcornan ...	2·13
„	Worcester, Diglis Lock	·84	„	Miltown Malbay	2·36
„	Coventry, Coundon	·78	XXI.	Gorey, Courtown House	3·49
VII.	Melton, Coston	·80	„	Navan, Balrath	1·21
„	Ketton Hall [Stamford]	1·00	„	Mullingar, Belvedere ...	1·95
„	Horncastle, Bucknall ...	·78	„	Athlone, Twyford	2·43
„	Mansfield, St. John's St.	·61	„	Longford, Currygrane...	2·41
VIII.	Knutsford, Heathside ...	1·58	XXII.	Galway, Queen's Coll...	2·47
„	Walton-on-the-Hill ...	1·44	„	Clifden, Kylemore	4·33
„	Lancaster, South Road.	1·66	„	Crossmolina, Enniscoe..	3·31
„	Broughton-in-Furness ..	2·82	„	Collooney, Markree Obs.	3·34
IX.	Shipley, Esholt Vic. ...	·74	XXIII.	Rockcorry	1·99
„	Ripon, Mickley	·97	„	Warrenpoint	1·77
„	Scarborough, West Bank	1·29	„	Seaforde	3·14
„	East Layton [Darlington]	·97	„	Belfast, New Barnsley .	2·77
„	Middleton, Mickleton ..	1·09	„	Cushendun	3·09
X.	Haltwhistle, Unthank..	1·70	„	Bushmills	2·23
„	Shap, Copy Hill	2·89	„	Stewartstown	1·63
XI.	Llanfrechfa Grange ...	1·57	„	Buncrana	2·66
„	Llandovery	2·28	„		

JANUARY, 1888.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.					Days on which ·01 or more fell.	TEMPERATURE.				No. of Nights below 32°.	
		Total Fall.	Differ- ence from average. 1870-9	Greatest Fall in 24 hours.		Max.		Min.					
				Dpth	Date.	Deg.		Date	Deg	Date.	In shade	On grass	
I.	London (Camden Square) ...	.90	— 1.45	.24	2	9	51.8	8	23.1	1	15	23
II.	Maidstone (Hunton Court)...	.67	— 1.90	.21	21	8	...	...	...	...	...	...
III.	Strathfield Turgiss .....	.87	— 1.68	.18	21	11	52.1	8, 10	17.5	30	20	26
III.	Hitchin .....	.60	— 1.62	.12	20	12	52.0	9	22.0	29	17	...
IV.	Winslow (Addington) .....	.85	— 1.70	.20	20	15	53.0	23	16.0	30	21	24
IV.	Bury St. Edmunds (Culford)	.86	— .98	.29	29	9	48.0	8, 22	12.0	29	19	...	
V.	Norwich (Cossey)	1.01	— .69	.25	31	10	...	...	...	...	...	...
V.	Weymouth (Langton Herring)	1.35	...	.43	20	16	49.0	22	24.0	30	12	...
"	Barnstaple	2.56	— 1.70	.56	20	11	53.0	10	30.0	1	...	...
"	Bodmin	2.96	— 3.55	.66	4	22	50.0	9	19.0	30	13	14	
VI.	Stroud (Upfield) .....	.69	— 2.30	.21	2	10	52.0	8	20.0	29	18	...
"	Church Stretton (Woolstaston)	.76	— 2.67	.17	20	13	58.0	9	24.0	1, 30	18	20	
"	Tenbury (Orleton) .....	.66	— 2.33	.14	20	11	55.5	8	15.3	30	20	23
VII.	Leicester .....	.81	...	.25	20	14	53.4	8	20.0	30	17	...
"	Boston .....	.74	— .98	.20	28	10	58.0	9	8.0	30	19	...
"	Hesley Hall [Tickhill] .....	.55	...	.12	2	14	57.0	8	20.0	30	18	...
VIII.	Manchester (Ardwick)	1.44	— 1.80	.28	30	11	47.0	24	25.0	20	16	...	
IX.	Wetherby (Ribston Hall) ...	.48	— 1.74	.18	3	6	...	...	...	...	...	...
"	Skipton (Arncliffe)	3.28	— 3.65	.93	3	16	55.0	10	21.0	19	16	...	
"	Hull (People's Park) .....	.81	— 1.10	.20	28	13	...	...	...	...	...	...
X.	North Shields	1.40	— .44	.40	31	14	57.0	8	21.5	30	14	...	
"	Borrowdale (Seathwaite)	8.32	— 10.43	1.80	25	16	...	...	...	...	...	...
XI.	Cardiff (Ely)	1.99	— 2.72	.56	1	17	...	...	...	...	...	...
"	Haverfordwest	2.85	— 3.42	.71	20	18	50.3	22	21.9	29	12	17	
"	Plinlimmon (Cwmsymlog) ...	2.73	...	.82	20	13	...	...	...	...	...	...
"	Llandudno	1.24	— 1.72	.30	5	16	57.2	9	25.8	19	9	...	
XII.	Cargen [Dumfries]	2.90	— 3.21	.68	3	14	52.0	8a	21.0	19	13	...	
"	Jedburgh (Sunnyside)	1.38	— .70	.60	31	11	53.0	8	18.0	19	15	...	
XIV.	Old Cumnock	3.60	— 1.04	.58	3	13	54.0	9	16.0	28	16	...	
XV.	Lochgilphhead (Kilmory)	5.71	— 2.16	1.21	24	16	...	...	...	...	...	...
"	Oban (Craigvarren)	5.78	...	1.07	4	18	55.0	23	25.0	28	11	...	
"	Mull (Quinish)	5.56	...	1.08	4	15	...	...	...	...	...	...
XVI.	Loch Leven Sluices	1.90	— 1.92	.50	26	9	...	...	...	...	...	...
"	Dundee (Eastern Necropolis)	2.20	— .25	.50	4	12	53.8	9	24.8	2	11	...	
XVII.	Braemar	3.18	+ .40	1.05	4	14	53.1	9	16.0	19	18	21	
"	Aberdeen	1.76	...	.24	3, 25	20	56.0	10	22.0	20	15	...
XVIII.	Lochbroom	3.22	...	.73	25	18	...	...	...	...	...	...
"	Culloden	1.27	— .50	...	...	...	54.0	9	19.0	19	11	21
XIX.	Dunrobin	1.83	...	.57	25	10	57.0	9	23.0	20	14	...
"	Kirkwall (Swanbister) .....	...	...	...	...	...	...	...	...	...	...	...
XX.	Cork (Blackrock)	5.15	— .87	1.81	3	16	54.0	8, 21	24.0	28b	5	...	
"	Dromore Castle	5.94	...	2.41	3	13	60.0	8	30.0	1	...	...
"	Waterford (Brook Lodge) ...	3.61	...	1.14	3	17	55.0	21	22.0	30	7	...	
"	O'Briensbridge (Ross)	1.92	...	.47	4	12	52.0	...	24.0	29	11	...
XXI.	Carlow (Browne's Hill)	2.93	— .69	.83	3, 4	11	...	...	...	...	...	...
"	Dublin (Fitz William Square)	1.25	— 1.01	.35	1, 3	9	58.8	9	25.9	29	3	17	
XXII.	Ballinasloe	2.69	— 1.67	1.03	4	13	50.0	8, 9	19.0	29	11	...	
XXIII.	Waringstown	1.87	— 1.54	.41	1	12	55.0	9	19.0	27c	11	16	
"	Londonderry (Creggan Res.) ..	2.41	...	.46	4	17	...	...	...	...	...	...
"	Omagh (Edenfel)	2.47	— 1.30	.82	4	12	51.0	7, 24	20.0	28	12	15	

a And 24, 25. b And 29. c And 28.

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

METEOROLOGICAL NOTES ON JANUARY, 1888.

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

ENGLAND.

STRATHFIELD TURGISS.—A fine, dry, healthy month, with considerable range of pressure and a complete absence of S until the 30th and 31st.

HITCHIN.—The driest January on record here, as fog accounted for some of the registered rainfall. The streams, springs, and wells were lower than ever before known.

ADDINGTON.—Rainfall much below the average. From the 7th to the 14th fog occurred every day, dense all day on 9th, 11th, and 12th, exceptionally so on the afternoon and night of the 12th. Very high wind prevailed all day on the 26th. S showers on 31st.

CULFORD.—Fine during the greater part of the month. Sharp frost and deep S on the 29th. More or less fog on 7 days.

LANGTON HERRING.—The most noticeable feature of the month was the long continued fog, lasting almost without intermission from the 8th to the 14th inclusive. Rainfall 1·79 in. below the average. The mean temp. at 9 a.m. and the mean min. temp. were each 1·5 below the average, and the mean max. temp. was 2° below the average. On the 9th a faint, white rainbow was observed.

BODMIN.—The mean pressure was singularly high and fogs were exceptionally frequent. Mean temp. 38°·2.

WOOLSTASTON.—The genial weather of the early part of the month was succeeded by a dense cold fog, lasting from 10th to 14th. The remainder of the month was cold, with a good deal of frost. Mean temp. 37°·1. S on 30th and 31st.

ORLETON.—The fluctuations of temperature and pressure during the month were very great, and the fall of R was very small. Mean temp about 1° below the average of 27 years. Frosty nights prevailed and there were several slight falls of S, covering the ground, but at no time to the depth of half an inch. Dense fog prevailed on the 9th till 9 a.m., followed by a cloudless sky till night, when a dense fog came on, which continued till the 14th, and was succeeded by a cloudy sky and dry frost for many days. Very high wind on 26th and again in squalls on 31st.

MANCHESTER.—An average winter month. S fell slightly on three or four occasions, and from the 9th to the 14th there was a continuous and dense damp fog, which rendered road or marine traffic difficult and dangerous.

HULL.—The weather of the month was chiefly remarkable for the large amount of cloud and the frequency of fogs and mists.

WALES.

HAVERFORDWEST.—A dense fog commenced on the 7th and lasted till the 13th. When driving at night it was impossible to see the horse's head. The fog again came on on the 20th, and lasted till the 24th. The highest reading of the barometer was on the 9th, when it reached 30·667 in. (corr.) It never froze hard enough to permit skating. Rainfall exceeded half an inch on one day only.

SCOTLAND.

CARGEN.—The meteorological conditions of the month were somewhat remarkable. For 11 days, from 9th to 19th, the pressure was unusually high, thick fog prevailed, and only two hours of sunshine were recorded. No R fell, but the atmosphere was nearly at saturation point during the whole of the period. Mean pressure 30·092 in., ·368 in. above the average. 38 hours of sunshine were recorded, only 11 of which occurred from 1st to 21st. A few nights of sharp frost were experienced, but the cold in no case lasted long.

JEDBURGH.—Generally mild and quiet. Spring flowers in bloom. Nest building was frequent, and a mavis was reported to be sitting on eggs on 25th. Pressure generally high. S three inches deep on 31st.

OBAN.—The month was decidedly mild, the only cold period being from 9th to 19th. S.W. to E. winds prevailed. Wall flowers and other spring plants were in bloom all the month. Gales on 4th, 21st, 25th, and 30th.

LOCHBROOM.—Up to the 25th the weather was more like summer than winter. From that date to the close variable weather occurred, with S and sleet every day on the lower grounds, and very severe and deep S with drifts on the elevated grounds, the high hills being one deep sheet of S without a break.

CULLODEN.—Very fine throughout, with many days very fine and warm, and with a greater amount of sunshine than usual. All labour was well forward at the close.

IRELAND.

BLACKROCK.—The first six days were wet, cold and stormy, then, with the exception of a few fine days, it was misty, raw and damp, with E mostly at night. Mean temp. ($42^{\circ}5$) $2^{\circ}4$ above the average. Gale on 31st.

O'BRIENSBRIDGE.—A fortnight of unusually fine weather, bright, calm and warm, prevailed from the 6th to 20th, and there was very little wintry weather at all.

DUBLIN.—During the greater part of the month the weather was open, although changeable. Warm, damp, squally weather prevailed during the first week, with heavy southerly gales. The mean temp. ($42^{\circ}1$) was perceptibly above the average ($41^{\circ}4$), and the mean pressure (30.192 in.) was $.311$ in. above the average. High winds were noted on 12 days, gales on 4. Fog on 10 days. H on 1st and 19th; S or sleet on 1st, 30th, and 31st. Mean humidity 87; mean amount of cloud 6.3 .

WARINGSTOWN.—The water supply was not replenished, springs being still very deficient.

EDENFEL.—A remarkably fine and mild month, with a calm and perfectly rainless period from 7th to 19th. E fell mostly at night. S on 1st only.

THE RAINFALL OF HULL.

SOME years since Mr. Harold Smith prepared a summary of the rainfall observations made by him at Hull, and allowed us to have the pleasure of presenting a copy to each of our readers.

Mr. Smith having removed to Surrey, his long and valuable record has terminated, and he has now prepared an abstract of the whole 30 years, and has favoured us with copies, which we are very glad to have the pleasure of issuing with this number.

It will be seen that 1887 was the driest of the whole 30 years, being only 69 per cent. of the average, and 1872 the wettest, being no less than 40 per cent. in excess. April is usually the driest month, but February has only 0.01 in. more, so that they may be considered as identical; October (as is so frequently the case in the British Isles), is the wettest month, followed, however, by August instead of by July, as is, we think, most usual, but there is evidently some tendency to heavy rains in August, for a quite original and very useful little table of the number of days in each month with 1 inch or more of rain shows the striking facts: (1) that while the average number of such days *per mensem* is $4\frac{1}{2}$, August had 12; and (2) their number in August is 50 per cent. greater than in any other month in the year.

RAINFALL:

RESULTS OF 30 YEARS' OBSERVATIONS ON THE BEVERLEY ROAD, HULL,

From October 1st, 1857, to September 30th, 1887.

YEARLY FALL.

Year.	Fall in Inches.	*Days.	Average	Inches.	Days.
1858	22.42	135	Wettest Year —1872	26.02	187
1859	21.12	170	Year with largest number of Days—1877	36.51	221
1860	31.74	205	Driest Year—1887	29.33	222
1861	19.97	163	Year with least number of Days—1858	18.05	174
1862	23.69	174			
1863	24.63	155			
1864	18.27	152			
1865	23.80	170			
1866	29.20	202			
1867	24.10	184			
1868	26.54	163			
1869	28.29	189			
1870	25.81	172			
1871	25.69	170			
1872	36.51	221			
1873	22.09	180			
1874	20.19	176			
1875	28.37	178			
1876	30.77	191			
1877	29.33	222			
1878	27.86	212			
1879	25.92	189			
1880	31.94	172			
1881	27.61	194			
1882	33.91	205			
1883	29.39	215			
1884	19.26	173			
1885	26.44	189			
1886	27.18	213			
1887					

YEARLY FALL IN EACH 5 YEARS.

Years.	Inches.	Days.
1858 to 1862	23.79	169
1863 to 1867	24.00	173
1868 to 1872	28.57	183
1873 to 1877	26.25	189
1878 to 1882	29.14	194
1883 to 1887 (computed)	24.06	192

QUARTERLY FALL.

First Quarter...	Wettest Quarters		Average.		Driest Quarters.	
	Year.	Inches.	Inches.	Days.	Year.	Inches.
Second "	1872	8.60	5.34	49	1858	1.50
Third "	1882	8.69	5.36	41	1887	3.02
Fourth "	1880	11.53	7.53	40	1864	3.59
	1882	14.08	7.78	53	1857	2.08

Having removed from Hull in November, I have been unable to complete 1887 with my own observations, but my friend, Mr. LAWSON, whose gauge is about half-a-mile from here, has kindly given me this Fall for November and December. Comparing the Year by that means the total Fall for 1887 amounts to 18.05 inches 174 days.

The past year has been remarkable for its fine summer. During June only .04 of rain was measured, the driest month, consequently, in the 30 years, in fact, since April, 1852, when only .02 fell. The year itself is the driest in the period; nevertheless, the extraordinary dry six months from October, 1857, to March, 1858, when only 3.58 fell, stand unparalleled. The statistics for periods of five years continue to show, in the number of days, a high average, but the average Fall during the last quinquennial period shows a large decrease. That decrease has been very much felt throughout the country, and the question of water supply should have the most serious attention of those in authority, as a series of dry years would be very disastrous to our large towns, which are so dependent on an adequate supply of water both for health and business purposes. A Table has been compiled showing the Rainfall over Central England for the last 100 years. From this Table it appears that 19 out of the 30 years of my observations are over the average and 11 below, thus showing that during that time we have had a high average. The five years ending 1858 were all below the average. Where would our water supply come from now, if we had five similar years?

The wettest half-year was the second half of 1880, when 20.27 fell.

MONTHLY FALL.

January ...	Wettest Months.		Average.		Driest Months.		Number of Days on which 1 inch or more fell in the 30 years.
	Year.	Inches.	Inches.	Days.	Year.	Inches.	
February ...	1863	3.48	1.84	16	1880	.17	2
March ...	1881	3.27	1.64	16	1885	.26	0
April ...	1876	3.65	1.85	17	1875	.81	2
May ...	1882	3.83	1.63	14	1875	.47	3
June ...	1869	4.69	1.78	14	1859	.47	2
July ...	1860	4.82	1.97	13	1887	.04	8
August ...	1881	5.34	2.67	13	1861	.45	12
September ...	1866	5.34	2.63	15	1865	.47	8
October ...	1880	5.87	2.86	18	1879	.81	7
November ...	1875	5.76	2.42	18	1862	1.04	2
December ...	1868	6.54	2.50	18	1873	.30	5

Heaviest Fall in one Day, 2.00 on August 21, 1858.

Average Rainfall for the 20 Years 1860 to 1879.

At Hull	26.16	At Hunstanton	21.41
Leeds	23.93	London	26.46
Sheffield	31.97	Exeter	33.22
Malton	27.95	Penzance	44.15
Manchester	34.66	Belfast	34.57
Bolton	46.38	Seathwaite,	
Lincoln	22.28	Cumberltd.	144.50

Fall of Rain at the Syke, Head of Borrowdale, in 1872, amounted to 243.98 inches.

HAROLD SMITH, F.R. Met. Soc.
Ingleside, Kenley, Surrey,
January, 1868.

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The wettest half-year was the second half of 1880, when 20.27 fell.

* Days—by "Days" is meant the number of days in which any Rain was measured, without any reference to quantity

A Fall of One Inch of Rain is equal to 100 Tons per Acre.