SYMONS'S

MONTHLY

METEOROLOGICAL MAGAZINE.

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SEA TEMPERATURE AND THE HERRING FISHERY.

IT is not at all easy to understand why so few observations are made upon the temperature of the sea round the coast of England. Attention has been repeatedly called to the subject in these pages*, but with, we believe, very little effect. English observers never seem to think of observing the temperature of the sea, and even the telegraph stations of the Meteorological Office, though mostly on the coast, do not report sea temperatures. We have an impression that it was stated at a meeting of the Meteorological Society that arrangements were in progress for a few sets of observations being made under some branch of Government, but we cannot find any record in the Society's publications, and do not know what, or whether anything, is being done. In either case there is plenty of room for private enterprise, and we trust that English observers will cease compelling investigators to rely solely on the records of their Scottish *confrères.*

We have been led to these remarks by the following note from one of the Scotch Fishery Commissioners, A. S. Finlay, Esq., of Castle Toward, which we desire to support in every way in our power :—

SEA TEMPERATURE.

To the Editor of the Meteorological Magazine.

DEAR SIR,—Allow me to suggest that it might help to increase our knowledge of the meteorological phenomena of this country if the temperature of the sea on the British coast, as well as in the Northern seas, could be registered. The Fishery Board of Scotland keep such registers of the sea temperature off the Scotch coasts, as it is found to influence the motions of the herrings, and I have no doubt the secretary, the Honble. W. F. Primrose, Fishery Board, Edinburgh, would let you have such information on the subject as he possesses.—Yours faithfully,

ALEX. S. FINLAY.

Castle Toward, Argyllshire, 6th July, 1877.

* See especially *Meteorological Magazine,* vol. V., p. 11, 12.

What number of stations, or what class of observations the Scotch Fishery Board may have, we do not know, nor whether or not any English Board is at work upon the subject. At present we believe that there is not one English meteorological station where sea temperature is observed. In December, 1875 (our Scotch friends are rather behindhand, for we cannot find any later records), sea temperature was regularly recorded at Sandwick and Barry, and also at Stykkisholm in Iceland, and Thorshavn in Faroe. In the previous month observations are also reported from Stornoway, but even this gives the Scottish Society only three sea temperature stations in Scotland.

HAILSTORM IN NORTH LONDON.

[Although part of the following communication appeared in *The Times* of July 4th, we hope that in its completed form it is worthy of insertion.—ED.]

A hailstorm occurred here at 8.4 p.m. to-day, July 3rd, which has had no equal since I commenced recording meteorological observations more than 20 years ago. Nay, more; it has not, I believe, been equalled in London since the great storm on August 1st, 1846, when skylights were broken in all directions, notably those of the picture gallery in Buckingham Palace.

Before stating what I have been able to ascertain respecting its limits (and fortunately those of hailstorms are generally narrow), I will state what occurred here; but, as the whole duration was only three minutes, the observations were necessarily hurried, and, but for Pastorelli's storm rain-gauge, matters would have been much worse.

Rain had fallen at intervals during the day, and up to 8 p.m. a little more than a tenth of an inch had been recorded. At 8.2 it began to rain, at 8.3 a little hail fell, and a confused rushing or rattling sound was plainly audible. In about 10 or 15 seconds the storm was full upon us, and by 8.7, or in three minutes and a half, or thereabouts, the mingled hail and rain amounted to more than half-an-inch deep. In point of quantity and time combined I do not know that such a fall has ever been measured in this country. It was at the rate of nearly eight inches an hour. The hailstones were not excessively large, but they were remarkably uniform in size, shape, and composition. They were almost wholly crystalline ice, with a little speck of opaque in most of them; they were very symmetrical, and about intermediate between true spheres and the shape of acidulated drops, their average diameters were 0·3 in. by 0·2 in., but they ranged from that of large peas to that of large cherries. I measured several which were more than $\frac{3}{4}$-inch across. The effect upon my garden has been very severe. I enclose a riddled leaf as a specimen, and I may also mention that it has broken two solar radiation thermometers, one of which has been exposed to all weathers since 1860.

It is not easy to define the precise boundaries of a hailstorm, except where the hail falls with such impetus as to break all the glass ex-

posed to it. This local storm fell with remarkable gentleness, considering the size of the stones, and hence it was only practicable to trace it by verbal description, and by comparing the effect upon a few definite and almost universal plants. From this it appears that the limits which I assigned to it the same night were substantially correct. The worst of it was about 200 yards S.E. of this station, and this is partly confirmed by the line of rain gauges which, going from S.W. to N.E., gave—

Royal Botanic Gardns. Regent's Park.	Camden Square.	Camden Road. No. 235.	Camden Road. No. 277.
·28 in.	·64 in.	·39 in.	·37 in.
Distance from Camden Sq. 1·35 mile.	0 mile.	0·45 mile.	0·70 mile.

Very little hail fell west of the Tottenham Court Road, and the heaviest line was parallel with the North London Railway from Camden Town Station to Barnsbury.

G. J. SYMONS.

Camden Square.

THE THUNDERSTORM OF JUNE 11TH, 1877.

We have not received so many notes as usual respecting the above storm, and this is rather remarkable, as it was, we believe, an exceptionally severe storm, and the rainfall in some places very unusual—for instance, the fall of 2·97 in. at the very dry station of Acol, near Margate, is altogether an unusual fact; and 2·40 in. and 1·71 in. at two Hastings stations are large amounts. Slightly more than an inch is reported from Benenden, Tenterden, and Hailsham, but the average over the S.E. counties seems to have been under half an inch.

OBSERVATIONS MADE DURING THE STORM AT HASTINGS, 11TH JUNE, 1877.

6.30 P.M.—Wind N.E.; clouds S.W.; heavy thunder, with vivid lightning over the sea; rain just commenced.

9.10.—*Memo.* A little before six, heavy clouds were noticed over the sea, and the rolling of thunder heard. By 6.30 the thunder was more distinct, and lightning began to be seen, and rain in heavy drops to fall, which continued till 8.30, but the amount was not great. From 7 till 8 the storm seemed almost stationary over us, perhaps a little to the northward; the lightning was most vivid, flashing apparently chiefly between clouds, but some flashes reached the earth, and many extended certainly a quarter of a circle, although at some distance off. The thunder was very heavy. At 9, there was lightning nearly all round, especially in the S.S.W. and W. The clouds came from S.—S.S.W., but the wind the whole time blew from the N.E.; eight and nine there was very little, but soon after eight it freshened. At nine, there were distinct streamers from S., but although in all probability the motion was from there, it could not be told.

9.25.—Barometer rising slightly, had been falling rather fast.

10.30.—Almost constant lightning to southward, with occasional thunder.

10.40.—Heavy squall from southward.

11.0.—Tremendous rain from northward, with incessant lightning and thunder. Thunder not very loud; most of the lightning appeared to be high up. Barometer had risen rapidly. Wind N.N.E.

11.35.—Heavy thunder, lightning, and rain, since last observation, and still continues. Barometer has fallen fast.

11.45.—Heavy rain just commenced from about S.W. Barometer rising very rapidly.

11.52.—Barometer still rising.

12.15.—From 12 to the present time the storm has been worse than before, the lightning being more brilliant and nearer. Raining, but little wind. Barometer falling.

12.30.—Raining, but little wind. Lightning still bad, but flashes not so frequent. Barometer falling. Wind back to about N.N.E.

12.45.—Wind E.S.E. Raining heavily, lightning vivid, thunder still heavy. Barometer rising.

12.55.—Lightning very much less frequent, but still bright, more distant. Barometer steady.

1.15.—Lightning now only at long intervals.

Rainfall at 9 a.m. next morning, 1·710.

ALEX. E. MURRAY.

GROVE, ST. LEONARDS-ON-SEA.

The rainfall at this place (about 100 feet above sea level) between 6.30 p.m. on June 11th, and 6.30 a.m. on June 12th, was 2·40 in.

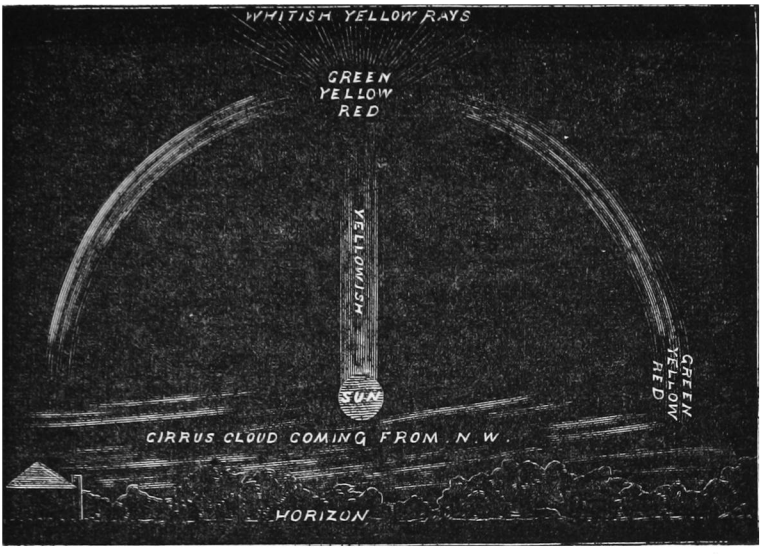
WM. B. YOUNG.

HALOS, PARHELIA, AND A PARASELENA.

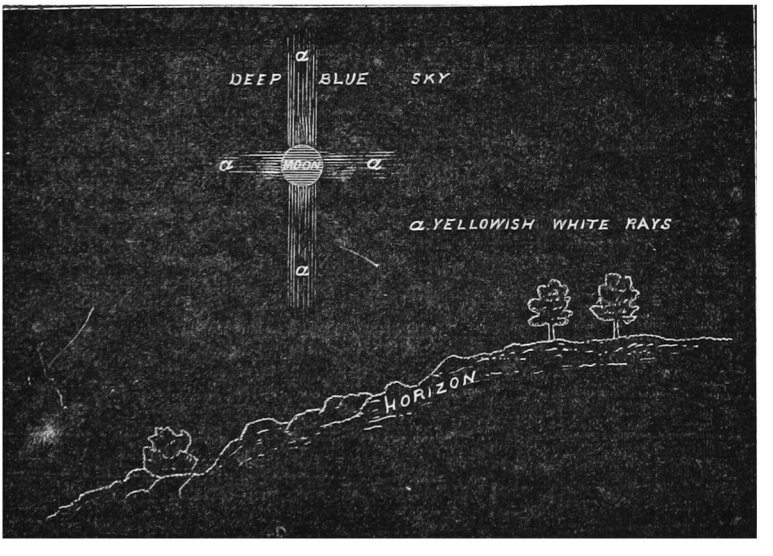
To the Editor of the Meteorological Magazine.

SIR,—Yesterday evening (June 24th) I observed both parhelia and paraselena here.

From 7.30 to 8.30 p.m. the sun was setting in the W.N.W., and a low bank of cirrus cloud extended from the W. to the N. horizon, in which the sun became enveloped after 8 p.m.; elsewhere the sky was clear, though rather greyish blue. During this time a faint yellowish ray extended upwards from the sun about 15°, and above this, at 22½° above the sun, a bright prismatic coloured patch appeared; a similar one was also visible 22½° on the right hand of the sun (towards the N.W.). This latter only lasted till 7.50 p.m., but the former one continued till 8.30 p.m. Both patches were reddish towards the sun, and greenish yellow outside. There were faint signs of a circle 45° diameter round the sun about 8 p.m. Annexed is a slight sketch of the appearance at 7.45 p.m., looking W.N.W.:—



The nearly full moon rose in the S.E. about 8.30 p.m., and from 9.10 to 9.45 p.m. formed the centre of a cross of yellowish white rays, extending about 5° on either side. After 9.30 p.m. the lower rays became longer (about 7°), changing what was at first a Greek cross into a Latin one. Annexed is a sketch of the appearance about 9.30 p.m., looking S.S.E.:—



The horizontal rays faded away about 9.45 p.m., but the vertical ones remained more or less visible till 11.30 p.m. Between 11.15 and 11.30 p.m. a bright whitish patch (paraselena) was visible 22½° above the moon, and a circle of whitish light, 45° diameter, surrounded the

moon at all but the lower part. The sky was then partially covered with cirrus cloud coming from and radiating to the N.W.

The evening was cold for the season, temp. at 9.14 p.m. (Greenwich time) being, dry 49°·5, wet 45°·3, and barometer at 32°, and sea level 30·230 in., with a very light air from S.W. Temp. fell in the night to 44°·6 in the air, and 37°·1 on grass.—Yours sincerely,

EDWIN E. GLYDE.

Kirkham, Babbacombe, Torquay, June 25, 1877.

REMARKABLE HAILSTONES.

To the Editor of the Meteorological Magazine.

SIR,—During a thunderstorm of some severity to-day, hailstones of a remarkable shape and size, fell here. They closely resembled a peg-top in shape, the upper part being formed of transparent ice, clear as crystal, while the lower part was composed of non-transparent ice like ordinary hailstones. We weighed a dozen of them, and found them in the aggregate to equal an ounce in weight.—Yours truly,

HENRY A. COSGRAVE, M.A.

Corrstown House, Kilsallaghan, Co. Dublin, July 3, 1877.

TEMPERATURE OF RAIN.

To the Editor of the Meteorological Magazine.

DEAR SIR,—I see a letter in your last issue about the temperature of rain, and asking for information on the subject.

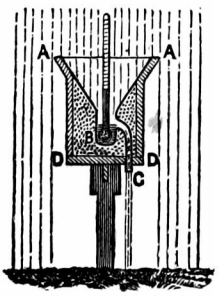
I send you the accompanying from the proceedings of the Edinburgh Royal Society.—Yours very truly,

T. STEVENSON.

Chambers, 84, George Street, Edinburgh, June 20th, 1877.

Proposed Method of ascertaining the Temperature of Falling Rain. By THOMAS STEVENSON, F.R.S.E., Civil Engineer.

A FRIEND informed me some time ago that the late Principal J. D. Forbes had often noticed that a long continuance of rain resulted in a track of cold weather. Principal Forbes attributed this fact to the rain having a lower temperature than the atmosphere through which it fell. It does not appear, however, that he made any observations to determine the truth of his hypothesis, and as the subject is of considerable importance in other meteorological questions, it occured to me that a simple instrument could be made for ascertaining the temperature of falling rain. This instrument, a rough model of the funnel of which was lately shown at a meeting of the Scottish Meteorological Society, is represented in the accompanying diagram, in which A B C is a conical funnel of thin glass, terminating in a small tube deep enough to contain the bulb of a thermometer, and recurved so as to form an off-let or waster. A D D A represents a box of wood into which the glass funnel is inserted, the space between the glass and the wood being carefully filled with sawdust or any other bad conductor of heat. The rim of the funnel should be bent over the upper edges of the box,* so as to



* It may be found better to carry the tube, at the second curve, horizontally through the side of the box instead of downwards.

prevent the possibility of rain lodging itself among the sawdust. The raindrops intercepted by the funnel will pass off through the bottom of the box by the tube C.

By this or some such simple arrangement the temperature of any heavy fall of rain may be ascertained with tolerable accuracy. It is, of course, necessary that a dry bulb thermometer, properly protected by a louvre boarded box, should be observed simultaneously with the *rain thermometer*.

The difference of temperature between the air and rain could also be ascertained by means of an instrument on the principle of Leslie's differential thermometer, one bulb of which would be placed at the bottom of the glass funnel, while the other would be protected from the rain. In this way the differences of temperature would be constantly shown by means of a single instrument.

[A report upon this subject by the Rev. J. Chadwick Bates, some of his observations *in extenso*, and a description of his apparatus, will be found in *British Rainfall*, 1865, pages 10 to 12. The article is too long to reprint here.—ED.]

GREENWICH EXTREME TEMPERATURES.

The extreme Shade Temperatures of the month of June at the Royal Observatory, Greenwich, during the past 36 years.

Year.	Maximum.		Minimum.		Year.	Maximum.		Minimum.	
	deg.	date.	deg.	date.		deg.	date.	deg.	date.
1841	78·5	18	40·3	15	1859	81·3	26	43·5	25
1842	87·4	12	44·7	2	1860	74·0	24	43·5	6
1843	77·3	27	42·9	4	1861	81·8	19	42·9	10
1844	87·6	24	43·4	2	1862	73·5	2	43·4	10
1845	86·0	13	43·8	28	1863	84·0	3	42·1	1
1846	91·1	20	49·4	1	1864	78·4	7	42·3	2
1847	80·4	2	41·4	8	1865	87·6	23	41·2	12
1848	79·0	15	39·7	3	1866	86·5	27	42·2	17
1849	80·7	5	38·6	14	1867	82·1	12	40·5	29
1850	85·1	23	36·2	16	1868	88·0	20, 27	44·7	1
1851	87·0	27	38·5	1	1869	87·5	7	35·6	1
1852	72·7	25	41·0	1	1870	90·2	22	41·4	6
1853	81·0	11	39·9	4	1871	77·2	15	38·7	5
1854	80·0	25	41·4	1	1872	86·0	17	40·6	7
1855	83·5	6	39·3	3	1873	81·2	27	42·0	7
1856	83·1	27	41·1	6	1874	83·7	2	37·5	13
1857	92·7	28	38·8	14	1875	83·3	4	41·0	1
1858	94·5	16	45·3	28	1876	83·9	21	40·1	11

Extremes in 1877, Max. : 85°5· on 29th ; Min. : 44°·2 on 7th and 25th.

	Year.	Max.	Date.	Min.	Date.	Year.
Means of 36 years	...	83·3	17	41·4	9	...
Highest	1858	94·5	16	49·4	1	1846
Lowest.....	1852	72·7	25	35·6	1	1869
Range	...	21·8	...	13·8	...	...

EDWD. MAWLEY.

A WHIRLWIND.

To the Editor of the Meteorological Magazine.

SIR,—I must send you a short account of a whirlwind which I witnessed yesterday afternoon (July 5th).

At 1.50 p.m. I observed some men, who were haymaking in a meadow a short distance below the house, looking up in the air. On my looking up also, I saw some hay whirling round and round in the air. Some of the hay kept falling, turning round and round as it fell, but a considerable portion flew off at a great height, high above the trees, to the N.E., and I lost sight of it. The hay was evidently whirled up from the field in which the men were at work. The wind was S.W., and light at the time, the clouds being rather stormy.

Nothing remarkable happened afterwards; but about 3 p.m. a storm appeared in the south, and distant thunder was heard several times. Rain began at 3.30, and it looked threatening, the wind also being very gusty, but we only had here a steady rain till 5.30 p.m. (0·12). At 10 p.m. there was bright lightning and slight thunder in the N.W.—Yours faithfully,

EDWARD C. MORRELL,

Broughton Lodge, Banbury, July 6, 1877.

MODERN METEOROLOGY.

"A mere glance at the proceedings of a meteorological observatory of the present will suffice to convince one who is familiar with the old methods that this branch of science has been greatly extended of late in its range of observation. To make daily note of the temperature of the air and the ground, the atmospheric pressure and moisture, the state of the sky, the direction and force of the winds, and the quantity of rain or snow that may fall; this might fairly represent the work of former meteorologists, but it is far from being equal to the requirements arising out of the fuller knowledge now possessed of the significance of natural phenomena. He who would acquire scientific notions regarding what is termed the weather cannot now afford to neglect a domain that was formerly reserved for the physicist proper, including the phenomena of terrestrial magnetism, atmospheric electricity, ozone, the action of solar rays, &c. Who among the earlier meteorologists would have thought of foretelling changes in weather from the delicate motions of a magnetic needle, or the changes of colour in a piece of paper? But, according to M. Marié Davy, certain changes in the declination of the needle will indicate nearly always, and several days in advance, the passage of a squall in the north-west Atlantic, or the coming of rainy winds. And the chemically-prepared papers which colour under the influence of atmospheric ozone have been found to announce the approach of a storm almost as surely as the barometer. They colour, more or less, every time the centre of the whirling motion passes to the north of the place of observation, whereas they remain nearly unaltered if the centre passes to the south. The recent publications of the French Observatory of Montsouris (which is under the enterprising directorate of the *savant* just named) are highly instructive as indicating some of the new directions in which meteorologists are working; and we will here invite attention more especially to two of these. The labours of Montsouris have elucidated the important bearings of meteorology at once on agriculture and on hygiene.

"The proper object of agricultural meteorology is obviously to determine the influence of the various conditions of climate on vegetation. Everybody knows that heat, light, and water are indispensable to a plant; but it is desirable to ascertain and define what part is played by each of these elements individually in the development of each plant, in each of its phases of vegetation, and in the

formation of the various organic principles—starch, sugar, gluten, &c.—which it furnishes. On this problem the observers at Montsouris are busily at work, noting the phases of vegetation, making 'chemical analyses' of plants, taken periodically, so as to compare the progress of vegetation with the climatic conditions thoughout the year, and analysing the air and the rain with regard to the products they furnish to vegetation. This last point has excited no little interest lately. Nitrogen, of course, forms a large proportion of our atmosphere; but in this free state it does not appear capable of being assimilated by plants. It has to be offered them in a state of combination, as in manures. Now, the air often contains small quantities of natural manures of this character, viz., nitrogen compounds, which are supplied by the air to the ground; such are ammonia, nitrous acid, and nitric acid. Whence they come seems still to be doubtful. There is some reason to believe that the ammonia of the air comes from the sea, and the traces of nitric and nitrous acid are said by M. Thenard to arise from electric discharges which traverse the air either in a silent and continuous manner, or in the form of sparks. Then M. Berthelot has shown that under the influence of atmospheric electricity the nitrogen of the air may be fixed directly in organic compounds of the ground, and that this fixation is favoured by the development of certain microscopic plants. There is evidently here a wide field for scientific research, from which the art of agriculture may be expected to reap great benefit. The rain, too, is an instructive teacher. At Montsouris it is carefully analysed from time to time, and (as an example of the results) it has been calculated that during the year September, 1875, to September, 1876, a total quantity of 1·363 grammes of ammonia was poured in rain on each square metre of the park of Montsouris, or more than 13 kilogrammes per hectare. The quantity of other gaseous constituents carried down by the rain, and the irregular impurities it washes out of the atmosphere, are also recorded. The mention of impurities in the air naturally suggests the valuable services which meteorological research appears destined to render to the public health. If air be drawn for some days through a tube containing carded cotton, the cotton will be found to have turned grey, through the powdery matters it has intercepted. Now these powders are well worthy of being studied. Their nature is very varied; they contain such mineral matters as carbonate of lime, carbon, iron, also the *débris* of fires, spores of cryptogamic plants, pollen, grains of starch, &c., and excessively minute grains which are probably the germs of living creatures. For more than a year these powders of the air have been subjected, at Montsouris, to daily microscopic analogy [analysis ?], and, in relation to the germ-theory of disease, which now engages so much thought, the results can hardly fail to prove of great value. It will be seen whether there is really a strict correlation between endemic or epidemic disease, and the frequency, local or general, of germs borne in the atmosphere. Perhaps it will be possible by and by to say what kind of germs produce particular kinds of disease, and to take protective measures accordingly. Indeed, not a little has been accomplished in this direction already, through the researches of Beale, Sanderson, Klein, and others.

"One of the means employed at Montsouris for collecting the organisms of the air consists in directing a slow current of air, produced by a small bellows, upon a drop of glycerine. In this way are especially caught the spores, pollens, particles of meteoric iron, starch grains, and *débris* of all kinds carried about by the wind. But the fine germs, which are of more importance, are apt to escape notice among the larger corpuscles; and, besides, in glycerine they lose the mobility which they show in water. So they are better observed in drops of water resulting from the condensation of atmospheric vapour, in night dew, in the first drops of rain, or in the dew which forms on the outside of a vessel with a freezing mixture in it; or, again, after washing the air with water from a spray-producing apparatus. Moving organisms, as has been stated, are often met with in such water, and their rotatory or irregular movements leave no doubt as to the real nature of these minute corpuscles; they are vibrions and bacteria. Sometimes, chiefly in February and March, minute colourless corpuscles, with a circular motion, are observed, which are thought to be mostly zoospores. Germs of infusoria are also frequently present. The spores of cryptogami become more abundant towards May.

"Last year, the municipal authorities of Paris having decided that meteorological researches with reference to public health should be carried on in various quarters of the city, charged Montsouris to make arrangements for this purpose, and promised an annual grant of 12,000fr. The new system, inaugurated this year, comprises at present 21 stations distributed over Paris. The principal object of the inquiries will obviously be the investigation of the relations between the general state of the public health, and the impurities found in the atmosphere and in drinking water. The epidemic of typhoid fever which prevailed in Paris last autumn furnished the occasion for some preliminary researches of this kind, which M. Marié Davy has described to the Paris Academy. The experiments were chiefly made at the Prince Eugène barracks, which the War authorities had caused to be evacuated for disinfection. The water of an artificial dew got in the infirmary, which was inhabited several days before, was found very pure; but on scratching the floor of this infirmary, and of the rooms at different heights, a dark powder was detached, which on being brought into water showed a multitude of threadlike vibrions, having a slow, undulatory movement and vibrating points which were rapidly displaced. The window-sills of certain halls particularly gave an abundance of microscopic algæ, vibrions, bacteria, and monads. It is clear that when the troops were in the building these powders, raised by the tramping of feet and other causes, must have got mixed with the air that was breathed, and with the food and the drink. Similar vibrions in considerable quantity have been found in some of the houses in course of demolition for the Boulevard de l'Opera. The ground of certain quarters in Paris contains them also, but in less quantity; but no trace of them has been met with in the subsoil, and the rooms of the Montsouris Observatory are also exempt. M. Marié Davy attributes the epidemic in question to such living powders accumulated during summer on the ground and walls, and producing their morbid effects when the change of season rendered the conditions favourable."—*The Globe.*

REVIEW.

Annual Report of the Chief Signal Officer to the Secretary of War for the year 1875. 8vo, 475 pages, 76 plates. Washington: Government Printing Office, 1875.

General Myer's reports are extremely interesting. They contain an immense mass of facts, excellent charts, and many valuable remarks. We need not on the present occasion give any details of the general arrangements, and we shall, therefore, select three or four special subjects.

The most valuable feature in this volume (which, by the bye, sadly needs an index) is Sergeant Calver's report on the Tornadoes of March 20th, 1875. It occupies about 40 pages of small type, is copiously illustrated, and is in every respect creditable to its author and to the service. Although rigidly confined to facts, it contains statements exciting enough for any novel, and numerous enough for a small library. We quote the record of what became of one farm house:—

"S. D. Massey was the next person who suffered from this terrible visitor. His house stood directly in its path, and he thus had a good front view of the approaching black cloud. Its apparent width was 200 yards, or half as wide as the track of destruction. Knowing the dangerous character of the storm, Mr. Massey made a frantic effort to get his family out of the house, but before he could do so it was upon them with a deafening roar and midnight darkness. The house was strongly built of heavy hewn timbers, dovetailed together at the corners, ceiled within and weather-boarded without. For a few seconds it resisted the

fury of the storm. Mr. Massey stated that the south-east side of the house was first crushed in. Then the whole structure was moved 10 feet eastward and torn to fragments. The house was 31 by 40 feet, with an exposed surface of about 600 square feet on each side, including the roof, and 475 on each end. Nothing could be more complete than the picture of destruction at this place."

"The gin-house, standing 100 yards south-west of the dwelling, was literally blown away, the timbers having been scattered for hundreds of yards eastward. The cotton-gin was torn into fragments, and the saws scattered in all directions, two of them having been hurled with such force against the trees, 200 yards eastward, as to remain sticking into the wood. Mr. Massey's wife, child, and a young lady cousin were instantly killed. The child, a boy of five or six years, was found about 30 yards east of the house, half covered with dirt, which had been blown up from the wheat-field. The young lady was thrown some 18 yards eastward among the branches of a fallen tree. Massey was buried beneath the timbers of the house, and was badly injured. His shoes, which he assured me were tight-fitting, were torn from his feet, as were also his stockings. The lower portions of his pantaloons were likewise carried away by the fury of the blast. Nearly the entire contents of the house suddenly took flight on the wings of the storm. The cotton mattresses from the beds were strewn upon the bushes and broken trees in the woods hundreds of yards eastward. The ground presented the appearance of having been swept by a rushing torrent of water. Even the bark was torn from the broken trees that remained. This looked more like the effect of the drift of the *débris* than the direct effect of the wind. I noticed sand and gravel-stones in the trunks and limbs of the trees in this vicinity as in other places. Dead chickens and quails, nearly stripped of their feathers, were found after the storm; also rats, cats, and rabbits, with nearly every bone broken. So terrific, indeed, was the force of the wind here, that nothing could live long when exposed to its fury."

We next pass to Sergeant Calver's summary of

THE VELOCITY OF THE WINDS.

"I found it almost impossible to get any reliable data upon which to base calculations that would give accurate results, showing the full force of the winds. In the track, where the storm raged in its full fury, everything was completely swept away, and it was only in the edges of the storm-path that I could find such objects as buildings, &c., moved without being torn to pieces. I collate below a few examples of the force of the wind given in the foregoing pages:—

"1. A house exposing 700 square feet of surface, and weighing probably 50,000 pounds, was moved six feet.

"2. A bale of cotton exposing 18 square feet, and weighing 550 pounds, was carried 50 yards.

"3. Cotton-press exposing 70 square feet to the winds, and weighing 12,000 pounds, was torn from its foundation and thrown 15 feet.

"4. Oak log weighing 700 pounds, and exposing 26 square feet, was moved 40 yards.

"5. Cotton-press thrown 13 feet. Weight 10,000 pounds, surface 60 square feet.

"6. West wing of Taylor's house, surface 160 square feet, weight 10,000 pounds. Twisted round.

"7. Academy, weighing 35,000 pounds; greatest exposure in any one direction, (including roof,) 600 square feet. (Hypotenuse of square of 25 feet = 35·3 feet × 12 + roof = 600 square feet.) Building moved.

"8. Gravel-stones driven into trees.

"9. Pine log weighing 1,200 pounds, exposing a surface of 37 square feet, carried quarter of a mile.

"10. Rock weighing 18,000 pounds, moved 7 feet. Greatest exposed surface 35 square feet.

"11. Massey's house moved 10 feet. Weight estimated at 60,000 pounds, and greatest exposed surface at 750 square feet.

"12. Timber carried 100 yards. Weight 560 pounds, and surface 20 square feet.

"13. Five freight-cars were overthrown at Camak.
"14. Pine board was driven through a telegraph-pole.
"15. Cow carried twenty yards.
"16. Gin-house executes a somersault under the influence of the wind.
"17. Pine board driven 3 inches into the trunk of a pine tree, cutting the grain of the wood.
"18. Church thrown over endways.
"19. Horse blown half-a mile.
"20. Bale of cotton weighing 500 pounds, and exposing 16 square feet, carried a quarter of a mile.
"21. Horses carried away. Part of a wagon carried a mile.
"22. A pine shingle was driven 2 inches into an oak sapling.

"Many other similar examples are given which it is unnecessary to recapitulate. In many of these cases it will readily be seen that an upward as well as a horizontal current operated on the objects. In the following examples, if we estimate the static friction at one-third the weight of the buildings, we get the following results as to horizontal velocities:—

"1. Pressure per square foot, 95·2 pounds. Velocity, 139·9 miles per hour.
"6. Pressure, 83·3 pounds. Velocity, 129 miles.
"7. Pressure, 77·7 pounds. Velocity, 124·6 miles.
"11. Pressure, 114·2 pounds. Velocity, 151·1 miles.
"19. Pressure, 685 pounds. Velocity, 370 miles.

"This last instance was near the centre of the storm. The others were near its edges. In the following cases only a force sufficient to balance the attraction of gravitation is considered. Of course a much greater power was necessary at first to lift the bodies from the ground. The figures, therefore, represent a force less than the minimum:—

"2. Pressure, 30·5 pounds. Velocity, 78·1 miles.
"4. Pressure, 26·9 pounds. Velocity, 73·3 miles.
"9. Pressure, 32·4 pounds. Velocity, 80·4 miles.
"12. Pressure, 28 pounds. Velocity, 78·4 miles.
"20. Pressure, 31·2 pounds. Velocity, 79 miles.

"But what can be said in regard to examples 8, 14, 17, and 22? Here an incalculable force was exerted. A velocity of wind sufficient to produce such results could not have been less than that of a cannon-ball, or somewhere between six and eight hundred miles per hour."

DISTANCES TO WHICH OBJECTS WERE CARRIED.

"Many instances are given in the foregoing pages where objects were indisputably carried for immense distances, a few of which, with some others, I will give here:—

"1. A bonnet was brought from a distance of thirty miles.
"2. Shingles and pine-tops fell after passage of tornado twelve miles south.
"3. Basket carried fourteen miles.
"4. Door of dining-room carried eight miles north-eastward.
"5. Negro child blown away, and never found.
"6. Door of church carried seven miles."

A short, but good, paper on the best plans for recording earthquake shocks is contributed by Cleveland Abbe, and we may also mention with praise that great attention is being paid both to the temperature and *régime* of the principal United States rivers, but hitherto we have not noticed any investigations as to the ratio of their rises to the rainfall producing them.

We have five maps on the polar projection constructed from the synchronous observations, and from them we find that the strictures which we felt compelled to publish in *Met. Mag.*, vol. XII., p. 37, far from being too severe, are the reverse. The British Isles occupy

rather less than three-fourths of a square inch, and there are 70 stations; even if these were equally distributed, they would only be a tenth of an inch apart. Roughly, therefore, the scale is 700 miles to an inch, and equi-distant stations should be 70 miles apart, yet we find in the list, taking London as a centre, six stations within a 35 miles radius, and three of them within a five mile radius. We feel bound to protest against the following paragraph in Gen. Myer's report:—"The charts herewith exhibit the locations of the stations from which the series are received."

We should be delighted to see such a chart, not for its utility, but as an object for the microscope. Joking apart, this British list ought to be reduced to one fourth, several bad stations should be expunged, and then not a word could be said against it.

The report as a whole is at least equal to its precursors, and our high appreciation of them has already been expressed.

SUPPLEMENTARY TABLE OF RAINFALL IN JUNE, 1877.

[For the Counties, Latitudes, and Longitudes of most of these Stations, see Met. Mag., Vol. XI., p. 28., but the list is under revision and further details will be given in a month or two.]

Div.	Station.	Total Rain.	Div.	Station.	Total Rain.
		in.			in.
II.	*Acol	4·33	XI.	Llanfrechfa	2·54
,,	Hailsham	1·25	,,	Castle Malgwyn	3·16
,,	St. Lawrence, I. of W.	0·76	,,	Heyope	...
,,	Andover	0·60	,,	Carno	1·78
,,	Strathfield Turgiss	1·41	,,	Rhug, Corwen	1·02
III.	Addington Manor	1·03	,,	Port Madoc	3·11
,,	Oxford	0·89	XII.	Melrose	2·59
,,	Northampton	0·74	XIV.	Cessnock, Glasgow	2·82
,,	Cambridge	1·32	XV.	Gruinart	2·28
IV.	Sheering	1·10	XVII.	Keith	3·97
,,	Ipswich	0·69	XVIII.	Dalwhinnie	...
,,	Diss	1·68	,,	Auchnasheen	7·15
,,	Swaffham	1·86	,,	Springfield, Tain	3·07
V.	Compton Bassett	0·80	XX.	Skibbereen	...
,,	Dartmoor	4·92	,,	Glenville, Fermoy	4·77
,,	Teignmouth	1·38	,,	Tralee	2·67
,,	Langtree, Torrington	1·57	,,	Newcastle W., Limerick	1·71
,,	Trevarrick	2·16	,,	Kilrush	1·77
,,	Taunton	0·70	XXI.	Kilkenny	2·39
VI.	Bristol	1·30	,,	Kilsallaghan	1·71
,,	Sansaw	1·55	,,	Twyford, Athlone	3·13
,,	Cheadle	1·96	XXII.	Ballinasloe	3·75
VII.	Coston, Melton Mowbray	1·74	,,	Kylemore	7·12
,,	Bucknall	1·03	,,	Carrick on Shannon	2·92
VIII.	Walton, Liverpool	1·51	XXIII.	Rockcorry	3·32
,,	Broughton-in-Furness	3·72	,,	Warrenpoint	3·20
IX.	Stanley, Wakefield	1·27	,,	Carnlough, Larne	3·47
X.	Gainford	1·30	,,	Bushmills	3·84
,,	Shap	4·42	,,	Buncrana	2·89

* Excessive rain on 11th, 2·97 in. falling in 24 hours.

JUNE, 1877.

Div.		STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1860–5	Greatest Fall in 24 hours. Dpth	Date.	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date.	Min. Deg.	Date.	No. of Nights below 32° In shade	On grass
			inches	inches.	in.								
I.	ENGLAND.	Camden Town	·42	— 2·63	·21	11	6	84·7	19	44·7	7	0	0
II.		Maidstone (Hunton Court)	·77	— 1·95	·67	11	3	...	...	...	...	...	...
,,		Selborne (The Wakes)	·73	— 2·50	·30	6	6	80·0	18	41·7	15	0	0
III.		Hitchen	·98	— 1·66	·51	30	8	75·0	29	40·0	23	0	...
,,		Banbury	·89	— 2·39	·21	26	8	81·0	18	41·0	7, 24	0	...
IV.		Bury St. Edmunds (Culford)	1·53	— 1·05	1·01	30	10	82·0	29	37·0	23	0	0
,,		Norwich (Sprowston)	1·57	...	·50	30	11	...	...	...	...	...	...
V.		Bridport	·81	— 2·43	·22	11	7	...	...	...	...	...	...
,,		Barnstaple	1·42	— 2·70	·57	11	9	86·0	19	49·0	8	0	...
,,		Bodmin	2·11	— 1·93	·69	19	12	74·0	19	46·0	7	0	0
VI.		Cirencester	1·05	— 2·33	·34	22	8	...	...	...	...	...	...
,,		Shifnal (Haughton Hall)	1·06	— 2·05	·21	1	12	76·0	18‡	42·0	7,8‖	0	...
,,		Tenbury (Orleton)	1·27	— 2·25	·55	1	10	81·5	18	36·5	24	0	0
VII.		Leicester (Belmont Villas)	·83	...	·24	22	9	81·8	18	41·5	24	0	0
,,		Boston	1·17	— 1·02	·36	22	9	82·0	4	43·0	25	0	...
,,		Grimsby (Killingholme)	1·50	...	·39	22	12	74·0	3	44·0	8	0	...
,,		Mansfield	1·57	...	·57	1	9	82·4	4, 5	40·0	25	0	0
VIII.		Manchester	2·35	— ·99	·81	1	12	88·0	20	42·5	10	0	0
IX.		York	...	...	...	...	...	...	...	...	...	...	...
,,		Skipton (Arncliffe)	3·47	— ·63	·75	1	17	81·0	18	30·0	16	...	...
X.		North Shields	1·09	— 1·65	·37	22	10	73·0	3	42·0	24	0	0
,,		Borrowdale (Seathwaite)	10·51	·00	1·79	24	17	...	...	...	...	...	...
XI.	WALES.	Cardiff (Crockherbtown)	1·48	...	·41	1	12	82·5	18	44·0	25	0	...
,,		Haverfordwest	2·21	— 1·44	·57	1	14	80·0	18	43·0	28	0	...
,,		Aberdovey	3·69	...	1·05	1	11	86·0	17	46·0	24	0	0
,,		Llandudno	1·59	— ·70	·33	18	11	80·9	21	47·0	24	0	..
XII.	SCOTLAND.	Dumfries (Crichton Asylum)	2·66	— ·17	·42	6	17	80·0	18	37·6	24	0	...
,,		Hawick (Silverbut Hall)	2·17	...	·76	22	14	...	...	...	...	...	...
XIV.		Kilmarnock (Annanhill)	3·76	...	·65	6	20	78·2	19	42·7	12	0	...
XV.		Castle Toward	5·63	+ 2·14	1·21	20	16	78·0	17	36·0	4	0	...
XVI.		Mull (Quinish)	7·33	...	1·23	20	20	...	...	...	...	...	..
,,		St. Andrews (Cambo Ho.)	3·10	...	...	...	...	...	...	...	...	...	...
,,		Grandtully	4·26	...	1·03	26	17	...	...	...	...	...	...
XVII.		Braemar	5·76	+ 2·32	1·11	21	20	76·8	17	35·3	12†	0	4
,,		Aberdeen	3·68	...	·78	28	18	69·2	11*	41·7	13	0	0
XVIII		Gairloch	6·50	...	·94	23	21	...	...	...	...	...	...
,,		Portree	8·47	+ 3·69	·95	28	23	...	...	...	...	...	...
,,		Inverness (Culloden)	3·18	+ 1·26	·84	23	13	73·1	17	42·0	13	0	...
XIX.		Helmsdale	3·05	...	·87	22	16	...	...	...	...	...	...
,,		Sandwick	3·38	+ 1·84	·97	21	16	66·9	17	42·8	22	0	0
XX.	IRELAND.	Caherciveen Darrynane Abbey	2·39	...	·57	4	14	...	...	...	...	...	...
,,		Cork	3·88	...	1·30	5	11	...	...	...	...	...	...
,,		Waterford	3·25	+ ·26	·63	5	15	82·0	15	37·0	4	0	...
,,		Killaloe	4·34	+ ·71	1·03	21	16	86·0	20	35·0	4	0	...
XXI.		Portarlington	2·97	— ·28	·86	22	19	78·0	18	41·5	3	0	...
,,		Monkstown, Dublin	·96	— 1·65	·32	6	9	82·0	20	41·2	12§	0	...
XXII.		Galway	2·11	...	·59	7	18	83·0	18	38·0	6	0	...
,,		Ballyshannon	3·32	...	·60	21	19	...	..	...	...	...	...
XXIII		Waringstown	2·58	...	·53	5	19	81·0	20	39·0	23	0	...
,,		Edenfel (Omagh)	3·46	...	1·10	20	13	77·0	18	39·0	3	0	...

* And 17. † 16. ‡ 29. ‖ 24. § 13.

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

METEOROLOGICAL NOTES ON JUNE.

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

ENGLAND.

SELBORNE.—An exceptionally dry month; prevailing wind during the first half of the month S.W., then variable, but closing with S.W. TS at 2 a.m. on the 1st, with high S.W. wind; TS at 8 p.m. on 11th; max. temp. 76°, min. temp. 60°. Occasional rumbling T on 21st.

BANBURY.—High wind on 1st, and with L on 4th.

CULFORD.—High wind on 1st, 2nd, and 21st; T on 11th (distant) and 20th; dry weather until the last day, when the rainfall exceeded an inch. Mean temp. of the month above the average, being 60°·9.

SPROWSTON.—A fine month; very warm from the 14th to the 20th; TS in the afternoon of 1st.

BODMIN.—A remarkably genial month; mean temp. of the month 63°·3; rainfall considerably below the average of 28 years.

SHIFNAL.—On the whole a delightful month, just enough R to encourage vegetation and wonderfully improve all crops, whether of grass or grain; no nearer approach to frost at night than 42° on 7th, 8th, and 24th. After westerly winds during first 12 days they changed to E., with bright sun, from 14th to 22nd, on which was the hottest night, 59°; from that day to the close westerly winds again, rather high temp. and growing weather. Quite a sirocco wind on 22nd; no T. White butterfly first seen on 2nd, sulphur ditto on 7th, orange-tipped ditto on 14th; hollies white with blossom; dog-rose and fox-glove in flower on the 19th.

ORLETON.—The first half of the month was generally cold with a few bright warm days; on the 15th the weather set in fine, hot and very dry, and so continued to the 22nd; the remainder of the month was variable but dry, with a few warm days at its close. Distant L was seen on the night of the 4th, but no T was heard; the rainfall was not half the average quantity; the mean. temp. of the month was rather more than 1° above the average.

LEICESTER.—A very fine month, temp. at times very high; hay-making very general at the end of the month; crops heavy.

GRIMSBY.—A fine month, but more R wanted on the heavy lands. Garden crops, carrots, onions and beet have suffered much from the cold spring, and from slugs. The meadows and pastures look flourishing, but the corn crops (unless in the case of beans) will not be heavy; fruit scarce. Stormy night on the 1st; L at night on 4th, and TS at 4.30 p.m. on 22nd. Wild rose in flower on 16th. Sudden fall of temp., and shift of wind from W. to E.S.E., in afternoon of 28th.

MANSFIELD.—The month has been a fine one, with little R; forked L *without* T occurred on the evening of the 4th. From 14th to 21st the days were very calm, with cloudless skies; the highest temp. in sun was 128°·3 on 19th.

NORTH SHIELDS.—Distant solar halo on 27th.

SEATHWAITE.—Only two days on which the fall exceeded an inch, but as there were falls of ·70 in. or more on eight days, and R fell on 17 days, the average for June (10·51 in.) was exactly reached.

WALES.

HAVERFORDWEST.—Uniformly warm nights throughout the month have produced their effect on vegetation; a splendid hay crop, if weather is granted to save it. Great heat prevailed from the 14th to the 21st, otherwise the day temp. has been very moderate; temp. at or above 70° on 11 days.

ABERDOVEY.—A warm month, varied by some days of genial R, which was very acceptable; wind ranged from S.W. to S.E., but generally calm.

LLANDUDNO.—Altogether a very fine month, the temp. being 2°·5 above the average, culminating in a max. of 80°·9 on the 21st. Rainfall nearly $\frac{3}{4}$ of an inch below the average, but pretty equally distributed thoughout the month. Elder

in flower on 10th; wild rose in flower and grass cut on 14th; honeysuckle in flower on 15th; privet in flower on 23rd; corn shot on 25th; T at 6 p.m. on 26th: sea fog on 4th till 10.30 a.m.; high gale from S.W. in the night of 5th; a thick exhalation over the sea and hills on 19th; a sea fog passed over the hills from noon to 3 p.m. on 20th.

SCOTLAND.

DUMFRIES.—June has been a fine month for vegetation; the rainfall, though light, was distributed over 17 days, and the mean temp. (55°·4) about the average. Ten days of very warm weather, ended with a T S, about the middle of the month; the remaining days being breezy, moist and cool. Winds chiefly from S.W., and light.

HAWICK.—The first eight days, which were showery, were followed by twelve warm ones. The hay crop in this district is early, and will bulk more largely than that of last year. Gooseberries are a very unequal crop, while apricots, pears and apples, notwithstanding the great display of blossom are a comparative failure. There were T showers on 21st, 22nd and 23rd. Hornets and wasps seem to have been drowned out by the winter rains, as they have not been seen here this season.

CASTLE TOWARD.—Much R at beginning and close of the month; very fine in the middle, bringing vegetation much more forward than was anticipated.

QUINISH.—First ten days very stormy; great heat till the 20th, when we had a T S and wild weather to the close.

BRAEMAR.—A very seasonable month; more rapid growth of grass rarely seen. T S at 7 p.m. on 21st.

ABERDEEN.—Bar. pressure and estimated wind pressure below the average; rainfall above it. A month of dull, quiet, wet weather, with an average temp.

PORTREE.—The wettest June on record, and cold, with the exception of seven days, 12th to 18th inclusive, which were extremely hot and sultry; on the 16th the ther. in sun reached 110°. Gale from N. on 22nd; T S on 21st and 22nd.

CULLODEN.—Fine warm summer weather from 13th to the 17th inclusive, otherwise cold, windy and rainy for the season. Very high S.S.W. to S.W. wind, with slight showers on 2nd; strong gale from S.S.W. on 3rd. Fogs on 18th, 19th and 20th. Distant T to S.W., between 5 and 6 p.m. on 21st.

SANDWICK.—June has been 1·42 in. wetter, and 0°·7 colder than the mean of the previous 50 years; there has also been 1,023 miles more wind than the mean, but the weather is a great improvement on that of May, and the crops are progressing favourably, though late.

IRELAND.

DARRYNANE.—First few days wet and foggy; rest of month fine, but not very warm. Winds variable and moderate. Blight showing slightly on potatoes last ten days, harvest otherwise promising, and hay crop good. There has been more R during the past six months than even in the wet year 1872; the figures are—1872, 27·54 in. on 145 days; 1877, 27·63 in. on 129 days.

KILLALOE.—A very favourable month; abundance of rain, with high temp., has produced abundant vegetation. Mean temp. 61°, being 3° above 1876.

BALLYSHANNON.—High wind from N.W. on 1st and 7th. T S at 11 p.m., in S.W., on 4th. Distant T on 19th; heavy T on 20th at 3 p.m., and again at 1 p.m. and 8 p.m. on 21st.

EDENFEL.—Beginning of the month rainy and unsettled, but from 9th to 20th there followed a magnificent spell of clear hot weather, which, following the previous R, resulted in a vegetation almost tropical in its rapidity and luxuriance, and replaced what seemed to be the certainty of a deficient by that of an abundant harvest. On the evening of the 20th the greatest T S within memory burst almost over this house, which, although the highest in the neighbourhood, was not injured, but within a radius of two miles, horses and cattle were killed, and considerable damage done to property; during 1½ hours of its continuance, upwards of 1 in. of R fell, the heaviest fall ever recorded here.