IV.—*Notice of an unusual Fall of Rain in the Lake District, in January 1829.*

By JOHN DAVY, M.D., F.R.S., London and Edinburgh.

(Read 4th April 1859.)

The rain experienced in January of this year has so much exceeded the average quantity, considerable as that is in the Lake District,* that I have been led to consider it worthy of record, especially keeping in mind, that as regards risks from floods, it is not the ordinary, but the extraordinary that is to be guarded against in the construction of all works with which water is concerned as an element of danger.

It may not be amiss to premise, that the year preceding, as to weather, was chiefly remarkable for the mildness of the first quarter, for its high summer temperature, for the unusual cold experienced in November, and this succeeded by a mild December. January set in with weather of the same character, and was without any marked peculiarity, excepting its mildness, till the 9th, when rain commenced, and, with the exception of two or three days, continued to fall more or less heavily till the end of the month.

The maximum and minimum temperature during the month, and the prevailing winds, are shown in the following table, for which I am indebted to Mr SAMUEL MARSHALL of Kendal. His observations made in that town are applicable, with certain allowances, to the Lake District generally. I have selected them, having great reliance in his accuracy as an observer:—

TABLE I.

No.	Maximum Temperature.	Minimum Temperature.	Winds.
1	46	38·5	S.W.
2	45	33·5	S.W.
3	45	34	S.W.
4	47	36	S.W.
5	47	40	S.W.
6	43	40	S.
7	45	30	S.
8	34	28	N.E.

* The rain-fall at Lesketh How, Ambleside, in January, during the preceding six years, has averaged 4·22 inches.

In 1853 it was 1·62 inches.

... 1854 ... 10·54 ...

... 1855 ... 1·68 ...

In 1856 it was 6·96 inches.

... 1857 ... 7·73 ...

... 1858 ... 5·35 ...

TABLE I.—*continued.*

No.	Maximum Temperature.	Minimum Temperature.	Winds.
9	37°	30°	N.
10	44	34	S.
11	40	43	S.W.
12	48	45	S.W.
13	50	33·5	S.W.
14	40	36	N.E.
15	38	31	N.E.
16	42·5	33·5	S.E.
17	44	38·5	S.
18	49	40	S.W.
19	49	33	S.W.
20	46	32·5	S.W.
21	49	41	S.W.
22	52	42	S.
23	45	35	S.W.
24	45	37	W.
25	47	41·5	W.
26	48	35	W.
27	43	30	W.
28	46	34	S.W.
29	46	38	S.W.
30	47	36	S.
31	42	31·5	S.W.

During the month, the mean of the barometer was 29·853 ; its maximum (on the 13th), 30·398 ; its minimum (on the 23d), 29·097 ; the mean of the dry-bulb thermometer 40·4° ; of the wet-bulb 39·1° ; the maximum difference of the two 4°. These averages I owe to the same observer, and they are from observations made in the same place.

In recording the fall of rain, it appeared advisable not to restrict the account to one spot. Through the kindness of correspondents, I have been enabled to extend it to many localities, both in the district and at a distance. The registered results I shall give in a tabular form. The first table will show the days in which rain fell in the month in question, and its amount in the twenty-four hours, at five places, the remotest, Kendal and High Close, not exceeding twenty miles.

TABLE II.

No.	Kendal.	Ibbotsholme, Troutbeck.	The How, Trout- beck.	Lesketh How, Ambleside.	High Close, Grasmere.
1	·175	...	·372	...	·19
2	...	...	...	...	...
3	...	...	...	...	...
4	...	...	...	...	...
5	...	...	...	...	...
6	·010	...	...	...	...
7	...	...	...	...	...
8	...	...	...	...	...
9	...	...	...	...	...
10	...	...	...	...	·03
11	·034	·10	·135	·08	·05
12	·102	·10	·255	·11	·12
13	...	...	·015	...	...
14	...	·05	·018	·03	...
15	...	·03	·028	·75	·08
16	·250	·32	·353	...	·81
17	·170	·32	·360	·40	·35
18	1·980	2·43	3·135	3·65	2·15
19	·230	...	·145	·30	·13
20	...	·13	·085	...	...
21	1·015	2·02	3·125	2·61	1·75
22	...	·70	·818	1·37	1·31
23	·446	68	1·334	·71	1·00
24	·512	·72	1·065	1·06	1·04
25	·274	·15	·568	·26	·11
26	·223	·65	·821	·70	·18
27	·474	·45	·550	·94	·47
28	...	·03	·028	·08	·11
29	·048	·22	·385	·36	·16
30	·505	·68	1·075	·80	·77
31	·066	·32	·205	·40	·14
	6·514	10·10	14·875	14·82	10·95

In the next table will be given, besides the quantity of rain noticed in the Lake District in several localities, that which has been registered in some other

parts of the kingdom; the latter for the sake of comparison. The nine localities which stand first, may be considered as belonging to the district, unless Kendal and Whitehaven on its borders be excepted; and all but these last are a few miles only apart, and, with one exception, that of High Close above Grasmere, vary but little in elevation above the sea-level, ranging from about 130 to two or three hundred feet; High Close, probably being 500 feet more.* In one column, the amount of rain which was measured in January, will be found; in the other, the amount for the year, but from some defective information less complete than could be wished,—

	For January.	For the Year.
Kendal,	6·514 inches	40·226 inches.
Ibbotsholme Troutbeck,	10·10 ...	
The How, Troutbeck,	14·875 ...	60·168 ...
Lesketh How, Ambleside.	14·82 ...	63·44 ...
Wray Castle, above Windermere,	9·692 ...	54·269 ...
High Close, above Grasmere,	10·95 ...	58·64 ...
Keswick,	11·168 ...	50·27 ...
Whinell Hall, Vale of Lorton,	9·042 ...	47·848 ...
Coniston,	12·50 ...	62·71 ...
Paterdale Hall, at the head of Ulswater,	14·8 ...	57·50 ...
Whitehaven,	6·643 ...	
Penzance, Cornwall,	6·48 ...	
Plymouth,		39·84 ...
Bristol,		22·70 ...
Sherborne,	3·82 ...	32·73 ...
Bucher, near Kington, Herefordshire,	1·16 ...	27·98 ...
Cambridge,	·36 ...	13·221† ...
York,	1·07 ...	20·49 ...
Mirfield, Yorkshire, about 300 feet above the sea,	1·07 ...	21·13 ...
Scarborough,	·38 ...	16·43 ...
Wakefield,		25·408 ...
Edinburgh,	1·861 ...	22·67 ...
Hutton, eight miles west of Edinburgh,	5·1 ...	
Observatory, Glasgow,	5·30 ...	
Stornoway Castle, Isle of Lewis,	5·43 ...	40·43 ...

* Since the above was written, I have been favoured, by the direction of Lieut.-Col. JAMES, R.E., with the following "List of Ordnance Survey Altitudes, in the neighbourhood of Kendal, &c. :—

Description of Marks.	Altitudes above the Mean Level of the Sea,
	Feet.
Bolt in base of N.W. tower of St George's church, Kendal,	149·02
Mark on S.W. angle of Grasmere church,	219·19
Mark on Ambleside church,	163·18
Bolt in N.E. angle of Patterdale church tower,	490·83
Mark on top of east battlement of Netherfield bridge over Seathwaite Beck,	399·05
Bolt in N.W. angle of Keswick church Tower,	319·19
Bolt in west corner of old church, Whitehaven,	29·27
Mark on N.W. corner of Wray church,	309·33
Mark on east face of east battlement of Church Bridge, Troutbeck,	398·77
Mark on stone of door of tower entrance to Troutbeck church,	403·13
Mark on top of rock 10 links, S.E. of Lingmoor, triangle A,	1109·74
Mark on Kirby Quay, west side of Coniston Lake, about 20 chains south of Water-Head Inn,	144·00

† The Register for December is reported incomplete; yet the total for the year is considered near the truth; so dry a year as this has not been known, I am informed, for a long while. The yearly average of rain there is very low, about 17 inches.

From this table, it appears, that in the instance of the Lake District, the rain-fall for the month, with the exception of two spots, Wray Castle and High Close, increased with advance towards the higher central mountains, in accordance with all former observations, especially those of the late Mr MILLER. If a conjecture may be allowed as to the exceptional spots, I should be disposed to attribute the difference to the position of these places,—one, Wray Castle, standing on a low hill on the western margin of Windermere, flanked by no near mountains; the other, High Close, on an eminence between Langdale and Easdale; these vales, skirted by lofty hills, by their greater elevation, exercising on the atmosphere a much greater cooling effect.

Inequalities of rain-fall throughout the kingdom have been a remarkable feature of the meteorology of last year, and of the present season; this is strongly shown in the table. How singular, that more rain should have fallen in several places in the Lake District in the month than at Cambridge in the whole year!

As the prevailing winds during January were westerly, oceanic, and moist winds, the greater fall of rain on the west coasts is perhaps no more than might be expected, this, according with ordinary experience; it is the remarkable difference of amount in the Lake District that constitutes the speciality, as it now appears, and seems deserving of attention. Probably, were rain-gauges kept in the western highlands of Scotland the fall of rain there amongst the mountains bordering the coast, would be found to be not less, and it may be even greater. The flood descending from the hills which swept away so much of the embankments of the Crinan Canal in Argyshire may be mentioned in proof; it occurred early in February, after the heavy rains of the preceding month.*

* Since the above was written, I have been favoured by Professor ALLEN THOMSON of Glasgow; with the following return, comprising nineteen years' rain-fall at Stonefield, the residence of COLIN G. CAMPBELL, Esq., in the vicinity of the Crinan Canal, confirmatory of the remark I have made; no doubt, amongst the mountains there, as in the Lake District, the proportion of rain is much larger than at the lower levels.

Yearly Average.		<i>Average for each Month during these Nineteen Years.</i>			
1840, . . .	58·6	January, . . .	7·2	December, 1852, . .	14·35
1841, . . .	61·6	February, . . .	5·7	„ 1854, . .	14·4
1842, . . .	60·0	March, . . .	4	January, 1849, . .	12·9
1843, . . .	67·0	April, . . .	3·2	„ 1859, . .	8·4
1844, . . .	45·8	May, . . .	3	February, 1859, . .	6·15
1845, . . .	77·3	June, . . .	4·4		
1846, . . .	64·7	July, . . .	4·8		
1847, . . .	59·7	August, . . .	4·4		
1848, . . .	68·9	September, . . .	4		
1849, . . .	62·6	October, . . .	6·4		
1850, . . .	65·7	November, . . .	6·4		
1851, . . .	54·2	December, . . .	7·3		
1852, . . .	66·0				
1853, . . .	55·3	Total for year,	60·8		
1854, . . .	63·8				
1855, . . .	41·4				
1856, . . .	52·4				
1857, . . .	50·9				
1858, . . .	63·3				

Average 60 inches.

In commencing, I have stated that the fall of rain in January was so much greater than the average for the month as to seem deserving of record; this is strictly correct; yet instances have occurred, since rain-gauges have been kept in the district, of even greater quantities having been registered for the same time. The following table, giving the months in which rain equal to, or exceeding 12 inches, has fallen at Ambleside and Coniston,—at the former since 1848, at the latter since 1837,—is illustrative of the fact; the rain-fall at Kendal and Wray Castle, for the same months, is added for the purpose of comparison:—

TABLE III.

Date.	Coniston.	Ambleside.	Wray Castle.	Kendal.
	Inches.	Inches.	Inches.	Inches.
October . . . 1838	12·6	...	...	7·032
July . . . 1839	12·4	...	...	8·461
September . . 1839	12·9	...	...	7·437
October . . . 1843	13·1	...	...	7·883
November . . 1843	12·0	...	...	9·109
December . . . 1845	13·6	...	...	9·039
October . . . 1846	14·0	...	...	7·843
November . . 1847	13·2	...	...	8·002
February . . . 1848	14·5	14·19	...	10·237
December . . . 1848	12·0	...	...	7·107
January . . . 1849	13·5	12·30	...	8·439
October . . . 1849	12·0	...	...	7·333
November . . . 1850	12·2	...	9·670	5·722
January . . . 1851	13·3	19·54	13·735	10·057
January . . . 1852	17·6	20·37	15·332	9·886
February . . . 1852	12·0	13·00	10·074	7·907
December . . . 1852	19·9	24·39	18·651	12·766
January . . . 1853	12·0	13·25	10·867	6·696
December . . . 1854	15·3	19·80	12·159	8·129
January . . . 1859	12·2	14·83	9·692	6·514

Such heavy falls of rain as those recorded in this table are perhaps more characteristic of localities exposed to the west and adjoining mountains than even the great yearly averages. Taking Edinburgh as an example of a place on the east coast, it would appear from the register kept by the late Mr ADIE and his sons, from 1795 to the present time, that the greatest monthly fall there during the whole of that period was little more than six inches. This occurred five

times—once in January, once in October, and once in each of the three summer months. The greatest amount of rain registered in any one year, that of 1795, was 36·61 inches; the average of the whole 24·55 inches. Stornoway, in the Island of Lewis, affords an example of a locality well exposed to the west, fully open to the sea, but out of the near influence of any mountains. There showers are frequent, but seldom so heavy as those where that influence is exerted. In January, the daily fall of rain registered there was as follows:—

1st,	.	0·20 inches.	18th,	.	.	.	...	inches.
2d,	.	0·05 ...	19th,	.	.	.	0·05	...
3d,	.	0·02 ...	20th,	.	.	.	0·23	...
4th,	.	0·05 ...	21st,	.	.	.	0·47	...
6th,	.	0·01 ...	22d,	.	.	.	0·14	...
7th,	.	0·15 ...	23d,	.	.	.	0·80	...
8th,	.	...	24th,	.	.	.	0·18	...
9th,	.	0·11 ...	25th,	.	.	.	0·25	...
10th,	.	...	26th,	.	.	.	0·35	...
11th,	.	0·02 ...	27th,	.	.	.	0·15	...
12th,	.	0·05 ...	28th,	.	.	.	0·35	...
13th,	.	...	29th,	.	.	.	0·25	...
14th,	.	0·01 ...	30th,	.	.	.	0·62	...
15th,	.	...	31st,	.	.	.	0·28	...
16th,	.	0·10 ...						
17th,	.	0·53 ...					5·43	inches.

Exceptions there may be to the above remarks, even in localities where the average rain-fall is low,—exceptions which ought to be kept in mind, for the warding off of accidents by floods, but which unfortunately are commonly too soon forgotten after the event. One of the most remarkable that I am acquainted with took place at Scarborough in August 1857. In that year the total fall of rain registered was 29·982 inches, of which quantity 12·67 inches fell in August, and 9·50 inches during the night of the 6th and 7th of that month.* Another exceptional case is a fall of rain that occurred in London and its neighbourhood, on the 15th March 1851, amounting in a few hours to more than an inch, in London to 1·25 inch, at Lewisham to 1·725, which, for those localities, was designated by Mr GLAISHER as “extraordinary,” and on that account communicated by him to the Royal Society.†

I have made mention of the mildness of the season since November. February, as to weather, was very much a repetition of January, the prevailing winds were the same, and rain was in excess; here, at Lesketh How, 7·29 inches were registered. Now, in the first week of March, spring, judged of by the vegetation, is at least a month in advance; the gardens are gay with flowers. The same advance appears to be general. In a letter, with which I have been favoured by Sir JAMES MATHESON,

* The capacity of the rain-gauge was limited to 9·50 inches; it is stated to have been overflowing, so the amount registered was below the truth. See “Twenty-Sixth Report of the Scarborough Philosophical and Archæological Society for 1857.”

† Proceedings of Royal Society, vol. vi., page 39.

from Stornoway, of the 28th of February, are inclosed the flower of the *ribes sanguineum*, the young leaf of the sweet briar, and of the common fuschia, gathered in the grounds of the castle in rather an exposed situation, and it is stated that the *Loincera tartarica*, the honeysuckle, and Ayrshire rose, are in full leaf. The spawn of the frog I found here in the ditches as early as the 21st of the same month. A writer in the *Evening Mail* of the 4th of March, referring to the mildness of the season, says he heard a nightingale singing in the neighbourhood of Southampton on the evening of the 1st of the month, and that he had previously heard the same birds singing on the 13th of the preceding month in North Storeham Park. I shall mention another proof: in winters of ordinary coldness butterflies are torpid, lose very little of their weight, hardly an appreciable quantity, and when the warm weather of spring sets in, roused into action, they are vigorous and take wing. One that I have had under observation since December, a *Vanissa urticæ*, which then weighed 2·4 grains, has never become completely torpid; it has lost ·54 grains of its weight, and now, though not torpid, is almost inanimate, just opening its wings when warmed, but incapable of flight. Further proof may be offered in the unusual success of the angler in the month of January. The number of charr taken in that month in Windermere was unprecedented; one fisherman, trowling with the minnow, captured, it is said, nineteen dozen, in good condition, equal to those taken in April and May. In November, an adjoining lake, Rydalmere, was frozen over, and there was skating on it! *Lastly*, I may remark, that up to the present time the same inequalities as those already described of excess and deficiency of rain, would appear, from what is stated in the papers, to continue throughout the country; but the deficiency more common than the excess. Thus, whilst here we have had few days of sunshine, in Berkshire and the counties similarly situated drought has prevailed, and to so great a degree as to interfere with the operations of agriculture, the ground having become so parched and hard as hardly to receive the plough.

LESKEITH HOW, *March 8, 1859.*

Postscript.

Since the above was written, I have been favoured, through the kindness of my friend Dr LEITCH of Derwent Bank, Keswick, with a register of the fall of rain at Seathwaite, Borrowdale, from 1845 to the present time, kept by Mr JOHN DIXON. The results, it will be seen, are strongly confirmatory of those hitherto obtained, as showing the augmentation of the quantity the nearer the approach to the central part of the district, where the mountains are highest and the

valleys deepest. I shall extract the monthly falls when amounting to or exceeding 12 inches, and the fall of each year. The average yearly amount of the fourteen recorded years is the remarkable one of 129·97 inches.

Year.	Rain.	Year.	Rain.
1845,	151·86 inches.	October,	20·38 inches.
January,	16·81 ...	1852,	156·70 ...
March,	13·21 ...	January,	27·65 ...
August,	15·61 ...	February,	20·05 ...
October,	15·17 ..	June,	12·33 ...
November,	20·84 ...	August,	12·37 ...
December,	24·94 ...	November,	17·47 ...
1846,	143·45 ...	December,	32·83 ...
January,	17·07 ...	1853,	113·69 ...
March,	17·85 ...	January,	23·12 ...
July,	20·80 ...	April,	12·67 ...
October,	25·43 ...	July,	19·67 ...
1847,	129·24 ...	October,	13·25 ...
September,	13·28 ...	1854,	136·39 ...
October,	20·52 ...	January,	19·61 ...
November,	21·85 ...	June,	13·98 ...
December,	20·54 ...	September,	12·24 ...
1848,	160·55 ...	October,	14·62 ...
February,	30·45 ...	December,	28·86 ...
July,	17·76 ...	1855,	88·31 ...
August,	13·91 ...	October,	20·00 ...
October,	17·32 ...	1856,	105·52 ...
November,	14·07 ...	February,	14·36 ...
December,	20·71 ...	June,	12·66 ...
1849,	123·64 ...	December,	17·80 ...
January,	24·90 ...	1857,	116·60 ...
July,	16·64 ...	January,	15·12 ...
October,	16·14 ...	February,	14·94 ...
November,	16·97 ...	December,	20·49 ...
1850,	143·26 ...	1858,	114·60 ...
February,	22·58 ...	January,	13·72 ...
April,	15·62 ...	September,	18·39 ...
August,	16·22 ...	October,	15·60 ...
October,	12·94 ...	December,	15·58 ...
November,	22·60 ...	1859,	
1851,	135·85 ...	January,	23·40 ...
January,	28·63 ...	February,	15·80 ...
February,	15·33 ...	March,	20·84 ...
July,	14·48 ...		
August,	13·16 ...		