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THE QUEENSLAND FLOODS.

WE regret that we cannot place before our readers any official details as to the rainfall which caused such terrible ruin in Brisbane at the beginning of February. For most of the following information we are indebted to various numbers of *The British Australasian*, and to a friend, who has sent us the Melbourne *Argus* of February 11th, 1893.

Two subjects occupy nearly half of that paper—"The Heat and the Bush Fires," and "The Queensland Floods." It is rather venturesome to jump at a conclusion from these two titles, but we shall not be surprised if, when we do get full details, both results are proved to have had one origin.

As regards the rainfall, the following are all the data we yet have :—

"Brisbane, February 23rd, 1893.—The following are particulars from the statistics issued by the Chief Weather Bureau, showing the rainfall for four days ending February 3rd. The figures for February 2nd are phenomenal, and exceed the records of any previous rainfall in any other part of the world :—

	inches.
January 31st	10·775
February 1st	20·056
February 2nd	35·714
February 3rd	10·760
Total	77·305

But the following paragraph says that the above record was not obtained at Brisbane at all!

"With regard to the phenomenal rainfall in the Blackall Ranges, the cause of the flood, taken at Crohamhurst by Mr. J. O. Jones (77·305 inches in four days, and 35·714 inches in one of these days), it is well to point out that the fall, tremendous as it is, does not constitute a world's record. On June 16th, 1876, there fell at Cherrapanji, Khasi Hills, Assam, 40·80 inches in twenty-four hours, and this stands as the record of reported rainfalls for this period."

"The rainfall at Brisbane itself up to Tuesday morning [January 31st or February 7th ?] amounted to 19·42 in., or 9·19 in. more than in the great flood of 1890."

“The total rainfall reported at the Brisbane Observatory from January 28th to February 20th was over 43 in., as compared with 5·30 in. for the corresponding period of 1892.”

The above two records seem much more consistent.

“Ipswich, February 4th.—The rainfall for the last 24 hours is 2·53 in.”

“Toowoomba, February 6th.—The rainfall at Bundaberg since the 29th to date is 25·43 in.”

“The rainfall at Coochin Creek, in the Blackall Ranges, and at Yandina, from the 31st January to 8th February, was 80 in. and 73·36 in. respectively.

“Fifty miles north of Brisbane, at Mooloolah, 67 inches of rain fell in three days.”

As regards general damage, the following narrative will give a general idea. The loss is put at £1,500,000.

“Descending the great mountain which hems in the tableland, no trace is to be seen of the flood which so recently overwhelmed the plains. The little mountain streams flow quietly on, the gullies are unscoured by torrents, and the permanent way of the railway is uninjured. All this affords a clear illustration of the way in which the cyclonic rainfall, phenomenal in its intensity, confined itself to the coast regions, leaving the mountain ranges comparatively untouched. Some idea of the intensity and local character of the rain may be formed from the fact that the Warill Creek, a tributary of the Bremer about four miles from Ipswich, was not even in flood, whilst the Bremer itself rose about 80 ft., and almost swallowed up the town. Residents compare the rainfall to a waterspout, which descended on the watershed of the Brisbane and Stanley rivers. Thus at Brisbane itself, up to Tuesday morning last, 19·42 in. of rain had fallen, or 9·19 in. more than during the great flood of 1890. Further north again the rain was still heavier, and at Mooloolah, 50 miles away on the north coast line, 67 in. of rain fell in three days. These facts alone are quite sufficient to account for the unprecedented character of the inundation, which surpasses any in the memory of black men, let alone white men

“The first trace of the flood which one meets in approaching Brisbane from the south is at Ipswich, the town which has suffered most severely by the calamity. The Bremer River, which is now flowing deeply and sluggishly between its banks, was backed up by the overcharged waters of the Brisbane streams, and rose to a height of 80 ft. above the normal level. This flooded the lower portion of the town to a depth of 34 ft.—16 ft. higher than the hitherto famous flood of 1890.

“The result, even as viewed from the railway train, is seen to be disastrous. Houses are upset in every direction. They have been carried hundreds of yards from their original sites, and landed promiscuously in other people's back yards, in paddocks, and even on public roads. In one place a church is seen lying on its side in unconsecrated territory, and in another the iron roof of a large and well-built mansion has parted from its body, and is lying half across the highway. The station at Ipswich shows signs of the severe trouble it has passed through. The platforms are built deep down in the cuttings, and reached by stairs from the roads above. The water entered and filled this hollow, rising to the level of the roadway. Hence the place was completely swamped out, and the refreshment rooms, waiting-room, and other offices are in a pitiable plight. Passing along the line one notices everywhere traces of

the flood. Fields are covered thick with a slimy deposit, which gives off a disagreeable odour. Wherever there are low-lying settlements, houses have been either destroyed or completely swamped out. At Goodna, a few miles from Ipswich, the mighty power of the waters has been made still more manifest. The place is near the junction of the Bremer and Brisbane rivers, and consequently the current was exceptionally strong. A large station-house has been lifted bodily from its foundation, carried across the railway line, and deposited on the goods platform. A gang of workmen are now employed in shifting the dismantled station back to its place. Fortunately the railway line to South Brisbane has not been seriously injured, though, as the Indooroopilly railway bridge has been carried away, all communication with the city on the main northern line is cut off.

“As we get deeper into the flooded districts the stench of drying mud becomes stronger and stronger. Hundreds of acres of valuable crops, maize, and potatoes and vegetables of all kinds, are covered with offensive deposits. Beautiful gardens, belonging to many residential villas in this suburb, are utterly ruined, and houses are more or less damaged. Even if the main building has escaped damage, the outbuildings are turned over and scattered in all directions. Fences are destroyed, and all cultivation for at least a season will be out of the question. The telegraph wires along the side of the line indicate the extent of the flood, since there are fringes of weeds and other vegetable matter hanging from them. Evidences of the disaster crowd upon one as the dwelling places become more numerous. The condition of the muddy back yards indicates the intense misery which has overtaken weary housewives, who are to be seen hanging out little scraps of linen and bedding to dry in the tepid atmosphere. One man is on the roof of his cottage cleaning mud out of the gutters; another, less fortunate, is endeavouring with the aid of several friends to set his capsized house on end again. This we see as we pass over the heads of people before reaching South Brisbane, the only terminal station which the city now possesses. The streets are still thick with shining mud, and there is confusion everywhere.

“It is by no means an easy matter to reach Brisbane itself, for, since the destruction of the Victoria-bridge—the yawning red wreck of which is just above us—the ferry provides the only means of crossing the river. ‘I never knew before how many people used the Victoria-bridge,’ said a local gentleman to me as he looked down on the crowded ferry-boat just arriving at the high wharf. The boats, which are run by the Government, will only carry a limited number of passengers. They are always crowded to the utmost extent, and the task of embarking and disembarking all these people is difficult and even dangerous.”

The above describes matters as they appeared to a visitor approaching Brisbane from the south. From the northern districts we have little information, but the following paragraphs show that damage extended nearly 200 miles to the north of Brisbane:—

“At Gympie, 116 miles N. of Brisbane, about 20 houses were washed out of the main street.”

“At Maryborough, 64 miles N. of Gympie, the bridge was washed away.”

MARCH, 1893.

THE character of March has been so abnormal as to call for a few pages summarizing its more salient features, in addition to the information contained in our regular tables of rainfall and temperature, and in the Observers' remarks.

To study the rainfall we have plotted several hundreds of returns on a map of the British Isles, but the slight rains, which together make up the total for the month, appear to have been so dependent on extremely local conditions that variations of one or two tenths of an inch are frequent in the records of contiguous stations, and these one or two tenths are, over a great part of the country, sufficient to double the total fall.

We will endeavour to roughly outline the chief features of the distribution, but owing to the before-mentioned cause, cannot attempt to be precise.

Over a belt of country stretching from Huntingdon to Northampton and Northampton to Oxford, several stations report less than $\cdot 1$ in., many stations in the East Midlands report less than $\cdot 2$ in., and a large area of country, bounded on the N. by a line running from the Wash to Hereford, and on the S. by a line from Swaffham to Weston-super-Mare, recorded less than $\cdot 25$ in. A line stretching from Newcastle to Plymouth would have to the E. of it the country over which the fall generally was less than $\cdot 5$ in., though isolated high lands produced more. To the W. of this line, S. of Yorkshire, we find no English record reaching an inch, but in the N.W. of the country larger falls are plentiful, and Seathwaite, Cumberland, had a fall of $8\cdot 67$ in., or very near its average.

In Wales the rainfall, like the country, is almost too irregular to be described in words, but it was generally considerably less than half the average, though records exceeding an inch are plentiful.

Scotland, like Wales, is difficult to deal with, but although we do not find a single plus sign in the table on page 46, and many stations show a considerable deficiency, the fall there was not phenomenal.

In the S.E. of Ireland the fall was less than $\cdot 5$ in. ; in the E. and S. was less than $\cdot 75$ in. ; but it increased N.W.-ward to $2\cdot 5$ in. in the extreme N.W.

The following table gives no less than 33 stations where the total fall did not exceed a quarter of an inch, 32 distributed over 17 counties of England, from York in the N. to Sussex in the S., and from Suffolk in the E. to Cornwall in the W., and one in Limerick.

Station.	County.	Rainfall		Station.	County.	Rainfall	
		Total.	Days.			Total.	Days.
Pitsford, Sedg- brooke.....	Northampton	·07	3	Droitwich (Holt Lock).....	Worcester....	·18	5
Oxford, Mag. Coll.	Oxford.....	·08	4	Scarborough	York.....	·18	5
Alconbury.....	Hunts.....	·09	3	South Cliff.....	Cornwall.....	·20	—
Castle Ashby... ..	Northampton	·10	4	Morvah, Bospor- thenis.....	Oxford.....	·21	5
Eastbourne Ceme- tery.....	Sussex.....	·12	4	Steeple Aston	„.....	·21	4
Steyning.....	„.....	·13	—	Banbury (Blox- ham Grove)....	Suffolk.....	·21	—
Winslow, Adding- ton Manor.....	Bucks.....	·14	4	Ipswich (Bishop's Hill).....	Norfolk.....	·21	4
Oxford (St. Giles)	Oxford.....	·14	5	Swaffham.....	Hereford.....	·21	7
Denver.....	Norfolk.....	·14	3	Ross, The Graig.	Sussex.....	·23	6
Cheltenham (Southam Villa)	Gloucester ...	·14	5	Eastbourne, Os- borne Ho.....	„.....	·23	4
Gloucester (Llan- thony Lock) ..	„.....	·14	4	Probus, Lamel- lyn.....	Devon.....	·24	5
Harlow (Sheering)	Essex.....	·16	6	Ashburton, Druid House..	Rutland.....	·24	7
Henley-on- Thames.....	Oxford.....	·17	5	Ketton Hall [Stamford] ...	Limerick.....	·24	4
Tewkesbury (Upper Lode)...	Gloucester ...	·17	4	Limerick (Kil- cornan).....	Essex.....	·25	4
Worcester (Bevere Lock).....	Worcester....	·17	5	Southend W.W.	„.....	·25	10
Llanvihangel Court.....	Monmouth....	·17	5	Weston-super- Mare.....	Gloucester ...	·25	7
Torquay (Babba- combe).....	Devon.....	·18	6	Stroud, Upfield..			

As regards distribution in time, the description is fairly simple. Over the driest part of England rain fell only on the 1st, 2nd, and 3rd and on the 16th and 17th, and an absolute drought prevailed from the 18th to the end of the month. At Camden Square, and we believe over the greater part of the Midlands and Southern Counties, this drought has been prolonged to the time of writing (April 12th). At stations where the total was slightly greater, showers fell also on the 6th and 7th; still further increase of total corresponds with increased number of rainy days, the wet periods, 1st to 3rd and 5th to 7th, become merged into one, and the period 16th to 17th becomes prolonged, but over practically the whole of England except the north and west, the drought after the 18th was unbroken. In Wales the drought was generally broken by R on the 31st.

In Scotland, with the greater fall of rain the weather was generally more broken, a few fine days succeeding two or three wet ones somewhat irregularly, the wet or dry preponderating according to the normal character of the district. The drought, however, shows itself after the 17th or 18th, and in parts of the drier districts of the S. and E. continued to or beyond the close of the month.

In Ireland the wet periods were very similar to England—1st or 2nd to 3rd, 6th and 7th, and 15th to 18th—but showers intervened on the 12th, and the drought was generally broken up on the 31st. In the north the first two groups of days combine into a rainy period from 1st to 6th, and the drought is curtailed or disappears altogether.

The temperature, duration of sunshine, and other meteorological elements deserve—and will, we hope, receive—more thorough discussion than we are able to give them, inasmuch as we receive no detailed returns except those of rainfall, and have not the material for comparison with previous years.

We are therefore practically limited to a discussion of the Camden Square records, and have selected the following results for comparison :—

	Mean temp. at 9 a.m.	Absolute Shade Max. temp.	Absolute Shade Min. temp.	Mean Shade Max.	Mean Shade Min.	Absolute Max. in Sun.	Mean Max. in Sun.	Total Rain-fall.	Mean amount of Cloud.
1893, March...	44°·2	67°·6	25°·9	56°·6	36°·3	103°·4	86°·9	in. ·32	3·1
Highest in the previous 34 years.	46°·7	68°·7	29°·2	55°·5	39°·2	128°·7	91°·4	Lowest ·39	Lowest 4·8
No. of times 1893 has been exceeded	6	2	17	0	13	12	3	0	0
		1871	1868 1873 1879	1882	1859	1882	1882	1874	1863

From this it appears that the average shade max., the total rainfall, and the mean amount of cloud are the only records without precedent, and this is just what we should have expected. The beauty of the month has been due to the unexampled absence of cloud, with the consequent great amount of bright sunshine, resulting in high temperature by day, but a correspondingly low temperature, due to radiation, at night.

Our contemporary, *The Observatory*, contains some interesting notes as to the facts for Greenwich, of which we reprint the opening paragraphs :—

“ A SUNNY MARCH.—We are sufficiently familiar with the rough weather and winds of March to appreciate to the full the unexampled run of fine weather that we have lately enjoyed, and which still (March 30th) continues. A few particulars taken from the Royal Observatory registers may therefore prove interesting. The total amount of sunshine from March 18th to 29th inclusive was 100 hours exactly, the proportion of sunshine (constant sunshine = 1) being thus 0·68. The mean amount of cloud was only 1·2 on a scale 0–10. The mean maximum temperature was 57°·3, which is 6°·5 above the average for 50 years; the mean minimum temperature was 31°·2, or 4°·2 below the average of 50 years. The highest recorded tempera-

ture was $64^{\circ}3$ on March 23rd, and the lowest $24^{\circ}2$ on March 19th. The highest in 50 years during the same period was $70^{\circ}9$ on March 24th, 1871, and the lowest was $20^{\circ}0$ on March 26th, 1850. The mean temperature of the period (simple mean of maximum and minimum) was $44^{\circ}2$, or $1^{\circ}1$ above the average of 50 years.

“ There was a similar run of fine weather in 1892, but a little later in the year. From March 30th to April 11th the sunshine recorded amounted to 134.2 hours, the proportion of sunshine being 0.78. The mean amount of cloud was only 0.9. The mean maximum temperature was $65^{\circ}2$, and the mean minimum temperature $36^{\circ}0$, giving a mean temperature of $50^{\circ}6$, or $4^{\circ}0$ above the average of 50 years.”

ROYAL METEOROLOGICAL SOCIETY.

At the monthly meeting of this Society, held on March 15th, Dr. C. Theodore Williams (President) in the chair, Mr. Shelford Bidwell, F.R.S., delivered a lecture on “Some Meteorological Problems,” which was illustrated by numerous photographs and experiments. The lecturer said that one of the oldest and still unsolved problems of meteorology relates to the origin of atmospheric electricity. Many possible sources have been suggested, among them being the evaporation of water, and the friction of dust-laden air against the earth's surface. Having granted some sufficient source of electrification, Mr. Bidwell said that it is not difficult to account for the ordinary phenomena of thunderstorms.

Photography has shown that the lightning flash of the artists, formed of a number of perfectly straight lines arranged in a zig-zag, has no resemblance to anything in nature. The normal or typical flash is like the ordinary spark discharge of an electric machine; it follows a sinuous course, strikingly similar to that of a river as shown upon a map. The several variations from the normal type all have their counterparts in the forms taken by the machine spark under different conditions, and the known properties of these artificial discharges may be assumed to afford some indication as to the nature of the corresponding natural flashes. Thus, for example, the ramified or branched flash, from which, no doubt, the dreaded “forked lightning” derives its name, is probably one of the most harmless forms of discharge. Ever since the time of Franklin it has been customary to employ lightning rods for the protection of important buildings. According to Dr. Oliver Lodge, these are of no use in the case of an “impulsive rush” discharge, which, however, is of comparatively rare occurrence. Lightning conductors, however well constructed, cannot therefore be depended upon to afford perfect immunity from risk.

Mr. Preece is of opinion that the “impulsive rush,” though easily producible in the laboratory, never occurs in nature. Mr. Bidwell made some remarks as to the duration of a lightning flash, and the causes of its proverbial quiver, and suggested an explanation

of the characteristic darkness of thunder clouds, and of the large rain drops which fall during a thunder shower. The lecturer concluded with some observations concerning the probable cause of sunset colours, which he attributed to the presence of minute particles of dust in the air.

REVIEWS.

Modern Meteorology ; an outline of the growth and present condition of some of its phases, by FRANK WALDO, Ph.D., Member of the German and Austrian Meteorological Societies, &c. ; late Junior Professor, Signal Service, U.S.A ; with 112 illustrations. London. Walter Scott, Ltd., 1893. 8vo., xvi.—460 pages.

WE strongly advise all who desire to be instructed in the newest ideas on meteorological subjects, to buy this very one-sided, but for that very reason useful, book. In many respects we dislike it, but there is no work in the English language, which gives a tithe of the information which this does, as to what may be described as meteorology as viewed from a German standpoint ; and to all English meteorologists, who are not able to read the *Zeitschrift* regularly, this work will be most useful.

Our first complaint is against the title. Prof. Waldo says that his work was compiled at a distance of several hundred miles from any considerable meteorological library, and he explains that he is more familiar with the literature of Germany and America than with that of other countries. But it is strange that neither he nor his publisher had ever heard of *Modern Meteorology* as the title of the six lectures delivered before the Royal Meteorological Society in 1878, and published in 1879 ; and perhaps stranger still, considering how familiar Prof. Waldo is with German meteorology, that he had not heard of the English work in its German form as *Die Moderne Meteorologie*, as published at Brunswick in 1882. The only thing now to be done to avoid confusion, is to always quote the present work as *Waldo's Modern Meteorology*.

As an illustration of the unevenness, and of the utility, we may take the section upon thermometers, where eighteen pages are devoted to very instructive and interesting details as to the construction and verification of thermometers, and on the other hand where not one of the many forms of self-registering thermometers is even mentioned.

The section devoted to barometers is excellent, and spoiled only by some of the engravings being illegible.

As regards cup anemometers, Prof. Waldo is justly severe on the factor of 3, and, referring to Dohrandt's experiments at St. Petersburg, very neatly sums up the *status quo* in the following sentence :—

“These and other experiments have shown that anemometers of the size commonly used, record wind velocities about 20 per cent. too great, and though this has been known for nearly twenty years, yet no change has been made in the erroneous value introduced by Robinson, and the wind observations published by the various

meteorological institutions at the present time have only a relative but not absolute value."

In the rather short section upon rain gauges, there is one expression to which we strongly object. Prof. Waldo says: "In some of the best gauges there is a stop-cock at the bottom, through which the water may be drawn off without inverting the gauge." All taps and stop-cocks leak sooner or later—most of them before two winters have passed, and a leaky rain gauge is certainly not a good one.

The section on evaporation is very far from "modern." Prof. Waldo describes the Piche test tube and Wild's apparatus, but says nothing as to the important work of the French engineers, of Griffith at Strathfield Turgiss, or of his own countryman, Prof. Fitzgerald.

On the other hand, his descriptions and engravings of many of the principal meteorological observatories and establishments, are excellent. No one work in any language gives so much information upon the subject as this section.

The remainder of the work is devoted to the Thermodynamics of the Atmosphere, theories as to its general circulation and their relation to secondary circulations, and to the questions of secular change. Herein Prof. Waldo's familiarity with German, and with the works of German meteorologists, comes into full play, and the works of von Bezold, Hertz, Oberbeck, von Siemens, and Brückner, are brought fully before English readers. We ought, however, to point out, that this portion of the work will require very careful attention, because it is far from elementary, as the following paragraph, which is by no means exceptional, will illustrate:—

"Von Bezold now uses the so-called line of constant entropy as synonymous with the adiabatic curve; and he is thus able to show that by the decrease of entropy by isothermal expansion from one volume to another, if (see the diagram) we proceed along the isotherms which cut an adiabatic S_1 (line of constant entropy) a second adiabatic S_2 will be reached; the relations of expansion remaining constant."

Towards the end of his book, Prof. Waldo has devoted 16 pages to an epitome of Brückner's *Klimaschwankungen*, reviewed in the *Meteorological Magazine* for Dec., 1890 and Jan., 1891, the second notice finishing with these words:—

"By compiling this important work, Dr. Brückner has done good service, and we regret that we know of no English publisher who would venture upon such a publication in our own language."

Failing translation *in extenso*, Prof. Waldo's abstract is very acceptable.

Tyros must not imagine that this book is a complete text-book of modern meteorology, describing all the usual instruments, and explaining how to manipulate and observe them, and how to keep a record. The author did not aim at writing a book of instructions or an elementary treatise, but he and his publisher have given us, at a very moderate price, a large amount of useful information, much of which was previously not accessible in our own language.

A Record of the Rainfall at Uckfield, Sussex, from 1843 to 1892 inclusive ; and also an account of the Great Snowstorm December 25th, 1836, by C. LEESON PRINCE, F.R.Met.Soc. 8vo. 1893.

A VERY pleasantly written and useful little book, embodying the results of 34 years' consecutive observations by the author, and of their continuation by a friend for the 16 immediately subsequent ones, thus making a series for half a century.

Curiously enough, although Mr. Prince is *longo intervallo* the father of Sussex meteorologists, he is not well up in the early history of rainfall observations in the county. He says :—

“ With the exception of the record kept at Chilgrove, Chichester, which was commenced in the year 1834, I am not aware of any systematic registration of rainfall in this county previous to the commencement of my own register in July, 1842.”

It may be as well to give a list of earlier observations, as it may lead to the discovery of other records, or of additional years of those we possess.

The first record from Sussex known to us is that kept by Mr. Mossop in West Street, Brighton, of which we have the monthly values for one year only, 1790 ; we should be very glad to have more of that record.

From 1801 to 1813 a record was kept at, or near, Chichester, but for some of the years we have only the totals, and for 1806 we have not the total for the year, and only a few of the monthly totals.

In 1834 (as Mr. Prince states) the Chilgrove record was commenced, the continuation of which to the present time has been, and is, of extreme importance, being by far the oldest unbroken record in the S.E. of England.

Other Sussex records begun before 1842 are the following :—

Station.	Observer.	Period.	Remarks.
West Dean, Chichester	Rev. G. H. Woods	C 1834 to 1849 T ...	
Kingsham, „	—	C 1835 to 1837 imp. T	
Hastings.....	Mr. Phillips	C 1837 imp. to 1846 T	
Infirmary, Chichester	Mr. W. Hills.....	C 1838 imp. to 1873 T	
Petworth	—	1839 to 1858 ...	} Yearly totals only ; } monthly values } wanted.

Any further information respecting these or other old Sussex records will be most acceptable.

The next preliminary point to be dealt with is, whether Miss Laura Day's record at Uckfield House may be regarded as a continuation of Mr. Prince's record in the town. Captain Noble's record at Forest Lodge, Maresfield, which is within two miles of both stations, covers the period from 1860 to 1891 inclusive, and we have taken out the differences for each year ; they are not perfectly regular, but on the average we have—

	Forest Lodge. in.	Uckfield. in.	Excess of Forest Lodge in.
1860-76	31·76	30·51 Observatory	1·25
1877-91	32·01	30·21 House	1·80

From this it appears that the fall at Uckfield House is less than that

at Uckfield Observatory by 0·55 in.—say half an inch—but looking at the large variations in the relation of the three stations in individual years, we do not consider that it is possible to be sure of that half-inch, and we agree with Mr. Prince that the change of position [and of gauge] has not materially affected the results.

What then are the results? And first as to months:—

	Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
Least Rain {	·23	·00	·11	·25	·18	·16	·08	·63	·02	·77	·70	·32 in.
Year {	'55 & '61	'91	'54	'54	'44	'58	'69	'83	'65	'79	'71	'43
Most Rain {	7·07	4·43	4·05	4·54	5·69	7·04	5·25	6·05	6·54	11·23	7·68	7·95 in.
Year {	'77	'81	'62	'56	'43	'52	'67	'48	'52	'65	'77	'76
Average ...	2·78	1·88	1·86	1·80	2·03	2·06	2·37	2·63	2·67	4·10	3·12	2·60 in.
Per cent...	9·3	6·3	6·2	6·0	6·8	6·9	7·9	8·8	8·9	13·7	10·5	8·7 in.

The average fall during the seasons is—

Winter.	Spring.	Summer.	Autumn.
7·22 in.	5·68 in.	7·05 in.	9·89 in.

As regards the years—

	Inches.	Ratio.
Greatest fall in one year (1852)	50·55	1·69
„ mean „ „ two consecutive years (1852-3) ...	41·12	1·37
„ „ „ „ three „ „ (1851-3) ...	35·50	1·19
Mean fall for 50 years	29·90	1·00
Least mean fall in three consecutive years (1845-7)	21·91	·73
„ „ „ „ two „ „ (1846-7)	21·35	·71
„ „ „ „ one year (1847)	17·58	·59

These fluctuations are unusually large, as the following comparison will show:—

	Wettest year.	Three Driest.	Two Driest.	One Driest.
	in.	in.	in.	in.
Symons (<i>Brit. Rain.</i> , 1883).....	1·45	·79	·74	·66
Binnie (<i>Proc. I.C.E.</i> , 1892	1·45	·78	·73	·66
Prince	1·69	·73	·71	·59

By this comparison we do not in the least suggest any suspicion as to the accuracy of the records—there is no reason whatever for so doing.

On the contrary, instead of finding any error in Mr. Prince's book, we have detected one in *British Rainfall*, 1883, where on p. 30, at Station 3, under the head of "Driest Year," the entry ought to have been, "59, 1847."

The average number of rainy days (0·01 in. and upwards) during the fifty years has been—

Jan.	Feb.	March.	April.	May.	June.	July.	Aug.	Sept.	Oct.	Nov.	Dec.
15 ...	12 ...	12 ...	12 ...	12 ...	11 ...	12 ...	13 ...	12 ...	16 ...	15 ...	14

giving a total of 156 per annum; the lowest number was 113 in 1864 and in 1870, and the highest 211 in 1882. The variability in the number of days of rain is therefore only as 1 to 1·87, while the amount in the driest year is to that in the wettest as 1 to 2·88.

The account of the great Sussex snowstorm of 1836 is exciting enough to be useful to a sensational novelist, and adds one more to the many instances of truth being stranger than fiction. Mr. Prince has done well to put the sad and fatal facts on record, and we will not spoil his narrative by trying to epitomize it.

CLIMATOLOGICAL TABLE FOR THE BRITISH EMPIRE, OCTOBER, 1892.

STATIONS. <i>(Those in italics are South of the Equator.)</i>	Absolute.				Average.				Absolute.		Total Rain.		Aver. Cloud.
	Maximum.		Minimum.		Max.	Min.	Dew Point.	Humidity.	Max. in Sun.	Min. on Grass.	Depth.	Days.	
	Temp.	Date.	Temp.	Date.									
England, London	60·4	29	29·2	26	53·0	39·4	42·1	86	101·9	22·3	3·78	21	5·8
Malta	89·8	2	58·1	23	78·3	66·2	63·7	82	142·5	52·8	1·66	8	4·7
<i>Cape of Good Hope</i> ...	80·9	14	46·3	3	66·6	52·9	...	...	...	...	1·08	12	5·9
<i>Mauritius</i>	81·0	26	61·0	22	78·3	65·9	62·3	75	134·6	52·3	1·39	15	5·0
Calcutta	90·3	3	71·5	31	87·2	74·3	74·3	83	153·5	67·2	3·35	6	4·2
Bombay	92·1	17	74·5	17	87·0	77·0	75·7	82	141·5	65·4	1·89	6	4·6
Ceylon, Colombo	87·9	9	71·6	23	84·9	75·2	71·3	79	155·1	69·0	11·98	28	7·4
<i>Melbourne</i>	78·7	11	38·9	16	65·3	48·2	49·4	77	134·0	32·2	3·47	11	6·8
<i>Adelaide</i>	81·6	30	41·5	18	69·7	53·3	50·7	70	144·0	34·7	3·11	19	6·2
<i>Tasmania, Hobart</i> .....	...	...	...	...	...	...	...	...	...	...	...	...	...
<i>Wellington</i>	68·0	11	39·0	4, 26	60·5	47·4	45·6	74	127·0	33·0	4·59	14	4·8
<i>Auckland</i>	72·0	31	46·0	4	64·8	52·1	52·5	81	139·0	37·0	3·98	13	6·4
Jamaica, Kingston	90·7	9	69·1	15	86·0	71·7	71·9	86	...	...	7·36	22	7·0
Trinidad .....	...	...	...	...	...	...	...	...	...	...	...	...	...
Toronto	73·1	3	29·9	24	55·8	39·6	41·1	77	...	...	1·35	14	6·1
New Brunswick, } Fredericton	65·5	14	22·8	13	51·1	34·0	34·8	73	...	...	1·99	15	6·0
Manitoba, Winnipeg } British Columbia, } Esquimalt	74·6	3	14·0	29 ^a	55·8	32·0	...	...	...	...	·84	9	5·7
	61·1	3	35·2	16	55·0	44·3	47·3	93	...	...	1·56	16	6·9

^a And 30.

REMARKS.

MALTA.—Mean temp. 70°·5. Mean hourly velocity of wind 7·7 miles. The sea temp. fell from 76°·8 to 73°·0. Thunderstorms on 15th and 24th; lightning on 5 days. J. SCOLES.

Mauritius.—Mean temp. of air 0°·2 below, of dew point 0°·6 above, and rainfall 41 in. below, their respective averages. Mean hourly velocity of wind 10 miles, or 1·4 mile below average; extremes, 28·4 on 15th and 0·0 on 30th; prevailing direction S.E. by E. to E. by S. C. MELDRUM, F.R.S.

CEYLON, COLOMBO.—Thunderstorms occurred on 12 days; lightning only was seen on 7 days. J. C. H. CLARKE, Lt.-Col. R.E.

Melbourne.—Thunder and lightning on the 9th and 27th; thunderstorms on the 11th and 20th. R. L. J. ELLERY, F.R.S.

Adelaide.—The mean temp. was slightly under the average, but the month was characterised by very cool days (the mean max. being no less than 2°·8 below the average) and warm nights. Rains generally were heavy and well distributed over the Colony, especially over the northern areas, where, during the first half of the year, a severe drought prevailed. C. TODD, F.R.S.

Wellington.—The first three days very wet, fine from 4th to 10th, the middle of the month showery, and strong gales on 14th, 15th and 16th from N.W.; from the 23rd to the end of the month generally fine, with moderate winds and cool. Earthquake on 13th. R. B. GORE.

Auckland.—Rainfall, mean temp., and barometrical pressure all close to the average of October. T. F. CHEESEMAN.

SUPPLEMENTARY TABLE OF RAINFALL,
MARCH, 1893.

[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 Hall.	·64	XI.	Builth, Abergwessin Vic.	1·69
„	Birchington, Thor	·46	„	Rhayader, Nantgwiltt..	1·30
„	Brighton, Prestonville Rd	·34	„	Corwen, Rhug	·62
„	Hailsham	·37	„	Carnarvon, Cocksida ...	·75
„	Ryde, Thornbrough	·46	„	I. of Man, Douglas	1·01
„	Alton, Ashdell	·42	XII.	Stoneykirk, Ardwell Ho.	1·43
III.	Oxford, Magdalen Col...	·08	„	New Galloway, Glenlee	2·71
„	Banbury, Bloxham	·21	„	Melrose, Abbey Gate ..	1·15
„	Northampton, Sedgebrook	·07	XIII.	N. Esk Res. [Penicuik]	·95
„	Alconbury	·09	„	Edinburgh, Blacket Pl..	·88
„	Wisbech, Bank House..	·32	XIV.	Glasgow, Queen's Park.	·74
IV.	Southend	·25	XV.	Islay, Gruinart School..	3·98
„	Harlow, Sheering	·16	XVI.	Dollar	1·16
„	Colchester, Lexden	·41	„	Balquhider, Stronvar..	2·59
„	Rendlesham Hall	·33	„	Coupar Angus Station..	·83
„	Diss	·35	„	Dunkeld, Inver Braan..	·95
„	Swaffham	·34	„	Dalnaspidal H.R.S. ...	2·39
V.	Salisbury, Alderbury ...	·57	XVII.	Keith H.R.S.	·80
„	Bishop's Cannings	·40	„	Forres H.R.S.	·35
„	Blandford, Whatcombe ..	·48	XVIII.	Fearn, Lower Pitkerrie.	·45
„	Ashburton, Holne Vic. ...	·38	„	Loch Shiel, Glenaladale	7·29
„	Okehampton, Oaklands ..	·73	„	N. Uist. Loch Maddy ...	1·78
„	Hartland Abbey	·78	„	Invergarry	1·23
„	Lynmouth, Glenthorne.	·41	„	Aviemore H.R.S.	·97
„	Probus, Lamelley	·23	„	Loch Ness, Drumnadrochit	1·20
„	Wincanton, Stowell Rec.	·69	XIX.	Invershin	·73
„	Weston-super-Mare	·25	„	Scourie	3·70
VI.	Clifton, Pembroke Road	·38	„	Watten H.R.S.	·90
„	Ross, The Graig	·21	XX.	Dunmanway, Coolkelure	·71
„	Wem, Clive Vicarage ...	·59	„	Fermoy, Gas Works ...	·47
„	Cheadle, The Heath Ho.	·78	„	Killarney, Woodlawn ...	·68
„	Worcester, Diglis Lock	·31	„	Tipperary, Henry Street	·72
„	Coventry, Coundon	·41	„	Limerick, Kilcornan ...	·24
VII.	Ketton Hall [Stamford]	·24	„	Ennis	·44
„	Grantham, Stainby	·38	„	Miltown Malbay	·75
„	Horncastle, Bucknall ...	·43	XXI.	Gorey, Courtown House	·44
„	Worksop, Hodsck Priory	·49	„	Mullingar, Belvedere ...	·61
VIII.	Neston, Hinderton	·56	„	Athlone, Twyford	·60
„	Knutsford, Heathside ...	·50	„	Longford, Currygrane ...	1·01
„	Lancaster, Rose Bank ...	1·49	XXII.	Galway, Queen's Coll...	·86
„	Broughton-in-Furness ..	3·38	„	Crossmolina, Enniscoe..	1·68
IX.	Ripon, Mickley	·59	„	Collooney, Markree Obs.	1·55
„	Scarborough, South Cliff	·18	„	Ballinamore, Lawderdale	1·70
„	East Layton [Darlington]	·40	XXIII.	Lough Sheelin, Arley ..	1·01
„	Middleton, Mickleton..	1·25	„	Warrenpoint	1·10
X.	Haltwhistle, Unthank..	·95	„	Seaforde	1·06
„	Bamburgh	·51	„	Belfast, Springfield	1·38
„	Newton Reigny	1·67	„	Bushmills, Dundarave...	1·75
XI.	Llanfrechfa Grange	·29	„	Stewartstown	1·34
„	Llandoverly	·80	„	Buncrana	2·05
„	Castle Malgwyn	1·21	„	Lough Swilly, Carrablagh	2·50

MARCH, 1893.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL.					TEMPERATURE.				No. of Nights below 32°	
		Total Fall.	Difference from average 1880-9.	Greatest Fall in 24 hours		Days on which -01 or more fell.	Max.		Min.		In shade.	On grass.
				Dpth	Date		Deg.	Date	Deg.	Date.		
		inches.	inches.	in.								
I.	London (Camden Square) ...	·32	— 1·29	·13	1	6	67·6	31	25·9	19	4	22
II.	Maidstone (Hunton Court)...	·39	— 1·11	·26	1	5	...	...	...	...	...	...
III.	Strathfield Turgiss	·37	— 1·22	·11	1	11	67·1	30	20·8	19	14	24
IV.	Hitchin	·38	— ·96	·17	1	6	66·0	30 _a	23·0	18	12	...
V.	Winslow (Addington)	·14	— 1·58	·07	2	4	68·0	30 _a	20·0	19	19	23
VI.	Bury St. Edmunds (Westley)	·32	— 1·23	·11	1	5	62·0	31	22·0	20	...	...
VII.	Norwich (Cossey)	·43	— ·99	·23	1	5	...	...	...	...	...	...
VIII.	Weymouth (Langton Herring)	·32	— 1·58	·08	1	7	57·0	26	29·0	19	2	...
IX.	Torquay, Babbacombe	·18	— 2·77	·07	1	6	62·9	30	32·5	11	0	17
X.	Bodmin (Fore Street)	·39	— 3·39	·09	1	12	...	...	...	...	...	...
XI.	Stroud (Upfield)	·25	— 1·94	·10	2	7	64·0	29 _b	29·0	18 _g	3	...
XII.	Church Stretton (Woolstaston)	·72	— 1·41	·16	2	7	65·0	30	26·5	19	5	17
XIII.	Tenbury (Orleton)	·39	— 1·69	·12	1	7	68·1	30	23·0	19	17	18
XIV.	Leicester (Barkby)	·37	— 1·34	·10	1	6	69·0	30	18·0	18	19	22
XV.	Boston	·34	— 1·20	·15	1	4	72·0	29	22·0	19	12	...
XVI.	Hesley Hall (Tickhill).....	·33	— 1·57	·15	1	6	68·0	25	22·0	19 _h	15	...
XVII.	Manchester (Plymouth Grove)	·65	— 1·57	·13	3	10	67·0	29	26·0	18	5	13
XVIII.	Wetherby (Ribston Hall) ..	·30	— 1·76	·11	17	4	...	...	...	...	...	...
XIX.	Skipton (Arncliffe)	2·63	— 2·47	1·16	1	8	...	...	...	...	...	...
XX.	Hull (Pearson Park)	·43	— 1·62	·18	1	6	65·0	24 _c	24·0	19	16	20
XXI.	Newcastle (Town Moor)	·59	— 2·04	·45	3	5	...	...	...	...	...	...
XXII.	Borrowdale (Seathwaite).....	8·67	— 1·83	4·12	1	13	...	...	...	...	...	...
XXIII.	Cardiff (Ely)	·41	— 2·57	·17	2	6	...	...	...	...	...	...
XXIV.	Haverfordwest	1·24	— 2·00	·79	1	9	61·5	30	26·0	20	11	16
XXV.	Aberystwith, Gogerddan	1·06	— 1·92	·30	6	9	...	...	...	...	...	...
XXVI.	Llandudno	·77	— 1·31	·20	2	7	...	...	...	...	...	...
XXVII.	Cargen [Dumfries]	1·76	— 1·54	·58	3	11	63·8	25	23·0	19	12	...
XXVIII.	Jedburgh (Sunnyside).....	·80	— 1·16	·33	1	6	68·0	24 _c	21·0	19	14	...
XXIX.	Old Cunnock	1·76	— 1·37	·35	1	14	...	...	...	...	...	...
XXX.	Lochgilphead (Kilmory)	4·05	— ·41	·81	16	17	...	...	18·0	17	14	...
XXXI.	Oban (Craigvarren)	2·49	...	·38	15	16	62·0	24	29·8	17	4	...
XXXII.	Mull (Quinish)	3·15	— ·69	·35	3	20	...	...	...	...	...	...
XXXIII.	Loch Leven Sluices	1·00	— 1·97	·40	4	5	...	...	...	...	...	...
XXXIV.	Dundee (Eastern Necropolis)	1·05	— 1·35	·50	15	9	65·2	25	26·2	18	13	...
XXXV.	Braemar	·57	— 2·07	·16	9	9	61·0	25	17·3	19	18	24
XXXVI.	Aberdeen (Cranford)	·73	...	·29	1	11	62·0	21	26·0	17	8	...
XXXVII.	Strome Ferry	4·06	— ·57	·99	14	21	...	...	...	...	...	...
XXXVIII.	Cawdor [Nairn]	1·28	— ·76	·35	16	12	...	...	...	...	...	...
XXXIX.	Dunrobin	1·27	— ·98	·31	9	11	60·0	25	25·0	18	6	...
XL.	S. Ronaldsay (Roeberry).....	1·80	— ·74	·23	1	19	56·0	23 _d	25·0	17	4	...
XLI.	Darrynane Abbey	1·02	...	·20	24 _a	13	...	...	...	...	...	...
XLII.	Waterford (Brook Lodge) ...	·56	— 2·34	·18	31	7	58·0	7 _e	29·0	27	4	...
XLIII.	O'Briensbridge (Ross)	·63	...	·17	18	10	58·0	26 _f	30·0	12	4	...
XLIV.	Carlow (Browne's Hill)	·58	— 1·79	·12	31	12	...	...	...	...	...	...
XLV.	Dublin (FitzWilliam Square)	·29	— 1·72	·10	2	8	64·8	29	34·0	17	0	12
XLVI.	Ballinasloe	·60	— 2·03	·19	2	12	60·0	29	32·0	11 _i	4	...
XLVII.	Clifden (Kylemore)	2·47	...	·45	3	19	...	...	...	...	...	...
XLVIII.	Waringstown	1·30	— 1·05	·42	2	13	67·0	25	28·0	20	7	15
XLIX.	Londonderry (Creggan Res.) ..	2·27	— ·46	·42	1	16	...	...	...	...	...	...
L.	Omagh (Edenfel)	1·71	— ·80	·65	1	17	65·0	23	30·0	13 _j	4	7

a And 31. *b* And 30, 31. *c* And 30. *d* And 25. *e* And 23, 25, 30. *f* And 28, 30. *g* And 19, 20. *h* And 29. *i* And 12, 21, 22. *j* And 16.

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

METEOROLOGICAL NOTES ON MARCH, 1893.

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.

HUNTON COURT.—[In the February table the total R should have been 3·46 in., not 3·65 in.]

STRATHFIELD TURGISS.—A very fine dry March, with hot sun by day and cold winds, and at night sharp frosts quite up to the end of the month.

HITCHIN.—The hottest and finest March in our record of more than 40 years. S on the 16th.

ADDINGTON.—The driest March on record here. From the 3rd until the end absolutely dry, with the exception of just enough R to measure on the 17th. Frost occurred on every night after the 17th, the days being beautifully fine and sunny. Blossom on plum trees was fully out during the last week.

BURY ST. EDMUNDS.—The finest month of March that I have known; the R the least in any March since observations commenced in 1857. The only other March with less than half an inch was 1875, when ·38 in. fell. Much bright sunshine, with high temp. and vegetation very forward. Horse chestnut in full leaf on 31st. S on 16th and 17th.

LANGTON HERRING.—A very beautiful, bright and sunny month. Although E fell on 7 days, the greatest fall was ·08 in., and there was absolute drought for the last 14 days. In the last 18 years in only 4 months has the R here been less; namely: Feb., 1891, ·03 in.; Nov., 1879, ·08 in.; May, 1876, ·18 in.; and July, 1885, 25 in. The mean temp. at 9 a.m., 44°·6, is 3°·3 above the average of 21 years. The fruit trees are between a fortnight and three weeks earlier than usual. Solar halo on 26th; lunar halos on 26th and 27th; fogs on 5 days.

BABBACOMBE.—A very warm, fine, sunny month, with very small R; light winds and a high and generally steady bar. Slight showers from 1st to 4th, on 6th, 7th and 9th and from 13th to 17th, but no R was gauged in the last 14 days. It was fine and sunny from 10th to 12th, 20th to 21st 23rd to 25th, and 28th to 30th. Warm from 1st to 16th, and 21st to 31st. The shade temp. rose above 60° on the last two days. The mean temp., 46°·9, mean shade max., 54°·5, min. in shade, 32°·5, and on grass, 25°·9, were higher, while the total R, ·18 in., and number of wet days 6, were less, than in any of the preceding 16 Marches. S.W. gale on the morning of 1st; solar halos on 7 days; lunar halos on 6 days; H on 17th; fog on 4 days

BODMIN, FORE STREET.—The driest and finest March on record. Very sunny and dry from the 17th to the end of the month, and some days exceedingly hot, especially 23rd, 24th, 25th, 29th and 30th; more like July than March. The hedges are decked with spring flowers, and the black thorn full of blossom.

WOOLSTASTON.—A beautiful month, very dry with a great deal of bright sunshine and frosty nights. Mean temp., 46°·6. S fell on the 16th. A very favourable month for the farmer.

ORLETON.—With the exception of 1852, the driest March recorded in 63 years, and also one of the warmest, the mean max. being the highest in March for 35 years, and the absolute max. the highest since 1858. A very large percentage of bright sunshine throughout, and from 19th to 25th, 7 days absolutely cloudless.

BOSTON.—The smallest recorded rainfall in March since 1850, when the present observations began, excepting 1856, when ·25 in. fell.

MANCHESTER.—For the first eight days the weather was generally damp and foggy, with drizzling rain. H showers on the 16th; a very winterly, cold, windy day, with S and H on 17th. From the 18th the weather was remarkably bright and sunny.

WALES.

Haverfordwest.—One of the finest, driest, and mildest March months recorded here. A very large percentage of sunshine and very little wind. Foliage very early, but owing to absence of rain and the night frosts, grass is exceedingly scarce; if the drought continues, hay will reach a fabulous price. Water is becoming very scarce. Only two drier Marches have occurred in the last 44 years, viz. : 1852, 1.21 in., and 1858, 1.07 in.

Gogerddan.—Very bright throughout the month, and very hot in the sun; scarcely a cloud to be seen.

SCOTLAND.

Cargen.—The first half of the month was wet and rather stormy. Two inches of S fell on 1st and 4½ on the 16th. Early in the morning of the latter day a pretty sharp TS occurred, accompanied by heavy H. The latter half of the month was very fine, the max. temp. one day reaching 63° 8, which is a higher temp. in March than we have had for some years; and a temp. below freezing point occurred on most nights. The range of temp. during the latter part of the month was on several occasions 30° and upwards in 24 hours. N. and E. winds prevailed for 15 days.

Jedburgh.—There was much high temp during the day and low during the night, which checked vegetation a good deal. The dry state of the land and its pulverized condition, was favourable for sowing cereals. It is generally stated to have been the finest seed-time in the memory of man.

Old Cumnock.—Stormy on the 2nd and 14th; H and S on the 16th and 17th; slight frosts at night from 18th to 30th.

Roeberry.—The first part of the month, up to the 18th, was cold and stormy, the rest of the month very fine.

IRELAND.

Darrynane Abbey.—A very fine month, the R being less than one-third of the average of March for the 14 years 1870-79 and 1890-93, and the smallest during that period. On the whole a warm month, the last week quite summer-like; vegetation very forward.

Waterford, Brook Lodge.—Very dry. The driest March for at least 44 years. Mean temp. 46°. H on 15th and 16th; fogs on 4 days, thick on the night of the 23rd; lunar halo on the 29th.

O'Briensbridge, Ross.—A singularly lovely month. R far below the average, and very little frost. An abundance of sunshine and no equinoctial disturbances. Fog on the 30th, for a few hours in the forenoon.

Dublin.—A singularly dry, warm, sunny month, more like May than March. It broke the record as regards height of temp., deficiency of R, and clearness of sky and bright sunshine. The mean temp., (48°·1), was 5° 0 above the average for the month, and no less than 9°·0 above that of March, 1892. It was even 0°·8 above the mean temp. of March, 1868 (47°·3), which had proved the warmest March (since these records began in 1865) up to the present year. The deficiency of R was equally striking, the only comparable year for drought in March, being 1871, when, however, .82 in. of R fell on 12 days, against .29 in. on 8 days in the present month. Not one-half of the sky was on the average covered with clouds, and the air was often very dry, consequently the diurnal range of temp. was large; hot sunshine by day being followed by sharp nights. Dry smoke fog on 8 days; high winds on 11 days, reaching the force of a gale on the 1st; S or sleet on the 16th and 17th; and H on the 1st and 16th.

Edenfel.—A month without any of the characteristics of March, and that would have done credit to most Aprils and many Mays. The last week was especially warm and brilliant, with max. shade temperatures ranging from 61° to 65° on five days, a reading higher by 7° than had been made here in March for 29 years. Swallows seen on 5th April, the earliest ever noted.