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CII.]

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THE WATER SUPPLY OF NORTH WESTERN EUROPE DURING THE SUMMER OF 1874.

[Two papers have been published in rapid succession by the most able men in France upon the supply of water which the springs and streams of their country will yield during the present summer. These papers are of such importance that we give them *in extenso*, and having, by the kindness of the authors, and of MM. Buys Ballot of Utrecht, Cavalier of Ostend, and others, been favoured with certain details, we shall, at the end of the translations, add a few words on the question as it affects the North-West of Europe generally.—Ed.]

Probable diminution of the yield of Spring Water in the basin of the Seine, in the Summer and Autumn of 1874. By MM. E. BELGRAND and G. LEMOINE.

[Extrait des *Comptes rendus des séances de l'Académie des Sciences*, t. lxxviii. séance du 1er Juin 1874.]

THE object of this note is to announce that the streams and springs of the basin of the Seine will continue to decrease from now to the middle of next October, when their discharge will be very low.

By this warning, which applies to more than four months, we do not wish to imply that there will be no rain during the summer, but that, however rainy the summer months may be, the yield of the springs will not be affected to any extent. The slight river floods, which might even result from summer rains, would very rapidly disappear, and the springs will nevertheless yield a very greatly diminished supply.

M. Dausse has proved that the rain of the summer months scarcely at all increases the volume of streams, as most of it is carried into the air by evaporation. The result of our own observations in the Seine basin has been that when at the end of May the yield of the springs is low, it does not increase during the hot months, and we know that the minimum yield usually occurs in October.

Hence it will be understood that from the rainfall of the cold months one can foresee within certain limits what will be the state of the streams during the ensuing summer. If the cold season has been a wet one, we may rest assured that the springs and water courses will yield well, up to the ensuing autumn. If, on the contrary, the cold

season has been very dry, the springs and water-courses will be, throughout the hot season, at a very low point.

Resting upon these principles, we, on June 4th, 1870, gave warning of the great dryness of the streams which prevailed even to the winter of 1870-71 (*Annales des Ponts et Chaussées*, t. xix. 1870.) We now attempt, for 1874, similar forewarnings.

A division of the year into two halves commencing and ending on the 1st May is very convenient for many hydrological questions. In the basin of the Seine the six months, May 1st to October 31st, form the hot season; and the six months Nov. 1st to April 30th, the cold one. What have been the characteristics of the past cold season?

I. The rainfall from Nov. 1st, 1873, to April 30th, 1874, has been, throughout the basin of the Seine, exceptionally small. In many parts it hardly reached half its usual amount, as is shown by the following abstract of the observations collected by the hydrometric service of the basin of the Seine. The table not only brings into juxtaposition the average rainfall and that of the past season, but it also includes that preceding the great droughts of 1858 and 1870. These two cold seasons were very remarkable for their small rainfall; but in that of 1873-74 it has been still less.

Rainfall in France in the Cold Season (Nov. 1st to April 30th).

| STATIONS. | Mean 1859-68. Depth. in. | 1873-4. | | 1869-70. | | 1857-8. | |
|-------------------------------|-----------------------------------|---------|---------------------|----------|---------------------|---------|---------------------|
| | | Depth. | Relation to Mean | Depth. | Relation to Mean | Depth. | Relation to Mean |
| LesSettons(Source of theCure) | 37·21 | 19·84 | 0·53 | 33·11 | 0·89 | 17·17 | 0·46 |
| Pannetière, Morvan | 16·34 | 9·88 | 0·60 | 14·45 | 0·89 | 11·46 | 0·70 |
| La Colancelle „ | 11·76 | 8·43 | 0·57 | 11·14 | 0·75 | 8·86 | 0·60 |
| Pouilly, Cote d'Or | 13·15 | 7·87 | 0·60 | 8·62 | 0·66 | 10·32 | 0·78 |
| Grosbois „ | 13·07 | 9·57 | 0·73 | 9·65 | 0·74 | 10·43 | 0·80 |
| Montbard „ | 13·70 | 7·60 | 0·57 | 8·50 | 0·64 | 9·17 | 0·69 |
| Grignon, near Montbard | ... | 8·66 | ... | ... | ... | ... | ... |
| Chanceaux(Source of theSeine) | 17·95 | 9·21 | 0·51 | 15·16 | 0·84 | 13·58 | 0·76 |
| Chatillon-sur-Seine | ... | 7·60 | ... | 9·69 | ... | ... | ... |
| Bar-sur-Seine | ... | 10·83 | ... | 9·84 | ... | ... | ... |
| Vassy | ... | 9·88 | ... | 11·85 | ... | ... | ... |
| Vitry-le-Français | 11·38 | 4·80 | 0·43 | 6·81 | 0·60 | 5·95 | 0·52 |
| Snappes, Chalons | ... | 6·85 | ... | 7·64 | ... | ... | ... |
| Sommesous | ... | 5·79 | ... | 5·91 | ... | ... | ... |
| Saint-Martin, Sens | 9·92 | 4·25 | 0·42 | 7·01 | 0·71 | 5·00 | 0·50 |
| Paris (La Villette) | 9·37 | 5·55 | 0·59 | 7·21 | 0·77 | ... | ... |
| „ (Observatoire, cour) ... | 10·04* | 5·59 | 0·56 | ... | .. | 6·54 | 0·65 |

* Mean of 45 years, 1818-62.

After a cold season with slight rainfall, it may sometimes happen that partial compensation is afforded by rain at the commencement of the hot season, when May is very rainy. It was in this hope that we have delayed, until the present date, the warning which is the purport of this note, but nothing of this kind has occurred. We have at

Paris (La Villette) in May only had 0.87 in. instead of 2.24 in. which is the mean amount for this month. This will, therefore, not lessen the deficiency.

II. The streams have, in every respect, faithfully agreed with the rainfall of the cold season 1873-74. It would be difficult, throughout the entire extent of the observations made upon the Seine and its tributaries, to find a winter and a spring when the waters have remained at a lower level. There was a slight flood on the Seine at the end of October, 1873, but it only gave a maximum of 4 ft. on the scale on the *pont d'Austerlitz* at Paris. Since then the highest points have been 3 ft. 3 in. from December 1st to 5th, 1873, and 3 ft. 7 in. on January 4th, 1874. On May 31st the river had fallen to 4 in. From 1854 to 1870 the Seine had every year reached a higher point than 6 ft. 7 in. on the *pont d'Austerlitz*. In the cold season of 1866-67, it exceeded 13 ft. 2 in. during 62 days, and in the cold season of 1872-73, on 34 days.

The mean height of the Seine deduced from daily observations at the *pont d'Austerlitz*, from November 1st, 1873, to April 30th, 1874, has been exactly 2 ft. Now, from 1732 to 1854, that is to say, in 122 years (1776 being lost) the mean of the same months has once been less; and there are only seven instances of its being less than 3 ft. 3 in. on the scale on the *pont de la Tournelle*, Paris.

| Cold Season. | Mean Scale reading | Highest point. |
|---------------|--------------------|--|
| 1749-50 .. | 1 ft. 6½ in. ... | 3 ft. 6 in., Feb. 25, 3 ft. 3 in., April 3 |
| 62-63 ... | 2 ft. 10½ in. ... | 4 ft. 5 in., Nov. 19, 7 ft. Mar. 6 |
| 66-67 ... | 2 ft. 7½ in. ... | 7 ft. 3 in., Feb. 16, 7 ft. 9 in., Mar. 7 |
| 1799-1800 ... | 3 ft. ... | 7 ft. 6 in., Nov. 18, 8 ft. 2 in., Feb. 1 |
| 1802-03 ... | 3 ft. 1 in. ... | 11 ft. 5 in., Feb. 19, |
| 18-19 ... | 2 ft. 6 in. ... | 8 ft. 6 in., Feb. 26, |
| 1834-35 ... | 3 ft. 1 in. ... | 8 ft. 4 in., Feb. 25, 8 ft. 7 in., Mar. 21 |

Before the construction of the weir near the Pont-Neuf, the indications on the scale of the *pont de la Tournelle* agreed with those on that of the *pont d'Austerlitz*.

III. The springs have, during the cold season just ended, presented characteristics analogous to those of the Seine, the height of which faithfully epitomize the meteorological phenomena of its whole basin. Usually, the yield of the springs gradually increases during the cold months, and is at its maximum at the end of March. This year, on the contrary, it has not increased throughout the winter. These facts are very clearly proved by the observations of the springs of the Vanne, which are intended to be brought to Paris. The gaugings calculated in litres, per second, have been as follows:—

| Years. | Jan. | Feb. | Mar. | Apr. | May | June | July | Aug. | Sept. | Oct. | Nov. | Dec. |
|--------|------|------|------|------|------|------|------|------|-------|------|------|------|
| 1870 . | 1015 | 1112 | 970 | 927 | 801 | 859 | 829 | 784 | 738 | 717 | 760 | ... |
| 1 . | ... | ... | ... | ... | 1036 | 1029 | 1051 | 1023 | 911 | 825 | 799 | 749 |
| 2 . | 726 | 818 | 938 | 1046 | 1055 | 965 | 908 | 936 | 825 | 767 | 898 | 1714 |
| 3 . | 1788 | 2080 | 1868 | 1973 | 1800 | 1476 | 1337 | 1309 | 1159 | 1049 | 1018 | 965 |
| 4 . | 909 | 966 | 886 | 851 | ... | ... | ... | ... | ... | ... | ... | ... |

This table shows very clearly the contrast of the cold seasons of 1872-73 and 1873-74, the one very wet, the other very dry. It shows

that in March and April, when the yield is usually greatest, there is this year less than at the same period in 1870. The streams during the hot season of 1870 were exceptionally low, and this year the same causes will produce the same effects.

Even in the middle of spring the want of water was felt in the country. For instance, at certain farms near Noyers (Yonne) they were obliged, at the end of April, to send carts to the river for water. This is the beginning of a scarcity from which we shall suffer much during the next three or four months, and nothing now can prevent it.

IV. The springs, though *principally* regulated by the rainfall of the cold season, are, nevertheless, like all natural and physical phenomena, influenced by precedent conditions. A dry winter will produce a much smaller summer discharge, if, during the previous summer, the springs have been lower than usual. We may consider that, under these circumstances, the subterranean waters continue to diminish. It was thus that the dryness of 1870 was increased by that of 1869 and 1868; and that of 1858 by that of 1857.

In what condition was the ground at the beginning of the cold season of 1873-74? During the hot season of 1873, the yield of the springs was in no respect unusual, there was no deficiency. We may easily perceive why that was the case, for the cold months of 1872-73 had been, starting from October, 1872, exceptionally rainy, so that the soil had regained its normal condition. From this time the yield increased sufficiently until the spring of 1873, and kept the rivers adequately supplied. This is corroborated by the following table of the minima of the Seine at Mantes during each hot season from 1857 to 1873, the minimum height of 1ft. 7in in 1873 notably exceeds that of the driest years; it should, however, be regarded as very low, since the *étiage* adopted for the Seine at Mantes corresponds to 2ft. 7½in.

| | | |
|-----------------------|--------------------|-----------------|
| 1857, 1 ft. 2 in. ... | 1863, 7 in. ... | 1869, 7 in. |
| 8, 4 in. ... | 4, 10 in. ... | 70, zero. |
| 9, 7 in. ... | 5, 5 in. ... | 71, 10 in. |
| 1860, 3 ft. 2 in. ... | 6, 2 ft. 2 in. ... | 72, 4 in. |
| 1, 10 in. ... | 7, 1 ft. 8 in. .. | 73, 1 ft. 7 in. |
| 2, 1 ft. 8 in. ... | 8, 4 in. | |

This storage of moisture in the lowest beds of the soil might have been sufficient to diminish the intensity of the scarcity of spring water which is now beginning; but the past cold season has been so dry, that this natural store from the season 1872-73 has completely disappeared. This is the result of the actual discharge of the springs up to the present time.

To sum up—the principles upon which we rest do not permit us to foresee the weather of the summer and autumn of 1874. It may be that they will be very dry, or very wet—we are, in this respect, in absolute ignorance.

But, whatever may be the meteorological characteristics of the hot season now beginning, its hydrological character is now fixed. We may say that, in all probability, *the water-courses and springs of the basin of the Seine will fall between now and the middle of next October to almost the lowest point yet observed.* After the middle of October the streams may further diminish, but we cannot speak positively on the subject. To prevent the perfect fulfilment of our forewarning, altogether exceptional rains (like those of Sept. 1866) must occur; but at this period of the year they have not occurred more than once in a century.

We know how numerous are the material necessities of mankind which depend upon our streams; it may be very necessary for agriculture, for the supply of canals, and of towns, not to be unprovided against the dearth of water, which has already commenced, and can only increase from now until October next.

After the reading of this note, M. Belgrand, in accordance with a remark of M. Elie de Beaumont, undertook that the actual discharge of the great Artesian wells of Paris should be determined with the greatest care, at least once a fortnight, throughout 1874 and the first six months of 1875.

Probable Decrease of discharge of Spring Water in the South-West of France, in the Summer and Autumn of 1874, by PROF. V. RAULIN.

(Bulletin de l'Association Scientifique de France, 5 Juillet, 1874, t. xiv. p. 223-4.)

THAT which Messrs. Belgrand and Lemoine have announced for the North of France, and especially for the basin of the Seine, is perfectly applicable to the South-West, and in particular to the basins of the Garonne and the Adour.

In fact, since the months of October and November, which were very rainy, the six months December to May have been, three of them extraordinarily dry, and three of them very dry, whence it results that the whole six months have only furnished a very small quantity of water; relatively less indeed than has fallen in the North of France.

In the basin of the Seine they have not registered more than half of the usual rainfall. In the South-West of France, the quantity fallen during these six months hardly reaches two-fifths of its mean amount. This is the result of the observations made at the Botanical School of Bordeaux by myself, and at Marcenx by M. Claverie.

This dearth of water during the last six months, appears to have extended over the whole plain of South-West France, and to the Pyrenees, for M. Schroder, junr., tells me that on the mountains, snow during the last fortnight was very rare; that the snow line was 500 or 600 metres (1,600 to 2,000 feet) above its usual level, in the neighbourhood of the Cauterets, and that it has already almost entirely disappeared from the summits of Marboré. Similar drought is not

altogether without precedent at Bordeaux. During the 160 years, which have elapsed since rainfall observations were commenced in 1714, it has occurred six times, viz., in 1750, 1768, 1779, 1781, and in 1864, and 1874.

It is superfluous for us to express our agreement with the views and remarks in the foregoing papers; we therefore proceed at once to compare the deficiency in France with that elsewhere. In order that our readers may have the opportunity of doing this as well as ourselves, we have prepared the following small table for the British Isles in exactly the same manner as that for France, given by MM. Belgrand & Lemoine,

Rainfall in the British Isles in the Cold Season (Nov. 1st to April 30th).

| STATIONS. | Mean 1859-68. Depth. | 1873-4. | | 1869-70. | | 1857-8. | |
|------------------|----------------------------|---------|---------------------|----------|---------------------|---------|---------------------|
| | | Depth. | Relation to Mean | Depth | Relation to Mean | Depth | Relation to Mean |
| Camden | 10.29 | 6.09 | 59 | 10.69 | 104 | ... | ... |
| Linton | 12.30 | 7.51 | 61 | 10.80 | 88 | 6.93 | 56 |
| Selborne | 15.37 | 12.66 | 82 | 16.24 | 106 | ... | ... |
| Hitchen | 10.02 | 7.96 | 80 | 10.37 | 103 | 8.54 | 85 |
| Banbury | 10.75 | 8.31 | 77 | 12.55 | 117 | ... | ... |
| Culford | 10.12 | 6.44 | 64 | 11.64 | 115 | ... | ... |
| Bridport | 16.13 | 11.72 | 73 | 12.89 | 80 | 8.54 | 53 |
| Barnstaple | 18.02 | 14.42 | 80 | 16.60 | 92 | 12.05 | 67 |
| Bodmin | 23.65 | 23.54 | 100 | 23.12 | 98 | 18.01 | 76 |
| Orleton | 12.99 | 10.41 | 80 | 14.30 | 110 | 10.93 | 84 |
| Boston | 9.31 | 5.32 | 57 | 10.16 | 110 | 5.39 | 58 |
| Derby | 10.12 | 8.17 | 81 | 10.69 | 106 | 5.80 | 57 |
| York | 9.83 | 6.91 | 70 | 11.32 | 115 | 4.88 | 50 |
| Arnccliffe | 28.16 | 29.11 | 103 | 33.69 | 120 | 12.92 | 46 |
| N. Shields ... | 12.28 | 5.81 | 48 | 11.70 | 96 | ... | ... |
| Rhayader | 21.10 | 20.25 | 96 | 24.65 | 117 | ... | ... |
| Llandudno .. | 13.01 | 10.99 | 85 | 15.28 | 117 | ... | ... |
| Dumfries | 18.48 | 12.45 | 67 | 17.46 | 94 | 16.55 | 89 |
| Nookton | 13.71 | 10.53 | 77 | 8.20 | 60 | 8.72 | 64 |
| Culloden | 12.11 | 11.97 | 99 | 8.73 | 72 | 10.90 | 90 |
| Sandwich | 18.81 | 19.91 | 106 | 19.71 | 105 | 13.57 | 72 |
| Waterford | 20.38 | 14.87 | 73 | 19.46 | 95 | ... | ... |
| Killaloe | 22.59 | 19.20 | 85 | 25.57 | 113 | 19.66 | 87 |

and also the accompanying rather elaborate, but extremely interesting folding table from data supplied to us by the friends mentioned above. A very few words are required to explain certain omissions, purposely made in the table, in order to render it compact. The N. for North Latitude is omitted, as unnecessary in a table referring only to Europe. All measurements are converted into, and given in, English inches; all ratios are printed in Egyptian type, to distinguish them from measurements of rainfall. In case this may fall into the hands

of any persons not accustomed to this mode of discussing rainfall observations, it may be well to state (1) that they may be regarded as the answer to the following rule of three sum, *e.g.*, if at Carcassonne the average rainfall in November is 2·61 in., and the actual fall in November, 1873, was 5·55 in., what was the ratio of that fall to the average, if the latter be taken as 100? then

$$\text{As } 2\cdot61 : 5\cdot55 :: 100 : 212\cdot6.$$

Of course the short cut to this is

$$\begin{array}{r} 2\cdot61 \overline{) 5\cdot5500} \quad (212\cdot6 \\ \underline{522} \\ 330 \\ \underline{261} \\ 690 \\ \underline{522} \\ 1680 \\ \underline{1566} \\ 114 \end{array}$$

and as this is nearer 213 than 212, the former is entered in the table. It will be obvious to all who are familiar with computations that there is a much easier way even than this, but we need not enter into further details.

(2) The advantage of reducing observations to this form is, that it facilitates enormously comparisons between the fluctuation of rainfall at various stations, no matter how widely different may be the total amount.

(3) From these few remarks it will be evident to every one that the real meaning of the following entries is:—

| 200 | 150 | 100 | 50 | 25 |
|-----------------------------------|--|----------------------------------|----------------------------------|---|
| Rainfall twice the average. | Rainfall half as much again as the average. | Rainfall just the average. | Rainfall half the average. | Rainfall one quarter the average. |

With these few words for the benefit of those not used to the subject, all will be able to examine the table with profit. The results appear to us to be for the several months as follows:—

November, 1873.—Rainfall small in Belgium, Holland, and across the middle of England and Ireland; near the average, in central France; and above it, in the south of France, the south-west of England and in Scotland.

December, 1873.—Extremely dry throughout France and England, not a quarter of the average. In Holland and Belgium it was about one-third; in Ireland, half; and in Scotland, nearly the average.

January, 1874.—Another extremely dry month in France, especially in the south (except Ardèche), rather more rain in the east and north of that country, and nearly the average in other parts of western Europe.

February, 1874.—Ardèche again excepted, the fall in France may be taken as half the average. In Belgium, Holland, and the outer portion of the British Isles the fall was about three-quarters the average; but in Cornwall, Worcester, and Dublin it was nearly double the average—**193, 196, and 190** respectively.

March, 1874.—There were scarcely any French stations where the fall exceeded one-third of the average, and in London there was not one-fifth. In Scotland the fall was about the average, and in Holland and Belgium it was nearly 40 per cent. in excess.

April, 1874.—This month was almost the opposite of March; it was very dry in Belgium, Holland and the east of France; and above the average in most other districts, except the east of England.

May, 1874.—Rainfall above the average in Belgium and Holland, below it elsewhere, especially in the south of England and north of France.

June, 1874.—Rather dry generally, especially in England; above the average at Bordeaux and in Orkney.

Taking now each country separately we find the following:—

France.—The dry period may be considered to have extended from the beginning of December to the end of May, and the average ratios are—

| | Dec.-May | Nov.-April | | Dec.-May | Nov.-April |
|-----------------|----------|------------|-----------------|----------|------------|
| Carcassonne ... | 47 | 74 | Les Settons ... | 52 | 55 |
| Marcenx ... | 50 | 57 | St. Martin ... | 41 | 45 |
| Vals ... | 72 | 84 | Paris ... | 48 | 58 |
| Bordeaux ... | 51 | 71 | | | |

The first column shows the six months of greatest deficiency, the second gives the values for the period chiefly affecting the yield of springs. The small differences between these last values and those in M. Belgrand's paper arise from his values being worked from the totals for the period, ours from the sums of the ratios. It is clear, however, by either method, and in whatever way the subject is treated, that one of the driest parts of France, that near Paris and Fontainebleau, has had for six successive months less than half its usual rainfall.

Belgium and Holland may be taken together, the rainfall being very similar, and at all stations the drought began with November, but was much less severe than in France; in fact, January had an average rainfall, and March considerably above it. The following are the mean ratios, worked out in the same manner as those for France:—

| Station. | Dec.-May. | Nov.-April. |
|---------------|-----------|-------------|
| Ostend ... | 80 | 67 |
| Utrecht ... | 90 | 71 |
| Helder ... | 86 | 78 |
| Groningen ... | 74 | 65 |
| Brussels ... | 75 | 74 |

The British Isles.—In some parts of these islands there has been no drought whatever, in others it has been almost as severe as in any part of the area under consideration. The mean ratios are—

| Station. | Dec.-May | Nov.-April. | Station | Dec.-May. | Nov.-April. |
|----------------|----------|-------------|--------------|-----------|-------------|
| London ... | 63 | 58 | Braemar ... | 126 | 108 |
| Bodmin ... | 111 | 97 | Sandwick ... | 105 | 95 |
| Orleton ... | 87 | 88 | Killaloe ... | 91 | 89 |
| N. Shields ... | 49 | 56 | Dublin ... | 75 | 76 |

From which it will be seen that in the south-west of England, and in Scotland (in fact, in wet places) the rainfall has been equal to, or greater than, the average; but at dry stations, like London and North Shields (just as at Paris and St. Martin), the fall has been little more than half the average.

There is, therefore, reason to believe that in the eastern part of England the supply of water in wells, ponds and streams will be very deficient, although not quite to the same extent as in north-eastern France.

PROPOSED ISSUE OF DAILY WEATHER CHARTS OF EUROPE AND THE NORTH ATLANTIC.

To the Editor of the Meteorological Magazine.

SIR,—I have the honour to inform you that Capt. Hoffmeyer, Director of the Royal Meteorological Institute of Copenhagen, has sent me a circular announcing his intention to publish daily charts of the weather for the district from 60° E. to 60° W. long. and from 30° to 75° N. lat. The charts for the three months—Dec. 1873-Feb. 1874—will be published as an experiment.

The cost will be four francs per month, exclusive of postal charges.

Capt. Hoffmeyer states that he can only deal with central offices, and has requested me to undertake these islands as regards the distribution of the charts. I have therefore to announce that I have been instructed by the committee to subscribe for twenty-five copies of these charts, and I shall be happy to supply copies for the three months to any gentleman, at the cost of 11s., to cover carriage from Copenhagen, and postage from London to his address.

ROBERT H. SCOTT, *Director.*

Meteorological Office, June 22nd.

A METEOROLOGICAL BREAKFAST AT BELFAST.

THE following paragraph appeared in our notice of the Bradford meeting of the British Association :—

“On looking over this list [of 39 Meteorologists present at Bradford] one cannot but regret that amid the one, two, or three thousand members and associates it is very difficult to pick up individual persons whom one wishes to meet. It also seems a pity that, as a rule, meteorologists do not hold more together than they have done. At the Edinburgh meeting Mr. Milne Home, as Convener of the Council of the Scottish Meteorological Society, gave a breakfast to the principal meteorologists at the meeting. We cannot expect to find a Mr. Milne Home at every town the Association visits, but surely it only requires *the will*, to arrange for a friendly breakfast limited to meteorologists, and to take place on the morning of the day (the Monday) appropriated by long established custom to the discussion of Meteorological papers in section A.”

We are very glad to say that Mr. Smyth, of Milltown, one of the best observers in the north of Ireland, has entered warmly into the scheme, and that arrangements will be made for carrying out this

suggestion at Belfast, on August 24th. The proposal having been originated by ourselves, it is almost superfluous for us to express our wish for its success ; but it is by no means certain that the result will be such as to ensure its becoming a permanent institution, unless each reader of these lines does his utmost to advance the proposal, and to make it known to his friends. This early notice of the date will prevent anyone having a previous engagement for that morning, and if the gathering is half as pleasant as that at Mr. Milne Home's, we are sure that those who are absent will have cause to regret it.

A word or two as to details, the room will be open at 8.30 a.m. for conversation, breakfast will be served at 9 a.m. *precisely* (as many will require to be at Sectional Committees at 10). Seats can only be guaranteed to those who send in their names previously ; the cost will be very small, not exceeding five shillings, and being probably less ; until August 15th all communications should be addressed to Mr. G. J. Symons, 62, Camden Square ; after that date, Reception Room, Belfast.

SUPPLEMENTARY TABLE OF MONTHLY RAINFALL.

WE have been requested by several of our readers to print the total fall of rain at a few stations in addition to those given in our present table. We always desire to receive suggestions for improvement, and act upon them whenever we can. Admitting that there are in the present table considerable interstices, we accept the suggestion, and will insert in future a table similar to the following, and will enlarge it by the addition of such other records as may be promised to be sent to us, by the 4th of each month, from stations 15 miles distant from any of our regular stations, or from any of those quoted below (all of which fulfil this condition). Of course we shall only be able to accept one offer for each vacant district.

| Div. | County. | Station. | Total Fall. |
|--------|--------------------|-----------------------------------|----------------|
| | | | in. |
| II. | Kent | Margate, Acol | 1.43 |
| " | Sussex | Hailsham | 1.61 |
| " | Hampshire | Strathfield Turgiss | 0.90 |
| IV. | Suffolk | Ipswich, Bishop's Hill | 1.10 |
| " | Norfolk | Swaffham | 2.13 |
| V. | Devon | Teignmouth | 1.48 |
| " | Somerset | Taunton, The Castle | 1.07 |
| IX. | York | Wakefield, Stanley Vicarage | 0.74 |
| X. | Westmoreland | Shap | 1.86 |
| XI. | Pembroke | Castle Malgwyn | 1.25 |
| XVII. | Banff | Keith | 1.49 |
| XVIII. | West Ross | Strathconan | 4.02 |
| XX. | Cork | Fermoy, Glenville | 1.48 |
| XXI. | Westmeath | Athlone, Twyford | 1.50 |
| XXII. | Galway | Ballinasloe | 1.95 |

REVIEWS.

Report of the Rugby School Natural History Society for the Year 1873.

8vo. 76 pp. 3 plates. W. Billington : Rugby.

THE principal feature in this report is a paper by Mr. R. H. Scott, F.R.S. (Old Rugbeian), upon the Weather, giving a popular account of the general principles upon which the warnings of the Meteorological Office are based. We should be glad to see, that the boys themselves take an increasing interest in the work of the Society, the Meteorological register fuller, so re-arranged that the months are not divided, and supplemented by an abstract for the year. The right to prepare this abstract might perhaps be awarded to those who supplied most notices of halos, auroræ, thunderstorms, &c., the addition of which to the present list of instrumental readings would be a great improvement.

S. W. Silver and Co.'s Handbook for Australia and New Zealand.

Royal 8vo., 413 pp., 1 plate. Silver & Co., London.

ALTHOUGH there is no statement or advertisement to that effect, we believe that this work is the first of a series, which is to embrace the whole colonial empire of Great Britain—if so, we pity the compilers of the future issues, because they will naturally be expected to equal, if they do not surpass, the first of the series, which will be a very difficult task for several reasons. With future issues we have, however, nothing to do, and therefore we turn again to the work before us. It is, to the best of our judgment, very impartial, as well as very comprehensive, and well arranged. Each colony is treated separately, so that we have New South Wales, Victoria, South Australia, Queensland, Western Australia, Tasmania, and New Zealand; and respecting each colony the following subjects are treated—"Discovery, History, Geography, Climate, Geology, Natural History, Botany, Government, Population, Statistics, Education, Religion, Pastoral, Agricultural, Mining, Trade, Manufactures, Land Laws, Immigration, Rates of Wages, Prices of Provisions, Hints to Intending Emigrants." When our readers have recovered their breath after reading this long list, they may wish to know whether these numerous and various heads are properly treated; we have no hesitation in saying that all those branches of which of we are competent to judge are very well done, a remarkably large amount of information being given in a very condensed manner. The articles on climate are extremely good, and if they were all cut out of this work, and published with a separate title as a "Climate of Australia and New Zealand," we should be obliged to acknowledge it the most complete work of which we are aware. A practised meteorologist will see by two or three entirely unessential "trips" that the compiler is not familiar with the science, and will, therefore, probably share our high appreciation of one who could treat so well a subject with the technicalities of which he is evidently not familiar. It would be absurd for

us to attempt to epitomize the climate of our Antipodean empire in a single page, and we shall therefore not attempt it, but refer those of our readers who require information to this pleasantly written Australasian Encyclopædia.

We should not greatly regret the loss of the frontispiece, and we think that a series of maps of the colonies giving every place named in the text would be very valuable. It would also be better to abolish the head-line "Handbook to Australia and New Zealand," which is repeated on every left hand page (*i.e.* 194 times) and to give instead the name of the colony treated upon each opening of the book.

The Fenland Meteorological Circular and Weather Report. Edited by S. H. MILLER, F.R.A.S., F.M.S. No. I.-VI., Feb.-July, 1874. 4to. Leach & Son, Wisbech.

THE title of this new serial is so expressive, that it is unnecessary for us to say much respecting its contents, which (as those who know the editor would assume), are uniformly good. The circular aims at being a storehouse of meteorological records for the Fen district, and at bringing the medical and agricultural uses of meteorology forward in such a way as to prevent the present generation remaining, or the next growing up, incompetent to understand how much the atmosphere influences almost every sphere of human action. The observations at Wisbech are printed in great detail, and supplemented by a barometer diagram; there are also abstracts of those at about a dozen stations between Cambridge and Louth, with remarks upon the weather and crops. Considerable attention is given to tidal records, and we are glad to see in later numbers an increasing tendency towards giving them in relation to Ordnance datum; as many of the notes on this subject bear the signature of W. H. Wheeler, their trustworthy character may be taken for granted.

The editor should, however, not attempt more than is within his power; his June table bears the date of July 9th, which is remarkably early to issue tables based on returns from any staff of observers, earlier than any of the county associations with which we are acquainted, and implies an undue pressure on the editor's time, of which there is proof in half a dozen misprints on page 40. True they are mostly obvious, and printer's errors, but their presence shows that the proofs have been read too hastily. Few know better than we do the difficulty of maintaining a high standard of accuracy, especially when work is hurried, but there can be no question that Meteorological printing must be either very accurate, or—worthless. When the Editor reads this he will doubtless think that we are (as we are so often said to be) too severe. Probably he knows nothing of a storm (upon this subject) now gathering, but when it has burst he will feel that the unkind cut in the *Meteorological Magazine* was one of the most serviceable reviews which he had.

We think that this publication merits support even beyond the area to which it specially appeals, and we wish it a long and successful career.

JUNE, 1874.

| Div. | STATIONS. [The Roman numerals denote the division of the Annual Tables which each station belongs.] | RAINFALL. | | | | Days on which "01 or more fell. | TEMPERATURE. | | | | No. of Nights below 32° | |
|----------|--|----------------|--|----------------------------------|-------|------------------------------------|--------------|-------|------|-------|----------------------------------|----------|
| | | Total Fall. | Differ- ence from average 1860-5 | Greatest Fall in 24 hours. | | | Max. | | Min. | | | |
| | | | | Dpth | Date. | | Deg. | Date. | Deg. | Date. | | |
| | | | | | | | | | | | | |
| | | inches. | inches. | in. | | | Deg. | Date. | Deg. | Date. | In shade | On grass |
| I. | Camden Town | 2.05 | — 1.00 | .72 | 23 | 12 | 81.7 | 2 | 39.5 | 13 | 0 | 0 |
| II. | Maidstone (Linton Park) | 2.63 | — .11 | .73 | 17 | 11 | 83.0 | 5 | 32.0 | 13 | 1 | ... |
| III. | Selborne (The Wakes) | 2.63 | — .60 | .47 | 26 | 10 | 75.0 | 5 | 34.0 | 13 | ... | 1 |
| IV. | Hitchin | 1.35 | — 1.29 | .36 | 23 | 14 | 74.0 | 9 | 35.0 | 12 | 0 | ... |
| V. | Banbury | .50 | — 2.78 | .27 | 29 | 8 | 78.0 | 9 | 38.5 | 13 | 0 | ... |
| VI. | Bury St. Edmunds (Culford) | 1.64 | — .94 | .42 | 23 | 10 | 80.0 | 9 | ... | ... | ... | ... |
| VII. | Bridport | 2.46 | — .78 | 1.19 | 26 | 10 | 80.0 | 9 | 36.0 | 13 | 0 | ... |
| VIII. | Barnstaple | 1.48 | — 2.64 | .47 | 2 | 7 | 79.0 | 9 | 43.0 | 14 | ... | ... |
| IX. | Bodmin | 2.15 | — 1.89 | .80 | 26 | 10 | 70.0 | 10 | 36.0 | 13 | 0 | 2 |
| X. | Cirencester | 1.84 | — 1.54 | 1.05 | 28 | 7 | ... | ... | ... | ... | ... | ... |
| XI. | Shifnal (Haughton Hall) | .77 | — 2.34 | .46 | 24 | 10 | 74.0 | 9,30 | 39.0 | 15 | 0 | 0 |
| XII. | Tenbury (Orleton) | 1.15 | — 2.37 | .48 | 26 | 6 | 81.3 | 9 | 36.5 | 13 | 0 | 0 |
| XIII. | Leicester (Wigston) | .58 | — 2.18 | .23 | 29 | 9 | 80.0 | 2,* | 34.0 | 12 | 0 | ... |
| XIV. | Boston | .72 | — 1.47 | .33 | 2 | 7 | 81.0 | 5 | 38.0 | 15 | 0 | 0 |
| XV. | Grimsby (Killingholme) | .86 | ... | .20 | 29 | 9 | 76.0 | 9 | 40.0 | 12§ | 0 | ... |
| XVI. | Derby | 1.07 | — 1.82 | .37 | 24 | 10 | 80.0 | 9 | 41.0 | 12 | 0 | ... |
| XVII. | Manchester | 2.00 | — 2.34 | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| XVIII. | York | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| XIX. | Skipton (Arncliffe) | 1.53 | — 2.57 | .56 | 30 | 12 | 79.0 | 19 | 34.0 | 10 | 0 | ... |
| XX. | North Shields | 1.00 | — 1.74 | .59 | 24 | 8 | 72.0 | 4 | 37.0 | 12 | 0 | 0 |
| XXI. | Borrowdale (Seathwaite) | 3.02 | — 7.49 | 1.69 | 30 | 9 | ... | ... | ... | ... | ... | ... |
| XXII. | Cardiff (Ely) | 1.58 | — 3.06 | .54 | 24 | 5 | ... | ... | ... | ... | ... | ... |
| XXIII. | Haverfordwest | 1.31 | — 2.34 | .69 | 23 | 5 | 77.0 | 18 | 38.0 | 11 | 0 | ... |
| XXIV. | Rhayader (Cefnfaes) | .66 | — 3.32 | .35 | 24 | ... | 76.0 | ... | 35.0 | ... | 0 | ... |
| XXV. | Llandudno | .35 | — 1.94 | .09 | 29 | 5 | 72.0 | 4, 21 | 41.2 | 13 | ... | ... |
| XXVI. | Dumfries | .92 | — 1.98 | .30 | 25 | 10 | 74.0 | 18† | 36.0 | 12 | ... | ... |
| XXVII. | Hawick (Silverbut Hall) | .78 | ... | .27 | 24 | 6 | ... | ... | ... | ... | ... | ... |
| XXVIII. | Kilmarnock (Annanhill) | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| XXIX. | Castle Toward | 1.21 | — 2.28 | .40 | 1 | 6 | ... | ... | ... | ... | ... | ... |
| XXX. | Leven (Nookton) | .63 | — 1.61 | .27 | 30 | 5 | 75.0 | 19 | 34.0 | 12 | ... | 6 |
| XXXI. | Stirling (Deanston) | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... | ... |
| XXXII. | Logierait | 1.37 | ... | .55 | 23 | 9 | 85.0 | 17 | 34.0 | 11 | 0 | ... |
| XXXIII. | Braemar | 2.45 | — .99 | 1.17 | 29 | 14 | 70.0 | 17 | 34.3 | 18 | ... | 8 |
| XXXIV. | Aberdeen | .95 | ... | .46 | 21 | 7 | 74.0 | 4 | 39.5 | 13 | ... | 1 |
| XXXV. | Portree | 5.49 | + .71 | .80 | 1 | 19 | ... | ... | ... | ... | ... | ... |
| XXXVI. | Loch Broom | 5.41 | ... | .92 | 8 | 21 | ... | ... | ... | ... | ... | ... |
| XXXVII. | Inverness (Culloden) | .78 | — 1.14 | .21 | 22 | 17 | 67.8 | 28 | 35.1 | 12 | 0 | 2 |
| XXXVIII. | Helmsdale | 1.87 | ... | .47 | 10 | 11 | ... | ... | ... | ... | ... | ... |
| XXXIX. | Sandwick | 1.67 | + .13 | .58 | 10 | 14 | 64.0 | 2 | 40.2 | 11¶ | 0 | 0 |
| XL. | Caherciveen Darrynane Abbey | 2.34 | ... | ... | ... | 8 | ... | ... | ... | ... | ... | ... |
| XLI. | Cork | .91 | ... | .43 | 23 | 9 | ... | ... | ... | ... | ... | ... |
| XLII. | Waterford | 1.69 | — 1.30 | .62 | 22 | 8 | 74.0 | 18 | 42.0 | 13 | 0 | ... |
| XLIII. | Killaloe | 1.48 | — 2.15 | .40 | 30 | 8 | 78.0 | 4‡ | 40.0 | 8 | 0 | 0 |
| XLIV. | Portarlinton | .82 | — 2.43 | .20 | 25 | 11 | 72.0 | 18 | 37.5 | 12 | 0 | ... |
| XLV. | Monkstown, Dublin | .82 | — 1.79 | .39 | 21 | 10 | ... | ... | ... | ... | ... | ... |
| XLVI. | Galway | 3.65 | ... | 1.27 | 30 | 9 | 76.0 | 21 | 40.0 | 31 | 0 | ... |
| XLVII. | Ballyshannon | 1.85 | ... | .40 | 22 | 12 | 62.0 | 4 | 50.0 | 1 | 0 | 0 |
| XLVIII. | Waringstown | 1.40 | ... | .39 | 2 | 10 | 82.0 | 18 | 38.0 | 13 | 0 | 3 |
| XLIX. | Edenfell (Omagh) | 3.18 | ... | .75 | 24 | 13 | 73.0 | 17 | 35.0 | 21 | 0 | 0 |

* And 8 & 9. † 19. ‡ 7 & 15. § And 15. || 13. ¶ 12.

+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; TS for Thunderstorm; R for Rain; H for Hail; S for Snow.

ENGLAND.

LINTON PARK.—A few hot days in the first week. T on 6th, followed by a period of dry cold weather, with a decided frost on the 13th, (and in some places near here on other days as well, up to the 22nd); cold N. and N.E. winds blowing night and day from 12th to 16th, and our heaviest fall of R was from that direction. Very little T, but an average rainfall, the last week being showery. On the 13th I scraped rime from glass sufficient to form a small snowball.

SELBORNE.—Frost on the 13th, by which beans and potatoes were cut; T in afternoon of 21st; prevailing wind in middle of the month N.E., afterwards S.W. Hay extremely deficient from the extraordinary drought. From the 13th of April to the 22nd of June, (70 days) less than one inch ($\cdot 902$) of R has fallen. Mean max. temp. $68^{\circ}6$, mean min. $47^{\circ}4$.

CULFORD.—The coldest June of which I have any record, the temp. being at or below 32° on several days; on the 12th and 20th potatoes, beans, and tender plants were severely injured, and ice was found as late as six a.m. A severe TS with H on 24th; T also on 22nd and 25th. Polar or easterly winds prevailed on 16 days, and westerly on 14 days.

BRIDPORT.—Fine till the 22nd, from which date to the end of month (8 days) $2\cdot42$ in. of R fell; 17 days of easterly wind; severe TS, with heavy R ($1\cdot19$) on the 27th.

BODMIN.—Average temp. $62^{\circ}7$, being $4^{\circ}4$ above the average. The long drought was severely felt, and the R of the 22nd and following days was very welcome.

CIRENCESTER.—Thunderstorm on 28th, with $1\cdot05$ of R. No R fell between the 1st and 22nd.

SHIFFNAL.—This has been an ungenial June, owing chiefly to the cold nights. It opened favorably with temp. at 72° , from which it fell on 6th till (2 days excepted, 8th and 9th) the 29th. There were only slight showers on 4 days (6th, 9th, 21st, and 23rd) till the 24th, when a refreshing fall of $\cdot46$ took place, but shortly to be dried up by the westerly winds which prevailed; the pastures became bare as in August, and the hay crops on uplands very light; the wheat stood the drought well, and is likely to be a good crop. Turnips and mangold wurzel scarcely grown. The nights only reached temperate twice (5th and 9th); T on 27th; cumuli clouds frequent.

ORLETON.—A very dry month, with a mean temp. of about $\frac{1}{2}^{\circ}$ above the average. Very fine and pleasant till the 12th, when cold winds set in from the N., which continued till the 22nd; variable afterwards, with showers. A great shower of R fell on the 26th at 7.15 p.m., when $\cdot20$ of an inch fell in five minutes; distant T heard on 21st, 22nd, 24th, 25th, and 27th.

WIGSTON.—Owing to the continued absence of R the hay crops are not half the average, and the pastures are very poor. Corn looks well generally, but owing to the absence of sun it makes but slow progress.

BOSTON.—A very fine dry month; temp. about 1° below the average; a period of very cold weather occurring in the middle of the month. R more than an inch below the average; water very scarce. The pastures burnt up, and the hay crops very thin; wheat and other cereals looking splendid, the straw standing straight up, very level, with good heads, in ear about the 9th, which is very early; wild flowers very luxuriant; strawberries ripe in the air about the 26th; TS on the 1st and 22nd; T on 25th.

GRIMSBY.—The leaves of many ash trees have not opened fully. Hay crops very light, and the prospects of a crop of turnips very bad; most of the ponds dry, and springs very low. High bar. until the last week. TS 24th and 25th, in the after part of the day; T at 4.40 p.m. on 2nd, and at midday on the 22nd.

ARNcliffe.—Rainfall very much below the average; T on nearly every day of the last week; very high wind on 17th, from N. and N.E.,

NORTH SHIELDS.—Strawberries ripe on the 21st; TS on the 24th, four hours after the storm the hail was lying in heaps unmelted; pieces of ice fell three quarters of an inch long, cutting holes in the leaves of plants; .59 fell in one hour; another TS on the 29th.

SEATHWAITE.—Only one day on which the fall exceeded one inch, viz., the 30th, when 1.69 was measured, there being T on that day; T also on 24th, 25th, and 27th.

WALES.

HAVERFORDWEST.—.05 in. of R fell on the 1st; for 21 days after no R fell; 1.26 was measured during the last 7 days, this, however, came too late to save the country from the effects of the drought, which set in on the 13th of April, from which time till the 23rd of June only 1.32 in. of R fell. This dry season has been the most severe in this country since the memorable one of 1859, when the drought lasted from the last week in April to the second week in August. Temperature at or above 70° on nine days.

CEFNFAES.—A very dry month (only one sixth of the average); great want of water in this hilly country. Partial T showers, with heavy rains in some parts. Wind N.E. and S.E.; frosts at night.

LLANDUDNO.—The month has been remarkably dry; the prevailing winds N. and N.E.; the evenings occasionally chilly. Elder in flower on the 2nd, wheat in ear on 8th, began to cut hay on 9th, barley in ear on 18th.

SCOTLAND.

DUMFRIES.—The weather very droughty up to the 21st, and at the close of the month. On the morning of the 12th a frost, which blackened potatoes on mossy and low-lying soils, but did no injury on higher and drier land. The drought burned up the pasture on gravelly or sandy soils. Oats stunted in growth; hay, a very light crop; potatoes, where not injured by the frost, good; turnips, where sown early, very promising. Rainfall lowest since 1868: T on 25th and 26th.

SILVERBUT HALL (HAWICK).—T on 23rd. A month of extreme drought and cold E. wind; pastures burnt up from lack of moisture.

CASTLE TOWARD.—A dry warm month, with only six days of rain, the 1st, 2nd, and 3rd, and three others at intervals. Very little grass, and almost everything burnt up. Apples and pears scarce; currants plentiful; potatoes look well. Hay cutting commenced.

NOOKTON.—T on 29th.

BRAEMAR.—A very dry month; soil burnt up; hay crop light. TS 10.30 a.m. to 3 p.m. on 29th, total fall 1.17, .85 of which fell during the H storm, which lasted 35 minutes. TS on 25th, and T on 30th.

ABERDEEN.—A month of rather warm and very dry weather. The storm of the 21st was very brief, but the L damaged a house in the east end of the town. T reported every day to the end of the month in the neighbouring districts. On the 29th a "terrific" TS in Tarland district; a correspondent says, "several hours after the storm abated a hill to the S. of Aboyne continued thickly coated with S (or H) to its base, just as white as I ever saw Morven in January." In the TS on the 21st, .42 fell in 50 minutes.

PORTREE.—A very mild month; fine growing weather; the crops have made great progress; pasture grass very plentiful and cattle in prime condition. On 24th several loud peals of T, with a fearful fall of H, or rather lumps of ice, which remained in sheltered places to the depth of 2 inches for six hours after falling. On the 29th more T, with heavy R. At Sligachan H fell to the depth of 4½ inches.

LOCHBROOM.—This has been an excellent month for the farmer, plenty of sunshine and showers, with warmth without overheat; just a month to suit the working man and the growth of the produce of the soil; seldom have we such fine weather.

SANDWICK.—The rainfall of June has been below the mean of the previous 33 years. The first and last third of the month were generally pleasant, but from

the 10th to the 20th there was frequently northerly winds, with a touch of W., which made that part disagreeably cold. A gale of 45 miles an hour from 1 to 2 a.m. on the 10th.

IRELAND.

WATERFORD.—Vegetation suffered from the long drought; pastures burnt up, but revived by the welcome rain of the last few days. T and H on 24th, wind ranging from S.W. to W. and N.W.

KILLALOE.—Distant T on 24th and 25th.

BALLYSHANNON.—The month has been an unusually fine and dry one, and the crops are promising very well with the exception of the hay, as the drought has retarded the growth of the grass.

WARINGSTOWN.—An exceedingly dry month; meadows, turnips, flax, and indeed all crops, suffered much from want of rain.

EDENFELL, OMAGH.—Fine, dry, generally clear, and occasionally hot up to 21st; from that time to the end of the month, unsettled, with heavy showers. Hay harvest interrupted, but general effect of the rain exceedingly beneficial to all growing crops.

"POCKY CLOUDS."

To the Editor of the Meteorological Magazine.

SIR,—Is it too late to object to the above name? it by no means struck me as pleasant or appropriate, and reference to various dictionaries has increased rather than lessened my repugnance. How came Dr. Clouston to use such a name?

Yours truly,

E. S. H.

[We believe that although Dr. Clouston (in 1822) was the first scientific man who called attention to, and described, this cloud, it was previously well known to (and much dreaded by) Orcadian sailors, and that it was they, and not Dr. Clouston, who gave it the name above objected to. If our correspondent had carefully read the pamphlet to which we called attention, he would have noticed that Dr. Clouston speaks of "festoons or pocks)," and elsewhere of "drapery containing something heavy." The word is derived from the Saxon "*poc*," a swelling or bag; hence "pocket," a diminutive of "*poc*," i.e., "a little bag." "Pocky," therefore, which means baggy, is not an incorrect description of this form of cloud; but the expression is infelicitous on account of its more frequent use in reference to a loathsome disease.—ED.]

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