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ON THE RAINFALL OF SOUTH-WESTERN EUROPE AND ALGERIA.

THREE months since we inserted a translation of a portion of Professor Raulin's memoir, *Sur le Régime Pluvial du Bassin Occidental de la Méditerranée.* Almost simultaneously we received from our distinguished correspondent another memoir on the *Régime Pluvial de l'Algérie.* It was so evidently desirable that these memoirs should be jointly considered, that we deferred printing the second portion of the first paper until all the measures had been converted into English inches, and we were in a position to complete the consideration of the subject and place it clearly before our readers. In the present number we resume the translation of the first memoir, giving conversions of the most important tables, and a map showing the mean annual rainfall, in inches, at all the stations mentioned in *either* memoir.

"Lastly, the examination of the annual totals shows that very little rain falls at Madrid (16), and at Alicante (17), it increases at Valencia (21), and at Perpignan (21½), then gradually on the French coast at La Nouvelle (22), Sallèles-d'Aude (22), Béziers (24), Cette (29), increasing at Montpellier to 36, and then decreasing at Nîmes to 25, at Marseilles to 22, and at Toulon to 19. On the S.W. coast of Italy it is very considerable, at Genoa (51), then decreases at Pisa to 49, at Rome to 38, and at Naples to 33, and at Locorstondo to 35, and especially in Sicily, at Nicolosi to 28, and at Palermo to 23. In Africa, it is at Constantine (24), very little greater than at Palermo, less at Sétif (16), greater at Algiers (35), and less again at Oran (19). The quantities become greater at Gibraltar (29), and at Lisbon (31).

"In the interior of the Mediterranean the annual quantities decrease gradually from east to west, from Rome (38), by Ajaccio (25), to Palma (17), and Alicante (17). At Molfetta (21), on the Adriatic, there is not much more rain than on the south-east of Spain.

"Towards the north, in France, the well-marked Mediterranean rainfall district does not extend far inland. It is limited by La Montagne Noir, Les Cévennes, and Mont Pilat.

"This at least is the result indicated by the means for Castelnaudary, Saint-Ferriol, Albi, Rodez, Le Puy, and Lyons, which belong to different systems on the north-west of the mountain chains.

"In the west, the want of rainfall observations in northern Spain, prevents our ascertaining if the amount increases from Madrid up to the Pyrenees and the mountains of Asturia.

"Towards the east, we may be led to believe that a similar system extends even to the Alpine chain, which forms a lofty barrier between Italy and Germany. Nevertheless, the series of observations made in the plain of northern Italy, and which I have quoted for Milan, Padua, Chioggia, and Bologna, show that the basin of the Po possesses a distribution entirely different, and characterized like central and northern Europe by abundant summer rains. The line of demarcation between the two districts, wherein the seasonal distribution is thus wholly reversed, appears to be that of the Appenines from the Col de Tende, to Rimini on the Adriatic.

"Towards the south we know not yet how far the characteristics of the Mediterranean district extend into Algeria, for it is only since 1865 that meteorological observations have been made at the military hospitals in that country But in seven or eight years this want will be supplied, and we shall have ascertained facts, even on the great desert (Sahara) at Biskra and Laghouat, at from 100 to 200 miles inland.

Comparative Table of the Mean Monthly Rainfall in the Western Basin of the Mediterranean.

	Western Spain and Rousillon.				Southern Coasts of France.							
Station, Authority & Period.	A. Aguilar. 1859-67.	R. Chamorro. 1855-67.	J. Monserrat. 1857-67.	Béguin. 1856-67.	Ponts-et-Chausées. 1856-67.	Canal du Midi. 1856-67.	Crozals and Crouzat. 1856-67.	Doumet. 1864-67.	Martins. 1856-67.	Gasparin. 17 years before 1848.	Observatory. 1856-66.	Gasparin. 33 years before 1848.
	Madrid.	Alicante.	Valence.	Perpignan.	La Nouvelle.	Salleles d'Aude	Beziers.	Cette.	Montpellier.	Nimes.	Marseille.	Toulon.
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in
Jan.	1·36	·80	1·14	1·42	1·22	1·86	1·52	2·38	2·87	1·75	2·20	2·14
Feb.	·78	1·36	1·09	1·59	2·27	1·94	3·20	2·72	3·63	1·95	1·30	1·07
Mar	1·65	2·08	1·07	2·44	2·24	2·49	2·03	2·32	3·58	1·85	1·70	1·33
Apl.	1·41	2·14	1·51	1·18	1 70	·96	1·41	1·33	1·31	1·97	1·69	1·60
May	2·27	1·19	2·14	2·86	2·45	2·17	2·25	2·76	3·31	2·23	2·05	1·60
June	1·67	·42	·83	1·51	1·27	1·43	1·49	1·41	1·48	1·12	·90	·71
July	·19	·59	·58	·78	·54	·56	·43	·59	·59	1·07	·26	·36
Aug.	·24	·57	·46	·98	·98	·74	·69	·97	1·71	1·32	·54	·68
Sep.	1·01	1·78	2·33	2·21	2·48	2·37	1·46	3·51	3·95	3·63	2·84	2·62
Oct.	2·09	2·26	3·84	2·88	3·20	3·66	4·60	6·16	7·23	2·54	4·16	2·83
Nov.	1·65	2·20	2·86	2·07	2·22	2·32	3·12	2·95	3·67	3·92	1·99	2·67
Dec.	1·66	1·30	2·65	1·57	1·81	1·42	1·58	1·82	2·73	1·93	2·46	1·15
Totl.	15·98	16·69	20·50	21·49	22·38	21·92	23·78	28·92	36·06	25·28	22·09	18·76

Station, Authority & Period	S.W. Coast of Central Italy.			Mediterranean Isles		Southern Italy and Sicily.					Southern Spain and Portugal.	
	N. Fasiani. 1833-67.	Gasparin. 12 years before 1848.	M. Cat. Scarpellini. 1857-67.	Ponts-et-Chaussées. 1856-65.	F. Barcels. 1857-67.	Observatory. 1842-53.	Gasparin. 13 years before 1848.	A. Campanella. 1856-67.	Gemellaro. 27 years before 1848.	Cacciatore. 1856-67.	Kelaart. 1812-36.	Observatory of Dom. Luiz. 1856-63.
	Genoa	Pisa	Rome	Ajaccio	Palma	Naples	Molfetta	Locorotondo	Nicolosi	Palermo	Gibraltar	Lisbon
	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.	in.
Jan.	4·35	4·33	4·54	2·78	1·32	3·61	1·93	3·38	4·57	2·29	6·00	3·60
Feb.	4·38	2·78	2·91	1·97	1·51	3·87	1·83	2·78	2·66	2·36	2·50	3·96
Mar.	3·64	2·50	3·95	2·25	1·44	2·96	1·68	4·08	4·89	2·65	2·00	4·20
Apl.	3·74	4·20	1·72	1·44	1·54	2·32	1·35	1·65	2·27	1·54	3·00	3·36
May	3·61	2·89	2·38	1·94	1·14	1·59	1·63	1·65	·69	1·04	1·50	2·15
June	2·14	2·31	1·16	·86	·88	1·19	1·15	2·15	·41	·71	·50	1·98
July	1·39	1·88	·41	·05	·44	·54	·82	·74	·02	·06	·00	·78
Aug.	2·82	1·85	1·70	·56	·61	2·20	1·75	1·84	·17	·49	·50	·08
Sep.	5·46	5·76	2·73	1·39	2·24	3·04	2·31	3·33	1·98	1·22	1·00	·52
Oct.	8·26	6·77	7·48	3·79	2·30	3·85	2·43	4·10	3·72	3·90	2·50	1·03
Nov.	6·73	10·31	5·49	4·44	2·19	3·75	2·20	5·27	2·74	3·25	5·00	3·74
Dec.	4·06	3·38	3·99	3·35	1·72	4·03	2·25	4·07	3·75	3·54	4·00	5·40
Totl.	50·58	48·96	38·46	24·82	17·33*	32·95	21·33	35·04	27·87	23·05	28·50	30·80

Station, Authority & Period	Algeria.				Plains of Northern Italy.				Plains of S.W. of France.			
	Vital. 1854-67.	Dumas and Rengarde. 1857-67.	Hardy. 1855-67.	Ancour. 1854-63.	Gasparin. 68 years before 1848.	Gasparin. 48 years before 1848.	Gasparin. 26 years before 1848.	Gasparin. 18 years before 1848.	Abria. 1842-60.	Bartayres and Magen. 1850-60.	Adm. du Canal. 1809-60.	Adm. du Canal. 1839-60.
	Constantine	Setif	Alger	Oran	Milan	Padua	Chioggia	Bologna	Bordeaux	Agen	Toulouse	Castelnaudary
	in.	in.	in.	in.	in.	in.	in	in.	in.	in.	in.	in.
Jan.	2·76	1·70	5·46	3·20	2·84	2·59	3·06	·84	2·86	2·37	1·63	1·98
Feb.	3·01	1·67	4·49	3·62	2·12	1·86	1·67	1·25	2·13	1·74	1·60	1·77
Mar.	3·28	2·50	4·33	2·44	2·25	2·14	1·78	1·46	2·16	1·67	1·67	1·66
Apl.	2·31	1·83	3·13	1·49	3·07	2·21	2·02	1·36	2·87	3·00	2·46	2·38
May	1·77	1·46	1·47	1·28	3·73	3·00	2·17	1·42	2·51	3·34	3·31	3·31
June	·93	1·07	·95	·20	3·17	3·60	2·71	3·30	2·34	2·59	2·45	2·48
July	·11	·13	·03	·06	2·94	2·72	2·83	1·28	1·88	1·75	1·87	1·61
Aug.	·34	·55	·22	·16	3·06	2·62	2·20	1·69	2·93	2·43	1·72	1·87
Sep	·90	1·16	·75	·58	3·27	3·00	3·07	2·20	2·98	2·41	2·29	1·99
Oct.	2·38	1·23	2·97	1·18	4·33	3·91	3·68	2·82	4·03	2·85	2·27	2·04
Nov.	2·32	1·44	4·50	2·76	4·13	3·63	3·43	1·68	3·16	2·13	1·78	2·19
Dec.	4·31	1·61	6·78	2·15	3·13	2·54	2·71	1·78	2·42	2·15	1·85	1·50
Totl.	24·42	16·35*	35·08	19·12	38·04	33·82	31·33	21·08	32·27	28·43	24·90	24·78

* The totals for Palma and Sétif are given as 452mm·8 (=17·80 in.) and 412mm·6 (= 16·25 in.), but the values in the tables are the sums of the monthly amounts, and probably correct.

"*Postscript.*—Since presenting this note at the meeting of the learned societies, at La Sorbonne, in April, 1868, I have become aware of the Etudes sur les mouvements généraux de l'atmosphère (Ann. de la Soc. met., t. xv., p. 8). M. Sourel has arrived (p. 62-63) at the following result, by the study of the circulation [of the atmosphere] on the surface of the Mediterranean basin during the meteorological year 1865. We see, in short, as general rules, decreasing condensation from north to south, and from west to east; the maximum of rain in autumn in the north, the centre, and the west of the Mediterranean, and in winter in the south. Autumn is the rainy season for the western basin of the Mediterranean, except for Algeria, where the maximum is in the winter."

REMARKS ON THE PRESENT STATE OF METEOROLOGICAL SCIENCE.

By John Ruskin, Esq., of Christ Church College, Oxford.

[*Reprinted from the "Transactions of the Meteorological Society," Vol. I., published in* 1839.]

The comparison and estimation of the relative advantages of separate departments of science, is a task which is always partially executed, because it is never entered upon with an unbiassed mind; for, since it is only the accurate knowledge of a science which can enable us to perceive its beauty, or estimate its utility, the branch of knowledge with which we are most familiar, will always appear the most important. The endeavour, therefore, to judge of the relative *beauty* or *interest* of the sciences, is utterly hopeless. Let the astronomer boast of the magnificence of his speculations—the mathematician of the immutability of his facts—the chemist of the infinity of his combinations, and we will admit that they all have equal ground for their enthusiasm. But the highest standard of estimation, is that of utility. The far greater proportion of mankind, the uninformed, who are unable to perceive the beauty of the sciences, whose benefits they experience, are the true, the just, the only judges of their relative importance. It is they who feel what impartial men of learning know, that the mass of general knowledge is a perfect and beautiful body, among whose members there should be no schism, and whose prosperity must always be greatest, when none are partially pursued, and none unjustly neglected. We do not, therefore, advance any proud and unjustifiable claims to the superiority of that branch of science for the furtherance of which this Society has been formed, over all others; but we zealously come forward to deprecate the apathy with which it has long been regarded, to dissipate the prejudices which that apathy alone could have engendered, and to vindicate its claims to an honourable and equal position among the proud thrones of its sister sciences. We do not bring meteorology forward as a pursuit adapted for the occupation of tedious leisure, or the amusement of a careless hour,

Such qualifications are no inducements to its pursuit by men of science and learning, and to these alone do we now address ourselves. Neither do we advance it on the ground of its interest or beauty, though it is a science possessing both in no ordinary degree. As to its beauty, it may be remarked that it is not calculated to harden the mind which it strengthens, and bind it down to the measurement of magnitudes, and estimation of quantities, destroying all higher feelings, all finer sensibilities; it is not to be learned among the gaseous exhalations of the deathful laboratory; it has no dwelling in the cold caves of the dark earth; it is not to be followed up among the charnel houses of creation. But it is a science of the pure air, and the bright heaven; its thoughts are amidst the loveliness of creation; it leads the mind, as well as the eye, to the morning mist, and the noon-day glory, and the twilight cloud—to the purple peace of the mountain heaven—to the cloudy repose of the green valley; now expatiating in the silence of stormless æther, now on the rushing of the wings of the wind. It is indeed a knowledge, which must be felt to be, in its very essence, full of the soul of the beautiful. For its interest, it is universal; unabated in every place, and in all time. He, whose kingdom is the heaven, can never meet with an uninteresting space—can never exhaust the phenomena of an hour; he is in a realm of perpetual change, of eternal motion, of infinite mystery. Light and darkness, and cold and heat, are to him as friends of familiar countenance, but of infinite variety of conversation; and while the geologist yearns for the mountain, the botanist for the field, and the mathematician for the study, the meteorologist, like a spirit of a higher order than any, rejoices in the kingdoms of the air.

But, as we before said, it is neither for its interest, nor for its beauty, that we recommend the study of meteorology. It involves questions of the highest practical importance, and the solution of which will be productive of most substantial benefit to those classes who can least comprehend the speculations from which these advantages are derived. Times and seasons, and climates, calms and tempests, clouds and winds, whose alternations appear to the inexperienced mind the confused consequences of irregular, indefinite, and accidental causes, arrange themselves before the meteorologist in beautiful succession of undisturbed order, in direct derivation from definite causes; it is for him to trace the path of the tempest round the globe—to point out the place whence it arose—to foretell the time of its decline—to follow the hours around the earth, as she "spins beneath her pyramids of night" —to feel the pulses of the ocean—to pursue the course of its currents and its changes—to measure the power, direction, and duration of mysterious and invisible influences, and to assign constant and regular periods to the seed-time and harvest, cold and heat, summer and winter, and day and night, which we know shall not cease, till the universe be no more. It may be thought we are exaggerating the effects of a science which is yet in its infancy. But, it must be remembered, that we are not speaking of its attained, but of its attainable

power; it is the young Hercules, for the fostering of whose strength the Meteorological Society has been formed.

There is one point, it must now be observed, in which the science of meteorology differs from all others. A Galileo, or a Newton, by the unassisted workings of his solitary mind, may discover the secrets of the heavens, and form a new system of astronomy. A Davy in his lonely meditations on the crags of Cornwall, or, in his solitary laboratory, might discover the most sublime mysteries of nature, and trace out the most intricate combinations of her elements. But the meteorologist is impotent if alone; his observations are useless, for they are made upon a point, while the speculations to be derived from them must be on space. It is of no avail that he changes his position, ignorant of what is passing behind him and before; he desires to estimate the movements of space, and can only observe the dancing of atoms; he would calculate the currents of the atmosphere of the world, while he only knows the direction of a breeze. It is perhaps for this reason that the cause of meteorology has hitherto been so slightly supported; no progress can be made by the enthusiasm of an individual; no effect can be produced by the most gigantic efforts of a solitary intellect, and the co-operation demanded was difficult to obtain, because it was necessary that the individuals should think, observe, and act simultaneously, though separated from each other, by distances, on the greatness of which depended the utility of the observations.

The Meteorological Society, therefore, has been formed, not for a city, nor for a kingdom, but for the world. It wishes to be the central point, the moving power, of a vast machine, and it feels that unless it can be this, it must be powerless; if it cannot do all it can do nothing. It desires to have at its command, at stated periods, perfect systems of methodical, and simultaneous observations; it wishes its influence and its power to be omnipresent over the globe, so that it may be able to know, at any given instant, the state of the atmosphere at every point on its surface. Let it not be supposed that this is a chimerical imagination—the vain dream of a few philosophical enthusiasts. It is co-operation which we now come forward to request, in full confidence, that if our efforts are met with a zeal worthy of the cause, our associates will be astonished, *individually*, by the result of their labours in a body. Let none be discouraged, because they are alone, or far distant from their associates. What was formerly weakness, will now have become strength. Let the pastor of the Alps observe the variations of his mountain winds; let the voyager send us notes of their changes on the surface of the sea; let the solitary dweller in the American Prairie observe the passages of the storms, and the variations of the climate; and each, who alone would have been powerless, will find himself a part of one mighty Mind—a ray of light entering into one vast Eye—a member of a multitudinous Power, contributing to the knowledge, and aiding the efforts, which will be capable of solving the most deeply hidden problems of Nature, penetrating into the most occult causes, and reducing to principle and order, the vast multitude

of beautiful and wonderful phenomena, by which the wisdom and benevolence of the Supreme Deity regulates the course of the times and the seasons, robes the globe with verdure and fruitfulness, and adapts it to minister to the wants, and contribute to the felicity, of the innumerable tribes of animated existence.

Oxford University.

REVIEWS.

On the Mean Pressure of the Atmosphere, and the Prevailing Winds over the Globe for the Months and for the Year. By A. BUCHAN, Esq., M.A., F.R.S.E., &c. [Second notice.]

IN our last number we placed before our readers a short notice of this paper, and sketched briefly the principal features in the distribution of pressure shown, and some of the extreme changes in it which occur in the different parts of the year. This latter description was purposely curtailed, as it would be better in going more minutely into the subject, to refer also to the *prevailing* winds, as shown on Mr. Buchan's charts, and for this we had not sufficient space.

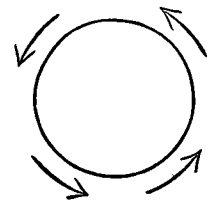
We now propose to do this, but in the absence of copies of the isobaric charts, must necessarily be a little verbose, to make the account clear to our readers.

Taking the chart for *January*, we find a vast area of mean pressure of 30 in. and upwards, embracing the whole of Central North America, where the northern border, running more southward, passes as a broad belt (between lat. 5° and 45° N.) across the Atlantic Ocean to the Old World. The southern border is then temporarily curved northward in crossing Northern Africa, but the two isobarics of 30 in. subsequently diverge, including in their bounds all but Northern Europe and the whole of Asia. At the eastern coasts of Asia a marked change takes place, for the northern boundary turns suddenly to the south and even south-westward, following closely the coast line of the seas of Okhotsk and Japan, and the Yellow Sea; it then turns eastward again, and with the southern boundary crosses the Pacific as a belt, between lat. 5° and 20° N., till near the American coast, when the northern line takes a more northern direction, and the area embraced (as before mentioned) is the whole of Central North America. Now in this region of high pressure, three distinct maxima occur, one equalling 30·3 ins. (and slightly upwards) near the centre of the United States, a second (of 30·2 ins. and more) in the North Atlantic, between the meridians of about 10° and 50° W., and the third (of 30 4 ins. and more) in Central Asia. The change from these maxima to the isobar of 30·0 ins., is in each case gradual, and each of them is separated from the other by a considerable space of about 30 ins. of mean pressure.

Thus far, then, for this one vast region of high readings in the northern hemisphere. Now, to the northward of its northern boundary, the barometer reads lower on an average, and in the neighbourhood of Iceland, there exists a minimum of about 29·4 ins. (and slightly less),

while a second depression (of about 29·6 ins.) is found in the North Pacific, near the peninsula of Aliaska. Here we have briefly explained what we stated in our last—that great condensation over the continents, and rarification over the oceans, is the feature of the winter months.

Now with regard to the winds in the northern hemisphere, we find that to the N.W. of the depression near Iceland, the prevailing direction is north easterly, to the S.W. of it north-westerly, to the S.E. of it south westerly, and to the E. of it southerly. Thus :—



And (so far as there are observations given) the same rule holds good in the case of the Pacific minimum. This circulation is precisely that found to hold from day to day, round the various areas of low barometrical pressure which exist in one place or another, and has recently been known by the term "Buys Ballott's Law." Around the high pressures we find a decided *tendency* to circulate in the opposite direction, but for reasons on which we will touch at some future time, these do not seem so *completely* shown. In this manner the south-westerly and westerly winds of northern and north-western Europe are accounted for, together with the more westerly breezes of the Atlantic and the northerly winds of northern America. The monsoons of the China seas are also shown to be dependent on conditions not nearly so local as have been imagined by some, and the theory of Dove as to their cause is abundantly confirmed. But we must just venture to remark, that there is some doubt as to the scientific correctness of comparing *average* pressures with *prevailing* winds, instead of *average* winds ; and striking as the present result is, we cannot doubt it would be doubly so, could the *prevailing* winds be compared with the average pressure during their continuance. This of course is merely mentioned as a suggestion, and in no way as complaining that absolute perfection has not been attained. Again, the present charts might be greatly improved were they supplemented by the results of marine observations on wind, published by Maury, the Board of Trade, or the Dutch or French authorities ; for it is well known that for wind the marine observations are by far the most accurate—at least, so far as *estimation* is concerned.

In the southern hemisphere the distribution of pressure differs very materially from the values being nearly uniform in all parts. There is a region of slight maximum in the South Atlantic and another lying in a belt from E. to W. in the South Pacific, about the parallel of 30° S.,

but readings in these are only between 30·0 and 30·1 inches, while the two minima noted are one in Central Africa (of 29·8 in. and slightly less), and one in Australia of 29·9 in. It is true there is represented a rapid decrease in pressure from about 30 in. in lat. 40° S. to about 29·2 in. in lat. 60° to 65° S., founded principally on one of the "Numbers of Meteorological Papers" published by the Board of Trade, but its existence uniformly *all round* the northern borders of the Antarctic regions, as given in the charts, is rather a disputed point among meteorologists, although the extraordinarily low readings in the neighbourhood of Cape Horn cannot be doubted. With regard to the winds observed south of the Line, very little information is given, but a tendency is observable to circulate round the respective depressions and regions of maximum pressure in directions exactly opposite to those noticed north of the equator—as, in fact, may be expected.

Thus, then, we have noticed the conditions observed in our mid-winter month, January, and with this we will briefly compare the results shown on the July chart. The band of max. pressures noticed in the northern hemisphere is now in the southern, but is connected with a distinct area of high readings, which exists over the North Atlantic, while a second condensation of air is noticed in the North Pacific. The high readings over Asia have given way to a minimum of 29·5 in., (while a second depression of 29·7 in. is found in North Africa,) and those in the United States to an area of 29·7 in. The winds still circulate round the districts of these depressions and elevations as before, though those in Asia are less clearly marked than we should have anticipated. The winds in the different districts are thus in most cases from points exactly opposite to those in January, the change being most marked in the monsoons of India and China. Our own British Islands, being under the influence of comparatively low readings to the N. and N.W. of them, are still influenced chiefly by the south-westerly winds, but European Russia now feels its northerly wind, and Eastern Asia experiences its southerly monsoons. Similarly, British Columbia has now northerly winds instead of southerly, and the eastern parts of the United States enjoy the contrary change. There appears to be (if we may judge by the winds charted) something defective in the isobarics which run from W. to E. across the South Atlantic and the southern part of Africa, but those in the northern hemisphere are from the better observations.

We feel that in giving this sketch of the features shown in the charts for these two months, we have done so inadequately; but the object has been not to supersede in any way the charts, but by drawing attention to their *principal* features to induce a desire in the minds of our readers to study the subject carefully for themselves. There is little doubt that a more extensive series of observations will will alter the precise courses of the isobarics; but the main features are too distinctly marked to admit of much doubt as to their accuracy. *Good* isothermal charts (if such exist) would be of immense value for comparison with the isobarics on the present scale.

Stonyhurst College Observatory.—Results of Meteorological and Magnetical Observations, 1869. JAMES ROBINSON, Preston: small 8vo, 32 pages.

THIS pamphlet consists mainly of a series of monthly abstracts of results for 1869, a comparison between them and the average of 22 previous years, and a short abstract of the magnetic observations. Our notice must, therefore, mainly consist of a few data selected as of more special interest. The barometer is a standard by Barrow, and the observations are given, corrected for temperature, but *not* for altitude. The height of the barometer above sea is 381 ft., *the mean annual temperature*, 22 years, 46°·8, the mean annual pressure for the same period, corrected for temp. and index error is 29·482, the correction for elevation is therefore 0·420, and hence we get the *mean pressure at sea level as* 29·902 *inches*.

The correction for the extremes of pressure cannot be accurately determined in the absence of information as to the temperatures at the time, but we shall certainly not err more than 0·03 in., and, possibly, not at all, if we apply the same correction to them; then we have—

Greatest pressure	(on Feb. 11, 1849, and on March 4, 1854)	30·872 in. at sea level.
Least ,,	(on Jan. 14th, 1865)	28·359 ,, ,,
Range		2·513 in.
Highest temperature of air in shade,	July 15th, 1868.....	88·1
Lowest ,, ,, ,,	Dec. 24th,* 1860 ...	6·7
Mean ,, ,, ,,	.....	46·8

The total horizontal motion of the air was, in 1869, 98,291 miles, or an average of 11·2 miles per hour.

The mean magnetic declination for 1869 was 21° 40′ 54″ W., but this appears to be simply the mean of one observation per month, and not the result of the photographic records. The high quality of the Stonyhurst observations has long been known, and we trust the able director will have such assistance as will enable him to place the results even more fully before the world than in the present abstract.

Devonshire Hospital and Buxton Bath Charity. Annual Report for the year 1869 Published at the Hospital, 8vo. 48 pages.

WITH this report, as that of an economically administered and excellent charity, we in these pages have nothing to do; our concern is with the Meteorological Report, drawn up by Mr. E. J. Sykes, F.M.S., and printed on pages 23 and 24.

We regard the inauguration of a series of accurate observations at Buxton as of considerable importance, not only on account of its geographical and geological situation, but also because of its altitude, 1,040 ft., and we should think that Dr. Robertson, the chairman of the board of trustees of the charity (especially if he is identical with the gentleman of the same name who in 1854 published a *Handbook*

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* Surely this should be Dec. 25th; we thought the lowest temperature occurred between 11 p.m. on 24th and 6 a.m., on 25th, if so, clearly the minimum should be that of 25th. The matter should be examined.

to the Peak), must be as glad as we are that the step has been taken. We wish the various health resorts would do likewise, and thus provide materials for accurate comparisons of their respective climates. We wish to see a fuller report next year, but in the interim, have hardly anything but praise for this first instalment. We know that the printing of meteorological tables is expensive, and we are glad to see that the treasurer of the charity seems to hold the purse-strings commendably tight. We see that the report may be purchased for a few pence, and therefore we do not quote a single result or a single word, and hope by so doing, we shall induce many of our readers to send some stray stamps, obtain the report for themselves, encourage the observer, and, perchance, induce the treasurer to look upon meteorological tables as a good investment.

HEIGHT OF RAIN GAUGES.

To the Editor of the Meteorological Magazine.

SIR,—As you court criticisms on your excellent rain gauge regulations, I venture to suggest a doubt as to one of them, that which limits the height of the gauge to one foot above the ground. It appears to me, that gauges so placed act as *traps* for the rain rather than fair measures of the average fall, that they retain all chance accessions, while they allow nothing once caught to escape them. The valuable experiments made at Rotherham, by Mr. Chrimes, tend to confirm this impression. They prove that on calm days a gauge on the surface of the ground receives no more rain than one placed 20 ft. above it; that on windy days the excess registered by the ground gauge varies with, and, we may fairly infer, is mainly caused by, the wind. The question is, does the wind increase the quantity of rain received by the ground gauge *above* the fair average; does it diminish the rain received by the high gauge *below* the fair average? or does it act in both ways, so that the true mean is to be found in some intermediate position?

Any one standing on the sea shore in a storm, will see the air filled to a great height with the spray, which is carried, as is proved by the salt it deposits, many miles inland. Now what is this spray but fine particles of water swept up, as it were, from the surface of the sea by the wind? And what is to hinder this same wind from carrying away a proportionate tribute from every field, every tree, every hedge-row it passes in its course, when field, tree, and hedge-row are all drenched and dripping with rain? Have we not here at least a partial explanation of the rapid decrease in the quantity of rain registered, with every foot of the first 10 above the surface, of the variation in the rate of decrease as determined by different observers, and of the discordant quantities received by similar ground gauges, even in the same locality.

On the other hand, the last issue of the *British Rainfall* records a remarkable experiment at Aldershot, in which two gauges, tilted at 45°, received the same quantity of rain every month in the year, though one was placed at 6, the other at 30 ft. above the ground. This result, if confirmed, would seem to show that a horizontal stratum

of wind contains as much rain at 30 as it does at 6 ft. above the ground, if we only know how to extract it, and we have, seemingly, no resource but the theory that wind when moving at a high velocity (at 30 ft. above the ground) carries a certain amount of rain with it, across the mouth of a *horizontal* gauge, which it allows to drop when its speed is checked by friction against the surface.

Being thus distrustful of both high and low gauges, I should advocate as a safer mean one (at least) 6 ft. above the ground, and I believe, if such gauges were generally adopted, the results would be more trustworthy, as well as more accordant. I may be allowed to doubt whether if the lower tilted gauge at Aldershot had been on the ground, instead of 6 ft. above it, the agreement with the upper would have been so perfect. Perhaps an experiment of this kind would be a fair test of the question.—Your obedient servant, R.

[We shall be glad to receive any remarks which our readers may desire to offer upon this subject (Rule IV. of *British Rainfall*, 1869,) provided they are sent in before April 30th.—ED.]

MOVEMENT OF AIR.

To the Editor of the Meteorological Magazine.

SIR,—Can any of your readers tell me whether any work on meteorology tells you how long it takes air to move from one latitude to another. A volume of air starts, we suppose, from the parallel of 30°, and proceeds towards the North Pole. How long, that is, what time would it occupy in its transmission from 30° to, say 68°? I know there is a general translation of air in an easterly direction, with earth's rotation, of about five to eight miles per hour, but this is not the motion I am desirous of knowing. I am making some observations with regard to the alternation of tropical and polar currents, and am anxious to ascertain the average time required for the transmission of air from one parallel to another.

I am, Sir, your obedient servant, W. L. B.

Alpha House, Hatcham, March 26th, 1870.

ENTRY OF MAXIMUM AND MINIMUM TEMPERATURES.

To the Editor of the Meteorological Magazine.

SIR,—It may be presumed that meteorologists desire to record the highest and lowest temperature that occurs between midnight and midnight, otherwise there would seem to be no sufficient reason for the usual practice of entering the maximum as that of the day previous to the morning on which it is read.

On this supposition there are two possible cases in which error may occur (when thermometers are read and set at 9 a.m.), in addition to that mentioned by Mr. Nunes in your last number.

For the sake of clearness and brevity, I will suppose a case, extreme certainly, but by no means impossible, in which both these errors are combined in a very palpable form.

At 9 a.m. on a Monday in January, with a bleak east wind, the thermometers stand at 30°, and are set accordingly. In the course of the day the temperature rises to 32°; at midnight the wind changes to S.W., and the temperature rises (as I have seen it do repeatedly in such cases) to 48°. On Tuesday morning, with bright sunshine, the thermometers stand at 50°. The maximum entered for Monday will then be 50°, whereas the true maximum was 32°; the minimum entered for Tuesday will be 30°, whereas the true minimum was 48°.

These sources of error are so obvious, and of such common occurrence, I must suppose that meteorologists have not overlooked, but ignored them under the impression that general conformity was of more consequence than occasional error, influenced, perhaps, also, by the difficulty of suggesting a satisfactory remedy. Theoretically, the registering thermometers ought to be set and read at midnight; as this would not be convenient in practice, I would suggest, as a compromise, that when the wind changes from a northerly to a southerly direction, after 9 a.m., the maximum should be read and the minimum set as late as possible in the evening.

Your obedient servant, R.

A TAX ON OBSERVERS.

To the Editor of the Meteorological Magazine.

SIR,—Allow me to call your attention to what is becoming quite a tax on observers. I refer to continual applications for the result of their observations. One gentleman lately sent me a form on which to take observations for him *hourly*. I supplied the results of my observations to another gentleman, who did me the politeness to send me a copy of the pamphlet for which he used them, when I found he stated, "they must be incorrect," as they did not agree with his theory. The climax was arrived at a week or ten days since, when I received a letter from a perfect stranger, asking me to send him ten years' observations. Being a medical man, in active practice, I was taking every opportunity of filling up this gentleman's form, in my very microscopical quantity of spare time, when I got another letter from my strange correspondent, expressing his astonishment at my not having sent the forms, &c.

Now, Sir, is there to be any limit to this? I am willing to do all in my power to advance scientific enquiries, but if one is expected to answer the letters and fill up the forms of any gentleman who wishes to publish on any particular theory, the more especially as my observations are already published in the Registrar-General's Reports, I for one must give up my observations altogether.

I am, truly yours, M. B.

April 2nd, 1870.

MARCH, 1870.

Div.	STATIONS. [The Roman numerals denote the division of the Annual Tables to which each station belongs.]	RAINFALL. Total Fall.	Difference from average 1860–5	Greatest Fall in 24 hours. Dpth	Date	Days on which ·01 or more fell.	TEMPERATURE. Max. Deg.	Date.	Min. Deg.	Date.	No. of Nights below 32°. In shade	On grass.
		inches	inches.	in.								
I.	ENGLAND. Camden Town	2·31	+ ·23	·95	3	13	60·5	3	23·8	14	8	18
II.	Maidstone (Linton Park)	1·64	— ·85	·38	4	17	62·0	3	22·0	14	13	...
„	Selborne (The Wakes)	2·67	+ ·07	·89	1	10	57·0	2	12·8	14	17	20
III.	Hitchen	1·82	— ·35	·56	4	15	56·0	2	24·0	13§	14	...
„	Banbury	1·49	— ·71	·57	1	13	55·0	2*	22·5	14	17	...
IV.	Bury St. Edmunds (Culford)	1·87	— ·33	·58	4	16	60·0	2	20·0	13	14	18
V.	Bridport	1·93	— ·94	1·23	1	10	60·0	17	22·5	14	12	...
„	Barnstaple	1·74	— 1·41	·46	1	9	58·0	19	26·0	14	6	..
„	Bodmin	2·91	— ·84	·95	1	14	54·0	31	28·0	24‖	6	9
VI.	Cirencester	1·76	— ·84	·70	1	7	....	...	...	...	...	...
„	Shifnall (Haughton Hall)	1·54	— ·40	·50	1	12	55·0	17	18·0	14	15	...
„	Tenbury (Orleton)	1·86	— ·56	·73	1	8	60·2	17	17·7	14	14	18
VII.	Leicester (Wigston)	1·10	— 1·01	·43	1	6	60·0	31	22·0	13	16	...
„	Boston	1·10	— ·69	·30	1	15	56·2	17	21·6	14	12	22
„	Grimsby (Killingholme)	2·30	..	·55	1	16	54·0	1*	26·5	14	6	...
„	Derby	1·72	— ·53	·52	1	9	57·0	17	24·0	14	14	...
VIII.	Manchester	2·38	— ·31	·59	2	9	57·0	31	22·0	14	11	19
IX.	York	1·80	— ·19	·39	3	13	59·0	19	27·0	12	10	...
„	Skipton (Arncliffe)	3·06	— 1·75	1·40	16	8	...	...	...	...	..	..
X.	North Shields	1·21	— 1·14	·33	22	13	57·0	20	25·0	13	8	10
„	Borrowdale (Seathwaite)	...	...	...	..	...	...	...	...	...	...	...
XI.	WALES. Cardiff (Town Hall)	...	...	...	...	...	...	...	...	...	...	...
„	Haverfordwest	3·88	+ ·43	1·33	1	8	56·0	31	22·0	13	7	11
„	Rhayader (Cefnfaes)	2·79	— 1·05	1·00	2	10	58·0	...	18·0	...	8	...
„	Llandudno	1·88	— ·38	·67	3	8	58·4	31	26·5	14	5	...
XII.	SCOTLAND. Dumfries	·86	— 2·12	·29	15	8	56·0	3, 17	24·5	13	15	...
„	Hawick (Silverbut Hall)	1·03	...	·25	21	13	...	...	...	...	...	...
XIV.	Ayr (Auchendrane House)	1·43	— 2·30	·52	14	7	56·0	17†	22·0	13§	15	18
XV.	Castle Toward	1·33	— 3·26	·33	15	9	56·0	31	24·0	24	21	26
XVI.	Leven (Nookton)	·77	— 1·30	·21	25	8	53·0	28†	22·0	14	14	28
„	Stirling (Deanston)	·52	— 3·01	·19	15	9	52·0	8‡	18·0	13§	24	...
„	Logierait	·49	...	·21	15	9	...	...	...	...	..	..
XVII.	Ballater	·88	...	·24	25	7	55·5	31	18·0	12	15	...
„	Aberdeen	·89	...	·12	30	16	56·0	19	22·0	12	9	17
XVIII.	Inverness (Culloden)	·28	...	·09	30	6	54·1	29	23·8	12	11	20
„	Portree	1·38	— 7·66	·30	29	16	...	...	...	...	...	...
„	Loch Broom	1·10	...	·25	10	17	...	...	...	...	...	...
XIX.	Helmsdale	1·22	...	·34	15	16	...	..	...	...	...	...
„	Sandwick	1·25	— 2·08	·23	12	22	50·0	19	19·9	12	10	17
XX.	IRELAND. Cork	2·22	...	·55	15	11	...	...	...	...	...	...
„	Waterford	2·99	+ ·10	·70	15	17	48·0	16†	25·0	14¶	17	...
„	Killaloe	2·74	— 1·58	·57	24	14	62·5	31	24·0	14	7	...
XXI.	Portarlington	2·28	— 1·03	·67	25	18	58·5	18	28·0	26	8	...
„	Monkstown	2·08	— ·50	·90	3	13	...	...	...	...	...	...
XXII.	Galway	1·45	...	·36	15	16	55·0	20	30·0	5**	6	...
„	Bunninadden (Doo Castle)	2·23	...	·82	24	13	...	...	..	...	...	...
XXIII	Bawnboy (Owendoon)	2·01	...	·42	24	13	60·0	19†	23·0	13	7	14
„	Waringstown	1·27	...	·24	21	13	65·0	19	21·0	12	13	17
„	Strabane (Leckpatrick)	1·31	..	·18	21	15	61·0	18	18·0	13	18	19

* And 16, 17. † And 31. ‡ And 10, 20, 21. § And 14. ‖ And 27. ¶ And 26.
** And 6, 12.

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

METEOROLOGICAL NOTES ON MARCH.

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.

STAPLEHURST.—A cold, but not wet, month; rather heavy falls of S on 13th and 26th; no high winds, and very little sunshine; frosts numerous, but not severe; no floods in the river, but the frequent driblets of R and S kept the roads very dirty the greater part of the month, but for tillage purposes the land works well.

SELBORNE.—On the whole, a cold dreary month; all vegetation retarded and the crops very unpromising; great destruction in the flower gardens. The ther. on the morning of the 14th lower than I have ever known it in March (12·8), at E. Tisted three miles W. of this place it was rather lower, and at Guildford also (as I am told). The variations in temp. have been very remarkable. S 6 in. deep on 13th, and temp. 12°·8 on 14th; min. 43° on 22nd and max. only 39° on the following day.

BANBURY.—High winds on 2nd and 3rd; ball S at 2.30 p.m. on 26th; fog on 31st.

CULFORD.—March has again been an exceedingly cold month, the mean temp. being slightly in advance upon February, 39·6 to 35·3, it is also higher than March of last year, which was only 36·2, but that was the coldest March on record in the eastern counties; vegetation very backward.

BRIDPORT.—Very fine but cold month; 22 days on which the wind was from N. or E.; no S fell for the month enough to register.

CIRENCESTER.—The month has been remarkable for dryness and cold, with the exception of two fits of warmth, one at the beginning, the other, 17th and 18th of the month; frosty nights have been so frequent that vegetation is universally backward and spring flowers rare.

SHIFNALL.—The month came in warm, with high wind and R from S.W., which changed on the 2nd to the N.E., where it continued till the 8th, inclusive, from which day till the 19th it returned to N.W. and S W., the temp. varying greatly. On the 13th, 2 in. of S, followed by a severe frost next day, ther. 18°; from thence to the end of the month varying from N.W. to N.E.; on 22nd a sudden fall in temp. in midday from 53° to 36°. Vegetation exceedingly backward, the hawthorn hedges scarcely in bud on 31st, wheat no higher than in November, and in many places, especially on light soils, greatly injured by the repeated frosts. On 31st, S.W. wind with a cloudless sky; catkins on hazel open on 1st, yellow crocus beginning to flower on the 6th, apricots beginning to blossom on 23rd, celandine in flower on 25th; rooks beginning to build on 10th; chaffinch and yellowhammer singing on 20th, and eggs laid by throstle before the 26th.

ORLETON.—Warm with much R on the first three days, then generally dry with a variable temp., occasionally very cold, and a cloudy sky with wind chiefly from the N. and N.E.; S 4 in. deep on the 13th. Min. on grass, 14° on 14th. The last week fine, with severe frosts each night; bar. generally high during the month; temp. about 1° below the average.

WIGSTON.—Both rainfall and temp. have been below the mean of many years for the same month; vegetation very backward.

KILLINGHOLME.—Vegetation backward; laurels much scorched by the cold easterly winds; ground in first-rate condition for sowing at the end of the month; wild violets in flower on 19th, apricots beginning to flower on 25th, pyrus japonica on 27th, and peach on 31st; rooks building on 6th, chaffinch singing on 9th, larks soaring and singing on 21st, frogs spawning on 10th; aurora on 13th, Noah's ark from N.W. to S.W. on 30th.

DERBY.—The month has ended with beautiful weather, but, except at the end and a few days about the 15th, it has been unusually raw and cold, with frosts of great severity, not doing, it is hoped, much harm in so backward a season. The atmospheric pressure has been above the mean, and, consequently, the rainfall considerably below. The weather is now all that the husbandman or gardener could desire, the soil never broke up in a more splendid condition; let us hope the results will be in harmony with the seed-time.

WALES.

HAVERFORDWEST.—The commencement very wet, but afterwards a fine month, good for field operations, excellent sowing time; temp. below the mean, yet not severe; no gales of any importance; some S fell on the 4th, and a considerable fall on the 25th; cold fine weather continued to the end of the month; wind principally from the N.E.

CEFNFAES.—Dry cold weather, with frosts; fall of S on the 20th; temp. low, wind generally from N.E.

LLANDUDNO.—S about 3 ins. deep on 13th. On the whole, a fine month, especially the last week of it; measurable R only on eight days.

SCOTLAND.

DUMFRIES.—With the exception of a few days in the middle of the month, the weather has been ungenial, frost by night and drought by day; S fell on 2nd, 3rd, 11th, 22nd, 25th, and 27th; vegetation behind previous season; mean temp. of month 41°·7.

SILVERBUT HALL, HAWICK.—The cold easterly gales, and the hard frosts, H, and S showers which we had on no less than 15 days, were most trying for young lambs, and the little bleaters had a very chilling welcome. We have frequently had more severe S storms and longer frosts, but for protracted duration not many winters can parallel that of 1869-1870.

AUCHENDRANE.—With reference to our local averages, the bar., mean temp., and amount of cloud are slightly above, while the bar. range, rainfall, evaporation, and mean force of wind are slightly below; the elastic force of vapour, dew-point, and humidity are close on the average, as is also the difference between temp., dew point and the mean temp. of the month; the polar and equatorial currents prevailed during an equal number of days each; calms also were very numerous; a small rainfall and an evaporation equalling it in quantity, reduced the rivers considerably, without bringing much of the welcome March dust.

CASTLE TOWARD.—A cold dry month; frost more or less to the 15th, and again from the 20th to the 26th, so that vegetation has made little progress; early cabbages and broccoli are much injured; very favourable seed time, the ground being dry and in good condition; mild and warm from the 27th to the end of the month.

DEANSTON.—Whole month very dry, but frequent strong cold east winds and much frost at night; some S on the hills on the 22nd.

LOGIERAIT.—Keen frost with high wind on 12th. General character of the month, favourable, vegetation advancing; saw lapwings on 17th.

ABERDEEN.—Bar. and temp. above the average; R less than in any year since 1856; most prevalent wind, N.W. A dull cold month; very little has yet been done in cropping the ground; agricultural operations have been kept terribly back.

PORTREE.—This month, on the whole, has been very favourable for out-of-door labour; much less R than usual, and more frost and S than is usual for the month of March. Solar halos on the 26th and 27th from noon to sunset.

LOCHBROOM.—This has been, on the whole, a fine month for the farmers and farm labour, and in a measure makes up for the backwardness of last month.

SANDWICK.—March has been 1°·85 colder than the mean of previous 43 years; a gale of 50 miles an hour on the 11th, and one of 60 miles an hour on the 12th; S on several days, drift on 22nd; aurora on six nights; large lunar halo on the 14th.

IRELAND.

OWENDOON.—This has been a splendid month for the farmers.

WARINGSTOWN.—Cold and parching during the first fortnight, then a few fine days, and again cold weather till the end of the month; rainfall much below the average.

LECKPATRICK.—Driest March ever registered; in 1863, the next driest, there fell 1·52 in. The average temp. of the quarter is about 2½° under the mean of quarter deduced from eight years observations; the average rainfall (for eight years) in March is 3.55, consequently the fall of this month (1·31) is not half the average. Very favourable seed time.