Meteor Showers

The principal shower of this week is that of the *Aquarids*, radiant R.A. 326°, Decl. 2° S. It is a strong shower, visible just before daybreak, from April 29 to May 2.

GEOGRAPHICAL NOTES

THE Geographical Society of Paris held last Friday its first general annual meeting. M. de Lesseps was in the chair, and delivered an address on the Panama Isthmus and Canal. Amongst the gold medallists are MM. Capello and Ivens, the Pandit Krishna, and Alfred Marche.

M. PELLET, a French explorer belonging to the cavalry, was murdered by an unfaithful guide on his way to Timbuctu, before reaching Insalah, the capital of Tuat.

THE Portuguese Legislature has, at the initiative of the Geographical Society of Lisbon, passed an act relating to MM. Capello and Ivens, of which the following are the main provisions :—(1) They are to receive a pension of 600,000 *reis* (135*l.*) per annum each, in addition to a similar pension granted to them after their first journey ; (2) exemption from all taxes ; (3) the Treasury is to bear the expense of printing an edition of the account of their last African journey, of which 5000 copies will be given to them, and the copyright will be their property ; (4) confirmation of the rank conferred on them, and dispensing with the condition of serving the remainder of the term in Africa in consideration of which the rank was granted to them by law. Portugal, it would thus appear, knows how to honour officially, as a nation, her sons who have done honour to her. MM. Capello and Ivens's work is in the National Press at Lisbon, and the first volume is expected to be published in two months.

THE current number (Band v., Heft 1) of the *Mittheilungen* of the German African Society is full of interesting matter. The contents are divided into two parts : (1) the reports of the Society's explorers in the Congo region, and (2) those in the Western Soudan. The first part contains Dr. Büttner's diary of his journey during July, August, and September last year. Leaving Arthington Falls on July 3, he travelled eastward to the Quango, at its junction with the Quilo, which point he reached on the 21st of the same month. He then turned south along the right bank of the Quango for seven days, as far as Muene Putu, where he stayed for a fortnight, again returning northward, and crossing to the left bank near the spot where the Quilo joins it. Leaving this on August 21, he continued down the left bank to Kiballa, whence he turned westward to Stanley Pool. A map compiled by Dr. R. Kiepert accompanies the diary, and also tables of various measurements calculated by Dr. von Danckelman. The reports from the Expedition in the Western Soudan are written by Dr. Flegel (from Bakundi, on the Tarabba) and Dr. Semon.

THE last number of the *Mittheilungen* of the Geographical Society of Vienna, like so many similar publications just now, is mainly devoted to African geography. It contains, with a description, routes, &c., a map of the neighbourhood of Ango-Ango, by Herr Baumann, a member of Dr. Lenz's Austrian Congo Expedition. The topographical material was collected during a stay at Ango-Ango, and was put together in Vienna. Two further letters from Dr. Lenz are also published : the first describes the journey from Ngombe to Stanley Pool, and the second the journey to the Equator Station on the Upper Congo. It is satisfactory to learn that the Expedition reached this point in excellent health, and that the Free State officials gave it every assistance. The only other paper in the number is the conclusion of Dr. Diener's contribution to the geography of Central Syria. At the end he confesses that it is at present impossible to say whether the physical features of a great part of this region have altered since the days of the Romans. There are facts, historical, climatic, and geographical, which tend in favour of both sides, and the problem is one for solution in the future.

ACCORDING to a recent communication of M. Venukoff to the Geographical Society of Paris (to which we have already referred), the results of a survey of the basin of the Neva, executed in 1884–85, show that hitherto the levels generally accepted by geographers here have been totally incorrect. The following is a comparison of the levels now ascertained with those given by M. Reclus in his "Géographie Universelle" for Lakes Ladoga, Onega, and Ilmen :—

	New Survey	M. Reclus
Ladoga ...	5·01 metres ...	18 metres
Onega ...	34·97 ,, ...	72 ,,
Ilmen ...	17·97 ,, ...	82 ,,

These figures, and others which might be quoted, show that the region watered by the Neva and its tributaries is much lower than was generally supposed. The new figures refer to the normal zero of Cronstadt, which is itself 0·66 m. above the level of the Baltic at Revel. The absolute heights of the lakes is thus slightly increased, but still the differences between the old and the new figures are very great. As the results of the new survey appear unquestionable, the former hypsometric details respecting the basin of the Neva must be dismissed as wholly incorrect.

THE French Topographical Society proposes that an International Exhibition of Topography should take place in the Palais de l'Industrie next year, under the patronage and with the assistance of the Government. The Committee of Organisation which has been appointed has addressed a circular to French topographers, geologists, geographers, and explorers, asking for their co-operation. The Society, the circular says, has for its aim the popularisation of the science of topography, especially by means of gratuitous lectures, and it is anticipated that an exhibition will give a spur to this work.

SOME RESULTS OF OBSERVATIONS WITH KITE-WIRE SUSPENDED ANEMOMETERS UP TO 1300 FEET ABOVE THE GROUND IN 1883-85

SINCE I had the honour of reading a paper on the first series of observations taken in 1883–84 before the Association in Montreal last year, I have made twenty-five fresh observations at heights above the ground varying from 300 to about 1300 feet, or double the greatest height before attained. I had hoped in have been able to make a greater number and variety of observations, but a pressure of private and other work has stood to the way.

Since, however, in ten of the new observations the upper anemometer was suspended at a height of over 1000 feet above the ground, or 1500 feet above the sea, I trust the results may be thought sufficiently novel and valuable to merit the brief discussion to which I have subjected them.

In dealing with the observations I have included fifteen of those made in 1883–84, and have thus been able to utilise forty observations in all. As the observations were intentionally made as nearly as possible at certain desired heights, so as to afford a regular progression upwards in the scale of height, I have been able to arrange forty-two pairs of observations at two different levels in six groups.

In order to present the results in a form in which they can be readily compared, as well as to exhibit the law of change of the velocity with the height, I have computed for each observation the value of the corresponding exponent in the empirical formula $\frac{V}{v}=\left(\frac{H}{h}\right)^x$, where V, v, H, h, are the velocities and heights of the upper and lower instruments respectively. The several groups, together with their corresponding heights, mean velocities, and exponents, are given in the following table :—

TABLE I.

Group	No. of observations	Mean height of upper instrument above ground, in feet	Mean height of lower instrument above ground, in feet	Mean height of both	Mean velocity at both heights in feet per minute	Mean upper and lower velocities: Upper	Mean upper and lower velocities: Lower	Mean value of x
*1	7	250	102	176	1395	1617	1174	0·372
2	3	322	128	225	1955	2232	1679	0·307
*3	8	407	179	293	1545	1705	1385	0·275
4	5	549	252	400	1940	2107	1773	0·237
5	9	795	481	638	2074	2192	1957	0·250
6	10	1095	767	931	2166	2236	2096	0·194

The general and obvious conclusion to be drawn from this table, as well as from the individual observations (in which a reverse case has never occurred), is that the velocity of the wind

* These two groups comprise observations made in 1883-84 only. The other groups those made in 1884-85 only.

TABLE II.—*Exponents in Formula* $\frac{V}{v} = \left(\frac{H}{h}\right)^x$ *arranged for Different Mean Velocities in all 6 Groups. Groups and Values of x with the Corresponding Mean Resultant Directions D**

Range of mean velocities in feet per minute	1	*D*	2	*D*	3	*D*	4	*D*	5	*D*	6	*D*
700 to 1100	·422 (1)	N. 85 W.	—	—	·343 (2)	N. 39 W.	—	—	·576 (1)	N. 43 W.	·279 (1)	N. 43 W.
1100 to 1500	·345 (5)	S. 83 W.	—	—	·376 (2)	S. 14 W.	·290 (1)	N. 59 E.	·235 (1)	S. 26 W.	—	—
1500 to 1900	·440 (2)	S. 22 W.	·286 (1)	S. 63 E.	·156 (2)	N. 61 W.	·290 (2)	S. 22 W.	·214 (1)	N. 39 W.	·290 (1)	N. 71 W.
1900 to 2300	—	—	·317 (2)	N. 19 W.	·225 (2)	S. 21 W.	—	—	·212 (2)	N. 24 W.	·196 (5)	S. 80 W.
2300 to 2700	—	—	—	—	—	—	·158 (2)	N. 53 E.	·237 (3)	N. 16 E.	·239 (1)	N. 40 E.
2700 to 3100	—	—	—	—	—	—	—	—	·091 (1)	N. 57 E.	·077 (2)	N. 57 E.
Mean range of exponent for 400 feet of velocity. + if it varies directly with velocity, − ,, inversely with velocity	+ ·009		+ ·031		− ·039		− ·033		− ·097		− ·040	

TABLE III.—*Exponents in Formula* $\frac{V}{v} = \left(\frac{H}{h}\right)^x$ *arranged for the Different Hours of the Day during which the Instruments were suspended, together with the Mean Velocities (V′) and Directions (D) of the Wind†*

HOURS	GROUP 1 *x*	*D*	*V′*	GROUP 2 *x*	*D*	*V′*	GROUP 3 *x*	*D*	*V′*	GROUP 4 *x*	*D*	*V′*	GROUP 5 *x*	*D*	*V′*	GROUP 6 *x*	*D*	*V′*
11 to 12	—	—	—	—	—	—	—	—	—	—	—	—	—	—	—	·058 (1)	N. 57 E.	2703
12 to 1	·360 (1)	S. 8 E.	1447	—	—	—	·163 (1)	N. 48 W.	1635	—	—	—	—	—	—	·174 (2)	N. 7 W.	2286
1 to 2	·360 (1)	S. 8 E.	1447	—	—	—	·163 (1)	N. 48 W.	1635	—	—	—	—	—	—	·154 (3)	N. 31 E.	2286
2 to 3	·360 (1)	S. 8 E.	1447	—	—	—	·163 (1)	N. 48 W.	1635	—	—	—	·235 (1)	S. 26 W.	1368	·087 (2)	N. 60 E.	2494
3 to 4	—	—	—	·307 (3)	N. 45 E.	1956	·257 (5)	N. 75 W.	1580	·119 (1)	N. 39 E.	2378	·163 (4)	N. 61 E.	2183	·116 (4)	N. 41 W.	2479
4 to 5	·386 (4)	S.	1521	·332 (2)	S. 17 W.	1889	·263 (6)	S. 89 W.	1546	·183 (2)	N. 36 W.	1945	·240 (8)	N. 22 W.	1997	·185 (7)	N. 70 W.	2129
5 to 6	·335 (5)	S. 34 W.	1348	·286 (1)	S. 63 E.	1609	·342 (4)	S. 18 E.	1460	·237 (5)	N. 78 E.	1940	·252 (8)	N. 13 W.	2162	·192 (8)	N. 41 W.	2188
6 to 7	·315 (3)	S. 45 W.	1284	·286 (1)	S. 63 E.	1609	·414 (2)	N. 82 E.	1203	·237 (5)	N. 78 E.	1940	·251 (7)	N. 13 E.	2194	·215 (6)	N. 48 W.	2099
7 to 8	—	—	—	—	—	—	·458 (1)	S. 23 E.	1402	·204 (2)	N. 49 E.	1884	·328 (1)	N. 49 E.	2691	—	—	—
Ranges of exponents and velocities	− ·071		− 237	− ·046		− 280	+ ·295		− 233	+ ·118		− 438	+ ·165		+ 508	+ ·128		− 395

+ if increasing, − if decreasing, towards evening; ═ signifies maximum, ---- minimum.

* The resultant wind directions when calculated from more than two observations have been derived by means of Lambert's formula.

† The resultant wind directions are calculated by Lambert's formula.

always increases from the surface of the ground up to 1800 feet above sea-level, and that the ratio of the increase steadily diminishes up to that height. The only exception to the steady decrease in the value of x occurs in Group 5, and this is evidently due to the inclusion in that group of an abnormally large value of x (0·576), corresponding to an equally abnormally small velocity of 789 feet per minute, which is little more than a third of the mean velocity of the stratum corresponding to that group. The mean velocities of each group are also seen to increase with some degree of regularity with the height, but this is, of course, partly accidental. In estimating the value of the exponent x for strata of the atmosphere at different heights above sea-level, it must be remembered that the place of observation is 500 feet above sea-level, and therefore that at a certain height above the ground the motion of the air in all probability approximates to what it would have at its real height above the sea. Where this state of things *actually* occurs, we have no ready means of determining, but at a height of 1000 feet above the ground we may assume that the influence of the subjacent tableland is almost obliterated, and the motion of the air *approximates* to what it would have at its real sea-level height. On this assumption, if we add the full 500 feet to each height in Group 6, we get the following value for the exponent :—

	Upper sea-level height	Lower sea-level height	Value of x
Group 6	1595	1267	0·28

If more reasonably we add 400 feet only, we get $x = 0·26$, or almost identically the same value as 0·25, which I found agree best on the average with Dr. Vettin's cloud observations at Berlin, ranging from 1600 to 23,000 feet above sea-level (NATURE, January 11, 1883). I think, therefore, that the results of the present series of observations may be taken to add strong confirmation to the general agreement of the empirical formula $\frac{V}{v} = \left(\frac{H}{h}\right)^{0·25}$, with the average motion of the air at heights over 1600 above sea-level.

One great advantage which results from the representation of the observations in the form of exponents is that we are thus enabled to compare observations differing from one another, both as to height and velocity, in a manner which would otherwise be almost impossible.

There are four principal variables which have been observed, and which are likely to affect the value of these exponents, viz. (1) the mean velocity at the upper and lower elevations ; (2) the direction of the wind ; (3) the time of day ; and (4) the month of the year. I have, so to speak, differentiated the exponents with respect to each of these variables in turn, and have in each case placed the corresponding values of the other variables alongside, in order to see how much of the resulting variation of the exponent is independent, or dependent on accidental collocations of the other variables. The results I find most curiously involved, owing to apparently accidental groupings of some of the variables.

One or two variations can, however, be shown to arise from the influence of one factor alone, after that due to the coexistence of others is allowed for. One of these is that due to the change of mean velocity, and the other is the diurnal change with the hour of the day. These are shown in the accompanying Tables II. and III. respectively.

In Table II. the exponent is found, on the whole, to increase with an increase in the velocity in the two lowest groups (1 and 2), and to decrease in the four upper groups, the maxima in each of these groups occurring at the lower velocities, and the minima at the highest ones.

This latter result is what might have been expected *a priori*, and though the first two groups would appear at first sight to present an anomaly, it must be remembered that in these groups the lower instrument is hardly above the influence of surrounding trees, so that in high winds, while the upper instrument might be feeling the full force of the wind, the lower one might be unduly sheltered from it by adjacent trees or buildings.

In Table III. the diurnal variation in the value of the exponents, reaching its minimum from 2 to 3 or 3 to 4, and its maximum between 6 and 8 (as far as the observations go), is most clearly and regularly shown in each of the four upper groups, and as these last are well beyond the influence of local obstructions, I regard the uniformity with which they exhibit this variation as a strong proof in favour of its physical existence independently of any similar variation caused by the parallel march of other factors. Even if part of the variation in groups 3, 4, and 6 is due to the equally regular decrease in the mean velocity from midday to evening, it can be shown from Table II. that this only accounts for a portion of the observed variation.

Thus, taking the ranges of the exponents in Table III., and adding to or subtracting from them the proportional ranges of the exponents for the corresponding opposite range of velocity (deduced from the mean range of the exponents for 400 feet range of velocity in Table II.), we get the following results :—

	Groups 1	2	3	4	5	6
Ranges of exponents from diurnal minimum to diurnal maximum ; + increasing towards evening; − decreasing towards evening.	−·065	−·025	+·273	+·083	+·286	+·088

that is to say, for Group 5 the variation is increased, and for the rest not materially diminished.

The opposite variation in the two lowest groups (1 and 2) may be capable of an explanation somewhat analogous to the similar anomaly presented by these two groups in Table II., but in any case it cannot be said either to sensibly corroborate or invalidate the physical existence of the variation so statistically marked in all the four upper groups.

This diurnal change in the value of the ratio of the velocity of the upper to the lower strata which is here shown to occur for the afternoon hours, is confirmed by various other casual observations, and is in complete accord with the results afforded by anemometrical observations on Ben Nevis and other lofty mountain observatories, as well as with Dr. Köppen's theory of the diurnal period in the surface-wind alluded to in my former paper.

Since at stations near sea-level the diurnal wind-velocity reaches its maximum at midday and its minimum at midnight, while at lofty stations about 4000 feet above sea-level the critical epochs are reversed, it is evident that somewhere between these levels a neutral plane exists where the diurnal variation is *nil.* The ratio of the upper velocity to the lower for a given difference of height would, however, continue to vary diurnally all the way up (unless some unknown law intervene), reaching its minimum value about midday and its maximum about midnight.

Indications of other laws have been noticed in the value of the exponents, such as a maximum for west winds and a minimum for east winds in five out of six of the groups, and also a maximum in the autumn, minimum in the winter, and maximum again in the summer in all the groups, but the observations are too few and the factors too involved to establish these with any certainty. I trust on a future occasion to be able to go into these questions more in detail, and also to supply the morning half of the diurnal variation, which I consider to be the most certain and valuable result I have as yet obtained in addition to the law of the general progressive decrease in the value of the exponent up to 1800 feet above sea-level in the *free* atmosphere.

E. DOUGLAS ARCHIBALD

BASIC CINDER[1]

THE interest of this report centres principally around the question of the manurial value of undissolved phosphates present in basic steel slag or cinder. The basic cinder is the effete and broken up basic lining of the converters used in the Thomas and Gilchrist process for dephosphorising iron, and is made in very large quantities as a by-product of steel manufacture. It contains from 16 to 19 per cent. of phosphoric acid in union with lime and other bases in combinations insoluble in water.

At the request of the North-Eastern Steel Company Prof. Wrightson and Dr. Munro undertook field experiments in order to test the manurial value of this substance. These experiments were carried out last summer on the College farm at Downton, and at East Howle, Ferry Hill, county of Durham, upon dissimilar soils, and under different climatic conditions. The results as given in the very concise report before us are remarkable, and certainly must be highly satisfactory to those who are interested in the future of basic cinder. The value of this substance as a fertiliser for swedes and turnips, as well as for grass, is placed beyond reasonable doubt by a most remarkable unanimity of results obtained at both experimental stations. Each series

[1] "Report on Experiments made to test the Manurial Value of Basic Cinder from the North-Eastern Steel Works." By Prof Wrightson and Dr. Munro, of the College of Agriculture, Downton, Salisbury. Middlesbrough : *Daily Exchange* Offices, 1886.