the limits of possibility. The reviewer, however, can not agree with him here. For the physical interpretation of the result would be, that, for very small surface densities, the dispersion of electricity from the earth into the atmosphere reaches a value greatly in excess of that which is observed at greater surface densities. Thus, Linss,[1] by direct measurement, found the dispersion coefficient of electricity in the free atmosphere to be 0.01 per minute. From this it follows that, in 100 minutes, the electric charge of the earth's surface remaining constant, a quantity of electricity escapes into the air which approaches the amount covering the earth at any moment. More plausible, doubtless, would be the assumption that the adopted intensity of the earth-air electric currents has been estimated too high.

Entirely unsuccessful, as is emphasized by Trabert, must be the attempt to account for east-west electric currents in the atmosphere by mechanical transfer, as in this case the requisite current intensities would be much larger.

In any case Trabert's paper deserves to receive the greatest attention from magneticians and electricians. The magneticians should give us a reliable determination of the order of magnitude of the intensity of the earth-air currents, and the electricians should furnish the material for determining the conductivity of the free air and its relation to other meteorological elements. Linss's cited paper is the only one bearing on this subject, although the matter is of such prime importance for a theory of atmospheric electricity. Recent investigations[2] have shown that air made conducting by ionization, on account of the unequal velocity of the oppositely charged ions, gives off free negative electricity to conducting bodies with which it comes in contact, and thus develops an electromotive force precisely in the sense required for the maintenance of the stationary electric condition of the earth's surface.[3]

H. GEITEL.

LEMSTRÖM AND BIESE. *Observations faites aux stations de Sodankylä et de Kultala. Electricité atmosphérique, courants telluriques, courant électrique de l'atmosphère, phénomènes lumineux de l'aurore, boréale, naturels et artificiels.* Helsingfors, 1898. 10 x 13 cm. Pp. IX+26+50+98+30+34. 16 plates

The work which is here presented to the scientific world has been delayed by causes beyond the control of the authors. Poor health which had its origin in the exposure incident to a circumpolar expedition prevented Professor Lemström from attempting more than his regular courses at the University of Helsingfors.

The observations of the circumpolar expeditions were divided into two classes: those which were obligatory and those which were optional. The first-named observations of the Finnish Expedition were published in two volumes in 1886–7, embracing Meteorology and Terrestrial Magnetism. The present volume treats of Atmospheric Electricity; Earth Currents; Air Currents (Electrical) and Auroral Phenomena.

The observations of atmospheric electricity began on September 4, 1882. The instrumental outfit consisted of a Thomson quadrant electrometer as

[1] LINSS, W. *Meteorolog. Z. S.*, 1887, p. 354, and *Electrotech. Z. S.*, 1890. Heft 38.

[2] ZELENY, *Phil. Mag.*, July, 1898, and RUTHERFORD, *Phil. Mag.*, January, 1898.

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modified by Mascart; the distance between the mirror and scale being 1.72 meters. A Thomson water collector mounted upon three insulators was used. The length of the tube from which the water ran was 2.5 meters, and the height above the ground 3 meters The electrometer was calibrated by means of five Leclanché cells and the electromotive force determined by comparison with a standard Daniel (1.124 volt). During 1882–3, observations were made each hour, but during 1883–4 only three times a day, except on "term" days when they were made more freqnently. Owing to low temperatures and impurities in the water a copper wire ring, with the mesh soaked in coal-oil, was used as a collector at Kultala. The authors are convinced that the results thus obtained did not differ materially from those with the other collector. Frequently the potential values were so large as to pass beyond the scale limits.

Considering the observations of two years at Sodankylä it appears that the potential was generally positive and rarely negative. Negative values occurred during the first year only three times, and only five times during the second year. The greatest negative values were observed during warm weather, as shown in the following table, where the values in volts of the negative potential are given:

	Sept.	Oct.	Nov.	Dec	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.
1882–3 . .	1492.7	518.6	104.9	93.5	31.3	659.2	18 4	181.0	2456.6	5130.2	1166.8	1509.0
1883–4 . .	296.8	59.2	97 7	5.7	15.3	6.3	12.3	7.1	121.2	215.9	172.8	6.7

Dividing the sums given above by the monthly means as given below, it will be seen that negative values during both years were most frequent during warm weather, and that a marked increase is shown with the approach of summer.

	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.
1882–3 . .	30.7	46.6	45.8	45.9	60.9	86.5	96.1	100.9	120 6	60.2	34.4	50.3
1883–4 . .	52.3	50.9	22.4	19.8	42 1	18.5	28.3	42.5	29.3	9.2	14.7	1.0

	Sept.	Oct.	Nov.	Dec.	Jan.	Feb.	Mar.	Apr.	May	June	July	Aug.
1882–3 . .	48.6	11.2	2.3	2.1	0.5	7.7	0.2	1.8	20.4	85.2	33.9	30.0
1883–4 . .	5.7	1.2	4.4	0.4	0.4	0.4	0.4	0.2	4.2	23.5	11.8	6.7

One might naturally expect to find, both in the daily and annual temperature curves, an inverse relation to the curves of electrification. But no such relationship was found in these observations. Nor is any definite relation apparent when the observations are grouped by seasons. In order to throw some light upon the relation of temperature and electricity, Profesor Lemström divided the observations into two equal groups, one comprising all the observations made during the warm hours, and the other, those made during cold hours.

The following table shows the results:

AUTUMN		WINTER		SPRING		SUMMER		YEAR	
Warm	Cold	Warm	Cold	Warm	Cold	Warm	Cold	Warm	Cold
499.0	484.8	837.7	720.1	2364.2	1169.9	578.7	580.0	823.3	735.4

The relations of the values of potential with humidity, rain, clear and cloudy weather, are also discussed; but, on the whole, these are not so strongly marked as might have been expected. During summer and autumn the curves are, for the most part, opposed to each other; but during winter and spring there would seem to be an agreement.

Comparing the observations made at the two stations—Sodankylä and Kultala—a distinct agreement was found to exist in the main. At times of great variations, however, there would be differences in values. The sign was nearly always the same.

A. MCADIE.