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AIR IONS AND ELECTRICAL AEROSOL ANALYSIS

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ATMOSPHERIC ELECTRICITY AT THE PROSPECTIVE BOROVOYE BACKGROUND MONITORING STATION

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In the framework of the international program of environment pollution studies "Monitoring", a worldwide system of background stations is created. The concentration of pollutants at these stations should not depend on local sources, but rather reflect their global concentration, i.e. the background.

The authors of this paper have participated in pilot studies of atmospheric electricity at a background station.

The location of the background station is the conservation and hunting area at Borovoye, Kokchetavsky region, Kasakhstan. The height of the location of the station is about 300 m above the sea level.

Atmospheric electricity measurements were conducted with three air ion counters *UT-7502*. One device was used to measure the air ion spectrum, the two others were used for uninterrupted 24-hour measurements of the polar conductivity $\lambda_{\pm}$ (at the limiting mobility $k_0 = \pm 2.0$ cm^2/(V·s). The results were registered with automatic recorders.

The potential gradient of the electric field of the atmosphere dv/dh was measured with *S50* static voltmeter provided with a radioactive collector.

The measurement period was 16-31 August 1976.

As Borovoye is situated in a weakly polluted region of the subcontinent of Eurasia, a high conductivity of the air could be expected. This expectation was confirmed (see Table 1). As can be seen in the Table 1, the total electric conductivity of the air exceeds the mean for the Earth approximately 4 times. Accordingly, the potential gradient was found to be very low. It should be kept in mind that the mean value of dv/dh is taken to be 130 V/m. The content of Table 1 is obtained by the statistical processing of hourly means of the measurement results corresponding to fair weather.

The discovered positive correlation between small (n_++ n_-) and large (N_++ N_-) air ions is of special interest. The limiting mobility was 0.5 cm^2/(V·s) for the small ions, and 0.001 cm^2/(V·s) for the large ions. The correlation coefficient between these concentrations was +42%. The critical

Table 1

Local time	Positive mobility			Negative mobility			Mean value of the potential gradient
	No.of measurements	mean fS/m	standard deviation	No.of measurements	mean fS/m	standard deviation	V/m
0-1	4	89	7	5	78	8	42
1-2	5	88	5	5	79	2	-
2-3	5	91	5	5	78	3	23
3-4	4	92	7	5	83	8	21
4-5	3	89	2	5	80	6	-
5-6	3	83	1	5	77	8	-
6-7	4	92	6	4	81	11	15
7-8	6	81	21	5	68	16	-
8-9	8	58	19	6	52	21	-
9-10	8	31	5	7	27	7	64
10-11	8	25	4	7	21	3	48
11-12	7	23	4	7	20	3	58
12-13	6	23	4	6	20	3	-
13-14	7	23	5	7	21	5	89
14-15	7	23	5	7	21	4	68
15-16	7	22	5	7	21	4	88
16-17	7	23	4	7	22	5	60
17-18	8	25	4	8	23	4	58
18-19	8	27	3	8	27	5	57
19-20	7	43	11	7	40	8	41
20-21	4	62	11	4	50	13	36
21-22	7	72	14	8	60	12	-
22-23	7	75	11	7	68	13	24
23-24	7	83	13	7	73	10	22
Total:	145	51	29	149	46	26	46

value of the correlation coefficient for checking the hypothesis of independence against the bilateral alternative is 28% on a 95% level of reliability [1]. The other computed values included the correlation coefficients of the concentrations of air ions with the air pressure, with the relative humidity

of the air, with the temperature, with the solar irradiation (units were 0 or 1) and with the potential gradient; also all mutual correlation coefficients between all the above parameters. On the basis of these data the correlation of (n_+ + n_-) and (N_+ + N_-) was found, whereas the influence of other listed meteorological parameters is excluded. In this case the correlation between small and large ions was low as expected. Consequently, these parameters are not connected causally, but are both dependent on the meteorological parameters. A possible explanation of the discovered phenomenon can be a hypothesis of positive correlation between the intensity of ion formation and the aerosol content of the air.

Let us try to explain this hypothesis. In the daytime convection mixes the lower layers of the air which have higher conductivities with the higher layers of lower conductivities. Assuming that in the nighttime the preterrestrial layer has an inverted or similar height distribution of the temperature, then the convection is either absent or negligible. Due to this (according to the known mechanism [2]) both, the electrical conductivity of the preterrestrial air and aerosol concentration in it, increase. This is completely understandable, but in all locations the authors have studied except Borovoye, the ion absorption by atmospheric particles dominates over the growth of conductivity.

Thus, from the point of view of atmospheric electricity, Borovoye is an exceptional place, and as any exception, is to be carefully studied on the basis of a special program.

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