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MEASURING THE AEROSOL IN THE SURFACE LAYER OF THE ATMOSPHERE IN--ETC(U
SEP 78 V I DMOKHOVSKIY, L S IVLEV, A Y SEMOVA

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FOREIGN TECHNOLOGY DIVISION

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MEASURING THE AEROSOL IN THE SURFACE LAYER OF THE ATMOSPHERE IN THE KARA-KUMY REGION

By

V. I. Dmokhovskiy, L. S. Ivlev, A. Yu. Semova

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К к	*К к*	K, k	Ъ ъ	*Ъ ъ*	"
Л л	*Л л*	L, l	Ы ы	*Ы ы*	Y, y
М м	*М м*	M, m	Ь ь	*Ь ь*	'
Н н	*Н н*	N, n	Э э	*Э э*	E, e
О о	*О о*	O, o	Ю ю	*Ю ю*	Yu, yu
П п	*П п*	P, p	Я я	*Я я*	Ya, ya

*ye initially, after vowels, and after ъ, ь; e elsewhere.
When written as ё in Russian, transliterate as yё or ё.

RUSSIAN AND ENGLISH TRIGONOMETRIC FUNCTIONS

Russian	English	Russian	English	Russian	English
sin	sin	sh	sinh	arc sh	$\sinh^{-1}$
cos	cos	ch	cosh	arc ch	$\cosh^{-1}$
tg	tan	th	tanh	arc th	$\tanh^{-1}$
ctg	cot	cth	coth	arc cth	$\coth^{-1}$
sec	sec	sch	sech	arc sch	sech^{-1}
cosec	csc	csch	csch	arc csch	csch^{-1}

Russian	English
rot	curl
lg	log

MEASURING THE AEROSOL IN THE SURFACE LAYER OF THE ATMOSPHERE IN THE KARA-KUMY REGION

V. I. Dmokhovskiy, L. S. Ivlev, A. Yu. Semova

A program for measuring the aerosol in the surface layer of the atmosphere in the fall of 1970 included an investigation of the following questions: measurement of a calculated concentration and the spectral distribution density of aerosol particles by dimensions at various times of the day at various altitudes (up to 11-15 meters), the stability of the measured characteristics, their dependence on various meteorological elements, and the determination of the chemical composition of the particles.

Measurements were conducted with the aid of FPP-15-1.7 filters, which were developed according to the method described in [1 and 2].

Given below are some results of the measurements conducted for the most interesting and typical cases (tables 1 and 2). Distribution of particles by dimensions C(r) cm^{-3} for the surface layer of the atmosphere (Repetek, October 1970). Table 1.

(1) Дата, час. мин.	H м	C	r мкм					
			0,2÷0,25	0,25÷0,3	0,3÷0,4	0,4÷0,8	0,8÷2	2÷3
(2) 18/X								
11 час. 20 мин. (3)	2	269	210	33	15	5	5	1
22 час. 45 мин.	11	131	110	10	4	2	3	2
19/X								
0 час. 30 мин.	5	117	82	15	9	5	4	2
2 час. 20 мин.	5	300	202	45	30	15	5	3
3 час. 10 мин.	5	103	60	18	17	4	3	1
5 час. 25 мин.	5	99	71	10	6	3	7	2
22/X								
11 час. 00 мин.	2	91	57	16	5	4	8	1
25/X								
21 час. 30 мин.	11	224	156	31	18	11	7	1
26/X								
2 час. 45 мин.	2	188	90	53	26	10	7	2
9 час. 30 мин.	2	80	58	13	7	0,5	1	0.5
9 час. 30 мин.	11	79	58	13	4	1	2	1

Key to Table 1: 1) Date, hour, minutes. 2) hour. 3) minute.

Note: In the table C is the total concentration of particles with $r \geqslant 0.2$ μm.

Table 2. Results of quantitative spectral analysis (mg/m^3).

Repetek, October 1970.

Key to Table 2: 1) date, hours, minutes. 2) hour. 3) minute.

4) clean filter FPP. 5) Dry HCl (100 ml).

Дата, час. мин. (1)	// м	Mg	Mn	Pb	Cr	Fe	Ni	Al	Ca	Cu	Zn
(2) 18/X (3)											
10 час. 30 мин.	2	3,20	0,13	1,71	0,33	16,40	0,47	5,47	22,6	—	1,60
22 час. 15 мин.	11	9,80	0,13	0,93	0,20	6,93	0,20	2,73	8,20	—	1,60
19/X											
0 час. 30 мин.	5	6,70	0,13	0,33	0,13	17,2	—	2,80	32,7	—	—
2 час. 20 мин.	5	5,50	0,13	0,13	0,13	2,27	0,07	1,40	8,60	—	—
2 час. 10 мин.	5	4,30	0,15	0,13	0,13	4,53	0,07	1,47	10,8	—	2,47
5 час. 20 мин.	5	9,10	0,07	0,47	0,15	9,73	0,20	3,13	8,73	—	4,33
22/X											
11 час. 00 мин.	2	7,60	0,07	0,60	0,33	10,60	0,013	2,67	11,7	—	—
25/X											
21 час. 50 мин.	11	7,65	0,07	0,53	0,47	5,40	0,40	1,27	8,13	—	—
26/X											
7 час. 45 мин.	2	4,74	0,15	—	0,13	2,60	0,13	1,40	8,13	8,60	—
7 час. 50 мин.	2	—	0,15	0,33	0,07	4,67	0,20	1,60	8,33	8,60	2,20
9 час. 30 мин.	11	4,53	0,20	0,07	0,06	9,30	0,13	2,47	9,30	—	—
(4) Чистый фильтр ФПП		1,15	0,006	0,24	0,06	2,00	0,06	0,60	8,67	0,20	1,20
(5) Холостая HCl (100 мл)		1,25	0,012	—	0,12	0,36	—	0,36	0,60	0,02	0,53

Spectral density of distribution of particles according to dimensions. The relatively high stability of the distribution function of particles according to dimensions, including a monotonically diminishing value with an increase in the size of particles, is typical; it can be very closely described by the Young formula. For distribution, the instability of the content of particles is typical with a radius of 0.25-0.35 μm.

Vertical profile of aerosol in the surface layer. For particles with $r \geq 0.2$ m, we noted no dependence of the calculated concentration on altitude, at least up to H = 15 m. This speaks for the good mixability of the air mass near the bottom surface. Only for particles with $r > 1$ m did we notice some relative increase in the concentration in the lower layer (H = 2 m).

Daily course of the calculated concentration and spectral density of distribution of particles according to dimensions. The daily course of calculated concentration of aerosol was carefully followed with the maximum in the evening hours and the minimum in the morning. The spectral density of distribution of particles according to dimensions hardly depends on the time of day. In the evening hours we observe a small relative increase in the concentration of giant aerosol particles.

Washing away. For the beginning of the rain on October 19, 1970, there was a typical increase in the calculated concentration of particles, in which regard only up to the end of the rain did we notice a substantial and strong decrease in the calculated concentration value. A chemical analysis shows that the strong increase in the concentration of particles occurs as a result of an increase in the content in the surface layer of quartz particles, basically finely divided with $r < 0.4$ μm. Washing away of aerosol particles containing various elements occurred normally, except for particles which contained iron, magnesium, and aluminum. The content of these elements in aerosols after rain increased, which was also noted earlier in [2].

Chemical composition of aerosol. The basic component of aerosol in the surface layer of the atmosphere at Repetek is quartz particles. The total weight concentration of aerosol is about 250 $\mu g/m^3$, where for a fraction of non-quartz particles there occurs about 100 $\mu g/m^3$, in which regard from the studied elements the content of iron, calcium, and zinc is extremely unstable, which speaks for the existence of these elements in the coarse-dispersion fraction of aerosol (Table 2). The noted relative increase in the content of iron, aluminum, and magnesium at the end of the rain can be explained by the presence of particles with these elements above the surface layer of the atmosphere. This hypothesis is corroborated and repeated by the observed increase in the content of these elements in the morning hours.

Dependence on various meteorological elements. An analysis of the data on the content of aerosol in the surface layer depending on various meteorological elements shows that there turns out to be comparatively little humidity in the atmosphere and a low wind velocity in the content of aerosol in the surface layer, although we also observe a general tendency for a decrease in the calculated concentration of aerosol with an increase in humidity and a direct dependence of the concentration of aerosol on the wind velocity in the range of velocities from 2-7 m/s. The basic determining factor is the temperature conditions in the surface layer and its turbulence. This is supported by both the daily course of the content of aerosol in the surface layer and by the frequently observed dependence between the concentration of aerosol and the difference in temperature between the ground and the air, in which regard this

dependence is particularly strong in the coarse-dispersion fraction.

Sources of aerosol. During the entire cycle of measurements the wind direction was virtually constant. Judging the chemical content, the basic source of aerosol was sandy earth from the desert. The contribution from the solonchak was comparatively small (about 20-30%).

Thus, the basic distinguishing feature of aerosol in the surface layer in the Repetek region, determined by the law of its distribution, is the high content in it of quartz particles. As a result of this, we observe poor washability of the particles by settlings, weak dependence of the content of aerosol on humidity, relatively small portion of coarse dispersion fraction in the total content of aerosol. The optical characteristics of this aerosol are determined almost completely by its "dry" component.

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