# STUDY OF LONG-TERM VARIABILITY OF SUBMICRON AEROSOL CONCENTRATION

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*This paper describes the results of regular 24-hour measurements (1984–1994) of the scattering coefficient of the near-ground aerosol dry base. We have investigated the seasonal and annual variations of the submicron aerosol.*

Up to now the regularities in time and spatial variations of the submicron aerosol have been only little studied. This situation does not allow one to better understand the role of different geophysical processes in transformations of the atmospheric aerosol. The daily variation of the submicron aerosol parameters has been investigated most thoroughly (see, e.g. Ref. 1). However, there are still many questions concerning the nature of the aerosol variations associated with the atmospheric turbulence, convection, precipitation, and emission of aerosol from the underlying surface.

This paper presents analysis of the results of regular 24-hour measurements of the scattering coefficient of the near-ground aerosol dry base. Using the values of this scattering coefficient we have calculated the mass concentration of the submicron aerosol dry base. The measurements were carried out in 1984–1994 in Kislovodsk and nearby Moscow.

The variability of submicron aerosol during a year is determined by some factors of regional, continental, and global scale. It has been known that one of the main factors that governs the aerosol variability are the synoptic processes with the periods from 2 to 7 days. Analysis of daily variations of optical and microphysical parameters of the aerosol was performed based on the data of complex measurements in Abastumani in summer 1979.[1]

The synoptic variability of aerosol characteristics changes from season to season and from year to year what results in the variability of the annual behavior of mass concentration and other parameters of the submicron aerosol. Examples of annual variation of monthly mean values of mass concentration of submicron aerosol based on the measurement data nearby Moscow in 1991–1994 are shown in Fig. 1.

It follows from Fig. 1 that, as a rule, there occurs a winter-spring maximum in the annual variation of the concentration. However, the position and shape of this maximum vary within wide limits. The concentration can reach its maximum at different time from February to April. Sometimes, instead of one winter-spring maximum there are observed two maxima, winter and spring, ones.

From the above results it follows that in the summer-fall season the annual variation of aerosol concentration can undergo considerable disturbances due to regional processes, for example, the long-term fires on peatbogs in Moscow Region (1992).

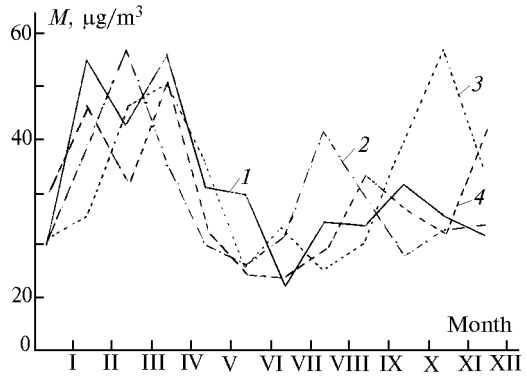


*FIG. 1. Annual variation of the submicron aerosol concentration based on the measurement data in the vicinity of Moscow 1991 (1); 1992 (2); 1993 (3); 1994 (4).*

To elucidate the role of regional sources in aerosol pollution of the atmospheric boundary layer it is essential to conduct measurements at several points of the region. The geographic factors[2] can produce a noticeable effect on the annual variation of the submicron aerosol.

As is seen from our analysis the synoptic variability, as well as the regional perturbations and "regular" seasonal variation are not all the factors that govern the annual variation of the submicron aerosol. As a rule, it may be seen from the measurement data obtained during a year the contribution can come into the annual behavior of the submicron aerosol mass concentration from the planetary waves with the periods from 14–15 to 35–60 days, and sometimes with the 10-day periods.

Figure 2 shows the examples of power spectra of time variations in submicron aerosol mass concentration constructed based on the measurement data acquired in Kislovodsk in 1987 (dashed line) and nearby Moscow in 1994. In the spectrum the variations are clearly discernible with the periods of 10, 14, and 28 days. The broad peak of a 40- to 50-day period is also observed in the spectrum. The spectrum of a long-period variability,

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due to planetary waves, varies from year to year. The annual variation of the submicron aerosol concentration may also be quite considerable, being several percent a year as much.

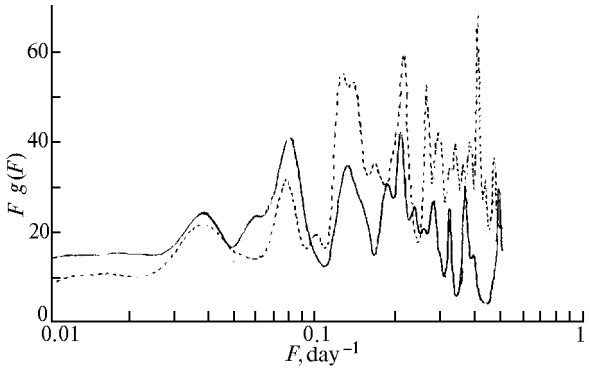


*FIG. 2. Power spectrum of annual variations of submicron aerosol concentrations.*

The variations of the submicron aerosol discussed above could be of a particular importance for the climate theory and atmospheric ecology.

## ACKNOWLEDGMENT

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