



Some Regularities in the Distribution of Inorganic Chemical Components of Aerosol Matter over Background Region of West Siberia

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The Antonov-30 "OPTIK-E" airborne laboratory of the Institute of Atmospheric Optics has been carrying out regular (monthly) airborne sounding over southern regions of West Siberia since July 1997. Airborne surveys are mainly performed over forest zone near boundary of Novosibirsk and Altai regions in the 500 to 7000 m atmospheric layer, separately for each from 8 altitudes. Aerosol is sampled onto Petryanov filters (AFA-type), which then analyzed in the Laboratory of Environmental Monitoring of Tomsk State University. The volume of air aspirated through each filter is 1-4 m³. Physico-chemical techniques of quantitative analysis are used to analyze the chemical composition of the aerosol (Si, Al, Fe, Mg, Ca, Ti, Cu, Mn, Cr, Ag, Pb, Ni, Ba, Sn, V, Mo, Co, B, Be, K⁺, Na⁺, Cl⁻, SO₄²⁻, NO₃⁻, Br⁻, F⁻, NH₄⁺).

In the paper we consider the results on a number of samples for more than 12 years, right up to August 2009. It makes up about 1000 samples. Statistic analysis of numbers of mass concentrations of ions and elements showed that empiric distributions for majority components are described by logarithmically normal law. It is verified by high values of correlation coefficients and χ^2 -criterion between empiric and theoretical distributions of artificial numbers of component concentrations.

Analysis of samples enabled us to reconstruct differential distributions of ions and elements. Designed log-scale empiric distributions of Si, Al, and majority ions have two modes. A number of modal dispersions reach the order of magnitude.

Data obtained during this study showed that at all altitudes there is a seasonal behaviour of the concentrations of some elements and ions. Amplitude of the seasonal behaviour is higher in the boundary layer. Concentration peaks at higher altitudes in the vertical distribution were observed during springtime that, most likely, can be a result of trans-boundary transport. Comparative analysis of the results showed that ion and elemental aerosol concentrations over West Siberia represent physico-geographical peculiarities of the region. On the other hand, there are traced the influence of Central Asian deserts and industrial centres of the Ural region.

Analyzing behaviour of annual mean ion concentrations we found that there is a good correlation of SO₄²⁻, NO₃⁻, and K⁺ with Wolf numbers. We assume that production of oxygen-containing anions (of both anthropogenic and natural origin) in the remote continental troposphere is determined by gas-to-particle conversion due to solar-terrestrial interactions.

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