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Properties of near-surface aerosol in Moscow during the season of minimal air pollution (two differing winters of 2019-20 and 2020-21)

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The results of an intensive complex experiment to study the composition and temporal variability of urban aerosol in near-surface air in the center of Moscow include daily data for two years on concentrations of PM_{10} and $PM_{2.5}$ particles. In addition, in each season (for 35-40 days), measurements of the total aerosol mass concentration (by gravimetric method) and 65 chemical elements included in its composition are also carried out daily. For winter seasons, it is from January 10 to February 14, 2020 and 2021. Winter is the season with minimal aerosol pollution in Moscow. The total aerosol mass was 20.8 μg/m^3 and 32.0 μg/m^3 in the 2019-20 and 2020-21 seasons, respectively. Concentrations of all measured components in near-surface air did not exceed the MPC values for residential areas during both winters. However, the ratios of mass concentrations for particles $PM_{2.5}$, PM_{10} and larger particles were different in these years. Mass ratios (in %) of aerosols of different sizes (<2.5 μm):(from 2.5 to 10 μm):(>10 μm) were 23:27:50 and 33:8:59 for 2020 and 2021, respectively. According to weather conditions, these two winters in Moscow were very different: the winter of 2019-2020 was abnormally warm with the shortest duration of snow cover for all the years of observations. On the contrary, the next winter of 2020-2021 was close to normal in terms of the main meteorological parameters, although the wind rose was characterized by an increased frequency of winds from the south. Studies have shown the leading role of meteorological conditions (in particular, humidity and air pressure), as well as long-range atmospheric transport in changing the level of aerosol pollution of near-surface air in Moscow. Analysis of the variability of the chemical element concentrations and enrichment factors (relative to the composition of the Earth's crust) identifies elements of predominantly anthropogenic (for example, Cd, Sb, Pb) or terrigenous (Co, Fe, Al, Cr), as well as global (S, P, B, Se, Bi) or local (Ca, Ni, W) origin. The results of winter observations of urban aerosol in Moscow are compared with the spring data of 2020 [1] and 2021.

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[1] *Gubanova, D.P., Vinogradova, A.A., Iordanskii, M.A., Skorokhod A.I.* Time Variations in the Composition of Atmospheric Aerosol in Moscow in Spring 2020. , Atmospheric and Oceanic Physics. 2021. V. 57, No. 3. P. 297–309. https://doi.org/10.1134/S0001433821030051