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Temporal variability of black carbon mass concentration in surface submicron aerosol in Moscow in 2022-2025.

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The peculiarities of temporal variability of daily, monthly, seasonal and annual mean values of the concentration of absorbing black carbon in submicron aerosol according to 24-hour measurements in the surface air layer in the center of Moscow in 2022-2025 using the AE33-7 aethalometer located at the A.M. Obukhov Institute of Atmospheric Physics of RAS have been studied. The analysis showed that the data of annual measurements differ in the peculiarities of temporal variability of absorbing aerosol. In 2022, during the summer-autumn period, the Moscow region received plumes of smoke of strong forest fires from the Ryazan and Nizhny Novgorod regions. In June-August 2022 the average daily values reached maximum values of 5.0-15.5 μg/m3, the average monthly maximum of 4.0 μg/m3 was observed in August, and the minimum of 1.5 μg/m3 - in May. In 2024, measurements were influenced by residential construction activities in the observation area - a monthly average maximum of 3.3 μg/m3 was observed in August and a minimum of 1.0 μg/m3 was observed in December. 2023 was characterized by a relatively stable aerosol situation: monthly mean maximums of 3 μg/m3 in April and September. Seasonal mean concentrations in 2023 were 2.64μg/m3 in spring, 2.10μg/m3 in summer, 2.04μg/m3 in fall and 1.86μg/m3 in winter, i.e. spring and summer seasons contain elevated levels of BC, while the minimum value is observed in winter. For the annual average weekly course of BC in 2022, the dependence is characterized by a maximum of 2.90 μg/m3 on Thursday; in 2023, it contains two maximums of 2.35 μg/m3 on Tuesday and Thursday; in 2024, there is a decrease during the week from 2.35 to 1.85 μg/m3. The weekly diurnal course in 2022 reveals an overnight minimum of 2.5 μg/m3, a morning maximum of 2.9 μg/m3, and an afternoon minimum of 2.2 μg/m3 on weekdays, and a morning maximum of 2.9 μg/m3 and an overnight minimum of 1.9 μg/m3 on weekends. Thus, at night (before 7:00 AM), the weekend average values are 0.5 μg/m3 higher than the weekday values (manifestation of inversion). In 2023, when the inversion is reversed to weekends, the VS decreases by 0.6 μg/m3 at night and by 0.34 μg/m3 during the day. In 2024 the differences in the diurnal variations do not exceed 0.2 μg/m3 with manifestation of the night (up to 5 h) inversion. Stable peculiarities of daily variations of mean seasonal concentrations were noted in 2023: 1) spring maximum 3.4-3.6 μg/m3; 2) summer maximum 3.06 μg/m3; 3) fall maximum 2.15 μg/m3; fall minimum 1.75 μg/m3; 4) winter minimum 1.30 μg/m3. At night, seasonal mean concentrations range from 1.3 μg/m3 in winter to 3.5 μg/m3 in spring. During the day, a winter maximum of 2.25 μg/m3 and a summer minimum of 1.5 μg/m3 are observed. In 2022, the diurnal variation in dynamics is consistent with 2023, revealing a summer maximum of 4.7 μg/m3 at night; a spring minimum of 2.2 μg/m3; a fall minimum of 2.0 μg/m3; and a winter minimum of 1.70 μg/m3. During the day, a winter maximum of 3.0 μg/m3 and a summer minimum of 1.5 μg/m3 are observed. The diurnal course in 2024 differs significantly from 2022 and 2023. In it, maximum BC concentrations for each season appeared in the morning period of the day (9-12 hours): 3.0 μg/m3 - for summer; 2.6 μg/m3 - for spring; 2.4 μg/m3 - for winter; 2.3 μg/m3 - for autumn, probably caused by dust load.

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