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Changes in air quality and aerosol pollution in Moscow megacity and its direct and indirect impact on radiative and meteorological properties of the atmosphere due to COVID-19 pandemic lockdown in spring 2020 according to modelling and measurements.

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Atmospheric aerosol has a noticeable effect on the microphysical and optical properties of the atmosphere, solar radiation, temperature and humidity conditions, thereby determining the quality of the forecast of important meteorological elements and affecting the regional climate and the dynamics of geochemical processes. Using the results of the spring AeroRadCity experiment at the MSU Meteorological Observatory in 2018-2019, and numerical calculations on the base of modern COSMO and COSMO-ART mesoscale models using Russian (-Ru) configurations we determined the level and main features of urban air/aerosol pollution, and assessed its magnitude and its impact on the radiative and meteorological characteristics of the atmosphere in typical conditions (Chubarova et al., 2020). In the context of the coronavirus pandemic in 2020, especially during the period of lockdown in the spring, there was a significant decrease in emissions of pollutants in many countries, including Russia. The aim of this study is to show the consequences of decrease in emissions of pollutants on the air quality and on urban aerosol pollution. A special attention is paid to the division between the effects of meteorological factors and the influence of pollution emission on aerosol and gas concentration. The effects of the air pollution decrease on solar radiation and air temperature during this period have been analyzed using COSMO-Ru-ART model. For a more detailed study of the observed spatial aerosol distribution on solar radiation and air temperature, we have developed a methodology of the implementation of the satellite aerosol optical thickness (AOT) data in the COSMO-Ru model. Using this approach we evaluated the radiative and temperature effects observed due to aerosol in typical conditions during the spring of 2018-2019 and during the period of lockdown in the spring of 2020 under various meteorological conditions. To do this, the satellite AOT data from the MAIAC/MODIS algorithm and aerosol measurements from Cimel sun photometers data were used for characterising the urban aerosol in typical and lockdown conditions. We also discuss the aerosol indirect effects on cloud properties using an experimental scheme of COSMO-Ru model and their influence on solar radiation and surface temperature during this period. The aerosol

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Reference:

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