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Radiative characteristics for atmospheric models from lidar sounding and AERONET

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Optical models of atmospheric aerosols above of St. Petersburg are constraint on the base of the results of lidar sounding. The lidar system of the Resource Center "Observatory of environmental safety" of the St. Petersburg University Research Park is situated the city center, Vasilievsky Island. The measurements of the vertical profile of velocity and wind direction in the center of St. Petersburg for 2014 -2015 are fulfilled in addition. Height of laser sounding of aerosols is up to 25 km and wind up to 12 km. Observations are accomplished in the daytime and at night and mapped to vertical profiles of temperature, humidity, wind speed and pressure obtained from radiosounding in Voeikovo (St. Petersburg suburb). Results of wind observations are compared with those of upper-air measurements of meteorological service in Voeikovo. The distance between the points of observation is 25 km. Statistics of wind directions at different heights are identified. The comparison is based on the assumption of homogeneity of the wind field on such a scale. In most cases, good agreement between the observed vertical profiles of wind, obtained by both methods is appeared. However, there were several cases, when the results differ sharply or at high altitudes, or, on the contrary, in the surface layer. The analysis of the impact of wind, temperature, and humidity profiles in the atmosphere on the properties and dynamics of solid impurities is implemented.

Comparison with AOT results from AERONET observations in St. Petersburg suburb Peterhof is done. It is shown that diurnal and seasonal variations of optical and morphological parameters of atmospheric aerosols in the pollution cap over the city to a large extent determined by the variability of meteorological parameters. The results of the comparison are presented and possible explanation of the differences is proposed. Optical models of the atmosphere in day and night time in different seasons are constructed from lidar and AERONET observations and used for radiation calculation.

Radiative divergence, transmitted and reflected irradiance and heating rate are calculated. These radiative characteristics are important for cloud and precipitation prognosis.

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