

# Aerosol optical properties and BC mass concentration in Saint Petersburg suburb

M.A. Sviridenkov<sup>1</sup>, E.Yu. Nebosko<sup>2</sup> and E.F. Mikhailov<sup>2</sup>

<sup>1</sup>A.M. Obukhov Institute of Atmospheric Physics, Russian Academy of Sciences, Moscow, 119017, Russia

<sup>2</sup>Department of Physics, Saint Petersburg State University, Saint Petersburg, 198504, Russia

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Presenting author email: sviridenkov@ifaran.ru

Peterhof is a part of Saint Petersburg, located in the coast of the Gulf of Finland about 30 km from the centre of the city. Recent years, regular measurements of the aerosol optical properties and concentration of the aerosol carbonaceous fraction are carried out in Peterhof by means of the instruments of the Geo Environmental Research Center “Geomodel” of the Saint Petersburg State University. In the present paper, the results of measurements of the aerosol scattering coefficients and black carbon (BC) concentration in 2015 are presented. The values of the asymmetry factor of the aerosol phase function were also retrieved from the data of nephelometric scattering and backscattering measurements.

Aerosol scattering coefficients and their fraction due to the scattering into backward hemisphere were measured with TSI 3563 integrating nephelometer. From January to the middle of July, observations were taken in working days during daytime. From September till the end the year, measurements were carried out in 24-hour mode. Continuous measurements of BC mass concentration were carried out from January to June and from September to the end of December using AE51 aethalometer. To avoid negative values of BC concentration, a smoothing algorithm of Hagler *et al* (2011) was applied. Air quality in Peterhof is characterized by very low level of aerosol load. The annual mean of the scattering coefficient  $\beta_{sc}(550\text{ nm})$  is about  $0.02\text{ km}^{-1}$ . Seasonal behaviour of  $\beta_{sc}(550\text{ nm})$  is shown in Figure 1. It should be noted that nephelometer underestimates  $\beta_{sc}$  within 5 – 20% (Sviridenkov *et al*, 2014).

Time series of the daily mean BC mass concentration is shown in Figure 2. In most cases, BC concentration is less than  $1\text{ }\mu\text{g}/\text{m}^3$ . There are only few days with BC mass concentration exceeding  $2\text{ }\mu\text{g}/\text{m}^3$ . Maximal monthly mean were registered in February ( $0.88\text{ }\mu\text{g}/\text{m}^3$ ) and September ( $0.90\text{ }\mu\text{g}/\text{m}^3$ ), and minimal in December ( $0.27\text{ }\mu\text{g}/\text{m}^3$ ). Correlation coefficient between BC concentration and  $\beta_{sc}(550\text{ nm})$  is about 0.7.

Asymmetry factors  $g$  of the aerosol scattering phase function were evaluated from the measured values of the volume scattering coefficients and their constituents due to the scattering into backward hemisphere  $\beta_{bsc}$  (Sviridenkov, 2015). Their seasonal courses are shown in Figure 1. Maximal values of  $g$  were observed in fall and winter, minimal – in spring and summer. Asymmetry factors are noticeably spectrally dependent. This means that aerosol size distributions differ from power law and have fractional structure.

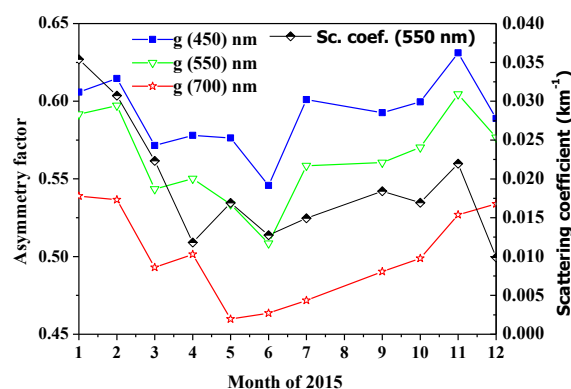


Figure 1. Monthly averaged asymmetry factors  $g$  (left axis) and scattering coefficients  $\beta_{sc}(550\text{ nm})$  (right axis). Peterhof, 2015.

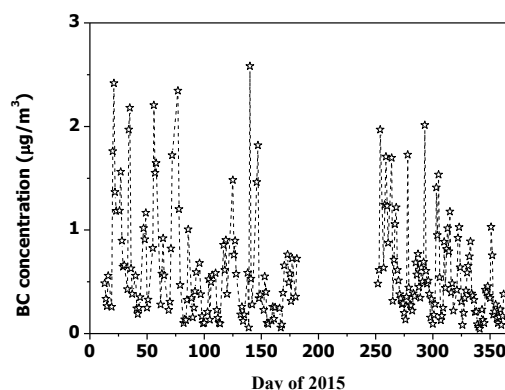


Figure 2. BC mass concentration. Peterhof.

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