Supplementary material

Office Indoor PM and BC Level in Lithuania: The Role of a Long-Range Smoke Transport Event

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Instrumentation and evaluation of in-situ aerosol properties

Aethalometer and aerodynamic particle sizer used in this study were connected to the sampling system which automatically switches sampling from one environment to another every 30 minutes. Nephelometer measured just in outdoor environment.

Mass concentration and light absorption coefficient (b_{abs}) of eBC were retrieved from the measurements of 7-wavelenghts (370, 470, 520, 590, 660, 880 and 950 nm) Aethalometer (A Magee Scientific, Model AE31 Spectrum, manufactured by Aerosol d.o.o., Slovenia). The time resolution of measurements was set to 5 min (collecting area of 0.5 cm^2 and flow rate of 4 l/min). The Aethalometer measures the real time light attenuation caused by particles collected on the quartz filter. Since BC is the main light absorbent in the ambient air, it is assumed that light attenuation is the result of eBC absorption. The measurements at 880 nm were used as eBC mass concentration in the ambient air [1].

A correction proposed by Weingartner et al., (2003) [2] was implemented to reduce 'shadow', multiscattering and other effects causing measurement biases. 'Aethalometer model' by Sandradewi et al. (2008) [3] was applied to assign eBC mass concentration to biomass burning (eBC_{bb}) and fossil fuels (eBC_{ff}) origin. This method uses absorption Angström exponent (AAE) for selected wavelengths (470 and 880 nm) as following:

$$b_{\mathrm{abs,BC_{ff}}}(880\ \mathrm{nm}) = \frac{b_{\mathrm{abs}}(470\ \mathrm{nm}) - \left(\frac{470}{880}\right)^{\mathrm{AAE_{ff}}}}{\left(\frac{470}{880}\right)^{\mathrm{AAE_{bb}}} - \left(\frac{470}{880}\right)^{\mathrm{AAE_{ff}}}}, \quad (1)$$

$$b_{\mathrm{abs,BC_{bb}}}(880\ \mathrm{nm}) = \frac{b_{\mathrm{abs}}(470\ \mathrm{nm}) - \left(\frac{470}{880}\right)^{\mathrm{AAE_{bb}}}}{\left(\frac{470}{880}\right)^{\mathrm{AAE_{ff}}} - \left(\frac{470}{880}\right)^{\mathrm{AAE_{bb}}}}, \quad (2)$$

AAE values were selected following Zotter et al. (2017) [4] suggestions: AAE_{ff}=0.9 for fossil fuel and AAE_{bb}=1.68 for biomass burning related eBC.

Brown carbon (BrC) was investigated based on AAE wavelength dependence method (WDA) [5]. This method is based on an assumption that light absorption at 880 nm represents only BC while absorption at 370 nm could be related to both eBC and BrC light absorption. WDA method can be expressed as following:

$$\mathrm{AAE}^{\mathrm{BC}}_{370/880} = \mathrm{AAE}_{660/880} + \mathrm{WDA} \quad (3)$$

$$\mathrm{b_{abs,BrC}}(370\ \mathrm{nm}) = \mathrm{b_{abs}}(370\mathrm{nm}) - \mathrm{b_{abs,BC}}(370\mathrm{nm}). \quad (4)$$

Outdoor aerosol particle light scattering properties were measured by a 3-wavelenght (450, 550 and 700 nm) integrating Nephelometer (TSI model 3563) with 5 min time

resolution and an automatic calibration every 60 min. The scattering Angström exponent (SAE) was calculated using scattering coefficient (b_{scat}) at 450 and 550 nm. For light scattering coefficient a truncation correction was applied following Anderson and Ogren (1998) [6].

Based on the wavelength-dependent b_{scat} scattering Angström exponent (SAE) was estimated as follows:

$$SAE_{450/700} = -\frac{\ln\left(\frac{B_{scat_{450}}}{B_{scat_{700}}}\right)}{\ln\left(\frac{450}{700}\right)}. \quad (5)$$

For indoor and outdoor aerosol particle size, number and mass concentration assessment, we used an aerodynamic particle sizer (APS; TSI model 3321). It measures the time-of-flight (TOF) of sampled aerosol particles in the size range from 0.5 to 20.0 μm (TSI, Inc. 2004). Although, the APS sizing accuracy of aerodynamic diameter is estimated correctly for most of aerosol particles [7], however, its counting efficiency (CE) varies and is particle size-dependent [8]. Sizing calibration was performed using PSL particles (1 and 2 micrometer). The aerosol mass-weighted aerodynamic concentration was estimated by utilizing the APS data of number-weighted distributions [9]. The estimation of mass concentration for each size bin is defined as follows:

$$dM_{D_a} = dN_{D_a} \frac{\pi}{6} D_a^3 \left(\frac{\rho_0 \cdot C_a \cdot \chi}{C_v}\right)^{3/2} \left(\rho_p\right)^{-1/2}. \quad (6)$$

For this purpose, the aerodynamic diameter is transformed into volumetric equivalent diameter [10]. The shape factor χ was assumed to be 1 and the density of aerosol particles ϱ_p - 1.52 g cm^{-3} [11].

Satellites data and fire map tool

The air mass backward trajectories (HYSPLIT4, [12]) were used to provide information on long-range transport dynamics during the pollution event. Backward trajectories were calculated for a 72 h period at three selected heights: 500, 1000, and 1500 m a. g. l. The 48 h backward trajectory frequency was calculated from our sampling site at 500 m height. The resulting graph showed the sum frequency that the trajectory passed over a grid cell (1.0° × 1.0°) normalized by the total number of the trajectories.

Wildfire locations were surveyed using Fire Information for Resource Management System (FIRMS), which assigns Near Real-Time (NRT) active fire data within 3 hours of satellite measurement from NASA's Moderate Resolution Imaging Spectro-radiometer (MODIS) aboard on Terra and Aqua satellites and Visible Infrared Imaging Radiometer Suite (VIIRS) aboard on Suomi NPP and NOAA-20 satellites. The Navy Aerosol Analysis and Prediction System (NAAPS) was employed to provide information about aerosol satellite measurements over Europe.

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