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Introduction

Source apportionment of organic aerosols (OA) at background sites is one of the important tasks of the current air quality protection. OA are emitted directly from primary sources or formed in the atmosphere via the oxidation of gas-phase precursors with subsequent partitioning resulting in low-volatility products into the particle phase.[3]

Methods

The variability of OA sources and their origin during four measurement campaigns were studied at the rural background station National Atmospheric Observatory Košetice (NAOK) in the Czech Republic. Ambient aerosol measurements of non-refractory PM_1 (NR-PM_1) were performed using a Compact Time-of-Flight Aerosol Mass Spectrometer (C-ToF-AMS,[2]) from 8th January to 14th October 2019 with a 5- min time resolution. The C-ToF-AMS measurements were supplemented with 1-min equivalent black carbon (eBC) data by an aethalometer (Mo-del AE33, Magee Scientific, Berkeley, CA), 1-hour boundary layer height (BLH) by satellite measurements (ERA hourly dataset provided by the Copernicus Climate Change Service), 72-h back-trajectories (GDAS 1°) for every hour by the Hybrid Single Particle Lagrangian Integrated Trajectory model (HYSPLIT) and 1-hour meteorology data. 30-min averages of NR-PM_1 were calculated from the 5-min data. A Positive Matrix Factorization (PMF) with multi-linear engine (ME-2) was applied to separate OA into different factors in terms of their mass spectra and time series. The Source Finder (SoFi[1]) was used to run PMF and ME-2.

Results and discussion

During three seasons (winter, spring, and autumn), five OA factors and/or sources were identified namely hydrocarbon-like OA (HOA), biomass burning OA (BBOA), coal combustion OA (CCOA) and more and less oxidized OA (MO-OOA and LO-OOA). Four OA factors/sources were identified for the summer, HOA, BBOA, MO-OOA, and LO-OOA. Three of these factors represent primary sources (HOA, BBOA, and CCOA), the other two represent secondary/oxidized factors. The largest share of primary factors (29% of total OA concentrations) was found in winter, the lowest (20%) in summer. Since the aged primary OA becomes part of OOA and therefore, the percentage of primary factors cannot be directly related to the share of these emission sources in the overall immission budget. The concentrations of individual factors were significantly influenced by meteorological and dispersion conditions. The highest concentrations of primary factors were calculated for periods with low wind speed and low atmospheric boundary layer height.

References

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