Comparison of Black carbon and EC-OC measurements at ACTRIS site Košetice-Křešín u Pacova

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Keywords: atmospheric aerosols, elemental carbon, black carbon, ACTRIS
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Black carbon (BC) is one of the key atmospheric particulate components driving climate change and air quality. BC, a fraction of the carbonaceous material that absorbs visible light, is produced by incomplete combustion of fossil fuels by transport, heating, power plants, wood and biomass burning. Because of its light absorbing properties, BC contributes significantly to global warming. Due to the fine size and chemical composition of BC, its negative health effects are also widely recognized.

No standard reference method for BC measurement exists yet and uncertainties are too high. It is strongly recommended (Petzold et al, 2013) to combine the measurements using aethalometer with the elemental carbon (EC) measurement using thermo-optical method to improve the data quality.

Both measurements are implemented at the research infrastructure Observatory Kosetice – Křešín u Pacova within ACTRIS (Aerosols, Clouds, and Trace gases Research Infrastructure Network) project. The observatory is located in free area outside of settlement (49°35´ N, 15°05´E, 534 m above sea level) and represents the Czech Republic in several international long-term monitoring programmes and projects.

In 2013, EC/OC measurement using a field semi-online analyser (Sunset Instrument) started. The instrument sampled $PM_{2.5}$ fraction, denuder is used to remove volatile organic compounds. Automatic optical corrections (based on a laser transmission monitoring) for charring were made during each thermal-optical analysis. Shorted EUSAAR thermal protocol is used. Time resolution of sampling is 4 hours. Measurement of black carbon is carried out by 7-wavelenght Aethalometer AE31 (Magee Scientific) in real-time mode. This filter based measurement use optical analyze. Time resolution of sampling is 5 minutes, sampled air is dried by nafion drier.

Daily averaged concentrations of optical EC and BC (in wavelength 880 nm) were used for comparison of above mentioned methods. Correlation between optical EC and BC was calculated for two years of measurement (2013-2014). Fig. 1 shows, that optical EC strongly correlated with BC, correlation coefficient r^2=0.93. Concentrations of BC varies from 0.05 to 8.46 µg.m^{-3}, average value is 0.79 µg.m^{-3}. Optical EC concentration oscillates in the range 0.04 to 3.95 µg.m^{-3}, average value is 0.47 µg.m^{-3}. The BC concentrations were in average by 0,32 µg.m^{-3} higher than EC, which is in line with previous comparisons (Husain et al., 2007, Jeong et al., 2004). BC may contain not only EC but organic carbon that effciently absorbs light at blue and near-ultraviolet (UV) wavelengths (Chow et al., 2009).

Presented results cover only 2 years, but the regular measurements will continue within ACTRIS 2 project under Horizon 2020.

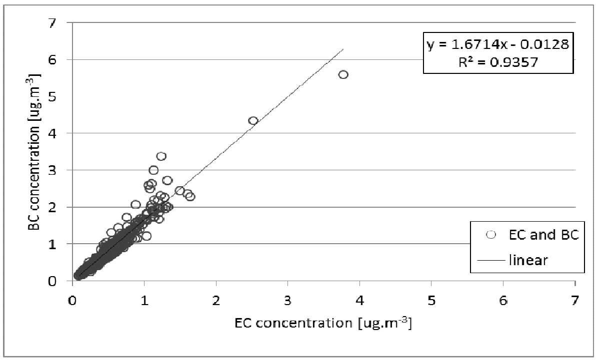

Figure 1. Correlation between BC and EC measurements at the Košetice Observatory (2013-2014)

Acknowledgements

The research leading to these results has received funding from the European Union Seventh Framework Programme (FP7/2007-2013) under grant agreement n° 262254 (project ACTRIS).

This abstract is an output of the CzechGlobe Centre that is being developed within the OP RDI and co-financed from EU funds and the State Budget of the Czech Republic (Project: CzechGlobe – Centre for Global Climate Change Impacts Studies, Reg. No. CZ.1.05/1.1.00/02.0073).

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