Comparability of methods to measure black and elemental carbon in two European urban areas - site and seasonal similarities and differences

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Black (BC) and elemental carbon (EC) originate from incomplete combustion of carbonaceous fuels and are important constituents of atmospheric aerosols because of their optical and climatic effects (Jacobson 2005) and their possible health effects (Kim *et al.* 2003). Despite intensive efforts over the last decades, no standard measurement technique has been identified. In this presentation, we use the term BC for data obtained by optical methods, and EC for those obtained by thermal methods.

The study is focussed on an intercomparison of various measurement methods for BC and EC in two Central European cities (Prague, Czech Republic, and Vienna, Austria) which are rather similar in geographical features (total area covered, hilly surroundings, river, building density and characteristics) and have similarities and differences with regard to aerosol sources (in particular sources of black / elemental carbon). In earlier studies in Vienna under summer (Hitzenberger *et al.* 2006) and winter conditions (Reisinger *et al.* 2008) we found different conversion factors for BC and EC measured with different methods for the seasons.

The goal of the current study is to investigate whether similar conversion factors are applicable at the sites and whether the conversion factors obtained earlier (i.e. ca. 10 years ago) for Vienna are still valid or whether changing source conditions have resulted in shifts of the carbonaceous fractions of the aerosol that would require a new set of conversion factors.

For this goal, we performed two back-to-back campaigns in the two cities. The summer campaign was performed first in Prague (June 25 - July 9, 2012) and then in Vienna (July 16 – 30, 2012). The winter campaign was performed in Vienna (Jan. 14 – 30, 2013) and subsequently in Prague (Feb. 4 – 16, 2013).

In both campaigns, BC concentrations were measured on-line with a Multi Angle Absorption Photometer (MAAP) and a Micro-Aethalometer. For Prague, also data from a semi-continuous Sunset Analyzer (NIOSH and EUSAAR II protocols) are available. Off-line measurements of BC and brown carbon (BrC) were also performed using the modified integrating sphere technique capable to separate BC and BrC (Wonaschuetz *et* al 2009). EC concentrations were measured off-line using a Sunset analyzer. In addition to the EC / BC measurements, number size distributions and mass size distributions of the total aerosol were obtained and later analyzed for major ions as well as for black carbon (usually attributable to Diesel traffic) and brown carbon (usually attributable to wood combustion).

First results from the summer study on the intercomparability of the different methods of EC and BC determination show that as expected, the methods are rather well comparable under summer conditions, which agrees well with the earlier study in Vienna. The campaign averages seem to be rather different (e.g. in Vienna, the highest average EC concentration - 1.5 µg/m³ - was measured with the Aethalometer and the lowest - 0.5 µg/m³ - with the Sunset analyzer, transmission correction), but if the data variation is considered, these differences are not significant. Similar results were found for the Prague campaign. The influence of biomass smoke in summer in Prague is sometimes visible also in the BrC data, and is mostly absent in the Vienna summer data (BrC concentrations seldom were found to be above the detection limit). The full results of the intercomparison study will be the focus of this presentation.

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