Atmos. Meas. Tech. Discuss., 3, C2727–C2730, 2011
www.atmos-meas-tech-discuss.net/3/C2727/2011/

Atmospheric Measurement Techniques Discussions

Interactive comment on "A two year's source apportionment study of wood burning and traffic aerosols for urban and rural sites in Switzerland" *by* H. Herich et al.

H. Herich et al.

hanna.herich@empa.ch

Received and published: 16 February 2011

We thank the referee for the comments and will consider them in the revised version of the manuscript.

Please note: In the revised manuscript, the BC data from the three sites was extended until October 2010. The longer time series provide improved information about the temporal variation of considered measures (e.g. Angstrom exponent α) and even more robust results. In the revised version, the figures and the numbers in

Full Screen / Esc
Printer-friendly Version
Interactive Discussion
Discussion Paper

tables have thus slightly changed. This has, however, no impact on the results and the conclusions.

1. The title refers to “traffic aerosols” while the manuscript discusses aerosols from fossil fuel combustion. Therefore in the title “traffic aerosols” should be replace with “fossil fuel combustion aerosols”.

-The title will be changed accordingly

2. Filter-based measurements of aerosol light absorption such as implemented in the aethalometer have several systematic errors. Here, the authors just refer to the correction algorithms used. However, some of these errors cannot be corrected and their influence must be discussed. Most prominently is the morphology change of liquid particles when sampled on filter media. For an example for WB aerosols sampled on quartz fiber filters, please see (Subramanian et al. 2007).

- The reviewer is correct, filter measurements can be affected by several further systematic errors. We will mention this in the introduction and section 2.1. The work Subramanian et al. will be cited. Nevertheless, it should be kept in mind that aerosol absorption measurements using an aethalometer corrected by the method of Weingartner et al. (2003) are widely used in studies on atmospheric black carbon. A physically correct measurement of the aerosol absorption coefficient is not required for our approach. Systematic errors in aerosol absorption measurements would lead to different values for the aerosol light absorption cross sections σ_{abs} listed in Table 2 but would not have an effect on the source apportionment of BC. The mentioned systematic errors in the aerosol absorption measurement could also contribute to the variability of the absorption coefficient and thus to an increasing random uncertainty of the σ_{abs}. However, as indicated in the answer to Referee 1, the uncertainty caused by the assumption of the correct Angstrom exponent is the dominating source of uncertainty in our approach, the uncertainty of the values for σ_{abs} is of minor importance.

AMTD

3, C2727–C2730, 2011

3. The “absorption Angstrom coefficient” is discussed in many places in the manuscript but referred to with several different, sometimes misleading terms. Examples include “Angstrom exponent” (line 67), “absorption exponent” (line 146), “absorption coefficient” (lines 214, 215). The authors need to use a uniform term; I suggest “Absorption Angstrom Coefficient (AAC)”.

- We will change the terms. We will use consistently "aerosol absorption coeff." for b_{abs} and "Angstrom exponent" for α

4. Lines 42, 43: “BC is the light absorbing part of carbonaceous material...”. Incorrect! BC is the light absorbing part of carbonaceous material, which has a wavelength independent imaginary part of the refractive index. The roles of BC and light-absorbing OC are correctly discussed in lines 68-75.

-will be changed

5. “The aethalometer model”. Here, the authors use only absorption coefficients measured at two wavelengths (i.e., 470 nm and 880 nm (or 950 nm)) to separate absorption due to FF and WB. Using only two of the seven aethalometer wavelengths necessitates using absorption Angstrom coefficients (AACs) from the literature. The use of an AAC value near or equal one for FF aerosol is fine, but the AACs for WB are far less well established and probably dependent on the source and combustion phase. Here it is very important to use absorption coefficients at all seven wavelengths to determine the AACs for FF and WB for the individual receptor sites. At the very least, seven wavelength spectra for FF and WB dominated episodes must be shown and fitted with a power law. This would also demonstrate to what degree the power law dependence of aerosol light absorption, inherent in the AAC concept, holds for the

AMTD

3, C2727–C2730, 2011

existing aethalometer measurements over all wavelengths.

- For the whole dataset we used seven wavelength spectra to obtain hourly Angstrom exponents alpha. Alpha was determined from power law fits of $b_{abs}(\lambda)$ / b_{abs} (950nm)as a function of the wavelength. These data were used for figure 1 and figure 2.
We assume that none of the alpha values we determined is representative for WB or FF particles as aerosols are aged and mixed. Thus we cannot determine alphas for FF and WB at the individual receptor sites.
That is why we took literature values for α_{FF} and α_{WB}. We chose α_{WB}=1.9 as this value is close to 2.0 (Favez et al.) and 1.86 (Sandradewi et al.). Both publications showed that these values are appropriate for ambient aerosols originating from domestic heating. Additional references for the choice of α_{WB} values are given in the two mentioned publications. Please see also the answer to Referee 1 on the choice of values and ranges of α_{WB} and α_{FF} and the sensitivity tests performed.

6. line 162: Define σ_{abs}.

-defined p.3 l.25

7. line 171: ...the absorption exponent alpha was calculated over all seven wavelength.... Please tell the readers how this was done, for example by a linear regression of absorption coefficient as function of wavelengths in log-log space. For more information, please see (Moosmuller et al., 2010)

- We will add how it was done

Interactive comment on Atmos. Meas. Tech. Discuss., 3, 5313, 2010.