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Atmospheric Measurement Techniques Discussions

Interactive comment on "A new algorithm for brown and black carbon identification and organic carbon detection in fine atmospheric aerosols by a multi-wavelength Aethalometer" *by* F. Esposito et al.

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Dear Authors, the use of the absorption Angstrom exponent to discriminate between sources of combustion have been used in the past, most exhaustively for discrimination of fossil fuel and biomass combustion in Sandradewi (2008) and Favez (2010). The Angstrom exponent specific to the type of fuel combustion is used to apportion the absorption and then BC to one source or the other. The wavelength dependence of absorption has also been use to identify Saharan dust events (Collaud Coen 2004, Fialho 2005). The methodology that Esposito et al. use is slightly awkward.

> The alpha exponent estimation, used in the past to distinguish among different aerosol types, has been used in this paper firstly to verify the presence of BrC and then to re-estimate equivalent UVPM reducing systematic errors due to the variation of alpha exponent. In figure 7 it can be verified that when alpha = 1.3, equivalent UVPM by MAGEE algorithm is twice the value estimate by the best-fit technique. The usefulness of the technique has been tested comparing results obtained when the refinery was working or it was out (see figures 3 and 4). —-

The increase of the Angstrom exponent for absorbing aerosols is exactly due to the increased absorption at low wavelengths. This may be operationally defined as UV absorbing particulate matter (UVPM) or as brown carbon (BrC) or as absorbing OC. I believe the method of extrapolating absorption to blue and then attributing the increased absorption in the UV is methodologically weak.

> The technique is firstly applied to the spectral range 470-950 nm: if alpha > 1 it is assumed the presence of BrC. After this, fitted values of ATN are extrapolated at 370 nm and then the difference between measured and extrapolated ATN at 370 nm (equation 7) is computed. This difference is used to estimate UVPM in a similar way as in MAGEE manual (pg 28, eq. 7 and pg. 29, eq. 12). The only difference is that MAGEE algorithm is based on the hypothesis that Angstrom exponent is equal to 1, while it could not be always true, as verified in figures 4, 5, 6. —-

The Angstrom exponent changes with the wavelength (Moosmueller 2011). Attributing this to operationally defined substances is somewhat arbitrary: how do we differentiate between BrC and absorbing OC?

> As said above, increased alpha values estimated in the spectral range 470 – 950 nm suggests the presence of BrC, while a higher absorption found at 370 nm is due to OC. —-

Converting the Aethalometer measurements of mass absorption to absorption coefficient and deriving its wavelength dependence has been shown as a very useful tool

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for source apportionment. Calculation of the absorption and SSA Angstrom exponent does identify the episodes with aerosol from various regions. The authors may wish to use the wealth of data they have and clarify and simplify their methodology to process it.

> We would like to thank you for this suggestion: in the future we will work on the possibility to discriminate among different atmospheric aerosols types using Aethalometer data alone or integrating them with other techniques. Measurements discussed in the present paper have been collected in a site very close (2 km) to a pre-treatment fresh oil center, where flames are continuously burning and this activity lets aerosol properties to be dominated by emissions products. In this context we think our procedure to be able to follow aerosol properties variations.

Best regards —-

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