Atmos. Chem. Phys. Discuss.,
https://doi.org/10.5194/acp-2019-123-RC2, 2019

Atmospheric Chemistry and Physics Discussions

Interactive comment on "Exploiting multi-wavelength aerosol absorption coefficients in a multi-time source apportionment study to retrieve source-dependent absorption parameters" *by* Alice C. Forello et al.

Anonymous Referee #3

Received and published: 6 June 2019

The article describes a new method to determine source-dependent absorption parameters using a receptor model based on multiple time resolution data (Crespi et al., 2016). Determination of source-dependent Angstrom exponents using C14 technique (Zotter et al., 2017) is time consuming and expensive. There is a need for alternative methods, such as the one proposed by Crespi et al. (2016).

The receptor model was run using data from the offline analysis of chemical composition and the absorption coefficient of particles collected on filters. The absorption was measured using a custom polar photometer which was validated using MAAP at

Printer-friendly version

Discussion paper

a single wavelength (Vechi et al., 2014; Bernardoni et al., 2017c). Measurements at 4 different wavelengths are used to calculate the absorption Angstrom exponent. It is not clear how accurate is the value of Angstrom exponent measured by polar photometer as it has not been compared to other multi-wavelength methods, for example: photo-acoustic spectroscopy (Lack et al., 2006), extinction minus scattering, filter photometry (Moosmuller et al., 2009) or being calibrated with laboratory generated aerosol samples (carbon black, nigrosin ...) with known spectral absorption properties and size distribution.

The article proposes a new set of values for the source specific Angstrom exponents for biomass burning and fossil fuel combustion: 1.83 and 0.8, respectively. The biomass burning value is in agreement with previous studies (Zotter et al., 2017), but the value for fossil is quite low. These results are not un-expected as the summer campaign resulted in the average absorption Angstrom exponent as low as 0.58 (data from Table S2) – this value lies outside the range measured in a different settings in Europe. It is also strange that there is no wavelength dependency in absorption coefficients between 532 and 780 nm for the traffic component (Figure 1). Authors should provide an extensive quality control assessment of absorption data to support their findings.

Raw measurements (time-series, diurnal profile) should be presented and discussed before proceeding to the data evaluation using the receptor model.

The language in certain parts of the article is not clear. Here are some specific remarks:

- the parameter describing the spectral dependence of the absorption coefficient is usually named Absorption Angstrom Exponent (similar to Scattering Angstrom Exponent).

- the term Multi-time source apportionment study is not clear. The term Multi-time resolution source apportionment is proposed.

Printer-friendly version

Discussion paper

- Line 20: MAC should be defined as Mass Absorption Cross-section instead of Mass Absorption Coefficient

I recommend performing another review after extensive revision of the manuscript. Concerning the scope of the journal, the article might be better suited for the publication in AMT.

Interactive comment on Atmos. Chem. Phys. Discuss., https://doi.org/10.5194/acp-2019-123, 2019.