Geophysical Research Abstracts
Vol. 19, EGU2017-19597-1, 2017
EGU General Assembly 2017

Aerosol source apportionment based on multi-wavelength photoacoustic light absorption measurements: a simulation method for system's optimisation

Károly Simon (1), Tibor Ajtai (2), Gergely Kiss-Albert (3), Noémi Utry (2), Máté Pintér (1), Gábor Szabó (1), Zoltán Bozóki (1,2)

(1)) Department of Optics and Quantum Electronics University of Szeged, Szeged, H-6720, Hungary, (2) MTA-SZTE Research Group on Photoacoustic Spectroscopy, Szeged, H-6720, Hungary, (3) Hilase Development, Production, Service and Trading Limited, Székesfehérvár, H-8000, Hungary

Aerosol source apportionment is currently one of the outstanding challenges for environmental monitoring. In most cases atmospheric aerosol is a heterogeneous mixture as it typically originates from various sources. Consequently, each aerosol type has distinct chemical and physical properties. Contrary to chemical properties, optical absorption and size distribution of airborne particles can be measured in real time with high time resolution i.e. their measurement facilitates real time source apportionment (Favez et al (2009), Ajtai et al (2011), Favez et al (2010)). The wavelength dependency of the optical absorption coefficient
(OAC) is usually characterised by the Absorption Angström Exponent (AAE).
So far, the selection of light sources (lasers) into a photoacoustic aerosol measuring system was based on rule of thumb type estimations only. Recently, we proposed a simulation method that can be used to estimate the accuracy of aerosol source apportionment in case of a dual wavelength photoacoustic system (Simon et al., (2017)). This simulation is based on the assumption that the atmospheric aerosol load is dominated by two distinct sources and each of them is strongly light absorbing with specific AAE values. This is a typical scenario e.g. for urban measurements under wintry conditions when dominating aerosol sources are fossil fuel and wood burning with characteristic AAE $\sim$1 and $\sim$2, respectively. The wavelength pair of 405 and 1064 nm was found to be optimal for source apportionment in this case.
In the presented study we investigated the situation when there are aerosol components with only slightly different AAE values and searched for a photoacoustic system which is optimal for distinguishing these components.

Ajtai, T.; Filep, Á.; Utry, N.; Schnaiter, M.; Linke, C.; Bozóki, Z.; Szabó, G. and Leisner T. (2011) Journal of Aerosol Science 42, 859-866.
Favez, O.; Cachier, H.; Sciare, J.; Sarda-Estève, R. and Martinon, L.
(2009) Atmospheric Environment 43, 3640-3644.

Favez, O.; El Haddad, I.; Piot, C.; Boréave, A.; Abidi, E.; Marchand, N.; Jaffrezo, J. L.; Besombes, J. L.; Personnaz, M. B.; Sciare, J.; Wortham, H.; George, C. and D'Anna, B. (2010), Atmos. Chem. Phys. 10, 5295-5314.

Simon, K.A.; Ajtai, T; Gulyas, G; Utry, N; Pinter, M; Szabo, G. and Bozoki, Bozoki, Z. (2017), Journal of Aerosol Science 104, 10-15.