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Demonstration of the Applicability of Novel Photoacoustic Aerosol Monitor for Optical Absorption Coefficient Determination. Laboratory and Field Test.

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Despite of its importance, the possibilities to determine the direct radiative forcing by atmospheric aerosols is very limited due to lack of the reliable on-line instruments. Therefore there is an increasing concern for novel methods promising more accurate and reliable results in this field. The accuracy and reliability of the available on-line instruments like SP2 (Single Particle Soot Photometer), MAAP (Multi Angle Absorption Photometer), are limited by the weakness of the spectral resolution or the sampling artefact of filter matrix during the light attenuation measurement on the deposited filter. These methods neither suitable for direct determination of the light absorption by aerosols nor dispose the capability of the source apportionment.
In this work we present a novel photoacoustic based instrument for direct light absorption measurements in the atmosphere and demonstrate the suitability of that both in laboratory and field circumstances.
We have developed a novel Multi Wavelength PhotoAcoustic System (WaSul-MuWaPas) based on the diode laser pumped, high repetition rate, Q-switched Nd:YAG laser and its frequency converted harmonics for direct determination of light absorption by aerosols.
This instrument has designed to make in situ measurements at four different wavelengths simultaneously from the NIR to the UV wavelength range (1064nm, 532nm, 355nm, 266nm). The Wasul-MuWaPas measures directly the optical absorption coefficient on airborne particles, not belong to the integrated plate type technique (filter-free operation), operating at wide wavelength range (source apportionment possibilities), due to the possibilities of the wavelength independent cell constant determination the measurement method is absolute. Because of these the Wasul-MuWaPas system may become one of the best candidate for absorption measurements of various atmospheric aerosols such as black carbon, mineral dust, and secondary organic and inorganic aerosols as well as for source apportionment studies.
The present system was successfully tested both under the laboratory and field circumstances. The results of these studied, demonstrated here, is shown excellent agreements with reference methods and presents the main characteristic performances of the system verifying the potential of Wasul-MuWaPas to characterizing the spectral properties of atmospheric aerosols.
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