

2ND EUSAAR ABSORPTION PHOTOMETER WORKSHOP

The 2nd EUSAAR absorption photometer workshop will take place from

29 June to 10 July 2009

at the Leibniz Institute for Tropospheric Research, Leipzig.

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MOTIVATION

The calibration of particle absorption photometers, which functional principle is based on sampling air borne particles on/into fiber filters and measuring the transmittance of radiation (Aethalometer, MAAP, PSAP and several custom made photometer), is still a challenging tasks. A calibration standard is lacking and the photometers respond to scattering particles, which misleadingly can be interpreted as particle light-absorption. An additional complication is that the response of photometers to both, absorption and scattering, depends on the total amount, chemical composition, and particle size of the particulate matter that is collected on the filters. Moreover, differences in measured absorption coefficients are caused by different calibrations and design features of different instruments. Despite all problem, comparability of absorption coefficients is a necessary prerequisite for Monitoring Networks. This network activity (NA4) aims to understand the differences in absorption coefficients recorded by various instruments and to correct absorption coefficients where possible. To do so, a series of workshops is organized.

The first EUSAAR Absorption photometer workshop was held in Leipzig in 2007. Beside general performance characteristics (different calibrations, maintenance), the workshop focused on 1) differences between basically identical instruments (instrument unit-to-unit variability,

instrument precision) and 2) differences between various suits of instruments (difference between the average of MAAP, PSAP, and aethalometer). Moreover the workshop revealed: 3) cross sensitivity to particle scattering was found not to be constant correction factor as introduced by Bond et al. (1999), and 4) apparent absorption caused by particle scatter does not only depend on single scattering albedo (chemical composition) but also on the scattering phase function (particle size).

The coming second EUSAAR absorption photometer workshop will focus on the unfinished work of the first workshop. The focus will be on instrumental sensitivity to various chemical and physical particle compositions. The main goal is to determine the magnitude of the sensitivities and to develop means to correct for apparent absorption caused by scattering.

WORK PLAN

1. Measuring loading dependent response of absorption photometers to
 - a. Absorbing particles: Carbon black, kerosene soot
 - b. Scattering particles: Ammonium sulfate
 - c. Ambient air
2. Test of existing correction schemes for Aethalometer, PSAP, and MAAP
3. Developing new correction methods for Aethalometer, PSAP, MAAP

EXPERIMENTAL SETUP

Calibration experiments necessarily require instruments which are “reference” instruments for particle absorption and scattering. Reference instruments for absorption are a) Photo-acoustic absorption spectrometer, and c) Cavity Ring down.

These instruments do not accumulate particles on a filter and therefore do not show any loading effect. An integrating nephelometer typically acts as reference instrument for particle scattering. The physical aerosol characterization is aimed to be complemented by measurement of particle number size distribution (SMPS, APS, etc.) and auxiliary (temperature, humidity).

All photometers and reference instruments will be connected to one high volume aerosol tank. The Aerosol tank will be connected to the aerosol generators. The aerosol tank acts as a buffer volume to diminish potential spikes in the particle number concentration of the aerosol generators, and to uniformly distribute the aerosol particles to different output ports. All aerosol sources and instruments will be connected to the aerosol tank, which facilitates to switch

between different aerosols and mixtures of aerosols. It is planned to do night time measurements with ambient air.

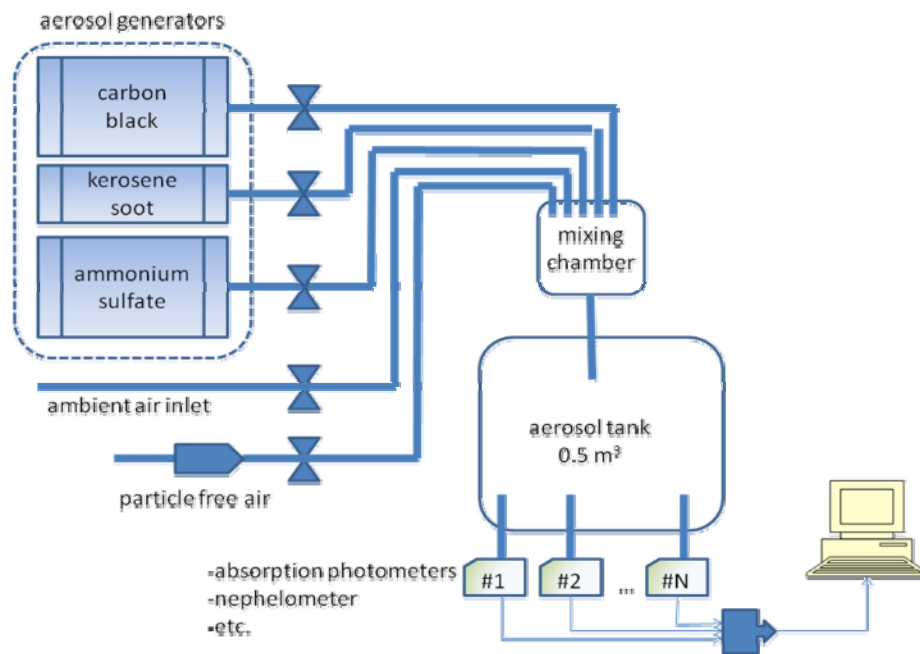


Figure: Experimental setup with aerosol generators and instruments.

TIME SCHEDULE

22 – 26 June: Not compulsory for workshop participants

- The instruments for the workshop are expected to arrive on June 22.
- Technical checks of instruments (leak test, etc...)
- Installing instruments, aerosol generators, and data acquisition.

29 June:

- Kick-off meeting for all workshop participants

29 June - 9 July:

- Performing experiments
- Preliminary data evaluation and discussion of experiments

10 July:

- Packing instruments