

MoLa – A new mobile laboratory for atmospheric aerosol research

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Keywords: aerosol sampling, mobile measurements, on-line measurements, urban aerosols.

In recent years, significant improvements in the development of aerosol measurement instruments have been made, especially regarding on-line methods. A major limitation in analysing ambient aerosols is the large effort associated with the deployment of modern aerosol measurement technology in the field. Due to this issue, sampling is often performed at non-representative locations or under non-ideal conditions. In addition, traditional, fixed sampling setups do not allow measurements performed at changing locations, in order to determine the local variability of aerosol parameters.

Here we present a new aerosol research platform, which was developed at the Max Planck Institute for Chemistry in Mainz, Germany: the Mobile Aerosol Research Laboratory (MoLa). The Mobile Laboratory is equipped with state-of-the-art instrumentation for physical and chemical aerosol characterization as well as for the measurement of standard trace gas concentrations (Table 1).

Scientific applications of the Mobile Laboratory are mainly mobile measurements of the ambient aerosol for investigation of the spatial distribution of pollution parameters (e.g., area mapping), or for probing of individual mobile sources (e.g., car chasing), but also stationary measurements under well-known sampling conditions (Figure 1).

The Mobile Laboratory is built on the basis of a Ford Transit F350. The vehicle is refitted with an air conditioning unit and two electrical generators,

attached to the vehicle's engine. They generate a total of 10 kW of electrical power, of which 7 kW are UPS buffered and can be used for instrumentation. Intelligent power distribution selects the power source (internal or external power) according to a priority list, and feeds it into the three on-board power circuits.

Large effort in the development of MoLa was put into representativeness of the measurement setup. The aerosol inlet system has been optimized for minimum particle loss, especially for the size range relevant for the individual instruments (Figure 1). Using a recently developed software tool and additional characterization measurements, the particle losses in the inlet system were determined for all instruments (von der Weiden, 2008).

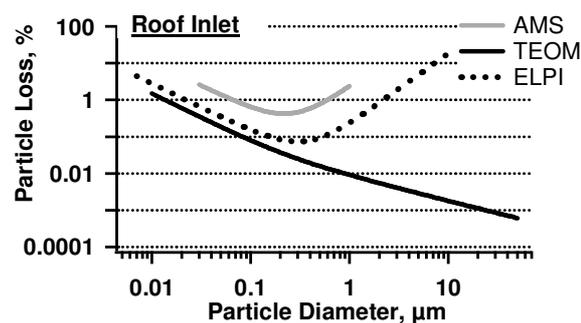


Figure 1: Calculated inlet losses for three of the instruments on MoLa

Three inlets are available: one inlet on the roof for stationary measurements, one inlet at the upper front for mobile measurements (e.g., area mapping), and one inlet at the lower front for car chasing measurements. The weather station is located at the top of a mast, which can be extended up to 10 m above ground level for stationary measurements.

In addition to a detailed description of the Mobile Laboratory, its instrumentation and its inlet setup and characterisation, we present first results from mobile and stationary measurements.

This work was funded by the Max Planck Society. We acknowledge technical support by T. Böttger, W. Schneider, C. von Glahn, and J. Sody.

von der Weiden, S.-L. (2008), *Diploma Thesis*, University of Mainz.

Table 1. Instrumentation of MoLa.

Measured Quantity	Instrument	Time Resolution
Number conc.	CPC	1 s
PM _{1/2.5/10}	TEOM	15 min
Size distribution	FMPS (5-500 nm)	1 s
	OPC (0.2-32 μm)	6 s
	APS (0.5-10 μm)	1 s
	ELPI (0.03-10 μm)	1 s
Aeros. PAH	PAS2000 (<1 μm)	10 s
Soot	MAAP (<1 μm)	1 min
Size-resolved aerosol composition	HR-ToF-AMS (40 nm – 1 μm)	Few seconds
Trace gases	AIRPOINTER	1 min
(O ₃ , SO ₂ , NO _x , CO, CO ₂)	LICOR 840	1 s
Meteorology	Vaisala WXT510	1 min