Leibniz Institute for Tropospheric Research

European Center for Aerosol Calibration

World Calibration Centre for Aerosol Physics

Intercomparison of Absorption Photometers
Project No.: AP-2017-3-6

Location of the quality assurance: TROPOS, lab 121

Date: 15 October, 2017

Principal Investigator	Home Institution	Participant	Instrument
B. Briel	DWD	B. Briel	MAAP, SN 32768

1. Intercomparison summary

Flow calibration: The flow meter of the instrument is set to report flow for conditions of 0°C and 1013.25 hPa. The flow was 6% too low compared to reference flow meter (Gilibrator). Corrections for the flow deviation and the temperature and pressure (STP correction) were considered in the data evaluation.

Noise: The noise level of the instrument was higher than expected from the MAAP specification sheet. The average noise (1σ) was 54.5 $ng \cdot m^{-3}$ for 1 min averaging time.

Inspection: Measurement cell was clean. The sample spots showed well defined, sharp edges.

Comparison to a reference MAAP: BC concentrations are about 4.6% higher than BC concentrations from reference MAAP.

Comparison to reference absorption: The absorption coefficients derived from MAAP are 21% lower than absorption coefficients from the multi-wavelength absorption reference setup. The uncertainty of the reference absorption for the present concentrations is about 10% to 15%.

Recommendations: None.

Overall assessment: The instrument meets the requirements.

2. Details

Configuration parameters
SIGMA BC: 6.6 m2/g LUFTDURCHSATZ l/h 480 MITTELWERTSPEICHER: 1 min KONZ. BEZOGEN AUF BETRIEBSBEDINGUNGEN NORMTEMPERATUR 0 _C DRUCKFORMAT: COM1 12 DRUCKZYCLUS: 1 min BAUDRATE: Bd COM1 9600 BAUDRATE: Bd COM2 9600 GERAETE-ADRESSE: 0 FILTERWECHSEL TRANSM. < % 50 ZYCLUS h 0 UHRZEIT UHR 0 SENSORKALIBRIERUNG P1,V P1,NP P2,V P2,NP P3,NP T1,NP T2,NP T3,NP -25 -9 -81 65 -85 -249 -180 LUFTDURCHSATZ 88.6 ANALOGAUSGAENGE AUSGABENULLPUNKT: 4mA CBC 0 10 MBC 0 2400 Q-OP 0 1000 T1 -20 40 T2 -20 40 P3 900 1100 GESYTEC-PROTOKOLL STATUSBELEGUNG STANDARD VARIABLEN-ANZAHL 1 CBC END

Flow check

[1]Correction factors F_{flow} and F_{STP} for correcting eBC concentrations. F_{flow} corrects for inlet flow errors considering leakage. F_{STP} is used to adjust concentrations to STP conditions (0°C, 1013.25 hPa).

Date	System Flow			Reference flow Reference flow meter: Gilibrator 'TROPOS-T'			Flow correction factor[1]**Fehler! Textmarke nicht definiert.**	STP correction factor[1]**Fehler! Textmarke nicht definiert.**
	Mass flow	Volume reference		Volume flow	Ambient *T* and *P*			
	Q_{MAAP} [slpm]	$T_{0,MAAP}$ [°C]	$P_{0,MAAP}$ [hPa]	Q [lpm]	T [°C]	P [hPa]	F_{flow}	F_{STP}
2017-09-27	8	0	1013.25	8.090	20	1010	1.065	1.000

Spot size check

Correction factor for spot sizes F_{spot}.

Date	Nominal spot size [cm^2]	Measured spot size [mm^2]	F_{spot}
2017-09-27	0.785	Well defined spot, spot size not measured	1.0

Instrumental Noise

Noise in units of eBC concentration measured with filtered air.

Date	Avg. time	Wave-length [nm]	Num data points	Median [ng]	10th percentile [ng/m^3]	90th percentile [ng/m^3]	Mean [ng/m^3]	Standard deviation [ng/m^3]	Error of the mean [ng/m^3]
2017-09-28	1 min	637	76	-3.5	-104.5	41	-21.29	54.54	6.26

Comparison to reference MAAP

Correlation of eBC from MAAP (SN 32768) and the reference MAAP (SN 504).

Slope	1.046±0.002
R^2	0.998

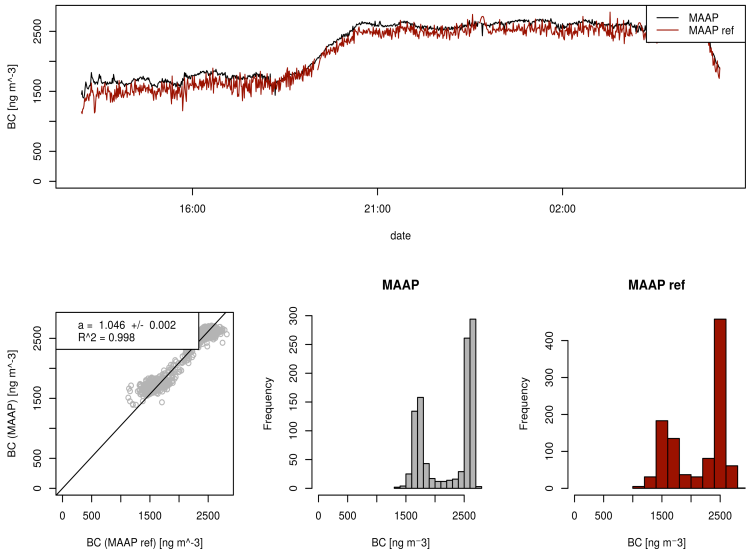

Figure: Comparison of eBC concentrations from MAAP SN-32768 (637 nm) and MAAP SN-504 (637 nm).

Comparison to multi-wavelenght absorption reference
Correlation of absorption coefficients from MAAP (SN 32768) and the multi-wavelenght absorption reference

Slope	0.791±0.004
R^2	0.976

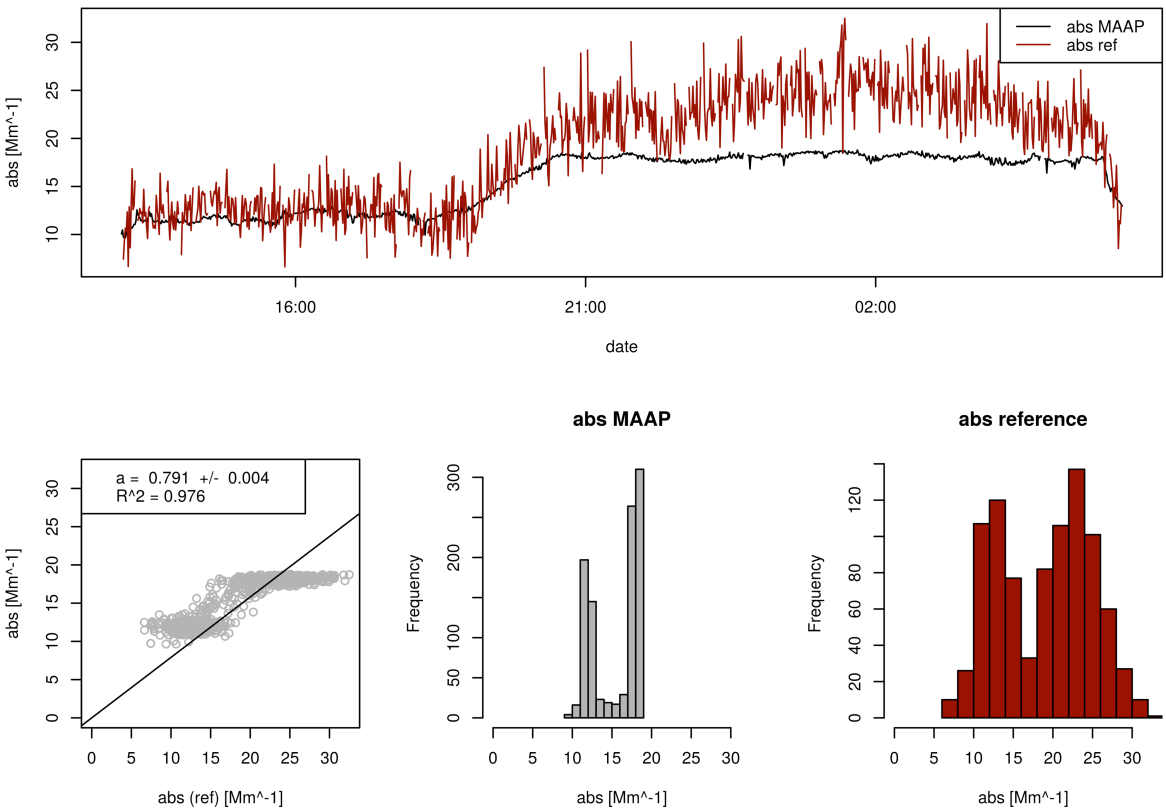

Figure: Comparison of absorption coefficient from MAAP SN-32768 (637 nm) and absorption reference (660 nm).