



Intercomparison of absorption photometer Project No.: AP-2019-4-3

Basic informations:

Location of the quality assurance: TROPOS, Lab 121
Date: 14 October - 18 October 2019

Principal Investigator	Home Institution	Participant	Instrument
O. Bath	UBA	O. Bath	161

1 Intercomparison summary

Status on arrival

No issues due to transportation or other damages.

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 0.3 % too high compared to reference flow meter (TSI 4100). 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 is in the normal range. The average noise (1σ) for the all wavelengths was less equal 50 ng m^{-3} for one minute averaging time. The background level was acceptable with deviations of less equal 1 ng m^{-3} .

Inspection

The measuring cell was slightly contaminated with dust. The cell was cleaned.

Comparison to reference MAAP

BC concentrations of MAAP are 0.2 % higher than BC concentrations from a reference MAAP.

Comparison to reference absorption

The deviations of the absorption coefficients derived from MAAP relative to the absorption coefficients from the multi-wavelength absorption reference setup is 10.8 %.

Recommendations

No recommendations.

Overall assessment

The instrument meets the requirements.

2 Details

Configuration parameters

THERMO SCIENTIFIC		MAAP v1.33		SERIENNUMMER 161		19-10-14	
<hr/>							
SIGMA BC:		6.6 m2/g					
LUFTDURCHSATZ 1/h		480					
MITTELWERTSPEICHER:		1 min					
KONZ. BEZOGEN AUF		NORMTEMPERATUR					
NORMTEMPERATUR		0 _C					
DRUCKFORMAT:		COM2 8					
DRUCKZYCLUS:		0 s					
BAUDRATE:		Bd COM1	9600				
BAUDRATE:		Bd COM2	9600				
GERAETE-ADRESSE:		30					
FILTERWECHSEL							
TRANSM. <	%	50					
ZYCLUS	h	100					
UHRZEIT	UHR	24					
SENSORKALIBRIERUNG							
T1	T2	T3	T4	P1	P2	P3	
-28	-47	-55	50	-303	-80	46	
LUFTDURCHSATZ		91.3					
HEIZUNGSPARAMETER							
Sollwert T2 UEBER T1		0 _C					
Max. Heiztemperatur		45 _C					
Min. Heizleistung		10 %					
ANALOGAUSGAENGE							
AUSGABENULLPUNKT:		4mA					
CBC	0	10					
MBC	0	2400					
GESYTEC-PROTOKOLL							
STATUSBELEGUNG		STANDARD					
VARIABLEN-ANZAHL		1					
CBC							
END							

Flow check

Table 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).

System flow and reference			Measured	F_{flow}	F_{STP}
Q_{MAAP}	$T_{0,MAAP}$	$p_{0,MAAP}$	flow Q		
[slpm]	[°C]	[hPa]	[slpm]		
7.267	0	1013.25	7.856	0.997	1

Spot size check

Table 2: Correction factor for spot sizes F_{spot} .

Nominal spot size [cm ²]	Measured spot size [cm ²]	F_{spot}
2.00	Well defined spot, spot size not measured	1.0

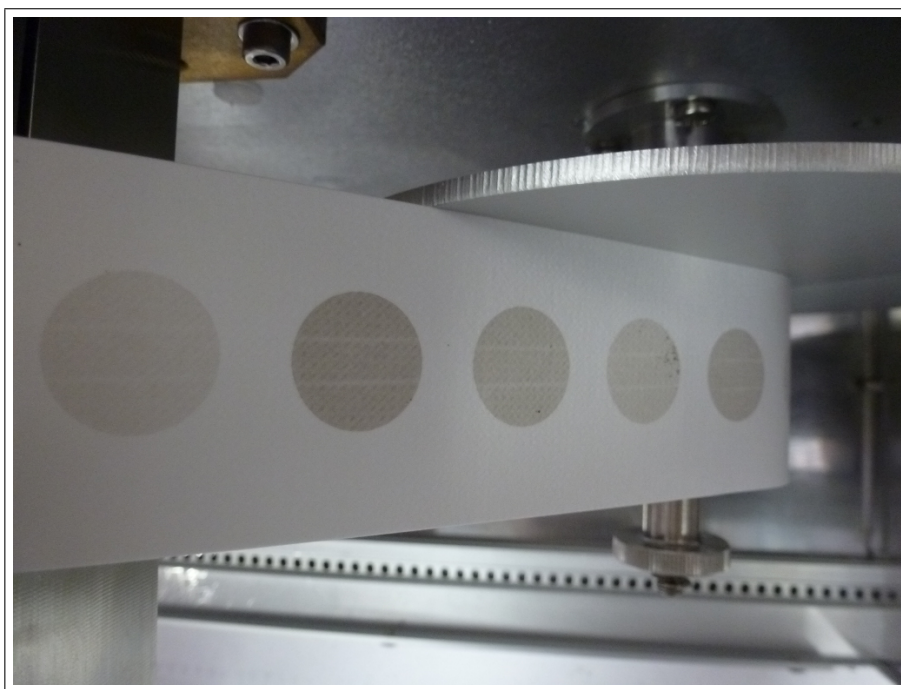


Figure 1: New spot from MAAP (161) on filter tape.

Instrumental Noise

Table 3: Noise parameters of MAAP (161) measured with filtered air.

Wavelength [nm]	Number of data points	Median [ng m ⁻³]	10th percentile [ng m ⁻³]	90th percentile [ng m ⁻³]	Mean [ng m ⁻³]	Std. dev. [ng m ⁻³]	Error of mean [ng m ⁻³]
660	121	1	-57	54	1	50	5

Comparison to reference MAAP

Table 4: Correlation parameter of eBC coefficients from MAAP (161) and reference MAAP.

Wavelength [nm]	Slope	Error	R^2
660	0.998	0.009	0.991

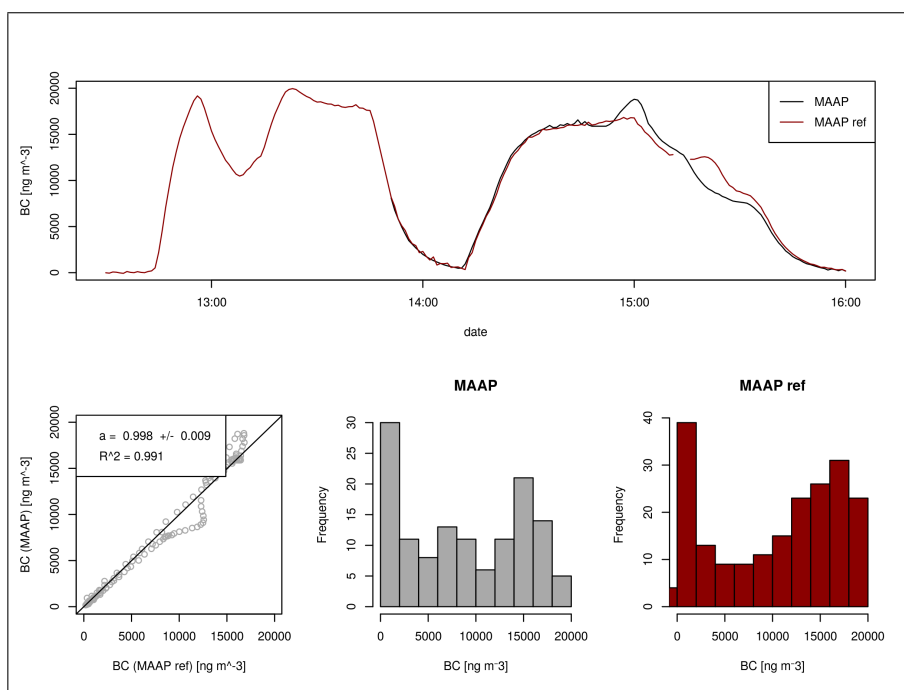


Figure 2: Correlation of eBC coefficient from MAAP (161) and reference MAAP.

Comparison to multi-wavelength absorption

Table 5: Correlation parameter of absorption from MAAP (161) and the multi-wavelength absorption reference.

Wavelength [nm]	Slope	Error	R^2
637	1.108	0.009	0.993

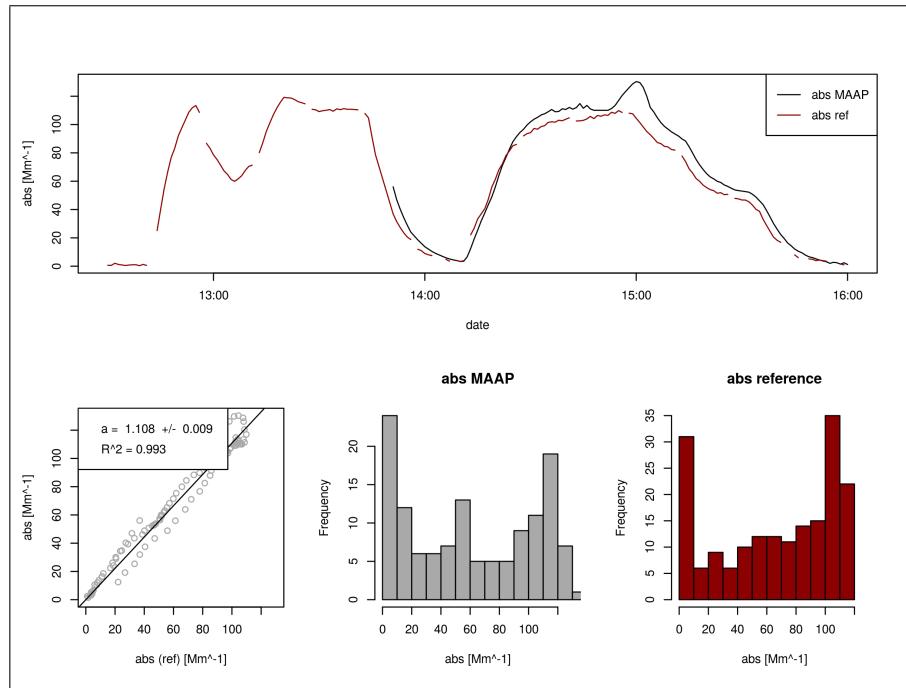


Figure 3: Correlation of absorption from MAAP (161) and the multi-wavelength absorption reference at 660 nm.