



Intercomparison of absorption photometer Project No.: AP-2019-3-1

Basic informations:

Location of the quality assurance: TROPOS, Lab 121

Date: 7 October - 11 October 2019

Principal Investigator	Home Institution	Participant	Instrument
B. Briel	DWD	B. Briel	3139

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 0.1 % too low 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 40 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 contaminated with dust and a mosquito. On the inner wall there was a small amount of a yellow oily liquid, probably old grease. The cell was cleaned.

Comparison to reference MAAP

BC concentrations of MAAP are 8.4 % 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 -0.6% .

Recommendations

No recommendations.

Overall assessment

The instrument meets the requirements.

2 Details

Configuration parameters

THERMO SCIENTIFIC		MAAP v1.33		SERIAL NUMBER 98		19-06-03	
<hr/>							
SIGMA BC:		6.6 m2/g					
AIR FLOW:		1000					
STORE AVERAGES:		5 min					
VOLUME REFERENCE		OPERATING CONDITIONS					
STANDARD TEMPERATURE		0 _C					
PRINTFORMAT:		COM1		40			
PRINTCYCLE:		40 s					
BAUDRATE:		Bd	COM1	9600			
BAUDRATE:		Bd	COM2	9600			
DEVICE-ADDRESS:		0					
FILTER CHANGE							
TRANSM. <		%	70				
CYCLE		h	100				
HOUR:		0					
CALIBRATION OF SENS.							
T1		T2	T3	T4	P1	P2	P3
-23		-5	-37	65	257	-36	-29
AIR FLOW		110.5					
HEATER PARAMETERS							
Diff. T2-T1 nominal		0 _C					
Max. Heating Temp.		45 _C					
Min. Heating Power		10 %					
ANALOG OUTPUTS							
OUTPUT ZERO:		4mA					
CBC		0	10				
MBC		0	2400				
GESYTEC-PROTOKOL							
STATUS VERSION		STANDARD					
NUMBER OF VARIABLES		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]		
8.083	0	1013.25	8.7	1.001	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

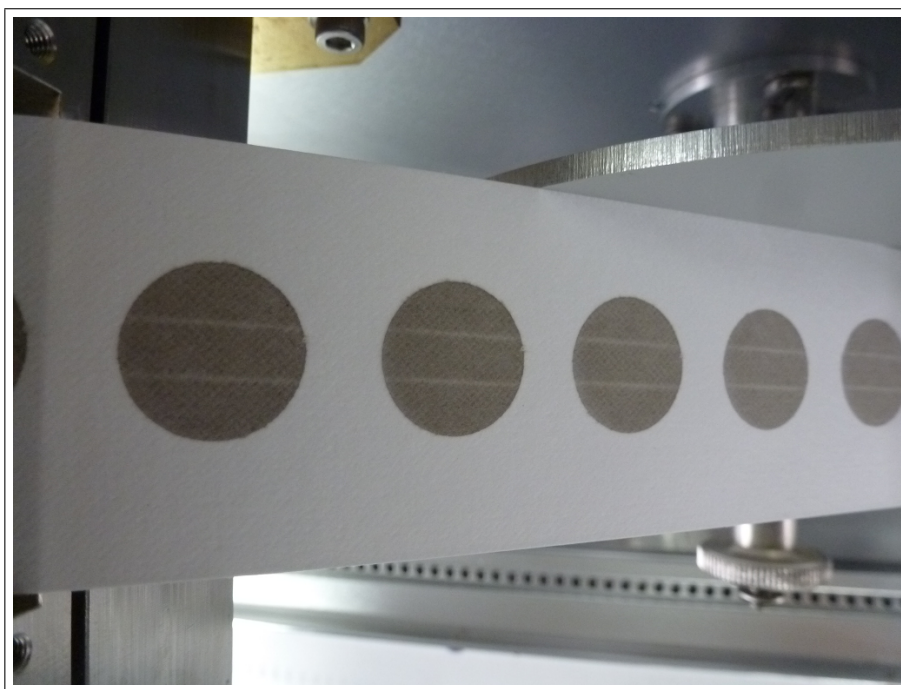


Figure 1: New spot from MAAP (3139) on filter tape.

Instrumental Noise

Table 3: Noise parameters of MAAP (3139) 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	49	-1	40	4

Comparison to reference MAAP

Table 4: Correlation parameter of eBC coefficients from MAAP (3139) and reference MAAP.

Wavelength [nm]	Slope	Error	R^2
660	0.916	0.003	0.999

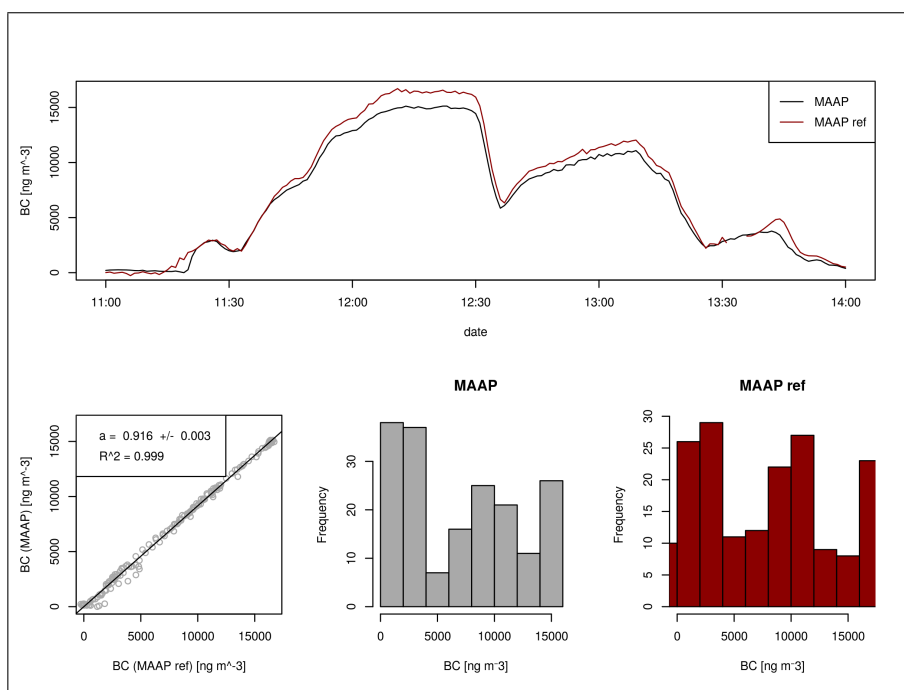


Figure 2: Correlation of eBC coefficient from MAAP (3139) and reference MAAP.

Comparison to multi-wavelength absorption

Table 5: Correlation parameter of absorption from MAAP (3139) and the multi-wavelength absorption reference.

Wavelength [nm]	Slope	Error	R^2
637	0.994	0.006	0.994

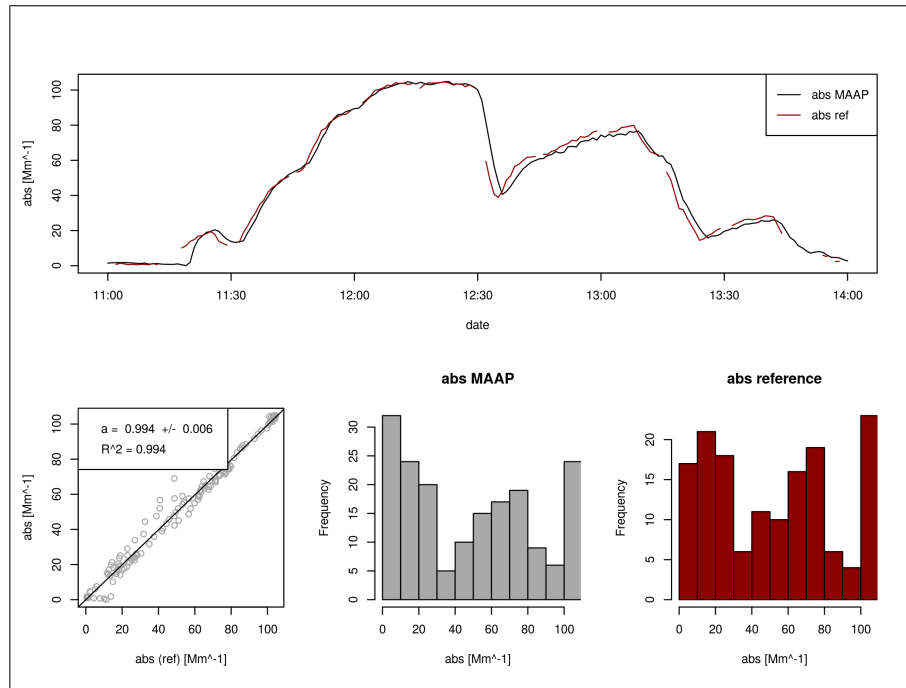


Figure 3: Correlation of absorption from MAAP (3139) and the multi-wavelength absorption reference at 660 nm.