



## Intercomparison of absorption photometer Project No.: AP-2019-4-1

### Basic informations:

Location of the quality assurance: TROPOS, Lab 121

Date: 14 October - 18 October 2019

Principal Investigator	Home Institution	Participant	Instrument
M. Schütze	UBA	M. Schütze	159

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## 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 1.1 % 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 ( $1\sigma$ ) for the all wavelengths was less equal  $48 \text{ ng m}^{-3}$  for one minute averaging time. The background level was acceptable with deviations of less equal  $-2 \text{ ng m}^{-3}$ .

### **Inspection**

The measuring cell was contaminated with dust. 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 2.0 % 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 15.4 %.

### **Recommendations**

No recommendations.

### **Overall assessment**

The instrument meets the requirements.

## 2 Details

### Configuration parameters

THERMO SCIENTIFIC		MAAP v1.33		SERIENNUMMER 159		19-10-14	
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SIGMA BC:		6.6		m2/g			
LUFTDURCHSATZ 1/h		480					
MITTELWERTSPEICHER:		30		min			
KONZ. BEZOGEN AUF		NORMTEMPERATUR					
NORMTEMPERATUR		0		_C			
DRUCKFORMAT:		COM2		8			
DRUCKZYCLUS:		0		s			
BAUDRATE:		Bd	COM1	9600			
BAUDRATE:		Bd	COM2	9600			
GERAETE-ADRESSE:		50					
FILTERWECHSEL							
TRANSM. <		%	45				
ZYCLUS		h	100				
UHRZEIT		UHR	24				
SENSORKALIBRIERUNG							
T1	T2	T3	T4	P1	P2	P3	
-14	0	-60	68	34	-104	-6	
LUFTDURCHSATZ		94.9					
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]		
7.33	0	1013.25	7.985	0.989	1

## Spot size check

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

Nominal spot size [cm <sup>2</sup> ]	Measured spot size [cm <sup>2</sup> ]	$F_{spot}$
2.00	Well defined spot, spot size not measured	1.0

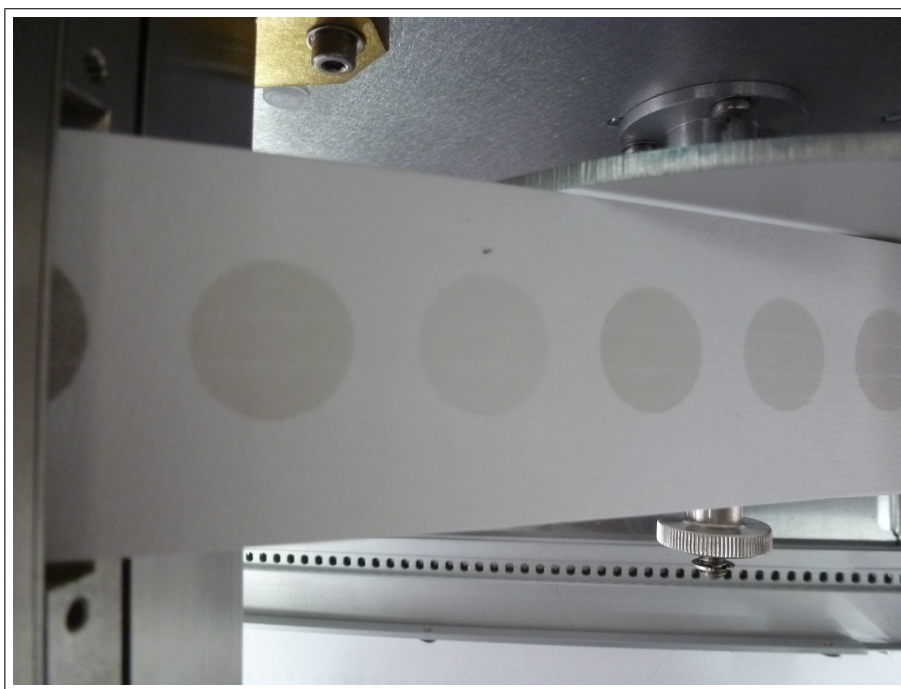


Figure 1: New spot from MAAP (159) on filter tape.

## Instrumental Noise

Table 3: Noise parameters of MAAP (159) measured with filtered air.

Wavelength [nm]	Number of data points	Median [ng m <sup>-3</sup> ]	10th percentile [ng m <sup>-3</sup> ]	90th percentile [ng m <sup>-3</sup> ]	Mean [ng m <sup>-3</sup> ]	Std. dev. [ng m <sup>-3</sup> ]	Error of mean [ng m <sup>-3</sup> ]
660	121	-2	-96	28	-19	48	4

## Comparison to reference MAAP

Table 4: Correlation parameter of eBC coefficients from MAAP (159) and reference MAAP.

Wavelength [nm]	Slope	Error	$R^2$
660	1.02	0.009	0.986

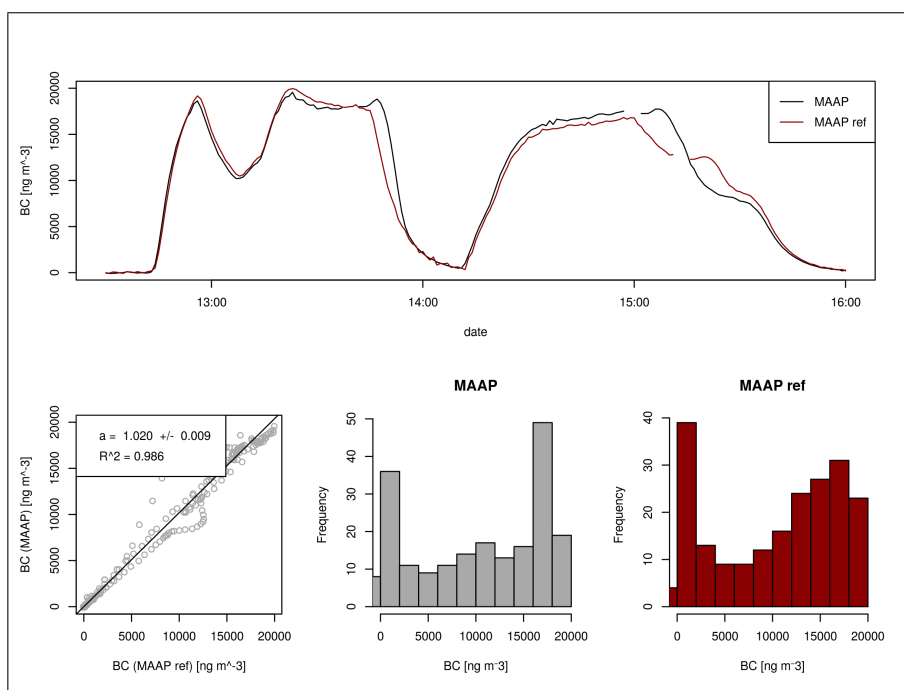


Figure 2: Correlation of eBC coefficient from MAAP (159) and reference MAAP.

## Comparison to multi-wavelength absorption

Table 5: Correlation parameter of absorption from MAAP (159) and the multi-wavelength absorption reference.

Wavelength [nm]	Slope	Error	$R^2$
637	1.154	0.014	0.975

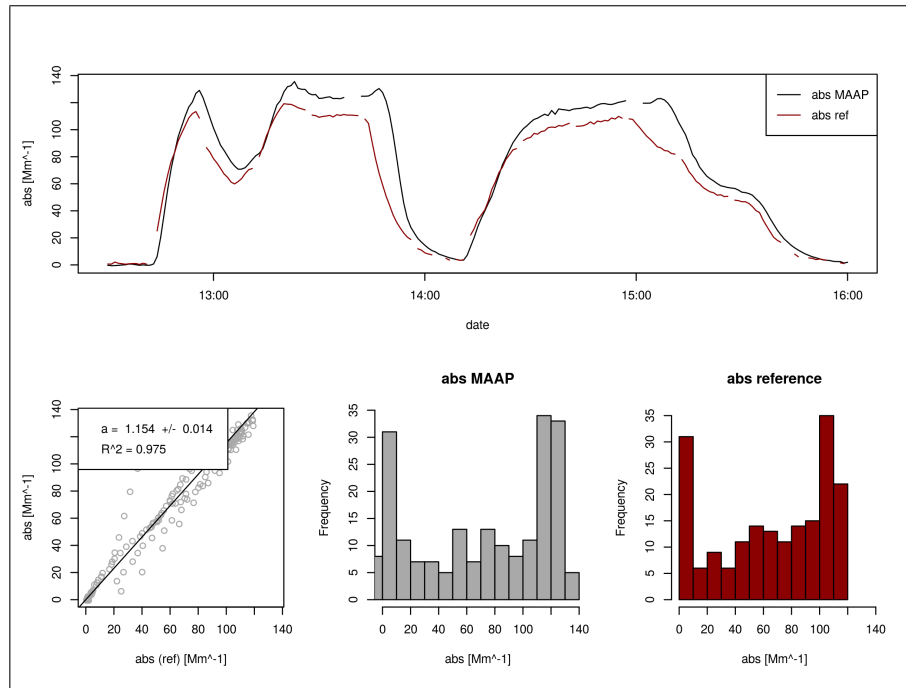


Figure 3: Correlation of absorption from MAAP (159) and the multi-wavelength absorption reference at 660 nm.