Intercomparison of absorption photometer
Project: AP-2022-6-2

Location of the quality assurance: TROPOS, Lab 121
Date: 2022-09-19 to 2022-09-23

Principal Investigator	Institution	Participant	Instrument SN
F. Meinhardt	UBA	F. Meinhardt	116

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 deviation of the flow was -1.9% 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.

Instrumental Noise

The noise level of the instrument is in the normal range. The average noise (1σ) was less eqal 7 ng m^{-3} for 10 second averaging time. The background level was acceptable with deviations of less equal 2 ng m^{-3} .

Inspection

A flow recalibration was not performed.

Comparison to reference MAAP

BC concentrations of MAAP are 1 % higher than BC concentrations from the reference MAAP.

Comparison to reference absorption

Absorption coefficients of the MAAP 116 are 6 % higher compared to the reference .

Recommendations

No recommenations.

Overall assessment

The instrument meets the requirements.

Details

Configuration parameters

```
 THERMO SCIENTIFIC   MAAP v1.33       SERIENNUMMER  116    22-09-19
--------------------------------------------------------------------------------

SIGMA BC:             6.6 m2/g
LUFTDURCHSATZ l/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:        90

FILTERWECHSEL
TRANSM. <       %       50
ZYCLUS          h      100
UHRZEIT         UHR     24

SENSORKALIBRIERUNG
   T1    T2    T3    T4    P1    P2    P3
  -29     1   -66    46   -79    84  -322
LUFTDURCHSATZ         94.3

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 2: 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					
Q_{MAAP} (slpm)	$T_{0,MAAP}$ (°C)	$p_{0,MAAP}$ (hPa)	Q (slpm)	F_{flow}	F_{STP}
8.0	0	1013.25	7.87	1.000	1

Spot size check

Table 3: Correction factor for spot sizes F_{spot}.

Nominal spot size (cm)	Measured spot size (cm)	F_{spot}
2	Well defined spot, spot size not measured	1

Figure 1: New spot from MAAP (112) on filter tape.

Instrumental noise

Table 4: Noise parameters measured with filtered air.

Wavelength (nm)	Data points	Median (ng/m³)	10th perc. (ng/m³)	90th perc. (ng/m³)	Mean (ng/m³)	Std.dev. (ng/m³)	Error of mean (ng/m³)
637	4736	2	-37	57	7	43	1

Comparison to reference MAAP

Figure 2: Correlation of eBC coefficient from MAAP (116) and reference MAAP.

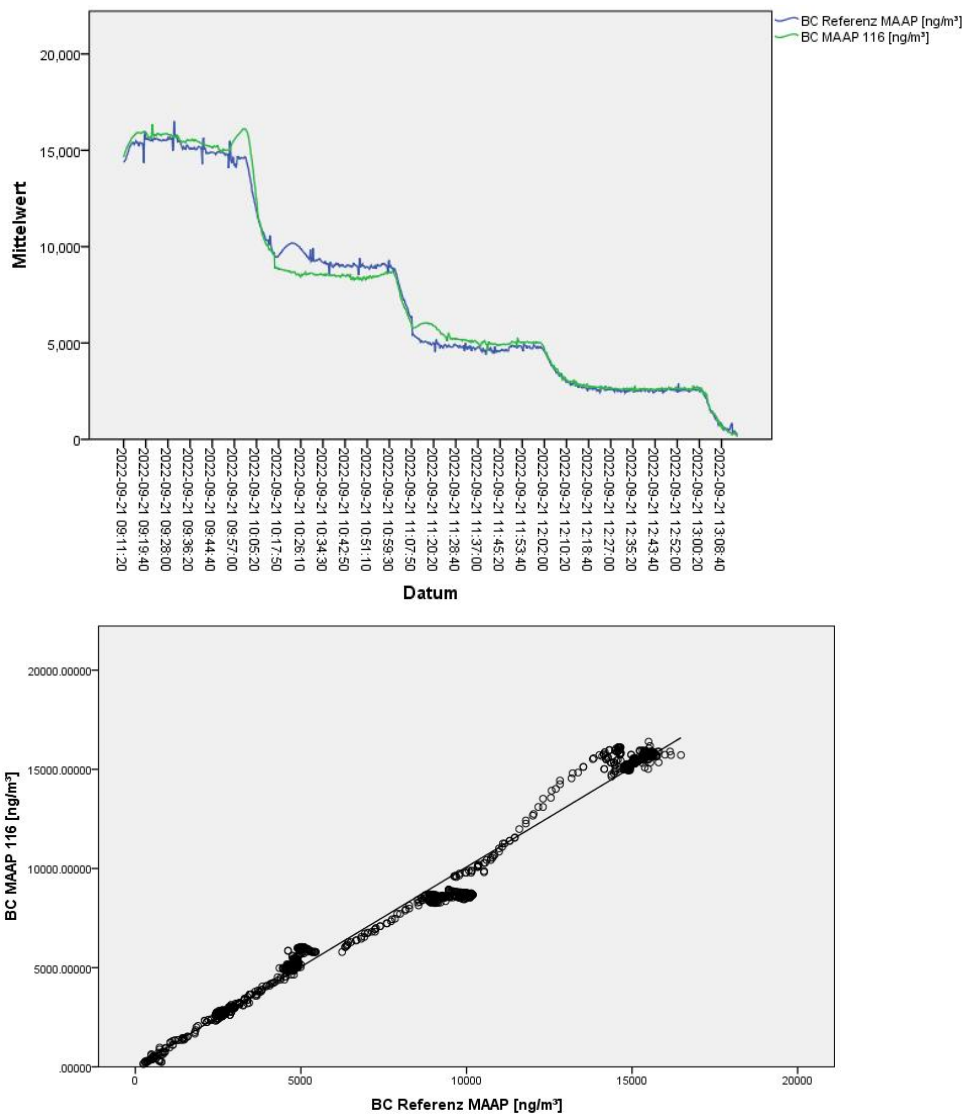

Table 5: Correlation parameter of eBC coefficients from MAAP (116) and reference MAAP.

Model Summary and Parameter Estimates

Dependent Variable: BC MAAP 116 [ng/m³]

Equation	Model Summary					Parameter Estimates
	R Square	F	df1	df2	Sig.	b1
Linear	.996	377240.800	1	1386	.000	1.008

The independent variable is BC Referenz MAAP [ng/m³].

Comparison to multi-wavelength absorption

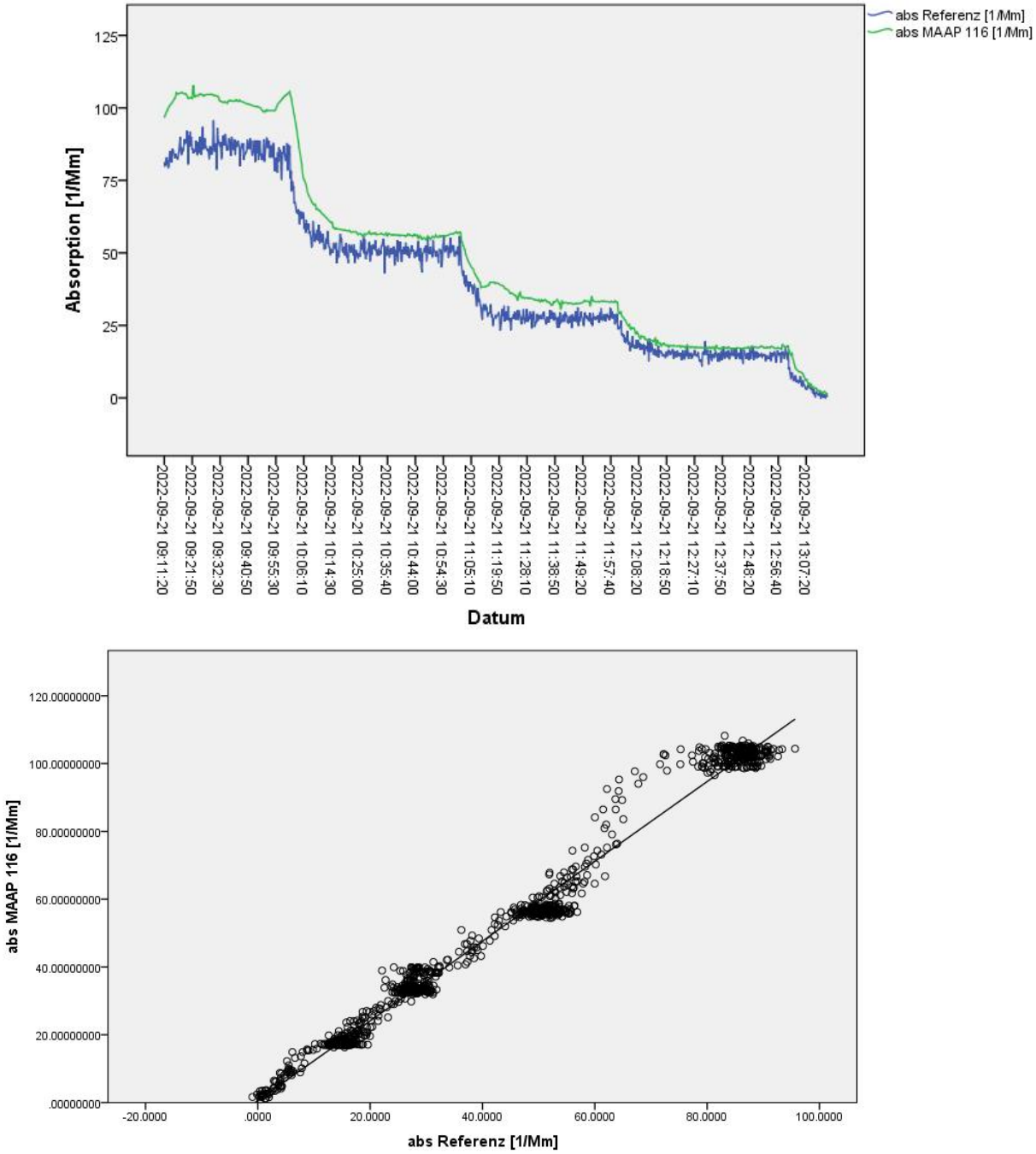

Figure 3: Correlation of absorption from MAAP (116) and the multi-wavelength absorption reference at 660 nm.

Table 6: Correlation parameter of absorption coefficients from MAAP (112) and reference.

Model Summary and Parameter Estimates

Dependent Variable: abs MAAP 116 [1/Mm]

Equation	Model Summary					Parameter Estimates	
	R Square	F	df1	df2	Sig.	Constant	b1
Linear	.988	111542.477	1	1385	.000	.092	1.006

The independent variable is abs_ref.