Intercomparison of absorption photometer
Project: AP-2022-6-1

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

Principal Investigator	Institution	Participant	Instrument SN
C.Couret	UBA	C.Couret	112

Intercomparison summary

Status on arrival

No issues due to transportation or other damages, Vacuum pump has not been supplied.

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 -2.2% 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 11 ng m^{-3} for 10 second averaging time. The background level was acceptable with deviations of less equal 10 ng m^{-3} .

Inspection

The sensor head was contaminated. The sensor head was cleaned. A flow recalibration was not performed.

Comparison to reference MAAP

BC concentrations of MAAP are 4.1 % higher than BC concentrations from the reference MAAP.

Comparison to reference absorption

Absorption coefficients of the MAAP 112 are 23.1 % higher compared to the reference .

Recommendations

No recommenations.

Overall assessment

The instrument meets the requirements.

Details

Configuration parameters

THERMO SCIENTIFIC MAAP v1.33 SERIAL NUMBER 112 22-09-19

SIGMA BC: 6.6 m2/g
AIR FLOW: 1000
STORE AVERAGES: 0 min

VOLUME REFERENCE STANDARD TEMPERATURE
STANDARD TEMPERATURE 0 _C

PRINTFORMAT: COM2 8
PRINTCYCLE: 1 s
BAUDRATE: Bd COM1 9600
BAUDRATE: Bd COM2 9600
DEVICE-ADDRESS: 0

FILTER CHANGE
TRANSM. < % 50
CYCLE h 100
HOUR: 24

CALIBRATION OF SENS.

T1	T2	T3	T4	P1	P2	P3
-21	8	-59	49	-254	-30	-359

AIR FLOW 96.5

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 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}
16.41	0	1013.25	16.41	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	352	0	-60	30	-11	40	2

Comparison to reference MAAP

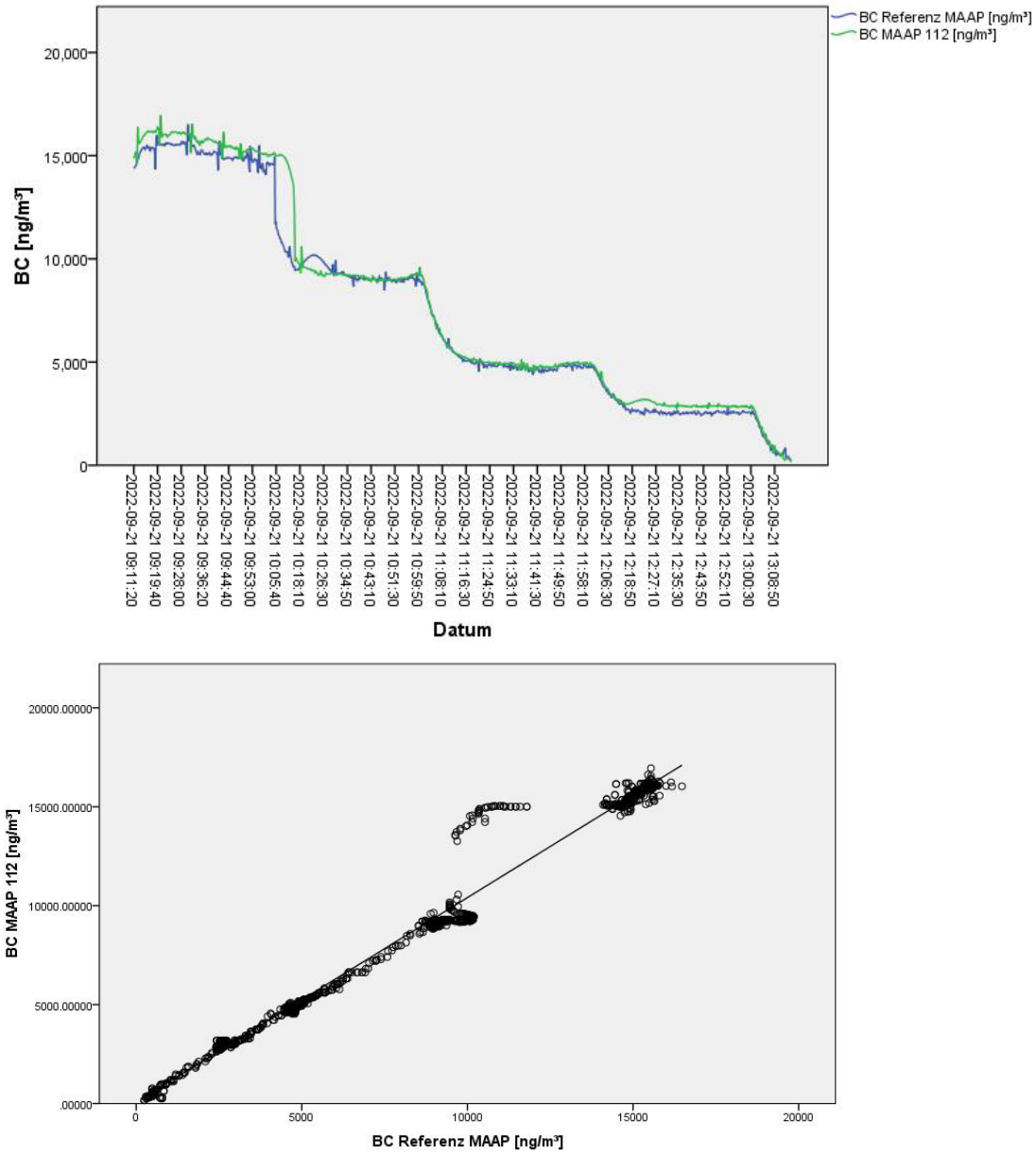

Figure 2: Correlation of eBC coefficient from MAAP (112) and reference MAAP.

Table 5: Correlation parameter of eBC coefficients from MAAP (112) and reference MAAP.

Model Summary and Parameter Estimates

Dependent Variable: BC MAAP 112 [ng/m³]

	Model Summary					Parameter Estimates
Equation	R Square	F	df1	df2	Sig.	b1
Linear	.994	236264.439	1	1385	.000	1.041

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

Comparison to multi-wavelength absorption

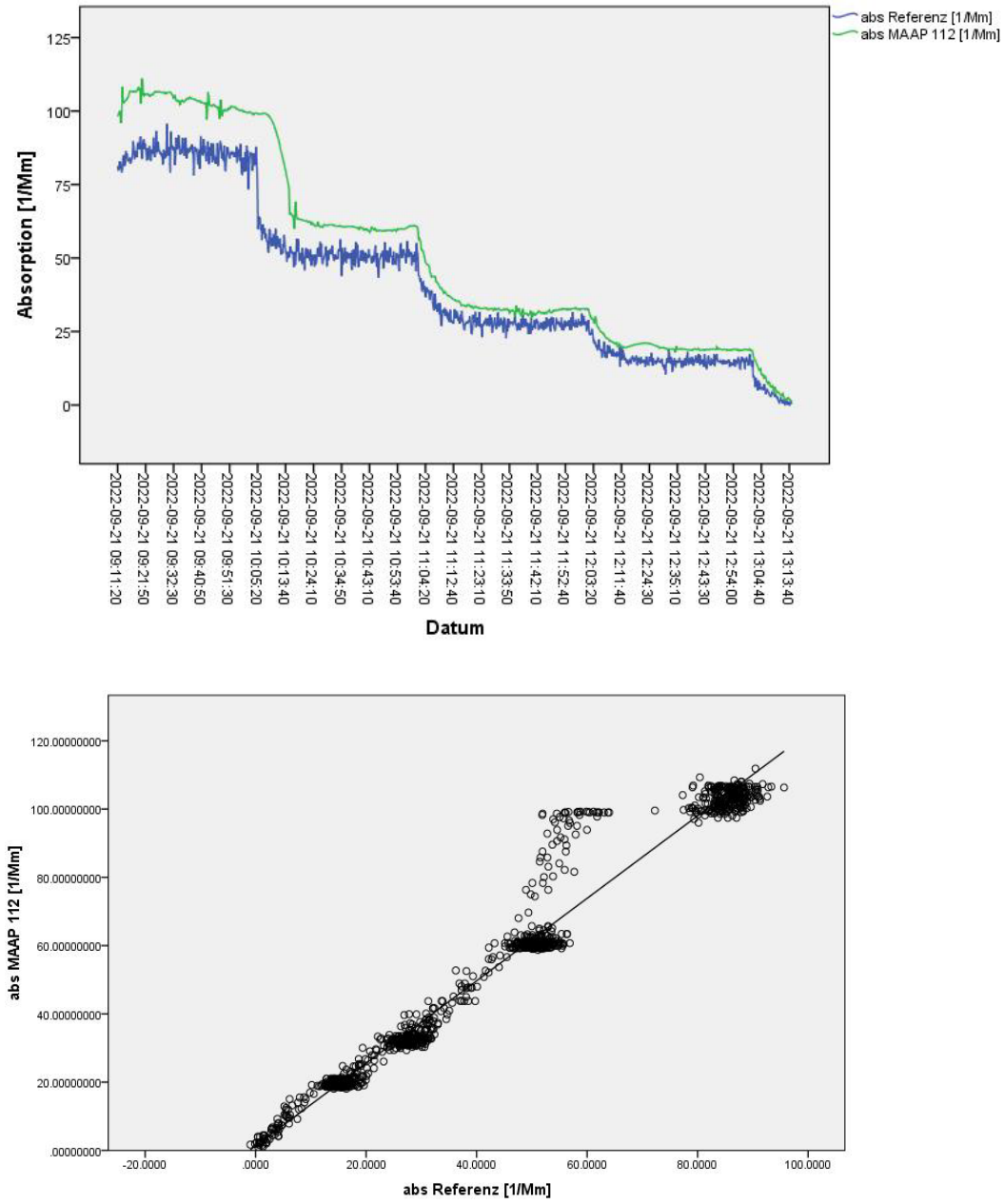

Figure 3: Correlation of absorption from MAAP (112) and the multi-wavelength absorption reference at 660 nm.

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

Model Summary and Parameter Estimates

Dependent Variable: abs MAAP 112 [1/Mm]

	Model Summary					Parameter Estimates
Equation	R Square	F	df1	df2	Sig.	b1
Linear	.990	120614.387	1	1204	.000	1.231

The independent variable is abs Referenz [1/Mm].