Intercomparison of absorption photometer Project No.: AP-2019-2-3

Basic informations:

Location of the quality assurance:	TROPOS, Lab 121
Date:	3 June - 7 June 2019

Principal Investigator	Home Institution	Participant	Instrument
S. M. dos Santos	JRC	S. M. dos Santos	2310

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 25 °C and 1013.25 hPa. The flow was 1.4 % 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 eqal 22 ng m^{-3} for one minute averaging time. The background level was acceptable with deviations of less equal -5 ng m^{-3}.

Inspection

The instrument was clean without any contamination.

Comparison to reference MAAP

BC concentrations of MAAP are 17.0 % 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 25.4 %.

Recommendations

No recommendations.

Overall assessment

The instrument meets the requirements.

2 Details

Configuration parameters

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  THERMO SCIENTIFIC    MAAP v1.33          SERIAL NUMBER-32768      19-06-03
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SIGMA BC:                  6.6 m2/g
AIR FLOW:                  480
STORE AVERAGES:             10 min

VOLUME REFERENCE     STANDARD TEMPERATURE
STANDARD TEMPERATURE     25 _C

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

FILTER CHANGE
TRANSM. <          %         50
CYCLE              h          0
HOUR:                         0

CALIBRATION OF SENS.
     T1     T2     T3     T4     P1     P2     P3
    -17     28    -22     58    -39   -154   -104
AIR FLOW                  98.5

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
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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} [slpm]	$T_{0,MAAP}$ [°C]	$p_{0,MAAP}$ [hPa]	flow Q [slpm]		
8	25	1013.25	8.01	0.986	1.092

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

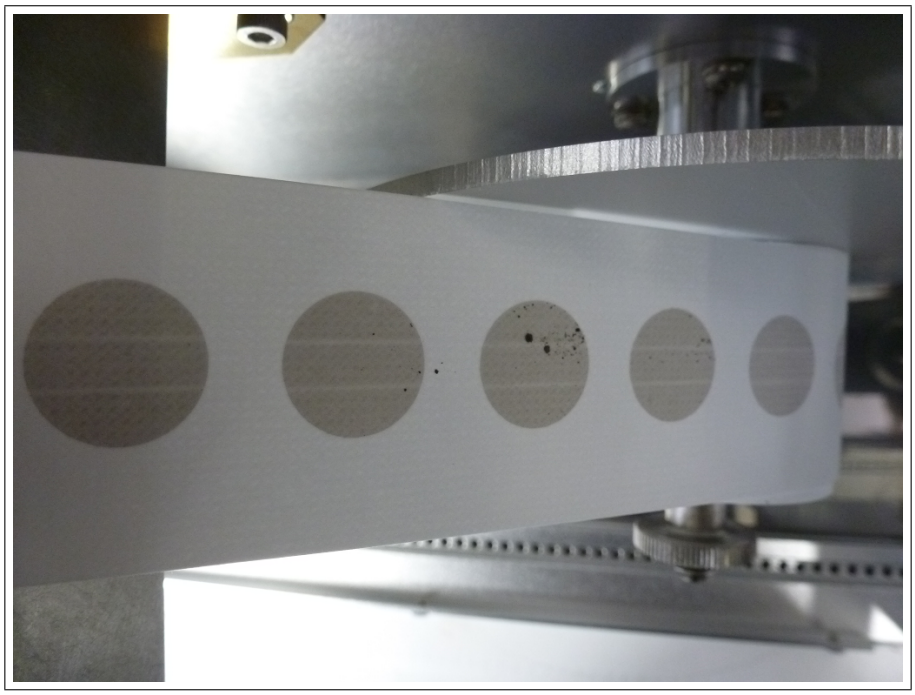

Figure 1: New spot from MAAP (2310) on filter tape.

Instrumental Noise

Table 3: Noise parameters of MAAP (2310) 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	221	-5	-36	18	-7	22	1

Comparison to reference MAAP

Table 4: Correlation parameter of eBC coefficients from MAAP (2310) and reference MAAP.

Wavelength [nm]	Slope	Error	R^2
660	0.83	0.003	0.999

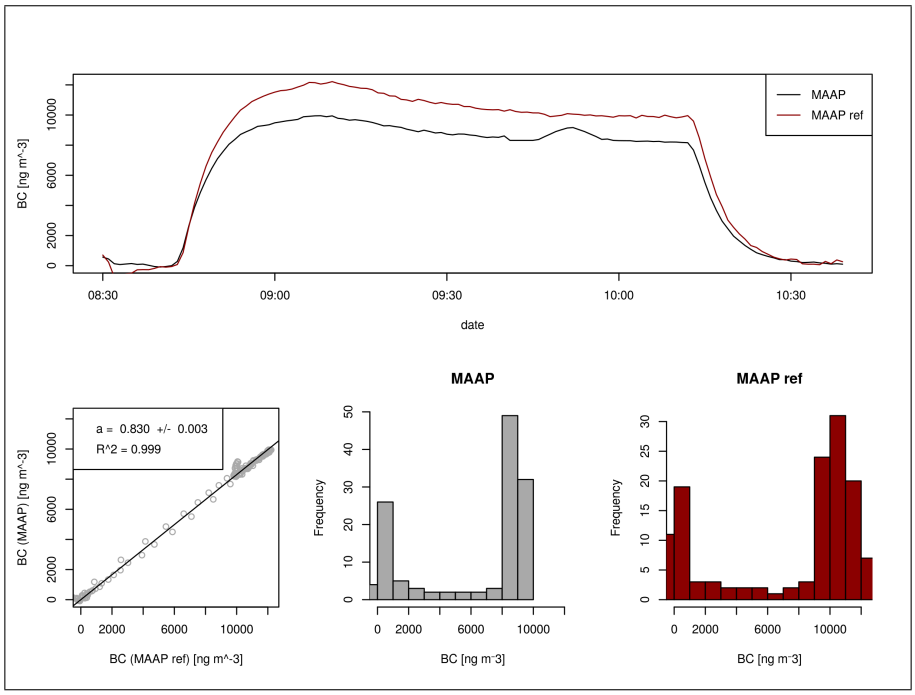

Figure 2: Correlation of eBC coefficient from MAAP (2310) and reference MAAP.

Comparison to multi-wavelength absorption

Table 5: Correlation parameter of absorption from MAAP (2310) and the multi-wavelength absorption reference.

Wavelength [nm]	Slope	Error	R^2
637	1.254	0.011	0.995

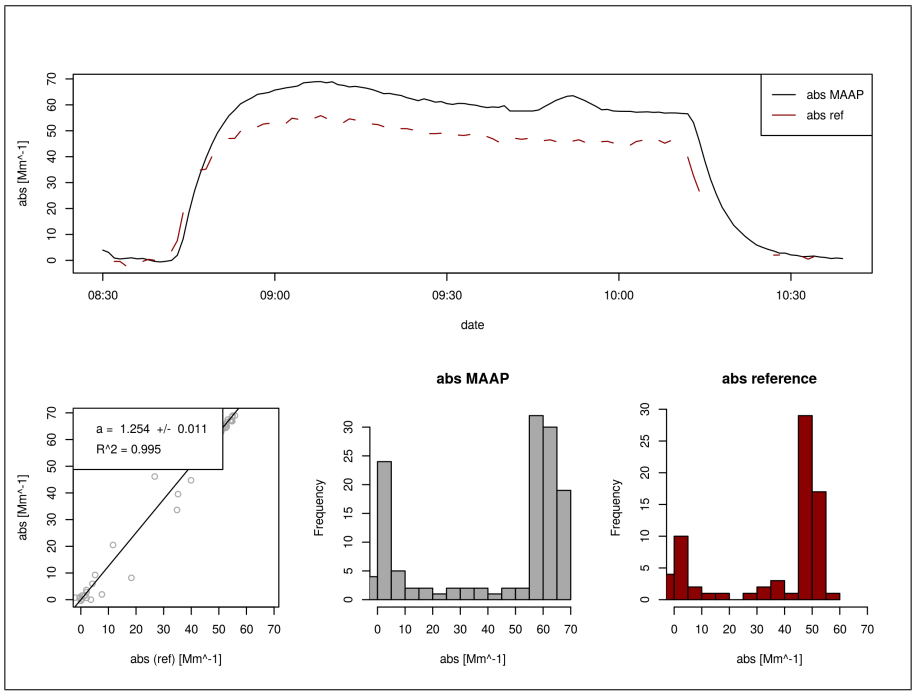

Figure 3: Correlation of absorption from MAAP (2310) and the multi-wavelength absorption reference at 660 nm.