



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

Basic informations:

Location of the quality assurance: TROPOS, Lab 121

Date: 7 October - 11 October 2019

Principal Investigator	Home Institution	Participant	Instrument
K. Luoma	INAR	K. Luoma	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 0 °C and 1013.25 hPa. The flow was 1.4 % 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 33 ng m^{-3} for one minute averaging time. The background level was acceptable with deviations of less equal 13 ng m^{-3} for all wavelengths.

Inspection

The instrument was clean without any contamination.

Comparison to reference MAAP

BC concentrations at 652 nm of CLAP are 17.0 % higher than BC concentrations from a reference MAAP.

Comparison to reference AE33

The deviations of BC concentrations relative to the reference AE33 are in the range of -64.0 to -16.3 %.

Comparison to reference absorption

The deviations of the absorption coefficients derived from AE33 relative to the absorption coefficients from the multi-wavelength absorption reference setup are in the range of -33.3 to 58.7 %.

Recommendations

No recommendations.

Overall assessment

The instrument meets the requirements.

2 Details

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_{CLAP}	$T_{0,CLAP}$	$p_{0,CLAP}$	flow Q		
[slpm]	[°C]	[hPa]	[slpm]		
0.975	0	1013.25	1.036	1.014	1

Spot size check

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

Nominal spot size	Measured spot size	F_{spot}
[cm ²]	[cm ²]	
-	Well defined spot, spot size not measured	1.0

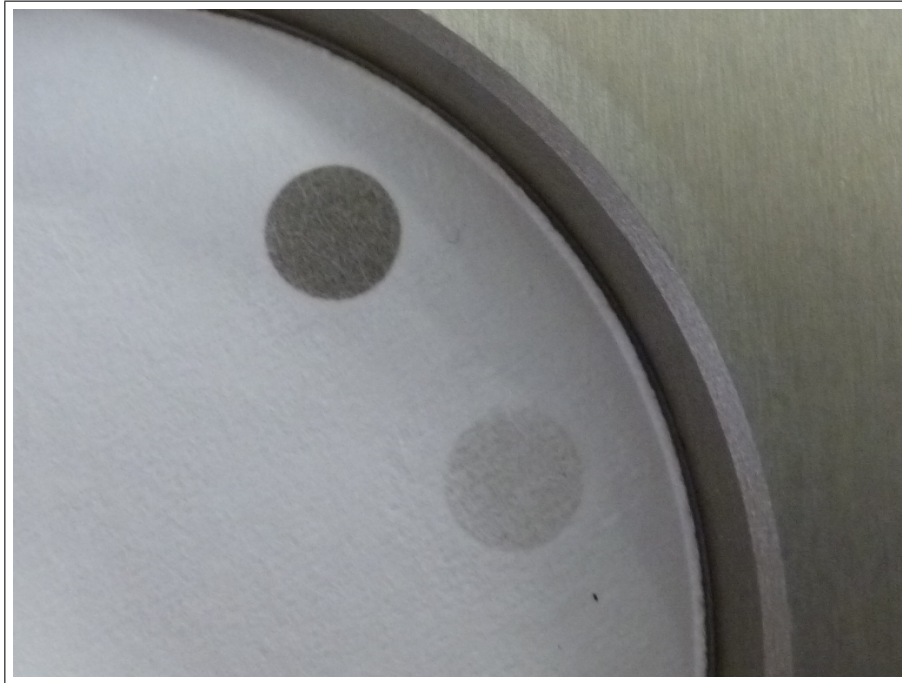


Figure 1: New spot from CLAP (2310) on filter tape.

Instrumental Noise

Table 3: Noise parameters of CLAP (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]
467	121	-6	-27	8	-8	13	1
529	121	-12	-25	3	-11	11	1
653	121	-13	-60	23	-15	33	3

Comparison to reference MAAP

Table 4: Correlation parameter of eBC coefficient from CLAP (2310) and reference MAAP after inspection.

Wavelength [nm]	Slope	Error	R^2
653	1.17	0.021	0.959

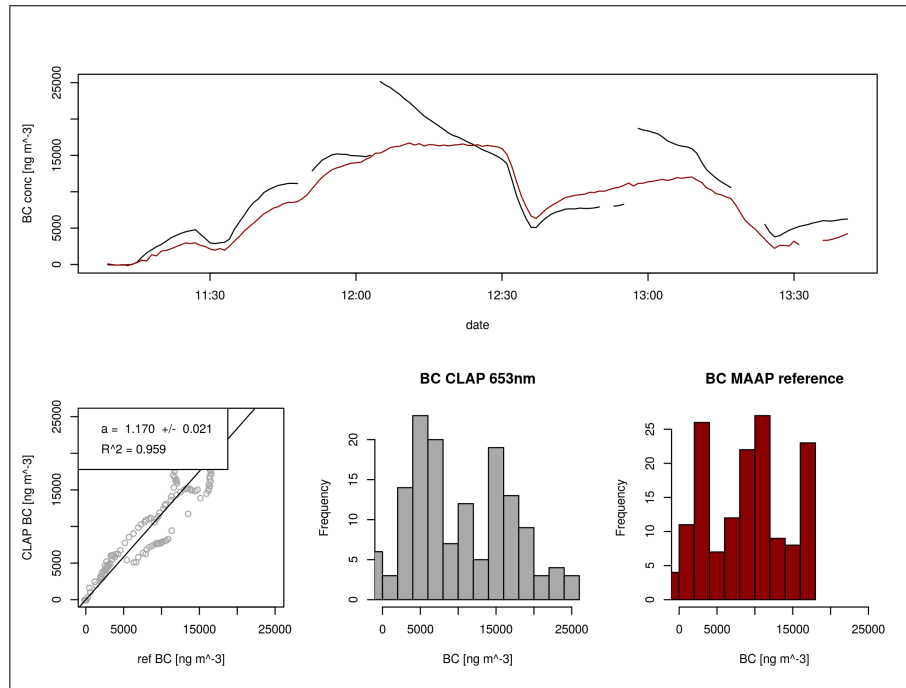


Figure 2: Correlation of eBC coefficient from CLAP (2310) and reference MAAP.

Comparison to reference AE33

Table 5: Correlation parameter of eBC coefficients from CLAP (2310) and reference AE33 after inspection.

Wavelength [nm]	Slope	Error	R^2
467	0.36	0.006	0.963
529	0.56	0.01	0.955
653	0.837	0.016	0.952

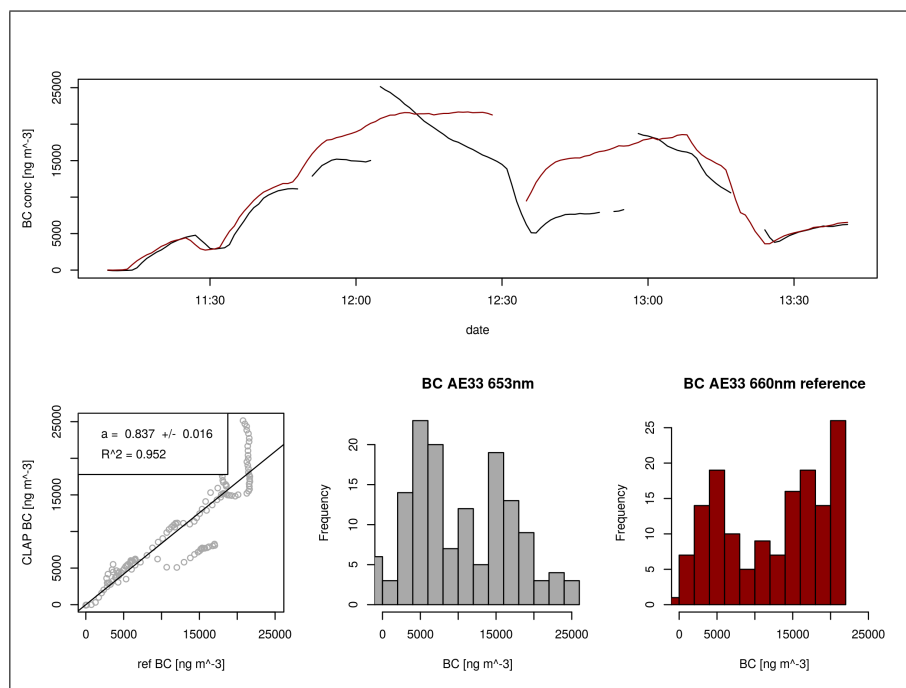


Figure 3: Correlation of eBC coefficient from CLAP (2310) and reference AE33.

Comparison to multi-wavelength absorption

Table 6: Correlation parameter of absorption from CLAP (2310) and the multi-wavelength absorption reference after inspection.

Wavelength [nm]	Slope	Error	R^2
467	0.667	0.007	0.988
529	1.055	0.011	0.987
653	1.587	0.017	0.987

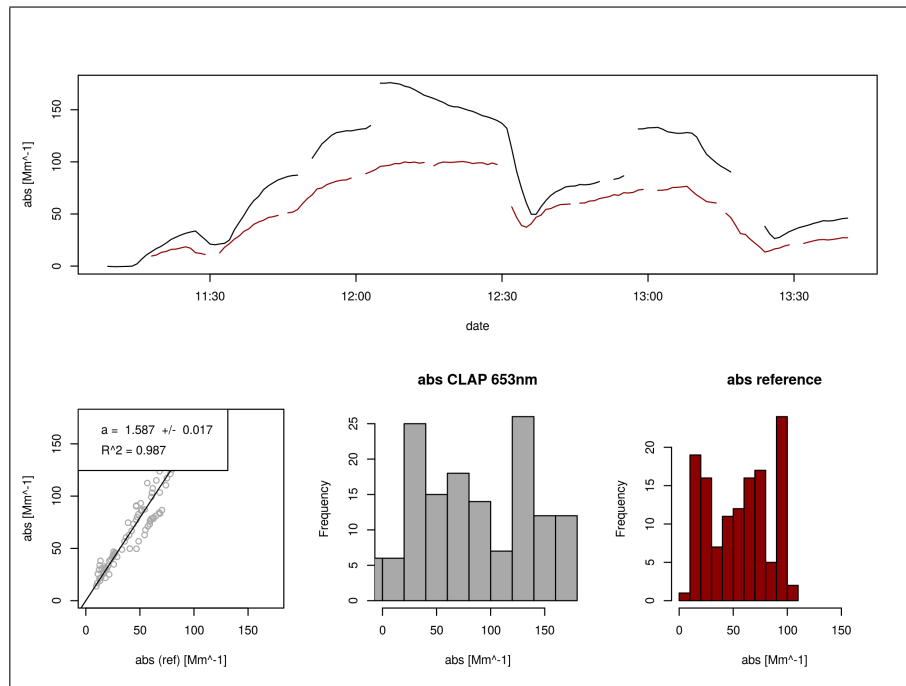


Figure 4: Correlation of absorption from CLAP (2310) and the multi-wavelength absorption reference at 660 nm.