



## Intercomparison of absorption photometer Project No.: AP-2018-3-3

### Basic informations:

Location of the quality assurance: TROPOS, Lab 121

Date: 15 October - 19 October 2018

Principal Investigator	Home Institution	Participant	Instrument
P. Tulet	Laboratoire de l'atmosphère et des Cyclones	J.-M. Metzger	495:0405

---

## 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 20 °C and 1013.25 hPa. The flow was 2.5 % 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 ( $1\sigma$ ) for the all wavelengths was less equal  $28 \text{ ng m}^{-3}$  for two minute averaging time. The background level was acceptable with deviations of less equal  $14 \text{ ng m}^{-3}$  for all wavelengths.

## **Inspection**

The measuring cell was contaminated with dust and a few insects. The measuring cell was cleaned. After assembly, the device was no longer functional due to an error with the internal CF card.

## **Comparison to reference MAAP**

BC concentrations at 880 nm (BC6) of AE31 are 15.0 % 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  $-29.8$  to  $-13.5$  %.

## **Comparison to reference absorption**

The deviations of the absorption coefficients derived from AE31 relative to the absorption coefficients from the multi-wavelength absorption reference setup are in the range of 41.4 to 62.6 %.

## **Recommendations**

The device must be repaired.

## **Overall assessment**

Due to the defective device no assessment can be given.

## 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	$F_{flow}$	$F_{STP}$
$Q_{AE42}$	$T_{0,AE42}$	$p_{0,AE42}$	flow $Q$		
[slpm]	[°C]	[hPa]	[slpm]		
4	20	1013.25	3.917	1.025	1.073

### Spot size check

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

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

### Instrumental Noise

Table 3: Noise parameters of AE42 (495:0405) measured with filtered air.

Wavelength	Number	Median	10th	90th	Mean	Std.	Error
[nm]	of data	[ng m <sup>-3</sup> ]	percentile	percentile	[ng m <sup>-3</sup> ]	dev.	of mean
	points		[ng m <sup>-3</sup> ]	[ng m <sup>-3</sup> ]		[ng m <sup>-3</sup> ]	[ng m <sup>-3</sup> ]
370	481	14	-3	33	14	15	1
470	481	1	-15	17	1	12	1
520	481	0	-17	17	0	14	1
590	481	-1	-20	20	-1	18	1
660	481	2	-21	24	1	19	1
880	481	-2	-30	28	-1	25	1
950	481	-2	-31	29	-2	28	1

## Comparison to reference MAAP

Table 4: Correlation parameter of eBC coefficient (BC6) from AE42 (495:0405) and reference MAAP.

Wavelength [nm]	Slope	Error	$R^2$
880	1.15	0.028	0.977

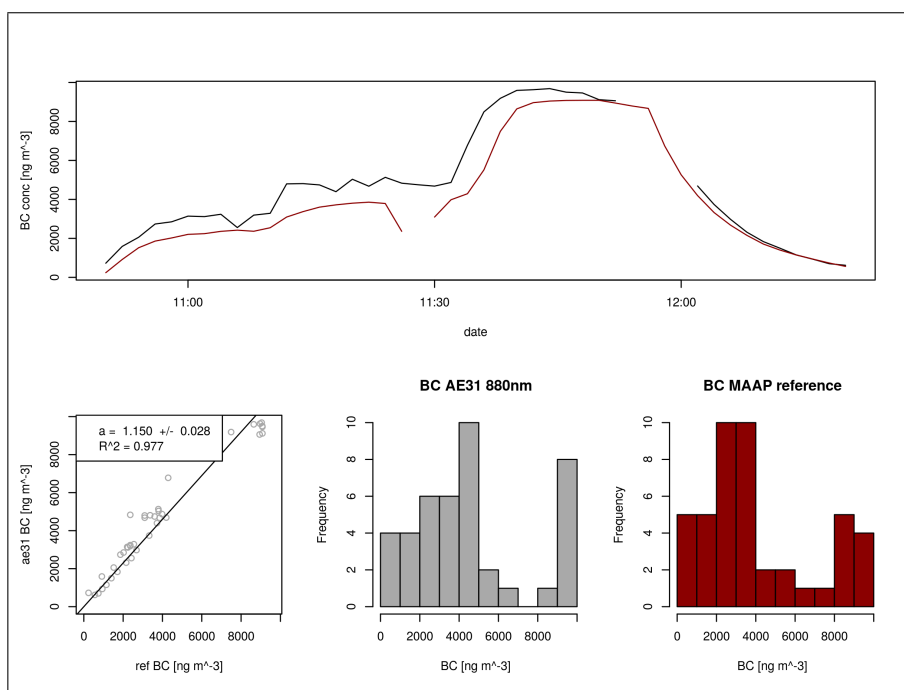


Figure 1: Correlation of eBC coefficient (BC6) from AE42 (495:0405) and reference MAAP.

## Comparison to reference AE33

Table 5: Correlation parameter of eBC coefficients from AE42 (495:0405) and reference AE33.

Wavelength [nm]	Slope	Error	$R^2$
370	0.702	0.019	0.971
470	0.715	0.017	0.978
520	0.757	0.015	0.983
590	0.801	0.014	0.987
660	0.814	0.013	0.99
880	0.865	0.011	0.993
950	0.855	0.01	0.994

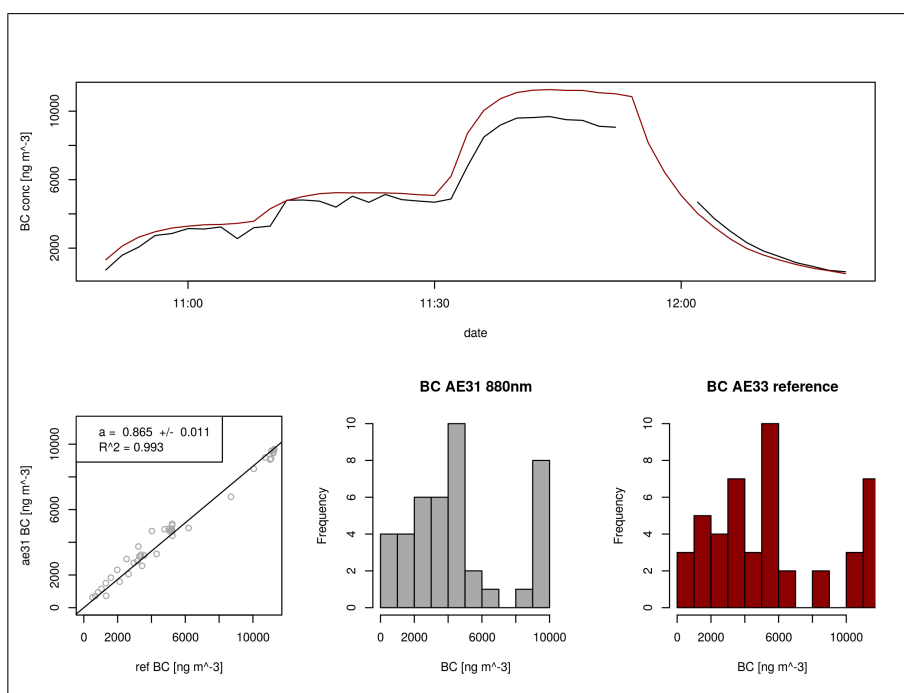


Figure 2: Correlation of eBC coefficient (BC6) from AE42 (495:0405) and reference AE33.

## Comparison to multi-wavelength absorption

Table 6: Correlation parameter of absorption from AE42 (495:0405) and the multi-wavelength absorption reference.

Wavelength [nm]	Slope	Error	$R^2$
470	1.414	0.035	0.977
520	1.51	0.036	0.979
660	1.626	0.03	0.988

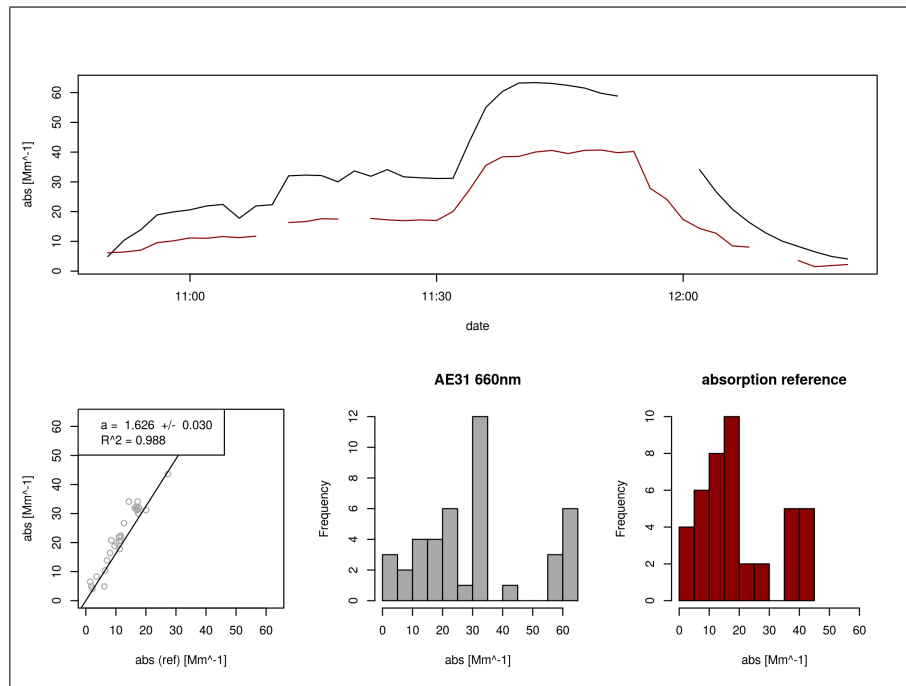


Figure 3: Correlation of absorption from AE42 (495:0405) and the multi-wavelength absorption reference at 660 nm.