



Leibniz Institute for
Tropospheric Research



Intercomparison of Absorption Photometers Project No.: AP-2017-3-5

Location of the quality assurance: TROPOS, lab 121

Date: 18 October, 2017

Principal Investigator	Home Institution	Participant	Instrument
J.-P. Putaud	Joint Research Center (JRC)	-	AE31, SN 7400609

1. Intercomparison summary

Flow calibration: The flow meter of the instrument is set to report flow for conditions of 24°C and 931 hPa. The flow was 3.4% too high compared to reference flow meter (Gilibrator). Corrections for the flow deviation and the temperature and pressure (STP correction) were considered in the data evaluation.

Noise and instrument background. The noise level of the instrument is in the normal range. The average noise (1σ) for all seven wavelengths was less than 28 ng/m^3 for five minute averaging time. The background level was moderate with values of less than 24 ng/m^3 for all wavelengths.

Inspection: Measurement cell was clean. The sample spots showed well defined, sharp edges.

Comparison to a reference MAAP: BC concentrations at 660 nm (BC5) of AE31 7400609 are 8.4% higher than BC concentrations from a reference MAAP (SN 504).

Comparison to reference absorption: The absorption coefficients at 660 nm derived from AE31 are 7.2% lower than absorption coefficients from the multi-wavelength absorption reference setup.

Recommendations: None.

Overall assessment: The instrument meets the requirements.

2. Details

Configuration parameters

Instrument serial number: 740
Software version: 985b8
Instrument type (0..U (1X), 1..UV+LED (2X), 2..7xLED (3X)): 2
Instrument Chassis : Stationary
Smoothing factor : 0
Selected Pump Flow : 2.5 LPM
Flow scale factor : 1.80 LPM/V
Flow zero : .026V
Date format (0=US, 1=EU): 1
Tape saver: 0
Spots per advance: 2
Filter change interval: 0
Maximum attenuation: 50
Over old data: 1
Warm up wait: 0
Spot size: Extended Range
MeanRatio: 1.00
BC Unit (0..ng, 1..ug): 0
.
Serial comm. mode (1..OFF, 2..Dataline, 3..Gesyttec): 2
Serial communication parameters:
 Speed(bps) : 9600
 Data bits : 8
 Parity bits:N
 Stop bits : 1
.
Gesyttec parameters:
 Network Scale Factor: 10
 Instrument ID for Gesyttec:740
.
Dataline parameters:
Alarm mode (0..Analog out, 1..Alarm): 0
Alarm ON/OFF : 1
Alarm value limit: 10
Alarm channel selection (channel number): 1
.
Data format (0..Extended, 1..Compressed): 0
.
UV channel OFF (0..UV ch. ON, 1..UV ch. OFF): 0
.
Sigma values:
 Sigma 1 : 39.5
 Sigma 2 : 31.1
 Sigma 3 : 28.1
 Sigma 4 : 24.8
 Sigma 5 : 22.2
 Sigma 6 : 16.6
 Sigma 7 : 15.4
Volumetric unit settings:
 Volumetric units (0..Standard, 1..Volumetric): 0
 Air Pressure(mbars): 990
 Temperature(C): 24

Flow check

¹Correction 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).

Date	System Flow			Reference flow			Flow correctio n factor	STP correctio n factor
				Reference flow meter: Gilibrator ‘TROPOS-T’				
	Mass flow	Volume reference		Volume flow	Ambient T and P			
	Q_{AE31} [slpm]	$T_{0,AE31}$ [°C]	$P_{0,AE31}$ [hPa]	Q [lpm]	T [°C]	P [hPa]	F_{flow}	F_{STP}
2017-09-12	2.5	24	990	2.553	20	990	0.966	1.113

Spot size check			
Correction factor for spot sizes F_{spot}			
Date	Nominal spot size [cm ²]	Measured spot size [mm ²]	F_{spot}
2017-09-12	NA	Well defined spot, spot size not measured	1.0

Instrumental Noise									
Noise in units of eBC concentration measured with filtered air.									
Date	Avg. time	Wave-length [nm]	Num data points	Median [ng]	10 th percentile [ng/m ³]	90 th percentile [ng/m ³]	Mean [ng/m ³]	Standard deviation [ng/m ³]	Error of the mean [ng/m ³]
2017-09-12	5 min	370	13	-4.0	-9.8	2.1	-3.3	6.0	1.7
		450	13	-6.4	-20.2	2.8	-7.6	10.0	2.8
		520	13	-10.0	-24.4	4.3	-10.5	13.5	3.7
		590	13	-1.3	-29.7	6.2	-8.3	15.4	4.3
		660	13	-5.6	-23.5	9.4	-5.1	16.1	4.5
		880	13	-23.5	-38.2	11.1	-16.2	23.6	6.5
		950	13	-11.0	-42.8	16.6	-8.9	27.1	7.5

Comparison to reference MAAP	
Correlation of eBC from AE31 (SN 7400609) and the reference MAAP (SN 504).	
Slope	1.084±0.011
R ²	0.978

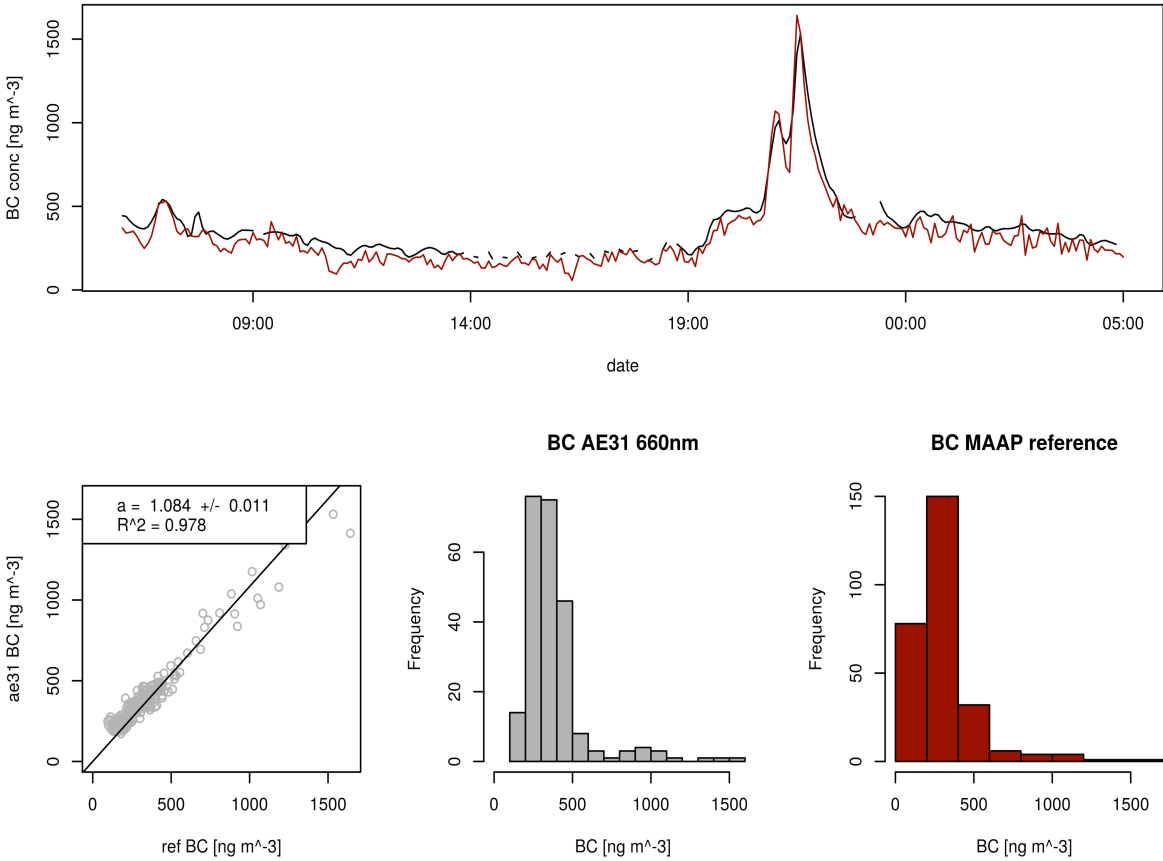


Figure: Comparison of eBC concentrations from AE31 SN 7400609 and MAAP SN-504.

Comparison to multi-wavelength absorption reference
 Correlation of absorption coefficients from AE31 (SN 7400609) and the multi-wavelength absorption reference

Slope	0.928±0.015
R ²	0.942

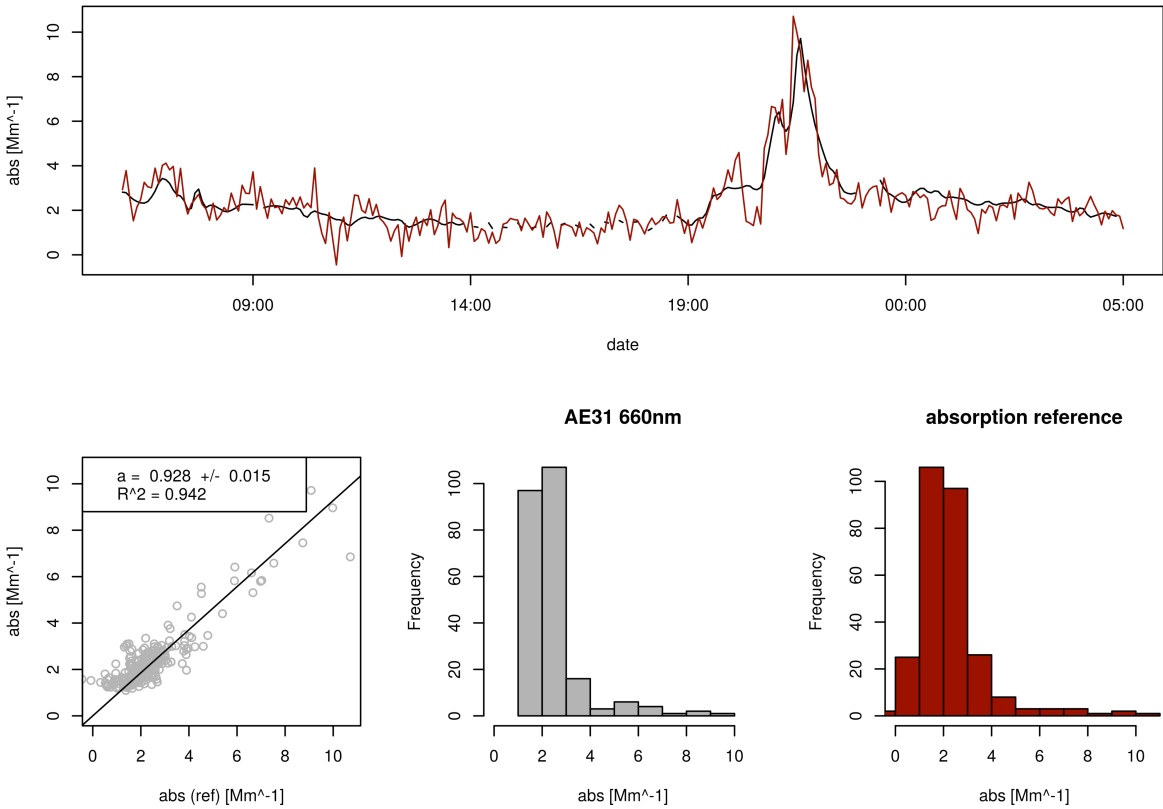


Figure: Comparison of absorption coefficients from AE31 SN 7400609 and absorption reference.