



Leibniz Institute for
Tropospheric Research



Intercomparison of Absorption Photometers Project No.: AP-2017-2-1

Location of the quality assurance: TROPOS, lab 121

Date: 18 October, 2017

Principal Investigator	Home Institution	Participant	Instrument
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1. Intercomparison summary

Flow calibration: The flow meter of the instrument is set to report flow for conditions of 20°C and 1013 hPa. The flow was 3.2% too low compared to reference flow meter (Giliblator). 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 out of the normal range. The average noise (1σ) for 370 nm wavelengths has reached a value of 103.5 ng/m³ for two minute averaging time. The background level was moderate with values in the range from -33.0 to -14.7 ng/m³.

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

Comparison to a reference MAAP: BC concentrations at 660 nm (BC5) of AE31 11691204 are 23.3% lower than BC concentrations from a reference MAAP (SN 504).

Comparison to reference absorption: The absorption coefficients at 660 nm derived from AE31 are 35.8% lower than absorption coefficients from the multi-wavelength absorption reference setup. This significant deviation is in agreement with the results from reference MAAP. The concentrations are relative low. The result is not representative.

Recommendations: None.

Overall assessment: The instrument meets the requirements

2. Details

Configuration parameters

Instrument serial number: 1169
Software version: 985d8
Instrument type (0..U (1X), 1..UV+LED (2X), 2..7xLED (3X)): 2
Instrument Chassis : Stationary
Smoothing factor : 0
Selected Pump Flow : 4.0 LPM
Flow scale factor : 1.84 LPM/V
Flow zero : .033V
Date format (0=US, 1=EU): 0
Tape saver: 0
Spots per advance: 1
Filter change interval: 2
Maximum attenuation: 150
Over old data: 0
Warm up wait: 0
Spot size: Standard 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:333
.
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
Prepend SerNumber to dataline (0..No, 1..Yes): 1
.
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): 1013
 Temperature(C): 20

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 correction factor	STP correction 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}
2017-09-06	4.0	20	1013	3.945	20	995.2	1.032	1.073

Spot size check			
Correction factor for spot sizes F_{spot} .			
Date	Nominal spot size [cm ²]	Measured spot size [mm ²]	F_{spot}
2017-09-06	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]
2017-09-06	1 min	370	63	-14.7	-98.6	31.5	-39.6	103.5	13.0
		450	63	-16.3	-55.6	8.9	-26.5	53.1	6.7
		520	63	-14.9	-86.8	20.2	-33.5	72.9	9.2
		590	63	-16.6	-94.4	26.8	-37.7	90.6	11.4
		660	63	-19.7	-88.2	20.5	-37.2	79.5	10.0
		880	63	-20.1	-64.8	1.0	-37.9	52.0	6.5
		950	63	-33.0	-119.0	6.4	-46.9	71.1	9.0

Comparison to reference MAAP	
Correlation of eBC from AE31 (SN 11691204) and the reference MAAP (SN 504).	
Slope	0.767±0.019
R ²	0.971

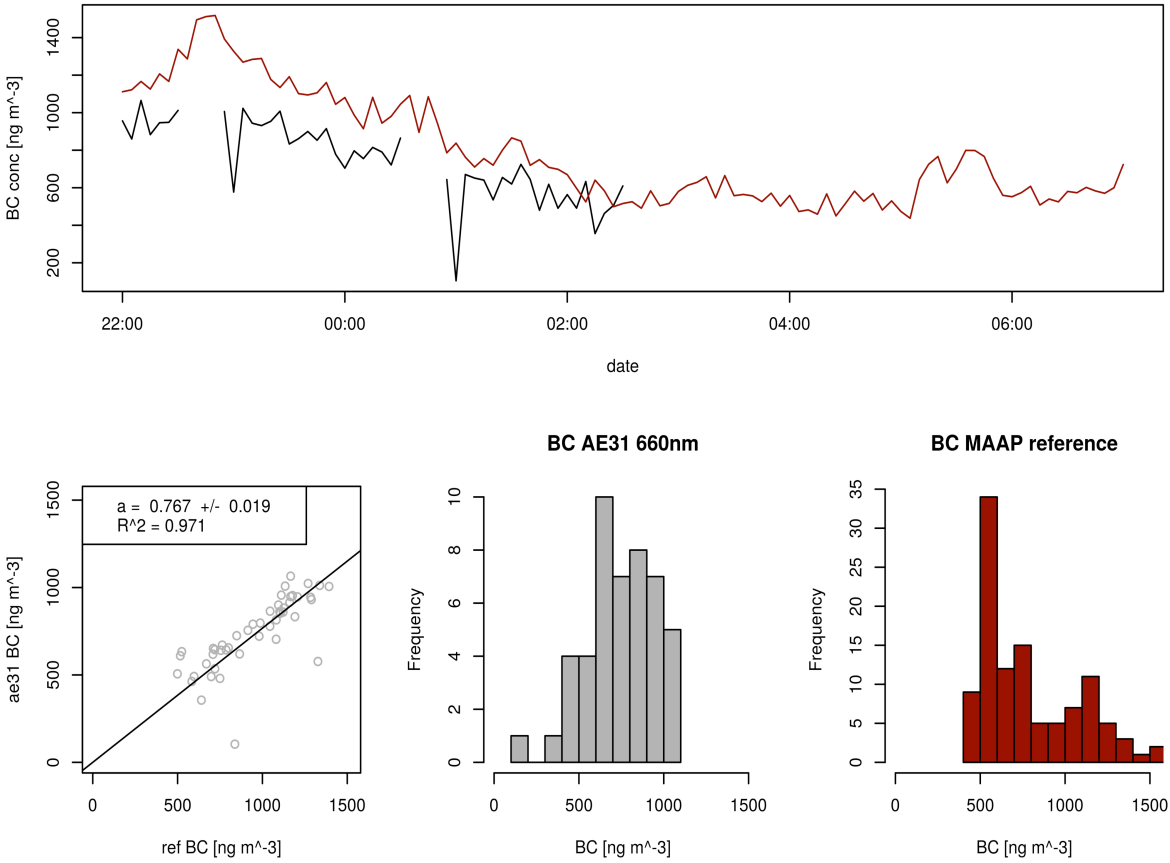


Figure: Comparison of eBC concentrations from AE31 SN 11691204 and MAAP SN-504.

Comparison to multi-wavelength absorption reference
 Correlation of absorption coefficients from AE31 (SN 11691204) and the multi-wavelength absorption reference

Slope	0.642±0.018
R ²	0.963

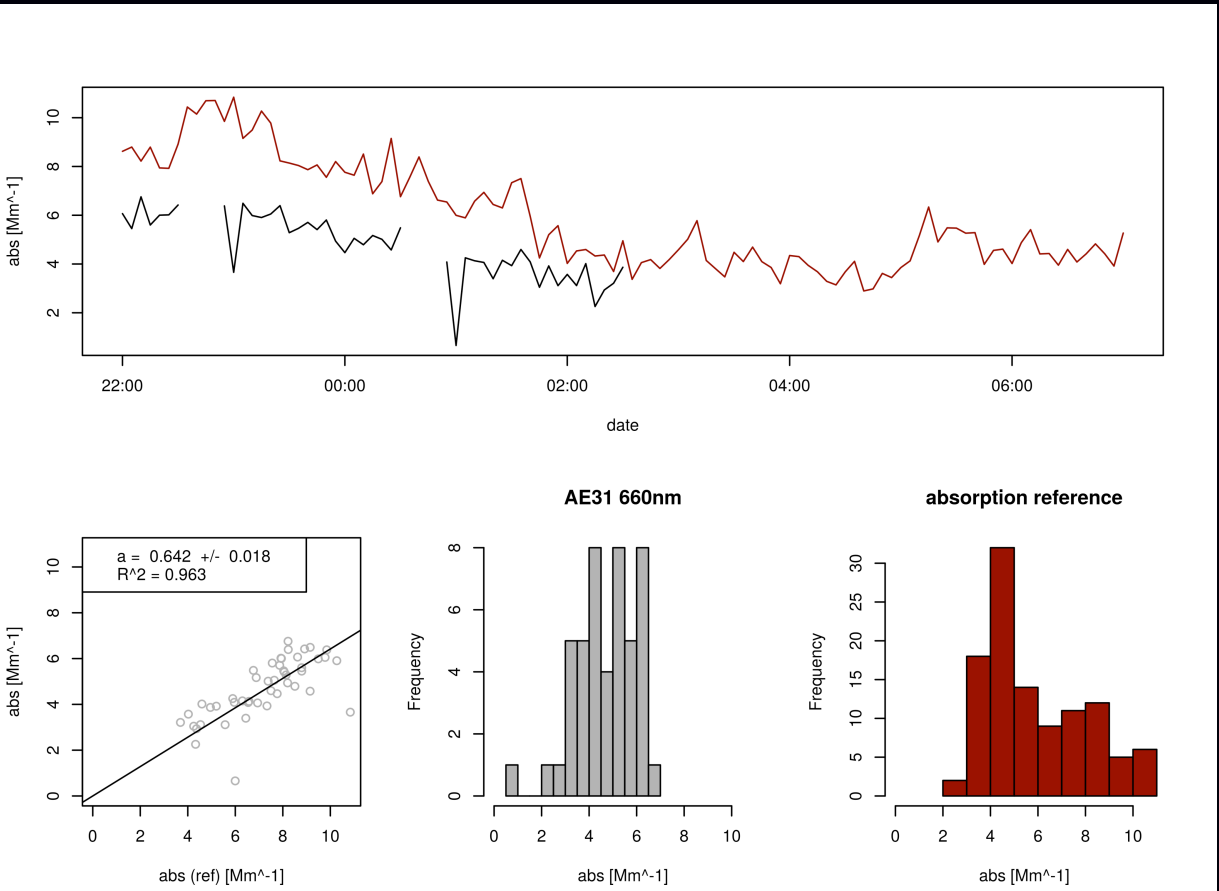


Figure: Comparison of absorption coefficients from AE31 SN 11691204 and absorption reference.