TROPOS
Leibniz Institute for Tropospheric Research

ECAC
European Center for Aerosol Calibration

WCCAP
World Calibration Centre for Aerosol Physics

Intercomparison of Absorption Photometers
Project No.: AP-2017-2-3

Location of the quality assurance: TROPOS, lab 121

Date: 18 October, 2017

Principal Investigator	Home Institution	Participant	Instrument
A. Eija	Finish Meteorological Institue (FMI)	J. Backmann	AE31, SN 6790601

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 1.5% too low 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 21 ng/m^3 for five minute averaging time. The background level was moderate with values of less than 15 ng/m^3 for all wavelengths.

Inspection: Inlet and measuring cell was slightly dirty. The sample spots showed well defined, sharp edges.

Comparison to a reference MAAP: BC concentrations at 660 nm (BC5) of AE31 6790601 are 3.5% higher than BC concentrations from a reference MAAP (SN 504).

Comparison to reference absorption: The absorption coefficients at 660 nm derived from AE31 are 22.7% lower than absorption coefficients from the multi-wavelength absorption reference setup. 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: 679
Software version: 984zz
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 : 2.12 LPM/V
Flow zero : .027V
Date format (0=US, 1=EU): 1
Tape saver: 0
Spots per advance: 2
Filter change interval: 0
Maximum attenuation: 125
Over old data: 1
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..Gesytec): 2
Serial communication parameters:
  Speed(bps) : 9600
  Data bits : 8
  Parity bits:N
  Stop bits : 1
.
Gesytec parameters:
  Network Scale Factor: 10
  Instrument ID for Gesytec: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
.
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): 931
  Temperature(C): 24

Flow check

[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).

Date	System Flow			Reference flow Reference flow meter: Gilibrator 'TROPOS-T'			Flow correction factor	STP correction factor
	Mass flow	Volume reference		Volume flow	Ambient T and P			
	Q_{AE33} [slpm]	$T_{0,AE33}$ [°C]	$P_{0,AE33}$ [hPa]	Q [lpm]	T [°C]	P [hPa]	F_{flow}	F_{STP}
2017-09-06	3.8	24	931	3.454	20	995.2	1.015	1.184

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	0.5	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	72	3.3	-4.2	10.3	3.3	6.1	0.7
		450	72	-5.7	-14.9	6.4	-5.6	8.2	1.0
		520	72	-6.5	-16.0	6.8	-6.0	9.0	1.1
		590	72	-8.7	-17.3	4.5	-7.9	8.9	1.1
		660	72	-10	-20.8	4.9	-8.6	9.8	1.2
		880	72	-13.9	-29.4	6.2	-11.6	16.1	1.9
		950	72	-14.2	-41.1	12.3	-13.3	20.4	2.4

Comparison to reference MAAP
Correlation of eBC from AE31 (SN 6790601) and the reference MAAP (SN 504).

Slope	1.035±0.007
R^2	0.995

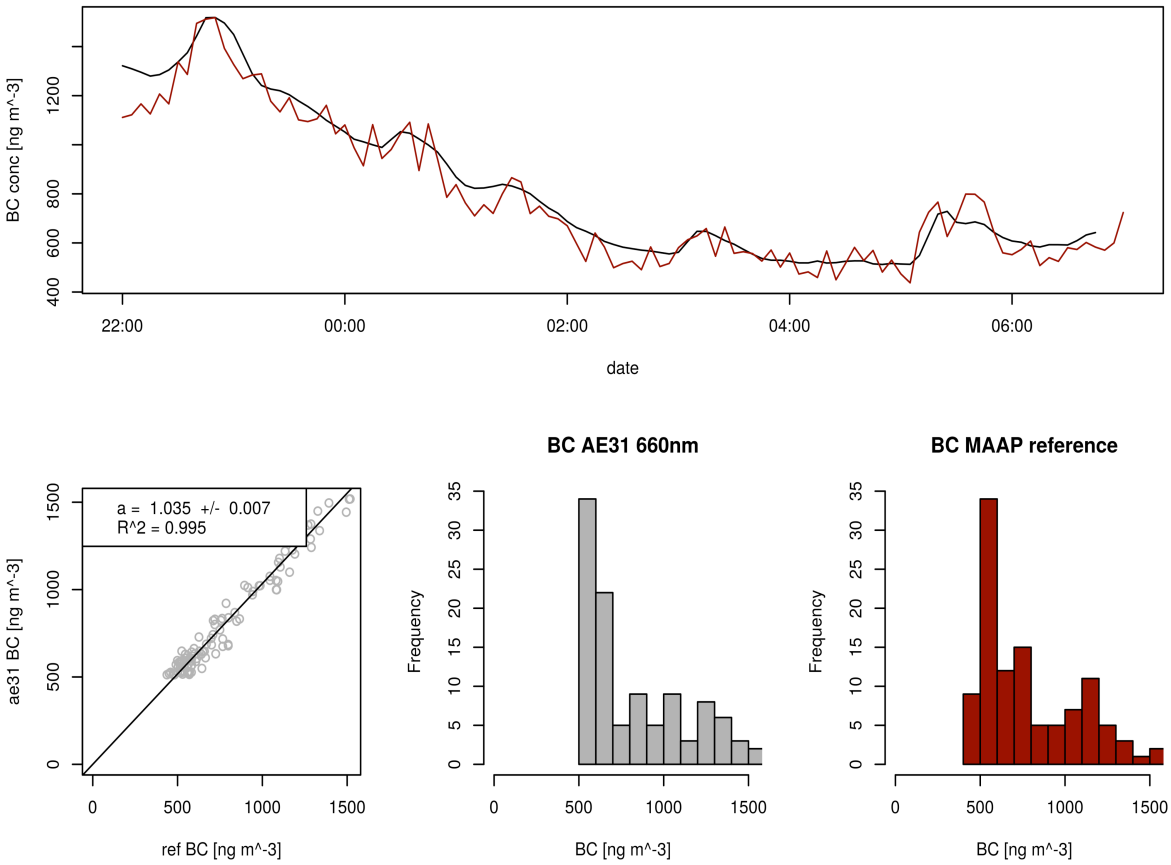

Figure: Comparison of eBC concentrations from AE31 SN 6790601 and MAAP SN-504.

Comparison to multi-wavelenght absorption reference
Correlation of absorption coefficients from AE31 (SN 6790601) and the multi-wavelenght absorption reference

Slope	0.873±0.009
R^2	0.989

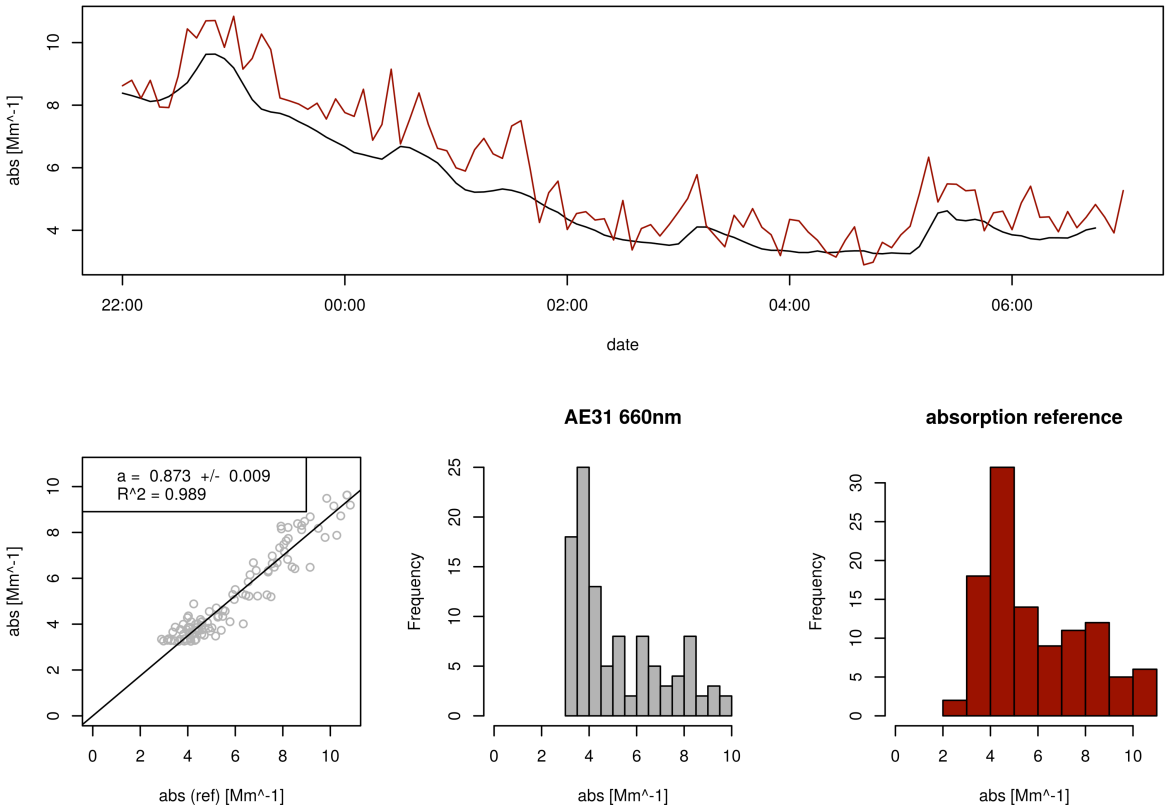

Figure: Comparison of absorption coefficients from AE31 SN 6790601 and absorption reference.