Leibniz Institute for Tropospheric Research

European Center for Aerosol Calibration

World Calibration Centre for Aerosol Physics

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

Location of the quality assurance: TROPOS, lab 121

Date: 18 October, 2017

Principal Investigator	Home Institution	Participant	Instrument
S. Rodriguez	AEMET	S. Rodriguez	AE31, SN 11651203

1. Intercomparison summary

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 2.6% 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 49 ng/m^3 for five minute averaging time. The background level was rather high with values of up to 169 ng/m^3, decreasing for increasing wavelength.

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 11651203 are 4.5% higher than BC concentrations from a reference MAAP (SN 504).

Comparison to reference absorption: The absorption coefficients at 660 nm derived from AE31 are 27.2% 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: 1165 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 : 6.6 LPM Flow scale factor : 1.87 LPM/V Flow zero : .027V Date format (0=US, 1=EU): 0 Tape saver: 0 Spots per advance: 1 Filter change interval: 0 Maximum attenuation: 100 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 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
[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_{AE31} [slpm]	$T_{0,AE31}$ [°C]	$P_{0,AE31}$ [hPa]	Q [lpm]	T [°C]	P [hPa]	F_{flow}	F_{STP}
2017-10-10	10	20	1013	10.46	22	1001	0.974	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}
2017-10-10	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]	10th percentile [ng/m^3]	90th percentile [ng/m^3]	Mean [ng/m^3]	Standard deviation [ng/m^3]	Error of the mean [ng/m^3]
2017-10-10	5 min	370	12	169.0	146.3	248.5	189.2	48.7	14.1
		450	12	145.0	121.7	197.4	159.5	39.0	11.3
		520	12	105.0	90.3	141.8	114.7	27.4	7.9
		590	12	72.5	63.3	100.0	80.1	17.3	5.0
		660	12	70.5	58.5	96.9	75.5	15.1	4.4
		880	12	53.5	49.2	83.3	61.6	14.4	4.1
		950	12	59.0	49.4	83.2	63.5	13.1	3.8

Comparison to reference MAAP

Correlation of eBC from AE31 (SN 11651203) and the reference MAAP (SN 504).

Slope	1.045±0.014
R^2	0.989

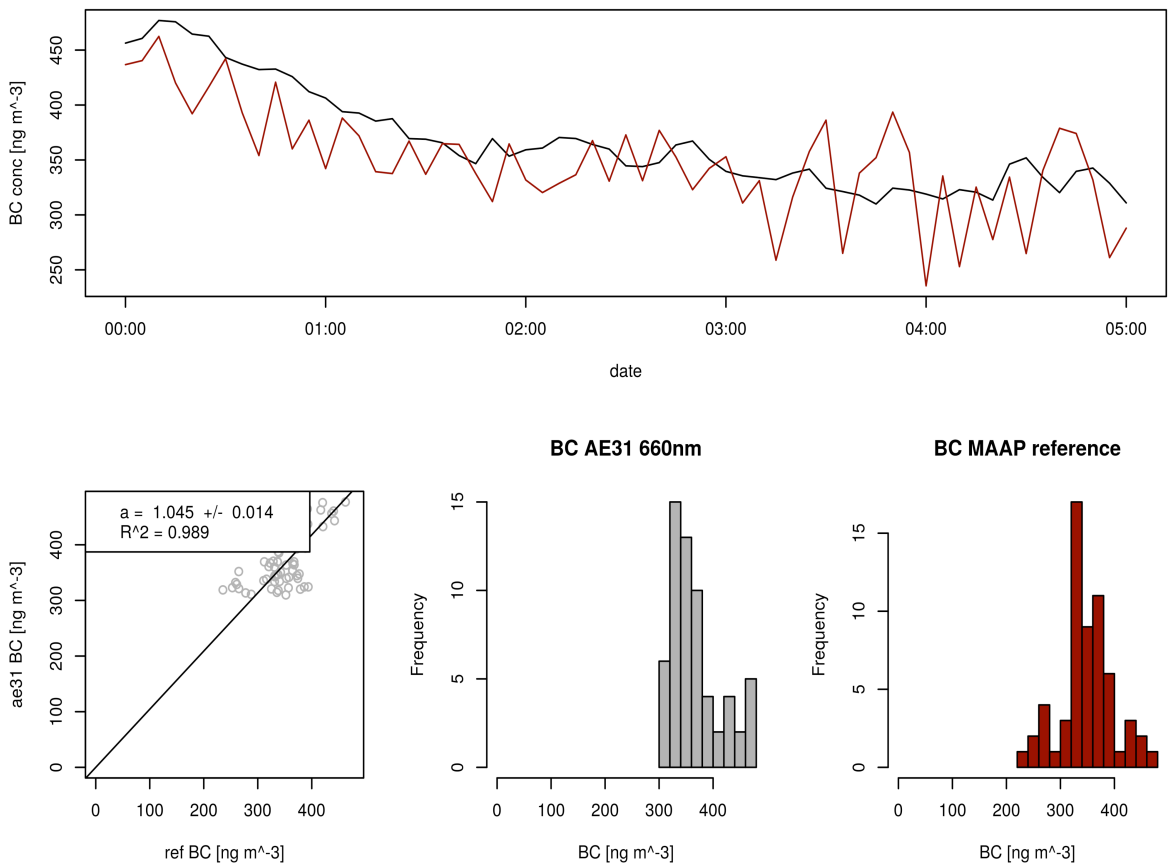

Figure: Comparison of eBC from AE31 (SN 11651203) and the reference MAAP (SN 504).

Comparison to multi-wavelenght absorption reference
Correlation of absorption coefficients from AE31 (SN 11651203) and the multi-wavelength absorption reference

Slope	0.728±0.024
R^2	0.938

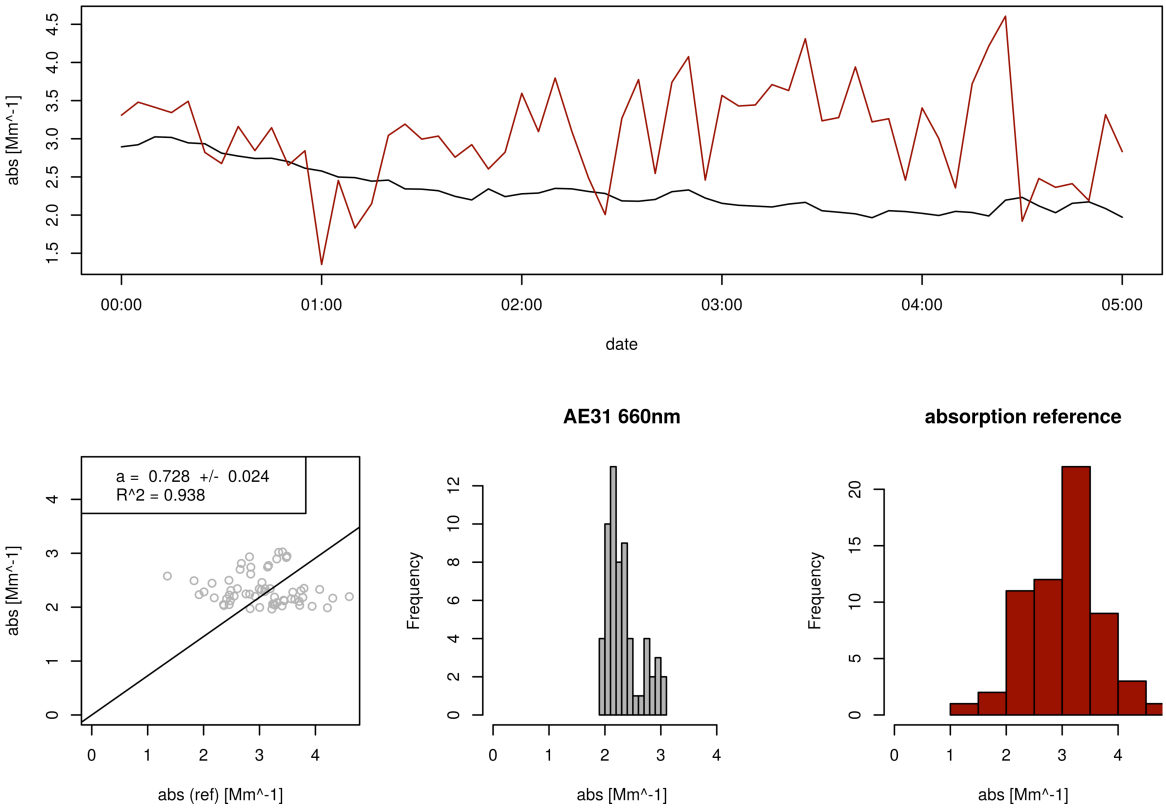

Figure: Comparison of absorption coefficients from AE31 (SN 11651203) and the multi-wavelength absorption reference.