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-2016-2-3

Location of the quality assurance: TROPOS, lab 121

Date: 26 July, 2017

Principal Investigator	Home Institution	Participant	Instrument
Marco Pandolfi	Spanish National Research Council (CSIC)	Marina Ealo	AE33, SN AE33-S01-00113

1. Intercomparison summary

Flow calibration: The flow meter of the instrument is set to report flow for conditions of 21.11°C and 1013.25 hPa. The flow was 0.2% 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 20 ng/m³ for one minute averaging time. The background level was very low with values of less than 5 ng/m³ for all wavelengths.

Inspection: Measurement cell was clean. Just a negligible amount of deposited particulates was found in the cell. The sample spots showed well defined, sharp edges.

Comparison to a reference MAAP: BC concentrations at 660 nm (BC5) of AE33-SN133 are 27% higher than BC concentrations from a reference MAAP (SN 504). Differences can be caused by different sensitivities of instrument depending on aerosol type.

Comparison to reference Aethalometer AE33 (SN 163): The AE33 (SN 113) measures higher concentrations than the reference Aethalometer of type AE33 (SN 163). At 370 nm it measures 9% higher concentration. At all other wavelengths the values are just 5% higher than from the reference instrument.

Comparison to reference absorption: An inter-comparison to the reference absorption setup (extinction minus scattering) was not possible because of very low aerosol concentration.

Recommendations: None.

Overall assessment: The instrument meets the requirements.

2. Details

Configuration parameters
Instrument serial number: S01-00113 BC Unit: ng Sigma values: 18.47, 14.54, 13.13, 11.58, 99.89, 7.77, 7.19 Volumetric reference: ACMA, P_0=1013.25 hPa and T_0=21.11°C Spot Area: 0.785 cm^2 Leakage factor: 0.07

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			Flow correction factor**Fehler! Textmarke nicht definiert.**	STP correction factor**Fehler! Textmarke nicht definiert.**
					Reference flow meter: Gilibrator 'TROPOS-T'				
	Mass flow		Volume reference		Volume flow	Ambient T and P			
	Q_{AE33} [slpm]	leak age	$T_{0,AE33}$ [°C]	$P_{0,AE33}$ [hPa]	Q [lpm]	T [°C]	P [hPa]	F_{flow}	F_{STP}
26. Sep	5	0.07	21.11	1013.25	4.658	20	1010	0.992	1.076

Spot size check

Correction factor for spot sizes F_{spot}.

Date	Nominal spot size [cm^2]	Measured spot size [mm^2]	F_{spot}
2016-09-28	0.785	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]
March 10	5 min	370	231	4.2	-5.2	13.6	4.2	7.4	0.49
		450	231	-2.1	-16	12.6	-2.2	17.2	1.1
		520	231	-1.1	-13.6	10.5	-1.1	9.9	0.7
		590	231	-2.1	-18.9	15.8	-1.3	13.4	0.9
		660	231	3.1	-11.3	17.8	3.2	11.8	0.8
		880	231	0.0	-19.6	19.6	0.49	15.1	1.0
		950	231	-1.1	-19.5	22.0	-0.1	15.3	1.0

Comparison of AE33 and MAAP

Comparison of eBC from AE33 (SN 00113) and the reference MAAP (SN 504).

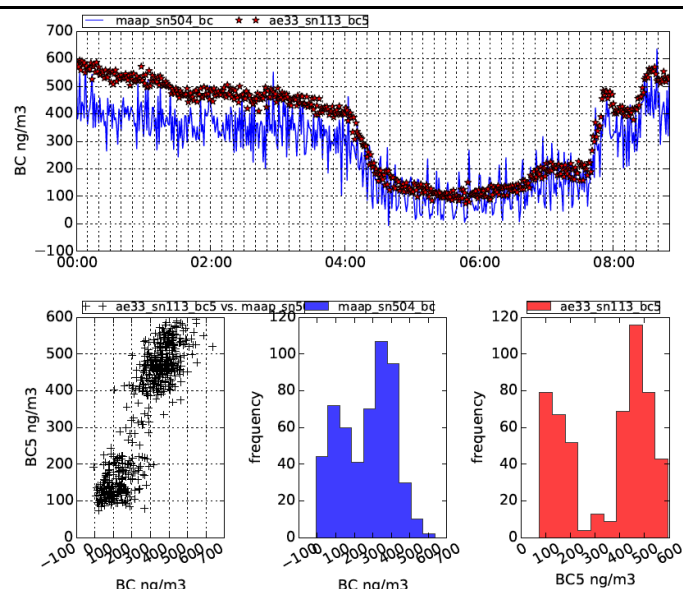| Measurement wavelength [nm]	AE33: 660 nm MAAP: 637 nm
Slope [1]	1.275 ± 0.02
R^2	0.786

Figure: Comparison of eBC concentration from AE33 SN-00113 (660 nm) and MAAP

SN-504 (637 nm).

Comparison of AE33 (SN 113) and reference AE33 (SN163)
Slope larger one means that AE-SN113 measured higher BC concentrations.

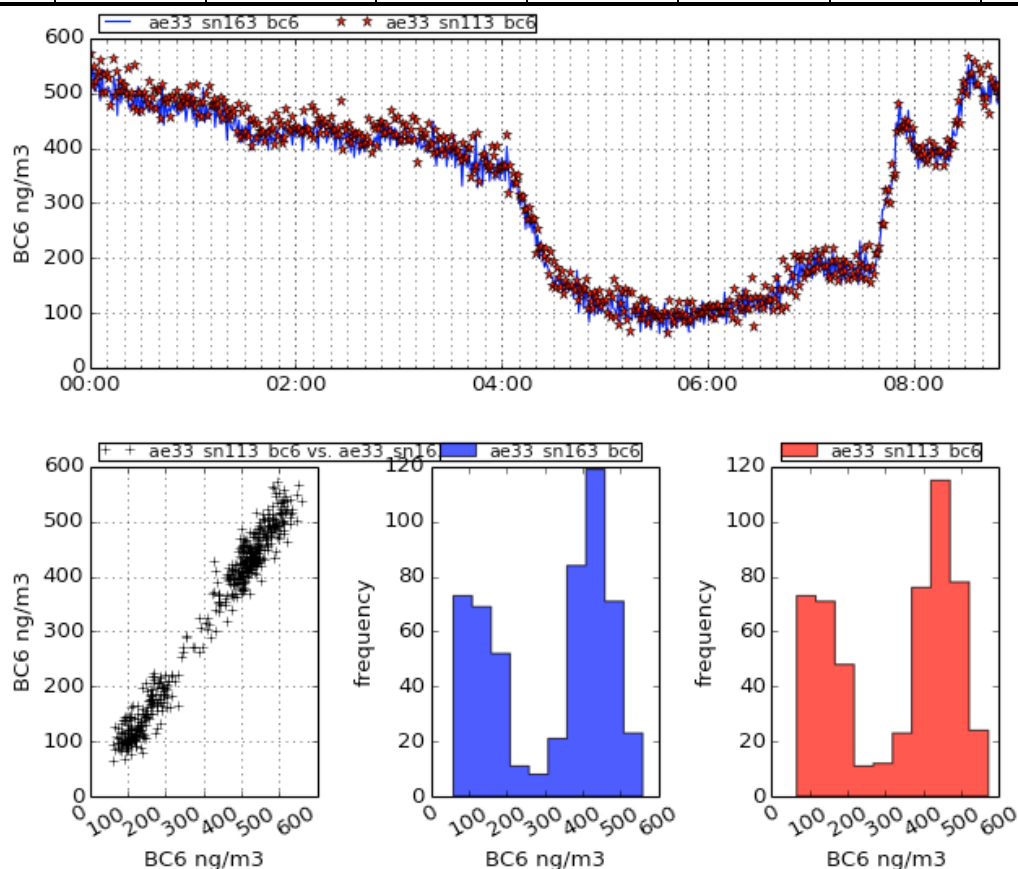| Wavelength [nm]	370	470	520	590	660	880	950
Slope	1.090±0.002	1.013±0.003	1.038±0.002	1.036±0.003	1.045±0.003	1.030±0.003	1.025±0.003
R^2	0.984	0.972	0.985	0.980	0.982	0.972	0.976

Figure: Comparion of eBC concentrations from of AE33 SN-113 and the reference instrument AE33 SN-163.