ACTRIS-2 ECAC Workshop 26/09 to 30/09/2016

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-S01-00114

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 2.5% 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 21 ng/m^3 for one minute averaging time. The background level was very low with values of less than 6 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 AE33-SN134 are 23% 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 248) measures higher concentrations than the reference Aethalometer of type AE33 (SN 163). At 370 nm it measures 6% higher concentration. At all other wavelengths the differences are between -1% and 2%.

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: S01-00114 BC Unit: 0 (ng) Sigma values: 18.47, 14.54, 13.13, 11.58, 10.35 , 7.77, 7.19 Volumetric reference: ACMA, P_0=1013.25 hPa and T_0=21.11°C Spot Area: 0.785 cm² 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 Reference flow meter: Gilibrator 'TROPOS-T'			Flow correction factor**Fehler! Textmarke nicht definiert.**	STP correction factor**Fehler! Textmarke nicht definiert.**
	Mass flow		Volume reference		Volume flow	Ambient *T* and *P*			
	Q_{AE33} [slpm]	leakage	$T_{0,AE33}$ [°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	0.975	1.076

Spot size check

Correction factor for spot sizes F_{spot}.

Date	Nominal spot size [cm²]	Measured spot size [mm²]	F_{spot}
2016-09-	0.785	Well defined spot, spot size not	1.0

28		measured	

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/m³]	90th percentile [ng/m³]	Mean [ng/ m³]	Standard deviation [ng/m³]	Error of the mean [ng/m³]
2016-09-30	1 min	370	66	0.0	-21.0	15.5	-0.57	15.43	1.9
		450	66	-6.3	-27.8	15.2	-5.7	20.5	2.5
		520	66	-2	-17.0	12	-3.5	12.1	1.4
		590	66	-6.3	-31	17.8	-5.8	18.9	2.2
		660	66	4.00	-15	18.4	2.9	13.5	1.6
		880	66	-4.7	-18.9	14.7	-2.2	14.6	1.7
		950	66	-1.0	-22.3	15.1	-3.1	15.6	1.9

Comparison of AE33 and MAAP
Comparison of eBC from AE33 (SN 00114) and the reference MAAP (SN 504).

Wavelength [nm]	AE33: 660 nm MAAP: 637 nm
Slope	1.225±0.012
R^2	0.786

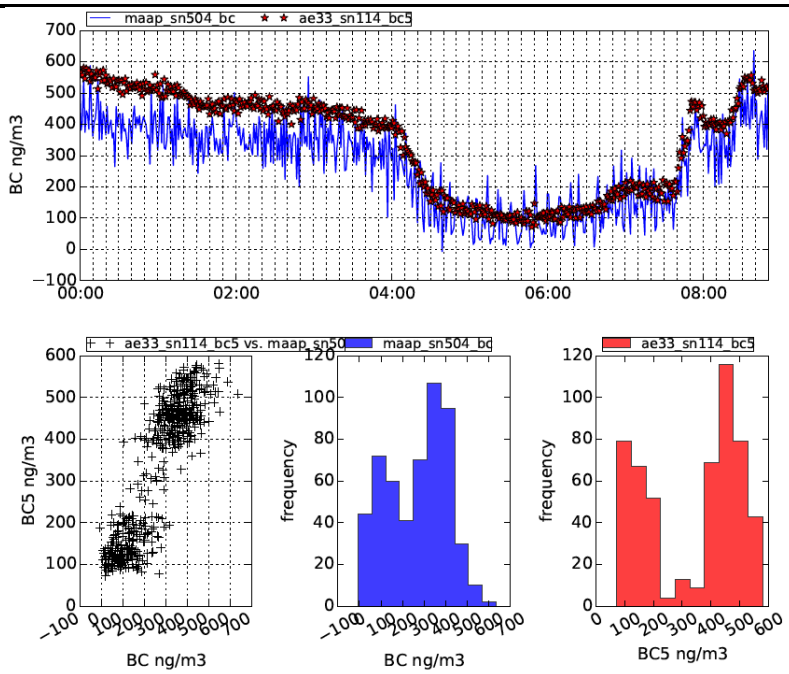

Figure: Comparison of eBC concentrations from AE33 SN-00113 (660 nm) and MAAP SN-504 (637 nm).

Comparison of AE33 (SN 114) and reference AE33 (SN163)

Slope larger one means that SN114 measured higher BC concentrations

Wavelength [nm]	370	470	520	590	660	880	950
Slope	1.065±0.002	0.990±0.003	1.014±0.002	1.012±0.003	1.021±0.003	1.006±0.003	1.001±0.003
R^2	0.984	0.972	0.985	0.980	0.982	0.972	0.976

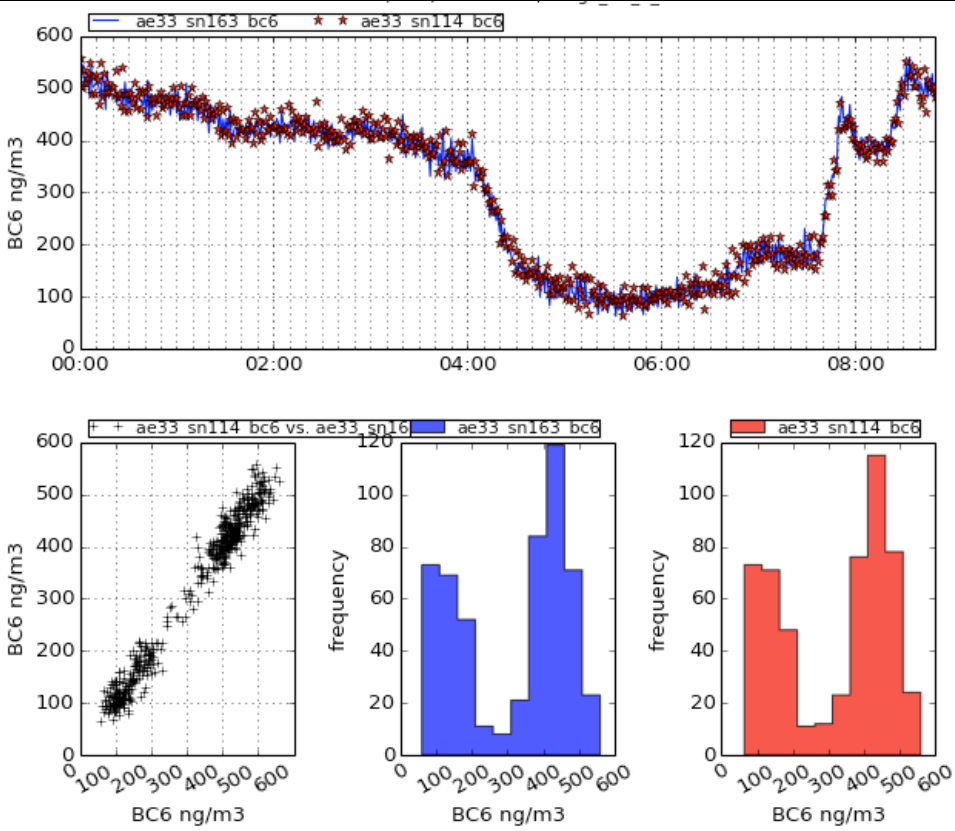

Figure: Comparison of eBC concentrations from of AE33 SN-113 and the reference instrument AE33 SN-163.