Intercomparison of absorption photometer
Project No.: AP-2018-3-4

Basic informations:

Location of the quality assurance:	TROPOS, Lab 121
Date:	22 October - 26 October 2018

Principal Investigator	Home Institution	Participant	Instrument
K. Jeongeun	Korea National Institute of Meteorological Science	H. Jeeyoung	1007:1004

1 Intercomparison summary

Status on arrival

No issues due to transportation or other damages.

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 1.3 % too high compared to reference flow meter (TSI 4100). Corrections for the flow deviation and the temperature and pressure (STP correction) were considered in the data evaluation.

Noise

The noise level of the instrument is out of the normal range. The average noise (1σ) for the all wavelengths was less eqal $67\,\mathrm{ng\,m^{-3}}$ for two minute averaging time. The background level was acceptable with deviations of less equal $15\,\mathrm{ng\,m^{-3}}$ for all wavelengths.

Inspection

The measuring cell was slightly contaminated with dust and was cleaned.

Comparison to reference MAAP

BC concentrations at 880 nm (BC6) of AE31 are 14.8 % lower than BC concentrations from a reference MAAP.

Comparison to reference AE33

The deviations of BC concentrations relative to the reference AE33 are in the range of -21.0 to -14.6 %.

Comparison to reference absorption

The deviations of the absorption coefficients derived from AE31 relative to the absorption coefficients from the multi-wavelength absorption reference setup are in the range of -35.8 to -15.5 %.

Recommendations

No recommendations.

Overall assessment

The instrument meets the requirements.

2 Details

Configuration parameters

```
--- AE-SETUP.TXT ---
Created : 24-oct-18 20:59:18
.
Instrument serial number: 1007
Software version: 985d7
Instrument type (0..U (1X), 1..UV+LED (2X), 2..7xLED (3X)): 2
Instrument Chassis : Stationary
Smoothing factor : 0
Selected Pump Flow : 3.0 LPM
Flow scale factor : 1.62 LPM/V
Flow zero : .031V
Date format (0=US, 1=EU): 0
Tape saver: 0
Spots per advance: 1
Filter change interval: 0
Maximum attenuation: 125
Over old data: 1
Warm up wait: 0
Spot size: Extended Range
MeanRatio:  .85
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): 6
.
Data format (0..Extended, 1..Compressed): 0
Prepend SerNumber to dataline (0..No, 1..Yes): 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): 1013
   Temperature(C): 20
```

Flow check

Table 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).

System flow and reference			Measured flow Q [slpm]	F_{flow}	F_{STP}
Q_{AE42} [slpm]	$T_{0,AE42}$ [°C]	$p_{0,AE42}$ [hPa]			
3	20	1013.25	3.05	0.987	1.073

Spot size check

Table 2: Correction factor for spot sizes F_{spot}.

Nominal spot size [cm^2]	Measured spot size [cm^2]	F_{spot}
-	Well defined spot, spot size not measured	1.0

Instrumental Noise

Table 3: Noise parameters of AE33 (1007:1004) measured with filtered air.

Wavelength [nm]	Number of data points	Median [ng m^{-3}]	10th percentile [ng m^{-3}]	90th percentile [ng m^{-3}]	Mean [ng m^{-3}]	Std. dev. [ng m^{-3}]	Error of mean [ng m^{-3}]
370	238	2	-36	33	0	27	2
470	238	-5	-50	48	-2	36	2
520	238	0	-70	57	-3	51	3
590	238	-1	-65	56	-4	49	3
660	238	-15	-79	67	-11	58	4
880	238	-10	-85	77	-7	65	4
950	238	-9	-100	75	-12	67	4

Comparison to reference MAAP

Table 4: Correlation parameter of eBC coefficient (BC6) from AE33 (1007:1004) and reference MAAP.

Wavelength [nm]	Slope	Error	R^2
880	0.852	0.009	0.942

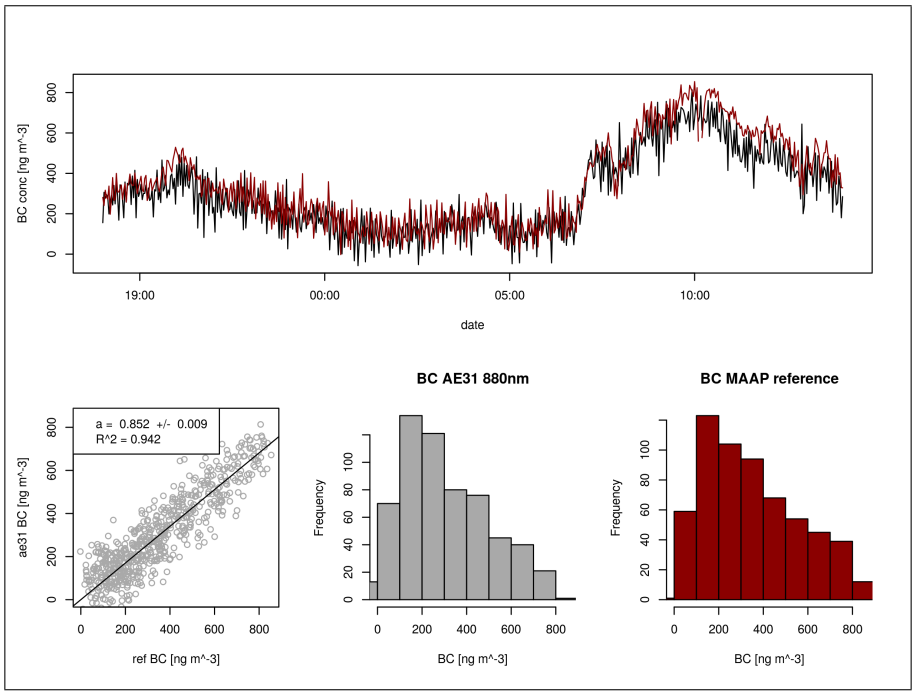

Figure 1: Correlation of eBC coefficient (BC6) from AE33 (1007:1004) and reference MAAP.

Comparison to reference AE33

Table 5: Correlation parameter of eBC coefficients from AE33 (1007:1004) and reference AE33.

Wavelength [nm]	Slope	Error	R^2
370	0.79	0.003	0.989
470	0.79	0.004	0.987
520	0.801	0.006	0.972
590	0.844	0.005	0.983
660	0.835	0.006	0.968
880	0.854	0.007	0.959
950	0.8	0.006	0.963

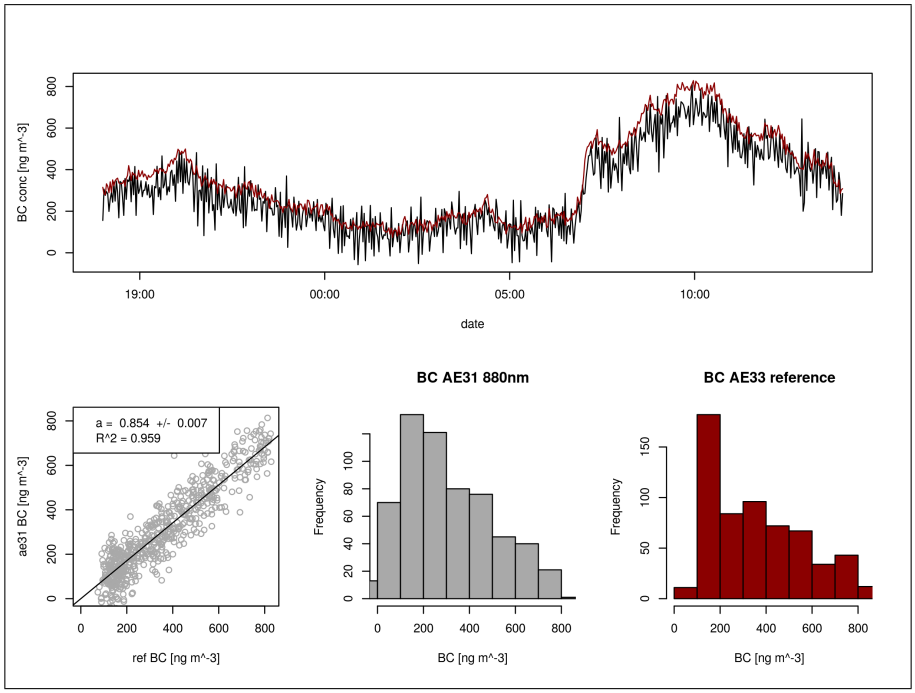

Figure 2: Correlation of eBC coefficient (BC6) from AE33 (1007:1004) and reference AE33.

Comparison to multi-wavelength absorption

Table 6: Correlation parameter of absorption from AE33 (1007:1004) and the multi-wavelength absorption reference.

Wavelength [nm]	Slope	Error	R^2
470	0.642	0.006	0.944
520	0.757	0.011	0.893
660	0.845	0.027	0.628

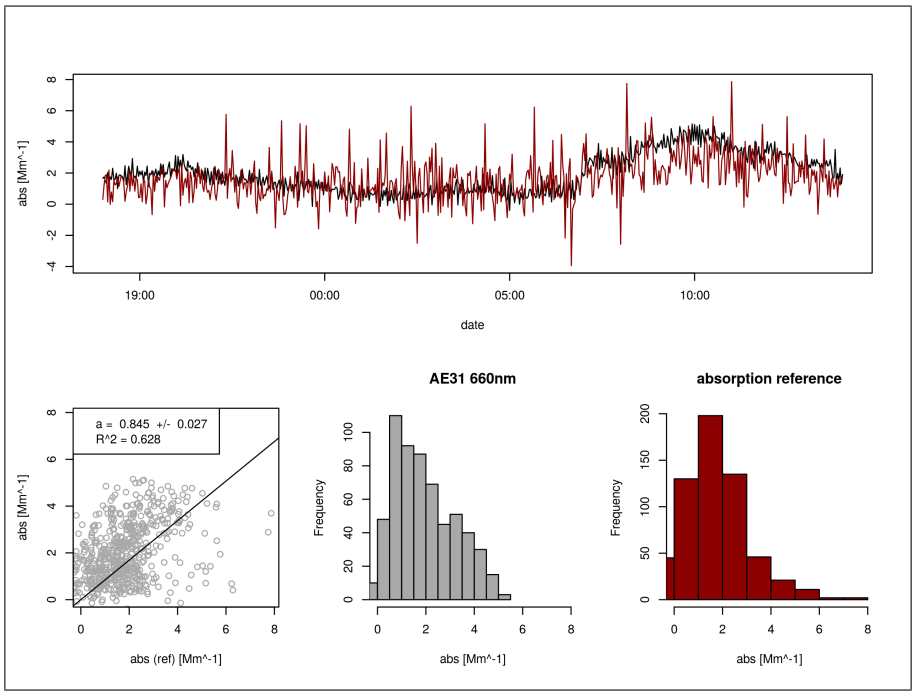

Figure 3: Correlation of absorption from AE33 (1007:1004) and the multi-wavelength absorption reference at 660 nm.